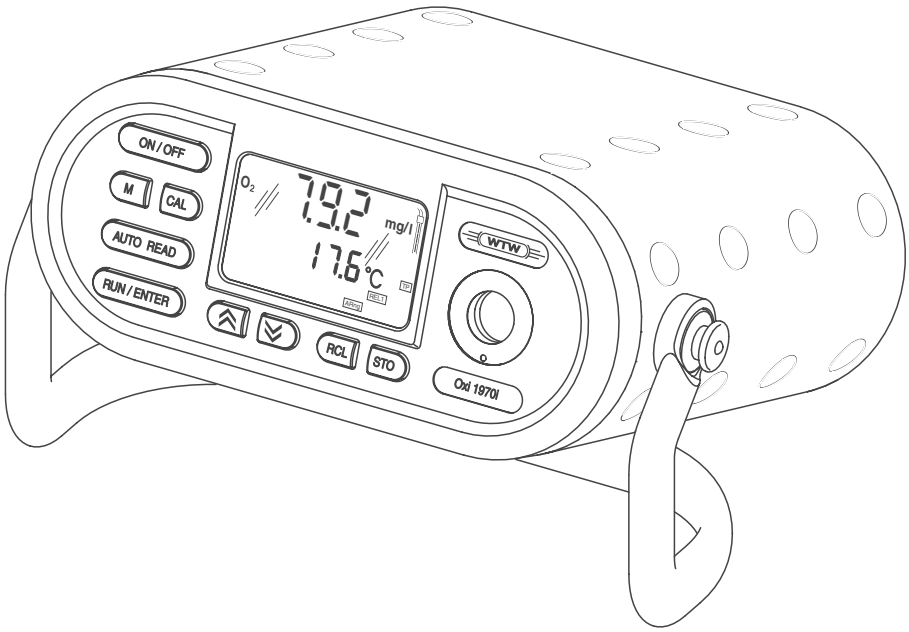
Operating manual

Oxi 1970i



Portable oxygen measuring instrument

ba75691e01 01/2007

Accuracy when going to press

The use of advanced technology and the high quality standard of our instruments are the result of a continuous development. This may result in differences between this operating manual and your instrument. Also, we cannot guarantee that there are absolutely no errors in this manual. Therefore, we are sure you will understand that we cannot accept any legal claims resulting from the data, figures or descriptions.

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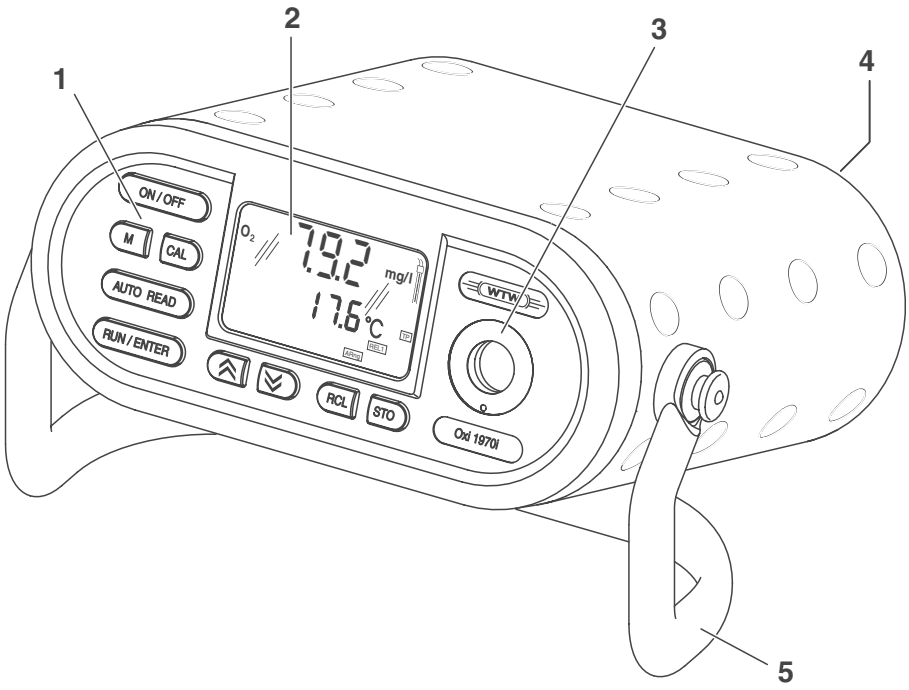
Oxi 1970i - Contents

1 Overview

The portable Oxi 1970i measuring instrument enables you to carry out oxygen measurements rapidly and reliably.
The Oxi 1970i provides the maximum degree of operating comfort, reliability and measuring certainty for all applications.

The proven OxiCal® calibration procedure supports you in your work with the measuring instrument. The special AutoRead function enables precise measurements.



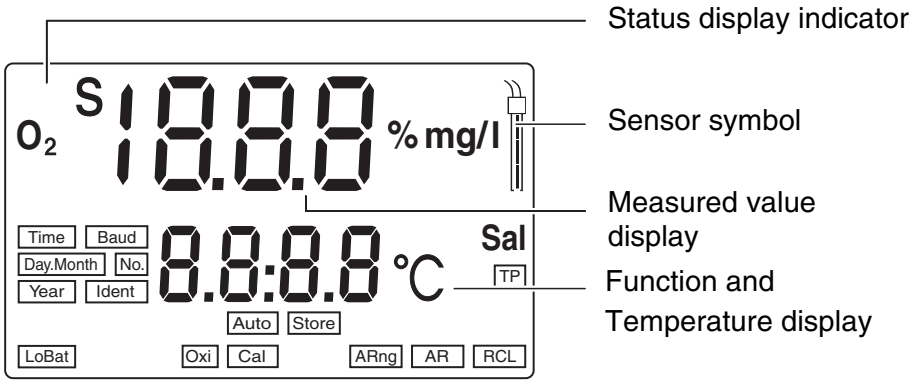
1	Keypad
2	Display
3	Integrated, exchangeable sensor quiver
4	Socket field
5	Carrying and positioning handle

Note
If you need further information or application notes, you can obtain the following material from WTW:

- Application reports
- Primers
- Safety datasheets.

You will find information on available literature in the WTW catalog or via the Internet.

1.1 Display



1.2 Keypad

Key functions

ON / OFF	Switch measuring instrument on/off **<ON/OFF>**
M	Select the measuring mode **<M>**: – D. O. concentration – Oxygen saturation
CAL	Calibrate **<CAL>**
AUTO READ	Activate/deactivate the AutoRead function **<AUTO READ>**
RUN / ENTER	Confirm entries, start AutoRead, output measured values **<RUN/ENTER>**
	Select the measuring mode, increase values, scroll **<▲ >**
	Select the measuring mode, decrease values, scroll **<▼ >**
RCL	Display/transmit measured values **<RCL>**
STO	Save a measured value **<STO>**

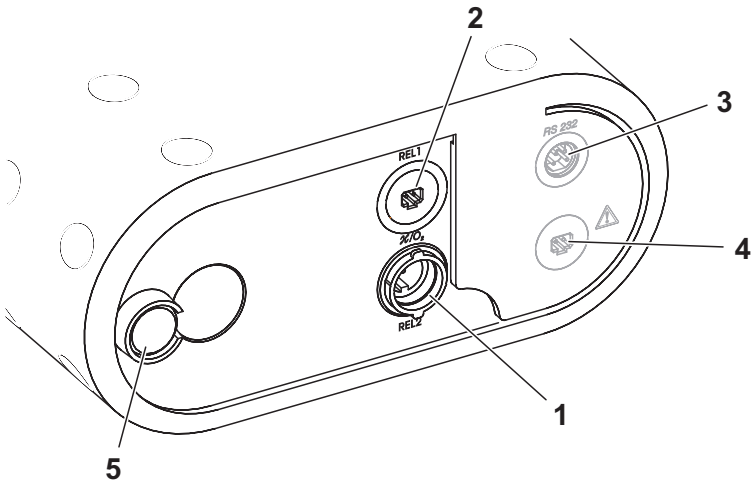
1.3 Socket field

Sensors

You can use the following sensors with the Oxi 1970i:

- Oxygen depth armature
- D. O. sensor CellOx 325, or
- D. O. sensor DurOx 325, or
- Self-stirring D. O. sensor StirrOx G

Connectors



Sensor / Instrument	Socket
Oxygen sensor	**1**
Integrated stirrer StirrOx G	**2**
Printer or PC (serial interface, RS232)	**3**
Plug-in power supply unit	**4**
Watertight valve for internal pressure equalization	**5**

Warning
Only connect sensors to the measuring instrument that cannot return any voltages or currents that are not allowed (> SELV and > current circuit with current limiting). Nearly all sensors - especially WTW sensors - fulfill these conditions.

2 Safety

This operating manual contains basic instructions that you must follow during the commissioning, operation and maintenance of the measuring instrument . Consequently, all responsible personnel must read this operating manual before working with the measuring system. The operating manual must always be available within the vicinity of the measuring system.

Target group

The measuring instrument was developed for work in the field and in the laboratory.
We assume that, as a result of their professional training and experience, the operators will know the necessary safety precautions to take when handling chemicals.

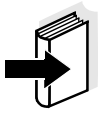
Safety instructions

The individual chapters of this operating manual use safety instructions such as the label shown below to indicate various hazards or dangers:

Warning
indicates instructions that must be followed precisely in order to avoid the possibility of slight injuries or damage to the instrument or the environment.

Further notes

Note
indicates notes that draw your attention to special features.



Note
indicates cross-references to other documents, e.g. operating manuals.

2.1 Authorized use

The authorized use of the measuring instrument consists exclusively of the measurement of the dissolved oxygen (D. O.) content of liquid media in the field and laboratory.
The technical specifications as given in chapter 7 TECHNICAL DATA must be observed. Only the operation and running of the measuring instrument according to the instructions given in this operating manual is authorized.
Any other use is considered to be **unauthorized**.

2.2 General safety instructions

This instrument is built and inspected according to the relevant guidelines and norms for electronic measuring instruments (see chapter 7 TECHNICAL DATA).
It left the factory in a safe and secure technical condition.

Function and operating safety

The smooth functioning and operational safety of the measuring instrument can only be guaranteed if the generally applicable safety measures and the specific safety instructions in this operating manual are followed during operation.

The smooth functioning and operational safety of the measuring instrument can only be guaranteed under the environmental conditions that are specified in chapter 7 TECHNICAL DATA.

If the instrument was transported from a cold environment to a warm environment, the formation of condensate can lead to the faulty functioning of the instrument. In this event, wait until the temperature of the instrument reaches room temperature before putting the instrument back into operation.

Safe operation

If safe operation is no longer possible, the instrument must be taken out of service and secured against inadvertent operation!
Safe operation is no longer possible if the measuring instrument:

- has been damaged in transport
- has been stored under adverse conditions for a lengthy period of time
- is visibly damaged
- no longer operates as described in this manual.

If you are in any doubt, please contact the supplier of the instrument.

Obligations of the purchaser

The purchaser of the measuring instrument must ensure that the following laws and guidelines are observed when using dangerous substances:

- EEC directives for protective labor legislation
- National protective labor legislation
- Safety regulations
- Safety datasheets of the chemical manufacturers.

3 Commissioning

3.1 Scope of delivery

- Portable measuring instrument, Oxi 1970i with integrated rechargeable battery
- Carrying and positioning handle
- Carrying strap
- Sensor quiver
- Plug-in power supply unit
- Operating manual

3.2 Power supply

Mains operation and charging the battery

You can either operate the measuring instrument with the integrated rechargeable battery or with the plug-in power supply. The plug-in power supply supplies the measuring instrument with low voltage (12 V DC). At the same time, the rechargeable battery is charged.

Note
The automatic stirring function of the self-stirring D. O. sensor StirrOx G can only be used when the plug-in power supply is connected.

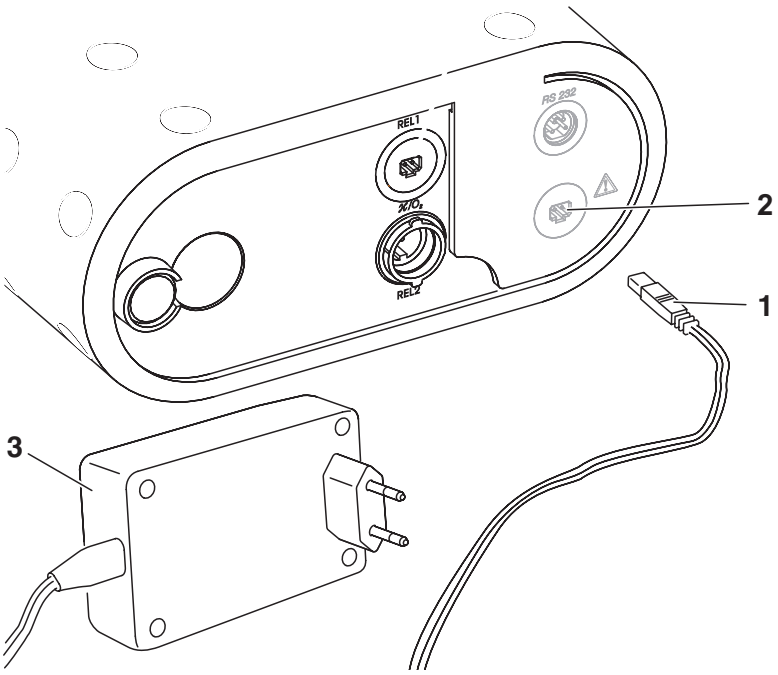
Charging time of the battery

approx. 16 hours. The battery is charged even when the instrument is switched off. The *LoBat* display indicator appears when the battery is nearly empty and has to be charged as soon as possible.

Warning
The line voltage at the operating site must lie within the input voltage range of the original plug-in power supply (see chapter 7 TECHNICAL DATA).

Warning
Use original plug-in power supplies only (see chapter 7 TECHNICAL DATA).

Connecting the plug-in power supply unit



1	Connect the plug (1) to the socket (2) of the measuring instrument.
2	Connect the original WTW plug-in power supply (3) to an easily accessible mains socket.

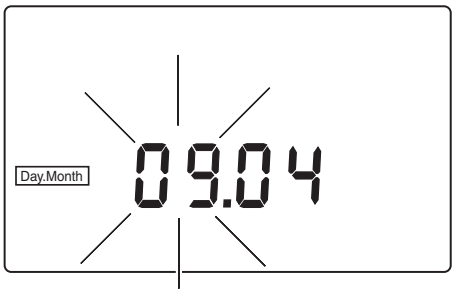
3.3 Initial commissioning

Perform the following activities:

- For mains operation and charging the battery: Connect the plug-in power supply (see section 3.2 POWER SUPPLY).
- Set the date and time.

Setting the date and time

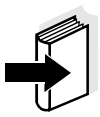
1	Press the **<M>** key and hold it down.
2	Press the **<ON/OFF>** key. The display test appears briefly on the display.
3	Press the **<RUN/ENTER>** key repeatedly until the date flashes on the display (*Day.Month* display indicator).



4	Set the date of the current day with **<▲> <▼>**.
5	Confirm with **<RUN/ENTER>**. The date (month) flashes in the display.
6	Set the current month with **<▲> <▼>**.
7	Confirm with **<RUN/ENTER>**. The year appears on the display.
8	Set the current year with **<▲> <▼>**.
9	Confirm with **<RUN/ENTER>**. The hours flash on the display.
10	Set the current time with **<▲> <▼>**.
11	Confirm with **<RUN/ENTER>**. The minutes flash on the display.
12	Set the current time with **<▲> <▼>**.
13	Confirm with **<RUN/ENTER>**. The instrument switches to the measuring mode.

3.4 Sensor quiver

To store the sensors during field operation and to keep the sensor element moist, the quiver tip contains a sponge rubber insert that can be moistened with deionized water.



Note
For further details on proper storage, refer to the operating manual of the sensor.

Moistening the quiver insert

1	Press the quiver out of the holder from the back side of the instrument and pull it out completely.
2	Pull off the quiver tip and moisten the sponge rubber with deionized water.

4 Operation

4.1 Switching on the measuring instrument

1	Connect the D. O. sensor to the measuring instrument.
2	Press the **<ON/OFF>** key. The display test appears briefly on the display. The relative slope for the sensor type that was just connected subsequently appears for approx. one second. The measuring instrument then automatically switches to the measuring mode that was last selected. The display shows the relevant measured value.

Note
The measuring instrument has an energy saving feature to avoid unnecessary battery depletion. The energy saving feature switches the measuring instrument off if no key has been pressed for an hour. The energy saving feature is not active when the AutoStore function is active.

The energy saving feature is also not active

- if the power is supplied by the plug-in power supply,
- if the communication cable and a PC with a running communication program are connected,
- if the recorder cable is connected,
- if the printer cable is connected (for external printers).

4.2 Measuring

4.2.1 General information

You can measure the following variables:

- D. O. concentration
- D. O. saturation

The measuring instrument is supplied with the following functions:

- AutoRange (automatic switchover of the measurement range). If a measuring range is exceeded, AutoRange causes the measuring instrument to change automatically to the next higher measuring range and back again. Therefore, the instrument always measures in the measuring range with the highest possible resolution. The function can be switched off.
- The AutoRead function (drift control) for checking the stability of the measurement signal. This ensures the reproducibility of the measuring signal. For details of how to switch the AutoRead function on/off, see page 19.

Preparatory activities

Perform the following preparatory activities when you want to measure:

1	Connect the D. O. sensor to the measuring instrument (see section 1.3 SOCKET FIELD).
2	Calibrate or check the measuring instrument with the D. O. sensor. How to calibrate is described in section 4.3.
3	Select the measuring mode with **<M>**.

Note
Incorrect calibration of D. O. sensors will result in incorrect measured values. Calibrate at regular intervals.

Note
The measuring instrument automatically recognizes the type of the D. O. sensor (CellOx 325 or DurOx 325).

Temperature sensor

The D. O. sensor has an integrated temperature sensor that always measures the current temperature of the test sample.

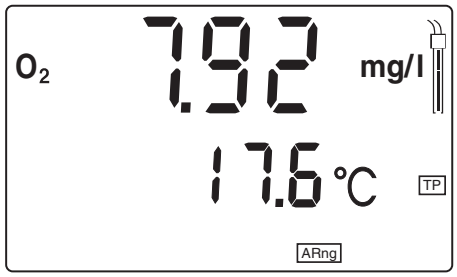
Warning
When connecting an earthed PC/printer, measurements cannot be performed in earthed media as incorrect values would result. The RS232 interface is not galvanically isolated.

4.2.2 Measuring the D. O. concentration

Note
When measuring the concentration of test samples with a salt content of more than 1 g/l, a salinity correction is required. For this, you have to measure and input the salinity of the measured medium first. This is described in section 4.3.3 on page 27.
Switching the salt content correction on or off, see below.

To measure the D. O. concentration with and without salt content correction, proceed as follows:

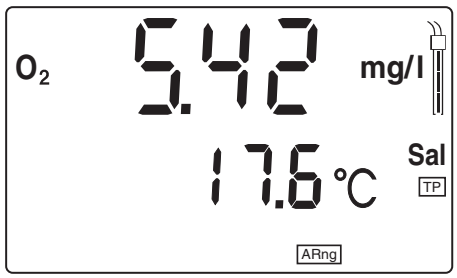
1	Perform the preparatory activities according to section 4.2.1.
2	Immerse the D. O. sensor in the test sample.
3	Press the **<M>** key repeatedly until the D. O. concentration in *mg/l* appears on the display.



Switching on/off the salt content correction

Proceed as follows to switch on the salt content correction:

1	In the D. O. concentration measuring mode, switch on the salt content correction with **<▲>** . The *SAL* display indicator appears on the display. The value that was entered is taken into consideration during the measurement (see section 4.3.3).

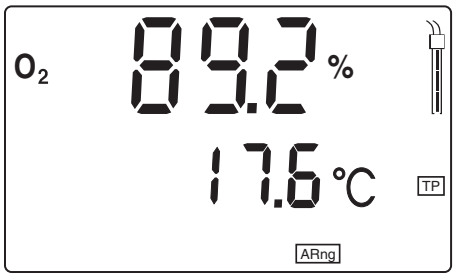


2	Switch the salt content correction off with **<▼>**. The SAL display indicator is no longer displayed.

4.2.3 Measuring the D. O. saturation

You can measure the D. O. saturation as follows:

1	Perform the preparatory activities according to section 4.2.1
2	Immerse the D. O. sensor in the test sample.
3	Press the **<M>** key repeatedly until the saturation in % appears on the display.



4.2.4 Automatic selection of the measuring range, AutoRange

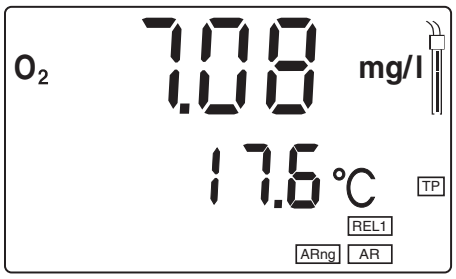
Sensors

You can use the sensors listed in section 1.3 on page 8. The sensor type is automatically recognized and the resolution is adjusted if necessary (see chapter 7 TECHNICAL DATA).

AutoRange

Two measuring ranges are available for each measuring mode. If a measuring range is exceeded, AutoRange causes the measuring instrument to change automatically to the next higher measuring range and back again. Therefore, the instrument always measures in the measuring range with the highest possible resolution.

To switch the automatic measurement range selection on/off, see section 4.6 CONFIGURATION. When the AutoRange function is switched on, *ARng* appears on the display.



4.2.5 AutoRead AR (drift control) and hold function

The AutoRead function (drift control) checks the stability of the measurement signal. The stability has a considerable impact on the reproducibility of the measured values. With the aid of the hold function the measured value display is frozen.

Criteria

With identical measurement conditions, the following criteria are valid for the AutoRead function:

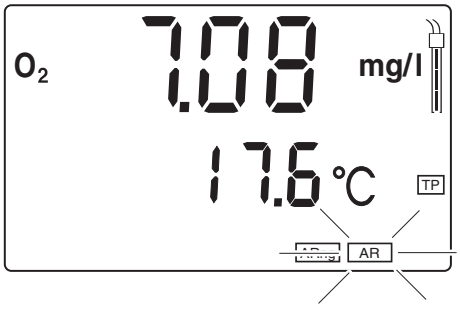
Measuring mode	Reproducibility	Response time
D. O. concentration	better than 0.05 mg/l	> 10 seconds
D. O. saturation index	better than 0.6 %	> 10 seconds

Use the AutoRead function and hold function like this with the sensors

- Oxygen depth armature
- CellOx 325
- DurOx 325

Note
The special features of the self-stirring D. O. sensor StirrOx G can be found in section 4.2.6 on page 20.

1	Select the measuring mode with **<M>**.
2	Activate the AutoRead function with **<AR>**. The current measured value is frozen (hold function).
3	Start AutoRead with **<RUN/ENTER>**. *AR* flashes until a stable measured value is reached.



4	If necessary, start the next AutoRead measurement with **<RUN/ENTER>**.

5	To terminate the AutoRead function: Press the **<AR>** key.

4.2.6 Sensor with stirrer (StirrOx G)

Connection

Connect the 2-pole stirrer plug to the stirrer output of the measuring instrument (designation *REL1*).

Note
The automatic stirring function of the self-stirring D. O. sensor StirrOx G can only be used when the plug-in power supply is connected.

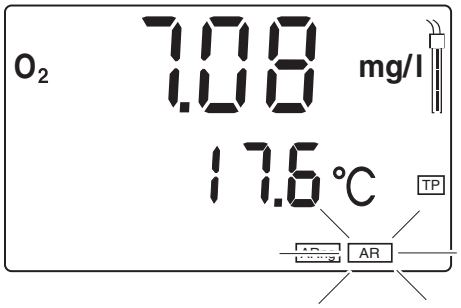
Stirrer function

The D. O. sensor, StirrOx G, has a temperature sensor and stirrer integrated. Using the key on the sensor you switch the stirrer on.

Measuring with AutoRead

You can switch on the stirrer and start an AutoRead measurement at the same time. To do so, proceed as follows:

1	Select the measuring mode with **<M>**.
2	Activate the AutoRead function with **<AR>**. The current measured value is frozen (hold function).
3	Submerse the sensor in the test sample and press the stirrer button. The stirrer is startet. At the same time, the AutoRead measurement starts. *AR* flashes until a stable measured value is achieved. Subsequently, the stirrer switches itself off.



4.3 Calibration

Why calibrate?

D. O. sensors age. This changes the slope of the D. O. sensor. Calibration determines the current slope of the sensor and stores this value in the instrument.
Thus, you should calibrate at regular intervals.

Calibration data records

The Oxi 1970i administrates two sets of calibration data:

- Set 1, for sensor class 1:
  - Oxygen depth armature
  - CellOx 325, or
  - StirrOx G
- Set 2, for sensor class 2:
  - DurOx 325

Sensors of different classes can be calibrated separately. When a sensor of one class is calibrated the calibration data of the other class remain stored. The Oxi 1970i recognizes the class of the connected sensor and automatically uses the correct calibration data.

Calibration procedures

The Oxi 1970i provides 2 calibration procedures:

- Calibration in water vapor-saturated air.
  To calibrate the CellOx 325, use theOxiCal®-SL air calibration vessel (accessory), to calibrate the DurOx 325, use the OxiCal®-D air calibration vessel (contained in the scope of delivery of the sensor).
- Calibration via a comparison measurement (e. g. Winkler titration according to DIN EN 25813 or ISO 5813). At the same time, the relative slope is adapted to the comparison measurement by a correction factor.

When to calibrate?

- After connecting another D. O. sensor
- If the sensor symbol flashes, i. e. after the calibration interval has expired

Calibration interval

The calibration interval (Int 3) is set to 14 days in the factory. You can select the interval in the range of 1 ... 999 days.

AutoRead

The calibration procedure automatically activates the *AutoRead* function.

Displaying calibration data

Each time the instrument is switched on, the calibration data are shown on the display for a short time (see section 4.1 SWITCHING ON THE MEASURING INSTRUMENT). In order to view the calibration data, switch the measuring instrument off and switch it on again.

Printing the calibration record

The calibration protocol contains the calibration data of the current calibration. You can transmit the calibration protocol to a printer via the serial interface (see page 35).

Note
You can automatically print a calibration record after the calibration. To do so, connect a printer to the interface according to section 4.5.3 before calibrating. After a valid calibration, the record is printed.

Sample printout:

```
CALIBRATION PROTOCOL
 02.03.02     14:19
Device No.: 12345678
CALIBRATION 02
Cal time: 02.03.02 / 14:19
Cal interval:   14d
OxiCal        Tauto AR
Relative Slope:   0,88
Probe:     +++
```

Sensor evaluation

After the calibration, the measuring instrument evaluates the current status of the sensor against the relative slope. The evaluation appears on the display. The relative slope has no effect on the measuring accuracy. Low values indicate that the electrolyte will soon be depleted and the sensor will have to be regenerated.

Display	Relative slope
	S = 0.8 ... 1.25
	S = 0.7 ... 0.8
	S = 0.6 ... 0.7
E3 Eliminate the error according to chapter 6 WHAT TO DO IF...	S < 0.6 or S > 1.25

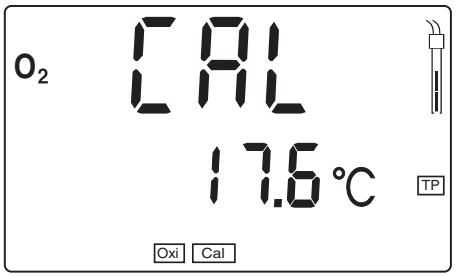
4.3.1 Calibrating with the air calibration vessel

Proceed as follows to calibrate the instrument:

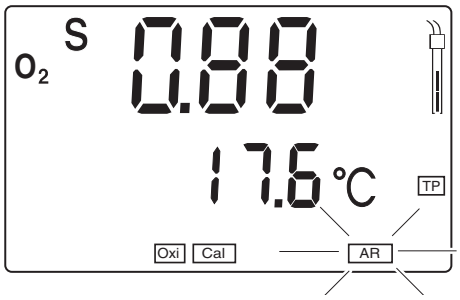
1	Connect the D. O. sensor to the measuring instrument.
2	Keep an air calibration vessel ready for use.

Note
The sponge in the air calibration vessel must be moist (not wet). Follow the instructions in the OxiCal®-SL or DurOx 325 operating manual.

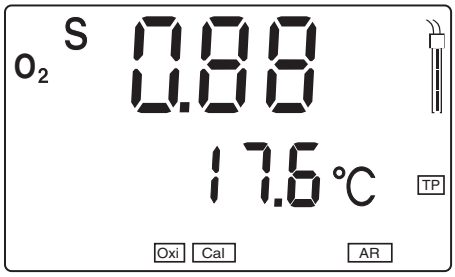
3	Put the D. O. sensor into the air calibration vessel.
4	Press the **<CAL>** key repeatedly until *O_2 CAL* appears.



5	Press the **<RUN/ENTER>** key. AutoRead is active, *AR* flashes.



6	As soon as a stable value is achieved, *AR* stops flashing. Calibration is finished; the sensor symbol indicates the relative slope determined and the sensor evaluation (see page 22).



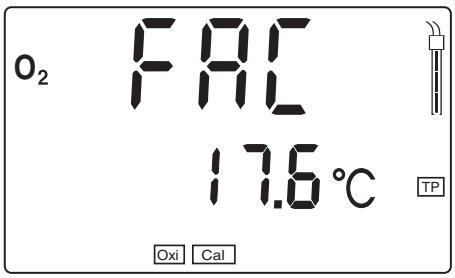
7	Switch to the measuring mode with **<M>**.

Note
In chapter 6 WHAT TO DO IF... page 49, you will find the measures to take for error elimination.

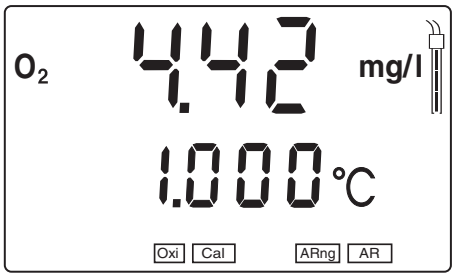
4.3.2 Calibrating via a comparison measurement

Proceed as follows to calibrate the instrument:

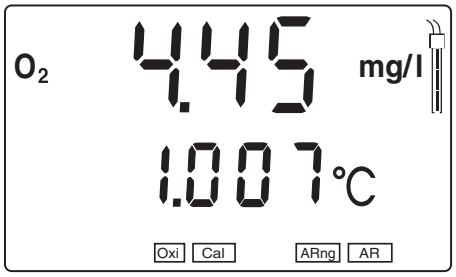
1	Connect the D. O. sensor to the measuring instrument.
2	Press the **<CAL>** key repeatedly until *O_2 FAC* appears.



3	Immerse the D. O. sensor in the calibrating solution.
4	Press the **<RUN/ENTER>** key. The AutoRead measurement begins. If the measured value is stable, the instrument displays the determined measured value and the correction factor of the relative slope (initial value = 1.000).



5	Remove the D. O. sensor from the calibrating solution.
6	Perform a comparison measurement, e. g. Winkler titration, with the calibrating solution (determine the nominal value). Leave the measuring instrument switched on until the nominal value is determined.
7	Set the displayed value on the measuring instrument to the nominal value with **<▲> <▼>**. This changes the related correction factor of the relative slope.



8	Switch to the measuring mode with **<M>** or **<RUN/ENTER>** .

Note
If the correction factor deviates from 1.000, the display of the measured value units flashes.

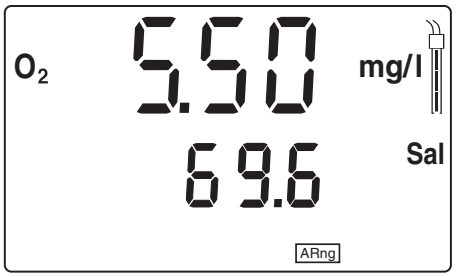
4.3.3 Entering the salt content (salinity)

A salt content correction is required in the oxygen concentration measurement of samples with a salt content of more than 1 g/l. To do this, you have to enter the salinity equivalent (the measured salinity) of the test sample (range 0.0 - 70.0) and to switch on the salinity correction.

Parameter	Value range
Salinity	0.0 ... 70.0 in steps of 0.1

Entering the salt content

1	Determining the salinity of the test sample (any method).
2	Press the **<CAL>** key repeatedly until *Sal* appears on the display.



3	Enter the salt content with **<▲> <▼>**.
4	Switch to the measuring mode with **<M>**.

Note
How to switch on the salt content correction is described on page 17.

4.4 Saving

The measuring instrument has an internal data memory. It can store up to 500 datasets.
A complete data record consists of:

- Storage location
- Date/time
- Measured value
- Temperature
- Temperature measuring procedure
- ID number

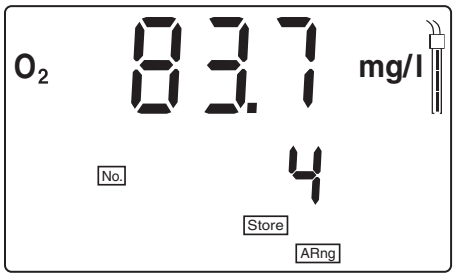
You can transmit measured values (data records) to the data storage in two ways:

- Save manually
- Switch on AutoStore (Int 1).

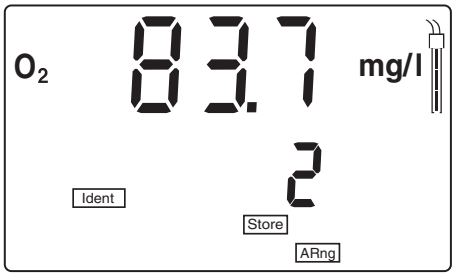
4.4.1 Saving manually

You can transmit a measured value to the data storage as follows:

1	Press the **<STO>** key. The current number (location number *No.*) of the next free storage location appears under the current measured value on the display.



2	Confirm with **<RUN/ENTER>**. The display switches to entering the ID number.



3	Using **<▲> <▼>**, enter the required ID number (1 ... 999).
4	Confirm with **<RUN/ENTER>**. The instrument changes to the measuring mode.

Message StoFull

This message appears when all of the 500 storage locations are occupied.

You have the following options:

Saving the current measured value. The oldest measured value (storage location 1) will be overwritten by this	Press **<RUN/ENTER>**
Returning to the measuring mode without saving	press any key
Outputting the data storage	see section 4.4.3
Clearing the memory	see section 4.4.4

4.4.2 Saving automatically

The save interval (Int 1) determines the chronological interval between automatic save processes.
After the fixed interval has expired, the current data record is transmitted to the storage and to the interface.

Setting the save interval:

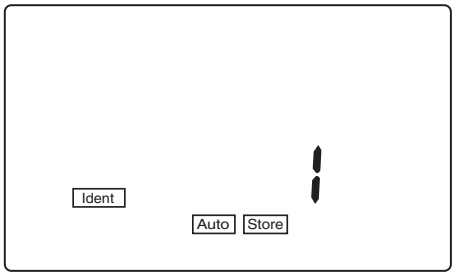
The default setting for the save interval (Int 1) is OFF.
By this, the AutoStore function is switched off.
To switch the function on, set an interval (5 s, 10 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min):

1	Press the **<RUN/ENTER>** key and hold it down.
2	Press the **<STO>** key. *Int 1* appears on the display.

3	Set the required interval between the saving procedures with **<▲> <▼>**.
4	Confirm with **<RUN/ENTER>**. The number of free memory locations appears on the display.

5	As soon as all of the 500 storage locations are occupied, *AutoStore* is terminated (Int 1 = OFF). If there are not enough storage locations available for your measurements: – Output and backup the data storage (see page 32) and – clear the memory (see page 36).

6	Confirm with **<RUN/ENTER>**. The prompt for the ID number appears on the display.



7	Set the required ID number with **<▲> <▼>**.
8	Confirm with **<RUN/ENTER>**. The instrument switches to the Oxi measuring mode and starts the measuring and saving process. *AutoStore* flashes on the display.

Note
The AutoStore function is interrupted if you start other functions, e.g. output the data storage.
After the function is finished, the AutoStore function is continued. By this, however, temporal gaps in the recording of the measured values will occur.

Switching off AutoStore

Switch AutoStore off by:

- setting the save interval (Int 1) to OFF, or
- switching the measuring instrument off and then on again.

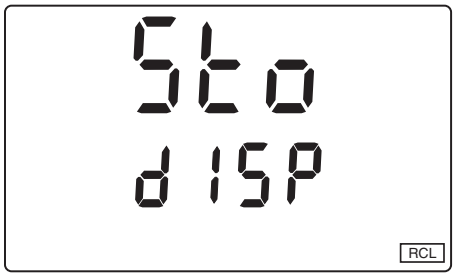
4.4.3 Outputting the data storage

You can output the contents of the data storage:

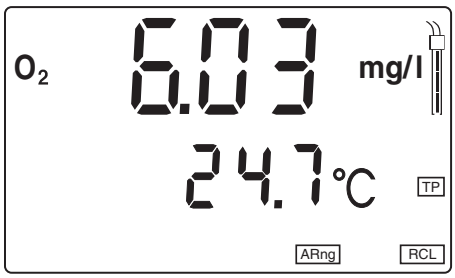
- Stored data on the display
- Calibration data on the display
- Stored data on the serial interface
- Calibration protocol on the interface

Outputting stored data on the display

1	Press the **<RCL>** key repeatedly until *StO dISP* appears on the display.



2	Press the **<RUN/ENTER>** key. A measured value appears on the display. The storage location of the data record is displayed for approx. 2 s, then the respective temperature appears.



You can perform the following activities:

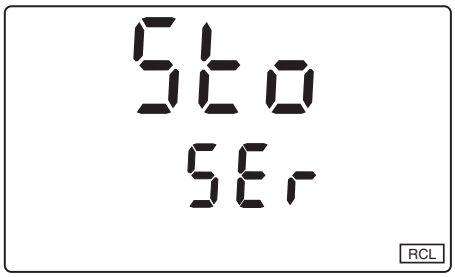
Display further elements of the data record (ID number, date, time, storage location)	Press **<RUN/ENTER>**
Advance one data record (storage location)	Press **<▲>**
Go back one data record (storage location)	Press **<▼>**

Note
If you want to search for a certain element (e.g. date), proceed as follows:

1	Using **<RUN/ENTER>**, select the element (e.g. date).
2	Press **<▲>** or **<▼>** repeatedly until the required date appears on the display. After approx. 2 s the temperature of the displayed measured value appears.

Outputting stored data to the interface

1	Press the **<RCL>** key repeatedly until *Sto SEr* appears on the display.



2	Press the **<RUN/ENTER>** key. The complete storage content is transmitted to the interface; during the data transmission the numbers of the currently transmitted storage locations run through. After the data transmission, the measuring instrument automatically switches to the measuring mode.

Note
You can cancel the transmission with **<M>** or **<RUN/ENTER>**.

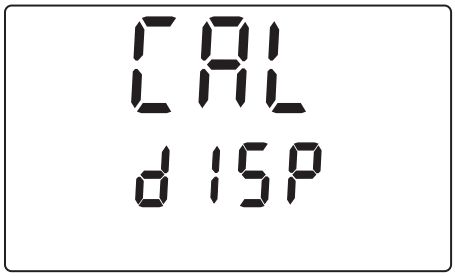
After the instrument number, the printout contains the complete storage contents in ascending order of the storage location numbers.

Sample printout:

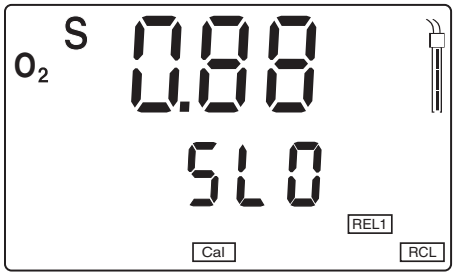
```
Device No.: 99990000

No.    1:
 09.03.02        17:10
 101.7 %         17.6°  C
Tauto          AR
Ident :  10

No.    2:
 09.03.02        17:11
 7.11 mbar       17.6°  C
Tauto          AR
Ident :  10

No.    3:
 09.03.02        17:12
  7.88 mg/l      17.6°  C
Tauto
Ident :  10

No.    4:
 09.03.02        17:15
  7.11 mg/l      17.8°  C
Tauto
 SAL = 17.9
Ident :   7
...
```

Outputting the calibration data on the display

1	Press the **<RCL>** key repeatedly until *CAL dISP* appears on the display.



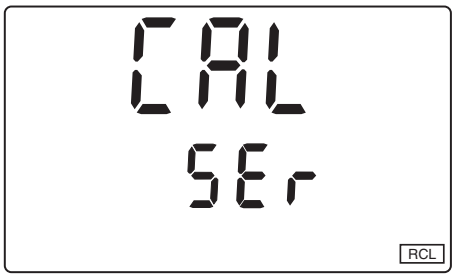
2	Press the **<RUN/ENTER>** key. The relative slope appears on the display:



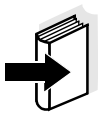
3	Using **<M>** or **<RUN/ENTER>,** you can switch back to the measuring mode.

Outputting the calibration protocol on the interface

1	Press the **<RCL>** key repeatedly until *CAL SEr* appears on the display.



2	Press the **<RUN/ENTER>** key. The calibration protocol is transmitted to the interface. After the data transmission, the measuring instrument automatically switches to the measuring mode.



Note
You will find a sample calibration protocol in PRINTING THE CALIBRATION RECORD, page 22.

4.4.4 Clearing the memory

With this function, you can delete the stored data records. 500 storage locations will then be available again.

Note
The *Clear memory* function only appears when there are data records stored in the memory. Otherwise, the measuring instrument automatically switches to the measuring mode.

Proceed as follows to clear all data records:

1	Switch off the measuring instrument.
2	Press the **<STO>** key and hold it down.
3	Press the **<ON/OFF>** key. The display test appears briefly on the display. Subsequently, *Sto CLr* appears.

4	Confirm the clearing process with **<RUN/ENTER>**. Pressing any other key prevents the clearing, the data records will remain stored.

Note
The calibration data remain stored and can be called up.

4.5 Transmitting data

You have the following possibilities of transmitting data:

- One of the following options:
  - With the *AutoStore* function (page 30), measured values are periodically saved internally (save interval Int 1) and output on the interface.
  - With the *Data transmission interval* function (Int 2), measured values are periodically output on the interface (see below).
- With the *Output data storage* function (page 32), calibration data or saved measured values are output on the interface.
- Via the analog recorder output (page 39), measured values are output as voltage values.
- With the KOM pilot communication kit (accessory), data can be transmitted bidirectionally (page 40).

Note
If you connect a recorder (analog output), the output on the digital interface is switched off.

4.5.1 Data transmission interval (Int 2)

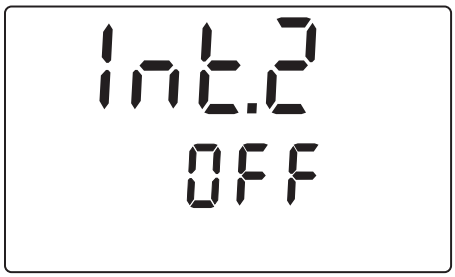
The interval for the data transmission (Int 2) determines the chronological interval between automatic data transmissions. After the selected interval expires, the current data record is transmitted to the interface.

Note
When the *AutoStore* function is active, the data transmission is performed according to the setting of the save interval (Int 1). Set the save interval (Int 1) to OFF to activate the Data transmission *interval* (Int 2).

Setting the Data transmission interval

The default setting for the interval is OFF.
To start the data transmission, set an interval (5 s, 10 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min):

1	Press the **<RUN/ENTER>** key and hold it down.
2	Press the **<RCL>** key. *Int 2* appears on the display.

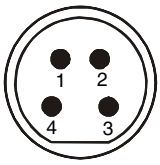


3	Set the required interval between the saving procedures with **<▲> <▼>**.
4	Confirm with **<RUN/ENTER>**. The measuring instrument automatically switches to the measuring mode.

4.5.2 Recorder (analog output)

You can transmit data to a recorder via the analog output. Connect the analog output to the recorder via the AK323 interface cable.
The data output automatically switches to *Recorder output.*

Socket assignment



RS 232
REC

1 free
2 Plug coding
3 Ground
4 Analog output
(internal resistance < 5 Ohm)

Note
The analog output is activated automatically in the cable by connecting 2 and 3.

The output on the analog output corresponds to the value shown on the display.

Signal range

The signal range of the analog output depends on the measured variable and the measuring range:

Concentration

Measuring range	Voltage	Resolution
0 ... 19.99 mg/l	0 ... 1999 mV	0.01 mg/l per 1 mV
0 ... 90.0 mg/l	0 ... 900 mV	0.1 mg/l per 1 mV

Saturation

Measuring range	Voltage	Resolution
0 ... 199.9	0 ... 1999 mV	0.1 % per 1 mV
0 ... 600 %	0 ... 600 mV	1 % per 1 mV

4.5.3 PC/external printer (RS232 interface)

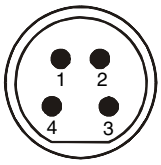
Via the RS 232 interface, you can transmit the data to a PC or an external printer.
Use the AK340/B (PC) or AK325/S (ext. printer) cable to connect the interface to the devices.
The data output automatically switches to the RS*232* interface.

Warning
The RS232 interface is not galvanically isolated.
When connecting an earthed PC/printer, measurements cannot be performed in earthed media as incorrect values would result.

Set up the following transmission data at the PC/printer:

Baud rate	selectable between: 1200, 2400, **4800**, 9600
Handshake	RTS/CTS + Xon/Xoff
Parity	none
Data bits	8
Stop bits	1

Socket assignment



RS 232
REC

1 CTS
2 RxD
3 Ground
4 TxD

4.5.4 Remote control

The measuring instrument can be remotely controlled from a PC. This requires the KOM pilot communication kit. It is available as an accessory.
The instrument is then controlled via commands that simulate keystrokes and request the current display contents.

Note
A more detailed description is provided within the scope of delivery of the communication kit.

4.6 Configuration

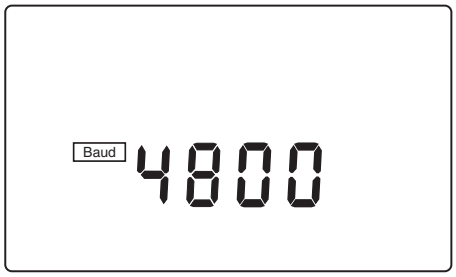
You can adapt the measuring instrument to your individual requirements. To do this, the following parameters can be changed (the status on delivery is marked in bold):

Baud rate	1200, 2400, **4800**, 9600
Air pressure display	Current value in mbar (no input possible)
Calibration interval (Int 3)	1 ... **14** ... 999 d
AutoRange ARng	**On** or off
Date/time	Any

Note
You can leave the configuration menu at any time with **<M>** . The parameters that have already been changed are stored.

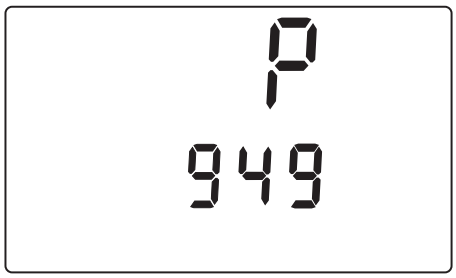
1	Switch off the measuring instrument.
2	Press the **<M>** key and hold it down.
3	Press the **<ON/OFF>** key. The display test appears briefly on the display. The measuring instrument then switches automatically to the setting of the baud rate.

Baud rate



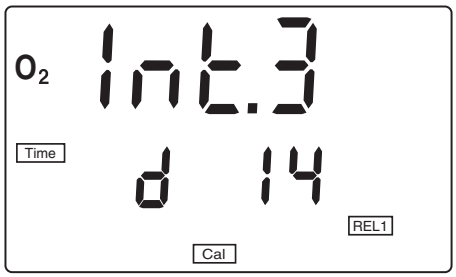
4	Select the required baud rate with **<▲> <▼>**.
5	Confirm with **<RUN/ENTER>**. On the display, the current air pressure in *mbar* appears.

Displaying the air pressure



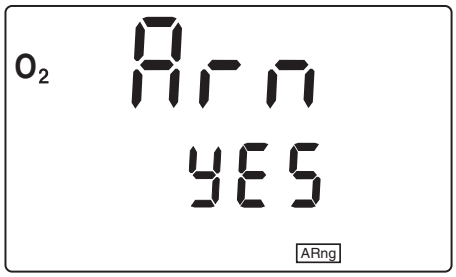
6	Confirm with **<RUN/ENTER>**. *Int 3 appears on the display.*

Calibration interval



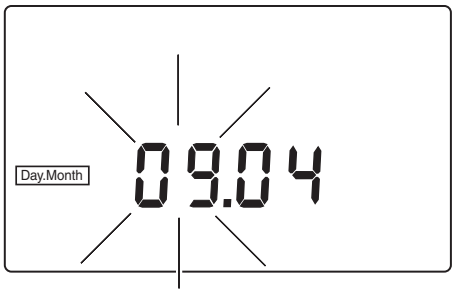
7	Set the required interval in days (d) with **<▲> <▼>**.
8	Confirm with **<RUN/ENTER>**. ARng appears on the display.

AutoRange automatic selection of the measurement range



9	Using **<▲> <▼>**, switch between *no* and *YES*. *YES*: Switch on AutoRange. *no*: Switch off AutoRange.
10	Confirm with **<RUN/ENTER>**. The date (day) flashes in the display.

Date and time



11	Set the date of the current day with **<▲> <▼>**.
12	Confirm with **<RUN/ENTER>**. The date (month) flashes in the display.
13	Set the current month with **<▲> <▼>**.
14	Confirm with **<RUN/ENTER>**. The year appears on the display.
15	Set the current year with **<▲> <▼>**.
16	Confirm with **<RUN/ENTER>**. The hours flash on the display.
17	Set the current time with **<▲> <▼>**.
18	Confirm with **<RUN/ENTER>**. The minutes flash on the display.
19	Set the current time with **<▲> <▼>**.
20	Confirm with **<RUN/ENTER>**. The measuring instrument automatically switches to the measuring mode.

4.7 Reset

You can reset (initialize) the measurement parameters and the configuration parameters separately from one another.

Measurement parameters

The following measured parameters (O_2 InI) are reset to the default condition:

Measuring mode	D. O. concentration
AutoRange automatic measurement range selection	On (*YES*)
Relative slope	1.00
Correction factor of the relative slope	1.000
Salinity equivalent	0.0
Salinity correction	Off

Note
The calibration data gets lost when the measuring parameters are reset. Recalibrate after performing a reset.

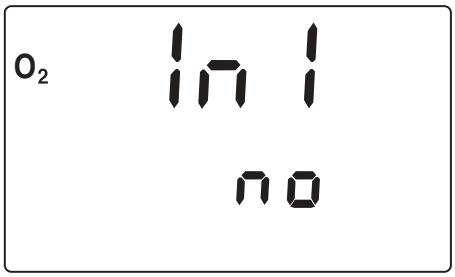
Configuration parameters

The following configuration parameters (*InI*) are reset to the delivery status:

Baud rate	4800
Interval 1 (automatic saving)	OFF
Interval 2 (for data transmission)	OFF

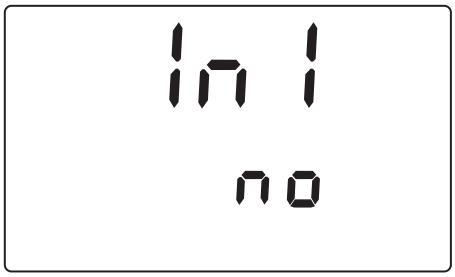
Resetting the measuring parameters

1	Press the **<RUN/ENTER>** key and hold it down.
2	Press the **<CAL>** key.



3	Using **<▲> <▼>**, switch between *no* and *YES*. *YES*: Resetting the measuring parameters *no*: Retaining settings.
4	Confirm with **<RUN/ENTER>**. The measuring instrument switches to the configuration parameters.

Resetting the configuration parameters



5	Using **<▲> <▼>**, switch between *no* and *YES*. *YES*: Resetting the configuration parameters *no*: Retaining settings.
6	Confirm with **<RUN/ENTER>**. The measuring instrument automatically switches to the measuring mode.

5 Maintenance, cleaning, disposal

5.1 Maintenance

The measuring instrument is maintenance-free.

5.2 Cleaning

Occasionally wipe the outside of the measuring instrument with a damp, lint-free cloth. Disinfect the housing with isopropanol as required.

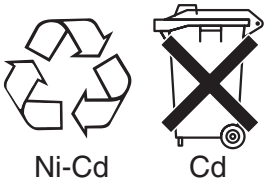
Warning
The housing components are made out of synthetic materials (polyurethane, ABS and PMMA). Thus, avoid contact with acetone and similar detergents that contain solvents. Remove any splashes immediately.

5.3 Disposal

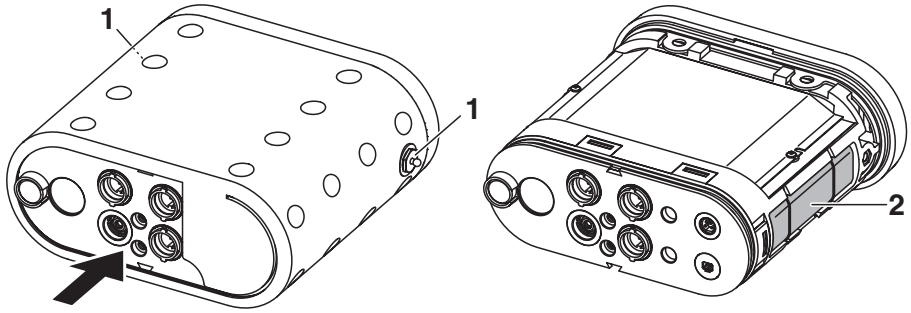
Packing

This measuring instrument is sent out in a protective transport packing. We recommend: Keep the packing material. The original packing protects the measuring instrument from transport damages.

Rechargeable battery



Remove the rechargeable battery from the instrument and dispose of it at a suitable facility according to local legal requirements. It is illegal to dispose of the rechargeable battery with household refuse. Proceed as follows to disassemble the rechargeable battery:



1	Remove the carrying and positioning handle or the carrying strap.
2	Unscrew the fixing elements (1) using a hexagon key.
3	Remove the instrument from the enclosure by vigorously pressing against the socket field.
4	Take out the rechargeable battery (2) and cut off the battery cable.

Measuring instrument, Dispose of the measuring instrument without the rechargeable battery as electronic waste at an appropriate collection point.

6 What to do if...

Display LoBat

Cause	Remedy
– Battery almost empty	– Charge the battery (see section 3.2)

Instrument does not react to keystroke

Cause	Remedy
– Operating condition undefined or EMC load unallowed	– Processor reset: Press the **<RCL>** and **<ON/OFF>** keys at the same time and release them again. The software version is displayed.

Error message OFL

Cause	Remedy
Display range exceeded	
Oxygen sensor:	
– Not connected	– Connect the sensor
– Cable broken	– Replace sensor
– Depleted	– Replace sensor
– Short-circuit between gold and lead electrode	– Clean sensor and replace it if necessary

Error message E3

Cause	Remedy
Invalid calibration	
Oxygen sensor:	
– Electrolyte solution depleted	– Regenerate sensor
– Membrane contaminated	– Clean membrane
– Electrode system poisoned	– Regenerate sensor
– Obsolete	– Replace sensor
– Broken	– Replace sensor

Error message E7

Cause	Remedy
Membrane damaged	
– Membrane damaged	– Regenerate sensor
– Membrane head not screwed on tight enough	– Screw membrane head tight

AR flashes continuously

Cause	Remedy
No stable measured value	
– Membrane contaminated	– Clean membrane

Measured value too low

Cause	Remedy
– Insufficient flow	– Provide flow to the sensor

Measured value too high

Cause	Remedy
– High amount of dissolved substances	– Correct solubility function using the salinity equivalent
– Air bubbles bump on the membrane with high velocity	– Avoid direct flow to the membrane
– The carbon dioxide pressure is too high (> 1 bar)	– Measuring not possible

Display to

Cause	Remedy
– Time-out of the interface	– Check the instrument connected

Sensor symbol flashes

Cause	Remedy
– Calibration interval expired	– Recalibrate the measuring system

Message StoFull

Cause	Remedy
– All memory locations are full	– Output data storage and clear data storage

You want to know which software version is in the instrument

Cause	Remedy
– E. g., a question by the WTW service department	– Simultaneously press the **<CAL>** and **<ON/OFF>** keys and release them again. The software version is displayed.

7 Technical data

7.1 General data

Test certificates cETLus, CE

Dimensions approx. 90 x 200 x 190 mm

Weight approx. 1.5 kg (without plug-in power supply)

Mechanical structure Type of protection: IP 67

Electrical safety Protective class: III

Ambient conditions

Operation	-10 °C ... + 55 °C
Storage	- 25 °C ... + 65 °C
Climatic class	2

Power supply

Rechargeable battery	Nickel-cadmium (NiCad) rechargeable battery
Operational life	approx. 600 hours with one charging
Plug-in power supply unit (charging device)	The following applies to all plug-in power supplies: Connection max. Overvoltage category II Plug-in power supply unit (Euro, US , UK, Australian plug) FRIWO FW7555M/09, 15.1432 Friwo Part. No. 1883259 Input: 100 ... 240 V ~ / 50 ... 60 Hz / 400 mA Output: 9 V = / 1,5 A

Serial interface

Automatic switchover when a PC or a printer is connected via the cable, AK 340/B or AK 325/S.

Type	RS232, data output
Baud rate	Can be set to 1200, 2400, 4800, 9600 Baud
Data bits	8
Stop bits	2
Parity	None
Handshake	RTS/CTS + Xon/Xoff
Cable length	Max. 15m

Analog output (AK 323/ S cable)

Automatic switchover when the recorder is connected by the cable, AK 323/S.

pH output signal	-200 ... +1999 mV for the range - 2.00 ... + 19.99
mV output signal	-1999 ... +1999 mV for the range -1999 ... +1999 mV for the range
Accuracy	± 0.5 % of display value
Internal resistance	< 5 Ohm (current limited to max. 0.2 mA output current)

Variable	Voltage	Resolution
Saturation [%] */ Range*		
0 ... 200.0 % *0 ... 600 %*	0 ... 2 V 0 ... 600 mV	± 0.1 ± 1
Concentration [mg/l] */ Range*		
0...20.00 mg/l *0...100.0 mg/l*	0 ... 2 V 0 ... 1 V	0.01 mg/l 0.1 mg/l

Accuracy	± 0.5 % of display value ± 0.1(% saturation) or ± 0.5 % of the display value ± 0.01 mg/l

Internal resistance	< 5 Ohm (current limited to max. 0.2 mA output current)

Guidelines and norms used

EMC	E.C. guideline 89/336/EEC EN 61326-1:1997 EN 61000-3-2 A14:2000 EN 61000-3-3:1995 FCC Class A
Instrument safety	E.C. guideline 73/23/EEC EN 61010-1 A2:1995
Climatic class	VDI/VDE 3540
IP protection	EN 60529:1991

7.2 Measuring ranges, resolutions, accuracies

Measuring ranges, resolutions

Note: The values given in brackets apply to the sensor DurOx 325 especially.

Variable	Measuring range	Resolution
Concentration [mg/l]	0 ... 19.99 (0 ... 19.9) 0 ... 90.0 (0 ... 90)	0.01 (0.1) 0.1 (1)
Saturation [%]	0 ... 199.9 (0 ... 199) 0 ... 600	0.1 (1) 1
T [°C]	0 ... 50.0	0.1

Accuracy (± 1 digit)

Variable	Accuracy
Concentration [mg/l]	± 0.5 % of measured value at ambient temperature of + 5 °C ... + 30 °C
Saturation [%]	± 0.5 % of measured value when measuring in the range of ± 10 K around the calibration temperature
T [°C]	± 0.1

Correction functions

Temperature compensation	Accuracy better than 2 % at 0 ... + 40 °C
Salinity correction	0 ... 70.0 SAL

Air pressure correction	Automatic through integrated pressure sensor in the range of 500 ... 1100 mbar

8 Lists

This chapter provides additional information and orientation aids.

Abbreviations The list of abbreviations explains the indicators and the abbreviations that appear on the display and in the manual.

Specialist terms The glossary briefly explains the meaning of the specialist terms. However, terms that should already be familiar to the target group are not described here.

Index The index helps you to find the topics that you are looking for.

Abbreviations

AR	AutoRead (drift control)
ARng	Automatic range switching Measuring instrument measures with highest resolution
°C	Temperature unit, degrees Celsius
Cal	Calibration
E3	Error message see chapter 6 WHAT TO DO IF...
Inl	Initialization Resets individual basic functions to the status they had on delivery
LoBat	Battery almost empty (Low Battery)
OFL	Display range exceeded (Overflow)
OxiCal	Automatic calibration for D. O. measurements
SAL	Salinity
SELV	Safety Extra Low Voltage
TP	Temperature measurement active (Temperature Probe)

Glossary

Adjusting To manipulate a measuring system so that the relevant value (e. g. the displayed value) differs as little as possible from the correct value or a value that is regarded as correct, or that the difference remains within the tolerance.

Amperometry Name of a measuring technique. The signal (depending on the measured parameter) of the sensor is the electric current. The electrical voltage remains constant.

AutoRange Name of the automatic selection of the measuring range.

AutoRead WTW name for a function to check the stability of the measured value.

Calibration Comparing the value from a measuring system (e. g. the displayed value) to the correct value or a value that is regarded as correct. Often, this expression is also used when the measuring system is adjusted at the same time (see adjusting).

D. O. partial pressure Pressure caused by the oxygen in a gas mixture or liquid.

Measured parameter The measured parameter is the physical dimension determined by measuring, e. g. pH, conductivity or D. O. concentration.

Measured value The measured value is the special value of a measured parameter to be determined. It is given as a combination of the numerical value and unit (e. g. 3 m; 0.5 s; 5.2 A; 373.15 K).

Measuring system The measuring system comprises all the devices used for measuring, e. g. measuring instrument and sensor. In addition, there is the cable and possibly an amplifier, terminal strip and armature.

Molality Molality is the quantity (in Mol) of a dissolved substance in 1000 g solvent.

OxiCal® WTW name for a procedure to calibrate D. O. measuring systems in water vapor saturated air.

Oxygen saturation Short name for the relative D. O. saturation.
Note: The D. O. saturation value of air-saturated water and the D. O. saturation value of oxygen-saturated water are different.

Reset Restoring the original condition of all settings of a measuring system.

Resolution Smallest difference between two measured values that can be displayed by a measuring instrument.

Salinity The absolute salinity S_A of seawater corresponds to the relationship of the mass of dissolved salts to the mass of the solution (in g/Kg). In practice, this dimension cannot be measured directly. Therefore, the practical salinity is used for oceanographic monitoring. It is determined by measuring the electrical conductivity.

Salt content General designation for the quantity of salt dissolved in water.

Sample Designation of the sample ready to be measured. Normally, a test sample is made by processing the original sample. The test sample and original sample are identical if the test sample was not processed.

Slope The slope of a linear calibration function.

Slope (relative) Designation used by WTW in the D. O. measuring technique. It expresses the relationship of the slope value to the value of a theoretical reference sensor of the same type of construction.

Standard solution The standard solution is a solution where the measured value is known by definition. It is used to calibrate a measuring system.

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