GAS DETECTION PANEL

mCDG 6000

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OPERATION AND MAINTENANCE
DOCUMENTATION

ID-E384-001GB

Edition I

The mCDG 6000 gas detection control panel, which is the subject of this Operation and Maintenance Documentation, meets the essential requirements of the following European Parliament and Council (EU) regulations and European Union directives:

LVD   Directive 2014/35/EC regarding electrical equipment designed for use within certain voltage limits;

EMC   Electromagnetic Compatibility Directive (EU) 2014/30/EC.

For the mCDG 6000 gas detection panel, the Declaration of Conformity No. 1/E384/2020/PL was issued, which can be downloaded from the www.polon-alfa.pl website.

Read the content of this manual before commencing installation and operation. Failure to follow the instructions in this manual may prove dangerous or result in violation of applicable regulations.

POLON-ALFA S.A. is not responsible for any damage resulting from use that does not comply with this manual.

CE

NOTE! POLON-ALFA reserves the right to introduce changes to this manual.

A worn out product, which is not suitable for further use, should be handed over to one of the points that collect waste electrical and electronic equipment.	

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1. Introduction

1.1. Content of the documentation

This Operation and Maintenance Documentation (OMD) regards the mCDG 6000 Gas Detection Panel (Figure 1/1.).

The DTR is intended for designers, installers, and maintenance staff of mCDG 6000 control panels and contains information necessary for proper installation, programming, handling, and operation of control panels.
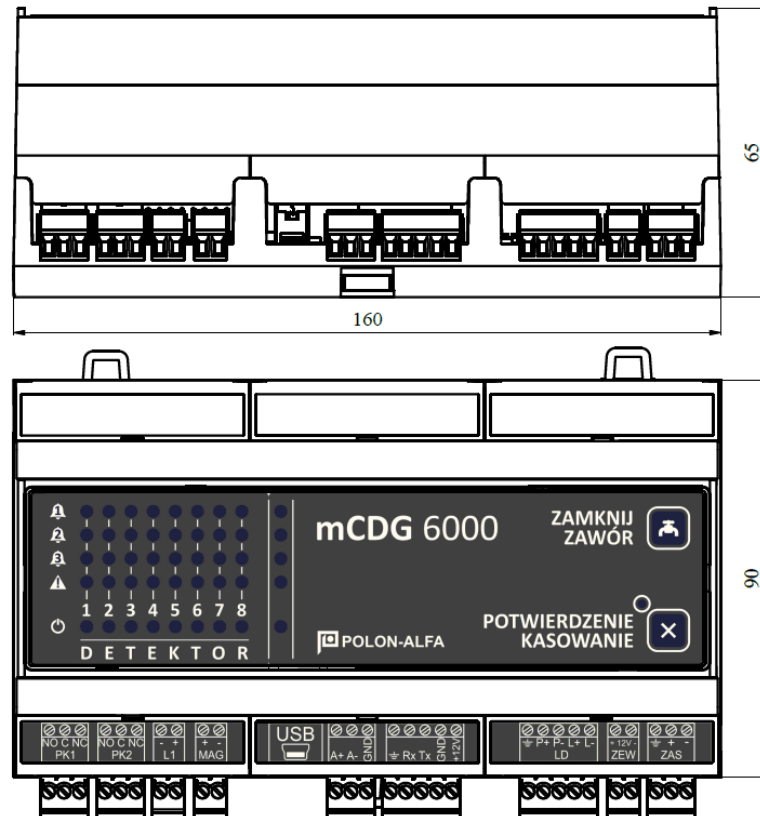
Figure 1/1 Central mCDG 6000

1.2. Intended use of the control panel

The mCDG 6000 gas detection panel (hereinafter referred to as the control panel) is a stationary microprocessor device designed to detect leakage of flammable gases and carbon monoxide.

The control panel features a detect or communication line, 2 potential-free outputs for controlling external devices, 1 universal output that can operate as a potential output with continuity check or as a input. The device is additionally fitted with a ModBus/RTU protocol, enabling integration with the POLON 6000 system through AKC-6000, and with a signal output for controlling the gas shut-off valve.

The device is designed to work in closed rooms with low dustiness, in the temperature range from -5°C to 40°C and relative humidity of air up to 80% at 40°C.

The mCDG 6000 control panel should be mounted on a DIN rail. It requires external power supply.

1.3. Safety conditions

1.3.1. Safety of plant and devices

In order to avoid unwanted interactions, the required distances between the low-voltage installation and the power and lightning protection system must be maintained.

From the point of view of the system's resistance to interference, it is recommended to use protective grounding.

Panel components are heat sensitive. The maximum ambient temperature should not exceed +40°C, and air humidity in the rooms where the device works - 80%.

No objects should be placed on the device. The control panel should be protected against penetration by water.

1.3.2. Repairs and maintenance

Maintenance works and periodical inspections must be carried out by authorized personnel of companies authorized or trained by POLON-ALFA. All repairs must be done by the manufacturer.

POLON-ALFA S.A. is not responsible for the operation of devices maintained and repaired by unauthorized personnel.

1.3.3. Fuse replacement

When replacing fuses, use substitutes of the correct type and rating. The relevant types and rated values are indicated in section 8.1 of this manual.

2. Design and component set of the control panel

An external power supply is required for proper operation of the mCDG 6000 control panel. The selection of the power supply unit depends on the control panel usage. The control panel is compatible with PSG-6000 series gas detectors.

Table 2/1 Selection of detectors from PSG-6000 series

Gas detected	CNG (natural gas)	LPG (propane-butane)	CO (carbon monoxide)	
Model	PSG-6001	PSG-6002	PSG-6003	PSG-6103
Sensor module	**MSG-6001**	**MSG-6002**	**MSG-6003**	**MSG-6003**
Sensor type	Semiconductor	semiconductor	electrochemical	Electrochemical
Sensor power supply	external 9 - 30 V	external 9 - 30 V	external 9 - 30 V	from the supervision line

Detectors connected to the control panel can be powered from an external power supply or from an external power supply line provided to the user in the control panel.

The control panel can be additionally equipped with a AKC-6000 digital communication adapter module, which extends its capabilities and enables direct cooperation of the control panel with the POLON 6000 fire alarm systems.

2.1. Arrangement of components inside the panel

The necessary connectors and location of service points are shown in Figure 2.1/1. The control panel view is shown there in condition after removing covers over connectors.
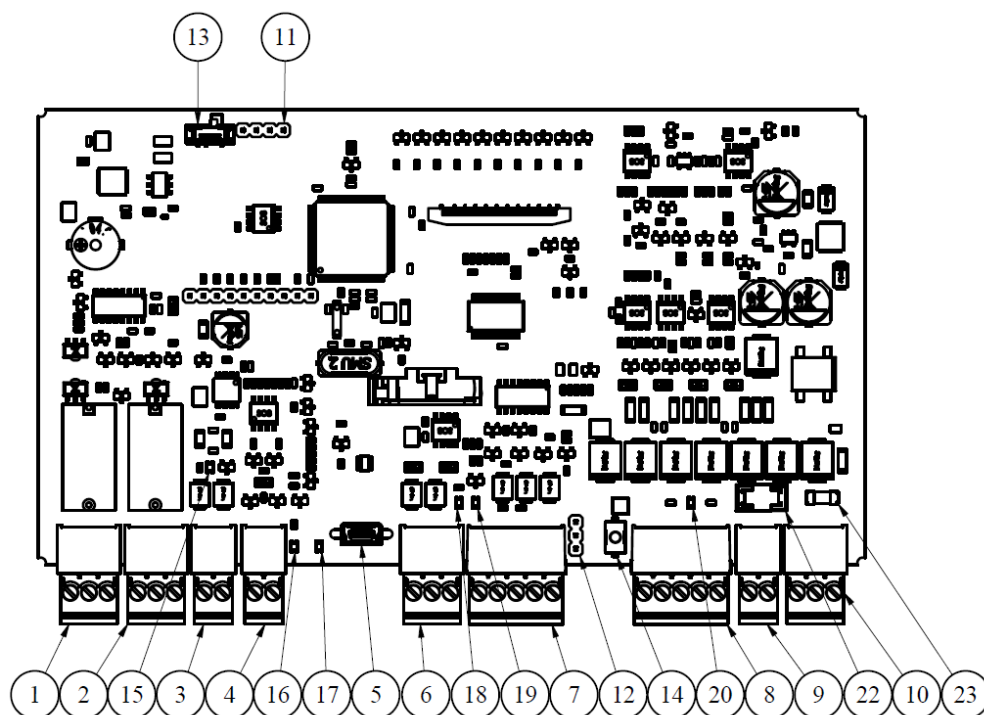
Figure 2.1/1 Layout of mCDG 6000 control panel components

1. Relay connector PK1

2. Relay connector PK2

3. Universal output connector L1

4. Signal output connector for controlling the gas shut-off valve

5. USB connector

6. ModBus/RTU bus interface

7. Connector for AKC-6000 module

8. Detection line connector

9. Power connector for external devices

10. Panel power connector

11. Programming connector

12. Activation jumper for grounding check of the detection line

13. Microcontroller programming mode switch

14. RESET button

15. Universal line modulation indicator LED

16. Shut-off valve modulation indicator LED

17. Panel indicator LED

18. ModBus/RTU protocol communication LED

19. AKC-6000 module power supply indicator LED

20. Indicator LED of the security line grounding

21. Acknowledgement/System fault indicator LED

22. External devices power supply output fuse F1 - 630 mA

23. Control panel power supply fuse F2 - 3.15 A

24. Capacitive remote valve closure button

25. Capacitive event deletion/acknowledgement button

3. Technical data

Table 3/1 Control panel technical data

POWER SUPPLY PARAMETERS	
Basic power supply voltage	+10 V ÷ +25 V, recommended: +12 V
Maximum current consumption	3.15 A
Current consumption of the POLON 6000 system addressable supervision line	< 60 mA
INPUT PARAMETERS	
Universal input in L1 supervision line mode	
Test current value (in supervision mode) Number of distinguishable input states	0.3 mA 3 + 2 (short circuit and open)
Supervision line	
Maximum number of detectors per detection line	8/4/2
Maximum supervision line load current / maximum line conductor resistance:	50 mA / 2 x 45 Ω 20 mA / 2 x 100 Ω 22 mA / 2 x 75 Ω
Maximum resistance of line conductors between successive elements: Maximum allowable capacity of line conductors: Minimum insulation resistance of the system conductors:	40 Ω 300 nF 100 kΩ
AKC-6000	
AKC-6000 device supply voltage Maximum load current Data transmission	Control panel supply voltage 50 mA Serial
OUTPUT PARAMETERS	
External device power supply output:	
External power supply line voltage Continuous current available from external power line	Control panel supply voltage 500 mA
Relay outputs PK1 - PK2	
Current-voltage load capacity of NO/NC contact	5 A / 250 V AC 5 A / 30 V DC

Shut-off valve control output:	Supply voltage of the control panel
Output voltage	
Maximum output current	50 mA
Control pulse time (programmable)	from 0.2 to 1 second
Minimum time between control pulses (programmable)	from 10 to 60 seconds
Universal output in potential output mode L1	
Output voltage	Control panel supply voltage
Maximum output current	1.5 A
Test current value (in supervision mode)	0.3 mA
ENVIRONMENTAL PARAMETERS	
Transport temperature	-25°C ÷ +55°C
Operating temperature	-5°C ÷ +40°C
Permissible operating relative humidity	80% at +40°C
STRUCTURAL PARAMETERS	
Dimensions (incl. connectors) L x H x D	160 x 100 x 65 mm
Weight (without batteries)	< 0.25 kg

4. Description of functions

4.1. General description

The mCDG 6000 gas detection panel is designed to signal and respond to gas leaks or exceeded gas concentrations and enables:

- detection of exceeding three gas concentration thresholds,

- automatic or manual generation of signal for closing the shut-off valve,

- automatic control of three devices,

- checking the condition of the devices,

- automatic control of the panel's own circuits and systems,

- transmitting basic information about alarm, fault and status of activated devices to master systems (e.g. by means of AKC-6000 or ModBus/RTU protocol).

4.2. Basic operating states of the control panel

4.2.1. System start

When starting the system, subsequent rows of indicator lights on the control panel board will light up in a flowing manner from top to bottom. It takes about 15 seconds for the system to boot. During this time the detection line does not detect and react to events.

4.2.2. Sensor warm-up

For installed sensors that need to be warmed-up, a warm-up mode will start after the system starts. It lasts about 1 minute and can be recognized by the lights lighting up progressively from bottom to top.

4.2.3. Supervision

During supervision, the extreme right power supply indicator light with the ⏻ marking should be lit continuously on the control panel board.

The indicator light described above should also be lit continuously for each of the declared and detected sensors.

4.2.4. Alarm signalling

The control panel can signal three alarm levels.

The current alarm level of the control panel is shown by means of indicator lights in the right end, which are marked with 1 2 and 3. This is the sum of alarms from all detectors connected to the control panel. When an alarm occurs in any of the detectors, the warning light on the control panel and the light in the column of the respective detector are lit. In addition, a continuous beep is generated, which can be switched off if necessary via the configurator.

Flashing indicator LEDs and intermittent sound signal notify of alarms stored. An alarm condition can also be generated by using a input line.

4.2.5. Fault indication

The control panel has an extensive system of diagnostics of the device itself and the external devices connected. Summarized information about the fault is presented by means of the indicator light in the right end position on the device panel and marked with the ⚠ icon.

The occurrence of a fault in any of the detectors is indicated by lighting the above-mentioned indicator light in the column corresponding to the respective detector. System and panel faults result in the indicator light in the column corresponding to the panel condition (right end column) becoming lit. Analogously to the alarms, a continuous beep is generated that can be turned off using the configurator, if necessary. Flashing indicator lights and an intermittent beep indicate stored faults.

A list of possible faults can be found in Table 4.2.5/1.

Table 4.2.5/1 Faults in the gas detection system

	Detector faults	
1	Fault in detector base	
2	Failure of the detector base EEPROM memory	
3	Sensor does not respond or there is no sensor	
4	30 days left of sensor calibration validity	
5	The sensor calibration date has expired	
6	Sensor fault	
7	Detector does not respond or there is no detector on the line	
8	Sensor EEPROM memory failure	
9	Incorrect sensor type	
10	Warming up during operation	
11	Activation of the short circuit isolator	
	Input line faults	
12	Input line short circuit	
13	Break in the input line	
	External line faults	
14	The device has not reached the expected state after activation	
15	The device has not reached the expected state after shutdown	
	Control panel faults	
16	Panel supply voltage too high (above 25.5 V)	
17	Panel supply voltage too low (below 9 V)	

18	No 24 V power supply to detection line	
19	12 V output fuse defective	
20	Failure of the control panel internal memory	
21	AKC module not responding	
Detection line faults		
22	Undeclared elements on the line	
23	Replaced elements on the line	
24	Line earthing	
25	Break in the loop line	
26	Short circuit of the line start	
27	Short circuit of loop return	
28	Incorrect RC loop parameters	

To check the type of fault, connect the control panel to a computer and, using the configurator, read the current events from the control panel status window (icon) or display the event log (icon). The most important faults from the point of view of system functioning can be identified on the basis of flashing of the indicator lights.

The table below shows the available signals.

Table 4.2.5/2 Available signals

Detector faults		
Item	**Fault**	**Signal description**
1	Detector does not respond or there is no detector on the line	The fault indicator light of the respective detector is lit continuously, the power LED flashes slowly
2	30 days left of sensor calibration validity	The fault indicator light of the respective detector is lit continuously, the power LED flashes quickly
3	The sensor calibration deadline has expired	The fault indicator light of the respective detector is lit continuously, the power LED emits one short pulse.
Control panel faults		
Item	**Fault**	**Signal description**
4	Panel supply voltage too high (above 25.5 V).	The fault indicator light of the control panel is lit continuously, the power LED flashes quickly
5	Panel supply voltage too low (below 9 V)	The fault indicator light of the control panel is lit continuously, the power LED flashes for a short time
6	Defective fuse for external devices power supply output	The fault indicator light of the control panel is lit continuously, the power LED flashes slowly

4.2.6. Detector location

The control panel is equipped with a function locating an element on the line, which activates the signaling LED in the detector. To activate this function, double-click the left mouse button on the desired item in the configuration window, on the Detectors tab. Activation of the function is indicated by the appearance of the dot icon in brackets shown in Figure 4.2.6/1.

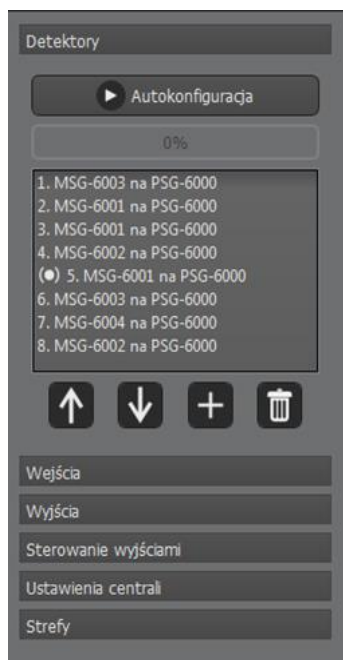To disable this function, double-click the item again with the left mouse button.

Figure 4.2.6/1 Running function for locating the detector No. 5

When a magnet is applied to the detector at the nameplate location, the locating function in the control panel is activated. All indicator lights on the control panel under the number of the detector being located will go out and the power indicator light will flash rapidly. When the magnet is removed, the control panel returns to its previous state.

System faults

In the event of the microcontroller fault or incorrect functioning thereof, the control panel will enter the system fault status, the symptom of which is the RESET/ACKNOWLEDGE LED becoming lit and the PK1* relay becoming switched.

If a system fault occurs, disconnect the control panel from power supply for 1 minute and turn power back on. If the situation repeats, contact the manufacturer's technical support department.

* Because the PK1 relay is used as a system fault relay, it is recommended to configure it for fault-related applications.

4.3. Reading the control panel software version

The device allows reading the control panel software version in two ways.

4.3.1. Reading the control panel software version from the device level

In order to read the software version from the device level, press the RESET/ACKNOWLEDGE button five times. The software version is displayed on the panel in binary code. The version should be read from the right. The extreme right column is responsible for the value after the decimal point. The adjacent column represents the unity part and the third column from the right represents the decimal part of the software version. This mode will be turned off after 5 seconds.

4.3.2. Reading the control panel software version from the configurator level

In order to read the panel software version from the configurator software level, it is necessary to switch on the control panel status window. At the bottom left corner, the uploaded panel software version is visible, as shown in Figure 4.3.2/1
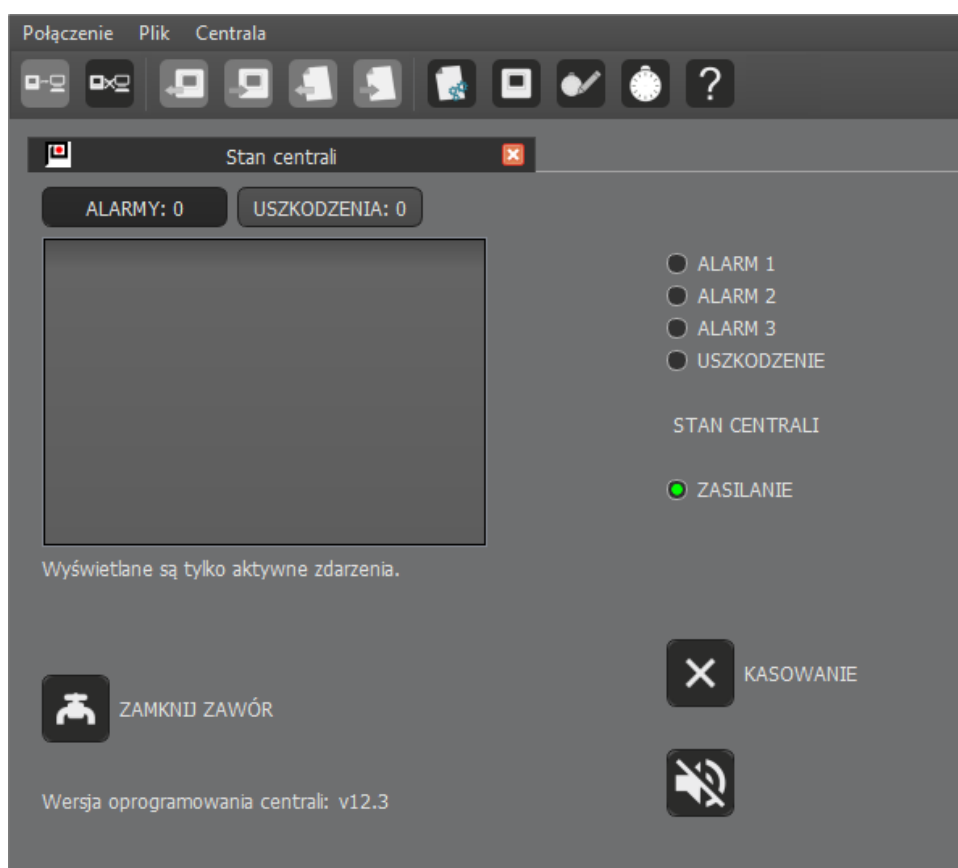

Figure 4.3.2/1 Control panel status

4.4. Control of acoustic signaling

The buzzer is custom free configurable.

4.4.1. Permanent deactivation of the buzzer

The configurator allows to permanently switch off the buzzer. No event will trigger the acoustic signaling, and on the control panel, the RESET/ACKNOWLEDGE LED will emit a single quick flash.

In order to activate the function, uncheck the "Enable buzzer:" item in the "Control panel settings" tab of the configuration. The buzzer is in the active state by default. It is not recommended to permanently turn off the buzzer. The settings window is shown in Figure 4.4.1/1.
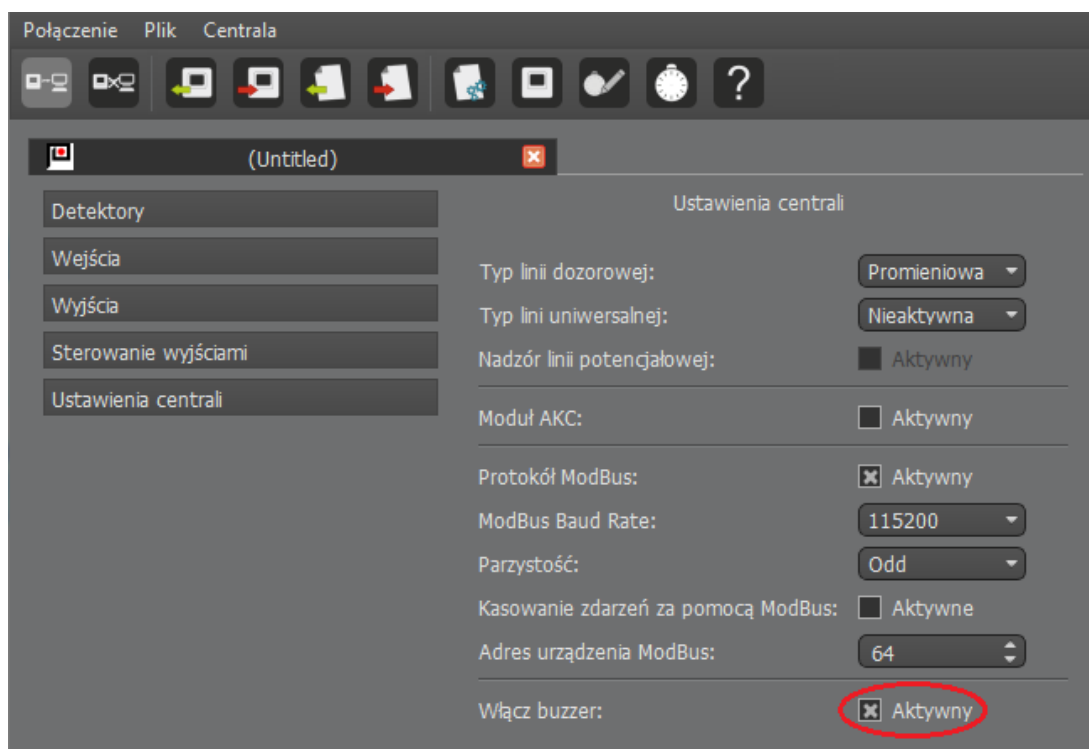

Figure 4.4.1/1 Control panel settings window

4.4.2. Switching off acoustic signalling temporarily from the configurator level

The configurator allows to disable the buzzer temporarily from the configurator level. This is possible in the status window of the panel. In the lower right corner there is an [icon] icon indicating a switched on buzzer, which, after clicking on it, activates a temporary acoustic signaling switch-off . The function is active for 60 minutes or until the icon is clicked again. When the timed deactivation of acoustic signaling is on, no event triggers the buzzer, the icon in the configurator changes to the one shown in Figure 4.4.2/1 and the RESET/ACKNOWLEDGE indicator light is lit on the control panel board.

Using this feature is recommended for installers during system configuration. When the works are complete, be sure to reactivate the buzzer.
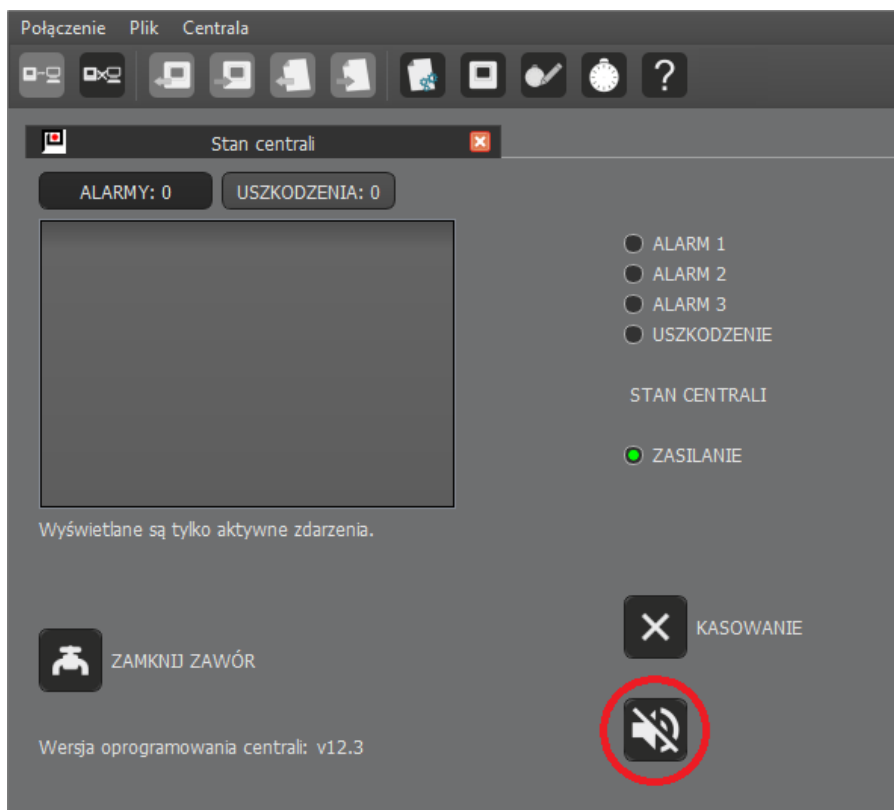
Figure 4.4.2/1 Status window with the panel muting function activated

4.4.3. Event acknowledgment

The mCDG 6000 features an event acknowledgement function.

When an alarm is triggered or a system fault occurs, you can touch the RESET/ACKNOWLEDGE button to silence the panel. The function is active for 30 minutes or until a new event occurs. The yellow LED next to the button will light up then.

When the fault or alarm is cleared, the acknowledgement function will prevent the periodic acoustic signalling appearing with the stored events.

5. Connecting external circuits

5.1. Connecting the control panel power supply

The control panel is supplied with DC voltage within the range of +10 V ÷ +25 V. Exceeding acceptable voltages causes adequate faults visible on the control panel board and deactivation of the detection line functioning.

The device is equipped with protection against reverse polarity of the power supply. It is recommended to connect the ground wire to the power connector terminal featuring the ⏚ icon in order to provide additional protection for the detection line.

5.2. Power supply output for external devices

The control panel provides voltage to power detectors and external devices. The maximum current that can be drawn from this output is 500 mA. The output is protected by a NANO2 630 mA fuse. The state of the fuse is supervised by the control panel – its malfunction will result in a fault being signalled.

5.3. Detection line input

The gas detectors are connected to the mCDG control panel by a specially designed detection line. Each detector is assigned a unique address. This allows the control panel to report the status of each detector.

The detection line can operate in two modes, radial (open) or loop. In the loop line mode, the end of the line is connected to the control panel. This ensures that the system is able to work properly even if the line is broken in one point. There is no line continuity supervision in the radial line mode. When performing the configuration, pay special attention whether all the connected sensors have been detected.

Care has also been taken to ensure that the line is short-circuit proof. There are isolators in the detectors which, when switched on, isolate the short circuit to ensure that the maximum possible number of detectors continue to operate correctly.

When connecting the detection line wires to the control panel, pay special attention to the polarity of the lines, as well as the correct connection of the wiring shielding to the corresponding terminal.

The supervisory line connector designations are shown in Table 5.3/1.

Table 5.3/1 Description of the supervision line connector

Name	Function
L L+	Line start
P. P+	Loop return input
E	Shielding connector

5.4. Connection of AKC-6000 module

In order to integrate the SDG 6000 system (with the mCDG 6000 control panel) with POLON 6000, an additional AKC-6000 module should be used. The AKC connector is intended for making the connection. The designations of that connector are described in Table 5.4/1. The power supply of the device has been limited to 50mA. The wiring diagram for connecting the AKC-6000 to the gas detection panel is shown in Figure 5.4/1.
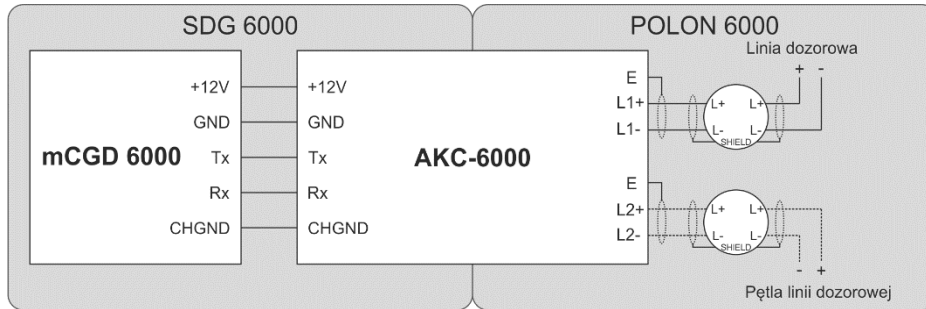

Figure 5.4/1 Connection diagram for connecting AKC-6000 to mCDG 6000.

Table 5.4/1 Description of the AKC-6000 connector

Name	Function
+12V GND	Power supply for the AKC-6000 device
Tx Rx	Communication lines of the AKC-6000 device
E	Shielding connector

5.5. Connection via ModBus/RTU protocol

The device enables communication with control and supervision systems, using the RS485 serial transmission standard using the Modbus protocol (two-wire connection). To establish communication, connect the wires according to Table 5.5/1.

The ground (GND) output is protected and used for algnment voltage levels between devices.

Table 5.5/1 ModBus/RTU communication interface description

Name	Description
A+	Signal not inverted
A-	Signal inverted
GND	Ground for voltage leveling

5.6. Connecting the panel to the configurator via USB port

To upload a configuration to the control panel, connect it to a computer. A MINI USB type connector was used for this purpose. In case of longer distances between PC and the control panel it is necessary to use a so-called active extension USB cable. Once connected, the device will be automatically installed and then it will be detected by the configurator program. Control panel detection can be recognized by highlighting the "Connect" icon, (Figure 5.6/1). The device should be seen as a USB Serial Port (COMxxx). Establishing an active connection with a the control panel is done by clicking the icon.
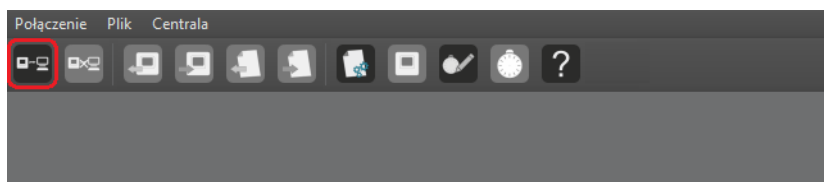

Figure 5.6/1 Selected active connection icon

5.7. Gas shut-off valve control signal output

The control panel has an output intended for controlling triggering of shut-off valves. The output generates a pulse with supply voltage and has a built-in protection, limiting the maximum current to 50 mA. The pulse time can be programmed from 0.2 to 1 s.

The output features software protection against destruction of the valve solenoid. This protection limits the possibility of the valve next triggering with specific pause time.

Note!
The unit does not allow direct connection of a shut-off valve due to insufficient current output capacity.

5.8. Universal output

The control panel is equipped with a freely configurable universal output. The operation mode should be selected from the configurator level on the control panel settings tab. The available options are shown in Figure 5.8/1.
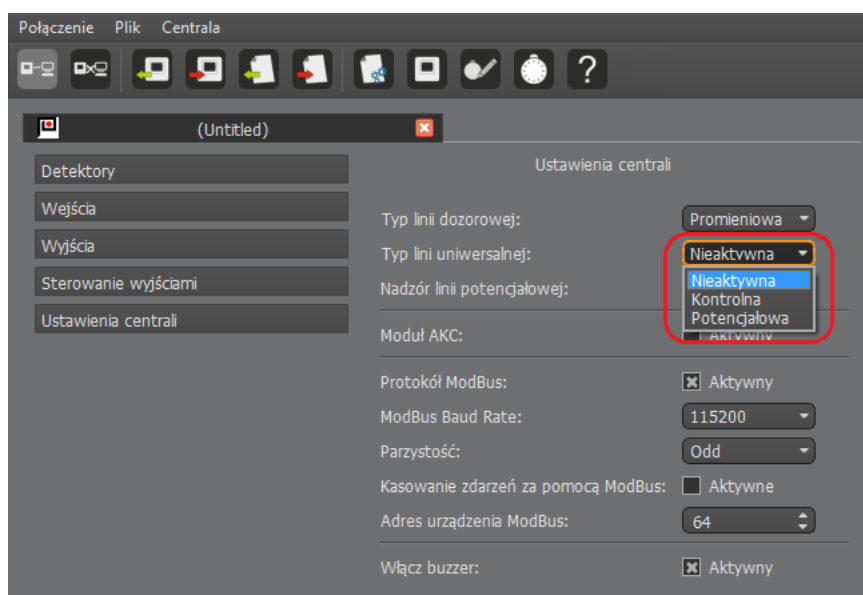

Figure 5.8/1 Universal line settings window.

5.8.1. Input line

The input line can be used for receiving alarms from external devices or supervise the operation of devices controlled directly from the control panel. The control line is a parametric input. In addition to short-circuit and break detection, the input senses between three resistance ranges. This allows the input to be fully supervised, providing a fully fault-resistant connection to an external device. The description of the states is shown in Table 5.8.1/1.

Additionally, there is a possibility of remote deletion of events by means of a control line by attaching the input with 750 Ohm resistance. For the purpose of input supervision, remember to connect the 2k ÷ 6.3k Ohm EOL resistance. Otherwise, a fault will occur, indicating a break on the line.

Table 5.8.1/1 Control line states

Resistance level	Description
R < 240 Ω	Short circuit
R = 750 Ω	State 1 (Y active)
R = 2 kΩ	State 2 (X active)
R = 6.3 kΩ	State 3 (Supervision)
R > 12 kΩ	Break

For each range of resistance it is possible to assign any system reaction and the control line can cooperate with an contact switch. Only short-circuit and break states will be supported then.

Full utilization of the panel's capabilities requires using resistors. Figure 5.8.1/1 shows how to connect a single external device contact. Such a connection ensures supervision of the wires in case of a short circuit or a disconnection.

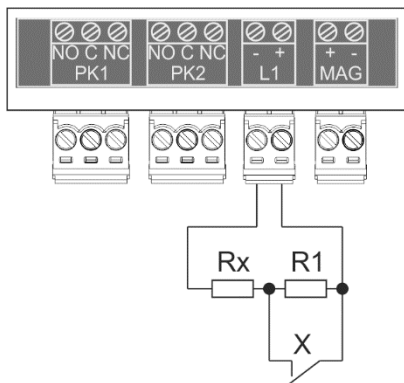The full use of the input line capabilities is shown in Figure 5.8.1/2.

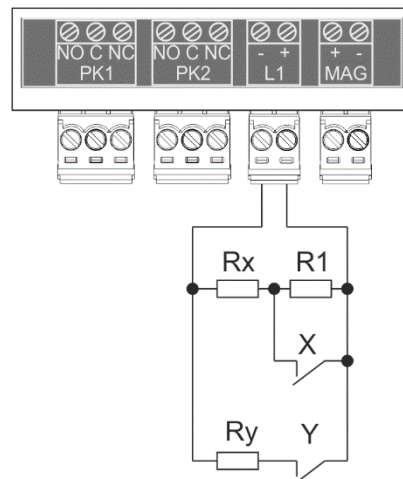*Figure 5.8.1/1 Supervising a control input with 3 states*

Figure 5.8.1/2. Connection of a single control contact

5.9. Potential output lines

The potential line can be used to power external devices, with additional line continuity supervision. The current capacity is 1.5 A. The supply voltage is present on the output, reduced by approximately 1.2 V. The connection diagram is shown in Figure 5.9/1.
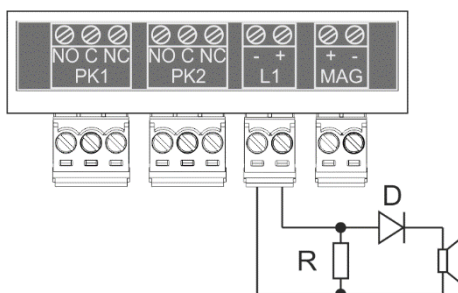

Figure 5.9/1 Wiring diagram for potential output.

To disable the continuity check, uncheck the "Potential line supervision" box in the control panel settings. The location of the setting is shown in Figure 5.9/2. In this case it is not necessary to use a terminating resistor, but a diode with sufficient current capacity is still required, e.g. 1N5401. The potential line is protected by an electronic fuse which cuts off voltage in case of a short circuit or overload. The output will not be activated when a short-circuit is detected and it will switch on automatically after the short-circuit is removed.
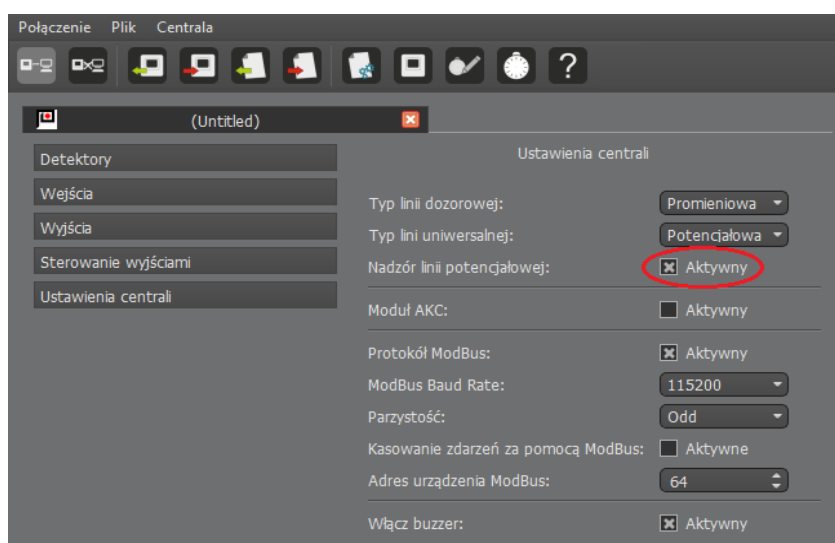

Figure 5.9/2 Setup of potential line supervision.

5.10. Control relay outputs

The control panel has two universal relay outputs for controlling external devices. Relay outputs are potential-free and can operate with DC or AC current. Table 5.10/1 shows the description of the relay contacts.

Name	Function
NO	Normally open contact (OFF)
C	Common contact
NC	Normally-closed contact (ON)

6. Configuring and programming the control panel

Configuration and programming of the mCDG 6000 control panel is performed using the *mCDG6000 Configurator* PC application.

mCDG6000 Configurator allows:

- configuring control panel operation parameters, including:

    - saving configuration to a file

    - reading configuration from a file

    - sending configuration to the control panel

    - reading configuration from the control panel

- reading the event log, including:

    - writing the log to a file

    - reading the log from a file

    - reading the log from the control panel

    - printing the event list

    - saving to PDF

    - deleting the list of events

- status monitoring and remote control over the control panel

- setting and reading the control panel system date and time

- using context-sensitive help for the software.

6.1. Configuring the control panel

To start configuring the control panel, create an empty configuration. This is done with the [icon] icon, which, when pressed, will display a window for entering the configuration name. The configuration tab, shown in Figure 6.1/1, will open then. The icons for reading the configuration and writing it to a disk are active then. In addition, if communication with the panel has been established, the icons for reading and sending the configuration to the panel are also active.

In the left part of the tab there is a menu with system elements that can be configured.

These elements are grouped into categories:

- Detectors,

- Inputs,

- Outputs,

- Output control

- Setting up the control panel

- Zones.

Figure 6.1/1 Window with empty configuration tab

6.1.1. Configuring the detectors

At the beginning of the operation, the line should be autoconfigured. This procedure detects all detectors connected to the control panel. To start the autoconfiguration, press the "Autoconfigure" button. The procedure continues until the "Auto-configure" button is available again. The progress of the process is shown below as a percentage.

When the procedure is complete, all detectors connected to the control panel should appear in the list. When you click on an item, detailed detector information will be displayed on the right side of the window, which is shown in Figure 6.1.1/1. Also, for each detector it is necessary to set the required sensor type for it to work with. During operation, the control panel constantly checks whether there is a working sensor of the required type in each base.
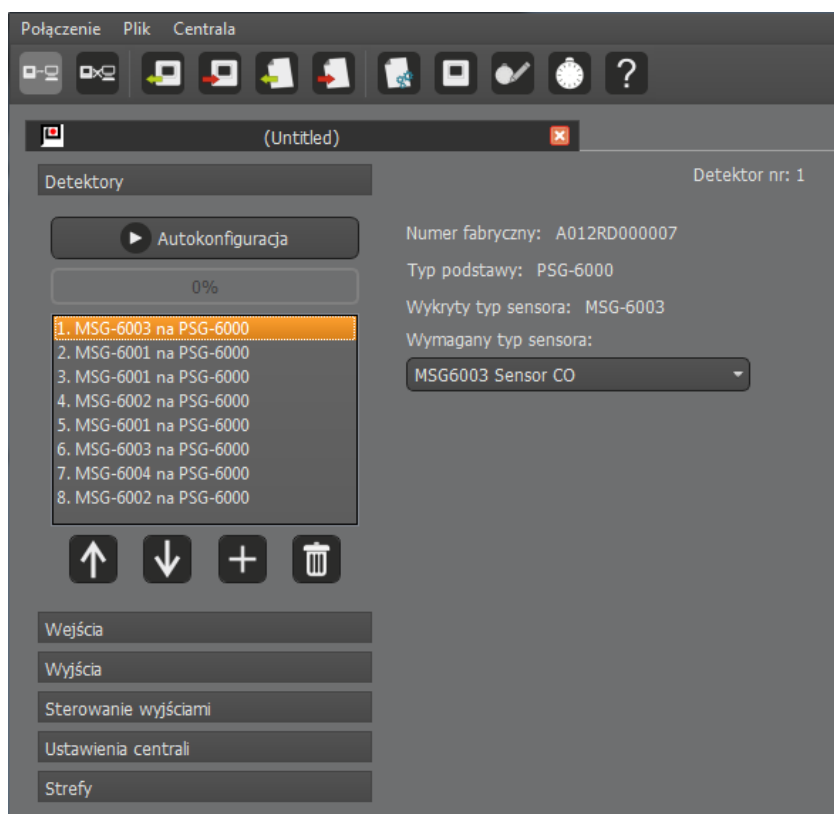
Figure 6.1.1/1 Detector settings

6.1.2. Configuring the control inputs

The inputs of the mCDG control panel can operate in four modes:

- Status check,

- Activation supervision,

- Alarm input,

- Remote deletion of the event log.

The first mode allows you to check the state of an input in order to link its states with the relay modulations. In this mode, you decide only whether a short-circuit state and a break state should cause a fault indication.

The activation supervision mode is designed to supervise panel-controlled devices. This makes it possible to continuously check external devices and report information about their malfunctioning. In

order to control the operation of a controlled device, it must have contacts that provide feedback about its state. An example connection is shown in Figures 5.8.1/1 and 5.8.1/2.

In the Activation Status area, select the output to which the controlled device is connected from the drop-down list. The delays of turning on and off are set here as well. This is the time for changing the state of the device. The delay timer starts after each change of state of the control relay. If, after the delay time has elapsed, the status of the input which controls a given device does not change, the control panel will report a fault of the device controlled.

The alarm input mode allows you to receive alarms from external devices, other than detector connected to the detection line. In this mode, you set for which resistance levels the control panel should report individual alarm levels. Alarms received from inputs affect the overall alarm status of the control panel.

The events displayed on the control panel are deleted by a pulse input load with resistance of 750 Ω in the remote erase mode. The duration of the deleting pulse should be 5 seconds and it must not exceed 60 seconds. If time is exceeded, the panel will report a short circuit error on the input line. In remote erase mode, the control input is supervised. The EOL resistance should be a resistor within range of 2k ÷ 6.3k Ω.

6.1.3. Configuring the control outputs

The mCGD control panel has two relays - one universal line which can operate as a potential output, and a signal output controlling a gas cut-off valve. In order to properly configure the operation of the outputs, you must first enter the activation configuration. In the next step, you set up the modulation logic.

In addition to the continuous activation mode, the relays and the potential output can operate in the following modes:

- – time mode - allows to generate a single pulse of a duration (activation time),
- – pulsed mode - the relay continuously generates pulses with preset time parameters: pulse duration (activation time) and pause time,
- – counted pulses - the relay generates a set number of pulses with set time parameters.

In addition, it is possible to enter a activation delay and a shutdown delay.

A special control output is the output for triggering the shut-off valve. For this output, the configuration tab contains settings for the pulse duration and the minimum pulse interval time.

Note!
The settings for the pulse controlling the shut-off valve must be as recommended by the manufacturer of the valve being controlled. Failure to do so may result in valve ineffectiveness or damage.

The unit does not allow direct connection of a shut-off valve due to insufficient current output capacity.

6.1.4. Configuring the activation logic

You can set an independent activation criterion for each control output of the control panel. A criterion consists of 1 to 4 conditions that form a scenario of events that must be fulfilled for the output to be activated. Each of the four events can be negated so that its absence is a condition for output activation. Additionally, it is possible to specify whether the occurrence of one of the four events or all of the active events is required to meet the criterion. A gray, blank control settings field indicates that the control output operation mode has not been specified. The configuration window is shown in Figure 6.1.4/1 and the configuration options are shown in Table 6.1.4/1.
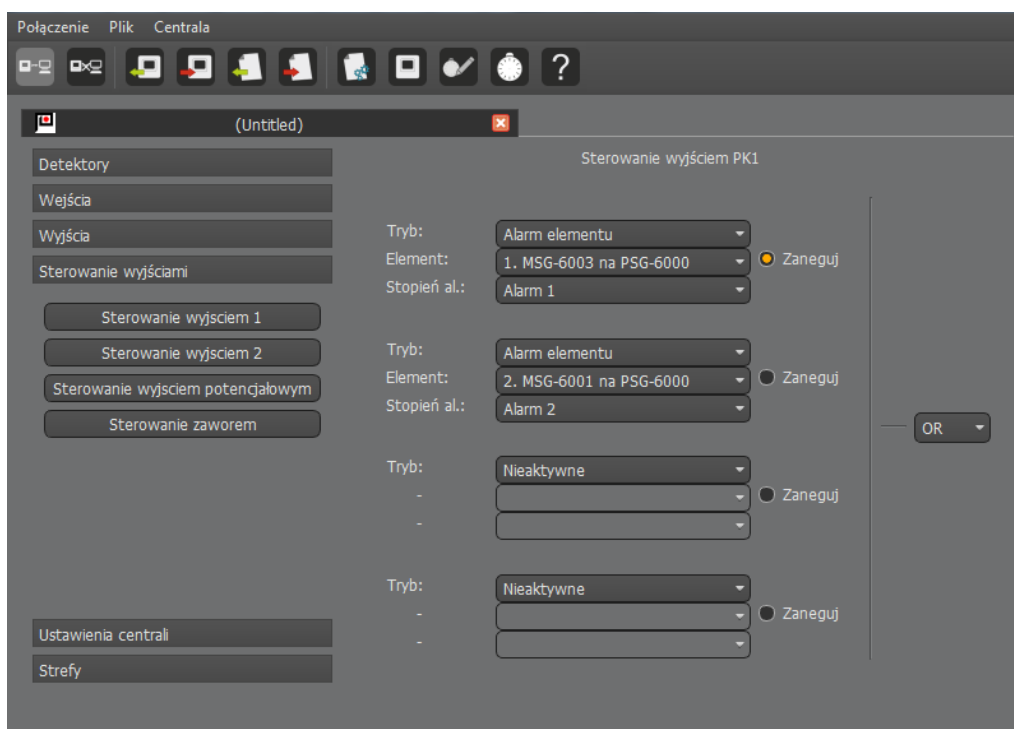
Figure 6.1.4/1 Modulation logic configuration window.

Table 6.1.4/1 Configuration options for control panel outputs

Type of event	System element	Type of event	Description
Input line status	LK input	Short circuit	Short circuit in input line
		Break	Break in the input line
		Device On	'Device on' status in the input line
		Device Off	'Device off' status in the input line
		Device - status change	Change of device status in the input line
		Supervision	Supervision status in the input line
		Alarm 1	'Alarm 1' status in the input line

		Alarm 2	'Alarm 2' status in the input line
		Alarm 3	'Alarm 3' status in the input line
		Status X	'Alarm X' status in the input line
		Status Y	'Alarm Y' status in the input line
		Status Z	'Alarm Z' status in the input line
Element Alarm	Detectors from 1 to 8	Alarm 1	Alarm 1 for the respective detector
		Alarm 2	Alarm 2 for the respective detector
		Alarm 3	Alarm 3 for the respective detector
Element fault	Detectors from 1 to 8	Any	Any fault of the respective detector
Control panel alarm	-	Alarm 1	1st level alarm for the control panel
		Alarm 2	2nd level alarm for the control panel
		Alarm 3	3rd level alarm for the control panel
Stored alarm of the control panel	-	Alarm 1	Stored 1st level alarm for the control panel
		Alarm 2	Stored 2nd level alarm for the control panel
		Alarm 3	Stored 3rd level alarm for the control panel
Fault	Elements	Any	Any fault of any element
	Control lines		Any fault of any control line
	Devices		Any fault of any device in the trip control
	System		Any system fault
	Any		Any fault
Stored fault	Elements	Any	Any stored fault of any element
	Control lines		Any stored fault of any control line
	Devices		Any stored failure of any of the devices in the trip control
	System		Any stored fault of the system

		Any		Any stored fault
Alarm detector groups	Detector groups MSG-6001 ÷ 6003	Alarm 1		1st level alarm for the selected detector group
		Alarm 2		2nd level alarm for the selected detector group
		Alarm 3		3rd level alarm for the selected detector group
Zone alarm	Zones from 1 to 8	Alarm 1		Alarm 1 for selected zone
		Alarm 2		Alarm 2 for selected zone
		Alarm 3		Alarm 3 for selected zone
Zone fault	Zones from 1 to 8	Any		Any fault for a given zone

6.1.5. Setting up the detector line and the AKC-6000

The settings for the detection line and the AKC-6000 are located in the configuration tab called *Control Panel Settings.* A detection line can operate as a loop line or a radial line. In loop mode, the end of the line (loop return) is connected to the control panel. This allows the detector line to work properly even if the line is broken at one point. Thus, a single short-circuit on a line can be isolated by adjacent components without losing communication with any of them. In the case of a radial line, the continuity of the line is not checked. Any short circuit cuts off the communication of the components downstream of the fault.

The AKC module allows the control panel to operate as a line element of the POLON 6000 system. For such a cooperation to be possible, the control panel must be equipped with the AKC module, and the "AKC Module: Active" option must be selected in the *Control Panel Settings* tab. The connection of the AKC module is described in section 5.4.

6.1.6. Zone configuration

The configurator in version v1.6 introduces an additional functionality - zonal activations. The settings are located in the "Zones" tab of the system configuration. The configuration view is shown in Figure 6.1.6/1.
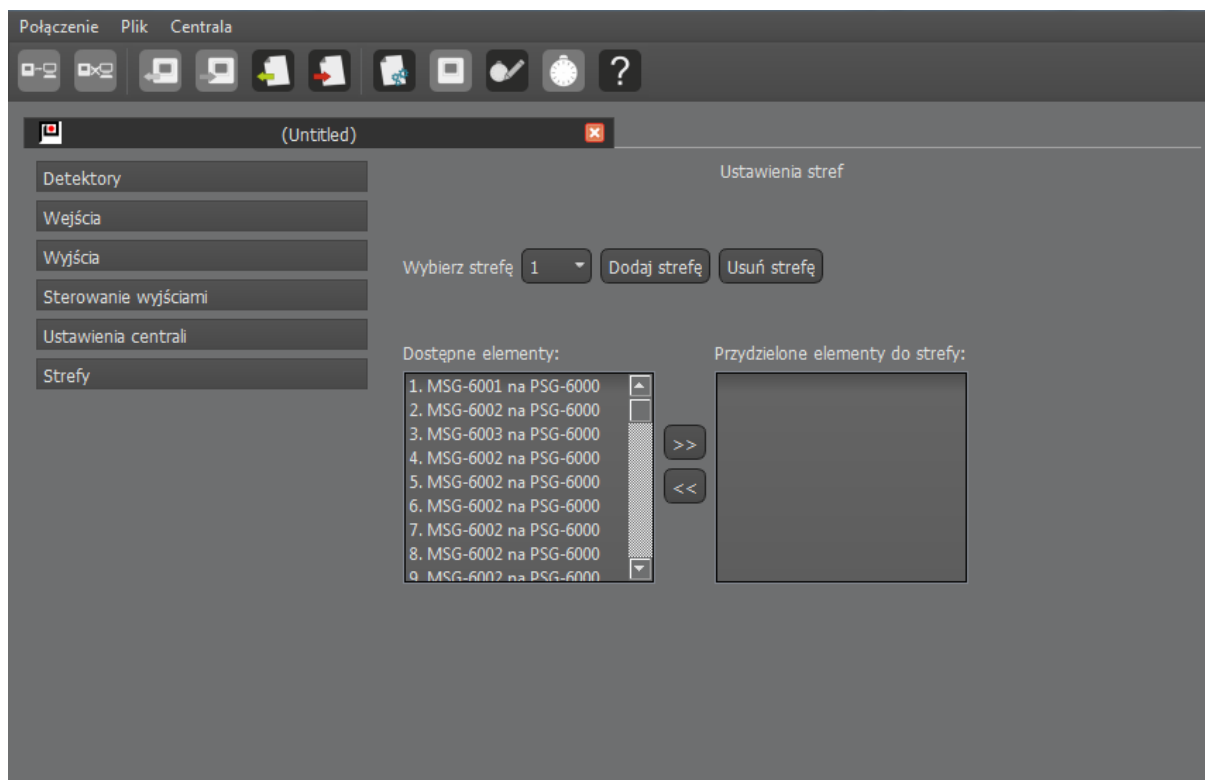
Figure 6.1.6/1 Zone configuration window

To define a zone, add it with the "Add zone" button. There are unused items in the left window. The detectors assigned to the zone are displayed on the right. To add items to the zone, click the button with the arrows to the right, and to delete them, click the button with the arrows to the left. You can select more than one element. The "Delete Zone" button moves all items assigned to the zone to the "Available Items" window.

6.2. Event log

All circuits of the CDG 6000 control panel are controlled. Any fault is reported and recorded in an event log with a capacity of 5000 entries. When the memory space is exceeded, the oldest events are over-written by new ones.

The event log can be read using the *mCDG600 Configurator* application. When you select the icon, the event log tab will appear as shown in Figure 6.2/1. To read the log from the control panel,

use the ![icon] icon The configurator allows to save the log on a computer disk. To do this, use the ![icon]

icon. To read a log from a previously saved file, click ![icon] .
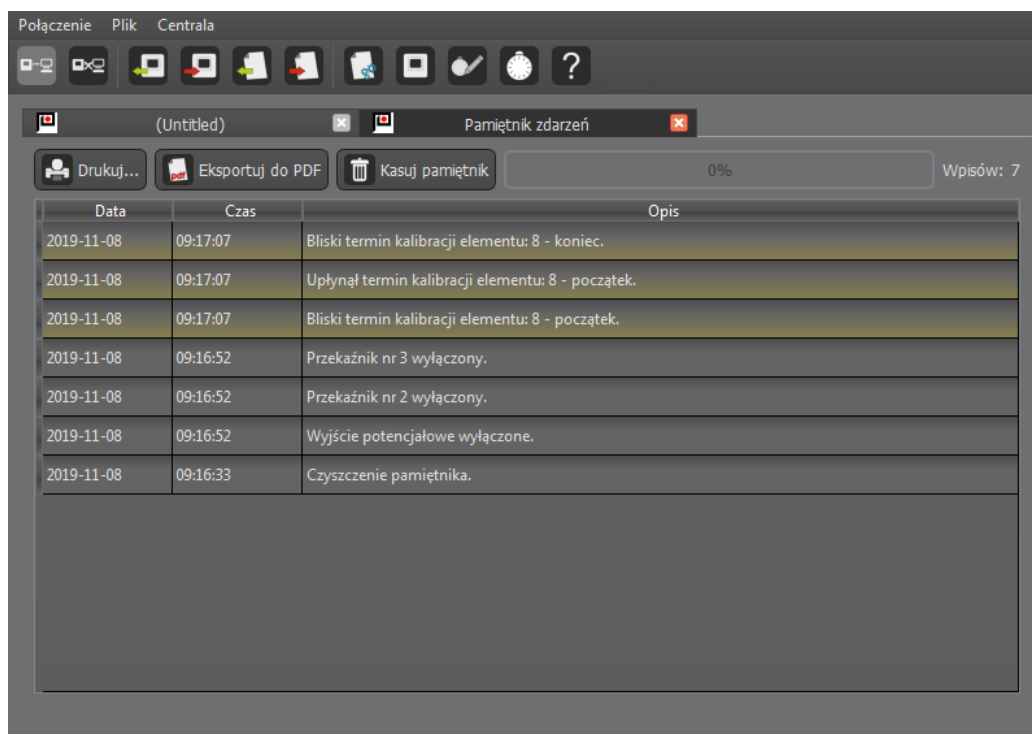
Figure 6.2/1 Log with events from mCDG 6000 control panel read

6.3. System time

To set the date and time of the control panel, select the ![icon] icon. This will open a window with current settings of the control panel and current data downloaded from the system. It is possible to switch off the automatic summer/winter time switchover. The settings window is shown in Figure 6.3/1.
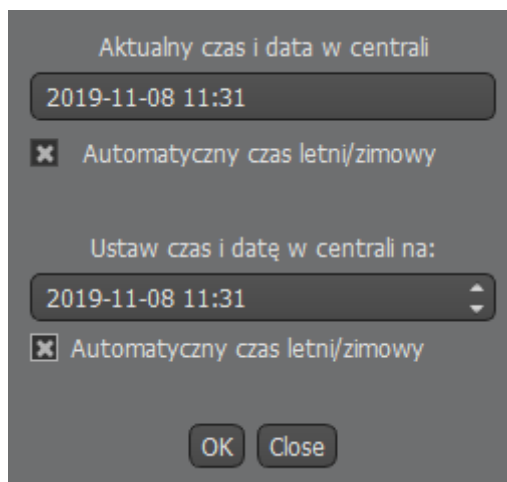
Figure 6.3/1 Time setting window

6.4. ModBus/RTU protocol

The device enables communication with control and supervision systems using the RS485 serial transmission standard with Modbus protocol. All settings for the Modbus protocol can be found in the Control Panel Settings tab. The view of the configurator window is shown in Figure 6.4/1. Protocol communication is disabled by default.

Configure the connection parameters before establishing communication. The default settings are: Baud Rate - 19200, Parity - Even, and one stop bit. The configurator allows changing the settings of connection parameters.

The control panel also enables remote deletion of entries in the log and selection of the device address from the range of $1 \div 64$.

Note that if you select the transmission option without parity, there are two stop bits at the end of the data frame (the data frame always consists of 11 bits).

All supported functions are listed in the following subsections.

Figure 6.4/1 Modbus protocol configuration window

6.4.1. Relay status readout function

Using the read coils function (0x01), the gas detection panel can read the states of 2 relays, the potential line, and the output controlling the gas cut-off valve. According to the Modbus v1.1b protocol, the relays are numbered from 0. The addresses of the relay outputs are shown in Table 6.4.1/1.

Table 6.4.1/1 Output addresses in the ModBus protocol

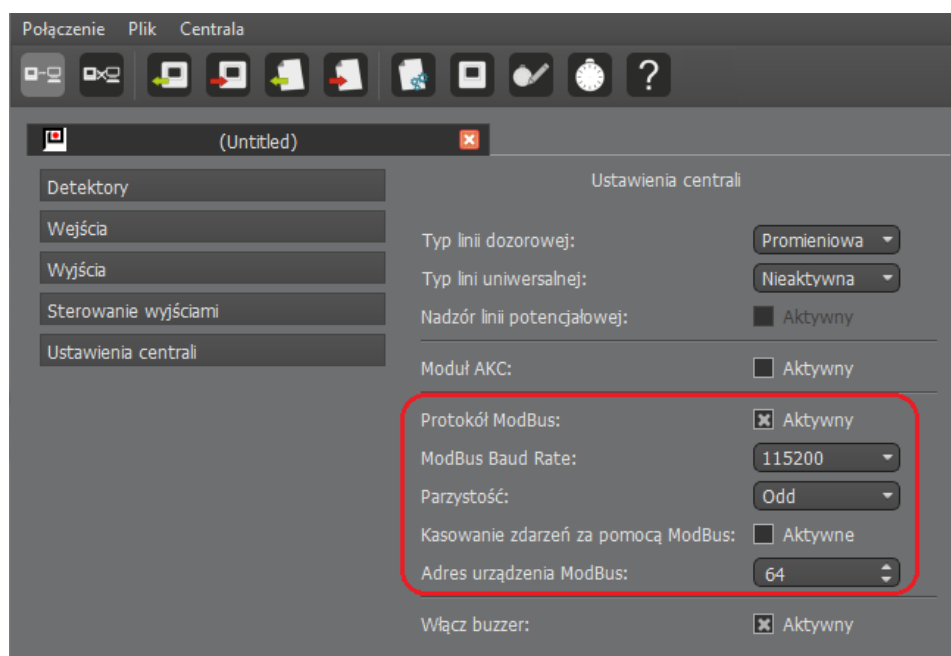| Address	Output
0	L1 (potential)
1	PK1
2	PK2
3	Valve control

Returned value 1 means that relay contacts are on, while 0 means that they are off.

Note!
When controlling a gas shut-off valve, a value of 1 is sent from the start of the control pulse until the set time required for the valve to cool down.

6.4.2. Function of reading out the states of the control panel and detectors

The READ HOLDING REGISTERS function (0 x 03) provides access to panel and detector states. The returned information is divided into two parts: the state of the control panel and the states of the detectors.

The gas detection panel allows you to read two bytes of panel status information. This information is located at the zero address of the register.

The fault codes of the gas detection panel are listed in table 6.4.2/1. The following register positions contain two-byte detector status information. The address of the first detector is located in register number one. The detector fault codes are shown in Table 6.4.2/2.

Table 6.4.2/1 Fault codes of the mCDG 6000 control panel

Code	Status of the control panel
Faults	
1	Internal resistance of battery exceeded
2	Battery charging time exceeded
4	Battery voltage too low
8	No basic power supply
512	No power supply to detection line
1024	12 V output fuse fault
2048	Failure of the control panel internal memory
4096	AKC module not responding
Alarms	
8192	1st level alarm
16384	2nd level alarm
32768	3rd level alarm

Table 6.4.2/2. Fault codes for SDG-6000 system detectors

Code	Detector status
Code	**Detector status**
Faults	
1	Fault of detector base
2	Failure of the detector base internal memory
4	Sensor does not respond or there is no sensor
8	30 days left of sensor calibration validity
16	The sensor calibration date has expired
32	Sensor fault
64	Detector does not respond or there is no detector on the line
128	Failure of the internal sensor memory
256	Incorrect sensor type
512	Warming up during operation
1024	Activation of the short circuit isolator
Alarms	
8192	1st level alarm
16384	2nd level alarm
32768	3rd level alarm

6.4.3. Reading the states of the control inputs

The gas detection panel can read the status of the control input through the READ INPUT REGISTERS function (0 x 04). The feedback provides the states declared in the device configuration. Table number 6.4.3/1 shows the codes for the possible states of the control inputs.

Table 6.4.3/1 Code of control input states of mCDG-6000 control panel

Code	Detector status
0	Short circuit
1	Break
2	Device On
3	Device Off
4	Device status change
5	Supervision
6	Alarm 1
7	Alarm 2
8	Alarm 3
9	Status X
10	Status Y
11	Status Z

6.4.4. Remote deletion of events

The gas detection panel allows you to delete events remotely by using the WRITE SINGLE REGISTER function (0 x 06). In order to use the option, a value of 1 must be entered in register number 19. This functionality has to be unlocked from the configurator level.

Note!
The register number specified is a decimal value.

6.5. Help

Pushing the [?] button results in the help module for the ***CDGKonfigurator*** software being launched. This module provides information about the software version of the application.

7. Installation

The mCDG 6000 control panel must be mounted on the wall using a DIN rail. After placing the unit in its intended location, check whether the three latches are pushed all the way in so that the control panel is properly fastened. The location of the fasteners is shown in Figure 1.1/1

8. Operation and maintenance

8.1. Provisions for proper use

Reliable operation of the control panel depends on maintaining appropriate working conditions, supply voltage, and condition of batteries, as well as carrying out periodic tests.

Periodic tests should be carried out by an authorized maintenance technician contracted by the user to maintain the system. Any damage that occurs should be reported to the maintenance technician immediately.

When replacing fuses, pay attention to their nominal values. **Do not** replace a blown fuse with a spare fuse with a higher nominal value because it may cause damage to the device.

The following fuses are used in mCDG-6000 control panels:

- F1: 630 mA type: miniature NANO^2 fuse - external power supply circuit

- F2: 3.15 A type: miniature fuse - control panel power supply circuit

8.2. Periodic inspections and maintenance regulations

Check the condition of the wire connections at the terminals at least once a year.

A well-functioning control panel, which is regularly subjected to periodical inspections, does not require special maintenance. It is advisable, from time to time, to vacuum the external surface of the panel.

9. Packaging, storage, transport

9.1. Packaging

The control panel is placed in individual packaging, limiting the possibility of free movements and excluding the possibility of damage during handling and transport.

The following information is displayed on the package:

- name or mark of the manufacturer,

- control panel name and type,

- control panel weight.

In addition, the following captions should appear on the packaging: "CAUTION - FRAGILE", "THIS SIDE UP", "PROTECT AGAINST HUMIDITY" or equivalent signs according to PN-EN ISO 780:2001

9.2. Transport

The control panel in a package according to 9.1. should be transported by covered means of transport, taking into account the transport indications specified on the package, and protected against sudden shocks and ambient temperatures exceeding the range from -25°C to +55°C.

9.3. Storage

The control panel should be stored in closed rooms with temperature of +5°C ÷ +40°C and relative humidity of 40 - 80%, free from vapours and corrosive gases.

In case of prolonged storage, disconnect the battery and connect the control panel to the power supply for 1 hour every 6 months, checking its correct operation.

During storage the unit should not be exposed to heat radiation, sunlight or the impact of heating devices.

10. Instructions for checking the correct operation of the control panel after installation

10.1. Work to be done before commissioning

- installation of detection lines, power supply and control lines for external devices, etc. according to the design

- installation of the control panel

- connection of the lines entering the control panel to the connectors, except for the power supply wires

10.2. Checking the electrical connections

- checking the correct connection of the detector line wires in the control panel, paying attention to the polarity + , -

- checking the correct connection of the wires to the control outputs (shut-off valve, potential output, Modbus, AKC-6000), paying attention to polarity + , -

- checking the connection of the terminating resistors in the last sockets of the supervised line

10.3. Launch

- connection of power supply with appropriate parameters to the control panel

- reading of faults detected by the control panel and removal of possible errors in the installation

- setting the optimum control panel configuration parameters, using the functions described in section 6;

- checking the operation of executive devices cooperating with the control panel.

After starting the system, it is recommended to check and possibly set the current date and time and delete the event memory.

The works may be considered completed if the above-mentioned activities have been carried out and correct functioning of all system devices and control panel operation in the detection state (without fault signaling) has been found. – the system can be handed over to the user.

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