Operation Manual

Transmitter EC22 / EC22 O

Translation of the original operation manual
218-000.30_OM_EC22.doc
Version 16 as of 20/06/2024

smart
GasDetection
Technologies

Table of Contents

		Page
1	**INTRODUCTION**	**4**
1.1	For Your Safety	4
1.2	Operating notes	4
2	**GENERAL INFORMATION ABOUT THE TRANSMITTER**	**5**
2.1	General description	5
2.2	Measurement method	5
2.3	Transmission behavior	5
2.4	Device overview	6
3	**MOUNTING AND INSTALLATION INSTRUCTIONS**	**7**
3.1	Mounting location	7
3.2	Mounting	7
3.3	Install electrical connections	7
4	**OPERATING INSTRUCTIONS**	**8**
4.1	Commissioning	8
4.2	Measuring mode	9
4.2.1	Measured values exceeding the measuring range	10
4.2.2	Measured values falling below the measuring range	10
4.2.3	Buttons	10
4.2.4	Display, LED and horn test [TEST]	11
4.2.5	Display of Operating Parameters [INFO]	11
4.2.6	Sensor life	11
4.3	Calibration and Adjustment	11
4.3.1	Zero point calibration	11
4.3.2	Zero adjustment with display and push button interface [ZERO]	12
4.3.3	Zero point adjustment with the AutoCal button [ZERO]	12
4.3.4	Zero point adjustment using the ZERO potentiometer	12
4.3.5	Sensitivity calibration	13
4.3.6	Sensitivity adjustment using display and buttons [SPAN]	13
4.3.7	Sensitivity adjustment using the AutoCal button [SPAN]	13
4.3.8	Sensitivity adjustment using the SPAN potentiometer	14
4.3.9	Remote calibration and adjustment	15
4.4	Main and Service Menu [MENU]	16
4.4.1	Main Menu	16
4.4.2	Service-Menu	17
4.5	Readouts and Notifications	19
4.5.1	Overview of status LED states and current output signals	19
4.5.2	Displaying special states (device start and fault)	19
4.5.3	Readouts in service mode and during sensor adjustment	20
4.5.4	Readouts in measuring mode	21
4.5.5	Priority of readouts and messages in measuring mode	22
4.6	Fault, cause, remedy	22
5	**APPENDIX**	**23**
5.1	Cleaning and Care	23
5.2	Service and Maintenance	23
5.2.1	Visual inspection	23
5.2.2	Function check	23
5.2.3	System check (Proof Test)	23
5.2.4	Repair	23
5.3	Replacing the sensor	23
5.4	Information on the environmentally safe disposal of used parts	24
5.5	Accessories and spare parts	24
5.6	Sensor specification	24
5.7	Technical Data	28

Declaration of Conformity 29
5.8 Housing drawing and mounting template EC22 32
5.9 Housing drawing and mounting template EC22 O 33

1 Introduction

1.1 For Your Safety

This operation manual informs you about the intended use of the product in accordance with §3 of the German Law of technical working equipment. Its purpose is the prevention of dangers. It must be read and adhered to by every person using, maintaining, servicing and controlling the device. This is particularly important for all safety instructions in this operation manual which labelled with the symbol. This product can only fulfill its intended purpose if it is used, maintained, serviced and controlled in accordance with GfG - Gesellschaft für Gerätebau mbH's instructions.
Using, maintaining, servicing and controlling the product contrary to these instructions will void the warranty given by GfG. The above does not change the information on warranty and liability stated in GfG's general Terms and Conditions of Purchase and Delivery.

1.2 Operating notes

In accordance with national regulations, gas warning devices must be tested for function by a competent person after installation but before measurement operation is started (initial commissioning). In Germany, "DGUV Information 213-056 (Leaflet T 021 / previously BGI 836 Section 8.1)" and "DGUV Information 213-057 (Leaflet T 023 / previously BGI 518 Section 8.1)" apply to this.

The transmitter has been tested for function and correct display of the measured values before delivery. Calibration and adjustment were performed using appropriate test or calibration gases. **This does not release you from calibration and, if necessary, adjustment after installation.**

The transmitter EC22 is **not** approved for use in hazardous areas.

CAUTION:
The supply voltage must not exceed 30 V DC!
This also applies to voltage peaks!

2 General Information about the Transmitter

2.1 General description

A fixed gas detection system consists of a transmitter and a controller (GMA - gas measuring and evaluation unit, not included in the scope of delivery). Transmitter and GMA are connected via a cable. The transmitter converts the gas concentration into an electrical measurement signal and sends it for further processing to the controler.

The transmitter EC22 can optionally be equipped with an additional graphic display with buttons and acoustic signaling device. In measurement mode, the backlight of the display is green. In the event of a fault or alarm, the backlight color changes to red for visual alarm. The display variant also features a horn for acoustic alerting.

Each transmitter of the 22 series has two status LEDs to indicate the operating status. A green one to signal operational readiness and a yellow one to indicate a fault or special condition.
The transmitters of the 22 series can optionally be equipped with an analog current interface or a digital RS-485 interface. The current interface outputs the measurement information with 4-20 mA as standard or alternatively with 0.2-1 mA. The communication of the digital RS-485 interface takes place according to the Modbus (RTU) protocol.

The electronics take over a multitude of tasks which, on the one hand, facilitate operation and maintenance and, on the other hand, considerably increase operational reliability and measuring accuracy. The transmitter is characterized by:

- Display of the measured gas concentration (version with display)
- Settings via push buttons without having to open the housing (version with display)
- Compensation of temperature influences
- Continuous display of the status (measuring operation, fault or special status) on the transmitter

2.2 Measurement method

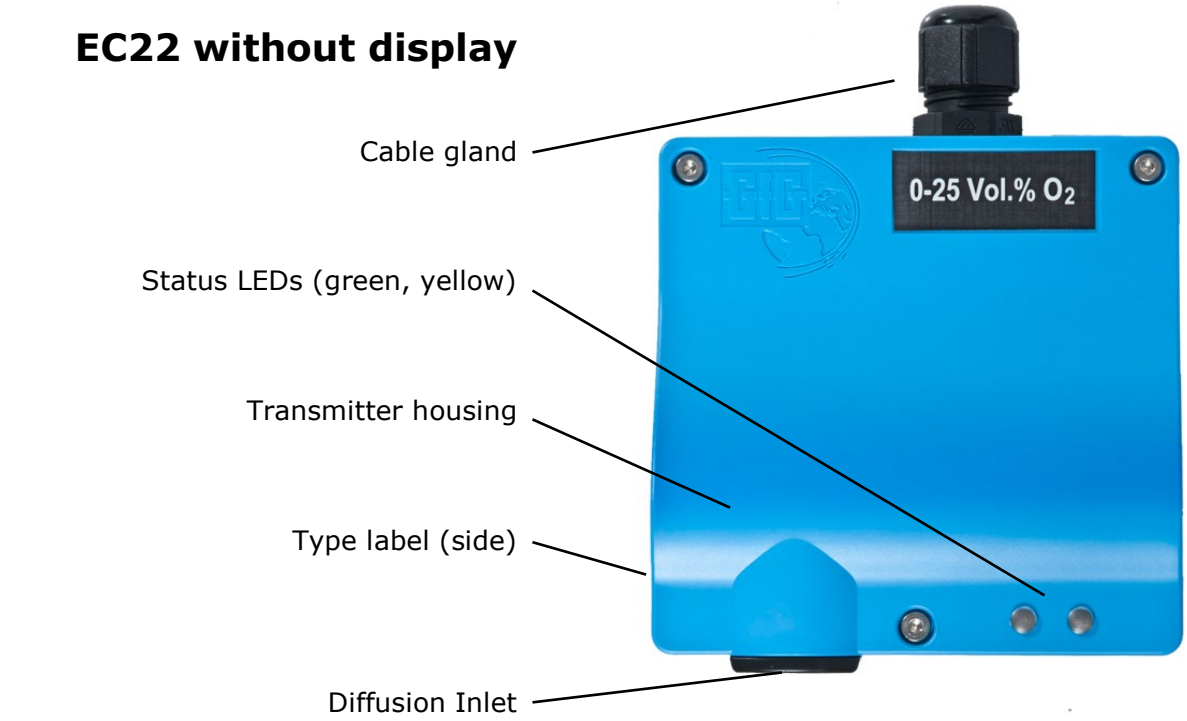
The sensors installed in the EC22 transmitter are electrochemical sensors. Electrochemical Sensors contain an electrolyte, a working electrode (anode), a counter electrode (cathode) and, if necessary, a reference electrode. Specific electrodes in combination with a suitable electrolyte are used to match the type of gas you need to monitor. With this measuring method, an electrical signal proportional to the gas concentration is generated in the measuring cell. This electrical signal is converted by the electronics integrated in the EC22 into a standardized analog current signal (4-20 mA or 0.2-1 mA) or into a digital bus signal.

2.3 Transmission behavior

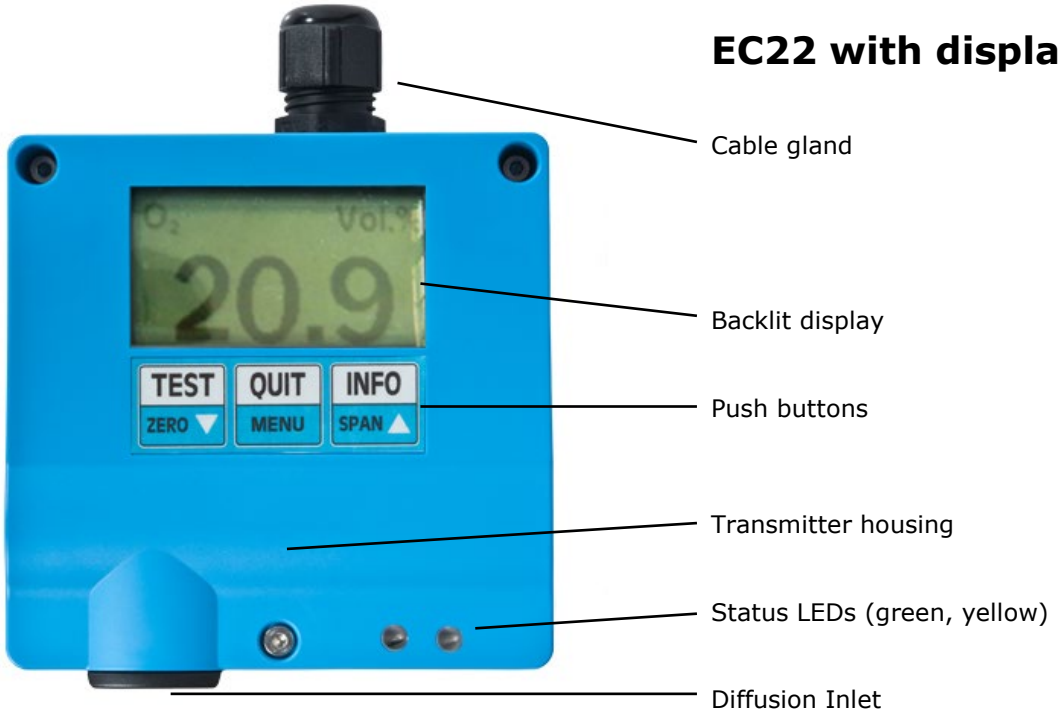
Depending on the type of measured gas, the transmitter has different transmission characteristics. The adjustment times may vary depending on the measured gas. The displayed gas concentration and the output signal are always proportional to the gas concentration.

2.4 Device overview

EC22 without display



EC22 with display



The transmitter housing contains the gas sensor and the transmitter electronics. The electronics converts the measuring signal into a gas concentration which is then signaled via an analog current signal of 4-20 mA or 0.2-1 mA or a digital RS-485 bus signal using the Modbus RTU protocol. In the display variant, gas concentration and status information are displayed.

The transmitter can be adjusted using a multimeter and the two built-in potentiometers or - if available - via the display and buttons.

3 Mounting and installation instructions

3.1 Mounting location

It is essential to be well informed about the environmental conditions when determining a mounting location. Also consider the ventilation conditions to ensure representative measurement results.

The transmitter must be installed in a position which allows gases to reach the sensor even in unfavorable ventilation conditions. If necessary, test this using smoke generator vials etc.

When determining the mounting location, it must also be ensured that the transmitter is always freely accessible for service and calibration work.

Also consider these external influences:

- Rainwater, gushing water, dripping water, condensate
- the amount of dust in the ambient air

The transmitter is largely protected against ingress of water and dust. In very difficult measuring conditions, special accessories can be used to protect the transmitter from damage. Contact GfG for more information.

If the sensor is exposed to environmental conditions unknown to GfG at the time of planning or delivery, the warranty may be voided.

3.2 Mounting

Install the transmitter in a location which can be accessed for service work and calibration at all times. It must be mounted vertically with the sensor pointing down.
The transmitter is connected to the controller according to the connection diagram (see *connections and terminal assignment*). To mount it, you first have to loosen the three Allen screws and remove the housing. The housing is attached with three screws. The PCB is located inside the housing. The connection terminals for the connection to the controller are located in the upper area of the printed circuit board.

3.3 Install electrical connections

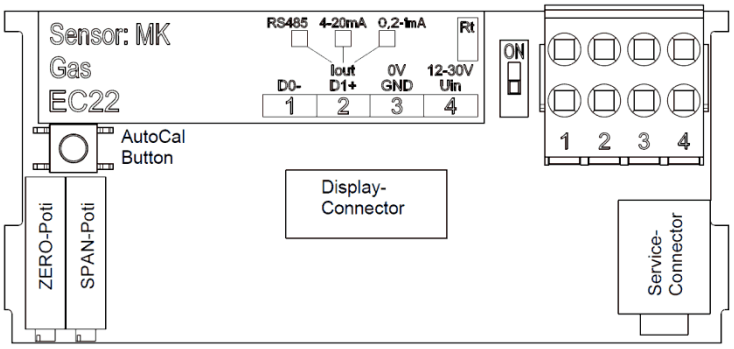
Only specialists may lay the cables and connect the electrical installation. They must adhere to all relevant regulations. The wire cross-section depends on the length of the connecting cable and the transmitter model. Check whether the operating voltage of the bus version is sufficient to supply even the last transmitter on the transmitter bus for each induvidual case. If necessary, you will have to upgrade the power supply by an additional voltage source. Screw the cover of the housing back on and tightly affix it again after the installation has been completed successfully.

For analog data transmission, a cable with the wire cross-section of 0.34 mm² can be used on shorter distances up to 500 m. For longer distances, the wire cross-section should be be 0.75 mm². The length of the cable should not exceed 1200 m.

Connection diagram:

Terminals for cable connection
1: Data– D0
2: Data+ D1 / 4-20 mA / 0,2-1 mA
3: 0 V GND
4: 24 V DC (12 to 30 V DC)

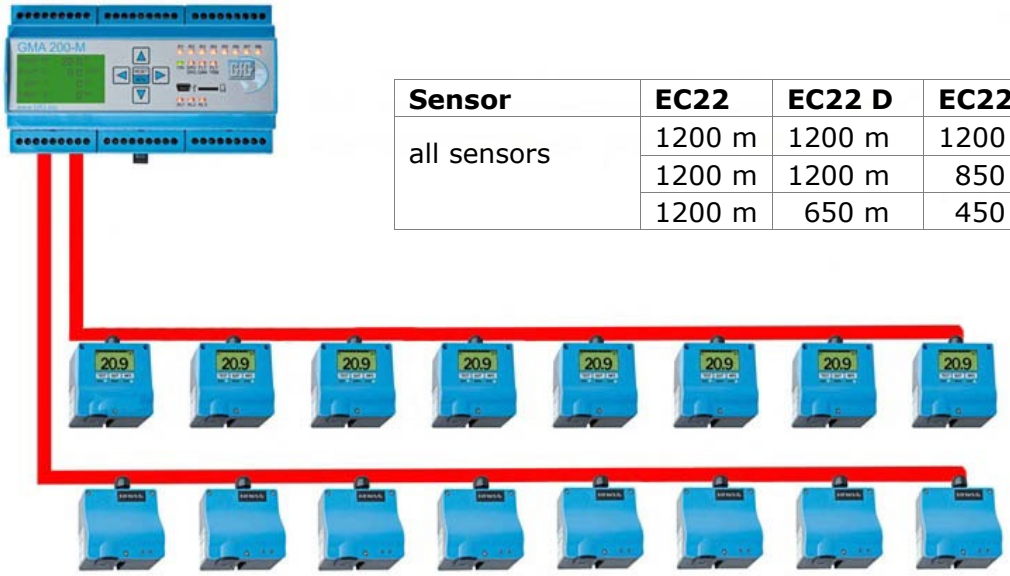
Slide switch (Rt)
Terminating resistor for RS-485
(Factory setting = OFF)



For digital data transmission via RS-485, the bus cabling depends on various factors. This includes the structure of the bus as a string or as a ring, the number of transmitters on the bus, the distance of the individual transmitters from the controller, the transmitter type/model, the sensor type and,

of course, the bus cable type. Check whether the operating voltage of the bus version is sufficient to supply even the last transmitter on the transmitter bus for each individual case. If necessary, upgrade the power supply by an additional voltage source. The length of the cable should not exceed 1200 m.

The example below shows the maximum cable lengths for an installation including 8 EC22s, each at a distance of 10m at the end of the bus cable harness. "EC22" refers to transmitters without display, "EC22 D" to transmitters with display and "EC22 DA" to transmitters with display and an alarm device.



Sensor	EC22	EC22 D	EC22 DA	Cable
all sensors	1200 m	1200 m	1200 m	2x2x1.5mm²
	1200 m	1200 m	850 m	2x2x1.0mm²
	1200 m	650 m	450 m	2x2x0.5mm²

(2x2x0.5 mm² = 2x2x0.8 mm)

4 Operating Instructions

4.1 Commissioning

The EC22 transmitter has been tested for function and display capabilities before delivery. The adjustment was performed using appropriate test or calibration gases. However, deviations may still arise during transport and assembly or due to ambient conditions.
The gas detection system must therefore be commissioned and tested for function by aspecialist.

After it has been turned on, the transmitter will likely need a few minutes to:

- Perform a self-test during which the program and RAM are checked
- Read and evaluate the device parameters including a simultaneous memory check
- Read and evaluate the sensor parameters including a simultaneous memory check
- Stabilize the sensor

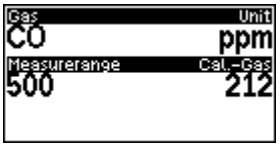
Memory tests are performed within the first few seconds of the start-up phase.

Version with analog current interface (0.2-1mA):
The current interface emits 0.0 mA immediately after it has been turned on and 0.08 mA after four seconds. The green and yellow LEDs are lit.

Version with analog current interface (4-20 mA):
The current interface emits 0.0 mA immediately after it has been turned on and 1.6 mA after four seconds. The green and yellow LEDs are lit.

Vesion with digital Modbus interface (RS-485):
On the Modbus version, the connected controller, e.g. a GMA200, will display "Startup". For more information refer to the "Modbus" appendix of the transmitter series 22 operation manual.

The EC22 will first display information on the firmware versions, and then on the measuring range, unit of measurement, gas type and calibration gas concentration. The remaining time of the warm-up phase (in seconds) is also displayed. The EC22 will automatically switch to measuring mode after the sensor warm-up phase.



If a device error is detected during the startup phase, the device switches to fault operation.

Version with analog current interface (0.2-1mA):
The current interface emits 0.06 mA. An error message is displayed (see Indications of special states and malfunctions). The yellow fault LED is lit continuously.

Version with analog current interface (4-20 mA):
The current interface emits 1.2 mA. An error message is displayed (see Indications of special states and malfunctions). The yellow fault LED is lit continuously.

Vesion with digital Modbus interface (RS-485):
On the Modbus version, an error message is displayed on the transmitter and/or the GMA (see Indications of special states and malfunctions). The yellow fault LED is lit continuously.

Notice:
The initial commissioning of the transmitter requires a check and, if necessary, adjustment of the zero point (ZERO) and subsequently also of the sensitivity (SPAN) after the warm-up period.

4.2 Measuring mode

In fault-free measuring mode, the green operation LED is permanently on while the yellow fault LED is off. The functionality of the electronics is constantly monitored by various tests, such as sensor, processor and memory tests. The gas concentration is measured continuously and updated every second.

The digital display shows the current detected gas concentration in measuring mode.

In normal measuring mode, the transmitter displays a bar graph with the set measuring range above the current gas concentration as well as the gas type and unit in 5-second intervals.

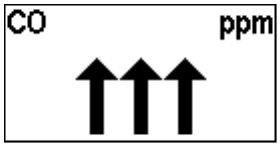
You can configure up to three threshold alarms on EC22s with display. It indicates these alarms using an audible and visual (screen lighting up red) signal.

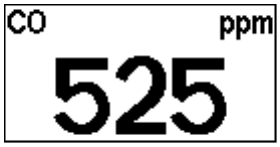
An alarm is triggered as soon as the gas concentration exceeds or falls below the set alarm threshold value. Depending on the function setting, threshold alarms can either be reset automatically or, if the latching function is active, by pressing the QUIT MENU button to acknowledge it after the measured value has fallen back below (or has exceeded) the threshold value.

Caution! As soon as the remote calibration of measuring points has been started at the connected GMA, the alarm is suppressed for the entire duration of the remote calibration!

4.2.1 Measured values exceeding the measuring range

If the measured values exceede the measuring range in the range of 100 to 112 % MR, the device will indicate this by displaying arrows ↑↑↑ in alternation with the measured value.





Transmitter with analog current interface 0.2-1 mA:
The current interface emits a signal in the range of 1.0 to 1.1 mA according to the measured value.

Transmitter with analog current interface 4-20 mA:
The current interface emits a signal in the range of 20 to 22 mA according to the measured value.

Transmitter with digital Modbus interface (RS-485):
On the Modbus version, the transmitter and/or the GMA displays the corresponding measured valuein alternation with ↑↑↑ (see Indications of special states and malfunctions).

If the measured value exceeds the measuring range even more significantly, i.e. more than 112 % MR, the device indicates this by permanently displaying arrows ↑↑↑ while the yellow status LED flashes rapidly.

Transmitter with analog current interface 0.2-1 mA:
The current interface emits 1.1 mA.

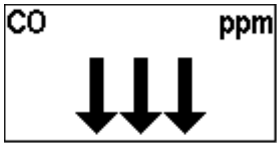
Transmitter with analog current interface 4-20 mA:
The current interface emits 22 mA.

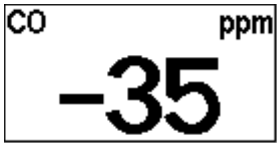
Transmitter with digital Modbus interface (RS-485):
On the Modbus variant, the transmitter and/or GMA permanently display ↑↑↑ (see Indications of special states and malfunctions).

4.2.2 Measured values falling below the measuring range

Values below the zero point are displayed as numerical values with a negative sign. If the measured value is between 0 and -5 % of the measuring range, it will still be displayed on the transmitter or the controller (e.g. GMA200).

If the measured value is between -5 and -7.5 %, thetransmitter will display arrows ↓↓↓ in alternation with the measured value.





f the measurement signal falls below the value of -7.5 %, the arrows ↓↓↓ are displayed permanently.

Transmitter with analog current interface 0.2-1 mA:
The current interface emits a signal in the range of 0.14 to 0.2 mA according to the measured value.

Transmitter with analog current interface 4-20 mA:
The current interface emits a signal in the range of 2.8 to 4.0 mA according to the measured value.

Transmitter with digital Modbus interface (RS-485):
On the Modbus variant, the corresponding measured value is displayed on the transmitter and/or the GMA (refer to Displaying Special States).

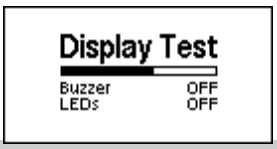
4.2.3 Buttons

The transmitter's buttons TEST ZERO ▼ QUIT MENU INFO SPAN ▲ can be used to make sensor adjustments and settings via the menu.

4.2.4 Display, LED and horn test [TEST]

You can trigger a test of the display and LEDs while in measuring mode by briefly pressing the TEST/ZERO ▼ button.

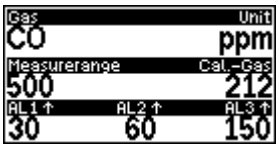
This will activate all LEDs and display segments as well as the status LEDs and the signal sound. (briefly)



4.2.5 Display of Operating Parameters [INFO]

While measuring is in progress, the following operating parameters can be shown one after the other by briefly pressing the INFO/SPAN ▲ button.

- Measuring gas
- Measuring unit
- Measuring range
- Concentration of calibration or test gas
- Alarm limits (with alarm function activated)



This information is also displayed during the device startup phase.

4.2.6 Sensor life

Electrochemical sensors have a limited service life. The expected service life of the sensors used in the EC22 is approximately one to three years, depending on the operating conditions. When the end of their expected service life is reached, the transmitter will notify you that the sensor should be replaced during the next maintenance. A corresponding notification is then displayed while the screen is backlit red and the yellow fault LED lights up briefly every 5 seconds. This does not affect the transmitter's operation or the remaining lifetime of the sensor.

4.3 Calibration and Adjustment

4.3.1 Zero point calibration

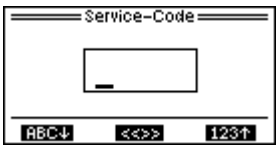
When calibrating (checking) or adjusting (setting) the zero point, there is a difference between oxygen sensors and other electrochemical sensors regarding the choice of zero gas.

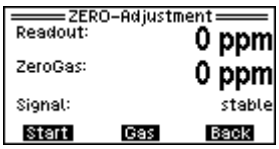
- Oxygen sensors need to be calibrated or adjusted exclusively with 100 vol% N_2.
- All other electrochemical sensors can be calibrated and adjusted using fresh air (without interfering gas components) or, in polluted atmospheres, synthetic air.

Calibration (Check):
To calibrate the device, attach a calibration adpter to the diffusion opening of the transmitter housing. Using this calibration adapter, you can then supply zero gas can then be supplied to the sensor without pressure at flow rates of approx. 0.5 $^{l}/_{mi}$. If the displayed value deviates from zero, the transmitterwill have to be adjusted.

Adjustment of the transmitter:
There are different methods of adjusting the zero point. They are described below.

4.3.2 Zero adjustment with display and push button interface [ZERO]

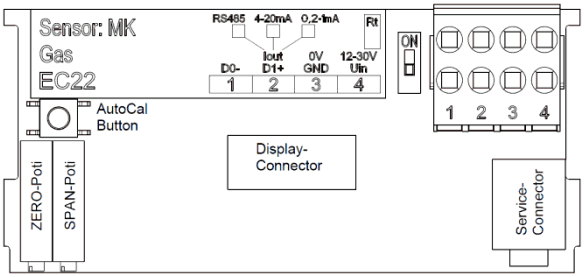




To carry out the zero point adjustment, you will first need to access the service code query by holding down the TEST/ZERO button (> 3 s). Entering the standard service code "0011" (factory setting), will activate the "ZERO adjustment" program. This is indicated by the yellow status LED flashing and, on transmitters with an analog interface (4-20 mA or 0.2-1 mA), by an output signal of 2.4 mA or 0.12 mA.

The device will then display the current measured value (Readout) and the set zero gas concentration. If the measured value is not more than 10 % of the measuring range, you can start the zero point adjustment by pressing the left button [Start]. If the current measurement value remains stable for a set amount of time, the new zero point is adopted and displayed. Use the right button to exit the "ZERO adjustment" program and return to measurement mode.

4.3.3 Zero point adjustment with the AutoCal button [ZERO]



The easiest way to adjust the zero point on transmitters without a display is to use the AutoCal button. Remove the trsnmitter's cover to access this button. Hold the button down for at least five seconds to prepare the adjustment. During the 1st phase (0th to 5th sec), the green status LED flashes at 1 Hz and is lit 50 % of the time.

If you release the button during the first phase, which would be too early, no adjustment is made and the transmitter continues measuring as usual.

In the next phase (6th to 10th sec), the 1 Hz flashing changes: the green LED is lit only briefly (10 %) each time. Release the button during this phase to start the zero point adjustment. The adjustment process is indicated by the yellow status LED flashing and a current output signal of 2.0 mA (or 0.1 mA). If the measured value remains stable for a set amount of time, the new zero point is adopted and the measured value is set to 0 ppm or 0.0 vol%. A successful adjustment is indicated by the green LED flashing rapidly. A failed adjustment is indicated by the yellow LED flashin rapidly. The adjustment process is then cancelled automatically.

If you hold down the button for more than 10 seconds, you could theoretically start the AutoCal sensitivity adjustment during the 3rd phase (10th to 15th sec.). However, it would immediately fail as there is no test gas.
If you hold down the button for even more than 15 seconds, no calibration is performed and the device continues to run in normal measuring mode.

4.3.4 Zero point adjustment using the ZERO potentiometer

On transmitters without display, you can perform the zero adjustment using a small screwdriver, a multimeter and cable with a service plug (see section 5.5 "Accessories and Spare Parts") while the transmitter's cover is open. The two connectors at one end of the cable are plugged into the COM input jack and the V input jack, the service connector is plugged into the service connector of the transmitter (refer to the "Please note:" section for more information).

As long as the ZERO potentiometer is not turned, a voltage value of 0.2-1 V DC can be read on the multimeter, which corresponds proportionally to the current measurement value in the range 0-100 % of the measurement range.

As soon as the ZERO potentiometer is turned, you can read out the set value of the zero point on the multimeter. This is indicated by the yellow status LED flashing. Change the setting of the potentiometer until a voltage value of 0.200 V is displayed. As soon as this value remains unchanged for a certain period of time, the transmitter will start the zero point adjustment. The yellow status LED will turn off as soon as the adjustment process is completed.

You can perform the zero adjustment using the ZERO potentiometer for values up to 25 % of the measuring range. If the transmitter displays the original (unadjusted) measured value again after the adjustment process, despite the calibration gas having been inserted correctly, the adjustment could not be carried out successfully. This is likely due to the tolerable signal limits being exceeded or an increased signal noise. Since this can be an indication for the sensor being defective, it should be replaced as soon as possible.

Please note:
If you do not have a cable with a service plug available, the output current (Iout) between terminal 2 and terminal 3 (GND) can also be measured directly on transmitters with an analog interface (4-20 mA or 0.2-1 mA). Nothing but the multimeter may be connected to terminal 2 during this process.

4.3.5 Sensitivity calibration

There are special safety instructions when handling toxic gases. These depend on the type of gas and must be observed under all circumstances. For more information refer to the corresponding safety data sheets.

You will need to attach a calibration adapter onto the diffusion opening of the transmitter's housing to calibrate (control) or adjust the gas sensitivity. Using the calibration adapter, the test or calibration gas (fresh air or synthetic air in the case of an oxygen sensor) is supplied to the sensor without pressure at a flow rate of approx. 0.5 $^{l}/_{mi}$.

The current measured value is displayed on the device. If the displayed value deviates from the calibration gas concentration, you have to adjust the sensitivity.

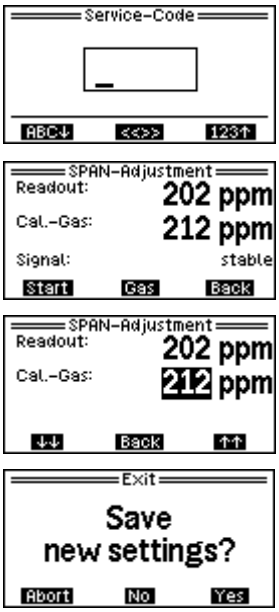
Adjusting the transmitter:
You need to check and (if necessary) readjust the zero point before each sensitivity adjustment. Depending on the type of transmitter, there are different methods of adjusting the sensitivity. They are described below.

4.3.6 Sensitivity adjustment using display and buttons [SPAN]

To carry out the sensitivity adjustment, you will first have to access the service code query by holding down the INFO / SPAN ▲ button (> 3 s). Entering the standard service code "0011" (factory setting) will activate the SPAN adjustment. This is indicated by the yellow status LEDs flashing and, on transmitters with an analog interface (4-20 mA or 0.2-1 mA), by an output signal of 2.4 mA or 0.12 mA.

The current measured value (Readout) and the test gas concentration (Cal.-Gas) will then be displayed. You can adjust the test gas concentration by pressing the middle button [Gas], making your adjustment using the left or right button and saving by pressing the middle button again.

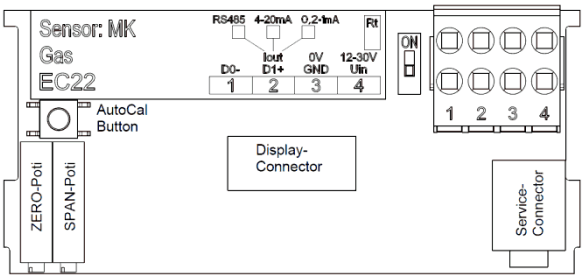
If the displayed measured value is at least 7 % of the measuring range, the sensitivity adjustment can be started by pressing the left button [Start]. As soon as a stable measured value is recorded over a certain amount of time, the sensitivity is calibrated and the new measured value is displayed. Press the right key to accknowlege the adjustment, exit the "SPAN adjustment" program and return to measuring mode.



4.3.7 Sensitivity adjustment using the AutoCal button [SPAN]

If you know the gas concentration set in the transmitter and have a test gas with this concentration available, using the AutoCal button is the easiest method of adjusting the sensitivity on tranmitters without display.

Remove the transmitter's cover to access the button.



Press the button for at least 10 seconds to prepare the adjustment.

In the first phase (0th to 5th sec), the green status LED flashes at 1 Hz and is lit 50 % of the time. If you release the button during this phase, which would be too early, no adjustment is made and the transmitter continues measuring as usual. In the next phase (6th to 10th sec), the 1 Hz flashing changes: the green LED is lit only briefly (10 %) each time. Releasing the button during this second phase would start the zero point adjustment.

To start the sensitivity adjustment however, you need to release the button in the third phase (10th to 15th sec.). The 1 Hz flashing of the green LED changes again: the green LED is now lit significantly longer (90%). The adjustment process is indicated by the yellow status LED flashing and a current output signal of 2.0 mA (or 0.1 mA). If the measured value remains constant for a certain amount of time, the sensitivity is adjusted in such a way that the measured value indicates the set test gas concentration. A successful adjustment is indicated by the green LED flashing rapidly. A failed adjustment is indicated by the yellow LED flashing rapidly. Remove the test gas. The adjustment process is then cancelled automatically.

If you hold down the button for even more than 15 seconds, no calibration is performed and the device continues to run in normal measuring mode.

4.3.8 Sensitivity adjustment using the SPAN potentiometer

On transmitters without display, you can perform the sensitivity adjustment using a small screwdriver, a multimeter and cable with a service plug (see section 5.5 "Accessories and Spare Parts") while the transmitter's cover is open.

The two connectors at one end of the cable are plugged into the COM input jack and the V input jack, the service connector is plugged into the service connector of the transmitter (refer to the "Please note:" section for more information). As long as the SPAN potentiometer is not turned, a voltage value of 0.2-1 V DC can be read on the multimeter, which corresponds proportionally to the current measurement value in the range 0-100 % of the measurement range.
As soon as the SPAN potentiometer is turned, you can read out the set value for the sensitivity adjustment on the potentiometer. This is indicated by the yellow status LED flashing. Change the setting of the potentiometer until a voltage value of e.g. 0.600 V (for 50 % MR) is displayed. The yellow status LED will turn off as soon as the adjustment process is completed.

If the transmitter display the original (unadjusted) measured value again after the adjustment process, despite the calibration gas having been inserted correctly, the adjustment could not be carried out successfully. This is likely due to the tolerable signal limits being exceeded or an increased signal noise. Since this can be an indication for the sensor being defective, it should be replaced as soon as possible.

Please note:
If you do not have a cable with a service plug available, the output current (Iout) between terminal 2 and terminal 3 (GND) can also be measured directly on transmitters with an analog interface (4-20 mA or 0.2-1 mA). Nothing but the multimeter may be connected to terminal 2 during this process.

4.3.9 Remote calibration and adjustment

If the EC22 is connected to a GMA which allows for remote calibration (e.g. GMA22-M as of firmware V1.10) via the RS-485 interface, the zero point and gas sensitivity can also be adjusted on the GMA after test gas has been applied to the transmitter. However, you will need to set the test gas concentration (Cal. gas) on the GMA and start calibration mode before applying the test gas. The sequence of feeding zero gas and test gas depends on the gas type and measuring range.

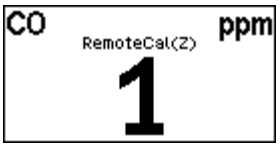
In case of transmitters for toxic gases and for hydrogen:

On all transmitter except oxygen ones, which can be SPAN adjusted with either fresh air or synthetic air, you will first have to determine the minimum test gas signal with zero gas and then the maximum test signal with test gas. A complete remote calibration includes the three phases described below.

In the first phase, the EC22 displays the text "RemoteCal **...** " above the the measured value. The yellow LED also pulses once every 5 seconds.

You can then supply the zero gas.

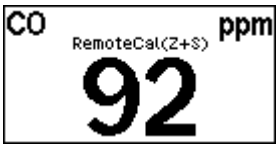
This will prompt the EC22 to attempt to acquire a stable minimum zero gas signal.



In the second phase, the EC22 has acquired a stable minimum zero gas signal. It displays the text "RemoteCal **(Z)**" above the measured value. The yellow LED also pulses twice every 5 seconds, with a slight delay.

You can then supply the test gas.

This will prompt the EC22 to attempt to acquire a stable maximum test gas signal.



In the third phase, the EC22 has acquired a stable maximum test gas signal.

It displays the text "RemoteCal **(Z+S)**" above the measured value. The yellow LED also pulses three times every 5 seconds, with a slight delay.

You can then remove the test gas.

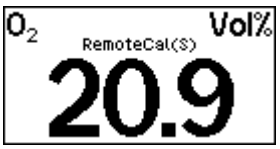
In case of transmitters for oxygen:

For oxygen transmitters, whose sensitivity can be calibrated with fresh air or synthetic air, you must first acquire the maximum test gas signal, followed by the minimum test gas signal. A complete remote calibration includes the three phases explained below.

In the first phase, the EC22 displays the text "RemoteCal **...** " above the measured value. The yellow LED also pulses once every 5 seconds.

You can then supply the test gas can.

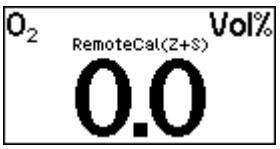
This will prompt the EC22 to attempt to acquire a stable maximum test gas signal.



In the second phase, the EC22 has acquired a stable maximum test gas signal. It displays the text "RemoteCal **(S)**" above the measured value. The yellow LED also pulses three times every 5 seconds, with a slight delay.

You can then supply nitrogen as a zero gas.

This will prompt the EC22 to attempt to acquire a stable minimum zero gas signal.



In the third phase, the EC22 has acquired a stable minimum zero gas signal.

It will display the text "RemoteCal **(Z+S)**" above the measured value. The yellow LED then also pulses twice every five seconds, with a slight delay.

You can then remove the zero gas.

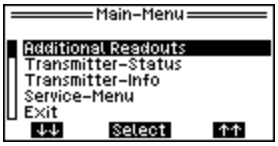
The recorded minimum and maximum measured values can now be displayed on the GMA and the zero point and gas sensitivity can be adjusted to the previously set test gas concentrations.

4.4 Main and Service Menu [MENU]

Hold down the middle button [MENU] for at least three seconds to switch to the main menu and from there to the service menu. Access to the main menu is not protected by an access code.

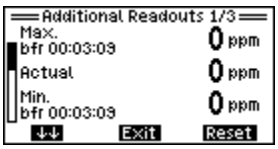
4.4.1 Main Menu

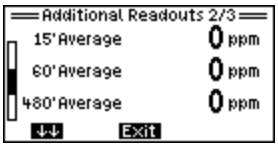
The transmitter will remain in measuring mode while you are in the main menu or any of its submenus. This means is will continue measuring, processing and emitting signals in the background. The only exception to this is the service menu which is described in the next section. The main menu's submenus are explained below.

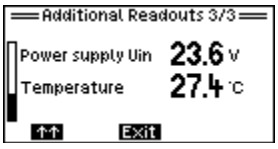


Main menu includes:

- Additional Readouts
- Transmitter-Status
- Transmitter-Info
- Service-Menu



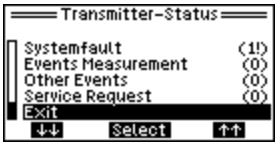




Additional Readouts

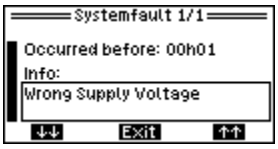
View further measured values of the transmitter. Pressing the left button (TEST / ZERO ▼) will call up the following values in succession:

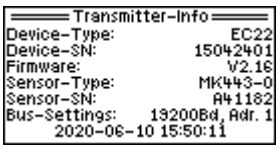
- Minimum, maximum and current measured value
  Briefly pressing the right key resets the measured value memory.
- Mean values with configured time intervals
  Time-weighted averages (in this case of the last 15 minutes, one hour and 8 hours).
- Supply voltage and temperature



Transmitter-Status

Current system errors, errors in the measuring process, service requirements and events can be called up under the Transmitter-Status menu. There are numbers in parentheses next to each category. These numbers indicate the number of available reports in this category. Exclamation marks signal active events. Available notifications can be displayed by selecting a category. Notifications regarding past events can be deleted after leaving the detailed display.

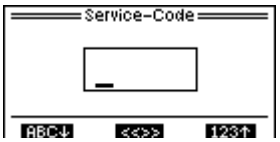




Transmitter-Info

This device overview displays transmitter-specific details such as the firmware version, the device serial number and the sensor type. If an RS-485 bus interface is available, the configured baud rate and the bus address are also displayed here.

4.4.2 Service-Menu



You will have to enter an access code to access the service menu. For the standard service menu this code is "1100". Additional functions are available in an extended service menu. Access to this extended service menu is reserved for GfG service personnel only.

The service menu consists of:

System-Settings This menu lets you adjust general settings for the RS-485 bus interface or the analog interface, the language, the display contrast, the tolerance band and the horn.

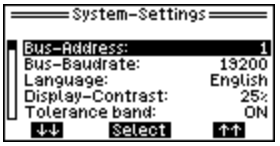
Sensor-Settings: This menu contains the settings required for sensor replacements as well as the measuring range selection.

Alarm-Settings This menu lets you configure the alarm thresholds.

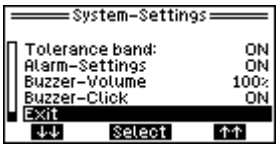
Readout-Simulation This menu lets you generate measured values without a test gas, allowing you to check the output signal interface and the downstream signal processing.

The setting options are explained in more detail below.

4.4.2.1 System-Settings



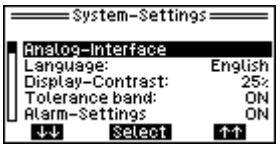
If the transmitter has a RS-485 bus interface, then the **Bus-Address** can be set anywhere between 1 and 247 (0=inactive). A bus address may not be used more than once in the same bus segment.



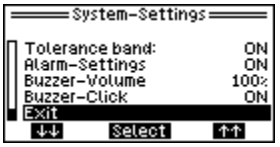
The **Bus-Baudrate** can be set to 9600, 19200 or 38400 baud. It is by default set to 19200 baud. For very long bus cables the baud rate can be reduced to 9600 baud and for very many bus nodes it can be increased to 38400 baud. Within the same bus segment, the baud rate must be set to the same value for all devices on the bus.

The **Language** can be set to German or English and is relevant for all display outputs, especially for the menus.

The **Display-Contrast** can be adjusted between 0 and 100 %. This value may vary from display to display and is usually set between 25 and 40 %.



The **Tolerance band** can be "ON" or "OFF". When set to "ON" (default), minor signal deviations from zero gas are displayed as 0 ppm or as 0.0 % LEL. The actual measured value is only displayed when the measured values exceed or fall below the tolerance band. If set to "OFF", the device will always display the actual measured value.

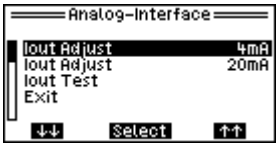


Alarm-Settings activates the alarm function and the associated service menu for alarm configuration.

The **Buzzer volume** can be set from 0 to 100 %. However, this is only relevant if the transmitter is used on site to warn of gas hazards.

The **Buzzer click** can be "ON" or "OFF". If set to "ON" (default), the internal horn generates a short click sound each time a button is pressed.

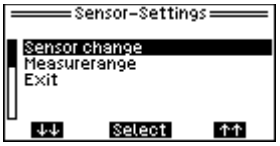
If the transmitter has an analog 4-20 mA (0.2-1 mA) interface, then the current interface itself can be adjusted and tested via the extended service menu in the **Analog-Interface** section.

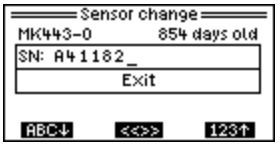


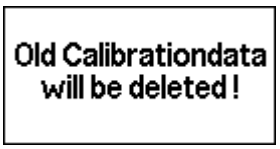
Iout Adjust: Caution! The adjustment of the current interface may only be carried out with the aid of a very accurate current measuring device.

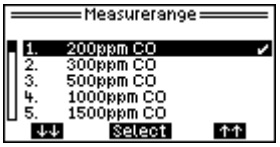
Iout Test: This is where the current output can be tested in the range of 0.5 to 24.5 mA. Caution! Connected controlers may respond to these test levels.

4.4.2.2 Sensor-Settings









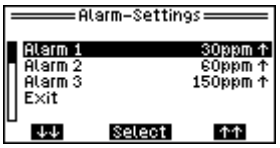
The following sensor-related settings can only be made in the extended service menu:

Sensor change: If the gas sensor is used up and needs to be replaced by a new sensor of the same type (MK...), you have to enter the serial number of the new gas sensor in this menu. The calibration data of the old sensor will be deleted and replaced by default values as soon as you do so. The zero point and gas sensitivity of the new gas sensor must be adjusted in any case.

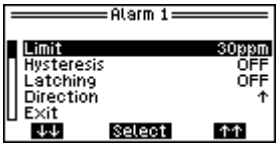
Measuring range: GfG supplies transmitters already adjusted to the customer's measuring range specifications. If you require a different measuring range at a later point (and other measuring ranges are available for the sensor), you can select a different measuring range in this menu.

Calibration data of previous measuring ranges is not always adopted, as there might be large differences in the measuring range or gas type.
If you select a different measuring range or gas type, the zero point and gas sensitivity may have to be readjusted.

4.4.2.3 Alarm-Settings

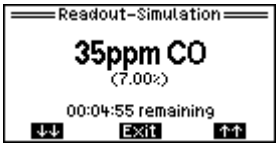


Alarm1 to Alarm3: Select the alarm threshold value you need to configure.



These settings are available for all three alarms:
Limit: Set the alarm threshold value.
Hysteresis: Activate/deactivate switch-off hysteresis.
Latching: Activate/deactivate the latching function. When latching is activated, the alarm remains active until acknowledged.
Direction: Set whether an alarm is triggered when the measured value exceeds the threshold or falls below it.

4.4.2.4 Readout-Simulation



The readout simulation, allows you to test the output signal interface, the measured value transmission and the downstream signal processing. If available, the alarm thresholds can also be checked. The simulation lets you temporarily generate measured values without using a corresponding test gas.
Initially, the display will still show the real, current measured value. The simulation mode is only started after you press the left or right button. The maximum remaining simulation time is then displayed above the buttons' function descriptions. It will reset to five minutes if you change the value of simulated gas using the left or right button. An audible signal is triggered if the values exceed an alarm threshold or fall below it. You can cancel simulation mode by pressing the middle button. If you do not press any buttons, the simulation mode will end after the remaining simulation time has elapsed and the device will automatically return to measurement mode. Any alarms triggered by the simulation will end as soon as you exit the menu.

4.5 Readouts and Notifications

4.5.1 Overview of status LED states and current output signals

The following table lists the various status indications of the two status LEDs and current output signals and eyplains what they signify.

Green LED	Yellow LED	Current output	For description see section ...
Off	Flashes with 1 Hz	0.0 mA	Displaying special states No. 001
Off	On	0.0 mA	Displaying special states No. 002
Off	On	1.2 mA	Displaying special states No. 102-111
Flashes once every 5 s	On	1.2 mA	Displaying special states No. 101
Flashes with 1 Hz	On	1.6 mA	Displaying special states No. 002, 003
On	Flashes with 1 Hz	2.0 mA	Indications in service mode No. 204, 205
On	Flashes with 1 Hz	2.4 mA	Indications in service mode No. 203
On	Flashes with 1 Hz	4-20 mA	Indications in service mode No. 201, 202
On	Flashes once every 5 s	2.8-22 mA	Indications in measuring mode No. 309-316
On	On	2.8 mA	Indications in measuring mode No. 307, 308
On	Off	2.8-22 mA	Indications in measuring mode No. 303 to 306
On	Flashes with 5 Hz	22 mA	Indications in measuring mode No. 301, 302

4.5.2 Displaying special states (device start and fault)

The following table lists all statuses indicated by the yellow fault LED being permanently lit and the 4-20 mA current output emitting a signal of ≤ 1.6 mA.
For the 0.2-1 mA current output, the signals in parentheses apply (≤ 0.08 mA).

Start-up behavior

No.	Displayed information	Green LED	Yellow LED	Current output	Cause	Note/Explanation
001	Boot V1.20 GfG EC22 Error:Flash	Off	Flashes with 1Hz	0.0 mA	During the memory test, an error was detected in the program memory.	Restart transmitter. Firmware update necessary if error message is displayed again.
002	Boot V1.20 GfG EC22 Verify	Off	On	0.0 mA	Program and memory tests during the first seconds of device startup.	After approx. 4 seconds automatic transition to the initialization phase.
003	V2.19 GfG EC22	Flashes with 1Hz	On	1.6 mA (0.08 mA)	Initialization phase of the transmitter.	After approx. 3 seconds automatic transition to sensor warm-up
004	Warm-up XX seconds remaining	Flashes with 1Hz	On	1.6 mA (0.08 mA)	Sensor warm-up	After the time has elapsed, automatic transition to measuring mode

Behavior in case of malfunction:

No.	Displayed information	Green LED	Yellow LED	Current output	Cause	Note/Explanation
101	Sensor defective	Flashes once every 5 s	On	1.2 mA (0.06 mA)	Sensor no longer responds correctly to gas. It may be that the sensor is too old.	Sensor must be replaced.
102	Supply voltage incorrect	Off	On	1.2 mA (0.06 mA)	The supply voltage of the transmitter is too low or too high.	Check and readjust the voltage supply.
103	Temp.signal < MIN Temp.signal > MAX	Off	On	1.2 mA (0.06 mA)	Most likely, the temperature measurement is faulty.	
104	Watchdog error	Off	On	1.2 mA (0.06 mA)	A hardware error was detected when testing the external watchdog.	Restart the device. Replace device if error message is displayed again.
105	FLASH Error	Off	On	1.2 mA (0.06 mA)	During the memory test, an error was detected in the program memory.	
106	RAM Error	Off	On	1.2 mA (0.06 mA)	During the memory test, an error was detected in the RAM.	
107	EEPROM error 1 EEPROM error 2 EEPROM error 2c EEPROM error 1+2 EEPROM error 1<>2	Off	On	1.2 mA (0.06 mA)	Error in the parameter memory or when accessing the external parameter memory module.	
108	Wrong PCB type	Off	On	1.2 mA (0.06 mA)	An incorrect PCB type or a PCB error has been detected.	Restart the device. Replace device if error message is displayed again.
109	Digipoti error	Off	On	1.2 mA (0.06 mA)	A hardware error was detected in the digital potentiometer.	
110	ADC error 1 ADC error 2	Off	On	1.2 mA (0.06 mA)	An error was detected at the analog/digital converter.	
111	Program flow error	Off	On	1.2 mA (0.06 mA)	A logical flow error was detected in the program execution.	

4.5.3 Readouts in service mode and during sensor adjustment

The following table lists all statuses indicated by the green operation LED being permanently lit and the 4-20 mA current output emitting a signal between 2.0 and 2.4 mA.
For the 0.2-1 mA current output, the signals in parentheses apply (0.10 to 0.12 mA).

No.	Displayed information	Green LED	Yellow LED	Current output	Cause	Note/Explanation
201	Adjustment: Zero point (ZERO potentiometer)	On	Flashes with 1Hz	4-20 mA (0.2-1mA)	The AutoCal program for zero point adjustment was activated with the ZERO potentiometer	The zero gas setting is performed by means of the ZERO potentiometer
202	Adjustment: Sensitivity (SPAN potentiometer)	On	Flashes with 1Hz	4-20 mA (0.2-1mA)	The AutoCal program for the sensitivity adjustment was activated with the SPAN potentiometer	The calibration gas setting is made by means of the SPAN potentiometer
203	Menu item	On	Flashes with 1Hz	2.4 mA (0.12 mA)	Service menu was activated via push button interface	Select menu item. If no input is made for one minute, the transmitter automatically returns to the measuring mode
204	Adjustment: Zero point	On	Flashes with 1Hz	2.0 mA (0.10 mA)	Zero point adjustment was activated via push button interface	AutoCal adjustment of the zero point
205	Adjustment: Sensitivity	On	Flashes with 1Hz	2.0 mA (0.10 mA)	Sensitivity adjustment was activated via push button interface	AutoCal adjustment of the sensitivity

4.5.4 Readouts in measuring mode

The following table lists all statuses indicated by the green operation LED being permanently lit and the 4-20 mA current output emitting a signal between 2.8 and 22 mA.
For the 0.2-1 mA current output, the signals in parentheses apply (0.14 to 1.1 mA).

No.	Displayed information	green LED	yellow LED	Current output	Cause	Note/Explanation
301	↑↑↑ permanent	On	Flashes with 5 Hz	22 mA (1.1 mA)	The gas concentration has exceeded the measuring range of the transmitter electronics.	
302	↑↑↑ permanent	On	Flashes with 5 Hz	22 mA (1.1 mA)	The gas concentration has significantly exceeded the measuring range (Gas ≥ 112.5 % MR)	
303	↑↑↑ alternating with measured value	On	Off	20 to 22 mA (1.0 to 1.1 mA)	The gas concentration has exceeded the measuring range of (100 to 112.4 % MR).	
304	Measured value	On	Off	4-20 mA (0.2-1mA)	Trouble-free measurement operation	
305	Measured value	On	Off	3.2 to 4.0 mA (0.16 to 0.2 mA)	Underrange (-5.0 to 0.0 % MR)	
306	Measured value alternating with ↓↓↓	On	Off	2.8 to 3.2 mA (0.14 to 0.16 mA)	Underrange (-7.5 to -5.0 % MR)	Zero point adjustment is appropriate
307	Permanent ↓↓↓	On	On	2.8 mA (0.14 mA)	Underrange (below -7.5 % MR)	Zero point adjustment is necessary
308	Permanent ↓↓↓	On	On	2.8 mA (0.14 mA)	Measuring signal has fallen below the measuring range of the transmitter electronics	Zero point adjustment is necessary and the sensitivity must be checked
309	*Replacing the sensor < 1 month*	On	Flashes once every 5 s	2.8 to 22.0 mA (0.14 to 1.10 mA)	Expected sensor lifetime soon reached.	Replace or adjust sensor
310	*Replace sensor.*	On	Flashes once every 5 s	2.8 to 22.0 mA (0.14 to 1.10 mA)	Expected sensor lifetime exceeded.	Replace or adjust sensor
Remote calibration (not on transmitters for oxygen)						
311	RemoteCal ... and measured value	On	Flashes once every 5 s		Remote calibration started. A stable minimum zero gas signal is being searched for.	The zero gas can be applied.
312	RemoteCal(Z) and measured value	On	Flashes twice every 5 s		A stable minimum zero gas signal was found for remote adjustment.	The test gas can be applied. The zero point can be adjusted on the GMA.
313	RemoteCal(Z+S) and measured value	On	Flashes three times every 5 s		A Stable maximum and minimum Test gas signal was found for remote adjustment.	Test gas can be removed. Zero point and sensitivity can be adjusted on the GMA.
Remote calibration (only on the transmitter for oxygen)						
314	RemoteCal ... and measured value	On	Flashes once every 5 s		Remote calibration started, a stable maximum test gas signal is sought.	The test gas can be applied.
315	RemoteCal(S) and measured value	On	Flashes three times every 5 s		A stable maximum test gas signal for remote adjustment was found.	Sensitivity adjustment on the GMA is possible. The zero gas can now be applied.
316	RemoteCal(Z+S) and measured value	On	Flashes twice every 5 s		A stable maximum and minimum test gas signal for remote adjustment was found.	Zero gas can be removed. Zero point and sensitivity can be adjusted on the GMA.

4.5.5 Priority of readouts and messages in measuring mode

Low priority statuses are overwritten by higher priority ones. The lower priority statuses are not reset.

Priority	State	For description see section ...	
	Values significantly exceeding measuring range	Indications in measuring mode	No. 301, 302
	Values slightly exceeding measuring range	Indications in measuring mode	No. 303
	Values falling slightly below the measuring range	Indications in measuring mode	No. 305-308
	Sensor replacement	Indications in measuring mode	No. 309, 310

Sensor error no. 101 and transmitter error no. 102...113 suspend the measuring operation with their respective messages.

4.6 Fault, cause, remedy

Fault	Cause	Remedy
Zero point can no longer be adjusted	Sensor defective	Replace sensor
Sensitivity can no longer be adjusted	Sensor defective	Replace sensor
Output current has dropped to 0 mA	Fuse or electronics defective	Replace printed circuit board
	Wire interrupted	Reconnect

5 APPENDIX

5.1 Cleaning and Care

External contaminations of the transmitter housing can be removed with a damp cloth. Do not use solvents or cleaning agents!

5.2 Service and Maintenance

Service and maintenance includes regular visual inspections, function checks and system checks as well as repair of the gas detection system. In Germany, "DGUV Information 213-056 (Leaflet T 021 / previously BGI 836 Section 9)" and "DGUV Information 213-057 (Leaflet T 023 / previously BGI 518 Section 9)" apply to this.

5.2.1 Visual inspection

Visual inspections should be performed regularly, with a maximum interval of one month, and should include the following activities:

- Checking the display readings and the status messages,
e.g. operating LED "On", alarm and fault LEDs "Off"
- Check for mechanical damage and external soiling

5.2.2 Function check

The function check can be performed at intervals depending on the monitored gas hazard. The intervals between checks should not exceed four months. In Germany, this maximum inspection interval is specified in regulations T 21 and T 023 of the BG RCI employers' liability insurance association.

It includes the following activities:

- Visual inspection according to section 5.2.1 of these operating instructions
- Checking and evaluating the measured values displayed
- Triggering the alarm thresholds
- Triggering test functions for display elements as well as visual and audible alarms without triggering the switching functions
- Checking the stored information on messages, faults and maintenance requests

5.2.3 System check (Proof Test)

The system check must be performed at regular intervals. This interval may not exceed 1 year. It includes the following activities:

- Function check according to section 5.2.2 of these operating instructions
- Inspection of all safety functions including triggering the switching functions.
- Control of parameterization by target/actual comparison
- Control of the reporting and registration functions

5.2.4 Repair

"Repair" includes all repair and replacement work. They may only be carried out by the manufacturer and by people authorized by the manufacturer, GfG Gesellschaft für Gerätebau mbH. Only original spare parts tested and approved by the manufacturer and original assemblies may be used.

5.3 Replacing the sensor

To replace the sensor, you will first have to remove the transmitter's cover. When it is de-energized, you can pull the electronics including the sensor out of the guide rail. The ols sensor can then be removed and replaced with the new one. The rest of the assembly process is then performing the previous steps in reverse order. Only a sensor of the same type may be used as a replacement sensor. Its serial number must be entered in the service menu of the transmitter after installation and commissioning.

5.4 Information on the environmentally safe disposal of used parts

According to GfG's general terms and conditions, the customer assumes responsibility for the environmentally safe disposal of the device or any device components (such as replaced sensors). In Germany, this is regulated by §§11, 12 ElektroG. On request, GfG in Dortmund can also handle the proper disposal.

5.5 Accessories and spare parts

	Designation	Item no.
1.	Calibration adapter for transmitters EC22 and IR22	2220200
2.	Calibration adapter for transmitters CC22, ZD22, CS22 and EC22 O	2000209
3.	Test cable with service plug for transmitters EC22, CC22, ZD22, CS22 and IR22	2220201
4.	Replacement sensors for transmitters EC22 and EC22 O	on request

5.6 Sensor specification

MK229-0 Electrochemical sensor for nitrogen monoxide NO			
Measuring ranges:	0 to 10 ppm	0 to 20 or 30 ppm	0 to 40 or 50 ppm
Resolution / Tolerance band:	0.05 ppm / ±0.15 ppm	0.1 ppm / ±0.2 ppm	0.1 ppm / ±0.3 ppm
Adjustment time:	t_{50} < 5 s	t_{90} < 15 s	
Pressure 80 to 120 kPa:	max ±1 ppm or ±7 % of the displayed value		(ref.: 100 kPa)
Humidity 15 to 90 % RH:	max ±1 ppm or ±7 % of the displayed value		(ref.: 50 % RH at 20 °C)
Temperature -20 to +40(50) °C:	max ±2(3) ppm or ±7 % of the displayed value		(ref.: 20 °C)
Cross sensitivities:	H_2S < 35 %; NO_2 < 5 %; CO = 0 %; SO_2 = 0 %; (*1)		
Expected lifetime:	3 years in air		
Adjustment time:	3 minutes to 1 day - depending on the switch-off time		

MK390-0 Electrochemical sensor for chlorine Cl_2		
Measuring ranges:	0 to 10/20/50 ppm	
Resolution / Tolerance band:	0.1 ppm / ±0.2 ppm	
Adjustment time:	t_{50} < 10 s t_{90} < 30 s	
Pressure 80 to 120 kPa:	max ±0.2 ppm or ±10% of the displayed value	(ref.: 100 kPa)
Humidity 10 to 95 % RH:	max ±0.2 ppm or ±10% of the displayed value	(ref.: 50 % RH at 20 °C)
Temperature -20 to +50 °C:	max ±0.2ppm or ±10% of the displayed value	(ref.: 20 °C)
Cross sensitivities:	ClO_2: 50 %; F_2: 40 %; NO_2: 20 %; O_3: 20 %; SO_2: 18 %; CO_2=CO=H_2S=H_2 = 0 % (*1)	
Expected lifetime:	2 to 3 years in air	

MK390-0 Electrochemical sensor for Fluorine F_2		
Measuring ranges:	0 to 20/50/100 ppm	
Resolution / Tolerance band:	0.1 ppm / ±0.2 ppm	
Adjustment time:	t_{50} < 10 s t_{90} < 30 s	
Pressure 80 to 120 kPa:	max ±0.2 ppm or ±10% of the displayed value	(ref.: 100 kPa)
Humidity 10 to 95 % RH:	max ±0.2 ppm or ±10% of the displayed value	(ref.: 50 % RH at 20 °C)
Temperature -20 to +50 °C:	max ±0.2ppm or ±10% of the displayed value	(ref.: 20 °C)
Cross sensitivities:	Cl_2: 250 %; ClO_2: 125 %; NO_2: 50 %; O_3: 50 %; SO_2: 45 %; CO_2=CO=H_2S=H_2 = 0 % (*1)	
Expected lifetime:	2 to 3 years in air	

MK392-0 Electrochemical sensor for hydrogen chloride Cl		
Measuring ranges:	0 to 10/20/30 ppm	
Resolution / Tolerance band:	0.2 ppm / ±0.4 ppm	
Adjustment time:	t_{50} < 30 s t_{90} < 90 s	
Pressure 80 to 120 kPa:	max ±1 ppm or ±10 % of the displayed value	(ref.: 100 kPa)
Humidity 10 to 95 % RH:	max ±1 ppm or ±10 % of the displayed value	(ref.: 50 % RH at 20 °C)
Temperature -20 to +50 °C:	max ±1ppm or ±10% of the displayed value	(ref.: 20 °C)
Cross sensitivities:	AsH_3: 350 %; PH_3: 300 %; H_2S: 300 %; HBr: 100 %; NO: 45 %; SO_2: 40 %; HCN: 35 %; Cl_2: 6 %; NO_2: 3 %; NH_3=CO=CO_2=H_2 = 0 %; (*1)	
Expected lifetime:	2 to 3 years in air	

MK393-0 Electrochemical sensor for ammonia NH_3		
Measuring ranges:	0 to 100/200 ppm	
Resolution / Tolerance band:	1 ppm / ±3 ppm	
Adjustment time:	t_{90} < 60 s (at 20 °C)	
Pressure 80 to 120 kPa:	max 1 ppm or 10 % of the displayed value	(ref.: 100 kPa)
Humidity 15 to 90 % RH:	max 1 ppm or 10 % of the displayed value	(ref.: 50 % RH at 20 °C)
Temperature (-20)-10 to +40 °C:	max 1(2) ppm or 15(20) % of the displayed value	(ref.: 20 °C)
Cross sensitivities:	H_2S ≈ 10 %, CO=CO_2=H_2 = 0 % (*1)	
Expected lifetime:	2 to 3 years in air	

*1: Displayed values at low gas concentrations (below the occupational exposure limit)

MK396-0 Electrochemical sensor for hydrogen H_2			
Measuring ranges:		0 to 1000/2000 ppm	
Resolution / Tolerance band:		2 ppm / ±50 ppm	
Adjustment time:		t_{50} < 30 s t_{90} < 90 s	
Pressure	80 to 120 kPa:	max ±10 ppm or ±10 % of the displayed value	(ref.: 100 kPa)
Humidity	15 to 90 % RH:	max ±10 ppm or ±10 % of the displayed value	(ref.: 50 % RH)
Temperature	-20 to +50 °C:	max ±20 ppm or ±20 % of the displayed value	(ref.: 20 °C)
Cross sensitivities:		C_2H_4 ≈ 80 %; NO ≈ 35 %; HCN ≈ 30 %; CO < 20 %; H_2S < 20 %; NO_2=SO_2=Cl_2=HCl = 0 %; (*1)	
Expected lifetime:		2 to 3 years in air	

MK397-0 Electrochemical sensor for ozone O_3(or chlorine Cl_2 or chlorine dioxide ClO_2)				
Measuring ranges:		0 to 3/5 ppm O_3	0 to 5/10 ppm Cl_2	0 to 1/3 ppm ClO_2
Resolution / Tolerance band:		0.01 ppm / ±0.03 ppm	0.02 ppm / ±0.10 ppm	0.01 ppm / ±0.02 ppm
Adjustment time:		t_{90} ≤ 150 s		
Pressure	80 to 120 kPa:	max ±0.03 ppm O_3 or ±10 % of the measuring range		(ref.: 100 kPa)
Humidity	15 to 90 % RH:	max ±0.03 ppm O_3 or ±10 % of the measuring range		(ref.: 50 % RH at 20 °C)
Temperature	-20 to +50 °C:	max ±0.05 ppm or ±15 % of the displayed value		(ref.: 20 °C)
Cross sensitivities in the O_3 MR:		ClO_2 ≈ 200 %; NO_2 ≈ 80 %; H_2S ≈ -70 %; Cl_2 ≈ 60 %; SO_2 ≈ -50 %; CO < 0.1 % (*1)		
Expected lifetime:		2 to 3 years in air		

MK399-0 Electrochemical sensor for ammonia NH_3		
Measuring ranges:		0 to 500/1000 ppm
Resolution / Tolerance band:		5 ppm / ±10 ppm
Adjustment time:		t_{90} < 90 s (at 20 °C)
Pressure	80 to 120 kPa:	max 5 ppm or 10 % of the displayed value (ref.: 100 kPa)
Humidity	15 to 90 % RH:	max 5 ppm or 10 % of the displayed value (ref.: 50 % RH @ 20 °C)
Temperature	-20 to +40 °C:	max 5 ppm or 10 % of the displayed value (ref.: 20 °C)
Cross sensitivities:		NO_2 ≈ 65 %; H_2S ≈ 60 %; Cl_2 ≈ 17 %; SO_2 ≈ -10 %, CO=NO=H_2=0 % (*1)
Expected lifetime:		2 to 3 years in air

MK409-0 Electrochemical sensor for hydrogen cyanide HCN			
Measuring range:		0 to 20/30/50/100 ppm	
Resolution / Tolerance band:		0.1 ppm / ±0.5 ppm	
Adjustment time:		t_{50} < 25 s t_{90} < 60 s	
Pressure	80 to 120 kPa:	max ±0.5 ppm or ±10 % of the displayed value	(ref.: 100 kPa)
Humidity	10 to 95 % RH:	max ±0.5 ppm or ±10 % of the displayed value	(ref.: 50 % RH at 20 °C)
Temperature	-20 to +50 °C:	max ±0.5 ppm or ±15 % of the displayed value	(ref.: 20 °C)
Cross sensitivities:		NO_2 ≈ -70 %, NO ≈ -5 %, H_2S ≈ 0…200 % (depending on filter saturation) CO=CO_2=H_2 = 0 % (*1)	
Expected lifetime:		2 years in air	

MK422-0 Electrochemical partial pressure sensor for oxygen O_2 (for the EC22 O)			
Measuring range:		0.5 to 25.0(35.0) vol%	
Resolution / Tolerance band:		0.1 vol% / ±0.3 vol%	
Adjustment time:		t_{90} ≤ 5 s	
Pressure	70 to 125 kPa:	proportional to the oxygen partial pressure	
Humidity	0 to 90 % RH:	Negligible	
Temperature +10(0) to +40(50) °C:		max ±0.5 vol% or ±3(6) % of the displayed value	(ref.: 20 °C)
Cross sensitivities:		CO=CO_2=H_2=H_2S=Ar=CH_4=C_3H_8 = 0 % (*1)	
Expected lifetime:		5 years in air	

MK440-0 Electrochemical sensor for sulfur dioxide SO_2			
Measuring ranges:		0 to 10/20/50/100 ppm	
Resolution / Tolerance band:		0.1 ppm / ±0.2 ppm	
Adjustment time:		t_{50} < 10 s t_{90} < 30 s	
Pressure	80 to 120 kPa:	max ±0.2 ppm or ±5 % of the displayed value	(ref.: 100 kPa)
Humidity	15 to 90 % RH:	max ±0.3 ppm or ±3 % of the displayed value	(ref.: 50 % RH at 20 °C)
Temperature	-20 to +50 °C:	max ±0.3 ppm or ±5 % of the displayed value	(ref.: 20 °C)
Cross sensitivities:		C_2H_2 < 300 %; NO_2 < -170 %; C_2H_4 < 90 %; HCN < 50 %; Cl_2 < -40 %; NO < 10 %; H_2S < 0.4 %; CO < 0.4 %; H_2 < 0.3 %; NH_3 = 0 %; (*1)	
Expected lifetime:		3 years in air	

MK443-0 Electrochemical sensor for carbon monoxide CO			
Measuring ranges:		0 to 200/300/500/1000/1500/2000 ppm	
Resolution / Tolerance band:		1 ppm / ±3 ppm	
Adjustment time:		t_{90} ≤ 30 s	(at 20 °C)
Pressure	80 to 120 kPa:	max ±3 ppm or ±5 % of the displayed value	(ref.: 100 kPa)
Humidity	15 to 90 % RH:	max ±3 ppm or ±2 % of the displayed value	(ref.: 50 % RH at 20 °C)
Temperature	-20 to +50 °C:	max ±3(5) ppm or ±7(10) % of the displayed value	(ref.: 20 °C)
Cross sensitivities:		C_2H_4 ≈ 96 %; C_2H_2 ≈ 90 %; H_2 < 30 % (typically 15 %); NO < 20 %; Cl_2 < 7 %; C_2H_6O < 0,5 %; SO_2=NH_3=H_2S = 0 % (*1)	
Expected lifetime:		3 years in air	

*1: Displayed values at low gas concentrations (below the occupational exposure limit)

MK445-0 Electrochemical sensor for hydrogen sulfide H_2S		
Measuring ranges:	0 to 30/50/100/200/300/500 ppm	
Resolution / Tolerance band:	0.1 ppm / ±0.3 ppm	
Adjustment time:	t_{90} < 30 s	(at 20 °C)
Pressure 80 to 120 kPa:	max ±1 ppm or ±7 % of the displayed value	(ref.: 100 kPa)
Humidity 15 to 90 % RH:	max ±1 ppm or ±7 % of the displayed value	(ref.: 50 % RH at 20 °C)
Temperature -20 to +50 °C:	max ±1 ppm or ±7 % of the displayed value	(ref.: 20 °C)
Cross sensitivities [#]:	NO_2 < 10 %; CO < 2 %; NO < 1 %; CO_2=SO_2=Cl_2=NH_3=C_2H_4 = 0 % (*1) low methanol cross-sensitivity	
Expected lifetime:	3 years in air	

MK452-0 Electrochemical sensor for Ethylene oxide C_2H_4O (ETO)			
Measuring ranges:	0 to 20 ppm	0 to 50 ppm	
Resolution / Tolerance band:	0.1 ppm / ±0.3 ppm	0.1 ppm / ±0.5 ppm	
Adjustment time:	t_{90} < 30 s	t_{90} < 120 s	(at 20 °C)
Pressure 80 to 120 kPa:	max. 1 ppm or 15 % of the displayed value		(ref.: 100 kPa)
Humidity 15 to 90 % RH:	max. 2 ppm or 15 % of the displayed value		(ref.: 50 % RH at 20 °C)
Temperature (-20)-10 to +50 °C:	max. 1(2) ppm or 15(20) % of the displayed value		(ref.: 20 °C)
Cross sensitivities:	CO≈40%; CH_4O≈150%; C_2H_2≈125%; CH_2O≈120%; CH_4S≈100%; C_2H_4≈80%; C_2H_6O≈55%; $C_4H_{10}O$≈40%; C_7H_8≈20%; MEK≈10%; a.o. organic vapors		
Expected lifetime:	2 to 3 years in air		
Warm-up time:	4 minutes up to 7 days – depending on the switch-off time		

MK453-0 Electrochemical sensor for ammonia NH_3		
Measuring ranges:	0 to 100/200/300/400/500 ppm	
Resolution / Tolerance band:	1 ppm / ±3 ppm	
Adjustment time:	t_{90} < 45 s	(at 20 °C)
Pressure 80 to 120 kPa:	max ±1 ppm or ±10 % of the displayed value	(ref.: 100 kPa)
Humidity 15 to 90 % RH:	max ±1 ppm or ±10 % of the displayed value	(ref.: 50 % RH at 20 °C)
Temperature (-20)-10 to +50 °C:	max ±1(2) ppm or ±15(20) % of the displayed value	(ref.: 20 °C)
Cross sensitivities:	H_2S ≈ 120 %; NO_2 ≈ -100 %; SO_2 ≈ -30 %, CO=NO=CO_2=H_2=C_2H_6O = 0 % (*1)	
Expected lifetime:	2 to 3 years in air	

MK454-0 Electrochemical sensor for ammonia NH_3		
Measuring ranges:	0 to 300/500/1000/1500 ppm	
Resolution / Tolerance band:	5 ppm / ±10 ppm	
Adjustment time:	t_{90} < 60 s	(at 20 °C)
Pressure 80 to 120 kPa:	max ±5 ppm or ±10 % of the displayed value	(ref.: 100 kPa)
Humidity 15 to 90 % RH:	max ±5 ppm or ±10 % of the displayed value	(ref.: 50 % RH at 20 °C)
Temperature -20 to +50 °C:	max ±5ppm or ±10% of the displayed value	(ref.: 20 °C)
Cross sensitivities:	H_2S ≈ 140 %; NO_2 ≈ -100 %; SO_2 ≈ -30 %; CO=NO=CO_2=H_2=C_2H_6O = 0 % (*1)	
Expected lifetime:	2 to 3 years in air	

MK457-0 Electrochemical sensor for nitrogen monoxide NO		
Measuring ranges:	0 to 50/100/200/300 ppm	
Resolution / Tolerance band:	0.5 ppm / ±2.5 ppm	
Adjustment time:	t_{90} < 45 s	(at 20 °C)
Pressure 80 to 120 kPa:	max ±1 ppm or ±10 % of the displayed value	(ref.: 100 kPa)
Humidity 15 to 90 % RH:	max ±1 ppm or ±10 % of the displayed value	(ref.: 50 % RH at 20 °C)
Temperature -20 to +50 °C:	max ±2 ppm or ±10 % of the displayed value	(ref.: 20 °C)
Cross sensitivities:	H_2S < 50 %; NO_2 < 40 %; C_2H_6O ±10 %; SO_2 < 5 %; H_2 < 1 %; NH_3 < 1 %; CO < -1 %; CO_2=CL_2 = 0; (*1)	
Expected lifetime:	3 years in air	

MK458-0 Electrochemical sensor for nitrogen dioxide NO_2		
Measuring ranges:	0 to 20/30/50/100 ppm	
Resolution / Tolerance band:	0.1 ppm / ±0.5 ppm	
Adjustment time:	t_{90} < 30 s	(at 20 °C)
Pressure 80 to 120 kPa:	max ±0.2 ppm or ±10 % of the displayed value	(ref.: 100 kPa)
Humidity 15 to 90 % RH:	max ±0.2 ppm or ±10 % of the displayed value	(ref.: 50 % RH at 20 °C)
Temperature -20 to +50 °C:	max ±0.2ppm or ±10% of the displayed value	(ref.: 20 °C)
Cross sensitivities:	Cl_2 ≈ 100 %; H_2S < -40 %; NO < 20 %; C_2H_6O < 1 %; CO < -1 %; SO_2 < -1 %; H_2 < -1 %; NH_3 < -1 %, CO_2 = 0; (*1)	
Expected lifetime:	3 years in air	

MK465-0 Electrochemical sensor for oxygen O_2			
Measuring range:		0 to 25/30 vol%	
Resolution / Tolerance band:		0.1 vol% / ±0.3 vol%	
Adjustment time:		t_{20} ≤ 5 s t_{90} ≤ 15 s	(at 20 °C)
Pressure	80 to 120 kPa:	max ±0.3 vol% or ±2.5 % of the measuring range	(ref.: 100 kPa)
Humidity	5 to 95 % RH:	max ±0.3 vol% or ±2.5 % of the measuring range	(ref.: 50 % RH at 40 °C)
Temperature	-20 to +50 °C:	max ±0.4 vol% or ±3.0 % of the displayed value	(ref.: 20 °C)
Expected lifetime:		3 years in air	
MK466-0 Electrochemical sensor for oxygen O_2			
Measuring range:		0 to 25/30 vol %	
Resolution / Tolerance band:		0.1 vol % / ±0.3 vol %	
Adjustment time:		t_{20} ≤ 5sec t_{90} ≤ 15sec	(at 20 °C)
Pressure	80 to 120kPa:	max. 0.3 vol % or 2.5 % of the measuring range	(ref.: 100kPa)
Humidity	15 to 90 % RH:	max. 0.3 vol % or 2.5 % of the measuring range	(ref.: 50 % RH at 40 °C)
Temperature	-20 to +50 °C:	max. 0.4 vol % or 3.0 % of the displayed value	(ref.: 20 °C)
Expected lifetime:		5 years in air	

*1: Displayed values at low gas concentrations (below the occupational exposure limit)

MK467-0 Electrochemical sensor for oxygen O_2			
Measuring range:		0 to 25/30 vol %	
Resolution / Tolerance band:		0.1 vol% / ±0.3 vol%	
Adjustment time:		t_{20} ≤ 10 s t_{90} ≤ 20 s	
Pressure	80 to 120 kPa:	max ±0.2 vol% or ±2.5 % of the measuring range	(ref.: 100 kPa)
Humidity	0 to 90 % RH:	max ±0.2 vol% or ±2.5 % of the measuring range	(ref.: 50 % RH at 40 °C)
Temperature	-20 to +50 °C:	max ±0.5 vol% or ±2.5 % of the displayed value	(ref.: 20 °C)
Expected lifetime:		2 years in air	

MK474-0 Electrochemical sensor for chlorine Cl_2			
Measuring ranges:		0 to 10/20ppm	0 to 50ppm
Resolution / Tolerance band:		0.05ppm / ±0.15ppm	0.1ppm / ±0.2ppm
Adjustment time:		t_{90} < 60sec	
Pressure	80 to 120kPa:	max. ±0.2ppm or ±10% of the displayed value	(ref.: 100kPa)
Humidity	15% to 90% RH.:	max. ±0.2ppm or ±10% of the displayed value	(ref.: 50%RH at 20°C)
Temperature	-20 to +40°C:	max. ±0.2ppm or ±10% of the displayed value	(ref.: 20°C)
Cross sensitivities:		Br_2:100%; O_3:80%; ClO_2:50%; F_2:50%; NO_2:10%; H_2S:-10%; $CO=C_3H_8O=H_2=SO_2$:0% (*1)	
Expected lifetime:		2 to 3 years in air	

MK476-0 Electrochemical sensor for nitric oxide NO				
Measuring range:		0 to 10 ppm	0 to 20/30 ppm	0 to 40/50 ppm
Resolution / Tolerance band:		0.05 ppm / ±0.15 ppm	0.1 ppm / ±0.2 ppm	0.1 ppm / ±0.3 ppm
Adjustment time:		t_{50} < 5 s t_{90} < 15 s		
Pressure	80 to 120 kPa:	max 1 ppm or 7% of the displayed value		(ref.: 100 kPa)
Humidity	15 to 90 % RH:	max 1 ppm or 7% of the displayed value		(ref.: 50 % RH at 20 °C)
Temperature	-20 to +40(50) °C:	max 2(3) ppm or 7% of the displayed value		(ref.: 20 °C)
Cross sensitivities:		H_2S<16 %; NO_2<10 %; SO_2<2 %; $CO=H_2$=0 %; (*1)		
Expected service life:		3 years in air		
Warm-up time:		3 minutes to 1 day - depending on the time the sensor was switched off		

MK477-0 Electrochemical sensor for silane SiH_4			
Measuring ranges:		0 to 10/20/30/40/50 ppm	
Resolution / Tolerance band:		0.1 ppm / ±0.2 ppm	
Adjustment time:		t_{90} < 60 s	(at 20 °C)
Pressure	80 to 120 kPa:	max ±0.1 ppm or ±10 % of the displayed value	(ref.: 100 kPa)
Humidity	15 to 90 % RH:	max ±0.2 ppm or ±10 % of the displayed value	(ref.: 50 % RH at 20 °C)
Temperature	-20 to +50 °C:	max ±0.3 ppm or ±10 % of the displayed value	(ref.: 20 °C)
Cross sensitivities:		$H_2S \approx 160$ %; $PH_3 \approx 100$ %; $SO_2 \approx 20$ %; H_2=CO = 0 %; (*1)	
Expected lifetime:		2 to 3 years in air	

*1: Displayed values at low gas concentrations (below the occupational exposure limit)

5.7 Technical Data

Type designation:	**EC22**
Ambient conditions	
Operating temperature:	-20 to +50 °C (sensor dependent)
Storage temperature:	-25 to +60 °C (recommended 0 to +30 °C)
Humidity:	20 to 95 % RH (sensor dependent)
Pressure:	80 to 120 kPa (sensor dependent)
Power supply	
Operating voltage:	24 V DC (12-30 V DC allowed)
Current consumption	for RS-485 and 0.2-1 mA version 4-20 mA version
without display:	typically 10/12/14 mA at 24/18/12 V max. 32/34/36 mA at 24/18/12 V
with display:	typically 16/20/26 mA at 24/18/12 V max. 38/42/48 mA at 24/18/12 V
with display + horn:	max. 25/30/40 mA at 24/18/12 V max. 47/52/62 mA at 24/18/12 V
Fuses:	250 mA (not replaceable)
Sensors	
Measuring range and measuring gas:	Sensor dependent
Sample gas feed:	Diffusion
Processing of measured values	
Update time:	1 s
Readiness Delay:	5 s plus 20-90 s adjustment time of the sensors
Display & Controls	
Status LEDs:	green for operation and yellow for fault or service
Display, buttons:	2.2" graphic display and 3 push buttons (display version)
AutoCal button:	for ZERO and SPAN adjustment (internal)
Potentiometer:	for ZERO and SPAN adjustment (internal)
Service Connector	
Type:	3.5 mm stereo jack socket (internal)
Analog output:	0.2 to 1.0 V corresponding to 0 to 100 % MR for sensor calibration
Digital input:	for configuration and firmware updates
Signal output	
analog:	4-20 mA (max. load: 650/400/150 Ω at 24/18/12 V supply)
or analog:	0.2-1 mA (max. load: 14K1/9K3/4K5 at 24/18/12 V supply)
or digital:	RS485; half-duplex; 9600/19200/38400 baud; Modbus protocol Slide switch for 120 Ω terminating resistor
Connection cable	
Cable glands:	1x or 2x M16x1.5 (for cable diameter 4.5-10 mm)
Connection terminals:	4 double terminals (0.08 to 2.5 mm^2 conductor cross-section)
Cable (analog):	3-core e.g. LiYY 3x0,34 to 0,75mm^2 or LiYCY
Cable (digital):	4-core e.g. LiYY 4x0.50 to 1.5mm^2 or bus cable Y(St)Y 2x2x0.8 ***1**
Housing	
Protection class:	IP54 according to IEC 60529
Material:	Plastic
Dimensions:	96 x 123 x 49 mm (W x H x D) with sensor
Weight:	125...150g or 170 to 195g (for version with display)
Approvals/Certifications	
Electromagnetic compatibility:	DIN EN 50270:2015 Interference emission: Type class I Interference immunity: Type class II

***1:** The bus cable Y(St)Y 2x2x0.8 is suitable for the power supply of several bus transmitters via the same cable only for short cable runs. The achievable distance depends on the number and local distribution of transmitters on the bus cable. Refer to section 3.3 for more information.

Declaration of Conformity

EU Declaration of Conformity

Transmitter
EC22
EC22 O

Edited: 20.12.2011 Amended: 23.07.2020

GfG Gesellschaft für Gerätebau mbH

Klönnestraße 99
44143 Dortmund
Tel: +49 (231) 56400-0
Fax: +49 (231) 516313
E-Mail: info@gfg-mbh.com
www.gfg.biz

GfG Gesellschaft für Gerätebau mbH develops produces and sells gas sensors and gas warning devices which are subject to a **quality management system** as per DIN EN ISO 9001.
Subject to supervision by means of a **quality system**, surveilled by the notified body, DEKRA Testing and Certification GmbH (0158), is the production of electrical apparatus of instrumentation Group I and II, categories M1, M2, 1G and 2G for gas sensors, gas detectors, gas warning systems in types of protection flameproof enclosures, increased safety, encapsulation and intrinsic safety, as well as their measuring function.

The Transmitters **EC22, EC22 O** comply with council directive **2014/30/EU** for electromagnetic compatibility and with directive **2011/65/EU** (RoHS) on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The directive 2014/30/EU is complied considering the following standard:

- Electromagnetic compatibility - Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen	EN 50270: 2015
Radio shielding	Type class 1
Interference resistance	Type class 2

The EMC test laboratory AMETEK CTS Germany GmbH at Kamen has tested and certified the electromagnetic compatibility.

The directive 2011/65/EU is complied considering the following standard:

- Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances	EN 50581: 2012

Dortmund, 23 July 2020

i.V. B. Siebrecht

B. Siebrecht
QMB

GfG Gesellschaft für Gerätebau mbH
Klönnestraße 99
44143 Dortmund
Tel: +49 (231) 56400-0
Fax: +49 (231) 56400-895
E-Mail: info@gfg-mbh.com
www.gasmessung.de

Einsatzbedingungen

Die SIL-Fähigkeit des Detektors in Verbindung mit den ermittelten Fehlerraten ist nur dann gültig, wenn die folgenden Einsatzbedingungen eingehalten werden:

Die FMEDA zur Ermittlung der Hardwarefehlerraten wurde unter der Annahme erstellt, dass ein zu niedriges Gassignal einen gefährlichen Fehler darstellt. Ein zu hohes Gassignal stellt einen sicheren Fehler dar, da ein Alarm sicher ausgelöst wird, allerdings bei einer niedrigeren Konzentration als notwendig. Aus diesem Grund gelten die Fehlerraten **nicht** für Sauerstoffmangelüberwachung, bei der ein zu hohes Gassignal einen gefährlichen Fehler darstellt.

Der Detektor muss an einer für die Messaufgabe geeigneten Position angebracht, ordnungsgemäß an eine Auswertezentrale angeschlossen, und vom Hersteller GfG Gesellschaft für Gerätebau mbH oder einer autorisierten Vertretung in Betrieb genommen sein.

Transmitter mit analogem Ausgang:

Folgende Statussignale müssen von der verwendeten Auswerteeinheit erkannt werden. Bei Verwendung einer Auswerteeinheit der Firma GfG Gesellschaft für Gerätebau mbH ist das automatisch sichergestellt.

≤ 2,8 mA	Störung (Fault Low) = Transmitterstörung oder Leitungsunterbrechung
> 2,8 bis < 4 mA	Messbereichsunterschreitung — (Messbetrieb)
> 20 bis < 22 mA	Messbereichsüberschreitung — (Messbetrieb)
≥ 22 mA	Störung (Fault High) = Transmitterstörung oder Kurzschluss

Transmitter mit digitalem Ausgang:

Die Sicherheitsfunktion ist ein digitales RS 485 Ausgangssignal mit einem proprietären Protokoll. Statussignale des Detektors einschließlich Störungsmeldungen sind in das digitale Protokoll implementiert. Die funktionale Sicherheit des digitalen Protokolls ist Bestandteil der SIL-Prüfung der zugehörigen GfG-Auswertezentrale z.B. der GMA200.

Die in der Herstellerdokumentation angegebenen Umgebungsbedingungen z.B. bezüglich Temperatur, Feuchte und Druck sind einzuhalten.

Der Detektor muss gemäß Herstellerangaben regelmäßig fachkundig gewartet und mit einem zertifizierten Prüfgas kalibriert werden. Das Kalibrierintervall ergibt sich aus dem Gefahrenpotential der jeweiligen Anwendung. In Deutschland ist dieses Kalibrierintervall in den Regelwerken T 021 der BG-RCI (= DGUV Information 213-056 der Deutschen Gesetzlichen Unfallversicherung) festgelegt.

Jährlicher Proof Test

Mindestens einmal pro Jahr muss ein Proof Test der gesamten Sicherheitskette durchgeführt werden. Für den Transmitter entspricht der Proof Test der Systemkontrolle gemäß Betriebssicherheitsverordnung und umfasst die reguläre Kalibrierung / Justierung ohne zusätzliche Anforderungen.

SIL - Konformitätserklärung
EC22

GfG Gesellschaft für Gerätebau mbH
Klönnestraße 99
44143 Dortmund
Tel: +49 (231) 56400-0
Fax: +49 (231) 56400-895
E-Mail: info@gfg-mbh.com
www.gasmessung.de

Erstellt: 12.04.2016 Geändert: 22.07.2020

Der Transmitter **EC22** mit analogem 4 - 20mA bzw. mit digitalem RS 485 Ausgangssignal stimmen mit der folgenden Europäischen Norm zur Funktionalen Sicherheit überein:

Funktionale Sicherheit sicherheitsbezogener elektrischer/ elektronischer/programmierbarer elektronischer Systeme **DIN EN 61508–2: 2011**

Es wurden die folgenden Kenngrößen für die Hardware mit Sensor zum einkanaligen und zweikanaligen Einsatz des **Transmitters EC22** mit analogem bzw. digitalem Ausgang bestimmt:

	Einkanaliger Einsatz (1oo1)	**Redundanter Einsatz (1oo2)**
Sicherheitsfunktion	Detektion toxischer Gase oder Inertisierungsüberwachung	
Sensortyp, Messbereich, Gasart	MK390-0: 0–10ppm / 0–20ppm / 0–50ppm Cl_2 MK392-0: 0–10ppm / 0–20ppm / 0–30ppm HCl MK393-0: 0–100ppm / 0–200ppm NH_3 MK409-0: 0–20ppm / 0–30ppm HCN MK440-0: 0–10ppm / 0–20ppm SO_2 MK445-0: 0–30ppm / 0–50ppm / 0–100ppm H_2S MK457-0: 0–50ppm / 0–100ppm / 0–200ppm NO MK458-0: 0–20ppm / 0–30ppm NO_2	
Gerätetyp	B	
MTTR	72 h	
Proof Test Intervall	1 Jahr	
SFF	84,45% bzw. 84,47%	
SIL-Fähigkeit Hardware	1	2
HFT	0	1
β Faktor	—	10%
λ_{SD} [1/h]	$1{,}12\times10^{-7}$ bzw. $1{,}12\times10^{-7}$	
λ_{SU} [1/h]	$3{,}03\times10^{-6}$ bzw. $3{,}02\times10^{-6}$	
λ_{DD} [1/h]	$2{,}29\times10^{-7}$ bzw. $2{,}36\times10^{-7}$	
PFH = λ_{DU} [1/h]	$6{,}21\times10^{-7}$ bzw. $6{,}20\times10^{-7}$	$6{,}49\times10^{-8}$ bzw. $6{,}48\times10^{-8}$
PFD_{avg} [1/Jahr]	$2{,}78\times10^{-3}$ bzw. $2{,}78\times10^{-3}$	$2{,}86\times10^{-4}$ bzw. $2{,}86\times10^{-4}$

Die zugrundeliegende Berechnung der Kenndaten wurde von der Firma GWW GasWarn Dr. Wenker GmbH als unabhängigem Sachverständigen durchgeführt.

Die folgend aufgeführten Einsatzbedingungen und die Sicherheitshinweise in der Betriebsanleitung 218-000.20 sind zu beachten.

Dortmund, den 22. Juli 2020

Dipl. Kfm. H.J. Hübner
Geschäftsführer

SIL - Konformitätserklärung
EC22

GfG Gesellschaft für Gerätebau mbH
Klönnestraße 99
44143 Dortmund
Tel: +49 (231) 56400-0
Fax: +49 (231) 56400-895
E-Mail: info@gfg-mbh.com
www.gasmessung.de

Erstellt: 12.04.2016 Geändert: 22.07.2020

Der Transmitter **EC22** mit analogem 4 - 20mA bzw. mit digitalem RS 485 Ausgangssignal stimmen mit der folgenden Europäischen Norm zur Funktionalen Sicherheit überein:

Funktionale Sicherheit sicherheitsbezogener elektrischer/ elektronischer/programmierbarer elektronischer Systeme **DIN EN 61508–2: 2011**

Es wurden die folgenden Kenngrößen für die Hardware mit Sensor zum einkanaligen und zweikanaligen Einsatz des **Transmitters EC22** mit analogem bzw. digitalem Ausgang bestimmt:

	Einkanaliger Einsatz (1oo1)	**Redundanter Einsatz (1oo2)**
Sicherheitsfunktion	Detektion toxischer Gase oder Inertisierungsüberwachung	
Sensortyp, Messbereich, Gasart	MK397-0: 0–3ppm / 0–5ppm O_3 MK398-0: 0–25Vol.% O_2 zur Inertisierungsüberwachung MK399-0: 0–500ppm / 0–1000ppm NH_3 MK443-0: 0–200ppm / 0–300ppm / 0–500ppm CO MK443-0: 0–1000ppm / 0–1500ppm / 0–2000ppm CO	
Gerätetyp	B	
MTTR	72 h	
Proof Test Intervall	1 Jahr	
SFF	91,01% bzw. 91,04%	
SIL-Fähigkeit Hardware	2	3
HFT	0	1
β Faktor	—	10%
λ_{SD} [1/h]	$1{,}12\times10^{-7}$ bzw. $1{,}12\times10^{-7}$	
λ_{SU} [1/h]	$2{,}45\times10^{-6}$ bzw. $2{,}44\times10^{-6}$	
λ_{DD} [1/h]	$2{,}29\times10^{-7}$ bzw. $2{,}36\times10^{-7}$	
PFH = λ_{DU} [1/h]	$2{,}75\times10^{-7}$ bzw. $2{,}74\times10^{-7}$	$2{,}81\times10^{-8}$ bzw. $2{,}80\times10^{-8}$
PFD_{avg} [1/Jahr]	$1{,}24\times10^{-3}$ bzw. $1{,}24\times10^{-3}$	$1{,}26\times10^{-4}$ bzw. $1{,}26\times10^{-4}$

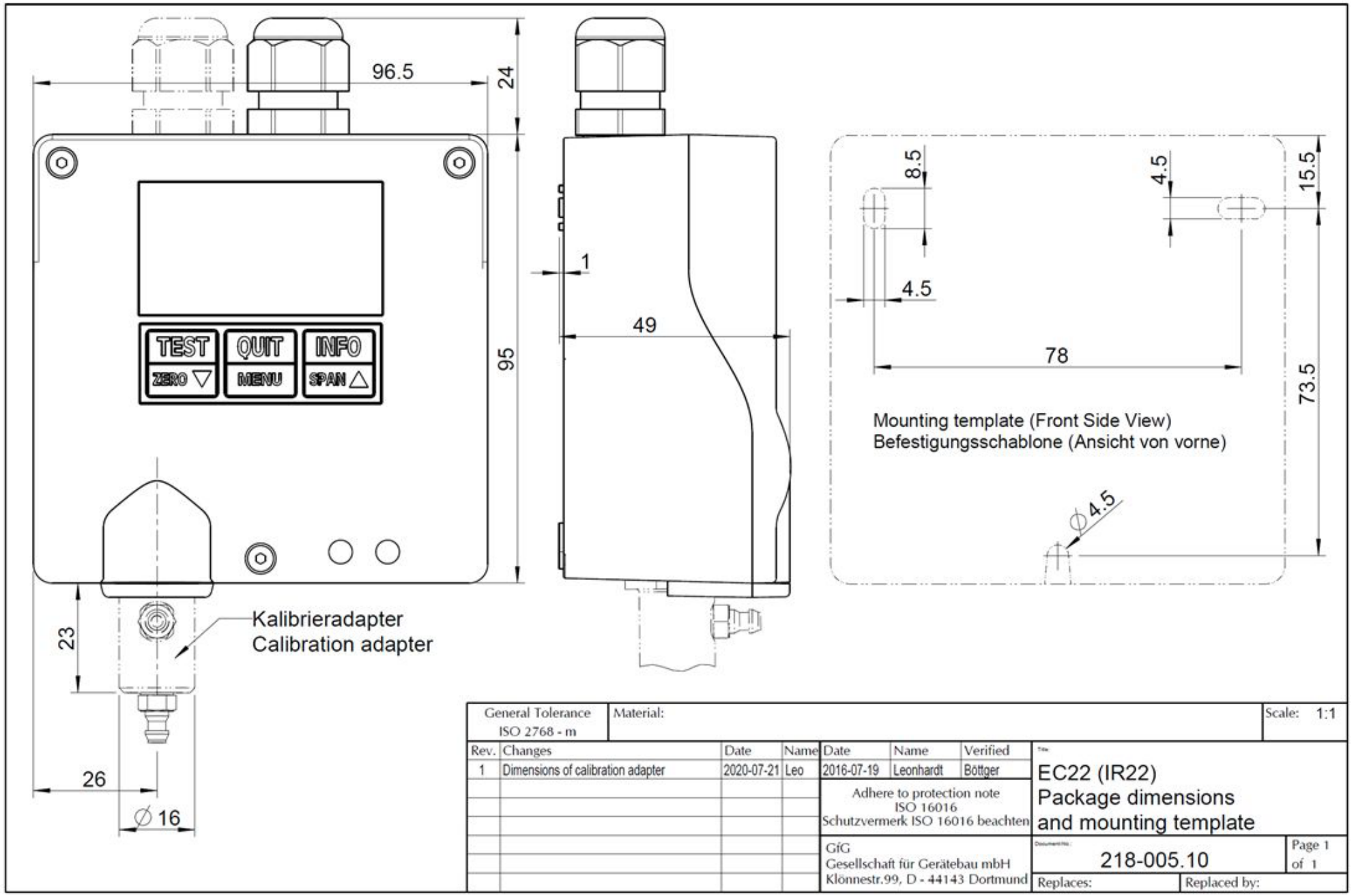
Die zugrundeliegende Berechnung der Kenndaten wurde von der Firma GWW GasWarn Dr. Wenker GmbH als unabhängigem Sachverständigen durchgeführt.

Die folgend aufgeführten Einsatzbedingungen und die Sicherheitshinweise in der Betriebsanleitung 218-000.20 sind zu beachten.

Dortmund, den 22. Juli 2020

Dipl. Kfm. H.J. Hübner
Geschäftsführer

5.8 Housing drawing and mounting template EC22



General Tolerance ISO 2768 - m	Material:						Scale: 1:1
Rev.	Changes	Date	Name	Date	Name	Verified	EC22 (IR22) Package dimensions and mounting template
1	Dimensions of calibration adapter	2020-07-21	Leo	2016-07-19	Leonhardt	Böttger	
				Adhere to protection note ISO 16016 Schutzvermerk ISO 16016 beachten			
				GfG Gesellschaft für Gerätebau mbH Klönnestr.99, D - 44143 Dortmund			Document No.: 218-005.10 Page 1 of 1
							Replaces: Replaced by:

5.9 Housing drawing and mounting template EC22 O