METROTEC

Systeme zur Messung und Regelung von Sauerstoff

Operating instructions

GSM basic-touch

Oxygen Measuring Device

GSM Series

*** Version 1.0 ***

EC Declaration of Conformity

for

Oxygen Measuring Device Type GSM basic-touch

This device has been designed for industrial purposes in accordance with:

EN 61000-6-4
EN 61000-6-2

It is compliant with the directives:
EMC Directive: 2014/30/EU
Low-voltage Directive: 2014/35/EU
RoHs: 2011/65/EU

This device complies with the following standards:
EN 61010-1
EN 61000-6-4
EN 61000-6-2
EN 63000

Description of measures taken to assure compliance:
Quality management system DIN EN ISO 9001:2015, No. 12 100 27736 TMS

This declaration becomes invalid if changes are made without our consent.

Kirchheim/Teck, 11.08.2025

Place, Date | Signature

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1 Safety Instructions

	Please read these operating instructions carefully before installing and using the device. Improper use of the product will invalidate the warranty!
	The ambient conditions described in the Specifications chapter must be complied with in order to ensure the device's proper functioning and operational safety.
	The device may only be started up and operated by qualified and trained personnel. The operator of the device must ensure that all applicable regulations and guidelines are complied with. These are, among others, the EU Directive on work safety, national work safety legislation, accident prevention regulations, etc.
	Please ensure that the supply corresponds with the information given on the type plate. All coverings necessary to provide touch protection must be installed. In case the device is interconnected with other devices and/or installations, the consequences must be considered and appropriate precautions taken before switching the device on.
	In some cases, hot parts or surfaces may be unprotected during or after installing or uninstalling the device. Appropriate precautions must be taken to avoid injuries and/or damage.
	In case the device shows defects which suggest that it will not be possible to operate it safely, it must not be put into operation. We recommend to have the device inspected at least once a year at the factory or by a customer service representative.
	Disposal of the device must be performed according to the applicable regulations.

2 Preface

The measuring device serves for recording oxygen partial pressures in gas atmospheres in connection with an oxygen sensor. Such sensors operate at high temperatures. Therefore, precautions must be taken to keep ignitable gas mixtures from reaching the sensor or the device. In case of the sensor ceramic breaking, sample gases may leak or air may enter the sample gas side. Should this occur, applicable measures must be provided for to protect the environment and device parts from damage.

Wrong entries, leaks, corrosion, condensation, etc. may cause damage of the plant and erroneous measurements. It is vital to have all parts of the system maintained regularly.

The oxygen meters and the attachments have been produced and controlled subject to complete quality assurance in accordance with DIN EN-ISO 9001.
Installation and operation must be performed subject to compliance with all local and special regulations. These particularly include VDE and DVGW requirements.
Depending on the application, a periodic inspection of the measuring device in terms of measuring accuracy and function may be required and must be performed in the course of calibration and inspection procedures after initial commissioning.


METROTEC
GSM basic-touch
Ready Limit alarm
20,94 %
-0,67 log

3 Introduction

The GSM basic-touch is a user-friendly measuring instrument for the detection of oxygen partial pressures. The applied measuring principle, with a measuring span of more than 30 decades, allows for the measuring of high concentrations to very small traces.

3.1 Measuring Principle

Oxygen measuring devices are designed to process signals received from an oxygen sensor made of stabilized zirconium dioxide. Zirconium dioxide, a ceramic also referred to as solid state electrolyte, is perfectly suited to serve as an oxygen-ion conductor at high temperatures.
Within a certain temperature range depending on the doping of the material, ion conductors of this type are able to fill vacancies in their crystal lattices with oxygen ions. The oxygen ions form itself on a conductive contact layer, which usually consists of platinum.
Thus, the oxygen concentration in a sample gas is essential for the extent of oxygen activity and accordingly the number of oxygen ions.
The basic structure of a sensor revolves around a solid state electrolyte which is contacted on both sides. One side of the electrolyte is operated by a reference gas, such as air, the other one with sample gas. The mechanical structure of the sensor separates the two gas sides from each other, so that the gases cannot mix.
Heated sensors are adjusted to a certain target temperature by means of a temperature controller integrated in the processing electronics. The temperature of heated and unheated sensors is measured by the electronic unit and is an essential element in the calculation of the oxygen level (oxygen partial pressure).
The value is calculated by means of the following formula:

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

whereby

R	=	8.31J/mol K
T	=	Temperature in Kelvin
F	=	96493 As/mol
P1	=	Oxygen partial pressure on the reference side with 0.20946 bar
P2	=	Oxygen partial pressure on the sample gas side
EMF	=	Electromotive force in Volt

3.2 Measuring Electronics

The GSM-touch measuring device electronics features the following functions:

- ✓ Measuring the oxygen partial pressure
- ✓ Display of the oxygen partial pressure optionally as a graph
- ✓ Generation of alarms, visual and acoustic
- ✓ Analogue output for output and evaluation of the measured values
- ✓ Measurement by sucking the measuring gas from a measuring chamber with the built-in gas pump or overpressure from a gas cylinder or similar. When the gas pump is switched off, the measuring gas is passed directly through the sensor without mechanical influence of the gas pump.

The measuring device is operated via a touchscreen.
Inputs and outputs are preselected and configured by the operator via menus.

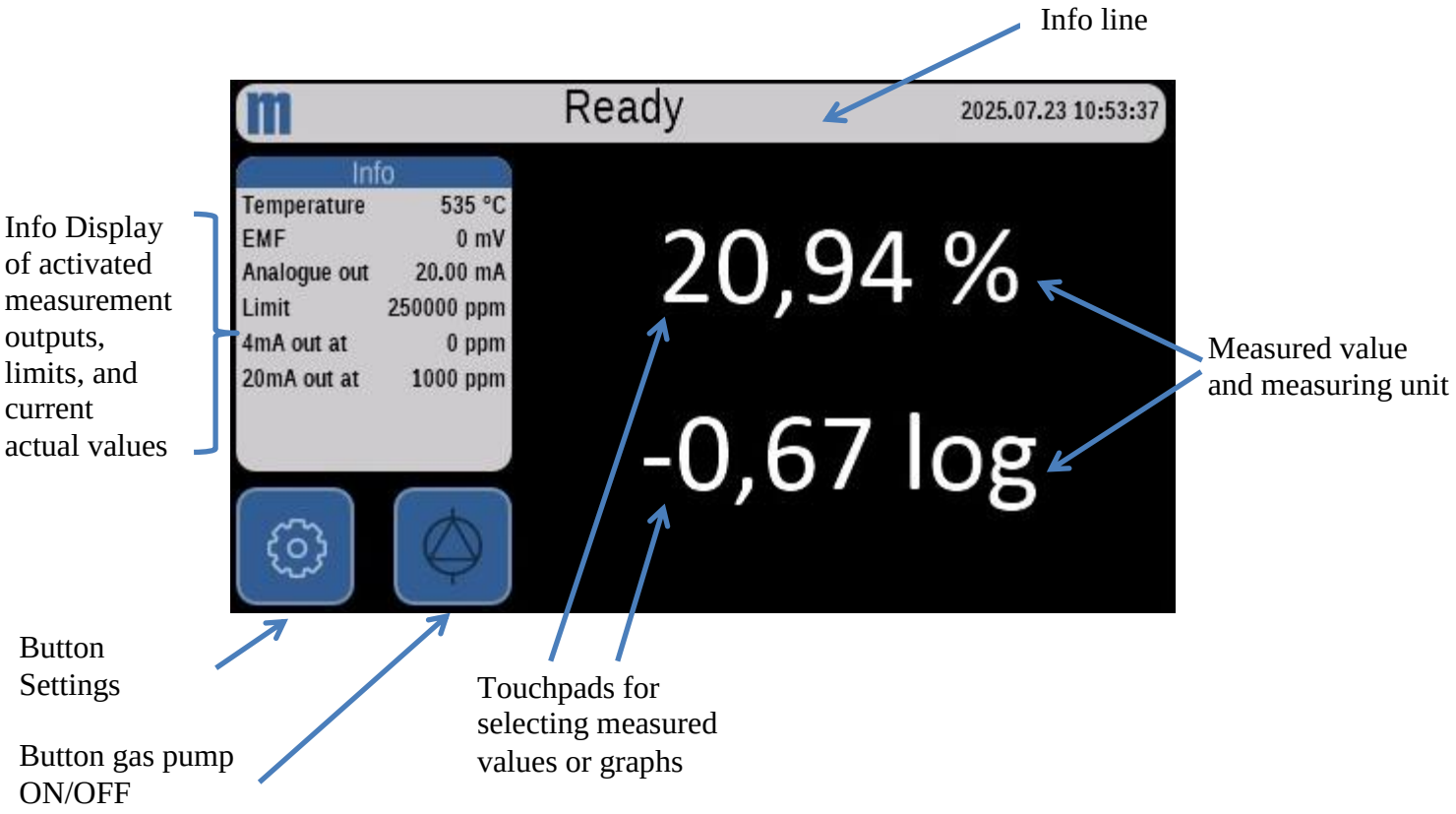
3.3 Sensor

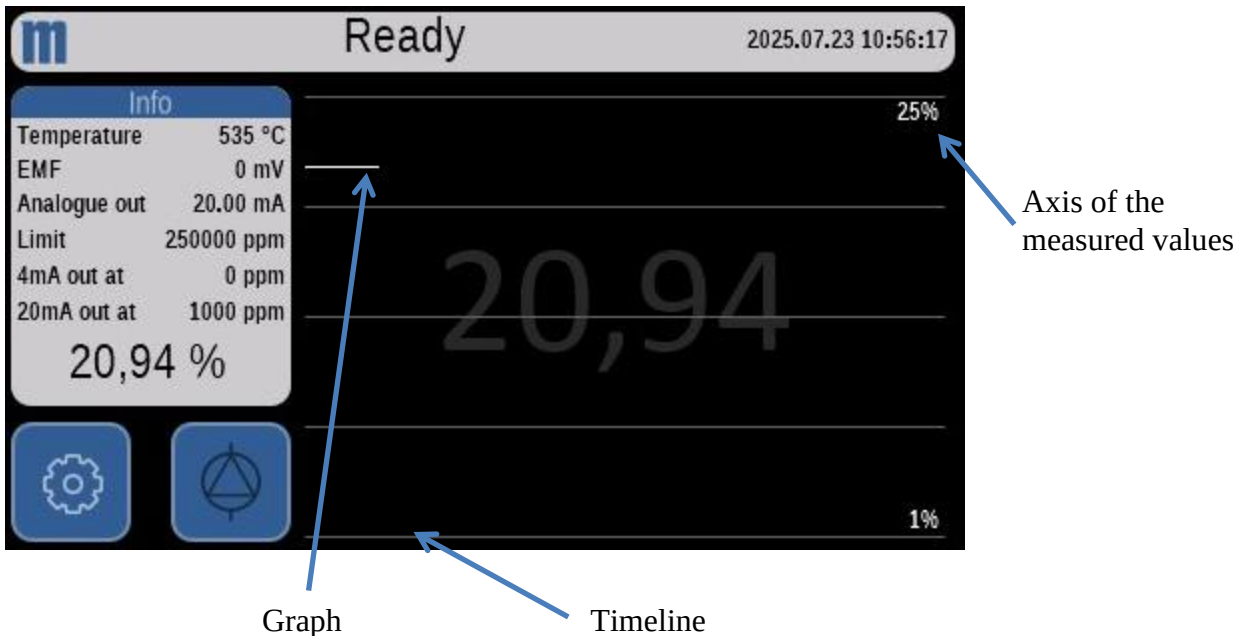
The sensor is integrated in the measuring electronics. It consists of the measuring element made of plated zirconium oxide, the heating required to heat up the measuring element to the temperature allowing the measuring operation, as well a temperature detection, which serves for the precise heating control.

4 General Layout

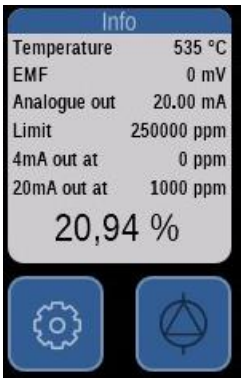
4.1 Description of the Measuring Electronics

4.1.1 Main Display





4.1.2 Touch pad and function buttons



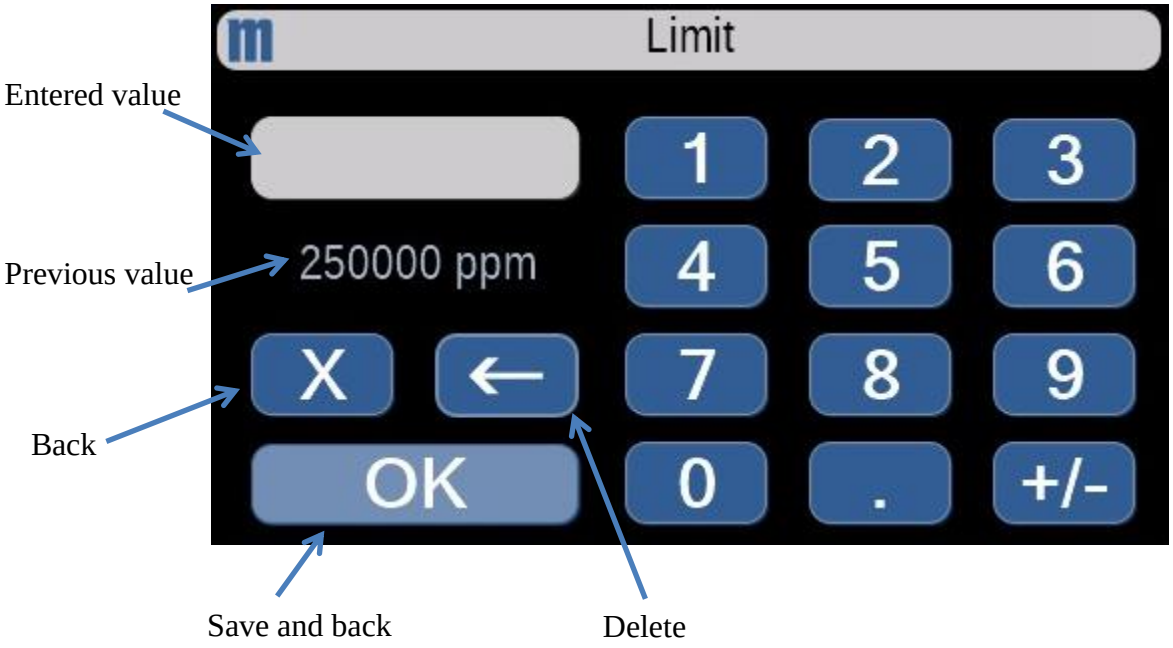
Touch pad for switching between measured values and measurement functions

Buttons for general operation

Button opens the menu for settings and parameterization.

Button switches the gas pump
ON OFF

4.1.3 Keyboard entry



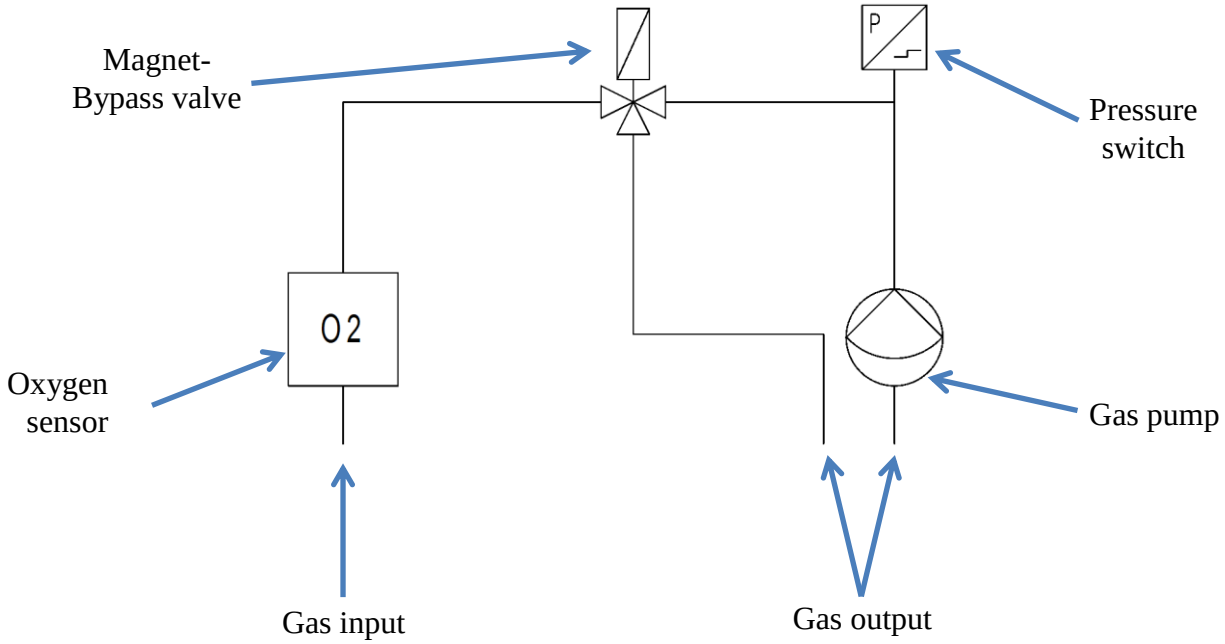
4.1.4 Special Buttons

Currently entered value is deleted

Back without saving

Save and back to menu page

4.2 Draft of Flow run

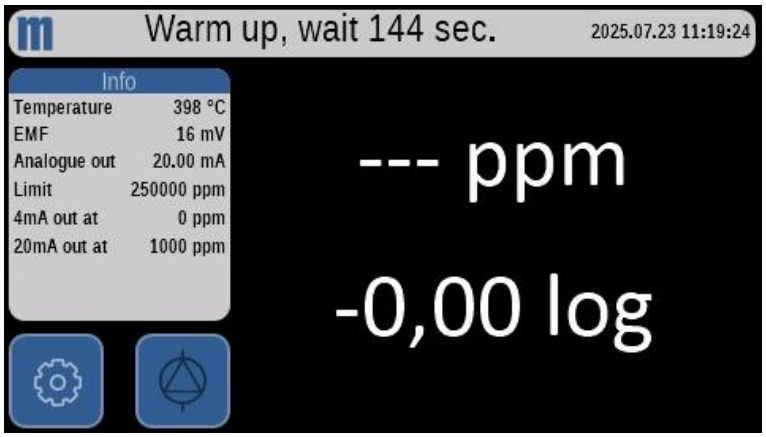


5 Commissioning the device

5.1 Switching on the measuring device

After connecting the power cable to the mains, the power switch can be activated.

During the heating phase of approximately 5 minutes, no measured values are displayed. The current status of the heating process is displayed in the info line.



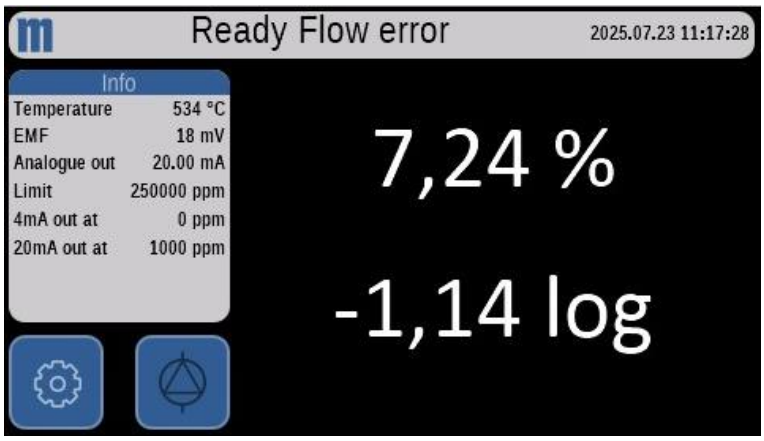
After the warm-up period is complete, the display shows the currently measured oxygen content (20.94% for ambient air). This is confirmed by the "Ready" indicator in the info line.

Tapping the linear measurement value display (% or ppm) switches to the graphical display. Tapping again switches back to the numerical display.

Tapping the logarithmic measurement value display (log) switches to the graphical display. Tapping again switches back to the numerical display.

Any alarms are indicated via the info line and a red frame around the measured value. **Note:** *The measured value is displayed independently of alarms.*

The info line indicates insufficient flow when the sample gas pump is switched on. **Note:** *Flow monitoring is not performed when the sample gas pump is switched off. The measured value is displayed regardless of alarms.*



5.2 Measurement

5.2.1 Sample gas connection

After the starting routine the device is ready for use and can determine the oxygen content in gases. This requires connecting the measured medium with the sample gas port.

Sample gas connection

Sample gas output

5.2.2 Flow

For accurate oxygen measurement, the measuring gas must be introduced into the measuring instrument at a reasonable flow rate. The GSM basic-touch provides two options for this:

1. The gas to be measured is extracted from a pressure-neutral container using the built-in measuring gas pump.
2. For measurements from a container with excess pressure (e.g. a gas cylinder), the sample gas pump should be deactivated. The gas to be measured is measured via a bypass without a sample gas pump. For this measurement, ensure that the flow rate is between 5 l/h and 120 l/h (the optimal flow rate range is between 60 and 80 l/h).

Note:
When gassing with the sample gas pump switched off, no flow monitoring takes place.
The flow rate is recorded when the sample gas pump is switched on based on a differential pressure measurement.

5.3 Cylinder Gases

When measuring synthetic gases, such as nitrogen, argon, helium etc., no further preparations are required for processing the gas. However, pressure must be reduced and the amount fine-tuned.

5.4 Process Gases

5.4.1 General

There is no exact procedure the adherence of which would ensure that all process gases used for technical purposes are correctly prepared and will not harm the measuring device.
In principle, process gases are to be kept free of dust, condensate and products capable of condensation. Such components may clog the gas pipes in the sensor and damage the sensor.

5.4.2 Hot process gases

In case hot process gases are the subject of an analysis, the gases will be sucked away from the process and fed into the sensor after having been properly prepared. The suction pipe may be made of metal or ceramic, depending on the temperature.
Due to the small amounts required for the measurement, in most cases no special cooling equipment is necessary. Usually, the process gases cool down to room temperature on their way to the sensor. Pipes must be kept leak-tight!

5.4.3 Special sample gases

There are a number of processes the process gases of which contain gaseous components forming solid or liquid condensates if the temperature falls below a certain threshold. These condensates may precipitate in the sensor's pipe system and impair the measurement or damage the sensor. We recommend to inquire about such components prior to the measurement and filter them out if necessary.

5.4.4 Special instructions

When deploying condensate separators, especially for water, make sure that the collecting tank is located at the lowest point in the entire pipe system.

Due to the dead volume of condensate containers and filters, delay times must be expected.

5.4.5 Filter system: Structure

The gas treatment system must be adapted to the specific task.
A standard system includes the following proposal:

1. Upstream connection of a water separator, potentially with an automatic condensate drainer.

2. Coarse filter for the separation of particles sizes above 50µm. (Use only with high amounts of dust).

3. Fine filter for the separation of particle sizes above 5 µm. It is an advantage if this filter immediately closes itself off when steamed up and interrupts the sample gas flow.

5.5 Switching off the measuring device

It is advisable to operate the measuring instrument in ambient air with the pump switched on before switching it off in order to dry any condensation in the pipe system and the sensor element. This could otherwise lead to damage to the measuring instrument.

To switch off, turn off the power switch and possibly unplug the power cord.

6 Measured value display

The oxygen content is shown on the display in two different measurement values.

6.1 Linear measured value display (% / ppm)

The oxygen reading is displayed as a percentage and automatically changes to ppm (parts per million) if the reading is less than 0.1%. If less than 1 ppm is measured, 0 ppm is displayed. Lower readings can be read from the logarithmic reading display.

6.2 Logarithmic measured value display (log)

The display can take values between 0.0 and -30.0. The displayed value represents the logarithm of the oxygen partial pressure.
The logarithmic representation allows values over many powers of ten to be represented with a number of just a few digits.

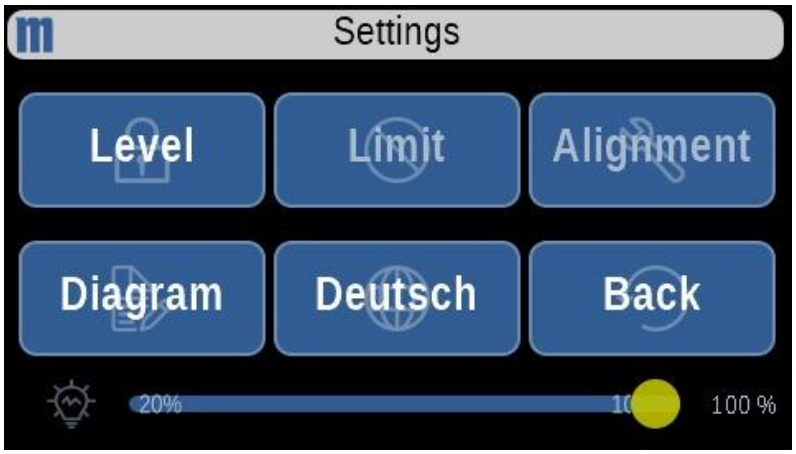
Conversation table				
%	**bar**	**ppm**	**log (x)**	**10^x**
100	1	1000000	0,00	10^0
10	0,1	100000	-1,00	10^{-1}
1	0,01	10000	-2,00	10^{-2}
0,1	0,001	1000	-3,00	10^{-3}
0,01	0,0001	100	-4,00	10^{-4}
0,001	0,00001	10	-5,00	10^{-5}
0,0001	0,000001	1	-6,00	10^{-6}
0,00001	0,0000001	0,1	-7,00	10^{-7}
0,000001	0,00000001	0,01	-8,00	10^{-8}

Note: *The measuring instrument can display values down to 10^{-30}.*

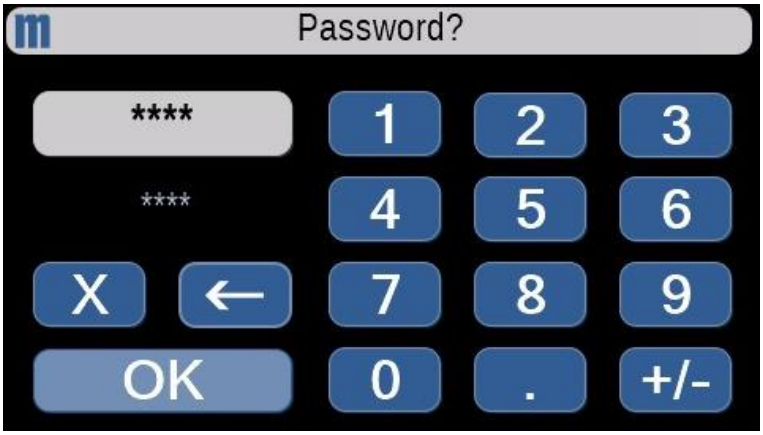
7 Parameterization

7.1 Enabling user levels

On the Main Image page, pressing the button  will switch the display on the parameter level.

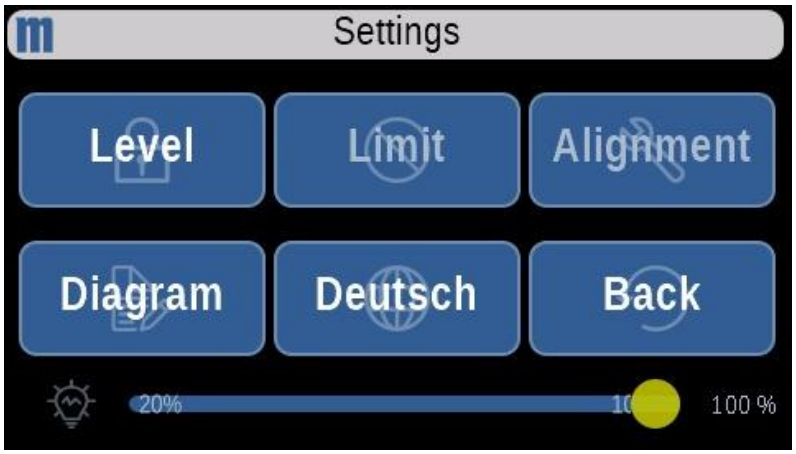


Access to the settings is divided into three code levels.
Pressing the button  opens the input screen.



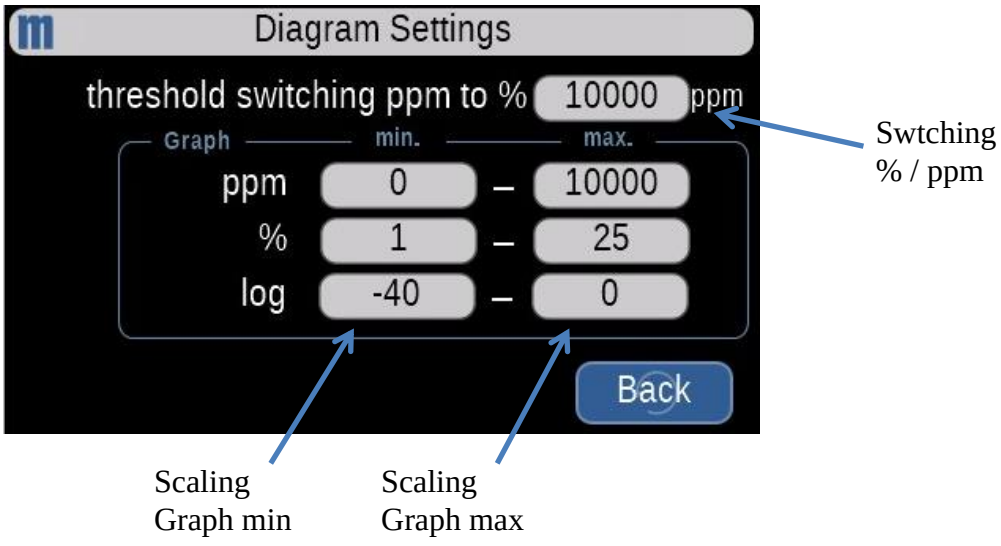
7.2 Access level 0

The settings at access level 0 can be accessed **without code** and are available after switching to the settings.



Level	Selecting access levels (7.1)
Diagram	Adjustment of the graphical display of the measured values (7.2.1)
Deutsch	Switching display language between German and English
Back	Back to the main screen

7.2.1 Graphics



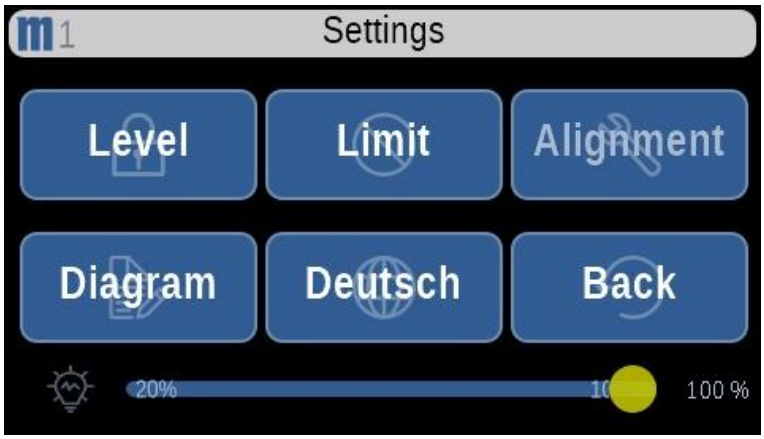
Setting the switching point between % display and ppm display.

Scaling of the axes for the graph display. Adjustable for each display unit.

Back to Settings

7.3 Access level 1

The settings at access level 1 can be reached with the **code 1234**.



Selecting access levels (7.1)

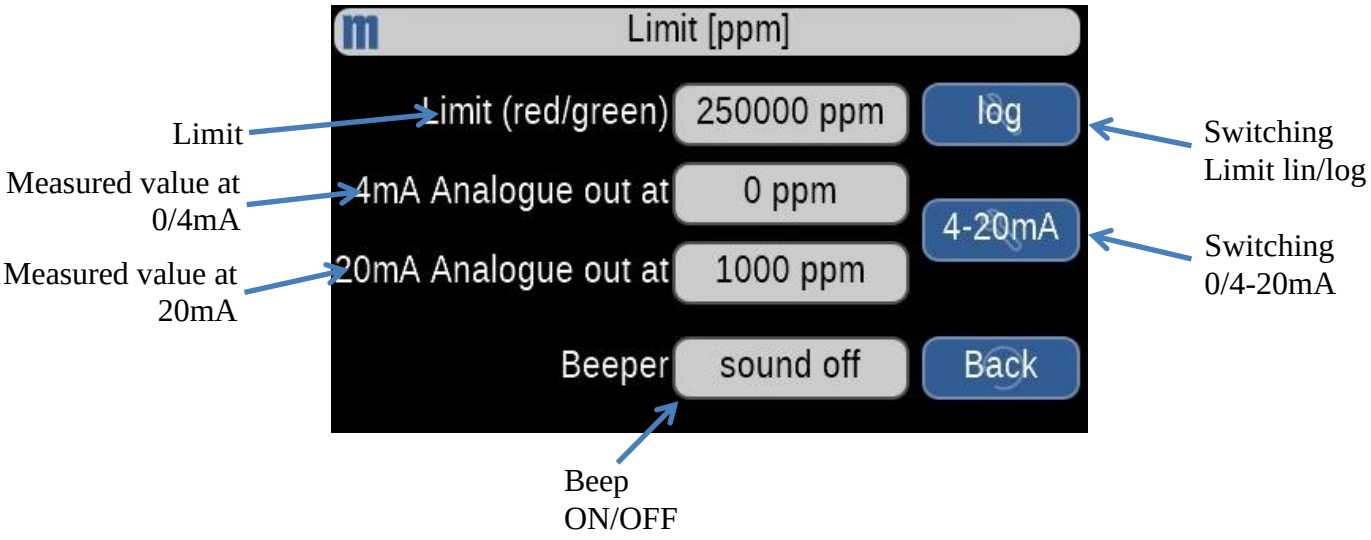
Setting the limits for alarm and mA output (7.3.1)

Adjustment of the graphical display of the measured values (7.2.1)

Switching display language between German and English

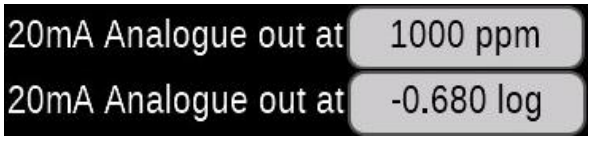
Back to the main screen

7.3.1 Limit



Setting the limit value for visual and acoustic alarm

Setting the measured value at 0/4 mA



Setting the measured value at 20 mA

Switching the acoustic alarm tone on and off

Switching the limit value input between lin and log

Switching the analogue output between 0-20mA and 4-20mA

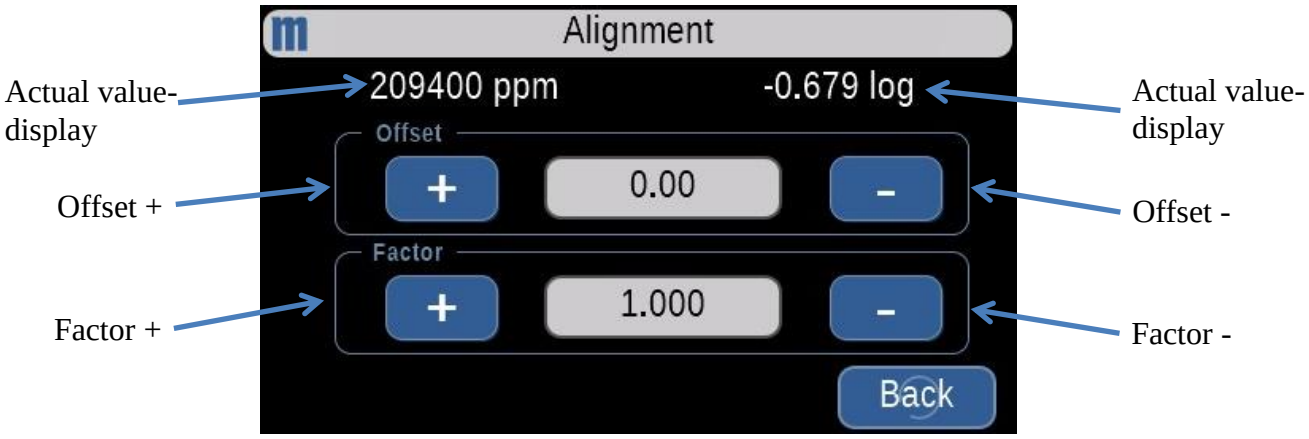
Back to Settings

7.4 Access level 2

The settings at access level 1 can be reached with the code **code 5678**.

Level	Selecting access levels (7.1)
Limit	Setting the limits for alarm and mA output (7.3.1)
Alignment	Calibration of the measuring instrument (7.4.1)
Diagram	Adjustment of the graphical display of the measured values (7.2.1)
Deutsch	Switching display language between German and English
Back	Back to Settings

7.4.1 Calibration



Actual value display

Setting the offset via +/- Button

Setting the factor via +/- Button

Back to Settings

Note:
The adjustment process is described in the separate chapter 8 Measured Value Corrections

7.5 Date/Time

Enter or correct date and time by tapping on the date/time display

The process is intuitive. Any position can be corrected using the +/- buttons.

8 Correction of a measured value

If necessary, the current measured value can be corrected. In this case it is advisable to make the adjustment after a stable measurement has been achieved and possible errors in measurement can be ruled out.
To perform correct measurement value corrections, the measuring instrument must display Ready in the info line.

8.1 Offset

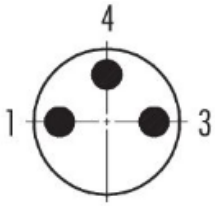
1. The measuring instrument must be supplied with clean ambient air, e.g. by switching on the measuring gas pump
2. Change the offset using the +/- buttons until the actual value display shows 209400 ppm (7.4.1)
3. If no calibration with a test gas is to be carried out, the measured value correction is completed

8.2 Factor

1. The measuring instrument must be flowed through with a test gas with a known oxygen content
2. Change the factor using the +/- button until the actual value display shows the value of the test gas (7.4.1)
3. The measured value correction is completed and the test gas can be removed again.

9 Connections

All available connectors are located in the upper side of the GSM basic-touch.

	View of M8 connector 	Output 0/4-20 mA **Pin** / **Type** 1 – mA + 3 – mA - 4 – n.c.

10 Technical data

Measuring range	Lin 0 bis100 % Log 10^{-0} to 10^{-33} bar O_2
Ambient temperature	0 to 50 degrees Celsius
Measurement accuracy	+/- 0.3 mV of the sensor EMF +/- 2 degrees Celsius +/- 2% of the mA output +/- 2% of the log oxygen partial pressure
Dimensions without handle	ca. 220 x 170 x 90 mm
Weight	ca. 2,3 kg
Supply voltage	100 - 240 Volt AC
Heating-up time for sensors	ca. 5 minutes
Response time	T90 < 2 s
Max. sample gas temperature	ca. 80 °C
Sample gas amount	min. 5 l/h, max. 120 l/h
Analog output	0/4 – 20 mA configurable, potential-free, pin socket M8

Measurement accuracy
At standard temperature and pressure / in N2

Measuring range	
10 ppm	+/- 0.5 ppm
100 ppm	+/- 1 ppm
1000 ppm	+/- 3 ppm @ 100 ppm +/- 1 ppm @ 10 ppm
1%	+/- 5 ppm @ 100 ppm
25%	+/- 0.03 % @ 1 % +/- 0.02 % @ 0.1 %
100%	+/- 1 % @ 99 %