

OxiDirect[®]
B S B B O D

BOD-System
OxiDirect[®]



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1. The System

1.1 Principle of operation

BOD is measured by the pressure difference within a closed system (respirometric BOD). The integrated memory saves a BOD value automatically every 24 hours for a test period of more than 3 days.

1.2 Applications

Determination of BOD₅ and BOD₇, OECD 301F / biological degradability.
Other bio-technological applications in aqueous solutions.

1.3 Illustrations / Equipment supplied



- 1 x BOD measuring device with integrated bottle rack
- 6 x BOD sensor (material ABS)*
- 6 x BOD bottles
- 6 x seal cups (Gasket)
- 6 x magnetic stirring rods
- 1 x stirring system drive
- 1 x stirring system controller
- 1 x nitrification inhibitor (ATH)
- 1 x potassium hydroxide solution (KOH solution, 45%)
- 2 x overflow measurement flasks (157 ml and 428 ml)
- 1 x instruction manual

* before using not aqueous solutions proof the resistance of the material against the sample

2. The Method

2.1 Biochemical Oxygen Demand (BOD)

The biochemical oxygen demand (BOD) of waste water, industrial effluents and surface water is an expression for the amount of oxygen consumed by the decomposition of organic matter in a biochemical process.

2.2 Principle of Measurement

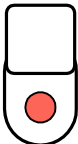
The BOD system, consisting of the sample bottle and the BOD sensor, represents a closed system. In the bottle, above the sample itself, is a defined volume of air. During the BOD measurement, the bacteria in the sample consume the dissolved oxygen in the sample. This is replaced by oxygen in the bottle above the sample. The carbon dioxide released at the same time react with the potassium hydroxide in the seal gasket. This generates a decrease in pressure within the system. This is measured by the BOD sensor and displayed as a BOD value in mg/l O₂.

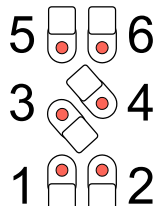
2.3 Preparing the Sample / Brief Summary

- Estimate the measurement range and select the volume for the sample (4.1).
- Carry out necessary pre-treatment of the sample (e.g., setting the pH value; filtering; etc.) (4.2).
- Measure the volume of the sample precisely, using the overflow measurement flask and transfer it to the BOD bottle, with the aid of a funnel. If necessary, add nitrification inhibitor (4.1).
- Insert the magnetic stirring rod.
- Place 3-4 drops of KOH solution into the seal gasket. Then insert the gasket in the neck of the bottle.
- Screw the BOD sensors to the sample bottles.
- Place the bottle in the bottle rack.
- Start the measurement (3.10).
- Incubate the sample in accordance with the instructions (e.g. BOD₅ for 5 days at 20 °C)

3. Operation

3.1 Keys

Key	Functions
On Off	<ul style="list-style-type: none"> Switches the unit on and off (automatic switch off approx. 45 sec after last operation) Quits sub-menus Breaks off operations
START	<ul style="list-style-type: none"> Set Up of measurements
READ	<ul style="list-style-type: none"> Reading of a current value for a selected position (does not store value!)
+	<ul style="list-style-type: none"> Increases parameter / figure
-	<ul style="list-style-type: none"> Reduces parameter / figure
ENTER	<ul style="list-style-type: none"> Confirms input Switches to other sections in menus
	<ul style="list-style-type: none"> Head key : selects the position required <i>Head LED : indicates the position which has been selected</i>



3.2 Operating Modes

Display mode	Operating status, in which the „OxiDirect“ displays the last stored value and the selected measurement period for a head
Read-out mode	Operating status, in which all the stored values for a head can be displayed, together with the associated time of measurement
Start mode	Operating status, in which measurements can be started
Background mode	The „OxiDirect“ carries out sporadic measurements independently. The indication is a line in the centre of the upper display. Do not change any bottles while this is in operation.

3.3 Technical Terms

Finished head	A head which has completed its series of measurements
Free head	A head where the series of measurements has been finished and at least one figure has been displayed in read-out mode (see „Reading out stored values“).
Start value	BOD measurement is based on a difference in pressure. When a measurement is started, the initial pressure is stored as the start value. BOD figures are then obtained by measuring current pressure values and calculating the BOD from the difference between the two.

3.4 Displays and their Meanings

LEDs	Meaning	Action required
LEDs	Indicate the position which has been activated	
LED is lit	Measurement is complete	
LED flashes	Measurement is not yet complete	

Display	Meaning	Action required
Lo bAt	Battery is nearly empty	<ul style="list-style-type: none"> • Change batteries (see „Changing the Batteries“-3.11.4)
LoAd	„OxiDirect“ has not found a head at this position	<ul style="list-style-type: none"> • Check whether there is a head at the selected position • Check contacts between head and rack
xd	The unit is in „display mode“. The upper display shows the selected measurement period. The lower display shows the last value which has been stored	
d x h x	The unit is in „read-out mode“ and shows the stored value for day ‚d‘ / hour ‚h‘ (x = 1...28 days or 1...48 hrs.)	
UFL	The values are below the permitted measurement range (below zero)	<ul style="list-style-type: none"> • Check that the flask is fully sealed with the measurement head • Check the temperature
OFL	The values are above the permitted measurement range	<ul style="list-style-type: none"> • Check the temperature

3.4 Displays and their Meanings

Display	Meaning	Action required
F 1	No measurement figure present	
F 2	No „start-value“ present, so no actual BOD value can be calculated	see „Autostart“
F120	An error has occurred on „Start“	Bottles must not be removed during the „start“ process. Also, positions must not be changed during the „start“ process
Set DAtE	During initial set up or after power supply fails the time and date must be reset	See „Setting Time and Date“ (parameters menu 3.11.1)
Srt und LoAd	The unit has not located a head at the position which has been selected	<ul style="list-style-type: none"> • Insert a bottle with head and press the On/Off key; or : • Select another position. The unit will change to „Display Mode“
Srt und DEL	The data for the head at the selected position have not yet been read out.	<ul style="list-style-type: none"> • To continue the „start“ process, press the „Enter“ key. (NOTE : All data on this head will be deleted !) • To quit the „start“ process, press the On/Off key. The unit will then change to „Display Mode“
End und LiFE	The electronics on the head cannot store any more values (this should not occur in normal use).	The values most recently stored can be read out. The head must be replaced.

3.5 Initial Set Up

The batteries are packed separately when the unit is delivered. If necessary, remove all the bottles from the rack, turn the rack and open the battery compartment. Install the three alkali-manganese batteries (C/LR14) in the battery compartment (checking for correct polarity). The unit should then switch on automatically and the display will show „**Set Date**“. If necessary, switch the unit on. Set the date and time (see the parameters menu 3.11.1).

3.6 Switching on

The unit is switched on with the On/Off key. The „OxiDirect“ will activate the left position in the front (position 1) and will indicate this by the LED, which will be permanently lit (= measurement is complete) or by flashing (= measurement in progress).

If there is no head at this position, the „OxiDirect“ will display „**LoAd**“.

When it is switched on, the „OxiDirect“ is in „**Display Mode**“, in which the last stored value and the selected measurement period are displayed (or a display as shown in Table 3.4). For example:

			Meaning
Upper display	5d	days	5 days' BOD
Lower display	178	mg/l	178 mg/l O ₂ as the last stored value

3.7 Switching off

The unit is switched off by pressing the On/Off key. If the unit is not in „Display Mode“, the On/Off key must be pressed several times in order to switch off.

During the switching-off sequence the upper display will show „**OFF**“ and a line will then appear in the middle of the display. During this period, do not remove any bottles from the rack, or change places, or add bottles, or press any other keys. The switching-off sequence is complete when both the displays are blank. At this point, wait a further 2 seconds minimum before switching on again.

3.8 Reading out stored values

Once the unit is switched on, press the key to select the position required and confirm by pressing the „Enter“ key. The unit will switch to „Display Mode“ for this position. The upper display will now show the measurement time and the lower display will show the value which has been stored.

The unit always starts with the first value – i.e., with a BOD-5 set-up it will start with day 1 (d1), for example:

Upper display	d1	days	Value of the first day
Lower display	147	mg/l	147 mg/l O ₂ as the value for the first day

The „+“ and „-“ keys can be used to display other stored data for this position.

The head keys can be used to select another position. If this position is vacant the unit remains in „read-out“ mode and shows „LoAd“. Place a head in this position for reading out the stored values or select another position.

Pressing the On/Off key will cause the unit to quit „read-out“ mode and go to „display mode“.

For a measurement period of one or 2 days (BOD-1 and BOD-2) the measurement time is stated in hours. For measurement periods exceeding 2 days (BOD-3, BOD-4...) it is shown in days. The hours are shown in the form of „hxx“ so the latest figure for a BOD-2, for example :

Upper display	h1	hrs	Value of the first hour
Lower display	178	mg/l	178 mg/l O ₂ value for the first hour

3.9 Reading out the current values

Once the unit is switched on, press the key for the position required. Then press the „READ“ key. The current value will then and displayed.

3.10 Starting measurement

Starting a new measurement will delete all stored data from the head !

Place a prepared bottle in a vacant position of the rack. Switch on the unit and press the corresponding head key to activate this position.

Pressing the „Start“ key will now start the measurement for this bottle. When the „Start“ key is pressed, the unit changes to „Start Mode“ and will display the last selected range used for this head, with the sample volume required (special cases are described later in this section). The display will flash. For example :

Upper display	157	ml	157 ml (sample volume required for the measurement range)
Lower display	400	mg/l	Range up to 400 mg/l O ₂

Various actions are now possible :

- The „+“ and „-“ keys can be used to change the sample volume and the measurement range.
- Pressing the „Enter“ key will select the displayed sample volume / range and the „start“ process will continue.

The unit checks whether „Autoduration“ is active. If so, the unit will automatically select the specified measurement period and will activate the measurement. The measurement period is not displayed.

If „Autoduration“ is not active, the unit will display the last measurement period which was used (the display will flash). For example :

Upper display	5d	ml	5 days' BOD (BOD-5)
Lower display			The lower display is blank

Various actions are now possible :

- The „+“ and „-“ keys can be used to change the measurement period in one-day steps.
- Pressing the „Enter“ key will select the displayed measurement period to be used and the unit will start the measurement.

While the unit attempts to start the measurement, the displays will show „0.0.0“ and „0.0.0.0“ (flashing). Time can vary.

When the unit has successfully started the measurement the displays will show „000“ and „donE“.

3.11 Parameters Menu

Press the „ENTER“ key and hold it depressed. Switch on the unit with the On/Off key. Allow three decimal points in the lower display to flash for 3 seconds and then release the „ENTER“ key. The unit is now in the parameters menu. The „+“ and „-“ keys can now be used to select between the Date/Time, „Autostart“, „Autoduration“ and „Change Batteries“ menus. Pressing the „ENTER“ key will give access to the sub-menu which is selected. Quit the parameters menu with the On/Off key. The unit will return to „Display Mode“.

3.11.1 Setting the Date and Time

Confirm „Set“ „DATE“ by pressing the „ENTER“ key. The unit will display „dA“ and the year which is currently set. Press the „ENTER“ key. The unit displays „dA“ and now shows the date which is currently set in the form of „MM.TT“, where „MM“ indicates the month and „TT“ indicates the day.

Press the „ENTER“ key. The unit displays „ti“ and the time in the form of „hh.mm“ where „hh“ indicates the hours and „mm“ indicates the minutes. Press the „ENTER“ key. The upper display flashes and shows „JJ“ and the lower display shows the year in figures. The year can be changed with the „+/-“ key. Press the „ENTER“ key.

In this way it is possible to reset the figures for the month (the display shows „Mo“), the day (the display shows „dd“), the hour (the display shows „hh“), the tens of minutes (the display shows „M“) and the single minutes (the display shows „m“). Each entry must be confirmed by pressing the „ENTER“ key. Finally, press the „ENTER“ key once more to adopt the figures which have been set. The unit sets the internal clock to these figures and (provided no mistakes have been made) will display „iS“ „Set“. The date/time menu can be quit at any time by pressing the On/Off key.

3.11.2 Autostart

Using the „Autostart“ function does **not** replace tempering of the sample to the required temperature before measurement is activated.

If „Autostart“ is active, the unit will wait for proper temperature of the sample, indicated by a decrease in pressure. It takes this pressure as the „start“ value for the following BOD calculations. However, the maximum waiting time is 3 hours. After this time the unit will automatically take the current pressure as the „start“ value, even if no decrease in pressure has been detected. This will be indicated later by flashing measurement values.

If the temperature of the BOD samples is significantly different from the specified temperature, a change in pressure will cause errors in determining the BOD values.

The „Autostart“ function can be switched on and off. The setting always applies from the time it is done and applies to all the heads on the rack.

Confirm „Set“ „Auto“ with the „ENTER“ key. The „+“ key is used to switch on the „Autostart“ function – „On“ „Auto“ and the „-“ key is used to switch it off – „Off“ „Auto“. Once the selection has been made, the sub-menu is quit with the On/Off key.

3.11.3 Autoduration

Confirm „Set“ **„dur“** with the „ENTER“ key. The „+“ and „-“ keys can be used to set figures between 1 and 28, as well as „OFF“. Figures between 1 and 28 specify the measurement period in days, while „OFF“ deactivates the „Autoduration“. With „Autoduration“ deactivated, the unit will ask for the required measurement period in the „Start Mode“ for each sample and/or rack position.

The unit is preset by the manufacturer for an „Autoduration“ of 5 – that is, for 5 days' BOD. The „Autoduration“ setting is retained even if the power supply fails and valid always for all positions.

3.11.4 Changing the Batteries

To change the batteries without affecting a current measurement, make sure you have the tool required to open the battery compartment and have three replacement alkali-manganese batteries (C/LR14) ready.

Go to the parameters menu and select the battery change menu **„Set“ „bAt“** („+“ key). Press the „ENTER“ key. The unit will display **„bAt“**. Press the „ENTER“ key again. The unit display will now flash, showing **„bAt“ „chg“**. Wait until the display disappears – this may take up to 6 minutes. When a measurement is active, the battery change must be carried out within 4 minutes and the unit must not be left without power for more than one minute maximum !

If necessary, remove all samples from the frame, rotate the frame and open the battery compartment. Take out the old batteries and replace them immediately with the new ones, checking for correct polarity. Close the cover of the battery compartment, replace all the samples (their positions are not important) and switch the unit on again.

If the unit switches automatically to the date/time menu after a change of batteries, this means that the break in the power supply was too long. It will then be necessary to reset the date and time.

3.12 Data transfer

Switch the OxiDirect off. Connect the OxiDirect RS232 interface with the serial interface of the computer using the cable, which is part of the delivery.

Transferring stored data from the OxiDirect to the computer requires a transfer program, e. g. Hyperterminal (this is part of standard Windows software). Please find detailed information on our homepage in the download area.

Press the READ key and hold it depressed. Switch the unit on with the On/Off key. Allow 3 decimal points in the lower display to flash for 3 seconds, then release the READ key. The unit is now transferring all stored data.

3.13 Notes

- If a bottle has been added to the rack while a measurement is active, the unit must be switched on again, so that this new flask is detected and correct measurement can take place.
- If a bottle has been removed permanently from the frame, the unit should be switched on once and then off again, so that these missing bottle no longer cause a power consumption.
- The unit will switch off automatically if no key is pressed for approx. 45 seconds. However, to achieve maximum battery life, the unit should always be switched off immediately, if no further user action is required. The unit will switch in background mode when measurements are required, indicated by a line in the the upper display. Once measurement is complete, the unit switches off again.

4. BOD Measurement

4.1 Sample Volume

The sample volume is related to the expected BOD value. The OxiDirect® is designed to operate with the following ranges and sample volumes, allowing BOD measurement up to 0 - 4000 mg/l, without any dilution.

Range BOD mg/l	Sample volume in ml	Dosage ATH
0 – 40	428	10 drops
0 – 80	360	10 drops
0 – 200	244	5 drops
0 – 400	157	5 drops
0 – 800	94	3 drops
0 – 2000	56	3 drops
0 – 4000	21.7	1 drops

Note

The expected results should be in the upper half of the range.

For domestic waste it is generally appropriate to consider a BOD₅ value which is approximately 80 % of the COD value.

4.2 Preparing the Water Sample

1. Check the pH value of the effluent sample. The optimum pH value for biochemical oxidation is between pH 6.5 and 7.5. If the pH value of the sample is higher or lower, it should be pre-adjusted. Any significant deviation will result in a lower BOD value. If the pH value is too high, it can be reduced by adding dilute hydrochloric acid (1 mol/l) or dilute sulphuric acid (1 mol/l). If the pH value is low, it can be adjusted with a sodium hydroxide solution (1 mol/l).
2. Mix the water sample well and allow to settle for a short while. It may also be advisable to filter or homogenise the sample.
3. Measure the sample volume precisely, using the appropriate overflow measurement flask and pour the sample into the sample bottle (it may be helpful to use a funnel for this). Ensure that the sample in the bottle contains a representative portion of any solids in suspension. It is recommended that each sample should be tested twice or three times.

4. To inhibit nitrification, we recommend the addition of nitrification inhibitor B (= Allyl Thiourea, or ATH). This is particularly important for the low range 0 - 40 mg/l (for example, when checking discharges from effluent treatment plants). The right amount of nitrification inhibitor B is related to the measurement range - see 4.1.

Note

Nitrifying bacteria also consume oxygen. This consumption can occur within the first 5 days and is more likely with samples with low BOD levels. As a general rule, the BOD measurement should not include the oxygen consumption caused by nitrifying bacteria and this can be inhibited by using nitrification inhibitor B. This inhibitor suppresses the activity of the bacteria by enzymatic inhibition, so that only the breakdown of organic substances in the sample will be measured as the BOD value.

If it is desired to measure oxygen consumption resulting from nitrification (N-BOD), carry out measurements samples, one with and one without nitrification inhibitor and compare the results. The difference between the two BOD values will represent the oxygen demand of the nitrifying bacteria.

5. Add a clean magnetic stirring rod to each sample bottle and add 3-4 drops of 45% potassium hydroxide solution to the seal gasket (this will absorb the carbon dioxide). Then insert the seal gasket in the neck of the bottle.

Important

The sample must never come into contact with the potassium hydroxide solution. Never use grease or any other lubricants as an additional sealing agent, for the BOD sensors or for the seal gasket. Products of this kind may contain solvents which will attack the sensor, resulting in severe damage to the plastic housing and even to a failure of the sensor. The use of sealing greases and lubricants is not covered by our guarantee !

6. Before measurement begins, the prepared sample must be brought to the desired temperature (e.g. BOD₅, 20 °C). This can be achieved by placing the sample in a thermostatically controlled cabinet, while stirring the sample continuously with the inductive stirring system.

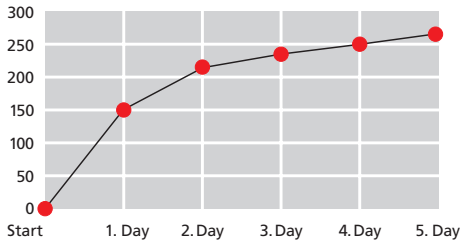
The OxiDirect® has an optional "Auto-Start" function, which enables it to start with samples at temperatures from 15° to 20°C. When this "Auto-Start" function is switched on, the system checks in specific intervals whether there has been a decrease of the pressure in the BOD bottle and will not start the timer until a pressure decrease is detected (latest, the timer will start 3 hours after the BOD sensor has been started).

7. Place the BOD sensors on the sample bottles and tighten carefully. This is extremely important – the system must be completely air-tight. Then place the BOD bottle, with the sensor screwed in position, into the bottle rack. This can be done in the thermostatically controlled cabinet itself.

Alternatively, because of the user-friendly design of the OxiDirect®, you can remove the entire BOD unit, with its integral bottle rack, from the thermostatically controlled cabinet, while leaving the inductive stirring system in the cabinet. There is no need to disconnect the cabling. Once the BOD bottles have been placed in the rack, the system is positioned over the inductive stirring system so that the 4 adjustment screws fit in the associated recesses of the stirring system.

8. Start the measurement process (see Section 3.10).
9. Incubate the sample in accordance with the instruction (e.g. BOD₅ for 5 days at 20 °C).

5. Interpreting the Results



1. The BOD value on any particular day must be higher than the one of the previous day.
2. BOD values do not increase in a linear manner. The increase is always smaller than the one of the previous day.
3. If the BOD results increase in a linear manner, the sample has a higher BOD value than expected.
4. If BOD results increased suddenly during the measurement, this may be the result of nitrification.
5. If BOD results decrease suddenly during the measurement, this may indicate leakage of the system.

The information given refers to normal samples (municipal wastes) and the normal circumstances of a BOD measurement. However, deviations are always possible, depending on the samples. For example, if there is a reading of zero after 5 days, this may be a sign of severe inhibition or oxidizing of the sample.

In the case of industrial effluents, samples may contain toxic substances. These must be removed, or the sample must be diluted. In addition, nutrients (nitrogen; phosphate) and trace elements (such as iron) must be present in sufficient concentrations; otherwise bacterial growth may be limited and artificially low BOD values may be recorded. Where problems of this kind occur, each individual case must be considered.

For further information, please ask for our application reports.

6. Checking the Measurement System

Test Set (Order code: 418328)

The test set enables a check of all the components of the OxiDirect®. Using a special reagent tablet, a defined underpressure is generated in the sealed BOD bottle.

7. Maintenance

High-quality metal alloys are used for the contacts between the BOD sensors and the bottle rack. If necessary, the contacts may be cleaned carefully with a soft cloth.

To compensate for any irregularities and to ensure optimum contact between the BOD sensor and the bottle rack as well as insuring proper stirring, the BOD measurement system has 4 levelling screws on its base.

If necessary, the BOD base unit (including the bottle rack) and the BOD sensors can be cleaned carefully with a soft cloth.

All parts which come into contact with the sample (BOD bottles; seal cups; magnetic stirring rod) must be cleaned thoroughly after each measurement. The bottles must be emptied completely and washed several times in hot water.

When any cleaning agents, dish-washing liquids, etc., are used, all parts must be rinsed thoroughly afterwards! The residues of such agents can interfere with BOD measurements.

8. Inductive Stirring System

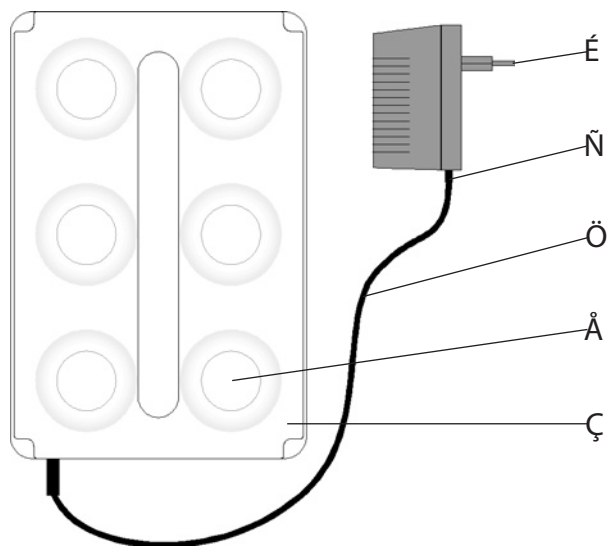


Fig. 1: Inductive stirring drive with stirring controller

- Å Stirring place
- Ç Stirring device
- É Controller
- Ñ Plug
- Ö Cable

8.1 Instructions

8.1.1 Correct use

This inductive stirring system has been designed for stirring liquids in BOD bottles.

8.1.2 Symbols

The following instruction symbols are used in this operating manual:



DANGER!

This sign refers to dangerous voltages



DANGER!

This sign refers to hazardous situations.
Risks to human life are indicated by the term "LIFE HAZARD"



CAUTION!

This sign indicates risks to equipment and machinery



INFORMATION

This sign indicates easier working practices

8.2 Safety Requirements

For your own safety, you should observe the following warnings.

The safety warnings indicate a possible source of danger. At the same time they give information how to avoid damage. You will always find these signs where danger can occur.



DANGER!

Magnetism.

Magnetic or metallic parts (e.g. data carriers, pacemakers, watches ...) can be affected by magnetic fields.

Keep such parts away from the magnetic stirrer (2) and the magnetic stirring rods



DANGER!

Voltage and frequency must be within the range specified for the control unit (3)



CAUTION!

Do not use in hazardous locations



CAUTION!

General ambient conditions :

Stirring drive (2): -10 to +56 °C at 100% humidity.

Control unit (3): 0 to +40 °C at max. 80% humidity.

Avoid extreme temperature changes.

The control unit (3) must not be used in areas of high humidity or in areas where water may splash!

**CAUTION!**

Do not place hot samples on top of the magnetic stirrer (2).
Maximum temperature : 56 °C.

**CAUTION!**

In case of repair, the equipment must only be opened by an authorised service technician. Disconnect from mains before opening !

**CAUTION!**

Do not allow the magnetic stirring rod to rest in an alternating magnetic field.
Do not place the magnetic stirring rod in a strong inverse magnetic field. This may result in destruction of the magnetic field of the stirring rod.

**INFORMATION**

The length of the magnetic stirring rod must not exceed 40 mm.
Do not use elliptical stirring rods with a round cross-section.

8.3 Equipment Description and Function

The stirring system has been designed for stirring liquids in standard BOD bottles. The ultra-slim stirring drive (2) has 6 stirring areas (1) and a separate controller (3). Bottles can be removed from the rack without stopping the stirring drive (2).

The inductive stirring drive has no motor and is therefore wear-free. It is particularly designed for continuous stirring in an incubator. It is hermetically sealed (fully protected against splashing water) and can be used even in the roughest environments. The wide space between the stirring areas (1) ensures good ventilation of the bottles, specially in an incubator. The stirring drive (2) is driven by a controller (3) with a pre-set speed. When turned on, the soft start feature ensures a uniform start of the magnetic stirring rods at half speed.

Every 40 seconds, the controller reduces the stirring speed by 50%, re-centring the magnetic stirring rod in the middle of the bottle.

The magnetic stirring rods are driven synchronously, preventing practically any interference between them.

8.4 Set Up



DANGER!

Voltage and frequency must be within the range specified for the control unit (3)



DANGER!

Magnetism. Magnetic or metallic parts (e.g. data carriers, pacemakers, watches ...) can be affected by magnetic fields. Keep such parts away from the magnetic stirrer (2) and the magnetic stirring rods.



CAUTION!

Do not use in hazardous locations



CAUTION!

General ambient conditions:
Stirring drive (2): -10 to +56 °C at 100% humidity.
Control unit (3): 0 to +40 °C at max. 80% humidity.
Avoid extreme temperature changes.
The control unit (3) must not be used in areas of high humidity or in areas where water may splash!

The control unit (3) does not have any switch. It is ready for use as soon as it is plugged in:

Connect the cable (5) from the stirring drive (2) with the socket (4) of the control unit (3) and fix it.

Plug the control unit (3) into the mains socket.

To ensure proper stirring the four screws at the bottom of the rack can be used to optimize the distance between stirring drive and magnetic stirring rod.

8.5 Magnetic stirring rods

We recommend the use of PTFE-coated magnetic stirring rods.



INFORMATION

The length of the magnetic stirring rod (8) must not exceed 40 mm.

8.6 Stirring



CAUTION!

Do not place hot samples on the magnetic stirrer (2).
Maximum temperature : 56 °C.

Fill the bottles with the sample.

Place a magnetic stirring rod into every bottle.

Place bottles in the BOD rack.

The control unit (3) is preset to operate at 320 rpm. Every 40 seconds the speed is reduced to 200 rpm, which will re-center the magnetic stirring rod, if necessary.

If you want to stop the stirring process:

Disconnect the control unit (3) from the mains socket.

8.7 Maintenance and Cleaning

The stirring drive (2) is maintenance-free.

The magnetic drive is embedded in a synthetic resin and is completely watertight. Clean the surface of the stirring drive (2) in regular intervals using a cleaning or a disinfectant solution suitable for use on PVC. Clean the surface of the stirring controller (3) using dry cloth.



CAUTION!

In case of repair, the equipment must only be opened by an authorised service agent. Disconnect from mains before opening !

8.8 Trouble shooting

8.8.1 The magnetic stirring rod rotates unevenly:

Over time, some ageing of the stirring rod cannot be avoided. This may reduce its magnetisation.



CAUTION!

Do not allow the magnetic stirring rod to come to rest in an alternating magnetic field (e.g. in an unfilled stirring vessel when the stirring or mixing mode is selected). Do not subject the magnetic stirring rod to a strong inverse magnetic field or to strong impact shocks (e.g. by dropping it). This may result in destruction of the magnetic stirring rod. Replace it by a new one.

8.8.2 The stirring rod swerves back and forth:

Swerving movements of the stirring rod may be caused by irregular shaped bottom of the bottle. Replace the bottle by a new one.

9. Technical Data

9.1 BOD System

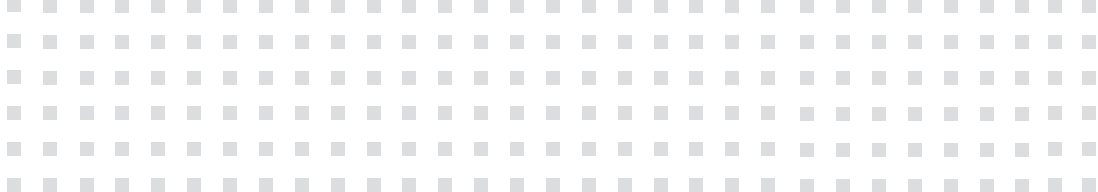
Type	OxiDirect®
Measurement principle	Manometric; mercury-free; electronic pressure sensor
Ranges [mg/l O ₂]	0 - 40, 0 - 80, 0 - 200, 0 - 400, 0 - 800, 0 - 2000, 0 - 4000 mg/l
Applications	BSB ₅ , BSB ₇ , OECD 301 F ...
Result display	BSB [mg/l]; 4 - digits; 7 - segment LED
Measurement parameter display	BOD-range, volume, duration, display time of measurement
Measurement period	User-selectable, between 1 and 28 days
Auto result storage	up to 28 results, depending on measurement period
Storage interval (for measurement period of...)	– hourly (1 day); – every 2 hours (2 days); – daily (3-28 days)
Automatic start function	– automatic start after pressure decrease – can be switched off
Power supply	3 alkaline-manganese batteries
Battery life	1 year (normal use as BOD ₅ meter – max. one reading a day); Low-Batt-Indication
Clock	Real-time clock
Protection class	IP54 (sensor head)
Dimensions (L x W x H)	375 x 195 x 230 mm including stirring unit
Housing	ABS
Approval	CE

9.2 Inductive Stirring System

Type	Inductive Stirring System
Stirring volume	6 BOD bottles
Stirring power	7 W
Rotation speed	320 rpm (reduced to 200 rpm every 40 s)
Dimensions (W x D x H)	270 x 180 x 25 mm
Distance between stirring points	88 mm
Weight (stirring drive)	1800 g
Housing material	PVC
General Ambient Conditions	-10 to +56 °C at 100 % humidity
Operating voltage	20 V max.
Control cable	2 m
Protection class	IP 68 (DIN 40050)
Stirring controller	
230 V version	220 – 240 V / 10 V / 50 - 60 Hz, protection class II, thermal fuse, CE
115 V version	110 – 120 V / 10 V / 50 - 60 Hz, protection class II, thermal fuse, CE
Permanent ambient conditions	0 to + 40 °C at max. 80 % humidity
Protection class	IP 20 (DIN 40050)

10. Accessories and Spare Parts List

Article	Order code
Replacement BOD sensor	2444430
Stirring controller	444413
Inductive stirring drive	2444451
Test Set	418328
Potassium hydroxide solution (50 ml)	2418634
Nitrification inhibitor B (50 ml)	2418642
BOD sample bottle	418644
Seal cup (gasket)	418636
Magnetic stirring rod	418637
Magnetic stirring rod remover	418638
Overflow measuring flask, 428 ml	418660
Overflow measuring flask, 360 ml	418659
Overflow measuring flask, 244 ml	418658
Overflow measuring flask, 157 ml	418657
Overflow measuring flask, 94 ml	418656
Overflow measuring flask, 56 ml	418655
Overflow measuring flask, 21. 7 ml	418664
Complete set overflow flasks	418654
Thermostatically controlled incubators	see general catalogue
Thermostatically controlled incubators with glass door	see general catalogue



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