PEWA Messtechnik GmbH

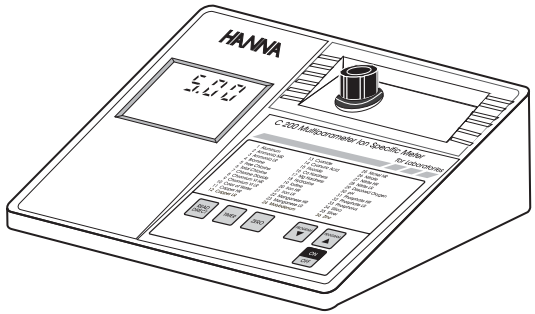
Weidenweg 21
58239 Schwerte

Telefon: +49 (0) 2304-96109- 0
Telefax: +49 (0) 2304-96109-88
eMail: info@pewa.de
Homepage: www.pewa.de

Instruction Manual

C 99 & C 200 Series

Multiparameter Bench Photometers



CE

Manufacturers since 1978

Dear Customer,

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

TABLE OF CONTENTS

PRELIMINARY EXAMINATION

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

Each Meter is supplied complete with:

- Two Sample Cuvets and Caps*
- One Transport Cap
- Two 9 V Batteries
- 12 VDC Transformer (**HI 710005** or **HI 710006**)

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

* C99 & C200, C206, C207, C209, C210 and C213 are supplied with 3 cuvets and caps

GENERAL DESCRIPTION

C 99 & C 200 Series is a line of 15 different bench, microprocessor-based photometers that measure up to 46 parameters in water and wastewater. These multipurpose meters are manufactured to measure the most important parameters of the application they have been especially designed for:

C 99 Laboratories, with COD	C 200 Laboratories
C 203 Aquaculture	C 205 Boilers & Cooling Towers
C 206 Environmental Testing	C 207 Industrial Wastewater
C 208 Water Conditioning	C 209 Education
C 210 Pulp & Paper Mills	C 211 Chemical Manufacturers
C 212 Power Plant Utilities	C 213 Municipal Wastewater
C 215 Nutrient Analyses	C 216 Swimming Pool Applic.
C 218 Environmental Applic.	

All meters use an exclusive positive-locking system to ensure that the cuvet is in the same position every time it is placed into the measurement cell. The reagents are in liquid or powder form and are supplied in bottles or in packets. The amount of reagent is precisely dosed to ensure the maximum repeatability.

Display codes aid the user in routine operations.

The meters have an auto-shut off feature, turning the unit off after 10 minutes of non-use.

The C 99 & C 200 Series can be connected to a personal computer via the HI 920010 three wire RS 232 cable. The HI 92000 Hanna Windows® Compatible Software aids the user to manage all test data.

SPECIFICATIONS

Light Life	Life of the instrument
Light Detector	Silicon Photocell
Environment	0 to 50°C (32 to 122°F); max 95% RH non-condensing
Power Supply	2 x 9 V batteries / 12 to 20 VDC through voltage adapter
Auto-Shut off	After 10' of non-use
Dimensions	230 x 165 x 70 mm (9.0 x 6.5 x 2.8")
Weight	640 g (22.6 oz.)

For specifications related to each single parameter (e.g. range, accuracy, etc.), refer to the related measurement section.

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 physico-chemical characteristics of substance according to the Lambert-Beer Law:

$$-\log \mathbf{I/I_o} = \varepsilon_\lambda \, c \, d$$

or

$$A = \varepsilon_\lambda \, c \, d$$

Where:

- $-\log \mathbf{I/I_o}$ = Absorbance (A)
- $\mathbf{I_o}$ = intensity of incident light beam
- $\mathbf{I}$ = intensity of light beam after absorption
- ε_λ = molar extinction coefficient at wavelength λ
- c = molar concentration of the substance
- d = optical path through the substance

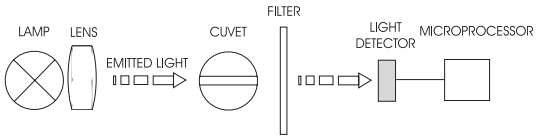
Therefore, the concentration "c" can be calculated from the absorbance of the substance as the other factors are known.

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 Hanna's C 99 & C 200 multiparameter photometers is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

Four measuring channels (at four different wavelengths) allow a wide range of tests.



C 200 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 cuvet. The optical path is fixed by the diameter of the cuvet. Then the light is spectrally filtered to a narrow spectral bandwidth, to obtain a light beam of intensity $\mathbf{I}_0$ 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.

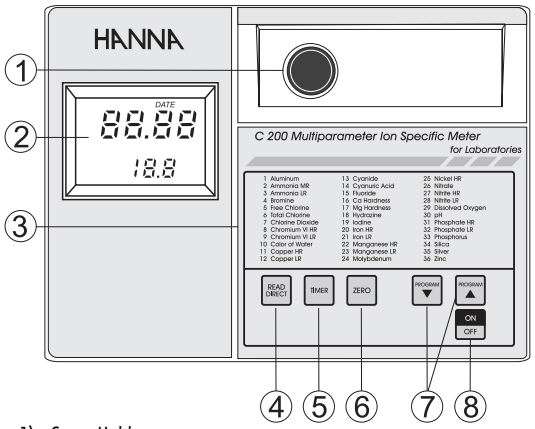
The cuvet has a very important role because it is an optical element and thus requires particular attention. It is important that both the measurement and the calibration (zeroing) cuvets are optically identical to provide the same measurement conditions. Whenever possible use the same cuvet for both.

It is also necessary that the surface of the cuvet is 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 cuvet walls with hands.

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

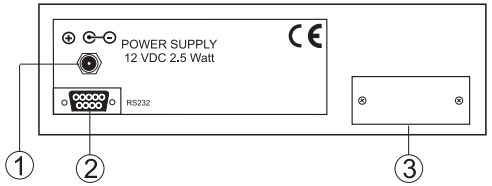
FUNCTIONAL DESCRIPTION

FRONT PANEL



1) Cuvet Holder
2) Dual Level Liquid Crystal Display
3) Programs List
4) READ DIRECT, to perform measurement immediately
5) TIMER, to perform measurements after a preprogrammed countdown
6) ZERO, to zero the meter prior to measurement
7) Program ▼ and ▲, to select the desired parameter
8) ON/OFF, to turn the meter on and off

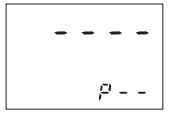
REAR PANEL



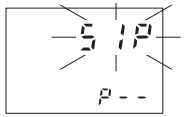
1) Power Supply 12 VDC 2.5 Watt
2) RS 232 Socket
3) Batteries Compartment

GUIDE TO DISPLAY CODES

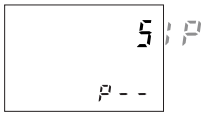
Note: The secondary LCD below shows a generic "P– –", whereas the meter will indicate the exact program number (e.g. in C 200, "P1" for Aluminum).



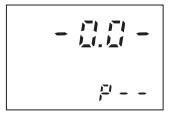
This indicates that the meter is in a ready state and zeroing can be performed.



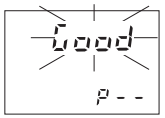
Sampling in progress. This flashing prompt appears each time the meter is performing a measurement.



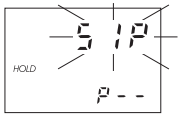
The microprocessor is adjusting the light level, indicated by a scrolling "SIP".



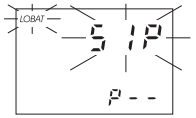
This indicates that the meter is in a zeroed state and measurement can be performed.



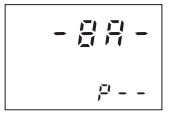
The light level is accepted. The instrument is ready to perform a zero reading. This flashing prompt will only appear when a second zero reading needs to be performed. Follow the measurement procedure described in the related chapter.



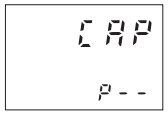
The instrument is performing an internal check-up.



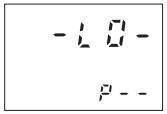
The blinking "LOBAT" indicates that the battery voltage is getting low and the batteries need to be replaced.



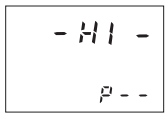
This indicates that the batteries are dead and must be replaced.



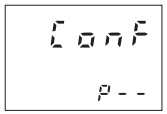
Light over range. The cuvet is not inserted correctly and an eccess ambient light is reaching the detector. If the cuvet is properly inserted, then contact your dealer or the nearest Hanna Customer Service Center.



The lamp is not working properly. Contact your dealer or the nearest Hanna Customer Service Center.



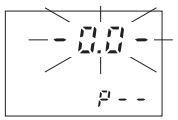
The lamp is not working properly. Contact your dealer or the nearest Hanna Customer Service Center.



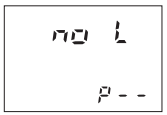
This indicates that the meter has lost its configuration. Contact your dealer or the nearest Hanna Customer Service Center.

ERROR MESSAGES

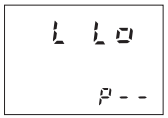
a) on zero reading:



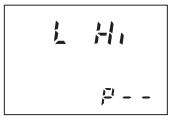
This indicates that the zeroing procedure failed due to a low signal-to-noise ratio. In this case press ZERO again.



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

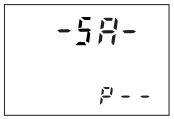


There is not enough light to perform a measurement. Please check the preparation of the zero cuvet.

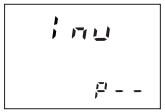


There is too much light to perform a measurement. Please check the preparation of the zero cuvet.

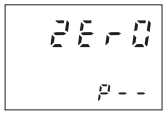
b) on sample reading:



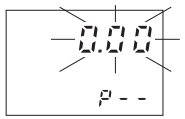
There is too much light for the sample measurement. Please check if the right sample cuvet is inserted.



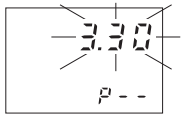
The sample and zero cuvet are inverted.



A zero reading was not taken. Follow the instruction described in the measurement procedures for zeroing the meter.



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



1) A flashing value of the maximum concentration indicates an over range condition. The concentration of the sample is beyond the programmed range: dilute the sample and rerun the test.

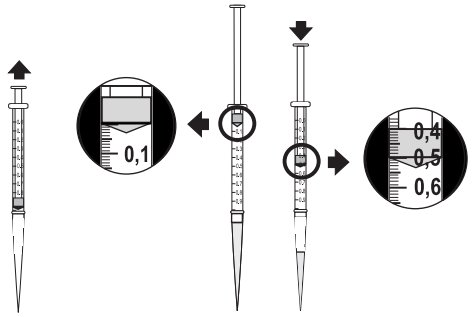
2) A flashing value lower than the maximum concentration indicates a low signal-to-noise ratio condition. In this case accuracy of the result is not guaranteed. Repeat the reading procedure.

TIPS FOR AN ACCURATE MEASUREMENT

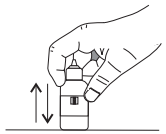
The instructions listed below should be carefully followed during testing to ensure best accuracy.

- Color or suspended matter in large amounts may cause interference, therefore, these should be removed by treatment with active carbon and by prior filtration.
- For a correct filling of the cuvet: the liquid in the cuvet forms a convexity on the top; the bottom of this convexity must be at the same level of the 10 mL mark.

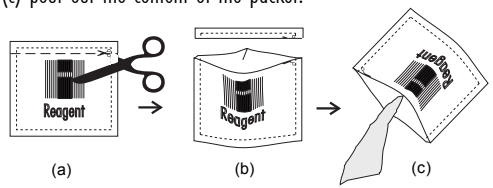
- In order to measure exactly e.g. 0.5 mL of sample or reagent with the 1 mL syringe, push the plunger completely into the syringe and insert the tip into the solution. Pull the plunger up to above the 0.0 mL mark. Take out the syringe and clean the outside of the syringe tip. Then, adjust the plunger to the 0.0 mL mark (the lower edge of the seal must be exactly on the 0.0 mL mark). 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 cuvet, push the plunger down 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 cuvet, even if the tip still contains some reagent or sample.



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

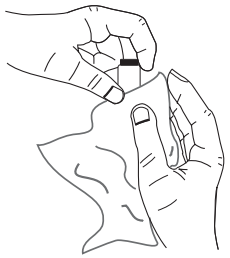


- Proper use of the powder reagent packet:
  (a) use scissors to open the powder packet;
  (b) push the edges of the packet to form a spout;
  (c) pour out the content of the packet.



- It is important that the sample does not contain any debris. This would corrupt the readings.
- Do not let the reacted sample stand too long after reagent is added, or accuracy will be lost.

- In order to avoid reagent leaking and to obtain more accurate measurements, it is recommended to close the cuvet first with the supplied HDPE plastic stopper and then with the black cap.
- Each time the cuvet is used, the cap must be tightened to the same degree.



- Whenever the cuvet is placed into the measurement cell, it must be dry outside, and completely free of fingerprints, oil or dirt. Wipe it thoroughly with **HI 731318** or a lint-free cloth prior to insertion.
- 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 cuvet for zeroing and measurement.
- It is important to discard the sample immediately after the reading is taken because the glass might become permanently stained.
- All the reaction times reported in this manual are referred to 20°C (68°F). As a general rule of thumb, they should be doubled at 10°C (50°F) and halved at 30°C (86°F).

PARAMETERS REFERENCE TABLES

C99 - LABORATORIES, with COD

C 200 - LABORATORIES

C 203 - AQUACULTURE

C 205 - BOILERS & COOLING TOWERS

Code	Parameter	Page
1	Aluminum	21
2	Ammonia MR	25
3	Ammonia LR	27
4	Bromine	29
5	Free Chlorine	31
6	Total Chlorine	37
7	Chlorine Dioxide	43
8	Chromium VI HR	46
9	Chromium VI LR	48
10	Copper HR	52
11	Copper LR	54
12	Hydrazine	79

Code	Parameter	Page
13	Iron HR	84
14	Iron LR	86
15	Molybdenum	94
16	Nitrate	102
17	Nitrite HR	104
18	Nitrite LR	106
19	Oxygen, Dissolved	117
20	pH	120
21	Phosphate HR	122
22	Phosphate LR	124
23	Silica	128
24	Zinc	134

C 206 - ENVIRONMENTAL TESTING

Code	Parameter	Page
1	Ammonia MR	25
2	Ammonia LR	27
3	Free Chlorine	31
4	Total Chlorine	37
5	Chromium VI HR	46
6	Chromium VI LR	48
7	Color of Water	50
8	Copper HR	52
9	Copper LR	54
10	Cyanuric Acid	59
11	Molybdenum	94
12	Nickel HR	97

Code	Parameter	Page
13	Nickel LR	99
14	Nitrate	102
15	Nitrite HR	104
16	Nitrite LR	106
17	Oxygen, Dissolved	117
18	pH	120
19	Phosphate HR	122
20	Phosphate LR	124
21	Phosphorus	126
22	Silica	128
23	Silver	131
24	Zinc	134

C 207 - INDUSTRIAL WASTEWATER

Code	Parameter	Page
1	Aluminum	21
2	Free Chlorine	31
3	Total Chlorine	37
4	Color of Water	50
5	Copper HR	52
6	Copper LR	54
7	Fluoride	61
8	Manganese HR	89
9	Manganese LR	91
10	Molybdenum	94

Code	Parameter	Page
11	Nickel HR	97
12	Nickel LR	99
13	Nitrate	102
14	Oxygen, Dissolved	117
15	pH	120
16	Phosphate HR	122
17	Phosphate LR	124
18	Phosphorus	126
19	Silver	131
20	Zinc	134

C 208 - WATER CONDITIONING

Code	Parameter	Page
1	Ammonia MR	25
2	Ammonia LR	27
3	Free Chlorine	31
4	Total Chlorine	37
5	Copper HR	52
6	Copper LR	54
7	Fluoride	61
8	Iron HR	84
9	Iron LR	86
10	Manganese HR	89
11	Manganese LR	91
12	Molybdenum	94

Code	Parameter	Page
13	Nickel HR	97
14	Nickel LR	99
15	Nitrate	102
16	Oxygen, Dissolved	117
17	pH	120
18	Phosphate HR	122
19	Phosphate LR	124
20	Phosphorus	126
21	Silica	128
22	Silver	131
23	Zinc	134

C 209 - EDUCATION

Code	Parameter	Page
1	Ammonia MR	25
2	Ammonia LR	27
3	Free Chlorine	31
4	Total Chlorine	37
5	Chromium VI HR	46
6	Chromium VI LR	48
7	Color of Water	50
8	Copper HR	52
9	Copper LR	54
10	Nitrate	102
11	Nitrite HR	104
12	Nitrite LR	106
13	Oxygen, Dissolved	117
14	pH	120
15	Phosphate HR	122
16	Phosphate LR	124
17	Phosphorus	126
18	Silica	128
19	Silver	131
20	Zinc	134

C 210 - PULP & PAPER MILLS

Code	Parameter	Page
1	Aluminum	21
2	Free Chlorine	31
3	Total Chlorine	37
4	Chlorine Dioxide	43
5	Color of Water	50
6	Dissolved Oxygen	117
7	pH	120
8	Phosphate HR	122
9	Phosphate LR	124
10	Silica	128
11	Silver	131
12	Zinc	134

C 211 - CHEMICAL MANUFACTURERS

Code	Parameter	Page
1	Aluminum	21
2	Ammonia MR	25
3	Ammonia LR	27
4	Chromium VI HR	46
5	Chromium VI LR	48
6	Copper HR	52
7	Copper LR	54
8	Cyanuric Acid	59
9	Iodine	82
10	Iron HR	84
11	Iron LR	86
12	Molybdenum	94
13	Nickel HR	97
14	Nickel LR	99
15	pH	120
16	Phosphate HR	122
17	Phosphate LR	124
18	Phosphorus	126
19	Silica	128
20	Silver	131
21	Zinc	134

C 212 - POWER PLANT UTILITIES

Code	Parameter	Page
1	Ammonia MR	25
2	Ammonia LR	27
3	Free Chlorine	31
4	Total Chlorine	37
5	Copper HR	52
6	Copper LR	54
7	Hydrazine	79
8	Molybdenum	94
9	Phosphate HR	122
10	Phosphate LR	124
11	Phosphorus	126
12	Silica	128
13	Silver	131

C 213 - MUNICIPAL WASTEWATER

Code	Parameter	Page
1	Aluminum	21
2	Ammonia MR	25
3	Ammonia LR	27
4	Bromine	29
5	Free Chlorine	31
6	Total Chlorine	37
7	Chromium VI HR	46
8	Chromium VI LR	48
9	Color of Water	50
10	Copper HR	52
11	Copper LR	54
12	Iodine	82

Code	Parameter	Page
13	Nickel HR	97
14	Nickel LR	99
15	Nitrate	102
16	Nitrite HR	104
17	Nitrite LR	106
18	Oxygen, Dissolved	117
19	pH	120
20	Phosphate HR	122
21	Phosphate LR	124
22	Phosphorus	126
23	Silver	131
24	Zinc	134

C 216 - SWIMMING POOL APPLICATION

Code	Parameter	Page
1	Free Chlorine HR	34
2	Total Chlorine HR	40
3	Cyanuric Acid	59
4	Bromine	29

Code	Parameter	Page
5	pH	120
6	Total Hardness LR	76
7	Total Hardness MR	73
8	Total Hardness HR	70

C 218 - ENVIRONMENTAL APPLICATION

Code	Parameter	Page
1	Ammonia MR	25
2	Ammonia HR	23
3	Cyanide	56
4	Chromium VI HR	46
5	Chromium VI LR	48

Code	Parameter	Page
6	Phosphorus	126
7	Nitrite HR	104
8	Nitrite LR	106
9	Nitrate	102

OPERATIONAL GUIDE

POWER CONNECTION

Plug the 12VDC adapter (**HI 710005** - 110VDC, or **HI 710006** - 220VDC) into the DC socket. Plug the adapter into the outlet.

Alternatively, remove the battery cover on the back of the meter; attach 2 fresh 9V batteries and replace the cover.

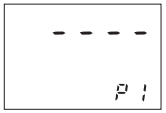
Note: Insure the main line is surge protected.

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

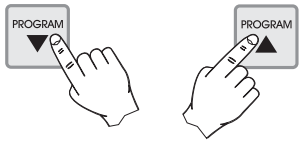
MEASUREMENT PROCEDURE

- Turn the meter on by pressing ON/OFF.

- The meter will first perform an LCD self diagnostic test by displaying a full set of figures.
- Then it will show a scrolling "c --- Hanna Inst" message.

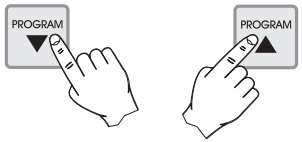


- When the LCD displays "----", the meter is ready. On the secondary LCD "P1" will appear to inform that the first parameter measurement procedure (e.g. in C200, P1 for Aluminum) can be performed.
- Press the PROGRAM ▼ and PROGRAM ▲ keys to select the desired parameter.

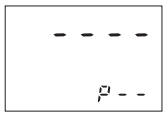


For the program number, see the tables on page 12 or look at the list printed on the mask of the meter.

- After the desired program number appears on the secondary display, follow the measurement procedure described in the related chapter.
- Select a new parameter measurement procedure by pressing the PROGRAM ▼ and PROGRAM ▲ keys.



Note: in the following measurement sections, a generic "P– –" will be placed on the secondary LCD instead of the exact related message (e.g. in C 200, "P1" for Aluminum).



- Before performing a test read carefully all the instructions related to the selected parameter.

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-naphtol
TPTZ: 2,4,6-tri-(2-pyridyl)-1,3,5-triazine

ALUMINUM

SPECIFICATIONS

Range	0.00 to 1.00 mg/L
Resolution	0.01 mg/L
Accuracy	±0.02 mg/L ±4% of reading
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the aluminon method. The reaction between aluminum and reagents causes a reddish tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93712**A**-0	Ascorbic acid	1 packet
HI 93712**B**-0	Aluminon reagent	1 packet
HI 93712**C**-0	Bleaching powder	1 packet

REAGENT SETS

HI 93712-01 Reagents for 100 tests
HI 93712-03 Reagents for 300 tests
For other accessories see page 141.

MEASUREMENT PROCEDURE

- Select the program number corresponding to Aluminum on the secondary LCD by pressing PROGRAM ▼ and ▲.

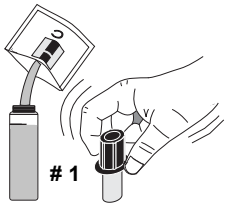
- Fill a graduated beaker with 50 mL of sample.

- Add the content of one packet of HI 93712A Ascorbic acid reagent and mix until dissolution is complete.

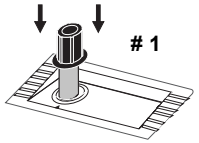
- Add the content of one packet of HI 93712B Aluminon reagent and mix until dissolution is complete. This is the sample.

- Fill two cuvets with 10 mL of sample each (up to the mark).

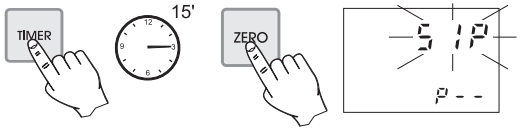
- Add the content of one HI 93712C Bleaching powder packet to one of the two cuvets. Replace the cap and shake vigorously until dissolution is complete. This is the blank.



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

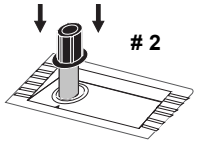


- Press TIMER and the display will show the countdown prior to zeroing the blank. Alternatively wait for 15 minutes and then press ZERO. "SIP" will blink during zeroing.

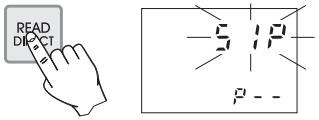


- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.

- Remove the blank and insert the other cuvet into the instrument.



- Press READ DIRECT. "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of aluminum on the Liquid Crystal Display.

INTERFERENCES

Interference may be caused by:

Iron above 20 mg/L	Alkalinity above 1000 mg/L
Phosphate above 50 mg/L	Fluoride must be absent

AMMONIA HIGH RANGE

SPECIFICATIONS

Range	0.0 to 50.0 mg/L
Resolution	0.1 mg/L
Accuracy	±0.5 mg/L ±5% of reading
Typical EMC Deviation	±0.1 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 420 nm
Method	Adaptation of the *ASTM Manual of Water and Environmental Technology, D1426-92,* Nessler method. The reaction between ammonia and reagents causes a yellow tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93733**A**-0	Nessler Reagent	4 drops (in fresh and seawater)
HI 93733**B**-0	Ammonia Reagent	9 mL (in fresh and seawater)

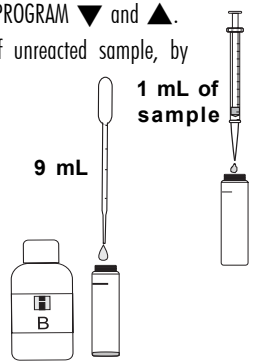
REAGENT SETS

HI 93733-01 Reagents for 100 tests
HI 93733-03 Reagents for 300 tests

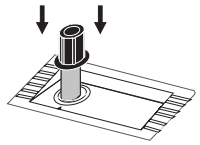
For other accessories see page 141.

MEASUREMENT PROCEDURE

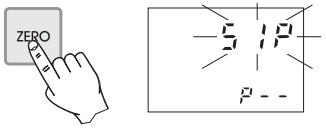
- Select the program number corresponding to Ammonia HR on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill a cuvet with 1 mL of unreacted sample, by means of the syringe.



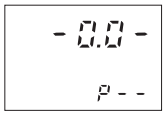
- Add 9 mL of HI 93733B Ammonia Reagent, by means of the 3 mL plastic pipette. Place the cap and swirl the solution to mix.
- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



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

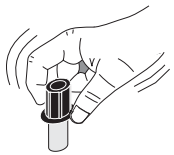


- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.

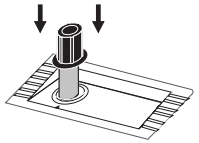


- Remove the cuvet.
- Add 4 drops of HI 93733A Nessler Reagent. Replace the cap and mix the solution.

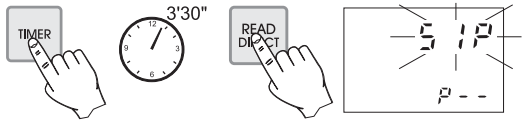
x 4



- Reinsert the cuvet into the instrument.



- Press TIMER and the display will show the countdown prior to measurement or, alternatively, wait for 3 minutes and 30 seconds and then press READ DIRECT. In both cases the display will show "SIP" during measurement.



- The instrument directly displays concentration in mg/L of Ammonium ion (NH_4^+) on the Liquid Crystal Display.

- To convert the reading to mg/L of ammonia (NH_3), multiply by a factor of 0.944.
- To convert the reading to ammonia nitrogen (NH_3-N), multiply by a factor of 0.776.

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 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 *ASTM Manual of Water and Environmental Technology, D1426-92,* Nessler method. The reaction between ammonia and reagents causes a yellow tint in the sample.

REQUIRED REAGENTS

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

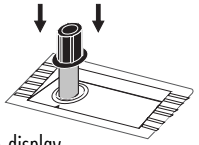
REAGENT SETS

HI 93715-01 Reagents for 100 tests
HI 93715-03 Reagents for 300 tests
For other accessories see page 141.

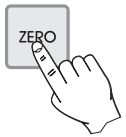
MEASUREMENT PROCEDURE

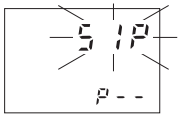
- Select the program number corresponding to Ammonia MR on the secondary LCD by pressing PROGRAM ▼ and ▲.

- Fill the cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.
- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

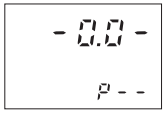


- Press ZERO and "SIP" will blink on the display.



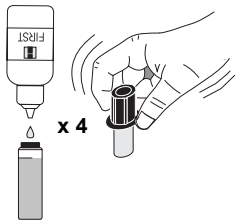


- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.

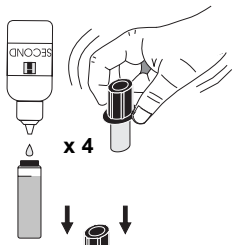


- Remove the cuvet.

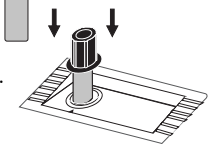
- Add 4 drops of the First reagent (6 drops in case of seawater analysis). Replace the cap and mix the solution.



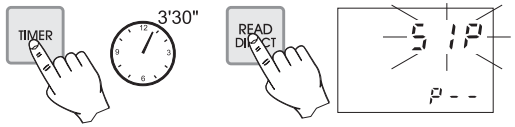
- Add 4 drops of the Second reagent (10 drops in case of seawater analysis). Replace the cap and mix the solution.



- Reinsert the cuvet 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 DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of ammonia nitrogen (NH_3-N) on the display.
- To convert the reading to mg/L of ammonia (NH_3), multiply by a factor of 1.216.

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	±0.04 mg/L ±4% of reading
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 420 nm
Method	Adaptation of the *ASTM Manual of Water and Environmental Technology, D1426-92,* Nessler method. The reaction between ammonia and reagents causes a yellow tint in the sample.

REQUIRED REAGENTS

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

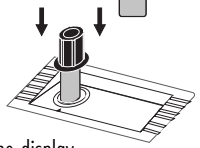
REAGENT SETS

HI 93700-01 Reagents for 100 tests
HI 93700-03 Reagents for 300 tests
For other accessories see page 141.

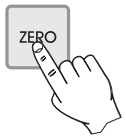
MEASUREMENT PROCEDURE

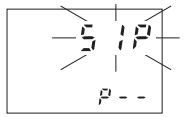
- Select the program number corresponding to Ammonia LR on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample, up to the mark, and replace the cap.

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

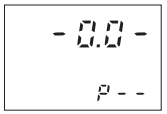


- Press ZERO and "SIP" will blink on the display.

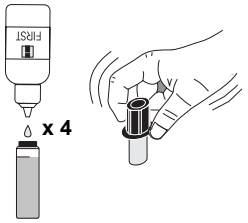




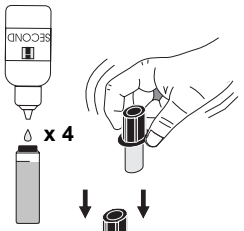
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



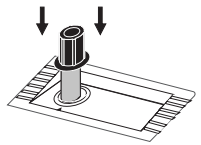
- Remove the cuvet.
- Add 4 drops of the First reagent (6 drops in case of seawater analysis). Replace the cap and mix the solution.



- Add 4 drops of the Second reagent (10 drops in case of seawater analysis). Replace the cap and mix the solution.



- Reinsert the cuvet 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 DIRECT. In both cases "SIP" will blink during measurement.

- The instrument directly displays concentration in mg/L of ammonia nitrogen (NH_3-N) on the display.

- To convert the reading to mg/L of ammonia (NH_3), multiply the display by a factor of 1.216.

INTERFERENCES

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

BROMINE

SPECIFICATIONS

Range	0.00 to 8.00 mg/L
Resolution	0.01 mg/L
Accuracy	±0.08 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 *Standard Methods for the Examination of Water and Wastewater, 18th edition,* DPD method. The reaction between bromine and the reagent causes a pink tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93716-0	DPD Reagent	1 packet

REAGENT SETS

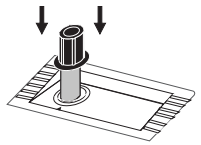
HI 93716-01 Reagents for 100 tests
HI 93716-03 Reagents for 300 tests
For other accessories see page 141.

MEASUREMENT PROCEDURE

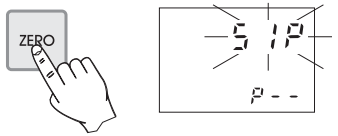
- Select the program number corresponding to Bromine on the secondary LCD by pressing PROGRAM ▼ and ▲.

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

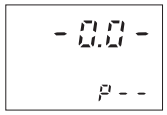
- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



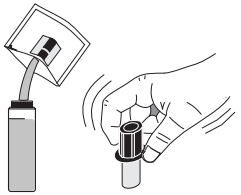
- Press ZERO and "SIP" will blink on the display.



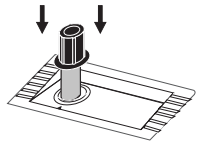
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



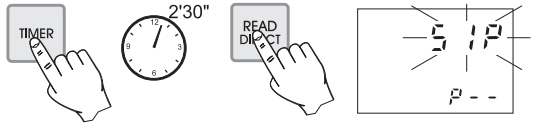
- Remove the cuvet and add the content of one packet of HI 93716 reagent. Replace the cap and shake gently for about 20 seconds to dissolve most of the reagent.



- Reinsert the cuvet 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 DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of bromine on the Liquid Crystal Display.

INTERFERENCES

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

In case of water with hardness greater than 500 mg/L $CaCO_3$, shake the sample for approximately 2 minutes after adding the reagent.

In case of water with alkalinity greater than 250 mg/L $CaCO_3$ or acidity greater than 150 mg/L $CaCO_3$, the color of the sample may develop only partially, or may rapidly fade. To resolve this, neutralize the sample with diluted HCl or NaOH.

FREE CHLORINE

SPECIFICATIONS

Range	0.00 to 2.50 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 *EPA DPD method 330.5.* 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 93701**A**-F	DPD1 Indicator	3 drops
HI 93701**B**-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)

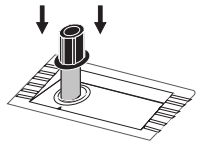
For other accessories see page 141.

MEASUREMENT PROCEDURE

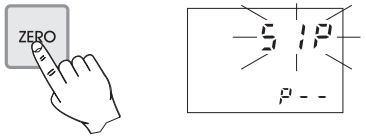
- Select the program number corresponding to Free Chlorine on the secondary LCD by pressing PROGRAM ▼ and ▲.

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

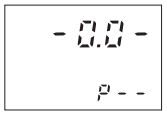
- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



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



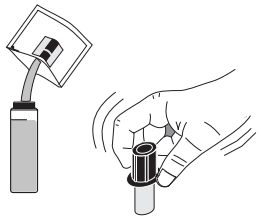
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



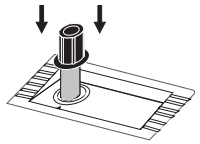
- Remove the cuvet.

<u>Powder reagents procedure</u>

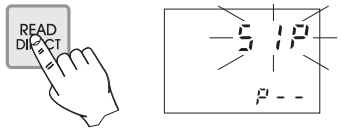
- Add the content of one packet of HI 93701 DPD reagent. Replace the cap and shake gently for 20 seconds (or 2 minutes in case of seawater analysis).



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



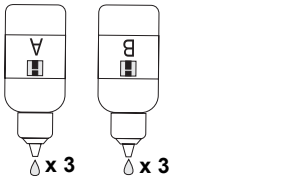
- Press READ DIRECT and the display will show "SIP" during measurement.

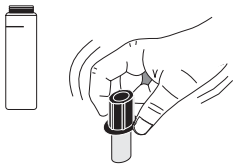


- The instrument directly displays concentration in mg/L of free chlorine on the Liquid Crystal Display.

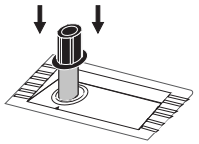
Liquid reagents procedure

- To an empty cuvet 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.

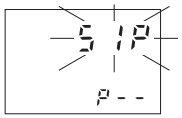




- Reinsert the cuvet into the instrument.



- Press READ DIRECT and the display will show "SIP" during measurement.



- The instrument directly displays concentration in mg/L of free chlorine on the Liquid Crystal Display.

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 $CaCO_3$, shake the sample for approximately 2 minutes after adding the powder reagent.

In case of water with alkalinity greater than 250 mg/L $CaCO_3$ or acidity greater than 150 mg/L $CaCO_3$, the color of the sample may develop only partially, or may rapidly fade. To resolve this, neutralize the sample with diluted HCl or NaOH.

FREE CHLORINE HIGH RANGE

SPECIFICATIONS

Range	0.0 to 10.0 mg/L
Resolution	0.1 mg/L
Accuracy	±0.1 mg/L ±3% of reading
Typical EMC Deviation	±0.1 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the *EPA DPD method 330.5*. The reaction between free chlorine and the DPD reagent causes a pink tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93701-0	DPD	1 packet
HI 93734**B**-0	Free & Total Chlorine HR Reagent	5 mL

REAGENT SETS

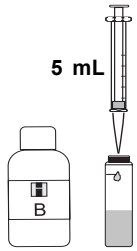
HI 93734-01	Reagents for 100 tests
HI 93734-03	Reagents for 300 tests

For other accessories see page 141.

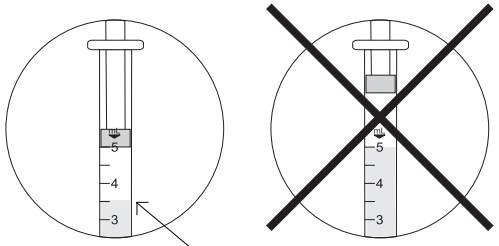
MEASUREMENT PROCEDURE

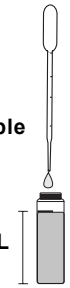
- Select the program number corresponding to Free Chlorine HR on the secondary LCD by pressing PROGRAM ▼ and ▲.

- Add to the cuvet 5 mL of HI 93734B reagent by means of the 5 mL syringe.

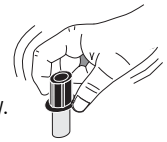


Note: To measure exactly 5 mL of reagent with the syringe, push the plunger completely into the syringe and insert the tip into HI 93734B reagent bottle. Pull the plunger out until the lower edge of the seal is on the 5 mL mark of the syringe.

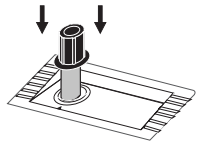




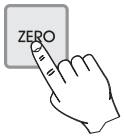
- Fill the cuvet up to the 10 mL mark with 5 mL of unreacted sample, using the 3 mL plastic pipette.
  Note: rinse the 3 mL plastic pipette 2 or 3 times with sample before adding it to the cuvet with reagent.

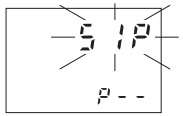


- Replace the cap and shake gently.

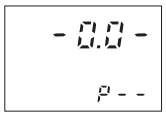


- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.
- Press ZERO and "SIP" will blink on the display.

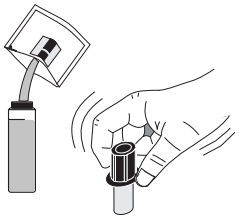




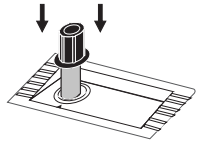
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



- Remove the cuvet.

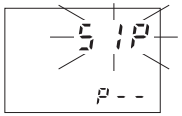


- Add the content of one packet of HI 93701 DPD reagent. Replace the cap and shake gently for 20 seconds (or 2 minutes in case of seawater analysis).



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

- Press READ DIRECT and the display will show "SIP" during measurement.



- The instrument directly displays concentration in mg/L of free chlorine on the Liquid Crystal Display.

INTERFERENCES

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

Alkalinity above 250 mg/L or acidity above 150 mg/L will not reliably develop the full amount of color or it may rapidly fade. To resolve this, neutralize the sample with diluted HCl or NaOH.

In case of water with hardness greater than 1000 mg/L $CaCO_3$, shake the sample for approximately 1 minute after adding the powder reagent.

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 *EPA DPD method 330.5*. 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 93701**A**-T	DPD1 indicator	3 drops
HI 93701**B**-T	DPD1 buffer	3 drops
HI 93701**C**	DPD3 solution	1 drop

REAGENT SETS

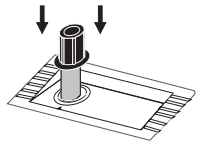
HI 93701-T Reagents for 300 total chlorine tests (liquid)
HI 93711-01 Reagents for 100 total chlorine tests (powder)
HI 93711-03 Reagents for 300 total chlorine tests (powder)

For other accessories see page 141.

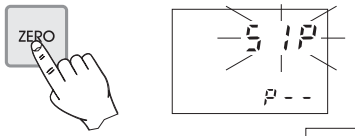
MEASUREMENT PROCEDURE

- Select the program number corresponding to Total Chlorine on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.

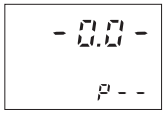
- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



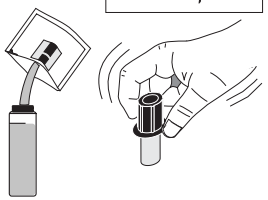
- Press ZERO and "SIP" will blink on the display.



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

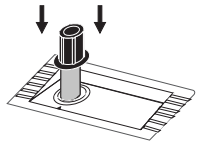


- Remove the cuvet.

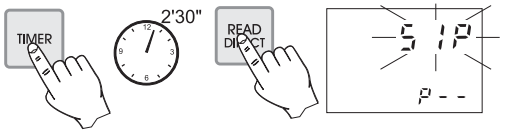


<u>Powder reagents procedure</u>

- Add 1 packet of HI 93711 reagent. Replace the cap and shake gently for 20 seconds (or 2 minutes in case of sea-water analysis).
- Reinsert the cuvet into the instrument.



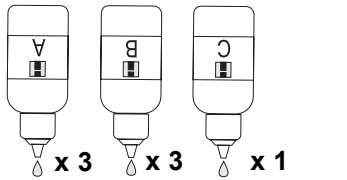
- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 2 minutes and 30 seconds and press READ DIRECT. In both cases "SIP" will blink during measurement.

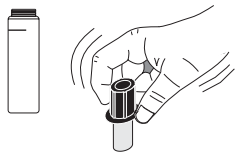


- The instrument directly displays concentration in mg/L of total chlorine on the Liquid Crystal Display.

<u>Liquid reagents procedure</u>

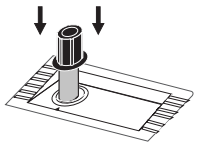
- To an empty cuvet add 3 drops of HI 93701A-T DPD1 indicator, 3 drops of HI 93701B-T DPD1 buffer and 1 drop of HI 93701C DPD solution. Swirl gently to mix and <u>immediately</u> add 10



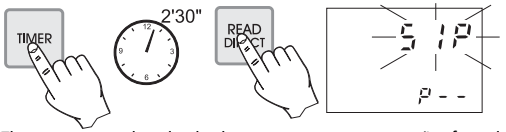


mL of unreacted sample. Replace the cap and shake gently again.

- Reinsert the cuvet 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 DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of total chlorine on the Liquid Crystal Display.

  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 $CaCO_3$, shake the sample for approximately 2 minutes after adding the powder reagent.

In case of water with alkalinity greater than 250 mg/L $CaCO_3$ or acidity greater than 150 mg/L $CaCO_3$, the color of the sample may develop only partially, or may rapidly fade. To resolve this, neutralize the sample with diluted HCl or NaOH.

TOTAL CHLORINE HIGH RANGE

SPECIFICATIONS

Range	0.0 to 10.0 mg/L
Resolution	0.1 mg/L
Accuracy	±0.1 mg/L ±3% of reading
Typical EMC Deviation	±0.1 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the *EPA DPD method 330.5*. The reaction between free chlorine and the DPD reagent causes a pink tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93701-0	DPD	1 packet
HI 93734**B**-0	Free & Total Chlorine HR Reagent	5 mL
HI 93734**C**-0	Total Chlorine HR Reagent	3 drops

REAGENT SETS

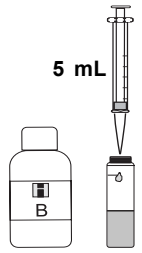
HI 93734-01	Reagents for 100 tests
HI 93734-03	Reagents for 300 tests

For other accessories see page 141.

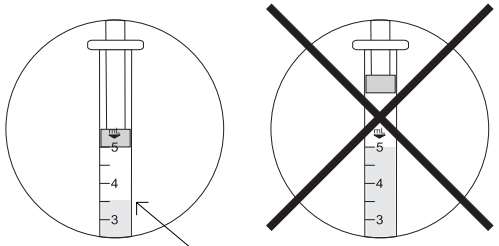
MEASUREMENT PROCEDURE

- Select the program number corresponding to Total Chlorine HR on the secondary LCD by pressing PROGRAM ▼ and ▲.

- Add to the cuvet 5 mL of HI 93734B reagent by means of the 5 mL syringe.

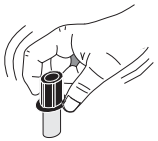


Note: To measure exactly 5 mL of reagent with the syringe, push the plunger completely into the syringe and insert the tip into HI 93734B reagent bottle. Pull the plunger out until the lower edge of the seal is on the 5 mL mark of the syringe.

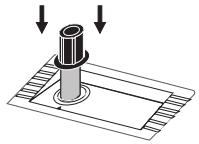


- Fill the cuvet up to the 10 mL mark with 5 mL of unreacted sample, using the 3 mL plastic pipette.
  Note: rinse the 3 mL plastic pipette 2 or 3 times with sample before adding it to the cuvet with reagent.

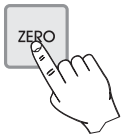
- Replace the cap and shake gently.

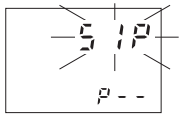


- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

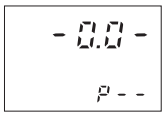


- Press ZERO and "SIP" will blink on the display.

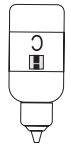




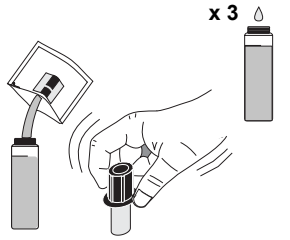
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



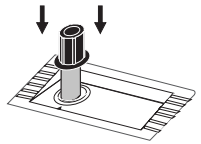
- Remove the cuvet.
- Add 3 drops of HI 93734C reagent to the cuvet.



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



- Reinsert the cuvet into the instrument.



- Press TIMER and the display will show a countdown prior to the measurement or, alternatively, wait for 2 minutes and 30 seconds and press READ DIRECT. The display will show "SIP" during measurement.

- The instrument directly displays concentration in mg/L of total chlorine on the Liquid Crystal Display.

INTERFERENCES

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

Alkalinity above 250 mg/L or acidity above 150 mg/L will not reliably develop the full amount of color or it may rapidly fade. To resolve this, neutralize the sample with diluted HCl or NaOH.

In case of water with hardness greater than 1000 mg/L $CaCO_3$, shake the sample for approximately 1 minute after adding the powder reagent.

CHLORINE DIOXIDE

SPECIFICATIONS

Range	0.00 to 2.00 mg/L
Resolution	0.01 mg/L
Accuracy	±0.10 mg/L ±5% of reading
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 575 nm
Method	Adaptation of the Chlorophenol Red method. The reaction between chlorine dioxide and reagents causes a colorless to purple tint in the sample.

REQUIRED REAGENT

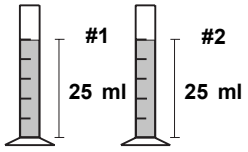
Code	Description	Quantity
HI 93738**A**-0	Reagent A	1 mL
HI 93738**B**-0	Dechlorinating Reagent B	1 packet
HI 93738**C**-0	Reagent C	1 mL
HI 93738**D**-0	Reagent D	1 mL

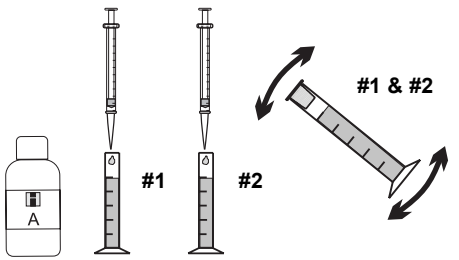
REAGENT SETS

HI 93738-01 Reagents for 100 tests
HI 93738-03 Reagents for 300 tests
For other accessories see page 141.

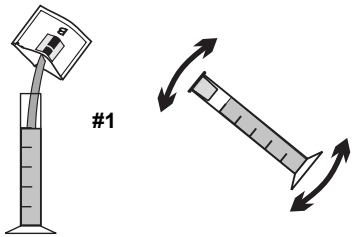
MEASUREMENT PROCEDURE

- Select the program number corresponding to Chlorine Dioxide on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill two graduated mixing cylinders (#1 & #2) up to the 25 mL mark with the sample.
- Add 0.5 mL of HI 93738A chlorine dioxide reagent to each cylinder (#1 & #2), close them and invert several times to mix.

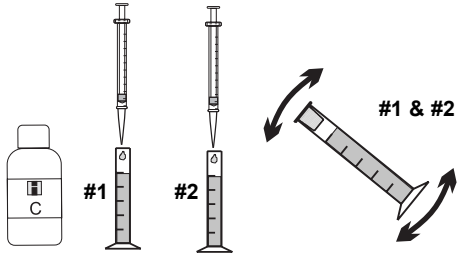




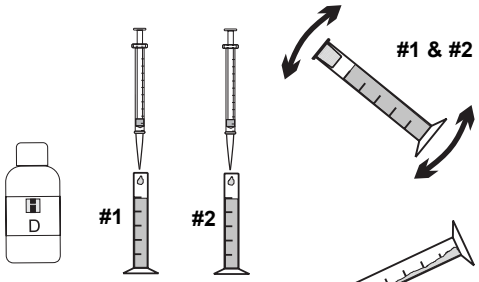
- Add the content of one packet of HI 93738B dechlorinating reagent to only one of the two cylinders (#1), close and invert it several times until it is totally dissolved. This is the blank.



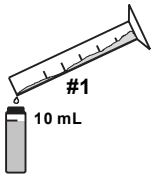
- Add precisely 0.5 mL of HI 93738C chlorine dioxide reagent to each cylinder (#1 & #2), close them and invert several times to mix.



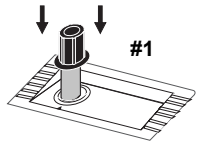
- Add 0.5 mL of HI 93738D chlorine dioxide reagent to each cylinder (#1 & #2), close them and invert several times to mix. Cylinder #2 is the reacted sample.



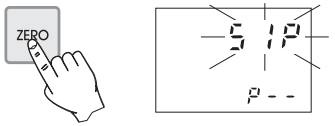
- Fill a cuvet with 10 mL of the blank (#1) up to the mark and replace the cap.



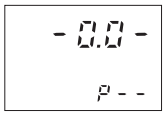
- Place the blank (#1) into the holder and ensure that the notch on the cap is positioned securely into the groove.



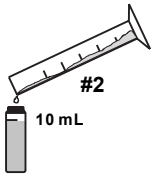
- Press ZERO and "SIP" will blink on the display.



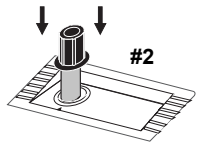
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



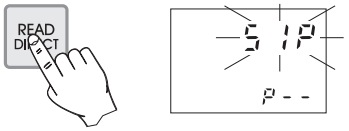
- Fill another cuvet with 10 mL of the reacted sample (#2) up to the mark and replace the cap.



- Insert the sample into the instrument.



- Press READ DIRECT and "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of chlorine dioxide on the Liquid Crystal Display.

SAMPLING PROCEDURE

It is recommended to analyze chlorine dioxide samples immediately after collection. Chlorine dioxide samples must be stored in dark glass stoppered bottles, with minimal head space. Excessive heat (above 25°C/78°F), agitation and exposure to light must be avoided.

INTERFERENCES

Interferences may be caused by strong oxidants.

CHROMIUM VI HIGH RANGE

SPECIFICATIONS

Range	0 to 1000 µg/L
Resolution	1 µg/L
Accuracy	±5 µg/L ±4% of reading
Typical EMC Deviation	±1 µg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the *ASTM Manual of Water and Environmental Technology, D1687-92,* Diphenylcarbohydrazide method. The reaction between chromium VI and the reagent causes a purple tint in the sample.

REQUIRED REAGENTS

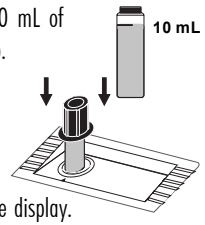
Code	Description	Quantity
HI 93723-0	Powder reagent	1 packet

REAGENT SETS

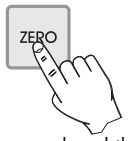
HI 93723-01 Reagents for 100 tests
HI 93723-03 Reagents for 300 tests
For other accessories see page 141.

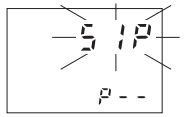
MEASUREMENT PROCEDURE

- Select the program number corresponding to Chromium VI HR on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet up to the mark with 10 mL of unreacted sample and replace the cap.
- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

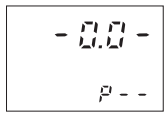


- Press ZERO and "SIP" will blink on the display.

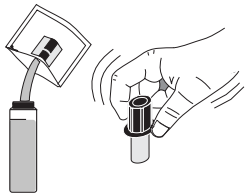




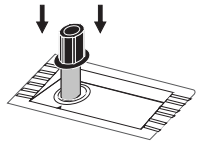
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



- Remove the cuvet and add the content of one packet of HI 93723 reagent. Replace the cap and shake vigorously for about 10 seconds.



- Reinsert the cuvet into the instrument.



- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 6 minutes and press READ DIRECT. In both cases "SIP" will blink during measurement.

- The instrument directly displays concentration in µg/L of chromium VI on the Liquid Crystal Display.

INTERFERENCES

Interference may be caused by:
Vanadium above 1 ppm. However, waiting 10 minutes before reading, the interference is removed
Iron above 1 ppm
Mercurous and mercuric ions cause slight inhibition of the reaction.

CHROMIUM VI LOW RANGE

SPECIFICATIONS

Range	0 to 300 µg/L
Resolution	1 µg/L
Accuracy	±1 µg/L ±4% of reading
Typical EMC Deviation	±1 µg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the *ASTM Manual of Water and Environmental Technology, D1687-92,* Diphenylcarbohydrazide method. The reaction between chromium VI and the reagent causes a purple tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93749-0	Powder reagent	1 packet

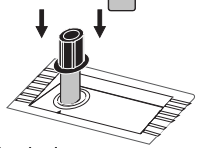
REAGENT SETS

HI 93749-01 Reagents for 100 tests
HI 93749-03 Reagents for 300 tests
For other accessories see page 141.

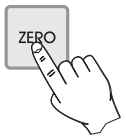
MEASUREMENT PROCEDURE

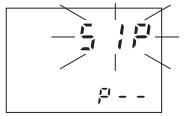
- Select the program number corresponding to Chromium VI LR on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.

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

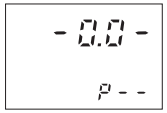


- Press ZERO and "SIP" will blink on the display.

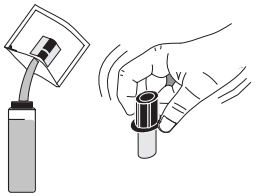




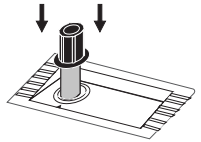
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



- Remove the cuvet and add the content of one packet of HI 93749 reagent. Replace the cap and shake vigorously for about 10 seconds.



- Reinsert the cuvet into the instrument.



- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 6 minutes and press READ DIRECT. In both cases "SIP" will blink during measurement.

- The instrument directly displays concentration in µg/L of Chromium VI on the Liquid Crystal Display.

INTERFERENCES

Interference may be caused by:
Vanadium above 1 ppm. However, waiting 10 minutes before reading, the interference is removed
Iron above 1 ppm
Mercurous and mercuric ions cause slight inhibition of the reaction.

COLOR OF WATER

SPECIFICATIONS

Range	0 to 500 PCU (Platinum Cobalt Units)
Resolution	1 PCU
Accuracy	±10 PCU ±5% of reading
Typical EMC Deviation	± 1 PCU
Light Source	Tungsten lamp with narrow band interference filter @ 420 nm
Method	Adaptation of the *Standard Methods for the Examination of Water and Wastewater, 18th edition,* Colorimetric Platinum Cobalt method.

REQUIRED ACCESSORIES

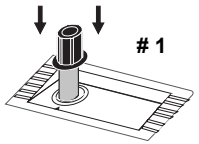
0.45 µm membrane for true color measurement.

For other accessories see page 141.

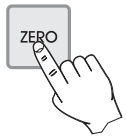
MEASUREMENT PROCEDURE

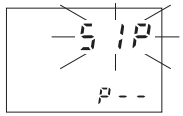
- Select the program number corresponding to Color of Water on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill one cuvet up to the mark with deionized water and replace the cap. This is the blank.

- Place the blank (# 1) into the holder and ensure that the notch on the cap is positioned securely into the groove.

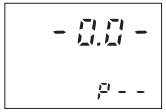


- Press ZERO and "SIP" will blink on the display.





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

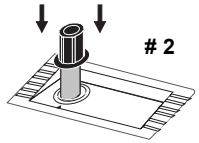


- Remove the blank.

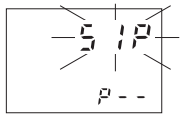
- Fill another cuvet up to the mark with unfiltered sample and replace the cap. This is the apparent color.

- Filter 10 mL of sample through a filter with a 0.45 μm membrane into the third cuvet, up to the 10 mL mark and replace the cap. This is the true color.

- Insert the apparent color cuvet (# 2) into the instrument and ensure that the notch on the cap is positioned securely into the groove.

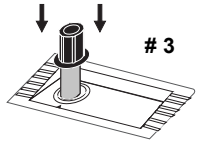


- Press READ DIRECT and "SIP" will blink on the display.

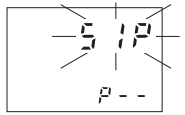


- The meter directly displays the value of apparent color in PCU on the Liquid Crystal Display.

- Remove the cuvet, insert the true color cuvet (# 3) into the instrument and ensure that the notch on the cap is positioned securely into the groove.



- Press READ DIRECT and "SIP" will blink on the display.



- The meter directly displays the value of true color in PCU on the Liquid Crystal Display.

COPPER HIGH RANGE

SPECIFICATIONS

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

REQUIRED REAGENTS

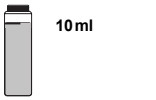
Code	Description	Quantity
HI 93702-0	Bicinchoninate	1 packet

REAGENT SETS

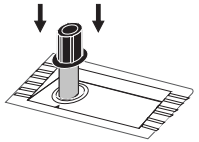
HI 93702-01 Reagents for 100 tests
HI 93702-03 Reagents for 300 tests
For other accessories see page 141.

MEASUREMENT PROCEDURE

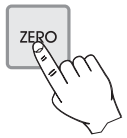
- Select the program number corresponding to Copper HR on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.

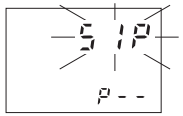


- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

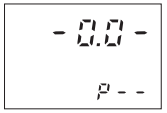


- Press ZERO and "SIP" will blink on the display.

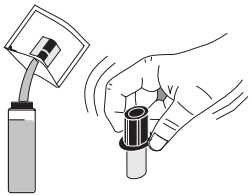




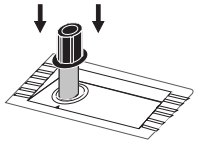
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



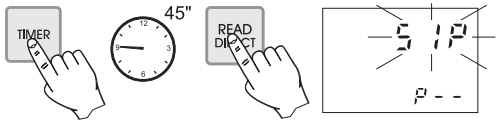
- Remove the cuvet.
- Add the content of one packet of HI 93702 reagent. Replace the cap and shake gently for about 15 seconds.



- Reinsert the cuvet 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 DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of copper on the Liquid Crystal Display.

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 *EPA method*. 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

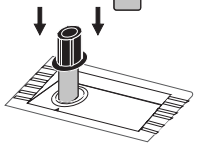
HI 93747-03 Reagents for 300 tests

For other accessories see page 141.

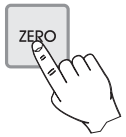
MEASUREMENT PROCEDURE

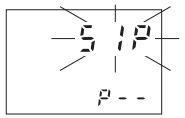
- Select the program number corresponding to Copper LR on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.

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

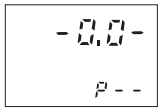


- Press ZERO and "SIP" will blink on the display.

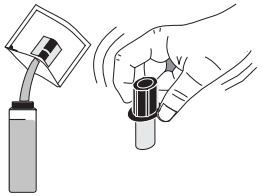




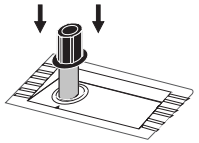
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



- Remove the cuvet.

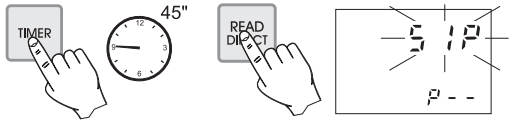


- Add the content of one packet of HI 93747 reagent. Replace the cap and shake gently for about 15 seconds.



- Reinsert the cuvet 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 DIRECT. In both cases "SIP" will blink during measurement.



- Multiply the reading on the Liquid Crystal Display by 10 to obtain the concetration in mg/L of oxygen demand.

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.

CYANIDE

SPECIFICATIONS

Range	0.000 to 0.200 mg/L
Resolution	0.001 mg/L
Accuracy	±0.005 mg/L ±3% of reading
Typical EMC Dev.	±0.001 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 610 nm
Method	Adaptation of the *Standard Methods for the Examination of Water and Wastewater, 18th edition,* Pyridine-Pyrazolone method. The reaction between cyanide and reagents causes a blue tint in the sample.

REQUIRED REAGENTS

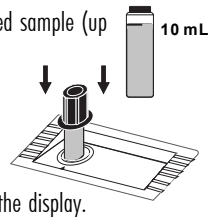
Code	Description	Quantity
HI 93714**A**-0	Reagent A	1 spoon
HI 93714**B**-0	Reagent B	1 packet
HI 93714**C**-0	Reagent C	1 packet

REAGENT SETS

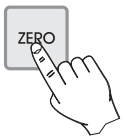
HI 93714-01 Reagents for 100 tests
HI 93714-03 Reagents for 300 tests
For other accessories see page 141.

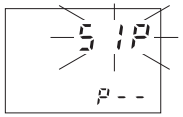
MEASUREMENT PROCEDURE

- Select the program number corresponding to Cyanide on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.
- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

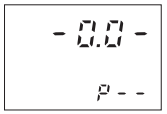


- Press ZERO and "SIP" will blink on the display.

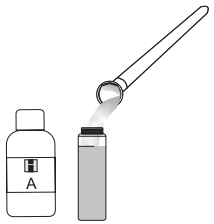




- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



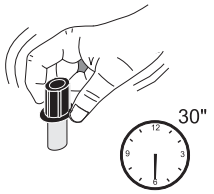
- Remove the cuvet and add 1 level spoon of HI 93714A Cyanide Reagent. Remember to close the reagent bottle immediately after use.



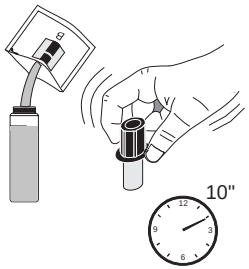
Note: Pay attention to the way the spoon is filled:

- do not press the powder;
- do not overfill it.

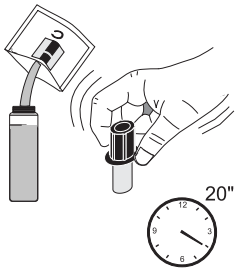
- Place the HDPE plastic stopper and cap immediately, to prevent the escape of chlorine gas which is developed during the reaction, and shake gently for 30 seconds.



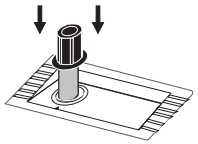
- Wait for 30 seconds leaving the cuvet tightly capped and undisturbed, then add the content of one packet of HI 93714B reagent and shake gently for 10 seconds.



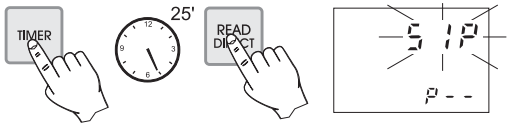
- Immediately add the content of one packet of HI 93714C reagent, replace the cap and shake vigorously for 20 seconds.



- Reinsert the cuvet into the instrument.



- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 25 minutes and press READ DIRECT. In both cases "SIP" will blink during measurement.



  Note: Shake gently the cuvet 4 or 5 times during the first 20 minutes of the countdown prior to the measurement. Accuracy is not affected by undissolved reagent powder.
- The instrument directly displays concentration in mg/L of cyanide on the Liquid Crystal Display.
- To convert the result in mg/L of Potassium Cyanide (KCN) multiply by a factor of 2.5.

Note: for most accurate results perform the test at 20-25 °C.

INTERFERENCES

Interference may be caused by large amounts of turbidity that will cause high readings.

Oxidizing (like chlorine) or reducing agents (such as sulfide or sulfur dioxide) are known to interfere with the measurement. Distillation will remove these.

Samples with high pH values should be adjusted to approximately pH 7 before testing.

CAUTION: cyanides, their solutions, and hydrogen cyanide liberated by acids, are very poisonous.

CYANURIC ACID

SPECIFICATIONS

Range	0 to 80 mg/L
Resolution	1 mg/L
Accuracy	±1 mg/L ±15% of reading
Typical EMC Deviation	±1 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the turbidimetric method. The reaction between cyanuric acid and the reagent causes a white suspension in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93722-0	Powder reagent	1 packet

REAGENT SETS

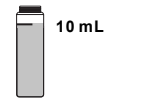
HI 93722-01 Reagents for 100 tests

HI 93722-03 Reagents for 300 tests

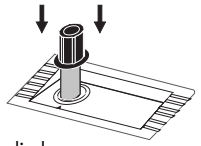
For other accessories see page 141.

MEASUREMENT PROCEDURE

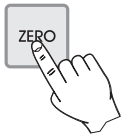
- Select the program number corresponding to Cyanuric Acid on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.

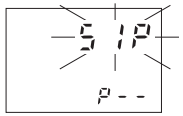


- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

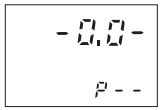


- Press ZERO and "SIP" will blink on the display.

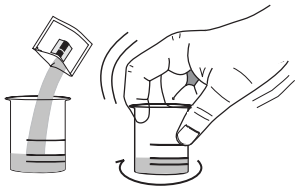




- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.

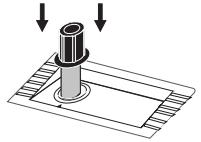


- Fill a graduated beaker up to the 25 mL mark with the sample, add the content of one packet of HI 93722 reagent and swirl gently to mix.

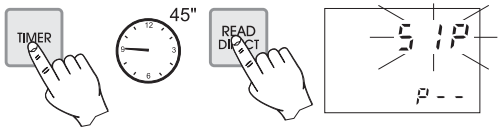


- Fill a second cuvet with 10 mL of the reacted sample up to the mark. Replace the cap.

- Reinsert the cuvet 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 DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of cyanuric acid on the Liquid Crystal Display.

FLUORIDE

SPECIFICATIONS

Range	0.00 to 2.00 mg/L
Resolution	0.01 mg/L
Accuracy	±5% of reading
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 575 nm
Method	Adaptation of the *Standard Methods for the Examination of Water and Wastewater, 18th edition,* SPADNS method. The reaction between fluoride and the liquid reagent causes a red tint in the sample.

REQUIRED REAGENT

Code	Description	Quantity
HI 93729-0	SPADNS Reagent	4 mL

REAGENT SETS

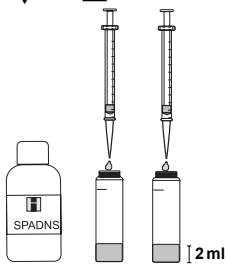
HI 93729-01 Reagents for 100 tests

HI 93729-03 Reagents for 300 tests

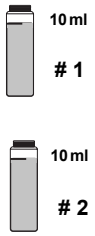
For other accessories see page 141.

MEASUREMENT PROCEDURE

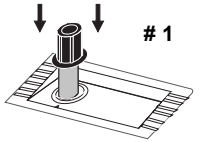
- Select the program number corresponding to Fluoride on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Add 2 mL of HI 93729 SPADNS reagent to two cuvets.



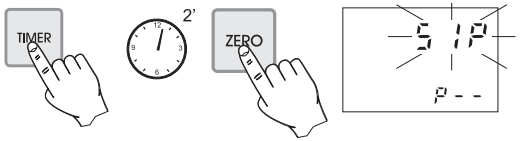
- Fill one of the cuvets with distilled water (up to the mark), replace the cap and invert several times to mix.
- Fill the other cuvet with sample (up to the mark), replace the cap and invert several times to mix.



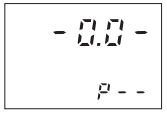
- Place the cuvet with the reacted distilled water (# 1) into the holder and ensure that the notch on the cap is positioned securely into the groove.



- Press TIMER and the display will show the countdown prior to zeroing the blank or, alternatively, wait for two minutes and press ZERO and "SIP" will blink on the display.

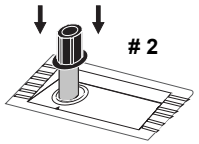


- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.

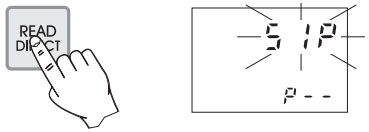


- Remove the cuvet.

- Insert the other cuvet (# 2) with the reacted sample into the instrument.



- Press READ DIRECT and "SIP" will blink on the LCD during measurement.



- The instrument directly displays concentration in mg/L of fluoride on the Liquid Crystal Display.

  Note: For wastewater or seawater samples, before performing measurements, distillation is required.

  Note: For most accurate results, use two graduated pipettes to deliver exactly 8 mL of distilled water and 8 mL of sample.

INTERFERENCES

Negative interferences may be caused by:
Alkalinity (as $CaCO_3$) above 5000 mg/L
Aluminum above 0.1 mg/L
Iron, ferric above 10 mg/L
Positive interferences may be caused by:
Chloride above 700 mg/L
Phosphate, ortho above 16 mg/L
Sodium hexametaphosphate above 1.0 mg/L
Sulfate above 200 mg/L
Highly colored and turbid samples may require distillation
Highly alkaline samples can be neutralized with nitric acid.

CALCIUM HARDNESS

SPECIFICATIONS

Range	0.00 to 2.70 mg/L
Resolution	0.01 mg/L
Accuracy	±0.11 mg/L ±5% of reading
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the *Standard Methods for the Examination of Water and Wastewater, 18th edition,* Calmagite method. The reaction between calcium and reagents causes a reddish-violet tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93720**A**-0	Ca & Mg indicator	0.5 mL
HI 93720**B**-0	Alkali solution	0.5 mL
HI 93720**C**-0	EGTA solution	1 drop

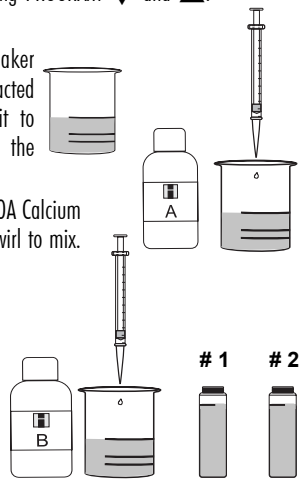
REAGENT SETS

HI 93720-01 Reagents for 100 tests
HI 93720-03 Reagents for 300 tests
For other accessories see page 141.

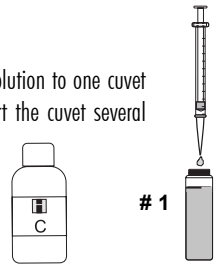
MEASUREMENT PROCEDURE

- Select the program number corresponding to Hardness Ca on the secondary LCD by pressing PROGRAM ▼ and ▲.

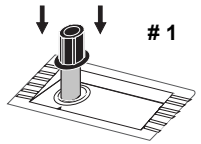
- Rinse a graduated beaker several times with unreacted sample, before filling it to the 50 mL mark with the sample.
- Add 0.5 mL of HI 93720A Calcium indicator solution and swirl to mix.
- Add 0.5 mL of HI 93720B Alkali solution and swirl to mix. Use this solution to rinse 2 cuvets before filling them up to the 10 mL mark.



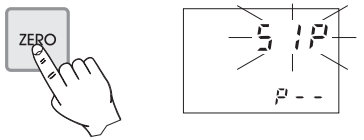
- Add 1 drop of HI 93720C EGTA solution to one cuvet (# 1), replace the cap and invert the cuvet several times to mix. This is the blank.



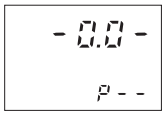
- Place the blank (# 1) into the holder and ensure that the notch on the cap is positioned securely into the groove.



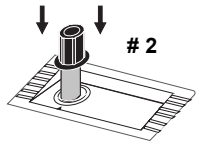
- Press ZERO and "SIP" will blink on the display.



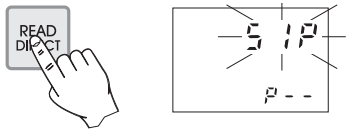
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



- Remove the blank and insert the second cuvet (# 2) into the instrument.



- Press READ DIRECT. "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of calcium hardness, as $CaCO_3$, on the Liquid Crystal Display.
- To convert the reading to mg/L of calcium (Ca), multiply by a factor of 0.4.

Note: The test will detect any calcium contamination in the beaker, measuring syringes or sample cells. To test cleanliness, repeat the test multiple times until you obtain consistent results.

Note: For better accuracy wash glassware with HCl 6N.

SAMPLE DILUTION

This meter is designed to determine low levels of hardness, typically found in water purification systems.

When testing some other sources of water, it is not uncommon to come across levels of hardness that are greater than the range of this meter.

This problem can be overcome through dilution. Dilutions must be performed with hardness-free water or the readings will be erroneous.

A dilution to reduce the level of hardness by a factor of one hundred is performed as follows:

- Fill a 1 mL syringe with the sample.
- Place the syringe in a 50 mL beaker, making sure that the beaker is clean and empty, and inject 0.5 mL into the beaker.
- Fill the beaker up to the 50 mL mark with hardness-free water.

Now, follow normal measurement procedure. The true value of the sample is the reading obtained multiplied by a factor of one hundred (the dilution factor).

The conversion factors to convert readings in mg/L to French degrees (FD), German degrees (DD) and English degrees (ED) of hardness are as follows:

$$1 \text{ mg/L} = 0.1 \text{ FD} = 0.0556 \text{ DD} = 0.07 \text{ ED}.$$

INTERFERENCES

Interference may be caused by excessive amounts of heavy metals.

MAGNESIUM HARDNESS

SPECIFICATIONS

Range	0.00 to 2.00 mg/L
Resolution	0.01 mg/L
Accuracy	±0.11 mg/L ±5% of reading
Typical EMC Deviation	±0.02 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the *Standard Methods for the Examination of Water and Wastewater, 18th edition,* EDTA colorimetric method. The reaction between magnesium and reagents causes a reddish-violet tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93719**A**-0	Mg indicator	0.5 mL
HI 93719**B**-0	Alkali solution	0.5 mL
HI 93719**C**-0	EDTA solution	1 drop
HI 93719**D**-0	EGTA solution	1 drop

REAGENT SETS

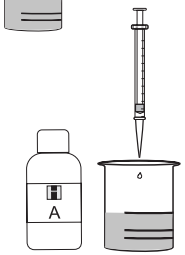
HI 93719-01 Reagents for 100 tests
HI 93719-03 Reagents for 300 tests
For other accessories see page 141.

MEASUREMENT PROCEDURE

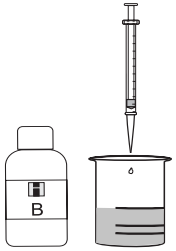
- Select the program number corresponding to Hardness Mg on the secondary LCD by pressing PROGRAM ▼ and ▲.

- Rinse a graduated beaker several times with unreacted sample, before filling it to the 50 mL mark with the sample.

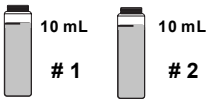
- Add 0.5 mL of HI 93719A Magnesium indicator solution, then swirl to mix.



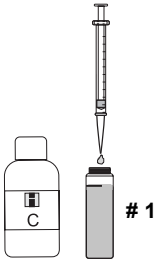
- Add 0.5 mL of HI 93719B Alkali solution and swirl to mix. Use this solution to rinse 2 cuvets.



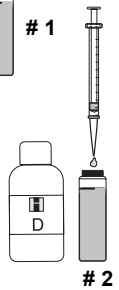
- Fill both cuvets up to the 10 mL mark.



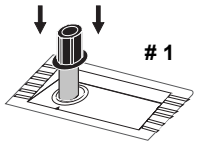
- Add 1 drop of HI 93719C EDTA solution to one cuvet (# 1), replace the cap and invert the cuvet several times to mix. This is the blank.



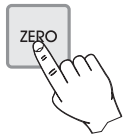
- Add 1 drop of HI 93719D EGTA solution to the second cuvet (# 2), replace the cap and invert the cuvet several times to mix. This is the sample.

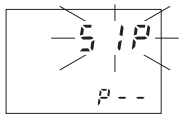


- Place the blank (# 1) into the holder and ensure that the notch on the cap is positioned securely into the groove.

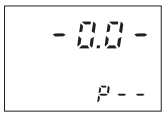


- Press ZERO and "SIP" will blink on the display.

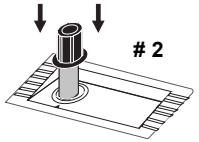




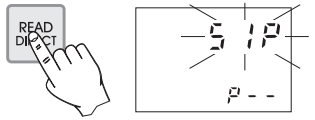
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



- Remove the blank (# 1) and insert the sample (# 2) into the instrument, making sure that the notch on the cap is positioned securely into the groove.



- Press READ DIRECT. "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of magnesium hardness, as $CaCO_3$, on the Liquid Crystal Display.

- To convert the result to mg/L of magnesium (Mg), multiply by a factor of 0.243.

  Note: The test will detect any magnesium contamination in the beakers, measuring syringes or sample cells. To test cleanliness, repeat the test multiple times until you obtain consistent results.

SAMPLE DILUTION

This meter is designed to determine hardness typically found in water purification systems. In order to measure samples with high hardness, follow dilution procedure explained on page 66 (Ca Hardness).

The conversion factors to convert readings in mg/L to French degrees (FD), German degrees (DD) and English degrees (ED) of hardness are as follows:

$$1 \text{ mg/L} = 0.1 \text{ FD} = 0.0556 \text{ DD} = 0.07 \text{ ED}$$

INTERFERENCES

Interference may be caused by excessive amounts of heavy metals.

TOTAL HARDNESS HIGH RANGE

SPECIFICATIONS

Range	400 to 750 mg/L
Resolution	5 mg/L
Accuracy	±10 mg/L ±2% of reading
Typical EMC Deviation	±5 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 466 nm
Method	Adaptation of the *EPA method 130.1*. The reaction between calcium, magnesium and reagents causes a red-violet tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93735**A-HR**	Hardness Indicator reagent HR	9.5 mL
HI 93735**B**-0	Hardness Buffer reagent	2 drops
HI 93735**C**-0	Fixing reagent	1 packet

REAGENT SETS

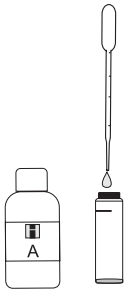
HI 93735-02 Reagents for 100 tests High Range (400 to 750 mg/L)
HI 93735-0 Reagents for 100 tests (0 to 750 mg/L)
For other accessories see page 141.

MEASUREMENT PROCEDURE

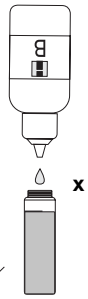
- Select the program number corresponding to Total Hardness HR on the secondary LCD by pressing PROGRAM ▼ and ▲.

- Using the syringe, add exactly 0.5 mL of unreacted sample to the cuvet.

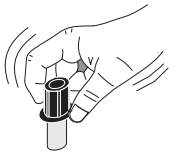
- With the plastic pipette fill the cuvet up to the 10 mL mark adding HI 93735A-HR Indicator reagent.



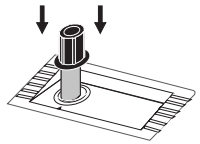
- Add 2 drops of HI 93735B Buffer reagent.



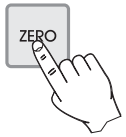
- Replace the cap, shake gently to mix and wait for 15 seconds.

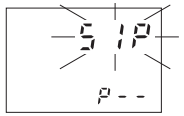


- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

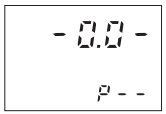


- Press ZERO and "SIP" will blink on the display.



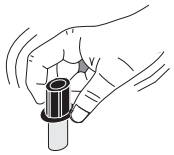


- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.

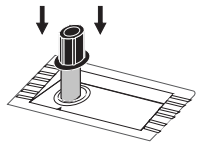


- Remove the cuvet and add the content of 1 packet of HI 93735C Fixing reagent.

- Replace the cap and shake gently till dissolution is complete.



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



- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 2 minutes and press READ DIRECT. In both cases "SIP" will blink during measurement.

- The instrument directly displays the total hardness in mg/L of $CaCO_3$ on the Liquid Crystal Display.

- The conversion factors to convert readings in mg/L to French Degrees (FD), German Degrees (DD) and English Degrees (ED) of hardness are as follows:

1 mg/L= 0.1 FD = 0.0556 DD = 0.07 ED

INTERFERENCES

Interference may be caused by excessive amounts of heavy metals.

Note: if the sample is very acidic, some extra drops of HI 93735B Buffer reagent may be added.

TOTAL HARDNESS MEDIUM RANGE

SPECIFICATIONS

Range	200 to 500 mg/L
Resolution	5 mg/L
Accuracy	±7 mg/L ±3% of reading
Typical EMC Deviation	±5 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 466 nm
Method	Adaptation of the *EPA method 130.1*. The reaction between calcium, magnesium and reagents causes a red-violet tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93735**A-MR**	Hardness Indicator reagent MR	9.5 mL
HI 93735**B**-0	Hardness Buffer reagent	2 drops
HI 93735**C**-0	Fixing reagent	1 packet

REAGENT SETS

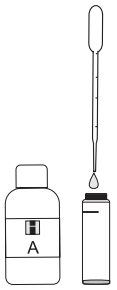
HI 93735-01 Reagents for 100 tests Medium Range (200 to 500 mg/L)
HI 93735-0 Reagents for 100 tests (0 to 750 mg/L)
For other accessories see page 141.

MEASUREMENT PROCEDURE

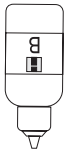
- Select the program number corresponding to Total Hardness MR on the secondary LCD by pressing PROGRAM ▼ and ▲.

- Using the syringe, add exactly 0.5 mL of unreacted sample to the cuvet.

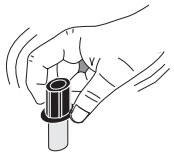
- With the plastic pipette fill the cuvet up to the 10 mL mark adding HI 93735A-MR Indicator reagent.



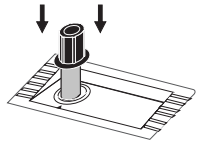
- Add 2 drops of HI 93735B Buffer reagent



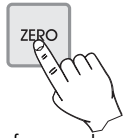
- Replace the cap and shake gently to mix. Wait for 15 seconds.

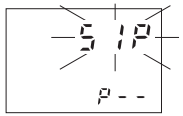


- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

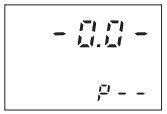


- Press ZERO and "SIP" will blink on the display.



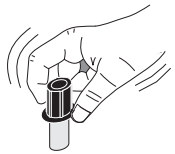


- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.

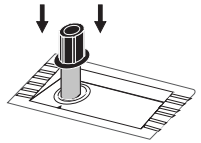


- Remove the cuvet and add the content of 1 packet of HI 93735C Fixing reagent.

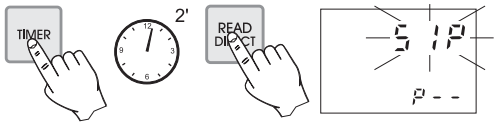
- Replace the cap and shake gently till dissolution is complete.



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



- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 2 minutes and press READ DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays the hardness in mg/L of $CaCO_3$, on the Liquid Crystal Display.

- The conversion factors to convert readings in mg/L to French Degrees (FD), German Degrees (DD) and English Degrees (ED) of hardness are as follows:

1 mg/L= 0.1 FD = 0.0556 DD = 0.07 ED

INTERFERENCES

Interference may be caused by excessive amounts of heavy metals.

Note: if the sample is very acidic, some extra drops of HI 93735B Buffer reagent may be added.

TOTAL HARDNESS LOW RANGE

SPECIFICATIONS

Range	0 to 250 mg/L
Resolution	1 mg/L from 0 to 100 mg/L 5 mg/L from 100 to 250 mg/L
Accuracy	±5 mg/L ±4% of reading
Typical EMC Deviation	±5 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 466 nm
Method	Adaptation of the *EPA method 130.1*. The reaction between calcium, magnesium and reagents causes a red-violet tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93735**A-LR**	Hardness Indicator reagent LR	9.5 mL
HI 93735**B**-0	Hardness Buffer reagent	2 drops
HI 93735**C**-0	Fixing reagent	1 packet

REAGENT SETS

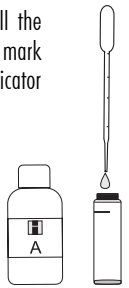
HI 93735-00 Reagents for 100 tests Low Range (0 to 250 mg/L)
HI 93735-0 Reagents for 100 tests (0 to 750 mg/L)
For other accessories see page 141.

MEASUREMENT PROCEDURE

- Select the program number corresponding to Total Hardness LR on the secondary LCD by pressing PROGRAM ▼ and ▲.

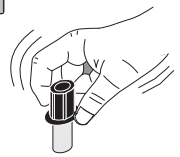
- Using the syringe, add exactly 0.5 mL of unreacted sample to the cuvet.

- With the plastic pipette fill the cuvet up to the 10 mL mark adding HI 93735A-LR Indicator reagent.

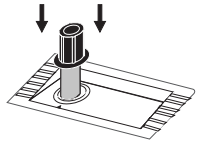


- Add 2 drops of HI 93735B-0 Buffer reagent.

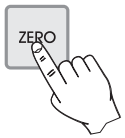
- Replace the cap and shake gently to mix. Wait for 15 seconds.

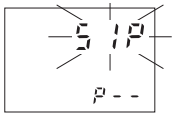


- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

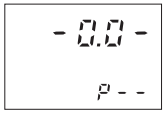


- Press ZERO and "SIP" will blink on the display.



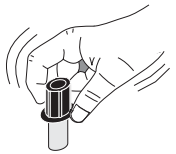


- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.

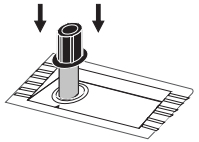


- Remove the cuvet and add the content of 1 packet of HI 93735C Fixing reagent.

- Replace the cap and shake gently till dissolution is complete.



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



- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 2 minutes and press READ DIRECT. In both cases "SIP" will blink during measurement.

- The instrument directly displays the hardness in mg/L of $CaCO_3$, on the Liquid Crystal Display.

- The conversion factors to convert readings in mg/L to French Degrees (FD), German Degrees (DD) and English Degrees (ED) of hardness are as follows:

1 mg/L= 0.1 FD = 0.0556 DD = 0.07 ED

INTERFERENCES

Interference may be caused by excessive amounts of heavy metals.

Note: if the sample is very acidic, some extra drops of HI 93735B Buffer reagent may be added.

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 *ASTM Manual of Water and Environmental Technology, method D1385-88,* 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

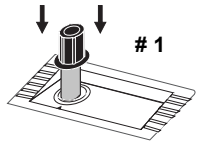
HI 93704-01 Reagents for 100 tests
HI 93704-03 Reagents for 300 tests
For other accessories see page 141.

MEASUREMENT PROCEDURE

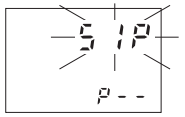
- Select the program number corresponding to Hydrazine on the secondary LCD by pressing PROGRAM ▼ and ▲.

- Fill one cuvet up to the mark with 10 mL of distilled water.

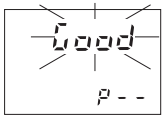
- Place the cap and insert the cuvet # 1 into the holder. Ensure that the notch on the cap is positioned securely into the groove.



- Press ZERO and SIP will blink while the instrument is adjusting the light level.

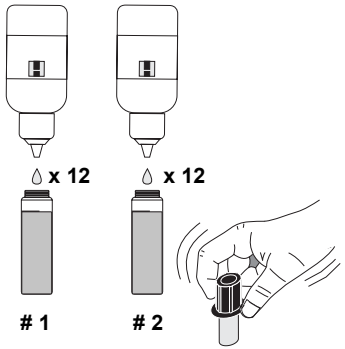


- Wait for a few seconds and the display will show a blinking "good". Now the meter is ready to take a zero measurement.

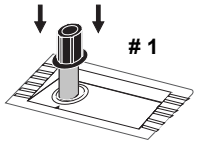


- Fill a second cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.

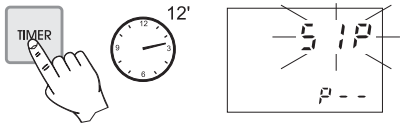
- Add 12 drops of the HI 93704 reagent to each cuvet. Replace the caps and shake gently to mix.



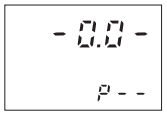
- Place the blank (#1) into the holder and ensure that the notch on the cap is positioned securely into the groove.



- Press TIMER and the display will show the countdown prior to zeroing the blank. "SIP" will blink during zeroing.

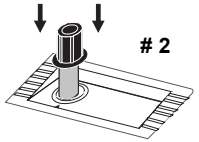


- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.

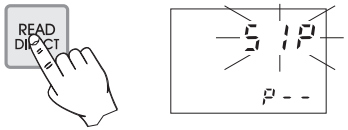


- Remove the blank.

- Insert the cuvet with the reacted sample (# 2) into the instrument. Ensure that the notch on the cap is positioned securely into the groove.



- Press READ DIRECT and "SIP" will blink during measurement.



- The instrument directly displays concentration in µg/L of hydrazine on the Liquid Crystal Display.

INTERFERENCES

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

IODINE

SPECIFICATIONS

Range	0.0 to 12.5 mg/L
Resolution	0.1 mg/L
Accuracy	±0.1 mg/L ±5% of reading
Typical EMC Deviation	±0.1 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the *Standard Methods for the Examination of Water and Wastewater, 18th edition,* DPD method. The reaction between iodine and the reagent causes a pink tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93718-0	DPD Reagent	1 packet

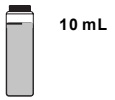
REAGENT SETS

HI 93718-01 Reagents for 100 tests
HI 93718-03 Reagents for 300 tests
For other accessories see page 141.

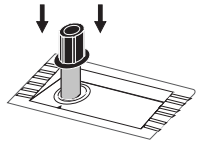
MEASUREMENT PROCEDURE

- Select the program number corresponding to Iodine on the secondary LCD by pressing PROGRAM ▼ and ▲.

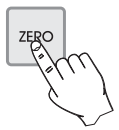
- Fill the cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.

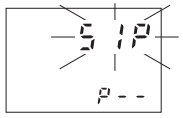


- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

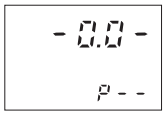


- Press ZERO and "SIP" will blink on the display.

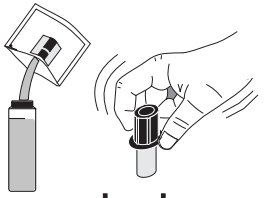




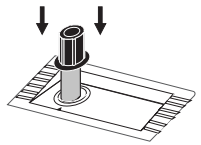
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



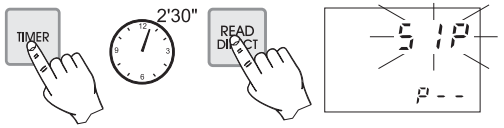
- Remove the cap and add the content of one packet of HI 93718 reagent. Replace the cap and shake gently for about 30 seconds to dissolve most of the reagent.



- Reinsert the cuvet 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 DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of iodine on the Liquid Crystal Display.

INTERFERENCES

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

In case of water with hardness greater than 500 mg/L $CaCO_3$, shake the sample for approximately 2 minutes after adding the reagent.

In case of water with alkalinity greater than 250 mg/L $CaCO_3$ or acidity greater than 150 mg/L $CaCO_3$, the color of the sample may develop only partially, or may rapidly fade. To resolve this, neutralize the sample with diluted HCl or NaOH.

IRON HIGH RANGE

SPECIFICATIONS

Range	0.00 to 5.00 mg/L
Resolution	0.01 mg/L
Accuracy	±0.04 mg/L ±2% of reading
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the *EPA Phenantroline method 315B,* for natural and treated waters. The reaction between iron and reagents causes an orange tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93721-0	Powder Reagent	1 packet

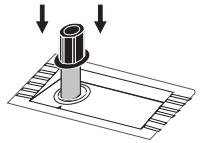
REAGENT SETS

HI 93721-01 Reagents for 100 tests
HI 93721-03 Reagents for 300 tests
For other accessories see page 141.

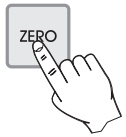
MEASUREMENT PROCEDURE

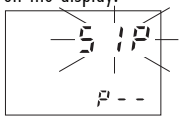
- Select the program number corresponding to Iron HR on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.

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

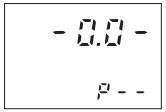


- Press ZERO and "SIP" will blink on the display.

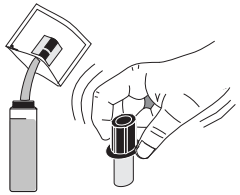




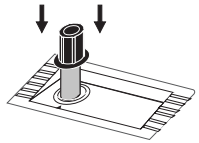
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



- Remove the cuvet and add the content of one packet of HI 93721 reagent. Replace the cap and shake until dissolution is complete.



- Reinsert the cuvet 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 DIRECT. In both cases "SIP" will blink during measurement.

- The instrument directly displays concentration in mg/L of iron on the Liquid Crystal Display.

INTERFERENCES

Interference may be caused by:
Molybdate Molybdenum above 50 ppm
Calcium above 10000 ppm (as $CaCO_3$)
Magnesium above 100000 ppm (as $CaCO_3$)
Chloride above 185000 ppm.

IRON LOW RANGE

SPECIFICATIONS

Range	0 to 400 µg/L
Resolution	1 µg/L
Accuracy	±10 µg/L ±8% of reading
Typical EMC Deviation	±1 µg/L
Light Source	Tungsten lamp with narrow band interference filter @ 575 nm
Method	Adaptation of the TPTZ Method. The reaction between iron and the reagent causes a violet tint in the sample.

REQUIRED REAGENTS

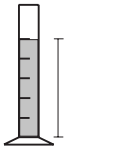
Code	Description	Quantity
HI 93746-0	TPTZ Reagent	2 packets

REAGENT SETS

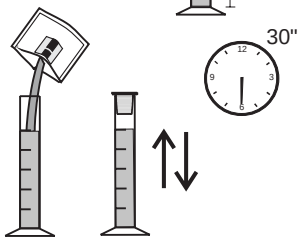
HI 93746-01 Reagents for 50 tests
HI 93746-03 Reagents for 100 tests
For other accessories see page 141.

MEASUREMENT PROCEDURE

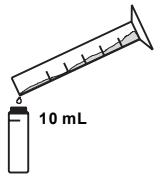
- Select the program number corresponding to Iron LR on the secondary LCD by pressing PROGRAM ▼ and ▲.



- Fill one graduated mixing cylinder up to the 25 mL mark with deionized water.
- Add the content of one packet of HI 93746 TPTZ reagent, close the cylinder and shake vigorously for 30 seconds. This is the blank.

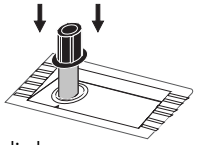


- Fill a cuvet with 10 mL of the blank up to the mark and replace the cap.

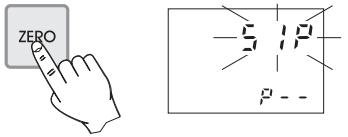


25 ml

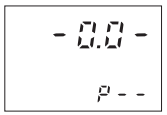
- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



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

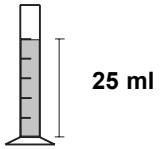


- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.

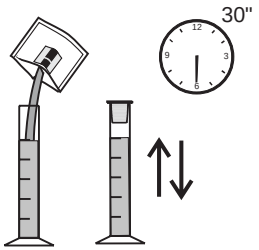


- Remove the cuvet.

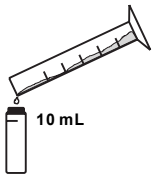
- Fill another graduated mixing cylinder up to the 25 mL mark with the sample.



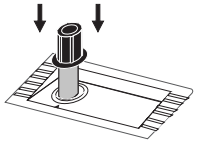
- Add the content of one packet of HI 93746 TPTZ reagent, close the cylinder and shake vigorously for 30 seconds. This is the reacted sample.



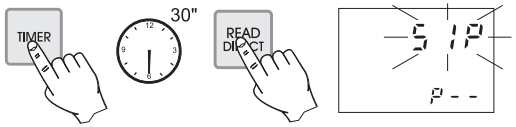
- Fill a cuvet with 10 mL of the reacted sample up to the mark and replace the cap.



- Insert the sample into the instrument.



- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 30 seconds and press READ DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in μg/L of iron on the Liquid Crystal Display.

INTERFERENCES

Interference may be caused by:
Cadmium above 4.0 mg/L
Chromium^{3+} above 0.25 mg/L
Chromium^{6+} above 1.2 mg/L
Cobalt above 0.05 mg/L
Copper above 0.6 mg/L
Cyanide above 2.8 mg/L
Manganese above 50.0 mg/L
Mercury above 0.4 mg/L
Molybdenum above 4.0 mg/L
Nickel above 1.0 mg/L
Nitrite ion above 0.8 mg/L
Sample pH should be between 3 and 4 to avoid developed color to fade or turbidity formation.

MANGANESE HIGH RANGE

SPECIFICATIONS

Range	0.0 to 20.0 mg/L
Resolution	0.1 mg/L
Accuracy	±0.2 mg/L ±3% of reading
Typical EMC Deviation	±0.1 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the *Standard Methods for the Examination of Water and Wastewater, 18th edition,* Periodate method. The reaction between manganese and reagents causes a pink tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93709**A**-0	Citrate	1 packet
HI 93709**B**-0	Sodium periodate	1 packet

REAGENT SETS

HI 93709-01 Reagents for 100 tests

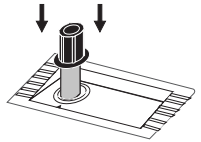
HI 93709-03 Reagents for 300 tests

For other accessories see page 141.

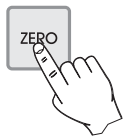
MEASUREMENT PROCEDURE

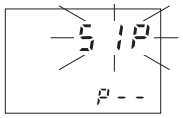
- Select the program number corresponding to Manganese HR on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.

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

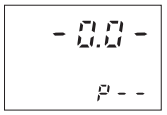


- Press ZERO and "SIP" will blink on the display.

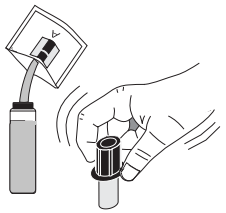




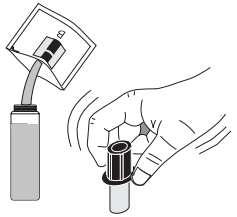
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



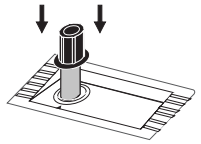
- Remove the cuvet.
- Add the content of one packet of HI 93709A Citrate reagent. Replace the cap and shake gently until dissolution is complete.



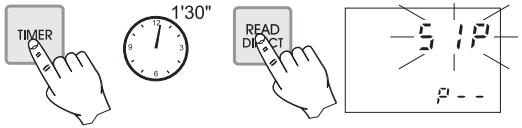
- Add the content of one packet of HI 93709B Sodium Periodate reagent. Replace the cap and shake gently until dissolution is complete.



- Reinsert the cuvet into the instrument.



- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 1 minute and 30 seconds and press READ DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of manganese on the Liquid Crystal Display.

INTERFERENCES

Interference may be caused by:
Calcium above 700 mg/L
Chloride above 70000 mg/L
Iron above 5 mg/L
Magnesium above 100000 mg/L.

MANGANESE LOW RANGE

SPECIFICATIONS

Range	0 to 300 µg/L
Resolution	1 µg/L
Accuracy	±2 µg/L ±3% of reading
Typical EMC Deviation	±1 µg/L
Light Source	Tungsten lamp with narrow band interference filter @ 575 nm
Method	Adaptation of the PAN Method. The reaction between manganese and the reagents causes an orange tint in the sample.

REQUIRED REAGENT

Code	Description	Quantity
HI 93748**A**-0	Ascorbic acid	2 packets
HI 93748**B**-0	Alkaline-cyanide sol.	0.40 mL
HI 93748**C**-0	0.1% PAN indicator	2 mL
HI 93703-51	Dispersing Agent	4-6 drops (only when necessary, see note)

REAGENT SETS

HI 93748-01 Reagents for 50 tests

HI 93748-03 Reagents for 150 tests

For other accessories see page 141.

MEASUREMENT PROCEDURE

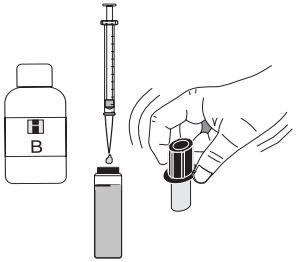
- Select the program number corresponding to Manganese LR on the secondary LCD by pressing PROGRAM ▼ and ▲.

- Fill one cuvet with 10 mL of deionized water (up to the mark).

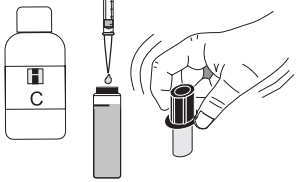
- Fill a second cuvet with 10 mL of sample (up to the mark).

- Add the content of one packet of HI 93748A Ascorbic acid to each cuvet, replace the caps and shake gently until dissolution is complete.

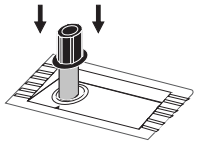
- Add 0.2 mL of the HI 93748B Alkaline-cyanide reagent solution to each cuvet, replace the caps and shake gently.



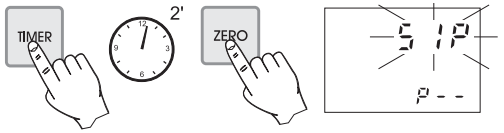
- Add 1 mL of the HI 93748C 0.1% PAN indicator solution to each cuvet, replace the caps and shake gently.



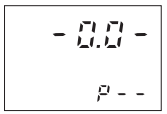
- Place the cuvet with the reacted deionized water (blank) into the holder and ensure that the notch on the cap is positioned securely into the groove.



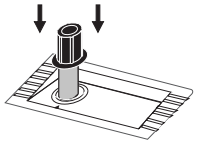
- Press TIMER and the display will show the countdown prior to zeroing the blank. Alternatively wait for 2 minutes and then press ZERO. "SIP" will blink during zeroing.



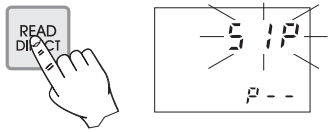
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



- Insert the second cuvet with the reacted sample into the instrument.



- Press READ DIRECT. "SIP" will blink during measurement.



- The instrument directly displays concentration in µg/L of manganese on the display.

  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 cuvet and swirl until complete dissolution of the turbidity.

INTERFERENCES

Interference may be caused by:
Aluminum above 20 mg/L
Cadmium above 10 mg/L
Calcium above 200 mg/L as $CaCO_3$
Cobalt above 20 mg/L
Copper above 50 mg/L
Iron above 10 mg/L
Lead above 0.5 mg/L
Magnesium above 100 mg/L as $CaCO_3$
Nickel above 40 mg/L
Zinc above 15 mg/L.

MOLYBDENUM

SPECIFICATIONS

Range	0.0 to 40.0 mg/L
Resolution	0.1 mg/L
Accuracy	±0.3 mg/L ±5% of reading
Typical EMC Deviation	±0.1 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 93730**A**-0	Reagent A	1 packet
HI 93730**B**-0	Reagent B	1 packet
HI 93730**C**-0	Reagent C	1 packet

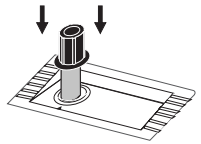
REAGENT SETS

HI 93730-01 Reagents for 100 tests
HI 93730-03 Reagents for 300 tests
For other accessories see page 141.

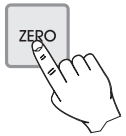
MEASUREMENT PROCEDURE

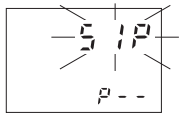
- Select the program number corresponding to Molybdenum on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.

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

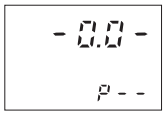


- Press ZERO and "SIP" will blink on the display.

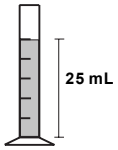




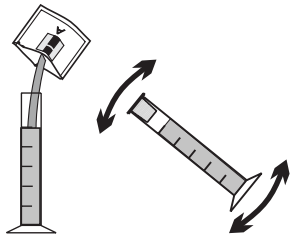
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



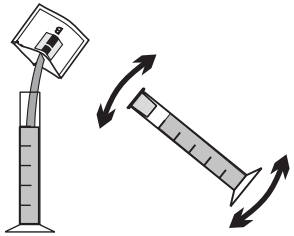
- Fill one graduated mixing cylinder up to the 25 mL mark with the sample.



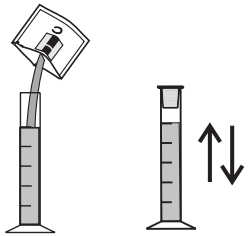
- Add the content of one packet of HI 93730A molybdenum reagent, close the cylinder and invert it several times until dissolution is complete.



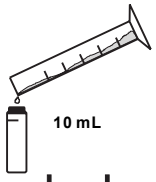
- Add the content of one packet of HI 93730B molybdenum reagent to the cylinder, close and invert it several times until dissolution is complete.



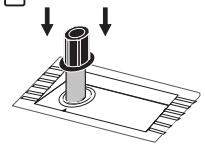
- Add the content of one packet of HI 93730C molybdenum reagent to the cylinder, close and shake it vigorously.



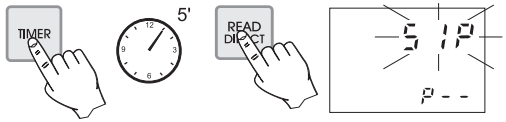
- Fill an empty cuvet with 10 mL of sample up to the mark and replace the cap.



- Insert the cuvet 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 DIRECT. In both cases, "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of molybdenum on the Liquid Crystal Display.

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 NO_2^-
Sulfate above 200 mg/L
Highly buffered samples or with extreme pH may exceed the buffering capacity of the reagents.

NICKEL HIGH RANGE

SPECIFICATIONS

Range	0.00 to 7.00 g/L
Resolution	0.01 g/L
Accuracy	±4% of reading
Typical EMC Deviation	±0.02 g/L
Light Source	Tungsten lamp with narrow band interference filter @ 575 nm
Method	Adaptation of the photometric method. The reaction between nickel and the reagent causes a blue tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93726-0	Powder reagent	1 packet

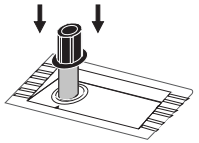
REAGENT SETS

HI 93726-01 Reagents for 100 tests
HI 93726-03 Reagents for 300 tests
For other accessories see page 141.

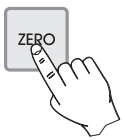
MEASUREMENT PROCEDURE

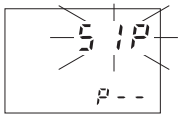
- Select the program number corresponding to Nickel HR on the secondary LCD by pressing PROGRAM ▼ and ▲.

- Fill the cuvet up to the mark with 10 mL of unreacted sample and replace the cap.
- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

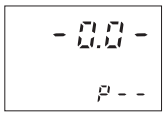


- Press ZERO and "SIP" will blink on the display.

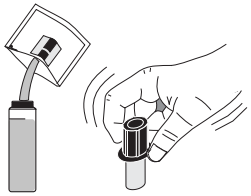




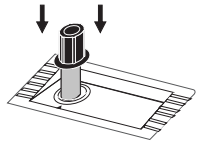
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



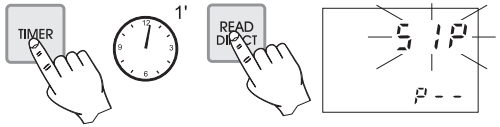
- Remove the cuvet and add the content of one packet of HI 93726 reagent. Replace the cap and shake gently until dissolution is complete.



- Reinsert the cuvet 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 DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in g/L of nickel on the Liquid Crystal Display.

INTERFERENCES

Interference may be caused by copper.

NICKEL LOW RANGE

SPECIFICATIONS

Range	0.000 to 1.000 mg/L
Resolution	0.001 mg/L
Accuracy	±0.010 mg/L ±7% of reading
Typical EMC Deviation	±0.001 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 575 nm
Method	Adaptation of the PAN method. The reaction between nickel and the reagents causes an orange tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93740A-0	Phthalate-phosphate	2 packets
HI 93740B-0	0.3% PAN indicator	2 mL
HI 93740C-0	EDTA	2 packets
HI 93703-51	Dispersing Agent	4-6 drops (only when necessary, see note)

REAGENT SETS

HI 93740-01 Reagents for 50 tests
HI 93740-03 Reagents for 150 tests
For other accessories see page 141.

MEASUREMENT PROCEDURE

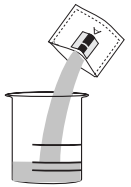
- Select the program number corresponding to Nickel LR on the secondary LCD by pressing PROGRAM ▼ and ▲.

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

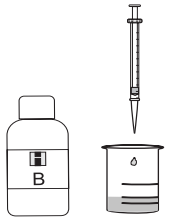
- Fill one graduated beaker with 25 mL of deionized water (blank) and another one with 25 mL of sample.

- Add the content of one packet of HI 93740A Phthalate-phosphate reagent to each beaker. Cap and swirl gently until the reagent is dissolved.

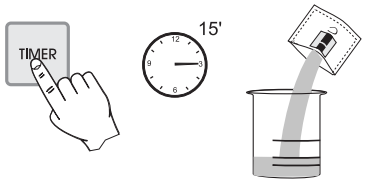
  Note: If sample contains iron (Fe^{3+}), it is important that all powder be dissolved completely before continuing with following step.



- Add 1 mL of HI 93740B 0.3% PAN solution to each beaker, cap and swirl to mix.

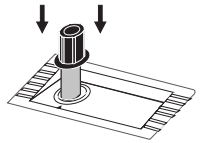


- Press TIMER and the display will show a countdown prior to adding reagent C or, alternatively, wait for 15 minutes. Then, in both cases, add one packet of HI 93740C EDTA reagent to each beaker, cap and swirl to mix until complete dissolution.

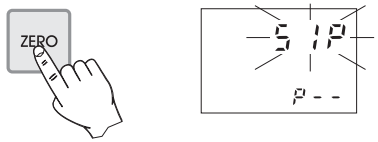


- Fill one cuvet up to the mark with 10 mL of the blank.

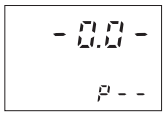
- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



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

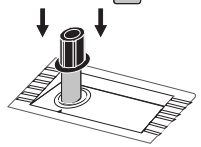


- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.

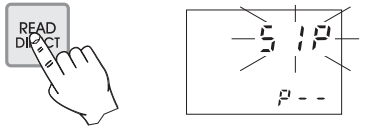


- Fill a second cuvet up to the mark with 10 mL of the reacted sample.

- Insert the second cuvet into the instrument.



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



- The instrument directly displays concentration in mg/L of nickel on the Liquid Crystal Display.

  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 cuvet and swirl until complete dissolution of the turbidity.

INTERFERENCES

Interference may be caused by:

Co^{2+} must not be present
Fe^{2+} must not be present
Al^{3+} above 32 mg/L
Ca^{2+} above 1000 mg/L (as $CaCO_3$)
Cd^{2+} above 20 mg/L
Cl^- above 8000 mg/L
Cr^{3+} above 20 mg/L
Cr^{6+} above 40 mg/L
Cu^{2+} above 15 mg/L
F^- above 20 mg/L
Fe^{3+} above 10 mg/L
K^+ above 500 mg/L
Mg^{2+} above 400 mg/L
Mn^{2+} above 25 mg/L
Mo^{6+} above 60 mg/L
Na^+ above 5000 mg/L
Pb^{2+} above 20 mg/L
Zn^{2+} above 30 mg/L

NITRATE

SPECIFICATIONS

Range	0.0 to 30.0 mg/L
Resolution	0.1 mg/L
Accuracy	±0.5 mg/L ±10% of reading
Typical EMC Deviation	±0.1 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the cadmium reduction method. The reaction between nitrate and the reagent causes an amber tint in the sample.

REQUIRED REAGENTS

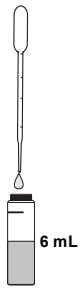
Code	Description	Quantity
HI 93728-0	Powder reagent	1 packet

REAGENT SETS

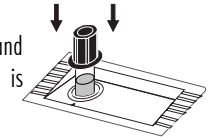
HI 93728-01 Reagents for 100 tests
HI 93728-03 Reagents for 300 tests
For other accessories see page 141.

MEASUREMENT PROCEDURE

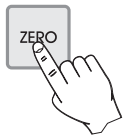
- Select the program number corresponding to Nitrate on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Using the pipette, fill the cuvet with 6 ml of sample, up to half of its height, and replace the cap.

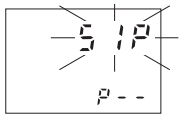


- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

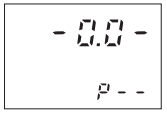


- Press ZERO and "SIP" will blink on the display.

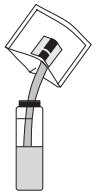




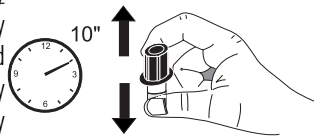
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.

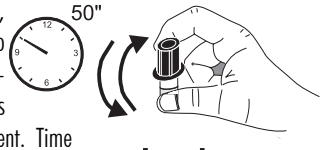


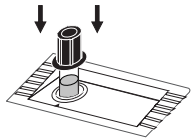
- Remove the cuvet and add the content of one packet of HI 93728 reagent.



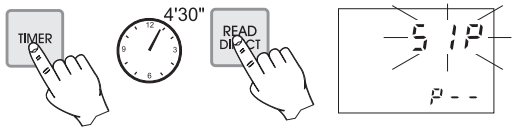
- Replace the cap and immediately shake <u>vigorously</u> for exactly 10 seconds by moving the cuvet up and down. Continue to mix by inverting the cuvet gently and slowly for 50 seconds, while taking care not to induce air bubbles. A deposit remains, but this does not affect the measurement. Time and way of shaking could sensitively affect the measurement.







- Reinsert the cuvet into the instrument, taking care not to shake it.
- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 4 minutes and 30 seconds and press READ DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of nitrate-nitrogen on the Liquid Crystal Display.
- To convert the reading to mg/L of nitrate (NO_3^-), multiply by a factor of 4.43.

INTERFERENCES

Interference may be caused by:

Ammonia and amines, as urea and primary aliphatic amines

Chloride above 100 ppm (negative interference)

Chlorine above 2 ppm (positive interference)

Copper

Iron(III) (positive interference)

Strong oxidizing and reducing substances

Sulfide (it must be absent)

NITRITE HIGH RANGE

SPECIFICATIONS

Range	0 to 150 mg/L
Resolution	1 mg/L
Accuracy	±4 mg/L ±4% of reading
Typical EMC Deviation	±1 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 575 nm
Method	Adaptation of the Ferrous Sulfate method. The reaction between nitrite and the reagent causes a greenish-brown tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93708-0	Powder reagent	1 packet

REAGENT SETS

HI 93708-01 Reagents for 100 tests

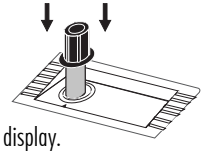
HI 93708-03 Reagents for 300 tests

For other accessories see page 141.

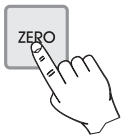
MEASUREMENT PROCEDURE

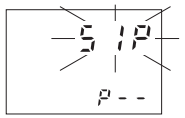
- Select the program number corresponding to Nitrite HR on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet up to the mark with 10 mL of unreacted sample and replace the cap.

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

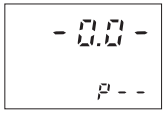


- Press ZERO and "SIP" will blink on the display.

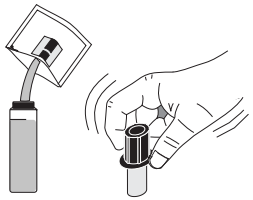




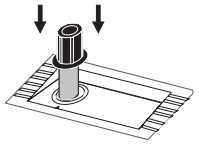
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



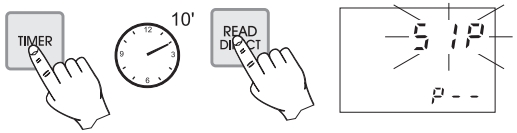
- Remove the cuvet.
- Add the content of one packet of HI 93708 reagent. Replace the cap and shake gently until dissolution is complete.



- Reinsert the cuvet into the instrument.



- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 10 minutes and press READ DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of nitrite on the Liquid Crystal Display.
- To convert the reading to mg/L of nitrogen-nitrite (NO_2^--N) concentration, multiply the reading by a factor of 0.304.
- To convert the reading to mg/L of sodium nitrite ($NaNO_2$) multiply the reading by a factor of 1.5.

NITRITE LOW RANGE

SPECIFICATIONS

Range	0.00 to 0.35 mg/L
Resolution	0.01 mg/L
Accuracy	±0.02 mg/L ±4% of reading
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the *EPA Diazotization method 354.1*. The reaction between nitrite and the reagent causes a pink tint in the sample.

REQUIRED REAGENTS

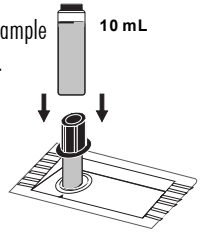
Code	Description	Quantity
HI 93707-0	Powder reagent	1 packet

REAGENT SETS

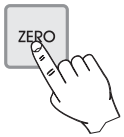
HI 93707-01 Reagents for 100 tests
HI 93707-03 Reagents for 300 tests
For other accessories see page 141.

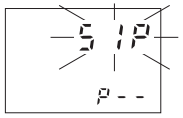
MEASUREMENT PROCEDURE

- Select the program number corresponding to Nitrite LR on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.

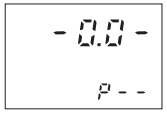


- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.
- Press ZERO and "SIP" will blink on the display.

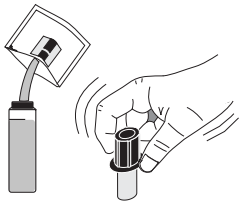




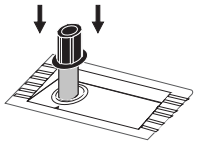
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



- Remove the cuvet.

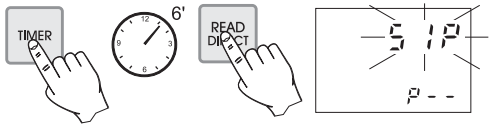


- Add the content of one packet of HI 93707 reagent. Replace the cap and shake gently for about 15 seconds.



- Reinsert the cuvet into the instrument.

- Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 6 minutes and press READ DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of nitrite nitrogen.

- To convert the NO_2^--N concentration to the nitrite ion concentration (NO_2^-), multiply the reading by factor of 3.29.

- To convert the NO_2^--N concentration to sodium nitrite concentration ($NaNO_2$), multiply the reading by factor of 4.93.

INTERFERENCES

Interference may be caused by the following ions:

ferrous, ferric, cupric, mercurous, silver, antimonious, bismuth, auric, lead, metavanadate and chloroplatinate.

Strongly reducing and oxidizing reagents.

High levels of nitrate (above 100 mg/L) could yield falsely high readings due to a minute amount of reduction to nitrite that could occur at these levels.

CHEMICAL OXYGEN DEMAND HIGH RANGE

SPECIFICATIONS

Range	0 to 15000 mg/L
Resolution	10 mg/L (1 mg/L x 10)
Precision	Standard deviation ±220 @ 10000 mg/L
Typical EMC Deviation	±1 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 610 nm
Method	Adaptation of the *EPA method 410.4*. Oxidizable organic compounds reduce the dichromate ion (orange) to the Chromium (III) ion (green). The amount of Chromium (III) formed is determined.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93754C	Liquid Reagent	25 vials

REAGENT SETS AND ACCESSORIES

C 9800-01	Hanna Reactor (115 VAC)
C 9800-02	Hanna Reactor (230 VAC)
HI 93754C-25	Reagents for up to 24 tests
HI 740216	Test tube cooling rack (25 holes)
HI 740217	Laboratory bench safety shield

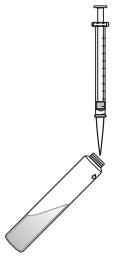
For other accessories see page 141.

MEASUREMENT PROCEDURE

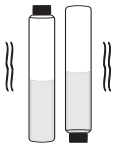
Before starting to use the reagent kit it is important to read carefully all the instructions and the Health & Safety Data Sheet (HSDS). Pay particular attention to all warnings, cautions and notes. Failure to do so may result in serious injury to the operator.

- Choose a homogeneous sample. Samples containing settleable solids need to be homogenized with a blender.

- For sample digestion use a block heater reactor with holes to accommodate digestion vials. Use of the optional HI 740217 safety shield is strongly recommended.
  Preheat the Hanna Reactor C 9800 to 150 °C (302°F). For correct use of the reactor follow Reactor Instruction Manual.
  Do not use an oven or microwave because leaking samples can generate a corrosive and possibly explosive atmosphere.

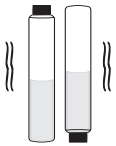


- Remove the cap from a reagent vial for the COD-HR.
  Note: The reagent is light sensitive, thus store the unused vials in their container and in a refrigerator if possible.
- Use the supplied syringe to add exactly 0.2 mL of sample to the vial, while keeping the vial at a 45-degree angle. This is the sample.



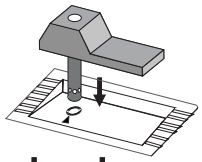
- Replace the cap tightly and mix by inverting the vial a couple of times.
  Warning: as the vial becomes very hot, be careful in handling it.
- Using the other clean syringe, add to another reagent vial exactly 0.2 mL of deionized water, while keeping the vial at a 45-degree angle. Replace the cap tightly and invert several times. This is the blank.
  Warning: as the vial becomes very hot, be careful in handling it.
  Note: for an accurate measurement:
  1) run a blank with each set of samples and use the same box of reagents for blank and samples.
  2) use two graduated pipettes to deliver exactly 0.2 mL of deionized water and 0.2 mL of sample to the vials.

- Insert the vials into the reactor and heat them for 2 hours at 150°C.
- At the end of the digestion period the Hanna Reactor will automatically switch off. Wait for twenty minutes to allow the vials to cool to about 120°C.

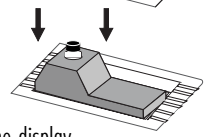


- Invert each vial several times while still warm, then place them in the HI 740216 rack.
  Warning: as the vials are still hot, be careful in handling them.

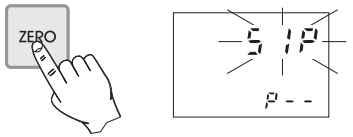
- Leave the vials in the tube rack to cool to room temperature. Do not shake or invert them anymore otherwise the samples may become turbid.
- Select the program number corresponding to Oxygen Demand, Chemical (COD) - HR on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Place carefully the COD-vial adapter in the instrument and check that it fits properly.



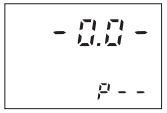
- Place the blank into the holder.



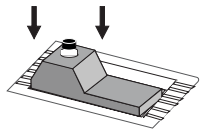
- Press ZERO and "SIP" will blink on the display.



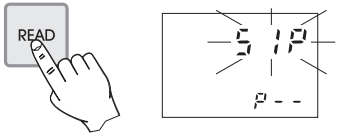
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



- Remove the blank.
- Place the sample into the holder.



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



- Multiply the reading on the Liquid Crystal Display by 10 to abtain the concentration in mg/L of oxygen demand.

INTERFERENCES:
chlorides > 20000 ppm

CHEMICAL OXYGEN DEMAND MEDIUM RANGE

SPECIFICATIONS

Range	0 to 1500 mg/L
Resolution	1 mg/L
Precision	Standard deviation ±22 @ 1000 mg/L
Typical EMC Deviation	±1 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 610 nm
Method	Adaptation of the *EPA method 410.4*. Oxidizable organic compounds reduce the dichromate ion (orange) to the Chromium (III) ion (green). The amount of Chromium (III) formed is determined.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93754B	Liquid Reagent	25 vials

REAGENT SETS AND ACCESSORIES

C 9800-01	Hanna Reactor (115 VAC)
C 9800-02	Hanna Reactor (230 VAC)
HI 93754B-25	Reagents for up to 24 tests
HI 740216	Test tube cooling rack (25 holes)
HI 740217	Laboratory bench safety shield

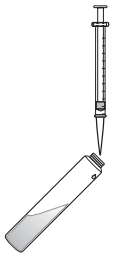
For other accessories see page 141.

MEASUREMENT PROCEDURE

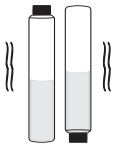
Before starting to use the reagent kit it is important to read carefully all the instructions and the Health & Safety Data Sheet (HSDS). Pay particular attention to all warnings, cautions and notes. Failure to do so may result in serious injury to the operator.

- Choose a homogeneous sample. Samples containing settleable solids need to be homogenized with a blender.

- For sample digestion use a block heater reactor with holes to accommodate digestion vials. Use of the optional HI 740217 safety shield is strongly recommended.
  Preheat the Hanna Reactor C 9800 to 150 °C (302°F). For correct use of the reactor follow Reactor Instruction Manual.
  Do not use an oven or microwave because leaking samples can generate a corrosive and possibly explosive atmosphere.

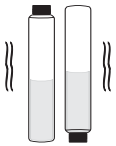


- Remove the cap from a reagent vial for the COD-MR.
  Note: The reagent is light sensitive, thus store the unused vials in their container and in a refrigerator if possible.
- Use the supplied syringe to add exactly 2.0 mL of sample to the vial, while keeping the vial at a 45-degree angle. This is the sample.



- Replace the cap tightly and mix by inverting the vial a couple of times.
  Warning: as the vial becomes very hot, be careful in handling it.
- Using the other clean syringe, add to another reagent vial exactly 2.0 mL of deionized water, while keeping the vial at a 45-degree angle. Replace the cap tightly and invert several times. This is the blank.
  Warning: as the vial becomes very hot, be careful in handling it.
  Note: for an accurate measurement:
  1) run a blank with each set of samples and use the same box of reagents for blank and samples.
  2) use two graduated pipettes to deliver exactly 2.0 mL of deionized water and 2.0 mL of sample to the vials.

- Insert the vials into the reactor and heat them for 2 hours at 150°C.
- At the end of the digestion period the Hanna Reactor will automatically switch off. Wait for twenty minutes to allow the vials to cool to about 120°C.

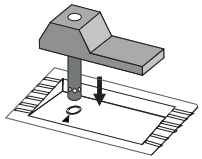


- Invert each vial several times while still warm, then place them in the HI 740216 rack.
  Warning: as the vials are still hot, be careful in handling them.

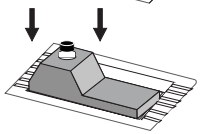
- Leave the vials in the tube rack to cool to room temperature. Do not shake or invert them anymore otherwise the samples may become turbid.

- Select the program number corresponding to Oxygen Demand, Chemical (COD) - MR on the secondary LCD by pressing PROGRAM ▼ and ▲.

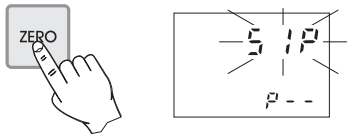
- Place carefully the COD-vial adaptor in the instrument and check that it fits properly.



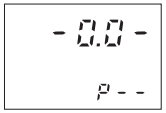
- Place the blank into the holder.



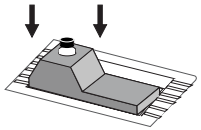
- Press ZERO and "SIP" will blink on the display.



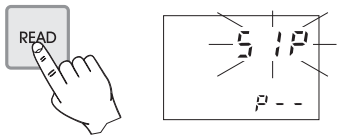
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



- Remove the blank.



- Place the sample into the holder.
- Press READ and "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of oxygen demand on the Liquid Crystal Display.

INTERFERENCES:
chlorides > 2000 ppm

CHEMICAL OXYGEN DEMAND LOW RANGE

SPECIFICATIONS

Range	0 to 150 mg/L
Resolution	1 mg/L
Precision	Standard deviation ±4 @ 150 mg/L
Typical EMC Deviation	±1 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 420 nm
Method	Adaptation of the *EPA method 410.4*. Oxidizable organic compounds reduce the dichromate ion (orange) to the Chromium (III) ion (green). The amount of remaining dichromate is determined.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93754A	Liquid Reagent	25 vials

REAGENT SETS AND ACCESSORIES

C 9800-01	Hanna Reactor (115 VAC)
C 9800-02	Hanna Reactor (230 VAC)
HI 93754A-25	Reagents for up to 24 tests
HI 740216	Test tube cooling rack (25 holes)
HI 740217	Laboratory bench safety shield

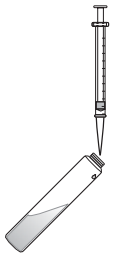
For other accessories see page 141.

MEASUREMENT PROCEDURE

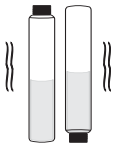
Before starting to use the reagent kit it is important to read carefully all the instructions and the Health & Safety Data Sheet (HSDS). Pay particular attention to all warnings, cautions and notes. Failure to do so may result in serious injury to the operator.

- Choose a homogeneous sample. Samples containing settleable solids need to be homogenized with a blender.

- For sample digestion use a block heater reactor with holes to accommodate digestion vials. Use of the optional HI 740217 safety shield is strongly recommended.
  Preheat the Hanna Reactor C 9800 to 150 °C (302°F). For correct use of the reactor follow Reactor Instruction Manual.
  Do not use an oven or microwave because leaking samples can generate a corrosive and possibly explosive atmosphere.

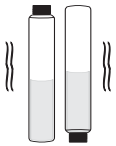


- Remove the cap from a reagent vial for the COD-LR.
  Note: The reagent is light sensitive, thus store the unused vials in their container and in a refrigerator if possible.
- Use the supplied syringe to add exactly 2.0 mL of sample to the vial, while keeping the vial at a 45-degree angle. This is the sample.



- Replace the cap tightly and mix by inverting the vial a couple of times.
  Warning: as the vial becomes very hot, be careful in handling it.
- Using the other clean syringe, add to another reagent vial exactly 2.0 mL of deionized water, while keeping the vial at a 45-degree angle. Replace the cap tightly and invert several times. This is the blank.
  Warning: as the vial becomes very hot, be careful in handling it.
  Note: for an accurate measurement:
  1) run a blank with each set of samples and use the same box of reagents for blank and samples.
  2) use two graduated pipettes to deliver exactly 2.0 mL of deionized water and 2.0 mL of sample to the vials.

- Insert the vials into the reactor and heat them for 2 hours at 150°C.
- At the end of the digestion period the Hanna Reactor will automatically switch off. Wait for twenty minutes to allow the vials to cool to about 120°C.

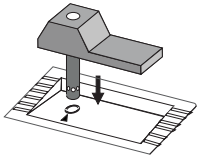


- Invert each vial several times while still warm, then place them in the HI 740216 rack.
  Warning: as the vials are still hot, be careful in handling them.

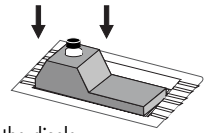
- Leave the vials in the tube rack to cool to room temperature. Do not shake or invert them anymore otherwise the samples may become turbid.

- Select the program number corresponding to Oxygen Demand, Chemical (COD) - LR on the secondary LCD by pressing PROGRAM ▼ and ▲.

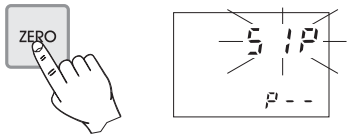
- Place carefully the COD-vial adapter in the instrument and check that it fits properly.



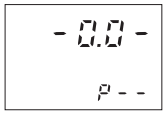
- Place the blank into the holder.



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

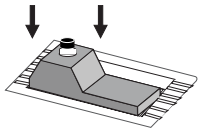


- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.

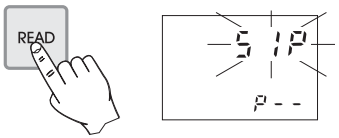


- Remove the blank.

- Place the sample into the holder.



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



- The instrument directly displays concentration in mg/L of oxygen demand on the Liquid Crystal Display.

INTERFERENCES:

chlorides > 2000 ppm

DISSOLVED OXYGEN

SPECIFICATIONS

Range	0.0 to 10.0 mg/L
Resolution	0.1 mg/L
Accuracy	±0.4 mg/L ±3% of reading
Typical EMC Deviation	± 0.1 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 420 nm
Method	Adaptation of the *Standard Methods for the Examination of Water and Wastewater, 18th edition,* Azide modified Winkler method. The reaction between dissolved oxygen and the reagents causes a yellow tint in the sample.

REQUIRED REAGENTS

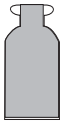
Code	Description	Quantity
HI 93732**A**-0	Reagent A	5 drops
HI 93732**B**-0	Reagent B	5 drops
HI 93732**C**-0	Reagent C	10 drops

REAGENT SET

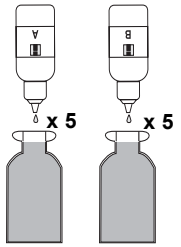
HI 93732-01 Reagents for 100 tests
HI 93732-03 Reagents for 300 tests
For other accessories see page 141.

MEASUREMENT PROCEDURE

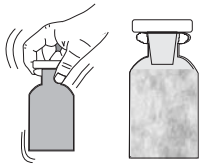
- Select the program number corresponding to Dissolved Oxygen on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill one 60 mL glass bottle completely with the unreacted sample.



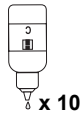
- Replace the cap and ensure that a small part of the sample spills over.
- Remove the cap and add 5 drops of HI 93732A and 5 drops of HI 93732B.



- Add some more sample, to fill the bottle completely. Replace the cap again and ensure that a part of the sample spills over. This is to make sure that no air bubbles have been trapped inside, which would corrupt the reading.
- Invert several times the bottle. The sample becomes orange-yellow and a flocculant agent will appear.

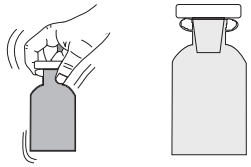


- Let the sample stand and the flocculant agent will start to settle.



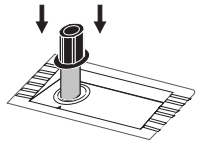
- After approximately 2 minutes, when the upper half of the bottle becomes limpid, add 10 drops of HI 93732C.

- Replace the cap and invert the bottle until dissolution of the settled flocculant is complete. The sample is ready for measurement when it is yellow and <u>completely limpid</u>.

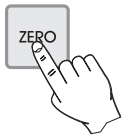


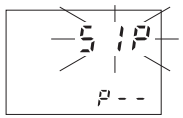
- Fill the cuvet up to the mark with 10 mL of the unreacted (original) sample, and replace the cap. This is the blank.

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

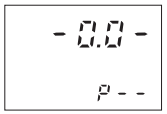


- Press ZERO and "SIP" will blink on the display.

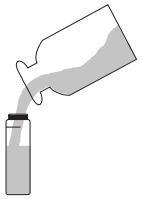




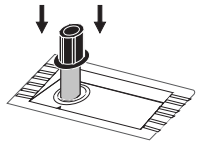
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



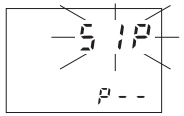
- Remove the cuvet.
- Fill another cuvet up to the mark with 10 mL of the reacted sample and replace the cap.



- Reinsert the cuvet into the instrument.



- Press READ DIRECT and "SIP" will blink during measurement.



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

INTERFERENCES

Interferences may be caused by reducing and oxidizing materials.

pH

SPECIFICATIONS

Range	6.5 to 8.5 pH
Resolution	0.1 pH
Accuracy	±0.1 pH
Typical EMC Deviation	±0.1 pH
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the Phenol Red method. The reaction with the reagent causes a yellow to red tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93710-0	Phenol Red Indicator	5 drops

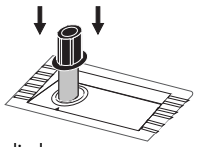
REAGENT SETS

HI 93710-01 Reagents for 100 pH tests
HI 93710-03 Reagents for 300 pH tests
For other accessories see page 141.

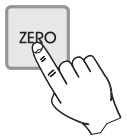
MEASUREMENT PROCEDURE

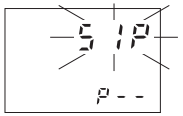
- Select the program number corresponding to pH on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.

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

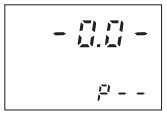


- Press ZERO and "SIP" will blink on the display.

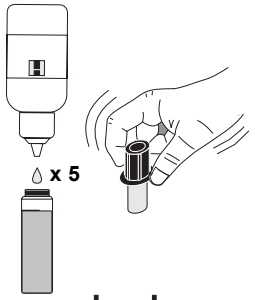




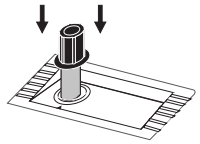
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



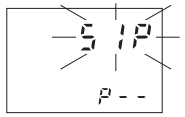
- Remove the cuvet and add 5 drops of HI 93710 Phenol Red Indicator. Replace the cap and mix the solution.



- Reinsert the cuvet into the instrument.



- Press the READ DIRECT key and "SIP" will blink on the display during measurement.



- The instrument directly displays the pH measured value on the Liquid Crystal Display.

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 *Standard Methods for the Examination of Water and Wastewater, 18th edition,* Amino Acid method. The reaction between phosphate and reagents causes a blue tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity
HI 93717**A**-0	Molybdate	10 drops
HI 93717**B**-0	Amino Acid	0.5 mL
HI 93717**B**-P	Amino Acid powder	2 packets for 100 tests

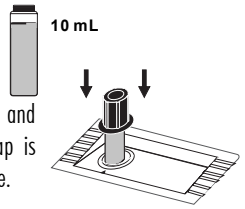
REAGENT SETS

HI 93717-01 Reagents for 100 tests
HI 93717-03 Reagents for 300 tests
For other accessories see page 141.

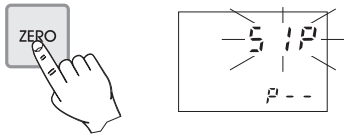
MEASUREMENT PROCEDURE

- Add the content of one packet of HI 93717B-P Amino Acid powder to HI 93717B Amino Acid bottle when you use it for the first time only. After you have added the powder, replace the cap of the bottle and swirl it gently for 2 minutes to dissolve the powder. Leave the bottle undisturbed for about 5 minutes, then the reagent is ready.

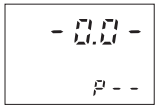
  Note: after adding the Amino Acid powder, the HI 93717B reagent will last for about one month.
- Select the program number corresponding to Phosphate HR on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.
- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



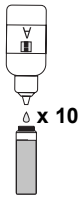
- Press ZERO and “SIP” will blink on the display.



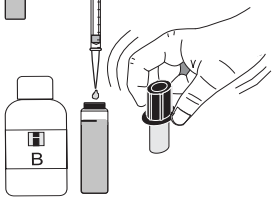
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



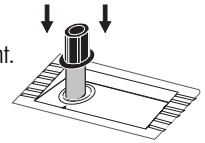
- Remove the cuvet.
- Add 10 drops of HI 93717A Molybdate reagent.



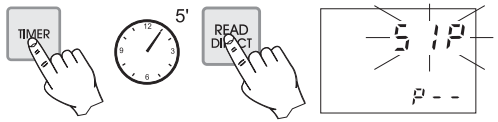
- Add to the cuvet 0.5 mL of the solution prepared in the HI 93717B bottle. Replace the cap and mix the solution.



- Reinsert the cuvet 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 DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of phosphate (PO_4^{3-}) on the Liquid Crystal Display.

INTERFERENCES

Interference may be caused by:
Sulfide
Chloride above 150000 mg/L
Calcium above 10000 mg/L as $CaCO_3$
Magnesium above 40000 mg/L as $CaCO_3$
Ferrous iron above 100 mg/L

PHOSPHATE LOW RANGE

SPECIFICATIONS

Range	0.00 to 2.50 mg/L
Resolution	0.01 mg/L
Accuracy	±0.04 mg/L ±4% of reading
Typical EMC Deviation	±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

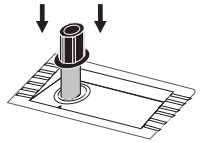
HI 93713-01 Reagents for 100 tests
HI 93713-03 Reagents for 300 tests
For other accessories see page 141.

MEASUREMENT PROCEDURE

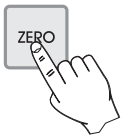
- Select the program number corresponding to Phosphate LR on the secondary LCD by pressing PROGRAM ▼ and ▲.

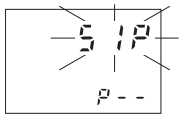
- Rinse, cap and shake the cuvet several times with unreacted sample. Fill the cuvet with 10 mL of sample up to the mark and replace the cap.

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

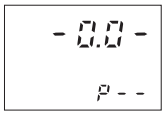


- Press ZERO and "SIP" will blink on the display.

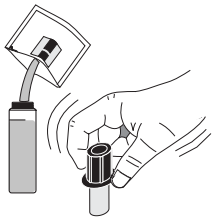




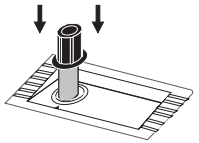
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



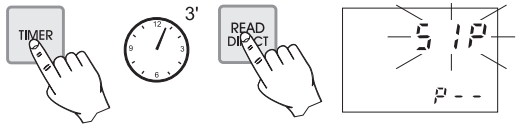
- Remove the cuvet and add the content of one packet of HI 93713 reagent. Replace the cap and shake gently (for about 2 minutes) until the powder is completely dissolved.



- Reinsert the cuvet 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 DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of phosphate on the Liquid Crystal Display.
- To convert the reading to mg/L of P_2O_5 , multiply by a factor of 0.747.
- To convert the reading to mg/L of phosphorus (P) concentration, multiply by a factor of 0.326.

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 *Standard Methods for the Examination of Water and Wastewater, 18th edition,* Amino Acid method. The reaction between phosphorus and the reagents causes a blue tint in the sample.

REQUIRED REAGENTS

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

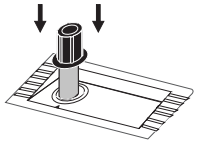
REAGENT SETS

HI 93706-01 Reagents for 100 tests
HI 93706-03 Reagents for 300 tests
For other accessories see page 141.

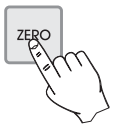
MEASUREMENT PROCEDURE

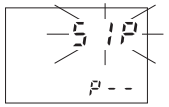
- Select the program number corresponding to Phosphorus on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample (up to the mark) and replace the cap.

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

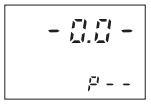


- Press ZERO and "SIP" will blink on the display.

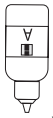




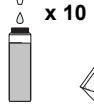
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



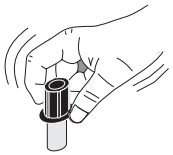
- Remove the cuvet.



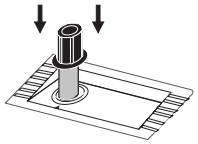
- Add 10 drops of HI 93706A Molybdate reagent.



- Add the content of one packet of HI 93706B-0 Phosphorus Reagent B (Amino Acid) to the cuvet. Replace the cap and shake gently until dissolution is complete.



- Reinsert the cuvet 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 DIRECT. In both cases "SIP" will blink during measurement.

- The instrument directly displays concentration in mg/L of phosphorus on the Liquid Crystal Display.

INTERFERENCES

Interference may be caused by:
Sulfide
Chloride above 150000 mg/L
Calcium above 10000 mg/L as $CaCO_3$
Magnesium above 40000 mg/L as $CaCO_3$
Ferrous iron above 100 mg/L

SILICA

SPECIFICATIONS

Range	0.00 to 2.00 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 @ 610 nm
Method	Adaptation of the *ASTM Manual of Water and Environmental Technology, D859,* Heteropoly Blue method. The reaction between silica and reagents causes a blue tint in the sample.

REQUIRED REAGENTS

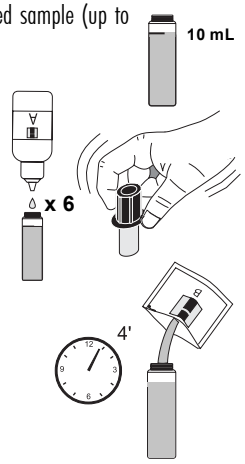
Code	Description	Quantity
HI 93705**A**-0	Molybdate	6 drops
HI 93705**B**-0	Citric acid	1 packet
HI 93705**C**-0	Amino acid	1 packet

REAGENT SETS

HI 93705-01 Reagents for 100 tests
HI 93705-03 Reagents for 300 tests
For other accessories see page 141.

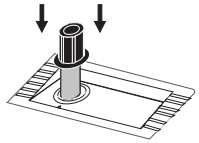
MEASUREMENT PROCEDURE

- Select the program number corresponding to Silica on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample (up to the mark).
- Add 6 drops of HI 93705A Molybdate reagent. Replace the cap and swirl the solution.
- Wait for 4 minutes, add the content of one packet of HI 93705B Citric acid reagent and shake until it is completely dissolved.

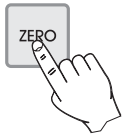


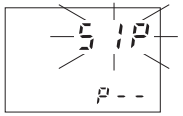
- Wait for 1 minute. This is the blank.

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

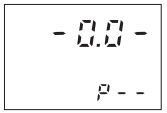


- Press ZERO and "SIP" will blink on the display.

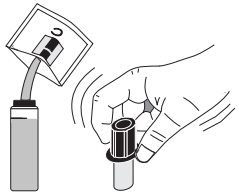




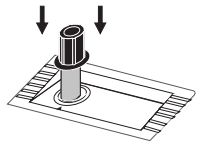
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



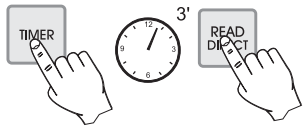
- Remove the cuvet and add the content of one packet of HI 93705C Amino acid reagent and shake until it is completely dissolved.

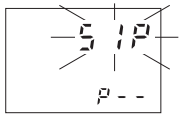


- Reinsert the cuvet into the instrument.



- Press TIMER and the display will show the countdown prior to the measurement. Alternatively, wait for exactly 3 minutes and press READ DIRECT. In both cases "SIP" will blink during measurement.





- The instrument directly displays concentration in mg/L of silica (SiO_2) on the Liquid Crystal Display.

INTERFERENCES

Interference may be caused by:

Phosphate above 60 mg/L (causes a 2% reduction in reading)

Phosphate above 75 mg/L (causes an 11% reduction in reading)

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	±0.005 mg/L ±10% of reading
Typical EMC Deviation	± 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 93737**A**-0	Buffer Reagent A	1 mL
HI 93737**B**-0	Buffer Reagent B	1 mL
HI 93737**C**-0	Indicator Reagent C	2 mL
HI 93737**D**-0	Fixing Reagent D	2 mL
HI 93703-51	Dispersing Agent (only when necessary, see note)	4-6 drops

REAGENT SETS

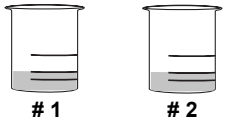
HI 93737-01 Reagents for 50 tests
HI 93737-03 Reagents for 150 tests
For other accessories see page 141.

MEASUREMENT PROCEDURE

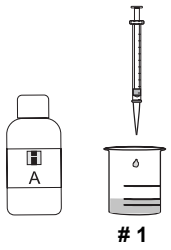
- Select the program number corresponding to Silver on the secondary LCD by pressing PROGRAM ▼ and ▲.

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

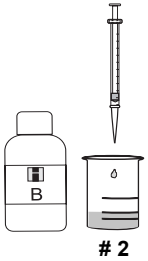
- Fill two graduated beakers with 25 mL of sample.



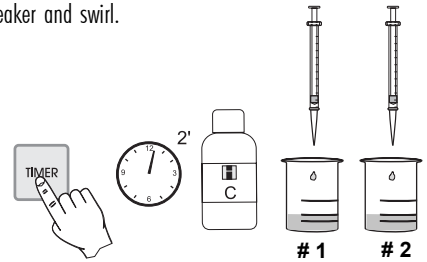
- Add 1.0 mL of HI 93737A reagent to only one beaker (the blank) and swirl gently to mix.



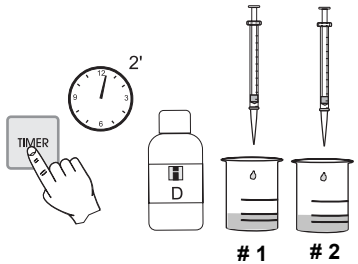
- Add exactly 1.0 mL of HI 93737B reagent to the other beaker (the sample) and swirl gently to mix.



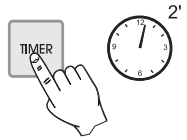
- Press TIMER and the display will show the countdown prior to adding reagent C or, alternatively, wait for 2 minutes. Then, in both cases, add exactly 1.0 mL of HI 93737C reagent to each beaker and swirl.



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

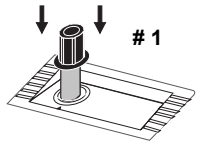


- Then press TIMER or, alternatively, wait for 2 minutes to allow reaction to complete.

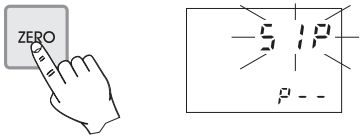


- Fill one cuvet up to the mark with 10 mL of the blank.

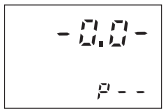
- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



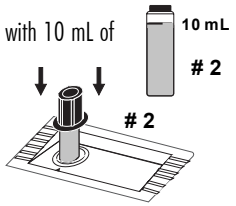
- Press ZERO and "SIP" will blink on the display.



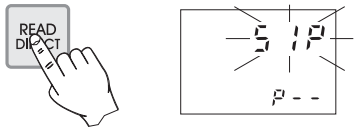
- Wait for a few seconds and the display will show "-0.0.-". Now the meter is zeroed and ready for measurement.



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



- Press READ DIRECT and the display will show "SIP" during measurement.



- The instrument directly displays concentration in mg/L of silver on the Liquid Crystal Display.

  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 cuvet and swirl until complete dissolution of turbidity.

INTERFERENCES

Interference may be caused by:

Al^{3+}	above 30 mg/L	Fe^{2+}	above 1.5 mg/L
Ca^{2+}	above 1000 mg/L as $CaCO_3$	Fe^{3+}	above 10 mg/L
		K^{+}	above 500 mg/L
Cd^{2+}	above 20 mg/L	Mn^{2+}	above 25 mg/L
Cl^{-}	above 8000 mg/L	Mg^{2+}	above 1000 mg/L as $CaCO_3$
Co^{2+}	above 1.5 mg/L		
Cr^{3+}	above 20 mg/L	Na^{+}	above 5000 mg/L
Cr^{6+}	above 40 mg/L	Ni^{2+}	above 1.5 mg/L
Cu^{2+}	above 15 mg/L	Pb^{2+}	above 20 mg/L
F^{-}	above 20 mg/L	Zn^{2+}	above 30 mg/L

ZINC

SPECIFICATIONS

Range	0.00 to 3.00 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 @ 575 nm
Method	Adaptation of the *Standard Methods for the Examination of Water and Wastewater, 18th edition,* Zincon method. The reaction between zinc and the reagents causes an orange to a dark violet tint in the sample.

REQUIRED REAGENT

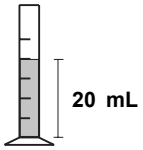
Code	Description	Quantity
HI 93731**A**-0	Reagent A	1 packet
HI 93731**B**-0	Reagent B	0.5 mL

REAGENT SETS

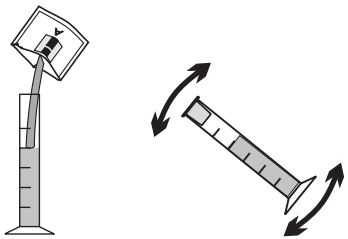
HI 93731-01 Reagents for 100 tests
HI 93731-03 Reagents for 300 tests
For other accessories see page 141.

MEASUREMENT PROCEDURE

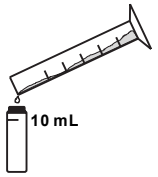
- Select the program number corresponding to Zinc on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill one graduated mixing cylinder up to the 20 mL mark with the sample.



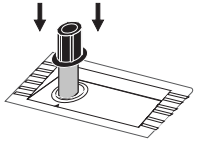
- Add the content of one packet of HI 93731A zinc reagent, close the cylinder and invert several times to mix until dissolution is complete.



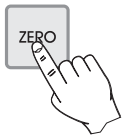
- Fill one cuvet with 10 mL of the reacted sample up to the mark.

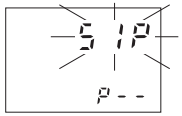


- Place the cap and insert the cuvet into the cell and ensure that the notch on the cap is positioned securely into the groove.

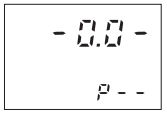


- Press ZERO and "SIP" will blink on the display.



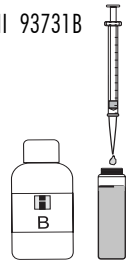


- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.

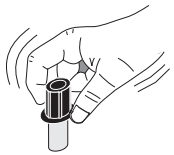


- Remove the cuvet and add 0.5 mL of HI 93731B cyclohexanone to the cuvet.

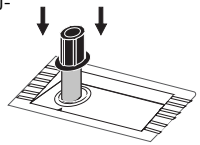
  Note: To prevent any contamination from the polycarbonate cap, prior to replacing it, close the sample cuvet with the supplied HDPE plastic stopper.



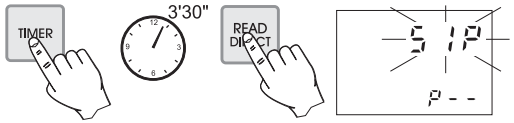
- Replace the cap and mix the sample for 15 seconds.



- Insert the sample 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 DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of zinc on the Liquid Crystal Display.

INTERFERENCES

Interference may be caused by:
Aluminum above 6 mg/L
Cadmium above 0.5 mg/L
Copper above 5 mg/L
Iron above 7 mg/L
Manganese above 5 mg/L
Nickel above 5 mg/L

INTERFACE WITH PC

To connect your meter to the PC use the optional **HI 920010** (available from your Hanna Dealer). Make sure that your meter is switched off and plug the connectors, one into the meter RS 232C socket, the other into the serial port of your PC.

Note: Cables other than **HI 920010** may use a different configuration, in which case, communication between the meter and the PC may not be possible.

SETTING THE BAUD RATE

The transmission speed (baud rate) of the meter and the external device must be identical. The meter is factory set to 2400.

If you wish to change this value, please contact your nearest Hanna Center.

SENDING COMMANDS FROM PC

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

Command Types

To send a command to the meter the scheme is:

<DLE> <*command*> <CR>

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

Note: Windows Terminal® and all the other terminal programs that support the ANSI escape sequence, represent the DLE character by the string '^P' and the CR character by the string '^M'.

Type of Commands

/OFF - Turn the meter OFF

/PDR - Press Read Direct

/PTR - Press Timer

/PZR - Press Zero

/PUP - Program Up

/PDN - Program Down

/PTM - Turn Test Mode On

/Brx - Set the baud rate

1 - 300	2 - 600
3 - 1200	4 - 2400

/KBL - Lock Keyboard

/KBU - Unlock Keyboard

?PR# - Send Current Program Number

?BRQ - Send current baud rate

1 - 150	2 - 300
3 - 600	4 - 1200
5 - 2400	

?CNQ - Send Concentration (three bytes)

conc

decimal point

unit

m - ppm	b - ppb
t - ppt	u - pcu
h - pH	

?ERR - send error / status information

0 - No error
1 - CAP
2 - HI
3 - ZERO
4 - LO
5 - IDLE
6 - ZERO DONE
7 - TIMED READ

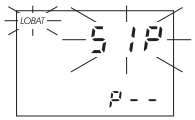
STANDARD METHODS

Description	Range	Method
Aluminum	0.00 to 1.00 mg/L	Aluminon
Ammonia, HR	0.0 to 50.0 mg/L	Nessler
Ammonia, MR	0.00 to 10.00 mg/L	Nessler
Ammonia, LR	0.00 to 3.00 mg/L	Nessler
Bromine	0.00 to 8.00 mg/L	DPD
Chlorine, Free	0.00 to 2.50 mg/L	DPD
Chlorine, Free HR	0.00 to 10.00 mg/L	DPD
Chlorine, Total	0.00 to 3.50 mg/L	DPD
Chlorine, Total HR	0.00 to 10.00 mg/L	DPD
Chlorine Dioxide	0.00 to 2.00 mg/L	Chlorophenol Red
Chromium VI, HR	0 to 1000 μg/L	Diphenylcarbohydrazide
Chromium VI, LR	0 to 300 μg/L	Diphenylcarbohydrazide
COD HR	0 to 15000 mg/L	Dichromate, Mercuric Sulphate
COD MR	0 to 1500 mg/L	Dichromate, Mercuric Sulphate
COD LR	0 to 150 mg/L	Dichromate, Mercuric Sulphate
Color of Water	0 to 500 PCU	Colorimetric Platinum Cobalt
Copper, HR	0.00 to 5.00 mg/L	Bicinchoninate
Copper, LR	0 to 1000 μg/L	Bicinchoninate
Cyanide	0.000 to 0.200 mg/L	Pyridine-Pyrazolone
Cyanuric Acid	0 to 80 mg/L	Turbidimetric
Fluoride	0.00 to 2.00 mg/L	SPADNS
Hardness, Ca	0.00 to 2.70 mg/L	Calmagite
Hardness, Mg	0.00 to 2.00 mg/L	Calmagite
Hardness, Total HR	400 to 750 mg/L	Calmagite
Hardness, Total MR	200 to 500 mg/L	Calmagite
Hardness, Total LR	0 to 250 mg/L	Calmagite
Hydrazine	0 to 400 μg/L	p-Dimethylaminobenzaldehyde
Iodine	0.0 to 12.5 mg/L	DPD
Iron, HR	0.00 to 5.00 mg/L	Phenantroline
Iron, LR	0 to 400 μg/L	TPTZ
Manganese, HR	0.0 to 20.0 mg/L	Periodate Oxidation
Manganese, LR	0 to 300 μg/L	PAN
Molybdenum	0.0 to 40.0 mg/L	Mercaptoacetic Acid
Nickel, HR	0.00 to 7.00 g/L	Photometric
Nickel, LR	0.000 to 1.000 mg/L	PAN
Nitrate	0.0 to 30.0 mg/L	Cadmium Reduction
Nitrite, HR	0 to 150 mg/L	Ferrous Sulfate
Nitrite, LR	0.00 to 0.35 mg/L	Diazotization
Oxygen, Dissolved	0.0 to 10.0 mg/L	Winkler
pH	6.5 to 8.5 pH	Phenol Red
Phosphate, HR	0.0 to 30.0 mg/L	Amino Acid
Phosphate, LR	0.00 to 2.50 mg/L	Ascorbic Acid
Phosphorus	0.0 to 15.0 mg/L	Amino Acid
Silica	0.00 to 2.00 mg/L	Heteropoly Blue
Silver	0.000 to 1.000 mg/L	PAN
Zinc	0.00 to 3.00 mg/L	Zincon

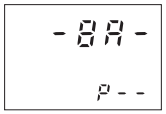
BATTERY REPLACEMENT

Besides to the 12 VDC supply, these meters can also be fed by two 9V batteries.

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



A blinking "LOBAT" on the display, while a measurement is in progress, indicates low voltage and the batteries should be replaced.



If the batteries are not replaced immediately, in order to prevent erroneous readings due to low voltage, "-BA-" is displayed soon afterwards. At this point the batteries must be changed.

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

Remove the battery cover on the back of photometer, attach two fresh 9V batteries, while paying attention to the correct polarity, and replace the cover.

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