Cobra SMARTsense Oxygen

12933-01

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Fig. 1: 12933-01 Cobra SMARTsense Oxygen

Operating instructions

The unit complies with the applicable EC-guidelines

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1 SAFETY PRECAUTIONS

Caution!

- Carefully read these operating instructions completely before operating this instrument. This is necessary to avoid damage to it, as well as for user-safety.
- Only use the instrument for the purpose for which it was designed.
- Only use the instrument in dry rooms in which there is no risk of explosion.
- Protect the instrument from dust, moisture and vapours. Use a slightly moist lint-free cloth to clean the instrument. Do not use aggressive cleaning agents or solvents.
- Take care that no liquid penetrates in through the housing openings, as such penetration would result in damage to Sensor.
- Do not open the unit.

2 PURPOSE AND CHARACTERISTICS

The sensor is used for measuring the gaseous oxygen content and the concentration of dissolved oxygen and for transferring the values to a terminal device, e.g. a tablet computer, smartphone, etc., via Bluetooth or USB.

3 FUNCTIONAL AND OPERATING ELEMENTS

3.1 Operating elements

The sensor has an on-button and two LEDs for indicating the Bluetooth and battery charge status.

On-button

To switch the sensor on and off in Bluetooth mode, the power button must be pressed for longer than 3s. If the sensor is to be connected via USB, it is not necessary to press the power button.

Bluetooth-LED

Flashing red every 2 seconds	Not connected
Flashing green every 2 seconds	Connected to the terminal device
Flashing green every 4 seconds	Running measurement

Battery charge LED

Flashing red every 2 seconds	Low battery
Illuminated red	Active charging process
Illuminated red	Charging process completed

3.2 USB port

The battery, which is permanently installed in the sensor, is charged via the type C USB port. Furthermore, communication with a computer takes place via this interface.

3.3 Measurement inputs

On the front of the sensor there is a four-pole connecting socket to which the supplied electrode can be connected

4 NOTES ON OPERATION

This device fulfils all of the technical requirements that are compiled in current EC guidelines. The characteristics of this product qualify it for the CE mark.

The individual connecting leads are each not to be longer than 2 m.

The instrument can be so influenced by electrostatic charges and other electromagnetic phenomena (HF, bursts, indirect lightning discharges) that it no longer works within the given specifications. Carry out the following measures to reduce or eliminate the effect of such disturbance: Ensure potential equalization at the PC (especially with Laptops). Use screening. Do not operate high frequency emitters (e.g. radio equipment or mobile radiotelephones) in the immediate vicinity. When a total failure of the instrument occurs, unplug it and plug it back in again for a reset.

5 HANDLING

This section describes the start-up of the sensor and the recording of measurement data. Please read this section thoroughly in order to avoid failures or operating errors.

5.1 Charging process

Use a USB-C cable to connect the sensor to a computer or USB charger (not included).

During the charging process, the battery charge LED lights up red. When the charging process is complete, the battery charge LED lights up green. The charging time for a completely discharged battery is 3 hours maximum.

Disconnect the charger at the latest four hours after the completion of the charging process. Otherwise, the service life of the battery may be negatively affected.

5.2 Start-up

Switch on the sensor by pressing the power button for more than 3s. Now the Bluetooth LED flashes red. Start the software and select the sensor.

If the sensor is to be used via the USB interface, it does not need to be switched on. The sensor is connected directly to the end device using the supplied USB cable.

There is a 9-digit code on the back of the sensor (Fig.2). The last 4 digits of the code are displayed as the sensor name in the software (Fig.3). This enables the precise assignment of the sensors within the software.

Fig. 2

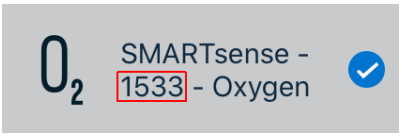

Fig. 3

Selection of the sensor via the Bluetooth interface

Make sure that the Bluetooth interface is activated on the terminal device (PC/Tablet/Smartphone) and that the software is allowed to access the interface.

After the sensor has been selected in the software, the LED flashes green to indicate that the connection has been established correctly. After the sensor has been coupled with the software, the sensor is no longer visible to other users in the software, and therefore can no longer be selected.

If the sensor is switched on and not connected, it switches off automatically after 5 minutes.

Selection of the sensor via the USB interface

For this purpose the sensor must be plugged into the USB port of the end device. It is not necessary to switch on the sensor. The sensor is automatically recognized and displayed. It can be selected and connected directly.

Topping-up the electrolyte solution

The lower end of the electrode can be unscrewed. This cap covers the actual electrode. The entire cavity between the cap and electrode must be filled with the liquid electrolyte (3 M KCl). Ensure that no air bubbles are entrapped. The electrode comes supplied in an unfilled state. In addition, the liquid evaporates gradually. This is why the liquid must be topped up from time to time.

1. Unscrew the lower end

2. Fill the cap with the liquid

3. Screw the filled cap back onto the electrode. Use a cloth to wipe off any liquid that leaks out.

Preparation
Connect the oxygen probe (included in the scope of supply) to the connector at the front of the sensor. Ensure that you can hear that the outer metal ring of the connector locks in place.
ATTENTION: Never turn the plug after it has been plugged in. This can lead to the destruction of the sensor.

Calibration
It is not necessary to recalibrate the sensor for every measurement. Especially if only the change in oxygen content is to be demonstrated, an already existing calibration (the last calibration remains automatically stored in the sensor) or the factory settings are usually sufficient. However, if absolute values are required for your measurement, e.g. if you are determining the oxygen content of bodies of water, or if you want to optimise the accuracy of your measurement, we recommend calibrating the sensor. **See section 5.4**.

5.3 Recording of measurement data

Measurement:
Two types of measurements can be performed with the Cobra SMARTsense Oxygen: Measurement of the oxygen content, e.g. in the air (%), and a measurement of the oxygen concentration in an aqueous solution (mg/l).

a) Measurement of oxygen in the air
Select the "Air" mode in the software.
It takes approximately 1 minute for the value to settle.

b) Measurement of dissolved oxygen
Select the "Fluid" mode in the software.

- Plunge the oxygen probe into the solution so that the temperature sensor is also covered (approximately. 5-6 cm). Do not immerse it completely in the liquid. The handle is not waterproof.

- Record the oxygen concentration with the aid of the recording function of the software.
- Ensure that the water sample that is to be analysed is slightly stirred in a continuous manner. This is important since the sensor consumes oxygen during the measurement. Without stirring, it would seem as if the oxygen concentration decreases.

Measuring principle:
This sensor type is an amperometric Clark sensor with a platinum cathode and a silver anode.
A fixed voltage is applied at the platinum electrode. When oxygen diffuses through the membrane and to the cathode, the latter will be reduced:

$$1/2\ O_2 + H_2O + 2^{e-} \rightarrow 2\ OH^-$$

The reference electrode (anode) is subject to oxidation:

$$Ag + Cl^- \rightarrow AgCl + e-$$

Correspondingly, a current flows and this current is proportional to the oxygen diffusion and, thereby, to the oxygen concentration. The current is converted into a voltage signal that is then received by the sensor.

5.4 Calibration

Ensure to perform the calibration at a temperature that is similar to the temperature of the sample. Like in the case of a measurement, wait for approximately 1-2 minutes after the connection of the sensor until the measurement value has settled. Then, perform the calibration.

Oxygen in air
A two-point calibration is performed.
Select the "Air" mode.

Use a commercial zero-oxygen calibration solution.

First calibration point
Select "Configuration/Calibration" from the software menu (APP). Immerse the measuring probe into the calibration liquid and wait approx. 2 minutes until the measurement values have settled. Enter the 0% value as set point 1 and send it to the sensor.

Second calibration point
Hold the sensor in the ambient (outdoor) air since, in this case, the oxygen content will be constantly at 20.9%. Wait approx. 2 minutes until the measurement values have settled. Enter the 20.9% value as set point 1 and send it to the sensor.

Dissolved oxygen
A two-point calibration is performed.

Use a comercial zero-oxygen calibration solution.

First calibration point
Select "Configuration/Calibration" from the software menu (APP). Immerse the measuring probe into the calibration liquid and wait approx. 2 minutes until the measurement values have settled. Enter the 0 mg/l value as set point 1 and send it to the sensor.

Second calibration point
Hold the oxygen probe into a receptacle fill with distilled water. The measurement value should have settled after approx. two minutes and the calibration can be performed. Set point 2 can be found in the table below. Take the temperature and atmospheric pressure into consideration.

hPa:	1026,5	1013,3	999,9	986,6	973,3
mmHg:	770	760	750	740	730
16°C	10.07	9.94	9.81	9.68	9.55
17°C	9.86	9.74	9.61	9.48	9.35
18°C	9.67	9.54	9.41	9.29	9.16
19°C	9.47	9.35	9.23	9.11	8.98
20°C	9.29	9.17	9.05	8.93	8.81
21°C	9.11	9.00	8.88	8.76	8.64
22°C	8.94	8.83	8.71	8.59	8.48
23°C	8.78	8.66	8.55	8.44	8.32
24°C	8.62	8.51	8.40	8.28	8.17
25°C	8.47	8.36	8.25	8.14	8.03
26°C	8.32	8.21	8.10	7.99	7.89
27°C	8.17	8.07	7.96	7.86	7.75
28°C	8.04	7.93	7.83	7.72	7.62
29°C	7.90	7.80	7.69	7.59	7.49
30°C	7.77	7.67	7.57	7.47	7.36
31°C	7.64	7.54	7.44	7.34	7.24
32°C	7.51	7.42	7.32	7.22	7.12
33°C	7.39	7.29	7.20	7.10	7.01
34°C	7.27	7.17	7.08	6.98	6.89
35°C	7.15	7.05	6.96	6.87	6.78

hPa:	959,9	946,6	933,3	919,9	906,6
mmHg:	720	710	700	690	680
16°C	9.42	9.29	9.15	9.02	8.89
17°C	9.22	9.10	8.97	8.84	8.71
18°C	9.04	8.91	8.79	8.66	8.54
19°C	8.86	8.74	8.61	8.49	8.37
20°C	8.69	8.57	8.45	8.33	8.20
21°C	8.52	8.40	8.28	8.17	8.05
22°C	8.36	8.25	8.13	8.01	7.90
23°C	8.21	8.09	7.98	7.87	7.75
24°C	8.06	7.95	7.84	7.72	7.61
25°C	7.92	7.81	7.70	7.59	7.48
26°C	7.78	7.67	7.56	7.45	7.35
27°C	7.64	7.54	7.43	7.33	7.22
28°C	7.51	7.41	7.30	7.20	7.10
29°C	7.39	7.28	7.18	7.08	6.98
30°C	7.26	7.16	7.06	6.96	6.86
31°C	7.14	7.04	6.94	6.85	6.75
32°C	7.03	6.93	6.83	6.73	6.63
33°C	6.91	6.81	6.72	6.62	6.53
34°C	6.80	6.70	6.61	6.51	6.42
35°C	6.68	6.59	6.50	6.40	6.31

5.5 Care

Membrane
Ensure not to damage the membrane and follow the storage instructions in order to increase the service life of the electrode. Creases or holes in the membrane are a sign that it does not work properly any more.
If the membrane is soiled or if it shows signs of damage (this might be indicated by incorrect measurement values), use a spare cap with a membrane.

Cathode and anode
They must be polished with polishing cloths from time to time. To do so, remove the cap so that the anode and cathode can be accessed. Polish them with slight pressure and a clean cleaning cloth in order to remove any deposits from the surface. Rinse them with distilled water and then with alcohol, shake the liquid off, and screw the cap back on loosely.

6 TECHNICAL DATA

Operating temperature range: 5 - 40°C
Rel. humidity < 80%

Oxygen in air:	
Measuring range	0…100 %
Resolution	0.1 %
Accuracy	±2%
Oxygen in liquid:	
Measuring range	0…20 mg/l
Resolution	0.01 mg/l
Accuracy (10~35°C)	±0.5mg/L
Max. date rate	10 Hz
Battery capacity	250 mAh
Max. wireless range (open field)	30 m
Dimensions (length x width x height)	85 x 40 x 23 mm
Weight	40 g

7 SCOPE OF DELIVERY

The extent of delivery is as follows

- Cobra SMARTsense Oxygen 12933-01
- USB connecting cable type C 07935-00
- Dissolved and Air Oxygen Electrode
- Operating instructions

8 ACCESSORIES

The following accessories are available:

- USB-charger 07934-99
- USB connecting cable type C 07935-00
- USB-Bluetooth-Adapter 07936-00
- Software measureLAB 14580-61
- Free measureApp available from supplier portals

iOS **Android** **Windows**

9 CONFORMITY

PHYWE Systeme GmbH & Co.KG hereby declares that the radio system type 12933-01 complies with the 2014/53/EU directive. The complete text of the EC Declaration of Conformity is available at the following Internet address:
www.phywe.com/en/ec-declaration

10 DISPOSAL

The packaging mainly consists of environmentally-friendly materials that should be returned to the local recycling stations.

Do not dispose of this product with normal household waste. If this unit needs to be disposed of, please return it to the address that is stated below for proper disposal

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