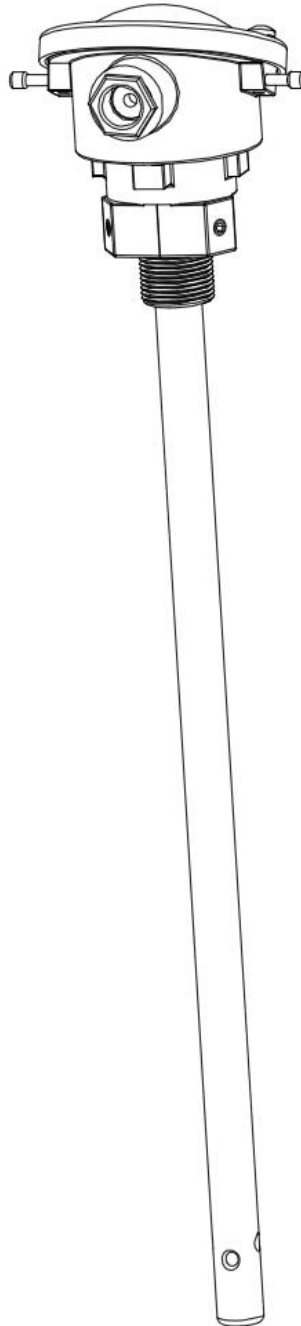


## Manual for thermo-control oxygen probes

Revision: A – 2009- April



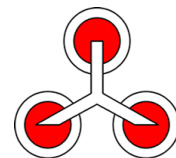
Applicable for designs to be used in inert gas furnaces with ambient gas pressure:

Fitting with screw: 8-01xx-R34, 8-01xx-R1, 8-01xx-R1SW28, 8-01xx-R24SW41

Fitting with flange: 8-01xx-KF25, 8-01xx-KF40

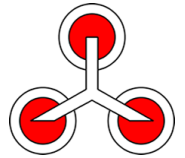
Fitting with tubes: 8-01xx-SR22, 8-01xx-SR1Z, 8-01xx-1Zx50, 8-01xx-SR27

ECCN: N AL: N Commodity code: 90258080



## Content

Receiving .....	3
Warranty .....	3
Position in the furnace .....	4
Mounting to the furnace .....	4
Electrical connection .....	7
Connection to the control unit.....	8
Testing the leak tightness .....	9
Never control the inside of the oxygen probe.....	9
Contact.....	9



## **1 Receiving**

Please take the oxygen probe out of the box after receiving it in order to check if any mechanical damage has occurred during transportation. Should it be damaged you have to immediately claim at the carrier company. Please note the depending from the carrier company the time claims are accepted are usually 5 work days.

The oxygen probe is delivered in an acryl protection tube with a fitting appropriate to the one of the probe specified. Remove the protection tube and shake the probe in axial direction. You should not hear anything. Shaking the probe in radial direction should make some noise as the Pt wires hit the internal ceramic tubes.

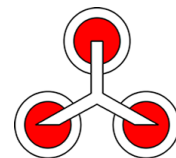
Usually the internal Zirconium tube is not broken unless the outer protection tube  $\varnothing 17\text{mm}$  is not damaged. All probes have been transported safely in the original thermo-control boxes. Please keep them in case you need to send the probe for an inspection or if you have not worked with thermo-control oxygen probes yet. You will quickly find out that thermo-control oxygen probes are different from common designs, but become used to it very fast that for example they hardly need reference air.

Please read the further instructions carefully to enjoy this high quality product for many years of untroubled measuring.

## **2 Warranty**

Oxygen probes from thermo-control have the longest available warranty time up to 4 years from delivery in the most suitable position in the furnace. This is possible due to the fact that you never need to exchange, clean (except for regular purge sessions) or adjust the oxygen probe. Any changes of the oxygen probe will immediately terminate the warranty. The warranty does not cover mechanical or chemical damages of the ceramic tubes. The warranty covers an error free function of the oxygen probe for the time period given. After the mechanically installation of the probe a picture of the probe on which the position in the furnace is visible has to be send to thermo-control along with the serial number and date of build in. This information is essential to enable the warranty.

The maximum warranty time can only be granted if the probe is build in the area where it receives the furnace gas with the highest temperature. As an example in a chamber furnace the best position is between two heat pipes beneath the grid.



## 3 Position in the furnace

This item is quite unknown in the literature; however it is essential for the lifetime of the oxygen probe. Build in through the ceiling of the furnace If the probe is build in at the top of the furnace, where usually also the ventilation and gas inlet are located, the worst position possible is found. This is due many facts. In this position the carbonizing gas is not fully mixed with the atmosphere. The area above the furnace is usually the one with the highest temperature and highest amount of dust. The maximum temperature of the ceramic terminal of 200°C (392°F) generates the highest thermo electrical error; where the dust increases the risk of plugging the air systems. The oxygen probe is built in the coolest area of the furnace. This has the consequence that furnace gas the highest tendency to deposit soot and other residuals of washing chemical or oil on the probe's tubes

As a summary the position on the sealing of the furnace is the worst possible and should only be made in emergency situations. In this case a warranty cannot be granted. Top-loading furnaces are excluded from this clause as in this case the above mentioned position is the only one.

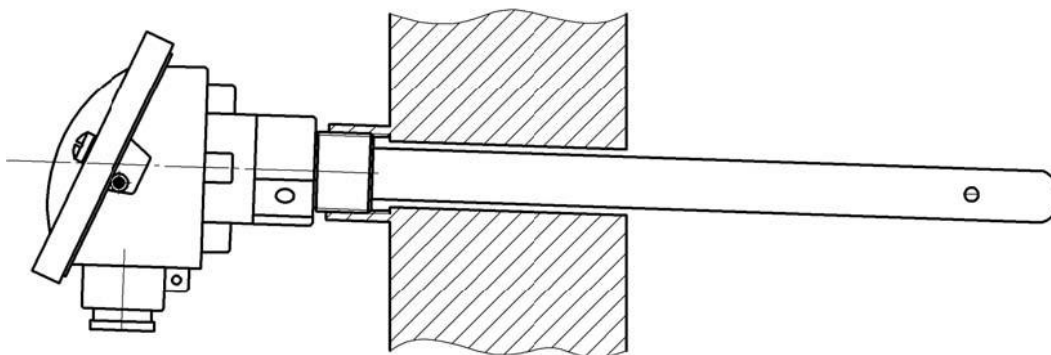
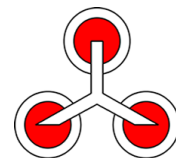
Mechanical assembly

### 3.1 Mounting to the furnace

In case you have used an oxygen probe with an Inconel protection tube, which is assembled from the top of the furnace, it is important to use another feed through for the thermo-control probe. It is beneficial if the feed through is made with a slight angle with the result that the tip of the probe is 5-10mm (0,3 - 0,5 inch) lower than the middle of the connection head. With this setup achieved, the thermo-control probe does not need a reference air supply.

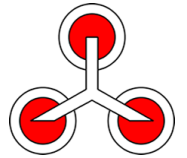
If the fitting system is via R3/4" screw, or another screw, the probe is to be sealed Teflon tape. In case of other fitting systems a sealed assembly is to be ensured. Please see the documentation of the used fitting system.

In case the probe is assembled in a horizontal position, please ensure that the M20x1 cable compression fitting of the connection head points down as shown in the image below.



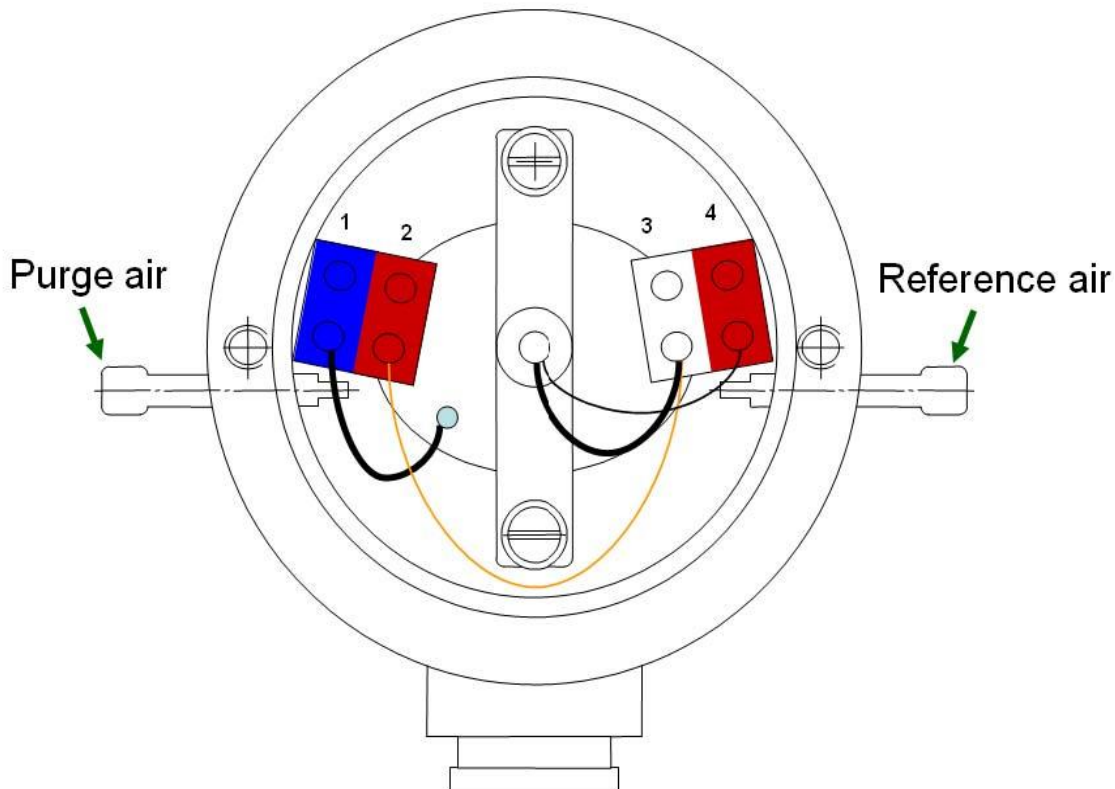
If it is intended to use an existing feed through on a position such as half furnace height or from below between the grids, it is possible to perform the assembly during operation. In order to do this the sealing material should be applied to the fitting system, i.e. Teflon tape for a screw fitting. Divide the ceramic tube into 8 parts (divide the length three times into halves) with a pencil. Open the newly made or existing feed through and place the probe into the hole. Now push the probe slowly into the feed through orientating on the marks. The tempo should be not faster than one minute per mark.

Check if the feed through is free and mount the probe with the fitting to the furnace. In case of an existing probe, release it from the fitting and pull it approximately ~6cm (~2.5 inch) out. Should the furnace gas ignite quench the flames with a wet cloth. Pull the existing probe out slowly. After the disassembly of the old probe perform the assembly of the new one as described above.



### 3.2 Connect air plugs

thermo-control oxygen probes have two connectors located in the connection head. Each is marked as either reference air inlet or purge air inlet. The plugs have a diameter of Ø6mm. Put the reference air hose over the respective plug and fix it with a cable strap or similar strap. If the probe is built in under a small angle as described in chapter 3.1, the reference air plug does not need to be connected.

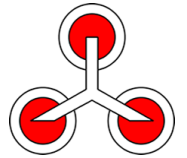


Important notice! To avoid plugging use a filter between the pump and the probe! To avoid damages only use clean and dry air as reference and purge air.

If connected the maximum amount of reference air should be 1 Liter / hour. An increased flow will not influence the probe's performance however will not increase it as well.

The maximum air flow of the purge air should not exceed 200 Liter / hour to avoid a rapid cooling of the probe, which increases the risk of cracking

The purging should be performed in regular time periods. The length of the purging period depends on the used gas mixes and position of the oxygen probe and should be determined experimentally.

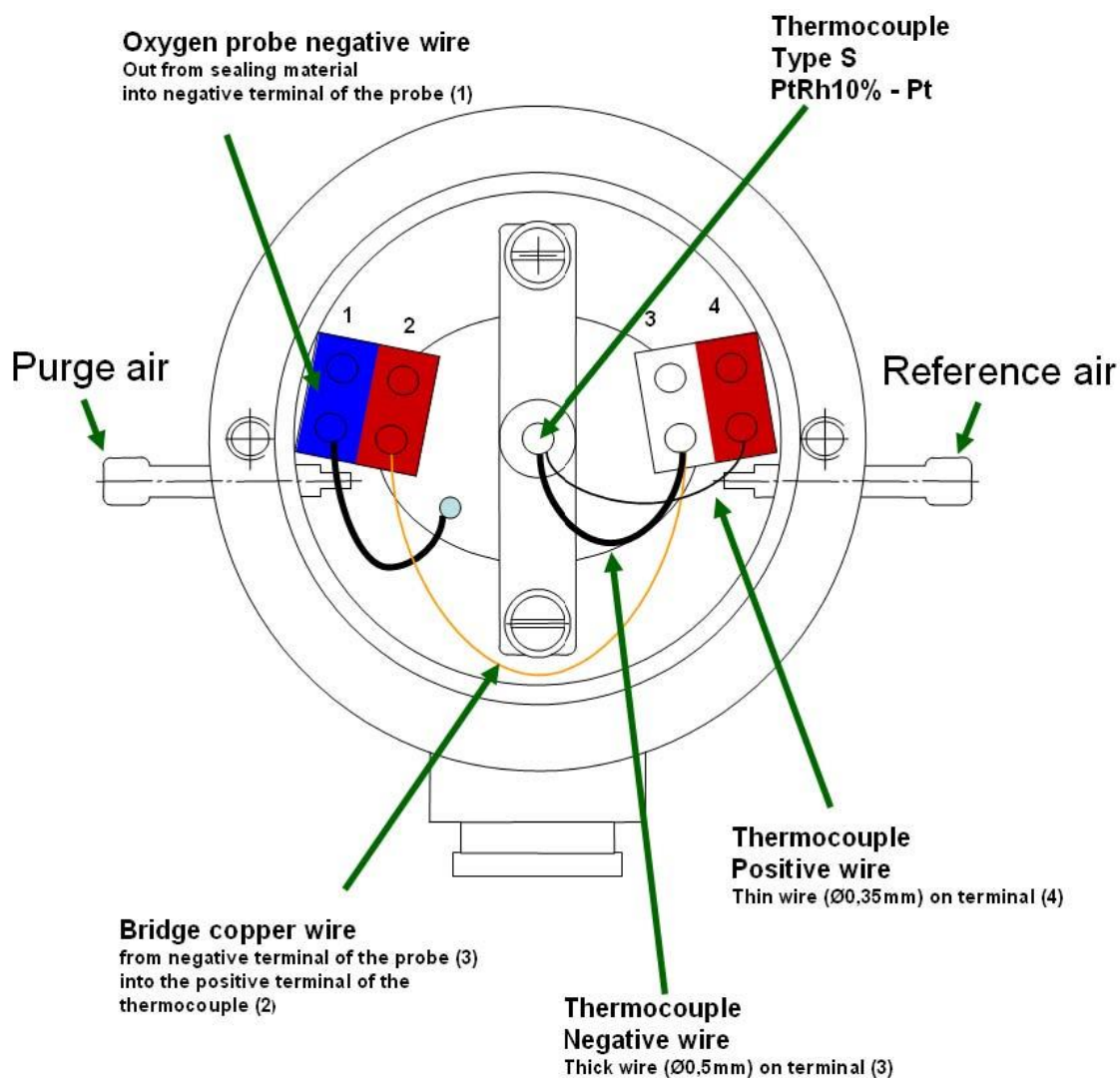


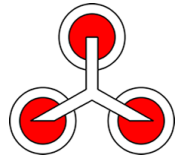
## 4 Electrical Assembly

### 4.1 Electrical connection

The copper wires for the oxygen probe signal are connected to the terminal of the oxygen probe which is painted blue for the negative and red for the positive wire and has either "O2" or "Sonde" printed on its side.

The compensation wire for the thermocouple (orange for positive wire and white for negative wire according to IEC 584) should be specified for type S, PtRh10% - Pt DIN EN 60584-1 and is to be connected to the terminal of the thermoelement which is painted red for the positive and white for the negative wire and has printed "Thermo" or "TC" on its side. The positive wire of the build in thermocouple is internally connected to the negative wire of the oxygen probe.





## 4.2 Connection to the control unit

Before connecting the probe to the control unit, please make sure that the control unit's resistance is appropriate to avoid an influence to the probe's signal. When the furnace has reached a balanced atmosphere, disconnect the probe's line from the control unit and then connect it to a high quality digital voltmeter with an input resistance of at least 10 MΩ. Read the display, e.g. 1140 mV. Switching back to the control unit, the voltage is not supposed to fall, e.g. on 1135mV. Do not adjust the lack of voltage by using the correction button of the control unit. The missing voltage is a result of the temperature and varies greatly (e.g. at 780°C it can reach -35mV). If that is the case, a pre-amplifier must be installed. It will considerably prolong the oxygen probes durability. Usually the inner resistance of the probes is rising. Eventually the problem could lead to a loss of voltage that cannot be corrected anymore. With the help of a pre-amplifier the problem can be largely avoided, the oxygen electrode lasts several years longer. As the thermo-control probes have a specially protected gas electrode, a rising of the inner resistance is quite unlikely. The inner resistance (RT) can be measured any time. Just connect one MΩ resistance to the clamps of the oxygen probe or else use the clamps of the pre-amplifier. The originally displayed data (E mV) changes to a different voltage (U mV).

To calculate the resistance use:

$$E - U$$

$$R_T = \frac{1.000.000\Omega}{U}$$

$$U$$

Example:

$$1126mV - 1112mV$$

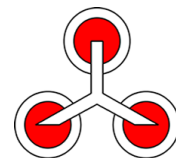
$$R = \frac{1.000.000\Omega}{950^\circ C} = 12.600\Omega$$

$$950^\circ C$$

$$1112mV$$

Please keep the information, temperature and resistance for the records. The same data will be shown years later, if the oxygen probe is still intact. As long as no zinc coated screws or aluminum parts are used inside of the furnace, the oxygen probe will have a long life-time. The guaranty ends, if more than 0,1% zinc or aluminum can be found in the characteristic corrosion of the originally 99,99% pure gas electrode.





It is understood that the composition of gases has to remain constant throughout the measurements. The probe in use causes the activation of the valve for additional gas. It is advised to switch off the valve in order to avoid a change of the furnace's atmosphere. Alternatively the measurement can be taken as soon as the valve has opened up.

## 5 Testing the leak tightness

In case the zirconium oxide tube of the oxygen probe begins to leak, the probe generates a lower voltage. By changing the amount of reference air, the data displayed should not change if the tube tight. If the data changes by 5-20 mV the sensor is quite likely leaky and should be send in for a repair.

## 6 Never control the inside of the oxygen probe

There is no necessity to clean, adjust or otherwise treat the inside of a thermo-control oxygen probe. Do not open or try to repair the tubes. Every attempt to repair the sensor terminates the warranty.

## 7 Contact

In any case of trouble please get in touch with us at either form.

Thermo-control Körtvélyessy GmbH

Grünspechtweg 19

D – 13469 Berlin Germany

Phone: +49 (0)30 40 58 69 40

Fax: +49 (0)30 40 58 69 41

E-Mail: [info@thermo-control.com](mailto:info@thermo-control.com)

Website: [www.thermo-control.com](http://www.thermo-control.com)