Mini probes SS27/MS27
Vacuum probe XS22
+
Electronic unit E2010

Measuring systems
for measuring the oxygen concentration in furnace atmospheres, flue gases and vacuum systems

Manual

ZIROX Sensoren & Elektronik GmbH

Am Koppelberg 21, 17489 Greifswald/Germany ☎+49 3834 830900, E-Mail: info@zirox.de

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1 General information

1.1 Notes on the manual

This manual describes composition, mode of operation and use of the SS27 and MS27 mini probes and the XS22 vacuum probe in combination with the E2010 electronic unit of ZIROX Sensoren und Elektronik GmbH.

Address of manufacturer:

ZIROX Sensoren und Elektronik GmbH
Am Koppelberg 21
17489 Greifswald
Germany
Phone: +49 38 34 830900
E-Mail: info@zirox.de
www.zirox.de

This manual is not subject to the amendment service. If the manufacturer modifies the device with the aim of making technical improvements, the user is responsible for inserting the additional or updated pages supplied.

Proper operation of the device can only be ensured if the contents of this manual are known. Therefore, all chapters of this manual must be read carefully before commissioning the appliance.

Pages, charts and figures are numbered consecutively.

The values shown in the display in this device manual are examples or the values preset by the manufacturer. The process-specific values must be determined by the user.

1.2 Copyright

1.3 Commonly used symbols

Symbol for imminent danger:

DANGER

You will find this symbol next to all instructions on occupational safety if there is an immediate danger to the life and health of persons.

Failure to follow these instructions may result in serious injury or death.

Symbol for indirect danger:

ATTENTION

This symbol indicates situations in which indirect hazards occur. The degree and intensity of the damage depend on the sequence of events triggered and the actions of the person concerned.

In case of disregard, destruction or damage of the device, its single components or other material assets as well as minor injuries may result.

Symbol for proper handling:

NOTE

This symbol is used in places in this appliance manual where reference is made to compliance with guidelines, regulations and correct work procedures.

In case of disregard, damage or destruction of the device or its single components may result.

2 Safety regulations

The following regulations for industrial safety provide basic information about potential danger during the operation of the measuring system. Therefore, they must be observed and strictly followed by the responsible staff.

- A failure-free and functional operating can only be guaranteed with knowledge of this manual. Therefore, all chapters of this manual must be read carefully before the installation and initiation of the measuring system.
- The measuring system may only be used for its intended purpose (see chapter 3).
- The measuring system may only be connected, operated and maintained by trained personnel.

DANGER

The use of the measuring system in explosive gas mixtures is strictly prohibited! The probe is a source of ignition.

ATTENTION

When measuring corrosive gases, the risk of condensate formation or carbon deposits, the manufacturer must be consulted before use. The probe must always be installed with the head up or the tip down to prevent condensate from flowing towards the measuring head.

ATTENTION

The use of the measuring system in gas mixtures with halogens in high concentrations and gases containing sulphur is not permitted and will damage the device. Furthermore, the electrodes of the probe can be irreversibly damaged by typical catalyst poisons (e.g. Pb).

ATTENTION

Before opening the housing cover of the E2010, switch off the device and disconnect it from the power supply.

NOTE

The requirements and limit values given in the "Technical Data" must be strictly observed. Any other use is treated as non-authorized use.

Special safety recommendations for potential danger during certain working processes are given in relevant text passages.

3 Area of application

The measuring system is used to continuously measure the oxygen concentration in furnace atmospheres, flue and process gases or vacuum systems.

The SS27 probe was designed for measuring the oxygen concentration in furnace atmospheres and process gases. Due to its open design, it reacts quickly and can cover a wide measuring range from 1 vol.-ppm to 20.64 vol.-% O_2.

Due to its robust design, the MS27 probe is mainly suitable for use in flue gases and under reducing conditions (e.g. forming gas). In contrast to conventional ZrO_2 sensors, the measuring range is limited to 0.1 to 20.6 vol.-% O_2 due to the design.

The XS22 probe is used for in situ oxygen measurement in gases under vacuum conditions. Due to its specially adapted design for vacuum applications, the probe is not suitable for measuring oxygen concentrations in the percentage range. Here the relative measuring error under normal pressure is more than 20%. Typical application examples for the XS22 probe are measurements in vacuum processes (PVD or other plasma processes, CVD only after consultation with the manufacturer), measurements in process gases that do not take place under normal pressure (e.g. surface treatment processes) or measurements in science and research.

The electronic unit E2010, developed for panel mounting, provides the power supply for ZIROX® sensors and probes, evaluates signals and displays measuring results in the form of a standard signal (4…20 mA) for process control.

The electronics realizes the following functions:

- Power supply and control of sensor heating
- Processing of the thermoelectric and cell voltage of the probe to the oxygen concentration
- Output of the oxygen concentration as a standard signal
- Calibration
- Reference air supply by internal pump (optional)
- Signalization of limit value underruns/overruns by means of a limit value relay

4 Theoretical foundations

4.1 General

The oxygen concentration is measured using a potentiometric solid electrolyte cell. Basis for the determination of the oxygen concentration in gases is the NERNST equation:

Nernst equation

$$U = \frac{RT}{4F} \cdot \ln \frac{p_{O_2,\,\text{meas gas}}}{p_{O_2,\,\text{air}}} \tag{I}$$

U – Cell voltage in mV

R – molar gas constant, R = 8.31 J/(mol · K)

F – Faraday-constant, F = 9.64 · 10^4 C/mol

T – measuring temperature in K

$p_{O_2,\,\text{air}}$ – partial pressure of the oxygen at the reference electrode

$p_{O_2,\,\text{meas gas}}$ – partial pressure of the oxygen at the measuring electrode

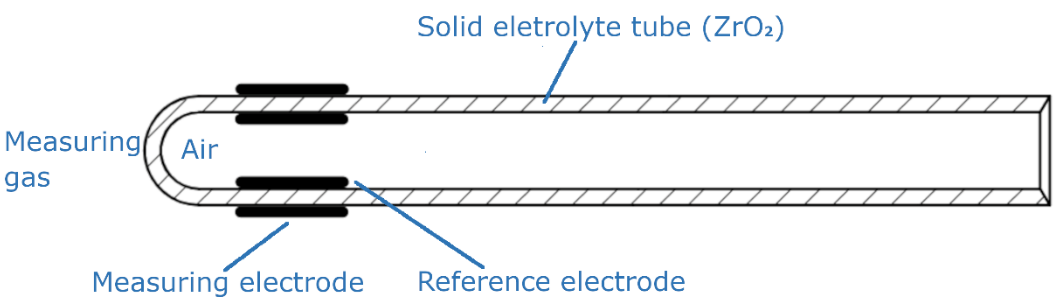


Figure 1: Construction of the solid electrolyte measuring cell

The measuring probe consists of a solid electrolyte tube made of zirconium dioxide (ZrO_2) with two electrodes made of platinum wire. The measuring electrode is located outside the tube. It is surrounded by the measuring gas. The electrode inside the tube serves as a reference electrode with a constant electrode potential. It is located in ambient air. The electrodes and the ceramic tube thus form a galvanic cell (solid electrolyte measuring cell). This arrangement corresponds to the mini probe SS27 and the vacuum probe XS22. In the mini probe MS27, the measuring and reference electrodes are reversed. The sample gas is located inside the tube.

To gain a higher oxide ion conductivity of the zirconium dioxide tube the sensor is heated up to 700 °C. This also avoids interfering reactions at the electrode with combustible components of the measuring gas due to chemical non-equilibrium. A thermocouple (not illustrated) at the probe delivers the actual sensor temperature T. A heater control ensures a constant temperature.

Based on the assumption that the total pressures of the gases are almost the same at both electrodes (in this case, the volume concentrations may be used in the calculation instead of the partial pressures) and replacing the parameters by numbers in equation (I), the following equation is valid:

$$\varphi_{O_2} = 20.64\ \text{vol.\%} \cdot e^{\left(-46.42\,\frac{\text{K}}{\text{mV}} \cdot \frac{U}{T}\right)} \qquad \text{(II)}$$

φ_{O_2} – Oxygen concentration in the sample gas in vol.%

U – Cell voltage in mV (Note the sign. Insert positive voltage for $\varphi_{O_2} < 20.64\ \text{vol.\%}$)

T – Measuring temperature in K

$20.64\ \text{vol.\%}$ – O_2-concentration in air with a relative humidity of 50 %

Presence of reducing gases

If reducing gas components are present in the gas mixture (e.g. hydrocarbons), this gas reacts with the oxygen at the measuring electrode (high temperatures). This is an equilibrium reaction.

The determination equation **(II)** applies in any case. If there is excess oxygen or reducing gas components are not present, the oxygen concentration of the free oxygen that has not reacted is calculated. If there is an excess of reducing gas components, the chemical equilibrium at the measuring electrode shifts. The concentration of the remaining "equilibrium oxygen" is calculated from equation **(II)**. The concentration of this equilibrium oxygen is determined by the law of mass action of the reaction and often assumes extremely small values.

4.2 Vacuum probes

Due to the specially adapted design of the XS22 for vacuum applications, this probe is not suitable for measuring oxygen concentrations in the percentage range and the relative measurement error under normal pressure is more than 20 %.

The probe must not be used in gases with high thermal conductivity (e.g. H_2, He, NH_3) at ambient pressure, as this would have an impermissible effect on the heating field. The protective tube as part of the probe is also required for the symmetrical structure of the heating field and serves to protect the sensor from parasitic coatings. Without a protective tube, the required sensor temperature cannot be achieved and the thermal asymmetry increases significantly.

When measuring the oxygen concentration in a vacuum, the total pressures at both electrodes are not the same (prerequisite for equation (II)). In this case, the total pressure in the vacuum chamber must be taken into account.

Substituting the known natural constants into equation (I) gives the following result:

$$p_{O_2,meas\ gas} = p_{O_2,\ air} \cdot e^{\left(-46.42\,\frac{\text{K}}{\text{mV}} \cdot \frac{U}{T}\right)} \qquad \text{(III)}$$

With an oxygen concentration of 0.2064 at 50 % relative humidity and the air pressure p_L follows:

$$p_{\mathrm{O}_2,meas\ gas} = 0.2064\ p_\mathrm{L} \cdot e^{\left(-46.42\,\frac{\mathrm{K}}{\mathrm{mV}} \cdot \frac{U}{T}\right)} \tag{IV}$$

In order to calculate the substance amount fraction of oxygen χ_{O_2} in the vacuum, i.e. the ratio of the number of oxygen molecules to the total number of gas particles in the vacuum chamber, the total pressure p in the vacuum chamber is required.

With $\chi_{O_2} = \frac{p_{O_2,meas\ gas}}{p}$ follows:

$$\chi_{O_2} = \frac{0.2064\ p_\mathrm{L}}{p} \cdot e^{\left(-46.42\,\frac{\mathrm{K}}{\mathrm{mV}} \cdot \frac{U}{T}\right)} \tag{V}$$

χ_{O_2} – Substance amount fraction of oxygen in the vacuum chamber

U – Cell voltage in mV (Note the sign. Insert positive voltage for $\chi_{\mathrm{O}_2} < 0.2064$)

T – Measuring temperature in K

0.2064 – Substance amount fraction of oxygen in air with a relative humidity of 50 %

p_L – Ambient air pressure

p – Total pressure in the vacuum chamber

Calibration Notes

In contrast to probes that are used under normal pressure, vacuum probes are not calibration-free. The reason for this is the heating used in this probe within the solid electrolyte tube and the energy dissipation of the heated sensor element, which depends on the pressure and heat conduction of the surrounding gas. As a result, the isothermics of the electrodes required for the validity of the Nernst equation cannot be realized (the reference gas electrode is significantly warmer than the measuring electrode). For process control, it is usually sufficient to assess the condition of the system using empirically determined sensor signals. Only the calibration in air under normal pressure (zero point calibration) is carried out at the factory.

When operating in a vacuum, the temperature differences between the electrodes mentioned above generally result in asymmetry voltages that are dependent on the respective system and difficult to calculate. They are added to the signal voltage corresponding to the Nernst equation. For increased accuracy requirements and detection of system-specific influences, the measuring system must be calibrated using pressure measuring devices on the system filled with a known gas (preferably pure oxygen or air).

The following diagram shows a calibration test.

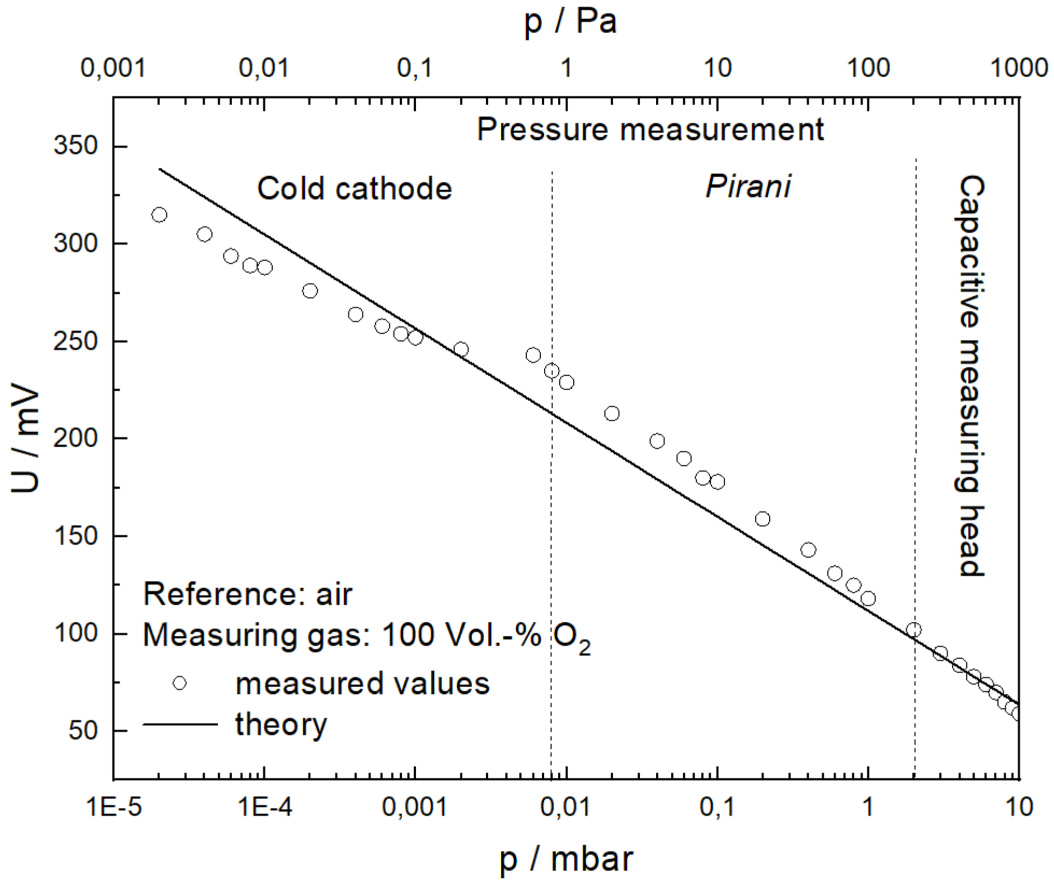


Figure 2: Calibration vacuum probe

The plotted line represents the cell voltage U that should theoretically be obtained for the oxygen pressure scale (abscissa) on the probe with air as the reference gas. The measured values represent the probe signal after evacuation in stages with different pumps via the pressure. This was measured in the upper pressure range with a capacitance probe, in the middle pressure range with the Pirani device and in the lower pressure range on a cold cathode. The jumps between the individual ranges show that the pressure measuring devices were not precisely matched to each other and themselves delivered erroneous results. However, it is clear that the probe behaved as expected over a range of 6 powers of ten. For pure oxygen, the range shown extends from approximately one hundredth of the normal pressure to 10 billionths of this pressure (corresponding to 10 vol.-ppb).

In practice, calibrations should be carried out with only one reliable pressure measuring device in the range that is important for the use of the probe.

5 Technical data

5.1 Mini probes SS27/MS27

Measuring range	**SS27:** 20,6 vol.-% ... 1 ppm O_2	**MS27:** 20,6 ... 0,1 vol.-% O2 or forming gas
Accuracy	< ($\pm$ 5 % rel., $\pm$ 0,5 vol.-ppm abs.)	
Set temperature	700 °C	
Gas temperature	300 °C max. gas temperature	600 °C special construction possible
Warm up	Ca. 5 min	Ready for operation after 60 min. (thermal equalization)
Heater voltage	24 V, PWM	Regulated by E2010
Power consumption	Ca. 30 W max.	Ca. 17 W steady state
Surrounding condi-tions	0…50 °C, 0…85 % rH	
Storage conditions	-10…50 °C, 0…85 % rH	
Gas pressure	± 500 mbar over- resp. underpres-sure	Measuring value is pressure dependent! (see section 4)
Diameter	10 mm	
Dimensions clamp head (BxHxT)	64 mm x 58 mm x 34 mm	
Weight	Approx. 500 g	
Protection degree	IP52	Optional: IP65
Installation length	65 mm (incl. M18x1,5) or 75 mm (DN40KF)	Others on request
Gas flow	max. 10 m/s	>10 m/s: immersion sleeve recommended
Reference gas	Air	Supply usually by diffusion
Cross sensitivity	None, but reducing gas components react with oxygen	see section 4
Calibration	Calibration-free procedure, zero point adjustment (asymmetry adjustment) by the user in ambient air	

5.2 Vacuum probe XS22

Measuring range	210 mbar … $1 \cdot 10^{-24}$ mbar O_2	
Set temperature	700 °C	
Gas temperature	200 °C max. gas temperature	Max. 60 °C at flange
Warm up	Ca. 5 min	Ready for operation after 60 min. (thermal equalization)
Heater voltage	24 V, PWM	Regulated by E2010
Power consumption	Ca. 30 W max.	Ca. 17 W steady state
Surrounding conditions	0…50 °C, 0…85 % rH	
Storage conditions	-10…50 °C, 0…85 % rH	
Gas pressure	$1{,}5$ bar … $1 \cdot 10^{-7}$ mbar	
Diameter	16 mm	
Dimensions clamp head (BxHxT)	64 mm x 58 mm x 34 mm	
Weight	Ca. 500 g	
Protection degree	IP52	Optional: IP65
Installation length	140 mm (DN40KF oder DN25KF)	Others on request
He leakage rate	$<10^{-8}$ mbar l/s	
Reference gas	Air	Supply usually by diffusion
Cross sensitivity	None, but reducing gas components react with oxygen	See section 4
Calibration	See section 4.2	

5.3 E2010

Power supply	24 VDC ± 10 %	
Power consumption	2 W + sensor heating power	
Fuse	2,5 A resetting	
Input signal	Sensor voltage (± 1500 mV), thermoelectric voltage TE type B (400 °C to 1500 °C)	Optional: TE type K (0 °C to 1000 °C)
Output signal	Analog output 4…20 mA (optional: 0…10 V), serial port RS232, limit value relay	Analog output: load max. 500 Ω, do not apply any (auxiliary) voltage!
Set temperature	Usually 700 °C	Depending on the connected sensor/probe type
Error signalization	Current output goes to 0 mA	
Display	Two-line LCD display, 2 x 16 digits	
Keypad	Membrane keypad witch 2 keys	
Dimensions (WxHxD)	96 mm x 96 mm x 126 mm	Panel cut-out: 91 mm x 91 mm
Weight	Approx. 650 g	
Protection degree	IP30 **(Front IP50)**	
Mounting	Panel mounting	
Ambient conditions during operation	0…40 °C, 0…95 % rH	
Storage conditions	0…50 °C, 0…95 % rH	

6 Dimensional drawings

6.1 Mini probes SS27/MS27

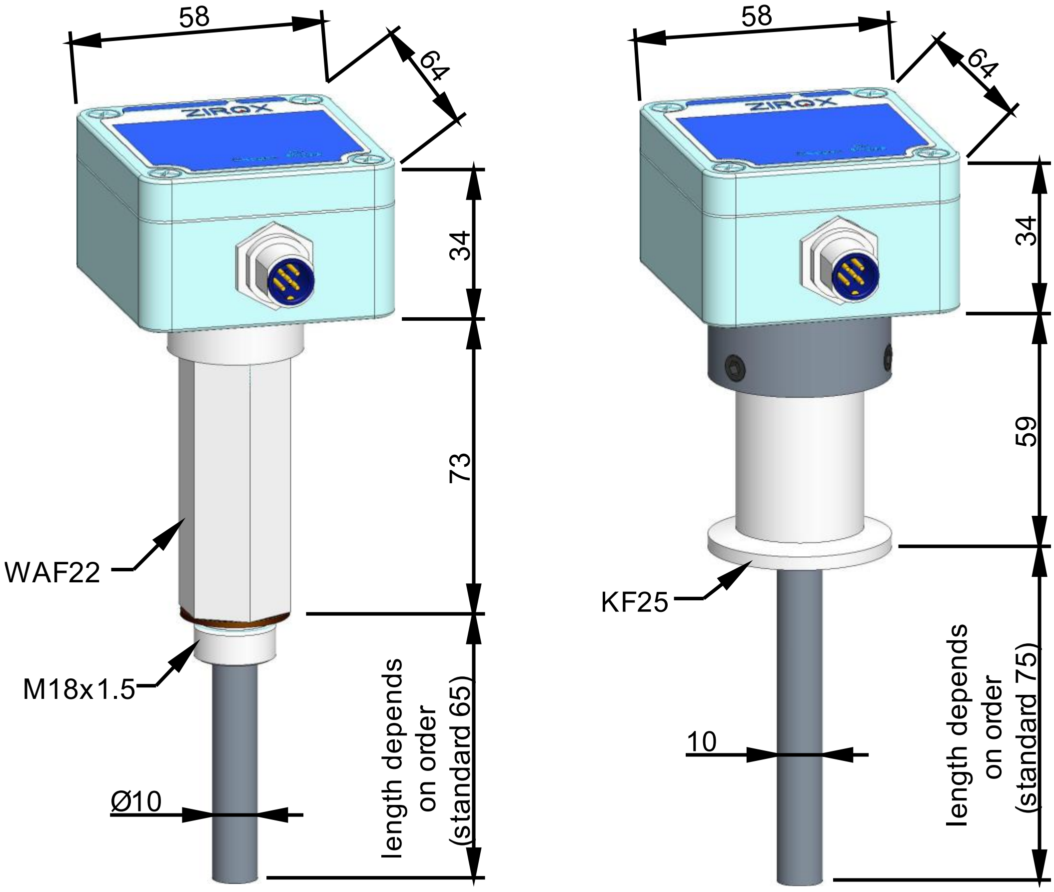


Figure 3: Dimensional drawings of probe with screw-in thread (left) and flange (right)

6.2 Vacuum probe

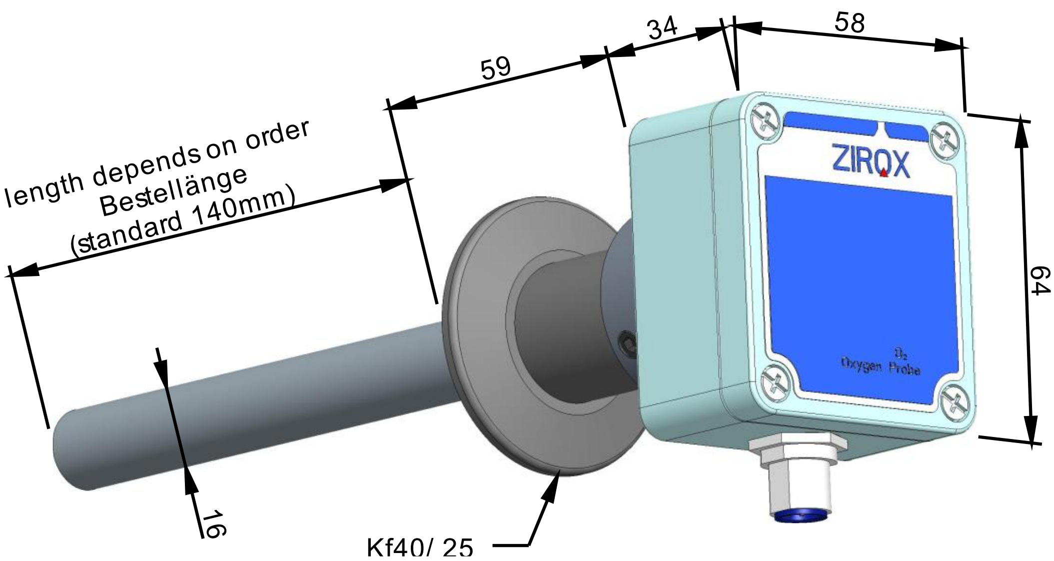


Figure 4: Dimensional drawing probe with flange

6.3 E2010

Figure 5: Dimensional drawing E2010

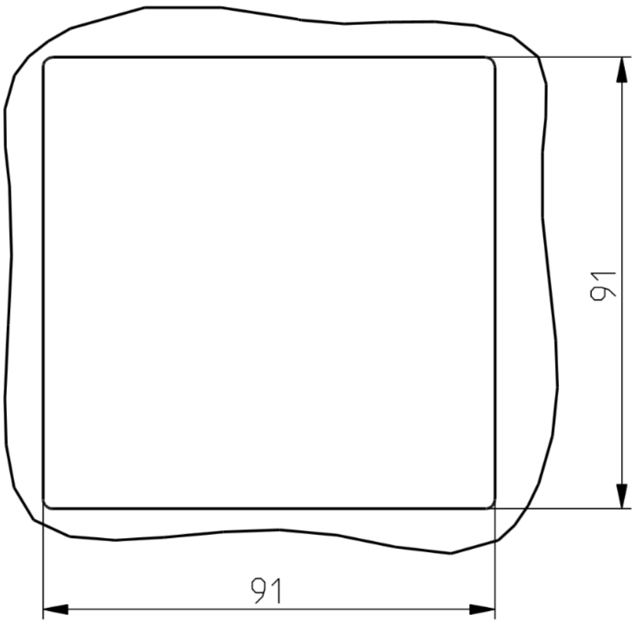
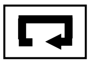


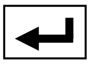
Figure 6: Dimensional drawing panel cut-out

7 Device structure and features E2010

7.1 Front side, keys

The display and the control keys are located at the front.

 Menu key: scroll or select the requested parameter

 ENTER key: activate or enter adjusted parameter (save change)

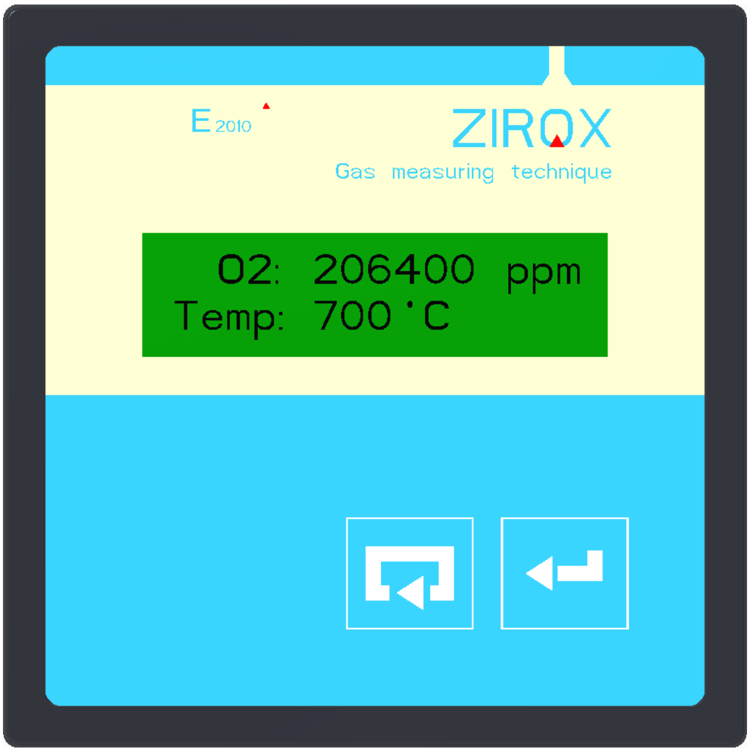


Figure 7: Front view E2010 with keys and display

7.2 Rear, connections

All connections are located on the rear.

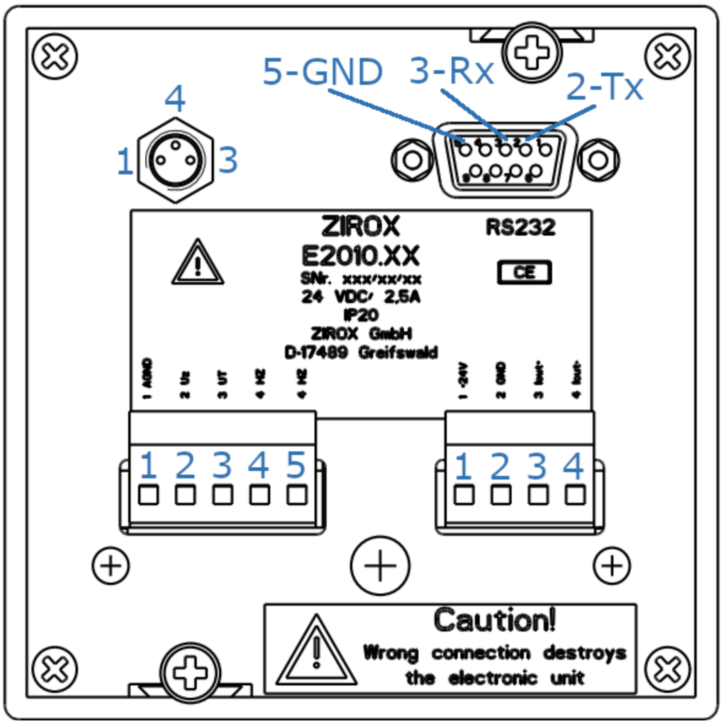


Figure 8: Rear view E2010 with connections

Connections sensor/probe (terminal strip left)

Pin	Description	Cable	Kabel (optional)
1	Sensor ground (Uz-, Ut-)	br	br
2	Sensor voltage Uz+	wt	wt
3	Thermoelectric voltage Ut+	blu	gn
4	Heating Hz+	bla	ye
5	Heating Hz-	gr	gr

Connections power supply/analog output (terminal strip right)

Pin	Description
1	Power supply +24V DC
2	GND
3	Analog output Iout+/Uout+
4	Analog output Iout-/Uout-

Counterpart (socket) for 5-pin plug:
Socket header 5pol. (Weco), order No.: 10.808.105

Counterpart (socket) for 4-pin plug:
Socket header 4pol. (Weco), order No.: 10.808.104

Counterpart (socket with cable) for 3-pin plug:
Sensor-actuator cable (Lumberg Automation), order No.: RKMV 3-06/2 M

7.3 Analog output

The signals from the probe/sensor is issued via an analog output (4...20mA, isolated). The pin assignment can be found in Figure 8 (section 7.2). Configuration is carried out via the menu “settings” (see sec. 8.4). The load applied to the analog output must not exceed 500 Ω.

No voltage may be applied to the analog output! This may lead to the destruction of the device!

7.4 Limit value relay

The E2010 has a limit value relay with changeover contacts that signals when a set limit value is exceeded or not reached. It is configured in the “Settings” menu (see section 8.4). There you can set whether the relay is activated when the limit value is exceeded or undershot. The limit value itself can also be freely selected.

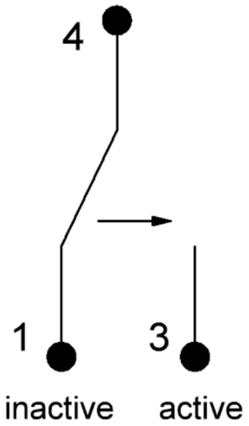


Figure 9: Assignment relay

The relay contacts are accessible via a three-pin connector on the rear of the device (top left, see Figure 2). The pin assignment can be seen in Figure 3. Pin 1 forms the normally closed contact, pin 4 the center contact and pin 3 the normally open contact. When the relay is inactive, pins 4 and 1 are connected to each other. When the relay is active, pins 4 and 3 are connected to each other. The relay is activated when the value exceeds/falls below the selected limit value (connection between pin 4 and pin 1 is disconnected, pin 4 and pin 3 are contacted).

The following relay is installed in the device:

Omron Electronics G5V-1

Load	Resistive load ($\cos\varphi = 1$)
Max. Switching voltage	125 VAC, 60 VDC
Max. Switching current	1A
Max. Switching power	62.5 VA, 30 W
Min. load	1 mA at 5 VDC

7.5 Digital interface

The device has a digital interface (RS232). The measured values can be issued via this. The pin assignment can be seen in Figure 8.

Pin-nr.	Description
2	TxD
3	RxD
5	GND

NOTE

The RS232 interface must be connected to a computer via SUB-D connection cable (9-pin, 1:1, not crossed).

Transmission rate: 9600 Baud

Stop bits	1	Parity	None
Data bits	8	Handshake	Without

Protocol of the digital interface (CR = carriage return):

Set	Feedback signal/ example	Transferred measuring value	Parameter
M2CR	M2x.xxExxCR M22.06E+05	$2.06*10^5$ ppm O_2	Oxygen concentration in ppm
A1CR	A1xxx.xCR A120.9	20.9 mV	Cell voltage in mV
A2CR	A2xxx.xCR A2749.9	749.9 °C	Measuring temperature in °C

Error messages:

ERROR0	Transfer error RS232 (or incorrect command)
ERROR1	Warm-up (cell temperature too low and shorter than 30 min)
ERROR2	Cell temperature too low (< set temp. – 10 °C, longer than 30 min)
ERROR3	Thermocouple broken
ERROR6	System error

8 Initiation and operation

8.1 Mounting the probes

The probe is mounted using an M18x1.5 screw-in thread or DN25KF/DN40KF flange (depending on the version ordered, others on request). Ensure good sealing in the area of the installation point. Otherwise, with pressure in the system, false air can penetrate along the probe and falsify the measurement signals.

NOTE

If the installation depth is too shallow, the sensor element of the probe may be located in false gas streaks, which can occur in peripheral areas of the system and thus provide incorrect measurements.

In gases with a high dust load or high flow velocities, it may be advisable to install the probe in a protective tube (immersion sleeve, available from the manufacturer) This is mandatory for vacuum probes (see section 4.2). In the case of chemical exposure, fitting a ceramic filter (details on request) can increase the service life of the probe.

NOTE

If the flow is too strong, the heating control may fail. The probe must also be protected against dust and condensation.

8.2 Initiation

The clamps on the rear must be connected with the corresponding sensor clamps (see section 7.2). The power supply is 24 V DC.

Depending on the connected probe/sensor, the E2010 needs a certain period of time until the operating state is reached (for further information see technical data of the sensor). Because of thermal balancing effects, the sensor needs approx. 60 minutes until the ultimate operating state with the specified error limits after reaching the operating temperature.

NOTE

The keys are locked until reaching the operating state!

DANGER

The connected probe (or sensor) can be very hot during operation of the system and for a long time after it has been switched off. There is a high risk of burns if you touch it!

Reference air supply for ZIROX® probes (optional):

The Reference air input of the sensor and the reference air output of the E2010 must be connected by a flexible hose (inner diameter 3 mm). The reference airflow is preset by the manufacturer.

ATTENTION

After starting the system (E2010 with connected sensor), the reference airflow must be checked by an inserted flow meter (5 - 10 l/h resp. approx. 100 - 200ml/min).

8.3 Operation of the main menu

The function of the operating buttons is described in section 7.

The heating phase begins after the device is switched on. From 400°C, the temperature currently reached is displayed. When the probe or sensor reaches the intended operating temperature, the main menu appears. The measured value is displayed in the first line. By pressing the key various values/options can be displayed in the second line. The confirmation is made with the key.

The various possible displays are shown below:

E2010	Start display, approx.3sec
Version 2.4.6	Software version
E2010	Start display, approx.3sec
THERMOCO. TYP B	Thermocouple type
WARM-UP	Warm-up
Temp: 450 °C	
O2: 20.64 Vol%	Main menu
Temp: 700 °C	Display second line selectable via
O2: 20.64 Vol%	
Vz: -2 mV	
O2: 20.64 Vol%	
SETTINGS	
O2: 20.64 Vol%	
CALIB.ZERO POINT	
O2: 20.64 Vol%	
CALIB. SPAN GAS	

8.4 Adjustable parameters

The following parameters are adjustable in the menu SETTINGS:

OUTPUT VALUE **Vol ppm O2**	Valid for display **and** analog output! Vol ppm O2, mbar O2, atm O2, Uz [mV]
OUTPUT VALUE **log[10]**	Scaling current output linear or log (for Uz linear only)
OUTPUT 4 - 20 mA **ZERO: 400 ppm**	Current output zero point Zero point 400 ppm corresponds to 4 mA
OUTPUT 4 – 20 mA **SPAN: 206400 ppm**	Current output terminal value Terminal value 206400 ppm corresponds to 20 mA
LIMIT **< 400 ppm**	Configuration limit value relay Set „<“ or „>“ and limit value
RETURN ? **NO YES**	"Yes" exits the menu
SAVE VALUES ? **NO YES**	Save set values

8.5 Zero point adjustment

A zero point adjustment must be carried out at regular intervals in clean air. This serves to equalize the offset voltage of the ZrO_2 sensor. The offset voltage is caused by the design (non-ideal position of the electrodes in the heating field) and can also occur due to ageing of the sensor.

The zero point adjustment is used to calibrate the operating point in ambient air at 20.64 v.% O2 and thus compensate for the offset voltage. Before the adjustment, the sensor is operated in ambient air for this purpose. The size of the gas flow (if present) must be set to the value at which the sample gas is also measured, as the size of the flow also has an influence on the offset voltage.

How to carry out the zero point adjustment in the E2010 menu is described in section 8.9.

8.6 Span gas calibration

In addition, a range gas calibration can be performed. In this case, the probe is connected to a gas with a defined oxygen concentration. The size of the gas flow (if present) must be set to the value at which the sample gas is measured. The E2010 is now calibrated to the defined oxygen concentration. A correction factor is determined internally, which is then used to correct the calculated oxygen concentration.

The range calibration procedure in the E2010 menu is described in section 8.9.

8.7 Reset of the calibration

The zero point adjustment and the range calibration can be reset. If both buttons are pressed for 3 seconds in the main menu when **CALIB.ZERO POINT** or **CALIB. SPAN GAS** displays, the **RESET CAL.ZERO?** or **RESET CAL.SPAN?** display appears. If the button ↵ is now pressed, the values are set to 0 (zero point) or 1 (span gas calibration).

8.8 Error massages calibration

```
CALIBR. FAILED
 OUT OF RANGE     //limits: ±50 mV resp. ±50 % of Vz
```

```
CALIBR. FAILED
 * TIMEOUT *      //no steady measuring value in 20 sec.
```

8.9 Menu navigation calibration

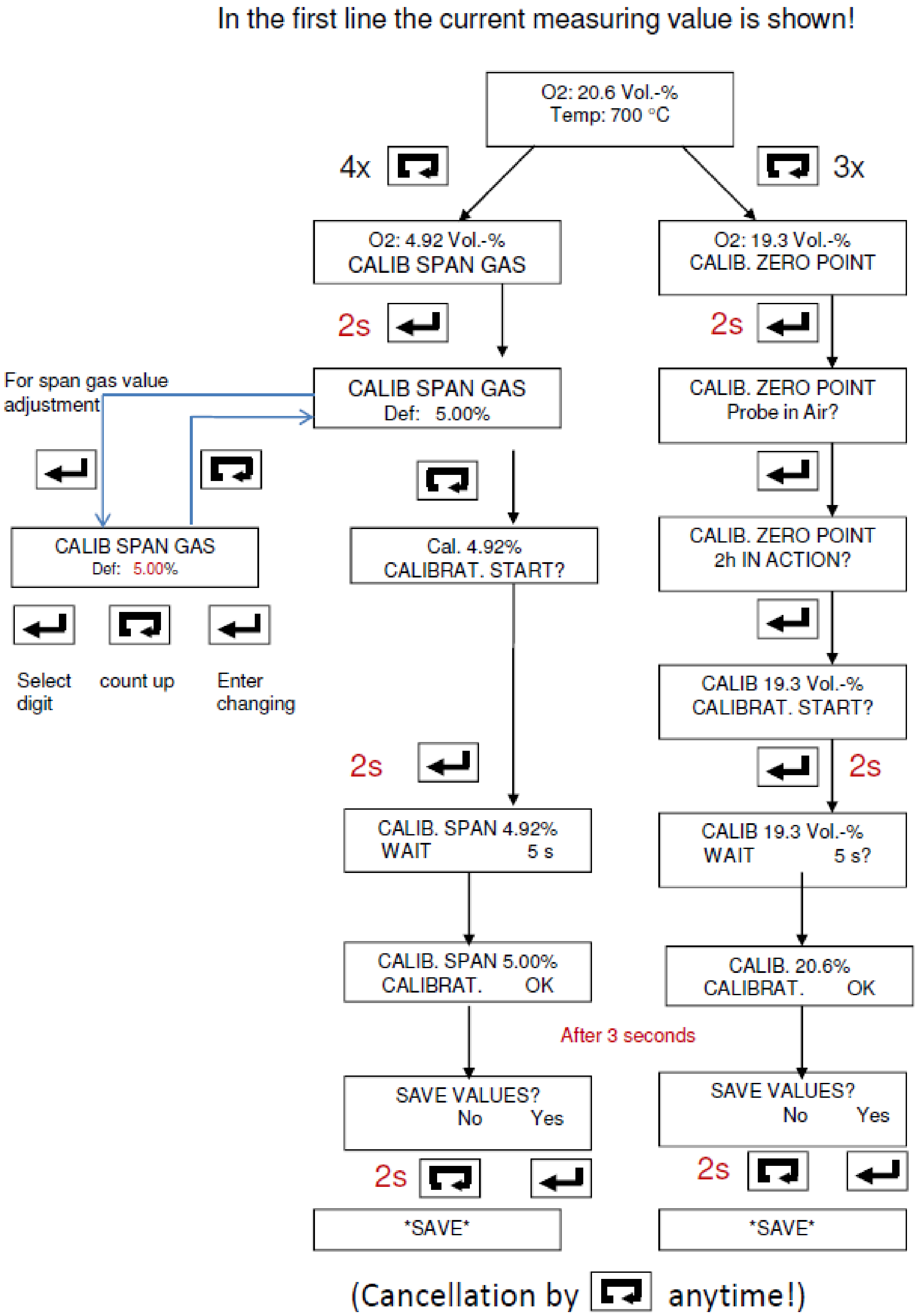


Figure 10: Chart zero point and span gas calibration

9 Fault clearance and maintenance

9.1 Typical faults

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Fault	Cause	Clearance
Display is off	No power supply or no sufficient operating voltage	Check power supply
	Device fuse tripped	Wait for self-resetting If repeatedly tripping, contact service
Set temperature of the probe has not been reached	Probe has not yet reached operating temperature when switched on	Wait 5 minutes
	Heating or control defective	Inform customer service
	Thermocouple defective	Inform customer service
	Sample gas too cold, excessive heat dissipation	Protect the probe from cooling down
No serial communication possible	No communication between PC and module	Check COM-port Use another cable Check connections
	Wrong COM-port	
	Serial cable defective	
	Cable incorrectly plugged	
	Wrong serial cable	
	Serial interface defective	Inform customer service
Measuring value is significantly higher than expected	Leaks in the gas supply	Check gas connections
	Probe broken (e.g. too much gas or penetration of condensate)	Inform customer service
Measuring value is significantly lower than expected	Components reacting with oxygen in measuring gas (e.g. hydrogen, hydrocarbons)	-

9.2 Fault messages

During operation, the probe is permanently monitored and typical errors identified.

The following error messages can appear:

LOW PROBE TEMP. **TEMP: 688 °C**	*Probe temperature too low* < Tsoll (e.g. 700 °C) - 10°C
+++ ERROR +++ **THERMOCOUPLE**	Probe not connected or Broken thermocouple
+++ ERROR +++ **COLD JUNCTION**	*Cold junction thermocouple defective* *(only type K)*

9.3 Maintenance

The device/measuring system can be sent in for maintenance. Please contact the manufacturer for this purpose:

ZIROX Sensoren und Elektronik GmbH
Am Koppelberg 21
17489 Greifswald
Germany

Order Processing
Phone: +49 38 34 830916
E-Mail: orders@zirox.de
www.zirox.de

10 Warranty conditions

ZIROX Sensoren und Elektronik GmbH warrants that the products manufactured and sold are free from manufacturing and material defects at the time of dispatch. In case of defects and faults within 12 months (measuring cell/probe) and 24 months (electronics assembly) respectively after dispatch, ZIROX will clear faults at its own option by repair or replacement. The purchaser must give prompt written notice to ZIROX. The purchaser is not entitled to claim other legal remedies based on this warranty.

ZIROX does not warrant supplied products, which are subject to normal wear and tear (e.g. reference gas pump).

Corrosive gases and solid particles may cause damage and require repair or replacement due to normal wear and tear.

The contact of the products with explosive gas compounds, halogens in high concentrations and sulphuric gases (e.g. SO_2) is not permitted.

The contact of the products with siliconic or phosphoric compounds is not permitted either.

A connection of ZIROX and non-ZIROX products voids any warranty claims.

Warranty and warranty claims are only accepted if they are in accordance with the "General Sales and Delivery Conditions" of the manufacturer.

Warranty and liability claims for damage to persons and/or property are void if they are subject to the following:

- Normal wear and tear
- Improper use of the product
- Disregard of the manual's instructions
- Improper installation, initiation, operation and maintenance of the product
- Operation of the product without protective measures
- Unauthorized functional and technical modification of the product
- Dismantling of parts as well as installation of spare parts or additional units, which are not delivered or permitted by the manufacturer
- Improper repairs or faulty operation
- External impact
- Acts of God

ATTENTION

When installing the equipment, the customer must ensure that all necessary supply lines are connected and the operating temperature of the probe is reached. Experience has shown that products installed but not in use may be damaged by the process or by external influence. ZIROX will not accept any responsibility for such damage.

11 Declaration of conformity

EG - Konformitätserklärung

Dokument- Nr.: **27** **Dezember 2010**

Hersteller: **Zirox Sensoren & Elektronik GmbH**

Anschrift: **Am Koppelberg 21**
D - 17489 Greifswald

Produktbezeichnung: E2010

Die Übereinstimmung des bezeichneten Produktes mit den Vorschriften der Richtlinien des Rates

2006/108/EG Elektromagnetische Verträglichkeit

wird nachgewiesen durch:

Der Hersteller hat die in den oben aufgeführten Richtlinien genannten harmonisierten Normen angewandt und die Übereinstimmung des Produktes festgestellt.

harmonisierte europäische Normen:

Nummer:	Text:
DIN EN 61000-6-2	Elektromagnetische Verträglichkeit (EMV) Teil 6-2: Fachgrundnorm: Störfestigkeit für Industriebereich
DIN EN 61326	leitungsgeführte Störaussendung Gestrahlte Störaussendung

Diese Erklärung bescheinigt die Übereinstimmung mit der genannten Richtlinie, beinhaltet jedoch keine Zusicherung von Eigenschaften. Die Sicherheitshinweise der mitgelieferten Produktdokumentation sind zu beachten.

Aussteller: **Zirox Sensoren & Elektronik GmbH**

Ort, Datum: Greifswald 3.12.2010

ZIROX
Sensoren & Elektronik GmbH
Am Koppelberg 21
17489 Greifswald

Rechtsverbindliche Unterschrift: D. Uhfeld