

User manual

Stationary sensor of toxic gases

SC-TOX

No. documentation: 20907

This user manual includes:

Instructions for assembling, installation, putting into operation, use, operation, setting, maintenance and servicing, dismantling, disposal and technical conditions

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User manual:

This user manual includes instructions for assembling, installation, putting into operation, use, operation, setting, maintenance and servicing, dismantling, disposal and technical conditions.

All workers carrying out installation, putting into operation, operation, maintenance and servicing shall be acquainted demonstrably with this operation manual. Keep this manual for further.

Use

- The sensor SC-TOX is designed for permanent measurement of volumetric concentrations of various toxic gases, oxygen or hydrogen. The non-explosive design I M1/II 2GD Ex ia I/IC T135°C allows use even in spaces with risk of explosion of SNM in coal mines or zones 1, 2, 21 and 22. According to the type of electrochemical sensor, the detector can measure these particular gases: O₂, CO, H₂S, NH₃, SO₂, H₂, HCN, NO₂, O₃, Cl₂, F₂, HF, ClO₂, COCl₂, PH₃, AsH₃, SiH₄. Cross dependencies of electrochemical sensors enable measurement of other gases.



Warning!

Basically, the sensor is an electrochemical cell and its electrolyte is subject to depletion and dehydration. This occurs even if it is not used. That is why the sensor has a limited service life and cannot be stored for a long time. Sensor warranty period is 6 months.



Warning!

The detector manufactured for a particular sensor / gas cannot be changed to detection of another gas by mere replacement of the sensor. An individual internal wiring is for each type of detector. Changing to another type of sensor / gas can only be carried out by the manufacturer in the workshop.



Warning!

- When handling toxic gases it is necessary to be extremely careful !!!
- It is recommended to carry out calibration of the sensor using gas at least once per 30 days; however, this may be carried out more frequently. In case the particular gas is not available, calibration can be carried out using cross dependence of the sensor on other gases.
- Dusty or damaged filter or grid in the sensor head shall be replaced. In case of operation in dusty or humid areas the filter shall be replaced before each calibration of the sensor or more frequently, depending of particular operating conditions.
- Foreign chemical substances, fire fumes or lack of oxygen may impair measurement results. Sudden changes of pressure may influence measurement of gas. Low humidity may dry electrolyte in the sensor.
- Leakage current in the cable with a current analog output or a voltage drop with the voltage analog output may cause measurement errors in the linked equipment.
- The warning LED and output transistor are not latch types. The function of self-holding of alarm shall be realised in the linked equipment.
- Installation, assembling and settings shall be carried out by a qualified person. In organisations subject to supervision of state mining administration it is necessary to follow the respective regulations.

- In case the sensor is exposed to a concentration exceeding the measuring range, it indicates that the range was exceeded. Then the user shall proceed according to the organisation emergency plan. End of danger can be found e.g. using a hand-held instrument that can be switched on out of the zone of danger and approached to the sensor and at the same time the data on the display are still watched. After decrease of concentration to the acceptable level it is possible to manipulate with the sensor. It is necessary to re-calibrate the sensor using gas, and then re-calibrate it again after 24 hour and again after 48 hours.
- The specific application, use or linkage to other devices might develop further requirements for operation, checks and maintenance of SC-CH4. These may be implied by relevant standards and technical recommendations concerning an application, operating assembly or a functional group as created. Introduction of such additional requirements to the application user is the responsibility of supplier of such application, operating assembly or a functional group.

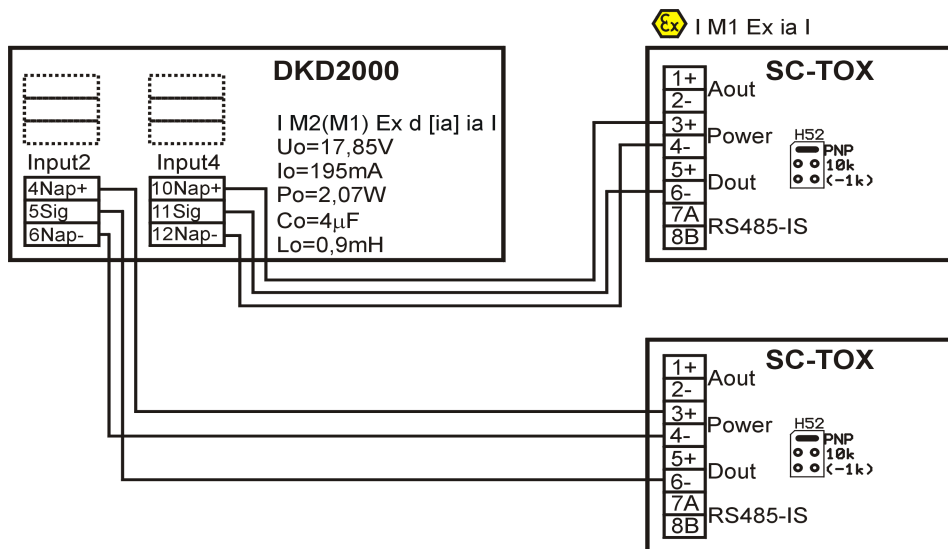
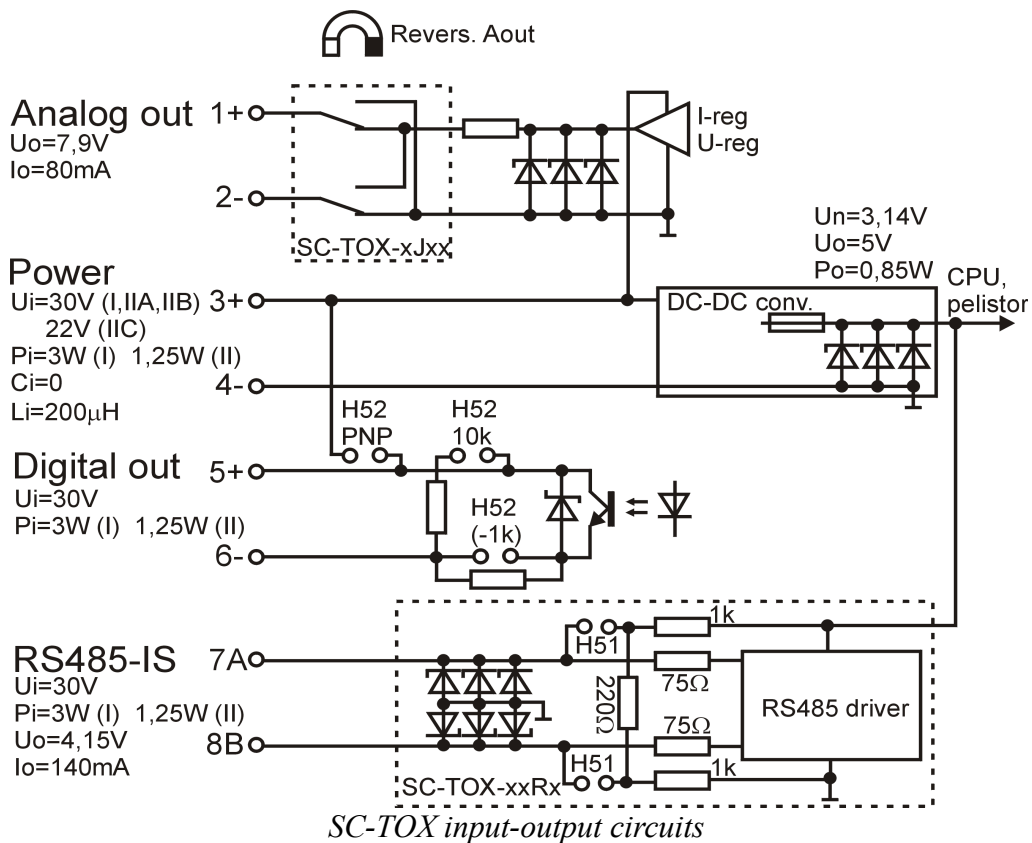


Warning!

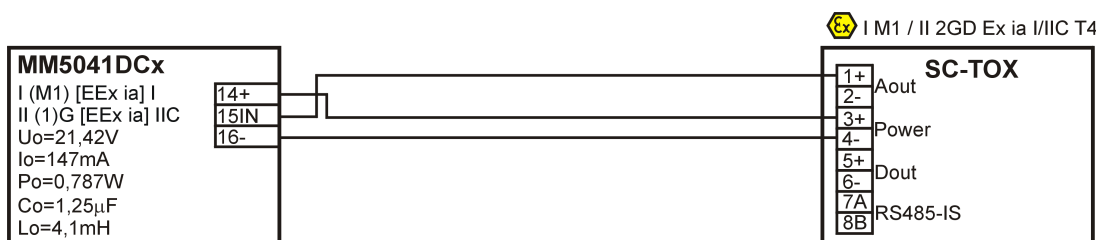
The SC-... sensor checking and testing may only be carried out by the calibration gas, the concentration of which is within the measuring span of the detector. Testing by any other backup procedure is not permitted as it may result in instantaneous damage to the detector and the loss of its functionality. That is why similar tests using a cigarette lighter and fabric soaked in various chemicals, etc. are prohibited!

Description and function

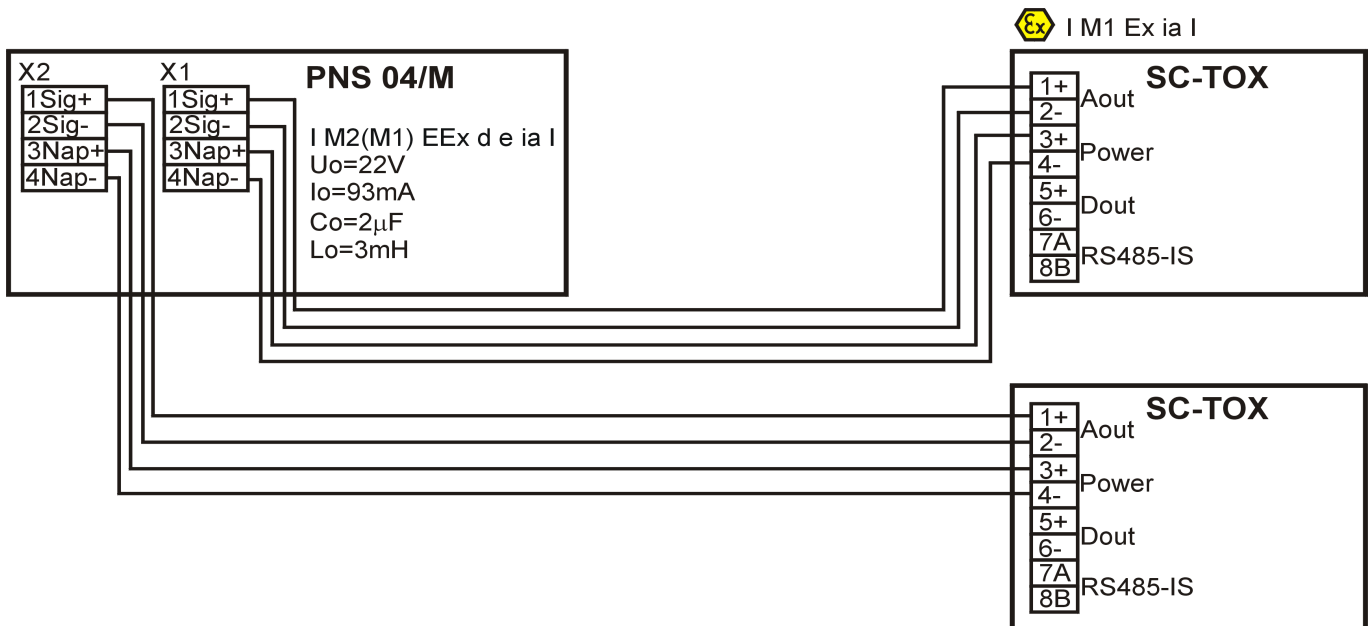
- The device body is made up of a polyester box with antistatic finish. It also includes a cable grommet, fixing bars, setting pushbuttons, LED indicators and measuring heads with grids and filters, through which the measured gas is brought by natural diffusion to the electrochemical sensor. The version P allows switching on orange backlight of the display. The version L has no backlight, but the display is visible better than on the version P with backlight switched off.
- The 3-electrode electrochemical sensor consists of a Sensing, Counter and Reference electrodes that enable to keep constant potential of the detecting electrode. The sensors of O₂ are only fitted with 2 electrodes (S and C), special sensors are fitted with 4 electrodes. An electrolyte and a diffusion barrier are inside the sensor; the diffusion barrier direct flow of the measured gas onto the detecting electrode, where gas reduces or oxidizes and creates positive or negative current that is proportional to volumetric concentration of the measured gas. Current from the detecting electrode is inverted and voltage-amplified and converted to digital values that are then processed by an internal micro-controller. The micro-controller software performs correction of the measured concentration according to two calibration constants (amplification and offset), temperature compensation of concentration according to fixed constants of temperature dependence of signals of individual sensors, automatic drift of the offset (if signal drops under zero level. The sensor carries out checks of external power supply (10 to 30V), internal power supply (3 to 3.3V), voltage of centre of symmetric power supply, checks of temperature under the sensor, internal checks of memory (FLASH, RAM and FRAM). Further software counts and checks age of the sensor and calibration (if the sensor is on), saves the values into its internal memory (every minute cyclically for a period of 24 hours), etc.
- Measured concentration is shown on the display (on version P with adjustable backlight) and converted into analog output (voltage or current output with freely adjustable range from 0 to 5.0V or 22.0mA). The analog output is also used for transfer of information about special states, running calibration or exceeded range. The analogue output is active; it is a current and voltage source.
- The digital output can be closed (or open) until the adjustable limit of concentration (or temperature) is reached, or it can send the measured concentration (or temperature) by a frequency signal with freely adjustable range from 1 to 999Hz. The transistor output can be configured using internal jumpers as an ordinary switch or output type NAMUR s with resistors 1k and 10k; further it can be galvanic-separated from power supply or connected to the positive supply branch as an output type PNP.
- All adjustments, calibrations, reading of actual quantities and values from the memory are accessible using two pushbuttons on side of the case. Information on the display can be shown in Czech, Russian or English. The calibration mode and settings are accessible after entering a 4-digit password.
- The version R with communication RS485-IS (protocol Modbus ASCII or RTU) enables reading of actual values of concentration, internal temperature, internal and external voltage, operating status of the sensor or history of these data from the internal memory (saved every minute cyclically for a period of 24 hours).
- The version J with tongue contacts enables, by attaching a magnet to side of the case, reversal of polarity of the analog output; this indicates for some systems that there is just carried out e.g. calibration.
- The sensor can be connected to systems DKD2000, PNS and other systems using a current, voltage or frequency signal or using a protocol Modbus ASCII or RTU.



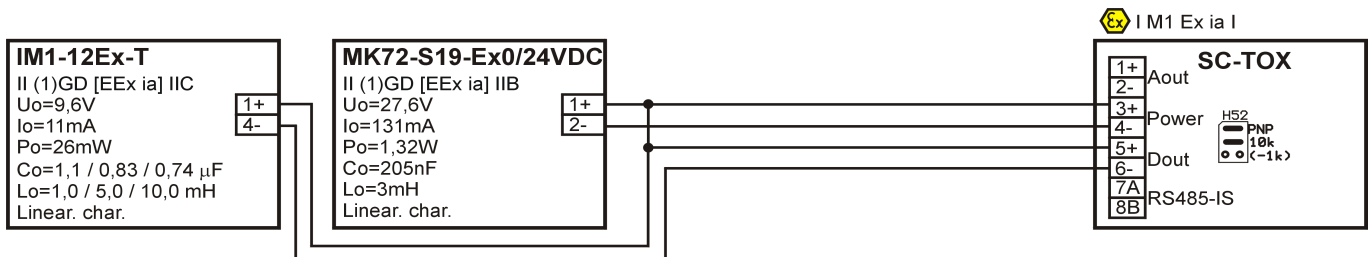
Example of wiring with a mining data concentrator DKD2000. The frequency output of SC-TOX is set to 200-600Hz a synchro-pulse 200us. The jumper H52-PNP connects internal terminals 3 and 5. The sensor can be connected to any frequency inputs of DKD2000. Max. resistance of power supply line loop of DKD2000 against the surface power supply line is 450Ω for 1 sensor and 300Ω for 2 sensors.



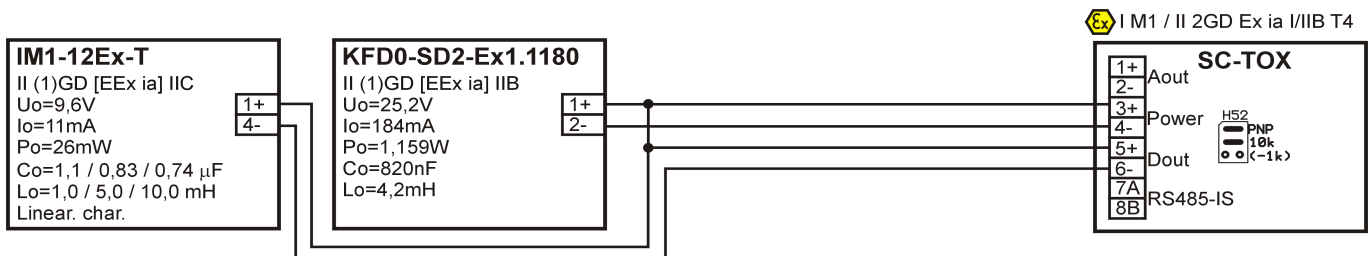
Example of wiring with a current converter MM5041DCx. The current output of SC-TOX is set to 0.2-1mA.



Example of wiring with the cabinet PNS 04/M. The current output of SC-TOX is set to 0.2-1mA. Max. power supply line loop of PNS against the surface power supply line is 800Ω.



Example of wiring with an insulation switching amplifier and spark-safe source. The frequency output of SC-TOX is set. The jumper H52-10k provides output type NAMUR..



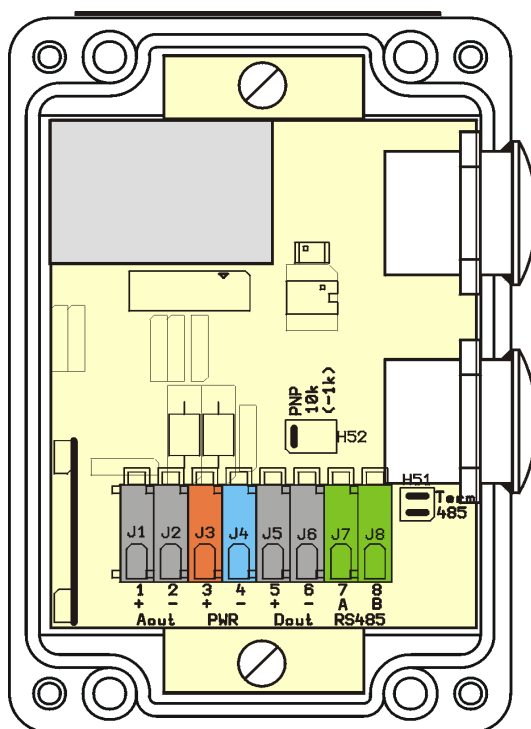
Example of wiring with an insulation switching amplifier and spark-safe source. The frequency output of SC-TOX is set. The jumper H52-10k provides output type NAMUR.

Assembling and installation

1. Choose the place of installation to minimise vibrations, mechanical stress, disturbing electromagnetic fields and temperature, wind, dust and humidity conditions. Before use check good condition of the case, cable grommets, sealing, grids and filter. SC-TOX should be fixed to a solid surface through fixing bars and 4 screws Ø 4mm on a place where increased concentration of gas can be expected or near to an electric equipment that has to be switched off in case of increased concentration of gas. For gases having lower specific density than air (H_2 , NH_3 , HCN) it is recommended to install the sensor at the ceiling; for gases having specific density similar to air (O_2 , CO , H_2S , F_2 , HF , PH_3 , SiH_4) at the operator's level and for gases heavier than air (SO_2 , NO_2 , O_3 , Cl_2 , ClO_2 , $COCl_2$, AsH_3) at the floor. The wind must not blow towards the sensor, but from behind or from the side and the potential condensation must not run to the sensor. The best thing is that the detector is directed with its sensor downwards or horizontally in

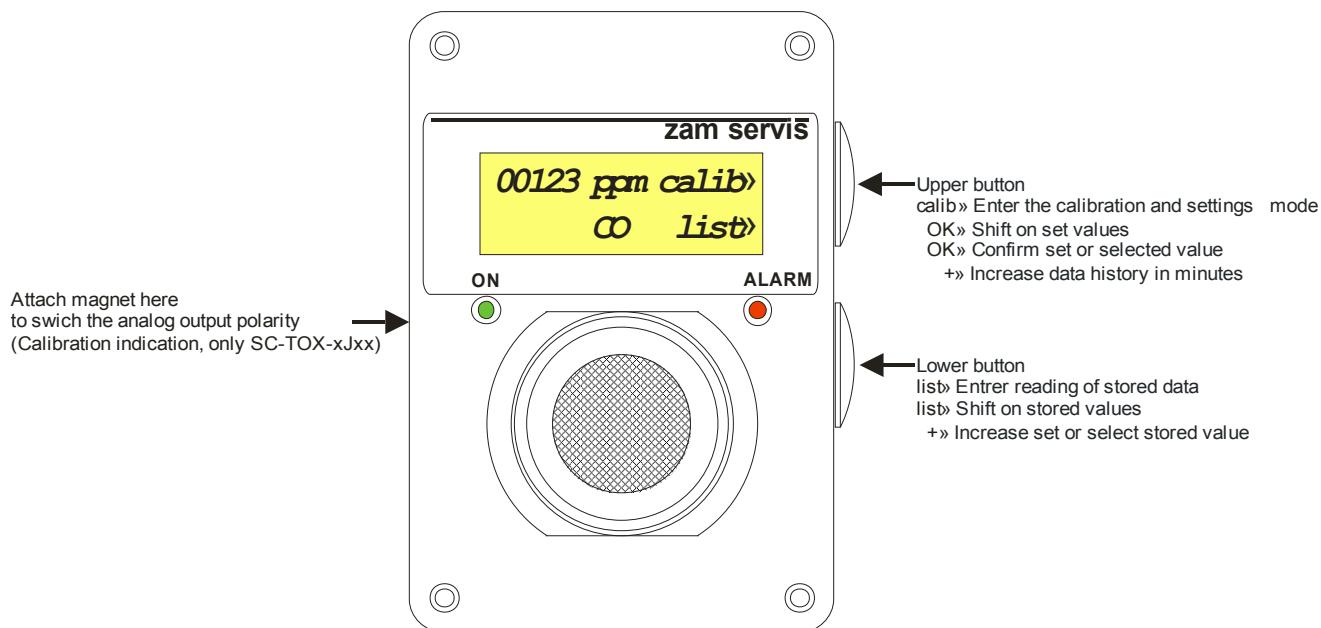
the wind direction.

2. Installation of the sensor in spaces with a risk of explosion shall comply with this user manual, local operating regulations, ČSN EN 50303, ČSN EN 50394-1, ČSN EN 60079-0, ČSN EN 60079-11, ČSN EN 60079-25 and other applicable regulations and standards.
3. Analog inputs of the linked equipment can be connected to screw-free terminals 1 and 2. Supply voltage 10 to 30V from a spark-safe source is connected to terminals 3 and 4. Galvanic-separated transistor output is brought to terminals 5 and 6. Communication wires A and B are connected to terminals 7 and 8 (only version with RS485-IS). The terminating resistor on the bus RS485-IS is connected to H51 using two jumpers. Carry out electric configuration of the digital output using jumpers connected to H52. The cross section of wires is max. 2.5mm² for wires and 1.5mm² for stranded wires, the wire stripping length is 5-6 mm. Any ends of wires shall not remain free. When manipulating with the sensor pay special attention that electronic part of the sensor is not damaged.
4. Diameter of the cable in the grommet M20 may be 6-12mm. Use only for fixed installation of the cable. The grommet shall be properly tightened to clamp and seal the cable. Installation shall guarantee that the cable will not be exposed to any tension and torsion in the grommet. After completion of installation it is necessary to install and seal properly the cover of the case.
5. Set the desired parameters of the sensor and after approx. 30 minutes carry out its calibration as described in the following chapter.



Terminal block and setting jumpers of SC-TOX

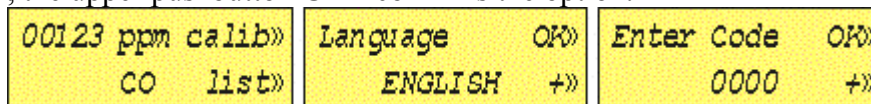
Control calibration and settings of SC-TOX



All settings, calibration, reading of actual quantities and values from the memory can be carried out using two pushbuttons on side of the case. During settings the functioning of SC-TOX is not limited and the sensor is fully functional according to original settings. Thanks to this fact the parameters can be checked without influencing functions of the sensor.

Entering the calibration and setting mode

In case the screen is in the measurement mode, pressing of the upper pushbutton **calib>** enters the calibration and setting mode. The screen language is the first option. The lower pushbutton selects Czech, Russian or English, the upper pushbutton **OK>** confirms the option.



Further there can be entered a 4-digit access code. The lower pushbutton +> changes the digits, the upper pushbutton OK> moves you on the digits and confirms the entered code. Unless the code has been changed, the implicit factory value is 0000. In case that correct code is not entered, the screen returns back to the measurement mode.

If you forget your access code, it is possible to restore it by default setting in the service centre only.



Warning!

When handling toxic gases, utmost care must be taken! There is a risk of health impairment.

Calibration of SC-TOX

Now the sensor can be calibrated by entering ANO or skip this option by entering NE. The lower pushbutton +> selects YES or NO, the upper pushbutton OK> confirms the option. Calibration should be carried out on a sensor that is in operation for at least 30 minutes. First enter volumetric density of the gas

that will be used for calibration (usually 10 to 50% of the measuring range) and confirm it by the pushbutton OK».

Calibr CO ? OK» YES +»	Calibr.Conc. OK» 00100ppm+»	Apply 0ppm OK» CO cca 00005	Apply 00100 OK» CO cca 00095
---------------------------	--------------------------------	--------------------------------	---------------------------------

In case the sensor is connected to a system with indication of calibration by reversing the polarity, attach a magnet to side of the case as required by the system. **Now carry out a two-point calibration. Fill it with zero gas, i.e. synthetic air (pure nitrogen for O₂ sensor) with flow about 0.1 to 0.5 l/min and wait for stabilisation of reading of the displayed concentration. After stabilisation (approx. 1 minute) press the pushbutton OK».** Now fill it with the gas, whose concentration was entered and again wait for stabilisation of reading of the displayed concentration. After stabilisation press the pushbutton OK». The recommended exposure time calibration gas at the calibration time is three times the T90. In case that stabilisation takes too much time (more than triple the time T90) at a constant flow, probably the filter is dusty and shall be replaced. In case of dusty and humid areas replace the filter before each calibration. The sensor will measure according to new calibration after **saving of the values at the end of the setting mode**, so that in case of any doubts about correct calibration, the values should not be saved. The running calibration can be indicated on analog and frequency output according to other settings and after saving the values the counter of age of calibration is reset to zero.

Confirmation of zero concentration by SC-TOX (except the O₂ sensor)

Unless the operating conditions allow frequent calibration using a test gas, a simplified calibration of zero can be carried out in case that some zero gas (synthetic air) is available or there is certainty that the sensor is just exposed to atmosphere with pure air. If possible, calibration should be carried out on a sensor that is in operation for at least 30 minutes. First enter volumetric 0ppm and confirm by **OK»**.

Calibr CO ? OK» YES +»	Calibr.Conc. OK» 00000ppm+»	Apply 0ppm OK» CO cca 00005
---------------------------	--------------------------------	--------------------------------

In case the sensor is connected to a system with indication of calibration by reversing polarity, attach a magnet to side of the case as required by the system. **Now confirm zero concentration. Fill it with zero gas (synthetic air with flow approx. 0.1 to 0.5 l/min) and wait for stabilisation of the displayed concentration. After stabilisation (approx. 1 minute) press OK».** In case of certainty of pure atmosphere confirm zero concentration of toxic gas. In case that stabilisation takes too much time (>1 minute) at a constant flow, probably the filter is dusty and shall be replaced. In case of dusty and humid areas replace the filter before each calibration. The sensor will measure according to new calibration after **saving of the values at the end of the setting mode**, so that in case of any doubts about correct calibration, the values should not be saved. The running calibration can be indicated on analog and frequency output according to other settings and after saving the values the counter of age of calibration is reset to zero.

Confirmation of zero concentration do not substitutes any full calibration using a test gas because a drift of “positively drifted zero” downwards also drifts the whole range downwards. Drifting of “negatively drifted zero” upwards also drifts the whole range upwards; this is performed by the sensor software automatically, so that supports safety of the equipment.

Setting of measurement of SC-TOX

Temperature compensation.

Now the measuring parameters can be set by entering **YES** or skip this option by entering **NO**. First there is switched on internal compensation of temperature effects to the sensor signal. The compensation

constants are fixed for each type of sensors in the internal memory. Temperature compensation can be switched on/off during operation, e.g. for verification of effectiveness of temperature compensation. Further there can be modified range of measurement of gas within the maximum measurement range that is defined for each type of sensors. With regard to overall measurement accuracy do not limit the measurement range under 25% of the maximum range.

Set.Measur? OK» YES +»	CompensTemp? OK» YES +»	RangeMeasur OK» 00500ppm+»
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Analog output.

Then you can select the current or voltage analog output, followed by entering a minimum value that corresponds 0ppm and a maximum value that corresponds to the measurement range. The minimum and maximum values can be set freely within 0-22.0mA pr 0-5.0V. The standard range 4 to 20mA may represent quite high consumption of energy; therefore more commonly used ranges 0.2-1mA, 1-5mA or 0.4-2V.

AnalogOutput OK» CURRENT conc +»	MinAnalogVal OK» Oppm: 04,0mA +»	MaxAnalogVal OK» 00500:20,0mA +»
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Digital, binary output.

Parameters of the transistor digital output can be also set here. The transistor output can be switched on or off unless a certain limit of concentration (or temperature) is reached, or the measured concentration (or temperature) can be set using a frequency signal. In case there is selected that the transistor output has to be closed (open) within certain limits, than there should be set the limit value of concentration of gas (or temperature).

Trans.Output OK» SW-ON TO CONC+»	LimitValConc OK» 00100ppm+»	Trans.Output OK» SW-ON TO TEMP+»	LimitValTemp OK» 055°C +»
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Digital frequency output.

In case that there is chosen that the transistor output will send concentration (or temperature) by a frequency signal, then there shall be entered the minimum frequency corresponding to 0ppm (or -40 °C), maximum frequency corresponding to the measurement range (or 100 °C) and alternation of pulses. The minimum and maximum can be set freely within range 1-999Hz. Standardly use range is 5 to 15Hz with alternating 1:1; the system DKD2000 uses range 200 to 600Hz with constant switching off time 200µs that is changed to 400µs during calibration.

Trans.Output OK» FREQUENCY CONC+»	MinFrequency OK» Oppm:200 Hz +»	MaxFrequency OK» 00500:600 Hz +»	Pulse Ratio OK» SYNCHRO 200us +»
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LED indicators.

Further there can be set concentration for switching on the red LED “ALARM“ within range 0ppm to the measurement range. Indication is not the latch type so that after elimination of the danger this LED is off. For the O₂ sensor this function is inverse, i.e. the LED “ALARM” is on until the preset value is not reached.

SignalingLED OK» 00100ppm+»

Other setting of SC-TOX

Other (additional) parameters can be set by entering **YES** or skip this option by entering **NO**. First you can set backlight of the display. The display can be illuminated permanently, not illuminated or illuminated only for 5 seconds after pressing the pushbutton (only version P). Backlight off reduces consumption of energy by up to 5mA from the source 10V. The version L has no backlight, but the display is visible better than on the version P with backlight switched off.

Other Set.? OK»	Back light OK»
YES +»	ALWAYS LUMIN +»

Access code, new sensor.

You can also enter a new 4-digit access code opening the calibration and settings mode. Keep the access code secret to prevent unauthorised access to the calibration and settings mode.

Setting of the new (replaced) sensor resets the counter of age of the sensor to zero and downloads implicit values for the type of the measured gas, measurement range, etc. according to the type number of the sensor that shall correspond to the actual sensor, and version of the sensor on the identification plate.

It is necessary to set a correct sensor type number and carry out calibration!!! Setting an incorrect sensor type number results in disqualification of the measurement because there are different compensation constants for each sensor.

Ner Code? OK»	Enter Code OK»	Ner Sensor? OK»	Sensor Type OK»
YES +»	1234 +»	YES +»	07 +»

Special states, calibration states.

Another option is setting of a value on the analog output (0-24.2mA or 0-5.5V) that indicates special states of the sensor and minimum duration of such states (0-255s). A special state occurs with errors of the memory, faulty supply voltage, measurement, temperature and if the sensor or calibration is too old.

Another option is setting on a value on the analog output se (0-24.2mA or 0-5.5V) that indicates running calibration and duration of this status (0-255s). The synchro-pulse 200µs will be changed to 400µs on the frequency output for this period.

SpecialState OK»	SpecStateMin OK»	Calibr.State OK»	CalStateMin OK»
0,00mA +»	060s +»	0,00mA +»	000s +»

Limit of age of calibration, sensor and network address.

Limit of age of calibration can be set from 0 to 255 days. In case it is higher than 0 and no calibration is made within this period, the sensor will indicate a special status "Old calibration".

Limit of age of the sensor can be set from 0 to 255 weeks. In case it is higher than 0 and no setting of the new sensor is made within this period, the sensor will indicate a special status "Old sensor".

The network address can be set on the bus Modbus (1-247). Each equipment in the network RS485-IS (only version R) shall be provided with its different network address.

Calibr.Limit OK»	Sensor Limit OK»	Network Addr OK»
040day +»	000week +»	001 +»

Factory parameter settings

In case that calibration of the sensor, setting of measurement and other settings were skipped, you can read factory (implicit) setting of all parameters. After saving then it is necessary to set correct number of type of the sensor.

```
ManufactSet? OK»
                YES +»
```



After saving the default setting, it is necessary to set a correct sensor type number and carry out calibration!!! Setting an incorrect sensor type number results in disqualification of the measurement because there are different compensation constants for each sensor.

Saving of settings

Finally all the above mentioned settings can be saved into memory. Entering **YES** shows a repeated inquiry and other **YES** saves all the data into memory, re-setting of the sensor to the new parameters and entering the measurement mode.

```
Save Values? OK» Really Save? OK» WRITTING.....
                YES +»                YES +»
```

Reading of saved data

SC-TOX saves measured values of concentration, internal temperature, external and internal voltage and operating status into internal memory every minute cyclically for a period of 24 hours. The data can be read through RS485-IS (only version R, the protocol is compatible with Modbus ASCII or RTU), or it can be read on the display without knowledge of the code.

```
00123 ppm calib» Befor00h00Min +» Befor02h34Min?+»
CO list» Conc 00095 list» Conc 00105 list»
```

In case the screen is in the measurement mode, pressing the lower pushbutton **list»** enters mode of reading of the saved data. The upper pushbutton **+»** drifts the history per minutes, holding the pushbutton **+»** pressed accelerates drifting time. In case that power supply was restarted, the time data is not unambiguous and this is indicated by a question mark. Pressing the lower pushbutton **list»** selects the particular quantities (concentration, temperature, internal voltage, external voltage).

```
Befor01h50Min +» Befor01h50Min +» Befor01h50Min +» Befor01h50Min +»
Conc 00123 list» Temp 035°C list» 3Sup 3,12V list» =Sup 016 V list»
```

Next pressing the lower pushbutton **list»** displays actual age of calibration and age of the sensor. Next pressing the pushbutton **list»** returns the screen back to the measurement mode.

```
Calibr Old      Sensor Old
012day list»    038rek list»
```

Overview of parameters of SC-TOX

No.	Description	Possible range of values		Factory value	Commonly used values	
1	Jazyk	CZ, RU, EN		CZ	CZ, RU, EN	
4	Kalibr.Konc.	0...40,000		100ppm CO	20.9% O ₂ 100ppm CO 10ppm H ₂ S, etc.	
11	RozsahMěření	0...40,000		500ppm CO	25% O ₂ 500ppm CO 50ppm H ₂ S, etc.	
12	AnalogVýstup	Current	Voltage	Current	Current	
13	MinAnalogHod	0...22.0mA	0...5.0V	0.2mA	0,2mA 1mA 4mA	0.4V
14	MaxAnalogHod	0...22.0mA	0...5.0V	1mA	1mA 5mA 20mA	2V
15	Tranz.Výstup	Closed to Conc Open to Conc Closed to Temp Open to temp Frequency Conc Frequency Temp		Open to Conc	Open to Conc Closed to Conc Frequency Conc	
16	MezníHodKonc	0...40,000		100ppm CO	19,5% O ₂ 100ppm CO 10ppm H ₂ S atd.	
17	MezníHodTep.	-99...+99°C		55°C	55°C	
18	MinFrekvence	1...999Hz		5Hz	5Hz	200Hz
19	MaxFrekvence	1...999Hz		15Hz	15Hz	600Hz
20	Střída Pulzů	1:1, SYNCHRO200μs		1:1	1:1	SYNCHRO200μs
21	Signaliz.LED	0...40,000		100ppm CO	19.5% O ₂ 100ppm CO 10ppm H ₂ S, etc.	
23	Podsvětlení	Permanently on Never on 5s after pressing		Never on	Never on	
25	Vstupní Kód	0000...9999		0000	xxxx	
27	TypSenzoru	1...78		7 (sensor 4CF, range 0-500 ppm CO)	1...78 (O ₂ , CO, H ₂ S, NH ₃ , SO ₂ , H ₂ , HCN, NO ₂ , O ₃ , Cl ₂ , F ₂ , HF, ClO ₂ , COCl ₂ , PH ₃ , AsH ₃ , SiH ₄)	
28	ZvláštníStav	0...24.2mA	0...5.5V	0	0mA	0V
29	ZvlStavMinim	0...255s		60s	60s	
30	Kalibr. Stav	0...24.2mA	0...5.5V	0	0.1mA 0.5mA 2mA	0.2V
31	KalibStavMin	0...255 seconds		0s	0s 60s 120s	
32	Kalibr.Limit	0...255 days		0 days	0 days 10 days 20 days 40 days	
33	Senzor Limit	0...255 weeks		0 weeks	100 week 150 week 200 week	
34	SíťováAdresa	1...247		1	1...247	

General faults of the sensor SC-TOX

Description of the fault	Possible solution
Green LED „ON“ is off	Measure supply voltage on terminals 3 and 4. Check whether the electronic circuits are not damaged or flooded.
No data on the LCD display	Measure supply voltage on terminals 3 and 4. Restart power supply. Check whether the electronic circuits are not damaged or flooded.
Big deviation of the instrument	Carry out calibration of the sensor. Shorten the calibration interval e.g. to 14 days. Verify that no significant changes of temperature, pressure, humidity, velocity of air flow, amount of dust and content of oxygen in atmosphere occur. Let the sensor replaced. Is not any equipment with high level of interference in vicinity? Check whether the electronic circuits are not damaged or flooded.
Analog output gives wrong signal	Check the current output, whether the detecting resistance incl. cable is $<R_{max}$ as on the diagram and leak resistance of the line is $>100x$ detecting resistance. Check the voltage output, whether the loading resistance is $<50k\Omega$ and $>100x$ resistance of the line. Check whether the electronic circuits are not damaged or flooded.
Digital output gives wrong signal	Measure parameters of the transistor output, terminals 5 and 6. On the frequency output check the course by an oscilloscope in a safe environment. Check whether the electronic circuits are not damaged or flooded.
The sensor in version RS485 does not communicate	Verify that different addresses are assigned to all pieces of equipment in the network and terminating resistors are set on ends of the bus. Change over wires A and B. Interconnect the equipment using a GND wire. Check configuration of the superior system. Check whether the electronic circuits are not damaged or flooded.
The detector does not respond to buttons; it has a special status value at the analogue output and some of the special statuses are reported on the display unit.	The calibration limit or sensor age limit have been exceeded or another special status is signaled. Some of the special statuses can be cancelled by performing calibration through the RS485 interface whereas others by repair at the manufacturer. Special statuses are described in a separate table.

Faults and special states detected by the sensor SC-TOX

If there are more special statuses at the same time, the special status with the highest priority is reported on the display and in the communication protocol. Statuses in the table are sorted according to priority; the first is the status with the highest priority.

Status no.	Screen	Description of the fault	Possible solution
47	00123 ppm ERROR FLASH!!!!!!13456	Critical error of the programme memory. The displayed concentration may be wrong. Special status on the output.	Restart power supply. Is not any equipment with high level of interference in vicinity?
	00123 ppm ERROR RAM !!!!!00456	Critical error of data memory. The displayed concentration may be wrong. Special status on the output.	Restart power supply. Is not any equipment with high level of interference in vicinity?
	00123 ppm ERROR FRAM !!!!!03456	The setting memory was unable to correct itself. The displayed concentration may be wrong. Special status on the output.	Restart power supply. Is not any equipment with high level of interference in vicinity? Try to save new values into memory.
44	00123 ppm ERROR =SUPPLY!!! 009 V	External power supply is outside the range 10 to 30V. The displayed output value may be wrong. Special status on the output.	Use more suitable power supply source. Move the sensor closer to the source. Enlarge cross section of the supply wires. Check whether the electronic circuits are not damaged or flooded.
45	00123 ppm ERROR 3VSUPPLY! 2,90V	Internal power supply is outside the range 3.0 to 3.3V. Displayed output value may be wrong. Special status on the output.	Restart power supply. Check whether the electronic circuits are not damaged or flooded.
46	00123 ppm calib» MEASURING!!!!!!!	Error of the sensor or control measurement. The displayed concentration may be wrong. Special status on the output.	Restart power supply. Let the sensor replaced. Check whether the electronic circuits are not damaged or flooded.
38	00123 ppm ERROR TEMPERAT!! 063°C	Internal temperature is outside the range -40°C to +60°C. The displayed concentration may be wrong. Special status on the output.	Move the sensor away from the sources of heat. Carry out calibration of the sensor.
48	00123 ppm meas.» EXCEEDED RANGE	The sensor was exposed to a concentration above the measurement range. Displayed concentration may be wrong. A status corresponding to 110% of the range is on the output.	In case the danger is eliminated, you can manipulate with the sensor. The sensor shall be calibrated, then re-calibrated after 24 h and again after 48 h.
40	00123 ppm calib» Old Sensor150t	Service life of the sensor terminates. Special status on the output.	Let the sensor repaired. Possibly set a longer limit of the sensor age.
39	00123 ppm calib» Old Calibr041d	Old calibration of the sensor. The displayed concentration may be with an error. Special status on the output.	Carry out calibration of the sensor.

Operating instructions



Warning!

When handling toxic gases, utmost care must be taken! There is a risk of health impairment.

- Measurement of concentration is unattended. Control calibration and setting of the sensor is performed as described in previous chapters.
- It is recommended to calibrate the sensor using gas at least once per 30 days; however, it can be performed more frequently.
- In case the sensor was exposed to a concentration exceeding the measurement range, it indicates that the range was exceeded. Then the user shall proceed according to the emergency plan of the organisation. End of danger can be found e.g. using a hand-held instrument that can be switched on out of the zone of danger and approached to the sensor and at the same time the data on the display are still watched. After decrease of concentration to the acceptable level it is possible to manipulate with the sensor. It is necessary to re-calibrate the sensor using gas, and then re-calibrate it again after 24 hour and again after 48 hours.

Maintenance

- Remove dust and dirt from the surface using a dry cloth, brush or broom; then clean surfaces using a damp cloth.
- Dusty or damaged filter or grid in the sensor head shall be replaced. In case of dusty and humid areas the filter shall be replaced before each calibration of the sensor or more frequently, depending of particular operating conditions.
- The filter and grid are accessible from outside after release of the lock nut on the head.
- It is recommended to have the unit checked by personnel from the manufacturer or a relevant authorised representative once a year.

Repairs and spare parts

- All repairs and spare parts are provided by the manufacturer. The user may replace the filter:
- Filter of glass fibres, type Whatman GF/D, Ø 25mm, Cat. No. 1823 025 (Supplier Merci, ordering no. 480 001 823 025, or Vitrum, ordering no. 624 901 823 025)
- The list for detectors equipped with connectors is indicated in Addendum A.

Manufacturer and servicing organisation

- ZAM - SERVIS s.r.o. Křišťanova 1116/14, 702 00 Ostrava - Přívov, Czech Republic, tel: 596 135 422, e-mail: zam@zam.cz

Related standards. Regulations and documents

LVD:

- ČSN 33 2000–4–41 Electrotechnical regulations – Electric equipment – Part 4: Safety – Chapter 41: Protection against injury from electric shock
- ČSN EN 60529 Levels of protection by covers (protection - IP code)
- ČSN EN 45544-1 Atmosphere on workplace – El. instruments used for direct detection and direct measurement of concentration of toxic gases and vapour – Part 1: general requirements and testing methods
- ČSN EN 45544-2 – Part 2: Functional requirements for instruments used for measurement of concentrations in the field of limit values
- ČSN EN 45544-3 – Part 3: Functional requirements for instruments used for measurement of concentrations high above limit values
- ČSN EN 45544-4 – Part 4: Instructions for selection, installation, use and maintenance
- ČSN EN 50271 Electric equipment for detection and measurement of combustible gases of oxygen – Requirements and tests for equipment that use software and/or digital technologies

EMC:

- ČSN EN 61000-6-2 Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Resistance to industrial environment
- ČSN EN 61000-6-3 Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emissions – Residential and commercial environment, environment of light industry
- ČSN EN 50270 Electromagnetic compatibility – Electric equipment for detection and measurement of combustible gases, toxic gases or oxygen

ATEX:

- ČSN EN 50303 Equipment of group I, category M1, designed for use under presence of methane and/or combustible dust
- ČSN EN 50394-1 Electric equipment for environment with a risk of explosion – Group I – Spark-safe systems
- ČSN EN 60079-0 Electric equipment for explosive gaseous atmosphere – Part 0: general requirements
- ČSN EN 60079-11 Explosive atmospheres – Part 11: Protection of equipment by spark safety ”I“
- ČSN EN 60079-25 Electric equipment for explosive gaseous atmosphere – Part 25: Spark-safe systems
- ČSN EN 1127-1 Explosive environments – Elimination and protection against explosion – Part 1: Basic terms and methodology
- ČSN EN 1127-2 Explosive environments – Prevention a protection against explosion – Part 2: Basic concepts and methodology for mines

Other documents:

Communication protocol and Data Map of SC-... sensors

Technical parameters and appearance

Basic technical parameters

Protection	IP 54
Dimensions including grommets	140x112x75mm
Total weight	600g
Of this electronics	100g
Max. cross section of connecting wires	Solid wire 2.5mm ² , stranded wire 1.5mm ²
Diameter of the cable in the grommet M20	6 to 12mm
Supply voltage	10 to 30V (10 to 22V for IIC)
Current consumption at 10V	16mA + current of analog output (max. 24.2mA) (+ 5mA if the display backlight is on, only version P) (+ 5mA if communication to RS485, only version R)
Current consumption at 20V	14mA + current of analog output (max. 24.2mA) (+ 3mA if the display backlight is on, only version P) (+ 3mA if communication to RS485, only version R)
Current consumption at 30V	13mA + current of analog output (max. 24.2mA) (+ 2mA if the display backlight is on, only version P) (+ 2mA if communication to RS485, only version R)
Voltage analog output	Adjustable 0.0 to 5.0V (over range max. 5.5V) Recommended load 5 to 50 k Ω
Current analog output, active	Adjustable 0.0 to 22.0mA (over range max. 24.2mA) Max. output voltage is 3.5V at 24 mA (150 Ω) Max. output voltage is 5.5V at 3 mA (1500 Ω) ref. To graph
Error of analog output	< \pm 1% of the range
Switched voltage of the transistor output	3 to 30V
Max. switched current of the transistor output	0.3A
Max. switched power of the transistor output	3W
Parameters of the frequency output	Adjustable 1 to 999Hz Alternating 1:1 or synchro-pulse 200 μ s (400 μ s with calibration)
Error of the frequency output	< \pm 1% of the range 5-15Hz or 200-600Hz
Protection against explosion	I M1 / II 2GD Ex ia I/IIC T135°C
Terminals 1, 2 (analog. output)	U _o =7,9V; I _o =80mA; P _o =158mW; C _o =8,8 μ F; L _o =5mH
Terminals 3, 4 (power supply)	U _i =30V (I,IIA, IIB); 22V (IIC); P _i = 3W (I); 1,25W (II); C _i =0; L _i =200 μ H
Terminals 5, 6 (digital output)	U _i =30V; P _i =3W (I); 1,25W (II); C _i =0; L _i =0
Terminals 7, 8 (RS485-IS)	U _i =30V; P _i =3W (I); 1,25W (II); C _i =0; L _i =0 U _o =4,15V; I _o =140mA; P _o =145mW; C _o =100 μ F; L _o =2mH

Max. ranges of measurement of O ₂	0-25% (standard testing gas 20.9%)
Max. ranges of measurement of CO	0-500 1000,, 2000, 5000, 10000ppm (stand. test. gas 50ppm)
Max. ranges of measurement of H ₂ S	0-50, 100, 200, 2000ppm (standard testing gas 10ppm)
Max. ranges of measurement of NH ₃	0-100, 500, 1000, 5000ppm (standard testing gas 25ppm)
Max. ranges of measurement of SO ₂	0-20, 100, 2000ppm (standard testing gas 2ppm)
Max. ranges of measurement of H ₂	0-1000, 10000, 40000ppm (=4%)
Max. ranges of measurement of HCN	0-30, 50, 100ppm (standard testing gas 10ppm)
Max. ranges of measurement of NO ₂	0-20, 50ppm (standard testing gas 3ppm)
Max. ranges of measurement of O ₃	0-1, 2ppm (standard testing gas 0.1ppm)
Max. ranges of measurement of Cl ₂	0-10, 20, 50ppm (standard testing gas 0.5ppm)
Max. ranges of measurement of F ₂	0-1ppm (standard testing gas 1ppm)
Max. ranges of measurement of HF	0-10ppm (standard testing gas 2ppm)
Max. ranges of measurement of ClO ₂	0-1ppm (standard testing gas 0.1ppm)
Max. ranges of measurement of COCl ₂	0-1ppm (standard testing gas 0.1ppm)
Max. ranges of measurement of PH ₃	0-5ppm (standard testing gas 0.3ppm)
Max. ranges of measurement of AsH ₃	0-1ppm (standard testing gas 0.05ppm)
Max. ranges of measurement of SiH ₄	0-50ppm (standard testing gas 5ppm)
Ambient temperature	-20 to +50°C
Atmospheric pressure	90 to 110kPa
Max. velocity of air flow	4m/s
Relative humidity	See the Table of sensors
Response time T ₉₀	See the Table of sensors
Service life of the sensor	See the Table of sensors
Total uncertainty of measurement for sensors with max. range ≤10x concentration of standard testing gas	< 50% of measured value for concentrations ≤0,5x concentration of standard testing gas < 30% of measured value for concentrations >0,5...10x concentration of standard testing gas
Total uncertainty of measurement for sensors with max. range >10x concentration of standard testing gas	< ±20% of measured value or ±10% of the range
Effect of vibrations 10-55Hz, 0.15mm, 10 varying cycles to axis (45min in each axis)	< Total uncertainty of measurement
Effects of temperature 5 to 40°C against 20°C	< Total uncertainty of measurement
Effects of temperature -10°C against 20°C	< 2x Total uncertainty of measurement
Effect of pressure 90 to 110kPa against 100kPa	< Total uncertainty of measurement
Effect of humidity 20 to 90% against 50%	< Total uncertainty of measurement
Effect of air velocity 0.5 and 4.0m/s	< Total uncertainty of measurement
Residual effect 60 minutes after exposure 20x concentration of standard testing gas for sensors with max. range ≤10x concentration	< 20% concentration of standard testing gas

of standard testing gas	
Residual effect 60 minutes after exposure 5x concentration of standard testing gas for sensors with max. range >10x concentration of standard testing gas	< 20% of the range
Effect of position 0 to 360° around three axes	< Total uncertainty of measurement

Table of sensors

N o.	Sensor type	Nominal gas	Max. range [ppm]	Properties	Cross dependence on other gases (if at least 5% of the signal)	Service life [yrs]	T ₉₀ [s]	Temp. [°C]	Rel. humid. [%]
1	7OX-V	O ₂	25%	Long service life, low drift, ventilation capillary		2	15	-20...+50	15...99
2	4OX(1)	O ₂	25%	Low drift		1	15	-20...+50	0...99
3	4OX(2)	O ₂	25%	Long service life		2	15	-20...+50	0...99
4	O2-A1	O ₂	25%	Low drift		1	15	-30...+55	5...95
5	O2-A2	O ₂	25%			2	15	-30...+55	5...95
6	O2-A3	O ₂	25%	Long service life		3	15	-30...+55	5...95
7	4CF	CO	500	Filter against H ₂ S, SO ₂	NO, NO ₂ , H ₂ , C ₂ H ₄	2	30	-20...+50	15...90
79	4CF+	CO	500	Fast response, without filter	NO,NO ₂ ,H ₂ ,C ₂ H ₄ ,H ₂ S,S O ₂	2	20	-20...+40 krátce(+55)	15...90
80	4CM	CO	500 2000	Fast response. Filter against H ₂ S,SO ₂	NO,NO ₂ ,H ₂ ,C ₂ H ₄ ,H ₂ S,S O ₂	2	20	-20...+55	15...90
8	4CO	CO	500	Fast response, without filter	H ₂ S, SO ₂ , NO, NO ₂ , Cl ₂ , H ₂	2	25	-20...+50	15...90
9	7E	CO	1000	Long service life, fast response, without filter	H ₂ S, SO ₂ , NO, NO ₂ , Cl ₂ , H ₂ , HCN, C ₂ H ₄	3	25	-20...+50	15...90
10	7E/F	CO	1000	Long service life, filter against H ₂ S, SO ₂ , NO _x	NO, NO ₂ , H ₂ , HCN, C ₂ H ₄	3	30	-20...+50	15...90
11	A7E	CO	1000	For compensation* of H ₂ , without filter	H ₂ S, SO ₂ , NO, NO ₂ , Cl ₂ , HCN, C ₂ H ₄	3	35	-20...+50	15...90
12	A7E/F	CO	1000	For compensation* of H ₂ , filter against H ₂ S, SO ₂	H ₂ S, NO, HCN, C ₂ H ₄	3	35	-20...+50	15...90
13	CO 3E 300	CO	500	Long service life, high sensitivity and selectivity	NO,H ₂	3	30	-40...+50	15...90
14	CO 3E 500 S	CO	500	Low dependence on H ₂	H ₂ S, NO, H ₂ , HCl	2	60	-20...+50	15...90
15	CO-AE	CO	10000	High range, strong filter against H ₂ S, SO ₂ , NO _x	H ₂ , C ₂ H ₄	2	75	-30...+50	15...95
16	CO-AF	CO	5000	Fast response, filter against H ₂ S, SO ₂ , NO _x	NO, H ₂ , C ₂ H ₄	2	25	-30...+50	15...95
17	CO-AX	CO	2000	Complies with EN 50379 (measurement of fume gases)	H ₂ , C ₂ H ₄	2	30	-30...+50	15...90
18	CO-BF	CO	5000	Low drift, filter against H ₂ S, SO ₂ , NO	NO, H ₂ , C ₂ H ₄	2	30	-30...+50	15...90
19	CO-BX	CO	2000	Low drift, filter against H ₂ S, SO ₂ , NO _x	NO, H ₂ , C ₂ H ₄	2	40	-30...+50	15...90

20	4H	H ₂ S	100	Low dependence on H ₂	SO ₂ , NO ₂	2	30	-40...+50	15...90
21	4H/LM	H ₂ S	100	Low dependence on H ₂ , methanol	SO ₂ , NO ₂	2	30	-40...+50	15...90
22	4HS	H ₂ S	100		SO ₂ , NO ₂	2	30	-40...+50	15...90
23	4HS/LM	H ₂ S	100	Low dependence on methanol	SO ₂ , NO ₂	2	30	-40...+50	15...90
24	7H	H ₂ S	200	High range	SO ₂ , NO ₂ , HCN	2	35	-40...+50	15...90
25	7H/LM	H ₂ S	200	High range, low dependence on methanol	SO ₂ , NO ₂ , HCN	2	35	-40...+50	15...90
26	7HH	H ₂ S	50	Low dependence on CO, H ₂	SO ₂ , NO, NO ₂ , Cl ₂ , HCN	2	30	-40...+50	15...90
27	7HH/LM	H ₂ S	50	Low dependence on CO, H ₂ , methanol	SO ₂ , NO, NO ₂ , Cl ₂	1	30	-40...+50	15...90
28	H2S 3E 100	H ₂ S	100		SO ₂ , CO, ClO ₂ , HCN, Isopropanol	2	30	-40...+40	15...90
29	H2S 3E 100 S	H ₂ S	100	High selectivity, low dependence on H ₂	SO ₂ , NO ₂ , Cl ₂	2	30	-40...+50	15...90
30	H2S-A1	H ₂ S	100	Fast response	SO ₂ , NO ₂ , Cl ₂	2	25	-30...+50	15...90
31	H2S-AH	H ₂ S	50	Fast response, high sensitivity	SO ₂ , NO ₂ , Cl ₂	2	25	-30...+50	15...90
32	H2S-B1	H ₂ S	200		SO ₂ , NO ₂ , Cl ₂	2	35	-30...+50	15...90
33	H2S-BE	H ₂ S	2000	High range	SO ₂ , NO, NO ₂ , Cl ₂	2	35	-30...+50	15...90
34	H2S-BH	H ₂ S	50	High sensitivity, low drift	SO ₂ , NO ₂ , Cl ₂	2	30	-30...+50	15...90
35	NH3 3E 100	NH ₃	100	No dependence on CO ₂	CO, H ₂ S, SO ₂ , Cl ₂ , H ₂	1,5	120	-40...+40	15...90
36	NH3 3E 100 SE	NH₃	100	High selectivity and sensitivity, low drift	H ₂ S	2	60	-20...+40	15...90
37	NH3 3E 500 SE	NH ₃	500		H ₂ S	2	90	-20...+40	15...90
38	NH3 3E 1000	NH ₃	1000	No dependence on CO ₂	CO, H ₂ S, SO ₂ , H ₂	1,5	120	-40...+40	15...90
39	NH3 3E 1000 SE	NH ₃	1000	High selectivity	H ₂ S, SO ₂	2	90	-20...+40	15...90
40	NH3 3E 5000 SE	NH ₃	5000	High range and selectivity	H ₂ S, SO ₂	2	90	-20...+40	15...90
41	4S	SO ₂	20	Filter against H ₂ S	NO ₂	2	75	-20...+50	15...90
42	7SH	SO ₂	20	Fast response, no filter	H ₂ S, NO ₂ , Cl ₂ , HCl, HCN	2	15	-20...+50	15...90
43	7ST/F	SO ₂	100	Filter against H ₂ S	NO, NO ₂ , Cl ₂ , HCN	2	20	-20...+50	15...90
44	SO2-AE	SO ₂	2000	High range, filter against H ₂ S	NO, NO ₂ , Cl ₂ , C ₂ H ₄	2	25	-30...+50	15...90
45	SO2-AF	SO ₂	20	High sensitivity, filter against H ₂ S	NO ₂ , Cl ₂ , C ₂ H ₄	2	25	-30...+50	15...90
46	SO2-BF	SO ₂	100	Filter against H ₂ S	NO ₂ , Cl ₂ , C ₂ H ₄	2	30	-30...+50	15...90
47	4HYT	H ₂	1000		CO, H ₂ S, NO, HCN, C ₂ H ₄	2	90	-20...+50	15...90
48	7HYE	H ₂	10000		CO, H ₂ S, NO, HCN, C ₂ H ₄	2	110	-20...+50	15...90
49	7HYT	H ₂	1000	Fast response	CO, H ₂ S, NO, HCN, C ₂ H ₄	2	50	-20...+50	15...90
50	H2 3E 1%	H ₂	10000	Fast response, long-term stability	CO, H ₂ S, NO ₂ , C ₂ H ₄ , Isopropanol	2	70	-20...+40	15...90
51	H2 3E 4%	H ₂	40000	Detection of LEL, resistance against toxins, long-term stability	H ₂ S, C ₂ H ₄ , Isopropanol	2	60	-20...+40	15...90

52	4HN	HCN	50	Long service life	CO, H ₂ S, SO ₂ , NO, NO ₂ , C ₂ H ₄	2	200	-20...+50	15...90
53	7HCN	HCN	100	High range	CO, H ₂ S, SO ₂ , NO, NO ₂ , Cl ₂ , C ₂ H ₄	1	150	-20...+50	15...90
54	HCN 3E 30F	HCN	30	Fast response, high selectivity, low drift	H ₂ S, NO, NO ₂	1,5	50	-40...+40	15...95
55	4ND	NO ₂	20		H ₂ S, Cl ₂	2	25	-20...+50	15...90
56	7NDH	NO ₂	20		H ₂ S, Cl ₂	2	40	-20...+50	15...90
57	NO2 3E 50	NO ₂	50	High range, fast response, low drift	SO ₂ , Cl ₂	2	30	-20...+40	15...90
58	NO2-A1	NO ₂	20		H ₂ S, Cl ₂	2	40	-20...+50	15...90
59	NO2-B1	NO ₂	20		H ₂ S, Cl ₂	2	60	-30...+50	15...90
60	7OZ	O ₃	2		H ₂ S, NO ₂ , Cl ₂	2	150	-20...+50	15...90
61	O3 3E 1	O ₃	1	Fast response	H ₂ S, NO ₂ , Cl ₂ , ClO ₂ , N ₂ H ₄ , Br ₂ , I ₂	1,5	60	-20...+40	15...90
62	O3 3E 1 F	O ₃	1	Fast response	H ₂ S, NO ₂ , Cl ₂ , ClO ₂ , N ₂ H ₄ , Br ₂ , I ₂	1,5	60	-20...+40	15...90
63	4CL	Cl ₂	10		H ₂ S	2	60	-20...+50	15...90
64	7CLH	Cl ₂	20		H ₂ S, NO ₂	2	60	-20...+50	15...90
65	Cl2 3E 10	Cl ₂	10	Low dependence on SO ₂ , resistance against toxins	NO ₂ , ClO ₂ , O ₃ , Br ₂	2	60	-20...+40	15...90
66	Cl2 3E 50	Cl ₂	50	High range, fast response	SO ₂ , NO ₂ , ClO ₂ , O ₃ , Br ₂ , F ₂	2	30	-20...+40	10...90
67	CL2-A1	Cl ₂	20		H ₂ S, NO ₂	2	40	-20...+50	15...90
68	CL2-B1	Cl ₂	20		H ₂ S, NO ₂	2	60	-20...+50	15...90
69	F2 3E 1	F ₂	1		H ₂ S, NO ₂ , Cl ₂ , HCN, O ₃ , Br ₂ , AsH ₃ , PH ₃ , B ₂ H ₆	1,5	80	-10...+40	15...90
70	HF 3E 10 SE	HF	10	High sensitivity, low drift	SO ₂ , Cl ₂ , HCl, CH ₃ COOH	1,5	90	-20...+40	15...90
71	ClO2 3E 1	ClO ₂	1	No dependence on H ₂ S	NO ₂ , Cl ₂ , AsH ₃ , ClF ₃	2	120	-20...+40	15...90
72	COCl2 3E 1	COCl ₂	1		NO ₂ , Cl ₂ , HCl, ClO ₂ , O ₃ , AsH ₃	1	120	-20...+40	15...90
73	4PH	PH ₃	5		SO ₂ , SiH ₄ , GeH ₄ , B ₂ H ₆	2	160	-20...+50	15...90
74	4PH-Fast	PH ₃	5	Fast response	SO ₂ , AsH ₃ , SiH ₄ , GeH ₄ , B ₂ H ₆	2	60	-20...+50	15...90
75	AsH3 3E 1	AsH ₃	1	Detection of all hydrides, fast response	H ₂ S, SO ₂ , NO ₂ , Cl ₂ , PH ₃ , SiH ₄ , B ₂ H ₆	1,5	30	-20...+40	20...95
76	SiH4 3E 50	SiH ₄	50		H ₂ S, SO ₂ , NO ₂ , PH ₃ , AsH ₃ , B ₂ H ₆	1,5	60	-20...+40	20...95
77	4COSH	CO	500	Double sensor of CO, H ₂ S, long service life	H ₂ S, SO ₂ , H ₂	3	35	-20...+50	15...90
78	4COSH	H ₂ S	200	Double sensor of CO, H ₂ S, long service life	SO ₂ , NO ₂	3	35	-20...+50	15...90
79	4CF+	CO	500	Fast response, without filter	NO, NO ₂ , H ₂ , C ₂ H ₄ , H ₂ S, SO ₂	2	20	-20...+40 krátce(+55)	15...90
80	4CM	CO	500 2000	Fast response. Filter against H ₂ S, SO ₂	NO, NO ₂ , H ₂ , C ₂ H ₄ , H ₂ S, SO ₂	2	20	-20...+55	15...90

Data in the table are taken over from data sheets of individual sensors.

Other gases, to which the sensor shows some response (so-called cross dependence) are mentioned only if this response reaches at least 5% of signal of the nominal gas.

Each sensor may show some cross dependence on of the gases that are not mentioned here.

Cross dependence can be used e.g. for calibration of a sensor if the nominal gas is not available.

The mentioned service life of each sensor is only presupposed in pure air.

Data sheets of each sensor are available upon request.

Cross dependencies of sensors

No.	Sensor type	Nominal gas	15ppm H ₂ S	5ppm SO ₂	35ppm NO	5ppm NO ₂	20ppm NO ₂	50ppm NO ₂	1ppm Cl ₂	100 ppm H ₂	10 ppm HCN	5 ppm HCl	100 ppm C ₂ H ₄	200 ppm ethanol
7	4CF	CO [ppm]	<0.5	0	<3		-1...+1		0	<40			<50	0
8	4CO	CO [ppm]	45	2.5	10	-3			-1...0	<40				
9	7E	CO [ppm]	38	3	10	-3			-0.5	<60	5	0	<100	
10	7E/F	CO [ppm]	<0,3	0	<7	-1...0			0	<60	<2	0	<100	0
11	A7E	CO [ppm]	38	3	10	-3			-0.5		5	0	<100	
12	A7E/F	CO [ppm]	1	0	<7			-0.5...+1	0	0	<2	0	<75	
80	4CM	CO [ppm]	0	0	10		<0,5	5	0	<28			97	0

No.	Sensor type	Nominal gas	20ppm H ₂ S	20ppm SO ₂	100ppm NO	10ppm NO ₂	1ppm Cl ₂	3000ppm H ₂	100ppm NH ₃	10% CO ₂	1ppm ClO ₂	1025ppm Alcohols	Gasol. vapours	Vapours CH ₃ COOH
13	CO 3E 300	CO	0*	0*	25	0*	0	1000	0,1	0	0	0*	0*	0

* with a built-in filter, long-term exposure to high concentrations may reduce its effectiveness

No.	Sensor type	Nominal gas	20ppm H ₂ S	2ppm SO ₂	20ppm NO	10ppm NO ₂	10ppm HCl	3000ppm H ₂	600ppm Alcohols	Gasoline vapours
14	CO 3E 500 S	CO [ppm]	<2*	0	20	0	7	<300	0*	0*

* with a built-in filter, long-term exposure to high concentrations may reduce its effectiveness

No.	Sensor type	Nominal gas	20ppm H ₂ S	20ppm SO ₂	50ppm NO	10ppm NO ₂	10ppm Cl ₂	400 ppm H ₂ at 20°C	20ppm NH ₃	400ppm C ₂ H ₄	900ppm H ₂ in 900ppm CO at 10°C	900ppm H ₂ in 900ppm CO at 20°C	900ppm H ₂ in 900ppm CO at 30°C
15	CO-AE	CO	0	0	0	0	0	<300	0	<240			
16	CO-AF	CO	0	0	<2.5	0	0	<240	0	<100			
17	CO-AX	CO		0	0	0	0		0	<120	<18	<36	<54
18	CO-BF	CO	0	0	<12.5	0	0	<260	0	<260			
19	CO-BX	CO	0	0	<12.5	0.1	0	<20	0	<40			

No.	Sensor type	Nominal gas	300ppm CO	5ppm SO ₂	35ppm NO	5ppm NO ₂	1ppm Cl ₂	10000ppm H ₂	10ppm HCN	5ppm HCl	100ppm C ₂ H ₄
20	4H	H ₂ S [ppm]	<6	0.5	<0.4	-1		<5			
21	4H/LM	H ₂ S [ppm]	<6	0.5	<0.4	-1		<5			
22	4HS	H ₂ S [ppm]	<3	1	<0.7	-1		<10			
23	4HS/LM	H ₂ S [ppm]	<2	1	<0.7	-1		<10			
24	7H	H ₂ S [ppm]	<6	<1	0	-1	-0.05...+0.04	<15	-1.4...-0.5	0	0
25	7H/LM	H ₂ S [ppm]	<6	<1	0	-1	-0.05...+0.04	<15	-1.4...-0.5	0	0

26	7HH	H ₂ S [ppm]	<1.5	<1	<2	-1...0	-0.2	<5	-1.4...-0.1	0	0
27	7HH/LM	H ₂ S [ppm]	<1.5	<1	<2	-1...0	-0.2	<5	0	0	0

No.	Sensor type	Nominal gas	100 ppm CO	20 ppm SO ₂	10 ppm NO ₂	1% CH ₄	1 ppm Cl ₂	3000 ppm H ₂	20 ppm HCN	110 ppm NH ₃	1 ppm ClO ₂	0.25 ppm O ₃	0.2 ppm AsH ₃	5000 ppm CO ₂	500 ppm C ₂ H ₄	200ppm Isopropanol
28	H2S 3E 100	H ₂ S [ppm]	5	5	0	0	0	45	4	0.1	-0.1	0	0	0	2	19

No.	Sensor type	Nomin. gas	100ppm CO	10ppm SO ₂	10ppm NO ₂	2,18% CH ₄	20ppm Cl ₂	10000ppm H ₂	15ppm HCN	100ppm NH ₃	500ppm C ₂ H ₄	600ppm Isopropanol	1000ppm Metanol
29	H2S 3E 100 S	H ₂ S	<1	<0.5	<3	0	<5	<10	<0.2	0	0	0	0

No.	Sensor type	Nominal gas	400ppm CO	20ppm SO ₂	50ppm NO	10ppm NO ₂	10ppm Cl ₂	400ppm H ₂	20ppm NH ₃	400ppm NH ₃	400ppm C ₂ H ₄	5% CO ₂
30	H2S-A1	H ₂ S [ppm]	<6	<2	<2	<-2	<-2.5	<0.8	<0.02		<2	
31	H2S-AH	H ₂ S [ppm]	<6	<2	<1	<-3	<-2.5	<0.6	<0.02		<0.6	
32	H2S-B1	H ₂ S [ppm]	<16	<3.6	<1	<-3	<-2.5	<4		<0.4	<3.2	<50
33	H2S-BE	H ₂ S [ppm]	<16	<4	<5	<-2.5	<-1.2	<0.8	<0.02		<1	
34	H2S-BH	H ₂ S [ppm]	<4	<2	<1.5	<-3	<-2.5	<1	<0.02		<0.4	

No.	Sensor type	Nominal gas	100ppm CO	20ppm H ₂ S	20ppm SO ₂	10ppm NO ₂	1ppm Cl ₂	10000ppm H ₂	1000ppm Alcohols	Hydrocarbons	5000ppm CO ₂
35	NH3 3E 100	NH ₃ [ppm]	40	25	-10	0	-6	1000	Yes		
36	NH3 3E 100 SE	NH ₃ [ppm]	0	2*				0	0	0	0

* short exposure in minutes

No.	Sensor type	Nominal gas	100ppm CO	20ppm H ₂ S	3000ppm H ₂	600ppm Alcohols	5% CO ₂
37	NH3 3E 500 SE	NH ₃ [ppm]	<1	5	<5	<1	-4

No.	Sensor type	Nominal gas	100 ppm CO	20 ppm H ₂ S	20 ppm SO ₂	10 ppm NO ₂	5 ppm Cl ₂	3000 ppm H ₂	10 ppm HCl	Amines	0,2 ppm AsH ₃	300 ppm PH ₃	5000 ppm CO ₂	1000 ppm Alcohols	Non-saturated hydrocarbons
38	NH3 3E 1000	NH ₃ [ppm]	95	40	5	0	0	3000	0	Yes	0	0	0	Yes	Yes
39	NH3 3E 1000 SE	NH ₃ [ppm]	0	2	-40	0	0	0						0	
40	NH3 3E 5000 SE	NH ₃ [ppm]	0	Yes	Yes	0	0	0						0	

No.	Typ senz.	Jmen. plyn	300ppm CO	15ppm H ₂ S	35ppm NO	5ppm NO ₂	1ppm Cl ₂	100ppm H ₂	10ppm HCN	5ppm HCl	100ppm C ₂ H ₄
41	4S	SO ₂ [ppm]	<3	0	0	-5					
42	7SH	SO ₂ [ppm]	<3	20	-1...0	-6	-0,5...0	0	5	1	0
43	7ST/F	SO ₂ [ppm]	<5	0	-7...0	-5	-1,5...0	0	<5	0	0

No.	Sensor type	Nominal gas	300ppm CO	15ppm H ₂ S	35ppm NO	5ppm NO ₂	1ppm Cl ₂	100ppm H ₂	10ppm HCN	5ppm HCl	100ppm C ₂ H ₄	No.
41	4S	SO ₂ [ppm]	<3	0	0	-5						41

42	7SH	SO ₂ [ppm]	<3	20	-1...0	-6	-0,5...0	0	5	1	0	42
43	7ST/F	SO ₂ [ppm]	<5	0	-7...0	-5	-1,5...0	0	<5	0	0	43

No.	Sensor type	Nominal gas	400ppm CO	20ppm H ₂ S	50ppm NO	500ppm NO	10ppm NO ₂	10ppm Cl ₂	400ppm H ₂	20ppm NH ₃	400ppm C ₂ H ₄	1000ppm C ₂ H ₄
44	SO2-AE	SO ₂ [ppm]	<8	0,02		<-50	<-14	<-14	<0,4	<0,02		<750
45	SO2-AF	SO ₂ [ppm]	<16	<0,02	<2		<-10	<-7	<0,8	<0,02	<60	
46	SO2-BF	SO ₂ [ppm]	<4	<0,02	<-1,5		<-12	<-5	<0,4	<0,02	<160	

No.	Sensor type	Nominal gas	300ppm CO	15ppm H ₂ S	5ppm SO ₂	35ppm NO	5ppm NO ₂	1ppm Cl ₂	10ppm HCN	5ppm HCl	100ppm C ₂ H ₄
47	4HYT	H ₂ [ppm]	<60	<3	0	10	0	0	3	0	80
48	7HYE	H ₂ [ppm]	<120	10	0	<10	0	0	10	0	40
49	7HYT	H ₂ [ppm]	0...60	<3	0	10	0	0	3	0	80

No.	Sensor type	Nominal gas	100 ppm CO	20 ppm H ₂ S	5 ppm SO ₂	100 ppm NO	10 ppm NO ₂	1 ppm Cl ₂	5 ppm Cl ₂	20 ppm HCN	100 ppm NH ₃	0,25 ppm O ₃	0,2 ppm AsH ₃	500 ppm C ₂ H ₄	1000 ppm CO ₂	1% CH ₄	1100 ppm Isopropanol
50	H2 3E 1%	H ₂ [ppm]	60	4*	0		-40	0		0	0	0	0	Yes	0	0	Yes
51	H2 3E 4%	H ₂ [ppm]	0	44*		0	0		0	0	0		0	Yes	0	0	Yes

* with a built-in filter, long-term exposure to high concentrations may reduce its effectiveness

No.	Sensor type	Nominal gas	300ppm CO	15ppm H ₂ S	5ppm SO ₂	20ppm SO ₂	35ppm NO	5ppm NO ₂	1ppm Cl ₂	200ppm H ₂	100ppm C ₂ H ₄
52	4HN	HCN [ppm]	<15	90		40...75	-28...0	-20...-10			<25
53	7HCN	HCN [ppm]	<54	350,00%	5.5...17.5		-17.5...0	-20...-10	-0.5	0	<55

No.	Type sensor	Nominal gas	100ppm CO	20ppm H ₂ S	100ppm NO	10ppm NO ₂	10000ppm H ₂	5000ppm CO ₂	1000ppm Alcohols	Hydrocarbons
54	HCN 3E 30F	HCN [ppm]	0	0*	-5	-7	0	0	0	0

* short exposure in minutes; after saturation of the filter, response approx. 40ppm

No.	Sensor type	Nominal gas	300ppm CO	15ppm H ₂ S	5ppm SO ₂	35ppm NO	1ppm Cl ₂	100ppm H ₂	10ppm HCN	5ppm HCl	100ppm C ₂ H ₄
55	4ND	NO ₂ [ppm]	0	-1.2	0	0	1				
56	7NDH	NO ₂ [ppm]	0	-1.5...0	-0.05...0	0	1	0	0	0	0

No.	Sensor type	Nominal gas	20ppm SO ₂	100ppm NO	1ppm Cl ₂	3000ppm H ₂	5000ppm CO ₂	1000ppm Alcohols
57	NO2 3E 50	NO ₂ [ppm]	5	0.4	1	0	0	0

No.	Sensor type	Nominal gas	400ppm CO	20ppm H ₂ S	20ppm SO ₂	50ppm NO	10ppm Cl ₂	400ppm H ₂	20ppm NH ₃	50ppm C ₂ H ₄	400ppm C ₂ H ₄	5% CO ₂
58	NO2-A1	NO ₂ [ppm]	<0.4	<-8	<-0.5	<0.25	10	<0.4	<0.02	<0.05		<50
59	NO2-B1	NO ₂ [ppm]	<0.4	-20	<-0.4	<0.25	10	<0.4	<0.02		<0.4	0

No.	Sensor type	Nominal gas	300ppm CO	15ppm H ₂ S	5ppm SO ₂	35ppm NO	5ppm NO ₂	1ppm Cl ₂	100ppm H ₂	10ppm HCN	5ppm HCl	100ppm C ₂ H ₄
60	7OZ	O ₃ [ppm]	0	-2	0	0	3.5	<1	0	0	0	0

No.	Sensor type	Nominal gas	100ppm CO	20ppm H ₂ S	10ppm NO ₂	1ppm Cl ₂	3000ppm H ₂	1ppm ClO ₂	5000ppm CO ₂	3ppm N ₂ H ₄	100% N ₂	Br ₂ , I ₂
61	O3 3E 1	O ₃ [ppm]	0	-1.6*	6	1.2	0	1.5	0	-3	0	Yes
62	O3 3E 1 F	O ₃ [ppm]	0	-1.6*	6	1.2	0	1.5	0	-3	0	Yes

* permanent exposure with level of ppm longer than 30 minutes may impair the sensor

No.	Sensor type	Nominal gas	300ppm CO	15ppm H ₂ S	5ppm SO ₂	35ppm NO	5ppm NO ₂	100ppm H ₂	10ppm HCN	5ppm HCl	100ppm C ₂ H ₄
63	4CL	Cl ₂ [ppm]	0	-7.5...0	0	0					
64	7CLH	Cl ₂ [ppm]	0	-3,8...0	-0,05	0	5	0	0	0	0

No.	Sensor type	Nominal gas	100 ppm CO	20 ppm H ₂ S	20 ppm SO ₂	10 ppm NO ₂	3000 ppm H ₂	1 ppm ClO ₂	2.4 ppm ClO ₂	100 ppm NH ₃	0.25 ppm O ₃	1 % CO ₂	1 ppm Br ₂	1.0 ppm F ₂
65	Cl2 3E 10	Cl ₂ [ppm]	0	0,1	0	4.5	0		0.55	0	0.11	0	1.0 (theoret.)	
66	Cl2 3E 50	Cl ₂ [ppm]	0	0*	3.5	2	0	0.5		0	0.05	0	1.0	0.4

* exposure to H₂S poisons the cell, later exposure to Cl₂ reactivates the sensor

No.	Sensor type	Nominal gas	400ppm CO	20ppm H ₂ S	20ppm SO ₂	50ppm NO	10ppm NO ₂	400ppm H ₂	400ppm C ₂ H ₄	20ppm NH ₃	5% CO ₂
67	CL2-A1	Cl ₂ [ppm]	<0.4	<-8	<-0.5	<0.25	10	<0.4	<0.4		
68	CL2-B1	Cl ₂ [ppm]	<0.4	-20	<-0.4	<0.25	10	<0.4	<0.4	<0.02	0

No.	Sensor type	Nom. gas	100 ppm CO	1 ppm H ₂ S	20 ppm SO ₂	10 ppm NO ₂	1 ppm Cl ₂	10000 ppm H ₂	1 ppm HCN	5 ppm HCl	0.25 ppm O ₃	5000 ppm CO ₂	100 % N ₂	Br ₂	0.2 ppm AsH ₃	0.3 ppm PH ₃	0.25 ppm B ₂ H ₆	1000 ppm Alcohols	Hydr ocarb ons
69	F2 3E 1	F2	1	-2	0.04	-19	1.4	0	-3	0*	0.3	0	0	Yes	1	Yes	0.4	0	0

* short exposure in minutes

No.	Sensor type	Nominal gas	100ppm CO	20ppm SO ₂	1ppm Cl ₂	3000ppm H ₂	10ppm HCl	5000ppm CO ₂	100ppm CH ₃ COOH	1000ppm Alcohols	Hydro-carbons
70	HF 3E 10 SE	HF [ppm]	0	16*	0.7	<1	6	0	Yes	0	0

* short exposure in minutes

No.	Sensor type	Nominal gas	100 ppm CO	20 ppm H ₂ S	10 ppm NO ₂	1ppm Cl ₂	3000 ppm H ₂	20 ppm HCN	5000 ppm CO ₂	100% N ₂	0.2ppm AsH ₃	1ppm ClF ₃	1000ppm Alcohols	Hydro-carbons
71	ClO2 3E 1	ClO ₂ [ppm]	0	0*	3.7	0.2...0.4	0	-0.9	0	0	-0.01	1 (theoret.)	0	0

* short exposure in minutes; capacity of the filter >15ppm/h

No.	Sensor type.	Nominal gas	100ppm CO	20ppm H ₂ S	10ppm NO ₂	1ppm Cl ₂	10 ppm HCl	1ppm ClO ₂	100 ppm NH ₃	0.25 ppm O ₃	5000 ppm CO ₂	0.2 ppm AsH ₃	1% CH ₄	1100ppm Isopropan ol
72	COCl2 3E 1	COCl ₂ [ppm]	0	Yes*	-1	0.4	25	-3	0	0.03	0	0.18	0	0

* after perforation of the filter

No.	Sensor type.	Nominal gas	1000ppm CO	5ppm SO ₂	1000ppm H ₂	100ppm C ₂ H ₄	0.15ppm AsH ₃	1ppm SiH ₄	0.6ppm GeH ₄	0.3ppm B ₂ H ₆
73	4PH	PH ₃ [ppm]	1	1	30	1,8	0	0.9	0.51	0.105
74	4PH-Fast	PH ₃ [ppm]	5	1	1	1	0,1	0.9	0.55	0.105

No.	Sensor type	Nom. gas	100 ppm CO	20 ppm H ₂ S	20 ppm SO ₂	10 ppm NO ₂	1 ppm Cl ₂	3000 ppm H ₂	20 ppm HCN	5 ppm HCl	100 ppm NH ₃	5000 ppm CO ₂	100 % N ₂	0,1 ppm PH ₃	0,2 ppm AsH ₃	5 ppm SiH ₄	0,25 ppm B ₂ H ₆	200ppm Isoprop anol	Hydr ocarb ons
75	AsH3 3E 1	AsH ₃	0	5	2	-2	-0.07	0**	0.5	0*	0.1	0	0	0.13	0.2	3.8	0.18	0	0
76	SiH4 3E 50	SiH ₄	0	7	4	-2	0	0**	0.5	0*	0	0	0	0.13	0.2	5	0.12	0	0

* short exposure in minutes (dose approx. 100ppm min.)

** assumed responde at >4% H₂

No.	Sensor type	Nominal gas	300ppm CO	15ppm H ₂ S	5ppm SO ₂	35ppm NO	5ppm NO ₂	1ppm Cl ₂	100ppm H ₂
77	4COSH	CO [ppm]	300	0...6	<1	<0.1	<0.1	0	20
78	4COSH	H ₂ S [ppm]	<6	15	0.4...1	<1	-1	0	0.03

Other gases and vapours detectable by electrochemical sensors SC-TOX

Gas name	Chemical formula	Relative gas density vs. air	Boiling point [°C]	Explosive concentration in air	PEL {TWA} [ppm]	NPK-P {STEL} [ppm]	Detectable by the sensor
Acetaldehyde	CH ₃ CHO	[1.5]	20.2	4-57%	25.45	50.9	CO
Arsenic trifluoride	AsF ₃		60.4	-	{0.2}		HF
Arsenic pentafluoride	AsF ₅		-52.8	-	{0.2}		HF
Borontrifluoride	BF ₃	2.3	-100	-	{1}		HF
Carbonylfluoride	COF ₂	2.2	-84	-	{2}		HF
Chlorine dioxide	ClO ₂	2.36	9.7	-	{0.1}	{0.3}	ClO ₂ , O ₃
Chlorous trifluoride	ClF ₃	3.1	11.7	-	{0.1}		ClO ₂ , HF
Disulphur decafluoride	S ₂ F ₁₀		30	!	{0.01}		HF
Formic acid	HCOOH	[1.03]	101	18-57%	{5}		CO
Iodine	I ₂	[9]	184	-	{0.1}		Cl ₂ , O ₃
Isopropanol	(CH ₃) ₂ CHOH	[2.1]	82.4	2.0-12.7%	{200}		CO without filter
Methanol	CH ₃ OH	[1.11]	64.7	6.0-36.5%	175 {200}	700	CO without filter
Stiban	SbH ₃	4.3	-17.1	!	{0.1}		AsH ₃
Sulfuryl fluoride	SO ₂ F ₂	3.7	-55.4	-			HF
Stannic fluoride	SnF ₄		>705	-			HF
Trifluorotriazine	C ₃ F ₃ N ₃		74	-			HF
Acetylene	C ₂ H ₂	0.85	-84	2.5-80%			H ₂
Ethanol	C ₂ H ₅ OH	[1.6]	78.4	3.3-15%			H ₂
Ethylene	C ₂ H ₄	0.91	-103	2.75-36%			H ₂
Propylene	C ₃ H ₆	1.4	-47.6	2.0-11.1%			H ₂

Table of gases, properties and toxicity

Gas name	Chemical formula	Relative gas density vs. air	Boiling point [°C]	Explosive concentration in air	* Standard testing gas [ppm]	PEL {TWA} [ppm]	NPK-P {STEL} [ppm]
Oxygen	O ₂	1.1	-183	-	20.9%	-	-
Carbon monoxide	CO	0.95	-192	10.9-74%	50	24	120
Hydrogen sulphide	H ₂ S	1.1	-60.3	4.3-46%	10	6.59	13.1
Ammonia	NH ₃	0.59	-33.3	15-30%	25	18.4	47.4
Sulphur dioxide	SO ₂	2.1	-10	-	2	1.75	3.5
Hydrogen	H ₂	0.07	-253	4.0-72%	-	-	-
Hydrogen cyanide	HCN	0.54	25.6	!	10	2.49	8.3
Nitrogen dioxide	NO ₂	2.64	21.1	-	3	{3}	{5}
Ozone	O ₃	1.7	-112	-	0.1	0.05	0.09
Chlorine	Cl ₂	2.47	-34.4	-	0.5	0.48	0.96
Fluorine	F ₂	1.3	-188	-	1	0.88	1.76
Hydrofluoride	HF	0.8	19.5	-	2	1.76	2.94
Chlorine dioxide	ClO ₂	2.36	9.7	-	0.1	{0.1}	{0.3}
Phosgene	COCl ₂	3.1	8.3	-	0.1	0.11	0.23
Phosphane	PH ₃	1.18	-87.4	1.6-98%	0.3	0.07	0.2
Arsane	AsH ₃	3.82	-62.4	3.9-77.8%	0.05	0.03	0.06
Silane	SiH ₄	1.04	-112	1.4-96%	5	{5}	{5}

- * Standard testing gas acc. to ČSN EN 45544-1, Annex A
- PEL Permissible Exposure Limit per shift (acc. to Decree of the government of CR, no. 178/2001 Coll.)
- {TWA} 8-hour Time-Weighted Average
- NPK-P Highest Permissible Concentration (acc. to decree of the government of CR, no. 178/2001 Coll.)
- {STEL} Short-Time Exposure Limit

The table is intended for quick reference, the current value must be obtained from the relevant regulations and standards, or from their current version.

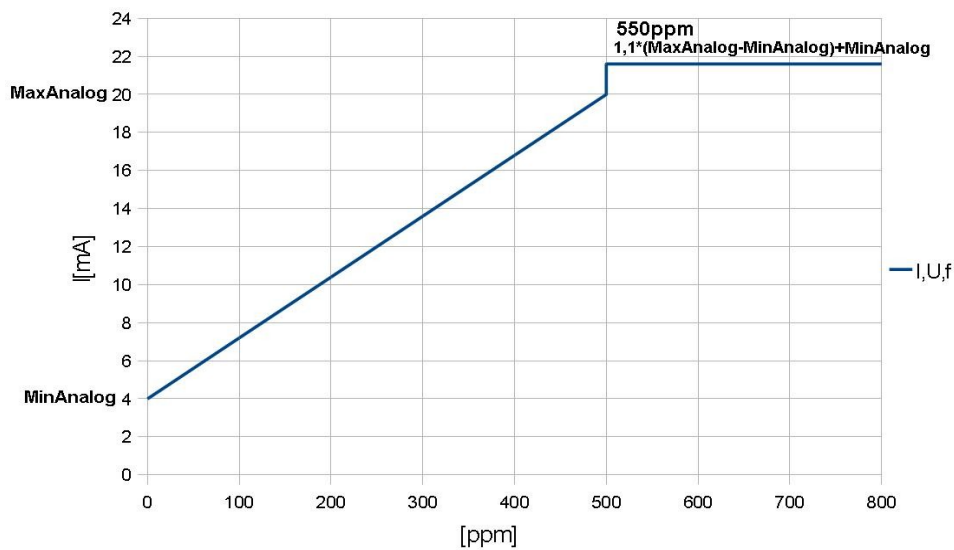
Max. resistance of a power supply line loop for some sources (backlight off, output 1mA)

Type	U _o [V]	I _o [mA]	P _o [W]	C _o [μF]	L _o [mH]	Protection against explosion	R _{max} [Ω]
ZAM-SERVIS HOUK-Z	18.9	106	1.07	1.6	5	I M2(M1) Ex e mb[ia] I	120
ZAM-SERVIS DKD-2000	17.85	195	2.07	4	0.9	I M2(M1) Ex d [ia] ia I	50
MTA PNS 04/M	22	93		2	3	I M2(M1) EEx d e [ia] I	50
MM Group MM5041DCx U _o =21,42V	21.42	147	0.787	I 1.25	I 4.1	I (M1) [EEx ia] I II (1)G [EEx ia] IIC	100
MM Group MM5041ACx U _o =28V	28	93	0.66	I 0.48 II 0.07/0.06/0.03	I 8 II 0/1/4.1	I (M1) [EEx ia] I II (1)G [EEx ia] IIC	60
MK72-S19-Ex0/24VDC	27.6	131	1.32	0.205	3	II (1)GD [EEx ia] IIB	180
Pepperl+Fuchs KFD0-SD2-Ex1.1180	25.2	184	1.159	I 4.15 II 0.82	I 13.78 II 4.2	I (M1) [Ex ia] I II (1)GD [Ex ia] IIB	120

Attainable distance

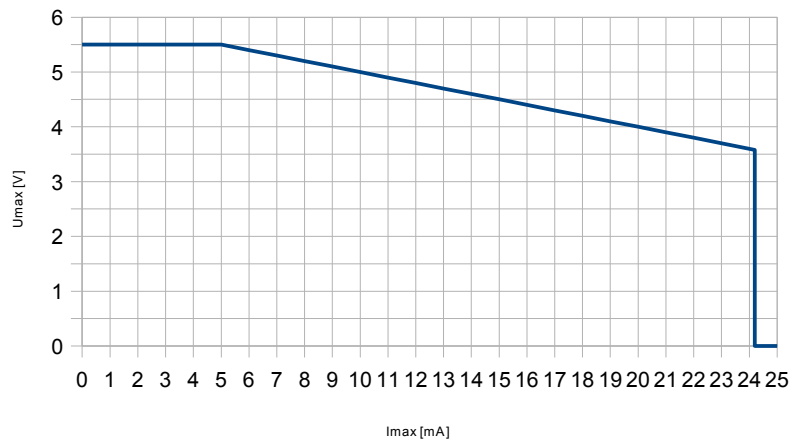
Cross section of a Cu conductor	Resistance of a line loop	Attainable distance from the source with R _{max} =40Ω
0.5mm ²	78 Ω/km	500m
0.75mm ²	52 Ω/km	750m
1mm ²	39 Ω/km	1000m
1.5mm ²	26,6 Ω/km	1500m
2.5mm ²	16,0 Ω/km	2500m

Conversion characteristic, range 0-500ppm on the analog output 4-20mA.

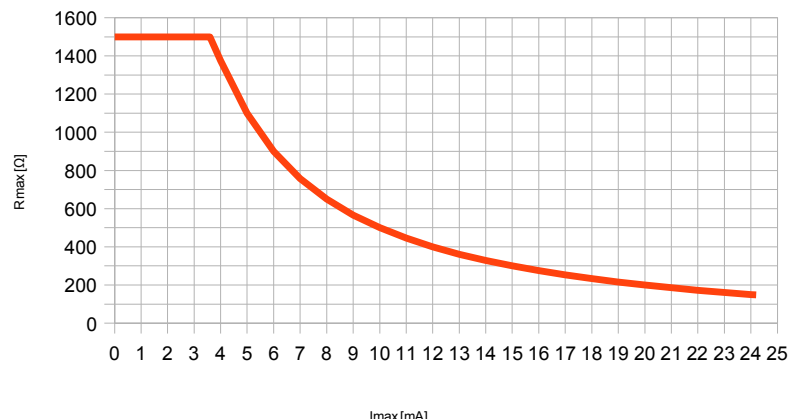


Conversion characteristic of freely adjustable current, voltage and frequency output. The example shows conversion of the range 0-500ppm on the analog output 4-20mA.

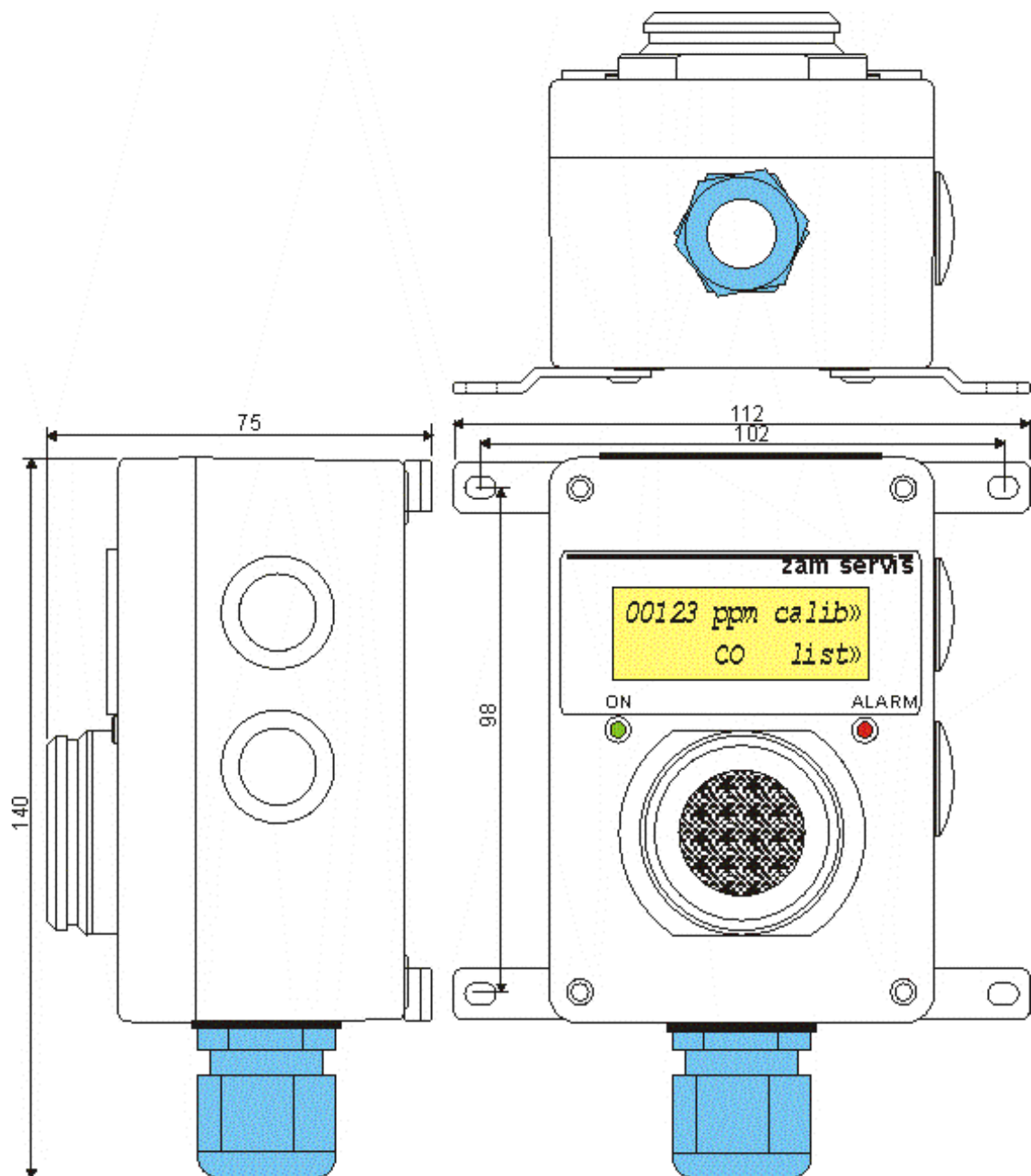
Internal limitation of maximum current and voltage



Internal limitation of maximum current and maximum voltage on analog output. Maximum output values obtainable according to analogue output loading.



Maximum value of resistance on the current output ($R_{max} = \text{detecting resistance} + \text{line resistance}$)
Recommended loading of the voltage output is 5 to 50 kΩ



Mechanical dimensions of SC-TOX

Supplement A: To sensors equipped with M12 connectors.

General

SC-... sensors may be equipped with connectors instead cable entries. The connectors are made in two versions: In case of the 8-pin version, all detector terminals are brought out to the connector, or in case of the 4-pin version, power supply and one of the interfaces are brought out to the connector, i.e. analogue output, digital output, and communication interface.

The connectors are already mounted on the detector body by the manufacturer. It must be specified in the order what type of connector it should be.

The cable connectors are delivered separately, i.e. connector, cable, and connector cover separately. Assembling is carried out by user.



Warning!

Owing to surface distances and clearances in the connector and cable parameters, it is necessary, while connecting, to consider the fact that all inputs and outputs of the detector as well as the circuits in the connected cable are part of one intrinsically safe circuit.

Use

Connection using the connector makes it possible to promptly replace one detector with another. When replacing, it is not necessary to open the detector.

This makes it possible to calibrate detectors in workshop premises, for example. At the measurement point, you can replace the existing detector with the calibrated one and take the one which was used to workshop and calibrate it there.

Description

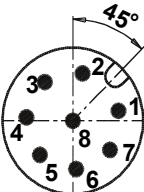
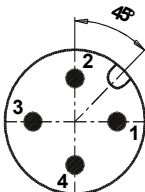
It is an industry standard M12 A-coded connector, "M12 connectors A-coded"; there are 4-pin or 8-pin connectors.

Instead of the bushing on the detector body, there is a zinc/nickel-plated brass male connector with protective cover that must be mounted in case that the connector with cable is not connected.

There is a plastic connector with a metal nut and connector cover on the cable. The connector cover must be put on or screwed onto the connector if the connector cable is not connected to the connector on the detector body. The connector has screw-type terminals.

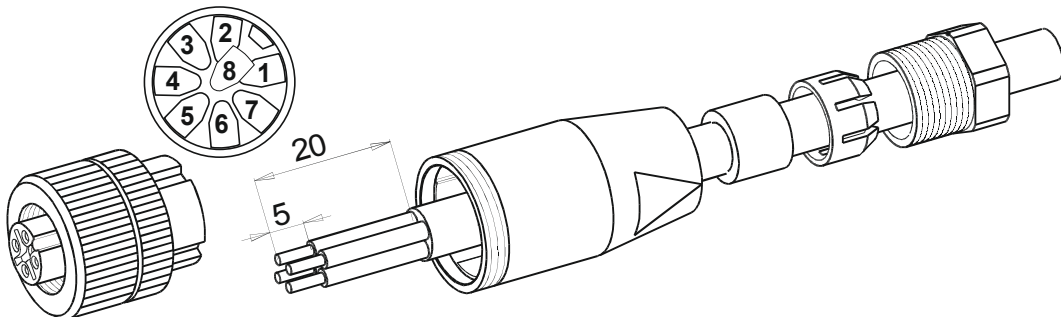
Installation and assembly

The connector on the detector body is delivered installed by manufacturer; including connector cover; pin numbering and wiring colour codes are referred to further. Connector pin numbering is consistent with detector terminal numbering.

8-pin	Pin	Colour	Terminal	4-pin	Pin	Colour	Terminal
	1	white	1 Analog out +		1	brown	3 Power +
	2	brown	2 Analog out -		2	white	1 A- (6 D-, 8 RS485B)
	3	green	3 Power +		3	blue	4 Power -
	4	yellow	4 Power -		4	black	2 A+ (6 D+, 8 RS485A)
	5	grey	5 Digital out +				
	6	pink	6 Digital out -				
	7	blue	7 RS485A				
	8	red	8 RS485B				

Wiring of connectors on detector body; pins are drawn when looking into the connector.

The cable connector uses the same wiring colour codes as the connector on the detector body. Wire stripping length and connector assembling is indicated in the figure below. It is absolutely necessary to keep the lengths and after assembling the connector, tighten the connector bushing properly so that it can grip the cable jacket. Use a 2 x 0.5 screwdriver for the screw terminals. After assembling, attach the cover to the cable and secure from losing it.



Adapting the cable conductor ends, connector assembling; pins are numbered when looking at screw-type terminals,

Operating instructions



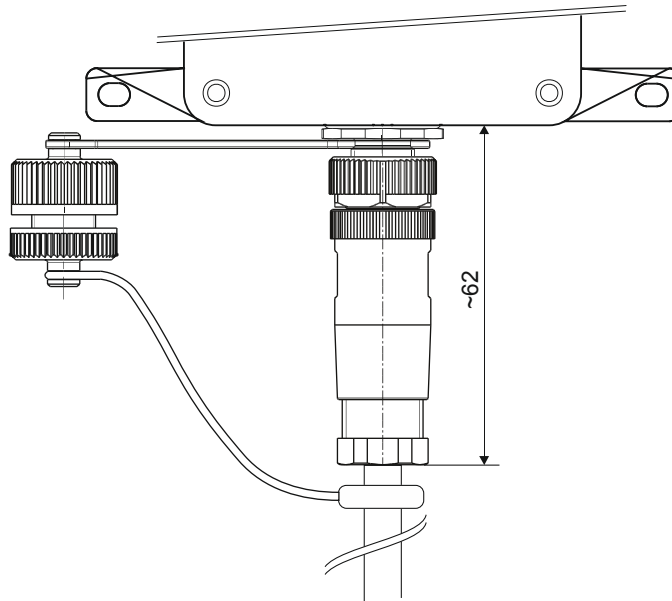
Warning!

The connectors and covers may never remain open! Either connector covers are put on the connectors or the connectors are connected and consequently, the covers of connected connectors are connected together!

Never use a pair of pliers while handling the connector!

Connection

Remove the covers from both connectors. Make sure that no dirt is found in the connectors and their covers and remove the dirt if present. Slide the cable connector into the connector on the detector body and turn until locking mechanisms and connector keys are correctly matched and push all the way in. Apply adequate torque to the knurled nut on the cable connector to secure the connection. Screw the connector covers together and tighten slightly.

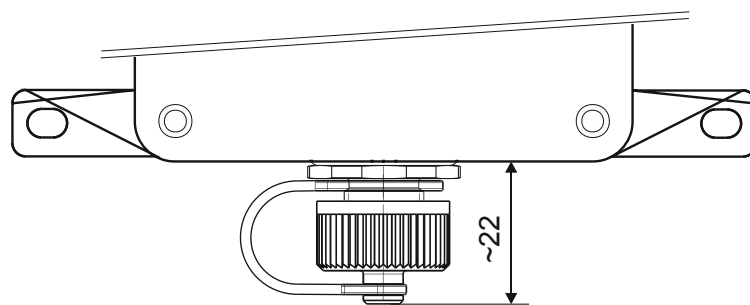


Connection of connectors and protective covers.

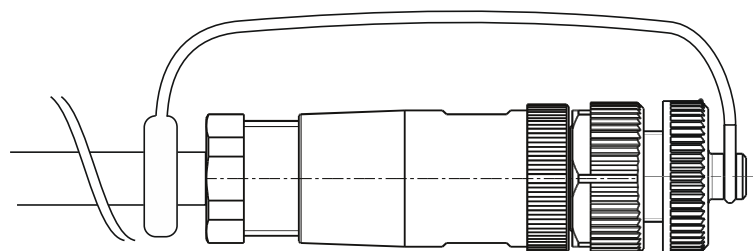
Disconnection

Separate the connector covers from each other by screwing them apart. Loosen the securing nut on the cable connector manually and screw out the nut as long as the connectors are disconnected from each other. Put protective covers on both connectors. To avoid damaging the connector cable, store it properly.

If the nut cannot be loosened by hand, use an 18mm spanner, 2mm high, for hexagon nuts. The securing nuts are provided with the hexagon. Be very careful not to damage the nut. At the same time, it is convenient to hold the connector on the body with a 22mm spanner.

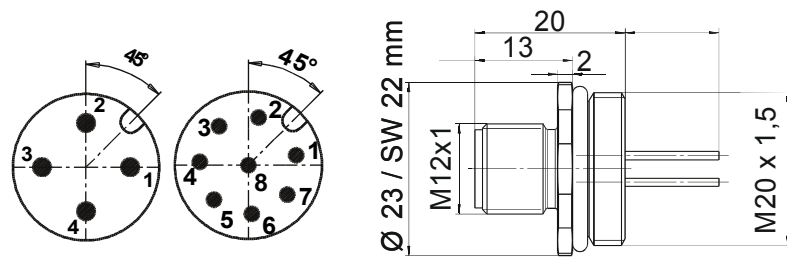


Detector body with the connector and the protective cover on.

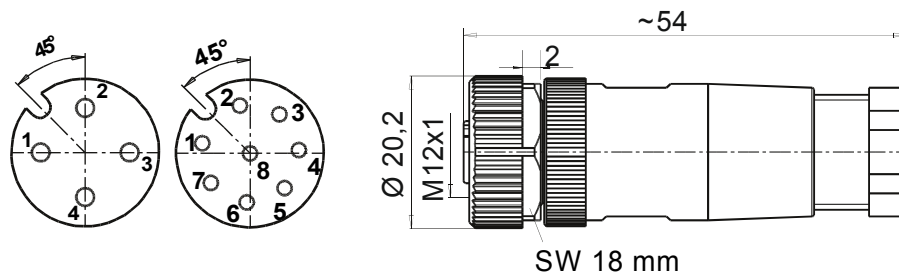


Cable connector with protective cover on.

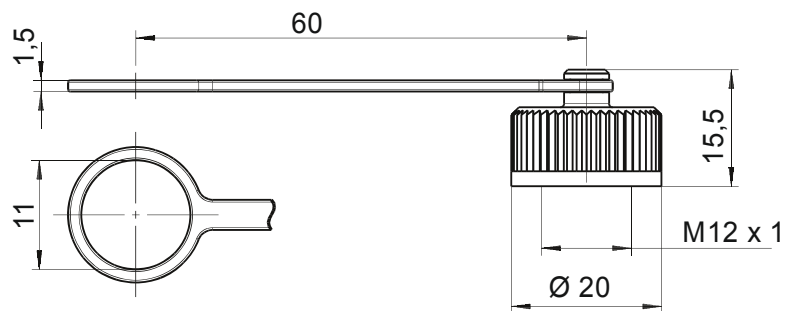
Connector figures



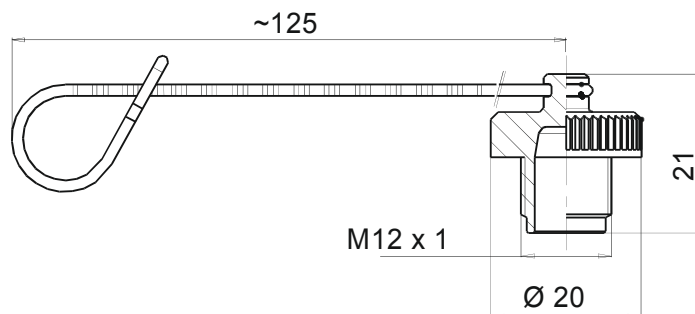
Panel mount connector, looking into the connector, dimensions.



Cable connector, looking into the connector, dimensions.



Panel mount connector cover.



Cable connector cover.

Connection of connectors and protective covers.

Maintenance

Carried out similarly as described for the product.

Make sure to keep inner spaces of connectors and covers as well as threads clean!

Repairs and spare parts

The following parts are delivered.

Type	Pins	Order number	Remark	Ver.
Cable connector	8	99-0486-12-08	cable diameter 6–8 mm	A
Cable connector	4	99-0430-14-04	cable diameter 4–6 mm	B
Cable connector	4	99-0430-314-04	cable diameter 2.5–3.5 mm	B
Connector cable cover		08-2425-010-000		A,B
Panel-mount connectors	8	09-3481-642-08	Cut the wires short to 60mm, strip 8mm insulation off and provide them with ferrules with 0.25mm ² insulation	A
Panel-mount connectors	4	09-3431-642-04		B
Connector cable cover		08-2989-000-000		A,B
Cable		LiYY 8 x 0,34	Minimum withdrawal quantity is in hundreds of metres. Upon enquiry.	A
Cable		LiYY 4 x 0,34		B

The panel mount connector is designed for mounting onto the detector body and it is tightened at 2 to 3 Nm. Owing to its low tightening nut, it is necessary to be very careful not to damage the connector. The remaining items as described for the product.

Document revision

28. 11. 2012	Type for NH3 and information about using in NH3 atmosphere added.
18. 9. 2012	Reformatting the document, removal of information not related to the existing software version, additional information for current software version. Modification of factory default settings. Calibration limit changed to 0 days. Description of connectors added.
18.4.2013	New sensor 4CM. Formal changes, reformatting. Unification, change the type description.