G 521
25.11.08 MZ
Rev. 02

GAS DETECTOR WITH REMOTE SENSOR

RFG 361 C1 Eng.

- **Remote sensor for detecting methane, propane-LPG, carbon monoxide (CO)**
- **Sensors with sensing element specific for each type of gas**
- **1 SPDT voltage-free output relay**
- **Adjustable alarm threshold (for methane and propane-LPG)**
- **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 ~**

CE

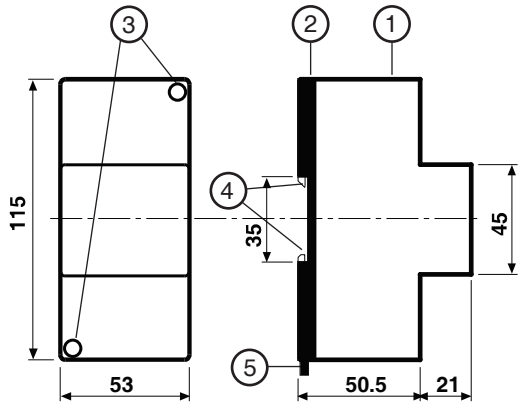
1. APPLICATION

RFG 361 is designed for the detection of gas in spaces such as: boiler rooms, laboratories, workshops, garages. parking silos.
According to the type of sensor connected, monitors 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 relay, permits making an operational intervention such as, for example:
– 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. GAS DETECTING SENSORS

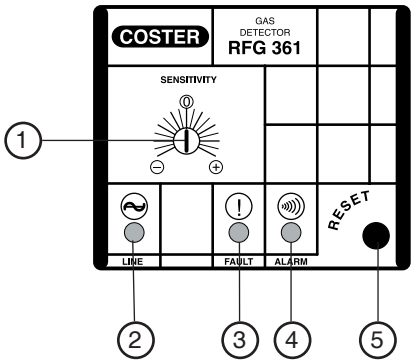
Code	Description	Gas	Sensing element **"SELECTIVE"**	Protection	Data sheet
SRD 150	Sensor in domestic enclosure	methane	Figaro TGS 2611-E00	IP 30	–
SRD 250	Sensor in domestic enclosure	propane-LPG	Figaro TGS 2610-D00	IP 30	–
SRD 350	Sensor in domestic enclosure	carbon monoxide	Sixth-Sense ECO-Sure/2e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

3. 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

4. FACIA



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

5. TECHNICAL DATA

Power supply	230 V ~ ± 10 %
Frequency	50…60 Hz
Consumption	3 VA
Protection	IP40
Radiodio sturbances	VDE0875/0871
Vibration test	with 2g (DIN 40046)
Output relay:	
– switch	voltage free
– maximum switched voltage	250 V ~
– maximum switched current	5 (1) A
Construction standards	CEI
Enclosure	DIN 3E 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	0.250 kg

Pre-alarm & alarm intervention thresholds
(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-LPG

– 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:	"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

6. SITING OF DEVICE

6.1 Detector

This must be sited in a dry space which meets the relevant ambiental requirements given in section 5.
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.

6.2 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 which 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,
– 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 "TECHNICAL DATA".

6.3 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)..

7. 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.

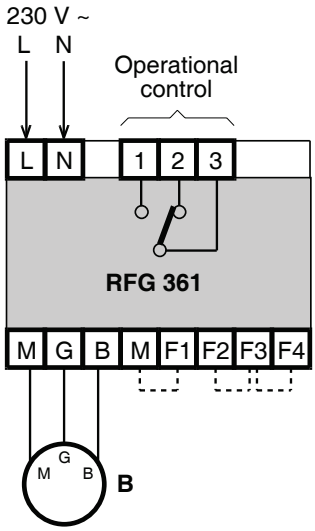
To carry out the wiring, proceed as follows:

– separate the base from the cover,
– mount the base on the DIN rail and check that the securing elements (3.4) anchor it firmly,
– carry out the wiring as in the diagram and in accordance with the safety regulations, using the following cables:
  - 1,5 mm^2 cross-section for power and relay control outputs,
  - 1 mm^2 cross-section for the sensor positioned up to a maximum distance of 50 meters; or 1.5 mm2 cross-section for the sensor 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~) and check its presence at terminals L and N,
– switch off power, replace cover on base and secure it with the two screws supplied(3.3)

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.

8. WIRING DIAGRAMS

8.1 General diagram



Functions of jumpers

M-F1 – without jumper = internal and external alarms enabled
with jumper = internal and external alarms disabled

F2-F3 – without jumper = relay normally energised, with gas leak de-energised
with jumper= relay normally de-energised, with gas leak energised

F3-F4 – without jumper= with latching of alarm with jumper
with jumper= without latching of alarm

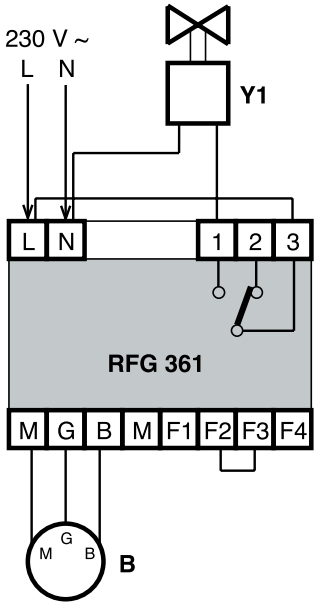
WARNING: before changing the position of the operational jumpers switch off power.

N. B. : the relay switch is shown in the condition of thedevice not being powered.

B – Gas monitoring sensor

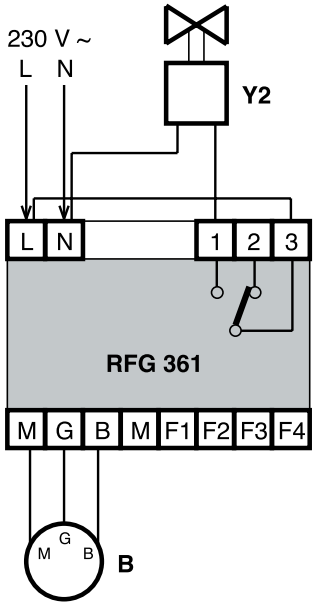
8.2 Examples of wiring

8.2.1 Diagram of wiring with N.O. valve with manual reset (230 V~)



B – Gas monitoring sensor
Y1 – N.O. solenoid valve with manual reset

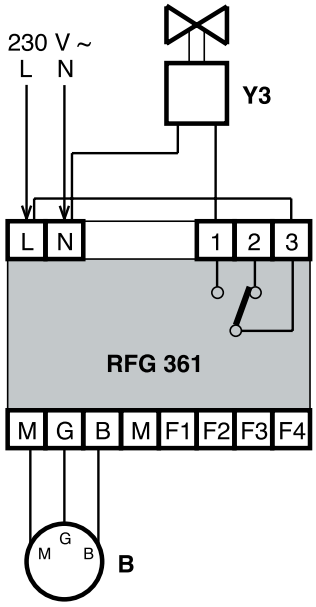
8.2.2 Diagram of wiring with N.C. valve (230 V~)



B – Gas monitoring sensor
Y2 – N.C. solenoid valve

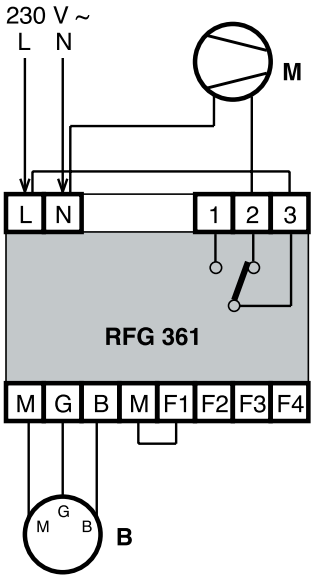
The normally-closed valve (without manual reset) is the preferred valve for boilers and boiler rooms in general.
Its use is **NOT recommended**, however, where there are open flames (e.g. gas hob) if not provided with a device for shutting off the gas in the absence of the flame.

8.2.3 Diagram of connection with N.C. valve with manual reset (230 V~)



B – Gas detection sensor
Y3 – N.C. solenoid valve with manual reset

8.2.4 Diagram of connection for control of aeration fan (230 V~)



B – Gas detection sensor
M – Aeration fan

Typical application for detecting carbon monoxide (CO) In garages where it is necessary to change the air, but without acoustic alarm

9. OPERATION

9.1 Switching on

When it is switched on the detector does not immediately sense gas and so does not signal the alarm for the first two minutes of operation.
This is the time necessary for the gas-sensitive elements to become stabilised so that their detection can be considered correct and reliable. This stabilisation period is indicated by the flashing of the FAULT (6.3) and ALARM 6.4) LEDs on the facia of the detector. At the end of the stabilisation period the FAULT and ALARM LEDs, in normal situations, switch off.

9.2 Pre-alarm and alarm threshold for methane and propane (LPG)

By means of the SENSITIVITY (4.1) knob on the detector, the intervention threshold (sensitivity) can be increased or decreased according to 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 level 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	LEL	Pre-alarm 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**...0.56% 2,200...**3,500**...5,600 ppm

9.3 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 extreme 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 keeps account of the concentration of the gas in the air and of the exposure time. For this reason the "Sensitivity" knob must not influence the sensor readout and 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 situation of "Pre-alarm" and after this period switches to "Alarm.,
– **concentration > 0.03%** (300 ppm): the safety of the persons present in the space is not guaranteed. The detector immediately switches to the "Alarm" condition.
The concentration values and the times taken into consideration by the detector are 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 calculation increases or decreases as a consequence, thereby modifying the response of the detector. In particular, if the concentration of carbon monoxide (CO) should return below 0.005% (50 ppm) for more than one minute, the detector returns to the "Normal" condition, canceling all the times counted up to that moment and, if it has been programmed "Without latching" will also exit from any "Alarm" condition.

9.4 Pre-alarm

If the pre-alarm threshold is exceeded, this is indicated by the intermittent lighting of the ALARM LED (4.4) on the detector.

9.5 Alarm

When the signal exceeds the alarm threshold for more than 20 seconds (so as to have 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 lights and stays lit (4.4).
Moreover, the alarm status causes the operational control relay to act as follows:
– 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, 2-3 closes).

9.6 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 (4.4) signal, indicates that the alarm triggered,
– to switch off, press RESET button (4.5) .
• 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 (4.5).

9.7 Autodiagnosis

In the event of a fault or incorrect connection of the sensor, the FAULT LED (4.3) lights or the detector goes into "Alarm", obviously with the lighting of the ALARM LED (4.4):

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 inverted	**X**	
– Connection G and M inverted		**X**

9.8 Life of sensors

The typical life span of gas detection sensors, from the moment of installation, is as follows:
– for semiconductor sensors for methane and propane (LPG): 10 years
– for electrochemical cell sensor for carbon monoxide (CO): 5 years.
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.

10. TESTING

- Power the device: LINE LED (4.2) lights and FAULT LED (4.3) and ALARM LED (4.4) flash..
- After 1.5…2 minutes the detector is ready to acquire alarms and the LEDs FAULT (4.3) and ALARM (4.4) should go out.
- Position the SENSITIVITY knob (4.1) on "0"..
- Since the sensors are selective, and so not influenced by gases other than that for which they are dedicated, to simulate a gas escape 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 (4.4) flashes.
- With a delay (about 20 seconds) after exceeding the alarm threshold::
  - ALARM LED (4.4) lights and stays lit. ,
  - the internal alarm and the outside warnings are switched on (only if without jumper M-F1)),
  - operational relay closes gas shut-off valve or switches on aeration fan.
- Stop erogation of gas. When gas concentration on the sensor returns below threshold level:
  - if detector is "without latching" (with jumper between F3-F4), alarm ceases and ALARM LED (4.4) remains with slow flashing until RESET button (4.5) is pushed.
  - if detector is "with latching" (without jumper between F3-F4), alarm remains until RESET button (4.5) is pressed for at least 5 seconds.
- If detector controls a valve with manual reset, it is necessary to re-open manually also the valve.

11. 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 are able to be aware of their presence even at concentrations below the alarm level set for the detector, so that this situation does not mean that the device 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, and since you do not know instinctively what type of gas may have brought about a dangerous situation, if the detector sounds the alarm, the following action should be taken:

– turn off any open flames,
– turn off all the 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 Developed wiring diagrams. Re-worded description operation with new sensors
25.11.08 MZ	**02**	5 - 6	9.2 Pre-alarm and alarm thresholds...	Adjust CO concentration value

COSTER
CONTROLLI TEMPERATURA ENERGIA
COSTER TECNOLOGIE ELETTRONICHE S.p.A.
Sede Legale: 20132 Milano - Via San G.B. De La Salle, 4/a
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Amministrazione e Vendita
Via San G.B. De La Salle, 4/a — Tel. +39 022722121
20132 - Milano — Fax +39 022593645
Ricevimento Ordini — Fax +39 0227221239
Uff. Regionale Centro-Sud
Via S. Longanesi, 14 — Tel. +39 065573330
00146 - Roma — Fax +39 065566517
Spedizioni
Via Gen. Treboldi, 190/192 — Tel. +39 0364773202
25048 - Edolo (BS) — Tel. +39 0364773217
E-mail: info@coster.eu — Web: www.coster.eu

INFORMAZIONI TECNICHE
Numero Verde 800-COSTER 800-267837

ISO 9001:2000
IQNet
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