

# 4-20 mA Transmitter Board for Electrochemical Gas Sensor

## Suitable for Miniature-Sensors (Pin layout: 4-Series)

### Application

Membrapor's analogue transmitter boards are suited for measurements **in ppm- to low-%-levels** (nominal range > 5 ppm) but not for ppb-level measurements. The boards are configured according to the output and type of gas sensor used.

Transmitter boards for gas sensors requiring a bias voltage are equipped with an additional potentiometer. Please contact the technical support ([sensor@membrapor.ch](mailto:sensor@membrapor.ch)) if you have any doubts about the correct choice for your application.

### Technical specifications

Supply voltage	12 – 36 VDC <sup>1</sup>
Output at zero gas concentration	4 mA (40 mV)
Output at full-scale	20 mA (200 mV)
Sockets plating	Gold
Compliance	RoHS-compliant
Weight	~ 18 g

Tab. 1: Technical specifications of transmitter board

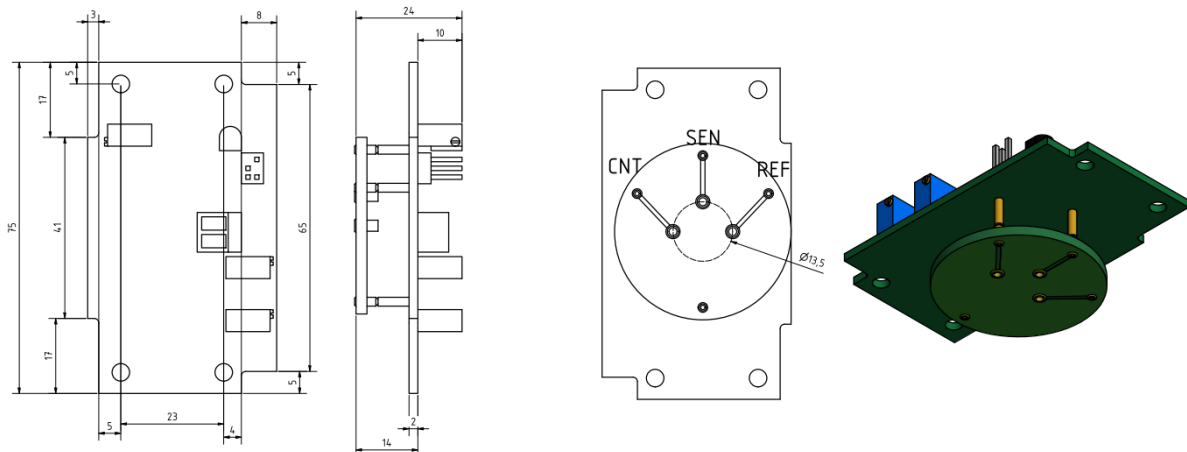


Fig. 1: Transmitter dimensions

<sup>1</sup> For sensors requiring a bias voltage the transmitter supply voltage should always be > 12 VDC.

## Operating transmitter with voltage output

**Note: Pay attention to the correct polarity to avoid damaging the transmitter!**

Connect the supply voltage to the connector (V/C) and the transmitter becomes immediately operable. On unpowered transmitter boards connected sensors will be short-circuited between sensing and reference electrode. This does not only apply to transmitter boards for sensors with bias voltage.

The voltage output signal can be measured between pins 1 and 2. The output signal has a linear range from 40 mV and 200 mV, respectively.

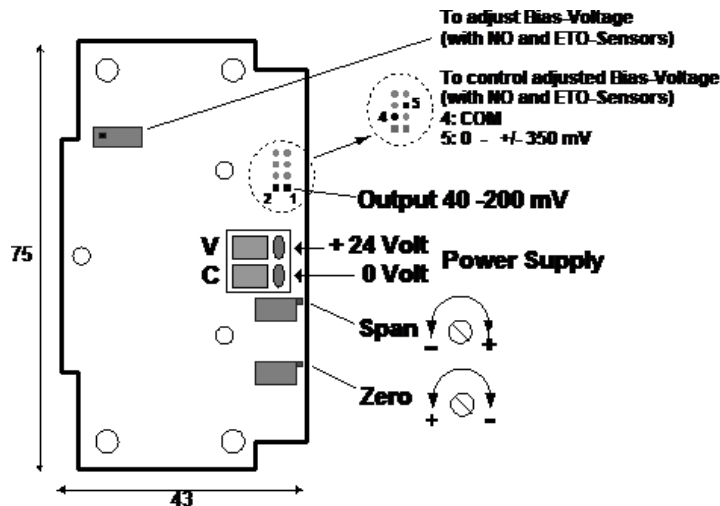


Fig. 2: Operating transmitter with voltage output. For illustration purposes a supply voltage of +24 VDC is used.

## Operating transmitter in current mode

The transmitter can be operated in a 2-wire mode. The drawn current (4-20 mA) is proportional to the sensor signal. This setup is widely used in (multi-channel) gas detectors.

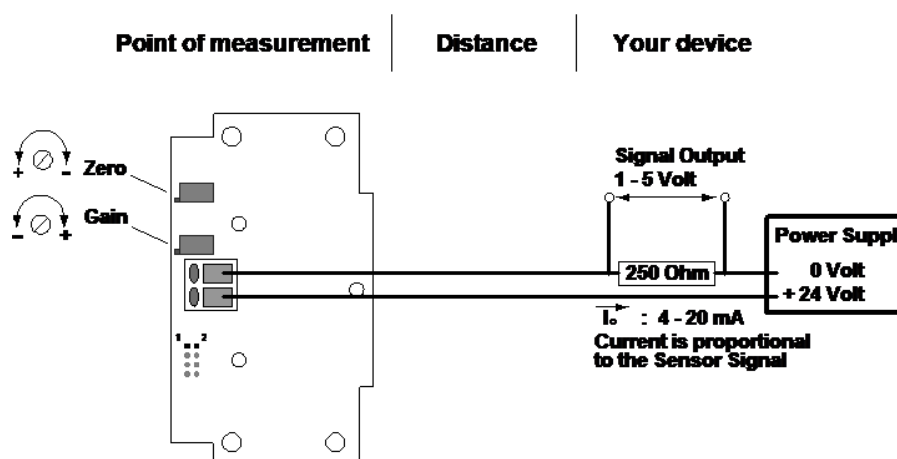


Fig. 3: Operating transmitter in current mode. For illustration purposes a supply voltage of +24 VDC and a load resistor of 250  $\Omega$  are used.

# Calibration

## General recommendations

- **Flow rate:** The gas flow rate strongly depends on the geometry and construction (volume, materials) of the gas sampling system. For calibrations we recommend using a flow rate of 300 – 1000 ml/min.
- **Calibration gas:** For the most accurate calibration results, the target gas must be used. In the case a surrogate is used, please refer to the cross-sensitivity table in sensor data sheet. Note that the value depicted in the cross-sensitivity table in the sensor data sheets represent average values recorded across many sensor batches. For an individual sensor, the value can slightly vary.
- **Conditions:** We recommend performing the calibrations at 20°C, a relative humidity range of 30 – 50% and standard atmospheric pressure.

For more information on the operation of Membrapor gas sensors, please refer to [Application Note MEM1](#).

## Procedure

1. Remove the short-cutting spring mounted on the outside of the sensor. Sensors requiring a bias-voltage are delivered without such a spring. Plug the sensor onto the transmitter board.
2. To obtain an accurate zero point of 40 mV (4 mA), the potentiometer zero must be adjusted accordingly. We recommend purging the sensor with synthetic air for at least 3 minutes and then adjust the zero line.
3. The amplification is adjusted when the target gas is applied to the sensor. Use at least 50% of the sensor's full-scale concentration to obtain an accurate result. Tab. 2 contains the expected output signal depending on the target gas concentration with respect to the full-scale of the sensor.

Target gas concentration w.r.t to full-scale of sensor [%]	Transmitter output voltage [mV]	Transmitter output in 2-wire mode [mA]
50	120	12.0
60	136	13.6
70	152	15.2
80	168	16.8
90	184	18.4
100	200	20.0

Tab. 2: Transmitter output as a function of the target gas concentration w.r.t to the sensor's full-scale in %.

## Transmitter configuration

### 1. Transmitter Board (TB) Pin Layout

Sensor housing	Code
<u>C</u> ompact	TBC
<u>M</u> iniature	TBM
<u>S</u> tandard, <u>S</u> lim	TBS

Tab. 3: Transmitter board pin layout code

### 2. General configuration

The code is composed of two letters and two numbers.

- Position 1: **N** (normal) or **B** (bias)
- Position 2: **1** ( $R_{load} = 10 \Omega$ ) or **3** ( $R_{load} = 33 \Omega$ )
- Position 3: **X** (oxidation) or **R** (reduction)
- Position 4: Amplification **1**, **2** (basic configuration), **3** or **4**

### 3. Coding of amplification

The maximal amplification  $G$  is where the potentiometer *span* is fully turned clockwise. The maximal current  $i_{max}$  is the current a given sensor produces at its full-scale concentration. **The amplification factors in Tab. 4 were determined for oxidation configurations.** Slight variations can occur for the reduction configuration.

Code	Max. amplification factor $G$	For max. sensor current $i_{max}$ [ $\mu A$ ]
1	600	150 – 700
2	1600	16 – 220
3	10000	13 – 30
4	11000	2 - 25

Tab. 4: Amplification factors for oxidation configuration with corresponding  $i_{max}$  and number code.

### 4. Example

The H<sub>2</sub>S/C-200 sensor has a specified sensitivity of  $370 \pm 80$  nA/ppm and a nominal full-scale range of 200 ppm. Therefore,  $i_{max} = (370 \text{ nA/ppm}) \cdot (200 \text{ ppm}) = 74 \mu A$  which would result in a recommended transmitter configuration TBC/N3X2.