

## Instruction Manual

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# HI 964400

## Microprocessor Bench Dissolved Oxygen Meter



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This Instrument is in Compliance with the CE Directives

 **HANNA**  
instruments  
[www.hannainst.com](http://www.hannainst.com)



Dear Customer,

Thank you for choosing a Hanna Instruments Product.

Please read this instruction manual carefully before using the instrument.

This manual will provide you with all the necessary information for the correct use of the instrument, as well as a precise idea of its versatility in a wide range of applications.

This instrument is in compliance with **CE** directives EN 50081-1 and EN 50082-1.

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

## PRELIMINARY EXAMINATION

Remove the instrument from the packing material and examine it to make sure that no damage has occurred during shipping. If there is any damage, notify your Dealer.

Each bench D.O. meter **HI 964400** comes supplied complete with:

- **HI 76407/2** D.O. probe with 2 m (6.7') cable
- **HI 76407A** membrane cap (2 pcs)
- **HI 7041S** electrolyte solution (30 ml)
- 12 VDC power adapter (**HI 710005** or **HI 710006**)
- dust cover.

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

## GENERAL DESCRIPTION

**HI 964400** is a bench microprocessor-based, logging meter for Dissolved Oxygen measurements.

It can store in memory up to 99 lots with up to 8,000 readings. These readings can be transferred to a computer system for elaboration or permanent storage.

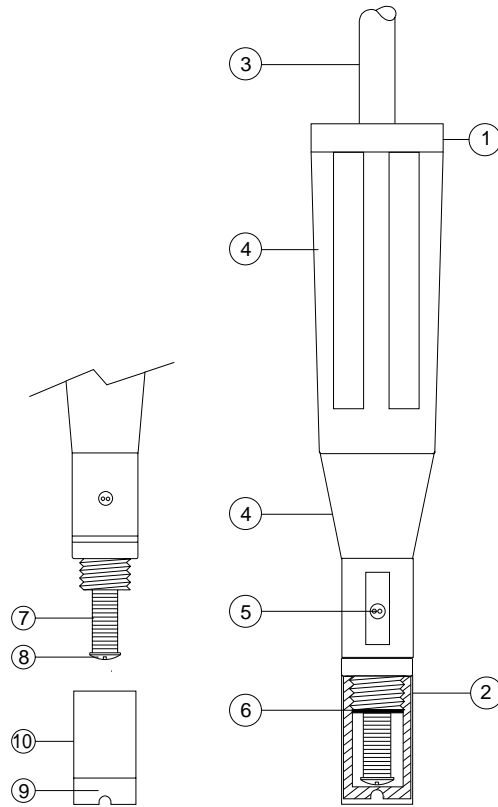
Dissolved oxygen is indicated in ppm (parts per million) or in %.

Temperature is compensated for by the meter's ATC circuitry. Salinity compensation in water allows direct determination of dissolved oxygen in saline waters and the altitude compensation readjusts for the altitude variance.

The dissolved oxygen probe has a membrane covering the polarographic sensors and a built-in thermistor for temperature measurements and compensation.

This permeable Teflon® membrane isolates the sensor elements from the testing solution, but allows oxygen to pass through. When a voltage is applied across the sensor, oxygen that has passed through the membrane reacts causing a current flow, and hence determining a reading.

## FUNCTIONAL DESCRIPTION PROBE

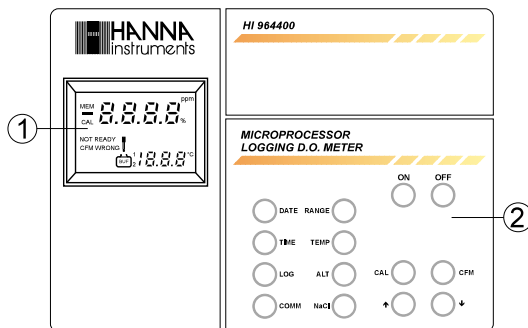


1. D.O. Probe
2. Protective Cap
3. Watertight Shielded Cable
4. Polypropylene Probe Body
5. Temperature Sensor
6. O-Ring Seal
7. Silver Chloride Anode
8. Platinum Cathode (sensor)
9. Oxygen Permeable Teflon® Membrane
10. Membrane Cap

Teflon® is registered Trademark of "du Pont de Nemours & Co."

## FUNCTIONAL DESCRIPTION OF HI 964400

### THE FRONT PANEL



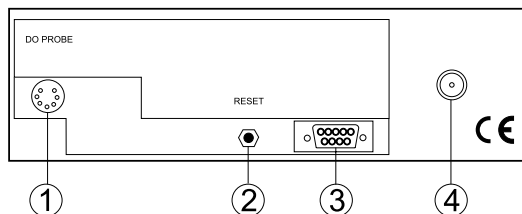
1. Liquid Crystal Display

2. Keyboard:


- ALT** key to display altitude settings
- CAL** key to enter or exit the calibration mode; to enable or disable the date or time settings; to start or exit the D.O. logging mode
- CFM** key to confirm the calibration values
- COMM** key to display the RS232C baud rate and command prefix
- DATE** key to display the date
- LOG** key to display the lot number on the primary LCD and the page number on the secondary one. Press again to display the sample number of the lot
- ↓** key to select the calibration value; to set date, time, logging interval; to set the altitude and the salinity factors; to set the baud rate and command

- prefix for communication to PC
- NaCl** key to display salinity settings
- OFF** key to turn the meter on off
- ON** key to turn the meter on
- RANGE** key to select dissolved oxygen measurement mode in ppm or in %
- TEMP** key to select temperature measurement mode
- TIME** key to display the time
- ↑** key to select the calibration value; to set date, time, logging interval; to set the altitude and the salinity factors; to set the baud rate and command prefix for communication to PC.

**THE REAR PANEL**



1. Socket for D.O. Probe
2. Reset Button
3. RS 232C Connector
4. DC Power Socket (for HI710005 or HI710006)

 Unplug the meter from the power supply before replacing the fuse.

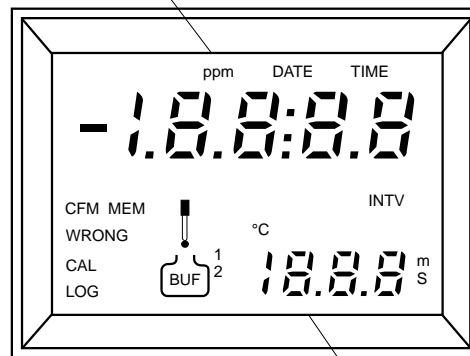
## SPECIFICATIONS OF HI964400

<b>Range</b>	D.O. ppm	0.00 to 45.00
	D.O. %	0.0 to 300.0
	Temp. °C	0.0 to 50.0
<b>Resolution</b>	D.O. ppm	0.01
	D.O. %	0.1
	Temp. °C	0.1
<b>Accuracy</b>	D.O.	±1.5% of full scale
	Temp. °C	±0.5
<b>Typical EMC Deviation</b>	D.O.	±1.5% of full scale
	Temp. °C	±0.5
<b>Calibration</b>	D.O.	single or double point at 0% (HI7040) and 100% (in air)
	Temp. °C	single point or double point at 0.0°C and/or 50.0°C
<b>Altitude Compensation Resolution</b>		0 to 1,900 m (6,230')
		100 m (328')
<b>Salinity Compensation Resolution</b>		0 to 40 g/l
		1 g/l
<b>Temperature Compensation</b>		0.0 to 50.0°C (32 to 122°F)
<b>Probe</b>		<b>HI76407/2</b> with 2 meters (6.7') cable
<b>Logging Interval</b>		1, 15, 30 seconds or 1, 2, 5, 15, 30, 60, 120, 180 minutes
<b>Computer Interface</b>		RS 232C (optoisolated)
<b>Power</b>		Power socket for 12 VCD
<b>Environment</b>		0 to 50°C (32 to 122°F); 95% RH
<b>Dimensions</b>		230x170x70 mm (9.1x6.7x2.7")
<b>Weight</b>		1 kg (2.2 lb.)
<b>Response Time</b> The response time is approximately 20 seconds for a 95% reading at a constant temperature of 25°C. The response time for low oxygen readings or at low temperature is approximately 40 seconds. Allow more time to obtain more accurate readings.		



## LCD FUNCTIONAL DESCRIPTION

### Primary Display



### Secondary Display

## OPERATIONAL GUIDE

### ***POWER CONNECTION***

Plug the 12VDC adapter to the meter and to the mains.

**HI964400** uses an EEPROM to retain the D.O. calibration and temperature calibration as well as the serial communication setting. The instrument will store the respective data after a calibration or serial communication setting, even when it is not plugged-in.

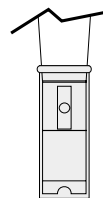
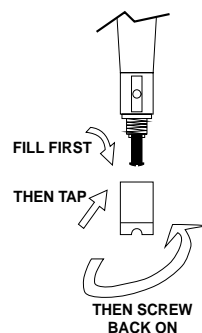
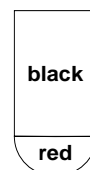
### **PROBE CONNECTION & PREPARATION**

To prepare the instrument for use, connect the D.O. probe to the meter securely by aligning the pins with the socket located on the back of the meter, pushing the plug in and tightening the threaded ring.

All probes shipped from Hanna Instruments are dry. To hydrate the probe and prepare it for use, connect it to the meter and proceed as follows.

1. Remove the red and black plastic cap. This cap is for shipping purposes and can be thrown away.
  2. Wet the sensor by soaking the bottom 2½ cm (1") of the probe in electrolyte (**HI 7041S**) for 5 minutes.
  3. Rinse the membrane cap (**HI 76407A** supplied in the kit with the meter) with electrolyte solution while shaking it gently. Refill with clean electrolyte solution.
  4. Gently tap the sides of the membrane cap with your finger tip to ensure that no air bubbles remain trapped. To avoid damaging the membrane, do not tap the membrane directly on the bottom.
  5. Make sure that the rubber O-ring sits properly inside the membrane cap.
  6. With the sensor facing down, slowly screw the cap clockwise. Some electrolyte will overflow.
- When not in use and during polarization (see below), place the protective transparent cap supplied in the kit with the meter.

**Shipping cap**

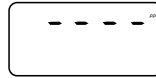


### **TURNING THE METER ON**

To switch the meter on, press the ON key and let the probe in the auto-conditioning (polarization) mode before proceeding. After approximately 5 minutes, the instrument can be calibrated (see page 17).



If the probe is disconnected, the meter will display "----".



This also indicates the possibility of a broken probe cable.

### **PROBE POLARIZATION**

The probe is under polarization with a fixed voltage of approximately 800 mV.

Probe polarization is essential for stable measurements with the same recurring degree of accuracy.

With the probe properly polarized, oxygen is continually "consumed" when it passes through the sensitive diaphragm and dissolves in the electrolyte solution contained in the probe.

If polarization is interrupted, the electrolyte solution continues to be enriched with oxygen until it reaches an equilibrium with the surrounding solution.

Whenever measurements are taken with a non-polarized probe, the oxygen level revealed is both that of the tested solution as well as that present in the electrolyte solution. This reading is **incorrect**.

The calibration of this instrument is very simple.

Before proceeding with the calibration make sure the probe is ready for measurements (see page 8), i.e. the membrane cap is filled with electrolyte and the probe is connected

to the meter and properly polarized.

For an accurate calibration, it is recommended to wait for 5 or 10 minutes to ensure precise conditioning of the probe.

Keep the protective cap on during the polarization time and remove it for the calibration and the measurements.

Follow the calibration procedure on page 17.

### **D.O. MEASUREMENTS (in ppm or in %)**

Make sure the meter has been calibrated (see page 17) and the protective cap has been removed.

### **Salinity and Altitude compensation**

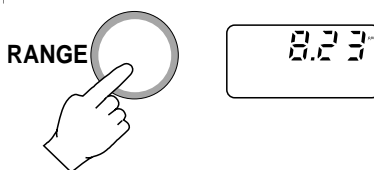
If the sample contains significant concentration of salinity or if you are performing measurements at an altitude different from sea level, the readout values must be corrected, taking into account the lower degree of oxygen solubility in such occasions as explained on pages 23-25.

Remember to set the altitude and/or the salinity before taking any D.O. measurements. The meter will automatically compensate for these factors.

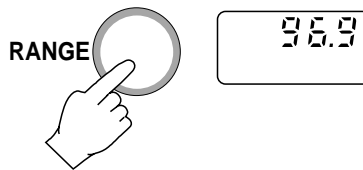
### **Taking measurements**

Immerse the tip of the probe in the sample to be tested. Make sure the temperature sensor is also immersed.

Press the RANGE key to display D.O. measurements. Allow approximately one minute for the meter to stabilize and read the **ppm** value of dissolved oxygen on the display.

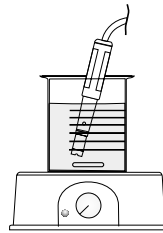


Press the RANGE key to change the reading from ppm to % and vice-versa.



For accurate dissolved oxygen measurements a water movement of 0.3 m/sec is required at a minimum. This is to ensure that the oxygen-depleted membrane surface is constantly replenished. A moving stream will provide adequate circulation.

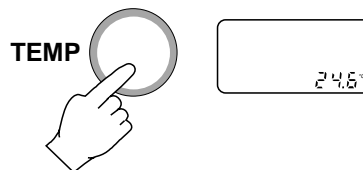
The use of a magnetic stirrer to ensure a certain velocity in the fluid is recommended. In this way, errors due to the diffusion of the oxygen present in the air in the solution are reduced to a minimum.



At all times, the time necessary for thermal equilibrium to occur between the probe and the measurement sample must be allowed (a few minutes if the temperature difference is only several degrees).

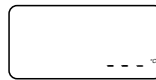
### **TAKING TEMPERATURE MEASUREMENTS**

The probe has a built-in temperature sensor. Press the TEMP key to display the measured temperature on the secondary display.



Allow the probe to reach the thermal equilibrium before taking any measurement. Reaching thermal equilibrium can take several minutes. The greater the difference between the temperature at which the probe was stored and the temperature of the sample, the longer the time will be.

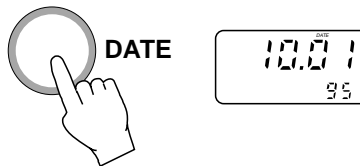
If "----" is displayed, it indicates that the D.O. probe is not properly connected or the temperature is out of range.



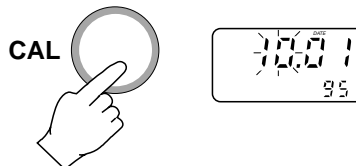
This also indicates the possibility of a broken probe cable.

### **SETTING THE DATE AND THE TIME AND THE LOGGING INTERVAL**

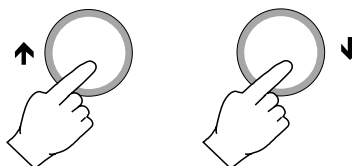
Press the DATE key to display the date. The month and the day will be displayed on the primary LCD, the year on the secondary one.



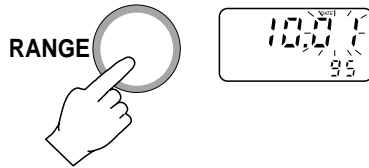
Press the CAL key to enter the setting mode, the month starts blinking.



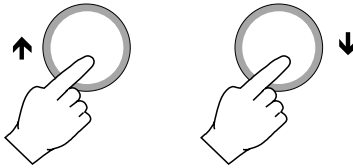
Use the UP or DOWN arrow keys to select the month.



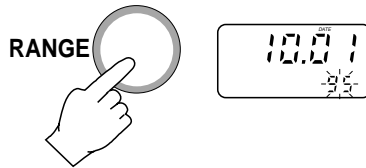
Press the RANGE key, the day starts blinking.



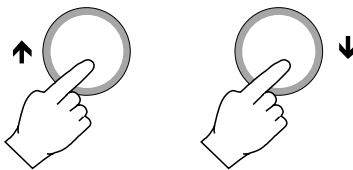
Use the UP or DOWN arrow keys to select the day.



Press the RANGE key and the year on the secondary LCD will blink.



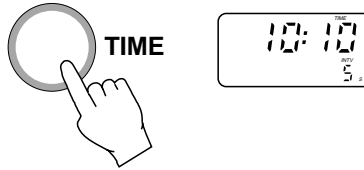
Use the UP or DOWN arrow keys to select the year.



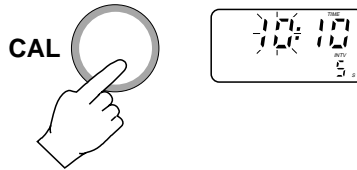
Press the CAL key to exit the date setting mode.



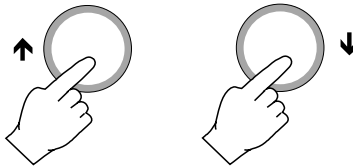
Press the TIME key to display the time. The hour and the minutes will be displayed on the primary LCD, the logging interval on the secondary one.



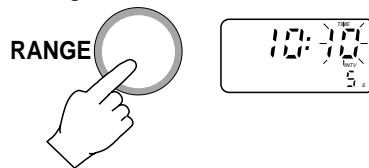
Press the CAL key to enter the setting mode, the hour will start blinking.



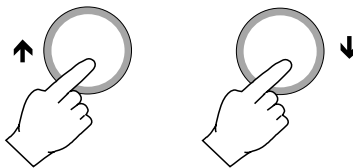
Use the UP or DOWN arrow keys to select the hour.



Press the RANGE key and the minutes will start blinking.

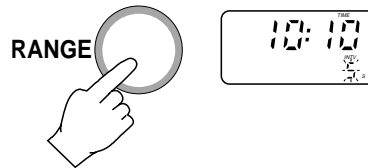


Use the UP or DOWN arrow keys to select the minutes.

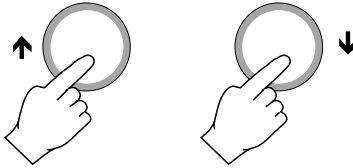




Press the RANGE key and the logging interval on the secondary LCD will start blinking (m = minutes, s = seconds).



Use the UP or DOWN arrow keys to select the logging interval.

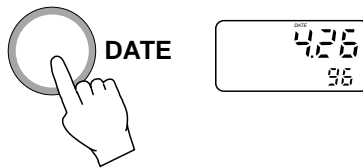


Press the CAL key to exit the time setting mode.

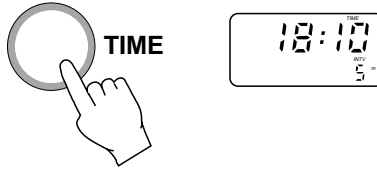


### **VIEWING THE DATE AND THE TIME**

Press the DATE key to display the date. The month and the day will be displayed on the primary LCD, the year on the secondary one.



Press the TIME key to display the time. The hour and the minutes will be displayed on the primary LCD, the logging interval on the secondary one.



### **RESET BUTTON**

The RESET button is used when the instrument displays erroneous messages due to strong electrical interference or when the instrument's power supply was disconnected before the meter was switched off.

It is necessary to press the RESET button and restart the entire operation.

Calibration points should remain memorized. It is recommended to verify calibration before proceeding.

## D.O. CALIBRATION

For greatest accuracy, it is recommended that the instrument is calibrated frequently.

The standard calibration program of the meter is prepared for 2 (maximum) values: 0.0% (**zero calibration**) and 100.0% (**slope calibration**).

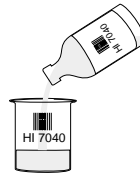
The meter is equipped with a stability indicator and the user will be guided step by step with easy indications on the display during the D.O. calibration. This will make the calibration a simple and error-free procedure.

The **zero calibration** of the **HI964400** is very stable, therefore this procedure needs only to be performed **whenever the probe or the membrane is replaced**.

However, because the **slope calibration** is more critical, **it is recommended to perform this procedure every week**.

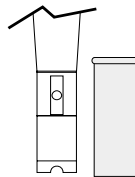
### INITIAL PREPARATION

- Pour small quantities of **HI7040** Zero Oxygen solution into a beaker. If possible, use a plastic beaker to minimize any EMC interferences.
- Make sure the probe is ready for measurements (see initial preparation at page 8), i.e. the membrane is filled with electrolyte and the probe is connected to the meter.
- Switch the meter on by pressing the ON key.
- For an accurate calibration, it is recommended to wait for at least 15



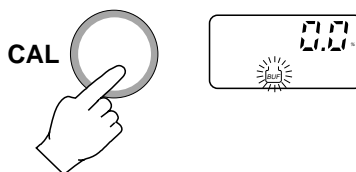
minutes to ensure precise conditioning of the probe.

- Remove the protective cap from the D.O. probe.
- Set the appropriate altitude factor (see page 23). Make sure the salinity factor is set to zero (see page 25).

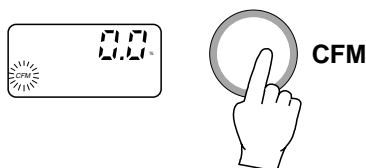


### **ZERO CALIBRATION**

- Dip the probe into **HI 7040** zero oxygen solution and stir gently for 2-3 minutes.
- Press the CAL key and the "BUF" indicator will blink until the reading is stable.



- As soon as the reading is stable, the "CFM" indicator will start blinking. Press the CFM key to confirm the "0.0%" D.O. reading.



- If the reading is not close to the selected value, "WRONG" and "WRONG!" will blink alternatively.



If the reading is within the margins ( $\pm 15\%$ ), the meter stores the value (and adjusts the offset point). The meter will then proceed with the next calibration point.

- Press the CAL key and the calibration process is ended with only the zero of the meter calibrated. For a two-point calibration do not press the CAL key and follow the procedure below.

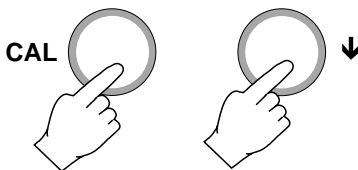


### **SLOPE CALIBRATION**

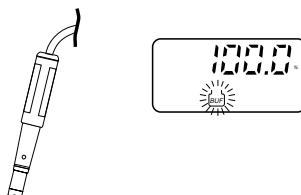
It is suggested to perform the slope calibration in saturated air.

- Rinse the probe in a large amount of clean water to remove any residual zero oxygen solution.

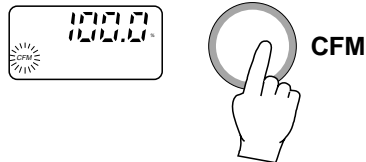
**Note:** If you did not perform the zero calibration procedure, press the CAL key and then the DOWN key to select the 100% calibration value.




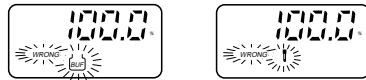
- Dry the probe tip and allow a few minutes for the LCD readout to stabilize. The "BUF" indicator will blink until the reading is stable.



- As soon as the reading is stable, the "CFM" indicator will start blinking. Press the CFM key to confirm the "100.0%" D.O. reading.



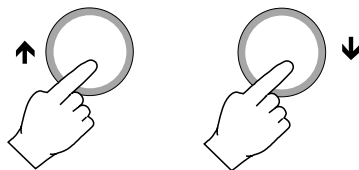
- If the reading is not close to the selected value, "WRONG " and "WRONG!" will blink alternatively.



- If the reading is within the margins ( $\pm 15\%$ ), the meter stores the value (and adjusts the slope point). The calibration is ended and the meter will then revert to the normal measurement mode.

**Note:**

- HI 964400** has automatic buffer recognition function. Press the UP or DOWN arrow keys to select the desired calibration value, but if these keys are pressed, the automatic buffer recognition function is disabled.



- Press the CAL key at any time to exit the calibration mode.



## TEMPERATURE CALIBRATION

Each meter has been factory calibrated for the temperature with the D.O. probe supplied and is ready for measurements.

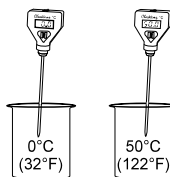
The D.O. probes are interchangeable and no temperature calibration is needed should the probe be replaced.

If, for any reason, the temperature measurements are out of accuracy, the temperature re-calibration should be carried out.

For an accurate re-calibration, contact your nearest Hanna Service Center or follow the procedure below (for technical personnel only).

### INITIAL PREPARATION

- Prepare a beaker containing ice (at 0.0°C/32°F) and water and another one containing hot water (at a temperature of 50.0°C/122°F). Place insulation material around the container to minimize temperature changes.
- Use a **ChecktempC** or a calibrated thermometer with a resolution of 0.1°C as a reference thermometer.

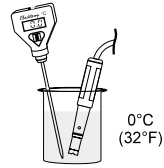


### PROCEDURE

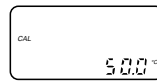
- Switch the meter on while pressing the CAL key. The "CAL" indicator will be lit. The secondary LCD section will show "0.0°C".



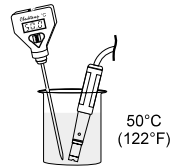
- Immerse the D.O. probe in the vessel with the ice and water.



- Wait for about 30 seconds. Press the CFM key. The secondary LCD section will show "50.0°C".



- Immerse the D.O. probe in the vessel with hot water.



- Wait for about 30 seconds. Press the CFM key.

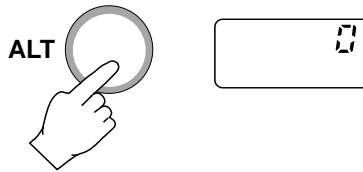


- The temperature calibration procedure is now completed.

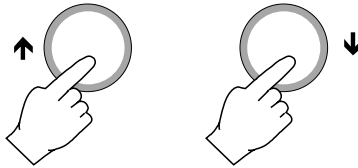


## ALTITUDE COMPENSATION

Press the ALT key and the altitude factor will be displayed.



Use the UP and the DOWN keys to set the altitude between 0 and 1900 m, in steps of 100 m (1 meter = 3.28 feet).

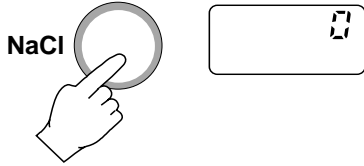


Altitude affects D.O. concentration decreasing its value. The table on the following page reports the maximum oxygen solubility at various temperatures and altitudes.

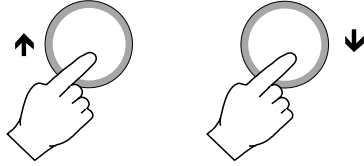
°C	Altitude, Meters above Sea Level							°F
	0 m	300 m	600 m	900 m	1200 m	1500 m	1800 m	
0	14.6	14.1	13.6	13.2	12.7	12.3	11.8	32.0
2	13.8	13.3	12.9	12.4	12.0	11.6	11.2	35.6
4	13.1	12.7	12.2	11.9	11.4	11.0	10.6	39.2
6	12.4	12.0	11.6	11.2	10.8	10.4	10.1	42.8
8	11.8	11.4	11.0	10.6	10.3	9.9	9.6	46.4
10	11.3	10.9	10.5	10.2	9.8	9.5	9.2	50.0
12	10.8	10.4	10.1	9.7	9.4	9.1	8.8	53.6
14	10.3	9.9	9.6	9.3	9.0	8.7	8.3	57.2
16	9.9	9.7	9.2	8.9	8.6	8.3	8.0	60.8
18	9.5	9.2	8.7	8.6	8.3	8.0	7.7	64.4
20	9.1	8.8	8.5	8.2	7.9	7.7	7.4	68.0
22	8.7	8.4	8.1	7.8	7.7	7.3	7.1	71.6
24	8.4	8.1	7.8	7.5	7.3	7.1	6.8	75.2
26	8.1	7.8	7.5	7.3	7.0	6.8	6.6	78.8
28	7.8	7.5	7.3	7.0	6.8	6.6	6.3	82.4
30	7.5	7.2	7.0	6.8	6.5	6.3	6.1	86.0
32	7.3	7.1	6.8	6.6	6.4	6.1	5.9	89.6
34	7.1	6.9	6.6	6.4	6.2	6.0	5.8	93.2
36	6.8	6.6	6.3	6.1	5.9	5.7	5.5	96.8
38	6.6	6.4	6.2	5.9	5.7	5.6	5.4	100.4
40	6.4	6.2	6.0	5.8	5.6	5.4	5.2	104.4

**SALINITY COMPENSATION**

Press the NaCl key and the salinity factor will be displayed.



Use the UP and DOWN keys to set the salinity between 0 and 40 g/l.



Salinity affects D.O. concentration decreasing its value. Below is a table showing the maximum solubility of oxygen at various temperature and salinity.

°C	Salinity (g/l) at Sea Level					°F
	0 g/l	10 g/l	20 g/l	30 g/l	35 g/l	
10	11.3	10.6	9.9	9.3	9.0	50.0
12	10.8	10.1	9.5	8.9	8.6	53.6
14	10.3	9.7	9.1	8.6	8.3	57.2
16	9.9	9.3	8.7	8.2	8.0	60.8
18	9.5	8.9	8.4	7.9	7.6	64.4
20	9.1	8.5	8.0	7.6	7.4	68.0
22	8.7	8.2	7.8	7.3	7.1	71.6
24	8.4	7.9	7.5	7.1	6.9	75.2
26	8.1	7.6	7.2	6.8	6.6	78.8
28	7.8	7.4	7.0	6.6	6.4	82.4

**TEMPERATURE COMPENSATION**

The D.O. probe has a built-in sensor for temperature so that the D.O. readings are automatically compensated for temperature effects.

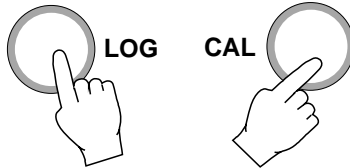
## LOGGING FUNCTION

This function allows to log D.O. (in ppm or %) together with the temperature automatically without the necessity of an operator and for a long period of time. All logged data can be stored into a PC through the RS232C port.

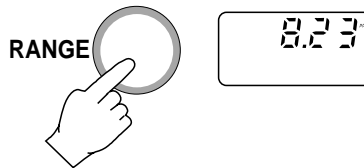
The lot number goes from 1 to 99 and then back to #1. The maximum capacity per lot is 8000 samples.

Set the appropriate logging interval (see page 12). Select between 1, 15, 30 seconds or 1, 5, 30, 60, 120, 180 minutes.

Press the RANGE key first (to select D.O. readings in ppm or in %), then press the LOG and then CAL key to enter the logging mode.

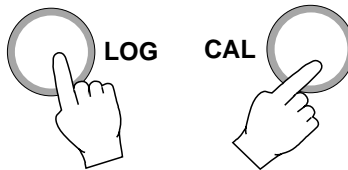


Press the RANGE key to display the measurement reading during the logging mode.



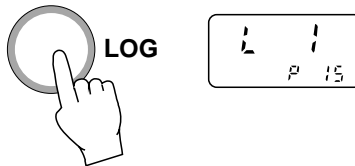
Once in the logging mode, the interval cannot be changed.

Exit the logging mode first (by pressing the LOG and then CAL key) before setting a new interval.

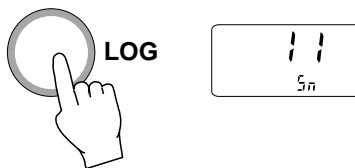


During logging, you can check some information about the logged data.

Press the LOG key and the primary LCD will show the current lot number and the secondary LCD will display the current page number.

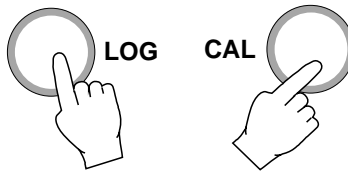


Press the LOG key again to display the current sample number (the number of readings that have been stored in the current lot).

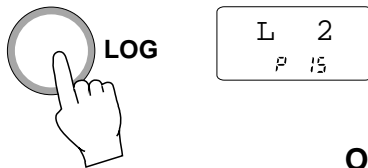


### **TO STOP LOGGING**

To stop logging press the LOG and then CAL key.



The display will show the next lot number.

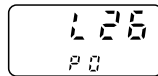


**Note:** if the OFF key is pressed while logging, the meter will stop the logging first and then will turn off.



### **MEMORY ORGANIZATION**

The memory used for storing the logged data is divided into 16 pages. The capacity of each page is 500 samples. It starts to log from page 16 downwards until 1 and then 16 again, overwriting the previous data. However, when this happens the LCD will show page "0", indicating the overwriting has occurred.

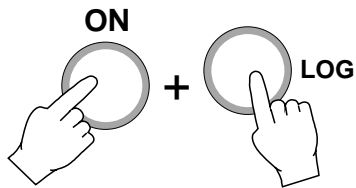


Each time a new logging period starts, it automatically starts from a new page.

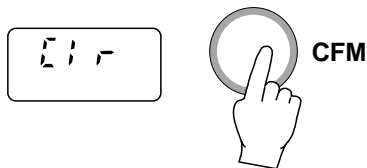
When the samples collected for a single lot are more than the limit (8000 samples) the meter will stop logging automatically.

**TO CLEAR LOGGED DATA**

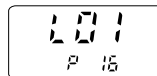
The entire logged data can be cleared by pressing the ON and the LOG keys simultaneously.



The choice has to be confirmed by pressing the CFM key.



The next logging will start from page 16.



## INTERFACE WITH PC

Data transmission from the instrument to the PC is now much easier with the new **HI 92000** Windows® compatible application software offered by Hanna Instruments.

User friendly, **HI 92000** offers a variety of features and has an on line help feature to support you throughout all situations.

**HI 92000** allows you to use the powerful means of the most diffused spread sheet programs (e.g. Excel®, Lotus 1-2-3®). Simply run your favorite spread sheet and open the file downloaded by **HI 92000**. It is then possible to make any elaboration available with your software (e.g. graphics, statistical analysis).

To install **HI 92000** you need a 3.5" drive and few minutes to follow the instructions conveniently printed on the disk's label.

Contact your Hanna Dealer to request a copy.

To connect your **HI 964400** to the PC use **HI 920010**, available through your Hanna Dealer. Make sure that your meter is switched off and plug the connectors, one into the meter RS232C connector, the other into the serial port of your PC.

**Note:** Cables different from the **HI 920010** may use a different configuration. In such case any communication between the meter and the PC is not possible.

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Lotus 1-2-3® Copyright of "Lotus Co."  
Windows® and Windows Terminal® are registered Trademark of "Microsoft Co."



## PROBE & MEMBRANE MAINTENANCE

The oxygen probe body is made of reinforced plastic for maximum durability.

A thermistor temperature sensor provides temperature measurements of the sample tested. It is always recommended that the protective cap be kept on the probe when the probe is not in use to provide protection against damage and dirt.

**To replace the membrane** or refill with electrolyte, proceed as follows:

- Remove the protective cap by gently twisting and pulling it off the body of the probe (see fig. 1).
- Unscrew the membrane cap by turning it counterclockwise (see fig.2).
- Wet the sensor by soaking the bottom 2½ cm (1") of the probe in electrolyte (**HI 7041S**) for 5 minutes.
- Rinse the new membrane cap (**HI 76407A**) supplied with the meter with electrolyte solution while shaking it gently. Refill with clean electrolyte solution.
- Gently tap the sides of the membrane cap with your finger tip to ensure that no air bubbles remain trapped. Do not directly tap the bottom

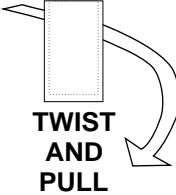


fig. 1

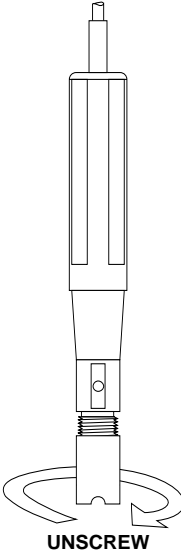


fig. 2

with your finger as this will damage the membrane.

- Make sure that the rubber O-ring sits properly inside the membrane cap.
- With the sensor facing down, slowly screw the membrane cap clockwise. Some electrolyte will overflow.

The Platinum cathode (#8 in the Functional Description at page 3) should always be bright and untarnished. If it is tarnished or stained, which could be due to contact with certain gases or extended use with a loose or damaged membrane, the cathode should be cleaned. You can use a clean lint-free cardboard or cloth. Rub the cathode very gently side to side 4-5 times. This will be enough to polish and remove any stains without damaging the platinum tip. Afterwards, rinse the probe with deionized or distilled water and install a new membrane cap using fresh electrolyte and follow the steps above. Re-calibrate the instrument.

**Important:** in order to have accurate and stable measurements, it is important that the surface of the membrane is in perfect condition. This semipermeable membrane isolates the sensor elements from the environment but allows oxygen to enter. If any dirt is observed on the membrane, rinse carefully with distilled or deionized water. If any imperfections still exist, or any damage is evident (such as wrinkles or tears-holes), the membrane should be replaced.

Make sure that the O-Ring sits properly in the membrane cap.

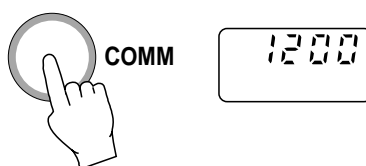
**ADDITIONAL INFORMATION**  
**(for Technical Personnel only)**

If you are not using Hanna Instruments **HI92000** application software, please find here below some additional information to help your connection to the PC.

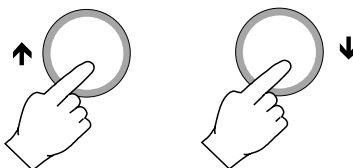
**SETTING THE BAUD RATE AND THE COMMAND PREFIX**

The transmission speed (baud rate) of your **HI964400** and of the external device must be the same.

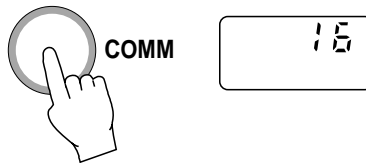
To set the baud rate of the meter press the COMM key, the primary LCD shows the current **baud rate**.



The following baud rate can be selected through the UP or DOWN arrow keys: 150, 300, 600, 1200 (factory setting), 2400, 4800 and 9600.

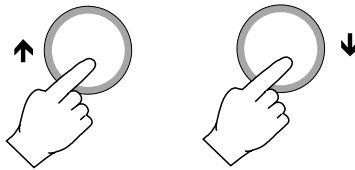


Press the COMM key to confirm the setting and the primary LCD shows the current **command prefix**; 16 is the factory setting.



**Note:** the Command Prefix does not have to be changed using **HI92000** Hanna Software.

Select a different command prefix (between 0 to 47 decimal) by pressing the UP or DOWN arrow keys.



Press the COMM key to confirm the setting.



### ***SENDING COMMANDS FROM PC***

With terminal programs such as Telix® and Windows Terminal®, it is possible to remotely control your **HI 964400**. Use **HI 920010** cable to connect the meter to the PC, start the terminal program and set the communication options as follows: 8, N, 1, no flow control.

#### ***Command Types***

To send a command to the D.O. meter the scheme is:

<DLE> <command> <CR>

This line makes the computer send a Data Link Escape character, the command expressed as a number or a 3-character sequence) and a CR character.

**Note:** Windows Terminal® and all the other terminal programs that support the ANSI escape sequence, represent the DLE character by the string '^P' and the CR character by the string '^M'. E.g. the line '^PPPM^M' sets the range to ppm.

#### ***Commands not requiring an answer from the meter:***

**PPM** sets the range to ppm D.O.

**PER** sets the range to % D.O.

**OFF** is equivalent to pressing the OFF key

#### ***Commands requiring an answer:***

**DO?** Causes the meter to send the D.O. (% or ppm will depend on the meter setting). If the reading is out of range "Err 1" is sent.

- TM?** Causes the meter to send the temperature value. If the reading is out of range "Err 3" is sent.
- DA?** Requests the meter to send the date  
E.g. "022896" for 28th Feb. 96
- TI?** Requests the meter to send the time  
E.g. "233001"  
for 23:30 hr, 1 sec. as interval  
"233002"  
for 23:30 hr, 15 sec. as interval  
"233003"  
for 23:30 hr, 30 sec. as interval  
"233004"  
for 23:30 hr, 1 min. as interval  
"233005"  
for 23:30 hr, 5 min. as interval  
"233006"  
for 23:30 hr, 30 min. as interval  
"233007"  
for 23:30 hr, 60 min. as interval  
"233008"  
for 23:30 hr, 120 min. as interval  
"233009"  
for 23:30 hr, 180 min. as interval
- ?ML** Requests the meter to send the available lot number collected in memory. The transmission begins with <STX> and terminates with <ETX>. The data are sent in the following order:
- 1) stx
  - 2) Lot number  
E.g. "01" for lot No. 1
  - 3) Total number of samples per lot  
E.g. "1234" for total no. of samples: 1234.

- 4) Channel #1 status  
E.g. "1" for ppm logging selected in this lot  
"0" for ppm logging not selected in this lot
- 5) Channel #2 status  
E.g. "1" for % logging selected in this lot  
"0" for % logging not selected in this lot
- 6) Channel #3 status  
E.g. "1" for not used  
"0" for not used
- 7) Channel #4 status  
E.g. "1" for temperature logging selected in this lot  
"0" for temperature logging not selected in this lot
- 8) ...  
Repeat from 2 to 7 for the next available lot No.
- 9) etx

**?VM** Requests the meter to send the selected lot status. The data are sent in the following order:

- 1) stx
- 2) Lot number  
E.g. "01" for lot No. 1
- 3) Total number of samples per lot  
E.g. "1234" for total no. of samples: 1234.
- 4) Channel #1 status  
E.g. "1" for ppm logging selected in this lot  
"0" for ppm logging not selected in this lot

- 5) Channel #2 status  
E.g. "1" for % logging selected in this lot  
"0" for % logging not selected in this lot
- 6) Channel #3 status  
E.g. "1" for not used  
"0" for not used
- 7) Channel #4 status  
E.g. "1" for temperature logging selected in this lot  
"0" for temperature logging not selected in this lot
- 8) begin sample time, min  
E.g. "59" for 59 minute
- 9) begin sample time, hour  
E.g. "12" for 12 hour
- 10) begin sample time, day  
E.g. "09" for 9th day
- 11) begin sample time, month  
E.g. "09" for September
- 12) begin sample time, year  
E.g. "96" for year 1996
- 13) logging interval  
E.g. "0" for 1 second  
"1" for 15 seconds  
"2" for 30 seconds  
"3" for 1 minute  
"4" for 5 minutes  
"5" for 30 minutes  
"6" for 60 minutes  
"7" for 120 minutes  
"8" for 180 minutes
- 14) last sample time, min  
E.g. "59" for 59 minute



- 15) last sample time, hour  
E.g. "12" for 12 hour
- 16) last sample time, day  
E.g. "09" for 9th day
- 17) last sample time, month  
E.g. "09" for September
- 18) last sample time, year  
E.g. "96" for year 1996
- 19) etx            end

**?DM** Requests the meter to send the selected lot data memory. The data are sent in the following order:

- 1) stx
- 2) Lot number  
E.g. "01" for lot No. 1
- 3) Channel #1 status  
E.g. "1" for ppm logging selected in this lot  
"0" for ppm logging not selected in this lot
- 4) Channel #2 status  
E.g. "1" for % logging selected in this lot  
"0" for % logging not selected in this lot
- 5) Channel #3 status  
E.g. "1" for not used  
"0" for not used
- 6) Channel #4 status  
E.g. "1" for temperature logging selected in this lot  
"0" for temperature logging not selected in this lot
- 7) begin sample time, min  
E.g. "59" for 59 minute

- 8) begin sample time, hour  
E.g. "12" for 12 hour
- 9) begin sample time, day  
E.g. "09" for 9th day
- 10) begin sample time, month  
E.g. "09" for September
- 11) begin sample time, year  
E.g. "96" for year 1996
- 12) logging interval  
E.g. "0" for 1 second  
"1" for 15 seconds  
"2" for 30 seconds  
"3" for 1 minute  
"4" for 5 minutes  
"5" for 30 minutes  
"6" for 60 minutes  
"7" for 120 minutes  
"8" for 180 minutes
- 13) Total number of samples per lot  
E.g. "1234" for total no. of samples: 1234.
- 14) Logged data in signed integer, repeat sending in logged channel sequence  
sample no. 1  
---- send ppm data if ppm is log selected  
---- send % data if %is log selected  
---- send temperature data if temperature is log selected  
sample no. 2 ...  
until the last sample  
sample "XXX" is signed hex format.

- 15) last sample time, min  
E.g. "59" for 59 minute
- 16) last sample time, hour  
E.g. "12" for 12 hour
- 17) last sample time, day  
E.g. "09" for 9th day
- 18) last sample time, month  
E.g. "09" for September
- 19) last sample time, year  
E.g. "96" for year 1996
- 20) etx                    end

The meter will send "Err6" if in a different measurement range.

***Commands setting parameters:***

**/ML** To select the data lot for data transfer.

E.g. send "/ML05" to select lot no. 5.

If the lot no. is valid, the meter will send <ACK>, otherwise it will send <CAN>.

**/BR** To set the RS232C baud rate.

E.g. send "/BR0" to set the meter to baud rate of 150

send "/BR1" to set the meter to baud rate of 300

send "/BR2" to set the meter to baud rate of 600

send "/BR3" to set the meter to baud rate of 1200

send "/BR4" to set the meter to baud rate of 2400

send "/BR5" to set the meter to baud rate of 4800

send "/BR6" to set the meter to baud rate of 9600

**/PF** To set the RS232C command prefix.  
E.g. send "/PF05" to set the command prefix to 05.

**Note:** <ACK> will be sent by the meter if the command received is accepted, otherwise it will send <CAN>.

<ACK> equals to ASCII code 06 and  
<CAN> equals to ASCII code 24.

If sample data is out of range "07FFFH" is sent.

These commands may be sent with either capital or small letters. Invalid commands will be ignored. The characters sent by the pH meter are always capital letters.

## ACCESSORIES

<b>ChecktempC</b>	Electronic thermometer (range: -50.0 to 150.0°C)
<b>ChecktempF</b>	Electronic thermometer (range: -58.0 to 302°F)
<b>HI 7040M</b>	Zero Oxygen Solution, 230 ml
<b>HI 7040L</b>	Zero Oxygen Solution, 460 ml
<b>HI 7041S</b>	Refilling Electrolyte Solution, 30 ml
<b>HI 710005</b>	115VAC to 12VDC converter
<b>HI 710006</b>	230VAC to 12VDC converter
<b>HI 76407/2</b>	Spare probe with 2 meters (6.7') cable
<b>HI 76407/10</b>	Spare probe with 10 meters (33') cable
<b>HI 76407/20</b>	Spare probe with 20 meters (67') cable
<b>HI 76407A/P</b>	5 spare membranes
<b>HI 92000/16</b>	Windows® 3.11 compatible ap- plication software
<b>HI 92000/32</b>	Windows® 95 compatible ap- plication software
<b>HI 920010</b>	25-pin PC connection cable
<b>HI 920010/9</b>	9-pin PC connection cable
<b>MANDOBNR1</b>	Instruction manual

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## WARRANTY

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

**The probes are warranted for a period of six months.**

Damages due to accident, misuse, tampering or lack of prescribed maintenance are not covered. This warranty is limited to repair or replacement free of charge of the meter only, whenever due to defect of manufacturing.


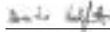
If service is required, contact the dealer from whom you purchased the instrument. If under warranty, report the model number, date of purchase, serial number and the nature of the failure. If the repair is not covered by the warranty, you will be notified of the charge for repair or replacement. If the instrument is to be returned to Hanna Instruments, obtain a Return Goods Authorization from the Customer Service Department first and then send it with shipment cost 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.

## CE DECLARATION OF CONFORMITY

								
<b>CE</b> <i>DECLARATION OF CONFORMITY</i>								
We Hanna Instruments Srl V.le delle industrie 12 35010 Ronchi di Villafranca (PD) ITALY								
herewith certify that the bench D.O. meter HI 964400								
has been tested and found to be in compliance with the following regulations:								
<table><tr><td><b>IEC 801-2</b></td><td>Electrostatic Discharge</td></tr><tr><td><b>IEC 801-3</b></td><td>RF Radiated</td></tr><tr><td><b>IEC 801-4</b></td><td>Fast Transient</td></tr><tr><td><b>EN 55022</b></td><td>Radiated, Class B</td></tr></table>	<b>IEC 801-2</b>	Electrostatic Discharge	<b>IEC 801-3</b>	RF Radiated	<b>IEC 801-4</b>	Fast Transient	<b>EN 55022</b>	Radiated, Class B
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<b>IEC 801-4</b>	Fast Transient							
<b>EN 55022</b>	Radiated, Class B							
Date of Issue: <u>18-04-1996</u>	 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 area 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 instrument's EMC performance.

To avoid damages or burns, do not perform any measurement in microwave ovens.

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