



User Manual

Control Unit Module

Sigma MOD LED / **Sigma** MOD DO

Product code: PW-033-A / PW-033-C



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Remarks and reservations

-  Connection and operation of the device is allowed only after reading and understanding the contents of this document. Keep User's Manual with the device for future use.
-  The manufacturer bears no responsibility for errors, damages and failures caused by improper selection of devices and cables, improper installation or failure to understand the contents of this document.
-  Unauthorised repairs and modifications of the device are not allowed. The manufacturer bears no responsibility for the results of such interventions.
-  Excessive mechanical, electrical or environmental exposure may result in damage to the device.
-  Use of damaged or incomplete devices is not allowed.
-  The design of the Gas Safety System for a protected facility may involve other requirements throughout all stages of the product life.

How to use this manual?

-  The following symbols of optical indicators status are used throughout the document:

| Symbol | Interpretation |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------|
|  | Optical indicator on |
|  | Optical indicator flashing |
|  | Optical indicator off |
|  | Optical indicator status not determined (depends on other factors) |

Table 1: Optical indicators status notation

-  Important parts of the text are marked as follows:



Pay special attention to information given in these fields.

-  User's Manual consists of main text and appendices. Appendices are independent documents and can exist without User's Manual. Appendices have their own page numbering independent of User's Manual page numbering. These documents can also have their own tables of contents. All documents included in the User's Manual are marked in the bottom right corner with their name (symbol) and revision (issue number).

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1 Preliminary information

1.1 General description

Gas Safety Systems have been used for many years for continuous monitoring of ambient atmospheres and detection of hazardous gases. The Sigma MOD LED and Sigma MOD DO described in this manual are parts of the Gas Safety System Sigma Gas, a comprehensive solution for safety of hazardous environments. The system includes the following components:

- ✍ gas detectors – to monitor composition of ambient atmospheres in areas to be protected,
- ✍ control units – to read and collect information from detectors and develop output signals, necessary, for instance, to control alarm systems,
- ✍ indication and warning devices (light beacons, stacklights and sound warning sirens) to alert persons on endangered areas about hazards,
- ✍ network hardware Sigma BUS to guarantee safe exchange of information within the system,
- ✍ auxiliary equipment, such as control HMI panels, data gateways, mimic boards to enhance performance of the system with additional functionalities, such as tuning of system parameters, advanced techniques for visual presentation of information, integration with external systems, etc.

The scope of functionalities implemented into the Sigma MOD LED and Sigma MOD DO control unit's cover a great portion of aforementioned features. These include (see also Figure 1 and 2):

- ✍ communication with gas detectors,
- ✍ control of light and sound warning devices (by means of relay outputs),
- ✍ transmission of information about the system status to other external systems (via the RS-485 digital link or by means of relay outputs),
- ✍ presentation of the system details for operators (by means of light indicators or an embedded buzzer),
- ✍ control of the entire system operation (by means of user interface pushbuttons, binary inputs and the RS-485 digital link).

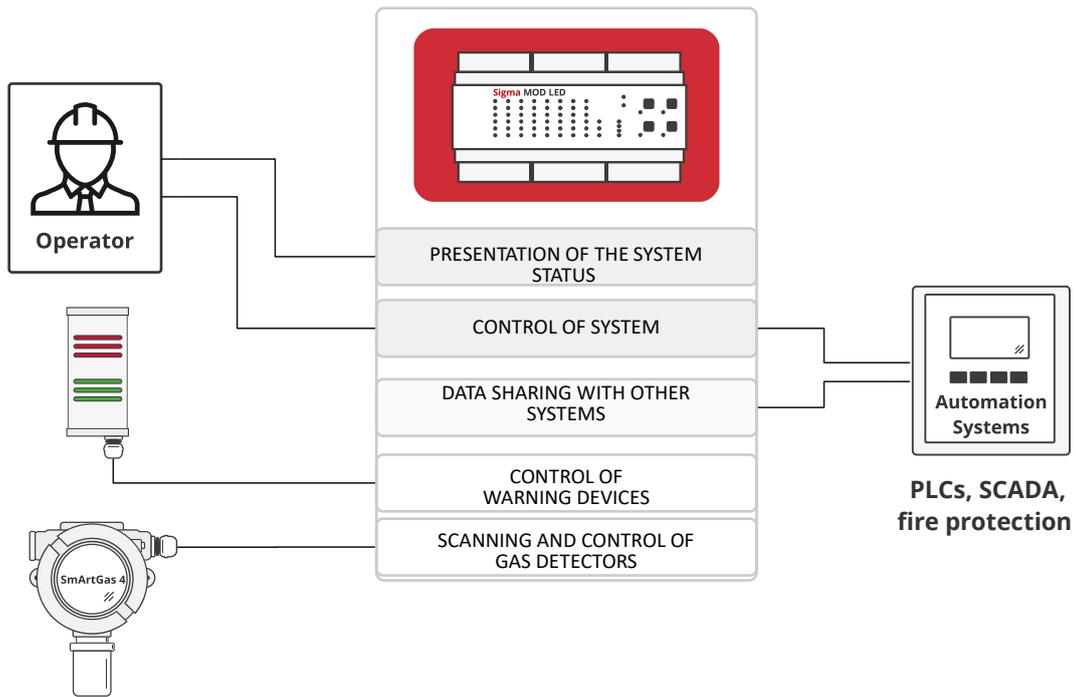


Figure 1: Application of the Control Unit Module Sigma MOD LED

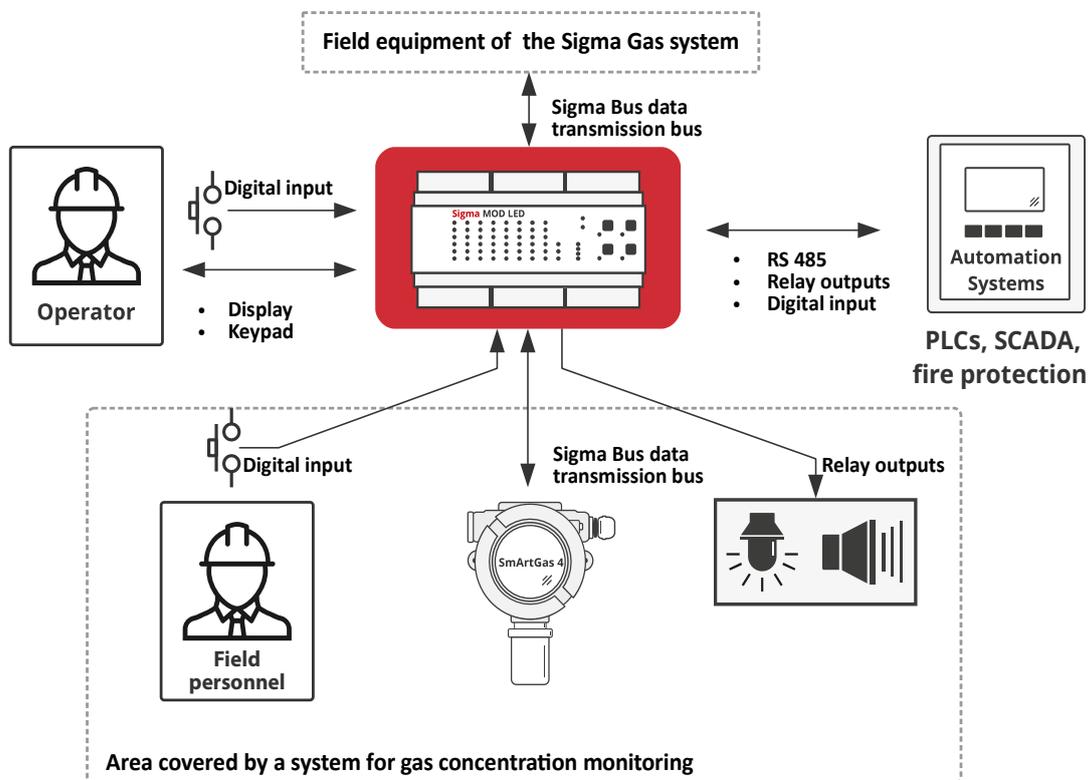


Figure 2: Example of collaboration between the Sigma MOD LED device and ambient environment

1.2 Operation principle

The Control Unit Modules Sigma MOD LED and Sigma MOD DO scan statuses of detectors connected to the gas monitoring system and read their indications. That information is depicted by means of indicating LEDs. The measured values of gas concentration as well as other special signals (e.g. defects) are used to control relay outputs of the unit. Specifically, these outputs may activate various sound and visual warning devices. The Control Unit Module reads statuses of binary inputs (both electric digital inputs (DI) and logic External Digital Inputs) and then, based on these inputs, control the system behaviour (activates or de-activates outputs of the controller).

The system image is made available to external clients by means of the RS-485 digital link with the MODBUS protocol. The serial communication enables connection to external automation systems or mimic panels.

1.3 Device characteristics

Basic functionalists

-  handling up to 32 gas detectors,
-  8 relays outputs,
-  4 binary inputs,
-  presentation of the gas detectors status (operation, exceeding the thresholds, its special conditions and diagnostic status) – only Sigma MOD LED,
-  presentation of historical states (exceeding the thresholds, failures) – only Sigma MOD LED,
-  presentation of the relays status – only Sigma MOD DO,
-  control of the entire system operation.

The control unit module is designed to work with:

-  Line 4.0 Gas Detectors,
-  Control Unit Module Sigma MOD DRV,
-  other devices compatible with the built-in input-output interfaces.



Control Unit Modules Sigma MOD LED and Sigma MOD DO are designed for installation in control rooms, inside control cabinets and other locations inside buildings. They are not suitable for operation in potentially explosive atmospheres.



Control Unit Modules Sigma MOD LED and Sigma MOD DO offer vast opportunities of configuration. However, to simplify understanding of this manual, many functionalities are described based on the default configuration.

2 Safety



All activities related to connecting detectors, signallers and other system components must be carried out while control unit's power supply is off.



Despite the power supply voltage for the Gas Safety System is off, dangerous voltage may persist across terminals of the control unit. Such a voltage may come from another system controlled by the same unit, for instance ventilation, that use one output pin of the control unit.



When performing repair, building and maintenance works, secure the device in a proper way.



Before painting the floors, make sure the device is secured.

3 Description of the construction

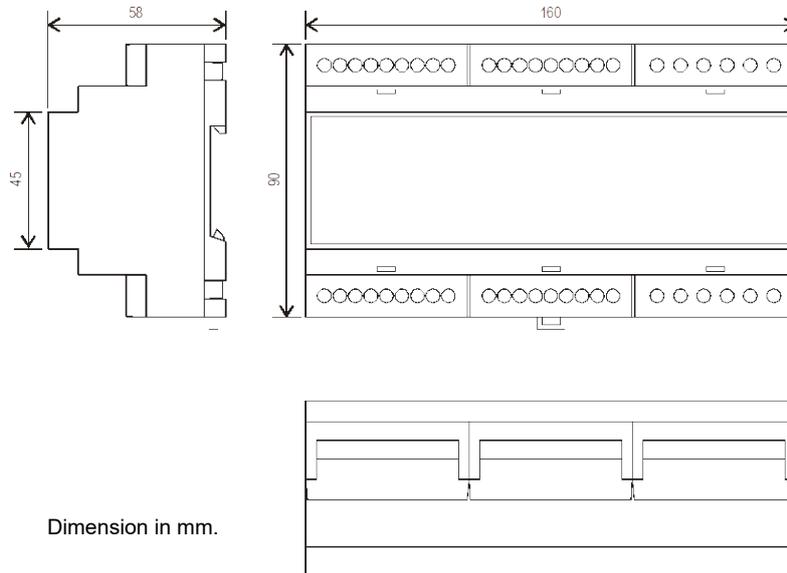


Figure 3: Dimension of device

4 Input-output interfaces

4.1 Terminal blocks

The unit is provided with the following input – output interfaces

-  8 relays output (R1 – R8),
-  4 binary inputs (DI1 – DI4),
-  2 digital links according to RS-485 standard (SBUS, ExBUS).

These interfaces are configurable with plenty of various options, but explanation of them would extend the Manual scope. For easier understanding of the unit operation, these interfaces are described in this Manual based on default settings (please refer to subsequent sections for more details).

All interface signals are delivered to a common terminal block. Specification of all signals is provided in Figure 4 and in Table 2.

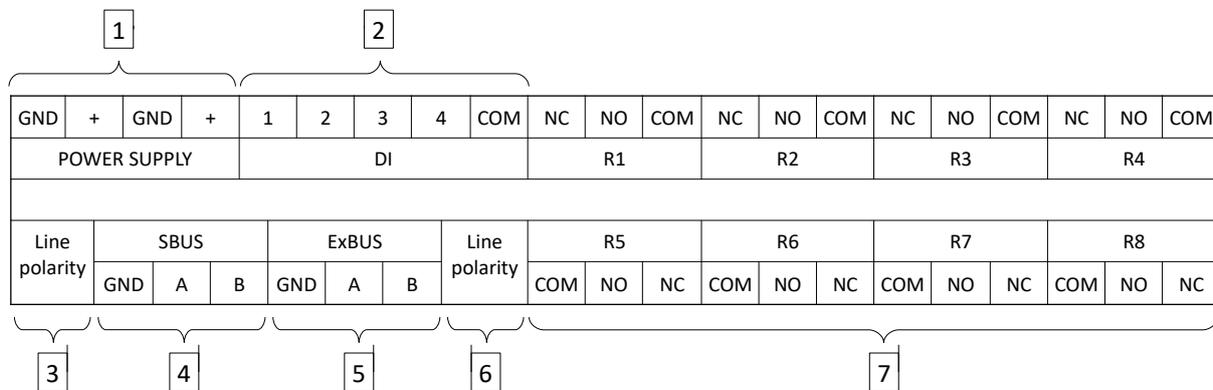


Figure 4: Electric Connections

Some interfaces are galvanic separated from each other. The idea is shown on the structural diagram below.

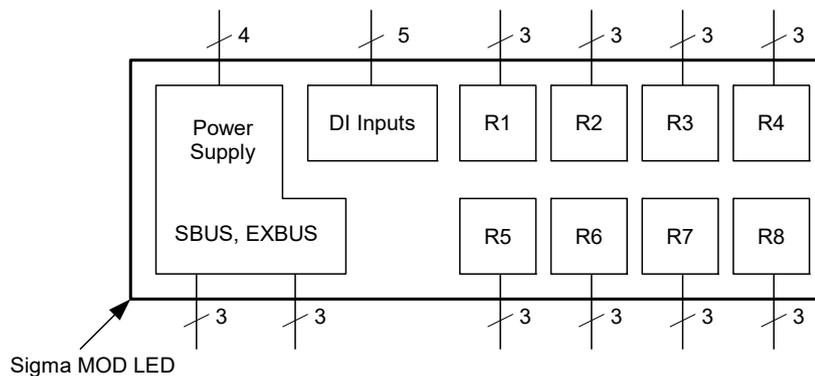


Figure 5: Galvanic separation between interfaces of the control unit module – structural diagram

| No. | Name | Pin | Description |
|-----|---------------|-------|---------------------------------------------------------------------------------------|
| 1 | Power Supply | | Device supply port. Parameters – see section 8 |
| | | GND | Negative. Both terminals GND are internally connected |
| | | + | Positive. Both terminals “+” are internally connected |
| 2 | DI | | Binary inputs, see section 4.3 |
| | | 1 – 4 | External alarm input DI1 – DI4 |
| | | COM | Common terminal of external alarm |
| 3 | Line polarity | | Configuration jumpers for the SBUS port. See section 4.6 |
| 4 | SBUS | | System communication port. Used for data exchange between devices in Sigma Gas system |
| | | A | Signal line A |
| | | B | Signal line B |
| | | GND | Negative supply pole (connected with GND of Power Supply port) |
| 5 | ExBUS | | Communication port, see section 4.5 |
| | | A | Signal line A |
| | | B | Signal line B |
| | | GND | Negative supply pole (connected with GND of Power Supply port) |
| 6 | Line polarity | | Configuration jumpers for the ExBUS port. See section 4.6 |
| 7 | R1 – R8 | | Relay outputs, see section 4.2 |
| | | COM | Common terminal of relay |
| | | NO | Normally open contact of relay |
| | | NC | Normally close contact of relay |

Table 2: Description of the electric interface

More details about interface connections – see Section 6.

4.2 Relays output R1 – R8

The control unit module has 8 universal relay outputs. These outputs can adopt one of the two statuses: active or inactive (the active state means that the voltage has been given to the relay coil). Terminals of relays can switch over to the following positions:

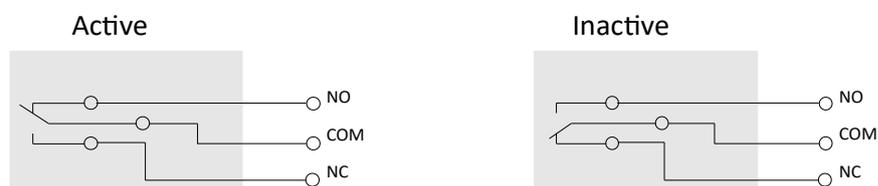


Figure 6: Relays in active and inactive state

Technical specification of outputs – see section 8.

The relay outputs offer various configuration options. Some of them are listed below:

- / tripping of an output relay:
 - by a whichever combination of alarm thresholds signals received from whichever detectors (alarm zones can be customized as desired),
 - by a failure signal received from a whichever detector,
 - by a collective failure signal (including a defect of the control unit itself),
 - by signals assigned to special statuses, e.g. maintenance, measurements (a common user interface device can be used to indicate status of the system)
 - from Digital Inputs (DI) and/or External Digital Inputs (ExDI),
- / MooN voting (M out of N means that M channels from the group of all N available ones are active and the output relay is triggered after at least M channels are activated, M and N may range from 1 to 32,
- / operation with a hysteresis according to tripping /reset thresholds of detectors,
- / tripping delay adjustment within the range from 1 s to 100 min,
- / reset delay adjustment within the range from 1 s to 100 min,
- / operation with a tripping status locked after disappearing of a tripping signal (tripped status can be reset by means of a pushbutton on the front panel, a DI or External DI signal),
- / temporary deactivation of an output signal whilst the tripping signal keeps remaining active (by means of the same methods as above),
- / inverted outputs,
- / control of a solenoid valve with power voltage of 230V for the valve – without a tests of the valve control line (3 impulses 1 second long with 1 second of interruption).

Table 3 summarizes default settings for the Sigma MOD LED unit:

| Output No. | Functionalities | Conditions for the output activation ¹ | Conditions for the output deactivation |
|------------|-----------------------|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R1 | WARNING 1 | Warning 1 – the first threshold is exceeded. | The monitored gas concentration drops below the first threshold. |
| R2 | WARNING 2 | Warning 2 – the second threshold is exceeded. | The monitored gas concentration drops below the second threshold. |
| R3 | ALARM | ALARM – the alarm threshold is exceeded. | The monitored gas concentration drops below the alarm threshold. |
| R4 | VISUAL ALARM (locked) | Warning 1 – the first threshold is exceeded. See figure 7. | The signal to reset a locked alarm (button ) can be issued only after the gas concentration drops below the first warning threshold. See Figure 7. |
| R5 | SOUND ALARM | ALARM – the third threshold is exceeded. See figure 8. | The monitored gas concentration drops below the third threshold. The sound alarm can be temporary muted (button ). See Figure 8. |
| R6 | MEASUREMENT | At least one detector is operating in the measurement mode. | None of the gas detectors is in MEASUREMENT mode. |

¹ See figure 6.

| Output No. | Functionalities | Conditions for the output activation ² | Conditions for the output deactivation |
|------------|-----------------|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| R7 | SERVICE | At least one detector is operating in the service mode. | None of the gas detectors is in SERVICE mode. |
| R8 | FAILURE | None of the controlled devices is in FAILURE mode. | At least one of the devices within the controlled system reports a defect or no power voltage supplied to the control module. |

Table 3: Default configuration of relay outputs Sigma MOD LED

Table 4 summarizes default settings for the Sigma MOD DO:

| Output No. | Functionalities | Conditions for the output activation ³ | Conditions for the output deactivation |
|------------|-----------------------------|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R1 | WARNING 1 | Warning 1 – the first threshold is exceeded. | The monitored gas concentration drops below the first threshold. |
| R2 | WARNING 2 | Warning 2 – the second threshold is exceeded. | The monitored gas concentration drops below the second threshold. |
| R3 | ALARM | ALARM – the alarm threshold is exceeded. | The monitored gas concentration drops below the alarm threshold. |
| R4 | OPTICAL ALARM (sustainable) | Warning 1 – the first threshold is exceeded. See figure 7. | The signal to reset a locked alarm (button B) can be issued only after the gas concentration drops below the first warning threshold. See Figure 7. |
| R5 | ACOUSTIC ALARM | ALARM – the third threshold is exceeded. See figure 8. | The monitored gas concentration drops below the third threshold. The sound alarm can be temporary muted (button A). See Figure 8. |
| R6 | MEASUREMENT | At least one detector is operating in the measurement mode | None of the gas detectors is in MEASUREMENT mode. |
| R7 | SERVICE | At least one detector is operating in the service mode. | None of the gas detectors is in SERVICE mode. |
| R8 | FAILURE | None of the controlled devices is in FAILURE mode. | At least one of the devices within the controlled system reports a defect or no power voltage supplied to the control module. |

Table 4: Default configuration of relay outputs Sigma MOD DO



The desired configuration of outputs R1 – R8 must be specified upon submission of the order (the outputs are configured by the manufacturer at the factory workshop).

² See figure 6.

³ See figure 6.

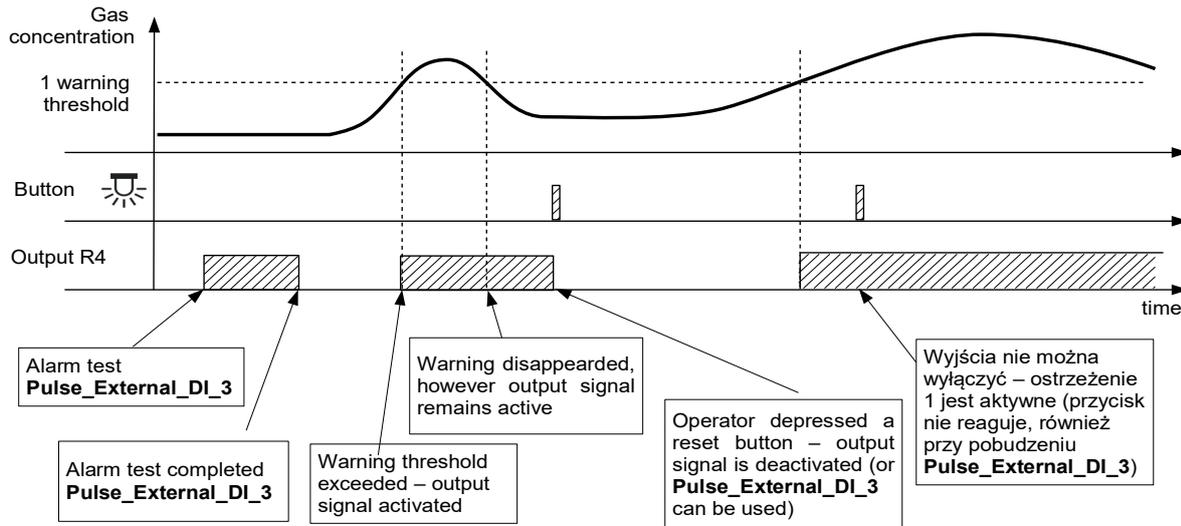


Figure 7: Visual alarm (locked) – behaviour of the R4 output depends on the gas concentration

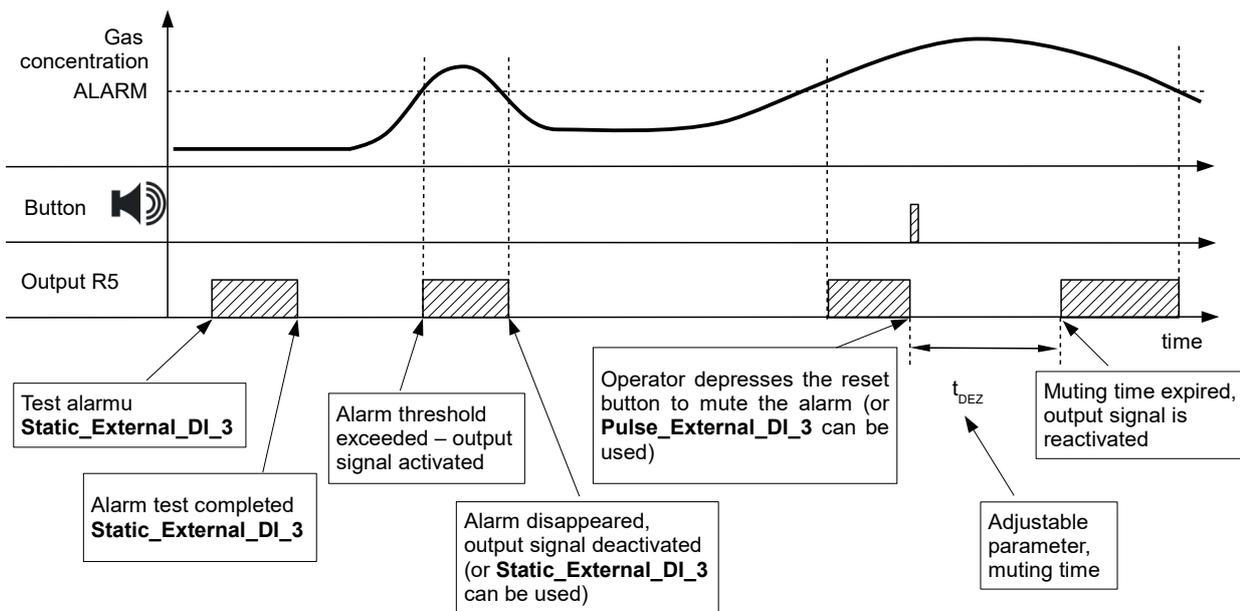


Figure 8: Sound alarm – behaviour of the R5 output depends on the gas concentration

Equivalent signals received from external systems are bolded on the foregoing waveforms (see details in Section 4.5).

4.3 Binary inputs DI 1 – DI 4

These inputs are meant to affect operation of the system by means of external signals, for instance signals received from other automation systems or pushbuttons. Depending on the signal voltage delivered to any specific inputs (see Section 8), these inputs can be considered as two logic levels. Current status of these inputs can be viewed on the user interface (see Section 5.1.2).

These inputs are galvanic separated from other circuits of the device, although no galvanic separation between individual inputs is provided (see Figure 5). An input is activated when voltage of any polarity is

delivered across the terminal 1 to 4 appropriate for a specific input and COM terminal. It is illustrated on the drawing below:

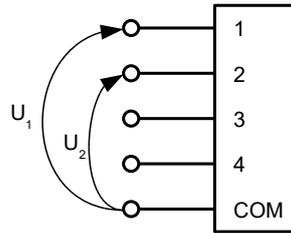


Figure 9: Delivery of input signals to logic inputs DI 1 and DI 2

The DI1 to DI4 offer a broad range of configuration options for operation of the control unit. For instance, they can be used to:

-  mute (deactivate) the internal buzzer for a predefined time (see Section 5.4),
-  switch off (deactivate) any relay output (in particular, mute an external sound warning device),
-  unlock any outputs already locked by a tripped detector (in particular, reset an optic/light warning device driven by a locked alarm),
-  enforce deactivation of any relay output.

Any input can operate as a non-inverted one (delivery of voltage activates the input) or an inverted one (the input is inactive when voltage is supplied to the input).

By default, inputs are assigned to the following operations:

| Input number | Operation | Non-inverted /inverted |
|--------------|----------------------------------------------------------|------------------------|
| DI 1 | Deactivation of an internal buzzer | non-inverted |
| DI 2 | Deactivation of an external sound warning device (siren) | non-inverted |
| DI 3 | Reset of a locked optic /light warning device | non-inverted |
| DI 4 | Activation of an alarm | non-inverted |

Table 5: Default assignment of digital inputs (DI)



The desired configuration of inputs DI 1 to DI 4 must be specified upon submission of the order (the outputs are configured by the manufacturer at the factory workshop).

4.4 SBUS communication port

The communication port is meant to exchange information between individual devices within the Sigma Gas system. It is a serial port for digital transmission based on RS-485 link and Sigma Bus protocol.

The port is sensitive to polarity of transmission lines – see details in Section 4.6.

4.5 ExBUS communication port – data gateway, External Data Inputs

The Control Unit Modules Sigma MOD LED and Sigma MOD DO comprise a communication port called ExBUS designed for exchange of information between the Sigma Gas system and external environment (e.g. PLCs, SCADA, etc.). The port is bidirectional and can be used both to read information about current status of the Sigma Gas system. e.g. statuses of detectors, and to affect operation of the system by means of

dedicated digital inputs. Purpose of those inputs is exactly the same as in case of DI lines outlined in Section 4.3.

Exchange of information is carried out by means of the RS-485 digital link and MODBUS protocol, where the control unit module operates as a SLAVE device. The mentioned functionalities are implemented as read and write operations for registers from the address space of 'holding registers' in the control module. Two options of MODBUS protocol are available:

- MODBUS ASCII – transmission rate of 19,200 bauds, frame format: 7 data bits, parity bit and one stop bit. It is the default configuration.
- MODBUS RTU – transmission rate of 19,200 bauds, frame format: 8 data bits, no parity bit and one stop bit. It is the default configuration.

The address of the control unit can be configured within the range from 1 to 255 with the default address of 20.

The map of the control unit memory is shown in Attachment [3].

The default configuration of External Data Inputs is shown in the table below.

| Bit | Flags | Description | Default configuration |
|-------|-------------------|-----------------|----------------------------------------------------------|
| 0 | External_DI_0 | Input no. 0 | Deactivation of an internal buzzer |
| 1 | External_DI_1 | Input no. 1 | Deactivation of an external sound warning device (siren) |
| 2 | External_DI_2 | Input no. 2 | Reset of a locked optic /light warning device |
| 3 | External_DI_3 | Input no. 3 | Activation of an alarm |
| 4..15 | External_DI_4..15 | Input no. 4..15 | Not assigned |

Table 6: Default configuration of External DI input



The desired functionalities for that port must be specified upon submission of the order (both the transmission protocol and assignment of External Digital Inputs to specific functions).

The port is sensitive to polarity of transmission lines – see details in Section 4.6.

4.6 Polarity of communication lines

SBUS and ExBUS communication ports are sensitive to polarity of transmission line. To configure the desired polarity it is necessary to gently open a lid that secures contacts of SBUS and ExBUS ports and insert jumpers into appropriate sockets of uncovered terminals.

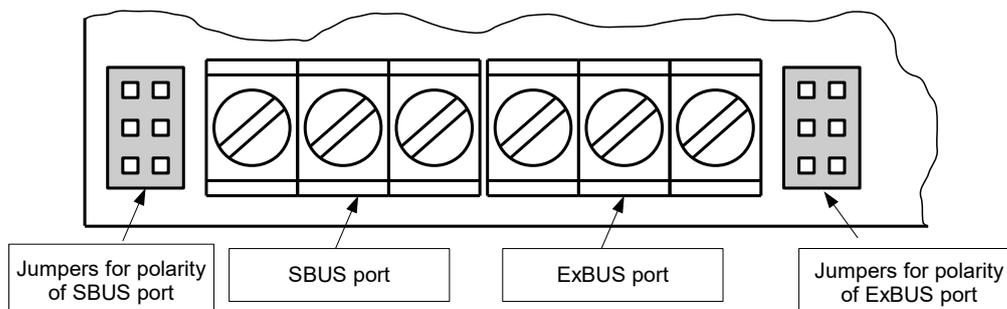


Figure 10: Jumpers to set polarity of SBUS and ExBUS, available after removing of the protection lid

Settings are explained in the table below:

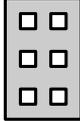
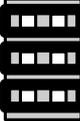
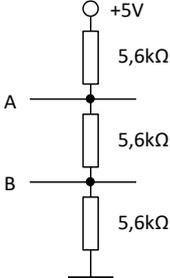
| Setting of jumpers | Operation | Schematic diagram |
|-----------------------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------------------|
|  | Polarity of SBUS and ExBUS ports inactive | A _____ B _____ |
|  | Polarity of SBUS and ExBUS ports active |  |

Table 7: Configuration of polarity for SBUS and ExBUS ports

5 User interface

5.1 Sigma MOD LED – Front panel

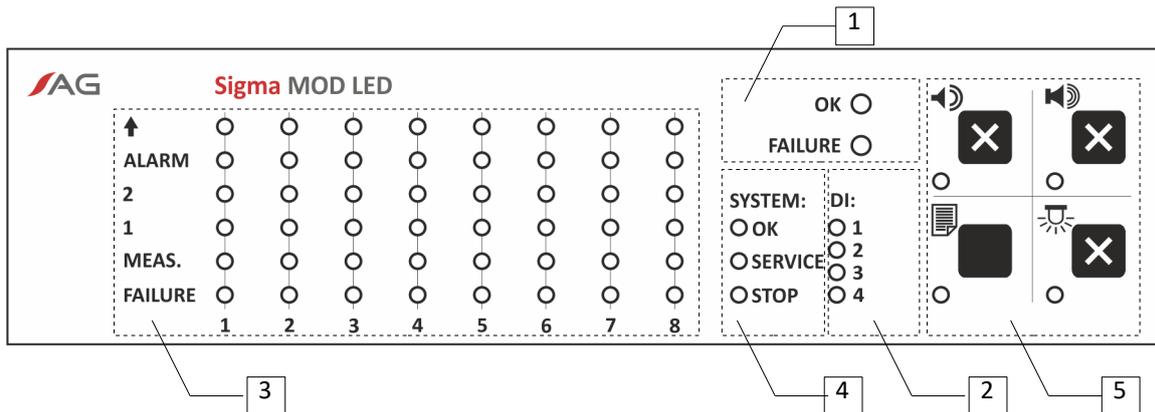


Figure 11: Sigma MOD LED front panel

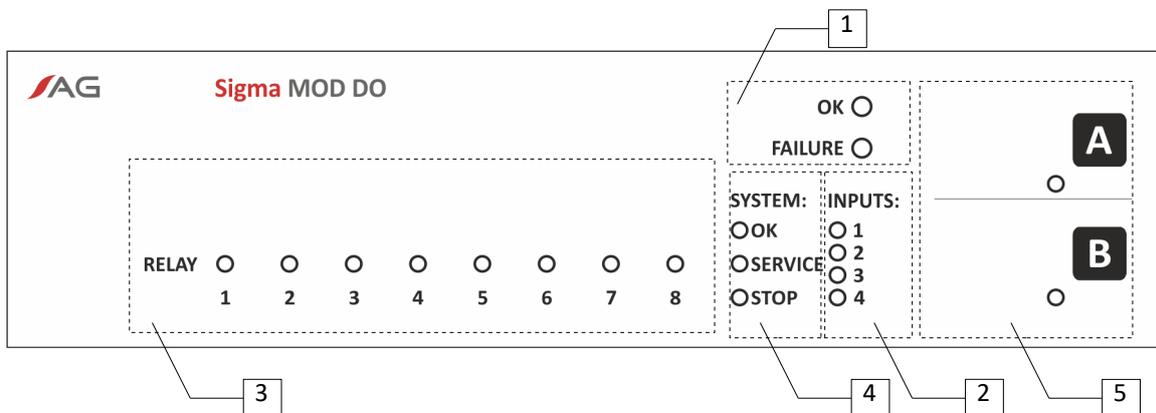


Figure 12: Sigma MOD DO front panel

5.1.3.2 Status area for relay outputs

LEDs are used to indicated statuses of eight relay outputs – from 1 to 8 (see Section 4.2).

| Indicator | Status / colour | Information |
|-----------|-------------------------------------------------------------------------------------------|----------------------------------------------|
| RELAY |  / green | Constant light – the relay coil is energized |
| |  | LED is off – the relay coil is de-energized |

Table 11: Operation of LEDs for indication of the detector status

5.1.4 Status area for the data transmission system

LED indicators in that area show the status of information exchange on the Sigma Bus data lines.

| Indicator | Status / colour | Information |
|-----------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| OK |  / green | Constant light – the system is in operation |
| SERVICE |  / green | Alternate blinking  – the system is in maintenance mode |
| STOP |  / red | Constant light – operation of the system is halted by an operator |

Table 12: Operation of LEDs for status indication of the data transmission system

5.1.5 Keypad

Each button has an indicator to confirm is activation. The keypad can be used to read content of the device memory (only Sigma MOD LED) and to reset specific signals.

5.1.5.1 Specification of buttons for Sigma MOD LED

| Button | Status / colour | Information |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
|  |  / red | Buzzer ⁴ muting – designed to mute (deactivate) an internal buzzer for a predefined time period |
|  |  / red | Siren muting – designed to mute (deactivate) an external sound warning device (siren) for a predefined time period |
|  |  / green | Button to access memory of events – designed to read and erase memory content |
|  |  / red | Button to reset a locked alarm – enables deactivation of a locked alarm |

Table 13: Description of buttons for Sigma MOD LED

For more detailed information – see Figure 7, 8 as well as Section 5.5.

Combinations of buttons:

| Combination of buttons | Description |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| Simultaneous depressing   | Start of the user interface test – see Section 5.2. |

Table 14: Available combinations of buttons

5.1.5.2 Specification of buttons for Sigma MOD DO

Buttons of Sigma MOD DO control unit module can be freely assigned to various functions. Possible use of buttons is explained in Table 15.

⁴ For simplicity of the description ‘buzzer’ is understood as any internal sound warning device.

| Button | Status / colour | Information |
|---------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A / B | ⊘ / red | <ul style="list-style-type: none"> • Button to reset a locked alarm – enables deactivation of a locked alarm • Button to mute an external sound warning device (siren) – enables temporary muting (deactivation) of an external sound warning device (siren). Default assignment of buttons is listed in Table 4 |
| | ○ | Button to test outputs – enables testing of relay outputs |

Table 15: Description of keypad buttons for Sigma MOD DO

5.2 Start-up of the device, test of user interface

5.2.1.1 Sigma MOD LED

Right upon connection to a source of power voltage Sigma MOD LED controller starts a test of its user interface. The test consists in activation of all LED indicators on the front panel and honring the internal buzzer⁵.

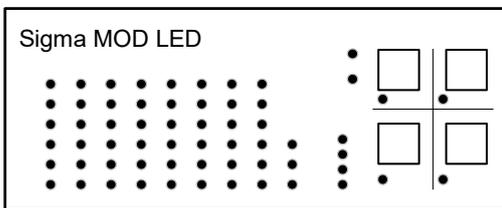


Figure 13: Front panel – test of user interface

Upon two seconds the display shown the product revision⁶ number:

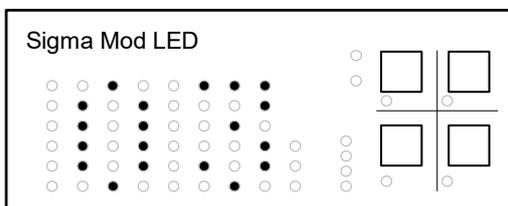


Figure 14: Front panel – number of the product revision

For instance, the foregoing picture shows the '03' product revision number (always two characters are displayed).

Upon subsequent two seconds the test is completed and the device moves to presentation of the basic view (see Section 5.3).

The test of user interface (i.e. the foregoing sequence) can be also launched upon request by means of the keypad (see Section 5.1.5).



It is recommended to run at the user interface test at least once a week to make sure that all LED indicators and the buzzer are in sound operating condition.

⁵ The sound signal may not be pronounced if the controller is configured for operation without an internal buzzer (see Section 3.4).

⁶ Product revision number identifies the current option of the product release and includes hardware, firmware and documentation.

5.2.1.2 Sigma MOD DO

For Sigma MOD DO controller all LED indicators on the front panel go on right after power up of the device.

5.3 Basic view

During regular operation the control unit modules display the following information:

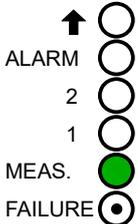
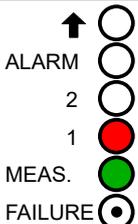
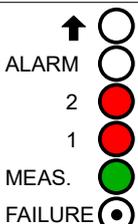
-  statuses of all lines (see Section 5.1.3),
-  status of the control device (see Section 5.1.1),
-  statuses of digital inputs DI (see Section 5.1.2),
-  status of the system operation (see Section 5.1.4),
-  statuses of individual buttons (see Section 5.1.5).

5.3.1 General code of indications

Status of a detector is indicated according to the following rules:

-  green continuous light – means, in general, that the detectors works properly, i.e. measures concentration of gases,
-  red light – means that a hazardous concentration of gas is detected,
-  yellow – any failures or defects within the system,
-  other colours or flashing light that are different from the foregoing indications are considered as any special status of the system.

5.3.2 Detector’s state signalling – gas alarms

| Situation | Description | Indicators | Buzzer |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| No danger | The detector works properly and continuously measures gas concentration, which is confirmed by continuous light of MEAS. indicator |  | |
| Warning 1 | The gas concentration exceeds the first warning threshold. Indicator 1 on the front panel is continuously on and the internal buzzer is activated (can be muted by means of the keypad) |  |  |
| Warning 2 | The gas concentration exceeds the second warning threshold. Indicators 1 and 2 on the front panel are continuously on and the internal buzzer is activated (can be muted by means of the keypad) |  |  |

| Situation | Description | Indicators | Buzzer |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------|
| Alarm | The gas concentration exceeds the second warning threshold. Indicators 1, 2 and ALARM on the front panel are continuously on and the internal buzzer is activated (can be muted by means of the keypad). | | |
| Overload | The gas concentration exceeds the overload value. Indicators 1, 2, ALARM and ↑ in the panel are continuously lit. The detector still performs measurement, which is indicated by continuously lit MEAS. Indicator. | | |
| Lock ⁷ | The gas concentration exceeds the overload limit. Indicators 1, 2, ALARM and ↑ on the front panel are blinking alternately. (□□□□□□). The detector is locked and the last concentration value is latched. The detector stops taking measurements and the MEAS. indicator goes off. | | |

Table 16: Indication of the detector statuses – gas warning and alarms

5.3.3 Indication of detector statuses – special statuses

| Situation | Description | Indicators | Buzzer |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------|
| Heating | Preparation of the detector to work. Its indications are ignored. The indicators are lit one after another from bottom to top. | | |
| Calibration | The detector is in calibration state – its indications are ignored. MEAS. indicator – one flash per 2 s (□□□□). Other indicators are off. | | |
| Non-critical failure | Detector malfunction that may negatively impact its measurement accuracy (e.g. exceeding of time until periodic calibration). The detector still performs measurement. FAILURE indicator flashes evenly. (□□□□□□). | | |

⁷ That status is only available for detectors provided with the locking functionality

| Situation | Description | Indicators | Buzzer |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------|
| Critical failure | The detector is damaged and does not perform measurement. FAILURE indicator is lit continuously, the remaining ones are turned off. The internal buzzer is on. | ↑ ○ ALARM ○ 2 ○ 1 ○ MEAS. ○ FAILURE ● |  |
| Short-time communication failure | Communication with a gas detector is interrupted for a short time. The previous status of the detector is still valid and the MEAS. indicator is off. | ↑ ○ ALARM ○ 2 ○ 1 ○ MEAS. ○ FAILURE ○ | |
| No communication | A gas detector fails to respond for a long time. It is a special case of a detector failure. The FAILURE indicator is continuously on and all other ones are off. The internal buzzer is active. | ↑ ○ ALARM ○ 2 ○ 1 ○ MEAS. ○ FAILURE ● |  |
| „Inhibit” mode | The detector is temporarily excluded from the system. Flags related to that detector are ignored by the controller. All indicators blink twice at the same time with the interval of 30 s (□□□□□□). | ↑ ○ ALARM ○ 2 ○ 1 ○ MEAS. ○ FAILURE ○ | |
| „STOP” mode | Operation of the system is halted by an operator. All indicators blink periodically - once per two seconds 2 s (□□□□□□). The STOP indicator on the control panel is on. | ↑ ○ ALARM ○ 2 ○ 1 ○ MEAS. ○ FAILURE ○ | |

Table 17: Indication of the detector statuses – special statuses

5.3.4 Response to gas concentration

Normal operation of a gas detector is confirmed by continuous activation of the green indicator. After a hazardous gas appears within vicinity of the detector and its concentration exceeds the first or second warning threshold or the alarm threshold, corresponding LED indicators on the front panel in the area of the detector status, i.e. LEDs denominated as 1, 2 or alarm (see Section 5.1.3), go on. At the same time the internal buzzer is activated, however it can be muted for a specific time by means of a keypad pushbutton (see Section 5.1.5).

When gas concentration exceeds the maximum range permissible for the detector (overload threshold), the following actions take place:

- for detectors with catalytic sensors – the detector is locked (its sensor is deactivated and the detector latches the most recent measurement result). The corresponding LED in the area for status indication goes on (see Section 5.3.2). To restore normal operation of the detector the detector must be unlocked from another device connected to the system,
- for detectors with other sensors – the corresponding LED in the status area, depicted as **↑**, goes on. The detector keeps working and continues measurements of gas concentration, which is confirmed by the MEAS. indicator that is still on.

Signalling depending on the concentration of gas measured by the detector:

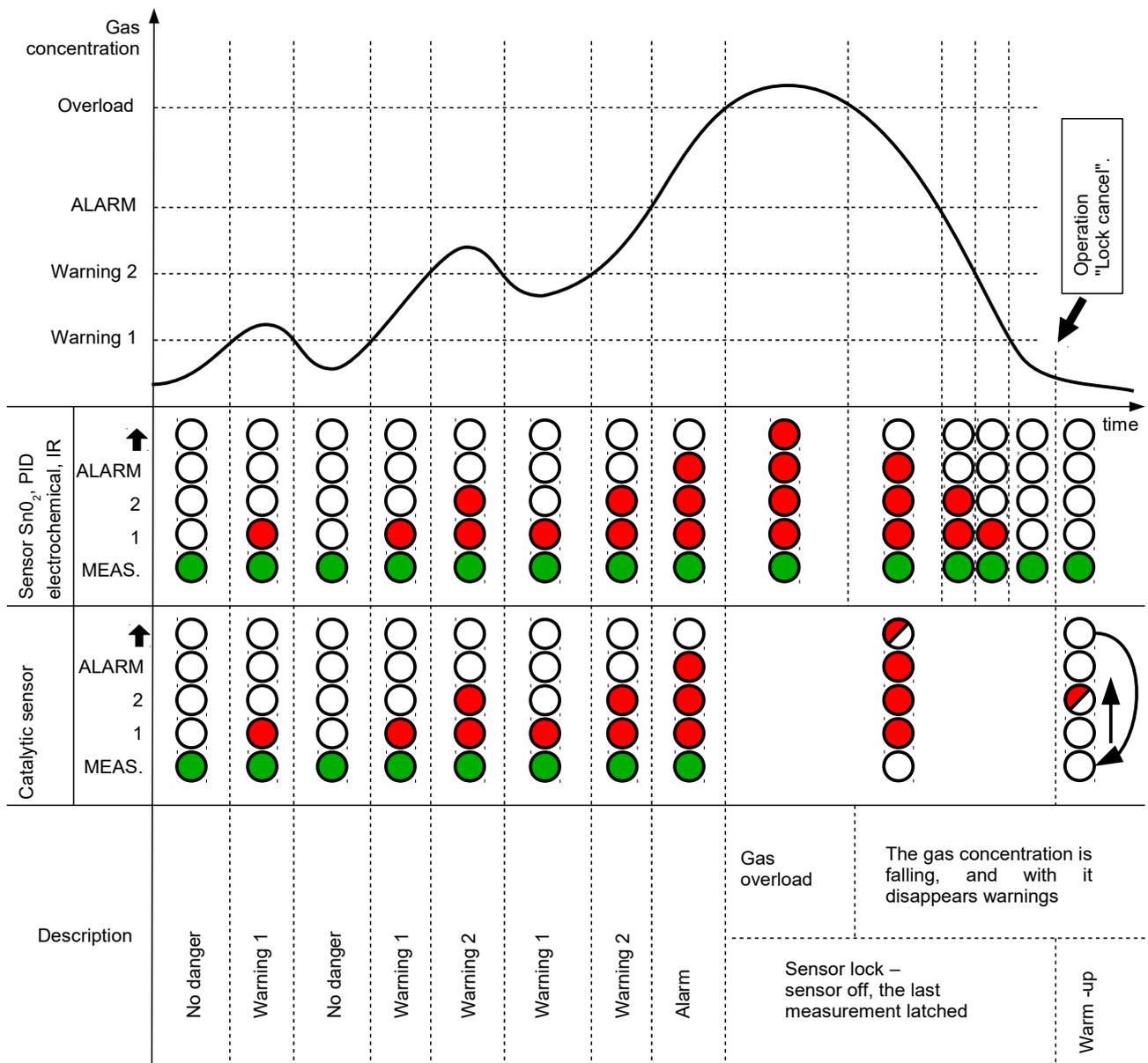


Figure 15: Indications of LEDs on the front panel versus gas concentration measured by the detector

5.4 Buzzer – internal acoustic warning /alarm device

The control module contains an internal audible warning/alarm device (buzzer) designed to horn an audible signal when intervention of the system operator is required, for instance when a gas hazard is detected or when any part /component of the system reports an error.

The buzzer is activated under the following circumstances:

-  gas alarms – exceeding of the first, second or third alarm threshold is reported by any of gas detectors connected to the control unit module,
-  defects /errors – a defect /error is reported by any of gas detectors connected to the control module or failure of communication with detectors or a defect of the control module itself.

The activated buzzer produces a modulated audible signal with 0.5 s of sound and 0.5 s of silence.

The buzzer can be switched off (deactivated) for a specific period of time. If so, the buzzer shall horn no sound, even in case when a triggering signal is active. However, after expiration of the deactivation time the buzzer is restarted (reactivated). In addition, any new gas alarm⁸ or a system defect /error that are reported during the time when the buzzer is off are capable of the buzzer reactivation. Upon disappearing of the triggering signal the buzzer goes off.

The buzzer can be deactivated by means of the keypad (see section 5.1.5), DI input (see section 4.3) and External DI input (see section 4.5). The functionality of temporary deactivation is handled in a different way for gas alarms and for defect. The possible duration of the buzzer deactivation time are:

-  for gas alarms: from 1 to 90 minutes,
-  for defects /errors: from 1 to 168 hours (1 week) or permanent deactivation (the buzzer shall never be reactivated).

The illustration below presents waveforms for the internal audible signal (under the assumption that the horn is triggered by a gas alarm and the buzzer is deactivated by means of a keypad button).

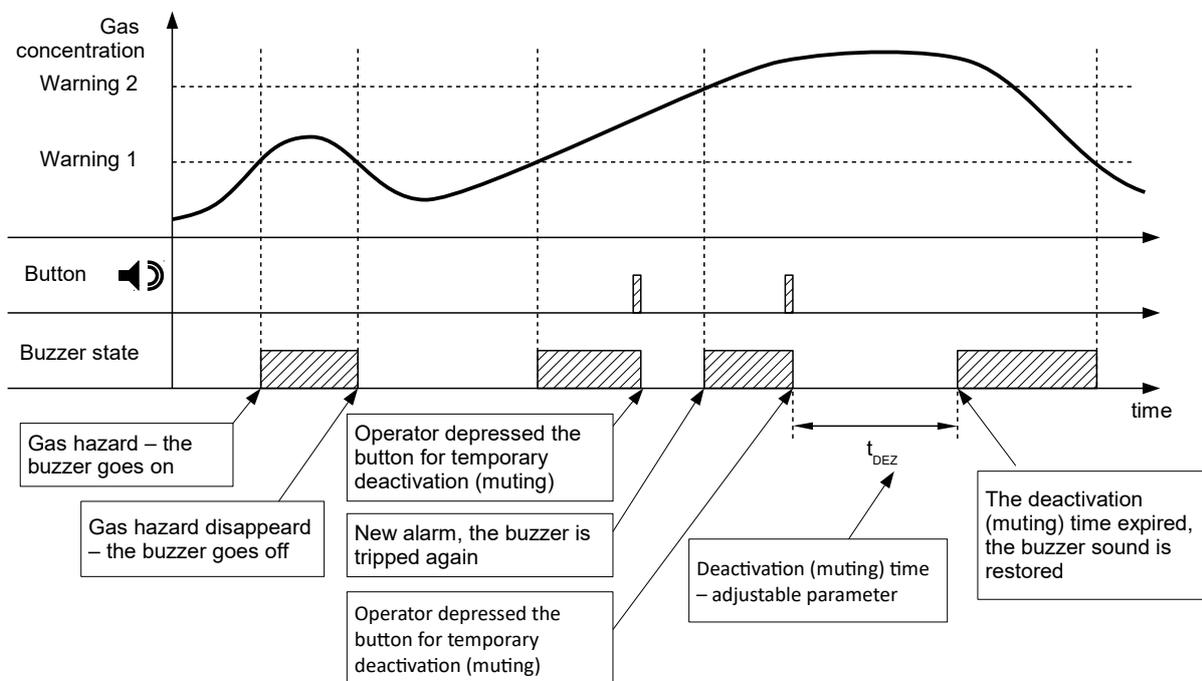


Figure 16: Behaviour of the internal buzzer – signal waveforms

⁸ A new gas alarm is understood as exceeding of the next (higher) alarm threshold on the same detector or appearing of any threshold exceeding on another detector



The buzzer can be also configured in such a way that it shall remain silent all the time. The desired configuration of the buzzer must be specified upon submission of the order (the buzzer is configured by the manufacturer at the factory workshop).

5.5 History of events

When the LED nearby the button ‘History of events’ starts blinking (see Section 5.1.5) it means that at least one event is stored in the memory.

| Button | Status /colour | Description of statuses |
|--------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | The indicator is off – the Control Unit memory is empty or a gas alarm is still pending |
| | / green | Alternate blinking – at least one event is stored, the button is activated and content of the memory can be displayed after the button is depressed. |
| | / green | Continuous light – event, stored in the memory, is currently displayed. |

Table 18: Indications of LEDs for the system status

After the button is depressed, the Control Unit Module Sigma LED displays a historical event stored in the controller memory.

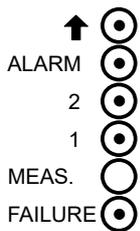


Figure 17: Interface LEDs with information about historical events

To distinguish that LED indications refer to past events instead of current status, the MEAS. indicator is always off. Historical events stored in the controller memory include:

- gas alarms, i.e. exceeding of the first or second warning thresholds or the alarm threshold,
- non-critical or critical failure of the detector.

After 10 seconds the Control Unit Module Sigma MOD LED quits presentation of historical events and returns to display the current status.

When the button ‘Memory of events’ is depressed and held for more than 3 seconds the memory of events is erased and the presentation of the current status on the front display is restored.

6 System architectures

Information about system architectures can be found in the Guide – "Sigma Gas Safety System" (POD-070-ENG) available for download at doc.atestgaz.pl/AG/POD/POD-070-ENGPrint.pdf



7 Life cycle

7.1 Transportation

The device can be shipped in the same way as new equipment of that type. If the original package or another protecting means (e.g. corks) is unavailable the conveyed equipment must be secured against shocks, vibrations or moisture by means of adequate methods and material at the own responsibility of the sender.

The device can be conveyed under environmental conditions as described in Table 19.

7.2 Mechanical mounting of detectors

The control unit module must be installed inside a control cabinet on a DIN35 rail or placed in a terminal box as shown in Figure 11. The unit must be accessible to system operators but, if possible, prevented from access of unauthorized persons. Elevation of the installation place must be convenient for operation and maintenance.

All cables and conductors connected to terminals of the control unit must be terminated with female sleeves of proper size.

7.3 Commissioning of the unit

No additional commissioning or start-up procedures are necessary after correct installation and configuration of the unit.

7.4 Utilization



This symbol on a product or on its packaging indicates that the product must not be disposed of with other household waste. Instead, it is the user's responsibility to ensure disposal of waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The proper recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. Information about relevant designated collection points can be obtained from the Local Authority, waste disposal companies and in the place of purchase. The equipment can also be returned to the manufacturer.

8 Technical specification

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Power supply | |
| <ul style="list-style-type: none"> • Voltage V_{cc} • Power | <p>10 – 34 V $\overline{\text{---}}$ 5 W</p> |
| Environment | |
| <ul style="list-style-type: none"> • Ambient temperatures T_a • Humidity | <p>-10 – +50°C 10 – 90% long term, without condensation</p> |
| IP | IP20 |
| Digital input parameters | |
| <ul style="list-style-type: none"> • R_{IN} • Inactive (not negated) • Active (not negated) | <p>10 kΩ 0 – 1 V 10 – 34 V Any polarity</p> |
| Digital output parameters | |
| <ul style="list-style-type: none"> • Relay | <p>Floating contacts, NO/NC 230 V \sim / 3 A 230 V $\overline{\text{---}}$ / 0.25 A Not protected against overloading</p> |
| Digital communication parameters | |
| <ul style="list-style-type: none"> • Port SBUS <ul style="list-style-type: none"> • Electric standard • Communication protocol • Port ExBUS <ul style="list-style-type: none"> • Electric standard • Communication protocol | <p>RS - 485 Sigma Bus RS - 485 Modbus ASCII, 19200 b/s 7E1, optionally Modbus RTU, 19200 b/s 8N1</p> |
| Integrated signalling equipment (optical) | LED controls |
| Integrated signalling equipment (acoustic) | 70dB, 0.1 m distance (only for Sigma MOD LED) |
| Protection class | III |
| Dimension | See section 3 |
| Acceptable cables | 1 – 2 mm ² (cable lugs 2 x 1 mm ² or 2 x 0.75 mm ² should be used for double wires) |
| Enclosure material | Self-extinguishing PPO |
| Weight | 0.4 kg |
| Mounting | On DIN-35 / TS35 |

Table 19: Technical specification

9 Product marking

| Product code | Device |
|--------------|-----------------------------------|
| PW-033-A | Control Unit Module Sigma MOD LED |
| PW-033-C | Control Unit Module Sigma MOD DO |

10 Configuration

| | | | |
|--------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Serial no.: | | Product revision: | Gas detector addresses: |
| SBUS port address: | ExBUS port address: | Protocols and parameters: Modbus ASCII, 19 200 7E1 <input type="checkbox"/> Modbus RTU, 19 200 8N1 <input type="checkbox"/> | |

| Output no. | Default setting (according to the manual) <input type="checkbox"/> | Configuration on customer's request <input type="checkbox"/> |
|------------|--------------------------------------------------------------------|--------------------------------------------------------------|
| R1 | WARNING 1 | |
| R2 | WARNING 2 | |
| R3 | ALARM | |
| R4 | VISUAL ALARM (locked) | |
| R5 | SOUND ALARM | |
| R6 | MEASUREMENT | |
| R7 | SERVICE | |
| R8 | FAILURE (negated) | |

| Output no. | Default setting (according to the manual) <input type="checkbox"/> | Configuration on customer's request <input type="checkbox"/> |
|------------|--------------------------------------------------------------------|--------------------------------------------------------------|
| DI1 | Mute (deactivate) the internal buzzer (not negated) | |
| DI2 | Mute (deactivate) the external sound warning device (not negated) | |
| DI3 | Reset of a locked optic /light alarm (not negated) | |
| DI4 | Alarm enforce (not negated) | |

| Button | Default setting (according to the manual) <input type="checkbox"/> | Configuration on customer's request <input type="checkbox"/> |
|--------|--------------------------------------------------------------------|--------------------------------------------------------------|
| A | Deactivation of a locked alarm | |
| B | Deactivation of an external acoustic signalling device | |

| |
|--------------|
| Note: |
|--------------|

11 Appendices

- [1] DEZG017-ENG – EU Declaration of Conformity – Sigma MOD LED, LCD, DO
- [2] PU-Z-005-ENG – Sigma Gas system – wiring diagram
- [3] PU-Z-006-ENG – The memory map for the GTW functionality in Control Unit Modules Sigma MOD LCD, Sigma MOD LED, Sigma MOD DO

EU Declaration of Conformity

Atest Gaz A. M. Pachole sp. j. declares with full responsibility, that the product:

| | | |
|-----------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------|
| (Product description) Control Unit Module | (Trade name) Sigma MOD LED Sigma MOD LCD Sigma MOD DO | (Type identifier or Product code) PW-033 |
|-----------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------|

complies with the following Directives and Standards:

-  in relation to Directive 2014/30/EU – on the harmonisation of the laws of the Member States relating to electromagnetic compatibility:
 - EN 50270:2015
-  in relation to Directive 2014/35/EU – on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits:
 - EN 60335-1:2012
 - EN 62368-1:2014
-  In relation to directive 2011/65/EU – on the restriction of the use of certain hazardous substances in electrical and electronic equipment
 - EN IEC 63000:2018
-  other:
 - EN 60529:1991

This declaration of conformity is issued under the sole responsibility of the manufacturer.

This EU Declaration of Conformity becomes not valid in case of product change or rebuild without manufacturer's permission.

Gliwice, 20.06.2022



(Name and Signature)

Managing Director
Aleksander Pachole

The memory map for the GTW functionality in Control Unit Modules Sigma MOD LCD, Sigma MOD LED, Sigma MOD DO

1 Memory map

| Registers range | Description |
|-----------------|---------------------------------------------------------------------------------|
| 40001 – 40064 | Status of detectors at channels 1 – 32 |
| 40065 – 40066 | Status of R1 ÷ R8 outputs and DI1 – DI4 inputs |
| 40067 – 40067 | Status of control unit |
| 40068 – 40099 | Temperature in measuring head of detectors at channels 1 – 32 |
| 43501 – 43503 | Interface for execution of operator commands (available only for Sigma MOD LCD) |
| 44001 – 44002 | External DI control inputs |

1.1 Detectors' statuses (read-only)

| Channel No. | Register | Name | Description | Type |
|-------------|----------|---------|-------------------------------|------------------|
| 1 | 40001 | State_A | Detector's status | flags |
| | 40002 | N | Output signal (concentration) | U16 ¹ |
| 2 | 40003 | State_A | Detector's status | flags |
| | 40004 | N | Output signal (concentration) | U16 |
| ... | ... | ... | ... | ... |
| 32 | 40063 | State_A | Detector's status | flags |
| | 40064 | N | Output signal (concentration) | U16 |

State_A – status of a detector at the specific channel. Assignment of the individual bits is listed in the table below.

| Bit | Flag | Description |
|-----|----------------------|-------------------------------------------------------|
| 0 | Collective_W1 | First warning threshold exceeded |
| 1 | Collective_W2 | Second warning threshold exceeded |
| 2 | Collective_AL | Alarm threshold exceeded |
| 3 | Collective_CrFail | Collective information about a critical failure |
| 4 | Collective_NonCrFail | Collective information about a non-critical failure |
| 5 | - | Unused |
| 6 | Gas_HiHi_Range | Gas overload |
| 7 | Sensor_Lock | Sensor locked (the last measurement result is stored) |
| 8 | Calibration | Calibration mode |

¹ U16 – unsigned 16-bit number.

| Bit | Flag | Description |
|-----|---------------------|------------------------------------------------|
| 9 | Test | Test mode |
| 10 | Warm_Up | Sensor's warm up |
| 11 | Sensor_Inhibit | Inhibit mode |
| 12 | Comm_Error | Error of communication with a detector |
| 13 | Calibration_Warning | Calibration time exceeded (non-critical error) |
| 14 | Monitoring | Measurement in progress |
| 15 | System_Stop | The system is stopped |

N – gas concentration. The value of 0 corresponds to zero concentration whilst the value of 1000 corresponds to the concentration equal to the measurement range of the detector.

1.2 Status of R1 – R8 outputs and DI1 – DI4 inputs (read-only)

| Register | Name | Description | Type / range |
|----------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 40065 | DO_Status | Status of power supply for solenoids of R1 – R8 relays Subsequent bits correspond to individual outputs: bit 0 – R1; ...; bit 7 – R8 Bit value of 1 (high): the R relay is active Bit value of 0 (low): the R relay is inactive | flags |
| 40066 | DI_Status | Status of DI1 inputs Subsequent bits correspond to individual inputs: bit 0 – DI1; ...; bit 3 – DI4 Bit value of 1 (high): the DI input is active Bit value of 0 (low): the DI input is inactive | flags |

1.3 Status of the control unit (read-only)

| Register | Name | Description | Type / range |
|----------|-----------|----------------------------|--------------|
| 40067 | CU_Status | Status of the Control Unit | flags |

CU_Status – status of control unit. Assignment of the individual bits is listed in the table below.

| Bit | Flag | Description |
|-------|-------------|-----------------------------------|
| 0 | System_fail | Collective flag of system failure |
| 1 | CU_fail | Failure of the control unit |
| 2..15 | - | Unused |

1.4 Temperature in measuring head of detectors (read-only)

| Channel no. | Register | Name | Description | Type |
|-------------|----------|-------|-------------------------------|------------------|
| 1 | 40068 | Temp. | Temperature in measuring head | S16 ² |
| 2 | 40069 | Temp. | Temperature in measuring head | S16 |
| ... | ... | ... | ... | ... |
| 32 | 40099 | Temp. | Temperature in measuring head | S16 |

1.5 External DI control inputs (read / write)

| Register | Name | Description | Type / range |
|----------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 44001 | Static_External_DI | External DI inputs – static (level controlled) Write 1 – the input value is set to active Write 0 – the input value is set to inactive Read – current status of inputs Use: source of the output activation | flags |
| 44002 | Pulse_External_DI | External DI inputs – pulse /edge controlled Write 1 – the previous status of '0': generates a single pulse at the selected input Write 1 – the previous status of '1': no action Write 0 – the input remains unaltered (the previous input value is preserved) Read – always '0' Use: temporary deactivation, latched output reset | flags |

Static_External_DI, Pulse_External_DI – assignment of individual bits is listed in the table below.

| Bit | Flag | Description |
|-----|----------------|-------------|
| 0 | External_DI_0 | Input #0 |
| 1 | External_DI_1 | Input #1 |
| ... | ... | ... |
| 15 | External_DI_15 | Input #15 |

² S16 – unsigned 16-bit number.

1.6 Interface for execution of operator commands (read /write; available only for Sigma MOD LCD)

| Register | Name | Description | Type /range |
|----------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 43501 | Command_Status | Current status of the command execution Write – data byte is ignored Read – status, the available values are: <ul style="list-style-type: none"> • 0 – inactive • 1 – command in progress • 2 – command successfully completed; the value is maintained for 5s after completion of the command execution • 3 – command execution failed, invalid command or its parameters; the value is maintained for 5s after completion of the command execution | U16 |
| 43502 | Command_Code | Code of the command to be executed Write – code of the command to be executed, loading to this register initiates execution of the command Read – current value of the command code Available values – see the description below | U16 |
| 43503 | Command_Param | Command parameter Read, write – command parameter Available values – see the description below | U16 |

List of commands:

| Command code | Description |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Detector's lock reset Execution parameters – no. of the sensor's channel where the sensor lock is to be cleared, available values: 1 – 32 |



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