

Manual

Oxygen module FCX-MP1000-Extern-FH-CH



The items mentioned in this manual are trademarks and might be used for identification purpose.

Output protocol

Issue	Month / Year	Valid for Software version
1.1	February 2015	

All rights reserved

This document may be used by the receiver for its designated purposes. It mustn't be copied or translated in any way without special consent in advance.

Technical amendments reserved.

Copyright: Pawatron AG

PEWATRON AG

Thurgauerstrasse 66
8052 Zurich
Switzerland

Tel: +41 (0)44- 877 35 00

Fax: +41 (0)44-877 35 25

info@pewatron.com

www.pewatron.com

Idt.-Nr.

Issue 1.1

Release 2.2015

1 List of Contents

	Page
1. List of Contents	2
2. Customer Service	3
3. Security Information	4
4. Measuring Principle	5
5. Operation Start	6
5.1 Mechanical Installation	6
5.2 Pneumatic Connections	6
5.3 Electrical Connections	7
5.3.1 Supply	7
5.3.2 Analog Output	7
6. Environment Conditions	8
7. Warm Up Time	8
8. Gas Flow	8
9. Calibration	9
9.1 Calibration Adjustment	9
9.2 Calibration Span and Zero	9
10. Important Advice	10
10.1 Restrictions	10
11. Specifications	11

2 Customer Service

We at PEWATRON AG would like to offer the best possible customer service. Should you have any questions, problems or comments regarding your FCX-MP1000-Extern-FH-CH, we would appreciate if you get in touch with us.

We recommend that all services, including repairs of the device, will only be taken care of by either our customer service or by specially trained staff.

You can reach us the following address:

Headquarter:

PEWATRON AG

Thurgauerstrasse 66
8052 Zurich
Switzerland

Tel +41 (0)44-877 35 00

Fax +41 (0)44-877 35 25

E-Mail: info@pewatron.com

Internet: www.pewatron.com

Before returning anything, please ask for an RMA-No.

Tel +41 (0)44 877 35 15

Please send return goods to our Logistic Center:

PEWATRON AG


Logistic Center
Hardhofstrasse 31
8424 Embrach/ZH
Switzerland

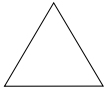
3 Security Information

Safety hazards that can endanger humans or do damage to the devices are specially mentioned in the user manual.

Before installing the device you should read the instructions carefully. Please take note of all paragraphs that point out possible hazards.

Warnings and instructions are expressed as followed:

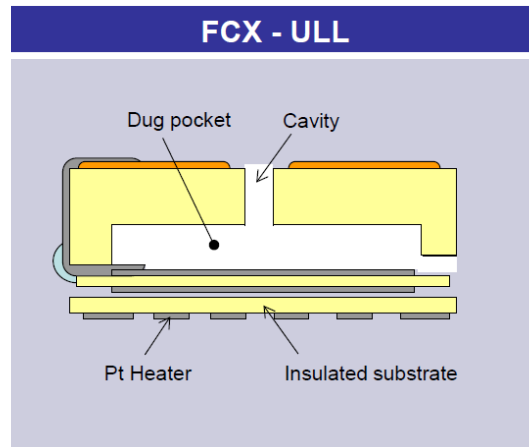
 Warning	Means that ignoring this instruction can endanger humans
---	--

 Attention	Means that this instruction has to be followed in order to prevent damage to the device
---	---

4 Measuring Principle

The sensor module is a complete solution for measuring oxygen within the range of 0...1000 ppmO₂. The sensor and the electronics are connected via board. The sensor is encapsulated in a pressure tight flow housing. The electronics amplify the sensor signal and transform it into a linear current output signal 4...20mA (according to IEC 60381)

In the picture below the schematics of zirconia sensing elements are shown.



Zirconium oxide, heated to about 450 °C, is penetrable for oxygen ions. A voltage applied to the sensor therefore pumps the oxygen out of the inner chamber. At a constant gas pressure, the quantity of oxygen pumped out is equal to the quantity of oxygen molecules diffusing in through the capillary, and within a certain range it is independent of the voltage applied between the electrodes. The measurement current is proportional to the quantity of oxygen molecules pumped away. The relationship between the oxygen partial pressure and sensor current is governed by the formula

$$I_L = (A/1000) \times [O_2\text{ppm}],$$

where

I_L = sensor current

A = sensor output current in 1000ppm O₂ (μA)

pO₂ = oxygen concentration (vol ppmO₂)

The sensor module performs four tasks:

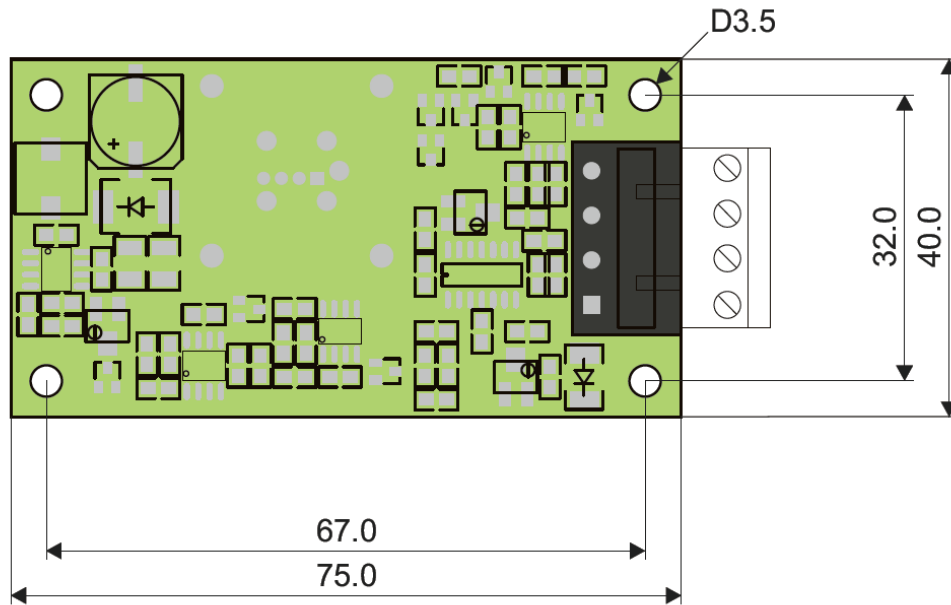
- Regulation of the heating power of the sensor
- Amplification of the microampere signal from the sensor
- Linearization of the relation between oxygen partial pressure and sensor current
- Conversion of the amplified signal into a standardised current output signal

The sensor and module are calibrated to one another at the factory. The heating voltage must be custom-adjusted for each sensor to bring the temperature to exactly 450 °C. The sensor is not directly replaceable, and cannot be used with other modules.

5. Operation Start

5.1 Mechanical Installation

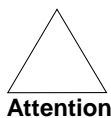
The dimensions of the board are 75 x 40 mm.
On every corner are mounting holes with a diameter of 3,5 mm.



The board holds highly sensitive switches. While installing make sure that no components get damaged mechanically

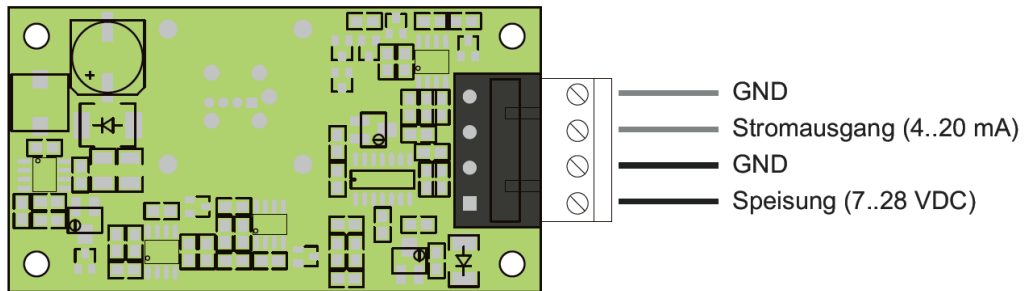
5.2 Pneumatical Connections

The flow housing has two pressure ports with 6 mm diameter. The flow direction is from the top part (with the bulb-form appearance) to the bottom part where the sensor connecting wires comes out.



Do never use silicone tubes.

5.3 Electrical Connections



5.3.1 Supply

The module gets supplied with 7...28VDC through the clamps 1 (+) and 2 (-), approx. 200mA (24VDC).

5.3.2 Analog Output


For the output signal the clamps 3 (+) and 4 (-) can be used.

6 Environment Condition

Also see item 11 in our specifications, especially for the temperature and humidity range (non-condensing).

- Not to be operated outdoors.
- Protect the module against humidity
- The sensor is best operated in oxygen concentrations below 1000 ppmO₂, but can see short periods of atmospheric oxygen (20.9 vol%O₂). Continuous exposure (> 2 min) of the sensor with oxygen concentrations above 1 vol%O₂ slows the sensor response and limits the lifetime of the sensor.

The temperature of the sensor is 450°C. Be aware of possible dangers while handling sensitive gas mixtures.

 Warning	Potentially explosive Atmosphere The device mustn't be opened in a potentially explosive atmosphere.
---	--

7 Warm Up Time

The modules need a warm up time of approx. 3 minutes

8 Gas Flow

The following points should be noted:

- The flow should not be less than 0.1 l/min and no greater than 1.0 l/min; ideally, it should be 0.5 l/min.
- We recommend placing an appropriate filter upstream of the module, since contaminants brought in by the flow can significantly shorten the service life of the sensor.
- Avoid condensation (H₂O) in the sensor housing.

9 Calibration

All necessary adjustments and calibrations are being done at the production site.
The output signal is to be read as followed:

$$pO_2 \text{ (ppm)} = 1000 \text{ (ppm)} (I_{out} [mA] - 4 [mA]) / 16 [mA]$$

means:

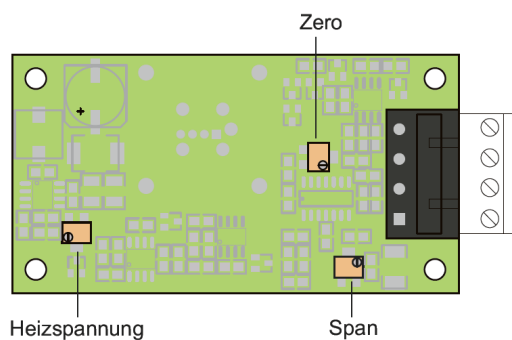
pO_2 : oxygen partial pressure in ppm of the total pressure
 I_{out} : output current in mA

9.1 Calibration Adjustments and Periodical Check-ups

It is recommended to check the device periodically by running it under regular lab conditions and flush the sensor with pure nitrogen (6N) to check the zero-point. After flushing the sensor for 1 minute the output current should be 4.005 +/-0.005 mA.

9.2 Adjustment Span and Zero

The modules are calibrated and each module is supplied with a calibration sheet. The result of the measuring at an environmental temperature of 25°C and in pure nitrogen should be 0+/-50 ppm. Should there be higher differences as expected try following procedure.



- 1 Attach the module to the supply
- 2 Expose the sensor with a gas with known concentration and in the range 1000+/-10 ppm.
- 3 After 10min. adjust the output signal using the span potentiometer. In a clean environment the amplifier should have an output signal of 20,00 mA ($\pm 0,05$ mA).
- 4 Flow pure N₂ (6N).
- 5 After approx. ca. 10min. adjust the output signal to 4,050 mA $\pm 0,05$ mA using the zero potentiometer.

This completes the calibration.

10 Important Advice

10.1 Restrictions

- 1 Don't separate the sensor from the circuit board.
- 2 Don't change the length of the lead wires.
- 3 Do not continuously operate the sensor in a high oxygen concentration ($> 0.1 \% O_2$)
If the sensor is exposed to such high oxygen concentration, limited output over 20mA will be observed. Should this happen, please turn off the power source.
- 4 Please use regulated DC power source with current capacity over 1 ampere/pc. If current capacity is not sufficient, the sensor module will not operate correctly.
- 5 This sensor module was adjusted for O_2-N_2 system, so abnormal output maybe observed if there are other gases present.
- 6 Don't use in a gas that contains the halogen atoms (F, Cl, Br) such as the flon gas. The sensor will be damaged by decomposition of the flon gas.
- 7 SO_x , NO_x und H_2S will damage the performance of the sensor. Therefore, please do not use sensor module in the atmosphere that contains these gases.

11 Specifications

Measurement Ranges	: 0...1000 ppmO ₂
Supply	: 24 VDC nominally (7...28 VDC)
Current supply	: typ. 200 mA (24 VDC). Turn off peak approx. 0,7 A
Power Consumption	: 2 W
Output	: 4...20 mA, linear
Accuracy	: ±50 ppmO ₂
Repeatability	: ±5% Reading
Temperature Influence	: measuring faults [in % pO ₂] ~ pO ₂ [% x (T _e [°C] – 25°C) / 500 T _e = environmental temperature of the sensors
Response Time	: < 8 sec. T ₉₀
Gas Temperature	: -10...+50 °C
Environmental temperature	: -20...+70 °C
Humidity	: 85% RH non-condensing
Dimensions L x W x H	: 75 x 40 mm
Weight	: 100 g

We are here for you. Addresses and Contacts

Sales Switzerland & Liechtenstein

Matthias Rüegg
Ruhbergstrasse 32
CH-9230 Flawil

Phone +41 44 877 35 18
Mobile+41 76 491 66 66
Fax +41 44 877 35 19

matthias.rueegg@pewatron.com

Sales International Key Accounts

Peter Felder
Thurgauerstrasse 66
CH-8052 Zürich

Phone +41 44 877 35 05
Mobile+41 79 406 49 83
Fax +41 44 877 35 25

peter.felder@pewatron.com

Sales Germany

Postcode 10000–59999
Postcode 80000–99999

Kurt Stritzelberger
Neumarkter Str. 86a
D-81673 Munich

Phone +49 89 260 38 47
Mobile+49 171 803 41 35
Fax +49 89 43 10 91 91

kurt.stritzelberger@pewatron.com

Postcode 60000–79999

Dieter Hirthe
Auf der Entenweide 4
69502 Hemsbach

Tel. +49 6201 508 9250
Mobil +49 1637 627 430
Fax +49 6201 508 9751

dieter.hirthe@pewatron.com

Sales Austria

Kurt Stritzelberger
Neumarkter Str. 86a
D-81673 Munich

Phone +49 89 260 38 47
Mobile+49 17 18 03 41 35
Fax +49 89 43 10 91 91

kurt.stritzelberger@pewatron.com

Sales Other Countries / Product Management

Sensors

Physical Sensors
Data Acquisition

Thomas Clausen
Phone +41 44 877 35 13
thomas.clausen@pewatron.com

Geometrical Sensors

Eric Letsch
Phone +41 44 877 35 14
eric.letsch@pewatron.com

Power Supplies

DC-DC Converters
Switching Power Supplies
DC-AC Inverters

Sebastiano Leggio
Phone +41 44 877 35 06
sebastiano.leggio@pewatron.com

E-Components

Current Sensors
Man Machine Interface
Measurement Probes

Sebastiano Leggio
Phone +41 44 877 35 06
sebastiano.leggio@pewatron.com

PEWATRON AG
Thurgauerstrasse 66
CH-8052 Zurich

Phone +41 44 877 35 00
Fax +41 44 877 35 25

www.pewatron.com
info@pewatron.com