

ZILA CO₂ detectors, switches and controls

The fields of application with carbon dioxide (CO₂) are very diverse, as are the demands in dealing with the media.

Carbon dioxide can occur in gaseous as well as in liquid and solid form and furthermore has characteristics that are more favorable. CO₂ is a chemical compound that arises during combustion processes, within carbonaceous substances, and as a byproduct of cellular respiration of living organisms. The frozen solid form of CO₂, known as "dry ice" is used as a refrigerant and as an abrasive in dry-ice blasting. The invisible gas is also odorless, colorless and heavier than air, which can lead to dangerous situations for humans.

Impact of CO₂ on human wellbeing and health

CO₂ is a natural part of our atmosphere. The total amount of CO₂ in dry air is about 0.038% or 380 parts per million (ppm). This low concentration is harmless to humans.

Uncontrolled increase of the CO₂ concentration in the ambient air, such as by exhaust gases or in rooms where there are many people, not only reduces the oxygen uptake but also can

Atmospheric composition		
Nitrogen	N ₂	78.084%
Oxygen	O ₂	20.942%
Argon	Ar	0.934%
Carbon dioxide	CO ₂	0.038%

lead to headaches, fatigue and reduced performance of the persons concerned. From a concentration of 8% (80,000ppm), CO₂ may lead to unconsciousness and death within 30-60 minutes. Higher concentrations accelerate this process accordingly.

For this reason, the monitoring of the air quality and the CO₂ concentration of indoor and ambient air is always necessary when people stay in rooms over a longer period as well as near machines where CO₂ is a process gas or occurs as a byproduct.



CO ₂ poisoning caused risks:	CO ₂ ppm benchmarks		
	ppm	air quality	action
<ul style="list-style-type: none"> ▪ Headache ▪ Nausea ▪ Dizziness ▪ Shortness of breath ▪ Disturbance of consciousness to unconsciousness ▪ Respiratory disorder to respiratory arrest 	350-700	good	urban air outdoors; recommended for common rooms
	> 1,000	borderline	wellbeing is disturbed, increased ventilation measures necessary
	800-1,400	bad	air in poorly ventilated flats, limit in offices
	1,400-3,500	stressful	maximum values in the classroom after a lesson; intensive ventilation required
	> 2,000	unacceptable	professional ventilation concept required
	> 3,500	unacceptable	maximum measured values in cinemas after a movie
	40,000		exhaled air by humans

CO₂ used as indicator of air quality at home, workplace and passenger spaces

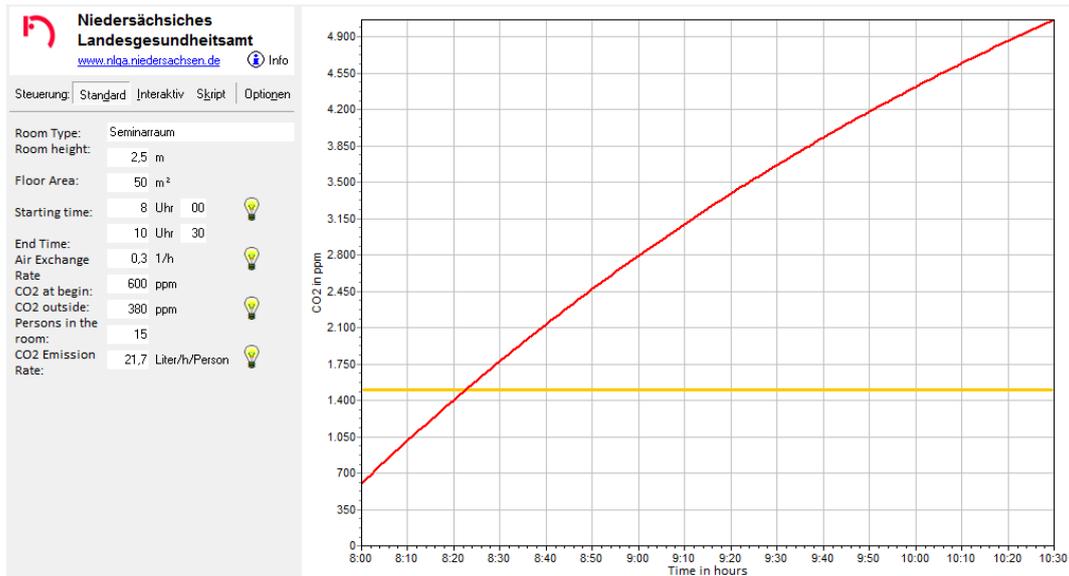
For 150 years, the concentration of carbon dioxide is used as indicator of indoor air quality (Pettenkoferzahl). Humans produce and exhale CO₂ themselves and therefore are a source of increased CO₂ concentration in the ambient air. The exhaled air contains a CO₂ concentration of about 40,000ppm. A graphical representation based on the CO₂ model software of the Lower Saxony State Health Department in Germany¹ demonstrates the increase of the CO₂ concentration in a room.

conditions:

A conference room with a size of 50m² (2.5m ceiling height) is used by 15 people over a period of 2.5 hours. The activity level of the persons is low.

- depending on the activity of the people, the CO₂ emission changes over time
- the CO₂ concentration at the start of the measurement is 380ppm outside and 600ppm in the room
- the air exchange rate per hour is lower because the windows are usually less permeable to air in modernized buildings

¹ Source: http://www.nlga.niedersachsen.de/portal/live.php?navigation_id=27083&article_id=19316&psmand=20



CO₂ model software from the Lower Saxony Health Department in Germany

Formation of CO₂ concentration in the conference room

- CO₂ limit for hygienically clean air (yellow line at 1,500ppm) reached after about 22 minutes even though the people in the room pursue no activity
- 3,000ppm already reached after 70 minutes
- after 1.5 hours approximately 3,700ppm are measurable in the room
- 5,000ppm at the end of the measurement

Poor indoor air quality leads to unpleasant odors and may endanger the health and performance of the people in the room!

To obtain good living and working conditions, a controlled ventilation of the rooms is required. The detection of CO₂ concentration is this therefore a good and reliable basis.

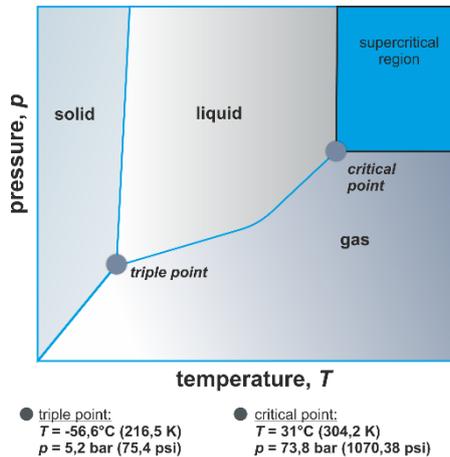
CO₂ in industrial applications

Use of CO₂ as a natural refrigerant R744

According to DIN EN 378-1 a fluid which is used to transfer heat in a refrigeration system is called a refrigerant. It should absorb heat at low temperature and low pressure and release it at high temperatures and high pressure. A change of state of the used refrigerant accompanies. Depending on the pressure and temperature CO₂ exists in gaseous (steam), liquid and solid (dry ice) form.



Using CO₂ as refrigerant in refrigeration and heat pumps has several advantages regarding to the cooling capacity, and due to the very good heat transfer coefficients in terms of efficiency. With today's technical possibilities, appropriate plants are built more compact and CO₂ as a refrigerant protects the system through better heat transfer and allows a lower pump performance.



CO₂ is a byproduct in many industries and therefore it does not have to be prepared in a complex process. Therefore, it can be used cost effective in both transcritical and subcritical industrial refrigeration applications.

Further advantages arise from the fact that the refrigerant R744 is neither toxic nor flammable. In case of leakages, one can discharge it safely in the material cycle without hesitation in most cases.

Despite these advantages mentioned, it is important to control the refrigerant CO₂ with regard to the safety of persons and machines as well as process efficiency and quality. Therefore precise CO₂ sensors and measuring-, testing- and control devices are required.

CO₂ in other applications

In the food and beverage industry CO₂ can be an additive, e.g. to produce carbonate soft drinks and soda water. To measure and control it is important for the quality of the final product.

Further areas of application of CO₂ arise when CO₂ needs to be controlled in order to establish ideal climatic conditions, e.g. in food and beverage, agricultural and other biological application. Plants require carbon dioxide to conduct photosynthesis. The atmospheres of greenhouses may be enriched with additional CO₂ to sustain and increase the rate of plant growth.



For fattening farms of today's dimensions where several thousand animals live, it is important to comply with requirements for air quality to protect the animals.

Where CO₂ occurs in a combustion process, discharging it safely through exhaust channels is required. Therefore high quality CO₂ sensors, switches and controls made in Germany detect leaks and hence protect the machine and plant and the people therein to increase the quality and efficiency in processes.

Product overview CO₂ devices

The versatile applications of carbon dioxide show that a precise detection of CO₂ in rooms and in various industrial processes is necessary. The protection of living beings and machinery maximizes in this way. ZILA GmbH offers robust and intelligent CO₂ gas detectors and controllers in the field of CO₂ monitoring that increase the efficiency in dealing with CO₂ and improve the life and work quality.

The product range includes:

- **ZMF-100-IR Industrial Sensor:** sensor for CO₂ detection in a very rugged aluminum enclosure
- **Air quality guard LGW-13:** CO₂ detector with optical (10 digit LED display) and acoustic warning signal output for industrial and consumer applications up to 50.000ppm
- **CO₂ switch CSC-1:** CO₂ switch with 4 switching outputs for direct control of industrial fans and other devices, like horns
- **Climate control KCS-10:** Air quality (CO₂) and climate conditions (temperature, humidity) guided system to control fans and motorized window openers
- **Taylor made detectors, test and control devices**

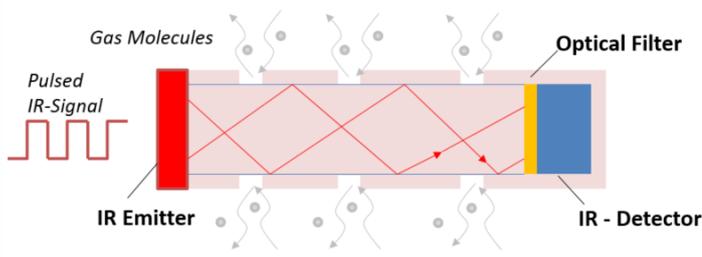
Areas of application

- Air quality guard
- Climate control
- Industrial safety
- Leakage monitoring
- Gas detector
- Ventilation control
- Environmental Monitoring



Technology and specifications

Technology	Non-dispersive infrared absorption (NDIR)	
Output	Depending on the application: 0 - 10 V, 4 - 20 mA Bus communication switching outputs	
Measuring range	0 – 3,000ppm 0 – 1 Vol-% 0 – 5 Vol-% On inquiry up to 50 Vol%	Measurement principles
Construction	Housing in different variations available	



The diagram illustrates the NDIR measurement principle. A pulsed IR signal enters from the left through an IR emitter. The light reflects off mirrors inside a chamber containing gas molecules. It then passes through an optical filter and is detected by an IR detector on the right. The amount of light absorbed by the gas molecules is proportional to their concentration.

NDIR (Non-dispersive infrared absorption)

Most of the gas molecules absorb infrared light because of their molecular vibrations. The amount of absorbed infrared light is proportional to its concentration.

Advantages and Benefits

- variable measuring ranges
- largely maintenance-free
- durable
- robust housing
- easy installation
- acoustic or optical warning signal (LGW13 or ZMF 100-IR)
- (floating) switching outputs



Products

	LGW-13 Air quality guard 	CSC-1 CO ₂ -Switch 	ZMF-100-IR CO ₂ -Detector 	KCS-10 climate- and CO ₂ guided control 
Housing	polycarbonate	ASA LURAN S	Aluminum	ASA LURAN S
Measur-and	CO ₂	CO ₂	CO ₂	CO ₂ temperature humidity
CO₂-Measur-ing range	selectable (0...5 %Vol)	selectable (0...5 %Vol)	selectable (0...5 %Vol)	Selectable (0...5 %Vol)
Signal output	4-20 mA and 0-10V	n.a.	4-20 mA, alternatively 0-10V	n.a.
Acoustic signal	2 Volume levels	n.a.	n.a.	n.a.
Optical Display	10 LEDs (measurement bargraph)	2 LEDs (Relay switching state)	n.a.	2-line LCD display 4 LEDs for switching outputs
switching output	1x floating 24V 2A	4 Relais outputs: - 2x 230V / 500 W - 2x floating (max.30V/1A)	n.a.	4 Relais outputs: - 2x 230V / 500 W - 2x floating (max.30V/1A)
Power supply	24 VDC optional 230 VAC with external power supply	230 VAC	24 VDC	230 VAC
Dimen-sions	120 x 80 x 35 mm	160 x 130 x 60 mm	90 x 85 x 65 mm	160 x 130 x 60 mm
Advan-tages	<ul style="list-style-type: none"> ▪ Small, compact wall housing ▪ Detailed Display measurement ▪ Can also be used as a CO₂ sensor with 4-20mA or 0-10V ▪ Surface mounting possible ▪ Integrated horn 	<ul style="list-style-type: none"> ▪ Robust housing ▪ Switching outputs for direct connection to fans ▪ Additional floating outputs ▪ Direct 230V power supply 	<ul style="list-style-type: none"> ▪ Very compact, rugged aluminum housing ▪ Temperature range - 10 ° C to + 50 ° C (-20 ° C on request) 	<ul style="list-style-type: none"> ▪ Measurement of temperature, humidity and air quality ▪ Controlling supply and exhaust air elements to 500W ▪ Comparison of absolute humidity: aH Outside> inner aH ▪ Integrated timer
	www.zila.de/en/lgw13	www.zila.de/en/csc1	www.zila.de/en/zmf100ir	www.zila.de/en/kcs10

Customizing and individual adaptation



With competencies in pressure, climate, leakage and ventilation from 20 years of experience in the market with innovative sensor technology and groundbreaking measuring, testing and control devices ZILA GmbH is a competent and reliable partner for customer-specific developments.

Our services include the individual, solution-oriented consulting and application-specific development of devices as well as customization. Considering the fast change of technology and standards as well as legal requirements, a continuous cooperation with our customers and partners has become the company's philosophy. Our experienced engineers and technicians will gladly help you find the best solution for your application.

Examples

CO₂-Gas detector for dry ice production



- Gas detector with external CO₂ Sensor
- Additional 4-20mA signal output for remote display
- Integrated horn
- Floating relays for additional external warning lights and fans

Air quality display in military vehicles



- CO₂ detector for displaying the air quality display
- Robust aluminum housing
- Integrated horn
- 3 high luminosity LEDs
- 1 relays



Leakage detection in refrigeration systems



- Leakage detection of CO₂ refrigerant (R744)
- Measurement und monitoring up to 4 %Vol
- integrated horn and display of CO₂ concentration
- Calibration Stick to activate the calibration process

Contact



If you need more information and data sheets regarding our CO₂ sensors, switches and controls, you get this on our website: www.zila.de/en/products/co2-sensoren

Do you have questions or wish a consultation concerning one of our other products? On our website www.zila.de you will find more information about our measuring, testing and control devices for liquid and gaseous media.

You can also address us with your questions by phone or via email.

We look forward to your inquiry!

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