MODEL 9200 WATERPROOF DO_2 METER OPERATING MANUAL

541 011

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9200/REV A/05-95

MODEL 9200 DO_2 METER
OPERATING MANUAL

INTRODUCTION

The Model 9200 is ruggedly designed and constructed to resist the harshest of field, industrial and laboratory environments. The whole system is rated at IP67 and will float if dropped into water.
The instrument is supplied with a fully integrated DO_2/Temperature sensor.

SPECIFICATION

DO_2	
Ranges:	0 to 199%
	0 to 25.0%
	0 to 19.99mg/l
Resolution:	1% / 0.1% / 0.01mg/l
Accuracy:	±2% within 10°C of calibration temperature
Temperature Measuring	
Ranges:	-10 to +60°C
	14 to 140°F
Resolution:	0.1°C / 1°F
Accuracy:	±0.5°C / ±1°F
ATC Range:	-10 to +60°C
*Pressure	
Range:	0 - 6bar
Resolution:	0.01bar
Accuracy:	±0.05bar

* available only with optional probe.

SPECIFICATION (continued)

* Depth:	
Range:	0 - 50metres
Resolution:	0.1metres
Accuracy:	0.5metres
* available only with optional probe.	
Clock:	24 hour, hours/mn/sec or day of month, month and year, leap year corrected
Power:	3 AA cells
Size:	200(l)x80(w)x60(d)mm
Weight:	370g

INSTALLATION

Unpack the instrument and ensure the following items are present:

1. Model 9200 pH Meter (541 001)
2. DO_2/Temperature Probe (541 520)
3. Membrane Kit (541 550)
4. Membrane Protective Cap (541 512)
5. Zero Powder (983 030)
6. 3 x AA alkaline batteries (021 007)
7. Membrane Cover (541 513)

Optional accessories which may have been ordered:

1. Carrying Case (033 175)
2. B.O.D. Probe (541 620)
3. Depth/Pressure Probe (541 701)
4. Interface Cradle (542 001)
5. Interface Cable Kit (542 009)
6. 40 Column Printer (543 001)
7. Paper Roll for Printer (060 287)
8. Printer Ribbon (060 288)

INSTALLATION (continued)

LCD CONTRAST

The LCD contrast can be set at initial power up of the instrument. The LCD contrast potentiometer is accessible with the battery compartment cover removed. This adjustment should only need to be made on receipt of the instrument. After initial adjustment the instrument will automatically adjust the contrast depending on the temperature of the glass.

Remove the battery compartment cover and fit the batteries, taking care to observe the correct polarity, as indicated on the moulding. Re-fit the cover and tighten the screws to achieve a watertight seal.

Once the batteries have been inserted a time of approximately 30 minutes will be required to allow full polarisation of the probe to take place. Re-polarisation will not be required unless the batteries are replaced. Polarisation continues even when the instrument is switched off.

PREPARATION FOR USE

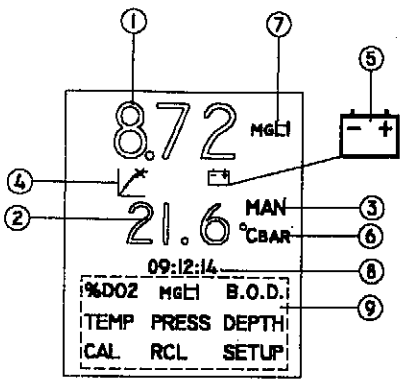
The probe is delivered with the membrane module detached. Prior to use the membrane module must be fitted to the probe body.
A protective cap is also supplied. This should be fitted to the probe when not in use. The sponge contained within the cap should be wetted with deionised water prior to fitting. This covers the membrane and keeps it wet, thus preventing the electrolyte filling from drying out.

1. Remove the protective cap from the probe.

2. Take a membrane module and hold in the vertical position. Fill with the electrolyte solution (5% KCl) supplied with the instrument.

3. Whilst still holding the module upright, screw the probe slowly down onto the thread, allowing the excess electrolyte to escape through the screw thread. Ensure no air bubbles are present and that the membrane is not creased.

DISPLAYS



1. Primary display - provides direct readout of % oxygen saturation, % air saturation, mg/l oxygen and B.O.D (Biochemical Oxygen Demand).
   If the primary reading is overrange this display will indicate "1" with all other digits blanked and the error message **OVERRANGE.**
   If the primary reading is underrange this display will indicate "-1" with all other digits blanked and the error message **UNDERRANGE.**

Primary Ranges:

% oxygen saturation	0 to 25.0%
% air saturation	0 to 199%
mg/l oxygen	0 to 19.99mg/l
B.O.D.	0 to 999.9mg/l

2. Auxiliary display - provides direct readout of temperature in °C or °F, pressure in bars* and depth* in metres. (*When fitted with optional Depth/Pressure probe).
If the auxiliary reading is overrange this display will indicate "1" with all other digits blanked.
If the auxiliary reading is underrange this display will indicate "-1" with all other digits blanked.

Auxiliary Ranges:

Temp	-10 to 60°C 14 to 140°F
Pressure	0 to 6bar
Depth	0 to 50 metres

3. MAN - indicates manual pressure set.

4. Endpoint Detection symbol - this is displayed once a stable reading is detected and is maintained until the input changes.

5. Low Battery Indicator - this will be displayed when a maximum of 5 hours battery life remains.

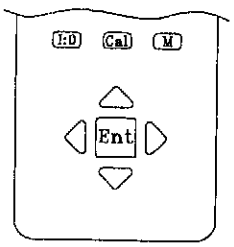
6. Pressure measurement unit (bar).

7. Measurement unit which is being used % DO_2 or mgL^{-1}.

8. Real Time Clock giving continuous display of hours, minutes and seconds or day, month and year. All logged results are automatically time stamped.

9. Menu - used for selection of modes of operation. The selected mode is reverse highlighted. To select, highlight the appropriate mode of operation using the arrow keys, then press ENT.
NOTE: The menu wraps around.
To exit to another mode, highlight the required mode using the arrow keys and press ENT. To escape from a measurement sequence/mode move to the EXIT option and press ENT. This will return the instrument to the start of the previously selected menu.

CONTROLS



I:O Switches the instrument on and off.

CAL This key, is used to perform a %oxygen saturation calibration or a % air saturation calibration.

M The Memory Store key is used to store the displayed readings in any measurement mode.

▲▼ These keys are used to change a parameter.
1. Used when storing a reading to change the stored location index.
2. In recall (RCL) mode these keys are used to change the displayed stored location.
3. The keys are used to move vertically between menu options.
4. In Set-Up mode these keys are used to modify the set up parameters.

◄ ► 1. These keys are used to move horizontally between menu options. 2. In Set-Up these keys are used to select the part of the parameter required for modification.

ENT The ENT (enter) key is used to select the displayed menu option. It also places stored values in the selected location(s).

INPUTS

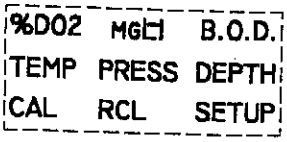
PL3 ELECT SOCKET

Connection socket for DO_2/Pressure/Temperature probe supplied with the instrument, or an alternative electrode.

OPERATION

Switch the instrument on using the I:O key. The display will show INITIALISING... for approximately 2 seconds. The primary display will then show the $\%DO_2$, or mgL^{-1} mode, the auxiliary display will then show temperature, pressure or depth. Both will show the mode last used prior to switch off. This will be indicated by the displayed measurement units. The selected primary mode will be reverse highlighted. To change the mode, move to the required mode by using the arrow keys and then press the ENT key.

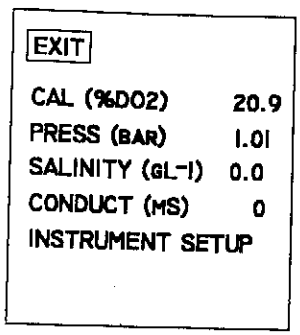
MENU OPTIONS



$\%DO_2$	% oxygen saturation or % air saturation mode.
mgL^{-1}	mg/l oxygen mode
B.O.D	Biochemical Oxygen Demand mode
TEMP	Temperature mode
PRESS	Pressure mode
DEPTH	Depth mode
CAL	% oxygen saturation or % air saturation calibration mode
RCL	recall mode for stored readings
SETUP	Used to set up mode specific parameters, instrument and clock set up.

SET UP OPTIONS

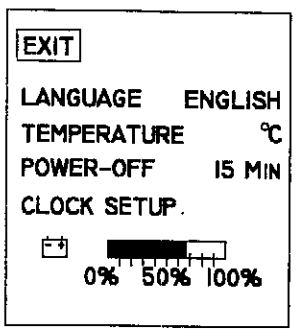
1. DO_2 SET UP MENU



EXIT - menu escape key
CAL ($\%DO_2$) - this is the $\%DO_2$ value with which the probe is calibrated to.
PRESS (bar) - used to set up barometric pressure in units of bars for manual pressure compensation.
SALINITY (gL^{-1}) - used to set up the salinity in units of g/l of the sample under test for salinity compensation.
CONDUCT (mS) - used to set up the conductivity in units of mS of the sample under test for salinity compensation.
NOTE: The oxygen dissolved in water changes with salinity when making measurements in mg/l. If measurements are made in % saturation no salinity compensation is required. The SALINITY and CONDUCT compensation values are interdependent, hence setting up one

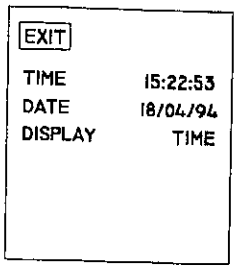
parameter will cause the 9200 to automatically adjust the other parameter.
INSTRUMENT SET UP - used to select the next set up menu for instrument parameters.

3. INSTRUMENT SET UP MENU



EXIT - menu escape key.
LANGUAGE - used to set preferred language option (English, French, German, Italian, Spanish or Swedish).
TEMPERATURE - used for selection of measurement in °F or °C.
POWER-OFF - used to select auto shut off time interval (15, 30, 45, 60 minutes, or disabled).
CLOCK SET UP - used to select clock set up menu.
Estimated battery life indicator.

4.CLOCK SET UP MENU



EXIT - menu escape key
TIME - real time clock set up
DATE - date set up
DISPLAY- used to select display of time, date or none

%DO_2 MODE

This gives a direct readout of the %DO_2 of the sample under test as either % oxygen saturation or % air saturation. If a cal value <25.0% is entered the resolution will automatically increase to 0.1%.

% Oxygen Saturation - this will give a reading of 20.9% in air where 20.9% is the amount of oxygen as a percentage of oxygen in air and will give a reading directly as a percentage of oxygen in the sample. All measurements in this range are given to a resolution of 0.1%.

% Air Saturation - this will directly assign a percentage dissolved oxygen to air saturated water and further readings are then given as a percentage of this air saturated water sample. All measurements in this range are given to a resolution of 1%.

CALIBRATION

DO_2 CALIBRATION

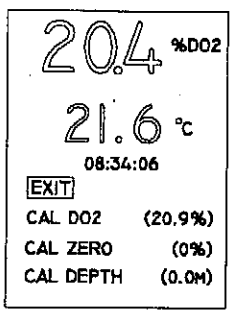
If DO_2 measurements are to be performed in mg/l and the depth probe is not connected then the current barometric pressure should be entered into the instrument using the PRESS(bar) menu option within the SETUP mode.

Prepare a zero oxygen solution by mixing

2gms of sodium sulphite in 100mls of water. Allow to stand for a few minutes prior to use.

NOTE: The powder supplied with the Model 9200 is sodium sulphite.

Calibration is performed by either pressing the CAL key or by moving the cursor to the CAL menu option by using the arrow keys and then pressing the ENT key. The screen will then change to show the calibration mode.



EXIT - Menu escape key.

CAL DO2 - Selecting this option with the ENT key will calibrate the instrument to the percentage dissolved oxygen value held within the adjacent brackets.

CAL ZERO - Selecting this option with the ENT key will calibrate the instrument to zero $\%DO_2$.

CAL DEPTH - Selecting this option with the ENT key will calibrate the depth probe (if connected) to zero metres.

Select CAL ZERO option using the ▲▼ keys. Immerse the probe in the zero solution and stir gently for approximately 2 minutes. Once the reading has stabilised i.e. the endpoint symbol has appeared press the ENT key. This will cause the primary display to read approximately zero. The highlighted menu option will now be showing CAL DO2. Should the instrument detect that the zero solution is no longer effective a CAL OUT OF RANGE error will be displayed for approximately 2 seconds and the instrument will not perform the zero calibration.

Remove the probe from the zero solution. Fill a suitable container with a sample of clean water. Hold the probe so that the membrane is close to, but not touching the surface of the water (approx. 1 cm above).

Once the reading has stablised i.e. the endpoint symbol has appeared press the ENT key. This will cause the primary display to read the value of percentage dissolved oxygen contained within the brackets adjacent to the CAL DO2 menu option. The highlighted menu option will now be showing EXIT.

Should the instrument detect that the probe has not been removed from the zero solution or there is an insufficient response from the probe to the immersion in air a CAL OUT OF RANGE error will be displayed for approximately 2 seconds and the instrument will not perform the calibration.

DEPTH CALIBRATION

This calibration can only be performed with the optional Depth Probe fitted (541 701).

Calibration must not be performed with the probe immersed in any depth of water as this will cause an incorrect calibration to be performed.
Select the CAL DEPTH menu option using the ▲▼ keys. Pressing the ENT key will zero the depth and the depth reading contained within the brackets adjacent to the CAL DEPTH menu option will now show 0.0m to indicate that the depth probe has been correctly calibrated.

B.O.D (Biochemical Oxygen Demand)

B.O.D (Biochemical Oxygen Demand) measurements are important in water treatment plants, laboratories and industrial waste water facilities for water quality testing and pollution control.

The B.O.D test is a measure of the amount of oxygen that is consumed by bacteria as they decompose the organic components of waste. Dissolved oxygen measurements are made at the beginning and end of a five day incubation period for the standard five day B.O.D test.

The dissolved oxygen probe membrane is not affected by intefering ions, the pH of the sample, sludge, clays or inorganic matter.

This is due to the electrolytic cell being separated from the sample by a selectively permeable membrane through which only gases can pass. The potential within the electrolytic cell is adjusted so that only the oxygen is reduced at the cathode, giving rise to a current flow proportional to the partial pressure of oxygen in the sample.

The Model 9200, when used in conjunction with the optional B.O.D probe kit, will perform all calculations associated with the procedures defined in ISO 5815 (B.S. 6068 2.14).

The B.O.D. calculation is based on the formula:

$$BOD_5 = \left[(C_1 - C_2) - \frac{V_i - V_e}{V_t} (C_3 - C_4)\right] \frac{V_t}{V_e}$$

Where:
C_1 is the dissolved oxygen concentration, in miiligrams per litre, of the test solution at time zero.
C_2 is the dissolved oxygen concentration, in millgrams per litre, of this same solution after five days.
C_3 is the dissolved oxygen concentration, in milligrams per litre, of the blank solution at time zero.
C_4 is the dissolved oxygen concentration, in milligrams per litre, of the blank solution after five days.

V_e is the volume, in millilitres, of sample used for the preparation of the test solution concerned.
V_t is the total volume, in millilitres of this test solution.

STORING RESULTS

The M key (Memory Store) is used to store the displayed readings in any measurement mode. When the M key is pressed the display will show the main and auxiliary readings, the previous menu options will be replaced by a new set containing the menu option ABORT NN (NN is the first available free location for the displayed reading).

To store the displayed reading at the current index number the ENT key should be pressed or if no key is pressed within 5 seconds the reading will be automatically stored in this location. The instrument will then return to the previously selected mode.

If the reading is not to be stored, moving to the ABORT option using the arrow keys and pressing ENT will return the instrument to the previously selected mode without storing the reading.

To store a reading in a specific location use the ▲▼ keys to select the required location and then press ENT or if no other key is pressed within 5 seconds the reading will be

automatically stored in this location. The instrument will then return to the previously selected mode.

NOTE: **Automatic storage after 5 seconds is only instigated after the last key press. If a key is pressed and held down the timer is disabled until the key is released. At this stage the 5 second timer is re-initialised.**

The non-volatile storage area has the facility to store 100 readings. If, however, an attempt is made to store a reading with all locations full, the highlighted message MEMORY FULL will be displayed for approx. 2 seconds, returning the highlighting to the ABORT option. If it is necessary to store the reading the location will have to be selected within the index option using the arrow keys.

NOTE: **Storing a reading when the memory is full will overwrite any previous data stored in selected location.**

RECALLING STORED READINGS

To recall a stored reading select the RCL menu option by using the arrow keys and then pressing ENT. The display will update to the stored reading and the stored index number will be shown at the bottom of the display.

If no stored reading is present the display will give the message NO RECORD STORED.

To select a specific stored reading, select the INDEX: option using the arrow keys and press ENT. To select the required location use the ▲▼ keys. The display will update to the selected reading. To exit the RCL mode select the EXIT option and press ENT. The instrument will return to the previous display.

CLEARING STORED READINGS

To clear an individual stored reading select the RCL mode using the arrow keys and press ENT. Select INDEX: by using the arrow keys and press ENT. Select the specific location to be deleted using the▲▼ keys. Move to the DELETE menu option by using the arrow keys and press ENT. The display will clear and then update to show the message NO RECORD STORED, returning the highlighting to the location number.

Selecting the EXIT option and pressing ENT will return the instrument to the previous display.

To clear all stored readings select the CLR/ALL menu option using the arrow keys and then pressing ENT. The display will momentarily display the message DELETING... The display will then update

to show the message ALL RECORDS DELETED.

Selecting the EXIT option and pressing ENT will return the instrument to the previous display.

DOWNLOADING STORED READINGS

NOTE: **To perform the downloading function ensure the Interface Cradle (542 001) and relevant interface cables are correctly installed to the receiving terminal. Please refer to separate installation/operating instructions supplied with the Interface Cradle.**

To download stored readings select the RCL mode using the arrow keys and press ENT. Select TX DATA by using the arrow keys and press ENT. This will start the downloading process, automatically returning the instrument to the previous display.

REAL TIME CLOCK SET UP

Real time clock set up is performed by entering into the INSTRUMENT SET UP mode, selecting CLOCK SET UP using the ▲▼ keys and pressing the ENT key.

Select the real time clock parameter to be changed using the ▲▼ keys, once

highlighted, adjustment of the parameter proceeds by pressing ENT or the ▸ key. The first part of the parameter is highlighted and can be adjusted to the required value using the ▲▼ keys. If further adjustment is required move the highlighted cursor to the next adjustable position using the ▸key and adjust as required. Continue moving across the parameter until full adjustment has been made. To confirm new time or date press ENT or press ◂ key until the selected parameter is re-highlighted.

AUTO SHUT OFF

This can be achieved by setting the required shut off time (15, 30, 45, 60 or disabled) in the Instrument Set Up menu.

GOOD PRACTICE GUIDELINES

1. Ensure the membrane is kept wet at all times. When not in use the probe should be stored with the tip in a beaker of deionised water. For longer periods (overnight) the protective sheath should be fitted, with the sponge insert soaked in distilled water. This will prevent the electrolyte fill solution from drying out due to loss of water through the porous membrane.
2. The probe is fitted with a temperature compensating element. This is housed underneath the silver ring on the probe body. Always ensure the probe is immersed in solution to a depth suitable to cover this ring. Allow sufficient time for these to

respond if measuring samples with varying temperatures or where sample temperature is significantly different to ambient temperature.

3. Ensure the sample is moving across the membrane at a speed greater than 15cm/min to avoid oxygen starvation at the membrane. If the flow rate is insufficient then the sample should be stirred (e.g. either by a gentle stirring motion with the probe or with a magnetic stirrer).

4. When using the probe in liquors, sludges or polymers a coating may be deposited on the membrane, causing low response or drifting. This can be reduced by rinsing the probe in deionised water after each test.

5. Ensure the probe is rinsed in deionised water after each test.

6. When measuring in mg/l (ppm) results are pressure dependent and determinations carried out at pressures other than 760mm/Hg will need to be compensated (refer to Correction for Barometric Pressure).

7. When measuring in mg/l (ppm) results obtained from saline samples will need to be adjusted for salinity (refer to Correction for Salinity).

8. Ensure the probe is polarised prior to use (refer Operation). It is essential to perform this procedure after replacement of the membrane or probe.

9. When replacing the membrane ensure no air bubbles are trapped in the electrolyte fill solution and that the membrane is not creased or damaged after fitting. If the probe

response is sluggish, or the readout is unstable after membrane replacement, clean the anode and cathode (refer Maintenance).

MAINTENANCE

Although the oxygen probe is supplied in a clean and tested condition it may, after some time, become sluggish or erratic due to contamination of the gold cathode, silver anode or membrane.

a) Membrane Replacement

1. Hold the probe in a vertical position and carefully unscrew the membrane module.
2. Take the new membrane module and holding it in a vertical position, fill with O_2 electrolyte (5% KCl).
3. Still holding the module in a vertical position, screw the probe slowly down onto the thread, allowing excess electrolyte to escape through the screw thread. Ensure no air bubbles are present and the membrane is not creased.

b) Cathode and Anode Cleaning

The gold cathode tip can be re-polished using a fine abrasive ("crocus paper") material. Lay the abrasive sheet on a flat surface, hold the probe in a vertical position and gently polish by moving the tip over the sheet in a circular motion.

A toothbrush dipped in diluted ammonia solution will remove any deposits from the silver anode. Rinse with deionised water prior to re-assembly. If the probe is not to be used for 24 hours, store with the

protective sheath fitted to prevent the electrolyte from drying out due to evaporation through the membrane, which is porous to water vapour as well as oxygen. If the probe is disconnected from the unit or a new membrane has been fitted, it will be necessary to allow the probe to polarise before stable readings can be obtained. Polarisation will normally be achieved within 30 minutes.

BATTERY REPLACEMENT

The battery symbol will be displayed to the right hand side of the display to indicate a maximum of 5 hours battery life remains. An approximation (±2%) of remaining battery life can be achieved by viewing the battery life indicator displayed within INSTRUMENT SET UP mode.

NOTE: Stored results are retained in non-volatile memory and will not be lost during battery replacement. Re-adjustment of the real time clock will be required.

To fit new batteries; remove the battery compartment cover, remove and carefully discard the used batteries. Fit the new batteries, type R6, AA or AM3, ensuring the correct polarities are observed, as indicated on the moulding. Refit the battery compartment cover, ensuring that the fixings are secured into place, but are not overtightened.

ELECTRODE REPLACEMENT

To replace the electrode switch the model 9200 off and disconnect the faulty electrode by first carefully unscrewing the locking ring counter-clockwise and withdrawing the connector from the receptacle.

Fit the new electrode by reversing the above method, ensuring that the polarising keyway is correctly aligned and the locking ring tightened to prevent the ingress of moisture.

OPTIONAL ACCESSORIES

The following list of items are available for use with the Model 9200:

033 175	Carrying Case
541 620	B.O.D. Probe
541 701	Depth/Pressure Probe
542 001	Interface Cradle
542 009	Interface Cable Kit
543 001	40 Column Printer
060 287	Printer Paper Roll
060 288	Printer Ribbon

SPARES

541 520	DO_2/Temp. Probe
541 550	DO_2 Probe Membrane Kit
541 650	B.O.D. Probe Membrane Kit
541 750	Depth Probe Membrane Kit

HEALTH & SAFETY

PRODUCT: Potassium Chloride Solution

PHYSICAL DATA
Description: Colourless solution
Specific Gravity: 1.0
Solubility in water: miscible in all proportions

HEALTH HAZARD - May be harmful if ingested in quantity, causing nausea, vomiting and diarrhoea.
May irritate eyes.

FIRST AID

Eyes	Irrigate thoroughly with water. If discomfort persists **OBTAIN MEDICAL ATTENTION.**
Lungs	Remove from exposure.
Skin	Wash off thoroughly with soap and water.
Mouth	Wash out mouth thoroughly with water. In severe cases **OBTAIN MEDICAL ATTENTION.**

PRODUCT: Sodium Sulphite Anhydrous

PHYSICAL DATA
Description: White Powder
Specific Gravity: 2.63
Solubility in water: very soluble

HEALTH HAZARD - If ingested in quantity can cause gastric irritation, colic, diarrhoea, central nervous system depression and death, due to liberation of sulphur dioxide. Irritating to skin, eyes and respiratory system. Used in controlled quantities as a food preservative and antioxidant.

FIRST AID

Eyes	Irrigate thoroughly with water for at least 10 minutes. **OBTAIN MEDICAL ATTENTION.**
Lungs	Remove from exposure, rest and keep warm. In severe cases **OBTAIN MEDICAL ATTENTION.**
Skin	Wash off thoroughly with water. Remove contaminated clothing and wash before re-use. In severe cases **OBTAIN MEDICAL ATTENTION.**
Mouth	Wash out mouth thoroughly with water and give plenty to drink. In severe cases **OBTAIN MEDICAL ATTENTION.**

EC Declaration of Conformity

JENWAY Models 9200 Dissolved Oxygen Meter complies with the following European Standards:

EN 50081-1:1992 Electromagnetic compatibility - Generic emission standard

EN 50082-1:1992 Electromagnetic compatibility - Generic immunity standard (Performance criterion B)

EN 61010-1:1993 Safety requirements for electrical equipment for measurement, control and laboratory use

Following the provision of:

EMC Directive - 89/336/EEC
and Low Voltage Directive - 73/23/EEC

Thank you for reading this data sheet.

For pricing or for further information, please contact us at our UK Office, using the details below.

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Please note - Product designs and specifications are subject to change without notice. The user is responsible for determining the suitability of this product.