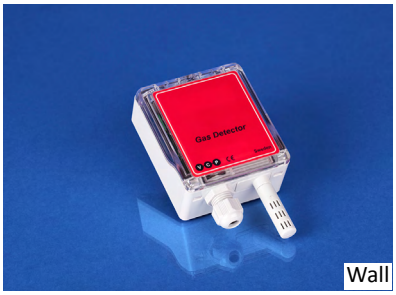
Carbon Monoxide (CO), Toxic Gas Detector, Analog, Relay, Modbus

COW/COD/COR Dec. 18



Wall

Duct

Features

- **LCD display**
- **Replaceable sensor cell**
- **Simple and fast mounting**
- **Modbus version**
- **Long sensor life time (10 years)**
- **Easy maintenance and calibration by exchange of the sensor unit or by comfortable on-site calibration**
- **Selectable analog outputs**
- **Wi-Fi Option**
- **Two universal and relay inputs (option)**
- **Early fire detection**
- **Mounting height, appr. 1.5 m above floor**
- **Coverage: Appr. 400 m² garage application as a rule of thumb**
- **Accuracy unaffected by poisoning**

Technical Data

Power Supply	24Vac (± %5), 50-60 Hz 14…35Vdc
Power Consumption	< 2.5 W
Current Output **Voltage Output**	4…20 mA, maximum 500 Ω 0…10 Vdc, minimum 1.000 Ω 0…5 Vdc, minimum 1,000 Ω
Relay Output	Max rating 1A@230V
Accuracy	±3 % for 0…300 ppm ±3 % for 0…1,000 ppm
T90	< 50 sec.
Life time	**10 years expected**
Drift	< 5% per year
Resolution	0.5 ppm
Repeatability	± 2%
Baseline	< 5 ppm
Filter capacity	> 20.000 ppm per hour
Operating Temperature	-20 …+50°C
Operating Humidity	15…90 %rH
Operating Pressure	900…1,100 mbar
Sensing Element	Electrochemical Cell
Media	Air or non-aggressive gases
Storage Temperature	-30 …+85°C

cont'd on p. 2

Technical data, cont'd

Design Features

Detector unit including digital value processing, temperature compensation and self control for the continuous monitoring of the ambient air.

The detector unit houses a module with a micro Controller, analog output, relay output and power supply in addition to the electro-chemical sensor element including amplifier.

The micro Controller calculates a linear 4 – 20 mA or 0 - 5Vdc and 0 - 10Vdc signal out of the measurement signal and also stores all relevant measured values and data of the sensor element.

Application

For detection of carbon monoxide (CO) within a wide range of commercial applications such as

- vehicle exhaust in parking structures (e.g. underground garages) and engine repair shops
- tunnels
- loading bays
- engine test benches
- shelters
- go-kart race courses etc.

Due to the standard analogue signal the CO detector is compatible with any electronic analogue control, DDC/PLC control or automation system.

Ordering Codes

Wall

COW 13FO	0 - 50, 0 - 100 or 0 - 300 ppm, 0-10Vdc/4-20mA

cont´d on p. 2

CO measuring range	0…300 ppm 0…1.000 ppm
Terminals	Pluggable screw terminal
Cable	maximum 1.5mm²
Cable Gland	M16 or PG9
Protection Class, Wall **Protection Class, Room**	IP65/IP41 (probe) IP340
EMC Directive	EN 61326-1 CE1701
Dimensions - wall/duct	enclosure 98.0 x 81.5 x 45.5 mm probe ø 12 mm x 46.5 mm
Dimensions - room	enclosure 80.0 x 80.0 x 34.2 mm

Weight	**Wall**	229 gr
	Room	82 gr
	Duct	250 gr

Cross Sensivity

The values given are only for information and should not be used as a basis for cross calibration.

Cross sensivities may not be linear and should not be scaled either.

Data based on gasing for 5 minutes using test equipment.

Test Gas	Test Gas Concentration	CO Equivalent
Carbon Monoxide	100	100
Hydrogen Sulfide	50	0
Sulphur Dioxide	20	0
Hydrogen	100	40
Nitric Oxide	50	0
Ethanol	200	< 2
Ammonia	50	0
Chlorine	15	0
Ethylene	100	0

Alarm levels - garage

Pre-alarm warning level set at **20 ppm**
Critical alarm level set at **25 ppm**

Ordering Codes, cont'd

COW 13F0D	COW 13FO with display
COW 13M	0 - 50/100/300 ppm, modbus RTU
COW 13MD	As COW 13M + display
COW 13DR	As COW 13M + display and relay output
COW 1351MDR	As COW RD + 0-10Vdc/4-20mA and modbus
Duct	
COD 13F0	0 - 50/100/300 ppm, 0-10Vdc/4-20mA
COD 13F0D	As COD 13FO + display
COD 13M	As COD 13FO + modbus RTU
COD 13MD	As COD13M + display and Modbus RTU
COD 13DR	As COD13M + display and relay output
COD 1351MDR	As COD 13RD + 0-10Vdc/4-20mA and modbus
Room	
COR 13F0	0 - 50/100/300 ppm, 0-10Vdc/4-20mA
COR 13M	0 - 50/100/300 ppm, modbus RTU

Other measuring ranges on request

On request, the passive measuring elements NTC1,8K, NTC 10K, NTC 20K, Pt1000 can be mounted in one or two alternative active 0-10Vdc.
Analogue output signals can be delivered in addition to the above with 0-10Vdc, 2-10Vdc, 0-5Vdc, 1-5Vdc or 4-20mA.
Two analog outputs can be configured (option)

The above combinations can be made with:
Modbus, LCD, Relay outputs, PID output, one or two temperature inserts.

HSG	Impact/vandal protection for gas detectors
Alarm units	
AAW 24	Warning siren, 24Vdc 98dB
AAW 230	Warning siren, 230Vac 98dB
OA 24R/Y/B/G	Warning siren 24Vdc 98dB, red/yellow/blue/green
OAW 24R/Y/B/G	Flashlight 24Vdc, red/yellow/blue/green
OAW 230R/Y/B/G	Warning siren/flashlight, 230V 98dB, red/yellow/blue/green
VCAGE	Impact protection for Warning siren/flashlight

General Notes

1. High density of some other gases may effect the reading.
2. Observe maximum permissible cable lengths.
3. If cable runs parallel to the mains cable: Use shielded cables.
4. Never test with flammable gases.
5. The cable entry always should have to be pointing downwards.
6. The data indicated under 'Technical Data' apply only to vertically mounted transmitters.
7. Duct type transmitters should be far away from humidifiers, min. 2 meters. (Duct version on request).
8. Room and Wall type transmitters should have to be mounted in the center of wall but not near to any windows. (Room version on request)

Output Jumpers

1. There is no output jumper for the fixed output types
2. Please check if there is any special Jumper Instruction in the enclosure
3. Range Jumpers for AO1 and AO2 have same specifications

Standard	
AO1	**Output 1**
no jumpers	fixed at the factory *according to your request*
AO1 	0...10V *jumper selection*
AO1 	4...20mA *jumper selection*

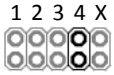
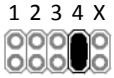
Option	
AO2	**Output 2**
no jumpers	fixed at the factory *according to your request*
AO2 	0...10V jumper selection
AO2 	4...20mA *jumper selection*

CONFIG Jumpers

1. Never use the jumper X at CONFIG..!
2. Please check if there is any special Jumper Instruction in the enclosure
3. There is no jumper for fixed range models

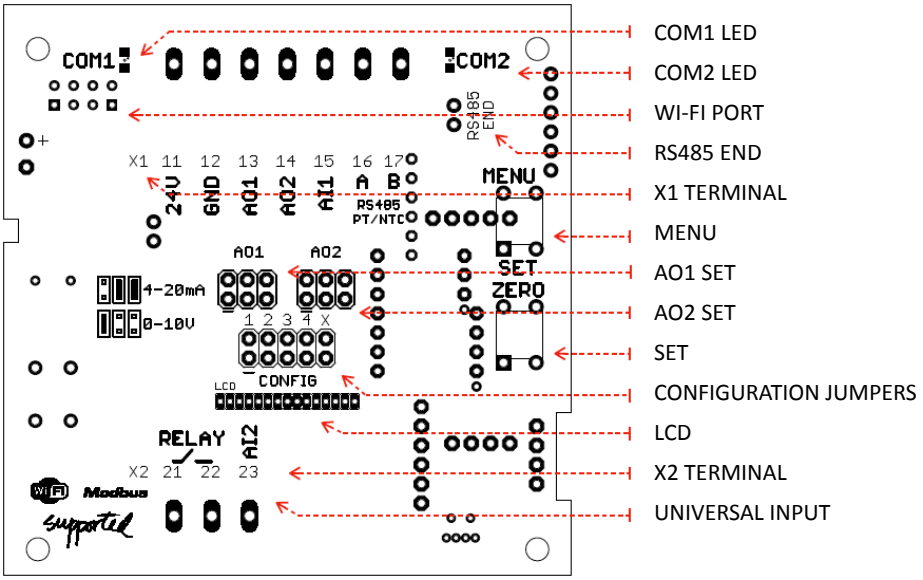
Range	COW 13
1 2 3 4 X  CONFIG	0 - 50 ppm
1 2 3 4 X  CONFIG	0 - 100 ppm
1 2 3 4 X  CONFIG	0 - 300 ppm

Range	COW 310
1 2 3 4 X  CONFIG	0 - 100 ppm
1 2 3 4 X  CONFIG	0 - 300 ppm
1 2 3 4 X  CONFIG	0 - 1000 ppm

Response	All types
1 2 3 4 X  CONFIG	5 sec.
1 2 3 4 X  CONFIG	60 sec.


Room

Transmitter Hardware



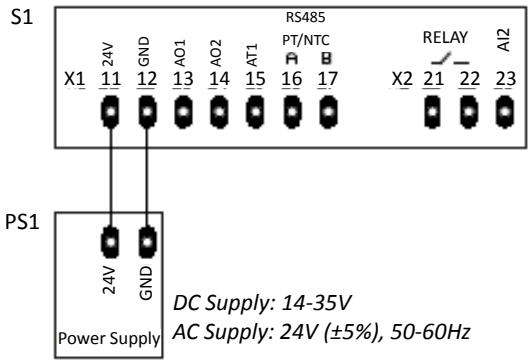
COM1 LED	without relay option, Bead LED, periodically gets ON and OFF with relay option, shows the relay position, lights when contact is closed (X2:21-22)	
COM2 LED	modbus communication LED, blinks when there is communication	
Wi-Fi PORT	wi-fi port, it is an advanced option, please contact us for more details	
RS485 END	modbus ending jumper to connect internal 120ohm resistor to the RS485 line	
X1 TERMINAL		
11	power	14…35 Vdc or 24 Vac (± %5, 50-60 Hz)
12	GND	ground for power and reference for outputs and inputs
13	output 1	analog output for main measurement
14	output 2	analog output for other measurement or duplicated output1 for third party devices
15	input 1	universal input for nearby passive field devices
16	A modbus	modbus communication positive pair
17	B modbus	modbus communication negative pair

MENU BUTTON	press and wait to enter MENU, click to navigate between sub menus one by one after all parameters turns back to main screen
AO1 & AO2 SET	output set as 0…10 Vdc or 4…20 mA with jumpers, only for output selectable products, for the fixed output models there is no jumpers, please be sure about the output type and electrical connections
SET BUTTON	click to change parameters, parameters are automatically set while exiting menu
CONFIGURATION	jumpers to set output range and delay time
JUMPERS	please refer to the “jumper reference” sticker on PCB or inside of cover
CAUTION	**never use jumper X..!**
LCD	12x2 LCD for monitoring and setting parameters
contrast	adjust the contrast from MENU for a better performance
brightness	adjust the brightness from MENU for a better performance

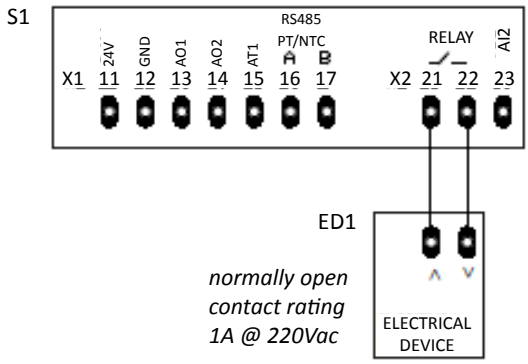
X2 TERMINAL		
21	NO contact relay dry contact max. rating 1A @ 220 Vac	
22	NO contact relay dry contact max. rating 1A @ 220 Vac	
23	input 2 universal input for nearby passive field devices	

UNIVERSAL INPUT	universal inputs (X1:15 and X2:23) can be digital input as dry contact or analog input as NTC10k, PT1000, 0…10 Vdc or 0…5 Vdc universal input is an advanced option, please contact us for more details

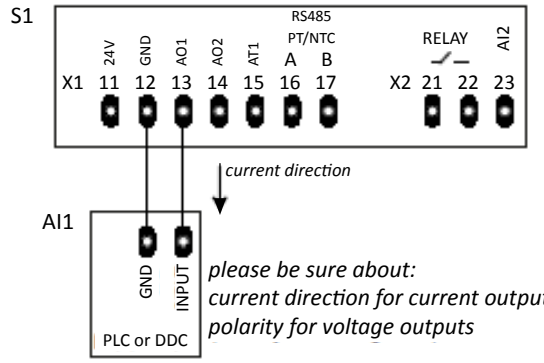
Electrical Connections



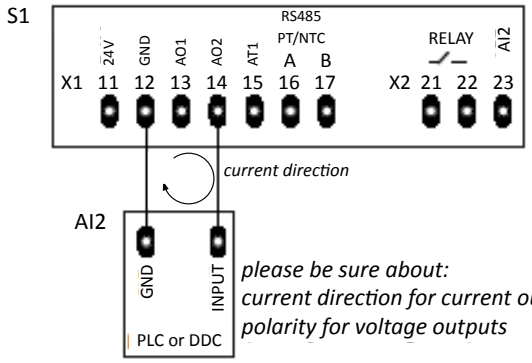
DC Supply: 14-35V
AC Supply: 24V (±5%), 50-60Hz



normally open
contact rating
1A @ 220Vac



please be sure about:
current direction for current outputs
polarity for voltage outputs



please be sure about:
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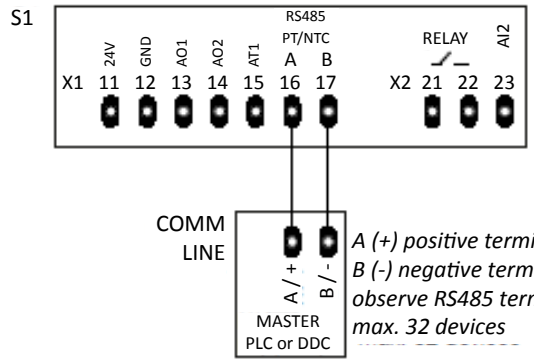
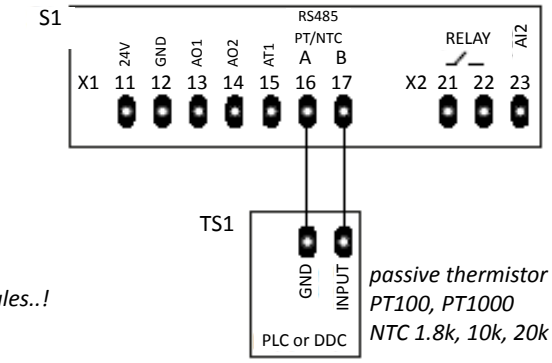
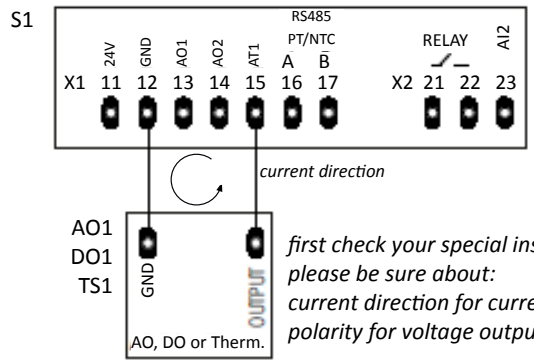
polarity for voltage outputs



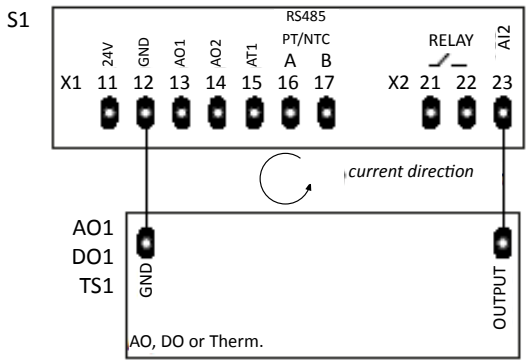
A (+) positive terminal
B (-) negative terminal
observe RS485 termination rules..!
max. 32 devices



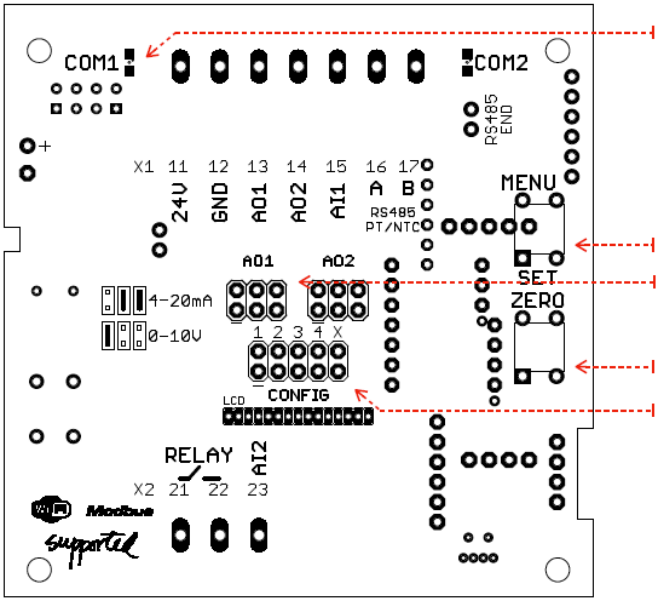
passive thermistor
PT100, PT1000
NTC 1.8k, 10k, 20k

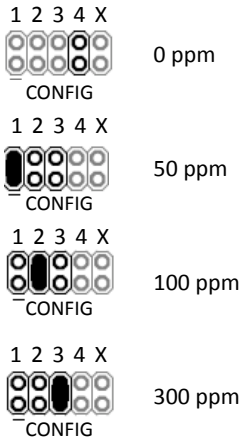


first check your special instructions
please be sure about:
current direction for current outputs
polarity for voltage outputs



Calibration - General Information





1. 6 months of stock life needs nearly 10 minutes of working at fresh air for settling the baseline.
2. SPAN Calibration can be done one by one for 0ppm, 50ppm, 100ppm and 300ppm for best performance.
3. 0…50ppm, 50…100ppm and 100…300ppm ranges have independent calibration maps.
4. Besides calibrating the max. range that will used, please make calibration for lower ranges.
5. Before any calibration, check CONFIG Jumpers and set to calibration level.

Calibration - 0ppm, 50ppm, 100ppm, 300ppm

1. Open the cover and power the detector, do not close the cover during process,
2. Wait for min. 3 minutes for warming up the sensor,
3. Use right CO Calibration Gas according to Jumper Settings, 0ppm, 50ppm, 100ppm or 300ppm
   You may use Fresh Air for 0ppm calibration (which is lower than 1ppm CO),
4. Apply the gas for min. 2 minutes with 0.5 lt/min. flow rate,
5. Keep pressing for min. 10 seconds to SPAN (MENU) button, LED will light continuously,
6. When LED gets OFF, take your finger from the button,
7. LED double flashes during ZERO process for 10 seconds,
8. The calibration point is an average of 20 measurements between 5th and 10th seconds,
9. LED lights continuously for 3 seconds,
10. Gas Detector turns back normal condition and works with new calibration setting.

Calibration - Factory Reset

1. Keep pressing for min. 10 seconds to ZERO button, LED will light continuously,
2. When LED gets OFF, take your finger from the button,
3. LED flashes continuously during RESET process for 10 seconds,
4. LED lights continuously for 3 seconds,
5. Gas Detector turns back to normal condition and works with factory calibration settings.

MENU

AP CONTROL	intro screen duration 2 seconds
CO ppm 8	Main screen, measuring value normal operating mode
ENTER MENU >>>>>>>	press and hold MENU button for entering menu if you skip pressing MENU button before seeing OK, you will be back to main screen
ENTER MENU OK	now you are in MENU
M1 Relay EnterSetting	RELAY_MENU, press SET button for entering RELAY_MENU, press MENU button to skip RELAY_MENU and pass to M2_RANGE
M1a Min.Set 10 ppm <>	you can set Min.Set for RELAY_MENU while arrows (< >) are on screen, press SET button for decreasing or MENU button for increasing the Min.Set
M1a Min.Set 12 ppm	wait for 3 sec. after pressing any button, the arrows (< >) are hidden, press MENU button to pass Max.Set, press SET button for editing Min.Set
M1b Max.Set 22 ppm <>	Max.Set setting is same as Min.Set setting
M1c Mode Set Closed 0.I.0	relay contact action according to min. and max. set points, select with SET button, skip or pass to next screen with MENU button
M2 RANGE 0...100 ppm	select the RANGE with SET button, skip or pass to next screen with MENU button
M3 RESPONSE SLOW (60sec)	select the RESPONSE time with SET button, skip or pass to next screen with MENU button
M4 CONTRAST 5	set the CONTRAST between 0 to 10 with SET button, default is 5, skip or pass to next screen with MENU button
M5 BRIGHTNESS 5	set the BRIGHTNESS between 0 to 10 with SET button, default is 5, skip or pass to next screen with MENU button
M6 Cal/Reset EnterSetting	device ID, check the identification datas of the device with SET button, skip and EXIT the menu with MENU button, you will be back to main screen
M6a 0 ppm Calibrate?	calibration for 0 ppm, press MENU button to pass next menu, for calibration, keep pressing SET button for 5 seconds and wait for 10 seconds,
M6b 50 ppm Calibrate?	calibration for 50 ppm, press MENU button to pass next menu, for calibration, keep pressing SET button for 5 seconds and wait for 10 seconds,
M6c 100 ppm Calibrate?	calibration for 100 ppm, press MENU button to pass next menu, for calibration, keep pressing SET button for 5 seconds and wait for 10 seconds,
M6d 300 ppm Calibrate?	calibration for 300 ppm, press MENU button to pass next menu, for calibration, keep pressing SET button for 5 seconds and wait for 10 seconds,
M6e Reset Factory Set?	reset to factory calibration, press MENU button to pass next menu, for resetting, keep pressing SET button for 5 seconds and wait for 10 seconds,
CO ppm 8	Main screen, measuring value normal operating mode

Modbus Protocol

Use Function 3 for Reading and Function 6 for Writing Holding Registers.
Register Table starts from Base 1. Default Settings: Modbus ID:1, 9600, 8bit, None, 1.

Register	R/W	Range	Description
1	R & W	1…254	Modbus Address
2	R & W	0…4	Baudrate, 0: 9.600, 1: 19.200, 2: 38.400, 3: 57.600, 4: 115.200
3	R & W	0…3	Bit_Parity_Stop, 0: 8bit_None_1, 1: 8bit_None_2, 2: 8bit_Even_1, 3: 8bit_Odd_1
4	R	0…1.000	CO level as ppm
5	R	0…1.000	CO level as ppm
6	R	0 or 1	Relay contact position, 0: OFF/Open, 1: ON/Close
7	R & W	0 to 4	Relay Mode, 0:Closed, 1:Open, 2:HighOn, 3:LowOn, 4:Off
8	R & W	0…1.000	MIN SET for Relay
9	R & W	0…1.000	MAX SET for Relay
10	R & W		Blank
11	R & W		Blank
12	R & W		Blank
13	R & W		Blank
14	R & W		Blank
15	R & W		Blank
16	R & W		Blank
17	R & W		Blank
18	R & W		Blank
19	R & W		Blank
20	R & W		Blank

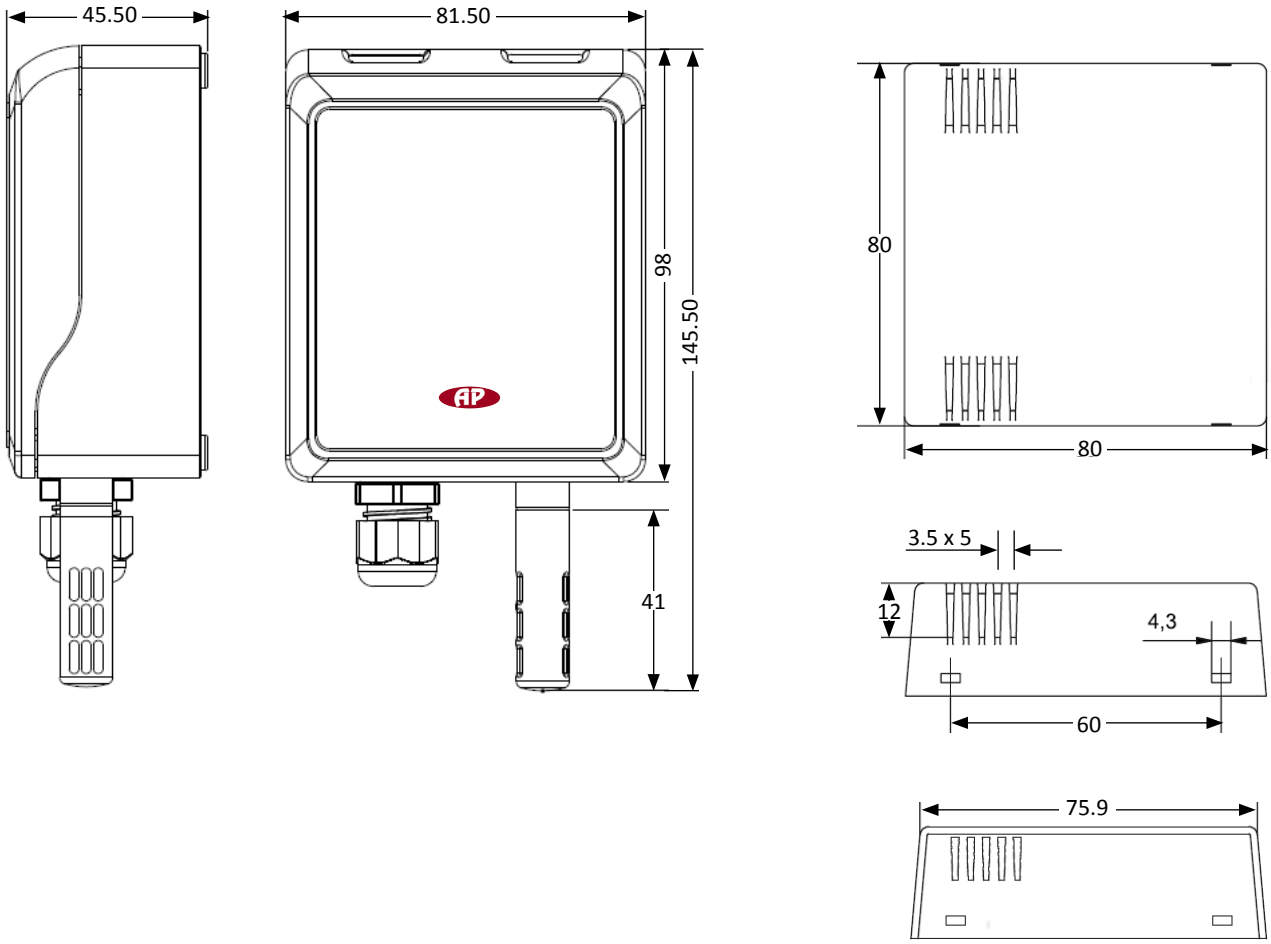
Relay Mode	< Min. Set	between Min. & Max. Set	> Max. Set
Closed / 0.I.0	OPEN	CLOSED	OPEN
Open / I.0.I	CLOSED	OPEN	CLOSED
HighOn / 0.X.I	OPEN	HYSTERESIS	CLOSED
LowOn / I.X.0	CLOSED	HYSTERESIS	OPEN
Off / 0.0.0	OPEN	OPEN	OPEN

0: Relay Contact is at OPEN position

1: Relay Contact is at CLOSED position

X: Relay Contact is at HYSTERESIS position, OPEN if previous position open, CLOSED if previous position closed,

Drawings



General information

When and where is comprehensive monitoring needed to cover a large area? You may fear that leaks could occur over the whole area. One example could be a solvent storage depot. In similar places you have to assume that an area of 20 - 40 m^2 per detector could be affected depending on to what extent the vapours can spread (shelving, obstacles, etc.).

In a garage, the sensors are distributed rather evenly. It is estimated that no dangerously high concentrations would form in a garage between two detectors at the specified alarm thresholds with one detector covering 400 m^2.

Concern about combustible gases has to be based on similar considerations with 80 - 120 m^2 per detector.

In a brewery, it is assumed that on a floor to be supervised the CO_2 will spread relatively evenly and close to the floor level.

In a storage depot one detector per 100 m^2 would probably be sufficient. It is important at on-site visits to detect the deeper located areas where CO_2 could accumulate. If there are several such places, each of these areas has to be monitored with (at least) one detector independent of the other detectors. In addition you would have to consider obstacles disturbing uniform spread of vapour.

For a comprehensive monitoring of toxic gases it is important to consider the rate of propagation for this gas. Chlorine for instance, diffuses only very slowly. One detector can monitor a maximum of 10 m^2.

Ammonia is lighter than air and propagates easily. But if there is moisture somewhere between the leak and the detector, a great deal of ammonia will be bound there and the detector will only detect a small amount of gas .

If there are ice deposits in cold stores, the ammonia will also be bound there and a detector will detect nothing. In this respect there is no general statement for a comprehensive monitoring, but in most applications this is not necessary.

Gas monitoring and ventilation control in parking areas

Gas monitoring in parking areas meets two main needs:

- To give a warning when the amount of harmful gases reaches an unhealthy level.
- To ensure that the ventilation control is done in the best and most profitable way, ie for fresh air needs.

Hazardous gases

Petrol and diesel exhaust fumes emit harmful levels of nitrogen dioxides (NO_2), hydrocarbons (CH) and carbon monoxides (CO).

As a rule only carbon monoxides and nitrogen dioxides are monitored in parking areas since it is often (wrongly) believed that other gases do not reach harmful levels.

Carbon monoxide is a highly dangerous toxic gas (see table at the top of page 5).

Nitrogen dioxide is a carcinogen.

When considering monoxide from gas monotoring persective it is appropriate to have two alarm levels, where one level, occurs at about 20 ppm, and the other at about 35 ppm.

A gas alert sign or similar can warn of unhealthy carbon monoxide levels at the lower alert level. At the higher alert level, ie critical alarm level, it may be appropriate to allow the system to activate a warning siren.

A detector density of at least 1 detector/400 m^2 is would be appropriate.

In case there are diesel vehicles in the parking area, it is important to take other harmful gases into consideration, such as nitrogen oxides and hydrocarbons.

In cases described above, specific monoxide detectors cannot cover the detection needs. Detectors that can detect these gases are required, eg, the GNO_2 gas detector.

Application areas

- Car repair shops
- Trucks/Indoor
- Parking areas
- Tunnels
- Mines
- Ice Hockey Rinks
- Bus/Lorry Terminals
- Generator rooms
- Garages

Ventilation control

The minimum requirement to be set in ventilation control is to make certain that the gas monotoring facility affects the ventilation in such a way that if harmful gas concentrations occur, the fresh air intakes must increase in order to reduce gas concentrations to reach harmless levels.

A well-regulated demand controlled ventilation in a parking area not only improves the air quality but it also minimizes the energy consumption by avoiding unnecessary ventilation.

Optimal ventilation with regard to gas concentrations can usually be achieved by regular ventilation.

In a modern gas monitoring facility there are functions both for alarms (two levels) and controls for air evacuation.

The control options in the gas monitoring facility can be adapted to the control modes of most ventilation facilities.

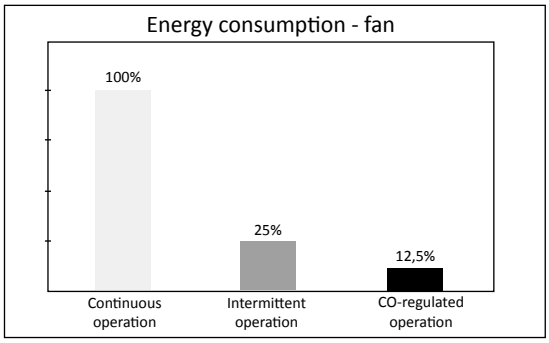
The gas monotoring facility allows for incrementally controlled ventilation.

Example:

At low load, ventilation is running at 1/2-power. If the gas concentration exceeds 20 ppm (level 1), the sensors react and ventilation is controlled is switched over to the 1/1 power.

Staff Alarm - e.g. warning by sirens in the parking area - is given when the concentration exceeds 35 ppm (level 2).

Stepless control via frequency converter controller or via DDC/PLC gives the best energy savings.



By monotoring CO levels and only running the fans when necessary the CO detector becomes a significant energy saver.

Normally parking area ventilation need only be operational in 2 out of 24 hours, which naturally saves a great deal of energy.

Poisoning Hazard

There are several gas that when released in the air uncontrolled can poison and kill people. Common poisonous gases in industry are e.g. ammonia, carbon monoxide and hydrogen sulphide (all the examples listed are also flammable).

Experts within occupational health and medicine estimate the gas concentrations for harmful gases when the adverse impacts are minor.

In Sweden, these so called hygienic levels are set and updated by the Swedish Work Environment Authority.
A distinction is made between the maximum exposure limit, i.e. the maximum value for a 15-minute average exposure, and the exposure limit value, i.e. the maximum value for an 8-hour average exposure.

When monotoring gas it is advisable to let the hygienic exposure limit values provide indications for the choice of alarm levels.

This does not mean however that you necessarily need to adhere to the above described levels.

Alarm levels should be chosen according to how dangerous the gas is and the particular installation conditions.

How carbon monoxide affects people			
Vol-%	**ppm**	**Contact duration**	**Symptom med möjliga följder**
0.02	200	2-3 h	Light headache
0.04	400	1-2 h	Severe headache (forehead)
0.08	800	45 min 2 h	Malfunctions in the body Unconsciousness
0.16	1600	20 min 2 h	Malfunctions in the body Death
0.32	3200	5-10 min 30 min	Malfunctions in the body Death
0.64	6400	1-2 min 10-15 min	Malfunctions in the body Death
1.28	12800	1-3 min	Death

Emission values for different engine types, as well as hygienic exposure limits of the gases									
GAS	Impurities (g/kg fuel) caused by petrol and diesel engines			ppm content petrol exhausts	ppm content diesel exhausts	Hygienic limits			
						ppm 8 h	mg/m³ 8 h	ppm 15 min	mg/m³ 15 min
NO_2	25	10,5	42	100-200	2000	25	30	-	-
CO	155	12	13	20000-60000	1000	35	39	50	55
CH	15	6	4	200-1500	500	25-1000			

By using gas detectors with an analog output, 4-20 mA, which sends the signal to a computerized control, regulation and monitoring system, the ventilation control is done in a more refined manner.

Depending on the capacity of the computerized system, the ventilation can be controlled continuously instead of stepwise. One can have a throttle control, optional time delays, breakdown of the ventilation into zones, etc.

The impact of various gases and vapours on people and hygienic exposure limits. Gas concentration in ppm (parts per million).					
Gas	**Lethal dose 5-10 min duration**	**Severe poisoning**	**Tempo-rary trouble**	**Max exp. lim.**	**Av. exp. lim.**
Ammonia (NH_3)	5.000	2.500	250	50	25
Carbon monoxide (CO)	7.000	2.000	1.000	100	35
Petrol	20.000	7.500	3.000	-	200*
Acetylene	500.000	250.000	100.000	-	-
* Refers to mg/m³					

Installation exemple

nstallation in parking area with mechanical ventilation at 40 x 40 m (1600m²).

The CO-detectors are placed at 140-180 cm above the floor, evenly distributed over the area, with consideration taken for walls and section dividers.

As a rule of thumb there should be one detector per 400m², the exact number depending on the shape of the area.