

Operating Instructions

Gas Measuring System

AR420-C



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



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1. For your safety

Observe the instructions for use

Any person handling or operating the gas measuring system must first be fully familiar with and observe these instructions for use. The gas measuring system must only be used as described in section 1.2.

Servicing

The gas measuring system must be inspected and serviced regularly by qualified specialists. Repairs to the gas 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 gas 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 concerning some of the risks and dangers that may occur when using the gas 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. 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 AR420-C gas measuring system must be used exclusively for:

- Measuring the concentration of a **single** toxic gas or vapour in air.
- Measuring the oxygen concentration in air.

There is **one** specific electrochemical sensor built into the AR420-C gas measuring system which specifically measures **one** single substance. One device can never measure more than one substance! Please refer to the appendix to these operating instructions for an exact specification of the built-in sensor. Standard substances and measuring ranges please see chapter 7.



DANGER!

Danger to life due to poisoning!

The substances measured by the AR420-C gas measuring system are poisonous to humans (exception: oxygen up to 21 or 25 vol%). It is therefore essential that users and operators of the system ensure compliance with the relevant legal regulations (e.g. MAC values). In the event of an increased concentration, suitable measures must be taken to protect personnel, such as an increased supply of fresh air, a ban on leaving machinery running or evacuation of the plant.



DANGER!

Danger to life due to poisoning!

The electrochemical sensor inside the gas measuring system has a limited service life. Regular function checks and services are therefore essential (see section 5). **The gas measuring system does not indicate when the sensor has expired!**



DANGER!

Danger to life due to fire and explosion!

Certain toxic gases and vapours such as CO and NH₃ are in addition explosive. Explosive concentrations cannot, however, be detected with the AR420-C measuring system as they are outside the measuring range (several vol% instead of ppm).

**WARNING!****Danger of fire and explosion due to sparks!**

The AR420-C gas measuring system must not be operated in areas subject to explosion hazards.

The air mixture that is to be measured must not contain any substances that might contaminate the electrochemical sensor. In this case the sensor would output measured values that are too low! Please refer to the appendix if necessary for poisons for the sensor that is built into your device.

It is essential that the gas 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!

**IMPORTANT!**

The gas measuring system is a safety device and must only be repaired by the manufacturer. Do not modify the gas measuring system and do not reconstruct it. It might otherwise no longer measure the gas concentration reliably.

The measuring signals from the gas measuring system must be evaluated and further processed by the user's downstream device.

**WARNING!**

If the gas measuring system is used for a danger alarm, **the main alarm of the gas warning unit must be latching**: If the concentration of toxic gases/vapours increases greatly during an interruption to the power supply, then after the power has been reinstated the measuring system may in some circumstances no longer indicate a plausible measured value.

**IMPORTANT!**

It is essential to observe the information given in these operating instructions with regard to operation, maintenance and servicing.

Faults must be rectified immediately.

1.3 Other dangers

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

**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 gas measuring system, safely disconnect the mains voltage (safe electrical isolation).

Electrical work should only be carried out by a qualified electrician.

Only install in a voltage-free state.

**DANGER!**

Danger to life due to poisoning!

Certain external conditions can lead to the gas measuring system being **unable to measure** an increased gas concentration that may be present, e.g. in the event of a power failure. In this case, users and operators of the system must ensure that suitable measures are taken to protect personnel in accordance with legal regulations.

1.4 Qualification of personnel

Only qualified mechatronic engineers or persons with comparable training may mount, install or commission the gas 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 gas 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 gas measuring system

The electrochemical (EC) sensor is mounted on a sensor holder inside an aluminium housing and above a diffusion opening. The cable enters on the opposite side by means of a screwed cable gland (PG11). The aluminium housing also contains the transmitter with a signal amplifier and a 4-20 mA analogue output. The transmitter processes and transmits the measured signals (see Fig. 1). It works on a two-wire system.

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



Fig. 1: AR420-C gas measuring system.

2.2 Principle of operation

The AR420-C gas measuring system determines the concentration of a toxic gas or vapour in the air mixture by means of a specific electrochemical sensor. Calibration is carried out by means of a potentiometer using the relevant test gas. There is very little or no cross sensitivity to other substances (see appendix). The measured signals are processed and output (linear current output, 4-20 mA) as an integral feature of the measuring system. The AR420-C has a 24 V DC power supply.

2.3 Technical data

Transmitter to all Sensors		
power supply	terminal voltage	min. 14 V DC \pm 5%
screw terminals 2 pole	current	approx. 30 mA
connections	2 reverse-polarity screw terminals	24 V DC \pm 5% and 4-20 mA
connecting cable	2x1,5 ² Cu + functional ground	shielded cable
length	100 Ω forward and return conductor	
cable gland	for \varnothing 4-10mm	
housing	Alloy, red	
protection class housing	IP 54	
weight	ca. 500g	
dimensions housing	ca. L90 x W85 x H65 mm	without PG screw connection
potentiometer PS	setting reinforcement (span)	
testpins (+) and (-)	connection of digital voltmeter	
potentiometer PZ	zero point setting (Zero)	only with three-electrode sensor
output	4-20 m, max. burden 500 Ω , impedance 1000 Ω	
Sensor for Ammonia NH ₃ , 0-100 ppm		
gas inlet	per diffusion	
measuring range	0-100 ppm NH ₃	
measuring-principle	two-elektrode electro-chemical	
temperature range	-10° C to +50° C	pay attention to sunlight
permissible humidity	15-90% relative humidity	non condensing
air pressure	900 to 1100hPa	
longterm drift	<2% signal loss/month	
accuracy	<-8 to 4ppm equivalent	in clean air/20° C
reproducibility	< 3% of the signal	
reaction time	T90	<60 seconds
linearity	linear	
life time, depending on ambient conditions	>2 years in air under normal conditions, from date of production	it is a so-called consumption sensor

Sensor for Chlorine Cl ₂ , 0-10 ppm		
gas inlet	per diffusion	
measuring range	0-10 ppm Cl ₂	
measuring-principle	two-electrode electro-chemical	
temperature range	-20° C to +50° C	pay attention to sunlight
permissible humidity	15-90% relative humidity	non condensing
air pressure	900 bis 1100hPa	
longterm drift	<2% signal loss/month	
accuracy	<-2 bis 4ppm equivalent	In clean air
reproducibility	< +/- 2%	
reaction time	T90	<60 seconds
linearity	linear	
life time, depending on ambient conditions	>2 years in air under normal conditions, from date of production	

Sensor for Chlorine Cl ₂ , 0-20 ppm		
gas inlet	per diffusion	
measuring range	0-20 ppm Cl ₂	
measuring-principle	three-electrode electro-chemical	potentiometer P2
temperature range	-20° C to +40° C	pay attention to sunlight
permissible humidity	15-90% relative humidity	non condensing
air pressure	900 to 1100hPa	
longterm drift	<5% per year	
accuracy	<-2 bis 4ppm equivalent	in clean air
reproducibility	< +/- 3%	
reaction time	T90	<30 seconds
linearity	< +/- 5%	
life time, depending on ambient conditions	>2 years in air under normal conditions, from date of production	

Sensor for Carbon Monoxide CO, 0-300 / 500 ppm		
gas inlet	per diffusion	
measuring range	0-300 / 500 ppm CO	
measuring-principle	two electrode electro-chemical	
temperature range	-10° C to +50° C	pay attention to sunlight
permissible humidity	15-90% relative humidity	non condensing
air pressure	900 bis 1100hPa	
longterm drift	<5% per year	
accuracy	<-2 to 4ppm equivalent	in clean air
reproducibility	< +/- 5%	
reaction time	T90	<50 seconds
linearity	< +/- 5%	
life time, depending on ambient conditions	>2 years in air under normal conditions, from date of production	

Sensor for Carbon Monoxide CO, 0-1000 ppm		
gas inlet	per diffusion	
measuring range	0-1000 ppm CO	
measuring-principle	three electrode electro-chemical	potentiometer P2
temperature range	-20° C to +40° C	pay attention to sunlight
permissible humidity	15-90% relative humidity	non condensing
air pressure	900 to 1100hPa	
longterm drift	<5% per year	
accuracy	<-2 to 4ppm equivalent	in clean air
reproducibility	< +/- 3%	
reaction time	T90	<30 seconds
linearity	< +/- 5%	
life time, depending on ambient conditions	>2 years in air under normal conditions, from date of production	

Sensor for Oxygen O₂, 0-25 Vol %

gas inlet	per diffusion	
measuring range	0-100 Vol% O ₂	
measuring-principle	two electrode electro-chemical	
temperature range	5° C to +40° C	pay attention to sunlight
permissible humidity	10-90% relative humidity	non condensing
air pressure	811 to 1216 hPa	
longterm drift	?	
accuracy	<+/-1% full measuring range	in clean air
reproducibility	?	
reaction time	T ₉₀	ca.14 seconds
linearity	0,21 +/- 0,02	
life time, depending on ambient conditions	>5 years at 20° C in normal air	

Sensor for Sulfur Dioxide SO₂, 0- 50/100 ppm

gas inlet	per diffusion	
measuring range	0-100 ppm SO ₂	
measuring-principle	two electrode electro chemical	
temperature range	-20° C bis +50° C	pay attention to sunlight
permissible humidity	15-90% relative humidity	non condensing
air pressure	1013hPa	
longterm drift	<2% pro signal/month	
accuracy	0,5 ppm	In clean air
reproducibility	< 2% of signal	
reaction time	T ₉₀	<30 seconds
linearity	linear	
life time, depending on ambient conditions	>2 years in air	

Sensor for Hydrogen Sulfide H ₂ S, 0-200 ppm		
gas inlet	per diffusion	
measuring range	0-200 ppm H ₂ S	
measuring-principle	two electrode electro-chemical	
temperature range	-40° C to +50° C	pay attention to sunlight
permissible humidity	15-90% relative humidity	non condensing
air pressure	1013hPa	
longterm drift	<2% signal loss/month	
accuracy	<0,2 ppm equivalent	in clean air (+20 bis +40° C)
reproducibility	< 2% of signal	
reaction time	T90	<60 seconds
linearity	linear	
life time, depending on ambient conditions	>2 Jahre in air	

Sensor for Nitrogen Dioxide NO ₂ , 0-20 ppm		
gas inlet	per diffusion	
measuring range	0-20 ppm NO ₂	
measuring-principle	two electrode electro-chemical	
temperature range	-20° C to +50° C	pay attention to sunlight
permissible humidity	15-90% relative humidity	non condensing
air pressure	1013 hPa	
longterm drift	<2% signal loss/month	
accuracy	0,1 ppm	in clean air
reproducibility	< 2% of signal	
reaction time	T90	<60 seconds
linearity	linear	
life time, depending on ambient conditions	>2 years in air	

2.4 Certification

The gas 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 gas 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. Do not throw or drop. The gas measuring system may be damaged or scratched. Protect it against wet conditions, humidity, dirt and dust.


3.2 Storage

The gas 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 gas measuring system on a level, firm and dry wall.</p> <p>When installing, it is essential to remain within the following permissible ambient conditions:</p> <p>Ambient temperature as a rule between -10 and +50° C (see appendix). Please bear in mind that under certain circumstances the sun can heat up the housing considerably!</p> <p>The housing must be freely accessible and visible at all times.</p> <p>The gas measuring system must not come into contact with water (splashwater, condensate)!</p> <p>If mounted outdoors, therefore, the device must not be directly exposed to the weather!</p> <p>It must not be accessible to dust as this will block the diffusion opening and cause the gas measuring system to make erroneous measurements!</p> <p>The ambient air must contain no sensor poisons as these will destroy the sensor (if necessary, see appendix).</p> <p>The gas measuring system must not be installed in damp locations or areas subject to explosion hazards. Parasitic voltages must not be permitted to occur.</p>
 A large, bold, black lowercase letter 'i' with a dot above it, serving as an information icon.	<p><u>IMPORTANT!</u></p> <p>A gas measuring system should be mounted as close as possible to the place where it is anticipated that toxic gas or vapour might escape. A second device should be mounted in addition at mouth height.</p>

3.4 Electrical connection

	<p>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 gas measuring system, safely disconnect the mains voltage (safe electrical isolation). Electrical work should only be carried out by a qualified electrician. Only install in a voltage-free state.</p>
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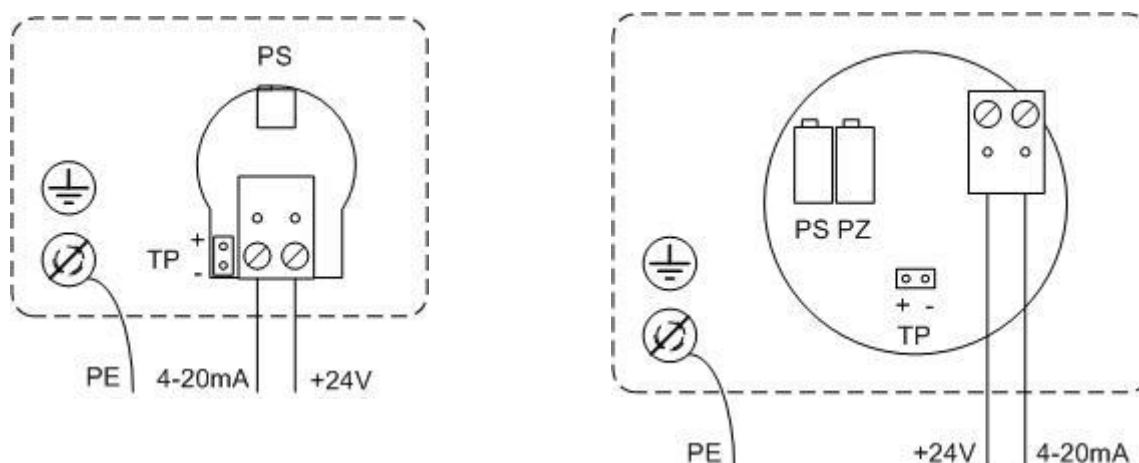


Fig. 2: AR420-C connection diagram.

Left: Version with two-electrode sensor.

Right: version with three-electrode sensor; PE, potential earth; PS, potentiometer span for setting the span; PZ, potentiometer zero for setting zero (three-electrode sensor only); TP (+) (-), test pins for connecting the voltmeter; 2 polarized screw terminals for power supply (+24 V DC) and measured signal output (4-20 mA).

The gas measuring system must be connected to any downstream equipment by means of a three-core, shielded cable (see Fig. 2) with maximum 100 Ω cable resistance, including go and return line. 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 (+24 V DC) by means of one of the two polarized screw terminals. The measured data (4-20 mA) is read by means of the second polarized screw terminal. The system earth (potential earth) is connected to the housing.

**CAUTION!**

In accordance with existing safety regulations, the gas 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 gas measuring system been installed?
- Is the gas measuring system accessible and visible?
- Have the ambient conditions been taken into account?
- Has the gas measuring system been connected?
- Has the housing been screwed down again?
- 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 some test gas (concentration half measuring range, e.g. 150 ppm CO) to the diffusion opening and read the measured value on the downstream device. If the measured value corresponds to the concentration of the test gas $\pm 5\%$ of FS (warning: allow for the tolerance of the test gas), the gas measuring system is ready for use. Prepare a commissioning report (see section 9.2, Warranty).

4.2 Calibration

- Unscrew and remove the housing lid.
- Place the digital voltmeter on test pins (+) and (-). Measuring range setting: 0 to 2 V.
- Offer up zero gas (synthetic air) to the diffusion opening.
- Three-electrode sensor only: turn potentiometer PZ (see Fig. 2) until the voltmeter displays 0.4 V.
- For the other sensors the voltmeter must automatically display $0.4 \text{ V} \pm \text{zero tolerance } 3\% \text{ of FS}$. If not, the system is not ready for operation (e.g. short circuit, cable break, faulty sensor).
- Remove zero gas.
- Offer up test gas with a concentration of 50% FS to the diffusion opening.
- Turn potentiometer PS until the voltmeter displays a voltage of 1.20 V.
- Remove test gas and voltmeter.
- Screw down the housing lid.
- Offer up the same test gas to the diffusion opening once more.
- Check the measured value on the downstream equipment. (Measured signal output: 12 mA)
- If the measured value is correct, remove the test gas.
- The gas measuring system is calibrated.

5. Maintenance and servicing

	<p><u>IMPORTANT!</u></p> <p>The gas measuring system is a safety device and must only be repaired by the manufacturer.</p> <p>Do not modify the gas measuring system and do not reconstruct it. It might otherwise no longer measure the gas concentration reliably.</p>
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	<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 gas measuring system, safely disconnect the mains voltage (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>
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The gas 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 the test gas corresponds to $\pm 5\%$ of FS (warning: allow for the tolerance of the test gas), the gas measuring system is ready for use again. If the measured value is outside this range, please calibrate the device (see section 4.2). If this does not work, then the gas measuring system is not functioning correctly. Inform the manufacturer or dealer and have the device repaired.

Carry out appropriate checks to ensure that the gas measuring system and its environment are always clean, accessible and visible. Above and beyond such measures the gas measuring system is maintenance-free.

6. Decommissioning

Switch off the supply voltage. Please refer to section 3.2 for information on storage.

7. Assortment / Overview

7.1 Product variants

Measuring system AR420 for substance	Measuring range	
Ammonia (NH ₃)	0 to 100 ppm	
Chlorine (Cl ₂).	0 to 10 ppm 0 to 20 ppm	
Carbon Monoxide (CO)	0 to 300 ppm 0 to 500 ppm 0 to 1000 ppm	
Oxygen (O ₂)	0 to 25 Vol%	
Sulfur Dioxide (SO ₂)	0 to 100 ppm	
Hydrogen Sulfide (H ₂ S)	0 to 50 ppm 0 to 100 ppm 0 to 200 ppm	
Nitrogen Dioxide (NO ₂)	0 to 20 ppm 0 to 50 ppm 0 to 100 ppm	

7.2 Spareparts

Spare sensor for substance	Measuring range	
Ammonia (NH ₃)	0 to 100 ppm	
Chlorine (Cl ₂).	0 to 10 ppm 0 to 20 ppm	
Carbon Monoxide (CO)	0 to 300 ppm 0 to 500 ppm 0 to 1000 ppm	
Oxygen (O ₂)	0 to 25 Vol%	
Sulfur Dioxide (SO ₂)	0 to 100 ppm	
Hydrogen Sulfide (H ₂ S)	0 to 50 ppm 0 to 100 ppm 0 to 200 ppm	
Nitrogen Dioxide (NO ₂)	0 to 20 ppm 0 to 50 ppm 0 to 100 ppm	
Sensor mounting-kit		
Spare electronics for substance	Measuring	
Carbon monoxid (CO)	0 to 300 ppm	

8. 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.

9. 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.

10. Appendix

10.1 Copyright

The copyright to these operating instructions is exclusively reserved .

10.2 Warranty

We the manufacturer grant a warranty for this device for a period of 6 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 gas measuring system shall pass at all events to the owner or operator if the gas 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.

10.3 Dimensions

