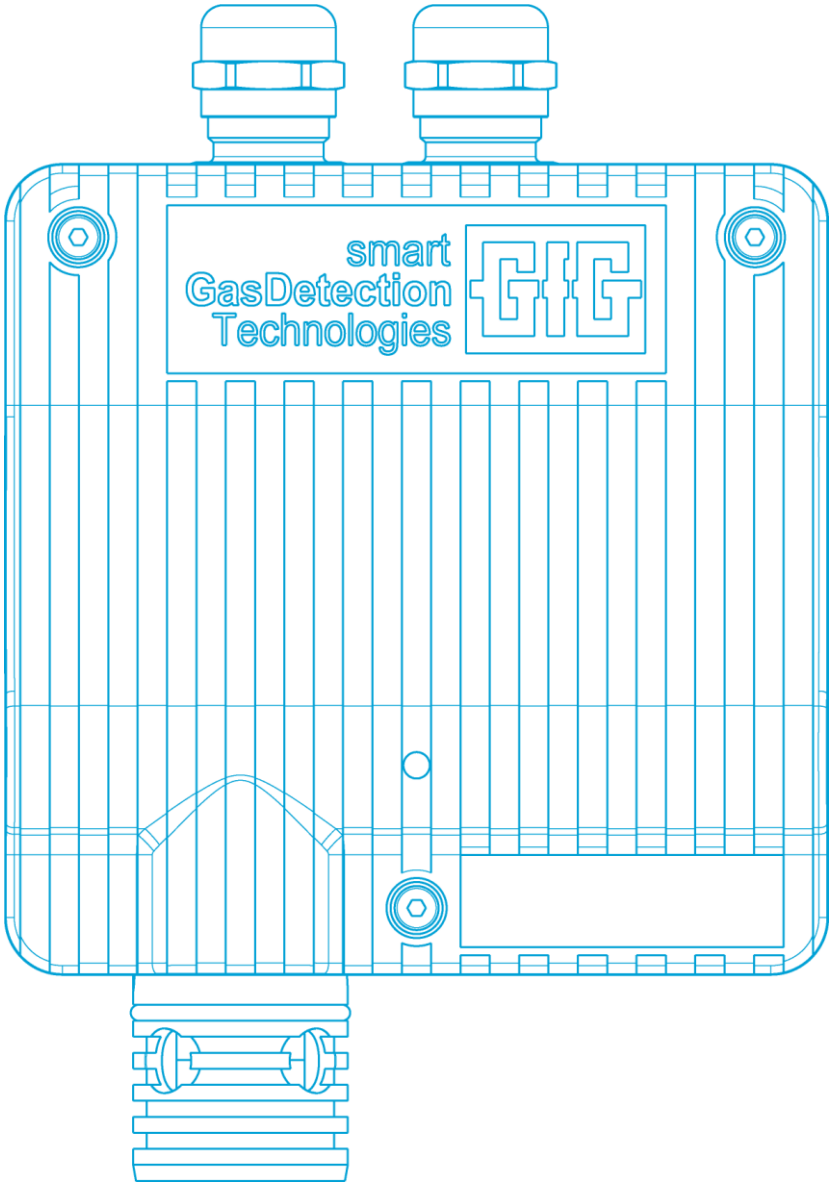
smart GasDetection Technologies

Operation Manual

CC22ex Transmitter



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1 INTRODUCTION

1.1 For your Safety

This operation manual informs you about the intended use of the product in accordance to the German Law of Market Supply (production safety law - "ProdSG"). Its purpose is to ensure the safety and health of people. It must be read and adhered to by every person using, maintaining, servicing and controlling the device. This product can only fulfill its intended purpose if it is used, maintained, serviced and controlled in accordance with GfG - Gesellschaft für Gerätebau'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 Instructions

In accordance with national regulations, all gas warning devices must be tested for functionality by a qualified person after installation but before being put into operation (initial commissioning). In Germany, this is regulated by the "DGUV Information 213-056 (Explanatory leaflet T 021 / previously BGI 836, section 8.1)" and "DGUV Information 213-057 (Explanatory leaflet T 023 / previously BGI 518, section 8.1)".

The transmitter's functionality has been tested before dispatch. Calibration and adjustment were performed using appropriate test or calibration gases.
This does not absolve you from calibrating and, if applicable, adjusting it after installation.

The CC22ex transmitter with its pressure resistant sensor is used for measuring combustible gases and vapors in ambient air up to the lower explosion limit under atmospheric conditions. The measured values are transmitted via a digital RS485 interface.

The CC22ex transmitter is suitable for use in potentially explosive areas of zone 2 classification, which means explosive atmospheres of gases, vapors or mist are unlikely to occur or - if it does - is only present for short amounts of time. These types of devices are designed to function in accordance with the operating parameters specified by the manufacturer and ensure a standard level of protection. In their manufacturer's declaration, Gesellschaft für Gerätebau mbH confirms conformity with Directive 2014/34/EU by complying with the relevant European standards for equipment in potentially explosive atmospheres.

Certification: GfG 19E01 X

Label: Ⓔx II 3G Ex nA db IIC T4 Gc -20°C≤Ta≤+55°

1.3 Special requirements for safe use

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

Caution: In potentially explosive areas, the transmitter may not be opened while powered!

Caution: Protect the transmitter from direct sunlight.

Caution: **The transmitter may only be used in areas of up to contamination degree 2.**

Caution: **In potentially explosive areas, the transmitter may only be cleaned with a damp cloth. Danger due to electrostatic charge. Observe IEC EN 60079-32.**

Caution: **The housing of the CC22ex transmitter meets the requirements for low level degree of mechanical danger according to EN 60079-0:2012, section 26.4.2 (shocks of 4 or 2 Joule) and thus may only be used in areas of the corresponding danger level, Otherwise, it has to be protected against mechanical dangers appropriately.**

2 GENERAL INFORMATION ON THE TRANSMITTER

2.1 General description

A fixed gas detection system consists of a transmitter and a controller (gas measuring and evaluation unit "GMA", not included in the scope of delivery). The transmitter and the GMA are connected via a cable. The transmitter converts the gas concentration into an electrical measurement signal which it then transmits to the controller for further evaluation. The CC22ex transmitter has a digital RS485 interface. The digital RS485 interface communicates on a Modbus (RTU) protocol.

The CC22ex transmitter does not have a display to indicate the measured value. Different states of operation are indicated by a three-colored status LED. The green LED signals that the device is ready for operation in normal measuring mode. The yellow LED signals a special condition, such as a fault or service operation. The red LED signals if the measuring range has been exceeded in measuring mode. Certain conditions are signaled in more detail by alternating flashes different colors. Overviews of these signals are found in section 4.4 "Indications and Notifications".

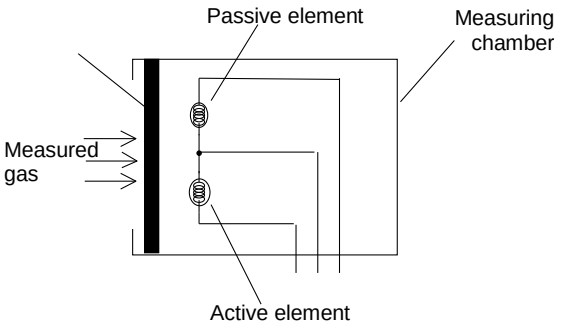
The electronics perform many tasks that facilitate operation and maintenance as well as increasing operational safety and measurement accuracy. The transmitter features:

- Compensation of temperature influences
- Permanent status display (measuring mode, fault or special condition) on the transmitter.

2.2 Measurement method

The CC22ex operates according to the catalytic combustion principle (see image below). The gas and air compound or vapor and air compound diffuses through the sinter metal into the measuring chamber. The measuring chamber contains an active and a passive sensor element. The heated active sensor burns (oxidized) the measured gas reaches the chamber on its catalyst layer. This increases the temperature of the active sensor element and thus results in a change of the electrical resistance.

Measurement method - Catalytic combustion



This change is used to determine the gas concentration and is converted into a digital Bus signal by the transmitter's integrated electronics. The passive sensor element is exposed to the same environmental conditions as the active sensor element and is used to compensate for environmental influences, such as changes in temperature.

2.3 Functional impairments due to insufficient oxygen

Consider that the measurement of gas and / or vapor concentrations within the measurement range up to 100% LEL can no longer be performed accurately, if the concentration of oxygen falls below 10 vol %. In this case, the catalytic combustion sensor would be missing the oxygen required for catalytic combustion.

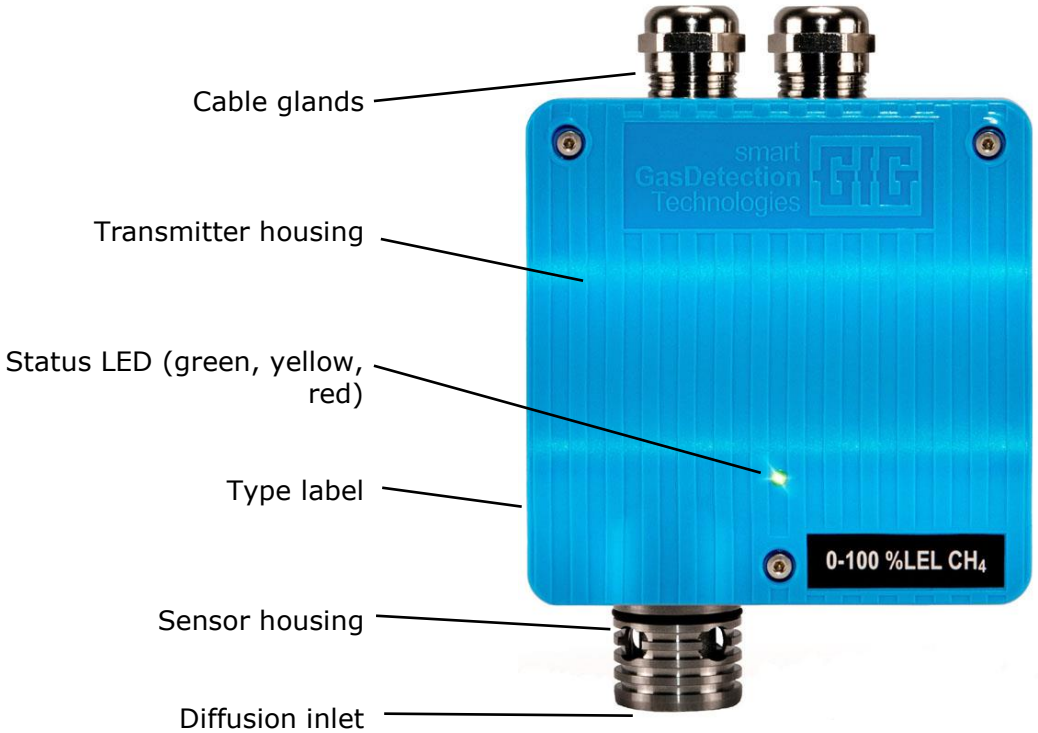
2.4 Sensor poisons falsifying the displayed information

Certain substances, called "sensor or catalyst poisons" by experts, can impair the sensor and its signaling behavior. Its "sensitivity" or ability to emit signals is reduced. Substances of this category include compounds of sulfur, lead and silicone. Pay special attention to any interfering gases which can cause irreversible damage of the das detection system being present at the measuring point. Depending on the type of substance, its concentration and the exposure time, these substances might cause faults ranging from more or less steady, long-term degradation to a sudden decline of the sensitivity.

2.5 Transmission behavior

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

2.6 Device design



The transmitter housing contains the transmitter electronics which register the measured signal of the gas sensor located in the sensor housing. The electronics convert the measuring signal into a gas concentration which is then signaled via a RS485 Bus signal using the Modbus RTU protocol.

3 MOUNTING AND INSTALLATION INSTRUCTIONS

3.1 Mounting location

It is important to know about the environmental conditions in detail and take them into account when choosing a suitable mounting location. Ventilation conditions must be taken into account to achieve representative measurement results.

The transmitter has to be installed in a way that ensures gases can reach the sensor, even in less favorable ventilation conditions. If necessary, you will have to test this using smoke vials etc.

Another factor in choosing the best mounting location is accessibility: the transmitter must always be accessible for service and calibration work.

Also consider the following external influences:

- Rainwater, water surges, dripping water, condensate
- The dust concentration in the ambient air

The transmitter is generally protected against the ingress of water and dust. In very harsh conditions, the transmitter can be protected from damages with accessories that were specifically designed for this purpose. GfG will gladly inform you about suitable measures.

If the sensor is exposed to environmental conditions that have not been made known to GfG at the time of planning or delivery, the warranty may be voided.

Only the transmitter may be installed within potentially explosive areas. The controller and the mains supply must be installed outside of it.

3.2 Mounting

When choosing the mounting location, consider that the transmitter must always be accessible for service and calibration work. The transmitter must be mounted vertically, with the sensor pointing down.
The transmitter must be connected to the controller according to the connection diagram (*see connections and terminal assignment*). To mount the transmitter, remove the three Allen screws and then the housing cover. The housing is attached with three screws. The housing contains the printed circuit board. The connection terminals used to connect the transmitter to the controller are located in the upper area of the printed circuit board.

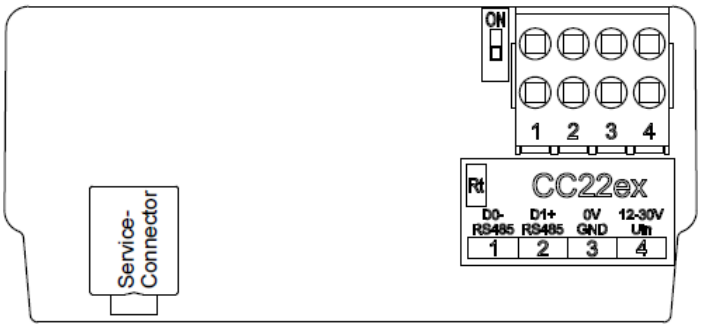
3.3 Installing electrical connections

Only trained specialists may lay the cables and carry out the connection of the electrical installation. They must comply with the relevant regulations. The wire cross-section depends on the length of the connecting cable. You will have to check whether the operating voltage is sufficient to supply even the last transmitters on the transmitter bus, for each individual situation. If necessary, the power supply will have to be amplified with an additional voltage source. The length of the cable should not exceed 1200 m. After the installation process is completed, the housing cover must be closed and screwed back on. You need to properly seal and tighten all cable inlets after connecting the cables.

Connection diagram:

Terminals for cable connections
1: RS485 D0– (Data–)
2: RS485 D1+ (Data+)
3: GND 0V
4: Uin 12-30VDC (24VDC)

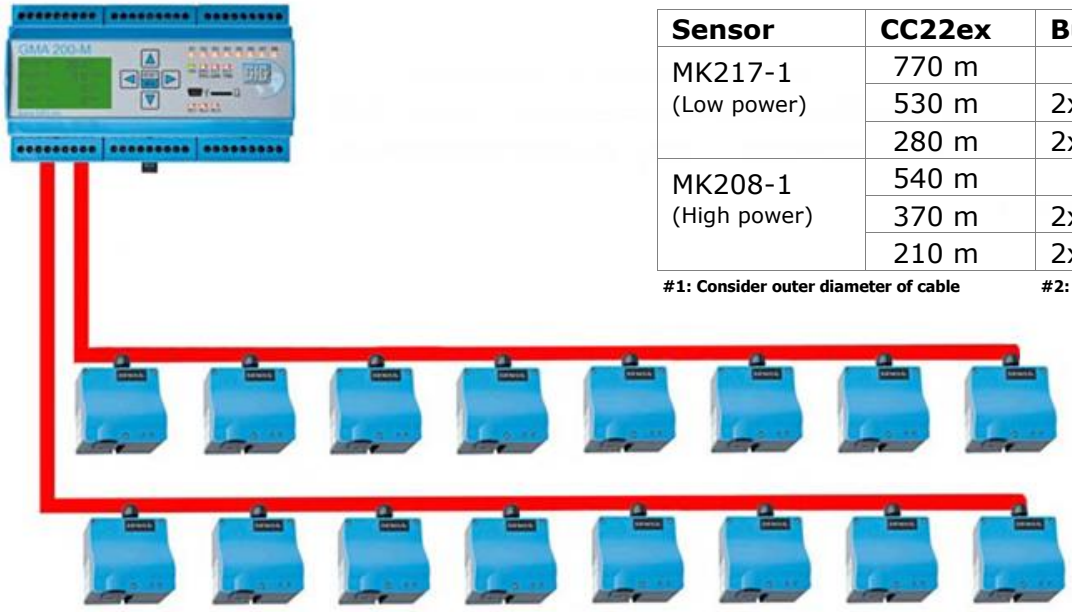
Slide switch S1 (Rt)
Terminating resistor for RS485
(Factory setting = OFF)



Caution: The transmitter may not be openend in potentially explosive areas while powered!

For digital data transmission via RS485, the bus cabling depends on several factors. These include the bus's structure (string or ring), the number of transmitters on the bus, the distance of each transmitter to the GMA, the transmitter type / version, the sensor type and, of course, the bus cable type.

The following example shows the maximum cable lengths for the installation of 8 CC22ex with a distance of 10m at the end of the bus cable strand.



Sensor	CC22ex	Bus cable
MK217-1 (Low power)	770 m	4x1.5mm² **#1**
	530 m	2x2x1.0mm²
	280 m	2x2x0.5mm² **#2**
MK208-1 (High power)	540 m	4x1.5mm² **#1**
	370 m	2x2x1.0mm²
	210 m	2x2x0.5mm² **#2**

#1: Consider outer diameter of cable **#2:** (2x2x0.5mm² = 2x2x0.8mm)

4 OPERATING INSTRUCTIONS

4.1 Commissioning

The CC22ex transmitter's functionality is tested before dispatch. Calibration and adjustment are performed using appropriate test or calibration gases. But deviations may occur due to transport, mounting and environmental factors.
This is why the gas detection system must be commissioned and tested or proper functioning by a trained person.

After activating the transmitter, it may need 1-2 minutes to:

- perform a self-test of the program memory and RAM
- read and evaluate the device parameters, including a simultaneous memory check
- Read and evaluate the sensor parameters, including a simultaneous memory check
- stabilize the sensors

Memory tests are performed during the first few seconds of the starting phase. On the connected controller, e.g. GMA200, "Startup" is displayed instead.

The CC22ex's status LED will indicate the starting phase by alternatively flashing green and yellow. If the device encounters an error in the starting phase, it will switch to fault mode. This is indicated by the status LED flashing yellow and red in alternation (see section 4.4.2 "Indication of special conditions (commissioning and errors)".)

After completing the starting phase and stabilizing the sensor, the transmitter automatically switches to measuring mode.

Note:
You can start commissioning the transmitter after the starting phase has been completed. It includes checking and - if necessary - adjusting the zero point (ZERO) and the sensitivity (SPAN).

4.2 Measuring mode

In standard, fault-free operating conditions, the status LED will be lit green. The functionality of the electronics is monitored by continuous tests of the sensor, processor and memory. Gas concentration is measured continuously and updated by the second.

4.2.1 Measurements exceeding the measuring range

If the measuring range is exceeded in the range of 100 % to 112 %, the status LED will indicate this by alternatively flashing green and red. During this, the green LED will light up for four seconds and then be be interrupted by the by the red LED lighting up for one second.

Should the value exceed the measuring range more significantly (more than 112% of the measuring range), the alternating green/red status LED will also indicate this: in this case, the green LED will only be lit for one second before being interrupted for four seconds by the red one.

If the measuring range is exceeded this severely, the CC22ex's catalytic combustion sensor will be deenergized for safety reasons, due to the risk of explosion and the fact that the measured signal would decrease in higher concentrations (ambiguity). The RS485 bus output however would continue to give out a measured value of 112.5% of the measuring range. This condition is maintained - and the red status LED will thus continue to periodically light up for four seconds - until it is acknowledged.

This status may only be terminated by briefly pressing the AutoCal magnetic contact when you have ensured that no combustible gas is left at the transmitter.

To activate this contact, a suitable magnet has to be briefly pressed against the location on the transmitter's cover marked by the red arrow.

4.2.2 Values falling below the measuring range

If the measured values fall short of the measuring range within a range of 0 % to -5 %, the status LED will not indicate this. It will continue to glow green, just like in normal operation.

If the measured values fall short of the measuring range within the range of -5 % to -7.5 %, the status LED will indicate this by alternatively flashing green and yellow. During this, the green LED will be lit for four seconds and then be interrupted for one second by the yellow LED.

If the measured value falls short of the measuring range by more than -7.5 %, the status LED will also indicate this by alternatively flashing green and yellow. In this case, however, the green LED will only be lit for one second before being interrupted for four seconds by the yellow LED. The evaluation unit (e.g. the controller) will then be alerted to the transmitter error via the RS485 bus outlet.

4.2.3 Sensor service life

Catalytic combustion sensors have a limited service life. The expected service life of the sensors used in the CC22ex is approximately five years, depending on the operation conditions. When the limit of the expected service life is reached, the transmitter will use the status LED to signal that the sensor should be replaced during the next planned maintenance. The LED, which is permanently lit green during normal operation, will be interrupted by a short yellow pulse every five seconds. This influences neither the measurement nor the remaining service life of the sensor.

4.2.4 LED test

An LED test is performed automatically upon starting the transmitter or activating the magnetic switch. During this test, all colors of the status LED will be activated consecutively.

4.3 Calibration and adjustment

4.3.1 Zero point calibration

Fresh air (with no interfering gas components) can be used as a zero gas to calibrate (check) or adjust (set) the zero point. In contaminated atmospheres, you can also use synthetic air.

Calibration (check):

A calibration adapter has to be attached to the sensor housing. Using the calibration adapter, the zero gas can then be supplied to the sensor without pressure at a flow rate of approx. 0.5 $^{l}/_{min.}$

Since the transmitter itself does not have a display, the measured value can only be read at the display of the evaluation device. If the measured value deviates from zero, the transmitter should be adjusted. This can be done in two ways, as explained below.

4.3.2 Zero point adjustment with the AutoCal Magnetic Contact [ZERO]

The easiest way of performing the zero point adjustment is to use the AutoCal magnetic contact. To activate this contact, a suitable magnet has to be pressed against the location on the transmitter's cover marked by the red arrow. The contact must be engaged for at least five seconds to activate the adjustment.

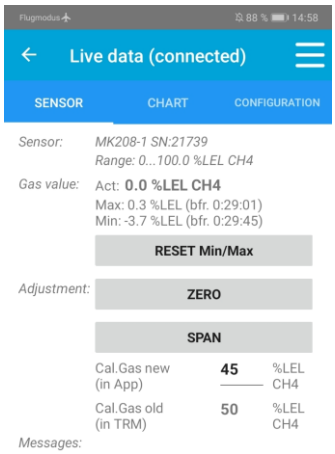
During this 1st phase (seconds 0 - 5), the green status LED will be flashing with 1Hz and be lit 50 % of the time. If the contact is released within the 1st phase (which is too soon), no adjustment is performed and the transmitter continues operating as before.

After the first five seconds, the 1Hz flashing will change to very short (10 %) bouts of lighting up the green LED for another five seconds. To start the zero point adjustment, the contact must be released in the 2nd phase (seconds 5 - 10). The adjustment process is then indicated by the status LED flashing yellow. If the measured value stays constant for a specified amount of time, the new zero point is adopted and the measured value is set to 0.0 LEL. A successful adjustment is indicated by the green LED flashing rapidly - a failed adjustment on the other hand by the yellow LED flashing rapidly. The adjustment process is then completed automatically.

If the contact was engaged for more than 10 seconds, the AutoCal sensitivity adjustment could be started during the 3rd phase (seconds 10 - 15), but it would fail as there is no test gas available. If the contact was engaged for more than 15 seconds, no adjustment would be performed and the transmitter would continue operating as before.

4.3.3 Zero point adjustment with the GfG app via IrDA interface

To perform the zero point adjustment, you will need an android smartphone with the GfG app, a TRM22-IrDA interface and a corresponding USB cable.



When the data connection is established, the current measured gas value is displayed in the app under "Gas value - Act:"

The zero point adjustment can be started with the ZERO button, if the measured gas value is not more than 25 % of the measurement range. The zero gas concentration will always be 0 ppm.

"Messages:" will give you information on the progress of the adjustment process, any problems or the successful completion of the adjustment.

If the measured value stays constant for a specified amount of time, the new zero point is adopted.

4.3.4 Sensitivity adjustment

Since most combustible gases and vapors also have toxic properties, there may be special behavior guidelines that must be adhered to, depending on the type of test gas. More information on this can be found on the corresponding safety data sheets.

To calibrate (check) or adjust the gas sensitivity, attach a calibration adapter to the sensor housing. Using the calibration adapter, the test or calibration gas can then be supplied to the sensor without pressure at a flow rate of approx. 0.5 $^{l}/_{min.}$.

Since the transmitter itself does not have a display, the measured value can only be read at the display of the controller. If the measured value deviates from the calibration gas concentration, you need to perform a sensitivity calibration.

Adjusting the measured gas value:
Check and – if necessary – adjust the zero point before every sensitivity adjustment. The sensitivity can be adjusted in different ways, which are explained below.

4.3.5 Sensitivity adjustment with the AutoCal Magnetic Contact [SPAN]

If you know the test gas concentration set on the transmitter and have a test gas with this concentration at your disposal, the easiest way to carry out a sensitivity adjustment is to use the AutoCal magnetic contact. To activate this contact, a suitable magnet has to be pressed against the location on the transmitter's cover marked by the red arrow. The contact must be engaged for at least five seconds to activate the adjustment.

During this 1st phase (seconds 0 - 5), the green status LED will be flashing with 1Hz and be lit 50 % of the time. If the contact is released within the 1st phase, no adjustment is performed and the transmitter continues operating as before.

After the 1st phase, the 1Hz flashing will change to very short (10 %) bouts of lighting up the green LED for another five seconds. If the contact was released during this phase, it would start the zero point adjustment.

To start the sensitivity adjustment however, the contact must be released during the 3rd phase (seconds 10 – 15). During this phase, the 1Hz flashing of the green LED will be considerably longer (90 %). The adjustment process is then indicated by the status LED flashing yellow. If the measured value stays constant during a defined time period, the sensitivity is adjusted. The

measured value will then reflect the set test gas concentration. A successful adjustment is indicated by the green LED flashing rapidly - a failed adjustment on the other hand with the yellow LED flashing rapidly. The test gas must now be removed. The adjustment process is then completed automatically.

If the contact is engaged for more than 15 seconds, no adjustment will take place and the transmitter continues operating as before.

4.3.6 Sensitivity adjustment with the GfG app via IrDA interface

To perform the sensitivity adjustment, you will need an android smartphone with the GfG app, a TRM22-IrDA interface and a corresponding USB cable.

When the data connection is established, the current measured gas value is displayed in the app, in "Gas value - Act:"

The test gas concentration set in the app is displayed under "Cal. gas new (in app)". This is also where the test gas concentration can be adjusted. "Cal. Gas old (in TRM)" will display the test gas concentration that was used for the last sensitivity adjustment.

You can now start the sensitivity adjustment by pressing the "SPAN" button. The test gas then has to reach the sensor.

If the measured gas value is at least 7 % of the measuring range and a stable measuring value has been recorded over a defined period of time, the sensitivity is then adjusted and the new measured value is displayed.

"Messages:" will give you information on the progress of the adjustment process, any problems or the successful completion of the adjustment.

4.3.7 Remote calibration and adjustment

If the CC22ex is connected to a GMA via the RS485 interface, and the GMA is capable of remote calibration (e.g. GMA22-M, firmware V1.10 and up), the zero point and sensitivity can also be adjusted on the GMA (after the test gas has been inserted). You will have to set the test gas concentration (Cal. gas) and start the calibration mode on the GMA before inserting the test gas. A full remote calibration consists of the following three phases.

During the first phase, the yellow LED will pulse once every 5 seconds. You can now insert the zero gas. The CC22ex will then try to reach a stable minimum zero gas signal.

In the second phase, the CC22ex has reached a stable minimum zero gas signal.
With a slight delay, the yellow LED will also pulse two times every five seconds. You can now insert the test gas and the CC22ex will try to reach a stable maximum test gas signal.

In the third phase, the CC22ex has reached a stable maximum test gas signal.
With a slight delay, the yellow LED will also pulse two times every five seconds. You can then remove the test gas.

You can subsequently use the GMA to display the recorded minimum and maximum values, and adjust the zero point and gas sensitivity according to the set test gas concentrations.

4.4 Indications and notifications

4.4.1 Overview of all status LED states

The following table will give you an overview of the status LED's different states and their meanings.

green LED	yellow LED	red LED	Description see section...	
off	ON for 3 s	off	Indication of special conditions	No. 001
off	off	ON for 0.5 s	Indication of special conditions	No. 002
flashing with 1Hz	flashing with 1Hz	off	Indication of special conditions	No. 003, 004
1 pulse every 5 s	ON	off	Indication of special conditions	No. 101
off	ON	1-5 pulses every 5 s	Indication of special conditions	No. 102 to 114
flashing with 1Hz	off	off	Indications in service mode	No. 201 to 203
off	flashing with 1Hz	off	Indications in service mode	No. 204, 205
flashing with 10Hz	off	off	Indications in service mode	No. 206
off	flashing with 10Hz	off	Indications in service mode	No. 207
ON for 1 s	off	ON for 4 s	Indications in measuring mode	No. 301, 302
ON for 4 s	off	ON for 1 s	Indications in measuring mode	No. 303
ON	off	off	Indications in measuring mode	No. 304 to 305
ON for 4 s	ON for 1 s	off	Indications in measuring mode	No. 306
ON for 1 s	ON for 4 s	off	Indications in measuring mode	No. 307, 308
ON	pulses every 5 s	off	Indications in measuring mode	No. 309 to 312

4.4.2 Indication of special conditions (commissioning and errors)

The following table describes all conditions indicated by the status LED either being constantly lit yellow or alternating between yellow and another color.

Behavior during start of the device:

No.	green LED	yellow LED	red LED	Cause	Note / Explanation
001	off	ON for **3 s**	off	Program and memory test during the first few seconds after starting the device	Automatic transition to initialization phase after approximately 4 seconds
002	off	off	ON for **0.5 s**	Test of the red LED	
003	**flashes** alternating with 1 Hz	**flashes** alternating with 1 Hz	off	Transmitter's initialization phase	Automatic transition into sensor stabilization phase after approximately 3 seconds
004	**flashes** alternating with 1 Hz	**flashes** alternating with 1 Hz	off	Sensor warm-up phase	automatic transition to measuring mode when timer reaches zero

Behavior in case of malfunctions:

No.	green LED	yellow LED	red LED	Cause	Note / Explanation
101	**1 pulse** /5 s (alternating)	**ON**	off	The sensor is no longer reacting to gas properly. It might be too old.	Sensor must be replaced
102	off	**ON**	**1 pulse** /5 s (alternating)	The transmitter's supply voltage is either too low or too high.	Check and readjust voltage supply
103	off	**ON**	**2 pulses** /5 s (alternating)	Temperature measurement is likely incorrect.	
104	off	**ON**	**2 pulses** /5 s (alternating)	An error was detected at the analog / digital converter.	
105	off	**ON**	**3 pulses** /5 s (alternating)	Heating voltage for the sensor is either too high or too low.	
106	off	**ON**	**3 pulses** /5 s (alternating)	Heating resistance of the sensor is either too high or too low.	Wrong sensor type or sensor was connected incorrectly
107	off	**ON**	**3 pulses** /5 s (alternating)	Heating voltage for sensor is incorrect.	Sensor might have been connected incorrectly.
108	off	**ON**	**4 pulses** /5 s (alternating)	The memory test detected an error concerning the program memory.	Restart transmitter. If the error persists, you will need to update the firmware.
109	off	**ON**	**4 pulses** /5 s (alternating)	The memory test detected an error concerning the RAM.	Restart device. If the error occurs again, a firmware update is necessary.
110	off	**ON**	**4 pulses** /5 s (alternating)	Fault in parameter memory or when trying to access the extern. Parameter memory.	

111	off	**ON**	**4 pulses** /5 s (alternating)	A logical error has been detected during program processing.	
112	off	**ON**	**5 pulses** /5 s (alternating)	A hardware malfunction has been detected when testing the external watchdog.	Restart device. If the error occurs again, a firmware update is necessary.
113	off	**ON**	**5 pulses** /5 s (alternating)	A wrong circuit board or circuit board error has been detected.	
114	off	**ON**	**5 pulses** /5 s (alternating)	A hardware malfunction has been detected in the digital potentiometer.	

The CC22ex can access more detailed information than can be displayed with the multi-colored LED status bar via the IrDA interface on the GfG app.

4.4.3 Indications in service mode and during sensor adjustment

The following table describes all conditions indicated by the Status LED either being constantly lit yellow or alternating between yellow and another color.

No.	green LED	yellow LED	red LED	Cause	Note / Explanation
201	**flashes** 5x with 50% on	off	off	Preparation AutoCal	
202	**flashes** 5x with 10% on	off	off	Preparation Zero point adjustment	
203	**flashes** 5x with 90% on	off	off	Preparation Sensitivity calibration	
204	off	**flashes** with 1Hz	off	Zero point adjustment has been activated	AutoCal adjustment of the zero point
205	off	**flashes** with 1Hz	off	Sensitivity calibration has been activated	AutoCal adjustment of the sensitivity
206	**flashes** 5 s with 10 Hz	off	off	Adjustment has been successful	
207	off	**flashes** 5s with 10Hz	off	Adjustment has not been successful	

4.4.4 Indications in measuring mode

The following table describes all conditions indicated by the status LED either being constantly lit green or alternating between green and another color.

No.	green LED	yellow LED	red LED	Cause	Note / Explanation
301	ON **1s** (alternating)	off	ON for **4 s** (alternating)	The gas concentration has exceeded the measuring range of the transmitter electronics. **Ambiguity!**	Caution: Explosion hazard! For preventative measures see p. 8. **Latching alarm.**
302	ON **1s** (alternating)	off	ON **for 4 s** (alternating)	The gas concentration has exceeded the measuring range considerably (Gas≥112.5%MR). **Ambiguity!**	Caution: Explosion hazard! For preventative measures see p. 8. **Latching alarm.**
303	ON **for 4 s** (alternating)	off	ON **1s** (alternating)	The gas concentration has exceeded the measuring range (100 to 112 % MR)	Caution: Explosion hazard!
304	**ON**	off	off	Error free measuring mode	
305	**ON**	off	off	Measured values falling short of the measuring range (-5.0 to 0.0 % MR)	
306	ON **for 4 s** (alternating)	ON **1s** (alternating)	off	The gas concentration falls short of the measuring range (-7.5 to -5.0 % MR)	A zero point adjustment is recommended
307	ON **1s** (alternating)	ON **for 4 s** (alternating)	off	Values falling below the measuring range (below -7.5%MR)	Zero point must be adjusted
308	ON **1s** (alternating)	ON **for 4 s** (alternating)	off	The measured signal has fallen below the measuring range of the transmitter electronics.	Zero point adjustment and sensitivity check are necessary
309	**ON**	**1 pulse** /5 s (alternating)	off	Expected operating life of the sensor has been exceeded.	Replace or calibrate the sensor
310	**ON**	**1 pulse** /5 s (alternating)	off	Remote calibration has been started, looking for stable minimum zero gas signal.	Zero gas can be inserted.

311	**ON**	**2 pulses** /5 s (alternating)	off	Stable minimum zero gas signal for remote calibration has been found.	Test gas can be inserted. Zero point adjustment can be performed on the GMA.
312	**ON**	**3 pulses** /5 s (alternating)	off	A stable maximum test signal for remote calibration has been found.	Test gas can be removed. The zero point and sensitivity can now be adjusted on the GMA.

Using the IrDA interface and the GfG app, the CC22ex can access more detailed information than those indicated by the multicolored status LEDs.

4.4.5 Priority of indications and notifications during measuring mode

Higher priority notifications will always be displayed over lower priority ones. The lower priority statuses are not reset.

Priority	Status	Description see section...
	Measured values exceed threshold considerably **(Ambiguity)**	Indications in measuring mode No. 301, 302
	Measured values exceed measuring range slightly	Indications in measuring mode No. 303
	Measurements fall below the measuring range	Indications in measuring mode No. 305 to 308
	Sensor replacement	Indications in measuring mode No. 309

Notifications of sensor error no. 101 and transmitter disruptions no. 102 to 114 will entirely suspend the measurement and their corresponding notifications.

4.5 Fault, cause, remedy

Fault	Cause	Remedy
Status LED is not lit	No supply voltage	Check power supply and cable connection
No bus communication	Line is disrupted or has been connected incorrectly	Check connection and reestablish or correct it
	Wrong bus address or wrong baud rate	Correct settings
Zero point cannot be set anymore	Sensor is defective	Replace sensor
Sensitivity cannot be set anymore	Sensor is defective	Replace sensor

5 ANNEX

5.1 Cleaning and care

External contaminations of the transmitter's 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 any repairs of the gas detection system. In Germany, this is regulated by the "DGUV Information 213-057 (Explanatory leaflet T 023 / previously BGI 518, section 9)"

5.2.1 Visual inspection

A visual inspection should be carried out regularly, at least once a month, and should include the following:

- Checking the status display
- Checking for mechanical damages and external contaminations

5.2.2 Function check

Function checks can be carried out in intervals that depend on the monitored gas hazard. These intervals may not exceed four months. In Germany, this maximum inspection interval is determined by the T 023 regulations of the Social Accident Insurance Institution BG RCI.

It includes the following:

- Visually inspecting the device according to section 5.2.1 of this instruction manual
- Checking and evaluating the displayed measured values for zero gas and test gas
- Triggering the alarm thresholds
- Triggering the test functions of display elements and acoustic signals without triggering the switching functions
- Checking saved notifications, errors and maintenance requests

5.2.3 System check (proof test)

A system check must be carried out at regular intervals. These intervals may not exceed one year. It includes the following:

- Performing a function control test according to section5.2.2 of this instruction manual
- Checking all safety functions. This includes triggering the switching functions.
- Checking the parameter settings via a target / actual comparison
- Checking the reporting and registration elements

5.2.4 Maintenance

Maintenance includes all repair and replacement work. Repairs may only be performed by the manufacturer or by people who have been authorized by the manufacturer (GfG – Gesellschaft für Gerätebau mbH). Only original spare parts and components that have been approved and cleared by the manufacturer may be used.

5.3 Replacing sensors

The sensor may only be replaced in potentially explosive areas if the transmitter is de-energized. To replace the sensor, you will have to remove the blue housing cover of the transmitter. Then, loosen the Allen screw on the side of the sensor's housing. You can then slide the old sensor out from the inside, using a suitable tool.

Insert the new sensor into the sensor housing from the bottom. Consider that the sensor's label has to face forward. An anti-rotation protector guides the sensor when it is inserted to ensure it reaches it is positioned correctly. Once the connector has clicked into place and lies flush, the sensor must be locked in place with the Allen screw. Lastly, the blue housing cover has to be reinstalled.

The GfG smart sensors MK208-1 and MK217-1 are equipped with a memory unit, which stores sensor data (serial number etc.), calibration data and the types of gas which can be set.

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.	Flow adapter for CC28, CC33 and CC22ex transmitters	2800202
2.	Remote calibration adapter for CC28, CC33 and CS22 adapters	2220205
3.	Wind shield	2800204
4.	MK208-1 Replacement sensor for 0 to 100%LEL combustible gases and vapors	2800750
5.	MK217-1 Replacement sensor for 0 to 100%LEL H_2/CH_4/C_3H_8	2800751

5.6 Lower explosion limits (LEL) of gases and vapors

LEL values according to DIN EN 60079-20-1:2010					
4.0 vol % H_2	Hydrogen	(CAS no. 1333-74-0)	15.0 vol % NH_3	Ammonia	(CAS no. 7664-41-7)
4.4 vol % CH_4	Methane	(CAS no. 74-82-8)	10.9 vol % CO	Carbon monoxide	(CAS no. 630-08-0)
4.0 vol % C_nH_m+…	Natural gas	(CAS no. 68410-63-9)	6.0 vol % CH_4O	Methanol	(CAS no. 67-56-1)
2.4 vol % C_2H_6	Ethane	(CAS no. 74-84-0)	3.1 vol % C_2H_6O	Ethanol	(CAS no. 64-17-5)
2.3 vol % C_2H_2	Acetylene	(CAS no. 74-86-2)	2.7 vol % C_2H_6O	Dimethyl ether	(CAS no. 115-10-6)
2.3 vol % C_2H_4	Ethylene	(CAS no. 74-85-1)	3.1 vol % $C_3H_6O_2$	Methyl acetate	(CAS no. 79-20-9)
2.0 vol % C_3H_6	Propene	(CAS no. 115-07-1)	2.7 vol % $C_3H_6O_2$	Ethyl formate ETF	(CAS no. 109-94-4)
1.7 vol % C_3H_4	Propyne	(CAS no. 74-99-7)	2.5 vol % C_3H_6O	Acetone	(CAS no. 67-64-1)
1.7 vol % C_3H_8	Propane	(CAS no. 74-98-6)	2.0 vol % C_3H_8O	Isopropanol	(CAS no. 67-63-0)
1.4 vol % C_4H_{10}	Butane	(CAS no. 106-97-8)	2.0 vol % $C_4H_8O_2$	Ethyl acetate	(CAS no. 141-78-6)
1.1 vol % C_5H_{12}	Pentane	(CAS no. 109-66-0)	1.5 vol % C_4H_8O	Methyl ethyl ketone MEK	(CAS no. 78-93-3)
1.2 vol % C_6H_6	Benzene	(CAS no. 71-43-2)	1.7 vol % $C_4H_{10}O$	Diethyl ether	(CAS no. 60-29-7)
1.0 vol % C_6H_{12}	Cyclohexane	(CAS no. 110-82-7)	1.4 vol % $C_4H_{10}O$	n-Butanol	(CAS no. 71-36-3)
1.0 vol % C_6H_{14}	n-Hexane	(CAS no. 110-54-3)	1.2 vol % $C_6H_{12}O$	Methyl isobutyl ketone MIBK	(CAS no. 108-10-1)
0.85 vol % C_7H_{16}	Heptane	(CAS no. 142-82-5)	1.0 vol % C_7H_8	Toluol	(CAS no. 108-88-3)
0.80 vol % C_8H_{18}	n-Octane	(CAS no. 111-65-9)	1.0 vol % C_8H_{10}	Xylene	(CAS no. 1330-20-7)
0.70 vol % C_9H_{20}	n-Nonane	(CAS no. 111-84-2)			

5.7 Sensor specifications

MK208-1 Catalytic Combustion sensor for combustible gases and vapors

Measuring range / resolution		0 to 100 %LEL / 0.5 %LEL	or 0 to 4 vol % NH_3 / 0.05 vol % NH_3	
Adjustment time	t_{50}:	≤ 5s (CH_4), ≤ 5s (C_3H_8) ***1**	with wind shield:	≤ 8s (CH_4), ≤ 8s (C_3H_8) ***1**
	t_{90}:	≤ 9s (CH_4), ≤10s (C_3H_8) ***1**	with wind shield:	≤15s (CH_4), ≤17s (C_3H_8) ***1**
Influence of pressure 80 to 110 kPa:		max. ±3% of the measuring range or ±7% of the displayed value (ref.: 100kPa) ***3**		
Influence of humidity 5% to 90% RH:		max. ±5% of the measuring range or ±10% of the displayed value (ref.: 50% RH and 40°C) ***3**		
Influence of temperature -25 to +55°C		max. ±5% of the measuring range or ±15% of the displayed value (ref.: 20°C) ***3**		
Cross sensitivity factors		Methane – measuring range (#)***2**	Propane – measuring range ***2**	Nonane – measuring range (#)***2**
	at 50 % LEL:	2.20 vol % CH_4: **=100%**	0.85 vol % C_3H_8: **= 100%**	0.35 vol % C_9H_{20}: **= 100%**
		2.00 vol % H_2: approx. 131%	2.00 vol % H_2: approx. 160%	2.00 vol % H_2 : approx. 328%
		1.25 vol % C_3H_6O: approx. 97%	1.25 vol % C_3H_6O: approx. 111%	1.25 vol % C_3H_6O: approx. 231%
		1.15 vol % C_2H_4: approx. 96%	2.20 vol % CH_4: approx. 107%	2.20 vol % CH_4 : approx. 224%
		0.85 vol % C_3H_8: approx. 96%	1.15 vol % C_2H_4: approx. 101%	1.15 vol % C_2H_4 : approx. 213%
		1.10 vol % $C_4H_8O_2$: approx. 92%	1.10 vol % $C_4H_8O_2$: approx. 95%	0.85 vol % C_3H_8 : approx. 210%
		1.00 vol % C_3H_8O: approx. 87%	1.00 vol % C_3H_8O: approx. 93%	1.10 vol % $C_4H_8O_2$: approx. 201%
		0.85 vol % $C_4H_{10}O$: approx. 87%	0.85 vol % $C_4H_{10}O$: approx. 87%	1.00 vol % C_3H_8O: approx. 193%
		0.50 vol % C_6H_{14}: approx. 74%	0.50 vol % C_6H_{14}: approx. 69%	0.85 vol % $C_4H_{10}O$: approx. 180%
		0.55 vol % C_7H_8: approx. 72%	0.55 vol % C_7H_8: approx. 67%	0.50 vol % C_6H_{14}: approx. 143%
		0.35 vol % C_9H_{20}: approx. 57%	0.35 vol % C_9H_{20}: approx. 49%	0.55 vol % C_7H_8: approx. 132%
	at 2 vol % NH3:	2.00 vol % NH_3: approx. 57%	2.00 vol % NH_3: approx. 49%	2.00 vol % NH_3: approx. 100%
Particularities:		This sensor is not suitable for measuring hydrogen or for use in any environment containing hydrogen. While the sensor will of course react to hydrogen, it is only suitable for warning purposes for this gas. If the sensor is constantly exposed to hydrogen, an ever-increasing signal is to be expected.		
Expected operating life:		5 years		

MK217-1 Catalytic Combustion sensor for combustible gases and vapors

Measuring range / resolution		0 to 100 %LEL / 0.5 %LEL		
Adjustment time	t_{50}:	≤ 5 s (CH_4), ≤ 7 s (C_3H_8) ***1**	with wind shield:	≤ 9 s (CH_4), ≤ 9 s (C_3H_8) ***1**
	t_{90}:	≤10 s (CH_4), ≤12 s (C_3H_8) ***1**	with wind shield:	≤18 s (CH_4), ≤21 s (C_3H_8) ***1**
Influence of pressure 80 to 110 kPa:		max. ±3% of the measuring range or ±7% of the displayed value (ref.: 100kPa) ***3**		
Influence of humidity 5% to 90% RH:		max. ±5 % of the measuring range or ±15 % of the displayed value (ref. to 50 % RH and 40 °C) ***3**		
Influence of temperature-10 to +40°C:		max. ±5% of the measuring range or±15% of the displayed value (ref.: 20°C) ***3**		
Cross sensitivity factors		Methane – Measuring range(#) ***2**	Propane – measuring range ***2**	Hydrogen – measuring range (#) ***2**
	at 50%LEL:	2.20 vol % CH_4: **= 100%**	0.85 vol % C_3H_8: **= 100%**	2.00 vol % H_2: **= 100%**
		2.00 vol % H_2: approx. 115%	2.00 vol % H_2: approx. 188%	2.20 vol % CH_4: approx. 86%
		0.85 vol % C_3H_8: approx. 65%	2.20 vol % CH_4: approx. 162%	0.85 vol % C_3H_8: approx. 53%
Particularities:		If the sensor has been exposed to gas concentrations significantly higher than 100 % LEL, the zero point and the sensor's sensitivity will have to be checked when the concentration is back to regular levels.		
Expected operating life:		5 years		

Explanation:

***1:** Longer stabilization times may apply to other gases, especially nonane.

***2:** Cross sensitivities may vary from sensor to sensor and depend on the gas concentration and the age of the sensor. Other combustible gases, which are not listed here, may also cause the displayed values to be increased.

***3:** This specification applies to methane and propane.

5.8 Technical Specifications

Type designation:	**CC22ex**
Environmental conditions	
Temperature (operation):	-20 to +55°C (depending on sensor)
Temperature (storage):	-25 to +60°C (0 to +30°C recommended)
Humidity:	5 to 90 % RH (depending on sensor)
Pressure:	80 to 120kPa (depending on sensor)
Power supply	
Operating voltage:	24V DC (12-30V DC permitted)
Current consumption	
with MK217-1:	typ. 40mA at 24V; 50mA at 18V; 70mA at 12V
with MK208-1:	typ. 55mA at 24V; 70mA at 18V; 100mA at 12V
Fuse:	160mA (can be reset independently)
Sensors	
Measuring principle:	Catalytic combustion
Sample gas feed:	Diffusion
Measuring range and sample gas:	depending on sensor
Measured value processing	
Update rate:	1s
Preparation delay:	5s plus 90s stabilization time of the sensors (warm-up)
Display & control elements	
Status LED:	Three-colored: green for operation, yellow for error or service
AutoCal magnetic contacts:	For ZERO and SPAN adjustment (internal) as well as for acknowledging when the measuring range has been exceeded
Service connector	
Type:	3.5mm stereo jack socket (internal)
Digital input:	for configuration and firmware updates
Signal output	
digital:	RS485; half-duplex; 9600/19200/38400 baud; Modbus protocol, Slide switch for 120Ω terminating resistor (Rated signal voltage <20V DC)
Connecting cable	
Cable glands:	2 pcs. M16x1.5 (for 4-8mm diameter cables)
Connecting terminals:	4 double terminals (0.08 to 2.5 mm^2 conductor cross-section)
Cable:	4-wire, e.g. control cable LiYCY or LiYY 4x 0.5 to 1.0 to (1.5) mm^2 or bus cable Y(St)Y 2x2x1.0 mm^2 or 2x2x0.8 mm ***1**
Housing	
Protection class:	IP65 according to IEC 60529
Material:	PC plastic
Dimensions:	103 x 147 x 52mm (WxHxD) with sensor
Weight:	298g
Certifications	
Electromagnetic Compatibility:	DIN EN 50270:2015 Interference emission: Type class I Interference resistance: Type class II
Ignition protection type:	Ⓔx II 3G Ex nA db IIC T4 Gc -20°C≤Ta≤+55°C
Manufacturer's declaration:	Certificate GfG 19E01 X

***1:** The Y(St)Y 2x2x0.8 Bus cable is only suitable for supplying several Bus transmitters at once over very short distances. The potential range depends on the number and position of the transmitters connected to the bus cable. For more information, refer to section 3.3

EU Declaration of Conformity

CC22ex

Issued: 05.09.2019 Revised:

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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 transmitter **CC22ex** complies with directive **2014/34/EU** (ATEX) for devices and protective systems for proper use in potentially explosive atmospheres, 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.

For electrical explosion protection	Certificate number GfG 19E01 X
Labelling	⟨Ex⟩ II 3G Ex nA db IIC T4 Gc

The directive 2014/34/EU is complied considering the following standards:

- General requirements	EN 60079-0	: 2012 +A11: 2013
- Flameproof enclosure "d"	EN 60079-1	: 2014
- Type of protection "n"	EN 60079-15	: 2010

The assessment of the ignition hazard was carried out, documented and filed under our responsibility. In the manufacturer's declaration [certificate number GfG19E01 X], Gesellschaft für Gerätebau mbH confirms the conformity with the above-mentioned directive.

The European standard contains the requirement for the class of construction, the inspection and the labelling of electric appliances of the group II in which the type of protection "n" will be used in areas of the zone 2, where are probably no explodable atmospheres out of gas, steam or fog or - if it is an explodable area - probably rare or just for a short time. Devices like this are rated at a operation coincidental with the operation parameter that are fixed by the manufacturer that secures a normal protection level.

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
Emitted interference	Type class 1	
Interference immunity	Type class 2	

The EMC test laboratory EM TEST GmbH at Kamen has tested and certified the electromagnetic compatibility.

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

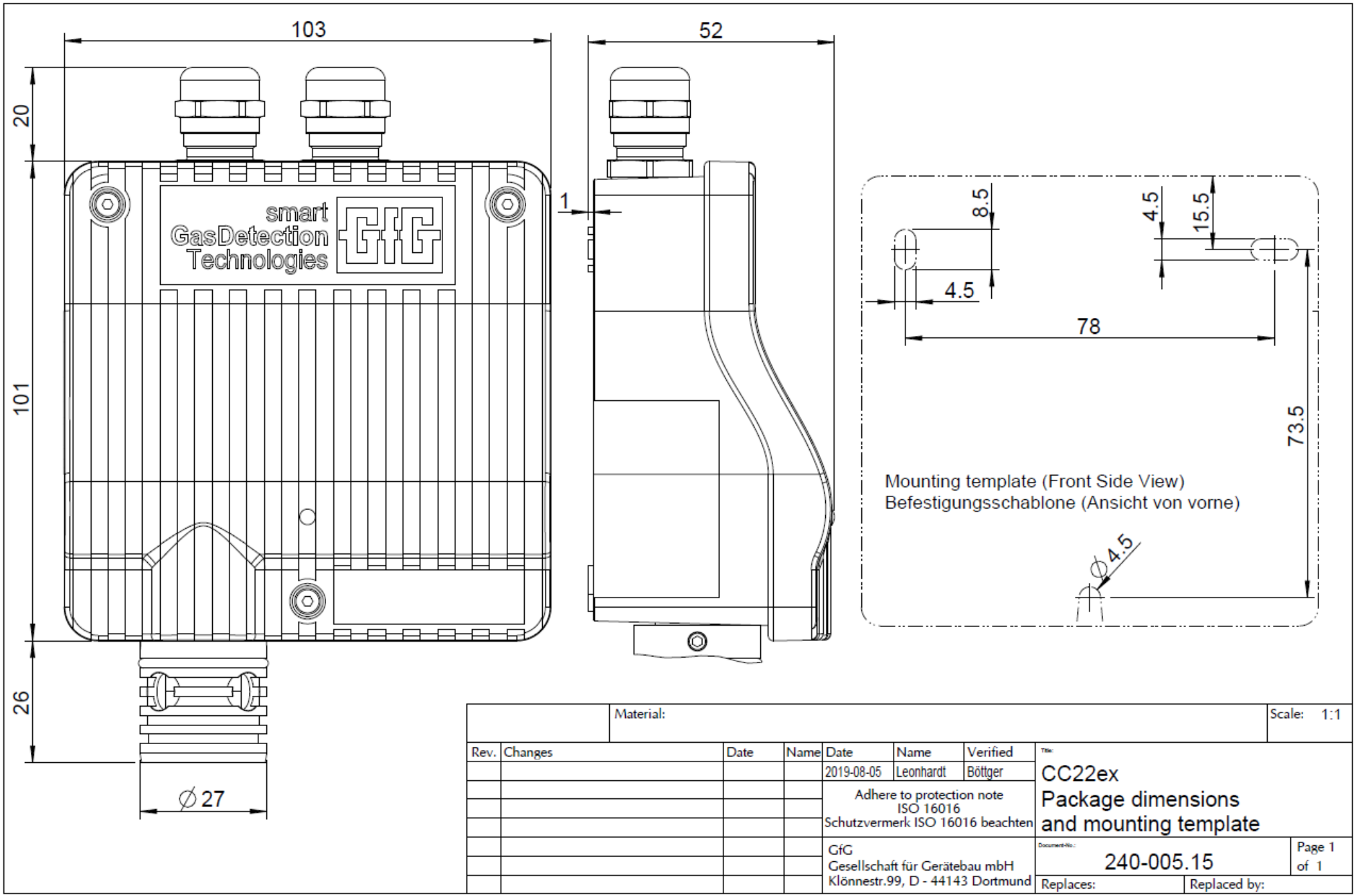
- Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances	EN 50581	: 2012

Dortmund, 05 September 2019

i.V. B. .....

B. Siebrecht
QMB

ATEX-EU-Konf.2019siebrecht



	Material:						Scale: 1:1
Rev.	Changes	Date	Name	Date	Name	Verified	Title: CC22ex Package dimensions and mounting template
				2019-08-05	Leonhardt	Böttger	
				Adhere to protection note ISO 16016 Schutzvermerk ISO 16016 beachten			
				GfG Gesellschaft für Gerätebau mbH Klönnestr.99, D - 44143 Dortmund			Document-No.: 240-005.15 Page 1 of 1
							Replaces: Replaced by: