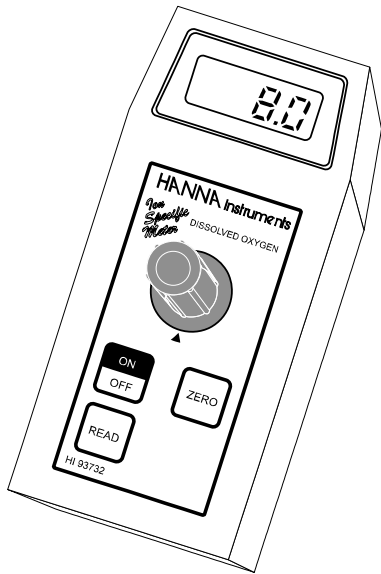


Instruction Manual

HI 93732N
MICROPROCESSOR-BASED
DISSOLVED OXYGEN
SPECTROPHOTOMETER



HANNA
instruments
<http://www.hannainst.com>

CE
This instrument is in compliance
with the CE Directives

Dear Customer,
Thank you for choosing a Hanna product.
Please read this instruction manual carefully before using the meter.
This manual will provide you with the necessary information for a
correct use of the instrument.
If you need additional technical information, do not hesitate to e-mail
us at tech@hannainst.com.
This instrument is in compliance with the CE directives EN 50081-1
and EN 50082-1.

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HANNA *ISO 9000 Certified*
instruments *Company since 1992*

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PRELIMINARY EXAMINATION

Remove the instrument from the packing material and examine it carefully to make sure that no damage has occurred during shipment. If there is any damage, notify your Dealer or the nearest Hanna Customer Service Center.

HI 93732N is supplied complete with:

- Two Sample Cuvets and Caps
- One Transport Cap
- One 60 mL BOD Bottle
- 9V Battery

Note: Save all packing material until you are sure that the instrument functions correctly. Any defective item must be returned in its original packing with the supplied accessories.

GENERAL DESCRIPTION

HI 93732N is a portable, microprocessor-based spectrophotometer that measure the content of dissolved oxygen in surface, feed, natural and waste waters.

The meter uses an exclusive positive-locking system to ensure that the cuvet is in the same place every time it is placed into the measurement cell.

The reagents are in liquid form and are supplied in bottles. The amount of reagent is precisely dosed to ensure maximum repeatability. Display codes aid the user in routine operations. The meter has an auto-shut off feature that will turn itself off after 10 minutes of non-use.

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PRINCIPLE OF OPERATION

The color of every object we see is determined by a process of absorption and emission of the electromagnetic radiation (light) of its molecules.

Colorimetric analysis is based on the principle that specific compounds react with others and form a color, the intensity of which is proportional to the concentration of the substance to be measured.

When a substance is exposed to a beam of light of intensity I_0 , a portion of the radiation is absorbed by the substance's molecules and a radiation of intensity I , lower than I_0 , is emitted.

The quantity of radiation absorbed is given by the Lambert-Beer Law:

$$\log I_0/I = \epsilon_\lambda \cdot c \cdot d$$

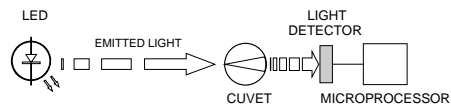
Where $\log I_0/I = \text{Absorbance (A)}$

$\epsilon_\lambda =$ molar extinction coefficient of the substance at wavelength λ

$c =$ molar concentration of the substance

$d =$ optical distance light travels through sample

Therefore, the concentration "c" can be calculated from the color intensity of the substance determined by the emitted radiation I , as the other factors are known.



BLOCK DIAGRAM OF A SPECTROPHOTOMETER

A monochromatic LED (Light Emitting Diode) emits radiation at a single wavelength, supplying the system with the intensity I_0 . Since a substance absorbs the color complimentary to the one it emits (for example, a substance appears yellow because it absorbs blue light), Hanna spectrophotometers use LEDs that emit the appropriate wavelength to measure the sample.

The optical distance (d) is measured by the diameter of the cuvet containing the sample.

The photoelectric cell collects the radiation I that is not absorbed by the sample and converts it into an electric current, producing a potential in the mV range.

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The microprocessor uses this potential to convert the incoming value into the desired measurement unit and to display it on the LCD.

The measurement process is done in two phases: setting the meter to zero and the actual measurement.

The cuvet has a very important role because it is an optical element, and thus requires particular attention.

It is important that both the measurement and the calibration (zeroing) cuvetts are optically identical to provide the same measurement conditions. Whenever possible use the same cuvet for both.

It is also necessary that the cuvet's surface is clean and not scratched, in order to avoid measurement interference due to unwanted reflection and absorption of light.


It is recommended not to touch the cuvet walls with hands.


Furthermore, in order to maintain the same conditions during the zeroing and the measuring phases, it is necessary to close the cuvet to prevent any contamination.


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
DISPLAY CODE GUIDE


 This indicates that the meter is in a ready state and zeroing can be performed.


 Sampling in Progress. This prompt appears each time the meter is performing a measurement.


 This indicates that the meter has been zeroed and measurement can be performed.


 A zero reading was not taken. Insert a sample before adding reagent and press ZERO.


 Under range. A blinking "0.00" indicates that the sample has absorbed less light than the zero reference. Check the procedure and make sure you use the same cuvet for reference (zero) and measurement.

 Over range. A flashing value higher than the maximum concentration of the meter (see specifications) indicates that the sample has absorbed less light than the zero reference. Check the procedure and make sure you use the same cuvet for reference (zero) and measurement.

 Light over range. The cuvet is not inserted correctly and an excess ambient light is reaching the detector. If the cover is properly installed, then contact your dealer or the nearest Hanna Customer Service Center.

 Light under range. The zero sample is too dark for proper zeroing. If this is not the case, contact your dealer or the nearest Hanna Customer Service Center.

 The "V" indicates that the battery voltage is getting low and the battery needs to be replaced.

 This indicates that the battery is dead and must be replaced.

Note: once this indication is displayed, the meter will lockup. Change the battery to restart.

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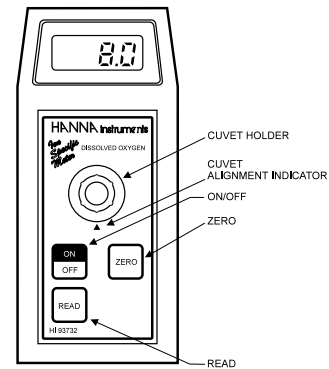
TIPS FOR AN ACCURATE MEASUREMENT

The instruction listed below should be carefully followed during testing to ensure best accuracy.

- Do not let the test sample stand too long after reagent is added or accuracy will be lost.
- Whenever the cuvet is placed into the measurement cell, it must be completely free of fingerprints, oil or dirt. Wipe it thoroughly with HI 93703-70 or a lint-free cloth prior to insertion.
- It is important that the sample does not contain any debris. This would corrupt the readings.
- Each time the cuvet is used, the cap must be tightened to the same degree.
- It is possible to take multiple readings in a row, but it is recommended that a zero reading be taken for each sample and that the same cuvet is used for zeroing and measurement.
- It is important to discard the sample immediately after the reading is taken because the glass might become permanently stained.
- Shaking the cuvet can generate bubbles in the sample, causing higher readings. To obtain accurate measurements, remove such bubbles by swirling or by gently tapping the vial.
- All the reaction times reported in this manual are referred to 20°C (68°F). As a general rule of thumb, they should be doubled at 10°C (50°F) and halved at 30°C (86°F).



FUNCTIONAL DESCRIPTION & SPECIFICATIONS

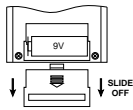


Range	0.0 to 10.0 mg/L (ppm)
Resolution	0.1 mg/L
Accuracy	±0.2 mg/L ± 3% of reading
Typical EMC Deviation	± 0.1 mg/L
Light Source	Light Emitting Diode @ 430 nm
Method	Adaptation of the <i>Standard Methods for the Examination of Water and Wastewater (18th edition)</i> , azide modified Winkler method. The reaction between dissolved oxygen and the reagent causes a yellow tint in the sample.
Light Life	Life of the instrument
Light Detector	Silicon Photocell
Environment	0 to 50°C (32 to 122°F); max 95% RH non-condensing
Battery Type/Life	1 x 9 volt/40 hours
Auto-Shut off	After 10' of non-use
Dimensions	180 x 83 x 46 mm (7.1 x 3.3 x 1.8")
Weight	290 g (10 oz.)

OPERATIONAL GUIDE

INITIAL PREPARATION

HI 93732N is supplied complete with a 9 V battery. Slide off the battery compartment cover on the back of the meter and install the battery while paying attention to its polarity.



REQUIRED REAGENTS

Code	Description	Quantity
HI 93732A-0	Reagent A	5 drops
HI 93732B-0	Reagent B	5 drops
HI 93732C-0	Reagent C	10 drops

MEASUREMENT PROCEDURE

- Turn the meter on by pressing ON/OFF.



- When the LCD displays "--", it is ready.

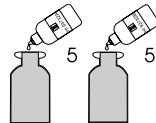


- Fill one 60 mL BOD bottle completely with the unreacted sample.

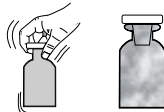


- Replace the cap and ensure that a small part of the sample spills over. This is to make sure that no air bubbles have been trapped inside.

- Remove the cap and add 5 drops of HI 93732A and 5 drops of HI 93732B. Replace the cap again and ensure that a part of the sample spills over.



- Swirl the solution. The sample becomes orange and a flocculant agent will appear.



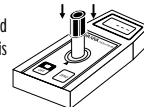
- Let the sample stand and the flocculant agent will start to settle.
- After approximately 2 minutes and when the upper half of the bottle becomes limpid, add 10 drops of HI 93732C.
- Replace the cap and swirl the solution. The sample is ready for measurement when it is yellow and completely limpid.



- Fill the cuvet up to 1.5 cm (3/4") below the rim with 10 mL of the unreacted (original) sample, and replace the cap. This is the blank.



- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



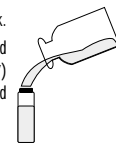
- Press ZERO and "SIP" will appear on the display.



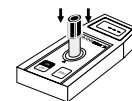
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



- Remove the cuvet and dispose of the blank.
- Rinse the cuvet with some of the reacted sample. Then, fill it up to 1.5 cm (3/4") below the rim with 10 mL of the reacted sample and replace the cap.



- Reinsert the cuvet into the instrument.



- Press READ and "SIP" will appear during measurement.



- The instrument will then directly display the concentration of dissolved oxygen in mg/L.

INTERFERENCES

Interferences may be caused by reducing and oxidizing materials. Na₂S₂O₃ (Sodium azide) is added to prevent interferences from NO₂.

BATTERY REPLACEMENT

To prolong the battery life, switch your meter off after use. The meter also has an auto-shut off feature that will turn itself off after 10 minutes of non-use.

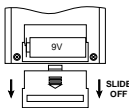
A "V" on the LCD indicates low voltage and, when it appears, the battery should be replaced.

If the battery is not replaced, "-BA-" is displayed soon afterwards. This is to prevent erroneous readings due to low voltage. The meter will then lockup and will not accept any commands. The display will also go blank.

Battery replacement must only take place in a non-hazardous area using a 9 V alkaline battery.

Simply slide off the battery cover on the back of the meter. Detach the battery from the terminals and attach a fresh 9 V battery while paying attention to the correct polarity. Replace the battery and the cover.

The meter will turn on automatically when a new battery is connected. You can turn it off by pressing ON/OFF.



OTHER SPECTROPHOTOMETERS FROM HANNA

Single-parameter Spectrophotometers

Description	Code	Range	Method
Aluminum	HI 93712	0.00 to 1.00 mg/L	Aluminon
Ammonia LR	HI 93700	0.00 to 3.00 mg/L	Nessler
Ammonia HR	HI 93715	0.00 to 9.99 mg/L	Nessler
Bromine	HI 93716	0.00 to 8.00 mg/L	DPD
Chlorine, Free	HI 93701	0.00 to 2.50 mg/L	DPD
Chlorine, Total	HI 93711	0.00 to 3.50 mg/L	DPD
Chlorine Dioxide	HI 93738	0.00 to 2.00 mg/L	Chlorophenol Red
Chromium VI, LR	HI 93749	0 to 300 µg/L	Diphenylcarbohydrazide
Chromium VI, HR	HI 93723	0 to 1000 µg/L	Diphenylcarbohydrazide
Color of Water	HI 93727	0 to 500 PCU	Colorimetric Platinum Cobalt
Copper, LR	HI 93747	0 to 990 µg/L	Bicinchoninate
Copper, HR	HI 93702	0.00 to 5.00 mg/L	Bicinchoninate
Cyanide	HI 93714	0.000 to 0.200 mg/L	Pyridine-Pyrazalone
Cyanuric Acid	HI 93722	0 to 80 mg/L	Turbidimetric
Fluoride	HI 93729	0.00 to 2.00 mg/L	SPADNS
Hardness, Ca	HI 93720	0.00 to 2.70 mg/L	Calmagite
Hardness, Mg	HI 93719	0.00 to 2.00 mg/L	Colorimetric
Hardness, Total	HI 93725	0.00 to 4.70 mg/L	Calmagite/colorimetric
Hydrazine	HI 93704	0 to 400 µg/L	p-Dimethylaminobenzaldehyde
Iodine	HI 93718	0.0 to 12.5 mg/L	DPD
Iron, LR	HI 93746	0 to 400 µg/L	TPIZ
Iron, HR	HI 93721	0.00 to 5.00 mg/L	Phenantroline
Manganese, LR	HI 93748	0 to 300 µg/L	PAN
Manganese, HR	HI 93709	0.0 to 20.0 mg/L	Periodate Oxidation
Molybdenum	HI 93730	0.0 to 40.0 mg/L	Mercaptoacetic Acid
Nickel LR	HI 93740	0.000 to 1.000 mg/L	Photometric
Nickel HR	HI 93726	0.00 to 7.00 g/L	Photometric
Nitrate	HI 93728	0.0 to 30.0 mg/L	Cadmium Reduction
Nitrite, LR	HI 93707	0.00 to 0.35 mg/L	Diazotolion
Nitrite, HR	HI 93708	0 to 150 mg/L	Ferrous Sulfate
pH	HI 93710	5.9 to 8.5 pH	Phenol Red
Phosphate, LR	HI 93713	0.00 to 2.50 mg/L	Ascorbic Acid
Phosphate, HR	HI 93717	0.0 to 30.0 mg/L	Amino Acid
Phosphorus	HI 93706	0.0 to 15.0 mg/L	Amino Acid
Silica	HI 93705	0.00 to 2.00 mg/L	Heteropoly Blue
Silver	HI 93737	0.000 to 0.600 mg/L	Cadion ZB
Zinc	HI 93731	0.00 to 3.00 mg/L	Zincon

Multi-parameter Spectrophotometers

Code	Parameters
HI 93710	Free & Total Cl, pH
HI 93724	CYS, pH
HI 93725	Total Hardness, pH
HI 93741	Fe LR, Total Hardness
HI 93742	Fe LR, Mn LR
HI 93743	Fe LR, pH
HI 93744	Fe LR, Total Hardness, pH
HI 93745	Free & Total Cl, Fe LR, Total Hardness, pH
C 101	Br, Free & Total Cl, CYS, Fe LR, I, pH
C 104	Free & Total Cl, CYS, pH

ACCESSORIES

HI 93732-01	Reagent kit for 100 D.O. tests
HI 93732-03	Reagent kit for 300 D.O. tests
HI 710009	Blue rubber boot
HI 710010	Orange rubber boot
HI 93700-C	Measurement cuvetts (4 pcs)
HI 93703-50	Cleaning solution for cuvetts (230 mL)
HI 93703-70	Tissue for wiping cuvetts (4 pcs)
MAN93732R1	Instruction manual

WARRANTY

All Hanna Instruments meters are warranted for two years against defects in workmanship and materials when used for their intended purpose and maintained according to instructions.

This warranty is limited to repair or replacement free of charge.

Damages due to accidents, misuse, tampering or lack of prescribed maintenance are not covered.

If service is required, contact the dealer from whom you purchased the instrument. If under warranty, report the model number, date of purchase, serial number and the nature of the failure. If the repair is not covered by the warranty, you will be notified of the charges incurred.

If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization Number from the Customer Service department and then send it with shipment costs prepaid. When shipping any instrument, make sure it is properly packaged for complete protection.

To validate your warranty, fill out and return the enclosed warranty card within 14 days from the date of purchase.

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Hanna Instruments reserves the right to modify the design, construction and appearance of its products without advance notice.

OTHER PRODUCTS FROM HANNA

- CALIBRATION AND MAINTENANCE SOLUTIONS
- CHEMICAL TEST KITS
- CHLORINE METERS
- CONDUCTIVITY/TDS METERS
- DISSOLVED OXYGEN METERS
- HYGROMETERS
- MAGNETIC STIRRERS
- Na/NaCl METERS
- pH/ORP/Na ELECTRODES
- pH METERS
- PROBES (DO, $\mu\text{S}/\text{cm}$, RH, T, TDS)
- PUMPS
- REAGENTS
- SOFTWARE
- THERMOMETERS
- TITRATORS
- TRANSMITTERS
- TURBIDITY METERS
- Wide Range of Accessories

Most Hanna meters are available in the following formats:

- BENCH-TOP METERS
- POCKET-SIZED METERS
- PORTABLE METERS
- PRINTING/LOGGING METERS
- PROCESS METERS (Panel and Wall-mounted)
- WATERPROOF METERS
- METERS FOR FOOD INDUSTRY

For additional information, contact your dealer or the nearest Hanna Customer Service Center.

You can also e-mail us at tech@hannainst.com.

CE DECLARATION OF CONFORMITY

HANNA
instruments

CE

DECLARATION OF CONFORMITY

We
Hanna Instruments Srl
via Enrico Fermi 10
35030 Sarmeola di Rubano (PD)
ITALY
herewith certify that the dissolved oxygen meter
HI 93732

has been tested and found to be in compliance with the following regulations:

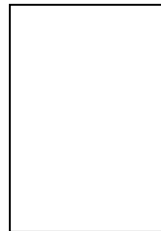
IEC 801-2	Electromagnetic Discharge
IEC 801-3	RF Radiated
EN 60022	Radiated, Class B

Date of issue: 20/05/1997

D.Volpato - Engineering Manager
On behalf of
Hanna Instruments S.r.l.

Recommendations for Users
Before using this product, make sure that it is entirely suitable for the environment in which it is used.
Operation of this instrument in residential areas could cause unacceptable interferences to radio and TV equipments, requiring the operator to take all necessary steps to correct interferences.
Any variation introduced by the user to the supplied equipment may degrade the instruments' EMC performance.
To avoid damages or burns, do not perform any measurement in microwave ovens.

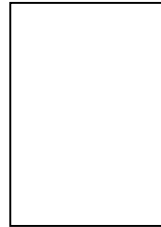
HANNA LITERATURE



FISH FARMING



WATER ANALYSIS



ENVIROCARE



GENERAL CATALOG

These and many others catalogs, handbooks and leaflets are available from Hanna. To receive your free copy, contact your dealer or the nearest Hanna Customer Service Center.

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