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SECTION 1
UDV Sequence

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SETUP

Colorimeter

1. Remove the colorimeter, tubes, vials, and AC adapter from the brown box. (Save the box for shipping in the future, if needed).
2. Attach the pin end of the AC adapter to the side of the colorimeter. Plug the other end of the adapter into a power outlet.
3. Use the computer cable to link the colorimeter to a computer, if desired. Insert the small, round connector at one end of the cable into the back of the colorimeter. Insert the rectangular 9-pin connector on the other end of the cable into the COM port on the computer.

   Note: The software is configured to read from COM port 1. Another COM port can be chosen within the SET UP function under port selection.
4. The colorimeter has four preprogrammed test sequences in the memory. The first sequence contains UDV tests. The test sequence is as follows:

   Blank > Free Chlorine > Total Chlorine > (Bromine, optional) >pH > Hardness > Alkalinity > Cyanuric Acid > Copper > Iron > (Nitrate, optional) > (Borate, optional)

Racks

1. Remove the white plastic racks from the packaging. Attach the grid by flipping the four sides up from the base.
2. Only one grid should be attached to allow the UDVs to slide into the rack more easily.

Pipettor, 3 mL fixed volume

1. Remove the pipettor from the box. Firmly attach the dispenser tip to the barrel. Hold the pipettor upright.
2. To fill the pipettor, depress the thumb button to the first stop. Immerse the pipettor tip in the sample. Slowly release the thumb button to fill the pipettor to 3 mL.
3. To dispense the sample, depress the thumb button slowly to the second stop.

The Counter Mat

1. Place the counter mat near the colorimeter. Put the two UDV racks on the mat in the designated positions.

The UDV Pouches

1. Each box of UDVs contains 50 vials for one test factor. UDVs are packaged 5 per pouch.
2. Remove one pouch from each box for tests that will be conducted over the next 24 hours. Avoid opening more pouches than will be needed for one day. UDVs have a limited shelf life and should not be exposed to air more than necessary. A foil storage bag is included to extend the shelf life 10 to 14 days.
3. To open pouches, tear or cut pouch horizontally across the top. Remove the group of 5 UDVs.
4. Separate the group of UDVs at the perforations. Place each set of UDVs in the rack directly behind the respective test factor as noted on the counter mat. (If testing for Bromine, insert a Free Chlorine UDV in the Free Chlorine space. Leave the Total Chlorine space empty.)

UDV Test Procedures

1. Press **ON** to turn the colorimeter on.

   Press the ***ENTER** button to start.

   Press the ***ENTER** button to enter the Testing Menu.

   Press the ***ENTER** button to enter the UDV Test sequence.

   Press the ***ENTER** button to begin the UDV test sequence with Free Chlorine. (If testing for Bromine, press the (down arrow) button twice and the ***ENTER** button once.)
2. Depress the thumb button of the pipettor to the first stop.
3. Immerse the pipettor tip in the sample to be tested. Slowly release the thumb button to fill the pipettor.
4. Press the thumb button to the second stop to dispense the sample into an empty vial. This is the Blank.
5. Insert the Blank into the colorimeter. Close the lid. Press the ***ENTER** button to scan the blank.
6. Refill the pipettor with sample. Begin with the Iron vial on the far right. Pierce the foil lid with the pipettor tip. Press the pipettor tip through the foil with your finger.
7. Slowly dispense the sample into the Iron vial.
8. Continue dispensing 3 mL of sample into the remaining vials in the rack, filling from RIGHT to LEFT, ending with Free Chlorine. (If testing for Bromine, end with the Bromine test in the Free Chlorine vial.) (The vials are filled from right to left to allow for proper color development time.)
9. Remove the Blank vial from the colorimeter.
10. Invert the Free Chlorine (or Bromine) vial three times to mix. (If powder residue remains in the bottom of the vial after inverting or air bubbles form, invert once more and tap the bottom of the vial sharply once or twice to dislodge powder and bubbles. Mix).

    ☑ Note: Finger protectors are included to avoid staining skin and to protect users with sensitive skin.
11. Insert the Free Chlorine (or Bromine) vial into the colorimeter. Press the ***ENTER** button to scan the sample. Record the result.
12. Press the ***ENTER** button to proceed to the next test in the sequence. (To skip over a test in the sequence, press the (down arrow) button followed by the ***ENTER** button to advance to the next test in the sequence. Repeat until the desired test is displayed.)
13. Continue testing from left to right, inverting each vial three times before placing it into the meter. (If powder residue remains in the bottom of the vial after inverting or air bubbles form, invert once more and tap the bottom of the vial sharply once or twice to dislodge powder and bubbles. Mix). Finish testing with the Iron vial on the right.
14. Follow the individual instructions for optional Nitrate and Borate tests.
15. Press the **OFF** button to turn the meter off.

BORATE - UDV

UNIT DOSE VIALS • CODE 4322-H

QUANTITY	CONTENTS	CODE
50	Borate UDV	4322-H

Equipment needed but not supplied:
STANDARD ACCESSORY PACKAGE • CODE 1961

1	Package of 3 Vials (empty)	0156
1	Syringe, 6 mL, plastic	1184
1	Foil Storage Bag	9467

Or:
ADVANCED ACCESSORY PACKAGE • CODE 1962

1	Pipettor	30528
1	Pipet Tip (0-5 mL)	30695
1	Cuvette Rack	31695
1	Package of 3 Vials (empty)	0156
1	Foil Storage Bag	9467

Some swimming pools use a borate buffering system. Borates lower the level of carbon dioxide in the pool, which slows algae growth. This results in a lower chlorine requirement. Free chlorine levels in pools with borate systems can be maintained at 1.0 ppm.

Small amounts of boron are necessary for plant growth but large amounts can be toxic. In humans, boron aids in the uptake of calcium and the production of strong bones. An excess of boron can affect the central nervous system resulting in a syndrome known as borism. Some natural waters may contain small amounts of boron. Large concentrations may be due to industrial effluent entering waterways. Boron compounds are used in cleaning compounds, paper and paints, fertilizers, glass and ceramics, fire retardants and the production of alloys. In the atomic energy field, boron is a component of neutron shields and nuclear reactors.

APPLICATION:	swimming pools, surface and saline waters, hydroponic solutions, industrial waste
RANGE:	0.00 – 80.0 ppm boron
METHOD:	Borate reacts with a selective boron indicator powder to form a colored complex at pH 7.2 to 7.4 in proportion to the concentration of boron present.
SAMPLE HANDLING & PRESERVATION:	Store samples in polyethylene bottles. Do not use borate detergents or glassware.
INTERFERENCES:	Interferences in swimming pool water are unlikely

PROCEDURE

Use 10 mm square cell adapter

1. Press and hold **ON** button until colorimeter turns on.
2. Press **ENTER** to start.
3. Press **ENTER** to select Testing Menu.
4. Select **ALL TESTS** (or another sequence containing 8. Borate) from **TESTING MENU**.
5. Scroll to and select 8. Borate UDV from menu.
6. Rinse a clean vial (0156) with sample water.
7. Use the syringe (1184) to add 3mL of sample to the vial.
8. Insert the vial into chamber, close the lid and select **SCAN BLANK**.
9. Remove the vial from the colorimeter.
10. Use the syringe (1184) to add 3mL of sample to a Borate UDV vial (4322).
11. Wait 1 minute.
12. Invert the vial three times to mix.

    ☑ NOTE: If powder residue remains in the bottom of the vial after inverting or air bubbles form, invert once more and tap bottom of vial sharply once or twice to dislodge powder and bubbles. Mix.

14. Immediately insert tube into chamber, close lid and select **SCAN SAMPLE**. Record result in ppm borate.
15. Press **OFF** button to turn the colorimeter off or press **EXIT** button to exit to a previous menu or make another menu selection.

☑ NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents are obtained.

☑ NOTE: UDVs from opened pouches should be used promptly. Store unused vials from opened pouches in the Foil Storage Bag (9467) to extend the shelf life of the reagent. Generally, UDVs stored in the bag should be used within 10 days if the humidity is less than 50% and within 5 days if humidity is greater than 50%. The Foil Storage Bag contains a desiccant pack with indicator. When the indicator in the window turns from blue to pink, the bag should be replaced.

NITRATE

UNIT DOSE VIALS •CODE

QUANTITY	CONTENTS	CODE
50	Nitrate UDV	4321-H

Equipment needed but not supplied:

STANDARD ACCESSORY PACKAGE • CODE 1961

1	Package of 3 Vials (empty)	0156
1	Syringe, 6 mL, plastic	1184
1	Foil Storage Bag	9467

Or:

ADVANCED ACCESSORY PACKAGE • CODE 1962

1	Pipettor	30528
1	Pipet Tip (0-5 mL)	30695
1	Cuvette Rack	31695
1	Package of 3 Vials (empty)	0156
1	Foil Storage Bag	9467

Nitrogen is essential for plant growth, but excessive amounts in water supplies can result in nutrient pollution. Nitrates may enter the water from leaves or debris but other sources of nitrates include well water supplies, localized spraying of lawn or crop fertilizers, acid rain, bird droppings and bather wastes, urine and sweat. Nitrates, in conjunction with phosphate, stimulate the growth of algae creating water quality problems. Pools that are properly maintained usually do not have unexpected difficulty controlling algae, even in the presence of low levels of nitrates. Higher levels of nitrates can make algae control more difficult and increase the amount of chlorine required to maintain satisfactory control of algae. The only practical way to remove nitrates is to drain the water. Nitrates also cause problems in drinking water. Large amounts can cause "blue baby syndrome" (methemoglobenemia) in infants in less than 6 months of age and other health problems.

APPLICATION: swimming pools, drinking water, surface and saline waters

RANGE: 0.00 – 80.0 ppm nitrate

METHOD: Zinc is used to reduce nitrate to nitrite. The nitrite that was originally present, plus the reduced nitrate, reacts with chromotropic acid to form a red color in proportion to the amount of nitrite in the sample.

SAMPLE HANDLING & PRESERVATION: Analysis should be made as soon as possible. If analysis cannot be made within 24 hours, the sample should be refrigerated at 4°C. When samples must be stored for more than 24 hours, add 2 mL

of concentrated sulfuric acid per liter of sample. For best results, the analysis for nitrate should be determined at temperatures between 20°C and 25°C.

INTERFERENCES: Nitrite interferes at all concentrations. Strong oxidizing and reducing substances interfere. Low results might be obtained for samples that contain high concentrations of copper and iron.

PROCEDURE

Use 10 mm square cell adapter

1. Press and hold **ON** button until colorimeter turns on.
2. Press **ENTER** to start.
3. Press **ENTER** to select Testing Menu.
4. Select **ALL TESTS** (or another sequence containing 65. Nitrate UDV) from **TESTING MENU**.
5. Scroll to and select 65. Nitrate UDV from menu.
6. Rinse a clean vial (0156) with sample water.
7. Use the syringe (1184) to add 3mL of sample to the vial.
8. Insert the vial into chamber, close the lid and select **SCAN BLANK**.
9. Remove the vial from the colorimeter.
10. Use the syringe (1184) to add 3mL of sample to a Nitrate UDV vial (4321).
11. Wait exactly 3 minutes.
12. Invert the vial three times to mix.

    NOTE: If powder residue remains in the bottom of the vial after inverting or air bubbles form, invert once more and tap bottom of vial sharply once or twice to dislodge powder and bubbles. Mix.
13. Immediately insert tube into chamber, close lid and select **SCAN SAMPLE**. Record result in ppm nitrate.
14. Press **OFF** button to turn the colorimeter off or press EXIT button to exit to a previous menu or make another menu selection.

☑ NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents are obtained.

☑ NOTE: UDVs from opened pouches should be used promptly. Store unused vials from opened pouches in the Foil Storage Bag (9467) to extend the shelf life of the reagent. Generally, UDVs stored in the bag should be used within 10 days if the humidity is less than 50% and within 5 days if humidity is greater than 50%. The Foil Storage Bag contains a desiccant pack with indicator. When the indicator in the window turns from blue to pink, the bag should be replaced.

The Color Development Reaction Times

The WaterLink PRO is designed to provide accurate results when all eight tests are run in sequence. To run an individual test for a selected test factor, wait the specified time before mixing and reading the test result.

	Free* Chlorine	Total Chlorine	pH	Calcium Hardness	Total Alkalinity	Cyanuric Acid	Copper	Iron
(Minimum) Color Development Time:								
(Maxiumum) Best if analyzed before:	0.5 minute	5 minutes	5 minutes	5 minutes	5 minutes	5 minutes	5 minutes	5 minutes

*Note: *Bromine tests are performed using Free Chlorine UDVs.*

Following the Water Analysis…

After conducting the analysis of the reacted samples, the analyst has the option to throw out the UDVs immediately, conduct an Acid/Base Demand test, or prepare the UDVs for local recycling.

Acid/Base Demand Testing

1. If the pH is LOW - Locate the reagent bottle marked "Base" and remove the cap.

   NOTE: For accurate results in pools with low pH and high alkalinity readings, the alkalinity level must be adjusted to the proper range before performing the Base Demand test.

   If the pH is HIGH - Locate the reagent bottle marked "Acid" and remove the cap.
2. Insert the small tip of the clear plastic dropper into the reagent bottle and squeeze the bulb to draw up reagent.
3. Add reagent one drop at a time to the reacted pH UDV while inverting to mix the UDV between each drop. Be sure to keep count of the drops being added.
4. Add reagent until the color in the vial is a bright orange (similar to a 7.4 pH reading). Record the number of drops used.

   Consult the UDV Acid/Base Demand Charts to determine the proper amount of treatment chemical needed to return the pool or spa to the ideal pH range.

Low pH											
		TOTAL DROPS OF BASE TITRANT ADDED TO REACH pH 7.4									
		1	2	3	4	5	6	7	8	9	10
Pool/ Spa Size	500	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
	1000	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.1	3.5	3.9
	5000	2.0	3.9	5.9	7.9	9.8	11.8	13.8	1.0	1.1	1.2
	10000	3.9	7.9	11.8	1.0	1.2	1.5	1.7	2.0	2.2	2.5
	20000	7.9	1.0	1.5	2.0	2.5	3.0	3.4	3.9	4.4	4.9
	50000	1.2	2.5	3.7	4.9	6.1	7.4	8.6	9.8	11.1	12.3
Sodium Carbonate (Soda Ash) needed: Shaded areas = Ounces / Unshaded areas = Pounds											

High pH											
		TOTAL DROPS OF ACID TITRANT ADDED TO REACH pH 7.4									
		1	2	3	4	5	6	7	8	9	10
Pool/ Spa Size	500	0.7	1.5	2.2	2.9	3.6	4.4	5.1	5.8	6.5	7.3
	1000	1.5	2.9	4.4	5.8	7.3	8.7	10.2	11.6	13.1	14.5
	5000	7.3	14.5	1.4	1.8	2.3	2.7	3.2	3.6	4.1	4.5
	10000	14.5	1.8	2.7	3.6	4.5	5.4	6.3	7.3	8.2	9.1
	20000	1.8	3.6	5.4	7.3	9.1	10.9	12.7	14.5	16.3	18.1
	50000	4.5	9.1	13.6	18.1	22.7	27.2	31.7	36.3	40.8	45.3
Muriatic Acid needed: Shaded areas = Ounces / Unshaded areas = Pints											

		TOTAL DROPS OF BASE TITRANT ADDED TO REACH pH 7.4									
		1	2	3	4	5	6	7	8	9	10
Pool/ Spa Size	500	0.9	1.8	2.7	3.6	4.5	5.3	6.2	7.1	8.0	8.9
	1000	1.8	3.6	5.3	7.1	8.9	10.7	12.5	14.3	1.0	1.1
	5000	8.9	1.1	1.7	2.2	2.8	3.3	3.9	4.5	5.0	5.6
	10000	1.1	2.2	3.3	4.5	5.6	6.7	7.8	8.9	10.0	11.1
	20000	2.2	4.5	6.7	8.9	11.1	13.4	15.6	17.8	20.0	22.3
	50000	5.6	11.1	16.7	22.3	27.8	33.4	39.0	44.6	50.1	55.7
Sodium Bisulfate (Dry Acid) needed: Shaded areas = Ounces / Unshaded areas = Pounds											

Recycling UDVs

Since the vials are heat sealed with foil lids they cannot be reused for new tests. One way to recycle the vials is to keep a bowl or bucket of soapy water nearby for placement of used vials. At the end of the day, drain the used batch over a sink and allow to dry overnight. The next day place them in your plastic recycling bin or rinse and use as an extra sample blank tube. Warning: Recyclers should check with the local authorities since some states may require that no chemical residue or foil remains on the plastic.

Troubleshooting

High Chlorine/Bromine - High sanitizer levels may cause the DPD powder in the UDV to bleach out to a colorless or near colorless solution. A dilution procedure can be used to determine the approximate level of sanitizer. Note: At high sanitizer levels, chloramines could break through into the free chlorine test, the pH UDV may turn purple and the alkalinity UDV may turn yellow.

High Copper - Copper at levels above 1.0 ppm may cause the Hardness test to read low.

Low Alkalinity - Algicide treatments above recommended levels, may lower the alkalinity results. Make sure reaction time has developed for 1.5 minutes.

Cyanuric Acid - Since cyanuric acid tests are temperature dependent, the best results are obtained when sample temperatures are between 70 and 80 degrees. In cold water, results may read high, while in warm water they may read low.

pH Purple - As noted under High Chlorine/Bromine above, sanitizer levels beyond 10 ppm can turn the pH sample purple.

Hardness - Be sure to allow the Hardness color to develop for at least one minute, but read the result before five minutes expire. High copper or low pH levels can significantly reduce the expected hardness result.

Color Development - The timing sequence for color development on the counter mats and inside this guide is important. Note that the test for free chlorine should be read immediately.

Air Bubbles in UDVs - When solution is dispensed too rapidly, air bubbles could develop and result in high results. Try inverting the vial again or tapping it on a firm surface to dislodge the bubbles.

Flashing Meter Display - When the digital display flashes, it signals a result outside the normal calibration range and is not accurate. A dilution test can be done. If this happens in the pH mode, an Acid or Base titration is highly recommended.

Software Results Differ - The WaterLink PRO colorimeter shows the test result on its digital display from the meter reading. The button must be pushed before removing the vial to go to the next test and to signal the computer to record the result from the meter.

Reagent on Pipettor Tip - Always gently break the seal of the vial with the tip of the pipettor and slowly release the sample without inserting the tip much beyond the foil opening. If reagent does get on the tip, rinse the tip in the sample water container before proceeding to the next test.

WaterLink® Pro

SECTION 2

Special Tests Sequence

LaMotte

V.1.5 • 08/05

SECTION 2 • Special Tests Sequence

Test Procedures in the following order:

Biguanide
Hydrogen Peroxide – Shock
Phosphate – Strip
Phosphate – Low Range
Nitrate – TesTab
Manganese – Low Range
Ozone
Turbidity
Ammonia Nitrogen – High Range
Sulfate – High Range

☑ Note: If a blank has been scanned previously in the same type of tube, the meter will not require that a blank be scanned. The display will prompt to scan the sample. For test procedures that require a reagent blank, a reagent blank MUST be scanned before scanning the sample.

BIGUANIDE

COLORIMETRIC METHOD • CODE 4044

QUANTITY	CONTENTS	CODE
2 X 60 mL	Biguanide Indicator	3994-H
1	Pipet, plastic, 1.0 mL	0354

Biguanide is a non-chlorine, non-bromine chemical sanitizer. It is more stable than chlorine or bromine and has little chemical odor. Biquanide is an effective bacteriacide but, unlike chlorine and bromine, it does not destroy organic contaminants. Therefore, hydrogen peroxide is added to biguanide pools on a regular basis to eliminate organic contaminants. The optimum recommended level of biguanide is 30 to 50 ppm.

APPLICATION: Swimming pools

RANGE: 0–70 ppm

METHOD: Biguanide complexes with the proprietary indicator to produce a colored solution. The color ranges from yellow through green to blue depending on the biguanide concentration.

SAMPLE HANDLING & PRESERVATION: Samples should be analyzed as soon as possible.

INTERFERENCES: The only interfering substances that are likely to be encountered in pool water are oxidized manganese and oxidizing agents, such as chlorine, bromine and ozone.

PROCEDURE

1. Press and hold **ON** button until colorimeter turns on.
2. Press **ENTER** to start.
3. Press **ENTER** to select Testing Menu.
4. Select `ALL TESTS` (or another sequence containing `7 Biguanide` from `TESTING MENU`.
5. Scroll to and select `7 Biguanide` from menu.
6. Rinse a tube (0290) with sample water. Fill to 10 mL with sample.
7. Insert the tube into chamber, close lid and select `SCAN BLANK`.
   ☑ Note: In these two sequences, if a blank has been scanned previously the the same type of tube, the meter will not require that a blank be scanned. The display will prompt to scan the sample. For test procedures that require a reagent blank, a reagent blank MUST be scanned before scanning the sample.
8. Remove the tube from colorimeter.
9. Use the 1.0 mL pipet (0354) to add 2.0 mL of Biguanide Indicator (3994). Cap and invert three times to mix.
10. Wait 1 minute.
11. Insert the tube into chamber. Close lid.
12. Select `SCAN SAMPLE`. Record result in ppm Biguanide
13. Press **OFF** button to turn the colorimeter off or press **EXIT** button to exit to a previous menu or make another menu selection.

NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents are obtained.

HYDROGEN PEROXIDE–SHOCK

DPD Method • CODE 4045

QUANTITY	CONTENTS	CODE
30 mL	*Hydrogen Peroxide Reagent #1	*6452-G
2 x 50	*Hydrogen Peroxide LR Tablets	*6454A-H
1	Tablet Crusher	0175
1	Pipet, glass	0342

*WARNING: Reagents marked with an * are considered hazardous substances. To view or print a Material Safety Data Sheet (MSDS) for these reagents see MSDS CD or our web site. To obtain a printed copy, contact us by e-mail, phone or fax.

Large quantities of hydrogen peroxide shock are added to a swimming pool to "shock" it. Shocking breaks down waste products and re-establishes a positive level of sanitizer. While many types of shock can be used with chlorine or bromine pools, only hydrogen peroxide shock can be used to shock biguanide pools.

APPLICATION: Swimming pools

RANGE: 0–225 ppm Hydrogen Peroxide Shock

METHOD: Hydrogen peroxide reacts with an excess of potassium iodide through the action of a catalyst and buffer to release an equivalent amount of iodine. The iodine in turn reacts with diethyl-p-phenylenediamine (DPD) to produce a pink-red color in proportion to the iodine released.

SAMPLE HANDLING & PRESERVATION: Hydrogen peroxide is not stable in aqueous solutions. Exposure to sunlight and agitation will accelerate the reduction of hydrogen peroxide in dilute solutions. For best results start analysis immediately after sampling.

INTERFERENCES: The likelihood of other oxidizing compounds interfering with this method is eliminated by the presence of hydrogen peroxide. Manganese may interfere and should be removed before analysis

PROCEDURE

1. Press and hold **ON** button until colorimeter turns on.
2. Press **ENTER** to start.
3. Press **ENTER** to select `Testing Menu`.
4. Select `ALL TESTS` (or another sequence containing `48 H Per Shock`) from `TESTING MENU`.
5. Scroll to and select `48 H Per Shock` from menu.
6. Use the pipet (0342) to add 5 drops of the sample water to a tube (0290).
7. Dilute to the 10 mL line with distilled or hydrogen peroxide-free water.
8. Insert the tube into chamber, close lid and select `SCAN BLANK`.
   ☑ Note: In these two sequences, if a blank has been scanned previously the the same type of tube, the meter will not require that a blank be scanned. The display will prompt to scan the sample. For test procedures that require a reagent blank, a reagent blank MUST be scanned before scanning the sample.
9. Remove the tube from colorimeter and add 4 drops of *Hydrogen Peroxide Reagent #1 (6452). Cap and mix.
10. Add one *Hydrogen Peroxide LR Tablet (6454A). Crush tablet with Tablet Crusher (0175). Cap and mix for 30 seconds. Solution will turn pink if hydrogen peroxide is present. Wait 5 minutes for full color development.
11. At the end of 5 minute waiting period, mix, insert tube into chamber, close lid and select `SCAN SAMPLE`. Record result.
12. Press **OFF** button to turn the meter off or press **EXIT** button to exit to a previous menu or make another menu selection.

☑ NOTES: For best possible results, a blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents are obtained.

For the most accurate results, the sample and reagents should be at 25 ±4°C.

PHOSPHATE - STRIP

ASCORBIC ACID METHOD•CODE 3021-G

QUANTITY	CONTENTS	CODE
25	Insta-Test Low Range Phosphate Strips	3021
1	Test tube, plastic, with cap	0106

Algae is probably the most annoying water problem in outdoor pools because it is unsightly and difficult to destroy. Algae multiplies so rapidly, that by the time the human eye can notice it there are billions of algae cells in the pool. Phosphate is a nutrient for algae. Some phosphates come from natural sources such as rivers, lakes, oceans or mined rock. Other sources of phosphate include fertilizer, organic debris such as leaves and grass, and some pool chemicals.

Phosphate containing compounds, such as sequestering agents, are added to swimming pools as phosphonates. Algae can not use this combined form of phosphate until it is eventually broken down by chlorine to the ortho-phosphate form. Algae thrive on ortho-phosphate so this is the form of phosphate that concerns pool owners. The greater the concentration of ortho-phosphate, the more the algae flourishes and the more resistant it becomes to sanitizers. If ortho-phosphate is removed from the pool it is harder for algae to grow.

APPLICATION: Swimming pool water

RANGE: 0 – 1000 ppb

METHOD: Sodium molybdate reacts in an acid medium with dilute solutions of PO_4^{-3} to form a phosphomolybdate complex. This complex is reduced to a blue colored complex by stannous chloride. The color is proportional to the amount of ortho-phosphate present and is measured colorimetrically.

SAMPLE HANDLING & PRESERVATION: If the sample can not be analyzed the same day of collection, the sample should be preserved by the addition of 2 mL of concentrated sulfuric acid or 40 mg mercuric chloride per liter and refrigerated at 4 °C.

INTERFERENCES: Copper, ferric iron, arsenate and silica will interfere. Salt error is not significant.

PROCEDURE

1. Press and hold **ON** button until colorimeter turns on.
2. Press **ENTER** to start.
3. Press **ENTER** to select Testing Menu.
4. Select **ALL TESTS** (or another sequence containing 80. Phos strip from **TESTING MENU**.
5. Scroll to and select 80. Phos strip from menu.
6. Rinse a clean, glass test tube (02909) with sample water. Fill to the 10 mL line with the sample.
7. Insert tube into chamber, close lid and select **SCAN BLANK**.

☑ NOTE: If a blank has been scanned previously in the same type of tube, the meter will not require that a blank be scanned. The display will prompt to scan the sample. For test procedures that require a reagent blank, a reagent blank MUST be scanned before scanning the sample.

8. Remove the tube from the colorimeter.
9. Rinse a clean plastic test tube (0106) with sample water. Fill to the 10 mL line with the sample.
10. Remove one Phosphate LR Test Strip (3021) from the vial. Gently bend strip in half (do not fold) with pads facing inward. Place strip inside test tube cap.

diagram from test strip label

11. Cap tube and slowly invert 5 times. In one complete inversion, the tube will be turned cap down and then right side up. The air bubble will move slowly to the bottom of the tube and back again to the cap end. Five inversions should take about 15 seconds.
12. Remove the cap and test strip from the plastic tube (0106). Pour the reacted sample into a glass tube (0290). Cap.
13. Immediately insert tube into chamber, close lid and select **SCAN SAMPLE.** Record result as ppb ortho-phosphate.
14. Press **OFF** button to turn the colorimeter off or press **EXIT** button to exit to a previous menu or make another menu selection.

PHOSPHATE – LOW RANGE

ASCORBIC ACID REDUCTION METHOD • CODE 3653-SC

QUANTITY	CONTENTS	CODE
60 mL	*Phosphate Acid Reagent	*V-6282-H
5 g	*Phosphate Reducing Reagent	*V-6283-C
1	Pipet, 1 mL, plastic	0354
1	Spoon, 0.1 g, plastic	0699

*WARNING: Reagents marked with an * are considered hazardous substances. To view or print a Material Safety Data Sheet (MSDS) for these reagents see MSDS CD or our web site. To obtain a printed copy, contact us by e-mail, phone or fax.

Phosphorus is an important nutrient for aquatic plants. The amount found in water is generally not more than 0.1 ppm unless the water has become polluted from waste water sources or excessive drainage from agricultural areas. When phosphorus is present in excess of the concentrations required for normal aquatic plant growth, a process called eutrophication takes place. This creates a favorable environment for the increase in algae and weeds. When algae cells die, oxygen is used in the decomposition and fish kills often result. Rapid decomposition of dense algae scums with associated organisms give rise to foul odors and hydrogen sulfide gas.

APPLICATION: Drinking, surface and saline waters; domestic and industrial wastes (Method based on reactions that are specific for orthophosphate).

RANGE: 0–3000 ppb Orthophosphate

METHOD: Ammonium molybdate and antimony potassium tartrate react in a filtered acid medium with dilute solution of PO_4^{-3} to form an antimony-phosphomolybdate complex. This complex is reduced to an intense blue colored complex by ascorbic acid. The color is proportional to the amount of phosphate present. (Only orthophosphate forms a blue color in this test.) Polyphosphates (and some organic phosphorus compounds) may be converted to the orthophosphate form by sulfuric acid digestion. Organic phosphorus compounds may be converted to the orthophosphate form by persulfate digestion.

SAMPLE HANDLING & PRESERVATION: If benthic deposits are present in the area being sampled, great care should be taken not to include these deposits. If the analysis cannot be performed the same day of collection, the sample should be preserved by the addition of 2 mL of concentrated sulfuric acid or 40 mg mercuric chloride per liter and refrigerated at 4°C.

INTERFERENCES: a. No interference from copper, iron, or silicate at concentrations many times the concentration of sea water. However, high iron concentrations can cause precipitation and subsequent loss of phosphorus.

b. Salt error for samples ranging from 5% to 20% salt content was found to be less than 1%.

c. Mercuric chloride, $HgCl_2$, when used as the preservative, interferes when the chloride levels are low (less than 50 mg/L). This interference is overcome by spiking samples with a minimum of 50 mg/L of sodium chloride.

PROCEDURE

1. Press and hold **ON** button until colorimeter turns on.
2. Press **ENTER** to start.
3. Press **ENTER** to select TESTING MENU.
4. Select ALL TESTS (or another sequence containing 78 Phosphate L) from TESTING MENU.
5. Scroll to and select 78 Phosphate L from menu.
6. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
7. Insert tube into chamber, close lid and select SCAN BLANK.

   ☑ NOTE: If a blank has been scanned previously in the same type of tube, the meter will not require a blank to be scanned. The display will prompt to scan the sample. For test procedures that require a reagent blank, a reagent blank MUST be scanned before scanning the sample.
8. Remove tube from colorimeter. Use 1.0 mL pipet (0354) to add 1.0 mL of *Phosphate Acid Reagent (V-6282). Cap and mix.
9. Use the 0.1 g spoon (0699) to add one measure of *Phosphate Reducing Reagent (V-6283). Cap and shake until powder dissolves. Wait 5 minutes for full color development. Solution will turn blue if phosphates are present.
10. At end of 5 minute waiting period, mix, insert tube into chamber, close lid and select SCAN SAMPLE. Record result.
11. Press **OFF** button to turn colorimeter off or press **EXIT** button to exit to a previous menu or make another menu selection.

NITRATE

ZINC REDUCTION • CODE 3689-SC

QUANTITY	CONTENTS	CODE
50	*Nitrate Spectrophotometric Grade Tablets	*3881A-H
1	Tablet Crusher	0175

*WARNING: Reagents marked with an * are considered hazardous substances. To view or print a Material Safety Data Sheet (MSDS) for these reagents see MSDS CD or our web site. To obtain a printed copy, contact us by e-mail, phone or fax.

Nitrogen is essential for plant growth, but excessive amounts in water supplies can result in nutrient pollution. Nitrates, in conjunction with phosphate, stimulate the growth of algae creating water quality problems. Nitrogen compounds may enter water as nitrates or be converted to nitrates from agricultural fertilizers, sewage, industrial and packing house wastes, drainage from livestock feeding areas and manure. Nitrates in large amounts in drinking water can cause "blue baby syndrome" (methemoglobenemia) in infants in less than 6 months of age and other health problems. US Public Health Service Drinking Water Standards state that 44 ppm nitrate should not be exceeded. To the sanitary and industrial engineer, concentrations of less than 4 ppm are acceptable.

APPLICATION: Drinking, surface, and saline waters; domestic and industrial waters.

RANGE: 0.0–60.0 ppm Nitrate

METHOD: Zinc is used to reduce nitrate to nitrite. The nitrite that was originally present, plus the reduced nitrate, reacts with chromotropic acid to form a red color in proportion to the amount of nitrite in the sample.

SAMPLE HANDLING & PRESERVATION: Analysis should be made as soon as possible. If analysis cannot be made within 24 hours, the sample should be refrigerated at 4°C. When samples must be stored for more than 24 hours, add 2 mL of concentrated sulfuric acid per liter of sample. For best results, the analysis for nitrate should be determined at temperatures between 20°C and 25°C.

INTERFERENCES: Nitrite interferes at all concentrations. Strong oxidizing and reducing substances interfere. Low results might be obtained for samples that contain high concentrations of copper and iron.

PROCEDURE

1. Press and hold **ON** button until colorimeter turns on.
2. Press **ENTER** to start.
3. Press **ENTER** to select TESTING MENU.
4. Select ALL TESTS (or another sequence containing 66 Nitrate-TT) from TESTING MENU.
5. Scroll to and select 66 Nitrate-TT from menu.
6. Rinse a tube (0290) with sample water. Fill to 10 mL line with sample.
7. Insert the tube into chamber, close lid and select SCAN BLANK.
   ☑ NOTE: If a blank has been scanned previously in the same type of tube, the meter will not require a blank to be scanned. The display will prompt to scan the sample. For test procedures that require a reagent blank, a reagent blank MUST be scanned before scanning the sample.
8. Remove the tube from colorimeter.
9. Add one *Nitrate Spectrophotometric Grade Tablet (3881A).
10. Use Tablet Crusher (0175) to crush tablet.
11. Cap tube.
12. Invert tube 60 times per minute for 2 minutes (one inversion equals 180°).
13. Wait 5 minutes. Do not mix.
14. Insert tube into chamber, close lid and select SCAN SAMPLE. Record result in ppm nitrate.
15. Press **OFF** button to turn the colorimeter off or press **EXIT** button to exit to a previous menu or make another menu selection.

☑ NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples.

To convert nitrate (NO_3) results to nitrate-nitrogen (NO_3-N), divide by 4.4.

MANGANESE–LOW RANGE

PAN METHOD • CODE 3658-01-SC

QUANTITY	CONTENTS	CODE
4x30 mL	*Hardness Buffer Reagent	*4255-G
30 mL	*Manganese Indicator Reagent	*3956-G
15 mL	*Sodium Cyanide, 10%	*6565-E
1	Pipet, 0.5 mL, plastic	0369
1	Pipet, 1.0 mL, plastic	0354

*WARNING: Reagents marked with an * are considered hazardous substances. To view or print a Material Safety Data Sheet (MSDS) for these reagents see MSDS CD or our web site. To obtain a printed copy, contact us by e-mail, phone or fax.

Manganese is present in ground water in the divalent state due to the lack of oxygen. In surface waters manganese may be in various oxidation states as soluble complexes or as suspended compounds. Manganese is rarely present in excess of 1 mg/L. It may cause an objectionable taste or cause staining problems in laundry, but manganese levels normally encountered in water seldom produce any health hazard.

Manganese is removed from water by various means including chemical precipitation, pH adjustment, aeration, superchlorination and the use of ion exchange resins.

APPLICATION: Drinking and surface waters; domestic and industrial wastewaters.

RANGE: 0.00–0.70 ppm Manganese

METHOD: PAN (1-[2-Pyridylazo]-2-Naphthol) forms a red complex with Manganese (Mn^{2+}) at a pH of 10 to 11.

SAMPLE HANDLING & PRESERVATION: Manganese may oxidize readily in neutral water and precipitate from solution. It may adhere to or be absorbed by container walls, especially glass. Acidified samples can be stored in plastic.

INTERFERENCES: None. Test is quite specific.

PROCEDURE

1. Press and hold **ON** button until colorimeter turns on.
2. Press **ENTER** to start.
3. Press **ENTER** to select TESTING MENU.
4. Select ALL TESTS (or another sequence containing 55 Manganese L) from TESTING MENU.
5. Scroll to and select 55 Manganese L from menu.
6. Rinse a tube (0290) with sample water. Fill to the 10 mL line with sample.
7. Insert tube into chamber, close lid and select SCAN BLANK.

   ☑ NOTE: If a blank has been scanned previously in the same type of tube, the meter will not require a blank to be scanned. The display will prompt to scan the sample. For test procedures that require a reagent blank, a reagent blank MUST be scanned before scanning the sample.
8. Remove tube from colorimeter. Use the 1.0 mL pipet (0354) to add 2.0 mL (two measures) of *Hardness Buffer Reagent (4255). Swirl to mix.
9. Add 2 drops of *Sodium Cyanide, 10% (6565). Cap and mix.
10. Use the 0.5 mL pipet (0369) to add 0.5 mL of *Manganese Indicator Reagent (3956). Cap and mix.
11. Immediately insert tube into chamber, close lid and select SCAN SAMPLE. Record result.
12. Press **OFF** button to turn colorimeter off or press **EXIT** button to exit to a previous menu or make another menu selection.

☑ NOTE: For best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents are obtained.

OZONE

INDIGO METHOD • CODE 365I-SC

QUANTITY	CONTENTS	CODE
15 mL	Chlorine Inhibitor	3990-E
250 mL	*Ozone Buffer	*3991-K
30 mL	Indigo Blue Stock Solution	3989-G
1	Sampling Apparatus	0681
1	Pipet, transfer, 1.0 mL	2-2170
1	Pipet, transfer, 5 mL	0329
1	Pump, 10 mL	30527
1	Bottle, HR Reagent, amber glass	0680-J
1	Graduated Cylinder, 50 mL, glass	0418

*WARNING: Reagents marked with an * are considered hazardous substances. To view or print a Material Safety Data Sheet (MSDS) for these reagents see MSDS CD or our web site. To obtain a printed copy, contact us by e-mail, phone or fax.

Ozone is sometimes used in place of, or in conjunction with, chlorine or other halogens for disinfection of pool, spa, or drinking waters. Recently, large aquatic facilities have begun using ozone as a disinfectant in many artificial habitats.

APPLICATION: Drinking, pool and aquatic waters.

RANGE: 0.00–0.40 ppm Ozone, Low Range
0.00–2.50 ppm Ozone, High Range

METHOD: Ozone rapidly and stoichiometrically decolorizes Indigo Trisulfonate under acidic conditions.

SAMPLE HANDLING & PRESERVATION: Ozone is extremely unstable in aqueous solutions. Test must be performed immediately and the sample must not be agitated.

INTERFERENCES: Manganese at any level interferes.

PROCEDURE–LOW RANGE

A. PREPARATION OF HR REAGENT

☑NOTE: The quantity of Indigo Blue Stock solution (3989) supplied will prepare one batch of HR Reagent for the High Range Ozone procedure or five batches of HR Reagent for the Low Range Ozone procedure.

1. Use the 50 mL graduated cylinder to carefully add 45 mL of *Ozone Buffer (3991) to amber glass bottle marked HR Reagent (0680).
2. Use the 5 mL transfer pipet (0329) and pump (30527) to add 5 mL of Indigo Blue Stock Solution (3989) to the amber glass bottle. Cap and mix.

B. DETERMINATION OF OZONE

3. Use the 1.0 mL transfer pipet (2-2170) and pump (30527) to add 1.0 mL of HR Reagent to each of 2 clean tubes (0290).
4. If chlorine is present add 3 drops Chlorine Inhibitor (3990) to each tube. Cap tubes.
5. Take one of the prepared tubes (0290) and sampling apparatus (0681) to sampling site.
6. Lower end of tubing of sampling apparatus to desired depth. Slowly withdraw and depress plunger several times to purge syringe and tubing. Slowly withdraw plunger to fill purged syringe.
7. Remove plastic tubing from syringe. Remove cap from the prepared tube. Place tip of syringe against inside of the prepared tube. Slowly depress plunger and fill to the 10 mL line and cap. This is the Sample Tube.

   ☑NOTE: DO NOT SHAKE OR INVERT THE SAMPLE.
8. Fill the second prepared tube (0290) to the 10 mL line with ozone free water. This is the Reagent Blank.
9. Press and hold **ON** button until colorimeter turns on.
10. Press **ENTER** to start.
11. Press **ENTER** to select `TESTING MENU`.
12. Select `ALL TESTS` (or another sequence containin `71 Ozone-LR`) from `TESTING MENU`.
13. Scroll to and select `71 Ozone-LR` from menu.
14. Insert the Reagent Blank tube into chamber, close lid and select `SCAN BLANK`.

    ☑NOTE: If a blank has been scanned previously in the same type of tube, the meter will not require a blank to be scanned. The display will prompt to scan the sample. For test procedures that require a reagent blank, a reagent blank MUST be scanned before scanning the sample.
15. Insert reacted Sample Tube into chamber, close lid and select `SCAN SAMPLE`. Record result.
16. Press **OFF** button to turn colorimeter off or press **EXIT** button to exit to a previous menu or make another menu selection.

☑NOTE: HR Reagent must be made fresh each week. If reagent is refrigerated, it may be kept up to 3 weeks.

PROCEDURE–HIGH RANGE

A. PREPARATION OF HR REAGENT

☑ NOTE: The quantity of Indigo Blue Stock solution (3989) supplied will prepare one batch of HR Reagent for the High Range Ozone procedure or five batches of HR Reagent for the Low Range Ozone procedure.

1. Use the 50 mL graduated cylinder to carefully add 25 mL of *Ozone Buffer (3991) to amber glass bottle marked HR Reagent (0680).
2. Use the 50 mL graduated cylinder to carefully add 25 mL of Indigo Blue Stock Solution (3989) to the amber glass bottle. Cap and mix.

B. DETERMINATION OF OZONE

3. Use the 1.0 mL transfer pipet (2-2170) and pump (30527) to add 1.0 mL of HR Reagent to each of 2 clean tubes (0290).
4. If chlorine is present add 3 drops Chlorine Inhibitor (3990) to each tube. Cap tubes.
5. Take one of the prepared tubes (0290) and sampling apparatus (0681) to sampling site.
6. Lower end of tubing of sampling apparatus to desired depth. Slowly withdraw and depress plunger several times to purge syringe and tubing. Slowly withdraw plunger to fill purged syringe.
7. Remove plastic tubing from syringe. Remove cap from the prepared tube. Place tip of syringe against inside of the prepared tube. Slowly depress plunger and fill to the 10 mL line and cap. This is the Sample Tube.

   ☑ NOTE: DO NOT SHAKE OR INVERT THE SAMPLE.
8. Fill the second prepared tube (0290) to the 10 mL line with ozone free water. This is the Reagent Blank.
9. Press and hold **ON** button until colorimeter turns on.
10. Press **ENTER** to start.
11. Press **ENTER** to select TESTING MENU.
12. Select ALL TESTS (or another sequence containing 72 Ozone–HR) from TESTING MENU.
13. Scroll to and select 72 Ozone–HR from menu.
14. Insert the Reagent Blank tube into chamber, close lid and select SCAN BLANK.

    ☑ NOTE: If a blank has been scanned previously in the same type of tube, the meter will not require a blank to be scanned. The display will prompt to scan the sample. For test procedures that require a reagent blank, a reagent blank MUST be scanned before scanning the sample.
15. Insert reacted Sample Tube into chamber, close lid and select SCAN SAMPLE. Record result.
16. Press **OFF** button to turn colorimeter off or press **EXIT** button to exit to a previous menu or make another menu selection.

☑ NOTE: HR Reagent must be made fresh each week. If reagent is refrigerated, it may be kept up to 3 weeks.

TURBIDITY

ABSORPTION METHOD • NO REAGENTS REQUIRED

Turbidity is a measure of water clarity and is independent of color. Turbidity is caused by undissolved and suspended solids. Mud, silt, algae, and microorganisms can all cause turbidity. Turbidity is a gross measurement of water quality.

APPLICATION:	Surface and industrial water for non-compliance monitoring. (For compliance monitoring at low turbidity levels, use a commercial nephelometer.)
RANGE:	0–400
METHOD:	Absorptimetric
SAMPLE HANDLING & PRESERVATION:	Measure sample as soon as possible after collection.
INTERFERENCES:	Check for stray light interference (see page 18).

PROCEDURE

1. Press and hold **ON** button until colorimeter turns on.
2. Press **ENTER** to start.
3. Press **ENTER** to select TESTING MENU.
4. Select ALL TESTS (or another sequence containing 98 Turbidity) from TESTING MENU.
5. Scroll to and select 98 Turbidity from menu.
6. Rinse a clean tube (0290) with deionized water (turbidity free). Fill to the 10 mL line with deionized water.
7. Insert tube into chamber, close lid and select SCAN BLANK.
   ☑ NOTE: If a blank has been scanned previously in the same type of tube, the meter will not require a blank to be scanned. The display will prompt to scan the sample. For test procedures that require a reagent blank, a reagent blank MUST be scanned before scanning the sample.
8. Rinse a second clean tube (0290) with sample water. Fill to the 10 mL line with sample. Cap tube. Wipe off excess water and fingerprints. Shake to resuspend particulate matter. Remove all bubbles before measurement.
9. Insert tube into chamber, close lid and select SCAN SAMPLE. Record result. Turbidity measurements should be taken as soon as possible after sample has been collected.
10. Press **OFF** button to turn colorimeter off or press **EXIT** button to exit to a previous menu or make another menu selection.

☑ NOTE: For the most accurate results, the sample should be at 25±4°C.

PREPARING FORMAZIN SOLUTIONS

The turbidity calibration was prepared by using standard formazin solutions as a reference. These solutions can be prepared by carefully following the procedure below.†

1. Dissolve 1.000 g of Hydrazine Sulfate in deionized water and dilute to mark in 100 mL volumetric flask.
2. Dissolve 10.00 g of Hexamethylenetetramine in deionized water and dilute to mark in 100 mL volumetric flask.
3. Mix 5 mL of each solution in a 100 mL volumetric flask and allow to set undisturbed for 24 hours.
4. At the end of the waiting period, dilute to mark with deionized water and mix.
5. The turbidity of the stock solution is 400 FTU. The stock solution is stable for one month. Dilutions from the stock should be prepared fresh daily.

†Alternatively, a prepared concentrated formazin standard of 4000 NTU may be ordered in a 60 mL size by Code 6195-H.

AMMONIA-NITROGEN - HIGH RANGE

NESSLERIZATION METHOD • CODE 3642-SC

QUANTITY	CONTENTS	CODE
30 mL	Ammonia Nitrogen Reagent #1	V-4797-G
2 x 30 mL	*Ammonia Nitrogen Reagent #2	*V-4798-G
1	Pipet, 1 mL, plastic	0354

*WARNING: Reagents marked with an * are considered hazardous substances. To view or print a Material Safety Data Sheet (MSDS) for these reagents see MSDS CD or our web site. To obtain a printed copy, contact us by e-mail, phone or fax.

Ammonia nitrogen is present in various concentrations in many surface and ground water supplies. Any sudden change in the concentration of ammonia nitrogen in a water supply is cause for suspicion. A product of microbiological activity, ammonia nitrogen is sometimes accepted as chemical evidence of pollution when encountered in natural waters.

Ammonia is rapidly oxidized in natural water systems by special bacterial groups that produce nitrite and nitrate. This oxidation requires that dissolved oxygen be available in the water. Ammonia is an additional source of nitrogen as a nutrient which may contribute to the expanded growth of undesirable algae and other forms of plant growth that overload the natural system and cause pollution.

APPLICATION: Drinking, surface, and saline waters; domestic and industrial wastes.

RANGE: 0.00–4.00 Ammonia Nitrogen

METHOD: Ammonia forms a colored complex with Nessler's Reagent in proportion to the amount of ammonia present in the sample. Rochelle salt is added to prevent precipitation of calcium or magnesium in undistilled samples.

SAMPLE HANDLING & PRESERVATION: Ammonia solutions tend to be unstable and should be analyzed immediately. Sample may be stored for 24 hours at 4°C or 28 days at –20°C.

INTERFERENCES: Sample turbidity and color may interfere. Turbidity may be removed by a filtration procedure. Color interference may be eliminated by blanking the instrument with a sample blank.

PROCEDURE

1. Press and hold **ON** button until colorimeter turns on.
2. Press **ENTER** to start.
3. Press **ENTER** to select TESTING MENU.
4. Scroll to and select ALL TESTS (or another sequence containing 5 Ammonia-N H) from TESTING MENU.
5. Scroll to and select 5 Ammonia-N H from menu.
6. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
7. Insert tube into chamber, close lid and select SCAN BLANK. (See Note)

   ☑ NOTE: If a blank has been scanned previously in the same type of tube, the meter will not require a blank to be scanned. The display will prompt to scan the sample. For test procedures that require a reagent blank, a reagent blank MUST be scanned before scanning the sample.
8. Remove tube from colorimeter. Add 8 drops of Ammonia Nitrogen Reagent #1 (V-4797). Cap and mix. Wait 1 minute.
9. Use the 1.0 mL pipet (0354) to add 1.0 mL of *Ammonia Nitrogen Reagent #2 (V-4798). Cap and mix. Allow 5 minutes for maximum color development.
10. At end of the 5 minute waiting period, immediately mix, insert tube into chamber, close lid and select SCAN SAMPLE. Record result.
11. Press **OFF** button to turn the colorimeter off or press the **EXIT** button exit to a previous menu or make another menu selection.

CALCULATIONS:

To express results as Unionized Ammonia (NH_3):

ppm Unionized Ammonia (NH_3) = ppm Ammonia-Nitrogen (NH_3–N) x 1.2

To express results as Ionized Ammonia (NH_4):

ppm Ionized Ammonia (NH_4^+) = ppm Ammonia-Nitrogen (NH_3–N) x 1.3

To determine the percentages of Unionized and Ionized Ammonia-Nitrogen, consult the Appendix.

NOTE: For the best possible results, a reagent blank should be determined to account for any contribution to the test result by the reagent system. To determine the reagent blank, follow the above test procedure to scan a distilled or deionized water blank. Then follow the above procedure to perform the test on a distilled or deionized water sample. This test result is the reagent blank. Subtract the reagent blank from all subsequent test results of unknown samples. It is necessary to determine the reagent blank only when a new lot number of reagents are obtained.

SULFATE – HIGH RANGE

BARIUM CHLORIDE METHOD • CODE 3665-SC

QUANTITY	CONTENTS	CODE
10 g	*Sulfate Reagent	*V-6277-D
1	Spoon, 0.1 g, plastic	0699

*WARNING: Reagents marked with an * are considered hazardous substances. To view or print a Material Safety Data Sheet (MSDS) for these reagents see MSDS CD or our web site. To obtain a printed copy, contact us by e-mail, phone or fax.

The most common mineral forms of sulfur are iron sulfide, lead sulfide, zinc sulfide and as calcium sulfate and magnesium sulfate. In most fresh waters the sulfate ion is the second or third most abundant anion, being exceeded only by bicarbonate and, in some cases, silicate. Sulfur, in the form of sulfate, is considered an important nutrient element. Mineral springs are rich in sulfate and feed appreciable quantities of this compound to the watershed. Acid mine water drainage is a form of pollution which may contribute extremely large amounts of sulfate content to natural waters. Other sources of sulfate include waste material from pulp mills, steel mills, food processing operations and municipal wastes. Many bacteria obtain sulfur from sulfate for the synthesis of amino acids. In lakes and streams low in oxygen, this process of sulfate reduction causes the production of hydrogen sulfide, with its characteristic offensive odor. Calcium sulfate and magnesium sulfate contribute significantly to the hardness of water. Under natural conditions, the quantities ordinarily to be expected in lakes are between 3 and 30 parts per million.

APPLICATION: Drinking and surface waters, domestic and industrial wastes.

RANGE: 0–100 ppm Sulfate

METHOD: Sulfate ion is precipitated in an acid medium with barium chloride to form a barium sulfate suspension in proportion to the amount of sulfate present.

SAMPLE HANDLING & PRESERVATION: Sulfate samples may be preserved by refrigeration at 4°C up to 7 days in glass or plastic containers without any change in concentration.

INTERFERENCE: Suspended matter and color interference may be removed by a filtration step. Silica in excess of 500 mg/L will interfere. Check for stray light interference (see page 18).

PROCEDURE

1. Press and hold **ON** button until colorimeter turns on.
2. Press **ENTER** to start.
3. Press **ENTER** to select TESTING MENU.
4. Select ALL TESTS (or another sequence containing 89 Sulfate-HR) from TESTING MENU.
5. Scroll to and select 89 Sulfate-HR from menu.
6. Rinse a clean tube (0290) with sample water. Fill to the 10 mL line with sample.
7. Insert tube into chamber, close lid and select SCAN BLANK.
   ☑ NOTE: If a blank has been scanned previously in the same type of tube, the meter will not require a blank to be scanned. The display will prompt to scan the sample. For test procedures that require a reagent blank, a reagent blank MUST be scanned before scanning the sample.
8. Remove tube from colorimeter. Use the 0.1 g spoon (0699) to add one measure of *Sulfate Reagent (V-6277). Cap and shake until powder dissolves. A white precipitate will develop if sulfates are present. Wait 5 minutes.
9. Mix tube again. Insert tube into chamber, close lid and select SCAN SAMPLE. Record result.
10. Press **OFF** button to turn colorimeter off or press **EXIT** button to exit to a previous menu or make another menu selection.

NOTE: If the sulfate concentration of the test sample is greater than 100 ppm, it is recommended that a dilution be made with deionized water and the results multiplied by the dilution factor.

A white film is deposited on the inside of test tubes as a result of the sulfate test. Thoroughly clean and rinse test tubes after each test.

For the most accurate results, samples and reactions should be at 25±4°C.

WaterLink® Pro

SECTION 3

Tablet & Liquid Tests Sequence & All Tests Sequence

LaMotte

v.1.5 • 08.05

WaterLink® Pro

SECTION 4

Operating Instructions

LaMotte

v.1.5 • 01/07

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GENERAL INFORMATION

PACKAGING & DELIVERY

Experienced packaging personnel at LaMotte Company assure adequate protection against normal hazards encountered in transportation of shipments. After the product leaves the manufacturer, all responsibility for its safe delivery is assured by the transportation company. Damage claims must be filed immediately with the transportation company to receive compensation for damaged goods.

Should it be necessary to return the instrument for repair or servicing, pack instrument carefully in suitable container with adequate packing material. A return authorization number must be obtained from LaMotte Company by calling 1-800-344-3100. Attach a letter with the authorization number to the shipping carton which describes the kind of trouble experienced. This valuable information will enable the service department to make the required repairs more efficiently.

GENERAL PRECAUTIONS

Before attempting to set up or operate this instrument it is important to read the instruction manual. Failure to do so could result in personal injury or damage to the equipment.

The WaterLink PRO Colorimeter should not be stored or used in a wet or corrosive environment. Care should be taken to prevent water or reagent chemicals from wet colorimeter tubes from entering the colorimeter chamber.

NEVER PUT WET TUBES IN COLORIMETER.

SAFETY PRECAUTIONS

Read the labels on all LaMotte reagent containers prior to use. Some containers include precautionary notices and first aid information. Certain reagents are considered hazardous substances and are designated with a * in the instruction manual. To view or print a Material Safety Data Sheet (MSDS) for these reagents, see MSDS CD or our website. To obtain a printed copy, contact us by email, phone, or fax. Additional information for all LaMotte reagents is available in the United States, Canada, Puerto Rico, and the U.S. Virgin Islands from Chem-Tel by calling 1-800-255-3924. For other areas, call collect 813-248-0585 to contact Chem-Tel's International access number. Each reagent can be identified by the four digit number listed on the upper left corner of the reagent label, in the contents list and in the test procedures.

Keep equipment and reagent chemicals out of the reach of young children.

Protect Yourself and Equipment: Use Proper Analytical Techniques

LIMITS OF LIABILITY

Under no circumstances shall LaMotte Company be liable for loss of life, property, profits, or other damages incurred through the use or misuse of its products.

SPECIFICATIONS

▪ INSTRUMENT TYPE: Colorimeter

Readout	Graphical 4 line, 16 character per line LCD
Wavelengths	430nm, 520 nm, 570 nm, 620 nm
Wavelength Accuracy	± 2
Readable Resolution	Determined by reagent system
Wavelength Bandwidth	10 typical
Photometric Range	–2 to +2A
Photometric Precision	± 0.001A
Sample Chamber	Accepts 25 mm diameter flat-bottomed test tubes, 10 mm square cuvettes, 16 mm COD test tubes
Light Sources	4 LEDs
Detectors	4 silicon photodiodes with integrated interference filters
Modes	Absorbance, pre-programmed tests
Pre-Programmed Tests	YES, with automatic wavelength selection
User Defined Tests	Up to 10 user tests can be input
RS232 Port	8 pin mini-DIN, 9600b, 8, 1, n
Power Requirements	*Battery Operation:* 9 volt alkaline *Line Operation:* 110/ AC; 50/60 Hz with adapter, 6V 500 mA DC
Dimensions (LxWxH)	8.5 x 16.2 x 16.7 cm, 3.4 x 6.4 x 2.6 inches
Weight	312 g, 11 oz (meter only)
Data Logger	350 test results stored for download to a PC

STATISTICAL AND TECHNICAL DEFINITIONS RELATED TO PRODUCT SPECIFICATIONS

Method Detection Limit (MDL): "The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte."[1] Note that, "As Dr. William Horwitz once stated, 'In almost all cases when dealing with a limit of detection or limit of determination, the primary purpose of determining that limit is to stay away from it.'"[2]

1. CFR 40, part 136, appendix B
2. Statistics in Analytical Chemistry: Part 7 – A Review, D. Coleman and L Vanatta, American Laboratory, Sept 2003, P. 31.

Precision: Precision is the numerical agreement between two or more measurements.[3] The precision can be reported as a range for a measurement (difference between the min and max). It can also be reported as the standard deviation or the relative standard deviation. It is a measure of how close together the measurements are, not how close they are to the correct or true value. *The precision can be very good and the accuracy very bad. This is a useful measure of the performance of a test method.*

3. Skoog, D.A., West, D. M., *Fundamental of Analytical Chemistry,* 2nd ed., Holt Rinehart and Winston, Inc, 1969, p. 26.

Accuracy: Accuracy is the nearness of a measurement to the accepted or true value.[4] The accuracy can be expressed as a range, about the true value, in which a measurement occurs (i.e. ±0.5 ppm). It can also be expressed as the % recovery of a know amount of analyte in a determination of the analyte (i.e. 103.5 %). *This is a useful measure and what most customers are interested in when they want to know about the performance of a test method.*

4. Skoog D.A., West D. M., *Fundamental of Analytical Chemistry,* 2nd ed., Holt Rinehart and Winston, Inc, 1969, p. 26.

Resolution: Resolution is the smallest discernible difference between any two measurements that can be made.[5] For meters this is usually how many decimal places are displayed. (i.e. 0.01). For titrations and various comparators it is the smallest interval the device is calibrated or marked to (i.e. 1 drop = 10 ppm, 0.2 ppm for a DRT, or ±half a unit difference for an octaslide or color chart). Note that the resolution many change with concentration or range. In some cases the resolution may be less than the smallest interval, if it is possible to make a reading that falls between calibration marks. This is often done with various comparators. *One caveat is, that resolution has very little relationship to accuracy or precision. The resolution will always be less than the accuracy or precision but it is not a statistical measure of how well a method of analysis works. The resolution can be very very good and the accuracy and precision can be very, very bad! This is not a useful measure of the performance of a test method.*

5. Statistics in Analytical Chemistry: Part 7 – A Review, D. Coleman and L Vanatta, American Laboratory, Sept 2003, P. 34.

Sensitivity: Sensitivity is the resolution based on how this term is used in LaMotte catalogs. This term is not listed in any of the references. Sometimes it is used for detection limit. It is a confusing term and should be avoided.

Repeatability: Repeatability is the within-run precision.[6] A run is a single data set, from set up to clean up. Generally, one run occurs on one day. However, for meter

calibrations, a single calibration is considered a single run or data set, even though it may take 2 or 3 days.

6. Jeffery G. H., Basset J., Mendham J., Denney R. C., *Vogel's Textbook of Quantitative Chemical Analysis,* 5th ed., Longman Scientific & Technical, 1989, p. 130.

Reproducibility: Reproducibility is the between-run precision.[7]

7. Jeffery G. H., Basset J., Mendham J., Denney R. C., *Vogel's Textbook of Quantitative Chemical Analysis,* 5th ed., Longman Scientific & Technical, 1989, p. 130.

CONTENTS AND ACCESSORIES

Qty	*Order Code*	*Description*
1	1748	WaterLink PRO colorimeter with AC adapter
1	3574-PRO-Mat	WaterLink PRO Counter Mat
2	31695	UDV racks, white plastic, 42-hole
1	30528	3 mL automatic pipettor
2	30695	Plastic, replacement pipettor dispenser tips
1	9467	UDV foil storage bag
2	4318-H	Alkalinity, Total, UDV 50-pack
2	4309-H	Hardness, Total, UDV 50-pack
2	4310-H	pH (phenol red), UDV 50-pack
2	4311-H	Free Chlorine, UDV 50-pack
2	4312-H	Total Chlorine, UDV 50-pack
2	4313-H	Cyanuric Acid, UDV 50-pack
2	4314-H	Copper, UDV 50-pack
2	4315-H	Iron, UDV 50-pack
10	29653	Empty UDV Vials
1	WL-6068-H	Acid Demand Reagent, 60 mL
1	WL-6460-H	Base Demand Reagent, 60 mL
2	30685	Plastic droppers for use with acid or base demand reagents
1	0160	Finger Protection Package, 36-pack
1	2987	Insta-Test Wide Range pH & Total Chlorine

▪ ACCESSORIES

COD Adapter	Code 5-0087
Small Field Carrying Case	Code 1919-GCS150
Large Field Carrying Case	Code 1919-BCS440
SMARTLink 2 Program & Interface Cable (3.5 disk)	Code 1912-3
SMARTLink 2 Program & Interface Cable (CD)	Code 1912-CD

EPA COMPLIANCE

The WaterLink PRO Colorimeter is an EPA-Accepted instrument. EPA-Accepted means that the instrument meets the requirements for instrumentation as found in test procedures that are approved for the National Primary Drinking Water Regulations (NPDWR) or National Pollutant Discharge Elimination System (NPDES) compliance monitoring programs. EPA-Accepted instruments may be used with approved test procedures without additional approval.

CE COMPLIANCE

The WaterLink PRO Colorimeter has earned the European CE Mark of Compliance for electromagnetic compatibility and safety.

DECLARATION OF CONFORMITY

Standards to which Conformity Declared:	EN61326:1998, IEC61326:1997, IEC61000-4-2:1995, IEC61000-4-3:1995 IEC61000-4-4:1995, IEC61000-4-5:1995 IEC61000-4-6:1996, IEC61000-4-11:1994, EN61000-3-2:1995, EN61000-3-3:1994-12, EN55011/CISPR11, FCCCFR47 Part 15, EN61558
Manufacturer's Name:	LaMotte Company
Manufacturer's Address:	802 Washington Avenue PO Box 329 Chestertown, MD 21620
Type of Equipment:	Colorimeter
Model Name:	WaterLink PRO
Year of Manufacture:	2001
Testing Performed By:	Windermere 2000 Windermere Court Annapolis, MD 21401

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive and Standards

Chestertown, Maryland
Place

1/15/02
Date


Signature

Scott H. Steffen
Name

VP New Products & Quality
Position

CHEMICAL TESTING

WATER SAMPLING FOR CHEMICAL ANALYSIS

▪ Taking Representative Samples

The underlying factor to be considered for any type of water sampling is whether or not the sample is truly representative of the source. To properly collect a representative sample:

- Sample as frequently as possible.
- Collect a large sample or at least enough to conduct whatever tests are necessary.
- Make a composite sample for the same sampling area.
- Handle the sample in such a way as to prevent deterioration or contamination before the analysis is performed.
- Perform analysis for dissolved gases such as dissolved oxygen, carbon dioxide, and hydrogen sulfide immediately at the site of sampling. These factors, as well as samples for pH, cannot be stored for later examination.
- Make a list of conditions or observations which may affect the sample. Other considerations for taking representative samples are dependent upon the source of the sample. Taking samples from surface waters involves different considerations than taking samples from impounded and sub-surface waters.

▪ Sampling of Open Water Systems

Surface waters, such as those found in streams and rivers, are usually well mixed. The sample should be taken downstream from any tributary, industrial or sewage pollution source. For comparison purposes samples may be taken upstream and at the source of the pollution before mixing.

In ponds, lakes, and reservoirs with restricted flow, it is necessary to collect a number of samples in a cross section of the body of water, and where possible composite samples should be made to ensure representative samples.

To collect samples from surface waters, select a suitable plastic container with a tight fitting screw cap. Rinse the container several times with the sample to be tested, then immerse the container below the surface until it is filled to overflowing and replace the cap. If the sample is not to be tested immediately, pour a small part of the sample out and reseal. This will allow for any expansion. Any condition which might affect the sample should be listed.

Sub-surface sampling is required to obtain a vertical profile of streams, lakes, ponds, and reservoirs at specific depths. This type of sampling requires more sophisticated sampling equipment.

For dissolved oxygen studies, or for tests requiring small sample sizes, a Water Sampler (LaMotte Code 1060) will serve as a subsurface or in-depth sampler. This weighted device is lowered to the sampling depth and allowed to rest at this depth for a few minutes. The water percolates into the sample chamber displacing the air which bubbles to the surface. When the bubbles cease to rise, the device has flushed itself approximately five times and it may be raised to the surface for examination. The inner chamber of the sampling device is lifted out and portions of the water sample are carefully dispensed for subsequent chemical analysis.

A Snap-Plunger Water Sampler (LaMotte Code 1077) is another "in-depth" sampling device which is designed to collect large samples which can be used for a multitude of tests. Basically, this collection apparatus is a hollow cylinder with a spring loaded plunger attached to each end. The device is cocked above the surface of the water and lowered to the desired depth. A weighted messenger is sent down the calibrated line to trip the closing mechanism and the plungers seal the sample from mixing with intermediate layers as it is brought to the surface. A special drain outlet is provided to draw off samples for chemical analysis.

▪ Sampling of Closed System

To obtain representative samples from confined water systems, such as pipe lines, tanks, vats, filters, water softeners, evaporators and condensers, different considerations are required because of chemical changes which occur between the inlet and outlet water. One must have a basic understanding of the type of chemical changes which occur for the type of equipment used. Also, consideration should be given to the rate of passage and retaining time for the process water.

Temperature changes play an important part in deciding exactly what test should be performed. Process water should be allowed to come to room temperature, 20–25°C, before conducting any tests.

When drawing off samples from an outlet pipe such as a tap, allow sample to run for several minutes, rinsing the container several times before taking the final sample. Avoid splashing and introduction of any contaminating material.

FILTRATION

When testing natural waters that contain significant turbidity due to suspended solids and algae, filtration is an option. Reagent systems, whether EPA, Standard Methods, LaMotte or any others, will generally only determine dissolved constituents. Both EPA and Standard Methods suggest filtration through a 0.45 micron filter membrane, to remove turbidity, for the determination of dissolved constituents.** To test for total constituents, organically bound and suspended or colloidal materials, a rigorous high temperature acid digestion is necessary.

**LaMotte offers a filtering apparatus: syringe assembly (Code 1050) and membrane filters, 0.45 micron, (Code 1103).

AN INTRODUCTION TO COLORIMETRIC ANALYSIS

Most test substances in water are colorless and undetectable to the human eye. To test for their presence we must find a way to "see" them. The WaterLink PRO Colorimeter can be used to measure any test substance that is itself colored or can be reacted to produce a color. In fact a simple definition of colorimetry is "the measurement of color" and a colorimetric method is "any technique used to evaluate an unknown color in reference to known colors". In a colorimetric chemical test the intensity of the color from the reaction must be proportional to the concentration of the substance being tested. Some reactions have limitations or variances inherent to them that may give misleading results. Many such interferences are discussed with each particular test instruction. In the most basic colorimetric method the reacted test sample is visually compared to a known color standard. However, accurate and reproducible results are limited by the eyesight of the analyst, inconsistencies in the light sources, and the fading of color standards.

To avoid these sources of error, a colorimeter can be used to photoelectrically measure the amount of colored light absorbed by a colored sample in reference to a colorless sample (blank).

White light is made up of many different colors or wavelengths of light. A colored sample typically absorbs only one color or one band of wavelengths from the white light. Only a small difference would be measured between white light before it passes through a colored sample versus after it passes through a colored sample. The reason for this is that the one color absorbed by the sample is only a small portion of the total amount of light passing through the sample. However, if we could select only that one color or band of wavelengths of light to which the test sample is most sensitive, we would see a large difference between the light before it passes through the sample and after it passes through the sample.

The WaterLink PRO Colorimeter passes one of four colored light beams through one of four optical filters which transmits only one particular color or band of wavelengths of light to the photodectector where it is measured. The difference in the amount of colored light transmitted by a colored sample is a measurement of the amount of colored light absorbed by the sample. In most colorimetric tests the amount of colored light absorbed is directly proportional to the concentration of the test factor producing the color and the path length through the sample. However, for some tests the amount of colored light absorbed is inversely proportional to the concentration.

The choice of the correct wavelength for testing is important. It is interesting to note that the wavelength that gives the most sensitivity (lower detection limit) for a test factor is the complementary color of the test sample. For example the Nitrate-Nitrogen test produces a pink color proportional to the nitrate concentration in the sample (the greater the nitrate concentration, the darker the pink color). A wavelength in the green region should be selected to analyze this sample since a pinkish-red solution absorbs mostly green light.

REAGENT BLANK

Some tests will provide greater accuracy if a reagent blank is determined to compensate for any color or turbidity resulting from the reagents themselves. A reagent blank is performed by running the test procedure on 10 mL of demineralized water. Use sample water to SCAN BLANK. Insert the reagent blank in the colorimeter chamber and select SCAN SAMPLE. Note result of reagent blank. Perform the tests on the sample water as described. Subtract results of reagent blank from all subsequent test results. NOTE: Some tests require a reagent blank to be used to SCAN BLANK.

COLORIMETER TUBES

Colorimeter tubes which have been scratched through excessive use should be discarded and replaced with new ones. Dirty tubes should be cleaned on both the inside and outside. Fingerprints on the exterior of the tubes can cause excessive light scattering and result in errors. Handle the tubes carefully, making sure the bottom half of the tube is not handled.

LaMotte Company makes every effort to provide high quality colorimeter tubes. However, wall thicknesses and diameter of tubes may still vary slightly. This may lead to slight variations in results (e.g. if a tube is turned while in the sample chamber, the reading will likely change slightly). To eliminate this error put the tubes into the sample chamber with the same orientation every time.

The tubes that are included with the colorimeter have an index mark to facilitate this. If possible, use the same tube to SCAN BLANK and SCAN SAMPLE.

METER CARE

The optical system of the WaterLink PRO Colorimeter must be kept clean and dry for optimal performance. Dry the colorimeter tubes before placing them in the chamber to avoid introducing moisture. For best results store the instrument in an area that is dry and free from aggressive chemical vapors.

SELECTING AN APPROPRIATE WAVELENGTH

The most appropriate wavelength to use when creating a calibration curve is usually the one which gives the greatest change from the lowest reacted standard concentration to the highest reacted standard concentration. However, the absorbance of the highest reacted standard concentration should never be greater than 2.0 absorbance units. Scan the lowest and highest reacted standards at different wavelengths using the absorbance mode to find the wavelength which gives the greatest change in absorbance without exceeding 2.0 absorbance units. Use this wavelength to create a calibration curve.

Below is a list of suggested wavelengths for the color of the reacted samples. Use these as a starting point.

Sample Color	Wavelength Range
Yellow	430
Pink	520
Red	570
Green and Blue	620

CALIBRATION

As with all pre-calibrated meters, it is highly recommended, even if not required by regulations, that the user periodically verify the performance of the meter by running standards with a predetermined concentration. Results outside of specification are an indication that the meter needs to be adjusted. This can be done following the user calibration described on page 29. If the user calibration fails to properly adjust the meter then the meter should be returned to LaMotte Company for recalibration. (See page 5).

CALIBRATION CURVES

The WaterLink PRO Colorimeter contains tests for the LaMotte reagent systems (see Page 49). The first step in using a non-LaMotte reagent system with your WaterLink PRO Colorimeter is to create a calibration curve for the reagent system. To create a calibration curve, prepare standard solutions of the test factor and use the reagent system to test the standard solutions with the WaterLink PRO Colorimeter. Select a wavelength for the test as described above.

Plot the results (in ABS or %Transmittance) versus concentration to create a calibration curve. The calibration curve may then be used to identify the concentration of an unknown sample by testing the unknown, reading Absorbance or %T, and finding the corresponding concentration from the curve. The linear range of the reagent system can be determined and this information can be used to input a User Test into the WaterLink PRO Colorimeter (see EDIT USER TESTS, page 37).

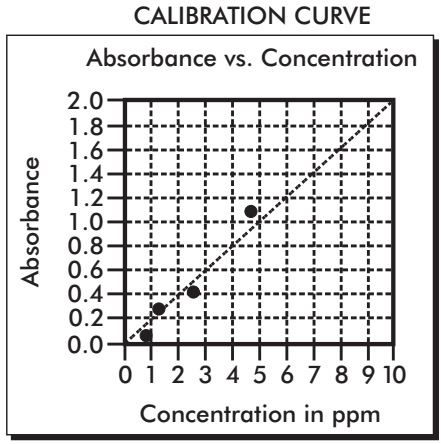
PROCEDURE

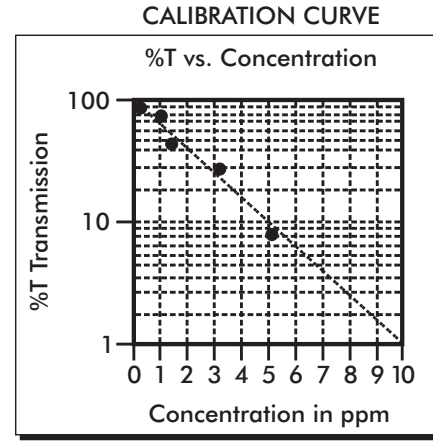
1. Prepare 5 or 6 standard solutions of the factor being tested. The concentration of these standards should be evenly distributed throughout the range of the reagent system, and should include a 0 ppm standard (distilled water). For instance, the solutions could measure 0, 10%, 30%, 50%, 70%, and 90% of the system's maximum range.
2. Turn on the WaterLink PRO Colorimeter. Select the appropriate wavelength from the absorbance mode. Be sure to select the appropriate wavelength for the color produced by the reagent system.
3. Use the unreacted 0 ppm standard to standardize the colorimeter by using it to scan blank.
4. Following the individual reagent system instructions, react each standard solution beginning with 0 ppm. Continue with standards in increasing concentration. Record the reading and the standard solution concentration on a chart. Readings can be recorded as percent transmittance (%T) or absorbance (A).

5. Plot results on graph paper or computer using any available plotting program. If results are as %T versus concentration, semilog graph paper must be used. Plot the standard solution concentrations on the horizontal, linear axis, and the %T on the vertical, logarithmic axis. If results are as absorbance versus standard solution concentration, simple linear graph paper can be used. Plot the standard solution concentration on the horizontal axis, and the absorbance on the vertical axis.
6. After plotting the results, draw a line, or curve, of best fit through the plotted points. The best fit may not connect the points. There should be approximately an equal number of points above the curve as below the curve. Some reagent systems will produce a straight line, while others produce a curve. Many computer spreadsheet programs can produce the curve of best fit by regression analysis of the standard solution data.

☑ NOTE: Only reagent systems which produce a straight line can be used for a User Test.

A sample of each type of graph appears below:





▪ PREPARING DILUTE STANDARD SOLUTIONS

Standard solutions should be prepared to create a calibration curve. Standard solutions can be prepared by diluting a known concentrated standard by specified amounts. A chart or computer spreadsheet can be created to determine the proper dilutions. Use volumetric flasks and volumetric pipets for all dilutions.

1. In Column A – Record the maximum concentration of test as determined by the range and path length.
2. In Column B – Record the percent of the maximum concentration the standard solution will be.
3. In Column C – Calculate the final concentration of the diluted standard solutions by multiplying the maximum concentration (In Column A) by the % of maximum concentration divided by 100. ($C = A \times {}^{B}/_{100}$).
4. In Column D – Record the final volume of the diluted sample (i.e. volume of volumetric flask).
5. In Column E – Record the concentration of the original standard.
6. In Column F – Calculate the milliliters of original standard required ($C \times {}^{D}/_{E} = F$).

A sample chart appears below:

A	B	$C = A \times {}^{B}/_{100}$	D	E	$F = C \times {}^{D}/_{E}$
Maximum concentration of test	% of Maximum concentration	Final concentration of Diluted Standard	Volume of Standard	Concentration of Original Standard	mL of Original Standard Required
10.0 ppm	90	9.0 ppm	100 mL	1000 ppm	0.90 mL
10.0 ppm	70	7.0 ppm	100 mL	1000 ppm	0.70 mL
10.0 ppm	50	5.0 ppm	100 mL	1000 ppm	0.50 mL
10.0 ppm	30	3.0 ppm	100 mL	1000 ppm	0.30 mL
10.0 ppm	10	1.0 ppm	100 mL	1000 ppm	0.10 mL
10.0 ppm	0	0 ppm	100 mL	1000 ppm	0 mL

■ STANDARD ADDITIONS

A common method to check the accuracy and precision of a test is by standard additions. In this method a sample is tested to determine the concentration of the test substance. A second sample is then "spiked" by the addition of a known quantity of the test substance. The second sample is then tested. The determined concentration of the spiked sample should equal the concentration of the first plus the amount added with the spike. The procedure can be repeated with larger and larger "spikes." If the determined concentrations do not equal the concentration of the sample plus that added with the "spike", then an interference may exist.

For example, a 10.0 mL water sample was determined to contain 0.3 ppm iron. To a second 10.0 mL sample, 0.1 mL of 50 ppm iron standard was added. The concentration of iron due to the "spike" was (0.10 mL x 50 ppm)/10.0 mL = 0.50 ppm. The concentration of iron determined in the spiked sample should be 0.3 + 0.5 = 0.8 ppm iron. (Note: any error due to the increased volume from the "spike" is negligible).

LaMotte offers a line of calibration standards which can be used to generate calibration curves and perform standard additions.

SAMPLE DILUTION TECHNIQUES & VOLUMETRIC MEASUREMENTS

If a test result using the WaterLink PRO Colorimeter gives an message then the sample concentration could be over range or under range. If it is over range, the sample must be diluted. Then the test should be repeated on the diluted sample to obtain a reading which is in the concentration range for the test. (Note: This is not true for colorimetric determination of pH.)

Example:

Measure 5 mL of the water sample into a graduated cylinder. Add demineralized water until the cylinder is filled to the 10 mL line. The sample has been diluted by one-half, and the dilution factor is therefore 2. Perform the test procedure, then multiply the resulting concentration by 2 to obtain the test result.

The following table gives quick reference guidelines on dilutions of various proportions. All dilutions are based on a 10 mL volume, so several dilutions will require small volumes of the water sample. Graduated pipets should be used for all dilutions.

Size of Sample	Deionized Water to Bring Volume to 10 mL	Multiplication Factor
10 mL	0 mL	1
5 mL	5 mL	2
2.5 mL	7.5 mL	4
1 mL	9 mL	10
0.5 mL	9.5 mL	20

If the above glassware is not available, dilutions can be made with the colorimeter tube. Fill the tube to the 10 mL line with the sample then transfer it to another container. Add 10 mL volumes of demineralized water to the container and mix. Transfer back 10 mL of the diluted sample to the tube and follow the test procedure. Continue diluting and testing until a reading, which is in the concentration range for the test, is obtained. Be sure to multiply the concentration found by the dilution factor (the number of total 10 mL volumes used).

Example:

10 mL of sample is diluted with three 10 mL volumes of demineralized water; the dilution factor is four.

INTERFERENCES

LaMotte reagent systems are designed to minimize most common interferences. Each individual test instruction discusses interferences unique to that test. Be aware of possible interferences in the water being tested.

The reagent systems also contain buffers to adjust the water sample to the ideal pH for the reaction. It is possible that the buffer capacity of the water sample may exceed the buffer capacity of the reagent system and the ideal pH will not be obtained. If this is suspected, measure the pH of a reacted distilled water reagent blank using a pH meter. This is the ideal pH for the test. Measure the pH of a reacted water sample using the pH meter. If the pH is significantly different from the ideal value, the pH of the sample should be adjusted before testing.

Interferences due to high concentration of the substance being tested, can be overcome by sample dilution (see page 16).

STRAY LIGHT INTERFERENCE

When scanning samples in 16 mm tubes, such as COD, the sample chamber lid can not be closed. The COD adapter minimizes stray light. To further reduce stray light interference, do not scan sample in direct sunlight.

OPERATION OF THE WaterLink PRO COLORIMETER

OVERVIEW

The WaterLink PRO Colorimeter is a portable, microprocessor controlled, direct reading colorimeter. It has a graphical 4 line, 16 character liquid crystal display for graphical, alphabetical and numerical messages. The operation is controlled with the keypad through menu driven software in response to selections shown on the display.

The test library consists of approximately 70 LaMotte tests and 10 "User Tests". The LaMotte tests are precalibrated for LaMotte reagent systems. The colorimeter displays the results of these tests directly in units of concentration. The 10 "User Tests" may be used to enter additional calibrations. All of these tests may be arranged in any of 3 sequences. These sequences can be modified a limitless number of times to meet changing testing needs.

The optics feature 4 different colored LEDs. Each LED has a corresponding silicon photodiode with an integrated interference filter. The interference filters select a narrow band of light from the corresponding LED for the colorimetric measurements. The microprocessor automatically selects the correct LED/photodiode combination for a test.

A RS-232 serial port on the back of the colorimeter, and optional software, allows the WaterLink PRO to be interfaced with an IBM compatible personal computer for real time data acquisition and data storage. This port also allows an interface with a RS-232 serial printer.

Due to its portability, alternate power sources, and rugged construction, the WaterLink PRO Colorimeter is ideal for lab and field use.

POWER SOURCE

The WaterLink PRO Colorimeter uses a 500 mA AC adapter. Please refer to the Parts List for the code number for the correct adapter.

USE OF ANY AC ADAPTER OTHER THAN THE ONE SPECIFIED FOR USE WITH THE WaterLink PRO COLORIMETER MAY DAMAGE THE METER AND WILL VOID THE WARRANTY. Do not use the adapter sold with the original SMART Colorimeter.

To use the adapter, slide the connector pin from the AC adapter into the small hole on the left side of the meter. Plug the AC adapter into an appropriate wall socket or power source.

COMPONENTS

Figure 1 shows a diagram of the WaterLink PRO Colorimeter and its components.

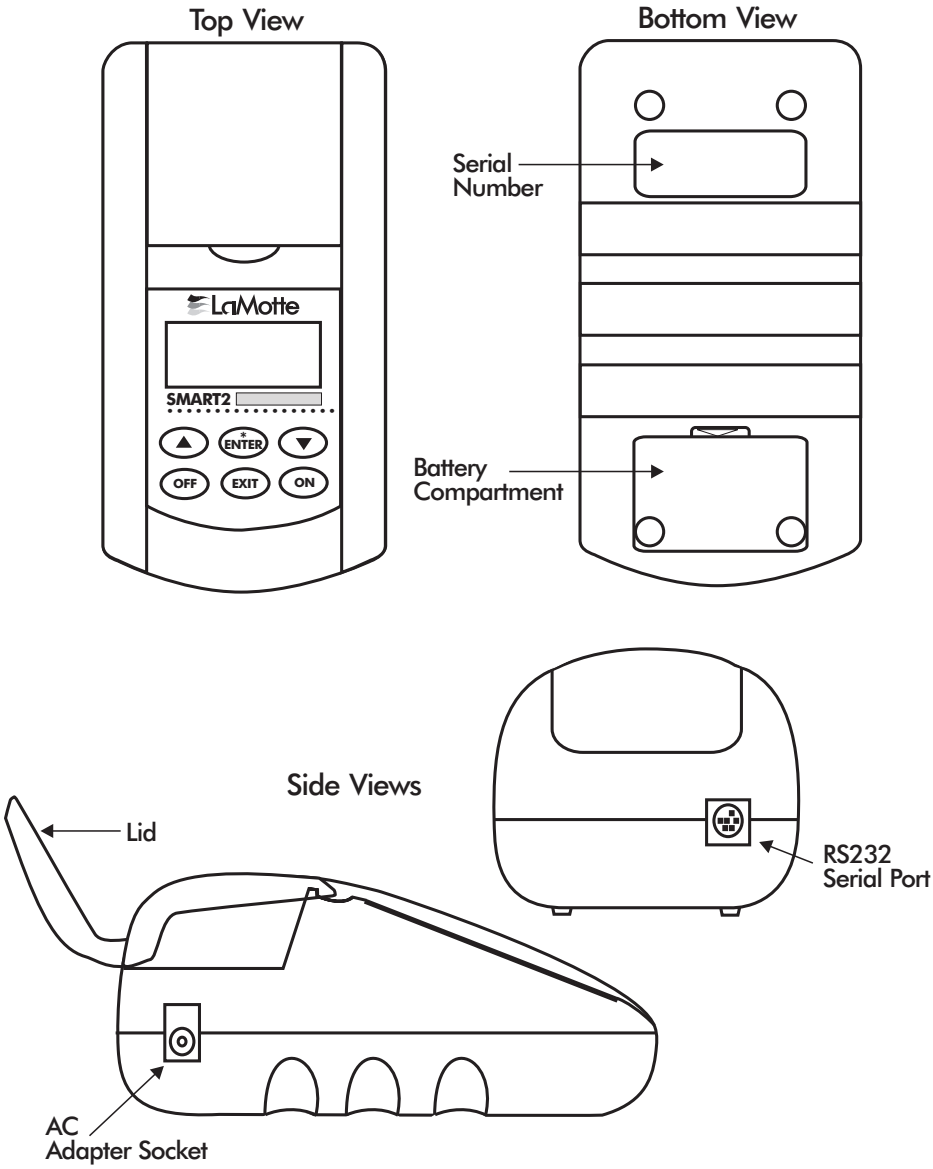


Figure 1

GENERAL OPERATING PROCEDURES

The operation of the WaterLink PRO Colorimeter is controlled by a microprocessor. The microprocessor is programmed with menu driven software. A menu is a list of choices. This allows a selection of various tasks for the colorimeter to perform, such as, scan blank, scan sample, and edit test sequences. The keypad is used to make menu selections which are viewed in the display. There are three selections accessible from the `MAIN MENU`: `Testing Menu`, `Editing Menu` and `PC Link`.

THE KEYPAD

The keypad has 6 buttons which are used to perform specific tasks.

ON	This button is used to turn the colorimeter on.
▼	This button will cause the display to scroll down through a list of menu choices. It will move through a list viewed in the display. It will auto scroll when held down.
▲	This button will cause the display to scroll up in a list of menu choices. It will move through a list viewed in the display. It will auto scroll when held down.
ENTER ✱	This button is used to select the menu choice adjacent to the "✱" in a menu viewed in the display.
EXIT	This button is an exit or escape button. When pressed, the display will exit from the current menu and go to the previous menu.
OFF	This button turns the colorimeter off.

SAMPLE HOLDERS

The sample chamber is designed for 25 mm round tubes. Additional sample holders for 16 mm COD tubes and for 1 cm square UDV cuvettes are available for the WaterLink PRO Colorimeter.

Position the COD adapter in the WaterLink PRO chamber so that the grooves in the adapter are aligned with the ridges located at the rear of the chamber. The adapter should be inserted with the small hole, containing the ball plunger, at the top. The ball plunger can be adjusted with a small screwdriver to control the tightness of the fit of the tube in the adapter.

Position so that the grooves in the UDV adapter are aligned with the ridges at 12 o'clock and 2 o'clock in the chamber.

THE DISPLAY & THE MENUS

The display allows menu selections to be viewed and chosen. These choices instruct the colorimeter to perform specific tasks. The menus are viewed in the display using two general formats which are followed from one menu to the next. Each menu is a list of choices or selections.

There are four lines in the display. The top line in each menu is a title or pertinent instruction. The top line does not change unless a new menu is selected. The second and third lines are used in two ways. One way is to display menu choices. The second way takes advantage of the graphical capabilities of the display. Both lines are used to display important messages, such as test results, in a large, easy to read format. The fourth line is used for menu choices.

DISPLAY

TESTING MENU
*FIRST CHOICE
SECOND CHOICE
ANOTHER
AND ANOTHER
AND SO ON

TITLE or INSTRUCTION

MENU CHOICE WINDOW

Think of the menu choices as a vertical list in the display which moves up or down each time an arrow button is pressed. This list or menu is viewed through a window, the menu choice window, in the display. The menu choice window is the lower 2 or 3 lines of the display. Pushing the arrow buttons brings another portion of the menu into menu choice window. This is referred to as scrolling through the menu.

TESTING MENU
*FIRST CHOICE
SECOND CHOICE
ANOTHER
AND ANOTHER
AND SO ON
LAST CHOICE

▼

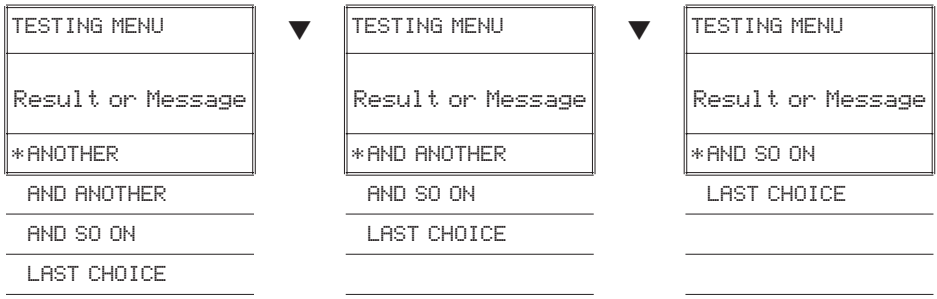
TESTING MENU
SECOND CHOICE
*ANOTHER
AND ANOTHER
AND SO ON
LAST CHOICE

▼

TESTING MENU
ANOTHER
AND ANOTHER
*AND SO ON
LAST CHOICE

An asterisk, "*", will start in the far left position of the top line in the menu choice window. As the menu is scrolled through, different choices appear next to the "*". The "*" in the display corresponds with the **✱/ENTER** button. Pushing the **✱/ENTER** button selects the menu choice which is adjacent to the "*" in the menu choice window.

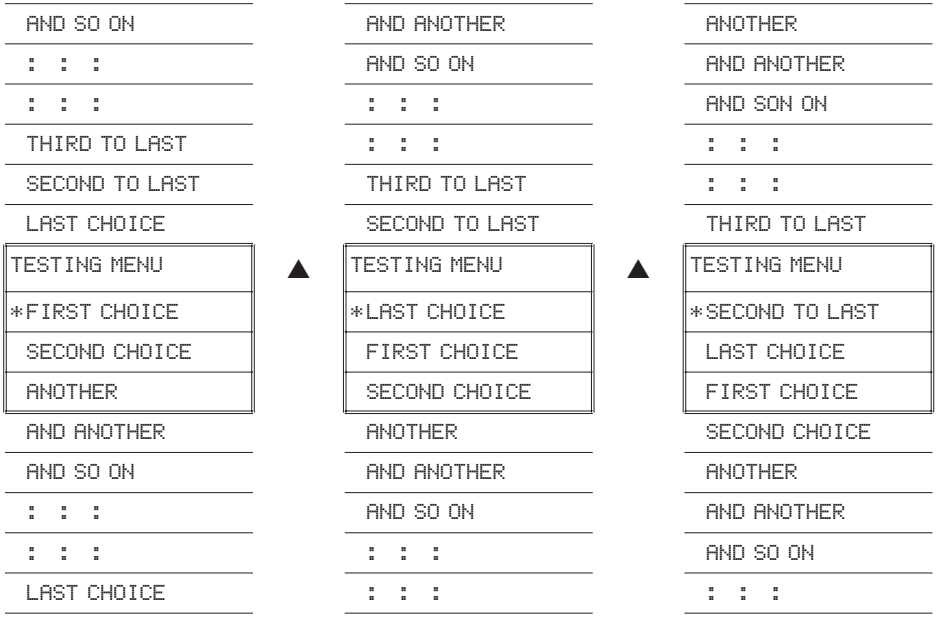
The second general format of the display takes advantage of the graphics capabilities of the display. The top line of the display is still a title line. The middle two lines of the display are used to display important messages, results or graphics in a large, easy to read format. The menus work in the same way as described previously but only one line of the menu is visible at the bottom of the display.



As described previously, the **EXIT** button allows an exit or escape from the current menu and a return to the previous menu. This allows a rapid exit from an inner menu to the main menu by repeatedly pushing the **EXIT** button. Pushing **OFF** at any time will turn the colorimeter off.

LOOPING MENUS

Long menus, such as `All Tests`, incorporate a looping feature which allow the user to quickly reach the last choice in the menu from the first choice. In a looping menu the last choices in the menu are above the first choice and scrolling upward moves through the menu in reverse order. Scrolling downward moves through the menu from first choice to last but the menu starts over following the last choice. So all menu choices can be reached by scrolling in either direction. The diagrams below demonstrate a looping menu.



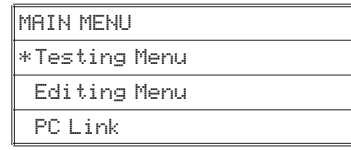
TESTING

TESTING MENU

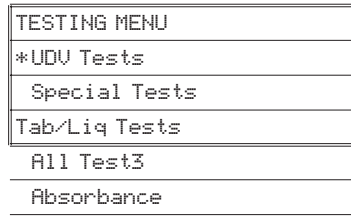
The Testing Menu is used to run all LaMotte pre-programmed tests, USER TESTS and Absorbance test at one of four wavelengths. Testing from any of three sequences can also be done.

1. Press the **ON** button to turn on the WaterLink PRO Colorimeter. The WaterLink PRO logo will appear for about 2 seconds and the the Start screen appears. Press the ✱/**ENTER** button to begin testing.

2. The MAIN MENU will appear. Press the ✱/**ENTER** button to select Testing Menu.



3. Scroll with the ▼ or ▲ buttons and make a selection with the ✱/**ENTER** button. The three sequences have selected tests. All Tests has all the available tests and Absorbance has %T/ABS tests.



SEQUENCES OF TESTS

UDV TESTS, SPECIAL TESTS, and TAB/LIQ TESTS are alterable sequences. They may be edited using the Editing Menu. Any of the LaMotte pre-programmed tests or User Tests may be placed in these sequences in whatever testing order that is preferred. Some examples of typical sequences are given below.

UDV TESTS
*016 Cl F – UDV
018 Cl T – UDV
011 Bromine – UDV
076 pH UDV
013 Ca&Mg H – UDV
001 Alk – UDV
037 Cya – UDV
033 Cu – UDV
052 Iron – UDV

SPECIAL TESTS
*007 Biguanide
048 H Per Shock
078 Phosphate L
066 Nitrate – TT
055 Manganese L
071 Ozone – LR
008 Borate
098 turbidity
005 Ammonia – N H
089 Sulfate – HR

TAB/LIQ TESTS
*015 Chlorine
017 Cl Liq DPD
075 pH PR
044 Hard TT
036 Cyanuric
032 Cu DDC
051 Iron BiPyr
009 Bromine – LR
007 Biguanide
046 H Pero – LR
078 Phosphate L
066 Nitrate TT
055 Manganese L
071 Ozone – LR
008 Borate
098 Turbidity
005 Ammonia – N H
089 Sulfate – HR

These alterable sequences allow a series of tests to be setup that are run frequently. The order of the individual tests in the sequence is determined by the user. After running a test, use the * button to select the next test in the sequence. Continue this pattern until the entire sequence has been completed.

All Tests is a fixed sequence containing the LaMotte pre-programmed tests, User Tests, and Absorbance tests.

Modification of the alterable sequences is accomplished through the Editing Menu. This menu is explained in greater detail in EDITING MENU (p. 32).

Pressing the **EXIT** button while in a sequence menu will escape back to the Testing Menu.

Pressing the **OFF** button at any time will turn the colorimeter off.

☑ NOTE: After scanning a sample the default choice is NEXT TEST in UDV TEST, SPECIAL TESTS, and TAB/LIQ TESTS. The default choice in ALL TESTS and ABSORBANCE is Scan Sample, the the same test.

GENERAL TESTING PROCEDURES

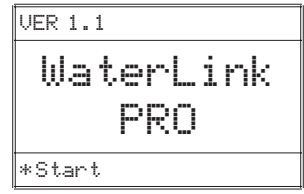
The following are some step by step examples of how to run tests from the Testing Menu. These test procedures are designed to be used with LaMotte SMART Reagent Systems.

LaMotte Company continuously updates the list of pre-programmed tests as the calibrations become available. Pre-programmed calibrations can be added to the WaterLink PRO Colorimeter in the field. A Windows-based computer running a Windows Operating System and an 8 pin mini-DIN/9 pin F D-submin serial cable (order Code 1771) are required.

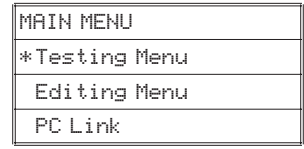
Call LaMotte Technical Services at 1-800-344-3100 (410-778-3100 outside the USA) or email at tech@lamotte.com for a current list of available calibrations and downloading instructions.

TESTING WITH THE LaMOTTE PRE-PROGRAMMED TESTS

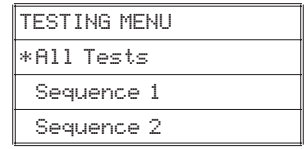
Press **ON** to turn on the WaterLink PRO Colorimeter. The WaterLink PRO logo will appear for about 2 seconds and then the Start screen appears. Press the **✱/ENTER** button to start testing.



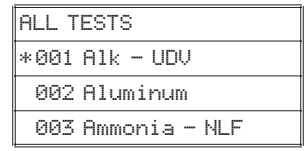
The MAIN MENU will appear. Press the **✱/ENTER** button to select Testing Menu.



Press the ▼ button to move to All Tests.



Press the ▼ button to move to the 002 Aluminum to ✱.



Press the ✱/**ENTER** button to select `002 Aluminum`.

ALL TESTS
*002 Aluminum
003 Ammonia – NLF
004 Ammonia – NLS

The WaterLink PRO Colorimeter is ready to scan at the correct wavelength. Place the blank in the sample chamber, close the lid and press the ✱/**ENTER** button to scan blank.

☑NOTE: Do not keep the button depressed.

002 Aluminum
*Scan Blank

The screen will display `Blank Done` for about 1 second. `Scan Sample` will be positioned next to ✱.

002 Aluminum
Blank Done
*Scan Blank

Place the reacted sample in the chamber, close the lid and press the ✱/**ENTER** button to scan sample. The colorimeter will scan the sample and the results screen will appear.

002 Aluminum
*Scan Sample

Record test result. To repeat the test, press the ✱/**ENTER** button to scan the sample again. The last blank scanned is used to zero the colorimeter for repeated scans. A different blank can be used by pressing the ▲ button to scroll back to `Scan Blank` and then scanning another blank. Scroll with the ▼ or ▲ buttons and make another selection with the ✱/**ENTER** button. The %T or Absorbance of the last test can be viewed by choosing `%T/Abs`. Press the **EXIT** button to escape to previous menus.

☑NOTE: The menus loop in this screen so either the ▲ or ▼ buttons will lead to the menu selection needed.

002 Aluminum
0.09 ppm
*Scan Sample
Next Test
Previous Test
%/Abs
Calibrate
Scan Blank

CALIBRATING LaMOTTE PRE-PROGRAMMED TESTS

The LaMotte Pre-Programmed Tests have been pre-calibrated. Recalibration of the pre-programmed tests by the user is not possible. However, a procedure to standardize the calibration can be performed to obtain the most accurate readings or to meet regulatory requirements.

The LaMotte Pre-Programmed tests are standardized with one standard solution. To standardize over the full range of the test, the concentration of the standard should be chosen from the high end of the range. Alternatively, if samples do not cover the full range of the test, a standard should be chosen that is close to the concentration of the samples.

The standardization procedure should be followed as often as required by regulations and laws for compliance monitoring.

In the example below the Aluminum calibration will be standardized.

Prepare a standard solution to be tested. Use 0.10 ppm aluminum.

Use the ▲ or ▼ button to scroll to `002 Aluminum`. Follow instructions in the WaterLink PRO Manual for testing the aluminum standard. Scan the blank.

002 Aluminum
*Scan Blank

The screen will display `Blank Done` for about 1 second. `Scan Sample` will be positioned next to *.

002 Aluminum
Blank Done
*Scan Sample

Place the reacted sample in the chamber, close the lid and press **✱/ENTER** to scan sample. The result will be displayed.

002 Aluminum
*Scan Sample

The displayed result can now be standardized. Use the ▲ or ▼ buttons to scroll to `Calibrate`. Press **✱/ENTER** to select.

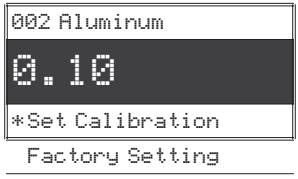
002 Aluminum
0.09 ppm
*Scan Sample

Next Test
Previous Test
%T/Abs
Calibrate
Scan Blank

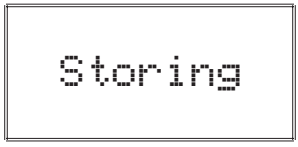
A reverse font (dark background with light characters) will appear to indicate that the reading can be adjusted. Use ▲ or ▼ to scroll to the concentration of the sample, 0.10 ppm in this example.

Set the calibration by pressing ✱/**ENTER** to select Calibrate.

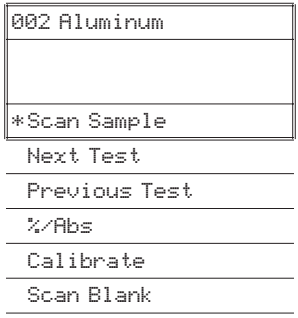
Two menu choices will be offered, Set Calibration and Factory Setting. Set the calibration by pressing ✱/**ENTER** to select Set Calibration; or use ▲ or ▼ to scroll to and select Factory Setting to revert to the factory calibration.



The meter will display the message "Storing" and return to 002 Aluminum test.

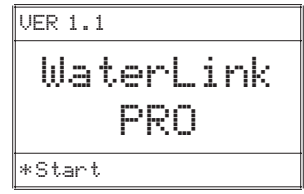


The calibration for 002 Aluminum has now been standardized and can be used for testing. The standardization can be removed by repeating the calibration and selecting Factory Setting.

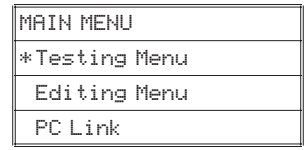


MEASURING IN THE ABSORBANCE MODE

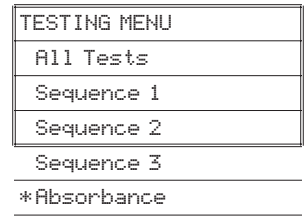
Press **ON** to turn on the WaterLink PRO Colorimeter. The WaterLink PRO logo will appear for about 2 seconds and then the Start screen appears. Press the **✱/ENTER** button to start testing.



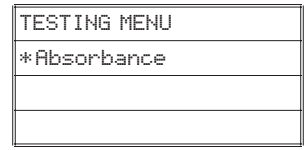
The MAIN MENU will appear. Press the **✱/ENTER** button to select Testing Menu.



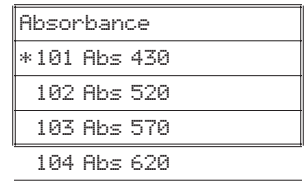
Press the ▼ button to scroll to Absorbance.



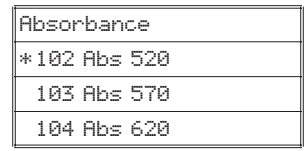
Press the **✱/ENTER** button to select Absorbance.



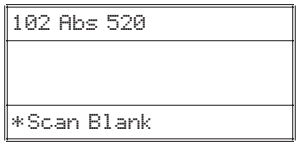
Press the ▼or ▲ buttons to move to the desired test.



Press the **✱/ENTER** button to select test.

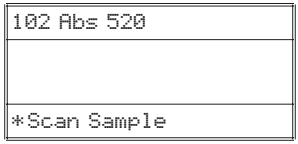


Insert blank, press the ✱/**ENTER** button to scan blank.

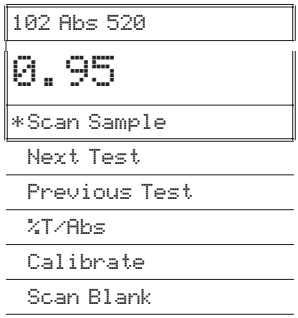


The screen will display `Blank Done` for about 1 second.

Insert the reacted sample. Press the ✱/**ENTER** button to scan the sample.



Record test result. To repeat the test, press the ✱/**ENTER** button to scan the sample again. The last blank scanned is used to zero the colorimeter for repeated scans. A different blank can be used by pressing the ▲ button to scroll back to `Scan Blank` and then scanning another blank. Scroll with ▼ or ▲ and make another selection with ✱/**ENTER**. The %T or Absorbance of the last test can be viewed by choosing `%T/Abs`. Press **EXIT** to escape to previous menus.



☑NOTE: The menus loop in this screen so either ▼ or ▲ will lead to the menu selection needed.

☑NOTE: The Calibrate function does not work in the Absorbance mode.

EDITING MENU

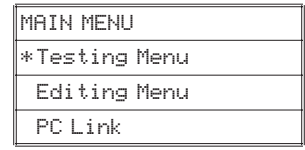
The EDITING MENU allows the user to edit sequences, edit user tests, set the clock, edit the logging function, and set the power saving function.

EDIT A SEQUENCE

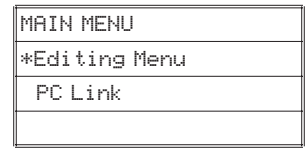
The EDIT SEQUENCE menu allows three alterable test sequences (SEQUENCE 1, SEQUENCE 2, and SEQUENCE 3) to be edited.

Press **ON** to turn on the WaterLink PRO Colorimeter. The WaterLink PRO will appear for about 2 seconds and then the Start screen appears. Press the ✱/**ENTER** button to start testing.

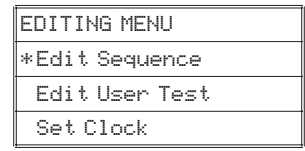
The Main Menu will appear. Press the ▼ button to scroll to Editing Menu.



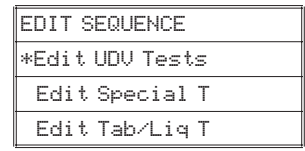
Press the ✱/**ENTER** button to select Editing Menu.



The Editing Menu appears. Press the ✱/**ENTER** button to select Editing Sequence.



The Edit Sequence menu appears. Press the ✱/**ENTER** button to scroll to select UDV TESTS.



Edit UDV TESTS appears.

EDIT UDV TESTS
*016 Cl F – UDV
018 Cl T – UDV
011 Bromine – UDV

ADDING OR DELETING TESTS

There are three ways to alter a sequence: Insert Before, Insert After, and Delete. Insert Before adds a new test to the sequence before the selected test. Insert After adds a new test to the sequence after the selected test. Delete is used to remove an existing test from a sequence.

Below is a step by step example of how to add a test to TAB/LIQ TESTS starting from the EDIT TAB/LIQ T menu.

Press the ▼ button to scroll to 075 pH PR.

EDIT TAB/LIQ T
*015 Chlorine
017 Cl Liq DPD
075 pH PR

Press the ✱/**ENTER** button to select 075 pH PR.

EDIT TAB/LIQ T
*075 pH PR
044 Hard TT
036 Cyanuric

Press the ✱/**ENTER** button to select Insert Before.

EDIT SEQUENCE 1
*Insert Before
Insert After
Delete

The ALL TESTS menu appears. Press the ▼ button to move the 002 Aluminum to *.

ALL TESTS
*002 Aluminum
003 Ammonia-N LF
004 Ammonia-N LS

Continued...

Press the ✱/**ENTER** button to selec t 002 Aluminum.

ALL TESTS
✱002 Aluminum
003 Ammonia-N LF
004 Ammonia-N LS

TAB/LIQ appears in EDIT TAB/LIQ T menu and 002 Aluminum is now before pH PR in the sequence. All changes to TAB/LIQ are automatically saved. Press the **EXIT** button to exit the EDIT TAB/LIQ T menu and return to the EDIT SEQUENCE menu or continue editing.

EDIT TAB/LIQ T
✱015 Chlorine
017 Cl Liq DPD
002 Aluminum
075 pH PR
044 Hard TT
036 Cyanuric

The EDIT SEQUENCE menu appears. Select another sequence to edit or press the **EXIT** button to return to the EDITING MENU. Press the **EXIT** button again to return the the MAIN MENU.

EDIT SEQUENCE 1
✱Edit UDV Tests
Edit Special T
Edit Tab/Liq

Below is a step by step example of how to delete a test from TAB/LIQ TESTS starting from the EDIT TAB/LIQ T menu. The test 002 Aluminum, added in the previous example, will be deleted.

Press the ▼ button to scroll to 002 Aluminum.

EDIT TAB/LIQ T
✱015 Chlorine
017 Cl Liq DPD
002 Aluminum
075 pH PR
044 Hard TT
036 Cyanuric

Press the ✱/**ENTER** button to select 002 Aluminum.

EDIT TAB/LIQ T
✱002 Aluminum
075 pH PR
044 Hard TT

Press the ▼ button to scroll to Delete.

EDIT SEQUENCE 1
*Insert Before
Insert After
Delete

Press the ***/ENTER** button to select Delete.

EDIT SEQUENCE 1
*Delete

EDIT TAB/LIQ T appears in the EDIT TAB/LIQ T menu and 002 Aluminum has been deleted. All changes to TAB/LIQ TESTS are automatically saved.

Press the **EXIT** button to exit the EDIT TAB/LIQ T menu and return to the EDIT SEQUENCE menu or continue editing.

EDIT TAB/LIQ T
*015 Chlorine
017 Cl Liq DPD
075 pH PR
044 Hard TT
036 Cyanuric

The EDIT SEQUENCE menu appears. Select another sequence to edit or press the **EXIT** button to return to the EDITING MENU. Press the **EXIT** button again to return the the MAIN MENU.

EDIT SEQUENCE 1
*Edit UDV Tests
Edit Special T
Edit Tab/Liq T

EDIT USER TESTS

If a test other than the LaMotte programmed tests is performed regularly, a calibration for it may be entered in one of the 10 User Tests. These tests are originally named "User Test 1 – 10". It will be possible to rename the test, select a wavelength, enter a new calibration, select the number of decimal places used to display the results, and select the units. A User Test may be added for a reagent system for which no precalibrated test exists. A calibration of a LaMotte reagent system may also be entered. The calibration of a User Test can be changed at any time.

The User Tests have the ability to handle 2 data points. The colorimeter will determine the absorbance of the standards and calculate a response that will be stored to determine the concentration of future samples of unknown concentration. These standards should cover all the concentrations for the range of the test being performed and be scanned beginning with the low concentration and finishing with the high concentration (for more information about this, see CALIBRATION CURVES, page 13). Prepare these solutions prior to entering a new calibration.

☑ NOTE: A calibration procedure must be performed before using any of the User Tests.

The User Tests can be placed in any of the alterable sequences using EDIT SEQUENCES.

To edit a User Test, start at the EDITING MENU. Scroll down to Edit User Test.

EDITING MENU
*Edit Sequences
Edit User Test
Set Clock

Press the ***/ENTER** button to select the Edit User Test.

EDITING MENU
*Edit User Test
Set Clock
Edit Logging

From the EDIT USER TEST menu, select the User Test to be entered or changed. In this example, choose 105 User Test 01. Use the ▼ and ▲ buttons to scroll to other User Tests if desired. Select the User Test by pressing the ***/ENTER** button.

EDIT USER TEST
*105 User Test01
106 User Test02
107 User Test03
108 User Test04
: : :
114 User Test10

NAMING THE TEST

A User Test can be up to 11 characters long. The menu choices for each character are 26 upper case letters A to Z, 26 lower case letters a to z, ten numerals 0 to 9, a space (SP), a dash (–) and a decimal point (.). The existing name is displayed on the bottom line of the display. A cursor will be over the character which is to be edited and that character is also displayed in the center of the display. The character can be changed by using the ▼ and ▲ buttons to scroll to other characters. Use the ✱/**ENTER** button to select a character. The edited name is saved at any time by pressing **EXIT** or by pressing the ✱/**ENTER** button after selecting the eleventh character.

From the Edit User Test01 menu press the **✱/ENTER** button to select Name The Test and change the name of User Test 01.

EDIT USER TEST01
*Name The Test
Select Vial/WL
New Calibration
Decimal Places
Select Units

The cursor is over the letter "U" in 105 User Test01 and the letter "U" is displayed in the large font in the center of the display.

NAME THE TEST
U
105 User Test01

Change the name to H2O. Use the ▼ and ▲ buttons to scroll to the letter "H" into the center of the display. Press the **✱/ENTER** button to select the letter "H".

NAME THE TEST
H
105 User Test01

The letter "H" has been entered in the first position of the name and the cursor has moved to the second letter "s".

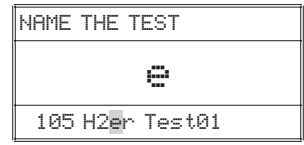
NAME THE TEST
s
105 User Test01

Use the ▼ and ▲ buttons to scroll to the number "2" into the center of the display. Press the **✱/ENTER** button to select the number "2".

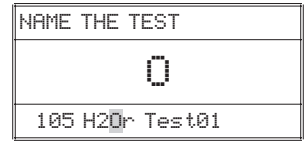
NAME THE TEST
2
105 Hser Test01

Continued...

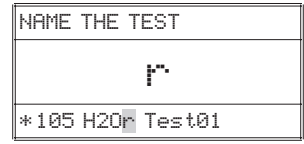
The number "2" has been entered in the second position of the name and the cursor has moved to the third letter "e".



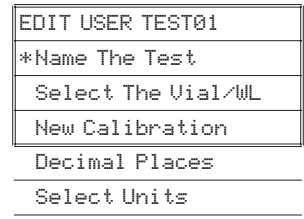
Use the ▼ and ▲ buttons to scroll to the letter "O" into the center of the display. Press the ***/ENTER** button to select the letter "O".



The letter "O" has been entered in the third position of the name and the cursor has moved to the fourth letter "r". Press the **EXIT** button to save the name entered up to this point.



The meter will display the message "Storing" and return to the EDIT USER TEST01 menu.



SELECTING THE VIAL AND WAVELENGTH

The WaterLink PRO Colorimeter has three different vials (the 25 mm 0290 tube, UDVs and COD tubes) and 4 different wavelengths (430, 520, 570, and 620 nm). The colorimeter uses different settings for each of the twelve combinations of vial and wavelength. These twelve settings are called channels. Choose the channel with the correct wavelength and vial for the test.

Use the ▼ button to scroll to `Select Vial/WL` and press ✱/**ENTER** button to select.

EDIT USER TEST01
*Name The Test
Select Vial/WL
New Calibration
Decimal Places
Select Units

Use the ▼ and ▲ buttons to scroll to the appropriate channel and press ✱/**ENTER** button to select.

☑NOTE: This is a looping menu.

: : :
Ch11 620nm COD
Ch12 570nm COD
SELECT CHANNEL
*Ch1 520nm 25mm
Ch2 430nm 25mm
Ch3 620nm 25mm
Ch4 570nm 25mm
Ch5 520nm UDV
Ch6 430nm UDV
: : :

The meter will display the message "`Storing`" and return to the `EDIT USER TEST01` menu.

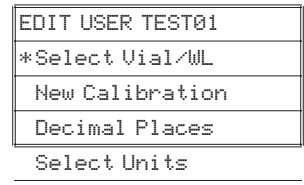
Storing

EDIT USER TEST01
*Select The Vial/WL
New Calibration
Decimal Places
Select Units

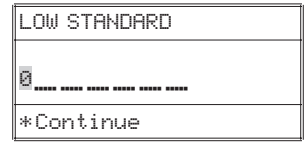
ENTERING A NEW CALIBRATION

To enter a new calibration two reacted standards solutions of known concentration are required: a "low standard" and a "high standard". These should be ready to use.

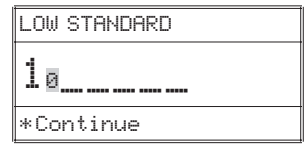
Use the ▼ button to scroll to `New Calibration` and press **✱/ENTER** button to select.



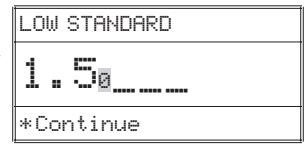
Input the concentration of the `LOW STANDARD` by using the ▼ and ▲ buttons to scroll the first digit of the concentration into the first position on the display. Press **✱/ENTER** button to select that digit (`1` for this example).



The number "`0`" is always the starting point for the next digit. Continue selecting digits or a decimal point to enter the concentration (up to seven characters).

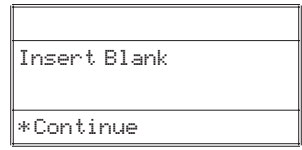


"`1.5`" has been entered in this example. Press **✱/ENTER** button four times to input "`0`" as the last four digits. Pressing **✱/ENTER** after selecting the last digit saves the concentration.



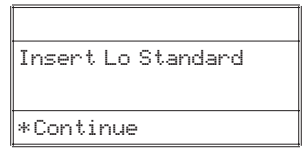
Input the concentration of the `HIGH STANDARD` by using the same method as for the low standard.

Place a clear blank in the sample chamber. Press the **✱/ENTER** button to scan the blank.



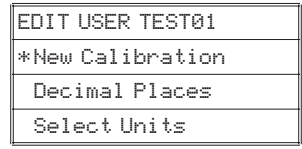
The screen will display `Blank Done` for about 1 second.

Place the reacted low standard in the sample chamber. Press **✱/ENTER** to scan the low standard.



Place the reacted high standard in the sample chamber. Press **✱/ENTER** to scan the high standard.

The meter will display the message "`Storing`" and return to the `EDIT USER TEST01` menu.



SELECTING THE NUMERICAL FORMAT OF THE RESULT

To input tests with very different ranges, the number of decimal places displayed for a result can be selected. A test which ranges from 20 to 1000 ppm should not be displayed with three decimal places. A test with a range from 0.010 to 0.500 needs three decimal places (the microprocessor will always calculate the concentration to many more significant figures than will be displayed). Menu choices of 0, 1, 2, or 3 decimal places will be given for the display.

Use the ▼ button to scroll to `Decimal Places` and press ✱/**ENTER** button to select.

EDIT USER TEST01
*New Calibration
Decimal Places
Select Units

Use the ▼ button to scroll to the number of decimal places to be shown and press ✱**/ENTER** to select.

DECIMAL PLACES?	
*None	0
One	0.0
Two	0.00
Three	0.000

The meter will display the message "`Storing`" and return to the `EDIT USER TEST01` menu.

EDIT USER TEST01
*Decimal Places
Select Units

SELECTING THE UNITS OF CONCENTRATION

The WaterLink PRO Colorimeter has seven options for units of concentration. They are No Units, ppm, pH, FTU, ppb, ppt and mgL.

Use the ▼ button to scroll to `Select Units` and press ***/ENTER** to select.

EDIT USER TEST01
*Decimal Places
Select Units

Use the ▼ button to scroll to the appropriate unit and press ***/ENTER** to select.

SELECT UNITS
*No Units
ppm
pH
FTU
ppb
ppt
mgL

The meter will display the message "`Storing`" and return to the `EDIT USER TEST01` menu.

Storing

EDIT USER TEST01
*Select Units

SETTING THE CLOCK

Setting the clock allows the correct time and date stamp to be stored with each reading in the data logger and with each reading sent out the serial port.

From the EDITING MENU use the ▼ button to scroll to Set Clock. Press ✱/**ENTER** to select.

EDITING MENU
*Edit Sequences
Edit User Test
Set Clock
Editing Logging
Factory Setup
Set PWR Save

The current date and time are displayed as month - day - year on the first line and as hours : minutes : seconds on the second line. A two-digit number is displayed for each setting. Use the ▼ and ▲ buttons to scroll to the appropriate number and press ✱/**ENTER** to select. The cursor will move to the next digit. Set all subsequent numbers in the same manner. Selecting the final digit in the seconds field stores the date and time and returns to the EDITING MENU.

☑NOTE: These are looping menus.

SET TIME
MM - DD - YY
HH : MM : SS

EDITING MENU
*Set Clock
Editing Logging
Factory Setup
Set PWR Save

TURNING THE DATA LOGGER ON AND OFF

The default setting for the datalogger is "Enabled" or turned off. If there is no need for data logging, this setting is suggested. If data logging is needed, the data logger can be "Enabled" or turned on.

From the EDITING MENU use the ▼ button to scroll to Edit Logging. Press ✱/**ENTER** to select.

EDITING MENU
*Edit Sequences
Edit User Test
Set Clock
Editing Logging
Factory Setup
Set PWR Save

The current setting is always displayed next to the ✱. To change the setting, use the ▼ or ▲ buttons to scroll to the other setting. Press ✱/**ENTER** to select.

EDIT LOGGING
*Enabled
Disabled

The meter will display the message "Storing" and return to the EDITING MENU.

Storing

EDITING MENU
*Editing Logging
Factory Setup
Set PWR Save

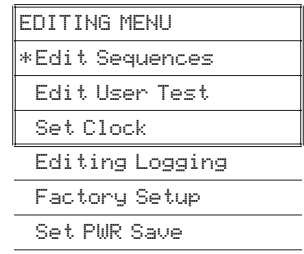
FACTORY SETUP

The Factory Setup menu is used in the manufacturing of the WaterLink PRO Colorimeter. This menu is not for use by the operator in the field.

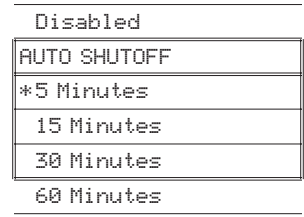
SETTING THE POWER SAVING FUNCTION

The WaterLink PRO Colorimeter has a power saving function that turns the meter off after an interval of inactivity. If no buttons have been pressed during that interval the meter will turn itself off. This interval can be disabled or set for 5, 15, 30 or 60 minutes. The default setting is 5 minutes.

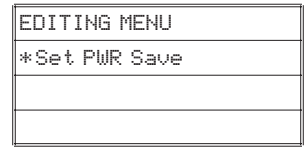
From the `EDITING MENU` use the ▼ button to scroll to `Set PWR Save`. Press ✱/**ENTER** to select.



The current setting is always displayed next to the ∗. To change the setting, use the ▼ or ▲ buttons to scroll to the appropriate setting. Press ✱/**ENTER** to select.



The meter will display the message "`Storing`" and return to the `EDITING MENU`.



PC LINK

The WaterLink PRO Colorimeter may be interfaced with any Windows-based computer by using the LaMotte SMARTLink2 Program and Interface Cable (Order Code 1912-3 [3.5 disk] or 1912-CD [compact disk]). The program stores customer information and test data in a database. It can be used to download data stored in the WaterLink PRO datalogger for each test site.

The colorimeter may also be interfaced with an RS-232 serial printer, using an interface cable (Order Code 1772) and setting the printer configuration to the Output as described below.

Choose PC Link from the Main Menu. The user can download the entire datalogging buffer. Downloading does not delete or empty the datalogger.

OUTPUT

RS-232 compatible, asynchronous serial, 9600 baud, no parity, 8 data bits, 1 stop bit.

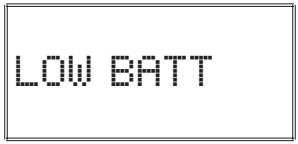
COMPUTER CONNECTION

RS-232 interface connection, 8 pin mini-DIN/9 pin F D-submin. (Order Code 1772).

BATTERY OPERATION

The colorimeter may be run on battery power or AC using the AC adapter. If using the meter as a benchtop unit, keep it plugged in if possible. If used on only battery power, always have a spare battery on hand.

If the battery power is low, the WaterLink PRO will display "LOW BATT" and turn off.



REPLACING THE BATTERY

The WaterLink PRO Colorimeter uses a standard 9-volt alkaline battery that is available worldwide. The battery compartment is located on the bottom of the the case.

To replace the battery:

1. Open the battery compartment lid.
2. Remove the battery and disconnect the battery from the polarized plug.
3. Carefully connect the new battery to the polarized plug and insert it into the compartment.
4. Close the battery compartment lid.

MAINTENANCE

CLEANING

Clean with a damp, lint-free cloth.

DO NOT ALLOW WATER TO ENTER THE COLORIMETER CHAMBER OR ANY OTHER PARTS OF THE METER.

METER CARE

The optical system of the WaterLink PRO Colorimeter must be kept clean and dry for optimal performance. Dry the colorimeter tubes before placing them in the chamber to avoid introducing moisture. For best results store the instrument in an area that is dry and free from aggressive chemical vapors.

METER DISPOSAL

Waste Electrical and Electronic Equipment (WEEE)

Natural resources were used in the production of this equipment. This equipment may contain materials that are hazardous to health and the environment. To avoid harm to the environment and natural resources, the use of appropriate take-back systems is recommended. The crossed out wheeled bin symbol on the meter encourages you to use these systems when disposing of this equipment.

Take-back systems will allow the materials to be reused or recycled in a way that will not harm the environment. For more information on approved collection, reuse, and recycling systems contact your local or regional waste administration or recycling service.

TROUBLESHOOTING GUIDE

ERROR MESSAGES

▪ OVER RANGE

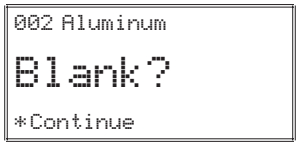
If the message OVERRANGE is displayed when scanning a sample, the sample may be over range or under range. If the sample is over range the sample should be diluted and tested again (see Sample Dilution Techniques and Volumetric Measurements, page 16).

If OVERRANGE is displayed, press the ✱/**ENTER** button to continue testing on diluted samples.

▪ BLANK

If the message Blank? is displayed when scanning a sample, the sample had a lower reading than the blank. Review test procedure to determine whether a reagent blank is required. Visually check for color development in reacted sample. Repeat test if necessary.

If Blank? is displayed, press the ✱/**ENTER** button to continue. Check to see if the meter was blanked properly.



CALIBRATION

As with all pre-calibrated meters, it is highly recommended, even if not required by regulations, that the user periodically verify the performance of the meter by running standards with a predetermined concentration. Results outside of specification are an indication that the meter needs to be adjusted. This can be done following the user calibration described on page 29. If the user calibration fails to properly adjust the meter then the meter should be returned to LaMotte Company for recalibration. (See page 5).

HELPFUL HINTS

▪ STRAY LIGHT

The WaterLink PRO Colorimeter should have no problems with stray light. Make sure that the sample compartment lid is always fully closed, except when testing COD with the adapter.

WaterLink PRO COLORIMETER REAGENT SYSTEMS

WaterLink PRO REAGENT SYSTEMS LIST

LaMotte Company continuously updates the list of pre-programmed tests as the calibrations become available. Pre-programmed calibrations can be added to the WaterLink PRO Colorimeter in the field. A Windows-based computer running a Windows Operating System and an 8 pin mini-DIN/9 pin F D-submin serial cable (order Code 1771) are required.

Call LaMotte Technical Services at 1-800-344-3100 (410-778-3100 outside the USA) or email at tech@lamotte.com for a current list of available calibrations and downloading instructions.

Test Factor	*Test Method (# of reagents)*	*Range ppm*	*# of Tests*	*Order Code*
Alkalinity UDV	Unit Dose Vial (1)	0-200	50	4318-H
Aluminum	Eriochrome Cyanine R (4)	0.00-0.30	50	3641-SC
Ammonia Nitrogen (Fresh Water)	Salicylate (3)	0.00-1.00	25	3659-01-SC
Ammonia Nitrogen (Salt Water)	Salicylate (3)	0.00-1.00	25	3659-01-SC
Ammonia Nitrogen HR	Nesslerization (2)	0.00-4.00	50	3642-SC
Benzotriazole/Tolyltriazoe	UV Photolysis (3)	0.0-30.0	50	4047
Biquanide	Colorimetric	0-70	50	4044
Borate	Azomethine-H	0.0-80.0	50	4868
Bromine LR	DPD Tablets (2)	0.00-9.00	100	3643-SC
Bromine UDV	Unit Dose Vial DPD (1)	0.0-22.0	50	4311-H
Cadmium	PAN (4)	0.00-1.00	50	4017
Calcium Hardness UDV	Unit Dose Vial (1)	0-400	50	4309-H
Carbohydrazide	Iron Reduction (3)	0.0000-0.900	100	4857
Chloride TesTab	Test Tab (1)	0.0-30.0	50	3693-SC
Chlorine - Free & Total	DPD Tablets (3)	0.00-4.00	100	3643-SC
Chlorine - Free UDV	Unit Dose Vial (1)	0.00-10.00	50	4311-H
Chlorine - Liquid DPD	DPD (3)	0.00-4.00	144	4859
Chlorine - Total UDV	Unit Dose Vial (1)	0.00-10.00	50	4312-H
Chlorine Dioxide	DPD tablet/Glycine (2)	0.00-8.00	50	3644-SC
Chromium (Hexavalent)	Diphenylcarbohydrazide (1)	0.00-1.00	100	3645-SC
Chromium (Total, Hex & Trivalent)	Diphenylcarbohydrazide (5)	0.00-1.00	100	3698-SC
Chromium TesTab	TestTab	0.00-1.00	50	3697-SC
Cobalt	PAN (3)	0.00-2.00	50	4851
COD LR with Mercury*	Digestion (1)	5-150	25	0075-SC
COD LR without Mercury*	Digestion (1)	0-150	25	0072-SC

Test Factor	*Test Method (# of reagents)*	*Range ppm*	*# of Tests*	*Order Code*
COD SR with Mercury*	Digestion (1)	0-1500	25	0076-SC
COD SR without Mercury*	Digestion (1)	0-1500	25	0073-SC
COD HR with Mercury*	Digestion (1)	0-15,000	25	0077-SC
COD HR without Mercury*	Digestion (1)	0-15,000	25	0074-SC
Color	Platinum Cobalt (0)	0-1000	∞	NA
Copper BCA - LR	Bicinchoninic Acid (1)	0.00-3.50	50	3640-SC
Copper - Cuprizone	Cuprizone (2)	0.00-2.00	50	4023
Copper DDC	Diethyldithiocarbamate (1)	0.00-6.00	100	3646-SC
Copper UDV	Unit Dose Vial, Bicinchoninic acid (1)	0.0-4.0	50	4314-H
Cyanide	Pyridine-Barbituric Acid (5)	0.00-0.50	50	3660-SC
Cyanuric Acid	Melamine (1)	5-200	50	3661-SC
Cyanuric Acid UDV	Unit Dose Vial, Melamine (1)	5-150	50	4313-H
DEHA	Iron Reduction (3)	0.000-0.700	100	4857
Dissolved Oxygen (DO)	Winkler Colorimetric (3)	0.0-11.0	200	3688-SC
Erythorbic Acid	Iron Reduction (3)	0.00-3.00	100	4857
Fluoride	SPADNS (2)	0.00-2.00	50	3647-01-SC
Hardness TesTabs	TestTab	0-500	50	3691-SC
Hydrazine	P-dimethylaminobenzaldehyde (2)	0.00-1.00	50	3656-SC
Hydrogen Peroxide LR	DPD (2)	0.00-1.50	100	3662-SC
Hydrogen Peroxide HR	DPD (2)	0-60	50	4045
Hydrogen Peroxide Shock	DPD (2)	0-225	100	4045
Hydroquinone	Iron Reduction (3)	0.00-2.00	100	4857
Iodine	DPD Tablets (2)	0.00-14.00	100	3643-SC
Iron - Bipyridyl	Bipyridyl (2)	0.00-6.00	50	3648-SC
Iron UDV	Unit Dose Vial Bipyridyl (1)	0.00-10.00	50	4315-H
Iron - Phenanthroline	1,10 Phenanthroline (2)	0.00-5.00	50	3668-SC
Lead	PAR (5)	0.00-5.00	50	4031
Manganese LR	PAN (3)	0.00-0.70	50	3658-SC
Manganese HR	Periodate (2)	0.0-15.0	50	3669-SC
Mercury	TMK (3)	0.00-1.50	50	4861
Methylethylketoxime	Iron Reduction (3)	0.00-3.00	100	4857
Molybdenum HR	Thioglycolate (3)	0.0-50.0	50	3699-02-SC
Nickel	Dimethylglyoxime (6)	0.00-8.00	50	3663-SC
Nitrate Nitrogen LR	Cadmium Reduction (2)	0.00-3.00	20	3649-SC
Nitrate TesTabs	Zinc Reduction (1)	0.0-60.0	50	3689-SC
Nitrite Nitrogen LR	Diazotization (2)	0.00-0.80	20	3650-SC

Nitrite TesTabs	Diazotization (1)	0.00-1.25	50	3886-H
Test Factor	*Test Method (# of reagents)*	*Range ppm*	*# of Tests*	*Order Code*
Nitrogen, Total†	Chromotropic Acid/ Digestion (6)	0-25 mg/L	25	4026
Ozone LR	Indigo Trisulfonate (3)	0.00-0.40	100	3651-SC
Ozone HR	Indigo Trisulfonate (3)	0.00-2.50	20	3651-SC
pH CPR (Chlorphenol Red)	Chlorophenyl Red (1)	pH 5.0-6.8	100	3700-SC
pH PR (Phenol Red)	Phenol Red (1)	pH 6.6-8.4	100	3700-SC
pH UDV	Phenol Red (1)	pH 6.6-8.2	100	4310-H
Phenol	Aminoantipyrine (3)	0.00-6.00	50	3652-SC
Phosphate LR	Ascorbic Acid Reduction (2)	0.00-3.00	50	3653-SC
Phosphate HR	Vanodomolybdovanadate Acid (1)	0.0-70.0	50	3655-SC
Phosphorus, Total - LR*	Ascorbic Acid/Digestion (5)	0.00-3.50 mg/L	25	4024
Phosphorus, Total - HR*	Molybdovanadate/ Digestion (5)	10.0-100.0 mg/L	25	4025
Potassium	Tetraphenylboron (2)	0.0-10.0	100	3639-SC
Silica LR	Heteropoly Blue (4)	0.0-4.0	100	3664-SC
Silica HR	Silicomolybdate	0-75	50	3687-SC
Sulfate HR	Barium Chloride (1)	0-100	100	3665-SC
Sulfide LR	Methylene Blue (3)	0.00-1.50	50	3654-01-SC
Surfactants	Bromthymol Blue (3)	0.5-8.0	100	4876
Tannin	Tungsto-Molybdophosphoric Acid (2)	0.0-10.0	50	3666-SC
Turbidity	Absorptimetric	0-400 FTU	∞	NA
Zinc LR	Zincon (6)	0.00-3.00	50	3667-SC
†Requires COD Heater Block, not included.				

☑ Note: On the meter display, "NA" following the test number indicates that a calibration for that test number is not available.