

GAS DETECTOR WITH REMOTE SENSOR

RFG 65.. C1 Eng.



- Remote sensors for detecting methane, propane-LPG, carbon monoxide (CO)
- Sensors with sensing element specific for each type of gas
- 1 output relay “Valve control” with voltage-free SPDT switch
- 1 output relay “External alarm” with voltage-free SPDT switch
- Adjustable alarm threshold
- Self-diagnosis sensor fault
- Construction and operation according to
CEI EN 50194 and CEI EN 50244 for Methane and Propane LPG
CEI EN 50291 and CEI EN 50292 for CO - carbone monoxide
- Installation on DIN rail; Protection IP 40
- Power supply: 230 V~ or 12 V–

1. APPLICATION

RFG 65.. are designed for the detection of gas in spaces such as: boiler rooms, laboratories, workshops, garages.

According to the type of sensor connected, monitor the concentration in air of the following gases: methane, propane-LPG, carbon monoxide.

The sensors used are **SELECTIVE**, and so are not influenced by gases other than that for which they are dedicated. They have the following characteristics:

- methane and propane-LPG: sensors with semiconductors rendered selective by means of special filters,
- carbon monoxide (CO): the sensor is an electrochemical cell with two electrodes specific for CO..

The detector provides as outputs a pre-alarm signal and an alarm signal:

- exceeding the pre-alarm threshold is indicated visibly by a flashing light,
- exceeding the alarm threshold is indicated by visible and acoustic warnings and, by means of an output relays, permits making operational interventions such as:
 - closing a N.C. shut-off valve,
 - closing a N.O. shut-off valve,
 - switching on an aeration fan,
 - sending an alarm signal to a remote site.

2. MODELS

Code	Description
RFG 651	Gas leak detector with option of connecting 1 remote sensor
RFG 652	Gas leak detector with option of connecting 2 remote sensors
RFG 653	Gas leak detector with option of connecting 3 remote sensors

3. GAS DETECTING SENSORS

Code	Description	Gas	Sensing element "SELECTIVE"	Protection	Data sheet
SRD 150	Sensor in domestic enclosure	Methane	Figaro TGS 2611-E00	IP 30	–
SRD 250	Sensor in domestic enclosure	Propane-LPG	Figaro TGS 2610-D00	IP 30	–
SRD 350	Sensor in domestic enclosure	carbon monoxide (CO)	Sixth-Sense ECO-Sure/2e	IP 30	–
SRS 150	Sensor in industrial enclosure	Methane	Figaro 2611-E00	IP 44	–
SRS 250	Sensor in industrial enclosure	Propane-LPG	Figaro 2610-D00	IP 44	–
SRS 350	Sensor in industrial enclosure	carbon monoxide-CO	Sixth-Sense ECO-Sure/2e	IP 44	–

4. TECHNICAL DATA

Power supply 230 V~ ± 10 %
frequency 50...60 Hz

or (as alternative)
Direct current 12 V- ± 10%

Consumption 7 VA

Protection IP40

Radio disturbances VDE0875/0871

Vibration test with 2g (DIN 40046)

Output relay:
- switches Voltage-free SPDT
- maximum switched voltage 250 V~
- maximum switched current 5 (1) A

Construction standard Italian Electrotech. Committee (CEI)

Enclosure DIN 6E module

Installation on DIN 35 rail

Materials:
- base NYLON
- cover ABS

Ambient temperature:
- operating 0...45 °C
- storage - 25...+ 60 °C

Ambient humidity Class F DIN 40040

Weight 0.600 kg

(in bold type threshold with Sensitivity = 0)

Methane

- Alarm methane 0.5...**0.8**...1.25 %
5,000...**8,000**...12,500 ppm

- Pre-alarm methane 0.3...**0.5**...0.8 %
3,000...**5,000**...8,000 ppm

Propane-GPL

- Alarm propane-LPG 0.22...**0.35**...0.56 %
2,200...**3,500**...5,600 ppm

- Pre-alarm propane-LPG 0.14...**0.22**...0.35 %
1,400...**2,200**...3,500 ppm

Carbon monoxide (CO)

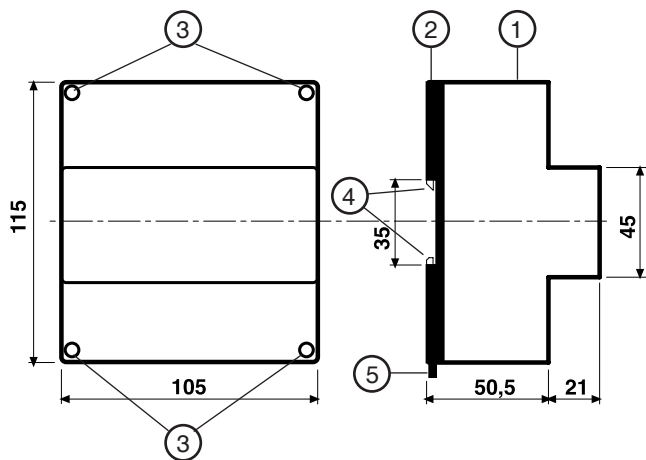
Warning: in detecting carbon monoxide (CO), the levels and intervention times are processed and controlled by a microprocessor. The "Sensitivity" control must obviously be set in the "0" position.

- Carbon monoxide-CO alarm: "threshold + time"
< 50 ppm: no alarm
50...100 ppm: 60 minutes
100...300 ppm: 10 minutes
> 300 ppm: immediate alarm

- Carbon monoxide-CO pre-alarm: time between exceeding alarm threshold and alarm

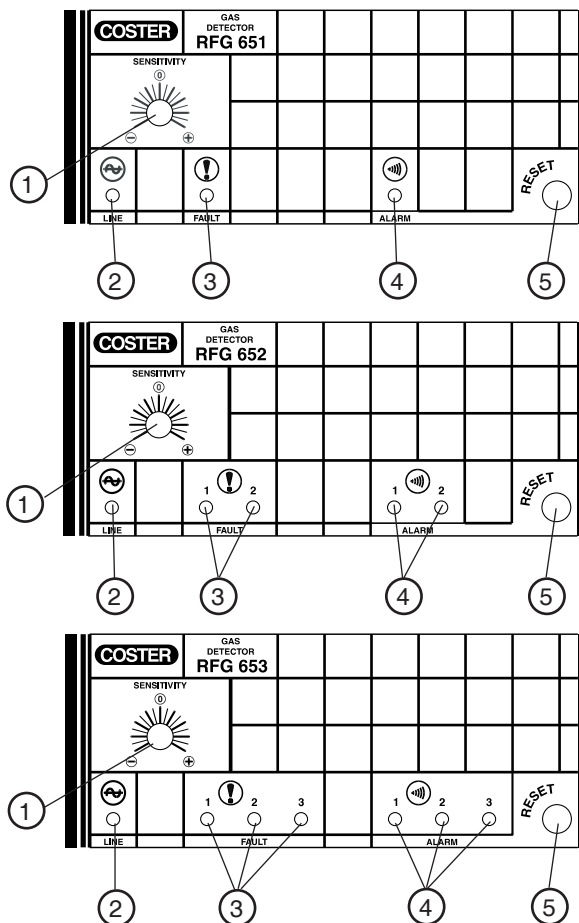
Pre-alarm & alarm intervention thresholds

5. OVERALL DIMENSIONS



- 1 - Protective cover for electronic components
- 2 - Base with transformer, relay and terminal blocks
- 3 - Screws for securing base and cover
- 4 - DIN rail securing elements
- 5 - DIN rail release lever

6. FACIA



- 1 - Sensitivity control knob
- 2 - Power LED
- 3 - Sensor fault or wrong connection LED
- 4 - Pre-alarm (flashing LED and alarm LED stays lit)
- 5 - Reset button

7. SITING OF DEVICES

7.1 Detector

This must be sited in a dry space which meets the relevant ambiantal requirements given in section 4. If installed in a location classified as "Hazardous" it must be installed in a cabinet for electrical equipment constructed according to the regulations in force for the class of danger concerned. The controller can be mounted on a DIN rail and housed in a standard DIN enclosure.

7.2 Sensors

The correct siting of the sensor is fundamental for the correct functioning of the system. The position depends on the type of gas to be monitored and, in particular, on its density in respect of air:

- **Methane** (gas lighter than air which therefore tends to rise).
Position: at a distance of 10...50 cm from the ceiling and, in any event, above doors or windows,
- **Propane (LPG)** (gas heavier than air and so tends to move downwards).
Position: at a distance of 10...50 cm from the floor.,
- **Carbon monoxide (CO)** (gas with a density very similar to that of air and which therefore tends to diffuse uniformly)
Position: at a height of 150...200 cm from floor.

Moreover, to ensure the correct operation of the detector and to avoid useless alarms due to a casual and momentary presence of gas, the sensor must **NOT** be positioned:

- less than 1...2 metres from boilers or water heaters,
- less than 2...3 metres from kitchen ranges and ovens,
- in spaces where air movement could be hindered (e.g. in corners or enclosed spaces),
- near to doors or windows,
- near to air extractors,
- in places where dust or dirt could contaminate the sensor and so render it ineffective,
- in places subject to possible sprays of water, particularly sensors positioned near the floor,
- in places where the temperature or humidity could be outside the limits stated in 5. TECHNICAL DATA.

7.3 Solenoid shut-off valve

This must be installed on the gas distribution pipe, taking the following precautions::

- if possible, in a different space from the one being controlled,
- in an easily-accessible place, especially for the valves which have to be reset manually.,
- if installed outside, it must be protected against the weather,
- in installations with external propane (LPG) gas tank, it must be installed downstream of the pressure-reducing valve (30...40 mbar).

8. ELECTRIC WIRING

IMPORTANT: the detection system must **always be in operation**, so that the electric power supply to the detector must come directly from the mains supply, without the interposition of switches or other devices which could accidentally cut it off.

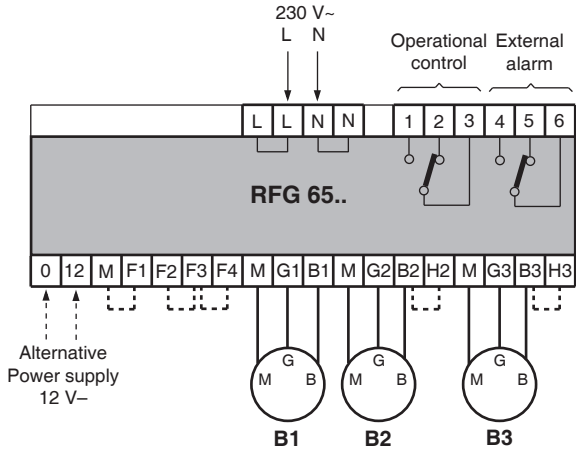
To carry out the wiring, proceed as follows :

- separate the base from the cover,
- mount the base on the DIN rail and check that the securing elements (5.4) anchor it firmly,
- carry out the wiring as in the diagram and in accordance with the safety regulations in force, using the following cables:
 - 1.5 mm² cross-section for power and relay control outputs,
 - 1 mm² cross-section for sensors positioned up to a maximum distance of 50 meters; or 1.5 mm² cross-section for sensors positioned up to a maximum distance of 75 meters.,
- carry out the "Jumper functions" to adapt the detector to the desired type of operational control,
- switch on power (230 V~ or 12 V-) and check its presence at the respective terminals (L and N for 230 V~, 0 and 12 for 12 V-),
- witch off power, replace cover on base and secure it with the two screws supplied (5.3).

You are advised not to insert more than two cables in a single terminal of the detector and, if necessary, to use an external terminal block.

9. WIRING DIAGRAM

9.1 General wiring diagram



Functions of jumpers

- M-F1 – without jumper = internal & external alarm On,
with jumper = internal & external alarm excluded,
- F2-F3 – without jumper = relay normally On, with gas leak switches Off
with jumper = relay normally Off, with gas leak switches On
- F3-F4 – without jumper = with latching alarm,
with jumper = without latching alarm
- B2-H2 – with jumper = necessary if B2 sensor not connected (valid for RFG 652 & RFG 653),
- B3-H3 – with jumper = necessary if B3 sensor not connected (valid for RFG 653).

WARNING : to change position of functional jumpers switch off power..

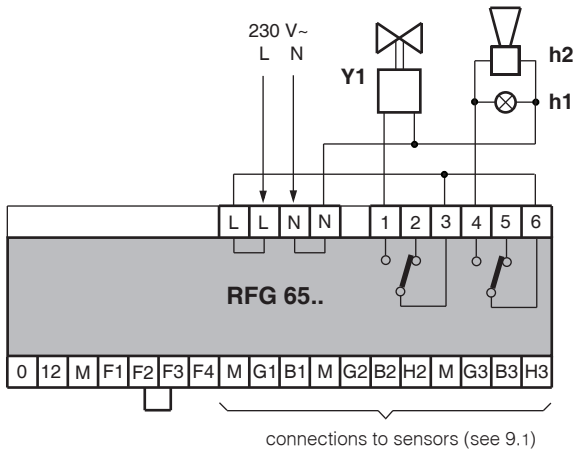
N. B. : The relay switches are shown in the condition detector not powered

B1, B2, B3 – Gas detecting sensors.

9.2 Examples of wiring with 230 V~ supply to detector

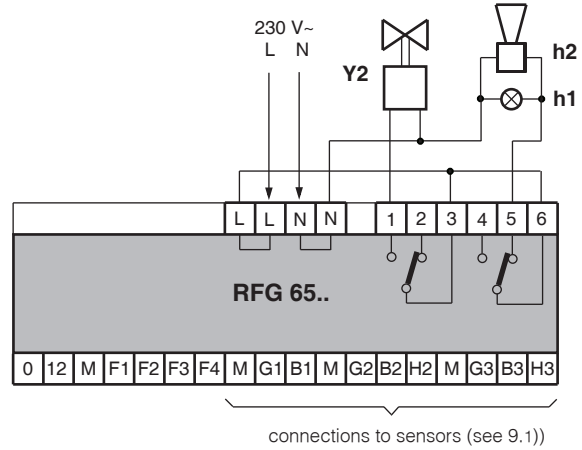
9.2.1 Wiring diagram with:

- N.O. valve with manual reset (230 V~)
- outside alarms powered by 230 V~



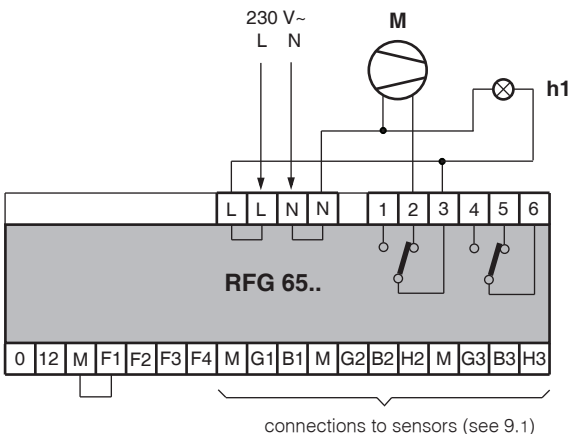
9.2.2 Wiring diagram with:

- N.C. valve with or N.C. valve with manual reset (230 V~)
- outside alarms powered by 230 V~



9.2.3 Wiring diagram with:

- aeration fan powered by 230 V~
- outside alarms powered by 230 V~



The N.C. valve (without manual reset) is the preferred valve for boilers and boiler rooms in general. Its use is NOT recommended, however, where there are open flames (e.g. kitchen ovens or hobs) if not provided with device to shut off the gas in the absence of a flame.

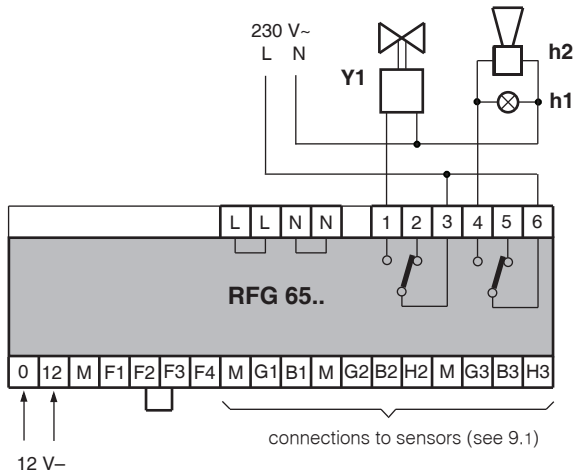
- Y1 – N.O. solenoid valve with manual reset 230 V~
- Y2 – N.C. solenoid valve or N.C. with manual reset 230 V~
- M – Aeration fan 230 V~
- h1 – External warning light 230 V~
- h2 – Siren 230 V~

Typical setup for detecting carbon monoxide (CO) in garages, where change of air is necessary and possibly remote visual warning that an aeration fan has been switched on but without local or remote acoustic warnings.

9.3 Examples of wiring with diagram with detector powered by 12 V-

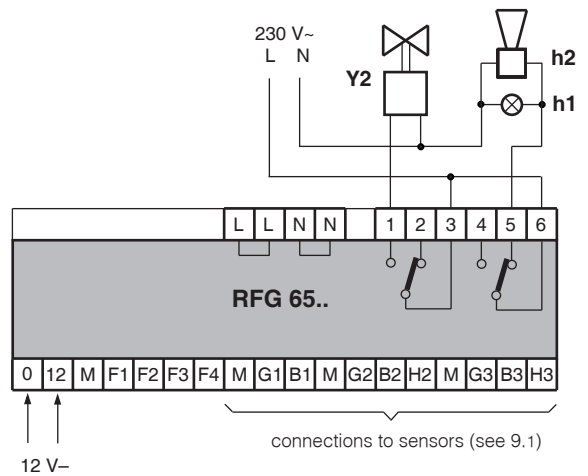
9.3.1 Wiring diagram for:

- N.O. valve with manual reset (230 V~)
- outside alarms powered by 230 V~



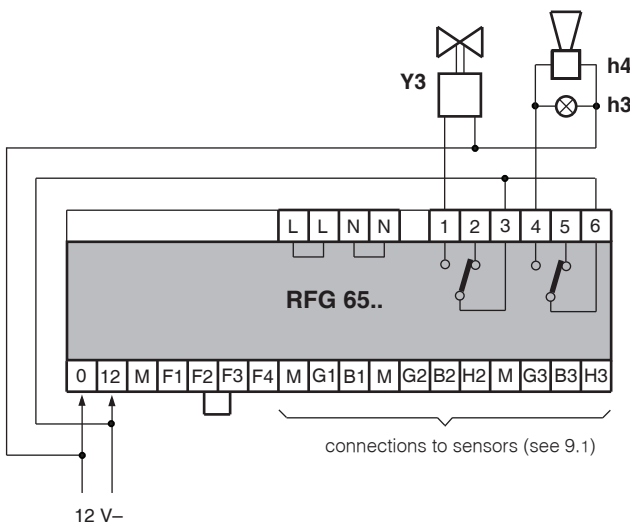
9.3.2 Wiring diagram for:

- N.C. valve or N.C. valve with manual reset 230 V~
- outside alarms powered by 230 V~



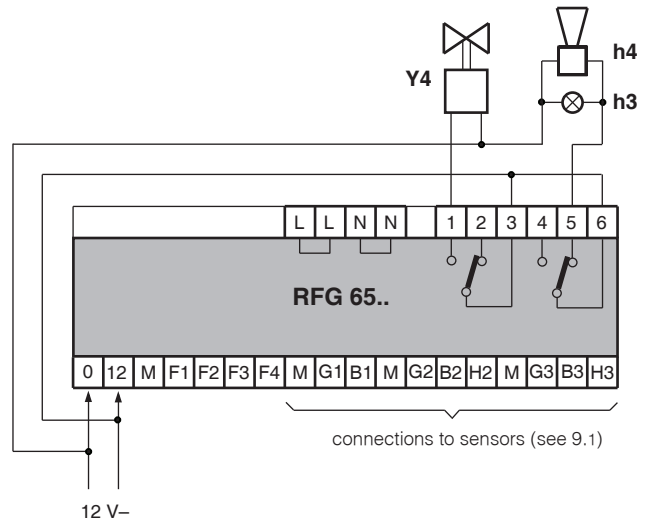
9.3.3 Wiring diagram for:

- N.O. valve with manual reset (12 V-)
- outside alarms powered by 12 V-



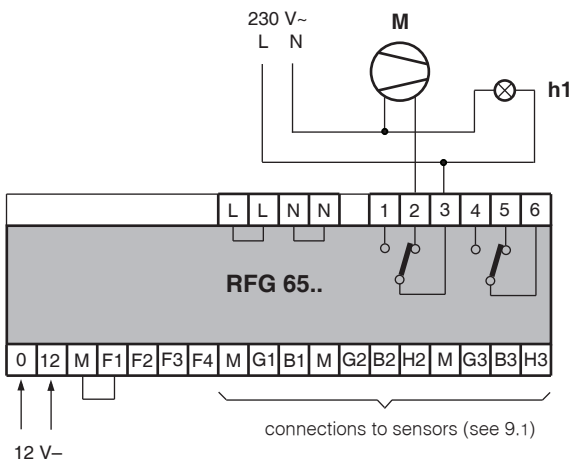
9.3.4 Wiring diagram for:

- N.C. valve or N.C. valve with manual reset (12 V-)
- outside alarms powered by 12 V-



9.3.5 Wiring diagram with:

- aeration fan (230 V~)
- outside alarms powered by 230 V~



Par. 9.3.2 e Par. 9.3.4 : the N.C. valve (without manual reset) is the valve recommended for boiler rooms and HVAC sites in general. Its use is **NOT** recommended, however, where there are open flames (e.g. kitchen ovens or hobs) if not provided with a device to shut off the gas in the absence of a flame.

- Y1 - N.O. solenoid valve with manual reset 230 V~
- Y2 - N.C. solenoid valve or N.C. with manual reset 230 V~
- Y3 - N.O. solenoid valve with manual reset 12 V-
- Y4 - N.C. solenoid valve or N.C. with manual reset 12 V-
- M - Aeration fan 230 V~
- h1 - Flashing light 230 V~
- h2 - Siren 230 V~
- h3 - Flashing light 12 V-
- h4 - Siren 12 V-

Typical application of carbon monoxide (CO) detection in garages, where change of air is necessary and possible remote visual warnings that an aeration fan has been switched on but without local or remote acoustic warnings.

10. OPERATION

10.1 Switching on

When it is powered RF.. does not start detecting immediately and does not signal any alarm for the first two minutes of operation.

This is the time necessary for the gas-sensing elements to become stabilised so that their readout can be considered accurate and reliable. This period for the stabilisation of the sensors is indicated, on the facia of the detector by the flashing of the FAULT (6.3) and ALARM (6.4) LEDs. At the end of the stabilisation period the FAULT and ALARM LEDs, in normal situations, switch off.

10.2 Pre-alarm and alarm thresholds for methane and propane-LPG)

By means of the SENSITIVITY (6.1) knob, the intervention threshold (sensitivity) can be increased or decreased according to the particular conditions of the space in which the sensor is positioned, or for specific requirements:

- knob towards + = increase of sensitivity,
- knob towards - = decrease of sensitivity..

These adjustments, however, remain within the limits required by the regulations so it is always possible to intervene under conditions of the maximum safety.

The intervention levels, referred to the LEL (Lower limit of Explosivity) = volumetric ratio in air of combustible gas or vapour below which an explosive mixture is not formed) for the gases methane and propane-LPG are as follows (the threshold values with the "SENSITIVITY" knob = 0 are shown in bold type):

Type of gas	LIE	Pre-larm threshold	Alarm threshold
methane	5 % 50,000 ppm	0.3... 0.5 ...0.8 % 3,000... 5,000 ...8,000 ppm	0.5... 0.8 ...1.25 % 5,000... 8,000 ...12,500 ppm
propane-LPG	2.1 % 21,000 ppm	0.14... 0.22 ...0.35 % 1.400... 2,200 ...3,500 ppm	0.22... 0.35 ...1.25 % 2,200... 3,500 ...5,600 ppm

10.3 Pre-alarm and alarm threshold for carbon monoxide (CO)

The danger of carbon monoxide (CO) does not derive from its inflammability or the danger of explosion, but from its very high toxicity to the human body. Moreover, its danger does not depend only on the concentration of the gas in air, but also on the length of time a person has remained in an atmosphere in which this gas is present.

The pre-alarm and alarm levels of the sensor are determined by the processing of a microprocessor which takes into account the concentration of the gas in the air and the exposure time. For this reason the "Sensitivity" knob on the detector must not influence the sensor readout and, even if there is only one carbon monoxide (CO) sensor, it must be set in "0" position.

The intervention modes of the detector are accordingly as follows:

- **concentration < 0.005%** (50 ppm): the safety of the persons is guaranteed for an indefinite length of time and so the detector does not intervene,
- **concentration 0.005...0.01%** (50...100 ppm): within this concentration range, for 60 minutes the detector signals a "Pre-alarm" situation and after this period switches to "Alarm".,
- **concentration 0.01...0.03%** (100...300 ppm): within this concentration range, for 10 minutes the detector signals a "Pre-alarm" situation and after this period switches to "Alarm".
- **concentrazione > 0.03%** (300 ppm): the safety of the persons present in the space is not guaranteed. The detector immediately switches to to the "Alarm" state.

The concentration values and times taken into consideration by the detector have been established allowing a large safety margin to ensure there is no danger to the persons.

The action of the detector is of the "Dynamic" type: if the concentration passes from one level to another, the time calculated increases or decreases as a consequence, thereby modifying the response of the detector. In particular, should the concentration of carbon monoxide (CO) return below 0.005% (50 ppm) for more than one minute, the detector returns to the "Normal" condition, cancelling all the times counted up to that moment and, if it has been programmed "Without latching" any "Alarm" condition will be terminated.

10.4 Pre-alarm

If the pre-alarm threshold is exceeded, this is indicated, on the detector facia, by the intermittent lighting of the ALARM LED (6.4) for the sensor which has detected the anomaly.

10.5 Alarm

When the signal exceeds the alarm threshold for more than 20 seconds (this time permits having the certainty that it is not a momentary situation or a false alarm), the detector:

- activates the internal alarm (only if without jumper M-F1),
- on the facia the ALARM LED (6.4) lights and stays lit.

Moreover, the alarm status causes the following actions by the output relays

- operational relay:
 - if normally switched off (with jumper between F2-F3): the relay is energised (switch 1-3 closes, 2-3 opens),
 - if normally switched on (without jumper between F2-F3): the relay is de-energised (switch 1-3 opens, 5-6 closes).
- relay for external alarms (only if without jumper M-F1):
 - if normally switched off (with jumper between F2-F3): the relay is energised (switch 4-6 closes, 5-6 opens),
 - if normally switched on (without jumper between F2-F3): the relay is de-energised (switch 4-6 opens, 5-6 closes).

10.6 Latching and restoration

The detector can be programmed in two ways:

- Without latching (with jumper between F3-F4):
 - alarm ceases when concentration of gas returns below threshold level.
 - a slow flashing (0.2 seconds On and 1 second Off) from the ALARM (6.4) signal, indicates that the alarm triggered,
 - to switch off, press RESET button (6.5) .
- With latching (without jumper between F3-F4):
 - the alarm continues even when the concentration of gas has returned below threshold level,
 - to switch off, press, for at least 5 seconds, the RESET button (6.5).

10.7 Autodiagnosis

In the event of a fault or incorrect connection of the sensor, the FAULT LED (6.3) lights or the detector goes into “Alarm”, obviously with the lighting of the ALARM LED (6.4):

Type of fault	Warning FAULT	ALARM
– Sensor fault	X	
– Not connected to terminal G	X	
– Not connected to terminal B	X	
– Not connected to terminal M		X
– Connection G and B terminals inverted	X	
– Connection G and M inverted		X

10.8 Life cycle of sensors

The typical life span of gas detection sensors, from the moment of installation, is as follows:

- **per i sensori a semiconduttore di Metano e Propano-GPL: 10 anni,**
- **per il sensore a cella elettrochimica di Monossido di carbonio-CO: 5 anni.**

After these periods the life cycle of the gas sensing element becomes exhausted and so the sensor must be replaced.

On the sensor cover a label shows the date when it should be replaced.

11. TESTING

- Power the device: LINE LED (6.2) lights and FAULT LED (6.3) and ALARM LED (6.4) flash.
- After 1.5...2 minutes the detector is enabled to acquire alarms and the LEDs FAULT (6.3) and ALARM (6.4) should go out.
- Position the SENSITIVITY knob (6.1) on "0".
- Since the sensors are selective, and so not influenced by gases other than that for which they are dedicated, to simulate the presence of gas it is necessary to use small gas cylinders containing specific gases at preset concentrations, releasing the gas as near as possible to the detecting sensor. Only for sensors for detecting propane (LPG) can gas from a normal cigarette lighter be used.
- When the gas concentration exceeds the pre-alarm threshold the ALARM LED (6.4) flashes.
- With a delay (about 20 seconds) after exceeding the alarm threshold:
 - ALARM LED (6.4) lights and stays lit,
 - the internal alarm and the outside warnings (only if without jumper M-F1) are switched on.
 - the operational relay closes the gas shut-off valve or switches on the aeration fan.
- Stop erogation of gas. When gas concentration on the sensor returns below the threshold level:
 - if detector is “without latching” (with jumper between F3-F4), alarm ceases and ALARM LED (6.4) remains flashing slowly until RESET button (6.5) is pushed
 - if detector is “with latching” (without jumper between F3-F4), alarm remains until RESET button (6.5) is pressed for at least 5 seconds.
- If the detector controls a valve with manual reset, it is necessary to re-open manually also the valve.

12. WARNING: IN EVENT OF ALARM!!**Combustible gases (methane and propane (LPG))**

First of all it must be remembered that, in regard to the combustible gases methane and propane (LPG), most people become aware of their presence even at concentrations below the alarm level set for the detector, so that this situation does not mean that the detector is faulty and does not necessarily indicate a dangerous situation.

Carbon monoxide-CO

Carbon monoxide (CO) is produced by the incomplete combustion of any apparatus which, in order to burn, has to use the oxygen present in the air of the space in which it is installed.

It is absolutely without odour and so it is impossible to detect its presence: this makes it extremely dangerous.

The only means of being aware of the presence of carbon monoxide (CO) is, therefore, a gas detector.

What to do

For the reasons given above, if the detector sounds the alarm, and you do not know instinctively which type of gas may have brought about a dangerous situation, the following action should be taken:

- turn off any open flames,
- turn off all devices running on gas,
- do not operate electric switches (since they could cause sparks),
- for methane, close the main valve of the gas supply,
- for propane (LPG), close the valve on the pipe coming from the storage tank,
- **it is strongly recommended in every case, but above all in the presence of carbon monoxide (CO), to open windows and doors to ventilate the spaces.**

Amendment to data sheet

Date	Revision No.	Page	Section	Amendment description
12.03.07 MZ	01	various	various	Replaced SGG – SGS sensors by SRD - SRS selective sensors Added wiring diagrams Re-worded description of operation with new sensors
19.03.07 MZ	02	6	10.2 Prealarm and alarm threshold...	Amended table
25.11.08 MZ	03	6	10.3 Pre-alarm and alarm thresholds for carbon monoxide (CO)	Adjust CO concentration value

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