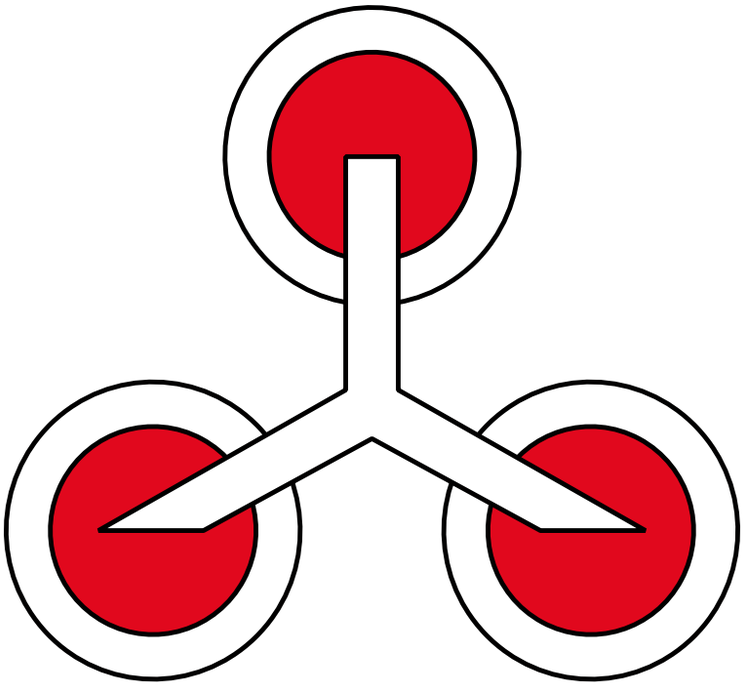
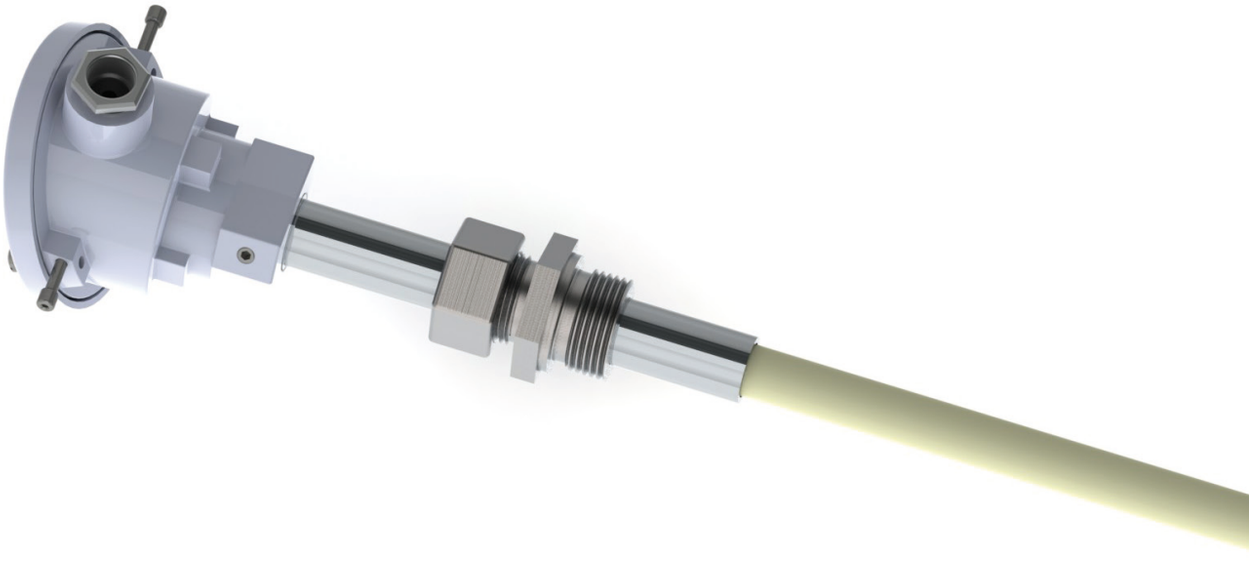
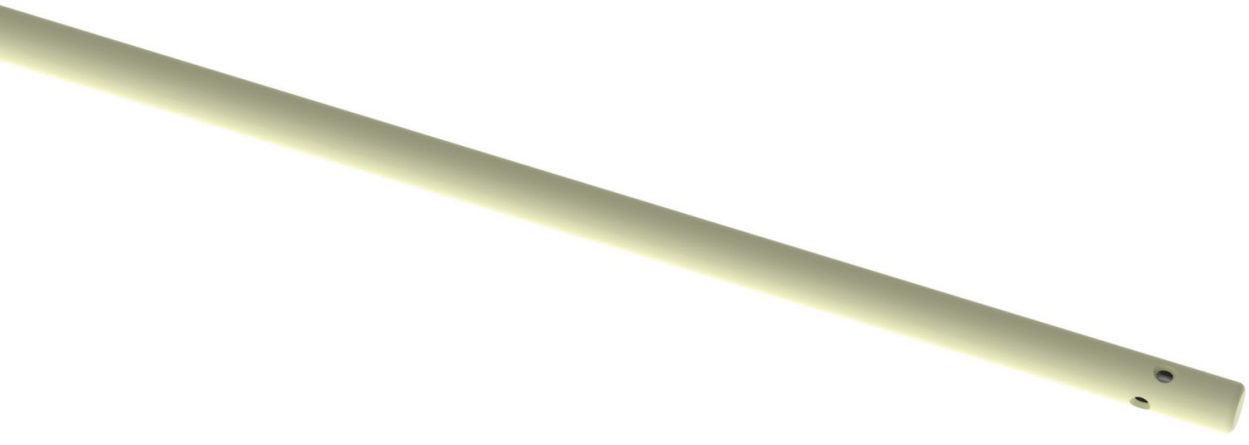


Product catalog

Combined Oxygen sensors

thermo-control Körtvélyessy GmbH • Grünspechtweg 19 • D-13469 Berlin

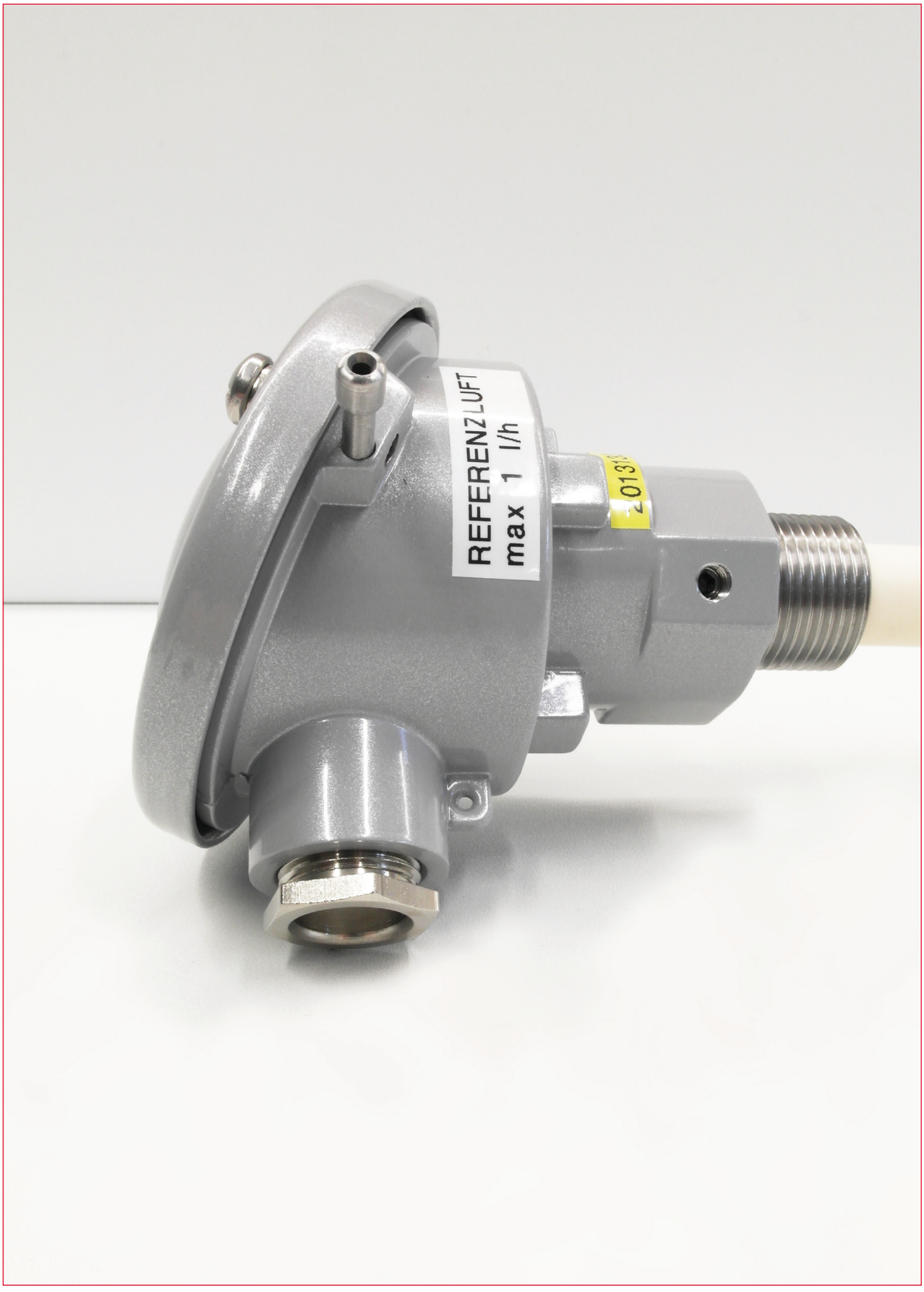




Product image

Oxygen probe for inert-gas atmosphere with Ø 22 x 150 tube and G1“ compression fitting

Content


REFERENZLUFT
max 1 l/h

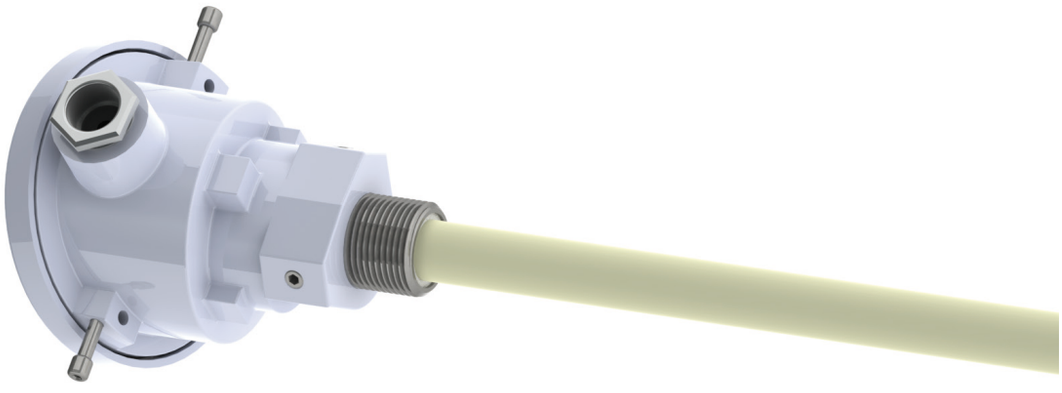
Oxygen probe for inter-gas applications

Overview

Pressure range	Gas tight and pressure proof up to 2 bar
Temperature range	500°C - 1300°C
Built-in thermocouple	Combined sensor type S
Diameter outer protection tube	Ø 17 mm
Material outer protection tube	High density Al_2O_3 99,7%
Diameter solid state electrolyte tube	Ø 6 mm
Material solid state electrolyte tube	Fully stabilized zirconium dioxide (FSZ)
Material gas electrode	Pt pure
Material reference electrode	Pt pure
Wires used for connection of electrodes	Pt pure
Fitting purge air supply	Plug Ø 6 mm max. 200 L/h
Fitting reference air supply	Plug Ø 6 mm max. 10 L/h
Electrical connection	Ceramic terminals max 1,5 mm²
Output voltage range	-2V ... +2V
Inner resistance	< 20kΩ
Connection head	Form A with M20x1,5 cable gland max 250°C
Certificates	*Thermocouple:* Report of calibration based on Ag and Pd fix-point measurements Optional: Certification in accordance to AMS 2750 *Oxygen sensor:* Report of function test including inner resistance, leak rate of solid state electrolyte tube and mV in N_2 6.0 and N_2H_2(5%) at 920°C

Process connection with thread

Process connection with thread



Standard configuration is a G3/4 DIN 228 thread with a length of 20 mm. Other threads such as G1“ or NPT are available upon request.

Product specification keys:

9	-	*01XXZZ*	-	*LLLLA*
		01 - Inert-gas design XX - Built-in thermocouple 00 - none 01 - with ZZ - Thermocouple alloy pairs 00 - none 01 - PtRh10% - Pt (Type S) 02 - PtRh13% - Pt (Type R)		LLLL - Nominal length [mm] 0400 - 400 mm to 1000 - 1000 mm in 100 mm steps A - Fitting G34 - G3/4“ Thread G1 - G1“ Thread G1SW28 - G1“ Thread with HEX28 neck

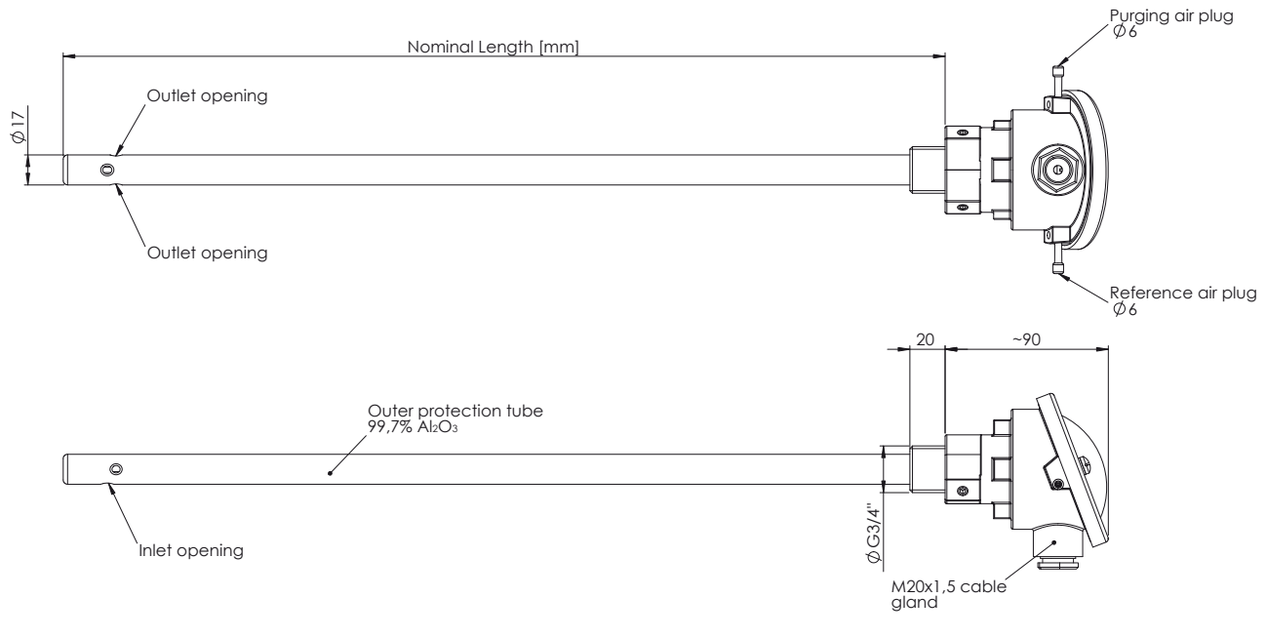
Example: 9-010101-0500G34

Oxygen probe for inert-gas application, as a combined sensor with built-in type S thermocouple, a nominal length of 500 mm and a G3/4“ thread.

Please let us know if you need a specific design or configuration. We will be pleased to design your custom-made oxygen probe.

Process connection with thread

Inert-gas oxygen with G3/4 thread



As combined sensor with a built-in thermocouple type S (PtRh10% - Pt)

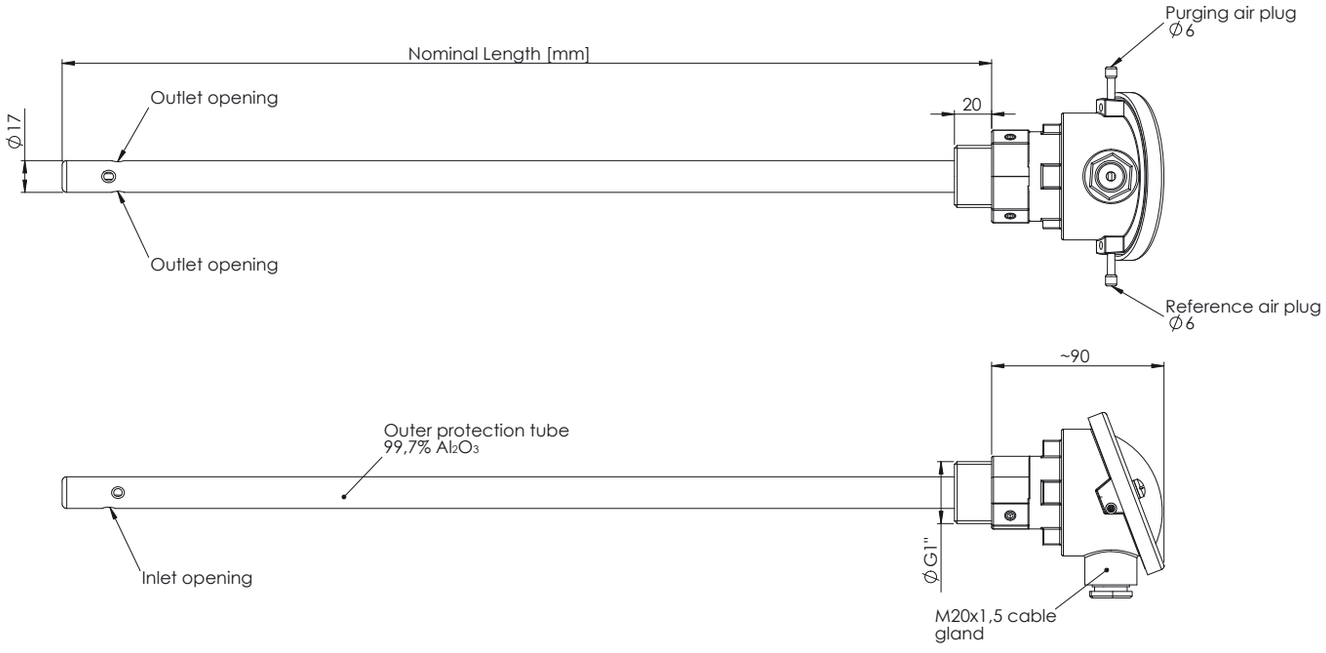
Material-No	*Description*	*Specification*
520461	*Inert-gas oxygen probe 500 mm, 1 x type S with G3/4 thread*	*9-010101-0500G34*
509913	*Inert-gas oxygen probe 600 mm, 1 x type S with G3/4 thread*	*9-010101-0600G34*
509914	*Inert-gas oxygen probe 700 mm, 1 x type S with G3/4 thread*	*9-010101-0700G34*
509915	*Inert-gas oxygen probe 800 mm, 1 x type S with G3/4 thread*	*9-010101-0800G34*
520631	*Inert-gas oxygen probe 900 mm, 1 x type S with G3/4 thread*	*9-010101-0900G34*
509916	*Inert-gas oxygen probe 1000 mm, 1 x type S with G3/4 thread*	*9-010101-1000G34*

Without thermocouple

Material-No	*Description*	*Specification*
92000184	*Inert-gas oxygen probe 500 mm with G3/4 thread*	*9-010000-0500G34*
92000946	*Inert-gas oxygen probe 600 mm with G3/4 thread*	*9-010000-0600G34*
92000947	*Inert-gas oxygen probe 700 mm with G3/4 thread*	*9-010000-0700G34*
92000948	*Inert-gas oxygen probe 800 mm with G3/4 thread*	*9-010000-0800G34*
92000949	*Inert-gas oxygen probe 900 mm with G3/4 thread*	*9-010000-0900G34*
92000950	*Inert-gas oxygen probe 1000 mm with G3/4 thread*	*9-010000-1000G34*

Process connection with thread

Inert-gas oxygen probe with G1 inch thread



As combined sensor with a built-in thermocouple type S (PtRh10% - Pt)

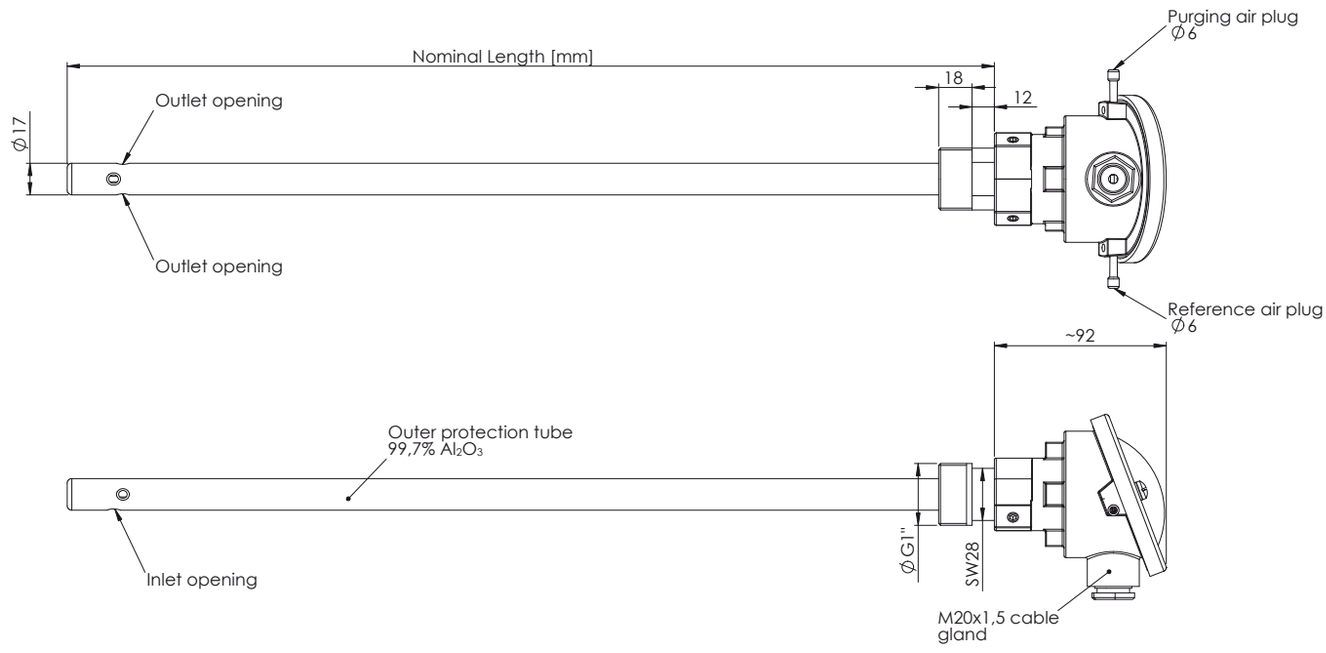
Material-No	*Description*	*Specification*
520861	*Inert-gas oxygen probe 500 mm, 1 x type S with G1 thread*	*9-010101-0500G1*
92000955	*Inert-gas oxygen probe 600 mm, 1 x type S with G1 thread*	*9-010101-0600G1*
92000956	*Inert-gas oxygen probe 700 mm, 1 x type S with G1 thread*	*9-010101-0700G1*
92000957	*Inert-gas oxygen probe 800 mm, 1 x type S with G1 thread*	*9-010101-0800G1*
92000958	*Inert-gas oxygen probe 900 mm, 1 x type S with G1 thread*	*9-010101-0900G1*
92000959	*Inert-gas oxygen probe 1000 mm, 1 x type S with G1 thread*	*9-010101-1000G1*

Without thermocouple

Material-No	*Description*	*Specification*
521030	*Inert-gas oxygen probe 500 mm, with G1 thread*	*9-010000-0500G1*
521031	*Inert-gas oxygen probe 600 mm with G1 thread*	*9-010000-0600G1*
512581	*Inert-gas oxygen probe 700 mm with G1 thread*	*9-010000-0700G1*
92000952	*Inert-gas oxygen probe 800 mm with G1 thread*	*9-010000-0800G1*
92000953	*Inert-gas oxygen probe 900 mm with G1 thread*	*9-010000-0900G1*
92000954	*Inert-gas oxygen probe 1000 mm with G1 thread*	*9-010000-1000G1*

Process connection with thread

Inert-gas oxygen probe with G1 inch Thread and HEX28 neck



As combined sensor with a built-in thermocouple type S (PtRh10% - Pt)

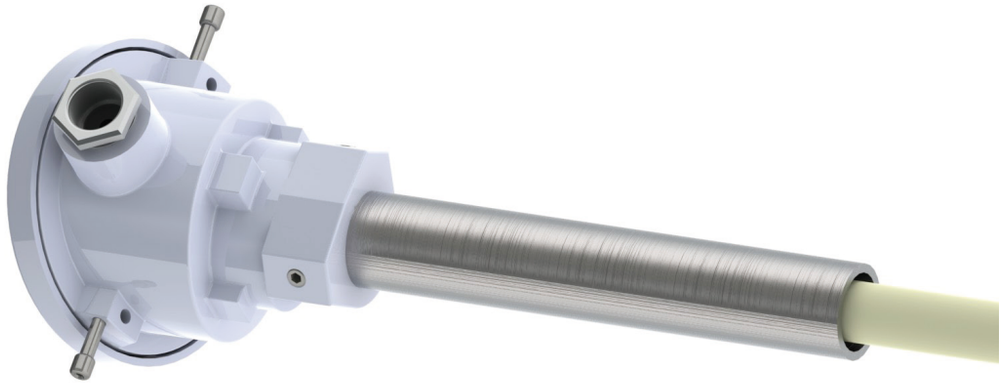
Material-No	*Description*	*Specification*
92000960	*Inert-gas oxygen probe 500 mm, 1 x type S with G1 thread and HEX28 neck*	*9-010101-0500G1SW28*
92000138	*Inert-gas oxygen probe 600 mm, 1 x type S with G1 thread and HEX28 neck*	*9-010101-0600G1SW28*
92000961	*Inert-gas oxygen probe 700 mm, 1 x type S with G1 thread and HEX28 neck*	*9-010101-0700G1SW28*
92000962	*Inert-gas oxygen probe 800 mm, 1 x type S with G1 thread and HEX28 neck*	*9-010101-0800G1SW28*
92000973	*Inert-gas oxygen probe 900 mm, 1 x type S with G1 thread and HEX28 neck*	*9-010101-0900G1SW28*
92000974	*Inert-gas oxygen probe 1000 mm, 1 x type S with G1 thread and HEX28 neck*	*9-010101-1000G1SW28*

Without thermocouple

Material-No	*Description*	*Specification*
92000975	*Inert-gas oxygen probe 500 mm with G1 thread and HEX28 neck*	*9-010000-0500G1SW28*
92000976	*Inert-gas oxygen probe 600 mm with G1 thread and HEX28 neck*	*9-010000-0600G1SW28*
512581	*Inert-gas oxygen probe 700 mm with G1 thread and HEX28 neck*	*9-010000-0700G1SW28*
512581	*Inert-gas oxygen probe 800 mm with G1 thread and HEX28 neck*	*9-010000-0800G1SW28*
512581	*Inert-gas oxygen probe 900 mm with G1 thread and HEX28 neck*	*9-010000-0900G1SW28*
92000086	*Inert-gas oxygen probe 1000 mm with G1 thread and HEX28 neck*	*9-010000-1000G1SW28*

Process connection with tubes

Process connection with tubes



The standard design is a stainless-steel tube (W1.4305) Ø22 mm x 150 mm length. Other designs with different tube dimensions such as Ø 1“ inch x 150 mm or Ø27 mm x 150 mm are also available.

Product specification keys:

9	-	*01XXZZ*	-	*LLLLA*
		01 - Inert-gas design XX - Built-in thermocouple 00 - none 01 - with ZZ - Thermocouple alloy pairs 00 - none 01 - PtRh10% - Pt (Type S) 02 - PtRh13% - Pt (Type R)		LLLL - Nominal length [mm] 0400 - 400 mm to 1000 - 1000 mm in 100 mm steps A - Fitting SR22 - Ø22 mm x 150 mm SG1Z - Ø 1“ inch x 150 mm SR27 - Ø27 mm x 150 mm

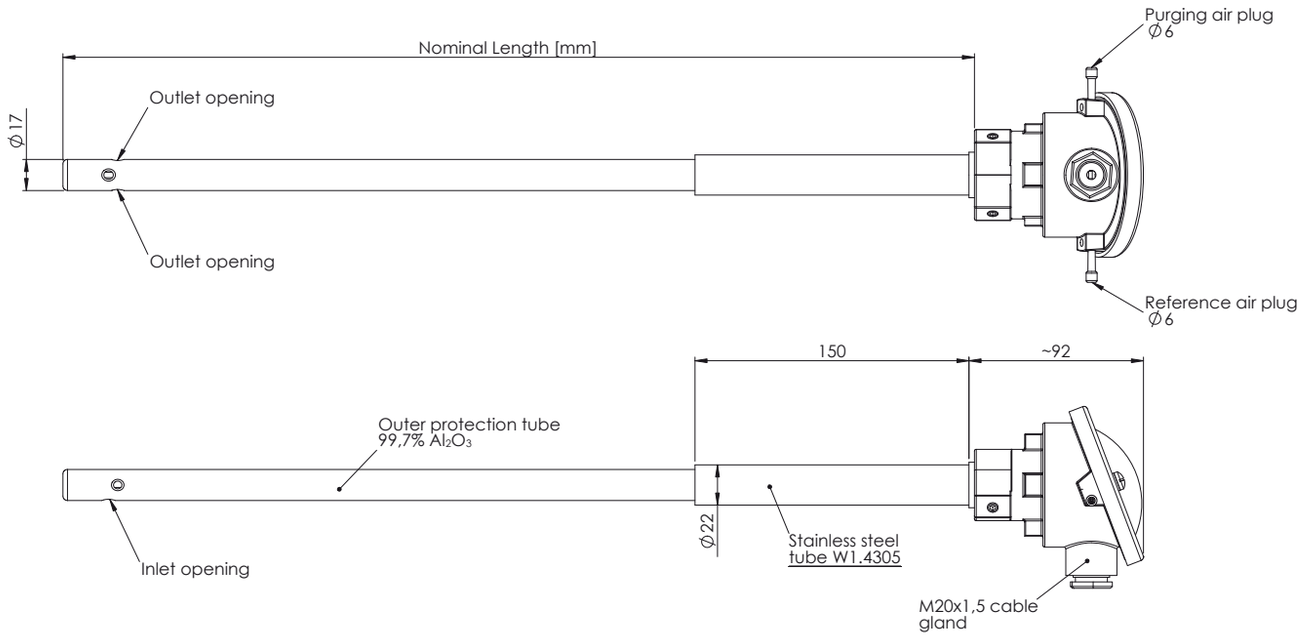
Example: 9-010101-0700SR22

Oxygen probe for inert-gas application, as a combined sensor with built-in type S thermocouple, a nominal length of 700 mm and a Ø22 mm x 150 mm tube.

Please let us know if you need a specific design or configuration. We will be happy to design your custom-made oxygen probe.

Process connection with tubes

Inert-gas oxygen probe with Ø22 x 150 stainless steel tube



As combined sensor with a built-in thermocouple type S (PtRh10% - Pt)

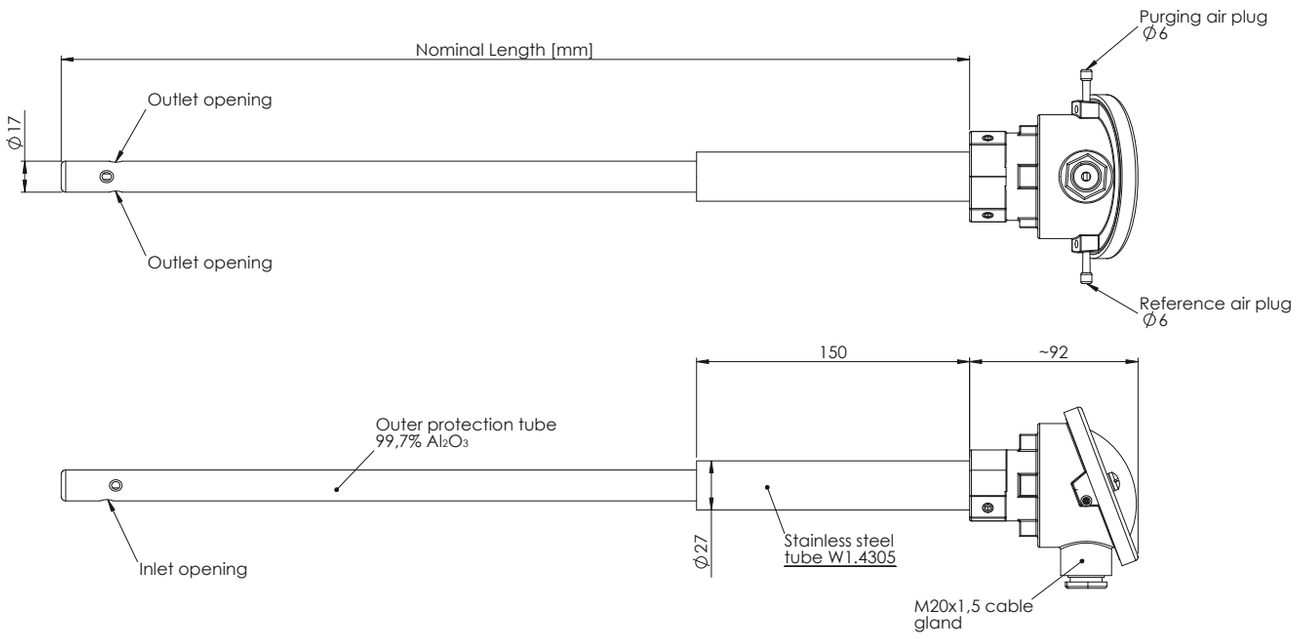
Material-No	*Description*	*Specification*
92000819	*Inert-gas oxygen probe 500 mm, 1 x type S with 22 x 150 stainless steel tube*	*9-010101-0500SR22*
520990	*Inert-gas oxygen probe 600 mm, 1 x type S with 22 x 150 stainless steel tube*	*9-010101-0600SR22*
92000994	*Inert-gas oxygen probe 700 mm, 1 x type S with 22 x 150 stainless steel tube*	*9-010101-0700SR22*
92000995	*Inert-gas oxygen probe 800 mm, 1 x type S with 22 x 150 stainless steel tube*	*9-010101-0800SR22*
92000996	*Inert-gas oxygen probe 900 mm, 1 x type S with 22 x 150 stainless steel tube*	*9-010101-0900SR22*
92000997	*Inert-gas oxygen probe 1000 mm, 1 x type S with 22 x 150 stainless steel tube*	*9-010101-1000SR22*

Oxygen probe without thermocouple

Material-No	*Description*	*Specification*
92000998	*Inert-gas oxygen probe 500 mm with 22 x 150 stainless steel tube*	*9-010000-0500SR22*
92000999	*Inert-gas oxygen probe 600 mm with 22 x 150 stainless steel tube*	*9-010000-0600SR22*
92001000	*Inert-gas oxygen probe 700 mm with 22 x 150 stainless steel tube*	*9-010000-0700SR22*
92001001	*Inert-gas oxygen probe 800 mm with 22 x 150 stainless steel tube*	*9-010000-0800SR22*
92001002	*Inert-gas oxygen probe 900 mm with 22 x 150 stainless steel tube*	*9-010000-0900SR22*
92001003	*Inert-gas oxygen probe 1000 mm with 22 x 150 stainless steel tube*	*9-010000-1000SR22*

Process connection with tubes

Inert-gas oxygen probe with Ø27 x 150 stainless steel tube



As combined sensor with a built-in thermocouple type S (PtRh10% - Pt)

Material-No	*Description*	*Specification*
92000157	*Inert-gas oxygen probe 500 mm, 1 x type S with 27 x 150 stainless steel tube*	*9-010101-0500SR27*
92001004	*Inert-gas oxygen probe 600 mm, 1 x type S with 27 x 150 stainless steel tube*	*9-010101-0600SR27*
92001005	*Inert-gas oxygen probe 700 mm, 1 x type S with 27 x 150 stainless steel tube*	*9-010101-0700SR27*
92001006	*Inert-gas oxygen probe 800 mm, 1 x type S with 27 x 150 stainless steel tube*	*9-010101-0800SR27*
92001007	*Inert-gas oxygen probe 900 mm, 1 x type S with 27 x 150 stainless steel tube*	*9-010101-0900SR27*
92001008	*Inert-gas oxygen probe 1000 mm, 1 x type S with 27 x 150 stainless steel tube*	*9-010101-1000SR27*

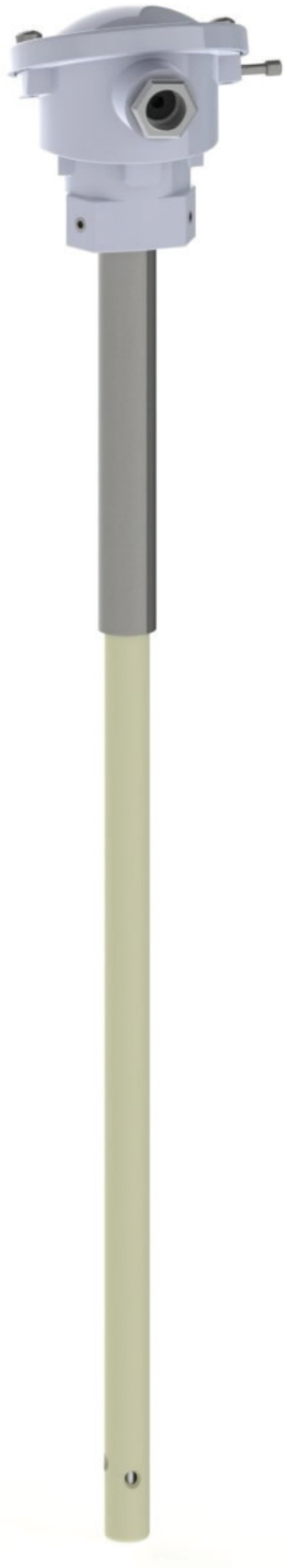
Oxygen probe without thermocouple

Material-No	*Description*	*Specification*
92001009	*Inert-gas oxygen probe 500 mm with 27 x 150 stainless steel tube*	*9-010000-0500SR27*
92001010	*Inert-gas oxygen probe 600 mm with 27 x 150 stainless steel tube*	*9-010000-0600SR27*
92001011	*Inert-gas oxygen probe 700 mm with 27 x 150 stainless steel tube*	*9-010000-0700SR27*
92001012	*Inert-gas oxygen probe 800 mm with 27 x 150 stainless steel tube*	*9-010000-0800SR27*
92001013	*Inert-gas oxygen probe 900 mm with 27 x 150 stainless steel tube*	*9-010000-0900SR27*
92001014	*Inert-gas oxygen probe 1000 mm with 27 x 150 stainless steel tube*	*9-010000-1000SR27*

Oxygen probes for vacuum applications

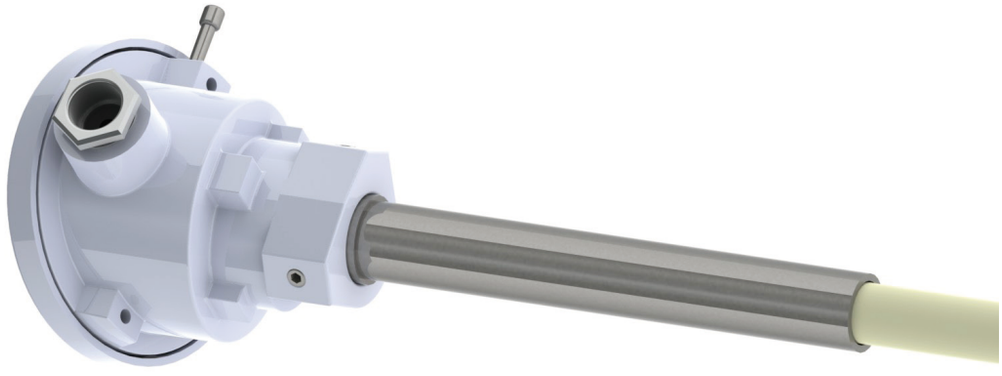
Overview

Pressure range	Vacuum tight and pressure proof to 6 bar
Temperature range	500°C - 1300°C
Built-in thermocouple	Type S, optional none
Diameter outer protection tube	Ø 17 mm
Material outer protection tube	High density Al_2O_3 99,7%
Diameter solid state electro-lyte tube	Ø 6 mm
Material solid state electrolyte tube	Fully stabilized zirconium dioxide (FSZ)
Material gas electrode	Pt pure
Material reference electrode	Pt pure
Wires used for connection of electrodes	Pt pure
Fitting reference air supply	Plug Ø 6 mm max 5L/h
Electrical terminals	Ceramic terminals max 1,5 mm^2
Output voltage	-2V .. +2V
Inner resistance	< 20kΩ
Connection head	Form A with M20x1,5 cable gland
Certificates	*Thermocouple:* Report of calibration based on Ag and Pd fix-point measurements Optional: Certification in accordance to AMS 2750 *Oxygen sensor:* Report of function test including inner resistance, leak rate of solid state electrolyte tube and mV in N_2 6.0 and N_2H_2(5%) at 920°C



Process connection with tubes

Process connection with tubes



Standard design is a stainless-steel tube (W1.4305) Ø22 mm x 150 mm length. Other designs with different tube dimensions such as Ø 1“ inch x 150 mm or Ø27 mm x 150 mm are also available upon request.

Product specification key:

9	-	*06XXZZ*	-	*LLLLA*
		06 - Vacuum design XX - Built-in thermocouple 00 - none 01 - with ZZ - Thermocouple alloy pairs 00 - none 01 - PtRh10% - Pt (Type S) 02 - PtRh13% - Pt (Type R)		LLLL - Nominal length [mm] 0400 - 400 mm to 1000 - 1000 mm in 100 mm steps A - Fitting SR22 - Ø22 mm x 150 mm

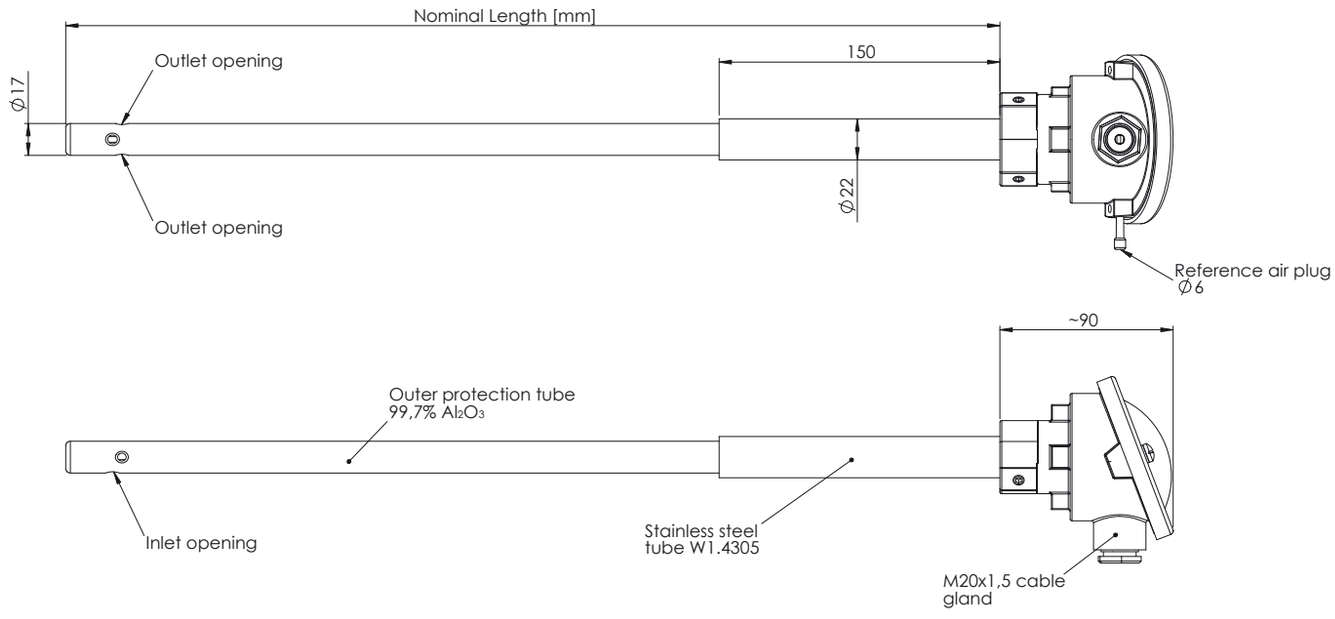
Example: 9-060101-0600SR22

Oxygen probe for vacuum applications, vacuum tight and pressure proof until 6bar, as combined sensor with built-in type S thermocouple, a nominal length of 600 mm and a Ø22 mm x 150 mm tube.

Please let us know if you need a specific design or configuration. We will be pleased to design your custom-made oxygen probe.

Process connection with tubes

Vacuum oxygen probe with stainless steel tube



As combined sensor with a built-in thermocouple type S (PtRh10% - Pt)

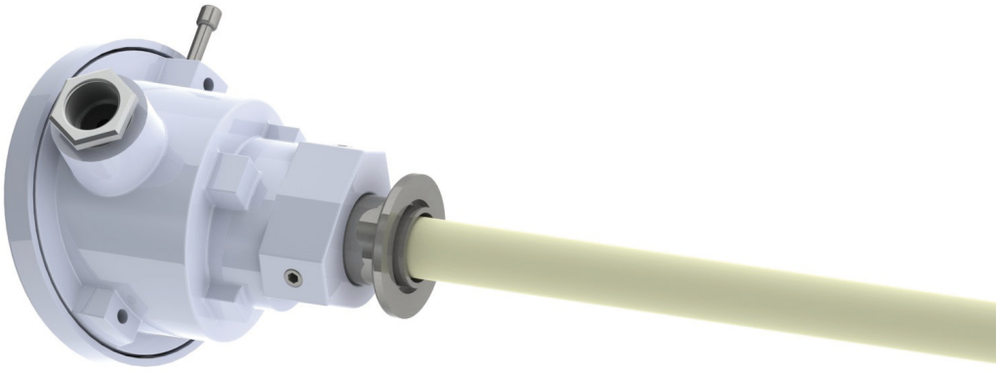
Material-No	*Description*	*Specification*
92001015	*Vacuum oxygen probe 500 mm, 1 x type S with 22 x 150 stainless steel tube*	*9-060101-0500SR22*
92001016	*Vacuum oxygen probe 600 mm, 1 x type S with 22 x 150 stainless steel tube*	*9-060101-0600SR22*
92001017	*Vacuum oxygen probe 700 mm, 1 x type S with 22 x 150 stainless steel tube*	*9-060101-0700SR22*
92001018	*Vacuum oxygen probe 800 mm, 1 x type S with 22 x 150 stainless steel tube*	*9-060101-0800SR22*
92001019	*Vacuum oxygen probe 900 mm, 1 x type S with 22 x 150 stainless steel tube*	*9-060101-0900SR22*
92001020	*Vacuum oxygen probe 1000 mm, 1 x type S with 22 x 150 stainless steel tube*	*9-060101-1000SR22*

Oxygen probe without thermocouple

Material-No	*Description*	*Specification*
92001021	*Vacuum oxygen probe 500 mm with 22 x 150 stainless steel tube*	*9-060000-0500SR22*
92001022	*Vacuum oxygen probe 600 mm with 22 x 150 stainless steel tube*	*9-060000-0600SR22*
92001023	*Vacuum oxygen probe 700 mm with 22 x 150 stainless steel tube*	*9-060000-0700SR22*
92001024	*Vacuum oxygen probe 800 mm with 22 x 150 stainless steel tube*	*9-060000-0800SR22*
92001025	*Vacuum oxygen probe 900 mm with 22 x 150 stainless steel tube*	*9-060000-0900SR22*
92001026	*Vacuum oxygen probe 1000 mm with 22 x 150 stainless steel tube*	*9-060000-1000SR22*

Process connection with small flange

Process connection with small flange



The fitting of the standard design is a ISO 669 DN 25 small flange. Optional fittings such as the DN40 are also available.

Product specification keys:

9	-	*06XXZZ*	-	*LLLLA*
		06 - Vacuum design XX - Built-in thermocouple 00 - none 01 - with ZZ - Thermocouple alloy pairs 00 - none 01 - PtRh10% - Pt (Type S) 02 - PtRh13% - Pt (Type R)		LLLL - Nominal length [mm] 0400 - 400 mm to 1000 - 1000 mm in 100 mm steps A - Fitting KF25 - small flange DN25 KF40 - small flange DN40

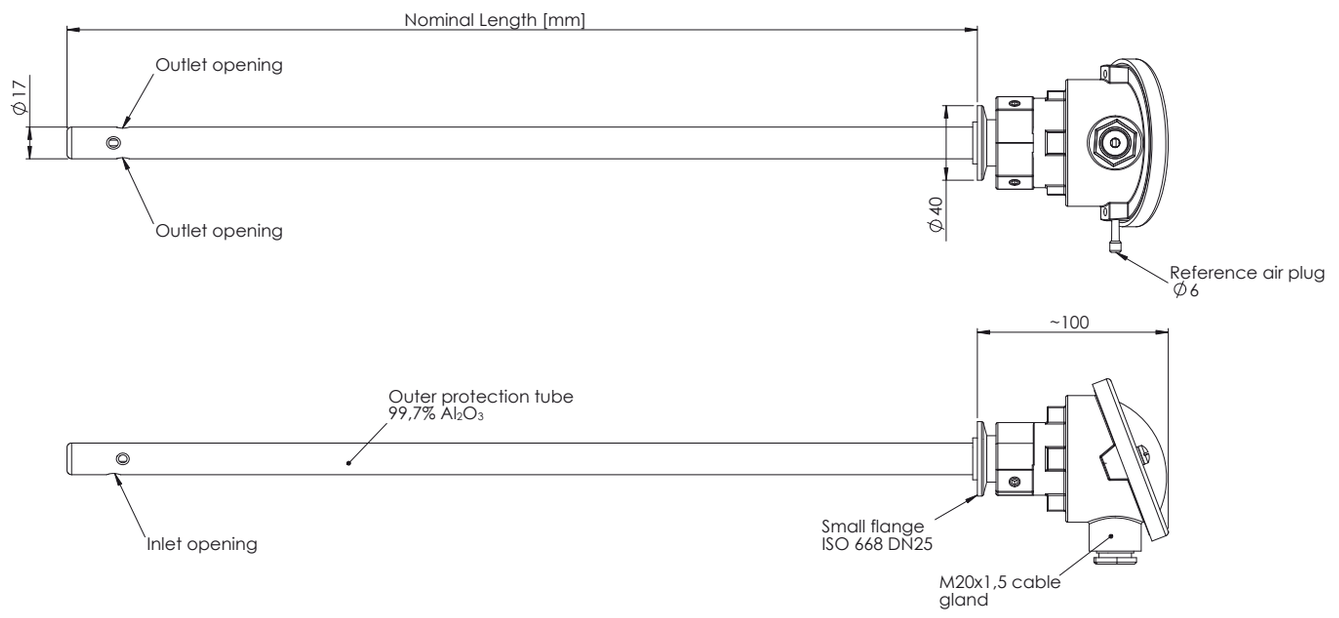
Example: 9-060101-0700KF25

Oxygen probe for vacuum applications, vacuum tight and pressure proof until 6bar, as combined sensor with built-in type S thermocouple, a nominal length of 600 mm and a DN 25 small flange fitting.

Please let us know if you need a specific design or configuration. We will be pleased to design your custom-made oxygen probe.

Process connection with small flange

Vacuum oxygen probe with small flange DN 25



As combined sensor with a built-in thermocouple type S (PtRh10% - Pt)

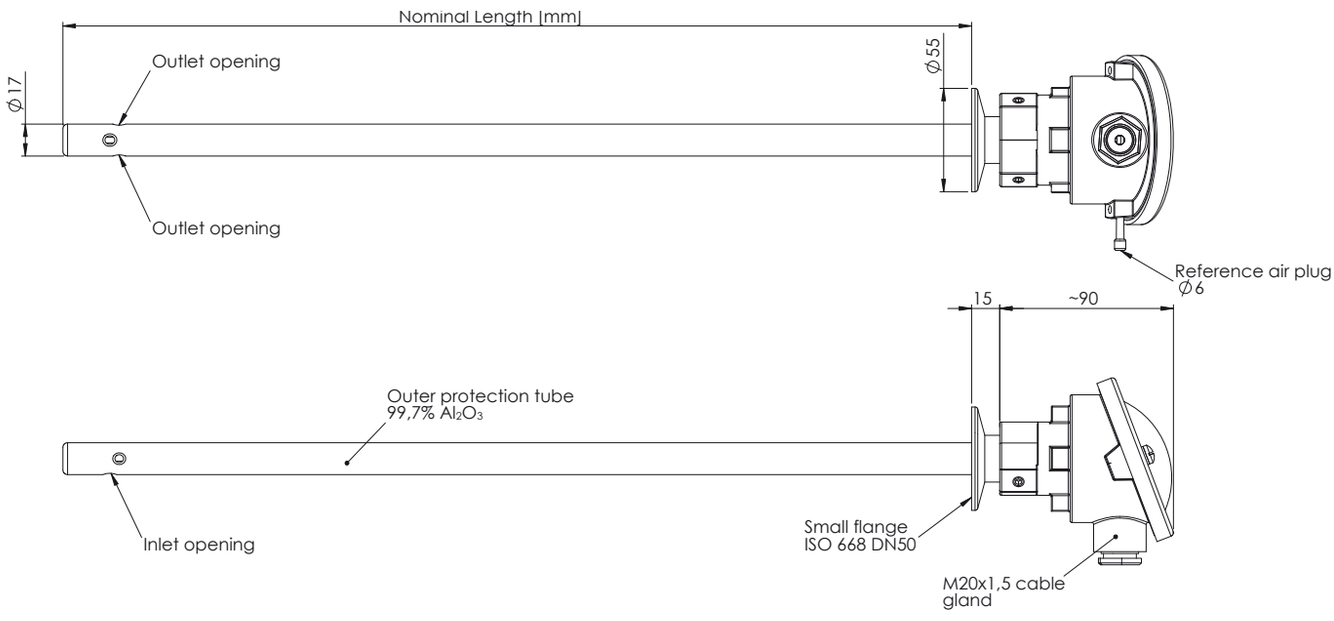
Material-No	*Description*	*Specification*
92000508	*Vacuum oxygen probe 500 mm, 1 x type S with small flange DN 25*	*9-060101-0500KF25*
92001027	*Vacuum oxygen probe 600 mm, 1 x type S with small flange DN 25*	*9-060101-0600KF25*
92001028	*Vacuum oxygen probe 700 mm, 1 x type S with small flange DN 25*	*9-060101-0700KF25*
92001029	*Vacuum oxygen probe 800 mm, 1 x type S with small flange DN 25*	*9-060101-0800KF25*
92001030	*Vacuum oxygen probe 900 mm, 1 x type S with small flange DN 25*	*9-060101-0900KF25*
92001031	*Vacuum oxygen probe 1000 mm, 1 x type S with small flange DN 25*	*9-060101-1000KF25*

Oxygen probe without thermocouple

Material-No	*Description*	*Specification*
92001032	*Vacuum oxygen probe 500 mm with small flange DN 25*	*9-060000-0500KF25*
92001033	*Vacuum oxygen probe 600 mm with small flange DN 25*	*9-060000-0600KF25*
92001034	*Vacuum oxygen probe 700 mm with small flange DN 25*	*9-060000-0700KF25*
92001035	*Vacuum oxygen probe 800 mm with small flange DN 25*	*9-060000-0800KF25*
92001036	*Vacuum oxygen probe 900 mm with small flange DN 25*	*9-060000-0900KF25*
92001037	*Vacuum oxygen probe 1000 mm with small flange DN 25*	*9-060000-1000KF25*

Process connection with small flange

Vacuum oxygen probe with small flange DN 40



As combined sensor with a built-in thermocouple type S (PtRh10% - Pt)

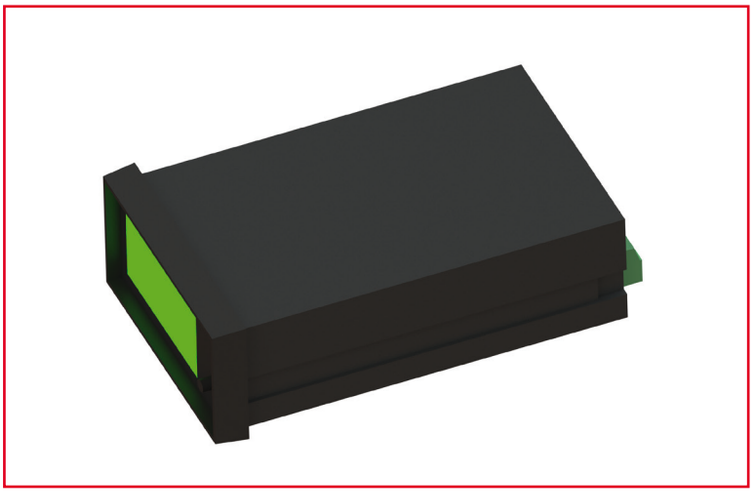
Material-No	*Description*	*Specification*
92001038	*Vacuum oxygen probe 500 mm, 1 x type S with small flange DN 40*	*9-060101-0500KF40*
92001039	*Vacuum oxygen probe 600 mm, 1 x type S with small flange DN 40*	*9-060101-0600KF40*
92001040	*Vacuum oxygen probe 700 mm, 1 x type S with small flange DN 40*	*9-060101-0700KF40*
92001041	*Vacuum oxygen probe 800 mm, 1 x type S with small flange DN 40*	*9-060101-0800KF40*
92001042	*Vacuum oxygen probe 900 mm, 1 x type S with small flange DN 40*	*9-060101-0900KF40*
92001043	*Vacuum oxygen probe 1000 mm, 1 x type S with small flange DN 40*	*9-060101-1000KF40*

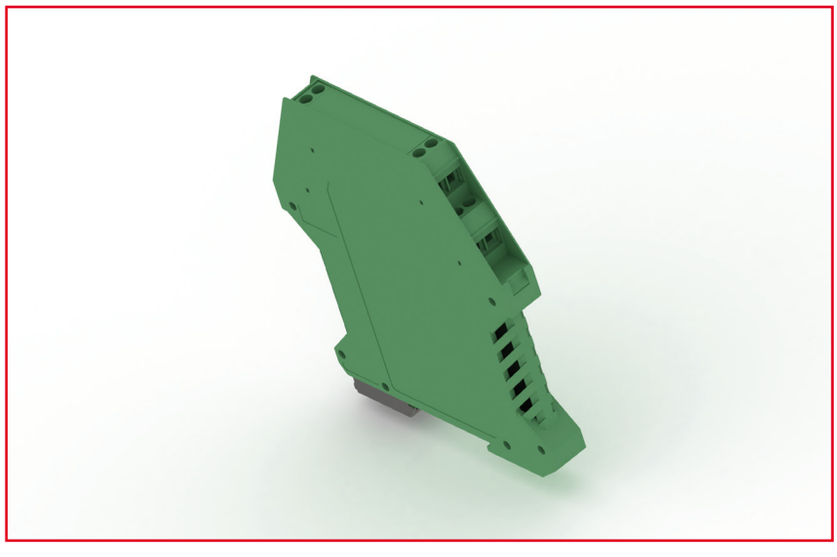
Oxygen probe without thermocouple

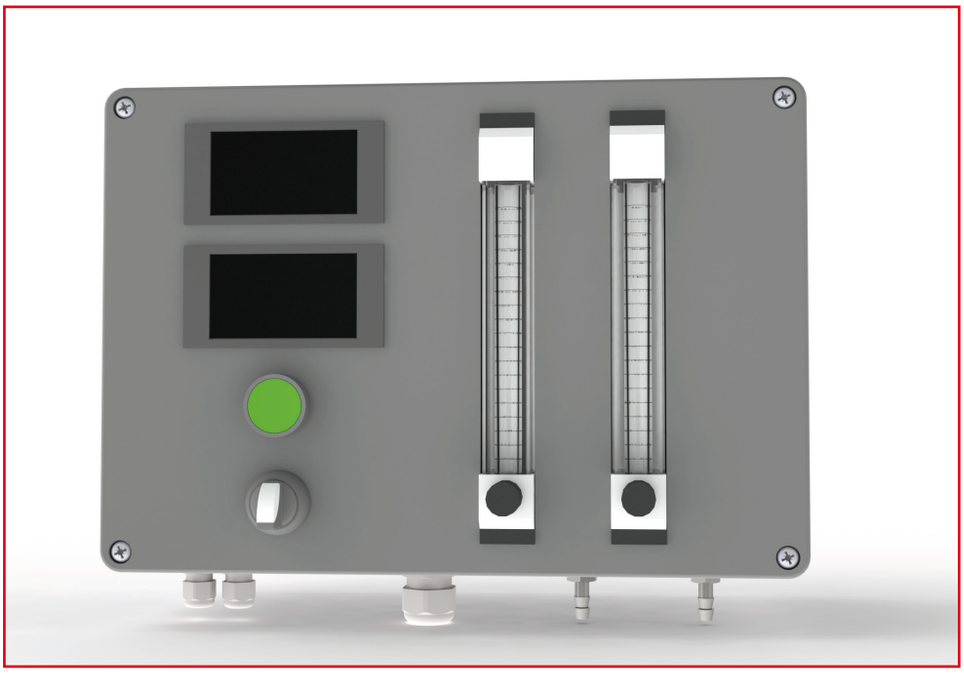
Material-No	*Description*	*Specification*
92001044	*Vacuum oxygen probe 500 mm with small flange DN 40*	*9-060000-0500KF40*
92001045	*Vacuum oxygen probe 600 mm with small flange DN 40*	*9-060000-0600KF40*
92001046	*Vacuum oxygen probe 700 mm with small flange DN 40*	*9-060000-0700KF40*
92001047	*Vacuum oxygen probe 800 mm with small flange DN 40*	*9-060000-0800KF40*
92001048	*Vacuum oxygen probe 900 mm with small flange DN 40*	*9-060000-0900KF40*
92001049	*Vacuum oxygen probe 1000 mm with small flange DN 40*	*9-060000-1000KF40*

Process connection with small flange

Accessories







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Air Supply Unit

Air Supply Unit

The unit supplies the oxygen probe with purging and, if necessary, reference air. The activation is triggered by electromagnetic valves using a 24V DC or 230V/50Hz (optionally 120V/60Hz) voltage.

The air flow is adjusted with a variable flow-meter for each air system. The flow range for reference air is between 5 and 50 l/h, purging air range between 50 and 500 l/h. The air is lead through nozzles, suitable for flexible tubes with 6mm inner diameter. The nozzles are mounted with a G1/8 thread and can be replaced by any nozzle connection system with a respective thread.

All parts are placed inside of an Aluminum casing, the cover can be modified with a hinge, to be protected against dust and dirt.

Upon request, additional components such as amplifiers or switches can be incorporated into the unit as well.

Material-No	*Description*	*Specification*
92001463	*Air Supply Unit Oxygen probe 230V AC*	*30-0230-MP*
92001464	*Air Supply Unit Oxygen probe 24V DC*	*30-0024-MP*

Reading Display Unit

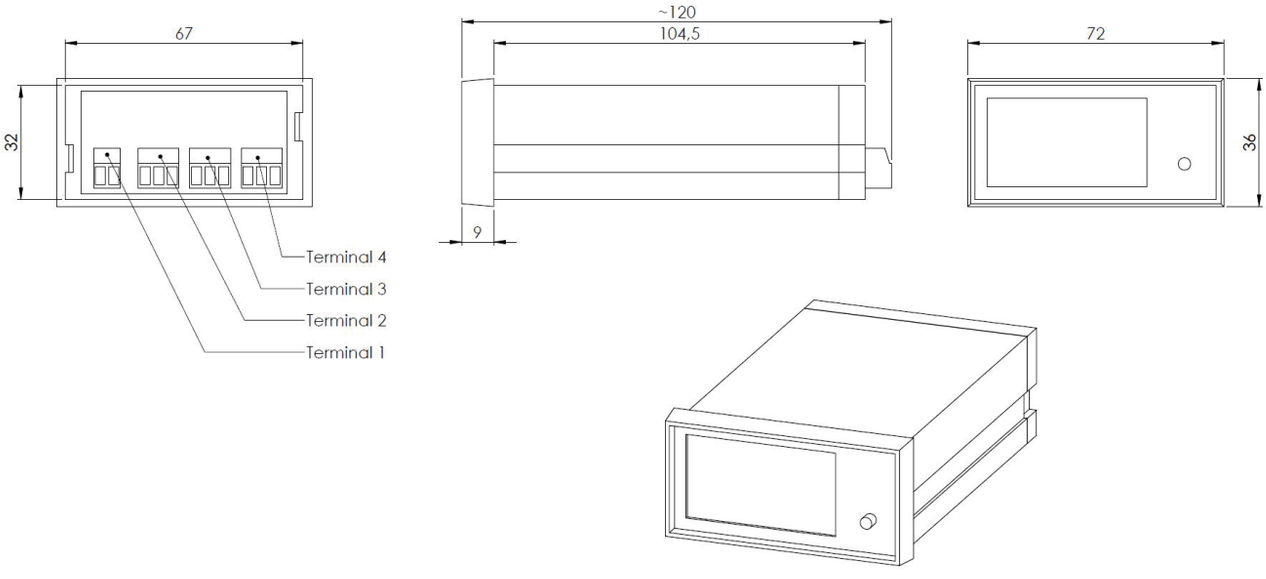
Reading Display Unit

This unit is designed to be placed into controlling cabinets with a 1/4 DIN slot. It displays the actual reading of the probe voltage and temperature, as well as the %-O2. The inner resistance of the meter is high enough to prevent a loading of the oxygen probe's voltage. The meter can be powered by 24V/DC or 230V/50Hz.

The output signal can be set as 4..20mA, RS485 or a simple -2/+2V. The RS485 output uses @[Typ]:O2=XX.XXE+XX%[CC] as configuration. The input signal of the thermocouple can be set as type S, K or N.

Following pins are available:

- Terminal 1 - 2 pin - power supply + / -
- Terminal 2 - 3 pin - signal output + / - / GND
- Terminal 3 - 3 pin - signal input emk thermocouple + / - / GND
- Terminal 4 - 3 pin - signal input emk probe + / - / GND



Material-No	*Description*	*Specification*
92001984	*O2 Meter 48V DC - 4..20mA*	*TTAG-I0420-048*
92001985	*O2 Meter 260V AC - 4..20mA*	*TTAG-I0420-260*
92001986	*O2 Meter 48V DC - RS486*	*TTAG-RS486-048*

Isolating Amplifiers

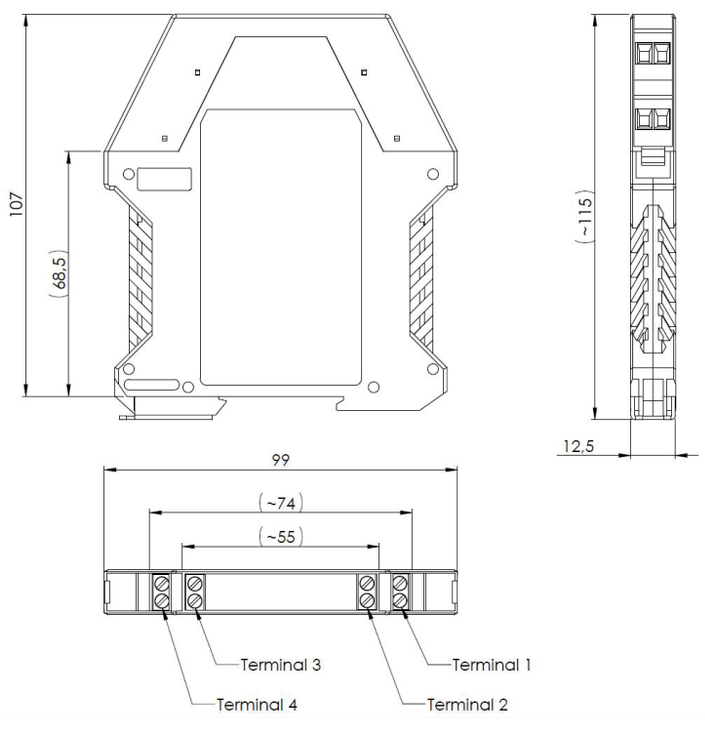
Isolating Amplifiers

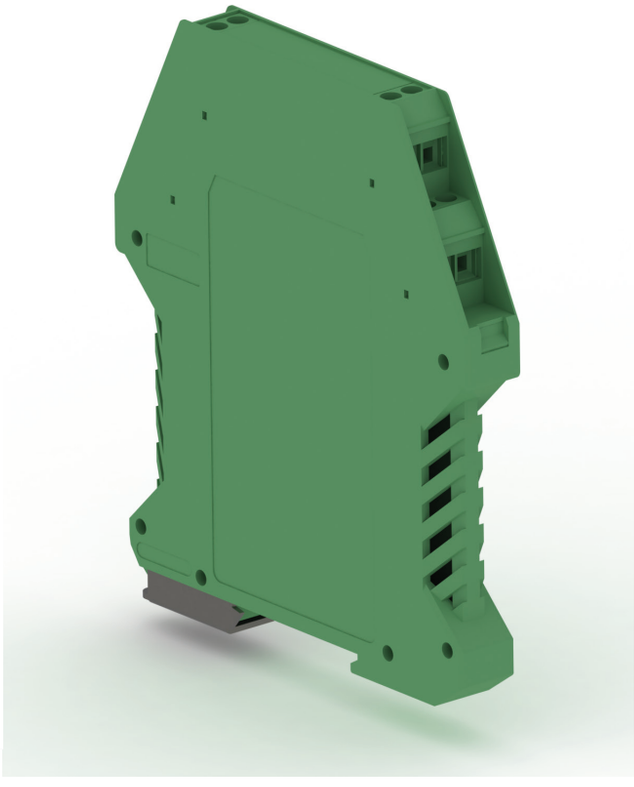
This amplifier is applied in environments where the probes output signal is interfered by magnetic fields or equipment with low inner resistance (such as old SPS units). Due to a very high inner resistance and a galvanic isolation, this amplifier does not load the oxygen probe and ensures a save operation.

The output signal can be set as a -2/+2V DC or 4..20mA signal. The power supply of the amplifier can be chosen between 48V or 230V. The different modes can be set individually via jumpers.

Following pins can be used:

- Terminal 1 - power supply + / -
- Terminal 2 - input signal emk probe + / -
- Terminal 3 - output probe + / -
- Terminal 4 - not assigned





Material-No	*Description*	*Specification*
92001073	*Isolating amplifiers oxygen probe for DIN cap rail 48V/DC with 4..20mA signal*	*TCA-TVOP-048-4A*
92001074	*Isolating amplifiers oxygen probe for DIN cap rail 48V/DC with -2V .. +2V signal*	*TCA-TVOP-048-2V*
92001085	*Isolating amplifiers oxygen probe for DIN cap rail 230V/AC with 4..20mA signal*	*TCA-TVOP-230-4A*
92001086	*Isolating amplifiers oxygen probe for DIN cap rail 230V/AC with -2V .. +2V signal*	*TCA-TVOP-230-2V*

General information about oxygen probes

Oxygen probes are used in the controlling of combustion processes. The most commonly known use of oxygen probes is to control the combustion process of engines in automobiles, the so-called λ - control. A similar application is the use of the probes in the exhaust-flow of power plants. In heat treatment industry, the oxygen probes are mostly used in carbonizing processes, to control the carbon level (so-called C-Pegel).

Theory of operation

All oxygen probes have a similar basic design and follow the principal according to the Nernst law.

The generic Nernst equation

The physical theory was described by Walther Nernst at the end of the 19th century and follows the equation:

$$E = E_o + \frac{R \cdot T}{z_e \cdot F} \cdot \ln\left(\frac{c_1}{c_2}\right)$$

The used variables are:

- E - Electrode potential
- E_0 - cell potential at standard conditions
- R - Universal gas constant
- T - Temperature of the cell in °K
- F - Faraday constant, the number of coulombs per mole of electrons
- C_1, c_2 - Concentration of the fluids
- z_e - number of electrons transferred in the cell reaction

The equation represents a generic galvanic cell. It is built by two fluids, which have a concentration gradient and are separated by a membrane. Due to the concentration gradient, a voltage is generated. Every battery works this way.

General design of an oxygen probe

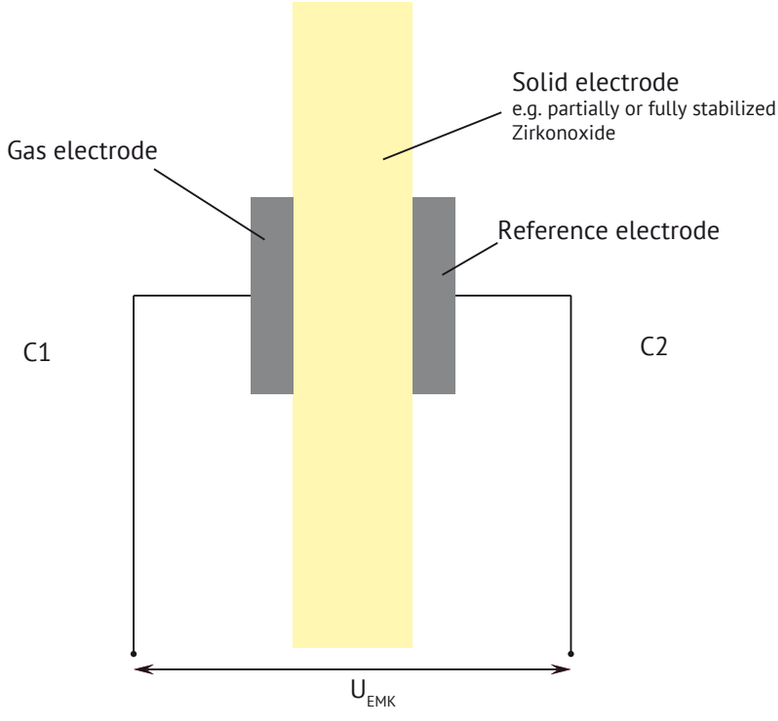
The basic item of an oxygen probe is a solid-state electrolyte (SSE) which separates the gas (e.g. furnace) atmosphere from the reference one (usually the ambient air). Each side is electrically connected with electrodes respectively called gas- and reference electrode. The task of the SSE is to function as the ion bridge for the electrochemical cell and is usually made from partial stabilized zirconium oxide (PSZ) or fully stabilized zirconium oxide (FSZ). The stabilization is achieved by doping of rare-earth metals such as Yttrium or Gallium as well a pure Al_2O_3.

To achieve a conductivity for ions, the temperature of the SSE needs to be above 500°C. The probe needs additional heating in applications with less heat, such as exhaust of car engines or other bypass-systems. In other applications, such as the carbonizing heat treatment, the temperatures are beyond 800°C. Consequently, a heating is not required.

thermo-control oxygen probe

Once a conductivity is reached, a movement of oxygen ions follows the gradient of concentration from high to low. In terms of heat treatment, from the reference side towards the carbonizing atmosphere side. The movement expands along the defect in the zirconium grid. The ions take two electrons on the reference air side and recombine on the gas side. The exchange takes place at the 3-phase border zirconium-gas-electrode.

Generical design of an oxygen probe



This generated voltage can be measured and it represents the current oxygen concentration ratio in accordance to the Nernst law.

thermo-control oxygen probe

The main field of use for oxygen probes made by thermo-control Körtvélyessy GmbH is the controlling of the carbonizing atmosphere in heat treatment furnaces. Following the high chemical and thermal demands thermo-control oxygen probes have specific design features to enhance their performance.

Ceramic protection tubes

Instead of the commonly used high temperature alloys such as Inconel©, thermo-control oxygen probes are built with ceramic components, e.g. the outer protection tube. Ceramic tubes provide a high durability at higher temperatures due to the lack of deformation (The deformation of metallic tubes, resulting in damaging the inner zirconium tube, being the most frequent reason for an exchange of the probe).

Since the ceramic tube is built into a dampening fitting, it has also a high resistance against vibration or thermal shocks.

thermo-control oxygen probe

Built-in type S thermocouple

All thermo-control Körtvélyessy GmbH oxygen probes are equipped with a type S thermocouple as a standard design. The thermocouple has the same benefits as all thermo-control Körtvélyessy made thermocouples: high precision measurement without a drift. This features enables a precise measurement of the oxygen probe cell for many years.

In many applications, the temperature of the cell is indirectly measured with the controlling thermocouple of the furnace (usually a type K or N thermocouple). Any kind of uneven temperature distribution along the furnace will result in a wrong calculation of the oxygen concentration, since the cell voltage is linear to its temperature. In addition, thermocouples of type K usually start to drift at temperatures beyond 900°C, a fact that has to be taken into consideration as well.

Electrodes and wiring made from Platinum

Platinum wiring seems to be costly at first view. However, it bears many advantages according to the performance of the oxygen probe. One is that the two Platinum wires do not build a thermocouple, unlike the combination of different metallic tubes and wires that do build a thermocouple with unknown voltage and behavior. Therefore, the two Platinum wires provide a stable and unchanged measurement of the oxygen probe cell.

Another advantage is the good bonding of the Platinum with the zirconium oxide tube, ensuring a tight electrical contact throughout long years of service. The bonding mechanism is already established already during the manufacturing process, to enable a high performance from the start.

thermo-control oxygen probe

Product image

Oxygen probe for high-pressure / vacuum atmosphere with Ø 22 x 150 tube

Notes

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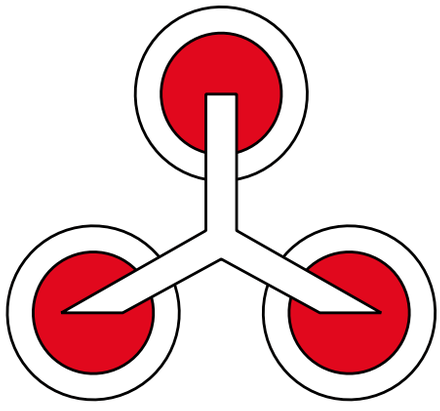

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