Instruction manual

PZA-MC25 electronics unit

EC Declaration of Conformity for PZA series oxygen measurement and control device

This device is designed for industrial use in accordance with:

EN 50081-2
EN 50082-2

It complies with the following directives:
EMC Directive: 2004/108/EC
Low Voltage Directive: 2006/95/EC
Machinery Directive: 2006/42/EC

The device meets the following standards:
EN 61010-1
EN 50081-2
EN 50082-2

Description of the measures taken to ensure conformity:
Quality management system DIN EN ISO 9001:2008, No. 12 100 27736 TMS

This declaration shall cease to be valid if changes are made without our consent.

*** Version 1.1 ***

Contents

1 Safety instructions

	Please read this instruction manual carefully before installing the sensor & module and using it for the first time. Improper use will void any warranty!
	The correct function and operational safety of the module are guaranteed only under the environmental conditions specified in the 'Technical data' section.
	Only qualified and trained personnel should be permitted to start up and operate the sensor & module. The operator of the sensor & module must ensure that all relevant laws and directives are observed. These include EC Directives and national legislation on workplace safety, accident prevention regulations, etc.
	Ensure that the supply voltage corresponds with the specification on the rating plate. Make sure that all the covers required to prevent accidental contact are fitted. If the module is to be connected to other devices and/or equipment, consider the effects before switching the unit on and take all necessary precautions.
	Hot surfaces or components may be exposed in the course of installing or uninstalling the sensor & module. Suitable precautions must be taken in order to prevent injuries or damage.
	If the module shows signs of damage that suggest operating it may not be safe, do not operate the device. We recommend that the device is inspected at our factory or by our customer service department at least once a year.
	At the end of its life, the module must be disposed of in compliance with statutory regulations.

2 Preface

The measuring module is designed to record the partial pressure of oxygen in a gas atmosphere in conjunction with an oxygen sensor. Sensors of this kind work at high temperatures. Precautions should therefore be taken to prevent flammable gas mixtures reaching the sensor or the device. If a fracture appears in the sensor ceramic, sample gases could escape or air could permeate the sample gas. Suitable measures must be taken to prevent damage to the environment and the equipment.

Incorrect parameters, leaks, corrosion, condensation, etc., can damage the equipment and result in faulty readings. Regular maintenance of all parts of the equipment is critical.

The manufacture and testing of our oxygen concentration measurement modules and accessories are subject to continuous quality control in accordance with ISO 9001.
They must only be installed and used in compliance with all applicable local and special regulations. These include the VDE and DVGW standards.
The accuracy and function of the measuring module must be checked at regular intervals that depend on the application. This check must form part of the calibration and inspection procedures carried out following initial use of the module.

3 Introduction

3.1 Measuring principle

Oxygen measuring devices are designed to process signals transmitted by an oxygen sensor made from stabilised zirconia. Zirconia, a ceramic material that is also referred to as a solid state electrolyte, acts as an excellent oxygen ion conductor at high temperatures.
Within certain temperature limits that depend on the doping of the material, ion conductors of this kind are able to fill empty spaces in their crystal lattice with oxygen ions. The oxygen ions form on a conductive contact layer that generally consists of platinum.
The concentration of oxygen in a sample gas indicates the degree of oxygen activity or, in other words, the number of oxygen ions.
A sensor essentially consists 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 sample gas. The mechanical structure of the sensor keeps the two sides separate, preventing the gases from intermingling.
Heated or unheated sensors are used, depending on the application. Unheated sensors are predominantly used in furnaces, while heated sensors are used for applications that involve measuring gas below around 600 degrees Celsius. (The measuring principle dictates a minimum temperature of 500–650 degrees.)
Heated sensors are maintained at a set temperature by a temperature regulator that forms part of the processing electronics. The temperature of both heated and unheated sensors is measured by the electronics and incorporated in the calculation of the oxygen content (partial pressure of oxygen).
The calculation is based on the following equation:

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

whereby:

R = 8.31J/mol K
T = temperature in Kelvin
F = 96493 As/mol
P1 = partial pressure of oxygen on the reference side with 0.20946 bar
P2 = partial pressure of oxygen on the sample gas side
EMF = electromotive force in volts

3.2 Measuring module

The PZA series measuring module features the following functions:

- Measurement of the partial pressure of oxygen in conjunction with a separate Series A sensor. Select the PZA-MC25-N variant for diffusion-based measurements and the PZA-MC25-P variant for flow-based measurements (see separate instruction manual for the Series A sensors)
- Output of the reading 4 to 20 mA
- Alarm signals

Following installation, you can adjust the module's parameters, if required. The module then remains in continuous operation with these settings.

Please note:

If you wish to make extensive changes and display the measured readings, you will need the PZA app for Android smartphones. The APP can be downloaded by using the QR code on the sensor and/or electronics units

3.3 Sensor

To function, the measuring module requires a separate A-series oxygen sensor.
To connect the A-series oxygen sensor, see point 2 under 'Terminal connections' and the separate instruction manual for the A-series sensor.

The chosen A-series sensor and the PZA-MC25 electronic unit are paired together in the factory. The calibration protocol has both serial numbers printed in the protocol.

Never use non-paired sensors and electronic units. This will result in erroneous measurements.

4 General design

4.1 Description of the measurement electronics

The front of the unit is divided into different areas: the LED display, the sensor connector and the terminal strip.

5 Starting up the device

5.1 Switching on the measuring module

The wiring of the measuring module is indicated in the circuit diagram. As soon as the power is switched on, the module is ready to start.

Once the sensor has heated up, the ‘Ready’ LED changes from red to green.
If the current reading is below the set limit, the ‘Alarm’ LED is green. If it is above the limit, a red light indicates a combined alarm.

After the sensor has heated up, the measuring module delivers the reading to the assigned mA output.

5.2 Measurement mode

Once switched on, the module is ready for operation and able to measure the oxygen in gases. Depending on the type of sensor used, the sample gas either has to be fed to the sensor or the sensor has to be placed in the sample gas. For details, see the instruction manual for the sensor.

5.3 Switching off the measuring module

It is advisable to keep the sensor & module in continuous operation. This prevents condensation that could lead to corrosion when using heated sensors.
However, if you do need to switch off the module, you can do this by cutting the power supply to the measuring module.
For details, see the instruction manual for the A-series sensor.

6 Output of readings

The measuring module output the reading in a linear format. The default setting is 0-25% O_2 'linear' at 4-20 mA. Another measuring range (0-1000 ppm O_2) can be activated using a terminal connection jumper. You can switch measuring ranges automatically via a potential-free contact.

Please note:

The assignment is fixed and can only be changed locally using a smartphone app.

7 Configuration

The configuration can be changed locally.
Please note:

If you wish to make extensive changes and display the measured readings, you will need the PZA app for Android smartphones.

7.1 Correcting readings

If necessary, you can correct the current reading. We advise that you only do this if the reading is stable and you have ruled out the possibility of other measuring errors.

The reading can only be adjusted using the PZA app for Android smartphones.

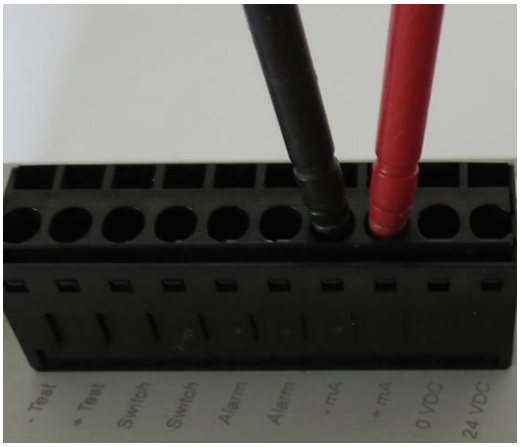
7.2 Setting the limit value

The alarm is activated if the current reading falls below the set threshold. As a rule, the limit value will be within the programmed measuring range. An alarm status is signalled by the Alarm LED.
At the same time, the semiconductor relay that contacts terminals Alarm and Alarm in the terminal connection is activated.

The limit value can only be changed using the PZA app for Android smartphones.

7.3 Practical tip

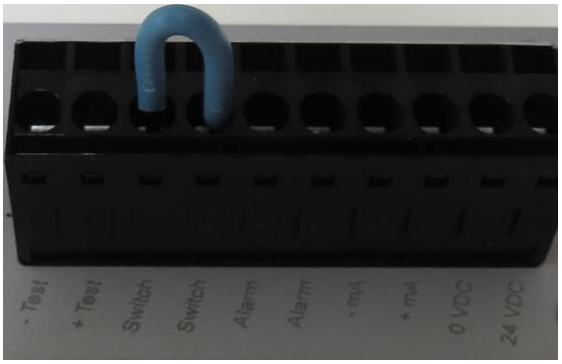
It is often the case that the mA signal is not displayed within comfortable viewing distance of the measuring module. We therefore suggest that you temporarily remove the connections from the '-mA' and '+mA' terminals and connect up a standard portable mA multimeter instead.



You can now make any checks and adjustments you need. After completing the settings, restore your previous connections.

7.4 Defining the analogue outputs

The two measuring ranges for analogue output can be switched using a jumper between terminals 'Switch' and 'Switch'. Or you can switch measuring ranges automatically via a potential-free contact.



8 Interfaces

8.1 Analogue interfaces

There is one 4-20 mA analogue interface.

8.2 Digital interfaces

Semiconductor relay for combined alarm

9 App for Android smartphones

The app allows you to view readings and change configuration settings. First, the measuring module and the smartphone have to be paired via Bluetooth. We recommend how to do this below. However, the procedure may differ slightly with some smartphones.

Image: Example of pairing.
The passkey required is '**1234**'. After entering the passkey, a connection is established between the measuring device and the smartphone.

1. Switch off the power to the measuring module.
2. Switch on the power to the measuring module. The 'BT' LED flashes.
   Please note: Pairing must be completed within 60 seconds of switching on the power supply. The process can then be repeated.
   The following image shows an example of a pairing passkey that is entered in the smartphone menu and activated.

3. Following pairing, the app can be activated on the smartphone.

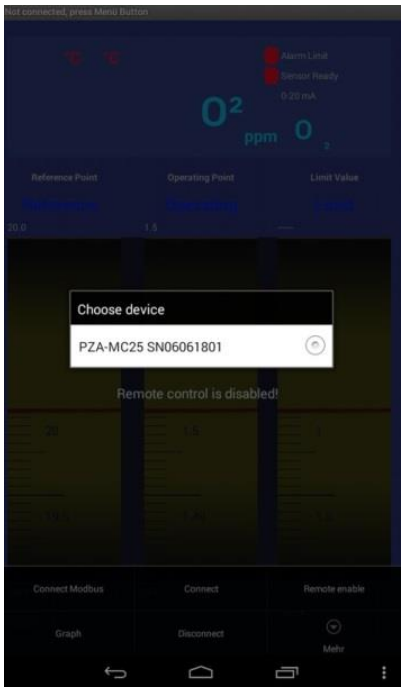
4. Select the Bluetooth module.

The app now launches. To open a message, click on the icon shown on the right.

5. The following display opens.

6. After clicking on ‘Connect’, you will be prompted to choose a device.

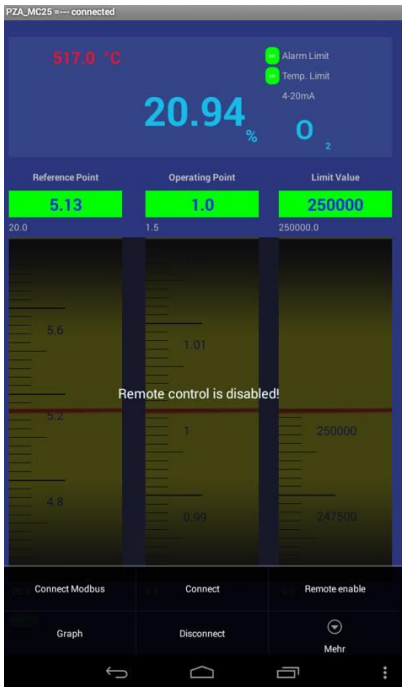
7. Select the correct device.



8. Communication begins after a few seconds and all of the parameters are transferred.

9. The app display shows the current values for Reference Point, Operating Point and Limit Value. You CANNOT make any changes here.
   The ‘BT’ LED on the device lights up in green.

10. To enable parameter changes, click on the arrow icon shown in the centre of the image



Then press ‘Remote enable’.

11. After entering the PIN ‘5678’, parameter changes are enabled.

12. The following display appears:

The display is now much more brightly lit.
ATTENTION! The Reference Point, Operating Point, and Limit Value can now be adjusted. Changing the ‘Reference Point’ and ‘Operating Point’ affects the reading currently displayed and the reading output.
We recommend that you read the ‘Input explained’ section before making the adjustments.

13. If you need to make further changes or see further information, you can call up an additional menu. To do this, click on the icon on the right of the image and then on ‘More’. The following pop-up appears:

If you now select ‘Settings’, a menu appears:

Details of what the various items in this list mean can be found in the ‘Input explained’ section.

10 Input explained

Menu	Explanation	Action
0	Current oxygen reading	Cannot be changed
1	Current temperature reading	Cannot be changed
2	Correction for air flushing Sensor must be at operating temperature and flushed with clean air. The value is corrected until menu item 9 shows zero millivolts	Can be changed
3	Correction for test gas Sensor must be at operating temperature and flushed with test gas. Menu item 2 should precede this stage. The value is corrected until menu item 0 shows the required value.	Can be changed
4	Reading output for 0/4 mA in ppm	Can be changed
5	Reading output for 20 mA in ppm	Can be changed
6	Limit value for alarm in ppm	Can be changed
7	Display for alarm, 0/4-20 mA	Cannot be changed
9	Display for sensor signal in mV	Cannot be changed
10	Display of output value in mA	Cannot be changed
12	Reading output for 0/4 mA in ppm for 2nd measuring range	Can be changed
13	Reading output for 20 mA in ppm for 2nd measuring range	Can be changed
14	Hysteresis for alarm relay in ppm	Can be changed
64	Cable length	Can be changed
80	Display of output status	Cannot be changed

11 Terminal connections

Terminal	Designation	Explanation
24 VDC	+ 24 VDC	Power
0 VDC	- (GND)	Power
+mA	mA+	Reading output +
- mA	mA-	Reading output -
Alarm	Alarm relay	Combined alarm
Alarm	Alarm relay	Combined alarm
Switch	Jumper to Switch terminal	Switch measuring range 1 to measuring range 2
Switch	Jumper to Switch terminal	
9		Test for service
10		Test for service

Please note:
Digital outputs are potential-free semiconductor contacts (1 A, 24 V), mA output is isolated.

12 Technical data

Measuring range	25% to 1 ppm O_2
Ambient temperature	0 to 45 degrees Celsius
Accuracy	+/- 0.3 mV of the sensor EMF +/- 2 degrees Celsius +/- 2% of mA output +/- 2% of the log partial pressure of oxygen
Dimensions	approx. 40 x 130 x 120 mm (h x w x d)
Weight	0.5 kg
Electromagnetic compatibility	The device complies with European Directive 89/336EEC. It meets the following generic standards: Emitted interference EN 50081-1 Interference immunity EN 50082-2. The device can be used without restrictions in domestic and industrial settings.
Mains voltage	24 VDC - note ! Incorrect voltage may cause permanent damage to the module!
Performance	Depends on sensor type, max. approx. 100 VA
Analogue output	4 – 20 mA potential-free
Relay output	For combined alarm, 1 A, 24 V (ohmic)

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