HI83314

Wastewater Treatment Photometer

INSTRUCTION MANUAL

HANNA instruments®

Dear Customer,

Thank you for choosing a Hanna Instruments product.
Please read this instruction manual carefully before using the instrument.
This manual will provide you with the necessary information for correct use of the instrument, as well as a precise idea of its versatility.
If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com or view our worldwide contact list at www.hannainst.com.

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1. PRELIMINARY EXAMINATION

Remove the instrument and accessories from the packaging and examine it carefully to make sure that no damage has occurred during shipping. Notify your nearest Hanna Customer Service Center if damage is observed.

Each HI83314 is supplied with:

- Sample Cuvette and Cap (4 pcs.)
- Cloth for Wiping Cuvettes
- Scissors
- USB Cable
- 5 Vdc Power Adapter
- 16 mm Vial Adapter
- 16 mm diameter Vial Cuvette with cap (6 pcs.)
- Instruction Manual
- Quality Certificate

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

2. SAFETY MEASURES

- The chemicals contained in the reagent kits may be hazardous if improperly handled.
- Read the Safety Data Sheets (SDS) before performing tests.
- Safety equipment: Wear suitable eye protection and clothing when required, and follow instructions carefully.
- Reagent spills: If a reagent spill occurs, wipe up immediately and rinse with plenty of water. If reagent contacts skin, rinse the affected area thoroughly with water. Avoid breathing released vapors.
- Waste disposal: for proper disposal of reagent kits and reacted samples, contact a licensed waste disposal provider.

3. SPECIFICATIONS

Measurement Channels		5 x optical channels 1 x digital electrode channel (pH measurement)
Absorbance	Range	0.000 to 4.000 Abs
	Resolution	0.001 Abs
	Accuracy	±0.003 Abs (at 1.000 Abs)
	Light Source	light emitting diode
	Bandpass Filter Bandwidth	8 nm
	Bandpass Filter Wavelength Accuracy	±1.0 nm
	Light Detector	silicon photocell
	Cuvette Types	round, 24.6 mm diameter and 16 mm diameter
	Number of Methods	26
pH	Range	-2.00 to 16.00 pH (± 1000.0 mV)*
	Resolution	0.01 pH (0.1 mV)
	Accuracy	±0.01 pH (±0.2 mV) (@ 25 °C / 77 °F)
	Temperature Compensation	ATC (-5.0 to 100.0 °C; 23.0 to 212.0 °F)*
	Calibration	2 points, eligible from 5 available buffers (4.01, 6.86, 7.01, 9.18, 10.01 pH)
	Electrode	Intelligent pH / temperature electrode
Temperature	Range	-20.0 to 120.0°C (-4.0 to 248.0 °F)
	Resolution	0.1 °C (0.1 °F)
	Accuracy	±0.5 °C (@ 25 °C / 77 °F)
Additional Specifications	Logging	1000 readings (mixed photometer and electrode)
	Display	128 x 64 pixel B/W LCD with backlight
	USB-A (Host) Functions	mass-storage host
	USB-B (Device) Functions	power input, mass-storage device
	Battery Life	> 500 photometer measurements, or 50 hours of continuous pH measurement
	Power Supply	5 Vdc USB 2.0 power adapter/type micro-B connector 3.7 Vdc Li-polymer rechargeable battery, non-serviceable
	Environment	0 to 50 °C (32 to 122 °F); 0 to 95% RH, non-serviceable
	Dimensions	206 x 177 x 97 mm (8.1 x 7.0 x 3.8")
	Weight	1.0 kg (2.2 lbs.)

*Limits will be reduced to actual probe/sensor limits.

4. DESCRIPTION

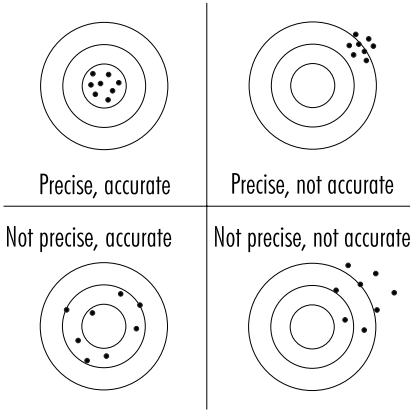
4.1.GENERAL DESCRIPTION

HI83314 multiparameter photometer is compact and versatile meter with two measurement modes: Absorbance and pH/ mV. Absorbance mode include CAL Check feature and 26 different methods that cover a wide variety of applications, making it ideal for both benchtop and portable operation.

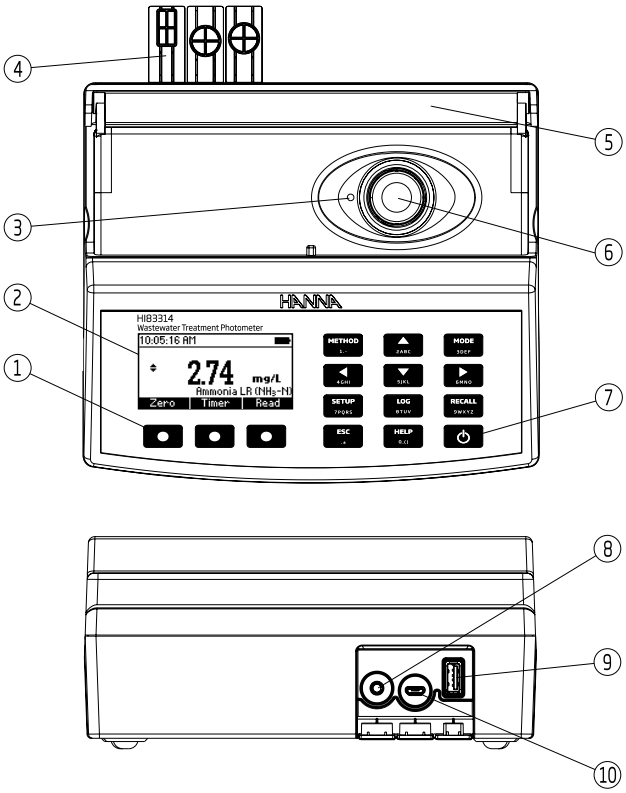
- Digital electrode input for pH measurements
- Certified CAL Check cuvettes to confirm meter functionality
- Dual purpose micro-USB flash drive
- Li-polymer rechargeable battery
- Auto-off
- Absorbance mode
- User and sample name entry
- GLP features

4.2.PRECISION AND ACCURACY

Precision is how closely repeated measurements are to one another. Precision is usually expressed as standard deviation (SD).
Accuracy is defined as the closeness of a test result to the true value.
Although good precision suggests good accuracy, precise results can be inaccurate. The figure explains these definitions.
For each method, the accuracy is expressed in the related measurement section.



4.3. FUNCTIONAL DESCRIPTION



1) Splash-proof keypad
2) Liquid Crystal Display (LCD)
3) Indexing mark
4) Protective port covers
5) Light-blocking cover panel
6) Cuvette holder
7) ON/OFF power button
8) 3.5-mm TRRS (jack) input for digital electrodes
9) Standard USB host connector for data transfer to a USB flash drive
10) Micro-USB device connector for power or PC interface

Keypad Description

The keypad contains 12 direct keys and 3 functional keys with the following functions:

Press the functional keys to perform the function displayed above them on the LCD.

Press to access the list of photometer methods.

Press to move up in a menu or a help screen, to increment a set value, or to access second level functions.

Press to toggle between photometer and pH (electrode) mode.

Press to move left in a menu or to decrement a set value.

Press to move down in a menu or a help screen, to decrement a set value, or to access second level functions.

Press to move right in a menu or to increment a set value.

Press to access the setup screen.

Press to log the current reading.

Press to review saved logs.

Press to exit the current screen.

Press to display the help screen.

ON/OFF power button.

4.4. PRINCIPLE OF OPERATION

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

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

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

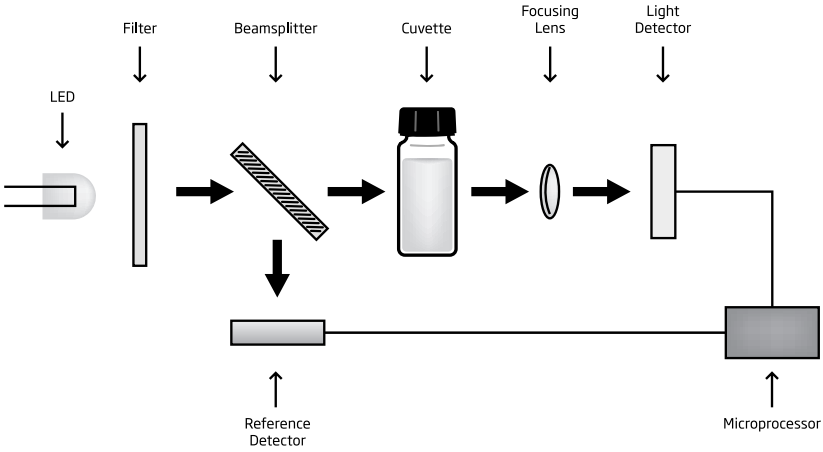
or

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

I_o = intensity of incident light beam
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 constant.
Photometric chemical analysis is based on specific chemical reactions between a sample and reagent to produce a light-absorbing compound.

4.5. OPTICAL SYSTEM



Instrument Block Diagram

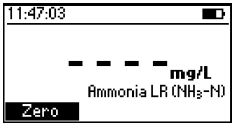
The internal reference system (reference detector) of the HI83314 photometer compensates for any drifts due to power fluctuations or ambient temperature changes, providing a stable source of light for your blank (zero) measurement and sample measurement.
LED light sources offer superior performance compared to tungsten lamps. LEDs have a much higher luminous efficiency, providing more light while using less power. They also produce little heat, which could otherwise affect electronic stability. LEDs are available in a wide array of wavelengths, whereas tungsten lamps have poor blue/violet light output.
Improved optical filters ensure greater wavelength accuracy and allow a brighter, stronger signal to be received. The end result is higher measurement stability and less wavelength error.
A focusing lens collects all of the light that exits the cuvette, eliminating errors from cuvette imperfections and scratches, eliminating the need to index the cuvette.

5. GENERAL OPERATIONS

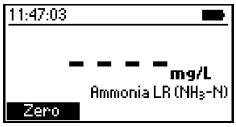
5.1. POWER CONNECTION AND BATTERY MANAGEMENT

The meter can be powered from an AC/DC adapter (included) or from the built-in rechargeable battery. The meter will perform an auto-diagnostic test when it is first powered on. During this test, the HANNA® logo will appear on the LCD. After 5 seconds, if the test was successful, the last method used will appear on the display.
The battery icon on the LCD will indicate the battery status:

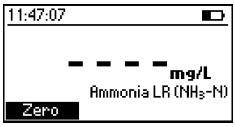
- battery is charging from external adapter



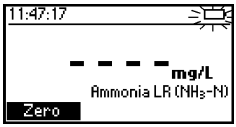
- battery fully charged (meter connected to AC/DC adapter)



- battery capacity (no external adapter)



- battery near 0% (no external adapter)



- battery exhausted (no external adapter)

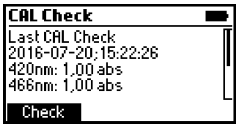
To conserve battery, the meter will turn off automatically after 15 minutes of inactivity (30 minutes before a READ measurement). If a photometer measurement is on the screen, an auto-log is created before shutdown.

5.2. GENERAL SETUP

Press **SETUP** key to enter in **Setup** menu, highlight desired option using  and press **Select**.

CAL Check (Photometer Only)

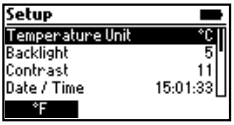
Press **Select** to enter the CAL Check screen. The date, time and values for the last CAL Check are displayed on the screen.
To start a new CAL Check press **Check** key and follow the prompts on the screen.



Temperature Unit (pH Only)

Option: °C or °F

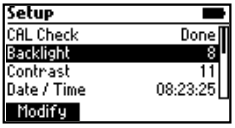
Press the functional key to select the desired temperature unit.

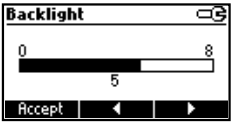


Backlight

Values: 0 to 8

Press the **Modify** key to access the backlight intensity.
Use the functional keys or the ◀ ▶ keys to increase or decrease the value.
Press the **Accept** key to confirm or **ESC** to return to the **Setup** menu without saving the new value.

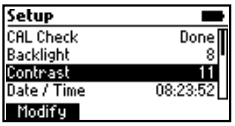


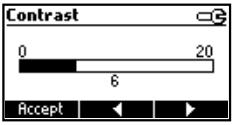


Contrast

Values: 0 to 20

Press the **Modify** key to change the display's contrast.
Use the functional keys or the ◀ ▶ keys to increase or decrease the value.
Press the **Accept** key to confirm the value or **ESC** to return to the **Setup** menu without saving the new value.





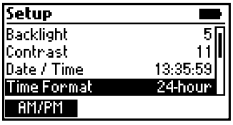
Date / Time

Press the **Modify** key to change the date/time.
Press the functional keys or the ◀ ▶ keys to highlight the value to be modified (year, month, day, hour, minute or second).
Use the ▲ ▼ keys to change the value.
Press the **Accept** key to confirm or **ESC** to return to the **Setup** without saving the new date or time.

Time Format

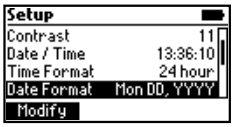
Option: AM/PM or 24-hour

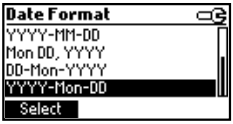
Press the functional key to select the desired time format.



Date Format

Press the **Modify** key to change the Date Format.
Use the ▲ ▼ keys to select the desired format.
Press the **Select** key to confirm or **ESC** to return to the **Setup** menu without saving the new format.

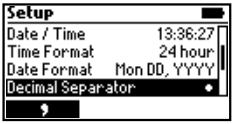




Decimal Separator

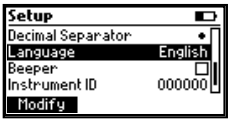
Option: Comma (,) or Period (.)

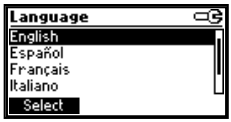
Press the functional key to select the desired decimal separator. The decimal separator is used on the measurement screen and CSV files.



Language

Press the **Modify** key to change the Language. Use the ▲ ▼ keys to select the desired language. Press **Select** to change the language.
Press the functional key to select one of the 7 languages installed.

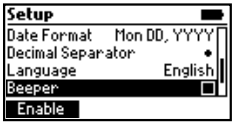




Beeper

Option: Enable or Disable

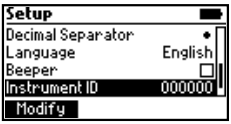
When enabled, a short beep is heard every time a key is pressed. A long beep alert sounds when the pressed key is not active or an error is detected. Press the functional key to enable/disable the beeper.



Instrument ID

Option: 0 to 999999

This option is used to set the instrument's ID (identification number). Press the **Modify** key to access the instrument ID screen. Use the functional keys or the ◀ ▶keys to highlight the digit to be modified. Press the ▲ ▼ keys in order to set the desired value. Press the **Accept** key to confirm the value or **ESC** to return to the **Setup** menu without saving the new value.

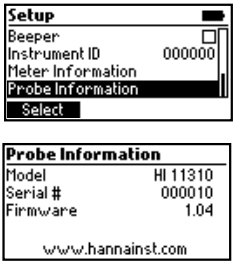


Meter Information

Press the **Select** key to view the model, serial number, firmware version and selected language. Press **ESC** to return to the **Setup** menu.

Probe Information (pH mode only)

Press the **Select** key to view model number, serial number and firmware version for the connected probe.
Press **ESC** to return to the **Setup** menu.



5.3. USING HANNA DIGITAL ELECTRODES

The HI83314 can be used to perform direct pH measurements by connecting a HANNA® digital pH electrode with a 3.5 mm TRRS connector. To begin taking probe measurements, connect the electrode to the 3.5 mm port marked with "EXT PROBE" located at the rear of the meter. If the meter is in "Photometer Mode", set the meter to "Probe Mode" by pressing the **MODE** key.

5.4. MODE SELECTION

The HI83314 has two operational modes: Photometer Mode and Probe Mode.
Photometer Mode enables on-demand measurement of a cuvette using the integrated optical system. Photometric-related functions, such as Method selection, Zero, Read, and Timers are available in this mode.

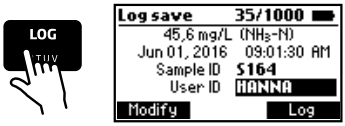
Probe Mode enables continuous measurement using a Hanna Digital Electrode connected to the 3.5 mm port. Probe-related functions, such as calibration and GLP, are available in this mode.
To switch between Photometer Mode and Probe Mode, use the MODE button.

Note: The active mode cannot be switched while in menus, such as Setup, Recall, Method, etc.

5.5. LOGGING DATA

The instrument features a data log function to help you keep track of all your analysis. The data log can hold 1000 individual measurements. Storing, viewing and deleting the data is possible using the **LOG** and **RECALL** keys.

Storing data: You can store only a valid measurement. Press **LOG** and the last valid measurement will be stored with date and time stamp.

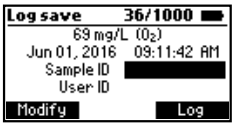


5.6. ADDING SAMPLE / USER NAMES TO LOG DATA

A sample ID and user ID can be added to the saved log. Use the ▲▼ keys to highlight the Sample ID or User ID then press **Modify**.

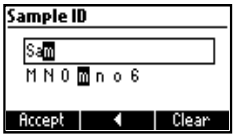
Text Entry

Sample ID and User ID care entered using the alphanumeric multi-tapping keypad.

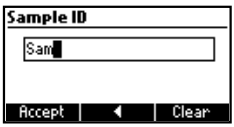


Enter one character at a time by pressing the key with the assigned character repeatedly until the desired character is highlighted. For reference, a list of the characters available for the current key will be shown under the text box.

The character will be entered after a two-second delay or after another key is pressed.



Once all characters have been entered, press **Accept** to use the displayed text.



The following functions are available during **Text Entry**:

- **Accept**: Press to accept the current displayed text.
- **Arrow**: Press to delete the last character.
- **Clear**: Press to delete all characters.

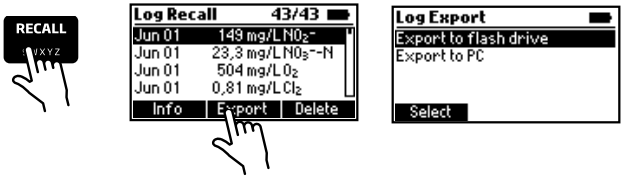
ESC Press to discard all changes and return to the previous screen.

5.7. DATA MANAGEMENT

Viewing and deleting: You can view, export and delete the data by pressing the **RECALL** key. Use the ▲▼ keys to scroll through the saved logs. Press **Info** to view additional information about the selected log.

Data Export:

Log data can be exported to a USB flash drive or to a PC. To access Data Export functions, press **Recall** then **Export**.



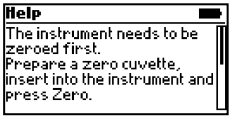
Use the ▲ ▼ keys to select the desired export location.
For export to USB Flash Drive, insert the USB Flash Drive into the dedicated port at the back of the meter labeled HOST USB, then follow the on-screen prompts.

For export to PC, connect the meter to a PC using the supplied micro-USB cable. Insert the cable into the port at the back of the meter labeled PC PWR. Follow the on-screen prompts. When the meter says PC connected, use a file manager (such as Windows Explorer or Mac Finder) to move the file from the meter to the PC. The meter will appear as a removable disk.

Log data is exported as a single file containing all logged photometer and probe data. The file name is: "HI83314.csv". The CSV file (Comma-Separated Values) may be opened with a text editor or spreadsheet application.

5.8. CONTEXTUAL HELP

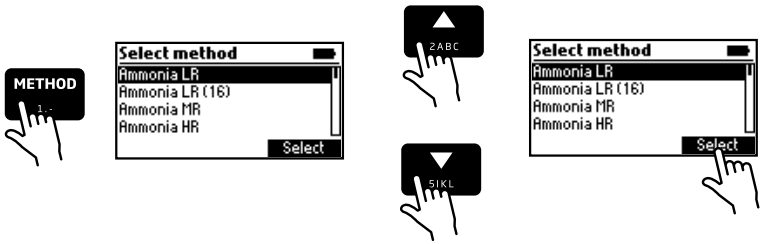
HI83314 offers an interactive contextual help mode that assists the user at any time.
To access the help screen press **HELP**.
The instrument will display additional information related to the current screen. To read all the available information, scroll the text using the ▲ ▼ keys.
To exit help mode press **ESC** key and the meter will return to the previous screen.



6. PHOTOMETER MODE

6.1. METHOD SELECTION

In order to select the desired method press the **METHOD** key and a screen with the available methods will appear.
Press the ▲▼ keys to highlight the desired method. Press **Select**.



After the desired method is selected, follow the procedure described in the related section.
Before performing a method read all the instructions carefully.

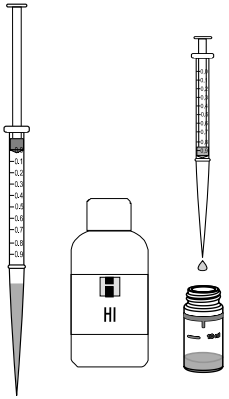
6.2. COLLECTING AND MEASURING SAMPLES AND REAGENTS

6.2.1. PROPER USE OF SYRINGE

(a) Push the plunger completely into the syringe and insert the tip into the solution.

(b) Pull the plunger up until the lower edge of the seal is exactly on the mark for the desired volume.

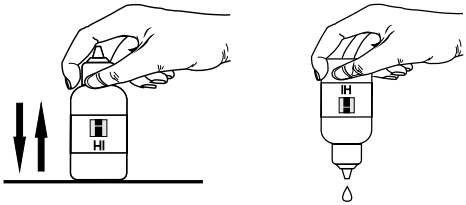
(c) Take out the syringe and clean the outside of the syringe tip, be sure that no drops are hanging on the tip of the syringe. Then, keeping the syringe in vertical position above the cuvette, push the plunger down into the syringe, the desired volume has been delivered into the cuvette.



6.2.2. PROPER USE OF DROPPER

(a) For reproducible results, tap the dropper on the table several times and wipe the outside of the tip with a cloth.

(b) Always keep the dropper bottle in a vertical position while dosing the reagent.

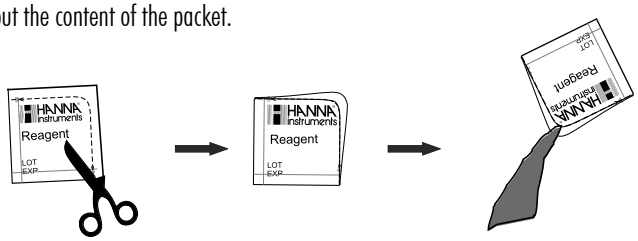


6.2.3. PROPER USE OF POWDER PACKET

(a) Use scissors to open the powder packet

(b) Push the edges of the packet to form a spout

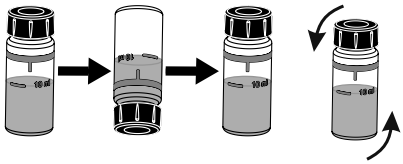
(c) Pour out the content of the packet.



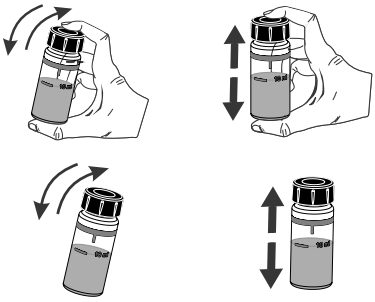
6.3. CUVETTE PREPARATION

Proper mixing is very important for reproducibility of the measurements. The proper mixing technique for each method is listed in the method procedure.

(a) Invert the cuvette a couple of times or for a specified time: hold the cuvette in the vertical position. Turn the cuvette upside-down and wait for all of the solution to flow to the cap end, then return the cuvette to the upright vertical position and wait for all of the solution to flow to the cuvette bottom. This is one inversion. The correct speed for this mixing technique is 10-15 complete inversions in 30 seconds.
This mixing technique is indicated with "invert to mix" and the following icon:



(b) Shaking the cuvette, moving the cuvette up and down. The movement may be gentle or vigorous. This mixing method is indicated with "shake gently" or "shake vigorously", and one of the following icons:



shake gently *shake vigorously*

In order to avoid reagent leaking and to obtain more accurate measurements, close the cuvette first with the supplied HDPE plastic stopper and then the black cap.
Whenever the cuvette is placed into the measurement holder, it must be dry outside and free of fingerprints, oil or dirt. Wipe it thoroughly with HI731318 or a lint-free cloth prior to insertion.
Shaking the cuvette can generate bubbles in the sample, causing higher readings. To obtain accurate measurements, remove such bubbles by swirling or by gently tapping the cuvette.

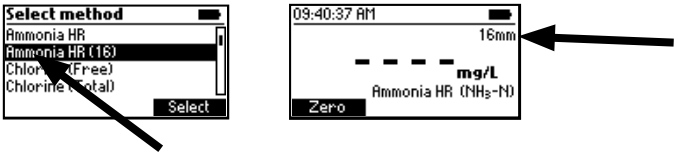
Do not let the reacted sample stand too long after reagent is added. For best accuracy, respect the timings described in each specific method.
It is possible to take multiple readings in a row, but it is recommended to take a new zero reading for each sample and to use the same cuvette for zeroing and measurement when possible.
Discard the sample immediately after the reading is taken, or the glass might become permanently stained.
All the reaction times reported in this manual are at 25 °C (77 °F). In general, the reaction time should be increased for temperatures lower than 20 °C (68 °F), and decreased for temperatures higher than 25 °C (77 °F).

Interference

In the method measurement section the most common interferences that may be present in a typical water sample have been reported. It is possible that a particular application could introduce other compounds that will also interfere.

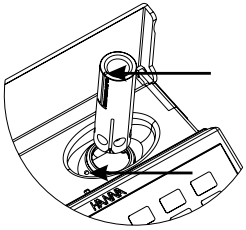
6.4. USING THE 16mm VIAL ADAPTER

Some parameters require special single-use 16 mm vials. These parameters can be identified by the "(16)" in the method name and the appearance of "16 mm" on the measurement screen.

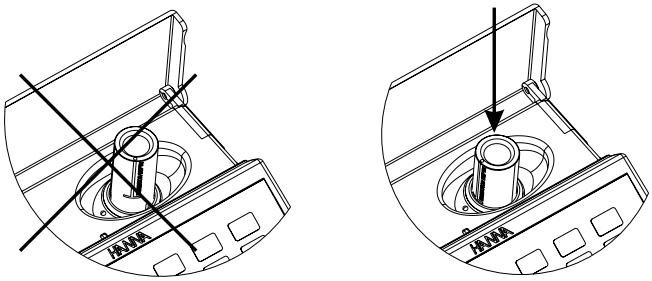


To prepare the meter for use with 16 mm vials:

1. Lift open the meter's sample cover.
2. Orient the vial adapter with the six small holes toward the bottom.
3. Orient the vial adapter with the indexing mark toward the left. This indexing mark should align with the indexing mark located on the meter.
4. Insert the vial slowly into the cuvette holder of the meter keeping the index marks on the adapter and meter aligned with each other. If the adapter appears blocked, the adapter may need to be rotated slightly in order to correctly engage the guides in the meter's cuvette holder.



5. Using light pressure, push the adapter down until it reaches the bottom of the meter's cuvette holder. When the vial adapter reaches the bottom, you should no longer be able to see the notched area of the adapter.



6. The meter is ready for use with 16 mm vial parameters. Always use the vial adapter for both "Zero" and "Read" measurements as specified in the parameter instructions.

Note :The meter's sample cover will not close completely while using the vial adapter. This is normal — the vial adapter itself will block out external light.

WARNING: Improper use of the 16 mm vial adapter could cause irreversible damage to the meter. Always use the following precautions while using the 16 mm vial adapter:

- Never use excessive force to insert the adapter. You should be able to insert the vial with light pressure using one finger. If the vial is not reaching the bottom, if there is large resistance, or if you are receiving a "light low" error during the "Zero" operation, re-check that the indexing marks are aligned on the adapter and meter.

- Never insert hot vials/samples into the vial adapter. Samples should be near room temperature before inserting into the meter/adapter.

- Do not attempt to close the sample cover while using the 16 mm vials or adapter. It is normal for the vials/adapter to prevent the cover from closing completely.

6.5. TIMERS AND MEASUREMENT FUNCTIONS

Each method requires a different preparation procedure, reaction times, sample preparations, etc. If a timer or timers are necessary for proper sample preparation, the **Timer** key will be available.

To use a reaction timer, press the **Timer** key.

The default timer will start immediately. To stop and reset the timer, press **Stop**.

If the selected method requires more than one timer, the meter will automatically select each timer in the appropriate order. To bypass the default order, you may press the desired key to activate a different timer (only while the current timer is stopped). Press **Continue** to start the active timer.

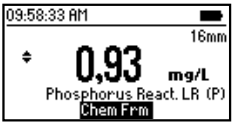
For some methods, the timer is only necessary after a **Zero** measurement has been performed. In this case, the timer key will only be available after the **Zero** measurement has been performed.

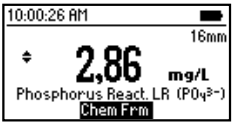
If the method requires a **Zero** or **Read** measurement after a timer has expired, the meter will automatically perform the appropriate action. Follow the instructions in the Method Procedure.

To perform a **Zero** or **Read** measurement, insert the appropriate prepared cuvette, then press the **Zero** or **Read** key. A **Zero** measurement must be conducted before **Read** measurements.

6.6. CHEMICAL FORMULA / UNIT CONVERSION

Chemical formula/unit conversion factors are pre-programmed into the instrument and are method specific. In order to view the displayed result in the desired chemical formula press ▲ ▼keys to access the second level function and then press the **Chem Frm** key to toggle between the available chemical formulas for the selected method.





6.7. METER VALIDATION / CAL CHECK

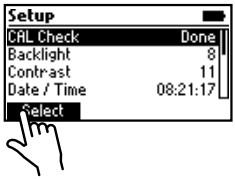
WARNING: Do not validate the meter with standard solutions other than the HANNA® CAL Check Standards. For accurate validation results, please perform tests at room temperature (18 to 25 °C; 64.5 to 77.0 °F).

Validation of the HI83314 involves absorbance measurements of certified HANNA® CAL Check Standards (see "Accessories"). The "CAL Check" screen guides the user through the measurement of each CAL Check Standard and applies the factory calibration corrections to each measurement. The HI83314 stores the results of the most recent CAL Check measurements which may be viewed on the "CAL Check" screen. Compare these results with the values printed on the Certificate provided with each HANNA® CAL Check Standards kit.

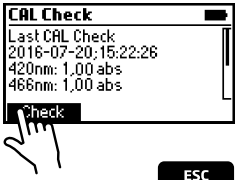
To perform a validation:

1. Press **Setup** button.

2. Highlight **CAL Check**, then press **Select**.



3. Follow the prompts on the screen. The meter will prompt to measure each cuvette provided in the HANNA® CAL Check Standards kit. To abort the process at any time, press **ESC** button.



4. Press **ESC** to return in **Setup** menu.

6.8. ABSORBANCE MEASUREMENTS

Raw absorbance measurements may be performed on the HI83314 for personal or diagnostic purposes. For example, you may monitor the stability of a reagent blank by occasionally measuring its absorbance versus deionized water.

To measure the raw absorbance of a prepared sample:

1. Enable "Photometer Mode" if necessary by pressing the **MODE** key.

2. Press the **METHOD** key.

3. Highlight the appropriate Absorbance method (according to the wavelength to be used), then press **Select**. Absorbance methods are located at the bottom of the method list.

4. Prepare the sample cuvette according to the method.

5. Insert a cuvette filled with deionized water, then press **Zero**.

6. Insert the prepared sample cuvette, then press **Read**.

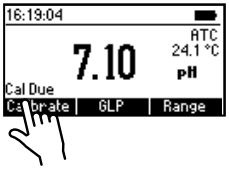
WARNING: Never use Absorbance methods for validation using HANNA® CAL Check cuvettes. The factory calibration corrections for CAL Check cuvettes are applied while in CAL Check mode only!

7. PROBE MODE

7.1. pH CALIBRATION

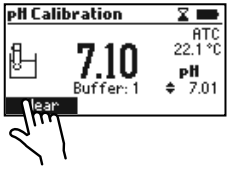
Press **MODE** to enter in pH/ mV measurement mode.

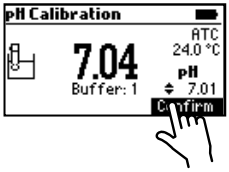
Press **Calibrate** to access electrode calibration functions.



Calibration Mode

While in pH Calibration Mode, the display will show the current pH reading, the current temperature reading, the current selected buffer, and the buffer number ("Buffer: 1" for the 1st buffer, "Buffer: 2" for the 2nd buffer).





The following functions are available in pH Calibration Mode:

- **Clear**: Press to clear the current calibration from the probe.
- **Confirm**: Press to accept the current calibration point. Only available if the measurement is stable and within the limits for the selected buffer.

Press to cycle through the list of available buffers: 4.01, 6.86, 7.01, 9.18, 10.01 pH.

Press to exit calibration and return to pH Measurement Mode.

Preparation

Pour small quantities of the buffer solutions into clean beakers. If possible, use plastic beakers to minimize any EMC interferences. For accurate calibration and to minimize cross-contamination, use two beakers for each buffer solution: one for rinsing the electrode and one for calibration. If you are measuring in the acidic range, use pH 7.01 or 6.86 as the first buffer and pH 4.01 as the second buffer. If you are measuring in the alkaline range, use pH 7.01 or 6.86 as the first buffer and pH 10.01 or 9.18 as the second buffer.

Procedure

Calibration can be performed using one or two calibration buffers. For more accurate measurements, a two-point calibration is recommended.
Submerse the pH electrode approximately 3 cm (1¼") into a buffer solution and stir gently. From the Probe Measurement screen, press the **Calibrate** key to begin the calibration process.

When the reading is stable and close to the selected buffer, the **Confirm** key will become available. Press **Confirm** to accept and store the calibration point.

The meter will now prompt for the second buffer ("Buffer: 2"). To use only a one-point calibration, press 

to exit calibration mode at this time. The meter will store the calibration information to the probe and return to Measurement mode. To continue calibrating with a second buffer, rinse and submerse the pH electrode approximately 3 cm (1¼") into the second buffer solution and stir gently. If necessary, press 

keys to select a different buffer value.

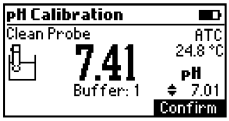
When the reading is stable and close to the selected buffer, the **Confirm** key will become available. Press **Confirm** to accept and store the second calibration point.

The meter will store the two-point calibration information to the probe and return to Measurement mode. The list of calibrated buffers will appear at the bottom of the screen.

7.2. pH CALIBRATION MESSAGES

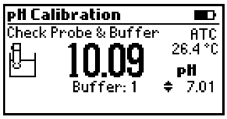
Clean Probe:

The "Clean Probe" message indicates poor electrode performance (offset out of accepted window, or slope under the accepted lower limit). Often, cleaning the probe will improve the pH electrode's response. See pH Electrode Conditioning and Maintenance for details. Repeat calibration after cleaning.



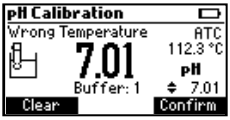
Check Probe & Buffer:

The “Check Probe & Buffer” message appears when there is a large difference between the pH measurement and the selected buffer value, or the electrode slope is outside of the accepted slope limit. You should check your probe and confirm the correct buffer selection. Cleaning may also improve this response.



Wrong Temperature:

The buffer temperature is too extreme for the selected buffer value.



7.3. pH MEASUREMENT

The HI83314 can be used to perform direct pH measurements by connecting a HANNA® digital pH electrode with a 3.5 mm TRRS connector. To begin taking probe measurements, connect the electrode to the 3.5 mm port marked with EXT PROBE located at the rear of the meter. If the meter is in “Photometer Mode”, set the meter to “Probe Mode” by pressing the **MODE** key.

While taking pH probe measurements, the following functions are available:

- **Calibrate**: Press to access electrode calibration functions.
- **GLP**: Press to review the last calibration information, including date/time, buffers used, slope, and offset.
- **Range**: Press to switch between “pH” units and “mV” units.

MODE 3DEF	Press to switch to Photometer mode.
SETUP 7PQRS	Press to access the meter's Setup menu.
LOG 8TUV	Press to log the current measurement.
RECALL 9WXYZ	Press to review the meter's log history.
HELP 0.()	Press to view contextual help information.

For high accuracy it is recommended to calibrate your electrode often. pH electrodes should be recalibrated at least once per week, but daily calibration is recommended. Always recalibrate after cleaning an electrode. See page 24 for more information on pH calibration.

To take pH measurements:

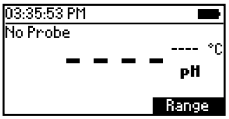
- Remove the protective cap and rinse the electrode with water.
- Collect some sample in a clean, dry beaker.
- Preferably, rinse the electrode with a small amount of sample. Discard the rinse.
- Submerse the electrode tip approximately 3 cm (1¼") into the sample to be tested and stir the sample gently. Make sure the electrode junction is completely submersed.
- Allow time for the electrode to stabilize in the sample. When the ⌛ symbol disappears, your reading is stable.

If measurements are taken successively in different samples, it is recommended to rinse the electrodes thoroughly with deionized or distilled water and then with some of the next sample to prevent cross-contamination.

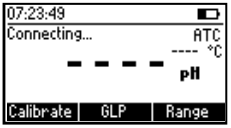
pH measurements are affected by temperature. HANNA® Digital pH electrodes include a built-in temperature sensor and automatically calculate corrected pH values. The measured temperature is displayed on the screen with the pH measurements.

7.4. pH MEASUREMENT MESSAGES / WARNINGS

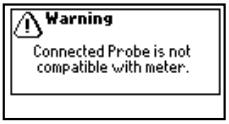
No Probe:
No probe is connected or the probe is broken.



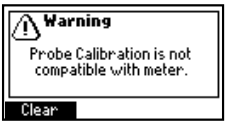
Connecting:
The meter has detected a probe and is reading the probe configuration and calibration information.



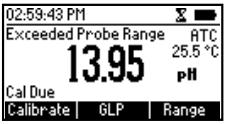
Incompatible Probe:
The connected probe is not compatible with this device.



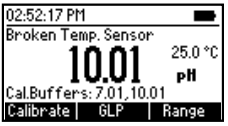
Incompatible Calibration:
The probe's current calibration is not compatible with this meter. The calibration must be cleared to use this probe.



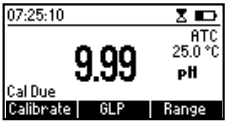
Exceeded Probe Range:
The pH and/or temperature measurement exceed the specifications of the probe. The affected measurement value(s) will be flashing.



Broken Temperature Sensor:
The temperature sensor inside the probe is broken. Temperature compensation will revert to a fixed value of 25 °C (77 °C).

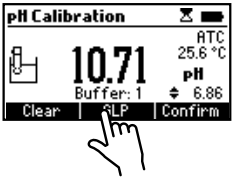


Cal Due:
The probe has no calibration. See section Probe Calibration.



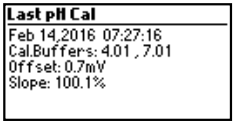
7.5. pH GLP

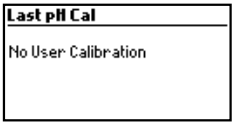
Good Laboratory Practice (GLP) refers to a quality control function used to ensure uniformity and consistency of sensor calibrations and measurements. To view the GLP information, press the **GLP** key from the Probe Measurement screen.



The pH GLP screen displays the following information about the last pH calibration:

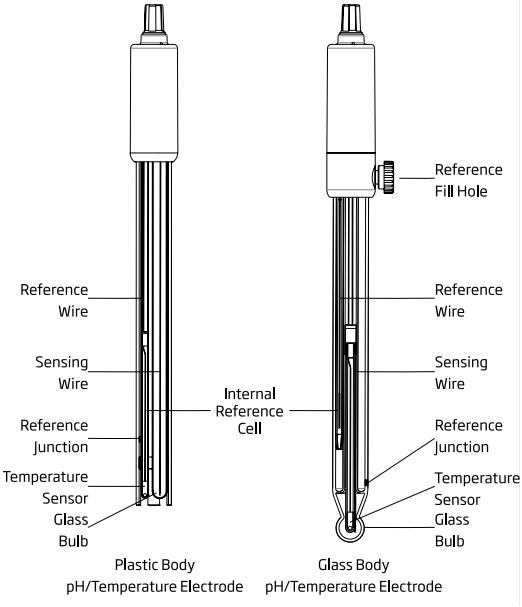
- Date and time of the last calibration
- List of buffers used in the last calibration
- Calculated slope and offset





- Press **ESC** to return in measurement mode.

7.6. pH ELECTRODE CONDITIONING AND MAINTENANCE



Remove the protective cap of the pH electrode.
DO NOT BE ALARMED IF SALT DEPOSITS ARE PRESENT.
This is normal with electrodes. They will disappear when rinsed with water.
During transport, tiny bubbles of air may form inside the glass bulb affecting proper functioning of the electrode. These bubbles can be removed by "shaking down" the electrode as you would do with a glass thermometer. If the bulb and/or junction is dry, soak the electrode in HI70300 or HI80300 storage solution for at least one hour.

For refillable electrodes:
If the filling solution (electrolyte) is more than 2½ cm (1") below the fill hole, add HI7082 or HI8082 3.5M KCl Electrolyte Solution for double junction electrodes.
Unscrew the fill hole cover during measurements so the liquid reference junction maintains an outward flow of electrolyte.

Measurement

Rinse the electrode tip with distilled water. Submerse the tip 3 cm (1¼") in the sample and stir gently for a few seconds. For a faster response and to avoid cross-contamination of the samples, rinse the electrode tip with a few drops of the solution to be tested, before taking measurements.

Storage Procedure

To minimize clogging and ensure a quick response time, the glass bulb and the junction should be kept moist and not allowed to dry out.

Replace the solution in the protective cap with a few drops of HI70300 or HI80300 Storage Solution or, in its absence, Filling Solution (HI7082 or HI8082 for double junction electrodes). Follow the preparation procedure before taking measurements.

Note: NEVER STORE THE ELECTRODE IN DISTILLED OR DEIONIZED WATER.

Periodic Maintenance

Inspect the electrode and the cable. The cable used for connection to the instrument must be intact and there must be no points of broken insulation on the cable or cracks on the electrode stem or bulb. Connectors must be perfectly clean and dry. If any scratches or cracks are present, replace the electrode. Rinse off any salt deposits with water.
For refillable electrodes: Refill the reference chamber with fresh electrolyte (HI7082 or HI8082 for double junction electrodes). Allow the electrode to stand upright for 1 hour.
Follow the Storage Procedure above.

Cleaning Procedure

Use diagnostic messages to aid pH electrode troubleshooting. Several cleaning solutions are available:

- General – Soak in Hanna HI7061 or HI8061 General Cleaning Solution for approximately ½ hour.
- Protein –Soak in Hanna HI7073 or HI8073 Protein Cleaning Solution for 15 minutes.
- Inorganic – Soak in Hanna HI7074 Inorganic Cleaning Solution for 15 minutes.
- Oil/grease – Rinse with Hanna HI7077 or HI8077 Oil and Fat Cleaning Solution.

Note: After performing any of the cleaning procedures, rinse the electrode thoroughly with distilled water, refill the reference chamber with fresh electrolyte (not necessary for gel- filled electrodes) and soak the electrode in HI70300 or HI80300 Storage Solution for at least 1 hour before taking measurements.

Temperature Correlation For pH Sensitive Glass

Verify the temperature range by reading the limits on electrodes cap. The pH electrode's life also depends on the temperature that is used. If constantly cycled between two temperatures, the life of the electrode is drastically reduced.

8. METHOD PROCEDURES
8.1. AMMONIA LOW RANGE

SPECIFICATIONS

Range	0.00 to 3.00 mg/L (as NH_3-N)
Resolution	0.01 mg/L
Accuracy	±0.04 mg/L ±4% of reading at 25 °C
Light Source	LED with narrow band interference filter @ 420 nm
Method	Adaptation of the ASTM Manual of Water and Environmental Technology, D1426 Nessler method.

REQUIRED REAGENTS

Code	Description	Quantity
HI93700A-0	Ammonia Low Range Reagent A	4 drops
HI93700B-0	Ammonia Low Range Reagent B	4 drops

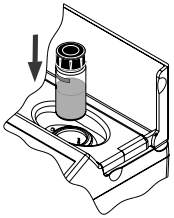
REAGENT SETS

HI93700-01	Reagents for 100 tests
HI93700-03	Reagents for 300 tests

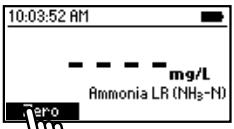
For other accessories see page 109.

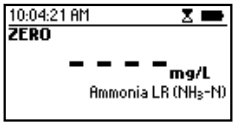
MEASUREMENT PROCEDURE

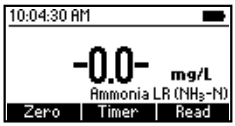
- Select the Ammonia LR method using the procedure described in the Method Selection section (see page 17).
- Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.
- Place the cuvette into the holder and close the lid.



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

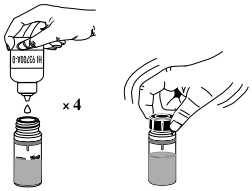




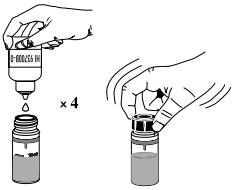


- Remove the cuvette.

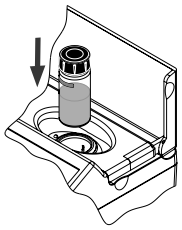
- Add 4 drops of HI93700A-0 Ammonia Low Range Reagent A. Replace the cap and mix the solution.



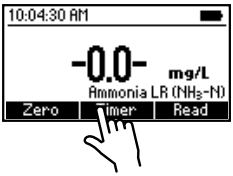
- Add 4 drops of HI93700B-0 Ammonia Low Range Reagent B. Replace the cap and mix the solution.

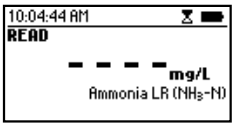


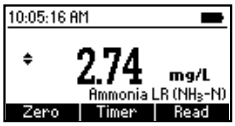
- Reinsert the cuvette into the instrument and close the lid.



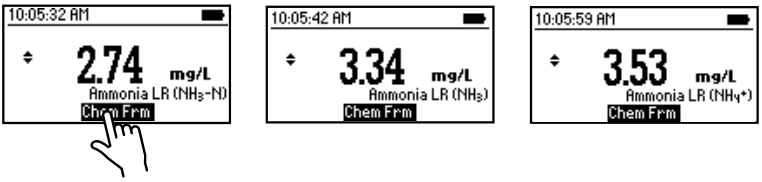
- Press **Timer** and the display will show the countdown prior to the measurement or, alternatively, wait for 3 minutes and 30 seconds and press **Read.** When the timer ends the meter will perform the reading. The instrument displays the results in **mg/L of ammonia nitrogen (NH_3-N).**







- Press ▲ or ▼ to access the second level functions.
- Press the **Chem Frm** key to convert the result to **mg/L of ammonia (NH_3) and ammonium (NH_4^+)**.



- Press ▲ or ▼ to return to the measurement screen.

INTERFERENCE

Interference may be caused by:
Acetone
Alcohols
Aldehydes
Glycine
Hardness above 1 g/L
Iron
Organic chloramines
Sulfide
Various aliphatic and aromatic amines

8.2. AMMONIA LOW RANGE (16 mm VIAL)

SPECIFICATIONS

Range	0.00 to 3.00 mg/L (as NH_3-N)
Resolution	0.01 mg/L
Accuracy	± 0.10 mg/L or ± 5% of reading at 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 420 nm
Method	Adaptation of the ASTM Manual of Water and Environmental Technology, D1426 Nessler method.

REQUIRED REAGENTS

Code	Description	Quantity
HI93764A-0*	Ammonia Low Range Reagent Vial	1 vial
HI93764-0	Nessler Reagent	4 drops

*Reagent Vial identification: A LR, white label

Note: Store the unused vials in a cool and dark place.

REAGENT SETS

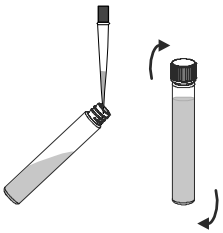
HI93764A-25 Reagents for 25 tests

For other accessories see page 109.

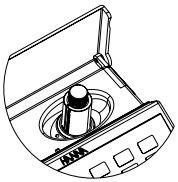
MEASUREMENT PROCEDURE

- Select the Ammonia LR (16) method following one of the procedures described in the Method Selection section (see page 17).
- Insert the 16mm vial adapter using the procedure described in the Using the 16mm Vial Adapter section (see page 20).

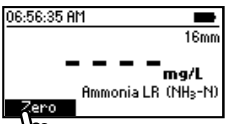
- Remove the cap from HI93764A-0 Ammonia Low Range Reagent Vial.
- Add 5.0 mL of sample to the vial, while keeping the vial at a 45-degree angle.
- Replace the cap and invert several times to mix.

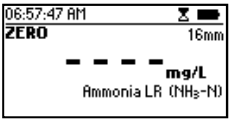


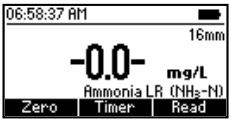
- Place the vial into the holder.



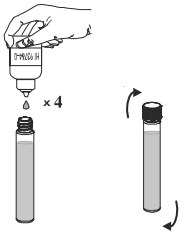
- Press the **Zero** key. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



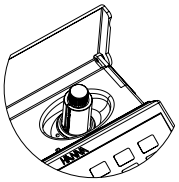




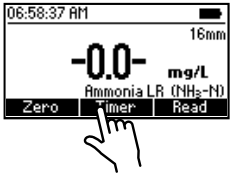
- Remove the vial.
- Remove the cap and add 4 drops of HI93764-0 Nessler Reagent.
- Replace the cap and invert the vial several times to mix.

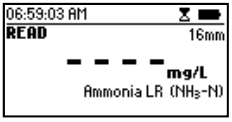


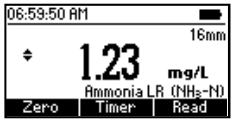
- Place the vial into the holder.



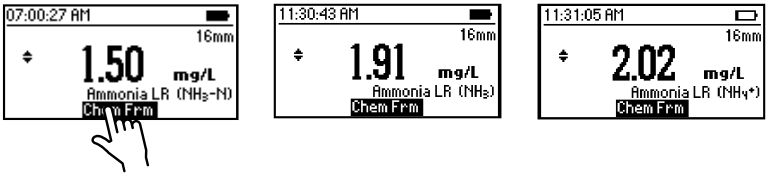
- Press **Timer** and the display will show the countdown prior to the measurement, or, alternatively, wait for 3 minutes and 30 seconds and press **Read**. When the timer ends the meter will perform the reading. The instrument displays the results in **mg/L ammonia nitrogen (NH_3-N)**.







- Press ▲ or ▼ to access the second level functions.
- Press the **Chem Frm** key to convert the result to **mg/L of ammonia (NH_3) and ammonium (NH_4^+)**.



- Press ▲ or ▼ to return to the measurement screen.

INTERFERENCES

Interference may be caused by:

Organic compounds like: chloramines, various aliphatic and aromatic amines, glycine or urea above 10 ppm (to eliminate these interferences distillation is required).

Organic compounds like: aldehydes, alcohols (e.g. ethanol), or acetone above 0.1%. (to eliminate these interferences distillation is required).

Sulfide: may cause turbidity.

8.3. AMMONIA MEDIUM RANGE

SPECIFICATIONS

Range	0.00 to 10.00 mg/L (as NH_3-N)
Resolution	0.01 mg/L
Accuracy	±0.05 mg/L ±5% of reading at 25 °C
Light Source	LED with narrow band interference filter @ 420 nm
Method	Adaptation of the ASTM Manual of Water and Environmental Technology, D1426, Nessler method.

REQUIRED REAGENTS

Code	Description	Quantity
HI93715A-0	Ammonia Medium Range Reagent A	4 drops
HI93715B-0	Ammonia Medium Range Reagent B	4 drops

REAGENT SETS

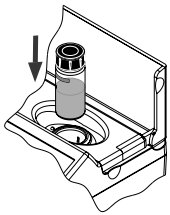
HI93715-01	Reagents for 100 tests
HI93715-03	Reagents for 300 tests

For other accessories see page 109.

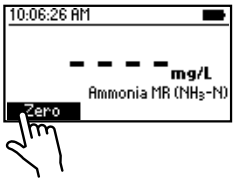
MEASUREMENT PROCEDURE

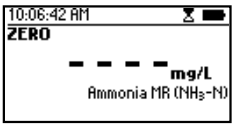
- Select the Ammonia MR method using the procedure described in the Method Selection section (see page 17).

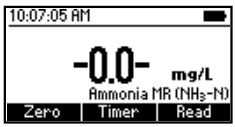
- Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.
- Place the cuvette into the holder and close the lid.



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

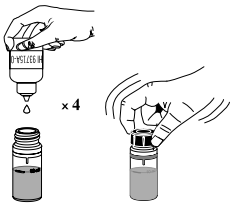




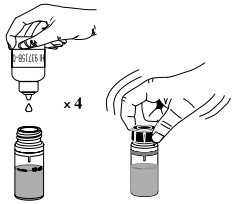


- Remove the cuvette.

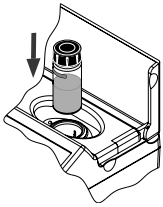
- Add 4 drops of HI93715A-0 Ammonia Medium Range Reagent A. Replace the cap and mix the solution.



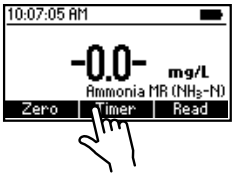
- Add 4 drops of HI93715B-0 Ammonia Medium Range Reagent B. Replace the cap and mix the solution.

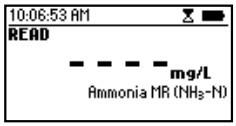


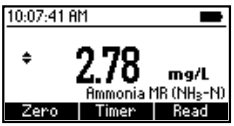
- Reinsert the cuvette into the instrument and close the lid.



- Press **Timer** and the display will show the countdown prior to the measurement or, alternatively, wait for 3 minutes and 30 seconds and press **Read**. When the timer ends the meter will perform the reading. The instrument displays the results to **mg/L of ammonia nitrogen (NH_3-N)**.

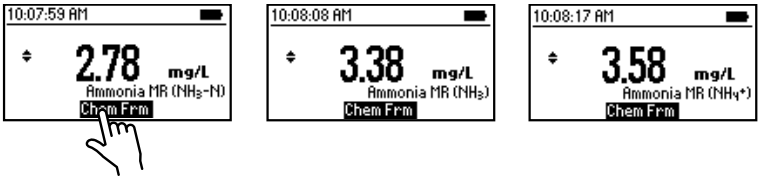






- Press ▲or▼ to access the second level functions.

- Press the **Chem Frm** key to convert the result in **mg/L of ammonia (NH_3) and ammonium (NH_4^+)**.



- Press ▲ or ▼ to return to the measurement screen.

INTERFERENCES

Interference may be caused by:
Acetone
Alcohols
Aldehydes
Glycine
Hardness above 1 g/L
Iron
Organic chloramines
Sulfide
Various aliphatic and aromatic amines

8.4. AMMONIA HIGH RANGE

SPECIFICATIONS

Range	0.0 to 100.0 mg/L (as NH_3-N)
Resolution	0.1 mg/L
Accuracy	±0.5 mg/L ±5% of reading at 25 °C
Light Source	LED with narrow band interference filter @ 420 nm
Method	Adaptation of the ASTM Manual of Water and Environmental Technology, D1426, Nessler method.

REQUIRED REAGENTS

Code	Description	Quantity
HI93733A-0	Ammonia High Range Reagent A	4 drops
HI93733B-0	Ammonia High Range Reagent B	9 mL

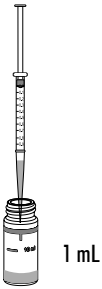
REAGENT SETS

HI93733-01	Reagents for 100 tests
HI93733-03	Reagents for 300 tests

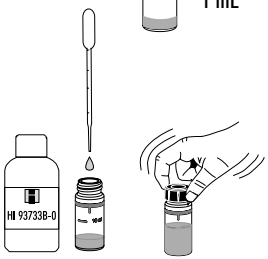
For other accessories see page 109.

MEASUREMENT PROCEDURE

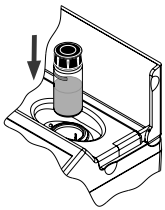
- Select the Ammonia HR method using the procedure described in the Method Selection section (see page 17).



- Add 1mL of unreacted sample to the cuvette using 1mL syringe.

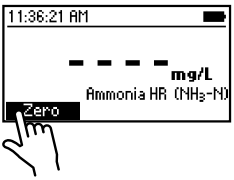


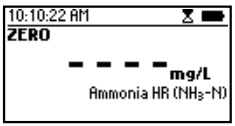
- Use the pipette to fill the cuvette up to the 10 mL mark with HI93733B-0 Ammonia High Range Reagent B. Replace the cap and mix the solution.

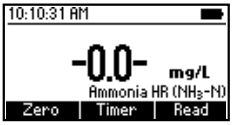


- Place the cuvette into the holder and close the lid.

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

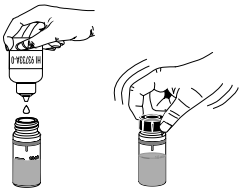




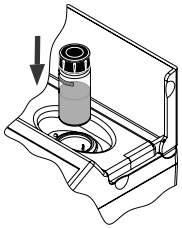


- Remove the cuvette.

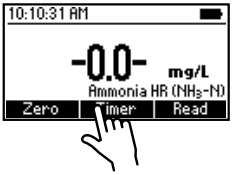
- Add 4 drops of HI93733A-0 Ammonia High Range Reagent A. Replace the cap and swirl the solution.

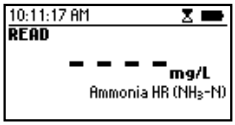


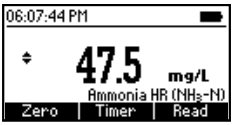
- Reinsert the cuvette into the instrument and close the lid.



- Press **Timer** and the display will show the countdown prior to the measurement or, alternatively, wait for 3 minutes and 30 seconds and press **Read**. When the timer ends the meter will perform the reading. The instrument displays the results in **mg/L of ammonia nitrogen (NH_3-N).**

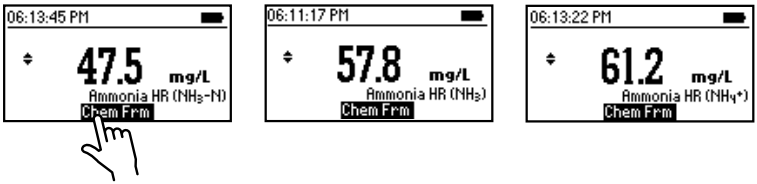






- Press ▲ or ▼ to access the second level functions.

• Press the **Chem Frm** key to convert the result to **mg/L of ammonia (NH_3) and ammonium (NH_4^+)**.



• Press ▲ or ▼ to return to the measurement screen.

INTERFERENCES

Interference may be caused by:
Acetone
Alcohols
Aldehydes
Glycine
Hardness above 1 g/L
Iron
Organic chloramines
Sulfide
Various aliphatic and aromatic amines

8.5. AMMONIA HIGH RANGE (16 mm VIAL)

SPECIFICATIONS

Range	0.0 to 100.0 mg/L (as NH_3-N)
Resolution	0.1 mg/L
Accuracy	± 1.0 mg/L or ± 5% of reading at 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 420 nm
Method	Adaptation of the ASTM Manual of Water and Environmental Technology, D1426 Nessler method.

REQUIRED REAGENTS

Code	Description	Quantity
HI93764B-0*	Ammonia High Range Reagent Vial	1 vial
HI93764-0	Nessler Reagent	4 drops

*Reagent Vial identification: A HR, green label.

Note: Store the unused vials in a cool and dark place.

REAGENT SETS

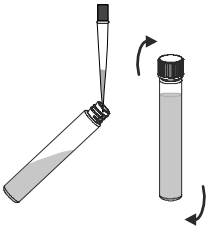
HI93764B-25 Reagents for 25 tests

For other accessories see page 109.

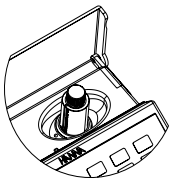
MEASUREMENT PROCEDURE

- Select the Ammonia HR (16) method using the procedure described in the Method Selection section (see page 17).
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section (see page 20).

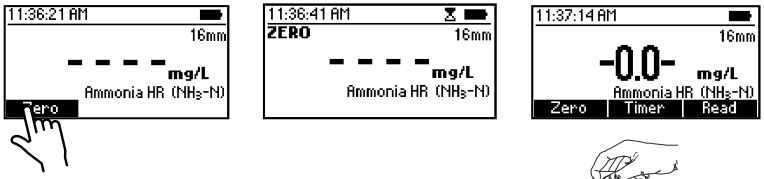
- Remove the cap from HI93764B-0 Ammonia High Range Reagent Vial.
- Add 1.0 mL of sample to the vial, while keeping the vial at a 45-degree angle.
- Replace the cap and invert several times to mix.



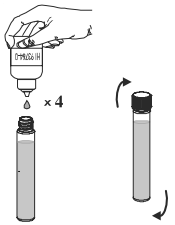
- Place the vial into the holder.



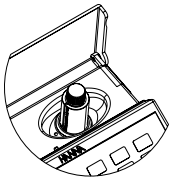
- Press the **Zero** key. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



- Remove the vial.
- Add 4 drops of HI93764-0 Nessler Reagent.



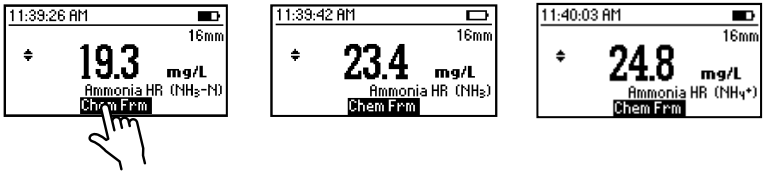
- Replace the cap and invert several times to mix.
- Place the vial into the holder.



- Press **Timer** and the display will show the countdown prior to the measurement, or, alternatively wait 3 minutes and 30 seconds. When the timer ends the meter will perform the reading. The instrument displays the results in **mg/L ammonia nitrogen (NH_3-N)**.

- Press ▲ or ▼ to access the second level functions.

- Press the **Chem Frm key** to convert the result to **mg/L of ammonia (NH_3) and ammonium (NH_4^+)**.



- Press ▲ or ▼ to return to the measurement screen.

INTERFERENCES

Interference may be caused by:
Organic compounds like: chloramines, various aliphatic and aromatic amines, glycine or urea above 100 ppm; to eliminate these interferences distillation is required.
Organic compounds like: aldehydes, alcohols (e.g. ethanol) or acetone above 1 %; to eliminate these interferences distillation is required.
Sulfide: may cause turbidity.

8.6. CHLORINE, FREE

SPECIFICATIONS

Range	0.00 to 5.00 mg/L (as Cl_2)
Resolution	0.01 mg/L
Accuracy	±0.03 mg/L ±3% of reading at 25 °C
Light Source	LED with narrow band interference filter @ 525 nm
Method	Adaptation of the EPA DPD method 330.5.

REQUIRED REAGENTS

POWDER:

Code	Description	Quantity
HI93701-0	Free Chlorine Reagent	1 packet

LIQUID:

Code	Description	Quantity
HI93701A-F	Free Chlorine Reagent A	3 drops
HI93701B-F	Free Chlorine Reagent B	3 drops

REAGENT SETS

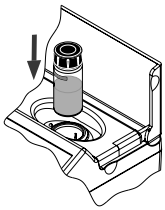
HI93701-F	Reagents for 300 tests (liquid)
HI93701-01	Reagents for 100 tests (powder)
HI93701-03	Reagents for 300 tests (powder)

For other accessories see page 109.

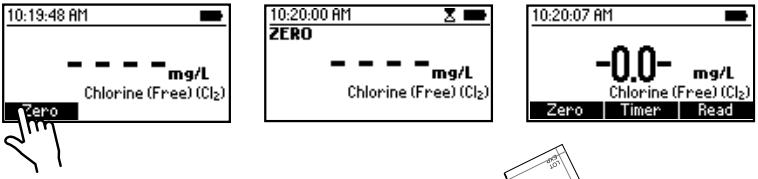
MEASUREMENT PROCEDURE

- Select the Chlorine (Free) method using the procedure described in the Method Selection section (see page 17).
- Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.

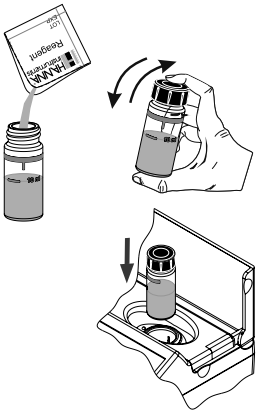
- Place the cuvette into the holder and close the lid.



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



- Remove the cuvette.

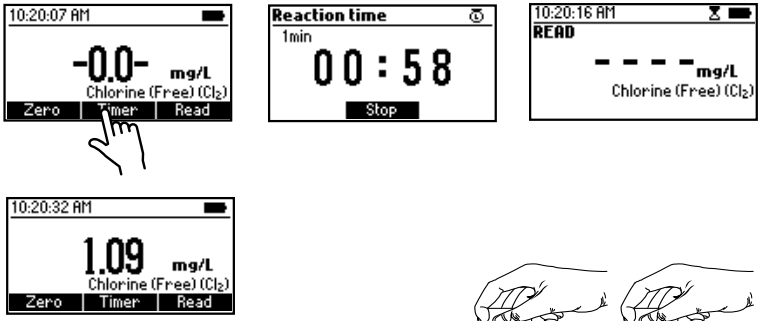


POWDER REAGENT PROCEDURE

- Add the content of one packet of HI93701-0 Free Chlorine Reagent. Replace the cap and shake gently for 20 seconds.

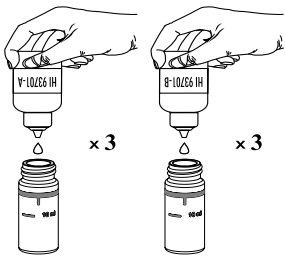
- Reinsert the cuvette into the instrument and close the lid.

- Press **Timer** and the display will show the countdown prior to the measurement or alternatively, wait for 1 minute and press **Read**. When the timer ends the meter will perform the reading. The instrument displays the results in **mg/L of chlorine (Cl_2)**.



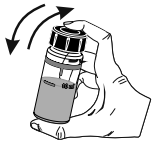
LIQUID REAGENT PROCEDURE

- To an empty cuvette add 3 drops of HI93701A-F Free Chlorine Reagent A and 3 drops of HI93701B-F Free Chlorine Reagent B.

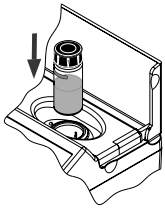


- Swirl gently to mix.

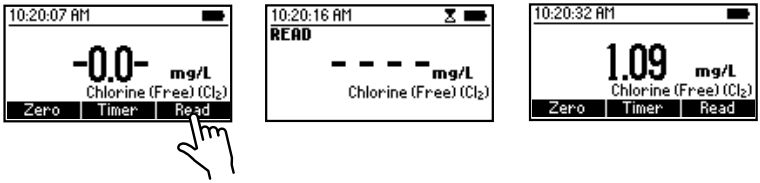
- Add 10 mL of unreacted sample (up to the mark). Replace the cap and shake gently.



- Insert the cuvette into the instrument and close the lid.



- Press **Read** to start the reading. The instrument displays the results in **mg/L of chlorine (Cl_2)**.



Note: Free and Total Chlorine have to be measured separately with fresh sample following the related procedure if both values are desired.

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.
If the water used for this procedure has an alkalinity value greater than 250 mg/L $CaCO_3$ or acidity value 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.

8.7. CHLORINE, TOTAL

SPECIFICATIONS

Range	0.00 to 5.00 mg/L (as Cl_2)
Resolution	0.01 mg/L
Accuracy	±0.03 mg/L ±3% of reading at 25 °C
Light Source	LED with narrow band interference filter @ 525 nm
Method	Adaptation of the EPA DPD method 330.5.

REQUIRED REAGENTS

POWDER:

Code	Description	Quantity
HI93711-0	Total Chlorine Reagent	1 packet

LIQUID:

Code	Description	Quantity
HI93701A-T	Total Chlorine Reagent A	3 drops
HI93701B-T	Total Chlorine Reagent B	3 drops
HI93701C-T	Total Chlorine Reagent C	1 drop

REAGENT SETS

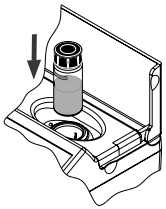
HI93701-T	Reagents for 300 tests (liquid)
HI93711-01	Reagents for 100 total tests (powder)
HI93711-03	Reagents for 300 total tests (powder)

For other accessories see page 109.

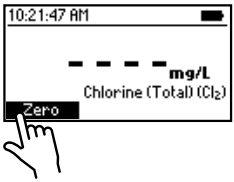
MEASUREMENT PROCEDURE

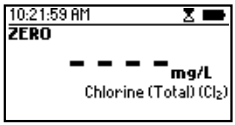
- Select the Chlorine (Total) method using the procedure described in the Method Selection section (see page 17).
- Fill the cuvette with 10 mL of unreacted sample (up to the mark) and replace the cap.

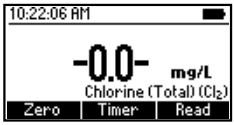
- Place the cuvette into the holder and close the lid.



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



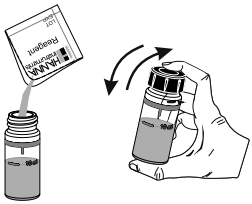




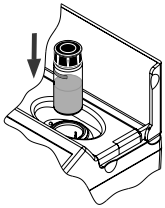
- Remove the cuvette.

POWDER REAGENT PROCEDURE

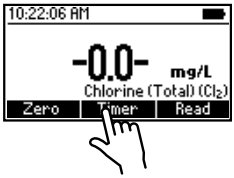
- Add 1 packet of HI93711-0 Total Chlorine Reagent. Replace the cap and shake gently for 20 seconds.

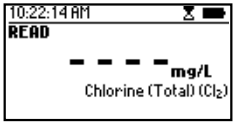


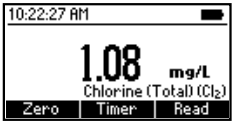
- Reinsert the cuvette into the instrument and close the lid.



- Press **Timer** and the display will show the countdown prior to the measurement or, alternatively, wait for 2 minutes and 30 seconds and press **Read.** When the timer ends the meter will perform the reading. The instrument displays the results in **mg/L of chlorine (Cl_2).**

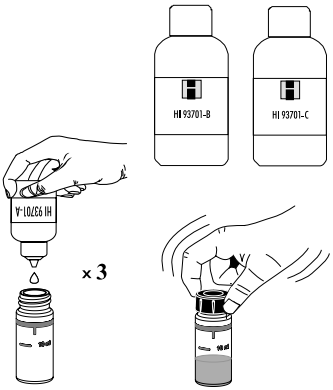




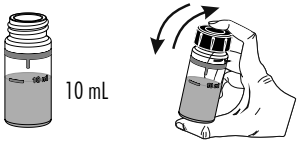


LIQUID REAGENT PROCEDURE

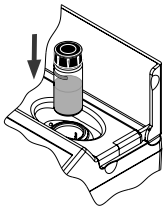
- To an empty cuvette add 3 drops of HI93701A-T Total Chlorine Reagent A, 3 drops of HI93701B-T Total Chlorine Reagent B, and 1 drop of HI93701C-T Total Chlorine Reagent C. Swirl gently to mix.



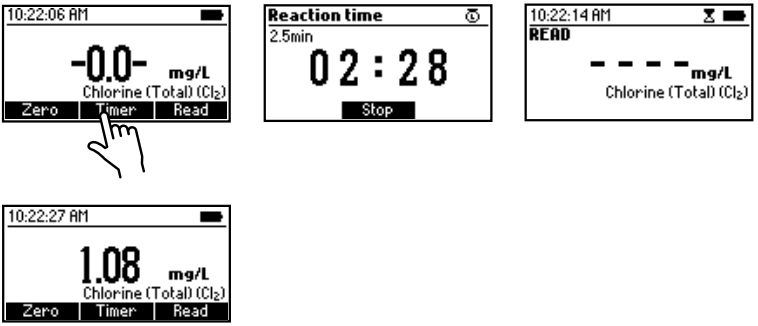
- Add 10 mL of unreacted sample (up to the mark). Replace the cap and shake gently.



- Insert the cuvette into the instrument and close the lid.



- Press **Timer** and the display will show the countdown prior to the measurement or, alternatively, wait for 2 minutes and 30 seconds and press **Read**. When the timer ends the meter will perform the reading. The instrument displays the results in **mg/L of chlorine (Cl_2)**.



Note: Free and Total Chlorine have to be measured separately with fresh unreacted samples following the related procedure if both values are desired.

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.
If the water used for this procedure has an alkalinity value greater than 250 mg/L $CaCO_3$ or acidity value 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.

8.8. CHEMICAL OXYGEN DEMAND LOW RANGE (16 mm VIAL)

SPECIFICATIONS

Range	0 to 150 mg/L (as O_2)
Resolution	1 mg/L
Accuracy	±5 mg/L or ±4% of reading @ 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 420 nm
Method	Adaptation of the USEPA 410.4 approved method for the COD determination on surface waters and wastewaters.

REQUIRED REAGENTS

Code	Description	Quantity
HI93754A-0*	COD Low Range Reagent Vial	2 vials
DEIONIZED120	Deionized Water	2 mL

*Reagent Vial identification: COD A, red label.

REAGENT SETS

HI93754A-25 Reagents for 24 tests

For other accessories see page 109.

Note: Store the unused vials in a cool and dark place.

MEASUREMENT PROCEDURE

Before using the reagent kit carefully read all the instructions and the Safety Data Sheets (SDS). Pay particular attention to all warnings, cautions, and notes. Failure to do so may result in serious injury to the operator.

Reagent Blank Correction: This method requires a reagent blank correction. A single blank vial may be used more than once. The blank vial is stable for several months at room temperature. For improved accuracy, run a blank for each set of measurements and always use the same lot of reagents for blank and samples.

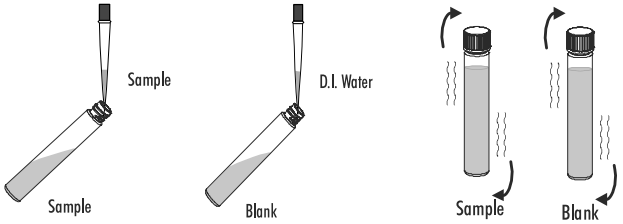
- Choose a homogeneous sample. Samples containing solids capable of settling need to be homogenized with a blender.
- Preheat the HANNA® Reactor HI839800 to 150 °C (302 °F).The optional HI740217 safety shield is strongly recommended.

  DO NOT USE AN OVEN OR MICROWAVE samples may leak and generate a corrosive and possibly explosive atmosphere.

- Remove the cap from two HI93754A-0 COD Low Range Reagent Vials.

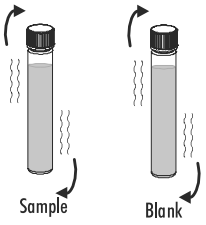
- Add 2.0 mL of deionized water to the first vial (#1) and 2.0 mL of sample to the second vial (#2), while keeping the vials at a 45-degree angle. Replace the cap and invert several times to mix.

  WARNING: The vials will become hot during mixing, use caution when handling.



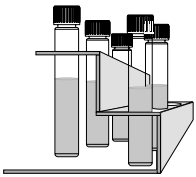
- Insert the vials into the reactor and heat them for 2 hours at 150 °C.

- At the end of the digestion period switch off the reactor. Wait for twenty minutes to allow the vials to cool to about 120 °C.



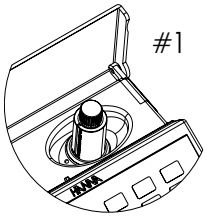
- Invert each vial several times while still warm, then place them in the test tube rack.

  WARNING: The vials are still hot, use caution when handling.

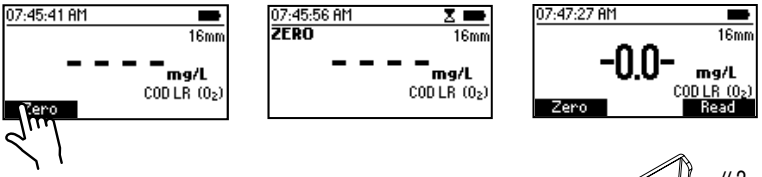


- Leave the vials in the tube rack to cool to room temperature. Do not shake or invert them, the samples may become turbid.

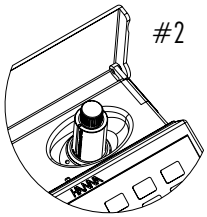
- Select COD LR (16) method using the procedure described in the Method Selection section (see page 17).
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section (see page 20).



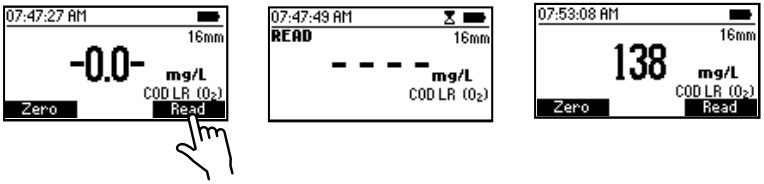
- Place the blank vial (#1) into the holder.
- Press the **Zero** key. The display will show -0.0- when the meter is zeroed and ready for measurement.



- Remove the vial.
- Place the sample vial (#2) into the holder.



- Press **Read** to start the reading. The instrument displays the results in **mg/L of oxygen (O_2)**.



INTERFERENCES

Interference may be caused by:
Chloride (Cl^-) above 2000 mg/L.
Samples with higher chloride concentration should be diluted.

8.9. CHEMICAL OXYGEN DEMAND MEDIUM RANGE (16 mm VIAL)

SPECIFICATIONS

Range	0 to 1500 mg/L (as O_2)
Resolution	1 mg/L
Accuracy	±15 mg/L or ±4% of reading @ 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 610 nm
Method	Adaptation of the USEPA 410.4 approved method for the COD determination on surface waters and wastewaters.

REQUIRED REAGENTS

Code	Description	Quantity
HI93754B-0*	COD Medium Range Reagent Vial	2 vials
DEIONIZED120	Deionized Water	2 mL

*Reagent Vial identification: COD B, white label.

REAGENT SETS

HI93754B-25 Reagents for 24 tests

For other accessories see page 109.

Note: Store the unused vials in a cool and dark place.

MEASUREMENT PROCEDURE

Before using the reagent kit carefully read all the instructions and the Safety Data Sheets (SDS). Pay particular attention to all warnings, cautions, and notes. Failure to do so may result in serious injury to the operator.

Reagent Blank Correction: This method requires a reagent blank correction. A single blank vial may be used more than once. The blank vial is stable for several months at room temperature. For improved accuracy measurement, run a blank for each set of measurements and always use the same lot of reagents for blank and samples.

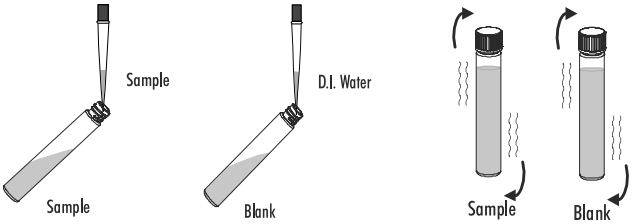
- Choose a homogeneous sample. Samples containing solids capable of settling need to be homogenized with a blender.
- Preheat the HANNA® Reactor HI839800 to 150 °C (302 °F). Use of the optional HI740217 safety shield is strongly recommended.

  DO NOT USE AN OVEN OR MICROWAVE samples may leak and generate a corrosive and possibly explosive atmosphere.

- Remove the cap from two HI93754B-0 COD Medium Range Reagent Vials.

- Add 2.0 mL of deionized water to the first vial (#1) and 2.0 mL of sample to the second vial (#2), while keeping the vials at a 45-degree angle. Replace the cap and invert several times to mix.

  WARNING: The vials will become hot during mixing, use caution when handling

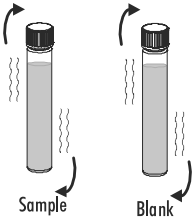


- Insert the vials into the reactor and heat them for 2 hours at 150 °C.

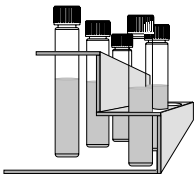
- At the end of the digestion period switch off the reactor. Wait for twenty minutes to allow the vials to cool to about 120 °C.

- Invert each vial several times while still warm, then place them in the test tube rack.

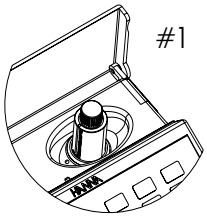
  WARNING: The vials are still hot, use caution when handling.



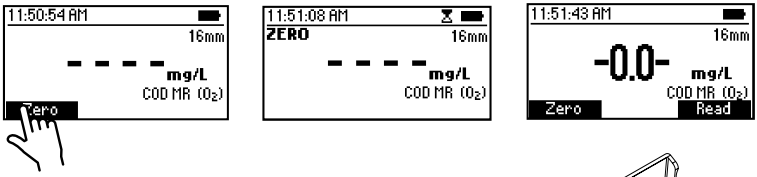
- Leave the vials in the tube rack to cool to room temperature. Do not shake or invert them, the samples may become turbid.

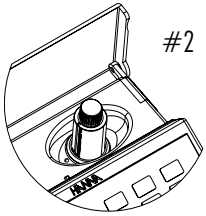


- Select COD MR (16) method using the procedure described in the Method Selection section (see page 17).
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section (see page 20).

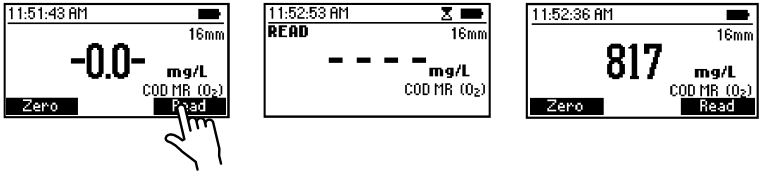


- Place the blank vial into the holder.
- Press **Zero** key the display will show -0.0- when the meter is zeroed and ready for measurement.





- Remove the vial.
- Place the sample vial (#2) into the holder.
- Press **Read** to start the reading. The instrument displays the results in **mg/L of oxygen (O_2)**.



INTERFERENCES

Interference may be caused by:
Chloride (Cl^-) above 2000 mg/L.
Samples with higher chloride concentration should be diluted.

8.10. CHEMICAL OXYGEN DEMAND HIGH RANGE (16 mm VIAL)

SPECIFICATIONS

Range	0 to 15000 mg/L (as O_2)
Resolution	1 mg/L
Accuracy	±150 mg/L or ±2% of reading @ 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 610 nm
Method	Adaptation of the USEPA 410.4 approved method for the COD determination on surface waters and wastewaters.

REQUIRED REAGENTS

Code	Description	Quantity
HI93754C-0*	COD High Range Reagent Vial	2 vials
DEIONIZED120	Deionized Water	0.2 mL

* Reagent Vial identification: COD C, green label

REAGENT SETS

HI93754C-25 Reagents for 24 tests

For other accessories see page 109.

Note: Store the unused vials in their container in a cool and dark place.

MEASUREMENT PROCEDURE

Before using the reagent kit carefully read all the instructions and the Safety Data Sheets (SDS). Pay particular attention to all warnings, cautions and notes. Failure to do so may result in serious injury to the operator.

Reagent Blank Correction: This method requires a reagent blank correction. A single blank vial may be used more than once. The blank vial is stable for several months at room temperature. For improved accuracy measurement, run a blank for each set of measurements and always use the same lot of reagents for blank and samples.

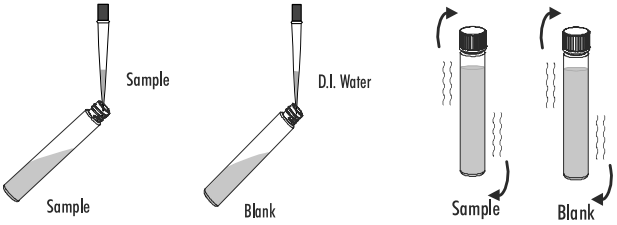
- Choose a homogeneous sample. Samples containing solids capable of settling need to be homogenized with a blender.
- Preheat the HANNA® Reactor HI839800 to 150 °C (302 °F). Use of the optional HI740217 safety shield is strongly recommended.

  DO NOT USE AN OVEN OR MICROWAVE samples may leak and generate a corrosive and possibly explosive atmosphere.

- Remove the cap from two HI93754C-0 COD High Range Reagent Vials.

- Add 0.2 mL of deionized water to the first vial (#1) and 0.2 mL of sample to the second vial (#2), while keeping the vials at a 45-degree angle. Replace the cap and invert several times to mix.

  WARNING: The vials will become hot during mixing, use caution when handling.

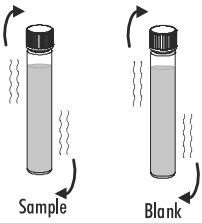


- Insert the vials into the reactor and heat them for 2 hours at 150 °C.

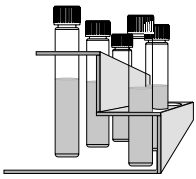
- At the end of the digestion period switch off the reactor. Wait for twenty minutes to allow the vials to cool to about 120 °C.

- Invert each vial several times while still warm, then place them in the test tube rack.

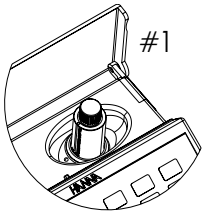
  WARNING: The vials are still hot, use caution when handling.



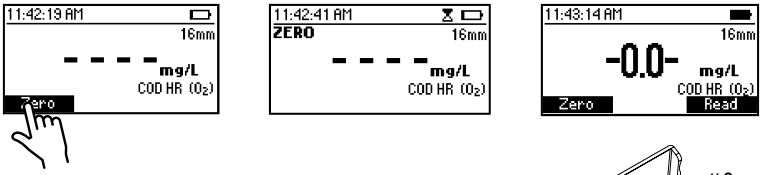
- Leave the vials in the tube rack to cool to room temperature. Do not shake or invert them, the samples may become turbid.



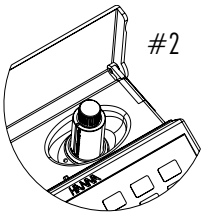
- Select COD HR (16) method using the procedure described in the Method Selection section (see page 17).
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section (see page 20).
- Place the blank vial (#1) into the holder.



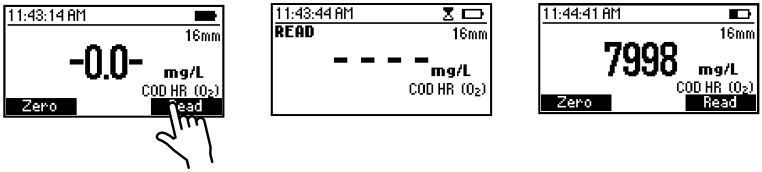
- Press **Zero** key. The display will show -0.0- when the meter is zeroed and ready for measurement.



- Remove the vial.
- Place the sample vial (#2) into the holder.



- Press **Read** key to start the reading. The instrument displays the results in **mg/L of oxygen (O_2)**.



INTERFERENCES

Interference may be caused by:
Chloride (Cl^-) above 20000 mg/L.
Samples with higher chloride concentration should be diluted.

8.11. IRON, TOTAL (16 mm VIAL)

SPECIFICATIONS

Range	0.00 to 7.00 mg/L (as Fe)
Resolution	0.01 mg/L
Accuracy	±0.20 mg/L or± 3% of reading, whichever is greater
Light Source	LED with narrow band interference filter @ 525 nm
Method	Adaptation of Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 3500-Fe B., Phenanthroline Method

REQUIRED REAGENTS

Code	Description	Quantity
HI96778V-0	Total Iron Digestion Vial	1 vial
HI96778A-0	Total Iron Reagent A	1 mL
HI96778B-0	Total Iron Reagent B	1 packet
PERSULFATE/I	Potassium Persulfate Reagent	1 packet

*Reagent vial Identification: IRON, red label

Note: Store the unused vials in their container in a cool and dark place.

REAGENTS SETS

HI96778-25 Reagent Set, 25 Tests.

For other accessories, see page 109.

PRINCIPLE

Digestion of the sample with sulfuric acid and persulfate liberates iron from organic and inorganic complexes. After digestion, the iron reacts with 1,10-phenanthroline to form an orange-red complex.

APPLICATION: Surface water, drinking water, groundwater, process control, wastewater.

SIGNIFICANCE AND USE

Iron is an abundant, naturally-occurring element found in soils, streams, surface waters, and groundwater. High levels of iron in drinking water can cause objectionable taste and can stain plumbing and laundry. Iron in drinking water and wastewater is regulated by the EPA and other regulatory bodies.

For samples that contain complexed/chelated iron or suspended iron, such as typical wastewater samples, digestion of the sample is required to allow all of the iron to react with the reagent. The Total Iron method measures all forms of iron, including ferrous, ferric, dissolved, suspended, and complexed iron.

SAFETY

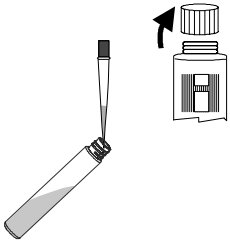
The acidification of samples containing reactive materials may result in the release of toxic gases, such as cyanides or sulfides; the preparation of sample and the digestion should be done in a fume hood. Safety data sheets for all chemical reagents should be read and understood by all personnel using this method. Specifically, concentrated sulfuric acid is moderately toxic and corrosive to skin and mucous membranes. Use these reagents in a fume hood whenever possible. If eye or skin contact occurs, flush with large volumes of water. Always wear skin and eye protection when working with these reagents.

- Preheat the HANNA® Reactor HI839800 to 150 °C (302 °F). The optional HI740217 safety shield is strongly recommended.

DO NOT USE AN OVEN OR MICROWAVE samples may leak and generate a corrosive and possibly explosive atmosphere.

MEASUREMENT PROCEDURE

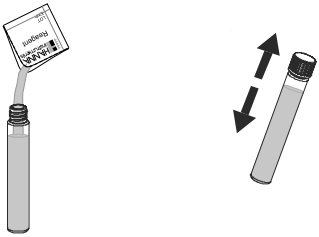
- Remove the cap from a HI96778V-0 Digestion Vial



- Add 8.0 mL of sample to the vial, while keeping the vial at a 45-degree angle. Replace the cap and invert several times to mix.

WARNING: The vials will become hot during mixing, use caution when handling.

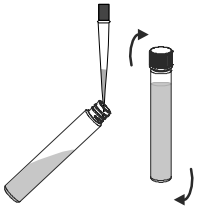
- Add one packet of PERSULFATE/I Potassium Persulfate Reagent. Replace the cap and shake the vial vigurously for 60 seconds.



- Insert the vial into the reactor and heat it for 30 minutes at 150 °C.

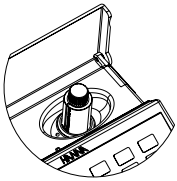
- At the end of the digestion switch off the reactor. Allow the vials to cool to room temperature. Invert each vial several times and place them in the test tube rack.

- Select the Iron (Total) (16) method using the procedure described in the Method Selection section (see page 17).
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section (see page 20).
- Remove the cap from the vial and add exactly 1.0 mL of HI96778A-0 Total Iron Reagent A, while keeping the vial at a 45-degree angle.
- Replace the cap and invert the vial several times to mix.

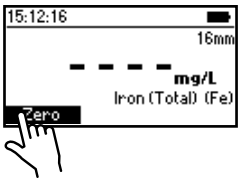


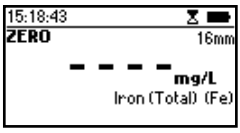
WARNING: The vials will become hot during mixing, use caution when handling.

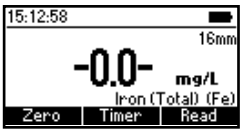
- Wipe the vial thoroughly with HI731318 or a lint-free cloth prior to insertion.
- Place the vial into the holder.



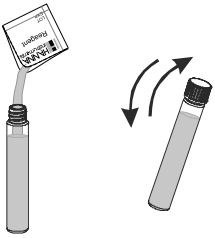
- Press the **Zero** key. The display will show "-0.0-"; the meter is zeroed and ready for measurement.



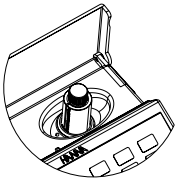




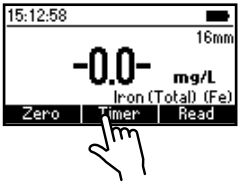
- Remove the vial from the meter.
- Ensure the temperature of the vial is 18 °C - 22 °C before continuing to the next step.
- Remove the cap and add one packet of HI96778B-0 Total Iron Reagent B.
- Replace the cap and shake gently for 30 seconds.
- Wipe the vial thoroughly with HI731318 or a lint-free cloth prior to insertion.

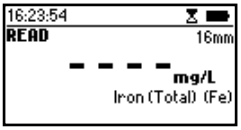


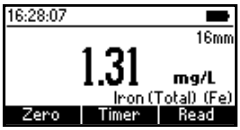
- Place the vial into the holder.



- Press **Timer** and the display will show the countdown prior to the measurement or, alternatively, wait for 3 minutes and press **Read**. The instrument displays the result in **mg/L** of **Iron, Total (Fe)**.







INTERFERENCES

Extreme pH or highly buffered samples. After adding the sample to digestion vial, the pH must be less than 1 for complete distinction of complexes. After addition of HI96778A-0 Total Iron Reagent A, the pH must be 3.8-5.5.

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.
If the sample exhibits turbidity after the digestion, this must be eliminated by filtration.

Matrix factors (e.g. interference ions, color, turbidities, etc.) may have a negative impact on the measurement and cause false results. Sample with suspended solids cannot be correctly determined without good homogenization before digestion.

8.12. NITRATE (16 mm VIAL)

SPECIFICATIONS

Range	0.0 to 30.0 mg/L Nitrate (as NO_3^--N)
Resolution	0.1 mg/L
Accuracy	±1.0 mg/L or ±3% of reading at 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 420 nm
Method	Chromotropic acid method.

REQUIRED REAGENTS

Code	Description	Quantity
HI93766V-0*	Nitrate Reagent Vial	1 vial
HI93766-0	Nitrate Reagent	1 packet

** Reagent Vial Identification: N, white label.*

Note: Store the unused vials in a cool and dark place.

REAGENT SETS

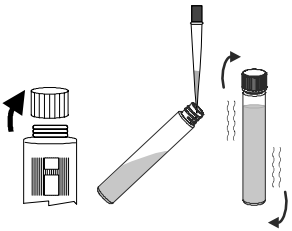
HI93766-50 Reagents for 50 tests

For other accessories see page 109.

MEASUREMENT PROCEDURE

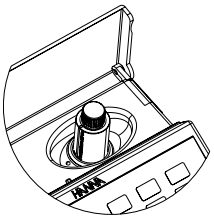
Before using the reagent kit carefully read all the instructions and the Safety Data Sheets (SDS). Pay particular attention to all warnings, cautions, and notes. Failure to do so may result in serious injury to the operator.

- Select the Nitrate (16) method using the procedure described in the Method Selection section (see page 17).
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section (see page 20).
- Remove the cap from a HI93766V-0 Nitrate Reagent Vial.
- Add 1.0 mL of sample to the vial, while keeping the vial at a 45-degree angle.
- Replace the cap and invert the vial 10 times. This is blank.

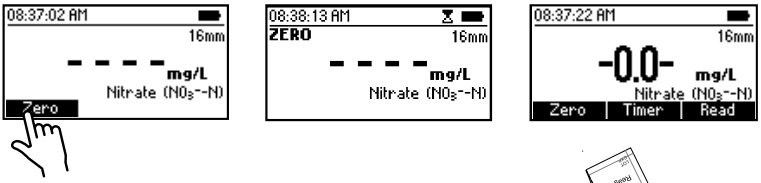


WARNING: The vial will become hot during mixing. Use caution when handling.

Note: The method is technique sensitive. See procedure on page 19 Cuvette Preparation for proper mixing technique.

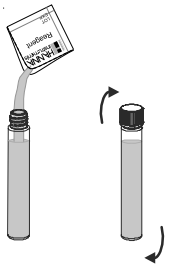


- Place the vial into the holder.
- Press **Zero**, the display will show "-0.0-" when the meter is zeroed and ready for measurement.

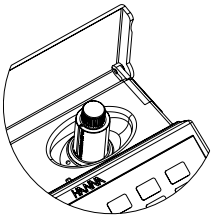


- Remove the vial.
- Add one packet of HI93766-0 Nitrate Reagent.
- Replace the cap and invert the vial 10 times. This is the reacted sample.

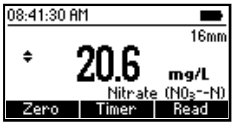
Note: The method is technique sensitive. See procedure on page 19 Cuvette Preparation for proper mixing technique.



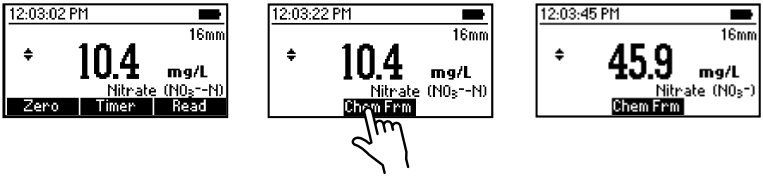
- Place the vial into the holder.



- Press **Timer** and the display will show the countdown prior to the measurement or alternatively, wait for 5 minutes and press **Read**. The instrument displays the concentration in **mg/L of nitrate-nitrogen (NO_3^--N)**.



- Press ▲ or ▼ to access the second level functions the **Chem Frm** key to convert the result in **mg/L of nitrate (NO_3^-)**.



- Press ▲ or ▼ to return to the measurement screen.

INTERFERENCES

Interference may be caused by:
Barium (Ba^{2+}) above 1 mg/L
Chloride (Cl^-) above 1000 mg/L
Nitrite (NO_2^-) above 50 mg/L
Samples containing up to 100 mg/L nitrite may be measured after the following treatment: add 400 mg of urea to 10 mL of sample, mix until completely dissolved, then proceed with the usual measurement procedure.

8.13. NITRITE LOW RANGE

SPECIFICATIONS

Range	0 to 600 µg/L (as NO_2^--N)
Resolution	1 µg/L
Accuracy	±20 µg/L ±4% of reading at 25 °C
Light Source	LED with narrow band interference filter @ 466 nm
Method	Adaptation of the EPA Diazotization method 354.1.

REQUIRED REAGENTS

Code	Description	Quantity
HI93707-0	Nitrite Low Range Reagent	1 packet

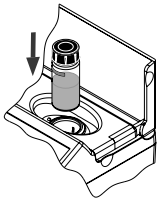
REAGENT SETS

HI93707-01	Reagents for 100 tests
HI93707-03	Reagents for 300 tests

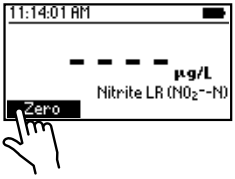
For other accessories see page 109.

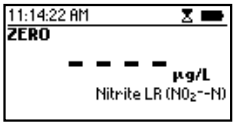
MEASUREMENT PROCEDURE

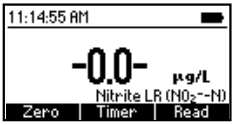
- Select the Nitrite LR method using the procedure described in the Method Selection section (see page 17).
- Fill the cuvette up to the mark with 10 mL of unreacted sample (up to the mark) and replace the cap.



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

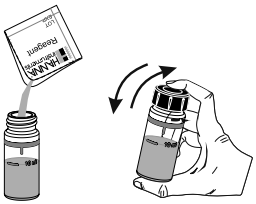




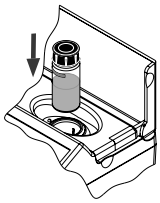


- Remove the cuvette.

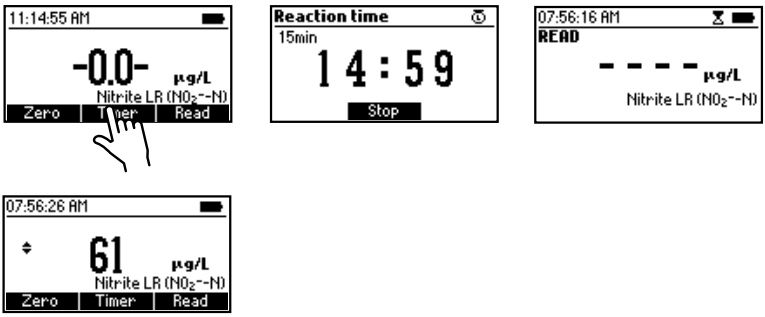
- Add one packet of HI93707-0 Nitrite Low Range Reagent. Replace the cap and shake gently for about 15 seconds.



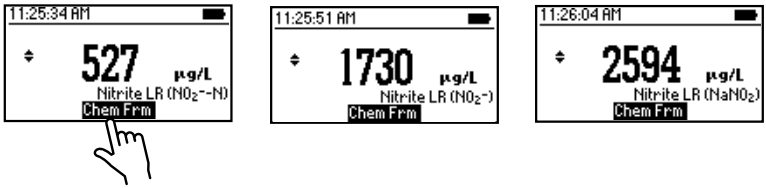
- Reinsert the cuvette into the instrument and close the lid.



- Press **Timer** and the display will show the countdown prior to the measurement or, alternatively, wait for 15 minutes and press **Read**. When the timer ends the meter will perform the reading. The instrument displays concentration in **µg/L of nitrite-nitrogen (NO_2^--N)**.



- Press ▲ or ▼ to access the second level functions.
- Press the **Chem Frm** key to convert the result to **µg/L of nitrite (NO_2^-) and sodium nitrite ($NaNO_2$)**.



- Press ▲ or ▼ to return to the measurement screen.

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.

8.14. NITRITE HIGH RANGE

SPECIFICATIONS

Range	0 to 150 mg/L (as NO_2^-)
Resolution	1 mg/L
Accuracy	±4 mg/L ±4% of reading at 25 °C
Light Source	LED with narrow band interference filter @ 575 nm
Method	Adaptation of the Ferrous Sulfate method.

REQUIRED REAGENTS

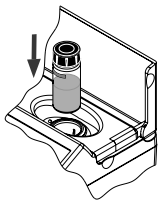
Code	Description	Quantity
HI93708-0	Nitrite High Range Reagent	1 packet

REAGENT SETS

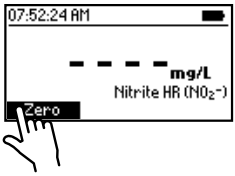
HI93708-01	Reagents for 100 tests
HI93708-03	Reagents for 300 tests

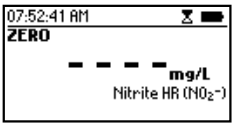
For other accessories see page 109.

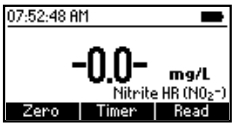
MEASUREMENT PROCEDURE



- Select the Nitrite HR method using the procedure described in the Method Selection section (see page 17).
- Fill the cuvette up to the mark with 10 mL of unreacted sample (up to the mark) and replace the cap.
- Place the cuvette into the holder and close the lid.
- Press the **Zero** key. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



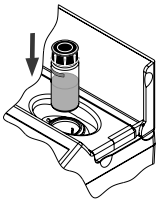




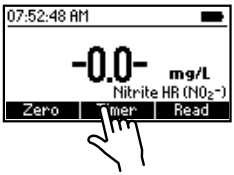
- Remove the cuvette.

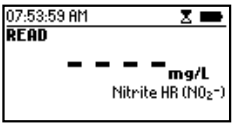
- Add one packet of HI93708-0 Nitrite High Range Reagent. Replace the cap and shake gently until completely dissolved.

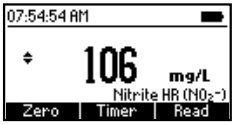
- Reinsert the cuvette into the instrument and close the lid.



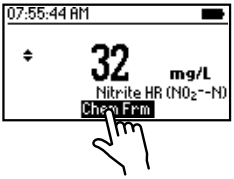
- Press **Timer** and the display will show the countdown prior to the measurement or, alternatively, wait for 10 minutes and press **Read**. When the timer ends the meter will perform the reading. The instrument displays concentration in **mg/L of nitrite (NO_2^-)**.

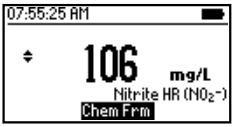


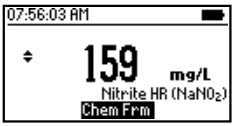




- Press ▲ or ▼ to access the second level functions.
- Press the **Chem Frm** key to convert the result to **mg/L of nitrite-nitrogen (NO_2^--N) and sodium nitrite ($NaNO_2$)**.







- Press ▲ or ▼ to return to the measurement screen.

8.15. NITROGEN, TOTAL LOW RANGE (16 mm VIAL)

SPECIFICATIONS

Range	0.0 to 25.0 mg/L (as N)
Resolution	0.1 mg/L
Accuracy	±1.0 mg/L or ±5% of reading at 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 420 nm
Method	Chromotropic acid method.

REQUIRED REAGENTS

Code	Description	Quantity
HI93767A-B*	Total Nitrogen Low Range Digestion Vial	2 vials
DEIONIZED120	Deionized Water	2 mL
PERSULFATE/N	Potassium Persulfate Reagent	2 packets
BISULFITE/N	Sodium Metabisulfite Reagent	2 packets
HI93767-0	Total Nitrogen Reagent	2 packets
HI93766V-0LR**	Total Nitrogen Low Range Reagent Vial	2 vials

** Reagent Vial identification: N LR, green label*

*** Reagent Vial identification: N LR, red label*

Notes: Store the unused vials in their container in a cool and dark place.

REAGENT SETS

HI93767A-50 Reagents for up to 49 tests.

Box 1: HI93767A-50 Reagent Set

Box 2: HI93767A&B-50 Reagent Set, for Nitrogen Total Low Range.

For other accessories see page 109.

MEASUREMENT PROCEDURE

Before using the reagent kit carefully read all the instructions and the Safety Data Sheets (SDS). Pay particular attention to all warnings, cautions and notes. Failure to do so may result in serious injury to the operator.

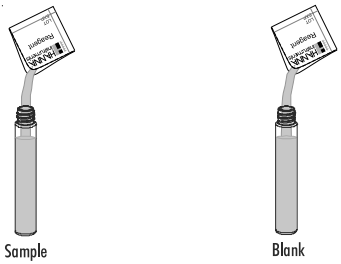
Reagent Blank Correction: This method requires a reagent blank correction. A single blank vial may be used more than once, the blank vial is stable for one week if stored in a dark place at room temperature. For improved accuracy use the same lot of reagents for the blank and sample, and run a blank for each set of measurements.

- Preheat the HANNA® Reactor HI839800 to 105 °C (221 °F). The optional HI740217 safety shield is strongly recommended.

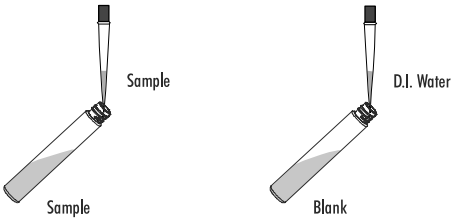
DO NOT USE AN OVEN OR MICROWAVE samples may leak and generate a corrosive and possibly explosive atmosphere.

- Remove the cap from two HI93767A-B Total Nitrogen Low Range Digestion Vials.

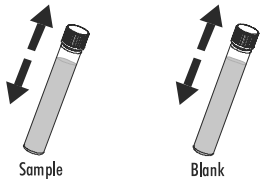
- Add one packet of Persulfate/N, Potassium Persulfate to each vial.



- Add 2 mL of deionized water to the first vial (#1, blank) and 2 mL of sample to the second vial (#2, sample), while keeping the vials at a 45-degree angle.



- Replace the cap and shake vigorously for 30 seconds or until powder is completely dissolved.



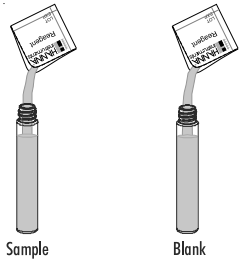
- Insert the vials into the reactor and heat them for 30 minutes at 105 °C.

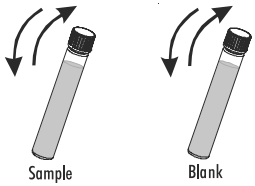
  Note: To obtain most accurate results, it is strongly recommended to remove the vials from the reactor after 30 minutes.

- At the end of the digestion period switch off the reactor, place the vials in the test tube rack and allow to cool to room temperature.

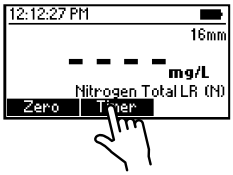
WARNING: The vials are still hot, use caution when handling.

- Select Nitrogen Total LR (16) method using the procedure described in Method Selection section (see page 17).
- Insert 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section (see Page 20).
- For this method the instrument provides 3 reaction timers which can be used troughout the procedure.
- Remove the cap from the vials and add one packet of BISULFITE/N Sodium Metabisulfite analysis to each vial. Replace the cap and shake gently for 15 seconds.

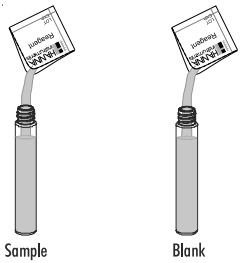


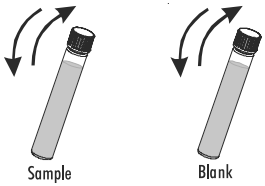


- Press **Timer** and the display will show the countdown prior to adding HI93767-0 Total Nitrogen Reagent, or alternatively wait 3 minutes.



- Remove the cap from the vials and add one packet of HI93767-0 Total Nitrogen Reagent to each vial. Replace the cap and shake gently for 15 seconds.

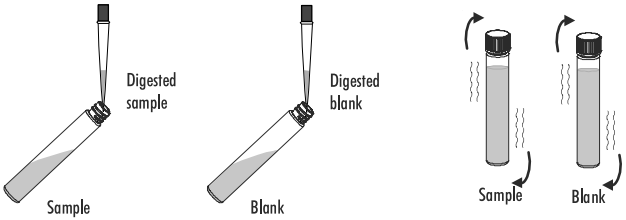




- Press **Continue** and the display will show the countdown, or alternatively wait 2 minutes (without shaking the vials) to allow the reaction to complete.

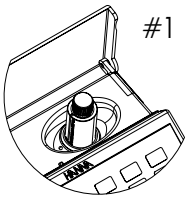
- Remove the cap from two HI93766V-0LR Total Nitrogen Low Range Reagent Vial.

- Add 2 mL of digested blank (#1) to one of the reagent vials and 2 mL of digested sample (#2) to the second reagent vial, while keeping the vials at a 45-degree angle.
- Replace the cap and invert 10 times.



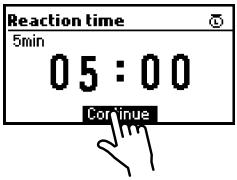
WARNING: The vials will become hot during mixing, use caution when handling.

Note: The method is technique sensitive. See procedure on page 19 Cuvette preparation for proper mixing technique.

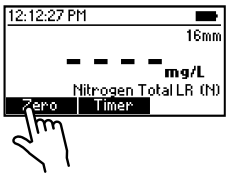


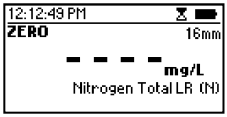
- Place the blank vial (#1) into the holder

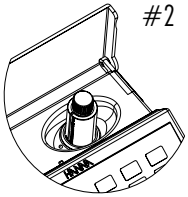
- Press **Continue** and the display will show the countdown, or alternatively wait for 5 minutes.



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



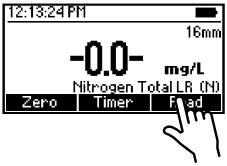


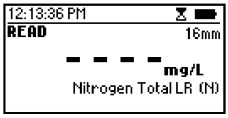


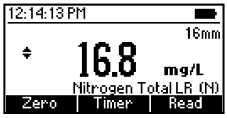
- Remove the blank vial.

- Place the sample vial (#2) into the holder.

- Press **Read** key to start the reading. The instrument displays the results in **mg/L of nitrogen (N)**.

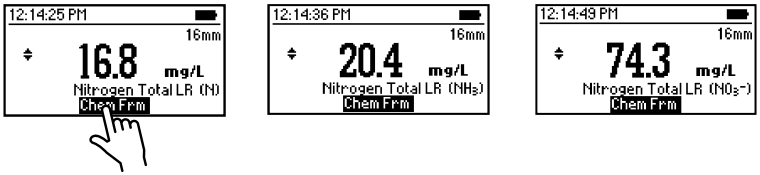






- Press ▲ or ▼ to access the second level functions.

- Press the **Chem Frm** key to convert the result to **mg/L of ammonia (NH_3) and nitrate (NO_3^-)**.



- Press ▲ or ▼ to return to the measurement screen.

INTERFERENCES

Interference may be caused by:
Bromide (Br^-) above 60 mg/L
Chloride (Cl^-) above 1000 mg/L
Chromium (Cr^{3+}) above 0.5 mg/L

8.16. NITROGEN, TOTAL HIGH RANGE (16 mm VIAL)

SPECIFICATIONS

Range	0 to 150 mg/L (as N)
Resolution	1 mg/L
Accuracy	±3 mg/L or ±4% of reading at 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 420 nm
Method	Chromotropic acid method.

REQUIRED REAGENTS

Code	Description	Quantity
HI93767B-B*	Total Nitrogen High Range Digestion Vial	2 vials
DEIONIZED120	Deionized Water	0.5 mL
PERSULFATE/N	Potassium Persulfate Reagent	2 packets
BISULFITE/N	Sodium Metabisulfite Reagent	2 packets
HI93767-0	Total Nitrogen Reagent	2 packets
HI93766V-0HR**	Total Nitrogen High Range Reagent Vial	2 vials

** Reagent Vial identification: N HR, red label*

*** Reagent Vial identification: N HR, green label*

Notes: Store the unused vials in their container in a cool and dark place.

REAGENT SETS

HI93767B-50 Reagents for up to 49 tests.

Box 1: HI93767B-50 Reagent Set

Box 2: HI93767A&B-50 Reagent Set, for Nitrogen Total High Range.

For other accessories see page 109.

MEASUREMENT PROCEDURE

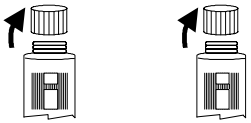
Before using the reagent kit carefully read all the instructions and the Safety Data Sheets (SDS). Pay particular attention to all warnings, cautions and notes. Failure to do so may result in serious injury to the operator.

Reagent Blank Correction: This method requires a reagent blank correction. A single blank vial may be used more than once, the blank vial is stable for one week if stored in a dark place at room temperature. For improved accuracy always use the same lot of reagents for the blank and sample, and run a blank for each set of measurements.

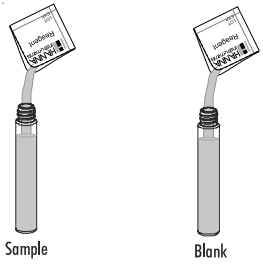
- Preheat the HANNA® Reactor HI839800 to 105 °C (221 °F). The optional HI740217 safety shield is strongly recommended.

DO NOT USE AN OVEN OR MICROWAVE samples may leak and generate a corrosive and possibly explosive atmosphere.

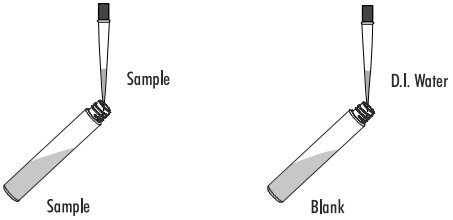
- Remove the cap from two HI93767B-B Total Nitrogen High Range Digestion Vials.



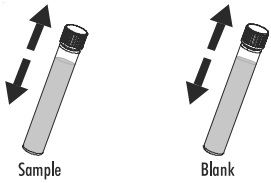
- Add one packet of PERSULFATE/N, Potassium Persulfate to each vial.



- Add 0.5 mL of deionized water to the first vial (#1, blank) and 0.5 mL of sample to the second vial (#2, sample), while keeping the vials at a 45-degree angle.



- Replace the cap and shake vigorously for about 30 seconds or until powder is completely dissolved.



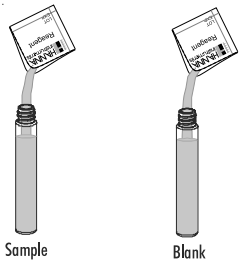
- Insert the vials into the reactor and heat them for 30 minutes at 105°C.

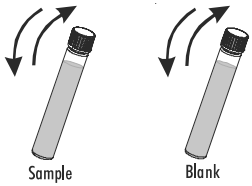
Note: To obtain most accurate results, it is strongly recommended to remove the vials from the reactor after 30 minutes.

- At the end of the digestion place the vials in the test tube rack and allow to cool to room temperature.

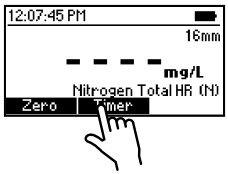
WARNING: The vials are still hot, use caution when handling.

- Select Nitrogen Total HR (16) method using the procedure described in Method selection section (page 17).
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section (see page 20).
- For this method the instrument provides 3 reaction timers which can be used throughout the procedure.
- Remove the cap from the vials and add one packet of BISULFITE/N, Sodium Metabisulfite to each vial. Replace the cap and shake gently for 15 seconds.

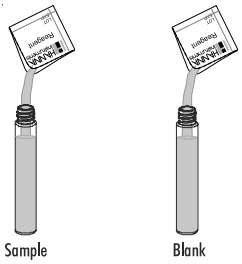


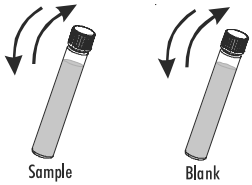


- Press **Timer** and the display will show the countdown prior to adding HI93767-0 Total Nitrogen Reagent, or alternatively wait 3 minutes.



- Remove the cap from the vials and add one packet of HI93767-0 Total Nitrogen Reagent to each vial. Replace the cap and shake gently for 15 seconds.

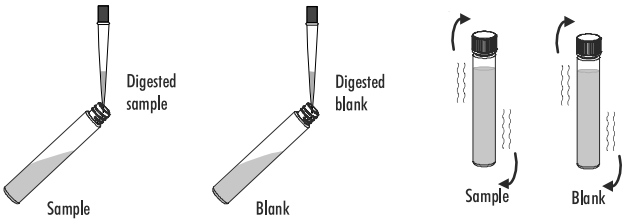




- Press **Continue** and the display will show the countdown, or alternatively wait 2 minutes.

- Remove the cap from two HI93766V-0HR Total Nitrogen High Range Regent Vials.

- Add 2 mL of digested blank (#1) to one of the reagent vials and 2 mL of digested sample (#2) to the second reagent vial, while keeping the vials at a 45-degree angle.



- Replace the cap tightly and invert the vials 10 times.

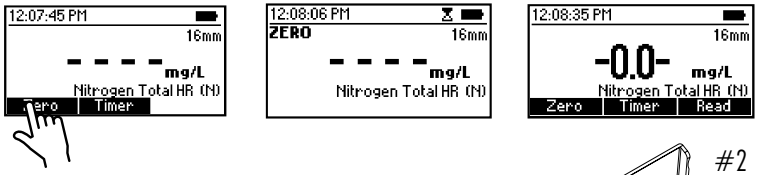
WARNING: The vials will become hot during mixing, use caution when handling.

Note: The method is technique sensitive, see procedure on page 19 Cuvette preparation for proper mixing technique.

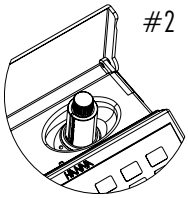
- Place the sample vial (#1) into the holder.

- Press **Continue** and the display will show the countdown, or alternatively wait for 5 minutes.

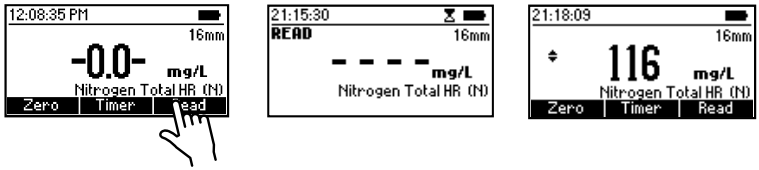
- Press the **Zero** key. The the display will show "-0.0-".



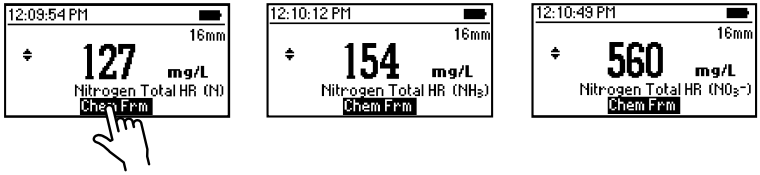
- Remove the blank vial.
- Place the sample vial (#2) into the holder.



- Press **Read** to start the reading. The instrument displays the results in **mg/L nitrogen (N)**.



- Press ▲ or ▼ to access the second level functions.
- Press the **Chem Frm** key to convert the result to **mg/L of ammonia (NH_3) and nitrate (NO_3^-)**.



- Press ▲ or ▼ to return to the measurement screen.

The method detects all organic and inorganic forms of nitrogen present in the sample.

INTERFERENCES

Interference may be caused by:
Bromide (Br^-) above 240 mg/L
Chloride (Cl^-) above 3000 mg/L
Chromium (Cr^{3+}) above 0.5 mg/L

8.17. PHOSPHORUS, REACTIVE LOW RANGE (16 mm VIAL)

SPECIFICATIONS

Range	0.00 to 1.60 mg/L (as P)
Resolution	0.01 mg/L
Accuracy	±0.05 mg/L or ±4% of reading at 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 610 nm
Method	Adaptation of the EPA method 365.2 and Standard Methods for the Examination of Water and Wastewater, 20th edition, 4500-P E, ascorbic acid method.

REQUIRED REAGENTS

Code	Description	Quantity
HI93758A-0*	Phosphorus Reactive Reagent Vial	1 vial
HI93758-0	Phosphorus Reagent	1 packet

** Reagent Vial identification: P R, red label*

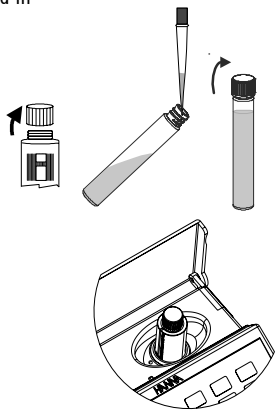
REAGENT SETS

HI93758A-50	Reagents for 50 tests

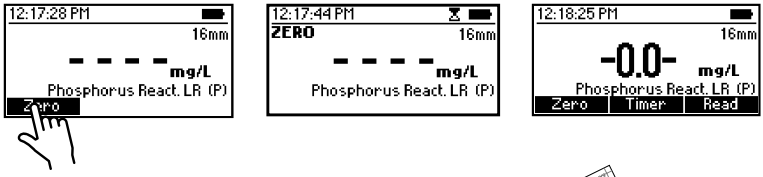
For other accessories see page 109.

MEASUREMENT PROCEDURE

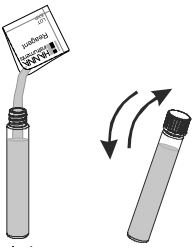
- Select the Phosphorus React. LR (16) method using the procedure described in the Method Selection section (see page 17).
- Insert the 16 mm vial adapter using the procedure described in the Using 16 mm Vial Adapter section (see page 20).
- Remove the cap from HI93758A-0 Reactive Phosphorus Reagent Vial.
- Add 5.0 mL of sample to the vial, while keeping the vial at a 45-degree angle.
- Replace the cap and invert several times to mix.
- Place the vial into the holder.



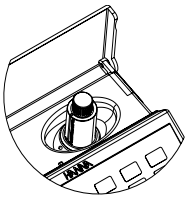
- Press the **Zero** key. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



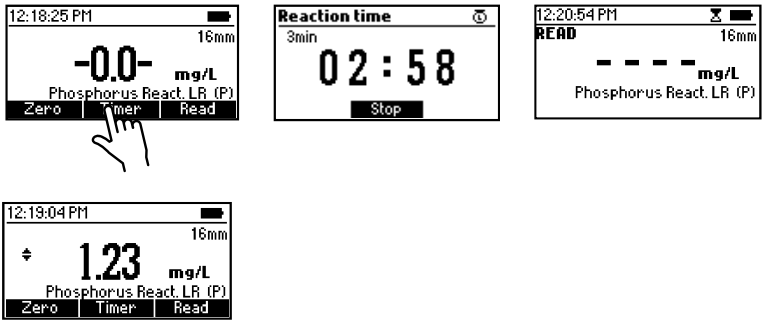
- Remove the vial.
- Remove the cap and add one packet of HI93758-0 Phosphorus Reagent.
- Replace the cap shake gently for 2 minutes until most of the powder is dissolved.



- Place the vial into the holder.

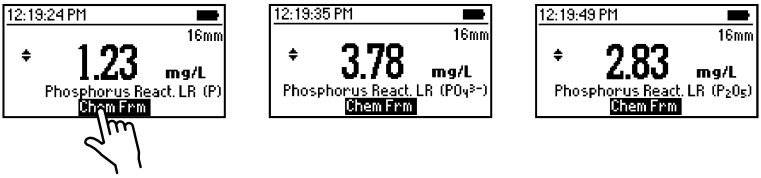


- Press **Timer** and the display will show the countdown prior to the measurement, or alternatively wait for 3 minutes and press **Read**. When the timer ends the meter will perform the reading.The instrument displays the results in **mg/L of Phosphorous (P)**.



- Press ▲ or ▼ to access the second level functions.

- And press the **Chem Frm** key to convert the result to **mg/L of phosphate (PO_4^{3-}) and phosphorus pentoxide (P_2O_5).**



- Press ▲ or ▼ to return to the measurement screen.

INTERFERENCES

Interference may be caused by:
Arsenate at any level
Silica above 50 mg/L
Sulfide above 6 mg/L
To eliminate sulfide: add Bromine Water drop-wise until a pale yellow color develops; remove Bromine Water excess by adding Phenol solution drop-wise.
Turbidity and suspended matter in large amounts may cause interference because the reaction conditions may dissolve suspended matter or cause desorption of phosphates from particles. Turbidity or suspended matter should be removed before measurement by treatment with active carbon and by prior filtration.

8.18. PHOSPHORUS, REACTIVE HIGH RANGE (16 mm VIAL)

SPECIFICATIONS

Range	0.0 to 32.6 mg/L (as P)
Resolution	0.1 mg/L
Accuracy	±0.5 mg/L or ±4% of reading at 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 420 nm
Method	Adaptation of the Standard Methods for the Examination of Water and Wastewater, 20th edition, 4500-P C, vanadomolybdophosphoric acid method.

REQUIRED REAGENTS

Code	Description	Quantity
HI93763A-0*	Reactive Phosphorus High Range Reagent Vial	2 vials
DEIONIZED120	Deionized Water	5 mL

**Reagent vial Identification: P RHR, green label*

Note: Store the unused vials in their container in a cool and dark place.

REAGENT SETS

HI93763A-50 Reagents for up to 49 tests

For other accessories see page 109.

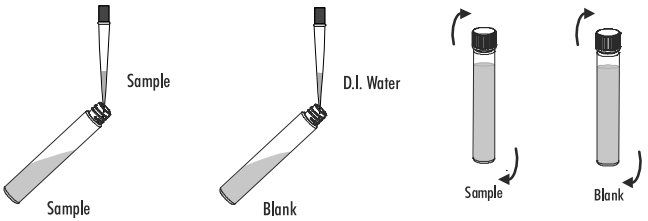
MEASUREMENT PROCEDURE

Reagent Blank Correction: This method requires a reagent blank correction. A single blank vial may be used more than once; the blank vial is stable up to two weeks (room temperature). For improved accuracy always use the same lot of reagents for the blank and sample, and run a blank for each set of measurements.

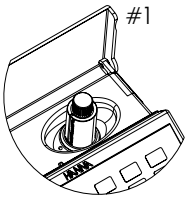
- Select the Phosphorus React. HR (16) method using the procedure described in the Method Selection section (see page 17).
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section (see page 20).
- Remove the cap from two HI93763A-0 Phosphorus Reactive High Range Reagent Vials.

- Add 5 mL of deionized water to the first vial (#1) and 5 mL of sample to the second vial (#2), while keeping the vials at a 45-degree angle.

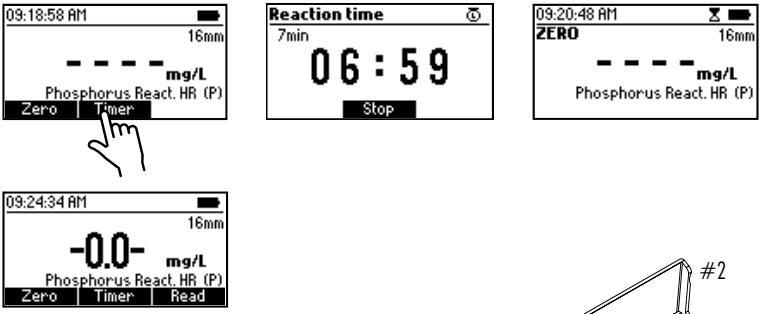
- Replace the cap and invert several times to mix.



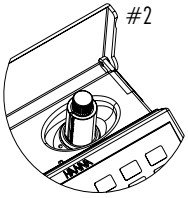
- Place the blank vial (#1) into the holder and push it completely down.



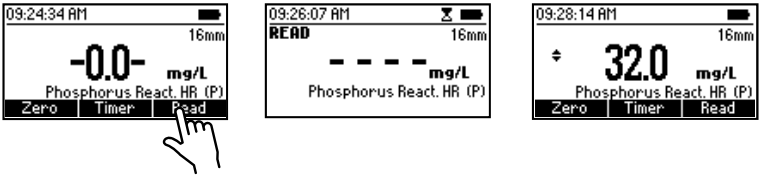
- Press **Timer** and the display will show the countdown prior to the zero reading, or alternatively wait 7 minutes and press **Zero.** The display will show "-0.0-" when the meter is zeroed and ready for measurement.



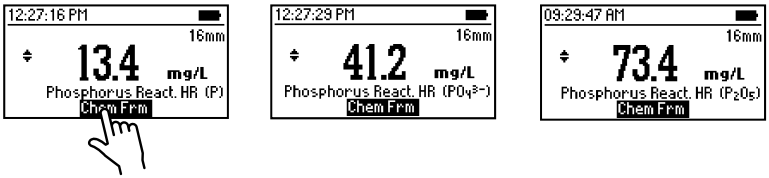
- Remove the blank vial.
- Place the sample vial (#2) into the holder.



- Press **Read** to start the measurement. The instrument displays the results in **mg/L of phosphorus (P)**.



- Press ▲ or ▼ to access the second level functions.
- Press the **Chem Frm** key to convert the result to **mg/L of phosphate (PO_4^{3-}) and phosphorus pentoxide (P_2O_5).**



- Press ▲ or ▼ to return to the measurement screen.

INTERFERENCES

Interference may be caused by:
Bismuth
Fluoride
pH: the sample should have a neutral pH
Sulfide: to eliminate sulfide add Bromine Water drop-wise until a pale yellow color develops; remove Bromine
Water excess by adding Phenol solution drop-wise.
Temperature: the method is temperature sensitive.
It is recommended to run measurements at T = 20 to 25 °C:
T < 20 °C causes a negative error
T > 25 °C causes a positive error
Turbidity and suspended matter in large amounts may cause interference because the strongly acidic reaction conditions may dissolve suspended matter or cause desorption of phosphates from particles. Before measurement, turbidity or suspended matter should be removed by treatment with active carbon and by prior filtration.

8.19. PHOSPHORUS, ACID HYDROLYZABLE (16 mm VIAL)

SPECIFICATIONS

Range	0.00 to 1.60 mg/L (as P)
Resolution	0.01 mg/L
Accuracy	±0.05 mg/L or ±5% of reading at 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 610 nm
Method	Adaptation of the EPA method 365.2 and Standard Methods for the Examination of Water and Wastewater, 20th edition, 4500-P E, ascorbic acid method.

REQUIRED REAGENTS

Code	Description	Quantity
HI93758V-0AH*	Phosphorus Reagent Vial	1 vial
HI93758B-0	NaOH Solution 1.20N	2 mL
HI93758-0	Phosphorous Reagent	1 packet

** Reagent vial Identification: P AH, white label*

Note: Store the unused vials in their container in a cool and dark place.

REAGENT SETS

HI93758B-50 Reagents for 50 tests

For other accessories see page 109.

MEASUREMENT PROCEDURE

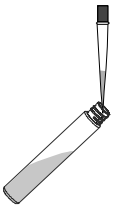
Before using the reagent kit carefully read all the instructions and the Safety Data Sheets (SDS). Pay particular attention to all warnings, cautions and notes. Failure to do so may result in serious injury to the operator.

- Preheat the HANNA® Reactor HI839800 to 150 °C (302°F). The optional HI740217 safety shield is strongly recommended.

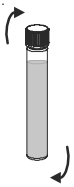
DO NOT USE AN OVEN OR MICROWAVE samples may leak and generate a corrosive and possibly explosive atmosphere.

- Remove the cap from a HI93758V-0AH Phosphorus Reagent Vial.

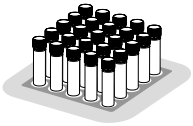
- Add 5.0 mL of sample to the vial, while keeping the vial at a 45-degree angle.



- Replace the cap and invert to mix.

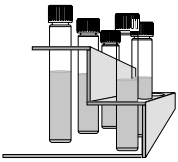


- Insert the vial into the reactor and heat it for 30 minutes at 150°C.

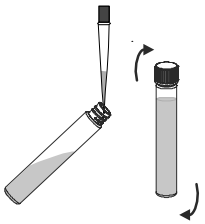


- At the end of the digestion place the vials carefully in the test tube rack and allow to cool to room temperature.

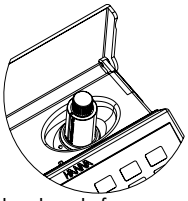
  WARNING: The vials are still hot, use caution when handling.



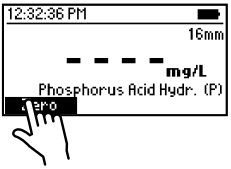
- Select the Phosphorus Acid Hydr. (16) method using the procedure described in the Method Selection section (see page 17).
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm vial Adapter section (see page 20).
- Remove the cap from the vial and add 2.0 mL of HI93758B-0 NaOH Solution 1.20N while keeping the vial at a 45-degree angle.
- Replace the cap and invert to mix.

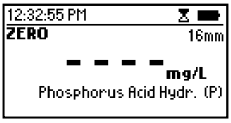


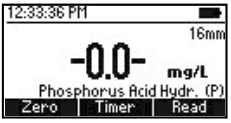
- Place the vial into the holder.



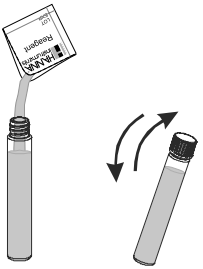
- Press **Zero** key. The display will show "-0.0-". Now the meter is zeroed and ready for measurement.



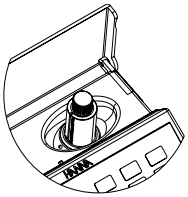




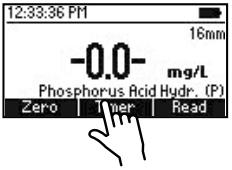
- Remove the vial.
- Remove the cap and add one packet of HI93758-0 Phosphorus Reagent.
- Replace the cap and shake gently for 2 minutes until most of the powder is dissolved.

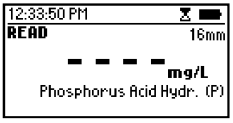


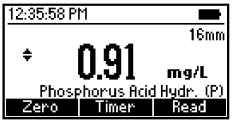
- Place the vial into the holder.



- Press **Timer** and the display will show the countdown prior to the measurement, or alternatively wait for 3 minutes and press **Read.** The instrument displays the results in **mg/L of phosphorus (P).**

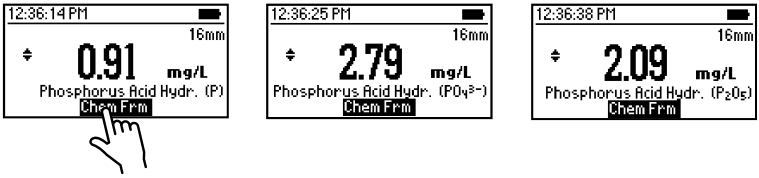






Note: The method detects free (orthophosphate) and condensed inorganic forms (meta-, pyro- and other polyphosphates) of phosphates present in the sample.

- Press ▲ or ▼ to access the second level functions.
- Press the **Chem Frm** key to convert the result in **mg/L of phosphate (PO_4^{3-}) and mg/L phosphorus pentoxide (P_2O_5).**



- Press ▲ or ▼ to return to the measurement screen.

INTERFERENCES

Interference may be caused by:
Arsenate at any level
Silica above 50 mg/L
Sulfide above 9 mg/L
To eliminate sulfide: add Bromine Water drop-wise until a pale yellow color develops; remove Bromine Water excess by adding Phenol solution drop-wise.
Turbidity and suspended matter in large amounts may cause interference because the strongly acidic reaction conditions may dissolve suspended matter or cause desorption of phosphates from particles. Before measurement, turbidity or suspended matter should be removed by treatment with active carbon and by prior filtration.

8.20. PHOSPHORUS, TOTAL LOW RANGE (16 mm VIAL)

SPECIFICATIONS

Range	0.00 to 1.15 mg/L (as P)
Resolution	0.01 mg/L
Accuracy	±0.05 mg/L or ±6% of reading at 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 610 nm
Method	Adaptation of the EPA method 365.2 and Standard Methods for the Examination of Water and Wastewater, 20th edition, 4500-P E, ascorbic acid method.

REQUIRED REAGENTS

Code	Description	Quantity
HI93758V-0*	Phosphorus Reagent Vial	1 vial
HI93758C-0	NaOH solution 1.54N	2 mL
HI93758-0	Phosphorous Reagent	1 packet
PERFULFATE/P	Potassium Persulfate	1 packet

** Reagent vial Identification: P TLR, red label*

Note: Store the unused vials in their container in a cool and dark place.

REAGENT SETS

HI93758C-50 Reagents for 50 tests

For other accessories see page 109.

MEASUREMENT PROCEDURE

Before using the reagent kit carefully read all the instructions and the Safety Data Sheets (SDS). Pay particular attention to all warnings, cautions and notes. Failure to do so may result in serious injury to the operator.

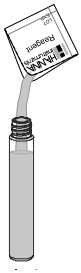
- Preheat the HANNA® Reactor HI839800 to 150 °C (302°F). The optional HI740217 safety shield is strongly recommended.

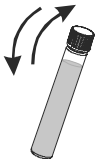
  DO NOT USE AN OVEN OR MICROWAVE samples may leak and generate a corrosive and possibly explosive atmosphere.

- Remove the cap from a HI93758V-0 Reagent Vial.

- Add 5.0 mL of sample to the vial, while keeping the vial at a 45-degree angle.

- Add one packet of PERSULFATE/P Potassium Persulfate. Replace the cap and shake gently the vial until all the powder is completely dissolved.



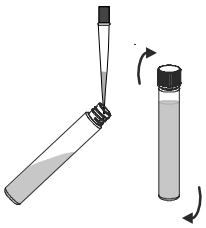


- Insert the vial into the reactor and heat it for 30 minutes at 150°C.

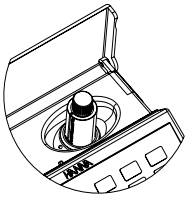
- At the end of the digestion place the vials carefully in the test tube rack and allow to cool to room temperature.

  WARNING: the vials are still hot, use caution when handling.

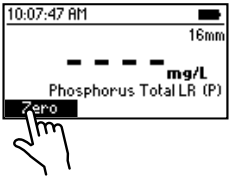
- Select the Phosphorus Total LR (16) method using the procedure described in the Method Selection section (see page 17).
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section (see page 20).
- Remove the cap from the vial and add exactly 2.0 mL of HI93758C-0 NaOH Solution 1.54 N, while keeping the vial at a 45-degree angle.
- Replace the cap and invert the vial several times to mix.

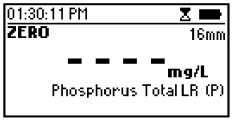


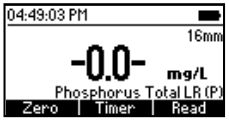
- Place the vial into the holder.



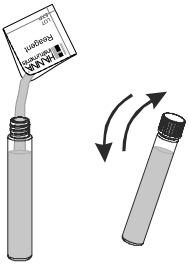
- Press **Zero** key. The display will show"-0.0-" when the meter is zeroed and ready for measurement.



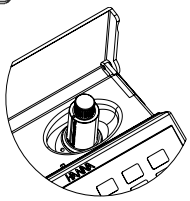




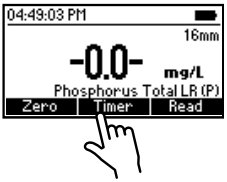
- Remove the vial.
- Remove the cap and add one packet of HI93758-0 Phosphorus Reagent.
- Replace the cap and shake for 2 minutes until the powder is completely dissolved.

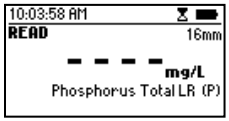


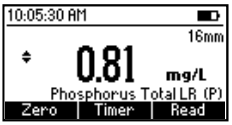
- Place the vial into the holder.



- Press **Timer** and the display will show the countdown prior to the measurement, or alternatively, wait for 3 minutes and press **Read**. The instrument displays the results in **mg/L of phosphorus (P)**.

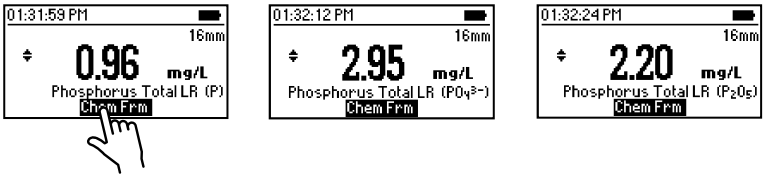






Note: The method detects free (orthophosphate) and condensed inorganic forms (meta-, pyro- and other polyphosphates) of phosphates present in the sample.

- Press ▲ or ▼ to access the second level functions.
- Press the **Chem Frm** key to convert the result to **mg/L of phosphate (PO_4^{3-}) and phosphorus pentoxide (P_2O_5).**



- Press ▲ or ▼ to return to the measurement screen.

INTERFERENCES

Interference may be caused by:
Arsenate at any level
Silica above 50 mg/L
Sulfide above 90 mg/L.
Turbidity and suspended matter in large amounts may cause interference because the strongly acidic reaction conditions may dissolve suspended matter or cause desorption of phosphates from particles. Before measurement, turbidity or suspended matter should be removed by treatment with active carbon and by prior filtration.

8.21. PHOSPHORUS, TOTAL HIGH RANGE (16 mm VIAL)

SPECIFICATIONS

Range	0.0 to 32.6 mg/L (as P)
Resolution	0.1 mg/L
Accuracy	±0.5 mg/L or ±5% of reading at 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 420 nm
Method	Adaptation of the Standard Methods for the Examination of Water and Wastewater, 20th edition, 4500-P C, vanadomolybdophosphoric acid method.

REQUIRED REAGENTS

Code	Description	Quantity
HI93758V-0HR*	Phosphorus Reagent Vial	2 vials
HI93758C-0	NaOH solution 1.54N	4 mL
HI93763B-0	Total Phosphorous High Range Reagent B	1 mL
DEIONIZED120	Deionized Water	5 mL
PERSULFATE/P	Potassium Persulfate	2 packets

**Reagent vial Identification: P THR, green label*

Note: Store the unused vials in their container in a cool and dark place.

REAGENT SETS

HI93763B-50 Reagents for up to 49 tests

For other accessories see page 109.

MEASUREMENT PROCEDURE

Before using the reagent kit carefully read all the instructions and the Safety Data Sheets (SDS). Pay particular attention to all warnings, cautions and notes. Failure to do so may result in serious injury to the operator.

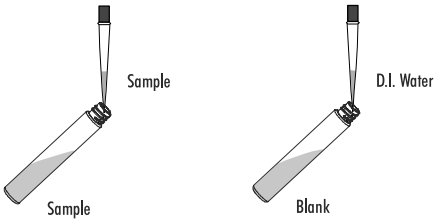
Reagent Blank Correction: This method requires a reagent blank correction. A single blank vial may be used more than once. The blank vial is stable for one day at room temperature.

- Preheat the HANNA® Reactor HI839800 to 150 °C (302°F). The optional HI740217 safety shield is strongly recommended.

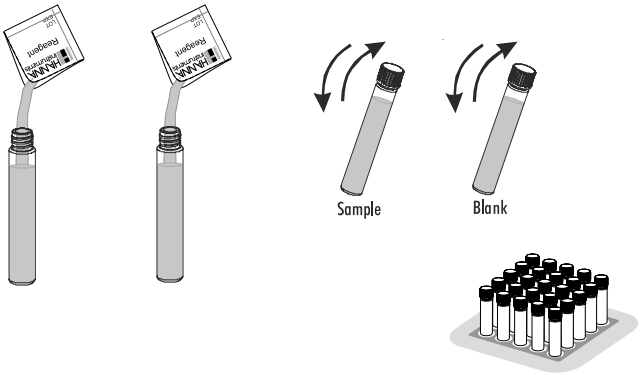
DO NOT USE AN OVEN OR MICROWAVE samples may leak and generate a corrosive and possibly explosive atmosphere.

- Remove the cap from two HI93758V-OHR Phosphorus Reagent Vials.

- Add 5 mL of deionized water to the first vial (#1) and 5 mL of sample to the second vial (#2), while keeping the vials at a 45-degree angle.



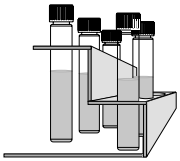
- Add one packet of PERFSULFATE/P Potassium Persulfate to each vial. Replace the cap and shake gently until all the powder is completely dissolved.



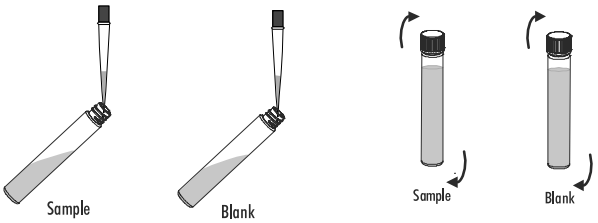
- Insert the vials into the reactor and heat them for 30 minutes at 150°C.

- At the end of the digestion place the vials carefully in the test tube rack and allow to cool to room temperature.

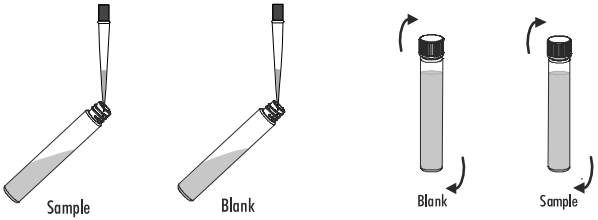
  WARNING: The vials are still hot, use caution when handling.



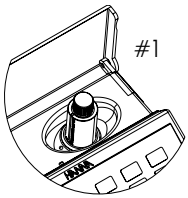
- Select the Phosphorus Total HR (16) method using the procedure described in the Method Selection section (see page 17).
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section (see page 20).
- Remove the cap from the vials and add 2.0 mL of HI93758C-0 NaOH Solution 1.54N to each vial, while keeping the vials at a 45-degree angle. Replace the cap tightly and invert the vials several times to mix.



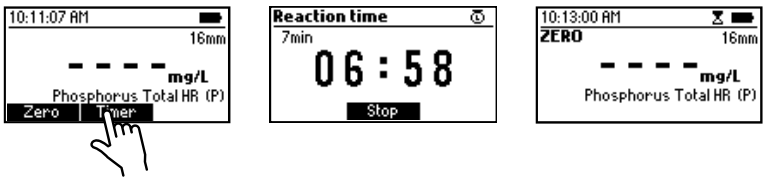
- Remove the cap from the vials and add 0.5 mL of HI93763B-0 Total Phosphorous High Range Reagent B to each vial, while keeping the vial at a 45-degree angle. Replace the cap and invert several times to mix.

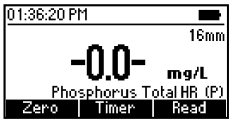


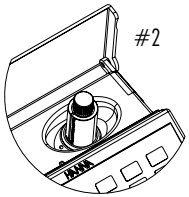
- Place the blank vial (#1) into the holder.



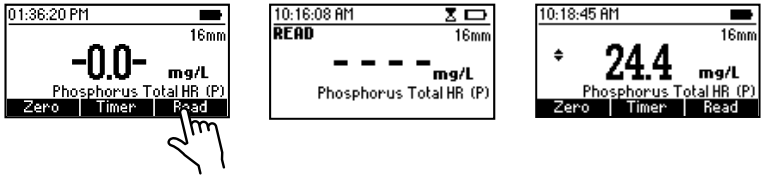
- Press **Timer** and the display will show the countdown prior to the measurement, or alternatively wait for 7 minutes and press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.





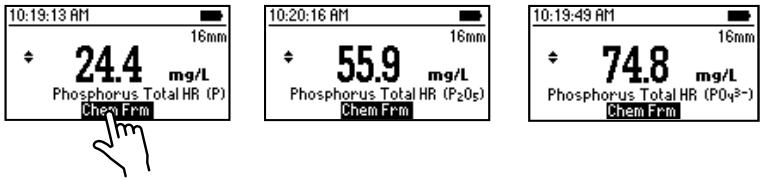


- Remove the blank vial.
- Place the sample vial (#2) into the holder.
- Press **Read** key. The instrument displays the results in **mg/L phosphorus (P)**.



Note: The method detects free (orthophosphate), condensed inorganic forms (meta-, pyro- and other polyphosphates) and organic forms of phosphates present in the sample.

- Press ▲ or ▼ to access the second level functions and then press the **Chem Frm** key to convert the result to **mg/L of phosphate (PO_4^{3-}) and phosphorus pentoxide (P_2O_5)**.



- Press ▲ or ▼ to return to the measurement screen.

INTERFERENCES

Interference may be caused by:

Arsenate

pH: the sample should have a neutral pH

Temperature: the method is temperature sensitive.

It is recommended to add the Molybdovanadate Reagent and to run measurements at T = 20 to 25 °C:

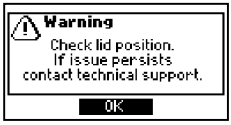
T < 20 °C causes a negative error

T > 25 °C causes a positive error

Turbidity and suspended matter in large amounts may cause interference because the strongly acidic reaction conditions may dissolve suspended matter or cause desorption of phosphates from particles. Before measurement, turbidity or suspended matter should be removed by treatment with active carbon and by prior filtration.

9. WARNINGS & ERRORS

The instrument shows clear warning messages when erroneous conditions appear and when measured values are outside the expected range. The information below provides an explanation of the errors and warnings, and recommended action to be taken.



Explanation: There is an excess amount of ambient light reaching the detector.

Recommended action: Make sure the lid is closed before performing any measurements. If the issue persists, please contact Hanna Instruments technical support.

Explanation: The sample and the Zero cuvettes are inverted.

Recommended action: Swap the cuvettes and repeat the measurement.

Explanation: There is either too much light or the instrument can not adjust the light level.

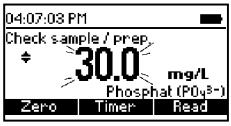
Recommended action: Please check the preparation of the Zero cuvette and that the sample does not contain any debris.

Explanation: The meter is either overheating or its temperature has dropped too low to operate within published accuracy specifications.

Recommended action: Allow the meter to reach normal environmental temperature before performing any measurements.

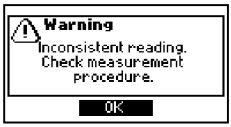
Explanation: Meter temperature has changed significantly since the zero measurement has been performed.

Recommended action: The zero measurement must be performed again.



Explanation: The measured value is outside the limits of the method.

Recommended action: If possible, change the method range. Verify that the sample does not contain any debris. Check the sample preparation and the measurement preparation.



Explanation: The measured value cannot be calculated.

Recommended action: Please check sample preparation and measurement procedure.

Explanation: Stored results of the CAL Check measurements have been lost.

Recommended action: Please redo the CAL Check measurements to ensure accurate results.

Explanation: User settings have been lost.

Recommended action: Please reset the values. If the issue persists, please contact Hanna Instruments technical support.

Explanation: Flash drive is not recognized or it might be damaged.

Recommended action: Please insert a new USB flash drive.

Explanation: Data log is full.

Recommended action: Please review logged data and delete unnecessary logs.

Explanation: Date and time settings have been lost.

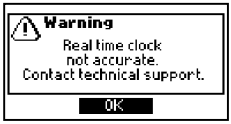
Recommended action: Please reset the values. If the issue persists, please contact Hanna Instruments technical support.

Explanation: Battery level is too low to ensure normal functioning and the meter will turn off.

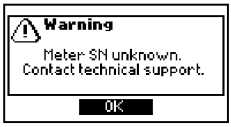
Recommended action: Connect the USB adapter to charge the battery.

The instrument shows warning messages when some of the features become unavailable. To recover them follow the *Recommended action:* Restart the meter. If the issue persists, please contact Hanna Instruments technical support.

Explanation: English is the only available language. Help function is not available.



Explanation: Real time clock it's not accurate.

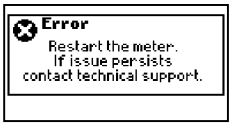


Explanation: The device serial number inside the memory can not be identified.

Explanation: Logged data are no longer accessible.

Explanation: Battery charge level is not accurate.

If a critical error appears, below message is displayed.



Explanation: A critical error has occured.

Recommended action: Restart the meter. If the issue persists, please contact Hanna Instruments technical support.

10. STANDARD METHODS

Description	Range	Method
Ammonia LR	0.00 to 3.00 mg/L	Nessler
Ammonia LR (16 mm Vial)	0.00 to 3.00 mg/L	Nessler
Ammonia MR	0.00 to 10.00 mg/L	Nessler
Ammonia HR	0.0 to 100.0 mg/L	Nessler
Ammonia HR (16 mm Vial)	0.0 to 100.0 mg/L	Nessler
Chlorine Free	0.00 to 5.00 mg/L	DPD
Chlorine Total	0.00 to 5.00 mg/L	DPD
Chemical Oxygen Demand LR (16 mm Vial)	0 to 150 mg/L	EPA 410.4
Chemical Oxygen Demand MR (16 mm Vial)	0 to 1500 mg/L	EPA 410.4
Chemical Oxygen Demand HR (16 mm Vial)	0 to 15000 mg/L	EPA 410.4
Iron, Total (16 mm Vial)	0.00 to 7.00 mg/L	EPA 315B
Nitrate (16 mm Vial)	0.0 to 30.0 mg/L	Chromotropic Acid
Nitrite LR	0 to 600 μg/L	Diazotization
Nitrite HR	0 to 150 mg/L	Ferrous Sulfate
Nitrogen, Total LR (16 mm Vial)	0.0 to 25.0 mg/L	Chromotropic Acid
Nitrogen, Total HR (16 mm Vial)	10 to 150 mg/L	Chromotropic Acid
Phosphorus, Reactive LR (16 mm Vial)	0.00 to 1.60 mg/L	Ascorbic Acid
Phosphorus, Reactive HR (16 mm Vial)	0.0 to 32.6 mg/L	Vanadomolybdophosphoric Acid
Phosphorus, Acid Hydrolyzable (16mm Vial)	0.00 to 1.60 mg/L	Ascorbic Acid
Phosphorus, Total LR (16 mm Vial)	0.00 to 1.15 mg/L	Ascorbic Acid
Phosphorus, Total HR (16 mm Vial)	0.0 to 32.6 mg/L	Vanadomolybdophosphoric Acid

11. ACCESSORIES

11.1. REAGENT SETS

Code	Description
HI93700-01	100 ammonia LR tests
HI93700-03	300 ammonia LR tests
HI93701-01	100 chlorine free tests (powder)
HI93701-03	300 chlorine free tests (powder)
HI93701-F	300 chlorine free tests (liquid)
HI93701-T	300 chlorine total tests (liquid)
HI93707-01	100 nitrite LR tests
HI93707-03	300 nitrite LR tests
HI93708-01	100 nitrite HR tests
HI93708-03	300 nitrite HR tests
HI93711-01	100 chlorine total tests (powder)
HI93711-03	300 chlorine total tests (powder)
HI93715-01	100 ammonia MR tests
HI93715-03	300 ammonia MR tests
HI93733-01	100 ammonia HR tests
HI93733-03	300 ammonia HR tests
HI93754A-25	24 chemical oxygen demand LR tests (Vial)
HI93754B-25	24 chemical oxygen demand MR tests (Vial)
HI93754C-25	24 chemical oxygen demand HR tests (Vial)
HI93758A-50	50 phosphorus reactive LR tests (Vial)
HI93758B-50	50 phosphorus acid hydrolyzed tests (Vial)
HI93758C-50	50 phosphorus total LR tests (Vial)
HI93763A-50	49 phosphorus reactive HR tests (Vial)
HI93763B-50	49 phosphorus total HR tests (Vial)
HI93764A-25	25 ammonia LR tests (Vial)
HI93764B-25	25 ammonia HR tests (Vial)
HI93766-50	50 nitrate tests (Vial)
HI93767A-50	49 nitrogen total LR tests (Vial)
HI93767B-50	49 nitrogen total HR tests (Vial)
HI96778-25	25 total iron tests (Vial)

11.2 pH ELECTRODES

Code	Description
HI10530	Triple ceramic, double junction, low temperature glass, refillable pH electrode with conical tip and temperature sensor
HI10430	Triple ceramic, double junction, high temperature glass, refillable pH electrode with temperature sensor
HI11310	Glass body, double junction, refillable pH/temperature electrode
HI11311	Glass body, double junction, refillable pH/temperature electrode with enhanced diagnostics
HI12300	Plastic body, double junction, gel filled, non refillable pH/temperature electrode
HI12301	Plastic body, double junction, gel filled, non refillable pH/temperature electrode with enhanced diagnostics
HI10480	Glass body, double junction with temperature sensor for wine analysis
FC2320	Double junction, open reference, non refillable, electrolyte viscolene, PVDF body with conical tip, pH/temperature electrode
FC2100	Double junction, open reference, non refillable, electrolyte viscolene, glass body with conical tip, pH/temperature electrode
FC2020	Double junction, open reference, non refillable, electrolyte viscolene, PVDF body with conical tip, pH/temperature electrode

Note: The enhanced diagnostics information are not displayed by meter.

11.3 pH SOLUTIONS

BUFFER SOLUTIONS

Code	Description
HI70004P	pH 4.01 Buffer Sachets, 20 mL (25 pcs.)
HI70007P	pH 7.01 Buffer Sachets, 20 mL (25 pcs.)
HI70010P	pH 10.01 Buffer Sachets, 20 mL (25 pcs.)
HI7001L	pH 1.68 Buffer Solution, 500 mL
HI7004L	pH 4.01 Buffer Solution, 500 mL
HI7006L	pH 6.86 Buffer Solution, 500 mL
HI7007L	pH 7.01 Buffer Solution, 500 mL
HI7009L	pH 9.18 Buffer Solution, 500 mL
HI7010L	pH 10.01 Buffer Solution, 500 mL
HI8004L	pH 4.01 Buffer Solution in FDA approved bottle, 500 mL
HI8006L	pH 6.86 Buffer Solution in FDA approved bottle, 500 mL
HI8007L	pH 7.01 Buffer Solution in FDA approved bottle, 500 mL
HI8009L	pH 9.18 Buffer Solution in FDA approved bottle, 500 mL
HI8010L	pH 10.01 Buffer Solution in FDA approved bottle, 500 mL

ELECTRODE STORAGE SOLUTIONS

HI70300L	Storage Solution, 500 mL
HI80300L	Storage Solution in FDA approved bottle, 500 mL

ELECTRODE CLEANING SOLUTIONS

HI70000P	Electrode Rinse Sachets, 20 mL (25 pcs.)
HI7061L	General Cleaning Solution, 500 mL
HI7073L	Protein Cleaning Solution, 500 mL
HI7074L	Inorganic Cleaning Solution, 500 mL
HI7077L	Oil & Fat Cleaning Solution, 500 mL
HI8061L	General Cleaning Solution in FDA approved bottle, 500 mL
HI8073L	Protein Cleaning Solution in FDA approved bottle, 500 mL
HI8077L	Oil & Fat Cleaning Solution in FDA approved bottle, 500 mL

ELECTRODE REFILL ELECTROLYTE SOLUTIONS

HI 7082	3.5M KCl Electrolyte, 4x30 mL, for double junction electrodes
HI 8082	3.5M KCl Electrolyte in FDA approved bottle, 4x30 mL, for double junction electrodes.

11.4. OTHER ACCESSORIES

Code	Description
HI72083300	carrying case
HI731311	vial cuvette 16 mm diam (5 pcs.)
HI731318	cloth for wiping cuvettes (4 pcs.)
HI731331	glass cuvettes (4 pcs.)
HI731335N	cap for cuvette (4 pcs.)
HI731340	200 µL automatic pipette
HI731341	1000 µL automatic pipette
HI731342	2000 µL automatic pipette
HI740034P	cap for 100 mL beaker (10 pcs.)
HI740036P	100 mL plastic beaker (10 pcs.)
HI740038	60 mL glass bottle and stopper
HI740142P	1 mL graduated syringe (10 pcs)
HI740143	1 mL graduated syringe (6 pcs.)
HI740144	pipette tip (6 pcs.)
HI740157P	plastic refilling pipette (20 pcs.)
HI740216	Cooling Rack
HI740217	safety shield for reactor
HI740220	25 mL graduated glass vial (2 pcs.)
HI740223	170 mL plastic beaker
HI740224	170 mL plastic beaker (12 pcs.)
HI740225	60 mL graduated syringe
HI740226	5 mL graduated syringe
HI740227	filter assembly
HI740228	filter discs (25 pcs.)
HI740229	100 mL graduated cylinder

Code	Description
HI74083300	COD Adapter
DEMI-02	demineralizer
HI75110/220E	USB power adapter, European plug
HI75110/220U	USB power adapter, USA plug
HI76404A	electrode holder
HI83314-11	CAL Check cuvette kit for HI83314
HI83300-100	Sample preparation kit consisting of activated carbon for 50 tests, demineralizer bottle for 10 L of water, 100 mL graduated beaker with cap, 170 mL graduated beaker with cap, 3 mL pipette, 60 mL syringe, 5 mL syringe, graduated cylinder, spoon, funnel, filter paper (25 pcs.).
HI839800-01	reactor, European plug
HI839800-02	reactor, USA plug
HI920015	USB to micro USB cable connector
HI93703-50	cuvette cleaning solution (230 mL)
HI93703-55	activated carbon (50 pcs.)

12. ABBREVIATIONS

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

Certification

All Hanna Instruments conform to the **CE European Directives**.

CE RoHS compliant

Disposal of Electrical & Electronic Equipment. The product should not be treated as household waste. Instead hand it over to the appropriate collection point for the recycling of electrical and electronic equipment which will conserve natural resources.

Disposal of waste batteries. This product contains batteries, do not dispose of them with other household waste. Hand them over to the appropriate collection point for recycling.

Ensuring proper product and battery disposal prevents potential negative consequences for the environment and human health. For more information, contact your city, your local household waste disposal service, the place of purchase or go to www.hannainst.com.

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Recommendations for Users

Before using this product, make sure it is entirely suitable for your specific application and for the environment in which it is used. Any variation introduced by the user to the supplied equipment may degrade the meters' performance. For yours and the meter's safety do not use or store the meter in hazardous environments.

Warranty

The HI83314 is warranted for two years against defects in workmanship and materials when used for their intended purpose and maintained according to instructions. Damage due to accidents, misuse, tampering or lack of prescribed maintenance is not covered.

If service is required, contact your local Hanna Instruments Office. If under warranty, report the model number, date of purchase, serial number and the nature of the problem. If the repair is not covered by the warranty, you will be notified of the charges incurred. If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization (RGA) number from the Technical Service department and then send it with shipping costs prepaid. When shipping any instrument, make sure it is properly packed for complete protection.

World Headquarters

Hanna Instruments Inc.
Highland Industrial Park
584 Park East Drive
Woonsocket, RI 02895 USA
www.hannainst.com

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