

smart
GasDetection
Technologies



CC 22

Operations Manual



GfG Instrumentation

1194 Oak Valley Dr, Ste 20, Ann Arbor MI 48108 USA
(800) 959-0329 • (734) 769-0573 • www.gfgsafety.com/us-en

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1. INTRODUCTION

1.1 For your safety

These operating instructions refer to the proper use of the product and serve to ensure personal safety and health. They must be read and followed by all persons that utilize this product or use, maintain, service and check this product. This product is only able to perform the tasks for which it is intended when it is utilized, used, maintained, serviced and checked in accordance with the information provided by GfG Instrumentation.

The warranty assumed by GfG shall become void if it is not utilized, 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

The transmitter has been tested for proper operation and display prior to delivery. The calibration and adjustment was carried out with appropriate testing or calibration gases.

This does not absolve from the responsibility of performing a calibration or, where necessary, an adjustment following installation.

The CC 22 transmitter is **not approved for use in potentially explosive atmospheres**.



CAUTION

**The supply voltage may exceed 30 V DC.
The same applies for voltage spikes.**

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 concentration of gas into an electric measurement signal and sends it to the analysis unit for further processing.

The CC 22 transmitter can be optionally equipped with an additional graphic display complete with control buttons. The display has a "green" background lighting in measurement mode. The display color changes to "red" in the event of a fault or alarm in order to provide a visual warning.

Each of the 22 series transmitters is equipped with two status LEDs, which indicate the operating status 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 22 series transmitter can be equipped either with an analog output current interface or a digital RS485 interface. The current interface can issue the measurement

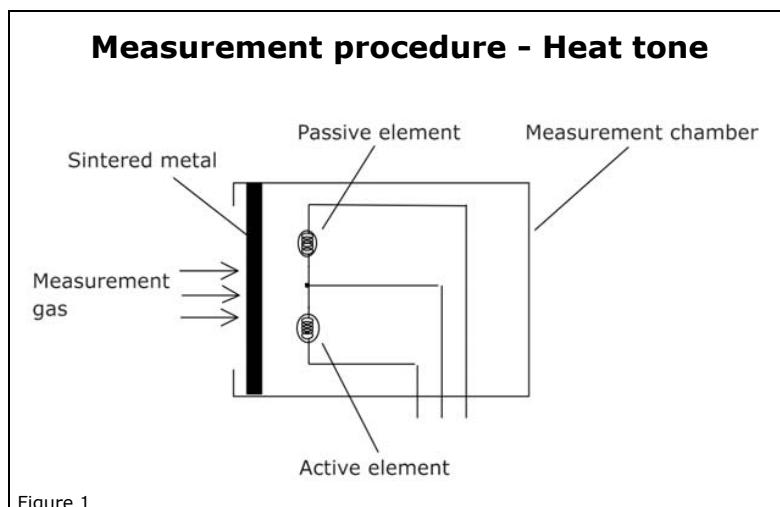
information with 4-20mA as standard or can, alternatively issue it with 0.2-1mA. The communication of the digital RS485 interface uses the Modbus (RTU) protocol.

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 characterized 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 CC 22 works according to the heat tone principle (see figure). The gas-air mixture or the vapor-air mixture diffuses through the sintered material and into the measurement chamber. An active and passive sensor element are located in the measurement chamber. The heated active sensor incinerates (oxidizes) 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).



2.3 Functional limitation in the event of insufficient oxygen

It must be observed that the measurement of gas and/or vapor 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.

2.4 Display falsification in the event of sensor poisons

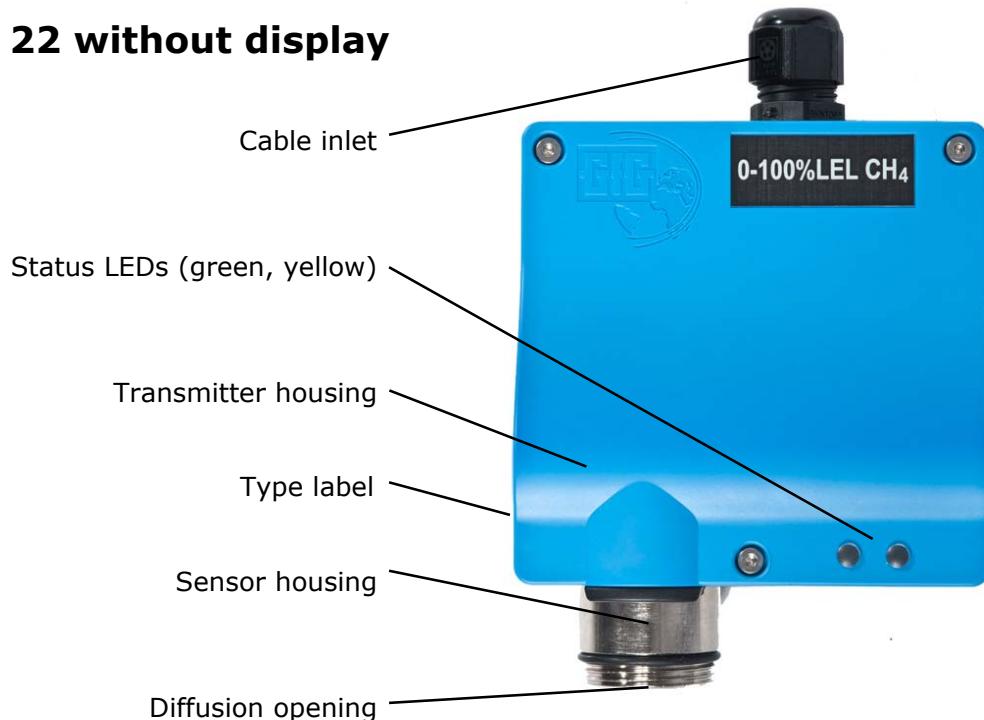
Certain substances that, in terms of technical vocabulary, are referred to as "sensor or catalyst poisons" can impair the sensor with regard to its signal behavior. The "sensitivity", i.e., the ability of the sensor to emit signals, decreases. Substances of this type include sulfur, lead and silicon compounds. Special attention must 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 Transmission response

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

2.6 Unit Design

CC 22 without display



CC 22 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

analog 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 by using a multimeter and customer test leads and two installed potentiometers or, on display version, via the display and the control button.

3. ASSEMBLY AND INSTALLATION INSTRUCTIONS

3.1 Installation location

In determining the place of installation, it is important to know the environmental conditions and to take this into account when selecting the location. To achieve representative measurement results, the ventilation conditions must be considered.

The transmitter must be installed in the room so that the gases reach the sensor, even with unfavorable ventilation. If necessary, calculations must be made, for example with smoke tubes. In determining the place of installation always ensure that the transmitter will always be freely accessible for service and calibration work.

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

- Rain water, splash water, dripping water, condensation
- The dust in the atmosphere

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

In determining the place of installation ensure that the transmitter is always freely accessible for service and calibration work. The transmitter must be positioned vertically with the sensor pointing downward.

The transmitter is connected to the analysis unit in accordance with the circuit diagram (see Installation of electrical connections). To install, release the three Allen bolts and remove the housing cover. The housing is fastened with three screws. The printed circuit board is inside the housing. The terminals for the connection to the analysis unit are on the top of the circuit board.

3.3 Installation of electrical connections

The laying of cables and connection of the electrical installation may only be carried out by a specialist taking into consideration the relevant provisions. The wire cross-section is based on the length of the connection cable and the transmitter version. When dealing with the bus version, it may be necessary to check whether the operating voltage is sufficient to also supply the last transmitter on the transmitter bus. If necessary, the power supply must be extended with an additional power source.

For analog data transmission a cable can be used with the wire diameter of 18 AWG gauge, this is suitable for short distances up to 1,640ft / 500m. For longer distances the wire cross-section has to be 16 AWG gauge. The cable length should not exceed 3,937ft / 1200m.

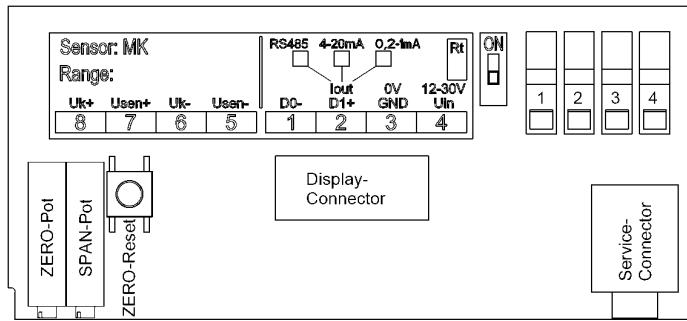
Circuit diagram:

Terminals for cable connection

- 1: Data- D0
- 2: Data+ D1 / 4-20mA / 0.2-1mA
- 3: 0V GND
- 4: 24V DC (12-30V DC)

Slide switch (Rt)

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 CC 22 transmitter has been tested for proper operation and display prior to the delivery. The adjustment is carried out with appropriate testing or calibration gases. Deviations can occur dependent on the transport, installation and environmental conditions.

Therefore, the gas detection system must be installed by a qualified person and checked for proper operation.

After switching on, the transmitter requires a 1-2 minutes for:

- the self-test, for checking the program and memory
- reading and evaluating the device parameters with concurrent memory testing
- reading and evaluating the sensor parameters with concurrent memory testing
- the stabilizing of the sensor

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

Version with analog current interface (0.2-1mA):

Directly after switching on, the current interface displays 0.1mA and after 4 seconds displays 0.08mA. In doing so, the green and yellow LEDs are on.

Version with analog current interface (4-20mA):

Directly after switching on, the current interface displays 0.0mA and after 4 seconds displays 1.6mA. In doing so, the green and yellow LEDs are on.

Version with digital Modbus interface (RS485):

In the Modbus version, "Startup" can be read on the connected analysis unit, e.g. the GMA 200. For further information, see the Modbus system for the TRM22 operating instructions.

The information regarding the firmware version initially appears in the CC 22 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 run-in phase can be seen on the display. The CC 22 automatically switches into measurement mode following completion of the run-in phase.

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

Version with analog current interface (0.2-1mA):

The current interface then displays 0.06mA. An error message appears in the display (see *Display of special conditions* section).

The yellow fault LED is permanently illuminated.

Version with analog current interface (4-20mA):

The current interface displays 1.2mA. An error message appears in the display (see *Display of special conditions* section).

The yellow fault LED is permanently illuminated.

Version with digital Modbus interface (RS485):

With the Modbus version, an error message displays on the transmitter and/or GMA display (see *Display of special conditions* section).

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 showing the current gas concentration complete with set measurement range is shown on the transmitter display. Furthermore, the gas unit and gas type are briefly displayed every minute.

4.2.1 Measurement range undershoot

Readings below the zero point are shown in the display as a number preceded with a negative sign. In the event of a measurement value underflow of 0 to -5% of the measurement range, the measurement value continues to be shown on the transmitter display or on the analysis unit (e.g. the GMA 200).

In the event of a measurement value underflow of -5 to -7.5%, the arrows ↓↓↓ are shown alternatively with the measurement value in the display.

With an underflow of the measured value below the measuring range of -7.5%, the arrows ↓↓↓ appear permanently on the display.

Transmitter with analog current interface 0.2-1mA:

In accordance with the measurement value, the current interface displays a signal within the 0.14 to 0.2mA range.

Transmitter with analog current interface 4-20mA:

In accordance with the measurement value, the current interface displays a signal within the 2.8 to 4.0mA corresponding to the reading.

Transmitter with digital Modbus interface (RS485):

In the Modbus version, the respective measurement value is shown on the transmitter and/or the GMA display (see *Display of special conditions* section).

4.2.2 Measurement range exceeded

Exceeding the measuring range between 100% and 112% of the measuring range the arrows ↑↑↑ are displayed alternating with the measured value.

Transmitter with analog current interface 0.2-1mA:

In accordance with the measurement value, the current interface displays a signal within the 1.0 to 1.1mA range.

Transmitter with analog current interface 4-20mA:

In accordance with the measurement value, the current interface displays a signal within the 20 to 22mA range.

Transmitter with digital Modbus interface (RS485):

In the Modbus version, the respective measurement value alternating with ↑↑↑ is shown on the transmitter and/or GMA display (see *Display of special conditions* section).

Exceeding by even more than 112% of the measurement range, the display shows permanent arrows ↑↑↑ and a rapidly-flashing yellow status LED.

Transmitter with analog current interface 0.2-1mA:

The current interface displays 1.1mA.

Transmitter with analog 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* section).

In the event of this clear measurement range transgression, the CC 22 heat tone sensor is disconnected from the mains for safety reasons. 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  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 (Display version only)

Calibrations and settings can be performed through the menu by using the control buttons of the transmitter.

4.2.4 Display, LED and test [TEST]

In measurement mode, a display and LED test can be performed through the menu by briefly pressing the test/zero  button. In doing so, all LEDs are triggered, all segments of the display are shown and all status LEDs as well as an audible beep are triggered.

4.2.5 Display of operating parameters [INFO]

During the operating mode, the following important operating parameters can be automatically displayed in succession by briefly pressing the  button.

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

These indicators 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 CC 22 amounts to approximately five years. Once the expected service life has been reached, the transmitter displays that the sensor should be replaced during the next service. The display illuminates red and a corresponding message is shown and the yellow fault LED briefly flashes every five 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. Through the calibration adapter, the zero gas can then be supplied to the sensor in a pressure-free manner with a flow of 0.5 l/min. If the display value deviates from zero, the deviation can be adjusted.

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   button (>3 seconds). The "ZERO adjustment" program is activated following entry of the "0011" standard service code (factory setting). This is signaled by a flashing yellow status LED and transmitters with an analog interface (4-20mA or 0.2-1mA) by an output signal of 2.4mA or 0.12mA.

The display shows the current gas reading (indicated value) and displays the adjusted zero gas concentration. If the measured gas value is no more than 10% of the measuring range, the zero point adjustment can be started with the left button [start]. If the current measured gas value remains constant during a defined interval of time, the new zero point is accepted and displayed. Using the right button, the program "ZERO adjustment" can be aborted and a change back to measuring mode can be made.

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.

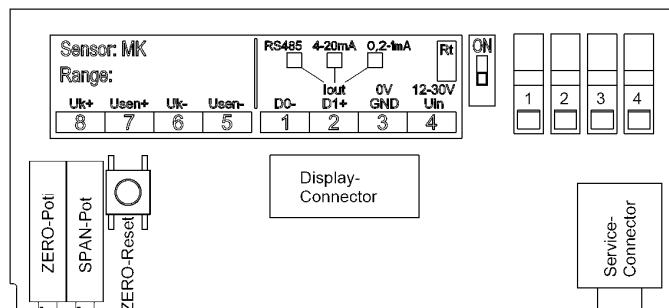
4.3.3 Zero point adjustment with the ZERO reset button

For transmitters without a display, the easiest method to perform the zero point adjustment is to press the ZERO reset button. To access this button, the transmitter cover must be removed. Afterwards, press and hold the button for 3 seconds in order to start the adjustment procedure. The adjustment procedure is signaled by a 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 finished.

Note:

While waiting for a constant measurement value, the adjustment procedure can be shortened by pressing the ZERO reset button. The hardware immediately starts the zero point adjustment.

If the current measured value is outside the permissible limit values, the transmitter switches back to measurement mode without having performed the adjustment.



4.3.4 Zero point adjustment with the ZERO potentiometer

For transmitters without a display, the zero point adjustment can be carried out when the transmitter cover is open on the ZERO pot using a small screwdriver, a multimeter and a test cable with service plug (see *Accessories and spare parts* section). The test cable must be connected to the voltage measuring jacks of the multimeter and the service plug must be inserted into the service connector of the transmitter (also see note).

As long as the ZERO pot is not turned, a voltage value is shown on the multimeter between 0.2-1V DC, this indicates the current gas measurement in the range of 0-100% of the measuring range proportional.

Once the ZERO pot is turned the setpoint can be read on the multimeter for the zero point adjustment. This is signaled by the flashing yellow status LED. It must be turned until a voltage

value of 0.200V is displayed. As long as this setpoint remains unchanged for a considerable time, the zero point adjustment is started by the transmitter. The yellow status LED goes off once the adjustment is complete.

The zero point adjustment with the ZERO potentiometer can be performed for display values up to 25% of the measuring range. If the transmitter, despite correct task of the calibration gas, jumps back to the original (unadjusted) measurement value after the adjustment, this could mean that the adjustment was not successful due to exceeding the tolerable signal limits or there was excessive signal noise. This can be a sign that the sensor is defective and should be replaced so as soon as possible.

Note:

If no test cable with service plug is available, the output current (I_{out}) can alternatively be measured directly between Terminal 2 and Terminal 3 (GND) on transmitters with an analog display (4-20mA or 0.2-1mA). Nothing may be connected to Terminal 2 except the multimeter during this current measurement. Multimeter in mA scale.

4.3.5 Sensitivity calibration



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

For calibration (checking) or adjusting the gas sensitivity, a calibration adapter has to be screwed on the sensor housing. The test or calibration gas (fresh air or synthetic air when dealing with an oxygen sensor) is supplied to the sensor without pressure at a flow rate of approx. 0.5 l/min. via the calibration adapter.

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

Adjustment of the display:

Before any adjustment of the sensitivity, the zero point should be checked and if necessary re-adjusted. The adjustment of the sensitivity can be done in different ways depending on the transmitter version. 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 button (>3 seconds). After entering the default service code "0011" (factory setting), the program "SPAN Adjustment" is activated. This is signaled by a flashing yellow status LED and transmitters with analog interface (4-20mA or 0.2-1mA) by an output signal of 2.4mA or 0.12mA.

The display shows the current gas reading (indicated value) and displays the adjusted test gas concentration (cal gas). After pressing the middle button [Gas] the test gas concentration can be changed with the left or right control buttons, and saved with the center control button.

If the measured gas value is at least 7% of the measuring range, the sensitivity adjustment can be started with the left button [Start]. Once a stable reading is detected for a defined period, the sensitivity is adjusted and the new measured value is displayed. Using the right button, the "SPAN Adjustment" program can be completed and a change back to measurement mode can be made.

4.3.7 Sensitivity adjustment with the SPAN potentiometer

For transmitters without display the sensitivity adjustment can be carried out when the transmitter cover is open via the SPAN pot using a small screwdriver, a multimeter and with a test cable with service plug (see *Accessories and spare parts* section). The test cable should be connected to the voltage measuring jacks of the multimeter and the service socket inside the service connector of the transmitter (also see note).

As long as the SPAN pot is not turned, a voltage value is shown on the multimeter between 0.2-1V DC, this indicates the current gas measurement in the range of 0-100% of the measuring range proportional.

Once the SPAN pot is turned the setpoint can be read on the multimeter for the sensitivity adjustment. This is signaled by the flashing yellow status LED. It must be turned until a voltage value of for example 0.600V (for 50% MR) is displayed. As long as this setpoint remains unchanged for a considerable time, the sensitivity adjustment is started by the transmitter. The yellow status LED goes off once the adjustment is complete.

If the transmitter, despite correct task of the calibration gas, jumps back to the original (unadjusted) measurement value after the adjustment, this could mean that the adjustment was not successful due to exceeding the tolerable signal limits or there was excessive signal noise. This can be a sign that the sensor is defective and should be replaced so as soon as possible.

Note:

If no test cable is available with service plug, the output current (I_{out}) of the transmitters with analog interface (4-20mA and 0.2-1mA) can be measured directly between terminal 2 and terminal 3 (GND). During this current measurement nothing may be connected to terminal 2 except the multimeter. Multimeter in mA scale.

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 items. This means that the measurement value recording, processing and output 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 follows:

- Transmitter Status
- Transmitter Info
- Service Menu
- Exit



Current system errors, errors in the measurement procedure, service needs and incidents can be retrieved in the transmitter status. Numbers inside parenthesis can be found after these groups. These numbers indicate the number of the existing information.

4.4.2 Service menu

To access the service menu, a special access code must be entered. The standard service menu code is supplied to trained personnel. Additional functions are available in an advanced service menu. Only GfG service personnel are permitted to access the advanced 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 states 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)

The following table shows the states with a description in which the yellow fault LED lights up and the 4-20mA current output transmits a signal $\leq 1.6mA$.

For the 0.2-1mA current output the value of the output signal is shown in parenthesis ($\leq 0.08mA$).

Behavior during device start-up:

No.	Display	Green LED	Yellow LED	Power output	Cause	Information/explanation
001	Boot V1.07 GfG CC 22 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 CC 22 Verify	Off	On	0.0mA	Program and memory tests in the first seconds of device start-up	Automatic transition to initialization phase after approximately 4 seconds
003	V1.55 GfG CC 22	Flashes at 1Hz	On	1.6mA (0.08mA)	Initialization 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

Behavior 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 U _k incorrect	Off	On	1.2mA (0.06mA)	Heating voltage for the sensor is incorrect.	
104	Sensor I _k < MIN Sensor I _k > 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 printed circuit board type or printed circuit board error was identified.	
111	Digital pot 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 analog-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 parenthesis (0.10-0.12mA) apply to the 0.2-1mA power output.

No.	Display	Green LED	Yellow LED	Power output	Cause	Information/explanation
201	Zero point adjustment (ZERO pot)	On	Flashes at 1Hz	4-20mA (0.2-1mA)	AutoCal program for zero point adjustment was activated with the ZERO pot	Zero gas setting takes place with the ZERO pot
202	Sensitivity adjustment (SPAN pot)	On	Flashes at 1Hz	4-20mA (0.2-1mA)	AutoCal program for sensitivity adjustment was activated with the SPAN pot	Calibration gas setting takes place with the SPAN pot
203	Menu item	On	Flashes at 1Hz	2.4mA (0.12mA)	Service menu was activated using the keyboard	Select the menu item. 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 using the keyboard	AutoCal adjustment of the zero point
205	Sensitivity adjustment	On	Flashes at 1Hz	2.0mA (0.10mA)	Sensitivity adjustment was activated using 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 parenthesis (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)	Underflow 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)	Underflow of the measurement range (-7.5...-5.0% measuring range)	Zero point calibration is useful
307	Permanent ↓↓	On	On	2.8mA (0.14mA)	Underflow of the measurement range (below -7.5% measuring range)	Zero point calibration is necessary
308	Permanent ↓↓	On	On	2.8mA (0.14mA)	Measurement signal has fallen below the measurement range of the transmitter electronics	Zero point calibration is necessary and sensitivity must be checked
309	<i>Sensor replacement required</i>	On	Single pulse every 5s	2.8-22mA (0.14-1.1mA)	Expected service life of the sensor is 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	Status	For description, please see Section ...
	Significant measurement range overflow (ambiguity)	Displays in measurement mode No. 301, 302
	Slight measurement range overflow	Displays in measurement mode No. 303
	Measurement range underflow	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 stop the measuring operation with their 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. APPENDIX

5.1 Cleaning and care

External soiling on the transmitter's housing can be removed with a damp cloth. Do not use any solvents or cleaning agents!

5.2 Servicing and maintenance

The servicing and maintenance includes a regular visual inspection, functional check and the system check as well as the repair of the gas warning system.

5.2.1 Visual inspection

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

- Check indicator light 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 dependent on the risk of the gas 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.

(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 must not exceed 1 year. This includes 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 parameterization through a target / actual comparison
- Check of the messaging and logging devices

5.2.4 Repair

The repair includes all repair and replacement work. They may only be performed by the manufacturer or persons that have been authorized by the manufacturer, GfG Instrumentation. 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. Once power is removed, 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 has been installed and commissioned.

5.4 Accessories and spare parts

	Description	Part. No.
1.	Calibration adapters for CC 22, ZD 22, CS 22, CI 22 transmitters	2000-209
2.	Service test cable w/service plug for CC 22 transmitters	2220201
3.	MK91-1 Replacement sensor for 0-100% LEL combustible gases and vapors	2224796
4.	MK217-2 Replacement sensor for 0-100% LEL H ₂ /CH ₄ /C ₃ H ₈	2224797

5.5 Lower explosion limits (LEL) of gases and vapors

LEL values according to DIN EN 60079-20-1:2010					
4.0Vol.% H ₂	Hydrogen	(CAS no.1333-74-0)	6.0Vol.% CH ₄ O	Methanol	(CAS no.67-56-1)
4.4Vol.% CH ₄	Methane	(CAS no.74-82-8)	3.1Vol.% C ₂ H ₆ O	Ethanol	(CAS no.64-17-5)
2.3Vol.% C ₂ H ₂	Acetylene	(CAS no.74-86-2)	2.5Vol.% C ₃ H ₆ O	Acetone	(CAS no.67-64-1)
2.3Vol.% C ₂ H ₄	Ethylene	(CAS no.74-85-1)	3.1Vol.% C ₃ H ₈ O ₂	Methyl acetate	(CAS no.79-20-9)
2.4Vol.% C ₂ H ₆	Ethane	(CAS no.74-84-0)	2.7Vol.% C ₃ H ₈ O ₂	Ethyl formate ETF	(CAS no.109-94-4)
1.7Vol.% C ₃ H ₈	Propane	(CAS no.74-98-6)	2.0Vol.% C ₃ H ₈ O	Isopropanol	(CAS no.67-63-0)
1.4Vol.% C ₄ H ₁₀	Butane	(CAS no.106-97-8)	1.5Vol.% C ₄ H ₈ O	Methylethyl ketone MEK	(CAS no.78-93-3)
1.1Vol.% C ₅ H ₁₂	Pentane	(CAS no.109-66-0)	2.0Vol.% C ₄ H ₈ O ₂	Ethyl acetate	(CAS no.141-78-6)
1.0Vol.% C ₆ H ₁₄	n-hexane	(CAS no.110-54-3)	1.4Vol.% C ₆ H ₁₀ O	n-butanol	(CAS no.71-36-3)
0.85Vol.% C ₇ H ₁₆	Heptane	(CAS no.142-82-5)	1.2Vol.% C ₆ H ₁₂ O	Methyl isobutyl ketone MIBK	(CAS no.108-10-1)
0.70Vol.% C ₉ H ₂₀	n-nonane	(CAS no.111-84-2)	1.0Vol.% C ₇ H ₈	Toluene	(CAS no.108-88-3)

5.6 Sensor specification

MK91-1 Heat tone sensor for combustible gases and vapors					
Measurement range / resolution	0...100 % LEL / 05 % LEL		or 0...4 Vol.% NH ₃ / 0.05 Vol.% NH ₃		
Setting time	t_{50} : ≤ 5 s (CH ₄), ≤ 5 s (C ₃ H ₈), *1		with wind protection: ≤ 8 s (CH ₄), ≤ 8 s (C ₃ H ₈), *1		
	t_{90} : ≤ 9 s (CH ₄), ≤ 10 s (C ₃ H ₈), *1		with wind protection: ≤ 15 s (CH ₄), ≤ 17 s (C ₃ H ₈), *1		
Pressure influence	80...110 kPa: max. $\pm 3\%$ of the measurement range or $\pm 7\%$ of the display (in terms of 100kPaC) *3				
Humidity influence	5%...90% relative h: max. $\pm 5\%$ of the measurement range or $\pm 10\%$ of the display (in terms of 50% relative humidity and 104°F/40°C) *3				
Temperature influence	-13...+131°F/-25...+55°C: max. $\pm 5\%$ of the measurement range or $\pm 15\%$ of the display (in terms of 20°C) *3				
Cross-sensitivity factors	Measurement range		Measurement range		Measurement range
at 50% LEL:	(#)*2.		*2.		(#)*2.
	2.20 Vol.% CH ₄ : = 100%		0.85 Vol.% C ₃ H ₈ : = 100%		0.35 Vol.% C ₉ H 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 ₃ H ₆ O: approx. 97%		1.25 Vol.% C ₃ H ₆ O: approx. 111%		1.25 Vol.% C ₃ H ₆ O: approx. 231%
	1.15 Vol.% C ₂ H ₄ : approx. 96%		2.20 Vol.% CH ₄ : approx. 107%		2.20 Vol.% CH ₄ : approx. 224%
	0.85 Vol.% C ₃ H ₈ : approx. 96%		1.15 Vol.% C ₂ H ₄ : approx. 101%		1.15 Vol.% C ₂ H ₄ : approx. 213%
	1.10 Vol.% C ₄ H ₈ O ₂ : approx. 92%		1.10 Vol.% C ₄ H ₈ O ₂ : approx. 95%		0.85 Vol.% C ₃ H ₈ : approx. 210%
	1.00 Vol.% C ₃ H ₈ O: approx. 87%		1.00 Vol.% C ₃ H ₈ O: approx. 93%		1.10 Vol.% C ₄ H ₈ O ₂ : approx. 201%
	0.85 Vol.% C ₄ H ₁₀ O: approx. 87%		0.85 Vol.% C ₄ H ₁₀ O: approx. 87%		1.00 Vol.% C ₃ H ₈ O: approx. 193%
	0.50 Vol.% C ₆ H ₁₄ : approx. 74%		0.50 Vol.% C ₆ H ₁₄ : approx. 69%		0.85 Vol.% C ₄ H ₁₀ O: approx. 180%
	0.55 Vol.% C ₇ H ₁₆ : approx. 72%		0.55 Vol.% C ₇ H ₈ : approx. 67%		0.50 Vol.% C ₆ H ₁₄ : approx. 143%
	0.35 Vol.% C ₉ H ₂₀ : approx. 57%		0.35 Vol.% C ₉ H ₂₀ : approx. 49%		0.55 Vol.% C ₇ H 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 vapors					
Measurement range / resolution	0...100 % LEL / 0,5 %LEL				
Setting time	t_{50} : ≤ 5 s (CH ₄), ≤ 7 s (C ₃ H ₈), *1		with wind protection: ≤ 9 s (CH ₄), ≤ 9 s (C ₃ H ₈), *1		
	t_{90} : ≤ 10 s (CH ₄), ≤ 12 s (C ₃ H ₈), *1		with wind protection: ≤ 18 s (CH ₄), ≤ 21 s (C ₃ H ₈), *1		
Pressure influence	80...110 kPa: max. $\pm 3\%$ of the measurement range or $\pm 7\%$ of the display (in terms of 100kPaC) *3				
Humidity influence	5%...90% relative h: max. $\pm 5\%$ of the measurement range or $\pm 15\%$ of the display (in terms of 50% relative humidity and 104°F/40°C) *3				
Temperature influence	+14...+104°F/-10...+40°C: max. $\pm 5\%$ of the measurement range or $\pm 15\%$ of the display (in terms of +68°F/20°C) *3				
Cross-sensitivity factors	Measurement range		Measurement range		Measurement range
at 50% LEL:	(#)*2.		*2.		(#)*2.
	2.20 Vol.% CH ₄ : = 100%		0.85 Vol.% C ₃ H 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 ₃ H ₈ : approx. 65%		2.20 Vol.% CH ₄ : approx. 162%		0.85 Vol.% C ₃ H 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.

5.7 Technical data

Type designation:	CC 22
Ambient conditions	Operating temperature: -4 to +122°F / -20..+50°C (sensor-dependent) Storage temperature: -13 to +140°F / -25..+60°C (recommended 32°...+86°F / 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) Analog output: 0.2...1.0V according to 0...100% measuring range for sensor calibration Digital input: For configuration and firmware update
Signal output	Analog: 4-20mA (max. load: 150Ω/400Ω/650Ω @12V/18V/24V supply) or analog: 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 M16x14 AWG (for cable diameter of 4.5-10mm) Connection terminals: 4 units (for 28...13 AWG conductor cross-section) Cable (analog): 3-wire e.g. LiYY 3x18...15 AWG or LiYCY Cable (digital): 4-wire e.g. LiYY 4x18...15 AWG or bus line Y(St)Y 2x2x0.8 *1
Housing	Protection class: IP54 according to IEC 60529 Material: Plastic Dimension: 3.8 x 5.5 x 2 in / 96 x 140 x 49 mm (WxHxD) with sensor Weight: 6 oz or 8 oz / 175 g or 220 g (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.

EC- Declaration of Conformity GfG Gesellschaft für Gerätebau mbH

Transmitter

CC22

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



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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.

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

H.J. Hübner
President CEO

Notes



GfG Instrumentation

1194 Oak Valley Drive, Suite 20, Ann Arbor, MI 48108 USA

1194 Oak Valley Drive, Suite 20, ANN ARBOR, MI 48108 USA
Phone: (734) 769-0573 • Toll Free (USA / Canada): (800) 955-

Website: www.goodforgas.com • info@gfg-inc.com

Worldwide Manufacturer of Gas Detection Solutions

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GfG Instrumentation

1194 Oak Valley Drive, Suite 20, Ann Arbor, MI 48108 USA

1194 Oak Valley Drive, Suite 20, Ann Arbor, MI 48108 USA
Phone: (734) 769-0573 • Toll Free (USA / Canada): (800) 95

Phone: (734) 769-0573 • Toll Free (USA / Canada): 1-800-933-1333
Website: www.goodforgas.com • info@gfg-inc.com

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1194 Oak Valley Drive, Suite 20, Ann Arbor, MI 48108 USA

1194 Oak Valley Drive, Suite 20, Ann Arbor, MI 48108 USA
Phone: (734) 769-0573 • Toll Free (USA / Canada): (800) 95

Website: www.goodforgas.com • info@gfg-inc.com

Worldwide Manufacturer of Gas Detection Solutions

GfG Instrumentation, Inc.

1194 Oak Valley Dr.
Suite 20
Ann Arbor, MI 48108
USA

US/Canada: (800) 959-0329
US/Canada Fax: (734) 769-1888
International: +1 734 769 0573
International Fax: +1 734 769 1888
Website: www.gfgsafety.com/us-en