

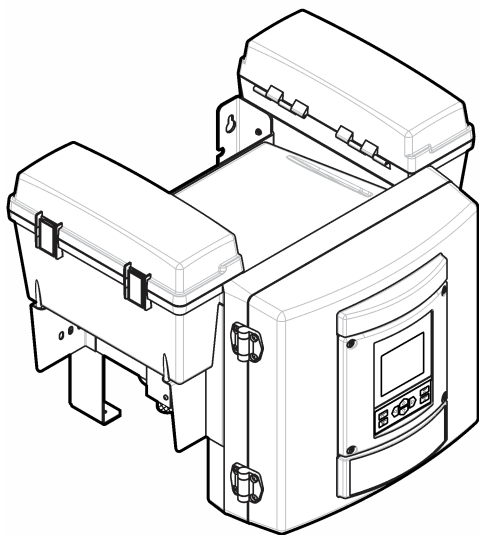


DOC023.53.80366

APA 6000

05/2013, Edition 1

Operations



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General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

Safety information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

Use of hazard information

▲ DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

▲ WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

▲ CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

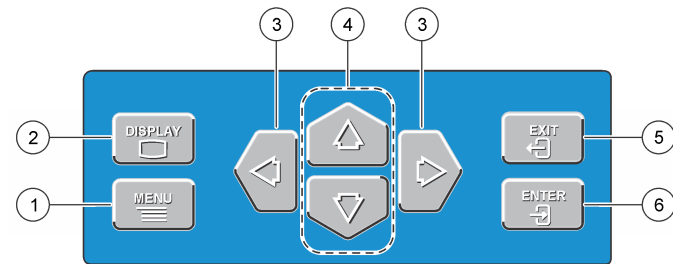
	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of-life equipment to the Producer for disposal at no charge to the user. Note: For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal.
	This symbol indicates that a risk of electrical shock and/or electrocution exists.
	This symbol indicates the need for protective eye wear.
	This symbol indicates that the marked item requires a protective earth connection. If the instrument is not supplied with a ground plug on a cord, make the protective earth connection to the protective conductor terminal.
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.

User interface and navigation

Keypad description

Refer to [Figure 1](#) for the keypad description and navigation information.

Figure 1 Keypad description

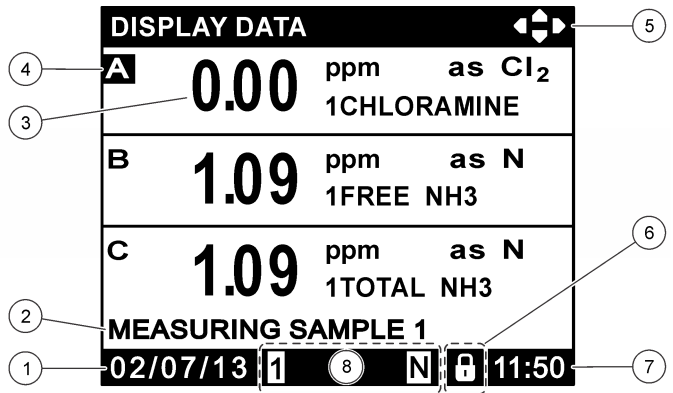


1 MENU: select options from the main menu	4 Navigation keys UP, DOWN: scroll menus, scroll measurement channels, enter numbers and letters
2 DISPLAY: go to the main measurement screen, toggle between numerical view and graph view	5 EXIT: go to the previous screen or cancel a change
3 Navigation keys RIGHT, LEFT: change the number of channels that show, move the cursor	6 ENTER: confirm and open sub-menus

Display description

The main measurement screen shows the measurements in numerical or graph format. Refer to [Figure 2](#) and [Figure 3](#). Push **DISPLAY** to toggle between the two views.

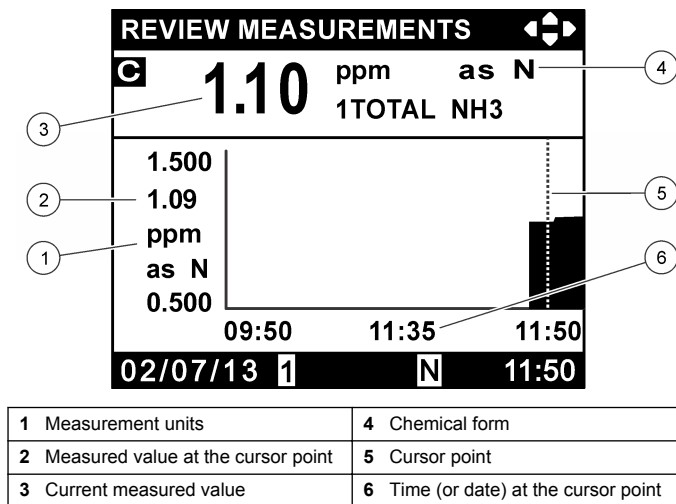
Figure 2 Main measurement screen - numerical



1 Date	5 Active arrow keys
2 Current operation	6 Security icon ³
3 Measured value ^{1, 2}	7 Time (24-hour clock)
4 Channel	8 Active alarm

- ¹ "----" shows if the current measurement for a channel is not available.
² For the ammonia/monochloramine analyzer, a total ammonia reading of "99999" shows if the monochloramine reading is more than the total ammonia reading. "99999" identifies that no free ammonia is present and dichloramine may be present in the sample.
³ Shows only when the security level is set to partial or total

Figure 3 Main measurement screen - graph



Additional displays

From the main measurement screen, additional display formats are available:

- From the numerical screen:
 - Push the **LEFT** and **RIGHT** arrows to change the number of channels that show.
 - Push the **UP** and **DOWN** arrows to scroll through the channels.
 - If the analyzer is connected to a network of analyzers, use the **UP** and **DOWN** arrows to select a channel, then push **ENTER** to identify the analyzer that supplies the measurement. Push **ENTER** again to go back to the data display screen.
- From the graphical screen:

- Push the **UP** and **DOWN** arrows to show the graph for the previous or next channel in sequence.
- Push the **LEFT** and **RIGHT** arrows to change the time period that shows on the X-axis of the graph (2, 8 or 30 hours, 7 days or 30 days).
- Push **ENTER** and then the **LEFT** and **RIGHT** arrows to move the cursor point.

Startup

Set the sample flow rate

Set the sample flow rate through the sample conditioning block. Set the flow rate to 100–2000 mL/minute (500–1000 mL/minute is recommended).

Measure the flow rate by putting the sample bypass drain tubing into a large measuring container (flask or cylinder) over a set amount of time. Collect the sample flow for 15 seconds, then multiply the collected volume (mL) by 4 to identify the flow rate (mL/minute). Keep the end of the sample bypass drain tubing no higher than the sample conditioning block when the flow is measured.

Prepare Reagent 2 (HR hardness analyzer only)

Reagent 2 is supplied as a liquid and a powder that must be mixed together before use. The approximate shelf life of the prepared reagent is 3 months.

1. Remove the cap and seal from the Reagent 2 bottle. The seal can be discarded.
2. Put the supplied powder funnel in the Reagent 2 bottle.
3. Add the powder to the liquid.
4. Install the original cap.
5. Hold the cap tight to prevent loosening and shake the bottle until the powder is dissolved.

Install the analyzer bottles

**DANGER**



Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

1. Put the supplied analyzer bottles (reagent, standard solution and cleaning solution) in the bottle enclosures.
Put the bottles in the bottle enclosures as follows:
 - Left enclosure: Reagent 1, Reagent 2, Reagent 3 (if present)
 - Right enclosure: Standard 1, Standard 2, Cleaning solution
2. Remove the bottle cap and protective seal from each analyzer bottle.
3. Pick up the tube assemblies that go into the analyzer bottles. Make sure that 12.7 mm (0.5-in.) of the tubing comes out of the bottom of each straw.
4. Install the correct analyzer bottle cap and tube assembly on each bottle. Each tube has a label that identifies the corresponding bottle.

Turn on the analyzer

1. Open the analyzer door.
2. Set the power switch to on. Refer to *Product overview* in the Installation manual for the power switch location.
3. Close the analyzer door and close the door latches. Keep the analyzer door closed during operation so that the temperature control system operates correctly.

Prime the analyzer

Make sure to plumb the sample lines and drain hoses and install the reagent and standard bottles before this task is started.

1. Push **MENU** and select SENSOR MENU>APA6000 #1 APA 6000>SOLUTIONS AND CLEANING>PRIMING>PRIME ENTIRE SYSTEM NOW to prime the analyzer.

Priming takes 7–15 minutes. A pop-up window shows the time that remains to complete the prime cycle. When the priming is complete, the analyzer automatically starts sample measurement.

2. If bubbles are seen in the tubing after the analyzer is primed, do step 1 again to remove the bubbles (maximum of 4 times).

Calibrate the analyzer

Calibrate the analyzer before initial use. The manufacturer recommends that the analyzer be calibrated after at least 5 hours of operation to let all system components stabilize. Refer to [Start a calibration manually](#) on page 12 to start a calibration.

Operation

Configuration

Set the language, date, time and analyzer name

1. Push **MENU** and select AQUATREND MENU>LANGUAGE.
2. Select the language.
3. Select SET TIME/DATE.
4. Select an option.

Option	Description
SET TIME	Enter the time in 24-hour format (HH:MM).
SET DATE	Enter the date.
DAY	Enter the day of the week.
DATE FORMAT	Select the date format (MM:DD:YY or DD:MM:YY).

5. Optional: Change the default name for the analyzer (default = #1 APA 6000).
 - a. Select EDIT NAME.

- b. Use the arrow keys to change the name, then push **ENTER**. The name can be a maximum of 12 alphanumeric characters. The first character must be a letter or #.

Configure the display settings

1. Push **MENU** and select AQUATREND MENU>DISPLAY SETUP.
2. Select an option.

Option	Description
MEASUREMENT TO CHANNEL>ATTACH	Assign a channel to each parameter measured on a sample stream—CHANNEL A–P. Only parameters assigned to channels show on the display. <i>Note: To change an assigned channel, detach the channel first and then attach the channel to a different parameter.</i>
CHANNEL GRAPH SETTINGS	Set the minimum (YMIN) and maximum (YMAX) y-axis graph values for each channel. To enter a negative value, change the first character to a negative sign.
FLASH ON ALARMS	Enable or disable the display to flash when there is an active alarm—YES (enable) or NO (disable).
CONTRAST LEVEL	Set the display contrast—00 to 24 (default = 14).

Select the measurement units

Select the measurement units for the parameters shown on the display.

Note: The data log for a parameter is erased when the measurement units for the parameter are changed.

1. Push **MENU** and select SENSOR MENU>APA6000 #1 APA 6000>MEASUREMENT OPTIONS.

2. Select an option.

Option	Description
CHEMICAL FORM	Select the chemical form shown on the display.
SAMPLE SEQUENCE	Set the sample sequence. This option is only available when the number of sample streams is set to 2. Refer to <i>Sensor diagnostics</i> in the maintenance manual.
DISPLAY	Not used
UNITS	Select HOLD OUTPUTS. Select the units shown for the parameter—mg/l, ug/l, ppm, ppb, etc.

Schedule automatic cleanings

The manufacturer recommends that a cleaning cycle is done:

- High range hardness, low range hardness and alkalinity analyzers—once a day
- Low range ammonia and ammonia/monochloramine analyzers—every 12 hours

A cleaning cycle dispenses cleaning solution through all the wetted parts of the analyzer. Cleanings keep the analyzer free of contamination buildup.

Note: The auto refresh function is not used.

1. Push **MENU** and select SENSOR MENU>APA6000 #1 APA 6000>SOLUTIONS AND CLEANING>INSTRUMENT CLEAN.
2. Set the schedule for automatic cleanings—4, 6 or 12 HOURS or EVERY DAY (default). The first cleaning cycle of the day is done at 12:00 am (00:00 on a 24-hour clock).

Configure the alarms (optional)

Configure Alarm A and Alarm B as set point alarms or to occur when a sensor warning or sensor alarm occurs. When an Alarm A or Alarm B occurs, it is recorded in an alarm log. If the flash on alarm setting is enabled, the screen also flashes.

Alarm A and Alarm B each have an associated alarm relay that energizes when the alarm occurs. Refer to [Alarm relay setup](#) on page 11 to enable the alarm relays.

Note: The other alarms (AL 1–AL 12) can also be configured and will occur even if the alarm relay associated with the alarm is not used or present.

1. Push **MENU** and select SENSOR MENU>APA6000 #1 APA 6000>ALARM SETUP.
2. Select the alarm. For example, select AL A (Alarm A) or AL B (Alarm B).
3. Select TYPE, then select the alarm type.

Option	Description
Unconfigured (default)	Disable the alarm.
High	Set the alarm to occur when a measurement higher than the set point value (mg/L) occurs.
Low	Set the alarm to occur when a measurement lower than the set point value (mg/L) occurs.
Rate	Set the alarm to occur when the measurement rate change (mg/L per hour) is higher than the set point value.
Sensor Warning	Set the alarm to occur when a sensor warning is active.
Sensor Alarm	Set the alarm to occur when a sensor alarm is active.

4. If High, Low or Rate is selected, select the measured parameter to monitor and the set point value.

Option	Description
MEASUREMENT	Select the measurement parameter (e.g., 1 HR HAR for high range hardness) to monitor.
SET POINT	Enter the set point value.

Option	Description
ENABLE	Optional: Enable (Yes) or disabled (No) the alarm relay that is associated with the alarm.
MEAS FAILURE	Optional: Set the alarm relay associated with the alarm to Off (de-energized), On (energized) or Hold (keep the current state) when a measurement failure occurs.

Configure the security settings (optional)

Configure the security settings to prevent unauthorized changes to the user settings.

1. Push **MENU** and select AQUATREND MENU>SECURITY SETUP.
2. Select an option. All the options that follow are password protected.

Option	Description
SET PASSWORD	Change the current security password (default = HACH). Use the LEFT and RIGHT arrows to select a different digit. Use the UP and DOWN arrows to change the value of a digit. Note: The default password will no longer access the security settings if a user password has been set.
SECURITY LEVEL	Set the level of security. NONE (default)—All users can change any of the user settings (except security setup) and can start analyzer operations (i.e., priming, cleaning or calibration). PARTIAL —All users can change the user settings for display setup, language and alarm log only. All users can start a priming, cleaning or calibration and set bottle fluid levels. TOTAL —The password must be entered before any of the user settings can be changed or analyzer operations can be done.
TEMPORARY UNLOCK	Temporarily disable security. This option is only available when the security level is set to partial or total. Select the amount of time security is disabled—30, 60, 120 or 360 minutes.

Configure the outputs

Alarm relay setup

If the alarm relay connections are used, enable the alarm relays in the alarm settings. Each alarm relay is associated with one alarm (e.g., Alarm A or Alarm B). When enabled, the alarm relay energizes when that alarm occurs. Refer to [Configure the alarms \(optional\)](#) on page 9 to configure the alarms.

Notes:

- During a cleaning cycle, the alarm relay states are held at their current settings until the first sample cycle that follows the cleaning is completed.
- An alarm relay de-energizes when the alarm is acknowledged (deactivated). When the alarm condition occurs again, the alarm relay is energized.
- The alarm relays cannot be configured to energize when network and Aquatrend alarms or warnings occur. Configure the alarm relays of an external signal output module instead.

1. Push **MENU** and select SENSOR MENU>APA6000 #1 APA 6000>ALARM SETUP.
2. Select the alarm that is associated with the alarm relay. For example, select AL A (Alarm A) or AL B (Alarm B).
3. Select an option.

Option	Description
ENABLE	Enable (Yes) or disabled (No) the alarm relay.
MEAS FAILURE	Set the alarm relay to Off (de-energized), On (energized) or Hold (keep the current state) when a measurement failure occurs. This option is only available when the alarm is configured as set point alarm.

Recorder output setup

If the recorder output connections are used, configure the recorder outputs. The current value at the recorder output (4–20 mA) represents the analyzer measurement.

Note: During a cleaning cycle, the recorder outputs are held at their current settings until the first sample cycle that follows the cleaning is completed.

1. Push **MENU** and select SENSOR MENU>APA6000 #1 APA 6000>RECORDER/CONTROL SETUP.
2. Select the recorder output. For example, select RC A (Recorder A) or RC B (Recorder B).
3. Select TYPE>RECORDER.
Note: To disable the recorder output, select TYPE>UNCONFIGURED.
4. Select an option.

Option	Description
MEASUREMENT	Select the measurement parameter (e.g., 1 HR HAR for high range hardness) to monitor.
MIN	Select the measurement value (mg/L) that will result in the minimum (0 or 4 mA) recorder output.
MAX	Select the measurement value (mg/L) that will result in the maximum (20 mA) recorder output.
ENABLED	Enable (On) or disabled (Off) the recorder output. When disabled, the recorder output stays at the minimum value (0 or 4 mA).
MEAS FAILURE	Set the recorder output to Go Max (20 mA), Go Min (0 or 4 mA) or Hold (keep the current value) when a measurement failure occurs.
OUTPUT SETUP	Adjust the minimum and maximum recorder outputs. ZERO SCALE TRIM—0.0 to 11 mA. FULL SCALE TRIM—13.2 to 22.5 mA. Set the recorder output range—0–20 mA or 4–20 mA.

Network connection setup

If the network connection is used, configure the external Aquatrend network device or the attached analyzer using the Other Device Menu and Network Menu. The Other Device Menu and Network Menu are only used when the network connection is used. Refer to the instructions in the AquaTrend Interface Manual.

Measure a grab sample or standard

NOTICE

Make sure that the analyzer is in shutdown mode before the sample line is disconnected. Dry operation may damage the analyzer.

Use the supplied grab sample kit to measure grab samples taken from other areas in the system or to measure a standard for a calibration verification.

Refer to the instructions supplied in the grab sample kit for installation and operation instructions. Put the analyzer in shutdown (standby) mode before the sample inlet line is disconnected. Refer to *Put the analyzer in shutdown mode* in the maintenance manual.

Calibration

A calibration uses the installed known standards to calibrate the analyzer. Calibration can be started manually or scheduled to occur automatically. The manufacturer recommends that automatic calibrations be scheduled.

Schedule automatic calibrations

The manufacturer recommends that a calibration is done once a day.

1. Push **MENU** and select SENSOR MENU>APA6000 #1 APA 6000>CALIBRATION>AUTO-CAL SETUP.
2. Set the schedule for automatic calibrations—Off (disabled), 12 hours, once a day or once a week on a specific day (default = Monday).
Note: If 12 hours is selected, a calibrate is done every 12 hours. For example, if the Auto-Cal Time is set to 14, a calibration is done at 2:00 pm and 2:00 am each day.
3. Select AUTO-CAL TIME and select the hour of the day (24-hour clock) a calibration is done—0–23 (default = 4 = 4:00 am).
Note: Do not schedule a calibration to occur at 12:00 am because a cleaning cycle starts automatically at 12:00 am. Cleaning solution in the tubing can result in a calibration with an accuracy error.

Start a calibration manually

1. Push **MENU**.
2. Select SENSOR MENU>APA6000 #1 APA 6000>CALIBRATION>EXECUTE CALIBRATION.

The analyzer completes any current measurement or priming cycle before the calibration is started.

Note: A calibration typically takes 30–60 minutes to complete.

View the calibration history

1. Push **MENU** and select SENSOR MENU>APA6000 #1 APA 6000>CALIBRATION>CAL HISTORY. A list on the seven most recent successful calibrations shows.
Note: The measured values of the standards are based on the previous calibration curve.
2. Select a calibration to see the calibration details.

Appendix

Bench comparison testing

Use bench comparison testing to identify the accuracy and precision of the analyzer. Use the bench test methods that follow to identify the hardness or concentration of a specific substance in the sample stream.

Alkalinity

Before starting

Four drops of Bromcresol Green-Methyl Red Indicator Solution¹ can be substituted for the Bromcresol Green-Methyl Red Indicator Powder Pillow.

Four drops of Phenolphthalein Indicator Solution¹ can be substituted for the Phenolphthalein Indicator Powder Pillow.

Four drops of methyl purple indicator solution¹ can be used instead of one bromcresol green-methyl red indicator powder pillow. Titrate from green to a gray end point (pH 5.1).

For added convenience when stirring, use the TitraStir® stirring apparatus¹.

meq/L Alkalinity = mg/L as CaCO₃ ÷ 50

Contact with carbon dioxide in the air decreases the sample P alkalinity with time. While the measurements given by this analyzer are representative of the sample P alkalinity where it is sampled, the results from the bench method may only be representative of the sample P alkalinity after some of it, with time, has reacted with carbon dioxide in the air.

Alkalinity measurements on the instrument are made at 50 °C, while the bench method is done at room temperature. Depending on the sample matrix, this may add to the differences between instrument and bench method results.

¹ Refer to [Optional reagents and apparatus](#) on page 18.

Items to collect

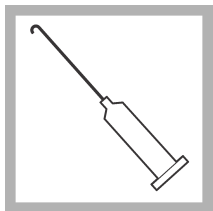
Description	Quantity
Bromcresol Green-Methyl Red Indicator Powder Pillow	1 pillow
Phenolphthalein Indicator Powder Pillow	1 pillow

Items to collect (continued)

Description	Quantity
Sulfuric acid titration cartridge (Table 1 on page 16)	1 cartridge
Digital titrator	1
Delivery tube for digital titrator	1
Volumetric pipet, Class A, 50-mL	1
Volumetric pipet, Class A, 100-mL	1
Erlenmeyer flask, 250-mL	1

Refer to [Consumables and replacement items](#) on page 18 for reorder information.

Alkalinity test



1. Select a sample volume and titration cartridge from [Table 1](#). Insert a clean delivery tube into the titration cartridge. Attach the cartridge to the titrator.



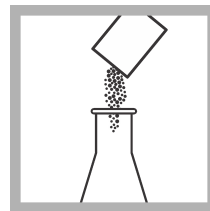
2. Turn the delivery knob to eject air and a few drops of titrant. Reset the counter to zero and wipe the tip.



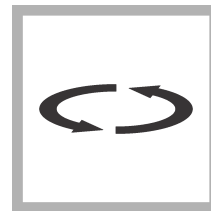
3. Use a volumetric pipet to add the sample volume from [Table 1](#) to a 250-mL Erlenmeyer flask.



4. If the sample volume is less than 100 mL, dilute to approximately 100 mL with deionized water.



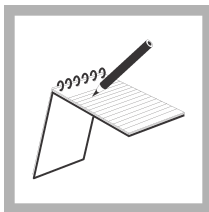
5. Add the contents of one Phenolphthalein Indicator Powder Pillow.



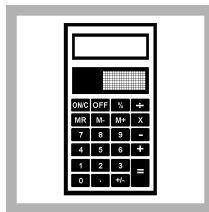
6. Swirl to mix.
If the solution turns pink, proceed to step [7](#).
If the solution is colorless, the Phenolphthalein (P) alkalinity is zero. Proceed to step [10](#).



7. Swirl the flask while titrating with sulfuric acid (H_2SO_4) from pink to colorless.

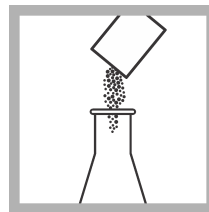


8. Record the number of digits of sulfuric acid (H_2SO_4) required.

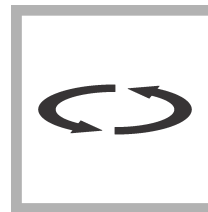


9. Use the multiplier in [Table 1](#) to calculate the concentration:
 digits $\times$ multiplier =
 mg/L as CaCO_3 P
 alkalinity

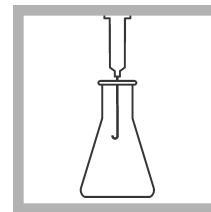
Example: 100 mL of sample was titrated with the 0.1600 N cartridge and 250 digits were used to reach the endpoint. The concentration is $250 \times 0.1 = 25$ mg/L as CaCO_3 .



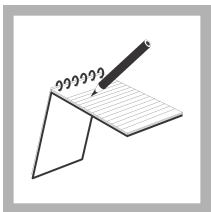
10. Add the contents of one Bromcresol Green-Methyl Red Indicator Powder Pillow.



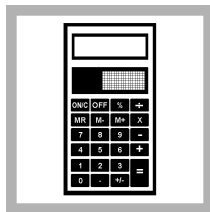
11. Swirl to mix.



12. Continue titrating with sulfuric acid (H_2SO_4) to a light greenish blue-gray (pH 5.1), a light violet-gray (pH 4.8) or a light pink (pH 4.5) color as required by the sample composition. Refer to [Table 2](#).



13. Record the number of digits of sulfuric acid (H_2SO_4) required.



14. Use the multiplier in the [Table 1](#) to calculate the concentration:

digits x multiplier =
mg/L as CaCO_3 total
alkalinity

Example: 100 mL of
sample was titrated with
the 0.1600 N cartridge
and 250 digits were
used to reach the
endpoint. The
concentration is $250 \times$
 $0.1 = 25$ mg/L as
 CaCO_3 .

Table 1 Range-specific information

Range (mg/L as CaCO_3)	Sample volume (mL)	Titration cartridge (H_2SO_4)	Multiplier
10–50	100	0.1600 N	0.1
50–100	50	0.1600 N	0.2
100–500	100	1.600 N	1.0
500–1000	50	1.600 N	2.0

Table 2 End point pH

Sample composition	End point	Sample composition	End point
Alkalinity about 30 mg/L	pH 5.1	Silicates or phosphates present	pH 4.5
Alkalinity about 150 mg/L	pH 4.8	Industrial wastes or complex system	pH 3.7
Alkalinity about 500 mg/L	pH 4.5		

Alkalinity relationship table

Total alkalinity mostly includes hydroxide, carbonate and bicarbonate alkalinities. The concentration of these alkalinities in a sample can be identified when the phenolphthalein alkalinity and total alkalinity are known. Refer to [Table 3](#).

1. Does the Phenolphthalein alkalinity equal zero? If yes, use Row 1.
2. Does the Phenolphthalein alkalinity equal the Total alkalinity? If yes, use Row 2.
3. Multiply the Phenolphthalein alkalinity by 2.
4. Compare the result with the Total alkalinity. Use Row 3, 4 or 5 based on the comparison.
5. Do the necessary calculations in the row if any.
6. Check the results. The sum of the three alkalinity types should equal the Total alkalinity.

Table 3 Alkalinity relationships

Row	Result of titration	Hydroxide alkalinity	Carbonate alkalinity	Bicarbonate alkalinity
1	Phenolphthalein alkalinity = 0	0	0	= Total alkalinity
2	Phenolphthalein alkalinity = Total alkalinity	= Total alkalinity	0	0
3	Phenolphthalein alkalinity $\times 2$ = less than Total alkalinity	0	= Phenolphthalein alkalinity $\times 2$	= Total alkalinity – (Phenolphthalein alkalinity $\times 2$)

Table 3 Alkalinity relationships (continued)

Row	Result of titration	Hydroxide alkalinity	Carbonate alkalinity	Bicarbonate alkalinity
4	Phenolphthalein alkalinity $\times 2$ = Total alkalinity	0	= Total alkalinity	0
5	Phenolphthalein alkalinity $\times 2$ = more than Total alkalinity	= (Phenolphthalein alkalinity $\times 2$) – Total alkalinity	= (Total alkalinity – Phenolphthalein alkalinity) $\times 2$	0

End point confirmation

- Phenolphthalein alkalinity—Add 50 mL of deionized water to a flask. Add one pH 8.3 buffer powder pillow and one Phenolphthalein Indicator Powder Pillow and swirl to mix. Use this solution for comparison during the titration with the sample.
- Total alkalinity—Add 50 mL of deionized water to a flask. Add one pH buffer powder pillow and one Bromcresol Green-Methyl Red Indicator Powder Pillow and swirl to mix. Refer to [Table 2](#) on page 17 for the correct pH value. Use this solution for comparison during the titration with the sample.

Note: If the pH 3.7 end point is used, use a Bromphenol Blue Indicator Powder Pillow instead of a Bromcresol Green-Methyl Red Indicator Powder Pillow and titrate to a green end point.

Consumables and replacement items

Required reagents

Description	Quantity/test	Unit	Item no.
Alkalinity Reagent Set (approximately 100 tests)			2271900
Bromcresol Green-Methyl Red Powder Pillows	1 pillow	100/pkg	94399
Phenolphthalein Indicator Powder Pillows	1 pillow	100/pkg	94299
Sulfuric Acid Titration Cartridge, 0.1600 N	varies	each	1438801
Sulfuric Acid Titration Cartridge, 1.600 N	varies	each	1438901

Required apparatus

Description	Quantity/test	Unit	Item no.
Digital Titrator	1	each	1690001
Flask, Erlenmeyer, graduated, 250-mL	1	each	50546
Volumetric pipet—select one or more based on range:			
Pipet, volumetric, Class A, 50-mL	1	each	1451541
Pipet, volumetric, Class A, 100-mL	1	each	1451542

Optional reagents and apparatus

Description	Unit	Item no.
Buffer Powder Pillows, pH 4.5	25/pkg	89568
Buffer Powder Pillows, pH 8.3	25/pkg	89868
Stir bar, octagonal 28.6 mm x 7.9 mm	each	2095352
Water, deionized	500 mL	27249
Pipet filler, safety bulb	each	1465100
Bottles, sampling, poly, 500 mL	each	2087079
Bromphenol Green-Methyl Red indicator solution	100 mL MDB	2329232
Phenolphthalein Indicator solution, 5 g/L	100 mL MDB	16232
pH meter	each	—
TitraStir stir plate, 115 VAC	each	1940000
TitraStir stir plate, 230 VAC	each	1940010
Scrubber kit, CO ₂ , for standard solution bottles	each	5143100
Scrubber, CO ₂ , soda lime absorbent (desiccant) ¹	each	2747600

¹ Replace the soda lime scrubber on each standard solution bottle when it turns purple. The soda lime scrubber removes carbon dioxide from the air that enters the standard solution bottles.

Total Ammonia and Monochloramine

Before starting

Ammonia—Many tests say they measure ammonia. In most cases, this value will correlate to the free ammonia value calculated by the analyzer. The total ammonia value is the sum of monochloramine and free ammonia.

Free chlorine—There is no correlation between free chlorine and the values supplied by the analyzer. Typically, if free chlorine is present, some measurable monochloramine may be present, but there will be no free ammonia present. It is likely the total and free ammonia will not be measurable (the analyzer shows "99999").

Total chlorine—This value should correlate well with the monochloramine value supplied by the analyzer if some free ammonia is still present in the sample. The total chlorine value may be skewed slightly higher since many total chlorine tests also detect dichloramine, nitrogen trichloride and many other unwanted organic chloramines. The analyzer is specific for monochloramine. Also, the typical output for total chlorine is given as mg/L as Cl_2 .

Calibration of the spectrophotometer (Hach DR 5000) is necessary before monochloramine or ammonia in samples is measured. Calibration with Standard 1 (0.0 mg/L $\text{NH}_3\text{-N}$) and Standard 2 (2.0 mg/L $\text{NH}_3\text{-N}$) identifies the blank and slope calibration values. Because monochloramine is not stable, the test uses an ammonia standard.

The free ammonia concentration of a sample can be calculated when the total ammonia and monochloramine concentrations are known. Free ammonia (mg/L) = total ammonia (mg/L) – monochloramine (mg/L)

Always do the calibration procedure just before sample analysis because reagents may change over time.

Take all measurements at 25 °C for best accuracy.

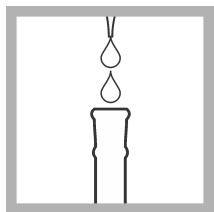
Items to collect

Description	Quantity
Reagent 1 for ammonia/monochloramine	20 mL
Reagent 2 for ammonia/monochloramine	20 mL
Reagent 3 for ammonia/monochloramine ¹	15 mL
Standard 1, 0 mg/L as NH_3	105 mL
Standard 2, 2.0 mg/L as NH_3	100 mL
Hach DR 5000 spectrophotometer	1
Volumetric pipet, Class A, 50-mL	1
Erlenmeyer flask, 250-mL	3
Volumetric flask, 100-mL	3

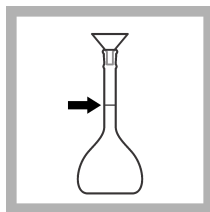
¹ The approximate shelf life of Reagent 3 is 6 months.

Refer to [Consumables and replacement items](#) on page 26 for reorder information.

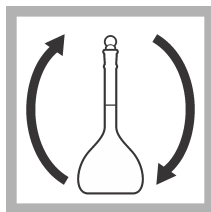
Calibration procedure



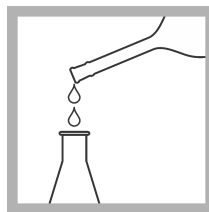
1. Prepare the solution: Use a volumetric pipet to add 5.0 mL of Reagent 3 to a 100-mL volumetric flask.



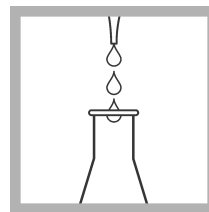
2. Fill the volumetric flask to the 100-mL mark with Standard 1.



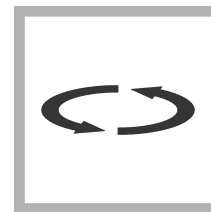
3. Close the volumetric flask and invert at least 7 times to mix.



4. Pour the solution into a clean 250-mL Erlenmeyer flask.



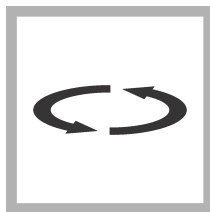
5. Use a volumetric pipet to add 5.0 mL of Reagent 2 to the Erlenmeyer flask.



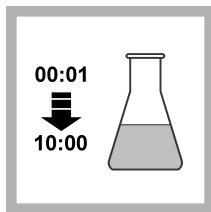
6. Swirl to mix.



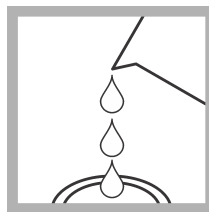
7. Use a volumetric pipet to add 5.0 mL of Reagent 1 to the Erlenmeyer flask.



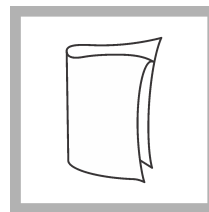
8. Swirl to mix.



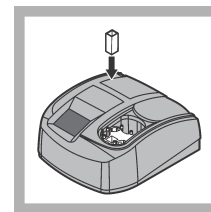
9. Set a timer for 10 minutes. Start the timer. A 10 minute reaction time starts.



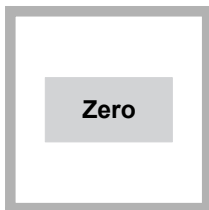
10. Prepare the blank: Fill a sample cell with deionized water.



11. Clean the blank.



12. Insert the blank in the Hach DR 5000 spectrophotometer.



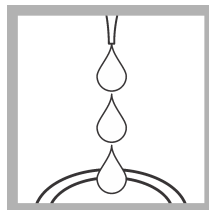
13. Zero the spectrophotometer at 650 nm.



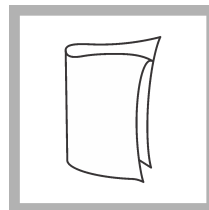
14. Remove the blank from the cell holder.



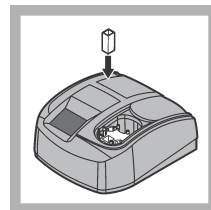
15. When the timer expires, rinse a sample cell with the prepared solution three times.



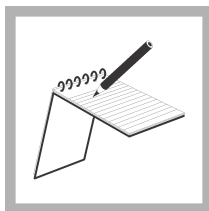
16. Use a volumetric pipet to add 3 mL of the prepared solution to the sample cell.



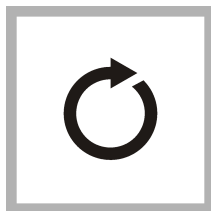
17. Clean the sample cell.



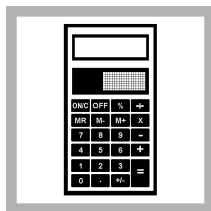
18. Insert the prepared solution into the Hach DR 5000 spectrophotometer.



19. Measure the absorbance (abs) at 650 nm. Record the value.



20. Do steps 1–19 with Standard 2.

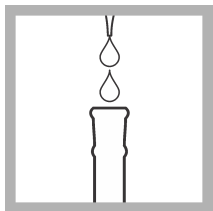


21. Calculate the calibration slope:

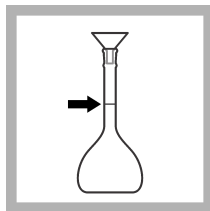
Slope = (abs of Standard 2 prepared solution – abs of Standard 1 prepared solution) ÷ 2

Note: The zero calibration value is the absorbance value of the Standard 1 prepared solution.

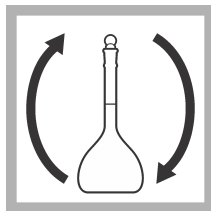
Monochloramine test



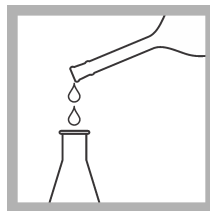
1. Prepare the solution: Use a volumetric pipet to add 5.0 mL of Standard 1 to a 100-mL volumetric flask.



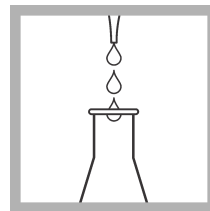
2. Fill the volumetric flask to the 100-mL mark with the sample.



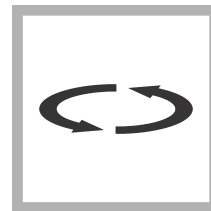
3. Close the volumetric flask and invert at least 7 times to mix.



4. Pour the solution into a clean 250-mL Erlenmeyer flask.



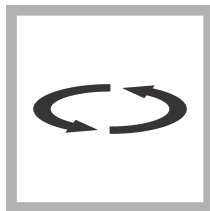
5. Use a volumetric pipet to add 5.0 mL of Reagent 2 to the Erlenmeyer flask.



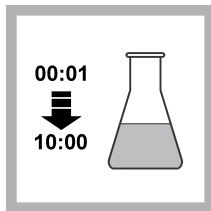
6. Swirl to mix.



7. Use a volumetric pipet to add 5.0 mL of Reagent 1 to the Erlenmeyer flask.



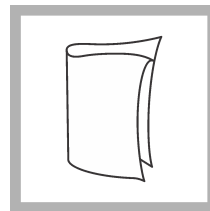
8. Swirl to mix.



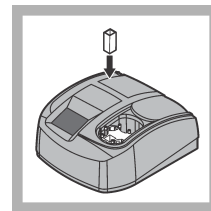
9. Set a timer for 10 minutes. Start the timer. A 10 minute reaction time starts.



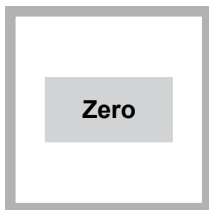
10. Prepare the blank: Fill a sample cell with deionized water.



11. Clean the blank.



12. Insert the blank in the Hach DR 5000 spectrophotometer.



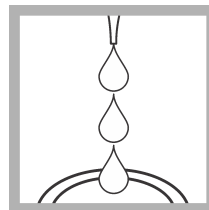
13. Zero the spectrophotometer at 646 nm.



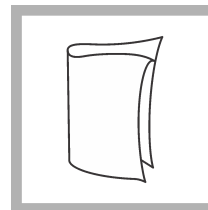
14. Remove the blank from the cell holder.



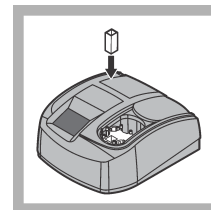
15. When the timer expires, rinse a sample cell with the prepared solution three times.



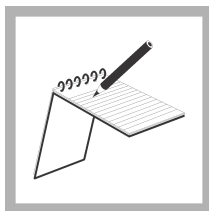
16. Use a volumetric pipet to add 3 mL of the prepared solution to the sample cell.



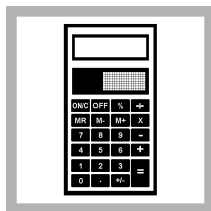
17. Clean the sample cell.



18. Insert the prepared solution into the Hach DR 5000 spectrophotometer.



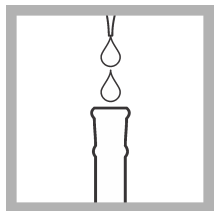
19. Measure the absorbance (abs) at 646 nm. Record the value.



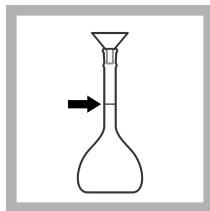
20. Calculate the Monochloramine concentration:

Monochloramine = (abs of prepared sample – abs of blank) ÷ calibration slope

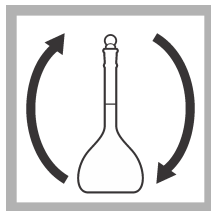
Total Ammonia test



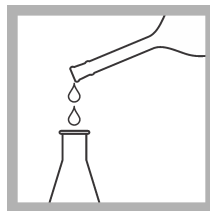
1. Prepare the solution: Use a volumetric pipet to add 5.0 mL of Reagent 3 to a 100-mL volumetric flask.



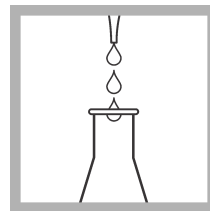
2. Fill the volumetric flask to the 100-mL mark with the sample.



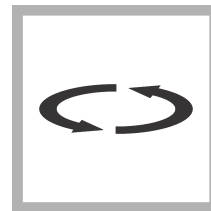
3. Close the volumetric flask and invert at least 7 times to mix.



4. Pour the solution into a clean 250-mL Erlenmeyer flask.



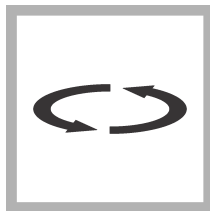
5. Use a volumetric pipet to add 5.0 mL of Reagent 2 to the Erlenmeyer flask.



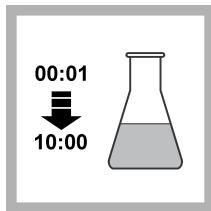
6. Swirl to mix.



7. Use a volumetric pipet to add 5.0 mL of Reagent 1 to the Erlenmeyer flask.



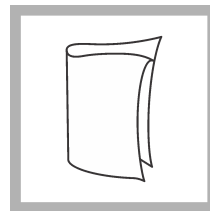
8. Swirl to mix.



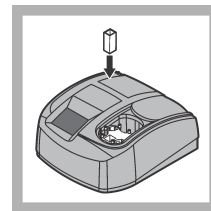
9. Set a timer for 10 minutes. Start the timer. A 10 minute reaction time starts.



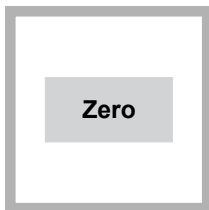
10. Prepare the blank: Fill a sample cell with deionized water.



11. Clean the blank.



12. Insert the blank in the Hach DR 5000 spectrophotometer.



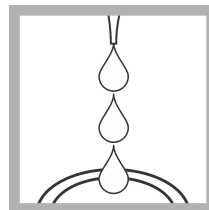
13. Zero the spectrophotometer at 650 nm.



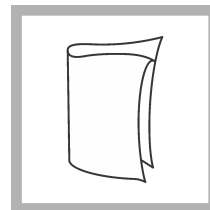
14. Remove the blank from the cell holder.



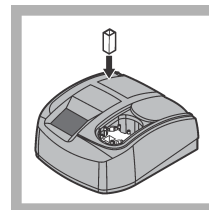
15. When the timer expires, rinse a sample cell with the prepared solution three times.



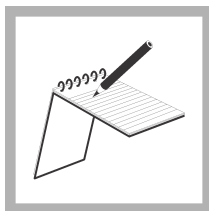
16. Use a volumetric pipet to add 3 mL of the prepared solution to the sample cell.



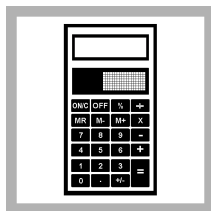
17. Clean the sample cell.



18. Insert the prepared solution into the Hach DR 5000 spectrophotometer.



19. Measure the absorbance (abs) at 650 nm. Record the value.



20. Calculate the Total Ammonia concentration:

Total Ammonia = (abs of prepared sample – abs of blank) ÷ calibration slope

Consumables and replacement items

Required reagents

Description	Quantity/test	Unit	Item no.
Reagent 1 for ammonia/monochloramine	15 mL	1 L	2776353
Reagent 2 for ammonia/monochloramine	15 mL	1 L	2776453
Reagent 3 for ammonia/monochloramine	15 mL	1 L	2776553
Standard 1, 0 mg/L as NH ₃	105 mL	1 L	2776653
Standard 2, 2.0 mg/L as NH ₃	100 mL	1 L	2776753

Required apparatus

Description	Quantity/test	Unit	Item no.
Flask, Erlenmeyer, graduated, 250-mL	4	each	50546
Volumetric flask, 100-mL	3	each	2636642
Pipet, volumetric, Class A, 50-mL	1	each	1451541

Low Range Hardness

Before starting

Other procedures may be used to identify the accuracy of the analyzer. These methods are typically referred to as Total Hardness methods. Hach offers multiple methods such as the Digital Titrator (Method 8213) or a standard burette (Method 8226). Both titrate hardness with EDTA. The EDTA titration outlined in Standard Methods for the Examination of Water and Wastewater should supply comparable results.

Always do the calibration procedure just before sample analysis because reagents may change over time.

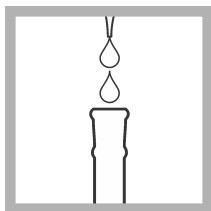
Take all measurements at 25 °C for best accuracy.

Items to collect

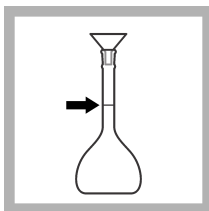
Description	Quantity
Reagent 1 for low range hardness	15 mL
Reagent 2 for low range hardness	15 mL
Standard 1, 0 ug/L as CaCO ₃	100 mL
Standard 2, 5 ug/L as CaCO ₃	100 mL
Hach DR 5000 spectrophotometer	1
Volumetric pipet, Class A, 50-mL	1
Erlenmeyer flask, 250-mL	1
Volumetric flask, 100-mL	2

Refer to [Consumables and replacement items](#) on page 29 for reorder information.

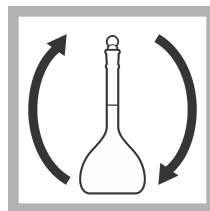
Calibration procedure



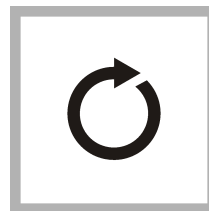
1. Prepare the solution: Use a volumetric pipet to add 5.0 mL of Reagent 2 and 5 mL of Reagent 1 to a 100-mL volumetric flask.



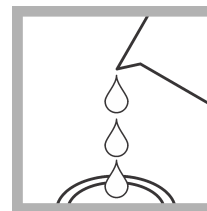
2. Fill the volumetric flask to the 100-mL mark with Standard 1. Put a "Standard 1" label on the flask.



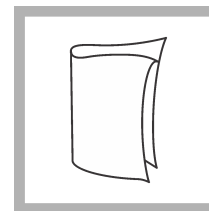
3. Close the volumetric flask and invert at least 7 times to mix.



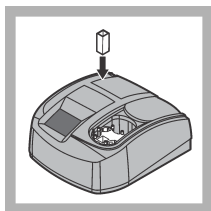
4. Do steps 1–3 with Standard 2. Put a "Standard 2" label on the flask.



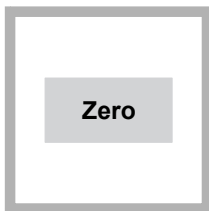
5. Prepare the blank: Fill a sample cell with deionized water.



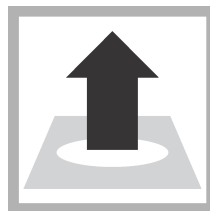
6. Clean the blank.



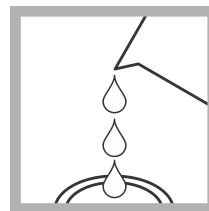
7. Insert the blank in the Hach DR5000 spectrophotometer.



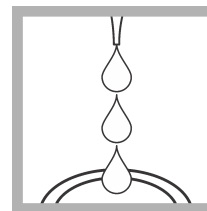
8. Zero the spectrophotometer at 520 nm.



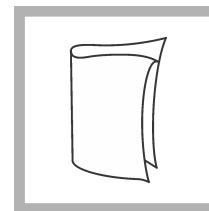
9. Remove the blank from the cell holder.



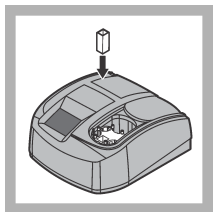
10. Rinse a sample cell with the Standard 1 prepared solution three times.



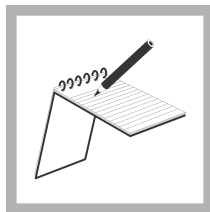
11. Use a volumetric pipet to add 3 mL of the Standard 1 prepared solution to the sample cell.



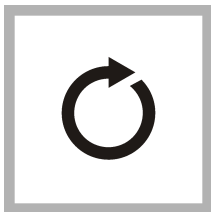
12. Clean the sample cell.



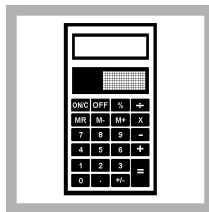
13. Insert the prepared solution into the Hach DR5000 spectrophotometer.



14. Measure the absorbance at 520 nm. Record the value.



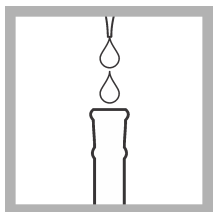
15. Do steps 10–14 with Standard 2.



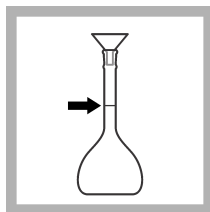
16. Calculate the calibration slope:
Slope = (absorbance of the Standard 2 solution) – (absorbance of the Standard 1 solution) ÷ 4.5

Note: The zero calibration value is the absorbance value of the Standard 1 solution.

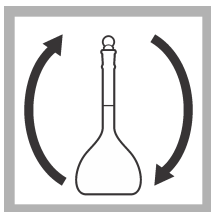
Low Range Hardness test



1. Use a volumetric pipet to add 5.0 mL of Reagent 2 and 5 mL of Reagent 1 to a 100-mL volumetric flask.



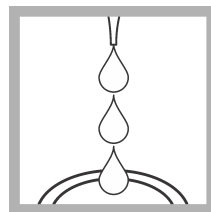
2. Fill the volumetric flask to the 100-mL mark with the sample.



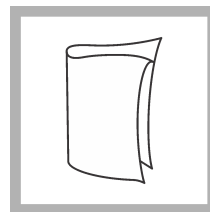
3. Close the volumetric flask and invert at least 7 times to mix.



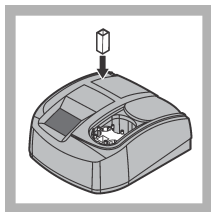
4. Rinse a sample cell with the prepared sample three times.



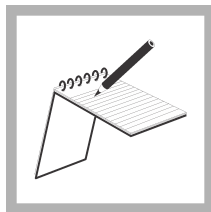
5. Use a volumetric pipet to add 3 mL of the prepared sample to the sample cell.



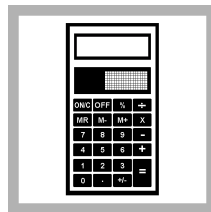
6. Clean the sample cell.



7. Insert the prepared solution into the Hach DR5000 spectrophotometer.



8. Measure the absorbance at 520 nm. Record the value.



9. Calculate the total hardness concentration:

$$\text{Slope} = (\text{absorbance of prepared sample}) - (\text{absorbance of Standard 1 solution}) \div 0.9$$

Consumables and replacement items

Required reagents

Description	Quantity/test	Unit	Item no.
Reagent 1 for low range hardness	10 mL	1 L	2695853
Reagent 2 for low range hardness	10 mL	1 L	2695753
Standard 1, 0 ug/L as CaCO ₃	100 mL	1 L	2696253
Standard 2, 5 mg/L as CaCO ₃	100 mL	1 L	2696353

Required apparatus

Description	Quantity/test	Unit	Item no.
Volumetric flask, 100-mL	3	each	2636642
Pipet, volumetric, Class A, 50-mL	1	each	1451541

High Range Hardness

Before starting

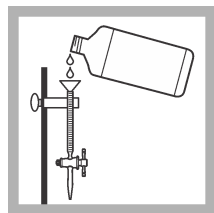
Standardize Reagent 3 with Standard 2 to identify the titer value of Reagent 3 before sample analysis for total hardness.

Always do the standardization procedure just before sample analysis because reagents may change over time.

Items to collect

Description	Quantity
Reagent 1 for high range hardness	4 mL
Reagent 2 for high range hardness ¹	32 mL
Reagent 3 for high range hardness	50 mL
Standard 2, 1000 mg/L	60 mL
Buret, 25-mL, Class A	1
Graduated cylinder, 10-mL	2
Digital titrator	1
Delivery tube for digital titrator	1

Standardization procedure



1. Fill a 25-mL buret with Reagent 3.



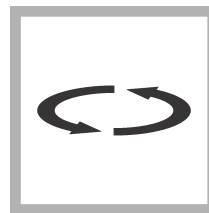
2. Use a volumetric pipet to add 20 mL of Standard 2 to a clean 250-mL Erlenmeyer flask.



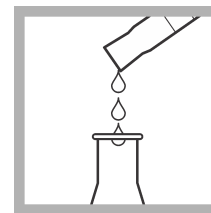
3. Fill the Erlenmeyer flask to the 100-mL mark with deionized water.



4. Use a marked dropper to add 1 mL of Reagent 1 to the Erlenmeyer flask.



5. Swirl to mix.



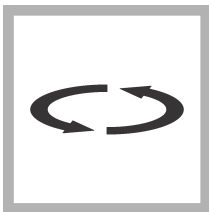
6. Use a graduated cylinder to add 8 mL of Reagent 2 to the Erlenmeyer flask.

Items to collect (continued)

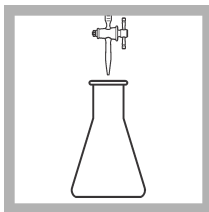
Description	Quantity
Dropper, glass with 0.5- and 1-mL mark	1
Erlenmeyer flask, 250-mL	2
Volumetric pipet, Class A, 50-mL	1
Volumetric pipet, Class A, 100-mL	1

¹ Refer to [Prepare Reagent 2 \(HR hardness analyzer only\)](#) on page 7.

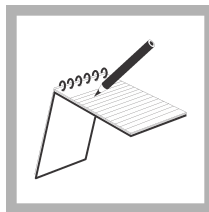
Refer to [Consumables and replacement items](#) on page 34 for reorder information.



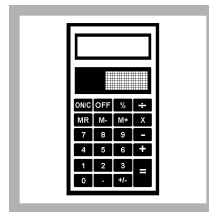
7. Swirl to mix.



8. Swirl the flask while titrating with Reagent 3 from red to pure blue.

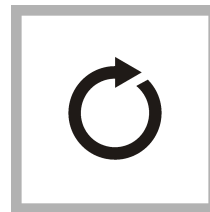


9. Record the volume of Reagent 3 required.

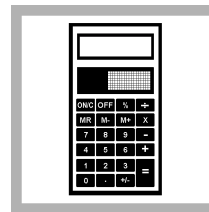


10. Calculate the titer of Reagent 3:

Reagent 3 titer (M) =
 $0.2 \div \text{Reagent 3 volume (mL)}$



11. Do steps 1–10 two more times.



12. Calculate the average value of the three titer values to identify the titer for Reagent 3.

Identify the correct sample size

Use a digital titrator to do titration when the sample concentration is 10–100 mg/L as CaCO_3 . Use a buret to do titration when the sample concentration is 100–1000 mg/L as CaCO_3 . Table 4 and Table 5 show the sample volume to use based on the sample concentration.

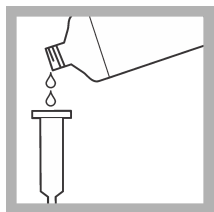
Table 4 Sample volume for digital titrator titration

Sample concentration (mg/L as CaCO_3)	Sample volume (mL)
10–50	20
50–100	10

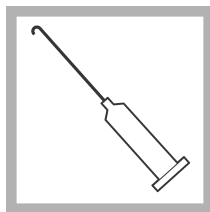
Table 5 Sample volume for buret titration

Sample concentration (mg/L as CaCO_3)	Sample volume (mL)
100–250	100
250–500	50
500–1000	20

Total Hardness - Digital Titrator method



1. Fill a clean and empty titration cartridge with Reagent 3.



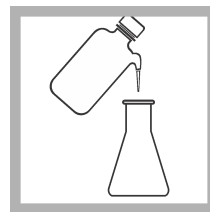
2. Insert a clean delivery tube into the titration cartridge. Attach the cartridge to the titrator.



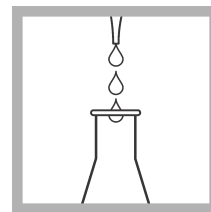
3. Turn the delivery knob to eject air and a few drops of titrant. Reset the counter to zero and wipe the tip.



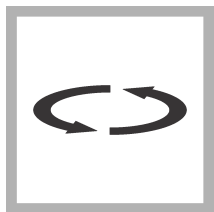
4. Use a volumetric pipette to add the sample to a clean 250-mL Erlenmeyer flask. Refer to [Identify the correct sample size](#) on page 31.



5. Fill the Erlenmeyer flask to the 100-mL mark with deionized water.



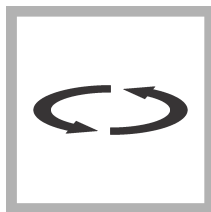
6. Use a marked dropper to add 1 mL of Reagent 1 to the Erlenmeyer flask.



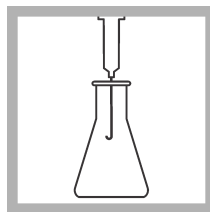
7. Swirl to mix.



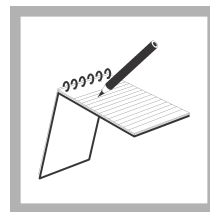
8. Use a graduated cylinder to add 8 mL of Reagent 2 to the Erlenmeyer flask.



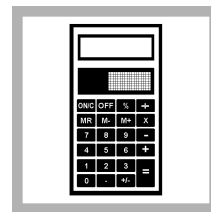
9. Swirl to mix.



10. Swirl the flask while titrating with Reagent 3 from red to pure blue.



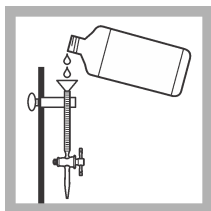
11. Record the number of digits of Reagent 3 required.



12. Calculate the sample concentration:

Sample concentration (mg/L as CaCO_3) =
 $(125 \times \text{digits required} \times \text{Reagent 3 titer (M)} + \text{sample volume (mL)})$

Total Hardness - Buret Method



1. Fill a 25-mL buret with Reagent 3.



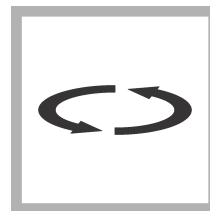
2. Use a volumetric pipe to add the sample to a clean 250-mL Erlenmeyer flask. Refer to [Identify the correct sample size](#) on page 31.



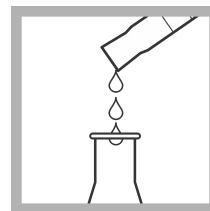
3. Fill the Erlenmeyer flask to the 100-mL mark with deionized water.



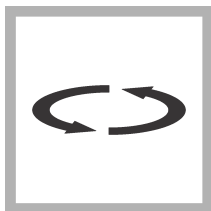
4. Use a marked dropper to add 1 mL of Reagent 1 to the Erlenmeyer flask.



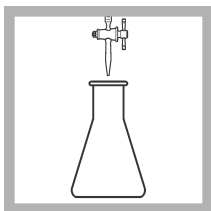
5. Swirl to mix.



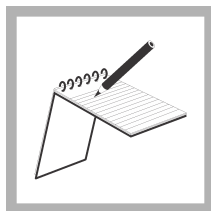
6. Use a graduated cylinder to add 8 mL of Reagent 2 to the Erlenmeyer flask.



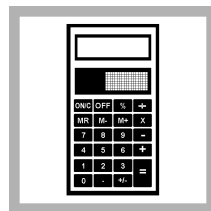
7. Swirl to mix.



8. Swirl the flask while titrating with Reagent 3 from red to pure blue.



9. Record the volume of Reagent 3 required.



10. Calculate the sample concentration.

Sample concentration
(mg/L as CaCO_3) =
 $(100,000 \times \text{volume}$
 $\text{required (mL)} \times$
 $\text{Reagent 3 titer (M)}) \div$
 $\text{sample volume (mL)}$

Consumables and replacement items

Required reagents

Description	Quantity/test	Unit	Item no.
Reagent 1 for high range hardness	4 mL	1 L	2793553
Reagent 2 for high range hardness	32 mL	1 L	2793600
Reagent 3 for high range hardness	50 mL	1 L	2793753
Standard 2, 1000 mg/L	60 mL	1 L	2793353

Required apparatus

Description	Quantity/test	Unit	Item no.
Buret, 25-mL, Class A	1	each	2636540
Graduated cylinder, 10-mL	2	each	50838
Digital Titrator	1	each	1690001
Delivery tubes for the Digital Titrator, 90° with hook	1	5/pkg	4157800
Digital Titrator cartridge, empty	1		1449501
Dropper, glass with 0.5- to 1.0-mL mark	1	5/pkg	1419705
Flask, Erlenmeyer, graduated, 250-mL	2	each	50546
Volumetric pipet—select one or more based on range:			

Required apparatus (continued)

Description	Quantity/test	Unit	Item no.
Pipet, volumetric, Class A, 50-mL	1	each	1451541
Pipet, volumetric, Class A, 100-mL	1	each	1451542

Printer and computer formats

The analyzer can be configured to send measurement readings, alarms and warnings to a printer or computer when a serial I/O module (SIO) is connected to the analyzer. Refer to SIO1 (or SIO2) SETUP in Sensor diagnostics in the maintenance manual. To send the data log to a computer or printer, push **MENU** and select AQUATREND MENU>PRINT DATA LOG.

Since the SIO can receive data from a maximum of eight analyzers, the SIO channel shows in the first three characters. For example, "[1]" identifies that the information is from the analyzer connected to SIO channel 1.

[1]01/01/97 00:23: 3.234 S1P1

[1]01/01/97 00:23: 0.527 S1P2

[1]01/01/97 11:28: 3.977 S1P1 *W

[1]01/01/97 11:28: SMP1 OUT ALARM *A

[1]01/01/97 11:28: 0.611 S1P2 *A * W

[1]01/01/97 11:29: End SMP1 OUT ALARM *A

The first occurrence of any alarm or warning is sent out. The time/date of the alarm or warning is printed followed by either "ALRM" or "WARN" to identify that it is an alarm or warning. The specific alarm or warning is then shown on the next line.

When the alarm or warning condition is corrected, the alarm/warning is sent preceded by "END:" to identify that the condition is cleared. Some alarms and warnings provide information only and do not have an end (i.e., a fail to calibrate message is printed out only when the condition occurs).

If an alarm or warning condition is active, then an "*"A" for alarm or a "*"W" for warning is added to the end of the measurement readings.

RS232 commands

Table 6 shows the commands that can be sent from a computer through the optional serial I/O module (SIO) to the analyzer for remote analyzer operation. Table 7 shows the analyzer responses to valid and invalid RS232 commands.

Terminate remote commands to the analyzer with a carriage return character to identify the end of the command. Linefeed characters and spaces are ignored. All incoming characters are converted to uppercase before they are evaluated.

Always put the channel number before a remote command. For example, if the analyzer is connected to SIO channel 1, send the remote command 1SRT to restart the analyzer. The analyzer response is "OK" and the SIO inserts the channel assigned for the analyzer (e.g., [1]OK).

Table 6 RS232 commands

Command	Function
HLT	Puts the analyzer in shutdown (standby) mode.
SRT	Puts the analyzer back into operation.
CAL	Starts a calibration at the end of the current cycle.
RCL=A	Gets the calibration values for the last calibration. Add "=A" to recall a maximum of 7 calibrations.
RDC	Sets the calibration to the factory default.
CLN	Starts a cleaning at the end of the current cycle.
CTM	Gets the auto calibration settings.
CTM=4,x	Set the auto calibrations to occur every 12 hours. Options: x = 0–23 (24-hour clock)
CTM=5,x	Set the auto calibrations to occur daily. Options: x = 0–23 (24-hour clock)
CTM=x,y	Set the auto calibrations to occur weekly. Options: x = 6–12 where Monday = 6 and Sunday = 12, y = 0–23 (24-hour clock)

Table 6 RS232 commands (continued)

Command	Function
CLI=x	Gets the auto cleaning setting. Add "=x" to set the auto cleaning setting. Options: x = 1 (6 hours), 2 (12 hours) or 3 (24 hours)
PMA	Starts priming all the reagents and standards.
PMR	Starts priming all the reagents at the end of the current cycle.
PMS	Starts priming all the standards at the end of the current cycle.
SEQ	Gets "SEQUENCE=12 1" which represents the order in which the sample streams are measured.
SEQ=12	Sets the sample stream sequence. The numbers after "=" represent the order in which the sample streams are measured (maximum of 8 characters).
RID	Gets the analyzer version (e.g., Alkalinity V1.0 C1.0).
RAR	Gets the latest alarms/warnings (maximum of 10) since the last RAR command was sent. Enabled only if the SIOx setting is set to Queried.
RMR	Gets the latest measurement readings for all cycles (grab, normal and calibration readings) (maximum of 10). Enabled only if the SIOx setting is set to Queried.
RFL	Sets all the standard, reagent and cleaning solution levels to 100%.
RG1=xxx	Gets the fluid level of the reagent in percent (e.g., RG1 = Reagent 1). Add "=xxx" to set the fluid level of the reagent in percent. Options: x = 0–100
SD1=xxx	Gets the fluid level of the standard solution in percent (e.g., SD1 = Standard 1). Add "=xxx" to set the fluid level of the standard solution in percent. Options: x = 0–100
WSH=xxx	Gets the fluid level of the cleaning solution in percent. Add "=xxx" to set the fluid level of the cleaning solution in percent. Options: x = 0–100
ALL	Gets all the analyzer settings.

Table 6 RS232 commands (continued)

Command	Function
RIN=xxx	Gets the analyzer name. Add "=xxx" to set the analyzer name (maximum of 12 characters after the equal sign). All letters will be converted to upper case.
RCA=x	Sets the output value of the recorder output connection. Options: x = F, H or Z. F = full-scale output (20 mA), H = half scale output (12 mA) and Z = zero scale output (4 mA). To stop the test, send just the first three letters.
RCB=x	
RLA=x	Sets the state of the relay. Options: x = 0 or 1 (0 = de-energized, 1 = energized). To stop the test, send just the first three letters.
RLB=x	
RVN	Gets the version numbers of the analyzer and the modules. For example, Hardness V1.0 C1.0, Valve module: VLV0103, Burette module: PMP0102, ...
TAL	Gets all the data in the alarm/warning logs.
WAL	Erases the data in the alarm/warning logs.

Table 7 Analyzer responses

Command type	Analyzer response
Valid command to change an analyzer setting	"OK"
Valid command to query settings or values	The settings or readings are supplied. Refer to Printer and computer formats on page 34.
Valid command but the settings are invalid	"BAD SETTINGS"
Invalid command	"BAD CMD"

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