Operating manual

A19-N/P

Oxygen Sensor

Declaration of Conformity

for
Oxygen measurement sensor

A19 type

This unit is designed for industrial applications in accordance with
EN 50081-2
EN 50082-2

The shipped version of this device complies with the requirements of the EEC norms:
EMC directive: 2014/30/EU
Low voltage directive: 2014/35/EU
Machinery directive: 2006/42/EG

Additional directrives:
EN 50081-2
EN 50082-2
EN 61010-1

Controlled by:
Quality-Management-System DIN EN ISO 9001:2008, No. 1210027736 TMS

The user is cautioned that modifications made to the device without the approval of the manufacturer could void the user´s authority to operate this device.

Contents

1 Safety instructions

Please read through this operating manual very carefully before installing and commissioning the unit.
Incorrect utilisation will invalidate the guarantee!

Correct functioning and the operating safety of the unit can only be guaranteed if the ambient conditions specified in the Specifications chapter are maintained.

Only qualified specialists are permitted to commission and operate the unit. The owner of the unit must ensure that the installation complies with the relevant laws and directives. These include, for example, the EU Directives covering safety in the workplace, national safety in the workplace regulations and the prevention of accidents regulations, etc.

You must ensure that the power supplies concur with the details listed on the nameplate. All of the covers needed to ensure that the unit cannot be touched when operating must always be fitted. You must consider the effects of the overall operation and take the necessary precautions if the unit will be linked up with other equipment and/or devices before you switch on.

Parts and surfaces will occasionally become and remain hot during the installation or de-installation. Suitable precautions must be taken in order to prevent injuries or damage to the unit from occurring.

If the unit shows signs of having been damaged and you are of the opinion that that safe operation is no longer possible then you must not run the unit. We recommend that periodical inspections are carried out at our factory or by our customer service department at least once a year.

Future disposal must always comply with the legal regulations.

2 Preface

With the aid of an oxygen sensor , the measurement unit serves to measure the oxygen partial pressure in gaseous atmospheres. Such sensors work at high temperatures and so it is necessary for measures to be taken to ensure that no flammable gas mixtures contact the sensor or the unit. In the event of the sensor ceramic suffering breakage the measurement gas could escape or air could enter the measurement gas side of the unit and so suitable measures have to be taken to avoid such an event leading to environmental pollution or damage being done to equipment.

In the event of incorrect parameters being set or the occurance of leakage, corrosion, condensation, etc., damage could be done to the equipment and incorrect measurement results be indicated and so it is essential that all parts of equipment be regularly serviced.

The oxygen sensor and its accessories are subjected to thorough quality control in accordance with DIN ISO 9001 in the course of their manufacture and testing.
They must only be installed and used in compliance with all applicable local and special regulations, particularly the VDE and DVGW standards that apply in Germany.
The measurement accuracy and effective function of the measurement device will need to be checked at intervals whose frequency will depend on the application concerned. Such a check must be effected in the course of a calibration and examination check on the equipment being first put into operation.

3 Introduction

3.1 Measurement principle

Oxygen measurement units are designed to process signals transmitted from an oxygen sensor constructed of stabilized zirconium oxide. Zirconium oxide, a ceramic material that is also spoken of as a solid-state electrolyte, acts as an excellent oxygen-ion conductor when at a high temperature.
Within certain temperature limits, that depend on the doping of the material concerned, such ion conductors are able to fill empty spaces in their crystal lattice with oxygen ions. The oxygen ions occur against an electrically conductive surface that is generally of platinum.
The concentration of oxygen in a measurement gas is thus decisive for the extent of oxygen activity, and thus for the number of oxygen ions.
An oxygen sensor consists essentially of a solid-state electrolyte with a contact surface on both sides.
One side of the electrolyte is in contact with a reference gas such as air, and the other with the gas whose oxygen content is to be measured. The mechanical construction of the sensor prevents contact between the two gases so that there is no risk of their being intermixed.
Depending on the application concerned, heated or unheated sensors are used. Unheated sensors are generally used in furnaces while heated sensors are used for applications where the gas to be measured is at a temperature of less than around 600 degrees Celsius (the measurement principle necessitates the sensor being maintained at a temperature of not less than 500 - 650 degrees Celsius).
Heated sensors are maintained at a set temperature by an electronic temperature regulator that forms part of the electronic control unit. The temperature of both heated and unheated sensors as measured by the electronic control is an important parameter for inclusion in the calculation of the oxygen content (oxygen partial pressure) in accordance with the following equation:

$$EMF = \frac{R \cdot T}{4 \cdot F} \cdot \ln(\frac{P_1}{P_2})$$

whereby:

R	=	8.31J/mol K
T	=	Temperature in Kelvin
F	=	96493 As/mol
P_1	=	Oxygen partial pressure on the reference side with 0.20946 bar
P_2	=	Oxygen partial pressure on the measurement gas side
EMF	=	Electromotive forcein Volts

3.2 Sensor

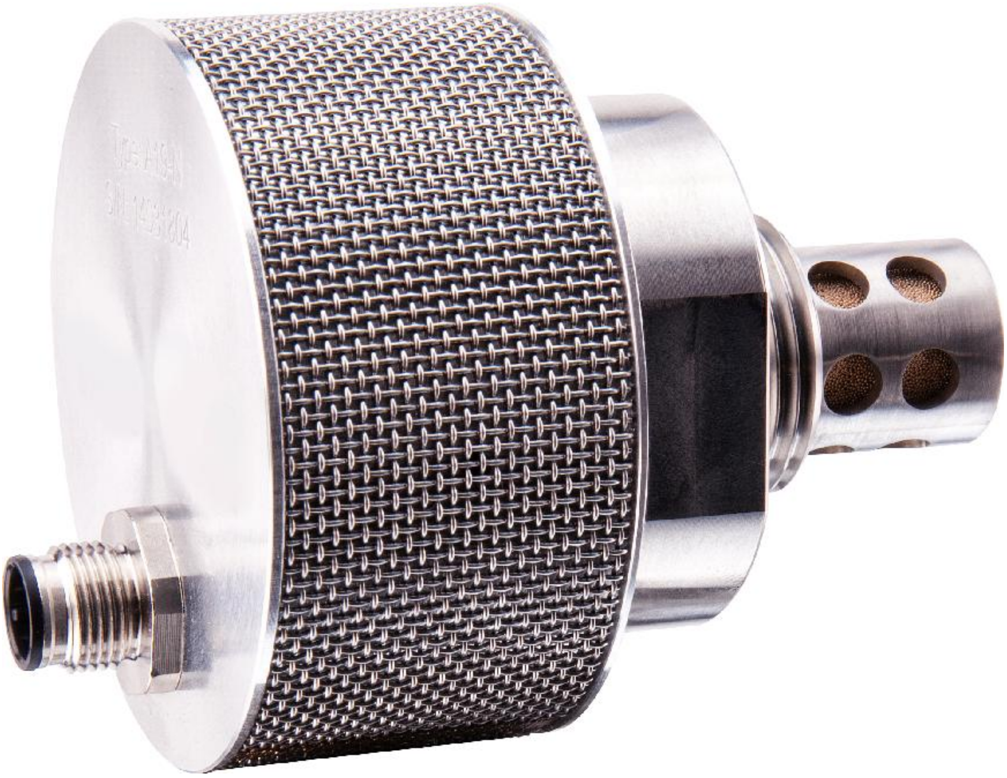

Figure 1: Sensor A19-N

The sensor is built into a stainless steel body, which has an aluminium housing with plug connection serving as the connection head.
In principle the sensor can be mounted in any position. However, we recommend assemblies with the connection head positioned at the top. The connection head has a multi-pin plug, to which the connecting cable leading to the converter module is attached.

3.3 Converter module

The sensor requires a series PZA-MC25 supply unit in order to function.
Please refer to the unit's operating instructions for additional information.

4 Assembly

4.1 Electrical

The electrical connection between the sensor & the PZA-MC25 converter module is via a cable. Pewatron delivers in the standard configuration a 2 meter long cable with the sensor and the converter module. Longer cable lenghts are possible.
The output signal of the converter module is connected with visualization and other types of modules for further signal processing.
The power supply is located in the converter module.

4.2 Mechanical

The A19-N sensor can be screw-mounted into the reaction space. It must be ensured, however, that the temperature at the screw-in thread does not exceed 150°C. It is possible that the screw-in thread will have to be separately cooled.

In some situations it is beneficial to guide the sample gas out of the sample gas chamber. In such cases the A19-P sensor for extractive measurements can be used

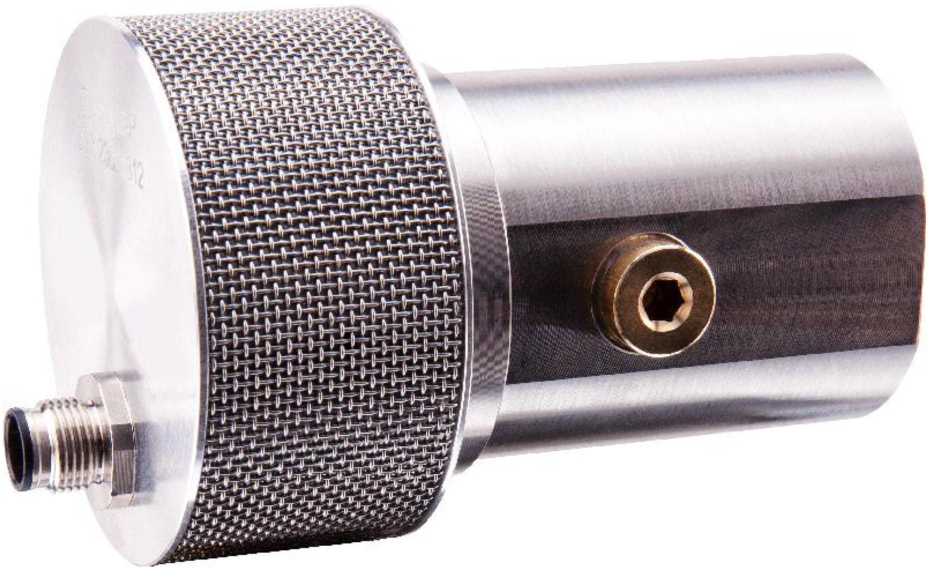

Figure 2: Sensor A19-P

The measuring chamber is connected with the system by means of a connection fitting. In some applications the sample gases need to cross through masonry or isolation materials. In such cases we recommend a sampling pipe made of metal or ceramics. This kind of pipe ensures that the sample gas is being drawn at the desired location and additionally that it is not modified by false air etc. on its way to the sensor.
In cases when there is the possibility of condensate formation, this pipe must ascend towards the sensor, and the gas outlet pipe must descend away from the sensor.
The other sensor port is connected with the point at which the sensor exhaust gases come in. The pressure at this point must be lower than the pressure at the gas inlet so that the gases will flow through the sensor on their way from the gas inlet to the gas outlet.
There are several options to force gas flow:

1. Making use of the overpressure at the sample gas side.
2. Making use of the differential pressure in the system. In this case the differential pressure must have developed between gas inlet and gas outlet.
3. A gas pump pushes or sucks the sample gases through the sensor.

With all methods described, the flow through the sensor must be kept at around 50 litres per hour.
Installing a gas flow meter and a needle valve in the gas pipes may be helpful and necessary. For example, some applications require gas flow control with a gas flow meter equipped with limit contacts.

5 Wiring diagram

Sensor A19-N, A19-P	
Pin 1	Sensor -
Pin 2	Sensor +
Pin 3	Heating
Pin 4	Heating

6 Specifications

	Sensor A19-N/Sensor A19-P
Measuring range	100 % up to 10E-31 bar O2
Ambient temperature	-10 to 80 °C
Max. sample gas temperature	200 °C
Measuring accuracy	+/- 1 mV of the sensor's EMK
Sensor heating-up time	app. 5 minutes
Response time	< 2 seconds
Weight	app. 1 kg
Connection head dimensions	Diameter 70 mm, Height 75 mm incl. plug
Mounting depth	Screw-in thread (A19-N): 30mm incl. thread, Diameter 20 mm M27 x 2 mm. NB ! For gas-tight connections using the A19-N sensor, please use teflon band directly on the thread before screw-mounting the sensor into the application. Avoid using liquid taping materials as this will destroy the sensor. Flow sensor (A19-P): Flow connections: 3/8" (outlet) & 1/4" (inlet), 1/8" optional (inlet)

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