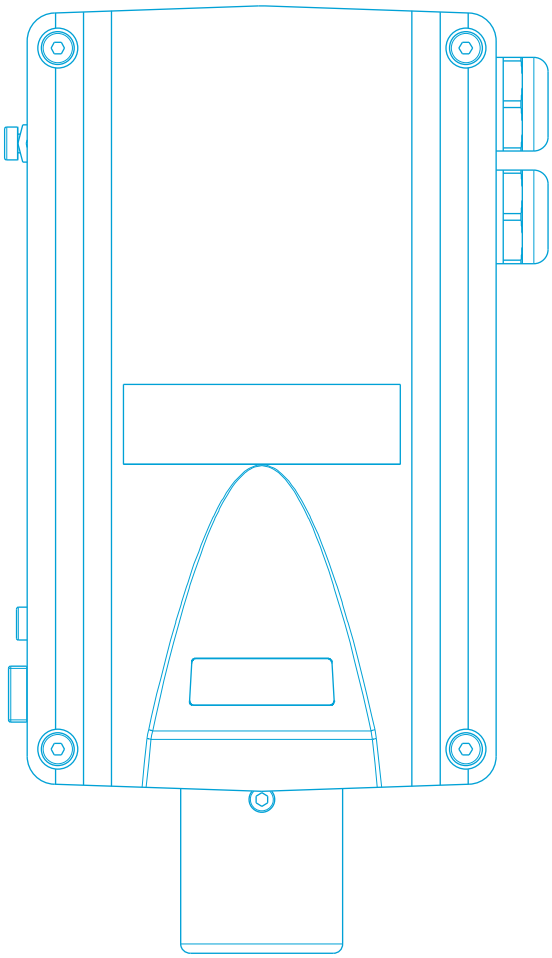
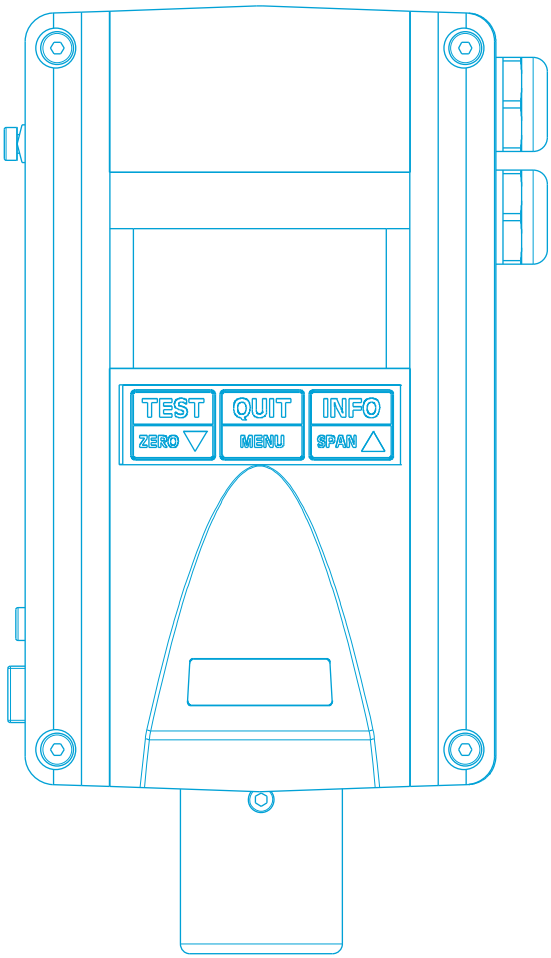
Operation Manual

Transmitter EC28





Translation of the original operation manual

smart
GasDetection
Technologies

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For your Safety

This operation manual informs you about the intended use of the product in accordance with §3 of the German Law of Technical Working Equipment. Its purpose is the prevention of dangers. It must be read and adhered to by every person using, maintaining, servicing and controlling the device. This product can only fulfill its intended purpose if it is used, maintained, serviced and controlled in accordance with GfG - Gesellschaft für Gerätebau mbH's instructions.

Using, maintaining, servicing and controlling the product contrary to these instructions will void the warranty given by GfG. The above does not change the information on warranty and liability stated in GfG's general Terms and Conditions of Purchase and Delivery.

Operating instructions

In accordance with national regulations, all gas warning devices must be tested for functionality by a qualified person after installation but before being put into operation (initial commissioning). In Germany, this is regulated by „BGR 500, chapter 2.33" (previously: "UVV Gase")

The transmitter's functionality has been tested before dispatch. It has been calibrated using appropriate test or calibration gases. **This does not release you from the obligation of calibrating and (if necessary) adjusting the device after installation.**

The EC28 transmitter (including its derivates listed below) is approved for use in potentially explosive areas and is certified with an EC Type Examination Certification issued by DEKRA Testing and Certification GmbH according to regulation 2014/34/EU.

The following applies to the EC28, EC28 D, EC28 DA, EC28 DAR, EC28 B, EC28 DB and EC28 DAB:

Certificate: BVS 04 ATEX E 132 X
Designation: ⟨Ex⟩ II 2G Ex eb mb [ib] IIC T4 Gb -20 °C≤Ta≤+50 °C

The following only applies to the EC28 i and EC28 Di:

Certificate: BVS 04 ATEX E 132 X
Designation: ⟨Ex⟩ II 1G Ex ia IIC T4 Ga -20 °C≤Ta≤+50 °C

CAUTION

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

General description

A fixed gas detection system consists of a transmitter and a controller ("GMA", not included in the scope of delivery). The transmitter and controller are connected via a cable. The transmitter converts the gas concentration into an electrical measurement signal which it then transmits to the controller for further evaluation.

The EC28 D transmitter differs from the standard EC28 transmitter, as it features an additional display; the EC28 DA transmitter also features an acoustic alarm in addition to a display.

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

- Indication of concentration on the display or remote control
- Adjustments can be performed without opening the housing via the control keys or remote control
- Compensation of temperature influences
- Ex protection in temperature range of -20 to +50 °C
- Function test in temperature range (see sensor specification)
- Smart Sensor System – Sensor replacement via plug-in, preadjusted sensors
- Permanent status display (operation / fault) on the transmitter (not EC28 i)

Measurement method

The sensors installed in the EC28 transmitter are electrochemical measuring units. Electrochemical sensors contain an electrolyte, a working electrode (anode), a counter electrode (cathode) and a reference electrode. The setting of the type of measured gas is done by specific electrodes in combination with a suitable electrolyte. In this measuring method, a current signal proportional to the concentration of pollution is generated within the measuring unit. This current signal is strengthened and used by the EC28 to display and transmit the measured values. The measuring units utilize capillary diffusion barrier technology. Through this method (and an additional temperature compensation), they avoid influences of fluctuating pressure and temperatures.

Device design

EC28 DA

Cable gland

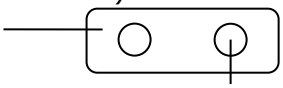
Alarm LEDs

Display

Control buttons

Type label indicating date of production
e.g. SN:0604xxxx
(06=year, 04=month)

Status display
(not for EC28 i/Di)



green Operation *yellow* Fault

Buzzer
(only on EC28 DA)

Sensor housing

EC28 DA

Potential equalization

Alarm LEDs

Button for quick adjustment (AutoZero button) behind safety screw

Terminal for remote control

The transmitter type is indicated on the type label. The sensor and sensor board are installed in the transmitter housing. The sensor board carries the components for the sensor circuitry. The electric zero point and display sensitivity (adjustment) can be set via the integrated display or the RC2 remote control. For a quick zero point check, you can also use the securely attached button at the side of the transmitter. The electronics of the main painted circuit board convert the measuring signal into a linear measured value output (4...20mA).

For servicing, only the RC2 remote control (BVS 04 ATEX E 212) may be attached to the transmitter's remote control terminal.
The RC2 remote control is approved for use in potentially explosive areas.

The buttons, functions and indications of the RC2 remote control are identical to those of the transmitter.

Mounting location of the transmitter

The housing was tested according to EN 60079-0 table 8 for devices of Group II with an impact energy of 4 Joule (low grade of mechanical dangers).
The housing of the transmitter types EC28, EC28 D, EC28 DA, EC28 DAR, EC28 B, EC28 DB and EC28 DAB must be protected against very heavy impacts.

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

The transmitter has to be installed in a way that ensures gases can reach the sensor, even in less favorable ventilation conditions. If necessary, a test, e.g. with smoke generator vials, must be carried out.
It is generally advisable to prevent the flow from hitting the bottom side (sensor side) of the transmitter.

The following external influences need to be taken into account as well:

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

The transmitter is generally protected against the ingress of water and dust (IP64).
In very harsh conditions, the transmitter can be protected from damages with accessories that were specifically designed for this purpose. GfG will gladly inform you about suitable measures.

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

Mounting

When choosing the mounting location, consider that the transmitter must always be accessible for service and calibration work. The transmitter must be mounted vertically, with the sensor pointing down.
The transmitter must be connected to the controller according to the connection diagram (*see connections and terminal assignment*). To install the device, remove the four special screws and take of the transmitter's cover. The housing is attached with two screws.
The inside of the housing contains the painted circuit board, which is enclosed in a casting compound (casting encapsulation "m"). The terminal room (intrinsically safe "i" on the EC28 i and EC28 Di; increased safety "e" for all other models) is located on the upper part of the printed circuit board.

Installing electrical connections

Only trained specialists may lay the cables and carry out the connection of the electrical installation. They must comply with the relevant regulations. Always use shielded cables (e.g. LIYCY 3 x 0.75 mm^2) for installations. The wire cross-section depends on the length of the connecting cable and the transmitter version. Cables with a cross-section of 0.75 mm^2 may be used for short distances of up to 500 m (200 m for EC28 DA). For longer distances, the cable cross section must be 1.5 mm^2. The length of the cable should not exceed 1000 m.
The shield is fixed to the M16x1.5 fitting. If the transmitter is attached to any conductive material (such as a steel beam), you will have to carry out a potential equalization. Only the transmitter may be installed within potentially explosive areas - the controller and the supply unit must be installed outside of it.

Electrical installation: The connecting lines must be routed directly from the cable glands to the terminals! The connecting lines may not come into contact with other internal circuits.

You may only install the transmitter if there are no ambient gases. The transmitter may only be opened while it is de-energized.

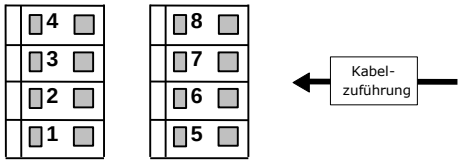
If the transmitter is not powered by the GMA controller, the operational voltage of its power supply may not exceed 30 V DC.

The housing cover must be closed and screwed back on after the installation process.

Ensure that there are no voltages exceeding the maximum voltage U_m (indicated on the <u>type label</u>) occurs at the transmitter terminals at any time, even in case of faults.
Depending on the model, U_m is either 250V AC or 45V DC.

Connection diagram

1: 18...30V DC
2: 0V GND
3: Data+ (D1)
4: Data– (D0) / 4...20mA

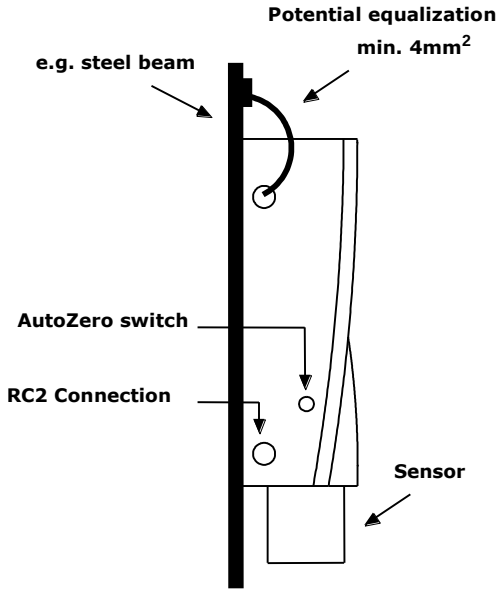


The number of available is different depending on the EC28 model.

5: 18...30V DC
6: 0V GND / Relais COM
7: Data+ (D1) / Relais NO
8: Data– (D0) / Relais NC

For more detail on the individual types of devices, refer to Connectors and terminal assignment.

Potential equalization



Commissioning

The EC28 transmitter's functionality and display are tested before dispatch. Calibration and adjustment are performed using appropriate test or calibration gases. But deviations may occur due to transport, mounting and environmental factors.
This is why the gas detection system must be commissioned and tested for proper functioning by a trained specialist or a person approved by the manufacturer.

After activating the gas detection system, it may need a few minutes to:

- perform the self-test, during which the program memory and RAM are checked
- read and evaluate the device parameters, including a simultaneous memory check
- read and evaluate the sensor parameters, including a simultaneous memory check
- stabilize the sensors

CAUTION: The EC28 i and EC28 Di do <u>not</u> include a yellow status LED!
You can only identify the EC28 i's status on the current interface or on the RC2 remote control.

Memory tests are performed during the first few seconds of the starting phase. This is indicated by the current interface emitting 0mA and the yellow and green LEDs being lit. When the process is completed, the current interface will emit 1.6mA, the fault LED will be lit and the operation LED will flash slowly. The display will show *transm. param.* / LoAd, . The devices will then consecutively display (either on their own display or on the RC2) the measuring unit, type of gas, measuring range, alarm thresholds and calibration gas concentration.
The EC28 will automatically switch to measuring mode after the start-up phase of the sensor - the display will show a countdown of the remaining seconds.

If the device encounters an error in the starting phase, it will switch to fault mode. The current interface will then emit 1.2mA, and an error code will be displayed (see *Indications of special*

conditions and faults). The yellow fault LED will be lit permanently. On models with display, the display's backlight will also flash.

Note:
Adjusting the zero point (AutoCal ZERO) is mandatory after commissioning, as is a check (and adjustment, if necessary) of the sensitivity (AutoCal SPAN) after the stabilization time.

Measuring mode

The digital display will indicate the current measured gas concentrations in measuring mode.
The displayed values of the device's display and any connected remote controls are always identical!
Gas concentration is measured continuously. The EC28 (with alarm functionality) will immediately detect if the threshold of the sensor signal is exceeded and dignal this circumstance visually. Functions of the electronics, such as the parameter memory or the sensor are continuously monitored. In normal, fault-free measuring mode, the green operation LED is lit permanently and the yellow fault LED is off (not on EC28 i/Di).

To indicate that the EC28 is in measuring mode, the display on the RC2 and EC28 Di will periodically (one minute intervals) display the gas unit and type of gas instead of the gas concentration.
On an EC28 with graphic display, a pending measurement value (>0) is displayed as a bar graph which always shows the current measurement value in addition to the numeric value (short display of measured gas and measuring unit every 30 seconds). If there is no measuring signal, the type of gas and measuring unit are displayed continuously.

Falling below the measuring range

Measured values below the zero point are displayed as negative numeric values. The current interface will output a signal in the area between 2.8...4.0mA, depending on the measuring range.
If the measured value falls below −7,5 % of the measuring range, this condition will be indicated by the fault LED being constantly lit and the display alternating between the negative measured values and ↓↓↓↓/---- . The current interface will continuously emit 2.8mA.
If the measured signal falls below the measuring range of the transmitter electronics, the display will continuously show ↓↓↓↓/---- and the current interface will emit 1.2mA.

Exceeding the measuring range

If the measured values exceed the measuring range between 100 % and 112.0 %, the display will indicate this by showing ---- alternating with the measured value. The current interface will emit a signal in the range of 20...22mA, depending on the measured value.
If the measured value exceeds 112.0 % of the measuring range, the display will flash ↑↑↑↑/ ----. The current interface will emit 22mA.
If the measured signal exceeds the measuring range of the transmitter electronics, the fault LED will light up, the display will continuously show ↓↓↓↓/---- and the current interface will emit 22mA.

Control buttons

The function of the buttons on the transmitter and the remote control identical. The display of the the EC28 Di and the RC2 remote control are also identical.

Display, LED and buzzer test

Briefly pressing the TEST / ZERO ▼ button while the device is in measuring mode will start a display and LED test. The test will activate all LEDs and every element of the display for two seconds. The EC28 DA will additionally activate the alarm LEDs and the buzzer briefly.

Indication of operating parameters

If you press the INFO / SPAN ▲ button while the device is in measuring mode, the following important operational parameters are automatically display.

- Measured gas **(1)**
- Measuring unit **(1)**
- Measuring range **(1)**
- Calibration gas concentration **(1)**
- Threshold alarm 1 **(1) (2)**
- Threshold alarm 2 **(1) (2)**
- Average value of the last eight recorded hours
- Average value of the last 15 recorded minutes

(1): These parameters are also displayed during the start-up phase.
(2): These indications are only displayed with alarm functionality

Example of a display sequence for RC2 remote control with 7-segment display on a EC28 DA transmitter:
UOL H2 SCAL 4.0 CLIAS 1.0 A1 0.2 A2 0.4 tUA 0.3 StEL 0.1

Measured value histogram

On devices with a graphical display, you may choose an alternative display mode. After you have triggered a display of the operating parameters via INFO / SPAN ▲, you can press INFO / SPAN ▲ again to access a bar graph selection menu.

You can choose between data of the last 24 hours, 8 hours or 2 hours (Select one by pressing the corresponding button). The display will then switch to histogram mode. (Briefly) pressing the button TEST / ZERO ▼ or INFO / SPAN ▲ again will switch between the average values, maximum values or minimum values.

Instead of displaying the measured values, the device will now show a bar graph visualizing the development of the measured values. The current pending measured value will also be displayed in the upper area, alongside the type of gas and gas unit. The histogram is updated constantly and can be used as a permanent display mode.

Briefly pressing QUIT / MENU or the appearance of a special condition notification (such as triggered alarms) will cancel this display mode.

Threshold value alarm

The EC28 has two threshold alarms (if supported by the device). An alarm is triggered as soon as the gas concentration exceeds (or falls below) the set alarm threshold (settings can be changed in the service menu). The EC28 indicates threshold alarms by activating the row of LEDs above the display, the display backlight and a buzzer. When the first threshold alarm (Alarm 1) is exceeded or undershot, the display backlight and the row of LEDs are activated in slow alternation. The display will alternately show the current measured value and *Alarm 1 /* A1.
When the second threshold alarm (Alarm 2) is exceeded, the display backlight, the row of LEDs and the buzzer will be activated in rapid alternation. The display will alternately show the current measured value and *Alarm 2/* A2.
Resetting the threshold alarms can be done either automatically or manually (meaning with or without latching alarm), depending on the function settings in the service menu.
The function of the buzzer is determined and cannot be changed: Activated with alarm 2, automatically canceled when values fall below second alarm threshold, can always be acknowledged via QUIT MENU.

Pressing the QUIT MENU button will reset a latching alarm after the values have fallen below the alarm threshold again.
Depending on the service menu settings (see corresponding section), the relay (only on EC28 DAR) will also be activated.

Sensor service life

Electrochemical sensor have a limited service life. The expected service life of the sensors used in an EC28 is approximately 1-3 years. A few month before reaching the service life limit, the transmitter will signal that the sensor should be replaced during the next planned maintenance. This is indicated by the fault LED flashing regularly and the display alternately showing *Sensor replacement /* CHnGE SEnS and the measured value. If the sensor is not replaced within the next months, the device will stop operating when the expected operating life of he sensor has been exceeded (*Sensor life expired /* CHnGE SEnS). The current interface will then emit 1.2mA, the yellow fault LED will be lit and the green operation LED will flash in intervals.
On the EC28 i, this is only discernable via the current interface. You will need the RC2 remote control to identify the fault.

Faults

If a fault within the transmitter is detected, the yellow fault LED will continuously be lit up (not on EC28 i/Di), the current interface will emit 1.2mA and an error notification will be displayed (see *Indications of special conditions and faults*).

A fault occurs when:

- the sensor or the transmitter's electronics are defective
- errors occur during the self-test of the device
- no sensor is plugged in

For more possible causes, see *Indication of special conditions and faults.*
The yellow fault LED will turn off as soon as the fault is corrected.

Check ans AutoCal adjustment of the zero point(ZERO)

For TOX/NOX sensors, atmospheric air without any interfering gas components is required to check or adjust the zero point. In polluted atmospheres, you can also use synthetic air. 100 vol % N_2 must be used for oxygen sensors.

Attach a calibration adapter to the sensor housing to start the checking / calibration process. With this calibration adapter synthetic air (or 100 vol % N_2) can be inserted without pressure with a flow rate of approximately 0.5l/min.

If the displayed value is not zero while in measuring mode, an adjustment of the zero point is required. After changing the measured gas or replacing a sensor, the zero point also has to be readjusted.
When the displayed value remains constant, you can begin setting the zero point with the AutoCal program. The AutoCal program will adjust the measured value to zero automatically.

Activation

The device status is not immediately discernable via a status LED (green / yellow) on the EC28 i and EC28 Di. You can identify their status via the current interface, the display or the RC2 remote control.

The automatic zero point adjustment can only be carried out via the AutoZero button or the regular access code 0011 if the current displayed value is max. 10 % of the measuring range.

On devices without display, you will not be able to identify whether the measured value is within the permitted tolerance range for zero adjustment (meaning <10 % of the measuring range) by pressing the AutoZero button. If the measured value is higher than 10 % LEL when you press the AutoZero button, the device will stay in measuring mode - as indicated by the fault LED staying off. In this case, you can only carry out the zero point adjustment with a remote control.

Trained users may activate the zero point adjustment with the access code 0055at a displayed value of up to 15 % of the max. measuring range. This access code should only be used by trained safety staff employed by the operator.

If the current displayed zero point exceeds the value of 15 % LEL at one point and you are absolutely sure that this is not caused by the presence of gas, a temporary hour code (valid for max. 1 h) can be activated in the menu item *Info* / InFo in the service menu (*Zero Code* / CodE). This will allow you to access the zero point settings without any restrictions.

Note:
The fact that this measure needs to be taken is likely a sign of a defective sensor. It should be replaced as soon as possible.
The access code thresholds (10 % / 15 %) do not apply to operations with oxygen sensors.

Process

To use the quick adjustment via the protected AutoZero button on the side of the housing, you will have to remove the screw above the button and then press the button for at least three seconds. The current output will change to 2.0mA, the fault LED will flash regularly (not on EC28 i/Di) and the third step of following description will be performed automatically.

Now, use the keyboard on the display or the RC2 remote control to follow these instructions in order:

1. Start the process by holding down the button TEST ZERO ▼ for at least three seconds. The current output will emit a 2.0mA signal during the entire process and the fault LED will be lit continuously. The notification *Code* / CodE will be displayed.
2. Then, enter the numeric access code 0011 or 0055 . Use the buttons TEST ZERO ▼ and INFO SPAN ▲ to change the digit of your current position and confirm it with the QUIT MENU button. Holding down QUIT MENU will delete the selected digit.
3. After you have entered the correct code, the display will alternate between showing the current measured value and *Zero* / 2Ero. If the measured value stays constant for a defined interval of time (for oxygen sensors: after an decrease of the concentration and a waiting time of 2 minutes), the new zero point will be set. The AutoCal program is then closed automatically after displaying *Save* / SAVE and will witch back to measuring mode. When adjusting oxygen sensors, the device will also display *Finished* / End to signal that you can stop inserting nitrogen. The transmitter will then wait for an increase of the measured values before returning to measuring mode.

Notes:
If the current measured value is outside the permitted thresholds for the used access code, the display will briefly show *Code invalid* / FAiL during the third phase and the device will switch back to measuring mode.

The AutoCal program can be shortened to a constant measured value by pressing the TEST ZERO ▼ button or the AutoZero button during the check. The hardware will then begin the zero point adjustment.
To cancel the AutoCal program during the waiting time without adjusting the zero point, briefly press the TEST ZERO ▼ button or the AutoZero button. The display will briefly show *Quit* / ESC.

After completing the quick adjustment via the AutoZero button on the side of the device, the screw and sealing have to be screwed back in again and tightened until stop.

The following error notifications may occur during the adjustment:

Display	**Note**	**Fault LED**
Cal error no. 2 / CAL Err.2	The gas signal is not stable.	rapid flashing
Cal. error no. 3 / CAL Err.3	The zero point is outside the permitted tolerance range.	

All error notifications must be confirmed with QUIT MENU or the AutoZero button on the side of the device. The transmitter will change back to measuring mode with unchanged zero point setting after confirming.

Check and AutoCal adjustment of the sensitivity (SPAN)

On devices without display, you will need the RC2 remote control to make this adjustment.

First, you will want to check the set concentration of calibration gas by pressing INFO / SPAN ▲. The value of the calibration gas concentration should be at least at 20 % of the measuring range, above the main alarm or 2. alarm threshold.

Special safety precautions have to be considered when handling toxic gases and vapors. TLVs will give you more information on the dangers of toxic gases.

Attach a calibration adapter to the sensor housing to start the process of checking / calibrating the gas sensitivity. Using the calibration adapter, the test or calibration gas (fresh or synthetic air for oxygen sensors) can then be supplied to the sensor without pressure at a flow rate of approx. 0.5 l/min.. The value is then indicated on the display. If the displayed value deviates from the calibration gas concentration, a sensitivity calibration should be performed. When the displayed value remains constant, you can begin setting the sensitivity with the AutoCal program. The AutoCal program will adjust the measured value to the set calibration gas concentration.

The sensor must be free of any calibration gas before it is readjusted (Display of zero) .

The device status is not immediately discernable via a status LED (green / yellow) on the EC28 i and EC28 Di. You can identify their status via the current interface, the display or the RC2 remote control.

Now, use the keyboard on the display or the RC2 remote control to follow these instructions in order:

1. Start the process by holding down the INFO / SPAN ▲ button for at least three seconds. The current output will emit a 2.0mA signal during the entire process and the fault LED will flash slowly and regularly. The notification *Code* / CodE will be displayed.
2. Then, enter the numeric access code 0011 . Use the buttons TEST / ZERO ▼ and INFO / SPAN ▲ to change the digit of your current position and confirm it with the QUIT / MENU button. Holding down QUIT / MENU will delete the selected digit.
3. After you have entered the correct code, the display will alternate between showing the current measured value and *Span* / SPAn. The device will then wait for a significant increase in concentration. If the measured value stays constant during a defined time period (after a set time of two minutes), the measured value is used to update the sensitivity (Display will show *Save* / SAVE).The adjustment data has successfully been updated. The device will not switch back to measuring mode just then though, as the current concentration of test or calibration gas would trigger an alarm. The device will remain in adjustment mode until it detects that the gas concentration has decreased and the displayed value has stabilized. The display will alternate between showing *Zero* / ZEro and the current measured value. After successful stabilization the device will switch back to measuring mode. If no decrease in the gas concentration or stabilization of the measured value can be detected, the device will automatically switch back to measuring mode after three minutes.

Notes:

The AutoCal program can be shortened at any point by holding down the INFO / SPAN ▲ button. The display will briefly show *Save* / SAVE and the measured value will be used to refresh the sensitivity.

To cancel the AutoCal program without sensitivity adjustment, press the INFO SPAN ▲ button briefly. The display will briefly show *Quit* / ESC.

The following error notifications may occur during the adjustment:

Display	Note	Fault LED
Cal. error no. 1 / CAL Err.1	No calibration gas has been detected.	rapid flashing
Cal. error no. 2 / CAL Err.2	The gas signal is not stable.	
Cal. error no. 3 / CAL Err.3	The zero point is outside the permitted tolerance range.	

All error notifications have to be confirmed with the QUIT MENU button. The transmitter will switch to measuring mode without readjustment. The adjustment has to be repeated.

Service menu and advanced service menu

Activating the service menu

The service menu enables you to view and change all important parameters of the EC28. Accessing the service menu will disrupt the monitoring function. The device will switch to service mode. No alarms will be triggered. The special condition "service" will be indicated by the fault LED slowly flashing and a current output signal of 2.4mA. If you do not press any buttons, the device will automatically leave service mode and switch back to measuring mode after one minute.

All parameter changes you make in the service menu apply to the current type of gas only!
If you need to change both the type of gas and parameters, you will have to set the new type of gas first, so it is affected by the parameter adjustments.

The service menu can be accessed in two different extension levels.
The Standard Service Menu is accessed via the code 1100 . No important parameters, such as the measured gas or measuring range limits, can be changed in this menu. The device will ignore changes you tr to make in this mode, and will respond with the notification *Blocked* / FAIL .
The Advanced Service Menu is accessed via the code 5050 . The advanced service menu can be used to make any changes without restrictions. This access code should only be used by trained safety staff employed by the operator.

Use the keyboard on the display or the RC2 remote control to follow these instructions in order:

1. Press QUIT MENU button for at least three seconds. The transmitter will switch to service mode. The notification *Code* / CodE will be displayed.
2. Then, enter the numerical access code 1100 (or 5050). Use the buttons TEST ZERO ▼ and INFO SPAN ▲ to change the digit of your current position and confirm it with the QUIT MENU button. Holding down QUIT MENU will delete the selected digit.

After you have correctly entered the the code, you will be directed to the menu item *Gas* / GAS in the service menu. Use the TEST ZERO ▼ and INFO SPAN ▲ buttons to select other menu items.

Controls

Select menu items using the TEST ZERO ▼ and INFO SPAN ▲ buttons.

Activate your chosen menu item by briefly pressing the QUIT MENU button.

Use the TEST ZERO ▼ and INFO SPAN ▲ buttons to set parameters or select a sub menu.

To confirm a changed parameter briefly press the QUIT MENU button.
You can leave the service menu with or without saving the changes you have made to parameters.

Notes:
You can change several parameters consecutively without saving in between when leaving the menu. Saving at the end of this process will save all parameters that have been changed in the service menu.
Exceptions: When changing the type of gas, confirming the menu item will immediately save your settings and activate the parameters for the chosen type of gas, the EC28 will restart. Setting the time and date will immediately safe them.
Some parameters are correlated. Changing a parameter might therefore automatically also change other, connected parameters.

Navigating the service menu

Service-Menu									
Quit	*Save*	*Gas* [0, 1]	Measuring range [1]	*Cal. Gas*	*Alarm* [2]	*Relays* [3]	Zero range [5]	*Info*	*Language / time / bus*
ESC	SAVE	GAS [0, 1]	SCAL [1]	CALGAS	AL [2]	rEL. [3]	bAnd [5]	inFo	LAnGU
Exiting the service menu <u>without saving</u> the changed parameters	Exiting the service menu and <u>saving</u> the changed parameters	Selection of measured gas	Setting the measuring range's limit values	Calibration gas concentration	Sub-menu	Sub-menu	Turning the sensor zero range on / off	Display information on the device	Sub-menu

Alarm						
Back	*Alarm 1*	*Alarm 2*	*Hys. A1*	*Hys. A2*	*Funct. A1*	*Funct. A2*
.ESC	A1	A2	H1	H2	F1	F2
Exiting the sub-menu	Threshold value of alarm 1	Threshold value of alarm 2	Switch-off hysteresis of alarm 1	Switch-off hysteresis of alarm 2	Function of alarm 1	Function of alarm 2

Relays			
Back	*Relay funct.* [1]	*Relay mode* [1, 4]	*Test*
.ESC	Fun [1]	A.rEL [1, 4]	tESt
Exiting the sub-menu	Relay function	(Alarm) relay operation mode	Triggering the relay's contacts for testing

Language/time/bus				
Back	*Language*	Time [6, 7]	*Modbus slave addr.* [1, 6]	*Modbus com. param.* [1, 6]
.ESC	LAnGU	CLoC [6, 7]	b.Add [1, 6]	b.Conf [1, 6]
Exiting the sub-menu	Language of displayed test	Current date and time	Modbus slave address	Modbus interface parameters

[0] Menu item you enter on
[1] Only adjustable in the advanced service menu
[2] Only visible on EC28s with alarm function
[3] Only visible on EC28s with relay function
[4] Visibility depends on relay function
[5] Size of range depends on sensor
[6] Only adjustable if device supports it
[7] Only adjustable if no RC2 is connected

Additional information on the menu

Quit
Exiting the service menu without saving the changed parameters. This will discard any changes you made.

Save
Exiting the service menu and saving the changed parameters

Gas
This function can be used to to explicitly select the parameters of different types of gas that have been stored on the sensor. Only gases that are suitable and parameterized for this sensor are displayed.

Notes:
The EC28 will restart after the type of measured gas is changed.
You will have to adjust the zero point (AutoCal ZERO) after changing the type of gas. You will also have to check and, if necessary, adjust (AutoCal SPAN) after the stabilization has finished.
No restrictions apply to the first zero point adjustment after replacing a sensor.
After the type of gas has been changed, parameters such as the measuring range, calibration gas concentration and alarm thresholds must be checked and, if necessary, adjusted.

Measuring range
The limit value of the measuring range can be set in absolute steps of ...100, 150, 200, 250, 300, 400, 500, 750, 1000..., but cannot be set to less than 1/6 of the measuring range's limit value.

Notes:
Changing the measuring range is mainly an adjustment to the current output. The standardized output signal of 4...20mA will be used for the new measuring range. The displayed numerical indication is not influenced by this.
When the measuring range is decreased, the alarm thresholds must be checked and, if applicable, adjusted. If alarm thresholds had been set at a higher value than the new limit value of the measuring range, they are automatically set to the current limit value of the measuring range.

Cal. gas
The set calibration gas concentration must correspond to the concentration of the test or calibration gas. The calibration gas concentration can be set in the range of 10 - 105 % of the current measuring range.

Zero range
The sensor's zero range can be deactivated if needed. This means the real measured value will be displayed, even around the zero point.
Possible settings:

- Zero range activated (On / on)
- Zero range deactivated (Off / oFF)

Info
Displayed information on the device

- Sensor type/MK number (Sensor type / S.tYP)
- Sensor serial number (*Sensor no.* / S.nr)
- Software version (*Software ver.* / SoFt)
- Transmitter serial number (Man*. no.* / F.nr- F.nr_)
- Hourly code (*ZERO code* / CodE)

Notes:
The number displayed in CodE corresponds to a time limited access code which can be used to activate the zero point adjustment without restrictions (see AutoCal ZERO).
If the RC2 remote control is connected or the device has no graphical display, all information will be shown consecutively once. In other cases, you can cycle through using the INFO / SPAN ▲ button.

***Alarm → Alarm 1* and**
Alarm → Alarm 2
The alarm is set upon reaching the corresponding alarm threshold.
The alarm threshold values can only be set to a maximum of the current measuring range limit value. Alarm 1 cannot be set to a higher value than alarm 2 when monitoring for exceeding values, and cannot be set lower than alarm 2 when monitoring for values falling short of the measuring range. As an example: Alarm 2 can only be set to zero for exceeding alarm, if alarm 1 has been set to zero before it.
If a threshold is set to zero , the alarm is turned off.

Note:
The EC28 DA's buzzer is fixed to the trigger of alarm 2.

***Alarm → hys. A1* and**
Alarm → hys. A2
The hysteresis id the difference between the turn-on and turn-off point of the alarm thresholds. Any value higher than zero will delay the alarm being turned off by the value set, in relation to the alarm threshold that sets the alarm.
The maximum value the hysteresis can be set to is 5 % of the max. measuring range limit value. The maximum value it can be set to is also limited to the size of the alarm threshold value on exceeding alarms or, for undershooting alarms, the current measuring range limit value minus the alarm threshold value.

***Alarm → funct. A1* and**
Alarm → funct. A2
Possible function settings for alarm 1 and alarm 2:
- Alarm on "less than", self-storing alarm, manually resettable after "more than" alarm (Under*.-stor.-reset. /* L SC)
- Alarm on "less than", not self-storing alarm, not manually resettable (Under*.-n.-stor.-n.-reset. /* L nS)
- Alarm on "more than", not self-storing alarm, not manually resettable (above-stor.-reset*. /* H nS)
- Alarm on "more than", self-saving alarm, manually resettable after "less than" alarm (above-*stor.-reset. /* H SC)

Note:
On the EC28, the buzzer's function is set to: "Alarm when exceeding or falling below the alarm 2 threshold, alarm not stored, manually resettable even with present alarm conditions".

Relays → Relays funct.
Possible function settings for the relay:
- Triggered during adjustments (AutoCal SPAN) for calibration gas supply (Cal. pump */* PUMP)
- Continuously triggered on alarm 1 (*Alarm 1 /* .A1)
- Continuously triggered on alarm 2 (*Alarm 2 /* .A2)
- Alternating trigger (interval) on alarm 1 und continuous trigger on alarm 2 *(Alarm 2 + 1 INT /* A2. I)

Relays → Relay mode
Possible operation settings for the alarm relay:
- Closed current mode (closed current */* n**.c.**)

- Operating current mode (operating current / n.o.)

Relays → Test
The relay is briefly activated twice.

Language/time/bus → Language
Possible language settings:
- German (Deutsch/ dEu)
- English (English / EnLi)
- Spanish (*Español* / SPA)

Note:
Setting the language mainly affects the visualization on the graphic display.

Language/time/bus → Time
Setting sequence: Year, month, day, hour, minute

Language/time/bus → Modbus slave addr.
Setting range: 1–247

Note:
See separate document "EC28 MODBUS implementation".

Language/time/bus → Modbus com. param.
Possible interface settings:
- 19200 Baud, 8 data bits, no parity, 2 stop bits (*19200, 8N2* / -8n2)
- 19200 Baud, 8 data bits, even parity, 1 stop bit (*19200, 8E1* / -8E 1)
- 9600 Baud, 8 data bits, no parity, 2 stop bits (*9600, 8N2* / _8n2)
- 9600 Baud, 8 data bits, even parity, 1 stop bit (*9600, 8E1* / _8E 1)

Note:
See also: separate document "EC28 MODBUS implementation".

Sensor replacement

GfG sensors are equipped with a non-volatile memory unit in which all sensor information (serial number etc.), adjustment data and the settable types of gas are stored.

To change the sensor, you will have to remove the Allen screw on the side of the sensor housing (see Device design). Then, carefully slide the sensor housing downwards to remove it. The sensor also needs to be pulled downwards to remove it. You can then carefully attach the new sensor. The plug-in connection is protected from twisting damage - the sensor will only fit in one specific orientation. After attaching the sensor, replace the sensor housing and screw it back on correctly.

After the sensor is removed, the display, status LEDs and current output (depending on device version) will indicate *sensor error no. 1/* SEnS Err.1 (see also *Indication of special conditions and faults*).
The EC28 will restart after attaching a new sensor (for process and more information see *Commissioning*)

On the EC28 i and EC Di, you cannot discern the device status from the status LED (green/yellow). You can identify their status via the current interface, the display or the RC2 remote control.

Error notification *Confirm change of gas /* CHEC GAS

If the new sensor is not specified for the type of gas that is set as "measured gas" on the device, this will be detected during the starting phase of the device. This circumstance will be signaled on the display and by the green LED emitting a double pulse (flashing briefly twice). The EC28 will <u>not</u> switch to measuring mode.

Navigate to the (advanced) service menu by holding down the QUIT MENU button (> 3sec) and entering the access code 5050. Select the menu item *Gas /* GAS to switch to a type of gas that is supported by the sensor (see *Service menu Changing the measured gas*).

Error notification *Confirm measuring range /* CHEC SCAL

If the new sensor is set to a different measuring range than the old one, this will be detected during the start-up phase. This circumstance will be signaled on the display and by the green LED emitting a double pulse (flashing briefly twice). The EC28 will <u>not</u> switch to measuring mode.

Navigate to the service menu by holding down the QUIT MENU button (> 3sec) and entering the access codes 5050 or 1100 . Select the menu item *measuring range/* SCAL to check and, if necessary, adjust the measuring range (see *Service menu→Setting the measuring range limit values*). You will have to exit the service menu using the menu item *Save/* SAVE .

<u>Notes:</u>
Adjusting the zero point (AutoCal ZERO) is mandatory after inserting a new sensor, as is a check (and adjustment, if necessary) of the sensitivity (AutoCal SPAN) after the stabilization time.
No restrictions apply to the first zero point adjustment after replacing a sensor.

Transmission behavior

Depending on the type of measured gas, the transmitter's transmission properties are different. The adjustment times may vary depending on the type of measured gas. The signal transmission is always proportional to the gas concentration.

Indications and notifications

The EC28 i and EC28 Di are <u>not</u> able to indicate special conditions via the current interface (<2.8mA).
The current output will reach a minimum output current of 2.8mA during these special conditions.

Indication of special conditions and faults

The following table lists all conditions during which the yellow fault LED is lit permanently (not on the EC28 i and EC28 Di) current interface emits a signal of ≤1,6mA. On transmitters without display, the following error notifications should viewed on the RC2 remote control for a better diagnosis. You can also analyze the exact value of the current output.

No.	Display	green LED	yellow LED	Current output	Cause	Note / Explanation
001	*Self test* tESt	On	On	0mA	Program and memory test when starting the system.	
002	*Reading device parameters* Operational parameters LoAd Operational parameters	Flashes	On	1.6mA	Turning on the system (during start-up; after changing the type of gas or replacing the sensor)	Automatically switches to sensor warm-up phase
003	*Sensor warm-up* remaining seconds remaining seconds	Flashes	On	1.6mA	Sensor warm-up phase	Automatic transition to measuring mode after the displayed remaining time reaches zero.

No.	Display	green LED	yellow LED	Current output	Cause	Note / Explanation
101	*Sensor service life exceeded* CHnLi SEnS	Single pulses	On	1.2mA	Sensor service life has run out	Sensor must be replaced
102	*Confirm gas change* CHEC LiAS	Double pulses	On	1.2mA	Sensor is not specified for sample gas (after sensor replacement)	Replace sensor again or choose a different measured gas (see *Sensor replacement*)
103	*Measuring range confirm* CHEC SCAL	Double pulses	On	1.2mA	Measuring range settings of sensor and device do not match (after sensor replacement)	Check measuring range SCAL and, if applicable, adjust it (see *Sensor replacement*)
104	*System error (Working memory defective)* SYS Err.1	Off	On	1.2mA	Error trying to access RAM	Restart the device. If the error occurs again, the device needs to be replaced.
105	*System error (Prog. memory defective)* SYS Err.2	Off	On	1.2mA	Error trying to access ROM	
106	*System error (Param. memory defective)* SYS Err.3	Off	On	1.2mA	Error trying to access EEPROM (internal)	
107	*System error (Temperature measurement defective)* SYS Err.7	Off	On	1.2mA	Temperature measurement not plausible	
108	*ADC error (Temperature measurement error)* Adu Err.2	Off	On	1.2mA	A/D converter error (temperature measurement / NTC)	
109	*Sensor error (No sensor detected)* SEnS Err.1	Off	On	1.2mA	No sensor available / detected	Insert sensor (automatic restart)
110	*Sensor error (Param. memory defective)* SEnS Err.2	Off	On	1.2mA	Error during EEPROM access (sensor)	Replace sensor (automatic restart)
111	*Sensor error (Error param. memory)* SEnS Err.3	Off	On	1.2mA	Wrong sensor / parameter memory	

Indications in measuring mode						
No.	**Display**	**green LED**	**yellow LED**	**Current output**	**Cause**	**Note / Explanation**
201	↑↑↑↑ permanently „----“ permanently	On	On	22 mA	The gas concentration has exceeded the measuring range of the transmitter electronics.	
202	Measured value alternating with ↑↑↑↑ Measured value alternating with „----“	On	Off	22mA	The gas concentration has exceeded the measuring range considerably (≥ 112.5 % of the measuring range)	
203	Measured value alternating with ↑↑↑↑ Measured value alternating with „----“	On	Off	20..22mA	The gas concentration has exceeded the measuring range (100...112 % of the measuring range).	Reduce gas concentration!
204	Measured value alternating with *Alarm 2* Measured value alternating with A2	On	Off	4...20mA	The gas concentration has reached or exceeded the 2nd alarm threshold.	
205	Measured value alternating with *Alarm 1* Measured value alternating with A1	On	Off	4...20mA	The gas concentration has reached or exceeded the 1st alarm threshold.	
206	*Scaling warning* SCAL Err.	On	Off	4...20mA	Precautionary warning notification: Measuring range limit value cannot be detected by hardware / sensor combination anymore	Acknowledge with QUIT MENU a) Readjust sensor (SPAN) b) Adjust or scale down measuring range in service menu
207	*Check voltage supply* CHEC SUPP	On	Off	4...20mA	Precautionary warning notification: The supply voltage is not within the required range	Check and readjust voltage supply
208	*Sensor replacement* CHnGn SEnS	On	Single pulses	4...20mA	Precautionary warning notification: The sensor’s expected service life will be reached within the next months.	Replace sensor during next service.
209	Measured value	On	Off	4...20mA	Fault-free measuring mode	
210	Measured value	On	Off	2.8...4mA	Measured values fall short of measuring range (-7.5...0.0 % of the measuring range)	
211	Measured value alternating with ↑↑↑↑ Measured value alternating with "----"	On	On	2.8mA	Measured values fall short of measuring range (< −7.5 % of the measuring range)	Zero point adjustment is necessary
212	↓↓↓↓ permanently "----" permanently	On	On	2.8mA	The measured signal has fallen short of the transmitter electronics	Zero point adjustment and sensitivity check are necessary.

Notes:
In measuring mode, the notification listed in the second column and the measured value are displayed alternately. The notifications described in no. 204 and no. 205 only occur on EC28 DA devices. The notifications described in no. 206 - 208 are precautionary warnings. The transmitter will stay in measuring mode. There is no need for immediate action. The conditions described in no. 203 and no. 210 apply to a de facto extension of the measuring range from 4-20mA to the range 2.8 - 22mA, to display measured values "close" to the actual measuring range. This is how a tolerance range around 4-20mA is generated before a special condition is assumed.

Indications in service mode and during adjustment

No.	Display	green LED	yellow LED	Current output	Cause	Note / Explanation
301	Menu item	On	Flashes	2.4 mA	Service menu has been activated via keyboard or RC2	Select menu item If no input is detected for more than a minute: automatic return to measuring mode
302	*ZERO* ZEro	On	Flashes	2.0mA	AutoCal setting of the zero point has been activated via keyboard, RC2 or the AutoZero button	Automatic completion after successful adjustment.
303	*SPAN* SPAn	On	Flashes	2.0mA	AutoCal adjustment of the sensitivity has been activated via keyboard or RC2	Automatic completion after successful adjustment
304	*Cal. error (No conc. change)* CAL Err.1	On	Flashes rapidly	2.0mA	No increase in the calibration gas concentration has been detected during the AutoCal setting of the sensitivity.	Acknowledge with QUIT MENU a) Check gas supply b) Do not supply gas before adjustment request
305	*Cal. error (Gas not stable)* CAL Err.2	On	Flashes rapidly	2.0mA	No stable zero gas or calibration gas concentration has been detected during the AutoCal setting	Acknowledge with QUIT MENU a) Stabilize gas supply
306	*Cal. error (Calibr. not plausible)* CAL Err.3	On	Flashes rapidly	2.0mA	The zero point or the sensitivity is outside the permitted tolerance range.	Acknowledge with QUIT MENU a) Check zero or calibration gas and repeat the process b) If necessary, replace sensor

Conditions of the status LEDs and the current output

The following table contains a comparison of the indications of the status LEDs and the current output signals (and their meanings) for a transmitter without display.
On devices without display, a RC2 remote control is mandatory to adjust the zero point (if displayed value is > 25 % LEL) and access the service menu.

green LED	**yellow LED**	**Current output**	**Description see section...**	
On	On	2.8mA	*Indications in measuring mode*	No. 211
On	On	1.2mA	*Indications in measuring mode*	No. 212
On	On	0mA	*Indication of special conditions...*	No.001
On	On	22mA	*Indications in measuring mode*	No. 201
On	Off	22mA	*Indications in measuring mode*	No. 202
On	Flashes rapidly	2.0mA	*Indications in service mode...*	Nr. 304–306
On	Flashes slowly	2.4 mA	*Indications in service mode...*	No.301
On	Flashes slowly	2.0mA	*Indications in service mode...*	No.302, 303
On	Single pulses	4...20mA	*Indications in measuring mode*	No. 208
On	Off	20...22mA	*Indications in measuring mode*	No. 203
On	Off	4...20mA	*Indications in measuring mode*	No. 204–207, 209
On	Off	2.8...4mA	*Indications in measuring mode*	No. 210
Flashes	On	1.6mA	*Indication of special conditions...*	No.002, 003
Single pulses	On	1.2mA	*Indication of special conditions...*	No.101
Double pulses	On	1.2mA	*Indication of special conditions...*	No.102, 103
Off	On	1.2mA	*Indication of special conditions...*	Nr. 104–111

Priority of indications and notifications during measuring mode

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

Priority	**Status**	**Description see section...**	
	A/D converter error	*Indication of special conditions...*	No. 108
	Exceeding the measuring range	*Indications in measuring mode*	No. 201–203
	Alarm 2	*Indications in measuring mode*	No. 204
	Alarm 1	*Indications in measuring mode*	No. 205
	Measured values fall below the measuring range	*Indications in measuring mode*	No. 211, 212
	Power supply defective (warning)	*Indications in measuring mode*	No. 207
	"SCAL error" (warning)	*Indications in measuring mode*	No. 206
	Sensor replacement (warning)	*Indications in measuring mode*	No. 208

System and sensor faults (no. 101 and no. 104-111) will entirely suspend the measurement mode with their notifications.

Commissioning and maintenance

The DIN EN 60079-29-2 ”Guide for the selection, installation, use and maintenance of apparatus for the detection and measurement of combustible gases or oxygen”, the DIN EN 45544-4 “Electronic instruments for the direct detection and direct concentration measurement of toxic gases and vapors, Part 4: Guideline for the selection, use and maintenance” as well as other national regulations must be observed.
During commissioning, gas detection systems must be tested for function by a trained specialist after they have been installed. (see DIN EN 60079-29-2 section 8.9 or DIN EN 45544-4 section 8.4.2)
Maintenance includes inspection, service, calibration and adjustment as well as regular function checks and repairs.
Checks must be carried out by a trained specialist and the results must be confirmed in writing.

Inspection, service, calibration and adjustment

Inspections should include visual checks of the gas detection device, including:

- Mechanical damage
- Contaminations by dust
- Condensation caused by humidity
- Protective elements for the transmitter
- Diffusion inlets on the transmitter
- Gas sampling system, gas processing system (if applicable)

Service and adjustments encompass measures to keep the gas detection systems in their desired state. They should be performed in regular intervals. These intervals must not exceed four months (see DIN EN 60079-29-2 section 11).

- Zero point
- Sensitivity with test or calibration gas
- Triggering the alarm thresholds
- Stabilizing time
- Output functions (visual and acoustic)
- Error notifications

We highly recommend to entrust the GfG service team with these tasks.

Regular function tests

Gas detection systems can behave differently depending on the ambient conditions. For the first few days after they have been installed, it is therefore important to visually inspect them every day.
In addition to the maintenance work, regular function checks of the gas detection device are mandatory. These intervals may not exceed one year.
Checks must be carried out by a trained specialist and the results must be confirmed in writing.

Repairs

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

Fault - cause - remedy

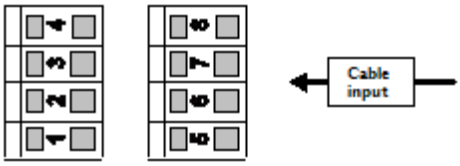
Fault	Cause	Remedy
Zero point cannot be set anymore	Sensor defective	Replace sensor
Sensitivity cannot be set anymore	Sensor defective	Replace sensor
Output current has fallen to 0mA	Fuse defective;	Replace main module
	Line is disrupted	Reestablish connection

Accessories

	Part-No.
Remote control RC2	2800201
EC28 calibration adapter for non-reactive gases for adjustment of the transmitter	2810202
EC28 calibration adapter for reactive gases for adjustment of the transmitter	2810204
EC28 flow adapter	2810203
Zener barrier type Z787.H.F	2810211

Connectors and terminal assignments

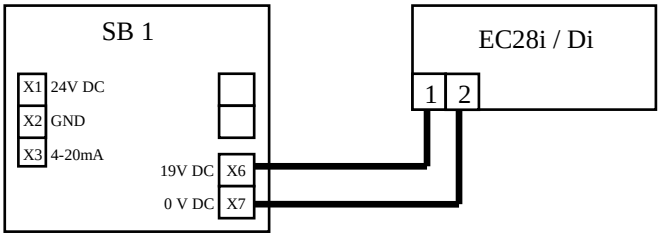
=► The number of available terminals varies depending on the expansion levels of the EC28.



EC28 i with 4...20 interface (two-wire) and SB1

EC28
1: 15...30V DC supply
2: 0V GND supply

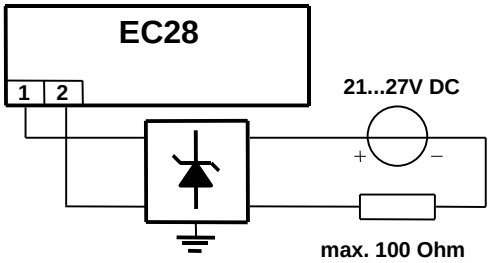
SB 1
X1: 24V Supply
X2: GND
X3: 4-20mA signal
X1-X3 e.g. directly on the GMA 200



EC28 i with 4...20mA interface (two-wire) and zener barrier

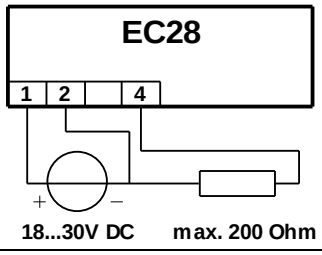
1: 21...27V DC supply (before zener barrier, see chapter *Accessories*)
2: 0V GND supply

Current measurements (4...20mA) in the supply cable



EC28 with 4...20mA interface (three-wire)

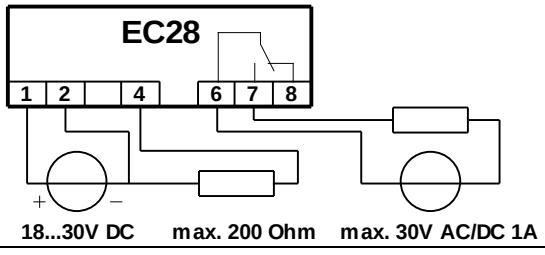
1: 18...30V DC supply
2: 0V GND supply
3: –
4: 4...20mA current output



EC28 with 4...20mA interface (three-wire) and relay

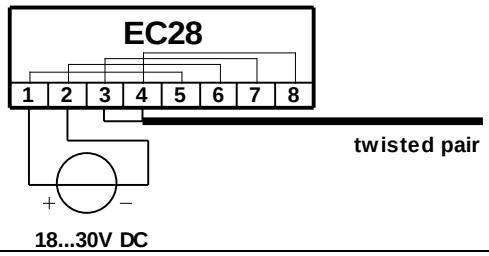
1: 18...30V DC supply
2: 0V GND supply
3: –
4: 4...20mA current output

6: COM relay
7: NO Relay
8: NC Relay



EC28 with MODBUS interface (RS-485)

1:	18...30V DC supply
2:	0V GND supply
3:	Data+ (D1)
4:	Data– (D0)
5:	18...30V DC supply
6:	0V GND supply
7:	Data+ (D1)
8:	Data– (D0)



Note:
See separate document "EC28 MODBUS implementation" for operation specifications.

Measured gas und measuring ranges

Measured gas	Measuring range Standard	Measuring ranges smallest / largest	Sensor type	Sensor item no.
Ammonia (NH_3)	0...100 ppm	0... 40 to 200 ppm	MK393-7	2810701
	0...200 ppm	0...100 to 500 ppm	MK453-7	2810750
	0...500 ppm	0...200 to 1000 ppm	MK399-7	2810703
	0...500 ppm	0...300 to 1500 ppm	MK454-7	2810751
	0...5000 ppm	0...2000 to 5000 ppm	MK455-7	2810756
Arsine (AsH_3)	0...2 ppm	0...1 to 2 ppm	MK349-7	2810730
Bromine gas (Br_2)	0...50 ppm	0...10 bis 50 ppm	MK390-7	2810709
Chlorine (Cl_2)	0...10 ppm	0...10 to 50 ppm	MK390-7	2810709
	0...50 ppm	0...50 to 250 ppm	MK304-4	2810711
Chlorine dioxide (ClO_2)	0...2 ppm	0...1 to 2 ppm	MK391-7	2810712
Hydrogen chloride (HCl)	0...10 ppm	0... 5 to 30 ppm	MK392-7	2810736
	0...50 ppm	0...20 to 100 ppm	MK309-7	2810717
Hydrogen cyanide (HCN)	0...50 ppm	0...10 bis 50 ppm	MK409-7	2810718
	0...100 ppm	0...40 to 200 ppm	MK336-7	2810719
Diborane (B_2H_6)	0...20 ppm	0... 4 to 20 ppm	MK353-4	2810743
Ethylene oxide (C_2H_4O)	0...20 ppm	0...20 to 100 ppm	MK340-7	2810713
Hydrogen fluoride (HF)	0...10 ppm	—	MK412-7	2810738
			MK412-8	2810744
Carbon monoxide (CO) without H_2S warning with reduced Hydrogen cross-sensitivity	0...300 ppm	0...100 to 500 ppm	MK369-7	2810735
Carbon Monoxide (CO) without H_2S warning	0...300 ppm	0...100 to 500 ppm	MK443-7	2810746
	0...1000 ppm	0...400 bis 2000 ppm	MK443-4	2810747
Ozone (O_3) for MAC monitoring	0...1 ppm	—	MK411-7	2810737
Ozone (O_3) for leakage monitoring	0...3 ppm	0...1 to 5 ppm	MK397-7	2810729
Phosgene ($COCl_2$)	0...2 ppm	0...1 to 2 ppm	MK349-7	2810730
Phosphine (PH_3)	0...10 ppm	0...4 to 20 ppm	MK353-7	2810742
			MK470-7	2810757
Oxygen (O_2)	0...25 vol %	0...5 to 30 vol %	MK398-7	2810727
			MK467-7	2810726
Sulphur dioxide (SO_2)	0...10 ppm	0...10 bis 50 ppm	MK306-7	2810731
	0...100 ppm	0...100 to 500 ppm	MK307-7	2810732
Hydrogen sulphide (H_2S)	0...50 ppm	0...40 to 200 ppm	MK445-7	2810748
reduced methanol cross-sensitivity	0...200 ppm	0...200 to 1000 ppm	MK447-4	2810749
Silane (SiH_4)	0...20 ppm	0...10 to 50 ppm	MK477-7	2810734
Nitrogen dioxide (NO_2)	0...30 ppm	0...10 to 50 ppm	MK468-7	2810758
			MK458-7	2810752
	0...100 ppm	0...40 to 200 ppm	MK458-4	2810753
Nitric oxide (NO)	0...50 ppm	0...10 to 50 ppm	MK229-7	2810759
	0...100 ppm	0...50 to 250 ppm	MK457-7	2810754
	0...500 ppm	0...200 to 1000 ppm	MK457-4	2810755
		0...300 to 1500 ppm	MK179-4	2810725
Tetrahydrothiophene THT (C_4H_8S)	0...100 mg/m³	0...20 to 100 mg/m³	MK405-7	2810760
Hydrogen (H_2)	0...2000 ppm	0...400 to 2000 ppm	MK305-7	2810714
	0...1 vol %	0...0.2 to 1 vol %	MK402-7	2810715
	0...2 vol %	0...1 to 4 vol %	MK403-7	2810716

Sensor specifications

MK179-7 (-4) Electrochemical sensor for nitrogen monoxide NO

Max. measuring ranges:	0...300(1500)ppm
Tolerance range / resolution:	±2.5(3)ppm / 0.5(1)ppm
Stabilization time:	t_{90} <25sec
Pressure 80...120kPa:	max. ±1ppm or ±7 % of the displayed value (ref. to 100kPa)
Humidity 15%...90% RH:	max. ±1ppm or±7 % of the displayed value (ref. to 50% RH at 20 °C)
Temperature -20...+35(50)°C:	max. ±3(6)ppm or ±7 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	H_2S≈35%, NO_2<30%, HCl<20%, SO_2=CO=NO=HCN=Cl_2=H_2=0% (*1)
Expected operating life:	> 3 years in air
Stabilization time:	Three minutes to one day, depending on switch-off time

MK229-7 Electrochemical sensor for nitrogen monoxide NO

Max. measuring ranges:	0...50ppm
Tolerance range / resolution:	±0.2ppm / 0.1ppm
Stabilization time:	t_{50} < 5sec t_{90} < 15sec
Pressure 80...120kPa:	max. ±1ppm or ±7 % of the displayed value (ref. to 100kPa)
Humidity 15%...90% RH:	max. ±1ppm or ±7 % of the displayed value (ref. to 50 % RH at 20 °C)
Temperature -20...+40(50)°C:	max. ±2(3)ppm or ±7 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	H_2S<35%; NO_2<5%; CO=SO_2=H_2=0%; (*1)
Expected operating life:	> 3 years in air
Stabilization time:	Three minutes to one day, depending on the switch-off time

MK304-4 Electrochemical sensor for chlorine Cl_2

Max. measuring range:	0...250ppm
Tolerance range / resolution:	±0.3ppm / 0.1ppm
Stabilization time:	t_{80} <70sec
Pressure 80...120kPa:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 15%...90% RH:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+35(50)°C:	max. ±0.3(0.5)ppm or ±10 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	NO_2≈100%, H_2S<-25%, SO_2≈-1%, H_2=HCN=HCl=NO=CO=0% (*1)
Expected operating life:	2..3 years in air

MK305-7 Electrochemical sensor for hydrogen H_2

Max. measuring range:	0...2000ppm
Tolerance range / resolution:	±20ppm / 2ppm
Stabilization time:	t_{90} <60sec
Pressure 80...120kPa:	max. ± 5ppm or ±5 % of the displayed value (ref. to 100kPa)
Humidity 15%...90% RH:	max. ± 5ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+40(50)°C:	max. ±10(20)ppm or±20 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	C_2H_4≈80%, NO≈30%, HCN≈30%, CO<20%, H_2S<20%, SO_2=NO_2=Cl_2=HCl=0% (*1)
Expected operating life:	2..3 years in air

MK306-7 Electrochemical sensor for sulphur dioxide SO_2

Max. measuring range:	0...50ppm
Tolerance range / resolution:	±0.2ppm / 0.1ppm
Stabilization time:	t_{90} <30sec
Pressure 80...120kPa:	max. ±0.2ppm or ±5 % of the displayed value (ref. to 100kPa)
Humidity 15%...90% RH:	max. ±0.2ppm or ±5 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±0.2ppm or ±5 % of the displayed value (ref. to 20°C)
Cross sensitivities:	H_2S≈130%, NO_2≈-120%, HCN≈50%, Cl_2≈-50%, HCl≈20%, CO<1%, NO<-3%, H_2=0% (*1)
Expected operating life:	2..3 years in air

MK307-7 Electrochemical sensor for sulphur dioxide SO_2

Max. measuring range:	0...500ppm
Tolerance range / resolution:	±1ppm / 0.5ppm
Stabilization time:	t_{90} <30sec
Pressure 80...120kPa:	max. ±0.2ppm or ±5 % of the displayed value (ref. to 100kPa)
Humidity 15%...90% RH:	max. ±0.2ppm or±5 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±0.2ppm or ±5 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	NO_2≈-100%, HCN<50%, Cl_2<-30%, NO=<-20%, CO<2%, H_2S=HCl=H_2=0% (*1)
Expected operating life:	2..3 years in air

MK309-7 Electrochemical sensor for hydrogen chloride HCl

Max. measuring range:	0...100ppm
Tolerance range / resolution:	±0.5ppm / 0.5ppm
Stabilization time:	t_{90} <150sec
Pressure 80...120kPa:	max. ±1ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...95% RH:	max. ±1ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+35(50)°C:	max. ±1(3)ppm or ±15(30)% of the displayed value (ref. to 20 °C)
Cross sensitivities:	H_2S≈180..300%, SO_2≈30..70%, NO_2<20%, Cl_2≈-5..+10%, HCN<3%, CO<1%, H_2<0.5%, NO=0% (*1)
Expected operating life:	2..3 years in air
Stabilization time:	Ten minutes to seven days, depending on the switch-off time

MK336-7 Electrochemical sensor for hydrogen cyanide HCN

Max. measuring range:	0...200ppm
Tolerance range / resolution:	±1ppm / 0.5ppm
Stabilization time:	t_{90} <150sec
Pressure 80...120kPa:	max. ±1 ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 15%...90% RH:	max. ±1 ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+35(50)°C:	max. ±1(3) ppm or±15 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	H_2S≈350%, SO_2<350%, NO_2<-400%, Cl_2≈-50%, NO<-50%, CO<18%, H_2=0% (*1)
Expected operating life:	2 years in air

(*1): Indicated gas values for the supplied concentration within MAC range

MK340-7 Electrochemical sensor for ethylene oxide C_2H_4O	
Max. measuring range:	0...100ppm
Tolerance range / resolution:	±0.2ppm / 0.1ppm
Stabilization time:	t_{90} <150sec
Pressure 80...120kPa:	max. ±1ppm or ±15 % of the displayed value (ref. to 100kPa)
Humidity 15%...90% RH:	max. ±2ppm or ±15 % of the displayed value (ref. to 50 % RH)
Temperature -20...+30(50)°C:	max. ±1(3)ppm or ±15(20) % of the displayed value (ref. to 20 °C)
Cross sensitivities:	CO≈40%, CH_4O≈150%, C_2H_2≈125%, CH_2O≈120%, CH_4S≈100%, C_2H_4≈80%, C_2H_6O≈55%, C_7H_8≈20%, MEC≈10% and others (*1)
Expected operating life:	2..3 years in air
Stabilization time:	Four minutes to seven days, depending on the switch-off time

MK349-7 Electrochemical sensor for phosgene $COCl_2$ and Arsine AsH_3	
Max. measuring range:	0...2ppm
Tolerance range / resolution:	±0.02ppm / 0.01ppm
Stabilization time:	t_{90} <150sec
Pressure 80...120kPa:	max. ±0.02ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...95% RH:	max. ±0.02ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+40°C:	max. ±0.02ppm or ±10 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	ClO_2≈-300%, HCl≈250%, AsH_3≈90%, Cl_2≈40%, O_3≈-12%, NO_2≈-10%, NH_3=CO_2=CO=CH_4=0% (*1)
Expected operating life:	1..1.5 years in air

MK353-4 Electrochemical sensor for diborane B_2H_6	
Max. measuring ranges:	0...20ppm B_2H_6
Tolerance range / resolution:	±0.2ppm / 0.1ppm B_2H_6
Stabilization time:	t_{90} <60sec
Pressure 80...120kPa:	max. ±0.1ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 15%...90% RH:	max. ±0.1ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	PH_3≈280%, SiH_4 ≈250%, GeH_4≈250%, AsH_3≈180%, SO_2≈60%, CO ≈1.5%, H_2≈0.3% (*1)
Expected operating life:	2..3 years in air

MK353-7 Electrochemical sensor for phosphine PH_3	
Max. measuring ranges:	0...20ppm PH_3
Tolerance range / resolution:	±0.05ppm / 0.05ppm PH_3
Stabilization time:	t_{90} <60sec
Pressure 80...120kPa:	max. ±0.05ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 15%...90% RH:	max. ±0.05ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±0.05ppm or ±10 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	SiH_4 ≈90%, GeH_4≈90%, AsH_3≈65%, B_2H_6≈35%, SO_2≈20%, CO ≈0.5%, H_2≈0.1% (*1)
Expected operating life:	2..3 years in air

MK369-7 Electrochemical sensor for Carbon Monoxide CO	
Max. measuring range:	0...500ppm
Tolerance range / resolution:	±3ppm / 1ppm
Stabilization time:	t_{20} <10sec t_{90} <30sec
Pressure 80...120kPa:	max. ±3ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 15%...90% RH:	max. ±3ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±3ppm or ±15 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	H_2<10%, NO<35%, NO_2<10%, H_2S<3%, SO_2=0% (*1)
Expected operating life:	2..3 years in air

MK390-7 Electrochemical sensor for chlorine Cl_2	or	**for fluorine F_2**
Max. measuring range:	0...50ppm Cl_2	or 0...100ppm F_2
Tolerance range / resolution:	±0.1ppm Cl_2 / 0.1ppm Cl_2	or ±0.1ppm F_2 / 0.1ppm F_2
Stabilization time:	t_{90} <30sec	
Pressure 80...120kPa:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 100kPa)	
Humidity 10%...95% RH:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 50 % RH)	
Temperature -20...+50°C:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 20 °C)	
Cross sensitivitiesMB=Cl_2:	Br_2≈100%, ClO_2≈50%, F_2≈40%, NO_2≈20%, O_3≈20%, SO_2≈18%, CO_2=CO=H_2S=H_2=0% (*1)	
Cross sensitivities MB=F_2:	Cl_2≈250%, Br_2≈250%, ClO_2≈125%, NO_2≈50%, O_3≈50%, SO_2≈45%, CO_2=CO=H_2S=H_2=0% (*1)	
Expected operating life:	2..3 years in air	

MK391-7 Electrochemical sensor for chlorine dioxid ClO_2	
Max. measuring range:	0...2ppm
Tolerance range / resolution:	±0.3ppm / 0.1ppm
Stabilization time:	t_{90} <120sec
Pressure 80...120kPa:	max. ±0.05ppm or±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...95% RH:	max. ±0.05ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±0.05ppm or ±10 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	O_3≈280%, Cl_2≈60%, H_2S≈-25%, H_2=CO=0% (*1)
Expected operating life:	2..3 years in air

MK392-7 Electrochemical sensor for hydrogen chloride HCl	
Max. measuring range:	0...30ppm
Tolerance range / resolution:	±0.4ppm / 0.2ppm
Stabilization time:	t_{90} <90sec
Pressure 80...120kPa:	max. ±1ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...95% RH:	max. ±1ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±1ppm or ±10 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	AsH_3≈350%, PH_3≈300%, H_2S≈65%, NO≈45%, SO_2≈40%, HCN≈35%, Cl_2≈6%, NO_2≈3%, NH_3≈0.1%, CO=CO_2=H_2=0% (*1)
Expected operating life:	2..3 years in air

(*1): Indicated gas values for the supplied concentration within MAC range

MK393-7 Electrochemical sensor for ammonia NH_3	
Max. measuring range:	0...200ppm
Tolerance range / resolution:	±3ppm / 0.5ppm
Stabilization time:	t_{90} <60sec
Pressure 80...120kPa:	max. ±1ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...95% RH:	max. ±1ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±1(2)ppm or ±15(20) % of the displayed value (ref. to 20 °C)
Cross sensitivities:	H_2S≈10%, CO=CO_2=H_2=0% (*1)
Expected operating life:	2..3 years in air
MK397-7 Electrochemical sensor for ozone O_3	
Max. measuring range:	0...5ppm
Tolerance range / resolution:	±0.03ppm / 0.01ppm
Stabilization time:	t_{90} <150sec
Pressure 80...120kPa:	max. ±0.03 ppm or ±10 % of the measured range (ref. to 100kPa)
Humidity 15%...90% RH:	max. ±0.03 ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±0.05 ppm or ±15 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	ClO_2≈200%, NO_2≈80%, H_2S≈-70%, Cl_2≈60%, SO_2≈-50%, CO<0.1% (*1)
Expected operating life:	2..3 years in air
MK398-7 Electrochemical sensor for oxygen O_2	
Max. measuring range:	0...30 vol %
Tolerance range / resolution:	±0.2 vol % / 0.1 vol %
Stabilization time:	t_{20} <10sec t_{90} <20sec
Pressure 80...120kPa:	max. ±0.2 vol % or ±2.5 % of the measuring range (ref. to 100kPa)
Humidity 0%...99% RH:	max. ±0.2 vol % or ±2,5 % of the measuring range (ref. to 50 % RH)
Temperature -20...+40(50)°C:	max. ±0.3(0.5) vol % or ±2(4) % of the displayed value (ref. to 20 °C)
Expected operating life:	2 years in air
MK399-7 Electrochemical sensor for ammonia NH_3	
Max. measuring range:	0...1000ppm
Tolerance range / resolution:	±10ppm / 5ppm
Stabilization time:	t_{90} <90sec
Pressure 80...120kPa:	max. ± 5ppm or±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...95% RH:	max. ± 5ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±10ppm or±20 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	NO_2≈65%, H_2S≈60%, Cl_2≈20%, SO_2≈-10%, CO=NO=H_2=0% (*1)
Expected operating life:	2..3 years in air
MK402-7 Electrochemical sensor for hydrogen H_2	
Max. measuring range:	0...1 vol %
Tolerance range / resolution:	±0.02 vol % / 0.01 vol %
Stabilization time:	t_{90} <90sec
Pressure 80...120kPa:	max. ±0.01 vol % or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...90% RH:	max. ±0.01 vol % or ±10 % of the displayed value (ref. to 100kPa)
Temperature -20...+50°C:	max. ±0.02 vol % or ±20 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	NO_2≈-400%, CO≈150%, H_2S≈20%, NH_3=CO_2=Cl_2=HCN=CH_4=SO_2=O_3=0% (*1)
Expected operating life:	2..3 years in air
MK403-7 Electrochemical sensor for hydrogen H_2	
Max. measuring range:	0...4 vol %
Tolerance range / resolution:	±0.05 vol % / 0.01 vol %
Stabilization time:	t_{90} <90sec
Pressure 80...120kPa:	max. ±0.01 vol % or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...90 % RH:	max. ±0.01 vol % or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±0.02 vol % or ±25 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	H_2S≈220%, NH_3=CO_2=CO=Cl_2=HCN=CH_4=NO=NO_2=0% (*1)
Expected operating life:	2..3 years in air
MK405-7 Electrochemical sensor for tetrahydrothiophene C_4H_8S (THT)	
Max. measuring range:	0...100mg/m3
Tolerance range / resolution:	±1.0mg/m^3 / 0.5mg/m^3
Stabilization time:	t_{50} < 15sec t_{90} < 30sec
Pressure 80...120kPa:	max. ±1.0mg/m^3 or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...95% RH:	max. ±1.0mg/m^3 or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -10...+45°C:	max. ±1.5mg/m^3 or ±25 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	C_3H_8O≈25%, H_2≈0.5%, CO≈0.5%, CO_2=0% (*1)
Stabilization time:	Four minutes to three days, depending on the switch-off time
Expected operating life:	2 years in air
MK409-7 Electrochemical sensor for hydrogen cyanide HCN	
Max. measuring range:	0...50ppm
Tolerance range / resolution:	±1.5ppm / 0.5ppm
Stabilization time:	t_{90} <60sec
Pressure 80...120kPa:	max. ±0.5 ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...95% RH:	max. ±0.5 ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±0.5 ppm or ±15 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	NO_2≈-70%, NO≈-5%, H_2S≈0…200%(depending on the filter saturation) CO=CO_2=H_2=0% (*1)
Expected operating life:	2 years in air

(*1): Indicated gas values for the supplied concentration within MAC range

MK411-7 Electrochemical sensor for ozone O_3	
Max. measuring range:	0...1ppm
Tolerance range / resolution:	±0.02ppm / 0.01ppm
Stabilization time:	t_{90} <60sec
Pressure 80...120kPa:	max. ±0.03 ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...95% RH:	max. ±0.03 ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -10...+45°C:	max. ±0.03 ppm or ±15 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	ClO_2≈150%, Cl_2≈120%, NO_2≈60%, H_2S≈-8%, CO_2=CO=H_2=0% (*1)
Expected operating life:	2 years in air
MK412-7 (-8) Electrochemical sensor for hydrogen fluoride HF	
Max. measuring range:	0...10ppm
Resolution:	0.1ppm (0.5ppm for MK412-8)
Tolerance range:	±0.1ppm (±0.5ppm for MK412-8)
Stabilization time:	t_{50} <40sec t_{90} <90sec
Pressure 80...120kPa:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...80% RH:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+40°C:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	Cl_2≈140%, HCl≈70%, CO=NO_2=H_2S=H_2=0% (*1)
Expected operating life:	1..2 years in air
MK443-7 (-4) Electrochemical sensor for carbon monoxide CO	
Max. measuring ranges:	0...500(2000)ppm
Tolerance range / resolution:	±3ppm / 1ppm
Stabilization time:	t_{90} <30sec
Pressure 80...120kPa:	max. ±3ppm or ±7 % of the displayed value (ref. to 100kPa)
Humidity 15%...90% RH:	max. ±3ppm or ±7 % of the displayed value (ref. to 50 % RH)
Temperature -20...+40(50)°C:	max. ±3(5)ppm or ±7(10) % of the displayed value (ref. to 20 °C)
Cross sensitivities	C_2H_4≈96%, C_2H_2≈90%, H_2<30%(typ.15%), NO<20%, Cl_2<7%, C_2H_6O<0.5%, SO_2=NH_3=H_2S=0% (*1)
Expected operating life:	3 years in air
MK445-7 Electrochemical sensor for hydrogen sulphide H_2S	
Max. measuring range:	0...200ppm
Tolerance range / resolution:	±0.5ppm / 0.1ppm
Stabilization time:	t_{90} <30sec
Pressure 80...120kPa:	max. ±1ppm or ±7 % of the displayed value (ref. to 100kPa)
Humidity 15%...90% RH:	max. ±1ppm or ±7% of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±1ppm or ±7 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	NO_2<10%, CO<2%, NO<1%, CO_2=SO_2=Cl_2=NH_3=C_2H_4=0% low methanol sensitivity (*1)
Expected operating life:	3 years in air
MK447-4 Electrochemical sensor for hydrogen sulphide H_2S	
Max. measuring range:	0...1000ppm
Tolerance range / resolution:	±1.0ppm / 0.5ppm
Stabilization time:	t_{90} <40sec
Pressure 80...120kPa:	max. ±1ppm or ±7 % of the displayed value (ref. to 100kPa)
Humidity 15%...90% RH:	max. ±1ppm or ±7 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±1ppm or ±7 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	SO_2<20%, NO_2<±10%, CO<2%, NO<2%, H_2<0,2% CO_2=Cl_2=C_2H_4=0% (*1)
Expected operating life:	3 years in air
MK453-7 Electrochemical sensor for ammonia NH_3	
Max. measuring range:	0...500ppm
Tolerance range / resolution:	±3ppm / 1ppm
Stabilization time:	t_{90} <45sec
Pressure 80...120kPa:	max. ±1ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...95% RH:	max. ±1ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±1(2)ppm or ±15(20) % of the displayed value (ref. to 20 °C)
Cross sensitivities:	H_2S≈120%, NO_2≈-100%, SO_2≈-30%, CO=NO=CO_2=H_2=C_2H_6O=0% (*1)
Expected operating life:	2..3 years in air
MK454-7 Electrochemical sensor for ammonia NH_3	
Max. measuring range:	0...1500ppm
Tolerance range / resolution:	±10ppm / 5ppm
Stabilization time:	t_{90} <60sec
Pressure 80...120kPa:	max. ± 5ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...95% RH:	max. ± 5ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±10ppm or±20 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	H_2S≈140%, NO_2≈-100%, SO_2≈-30%, CO=NO=CO_2=H_2=C_2H_6O=0% (*1)
Expected operating life:	2..3 years in air
MK455-7 Electrochemical sensor for ammonia NH_3	
Max. measuring range:	0...5000ppm
Tolerance range / resolution:	±50ppm / 10ppm
Stabilization time:	t_{90} <90sec
Pressure 80...120kPa:	max. ±10ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...90 % RH:	max. ±20ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±30ppm or±20 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	NO_2≈65%, H_2S≈60%, Cl_2≈20%, SO_2≈-10%, CO=NO=H_2=0% (*1)
Expected operating life:	2..3 years in air

(*1): Indicated gas values for the supplied concentration within MAC range

MK457-7 (-4) Electrochemical sensor for nitric oxide NO	
Max. measuring range:	0...250(1000)ppm
Tolerance range / resolution:	±2.0ppm / 0.5(1)ppm
Stabilization time:	t_{50} < 10sec t_{90} < 30sec
Pressure 80...120kPa:	max. ±1ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...90 % RH:	max. ±1ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±2ppm or ±10 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	H_2S<50%; NO_2<40%; C_2H_6O ±10%; SO_2<5%; H_2<1%; NH_3<1%; CO<-1%; CO_2=CL_2=0; (*1)
Stabilization time:	Three minutes to one day, depending on the switch-off time
Expected operating life:	3 years in air
MK458-7 (-4) Electrochemical sensor for nitrogen dioxide NO_2	
Max. measuring range:	0...50(200)ppm
Tolerance range / resolution:	±0.5ppm / 0.1ppm
Stabilization time:	t_{50} < 10sec t_{90} < 30sec
Pressure 80...120kPa:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...90 % RH:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	Cl_2≈100%; H_2S<-40%; NO<20%; $C_2H_6$0<1%; CO<-1%; SO2<-1%; H2<-1%; NH3<-1%, CO2=0; (*1)
Expected operating life:	3 years in air
MK477-7 Electrochemical sensor for silane SiH_4	
Max. measuring range:	0...50ppm
Tolerance range / resolution:	±0.2ppm / 0.1ppm
Stabilization time:	t_{50} < 20sec t_{90} < 60sec
Pressure 80...120kPa:	max. ±0.1ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 20%...95% RH:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+40°C:	max. ±0.3ppm or ±10 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	H_2S≈160%, PH_3≈100%; SO_2≈20%; H_2=CO=0%; (*1)
Expected operating life:	2..3 years in air
MK467-7 Electrochemical sensor for oxygen O_2	
Max. measuring range:	0...30 vol %
Tolerance range / resolution:	±0.2 vol % / 0.1 vol %
Stabilization time:	t_{20} <10sec t_{90} <20sec
Pressure 80...120kPa:	max. ±0.2 vol % or ±2.5 % of the measuring range (ref. to 100kPa)
Humidity 0%...99% RH:	max. ±0.2 vol % or ±2,5 % of the measuring range (ref. to 50 % RH)
Temperature -20...+40(50)°C:	max. ±0.3(0.5) vol % or ±2(4) % of the displayed value (ref. to 20 °C)
Expected operating life:	2 years in air
MK468-7 Electrochemical sensor for nitrogen dioxide NO_2	
Max. measuring range:	0...50ppm
Tolerance range / resolution:	±0.2ppm / 0.1ppm
Stabilization time:	t_{90} < 45sec
Pressure 80...120kPa:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 10%...90 % RH:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±0.2ppm or ±10 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	Cl_2<100%; H_2S<-10%; NO<-2%; CO= CO_2=H_2=NH_3=SO_2=0; (*1)
Expected operating life:	3 years in air
MK470-7 Electrochemical sensor for phosphine PH_3	
Max. measuring range:	0...20ppm PH_3
Tolerance range / resolution:	±0.04ppm / 0.02ppm
Stabilization time:	t_{90} <60sec
Pressure 80...120kPa:	max. ±0.05ppm or ±10 % of the displayed value (ref. to 100kPa)
Humidity 15%...90% RH:	max. ±0.05ppm or ±10 % of the displayed value (ref. to 50 % RH)
Temperature -20...+50°C:	max. ±0.05ppm or ±10 % of the displayed value (ref. to 20 °C)
Cross sensitivities:	SiH_4 ≈50%, NO_2≈-30%, SO_2≈25%, H_2S≈24%, C_2H_4≈2%, CO =H_2=NO=0%, (*1)
Expected operating life:	2..3 years in air

(*1): Indicated gas values for the supplied concentration within MAC range

Internal parameter memory of the EC28

Each transmitter comes pre-programmed with data of the most important gases and their additional parameters. In most cases, you will therefore not have to make any changes to the configuration. The following information is stored in the transmitter's memory:

Type of gas	**Molecular formula**	**Unit**	**CGAS** Calibration gas	**A1** Alarm 1	**A2** Alarm 2	**H1** Hyst. A1	**H2** Hyst. A2	**F1** Funct. A1	**F2** Funct. A2
Ammonia	NH_3	ppm	100	50	100	0	0	HNS	H SC
Bromine gas	Br_2	ppm	5.0	0.2	0.5	0.0	0.0	HNS	H SC
Chlorine	Cl_2	ppm	5.0	0.5	1.0	0.0	0.0	HNS	H SC
Chlorine dioxide	ClO_2	ppm	1.00	0.10	0.30	0.03	0.03	HNS	H SC
Hydrogen chloride	HCl	ppm	10.0	5.0	10.0	0.0	0.0	HNS	H SC
Hydrogen cyanide	HCN	ppm	50.0	10.0	20.0	0.0	0.0	HNS	H SC
Ethylene oxide	C_2H_4O	ppm	10.0	2.0	4.0	0.0	0.0	HNS	H SC
Hydrogen fluoride	HF	ppm	6.6	3.0	5.0	0.0	0.0	HNS	H SC
Carbon monoxide	CO	ppm	200	30	60	0	0	HNS	H SC
Ozone	O_3	ppm	1.00	0.30	0.50	0.05	0.05	HNS	H SC
Phosgene	$COCl_2$	ppm	1.00	0.10	0.20	0.00	0.00	HNS	H SC
Phosphine	PH_3	ppm	5.00	0.20	0.40	0.00	0.00	HNS	H SC
Oxygen	O_2	Vol %	20.9	19.0	17.0	0.0	0.0	LNS	L SC
Sulphur dioxide	SO_2	ppm	10.0	2.0	4.0	0.0	0.0	HNS	H SC
Hydrogen sulphide	H_2S	ppm	50.0	10.0	20.0	0.0	0.0	HNS	H SC
Silane	SiH_4	ppm	5.0	5.0	10.0	0.0	0.0	HNS	H SC
Nitrogen dioxide	NO_2	ppm	20.0	5.0	10.0	0.0	0.0	HNS	H SC
Nitric oxide	NO	ppm	50	25	50	0	0	HNS	H SC
Hydrogen	H_2	ppm	1000	1000	1500	0	0	HNS	H SC
Hydrogen	H_2	Vol %	1.00	0.20	0.40	0.00	0.00	HNS	H SC

If the transmitter is operating with a sensor whose data is not yet in this list, it will use pre-defined settings.
You can individually adapt these settings for the gas and save them on the transmitter.

Technical specifications – Part 1

Device type	**EC28, EC28 D, EC28 DA, EC28 DAR, EC28 B, EC28 DB** and **EC28 DAB**
Measuring function	
Measured gas:	Combustible gases and vapors and oxygen
Measuring range:	see inspection protocol
Gas supply:	Diffusion
Stabilization time:	see sensor specifications
Measuring principle:	Electrochemical
Expected operating life:	see sensor specifications
Output signal:	4...20mA (max. load 200 Ohm) or two wire Modbus (only EC28 B...)
Alarm:	Visual and acoustic (90dB / 10 cm; only EC28 DA)
Relay output:	1 floating changeover (only EC28 ...R) Umax=30V AC/DC, max. short-circuit current of supplying source 1A
Power supply	
Supply voltage:	18...30V DC
Maximum fault voltage:	250V AC or 45V DC (see type label)
Maximum supply current:	40 mA for EC28 & EC28 B 55 mA for EC28 D & EC28 DB 70 mA for EC28 DA & EC28 DAB 100 mA for EC28 DAR
Climatic conditions	
Storage temperature:	−25...+60 °C (short-term) or 0...+30°C (recommended)
Operating temperature (ambient):	−20...+50 °C (see also: sensor specifications)
Humidity range:	5...90 % RH (see also: sensor specifications)
Atmospheric pressure range:	80...120kPa (see also: sensor specifications)
Housing	
Sensor mount:	Stainless steel
Housing material:	Antistatic plastic Protect the housing from very heavy impacts (>4 J)!
Dimensions:	115mm x 203mm x 55mm (W x H x D)
Weight:	approximately 800 g (with Display)
Protection class:	IP 64
Cable connections:	Fittings M16 x 1.5 max. wire cross-section 3(4) x 1.5mm^2
Cable type and length:	LIYCY 3(4) x 0,75mm^2 up to 500m (EC28 DA: up to 200m) or LIYCY 3(4) x 1.5 mm^2 bis 1000 m
Approvals and certifications	
Designation:	⟨Ex⟩ II 2G CE 0158
Ignition protection type:	Ex eb mb [ib] IIC T4 Gb -20°C≤Ta≤+50°C
EC Type Examination Certificate:	BVS 04 ATEX E 132 X
Electromagnetic Compatibility (EMC)	Compliant with DIN EN 50270 emitted interference: Type 1 Interference resistance: Type 2 or type 1 for bus versions

Technical specifications – Part 2

Device type	**EC28 i** and **EC28 Di**
Measuring function	
Measured gas:	Toxic gases and vapors and oxygen
Measuring range:	See inspection protocol
Gas supply:	Diffusion
Stabilization time:	see sensor specifications
Measuring principle:	Electrochemical
Expected operating life:	See sensor specifications
Output signal:	4...20mA for Ex zone: max. load of 100 Ohm with zener barrier see chapter *Accessories* for non-Ex zone: max. load of 200 Ohm without zener barrier
Power supply	
Supply voltage:	15...30V DC for intrinsically safe supply $U_i \leq 30V$ 21...27V DC for supply via zener barrier, see chapter *Accessories*
Maximum supply current:	25 mA
Climatic conditions	
Storage temperature:	−25...+60 °C (short-term) or 0...+30°C (recommended)
Operating temperature (ambient):	−20...+50 °C (see also: sensor specifications)
Humidity range:	5...90 % RH (see also: sensor specifications)
Atmospheric pressure range:	80...120kPa (see also: sensor specifications)
Housing	
Sensor mount:	Stainless steel
Housing material:	Antistatic plastic Protect the housing from very heavy impacts (>4 J)!
Dimensions:	115mm x 203mm x 55mm (W x H x D)
Weight:	approximately 800 g (with Display)
Protection class:	IP 64
Cable connections:	Fittings M16 x 1.5 max. wire cross-section 3(4) x 1.5mm²
Cable type and length:	LIYCY 2 x 0,75mm² up to 500m or LIYCY 2 x 1,5mm² up to 1000m
Approvals and certifications	
Designation:	⟨Ex⟩ II 1G CE 0158
Ignition protection type:	Ex ia IIC T4 Ga -20°C≤Ta≤+50°C
EC Type Examination Certificate:	BVS 04 ATEX E 132 X
Electromagnetic Compatibility (EMC):	according to DIN EN 50270 emitted interference: Type 1 Interference resistance: Type 2

Declarations of Conformity

SIL–Declaration of Conformity **GfG Gesellschaft für Gerätebau mbH**

EC28 **EC28 B**
EC28 D **EC28 DB**
EC28 DA **EC28 DAB**

Issued: 2015-09-15 Changed: 2020-12-18

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The transmitter **EC28 (D, DA)** with 4 - 20mA analogue output signal respectively **EC28 B (DB, DAB)** with RS 485 digital output signal complies with the following European Standards for Functional Safety:

Functional safety of electrical/electronic/
programmable electronic safety-related systems **DIN EN 61508-2: 2011**

The following parameters for single channel and dual channel use of **transmitter EC28** with analogue respectively digital output have been determined:

	Single channel use (1oo1)	Redundant use (1oo2)
Safety function	Detection of toxic gases or inerting monitoring	
Sensor type / Metering range/ Type of Gas	MK353-4: 0–20ppm B_2H_6 MK353-7: 0–5ppm / 0–10ppm / 0–20ppm PH_3 MK390-7: 0–10ppm / 0–50ppm Cl_2 MK392-7: 0–10ppm / 0–30ppm HCl MK393-7: 0–100ppm / 0–200ppm NH_3 MK409-7: 0–30ppm HCN MK411-7: 0–1ppm O_3 MK412-7: 0–10ppm HF MK445-7: 0–50ppm / 0–100ppm H_2S MK457-7: 0–100ppm NO MK458-7: 0–30ppm NO_2 MK460-7: 0–20ppm / 0–50ppm SiH_4	
Device type	B	
MTTR	72 h	
Proof Test Intervall	1 Year	
SFF	84,61% resp. 84,94%	
SIL- level hardware	1	2
HFT	0	1
β Faktor	—	10%
λ_{SD} [1/h]	$1{,}52\times10^{-7}$ resp. $1{,}51\times10^{-7}$	
λ_{SU} [1/h]	$3{,}11\times10^{-6}$ resp. $3{,}08\times10^{-6}$	
λ_{DD} [1/h]	$2{,}85\times10^{-7}$ resp. $3{,}72\times10^{-7}$	
PFH = λ_{DU} [1/h]	$6{,}46\times10^{-7}$ resp. $6{,}40\times10^{-7}$	$6{,}76\times10^{-8}$ resp. $6{,}70\times10^{-8}$
PFD_{avg} [1/Year]	$2{,}90\times10^{-3}$ resp. $2{,}87\times10^{-3}$	$2{,}99\times10^{-4}$ resp. $2{,}97\times10^{-4}$

The original calculation of the parameters was done by GWW GasWarn Dr. Wenker GmbH as an independent expert

Always consider the following operational conditions and safety notes of the operation manual 207-000.34.

Dortmund, December 18, 2020

F. Böttger
Head of Development

SIL–Declaration of Conformity **GfG Gesellschaft für Gerätebau mbH**

EC28 **EC28 B**
EC28 D **EC28 DB**
EC28 DA **EC28 DAB**

Issued: 2015-09-15 Changed: 2020-07-22

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The transmitter **EC28 (D, DA)** with 4 - 20mA analogue output signal respectively **EC28 B (DB, DAB)** with RS 485 digital output signal complies with the following European Standards for Functional Safety:

Functional safety of electrical/electronic/
programmable electronic safety-related systems **DIN EN 61508-2: 2011**

The following parameters for single channel and dual channel use of **transmitter EC28** with analogue respectively digital output have been determined:

	Single channel use (1oo1)	Redundant use (1oo2)
Safety function	Detection of toxic gases or inerting monitoring	
Sensor type / Metering range/ Type of Gas	MK391-7: 0–2ppm ClO_2 MK397-7: 0–3ppm / 0–5ppm O_3 MK398-7: 0–25Vol.% O_2 to inerting monitoring MK399-7: 0–500ppm / 0–1000ppm NH_3 MK443-4: 0–1000ppm / 0–2000ppm CO MK443-7: 0–300ppm / 0–500ppm CO	
Device type	B	
MTTR	72 h	
Proof Test Intervall	1 Year	
SFF	90,80% resp. 91,13%	
SIL- level hardware	2	3
HFT	0	1
β Faktor	—	10%
λ_{SD} [1/h]	$1{,}52\times10^{-7}$ resp. $1{,}51\times10^{-7}$	
λ_{SU} [1/h]	$2{,}54\times10^{-6}$ resp. $2{,}51\times10^{-6}$	
λ_{DD} [1/h]	$2{,}85\times10^{-7}$ resp. $3{,}72\times10^{-7}$	
PFH = λ_{DU} [1/h]	$3{,}01\times10^{-7}$ resp. $2{,}95\times10^{-7}$	$3{,}08\times10^{-8}$ resp. $3{,}02\times10^{-8}$
PFD_{avg} [1/Year]	$1{,}36\times10^{-3}$ resp. $1{,}34\times10^{-3}$	$1{,}38\times10^{-4}$ resp. $1{,}36\times10^{-4}$

The original calculation of the parameters was done by GWW GasWarn Dr. Wenker GmbH as an independent expert.

Always consider the following operational conditions and safety notes of the operation manual 207-000.34.

Dortmund, July 22, 2020

H.J. Hübner
President

SIL–Declaration of Conformity **GfG Gesellschaft für Gerätebau mbH**

EC28 **EC28 B**
EC28 D **EC28 DB**
EC28 DA **EC28 DAB**

Issued: 2015-09-15 Changed: 2020-12-18

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Operational Conditions

The SIL level of the transmitter in combination with the determined error rate is only valid, if the following operational conditions are adhered:

The FMEDA for determining the hardware failure rate was worked out assuming that a too low gas signal represents a dangerous failure. A too high signal is an assured error because an alarm is triggered surely, but at a lower gas concentration as necessary. Therefore the error rate is **not valid** for the monitoring of lack of oxygen where a too high gas signal represents a dangerous failure.

The transmitter must be mounted in a position which is suitable for the detection task, must be properly connected to a controller and must be put into operation by the manufacturer GfG or by an authorised representative.

Transmitter with analogue output signal:

The following status signals must be detected by the used controller. This is automatically made sure when controllers are used which are produced by GfG Gesellschaft für Gerätebau mbH.

≤ 2.8 mA	Fault low = transmitter fault or disconnection
> 2.8 to < 4 mA	Under range (in measuring mode)
> 20 to < 22 mA	Over range (in measuring mode)
≥ 22 mA	Fault high = transmitter fault or short-circuit on line

Transmitter with digital output signal:

The safety function is a digital RS485 output signal with a proprietary protocol. Status signals from the detector including fault messages are implemented in the digital protocol. The functional safety of the digital protocol is part of the SIL-examination of the associated evaluation unit, e.g. the GMA200.

The ambient conditions e.g. referring temperature, humidity and pressure, which are specified in the manufacturer's documentation, have to be observed.

According to the manufacture's statements the transmitter has to be regularly serviced by an expert and must be calibrated with a certified test gas. In Germany the calibration interval is determined in bulletin T 021 of the BG-RCI (= DGUV Information 213-056 of the German Social Accident Insurance).

Annual Proof Test

At least once a year a Proof Test of the complete safety chain has to be effected. For the transmitter the Proof Test is equivalent to a system check according to the Ordinance on Industrial Safety and Health and includes the regular calibration / adjustment without additional requirements.

EU Declaration of Conformity

EC28, EC28 D, EC28 DA,
EC28 B, EC28 DB, EC28 DAB
EC28 R, EC28 DR, EC28 DAR

Edited: 18.09.2006 Amended: 27.09.2021

GfG Gesellschaft für Gerätebau mbH

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

The transmitter **EC28 (D, DA, B, DB, DAB, R, DR, DAR)** complies with directive **2014/34/EU** (ATEX) for devices and protective systems for proper use in potentially explosive atmospheres, directive **2014/30/EU** for electromagnetic compatibility and with directive **2011/65/EU** (RoHS) on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

For electrical explosion protection	BVS 04 ATEX E 132 X
Labelling	Ⓔx II **2G** Ex eb mb [ib] IIC T4 Gb

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

- General requirements	EN IEC 60079-0	: 2018
- Increased safety "e"	EN IEC 60079-7	: 2015 + A1: 2018
- Intrinsic safety "i"	EN 60079-11	: 2012
- Encapsulation "m"	EN 60079-18	: 2015 / A1: 2017

Certified by the notified body with ID number 0158 (DEKRA Testing and Certification, Dinnendahlstraße 9, D-44809 Bochum).

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

- Electromagnetic compatibility - Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen	EN 50270	: 2015
Emitted interference	Type class 1	
Interference immunity	Type class 2	[D, DA, R, DR, DAR]
Interference immunity	Type class 1	[B, DB, DAB]

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

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

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

Dortmund, 27. September 2021

i.V. .....

B. Siebrecht
QMB

EU Declaration of Conformity

EC28 i
EC28 Di

Edited: 18.09.2006 Amended: 27.09.2021

GfG Gesellschaft für Gerätebau mbH

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

The transmitter **EC28 i, EC28 Di** complies with directive **2014/34/EU** (ATEX) for devices and protective systems for proper use in potentially explosive atmospheres, directive **2014/30/EU** for electromagnetic compatibility and with directive **2011/65/EU** (RoHS) on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

For electrical explosion protection	BVS 04 ATEX E 132 X
Labelling	Ⓔx II **1G** Ex ia IIC T4 Ga

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

- General requirements	EN IEC 60079-0	: 2018
- Intrinsic safety "i"	EN 60079-11	: 2012

Certified by the notified body with ID number 0158 (DEKRA Testing and Certification, Dinnendahlstraße 9, D-44809 Bochum).

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

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

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

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

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

Dortmund, 27. September 2021

i.V. .....

B. Siebrecht
QMB

EC Type Examination Certificate

Translation

1 **EU-Type Examination Certificate Supplement 5**

Change to Directive 2014/34/EU

2 **Equipment intended for use in potentially explosive atmospheres Directive 2014/34/EU**

3 EU-Type Examination Certificate Number: **BVS 04 ATEX E 132 X**

4 Product: **Transmitter type CC28 * and type EC28 ***

5 Manufacturer: **GfG Gesellschaft für Gerätebau mbH**

6 Address: **Klönnestr. 99, 44143 Dortmund, Germany**

7 This supplementary certificate extends EC-Type Examination Certificate No. BVS 04 ATEX E 132 X to apply to products designed and constructed in accordance with the specification set out in the appendix of the said certificate but having any acceptable variations specified in the appendix to this certificate and the documents referred to therein.

8 DEKRA Testing and Certification GmbH, Notified Body number 0158, in accordance with Article 17 of Directive 2014/34/EU of the European Parliament and of the Council, dated 26 February 2014, certifies that this product has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to the Directive.
The examination and test results are recorded in the confidential Report No. BVS PP 04.2119 EU.

9 The Essential Health and Safety Requirements are assured in consideration of:

EN IEC 60079-0:2018	**General requirements**
EN 60079-1:2014	**Flameproof enclosure "d"**
EN IEC 60079-7:2015 + A1:2018	**Increased Safety "e"**
EN 60079-11:2012	**Intrinsic Safety "i"**
EN 60079-18:2015/A1:2017	**Encapsulation "m"**

10 If the sign "X" is placed after the certificate number, it indicates that the product is subject to the Special Conditions for Use specified in the appendix to this certificate.

11 This EU-Type Examination Certificate relates only to the design and construction of the specified product. Further requirements of the Directive apply to the manufacturing process and supply of this product. These are not covered by this certificate.

12 The marking of the product shall include the following:

II 2G Ex db eb mb [ib] IIC T4 Gb or
II 2G Ex eb mb [ib] IIC T4 Gb or
II 1G Ex ia IIC T4 Ga Details see next page

DEKRA Testing and Certification GmbH
Bochum, 2021-03-16

Signed: Jörg-Timm Kilisch

Managing Director

This certificate may only be reproduced in its entirety and without any change.

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Certification body: Dinnendahlstr. 9, 44809 Bochum, Germany
Phone +49.234.3696-400, Fax +49.234.3696-401, e-mail DTC-Certification-body@dekra.com

13 **Appendix**

14 **EU-Type Examination Certificate**

BVS 04 ATEX E 132 X
Supplement 5

15 **Product description**

15.1 **Subject and type**

Transmitter

Type	Connection type / Functionality	Marking
CC28	without display	**II 2G Ex db eb mb [ib] IIC T4 Gb**
CC28 D	with Display	
CC28 DA	with display and alarm	
EC28	4-20 mA, 1-wire bus	**II 2G Ex eb mb [ib] IIC T4 Gb**
EC28 D	4-20 mA, 1-wire bus, display	
EC28 DA	4-20 mA, 1-wire bus, display, alarm-LED and buzzer	
EC28 B	RS485, 2-wire bus	
EC28 DB	RS485, 2-wire bus, display	
EC28 DAB	RS485, 2-wire bus, display, alarm-LED and buzzer	
EC28 R	4-20 mA, 1-wire bus, relay	
EC28 DR	4-20 mA, 1-wire bus, relay, display	
EC28 DAR	4-20 mA, 1-wire bus, relay, display, alarm-LED and buzzer	
EC28 i	4-20 mA (intrinsically safe)	**II 1G Ex ia IIC T4 Ga**
EC28 Di	4-20 mA (intrinsically safe), display	

15.2 **Description**

With this supplement the certificate is changed to Directive 2014/34/EU.
(Annotation: In accordance with Article 41 of Directive 2014/34/EU, EC-Type Examination Certificates referring to 94/9/EC that were in existence prior to the date of application of 2014/34/EU (20 April 2016) may be referenced as if they were issued in accordance with Directive 2014/34/EU. Supplementary Certificates to such EC-Type Examination Certificates, and new issues of such certificates, may continue to bear the original certificate number issued prior to 20 April 2016.)

Reason for the supplement:

Change to Directive 2014/34/EU

The transmitters were tested in accordance to the standards lixted on page1.
The marking was modified in accordance to the standards.

The mechanical construction and the internal electronics was slightly modified.

This certificate may only be reproduced in its entirety and without any change.

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Description of Product:

The transmitters type CC28 * and type EC28 * serve the purpose of detecting gases in a stationary mode in atmospheric conditions.
For types CC28 *, EC28, EC28 D, EC28 DA, EC28 B, EC28 DB, EC28 DAB, EC28 R, EC28 DR and EC28 DAR, the transmitter enclosure is manufactured to meet the requirements of protection type "e", Increased Safety. The transmitter is equipped with non-intrinsically safe terminals for the supply and the output signal circuits; furthermore, it comes with a module designed to meet the requirements of both protection types, Intrinsic Safety "i" and Encapsulation "m", and, depending on the type, with intrinsically safe interfaces, display units and buzzers.

The transmitter type CC28 * has a sensor attached to it which meets the requirements of protection type Flameproof Enclosure "d".

The transmitter type EC28 * has a sensor attached to it which meets the requirements of protection type Intrinsic Safety "i".

The maximum default voltage U_m for transmitters of type CC28 *, EC28, EC28 D, EC28 DA, EC28 B, EC28 DB, EC28 DAB, EC28 R, EC28 DR and EC28 DAR is 45 V AC or 250 V AC when connected to the non-intrinsically safe terminals, depending on the variant.

The appropriate U_m is stated on the type label.

The intrinsically safe transmitters type EC28 i and type EC28 Di are manufactured with the same enclosure. Additionally, the transmitter is connected to the intrinsically safe supply and output signal circuits (4-20 mA) by terminals.

The transmitters are suitable for an ambient temperature range of -20 °C up to +50 °C.

15.3 **Parameters**

15.3.1 Electrical data for the transmitter type CC28 *, EC28, EC28 D, EC28 DA, EC28 B, EC28 DB, EC28 DAB, EC28 R, EC28 DR and EC28 DAR

15.3.1.1 Non-intrinsically safe supply circuit
type CC28 *, EC28, EC28 D, EC28 DA, EC28 R, EC28 DR, EC28 DAR
connected via terminals X1 and X2

type EC28 B, EC28 DB, EC28 DAB
connected via terminals X1, X2, X5 and X6

Rated supply voltage	up to			30	VDC
Maximum voltage	U_m	DC 45	or AC 250		V

The maximum voltage U_m is stated on the label.

15.3.1.2 Non-intrinsically safe signal circuit (4 up to 20 mA)
type CC28 *
connected via terminals X3, X4

type EC28, EC28 D, EC28 DA, EC28 R, EC28 DR, EC28 DAR
connected via terminals X4 and X2

type EC28 B, EC28 DB, EC28 DAB
connected via terminals X3, X4, X7 and X8

Rated signal voltage	up to			30	VDC
Maximum voltage	U_m	DC 45	or AC 250		V

The maximum voltage U_m is stated on the label.

15.3.1.3 Non-intrinsically safe relay contact circuit (change-over contact)
type EC28 R, EC28 DR, EC28 DAR
connected via X6 up to X8

Rated switch voltage	up to			30	VDC
Maximum switch voltage	U_m	DC 45	or AC 250		V

The maximum voltage U_m is stated on the label.

Maximum short circuit current of power source		1	A

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15.3.1.4 Intrinsically safe potential-free opto-coupling interface, connected by four-pole plug-in connector type CC28 *, type EC28, EC28 D, EC28 DA, EC28 B, EC28 DB, EC28 DAB, EC28 R, EC28 DR and EC28 DAR

Only for connection of the control set type RC2 (BVS 04 ATEX E 212)

15.3.2 Electrical data for transmitter type EC28 i and type EC28 Di

15.3.2.1 Intrinsically safe supply and signal circuit, connected via terminals X1 and X2

Maximum input voltage	U_i	DC 30	V
Maximum internal capacitance	C_i	negligible	
Maximum internal inductance	L_i	negligible	

15.3.2.2 Intrinsically safe potential-free opto-coupling interface, connected by four-pole plug-in connector

Only for connection of the control set type RC2 (BVS 04 ATEX E 212)

15.3.3 Thermal parameters

Ambient temperature range	-20 °C up to +50 °C

16 **Report Number**

BVS PP 04.2119 EU, as of 16.03.2021

17 **Special Conditions for Use**

The measuring function according to annex II paragraph 1.5.5 of the Directive 2014/34/EU is not part of this supplement to the EU-type Examination Certificate.

The enclosure of the transmitters type CC 28 *, EC28, EC28 D, EC28 DA, EC28 B, EC28 DB, EC28 DAB, EC28 R, EC28 DR and EC28 DAR meets the requirements for the low degree of mechanical hazards according to EN IEC 60079-0:2018 paragraph 26.4.2; thus it may only be used in such low-hazard areas or in areas where it is protected against mechanical hazards.

18 **Essential Health and Safety Requirements**

The Essential Health and Safety Requirements are covered by the standards listed under item 9.

19 **Drawings and Documents**

Drawings and documents are listed in the confidential report.

We confirm the correctness of the translation from the German original.
In the case of arbitration only the German wording shall be valid and binding.

DEKRA Testing and Certification GmbH
Bochum, 2021-03-16
BVS-Rip/Mu A20170239

Managing Director

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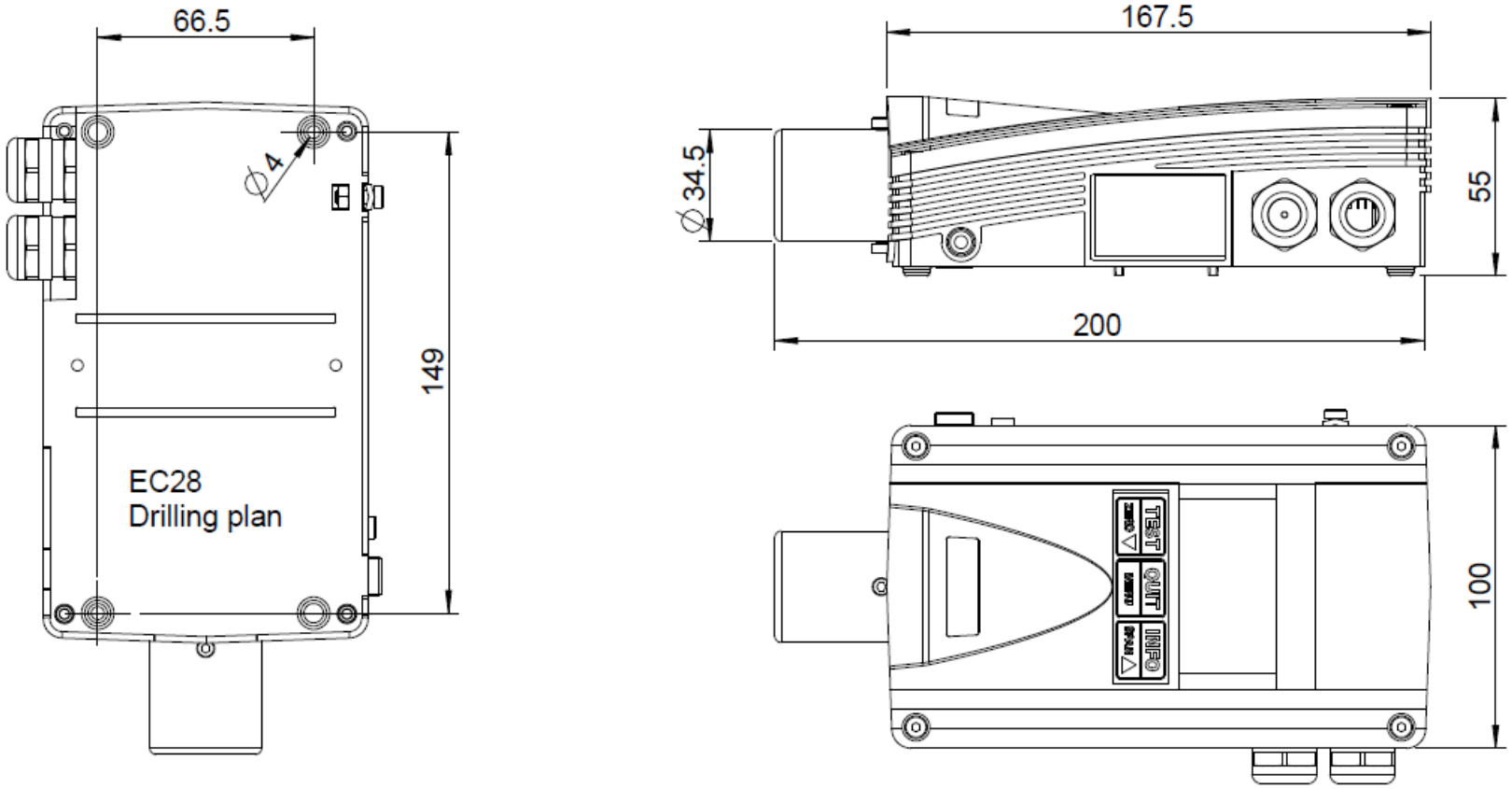
Case drawing and mounting template



General Tolerance ISO 2768 - m	Material:						Scale: 1:2
Rev.	Changes	Date	Name	Date	Name	Verified	Title: EC28 Package dimensions and mounting template
				2020-04-16	Leonhardt	Böttger	
				Adhere to protection note ISO 16016 Schutzvermerk ISO 16016 beachten			
				GfG Gesellschaft für Gerätebau mbH Klönnestr.99, D - 44143 Dortmund			Document-No.: 207-002.10 Page 1 of 1
							Replaces: Replaced by: