Gas Leakage Detector

For commercial and light industrial application

CAREL

ENG User manual

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READ AND SAVE THESE INSTRUCTIONS

READ CAREFULLY IN THE TEXT!

Integrated Control Solutions & Energy Savings

WARNINGS

CAREL bases the development of its products on decades of experience in HVAC, on the continuous investments in technological innovations to products, procedures and strict quality processes with in-circuit and functional testing on 100% of its products, and on the most innovative production technology available on the market. CAREL and its subsidiaries nonetheless cannot guarantee that all the aspects of the product and the software included with the product respond to the requirements of the final application, despite the product being developed according to start-of-the-art techniques. The customer (manufacturer, developer or installer of the final equipment) accepts all liability and risk relating to the configuration of the product in order to reach the expected results in relation to the specific final installation and/or equipment. CAREL may, based on specific agreements, acts as a consultant for the positive commissioning of the final unit/application, however in no case does it accept liability for the correct operation of the final equipment/system.

The CAREL product is a state-of-the-art product, whose operation is specified in the technical documentation supplied with the product or can be downloaded, even prior to purchase, from the website www.carel.com.
Each CAREL product, in relation to its advanced level of technology, requires setup/configuration/programming/commissioning to be able to operate in the best possible way for the specific application. The failure to complete such operations, which are required/indicated in the user manual, may cause the final product to malfunction; CAREL accepts no liability in such cases.
Only qualified personnel may install or carry out technical service on the product.
The customer must only use the product in the manner described in the documentation relating to the product.

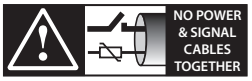
In addition to observing any further warnings described in this manual, the following warnings must be heeded for all CAREL products:

- prevent the electronic circuits from getting wet. Rain, humidity and all types of liquids or condensate contain corrosive minerals that may damage the electronic circuits. In any case, the product should be used or stored in environments that comply with the temperature and humidity limits specified in the manual.
- do not install the device in particularly hot environments. Too high temperatures may reduce the life of electronic devices, damage them and deform or melt the plastic parts. In any case, the product should be used or stored in environments that comply with the temperature and humidity limits specified in the manual.
- do not attempt to open the device in any way other than described in the manual.
- do not drop, hit or shake the device, as the internal circuits and mechanisms may be irreparably damaged.
- do not use corrosive chemicals, solvents or aggressive detergents to clean the device.
- do not use the product for applications other than those specified in the technical manual.

All of the above suggestions likewise apply to the controllers, serial boards, programming keys or any other accessory in the CAREL product portfolio.
CAREL adopts a policy of continual development. Consequently, CAREL reserves the right to make changes and improvements to any product described in this document without prior warning.
The technical specifications shown in the manual may be changed without prior warning.

The liability of CAREL in relation to its products is specified in the CAREL general contract conditions, available on the website www.carel.com and/or by specific agreements with customers; specifically, to the extent where allowed by applicable legislation, in no case will CAREL, its employees or subsidiaries be liable for any lost earnings or sales, losses of data and information, costs of replacement goods or services, damage to things or people, downtime or any direct, indirect, incidental, actual, punitive, exemplary, special or consequential damage of any kind whatsoever, whether contractual, extra-contractual or due to negligence, or any other liabilities deriving from the installation, use or impossibility to use the product, even if CAREL or its subsidiaries are warned of the possibility of such damage.

IMPORTANT



READ CAREFULLY IN THE TEXT!

Separate as much as possible the probe and digital input cables from the cables carrying inductive loads and power cables to avoid possible electromagnetic disturbance.
Never run power cables (including the electrical panel cables) and signal cables in the same conduits.

DISPOSAL

INFORMATION FOR USERS ON THE CORRECT HANDLING OF WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE)

In reference to European Union directive 2002/96/EC issued on 27 January 2003 and the related national legislation, please note that:

- WEEE cannot be disposed of as municipal waste and such waste must be collected and disposed of separately;
- the public or private waste collection systems defined by local legislation must be used. In addition, the equipment can be returned to the distributor at the end of its working life when buying new equipment;
- the equipment may contain hazardous substances: the improper use or incorrect disposal of such may have negative effects on human health and on the environment;
- the symbol (crossed-out wheeled bin) shown on the product or on the packaging and on the instruction sheet indicates that the equipment has been introduced onto the market after 13 August 2005 and that it must be disposed of separately;
- in the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste disposal legislation.

Warranty on materials: 2 years (from the date of production, excluding the consumable parts.

Certification: the quality and safety of CAREL S.p.A. products are guaranteed by the ISO 9001 certified design and production system.

Content

1. PRODUCT DESCRIPTIONS

1.1 Intended Uses / Applications

The GLD series detector instruments continuously monitor ambient air (indoor or outdoor) to detect any refrigerant leakage.
These devices can be used for refrigeration applications (cold-rooms, freezer rooms, plantrooms).

The GLD series detectors are available in the following configurations:
- GDWB – Built-In version
- GDWR – Remote version

and these are calibrated to detect most refrigerants currently on the market.
Sensible elements are built using semiconductor technology (SC) or infrared technology (IR).

Both the versions are provided with screws for wall mounting and a magnetic wand.
An RJ45 cable is also provided for Remote version.

The GLD series detectors can be used in stand-alone applications, or integrated with Carel controllers or third party devices.
Connection to Carel controllers is made using an analogue or digital output or Modbus® RS485 serial connection.

When a refrigerant leak exceeding a certain alarm concentration is detected, the device enters in alarm status (low or high, depending on exceeded concentration level):
- changing internal LED colour and blinking frequency;
- activating internal buzzer;
- activating a dedicated internal relay (SPDT);
- regulating the analogue output (proportional to detected concentration);
- reporting the state change through Modbus® RS485 output and the app RILEVA.

Furthermore, it is possible to connect to the device through the app "RILEVA", available on both App Store and Play Store.

The GLD series detector can meet the following requirements for ASHRAE 15 and EN 378 series standards:
- Equipment controls through many output signals (analogue, RS485, relays);
- Functions activation within needed response time, if properly set;
- Performs an automatic self-test to check main detector's functionalities;
- Visual and audible alarms with internal LED and buzzer;
- Manual alarm reset through "Alarm latching" function.

WARNING: The GLD series Detector is a device used for monitoring and controlling of gas concentration, it's NOT suitable to operate in systems and appliances which requires classified functional safety levels (SIL or PL), with prejudice on the health and safety of people, animals and/or things.

WARNING: This instrument is neither certified nor approved for operation in oxygen-enriched atmospheres. Failure to comply may result in EXPLOSION.

WARNING: This instrument has not been designed to be intrinsically safe for use in areas classified as being hazardous locations. For your safety, DO NOT use it in hazardous (classified) locations.

1.2 Gas Leakage Detector, Built-In Version

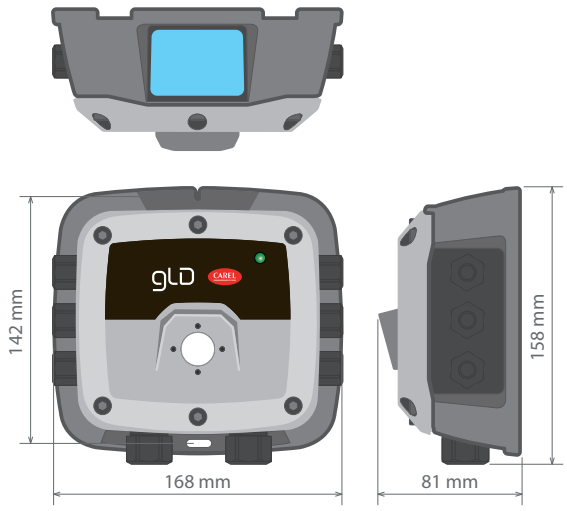


Fig. 1.a

Enclosure description:	IP66 rated ABS enclosure
Power options	24 VAC
	19.5 to 28.5 VDC
Diagnostic/status LED	3 color: green, orange and red)
Configurable output signal options	3× Relays (high alarm / low alarm / fault)
	1× Analog Output (4 to 20 mA, 0 to 5 V, 0 to 10 V, 1 to 5 V, 2 to 10 V)
	Digital Output (Modbus RS485)

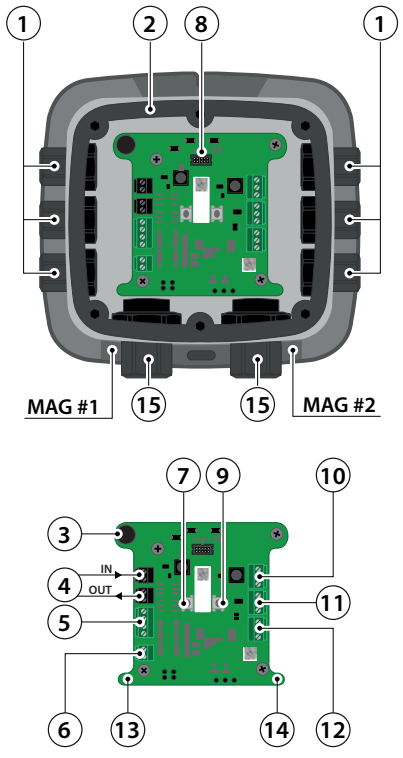


Fig. 1.b

#	Component Description
1	M16 Cable Glands (×6)
2	Rubber Gasket
3	Internal Alarm Buzzer
4	Power Connections (×2)
5	Digital Connection (Modbus)
6	Analog Connection
7	Tactile Switch #1
8	Ribbon Cable Connection (To Sensor)

#	Component Description
9	Tactile Switch #2
10	Relay 3 Connection (FAULT)
11	Relay 2 Connection (HIGH)
12	Relay 1 Connection (LOW)
13	Magnetic Switch #1
14	Magnetic Switch #2
15	M20 Cable Glands (×2)

Tab. 1.a

1.3 Gas Leakage Detector, Remote Version

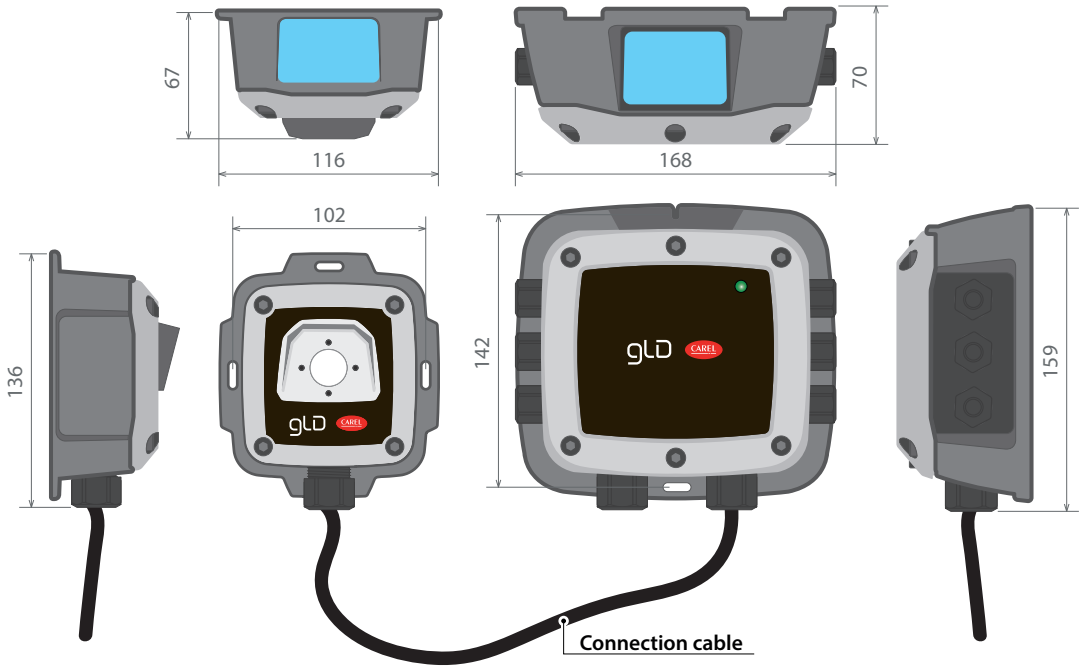


Fig. 1.c

Enclosure description:	2× IP66 rated ABS enclosure connected via RJ45 cable (up to 5 meters in length)
Power options	24 VAC
	19.5 to 28.5 VDC
Diagnostic/status LED	3 color: green, orange and red
Configurable output signal options	3 x relays (high alarm / low alarm / fault)
	1× Analog Output (4 to 20 mA, 0 to 5 V, 0 to 10 V, 1 to 5 V, 2 to 10 V)
	Digital output (Modbus RS485)

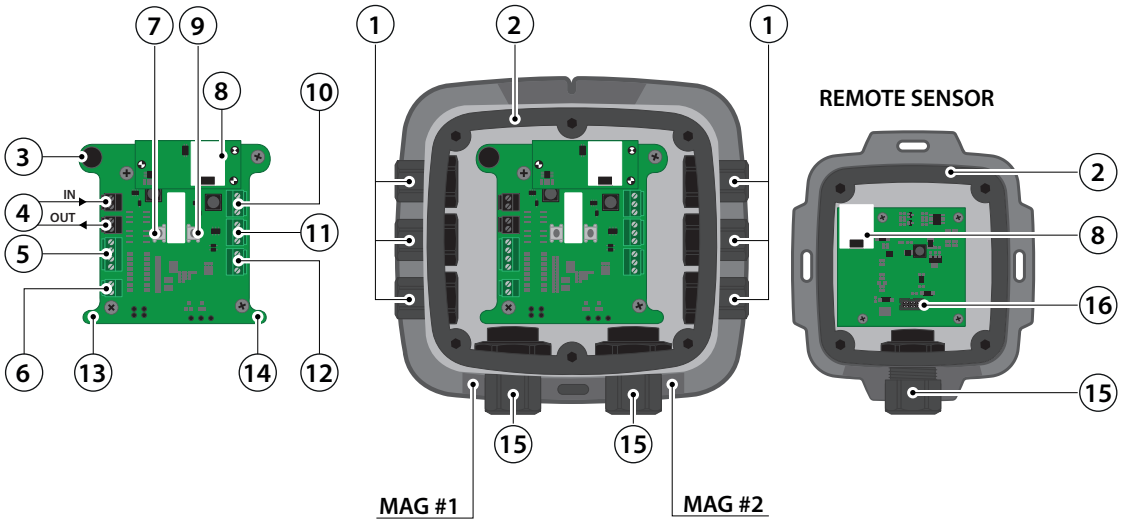


Fig. 1.d

#	Component Description
1	M16 Cable Glands (×6)
2	Rubber Gaskets (×2)
3	Internal Alarm Buzzer
4	Power Connections (×2)
5	Digital Connection (Modbus)
6	Analog Connection
7	Tactile Switch #1
8	Remote Sensor Connections (×2)

#	Component Description
9	Tactile Switch #2
10	Relay 3 Connection (FAULT)
11	Relay 2 Connection (HIGH)
12	Relay 1 Connection (LOW)
13	Magnetic Switch #1
14	Magnetic Switch #2
15	M20 Cable Glands (×3)
16	Ribbon Cable Connection (To Sensor)

Tab. 1.b

2. INSTALLATION

IMPORTANT: The manufacturer of this product requires that a bump test or adjustment be performed following installation to verify instrument functionality. See "Adjustments and Bump Test" paragraph as reference.

2.1 General Information

Every detail of installation site selection is critical to ensure overall system performance and effectiveness. Strict compliance and considerable thought must be given to every detail of the installation process, including, but not limited to the following:

- Regulations as well as local, state, and national codes that govern the installation of gas monitoring equipment
- Electrical codes that govern the routing and connection of electrical power and signal cables to gas monitoring equipment
- The full range of environmental conditions to which the instruments will be exposed
- The physical characteristics of the gas or vapor to be detected
- The specifics of the application (e.g., possible leaks, air movement/ draft, etc.)
- The degree of accessibility required for maintenance purposes
- The types of optional equipment and accessories that will be used with the system
- Any limiting factors or regulations that would affect system performance or installations

Wiring details, including:

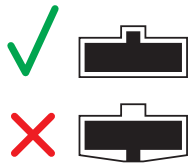
- The GDWB enclosure provides the following cable gland openings:
  - 2×, M20, supports 10-14mm cable outer diameter
  - 6×, M16, supports 4-8mm cable outer diameter
- The GDWR enclosure provides the following cable gland openings:
  - 1×, M20, supports 10-14mm cable outer diameter
  - 6×, M16, supports 4-8mm cable outer diameter
- Power input must be supplied by a safety isolating transformer (Class 2) with no ground connection on secondary winding.
- The wiring for the relays must be selected and fused according to the rated voltages, currents, and environmental conditions
- If stranded conductors are used, a ferrule should be used
- To comply with RFI immunity regulations, it is necessary to ground the shield of the communications cable at the BOSS, mini-BOSS, or other supervisors (e.g., the chassis, the ground bus-bar, etc.)
- Do not power the Gas Detector from Carel controllers or other third party devices, due to 1.5 A inrush current.

ATTENTION: The installation location must have appropriate supply power available for the instrument (i.e., 19.5 to 28.5 VDC or 24 VAC). This ultimately determines the distance the instrument can be mounted from the controller or power supply.

IMPORTANT: Installation surfaces shall not be subject to continuous vibrations, otherwise damage may occur to plugs and electronic devices.

2.2 Mechanical Installation

1. Using the provided hardware, securely mount the Gas Leakage Detector (GLD) according to the product dimensions, maximum wiring lengths and following considerations:
   a. Environment: the full range of environmental conditions when selecting a location.
   b. Application: the specifics of the application (possible leaks,air movement / draft, etc.) when selecting a location.
   c. Accessibility: the degree of accessibility required for maintenance purposes when selecting a location.
   d. Target Gas: the specific gravity of the target gas when selecting the height of the instrument.
2. Using a 5/32 (4 mm) hex key / allen wrench (not included) remove the lid and disconnect the ribbon cable from the base. For ribbon cable reconnection refer to the following indications.
3. Set the lid and rubber gasket aside to be reinstalled later.



2.3 Electrical Installation

2.3.1 Preparations

ATTENTION: Do not reverse the keyed connector of the flat cable connecting main PCB with sensor element PCB, otherwise the sensor element can be damaged.

CAUTION: Ensure wiring for relays and connections for sensor(s) are made before applying power.

CAUTION: This product uses semiconductors which can be damaged by electrostatic discharge (ESD). When handling the printed circuit boards (PCBs), observe proper ESD precautions so that the electronics are not damaged.

2.3.2 Power & Signal Wiring

The product comes with cable glands and plugs pre-installed. The power entry cable gland is without a gland plug. Use the appropriate cable glands to insert and connect the wires for power and signal to the appropriate terminals as indicated in the figure and wiring table that follow. The PCB terminal blocks are pluggable type and may be removed to aid termination.

Polarity must not be reversed.

For 24 VAC installations in a daisy-chain configuration, the neutral polarity must be maintained for all instruments.

Fasten terminal screws.

Connection	Description	Label	Wiring Termination
Power	24 VDC/VAC IN	24V IN: -	VAC neutral / VDC ground
		24V IN: +	VAC phase / +24 VDC
	24 VDC/VAC OUT (Depends on applied VDC/VAC IN power supply)	24V OUT: -	VAC neutral / VDC ground
		24V OUT: +	VAC phase / +24 VDC
Digital Output	Modbus Network Communications	MODBUS: B	RS-485 "B" (inverted, -, Rx)
		MODBUS: A	RS-485 "A" (non-inverted, +, Tx)
		MODBUS: GND	RS-485 GND
		MODBUS: SH	RS-485 Shield
Analog Output	Voltage or Current Output	ANALOG: -	Analog output ground (-)
		ANALOG: +	Analog output signal (+)

Tab. 2.a

2.3.3 Relay Wiring

WARNING: Relays are rated for 1 A at 24 VAC/VDC, resistive load. DO NOT apply mains power onto these relays.

Using appropriate cable glands, connect the wires for relay 1, relay 2, and relay 3 to the terminals as indicated in the following wiring table.

Relay	Function
1	Low Alarm
2	High Alarm
3	Fault

Tab. 2.b

When configured according to the factory default settings, the relays are de-energized during normal operation (not fail-safe). Fail-safe mode can be configured. When configured for fail-safe operation, relays are energized during normal operation. Fail-safe operation ensures relays are triggered in cases of power failure at the instrument. In failsafe operation normally open and normally closed terminals are reversed as indicated by the following table

Terminal	Normal operation	Failsafe Operation
NC	Normally Closed	Normally Open
COM	Common	Common
NO	Normally Open	Normally Closed

Tab. 2.c

2.3.4 Installation of Remote Sensing Head (only GDWR)

Standard RJ45 "Cat 5E STP" Ethernet cables up to 5 meters long may be used with the remote sensor. The cable provided from the factory is 5 meters long 8P8C plug dimensions are: 12 x 43 x 8 mm ±1 mm.

WARNING: Non standard cable lengths less than 5 meters may be used. Where non standard remote cables are used these must be shielded to comply with EMI regulations.

Remove the bottom right M20 cable gland plug and gland cap, and carefully remove the gland rubber insert. The rubber insert is split to allow it to be installed around the provided RJ45 cable.

Slip the cable gland nut over one end of the terminated RJ45 cable. Apply the split rubber insert onto the cable so that it is between the gland nut and the end of the cable.

Feed the RJ45 connector through a cable gland and into the enclosure, taking care to not damage the PCB.
Reassemble the cable gland by sliding the rubber insert into the gland body and then tightening the gland nut. Confirm that the RJ45 cable is not binding or stressing the PCB terminal blocks (leave no excess cable inside the enclosure).

Plug the RJ45 connector into the provided RJ45 socket. Take care on RJ45 connector pluging process, as the cable has to bended and excessive tensioning can damage the PCB.

IMPORTANT: A sensor is automatically recognized and registered by the instrument after a power cycle.

2.3.5 Electrical connection diagram examples

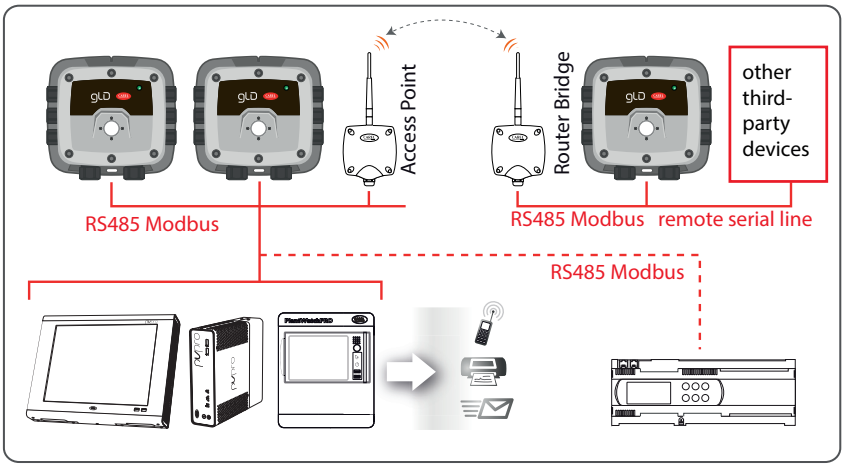


Fig. 2.e

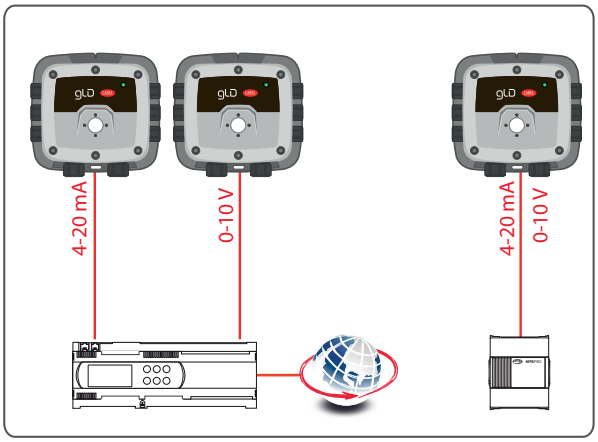


Fig. 2.f

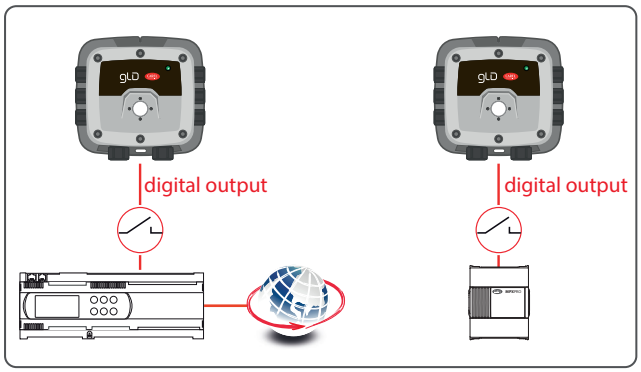


Fig. 2.g

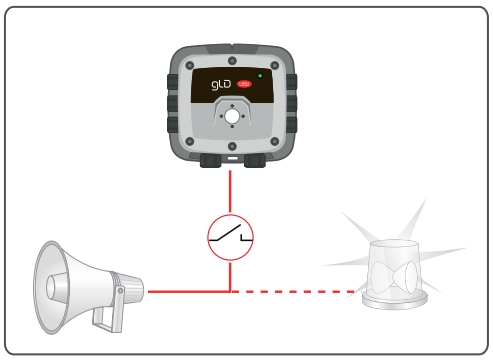


Fig. 2.h

IMPORTANT: check compatibility with the application on the controller.

2.3.6 Modbus RTU RS-485 Interface

For the Modbus RS-485 network use a 16 to 24 AWG (0.5 to 1 mm2) 3-core, 2 twisted pair + ground, shielded cable with 120 Ω characteristic impedance.

Recommended: Belden 3106A (or equivalent)

The Modbus address, baud rate, stop bit, parity and slave termination is configured through the setup menu. No jumpers or hardware switch settings are required.

Ensure that the communication parameters within the network, including the used supervisor, are configured identically.

To ensure optimal performance of the Modbus network ensure the following guidelines are implemented:

- Ensure instruments are configured in a single bus topology, connecting multiple buses in parallel or branching multiple units from the main bus, may introduce impedance mismatches, reflections and/or signal distortions
- Avoid long stubs when connecting instruments to the bus, stubs should be less than 1 meter in length
- Ensure instruments at end of bus have 120Ω terminating resistor enabled. Terminating resistors may be enabled via the Carel App.
- Ensure A (+, Tx)/B (-, Rx) signal polarity is maintained throughout RS-485 network
- Connect cable shield drain to physical earth or ground at the controller only.
- Connect cable shield drain to (SH) terminal at instrument
- Ensure cable shield integrity is maintained throughout RS-485 network.
- Do not use shield connection for signal ground. Use cable that provides dedicated ground conductor for signal ground. Connect signal ground to (GND) terminal of instrument.

2.3.7 Conclusion

After all wiring is completed, power the transmitter and confirm operation, and then prepare to seal the enclosure.

Align the enclosure gasket, and then put lid back on and tighten the six screws. Tightening torque should be limited to hand tight, and should be uniform.

3. OPERATION

3.1 Applying Power & the Start-up Sequence

After applying power, the instrument will go through a start-up sequence (initialization, audible/visual test and self-test sequence). After start-up sequence completes, the instrument will enter a warm-up period to allow the sensor element to stabilize before reporting a valid output.

Step	Description
1.	Switch power on.
2.	Observe start-up sequence and warm-up phase. • Green LED will blink at 0.5 Hz for about 5 minutes • Buzzer is off • Relay state is "no alarm" • Gas reading invalid
3.	Observe normal operation. • Green LED is steady on • Buzzer is off • Relay state is "no alarm" • Gas reading valid

Tab. 3.a

3.2 Analog Signals

The GLD Carel series Gas Detector features a single configurable analog output. During normal operation the analog output of the instrument is proportional to the detected gas concentration and can be selected from the following.

- 1 to 5 V
- 0 to 5 V
- 2 to 10 V
- 0 to 10V
- 4 to 20 mA (Default)

The GLD Carel series Gas Detector uses different voltage/current values to indicate various modes of operation. In normal operation the relative gas concentration output is indicated by the analogue output level. Output level is proportional to the gas level as shown below:

Gas Concentration	1-5V	0-5V	2-10V	0-10V	4-20mA
0%	1V	0V	2V	0V	4 mA
50%	3V	2.5V	6V	5V	12 mA
100%	5V	5V	10V	10V	20 mA

Tab. 3.b

The instrument may also enter several special states, these are indicated by the specific analogue output levels indicated below:

Mode of operation	1-5V	0-5V	2-10V	0-10V	4-20mA
Instrument Fault	≤ 0.3V	N/A	≤ 0.6V	N/A	≤ 1.2 mA
Offline Mode/Maintenance	0.75V	N/A	1.5V	N/A	3 mA
Drift below zero	0.95V	N/A	1.9V	N/A	3.8 mA
Normal operation	1-5V	0-5V	2-10V	0-10V	4-20 mA
Measuring range exceeded	5.12V	5.12V	10.25V	10.25V	20.5 mA
Fault on analog interface	> 5.25V	> 5.25V	> 10.5V	> 10.5V	> 21mA

Tab. 3.c

3.3 Modbus Signal

The GLD Carel series Gas Detector provides a Modbus RTU digital interface. All status messages and most parameters which can be accessed and/or configured through the Bluetooth® interface can also be accessed and/or configured via Modbus Carel Controller.

3.4 Status Indication

The GLD Carel series Gas Detector provides external indication of its current operational state via audible and visual feedback, together with relays outputs. Visual indication of the instrument status is provided by a single tri-color LED (Green/Red/Orange).

Instrument states and corresponding outputs are shown below:

State	LED	Buzzer	Relay 1 (LOW)	Relay 2 (HIGH)	Relay 3 (Fault)
Warm-up			OFF	OFF	OFF
Normal			OFF	OFF	OFF
Low Alarm			ON	OFF	OFF
High Alarm			ON	ON	OFF
Offline			OFF	OFF	OFF
Fault			OFF	OFF	ON
Negative Gas Fault			OFF	OFF	ON
Zero Cal. Fault			OFF	OFF	OFF
Span Cal. Fault			OFF	OFF	OFF

Tab. 3.d

3.5 Magnetic Switch Functions

User interaction with the GLD Carel series Gas Detector is accomplished through the use of two magnetic switches located on the bottom of each unit. To actuate a magnetic switch, apply the magnet provided along with the Gas Detector to the relevant switch location as indicated below:

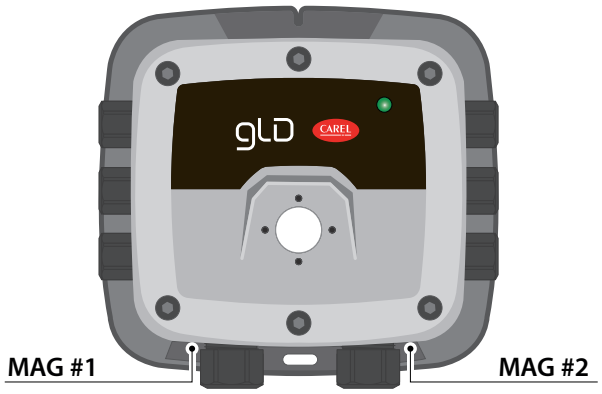


Fig. 3.i

Switch locations above are referred to in this document as MAG#1 and MAG#2.

Depending on the duration the switch is held, a short "TAP" or long "HOLD" will be detected.

To carry out a tap function, tap the relevant switch location for 1s, until a single "chirp" is heard, remove wand to confirm a "TAP"

To carry out a hold function, do not remove the magnetic wand after the first chirp but continue to hold for >5s, until a double "chirp" is heard, remove wand to confirm a "HOLD"

If either switch is held for >30s, a stuck switch fault will be indicated.

The function of each switch depends on the current state of the instrument. Refer to the table on the following page for switch functions in each instrument state.

State	Switch 1 Tap	Switch 1 Hold	Switch 2 Tap	Switch 2 Hold
Warm-up	Enable Bluetooth® Connectivity	-	Disable Bluetooth® Connectivity	-
Normal		Start Zero Calibration		Start Span Calibration
Low Alarm		Mute Buzzer		Ack. Latched Alarm
High Alarm		Mute Buzzer		Ack. Latched Alarm
Offline		-		-
Fault		Mute Buzzer		Ack. Latched Fault
Negative Gas Fault		Mute Buzzer		Start Zero Calibration
Zero Cal. Fault		Acknowledge Fault		-
Span Cal. Fault		-		Acknowledge Fault

Tab. 3.e

3.6 Tactile Switch Functions

To interact with the instrument without use of the magnetic wand, two internal push button tactile switches may be used. Remove lid without removing ribbon cable to access. Internal switches TACT#1 and TACT#2 mirror the functions of MAG#1 and MAG#2.

In addition to magnetic switches, is actually possible to reset system to factory defaults through tactile switches.
To reset system to factory defaults, remove lid and hold TACT#1 and TACT#2 simultaneously for 30s. Instrument will restart to confirm factory reset. Another option for this action is to set via Carel RILEVA app (see dedicated chapter).

3.7 RILEVA, the APP for GLD Gas Detectors

RILEVA, the app for interacting with the new CAREL GLD series Gas Detector, equipped with Bluetooth technology. RILEVA considerably simplifies configuration and maintenance, as well as interfacing to the latest CAREL Gas Detector models.
The use of a smartphone instead of a PC and/or serial converter makes daily functional checks more user-friendly and easy to perform.
Furthermore, RILEVA makes testing and calibration faster and effortless, with the focus on saving time. Features include:

- Configuration (rename device, define alarm thresholds, change Modbus settings, configure relay behaviour and manage analogue output settings)
- Maintenance (test LED/buzzer operation, relays and analogue output level)
- Calibration (view sensor type, serial number and "Calibration Due" timer and initiate zero/span calibrations with customisable field calibration certificate)
- Intuitive interface (view current gas measurement and acknowledge alarm/fault status)

To download RILEVA, scan here or visit www.carel.com/apps

Available on the App Store

ANDROID APP ON Google play

3.7.1 Enable Bluetooth® Connection

1. Enable Bluetooth® discovery by tapping MAG#1 for 1-second. (After 10-seconds, device will indicate that it is discoverable with audible heartbeat until it has been paired, discovery has timed-out or has been cancelled.)
2. Launch the RILEVA App and click the Bluetooth® icon at the bottom of the screen to initiate a scan.
3. Select the instrument from the list of available Carel gas detectors.
4. When prompted, enter the passkey (default is "123456").

WARNING: Default alias, passkey and unlock code can be changed via the RILEVA's configuration menu. Default values should be changed after instrument installation for security purposes.

3.7.2 Checking Status

Current Instrument status can be viewed from the Home tab. Home tab displays the following status information:

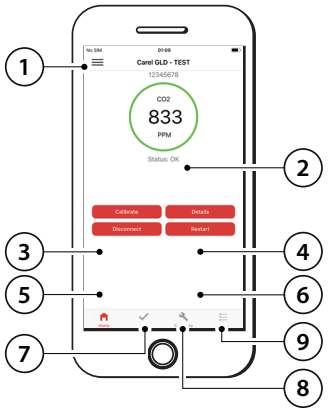


Fig. 3.j

#	Description
1	Main Menu (App Settings)
2	Status (Gas Concentration)
3	Calibrate (Calibration / Bump Test)
4	Details (Instrument Information)
5	Disconnect Bluetooth®
6	Restart Connected Device
7	Test Mode (LED / Buzzer / Relays / Analog Output)
8	Device Configuration
9	Logs

Tab. 3.f

State	Status Ring	Description
Warm-up	Green	Gas detector stabilizing after power on or restart
Normal	Green	Normal operation
Low Alarm	Yellow	Gas measurement has exceeded low alarm setpoint
High Alarm	Red	Gas measurement has exceeded high alarm setpoint
Offline	Orange	Gas Detector in maintenance mode and is not actively monitoring gas
Fault	Orange	A fault has been detected
Negative Gas Fault	Orange	Gas detector calibration has drifted below zero, requires zero calibration
Zero Cal. Fault	Orange	Error occurred during zero calibration. Zero calibration has not be updated. Zero calibration required.
Span Cal. Fault	Orange	Error occurred during span calibration. Span calibration has not be updated. Span calibration required.

Tab. 3.g

3.7.3 Instrument Configuration

For security, access to configuration and calibration options are restricted to authorized users only. Access to these functions require use of an unlock code.

To unlock instrument configuration, go to configure tab to setup device. When prompted, enter unlock code to access device configuration. (The instrument's default code is "1234").

Instrument will remain unlocked until Bluetooth® connection has ended.

WARNING: Default alias, passkey and unlock code can be changed via the GLD App's configuration menu. Default values should be changed after instrument installation for security purposes.

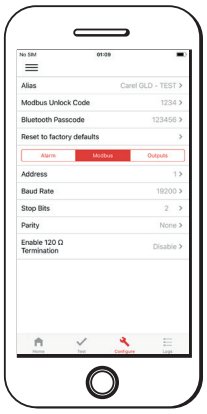


Fig. 3.k

Available instrument options:

- Alias
- Unlock code
- Bluetooth passcode
- Reset to factory defaults
- Low alarm setpoint
- High alarm setpoint
- Alarm latching
- Modbus: address
- Modbus: baud rate
- Modbus: stop bits
- Modbus: parity
- Modbus: enable 120ohm termination
- Analog output range
- Buzzer
- Relay failsafe
- Alarm delay
- Analog zero adjust
- Analog span range

ALIAS

To allow easy identification of a given instrument, an alias can be assigned to each instrument. This alias is displayed when searching for an instrument via Bluetooth®, on calibration cert and in home tab. To set alias:

- Configure Tab → Alias, Enter required alias for instrument, select OK.
- Instrument must be restarted for change to take effect. Home Tab → Restart, will reboot device.
- Reconnect to instrument to confirm alias has been updated.

UNLOCK CODE

- To change unlock code:
- Configure Tab → Modbus Unlock Code, enter new 4-digit unlock code for instrument, select OK.
- Instrument must be restarted for change to take effect. Home Tab → Restart, will reboot device.
- Reconnect to instrument to confirm unlock code has been updated.

IMPORTANT: If custom unlock code is forgotten, unlock code may be reset to default value (1234) by resetting system to factory defaults. Note system reset will return all custom system configurations to defaults

BLUETOOTH PASSCODE

To prevent unauthorized access to instrument status, default instrument Bluetooth® passcode code should be changed during commissioning. To change Bluetooth® passcode:

- Configure Tab → Bluetooth Passcode, enter new 6-digit passcode for instrument, select OK.
- Instrument must be restarted for change to take effect. Home Tab → Restart, will reboot device.
- Reconnect to instrument to confirm unlock code has been updated.

IMPORTANT: If custom passcode is forgotten, unlock code may be reset to default value (123456) by resetting system to factory defaults. Note system reset will return all custom system configurations to defaults.

RESET TO FACTORY DEFAULTS

Instrument configuration may be reset to factory defaults via the smartphone application:

- Configure Tab → Reset to factory default, select OK to confirm.
- Instrument will automatically restart and disconnect from smartphone application.

WARNING: Resetting system to factory defaults will remove all custom system configuration including unlock code and Bluetooth passcode. After system reset custom unlock and Bluetooth passcodes should be configured to prevent unauthorized access and reconfiguration of instrument.

LOW ALARM SETPOINT

Value above which a low alarm condition occurs. Low alarm setpoint must be less than the high alarm setpoint and greater than the low alarm limit. The low alarm limit is the fixed minimum limit that is sensor–specific and not editable.

Range of acceptable setpoints is displayed when updating parameter. To update setpoint:

- Configure Tab → Alarm → Low Alarm Setpoint, enter new setpoint, select OK to confirm.

IMPORTANT: To prevent intermittent alarm operation at the setpoint due to measurement noise this instrument implements hysteresis at the setpoint. Once the alarm level is exceeded, the gas measurement must return a fixed percentage below the alarm threshold before the alarm is disabled. Typical hysteresis value is set at 5% of full scale however this is sensor specific and non-editable.

HIGH ALARM SETPOINT

Value above which a high alarm condition occurs. High alarm setpoint must be less than the sensor full scale range and greater than the low alarm setpoint.

Range of acceptable setpoints is displayed when updating parameter. To update setpoint:

- Configure Tab → Alarm → High Alarm Setpoint, enter new setpoint, select OK to confirm.

IMPORTANT: To prevent intermittent alarm operation at the setpoint due to measurement noise this instrument implements hysteresis at the setpoint. Once the alarm level is exceeded, the gas measurement must return a fixed percentage below the alarm threshold before the alarm is disabled. Typical hysteresis value is set at 5% of full scale however this is sensor specific and non-editable.

ALARM LATCHING

Enabling alarm latching will maintain alarm or fault condition even after the alarm or fault condition is no longer active. When latched, the alarm or fault condition must be manually acknowledged before the condition will be cleared. This allows transient alarm or fault conditions to be identified.

If an alarm is latched, i.e. the condition has occurred but is no longer active, an acknowledgement button will appear on the home screen. Select this button to acknowledge the latched condition and clear the alarm or fault.

When disabled the alarm or fault status clears automatically as soon as the condition is no longer active. To configure:

- Configure Tab → Alarm → Alarm Latching, select enable/disable, select OK to confirm

MODBUS: ADDRESS
Sets instrument address for connection to RS-485 Modbus interface. (Default: 1).

To set address:
- Configure Tab → Modbus → Address, select 1-247, select OK to confirm

IMPORTANT: Ensure all instruments on RS-485 bus have been configured with unique node addresses. If two instruments have been configured with same address, bus contention will occur preventing communications with these instruments via the RS-485 interface.

MODBUS: BAUD RATE
Sets instrument baud rate for connection to RS-485 Modbus interface. (Default: 19200 baud)

To set baud rate:
- Configure Tab → Modbus → Baud Rate, select 9600/19200, select OK to confirm

MODBUS: STOP BITS
Sets instrument stop bits for connection to RS-485 Modbus interface. (Default: 2 stop bits)

To set number of stop bits:
- Configure Tab → Modbus → Stop Bits, select 1 or 2, select OK to confirm

MODBUS: PARITY
Sets instrument parity for connection to RS-485 Modbus interface. (Default: None)

To set parity:
- Configure Tab → Modbus → Parity, select None/Odd/Even, select OK to confirm

IMPORTANT: Stop bits must be set to 1 where parity is Odd or Even

MODBUS: ENABLE 120Ω TERMINATION
For optimal communication reliability, in RS-485 Modbus networks the last instrument physically connected to the RS-485 bus must include a 120Ω termination resistor. This is to reduce the potential for electrical signal reflection on long buses due to impedance mismatches.

Typically, this requires a physical resistor with the same characteristic impedance of the bus cable to be installed on the bus.

GLD Carel series instruments include this termination resistor on all instruments and allow this termination to be enabled via this configuration setting without the need for an external physical resisters.

To enable this termination resistor:
- Configure Tab → Modbus → Enable 120Ω Termination, select enable/disable, select OK to confirm

IMPORTANT: Termination resistor should only be enabled on last instrument physically connected to RS-485 bus. An external resistor should not be connected where this is enabled on the instrument.

ANALOG OUTPUT RANGE
Sets instrument analog output range.

Available ranges: 1-5V, 0-5V, 0-10V, 2-10V, 4-20mA (Default).

To set range:
- Configure Tab → Outputs → Analog Output Range, select desired range, select OK to confirm

BUZZER
Enable or disable buzzer. Buzzer provides local audible alarm/fault indication. Buzzer is enabled by default.

To enable/disable buzzer:
- Configure Tab → Outputs → Buzzer, select enable/disable, select OK to confirm

RELAY FAILSAFE
Enable or disable Relay Failsafe operation. When configured for fail-safe operation, relays are energized during normal operation. Fail-safe operation ensures relays are triggered in cases of power failure at the instrument. In failsafe operation normally open and normally closed terminals are reversed as indicated in Section 3.4.3.

Relays are configured as non-failsafe by default.

To enable/disable relay failsafe:
- Configure Tab → Outputs → Relay Failsafe, select enable/disable, select OK to confirm

ALARM DELAY
Sets delay in minutes before instrument will indicate an alarm condition after low or high alarm threshold has been exceeded. May be used to prevent short transient alarm conditions from activating alarms. Alarm delays may be set for 0-15 minutes. Alarm delay is configured as 0 minutes by default.

To set alarm delay:
- Configure Tab → Outputs → Alarm Delay, enter desired delay in minutes (0-15), select OK to confirm.

ANALOG ZERO ADJUST
Analog zero adjust applies a fixed offset to the analog output. This allows removal of small errors in the output between the gas detection instrument and the measurement at the controller due to cable resistance when using voltage outputs.
This function become very useful in case of remote measurement mismatches with real instrument voltage output.

To apply adjustment ensure instrument is outputting fixed value (default 4mA at zero ppm or use output test function to set specific output value), monitor remote measurement and adjust zero offset until remote measurement matches expected output.

Adjustment is limited to ±10% full scale

To set analog zero adjustment:
- Configure Tab → Outputs → Analog Zero Adjust, use slider to set desired offset adjustment.
- Alternatively, tap "Analog Zero Adjust (X.X%)" text and enter specific offset required (-10 to 10)

ANALOG SPAN RANGE
Analog span range scales the FSD (full-scale deflection) of the analog output. The selected range determines the equivalent gas measurement at the analog output maximum range.

Example: R134A 1000 ppm, 0-5V analog output. If Analog Span Range is set to 20%, the full analog output range only covers the first 20% of the gas measurement range, i.e 0-200 ppm will output 0-5V, above 200 ppm the output will be truncated to 5V.

Note: sensor resolution stays at the value for the max range.

Adjustment is limited to between 20%-100% FSD, Default is set to 100%.

To set analog span range:
- Configure Tab → Outputs → Analog Span Range, use slider to set desired range
- Alternatively, tap "Analog Span Range (X.X%)" text and enter specific range required.

4. CARE & MAINTENANCE

4.1 Maintenance Procedure

- Check LEDs, buzzer and relays operation
- Check RS485 transmission to the supervisor if connected
- Check for analogue output
- Calibrate the sensing element (Zero Adjustment and Span Adjustment) and perform the Bump test with Calibration Kit and proper gas or replace it with new factory-calibrated sensor

Such operations must also be perform within the commissioning.
For maintenance interval refer to Recommended Maintenance Interval par. 5.3, table 5.c (Sensing Element).

⚠ WARNING: Semiconductor sensitive elements perform a full maintenance cycle after exposure to significant concentrations of gas, which can shorten the sensor lifetime and/or reduce its sensitivity.

⚠ WARNING: commissioning and maintenance process shall be performed by qualified personnel.

4.2 Adjustments and Bump Test

4.2.1 Introduction

Adjustment of the detector must be performed at regular intervals to guarantee performances and functionalities of the device.

Breathing Hazard: Calibration gas MUST NOT be inhaled! See appropriate Safety Data Sheets. Calibration gas should be vented into a fume hood or to the outside of the building.

Zero First, Then Span: For proper operation, never adjust the span before completing a zero adjustment. Performing these operations out of order will cause faulty calibration.

IMPORTANT: Carel recommends calibrating detectors within the application-specific condition and with target gas. This method of zeroing the detector in the application environment and performing a target gas calibration is more accurate.

IMPORTANT: The sensor should be fully stabilized (at least 2 hours, preferably 24 hours).

IMPORTANT: When entering the functions for zero or span adjustment, the detector will automatically enter OFFLINE mode, and will remain OFFLINE until either the OFFLINE mode is canceled by tapping the respective magnetic switch, or the OFFLINE mode times out within 6 minutes (typical) after the adjustment has ended.

4.2.2 General Calibration Procedure

⚠ WARNING: The GLD Carel series Gas Detector MAY NOT be in an alarm or fault condition during calibration. Acknowledge any alarms or faults BEFORE attempting to begin the calibration process.

⚠ WARNING: Except for CO2 sensors, calibration gas must be in a balance of air, not nitrogen (N2). Furthermore, the area must be known to be free of the target gas or any gases to which the sensor may be cross-sensitive.

IMPORTANT: Calibration and / or bump testing requires the GLD calibration adapter kit (P/N: GDOPK00000).

IMPORTANT: At elevations higher than 6,560' (2,000 m), calibration will result in a lower reading. Above 6,560', the instrument should be calibrated in the environment of operation.

1. Fit calibration adapter to the gas detector lid.
2. If using a variable flow regulator, adjust the gas flow to approximately 0.3 L/min.

4.2.3 Zero Adjustment

Ambient air can be used to zero the sensor instead of synthetic air only if the area is known to be free of the target gas or any gas to which the sensor may be cross-sensitive. In this case, no cylinder or calibration adapter is needed for the zero adjustment.

1. Begin zero adjustment:
   a. App RILEVA: Home Tab → Calibrate → scan barcode on gas cylinder or manually enter values for zero gas.
   b. Manual: hold MAG#1 for >5-seconds. The LED will blink green-green-red when the instrument is ready.
2. Apply zero gas (or ambient air per warning above).
3. Confirm the start of calibration:
   a. App RILEVA: press the Start Zero button.
   b. Manual: tap MAG#1 within 30-seconds or the instrument will time-out and return to normal operation.
4. Complete zero adjustment:
   a. App RILEVA: app will countdown to completion. If calibration is successful, proceed to Step 5. If calibration is unsuccessful, return to the Home screen and press the Acknowledge button to clear the zero calibration fault.
   b. Manual: the LED will blink green-red, green-red-red, green-red-red-red, etc. until calibration is complete. To abort, hold MAG#1 for >5-seconds, turn off gas flow and remove the calibration adapter. If calibration is successful (green LED), proceed to Step 5. If calibration is unsuccessful (LED blinks orange @ 2 Hz), tap MAG#1 to discard the calibration attempt.
5. Turn off gas flow from zero gas.
6. Replace zero gas with calibration gas in preparation for span adjustment.

4.2.4 Span Adjustment

1. Begin span adjustment:
   a. App RILEVA: scan barcode on gas cylinder or manually enter values for calibration gas.
   b. Manual: hold MAG#2 for >5-seconds. The LED will blink green-green-orange when the instrument is ready.
2. Apply calibration gas at the concentration listed on the calibration gas concentration label (located on top of the instrument).
   - Part Number
   - Serial Number
   - Sensor Type
   - Maximum Range
3. Confirm the start of calibration:
   a. App RILEVA: press the Start Span button.
   b. Manual: tap MAG#2 within 30-seconds or the instrument will time-out and return to normal operation.
4. Complete span adjustment:
   a. App RILEVA: app will countdown to completion. If calibration is successful, proceed to Step 5. If calibration is unsuccessful, return to the Home screen and press the Acknowledge button to clear the span calibration fault.
   b. Manual: the LED will blink green-orange, green-orange-orange, green-orange-orange-orange, etc. until calibration is complete. To abort, hold MAG#2 for >5-seconds, turn off gas flow and remove the calibration adapter. If calibration is successful (LED blinks green-orange-red), proceed to Step 5. If calibration is unsuccessful (LED blinks orange @ 2 Hz), tap MAG#2 to discard the calibration attempt.
5. Turn off gas flow from calibration gas and remove the calibration adapter.
6. Allow sensor to recover / stabilize before the instrument returns to normal operation (green LED).

4.2.5 System Bump Test

A bump test is a live test of the system to verify that the detector responds to gas and all connected alarm devices, controllers, etc. are operating accordingly. It is recommended that all involved persons are informed about the test and certain alarms might have to be inhibited (e.g., shutdown valves, notification of authorities, etc.).

IMPORTANT: The manufacturer of this product requires that a bump test or calibration be performed following installation to verify instrument functionality.

1. Connect adapter and gas cylinder according to the instructions in the General Calibration Procedure.
2. If desired, disable / silence external annunciators (e.g., shutdown valves, notification of authorities, etc.):
   a. App RILEVA: Home Tab → Calibrate → Bump → toggle TAKE OFFLINE to disable communications to external devices.
   b. Manual: Inform building personnel of test so that external devices can be disabled / silenced.
3. Apply a sufficiently high concentration of the target gas to trigger alarms, but NOT pure refrigerant or hydrocarbons (e.g., do not use a butane lighter).
4. Once thresholds have been exceeded, relays should activate, digital outputs should transmit the gas concentration and:
   a. App RILEVA: gas concentration should be displayed, the instrument status should be "LOW ALARM" or "HIGH ALARM" and alarms states should be "ON."
   b. Manual: LED status should display "LOW ALARM" or "HIGH ALARM."
5. Turn off gas flow and remove the calibration adapter.
6. Allow sensor to recover / stabilize before the instrument returns to normal operation (green LED).

4.3 Troubleshooting

4.3.1 Hexadecimal Format

All fault codes can be retrieved through the App RILEVA interface and are shown in hexadecimal (hex) format. A hex digit can represent multiple codes as shown below.

Hex Code	Equivalent Error Code(s)	Hex Code	Equivalent Error Code(s)	Hex Code	Equivalent Error Code(s)	Hex Code	Equivalent Error Code(s)
0	0	4	4	8	8	C	4 + 8
1	1	5	1 + 4	9	1 + 8	D	1 + 4 + 8
2	2	6	1 + 2 + 3	A	2 + 8	E	2 + 4 + 8
3	1 + 2	7	1 + 2 + 4	B	1 + 2 + 8	F	1 + 2 + 4 + 8

Tab. 4.h

4.3.2 Fault Codes

NOTICE: If a sensor fault occurs during a gas alarm condition, then the fault overrides the alarm condition.

Sensor faults may be decoded using the following table. Note that several faults may be reported at the same time. For example, fault code 00000003 is a combination of fault codes 00000001 (No sensor signal) and 00000002 (Voltage out of specification 1V).

NOTICE: If a "last fault" attribute indicates that a fault has occurred at some point in time, but the corresponding "current fault" attribute shows no fault, then the problem has self-healed and no service action is required.

Fault Bit	System Fault	Possible Causes	Required Action(s)
0x00000001	Software fault	Firmware error (e.g. unexpected state)	Power-cycle. If it re-occurs then call service
0x00000002	Voltage out of specification 1V	Voltage rail out of range	Call service
0x00000004	Voltage out of specification 3.3V	Voltage rail out of range	Call service
0x00000008	Voltage out of specification 5V	Voltage rail out of range	Call service
0x00000010	Voltage out of specification 5.4V	Voltage rail out of range	Call service
0x00000020	Voltage out of specification 12V	Voltage rail out of range	Call service
0x00000040	Voltage out of specification VIN	Voltage rail out of range	Call service
0x00000080	System Flash Memory Read Fault	Error reading from internal Flash	Power-cycle. If it re-occurs then call service
0x00000100	System Flash Memory Write Fault	Error writing to internal Flash	Power-cycle. If it re-occurs then call service
0x00000200	System Flash Memory CRC fault	Error in internal Flash CRC	Power-cycle. If it re-occurs then call service
0x00000400	System Invalid Configuration	Error in system configuration	Power-cycle. If it re-occurs then call service
0x00000800	GPIO fault	Error detected on GPIO pin	Call service
0x00001000	Modbus Fault	Error detected in Modbus Communications	Power-cycle. If it re-occurs then call service
0x00002000	Analog Output Fault (GDWB Only)	Error updating DAC value	Power-cycle. If it re-occurs then call service
0x00004000	Bluetooth Fault	Error detected in Bluetooth module	Power-cycle. If it re-occurs then call service
0x00008000	Stuck switch	Magnetic and/or Tactile switch activated for > 1 minute	Call service
0x00010000	Sensor Element Out	Cannot detect sensor element	Check sensor connection
0x00020000	Sensor Element Fault	Fault detected in sensor element	Replace Sensor Module
0x00040000	Sensor ADC Sensor Read Fault	Cannot read from sensor ADC	Check sensor connection/Replace Sensor Module
0x00080000	Sensor ADC Current Read Fault	Cannot read from current ADC	Check sensor connection/Replace Sensor Module
0x00100000	Sensor AFE Read Fault (EC only)	Cannot read from EC sensor AFE	Check sensor connection/Replace Sensor Module
0x00200000	Sensor AFE Write Fault (EC only)	Cannot write to EC sensor AFE	Check sensor connection/Replace Sensor Module
0x00400000	Sensor AFE Status Fault (EC only)	Error in EC sensor AFE	Check sensor connection/Replace Sensor Module
0x00800000	Sensor EEPROM Read Fault	Error in reading from sensor EEPROM	Power-cycle/Check sensor connec./Replace Sensor Module
0x01000000	Sensor EEPROM Write Fault	Error in writing to sensor EEPROM	Call service
0x02000000	Sensor EEPROM CRC Fault	Error in CRC from sensor EEPROM	Power-cycle/Replace Sensor Module
0x04000000	Sensor EEPROM Configuration Fault	Error in sensor EEPROM data	Replace Sensor Module
0x08000000	Sensor UART Read Fault	Cannot read from sensor UART	Check sensor connection/Replace Sensor Module
0x10000000	Sensor Temperature Fault	Temperature cannot be read or is out of specification	Ensure Sensor is operating within specified temperature range/Check sensor connections
0x20000000	Negative Gas Concentration Fault	Sensor output has drifted too negative	Initiate Zero calibration (Via App/Hold MAG#2)
0x40000000	Zero Calibration failure	Zero calibration failed	Acknowledge failed calibration (Via App/Hold MAG#1)
0x80000000	Span Calibration failure	Span calibration failed	Acknowledge failed calibration (Via App/Hold MAG#2)

Tab. 4.i

4.4 Sensor Maintenance

ATTENTION: This product uses semiconductors which can be damaged by electrostatic discharge (ESD). When handling the PCB, care must be taken so that the electronics is not damaged.

4.4.1 Components Overview

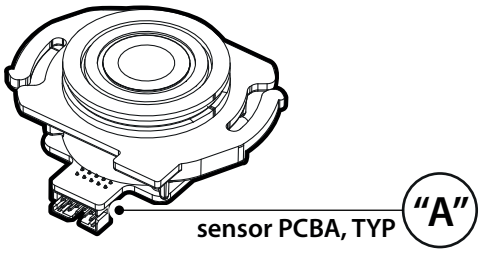


Fig. 4.l

Sensor element sketch, with overview on ribbon connector to main PCB ("A").

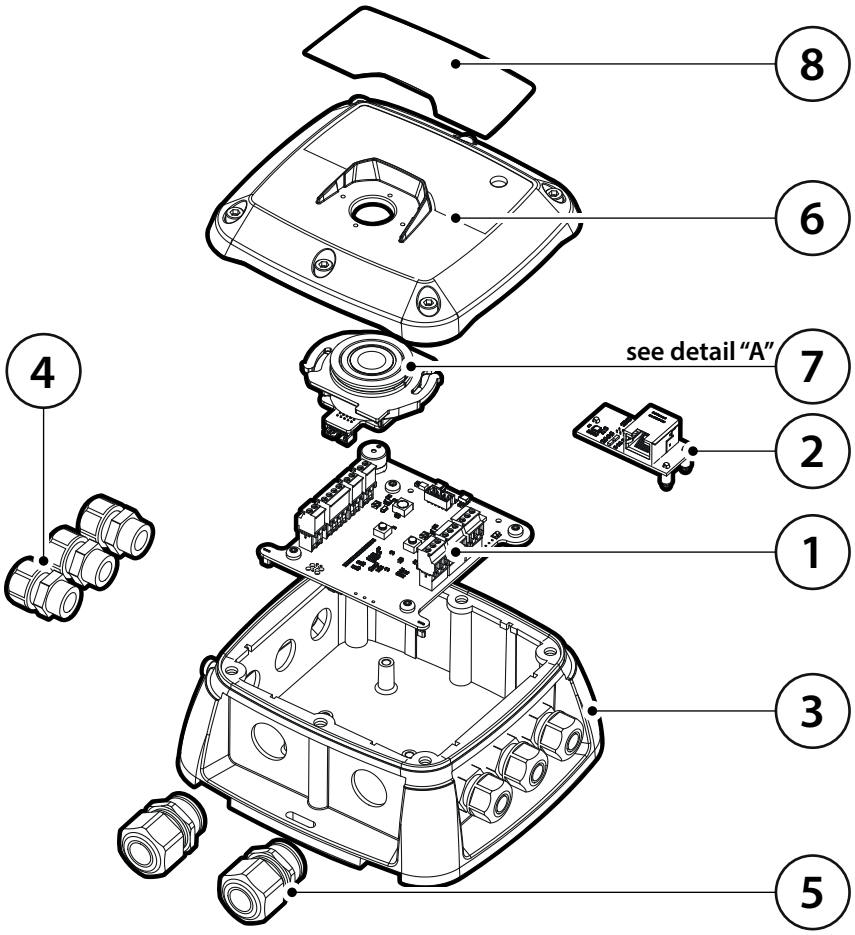


Fig. 4.m

#	Component Description
1	Main PCB
2	RJ45 PCB module (only for remote version)
3	Main Enclosure
4	M16 Cable Glands
5	M20 Cable Glands
6	Removable Lid
7	Sensor Element
8	Carel Label

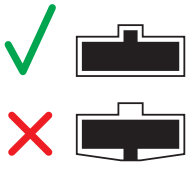
Tab. 4.j

4.4.2 Replacing the Sensor Module

ATTENTION: This product uses semiconductors which can be damaged by electrostatic discharge (ESD). When handling the PCB, care must be taken so that the electronics is not damaged. Inspection by trained service personnel.

To replace the gas detector's sensor module:

1. Power-down the gas detector.
2. Using a 5/32" (4mm) hex key / allen wrench (not included), remove the lid and disconnect the ribbon cable from the sensor module.
3. Remove installed sensor module from lid by holding onto the housing and turning counter-clockwise 90°. Take care not to apply excessive force to the sensor module's circuit board. When the square tab of the sensor housing is aligned with the lock icon, firmly pull the module to remove it from the housing.
4. Install the new sensor module by aligning the square tab with the lock icon before firmly pressing it into the enclosure. Taking care not to apply excessive force to the sensor module's circuit board, rotate the sensor module clockwise 90° (or until the triangle icon aligns with the lock icon on the lid).
5. Connect the ribbon cable (to the sensor module and transmitter) and close the lid. For ribbon cable reconnection, please refer to following indications.



6. Ensure gasket is aligned correctly and tighten the lid using the supplied hardware in an "X" pattern. Tightening torque should be limited to hand tight and should be uniform.
7. Power-up the gas detector.
8. After start-up sequence has finished, check sensor response (bump test).

4.5 Cleaning the Instrument

Clean the detector with a soft cloth using water and a mild detergent. Rinse with water. Do not use any alcohols, cleaning agents, sprays, polishes, detergents, etc.

5. TECHNICAL INFORMATION

5.1 Electrical Specifications

Category	Specifications	
Signals to Central Controller	Analog Current	Normal operation: 4 to 20 mA
		Drift below zero: 3.8 mA
		Measuring range exceeded: 20.5 mA
		Instrument fault: ≤ 1.2 mA
		Fault on analog interface: > 21 mA
		Offline mode/Maintenance signal: 3 mA steady signal
	Analog Voltage	0 to 5 V; 1 to 5 V; 0 to 10 V; 2 to 10 V (selectable)
		During fault condition, 1 to 5 V and 2 to 10 V outputs are 0 V.
	Modbus RTU over RS-485	Baud rate: 9,600 or 19,200 (selectable)
		Start bits: 1
		Data bits: 8
		Parity: None, odd, even (selectable)
		Stop bits: 1 or 2 (selectable)
		Retry time: 500 ms, min time between retries
		End of message: Silent 3.5 characters
Power Supply and Relays	Operating voltage	19.5 to 28.5 VDC; 24 VAC ± 20%, 50/60 Hz
	Inrush current	1.5 A
	Operating current, max.	4W, 170mA @ 24VDC
	Relay rating	3 SPDT
		1 A at 24 VAC/VDC, resistive load
	Audible alarm	Internal Buzzer 72 dB at 10 cm
	Alarm delay	0 to 15 minutes (selectable)
Wiring	Power and analog signal	2-core shielded cable, 16 to 20 AWG (0.5 to 1.5 mm2)
	Modbus network	3-core, 2 twisted pair + ground, shielded cable with 120 Ω characteristic impedance, 16 to 24 AWG (0.5 to 1.5 mm2).
	Cable gland	M20, 10-14mm cable outer diameter
		M16, 4-8mm cable outer diameter

Tab. 5.a

5.2 Physical Specifications

Dimensions	Enclosure Size (W×H×D) (Approx.)	Built-In: 168x158x81 mm
		Remote, main enclosure: 168x158x70 mm
		Remote, sensor enclosure: 116x136x67 mm
	Weight (Approx.)	Built-In: 643 g
		Remote: 732 g
	Operating Temperature	-40 to 50 °C
Environmental	Storage temperature	-20 to 40 °C
	Humidity	5 to 90 %RH, non-condensing
	Pressure	800 to 1,100 mbar
	Elevation	3,050 m altitude
	Enclosure protection	IP66

Tab. 5.b

5.3 Sensing Element

Operational life and Calibration requirements

Category	Semiconductor (SC)	Infrared (IR)
Recommended Maintenance Interval	6 months after commissioning 12 months thereafter	12 months
Typical Sensor Lifetime	4-6 years	5-7 years

Tab. 5.c

WARNING: Semiconductor sensitive elements should be checked after exposure to significant concentrations of gas, which can shorten the sensor lifetime and/or reduce its sensitivity.

Response Range and Resolution

MDL is the Minimum Detected Level of gas concentration. Values below the MDL are displayed as zero. Values below zero or above the range generate negative or positive saturation conditions respectively. If the gas level is below the negative concentration limit then the sensor will report a fault.

Sensor technology and gas	Full scale range	MDL	Display Resolution	Negative gas concentration limit	Units
SC, Refrigerants	0-1000	50	1	-100	ppm
SC, R290	0-2500	250	1	-500	ppm
SC, R717 (NH3)	0-1000	200	1	-150	ppm
IR, CO2 gas	0-10000	500	50	-1000	ppm

Tab. 5.d

Alarm set-points

All alarms must be equal or higher than the low limit. The high alarm must be higher than the low alarm. All alarms must be less than or equal to the full scale range.

Sensor technology and gas	Low Alarm Limit	Low Alarm Default	High Alarm Default	Units
SC, Refrigerants	150	150	500	ppm
SC, R290	400	800	2000	ppm
SC, R717 (NH3)	300	300	900	ppm
IR, CO2 gas	1500	1500	5000	ppm

Tab. 5.e

Temperature Compensation

Active temperature compensation is performed in the product for semiconductor sensors. Infrared sensors elements perform their own temperature adjustments. Temperature compensation error is defined at the concentration of calibration.

Sensor Technology	Error
IR, CO2 gas	±10 %FS
SC, Refrigerants	±20 %FS
SC, 1234ZE/R450A/R717	±30 %FS

Tab. 5.f

Response Time

The T50 or T90 response time (in seconds) is the time taken to get to 50% or 90% respectively of the sensor fullscale after application of gas at a concentration of 100% of sensor fullscale. On the other hand, T10 is the time taken to get back from 100% to 10% sensor fullscale.

Response times are typical values measured under reference conditions. All response times are in seconds and represents nominal values.

Gas Type	Range [ppm]	Average Response Time [s]			
		T50	T90	T100	T10 (recovery)
Semiconductor Refrigerant					
HFO1234YF	1000	132	348	544	300
HFO1234ZE	1000	154	429	903	363
R134A	1000	240	597	860	612
R32	1000	72	222	473	200
R404A	1000	104	315	495	248
R407A	1000	94	391	676	420
R407F	1000	114	412	732	366
R410A	1000	67	247	483	217
R448A	1000	95	307	544	233
R449A	1000	110	339	552	291
R450A	1000	158	494	844	462
R452A	1000	98	340	601	268
R452B	1000	86	265	539	281
R454A	1000	98	293	592	251
R507	1000	72	238	486	223
R513A	1000	135	411	659	452
R454B	1000	71	223	595	294
R455A	1000	97	262	598	309
NDIR CO2					
CO2	10000	28	97	217	96

Tab. 5.g

5.4 Modbus Registers

5.4.1 Modbus connections

RS485 communications port providing access to the Modbus-RTU protocol, for communicating with the gas detector.

Connection Symbol	Meaning
B	-, Rx, Inverting data signal
A	+, Tx, Non-inverting data signal
GND	Ground reference (different from 0V)
SH	Shield cable connection

Tab. 5.h

5.4.2 Modbus Configuration

RS-485 communication features that are selectable.

Feature	Selectable	Default
Address	1 … 247	1
Baud Rate	9600-19200 baud	19200 baud
Stop bit	1-2	2
Parity	None-Odd-Even	None
120Ω Termination	Enable-Disable	Disable

Tab. 5.i

5.4.3 Variable List

Analogue Input Registers (read only)

Register	Description	Range	Unit
100	Concentration gas level (% of full scale)	0 : 100	%
101	Concentration gas level in ppm	Ref. to Gas Range Table	ppm
103	Full scale sensor level in ppm		ppm
104	Low Alarm set-point (% of Full Scale) (local)	0 : 100	%
105	Sensor Timer	0 : 65,535	hours
106	Modbus detector address	1 : 247	
107	Software version (firmware revision)	-	
108	Machine Code (proprietary machine number)	527	
109	Order Number	300	

Tab. 5.j

Analogue Output Holding Registers (readable & writable)

Register	Description	Range	Details
200	High Alarm set-point (ppm)	Ref. to Gas Range Table	High Alarm set-point / threshold in parts per million (set by controller, override local sensor values)
201	Alarm Delay	0 : 15	Alarm-Sounder Delay set the time (in minutes) the Sounder Flag and the Alarm Flag are deactivated after gas concentration exceeds the alarm set-point.
202	Sounder Delay (mapped to register 201)		Set value in reg. 201 and reg. 202 are always the same
203	Low Alarm set-point (ppm)	Ref. to Gas Range Table	Low Alarm set-point / threshold level in parts per million

Tab. 5.k

Input Status Flags (read only)

Register	Description	Range	Details
300	High Alarm Flag	0 : 1	1: Gas concentration is greater or equal to high alarm set-point
			0: Gas concentration is less than the high alarm set-point
301	Relays state	0 : 1	1: One or more relays are active.
			0: All relays are inactive
302	Sensor Fault	0 : 1	1: Sensor absence or open circuit sensor fault is detected.
			0: Sensor present / in circuit and no open circuit fault detected
303	Red LED	0 : 1	1: Red LED is on. Alarm/Fault Indication.
			0: Red LED is off.
304	Green LED	0 : 1	1: Green LED is on. Warm-up or Normal status.
			0: Green LED is off.
307	Low Alarm Flag	0 : 1	1: Gas concentration is greater or equal to low alarm set-point
			0: Gas concentration is less than the low alarm set-point

Tab. 5.l

Output Status Flags (readable & writable)

Register	Description	Range	Details
400	Sounder Flag	0 : 1	1: Sounder is on
			0: Sounder is off
401	Test Flag	0 : 1	1: Sensor on / operating for more than 1 year and requires testing.
			0: Sensor does not require testing yet.
402	Relay Conctact Behavior	0 : 1	1: Failsafe relay operation (see table for relay logic)
			0: Standard relay operation (default)

Tab. 5.m

5.5 Table for relay logic

Relay behaviour when Failsafe Relay Operation (Register 402)
0: Standard relay operation (default)
1: Failsafe relay operation
This register value will affect each relay.

Triggering Event	0: Standard relay operation (default)	1: Failsafe relay operation
On power-up	De-energise relay 1,2,3: NO Output is open	Energise relay 1,2,3: NO Output is closed
On sensor fault	Energise relay 3: NO Output is closed	De-energise relay 3: NO Output is open
If the gas level exceeds the Low Alarm Threshold Register 203	Energise relay 2: NO Output is closed	De-energise relay 2: NO Output is open
If the gas level exceeds the High Alarm Threshold Register 200	Energise relay 1: NO Output is closed	De-energise relay 1: NO Output is open

Tab. 5.n

6. ADDITIONAL INFORMATION

6.1 Sensor Principles

6.1.1 Semiconductor Sensors

Semiconductor or metallic oxide sensors (MOSs) are among the most versatile of all broad-range sensors. They can be used to detect a variety of gases and vapors in low ppm or even combustible ranges. The sensor is made up of a mixture of metallic oxides. They are heated to a temperature between 150º and 300º C depending on the gas(es) to be detected. The temperature of operation as well as the "recipe" of mixed oxides determines the sensor selectivity to various toxic gases, vapors, and refrigerants. Electrical conductivity greatly increases as soon as a diffusion process allows the gas or vapor molecules to come in contact with the sensor surface. Water vapor, high ambient humidity, temperature fluctuations, and low oxygen levels can result in higher readings.

IMPORTANT: Certain substances in the environment to be monitored may impair the sensitivity of the sensors:

1. Materials containing silicone or silicone rubber/putty
2. Corrosive gases such as hydrogen sulfide, sulfur oxide, chlorine, hydrogen chloride, etc.
3. Alkaline metals, salt water spray.

6.1.2 Infrared Sensors

The infrared (IR) gas sensor is designed to measure the concentration of combustible gases and vapors in the ambient air. The sensor principle is based on the concentration-dependent absorption of infrared radiation in measured gases.

The monitored ambient air diffuses through a sintered metal material into the enclosure of an optical "bench". The broadband light emitted by an IR source passes through the gas in the optical bench and is reflected by the walls from where it is directed towards a dual-element detector. One channel of the detector measures the gas-dependent light transmission, while the other channel is used as a reference. The ratio between measurement and reference signal is used to determine the gas concentration. Internal electronics and software calculate the concentration and produce an output signal.

6.2 Disposing of the Instrument

6.2.1 Disposing of the Electrical & Electronic Equipment

EU-wide regulations governing the disposal of electrical and electronic appliances which have been defined in the EU Directive 2012/19/EU (WEEE) and in national laws have been effective since August 2012 and apply to this device.

Common household appliances can be disposed of using special collecting and recycling facilities. However, this device has not been registered for household usage. Therefore it must not be disposed of through these channels. Please do not hesitate to contact Carel if you have any further questions on this issue.

6.2.2 Disposing of Sensors

Dispose of sensors in accordance with local laws.

DANGER: Do not dispose of sensors in fire due to the risk of explosion and resulting chemical burns.

WARNING: Do not force open electrochemical sensors.

WARNING: Observe the applicable local waste disposal regulations. For information, consult your local environmental agency, local government offices or appropriate waste disposal companies.

6.3 Standard Conformities

- European Directive 2014/30/EU (EMC) and conforming to standards:
  - EN50270:2015,
  - EN55022:2010.
- European Directive 2014/35/EU (LVD) and conforming to standards related with "Electrical Equipment for Measurement, Control, and Laboratory Use":
  - UL61010-1/CSA C22.2 No. 61010-1,
  - IEC61010-1,
  - EN61010-1.
- European Directive 2014/53/EU (RED) for radio equipment;
- RoHS (2015/863/EU) e REACH;

Note:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that of the receiver.
- Consult the dealer or an experienced radio/TV technician for help.

7. ORDERING INFORMATION

7.1 Gas Detectors GLD series Part Numbers

Carel Code	Technology	Refrigerant	Max PPM	Transcode
GDWBS01A00	IP66 Built-in	Semiconductor	R-32	02GE1
GDWBS02A00	IP66 Built-in	Semiconductor	R-134a	02GE9
GDWBS03A00	IP66 Built-in	Semiconductor	R-290	02GEA
GDWBS04A00	IP66 Built-in	Semiconductor	R-404A	02GEB
GDWBS05A00	IP66 Built-in	Semiconductor	R-407A	02GEC
GDWBS06A00	IP66 Built-in	Semiconductor	R-407F	02GED
GDWBS07A00	IP66 Built-in	Semiconductor	R-410A	02GEE
GDWBS08A00	IP66 Built-in	Semiconductor	R-448A	02GEF
GDWBS09A00	IP66 Built-in	Semiconductor	R-449A	02GEG
GDWBS10A00	IP66 Built-in	Semiconductor	R-450A	02GEH
GDWBS11A00	IP66 Built-in	Semiconductor	R-452A	02GEI
GDWBS12A00	IP66 Built-in	Semiconductor	R-452B	02GEJ
GDWBS13A00	IP66 Built-in	Semiconductor	R-454A	02GEK
GDWBS14A00	IP66 Built-in	Semiconductor	R-454B	02GEL
GDWBS15A00	IP66 Built-in	Semiconductor	R-455A	02GEM
Coming Soon		Semiconductor	R-466A	xxxxx
GDWBS17A00	IP66 Built-in	Semiconductor	R-507A	02GEO
GDWBS18A00	IP66 Built-in	Semiconductor	R-513A	02GEP
GDWBS19A00	IP66 Built-in	Semiconductor	R-717 (Ammonia)	02GEQ
Coming Soon		Semiconductor	R-1150 (Ethylene)	xxxxx
GDWBS22A00	IP66 Built-in	Semiconductor	R-1234yf	02GET
GDWBS23A00	IP66 Built-in	Semiconductor	R-1234ze(E)	02GEU
Coming Soon		Semiconductor	R-1233zd(E)	xxxxx
Coming Soon		Semiconductor	R-1270	xxxxx
GDWRS01A00	IP66 Remote	Semiconductor	R-32	02GE3
GDWRS02A00	IP66 Remote	Semiconductor	R-134a	02GEX
GDWBS03A00	IP66 Remote	Semiconductor	R-290	02GEY
GDWRS04A00	IP66 Remote	Semiconductor	R-404A	02GEZ
GDWRS05A00	IP66 Remote	Semiconductor	R-407A	02GF0
GDWRS06A00	IP66 Remote	Semiconductor	R-407F	02GF1
GDWRS07A00	IP66 Remote	Semiconductor	R-410A	02GF2
GDWRS08A00	IP66 Remote	Semiconductor	R-448A	02GF3
GDWRS09A00	IP66 Remote	Semiconductor	R-449A	02GF4
GDWRS10A00	IP66 Remote	Semiconductor	R-450A	02GF5
GDWRS11A00	IP66 Remote	Semiconductor	R-452A	02GF6
GDWRS12A00	IP66 Remote	Semiconductor	R-452B	02GF7
GDWRS13A00	IP66 Remote	Semiconductor	R-454A	02GF8
GDWRS14A00	IP66 Remote	Semiconductor	R-454B	02GF9
GDWRS15A00	IP66 Remote	Semiconductor	R-455A	02GFA
Coming Soon		Semiconductor	R-466A	xxxxx
GDWRS17A00	IP66 Remote	Semiconductor	R-507A	02GFC
GDWRS18A00	IP66 Remote	Semiconductor	R-513A	02GFD
GDWRS19A00	IP66 Remote	Semiconductor	R-717 (Ammonia)	02GFE
Coming Soon		Semiconductor	R-1150 (Ethylene)	xxxxx
GDWRS22A00	IP66 Remote	Semiconductor	R-1234yf	02GFH
GDWRS23A00	IP66 Remote	Semiconductor	R-1234ze(E)	02GFI
Coming Soon		Semiconductor	R-1233zd(E)	xxxxx
Coming Soon		Semiconductor	R-1270	xxxxx
GDWBI20A00	IP66 Built-in	Infra-red	R-744 (CO_2)	02GFL
GDWRI20A00	IP66 Remote	Infra-red	R-744 (CO_2)	02GFM

Tab. 7.a

7.2 Sensor elements

Carel Code	Technology	Refrigerant	Max PPM	Transcode
GDOPZS0100	Semiconductor	R-32	1000	02GNS
GDOPZS0200	Semiconductor	R-134a	1000	02GNV
GDOPZS0300	Semiconductor	R-290	1000	02GNW
GDOPZS0400	Semiconductor	R-404A	1000	02GNX
GDOPZS0500	Semiconductor	R-407A	1000	02GNY
GDOPZS0600	Semiconductor	R-407F	1000	02GNZ
GDOPZS0700	Semiconductor	R-410A	1000	02GO0
GDOPZS0800	Semiconductor	R-448A	1000	02GO1
GDOPZS0900	Semiconductor	R-449A	1000	02GO2
GDOPZS1000	Semiconductor	R-450A	1000	02GO3
GDOPZS1100	Semiconductor	R-452A	1000	02GO4
GDOPZS1200	Semiconductor	R-452B	1000	02GO5
GDOPZS1300	Semiconductor	R-454A	1000	02GO6
GDOPZS1400	Semiconductor	R-454B	1000	02GO7
GDOPZS1500	Semiconductor	R-455A	1000	02GO8
Coming Soon		R-466A	1000	xxxxx
GDOPZS1700	Semiconductor	R-507A	1000	02GOA
GDOPZS1800	Semiconductor	R-513A	1000	02GOB
GDOPZS1900	Semiconductor	R-717 (Ammonia)	1000	02GOC
GDOPZI2000	Infra-red	R-744 (CO_2)	10000	02GNU
Coming Soon		R-1150 (Ethylene)	1000	xxxxx
GDOPZS2200	Semiconductor	R-1234yf	1000	02GOE
GDOPZS2300	Semiconductor	R-1234ze(E)	1000	02GOF
Coming Soon		R-1233zd(E)	1000	xxxxx
Coming Soon		R-1270	1000	xxxxx

Tab. 7.b

7.3 Accessories

Carel Code	Description	Transcode
GDOPZK0000	GAS DETECTOR - CALIBRATION KIT	02H29

Tab. 7.c

Notes:

Notes:

CAREL

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