Operating Manual

BCP-O2EC

BCP X-large
Aluminum IP65

BCP regular
with PA 6 housing

BlueSens

Rev. 130614001

Contents

1 About this document

1.1 Function

This operating manual provides you with all of the necessary information for quick start-up and safe operation of the ***BCP-O2ec***. Please read the operating manual before starting operation.

1.2 Target group

This operating manual is intended for use by trained specialist personnel. The contents of this manual must be made available to personnel and followed by them.

1.3 Symbols used

Danger!

This symbol indicates a situation that is possibly dangerous. Failure to observe the safety instructions can result in personal injury.

Caution!

The symbol indicates the possibility of damage to property.

Note!

This symbol indicates helpful additional information.

λ **List**

This symbol indicates a list. The order of the items is not significant.

1 Action sequence

Numbers indicate steps to be performed in sequence.

2 For your safety

2.1 General information

The ***BCP-O2ec*** was inspected in our plant and was ready for operation when it left.

Before installing and starting up the device, please read this operating manual carefully. The operating manual contains safety instructions that must be observed to ensure safe operation.

The device must never be operated in conditions that do not comply with the specifications on the type plate.

Maintenance and servicing may only be performed by specially trained personnel who are familiar with the hazards inherent to the work as well as the guarantee terms.

2.2 Authorized personnel

All of the actions described in this operating manual may only be performed by trained specialist personnel who have been authorized by the plant operator. Work on the device other than that described in this manual may only be performed by personnel of the BlueSens gas sensor GmbH Company for safety reasons and to ensure compliance with the terms of the guarantee.

2.3 Proper use

The ***BCP-O2ec*** is a gas sensor for measuring oxygen in the specified concentration area and under the conditions described in the technical data. It is used to monitor metabolism in biological processes such as fermentation. The BCP-O2ec sensor may only be used in well ventilated rooms.

Danger!

The sensor does not have an ATEX certificate and may therefore only be used in well ventilated rooms.

2.4 Misuse warning

The ***BCP-O2ec*** may not be used as a safety component for monitoring gasses in systems or as a gas warning device. It may also not be used in areas subject to explosion hazards.

2.5 General safety information

If the device is mishandled or not used for its intended purpose, application-specific dangers may arise.

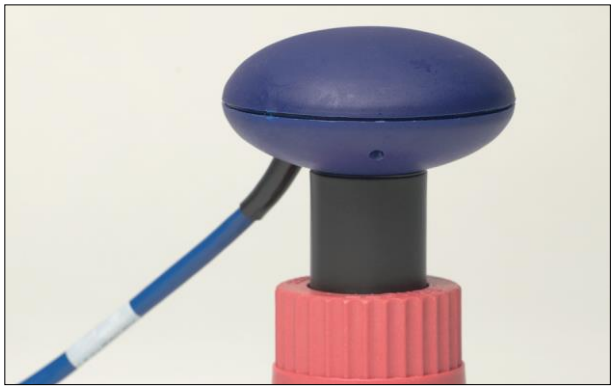
Danger!

If the device is incorrectly installed or set, there is a danger of explosions and poisoning.
After installation, check all connections for leaks.

2.6 CE conformity

The ***BCP-O2ec*** conforms to the EMC Directive (89/336/EEC, 92/31/EEC and 93/68/EEC) when applying the harmonized standards **EN50081–1, EN61000.**

The low-voltage directive (72/23/EEC und 93/68/EEC) is not applicable as no voltage greater than 24 V is used.



3 Product description

3.1 One-piece construction of the BCP-O2ec

The one-piece construction (fig. 1) means that the measuring adapter cannot be separated from the sensor head. The BCP-O2ec is designed for a particular mechanical connection that can only be altered subsequently at the plant for a certain fee.

Fig. 1: One-piece contruction

Caution!

Don't use in gases with ammonia (NH_3), ozone (O_3).
Sensor should not be used in liquid water.
Connecting or disconnecting of cap and head only without connected power supply

A Teflon filter is placed at the bottom of the cap to protect the sensor element for a short time against water under normal pressure. In the case of over pressure this could not be guaranteed.
If foam or dust pollutes the Teflon filter it has to be changed (see chapter 5.3). Behind the Teflon filter there is a second filter. If this filter is polluted, don't change it! Call the service of BlueSens.
If the senor element gets in contact with water it could be destroyed. In this case the sensor needs a new element and a new factory calibration at the BlueSens site.

Fig. 2: Teflon filter

Caution!

The filter does not serve to protect the sensor against water under overpressure.
If the measuring cap is full of water the sensor element has to be dried at max. 80°C.
Don't change the second filter of the sensor! Sensor could be destroyed.

3.2 Measuring principle

The BCP-O2ec sensor is a lead-oxygen battery which incorporates a lead anode, an oxygen cathode made of gold, and a weak acid electrolyte. Oxygen molecules enter the electrochemical cell through a non-porous flour carbonide membrane, diffuse in the acid electrolyte, and are reduced at the gold electrolyte. The current which flows between the electrodes is proportional to the oxygen concentration in the gas mixture being measured. The terminal voltages across the thermistor (for temperature compensation) and resistor are read as a signal, with the change in output voltages representing the change in oxygen concentration.

4 Installation

4.1 General instructions

The ***BCP-O2ec*** is protected by packaging on its way to its application location. This secures it against the usual transport strains. However, before installation, check whether the device has been damaged due to improper transport or improper storage. If the device is damaged in any way, operation without hazards is not possible and the device may not be installed and taken into operation.

Check whether the enclosed materials such as seals and screw-caps are suitable for your process conditions (pressure, temperature, etc.).

The installation should only be performed under supervision by a specialist and in compliance with all applicable work safety rules.

Your instrument was protected by packing during transport to assure normal loads during transport.

The packing of standard instruments consists of environment-friendly, recyclable cardboard. For special versions PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

Storage conditions see data sheet.

4.2 Mechanical connection

Caution!

The sterile filter is not intended for repelling fluids. Never install the sensor such that fluid can run into the measuring adapter.

If water has penetrated the measuring adapter, allow it to dry out for at least 12 hours at max. 80°C in a drying cabinet or on a hot plate.

Protect the measuring adapter from penetration by liquids.

After installation, check that the pipe connection is gas-tight.

4.2.1 Installation on pipes

The connection to a pipe is made with a 1 ¼" nozzle with an external thread:

1. Place the sealing ring (O-ring 30 x 4 mm, viton, item no. Z-OR-00003) on the nozzle (fig. 3).
2. Place on the sensor (fig. 4).
3. Connect the nozzle and the sensor with the screw cap so that the connection is gas-tight (fig. 5).

Fig. 3

Fig. 4

Note!

Only use the supplied screw caps. Do not use metal screw caps as they result in thermal contact between the measuring adapter and the pipe and thus violate the technical specifications.

Fig. 5

4.2.2 Installation on a Tri-Clamp SMS38 connection

:

1. Place the sealing ring (item no. Z-OR-00013) on the nozzle (fig. 6).
2. Place on the sensor (fig. 7).
3. Fix the sensor with the Tri-Clamp on the nozzle (fig. 8).

Fig. 6

Fig. 7

Fig. 8

4.2.3 Installation on a POM flow adapter

To install the sensor on a POM flow adapter:

1. Place the sealing ring (item no. Z-OR-00004) on the nozzle of the flow adapter (fig. 9).
2. Place on the sensor (fig. 10).
3. Connect the flow adapter and the sensor with the screw cap so that the connection is gas-tight (fig. 11).

Fig. 9

Fig. 10

Fig. 11

4.2.4 Installation on a stainless steel flow adapter

To install the sensor on a stainless steel flow adapter:

1. Place the sealing ring (item no. Z-OR-00004) on the stainless steel connection piece (fig. 12).
2. Place on the sensor and put the screws in place (fig. 13).
3. Fasten the 4 screws (item no. Z-XX-00007) so that the connection is gas-tight (fig. 14).

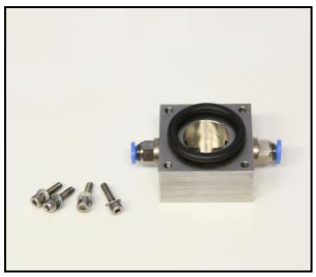


Fig. 12

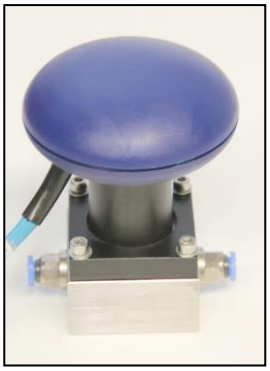


Fig. 13

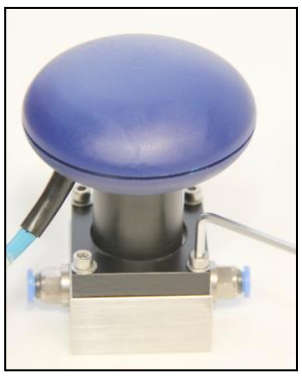


Fig. 14

4.2.5 Shake flask

Before starting a new measurement the shake flask with the aseptic filters, the Viton-ring and the ferrule (see accessories) and the culture medium has to be sterilized. During the sterilization of the flask, the sensors could be adjusted with ambient air on an additional shake flask. Place the sensors in a vessel with sterilized water and fresh ambient air (0.04 Vol.% CO2 and 20.97 Vol.% O2) or 100% nitrogen for at least 30 Minutes. Also note the data sheet for other specifications. Wait until 100% rel. humidity has been reached in the vessel (e.g., the first drops of humidity condensate on the glass) and the signals are constant. Carry out the 1-point calibration subsequently by clicking in the menu in ***Options/1-point calibration*** of FermVis .

Caution!

Read the manual of FermVis very carefully to avoid mistakes.

You will now be requested to expose the sensors to fresh air, which you are already doing. Wait until the adjustment is finished. The sensors are once again ready to use.

Preparations for autoclaving

1. Put the Viton-sealing (order no.: Z-FI-00001) for the crimp connection of the sensor into the GL 45 screw cap (Z-MA-00003) (fig. 16).
2. Put the ferrule (Z-MA-00004) on the Viton-sealing (fig. 17).
3. Put the aseptic filter (Z-FI-00001) on the ferrule (fig. 18).
4. Tighten the GL 45 screw cap on the shake flaks (fig. 19).

The connection in the middle could be closed with a cellulose plug. If a reproducible calculation of the oxygen and carbon dioxide transfer rates is desired, specified filters (Z-FI-00001) and specified shake flaks have to be used. The GL 14 connection has to be closed with a silicon membrane.

Fig. 16

Fig. 17

Fig.18

Fig. 19

Connect the sensor

1. Plug the senor (one-piece construction) into the GL 45 screw cap toward the ferrule (fig. 20).
2. Tighten the GL 45 screw cap so that the sensor is fixed and sealed by the Viton-sealing (fig. 21).

Fig. 20

Fig. 21

After the sterilization the sensors have to be fixed in the screw caps. In the case of shaking the flask they must be fixed on the shaking panel.

After that the software FermVis could be started and the culture medium could be inoculated.

Caution!

Use only specified filters (Z-FI-00001) and specified shake flasks to ensure a reproducible calculation of the oxygen and carbon dioxide transfer rates.

Caution!

Fix the BACCom and the cables onto the shaking plate (fig. 21) to avoid a cable break.

Fig. 21: Assembly on Sticky plate

4.3 Electrical connection

4.3.1 General information

Caution!

Read the installation instructions carefully to prevent damage to the device.

Proceed step-by-step.

Only use the original plugs, cables and power adapters.

Never connect or disconnect plugs when the device is connected to the power supply.

The device does not have an on/off switch; it starts operation as soon as it is connected to the power supply.

Improper operation can result in damage to the device.

4.3.2 Version 4 – 20 mA in PA6 housing

To connect the measuring device to the connection cable of the sensor head in the PA6 housing (fig. 22), use the supplied socket and strain relief (fig. 23).

Fig. 22

Fig. 23

☞ **Note!**

The numbering of the pins and their assignment refer to the socket when seen from behind (fig. 24).

Remove the insulation of the cables a little as possible to avoid short circuits in the plug housing.

PIN 1	V+ = 12 V
PIN 2	GND
PIN 3	RS232_TXD
PIN 4	RS232_RXD
PIN 5	1-point calibration
PIN 6	4–20mA, RL < 250 Ohm
PIN 7	For internal use only
PIN 8	GND

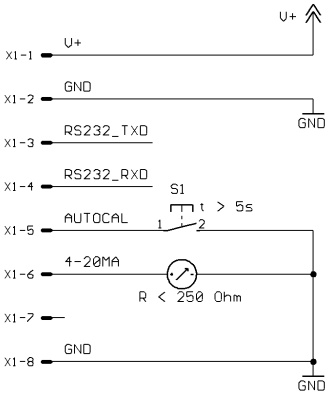


Fig. 24: Plug assignment

1. Connect the 12 V DC power supply to pin 1 of the socket.
2. Connect GND (ground) to pin 2.
3. Connect the measuring device to pin 6 (R_L < 250 Ohm) and pin 8 GND (ground).
4. Plug the sensor cable into the socket.

After around 1 hour of heating-up time, the sensor still requires adjusting. During the heating-up time, the sensor displays 2.3 mA. To make the adjustment, expose the sensor for approx. 30 minutes (depending on specification – see datasheet) to ambient air (20.97 Vol.% O2) or process gas without any biological activity in the reactor (20.97 Vol.% O2).

5. Afterwards, connect pin 5 to pin 8 (GND) for 5 seconds.

6. Screw on the strain relief. The sensor has been adjusted.

4.3.3 RS232 serial version in PA6 housing

1. Connect the sensor to the power supply with the cable supplied.
2. Connect the sensor to a computer using the serial cable.

Fig. 25

After around 1 hour of heating-up time, the sensor still requires adjusting. To do this, expose the sensor for approx. 30 minutes (depending on specification – see datasheet) to ambient air (20.97 Vol.% O2) or process gas without any biological activity in the reactor (20.97 Vol.% O2). The adjustment itself is performed with the ***BACVisSingle*** software (see ***BACVisSingle*** operating manual).

Start the ***BACVisSingle*** software. You will find further relevant information in the corresponding operating manual.

4.3.4 Version 4 – 20 mA in aluminum housing

To connect the measuring device to the connection cable of the sensor head in the aluminum housing (fig. 26), use the supplied socket and strain relief (fig. 27).

Fig. 26

Fig. 27

☞ **Note!**

The numbering of the pins and their assignment refer to the socket when seen from behind (fig. 28).

Remove the insulation of the cables a little as possible to avoid short circuits in the plug housing.

PIN 1	V+ = 12 V – 24 V
PIN 2	GND
PIN 3	RS232_TXD
PIN 4	RS232_RXD
PIN 5	1-point calibration
PIN 6	4–20 mA, RL < 250 Ohm
PIN 7	For internal use only
PIN 8	GND

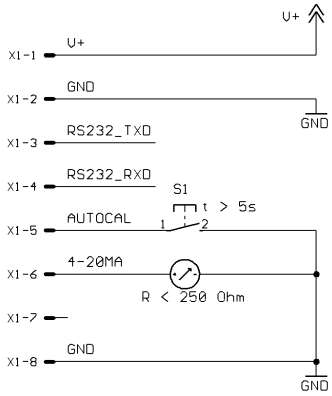


Fig. 28: Plug assignment

1. Connect the 12 – 24 V DC power supply to pin 1 of the socket.
2. Connect GND (ground) to pin 2.
3. Connect the measuring device to pin 6 (R_L < 250 Ohm) and pin 8 GND (ground).
4. Plug the sensor cable into the socket.

After around 1 hour of heating-up time, the sensor still requires adjusting. During the heating-up time, the sensor displays 2.3 mA. To make the adjustment, expose the sensor for approx. 30 minutes (depending on specification – see datasheet) to ambient air (20.97 Vol.% O2) or process gas without any biological activity in the reactor (20.97 Vol.% O2).

5. Afterwards, connect pin 5 to pin 8 (GND) for 5 seconds.

6. Screw on the strain relief. The sensor has been adjusted.

4.3.5 RS232 serial version in aluminum housing

1. Connect the sensor to the power supply with the cable supplied.
2. Connect the sensor to a computer using the serial cable.

After around 1 hour of heating-up time, the sensor still requires adjusting. To do this, expose the sensor for approx. 30 minutes (depending on specification – see datasheet) to ambient air (20.97 Vol.% O2) or process gas without any biological activity in the reactor (20.97 Vol.% O2).

The adjustment itself is performed with the ***BACVisSingle*** software (see ***BACVisSingle*** operating manual).

Start the ***BACVisSingle*** software. You will find all of the further relevant information in the corresponding operating manual.

Fig. 29

1 = +12 …+ 24 V
2 = 0 V
3 = RS232_RxD
4 = RS232_TxD
5 = RS232_GND = PE
PE = ground

Fig. 30: Plug assignment

4.3.6 Connection via BACCom12

The ***BACCom12*** connection box is an electronic multiplexer with an integrated pressure sensor. It facilitates the connection of up to 12 sensor heads.

Communication with a PC can be switched between RS232 and Ethernet.

The individual connections are explained in the following table:

	Designation	Description
A	RJ45	RJ45 socket for connecting the sensors
B	LED	Operating display when a voltage is present
C	Sub D 9 pin	Data transmission to the PC
D	Switch	Switches between RS232 and Ethernet
F	RJ45	Ethernet connection
G	Power socket	12 V 3.75 A, only use the supplied power adapter
H	Box reset	Resets the box; does not effect the sensors
K	M8 4 pin socket	4-pin connection sockets A–D for additional boxes

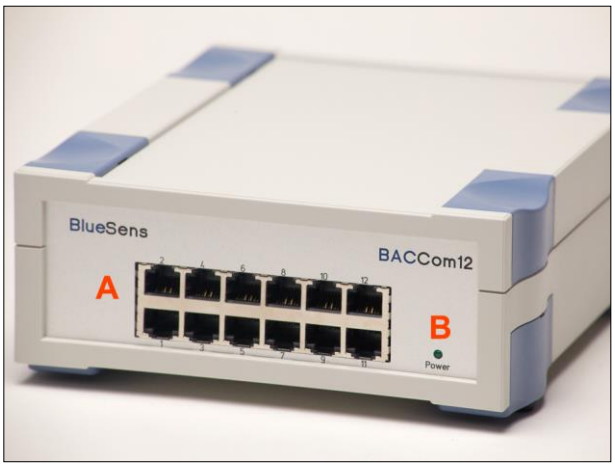


*Fig. 31: Front of the **BACCom12***

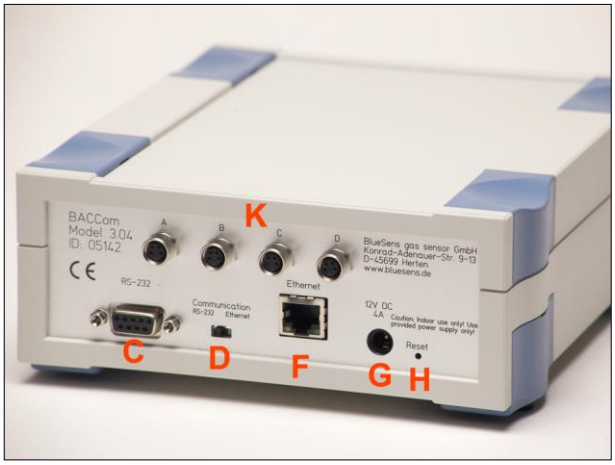


*Fig. 32: Connections on the **BACCom12***

Caution!

To prevent damage to the device, only use the supplied power adapter and the supplied cable.

Never disconnect or connect the connection plugs on the sensor heads when the *BACCom12* is switched on.

1. Connect all sensor heads with the ***BACCom12***.
2. Connect the supplied power adapter to the power socket **G**.
3. Plug the power plug of the power adapter into the socket.

After a heating-up time of approx. 1 hour, the measuring system is ready for operation.

4. Connect the ***BACCom12*** to the PC or network via the Ethernet port **E**,
   or connect the
   BACCom12 via the RS232 output **C** with the **supplied** cable to the serial interface of the computer.
5. Select the corresponding interface with the switch **D**.

After around 1 hour of heating-up time, the sensor still requires adjusting. To do this, expose the sensor for approx. 30 minutes (depending on specification – see datasheet) to ambient air (20.97 Vol.% O2) or process gas without any biological activity in the reactor (20.97 Vol.% O2). Adjustment of the sensors is performed with the ***BACVis*** software. Start the corresponding software. You will find all further information in the software instructions.

After initial commissioning, the measuring device can remain switched on constantly, meaning that the heating-up time is not required before every measuring.

Note!

If you use a plate shaker: Fix the BACCom directly onto the plate shaker and also fixate the cables to avoid cable breaks.

4.4 Minimization of dilution effects

To minimize the effect of dilution through accumulating water molecules in the dry process gas, the oxygen sensors could be adjusted with humid process gas (20.97 Vol.% O_2) (at working temperature) instead of ambient air.

5 Maintenance

We recommend sending the device to BlueSens for annual maintenance, checking and calibration of the sensors.

5.1 1-point calibration

Once monthly, or after each connection and disconnection of the sensor head and measuring adapter, the sensor head must be exposed for approx. 30 minutes (depending on specifications, see datasheet) to ambient air (20.97 Vol.% O2) or process gas without any biological activity in the reactor (20.97 Vol.% O2) .

Afterwards, connect pin 5 to pin 8 on the connection cable for 5 seconds, or, if present on the sensor, press the blue button for 5 seconds (fig. 33).

For the serial version, the adjustment can be made using the ***BACVis*** software.

Fig. 33

5.2 Recalibration

The sensor should be sent back to the manufacturer or an authorized dealer for annual recalibration.

You can get further information for our annual maintenance service Blue4Care incl. extension of the warranty up to 6 years on

http://www.bluesens.de/fileadmin/dl/Blue4Care.pdf

5.3 Filter change – coarse filter

5.3.1 Removing the filter cover

1. Hold the sensor head and screw off the lower cover counterclockwise using the clamping ring tongs (fig. 34).

Fig. 34

5.3.2 Changing the filter and sealings (Z-XX-00052)

1. Remove the filter from the recess (fig. 35).
2. Insert a new filter.
3. Check the seals for damage and replace as required.
4. Screw on the lower cover using the clamping ring tongs.

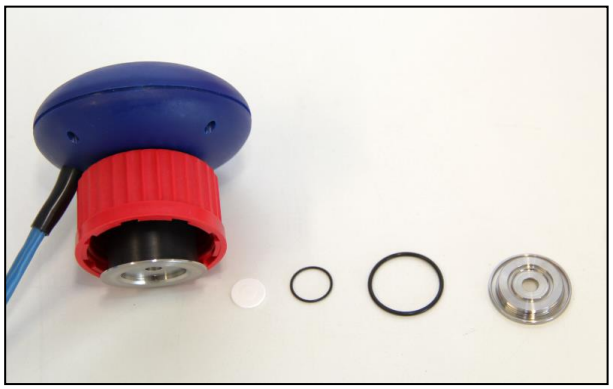


Fig. 35

6 External pressure sensor P2518G and P2518NPT

The external pressure sensor P2518G/P2518NPT measures the pressure directly in the gas line. Inaccurate results by changing pressures in the process can be prevented by this device. The external pressure senor is an optional accessory for the BCP-CO2 sensor. The pressure sensor (fig. 37:1) has got a 1/8” NPT male screw thread as default connection (Article No. M-DE-00003). With the screw adapter (fig. 37:2) the pressure sensor can also be equipped with a G 1/8” male screw thread. With these screw threads the pressure sensor can be integrated directly into the gas line. Please use an appropriate thread sealant to make the connection gas tight and check the connection for tightness afterwards.

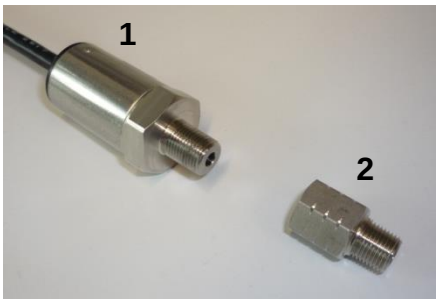


Fig.37: pressure sensor and adapter

Fig.38: connection pressure sensor to gas sensor and flow adaptor steel (optional accessories)

The pressure sensor is connected with a 4-pin M12 male connector (fig. 38:3) to the specified sensor. Plug the male connector into the female connector and tighten the thread connection (fig. 38:4). Every pessure sensor is calibrated individually for the corresponding gas sensor. Therefore the combination of a pressure sensor and a gas sensor belongs together and should not be mixed with other components.

The pressure sensor was factory-calibrated for a specified pressure range. Please note the enclosed data sheet for the specification of the sensor.

7 Appendix

7.1 Calibration table

Complete calibration can only be conducted by BlueSens. Monthly 1-point calibration can be performed as described in chapter 5.1. The adjustment must also be made each time the sensor head and the measuring adapter are disconnected from each other.

Fill out the table below when this is performed.

Date	Procedure	Conditions	Name	Signature
	Complete calibration	25 °C, 1 bar	BlueSens	
	1-point calibration			

7.2 Technical data

See enclosed datasheet.

EG-Konformitätserklärung
EC Declaration of conformity

Hiermit erklären wir, dass unser Produkt, Typ:

We hereby declare that our product, type;

BCP-O2ec

folgenden einschlägigen Bestimmungen entspricht:

complies with the following relevant provisions:

Niederspannungsrichtlinie (72/23/EWG und 93/68/EWG) findet keine Anwendung, da keine Spannung größer 24 V genutzt wird.

Low voltage guideline (72/23/EEC and 93/68/EEC) is not applicable as no voltage higher than 24 V is used.

EMV-Richtlinie (89/336/EWG, 92/31/EWG und 93/68/EWG)

EMC guideline (89/336/EEC, 92/31/EEC and 93/68/EEC)

Angewendete harmonisierte Normen, insbesondere:

Applied harmonized standards, in particular:

EN50081–1
EN61000

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