

Operating Instructions

Carbon Dioxide

Measuring System

AR420-IR-CO2



- Read before use!
- Observe all safety instructions!
- Keep for future reference!



Table of contents

1. For your safety	3
1.1 Safety information and tips.....	4
1.2 Intended use	5
1.3 Other dangers.....	6
1.4 Qualification of personnel	7
2. Product description	7
2.1 Design of the carbon dioxide measuring system	7
2.2 Principle of operation	8
2.3 Technical data	9
2.4 Certification	10
3. Transport and installation	10
3.1 Transport	10
3.2 Storage	10
3.3 Installation	10
3.4 Electrical connection	11
4. Operation.....	12
4.1 Commissioning	12
4.2 Calibration	13
5. Maintenance and servicing	13
6. Decommissioning	14
7. Packaging and transport	14
8. Disposal	14
9. Appendix	14
9.1 Spare parts and accessories	14
9.2 Copyright	14
9.3 Warranty	15

1. For your safety

Observe the instructions for use

Any person handling or operating the carbon dioxide measuring system must first be fully familiar with and observe these instructions for use. The carbon dioxide measuring system is designed only for the described purpose (see section 1.2).

Servicing

The carbon dioxide measuring system must be inspected and serviced regularly by qualified specialists. Repairs to the carbon dioxide measuring system must only be carried out by qualified specialists. (See sections 1.4 and 5.)

Do not operate in areas subject to explosion hazards

The carbon dioxide measuring system is not approved for operation in areas subject to explosion hazards. Do not operate it in any areas where combustible or explosive gas mixtures are likely to occur.

WARNING!





These operating instructions do not contain all the information necessary for the safe operation of the device. Please acquaint yourself with the regulations and operator's obligations that apply in your area. In addition to these operating instructions, for example, you should observe and instruct others concerning the universally valid legal and other binding regulations for the prevention of accidents and protection against accidents.

If there is any doubt regarding the information contained in this translation, the German wording shall apply.

1.1 Safety information and tips

A series of warnings is used in these instructions with regard to some risks and dangers that may occur when using the carbon dioxide measuring system. These warnings contain "signal words" designed to draw attention to the degree of danger that is to be expected.

These signal words and the associated hazards are as follows:

	<p><u>DANGER!</u> Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.</p>
	<p><u>WARNING!</u> Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.</p>
	<p><u>CAUTION!</u> Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or material damage. It may also be used to alert against unsafe practices.</p>
	<p><u>IMPORTANT!</u> Indicates information concerning use and other useful information.</p>

1.2 Intended use

The carbon dioxide measuring system AR420-IR-CO₂ must be used exclusively for:

- measuring the carbon dioxide concentration in air.

The air mixture to be measured must not contain any corrosive substances (e.g. SO₂, NH₃, H₂S, HF) as they may destroy the sample cell or filters.

The following standard measuring ranges are available:

- 0-3,000 ppm (0-0.3 Vol%) CO₂
- 0-6,000 ppm (0-0.6 Vol%) CO₂
- 0-10,000 ppm (0-1 Vol%) CO₂
- 0-50,000 ppm (0-5 Vol%) CO₂

It is essential that the carbon dioxide measuring system is installed only as described in section 3.3 and that the ambient conditions specified there (e.g. temperature limits) are adhered to!



DANGER!

Danger to life due to carbon dioxide poisoning!





In higher concentrations carbon dioxide is toxic for human beings. The MAC value (maximum admissible concentration) is 5,000 ppm CO₂ and the shortterm maximum value 20,000 ppm CO₂. Users and operators of the facility must make sure that, where there is a raised concentration of carbon dioxide, suitable measurements are taken to protect people in accordance with legal regulations. Examples of this include an increased supply of fresh air or evacuation of the facility. **Not all available standard measuring ranges are suitable for people protection!**



DANGER!



Danger of fire and explosion due to sparks!

The carbon dioxide measuring system AR420-IR-CO₂ may not be operated in areas where ignitable or explosive gas mixtures can arise.

	<p><u>WARNING!</u></p> <p>The carbon dioxide measuring system must only be repaired by the manufacturer. Do not modify the carbon dioxide measuring system and do not reconstruct it. It may otherwise no longer measure the concentration of carbon dioxide reliably.</p>
	<p><u>IMPORTANT!</u></p> <p>The measuring signals from the carbon dioxide measuring system must be evaluated and further processed by the user's downstream device.</p>
	<p><u>IMPORTANT!</u></p> <p>It is essential to observe the information given in these operating instructions with regard to operation, maintenance and servicing.</p>
	<p><u>IMPORTANT!</u></p> <p>Faults must be rectified immediately as they impair safety.</p>

1.3 Other dangers

Despite its careful design, there remain some further dangers associated with handling the carbon dioxide measuring system. The following are known to us:

	<p><u>DANGER!</u></p> <p>Mains voltage (230 V, 50 Hz).</p> <p>Danger to life due to electric shock or burns.</p> <p>Do not bring into contact with water.</p> <p>Before opening the carbon dioxide measuring system, disconnect the mains voltage safely (safe electrical isolation).</p> <p>Electrical work should only be carried out by a qualified electrician.</p> <p>Only install in a voltage-free state.</p>
	<p><u>DANGER!</u></p> <p>Danger to life due to carbon dioxide poisoning!</p> <p>Certain external circumstances can mean that the gas indicator system is unable to signal a possible increased concentration of carbon dioxide, e.g. in the event of a power failure. In this case, users and operators of the facility must make sure that suitable measures are taken to protect people in accordance with the legal regulations.</p>

1.4 Qualification of personnel

Only qualified mechatronic engineers or persons with comparable training may mount, install or commission the carbon dioxide measuring system or carry out maintenance and servicing work.

Only qualified electricians may carry out work on the electrical system (In Germany according to German VDE!)

The operator must instruct all users of the system on the basis of these operating instructions.

The minimum age is 16 years. An experienced person must supervise juveniles and apprentices when working on the carbon dioxide measuring system.

Any work that is not described in these operating instructions must be executed by the manufacturer.

2. Product description

2.1 Design of the carbon dioxide measuring system

The two-beam infrared sensor is mounted on a sensor holder in an aluminium housing over a diffusion opening. The cable entry is via a screwed cable gland (PG11) located on the opposite side. The aluminium housing additionally contains the transmitter with a signal amplifier and a 4-20 mA or 0.1-10 V analog output. The transmitter processes and transmits the measurement signals (see Fig. 1). It functions according to the three-wire system.

The output signals from the carbon dioxide measuring system are read and further processed according to the customer's specifications in a downstream device.



Fig. 1: Carbon dioxide measuring system AR420-IR-CO2.

2.2 Principle of operation

With the aid of a self developed and manufactured specific two-beam infrared photometer (NDIR, the carbon dioxide measuring system AR420-IR-CO2 determines the absolute CO₂ content of the ambient air (atmospheric partial pressure). As the measurement signals are evaluated and processed according to a new digital algorithm and the material as well as the design of the sample cell are novel, the measuring system detects the carbon dioxide concentration quickly, precisely and economically. It monitors itself continuously and signals hardware and software malfunctions. The entire measuring range is linear. Power is supplied via 24 V direct current. In normal applications calibration is not necessary. If required, however, calibration can be carried out by a specialist. The measured values are output via an analog channel, optionally 4-20 mA or 0.1-10 V.

2.3 Technical data

Transmitter		
Power supply		Screw terminals
	Electric current	Approx. 100 mA
Connections	Screw terminal 1	0 V
	Screw terminal 2	4-20 mA or 0.1-10 V
	Screw terminal 3	24 V DC \pm 5%
Ambient temperature	-10° C to +50° C	
Air pressure	900 hPa to 1100 hPa	
Permissible humidity	15-95% relative humidity	Non-condensing
Output	4-20 mA	Max. load 450 Ω
	Or 0.1-10 V	Minimum 1 K Ω
Housing	Aluminium	Red
Protection class of electrical connection housing	IP 54	
Weight of housing	Approx. 500 g	
Size of housing	Approx. L90 x W85 x H65 mm	
Connecting cable	3x1.5 ² Cu + functional ground	Shielded cable
Sensor		
Gas access	By diffusion	
Standard measuring ranges	0-3,000 ppm CO ₂	i.e. 0-0.3 Vol%
	0-6,000 ppm CO ₂	i.e. 0-0.6 Vol%
	0-10,000 ppm CO ₂	i.e. 0-1 Vol%
	0-50,000 ppm CO ₂	i.e. 0-5 Vol%
	Others upon request	
Warm-up time	Approx. 5 min	
Accuracy	\pm 2% at 25° C	FS (full scale)
Reproducibility	\pm 1%	
Reaction time	Approx. 30 s	

2.4 Certification

The carbon dioxide measuring system complies with EMC Directives EN 61000-6-2 and EN 61000-6-3 and thus Directives 89/336/EEC and 92/31/EEC.

3. Transport and installation


3.1 Transport

The carbon dioxide measuring system is supplied together with these operating instructions. Please check the packaging for any damage when the product is delivered and report any damage immediately to the forwarding agency and dealer. The carbon dioxide measuring system should not be thrown or dropped as it could be damaged or scratched. Protect against wet conditions, humidity, dirt and dust.


3.2 Storage

The carbon dioxide measuring system may be stored in its packaging in dry rooms at temperatures between +10° C and +50° C. Protect it against wet conditions, humidity, dirt and dust.


3.3 Installation

 A large, bold, black lowercase letter 'i' with a dot above it, serving as an information icon.	<p><u>IMPORTANT!</u></p> <p>Mount the carbon dioxide measuring system on a level, firm and dry wall. When installing it, it is essential to remain within the following permissible ambient conditions:</p> <p>Ambient temperature between -10 and +50° C. (Sun can heat up the housing considerably!)</p> <p>The housing must be freely accessible and visible at all times.</p> <p>The carbon dioxide measuring system must not be reached by water. This includes no splashwater and no condensate!</p> <p>For this reason protect the device against the weather when mounted outdoors!</p> <p>Special attention should be paid to material compatibility when installing: the sample cell, for example, must not under any circumstances corrode, and the filters must not become tarnished. For this reason the air mixture that is to be measured must contain, for example, no corrosive substances (see 1.2).</p> <p>The device must not be installed in damp locations or areas subject to explosion hazards.</p> <p>Parasitic voltages must not be permitted to occur.</p>
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Select the installation site according to the local circumstances and application purpose. If, for example, the carbon dioxide concentration shall be measured in a fermentation cellar in order to protect people, at least one measuring system must be mounted at ground level (lowest point) and a second one at mouth level. If leakages shall be recognised in time, one measuring system has to be mounted as close as possible to the place where it is likely that the gas will emerge.

	IMPORTANT! Carbon dioxide is heavier than air and accumulates at ground level ("sea of carbon dioxide"). If carbon dioxide is measured in order to protect people, one measuring system must always be mounted at ground level.
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3.4 Electrical connection

	DANGER! Mains voltage (230 V, 50 Hz). Danger to life due to electric shock or burns. Do not bring into contact with water. Before opening the carbon dioxide measuring system, disconnect the mains voltage safely (safe electrical isolation). Electrical work should only be carried out by a qualified electrician. Only install in a voltage-free state.
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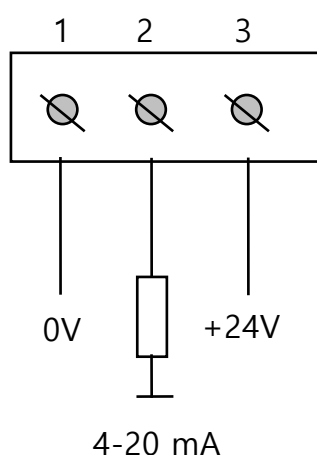


Fig. 2: AR420-IR-CO2 pin assignment. Screw terminal 2 optionally 0.1-10 V.

The gas measuring system is connected to the downstream device by means of a four core, shielded cable (see Fig. 2). Do not lay this line next to a high-tension power cable as there is a danger of radiated interference. The cable must be capable of withstanding the anticipated mechanical, chemical and thermal stresses.

The gas measuring system is connected to the electric circuit via Screw terminal 1 and Screw terminal 3 and the measured data are read via Screw terminal 2 (4-20 mA or 0.1-10 V). The system earth (potential earth) is connected to the housing.



CAUTION!

In view of existing safety regulations the carbon dioxide measuring system must only be connected to suitable power supply units that comply with the valid technical regulations. It must be ensured that fuse protection is provided that is suitable for the power supply units used (SAFE ELECTRICAL ISOLATION)!

4. Operation

4.1 Commissioning

Before commissioning use the following list to check whether all requirements for trouble-free operation are met:


- Has the carbon dioxide measuring system been installed?
- Is the housing freely accessible and visible?
- Have the ambient conditions been taken into account?
- Has the carbon dioxide measuring system been connected?
- Is the power supply switched on?
- Are you sure that the connection cable is not laid next to high-tension power cable?
- Please bear in mind that this is a sensitive measuring instrument!


Next, carry out a test of the measured values. To do this, offer up test gas (carbon dioxide, concentration $\frac{1}{2}$ of measuring range) to the diffusion opening and read the measured value on the downstream device. If the measured value of the concentration of test gas (note: allow for the tolerance of the test gas!) corresponds to $\pm 2\%$ of FS, the carbon dioxide measuring system is ready for use. Prepare a commissioning report (see section 9.4, Warranty).

4.2 Calibration

The measuring system is designed such that no additional calibration is required even if the device is in operation for a long period of time. If required, however, calibration can be carried out by a specialist.

5. Maintenance and servicing

	<p><u>WARNING!</u></p> <p>The carbon dioxide measuring system must only be repaired by the manufacturer. Do not modify the carbon dioxide measuring system and do not reconstruct it. It may otherwise no longer measure the concentration of carbon dioxide reliably.</p>
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The carbon dioxide measuring system and the connecting cable must be checked at least every six months by qualified personnel (see section 1.4) and a servicing report must be prepared. Always ensure that the interval between services meets safety requirements!

Check the measured values after each period of non-use or interruption of operation (see section 4.1). If the measured value of the concentration of test gas (note: allow for the tolerance of the test gas!) corresponds to $\pm 2\%$ of FS, the carbon dioxide measuring system is again ready for use. If the measured value lies outside this range, the device is not working correctly. Inform the manufacturer or dealer and have the device repaired.

Make appropriate checks to ensure that the carbon dioxide measuring system and its surrounding area are always clean, accessible and visible. Above and beyond such measures the carbon dioxide measuring system is maintenance-free.

6. Decommissioning

Switch off the power supply. For storage it is essential to refer to section 3.2.

7. Packaging and transport

This device is a measuring instrument with sensitive electronic components. When returning it, please use the appropriate class of packaging according to the applicable regulations.

8. Disposal

Obsolete devices should be rendered unusable immediately and disposed of according to the relevant regulations. Please contact your local authority for information about disposal.

9. Appendix

9.1 Spare parts and accessories

Calibration set, calibration software.

9.2 Copyright

The copyright to these operating instructions is exclusively reserved

9.3 Warranty

We the manufacturer grant a warranty for this device for a period of 24 months from commissioning, documented by a commissioning report. Within this warranty period we will at our discretion repair or replace the device free of charge if found to be defective as to workmanship or material.

The warranty excludes: damages attributable to improper use, normal wear, and defects that have only a negligible influence on the device's value or suitability for use.

Liability for the functioning of the carbon dioxide measuring system shall pass at all events to the owner or operator if the carbon dioxide measuring system is improperly maintained or repaired or if it is used other than for its intended purpose. alpha redline accepts no liability for damage caused by failure to observe the above information.

The warranty expires in the event that work is carried out by agents we have not authorised or if parts are used other than original spare parts.

Claims under the warranty may be made in all countries where this device is sold by authorised dealers.

In the event of any claim under the warranty, please return the device to us. The buyer shall bear the costs of transportation and the risk while the device is in transit. The execution of work under the warranty does not affect the warranty period in any way.

The manufacturer accepts no liability for printing errors or any damage resulting therefrom.

The above information does not extend the conditions of warranty and liability contained in the Terms and Conditions of Sale and Delivery of alpha redline (corresponding to the Terms and Conditions of Sale and Delivery for Sensor Technology, AMA Fachverband für Sensorik e. V.).

Subject to change without notice. (10/17)



Dr. Markus Kieninger
Vogelsangstr. 8
73666 Baltmannsweiler

Tel.: 07153 / 92 96 670
Tel.: 07153 / 92 96 671
Fax: 07153 / 94 50 25

www.alpha-redline.de
info@alpha-redline.de