



GasMOS® Gas Monitoring System



- Operating manual -
- 180516 -

Dear customer,

this operating manual is intended for all those who work/will work on/with the system described here. They require knowledge of this operating manual to avoid faults in the system and to operate the system without issues. They must therefore have knowledge of this operating manual.

This operating manual applies to the following devices:

- GasMOS®

The operating manual is part of the information for users when the system is placed on the market and must be kept so that it is accessible to the operating company and the operator. If the system is relocated, the operating manual and/or the operating manuals (including those of suppliers) must be provided at the new location.

In all phases of life, all the information in the operating manual and/or the operating manuals (including those of the supplier) must be observed. Please read the applicable sections in the operating manual carefully before starting work.

We accept no liability for damage or malfunctions that are the result of failure to comply with this operating manual. You must specify clearly who is responsible for the machine (the operating company) and who may work on the machine (the operator).

The responsibilities of personnel involved in transport, installation, setup, adjustment, operation, care, maintenance and servicing must be clearly defined.

The original version of the operating manual for GasMOS is provided.

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Index	Change	Date	Changed by

1 Technical data and scope of delivery

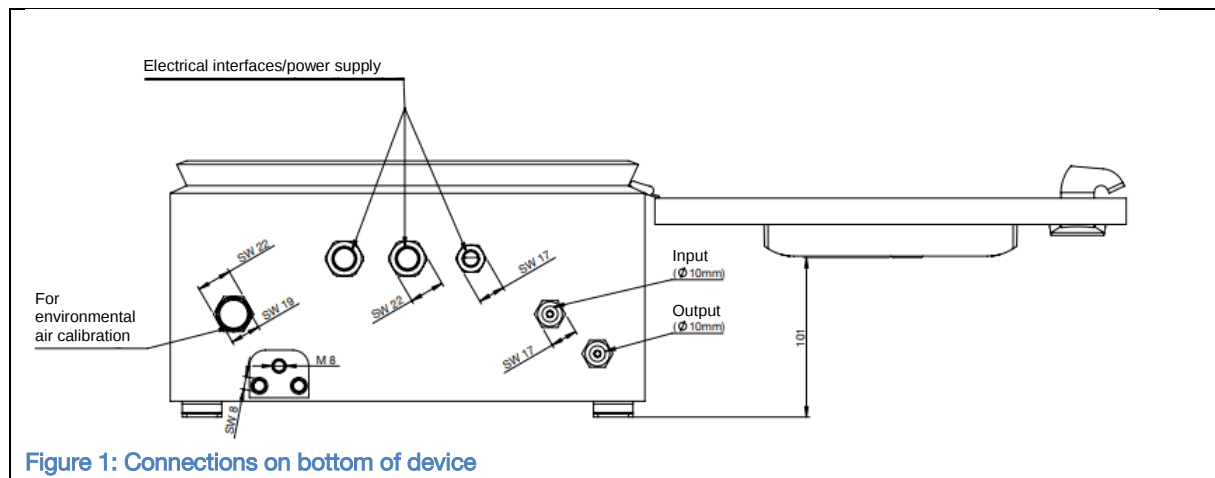
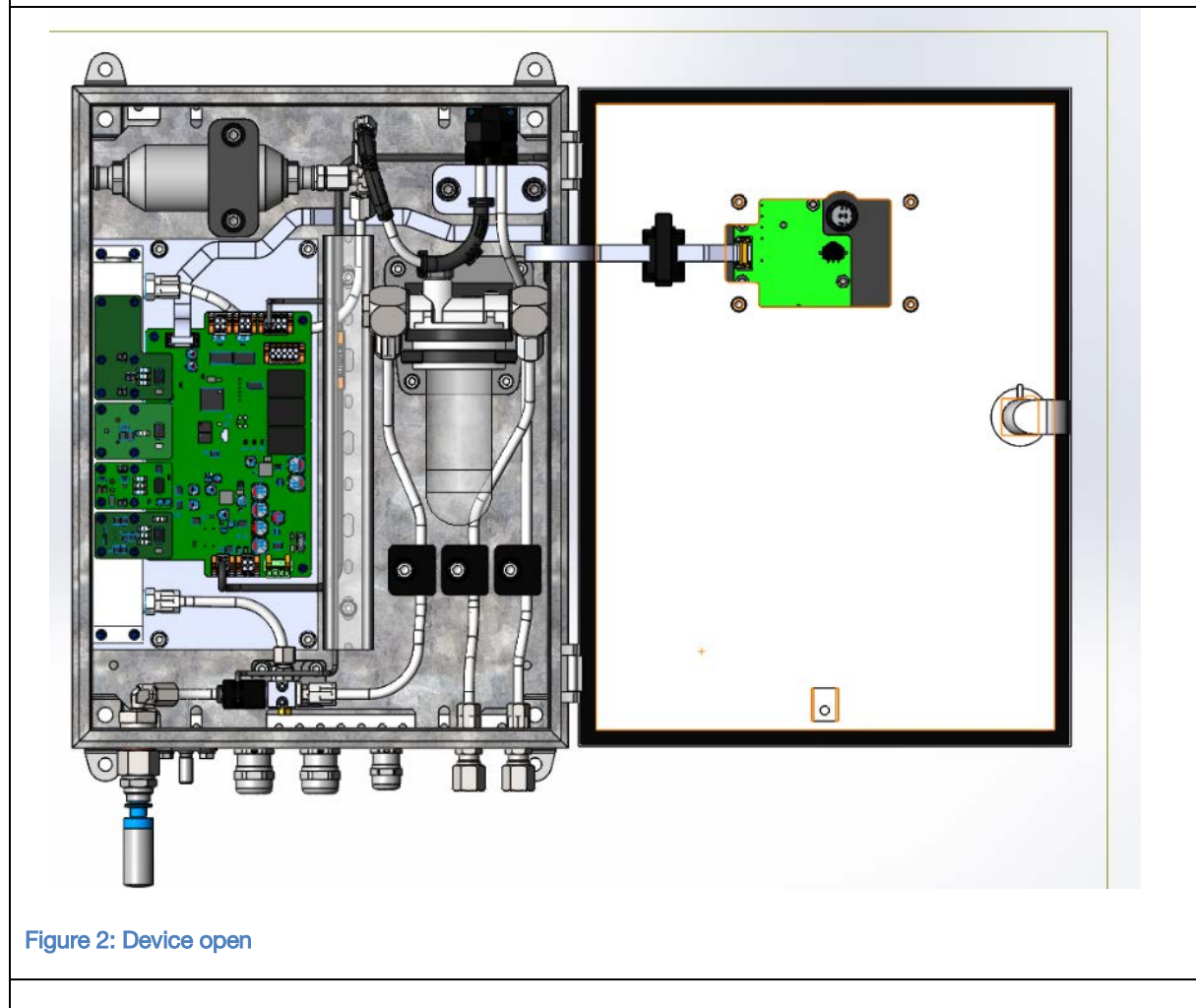


Figure 1: Connections on bottom of device



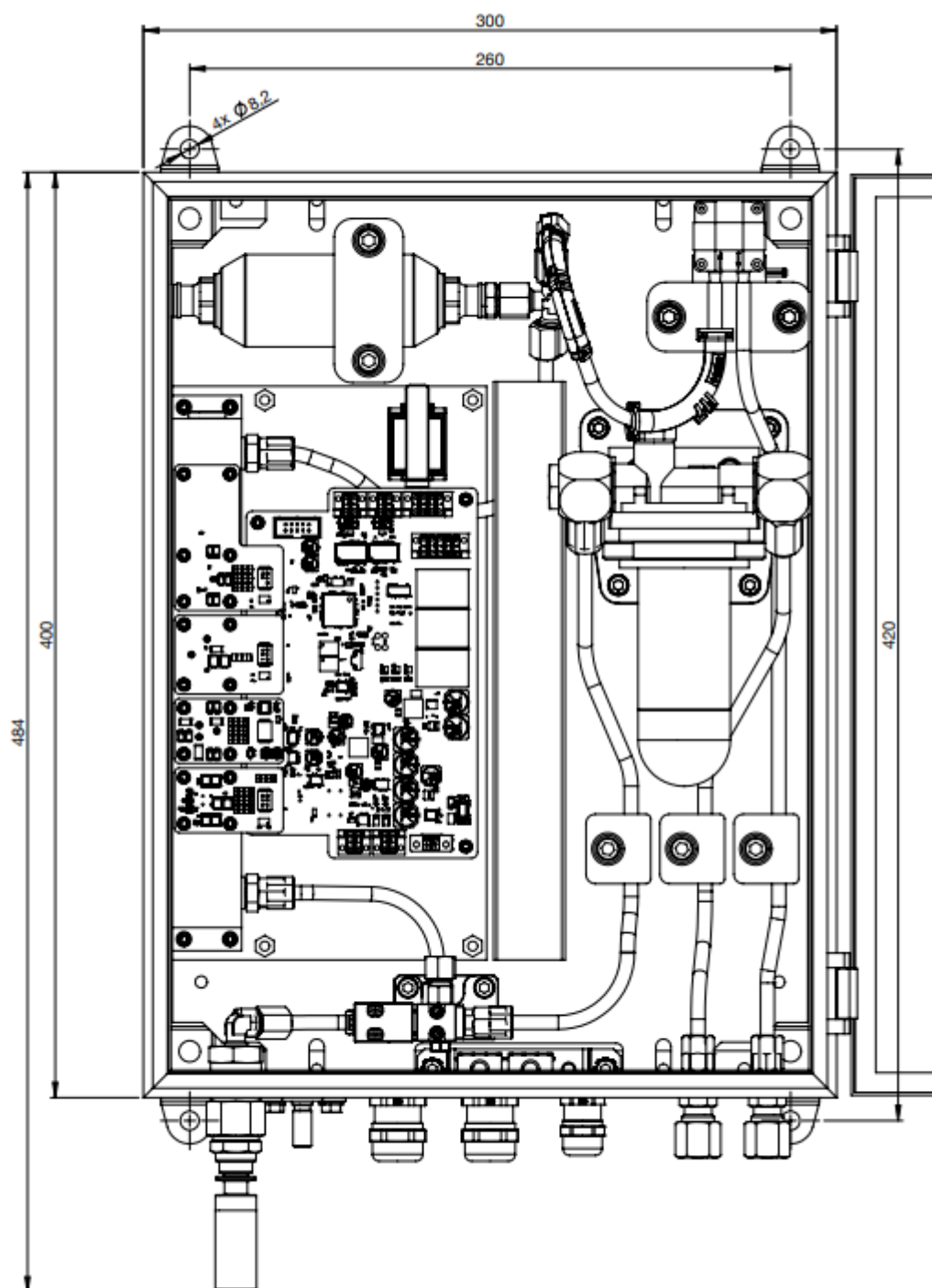


Figure 3: Device with dimensions

Mechanical interfaces

Dimensions	Approx. 310 x 450 x 175 mm
Weight	13.00 kg
M1	Pipe connection/hose connection Ø10
M2	Pipe connection/hose connection Ø10
M3	Pipe connection/hose connection G3/8
M4	Through hole Ø9.25
Flow rate	1 l/min ± 10%

Figure 4: Mechanical interfaces

Electrical interfaces

Power supply ^{*1}	18 – 31.2 V DC; $U_{min} < U_{Supply} < U_{max}$
Nominal voltage ^{*1}	24 V DC
Current consumption	Maximum 1.25 A
Supply E1	M20: Cable diameter 7-13 mm
Supply E2	M20: Cable diameter 7-13 mm
Supply E3	M16: Cable diameter 4.5-10 mm
Relay outputs ^{*1}	1 × “Ready” (ready for operation) 1 × “Warning” (methane warning level exceeded) (max. 31.2 Volt AC/DC, 2A) 1 x reserve
Isolated input ^{*1}	24 V signal, “Diesel”, “Gas” engine operating mode
Isolated input ^{*1}	24 V signal “Engine running”
Communication interface with monitoring device ^{*1}	3-wire RS485, electrically isolated <u>or</u> CANopen, electrically isolated
USB interface ^{*1}	Device parameterisation
Recommended communication cable	LAPP UNITRONIC-FD CP (TP) plus UL-CSA CABLE
Earth connection	M8, bottom of housing
^{*1} Max. fault voltage 32.1 V	

Figure 5: Electrical interfaces

Environmental conditions

Ambient temperature range	0 to 50 °C
Storage temperature range	-20 °C to 50 °C Recommended: 5 °C to 50 °C Avoid condensation
Relative humidity	up to 70%
Protection rating	IP 54
Vibrations	$2\frac{+3}{-0}$ – 13.2 Hz: ± 1.0 mm 13.2 – 100 Hz: 6.9m/s ² peak
Pressure ratio in the crankcase	-50 mbar to +50 mbar
Ambient pressure	750 hPa to 1200 hPa (corresponds to sea level up to 2400 m above sea level)

Figure 6: Environmental conditions

Measuring range^{*1*4}

Measuring range for methane under the following conditions	0 - 3.8 vol% with a measuring accuracy of $\pm 10\%$ LEL = ± 0.44 vol%
Flow ^{*2}	1000 ml/min $\pm 10\%$
Relative humidity ^{*2}	5% - 80% in the range of 5 °C - 50 °C <u>and</u> 5% - 80% standardised to T=30 °C
Air pressure ^{*3}	750 – 1200 hPa corresponds to sea level up to 1000 m above sea level
Oxygen	19.5 vol% to 20.9 vol%
Display range for methane	0 vol% to 4.3 vol%
^{*1} Temperature range of 5 °C to 50 °C within GasMOS ^{*2} relative to GESM unit of measurement ^{*3} relative to installation site ^{*4} ATEX and IECEx certificate only applies to the explosion protection, not to the measuring function	

Figure 7: Measuring range

2 Identification

2.1 Product brand and type designation

This operating manual is valid for the GasMOS[®] Gas Monitoring System.

The Gas Monitoring System is designed for use in potentially explosive atmospheres in accordance with ATEX/IECEx.

- ATEX: II 2/-G Ex ib db IIA T1 Gb/-
- IECEx: Ex ib db IIA T1 Gb/-

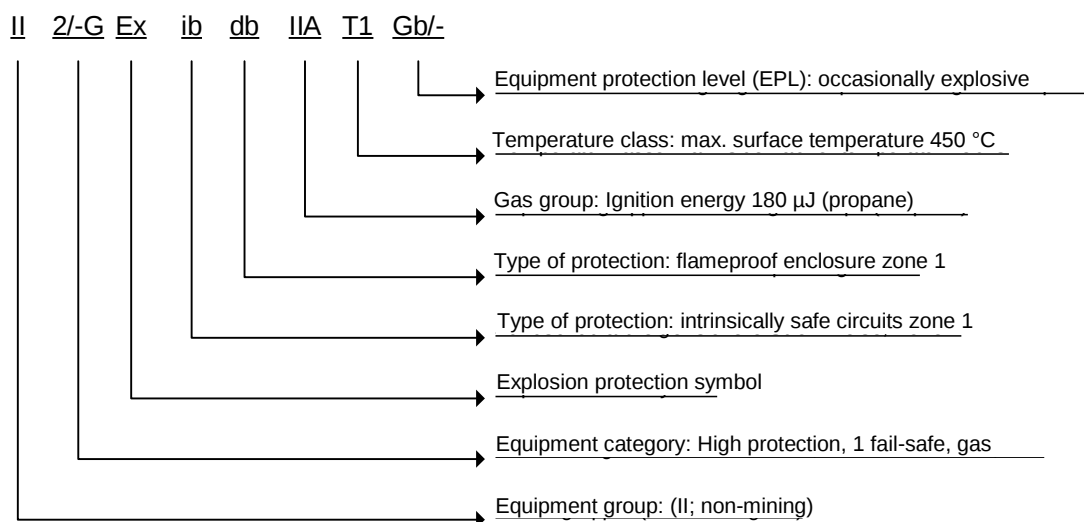


Figure 8: Explanation of ATEX marking

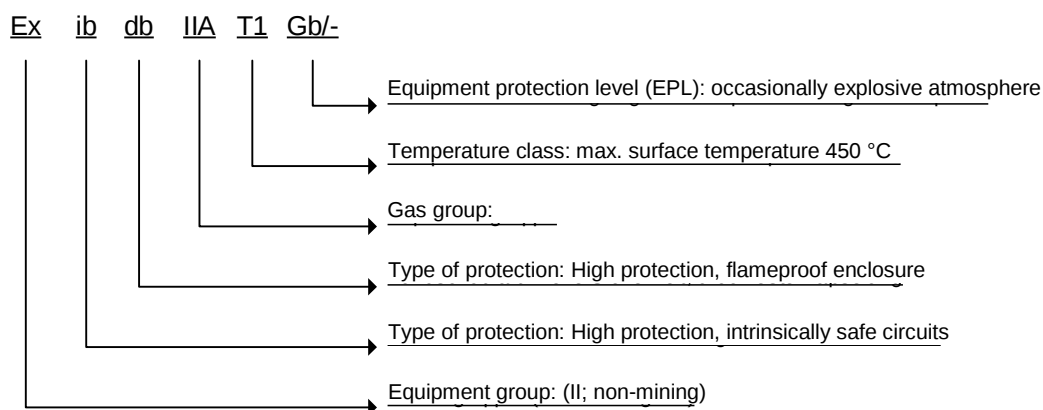


Figure 9: Explanation of IECEx marking

2.2 Manufacturer

Schaller Automation
Industrielle Automationstechnik GmbH & Co. KG
Industriering 14
66440 Blieskastel
Germany

2.3 Type plate

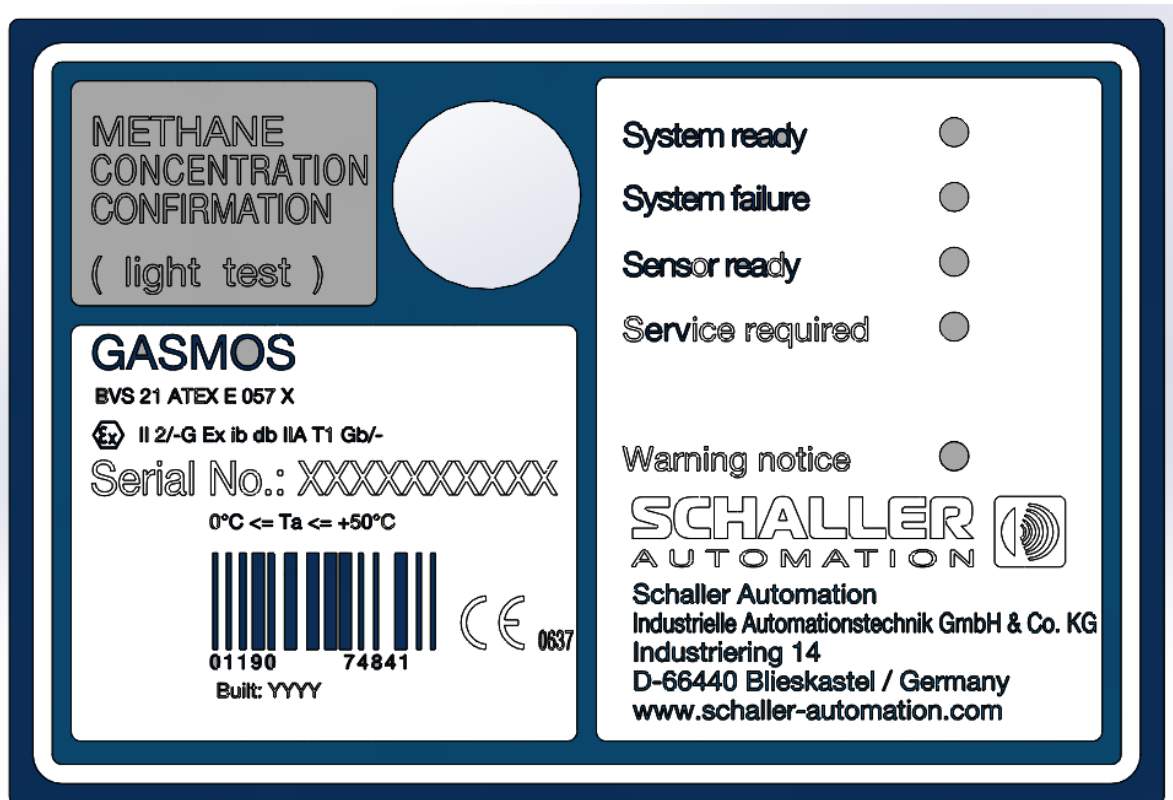


Figure 10 GasMOS type plate

2.4 Product description and technical data

2.4.1 Product description

The GasMOS Gas Monitoring System from SCHALLER AUTOMATION is used to continuously measure the methane content within the gas atmosphere of the crankcase of large engines (gas and dual fuel).

The Gas Monitoring System generates negative pressure with a built-in pump and draws in the sample gas from the crankcase. The sample gas is passed through a sensor device (GESM), which consists of various sensors (gas sensors, sensors for flow and pressure measurement and a sensor for oxygen measurement), and determines the methane content in the sample gas atmosphere.

The active and continuous suction of the gas atmosphere from the crankcase is used to calculate and output a measured value every 30 seconds.

To avoid false alarms, the system continuously calibrates, using the integrated self-monitoring. Environmental air calibration runs daily for 15 minutes.

GasMOS is suitable for use in stationary power plants, as well as on ships with their static or dynamic inclination angles.

The system can also be used to monitor methane in other applications, provided that the operating conditions specified in the operating manual are observed (temperature, pressure range etc.).

The device must not be installed in potentially explosive areas. Only gaseous medium from a potentially explosive area may be fed to and from the device via a pipe or hose line, as described in Section 2.6. The explosion protection measures applied in the design of the device (fireproof, intrinsically safe circuits) only applies to the GESM measuring module inside the device. There must be no explosive atmosphere inside the housing.

The type examination only applies to the explosion protection, not to the measuring function.

To ensure the device functions correctly, the sensor module (GESM) that is installed in the device must be calibrated every 12 months at Schaller Automation.

2.4.2 GasMOS Gas Monitoring System

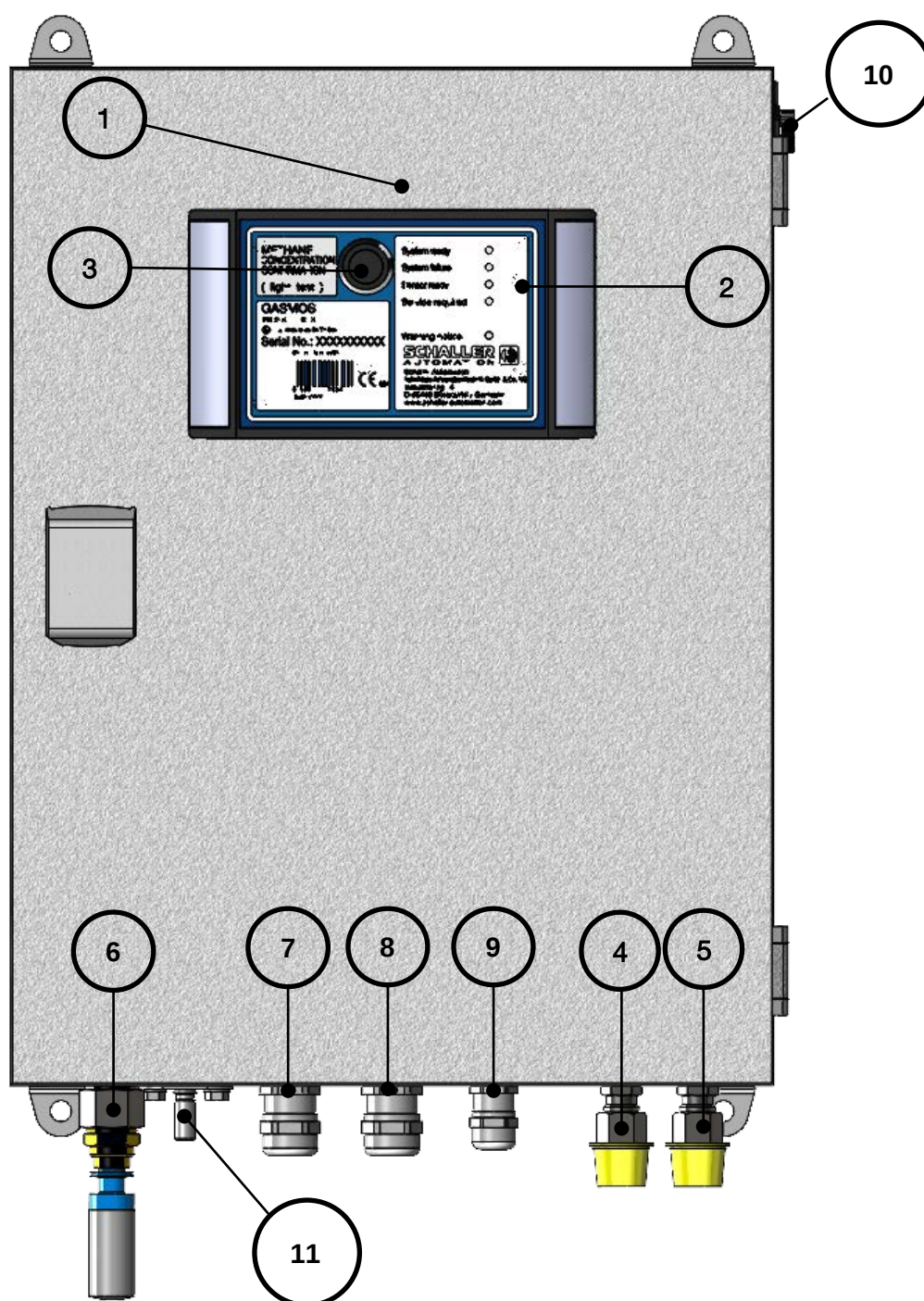


Figure 11 GasMOS exterior view

- | | |
|------------------------------|---------------------------------------|
| (1) Housing | (7) Electrical connection cable input |
| (2) Display | (8) Electrical connection cable input |
| (3) Button | (9) Electrical connection cable input |
| (4) Sample gas input/intake | (10) Pressure equalisation element |
| (5) Sample gas output/return | (11) Earth connection M8 |
| (6) Sample gas input/intake | |

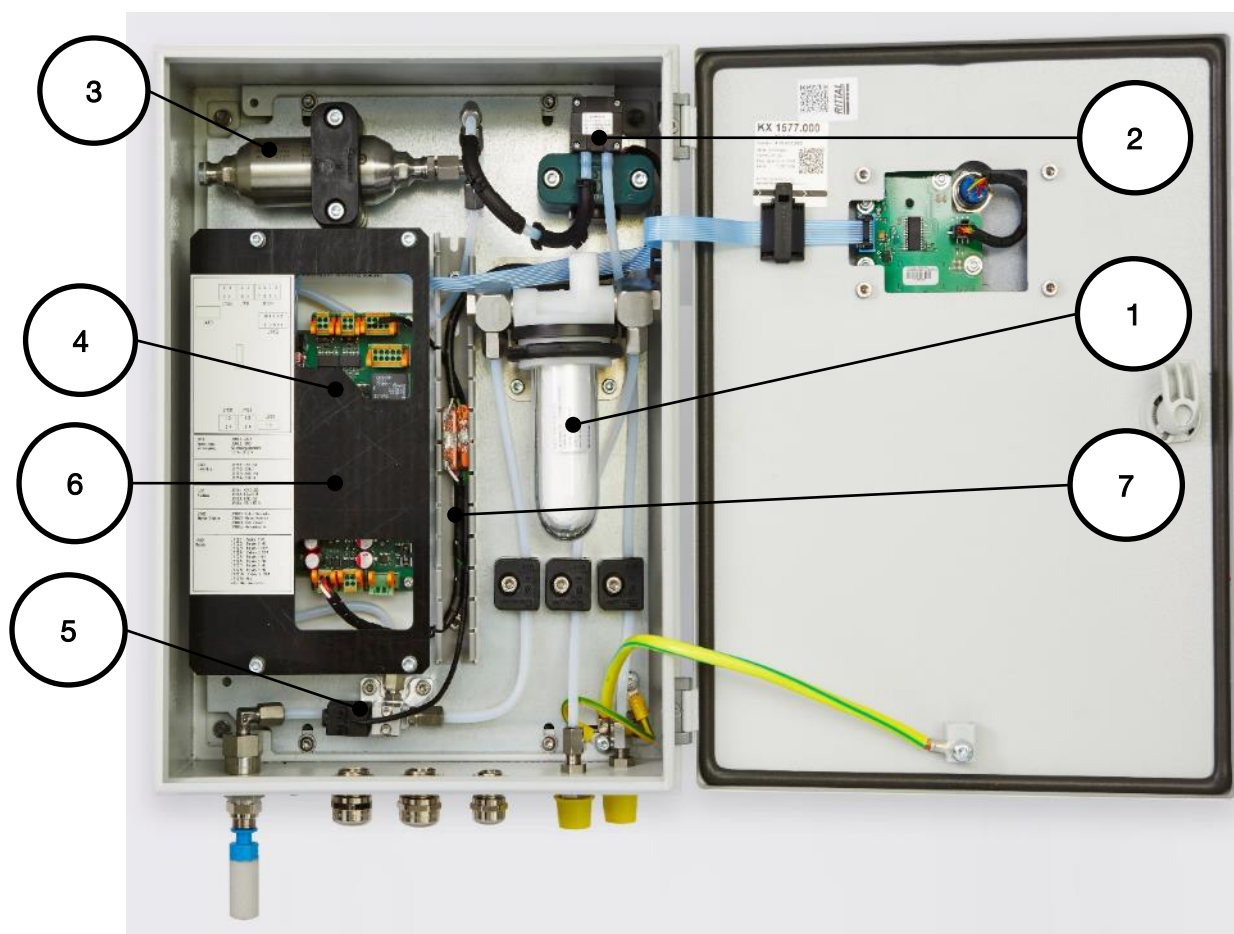


Figure 12 GasMOS interior view

- (1) Filter
- (2) Pump
- (3) Pressure compensation element for pulsation damping
- (4) Sensors: GESM module
- (5) Valve
- (6) Protection cover
- (7) Cable duct

WARNING!

Explosion of the crankcase

Serious injury, including death

- ➔ The GasMOS Gas Monitoring System is designed to draw in gases from a potentially explosive atmosphere (for example, the crankcase of a gas engine).



The Gas Monitoring System primarily consists of a housing (1) which has a display unit (2), a sample gas input (4), a sample gas output (5) and cable glands (7, 8, 9). The Gas Monitoring System also contains an interface for calibration and environmental air calibration (6), which is protected by a filter during normal operation. (see Figure 11)

The sample gas filter in the housing provides basic protection for the system against contamination by particles and oil. Operating the device without the filter insert provided for this purpose is not allowed. If particles get into the sample gas flow, this can lead to a static charge and therefore to an explosion.

If heavier contamination is anticipated during installation or in the selected air extraction position, the coalescing filter supplied must be installed between the engine extraction and the Gas Monitoring System.

The LED display (Figure 11) is used to display all the important information for the user under normal operating conditions.

Gaseous atmosphere is drawn out of the crankcase by the negative pressure generated in the housing by the pump (Figure 12) (Items 1.2 and 2.2 Figure 13). The gas enters the sensor module via the pipe/hose line. In the sensor module, the methane concentration in the gas atmosphere is measured in the fluidic block using various sensors. The gas is then returned to the crankcase via the return line. If there is a central exhaust on the engine, the gas can also be extracted from and returned to the central exhaust (Items 1.1 and 2.1 Figure 13: Interface schematic).

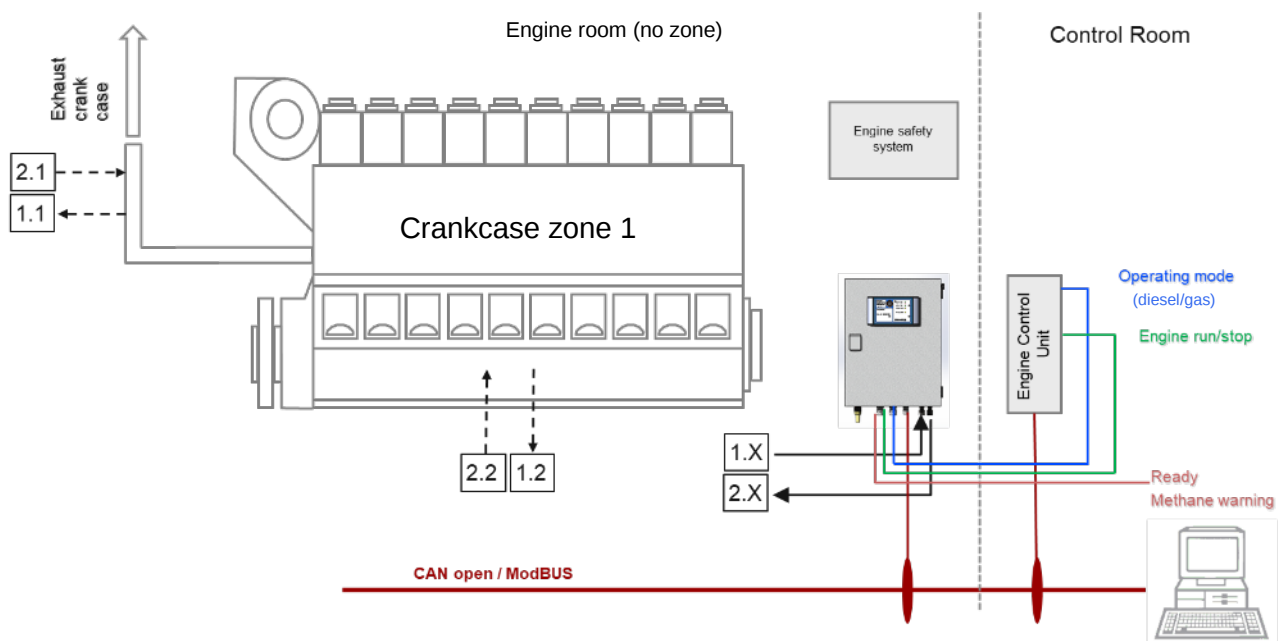


Figure 13: Interface schematic

Figure 13 shows the connection between the Gas Monitoring System and the engine schematically. The gas atmosphere can be drawn either via connections on the engine (1.2, 2.2) or, if available, via the crankcase exhaust (1.1 and 2.1).

The Gas Monitoring System can be connected directly to the engine's control system. The interface has a relay output for any exceeding of the set warning threshold, a ready-for-operation signal (System Ready), an electrically isolated input (24 V) for distinguishing between diesel/gas operation, and an electrically isolated input (24 V) for detecting engine operation.

A value of 3 vol% is set as the warning threshold.

2.5 Housing

The housing has wall brackets. These are used to mount it on a wall. The device is only suitable for mounting on walls that have flat, solid and continuous surfaces. Select fasteners with sufficient strength and that are appropriate to for the subsurface.

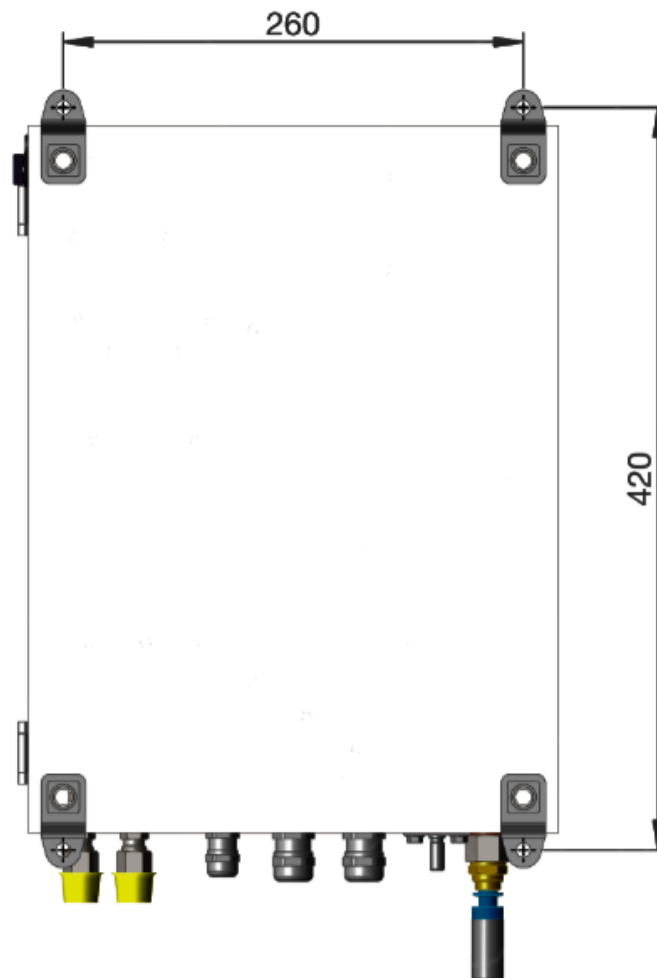


Figure 14Rear of the GasMOS

The hole diameter on the wall brackets is 8 mm (Figure 15).

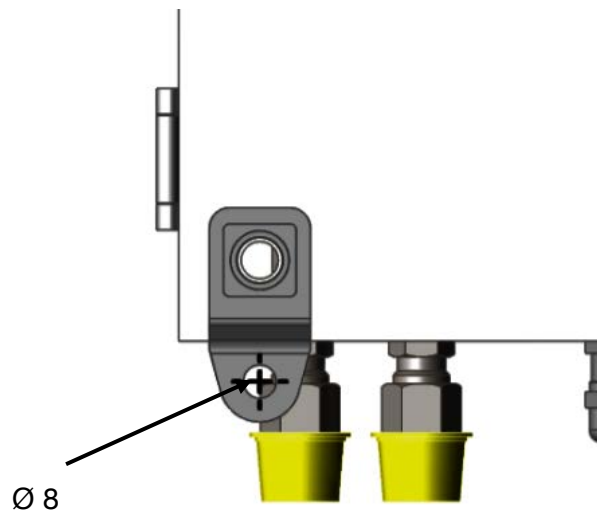


Figure 15 Hole diameter on wall bracket

The housing is designed for a maximum load of $F_{\max}=250 \text{ Nm}$ (Figure 16).

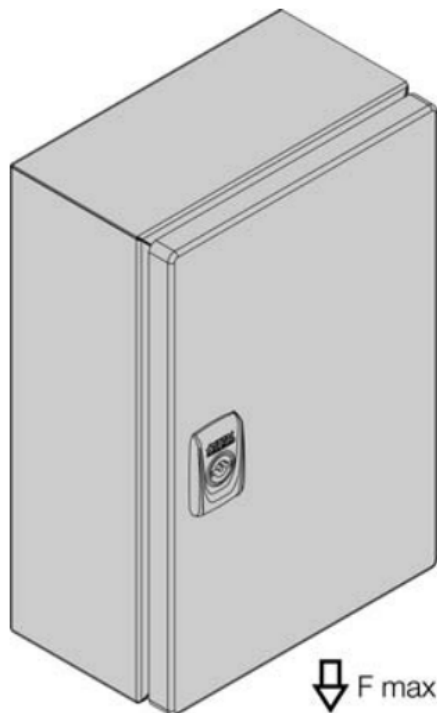


Figure 16: Max. load on housing (source: Rittal 3_8114)

When the door is open, a maximum load of $F_{\max}=50 \text{ Nm}$ is allowed on the door (Figure 17)

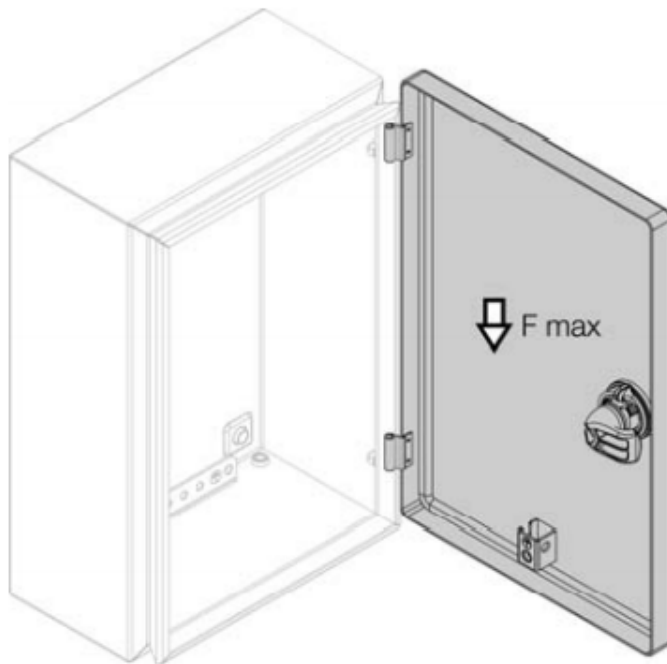


Figure 17: Max. load on open door (source: Rittal 3_8114)

2.6 Pipe and hose lines

Schaller Automation uses state-of-the-art equipment to draw in and transport the gaseous atmosphere. Therefore, only stainless steel pipes (tolerance ± 0.1 mm) according to DIN EN 10216-5, stainless steel screw connections or PTFE hoses may be used to connect the Gas Monitoring System to the equipment being tested.

The minimum inner diameter should be 8 mm. Sufficient dimensions must be ensured, in particular for the return line. If the inner diameter is too small, the back pressure increases, which shortens the service life of the diaphragm pump.

The device is supplied with SERTO fittings (SO type) (Figure 11, Items 4 and 5).

Extract from SERTO installation instructions:

- Cut the pipe to length at right angles and deburr.
- The pipe end must be straight over a length of $1.5 \times 10 \text{ mm} = 15 \text{ mm}$ and have an undamaged surface.
- Insert the pipe into the fitting as far as it will go.
- Screw on the connecting nut by hand until you feel it has screwed all the way on.
- Installation for the first time: Use an open spanner to tighten the connecting nut by $1\frac{3}{4}$ turns.
- Subsequent installation: Use an open spanner to tighten the connecting nut by a $\frac{1}{4}$ turn.

When using thin-walled pipes or PTFE lines, a stiffener sleeve (SERTO SO 50003) must also be used.

2.7 Safety and protection measures

The GasMOS Gas Monitoring System is manufactured according to Schaller Automation's high quality standards and undergoes strict factory tests. The safety instructions and warnings must be observed by the operator to ensure that the device operates smoothly and without problems. These instructions are identified in the operating manual with the following symbols.



CAUTION!

For safe and proper use, read the operating manual and other documents accompanying the product carefully and keep them for future reference.

2.8 Intended use

The task of the Gas Monitoring System is to measure the methane concentration, e.g. inside the crankcase of large engines. In the engines, blow-by under operating conditions, leaks or damage to the piston rings can cause unburnt methane to accumulate in the crankcase. When used on large engines with mandatory explosion protection, you must check the conformity of the explosion protection marking in Section 2.1. The safety instructions must be observed.

2.9 Foreseeable misuse

A suitable separating device must be provided, which does not impair the gas flow, but protects the device and the installation from oil ingress. Therefore, at least one suction funnel must be used.

Installation and maintenance of the Gas Monitoring System by unauthorised persons is prohibited.

Assembly of the components other than as shown in this operating manual and the applicable valid drawing is prohibited.

➔ Applications not referred to in this manual are only allowed after consulting the manufacturer! See information under 2.4.1.

2.10 Guide to symbols

This operating manual uses the following symbols in accordance with DIN EN 82079-1.



ATTENTION:

Indicates important information which helps to avoid damage to property.



CAUTION:

Indicates a low-risk hazard that, if not avoided, may result in minor or moderate injury.



WARNING:

Indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.



DANGER:

Indicates a high-risk hazard which, if not avoided, will result in death or serious injury.



Ex symbol contains important information for use regarding explosion protection.
Danger! Personal safety at risk.



The Ex symbol contains important information for action to avoid explosion.

3 Installation

3.1 Safety precautions before use



DANGER!

Explosion of the crankcase

Serious injury, including death

- You may only install and remove the Gas Monitoring System when the engine is switched off.



DANGER!

Explosion of the crankcase

Serious injury, including death

- The exhaust air from the sample gas output must be fed back to the crankcase and must not get into the engine room.



DANGER!

Explosion of the crankcase

Serious injury, including death

- Observe the permissible ambient temperature T_a (during intended use): $+0\text{ °C} \leq T_a \leq +50\text{ °C}$



DANGER!

Explosion of the crankcase

Serious injury, including death

- The Gas Monitoring System with return of the crankcase atmosphere into the crankcase is suitable for a crankcase pressure in the range of $\pm 500\text{ mmH}_2\text{O}$ (50 mbar) under normal operating conditions.



DANGER!

Explosion of the crankcase

Serious injury, including death

- Only qualified personnel are allowed to assemble, install and start up the Gas Monitoring System. The qualified personnel must have knowledge of the type of protection, instructions and regulations for the equipment in potentially explosive atmospheres. Check whether the classification (see type plate) is applicable for this application.



ATTENTION!

Overvoltage at the device

Damage to the device is possible

- ➔ For welding work on the engine, the Gas Monitoring System must be disconnected from the electrical power supply at all pins.

3.2 Unpacking, items included in delivery

When the Gas Monitoring System is delivered, always check the delivery to ensure that it includes all the components. Schaller Automation provides you with a corresponding parts list for this purpose.

Dispose of the packaging materials in accordance with your local disposal regulations in the containers provided for this purpose.

3.3 To be provided by the customer

For installation and operation of the Gas Monitoring System, the customer must provide:

- ➔ a way to attach the housing, which must be outside the engine;
- ➔ an electrical supply line, which must be laid to the installation site; and
- ➔ a bus line, in accordance with the connection data in Section 1, to the installation site.

3.4 Installation of the GasMOS

3.4.1 Assembly of the housing

Mount the Gas Monitoring System at a suitable installation location near the equipment being tested, but not on the equipment (engine) itself. To do this, use the four through-holes in the housing and the Rittal fasteners listed in Section 2.5.

To ensure effective environmental air calibration, the atmosphere at the installation site should not be contaminated by pollutants (particulate, gaseous or liquid). If this is not the case, the environmental air input must be operated away from the site. I.e. an intake line (stainless steel pipe or PTFE line according to specification) must be installed to an area that has an uncontaminated atmosphere.



ATTENTION!

Damage to the device

Damage to the device is possible

- ➔ The housing must not be installed directly on the engine, as it can be damaged by the vibration and temperatures that occur on the engine.

3.4.2 Assembly of the extraction and return line

Pipe or hose lines as described in Section 2.6 must be used. The supplied coalescing filter can also be installed between the Gas Monitoring System and the extraction point on the engine. When installing the pipe or hose line, make sure that it slopes towards the engine so that oil can flow back into the engine.



3.4.3 Electrical assembly

DANGER!

Risk of electric shock

Risk of injury

- ➔ Before connecting the electrical power supply lines, you must ensure that there is no voltage.

The Gas Monitoring System can be connected to the operator's network and the operator's interfaces using the connection lines, as follows.

Figure 18 Shows the wiring diagram.

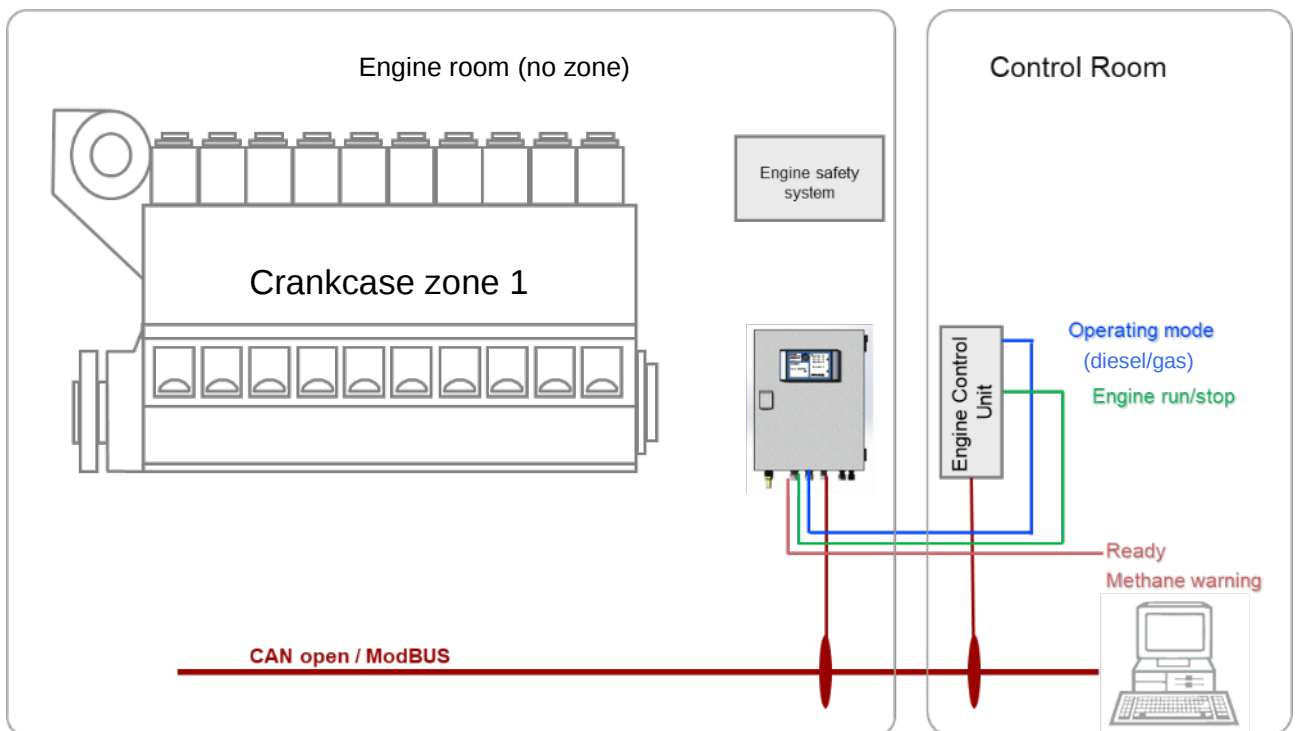


Figure 18: GasMOS wiring diagram

Required tools:

- Slotted screwdriver, width 3 mm
- Open spanner, width across flats 17 and 22

3.4.4 Pre-wired connectors

The connectors for the pump and valves are pre-wired at the factory. Table 1 shows the assignments of the interfaces.

J401 – Display			 Figure 19 Display connection
J1101 – Pump J1101.1: +12 V J1101.2: Speed setting J1101.3: GND J1101.4: Tachometer signal			 Figure 20 Pump connection
J1103 – Valve	J1103.1: Nc ^x J1103.2: Nc ^x J1103.3: Nc ^x J1103.4: Nc ^x	J1103.5: Valve 1 J1103.6: Nc ^x J1103.7: GND J1193.8: Nc ^x	 Figure 21 Valve connection

*Nc: not connected

Table 1Pre-wired connections of the GESM

3.4.5 Wiring on installation; customer interfaces

Connections for customer interfaces

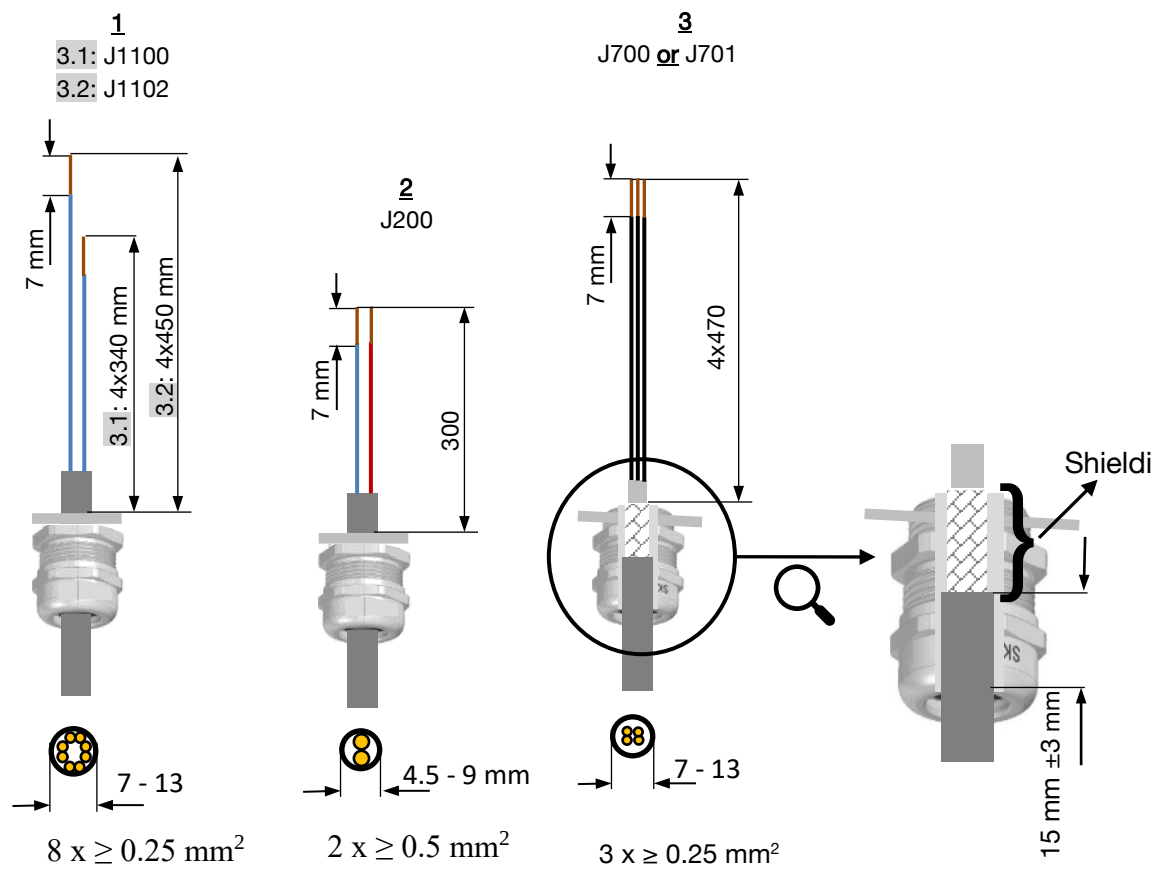
- Power supply
- Engine status
- Relay contacts
- Communication: CANopen or Modbus



- GasMOS with assembled supply lines
- 1: Relay outputs, engine operation
- 2: Power supply
- 3: Communication

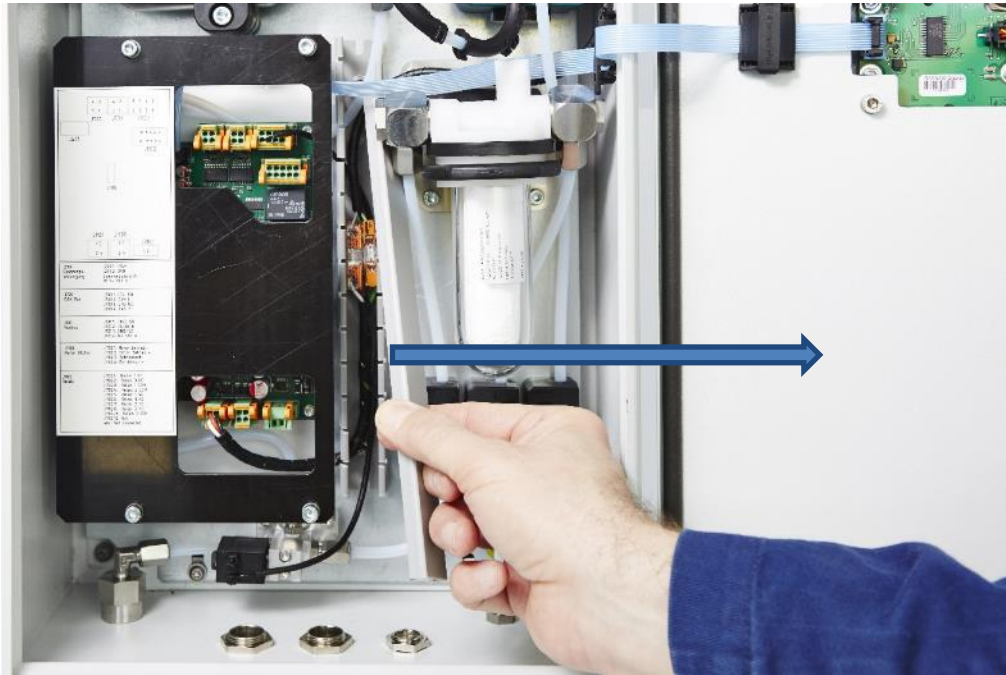
Figure 22 GasMOS with assembled supply lines

Figure 22 shows the GasMOS Gas Monitoring System with the supply lines fully assembled. The electrical installation of the cables is described below.



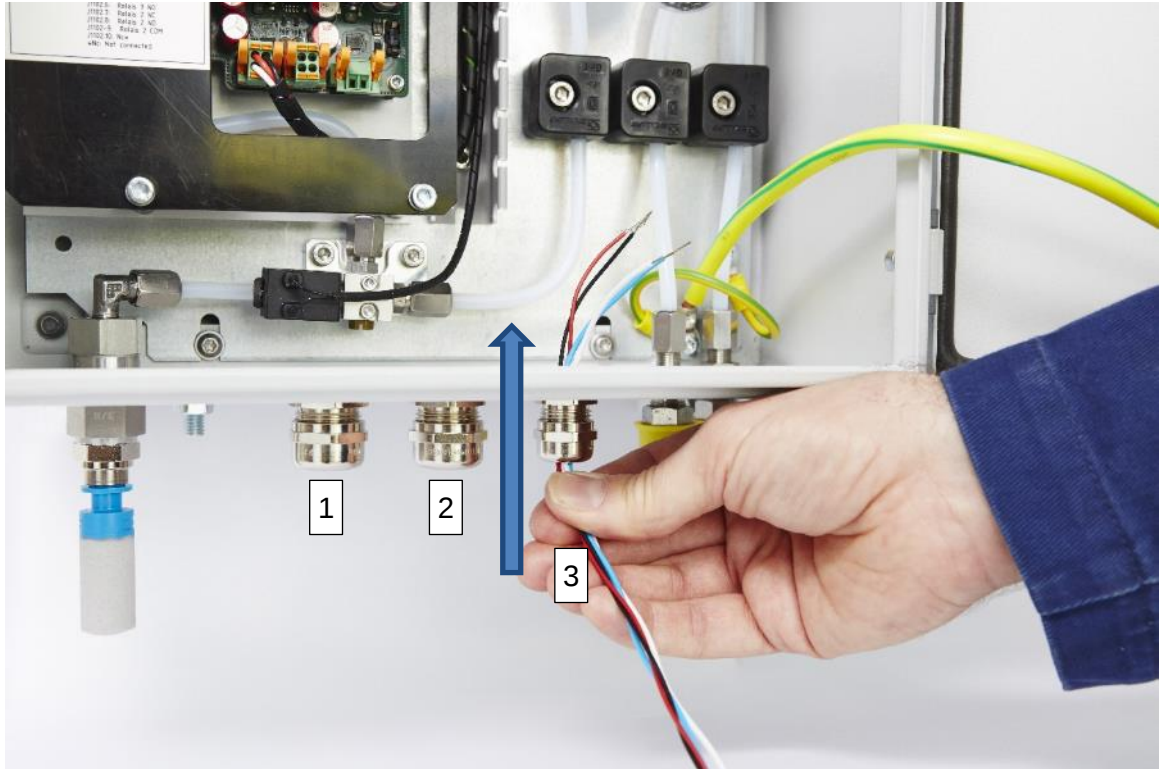
- Prepare the cables before feeding them in. To do this, cut the cables and strip them to size. For the communication cable (Item 3), note the position of the shielding.

Figure 23 Dimensions of supply cables



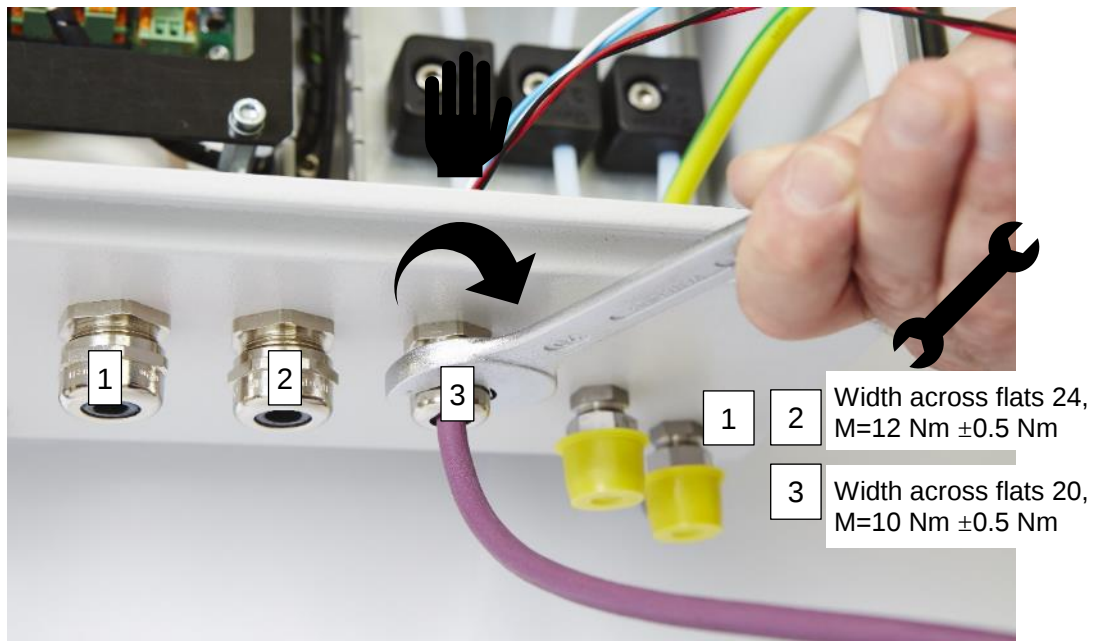
➤ Remove cable duct cover

Figure 24 Open cable duct



➤ Feed the cable through the provided cable gland.

Figure 25 Feed in the cables



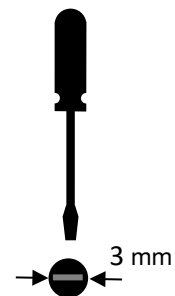
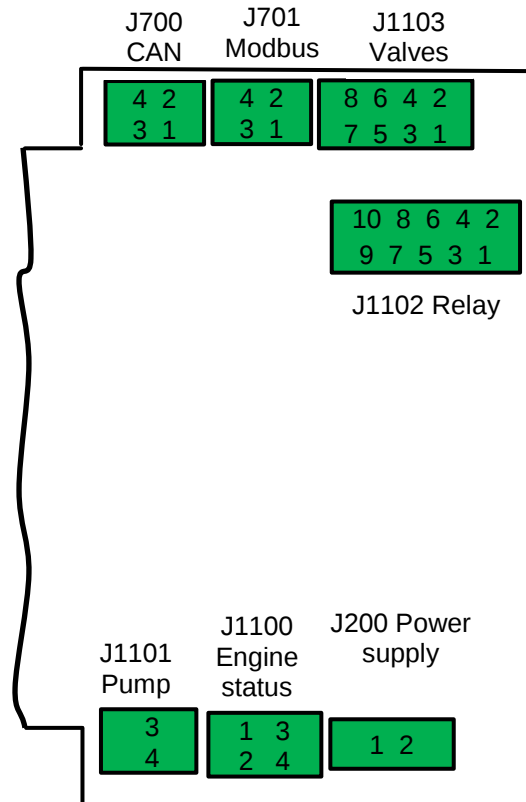
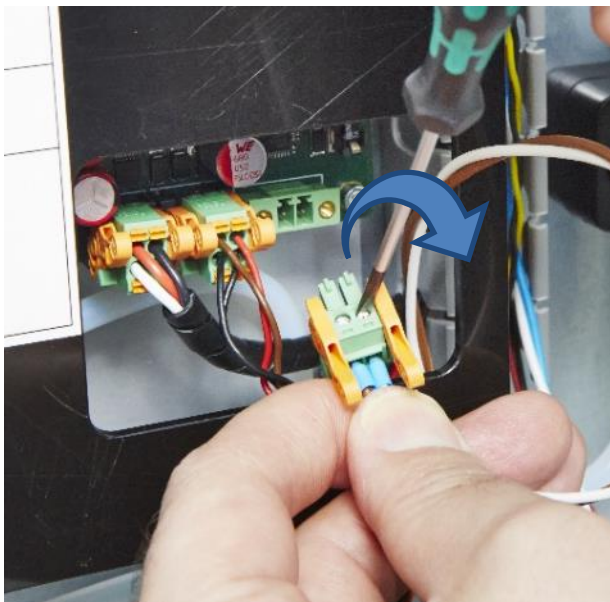
- Secure the cable to prevent it slipping out. To do this, tighten the cable gland hand-tight by hand or with a spanner.

Figure 26 Secure cables to prevent them slipping out



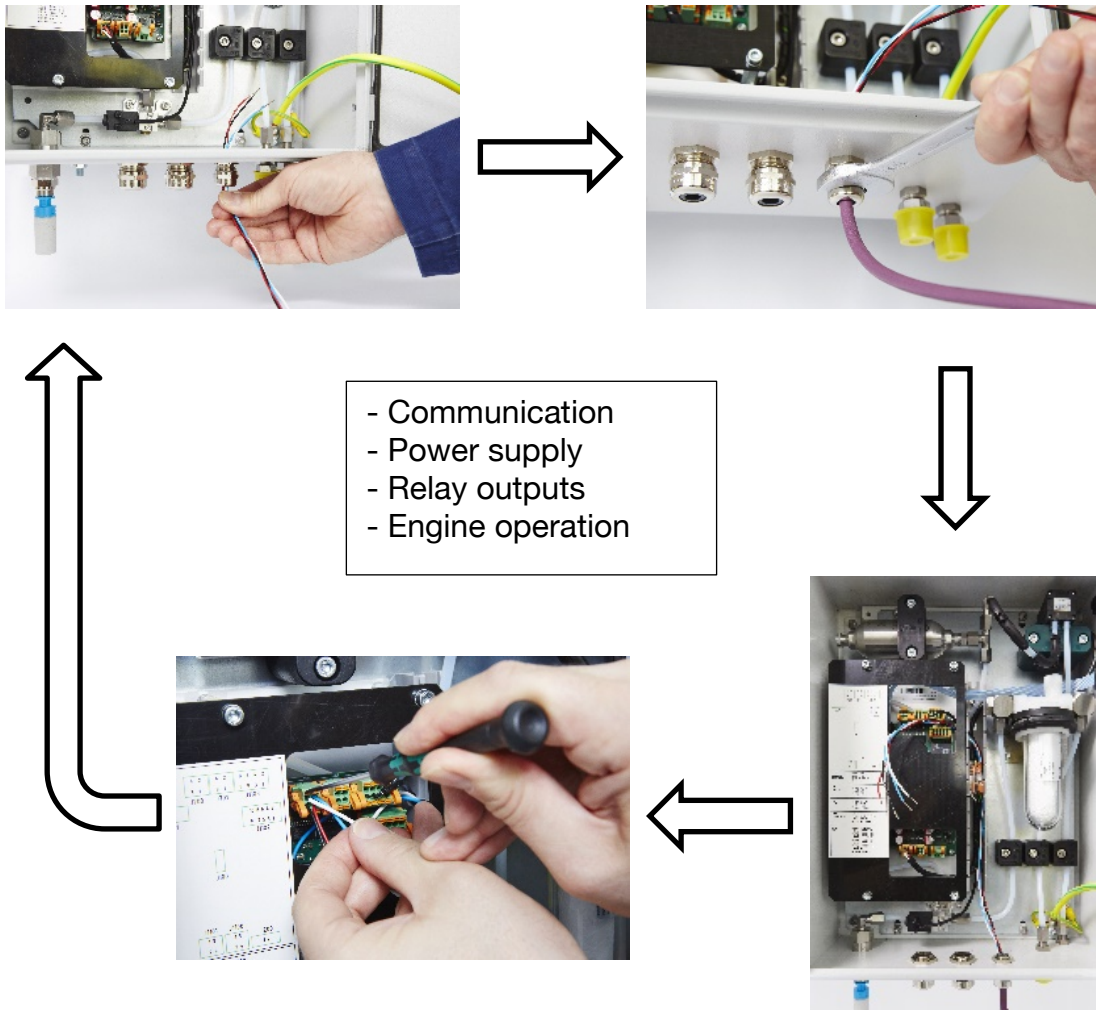
- Install the cable in the cable duct.

Figure 27 Install the cables in the cable duct



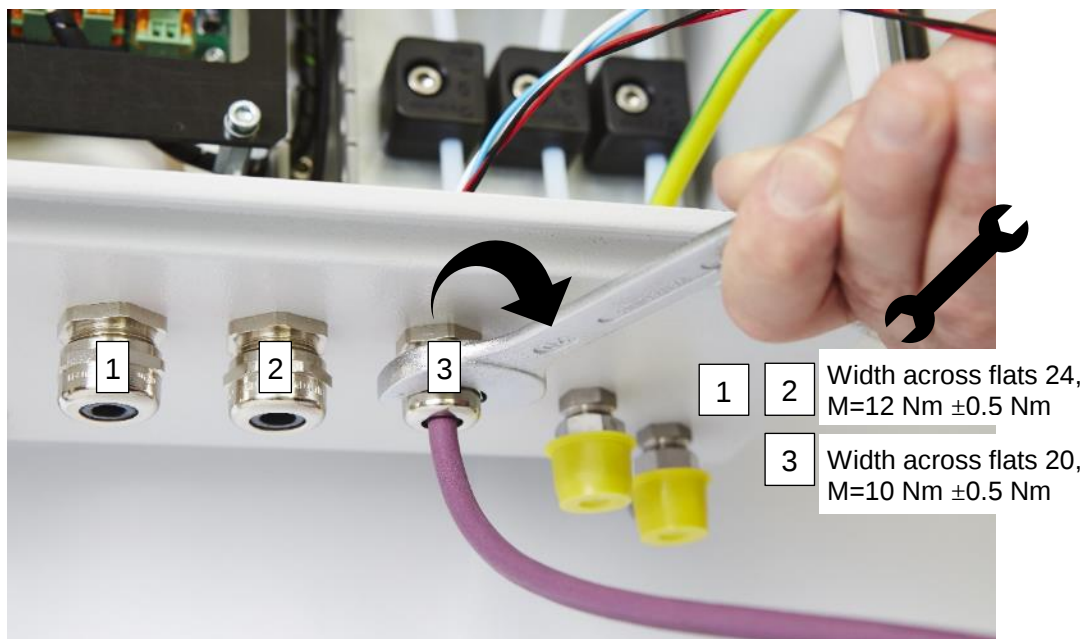
- Connect the individual wires to the screw or spring-loaded terminals. Connect the terminals as per Table 2.

Figure 33: Connect single wires



- Repeat the procedure from Figure 25 to Figure 33 until all the required cables are connected.

Figure 34: Procedure for installing the connection cables



➤ Tighten the cable glands according to the specifications in Figure 35.

Figure 35 Final assembly of the cable gland

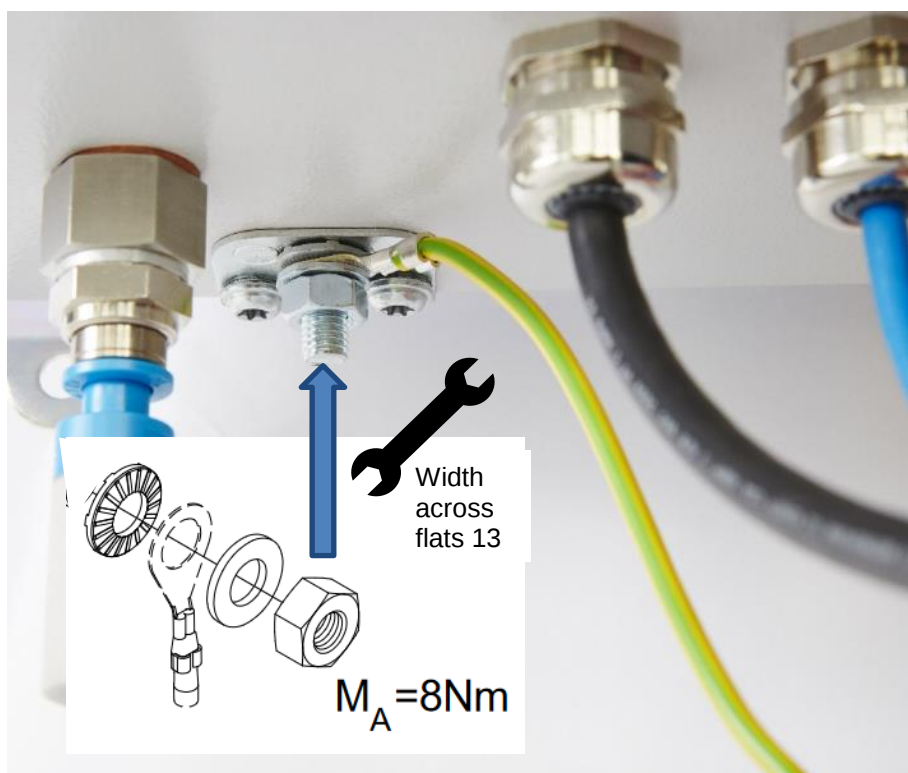


Figure 36 Connecting the earth cable

3.5 Starting up for the first time

WARNING!

Engine protection not guaranteed

Danger of explosion

- ➔ The Gas Monitoring System may only be started up after all the components have been completely attached.

If the device has been stored in a cold place ($T < 0\text{ °C}$) before starting up for the first time, wait until the device has reached ambient temperature before starting it up.

Required tools: None

Procedure for starting up the system for the first time:

1.



Figure 37: Switch on the power supply

Switch on the power supply to the system.

2.



Figure 38: "Sensor ready" indicator

"Sensor ready" on the system display comes on green. Self-diagnosis runs for approx. 60s.

3.



Figure 39 GasMOS ready for measurement

Note:

The device has been set to a flow rate of $1\text{ l/min} \pm 10\%$ before being shipped from the factory. If the value is different after installation, the flow must be adjusted using the GasMOS Service app. This adjustment is applied via the pump output.

See the "GasMOS Service app operating manual, Section 5, page 18, Fig. 12, Pump control".

The reason for the deviation may be a shorter or longer intake/return line than was taken into account for delivery from the factory.

In this case, the GasMOS Service app displays the following error message: “MEASUREMENT FLOW BOUND ERROR”. On the device display, the “System ready” LED goes off and the “System failure” LED comes on.

See Figure 40 for the start sequence of the device. After switching on, the system runs through a boot sequence. This is followed by a self-check (mode: “SELF_CHECK”). If this self-check is completed successfully, the device switches to measuring mode (mode: “Operation”).

If a problem is detected by the firmware during the self-check, the device goes into error mode (mode: “ERROR”). In this case, please see the Troubleshooting section and the GasMOS Service app operating manual.

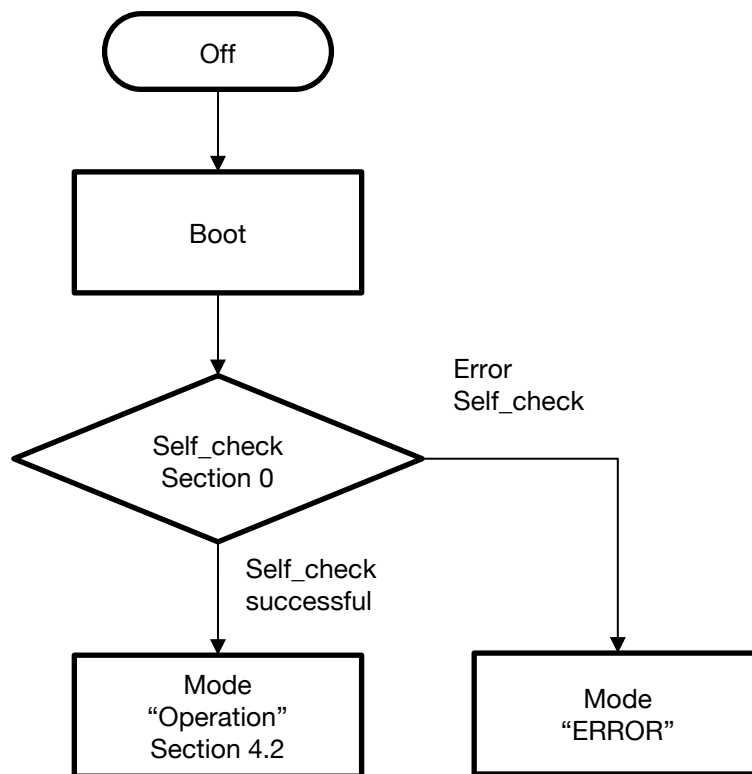


Figure 40 GasMOS start sequence

GasMOS is now ready for operation!

3.6 Starting up again

The power supply must be established when starting up again. After successful self-diagnosis, the device goes into measuring mode after approx. 60 seconds.

4 Operation and use

4.1 Operating statuses

Figure 41 lists and describes the operating statuses of the GasMOS measuring system.

System ready	System failure	Sensor ready	Service required	Warning notice	Button	Status
						Measuring mode operating mode
						Device "Off"
						Self-diagnosis/environmental air calibration/maintenance
						Methane warning
						Error
						Measuring measured value for methane, oxygen active.
						Measuring measured value for methane, oxygen inactive.
						Hardware error, additional service required

Figure 41 GasMOS LED display

LED indicator	Description
or	LED on
	LED off
or	LED on or off possible

Figure 42 Key for the LED status

The following options are also available to identify the current operating/error status:

- The device is connected to the operator's control system via the Modbus or CANopen interface. Information about the current status of the system is output over these interfaces.
- When using the *supplied display software (GasMOS Visu app)*, the current system status is displayed in the app.
- A computer running the GasMOS Service app can be connected via the service interface. You can also see the current mode in the app (see Operating manual_GasMOS_Service_App).

See subsections 4.2 to 4.6 for a description of the statuses.

The "System ready" LED goes off if the measuring system is in one of the following operating statuses: "Self-diagnosis", "Environmental air calibration" or "Maintenance". There is no methane measurement.

4.2 Operation mode

Operation mode is the normal measuring mode of the device.

Before Operation mode is active when the device is first started, a boot sequence and a subsequent self-check (“SELF_CHECK”) runs first.



Figure 43: GasMOS front panel in Operation mode

In normal measuring mode, the “System ready” and “Sensor ready” LEDs are on.

4.3 Methane concentration warning

The “Warning notice” LED comes on and the illuminated ring around the “METHANE CONCENTRATION CONFIRMATION” button flashes red. The “System ready” LED goes off.

If the warning threshold stored on the device is exceeded, the alarm on the Gas Monitoring System must be reset manually to the ready-to-operate status.

You do this by manually pressing the “METHANE CONCENTRATION CONFIRMATION” button on the display.



Figure 44: Example LED display with alarm

If the warning cannot be reset, it must be assumed that there is a methane concentration above the set warning threshold permanently present at the extraction point.

The GasMOS Visu app or data transfer over Modbus or CAN bus can be used to track the current methane concentration precisely.

If the methane concentration is above 4.3 vol%, the value for the methane concentration is no longer transferred.

4.4 “Self-diagnosis” mode

Self-diagnosis is carried out at regular intervals from “Operation” mode.

Self-diagnosis also runs on the following events:

- Return from “MAINTENANCE” mode
- Periodic triggering from “ERROR” mode

In this case, the “System ready” LED on the device display goes off (Figure 45).



Figure 45 Sensor OK, system not ready

Figure 46 shows the self-check sequence.

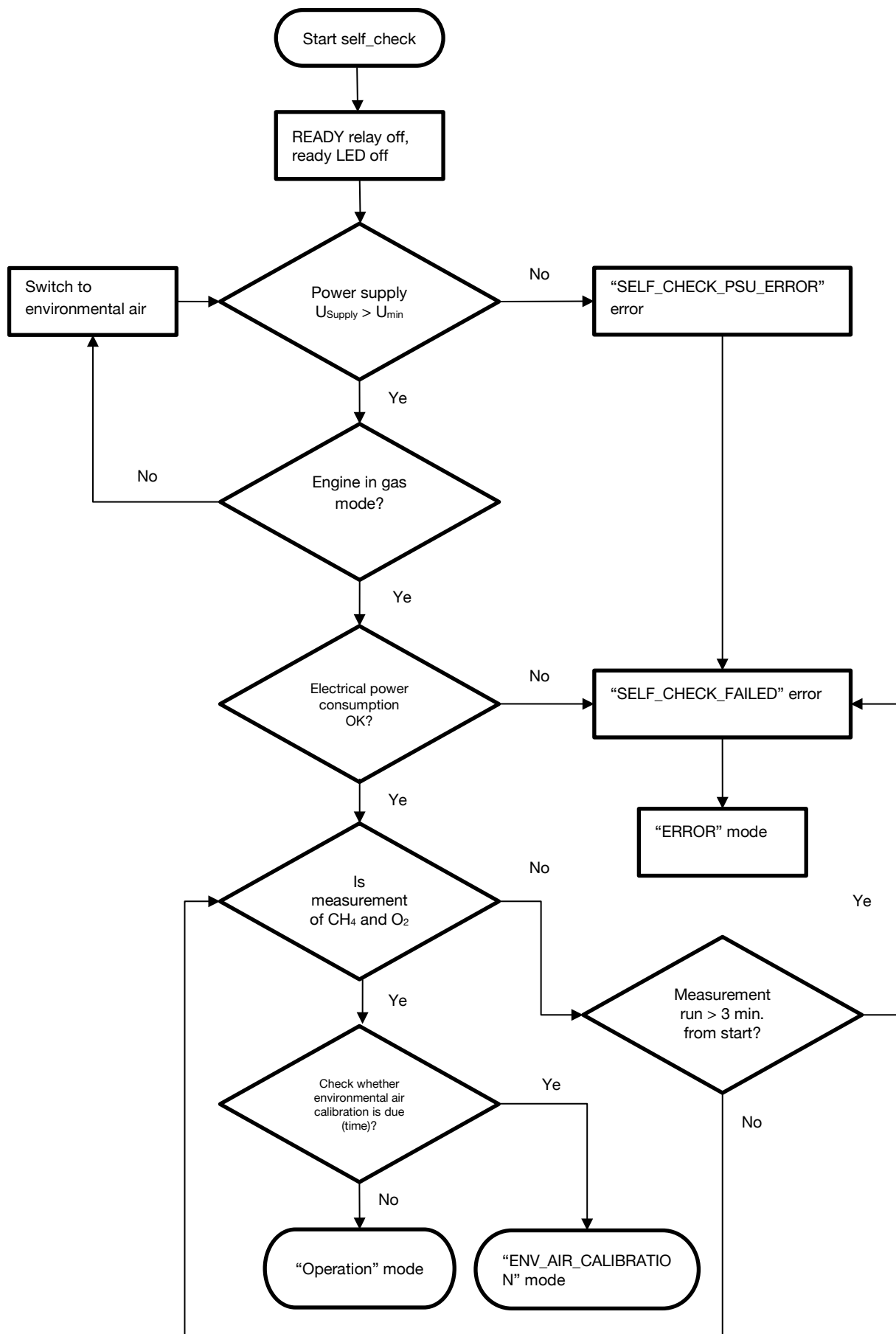


Figure 46: Self-diagnosis sequence

4.5 Environmental air calibration mode

Environmental air calibration runs automatically every day. It is the basis for automatic offset correction of the methane measurement. During environmental air calibration, the “System ready” status is cancelled and the device is not ready for measurement.

Figure 47 shows the environmental air calibration sequence.

During environmental air calibration, you must ensure that unpolluted environmental air is available to the device.

Otherwise, the zero point will be calibrated incorrectly.

It is also possible to initiate environmental air calibration manually via the GasMOS Service app. See Section 5, page 19, Final inspection, Start air calibration.

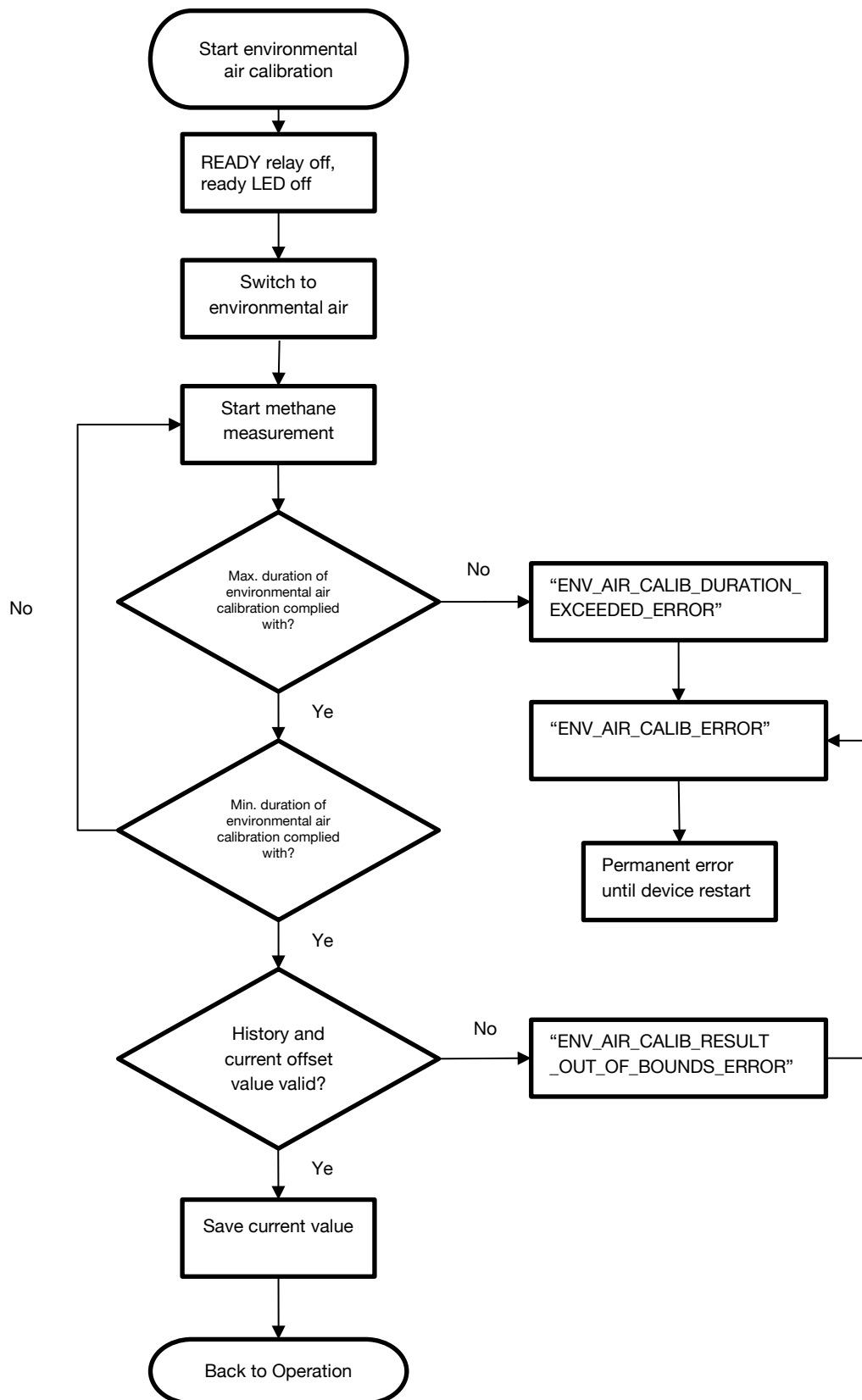


Figure 47 Environmental air calibration sequence

4.6 Maintenance mode

Maintenance mode is started via the GasMOS Service app. To start this mode, the GasMOS device has to be connected by USB cable to a computer on which the GasMOS Service app is installed.

Maintenance mode is started via the GasMOS Service app from the “Final inspection, Activate maintenance mode” submenu. See the GasMOS Service app operating manual, Section 5, page 16.

Various system settings can be checked and changed in this mode. It is also possible to start an environmental air calibration run manually.

4.7 Error diagnosis and troubleshooting



DANGER!

Risk of explosion due to methane.

Severe to fatal injuries.

- ➔ If a warning message is displayed, do not approach the engine again until the methane concentration has dropped below the warning threshold. This is indicated by the device if, after you have acknowledged the warning message, the measuring system does not enter the warning status again after waiting 30s.

If the “Sensor ready” LED does not come on during operation, no measured values are currently being measured for methane or oxygen.

If the “Service required” LED comes on, this indicates a hardware error. In this case, the device must be sent in to or checked by Schaller Service.

Table 3 lists and describes the error statuses of the device. To be able to narrow down the error, the information described in Section 4.1 is required, which is provided via the Modbus or CANopen interface, via the GasMOS Service app or via the GasMOS Visu software.

System ready	System failure	Sensor ready	Service required	Warning notice	Button	Status/error
○	●	○/●	○/●	○	⦿	Error, Section 4.9
		○			⦿	Measuring measured value for methane, oxygen inactive, Section 4.10
			●		⦿	Hardware error, additional service required, Section 4.11

Table 3 Error statuses on the LED display

LED indicator	Description
● or ●	LED on
○	LED off
○/● or ○/●	LED on or off possible

Table 4 Explanation of the LED status

The error messages are described in Section 4 “Dashboard” in the operating manual (see the GasMOS software operating manual).

4.8 “System ready” LED not on, “Sensor ready” LED is on

In this case, the device is in one of the following operating statuses:

- Self-check
- Maintenance
- Environmental air calibration
- Boot
- Alarm (alarm relay set)

The “Sensor ready” LED indicates that the measured value calculation for methane and oxygen is active. There is no error.



Figure 48 Device not ready for measurement

4.9 “System ready” LED not on, “System failure” LED is on

The system is in “ERROR” mode. The “System ready” relay is reset.

“ERROR” mode can be triggered by failed environmental air calibration or by a failed self-check. In these cases, the device should be restarted (disconnect the power supply for 5 seconds). If the error occurs again after restarting the device, the device must be checked by a service employee or sent to Schaller Automation for inspection.



Figure 49 Device in error mode

4.10 “Sensor ready” LED is not on

If the “Sensor ready” LED goes off, there is currently no methane or oxygen calculation. Whether there is an error must be considered from the combination with the other LEDs. (see the GasMOS Service app)

4.11 “Service required” LED comes on

If the “Service required” LED comes on, there is a hardware error.

See the GasMOS Service app operating manual for instructions on narrowing down the error. Section 4 “Dashboard” provides information about the error messages sent via the Service app. For a description of the errors in the hardware/peripheral, see Table 5, page 14.

5 Maintenance and repair

The following warning and safety instructions must always be observed for all maintenance and repair work.

WARNING!

Severe injury due to hot atmosphere escaping from crankcase

Risk of burns

➔ Only carry out maintenance and repair work when the engine is at a standstill.

WARNING!

Explosion of the crankcase

Serious injury, including death

➔ The methane detector must not be cleaned with a steam cleaner, high-pressure cleaner or similar equipment.

5.1 Maintenance

5.1.1 Maintenance cycles for reliable operation

The maintenance cycles for the GasMOS system are listed in the table below (Figure 50). With regular maintenance, Schaller Automation guarantees that the product will have a long service life.

If the maintenance intervals are not observed, the sensor may fail prematurely.

It is essential that you follow the given sequence for the work.



	Description	Interval (whichever occurs first)			See Section	Required parts/ tools
Steps	Hours	660	4000	8000		
	Or months	1	6	12		
1.	Sample gas filter → Replace filter element → Replace seal → Carry out a leak test	X			5.1.5 5.1.6	Leak test service kit
2.	Sample gas filter → Carry out a leak test		X		5.1.6	Leak test service kit
3.	Pre-filter → Replace filter element → Replace seal → Carry out a leak test	O			5.1.6	Leak test service kit
4.	Pre-filter → Carry out a leak test		O		5.1.6	Leak test service kit
5.	Cables in the device; visual inspection	X			5.1.2	
6.	Check/replace pump			SAB		
7.	Check/replace valve			SAB		
8.	Calibrate GESM			SAB		
9.	Replace environmental air filter	X				
<u>Key to maintenance measures</u> X – Work that must be done O – Optional; only if the pre-filter is installed SAB – By Schaller Automation only						

Figure 50 Maintenance intervals

5.1.2 Maintenance by the operator



WARNING!

Risk of explosion

Severe to fatal injuries from methane explosion

→ Only use Schaller Automation original spare parts.

5.1.3 Maintenance by Schaller

For maintenance, please contact Schaller Service (for contact details, see Section 7). To ensure that the device functions properly, the device must regularly undergo factory calibration (Annual inspection).

For this calibration, the device must be removed and sent to Schaller Automation.

5.1.4 Checking for contamination in the sample gas path

The path of the sample gas supply line (lines, including sample gas filter) should be checked for contamination at regular intervals (see Table 3). The filter insert is replaced as per Section 5.1.6. The sample gas supply line from the engine must be checked at regular intervals. Inside the device, contamination can be detected by visually inspecting the transparent PTFE line. The sections of the line inside the device can only be removed and cleaned on site by the operator if a leak test can be carried out afterwards. If this is not possible, the affected sections of line can only be cleaner or removed by Schaller Service personnel on site or by sending the device to Schaller Automation.

Impurities downstream of the sample gas filter cannot be removed on site. There is a risk in this case that contamination has already entered the measuring track, valve and pump. Functioning of the device is then no longer guaranteed. The device must be sent to Schaller Automation for inspection.

The testing process is shown in Figure 51.

The risk of this arising increases if the filter element of the sample gas filter is not checked and replaced regularly. The supplied coalescing filter should be installed as a pre-filter as close as possible to the extraction point upstream of the Gas Monitoring System. This filter provides additional protection against oil and other liquid contaminants. The relevant explosion protection rules must be observed for this.

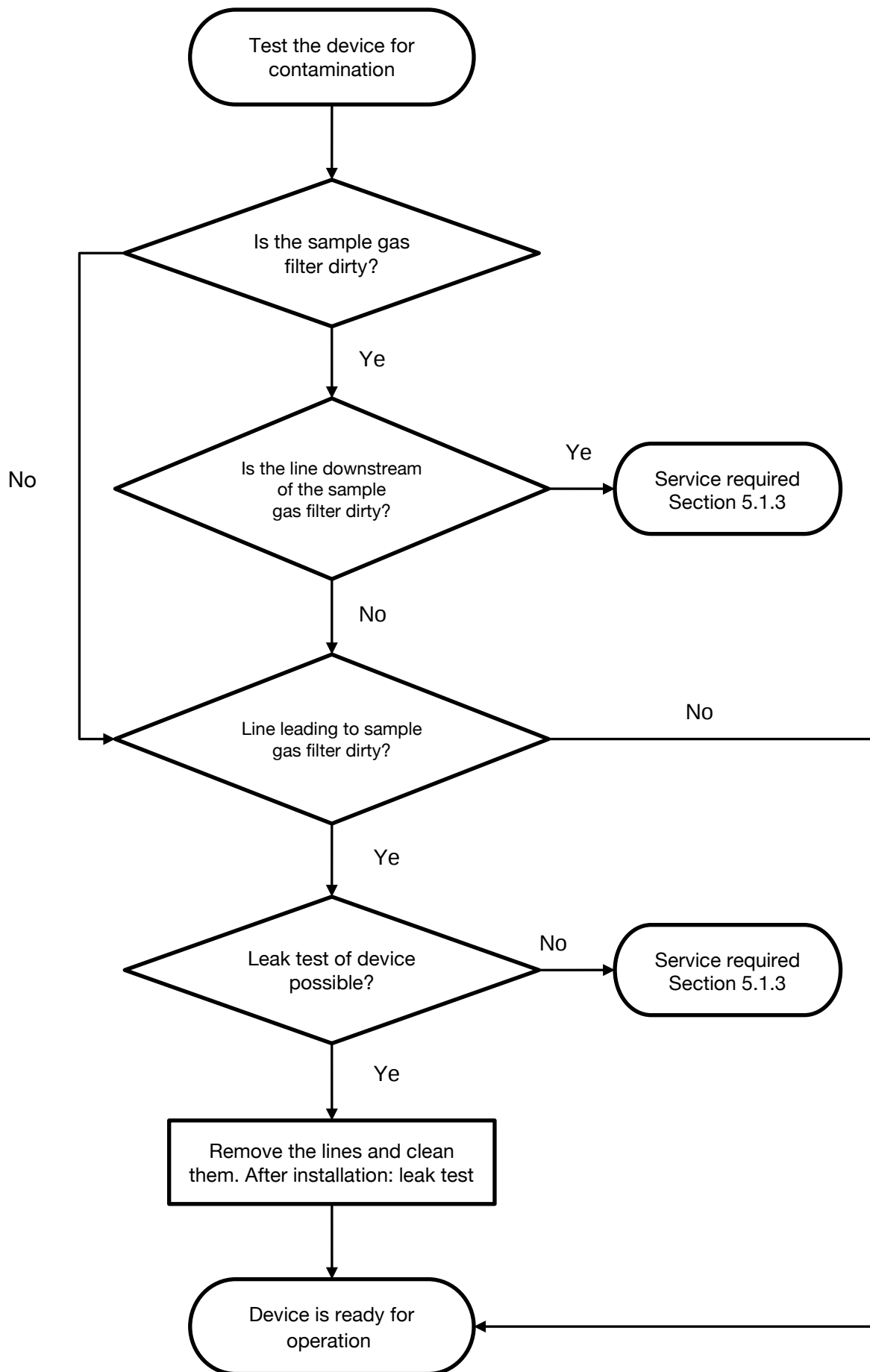


Figure 51 Checking the device for contamination

5.1.5 Cleaning the device filter

Dust deposits on the filter must be removed regularly (weekly). Clean the filter from the outside and only with a clean, damp cloth (do not use cleaning products that contain solvents).



DANGER!

Sparking due to electrostatic charge (risk of explosion)

Severe to fatal injuries due to explosion of the crankcase

→ Only clean the filter with a clean, damp cloth.

5.1.6 Replacing the filter element of the device filter



ATTENTION!

Perform maintenance only when it has cooled down!



DANGER!

Gas in the filter, condensate or even used filter elements can be toxic or corrosive

Sample gas can be hazardous to health.

→ Check the filter for condensate before replacing the filter element and wear protective equipment.



CAUTION!

Gas leakage at the filter

Sample gas can be hazardous to health.

→ The filter must not be under pressure when being removed. Do not reuse damaged parts or O-rings.



ATTENTION!

Disconnect the power supply to the device before starting work.



Note: If the device is not switched off before opening the filter housing, there is a risk that particles of dirt and foreign matter will be drawn in by the pump and enter the measuring track or pump. This can lead to reduced performance or failure of the measuring system.



ATTENTION!

Only use original filter inserts. They must be undamaged and clean. Do not reinsert used or removed filter inserts. There is a risk of mechanical damage to the filter insert and thereby a risk of loss of filter properties.

Tools: none

Other equipment: Cleaning cloth, soap solution (if necessary), clear water

Particle filter maintenance kit 12 S2 filter elements, 12 Viton sealing rings, 12 environmental air filters (environmental air input)
Spare part: Filter bowl



- Release the filter bowl lock by pulling out the black bracket.

Figure 52 Releasing the filter bowl lock



- Remove the filter bowl.

Figure 53 Removing the filter bowl



- Replace the filter element.

Figure 54 Replacing the filter element

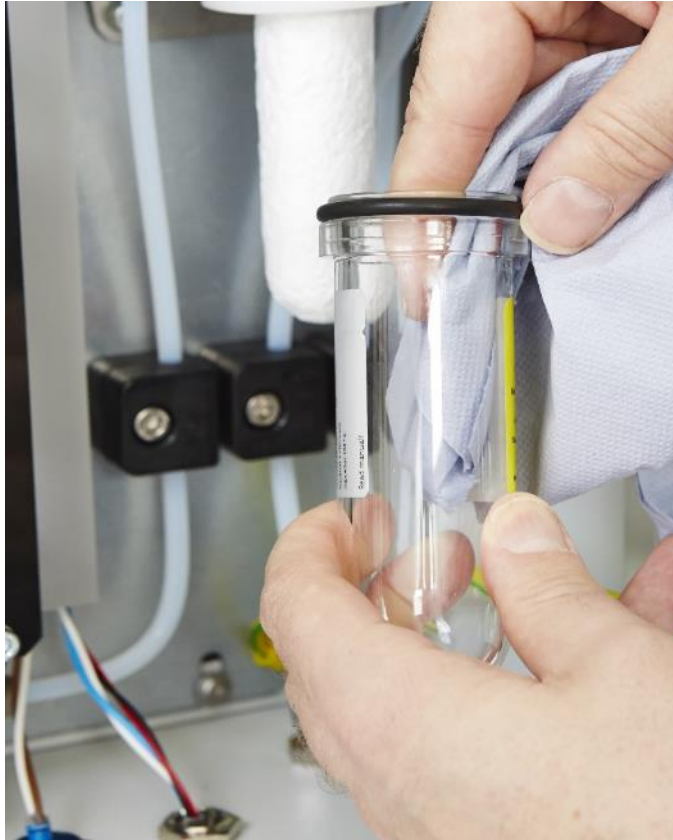


Figure 55 Cleaning the filter bowl, as necessary

- If necessary, clean the inside of the filter (filter glass, filter insert receptacle) with a soap solution, then rinse with clear water so that there is no soap residue left inside, and dry. The filter insert may only be inserted and the filter glass mounted when the inside area is dry. Make sure that no liquid gets into the lines.



Figure 56 Replacing the sealing ring

- Replace the Viton sealing ring.



- Press the filter bowl into the top part of the housing until the seal is no longer visible.

Figure 57 Pushing on the filter bowl



- Lock the filter bowl with the bracket

Figure 58 Inserting the filter bowl retaining bracket

5.1.7 Replace the filter element of the pre-filter (coalescing filter)



ATTENTION!

Perform maintenance only when it has cooled down!



DANGER!

Gas in the filter, condensate or even used filter elements can be toxic or corrosive
Sample gas can be hazardous to health.

- ➔ Check the filter for condensate before replacing the filter element and wear protective equipment.



CAUTION!

Gas leakage at the filter

Sample gas can be hazardous to health.

- ➔ The filter must not be under pressure when being removed. Do not reuse damaged parts or O-rings.



ATTENTION!

Disconnect the power supply to the device before starting work.



Note: If the device is not switched off before opening the filter housing, there is a risk that particles of dirt and foreign matter will be drawn in by the pump and enter the measuring track or pump. This can lead to reduced performance or failure of the measuring system.

ATTENTION!

Only use original filter inserts. They must be undamaged and clean. Do not reinsert used or removed filter inserts. There is a risk of mechanical damage to the filter insert and thereby a risk of loss of filter properties.



Tools: none

Other equipment: Cleaning cloth, soap solution (if necessary), clear water

Particle filter maintenance kit 12 S2 filter elements, 12 Viton sealing rings, 12 environmental air filters (environmental air input)

Spare part: Filter bowl

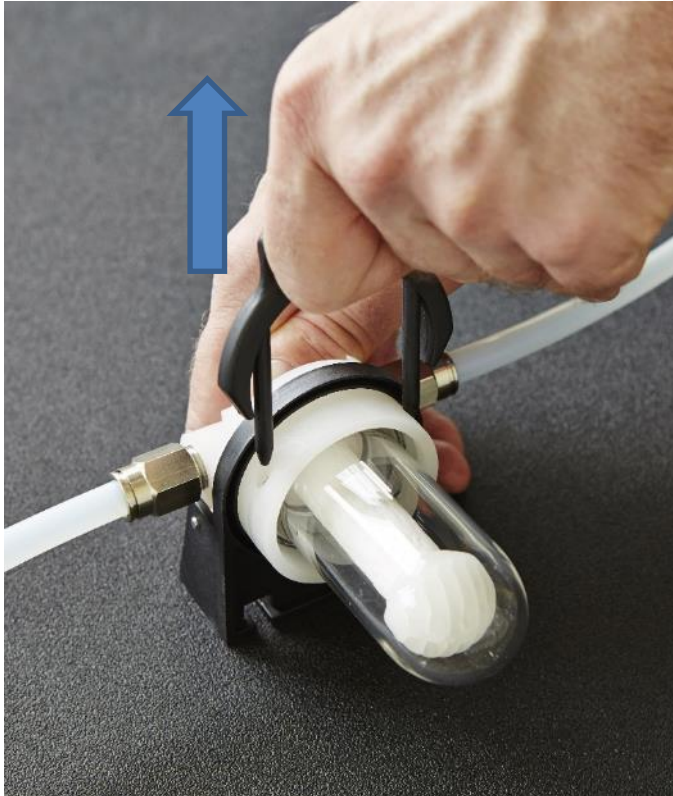


Figure 59 Releasing the filter bowl lock on the coalescing filter

- Release the filter bowl lock by pulling out the black bracket. Secure the filter bowl to prevent it falling down.



Figure 60 Removing the filter bowl on the coalescing filter

- Remove the filter bowl.



Figure 61 Removing the filter element

- Remove the filter element with the support tube



Figure 62 Replacing the filter element

- Pull the filter element (1) off the support tube (2).
- Clean the support tube if it is dirty, using a soap solution. Rinse with clear water; dry before installation
- Push on a new filter element
- Screw on the support tube with new filter element, as in Figure 61



- Remove Viton seal and fit new seal

Figure 63 Change seal



- Mount the filter bowl by pushing it on.
- If dirty, clean with soap solution and rinse with clear water. Dry before installation

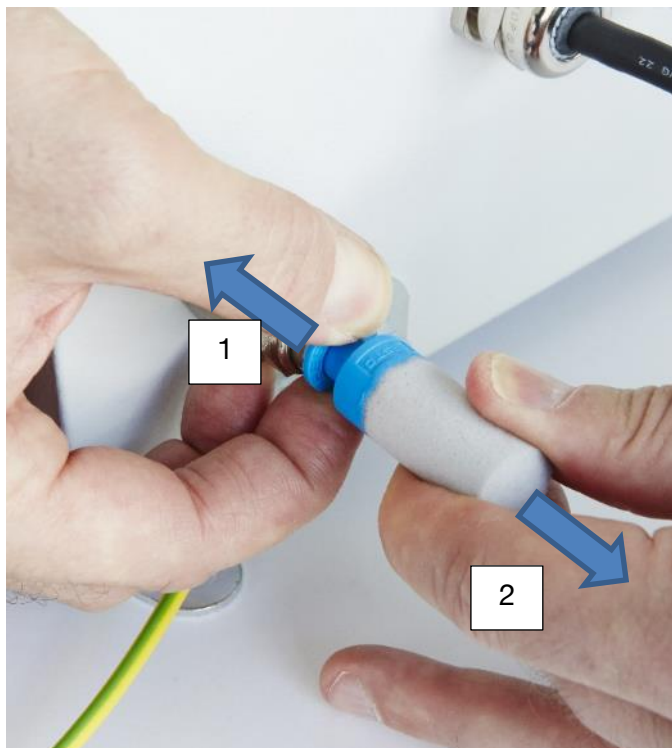
Figure 64 Pushing on the filter bowl on the coalescing filter



- Lock the filter bowl with the bracket by inserting the bracket.

Figure 65 Locking the filter bowl of the coalescing filter

5.1.8 Replacing the filter element of the environmental air input



- Pull back the plug-in connection environmental air input lock (1)
- Remove the filter element (2)

Figure 66 Replacing the filter element of the environmental air input



- Push on a new filter element

Figure 67 Replacing the filter

5.1.9 Leak test of the device's particle filter

After replacing a filter element, check the device for leaks. You can purchase a “Leak test” kit from Schaller Automation to do this.

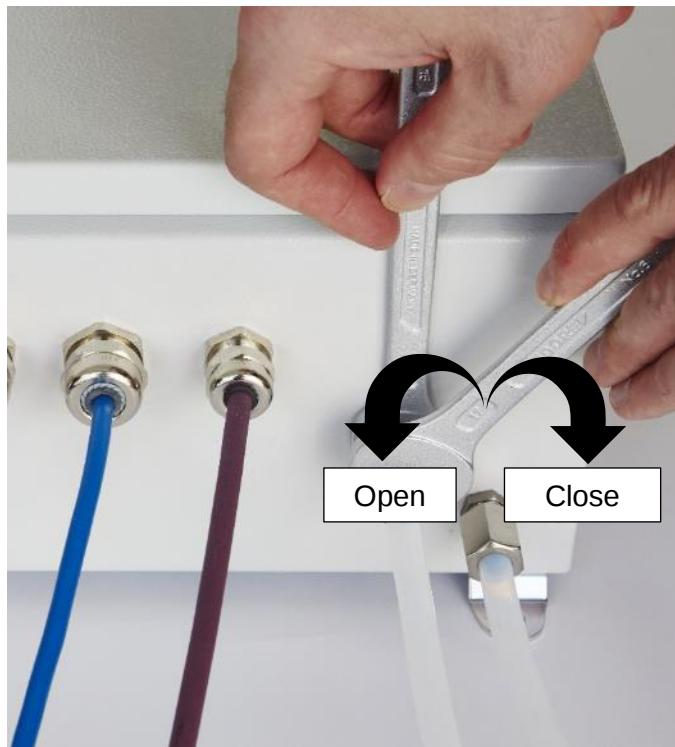
Below is a description of the leak test using this kit.

ATTENTION!

Disconnect the power supply to the device before starting work.



Figure 68 Leak test kit



- Unscrew the sample gas input line on the engine.
- Attach the test pump connection line. Tighten the fitting by hand.
- Tighten with 45° with spanner



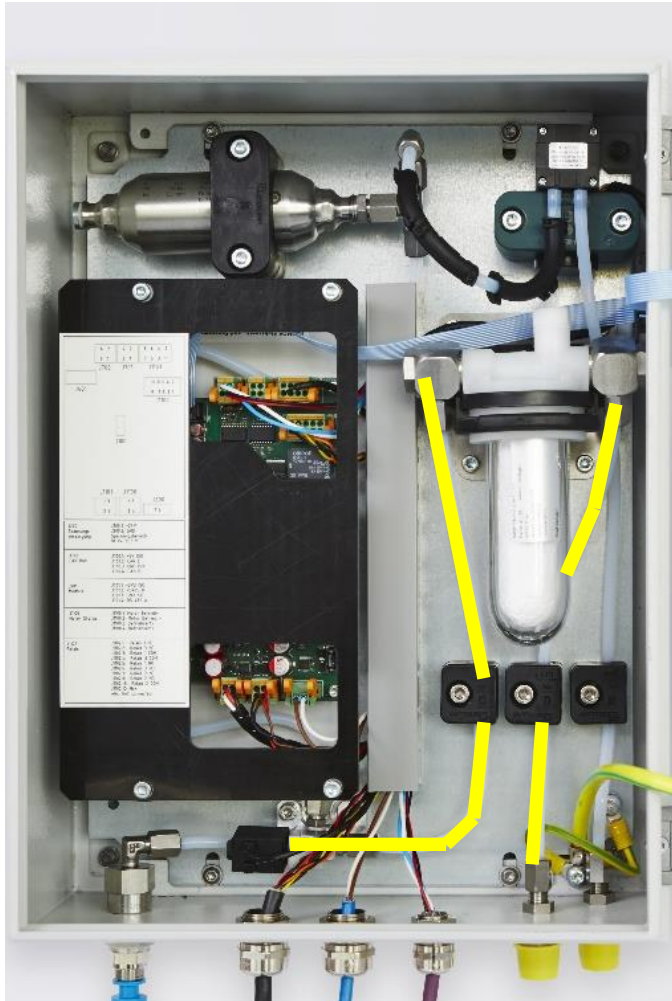
Width across

Figure 69 Connecting the test pump



- Apply overpressure of 250 mbar $\pm$ 30 mbar.

Figure 70 Overpressure test



➤ Test path on voltage-free device, marked yellow



t= 3 min

$\Delta p < 100 \text{ mbar}$



$\Delta p > 100 \text{ mbar}$



Figure 71 Test path, max. allowed pressure drop

5.2 Repair by the operator

Repair by the operator is not possible. If the device or components of the device are defective, the device must be removed and sent to Schaller Automation for repair (Section 5.3).



ATTENTION!

Early failure of the methane detector

Dirty parts increase the risk of device failure.

→ Clean parts according to the maintenance schedule.

5.3 Repair by Schaller Automation

If the Gas Monitoring System is defective or malfunctions, please contact Schaller Automation. See the Appendix for contact details. Visit our homepage.

<https://schaller-automation.com/kontakt/>

To ensure that the device functions properly, the measuring device (GESM) of the GasMOS methane detector regularly undergoes factory calibration (every 12 months). For this calibration, the device must be removed and sent to Schaller Automation.

If a malfunction occurs as described in Section 4.7, the device must also be removed and sent to Schaller Automation.

5.4 Taking out of service and disassembly

The Gas Monitoring System is taken out of service in the reverse order to starting up.

5.5 Storage

Recommended storage: 5 °C to 50 °C

If stored in the range of -20 °C to 50 °C, wait until the device has reached the current ambient temperature before starting it up.

5.6 Packaging

The packaging materials must be disposed of by the operator in accordance with the standard local regulations.

5.7 Spare parts, maintenance kits

5.7.1 GasMOS spare parts list

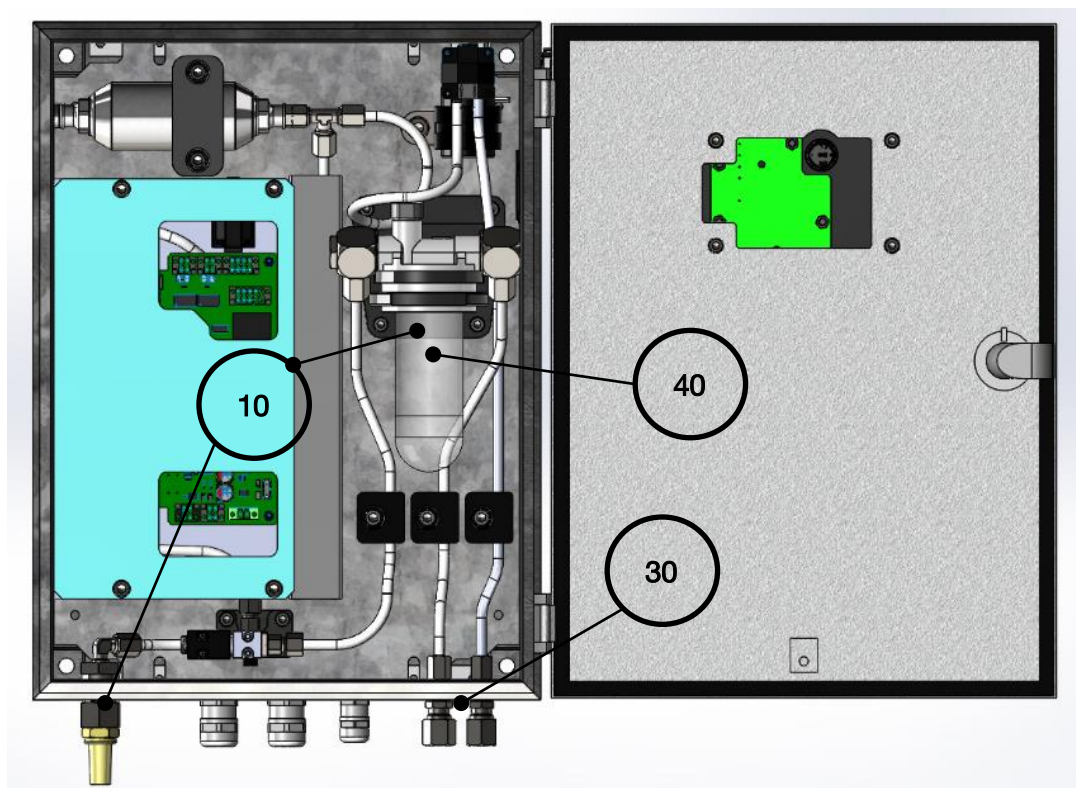


Figure 72: Exploded view of the GasMOS

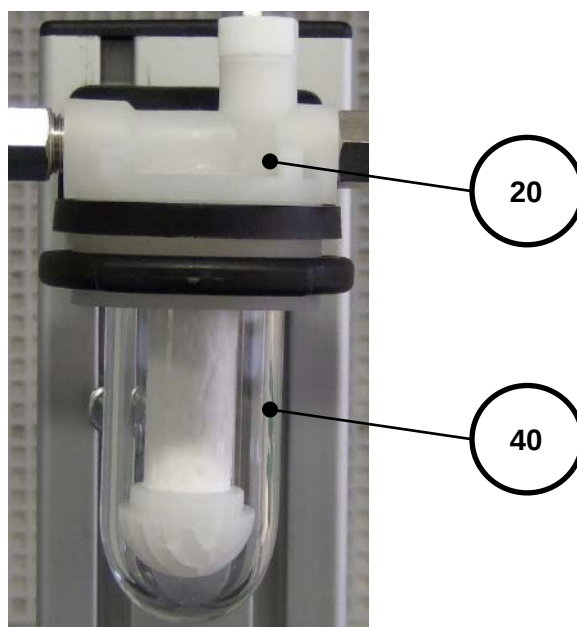


Figure 73: Pre-filter

GasMOS spare parts and maintenance parts			
Item	Material number	Description	Quantity
10	273504	Maintenance kit for internal particle filter - S2 filter elements, 12 pcs. - Viton sealing ring for filter, 12 pcs. - Silencer for environmental air input, 12 pcs.	1
20	273505	Maintenance kit for coalescing filter pre-filter - S2 filter elements, 12 pcs. - Viton sealing ring for filter, 12 pcs. - Silencer for environmental air input, 12 pcs.	1
30	273506	Spare part kit for GasMOS fluid connections - Clamping ring, 2 pcs. - Connection nut, 2 pcs. - Stiffener sleeve, 2 pcs.	1
40	273507	Filter bowl spare part	1

Figure 74 Spare parts

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8 Change history

Version	Change	Date	Changed by