INSTRUCTION MANUAL

HI83314

Multiparameter Photometer with COD

for Wastewater

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

Dear Customer,

Thank you for choosing a Hanna Instruments® product.
Please read this instruction manual carefully before using this instrument as it provides the necessary information for correct use of this instrument, and a precise idea of its versatility.
If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com.
Visit www.hannainst.com for more information about Hanna Instruments and our products.

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1. PRELIMINARY EXAMINATION

Remove the instrument and accessories from the packaging and examine it carefully. For further assistance, please contact your local Hanna Instruments® office or email us at tech@hannainst.com.

Each HI83314 is supplied complete with:

- Sample cuvette (4 pcs.)
- Sample cuvette cap (4 pcs.)
- Cloth for wiping cuvettes
- Scissors
- USB cable
- 5 Vdc power adapter
- 16 mm vial adapter
- 16 mm diameter vial with cap (6 pcs.)
- Instrument quality certificate
- Instruction manual

***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)
Photometer	Range	0.000 to 4.000 Abs
	Resolution	0.001 Abs
	Accuracy	±0.003 Abs @ 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 & 16 mm diameter
	Number of methods	38
Probe	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	two-point, from five 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 (±0.9 °F @ 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 × 177 × 97 mm (8.1 × 7.0 × 3.8″)
	Weight	1.0 kg (2.2 lbs.)

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

4. DESCRIPTION

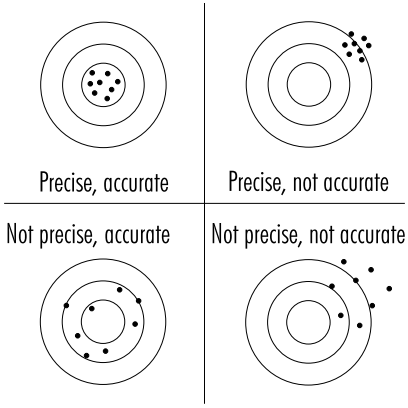
4.1. GENERAL DESCRIPTION & INTENDED USE

HI83314 multiparameter photometer is a compact and versatile meter with two measurement modes, Photometer and Probe. Photometer mode includes a CAL Check™ feature and 38 different methods that cover a wide variety of applications, making it ideal for both benchtop and portable operations.
With the CAL Check feature users are able to validate the performance of the instrument and apply a user calibration (if necessary). Hanna Instruments® CAL Check cuvettes are made with NIST traceable standards. Probe mode uses a digital pH probe with a one or two-point calibration.

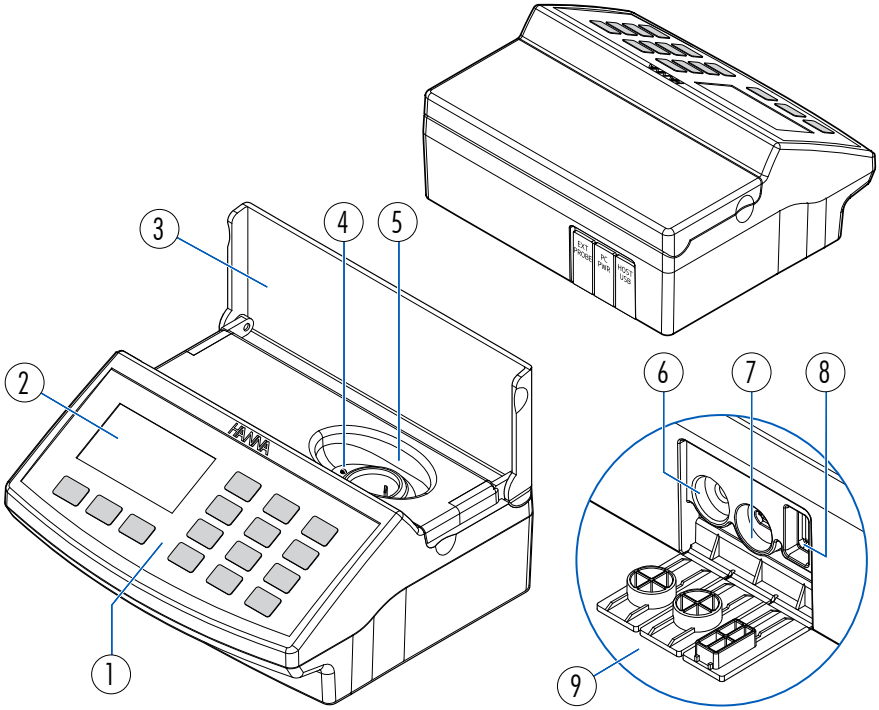
- Digital electrode input for pH measurements
- Certified CAL Check cuvettes to confirm meter functionality
- Dual purpose micro-USB flash drive
- Lithium polymer rechargeable battery
- Auto-off
- Absorbance mode
- User and sample name entry
- GLP features

4.2. PRECISION & ACCURACY

Precision is how closely repeated measurements are to one another. Precision is usually expressed as standard deviation. 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. Light-blocking cover panel (opened)
4. Indexing mark
5. Cuvette holder
6. 3.5 mm TRRS (jack) input for digital electrodes
7. Micro-USB device connector for power or PC interface
8. Standard USB host connector for data transfer to a USB flash drive
9. Protective port covers

Keypad Description

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


Press the functional key to perform the function displayed above it 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 probe (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. Photometric chemical analysis is based on specific chemical reactions between a sample and reagent to produce a light-absorbing compound.

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. If all other factors are constant, the concentration "c" can be calculated from the absorbance of the substance.

Lambert Beer Law:

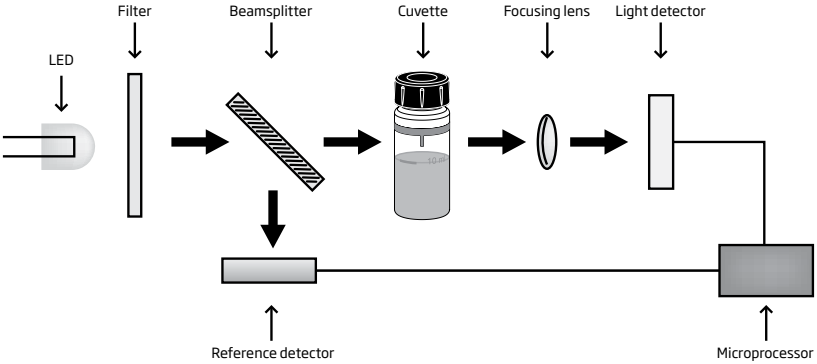
$$-\log I/I_o = \varepsilon_\lambda \, c \, d$$

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

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.

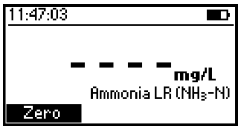
A focusing lens collects all of the light that exits the cuvette, eliminating errors from cuvette imperfections and scratches, eliminating the need to index the cuvette.

5. GENERAL OPERATIONS

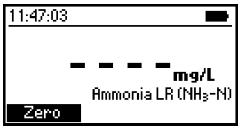
5.1. POWER CONNECTION & BATTERY MANAGEMENT

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 Instruments® 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:

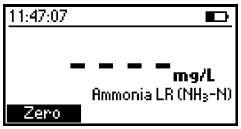
- battery is charging from external adapter



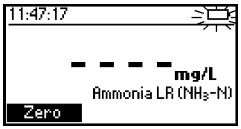
- battery fully charged (meter connected to AC / DC adapter)



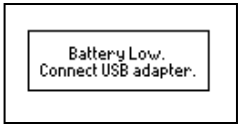
- battery capacity (no external adapter)



- 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 after a Zero measurement). If a photometer measurement is on the screen, an auto-log is created before shutdown.

5.2. MODE SELECTION

The HI83314 has two operational modes: Photometer and Probe.
Photometer mode enables on-demand measurement of a cuvette using the integrated optical system.
Probe mode enables continuous measurement using a Hanna digital electrode connected to the 3.5 mm port.
To switch between Photometer mode and Probe mode, use the **MODE** key.

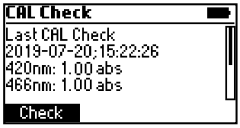
***Note**: The active mode cannot be switched while in Setup, Recall or Method menus.*

5.3. GENERAL SETUP

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

CAL Check™ (Photometer Mode Only)

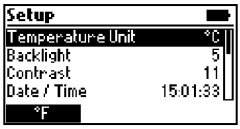
Press **Select** to enter the CAL Check screen. The date, time and values for the last CAL Check are displayed on the screen. To start a new CAL Check, press **Check** and follow the prompts on the screen. See the Meter Validation & CAL Check™ section for additional information.



Temperature Unit (Probe Mode Only)

Option: °C or °F

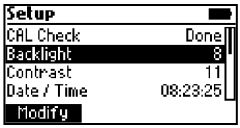
Press the functional key to select the desired temperature unit.

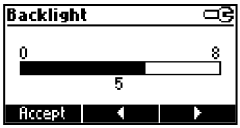


Backlight

Values: 0 to 8

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

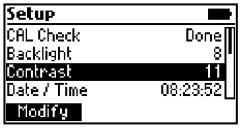


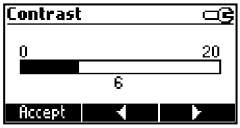


Contrast

Values: 0 to 20

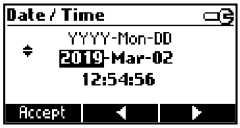
Press **Modify** to change the display's contrast. Use the functional keys or the ◀▶ keys to increase or decrease the value. Press **Accept** to confirm the value or the **ESC** key to return to the **Setup** menu without saving the new value.





Date & Time

Press **Modify** to change the date and 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 **Accept** to confirm or **ESC** key to return to the **Setup** without saving the new date or time.



Time Format

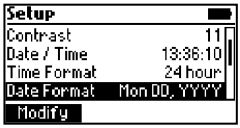
Option: AM/PM or 24-hour

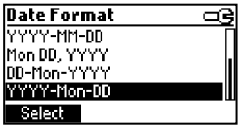
Press the functional key to select the desired time format.

Date Format

Option: DD/MM/YYYY, MM/DD/YYYY, YYYY/MM/DD, YYYY-MM-DD, Mon DD, YYYY, DD-Mon-YYYY, YYYY-Mon-DD

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

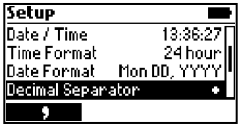




Decimal Separator

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 (Comma-Separated Values) files.



Language

Option: Português, Deutsch, English, Español, Français, Italiano, Dutch

Press **Modify** to change the language. Use the ▲▼ keys to select the desired language. Press **Select** to change the language.

Beeper

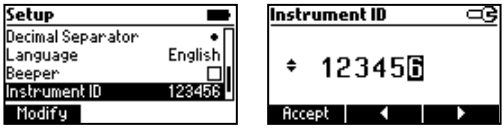
Option: Enable or Disable

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 or disable the beeper.

Instrument ID

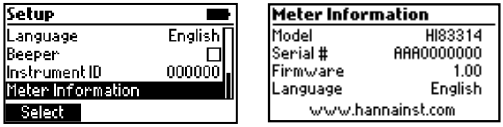
Option: 0 to 999999

This option is used to set the instrument's ID (identification number). Press **Modify** 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 **Accept** to confirm the value or press the **ESC** key to return to the **Setup** menu without saving the new value.



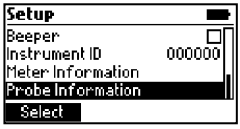
Meter Information

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



Probe Information (pH Mode Only)

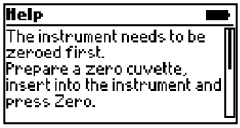
Press **Select** to view model number, serial number and firmware version for the connected probe. Press the **ESC** key to return to the **Setup** menu.



5.4. CONTEXTUAL HELP

HI83314 offers an interactive contextual help mode that assists the user at any time.

To access the help screen press the **HELP** key. The instrument will display additional information related to the current screen. To read all the available information, scroll the text using the ▲▼ keys. Press the **ESC** key to return to the previous screen.

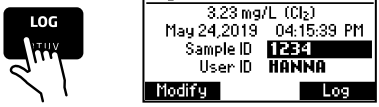


6. LOGGING DATA & DATA MANAGEMENT

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

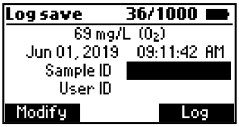
6.1. LOGGING DATA

Press the **LOG** key and the last valid measurement will be stored with a date and time stamp. Only valid measurements can be stored.

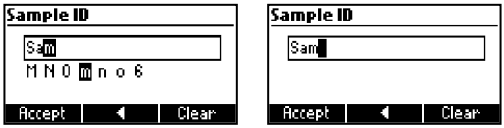


6.2. ADDING SAMPLE & USER NAMES TO LOG DATA

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**. Sample ID and user ID are 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.

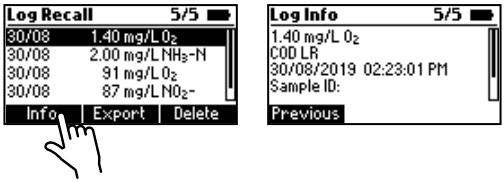


Press **Accept** to update the sample or user ID.
Press ◀ functional key to delete the last character.
Press **Clear** to delete all of the characters.
Press the **ESC** key to discard all changes and return to the previous screen.

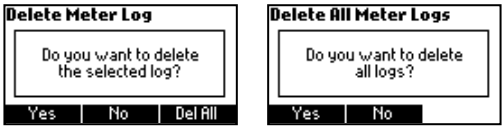
6.3. DATA MANAGEMENT

Viewing & Deleting

Data can be viewed, deleted and exported to a USB drive or a PC by pressing the **RECALL** key. Use the ▲▼ keys to scroll through the saved logs. Press **Info** to view additional information about the selected log.



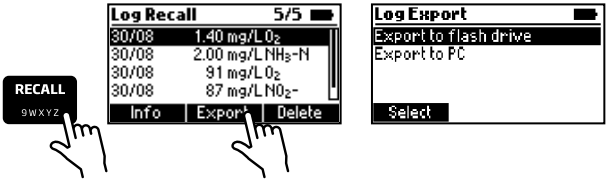
Use **Delete** to erase logged data. After pressing **Delete** the prompt on the display will confirm the action.



Press **No** or the **ESC** key to return to the previous screen.
Press **Yes** to delete the selected log.
Press **Del All** to erase all the logged data. If **Del All** is pressed the prompt on the display will confirm the action.
Press **Yes** to delete all logged data, **No** or the **ESC** key to return to the log recall.

Data Export

Log data can be exported to a USB flash drive or to a PC. To access data export functions, press the **RECALL** key then **Export**.

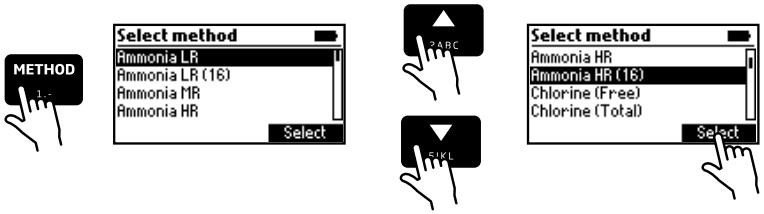


Use the ▲▼ keys to select the desired export location.
For export to flash drive, insert the USB flash drive into the dedicated port at the back of the meter labeled HOST USB, then follow the on-screen prompts.
For export to PC, connect the meter to a PC using the supplied micro-USB cable. Insert the cable into the port at the back of the meter labeled PC PWR. Follow the on-screen prompts. When the meter says PC connected, the meter will appear as a removable disk. Use a file manager (such as Windows Explorer or Mac Finder) to move the file from the meter to the PC.
Log data is exported as a single file (HI83314.csv) containing all logged photometer and probe data. The CSV file may be opened with a text editor or spreadsheet application.

7. PHOTOMETER MODE

7.1. 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**.

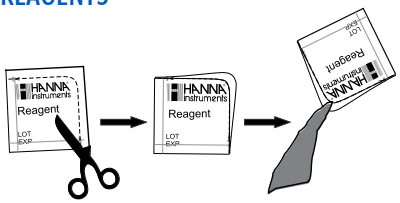


After the desired method is selected, follow the procedure described in the related section.
Before performing a method, read all the instructions carefully.

7.2. COLLECTING & MEASURING SAMPLES AND REAGENTS

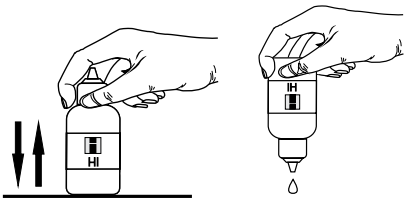
Proper Use of Powder Packet

1. Use scissors to open the powder packet.
2. Push the edges of the packet to form a spout.
3. Pour out the content of the packet.



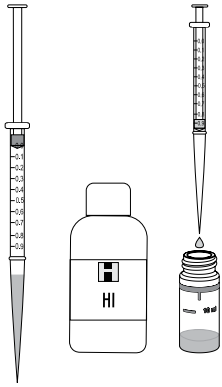
Proper Use of Dropper Bottle

1. Tap the dropper on the table several times.
2. Remove the cap and wipe the outside of the tip with a cloth.
3. Keep the dropper bottle in a vertical position while dosing the reagent.



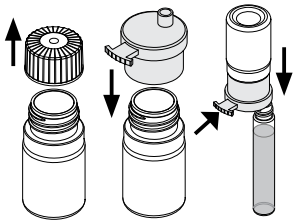
Proper Use of Syringe

1. Push the plunger completely into the syringe and insert the tip into the solution.
2. Pull the plunger up until the lower edge of the seal is exactly on the mark for the desired volume.
3. 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 a vertical position, push the plunger down into the syringe, the desired volume has been delivered.



Proper Use of Dispenser

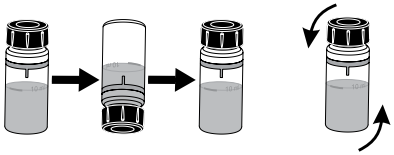
1. Remove the screw-on cap and securely attach the dispenser to the reagent bottle.
2. Hold the bottle downward and gently shake it (forward/backward movement) to fill the dispenser's powder chamber.
3. Place the powder dispenser's nozzle over the cuvette then press the feeder.
4. The exact amount of powder is released into the cuvette.



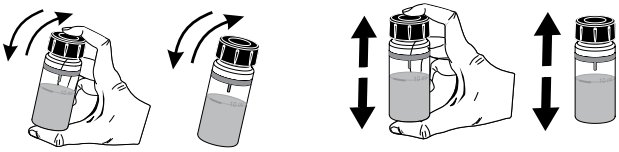
7.3. CUVETTE PREPARATION

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 to 15 complete inversions in 30 seconds. This mixing technique is indicated with "invert to mix" and one of the following icons:



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

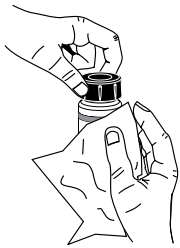


shake gently shake vigorously

c. Swirl the cuvette gently to mix the solution. This mixing technique is indicated with one of the following icons:

In order to avoid reagent leaking and to obtain more accurate measurements, close the cuvette first with the supplied High-Density Polyethylene (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 and dirt. Wipe it thoroughly with HI731318 microfiber cleaning cloth or a lint-free wipe 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.



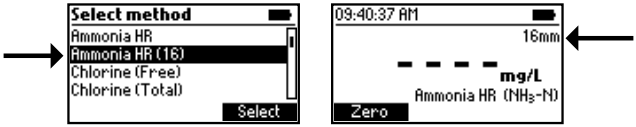
Do not let the reacted sample stand too long after reagent is added. For best accuracy, respect the timings described in each specific method.
It is possible to take multiple readings in a row, but it is recommended to take a new zero reading for each sample and to use the same cuvette for zeroing and 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).

Interferences

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.

7.4. USING THE 16 mm 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.



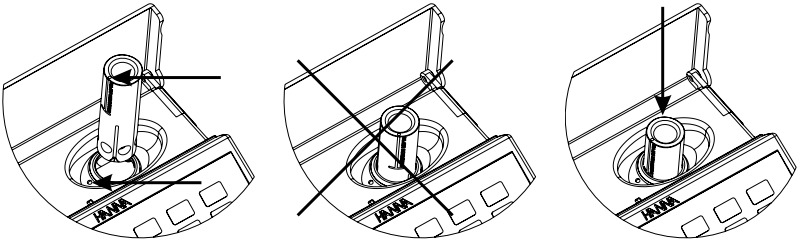
To insert the 16 mm vial adapter:

1. Lift open the meter's sample cover.

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

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 adapter 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, it 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, users should no longer be able to see the notched area of the adapter.



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.

***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. Users should be able to insert the vial with light pressure using one finger. If the vial is not reaching the bottom, if there is resistance, or in case of 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 or samples into the vial adapter. Samples should be near room temperature before inserting into the meter or adapter.*
- *Do not attempt to close the sample cover while using the 16 mm vials or adapter. It is normal for the vials or adapter to prevent the cover from closing completely.*

7.5. TIMERS & MEASUREMENT FUNCTIONS

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

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

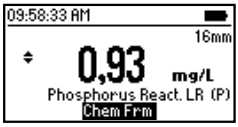
For some methods, the timer is only necessary after a Zero measurement has been performed. In this case, the timer key will only be available after the Zero measurement has been performed.

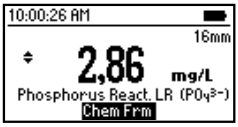
If the method requires a Zero or Read measurement after a timer has expired, the meter will automatically perform the appropriate action. Follow the instructions in the method procedure.

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

7.6. CHEMICAL FORMULA & UNIT CONVERSION

Chemical formula and 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 the ▲▼ keys to access the second level function and then press **Chem Frm** to toggle between the available chemical formulas for the selected method.





7.7. METER VALIDATION & CAL CHECK™

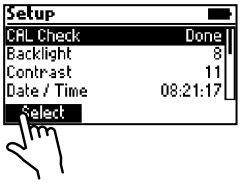
***Warning**: Do not validate the meter with standard solutions other than the Hanna Instruments® CAL Check Standards. For accurate validation results, please perform tests at room temperature, 18 to 25 °C (64.4 to 77.0 °F).*

Validation of the HI83314 involves absorbance measurements of certified Hanna Instruments CAL Check Standards (see the Accessories section). 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 Instruments CAL Check Standards kit.

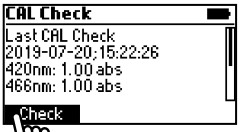
To perform a validation:

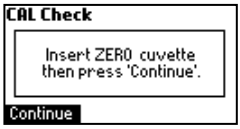
1. Press the **SETUP** key.

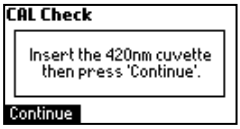
2. Highlight **CAL Check**, then press **Select**.



3. Follow the prompts on the screen. The meter will prompt to measure each cuvette provided in the Hanna Instruments® CAL Check™ Standards kit. To exit the process at any time, press **ESC** key.







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

7.8. 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. Press the **METHOD** key.
2. 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.
3. Prepare the sample cuvette according to the method.
4. Insert a cuvette filled with deionized water, then press **Zero**.
5. Insert the prepared sample cuvette, then press **Read**.

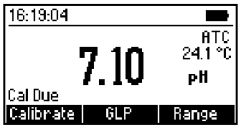
***Warning**: Never use absorbance methods for validation using Hanna Instruments CAL Check cuvettes. The factory calibration corrections for CAL Check cuvettes are applied while in CAL Check mode only!*

8. PROBE MODE

8.1. pH MEASUREMENT

The HI83314 can be used to perform direct pH measurements by connecting a Hanna Instruments® digital pH electrode with a 3.5 mm TRRS connector.

- 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.



- Press **Calibrate** to open the calibration window.
- Press **GLP** to review the calibration information.
- Press **Range** to switch between pH and mV.

For high accuracy it is recommended to calibrate the electrode often. pH electrodes should be recalibrated at least once per week, but daily calibration is recommended. Always recalibrate after cleaning an electrode, see the pH Calibration section for more information.

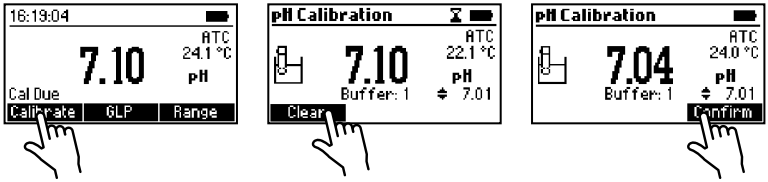
To take pH measurements:

1. Remove the protective cap and rinse the electrode with water.
2. Collect some sample in a clean, dry beaker.
3. Preferably, rinse the electrode with a small amount of sample.
4. Submerse the electrode tip approximately 3 cm (1 ¼") into the sample to be tested and stir the sample gently. Make sure the electrode junction is completely submersed.
5. Allow time for the electrode to stabilize in the sample. When the ⧗ symbol disappears, the 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 Instruments 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.

8.2. pH CALIBRATION

- From the probe measurement screen, press **Calibrate** to begin the calibration process. During pH calibration, the display will show the current pH reading, temperature reading, selected buffer type and the buffer number ("Buffer: 1" for the first buffer, "Buffer: 2" for the second buffer).



- Press **Clear** to clear the current calibration.
- Press **Confirm** to accept the current calibration point (only available if the reading is stable and within the limits for the selected buffer).
- Press the ▲▼ keys to cycle through the list of available buffers: pH 4.01, 6.86, 7.01, 9.18, 10.01.
- Press the **ESC** key 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 calibrations 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.

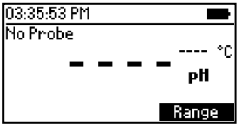
Procedure

Calibration can be performed using one or two calibration buffers. For more accurate measurements, a two-point calibration is recommended.

1. Submerse the pH electrode approximately 3 cm (1 ¼") into a buffer solution and stir gently.
2. When the reading is stable and close to the selected buffer, press **Confirm** to accept and store the calibration point. The meter will prompt for the second buffer (Buffer: 2).
3. To use only a one-point calibration, press the **ESC** key to exit calibration mode.
   The meter will store the calibration information to the probe and return to measurement mode.

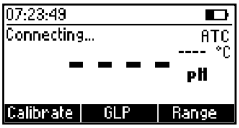
4. To continue calibrating with a second buffer, rinse and submerse the pH electrode approximately 3 cm (1 ¼") into the second buffer solution and stir gently. If necessary, use the ▲▼ keys to select a different buffer value.
5. When the reading is stable and close to the selected buffer, press **Confirm** 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.

8.3. pH MESSAGES & WARNINGS



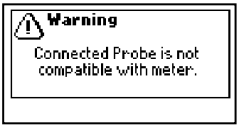
No Probe

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.

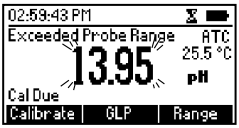


Incompatible Probe

The connected probe is not compatible with this device.

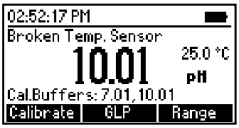
Incompatible Calibration

The probe's current calibration is not compatible with this meter.
Clear current calibration to use the probe.



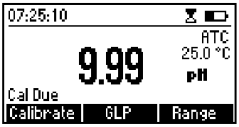
Exceeded Probe Range

The pH and / or temperature measurement exceed the specifications of the probe. The measurement value(s) will be blinking.



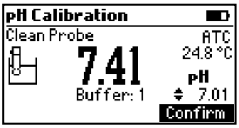
Broken Temperature Sensor

Probe's built-in temperature sensor is broken. Temperature compensation will revert to a fixed value of 25 °C (77 °F).



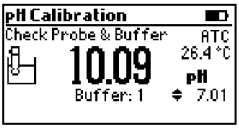
Cal Due

The probe has no calibration.
See the pH Calibration section for details.



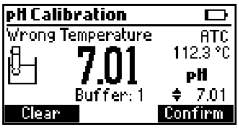
Clean Probe

The offset is outside the accepted window or the slope is under the accepted lower limit. Cleaning the probe will improve the pH electrode's response, repeat the calibration after cleaning.
See the pH Electrode Conditioning & Maintenance section for details.



Check Probe & Buffer

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.
Clean the probe and confirm the correct buffer selection.

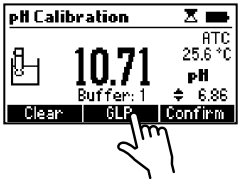


Wrong Temperature

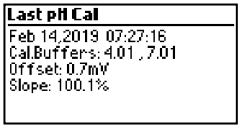
The buffer temperature is outside of the acceptable window for the selected buffer value.

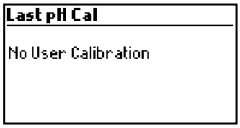
8.4. pH GLP

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 date and time, buffers, slope and offset for the last calibration. If the probe has not been calibrated, "No User Calibration" is displayed. Press the **ESC** key to return to the measurement mode.





8.5. pH ELECTRODE CONDITIONING & MAINTENANCE

- Remove the protective cap. Do not be alarmed if salt deposits are present, this is normal. Rinse the probe with water.
- Shake the electrode down to eliminate any air bubbles inside the glass bulb.
- If the bulb and / or junction are dry, soak the electrode in HI70300 or HI80300 Storage solution for a minimum of 30 minutes. Rinse with water.
- Calibrate before using.
- For refillable electrodes if the filling solution (electrolyte) is more than 2 ½ cm (1") below the fill hole, add HI7082 or HI8082 3.5M KCl Electrolyte solution. Unscrew the fill hole cover during measurements so the liquid reference junction maintains an outward flow of electrolyte.

Storage Procedure

- Keep the glass bulb and junction moist, to minimize clogging and ensure a quick response.
- Replace the solution in the protective cap with a few drops of HI70300 or HI80300 Storage solution or Filling solution (HI7082 or HI8082 3.5M KCl Electrolyte solution). pH 4.01 or 7.01 buffer can also be used.

***Note**: Never store the electrode in distilled or deionized water.*

Periodic Maintenance

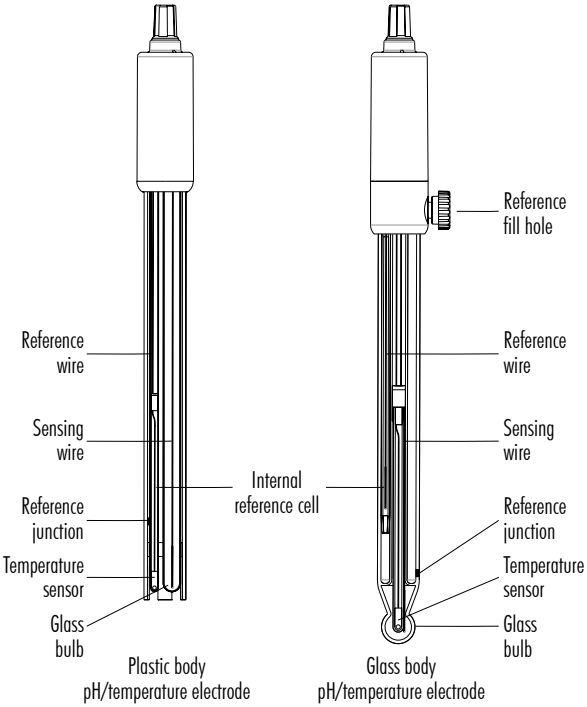
- Inspect the electrode and the cable. The cable used for connection to the instrument must be intact and there must be no points of broken insulation on the cable, connectors must be perfectly clean and dry.
- If there are any scratches or cracks on the electrode stem or bulb, replace the electrode.
- For refillable electrodes, refill the reference chamber with fresh electrolyte (HI7082 or HI8082 3.5M KCl Electrolyte solution). Allow the electrode to stand upright for 1 hour.

Cleaning Procedure

Several cleaning solutions are available.

- General
  Soak in HI7061 or HI8061 General cleaning solution for approximately 30 minutes.
- Protein
  Soak in HI7073 or HI8073 Protein cleaning solution for 15 minutes.
- Inorganic
  Soak in HI7074 Inorganic cleaning solution for 15 minutes.
- Oil and grease
  Rinse with HI7077 or HI8077 Oil and Fat cleaning solution.

After performing any of the cleaning procedures, rinse the electrode thoroughly with distilled water, refill the reference chamber with fresh electrolyte (refillable electrodes only) 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 electrode's cap.

The pH electrode's life is temperature dependent. If constantly cycled between two temperatures, the life of the electrode is drastically reduced.

9. METHOD PROCEDURES

9.1. 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

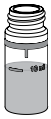
REAGENT SETS

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

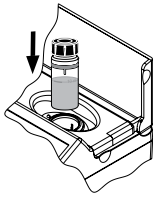
For other accessories see the Accessories section.

MEASUREMENT PROCEDURE

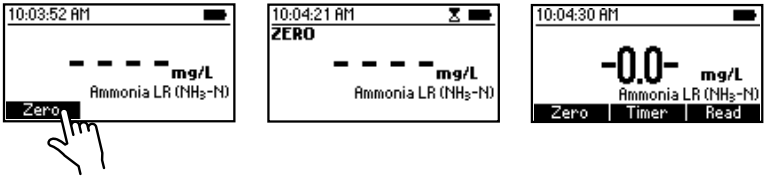
- Select the Ammonia LR method using the procedure described in the Method Selection section.
- Fill the cuvette with 10 mL of unreacted sample (up to the mark). Replace the plastic stopper and the cap.



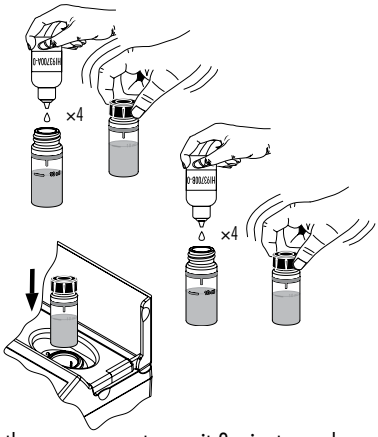
- Insert the cuvette into the holder and close the lid.



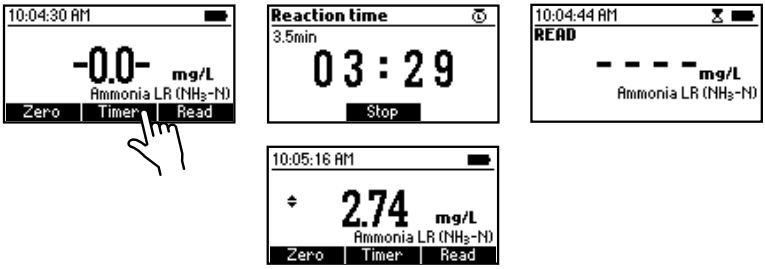
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



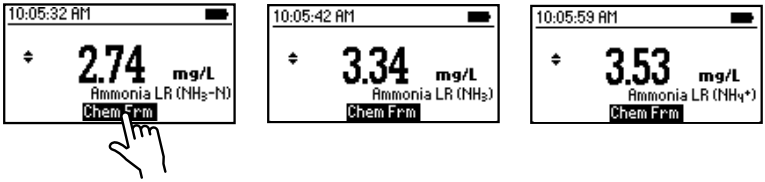
- Remove the cuvette.
- Add 4 drops of HI93700A-0 Ammonia Low Range Reagent A. Replace the plastic stopper and the cap. Swirl to mix the solution.
- Add 4 drops of HI93700B-0 Ammonia Low Range Reagent B. Replace the plastic stopper and the cap. Swirl to mix the solution.
- Insert the cuvette into the holder and close the lid.



- Press **Timer** and the display will show the countdown prior to the measurement or wait 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 the ▲ or ▼ key to access the second level functions.
- Press **Chem Frm** to convert the result to **mg/L** of **ammonia (NH_3)** and **ammonium (NH_4^+)**.



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

INTERFERENCES

Interference may be caused by:

- Hardness above 1 g/L
- Iron
- Sulfide may cause turbidity
- Organic compounds like acetone above 0.1 %, alcohols, aldehydes, aliphatic and aromatic amines, chloramines, glycine, or urea above 10 mg/L, to remove the interference distillation is required

9.2. 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: white label

REAGENT SETS

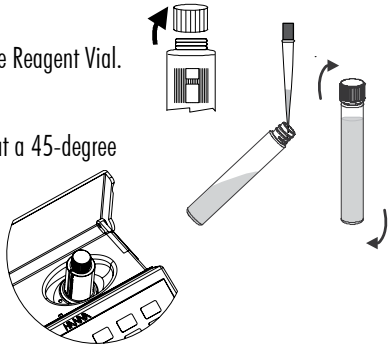
HI93764A-25 Reagents for 25 tests

For other accessories see the Accessories section.

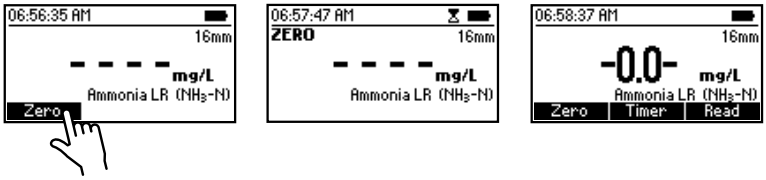
***Note**: Store the unused vials in their packaging in a cool and dark place.*

MEASUREMENT PROCEDURE

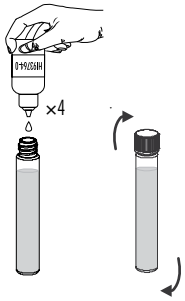
- Select the Ammonia LR (16) method following one of the procedures described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Remove the cap from HI93764A-0 Ammonia Low Range Reagent Vial.
- Add 5 mL of sample to the vial, while keeping the vial at a 45-degree angle.
- Replace the cap and invert several times to mix.
- Insert the vial into the holder.

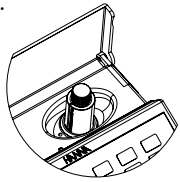


- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.

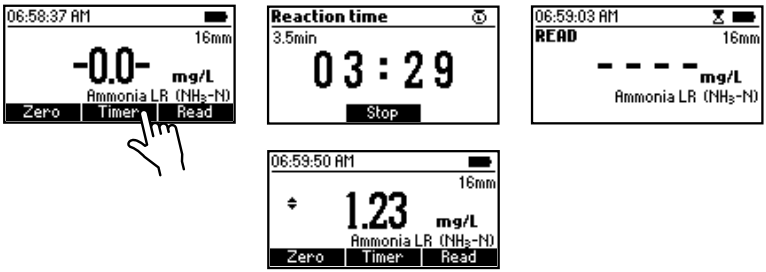


- Remove the vial.
- Remove the cap and add 4 drops of HI93764-0 Nessler Reagent.
- Replace the cap and invert the vial several times to mix.
- Insert the vial into the holder.

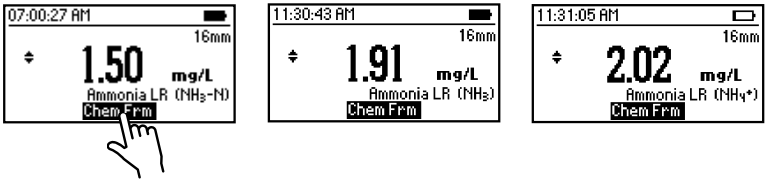




- Press **Timer** and the display will show the countdown prior to the measurement or wait 3 minutes and 30 seconds and press **Read**. When the timer ends the meter will perform the reading. The instrument displays the results in **mg/L ammonia nitrogen (NH_3-N)**.



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



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

INTERFERENCES

Interference may be caused by:

- Hardness above 1 g/L
- Iron
- Sulfide may cause turbidity
- Organic compounds like acetone above 0.1 %, alcohols, aldehydes, aliphatic and aromatic amines, chloramines, glycine, or urea above 10 mg/L, to remove the interference distillation is required

9.3. 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

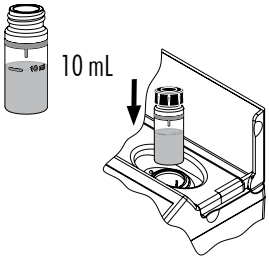
REAGENT SETS

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

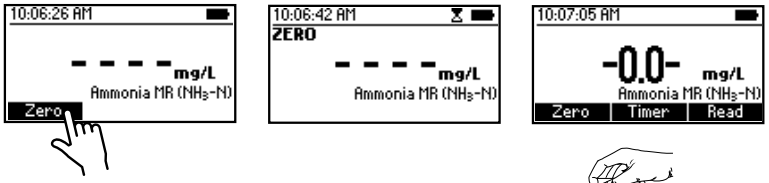
For other accessories see the Accessories section.

MEASUREMENT PROCEDURE

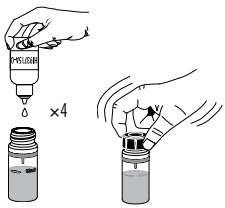
- Select the Ammonia MR method using the procedure described in the Method Selection section.
- Fill the cuvette with 10 mL of unreacted sample (up to the mark). Replace the plastic stopper and the cap.



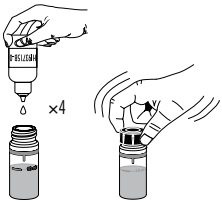
- Insert the cuvette into the holder and close the lid.
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



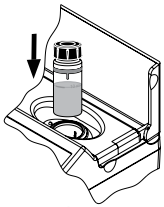
- Remove the cuvette.
- Add 4 drops of HI93715A-0 Ammonia Medium Range Reagent A. Replace the plastic stopper and the cap. Swirl to mix the solution.



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

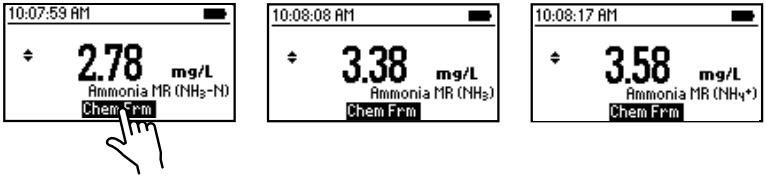


- Insert the cuvette into the holder and close the lid.



- Press **Timer** and the display will show the countdown prior to the measurement or wait 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 the ▲ or ▼ key to access the second level functions.
- Press **Chem Frm** to convert the result to **mg/L** of **ammonia (NH_3)** and **ammonium (NH_4^+)**.



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

INTERFERENCES

Interference may be caused by:

- Hardness above 1 g/L
- Iron
- Sulfide may cause turbidity
- Organic compounds like acetone above 0.1 %, alcohols, aldehydes, aliphatic and aromatic amines, chloramines, glycine, or urea above 10 mg/L, to remove the interference distillation is required

9.4. 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

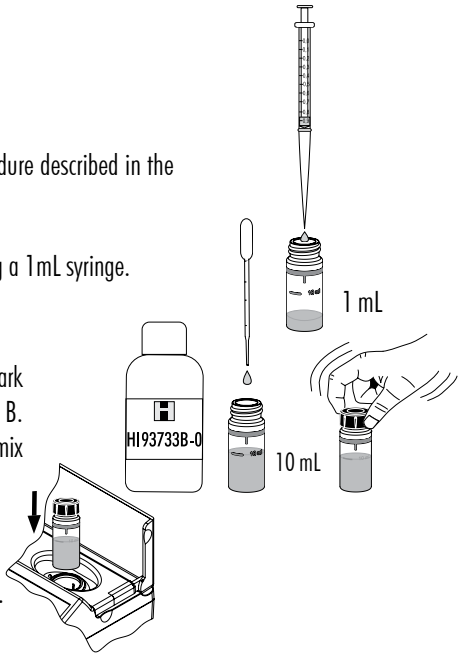
REAGENT SETS

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

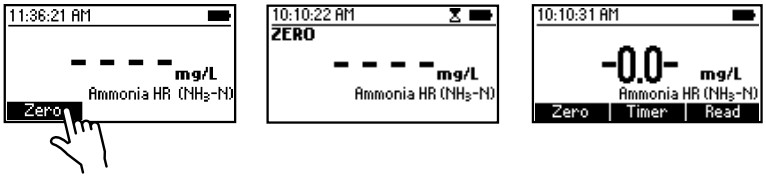
For other accessories see the Accessories section.

MEASUREMENT PROCEDURE

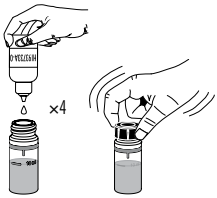
- Select the Ammonia HR method using the procedure described in the Method Selection section.
- Add 1mL of unreacted sample to the cuvette using a 1mL syringe.
- Use the pipette to fill the cuvette up to the 10 mL mark with HI93733B-0 Ammonia High Range Reagent B. Replace the plastic stopper and the cap. Swirl to mix the solution.
- Insert the cuvette into the holder and close the lid.



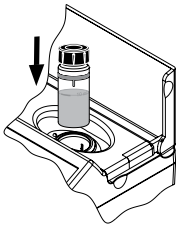
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



- Remove the cuvette.



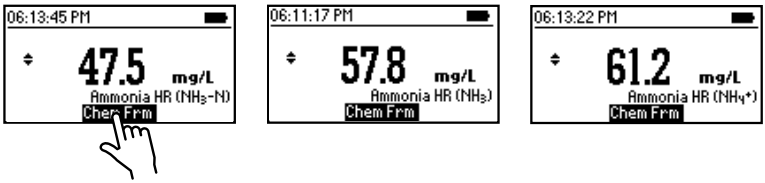
- Add 4 drops of HI93733A-0 Ammonia High Range Reagent A. Replace the plastic stopper and the cap. Swirl to mix the solution.



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

- Press **Timer** and the display will show the countdown prior to the measurement or wait 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 the ▲ or ▼ key to access the second level functions.
- Press **Chem Frm** to convert the result to **mg/L** of **ammonia (NH_3)** and **ammonium (NH_4^+)**.



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

INTERFERENCES

Interference may be caused by:

- Hardness above 1 g/L
- Iron
- Sulfide may cause turbidity
- Organic compounds like acetone above 0.1 %, alcohols, aldehydes, aliphatic and aromatic amines, chloramines, glycine, or urea above 10 mg/L, to remove the interference distillation is required

9.5. 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: green label

REAGENT SETS

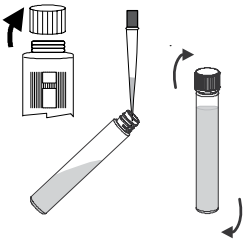
HI93764B-25 Reagents for 25 tests

For other accessories see the Accessories section.

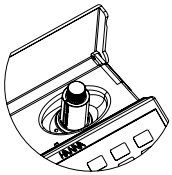
***Note**: Store the unused vials in their packaging in a cool and dark place.*

MEASUREMENT PROCEDURE

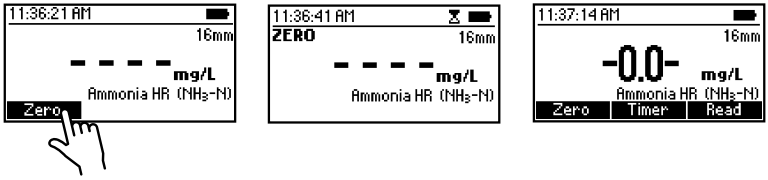
- Select the Ammonia HR (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Remove the cap from HI93764B-0 Ammonia High Range Reagent Vial.



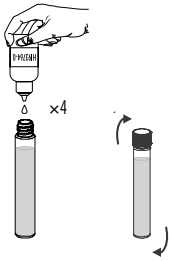
- Add 1 mL of sample to the vial, while keeping the vial at a 45-degree angle.
- Replace the cap and invert several times to mix.
- Insert the vial into the holder.



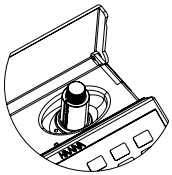
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



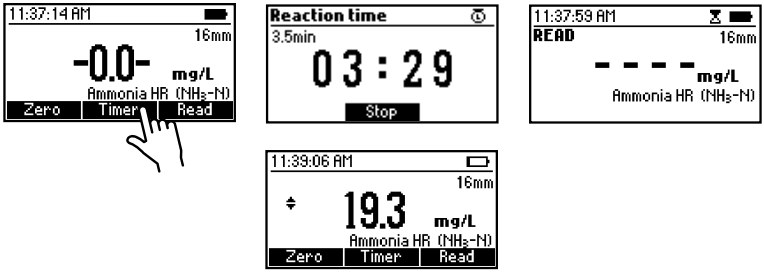
- Remove the vial.



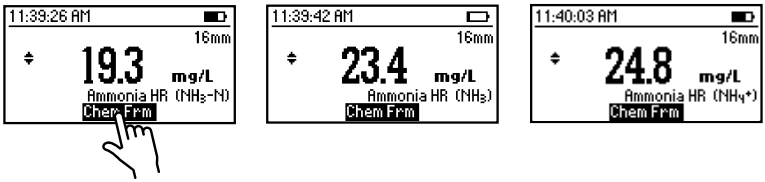
- Add 4 drops of HI93764-0 Nessler Reagent.
- Replace the cap and invert several times to mix.
- Insert the vial into the holder.



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



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

INTERFERENCES

Interference may be caused by:

- Hardness above 1 g/L
- Iron
- Sulfide may cause turbidity
- Organic compounds like acetone above 0.1 %, alcohols, aldehydes, aliphatic and aromatic amines, chloramines, glycine, or urea above 10 mg/L, to remove the interference distillation is required

9.6. CHLORIDE LOW RANGE (16 mm VIAL)

SPECIFICATIONS

Range	0.0 to 100.0 mg/L (as Cl^-)
Resolution	0.1 mg/L
Accuracy	±0.5 mg/L ±6 % of reading at 25 °C
Light Source	LED with narrow band interference filter @ 466 nm
Method	Adaptation of Standard Methods for the Examination of Water and Wastewater, 24th Edition, 4500-Cl^- Mercury Thiocyanate Method

REQUIRED REAGENTS

Code	Description	Quantity
HI96793-0	Chloride Reagent	6 mL
HI96793V-0*	Chloride Low Range Reagent Vial	2 vials
Deionized120	Deionized Water	2 mL

*Reagent vial identification: red label

REAGENT SETS

HI96793-25 Reagents for 24 tests

For other accessories see the Accessories section.

***Note**: Store the unused vials in their packaging, between 15 and 25 °C.*
Storage between 2 and 8 °C can extend the reagent life up to 6 months beyond the expiration date.

PRINCIPLE

Chloride ions in the sample react with mercury thiocyanate, forming mercury chloride ($HgCl_2$). The displaced thiocyanate ions then react with iron(III) to produce a red-colored iron(III) thiocyanate complex. The intensity of the red color is proportional to the chloride concentration and is measured photometrically.

APPLICATION

Testing chloride ions in following aqueous matrices: drinking water, wastewater, surface water

ATTENTION

The pH of the water sample must be between 3 pH and 10 pH. Adjust the pH if necessary.
The pH sample after reagent addition should be < 2 pH.
The method performs accurately when the sample temperature is between 20 °C and 25 °C.
The sample should be analyzed as soon as possible after it has been collected.
When working with intensely colored samples, adequately treat the samples before testing. Filter turbid samples.
In some cases, interferences can be eliminated using appropriate dilutions so that interfering ions fall below the maximum tolerable concentration and Cl^- remains within the measurement range.

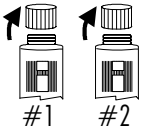
SIGNIFICANCE & USE

Chloride is a naturally occurring ion found in water, soil, and living organisms.
It enters the environment through salt dissolution, industrial discharge, and agricultural activities.
Monitoring chloride levels is essential for assessing water quality, detecting contamination, and ensuring compliance in industries such as food, pharmaceuticals, and chemical production.

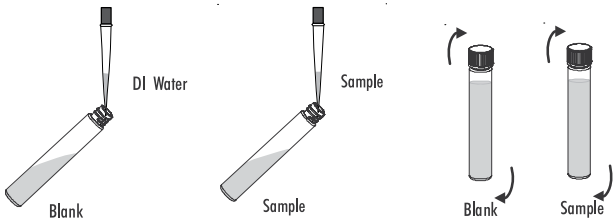
MEASUREMENT PROCEDURE

Reagent Blank Correction: This method requires reagent blank correction.
A single blank vial can be reused for up to one day if kept at room temperature (dark storage) or for up to three days if kept in a refrigerator. If refrigerated, allow the vial to reach room temperature before measurement.
For improved accuracy, always use the same lot of reagents for blank and samples.

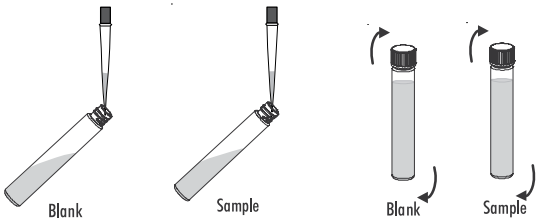
- Select the Chloride LR (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Remove the cap from two HI96793V-0 Chloride Low Range Reagent Vials.



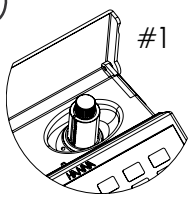
- Add 2 mL of deionized water to the first vial (#1) and 2 mL of sample to the second vial (#2), while keeping the vials at a 45-degree angle.
- Replace the cap and invert gently approximately 15 times to mix.



- Add slowly 3 mL of HI96793-0 Chloride Reagent to each vial, while keeping the vials at a 45-degree angle.
- Replace the cap and invert gently approximately 15 times to mix.

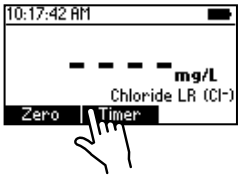


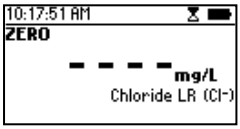
- Insert the blank vial (#1) into the adapter.

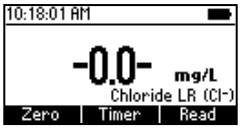


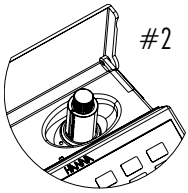
- Press **Timer** and the display will show the countdown prior to the zero reading or wait 3 minutes and press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.

  ***Note**: After the 3-minute waiting period if entrapped air bubbles are present, gently invert the vial to facilitate their dissipation.*

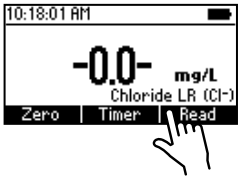


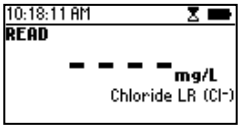


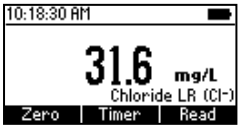




- Remove the blank vial.
- Insert the sample vial (#2) into the adapter.
- Press **Read** to start the measurement. The instrument displays the results in **mg/L** of **chloride (Cl^-)**.







INTERFERENCES

Interference may be caused by:

- Nitrate ($NO3^-$) 2500 mg/L
- Sulfate (SO_4^{2-}) 500 mg/L
- Zinc (Zn^{2+}) 200 mg/L
- Copper (Cu^{2+}), Cr (III) 150 mg/L
- Nickel (Ni^{2+}), Sulfides (S^{2-}) 50 mg/L
- Cr (VI) 10 mg/L

Turbidity, color can affect both measurement and speed of color development.

Interferences checked individually in solution containing 40.0 mg/L of Cl^-.

The cumulative effects have not been determined but cannot be excluded.

The determination is not known to have interfered with higher-concentration levels of foreign substances given above.

Bromides and iodides, commonly present in many mineral waters, undergo the same reaction, leading to high-bias results.

Additionally, substances that form colored complexes with iron(III) salts interfere with the determination.

9.7. CHLORIDE HIGH RANGE (16 mm VIAL)

SPECIFICATIONS

Range	80 to 1000 mg/L (as Cl^-)
Resolution	1 mg/L
Accuracy	±5 mg/L ±6 % of reading at 25 °C
Light Source	LED with narrow band interference filter @ 466 nm
Method	Adaptation of Standard Methods for the Examination of Water and Wastewater, 24th Edition, 4500-Cl^- Mercury Thiocyanate Method

REQUIRED REAGENTS

Code	Description	Quantity
HI96793-0	Chloride Reagent	6 mL
HI96794V-0*	Chloride High Range Reagent Vial	2 vials

*Reagent vial identification: blue label

REAGENT SETS

HI96794-25 Reagents for 24 tests

For other accessories see the Accessories section.

***Note**: Store the unused vials in their packaging, between 15 and 25 °C.*
Storage between 2 and 8 °C can extend the reagent life up to 6 months beyond the expiration date.

PRINCIPLE

Chloride ions in the sample react with mercury thiocyanate, forming mercury chloride (HgCl2). The displaced thiocyanate ions then react with iron(III) to produce a red-colored iron(III) thiocyanate complex. The intensity of the red color is proportional to the chloride concentration and is measured photometrically.

APPLICATION

Testing chloride ions in following aqueous matrices: surface water, drinking water, wastewater

ATTENTION

For samples with an expected chloride concentration below 100 ppm, use of HI96793-25 reagent is recommended to ensure greater measurement precision and consistent analytical results.
The pH of the water sample must be between 3 pH and 10 pH. Adjust the pH if necessary. The sample pH after reagent addition should be < 2 pH.
The method performs accurately when the sample temperature is between 20 °C and 25°C.
The sample should be analyzed as soon as possible after it has been collected.
When working with intensely colored samples, adequately treat the samples before testing. Filter turbid samples.
In some cases, interferences can be eliminated using appropriate dilutions so that interfering ions fall below the maximum tolerable concentration and Cl^- remains within the measurement range.

SIGNIFICANCE & USE

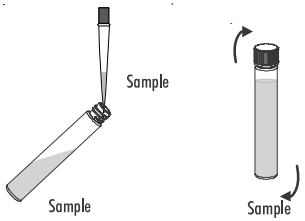
Chloride is a naturally occurring ion found in water, soil, and living organisms.
It enters the environment through salt dissolution, industrial discharge, and agricultural activities.
Monitoring chloride levels is essential for assessing water quality, detecting contamination, and ensuring compliance in industries such as food, pharmaceuticals, and chemical production.

MEASUREMENT PROCEDURE

Reagent Blank Correction: This method requires reagent blank correction. A single blank vial can be reused for up to one day if kept at room temperature (dark storage) or for up to three days if kept in a refrigerator. If refrigerated, allow the vial to reach room temperature before measurement. For improved accuracy, always use the same lot of reagents for blank and samples.

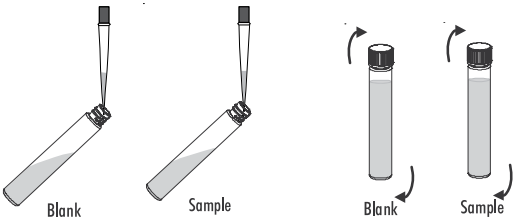
- Select the Chloride HR (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Remove the cap from one HI96794V-0 Chloride High Range Reagent Vial.

- Add 0.1 mL of sample to the vial (#2), while keeping the vial at a 45-degree angle.
- Replace the cap and invert gently approximately 15 times to mix.

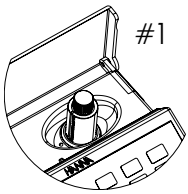


***Note**: Blank vial (#1) does not require preparation until this step.*

- Add slowly 3 mL of HI96793-0 Chloride Reagent to the first vial (#1) and to the second vial (#2), while keeping the vials at a 45-degree angle.
- Replace the cap and invert gently approximately 15 times to mix.

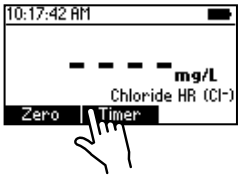


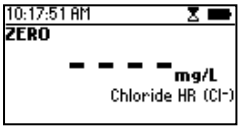
- Insert the blank vial (#1) into the adapter.

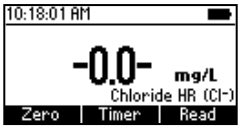


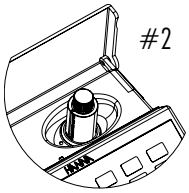
- Press **Timer** and the display will show the countdown prior to the zero reading or wait 3 minutes and press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.

  ***Note**: After the 3-minute waiting period if entrapped air bubbles are present, gently invert the vial to facilitate their dissipation.*

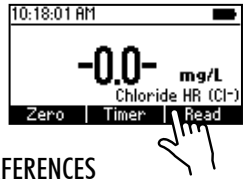


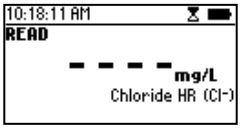


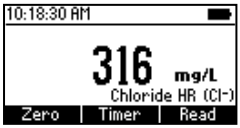




- Remove the blank vial.
- Insert the sample vial (#2) into the adapter.
- Press **READ** to start the measurement. The instrument displays the results in **mg/L** of **chloride (Cl^-)**.







INTERFERENCES

Interference may be caused by:

- Nitrate ($NO3^-$) 50000 mg/L
- Sulfate (SO_4^{2-}) 10000 mg/L
- Copper (Cu^{2+}), Cr (III), Nickel (Ni^{2+}), Zinc (Zn^{2+}) 1000 mg/L
- Sulfides (S^{2-}) 50 mg/L
- Cr (VI) 40 mg/L

Turbidity, color can affect both measurement and speed of color development.
Interferences checked individually in solution containing 400 mg/L of Cl^-.
The cumulative effects have not been determined but cannot be excluded.
The determination is not known to have interfered with higher-concentration levels of foreign substances given above.
Bromides and iodides, commonly present in many mineral waters, undergo the same reaction, leading to high-bias results.
Additionally, substances that form colored complexes with iron (III) salts interfere with the determination.

9.8. 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

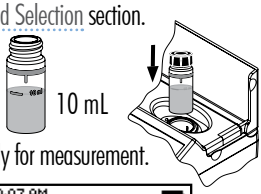
REAGENT SETS

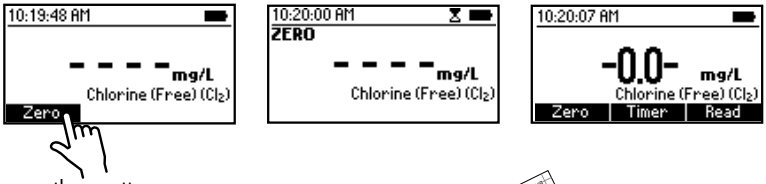
HI93701-F	Reagents for 300 tests (liquid)
HI93701-01	Reagents for 100 tests (powder)
HI93701-03	Reagents for 300 tests (powder)

For other accessories see the Accessories section.

MEASUREMENT PROCEDURE

- Select the Chlorine (Free) method using the procedure described in the Method Selection section.
- Fill the cuvette with 10 mL of unreacted sample (up to the mark). Replace the plastic stopper and the cap.
- Insert the cuvette into the holder and close the lid.
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.

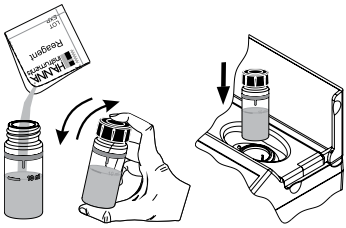




- Remove the cuvette.

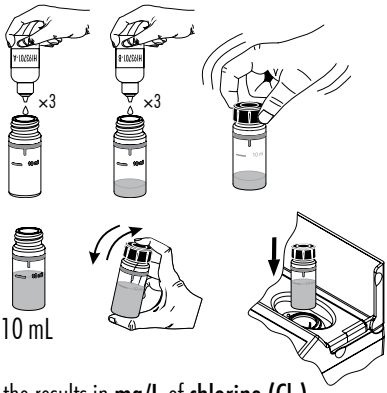
POWDER REAGENT PROCEDURE

- Add the content of one packet of HI93701-0 Free Chlorine Reagent. Replace the plastic stopper and the cap. Shake gently for 20 seconds.
- Insert the cuvette into the holder and close the lid.

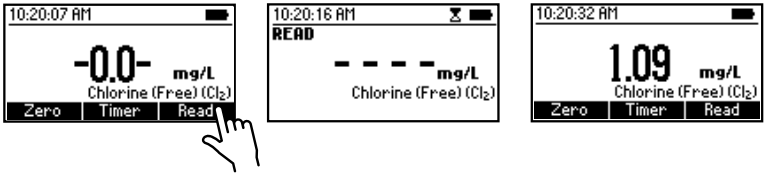


- Press **Timer** and the display will show the countdown prior to the measurement or wait 1 minute and press **Read**. When the timer ends the meter will perform the reading. The instrument displays the results in **mg/L** of **chlorine (Cl_2)**.

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.
- Replace the plastic stopper and the cap. Swirl gently to mix.
- Add unreacted sample up to the 10 mL mark. Replace the plastic stopper and the cap. Shake gently.
- Insert the cuvette into the holder 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, Oxidized forms of Chromium and Manganese, Ozone
- Hardness greater than 500 mg/L $CaCO_3$, to remove the interference shake the sample for approximately 2 minutes after adding the powder reagent
- Alkalinity 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 rapidly fade, to remove the interference neutralize the sample with diluted HCl or NaOH

9.9. 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

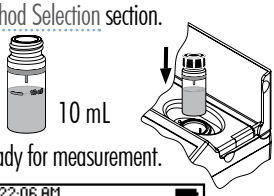
REAGENT SETS

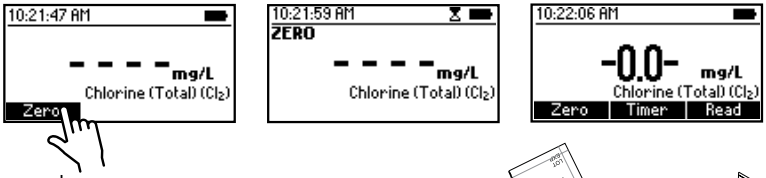
HI93701-T	Reagents for 300 tests (liquid)
HI93711-01	Reagents for 100 total tests (powder)
HI93711-03	Reagents for 300 total tests (powder)

For other accessories see the Accessories section.

MEASUREMENT PROCEDURE

- Select the Chlorine (Total) method using the procedure described in the Method Selection section.
- Fill the cuvette with 10 mL of unreacted sample (up to the mark). Replace the plastic stopper and the cap.
- Insert the cuvette into the holder and close the lid.
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.

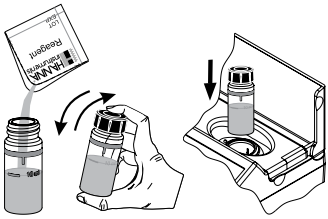




- Remove the cuvette.

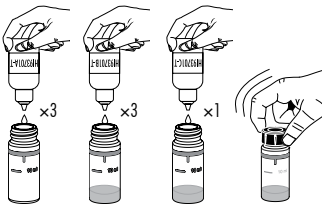
POWDER REAGENT PROCEDURE

- Add 1 packet of HI93711-0 Total Chlorine Reagent. Replace the plastic stopper and the cap. Shake gently for 20 seconds.
- Insert the cuvette into the holder and close the lid.

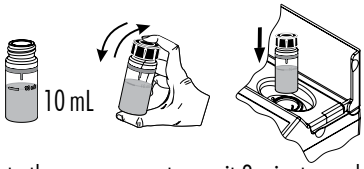


- Press **Timer** and the display will show the countdown prior to the measurement or wait 2 minutes and 30 seconds and press **Read**. When the timer ends the meter will perform the reading. The instrument displays the results in **mg/L** of **chlorine (Cl_2)**.

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.
- Replace the plastic stopper and the cap. Swirl gently to mix.
- Add unreacted sample up to the 10 mL mark.
  Replace the plastic stopper and the cap. Shake gently.
- Insert the cuvette into the holder and close the lid.



- Press **Timer** and the display will show the countdown prior to the measurement or wait 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, Oxidized forms of Chromium and Manganese, Ozone
- Hardness greater than 500 mg/L $CaCO_3$, to remove the interference shake the sample for approximately 2 minutes after adding the powder reagent
- Alkalinity greater than 250 mg/L $CaCO_3$ or acidity greater than 150 mg/L $CaCO_3$, the color of the sample may develop only partially or may rapidly fade, to remove the interference neutralize the sample with diluted HCl or NaOH

9.10. CHROMIUM(VI)/TOTAL (16 mm VIAL)

SPECIFICATIONS

Range	0 to 1000 µg/L (as Cr)
Resolution	1 µg/L
Accuracy	±10 µg/L ± 3 % of reading
Light Source	LED with narrow band interference filter @ 525 nm
Method	Adaptation of the Standard Methods of the Examination of Water and Wastewater, 22nd Edition, 3500-Cr, Diphenylcarbazide Method

REQUIRED REAGENTS

Code	Description	Quantity
HI96781V-0*	Chromium Digestion Vial	1 vial
HI96781A-0	Chromium Reagent A	1 packet
HI96781B-0	Chromium Reagent B	1 packet

*Reagent vial identification: red label

REAGENTS SETS

HI96781-25 Reagent for 25 tests

For other accessories see the Accessories section.

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

PRINCIPLE

The chromium in the sample is oxidized to hexavalent chromium during digestion. The hexavalent chromium reacts with the Diphenylcarbazide to form a red color proportional to the amount of chromium in the sample. This method has a strong temperature and pH dependence. The sample temperature must be between 18 and 22 °C (64.4 and 71.6 °F) and the pH between 3 and 9.

APPLICATION

Water, wastewater, process control

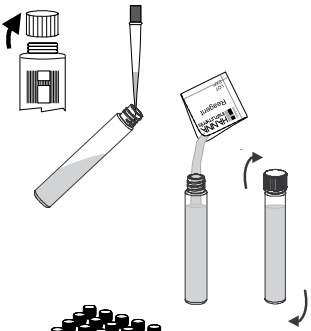
SIGNIFICANCE & USE

Chromium(III) is an essential element for humans and can be metabolized in the body. Chromium(III) is found naturally in fruit, vegetables, meat and grains. Chromium(VI) has been identified as a carcinogen and can alter genetic material. Chromium(VI) is discharged from steel and paper mills or through the oxidation of chromium(III). Chromium(VI) has been a regulated drinking water contaminate since the 1940s, the US EPA only regulates total chromium.

MEASUREMENT PROCEDURE
CHROMIUM TOTAL

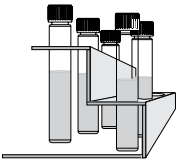
Before using the reagent kit carefully read all the instructions and the Safety Data Sheets (SDS). Pay particular attention to all warnings, cautions and notes. Failure to do so may result in serious injury to the operator.
The acidification of the sample may result in the release of toxic gas, such as cyanides and sulfides. Sample preparation and digestion should be done in a fume hood.

- Preheat the Hanna® Reactor HI839800 to 105 °C (221 °F).
  Use of the supplied HI740217 safety shield is strongly recommended.
  ***Warning**: Do not use an oven or microwave! Samples may leak and generate a corrosive and possibly explosive atmosphere.*

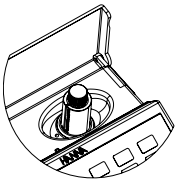


- Remove the cap from a HI96781V-0 Chromium Digestion Vial.
- Add 5 mL of sample to the vial, while keeping the vial at a 45-degree angle.
- Add one packet of HI96781A-0 Chromium Reagent A to the vial. Replace the cap and invert for 30 seconds.

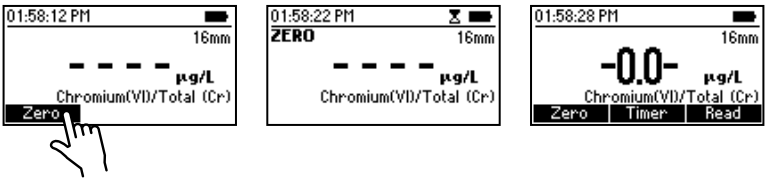
- Insert the vial into the reactor and heat it for 60 minutes at 105 °C (221 °F).



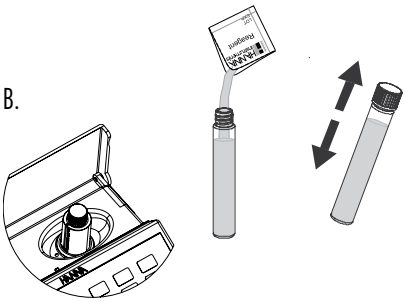
- At the end of the digestion period switch off the reactor. Allow the vials to cool to room temperature. Invert each vial several times and place them in the test tube rack.
- Select the Chromium(VI)/Total(16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.



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



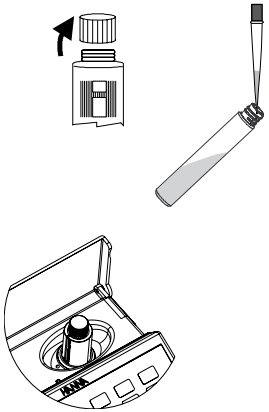
- Remove the vial.
- Add one packet of HI96781B-0 Chromium Reagent B. Replace the cap and shake vigorously for 1 minute.
- Place the vial into the holder.



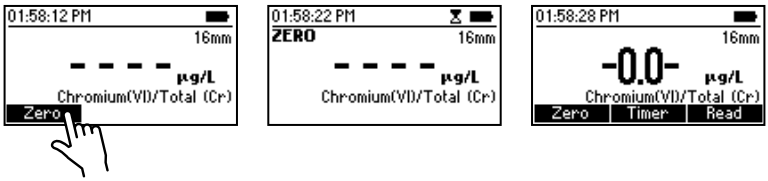
- Press **Timer** and the display will show the countdown prior to the measurement or wait 6 minutes and press **Read**. The instrument displays the result in µg/L of **chromium (Cr)**.

CHROMIUM(VI)

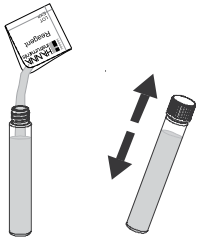
- Remove the cap from a HI96781V-0 Chromium Digestion Vial.
- Add 5 mL of sample to the vial, while keeping the vial at a 45-degree angle. Replace the cap and invert several times to mix.
- Select the Chromium(VI)/Total(16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Place the vial into the holder.



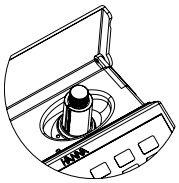
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



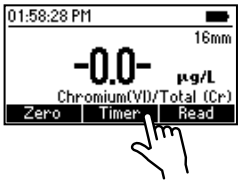
- Remove the cap and add one packet of HI96781B-0 Chromium Reagent B. Replace the cap and shake vigorously for 1 minute.

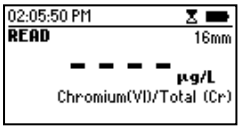


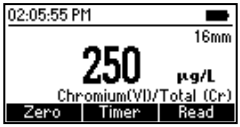
- Place the vial into the holder.



- Press **Timer** and the display will show the countdown prior to the measurement or wait 6 minutes and press **Read**. The instrument displays the result in µg/L of **chromium (Cr)**.







- To determine the Chromium(III) concentration, subtract the results from the Chromium(VI) procedure from the Chromium Total procedure.

INTERFERENCES

Interferences may be caused by:

- Large amounts of iron, copper or reducing and oxidizing agents yield falsely low readings
- Nitrate, Potassium, Sulfate above 2000 mg/L
- Chloride, Sodium above 1000 mg/L
- Calcium above 125 mg/L
- Ammonium, Magnesium above 100 mg/L
- Nickel, Zinc above 25 mg/L
- Copper, Iron above 10 mg/L

9.11. 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 at 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 420 nm
Method	Adaptation of the US EPA 410.4 Approved Method for the COD Determination on Surface Waters and Wastewaters

REQUIRED REAGENTS

EPA REAGENT

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

MERCURY FREE REAGENT

Code	Description	Quantity
HI93754D-0*	COD Low Range Hg Free Reagent Vial	2 vials
DEIONIZED120	Deionized Water	2 mL

ISO REAGENT

Code	Description	Quantity
HI93754F-0*	COD Low Range ISO Reagent Vial	2 vials
DEIONIZED120	Deionized Water	2 mL

* Reagent vial identification: red label

REAGENT SETS

HI93754A-25	Reagents EPA Low Range for 24 tests
HI93754D-25	Reagents Hg Free Low Range for 24 tests
HI93754F-25	Reagents ISO Low Range for 24 tests

For other accessories see the Accessories section.

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

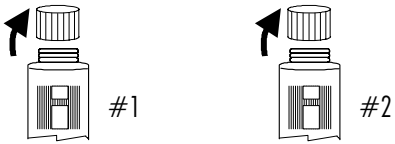
MEASUREMENT PROCEDURE

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.

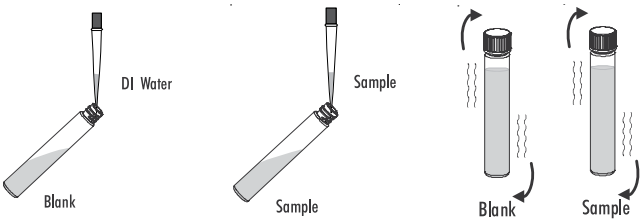
- Choose a homogeneous sample. Samples containing solids capable of settling need to be homogenized with a blender.
- Preheat the Hanna® Reactor HI839800 to 150 °C (302 °F).
  Use of the supplied HI740217 safety shield is strongly recommended.

  ***Warning**: Do not use an oven or microwave; samples may leak and generate a corrosive and possibly explosive atmosphere.*
- Remove the cap from two COD Low Range Reagent Vials.

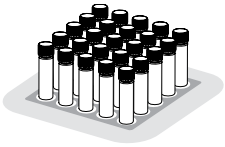


- Add 2 mL of deionized water to the first vial (#1) and 2 mL of sample to the second vial (#2), while keeping the vials at a 45-degree angle. Replace the caps and invert several times to mix.

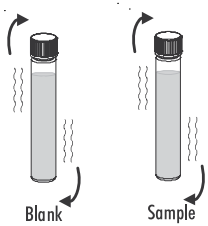
  ***Warning**: The vials will become hot during mixing, use caution when handling.*



- Insert the vials into the reactor and heat them for 2 hours at 150 °C (302 °F).

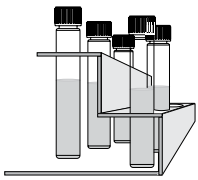


- At the end of the digestion period switch off the reactor. Wait 20 minutes to allow the vials to cool to about 120 °C (248 °F).



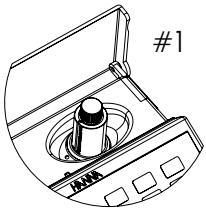
- Invert each vial several times while still warm, then place them in the test tube rack.

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

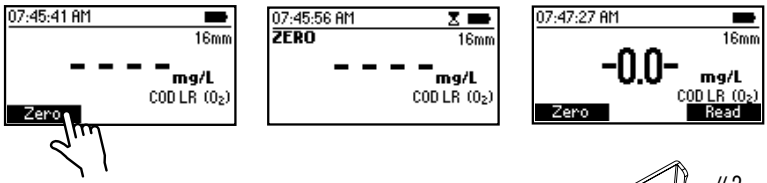


- Leave the vials in the tube rack to cool to room temperature. Do not shake or invert them, the samples may become turbid.

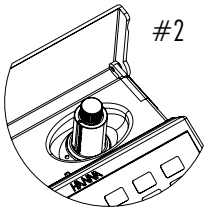
- Select COD LR (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Insert the blank vial (#1) into the holder.



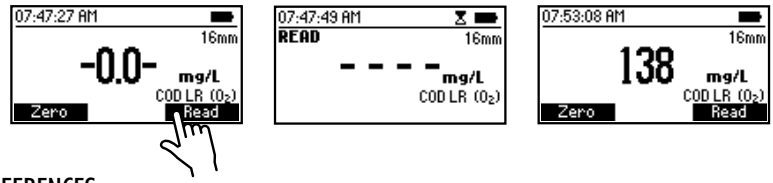
- Press **Zero**. The display will show -0.0- when the meter is zeroed and ready for measurement.



- Remove the vial.
- Insert 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 above 2000 mg/L, samples with higher chloride concentration should be diluted
- Chloride must be absent for Mercury Free Reagent

9.12. 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 at 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 610 nm
Method	Adaptation of the US EPA 410.4 Approved Method for the COD Determination on Surface Waters and Wastewaters

***Note**: Range is reduced to 1000 mg/L (as O_2) when HI93754G-25 reagents are used.*

REQUIRED REAGENTS

EPA REAGENT

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

MERCURY FREE REAGENT

Code	Description	Quantity
HI93754E-0*	COD Medium Range Hg Free Reagent Vial	2 vials
DEIONIZED120	Deionized Water	2 mL

ISO REAGENT

Code	Description	Quantity
HI93754G-0*	COD Medium Range ISO Reagent Vial	2 vials
DEIONIZED120	Deionized Water	2 mL

* Reagent vial identification: white label

REAGENT SETS

HI93754B-25	Reagents EPA Medium Range for 24 tests
HI93754E-25	Reagents Hg Free Medium Range for 24 tests
HI93754G-25	Reagents ISO Medium Range for 24 tests

For other accessories see the Accessories section.

***Note**: Store the unused vials in their packaging 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

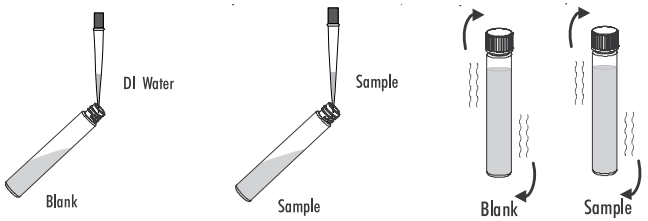
measurement, run a blank for each set of measurements and always use the same lot of reagents for blank and samples.

- 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 supplied HI740217 safety shield is strongly recommended.

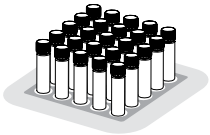
  ***Warning**: Do not use an oven or microwave; samples may leak and generate a corrosive and possibly explosive atmosphere.*
- Remove the cap from two COD Medium Range Reagent Vials.

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

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

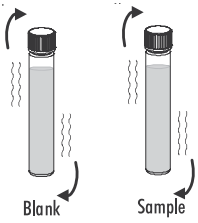


- Insert the vials into the reactor and heat them for 2 hours at 150 °C (302 °F).

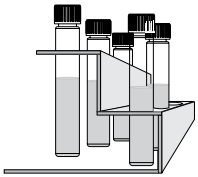


- At the end of the digestion period switch off the reactor. Wait 20 minutes to allow the vials to cool to about 120 °C (248 °F).
- Invert each vial several times while still warm, then place them in the test tube rack.

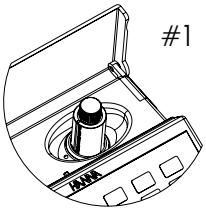
  ***Warning**: The vials are still hot, use caution when handling.*



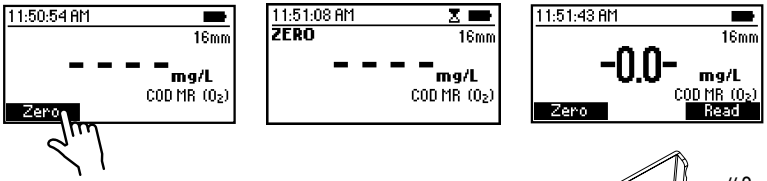
- Leave the vials in the tube rack to cool to room temperature. Do not shake or invert them, the samples may become turbid.

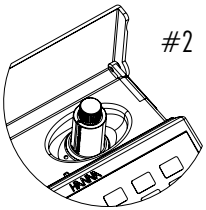


- Select COD MR (16) method using the procedure described in the Method Selection section.

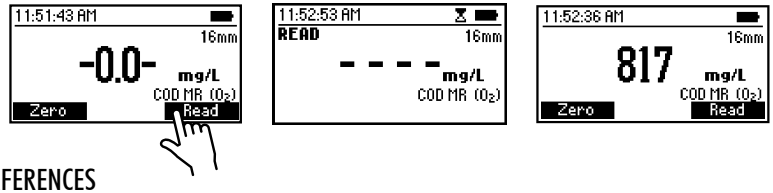


- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Insert the blank vial into the holder.
- Press **Zero.** The display will show -0.0- when the meter is zeroed and ready for measurement.





- Remove the vial.
- Insert 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 above 2000 mg/L, samples with higher chloride concentration should be diluted
- Chloride must be absent for Mercury Free Reagent

9.13. 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 at 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 610 nm
Method	Adaptation of the US EPA 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: green label

REAGENT SETS

HI93754C-25 Reagents COD High Range for 24 tests

For other accessories see the Accessories section.

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

MEASUREMENT PROCEDURE

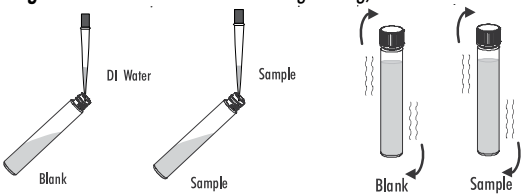
Before using the reagent kit carefully read all the instructions and the Safety Data Sheets (SDS). Pay particular attention to all warnings, cautions and notes. Failure to do so may result in serious injury to the operator.

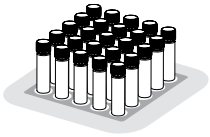
Reagent Blank Correction: This method requires a reagent blank correction. A single blank vial may be used more than once. The blank vial is stable for several months at room temperature. For improved accuracy measurement, run a blank for each set of measurements and always use the same lot of reagents 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 supplied HI740217 safety shield is strongly recommended.

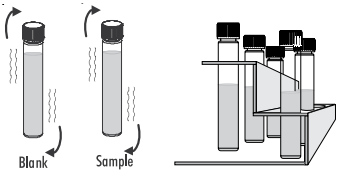
  ***Warning**: Do not use an oven or microwave, samples may leak and generate a corrosive and possibly explosive atmosphere.*
- Remove the cap from two COD High Range Reagent Vials.

- 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 caps and invert several times to mix.
  ***Warning**: The vials will become hot during mixing, use caution when handling.*

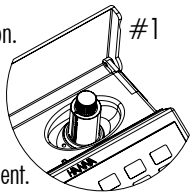


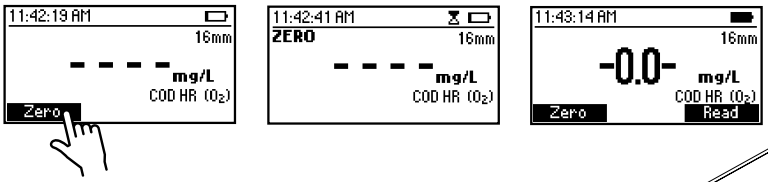


- Insert the vials into the reactor and heat them for 2 hours at 150 °C (302 °F).
- At the end of the digestion period switch off the reactor. Wait 20 minutes to allow the vials to cool to about 120 °C (248 °F).
- Invert each vial several times while still warm, then place them in the test tube rack.
  ***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.

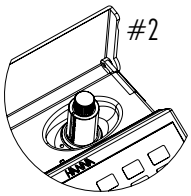


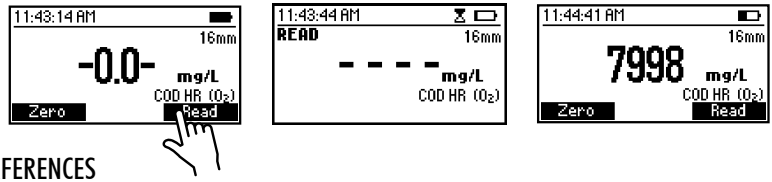
- Select COD HR (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Insert the blank vial (#1) into the holder.
- Press **Zero**. The display will show -0.0- when the meter is zeroed and ready for measurement.





- Remove the vial.
- Insert 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 above 20000 mg/L, samples with higher chloride concentration should be diluted

9.14. CHEMICAL OXYGEN DEMAND, ULTRA HIGH RANGE (16 mm VIAL)

SPECIFICATIONS

Range	0 to 60.0 g/L (as O_2)
Resolution	0.1 g/L
Accuracy	±0.5 g/L ±3 % of reading at 25 °C
Light Source	LED with narrow band interference filter @ 610 nm
Method	Adaptation of the US EPA 410.4 Approved Method for the COD Determination on Surface Waters and Wastewaters

REQUIRED REAGENTS

Code	Description	Quantity
HI93754J-0*	COD Ultra High Range Reagent Vial	2 vials
DEIONIZED120	Deionized Water	0.1 mL

* Reagent vial identification: blue label

REAGENT SETS

HI93754J-25 Reagents COD Ultra High Range for 24 tests

For other accessories see the Accessories section.

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

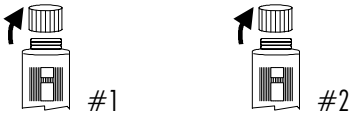
MEASUREMENT PROCEDURE

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.

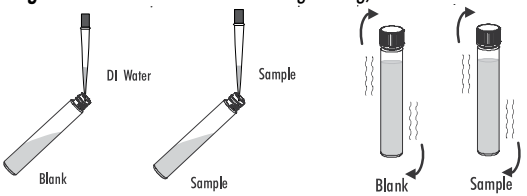
Reagent Blank Correction: This method requires a reagent blank correction. A single blank vial may be used more than once. The blank vial is stable for several months at room temperature. For improved accuracy measurement, run a blank for each set of measurements and always use the same lot of reagents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

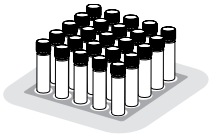
- Choose a homogeneous sample. Samples containing solids capable of settling need to be homogenized with a blender.
- Preheat the Hanna® Reactor HI839800 to 150 °C (302 °F).
  Use of the supplied HI740217 safety shield is strongly recommended.

  ***Warning**: Do not use an oven or microwave, samples may leak and generate a corrosive and possibly explosive atmosphere.*
- Remove the cap from two COD Ultra High Range Reagent Vials.

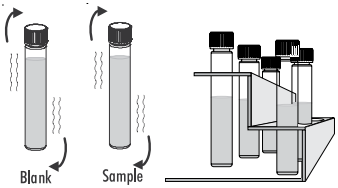


- Add 0.1 mL of deionized water to the first vial (#1) and 0.1 mL of sample to the second vial (#2), while keeping the vials at a 45-degree angle. Replace the caps and invert several times to mix.
  ***Warning**: The vials will become hot during mixing, use caution when handling.*

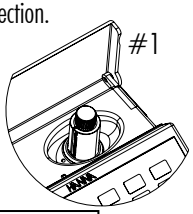


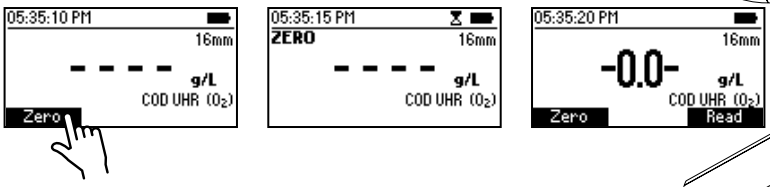


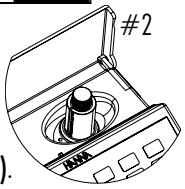
- Insert the vials into the reactor and heat them for 2 hours at 150 °C (302 °F).
- At the end of the digestion period, switch off the reactor. Wait 20 minutes to allow the vials to cool to about 120 °C (248 °F).
- Invert each vial several times while still warm, then place them in the test tube rack.
  ***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.



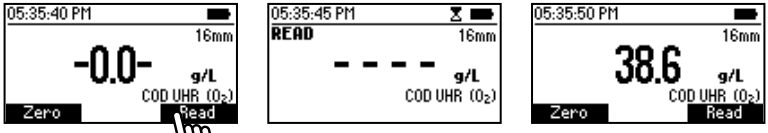
- Select COD UHR (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Insert the blank vial (#1) into the holder.
- Press **Zero**. The display will show -0.0- when the meter is zeroed and ready for measurement.







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



INTERFERENCES

Interference may be caused by:

- Chloride above 20000 mg/L, samples with higher chloride concentration should be diluted

9.15. IRON (16 mm VIAL)

SPECIFICATIONS

Range	0.00 to 6.00 mg/L (as Fe)
Resolution	0.01 mg/L
Accuracy	±0.10 mg/L or ± 3 % of reading at 25 °C
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
HI96786V-0	Iron Reagent Vial	1 vial
HI96786-0	Iron Powder Reagent	1 packet

REAGENTS SETS

HI96786-25 Reagents for 25 tests

For other accessories see the Accessories section.

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

PRINCIPLE

Ferrous iron (Fe^{2+}) reacts with 1,10-phenanthroline to form an orange - red colored complex.
All Fe^{3+} dissolved and not complexed or chelated is converted to ferrous iron (Fe^{2+}).

APPLICATION

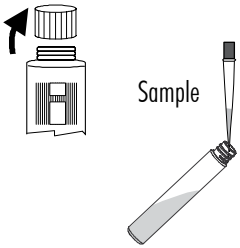
Surface water, drinking water, groundwater, process control, wastewater, pool water

SIGNIFICANCE & USE

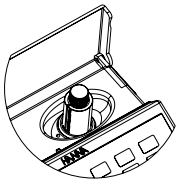
Iron is an abundant, naturally-occurring element found in soils, streams, surface water and groundwater. High levels of iron in drinking water can cause objectionable taste and can stain plumbing and laundry. Iron in drinking water and wastewater is regulated by the EPA and other regulatory bodies.

MEASUREMENT PROCEDURE

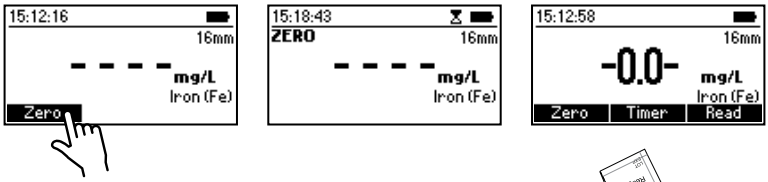
- Select the Iron (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Remove the cap from a HI96786V-0 Iron Reagent Vial.
- Add 5 mL of sample to the vial, while keeping the vial at a 45-degree angle.
  Replace the cap and invert several times to mix.



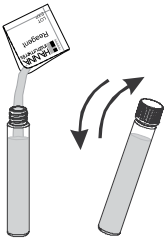
- Insert the HI96786V-0 vial into the holder.



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

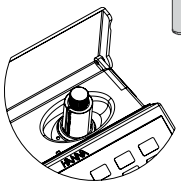


- Remove the vial from the meter.



- Remove the cap and add one packet of HI96786-0 Iron Powder Reagent.
- Replace the cap and shake until powder is dissolved.
- Wipe the vial thoroughly with HI731318 or a lint-free cloth prior to insertion.

- Insert the vial into the holder.



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

INTERFERENCES

Interference may also be caused by:

- Chloride above 185000 mg/L
- Hardness Magnesium above 100000 mg/L $CaCO_3$
- Hardness Calcium above 10000 mg/L $CaCO_3$
- Molybdate Molybdenum above 50 mg/L

9.16. 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: red label

REAGENTS SETS

HI96778-25 Reagents for 25 tests

For other accessories see the Accessories section.

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

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 & 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 or 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

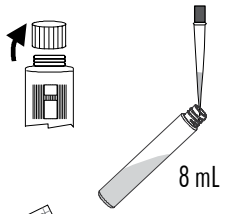
- The acidification of samples containing reactive materials may result in the release of toxic gases, such as cyanides or sulfides; the preparation of sample and the digestion should be done in a fume hood. Safety data sheets for all chemical reagents should be read and understood by all personnel

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). Use of the supplied HI740217 safety shield is strongly recommended.

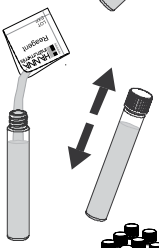
  ***Warning**: Do not use an oven or microwave; samples may leak and generate a corrosive and possibly explosive atmosphere.*

MEASUREMENT PROCEDURE



- Remove the cap from a HI96778V-0 Digestion Vial.
- Add 8 mL of sample to the vial, while keeping the vial at a 45-degree angle. Replace the cap and invert several times to mix.

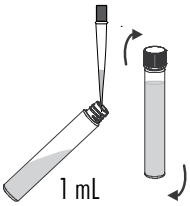
  ***Warning**: The vials will become hot during mixing, use caution when handling.*



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

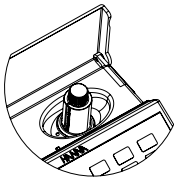
- Insert the vial into the reactor and heat it for 30 minutes at 150 °C.
- At the end of the digestion switch off the reactor. Allow the vials to cool to room temperature. Invert each vial several times and place them in the test tube rack.

- Select the Iron (Total) (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.



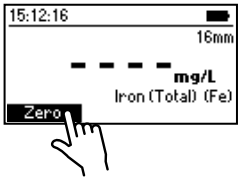
- Remove the cap from the vial and add 1 mL of HI96778A-0 Total Iron Reagent A, while keeping the vial at a 45-degree angle.
- Replace the cap and invert the vial several times to mix.

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

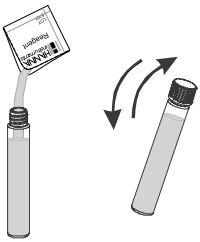


- Insert the vial into the holder.

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



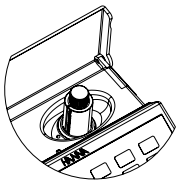
- Remove the vial from the meter.



***Note**: The temperature of the vial must be between 18 and 22 °C (64.4 and 71.6 °F) before continuing.*

- Remove the cap and add one packet of HI96778B-0 Total Iron Reagent B.
- Replace the cap and shake gently for 30 seconds.

- Insert the vial into the holder.



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

INTERFERENCES

Interference may also be caused by:

- Chloride above 185000 mg/L
- Magnesium above 100000 mg/L $CaCO_3$
- Calcium above 10000 mg/L $CaCO_3$
- Molybdate Molybdenum above 50 mg/L
- High pH or highly buffered samples the pH must be less than 1 after adding the sample to digestion vial, after addition of HI96778A-0 Total Iron Reagent A, the pH must be 3.8 to 5.5
- If turbidity forms after digestions, filter the sample
- Samples containing suspended solids need to be homogenized before digestion

9.17. NITRATE (16 mm VIAL)

SPECIFICATIONS

Range	0.0 to 30.0 mg/L (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: white label

REAGENT SETS

HI93766-50 Reagents for 50 tests

For other accessories see the Accessories section.

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

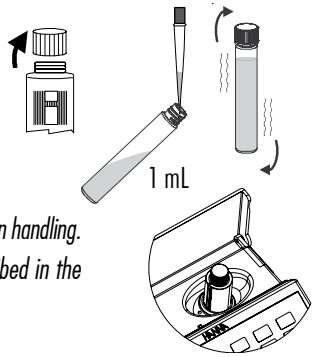
MEASUREMENT PROCEDURE

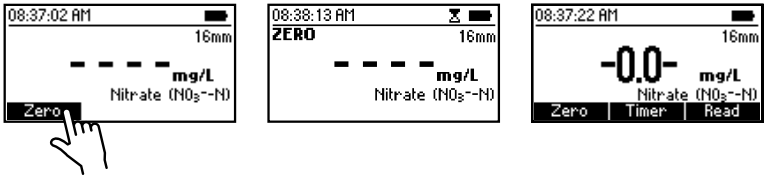
Before using the reagent kit carefully read all the instructions and the Safety Data Sheets (SDS). Pay particular attention to all warnings, cautions and notes. Failure to do so may result in serious injury to the operator.

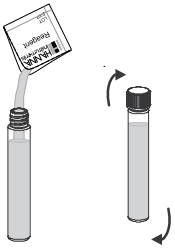
- Select the Nitrate (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Remove the cap from a HI93766V-0 Nitrate Reagent Vial.
- Add 1 mL of sample to the vial, while keeping the vial at a 45-degree angle.
- Replace the cap and invert the vial 10 times. This is the blank.

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

  ***Note**: The method is technique sensitive. See procedure described in the Cuvette Preparation section for proper mixing technique.*
- Insert the vial into the holder.
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.

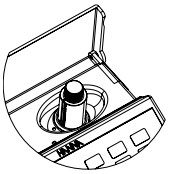






- Remove the vial.
- Add one packet of HI93766-0 Nitrate Reagent.
- Replace the cap and invert the vial 10 times.

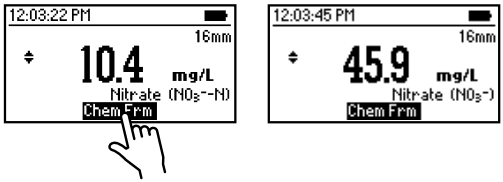
***Note**: The method is technique sensitive. See procedure described in the Cuvette Preparation section for proper mixing technique.*



- Insert the vial into the holder.

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

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



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

INTERFERENCES

Interference may be caused by:

- Chloride above 1000 mg/L
- For samples containing up to 100 mg/L nitrite, add 400 mg of urea to 10 mL of sample, mix until completely dissolved, then proceed with the usual measurement procedure
- Nitrite above 50 mg/L
- Barium above 1 mg/L

9.18. NITRITE, SEAWATER (16 mm VIAL)

SPECIFICATIONS

Range	0 to 600 µg/L (as NO_2^--N)
Resolution	1 µg/L
Accuracy	±15 µg/L ±5 % of reading at 25 °C
Light Source	LED with narrow band interference filter @ 525 nm
Method	Adaptation of the Standard Method for the Examination of Water and Wastewater, 23rd Edition, 4500 B Diazotization Method, Nitrogen Nitrite

REQUIRED REAGENTS

Code	Description	Quantity
HI96789V-0*	Nitrite in Seawater Reagent Vial	1 vial
HI96789-0	Nitrite in Seawater Reagent for Vial	1 packet

* Reagent vial identification: red label

REAGENT SETS

HI96789-25 Reagents for 25 tests

For other accessories see the Accessories section.

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

PRINCIPLE

Nitrite is determined through formation of a reddish-purple azo dye produced at acidic solution by coupling diazotized sulfanilamide with aromatic amines.

APPLICATION

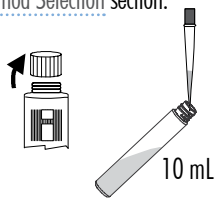
Seawater

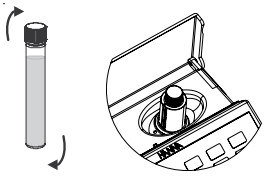
SIGNIFICANCE & USE

Nitrite is an intermediate oxidation state of nitrogen, occurring both during the oxidation of ammonia to nitrate and the reduction of nitrate; and it is part of the "nitrogen cycle".
Nitrite can follow various pathways in the ocean, and many organisms can absorb nitrite through their intestines. In the ocean, nitrite concentration typically varies from very low levels to about 0.2 ppm. Although nitrite in seawater is not directly toxic, disturbances in the nitrogen cycle can lead to further problems.

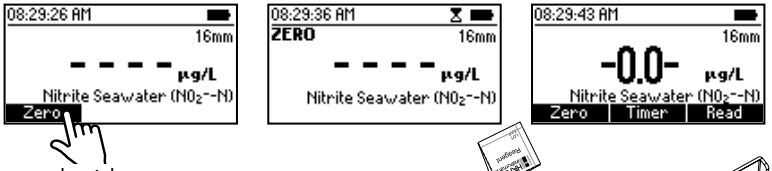
MEASUREMENT PROCEDURE

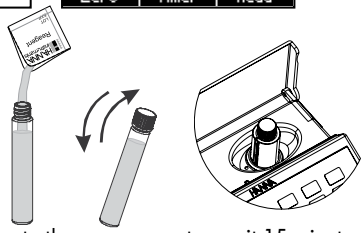
- Select the Nitrite Seawater (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Remove the cap from a HI96789V-0 Nitrite in Seawater Reagent Vial.
- Add 10 mL of sample to the vial, while keeping the vial at a 45-degree angle.





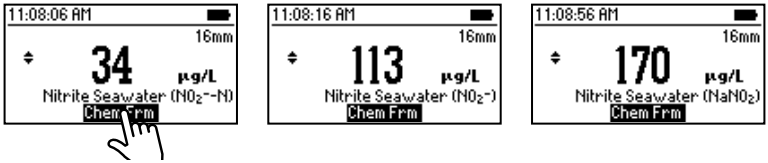
- Replace the cap and invert several times to mix. This is the blank.
- Insert the vial into the adapter.
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.





- Remove the vial.
- Remove the cap and add one packet of HI96789-0 Nitrite in Seawater Reagent.
- Replace the cap and shake gently for 90 seconds to mix.
- Insert the vial into the adapter.
- Press **Timer** and the display will show the countdown prior to the measurement or wait 15 minutes and press **Read.** The instrument displays the concentration in µg/L of **nitrite-nitrogen (NO_2^--N).**

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



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

INTERFERENCES

The kit has been tested with the following matrix: Synthetic Sea Water, ASTM D665.
Interference may be caused by:

- Chloride (Cl^-) above 24000 mg/L
- Sodium (Na) above 10000 mg/L
- Sulfate (SO_4^{2-}) above 3000 mg/L
- Magnesium (Mg^{2+}) above 2500 mg/L
- Calcium (Ca^{2+}) above 500 mg/L
- Potassium (K) above 400 mg/L
- Carbonate (CO_3^{2-}) above 145 mg/L
- Bromide (Br^-) above 70 mg/L
- Strontium (Sr^-) above 13 mg/L
- Boron (B) above 5.34 mg/L
- Fluoride (F^-) above 1.35 mg/L

9.19. 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

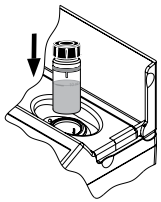
HI93707-01	Reagents for 100 tests
HI93707-03	Reagents for 300 tests

For other accessories see the Accessories section.

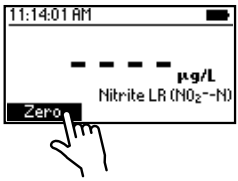
MEASUREMENT PROCEDURE

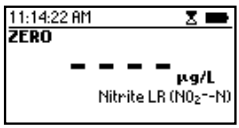
- Select the Nitrite LR method using the procedure described in the Method Selection section.
- Fill the cuvette with 10 mL of unreacted sample (up to the mark). Replace the plastic stopper and the cap.

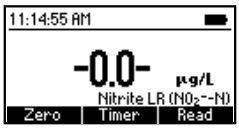
- Insert the cuvette into the holder and close the lid.



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

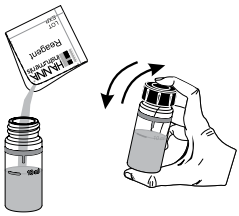




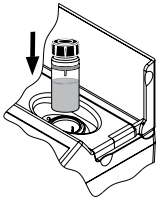


- Remove the cuvette.

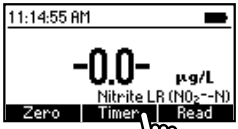
- Add one packet of HI93707-0 Nitrite Low Range Reagent.
- Replace the plastic stopper and the cap. Shake gently for about 15 seconds.

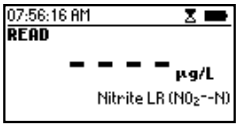


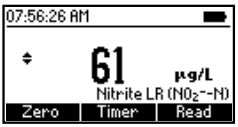
- Insert the cuvette into the holder and close the lid.



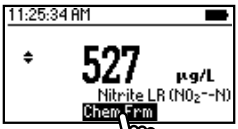
- Press **Timer** and the display will show the countdown prior to the measurement or wait 15 minutes and press **Read**. When the timer ends the meter will perform the reading. The instrument displays concentration in µg/L of **nitrite-nitrogen (NO_2^--N)**.

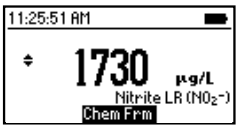


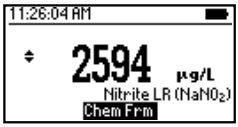




- Press the ▲ or ▼ key to access the second level functions.
- Press **Chem Frm** to convert the result to µg/L of **nitrite (NO_2^-)** and **sodium nitrite ($NaNO_2$)**.







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

INTERFERENCES

Interference may be caused by:

- Antimonious, Auric, Bismuth, Chloroplatinate ions, Cupric, Iron (Ferric), Iron (Ferrous), Lead, Mercurous, Silver, Strong reducing or oxidating agents
- Nitrate above 100 mg/L could yield falsely high readings

9.20. NITRITE LOW RANGE (16 mm VIAL)

SPECIFICATIONS

Range	0 to 600 µg/L (as NO^-_2-N)
Resolution	1 µg/L
Accuracy	±10 µg/L ± 3 % of reading at 25 °C
Light Source	LED with narrow band interference filter @ 525 nm
Method	Adaptation of the Standard Method for the Examination of Water and Wastewater, 23rd Edition, 4500B Diazotization Method, Nitrogen Nitrite

REQUIRED REAGENTS

Code	Description	Quantity
HI96783V-0*	Nitrite Low Range Reagent Vial	1 vial
HI96783-0	Nitrite Low Range Reagent for Vial	1 packet

*Reagent vial identification: green label

REAGENTS SETS

HI96783-25 Reagent for 25 tests

For other accessories see the Accessories section.

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

PRINCIPLE

Nitrite is determined through formation of a reddish purple azo dye produced in acidic solution by coupling diazotized sulfanilamide with aromatic amines.

APPLICATION

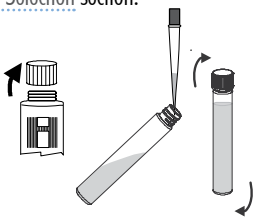
Wastewater, drinking water, surface water, mineral water, groundwater

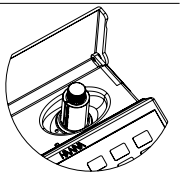
SIGNIFICANCE & USE

Nitrite is an intermediate oxidation state of nitrogen, both in the oxidation of ammonia to nitrate and in the reduction of nitrate. Such oxidation and reduction may occur in wastewater treatment plants, water distribution systems and natural waters. Nitrite can enter a water supply system through its use as a corrosion inhibitor in industrial process water. Nitrite changes the normal form of hemoglobin, which carries oxygen through blood to the rest of the body, into a form called methemoglobin that cannot carry oxygen.

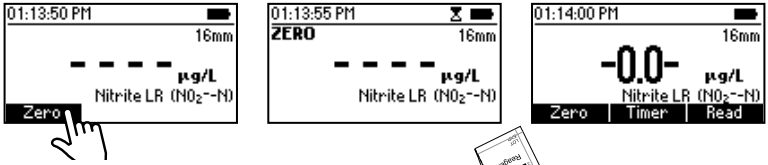
MEASUREMENT PROCEDURE

- Select the Nitrite LR (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Remove the cap from a HI96783V-0 Nitrite Low Range Reagent Vial.
- Add 4 mL of sample to the vial, while keeping the vial at a 45-degree angle.
- Replace the cap and invert several times to mix. This is the blank.

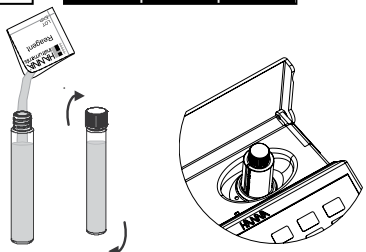




- Insert the vial into the holder.
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.

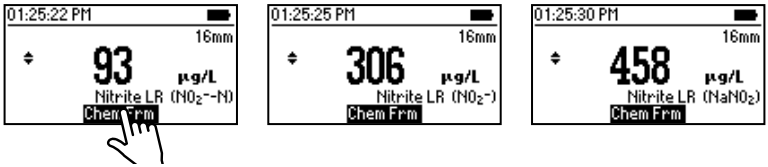


- Remove the vial.
- Remove the cap and add one packet of HI96783-0 Nitrite Low Range Reagent for Vial.
- Replace the cap and invert for 30 seconds to mix.
- Insert the vial into the holder.



- Press **Timer** and the display will show the countdown prior to the measurement or wait 10 minutes and press **Read**. The instrument displays the result in µg/L of **nitrite-nitrogen (NO^{2-}-N)**.

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



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

INTERFERENCES

The pH of the sample must be between 2.0 and 3.0 after the addition of the reagents.
Interference may be caused by:

- Chlorine, Sodium, Sulfate above 2000 mg/L
- Ammonium, Calcium, Nitrate, Phosphate, Potassium above 1000 mg/L
- Magnesium above 500 mg/L
- Copper above 100 mg/L
- Manganese, Zinc above 25 mg/L
- Nickel above 10 mg/L
- Iron above 5 mg/L

9.21. NITRITE MEDIUM RANGE (16 mm VIAL)

SPECIFICATIONS

Range	0.00 to 6.00 mg/L (as NO^-_2-N)
Resolution	0.01 mg/L
Accuracy	±0.10 mg/L ± 3 % of reading at 25 °C
Light Source	LED with narrow band interference filter @ 525 nm
Method	Adaptation of the Standard Method for the Examination of Water and Wastewater, 23rd Edition, 4500B Diazotization Method, Nitrogen Nitrite

REQUIRED REAGENTS

Code	Description	Quantity
HI96784V-0*	Nitrite Medium Range Reagent Vial	1 vial
HI96784-0	Nitrite Medium Range Reagent for Vial	1 packet

*Reagent vial identification: white label

REAGENTS SETS

HI96784-25 Reagent for 25 tests

For other accessories see the Accessories section.

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

PRINCIPLE

Nitrite is determined through formation of a reddish purple azo dye produced in acidic solution by coupling diazotized sulfanilamide with aromatic amines.

APPLICATION

Wastewater, drinking water, surface water, mineral water, groundwater

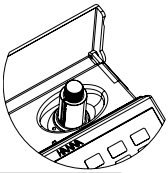
SIGNIFICANCE & USE

Nitrite is an intermediate oxidation state of nitrogen, both in the oxidation of ammonia to nitrate and in the reduction of nitrate. Such oxidation and reduction may occur in wastewater treatment plants, water distribution systems and natural waters. Nitrite can enter a water supply system through its use as a corrosion inhibitor in industrial process water. Nitrite changes the normal form of hemoglobin, which carries oxygen through blood to the rest of the body, into a form called methemoglobin that cannot carry oxygen.

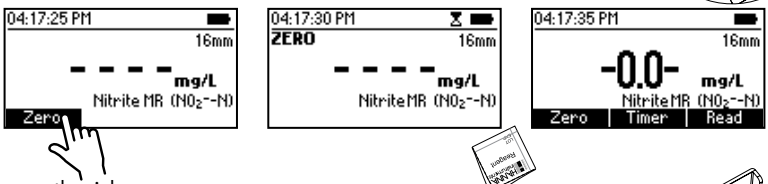
MEASUREMENT PROCEDURE

- Select the Nitrite MR (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Remove the cap from a HI96784V-0 Nitrite Medium Range Reagent Vial.
- Add 0.4 mL of sample to the vial, while keeping the vial at a 45-degree angle.
- Replace the cap and invert several times to mix. This is the blank.

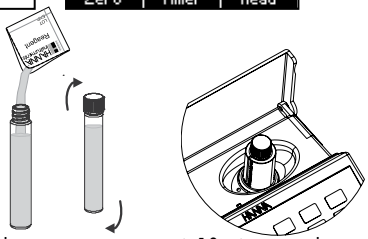
- Insert the vial into the holder.



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

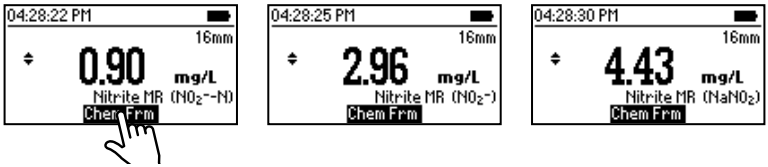


- Remove the vial.
- Remove the cap and add one packet of HI96784-0 Nitrite Medium Range Reagent for Vial.
- Replace the cap and invert for 30 seconds to mix.
- Insert the vial into the holder.



- Press **Timer** and the display will show the countdown prior to the measurement or wait 10 minutes and press **Read**. The instrument displays the result in **mg/L** of **nitrite-nitrogen (NO_2^--N)**.

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



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

INTERFERENCES

The pH of the sample must be between 2.0 and 3.0 after the addition of the reagents.
Interference may be caused by:

- Chlorine, Sodium, Sulfate above 4000 mg/L
- Potassium above 3000 mg/L
- Ammonium, Calcium, Nitrate, Phosphate above 2000 mg/L
- Magnesium above 1000 mg/L
- Copper above 200 mg/L
- Manganese, Zinc above 50 mg/L
- Nickel above 20 mg/L
- Iron above 10 mg/L

9.22. 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

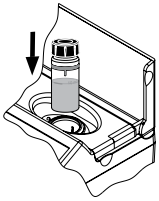
HI93708-01	Reagents for 100 tests
HI93708-03	Reagents for 300 tests

For other accessories see the Accessories section.

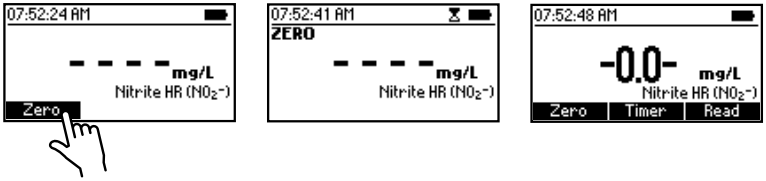
MEASUREMENT PROCEDURE

- Select the Nitrite HR method using the procedure described in the Method Selection section.
- Fill the cuvette with 10 mL of unreacted sample (up to the mark). Replace the plastic stopper and the cap.

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

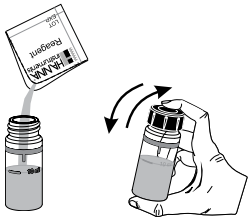


- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.

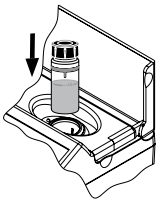


- Remove the cuvette.

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

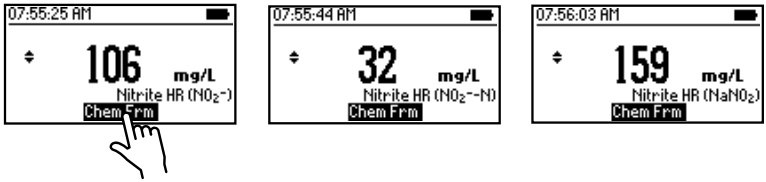


- Insert the cuvette into the holder and close the lid.



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



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

9.23. 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: green label

** Reagent vial identification: red label

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 the Accessories section.

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

MEASUREMENT PROCEDURE

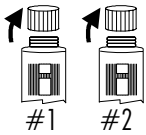
Before using the reagent kit carefully read all the instructions and the Safety Data Sheets (SDS). Pay particular attention to all warnings, cautions and notes. Failure to do so may result in serious injury to the operator.

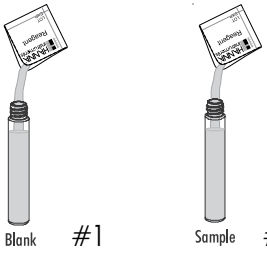
Reagent Blank Correction: This method requires a reagent blank correction. A single blank vial may be used more than once, the blank vial is stable for one week if stored in a dark place at room temperature. For improved accuracy use the same lot of reagents for the blank and sample, and run a blank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

Preheat the Hanna® Reactor HI839800 to 105 °C (221 °F). Use of the supplied HI740217 safety shield is strongly recommended.

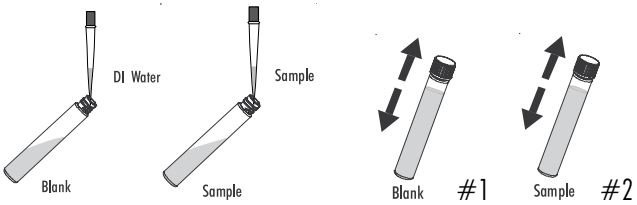
***Warning**: Do not use an oven or microwave, samples may leak and generate a corrosive and possibly explosive atmosphere.*

- 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.

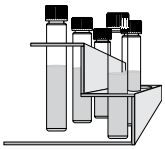


- Insert the vials into the reactor and heat them for 30 minutes at 105 °C (221 °F).

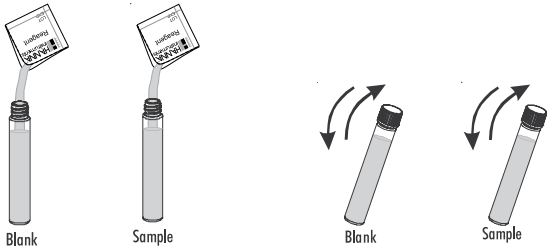
  ***Note**: To obtain most accurate results, it is strongly recommended to remove the vials from the reactor after 30 minutes.*

- 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.

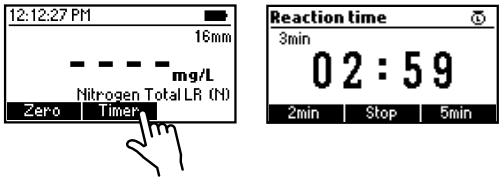
  Warning: *The vials are still hot, use caution when handling.*



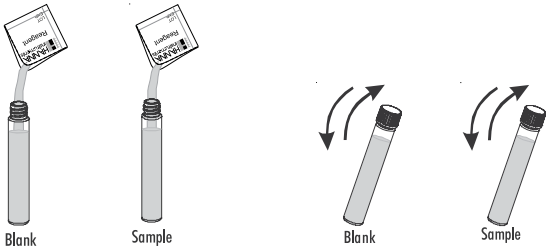
- Select Nitrogen Total LR (16) method using the procedure described in the Method Selection section.
- Insert 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- For this method the instrument provides 3 reaction timers which can be used throughout the procedure.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



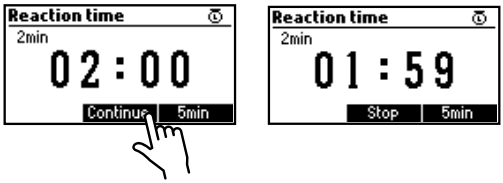
- Press **Timer** and the display will show the countdown prior to adding HI93767-0 Total Nitrogen Reagent or wait 3 minutes.



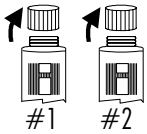
- Remove the cap from the vials and add one packet of HI93767-0 Total Nitrogen Reagent to each vial. Replace the cap and shake gently for 15 seconds.



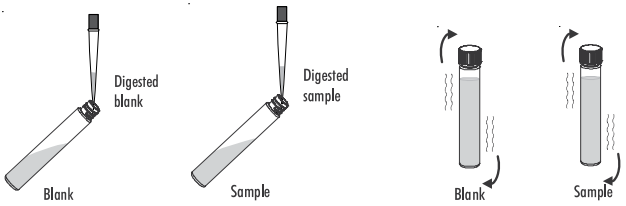
- Press **Continue** and the display will show the countdown or wait 2 minutes (without shaking the vials) to allow the reaction to complete.



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



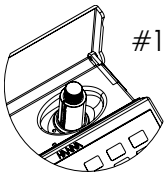
- Add 2 mL of digested blank (#1) to one of the reagent vials and 2 mL of digested sample (#2) to the second reagent vial, while keeping the vials at a 45-degree angle.
- Replace the cap and invert 10 times.



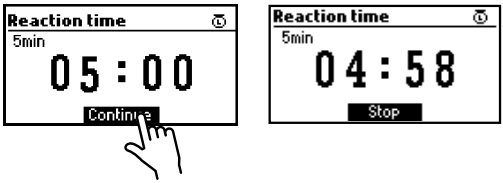
***Warning**: The vials will become hot during mixing, use caution when handling.*

***Note**: The method is technique sensitive. See procedure described in the Cuvette Preparation section for proper mixing technique.*

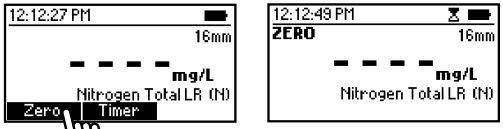
- Place the blank vial (#1) into the vial adapter.



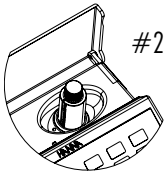
- Press **Continue** and the display will show the countdown or wait 5 minutes.



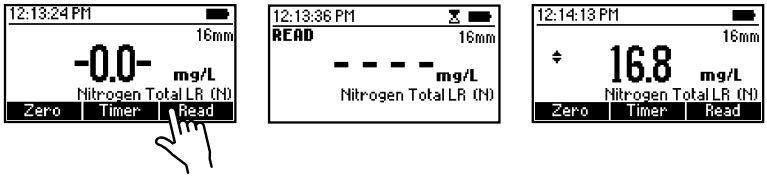
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



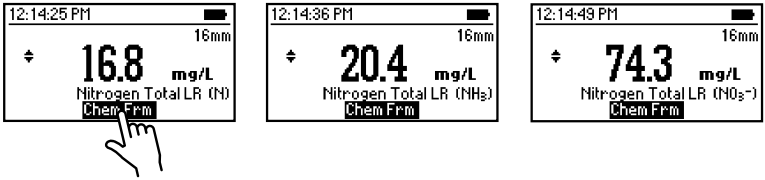
- Remove the blank vial.
- Place the sample vial (#2) into the vial adapter.



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



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



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

INTERFERENCES

Interference may be caused by:

- Chloride above 1000 mg/L
- Bromide above 60 mg/L
- Chromium above 0.5 mg/L

9.24. 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: red label

** Reagent vial identification: green label

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 the Accessories section.

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

MEASUREMENT PROCEDURE

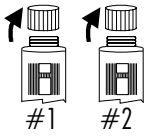
Before using the reagent kit carefully read all the instructions and the Safety Data Sheets (SDS). Pay particular attention to all warnings, cautions and notes. Failure to do so may result in serious injury to the operator.

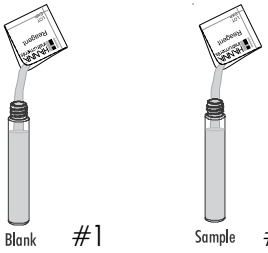
Reagent Blank Correction: This method requires a reagent blank correction. A single blank vial may be used more than once, the blank vial is stable for one week if stored in a dark place at room temperature. For improved accuracy always use the same lot of reagents for the blank and sample, and run a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

Preheat the Hanna® Reactor HI839800 to 105 °C (221 °F). Use of the supplied HI740217 safety shield is strongly recommended.

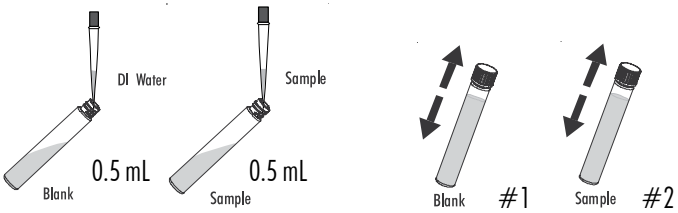
***Warning**: Do not use an oven or microwave, samples may leak and generate a corrosive and possibly explosive atmosphere.*

- 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 caps and shake vigorously for about 30 seconds or until powder is completely dissolved.

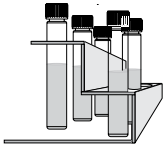


- Insert the vials into the reactor and heat them for 30 minutes at 105 °C (221 °F).

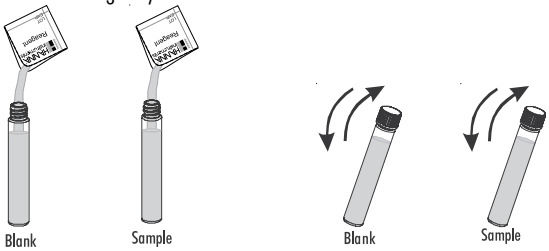
  ***Note**: To obtain most accurate results, it is strongly recommended to remove the vials from the reactor after 30 minutes.*

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

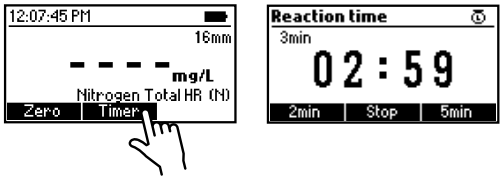
  ***Warning**: The vials are still hot, use caution when handling.*



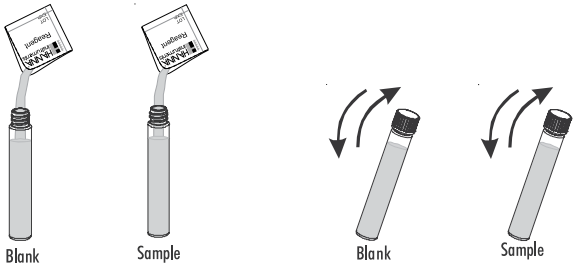
- Select Nitrogen Total HR (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- For this method the instrument provides 3 reaction timers which can be used throughout the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



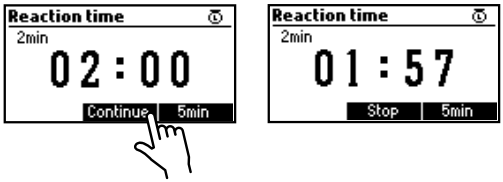
- Press **Timer** and the display will show the countdown prior to adding HI93767-0 Total Nitrogen Reagent or wait 3 minutes.



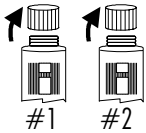
- Remove the caps from the vials and add one packet of HI93767-0 Total Nitrogen Reagent to each vial. Replace the caps and shake gently for 15 seconds.



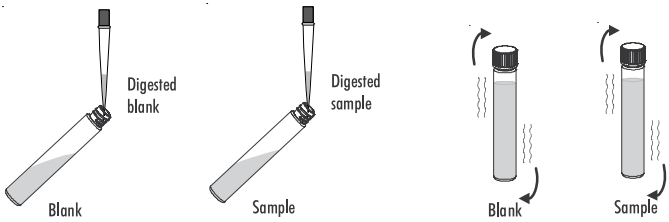
- Press **Continue** and the display will show the countdown or wait 2 minutes.



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



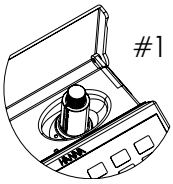
- Add 2 mL of digested blank (#1) to one of the reagent vials and 2 mL of digested sample (#2) to the second reagent vial, while keeping the vials at a 45-degree angle.



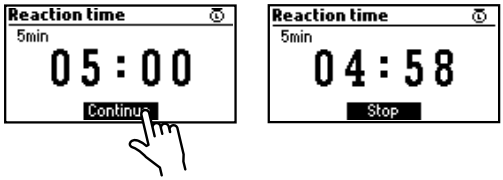
- Replace the caps tightly and invert the vials 10 times.

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

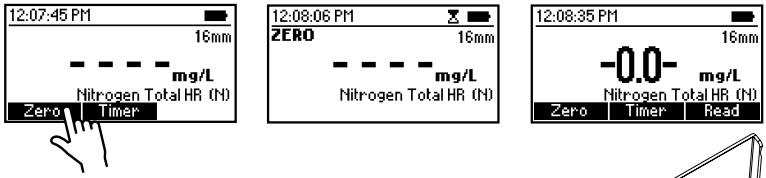
  ***Note**: The method is technique sensitive, see procedure described in the Cuvette Preparation section for proper mixing technique.*

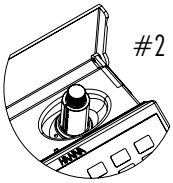


- Insert the blank vial (#1) into the holder.
- Press **Continue** and the display will show the countdown or wait 5 minutes.

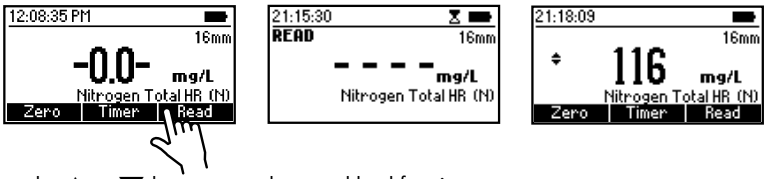


- Press **Zero**. The display will show "-0.0-".

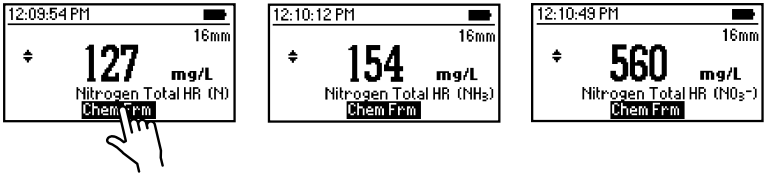




- Remove the blank vial.
- Insert the sample vial (#2) into the holder.
- Press **Read** to start the reading. The instrument displays the results in **mg/L nitrogen (N)**.



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



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

Note: *This method detects all organic and inorganic forms of nitrogen present in the sample.*

INTERFERENCES

Interference may be caused by:

- Chloride above 3000 mg/L
- Bromide above 240 mg/L
- Chromium above 0.5 mg/L

9.25. PHENOLS (16 mm VIAL)

SPECIFICATIONS

Range	0.00 to 5.00 mg/L
Resolution	0.01 mg/L
Accuracy	±0.05 mg/L ±3% of reading at 25 °C
Light Source	LED with narrow band interference filter @ 510 nm
Method	Adaptation of 4-aminoantipyrine method EPA 420.1

REQUIRED REAGENTS

Code	Description	Quantity
HI96788V-0	Phenol Reagent Vial	1 vial
HI96788A-0	Phenol Reagent A	1 packet
HI96788B-0	Phenol Reagent B	1 packet

REAGENT SETS

HI96788-25	Reagents for 25 tests

For other accessories see the Accessories section.

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

PRINCIPLE

Non-substituted phenols, as well as ortho- and meta-substituted phenols containing carboxyl, halogen, and sulfonic acid substituted groups will react with 4-aminoantipyrine in the presence of an oxidizer at a pH above 10 to form a yellow to red dye.

Because different phenol-containing compounds produce varying color responses, phenol is used as the standard and the measured value is the minimum reported concentration of phenols. To ensure accurate measurements, the sample temperature must be between 10 and 35 °C (50 and 95 °F). To eliminate possible interferences, distillation can be performed.

APPLICATION

Drinking water, wastewater, process water, natural waters

SIGNIFICANCE & USE

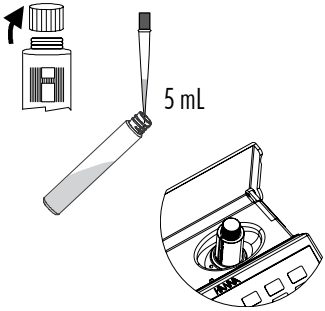
Phenols can occur in several sources of water such as natural waters, household and industrial wastewaters, and potable water.

It is important to monitor phenol levels, as they can produce unfavorable and malodorous water when undergoing chlorination.

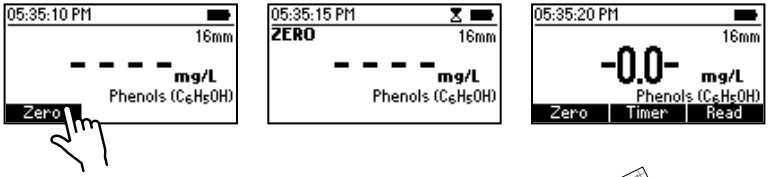
MEASUREMENT PROCEDURE

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.

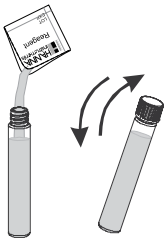
- Select the Phenols (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Remove the cap from a HI96788V-0 Phenol Reagent Vial.
- Add 5.0 mL of sample to the vial, while keeping the vial at a 45-degree angle. Replace the cap.
- Insert the vial into the adapter.



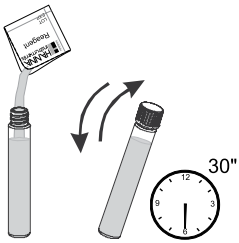
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



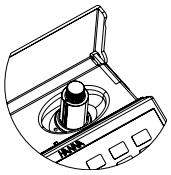
- Remove the vial from the meter.
- Remove the cap and add one packet of HI96788A-0 Phenol Reagent A to the vial.
- Replace the cap and shake gently to dissolve.



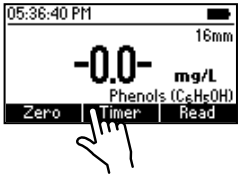
- Remove the cap and add one packet of HI96788B-0 Phenol Reagent B.
- Replace the cap and shake gently for 30 seconds.

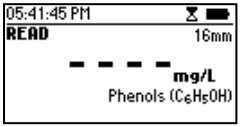


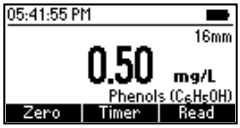
- Insert the vial into the adapter.



- Press **Timer** and the display will show the countdown prior to the measurement or wait 5 minutes and press **Read**. When the timer ends the meter will perform the reading.
  The instrument displays the results in **mg/L** of **phenols**.







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

INTERFERENCES

Interference may be caused by:

- Sulfate above 2000 mg/L
- Chloride (Cl^-) above 1000 mg/L
- Sodium above 900 mg/L
- Magnesium, Nitrate above 250 mg/L
- Calcium above 125 mg/L
- Copper(II), Zinc above 50 mg/L
- Aluminum(II) above 25 mg/L
- Ammonium above 9.5 mg/L
- Iron(III) above 5 mg/L
- Iron(II) above 2.5 mg/L
- High turbidity
  To eliminate this interference, distillation is required.
- Oxidizing and reducing agents

9.26. 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 & 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: red label

REAGENT SETS

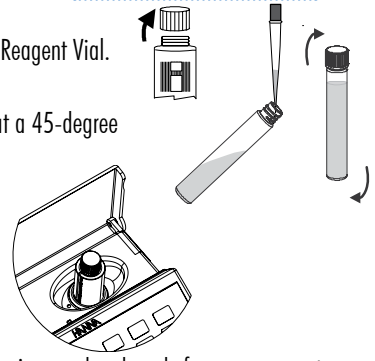
HI93758A-50 Reagents for 50 tests

For other accessories see the Accessories section.

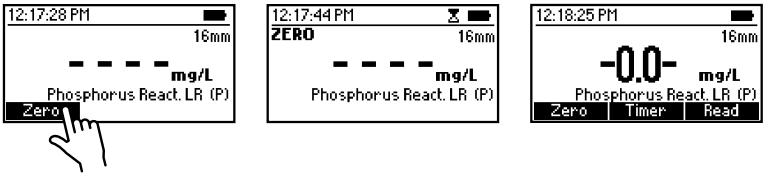
***Note**: Store the unused vials in their packaging in a cool and dark place.*

MEASUREMENT PROCEDURE

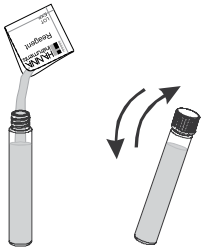
- Select the Phosphorus Reactive LR (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Remove the cap from HI93758A-0 Reactive Phosphorus Reagent Vial.
- Add 5 mL of sample to the vial, while keeping the vial at a 45-degree angle.
- Replace the cap and invert several times to mix.
- Insert the vial into the holder.



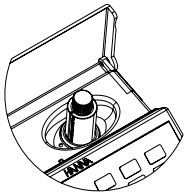
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



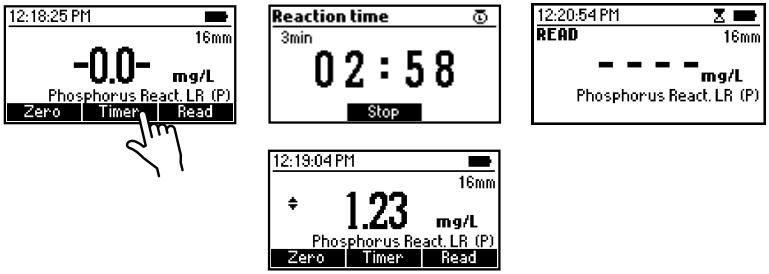
- Remove the vial.



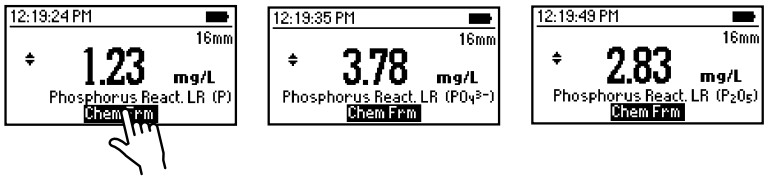
- Remove the cap and add one packet of HI93758-0 Phosphorus Reagent.
- Replace the cap shake gently for 2 minutes until most of the powder is dissolved.
- Insert the vial into the holder.



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



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

INTERFERENCES

Interference may be caused by:

- Arsenate must be absent
- Silica above 50 mg/L
- Sulfide above 6 mg/L, to remove interference add Bromine Water drop-wise until a pale yellow color develops, to remove excess bromine water add Phenol Solution drop-wise until the solution is clear
- Turbidity and suspended matter in large amounts, treat the sample with active carbon and filter, before measuring

9.27. 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 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: green label

REAGENT SETS

HI93763A-50 Reagents for up to 49 tests

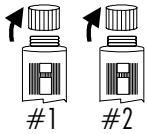
For other accessories see the Accessories section.

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

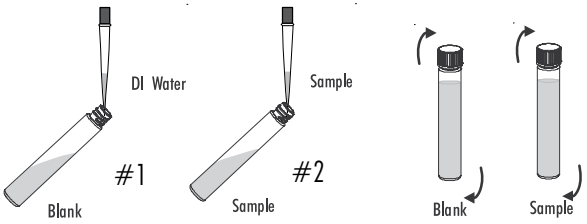
MEASUREMENT PROCEDURE

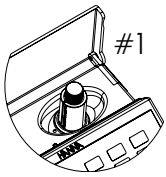
Reagent Blank Correction: This method requires a reagent blank correction. A single blank vial may be used more than once; the blank vial is stable up to two weeks (room temperature). For improved accuracy always use the same lot of reagents for the blank and sample, and run a blank for each set of measurements.

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

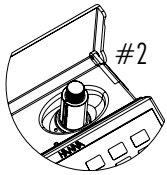


- Add 5 mL of deionized water to the first vial (#1) and 5 mL of sample to the second vial (#2), while keeping the vials at a 45-degree angle. Replace the caps and invert several times to mix.

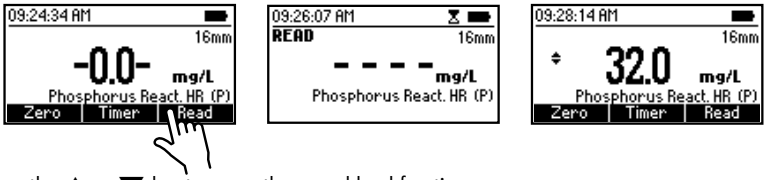




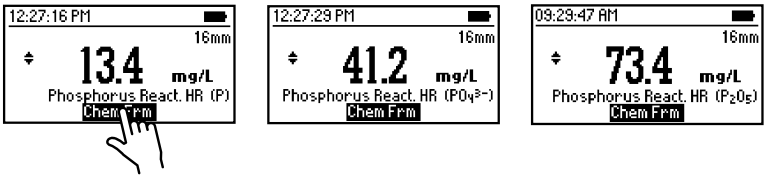
- Insert the blank vial (#1) into the holder and push it completely down.
- Press **Timer** and the display will show the countdown prior to the zero reading or wait 7 minutes and press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



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



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

INTERFERENCES

Interference may be caused by:

- Bismuth, Fluoride
- The sample should have a neutral pH
- Sulfide, to remove the interferent add Bromine Water drop-wise until a pale yellow color develops, remove excess Bromine Water by adding Phenol Solution drop-wise
- The method is temperature sensitive. It is recommended to run measurements between 20 and 25 °C (68 and 77 °F), temperatures below 20 °C (68 °F) cause a negative error, temperatures above 25 °C (77 °F) cause a positive error
- Turbidity and suspended matter in large amounts, treat the sample with active carbon and filter before measuring

9.28. 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 1.20 N	2 mL
HI93758-0	Phosphorous Reagent	1 packet

* Reagent vial identification: white label

REAGENT SETS

HI93758B-50 Reagents for 50 tests

For other accessories see the Accessories section.

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

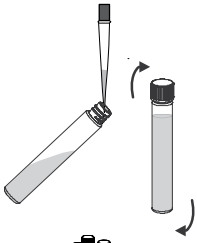
MEASUREMENT PROCEDURE

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.

- Preheat the Hanna® Reactor HI839800 to 150 °C (302 °F). Use of the supplied HI740217 safety shield is strongly recommended.

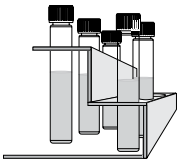
  ***Warning**: Do not use an oven or microwave! Samples may leak and generate a corrosive and possibly explosive atmosphere.*

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



- Add 5 mL of sample to the vial, while keeping the vial at a 45-degree angle.
- Replace the cap and invert to mix.

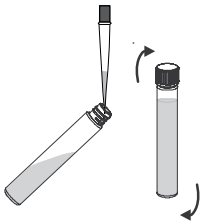
- Insert the vial into the reactor and heat it for 30 minutes at 150 °C (302 °F).



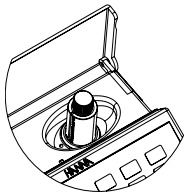
- At the end of the digestion place the vials carefully in the test tube rack and allow to cool to room temperature.

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

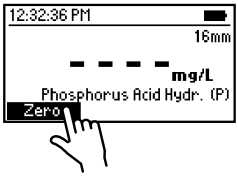
- Select the Phosphorus Acid Hydrolyzable (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Remove the cap from the vial and add 2 mL of HI93758B-0 NaOH Solution 1.20 N while keeping the vial at a 45-degree angle.

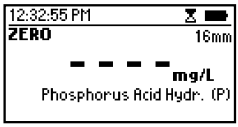


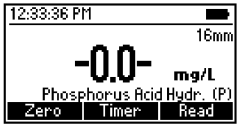
- Replace the cap and invert to mix.
- Insert the vial into the holder.



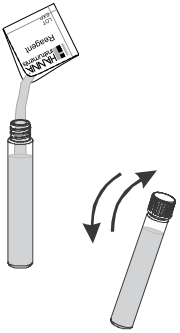
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



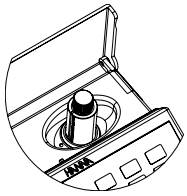




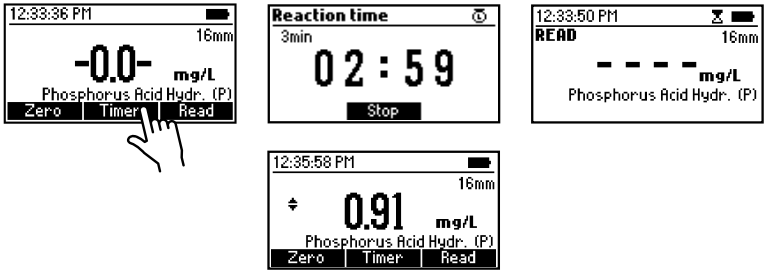
- Remove the vial.



- 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.
- Insert the vial into the holder.

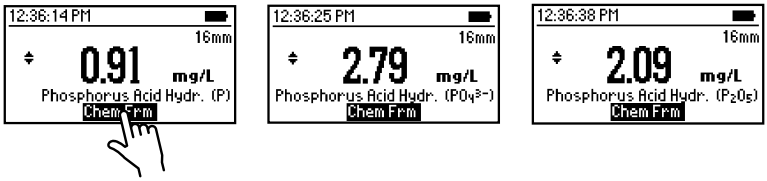


- Press **Timer** and the display will show the countdown prior to the measurement or wait 3 minutes and press **Read**. The instrument displays the results in **mg/L** of **phosphorus (P)**.



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

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



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

INTERFERENCES

Interference may be caused by:

- Arsenate must be absent
- Silica above 50 mg/L
- Sulfide, to remove the interferent add Bromine Water drop-wise until a pale yellow color develops, remove excess Bromine Water by adding Phenol Solution drop-wise
- Turbidity and suspended matter in large amounts, treat the sample with active carbon and filter, before measuring

9.29. 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 & 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 1.54 N	2 mL
HI93758-0	Phosphorous Reagent	1 packet
PERSULFATE/P	Potassium Persulfate	1 packet

* Reagent vial identification: red label

REAGENT SETS

HI93758C-50 Reagents for 50 tests

For other accessories see the Accessories section.

***Note**: Store the unused vials in their packaging 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.

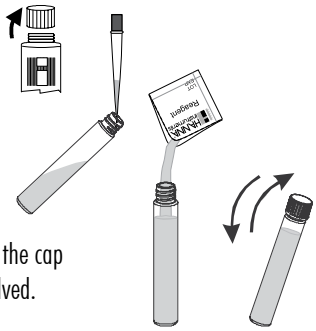
- Preheat the Hanna® Reactor HI839800 to 150 °C (302 °F). Use of the supplied HI740217 safety shield is strongly recommended.

  ***Warning**: Do not use an oven or microwave, samples may leak and generate a corrosive and possibly explosive atmosphere.*

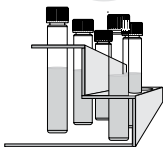
- Remove the cap from a HI93758V-0 Phosphorus Reagent vial.

- Add 5 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.



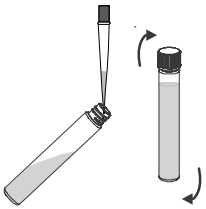
- Insert the vial into the reactor and heat it for 30 minutes at 150 °C (302 °F).



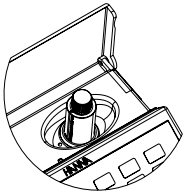
- At the end of the digestion place the vials carefully in the test tube rack and allow to cool to room temperature.

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

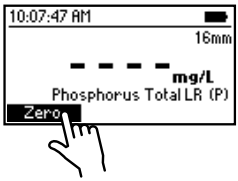
- Select the Phosphorus Total LR (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.

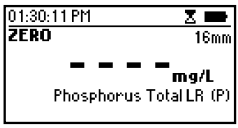


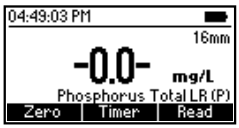
- Remove the cap from the vial and add exactly 2 mL of HI93758C-0 NaOH Solution 1.54 N, while keeping the vial at a 45-degree angle.
- Replace the cap and invert the vial several times to mix.



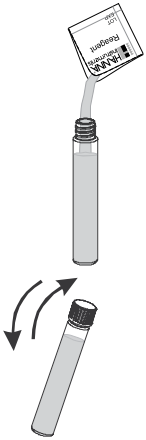
- Insert the vial into the holder.
- Press **Zero**. The display will show"-0.0-" when the meter is zeroed and ready for measurement.





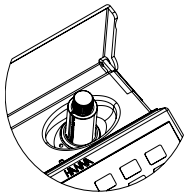


- Remove the vial.

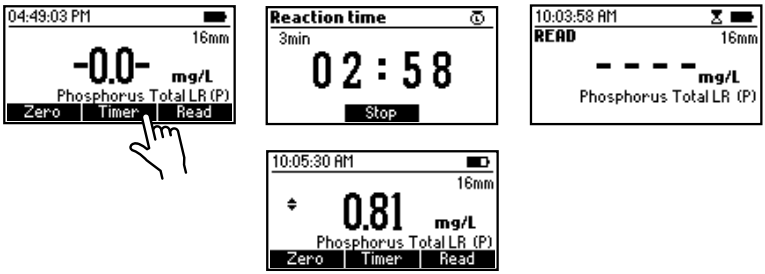


- Remove the cap and add one packet of HI93758-0 Phosphorus Reagent.
- Replace the cap and shake for 2 minutes until the powder is completely dissolved.

- Insert the vial into the holder.

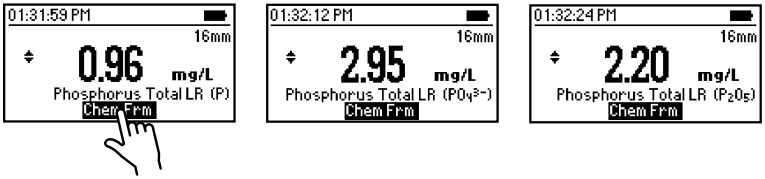


- Press **Timer** and the display will show the countdown prior to the measurement or wait 3 minutes and press **Read.** The instrument displays the results in **mg/L** of **phosphorus (P)**.



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

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



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

INTERFERENCES

Interference may be caused by:

- Arsenate must be absent
- Silica above 50 mg/L
- Sulfide, to remove the interferent add Bromine Water drop-wise until a pale yellow color develops, remove excess Bromine Water by adding Phenol Solution drop-wise
- Turbidity and suspended matter in large amounts, treat the sample with active carbon and filter, before measuring

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

SPECIFICATIONS

Range	0.0 to 32.6 mg/L (as P)
Resolution	0.1 mg/L
Accuracy	packet: ±0.5 mg/L or ±5 % of reading at 25 °C, whichever is greater dispenser: ±0.6 mg/L or ±6% of reading at 25 °C, whichever is greater
Light Source	LED with narrow band interference filter @ 420 nm
Method	Adaptation of Standard Methods for the Examination of Water and Wastewater, 20th Edition, 4500-P C, Vanadomolybdophosphoric Acid Method

REQUIRED REAGENTS (KIT WITH PACKETS)

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

*Reagent vial identification: green label

REQUIRED REAGENTS (KIT WITH DISPENSER)

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/D	Potassium Persulfate Reagent Dispenser	2 doses

*Reagent vial identification: green label

REAGENT SETS

HI93763B-50	Reagents for up to 49 tests
HI93763B-50D	Reagents for up to 49 tests

For other accessories see the Accessories section.

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

PRINCIPLE

In a dilute orthophosphate solution, ammonium molybdate reacts under acid conditions to form a heteropoly acid, molybdophosphoric acid. In the presence of vanadium, yellow vanadomolybdophosphoric acid is formed. The intensity of the yellow hue is proportional to phosphate concentration.

APPLICATION

Testing in aqueous matrices such as natural waters and in wastewaters.

ATTENTION

The powder reagent bottle should be kept, between 15 to 25 °C, with a maximum 60 % RH.
Make sure the powder dispenser is kept completely dry before and during usage.
To avoid blockages and ensure consistent results, make sure the dispenser is kept clean all the time and the slide is completely retracted when not in use.
After usage, please remove the attached dispenser and then put the reagent bottle cap back on.
Before using the reagent kit, carefully read all the instructions and the Safety Data Sheets (SDS).

DISPENSER HANDLING

1. Remove the screw-on cap and securely attach the dispenser to the reagent bottle.
2. Hold the bottle downward and gently shake it (forward/backward movement) to fill the dispenser's powder chamber.
3. Before every dose, swirl the dispenser bottle (held upside down) a few times, without pressing the feeder, to ensure dispensing repeatability.
4. Place the powder dispenser's nozzle over the cuvette then press the feeder.
   The exact amount of powder is released into the cuvette.

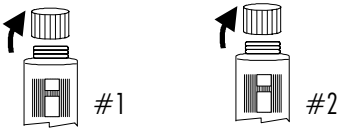
MEASUREMENT PROCEDURE

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.

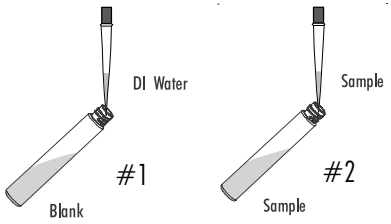
Reagent Blank Correction: This method requires a reagent blank correction. A single blank vial may be used more than once. The blank vial is stable for one day at room temperature.
Preheat the Hanna® Reactor HI839800 to 150 °C (302 °F).
Use of the supplied HI740217 safety shield is strongly recommended.

***Warning**: Do not use an oven or microwave, samples may leak and generate a corrosive and possibly explosive atmosphere.*

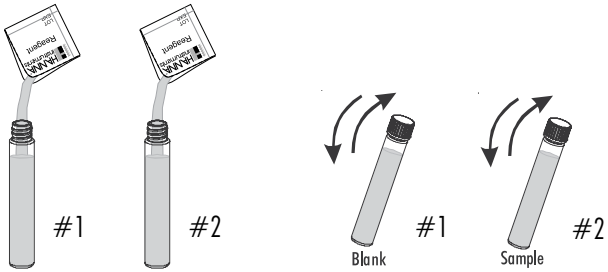
- Remove the cap from two HI93758V-0HR Phosphorus Reagent Vials.



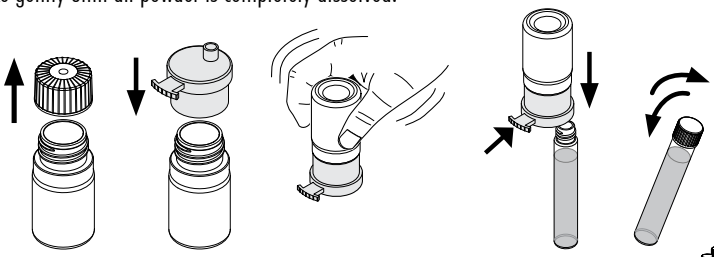
- Add 5 mL of deionized water to the first vial (#1) and 5 mL of sample to the second vial (#2), while keeping the vials at a 45-degree angle.



- **Using kit with pre-measured packet**
  Add one packet of PERFSULFATE/P Potassium Persulfate Reagent to each vial. Replace the caps. Shake gently until all the powder is completely dissolved.



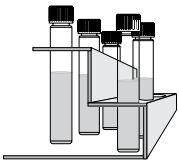
- **Using kit with pre-measured dispenser**
  Add one dose of PERFSULFATE/D Potassium Persulfate Reagent Dispenser to each vial. Swirl the bottle a few times prior to each dose. Replace the cap. Shake gently until all powder is completely dissolved.



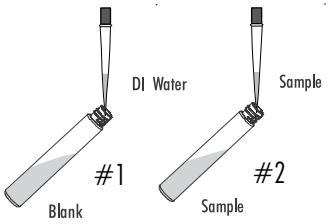
- Insert the vials into the reactor and heat them for 30 minutes at 150 °C (302 °F).

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

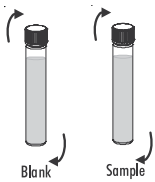
  ***Warning**: The vials are still hot, use caution when handling.*



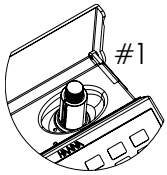
- Select the Phosphorus Total HR (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Remove the cap from the vials and add 2 mL of HI93758C-0 NaOH Solution 1.54 N to each vial, while keeping the vials at a 45-degree angle.
  Replace the cap tightly and invert the vials several times to mix.



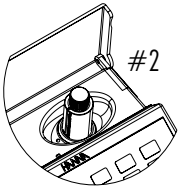
- Remove the cap from the vials and add 0.5 mL of HI93763B-0 Total Phosphorous HR Reagent B to each vial, while keeping the vial at a 45-degree angle.
  Replace the cap and invert several times to mix.



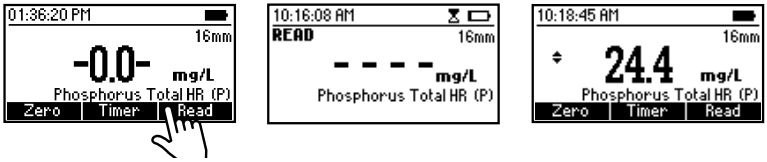
- Insert the blank vial (#1) into the holder.



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

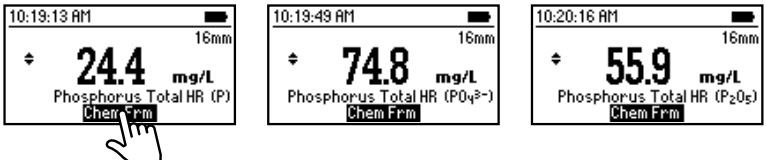


- Remove the blank vial.
- Insert the sample vial (#2) into the holder.
- Press **Read**. The instrument displays the results in **mg/L phosphorus (P)**.



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

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



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

INTERFERENCES

Interference may be caused by:

- Arsenate
- The sample should have a neutral pH
- The method is temperature sensitive.
  It is recommended to add the Molybdovanadate Reagent and to run measurements between 20 and 25 °C (68 and 77 °F).
  Temperatures below 20 °C (68 °F) cause a negative error, temperatures above 25 °C (77 °F) cause a positive error.
- Turbidity and suspended matter in large amounts
  Treat the sample with active carbon and filter before measuring.

9.31. SURFACTANTS, ANIONIC (16 mm VIAL)

SPECIFICATIONS

Range	0.00 to 3.50 mg/L (as SDBS)
Resolution	0.01 mg/L
Accuracy	±0.10 mg/L ± 5 % of reading
Light Source	LED with narrow band interference filter @ 610 nm
Method	Adaptation of the Standard Method for the Examination of Water and Wastewater, 23rd Edition, 5540C, Anionic Surfactants as MBAS

REQUIRED REAGENTS

Code	Description	Quantity
HI96782V-0*	Anionic Surfactants Reagent Vial	1 vial
HI96782A-0	Anionic Surfactants Buffer Reagent A	0.6 mL
HI96782B-0	Anionic Surfactants Indicator Reagent B	0.2 mL

* Reagent vial identification: white label

REAGENT SETS

HI96782-25 Reagents for 25 tests

For other accessories see the Accessories section.

***Note**: Store the unused vials in their packaging in a dark place, between 15 and 25 °C (59 and 77 °F).*

PRINCIPLE

Determination of anionic surfactants by measurement of the Methylene Blue Active Substances (MBAS) index. Anionic surfactants react with methylene blue in an alkaline medium, this reaction results in salts that are extracted using chloroform. The blue color of the organic phase is determined photometrically.

APPLICATION

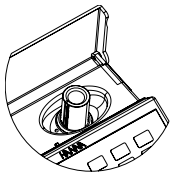
Water, wastewater, surface water, formulations, degreasing baths, wash solutions, process analysis

SIGNIFICANCE & USE

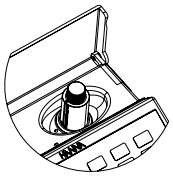
Surfactants decrease surface tension at the interface between a liquid and another solid, liquid, or gaseous phase, they are used in industry, agriculture, scientific studies and everyday life (cleaning agents, spot removers, cosmetics, etc.). The most widely used anionic surfactants include sodium dodecyl sulfate (SDS), sodium dodecylbenzene sulfonate (SDBS), sodium dodecane sulfonate (SDSA), sodium dioctyl sulfosuccinate (SDOSSA).

MEASUREMENT PROCEDURE

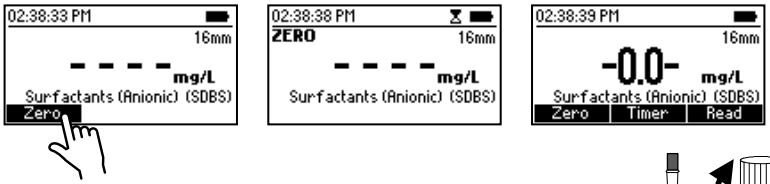
- Select the Surfactants (Anionic) (16) method using the procedure described in the Method Selection section.
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.



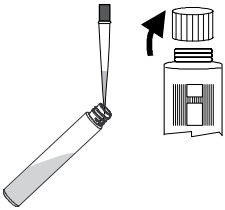
- Insert the HI96782V-0 Anionic Surfactants Reagent Vial into the holder.



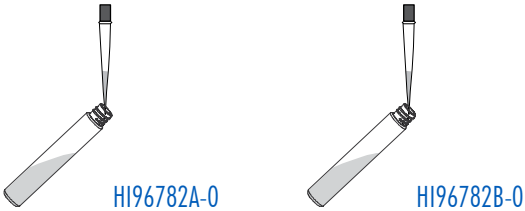
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



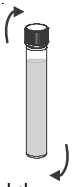
- Remove the blank vial.
- Add 5 mL of sample to the vial, while keeping the vial at a 45-degree angle.



- Add 0.6 mL of HI96782A-0 Anionic Surfactants Buffer Reagent A and 0.2 mL of HI96782B-0 Anionic Surfactants Indicator Reagent B.

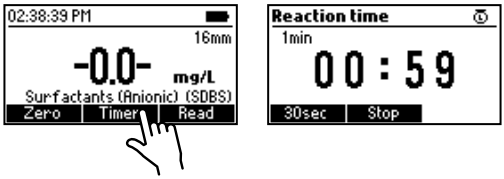


- Replace the cap and invert for 1 minute (about 45 inversions).



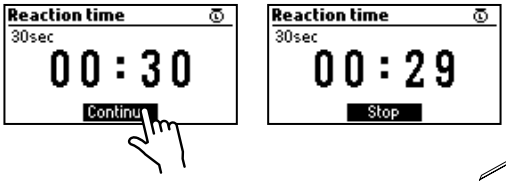
***Note**: This method is technique sensitive. See procedure described in the Cuvette Preparation section for proper mixing technique. If the vial is inverted too slowly the extraction may be incomplete resulting in low readings.*

- Press **Timer** and the display will show the countdown or wait 1 minute. During this period the organic layer separates from the aqueous layer.

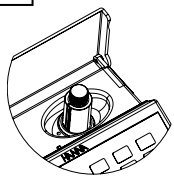


- Invert the vial gently two times.

- Press **Continue** and the display will show the countdown or wait 30 seconds. During this period, the organic layer separates from the aqueous layer.

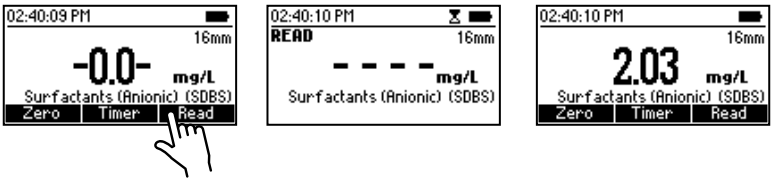


- Insert the vial into the holder.



***Note**: Phase separation must be complete before the measurement is taken. If the solution is cloudy, the separation between the organic and aqueous layer can be improved by gently warming the vial (holding the vial in your hand). If the organic layer contains some aqueous drops hanging on the vial wall, gently swirl or invert the vial.*

- Press **Read** to start the reading. The instrument displays the result in **mg/L** as **SDBS**.



INTERFERENCES

Interference may be caused by:

- Cationic surfactants cause negative interference
- Bicarbonate above 2000 mg/L
- Potassium, Sodium, Sulfate, Chloride above 1000 mg/L
- Phosphate above 300 mg/L
- Magnesium above 250 mg/L
- Calcium, Nitrate above 100 mg/L
- Chromium(VI), Copper above 10 mg/L
- Nickel, Zinc, Iron (Ferric) above 5 mg/L

9.32. SURFACTANTS, CATIONIC (16 mm VIAL)

SPECIFICATIONS

Range	0.00 to 2.50 mg/L (as CTAB)
Resolution	0.01 mg/L
Accuracy	packet: ±0.15 ppm ± 3 % of reading dispenser: ±0.20 mg/L ±4% of reading at 25 °C
Light Source	LED with narrow band interference filter @ 420 nm
Method	Bromophenol Blue Method

REQUIRED REAGENTS (KIT WITH PACKET)

Code	Description	Quantity
HI96785V-0	Cationic Surfactants Reagent Vial	1 vial
HI96785-0	Cationic Surfactants Reagent	1 packet

REQUIRED REAGENT (KIT WITH DISPENSER)

Code	Description	Quantity
HI96785V-0	Cationic Surfactants Reagent Vial	1 vial
HI96785-0D	Cationic Surfactants Reagent Dispenser	1 dose

REAGENT SETS

HI96785-25	Reagents for 25 tests
HI96785-25D	Reagents for 25 tests

For other accessories see the Accessories section.

***Note**: Store the unused vials in their packaging in a dark place, between 15 and 25 °C (59 and 77 °F).*

PRINCIPLE

Determination of cationic surfactants by measurement of the Methylene Blue Active Substances (MBAS) index. Cationic surfactants react with methylene blue in an acid medium, this reaction results in salts that are extracted using chloroform. The yellow color of the organic phase is determined photometrically.

***Note**: The sample temperature must be between 20 and 22 °C (68.0 and 71.6 °F), and the pH of the sample between 4 and 9.*

APPLICATION

Water, wastewater, surface water, formulations, degreasing baths, wash solutions, process analysis

SIGNIFICANCE & USE

Cationic surfactants are positively charged at their hydrophilic ends and as such are active agents in fabric softeners, an important group of detergent products.

Most cationic surfactants find use as disinfectants and sanitizers and include: Hexadecyltrimethylammonium bromide (CTAB), Benzalkonium chloride (BAC), Cetylpyridinum chloride (CPC), Benzethonium chloride (BZT).

ATTENTION

The powder reagent bottle should be kept between 15 to 25 °C, with a maximum of 60 % RH.

Make sure the powder dispenser is kept completely dry before, and during usage.

To avoid blockages and ensure consistent results, make sure the dispenser is kept clean all the time and the slide is completely retracted when not in use.

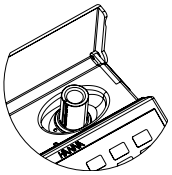
After usage, please remove the attached dispenser and then put the reagent bottle cap back on.
Before using the reagent kit, carefully read all the instructions and the Safety Data Sheets (SDS).

DISPENSER HANDLING

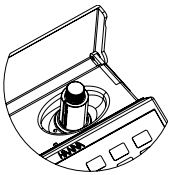
1. Remove the screw-on cap and securely attach the dispenser to the reagent bottle.
2. Hold the bottle downward and gently shake it (forward/backward movement) to fill the dispenser's powder chamber.
3. Before every dose, swirl the dispenser bottle (held upside down) a few times, without pressing the feeder, to ensure dispensing repeatability.
4. Place the powder dispenser's nozzle over the cuvette then press the feeder.
   The exact amount of powder is released into the cuvette.

MEASUREMENT PROCEDURE

- Select the Surfactants (Cationic) (16) method using the procedure described in the Method Selection section.

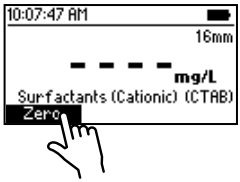


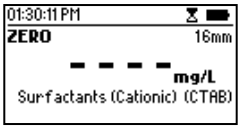
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.

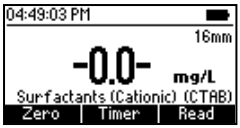


- Insert the HI96785V-0 Cationic Surfactants Reagent Vial into the holder.

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







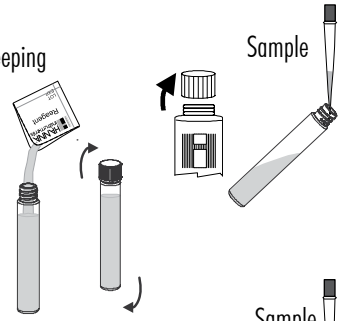
- Remove the vial.

- **Using kit with pre-measured packet**

  Remove the cap and add 5 mL of sample to the vial, while keeping the vial at a 45-degree angle.

  Add one packet of HI96785-0 Cationic Surfactants Reagent.

  Replace the cap and invert for 2 minutes to mix.

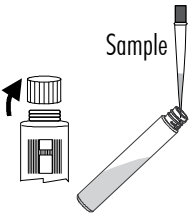


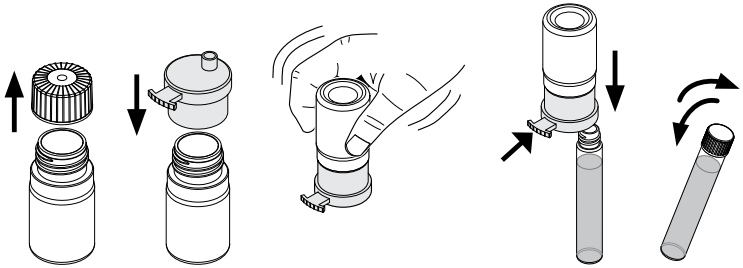
- **Using kit with pre-measured dispenser**

  Remove the cap and add 5 mL of sample to the vial, while keeping the vial at a 45-degree angle.

  Add one dose of HI96785-0D Cationic Surfactants Reagent Dispenser. Swirl the bottle a few times prior to each dose.

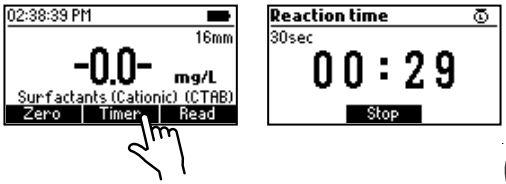
  Replace the vial cap and invert 2 minutes to mix.



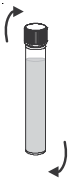


***Note**: This method is technique sensitive. See the Cuvette Preparation section for proper mixing technique. If the vial is inverted too slowly the extraction may be incomplete resulting in low readings.*

- Press **Timer** and the display will show the countdown or wait 30 seconds. During this period the organic layer separates from the aqueous layer.

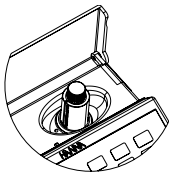


- Invert the vial gently two times.
- Wait for phase separation.



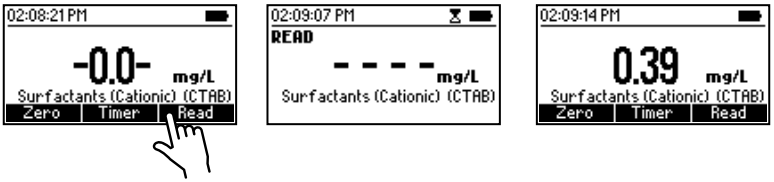
- Wipe the vial thoroughly with HI731318 microfiber cleaning cloth or a lint-free wipe prior to insertion.

- Insert the vial into the holder.



***Note**: Phase separation must be complete before the measurement is taken. If the solution is cloudy, the separation between the organic and aqueous layer can be improved by gently warming the capped vial (holding the vial in your hand). If the organic layer contains some aqueous drops hanging on the vial wall, gently swirl or invert the vial. The phase separation may take several hours if the vial is inverted or shaken too vigorously!*

- Press **Read** to start the reading. The instrument displays the result in **mg/L** as **CTAB**.



INTERFERENCES

Interference may be caused by:

- Chloride above 3000 mg/L
- Sodium above 2000 mg/L
- Carbonate, Sulfate, Potassium, Nitrate above 1000 mg/L
- Calcium above 500 mg/L
- Phosphate above 300 mg/L
- Ammonium, Magnesium above 250 mg/L
- Iron (Ferric), Nitrite above 100 mg/L
- Zinc, Nickel, Copper, Iron (Ferrous), Hydrogen peroxide (H_2O_2), Disulfite ($S_2O_5^{2-}$) above 50 mg/L
- Chlorine, Chromium (VI), Chromium (III) above 10 mg/L
- Anionic surfactants cause negative interference

Interferences checked individually in solution containing 1 mg/L of CTAB (Hexadecyltrimethylammonium bromide).
The cumulative effects have not been determined but can not be excluded.
The determination is not yet interfered with up to the concentrations of foreign substances given above.

9.33. SURFACTANTS, NONIONIC (16 mm VIAL)

SPECIFICATIONS

Range	0.00 to 6.00 mg/L (as TRITON X-100)
Resolution	0.01 mg/L
Accuracy	±0.10 mg/L ± 5 % of reading
Light Source	LED with narrow band interference filter @ 610 nm
Method	TBPE Method

REQUIRED REAGENTS

Code	Description	Quantity
HI96780V-0*	Surfactants Nonionic Reagent Vial	1 vial

* Reagent vial identification: blue label

REAGENT SETS

HI96780-25 Reagents for 24 tests

For other accessories see the Accessories section.

Note: *Store the unused vials in their packaging in a dark place, between 15 and 25 °C (59 and 77 °F).*

PRINCIPLE

Nonionic surfactants (ethoxylates with 3 to 20 ether bridges) react with the indicator TBPE to form a green complex, which is then extracted in dichloromethane and photometrically evaluated. This method has a strong temperature and pH dependence. The sample temperature must be between 20 and 22 °C (68.0 and 71.6 °F), and the pH between 4 and 9.

APPLICATION

Water, wastewater, surface water, formulations, degreasing baths, wash solutions, process analysis

SIGNIFICANCE & USE

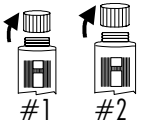
Surfactants are one of many different compounds that make up a detergent. Nonionic surfactants do not bear an electrical charge and are often used together with anionic surfactants. Nonionic surfactants account for nearly 50 % of surfactant production. Nonionic surfactants are more surface active and better emulsifiers than anionic surfactants at similar concentrations. They are less soluble than anionic surfactants in hot water and produce less foam. They are more efficient in removing oily and organic dirt. Nonionics are used in fabric washing detergents, hard surface cleaners and in many industrial processes such as emulsion polymerization and agrochemical formulations.

MEASUREMENT PROCEDURE

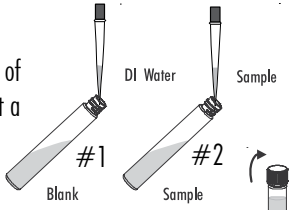
Before using the reagent kit carefully read all the instructions and the Safety Data Sheets (SDS). Pay particular attention to all warnings, cautions and notes. Failure to do so may result in serious injury to the operator.

Reagent Blank Correction: This method requires a reagent blank correction. A single blank vial may be used more than once. For improved accuracy use the same lot of reagents for the blank and sample, and run a blank for each set of measurements.

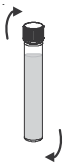
- Select the Surf. (Nonionic) (16) method using the procedure described in the Method Selection section.
- Remove the cap from two HI96780V-0 Surfactants Nonionic Reagent Vials.



- Add 3 mL of deionized water to the first vial (#1) and 3 mL of sample to the second vial (#2), while keeping the vials at a 45-degree angle.

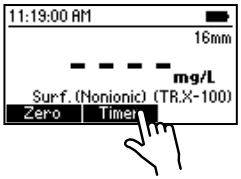


- Replace the cap and invert for 2 minutes (about 2 inverts per second).

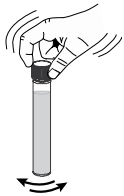


***Note**: This method is technique sensitive. See the Cuvette Preparation section for proper mixing technique. If the vial is inverted too slowly the extraction may be incomplete resulting in low readings.*

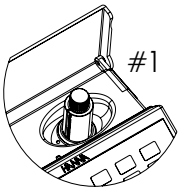
- Press **Timer** and the display will show the countdown or wait 2 minutes. During this period the organic layer separates from the aqueous layer.



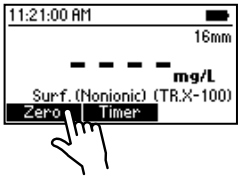
***Note**: Phase separation must be complete before the measurement is taken. If the organic layer contains some aqueous drops hanging on the vial wall, gently swirl or invert the vial.*

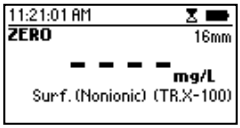


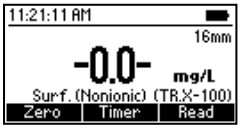
- Insert the 16 mm vial adapter using the procedure described in the Using the 16 mm Vial Adapter section.
- Insert the blank vial (#1) into the holder.



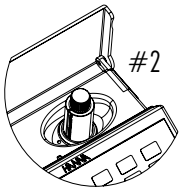
- Press **Zero**. The display will show "-0.0-" when the meter is zeroed and ready for measurement.



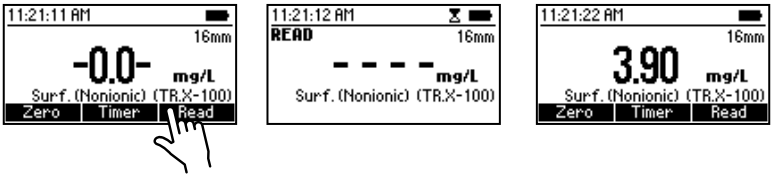




- Remove the blank vial.
- Insert the sample vial (#2) into the holder.



- Press **Read** to start the reading. The instrument displays the results in **mg/L** of **TRITON X-100**.



INTERFERENCES

Interference may be caused by:

- Chloride, Nitrate, Sulfate, above 20000 mg/L
- Calcium above 500 mg/L
- Aluminum, Ammonium, Magnesium above 200 mg/L
- Copper, Iron (Ferric), Zinc above 50 mg/L
- Cationic surfactants (as CTAB) cause positive interference, with a bias of about 120% at 1 mg/L CTAB, and 25% at 0.2 mg/L CTAB.
- Anionic surfactants (as SDBS) cause negative interference, with a bias of about 10% at the concentration of 2 mg/L SDBS and 30% at 20 mg/L SDBS

10. 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.

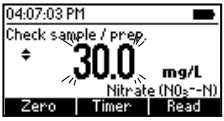
There is an excess amount of ambient light reaching the detector.
Make sure the lid is closed before performing any measurements. If the issue persists, please contact Hanna Instruments technical support.

The sample and the zero cuvettes are inverted.
Swap the cuvettes and repeat the measurement.

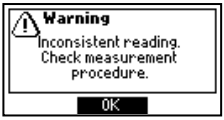
There is either too much light or the instrument can not adjust the light level.
Please check the preparation of the zero cuvette and that the sample does not contain any debris.

The meter is either overheating or its temperature has dropped too low to operate within published accuracy specifications.
The meter must be between 0 and 50 °C (32 and 122 °F) to perform any measurements.

Meter temperature has changed significantly since the zero measurement has been performed.
The zero measurement must be performed again.

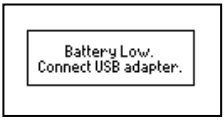
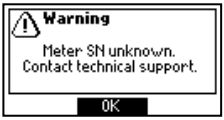
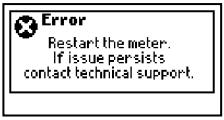


The measured value is outside the limits of the method.
If possible, change the method range. Verify that the sample does not contain any debris. Check the sample preparation and the measurement preparation.



The measured value cannot be calculated.
Please check sample preparation and measurement procedure.

Stored results of the CAL Check™ measurements have been lost.
Please redo the CAL Check measurements to ensure accurate results.

	User settings have been lost. Please reset the values. If the issue persists, please contact Hanna Instruments technical support.
	Flash drive is not recognized or it might be damaged. Please insert a new USB flash drive.
	Data log is full. Please review logged data and delete unnecessary logs.
	Date and time settings have been lost. Please reset the values. If the issue persists, please contact Hanna Instruments technical support.
	Battery level is too low to ensure normal functioning and the meter will turn off. Connect the USB adapter to charge the battery.
	English is the only available language. Some features are no longer available. Restart the meter. If the issue persists, please contact Hanna Instruments technical support.
	Real time clock is not accurate. Some features are no longer available. Restart the meter. If the issue persists, please contact Hanna Instruments technical support.
	The device serial number can not be identified. Some features are no longer available. Restart the meter. If the issue persists, please contact Hanna Instruments technical support.
	Logged data is no longer accessible. Some features are no longer available. Restart the meter. If the issue persists, please contact Hanna Instruments technical support.
	Battery charge level is not accurate. Some features are no longer available. Restart the meter. If the issue persists, please contact Hanna Instruments technical support.
	A critical error has occurred. Restart the meter. If the issue persists, please contact Hanna Instruments technical support.

11. STANDARD METHODS

Description	Range	Method
Ammonia LR	0.00 to 3.00 mg/L (as NH_3-N)	Nessler
Ammonia LR (16 mm Vial)	0.00 to 3.00 mg/L (as NH_3-N)	Nessler
Ammonia MR	0.00 to 10.00 mg/L (as NH_3-N)	Nessler
Ammonia HR	0.0 to 100.0 mg/L (as NH_3-N)	Nessler
Ammonia HR (16 mm Vial)	0.0 to 100.0 mg/L (as NH_3-N)	Nessler
Chloride LR (16 mm Vial)	0.0 to 100.0 mg/L (as Cl^-)	Mercury Thiocyanate
Chloride HR (16 mm Vial)	80 to 1000 mg/L (as Cl^-)	Mercury Thiocyanate
Chlorine, Free	0.00 to 5.00 mg/L (as Cl_2)	DPD
Chlorine, Total	0.00 to 5.00 mg/L (as Cl_2)	DPD
Chromium(VI)/Total (16 mm Vial)	0 to 1000 µg/L (as Cr)	Diphenylcarbazide
Chemical Oxygen Demand LR (16 mm Vial)	0 to 150 mg/L (as O_2)	EPA 410.4
Chemical Oxygen Demand MR (16 mm Vial)	0 to 1500 mg/L (as O_2)	EPA 410.4
Chemical Oxygen Demand HR (16 mm Vial)	0 to 15000 mg/L (as O_2)	EPA 410.4
Chemical Oxygen Demand UHR (16 mm Vial)	0 to 60.0 g/L (as O_2)	EPA 410.4
Iron (16 mm Vial)	0.00 to 6.00 mg/L (as Fe)	Phenanthroline
Iron, Total (16 mm Vial)	0.00 to 7.00 mg/L (as Fe)	EPA 315B
Nitrate (16 mm Vial)	0.0 to 30.0 mg/L (as NO_3^-- N)	Chromotropic Acid
Nitrite, Seawater (16 mm Vial)	0 to 600 µg/L (as NO_2^--N)	Diazotization
Nitrite LR	0 to 600 µg/L (as NO_2^--N)	Diazotization
Nitrite LR (16 mm Vial)	0 to 600 µg/L (as NO_2^--N)	Diazotization
Nitrite MR (16 mm Vial)	0.00 to 6.00 mg/L (as NO_2^--N)	Diazotization
Nitrite HR	0 to 150 mg/L (as NO_2^-)	Ferrous Sulfate
Nitrogen, Total LR (16 mm Vial)	0.0 to 25.0 mg/L (as N)	Chromotropic Acid
Nitrogen, Total HR (16 mm Vial)	10 to 150 mg/L (as N)	Chromotropic Acid
Phenols (16 mm Vial)	0.0 to 20.0 mg/L	EPA 420.1
Phosphorus, Reactive LR (16 mm Vial)	0.00 to 1.60 mg/L (as P)	Ascorbic Acid
Phosphorus, Reactive HR (16 mm Vial)	0.0 to 32.6 mg/L (as P)	Vanadomolybdophosphoric Acid
Phosphorus, Acid Hydrolyzable (16 mm Vial)	0.00 to 1.60 mg/L (as P)	Ascorbic Acid
Phosphorus, Total LR (16 mm Vial)	0.00 to 1.15 mg/L (as P)	Ascorbic Acid
Phosphorus, Total HR (16 mm Vial)	0.0 to 32.6 mg/L (as P)	Vanadomolybdophosphoric Acid
Surfactants, Anionic (16 mm Vial)	0.00 to 3.50 mg/L (as SDBS)	MBAS
Surfactants, Cationic (16 mm Vial)	0.00 to 2.50 mg/L (as CTAB)	Bromophenol Blue
Surfactants, Nonionic (16 mm Vial)	0.00 to 6.00 mg/L (as TRITON X-100)	TBPE

12. ACCESSORIES

12.1. REAGENT SETS

Ordering Information	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 EPA LR tests (Vial)
HI93754B-25	24 chemical oxygen demand EPA MR tests (Vial)
HI93754C-25	24 chemical oxygen demand HR tests (Vial)
HI93754D-25	24 chemical oxygen demand Hg Free LR tests (Vial)
HI93754E-25	24 chemical oxygen demand Hg Free MR tests (Vial)
HI93754F-25	24 chemical oxygen demand ISO LR tests (Vial)
HI93754G-25	24 chemical oxygen demand ISO MR tests (Vial)
HI93754J-25	24 chemical oxygen demand UHR 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)
HI93763B-50D	49 phosphorus total HR tests (Vial), with dispenser
HI93764A-25	25 ammonia LR tests (Vial)
HI93764B-25	25 ammonia HR tests (Vial)

Ordering Information	Description
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)
HI96780-25	24 surfactants, nonionic tests (Vial)
HI96781-25	25 chromium VI/total tests (Vial)
HI96782-25	25 surfactants, anionic tests (Vial)
HI96783-25	25 nitrite LR tests (Vial)
HI96784-25	25 nitrite MR tests (Vial)
HI96785-25	25 surfactants, cationic tests (Vial)
HI96785-25D	25 surfactants, cationic tests (Vial), with dispenser
HI96786-25	25 iron tests (Vial)
HI96788-25	25 phenol tests (Vial)
HI96789-25	25 nitrite in seawater tests (Vial)
HI96793-25	24 chloride LR tests (Vial)
HI96794-25	24 chloride HR tests (Vial)

12.2. pH ELECTRODES

Ordering Information	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.*

12.3. pH SOLUTIONS

Ordering Information	Description
BUFFER SOLUTIONS	
HI70004P	pH 4.01 buffer sachet, 20 mL (25 pcs.)
HI70007P	pH 7.01 buffer sachet, 20 mL (25 pcs.)
HI70010P	pH 10.01 buffer sachet, 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 sachet, 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	
HI7082	3.5M KCl electrolyte for double junction electrodes, 4×30 mL
HI8082	3.5M KCl electrolyte for double junction electrodes in FDA approved bottle, 4×30 mL

12.4. OTHER ACCESSORIES

Ordering Info.	Description
HI72083300	Carrying case
HI731311	Vial cuvette 16 mm diam. (5 pcs.)
HI731318	Cloth for wiping cuvettes (4 pcs.)
HI731331	Glass cuvette (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.)
HI740144P	Pipette tip for 1 mL graduated syringe (10 pcs.)
HI740157P	Plastic refilling pipette (20 pcs.)
HI740216	Cooling rack
HI740217	Safety shield for reactor
HI740220	25 mL graduated glass vial (2 pcs.)
HI740224	170 mL plastic beaker (6 pcs.)
HI740225	60 mL graduated syringe
HI740226	5 mL graduated syringe
HI740227	Filter assembly
HI740228	Filter disc (25 pcs.)
HI740229	100 mL graduated cylinder
HI74083300	COD Adapter
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, 115 VAC, USA plug
HI839800-02	Reactor, 230 VAC, European plug
HI920015	USB to micro USB cable connector
HI93703-50	Cuvette cleaning solution (250 mL)
HI93703-55	Activated carbon (50 pcs.)

13. ABBREVIATIONS

Abs Absorbance
ASTM American Society for Testing Materials
COD Chemical Oxygen Demand
DPD N,N-diethyl-p-phenylenediamine
EPA US Environmental Protection Agency
GLP Good Laboratory Practice
HDPE High-Density Polyethylene
ISO International Organization for Standardization
NIST National Institute of Standards and Technology
TRRS Tip/Ring/Ring/Sleeve
TBPE Tetrabromophenolphthalein ethyl ester
g/L grams per liter (parts per thousand, ppt)
µg/L micrograms per liter (parts per billion, ppb)
mg/L milligrams per liter (parts per million, ppm)
HR High Range
LR Low Range
MR Medium Range
UHR Ultra High Range
ULR Ultra Low Range

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, or the place of purchase.

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 photometer's performance. For your and the photometer'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 its intended purpose and maintained according to instructions. This warranty is limited to repair or replacement free of charge. Damage due to accidents, misuse, tampering, or lack of prescribed maintenance is not covered.

If service is required, contact your local Hanna Instruments® office. If under warranty, report the model number, date of purchase, serial number (engraved on the bottom of the meter), 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.

MAN83314 | Printed in Romania