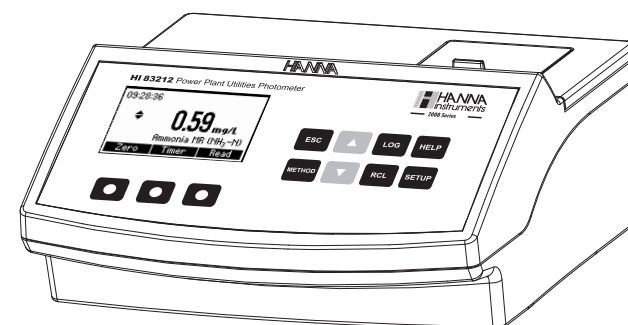


# HI 83212

## Multiparameter Bench Photometer for Power Plant Utilities



Dear Customer,

Thank you for choosing a Hanna product. Please read this instruction manual carefully before using the instrument. This manual will provide you with the necessary information for the correct use of the instrument. If you need additional technical information, do not hesitate to e-mail us at [tech@hannainst.com](mailto:tech@hannainst.com). This instrument is in compliance with **CE** directives.

## TABLE OF CONTENTS

PRELIMINARY EXAMINATION .....	3	TOTAL CHLORINE .....	24
ABBREVIATIONS .....	3	COPPER HR .....	27
GENERAL DESCRIPTION .....	3	COPPER LR .....	29
SPECIFICATIONS .....	4	HYDRAZINE .....	31
PRECISION AND ACCURACY .....	4	MOLYBDENUM .....	33
PRINCIPLE OF OPERATION .....	4	PHOSPHATE HR .....	36
FUNCTIONAL DESCRIPTION .....	6	PHOSPHATE LR .....	38
NEED TO KNOW .....	7	PHOSPHORUS .....	40
TIPS FOR AN ACCURATE MEASUREMENT .....	8	SILICA .....	42
HEALTH & SAFETY .....	11	SILVER .....	45
METHOD REFERENCE TABLE .....	11	ERRORS AND WARNINGS .....	48
OPERATIONAL GUIDE .....	12	DATA MANAGEMENT .....	49
SETUP .....	14	STANDARD METHODS .....	49
HELP MODE .....	16	ACCESSORIES .....	50
AMMONIA MR .....	17	WARRANTY .....	51
AMMONIA LR .....	19	HANNA LITERATURE .....	51
FREE CHLORINE .....	21		

## PRELIMINARY EXAMINATION

Please examine this product carefully. Make sure that the instrument is not damaged. If any damage occurred during shipment, please notify your Dealer.

Each Meter is supplied complete with:

- Two Sample Cuvettes and Caps
- Cloth for wiping cuvettes (4 pcs)
- Scissors
- AC/DC Power Adapter
- Instruction Manual

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

## ABBREVIATIONS

°C:	degree Celsius
EPA:	US Environmental Protection Agency
°F:	degree Fahrenheit
g/L:	grams per liter (ppt)
HR:	high range
LR:	low range
mg/L:	milligrams per liter (ppm)
mL:	milliliter
MR:	medium range
µg/L:	micrograms per liter (ppb)
PAN:	1-(2-pyridylazo)-2-naphthol
TPTZ:	2,4,6-tri-(2-pyridyl)-1,3,5-triazine

## GENERAL DESCRIPTION

**HI 83212** is a multiparameter bench photometer dedicated for Power Plant Utilities. It can measure 13 different methods using specific liquid or powder reagents. The amount of reagent is precisely dosed to ensure maximum reproducibility.

**HI 83212** bench photometer can be connected to a PC via an USB cable. The optional **HI 92000** Windows® Compatible Software helps users manage all their results.

## SPECIFICATIONS

<b>Light Life</b>	Life of the instrument
<b>Light Detector</b>	Silicon Photocell
<b>Environment</b>	0 to 50°C (32 to 122°F); max 90% RH non-condensing
<b>Power Supply</b>	external 12 Vdc power adapter built-in rechargeable battery
<b>Dimensions</b>	235 x 200 x 110 mm (9.2 x 7.87 x 4.33")
<b>Weight</b>	0.9 Kg

For specifications related to each method (e.g. range, precision, etc.) refer to the related measurement section.

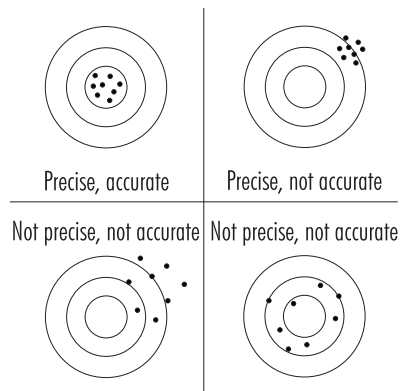
## PRECISION AND ACCURACY

**Precision** is how closely repeated measurements agree with each other. Precision is usually expressed as standard deviation (SD).

**Accuracy** is defined as the nearness of a test result to the true value.

Although good precision suggests good accuracy, precise results can be inaccurate. The figure explains these definitions.

For each method, the precision is expressed in the related measurement section as standard deviation at a specific concentration value of the analyte. The standard deviation is obtained with a single instrument using a representative lot of reagents.



## PRINCIPLE OF OPERATION

Absorption of Light is a typical phenomenon of interaction between electromagnetic radiation and matter. When a light beam crosses a substance, some of the radiation may be absorbed by atoms, molecules or crystal lattices.

If pure absorption occurs, the fraction of light absorbed depends both on the optical path length through the matter and on the physical-chemical characteristics of substance according to the Lambert-Beer Law:

$$-\log \frac{I}{I_0} = \epsilon_{\lambda} c d$$

or

$$A = \epsilon_{\lambda} c d$$

Where:

$$-\log \frac{I}{I_0} = \text{Absorbance (A)}$$

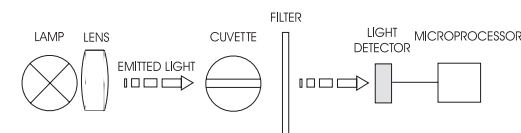
$I_0$  = intensity of incident light beam  
 $I$  = intensity of light beam after absorption  
 $\epsilon_{\lambda}$  = molar extinction coefficient at wavelength  $\lambda$   
 $c$  = molar concentration of the substance  
 $d$  = optical path through the substance

Therefore, the concentration "c" can be calculated from the absorbance of the substance as the other factors are known.

Photometric chemical analysis is based on the possibility to develop an absorbing compound from a specific chemical reaction between sample and reagents.

Given that the absorption of a compound strictly depends on the wavelength of the incident light beam, a narrow spectral bandwidth should be selected as well as a proper central wavelength to optimize measurements. The optical system of **HI 83212** is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

Four measuring channels allow a wide range of tests.



Instrument block diagram (optical layout)

A microprocessor controlled special tungsten lamp emits radiation which is first optically conditioned and beamed to the sample contained in the cuvette. The optical path is fixed by the diameter of the cuvette. Then the light is spectrally filtered to a narrow spectral bandwidth, to obtain a light beam of intensity  $-I_0-$  or  $-I-$ . The photoelectric cell collects the radiation  $-I-$  that is not absorbed by the sample and converts it into an electric current, producing a potential in the mV range.

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

The measurement process is carried out in two phases: first the meter is zeroed and then the actual measurement is performed.

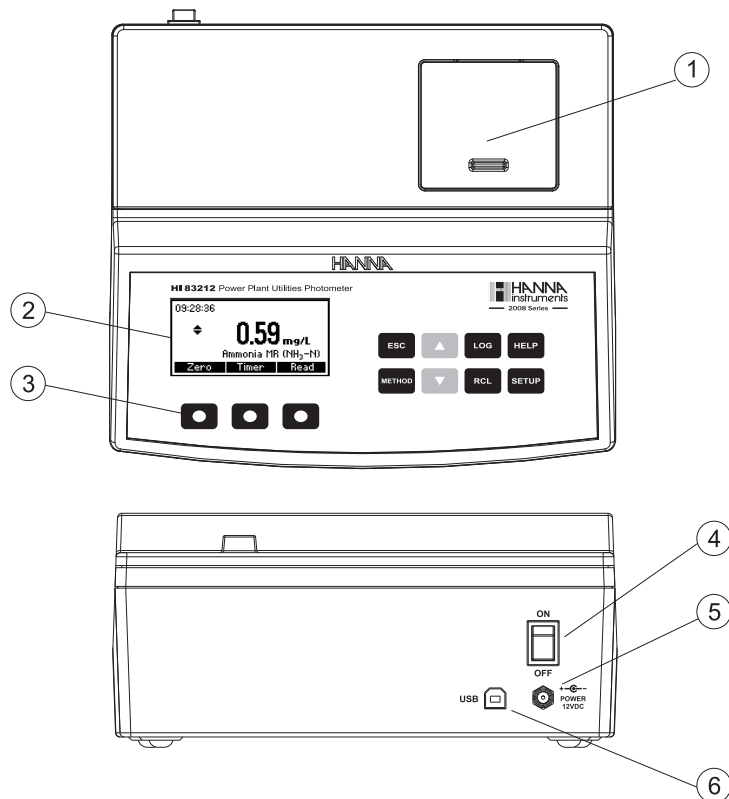
The cuvette has a very important role because it is an optical element and thus requires particular attention. It is important that both the measurement and the calibration (zeroing) cuvette are optically identical to provide the same measurement conditions. Most of methods use the same cuvette for both, so it is important that measurements are taken at the same optical point. The instrument and the cuvette cap have special marks that must be aligned in order to obtain better reproducibility.

The surface of the cuvette must be clean and not scratched. This is to avoid measurement interference due to unwanted reflection and absorption of light. It is recommended not to touch the cuvette walls with hands.

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

## FUNCTIONAL DESCRIPTION










### INSTRUMENT DESCRIPTION



- 1) Cuvette Lid
- 2) Liquid Crystal Display (LCD).
- 3) Splash proof keypad.
- 4) ON/OFF power switch
- 5) Power input connector
- 6) USB connector

### KEYPAD DESCRIPTION

The keypad contains 8 direct keys and 3 functional keys with the following functions:

-  Press to perform the function displayed above it. The functions are screen related.
-  Press to exit the current screen.
-  Press to access the select method menu.
-  Press to move up in a menu or a help screen, to increment a set value, to access second level functions.
-  Press to move down in a menu or a help screen, to decrement a set value, to access second level functions.
-  Press to log the current reading.
-  Press to recall the log.
-  Press to display the help screen.
-  Press to access the setup screen.

## NEED TO KNOW

HI 83212 has a powerful interactive user support that assists the user during the analysis process. Each step in the measurement process is help supported. A tutorial mode is available in the Setup Menu.

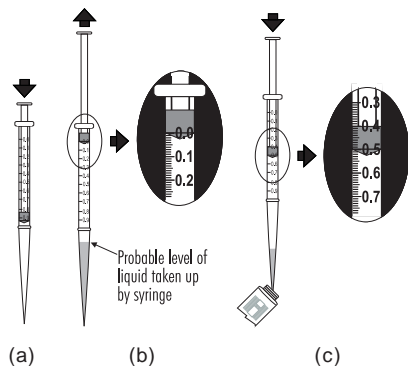
## TIPS FOR AN ACCURATE MEASUREMENT

The instructions listed below should be carefully followed during testing to ensure most accurate results.

- Color or suspended matter in large amounts may cause interference, they should be removed by treatment with active carbon and filtration.
- Ensure the cuvette is filled correctly: the liquid in the cuvette forms a convexity on the top; the bottom of this convexity must be at the same level of the 10 mL mark.

## COLLECTING AND MEASURING SAMPLES

- In order to measure exactly 0.5 mL of reagent with the 1 mL syringe:
  - (a) push the plunger completely into the syringe and insert the tip into the solution.
  - (b) pull the plunger up until the lower edge of the seal is exactly on the 0.0 mL mark.
  - (c) take out the syringe and clean the outside of the syringe tip. Be sure that no drops are hanging on the tip of the syringe, if so eliminate them. Then, keeping the syringe in vertical position above the cuvette, push the plunger down into the syringe until the lower edge of the seal is exactly on the 0.5 mL mark. Now the exact amount of 0.5 mL has been added to the cuvette, even if the tip still contains some solution.

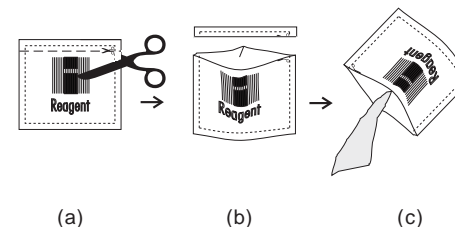


## USING LIQUID AND POWDER REAGENTS

- Proper use of the dropper:
  - (a) for reproducible results, tap the dropper on the table for several times and wipe the outside of the dropper tip with a cloth.
  - (b) always keep the dropper bottle in a vertical position while dosing the reagent.

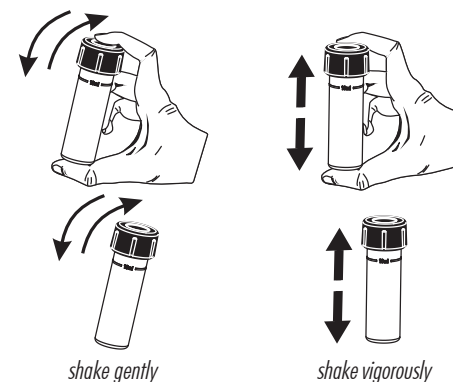


- Proper use of the powder reagent packet:
  - (a) use scissors to open the powder packet;
  - (b) push the edges of the packet to form a spout;
  - (c) pour out the content of the packet.

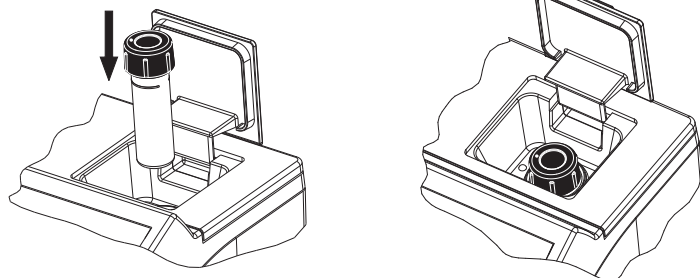


## USING CUVETTES

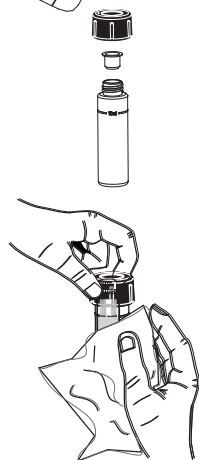
- Proper mixing of the cuvette is done by **shaking the cuvette**, moving the cuvette up and down. The movement may be gentle or vigorous. This mixing method is indicated with "shake gently" or "shake vigorously", and one of the following icons:



Pay attention to push the cuvette completely down in the holder.



- In order to avoid reagent leaking and to obtain more accurate measurements, close the cuvette first with the supplied HDPE plastic stopper and then the black cap.
- Whenever the cuvette is placed into the measurement cell, it must be dry outside, and free of fingerprints, oil or dirt. Wipe it thoroughly with **HI 731318** or a lint-free cloth prior to insertion.
- Shaking the cuvette can generate bubbles in the sample, causing higher readings. To obtain accurate measurements, remove such bubbles by swirling or by gently tapping the cuvette.
- Do not let the reacted sample stand too long after reagent is added, or accuracy will be lost.
- It is possible to take multiple readings in a row, but it is recommended to take a new zero reading for each sample and to use the same cuvette for zeroing and measurement when possible (for most precise results follow the measurement procedures carefully).
- Discard the sample immediately after the reading is taken, or the glass might become permanently stained.
- All the reaction times reported in this manual are at 20°C (68°F). As a general rule of thumb, they should be doubled at 10°C (50°F) and halved at 30°C (86°F).



### REAGENT BLANK CORRECTION

- Some methods require a "reagent blank correction". The blank and the sample are prepared exactly in the same way, only the blank is deionized water instead of sample. A blank cuvette may be used more than once: stability and storing conditions are described for each method in the related chapter.

### INTERFERENCES

- In the method measurement section the most common interferences that may be present in an average wastewater matrix have been reported. It may be that for a particular treatment process other compounds do interfere with the method of analysis.

## HEALTH & SAFETY



The chemicals contained in the reagent kits may be hazardous if improperly handled. Read the Material Safety Data Sheet (MSDS) before performing tests.

**Safety equipment:** Wear suitable eye protection and clothing when required, and follow instructions carefully.

**Reagent spills:** If a reagent spill occurs, wipe up immediately and rinse with plenty of water.

If reagent contacts skin, rinse the affected area thoroughly with water. Avoid breathing released vapors.

## METHOD REFERENCE TABLE

### HI83212 - POWER PLANT UTILITIES

Method	Method description	Page
1	Ammonia MR	17
2	Ammonia LR	19
3	Free Chlorine	21
4	Total Chlorine	24
5	Copper HR	27
6	Copper LR	29
7	Hydrazine	31

Method	Method description	Page
8	Molybdenum	33
9	Phosphate HR	36
10	Phosphate LR	38
11	Phosphorus	40
12	Silica	42
13	Silver	45

## OPERATIONAL GUIDE

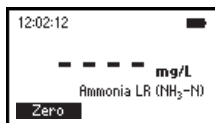
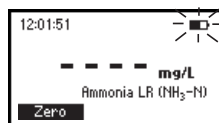
### POWER CONNECTION AND BATTERY MANAGEMENT

The meter can be powered from an AC/DC adapter (included) or from the built-in rechargeable battery.

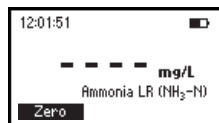
**Note:** Always turn the meter off before unplugging it to ensure no data is lost.

When the meter switches ON, it verifies if the power supply adapter is connected. The battery icon on the LCD will indicate the battery status:

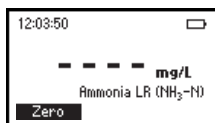
- battery is charging from external adapter
- battery fully charged (meter connected to AC/DC adapter)



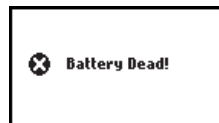
- battery capacity (no external adapter)



- battery Low (no external adapter)

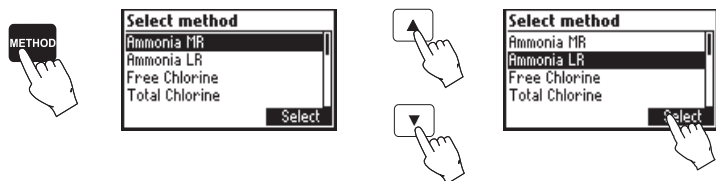


- battery Dead (no external adapter)



### METHOD SELECTION

- Turn ON the instrument via the ON/OFF power switch.
- The meter will perform an autodiagnostic test. During this test, the Hanna Instrument logo will appear on the LCD. After 5 seconds, if the test was successful, the last selected method will appear on the display.
- In order to select the desired method press **METHOD** and a screen with the available methods will appear.
- Press **▲ ▼** keys to highlight the desired method. Press **Select**.

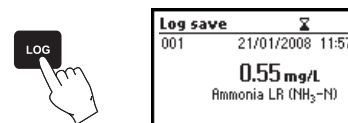


- After the desired method was selected, follow the measurement described in the related section.
- Before performing a test you should read all the instructions carefully.

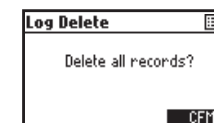
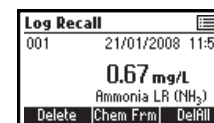
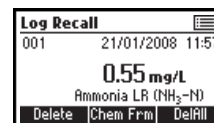
### DATA MANAGEMENT

The instrument features a data log function to help you keep track of all your analysis. The data log can hold 200 individual measurements. Storing, viewing and deleting the data is possible using **LOG** and **RCL** keys.

**Storing data:** You can store only a valid measurement. Press **LOG** and the last valid measurement will be stored in a stack as a record with date and time stamps.

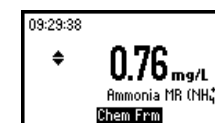
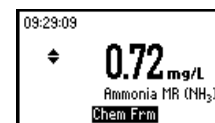


**Viewing and deleting:** You can view and delete the data log by pressing the **RCL** key. Deleting is based on the LIFO (last in, first out) scheme. Additionally, you can delete the data records all at once.



### CHEMICAL FORM

Chemical form conversion factors are pre-programmed into the instrument and are method specific. In order to view the displayed result in the desired chemical form press the **▲** or **▼** to access to the second level of functions and then press the **Chem Frm** functional key to toggle between the existing chemical forms for the selected method.



## SETUP

In the Setup mode the instrument's parameters can be changed. Some parameters affect the measuring sequence and others are general parameters that change the behavior or appearance of the instrument.

Press **SETUP** to enter the setup mode.

Press **ESC** or **SETUP** to return to the main screen.

A list of setup parameters will be displayed with currently configured settings. Press **HELP** for additional information.

Press the **▲ ▼** keys to select the parameter and select a new value as follows:



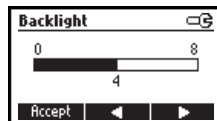
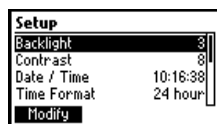
### Backlight

Values: 0 to 8.

Press **Modify** functional key to access the backlight value.

Use the **◀▶** functional keys or the **▲ ▼** keys to increase/decrease the value.

Press **Accept** functional key to confirm or **ESC** to return to the setup menu without saving the new value.



### Contrast

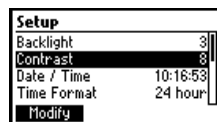
Values: 0 to 20.

This option is used to set the display's contrast.

Press **Modify** functional key to change the display's contrast.

Use the **◀▶** functional keys or the **▲ ▼** keys to increase/decrease the value.

Press **Accept** functional key to confirm the value or **ESC** to return to the setup menu without saving the new value.



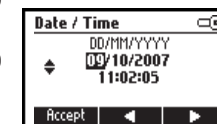
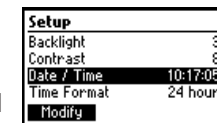
### Date / Time

This option is used to set the instrument's date and time.

Press **Modify** functional key to change the date/time.

Press the **◀▶** functional keys to highlight the value to be modified (year, month, day, hour, minute or second). Use the **▲ ▼** keys to change the value.

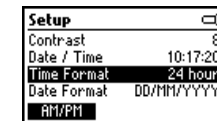
Press **Accept** functional key to confirm or **ESC** to return to the setup without saving the new date or time.



### Time format

Option: AM/PM or 24 hour.

Press the functional key to select the desired time format.

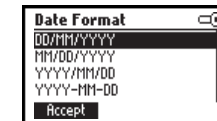
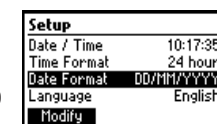


### Date format

Press **Modify** functional key to change the Date Format.

Use the **▲ ▼** keys to select the desired format.

Press **Accept** functional key to confirm or **ESC** to return to the setup menu without saving the new format.



### Language

Press the corresponding functional key to change the option.

If the new selected language cannot be loaded, the previously selected language will be reloaded.

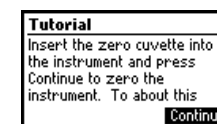
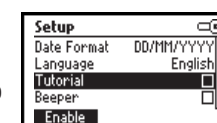


### Tutorial

Option: Enable or Disable.

If enabled this option will provide the user short guides, related to the current screen.

Press the functional key to enable/disable the tutorial mode.



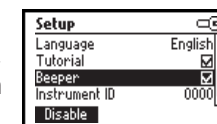
### Beeper

Option: Enable or Disable.

When enabled, a short beep is heard every time a key is pressed.

A long beep alert sounds when the pressed key is not active or an error is detected.

Press the functional key to enable/disable the beeper.





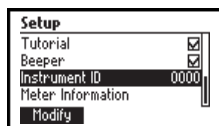
## Instrument ID

Option: 0 to 9999.

This option is used to set the instrument's ID (identification number). The instrument ID is used while exchanging data with a PC.

Press **Modify** functional key to access the instrument ID screen. Press the ▲ ▼ keys in order to set the desired value.

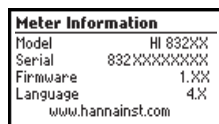
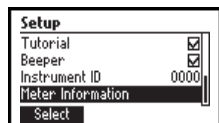
Press **Accept** functional key to confirm the value or **ESC** to return to the setup menu without saving the new value.



## Meter information

Press "Select" functional key to view the Instrument model, firmware version, language version and instrument serial number.

Press **ESC** to return to the Setup mode.



## HELP MODE

HI 83212 offers an interactive contextual help mode that assists the user at any time.

To access help screens press **HELP**.

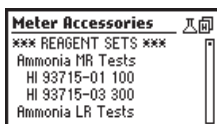
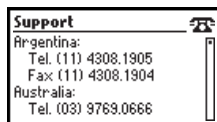
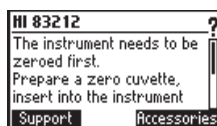
The instrument will display additional information related to the current screen. To read all available data, scroll the text using the ▲ ▼ keys.

Press **Support** functional key to access a screen with Hanna service centers and their contact details.

Press **Accessories** functional key to access a page with instrument accessories.

To exit support or accessories screens press **ESC** and the instrument will return to the previous help screen.

To exit help mode just press **HELP** or **ESC** key again and the meter will display the last screen the user was in before entering help mode.



## AMMONIA MEDIUM RANGE

### SPECIFICATIONS

Range	0.00 to 10.00 mg/L
Resolution	0.01 mg/L
Accuracy	±0.05 mg/L ±5% of reading
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 420 nm
Method	Adaptation of the <i>ASTM Manual of Water and Environmental Technology, D1426-92</i> , Nessler method. The reaction between ammonia and reagents causes a yellow tint in the sample.

### REQUIRED REAGENTS

Code	Description	Quantity
HI 93715A-0	First Reagent	4 drops (6 drops for seawater)
HI 93715B-0	Second Reagent	4 drops (10 drops for seawater)

### REAGENT SETS

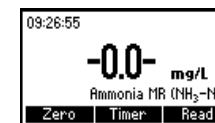
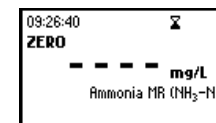
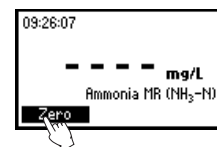
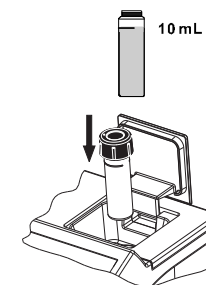
HI 93715-01 Reagents for 100 tests

HI 93715-03 Reagents for 300 tests

For other accessories see page 50.

### MEASUREMENT PROCEDURE

- Select the *Ammonia MR* method using the procedure described in the *Method Selection* section (see page 12).
- Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.
- Place the cuvette into the holder and close the lid.
- Press **ZERO** key. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



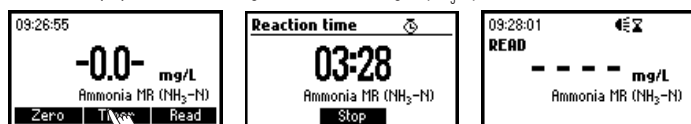
- Remove the cuvette.

- Add 4 drops of HI 93715A-0 First Reagent (6 drops for seawater analysis). Replace the cap and mix the solution.

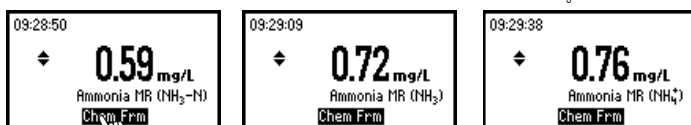
- Add 4 drops of HI 93715B-0 Second Reagent (10 drops for seawater analysis). Replace the cap and mix the solution.

- Reinsert the cuvette into the instrument.

- Press **TIMER** and the display will show the countdown prior to the measurement or, alternatively, wait for 3 minutes and 30 seconds and press **READ**. When the timer ends the meter will perform the reading. The instrument displays the results in mg/L of ammonia nitrogen ( $\text{NH}_3\text{-N}$ ).



- Press the  $\blacktriangle$  or  $\blacktriangledown$  to access the second level of functions.
- Press the **Chem Frm** functional key to convert the result in mg/L of ammonia ( $\text{NH}_3$ ) and ammonium ( $\text{NH}_4^+$ ).

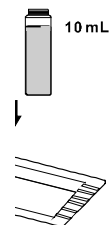
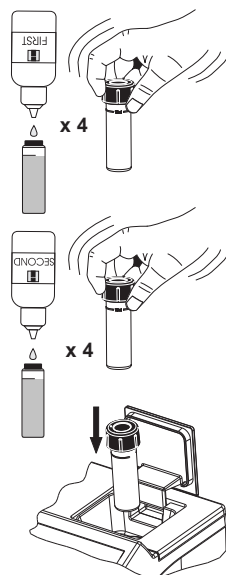


- Press the  $\blacktriangle$  or  $\blacktriangledown$  to go back to the measurement screen.

## INTERFERENCES

Interference may be caused by:

acetone, alcohols, aldehydes, glycine, hardness above 1 g/L, iron, organic chloramines, sulfide, various aliphatic and aromatic amines.



## AMMONIA LOW RANGE

### SPECIFICATIONS

Range	0.00 to 3.00 mg/L
Resolution	0.01 mg/L
Accuracy	$\pm 0.04$ mg/L $\pm 4\%$ of reading
Typical EMC Deviation	$\pm 0.01$ mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 420 nm
Method	Adaptation of the <i>ASTM Manual of Water and Environmental Technology, D1426-92</i> , Nessler method. The reaction between ammonia and reagents causes a yellow tint in the sample.

### REQUIRED REAGENTS

Code	Description	Quantity
HI 93700A-0	First Reagent	4 drops (6 drops for seawater)
HI 93700B-0	Second Reagent	4 drops (10 drops for seawater)

### REAGENT SETS

HI 93700-01 Reagents for 100 tests

HI 93700-03 Reagents for 300 tests

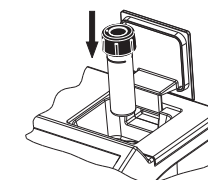
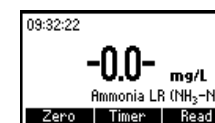
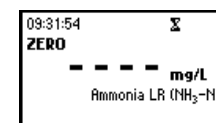
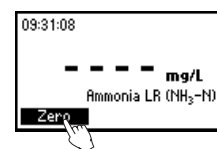
For other accessories see page 50.

### MEASUREMENT PROCEDURE

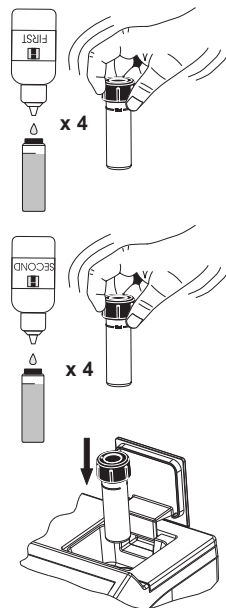
- Select the *Ammonia LR* method using the procedure described in the *Method Selection* section (see page 12).
- Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.

- Place the cuvette into the holder and close the lid.

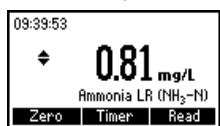
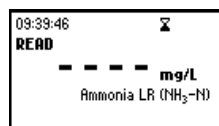
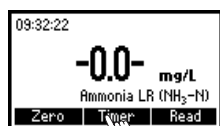
- Press **ZERO** key. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



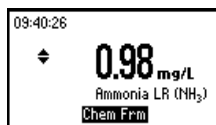
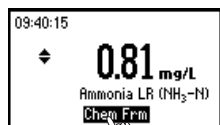
- Remove the cuvette.
- Add 4 drops of HI 93700A-0 First Reagent (6 drops for seawater analysis). Replace the cap and mix the solution.
- Add 4 drops of HI 93700B-0 Second Reagent (10 drops for seawater analysis). Replace the cap and mix the solution.
- Reinsert the cuvette into the instrument.



- Press **TIMER** and the display will show the countdown prior to the measurement or, alternatively, wait for 3 minutes and 30 seconds and press **READ**. When the timer ends the meter will perform the reading. The instrument displays the results in mg/L of ammonia nitrogen ( $\text{NH}_3\text{-N}$ ).



- Press the  $\blacktriangle$  or  $\blacktriangledown$  to access the second level of functions.
- Press the **Chem Frm** functional key to convert the result in mg/L of ammonia ( $\text{NH}_3$ ) and ammonium ( $\text{NH}_4^+$ ).



- Press the  $\blacktriangle$  or  $\blacktriangledown$  to go back to the measurement screen.

## INTERFERENCES

Interference may be caused by: acetone, alcohols, aldehydes, glycine, hardness above 1 g/L, iron, organic chloramines, sulfide, various aliphatic and aromatic amines.

## FREE CHLORINE

### SPECIFICATIONS

Range	0.00 to 2.50 mg/L
Resolution	0.01 mg/L
Accuracy	$\pm 0.03$ mg/L $\pm 3\%$ of reading
Typical EMC Deviation	$\pm 0.01$ mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the <i>EPA DPD method 330.5</i> . The reaction between free chlorine and the DPD reagent causes a pink tint in the sample.

### REQUIRED REAGENTS

#### POWDER:

Code	Description	Quantity
HI 93701-0	DPD	1 packet

#### LIQUID:

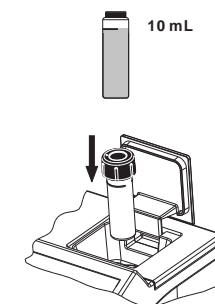
Code	Description	Quantity
HI 93701A-F	DPD1 Indicator	3 drops
HI 93701B-F	DPD1 Buffer	3 drops

### REAGENT SETS

- HI 93701-F Reagents for 300 tests (liquid)
  - HI 93701-01 Reagents for 100 tests (powder)
  - HI 93701-03 Reagents for 300 tests (powder)
- For other accessories see page 50.

### MEASUREMENT PROCEDURE

- Select the *Free Chlorine* method using the procedure described in the *Method Selection* section (see page 12).
- Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.
- Place the cuvette into the holder and close the lid.



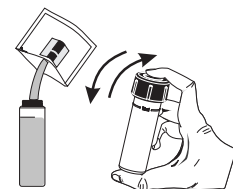
- Press ZERO key. The meter will show “-0.0-” when the meter is zeroed and ready for measurement.



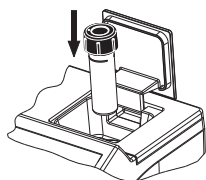
- Remove the cuvette.

### Powder reagents procedure

- Add the content of one packet of HI 93701 DPD reagent. Replace the cap and shake gently for 20 seconds (or 2 minutes for seawater analysis).



- Wait for a minute to allow the undissolved reagent to precipitate and reinsert the cuvette into the instrument.

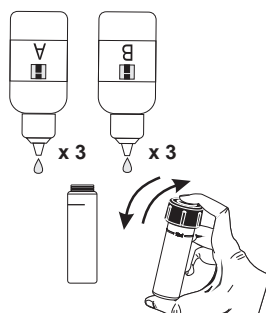


- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 1 minute and press READ. When the timer ends the meter will perform the reading. The instrument displays the results in mg/L of free chlorine.

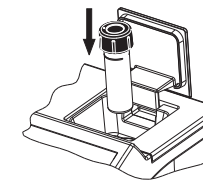


### Liquid reagents procedure

- To an empty cuvette add 3 drops of HI 93701A-F DPD1 indicator and 3 drops of HI 93701B-F DPD1 buffer. Swirl gently to mix, and immediately add 10 mL of unreacted sample. Replace the cap and shake gently again.



- Reinsert the cuvette into the instrument.



- Press READ to start the reading. The instrument displays the results in mg/L of free chlorine.



### INTERFERENCES

Interference may be caused by: Bromine, Iodine, Ozone, Oxidized forms of Chromium and Manganese. In case of water with hardness greater than 500 mg/L CaCO<sub>3</sub>, shake the sample for approximately 2 minutes after adding the powder reagent.

In case of water with alkalinity greater than 250 mg/L CaCO<sub>3</sub> or acidity greater than 150 mg/L CaCO<sub>3</sub>, the color of the sample may develop only partially, or may rapidly fade. To resolve this, neutralize the sample with diluted HCl or NaOH.

## TOTAL CHLORINE

### SPECIFICATIONS

Range	0.00 to 3.50 mg/L
Resolution	0.01 mg/L
Accuracy	±0.03 mg/L ±3% of reading
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the <i>EPA DPD method 330.5</i> . The reaction between the chlorine and the DPD reagent causes a pink tint in the sample.

### REQUIRED REAGENTS

#### POWDER:

Code	Description	Quantity
HI 93711-0	DPD	1 packet

#### LIQUID:

Code	Description	Quantity
HI 93701A-T	DPD1 indicator	3 drops
HI 93701B-T	DPD1 buffer	3 drops
HI 93701C	DPD3 solution	1 drop

### REAGENT SETS

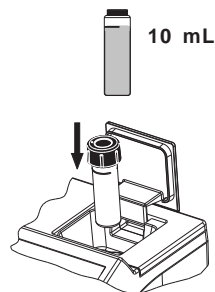
- HI 93701-T Reagents for 300 total chlorine tests (liquid)
- HI 93711-01 Reagents for 100 total chlorine tests (powder)
- HI 93711-03 Reagents for 300 total chlorine tests (powder)

For other accessories see page 50.

### MEASUREMENT PROCEDURE

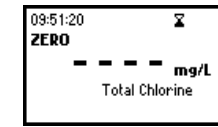
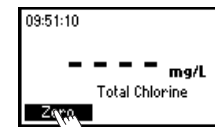
- Select the *Total Chlorine* method using the procedure described in the *Method Selection* section (see page 12).

- Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.



- Place the cuvette into the holder and close the lid.

- Press ZERO key. The meter will show “-0.0-” when the meter is zeroed and ready for measurement.



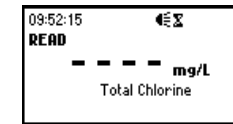
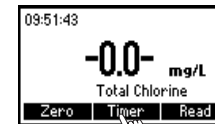
- Remove the cuvette.

#### Powder reagents procedure

- Add 1 packet of HI 93711 DPD reagent. Replace the cap and shake gently for 20 seconds (or 2 minutes for seawater analysis).

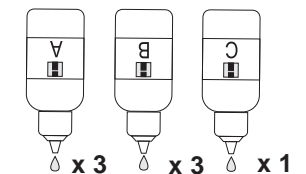
- Reinsert the cuvette into the instrument.

- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 2 minutes and 30 seconds and press READ. When the timer ends the meter will perform the reading. The instrument displays the results in mg/L of total chlorine.

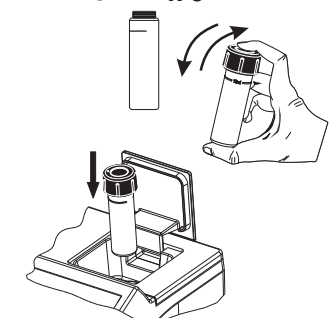


#### Liquid reagents procedure

- To an empty cuvette add 3 drops of HI 93701A-T DPD1 indicator, 3 drops of HI 93701B-T DPD1 buffer and 1 drop of HI 93701C DPD3 solution. Swirl gently to mix and immediately add 10 mL of unreacted sample. Replace the cap and shake gently again.



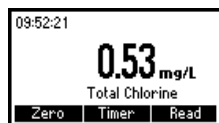
- Reinsert the cuvette into the instrument.



- Press **TIMER** and the display will show the countdown prior to the measurement or, alternatively, wait for 2 minutes and 30 seconds and press **READ**. When the timer ends the meter will perform the reading.



- The instrument displays the results in mg/L of total chlorine.



Note: free and total chlorine have to be measured separately with fresh unreacted samples following the related procedure if both values are requested.

## INTERFERENCES

Interference may be caused by: Bromine, Iodine, Ozone, Oxidized forms of Chromium and Manganese.

In case of water with hardness greater than 500 mg/L  $\text{CaCO}_3$ , shake the sample for approximately 2 minutes after adding the powder reagent.

In case of water with alkalinity greater than 250 mg/L  $\text{CaCO}_3$  or acidity greater than 150 mg/L  $\text{CaCO}_3$ , the color of the sample may develop only partially, or may rapidly fade. To resolve this, neutralize the sample with diluted HCl or NaOH.

## COPPER HIGH RANGE

### SPECIFICATIONS

Range	0.00 to 5.00 mg/L
Resolution	0.01 mg/L
Accuracy	$\pm 0.02$ mg/L $\pm 4\%$ of reading
Typical EMC Deviation	$\pm 0.01$ mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 575 nm
Method	Adaptation of the <i>EPA method</i> . The reaction between copper and the bicinchoninate reagent causes a purple tint in the sample.

### REQUIRED REAGENTS

Code	Description	Quantity
HI 93702-0	Bicinchoninate	1 packet

### REAGENT SETS

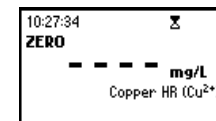
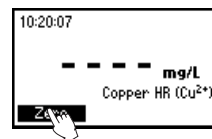
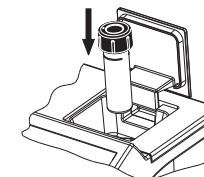
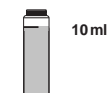
**HI 93702-01** Reagents for 100 tests

**HI 93702-03** Reagents for 300 tests

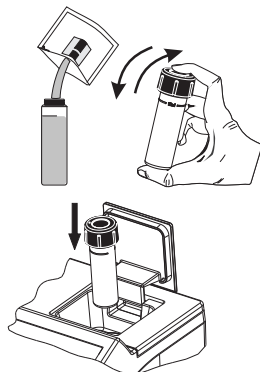
For other accessories see page 50.

### MEASUREMENT PROCEDURE

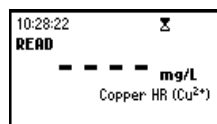
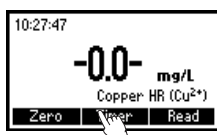
- Select the *Copper HR* method using the procedure described in the *Method Selection* section (see page 12).
- Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.
- Place the cuvette into the holder and close the lid.
- Press **ZERO** key. The meter will show “-0.0-” when the meter is zeroed and ready for measurement.



- Remove the cuvette.
- Add the content of one packet of HI 93702-0 Bicinchoninate. Replace the cap and shake gently for about 15 seconds.



- Reinsert the cuvette into the instrument.
- Press **TIMER** and the display will show the countdown prior to the measurement or, alternatively, wait for 45 seconds and press **READ**. When the timer ends the meter will perform the reading.



- The instrument displays the results in mg/L of copper.



## INTERFERENCES

Interference may be caused by:

Silver  
Cyanide

For samples overcoming buffering capacity of reagent (around pH 6.8), pH should be adjusted between 6 and 8.

## COPPER LOW RANGE

### SPECIFICATIONS

Range	0 to 1000 µg/L
Resolution	1 µg/L
Accuracy	±10 µg/L ±5% of reading
Typical EMC Deviation	±1 µg/L
Light Source	Tungsten lamp with narrow band interference filter @ 575 nm
Method	Adaptation of the <i>EPA method</i> . The reaction between copper and the bicinchoninate reagent causes a purple tint in the sample.

### REQUIRED REAGENTS

Code	Description	Quantity
HI 93747-0	Bicinchoninate	1 packet

### REAGENT SETS

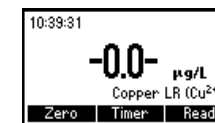
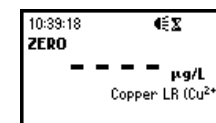
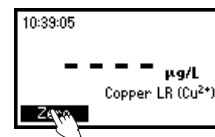
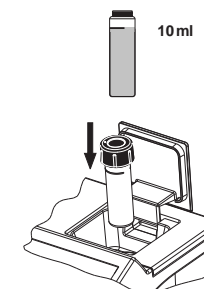
HI 93747-01 Reagents for 100 tests

HI 93747-03 Reagents for 300 tests

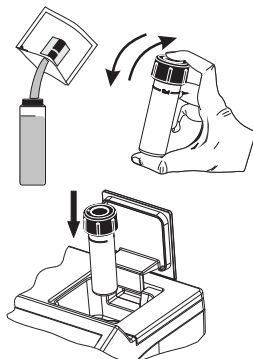
For other accessories see page 50.

### MEASUREMENT PROCEDURE

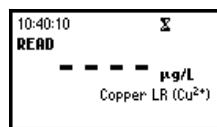
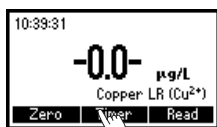
- Select the *Copper LR* method using the procedure described in the *Method Selection* section (see page 12).
- Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.
- Place the cuvette into the holder and close the lid.
- Press **ZERO** key. The meter will show “-0.0-” when the meter is zeroed and ready for measurement.



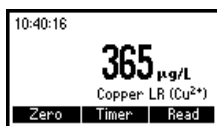
- Remove the cuvette.
- Add the content of one packet of HI 93747-0 Bicinchoninate. Replace the cap and shake gently for about 15 seconds.



- Reinsert the cuvette into the instrument.
- Press **TIMER** and the display will show the countdown prior to the measurement or, alternatively, wait for 45 seconds and press **READ**. When the timer ends the meter will perform the reading.



- The instrument displays the results in mg/L of copper.



## INTERFERENCES

Interference may be caused by:

Silver  
Cyanide

For samples overcoming buffering capacity of reagent (around pH 6.8), pH should be adjusted between 6 and 8.

## HYDRAZINE

### SPECIFICATIONS

Range	0 to 400 µg/L
Resolution	1 µg/L
Accuracy	± 4% of full scale
Typical EMC Deviation	± 2 µg/L
Light Source	Tungsten lamp with narrow band interference filter @ 420 nm
Method	Adaptation of the <i>ASTM Manual of Water and Environmental Technology, method D1385-88</i> , p-Dimethylaminobenzaldehyde method. The reaction between hydrazine and the liquid reagent causes a yellow tint in the sample.

### REQUIRED REAGENT

Code	Description	Quantity
HI 93704-0	Liquid Reagent	24 drops

### REAGENT SETS

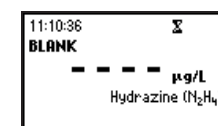
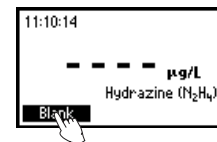
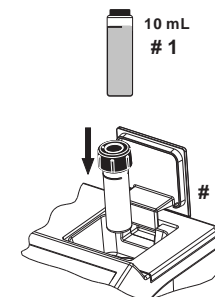
HI 93704-01 Reagents for 100 tests

HI 93704-03 Reagents for 300 tests

For other accessories see page 50.

### MEASUREMENT PROCEDURE

- Select the *Hydrazine* method using the procedure described in the *Method Selection* section (see page 12).
- Fill one cuvette up to the mark with 10 mL of distilled water.
- Place the cap, insert the cuvette # 1 into the holder and close the lid.
- Press the Blank function key to start adjusting the light level. The display will show "Blank Done" when the meter is ready to take a zero measurement.

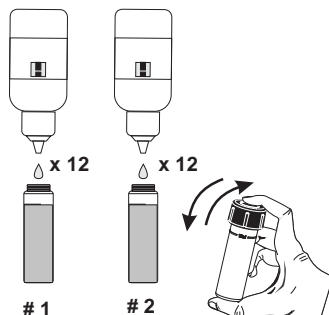


- Fill a second cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.

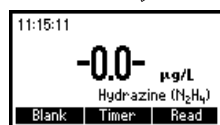
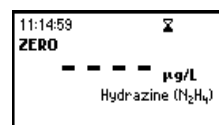
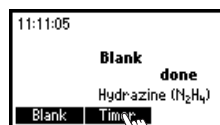




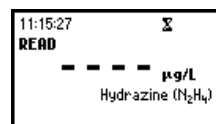
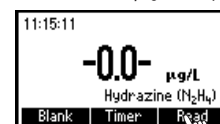
- Add 12 drops of the HI 93704-0 reagent to each cuvette. Replace the caps and shake gently to mix.



- Place the blank (#1) into the holder and close the lid.
- Press TIMER and the display will show the countdown prior to zeroing the blank. The display will show “-0.0-” when the meter is zeroed and ready for measurement.

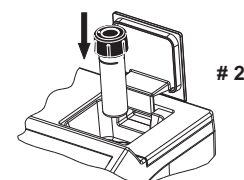
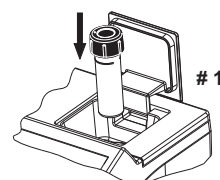


- Remove the blank.
- Insert the cuvette with the reacted sample (#2) into the instrument and close the lid.
- Press READ to start the reading. The instrument displays concentration in  $\mu\text{g/L}$  of hydrazine.



### INTERFERENCES

Interference may be caused by:  
Highly colored samples  
Highly turbid samples  
Aromatic amines



## MOLYBDENUM

### SPECIFICATIONS

Range	0.0 to 40.0 mg/L
Resolution	0.1 mg/L
Accuracy	$\pm 0.3 \text{ mg/L} \pm 5\%$ of reading
Typical EMC Deviation	$\pm 0.1 \text{ mg/L}$
Light Source	Tungsten lamp with narrow band interference filter @ 420 nm
Method	Adaptation of the mercaptoacetic acid method. The reaction between molybdenum and the reagents causes a yellow tint in the sample.

### REQUIRED REAGENT

Code	Description	Quantity
HI 93730A-0	Reagent A	1 packet
HI 93730B-0	Reagent B	1 packet
HI 93730C-0	Reagent C	1 packet

### REAGENT SETS

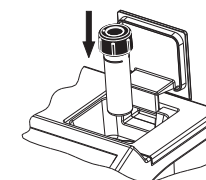
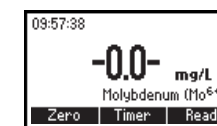
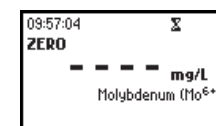
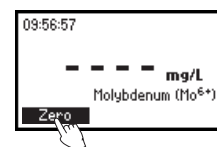
HI 93730-01 Reagents for 100 tests

HI 93730-03 Reagents for 300 tests

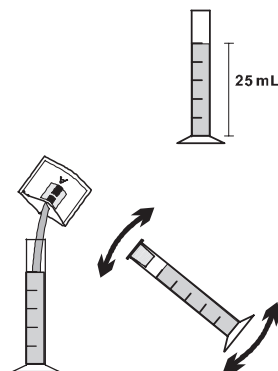
For other accessories see page 50.

### MEASUREMENT PROCEDURE

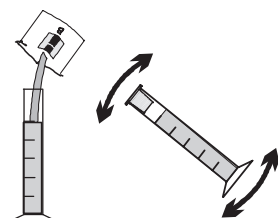
- Select the *Molybdenum* method using the procedure described in the *Method Selection* section (see page 12).
- Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.
- Place the cuvette into the holder and close the lid.
- Press ZERO key. The display will show “-0.0-” when the meter is zeroed and ready for measurement.



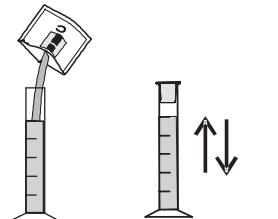
- Fill one graduated mixing cylinder up to the 25 mL mark with the sample.



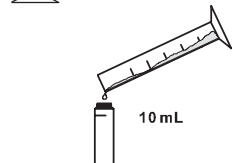
- Add the content of one packet of HI 93730A-0 molybdenum reagent, close the cylinder and invert it several times until completely dissolved.



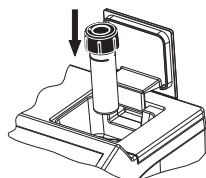
- Add the content of one packet of HI 93730B-0 molybdenum reagent to the cylinder, close and invert it several times until completely dissolved.



- Add the content of one packet of HI 93730C-0 molybdenum reagent to the cylinder, close and shake it vigorously.

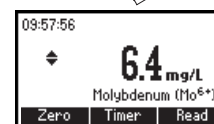
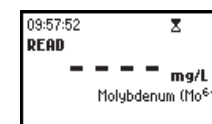
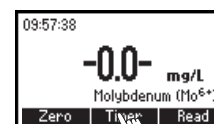


- Fill an empty cuvette with 10 mL of sample up to the mark and replace the cap.

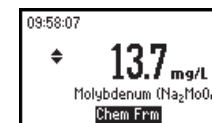
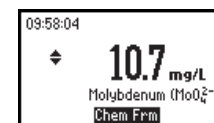
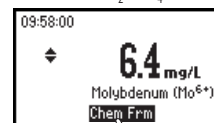


- Insert the cuvette into the instrument.

- Press **TIMER** and the display will show the countdown prior to the measurement or, alternatively, wait for five minutes and press **READ**. When the timer ends the meter will perform the reading. The instrument displays concentration in mg/L of molybdenum.



- Press the **▲** or **▼** to access the second level of functions.
- Press the **Chem Frm** functional key to convert the result in mg/L of molybdate ( $\text{MoO}_4$ ) and sodium molybdate ( $\text{Na}_2\text{MoO}_4$ ).



- Press the **▲** or **▼** to go back to the measurement screen.

### INTERFERENCES

Interference may be caused by:

Aluminum above 50 mg/L  
 Chromium above 1000 mg/L  
 Copper above 10 mg/L  
 Iron above 50 mg/L  
 Nickel above 50 mg/L  
 Nitrite, as  $\text{NO}_2^-$   
 Sulfate above 200 mg/L

Highly buffered samples or with extreme pH may exceed the buffering capacity of the reagents.

## PHOSPHATE HIGH RANGE

### SPECIFICATIONS

Range	0.0 to 30.0 mg/L
Resolution	0.1 mg/L
Accuracy	±1 mg/L ±4% of reading
Typical EMC Dev.	±0.1 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the <i>Standard Methods for the Examination of Water and Wastewater, 18<sup>th</sup> edition</i> , Amino Acid method. The reaction between phosphate and reagents causes a blue tint in the sample.

### REQUIRED REAGENTS

Code	Description	Quantity
HI 93717A-0	Molybdate	10 drops
HI 93717B-0	Reagent B	1 packet

### REAGENT SETS

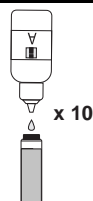
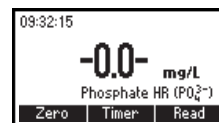
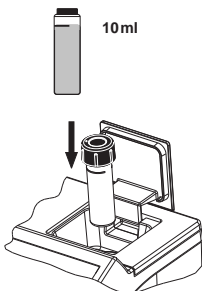
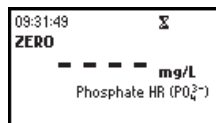
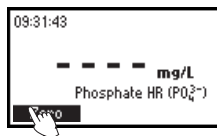
HI 93717-01 Reagents for 100 tests

HI 93717-03 Reagents for 300 tests

For other accessories see page 50.

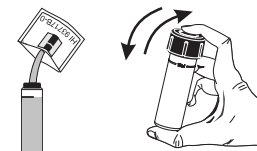
### MEASUREMENT PROCEDURE

- Select the *Phosphate HR* method using the procedure described in the *Method Selection* section (see page 12).
- Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.
- Place the cuvette into the holder and close the lid.
- Press ZERO key. The display will show “-0.0-” when the meter is zeroed and ready for measurement.

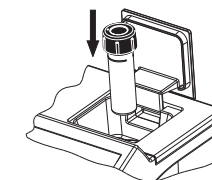


- Remove the cuvette.
- Add 10 drops of HI 93717A-0 Molybdate reagent.

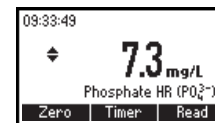
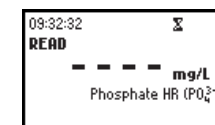
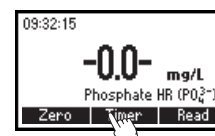
- Add the content of one packet of HI 93717B-0 Phosphate HR Reagent B to the cuvette. Replace the cap and shake gently until completely dissolved.



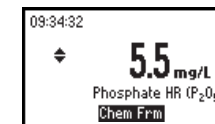
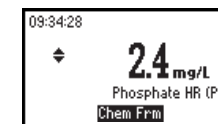
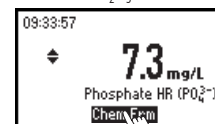
- Reinsert the cuvette into the instrument.



- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 5 minutes and press READ. When the timer ends the meter will perform the reading. The instrument displays the results in mg/L of phosphate ( $\text{PO}_4^{3-}$ ).



- Press the ▲ or ▼ to access the second level of functions.
- Press the **Chem Frm** functional key to convert the result in mg/L of phosphorus (P) and phosphorus pentoxide ( $\text{P}_2\text{O}_5$ ).



- Press the ▲ or ▼ to go back to the measurement screen.

### INTERFERENCES

Sulfide

Chloride above 150000 mg/L )

Calcium above 10000 mg/L as  $\text{CaCO}_3$

Magnesium above 40000 mg/L as  $\text{CaCO}_3$

Ferrous iron above 100 mg/L

## PHOSPHATE LOW RANGE

### SPECIFICATIONS

Range	0.00 to 2.50 mg/L
Resolution	0.01 mg/L
Accuracy	$\pm 0.04$ mg/L $\pm 4\%$ of reading
Typical EMC Dev.	$\pm 0.01$ mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 610 nm
Method	Adaptation of the Ascorbic Acid method. The reaction between phosphate and the reagent causes a blue tint in the sample.

### REQUIRED REAGENTS

Code	Description	Quantity
HI 93713-0	Powder reagent	1 packet

### REAGENT SETS

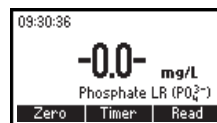
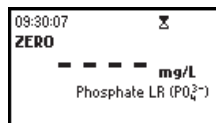
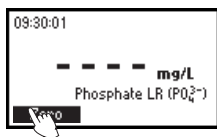
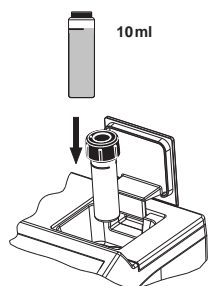
HI 93713-01 Reagents for 100 tests

HI 93713-03 Reagents for 300 tests

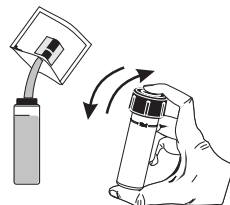
For other accessories see page 50.

### MEASUREMENT PROCEDURE

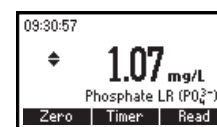
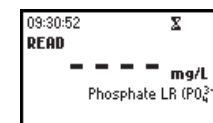
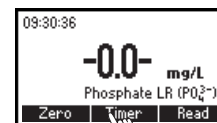
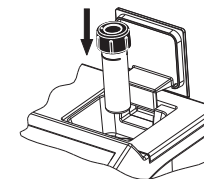
- Select the *Phosphate LR* method using the procedure described in the *Method Selection* section (see page 12).
- Rinse, cap and shake the cuvette several times with unreacted sample. Fill the cuvette with 10 mL of sample up to the mark and replace the cap.
- Place the cuvette into the holder and close the lid.
- Press ZERO key. The display will show “-0.0-” when the meter is zeroed and ready for measurement.



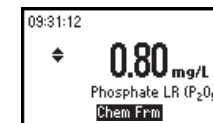
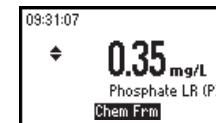
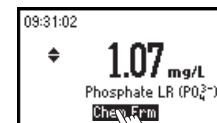
- Remove the cuvette and add the content of one packet of HI 93713-0 reagent. Replace the cap and shake gently (for about 2 minutes) until the powder is completely dissolved.



- Reinsert the cuvette into the instrument.
- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 3 minutes and press READ. When the timer ends the meter will perform the reading. The instrument displays concentration in mg/L of phosphate ( $\text{PO}_4^{3-}$ ).



- Press the  $\blacktriangle$  or  $\blacktriangledown$  to access the second level of functions.
- Press the **Chem Frm** functional key to convert the result in mg/L of phosphorus (P) and phosphorus pentoxide ( $\text{P}_2\text{O}_5$ ).



- Press the  $\blacktriangle$  or  $\blacktriangledown$  to go back to the measurement screen.

### INTERFERENCES

Interference may be caused by:

Iron above 50 mg/L

Silica above 50 mg/L

Silicate above 10 mg/L

Copper above 10 mg/L

Hydrogen sulfide, arsenate, turbid sample and highly buffered samples also interfere.

## PHOSPHORUS

### SPECIFICATIONS

Range	0.0 to 15.0 mg/L
Resolution	0.1 mg/L
Accuracy	±0.3 mg/L ±4% of reading
Typical EMC Dev.	±0.2 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the <i>Standard Methods for the Examination of Water and Wastewater</i> , 18 <sup>th</sup> edition, Amino Acid method. The reaction between phosphate and reagents causes a blue tint in the sample.

### REQUIRED REAGENTS

Code	Description	Quantity
HI 93706A-0	Molybdate	10 drops
HI 93706B-0	Amino Acid Powder	1 packet

### REAGENT SETS

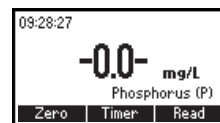
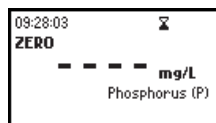
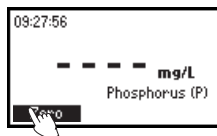
HI 93706-01 Reagents for 100 tests

HI 93706-03 Reagents for 300 tests

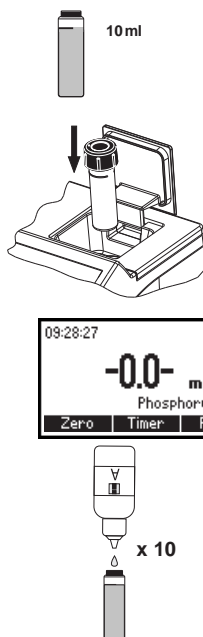
For other accessories see page 50.

### MEASUREMENT PROCEDURE

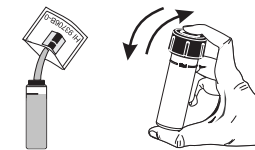
- Select the *Phosphorus* method using the procedure described in the *Method Selection* section (see page 12).
- Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.
- Place the cuvette into the holder and close the lid.
- Press ZERO key. The display will show “-0.0-” when the meter is zeroed and ready for measurement.



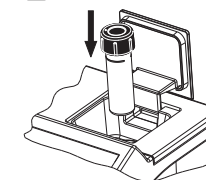
- Remove the cuvette.
- Add 10 drops of HI 93706A-0 Molybdate reagent.



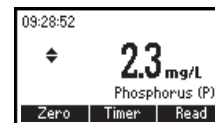
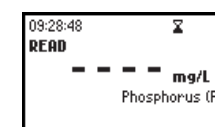
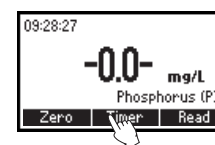
- Add the content of one packet of HI 93706B-0 Phosphorus Reagent B (Amino Acid) to the cuvette. Replace the cap and shake gently until completely dissolved.



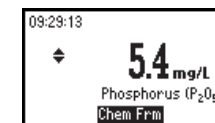
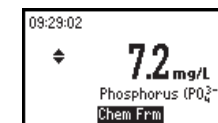
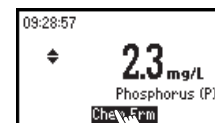
- Reinsert the cuvette into the instrument.



- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 5 minutes and press READ. When the timer ends the meter will perform the reading. The instrument displays the results in mg/L of phosphorus (P).



- Press the ▲ or ▼ to access the second level of functions.
- Press the Chem Frm functional key to convert the result in mg/L of phosphate ( $\text{PO}_4^{3-}$ ) and phosphorus pentoxide ( $\text{P}_2\text{O}_5$ ).



- Press the ▲ or ▼ to go back to the measurement screen.

### INTERFERENCES

Interference may be caused by:

Sulfide

Chloride above 150000 mg/L

Calcium above 10000 mg/L as  $\text{CaCO}_3$

Magnesium above 40000 mg/L as  $\text{CaCO}_3$

Ferrous iron above 100 mg/L

## SILICA

### SPECIFICATIONS

Range	0.00 to 2.00 mg/L
Resolution	0.01 mg/L
Accuracy	$\pm 0.03$ mg/L $\pm 3\%$ of reading
Typical EMC Deviation	$\pm 0.01$ mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 610 nm
Method	Adaptation of the <i>ASTM Manual of Water and Environmental Technology, D859</i> , Heteropoly Blue method. The reaction between silica and reagents causes a blue tint in the sample.

### REQUIRED REAGENTS

Code	Description	Quantity
HI 93705A-0	Molybdate	6 drops
HI 93705B-0	Citric acid	1 packet
HI 93705C-0	Amino acid	1 packet

### REAGENT SETS

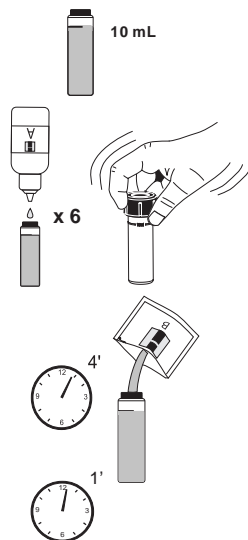
HI 93705-01 Reagents for 100 tests

HI 93705-03 Reagents for 300 tests

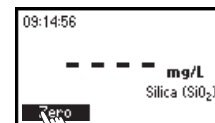
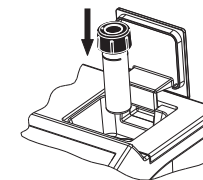
For other accessories see page 50.

### MEASUREMENT PROCEDURE

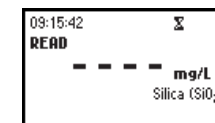
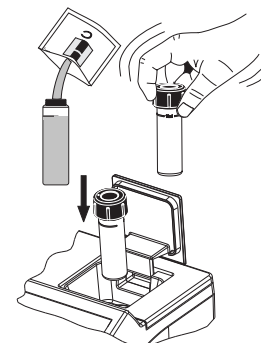
- Select the *Silica* method using the procedure described in the *Method Selection* section (see page 12).
- Fill the cuvette with 10 mL of unreacted sample (up to the mark).
- Add 6 drops of HI 93705A-0 Molybdate reagent. Replace the cap and swirl the solution.
- Wait for 4 minutes, add the content of one packet of HI 93705B-0 Citric acid reagent and shake until it is completely dissolved.
- Wait for 1 minute. This is the blank.



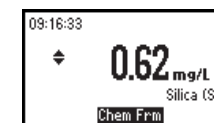
- Place the cuvette into the holder and close the lid.
- Press ZERO key. The display will show “-0.0-” when the meter is zeroed and ready for measurement.



- Remove the cuvette and add the content of one packet of HI 93705C-0 Amino acid reagent and shake until it is completely dissolved.
- Reinsert the cuvette into the instrument.
- Press TIMER and the display will show the countdown prior to the measurement. Alternatively, wait for exactly 3 minutes and press READ. When the timer ends the meter will perform the reading. The instrument displays concentration in mg/L of silica ( $\text{SiO}_2$ ).



- Press the  $\blacktriangle$  or  $\blacktriangledown$  to access the second level of functions.
- Press the **Chem Frm** functional key to convert the result in mg/L of Silicon (Si).



- Press the  $\blacktriangle$  or  $\blacktriangledown$  to go back to the measurement screen.

## INTERFERENCES

Interference may be caused by:

Phosphate above 60 mg/L

Phosphate above 75 mg/L

Sulfide and high concentration of iron

Eliminate color and turbidity interferences by zeroing the meter with the original water sample.

## SILVER

### SPECIFICATIONS

**Range** 0.000 to 1.000 mg/L

**Resolution** 0.001 mg/L

**Accuracy**  $\pm 0.005$  mg/L  $\pm 10\%$  of reading

**Typical EMC Deviation**  $\pm 0.001$  mg/L

**Light Source** Tungsten lamp with narrow band interference filter @ 575 nm.

**Method** Adaptation of the PAN method. The reaction between silver and reagents causes an orange tint in the sample.

### REQUIRED REAGENTS

Code	Description	Quantity
HI 93737A-0	Buffer Reagent A	1 mL
HI 93737B-0	Buffer Reagent B	1 mL
HI 93737C-0	Indicator Reagent C	2 mL
HI 93737D-0	Fixing Reagent D	2 mL
HI 93703-51	Dispersing Agent	4-6 drops (only when necessary, see note)

### REAGENT SETS

**HI 93737-01** Reagents for 50 tests

**HI 93737-03** Reagents for 150 tests

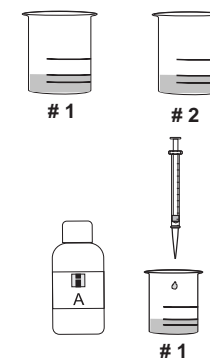
For other accessories see page 50.

### MEASUREMENT PROCEDURE

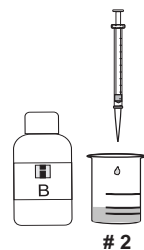
- Select the *Silver* method using the procedure described in the *Method Selection* section (see page 12).

Note: for best results perform your tests between 20-24°C.

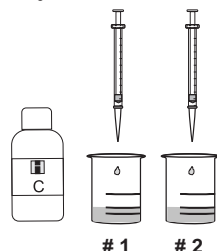
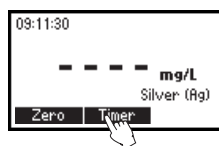
- Fill two graduated beakers with 25 mL of sample.
- Add 1.0 mL of HI 93737A-0 Buffer reagent to one beaker (the blank) and swirl gently to mix.



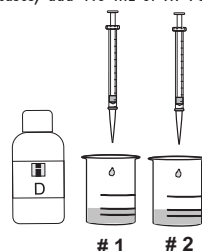
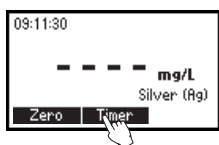
- Add exactly 1.0 mL of HI 93737B-0 Buffer reagent to the second beaker (the sample) and swirl gently to mix.



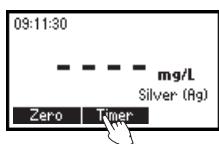
- Press TIMER and the display will show the countdown prior to adding reagent C or, alternatively, wait for 2 minutes. Then add exactly 1.0 mL of HI 93737C-0 Indicator reagent to each beaker and swirl.



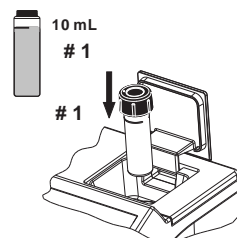
- Press TIMER or, alternatively, wait for 2 minutes. Then, in both cases, add 1.0 mL of HI 93737D-0 Fixing reagent to each beaker and swirl.



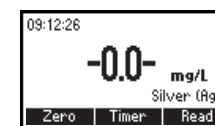
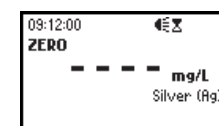
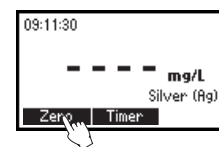
- Then press TIMER or, alternatively, wait for 2 minutes to allow reaction to complete.



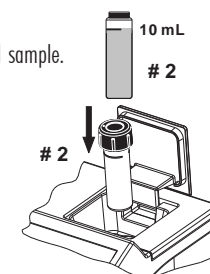
- Fill one cuvette up to the mark with 10 mL of the blank.
- Place the cuvette into the holder and close the lid.



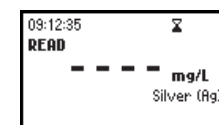
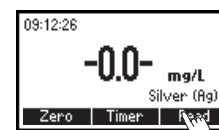
- Press ZERO key. The display will show “-0.0-” when the meter is zeroed and ready for measurement.



- Fill a second cuvette up to the mark with 10 mL of the reacted sample.
- Insert the second cuvette into the instrument.



- Press READ to start the reading. The instrument displays the results in mg/L of silver.



Note: a temperature above 30°C may cause turbidity. In this case, before zeroing and taking readings, add 2-3 drops of Dispersing agent (HI 93703-51) to each cuvette and swirl until turbidity is completely dissolved.

## INTERFERENCES

Interference may be caused by:

Al <sup>3+</sup> above 30 mg/L	Fe <sup>2+</sup> above 1.5 mg/L
Ca <sup>2+</sup> above 1000 mg/L as CaCO <sub>3</sub>	Fe <sup>3+</sup> above 10 mg/L
Cd <sup>2+</sup> above 20 mg/L	K <sup>+</sup> above 500 mg/L
Cl <sup>-</sup> above 8000 mg/L	Mn <sup>2+</sup> above 25 mg/L
Co <sup>2+</sup> above 1.5 mg/L	Mg <sup>2+</sup> above 1000 mg/L as CaCO <sub>3</sub>
Cr <sup>3+</sup> above 20 mg/L	Na <sup>+</sup> above 5000 mg/L
Cr <sup>6+</sup> above 40 mg/L	Ni <sup>2+</sup> above 1.5 mg/L
Cu <sup>2+</sup> above 15 mg/L	Pb <sup>2+</sup> above 20 mg/L
F above 20 mg/L	Zn <sup>2+</sup> above 30 mg/L



## ERRORS AND WARNINGS

The instrument shows clear warning messages when erroneous conditions appear and when measured values are outside the expected range. These messages are described below.



**No Light:** The light source is not functioning properly.



**Light Leak:** There is an excess amount of ambient light reaching the detector.



**Inverted cuvettes:** The sample and the zero cuvettes are inverted.



**Battery Low:** The battery capacity is lower than 10%.



**Light Low:** The instrument cannot adjust the light level. Please check that the sample does not contain any debris.



**Light High:** There is too much light to perform a measurement. Please check the preparation of the zero cuvette.

## DATA MANAGEMENT

The analyzed data can be managed using Hanna's product HI92000, Windows® Compatible Software.

	Description	Range	Method
1	Ammonia, HR	0.00 to 10.00 mg/L	Nessler
2	Ammonia, LR	0.00 to 3.00 mg/L	Nessler
3	Chlorine, Free	0.00 to 2.50 mg/L	DPD
4	Chlorine, Total	0.00 to 3.50 mg/L	DPD
5	Copper HR	0.00 to 5.00 mg/L	Biginichonate
6	Copper LR	0 to 1000 µg/L	Biginichonate
7	Hydrazine	0 to 400 µg/L	p-Dimethylaminobenzaldehyde
8	Molybdenum	0.0 to 40.0 mg/L	Mercaptoacetic Acid
9	Phosphate HR	0.0 to 30.0 mg/L	Amino Acid
10	Phosphate LR	0.00 to 2.50 mg/L	Ascorbic Acid
11	Phosphorus	0.0 to 15.0 mg/L	Amino Acid
12	Silica	0.00 to 2.00 mg/L	Heteropoly Blue
13	Silver	0.000 to 1.000 mg/L	PAN

## ACCESSORIES

### REAGENT SETS

HI 93700-01	100 ammonia LR tests	HI 93711-01	100 total chlorine tests (powder)
HI 93700-03	300 ammonia LR tests	HI 93711-03	300 total chlorine tests (powder)
HI 93701-01	100 free chlorine tests (powder)	HI 93713-01	100 phosphate LR tests
HI 93701-03	300 free chlorine tests (powder)	HI 93713-03	300 phosphate LR tests
HI 93701-F	300 free chlorine tests (liquid)	HI 93715-01	100 ammonia MR tests
HI 93701-T	300 total chlorine tests (liquid)	HI 93715-03	300 ammonia MR tests
HI 93702-01	100 copper HR tests	HI 93717-01	100 phosphate HR tests
HI 93702-03	300 copper HR tests	HI 93717-03	300 phosphate HR tests
HI 93704-01	100 hydrazine tests	HI 93730-01	100 molybdenum tests
HI 93704-03	300 hydrazine tests	HI 93730-03	300 molybdenum tests
HI 93705-01	100 silica tests	HI 93737-01	50 silver tests
HI 93705-03	300 silica tests	HI 93737-03	150 silver tests
HI 93706-01	100 phosphorus tests	HI 93747-01	100 copper LR tests
HI 93706-03	300 phosphorus tests	HI 93747-03	300 copper LR tests

### OTHER ACCESSORIES

HI 731318	cloth for wiping cuvettes (4 pcs)	HI 740224	170 mL plastic beakers (12 pcs)
HI 731321	glass cuvettes (4 pcs)	HI 740225	60 mL graduated syringe
HI 731325W	new cap for cuvette (4 pcs)	HI 740226	5 mL graduated syringe
HI 740034	cap for 100 mL beaker (6 pcs)	HI 740227	filter assembly
HI 740036	100 mL plastic beaker (6 pcs)	HI 740228	filter discs (25 pcs)
HI 740038	60 mL glass bottle and stopper	HI 740229	100 mL graduated cylinder
HI 740142	1 mL graduated syringe	HI 740230	230 mL demineralized water
HI 740143	1 mL graduated syringe (6 pcs)	HI 92000	Windows compatible software
HI 740144	pipette tip (6 pcs)	HI 920013	PC connection cable
HI 740157	plastic refilling pipette (20 pcs)	HI 93703-50	cuvette cleaning solution (230 mL)
HI 740220	25 mL glass cylinders with caps (2 pcs)	HI 93703-54	dried resin (100 g)
HI 740223	170 mL plastic beaker	HI 93703-55	activated carbon (50 pcs)

## WARRANTY

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

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

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

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

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

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

### Recommendations for Users

Before using these products, make sure that they are entirely suitable for your specific application and for the environment in which they are used.

Operation of these instruments may cause unacceptable interferences to other electronic equipments, this requiring the operator to take all necessary steps to correct interferences.

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

To avoid damages or burns, do not put the instrument in microwave ovens. For yours and the instrument safety do not use or store the instrument in hazardous environments.

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

## HANNA LITERATURE

Hanna publishes a wide range of catalogs and handbooks for an equally wide range of applications. The reference literature currently covers areas such as:

- Water Treatment
- Process
- Swimming Pools
- Agriculture
- Food
- Laboratory

and many others. New reference material is constantly being added to the library.

For these and other catalogs, handbooks and leaflets contact your dealer or the Hanna Customer Service Center nearest to you. To find the Hanna Office in your vicinity, check our home page at [www.hannainst.com](http://www.hannainst.com).

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