Instruction Manual

HI 4421

DO/BOD/OUR/SOUR/Temperature Bench Meter

HANNA instruments®
www.hannainst.com

Dear Customer,

Thank you for choosing a Hanna Instruments product. This manual will provide you with the necessary information for correct use of the instrument.

Please read this instruction manual carefully before using the instrument.

If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com or see the back side of this manual for our worldwide sales and technical service contacts.

These instruments are in compliance with CE directives.

WARRANTY

HI 4421 is warranted for two years against defects in workmanship and materials when used for their intended purpose and maintained according to instructions. The probe is guaranteed for six months. This warranty is limited to repair or replacement free of charge.

Damage due to accidents, misuse, tampering or lack of prescribed maintenance is 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 Technical Service Department and then send it with shipping costs prepaid. When shipping any instrument, make sure it is properly packed for complete protection.

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

TABLE OF CONTENTS

PRELIMINARY EXAMINATION

Remove the instrument from the packing material and examine it carefully to make sure that no damage has occurred during shipping. If there is any damage, notify your dealer or the nearest Hanna Service Center.
The meter is supplied complete with:

- **HI 76408** DO probe for laboratory use with built-in temperature sensor
- **HI 7041S** Electrolyte solution (30 mL)
- **HI 76407A** Membrane caps (2 pcs)
- **HI 76404N** Electrode Holder
- 12Vdc Power Adapter
- Instruction Manual

HI 4421 is supplied with 12 Vdc/230 Vac adapter.
HI 4421-01 is supplied with 12 Vdc/115 Vac adapter.

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

GENERAL DESCRIPTION

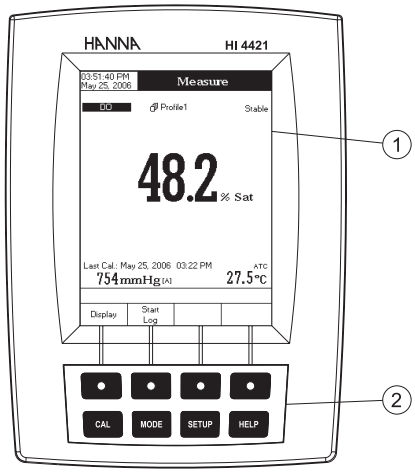
HI 4421 is a professional bench meter with color graphic LCD for DO, BOD, OUR, SOUR and temperature measurements.
The display viewing modes are: Basic information only, GLP information, Graph and Log History mode.
The main features of the instruments are:

- One input channel;
- Six measurement parameters: DO, BOD, OUR, SOUR, pressure and temperature;
- Automatic or user standard DO calibration;
- AutoHold feature to freeze the stable reading on the LCD (DO only);
- Two selectable alarm limits (for DO, BOD, OUR, SOUR);
- Three selectable logging modes: Automatic logging, Log on demand (manual logging) and AutoHold logging mode (DO only);
- Up to 100 logging lots for automatic or manual modes, up to 200 OUR and SOUR reports and up to 200 BOD method information entries;
- Selectable area and settable sampling period feature for automatic logging;
- GLP feature;
- Online and offline graph;
- User-friendly interface on large color graphic LCD (240x320 pixels);
- Opto-isolated PC interface via RS232 respectively USB.

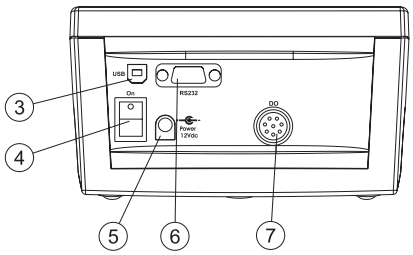
FUNCTIONAL DESCRIPTION

HI 4421 DESCRIPTION

FRONT PANEL



REAR PANEL



1) Liquid Crystal Display (LCD)
2) Main Keyboard
3) USB connector
4) ON/OFF switch
5) Power adapter socket
6) RS232 serial communication connector
7) DO probe input

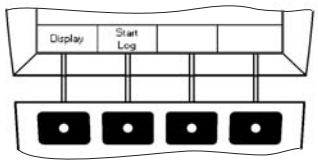
KEYBOARD DESCRIPTION

FUNCTION KEYS

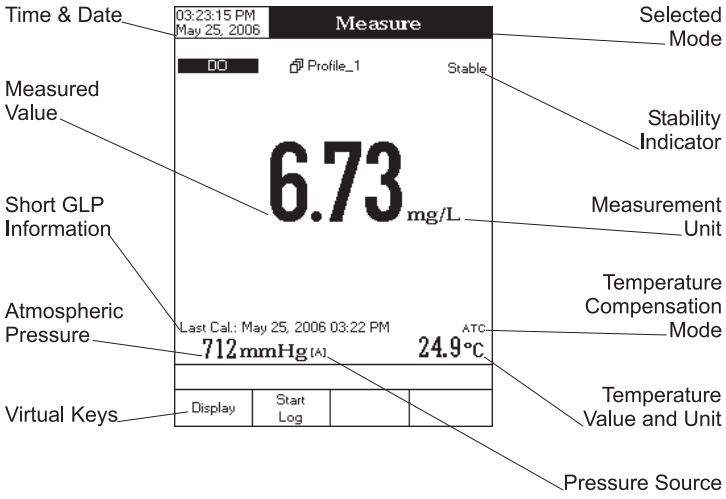
CAL	To enter / exit calibration mode.
MODE	To select the desired measurement mode: DO, BOD, OUR, SOUR.
SETUP	To enter Setup (System Setup, DO Setup, BOD Setup , OUR Setup or SOUR Setup) and to access Log Recall function.
HELP	To obtain general informations about the selected option / operation.

VIRTUAL KEYS

The upper row keys are assigned to the **virtual keys** placed on the bottom of the LCD, which allow you to perform the displayed function, depending on the current menu (e.g. Display and Start Log *in Measure* mode).



LCD GENERAL DESCRIPTION



SPECIFICATIONS

		HI 4421
DO	Range	0.00 to 90.00 ppm 0.0 to 600.0 % saturation
	Resolution	0.01 ppm 0.1 % saturation
	Accuracy	±1.5% of reading ±1 digit
Temperature	Measurement range	-20.0 to 120.0 °C -4.0 to 248.0 °F 253.1 to 393.1 K
	DO compensation range	0.0 to 50.0 °C 32.0 to 122.0 °F 237.1 to 323.1 K
	Resolution	0.1 °C, °F, K
	Accuracy	±0.2 °C, °F, K
	Units	°C, °F, K
Barometric pressure	Range	450 to 850 mmHg 560 to 1133 mBar
	Resolution	1 mm Hg
	Accuracy	±3 mm Hg + 1 least significant digit
Salinity comp.	Range	0 to 45 ppt, g/L
BOD (Biochemical Oxygen Demand)		Yes
OUR (Oxigen Uptake Rate)		Yes
SOUR (Specific Oxigen Uptake Rate)		Yes
Keyboard		8 keys (4 virtual keys)
Probe		Polarographic with temperature built-in
PC interface		Opto-isolated RS232, USB
External Data Storage		No
Logging Features	Record samples	up to 100 lots 10000 samples/lot for Automatic Logging 5000 samples/lot for Manual Logging
	Logging interval	1 to 300000 sec
	Type	Manual, Automatic
GLP		Last calibration data, calibration info
Back light Saver		Yes (automatic)
AutoEnd mode		DO only
Alarm (DO, BOD, OUR, SOUR)		Yes (Inside/Outside limits)
Calibration		Automatic / User standard (1 or 2 points)
Calibration standard		0 and 100% saturation
LCD		Color Graphic LCD 240 x 340 pixels
Dimensions		160 x 231 x 94 mm (6.3 x 9.1 x 3.7 ")
Weight		1.2 Kg (2.6 lb)

OPERATIONAL GUIDE

POWER CONNECTION

Plug the 12 Vdc adapter into the power supply socket.

Note: These instruments use non volatile memory to retain the meter settings, even when unplugged.

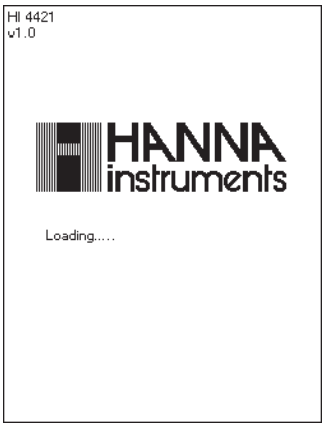
PROBE CONNECTION

For DO, BOD, OUR or SOUR measurements connect a DO probe to the DIN connector located on the rear panel of the instrument.

INSTRUMENT START UP

- Turn the instrument on from the power switch located on the rear panel of the instrument.
- Please wait until the instrument finishes the initialization process.

Note: It is normal for the loading process to take a few seconds. If the instrument doesn't display the next screen, restart the meter using the power switch. If the problem persists, contact your dealer.



DISPLAYING MODES

For each measurement mode (DO, BOD, OUR or SOUR) the following display configurations are available: Basic, Good Laboratory Practice (GLP), Graph and Log History.

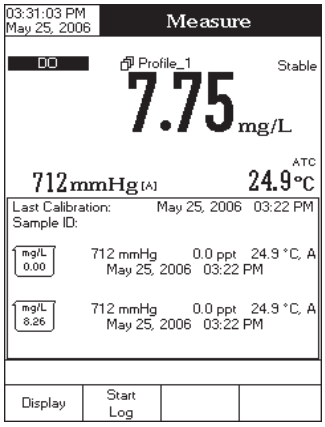
Basic

Accessing this option, the measured value and its units are displayed on the LCD, along with the temperature value, temperature compensation mode, pressure value, pressure compensation mode and minimal GLP data.

To choose the Basic displaying mode:

- Press [Display] while in *Measure* mode. The "Choose Display Configuration" message will be displayed in the Reminder messages area.
- Press [Basic]. The instrument will display the basic information for the selected measurement mode.

GLP

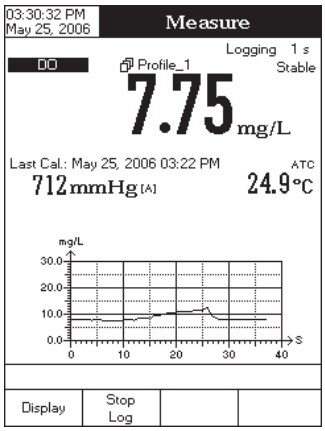


Accessing this option, a detailed GLP data will be displayed on the LCD for DO measure modes: Last Calibration Date and Time, Sample ID, Buffer Value, Pressure Value, Salinity Value, Temperature Value, Temperature Compensation, the Date and Time.

To access the GLP displaying mode:

- Press [Display] while in *Measure* mode. The "Choose Display Configuration" message will be displayed in the Reminder messages area.
- Press [GLP]. The instrument will display the detailed GLP data.

Graph



Accessing this option, the online graph with currently logged values (DO, BOD, OUR or SOUR vs. Seconds) could be displayed. If there is no active log, the previously logged data for the selected parameter will be plotted.

Notes:
- If no data were logged, the graph displaying mode will not be accessible.
- If no automatic log is saved, the offline graph will not be available.

To access the offline / online graph:

- Press [Display] while in *Measure* mode. The "Choose Display Configuration" message will be displayed in the Reminder messages area.
- Press [Graph].

When the **online graph** is displayed:

- Use [◁] and [▷] to move the graph along the horizontal (*Time*) axis.
- Press [SETUP] to access the zoom menu for the vertical (*Parameter*) axis. Use [Zoom IN] or [Zoom OUT] for vertical axis zooming.
- Press [Escape] to return to the main menu.

When the **offline graph** is displayed:

- Use the arrow keys to move the graph along the horizontal and vertical axes.
- Press [SETUP] to access the zoom menu for the horizontal and vertical axes. Use [Zoom Time] or [Zoom DO] / [Zoom BOD] / [Zoom OUR] / [Zoom SOUR] to switch between the active zooming axes. Press [Zoom IN] or [Zoom OUT] to zoom the selected axis.

Note: While in zoom graph menu the [MODE] key is not accessible.

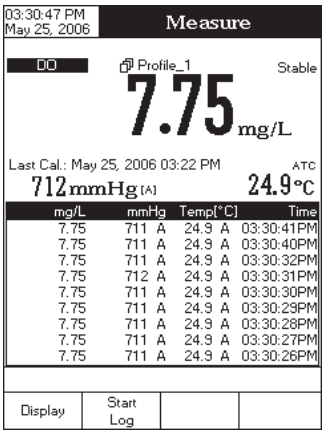
- Press [Escape] to return to the main menu.

Log History

Accessing this option, last logged records will be displayed on the LCD. The log history list also contains the appropriate DO / BOD / OUR / SOUR values, the logged temperature, the temperature source, as well as the records time stamp.

To access the Log History displaying mode:

- Press [Display] while in *Measure* mode. The "Choose Display Configuration" message will be displayed in the Reminder messages area.
- Press [Log History]. The instrument will display the log history regarding the selected measure mode.



Notes:
- When an alarm condition is active, the logged records will have an exclamation mark (!).
- When a meter is in auto-hold, the logged records will have an "H" symbol.
- If another measure mode is selected, the Log History will be cleared.
- If the temperature unit is changed, all logged temperature values will be automatically displayed in the new temperature unit.

SYSTEM SETUP

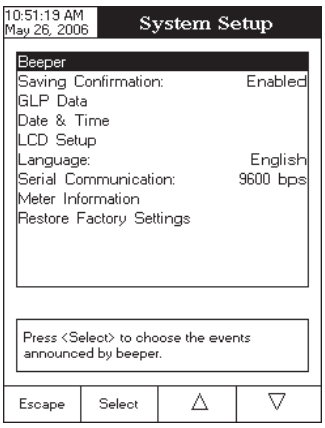
The System Setup menu allows the user to customize the user interface, consult the meter information, set the external serial communication interface and to restore the manufacturer settings.

Accessing System Setup

- Press [SETUP] while in *Measure* mode.
- Press [System Setup]. The system setup options will be displayed on the LCD.

To access a System Setup option:

- Use [△] or [▽] to highlight the desired option.
- Press [Select] to access the selected option.



The following is a detailed description of the System Setup option screen.

Beeper

This option allows the user to enable or disable the beeper. When the beeper is enabled, a specific beep will be heard when the reading becomes stable, when an alarm condition is reached, when pressing a key or if a wrong key is pressed.

Stability Indicator

When the reading becomes stable, the instrument delivers a medium beep only if this option is activated, along with the "Stable" indicator on the LCD.

Alarm

If this option is activated, a continuous double beep will be heard each time the set limits in *Measure* mode are exceeded, along with the "Alarm" indicator on the LCD.

Key Pressed

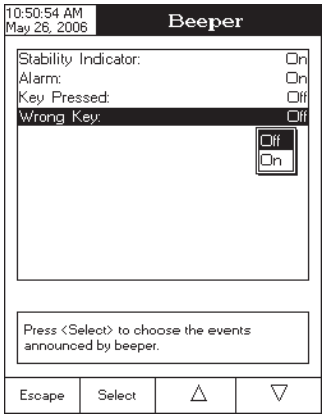
If this option is activated, a short beep will be heard each time a valid key is pressed.

Wrong Key

If this option is activated, a long beep will be heard when an incorrect key is pressed.

To set the Beeper:

- Use [△] or [▽] to select the *Beeper* option.
- Press [Select] and use [△] or [▽] to highlight the desired beeper associated event you want to modify.
- Press [Select] and use [△] or [▽] to highlight the beeper status option.
- Press [Select] to confirm your selection and return to the *Beeper* menu or press [Escape] to return without changing.

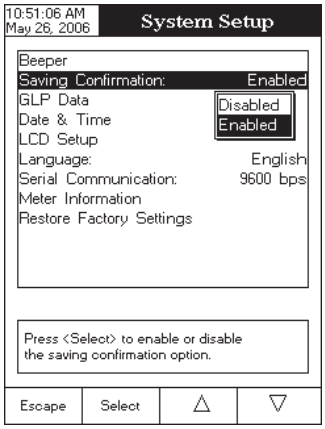


Saving Confirmation

When enabling this option, a prompt will appear on the LCD alerting the user to save the modified values by pressing [Yes], exiting without saving by pressing [No] or canceling the saving operation and return to the editing mode by pressing [Cancel]. If disabled, the modified values will be saved automatically.

To enabled /disabled the saving confirmation:

- Use [△] or [▽] to select the *Saving Confirmation* option.
- Press [Select] and use [△] or [▽] to choose enabled / disabled.
- Press [Select] to confirm your selection or press [Escape] to cancel operation.



GLP Data

This option allows the user to set general information which will appear in the log reports. The edited text can have max 10 characters.

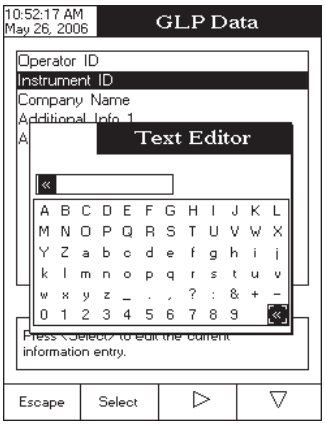
Operator ID – edit the operator's name.

Instrument ID – edit an identification name / number for the instrument.

Company Name – edit the company name.

Additional Info 1 & Additional Info 2 – for general purpose notations.

To set the GLP data:



- Use △ or ▽ to select the *GLP Data* option.
- Press Select and use △ or ▽ to highlight the desired option.
- Press Select to edit the desired information. The Text Editor menu will be displayed on the LCD.
- Enter the desired information by using ▷ and ▽ to highlight the desired character. It is also possible to delete the last character by positioning the cursor on the Backspace character (⌫) and pressing Select .
- Press Escape to return to the *GLP Data* menu. If the *Saving Confirmation* is enabled, press Yes to accept the modified option, No to escape without saving or Cancel to return to the editing mode. Otherwise, the modified options are saved automatically.

Date & Time

This option allows the user to set the current date & time and the format in which they appear. These parameters will be displayed on the *Measure* screens and also when storing measured data.

Set Date and Time

This option allows you to set the current date (year / month / day) and time (hour / minute / second).

Notes:
- Only years starting with 2000 are accepted.
- The time is set using the selected time format. For 12 Hour time format only, the AM / PM can also be selected with △ or ▽.

Set Time Format

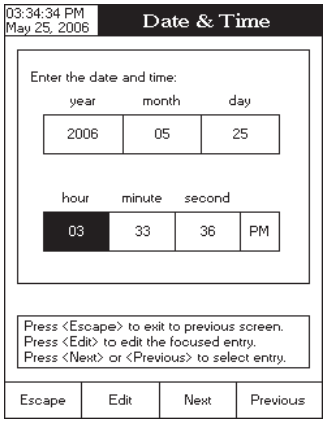
This option allows you to choose between 12 Hour (AM / PM) time format and 24 Hour time format from the displayed pop-up box.

Set Date Format

This option allows you to choose the desired date format from the available formats: DD/MM/YYYY; MM/DD/YYYY; YYYY/MM/DD; Mon DD, YYYY; DD-MM-YYYY and YYYY-Mon-DD.

To set the Date & Time:

- Use [△] or [▽] to select the *Date & Time* option.
- Press [Select] and use [△] or [▽] to highlight the desired option you want to modify.
- Press [Select] to confirm your selection. Use [Next] and [Previous] and then use [Edit] to modify the value with [△] or [▽] (for *Set Date and Time* option). For the other two options press [Select] to confirm your selection and select one of the displayed formats with [△] or [▽].
- Press [Select] to confirm your selection and return to the *Date & Time* options.
- Press [Escape] to return to the previous mode.



Note: If the time is changed with more than one hour before last measure parameters user calibration, a pop-up warning will appear on the LCD, notifying the user that a date/time conflict has occured and some time-dependent features could work improperly (e.g. *GLP, Log*).

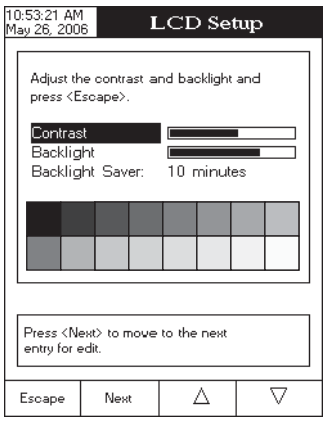
LCD Setup

This option allows the user to set the *Contrast,* the *Backlight* of the LCD and the *Backlight Saver*. The *Contrast* parameter can be adjusted within 7 steps, while the *Backlight* parameter within 4 steps. The *Backlight Saver* can be set from 1 to 60 minutes or it can be disabled (OFF). All the changes are visible on the LCD for each parameter.

Note: If the instrument backlight is turned off after the set period of time, press any key to turn it back on.

To set the LCD:

- Use [△] or [▽] to select the *LCD Setup* option;
- Press [Select] and use [Next] key to highlight the desired parameter;
- Use [△] or [▽] to adjust the selected parameter;
- Press [Escape] return to the *System Setup* menu with saving.

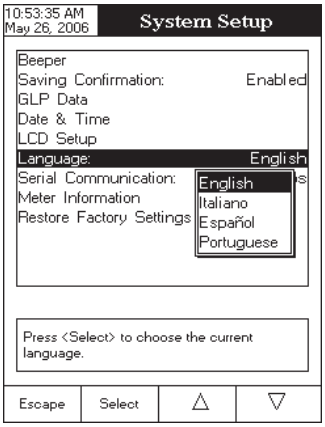


Language

This option allows the user to choose the desired language for the user interface.

To select the Language:

- Use [△] or [▽] to select the Language option.
- Press [Select] and use [△] or [▽] to highlight the desired language.
- Press [Select] to confirm your selection and return to the *System Setup* menu or press [Escape] to return to the *System Setup* menu without changing.



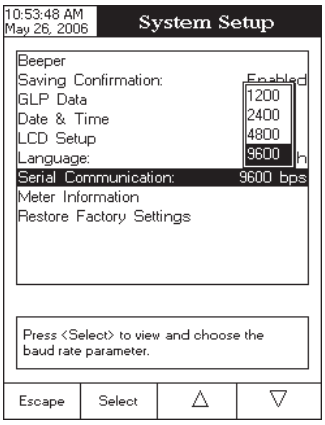
Serial Communication

This option allows the user to set the desired speed for the serial communication (baud rate) between the instrument and PC from *1200, 2400, 4800* or *9600*.

To set the serial communication:

- Use [△] or [▽] to select the *Serial Communication* option.
- Press [Select] and use [△] or [▽] to highlight the desired baud rate.
- Press [Select] to confirm your selection and return to the *System Setup* menu or press [Escape] to return without changing.

Note: The meter and the PC application must have the same baud rate.



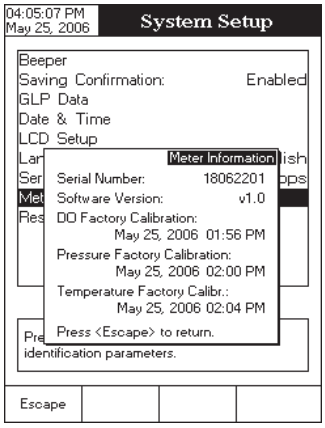
Meter Information

This option provides general information about the instrument serial number (each instrument has an unique identification serial number), the software version and the factory calibration date and time (for DO, pressure and temperature).

Note: All the instruments are factory calibrated for DO, pressure and temperature. After one year from last factory calibration, the warning will appear at meter startup to inform the user that a new factory calibration is required.

To view the meter information:

- Use [△] or [▽] to select the *Meter Information* option.
- Press [Select] to confirm and to view the meter information or press [Escape] to return to the *System Setup* menu.

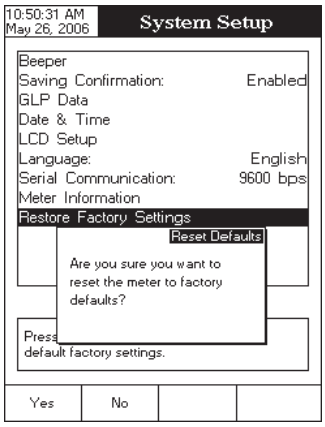


Restore Factory Settings

This option allows the user to reset the instrument to the default factory settings.

To restore the factory settings:

- Use [△] or [▽] to select the *Restore Factory Settings* option.
- Press [Select] to confirm your selection. A pop-up box will be displayed, asking for confirmation.
- Press [Yes] to confirm and return to the *System Setup* or press [No] to return without restoring defaults.



DO SETUP

The DO Setup menu allows the user to set the parameters related to the DO measurement.

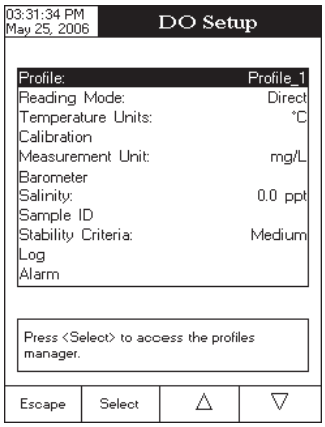
Accessing DO Setup

- Press [MODE] while in *Measure* mode and then [DO] to select the *DO* measure mode.
- Press [SETUP] and then [DO Setup] to access *DO Setup* menu.

To access a DO setup options:

- Use [△] or [▽] to highlight the desired option.
- Press [Select] to access the selected option or [Escape] to exit setup.

The following is a detailed description of the *DO Setup* option screens.



Profile

Choosing this option the measuring and the calibration mode can be customized. Up to 10 profiles can be defined by the user.

The available options are:

Save Current Profile: save the current profile.

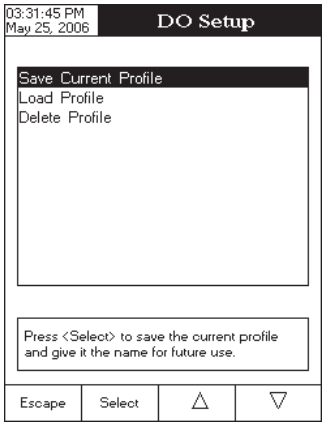
Load Profile: load from available profiles.

Delete Profile: delete a profile.

Save Current Profile

To save the current profile:

- Use [△] or [▽] to select the *Profile* option.
- Press [Select] and then select *Save Current Profile* option. The text editor box will be displayed on the LCD.
- Enter the desired profile name by using [▷] and [▽] to highlight the desired character and then press [Select] to add it to the text bar. It is also possible to delete the last character by positioning the cursor on the Backspace character (←) and pressing [Select].
- Press [Escape] to return to the Profile options.

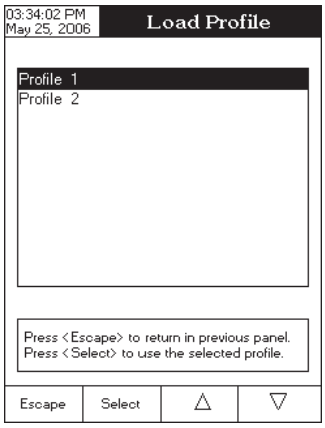


Note: The saved profile will automatically become the current profile.

Load Profile

To load the user customized profile:

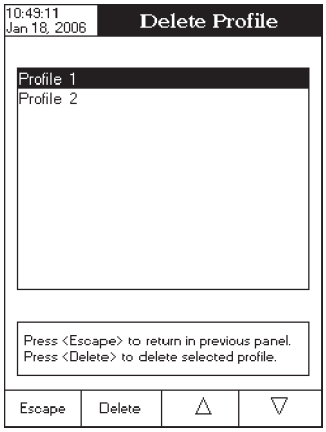
- Use [△] or [▽] to select the *Profile* option.
- Press [Select] and use [△] or [▽] to highlight the *Load Profile* option.
- Press [Select]. A list with all customised profiles will be displayed on the screen.
- Use [△] or [▽] to select the desired profile and press [Select] to confirm or [Escape] to exit without selecting.



Delete Profile

To delete one of the existing profiles:

- Use [△] or [▽] to select the *Profile* option.
- Press [Select] and use [△] or [▽] to highlight the *Delete Profile* option.
- Press [Select]. A list with all customised profiles will appear on the screen.
- Use [△] or [▽] to select the desired profile and press [Delete].
- Press [Escape] to return to the previous menu.

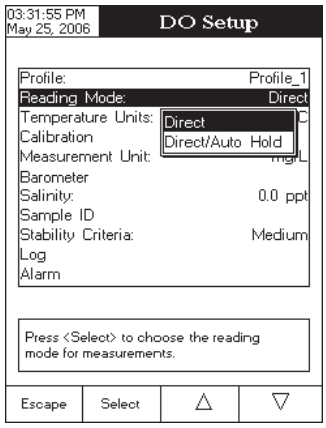


Reading Mode

This option allows the user to select between *Direct* and *Direct/AutoHold* DO reading modes.

To set the reading mode:

- Use [△] or [▽] to select the *Reading Mode* option.
- Press [Select] and use [△] or [▽] to highlight the desired option.
- Press [Select] to confirm your selection or press [Escape] to cancel operation.

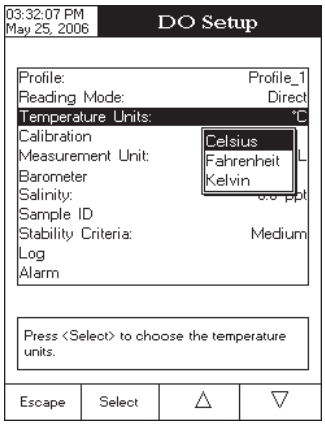


Temperature Units

The user can choose from the *Celsius, Fahrenheit* or *Kelvin* temperature units.

To set the temperature unit:

- Use [△] or [▽] to highlight the *Temperature Units* option.
- Press [Select] and then use [△] or [▽] to select *Celsius, Fahrenheit* or *Kelvin* degrees unit.
- Press [Select] to confirm your selection or press [Escape] to cancel operation.



Barometer

From the *Barometer* menu the user can choose the pressure source and units, as well as the pressure.

To access a *Barometer* option:

- Use [△] or [▽] to highlight the *Barometer* option from the *DO Setup* menu.
- Press [Select] to access the *Barometer* option.

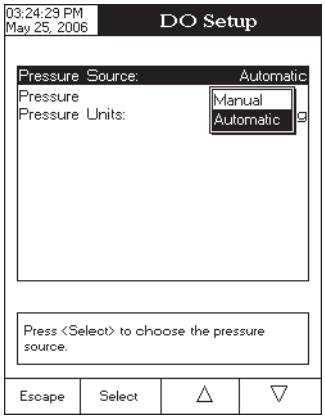
Pressure Source

The user can choose between *Manual* and *Automatic* pressure source.

To set the pressure source:

- Use [△] or [▽] to highlight the *Pressure Source* option.
- Press [Select] and then use [△] or [▽] to select *Automatic* or *Manual* pressure source.
- Press [Select] to confirm your selection or press [Escape] to cancel operation.

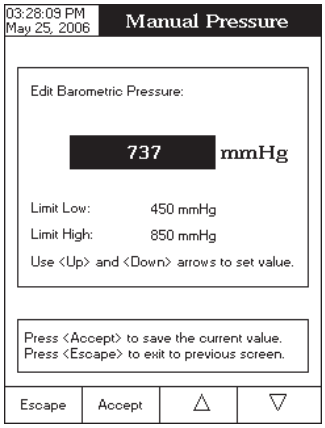
Note: If *Manual* pressure source is chosen, the pressure used as reference during measurements is set manually. If *Automatic* pressure source is chosen, a pressure calibration in one point can be performed (see *Pressure Calibration*).



Pressure

To set the pressure:

- Use △ or ▽ to highlight the *Pressure* option.
- Press Select and then use △ or ▽ to increase / decrease the value.
- Press Accept to save or press Escape to cancel operation.

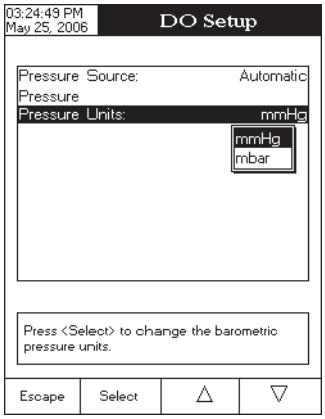


Pressure Units

The user can choose from the *mmHg* or *mbar* pressure units.

To set the pressure unit:

- Use △ or ▽ to highlight the *Pressure Units* option.
- Press Select and then use △ or ▽ to select between *mmHg* and *mbar* units.
- Press Select to confirm your selection or press Escape to cancel operation.

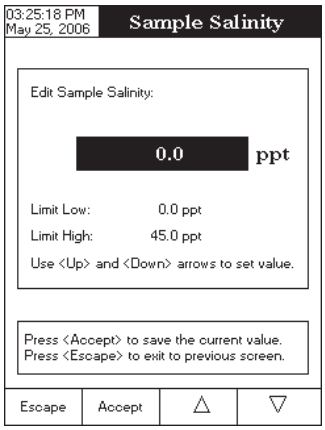


Salinity

The user can edit the sample salinity fot DO compensation.

To edit the sample salinity:

- Use △ or ▽ to highlight the *Salinity* option.
- Press Select and then use △ or ▽ to increase / decrease the value.
- Press Accept to save or press Escape to cancel operation.



Calibration

Using DO standards

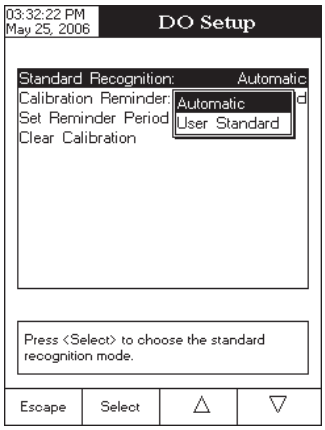
The meter can be calibrated in a single or multi-points (up to two points), using 2 DO standards (0.0%, 100%) or using the custom standards.

The following options are available for calibration:

Standard Recognition

The user can choose between *Automatic* recognition (from 2 Hanna standards available) or *User Standard*.

- Use △ or ▽ to highlight the *Standard Recognition* option.
- Use △ or ▽ to choose from *Automatic* or *User Standard* option.
- Press Select to confirm your selection or press Escape to cancel operation.

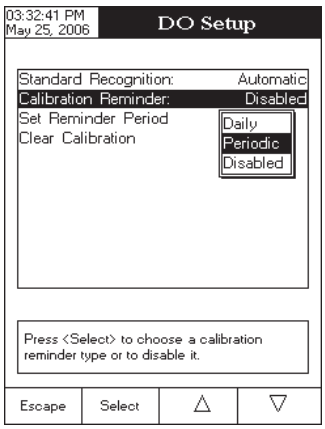


Calibration Reminder

This option allows the user to set the calibration reminder as *Daily, Periodic* or *Disabled*.

To set the calibration reminder:

- Use △ or ▽ to highlight the *Calibration reminder* option.
- Press Select to confirm your selection and then use △ or ▽ to choose the desired option.
- Press Select to confirm your selection or press Escape to cancel operation.

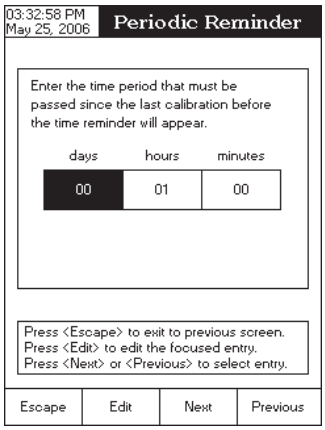


Set Reminder Period

Daily reminder - the user can set the time from the day when the reminder is to appear.
Periodic reminder - the user can set the time from the last calibration (days, hours and minutes) after which the reminder appears.

To set the reminder period:

- Use [△] or [▽] to highlight the *Set Reminder Period* option.
- Press [Select] and use [Next] / [Previous] to select next / previous entry to be edited.
- Press [Edit] and use [△] or [▽] to set the desired value, then press [Accept] to save the modified value.
- Press [Escape] to return to the previous menu.



Clear Calibration

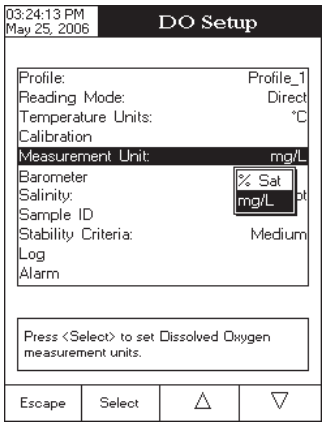
Accessing this option, the existent DO calibration can be cleared. If the calibration is cleared, another calibration has to be performed.
To clear calibration:

- Use [△] or [▽] to highlight the *Clear Calibration* option.
- Press [Select] to clear calibration. A pop-up menu will be displayed asking for confirmation.
- Press [Yes] to confirm or press [No] to escape without saving and return to the Calibration options.

Measurement Unit

The user can select the desired measurement unit. The available options are: % Sat and mg/L.

- Use [△] or [▽] to highlight the *Measurement Unit* option.
- Press [Select] to confirm your selection.
- Use [△] or [▽] to select *% Sat* or *mg/L*.
- Press [Select] to confirm your selection or press [Escape] to cancel operation.



Sample ID

This option allows the user to give to the measured samples an identification number/name. Two *Sample ID* options are available: *ID Increment* and *Edit Sample ID*.

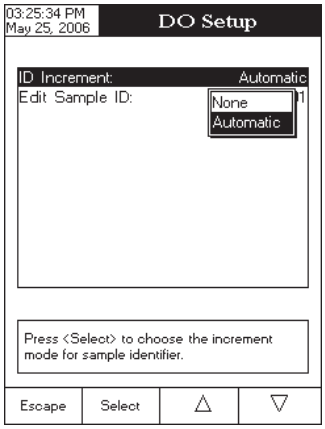
ID Increment

None – the sample ID will be edited alphanumerically by the user.

Automatic – the sample ID will be automatically incremented at every new log lot notification.

To select the ID increment mode:

- Use [△] or [▽] to highlight the *ID Increment* option.
- Press [Select] and then use [△] or [▽] to highlight the desired option.
- Press [Select] to confirm your selection or press [Escape] to cancel operation.



Edit Sample ID

This option allows the user to edit the sample ID (numeric - auto-increment mode, alphanumeric - user editable).

To edit the Sample ID:

- Use [△] or [▽] to select the Sample ID option.
- Press [Select] and use [△] or [▽] to highlight the *Edit Sample ID* option and then press [Select].
- Edit numerically / alphanumerically the sample ID.
- Press [Accept] to save the current sample ID or press [Escape] to cancel operation.

Log

This option allows the user to edit the settings related to the logging feature, as following:

Logging Type

Three logging types are available: *Automatic, Manual* and *AutoHold.*

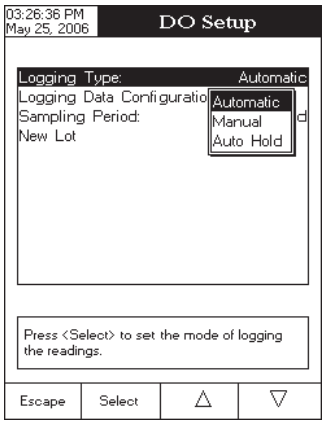
Automatic logging - the readings are logged automatically at constant time intervals (see *Sampling Period* option).

Manual logging (log on demand)- the readings are logged each time [Log] is pressed.

AutoHold logging - the readings are logged automatically at each auto-hold event occured.

To set the sample logging type:

- Use [△] or [▽] to highlight the *Logging Type* option.
- Press [Select] and use [△] or [▽] to choose from *Automatic, Manual* or *Auto Hold.*
- Press [Select] to confirm your selection or press [Escape] to cancel operation.

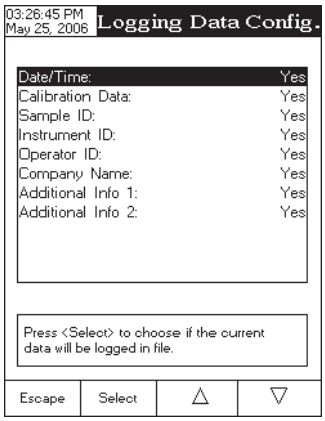


Logging Data Configuration

This option allows the user to select the parameters that accompany a logged value: *Date/Time, Calibration Data, Sample ID, Instrument ID, Operator ID, Company Name, Aditional Info 1* and *Aditional Info 2*.

To customise the logging data configuration:

- Use [△] or [▽] to highlight the *Logging Data Configuration* option.
- Press [Select] and then use [△] or [▽] to enable the parameter by selecting *Yes* or to disable it by selecting *No* for each option.
- Press [Escape] to return to the previous menu.

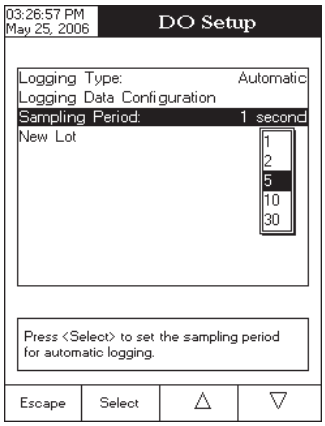


Sampling Period

This option allows the user to select the desired sampling period for automatic logging.

To set the sampling period:

- Use [△] or [▽] to highlight the *Sampling Period* option.
- Press [Select] and use [△] or [▽] to select the desired option from *1, 2, 5, 10, 30* seconds.
- Press [Select] to confirm your selection or press [Escape] to cancel operation.



New Lot

Accessing this option, the new manually logged readings will be put in a new log lot.

To generate a new lot:

- Use [△] or [▽] to highlight the *New Lot* option.
- Press [Select] to generate a new manual lot. A pop-up menu will be displayed to ask for confirmation.
- Press [Yes] to confirm or press [No] to escape without saving and return to the Log options.

Note: The *New Lot* option is available only for manual logging.

Alarm

This option allows the user to define two alarm limits for the measurements.

Alarm State

The following options are available:

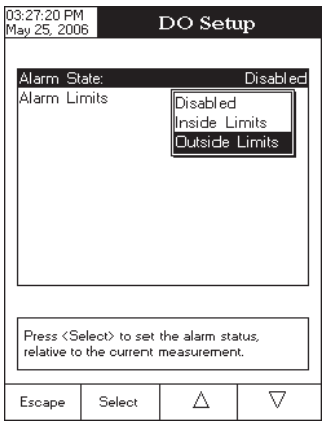
Disabled – the alarm will be disabled.

Inside Limits – the alarm will notify the user when the measured value is inside the preset limits.

Outside Limits – the alarm will notify the user when the measured value is outside the preset limits.

To set the alarm state:

- Use △ or ▽ to highlight the *Alarm State* option.
- Press Select and use △ or ▽ to highlight the desired option.
- Press Select to confirm your selection or press Escape to cancel operation.



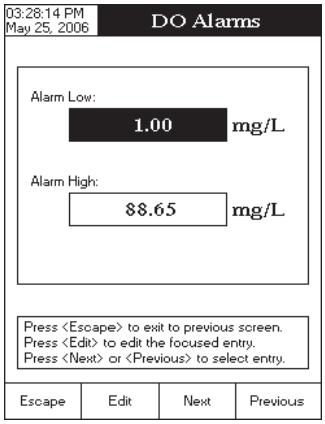
Alarm Limits

This option allows the user to set the alarm limits for the measured value.

Note: The alarm high value cannot be lower than the alarm low value.

To set the alarm limits:

- Highlight the *Alarm Limits* option and then press Select.
- Use Next or Previous to select the low / high alarm limit and then press Edit.
- Use △ or ▽ to increase / decrease the selected alarm value.
- Press Escape to return to the *Alarm* options.



BOD SETUP

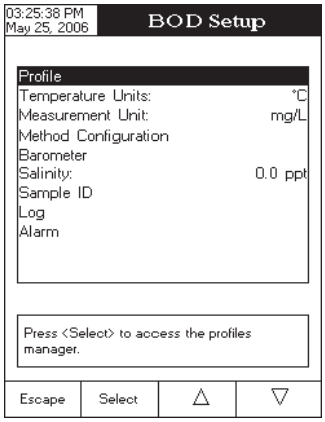
The BOD Setup menu allows the user to set the parameters related to the resistivity measurements.

Accessing BOD Setup

- Press [MODE] while in *Measure* mode and then [BOD] to select resistivity range.
- Press [SETUP] and then [BOD Setup] to access *BOD Setup* menu.

To access a *BOD Setup* option:

- Use [△] or [▽] to select the desired option.
- Press [Select] to confirm your selection.



The following is a description of the Resistivity Setup option screens.

Profile - see *DO Setup* section.

Temperature Units - see *DO Setup* section.

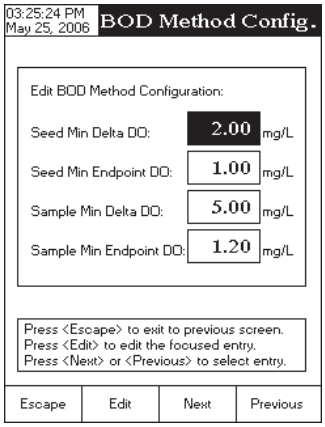
Measurement Unit - see *DO Setup* section.

Method Configuration

This option allows the user to edit the BOD method configuration.

To edit the options:

- Highlight the *Method Configuration* option and then press [Select].
- Use [Next] or [Previous] to select the parameter and then press [Edit].
- Use [△] or [▽] to increase / decrease the parameter value.
- Press [Escape] to return to the previous screen.



Barometer - see *DO Setup* section.

Salinity - see *DO Setup* section.

Sample ID - see *DO Setup* section.

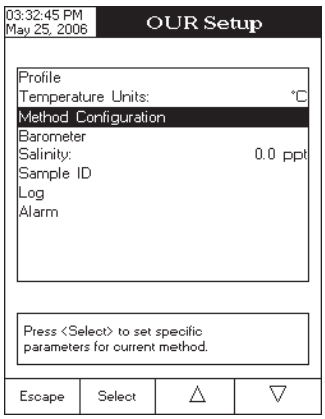
Log - see *DO Setup* section.

Alarm - see *DO Setup* section.

OUR SETUP

The OUR Setup menu allows the user to set the parameters related to the OUR measurement.

Accessing OUR Setup



- Press [MODE] while in *Measure* mode and then [OUR] to select OUR range.
- Press [SETUP] and then [OUR Setup] to access OUR Setup menu.

To access a OUR Setup option:

- Use [△] or [▽] to highlight the desired option.
- Press [Select] to access the selected option.

The following is a description of the OUR Setup option screens.

Profile - see *DO Setup* section.

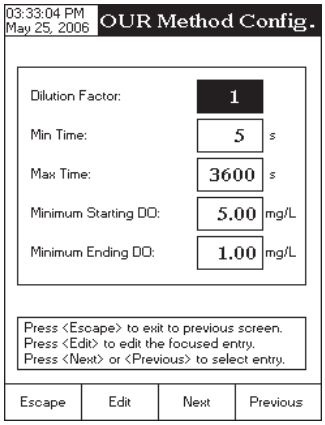
Temperature Units - see *DO Setup* section.

Method Configuration

This option allows the user to edit the OUR method configuration.

To edit the options:

- Highlight the *Method Configuration* option and then press [Select].
- Use [Next] or [Previous] to select the parameter and then press [Edit].
- Use [△] or [▽] to increase / decrease the parameter value.



Barometer - see *DO Setup* section.

Salinity - see *DO Setup* section.

Sample ID - see *DO Setup* section.

Log - see *DO Setup* section.

Alarm - see *DO Setup* section.

SOUR SETUP

The SOUR Setup menu allows the user to set the parameters related to SOUR measurement and calibration.

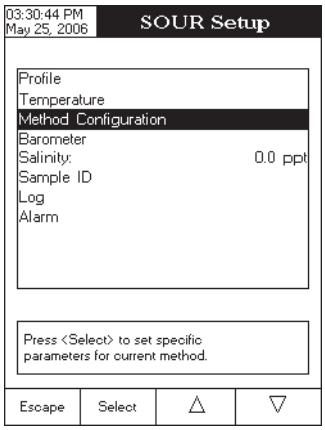
Accessing SOUR Setup

- Press [MODE] while in *Measure* mode and then [SOUR] to select *SOUR* range.
- Press [SETUP] and then [SOUR Setup] to access *SOUR Setup* menu.

To access an *SOUR Setup* option:

- Use [△] or [▽] to highlight the desired option.
- Press [Select] to access the selected option.

The following is a description of the *SOUR Setup* options.



Profile - see *DO Setup* section.

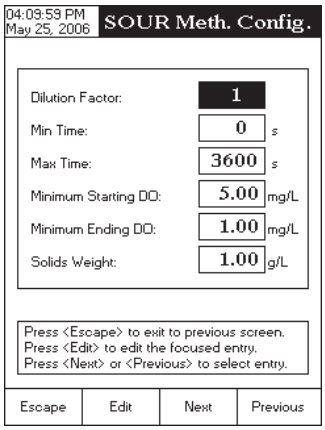
Temperature - see *DO Setup* section.

Method Configuration

This option allows the user to edit the SOUR method configuration.

To edit the options:

- Highlight the *Method Configuration* option and then press [Select].
- Use [Next] or [Previous] to select the parameter and then press [Edit].
- Use [△] or [▽] to increase / decrease the parameter value.
- Press [Escape] to return to the previous screen.



Barometer - see *DO Setup* section.

Salinity - see *DO Setup* section.

Sample ID - see *DO Setup* section.

Log - see *DO Setup* section.

Alarm - see *DO Setup* section.

DO CALIBRATION

It is recommended to calibrate the instrument frequently, especially if high accuracy is required.
The DO range should be recalibrated:

- Whenever the DO probe is replaced.
- At least once a week.
- Before BOD, OUR, SOUR measurements.
- After testing aggressive chemicals.
- When calibration reminder is activated ("DO Cal Expired").
- If the readings are far from the calibration point.

Note: BOD, OUR and SOUR readings are automatically derived from the DO readings and no specific calibration is needed.

The following options are available for the Dissolved Oxygen calibration:

- one point automatic zero calibration at 0% saturation or 0 mg/L
- one point automatic slope calibration at 100% saturation or 8.26 mg/L
- 1 point manual calibration using a standard value set by the user in % saturation or mg/L

When automatic calibrations are performed it is assumed that the standard value is the saturated DO value at 25 °C, 0 g/L salinity and 760 mmHg.
When manual calibrations are performed it is assumed that the standard value is the DO value at the current pressure, temperature and salinity.

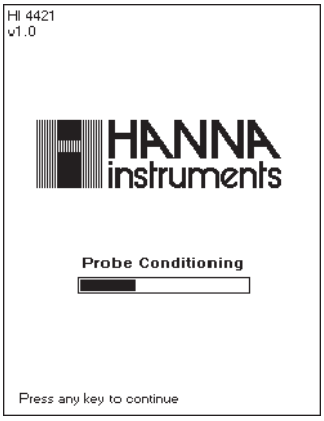
Initial preparation

Make sure the probe is ready for measurements, i.e. the membrane is filled with electrolyte and the probe is connected to the meter.
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 DO probe.
Make sure the salinity value has been set to the salinity of the standard.

Probe conditioning

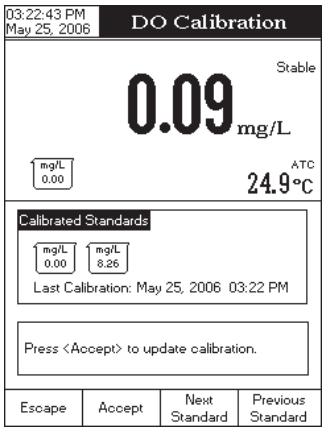
At startup, the probe is under polarization with a fixed voltage of approximately 800 mV for 1 minute.
Probe polarization is essential for stable measurements with the same recurring degree of accuracy.
With the probe properly polarized, oxygen is continually consumed when it passes through the sensitive diaphragm and dissolves in the electrolyte solution contained in the probe.
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 measurement is **incorrect**.

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



To calibrate the meter:

- Insert and rinse the probe in the first beaker in order to decontaminate it;
- Insert the probe in the second beaker;
- Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.
- Enter in calibration mode by pressing [CAL];
- Wait to stabilize;
- You can delete a previously performed calibration by pressing [Clear Cal].



When the automatic standard recognition is selected:

- The calibration point will be automatically selected from the two standards available.
- Press [Accept] to perform the calibration or [Escape] to exit calibration.

Note: If you want to perform automatic DO calibration in two points, perform the calibration at 0% saturation first and then at 100% saturation.

When the user standard is selected:

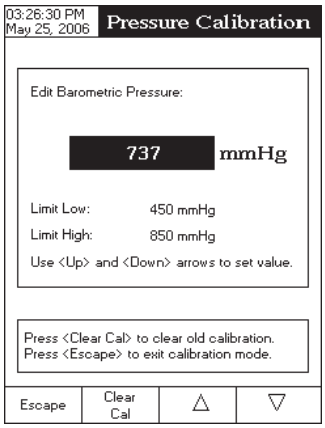
- The calibration can be performed only in one point.
- Edit the desired standard value by using [△] and [▽].
- Press [Accept] to finish the calibration or [Escape] to exit calibration.

PRESSURE CALIBRATION

If *Automatic* pressure source is chosen from the *Pressure Source* menu (see *DO Setup*), a pressure calibration in one point can be performed.

To perform pressure calibration:

- Press [Clear Cal] to clear the current calibration;
- Use [△] or [▽] to modify the pressure value;
- Press [Accept] to finish the calibration or [Escape] to exit calibration.



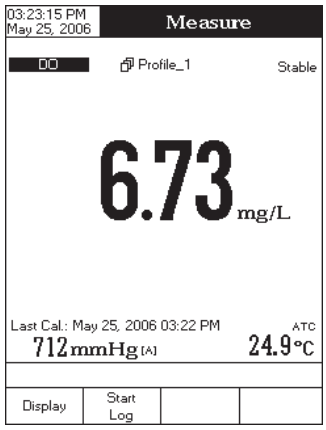
DO MEASUREMENT

Make sure the instrument has been calibrated before taking DO measurements.

DIRECT MEASUREMENT

To measure the DO of a sample using the Direct reading mode:

- Press MODE and then DO to select DO measure mode.
- Select the *Direct* reading mode (see *DO Setup*).
- Submerge the DO probe and tap it repeatedly to remove any air bubbles that may be trapped inside the sleeve. Allow time for the reading to stabilize.
- The measured DO value will be displayed together with the temperature and pressure values.

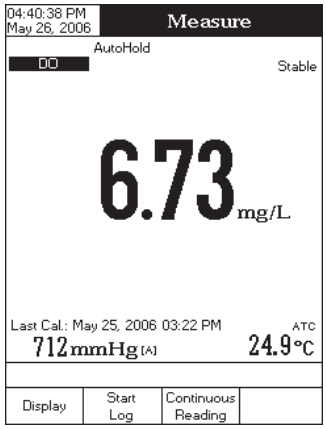


Notes:
- For accurate DO measurements, a water movement of 0.3 m/s is required. This is to ensure that the oxygen-depleted membrane surface is constantly replenished. A moving stream will provide adequate circulation.
- If the reading is out of range, "-----" will be displayed.

DIRECT/AUTOHOLD MEASUREMENT

To measure DO of a sample using the Direct/AutoHold reading mode:

- Select the Direct/AutoHold reading mode (see *DO Setup*).
- If pressing Auto Hold, the "AutoHold" indicator will start blinking on the display until the stability criterion is reached. The DO value will be frozen on the display, along with "AutoHold" indicator.
- To return to normal measure mode press Continuous Reading.



SALINITY COMPENSATION

If the sample contains significant concentration of salinity, the read out values must be corrected, taking into account the lower degree of oxygen solubility in this situation.

Before taking any DO measurements remember to set the salinity value from the DO setup menu.

The salinity affects the DO concentration, decreasing its value. The table below shows the maximum oxygen solubility at various temperatures and salinity levels.

°C	Salinity (g/l) at Sea Level					°F
	0 g/l	10 g/l	20 g/l	30 g/l	35 g/l	
0	14.60	13.64	12.74	11.90	11.50	32.0
2	13.81	12.91	12.07	11.29	10.91	36.5
4	13.09	12.25	11.47	10.73	10.38	39.2
6	12.44	11.65	10.91	10.22	9.89	42.8
8	11.83	11.09	10.40	9.75	9.44	46.4
10	11.28	10.58	9.93	9.32	9.03	50.0
12	10.77	10.11	9.50	8.92	8.65	53.6
14	10.29	9.68	9.10	8.55	8.30	57.2
16	9.86	9.28	8.73	8.21	7.97	60.8
18	9.45	8.90	8.39	7.90	7.66	64.4
20	9.08	8.56	8.07	7.60	7.38	68.0
22	8.73	8.23	7.77	7.33	7.12	71.6
24	8.40	7.93	7.49	7.07	6.87	75.2
25	8.24	7.79	7.36	6.95	6.75	77.0
26	8.09	7.65	7.23	6.83	6.64	78.8
28	7.81	7.38	6.98	6.61	6.42	82.4
30	7.54	7.14	6.75	6.39	6.22	86.0
32	7.29	6.90	6.54	6.19	6.03	89.6
34	7.05	6.68	6.33	6.01	5.85	93.2
36	6.82	6.47	6.14	5.83	5.68	96.8
38	6.61	6.28	5.96	5.66	5.51	100.4
40	6.41	6.09	5.79	5.50	5.36	104.0
42	6.22	5.93	5.63	5.35	5.22	107.6
44	6.04	5.77	5.48	5.21	5.09	111.2
46	5.87	5.61	5.33	5.07	4.97	114.8
48	5.70	5.47	5.20	4.95	4.85	118.4
50	5.54	5.33	5.07	4.83	4.75	122.0

Note: The relationship between salinity and chlorinity for sea water is given by the equation below:

$$\text{Salinity (g/l)} = 1.80655 \text{ Chlorinity (g/l)}$$

BAROMETRIC PRESSURE COMPENSATION

The dissolved oxygen saturation value varies with pressure, so it is important to compensate the effect that pressure has on DO measurements.

°C	Altitude, Meters above Sea Level															°F
	0 m	300 m	600 m	900 m	1200 m	1500 m	1800 m	2100 m	2400 m	2700 m	3000 m	3300 m	3600 m	3900 m	4000 m	
0	14.6	14.1	13.6	13.1	12.6	12.1	11.7	11.2	10.8	10.4	10.0	9.7	9.3	9.0	8.9	32.0
2	13.8	13.3	12.8	12.4	11.9	11.5	11.0	10.6	10.2	9.9	9.5	9.2	8.8	8.5	8.4	35.6
4	13.1	12.6	12.2	11.7	11.3	10.9	10.5	10.1	9.7	9.3	9.0	8.7	8.4	8.0	7.9	39.2
6	12.4	12.0	11.5	11.1	10.7	10.3	9.9	9.6	9.2	8.9	8.6	8.2	7.9	7.6	7.5	42.8
8	11.8	11.4	11.0	10.6	10.2	9.8	9.5	9.1	8.8	8.4	8.1	7.8	7.5	7.3	7.2	46.4
10	11.3	10.9	10.5	10.1	9.7	9.4	9.0	8.7	8.4	8.1	7.8	7.5	7.2	6.9	6.8	50.0
12	10.8	10.4	10.0	9.6	9.3	8.9	8.6	8.3	8.0	7.7	7.4	7.1	6.9	6.6	6.5	53.6
14	10.3	9.9	9.6	9.2	8.9	8.5	8.2	7.9	7.6	7.4	7.1	6.8	6.6	6.3	6.2	57.2
16	9.9	9.5	9.2	8.8	8.5	8.2	7.9	7.6	7.3	7.0	6.8	6.5	6.3	6.1	6.0	60.8
18	9.5	9.1	8.8	8.5	8.1	7.8	7.6	7.3	7.0	6.8	6.5	6.3	6.0	5.8	5.7	64.4
20	9.1	8.8	8.4	8.1	7.8	7.5	7.3	7.0	6.7	6.5	6.2	6.0	5.8	5.6	5.5	68.0
22	8.7	8.4	8.1	7.8	7.5	7.2	7.0	6.7	6.5	6.2	6.0	5.8	5.6	5.4	5.3	71.6
24	8.4	8.1	7.8	7.5	7.2	7.0	6.7	6.5	6.2	6.0	5.8	5.6	5.4	5.2	5.1	75.2
25	8.3	8.0	7.7	7.4	7.1	6.8	6.6	6.4	6.1	5.9	5.7	5.5	5.3	5.1	5.0	77.0
26	8.1	7.8	7.5	7.2	7.0	6.7	6.5	6.2	6.0	5.8	5.6	5.4	5.2	5.0	4.9	78.8
28	7.8	7.5	7.3	7.0	6.7	6.5	6.2	6.0	5.8	5.6	5.4	5.2	5.0	4.8	4.7	82.4
30	7.6	7.3	7.0	6.8	6.5	6.3	6.0	5.8	5.6	5.4	5.2	5.0	4.8	4.6	4.6	86.0
32	7.3	7.0	6.8	6.5	6.3	6.1	5.8	5.6	5.4	5.2	5.0	4.8	4.7	4.5	4.4	89.6
34	7.1	6.8	6.6	6.3	6.1	5.9	5.6	5.4	5.2	5.0	4.9	4.7	4.5	4.3	4.3	93.2
36	6.8	6.6	6.3	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.7	4.5	4.4	4.2	4.1	96.8
38	6.6	6.4	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.7	4.5	4.4	4.2	4.1	4.0	100.4
40	6.4	6.2	5.9	5.7	5.5	5.3	5.1	4.9	4.7	4.6	4.4	4.2	4.1	3.9	3.9	104.4
42	6.2	6.0	5.8	5.6	5.3	5.2	5.0	4.8	4.6	4.4	4.3	4.1	4.0	3.8	3.8	107.6
44	6.0	5.8	5.6	5.4	5.2	5.0	4.8	4.6	4.5	4.3	4.1	4.0	3.8	3.7	3.7	111.2
46	5.8	5.6	5.4	5.2	5.0	4.8	4.7	4.5	4.3	4.2	4.0	3.9	3.7	3.6	3.5	114.8
48	5.7	5.5	5.3	5.1	4.9	4.7	4.5	4.4	4.2	4.0	3.9	3.7	3.6	3.5	3.4	118.4
50	5.5	5.3	5.1	4.9	4.7	4.6	4.4	4.2	4.1	3.9	3.8	3.6	3.5	3.4	3.3	122.0

The meter contains a built-in barometer, and it is able to automatically compensate for changes in barometric pressure. If another pressure value than the barometer's reading is to be used, then the manual pressure feature must be enabled. (See *DO Setup*).

The table below contains a conversion altitude (m) to pressure (mmHg) for the altitude values from the previous table.

Altitude (m)	0	300	600	900	1200	1500	1800	2100	2400	2700	3000	3300	3600	3900	4000
Pressure (mmHg)	760	732	705	679	654	630	607	584	563	542	522	503	484	467	461

BOD MEASUREMENT

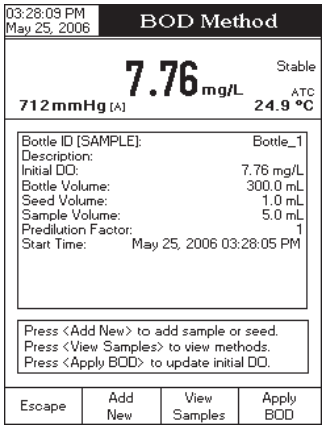
Biochemical oxygen demand (BOD) is an indicator for the concentration of biodegradable organic matter present in a sample of water. It can be used to determine the general quality of the water and its degree of pollution. BOD measures the rate of oxygen uptake by microorganisms in a sample of water at a fixed temperature and over a given period of time. To ensure that all other conditions are equal, a very small amount of microorganism seed is added to each sample being tested. This seed is typically generated by diluting activated sludge with deionized water. The samples are kept at 20 °C in the dark and tested for dissolved oxygen (DO) after five days. The loss of dissolved oxygen in the sample, once correction have been made for the degree of dilution, is called the BOD_5.

Before running an BOD measurement remember to set the BOD method configuration from the BOD setup menu and make sure the instrument has been calibrated on DO.

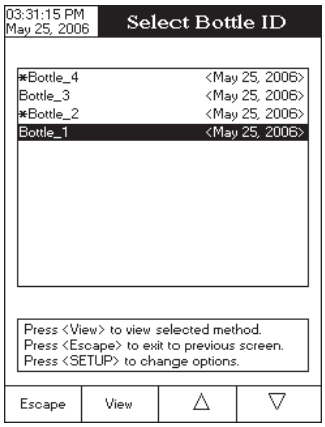
To take the BOD measurement:

- Press [MODE] and then [BOD] to select BOD measure mode.
- Press [Run BOD] to access the BOD data management screen.

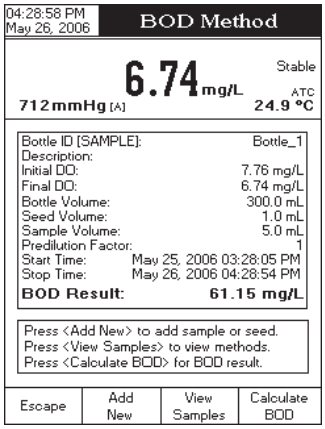
- Press [Add New] to add a new sample or a new seed. Select between [Add Sample] and [Add Seed].
- Press [Apply BOD] to repeat the initial DO measurement.
- Press [View Samples] to access the list of the samples and seeds available. The seed records will have the symbol "*" displayed before the bottle ID.



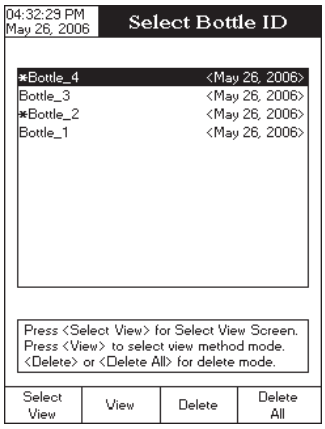
- Press [View] to display the BOD information screen corresponding to the selected bottle ID.
- Press [Evaluate BOD] to load the method data to the measurement screen.



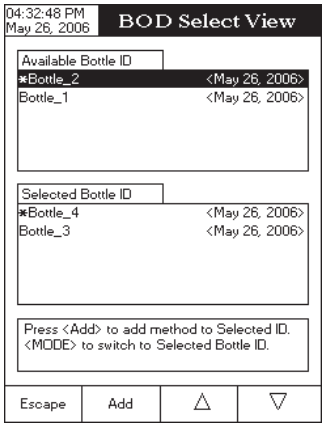
- If the time difference between the current reading and the selected reading is more than 1 day, [Calculate BOD] appears instead [Apply BOD] and the BOD value can be calculated.
- Press [Calculate BOD] to display the BOD value.



- If there are at least two BOD values calculated then you can press [SETUP] to enter the *Select Bottle ID* screen.
- Press [Select View] to access the *BOD Select View* screen.



- From the *Available Bottle ID* list select the desired bottle ID using △ or ▽ and press Add to add the method to the *Selected Bottle ID* list.
- Press Remove to delete a selected method from the *Selected Bottle ID* list.
- Press MODE to switch between the two lists.
- When in *Selected Bottle ID* list, press SETUP to access additionals options corresponding to the selected bottle ID.
- Press View Result for each sample to display the results containing the seed correction.



OUR MEASUREMENT

The OUR is used to determine the oxygen consumption or respiration rate. It is defined as the mg/L of oxygen consumed per hour.

The following equation is used for OUR determination:

$$OUR = \left(\frac{DO_{START} - DO_{END}}{t_{ELAPSED}}\right) \times \left(\frac{3600\ sec}{1h}\right) \times \left(\frac{total\ volume}{sample\ volume}\right)$$

where:
DO_{START} = Dissolved oxygen level at start of test
DO_{END} = Dissolved oxygen level at end of test
$t_{ELAPSED}$ = Elapsed time of test in seconds
total volume/sample volume = Dilution factor of sample

Before starting an OUR measurement remember to set the OUR configuration from the OUR setup menu and make sure the instrument has been calibrated on DO.

To measure the OUR of a sample:

- Press [MODE] and then [OUR] to select OUR measure mode.
- Press [Start OUR] to start taking the measurement.
- At the end of the measurement the meter will display the computed OUR value, the duration of the measurement and the pressure and temperature values.

SOUR MEASUREMENT

The Specific Oxygen Uptake Rate (SOUR), also known as the oxygen consumption or respiration rate, is defined as the milligram of oxygen consumed per gram of volatile suspended solids (VSS) per hour. This quick measurement has many advantages: rapid measure of influent organic load and biodegradability, indication of the presence of toxic or inhibitory wastes, degree of stability and condition of a sample, and calculation of oxygen demand rates at various points in the aeration basin.
The following equation is used for SOUR determination:

$$\text{SOUR} = \text{OUR} / \text{Solids Weight}$$

where:
OUR is the Oxygen Uptake Rate (see equation on the previous page)
Solids Weight is the *Total solids* or the *Volatile suspended solids* weight in g/L
Temperature correction:

The SOUR value is corrected to 20 °C (68 °F) according to the Farrel and Bhide equation:

$$SOUR_{20} = SOUR_T \times \Theta^{(20-T)}$$

Where T is the measured temperature in °C and Θ is a temperature dependent variable:

$$\Theta = 1.05 \text{ for T above 20 °C}$$
$$\Theta = 1.07 \text{ for T below 20 °C}$$

This calculation is valid only for temperature values in the range 10 to 30 °C. Temperature correction is performed only if the option **SOUR @20°C** is enabled. (see *Method Configuration* in *SOUR Setup*)
Before starting a SOUR measurement remember to set the SOUR configuration from the setup menu and make sure the instrument has been calibrated on DO.

To measure the SOUR of a sample:

- Press MODE and then SOUR to select OUR measure mode.
- Press Start SOUR to start taking the measurement.
- At the end of the measurement the meter will display the computed SOUR value, the duration of the measurement and the pressure and temperature values.

LOGGING

This feature allows the user to log DO, BOD, OUR, SOUR and temperature. The logging behaviour is dependent on the *Logging Type* and *Reading Mode* (DO only) options from the parameter setup.

The *Logging Data Configuration* options from the appropriate parameter setup must be set first in order to be saved into the log report.

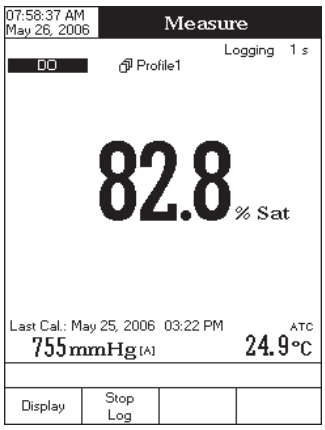
Regarding data logging, the available logging modes (DO only) are shown in the table below:

Logging Mode	Logging Type	Reading Mode
1	Automatic	Direct
2	Automatic	Direct/AutoHold
3	Manual	Direct
4	Manual	Direct/AutoHold
5	AutoHold	Direct/AutoHold

LOGGING MODE 1

This logging mode can be used to monitor a chemical reaction. By choosing this logging mode, [Start Log] will be available in *Measure* mode.

To log data using this mode:

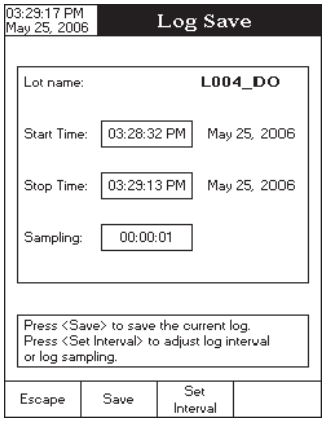


- Press [Start Log] while in *Measure* mode to start the logging session. The "Logging" and the Sampling Period indicators will be displayed on the LCD and data will be stored at the set sampling period.

Note: While automatic logging is running, the measured parameter setup is not available. A warning message will be displayed if the setup is accessed.

- If accessing Graph option while logging, the online graph can be visualized on the LCD (see *Display Mode* section).
- If accessing Log History option while logging, last logged data can be visualized on the LCD (see *Display Mode* section).
- To stop the logging session, press [Stop Log]. The Log Save screen will display the log lot ID, the settable log interval / sampling:
- Press [Set Interval] to adjust the log interval and / or the log sampling or press [Save] to save the current log.

- Press [Edit] to enter log interval edit menu and use [△] or [▽] to adjust the logging start-stop time or the log sampling. Press [Accept] to save the current value and use [Next] or [Previous] to adjust next / previous parameter.
- Press [Escape] to exit log interval edit menu and then press [Save] to save the current log.
- While the instrument is saving the data, a "Please wait..." pop-up message will be displayed on the LCD.



LOGGING MODE 2 (DO only)

This logging mode can be used for multiple samples measurement. By choosing this logging mode, [Start Log] and [Auto Hold] will be available in *Measure* mode.

To log data using this mode:

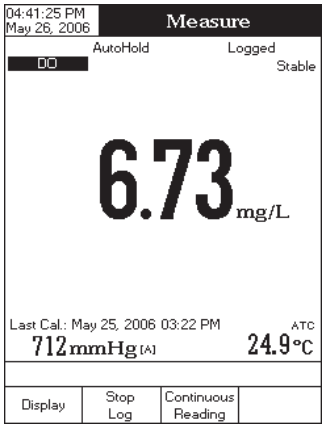
- Press [Start Log] while in *Measure* mode to start the logging session. When the measured value is frozen on the LCD by pressing [Auto Hold] and the stability criterion is reached, the logged value is the one that has been frozen on the LCD until returning to normal logging mode by pressing [Continuous Reading].
  The "Logging" and "AutoHold" indicators will be displayed on the LCD.
- To store another frozen value, press [Auto Hold] again.
- To stop the logging session, press [Stop Log].

LOGGING MODE 3

This logging mode can be used for any sample measurements. By choosing this logging mode, [Log] will be available in *Measure* mode.

To log data using this mode:

- Press [Log] while in *Measure* mode to manually log a record. The "Logged" indicator will be displayed on the LCD.
- The records will be stored in one lot. In order to change the logging lot, see the measured parameter setup for details, Log option, New Lot generation.



LOGGING MODE 4

This logging mode can be used for multiple samples measurement. By choosing this logging mode, [Log] and [Auto Hold] will be available in *Measure* mode.

To log data using this mode:

- Press [Log] while in *Measure* mode to manually log a record. Each value is logged at the time when the key was pressed. When the measured value is frozen on the LCD by pressing [Auto Hold] and the stability criterion is reached, the logged value is the one that has been frozen on the LCD.
- To store another frozen value, press [Continuous Reading] to return to normal logging mode and then [Auto Hold] again.
- The records will be stored in one lot. In order to change the logging lot, see the measured unit *Setup* for details, Log option, New Lot generation.

LOGGING MODE 5

This logging mode can be used for multiple samples measurement. By choosing this logging mode, [Start Log] and [Auto Hold] will be available in *Measure* mode.

Note: If the Reading Mode option is set as Direct and the Logging Mode 5 session is started, a warning pop-up will be displayed on the LCD, informing the user that the Reading Mode option must be set as Direct/ AutoHold in order to use this logging mode.

To log data using this mode:

- Press [Start Log] while in *Measure* mode to start the logging session. The logged values are only the ones frozen on the LCD, after [Auto Hold] was pressed and the stability criterion reached.
- To store another frozen value, press [Continuous Reading] to return to normal logging mode and then [Auto Hold] again.

• To stop the logging session, press [Stop Log].

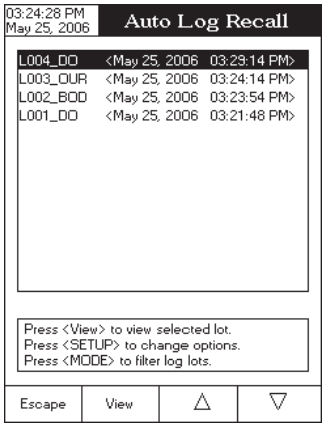
Notes: • For the automatic logging, if the maximum logging time (24h) has been reached, a warning pop-up will be displayed on the LCD in order to save the current log and start another one in a new lot.

• If 100 lots have been saved or maximum 10000 records have been manually stored, a warning pop-up will be displayed on the LCD in order to delete one lot or to select a new lot for the manual logging to log other records.

LOG RECALL

This feature allows the user to view all stored data. If no data were logged, the "No records were found" message will be displayed on the LCD in the Log Recall screen. Otherwise, the instrument will display all the memorized lots in accordance with the selected option: Automatic Log or Manual Log.

To view the memorized data:



• Press [SETUP] while in *Measure* mode.

• Press [Log Recall]. The "Choose Log Report Type" message will be displayed in the Reminder messages area.

• Press [Automatic Log] or [Manual Log] to select the desired Log Report type. All logged lots for the selected Log Report type will be displayed on the LCD.

• To filter the displayed lots, press [MODE] and then the desired unit [DO], [BOD], [OUR] or [SOUR]. Only the selected measurement unit lots will be displayed on the LCD.

• Select the desired lot with [△] or [▽] and press [View] to display the logged / report data from the highlighted lot. The "Please wait..." message will be displayed on the LCD for a short period. The user customised report will be displayed on the LCD.

Note: For automatic logging only, it is possible to view the plotted graph.

• Press [View Graph] to display the graph.

• By pressing [Shift Axes] it is possible to move the graph along the horizontal or vertical axis with the arrow keys.

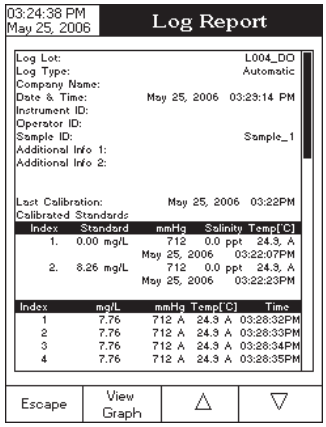
• If pressing [SETUP] while the graph is displayed, the zoom menu for the horizontal and vertical axes will be accessed. Press [Zoom Time] or [Zoom DO] / [Zoom BOD] / [Zoom OUR] / [Zoom SOUR] to switch between the active zooming axes and then zoom in or out on the selected axis by pressing the appropriate virtual key.

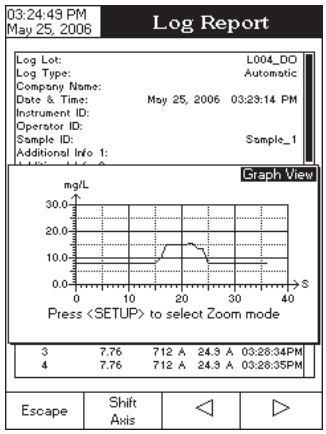
- Press [Escape] to return to the previous menu.

To delete lots:

- Press [SETUP] while in *Log Recall* mode.
- Press [Delete] or [Delete All] to access delete or delete all mode. Otherwise, press [View] to return to *Log Recall* view mode.
- After selecting one of the deleting modes, use [△] or [▽] to select one lot and then press [Delete] or [Delete All] to delete the selected lot or all lots. The "Please wait..." message will be displayed on the LCD until the selected lot or all lots are deleted.
- Press [SETUP] and then press [View] to exit deleting mode and return to *Log Recall* view mode.
- Press [Escape] to exit *Log Recall* mode and return to *Measure* mode.

Note: Logged lots should also be deleted whenever "Please Delete Old Log Files" or "Low Data Logging Space" message appears on the LCD, in the Reminder messages area.





PC INTERFACE

Data transmission from the instrument to the PC can be done with the **HI 92000** Windows® compatible software (optional). **HI 92000** also offers graphing and on-line help feature.

Data can be exported to the most popular spreadsheet programs for further analysis.

HI 4421 instrument has two available serial interfaces: RS232 and USB. The desired serial interface can be selected from the settings window of the **HI 92000** software.

If choosing the **RS232** serial interface, use the optional Hanna **HI 920010** cable connector to connect your instrument to a PC. Make sure that your instrument is switched off and then plug one connector to the instrument RS232 socket and the other one to the serial port of your PC.

Note: Other cables than **HI 920010** may use a different configuration. In this case, communication between instrument and PC may not be possible.

If choosing the **USB** serial interface, use a standard USB cable to connect your instrument to the PC.

For both serial interfaces, make sure that the instrument and the **HI 92000** software have the same baud rate and the appropriate communication port.

PROBE CONDITIONING & MAINTENANCE

The oxygen probe is made of reinforced plastic for maximum durability. A thermistor temperature sensor provides temperature measurements of the sample. Use the protective cap when not in use.

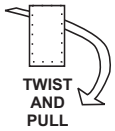


fig. 1

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

Remove the protective cap by gently twisting, and pulling 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 2 cm (1") of the probe in electrolyte for five minutes.

Rinse the new membrane cap, 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 tap directly the bottom 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.

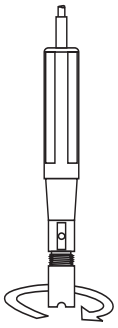


fig. 2

The Platinum cathode (#8 in the Probe Functional Description page 8) should always be bright and untarnished. If it is tarnished or stained, 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. Recalibrate the instrument.

TROUBLESHOOTING GUIDE

SYMPTOMS	PROBLEM	SOLUTION
Display shows "----" during measurements.	Reading out of range.	Recalibrate the meter; Check the sample is within the measurable range.
The meter fails to calibrate or gives faulty readings.	The probe is damaged.	Replace the probe.
The instrument doesn't measure the temperature from the probe.	The probe temperature sensor is broken.	Replace the probe.
Explicit warnings are displayed during calibration.	Dirty / damaged probe, contaminated standards.	Follow displayed instructions.
The instrument does not override the loading process.	Initializing / software error.	Restart the instrument using the power switch. If the error persists contact your vendor.
"Error Detected" pop-up at start up.	Initialization error.	Visualize the error (by pressing "Yes" key). Contact your vendor if critical error occurs.

ACCESSORIES

HI 7040M	Zero Oxygen Solution, 230 mL
HI 7040L	Zero Oxygen Solution, 500 mL
HI 7041S	Refilling Electrolyte Solution, 30 mL

PROBE CLEANING SOLUTIONS

HI 7061M	General Cleaning Solution, 230 mL bottle
HI 7061L	General Cleaning Solution, 500 mL bottle
HI 8061M	General Cleaning Solution, 230 mL FDA approved bottle
HI 8061L	General Cleaning Solution, 500 mL FDA approved bottle

OTHER ACCESSORIES

HI 76408	DO probe for laboratory use with built-in temperature sensor
HI 76407A/P	5 spare membranes
HI 710005/8	12Vdc voltage adapter (US plug)
HI 710006/8	12Vdc voltage adapter (European plug)
HI 920010	9 to 9-pin RS232 cable
HI 92000	Windows® compatible software

RECOMMENDATIONS FOR USERS

Before using these products, make sure they are entirely suitable for the environment in which they are used.

Operation of these instruments in residential areas could cause unacceptable interferences to radio and TV equipment, requiring the operator to follow all necessary steps to correct interferences.

During operation, ESD wrist straps should be worn to avoid possible damage to the probe by electrostatic discharges.

Any variation introduced by the user to the supplied equipment may degrade the instruments' EMC performance.

To avoid electrical shock, do not use these instruments when voltages at the measurement surface exceed 24 VAC or 60 VDC.

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

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