PolyGard® AT-1195 v1

Electrochemical Oxygen Transmitter
Serial No. EC-S – 003_O2

User Manual

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Electrochemical Oxygen Transmitter

1 Intended Use

The PolyGard® O_2 Analog Transmitter AT-92-1195 with 4 – 20 mA output and 2-wire connection is used for the continuous monitoring of the oxygen concentration (O_2) in the ambient air. Main fields of application are in laboratories, food production etc. where changes of the oxygen content are possible.

The sites intended for use are all areas being directly connected to the public low voltage supply, e.g. domestic, commercial and industrial ranges as well as small enterprises.

The PolyGard® O_2 Analog Transmitter is not suitable for the application in areas exposed to explosive hazards.

2 Functional Description

The chemical process of the measurement is based upon the principle of a galvanic micro-fuel cell. The target gas and/or the ambient air diffuse through a filtering membrane into the measuring cell to the cathode. Cathode and anode of the sensor are electrically in contact, therefore due to the oxidation there is an electric current proportional to the oxygen partial pressure. This current is translated into a 4 to 20 mA signal by the succeeding amplifier.

The diffusion through the membrane and the thin electrolytic coating are complex, temperature-dependant, electro-chemical processes which have an influence on the ion current of the sensor. Therefore the sensor is temperature compensated within a specified temperature range.

The electrolyte, the material of the cathode and the composition of the anode are designed in a way that the oxygen diffusing to the cathode is reduced electro-chemically.

The electrolyte is used up by the electro-chemical process. Thus the life expectance of the sensor is limited to two years. Calibration during the sensor life is not necessary.

Option relay package AT-2R:

With the PolyGard AT-2R relay package two potential-free contacts are available for the connection to external devices. The switching thresholds of these relays are selectable via potentiometer in the range of 10 - 90 % of the O_2 concentration. The hysteresis is programmable via jumpers. Additionally the relay mode, open-circuit or closed circuit, is selectable. The status of the two relays is displayed via LED.

Note:

There is a small quantity of corrosive liquid in the sensor elements. If in case of damage persons or objects touch the liquid, you have to clean the affected areas as fast and carefully as possible with tap water. Out of use sensors must be disposed in the same way as batteries.

3 Mounting

Caution:

Electronics can be destroyed by static electricity. Therefore, do not touch the equipment without a wrist strap connected to ground or without standing on conductive floor.

3.1 Mounting instructions

When choosing the mounting site please pay attention to the following:

- Installation 1.5 m to max. 1.8 m above floor-level.
- Select the location of the sensor according to local regulations.
- Consider the ventilation conditions! Do not mount the transmitter in the center of the airflow (air passages, suction holes)
- Mount the transmitter at a location with minimum vibration and minimum variation in temperature (avoid direct sunlight).
- Avoid locations where water, oil etc. may influence proper operation and where mechanical damage might be possible.
- Provide for adequate space for maintenance and calibration work.

Air duct mounting

- Mount only in a duct section with minimum air vortex. Keep a minimum distance of 1 m (3,5 feet) from any curve or obstacle.
- Mount only in a duct system with a maximum air velocity of 10 m/s (2000 ft/min) or less.
- Mounting must be performed so that the airflow is in line with probe openings.

3.2 Installation

- Open cover of enclosure.
- Unplug basic PCB from terminal blocks.
- Fix bottom part by screws vertically to the wall (terminal blocks to the ground).
- Plug in the basic PCB at X4 and X5.
- Replace the cover.

4 Electrical Connection

4.1 Instruction

Consider static electricity! See 3. Mounting.

- Installation of the electrical wiring should only be performed by a trained specialist according to the connection diagram, without any power applied to conductors and according to the corresponding regulations!
- Avoid any influence of external interference by using a shielded cable.
- Recommended cable: Belden Twisted Shielded. maximum resistance 73 Ω/km
- Cable for Relay Package AT-2R: no recommendations.
- When the PBC is mounted, it is important to ensure that the wire shields or any bare wires do not short the PCB.

4.2 Wiring connection

- Open cover of enclosure.
- Unplug basic PCB from terminal blocks X4 and X5.
- Enter cable through hole; connect cable leads to the terminal block.
- Re-plug basic PCB in the terminal blocks X4, X5.
- Close cover.

4.3 Mounting option relay package AT-2R

Consider static electricity! See 3. Mounting.

- Unplug PCB EC- S from terminal blocks fixed on base.
- Plug in the relay package at the multipoint connector X2 to the PCB EC- S. See Fig. 2.
- Secure by the enclosed screw M2,5x 6 at the back side of the PCB EC- S.
- Re-plug basic PCB in the terminal blocks X4, X5.

5 Commissioning

Caution:

Prior to calibration the sensor element must be fully stabilized by applying power voltage for at least one hour without interruption.

Follow commissioning instructions at any exchange of sensor elements.

Only trained technicians should perform the following:

- Check mounting location.
- Check power voltage.
- Check PCB EC-S for correct mounting at X4 and X5.
- Check sensor element (O2 - A2) for correct mounting at terminal X3 of the PCB EC-S.
- Calibration of the transmitter (if not already factory-calibrated)

Required instruments for commissioning of the transmitter:

- Test gas bottle with target gas O_2, in the range of 20 - 25 % vol. (alternatively ambient air with 20,9 % vol.)
- Gas pressure regulator with flow meter
- Sensor calibration adapter with tube. Type: CONKIT-COMB-AT. See Fig. 4
- Digital voltmeter with range 0 - 10V DC, accuracy 1%.
- Screwdriver small.

Caution:

Please observe proper handling procedures for test gas bottles!

5.1 Zero-point calibration

For the zero-point calibration the 4 mA signal is adjusted without the sensor. The zero-point is already factory-calibrated and only in case of exchange of the sensor the zero-point calibration must be carried out again.

- Remove the sensor from X3.
- Connect digital voltmeter to test pin X6 "Test" for zero-point calibration.
- Adjust the value 200 mV with the potentiometer "Zero".
- Ready.
- Plug the sensor in X6 again.

5.2 Gain calibration

- Connect calibration adapter to the sensor element.
- Connect digital voltmeter to the test pin X6.
- Apply span calibration gas 20 – 25 % vol. O_2, (300ml/min,; 1 Bar)

  Alternatively apply ambient air, 20,9 % vol. (only if concentration is known).
- Wait 2 minutes until the sensor is stable, adjust control voltage with potentiometer "Gain" until the signal corresponds to the calculated value, see formula section 5.3 ± 3 mV.
- Remote calibration adapter with a careful light turn. Inspect the correct mounting of the sensor element

5.3 Calculation of control voltage

$$\text{Control voltage (mV)} = \frac{800\ (\text{mV}) \times \text{Test gas concentration } O_2\ (\%\ \text{vol.})}{\text{Measuring range } O_2\ (\%\ \text{vol.})} + 200\ (\text{mV}).$$

Example:

Measuring range O_2	25 % vol. O_2
Test gas concentration	20.9 % vol. O_2
Control voltage	869 mV

$$\frac{800\ (\text{mV}) \times 20{,}9\ (\%\ \text{vol.})}{20.9\ (\%\ \text{vol.})} + 200\ (\text{mV}) = 869\ \text{mV}.$$

5.4 Commissioning of the Option Relay Package AT-2R

Note: Option relay package only possible in 3-wire technique.

5.4.1 Selection of open-circuit/closed-circuit current operation

Each relay can be configured to open-circuit current operation or closed-circuit current operation via jumper. Take the position of the jumpers from the following table.

	Relay R9 Jumper in position	Relay R10 Jumper in position
Closed-circuit mode	9 and 11	20 and 18
Open-circuit mode	10 and 12	19 and 21

Factory-set: Closed-circuit mode

5.4.2 Adjust switching threshold voltage

Required instruments:

- Digital multimeter with range 0 – 10 VDC, accuracy 1%.
- Screwdriver small.

Switching threshold voltage can be adjusted in the range of 1 V – 9 V, 10 % - 90 % of the measuring range.

Adjust switching voltage for relay R 9

- Connect digital multimeter to X9 + and -. Observe polarity!
- Adjust calculated switching voltage ± 10 mV, see section 5.4.3. by potentiometer P9.

Adjust switching voltage for relay R 10

- Connect digital multimeter to X10 + and X9 -. Observe polarity!
- Adjust calculated switching voltage ± 10 mV, see section 5.4.3. by potentiometer P10.

5.4.3 Calculation of switching threshold voltage

$$U_{threshold}\ (mV) = \frac{8000\ (mV) \times \text{alarm threshold } O_2\ (\%\ vol.)}{\text{Measuring range } O_2\ (\%\ vol.)} + 2000\ (mV).$$

Example:

Measuring range O_2	25 % vol.
Alarm threshold O_2	18 % vol.
$U_{threshold}$	7760 mV

$$\frac{8000\ (mV) \times 18\ (\%\ vol.)}{25\ \%\ vol.} + 2000\ (mV) = 7760\ mV.$$

5.4.4 Select switching hysteresis

The switch-off threshold is calculated according to the following formula:

$$U_{off} = U_{threshold} - U_{hysteresis}$$

The switching hysteresis can be selected via jumper to 5% or 10% of the measuring range. Depending on the calculated switching voltage one jumper for each relay has to be plugged into the correct position in order to select either 5% or 10%. See table below for jumper positions.

Calculated threshold voltage (V)	Switching hysteresis (%)	Relay 9 Jumper in position	Relay R10 Jumper in position
1.00 – 3.50	5	7	16
	10	5	14
3.51 – 6.50	5	4	13
	10	6	15
6.51 – 9.00	5	5	14
	10	8	17

Caution

If the calculated voltage is below 1.50 V, it's not allowed to adjust a switching differential of 10%. The triggered alarm relay would not reset.

6 Maintenance and Inspection

6.1 Inspections

For regular examination and calibration of the transmitters by trained technicians we recommend to conclude a service contract with IN*TEC* Wilson Mohr.
Maintenance and inspection has to be done in regular intervals.

6.2 Calibration

(see section 5.1 and 5.2)

- At commissioning and at periodic intervals determined by the person responsible for the gas detection system (recommendation: every 24 months)
- After exchange of the sensor element
- If in case of aging, operational or climatic influences the sensitivity of the sensor falls below 60 % in operation, calibration will not be possible any more. Then the sensor has to be changed.

6.3 Exchange of sensor element

Consider static electricity! See section 3.

Sensor should always be installed without voltage applied

- Unplug basic PCB EC-S carefully from the terminal blocks.
- Unplug old sensor element from the PCB EC - S.
- Take new sensor element out of original packing.
- Plug in sensor element into the PCB EC-S at X3.
- Plug in carefully the PCB EC-C at terminal blocks X4 and X5.
- Calibrate sensor element (see section 5.1 and 5.2).

7 Troubleshooting

7.1 Diagnostics at the transmitter

Trouble	Cause	Solution
Output signal 0 mA and/or control voltage 0V	Power voltage not applied	Measure power voltage at terminal block X4 terminal 3 (+) and 2(-) (18 – 28 VDC)
	Basic PCB EC-S not plugged in correctly at X4 and X5	Plug in the basic PCB EC-S correctly
Output signal < 3 mA and/or control voltage < 150 mV	Sensor element not calibrated	Calibrate sensor element
Control current signal not correct	Sensor sensivity < 40%	Replace sensor element

If faults cannot be eliminated by the above mentioned actions or if other faults not described in this table occur, please contact the service.

7.2 Diagnostics at option relay package AT-2R

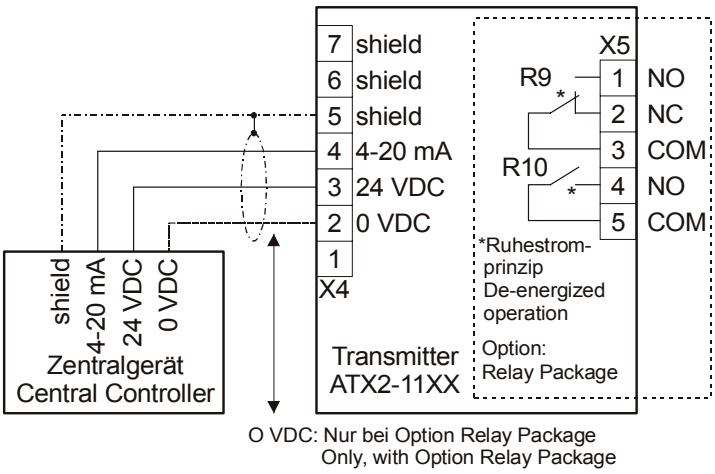
Trouble	Cause	Solution
No relay switching	Board AT-2R not installed correctly	Plug in AT-2R correctly into board
	Jumper JP 9 – 12 and/or 18 - 21 not installed	See fig. 3 for correct setting
Incorrect relay switching	Jumper JP 9 – 12 and/or 18 – 21 not installed correctly (open and closed circuit mode)	See fig. 3 for correct setting
No relay switching at calculated threshold setting	Switching voltage adjusted and/or calculated incorrectly	Check switching voltage
Relay return differential too long	Differential jumper not correct	Check jumper position

8 Technical Data

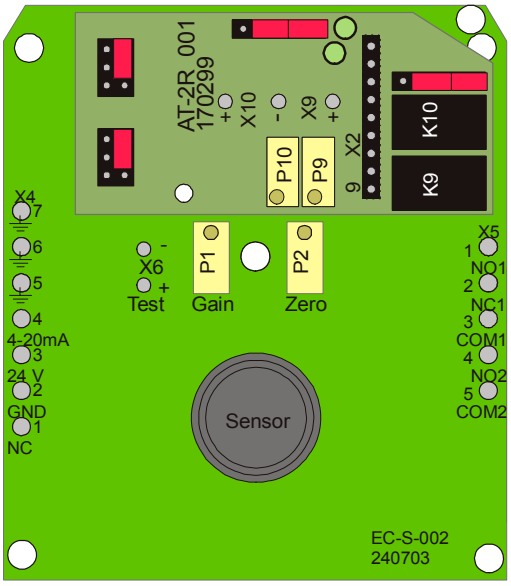
Electrical	
Power supply	18 - 28 VDC, reverse polarity protected
Power consumption	22 mA, max. (0.6 VA)
- with relay package	35 mA, max. (1.0 VA)
Sensor Performance	
Type of gas	Oxygen (O_2)
Sensor element	Electrochemical, diffusion
Measuring range	0 – 25 % vol
Accuracy	0.1 % vol
Long term zero-point drift	< 4 % of measured value /year
Response time	$t_{90} \leq 190$ s from 20.9 % to 0 % O_2
Sensor life expectancy	2 years/normal operating environment
Mounting height	1.5 to 1.8 m
Output signal	
Analog output signal	Proportional, 4 – 20 mA, load ≤ 500 Ω overload and short-circuit protected
Optional	2 x relay contacts, potential-free, max 30 VAC/DC, 0,5 A
Operating Environment	
Humidity Range	0 - 95 % RH non-condensing
Working temperature	-10 °C to + 50 °C
Storage temperature	5 °C to 30 °C
Pressure range	Atmospheric ± 10 %
Physical characteristics	
Enclosure material	Depending on type
Enclosure color	Depending on type
Dimensions	Depending on type
Weight	Depending on type
Protection class	Depending on type
Mounting	Wall mounting, pillar mounting, duct mounting, depending on type
Cable entry	Standard 1 x M 20
Wire connection	Screw type terminal min. 0.25 mm^2, max. 2.5 mm^2
Wire distance	Max. loop resist. 500 Ω (= wire resistor + controller input resistor)
Approvals/Listings	EMV directive 89/336/EWG
	CE
Warranty	One year / material (without sensor)

9 Figures

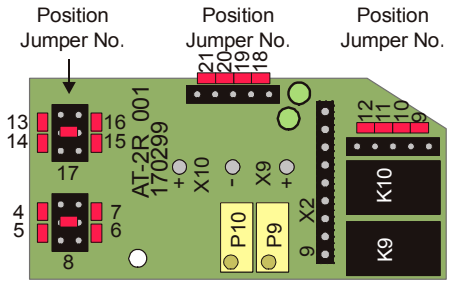
Application
Fig.1



Board PCB/S AT1195
Fig.2



Option Relay Package AT 2R
Fig. 3



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Calibration set-CONKIT-COMB-AT
Fig. 4

10 Notes and General Information

It is important to read this user manual thoroughly and clearly in order to understand the information and instructions. The PolyGard® transmitters must be used within product specification capabilities. The appropriate operating and maintenance instructions and recommendations must be followed.
Due to ongoing product development, MSR and IN*TEC* Wilson Mohr reserves the right to change specifications without notice. The information contained herein is based upon data considered to be accurate. However, no guarantee is expressed or implied regarding the accuracy of these data.

10.1 Intended product application

The PolyGard® O_2 AT-1195 transmitters are designed and manufactured for control applications and air quality compliance in commercial buildings and manufacturing plants.

10.2 Installer's responsibilities

It is the installer's responsibility to ensure that all PolyGard® transmitters are installed in compliance with all national and local codes and OSHA requirements. Installation should be implemented only by technicians familiar with proper installation techniques and with codes, standards and proper safety procedures for control installations and the latest edition of the National Electrical Code (ANSI/NFPA70). It is also essential to follow strictly all instructions as provided in the user manual.

10.3 Maintenance

It is recommended to check the PolyGard® transmitter regularly. Due to regular maintenance any performance deviations may easily be corrected. Re-calibration and part replacement may be implemented in the field by a qualified technician and with the appropriate tools. Alternatively, the easily removable plug-in transmitter card with the sensor may be returned for service to IN*TEC* Wilson Mohr.

10.4 Limited warranty

MSR-Electronic and IN*TEC* Wilson Mohr warrants the PolyGard® transmitters for a period of one (1) year from the date of shipment against defects in material or workmanship. Should any evidence of defects in material or workmanship occur during the warranty period, IN*TEC* Wilson Mohr will repair or replace the product at their own discretion, without charge.

This warranty does not apply to units that have been altered, had attempted repair, or been subject to abuse, accidental or otherwise. The warranty also does not apply to units in which the sensor element has been overexposed or gas poisoned. The above warranty is in lieu of all other express warranties, obligations or liabilities.
This warranty applies only to the PolyGard® transmitter. MSR-Electronic or IN*TEC* Wilson Mohr shall not be liable for any incidental or consequential damages arising out of or related to the use of the PolyGard® transmitters.