METROTEC

Systems for Measuring and Controlling Oxygen

Operating instructions

GSM-touch

Oxygen Measuring and Control Device

GSM Series

*** Version 3.0 ***

EC Declaration of Conformity

for

Oxygen Measuring and Controlling Device Type GSM-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, 04/05/2023

Place, Date Signature

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1 Safety Instructions

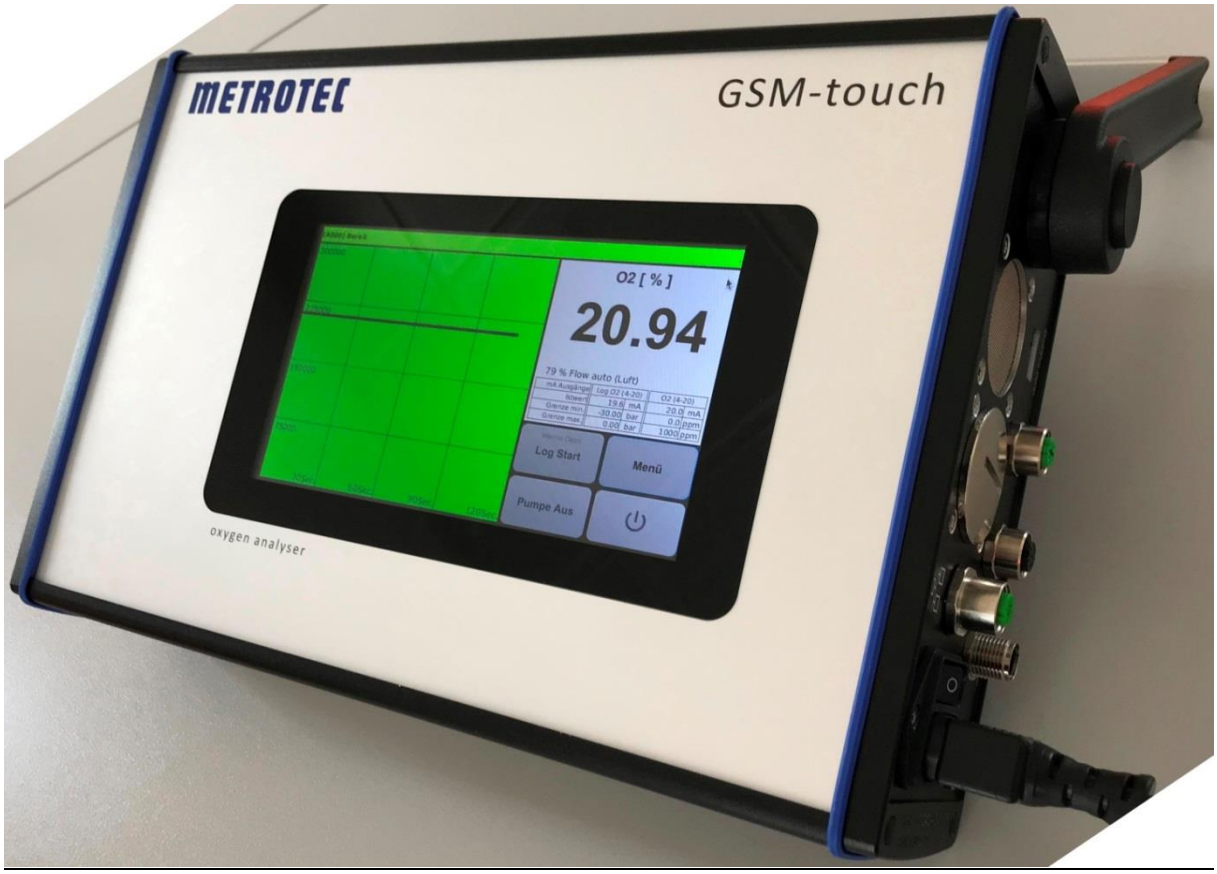
	Please read these operating instructions carefully before installing and using the device. Improper use of the product will invalidate the warranty!
	The ambient conditions described in the Specifications chapter must be complied with in order to ensure the device's proper functioning and operational 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-touch
O2 [%]
20.94
79 % Flow auto (Luft)
Log Start
Menü
Pumpe Aus
oxygen analyser

3 Introduction

The GSM-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.
Therefore, integrated functions facilitate the drawing of conclusions on a variety of technical processes in process engineering.

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.
Depending on the application, the sensors used are either heated or unheated. Unheated sensors are mainly used in the area of the oven, while heated sensors are chosen for applications in which gases with a temperature of less than 600 degrees Celsius are to be measured. (The measuring principle requires a minimum temperature of 500 – 650 degrees Celsius.)
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 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

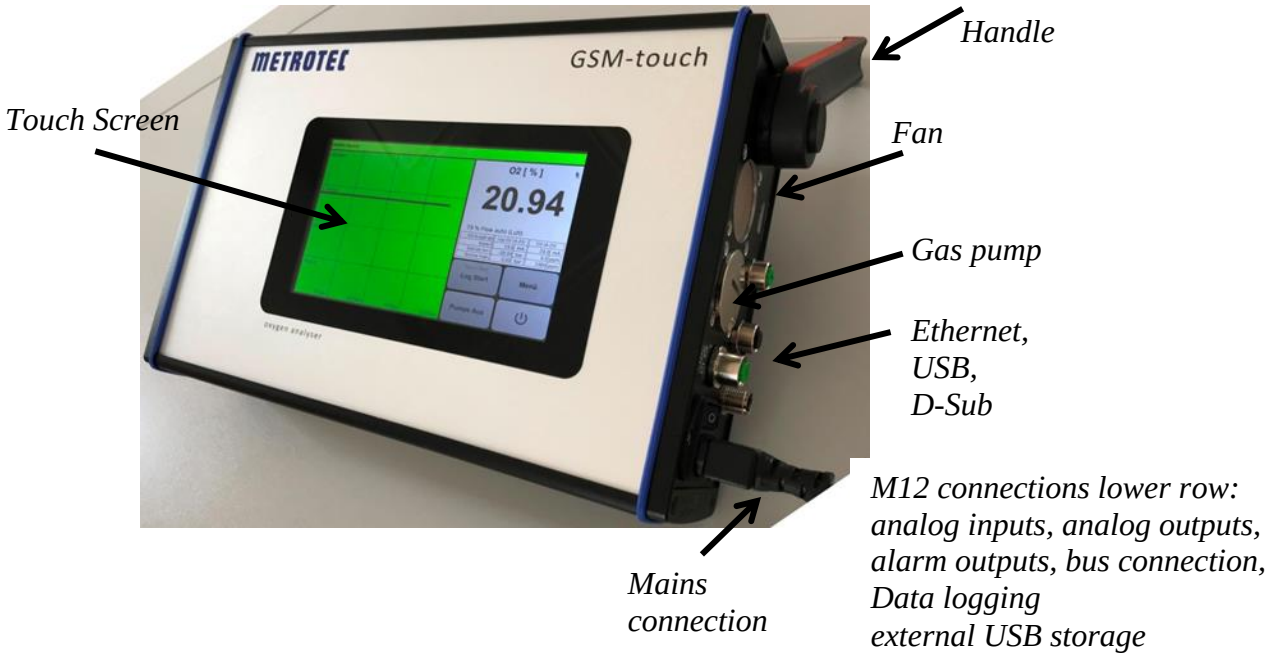
R = 8.31J/mol K
T = Temperature in Kelvin
F = 96493 As/mol
P1 = Oxygen partial pressure on the reference side with 0.20946 bar
P2 = Oxygen partial pressure on the sample gas side
EMF = Electromotive force in Volt

3.2 Measuring Electronics

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

- ✓ Measuring the oxygen partial pressure
- ✓ Generating alarms
- ✓ Calculating the dew point
- ✓ Calculating the Lambda air factor
- ✓ Calculating redox potentials

The measuring device is operated via a touch screen.
Inputs and outputs are preselected and parameterized by the operator via menus.



3.3 Sensor

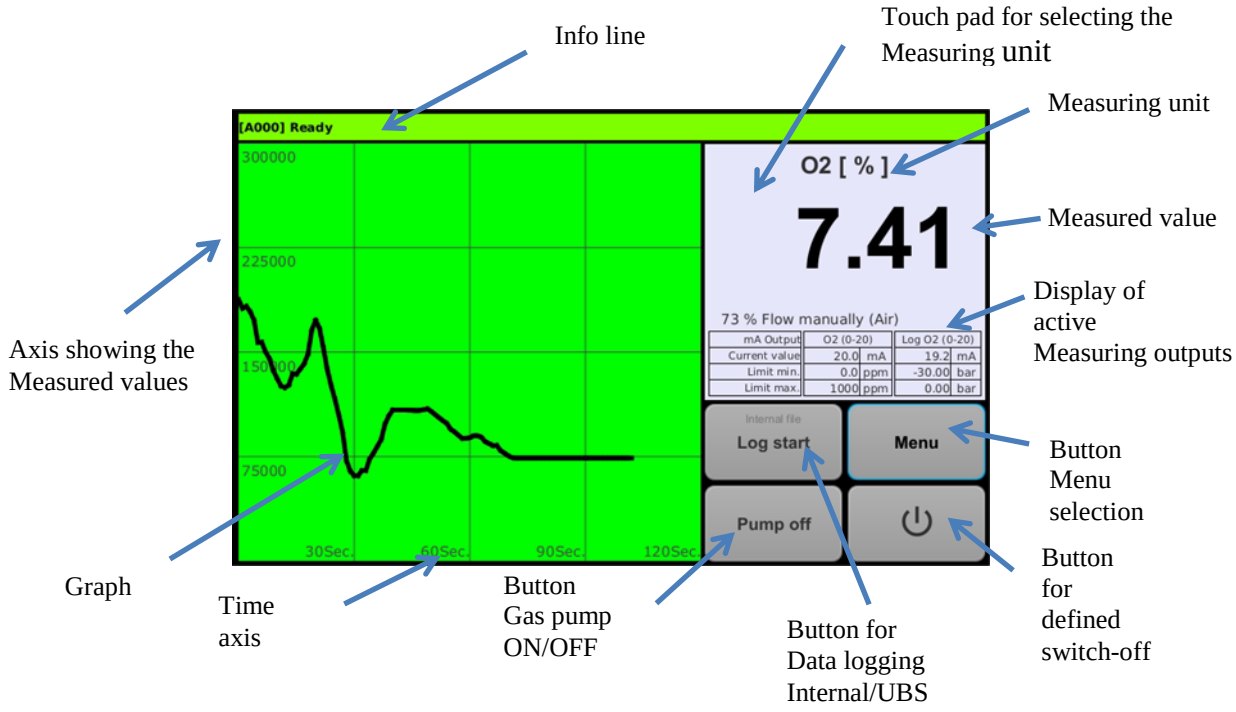
The sensor is integrated in the measuring electronics. It consists of the measuring element made of plated zirconium oxide, the heating required to heat up the measuring element to the temperature allowing the measuring operation, as well as the thermocouple for the exact recording of the temperature for the heating controller.

Note:
The heated block will grow hot during operation and warm up the housing due to its design, particularly on the left side. Please make sure that a minimum distance of ca. 50 cm to other objects is adhered to, so that the heat can freely dissipate from and circulate around the device.
Preventive measures, such as controlled case fans, temperature monitoring, and deactivation of the heating in case of excessive temperature will make sure that the housing temperature will not reach inadmissible temperatures.

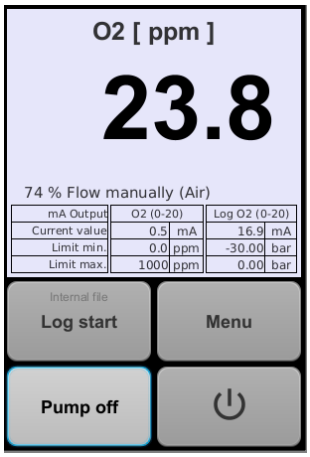
4 General Layout

4.1 Description of the Measuring Electronics

4.1.1 Main Display

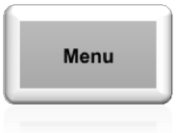


4.1.2 Touch pad and Function buttons

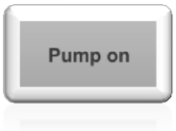


Touch pad for selecting measured values and measuring functions

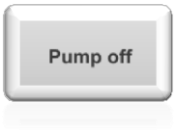
Buttons for the general handling of the device

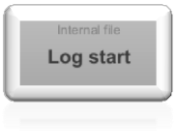


Button opens settings and parameterization menu.

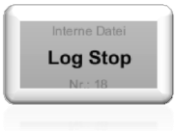


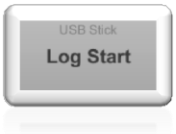
Button switches sample gas pump ON/OFF



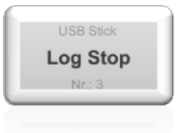


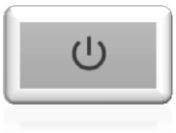
Button starts/stops data logging on internal memory. (In front of "Stop" the number of stored data records is shown)





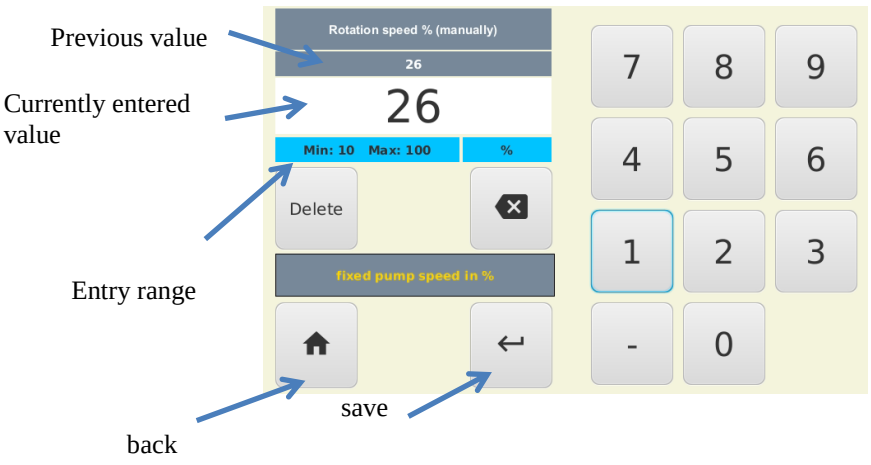
Button starts/stops data logging on USB stick. . (In front of "Stop" the number of stored data records is shown)





Button activates a shutdown procedure

4.1.3 Keyboard Entry



4.1.4 Special Buttons

Currently entered value is deleted

Last entry is deleted

One or more menu pages back without saving

Leave Save and Menu page

4.2 Description of Sensor

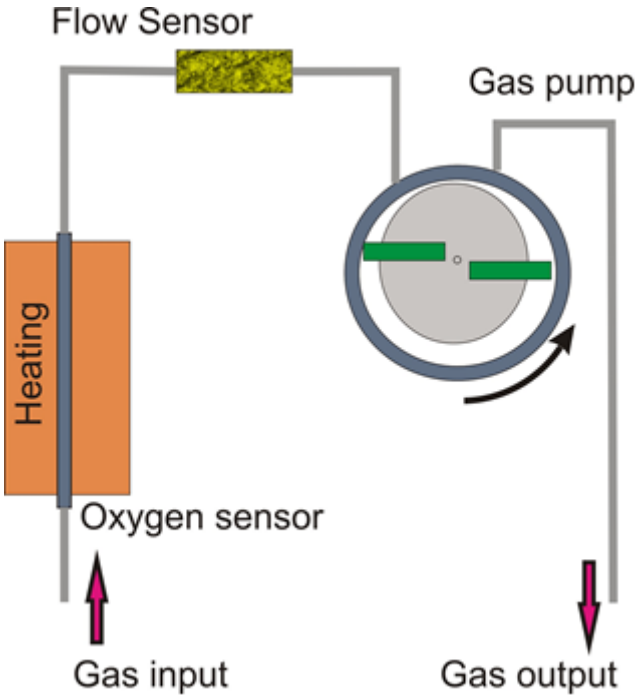
After switching on the device, the sensor will be heated up to measuring temperature within the following 15 minutes. (Attention: Sensor will not deliver viable measured values during this process.)

With the sample gas input open and gas pump activated, the device should display 20.9 % O_2. If required, this value can be corrected. (see "Measured value correction").

After the heating up phase, the sensor is connected with the sample gas. Please note that the maximum flow of sample gas will not exceed the display range of the flow meter. This is particularly important when measuring a gas cylinder with excess pressure.

Exceeding the flow limit may cause disruption of the sensor

4.3 Draft of Flow run

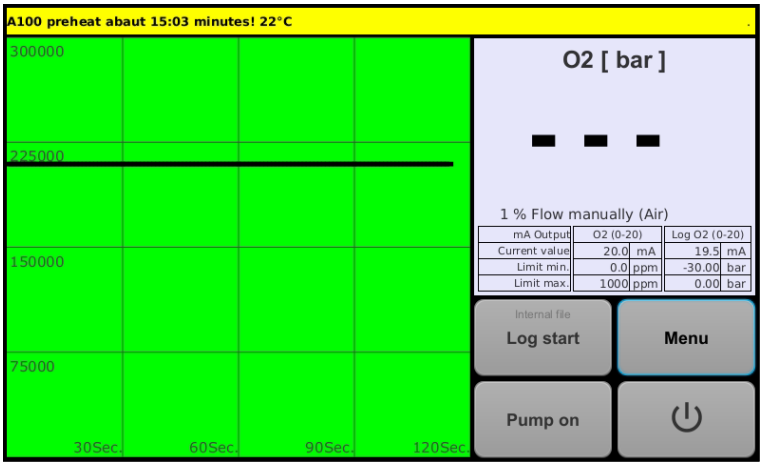


5 Commissioning the Device

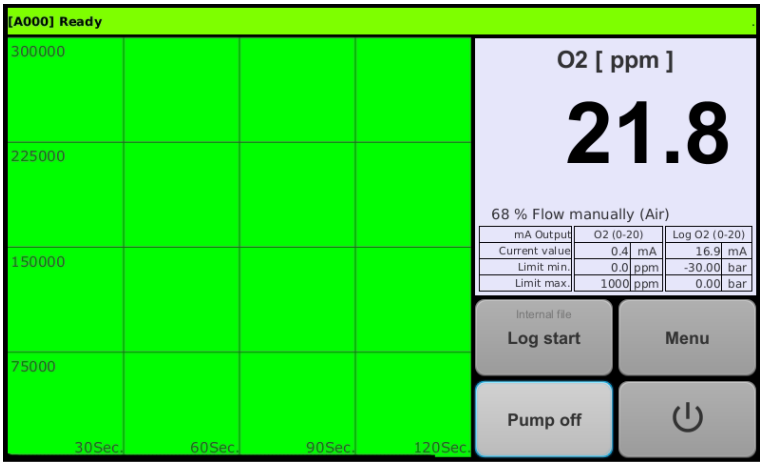
5.1 Switching on the Measuring device

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

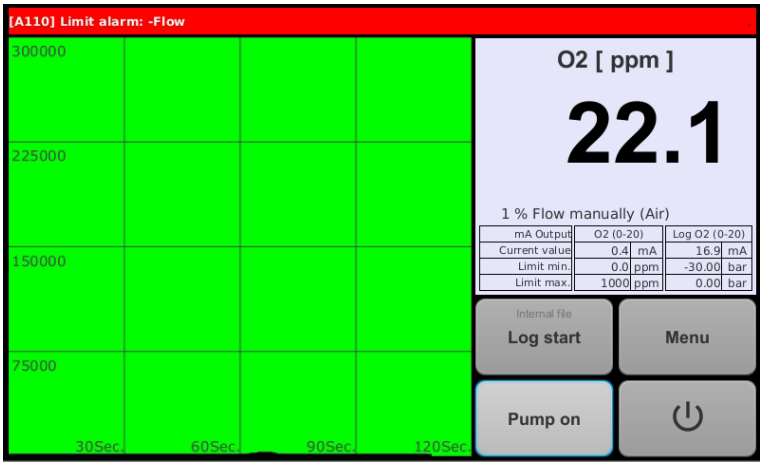
The display lights up briefly. After ca. 30 seconds, system start information and, after the boot procedure, the standard screen or the measuring instrument screen last activated will be displayed, depending on the default setting.



As long as the sensor temperature is below the target value, the measured value is shown as "- - - ". The info line displays the current status of the heating process on a yellow background.
The diagram area may show a measured value independent from the heating up status.

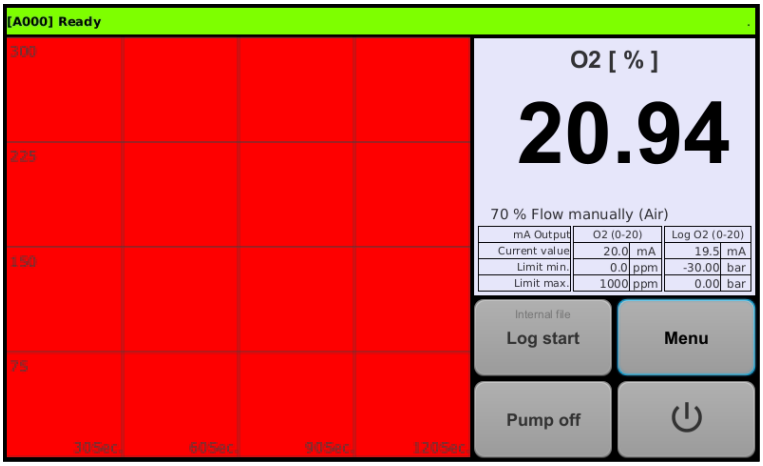


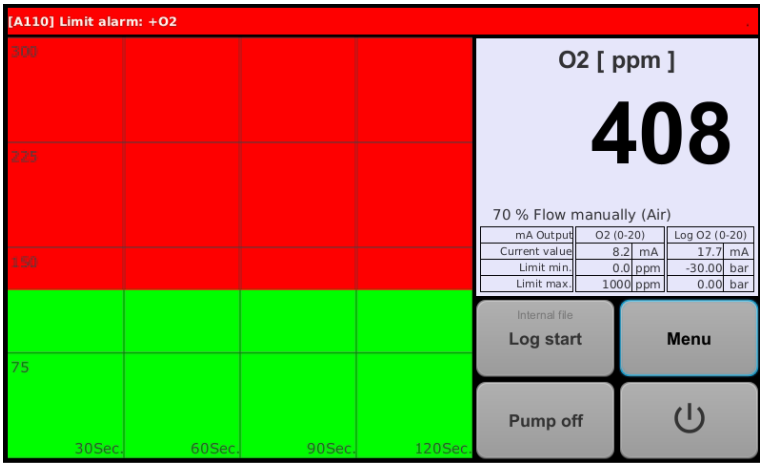
After the heating up phase, the measuring unit will display the measured oxygen value. In this case the info area shows: "Ready" while the background colour is green. A stable measured value is reached 15 minutes after the heating up process has been completed.



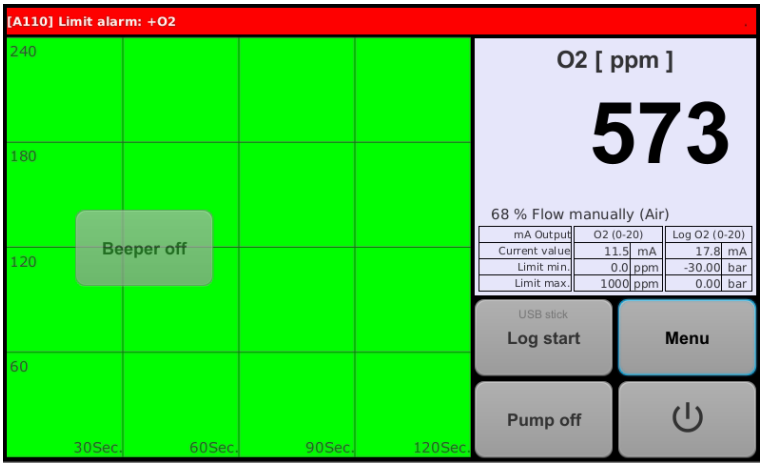
The start screen may display an alarm message in the info line on a red background. The alarm message can be removed by entering suitable alarm limits (see section "Alarms") and if the measured value lies within these limits.

The measured value is shown independently of alarms and diagram parameters.

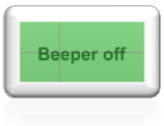




The start screen may display an alarm message in the info line on a red background. The alarm message can be removed by entering suitable alarm limits (see section "Alarms") and if the measured value lies within these limits.
The diagram area background will turn red if the measured value is beyond the defined diagram axis. (see section "Format Diagram").
The measured value is shown independently of alarms and diagram parameters.



In case the beeper is activated and an alarm pending, the diagram area will display "Beeper Off"

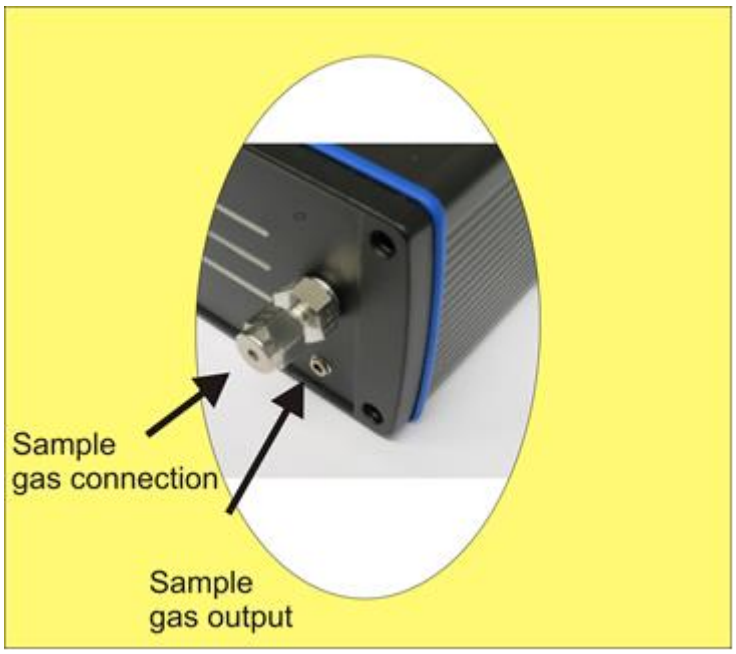
The button 

will acknowledge the beeper and the button fades out.

5.2 Measurement

5.2.1 Sample gas connection

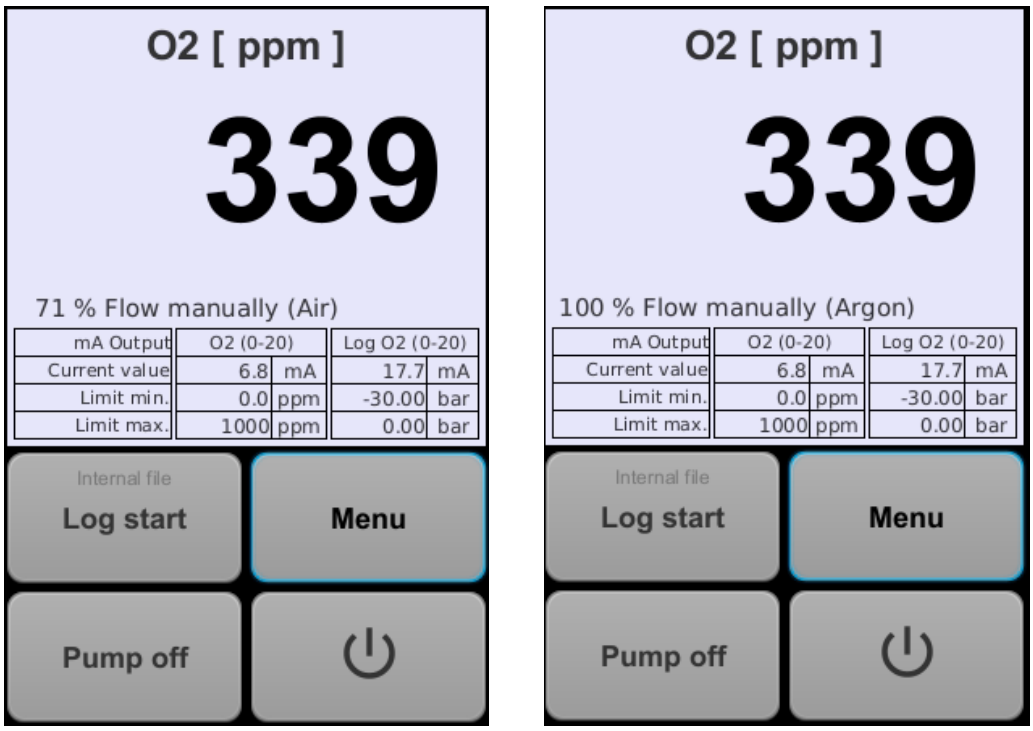
After the starting routine the device is ready for use and can determine the oxygen content in gases. This requires connecting the measured medium with the sample gas port.



5.2.2 Flow

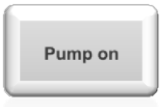
In order to examine the sample gases, they need to be supplied to the measuring instrument. In case the sample gas source has excess pressure, such as a gas cylinder, the gas flow must be reduced to an admissible level by means of a valve or a pressure reducer.
The maximum gas flow must not be exceeded, as otherwise the sensors will be destroyed. We recommend a 60 - 80 % flow.

Note:
Recording the amount of gas flowing is based on a calorimetric principle. Due to the fact, that different gases have different heat transfer properties, the particular characteristic curves for air, argon, forming gas and hydrogen have been stored. The current selection is displayed as text.

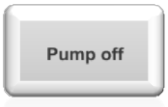


The flow is shown in the touch screen. The parameterization is described separately (see Pump parameters: Flow)

In case, the pressure of the sample gas source is too low to feed the sample gases through the measuring instrument, the integrated sample gas pump must be switched on by pressing the "Pump" button (see Pump parameters).

Pressing 

switches on the gas pump.

As long as the gas pump is activated, 

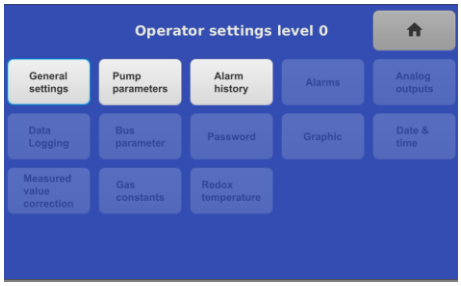
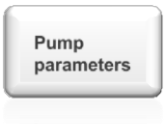
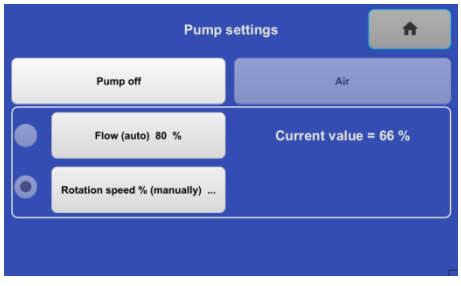
is displayed.

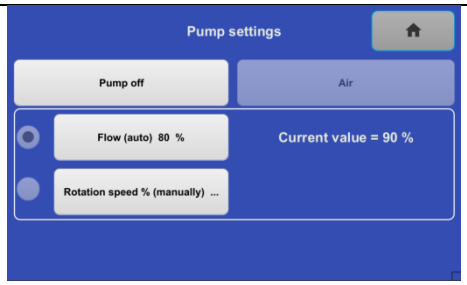
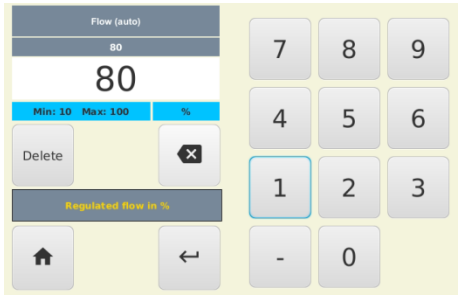
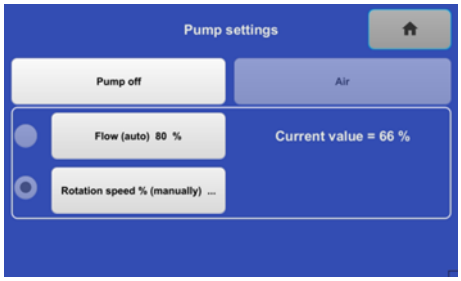
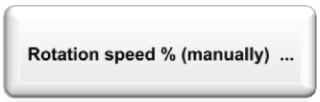
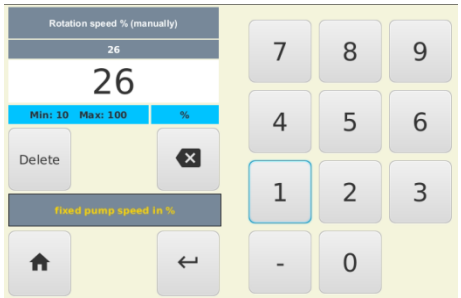
5.2.3 Pump capacity

There are two possible modes for operating the sample gas pump:

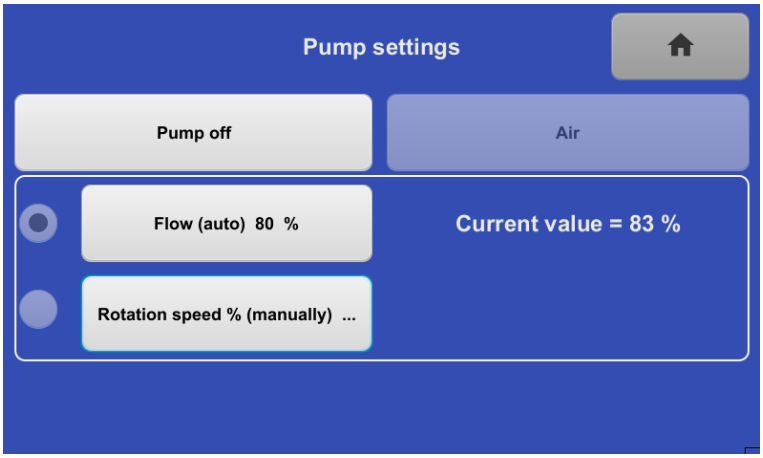
Automatic mode	In automatic mode, the capacity of the sample gas pump is controlled. For this purpose, the current indication of the flow meter, which is scaled to 0-100 %, will be compared with the target value. The resulting control deviation will then adjust the pump capacity so that the target value is observed. This should occur independently of the conditions of the gas sampling. *Note: This specification may have to be modified to be in accordance with the type of sample gas used. Entry can only be made by CODE from level 1 or higher.*
Manual mode	In manual mode, a specific speed is defined as target value. The speed is scaled to 0-100 %. The sample gas pump delivers a certain sample gas flow, depending on the length of the sample gas line and the pressure in the sample gas line. It must be adjusted such that the sample gas flow remains within the permissible limits.

The pump capacity can be set in the "Pump Parameter" menu.

Pressing the button  opens:		
Pressing the button  opens:		Current setting are shown here. These can be changed by pressing the corresponding buttons. *Note: The gas type relevant for measuring the flow cannot be changed on this enabling level.*
		For this example, the operation mode

		"Automatic" has been chosen. The current flow as well as the target value are displayed.
Pressing the button  opens:		A new target value can be entered here.
		For this example, the operation mode "Manual" has been chosen. The current flow as well as the target value are displayed.
Pressing the button  opens:		A new value within the range shown can be entered here.

The set values can be verified in the overview image.



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 Specific 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 preparation system must be adapted to the special task.
A standard system includes the following concept:

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

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

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

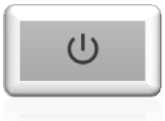
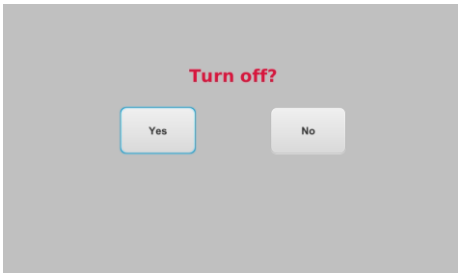
5.5 Switching off the Measuring device

It is advisable to keep the device continuously in operation. This will avoid the condensation of steam in heated sensors which may cause corrosion.
In case the device is required to be switched off, the power switch must be turned off and maybe the power plug pulled. Please do not forget to flush the measuring device with air.

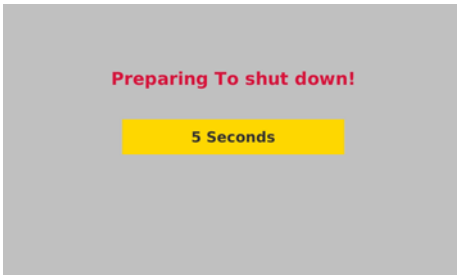
5.5.1 Short-term switch-off

In case the device is to be turned on after having been switched off for a short period, please refer to the section "Switching the measuring device on".

5.5.2 Long-term switch-off

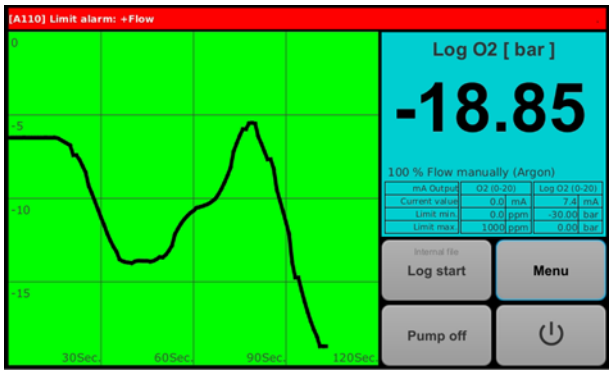
Pressing the button  opens:		Final request.

<table>
<tr>
<td>Confirmation with
 

opens:</td>
<td> 
</td>
<td>The sample gas pump and the fan are switched to run at maximum speed and the sensor is heating turned off.</td>
</tr>
<tr>
<td colspan="2"> 
</td>
<td>Pull the power plug.</td>
</tr>
</table>

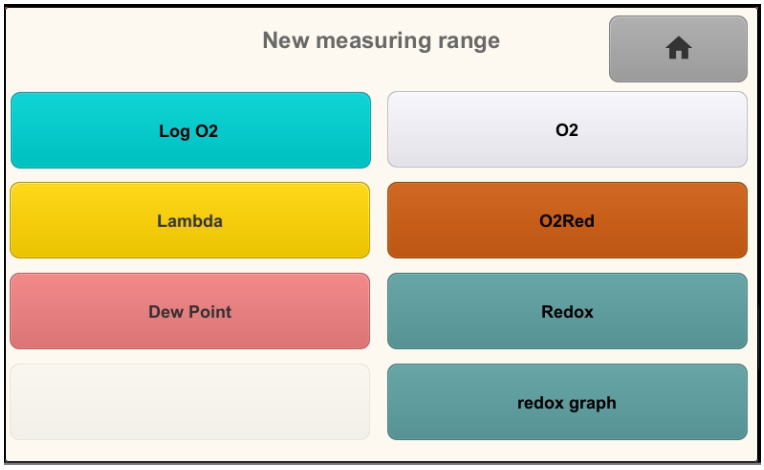
6 Selecting the Measured value

By selecting a measured value, several different ways of displaying the measured oxygen partial pressure are available.



Measured value display
and touchpad for
selecting the measured value

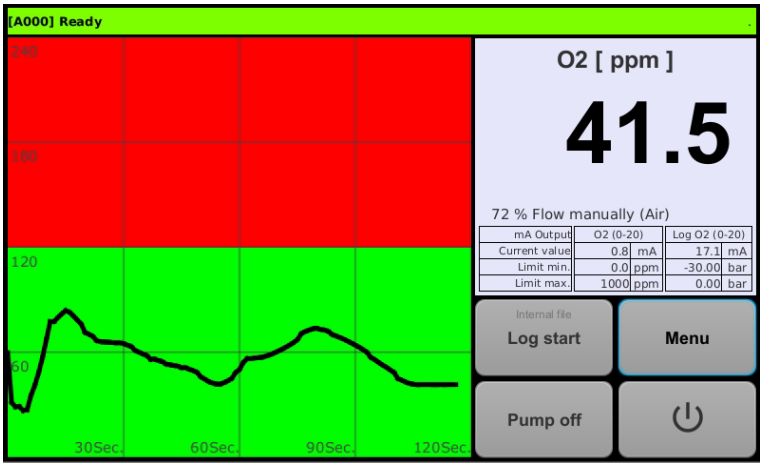
After activating the touchpad, the following table displays the available options.



Touch the respective button to select the value to be displayed.

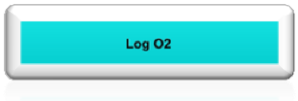
6.1 O2

The measured oxygen value is displayed as a percentage. In case the measured value is below 0.1 %, the unit will automatically change to ppm (parts per million).
If the measurement is below 0.1 ppm, the display reads 0.0 ppm. Lower measured values can be taken from the "Log O2" section.

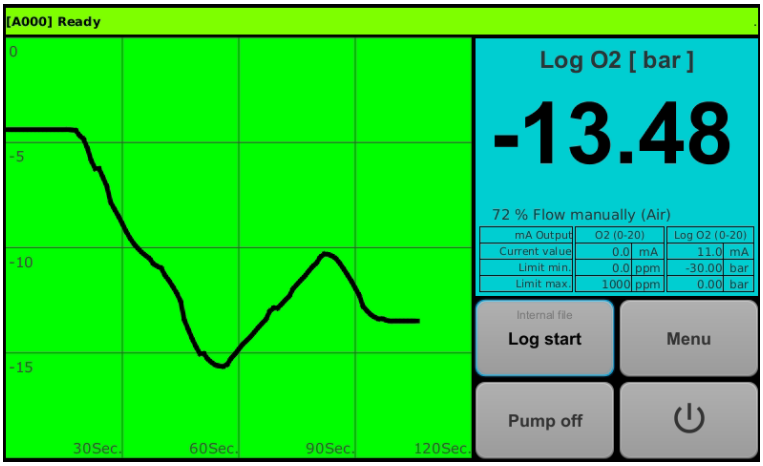


Example of the display showing a 0-240 ppm O_2 trend with band alarm

6.2 Log O2



The display can assume values between 0.0 und –30.0. The value shown is the logarithm of the oxygen partial pressure.



Example of the display showing a 10^{-20} - 10^{0} trend without band alarm

Displaying a logarithmic value allows values stretching over many powers of ten to be displayed as a number consisting of few characters.

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}

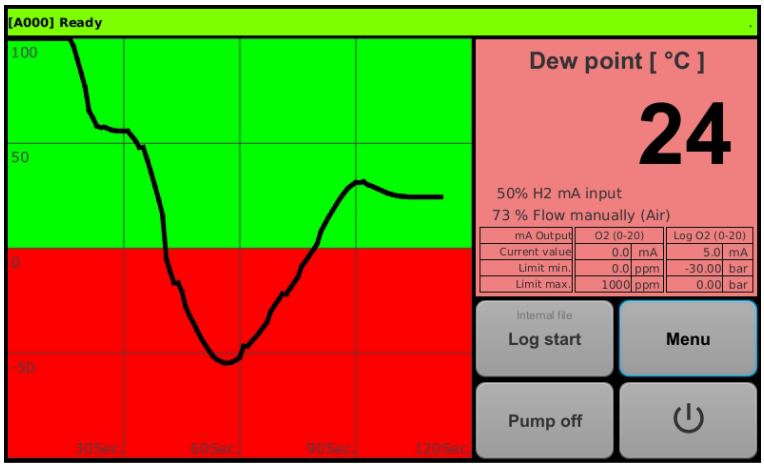
The measuring instrument can display values down to 10^{-35}.

6.3 Dew point

Some measurement tasks require an evaluation of the dew point in degrees. This is commonly the case with nitrogen/hydrogen mixtures. There the measured O_2 value is converted into a dew point, based on a known hydrogen proportion. It is necessary to enter the H_2 proportion in the "Gas constants" menu.

Note:

Calculating the dew point is a mathematical function. In case the hydrogen proportion changes or is not available, the dew point cannot be calculated correctly.



Example of the display showing a –100 to +100 degree range trend with band alarm

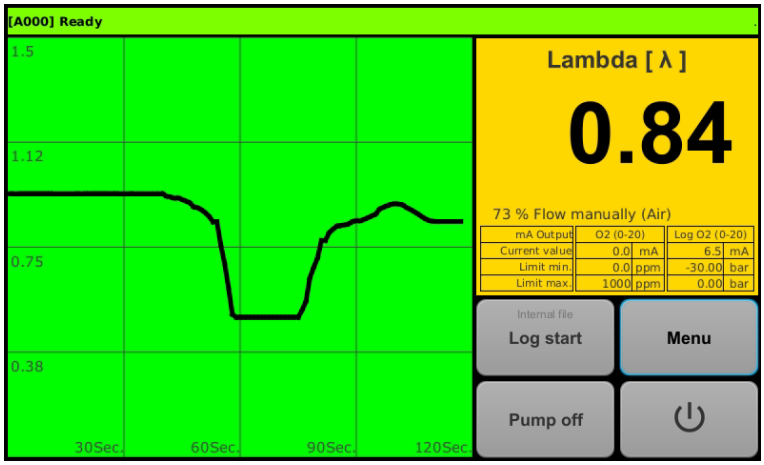
6.4 Lambda

With some processes, knowing the Lambda value of a combustion or a gas mixture is important. Lambda is defined as:

Lambda = (combustion air supply)/(theoretically required combustion air)

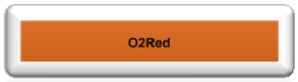
The calculation requires entering a password in menu line No. 27.

Note:
Calculating Lambda is a mathematical function. In case the C/H value changes or is not available, the Lambda value cannot be calculated correctly.



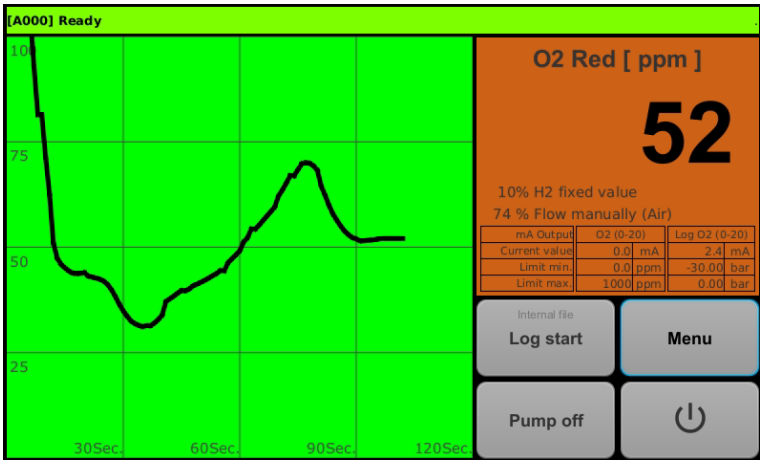
Example of the display showing a 0 - 10 range trend without band alarm

6.5 O2 Red (O_2 in H_2)



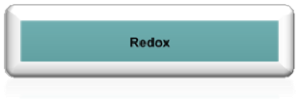
In order to conclude on the oxygen in a mixture which, for example, consists of nitrogen and hydrogen, an oxygen value can be calculated from the measured oxygen partial pressure considering the hydrogen proportion. The calculation uses the hydrogen proportion. In this example it is 1 %. (Changing the hydrogen proportion see "Gas Constants")

Note:
Calculating O2Red is a mathematical function. In case the hydrogen proportion changes or is not available, this value cannot be calculated correctly.

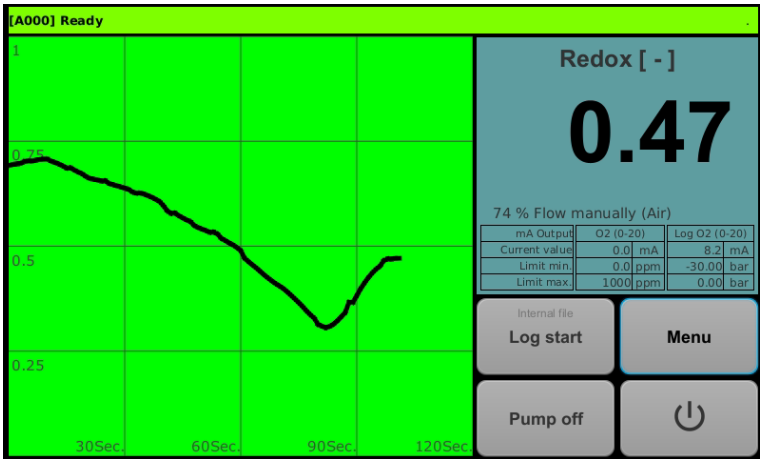


Example of the display showing a 0 - 1000 ppm range trend without band alarm

6.6 Redox



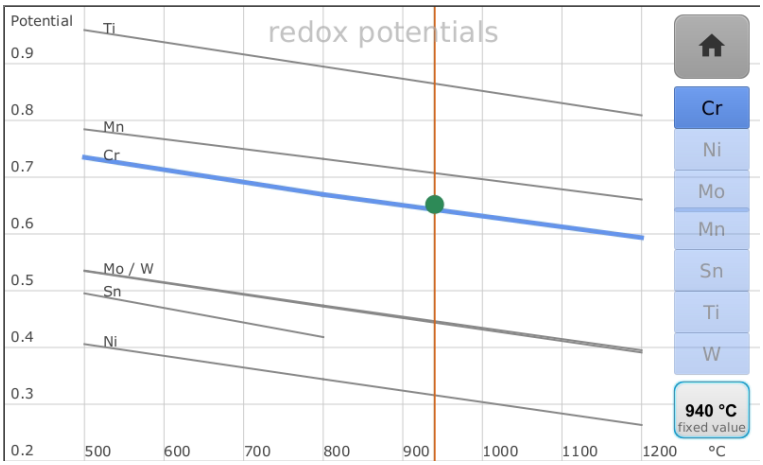
Redox potential is a mathematical function scaled on a 0-1 range. It is calculated from the oxygen partial pressure and the temperature entered in the redox graph or measured externally.

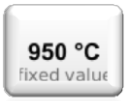


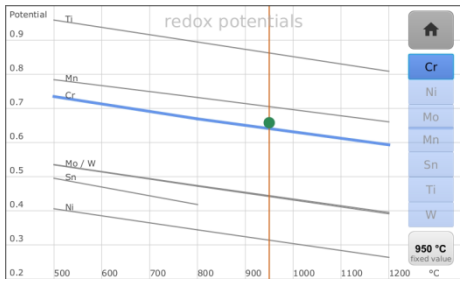
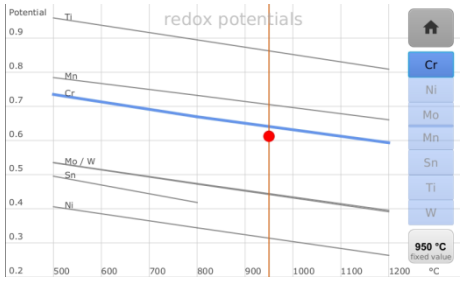
6.7 Redox Graph

The function "Redox Graph" is a tool used in order to display the $M + O_2 \leftrightarrow MO_2$ reaction. In this process, the measured oxygen partial pressure is calculated as redox potential based on

the respective entered or externally measured temperature. The redox potential display above the temperature shows the oxidation or oxygen reduction of a metal.



		The example uses a fixed value of 950 °C.
Pressing the button  opens:		A new value within the range shown can be entered and acknowledged here. (Valid only, if fixed value has been activated. See. Configuration "Redox Temperature")
		The example works with an externally measured temperature of 900° C. A manual change of this temperature is not possible.

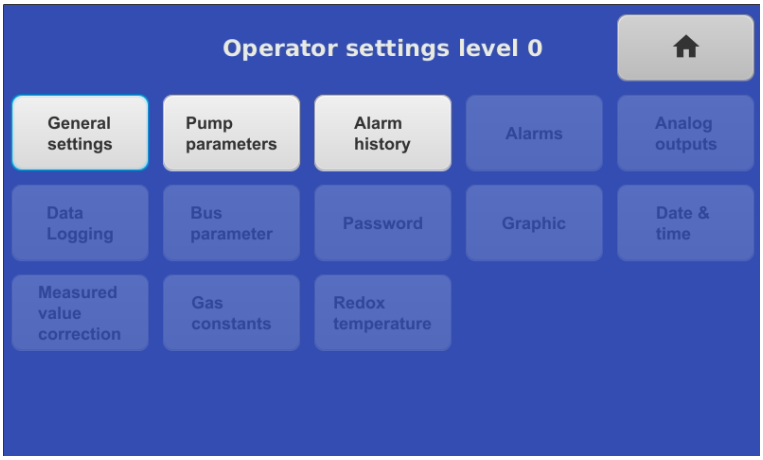
If "Cr" has been chosen 		In this example, the "Cr" line appears bold. The green point indicates: "No Oxidation"
		In this example showing a rising oxygen partial pressure, the potential falls below the "Cr" line at 950° C, with the red point indicating possible oxidation.

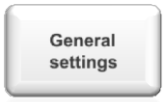
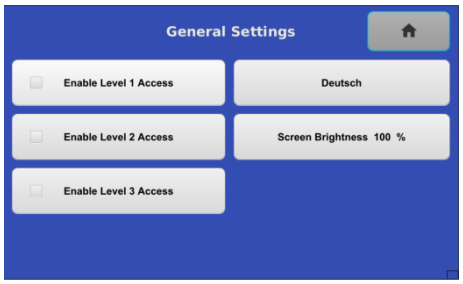
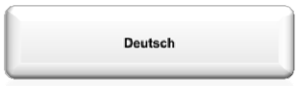
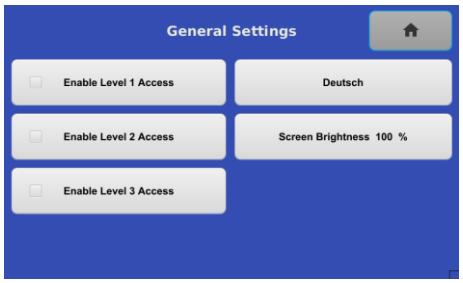
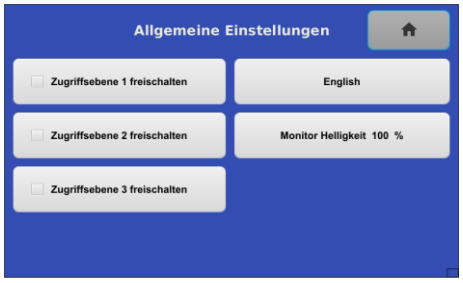
7 Parameterization

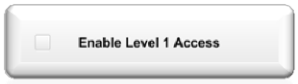
7.1 Enabling User levels

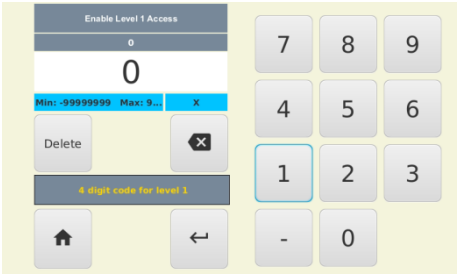
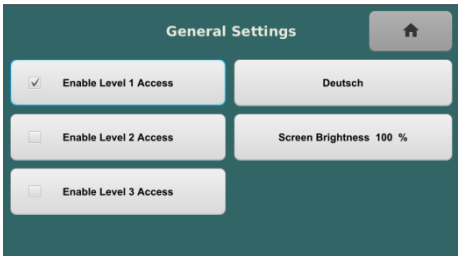
On the Main Image page, pressing the button  will switch the display on the Parameter level.

LEVEL "0" will open for which no CODE is required
(This level is active each time the device is switched on)



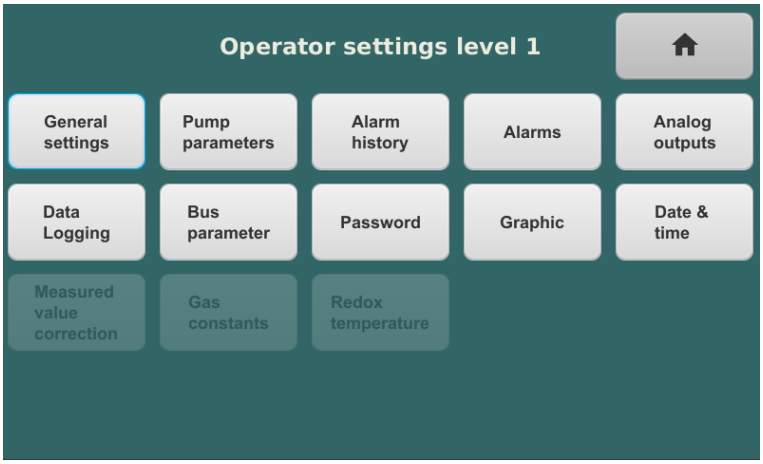
Pressing the button  opens:	 	In this example, only level "0" is accessible
Pressing the button  changes the language setting	 	Language is German
Pressing the button  changes the language	 	Language is English
Pressing the button  opens:		Here a new brightness value can be entered within the given range.

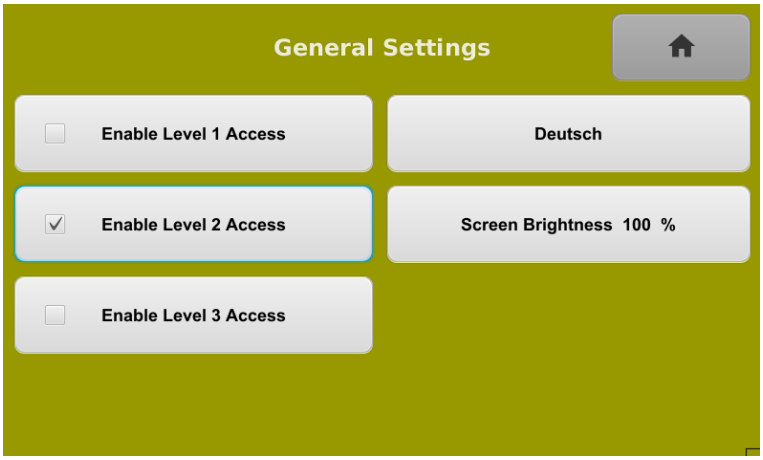
<table>
<tr>
<td></td>
<td> 
</td>
<td></td>
</tr>
<tr>
<td>Pressing the button
 

opens:</td>
<td> 
</td>
<td>Entering the correct CODE (initial state = 1234)</td>
</tr>
<tr>
<td>  </td>
<td> 
</td>
<td>Level 1 enabled is displayed.</td>
</tr>
<tr>
<td colspan="3">Enabling level 2 follows the same procedure. The factory CODE for LEVEL "2" is "5678".

Note: Level 3 can only be cleared by the factory</td>
</tr>
</table>

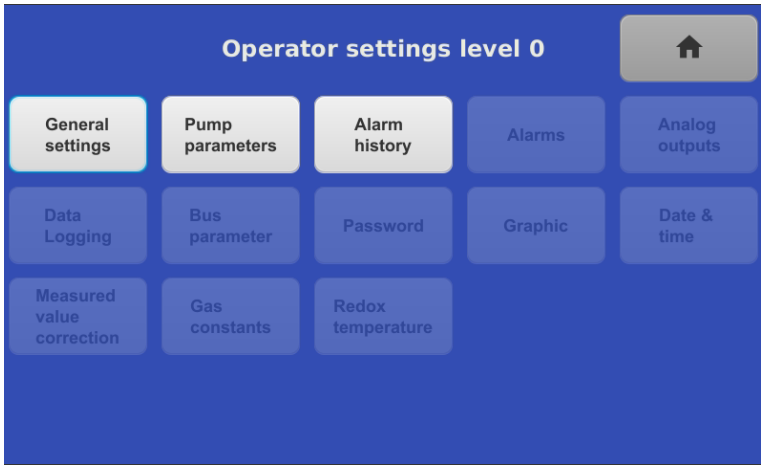
By pressing the button all entry fields available on this level will appear.





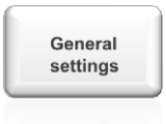
7.2 Level "0"

This level may be accessed by each user without entering a CODE.



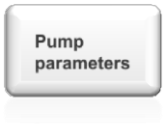
From this page all parameters and settings displayed can be changed.

7.2.1 General settings



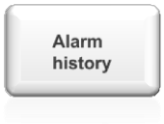
The respective description is explained in the previous chapter.

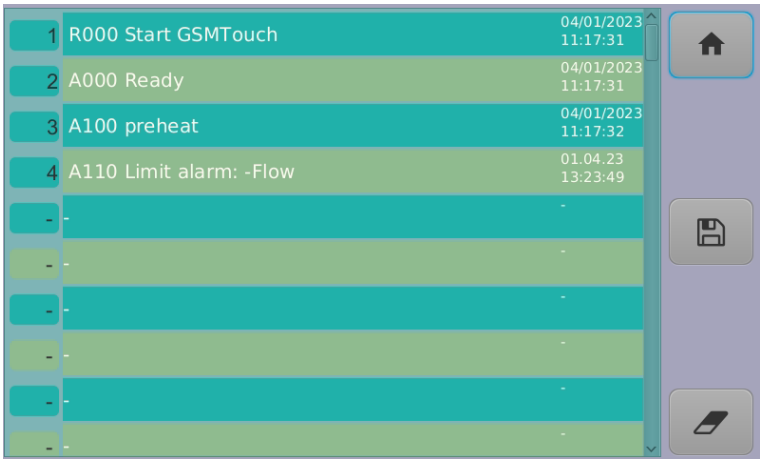
7.2.2 Pump Parameters



The respective description can be found in the "Pump Capacity" chapter.

7.2.3 Alarm History

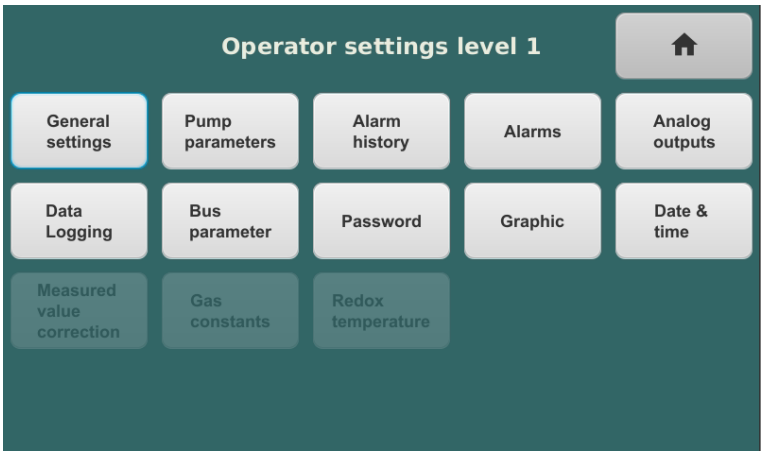




Lists all alarms stating date and time of each alarm.

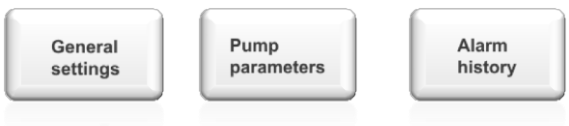
7.3 Level "1"

This level can be accessed by the user, if the correct CODE is entered.
The transparent buttons can only be activated on the next level up.



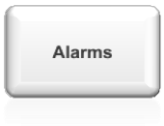
From this page all parameters and settings displayed can be changed.

7.3.1 Settings described on Level 0

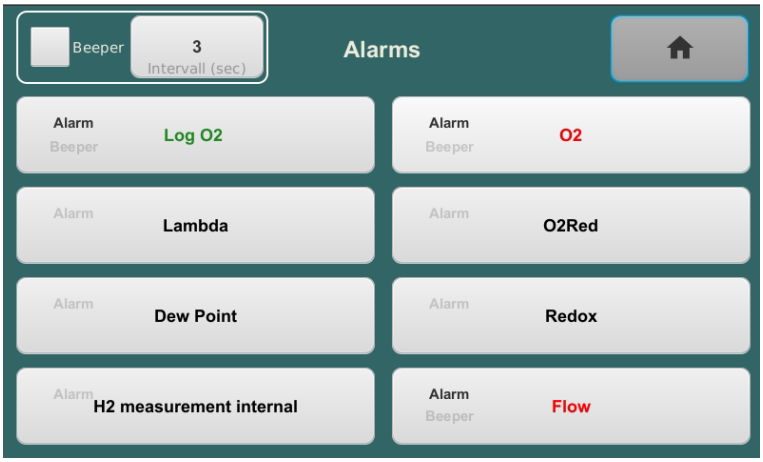


7.3.2 Alarms

The alarms refer to the diagram in which they are indicated in red, as well as to the sound alarms, the relay output and the message in the info line.

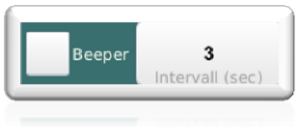
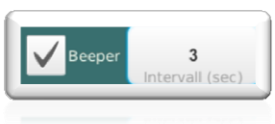


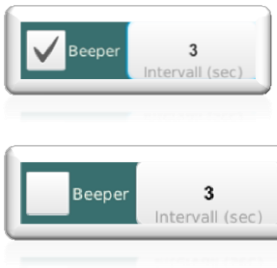
Pressing the button opens the following overview:



This overview shows all alarm functions

Meaning of colours and designations of buttons				
Unit		**Alarm**		**Beeper**
Green = no alarm		--		
Red = Current alarm		Red = Current alarm		Black = Beeper active
Grey = Alarm deactivated		Grey = Alarm deactivated		Grey = Beeper deactivated

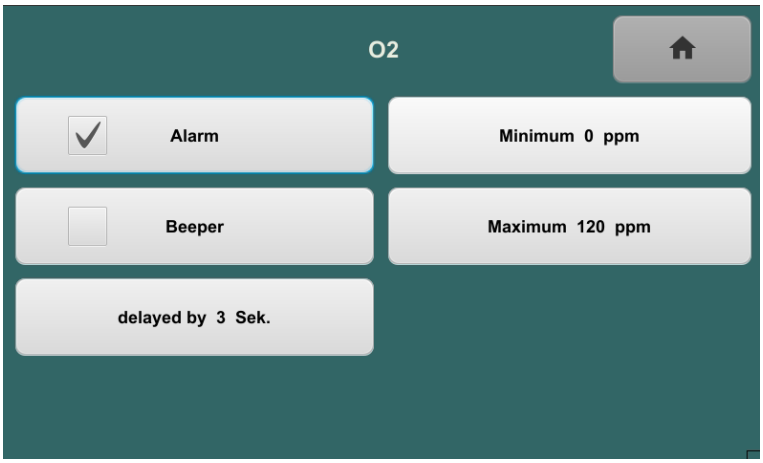
		Beeper is generally inactive, even if it has been set in the submenu.
Pressing the left field  checks the box		Beeper is generally active, if it has been set in the submenu.

Pressing the right field  opens:		Here a break can be programmed between the beeps within the indicated range. Note: == Continuous tone

In the following example

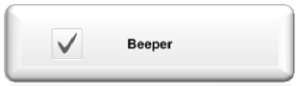
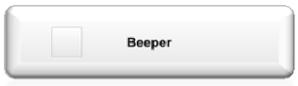
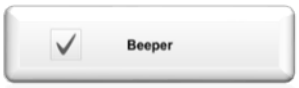
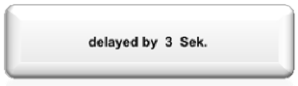
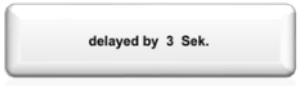
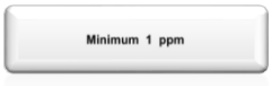
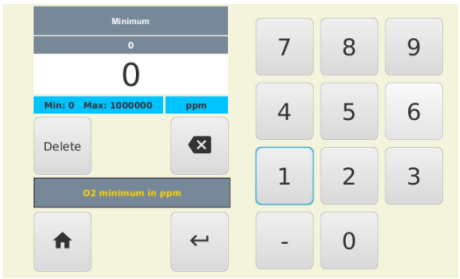
an alarm has been set for Lambda but the beeper remains off. The green text "Lambda" indicates that there is currently no alarm pending referring to the Lambda value display.

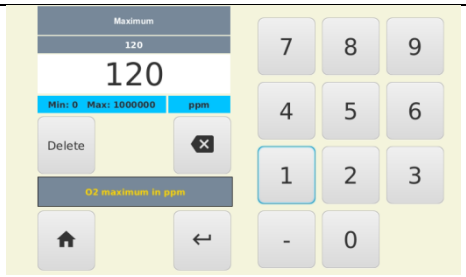
Example of the alarm settings for oxygen, "O_2".



Note: *All entries referring to "O_2" are given in ppm.*

The following settings can be made:

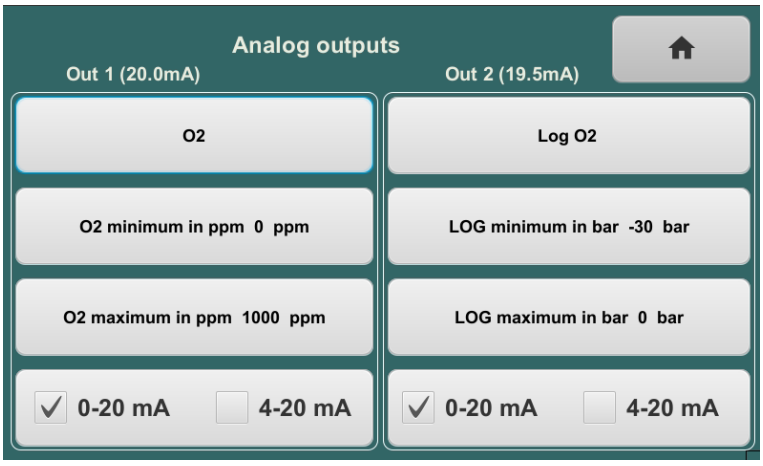
	An alarm will be given	
	No alarm will be given	
	Pressing the button results in:	
	Pressing the button results in:	
	If an alarm is given, there is a 3 second delay	
Pressing the button 		Here a time can be preset within the given range
		Here the value can be entered at which the alarm will be given in case the actual value falls below it. Entry is ALWAYS in ppm O_2 (1 % is equal to 10 000 ppm)
		Here the value can be entered at which the alarm will be given in case the actual value exceeds it. Entry is ALWAYS in ppm O_2 (1 % is equal to 10 000 ppm)

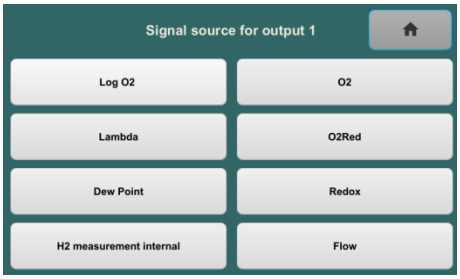
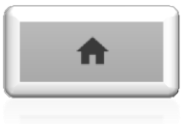
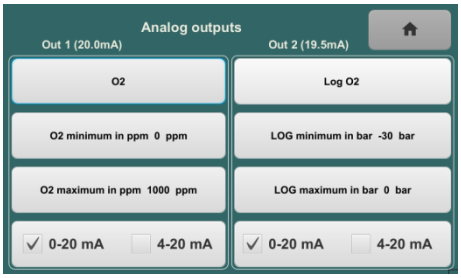
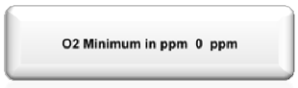
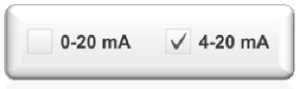
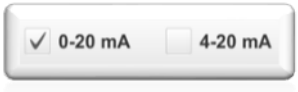
7.3.3 Analog outputs

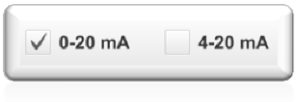
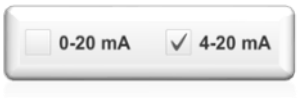
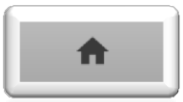
There are 2 analog outputs 0/4 to 20 mA available which can be configured independently of each other.

Pressing the button opens the following overview:



This overview shows all key settings of both analog outputs, including the currently delivered mA values.
The following table uses the measurement output "Out 1" as an example for all available settings. These are also valid for measurement output "Out 2".

Pressing the button opens: 		Here a measurand can be selected from the available options.
		Leaving the menu page (if no changes are required)
For example Pressing the button opens: 		Here the measurement range can be defined.
Pressing the button  opens:		Here the value can be entered at which 0 or 4 mA are to be put out.
Pressing the button  opens:		Here the value can be entered at which 20 mA are to be put out.
Pressing the button  defines:		Switch from 4-20 mA to 0-20 mA

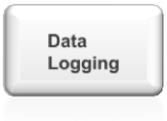
Pressing the button  defines:		Switch from 0-20 mA to 4-20 mA
		Leaving the menu page (if no changes are required)

7.3.4 Data logging

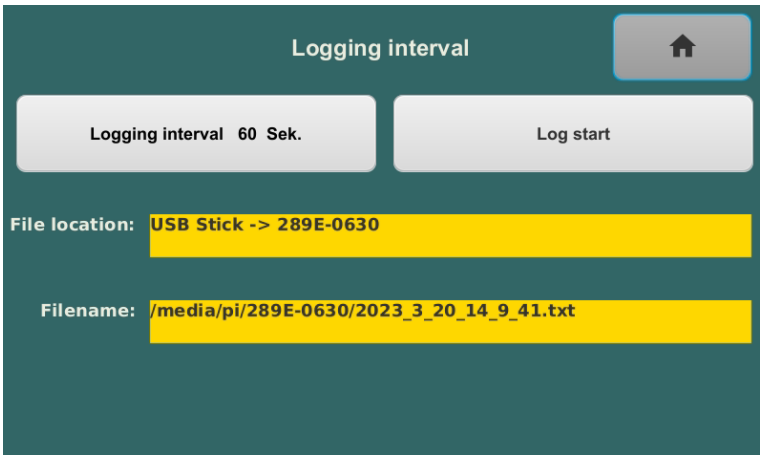
The measured and calculated measured values can be stored as data records. The data carrier can be an external USB stick or the internal SD memory card.

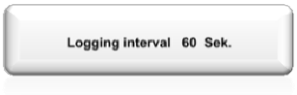
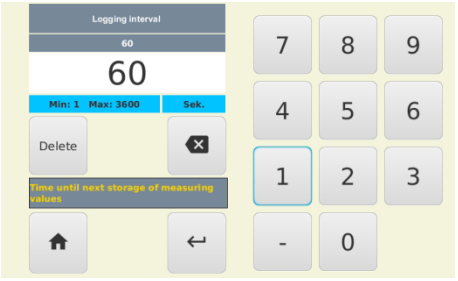
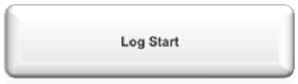
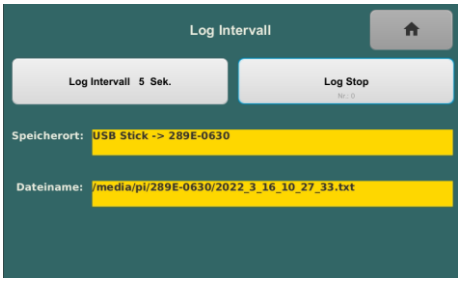
7.3.4.1 Data logging with USB stick

Note: *Each new START creates a new file. All individual data records, each one ca. 100 Byte large, will be stored in the file. The maximum number of data records depends on the available capacity on the USB stick and must be estimated by the user.*



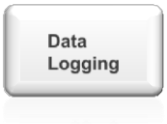
Pressing the button opens the following overview in case a USB stick was inserted:



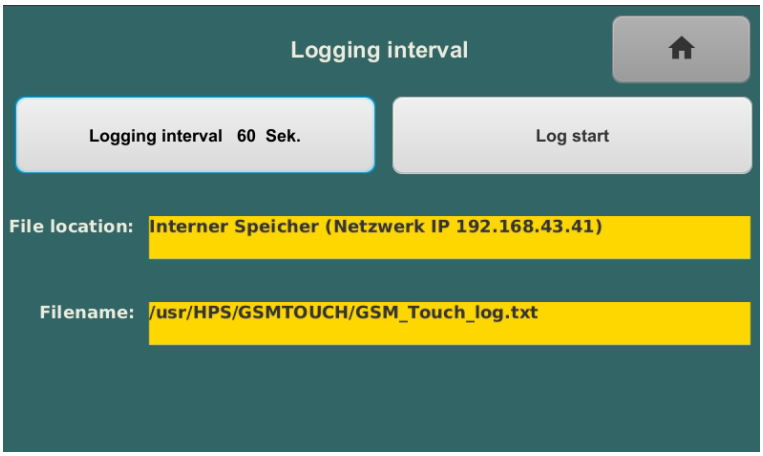
Pressing the button  opens:	 	A new value within the range shown can be entered here for the time interval between 2 measured values.
If the button  is pressed, the logging activity starts	 	The file name created at the start can be seen in the "File name" line. The name is created from date and time. On the USB stick the file name would be, for example: **2022_3_16_10_27_33.txt**

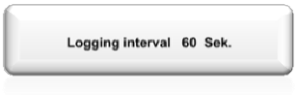
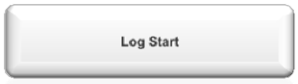
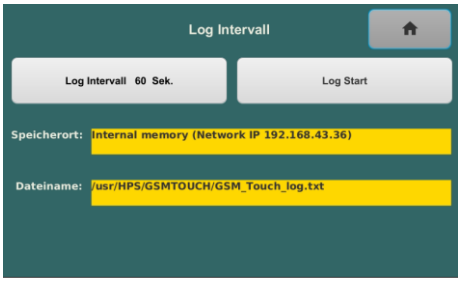
7.3.4.2 Data logging with internal SD Card

Note: *The data records will always be stored in the same file. Each new START will overwrite the previous data. A maximum of 50,000 data records can be stored. If this number is reached, the term "MAXIMUM" is entered in the button instead of the current data record number. No additional data records will be stored. The file can be picked up via the network.*



Pressing the button opens the following overview:



Pressing the button  opens:	 	A new value within the range shown can be entered here for the time interval between 2 measured values.
If the button  is pressed, the logging activity starts	 	The file name can be seen in the "File name" line. Access to the file takes place via the network, while the network identifier is displayed in the "Storage location" line.

7.3.4.3 Example of a file on USB stick

Example of a text file as it appears on the USB stick.
The individual bits of information are separated by a semicolon, acting as the separator.

2022_3_16_10_27_33.txt - Editor

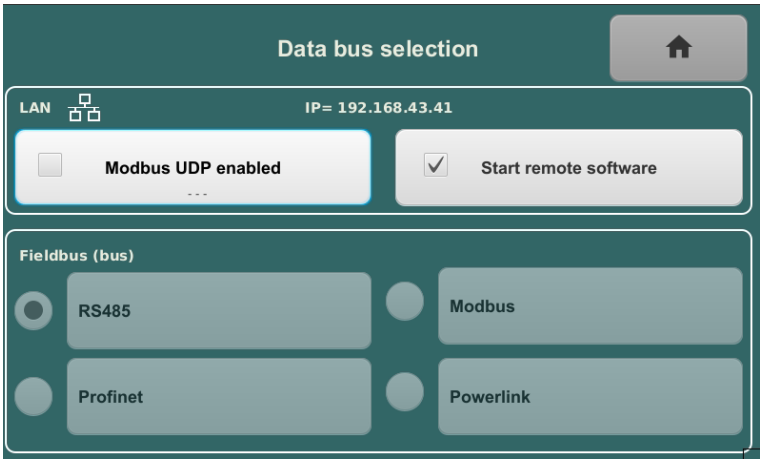
Datei Bearbeiten Format Ansicht Hilfe

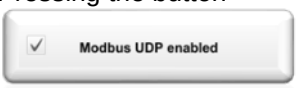
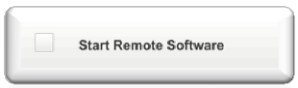
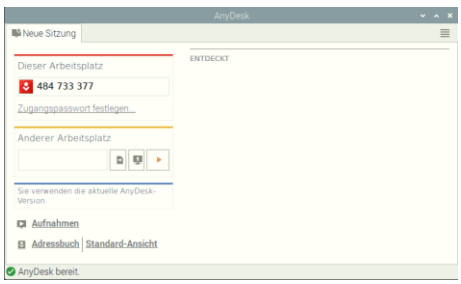
```
Nr;Date Time ;LogO2;O2 in ppm;Lambda;O2Red;Taupunkt;Redox;H2%;Alarmcode;Alarm
0; 2022,3,16 10:28:20; -4,63; 23,6; 1; 9999,00; 99; 0; 0; A000; Bereit
1; 2022,3,16 10:28:25; -0,68; 209400,0; 8; 9999,00; 99; 0; 0; A000; Bereit
2; 2022,3,16 10:28:30; -0,68; 209400,0; 8; 9999,00; 99; 0; 0; A000; Bereit
3; 2022,3,16 10:28:35; -18,97; 0,0; 1; 9999,00; 75; 0; 0; A000; Bereit
4; 2022,3,16 10:28:40; -16,60; 0,0; 1; 9999,00; 99; 0; 0; A000; Bereit
5; 2022,3,16 10:28:45; -13,19; 0,0; 1; 9999,00; 99; 0; 0; A000; Bereit
6; 2022,3,16 10:28:50; -11,50; 0,0; 1; 9999,00; 99; 0; 0; A000; Bereit
7; 2022,3,16 10:28:55; -10,03; 0,0; 1; 9999,00; 99; 0; 0; A000; Bereit
8; 2022,3,16 10:29:00; -8,96; 0,0; 1; 9999,00; 99; 0; 0; A000; Bereit
9; 2022,3,16 10:29:05; -7,18; 0,1; 1; 9999,00; 99; 0; 0; A000; Bereit
10; 2022,3,16 10:29:10; -5,21; 6,2; 1; 9999,00; 99; 0; 0; A000; Bereit
11; 2022,3,16 10:29:15; -2,55; 2847,0; 1; 9999,00; 99; 0; 0; A000; Bereit
12; 2022,3,16 10:29:20; -0,68; 209400,0; 8; 9999,00; 99; 0; 0; A000; Bereit
13; 2022,3,16 10:29:25; -0,68; 209400,0; 8; 9999,00; 99; 0; 0; A000; Bereit
```

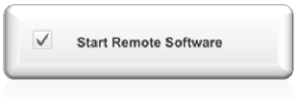
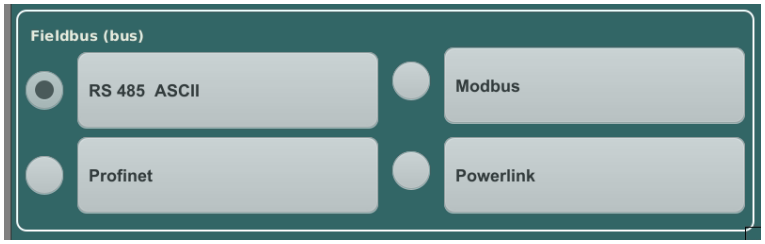
Sample file inserted via Excel										
No	Date Time	LogO2	O2 in ppm	Lambda	O2Red	Dew point	Redox	H2%	Alarm Code	Alarm
0	2022,3,16 10:28:20	-4.63	23.6	1	9999	99	0	0	A000	Ready
1	2022,3,16 10:28:25	-0.68	209400	8	9999	99	0	0	A000	Ready
2	2022,3,16 10:28:30	-0.68	209400	8	9999	99	0	0	A000	Ready
3	2022,3,16 10:28:35	-18.97	0	1	9999	75	0	0	A000	Ready
4	2022,3,16 10:28:40	-16.6	0	1	9999	99	0	0	A000	Ready
5	2022,3,16 10:28:45	-13.19	0	1	9999	99	0	0	A000	Ready
6	2022,3,16 10:28:50	-11.5	0	1	9999	99	0	0	A000	Ready
7	2022,3,16 10:28:55	-10.03	0	1	9999	99	0	0	A000	Ready
8	2022,3,16 10:29:00	-8.96	0	1	9999	99	0	0	A000	Ready
9	2022,3,16 10:29:05	-7.18	0.1	1	9999	99	0	0	A000	Ready
10	2022,3,16 10:29:10	-5.21	6.2	1	9999	99	0	0	A000	Ready
11	2022,3,16 10:29:15	-2.55	2847	1	9999	99	0	0	A000	Ready
12	2022,3,16 10:29:20	-0.68	209400	8	9999	99	0	0	A000	Ready
13	2022,3,16 10:29:25	-0.68	209400	8	9999	99	0	0	A000	Ready

7.3.5 Bus Parameters

Pressing the button opens the following overview of all available bus configurations.

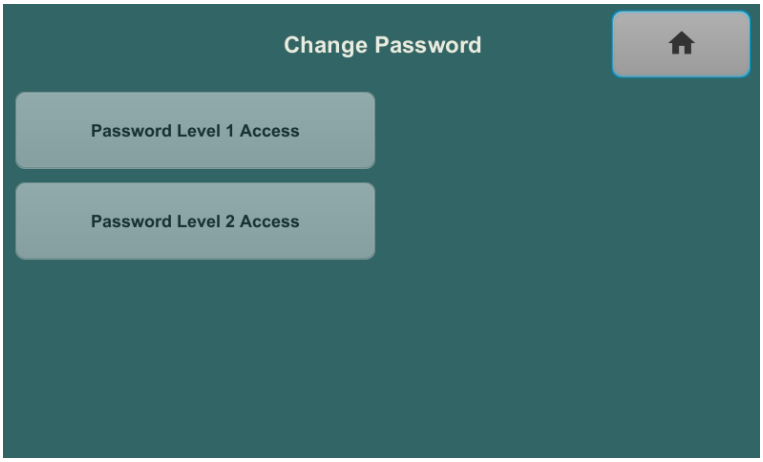


Pressing the button  activates	 	Network (LAN) is activated The current IP address is displayed. In this example: IP= 192.168.43.36 (Designation of socket M12 is "⊞"
Pressing the button  deactivates:	 	Network (LAN) is deactivated
Pressing the button  activates:	 	Here the remote maintenance program "AnyDesk" is activated. A PC with "Any Desk Master" on it can carry out all functions. In order to do this, the Master PC requires the AnyDesk address shown in this example. 484 733 377 As soon as the Master starts a session, it must be confirmed on the GSM-touch by pressing the "Accept" button on the AnyDesk input mask.
		AnyDesk is active, until GSM-touch has been separated

		from the mains.
		Here the field bus is displayed, the hardware of which has been factory-setting. The user cannot modify the bus. (Connector lable is "bus")
		The data transfer is continuously "9600,8,1,e" without request. (9600 Baud, 8 data bits, 1 stop bit, parity even)

7.3.6 Password

Pressing the button opens the following overview:

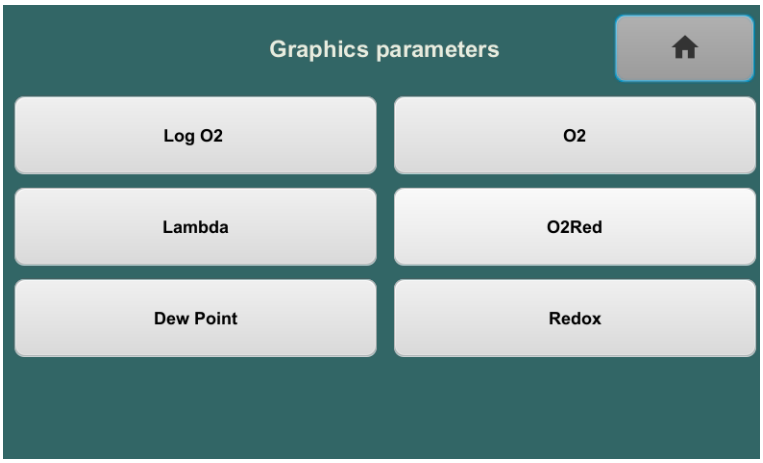


This overview shows the levels designed for entering a password, however, access is only possible on the next level up after entering the appropriate access CODE.

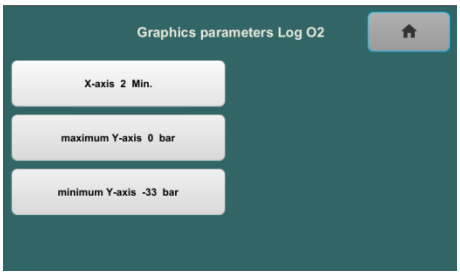
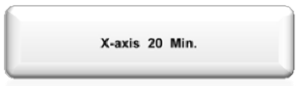
7.3.7 Diagram

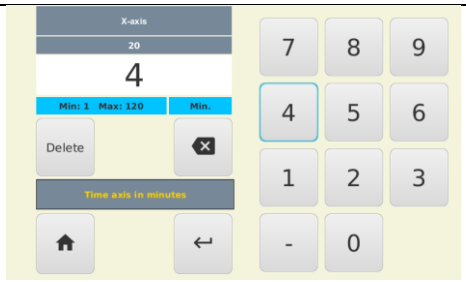
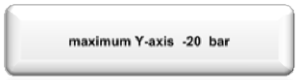
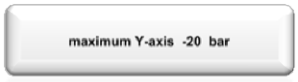
Note: *All entries referring to "O_2" are given in ppm.*

Pressing the button opens the following overview of all available diagrams.

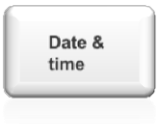


The following table shows the parameterization of the "Log O2" diagram as an example. All other diagram settings follow this pattern.

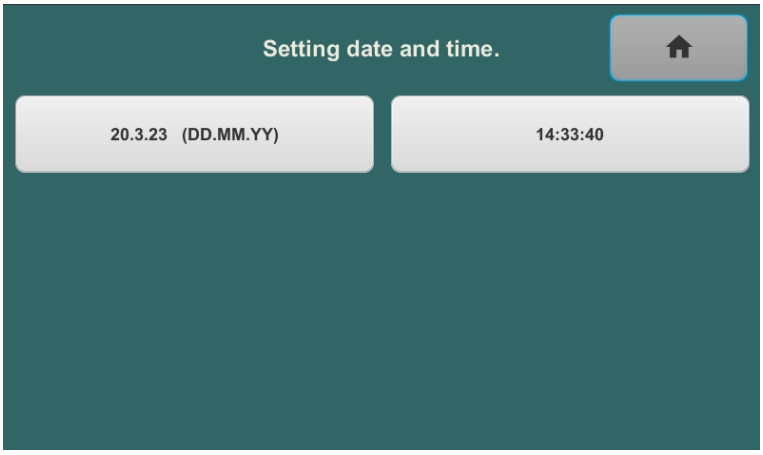
Pressing the button  opens:		
		In this example, 20 minutes are saved.
Pressing the button  opens:		A new target value can be entered here. *Note: Any number that is divisible by 4 without a remainder, makes the scale*

		*easier to read.*
		In this example, -20 bar are saved. This means that the oxygen partial pressure was programmed to be 10^{0} bar.
Pressing the button  opens:		A new target value can be entered here.
		In this example, -20 bar are saved. This means that the oxygen partial pressure was programmed to be 10^{-20} bar.
Pressing the button  opens:		A new target value can be entered here. *Note: Any number that is divisible by 4 without a remainder, makes the scale easier to read.*

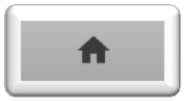
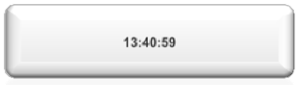
7.3.8 Date & Time

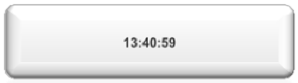
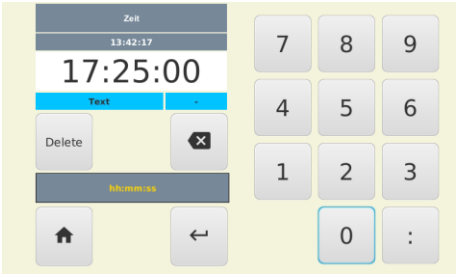


Pressing the button opens the following overview:

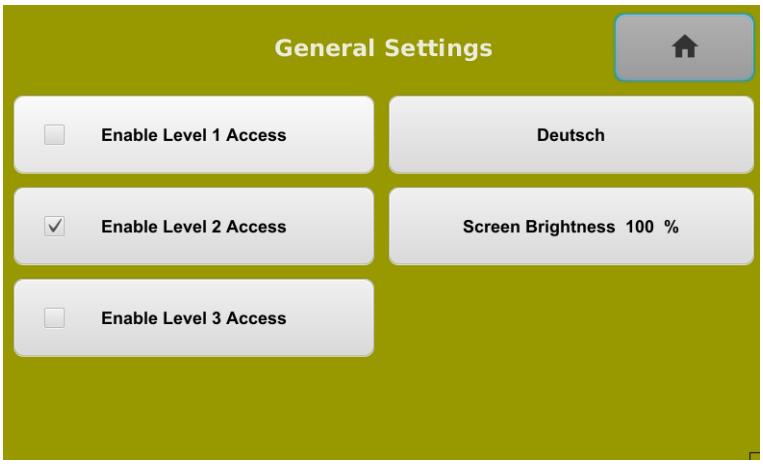


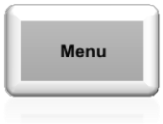
The following table shows the parameterization of date and time:

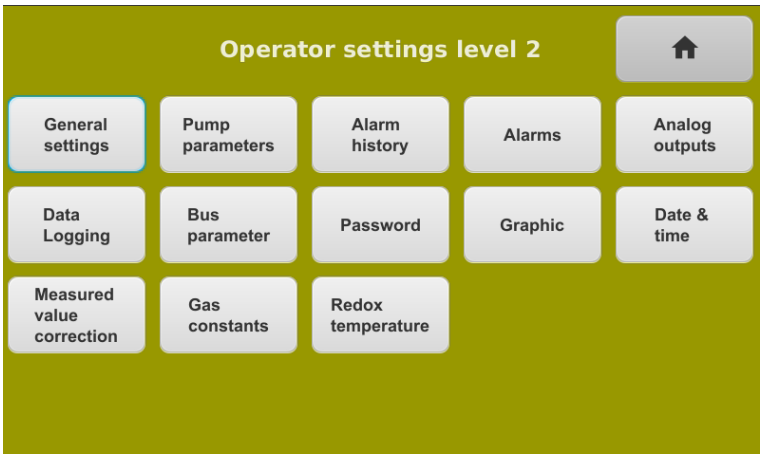
		The current date is 14 March, 2022
		Exit the menu page without saving
Pressing the button  opens:		A new target value can be entered here.
		The current time is 13:40 and 59 seconds

Pressing the button  opens:		A new target value can be entered here.

7.4 Level "2"



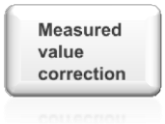
If level 2 has been enabled, the  button opens the following menu.



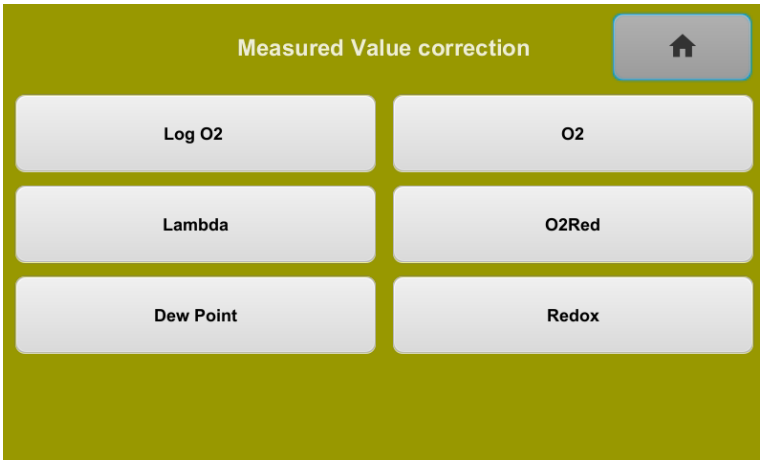
7.4.1 Settings described on Level 1

7.4.2 Correction of a measured value

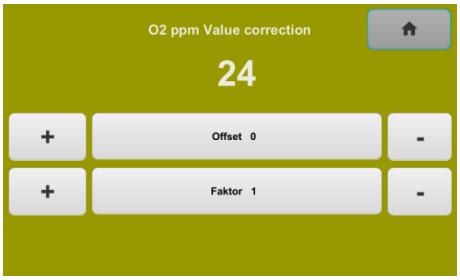
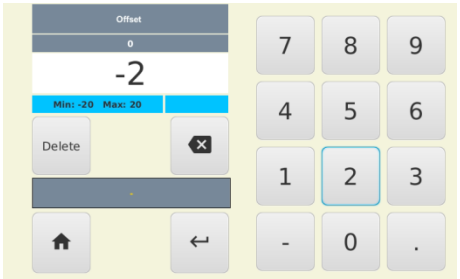
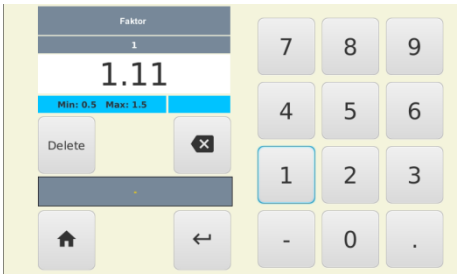
If necessary, the current measured value can be corrected. In this case it is advisable to make the adjustment after a stable measurement has been achieved and possible errors in measurement can be ruled out.
The reconciliation starts as soon as the menu is called up



Pressing the button opens the following overview:



Each measurand can have its individual correction factors. This is shown on "O2" as an example, which is also valid for all other measurands.

Pressing the button  opens:	 	Here the value displayed in the header can be changed by pressing the "+" or "-" button. The change is shown immediately.
Pressing the button  opens:	 	Here a numeric correction value can be entered, if the increments used for the "+“ and "-" are too small.
Pressing the button  opens:	 	Here a numeric correction value can be entered, if the increments used for the "+“ and "-" are too small.

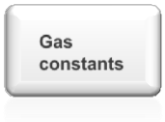
Note:
Corrections should only be made by trained users who are familiar with the calculation functions.

Notes for correcting "O2":

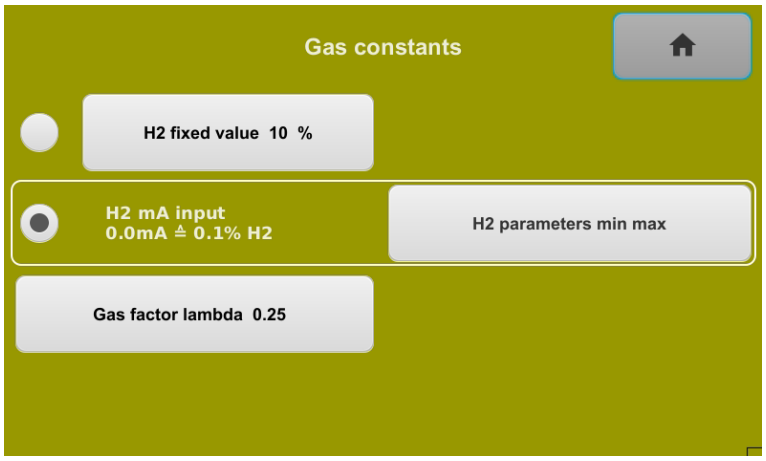
- The additive value is used for correcting oxygen, when the display is adjusted to 20.9 %. In this process the measuring input is kept open with the sample gas pump running, meaning that ambient air is sucked in. The result of the correction is displayed on the right side of the display.
- The multiplicative value will be entered, when the oxygen is corrected with the test gas connected up, and adjusted to the test gas value. (the additive correction value should not be changed with test gas)
- The correction values additive = 0.0 and multiplicative = 1.0 mean: A correction will have no effect.

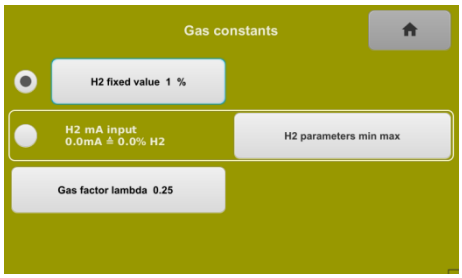
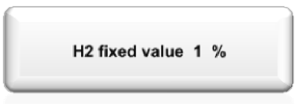
7.4.3 Gas Constants

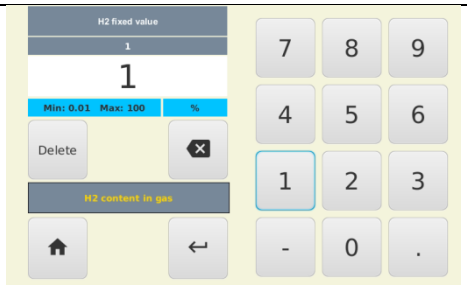
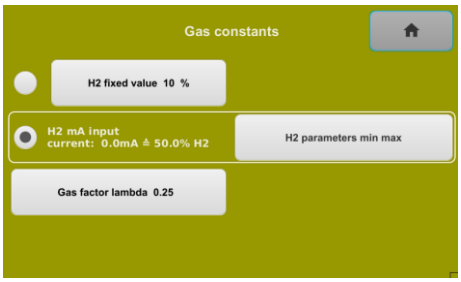
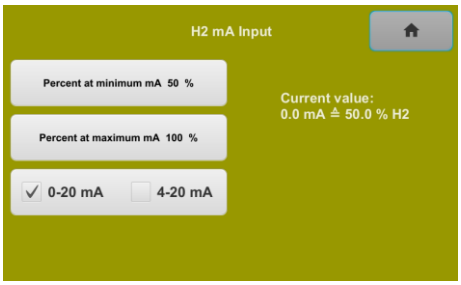
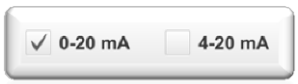
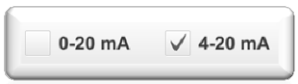
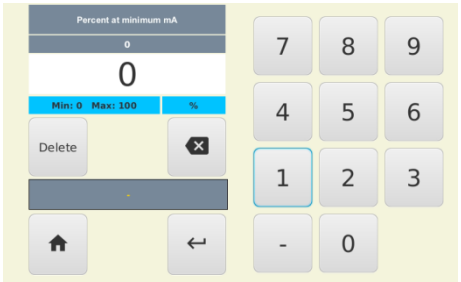
The calculation of the dew point is made based on the measured oxygen partial pressure and the known hydrogen proportion in the gas mixture. The hydrogen proportion must be entered as a percentage.
The calculation of the Lambda value is made based on the measured oxygen partial pressure and the gas used for combustion. This requires entering a factor, called the "Gas factor Lambda", which indicates the gas.

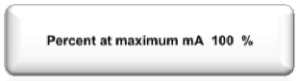
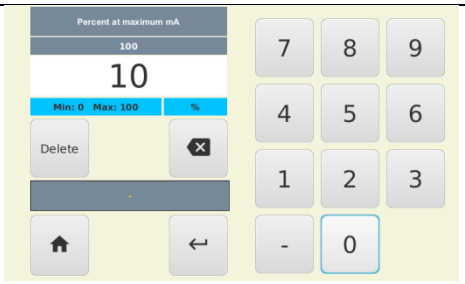


Pressing the button opens the following overview for defining the source of the hydrogen proportion.



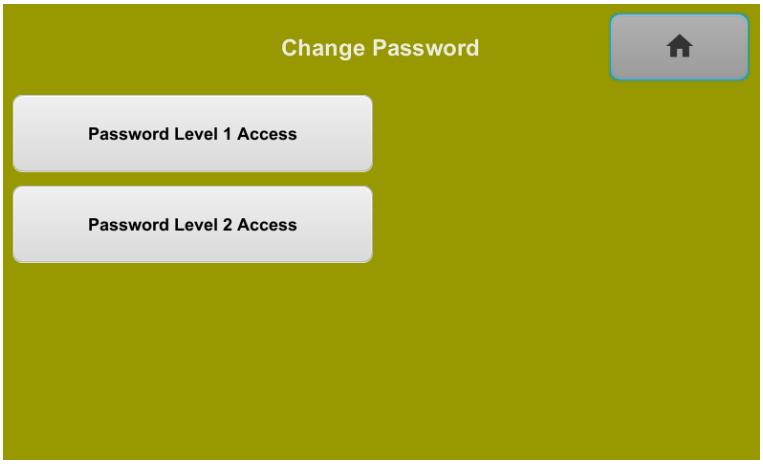
		In the example a fixed value of 1% H_2 has been used.
Pressing the button  opens:		Here a new value can be entered within the given range.

		
		In the example, the external input for measuring the H2 proportion currently displayed has been activated.
Pressing the button  opens:		This menu must be used to configure the required measured. In case an external measuring device has been connected up, the current value is shown, otherwise "--- ".
		Here a measuring input of 0-20 mA is activated.
Pressing the button  causes a switch:		Here a measuring input of 0-20 mA is activated.
Pressing the button  opens:		Here a new value can be entered within the given range. This value is the minimum percentage of the external measuring device.

Pressing the button  opens:	 	Here a new value can be entered within the given range. This value is the maximum percentage of the external measuring device.
 		In the example a fixed value of 0.25 has been used.
Pressing the button  opens:	 	Here a new value can be entered within the given range.

7.4.4 Password (CODE)

Pressing the button opens the following overview:



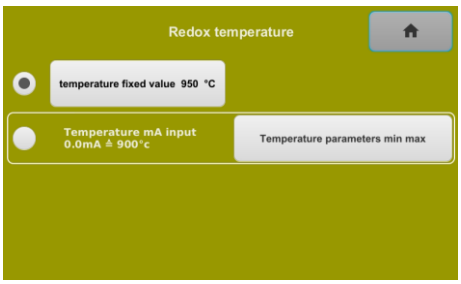
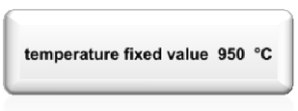
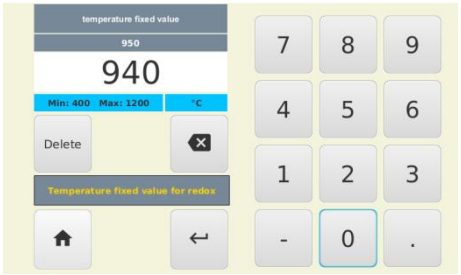
The factory-set CODE for access can be changed for both levels.

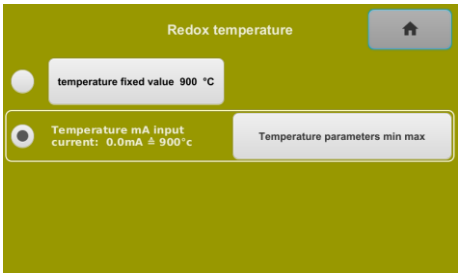
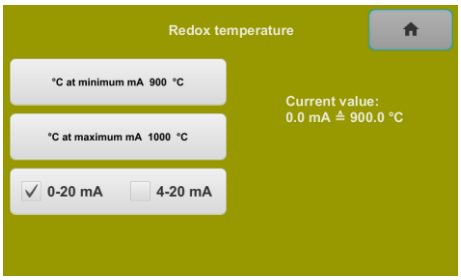
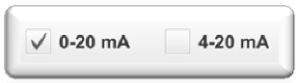
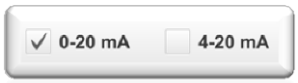
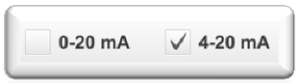
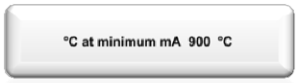
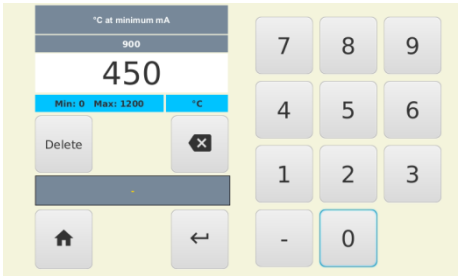
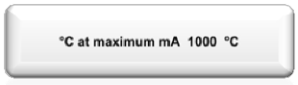
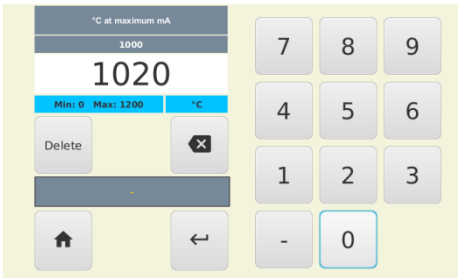
Attention! In case the CODE is lost or forgotten, the original state can only be re-established by resetting the device to factory settings.

The following table uses access level 1 as an example for all available settings. These are also valid for access level 2.

Pressing the button  opens:	 	Here a new CODE can be entered and stored by pressing ENTER button.
 	Can only be opened with a special CODE.	

7.4.5 Redox Temperature

Pressing the button  opens:	 	In this example, fixed value was selected and a fixed value of 940°C was entered.
Pressing the button  opens:	 	Here a new value can be entered within the given range.

		In this example, the external input for measuring the temperature currently displayed has been activated.
Pressing the button  opens:		This menu must be used to configure the required measured. In case an external temperature measuring device has been connected up, the current value is shown.
		Here a measuring input of 0-20 mA is activated.
Pressing the button  causes a switch:		Here a measuring input of 0-20 mA is activated.
Pressing the button  opens:		Here a new value can be entered within the given range. This value is the minimum percentage of the external measuring device.
Pressing the button  opens:		Here a new value can be entered within the given range. This value is the maximum percentage of the external measuring device.

7.5 Level "3"

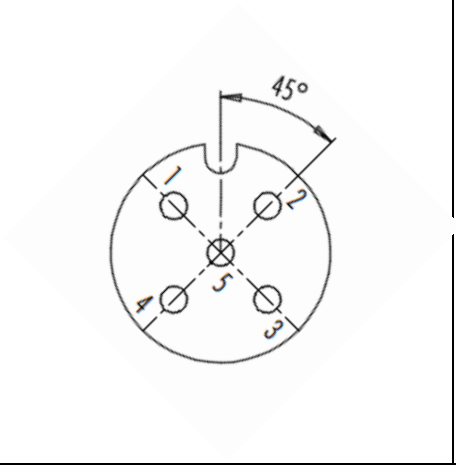
Note:
Only available for factory settings.

8 Connections

The right side panel of the GSM-touch accommodates all available sockets for connecting cables.

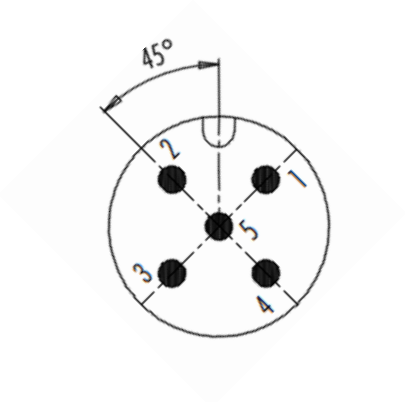
Photo of the right side panel of the GSM-touch

8.1 Analog inputs

<table>
<tr>
<td> 
</td>
<td>View of built-in M12 CODE A socket

</td>
<td>Input 0/4 – 20 mA from external transducers
<table>
<tr><th>Pin</th><th>Type</th></tr>
<tr><td>1</td><td rowspan="2">H_2 input</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td><td rowspan="2">Temperature</td></tr>
<tr><td>4</td></tr>
</table></td>
</tr>
</table>

8.2 Analog outputs

View of built-in M12 CODE A jack

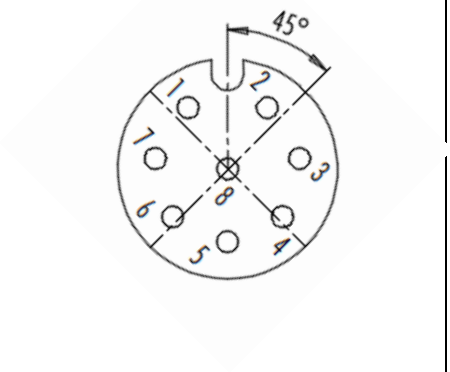


Output 0/4-20 mA

Pin	Type
1 -	Output 1
2 +	
3 -	Output 2
4 +	

8.3 Alarm outputs

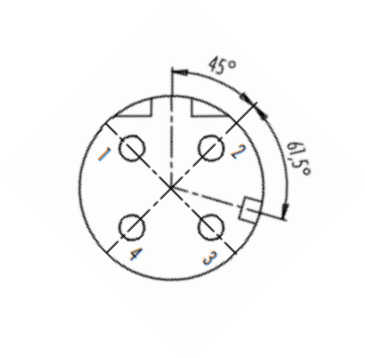
View of built-in M12 CODE A socket



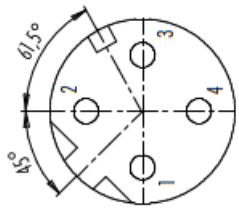
Relay output
Semiconductor relay 24VAC/DC, max 2 A)

Pin	Type
1	Collective alarm
2	
3	Maximum alarm
4	
5	Minimum alarm
6	
7	Redox alarm
8	

8.4 Data bus

<table>
<tr>
<td> 
</td>
<td> 
</td>
<td>Field bus depending on configuration. Factory setting RS422/485
<table>
<tr><th>Pin</th><th>Function</th></tr>
<tr><td>1</td><td>TX+ (+TX1)</td></tr>
<tr><td>2</td><td>RX+ (+RX1)</td></tr>
<tr><td>3</td><td>TX- (-TX1)</td></tr>
<tr><td>4</td><td>RX- (-RX1)</td></tr>
</table></td>
</tr>
<tr>
<td></td>
<td>View of built-in M12 CODE D socket</td>
<td></td>
</tr>
</table>

8.5 Network

<table>
<tr>
<td>  </td>
<td> 
</td>
<td>LAN connection e. g. with standard cable M12-Ethernet</td>
</tr>
<tr>
<td></td>
<td>View of built-in M12 CODE D socket</td>
<td></td>
</tr>
</table>

8.6 USB

<table>
<tr>
<td> 
</td>
<td>  </td>
<td>external data storage (USB-Stick)</td>
</tr>
</table>

9 Network

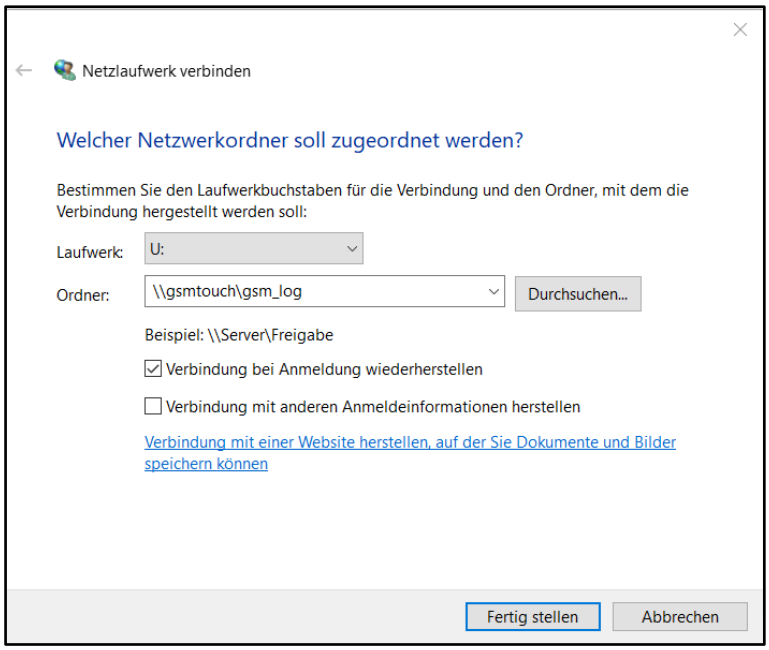
9.1 Connection to an Ethernet network

Attention!
Operating on the WINDOWS platform requires special skills and may only be performed by authorized personnel.
In other countries and languages, the headings and texts may differ from the examples shown.

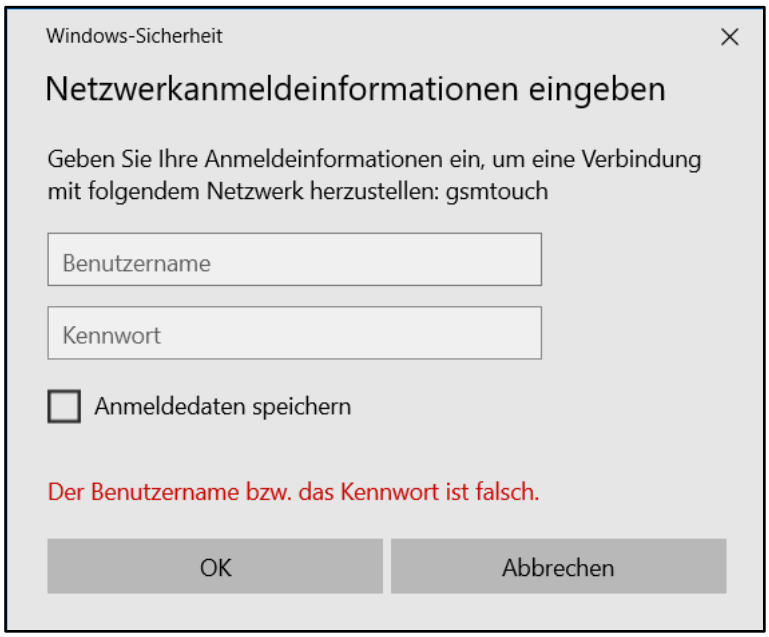
A connection will be established within the network by means of an Ethernet cable between router and GSM-touch.

The following instruction is an optional way to find the log file on the SD card in the device. The GSM-touch is not assigned to any specific "Workgroup". (DHCP will assign an IP address). The entries shown are an example and may vary between different PCs and Windows versions.

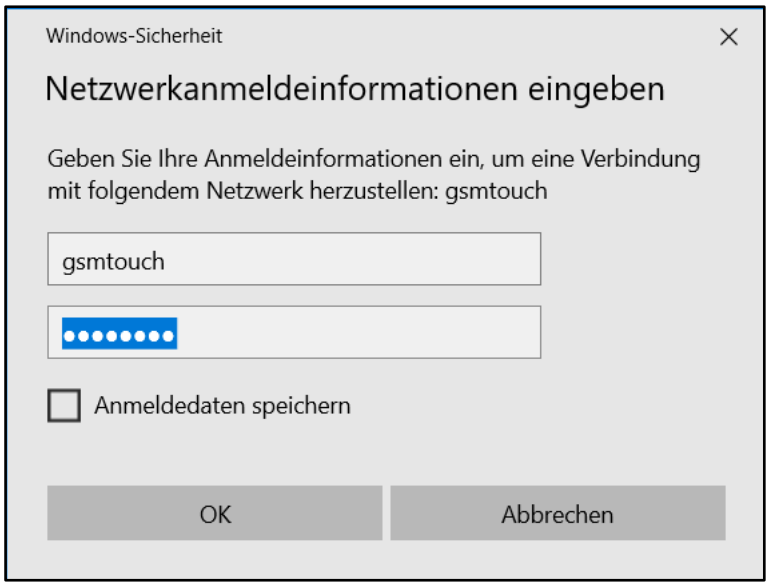
Now click "Network" in the Windows file explorer and "Connect with disk drive". In this example, this is drive "U".



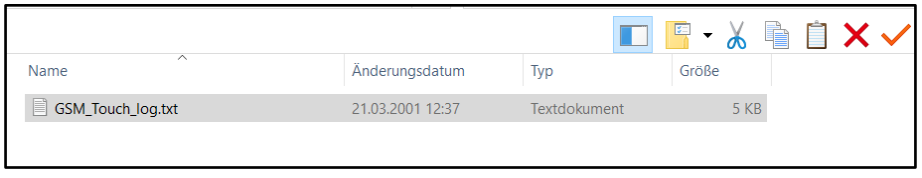
(Folder: \\gsmtouch\gsm_log)
After confirming by clicking on "Complete", you need to log into the network.



(User name: gsmtouch; Password: gsmtouch)



The file "GSM_Touch_log.txt" is listed on the right side of the file manager.



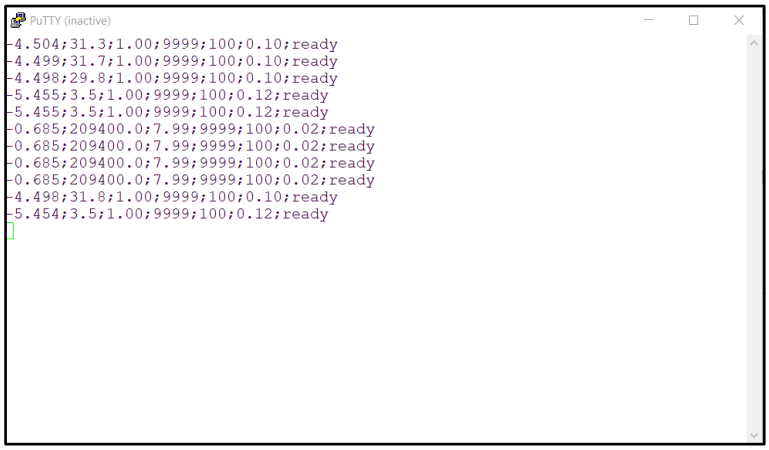
The file "GSM_Touch_log.txt" (for file contents see example further up) is now available.

10 Data File Examples

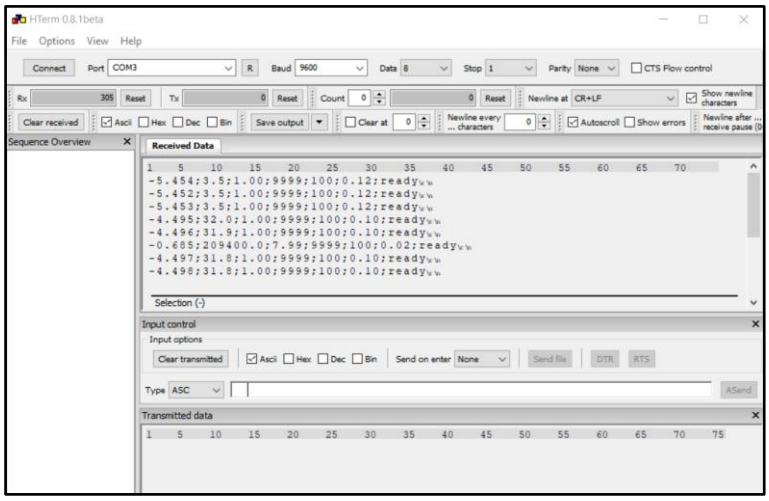
10.1 Field bus RS485

Field bus RS422/485 (9600,8,N,1)							
Log O_2	ppm O_2	Lambda	O_2 Red	Dew point	Redox	Status	CR/LF

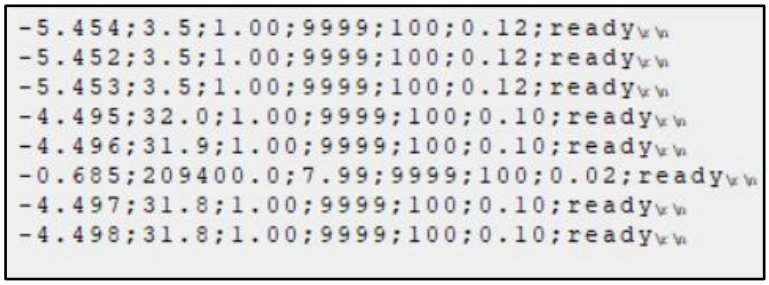
The data flow can be displayed and recorded with PUTTY or HTERM.



10.1.1 Example with Putty



10.1.2 Example with HTERM



Enlarged view of HTERM example

10.2 Modbus UDP

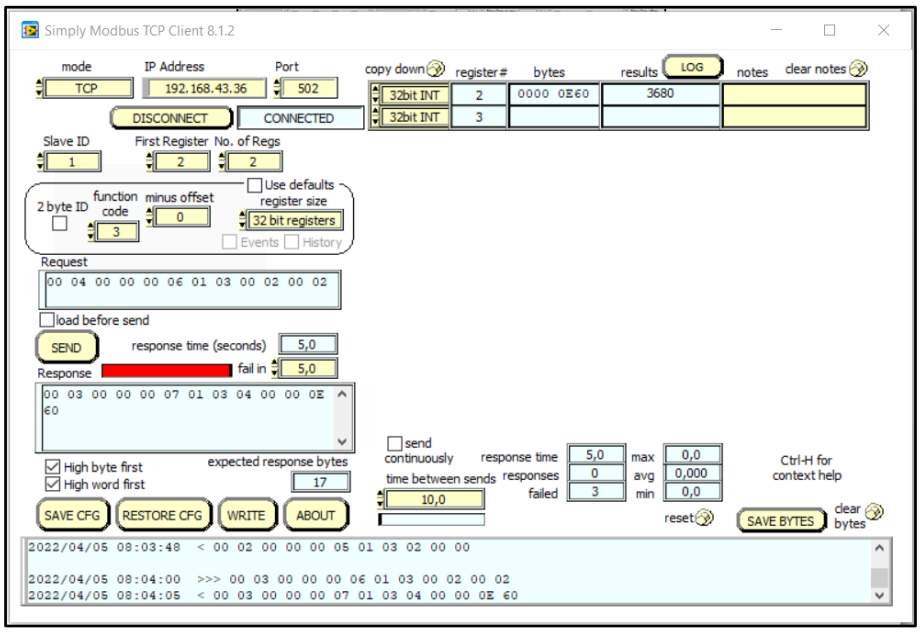
10.2.1 Example using SimplyModbus TCP

The following examples have been performed using the SimplyModbus TCP tool.
The bus is a read only tool. Write commands are not supported.
Settings: Slave ID = 1, Function Code for read = 3, results are 32 bit, while "High byte first" and "High word first" apply.
In order to simplify the handover of the measured values, they will only be stored as integers. When read, results need to be multiplied with factors.

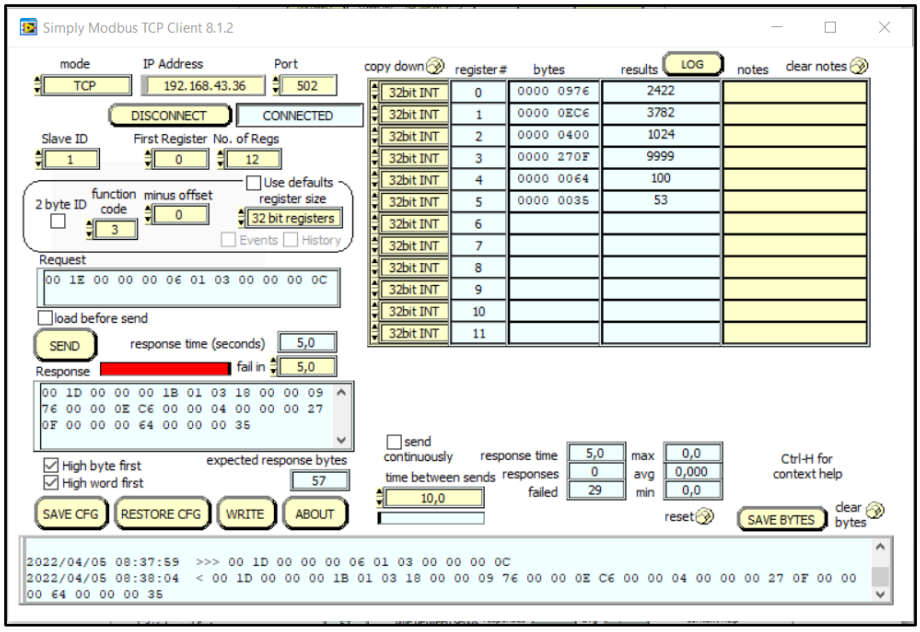
Analog measured values		
Register 32bit	Measured value	Factor
0	Log O2	-0.001
2	O2 in ppm	1
4	Lambda	0.001
6	O2 Red	1
8	Dew point	1
10	Redox	0.001
Digital values		
Register 16bit	Type	Meaning
12	Status	1=Heat up; 2=Ready
13	Collective alarm	0/1
14	Max Alarm	0/1
15	Min Alarm	0/1
16	Redox alarm	0/1
17	Alarm Code	

Table: Correction factors

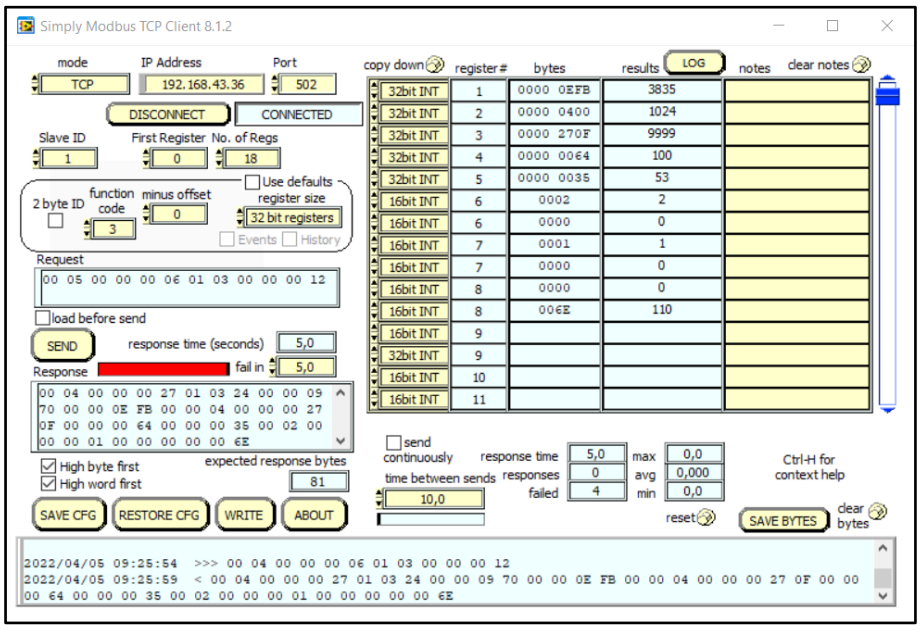
The read command for register 2 in HEX is: `00 00 00 06 01 03 00 02 00 02`



In the example, the reading was 3680 ppm



In the example, the reading included all analog measured values



In the example, the reading included all analog and digital values

10.2.2 Example using METROTEC Excel-MBAXP

Excel was adjusted in order to ensure a simple connection with GSM-touch and display measured values on the PC.

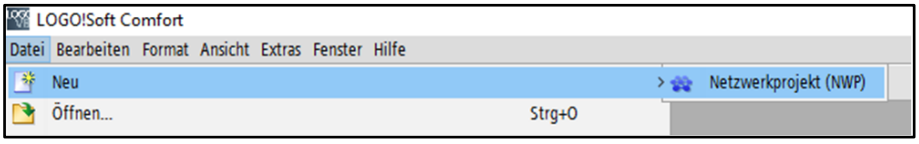
TCP/IP Connection = Open

Messbereich	Wert	Einheit
Log O2	-1,469	bar
O2	33955	ppm
Lambda	1,26	L
O2 Red	9999	-
Taupunkt	100	°C
14	0,03	bar
Status	2	
Datensatz Nr.	27	
Sammel Alarm	0	
Max Alarm	1	
Min Alarm	0	
Redox Alarm	0	
Alarmcode	110	

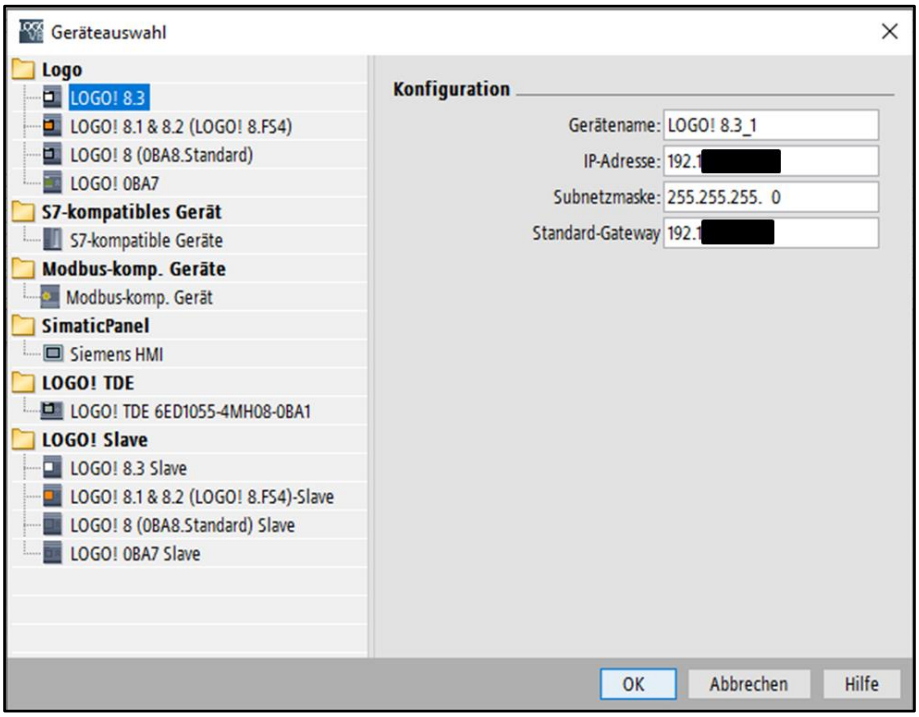
10.2.3 Example using Siemens LOGO! (German version)

Connection is prepared with Siemens Tools, as shown in the following example:

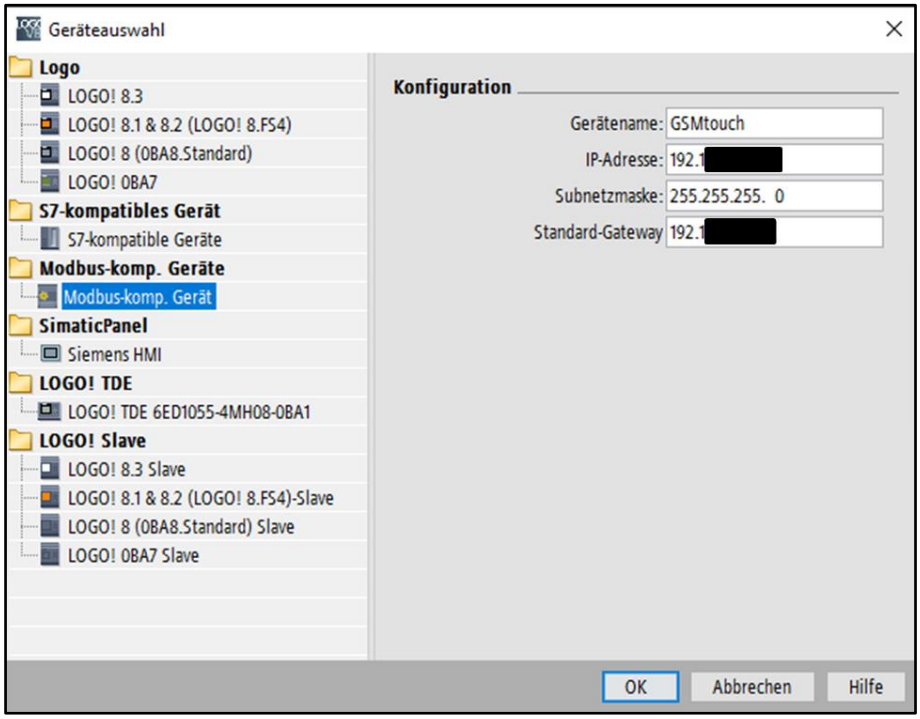
Create new network project

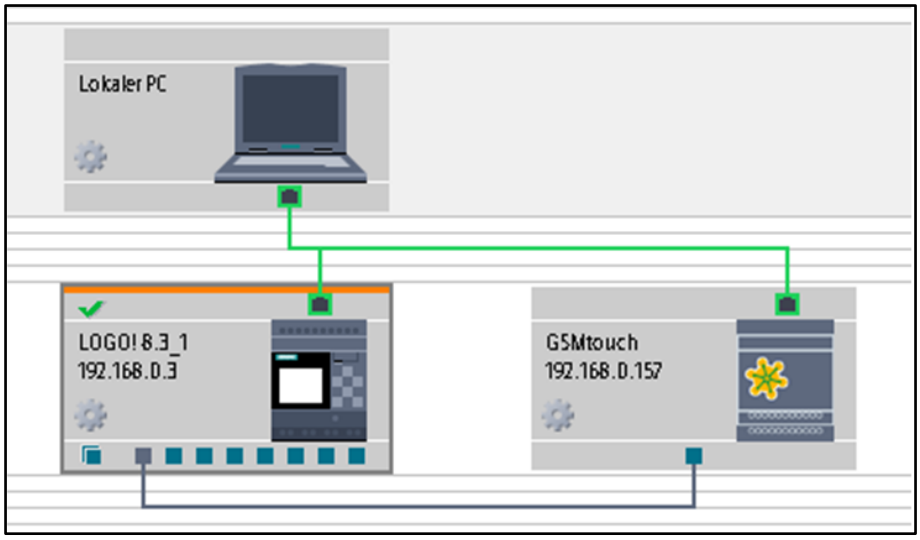


LOGO! by Add new device
LOGO! Select version
Configure network settings (PI…)

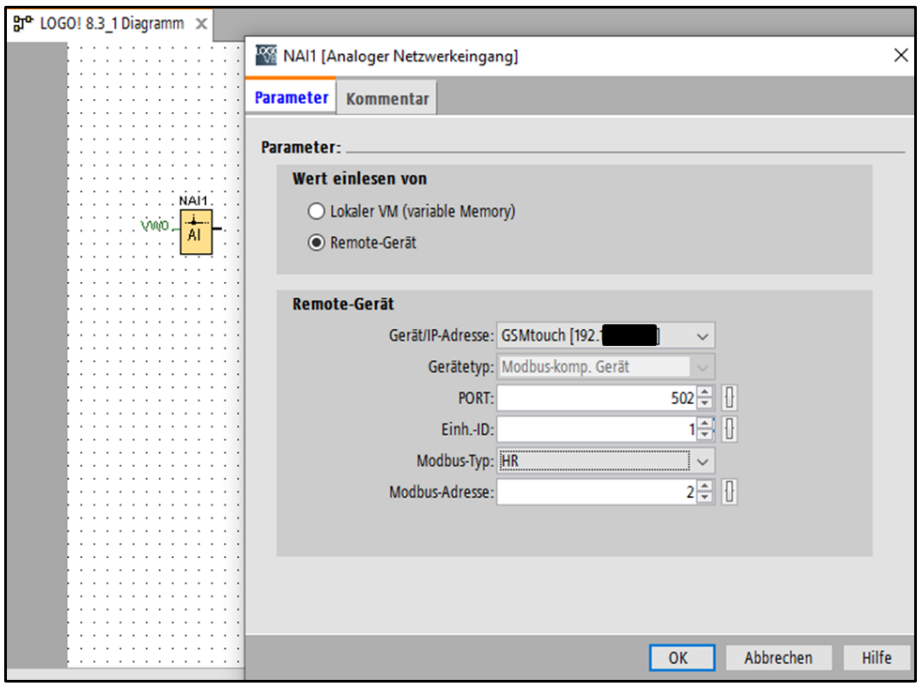


GSM-touch by Add new device,
Select Modbus compatible device
Configure network settings (IP…)

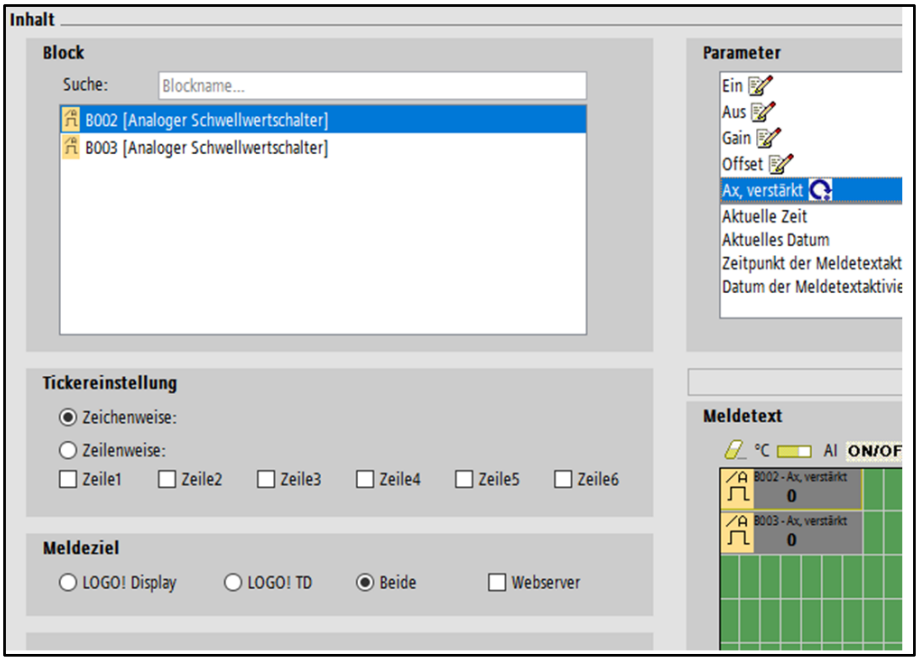




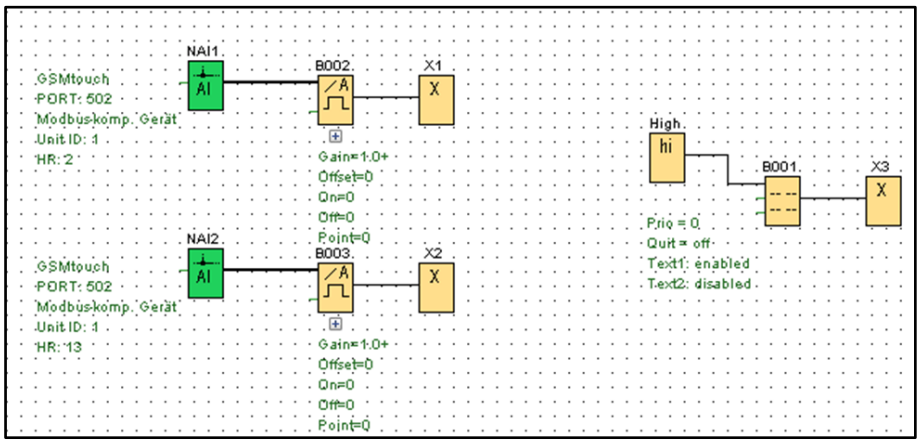
Insert analog network input module in diagram editor
Select parameter remote device
Select GSMtouch device
Port to 502
Device ID to 1
Modbus Type to HR
Modbus address to 2, Register 1 (Log=2 LowWord) + Offset 1
repeat above steps for each module
Modbus address to 13, Register 12 (Status) + Offset 1



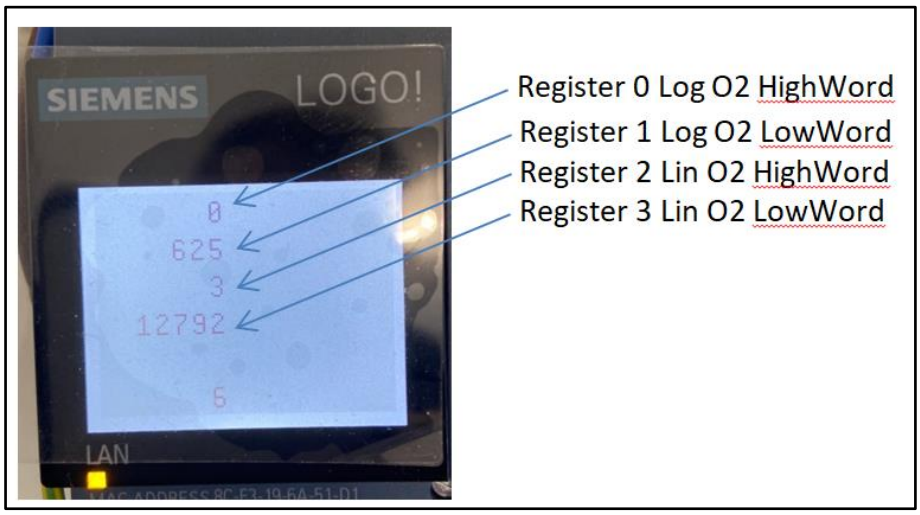
In order to display values on LOGO Display
Insert two analog threshold switches and connect with one analog network input module each
Insert a message text module
Pull parameter Ax from both analog threshold switch modules into message text



Insert three open terminal modules and connect with open module outputs.
Insert state hi module and connect with EN port of message text module.



Load program in LOGO and start it
Display line 1 shows Register 1 (Log=2 LowWord)
Display line 2 shows Register 12 (Status)



Result:
As described in chapter "Modbus UDP", the values are transferred with 32 bit in the form of 2 "Word". In addition, in order to simplify the handover of the measured values, they will only be stored as integers. When read, the results must be multiplied with factors such as those listed in the table "Correction factors".
The conversion follows the pattern:

Measured value = (Register_HighWord*65536+Register_LowWord) * Factor
Example 1: Register 0 = 0; Register 1 = 625 hence:
Log O_2 =(Reg_0 * 65536 + Reg_1)*-0.001 = 625*-0.001 = -0.625
Example_2:
ppm O_2= (Register 2*65536+Register 3)*1=(3*65536*12792)*1=209400
The further processing of the measured values rests with the user.

10.3 PLC

Connecting the device with a PLC requires knowledge about the PLC used. The principle of the data flow can be derived from the examples given. Usually, the administration of numerical formats is already implemented in the PLC, especially for float numbers.

Due to the large variety of products it is impossible to deliver descriptions in this context.

11 Messages in the info line

The info line in the display shows messages in [ ] + Text. The following table contains explanations of the messages and, if applicable, measures for troubleshooting errors and alarms.

Message	Meaning	Cause
[R000]	Information on the start	----
[R001]	Communication error	Contact service
[A000]	Device is ready without alarms	-----
[A110]	Limit values and alarms as text display	Set or remove limit values and alarms
[A901]	Device temperature too low	Device environment too cold, transfer device to a warmer place
[A902]	Device temperature too high	Device environment too warm, transfer device to a cooler place
[A911]	Temperature too low	Device may currently be in a heating-up phase
[A912]	Temperature too high	Problem: Switch device off, contact service

12 Interfaces

12.1 Analog interfaces

2 analog outputs 0/4-20 mA for the output of measured values. These can be operated simultaneously and independently of each other.
2 analog inputs 0/4-20 mA for external transducers.

12.2 Digital interfaces

Relay for minimum limit
Relay for maximum limit
Relay for collective alarm
Relay for Redox alarm
Modbus TCP/UDP
RS422/485
LAN

13 Technical data

Measuring range	100 % to 10^{-35} bar O_2
Environment temperature	0 to 45 degrees Celsius
Measurement accuracy	+/- 0.3 mV of the sensor e.m.f. +/- 2 degrees Celsius +/- 2% of the mA output +/- 2% of the log oxygen partial pressure
Dimensions	210 x 320 x 80 mm (HxWxD) 330 x 320 x 80 incl. handle
Weight	3.5 kg
Electromagnetic compatibility	The device complies with the European Directive 2014/30/EU. The following Generic Standards are satisfied: Emitted interference EN 61000-6-4 Interference immunity EN 61000-6-2 The device can be operated without restrictions in living and industrial environments.
Supply voltage	100 - 240 Volt AC
Heating-up time for sensors	ca. 15 minutes
Response time	ca. 2 seconds
Sample gas temperature	max. 50 °C
Sample gas amount	min. 30 l/h, max. 120 l/h
Humidity	Dew point must not be fallen short of Attention! Forming of condensate
Dust	Dust must be filtered out Filter out solid matter particles larger than 5 µ
2 analog outputs 2 analog inputs	0/4 – 20 mA configurable, floating, connector M12 0/4 – 20 mA configurable, floating, socket M12
3 Relay outputs	configurable for alarms, 1A, 24 V (ohmic) connector M12
Interfaces	Modbus socket M12, USB 2.0 Modbus TCP/UDP connector M12
Software tools used	AnyDesk, Ecxel-MBAXP