OPERATING INSTRUCTIONS

Dissolved Oxygen Meter

521-050

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Contents

1 Introduction

The 521-050 is a general purpose, hand held Dissolved Oxygen Meter allowing accurate measurement with ease of use. The custom liquid crystal display simultaneously shows percentage dissolved oxygen or oxygen concentration (mg/l) and temperature. The dissolved oxygen reading is automatically corrected for temperature. Corrections for pressure and salinity can be entered manually. The instrument is housed in a robust, ergonomically designed case. An indication of battery life is also permanently shown on the display. An automatic switch off facility helps to conserve battery life.

2 Specification

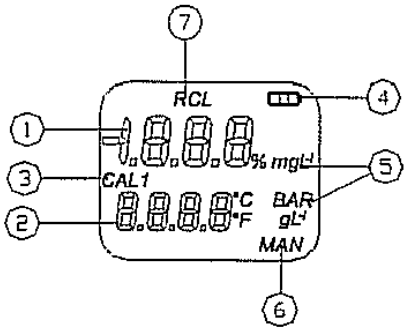
DO_2 Ranges:	-5 to 199%
	-5 to 25.0%
	-5 to 19.99 mg/l
Resolution:	1% / 0.1% / 0.01 mg/l
Accuracy:	±2% within 10°C of calibration temperature
Temperature Ranges:	-10 to +105°C / 14 to 220°F
Resolution:	0.1°C / 1°F
Accuracy:	±0.5°C / ±1°F
ATC Range:	0 to +60°C / 32 to 140°F
Power:	2 AA cells
Size:	175(l)x75(w)x35(d)mm
Weight:	250g

3 Installation

Unpack the instrument and ensure the following items are present:

A. DO_2 Meter
B. DO_2/Temperature Probe
C. 2 x AA alkaline batteries (fitted)
D. Membranes & KCl
E. Zero salts

4 Displays



4.1 Primary display - 3½ digit display providing direct readout of % oxygen saturation, % air saturation, mg/l oxygen. Underrange (-1) and Overrange (1) symbols will be displayed if the instrument is reading outside the ranges as shown below:

Primary Ranges:	
% oxygen saturation	-5 to 25.0%
% air saturation	-5 to 199%
mg/l oxygen	-5 to 19.99mg/l

4.2 Secondary display – 4 digit display showing temperature (manual temperature compensation value if used with a non-standard sensor, or ATC temperature using the standard probe) in °C or °F.

Manually adjusted pressure values (Bar) and salinity values (g/l) will be shown when the relevant mode is selected.

4.3 CAL annunciator – indicates when a calibration is being performed.

4.4 Battery Life Indication – 4 levels will be shown ranging from 25%, 25-50%, 50-75% and 75-100%. Sensor calibration data and user parameters are retained during battery replacement.

4.5 Mode annunciator – indicates which mode of operation is selected.

4.6 MAN – this is displayed to indicate when manual temperature compensation (only operates with non-standard probes or if the temperature sensor in the probe is defective), salinity or pressure value adjustment is being performed.

4.7 RCL annunciator – this indicates that the displayed reading is a stored value recalled from internal memory.

5 Controls

STO RCL	STO stores the current data reading. RCL enters recall mode to view the stored readings.
I:O	Switches the instrument on and off. This key should be pressed and held for 1-2 seconds to operate. The instrument will automatically switch off after 30 minutes if no key is pressed.
	Back light. Pressing this key will illuminate the back light for 10 seconds. it should be noted that, if used excessively, this will degrade battery life.
▲ ▼	Enables manual setting of DO_2 calibration values when performing a calibration, and adjustment of the manual temperature compensation value, pressure and salinity.
CAL	This key is used to select and perform DO_2 calibration.
MODE	This key changes the primary measurement parameter from $\%DO_2$ to mg/l, as required. When temperature is displayed, holding this key for 3 seconds changes the display to read in °C or °F.

6 Preparation for Use

NOTE: Prior to using the chemicals listed, please refer to the Health & Safety information at the rear of the manual.

The probe is delivered with the membrane module detached. Prior to use the membrane module must be fitted to the probe body. A protective sheath is also supplied. This should be fitted to the probe when not in use. The sponge contained within the sheath 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.

a. Remove the protective sheath from the probe.

b. Take a membrane module and hold in the vertical position. Fill with the electrolyte solution (5% KCl) supplied with the instrument. Ensure no air bubbles are trapped in the bottom of the membrane cap.

c. 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.

d. The probe should be connected to the instrument and left for 30 minutes to polarise, with the tip immersed in a beaker of water.

To maintain polarisation and to enable immediate use, it is recommended that the sensor should be permanently connected to the instrument.

If the sensor is to be kept in extended storage, the membrane cap should be removed and rinsed with water, and the sensor tip cleaned. The probe should be stored dry without the wetting sheath fitted.

7 Operation

Connect the DO_2 probe to the instrument. Switch the instrument on by holding down the I/O key for 1-2 seconds. All display segments will be illuminated for approximately 2 seconds. An internal self check routine is run during this display and on successful completion normal operating mode is activated. The display will either power up in $\%DO_2$ or mg/l mode depending upon previous usage.

7.1 $\%DO_2$ mode

This gives a direct readout of the $\%DO_2$ of the sample under test as either % oxygen saturation or % air saturation. When the instrument is calibrated to a value of <25.0% the resolution will automatically increase to 0.1%.

8 Calibration

Prepare a zero oxygen solution by dissolving the contents of the vial of sodium sulphite supplied with the instrument in 150mls of water. Allow to stand for a few minutes prior to use.

Press the CAL key. Immerse the probe in the zero solution and stir gently for approximately 2 minutes. Once the reading has stabilised press the Cal key. The instrument automatically detects the zero solution and will calibrate the reading to zero % dissolved oxygen, which will cause the primary display to read zero. Remove the probe from the zero solution and rinse thoroughly with deionised water.

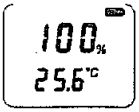
8.1 Air saturation

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%.

Calibrate the probe in zero solution as above.

Fill a suitable container with a sample of clean water. Press the Cal key. Hold the probe so that the membrane is close to, but not touching, the surface of the water (approximately 1 cm above).

Once the reading has stabilised press the Cal Key. This will cause the primary display to read 100% DO_2.



8.2 % 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%. Calibrate the probe in zero solution (see section 8).

Fill a suitable container with a sample of clean water. Press the CAL key. Use the ▲▼ keys to adjust the primary display to read 20.9%. The MAN annunciator will be displayed. Hold the probe so that the membrane is close to, but not touching, the surface of the water (approximately 1 cm above).

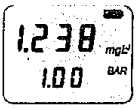
Once the reading has stabilised press the CAL key. The instrument measures the manually entered value (20.9%). Once a calibration value is set manually the instrument will automatically calibrate to this value until an alternative value is entered.

8.3 mg/l

If measurements are to be performed in mg/l it will be necessary to enter the current barometric pressure and salinity values.

8.4 Barometric pressure

Press the MODE key until the secondary display shows the BAR annunciator for barometric pressure. Adjustment to the correct value can be made by using the ▲▼ keys.



Fill a suitable container with a sample of clean water. Press the Cal key. Hold the probe so that the membrane is close to, but not touching, the surface of the water (approximately 1 cm above).

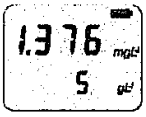
Once the reading has stabilised press the Cal key. This will cause the primary display to read 100% DO_2.

Press the Mode key to display pressure corrected mg/l readings.

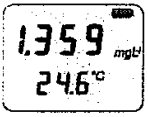
8.5 Salinity

The oxygen dissolved in water decreases with increasing salinity when making measurements in mg/l. If measurements are made in % saturation then no correction is required.

Press the Mode key until the secondary display shows the g/l annunciator for salinity. Adjustment to the correct value can be made by using the ▲▼ keys.



The instrument is now ready to perform sample measurements.



9 Performing Measurements

Select the mode required and immerse the probe in the sample to be measured (40mm depth minimum). A flow rate of 15cm/min in the sample is required to avoid errors due to oxygen starvation at the membrane. If the flow rate is insufficient then the sample should be stirred (either by a gentle stirring action with the probe or by use of a magnetic stirrer).

10 Data Storage

The dissolved oxygen meter can store up to 32 readings. Storage is initiated by manual key press.

10.1 Storing data

Pressing the STO key stores the current reading in the next available data location. The storage location is indicated by **Sto** and a number (1-32) momentarily displayed prior to the data point. The results are stored sequentially until the memory is full. When all 32 data locations are filled, the next stored reading will overwrite the result previously stored in position 1. The stored data is retained in the event of battery failure and during battery replacement.

10.2 Recalling data

Pressing the RCL key recalls the last stored reading onto the display. The instrument is now in RCL mode, indicated by the RCL annunciator at the top of the display.

The ▲▼ keys are used to select previously stored data. The storage location is indicated by **rCL** and a number (1-32) momentarily displayed prior to the data.

To clear all readings press and hold the CAL key (>3 seconds) while in RCL mode. When all stored readings are cleared the display will momentarily show **CLr ALL**. The instrument will then return to the main operating mode.

If storage locations are empty and the RCL key is pressed, the display will show **ALL CLr**.

NOTE: It is not possible to delete individual stored readings.

11 Good Practice Guidelines

a. 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.

b. Ensure the probe is polarised prior to use. It is essential to perform this procedure after replacement of the membrane or probe. A 30 minute period of polarisation is required.

c. 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 to Maintenance in Section 12).

d. 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.

e. 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 (eg. either by a gentle stirring motion with the probe or with a magnetic stirrer).

f. When using the probe in liquors, sludges or polymers a coating may be deposited on the membrane, causing slow response or drifting. This can be reduced by rinsing the probe in deionised water, or a suitable solvent for the sample, followed by a rinse with deionised water after each test.

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

h. 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.

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

12 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.

12.1 Membrane replacement

a. Hold the probe in a vertical position and carefully unscrew the membrane module.

b. Take the new membrane module and holding it in a vertical position, fill with electrolyte (5% KCI).

c. 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.

12.2 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. For stubborn deposits a very fine abrasive similar to that used for cleaning gold connectors in electronics may be used sparingly.

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.

13 Troubleshooting Guide

FAULT	PROBABLE CAUSE	ACTION
No power	Battery failure Battery polarity incorrect	Replace batteries Refit batteries
Unstable display	DO_2 probe defective Probe not fitted correctly Calibration to 100% with zero solution	Replace DO_2 probe Check connections Repeat zero calibration procedure with fresh zero solution. Calibrate the probe to 100% in air
Display permanently under or over range	Intermittent or no connection DO_2 probe defective Contaminated solutions Calibration on low oxygen concentration	Check electrode connection to instrument Replace DO_2 probe Replace solutions Recalibrate with the probe in air
Temp. value incorrect	DO_2 probe defective	Replace DO_2 probe
I/O switch not working	I/O key not held down long enough Batteries not fitted	Retry holding key for 2 seconds Fit batteries
▲▼ keys not working	Operating in incorrect mode	Refer to operation section of manual
Back light not on/goes out	10 second time elapsed/ normal function	Recheck

FAULT	PROBABLE CAUSE	ACTION
Unable to adjust manual temperature	Incorrect mode of operation	Reselect mode
Unable to calibrate - Erratic or slow response	Sensor tip may be tarnished (Ag or Au)	Clean the tip, replace membrane module
	Air bubbles inside the membrane cap	Refill or replace membrane
	Membrane damaged	Replace membrane
	Coating of membrane due to use in oils or slurries, strong solvents, acids or alkalis	Replace membrane
	DO_2 probe defective	Replace DO_2 probe
Inaccurate calibration - Erratic or slow response	Zero solution will absorb oxygen if left open	Use fresh zero solution and recalibrate
Measurement errors	Incorrect salinity	Reset salinity values
	Calibration error	Recalibrate instrument
	Contaminated solution	Replace solution
	Incorrect standards	Replace standards
	Incorrect barometric pressure	Reset barometric pressure
Unable to calibrate to 100%	Calibrating to previously set value	Manually reset value to 100%
Permanently reading zero	Membrane not fitted	Fit membrane
	Membrane damaged	Replace membrane
	Membrane not filled with KCl	Fill or replace membrane
	DO_2 probe defective	Replace DO_2 probe

If a fault is identified during the start up self check routine, an error code will be displayed. This indicates an internal hardware or software problem. In the event of this, please contact the ELE Service Department.

14 Battery Replacement

Switch the unit off using the I/O key.

To fit new batteries; loosen the battery compartment cover (the screws are captive in the 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.

15 Auto Shut Off

This will occur after 30 minutes if no key is pressed.

16 Health & Safety Information

16.1 **PRODUCT:** Potassium Chloride Solution
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**.

16.2 **PRODUCT:** Sodium Sulphite Anhydrous
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. If discomfort persists **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

The 521-050 Dissolved Oxygen Meter complies with the following European Standards:

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

EN 61326:1998 Electrical equipment for measurement, control and laboratory use – EMC requirements.

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

DIRECTIVE ON WASTE ELECTRICAL & ELECTRONIC EQUIPMENT (WEEE)

Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user.

Note: *For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment for proper disposal.*

Important document. Retain with product records.

GERMAN

Elektrogeräte, die mit diesem Symbol gekennzeichnet sind, dürfen in Europa nach dem 12. August 2005 nicht mehr über die öffentliche Abfallentsorgung entsorgt werden. In Übereinstimmung mit lokalen und nationalen europäischen Bestimmungen (EU-Richtlinie 2002/96/EC), müssen Benutzer von Elektrogeräten in Europa ab diesem Zeitpunkt alte bzw. zu verschrottende Geräte zur Entsorgung kostenfrei an den Hersteller zurückgeben.

Hinweis: *Bitte wenden Sie sich an den Hersteller bzw. an den Händler, von dem Sie das Gerät bezogen haben, um Informationen zur Rückgabe des Altgeräts zur ordnungsgemäßen Entsorgung zu erhalten.*

Wichtige Informationen. Bitte zusammen mit den Produktinformationen aufbewahren.

FRENCH

A partir du 12 août 2005, il est interdit de mettre au rebut le matériel électrique marqué de ce symbole par les voies habituelles de déchetterie publique. Conformément à la réglementation européenne (directive UE 2002/96/EC), les utilisateurs de matériel électrique en Europe doivent désormais retourner le matériel usé ou périmé au fabricant pour élimination, sans frais pour l'utilisateur.

Remarque : *Veuillez vous adresser au fabricant ou au fournisseur du matériel pour les instructions de retour du matériel usé ou périmé aux fins d'élimination conforme.*

Ce document est important. Conservez-le dans le dossier du produit.

ITALIAN

Le apparecchiature elettriche con apposto questo simbolo non possono essere smaltite nelle discariche pubbliche europee successivamente al 12 agosto 2005. In conformità alle normative europee locali e nazionali (Direttiva UE 2002/96/EC), gli utilizzatori europei di apparecchiature elettriche devono restituire al produttore le apparecchiature vecchie o a fine vita per lo smaltimento senza alcun costo a carico dell'utilizzatore.

Nota: *Per conoscere le modalità di restituzione delle apparecchiature a fine vita da riciclare, contattare il produttore o il fornitore dell'apparecchiatura per un corretto smaltimento.*

Documento importante. Conservare con la documentazione del prodotto.

DANISH

Elektriske apparater, der er mærket med dette symbol, må ikke bortskaffes i europæiske offentlige affaldssystemer efter den 12. august 2005. I henhold til europæiske lokale og nationale regler (EU-direktiv 2002/96/EF) skal europæiske brugere af elektriske apparater nu returnere gamle eller udtjente apparater til producenten med henblik på bortskaffelse uden omkostninger for brugeren.

Bemærk: *I forbindelse med returnering til genbrug skal du kontakte producenten eller leverandøren af apparatet for at få instruktioner om, hvordan udtjente apparater bortskaffes korrekt.*

Vigtigt dokument. Opbevares sammen med produktdokumenterne.

SWEDISH

Elektronikutrustning som är märkt med denna symbol kanske inte kan lämnas in på europeiska offentliga sopstationer efter 2005-08-12. Enligt europeiska lokala och nationella föreskrifter (EU-direktiv 2002/96/EC) måste användare av elektronikutrustning i Europa nu återlämna gammal eller utrangerad utrustning till tillverkaren för kassering utan kostnad för användaren.

Obs! *Om du ska återlämna utrustning för återvinning ska du kontakta tillverkaren av utrustningen eller återförsäljaren för att få anvisningar om hur du återlämnar kasserad utrustning för att den ska bortskaffas på rätt sätt.*

Viktigt dokument. Spara tillsammans med dina produktbeskrivningar.

SPANISH

A partir del 12 de agosto de 2005, los equipos eléctricos que lleven este símbolo no deberán ser desechados en los puntos limpios europeos. De conformidad con las normativas europeas locales y nacionales (Directiva de la UE 2002/96/EC), a partir de esa fecha, los usuarios europeos de equipos eléctricos deberán devolver los equipos usados u obsoletos al fabricante de los mismos para su reciclado, sin coste alguno para el usuario.

Nota: *Sírvase ponerse en contacto con el fabricante o proveedor de los equipos para solicitar instrucciones sobre cómo devolver los equipos obsoletos para su correcto reciclado.*

Documento importante. Guardar junto con los registros de los equipos.

DUTCH

Elektrische apparatuur die is voorzien van dit symbool mag na 12 augustus 2005 niet meer worden afgevoerd naar Europese openbare afvalsystemen. Conform Europese lokale en nationale wetgegeving (EU-richtlijn 2002/96/EC) dienen gebruikers van elektrische apparaten voortaan hun oude of afgedankte apparatuur kosteloos voor recycling of vernietiging naar de producent terug te brengen.

Nota: *Als u apparatuur voor recycling terugbrengt, moet u contact opnemen met de producent of leverancier voor instructies voor het terugbrengen van de afgedankte apparatuur voor een juiste verwerking.*

Belangrijk document. Bewaar het bij de productpapieren.

POLISH

Sprzęt elektryczny oznaczony takim symbolem nie może być likwidowany w europejskich systemach utylizacji po dniu 12 sierpnia 2005. Zgodnie z europejskimi, lokalnymi i państwowymi przepisami prawa (Dyrektywa Unii Europejskiej 2002/96/EC), użytkownicy sprzętu elektrycznego w Europie muszą obecnie przekazywać Producentowi stary sprzęt lub sprzęt po okresie użytkowania do bezpłatnej utylizacji.

Uwaga: *Aby przekazać sprzęt do recyklingu, należy zwrócić się do producenta lub dostawcy sprzętu w celu uzyskania instrukcji dotyczących procedur przekazywania do utylizacji sprzętu po okresie użytkowania.*

Ważny dokument. Zachować z dokumentacją produktu.

PORTUGESE

Qualquer equipamento eléctrico que ostente este símbolo não poderá ser eliminado através dos sistemas públicos europeus de tratamento de resíduos sólidos a partir de 12 de Agosto de 2005. De acordo com as normas locais e europeias (Directiva Europeia 2002/96/EC), os utilizadores europeus de equipamentos eléctricos deverão agora devolver os seus equipamentos velhos ou em fim de vida ao produtor para o respectivo tratamento sem quaisquer custos para o utilizador.

Nota: *No que toca à devolução para reciclagem, por favor, contacte o produtor ou fornecedor do equipamento para instruções de devolução de equipamento em fim de vida para a sua correcta eliminação.*

Documento importante. Mantenha junto dos registos do produto.