User Manual

CC22

Transmitter for the measurement of
combustible gases and vapours

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1. INTRODUCTION

1.1 For Your Safety

In accordance with the law pertaining to the provision of products on the market (German Product Safety Act - "ProdSG"), these operating instructions refer to the proper use of the product and serve to ensure personal safety and health. They must be read and observed by all persons who utilise, use, maintain, service and check this product. This product is only able to perform the tasks for which it is intended if it is utilised, used, maintained, serviced and checked in accordance with the information provided by GfG Gesellschaft für Gerätebau.
The warranty assumed by GfG shall become void if it is not utilised, used, maintained, serviced and checked in accordance with the information provided by GfG. The aforementioned does not alter the warranty and liability information contained in the GfG terms of sale and delivery.

1.2 Operating information

In accordance with the national rules, gas warning equipment must be tested in terms of its function by a qualified person following installation but prior to commencing measurement operations (initial commissioning). In Germany, "DGUV Information 213-056 (Data Sheet T 021 / previously BGI 836 Section 8.1)" and "DGUV Information 213-057 (Data Sheet T 023 / previously BGI 518 Section 8.1)" apply here (* "DGUV" = German Social Accident Insurance, "BGI" = German Trade Association Information).

The function and display of the transmitter were tested prior to delivery. The calibration and adjustment was implemented using the respective testing or calibration gases.
This does not absolve from the responsibility of performing a calibration or, where necessary, an adjustment following installation.

The CC22 transmitter is **not** approved for use in potentially explosive atmospheres.

ATTENTION
The supply voltage may exceed 30 V DC.
This also applies for voltage peaks.

2. GENERAL TRANSMITTER INFORMATION

2.1 General description

A stationary gas warning system consists of a transmitter and a gas measurement and analysis unit (GMA, not included in the scope of delivery). The transmitter and GMA are connected via a remote measuring cable. The transmitter converts the gas concentration into an electric measurement signal and sends it to the analysis unit for further processing.

The CC22 transmitter can be optionally equipped with an additional graphic display complete with operating buttons and an acoustic transducer. The display has a "green" background lighting in measurement mode. The display colour changes to "red" in the event of a fault or alarm in order to provide a visual warning. A horn is also integrated in the display version in order to provide an acoustic alarm.

Each transmitter belonging to the 22 range is equipped with two status LEDs that indicate the operating mode of the device. A "green" LED to indicate readiness for operation and a "yellow" LED in order to display a fault or special state.
The transmitters belonging to the 22 range can be either equipped with an analogue current interface or a digital RS485 interface. The current interface can issue the measurement information with 4-20mA as standard or can, alternatively issue it with 0.2-1mA. The communication of the digital RS485 interface takes place using the Modbus (RTU) protocol.

The electronics assume many tasks which, on one hand, make the operation and servicing easier and, on the other hand, significantly increase measurement accuracy. The transmitter is characterised by:

- Concentration display (on display version)
- Settings at the push of a button without the need to open the housing (on display version)
- Compensation of temperature influences
- Permanent status display (measurement mode, fault or special state) on the transmitter

2.2 Measurement procedure

The CC22 works according to the heat tone principle (see figure). The gas-air mixture or the vapour-air mixture diffuses through the sintered material and into the measurement chamber. An active and passive sensor element are located in the measurement chamber room. The heated active sensor incinerates (oxidises) the incoming measurement gas on to its catalyst layer. As a result, the sensor temperature rises and causes a change to the electrical resistance. This resistance change is the measure for the gas concentration. The passive sensor element is exposed to the same ambient conditions as the active sensor element and is used to compensate for the ambient influences (e.g. temperature changes).

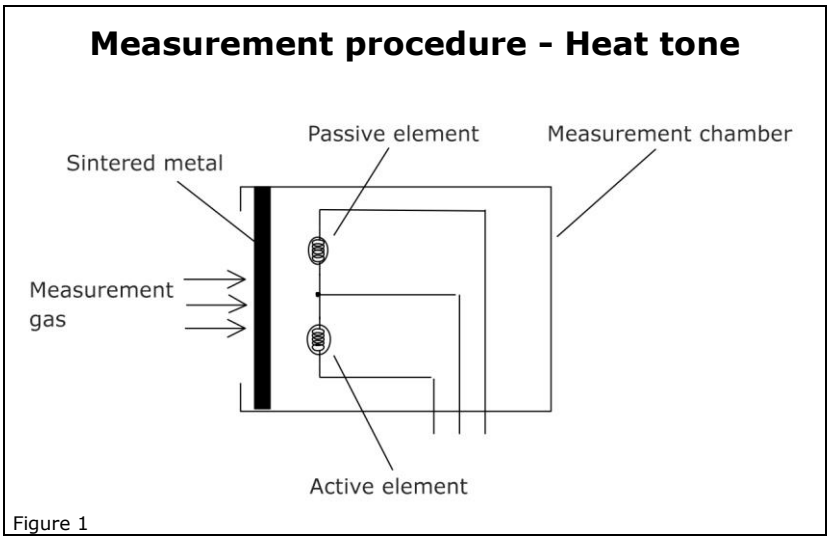


Figure 1

2.3 Functional limitation in the event of insufficient oxygen

It must be observed that the measurement of gas and/or vapour concentrations in the measurement range up to 100% LEL cannot be implemented accurately if the oxygen concentration is below 10 Vol.%. The oxygen necessary for the "catalytic combustion" is not available to the heat tone sensor.

2.4 Display falsification in the event of sensor poisons

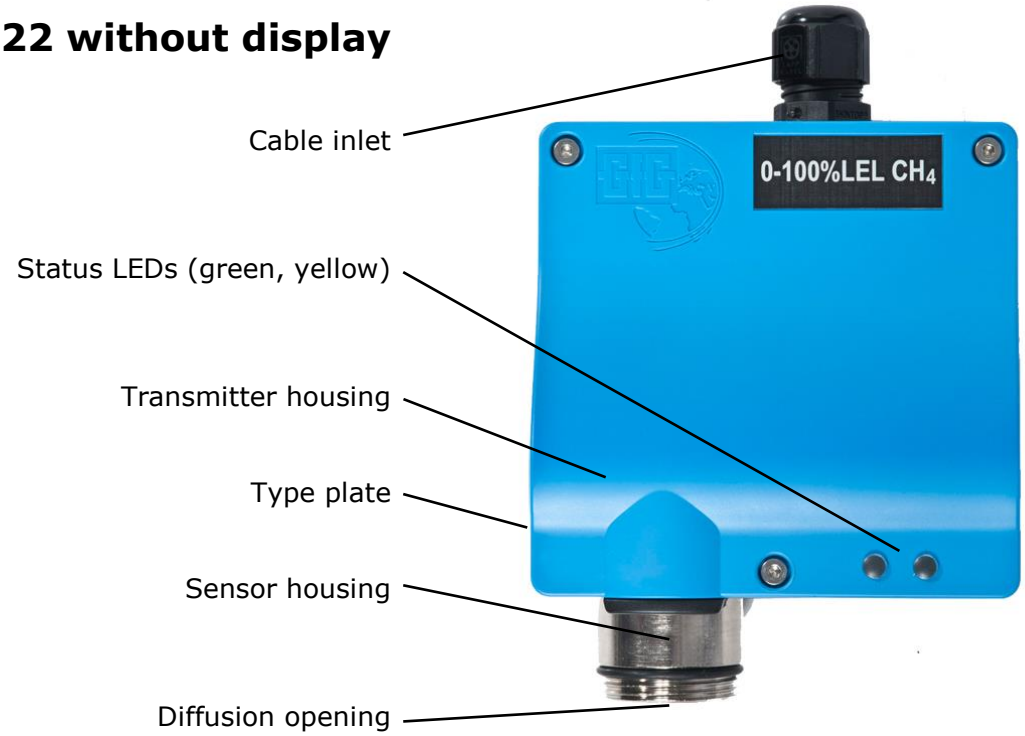
Certain substances that, in terms of technical vocabulary, are referred to a "sensor or catalyst poisons" can impair the sensor with regard to its signal behaviour. The "sensitivity", i.e., the ability of the sensor to emit signals, decreases. Substances of this type included sulphur, lead and silicon compounds. Special attention must to be given to disturbing gases that may be present at the measurement location that irreversibly impair the function of the gas warning equipment. Depending upon the type, concentration and exposure time, such substances can cause faults that range from a more-or-less constant, long-term reduction to a sudden severe decrease in sensitivity.

2.5 Transfer behaviour

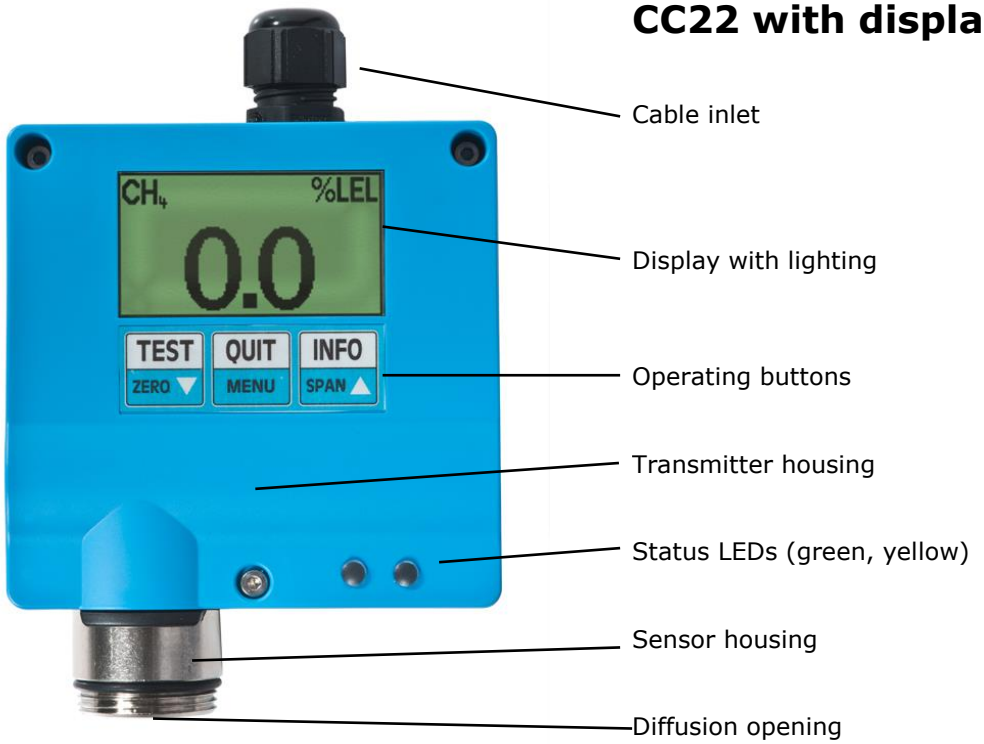
The transmitter boasts varying transfer attributes depending upon the type of measurement gas. The setting times can vary based upon the measurement gas. The gas display and the signal emission are always proportionate to the gas concentration.

2.6 Device set-up

CC22 without display



CC22 with display



The gas sensor and the transmitter electronics are installed in the transmitter housing. The electronics convert the measurement signal into a gas concentration and indicates it with an analogue current signal of 4-20mA or 0.2-1mA or with a digital RS485 bus signal in the Modbus RTU protocol. The gas concentration and the status information are displayed on the display version.

The transmitter can be adjusted with the help of a multimeter and two installed potentiometer or, when present, via the display and operating button.

3. ASSEMBLY AND INSTALLATION INFORMATION

3.1 Assembly location

When determining the assembly location, it is important to be completely familiar with the ambient conditions and to take them into account when selecting the location. The ventilation conditions must be observed in order to achieve representative measurement results.

The transmission must be installed in the room in such a manner that the gases reach the sensor, even in the event of unfavourable ventilation. If required, a measurement must take place, e.g. using a small flue tube.

When determining the assembly location, it must also be taken into consideration that the transmitter for service and calibration work is always freely accessible.

External influences such as those listed below must also be taken into consideration:

- Rain water, wave water, dripping water, condensate
- Dust content in the atmosphere

The transmitter is protected against the penetration of water and dust to the greatest possible extent. In the event of extremely difficult measurement conditions, special accessories are available in order to protect the transmitter against damage. GfG is happy to provide you with information regarding suitable measures.

The warranty may become void if the sensor is exposed to environmental conditions that GfG was unaware of during planning or delivery.

3.2 Assembly

When determining the assembly location, it must be taken into consideration that the transmitter for service and calibration work is always freely accessible. The installation position of the transmitter must be vertical and the sensor must point downwards.
The transmitter is connected to the analysis unit according to the connecting diagram (see *Connections and Terminal Allocation*). In order to assemble, the three Allen screws must be undone and the housing cover must be removed. The housing is fixed into place with three screws. The printed circuit board is located in the housing. The connection terminals for connection to the analysis unit are located in the upper area of the printed circuit board.

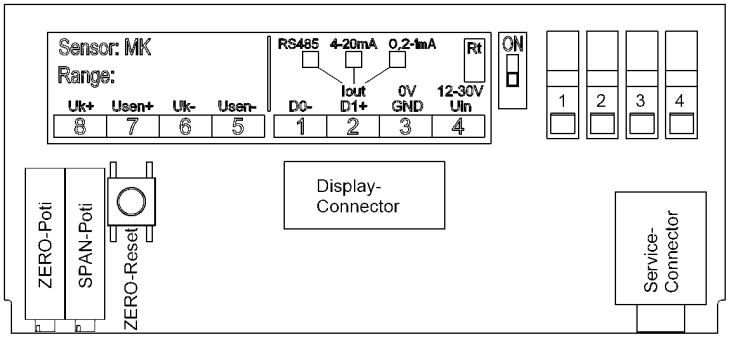
3.3 Installation of electrical connections

The laying of the cables and connection of the electrical installation may only be performed by a specialist whilst taking the relevant directives into account. The wire cross-section is based on the length of the connection line and the transmitter variant. When dealing with the bus version, it may be necessary to check here whether the operating voltage is sufficient to also be able to supply the last transmitter on the transmitter bus. If necessary, the voltage supply must be extended by an additional source of voltage.
For short distances up to 500 m, a cable with a wire cross-section of 0.75 mm² can be used for analogue data transmission. The wire cross-section must amount to 1.5 mm² for longer routes. The cable length should not exceed 1200 m.

Circuit diagram:

<u>Terminals for cable connection</u>
1: Data– D0
2: Data+ D1 / 4-20mA / 0.2-1mA
3: 0V GND
4: 24V DC (12-30V DC)

<u>Slide switch (Rt)</u>
Terminating resistor for RS485
(Factory setting = OFF)



Following installation, the housing cover must, once again, be sealed and screwed into place.

4. OPERATING INFORMATION

4.1 Commissioning

The function and display of the CC22 transmitter shall be tested prior to delivery. The adjustment is implemented using the respective testing or calibration gases. However, deviations may arise depending on the transport, assembly and ambient conditions.
Therefore, the gas warning system must be commissioned and tested in terms of its function by a qualified person.

When switched on, the transmitter requires 1-2 minutes for:

- Self-testing where the program memory and memory check are performed.
- Reading-in and analysis of the device parameters with simultaneous memory testing
- Reading-in and analysis of the sensor parameters with simultaneous memory testing
- Running-in of the sensor

The memory tests take place during the first seconds of the start-up phase.

<u>Version with analogue current interface (0.2-1mA):</u>
Directly after being switched on, the current interface displays 0.1mA and, after 4 seconds, displays 0.08mA. In doing so, the green and yellow LEDs are on.

<u>Version with analogue current interface (4-20mA):</u>
Directly after being switched on, the current interface displays 0.0mA and, after 4 seconds, displays 1.6mA. In doing so, the green and yellow LEDs are on.

<u>Version with digital Modbus interface (RS485):</u>
In the Modbus version, "Startup" can be seen on the connected analysis unit, e.g. the GMA200. For further information, also see the Modbus annex to the TRM22 operating instructions where necessary.

The information regarding the *firmware version* initially appears in the CC22 display. The measurement range, the unit of measurement, the gas type and the calibration gas concentration are then displayed. A countdown of the remaining seconds of the running-in phase can be seen in the display. The CC22 automatically switches into measurement mode following completion of the running-in phase.

The device switches to fault mode if a device error is detected during the start-up phase.

<u>Version with analogue current interface (0.2-1mA):</u>
The current interface then displays 0.06mA. An error message is shown in the display (see display of special conditions and functional faults).
The yellow fault LED is permanently illuminated.

<u>Version with analogue current interface (4-20mA):</u>
The current interface displays 1.2mA. An error message is shown in the display (see display of special conditions and functional faults).
The yellow fault LED is permanently illuminated.

<u>Version with digital Modbus interface (RS485):</u>
In the Modbus version, an error message is shown in the transmitter and/or GMA display (see display of special conditions and functional faults).

The yellow fault LED is permanently illuminated.

Note:
Following the running-in phase, the initial commissioning of the transmitter requires an examination and, where necessary, an adjustment of the zero point (ZERO) and, subsequently, also the sensitivity (SPAN).

4.2 Measurement mode

The green operating LED is permanently on and the yellow fault LED is off when the measurement mode is operating flawlessly. In measurement mode, the digital display shows the gas concentration currently being detected. The measurement of the gas concentration takes place constantly and is refreshed every second. The functionality of the electronics is constantly monitored by various tests such as sensor, processor and memory tests.

In normal measurement mode, a bar chart regarding the current gas concentration complete with set measurement range is shown in the transmitter display. Furthermore, the gas unit and gas type are briefly displayed every minute.

4.2.1 Measurement range undershoot

Measurement values below the zero point are shown as a numerical value complete with a negative sign. In the event of a measurement value undershoot of 0…-5% of the measurement range, the measurement value continues to be shown in the transmitter display or on the analysis unit (e.g. GMA200).

In the event of an measurement value undershoot of -5…-7.5%, the arrows ↓↓↓ are shown alternatively with the measurement value in the display.

If the measurement signal undershoots the measurement range of -7.5%, the arrows ↓↓↓ are permanently shown in the display.

Transmitter with analogue current interface 0.2-1mA:
In accordance with the measurement value, the current interface displays a signal within the 0.14...0.2mA range.

Transmitter with analogue current interface 4-20mA:
In accordance with the measurement value, the current interface displays a signal within the 2.8...4.0mA range.

Transmitter with digital Modbus interface (RS485):
In the Modbus version, the respective measurement value is shown in the transmitter and/or GMA display (see display of special conditions and functional faults).

4.2.2 Measurement range transgression

A transgression of the measurement range between 100% and 112% of the measurement range is shown in the display with arrows ↑↑↑ alternating with the measurement value.

Transmitter with analogue current interface 0.2-1mA:
In accordance with the measurement value, the current interface displays a signal within the 1.0...1.1mA range.

Transmitter with analogue current interface 4-20mA:
In accordance with the measurement value, the current interface displays a signal within the 20...22mA range.

Transmitter with digital Modbus interface (RS485):
In the Modbus version, the respective measurement value alternating with ↑↑↑ is shown in the transmitter and/or GMA display (see display of special conditions and functional faults).

An even clearer transgression of more than 112% of the measurement range is shown in the display via permanent arrows ↑↑↑ and a rapidly-flashing yellow status LED.

Transmitter with analogue current interface 0.2-1mA:
The current interface displays 1.1mA.

Transmitter with analogue current interface 4-20mA:
The current interface displays 22mA.

Transmitter with digital Modbus interface (RS485):
In the Modbus version, ↑ ↑ ↑ is permanently shown in the transmitter and/or GMA display (see display of special conditions and functional faults).

In the event of this clear measurement range transgression, the CC22 heat tone sensor is disconnected from the mains for safety reasons as, on one hand, there is a risk of explosion and, on the other hand, the measurement signal would become ever-smaller in the event of higher concentrations (ambiguity). The arrows in the transmitter display and the rapid flashing of the yellow status LED remain in place until this state is acknowledged.

Only once it has been ensured that combustible gas is no longer present on the transmitter may this state be rectified by pressing the middle button QUIT / MENU and confirmation of the subsequent question "Fresh air on sensor?" with [YES]. The transmitter cover must be removed and the ZERO reset button must be pressed when dealing with transmitters without a display.

4.2.3 Operating buttons

Calibrations and settings can be performed via the menu by using the operating buttons of the transmitter.

4.2.4 Display, LED and horn test [TEST]

In measurement mode, a display and LED test can be performed on transmitters with a display by briefly pressing the TEST / ZERO ▼ button. In doing so, all LEDs are triggered, all segments of the display are illustrated and all status LEDs as well as an acoustic signal tone are triggered.

4.2.5 Display of operating parameters [INFO]

Whilst in operating mode, the following important operating parameters can be automatically displayed in succession by briefly pressing the INFO / SPAN ▲ button.

- Measurement gas
- Unit of measurement
- Measurement range
- Calibration / test gas concentration

These displays also appear in the device start-up phase.

4.2.6 Sensor service life

Heat tone sensors have a limited service life. Depending upon the operating conditions, the expected service life of the sensors deployed in the CC22 amounts to approx. 5 years. Once the expected service life has been reached, the transmitter displays that the sensor should be replaced during the next service. A respective message then appears in the red display and the yellow fault LED briefly flashes every 5 seconds. This has no impact on the measurement mode and the remaining service life of the sensor.

4.3 Calibration and adjustment

4.3.1 Zero point calibration

Uncontaminated fresh air (without interfering components) can be used when calibrating (checking) or adjusting (setting) the zero point. However, in the event of a contaminated atmosphere, synthetic air can also be used.

Calibration (check):
In this case, a calibration adapter must be screwed on to the sensor housing. Via the calibration adapter, the zero gas can then be supplied to the sensor in a pressure-free manner with a throughput of 0.5 $^{l}/_{min}$. The deviation can be re-adjusted if, whilst doing so, the display value deviates from zero.

Adjustment of the display:

Depending on the transmitter version, the adjustment of the zero point can be implemented in different ways. These options are described below.

4.3.2 Zero point adjustment with display and keyboard [ZERO]

In order to be able to implement the zero point adjustment, a switch into service code query mode must be carried out by means of an extended press of the TEST / ZERO ▼ button (>3 seconds). The "ZERO adjustment" program is activated following entry of the "0011" standard service code (factory setting). This is indicated by the flashing of the yellow status LED and, when dealing with transmitters with an analogue interface (4-20mA or 0.2-1mA), by means of an output signal of 2.4mA or 0.12mA.

The current gas measurement value (actual) and the set zero gas concentration is shown in the display. If the gas measurement value no longer amounts to 10% of the measurement range, the zero point adjustment can be started by pressing the left button [Start]. If the current gas measurement value remains constant during the defined time interval, the new zero point is assumed and displayed. By pressing the button on the right, the "ZERO adjustment" program can be concluded once again and the switch into measurement mode can take place.

If it was not possible to perform the zero point adjustment because the current gas measurement value amounted to more than 10% of the measurement range as a result of a severe drift, it is also possible to adjust the zero point using the extended "0055" service code (factory setting), even in the event of a deviation of up to 25% of the measurement range. However, this can only be performed by trained service staff. In doing so, it must be ensured that the sensor is located in fresh air free from measurement gas or that the sensor is supplied with zero gas.

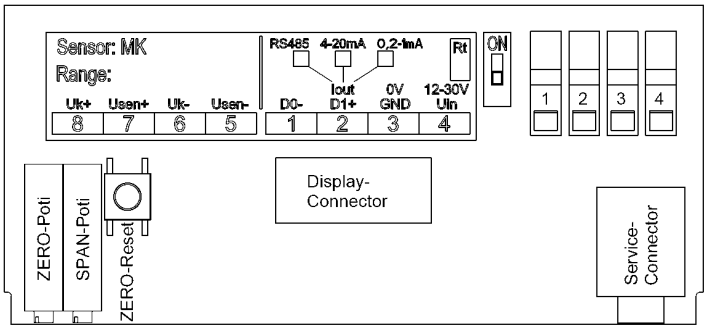
4.3.3 Zero point adjustment with the ZERO reset button

When dealing with transmitters without a display, the easiest method to perform the zero point adjustment is to use the ZERO reset button. The transmitter cover must be removed in order to press this button. The button must be pressed for 3 seconds in order to start the adjustment procedure. The adjustment procedure is indicated by the flashing of the yellow status LED and a current output signal of 2.0mA (or 0.1mA). If the measurement value remains constant during the defined time interval, the new zero point is assumed. The adjustment process is then automatically ended.

Note:

Whilst waiting for a constant measurement value, the adjustment procedure can be shortened by pressing the ZERO reset button for an extended period of time. The hardware then immediately commences with the zero point adjustment.

If the current measurement value is outside of the permissible thresholds, the transmitter switches back into measurement mode without implementing the adjustment.



4.3.4 Zero point adjustment with the ZERO poti

When dealing with transmitters without a display, the zero point adjustment can be implemented on the ZERO poti with the aid of a small screwdriver, a multimeter and a test cable with service plug (see "Accessories and spare parts" section) provided that the transmitter cover is open. The test cable must be inserted into the voltage measuring sockets belonging to the multimeter and the service plug must be inserted into the service connector belonging to the transmitter. (also see note)

Provided that no rotation is performed on the ZERO poti, it is possible to read a voltage value of 0.2-1V DC on the multimeter that proportionately corresponds to the current gas measurement value in the 0-100% range of the measurement value.

As soon as a rotation is performed on the ZERO poti, the target value for the zero point adjustment can be read on the multimeter. This is indicated via the flashing of the yellow status LED. It must be rotated until a voltage value of 0.200V is displayed. The transmitter commences with the zero point adjustment as soon as this target value remains unchanged for an extended

period of time. The yellow status LED is extinguished as soon as the adjustment procedure is completed.

The zero point adjustment with the ZERO poti can be implemented for display values up to 25% of the measurement range. If the transmitter jumps back to the original (non-calibrated) measurement value following the adjustment procedure despite the correct feeding of the calibration gas, it may be the case that it was not possible to successfully implement the adjustment due to a transgression of the tolerable signal thresholds or an increase signal noise. This can be an indication that the sensor is defective and should be replaced as quickly as possible.

Note:
If no test cable with service plug is available, the output current (Iout) can alternatively be measured directly between Terminal 2 and Terminal 3 (GND) on transmitters with an analogue display (4-20mA or 0.2-1mA). Nothing may be connected to Terminal 2 besides the multimeter during this current measurement.

4.3.5 Sensitivity calibration

As the majority of combustible gases and vapours also have toxic characteristics, particular methods of behaviour must be ensured depending on the used test gas. Information regarding this matter can be found in the appropriate safety data sheets.

A calibration adapter shall be screwed on to the sensor housing in order to calibrate (check) or adjust the gas sensitivity. The test or calibration gas (fresh air or synthetic air when dealing with an oxygen sensor) is supplied to the sensor in a pressure-free manner at a volume flow of approx. 0.5 $^{l}/_{min.}$ via the calibration adapter.

The display value is observed on the display. A sensitivity adjustment is required if the display value deviates from the calibration gas concentration.

Adjustment of the display:
The zero point should be checked and, where necessary, re-adjusted prior to each sensitivity adjustment. Depending on the transmitter version, the adjustment of the sensitivity can take place in different ways. Both options are described below.

4.3.6 Sensitivity adjustment with display and keyboard [SPAN]

In order to be able to implement the sensitivity adjustment, a switch into service code query mode must be carried out by means of an extended press of the INFO / SPAN ▲ button (>3 seconds). The "SPAN adjustment" program is activated following entry of the "0011" standard service code (factory setting). This is indicated by the flashing of the yellow status LED and, when dealing with transmitters with an analogue interface (4-20mA or 0.2-1mA), by means of an output signal of 2.4mA or 0.12mA.

The current gas measurement value (actual) and the set test gas concentration is shown in the display. After pressing the middle button [Gas], the test gas concentration can be changed with the left or right button and it can be saved by pressing the middle button.

If the gas measurement value amounts to at least 7% of the measurement range, the sensitivity adjustment can be started by pressing the left button [Start]. As soon as a stable measurement value is recorded within a defined time interval, the sensitivity is adjusted and the new measurement value is displayed. By pressing the button on the right, the "SPAN adjustment" program can be concluded once again and the switch into measurement mode can consequently take place.

4.3.7 Sensitivity adjustment with the SPAN poti

When dealing with transmitters without a display, the sensitivity adjustment can be implemented on the SPAN poti with the aid of a small screwdriver, a multimeter and a test cable with service plug (see "Accessories and spare parts" section) provided that the transmitter cover is open. The test cable must be inserted into the voltage measuring sockets belonging to the multimeter and the service plug must be inserted into the service connector belonging to the transmitter. (also see note)

Provided that no rotation is performed on the SPAN poti, it is possible to read a voltage value of 0.2-1V DC on the multimeter that proportionately corresponds to the current gas measurement value in the 0-100% range of the measurement value.

As soon as a rotation is performed on the SPAN poti, the target value for the sensitivity adjustment can be read on the multimeter. This is indicated via the flashing of the yellow status LED. It must now be rotated until a voltage value of e.g. 0.600V (for 50% measuring range) is displayed. The transmitter commences with the sensitivity adjustment as soon as this target value remains unchanged for an extended period of time. The yellow status LED is extinguished as soon as the adjustment procedure is completed.

If the transmitter jumps back to the original (non-calibrated) measurement value following the adjustment procedure despite the correct feeding of the calibration gas, it may be the case that it was not possible to successfully implement the adjustment due to a transgression of the tolerable signal thresholds or an increase signal noise. This can be an indication that the sensor is defective and should be replaced as quickly as possible.

Note:
If no test cable with service plug is available, the output current (Iout) can alternatively be measured directly between Terminal 2 and Terminal 3 (GND) on transmitters with an analogue display (4-20mA or 0.2-1mA). Nothing may be connected to Terminal 2 besides the multimeter during this current measurement.

4.4 Main and service menu [MENU]

The middle button [MENU] must be pressed and held for at least 3 seconds in order to switch to the main menu and, from there, into the service menu. Access to the main menu is not protected by an access code.

4.4.1 Main menu

The transmitter remains in measurement mode in the main menu itself and when switching into the individual menu points. This means that the measurement value recording, processing as well as the signal emission continues to function in the background. There is an exception in the service menu and this is described in the next section.

The main menu is structured as shown below:

- Transmitter status
- Transmitter info
- Service menu
- Leave

Current system errors, errors in the measurement procedure, service needs and incidents can be retrieved in the transmitter status. Numbers contained in brackets can be found after these groups. These numbers state the quantity of the pieces of information present there.

4.4.2 Service menu

A special access code must be entered in order to access the service menu. It is "????" for the standard service menu. Further additional functions are also available in an extended service menu. The code "????" must be entered in order to access the extended service menu. The service menu will be described in a later issue of these operating instructions.

4.5 Displays and messages

4.5.1 Overview of the status LED statuses and power output signals

The various display statuses of both of the status LEDs and the power output signals complete with a reference to their meaning are listed in the following table.

Green LED	Yellow LED	Power output	For description, please see Section ...
Off	Flashes at 1Hz	0.0mA	Display of special conditions… No. 001
Off	On	0.0mA	Display of special conditions… No. 002
Off	On	1.2mA	Display of special conditions… No. 102…113
Single pulse every 5s	On	1.2mA	Display of special conditions… No. 101
Flashes at 1Hz	On	1.6mA	Display of special conditions… No. 002, 003
On	Flashes at 1Hz	2.0mA	Displays in service mode ... No. 204, 205
On	Flashes at 1Hz	2.4mA	Displays in service mode ... No. 203
On	Flashes at 1Hz	4-20mA	Displays in service mode ... No. 201, 202
On	Single pulse every 5s	2.8-22mA	Displays in measurement mode No. 309
On	On	2.8mA	Displays in measurement mode No. 307, 308
On	Off	2.8-22mA	Displays in measurement mode No. 303…306
On	Flashes at 5Hz	22mA	Displays in measurement mode No. 301, 302

4.5.2 Display of special conditions (device start-up and fault)

Statuses where the yellow fault LED is permanently lit and where the 4-20mA power output emits a signal ≤1.6mA are described in the following table.
The signals in brackets (≤0.08mA) apply for the 0.2-1mA power output.

Behaviour during device start-up:

No.	Display	Green LED	Yellow LED	Power output	Cause	Information/explanation
001	Boot V1.07 GfG CC22 Error:Flash	Off	Flashes at 1Hz	0.0mA	An error was detected in the program memory during the memory check.	Restart the transmitter. Firmware update is required if an error message is displayed again.
002	Boot V1.07 GfG CC22 Verify	Off	On	0.0mA	Program and memory tests in the first seconds of device start-up	Automatic transition to initialisation phase after approximately 4 seconds
003	V1.55 GfG CC22	Flashes at 1Hz	On	1.6mA (0.08mA)	Initialisation phase of the transmitter	Automatic transition to sensor start-up phase after approximately 3 seconds
004	Warm-up XX seconds remaining	Flashes at 1Hz	On	1.6mA (0.08mA)	Sensor start-up phase	Automatic transition into measurement mode after time has elapsed

Behaviour in the event of a fault:

No.	Display	Green LED	Yellow LED	Power output	Cause	Information/explanation
101	Sensor defective	Single pulse every 5s	On	1.2mA (0.06mA)	Sensor no longer responds correctly to gas. The sensor may be too old.	The sensor must be replaced.
102	Supply voltage incorrect	Off	On	1.2mA (0.06mA)	The transmitter supply voltage is either too low or too high.	Examine the power supply and adjust.
103	Sensor Uk incorrect	Off	On	1.2mA (0.06mA)	Heating voltage for the sensor is incorrect.	
104	Sensor Ik < MIN Sensor Ik > MAX	Off	On	1.2mA (0.06mA)	Heating current for the sensor is too low or too high	
105	Temp.signal < MIN Temp.signal > MAX	Off	On	1.2mA (0.06mA)	Temperature measurement is presumably incorrect.	
106	Watchdog error	Off	On	1.2mA (0.06mA)	A hardware error was detected during the external watchdog test.	Restart the device. Replace the device if the error message is displayed again.
107	FLASH error	Off	On	1.2mA (0.06mA)	An error was detected in the program memory during the memory check.	
108	RAM error	Off	On	1.2mA (0.06mA)	Defective memory was detected during the memory check.	

109	EEPROM error 1 EEPROM error 2 EEPROM error 2c EEPROM error 1+2 EEPROM error 1<>2	Off	On	1.2mA (0.06mA)	Error in the parameter memory or when accessing the external parameter memory module.	
110	Incorrect PCB type	Off	On	1.2mA (0.06mA)	An incorrect printer circuit board type or printed circuit board error was identified.	
111	Digipoti error	Off	On	1.2mA (0.06mA)	A hardware error was detected on the digital potentiometer.	
112	ADC error 1 ADC error 2	Off	On	1.2mA (0.06mA)	An error was detected on the analogue-to-digital converter.	
113	Program sequence error	Off	On	1.2mA (0.06mA)	A logical process error was identified during program processing.	

4.5.3 Displays in service mode and during sensor adjustment

Statuses where the green operating LED is permanently lit and where the 4-20mA power output emits a signal 2.0...2.4mA are described in the following table.
The signals in brackets (0.10...0.12mA) apply for the 0.2-1mA power output.

No.	Display	Green LED	Yellow LED	Power output	Cause	Information/explanation
201	Zero point adjustment (ZERO poti)	On	Flashes at 1Hz	4-20mA (0.2-1mA)	AutoCal program for zero point adjustment was activated with the ZERO poti	Zero gas setting takes place with the ZERO poti
202	Sensitivity adjustment (SPAN poti)	On	Flashes at 1Hz	4-20mA (0.2-1mA)	AutoCal program for sensitivity adjustment was activated with the SPAN poti	Calibration gas setting takes place with the SPAN poti
203	Menu point	On	Flashes at 1Hz	2.4mA (0.12mA)	Service menu was activated via the keyboard	Select menu point. An automatic return to measurement mode takes place if no entry is performed for a period of one minute
204	Zero point adjustment	On	Flashes at 1Hz	2.0mA (0.10mA)	Zero point adjustment was activated via the keyboard	AutoCal adjustment of the zero point
205	Sensitivity adjustment	On	Flashes at 1Hz	2.0mA (0.10mA)	Sensitivity adjustment was activated via the keyboard	AutoCal adjustment of the sensitivity

4.5.4 Displays in measurement mode

Statuses where the green operating LED is permanently lit and where the 4-20mA power output emits a signal 2.8...22mA are described in the following table.
The signals in brackets (0.14...1.1mA) apply for the 0.2-1mA power output.

No.	Display	Green LED	Yellow LED	Power output	Cause	Information/explanation
301	↑↑↑ permanent	On	Flashes at 5Hz	22mA (1.1mA)	The gas concentration has exceeded the measurement range of the transmitter electronics. **Ambiguity !!!**	Attention, danger of explosion! For measures, please see Pages 8-9. **Self-locking alarm**
302	↑↑↑ permanent	On	Flashes at 5Hz	22mA (1.1mA)	The gas concentration has significantly exceeded the measurement range (Gas≥112.5% measuring range) **Ambiguity !!!**	Attention, danger of explosion! For measures, please see Pages 8-9. **Self-locking alarm**
303	↑↑↑ Alternating with the measurement value	On	Off	20-22mA (1-1.1mA)	The gas concentration has exceeded the measurement range (100...112% measuring range)	Attention, danger of explosion!
304	Measurement value	On	Off	4-20mA (0.2-1mA)	Fault-free measurement mode	
305	Measurement value	On	Off	3.2-4mA (0.16-0.2mA)	Undershoot of the measurement range (−5.0…0.0% measuring range)	

306	Measurement value alternating with ↓↓↓	On	Off	2.8-3.2mA (0.14-0.16mA)	Undershoot of the measurement range (−7.5…-5.0% measuring range)	Zero point comparison is useful
307	Permanent ↓↓↓	On	On	2.8mA (0.14mA)	Undershoot of the measurement range (below −7.5% measuring range)	Zero point comparison is necessary
308	Permanent ↓↓↓	On	On	2.8mA (0.14mA)	Measurement signal has undershot the measurement range of the transmitter electronics	Zero point comparison is necessary and sensitivity must be checked
309	*Sensor replacement required*	On	Single pulse every 5s	2.8-22mA (0.14-1.1mA)	Expected operating time of the sensor exceeded.	Sensor replacement or adjustment required

4.5.5 Priority of displays and messages in measurement mode

The display of statuses with lower priority are overwritten by displays with higher priority. The statuses with lower priority are not reset.

Priority	Condition	For description, please see Section ...
▼	Significant measurement range transgression **(ambiguity)**	Displays in measurement mode No. 301, 302
	Slight measurement range transgression	Displays in measurement mode No. 303
	Measurement range undershoot	Displays in measurement mode No. 305…308
	Sensor replacement	Displays in measurement mode No. 309

Sensor error no.101 and transmitter fault no. 102…113 stops measurement mode with its respective messages.

4.6 Fault, cause, remedy

Fault	Cause	Remedy
Zero point can no longer be set	Sensor defective	Replace sensor
Sensitivity can no longer be set	Sensor defective	Replace sensor
Output current has dropped to 0mA	Defective fuse or electronics	Replace printed circuit board
	Line interrupted	Re-establish connection

5. ANNEX

5.1 Cleaning and care

External soiling on the transmitter housing can be removed using a cloth moistened with water. Do not use any solvents or cleaning agents.

5.2 Servicing and maintenance

The servicing and maintenance consists of a regular visual check, functional check and system control as well as the repair of the gas warning system. In Germany, "DGUV Information 213-056 (Data Sheet T 021 / previously BGI 836 Section 9)" and "DGUV Information 213-057 (Data Sheet T 023 / previously BGI 518 Section 9)" apply here (* "DGUV" = German Social Accident Insurance, "BGI" = German Trade Association Information).

5.2.1 Visual check

The visual check should take place regularly, at least once per month, and consist of the following activities:

- Check of the operating display and the status messages,
  e.g. operating display "On", alarm and fault display "Off"
- Check for mechanical damage and outer soiling

5.2.2 Functional check

The functional check can be carried out at intervals that depend on the gas hazard to be monitored. When dealing with gas warning systems, the checking frequency for explosion protection is 4 months and is 6 months for the measurement of toxic gases and oxygen in accordance with the requirements as stated in rules T 021 and T 023 from the German "BG RCI"

(professional association of raw materials and chemical industry) employer's liability insurance association.

It consists of the following activities:

- Visual check according to section 5.2.1 of this operating manual
- Check and assessment of measurement value displays
- Triggering of alarm thresholds
- Triggering of test functions for display elements as well as optical and acoustic transducer without the triggering of switch functions
- Check of stored messages, faults and service requirements

5.2.3 System check

The system check must be performed at regular intervals. The period may not exceed 1 year. It consists of the following activities:

- Functional check according to section 5.2.2 of this operating manual
- Check of all safety functions including the triggering of switch functions.
- Check of the parameterisation by means of target / actual comparison
- Check of the notification and registration equipment

5.2.4 Repair

The repair consists of all repair and replacement work. They may only be performed by the manufacturer or persons that have been authorised by the manufacturer, GfG Gesellschaft für Gerätebau mbH. Only original spare parts as well as original assemblies that have been tested and approved by the manufacturer may be used.

5.3 Sensor replacement

The transmitter cover must be removed in order to replace the sensor. When in a de-energised state, the sensor cables can then be removed from connection terminals 6...8. The printed circuit board must then be pulled out of the guide so that the old sensor can be unscrewed. The assembly of the replacement sensor takes place in reverse order. Only a sensor of the same type may be used for this purpose. Furthermore, the serial number must be entered into the service menu of the transmitter once it had been installed and commissioned.

5.4 Information regarding the environmentally-compatible disposal of old parts

In accordance with Section 11 of the general terms and conditions of GfG, the purchaser assumes responsibility to dispose of the device or device components in an environmentally-friendly manner according to Sections 11 and 12 of the German Electrical Equipment Act ("ElektroG"). On request, the proper disposal can also be carried out by GfG in Dortmund.

5.5 Accessories and spare parts

	Description	**Art. No.**
1.	Calibration adapters for CC22, ZD22, CS22, CI22 transmitters	2000209
2.	Testing cable complete with service plug for EC22, CC22, ZD22, CS22, CI22 transmitters	2220201
3.	MK91-1 Replacement sensor for 0..100%LEL combustible gases and vapours	On request
4.	MK217-2 Replacement sensor for 0..100%LEL H_2/CH_4/C_3H_8	On request

5.6 Lower explosion limits (LEL) of gases and vapours

LEL values according to DIN EN 60079-20-1:2010					
4.0Vol.% H_2	Hydrogen	(CAS no.1333-74-0)	6.0Vol.% CH_4O	Methanol	(CAS no.67-56-1)
4.4Vol.% CH_4	Methane	(CAS no.74-82-8)	3.1Vol.% C_2H_6O	Ethanol	(CAS no.64-17-5)
2.3Vol.% C_2H_2	Acetylene	(CAS no.74-86-2)	2.5Vol.% C_3H_6O	Acetone	(CAS no.67-64-1)
2.3Vol.% C_2H_4	Ethylene	(CAS no.74-85-1)	3.1Vol.% $C_3H_6O_2$	Methyl acetate	(CAS no.79-20-9)
2.4Vol.% C_2H_6	Ethane	(CAS no.74-84-0)	2.7Vol.% $C_3H_6O_2$	Ethyl formate ETF	(CAS no.109-94-4)
1.7Vol.% C_3H_8	Propane	(CAS no.74-98-6)	2.0Vol.% C_3H_8O	Isopropanol	(CAS no.67-63-0)
1.4Vol.% C_4H_{10}	Butane	(CAS no.106-97-8)	1.5Vol.% C_4H_8O	Methylethyl ketone MEK	(CAS no.78-93-3)
1.1Vol.% C_5H_{12}	Pentane	(CAS no.109-66-0)	2.0Vol.% $C_4H_8O_2$	Ethyl acetate	(CAS no.141-78-6)
1.0Vol.% C_6H_{14}	n-hexane	(CAS no.110-54-3)	1.4Vol.% $C_4H_{10}O$	n-butanol	(CAS no.71-36-3)
0.85Vol.% C_7H_{16}	Heptane	(CAS no.142-82-5)	1.2Vol.% $C_6H_{12}O$	Methyl isobutyl ketone MIBK	(CAS no.108-10-1)
0.70Vol.% C_9H_{20}	n-nonane	(CAS no.111-84-2)	1.0Vol.% C_7H_8	Toluene	(CAS no.108-88-3)

5.7 Sensor specification

MK91-1 Heat tone sensor for combustible gases and vapours

Measurement range / resolution		0...100 % LEL / 05 % LEL	or 0...4 Vol.% NH_3 / 0.05 Vol.% NH_3
Setting time	t_{50}:	≤ 5s (CH_4), ≤ 5s (C_3H_8), ***1**	with wind protection: ≤ 8s (CH_4), ≤ 8s (C_3H_8), ***1**
	t_{90}:	≤ 9s (CH_4), ≤10s (C_3H_8),***1**	with wind protection: ≤15s (CH_4), ≤17s (C_3H_8), ***1**
Pressure influence	80...110 kPa:	max. ±3% of the measurement range or ±7% of the display (in terms of 100kPaC) ***3**	
Humidity influence	5%...90% relative h	max. ±5% of the measurement range or ±10% of the display (in terms of 50% relative humidity and 40°C) ***3**	
Temperature influence	-25...+55°C:	max. ±5% of the measurement range or ±15% of the display (in terms of 20°C) ***3**	

Cross-sensitivity factors

at 50% LEL:	Methane – measurement range (#)***2.**	Propane – measurement range ***2.**	Nonane – measurement range (#)***2.**
	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%
at 2 Vol.% NH3:	0.35 Vol.% C_9H_{20}: approx. 57%	0.35 Vol.% C_9H_{20}: approx. 49%	0.55 Vol.% C_7H_8: approx. 132%
	2.00 Vol.% NH_3: approx. 57%	2.00 Vol.% NH_3: approx. 49%	2.00 Vol.% NH_3: approx. 100%

Special features:	This sensor is not suitable for the measurement of hydrogen or use in an environment containing hydrogen. Naturally, the sensor reacts to hydrogen but is only suitable for warning purposes in terms of this gas. A constantly increasing signal should be assumed in the event of continuous gas application with hydrogen.
Expected service life:	5 years

MK217-2 Heat tone sensor for combustible gases and vapours

Measurement range / resolution		0...100 % LEL / 0,5 %LEL	
Setting time	t_{50}:	≤ 5 s (CH_4), ≤ 7 s (C_3H_8), ***1**	with wind protection: ≤ 9 s (CH_4), ≤ 9 s (C_3H_8), ***1**
	t_{90}:	≤10 s (CH_4), ≤12 s (C_3H_8),***1**	with wind protection: ≤18 s (CH_4), ≤21 s (C_3H_8), ***1**
Pressure influence	80...110 kPa:	max. ±3% of the measurement range or ±7% of the display (in terms of 100kPaC) ***3**	
Humidity influence	5%...90% relative h	max. ±5% of the measurement range or ±15% of the display (in terms of 50% relative humidity and 40°C) ***3**	
Temperature influence	-10...+40°C:	max. ±5% of the measurement range or ±15% of the display (in terms of 20°C) ***3**	

Cross-sensitivity factors

at 50% LEL:	Methane – measurement range (#) ***2.**	Propane – measurement range ***2.**	Hydrogen – measurement range (#)***2**
	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%

Special features:	If the sensor is exposed to a gas concentration that was significantly above 100% LEL, the zero point and the sensitivity of the sensor must be checked once this concentration has subsided.
Expected service life:	5 years

Explanation:

Regarding *1: Longer setting times apply for other gases, especially for nonane.

Regarding *2: The cross-sensitivities can significantly vary from sensor to sensor and depend upon the gas concentration as well as the age of the sensor. Other combustible gases that are not listed also lead to a display increase.

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

5.8 Technical data

Type designation:	**CC22**
Ambient conditions	
Operating temperature:	-20..+50°C (sensor-dependent)
Storage temperature:	-25..+60°C (recommended 0...+30°C)
Humidity:	5..90% relative humidity (sensor-dependent)
Air pressure:	80…120kPa (sensor-dependent)
Power supply	
Operating voltage:	24V DC (12-30V DC permissible)
Power consumption:	typ.50mA/max.70mA @24V DC (MK217-2) typ.70mA/max.90mA @24V DC (MK91-1) typ.75mA/max.110mA @24V DC (MK91-1 on 4…20mA version)
Fuses:	250mA (not replaceable)
Sensors	
Measurement range and measurement gas:	Sensor-dependent
Measurement gas supply:	Diffusion
Display & operating elements	
Status LEDs:	Green for operation and yellow for fault or service
Display, buttons:	2.2" graphic display and 3 functional buttons (on display version)
Auto ZERO button:	For the acknowledgement of measurement range transgressions (optional)
Potentiometer:	For ZERO and SPAN adjustment (optional)
Service connector	
Design:	3.5mm stereo jack socket (internally located)
Analogue output:	0.2…1.0V according to 0…100% measuring range for sensor calibration
Digital input:	For configuration and firmware update
Signal output	
Analogue:	4…20mA (max. load: 150Ω/400Ω/650Ω @12V/18V/24V supply)
or analogue:	0.2…1mA (max. load: 4K5/9K3/14K1 @12V/18V/24V supply)
or digital:	RS485; Half-duplex; max. 38400 Baud; Modbus protocol, slide switch for 120Ω terminating resistor,
Connector cable	
Cable inlets:	1 or 2 units of M16x1.5 (for cable diameter of 4.5-10mm)
Connection terminals:	4 units (for 0.08..2.5mm^2 conductor cross-section)
Cable (analogue):	3-wire e.g. LiYY 3x0.75…1.5mm^2 or LiYCY
Cable (digital):	4-wire e.g. LiYY 4x0.75…1.5mm^2 or bus line Y(St)Y 2x2x0.8 ***1**
Housing	
Protection class:	IP54 according to IEC 60529
Material:	Plastic
Dimension:	96 x 140 x 49mm (WxHxD) with sensor
Weight:	175g or 220g (display version)
Approvals/tests	
Electromagnetic compatibility	DIN EN 50270:2006 Emitted interference: Type Class I Interference immunity: Type Class II

Explanation regarding*1: The bus line Y(St)Y 2x2x0.8 is only suitable for short cable paths for the power supply of multiple bus transmitters via the same cable. The possible distance depends on the quantity and the local distribution of the transmitters on the bus cable.

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EC- Declaration of Conformity

Transmitter

CC22

Edited: 09.02.2015 Amended:

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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** -Certificate No. BVS 03 ATEX ZQS / E 187- issued by the notified body, DEKRA EXAM GmbH, 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 ignition protection classes explosion- proof encasing, increased safety, encapsulation and intrinsic safety, as well as their measuring function.

The Transmitter **CC22** complies with **council directive 2004/108/EC** for electromagnetic compatibility.

The guidelines have been complied with under consideration of the standard mentioned below:

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

The EMC testing laboratory EM TEST GmbH, Kamen has been charged with testing and evaluation of the electromagnetic compatibility.

Always adhere to the safety notes of the operation manual 219-000.30.

Dortmund, 09.March 2015

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H.J. Hübner
President CEO

EG-Kon054.1/Siebrecht