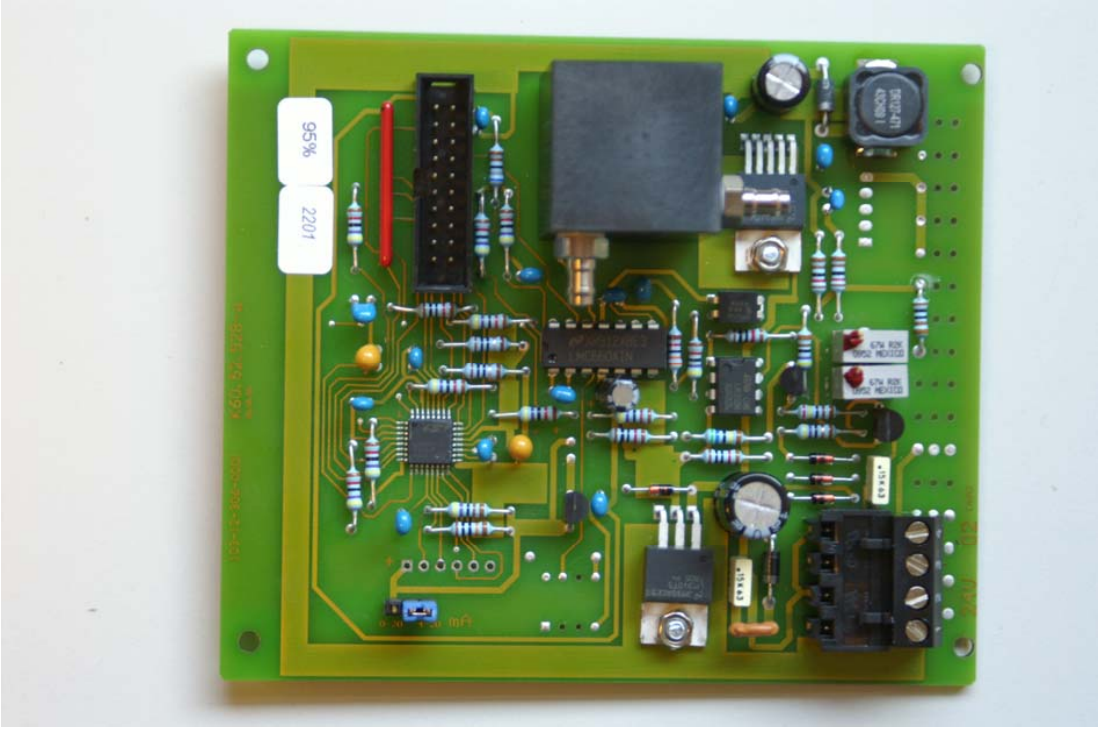
Manual

Oxygen module
FCX-MCxx-CH



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Output protocol

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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-MCxx-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:

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Please send return goods to our Logistic Center:
Before returning anything, please ask for an RMA-No.

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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

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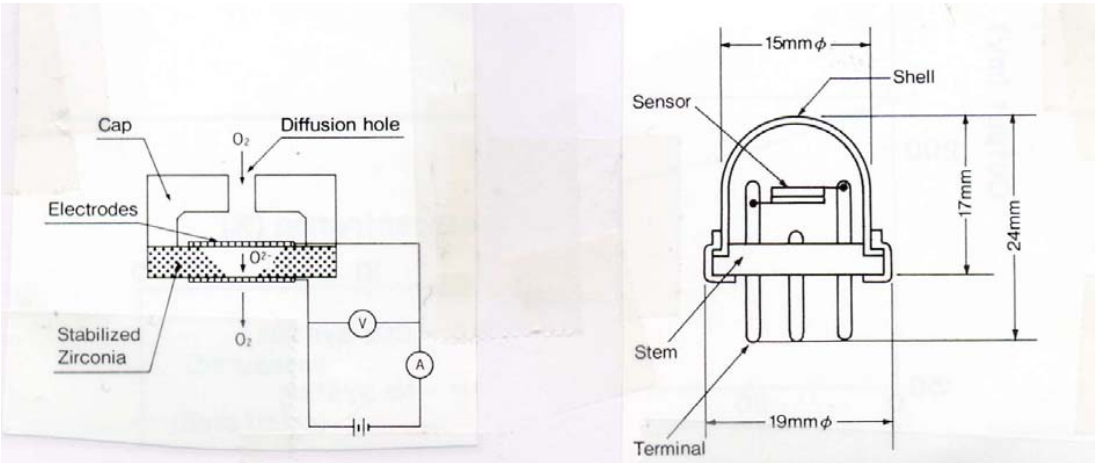
4 Measuring Principle

The sensor module is a complete solution for measuring oxygen within the range of 0,1...25% or 0,2…95%. The sensor and the electronics are united on one board. The microcontroller lineralizes the sensor signal and puts it out as analogical current. (output signal 0/4…20mA according IEC 60381)

Principle sketch of the O_2 Limiting-current sensor



The zirconia is pervious to oxygen ions when heated up to approx. 450°C. Therefore the oxygen gets pumped off a cavity by a current attached to the sensor. During a constant gas pressure the amount of pumped-off oxygen equals the amount of the through the capillaries post-defunded oxygen molecules and within a certain range independent of the current attached between the electrodes. The measure current is proportional to the amount of the pumped-off oxygen molecules. The link between oxygen partial pressure and sensor current is according to the following formula:

$$I_s = c\ I_n\ (1 - pO_2 / pt)$$

means:

I_s = sensor current
c = constant (sensor specific)
pO_2 = oxygen partial pressure
pt = gas pressure (total)

The sensor module takes care of two jobs:

- Linearizing of the link between oxygen partial pressure and sensor current
- Regulation of the heating performance of the sensor

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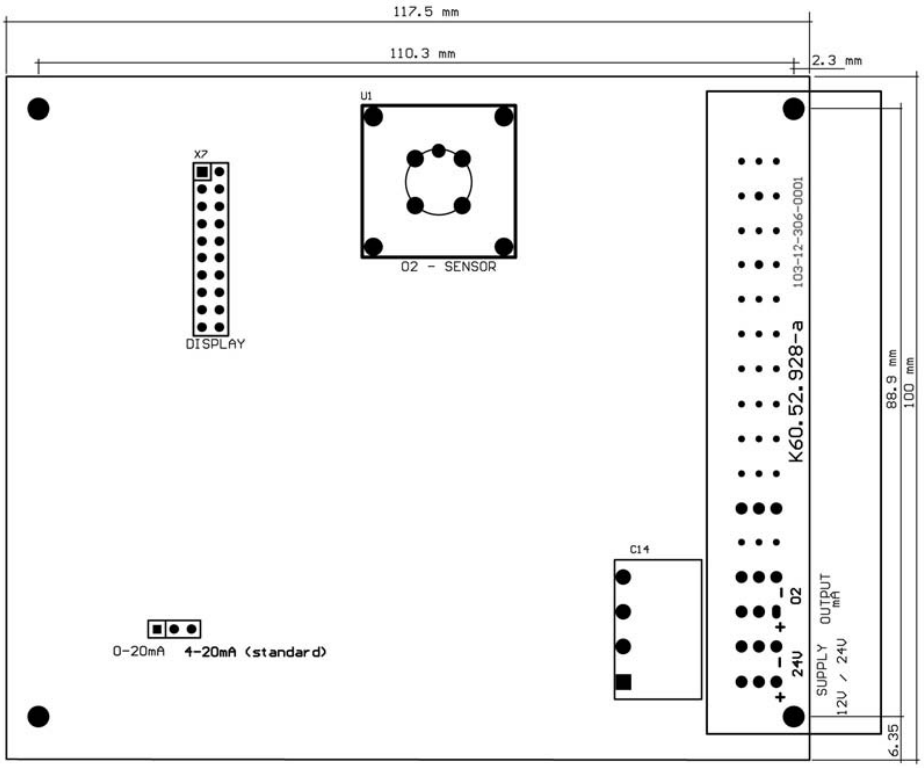
5 Operation Start

5.1 Mechanical Installation

The dimensions of the board are 117,5 x 100 x 28mm.
On every corner are mounting wholes with a diameter of 3,0 mm.



Attention	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 5mm diameter. The direction of the flow isn't important.

Attention	**Do never use silicone tubes.**

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5.3 Electrical Connections

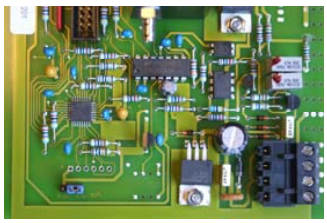
5.3.1 Supply

The module gets supplied with 11,5...28VDC through the clamps 1 (+) and 2 (-), approx. 250mA (24VDC).

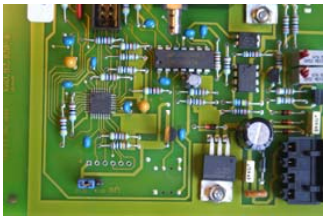
5.3.2 Analog Output

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

The module can be run by an output of 4...20mA or 0...20mA (3 Pin plug)..



4...20mA

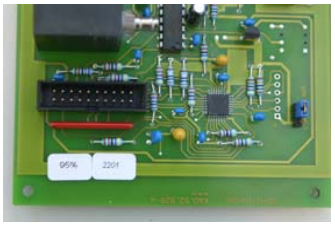


0...20mA

At 0...20mA with the help of an external shunt of 500Ω, and a minimal supply current of 15VDC, an output signal of 0...10VDC can be achieved.

5.3.3 Interface

At a interface the separately available display box can be attached to correct ZERO an SPAN.
See 9.1 Calibration adjustments.



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5.3.4 Connector DIN 41612-F

Optional the module can be supplied with a DIN 41612-F connector.

Supply	+	32 d, b, z
Supply	-	30 d, b, z
Output	+	28 d, b, z
Output	-	26 d, b, z

6 Environment Condition

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

- Not to be operated out doors.
- Protect against humidity

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 module need a warm up time of approx. 5 minutes

8 Gas Flow

Heed the following points:

- The flow should not be smaller than 0,1 and not larger than 3,0l/min. Optimal 0,5l/min
- We recommend to use a suitable filter, since the gas flow can contaminate the sensor, which will shorter its life span considerably.
- Avoid condensation (H_2O) inside 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:

0...20mA pO_2 (%) = 25 I_{out} (mA) / 20
4...20mA pO_2 (%) = 25 (I_{out} [mA] - 4) / 16

means:

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

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9.1 Calibration Adjustments

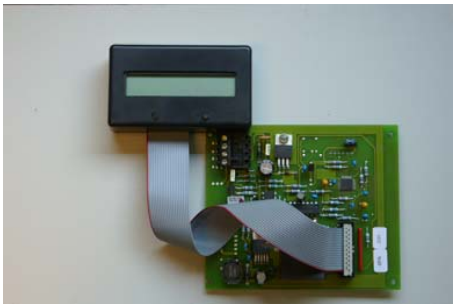
It is recommended to check the device periodically by running it under regular lab conditions and rinse the sensor with regular air (20,95% O_2).

Tip:

Rinse with air approx. 0,5l/min.. The result of the measuring at an environmental temperature of 25°C should be 20,95% O_2 ±0,1% O_2. Should there be higher differences, please send the device in for checking and possible re-calibration.

Achtung	**The potentiometers on the boards mustn't be tempered with.**

Authorized users may adjust through the display-box SPAN and ZERO as followed:



9.2 Setting via Display Box

- supply to the module must be switched off
- attach the display to the board
- switch on the supply
- the reading on the display must read:
  Version nnn e.g. 108 ➔ Version 1.08

than:

9.2.1 FCX-MC25-CH

ze = nnn	**sp** = nnn	factory setting: ZERO and SPAN (typical approx. 100) **Always note down these figures before setting**

- hold both buttons for approx. 6 seconds; if the display changes its reading, release immediately
- the display will read:

z nnn	p.pp	nnn = set value	p.pp = % O_2 rate Setting ZERO via +/-button. The calibration gas should be <10% (1% ideally)

- by pressing both buttons again, SPAN will get switched, release buttons immediately
- the display will read:

s nnn	pp.pp	nnn = set value	pp.pp = % O_2 rate Setting SPAN via +/-button. The calibration gas should be >18% (20,95% ideally)

By pressing both buttons the setting is complete

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9.2.2 FCX-MC95-CH

ze = nnn	**sp** = nnn	factory setting: ZERO and SPAN (typical approx. 100) **Always note down these figures before setting**

- hold both buttons for approx. 6 seconds; if the display changes its reading, release immediately
- the display will read:

z nnn	p.pp	nnn = set value p.pp = % O_2 rate Setting ZERO via +/-button. The calibration gas should be <25% (20,95% ideally)

- by pressing both buttons again, SPAN will get switched, release buttons immediately
- the display will read:

s nnn	pp.pp	nnn = set value pp.pp = % O_2 rate Setting SPAN via +/-button. The calibration gas should be >80% (90% ideally)

By pressing both buttons the setting is complete

10 Important Advice

10.1 Restrictions

Gas mix with admixtures which react with oxygen can lead to incorrect readings

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11 Specifications

Measurement Rangs	: 0,1...25% or 0,2...95% O_2
Supply	: 24VDC nominally (11,5...28VDC)
Current supply	: typ. 250mA (24VDC). Turn off peak approx. 0,7A
Power Consumption	: 3W
Output	: adjustable 0 / 4...20mA With 500Ω min. 15VDC Supply
Resolution	: input side : 10bit AD Output side : 11bit DAC
Accuracy	: ±0,5%FS
Stability	: ±0,5%FS/Year
Repeatability	: ±1% 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	: <30 sec. T_{90}
Gas Temperature	: -10...+50°C
Environment Temperature	: -20...+70°C
Humidity	: 98% r.h. non condensing
Dimensions L x W x H	: 117,5 x 100 x 28mm
Weight	: 200g

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