

TTi[®]

Colorimeter Series User's Manual

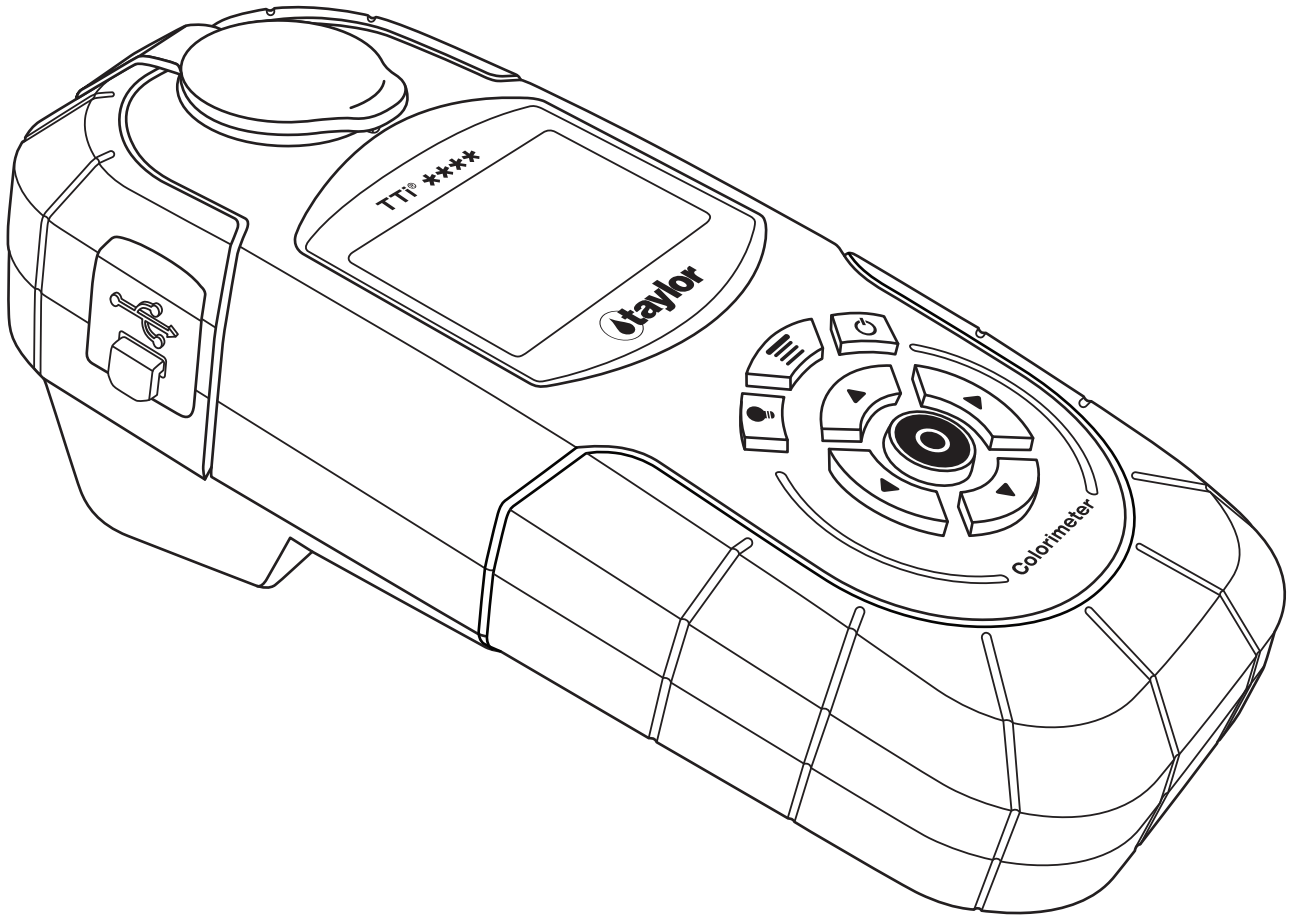


Taylor Technologies, Inc.
800-TEST KIT (837-8548)
www.taylortechnologies.com



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Colorimeter Series User's Manual



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First Edition

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Taylor Technologies, Inc., Sparks, Maryland 21152
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For ready reference by the reader, the date of the last revision to the manual is posted on the title page. The latest revision date for each chapter or subsection is posted in parentheses after its title in the table of contents. Check these periodically to make sure your file copy is up to date.

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Part 1

***General
Information***

SAFETY AND GENERAL PRECAUTIONS

The TTI® *Colorimeter Series User's Manual* and actual test instruction(s) should be read in their entirety before performing the initial setup, running any tests, or customizing the Colorimeter. We recommend printing a hard copy of this manual for your files. The preprinted *Quick-Start Guide* supplied with the Colorimeter summarizes key points in the *User's Manual* and is intended to travel with the device for ready reference.

Observe the following precautions:

- Chemical safety:

Reagents for use with the instrument can be hazardous. Read and observe all information printed on reagent labels and corresponding Safety Data Sheets (SDSs) prior to use. To view or print reagent SDSs, visit the Product Info/Documents area of our website, www.taylortechnologies.com. You will need to know the five-character product number signified by "R-XXXXX" on the reagent label and the test instruction. We recommend printing file copies of the SDSs for all your reagents.

- Keep all reagents out of reach of children.
- Use only Taylor reagents for preprogrammed tests for operator safety and to avoid damage to the instrument.
- Operational requirements:

During operation place the instrument on a stable surface that is reasonably level, or hold in a horizontal position if used as a handheld device.

- Environmental conditions:

Do not use or store the instrument in environments of extreme temperature or humidity.

Operational temperature range: 32°F–122°F (0°C–50°C)

Operational humidity limit: 90% @ 122°F (50°C) non-condensing

Do not immerse the instrument in water or use or store the instrument in environments with excessive dust. The instrument has an IP67 environmental protection rating signifying that it is dust-tight and can survive an accidental immersion in water of up to 1 meter for 30 minutes.

Do not leave the instrument exposed to direct sunlight for a prolonged period.

When not in use, keep the instrument stored in its carrying case.

- Voltage symbol  indicates DC voltage. See instrument label.

COLORIMETER DESCRIPTION

The TTI® Colorimeter, manufactured by Taylor Technologies, Inc., is a handheld, multiwavelength, microprocessor-controlled, menu-driven, direct-readout instrument that employs light-emitting diodes (LEDs) as light sources. The instrument design combines technical performance with an intuitive user-interface, the functional attributes most sought by water analysts, and durability. Its portability and data-logging capabilities make it well suited for use in the field in addition to the laboratory.

FEATURES

- High performance spectral optics:

LEDs are durable and ideally suited for use in portable instruments.

Wavelength filters are used to narrow the bandpass of light emitted from LEDs to obtain accurate, repeatable results. The instrument contains 6 wavelength filters (420, 470, 520, 570, 620, and 660 nm).

Wavelength filters are specified to provide a wavelength accuracy of ± 1 nm and a wavelength bandwidth of 10 nm ± 1 nm. In addition, all filters are manufactured using a process that provides enhanced thermal, environmental, and spectral stability.

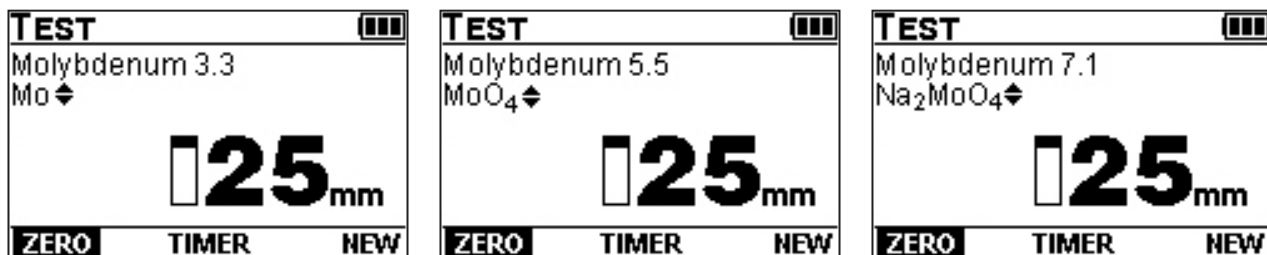
- Preprogrammed tests for each model cover the most common tests sought by water analysts.
- Automatic wavelength selection for preprogrammed and user-developed tests.
- Integrated test timers (includes up to 4 preprogrammed test timers with AUTO-Read option) and 1 user timer for general purposes.
- Test results displayed in concentration units (ppm, ppb, ppt, mg/L, $\mu\text{g/L}$, g/L), absorbance (ABS), or transmittance (% T).
- Test results displayed in optional chemical forms (available for most preprogrammed tests).
- ADJUST CALIBRATION option allows adjustment of preprogrammed calibrations.
- Intuitive, easy to navigate user-interface.
- FAVORITES menu allows for a customized test menu to be created and edited.
- SERIES feature allows a group of selected tests to be chosen and performed consecutively in any order.
- Data storage and recall for 100 test results with time and date stamps.
- User-developed test capability allows users to program up to 8 proprietary tests of 12 data points each.
- Free *PC App* allows users to transfer test results, download test files and firmware, create user-developed tests, and access helpful links.
- Custom graphical liquid crystal display (LCD) with anti-glare coating provides excellent contrast and readability.
- Adjustable backlighting permits use in low-light environments; a timeout feature conserves battery life.
- Custom 8-button, silicone rubber keypad combines a soft, tactile feel with superior durability.
- Portable, rugged design that is waterproof and dust-tight.
- Powered by 4 AA batteries or an AC power adapter for connecting to a wall outlet, or a USB cable for connecting to a PC or laptop (all power supply options are included with the instrument).

OPTIONAL CHEMICAL FORMS

Optional chemical forms for expression of test results are available for most tests. If available, ▲▼ will appear to the right of the chemical form. When an optional chemical form is selected within a test, the range (or range upper limit) on the test screen will change to correlate with the selected chemical form, and all subsequent test results and stored test data will be expressed in terms of the selected chemical form. The selected chemical form will remain the default for that test until changed by the user.

NOTE: If a new Taylor test file is downloaded using the *PC App*, the optional chemical forms for all tests will reset to the default chemical form.

Illustration of optional chemical forms available for testing molybdenum



COMPONENTS AND OPTIONAL ACCESSORIES

Your meter purchase includes the following components:

Quantity	Part Number	Description
1	M-XXXX	TTi® Colorimeter (model number on instrument faceplate)
1	5543	<i>Quick-Start Guide</i>
4	6105	AA Alkaline Battery
1	6535	AC Power Adapter
1	6551	Dilution Vial, 50 mL w/ cap
1	6552	USB Cable
4	6649	Foam Brush
2	9601	Sample Cell, 25 mm w/ cap
2	9602	Sample Cell, 15 mm w/ cap

The following optional accessories, viewable on www.taylortechnologies.com, may be purchased separately:

Part Number	Description
K-8000	TTi® Colorimeter Series Accuracy Check Kit
7146	Soft Carrying Case, gray (for use with TTi® 2000 or 3000), 11"w x 7"d x 4.625"h
7203	Replacement Foam Insert (for 7146)
9502	Hard Carrying Case, gray (for use with TTi® 3000), 20"w x 15.625"d x 5.5"h
9504	Hard Carrying Case, blue (for use with TTi® 2000), 20"w x 15.625"d x 5.5"h
9506	Hard Carrying Case, gray (for use with TTi® 2000), 10.75"w x 9"d x 7"h

All components and optional accessories, excluding batteries, as well as reagent packs (see next section), are available directly from Taylor Technologies or authorized distributors. To order from Taylor, call toll-free **800-TEST KIT** (837-8548).

COLORIMETER REAGENT PACKS

Currently available reagent packs for the **TTi® 2000 Colorimeter** are listed below. Each pack contains an instruction and all the reagents needed to run the specified test, housed in a snap-fit kit of ABS plastic. Instructions and kits are sized to fit securely in the optional Hard Carrying Case (#9504 or #9506). Alternatively, the contents of the reagent packs may be transferred to your existing carrier.

Part Number	Description
K-8001	Reagent Pack, Colorimeter, Chlorine (free/total), DPD (powder), 0-4.00, 0-8.0, or 0-10.0 ppm
K-8002	Reagent Pack, Colorimeter, Bromine (total), DPD (powder), 0-10.00 or 0-20.0 ppm
K-8005	Reagent Pack, Colorimeter, Phosphate, 0-3.00 ppm (20-3000 ppb)
K-8009	Reagent Pack, Colorimeter, Iron, 0-4.00 ppm
K-8012	Reagent Pack, Colorimeter, Copper, 0-3.00 ppm
K-8020	Reagent Pack, Colorimeter, Hydrogen Peroxide, 0-2.00 ppm
K-8023	Reagent Pack, Colorimeter, Sodium Chloride (Salt), 0-80 ppm
K-8024	Reagent Pack, Colorimeter, Alkalinity (total), 0-250 ppm
K-8027	Reagent Pack, Colorimeter, pH, 6.50-8.50
K-8027AB	Reagent Pack, Colorimeter, pH (with Acid & Base Demand), 6.50-8.50
K-8029	Reagent Pack, Colorimeter, Hardness (total), 0-500 ppm
K-8030	Reagent Pack, Colorimeter, Hardness (calcium), 0-800 ppm
K-8031	Reagent Pack, Colorimeter, Monopersulfate, 0-10.0 ppm

Colorimeter Reagent Packs (cont'd)

K-8032	Reagent Pack, Colorimeter, Cyanuric Acid, 7-120 ppm
K-8034	Reagent Pack, Colorimeter, Manganese, 0-0.80 ppm
K-8035	Reagent Pack, Colorimeter, Nitrate, 0-44 ppm
K-8040	Reagent Pack, Colorimeter, Biguanide, 0-70 ppm

Currently available reagent packs for the **TTi® 3000 Colorimeter** are listed below. Each pack contains an instruction and all the reagents needed to run the specified test, housed in a snap-fit kit of ABS plastic. Instructions and kits are sized to fit securely in the optional Hard Carrying Case (#9502). Alternatively, the contents of the reagent packs may be transferred to your existing carrier.

Part Number	Description
K-8001	Reagent Pack, Colorimeter, Chlorine (free/total), DPD (powder), 0-4.00, 0-8.0, or 0-10.0 ppm
K-8002	Reagent Pack, Colorimeter, Bromine (total), DPD (powder), 0-10.00 or 0-20.0 ppm
K-8003	Reagent Pack, Colorimeter, Molybdenum, 0-3.30 ppm
K-8004	Reagent Pack, Colorimeter, Phosphate, 0-70.0 ppm
K-8005	Reagent Pack, Colorimeter, Phosphate, 0-3.00 ppm (20-3000 ppb)
K-8006	Reagent Pack, Colorimeter, Polymer, 0-20 or 20-500 ppm
K-8007	Reagent Pack, Colorimeter, Silica, 0-60.0 ppm
K-8008	Reagent Pack, Colorimeter, Silica, 0-4.00 ppm
K-8009	Reagent Pack, Colorimeter, Iron, 0-4.00 ppm
K-8010	Reagent Pack, Colorimeter, Iron (ferrous), 0-3.00 ppm
K-8011	Reagent Pack, Colorimeter, Iron (total), 0-0.300 ppm
K-8012	Reagent Pack, Colorimeter, Copper, 0-3.00 ppm
K-8013	Reagent Pack, Colorimeter, Copper (free), 0-0.200 ppm
K-8014	Reagent Pack, Colorimeter, Phosphonate, 0-30.0 ppm
K-8014-AC	Reagent Pack w/ accessories, Colorimeter, Phosphonate, 0-30.0 ppm
K-8015	Reagent Pack, Colorimeter, Hydrazine, 0-1.50 ppm
K-8016	Reagent Pack, Colorimeter, Oxygen Scavenger, 0-1.000, 0-0.700, 0-2.450, 0-2.000, 0-3.000 ppm
K-8017	Reagent Pack, Colorimeter, Manganese, 0-30.0 ppm
K-8018	Reagent Pack, Colorimeter, Boron, 0-2.00 ppm
K-8019	Reagent Pack, Colorimeter, Zinc, 0-3.00 ppm
K-8020	Reagent Pack, Colorimeter, Hydrogen Peroxide, 0-2.00 ppm
K-8021	Reagent Pack, Colorimeter, Nitrite, 0-150 ppm
K-8022	Reagent Pack, Colorimeter, Hardness (total), 0-4.00 ppm
K-8023	Reagent Pack, Colorimeter, Sodium Chloride (Salt), 0-80 ppm
K-8024	Reagent Pack, Colorimeter, Alkalinity (total), 0-250 ppm
K-8025	Reagent Pack, Colorimeter, Sulfide, 0-1.00 ppm
K-8026	Reagent Pack, Colorimeter, Hardness (calcium), 0-4.00 ppm
K-8027	Reagent Pack, Colorimeter, pH, 6.50-8.50
K-8027AB	Reagent Pack, Colorimeter, pH (with Acid & Base Demand), 6.50-8.50
K-8028	Reagent Pack, Colorimeter, Molybdenum, 0-60.0 ppm
K-8029	Reagent Pack, Colorimeter, Hardness (total), 0-500 ppm
K-8030	Reagent Pack, Colorimeter, Hardness (calcium), 0-800 ppm
K-8031	Reagent Pack, Colorimeter, Monopersulfate, 0-10.0 ppm

Colorimeter Reagent Packs (cont'd)

K-8032	Reagent Pack, Colorimeter, Cyanuric Acid, 7-120 ppm
K-8033	Reagent Pack, Colorimeter, Azole, 0-25.0 ppm
K-8033-AC	Reagent Pack w/ accessories, Colorimeter, Azole, 0-25.0 ppm
K-8034	Reagent Pack, Colorimeter, Manganese, 0-0.80 ppm
K-8035	Reagent Pack, Colorimeter, Nitrate, 0-44 ppm
K-8036	Reagent Pack, Colorimeter, Turbidity, 10-400 FAU
K-8038	Reagent Pack, Colorimeter, Ammonia-Nitrogen, 0-1.00 ppm
K-8039	Reagent Pack, Colorimeter, Chlorine Dioxide, DPD, 0-8.0 ppm
K-8040	Reagent Pack, Colorimeter, Biguanide, 0-70 ppm
K-8041	Reagent Pack, Colorimeter, BlueTrace (6120), 0-10 mg/L

SUPPLEMENTARY TESTING SUPPLIES

4029	Pipet, Calibrated (0.5 & 1.0 mL), plastic
4078	Pipet, Graduated (3 mL w/ 0.5 mL div), plastic
9198	Sample Tube, Graduated (25 mL) w/ cap, plastic
9601-3	Sample Cell, 25 mm, 3-pack
9602-3	Sample Cell, 15 mm, 3-pack
6649-4	Foam Brush, 4-pack
6656	UV Light, SteriPEN® (use with all tests requiring UV digestion)
9803	Syringe Filter Start-Up Pack (no filter discs), 60 mL, plastic (contains 6247, 6249, and instruction)
6247	Syringe Filter (no filter disc holder or filter discs), 60 mL, plastic
6260	Syringe Filter (no filter disc holder or filter discs), 30 mL, plastic
6249	Filter Disc Holder, 25 mm, Millipore™, (fits 6247 or 6260) use with filter discs 6261, 6248, 6257
6086-10	Filter Discs (w/ individual filter disc holders), 0.45 μm, Millipore™, 10-pack
6261	Filter Discs, 25 mm diameter, 0.45 μm, Millipore™, 100/box
6248	Filter Discs, 25 mm diameter, 5.0 μm, Millipore™, 100/box
6257	Filter Discs, 25 mm diameter, 2.5 μm, Whatman™, 100/box
6551	Dilution Vial, 50 mL w/ cap, plastic

REGISTRATION

To have full use of the TTI® Colorimeter's features, you must first register as the owner of record. To begin the process, go to www.taylorsoftwaresupport.com and enter the site through the **TTI® Colorimeter portal**. Be prepared to enter the following information:

- Colorimeter serial number (S/N) - found on the product label on the bottom of the meter
- Owner's (contact's) name
- Business name
- Business mailing address
- Contact's telephone number
- Contact's e-mail – for notification about important news related to your meter model (e-mail addresses are not shared with third parties)

Upon completion of the registration process, you will be able to download the *TTI® Colorimeter Series PC App* to your computer. For complete information about this software, see Part 3, *The PC App*, and Part 4 in its entirety.

CONTACTING TAYLOR TECHNOLOGIES

- General Office: 410-472-4340
Our business hours are 8:00 a.m.–4:45 p.m. (Eastern Time), Monday through Friday, except major holidays.
- Customer Service: **800-TEST KIT (837-8548)**
Customer service representatives are available 8:00 a.m.–5:00 p.m. for application-specific advice, to open an account, place an order, inquire about order status, or report a problem with a shipment. If you require more advanced technical assistance, your call or e-mail will be forwarded to the appropriate resource. You may also leave us a voice-mail or e-mail message at anytime.
- Exchanges and credits are only considered within 30 days of shipment. **Please check your order upon receipt and notify us immediately if there is any problem.** To assure the quality of our chemistries, we do not resell reagents returned to us. For this reason they cannot be returned for credit, unless the reagents were shipped in error by Taylor or their quality was compromised before they were shipped. To apply for an exchange or credit under these mitigating circumstances, you will need to know the lot number located on the lower left-hand corner of the reagent label.
- Technical Assistance: **800-TEST KIT (837-8548)**
General assistance for TTI[®] Colorimeter owners is available Monday through Friday from 8:00 a.m. – 4:45 p.m. Eastern Time, except major holidays, from Taylor Technologies' customer service group by calling 800-TEST KIT (837-8548). Outside normal business hours you may record a message for us by using the same toll-free number, or you can leave an e-mail message using customerservice@taylortechnologies.com.
- 877-TEST KIT (837-8548)**
Help specifically related to the *TTi[®] Colorimeter Series PC App* is available 9:00 a.m.–5:00 p.m. (Pacific Time), Monday through Friday (except major holidays), from Taylor Technologies' programmers. Online guidance may be found at www.taylorsoftwaresupport.com. Enter through the TTI[®] Colorimeter portal.
- E-mail: customerservice@taylortechnologies.com
- Fax: 410-771-4291
- Mailing Address: Taylor Technologies, Inc.
31 Loveton Circle
Sparks, Maryland 21152
USA
- Corporate Website: www.taylortechnologies.com
Here you will find product descriptions, including test instructions, potential interferences, and Safety Data Sheets; video product demonstrations; high- and low-resolution product photography; and articles of interest to water analysts. While online, you may apply for an open-terms account, place an order, or post a question for our staff.
- Software Website: www.taylorsoftwaresupport.com
This site is dedicated to supporting Taylor software products only. Enter through the TTI[®] Colorimeter portal.

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Part 2

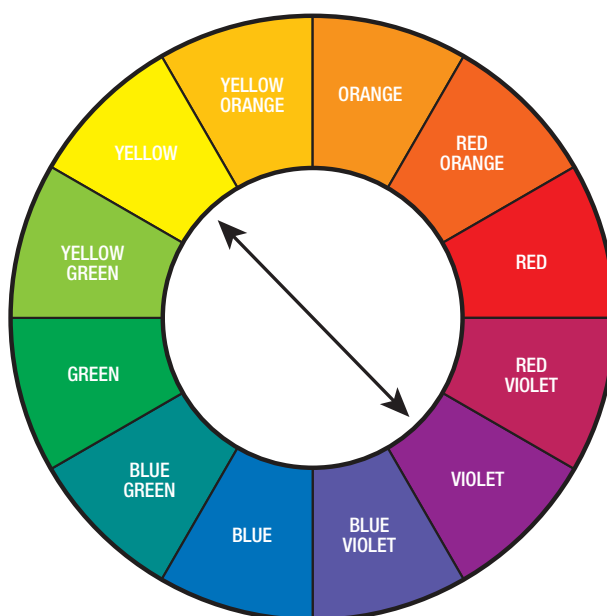
Testing Primer

INTRODUCTION TO COLORIMETRIC ABSORPTION ANALYSIS

Colorimetric absorption analysis, as used in this manual, refers to a technique for determining the concentration of various constituents of a water sample by adding reagents that selectively react with the substance being analyzed to produce a color then measuring the absorbance of the resulting color to determine the substance concentration.

Visible light (as opposed to ultraviolet, infrared, etc.) is a type of electromagnetic radiation that can be seen by the human eye. It consists of wavelengths ranging from approximately 400 to 700 nm. When visible light passes through a colored solution, certain wavelengths are selectively and strongly absorbed while other wavelengths pass through without being absorbed. This principle of absorption provides a means for quantification based on the Beer-Lambert Law, which states the concentration of a substance in solution is directly proportional to both the absorbance and viewdepth of the solution. It is interesting to note the wavelengths strongly absorbed by a colored solution correspond to colors which are complementary to the color of the solution. For example, a yellow solution strongly absorbs violet wavelengths, a blue solution strongly absorbs orange wavelengths, and a red solution strongly absorbs green wavelengths. Many substances in water samples are colorless, so reagents must be added that selectively react with the analyte to produce a color that will absorb specific wavelengths of visible light.

Illustration of complementary colors on a color wheel



Taylor's TTI[®] Colorimeter is an optical instrument for colorimetric absorption analysis which incorporates light-emitting diodes (LEDs) to produce visible light, wavelength filters to isolate narrow bands of light that pass through the sample, photoelectric detectors to convert light that passes through the sample into a useable signal, a signal processor, and software to determine the concentration of a sample. In general, to perform an instrumental absorption analysis, the instrument is first ZEROED with a blank (usually a sample containing no reagents) to compensate for inherent color in the sample. Next, a sample containing all necessary reagents is READ and the concentration is computed and displayed.

BEST PRACTICES

Proper technique is essential for obtaining accurate results when performing a water test. False test results can lead the analyst into making an incorrect evaluation of the condition of the water, thereby applying the wrong corrective actions to a system. The following practices will help you obtain reliable test results.

SAMPLING

- Use dedicated sample bottles. These bottles should be labeled as such and not used for another purpose.
- Use a sample bottle of sufficient size. If too small, you will not have enough water to perform multiple tests.
- Rinse the sample bottle and cap well (we recommend three times) with deionized water, distilled water, or sample water.
- Take a sample that is representative of conditions in the whole system:

Closed Systems - Let the sample stream flow at a constant velocity for at least five minutes before beginning the collection process. If you blow out the line with a higher-than-normal flow, subsequently be sure to reduce the flow to the normal rate for five minutes before proceeding with sampling.

Open Systems - Chemistry at the surface is atypical as the water is interacting with the air above and oils and debris may be present. Samples taken near return lines, makeup water inlets, chemical feeders, or in corners also can be different than in the body-at-large since the water may not have experienced the same mixing action as in open areas. A sample taken downstream from a tributary or pollution source will be different from a sample taken upstream. With these considerations in mind, select a representative location, immerse the sample container bottomsides up to about elbow depth, and then turn the container upright to fill.

- Fill the sample bottle to overflowing. Do not leave any room for air in the bottle.
- Avoid contaminating the sample once collected. Immediately cap the bottle tightly to avoid contamination.
- Do not put any probe into a bottle of sample water that will be used for multiple tests.
- Do not let the sample sit before testing, or it may change its character. Boiler water samples that should be at room temperature when beginning the test should be promptly cooled in a cold water bath to between 80°F– 90°F (27°C–32°C).
- Dispense sample water into the sample cell until the lowest point of the meniscus sits on the correct fill mark when viewed at eye level.
- After a sample cell has been filled and capped, hold it by the cap and then wipe off any moisture or fingerprints on the glass using a clean, lint-free cloth.

FILTERING SAMPLES

Unless otherwise specified, test methods are designed to determine dissolved substances in water samples. If samples are turbid they may contain suspended solids, algae, or other substances that may interfere in the test procedure. We recommend using a 0.45 μm membrane filter disc in a syringe-type filter to remove these substances prior to testing.

DILUTING SAMPLES

Some test procedures specify diluting a sample to adjust the concentration of the analyte to fit the range of the test. In such cases, the instruction will provide all details for performing the procedure with the dilution vial supplied with the kit. When a test sample is diluted, the result displayed must be multiplied by a factor to obtain the concentration of the undiluted analyte. This multiplication factor will be specified in the test instruction.

Sample dilution also may be required even if a this procedure is not specified in the test instruction. When the test result is above RANGE, the sample must be diluted using high-purity water and the dilution vial supplied with the kit. See example display, following.

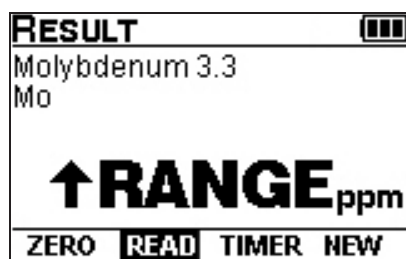


Illustration of above RANGE alert signaling dilution is necessary

Start with a small dilution and continue to increase the dilution as necessary to bring the concentration of the analyte into the range of the test. (**NOTE:** Sample dilution should not be performed when testing pH or after reagent addition, only before reagent addition.) The following table can be used as a guide.

Sample	High-Purity Water	Multiplication Factor
Add this volume of sample to the dilution vial	Add this volume of high-purity water to the dilution vial, cap, and mix thoroughly. Retest this diluted sample according to the test instructions.	If the test result is now within the range of the test, multiply the result by the multiplication factor listed below to determine the concentration of the analyte in the undiluted sample. If the test result is still above RANGE, increase the dilution and retest.
33 mL	17 mL	1.5
25 mL	25 mL	2
10 mL	40 mL	5
5 mL	45 mL	10
2 mL	48 mL	25

PRETREATING SAMPLES

Some samples may require digestion in order to test for total metals. To perform a digestion, first reduce the sample volume by gently heating and then refluxing to ensure all organometallic bonds have been broken. Allow the sample to cool and then dilute to a specified volume with deionized water. Sample digestion will require the following materials:

- ASTM Type I water
- Beaker, 250 mL
- Graduated cylinder, 100 mL
- Hotplate or steam bath
- Hydrochloric acid (high-purity grade)
- Hydrochloric acid solution 1:1
Add 50 mL hydrochloric acid (high-purity grade) to 40 mL ASTM Type I water. Dilute to 100 mL with ASTM Type I water.
- Nitric acid (high-purity grade)
- Nitric acid solution 1:1
Add 50 mL nitric acid (high-purity grade) to 40 mL ASTM Type I water. Dilute to 100 mL with ASTM Type I water.
- Ribbed watch glass, 75 mm
- Volumetric flask, 100 mL
- Watch glass, 75 mm

Procedure:

1. Acidify entire sample using nitric acid solution 1:1 to a pH of less than 2.0. Mix well and let sit for 16 hours. Do not filter sample to remove insoluble materials.
2. Transfer 100 mL of acidified sample water to 250 mL beaker.
3. Working inside a fume hood, add 2 mL nitric acid solution 1:1 and 1 mL hydrochloric acid solution 1:1.
4. Place beaker on hotplate inside a fume hood and cover with ribbed watch glass.
5. Turn on hotplate and evaporate sample to approximately 20 mL being careful not to allow sample to boil. (This step should take approximately 2 hours.)
6. Carefully remove ribbed watch glass and replace with smooth watch glass.
7. Continue heating and gently reflux sample for 30 minutes. Slight boiling may occur, but avoid vigorous boiling.
8. After 30 minutes turn off hotplate, carefully remove beaker, and allow beaker to cool to room temperature.
9. Quantitatively transfer sample to 100 mL volumetric flask and dilute to the mark with ASTM Type I water. Mix well. If insoluble materials remain, the sample may be filtered being careful not to introduce contamination to the sample.
10. The sample is now ready for testing.

ADDING AND MIXING REAGENTS

A reagent is added to sample water using a dropper bottle with a precisely bored tip, a pipet, or a dipper spoon. To assure the correct amount of liquid reagent is added to the sample when using a dropper bottle, hold it vertically when dispensing, not at a slant. If static builds up at the dropper tip making the drop size progressively smaller, eliminate the static by wiping around the tip with a clean, damp cloth or paper towel. When using a pipet, fill the pipet to the correct mark; then be sure to dispense the entire contents into the sample. When using a dipper spoon, a gentle tapping action against the rim of the sample cell may be required to dislodge all the powdered reagent. Cap the sample cell and then swirl the contents, using wrist action, to assure thorough mixing. Do not shake or invert the sample cell unless specified in the test instruction.

Observe the following precautions:

- To prevent contamination, cap reagents tightly immediately after use and be careful not to exchange bottle caps.
- Do not substitute another manufacturer's reagents for Taylor's.
- Replace reagents that are more than a year old.
- Wipe off spills and soil on the Colorimeter's exterior with a soft, damp cloth as soon as possible.
- Remove stray fluid from the sample cell compartment with a clean cotton swab.

STORING REAGENTS

Reagents are perishables. The chemicals used with the TTI® Colorimeter will degrade over time, even under optimum conditions. The process of deterioration speeds up when storage conditions are not ideal. Extremes of heat and cold, as well as prolonged exposure to air, sunlight, humidity/moisture, and volatile treatment chemicals, will diminish their useful life.

To preserve freshness, make sure reagent containers are kept tightly closed. When in storage, reagents do best in a cool, dark place away from drums and bags of treatment chemicals, especially chlorine and bromine. If you must choose between a hot warehouse (or vehicle trunk) and the refrigerator, opt for the latter for longer-term storage. Keeping reagents in the refrigerator will prolong shelf life; however, once they are taken out, they

should be used because subjecting them to constant fluctuations in temperature will cause them to degrade faster. Ideal storage temperatures are between 36°F–85°F (2°C–29°C), preferably in an environment without big temperature swings.

Generally speaking, a reagent's suitability for testing is suspect if it is over one year old, if it is not its usual color, if there are floating particles that do not dissolve when shaken, if it has begun to stain its container, or if it has crusted around the tip of the dropper bottle.

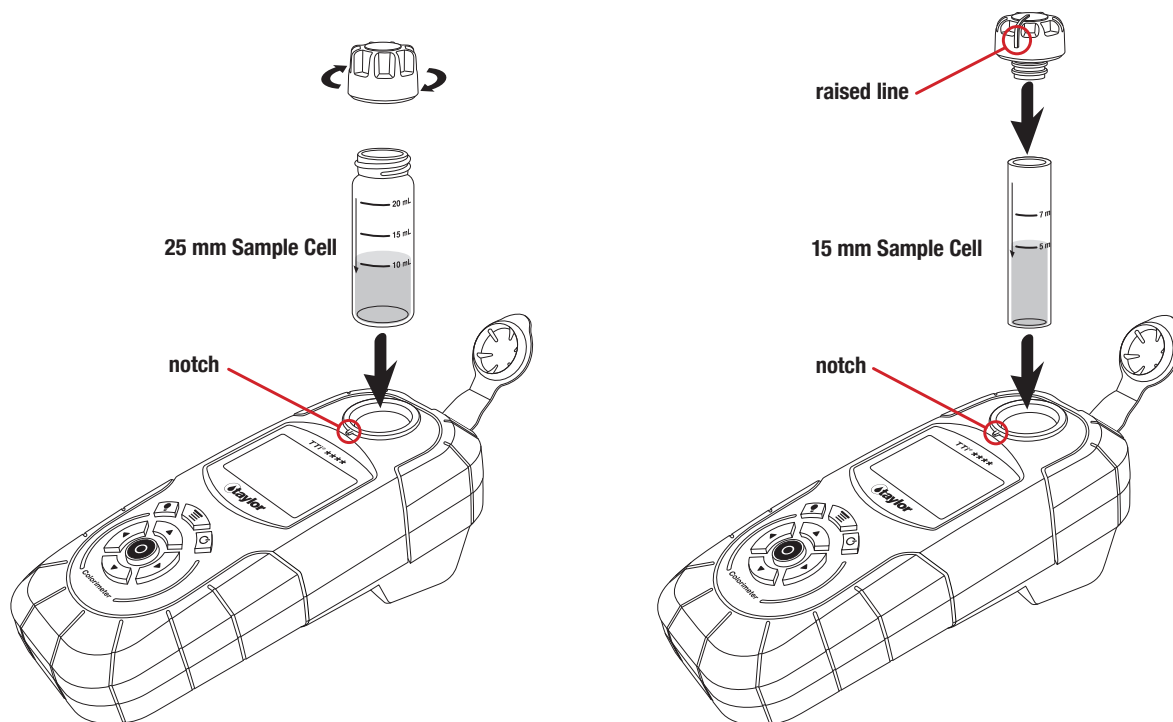
INSERTING AND ALIGNING SAMPLE CELLS

Taylor test procedures use either a 25 mm or 15 mm viewdepth sample cell, depending on which provides the best combination of sensitivity and useable range. The 25 mm sample cell has greater viewdepth and employs a screw thread cap. The 15 mm sample cell has less viewdepth and employs a plug cap. Test instructions specify which sample cell to use.

For the most accurate result, align the sample cell correctly when inserting it in the sample cell compartment. High-quality sample cells are supplied for use with the instrument but even minor variations in wall thickness or diameter can cause slight variations in results if sample cells are not inserted in a consistent manner. Use the following techniques to insert and align the 25 mm and 15 mm sample cells into the sample cell compartment:

25 mm Sample Cell - Partially insert the sample cell into the sample cell compartment. Align the arrow on the sample cell with the notch on the meter; then gently push the sample cell down (without rotating) until it rests on the base of the sample cell compartment.

15 mm Sample Cell - Align the raised line on the sample cell cap with the arrow on the sample cell. Insert the sample cell into the sample cell compartment and align the raised line on the sample cell cap with the notch on the meter.



PERFORMING A TEST

- Carefully read test instructions before beginning a test. Instructions may change from time to time so it is particularly important to review the procedure each time a reagent pack is purchased.
- Follow procedure exactly.
- For proper sample volume, be sure the low point of the meniscus sits on the correct fill mark when viewed at eye level.
- Hold reagent bottles vertically when dispensing liquids.
- Add the precise amount of reagent specified.
- Before inserting a sample cell into the sample cell compartment, hold the sample cell by the cap and wipe off any moisture or fingerprints on the glass using a clean, lint-free cloth.
- During operation, place the TTI® Colorimeter on a stable surface that is reasonably level. When using it as a handheld device, keep the meter horizontal.
- Compare your results with the previous results from the sampling location. Do the results make sense? If you get an inexplicable result, take a new sample and retest. We recommend graphing your data with statistical process control software to facilitate comparisons.

CLEANING SAMPLE CELLS

Sample cells must be clean inside and out as well as scratch-free to prevent optical interference in the test procedure.

- Use the foam brush (supplied) or a soft, nonabrasive cloth and water or mild detergent. Rinse thoroughly with deionized or distilled water. **NOTE:** Test methods may recommend additional cleaning procedures.
- At least once a week, clean all sampling containers and sample cells with a 1:1 solution of hydrochloric acid (Taylor reagent R-1305J) and high-purity water.
- Upon completing a test, flush out the sample cell with fresh sample water to avoid having residual contaminate the next test.

Part 3

***Colorimeter
Operation***

THE PC APP

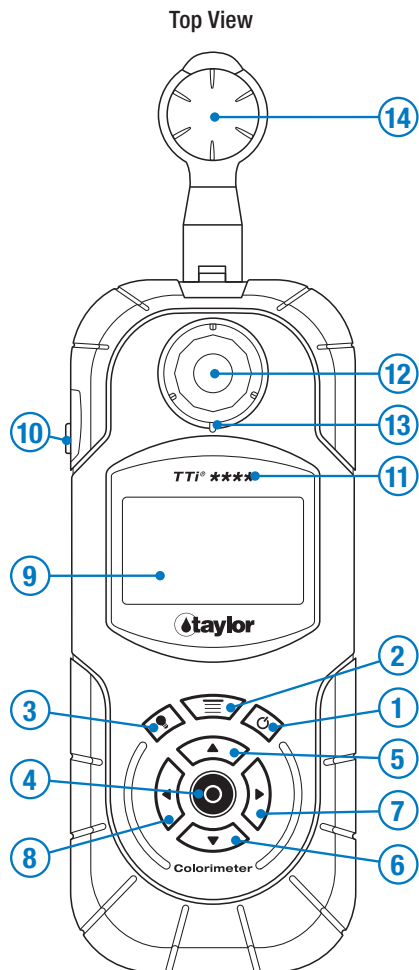
To use the TTI® Colorimeter to the fullest extent possible, it is necessary to install a special free software application on your computer. This *TTi® Colorimeter Series PC App* is required to perform the following functions:

- Transfer test results from the meter to the customer database you maintain on your PC or laptop
- Keep the meter's operating software (i.e., firmware) up to date
- Obtain new and improved test files to add to your meter's capabilities
- Access helpful links for further information and assistance
- Create proprietary (i.e., user-developed) test files

See Part 1, Registration, and Part 4 for complete information.

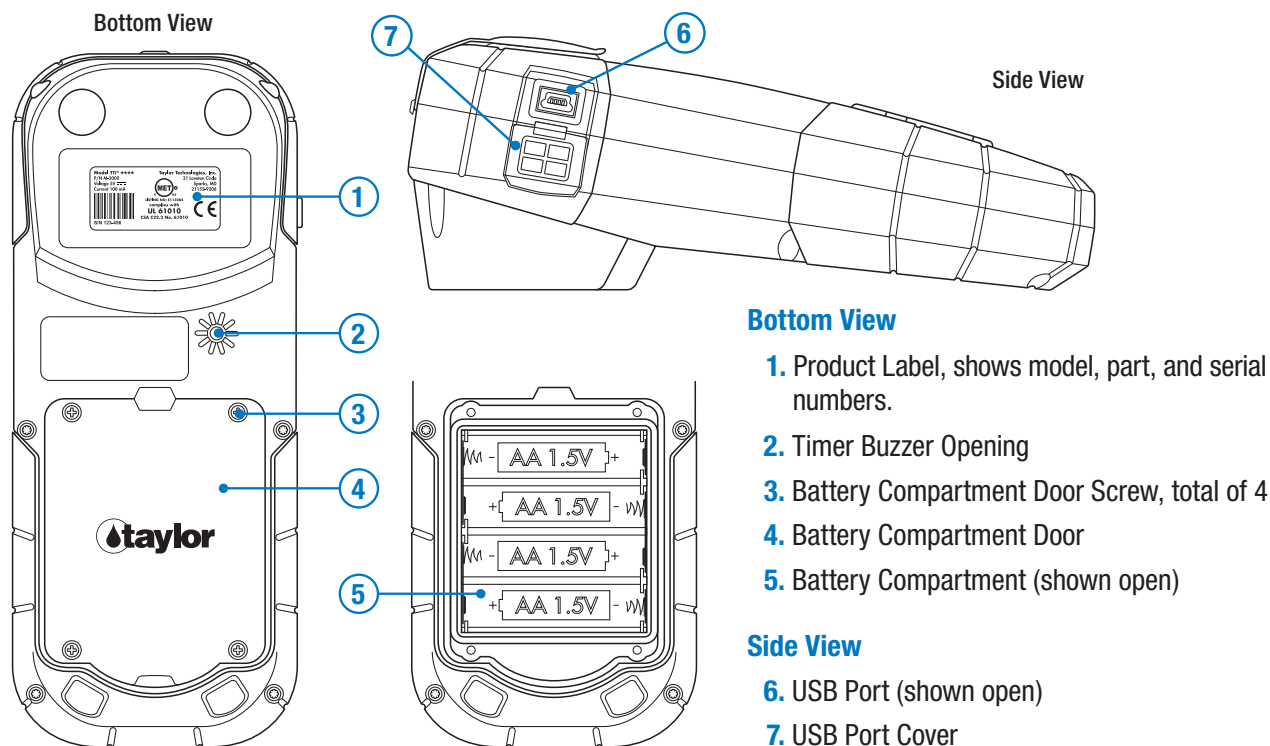
GUIDE TO OPERATING PARTS AND CONTROLS

Review the following illustrations to become familiar with parts and operating controls.



Top View

1. Power Button
2. Main Menu Button
3. Backlight Button
4. Enter Button, to enter the highlighted function
5. Scroll Up Arrow
6. Scroll Down Arrow
7. Scroll Right Arrow
8. Scroll Left Arrow
9. Liquid Crystal Display
10. USB Port Cover
11. Model Number
12. Sample Cell Compartment (shown open)
13. Alignment Notch
14. Sample Cell Compartment Cover



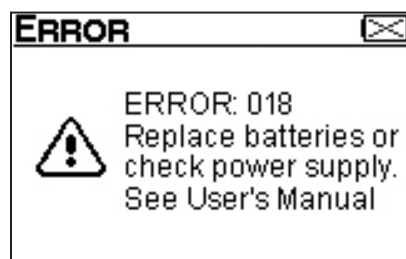
BATTERY INSTALLATION/CONNECTION TO A POWER SUPPLY

The instrument can be powered by batteries, an AC power adapter, or a USB cable, described respectively as Options A, B, and C below. Use Option A to replace the batteries, as well.

Option A - Battery Installation/Replacement

Turn the instrument off. Remove the battery compartment door and insert 4 AA alkaline (supplied) or lithium batteries by matching the + and – ends on the batteries to the markings inside the battery compartment. Replace the battery compartment door.

Replace batteries when the battery status icon indicates a low-battery status or when directed by an error code. The battery status icon is displayed in the title bar on all screens when the instrument is powered by batteries.



To conserve battery life, adjust the following settings (see Part 3, Settings) to the lowest acceptable option:

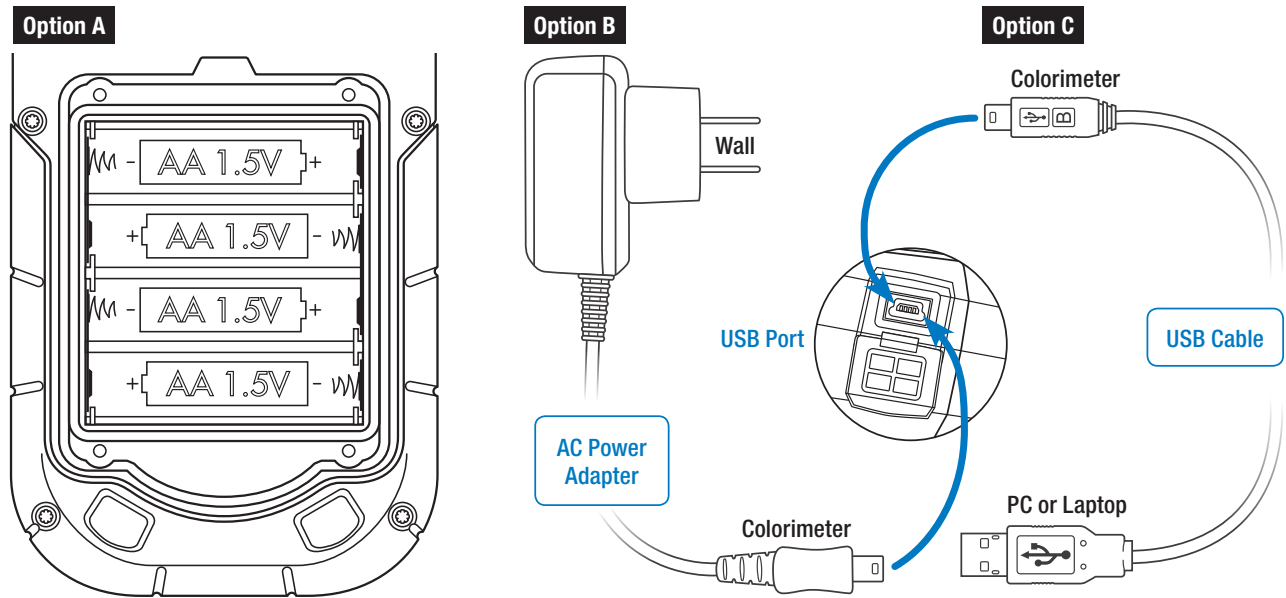
- Device Timeout
- Backlight Timeout
- Backlight Level
- Adjust Contrast

Option B - AC Power Adapter

Turn the instrument off. Connect the AC power adapter (supplied) to the USB port (located under the USB port cover); then plug the AC power adapter into a 120V AC wall outlet. **Always turn the instrument off before disconnecting the AC power adapter.**

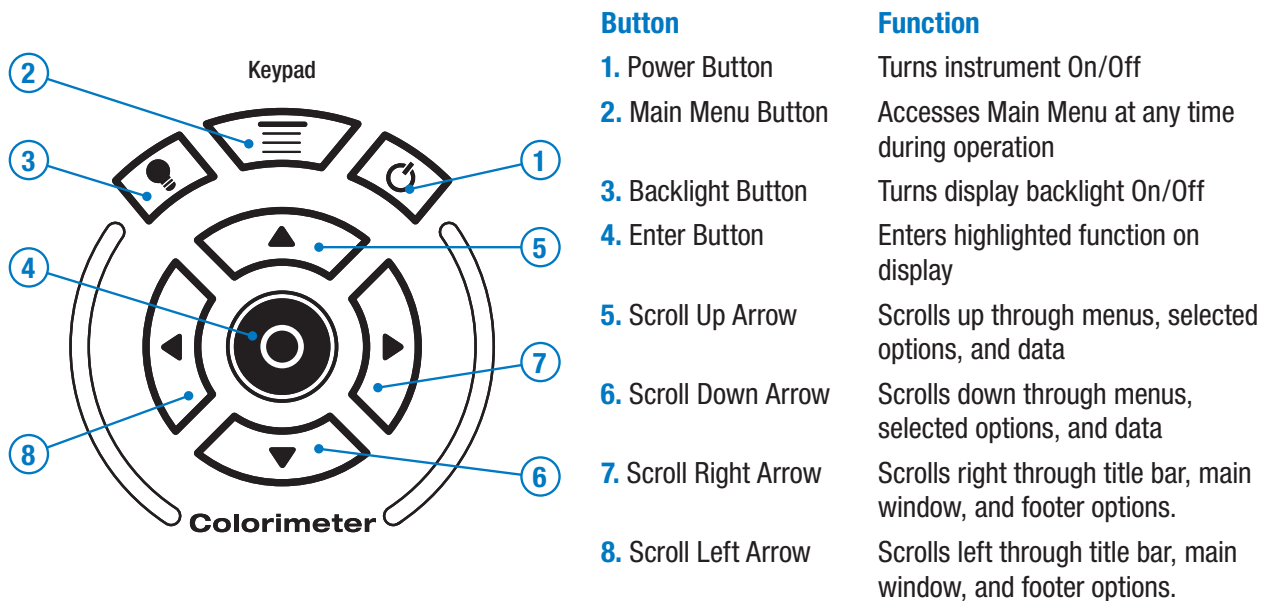
Option C - USB Cable

Turn the instrument off. Connect the USB cable (supplied) to the USB port (located under the USB port cover); then connect the USB cable to the corresponding USB port on a PC or laptop. **Always turn the instrument off before disconnecting the USB cable.**



KEYPAD

The 8-button keypad is designed for intuitive, rapid navigation. Silicone rubber enhances the user's touch perception. A custom coating provides resistance to chemical swelling and wear in a wide variety of environments.

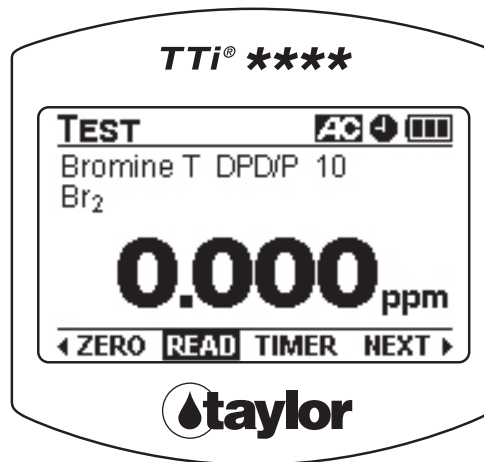


DISPLAY

The graphical liquid crystal display (LCD) provides excellent viewing contrast and readability. An integrated backlight can be set at either a 50% or 100% brightness level to provide easy reading in low-light or no-light environments, and an adjustable timeout feature can be utilized to conserve battery life. The LCD is covered by a protective plastic window. An abrasion- and chemical-resistant coating combined with an anti-glare coating provide superior wear and chemical resistance while minimizing surface glare.

NOTE: The protective plastic window has a temporary film covering to provide additional scratch protection during transit. Upon first use, this film should be gently peeled off to provide maximum viewing clarity.

Display




SCREEN FORMAT AND NAVIGATION

There are three designated sections of the screen where icons, menus, symbols, options, etc., are displayed. These sections include the title bar (located at the top of the screen), the main window (located in the middle of the screen), and the footer (located at the bottom of the screen). Screens may or may not contain all three sections.



Screen navigation is simple and intuitive. The MAIN MENU button  and the , and  arrows are used to access and navigate through all screens. The ENTER  button is used to enter highlighted functions.

SCREEN SECTIONS


Title Bar

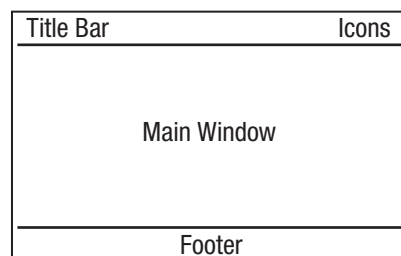
Identifies each screen, displays active icons and options. The  arrows on the keypad are used to scroll between options in the title bar.

Main Window

Displays menus (lists), test information, symbols, and options. The , and  arrows on the keypad are used to scroll through menus and between options in the main window.

Footer

Displays options. The  arrows on the keypad are used to scroll between options in the footer.



Following are examples of various screen formats displayed when using the instrument. **NOTE:** Symbols for directional arrows  and  and the ENTER  button appear in test instructions, too.

EXAMPLE 1**Title Bar + Main Window Sections**

The **title bar** shows the screen name (ALL TESTS). Use the ◀▶ arrows to scroll between options in the title bar. The battery status icon is displayed.

The **main window** shows tests that are available in the ALL TESTS screen. Use in combination with the highlight on the display to select a test. All main window menus use a continuous scroll to the end of the menu. When scrolling, the highlight starts at the top of the menu and travels to the bottom. The highlight then remains at the bottom as the menu travels up the screen. At the end of the menu, the screen pages back to the beginning of the menu with the first item highlighted. **NOTE:** You can access the bottom of a list by scrolling up on any initial screen.

◀ALL TESTS▶		🔋
▲ Alkalinity Total	250	
Boron	2	
Bromine T DPD/P	10	
Bromine T DPD/P	20	
Chlorine F&T DPD/P	4	
▼ Chlorine F&T DPD/P	8	

EXAMPLE 2**Title Bar + Main Window + Footer Sections**

The **title bar** shows the screen name (TEST). The AC (Adjust Calibration), timer, and battery status icons are displayed.

The **main window** shows test information (test name and upper range, chemical form, test result, and units).

The footer shows four test options (ZERO, READ, TIMER, NEW). Use the ◀▶ arrows on the keypad to scroll between options or to access more options.

TEST		AC	🕒	🔋
Chlorine F&T DPD/P 4				
Cl ₂				
1.37 ppm				
◀	ZERO	READ	TIMER	NEW ▶

EXAMPLE 3**Title Bar +Main Window Sections**

The **title bar** shows the screen name (TEST). The battery status icon is displayed.

The **main window** shows a test procedure transition. This animated graphic is displayed during a test procedure when the instrument is zeroed. This type of screen format is used for transitions, warnings, and errors. Text is displayed in the main window, often with accompanying graphics. An animated graphic is used when ZEROING the instrument and READING samples.

TEST		🔋
 ZEROING...		

EXAMPLE 4**Title Bar + Main Window + Footer Sections**

The **title bar** shows the SET DATE screen. The battery status icon is displayed.

The **main window** shows the date format and SET DATE prompt. Use the ▲▼, ◀▶ arrows on the keypad to set the date. This type of screen format is used for setting the date and time. The left and right scroll arrows move to the next unit, while the up and down scroll arrows select the character. The numbers are highlighted upon entering the screen.



The **footer** shows the OK option. After setting the date, OK is selected.

ICONS AND SYMBOLS

ICONS

AC (Adjust Calibration)

Displayed in the title bar when the test result has been adjusted to agree with a prepared standard. The adjusted calibration icon will remain on for that specific test unless turned off by the user. The next time that specific test is selected from the test menu, the adjust calibration icon will remain on.

Timer

Displayed in the title bar when the timer is started in a Taylor- or user-developed test. While the timer is running, the icon will flash. When the timer expires, the icon will remain solid until a key is pressed, at which point it will be turned off. This icon is not enabled or disabled by the User Timer, located in Tools.

Battery Status

Displayed in the title bar when the instrument is powered by batteries. Informs user how much power is remaining (3 bars indicate a full charge; 0 bars indicate a very low charge).

USB

Displayed in the title bar when the instrument is powered by USB.

SYMBOLS

Action



Indicates an action operation

Information



Indicates relevant information

Error



Indicates an operational error

Warning (flashing)




Indicates an operational warning

Sample Cell



Indicates sample cell viewdepth used in a test

MAIN MENU

The MAIN MENU  contains six top-level options. It can be accessed anytime during operation by pressing the MAIN MENU button on the keypad.

TOP LEVEL OPTIONS

Start Test

Select to access FAVORITES, RECENT TESTS, or ALL TESTS menus. After initial start-up, the program will always open on the current test menu.

Access Test Data

Select to recall or erase test data. The instrument will store the results of the last 100 tests performed.

Edit Favorites

Select to create or edit (add, remove, sort) a Favorites menu to establish a testing shortcut and save time when selecting tests. A total of 120 Favorite tests can be created and arranged in any order.

Edit Series

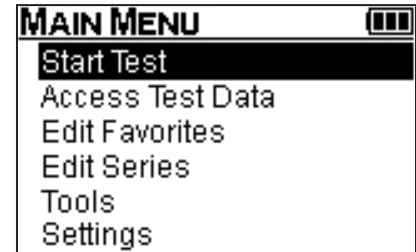
Select to create or edit (add, remove, sort) a Series test that allows selected tests to be performed in rapid succession. A total of 10 Series tests can be created and arranged in any order. Each series can encompass as many as 25 individual tests.

Tools

Select to transfer data to a PC or laptop, update firmware and test files, create user-developed tests using the *TTI® Colorimeter Series PC App*, and to access the user timer to set an audible timer for general purposes. The user timer beep can be distinguished from the test timer beep. Both timers can run simultaneously.

Settings

Select to access About (displays current Firmware, Test File, and Bootloader Versions), or to modify instrument settings (Format Date, Set Date, Format Time, Set Time, Device Timeout, Backlight Timeout, Backlight Level, Adjust Contrast, Language, and Factory Restore).



TEST MENUS

Three separate test menus are available in the test mode (Start Test), namely ALL TESTS, RECENT TESTS, and FAVORITES. Details are provided below. Use ◀▶ to select between menus. Menu priority is FAVORITES, RECENT TESTS, and then ALL TESTS as long as one test resides in a menu. After initial start-up, the program will always open in the current test menu.

THREE KINDS OF TEST MENUS

ALL TESTS

The ALL TESTS Menu contains all preprogrammed Taylor tests including absorbance and transmittance. In addition, all series tests, user-developed tests, and test file updates will be stored in the ALL TESTS Menu.

ALL TESTS GROUPING

- Preprogrammed Taylor tests in alphanumeric order
- Series tests in numeric order (see Part 3, Edit Series)
- Reserved tests (Absorbance and Transmittance; see Part 3, Absorbance and Transmittance Tests)
- User-developed tests in alphanumeric order (see Part 3, User-Developed Tests)

◀ALL TESTS▶	
▲ Alkalinity Total	250
Boron	2
Bromine T DPD/P	10
Bromine T DPD/P	20
Chlorine F&T DPD/P	4
▼ Chlorine F&T DPD/P	8

RECENT TESTS

The RECENT TESTS menu contains the 10 most recent tests performed.


RECENT TESTS GROUPING

The last test performed is moved to the top of the menu.

◀RECENT TESTS▶	
▲ Molybdenum	3.3
Chlorine F&T DPD/P	4
Polymer	500
Copper Total	3
Hardness Total	4
▼ Iron Total	4

RECENT TESTS EMPTY

Displayed when the RECENT TESTS Menu is empty. This menu can only be emptied by performing a Factory Restore (see Part 3, Settings).

◀RECENT TESTS▶	
 EMPTY	

FAVORITES

The FAVORITES menu contains only tests added by the user (see Part 3, Edit Favorites). A maximum of 120 favorites can be added.

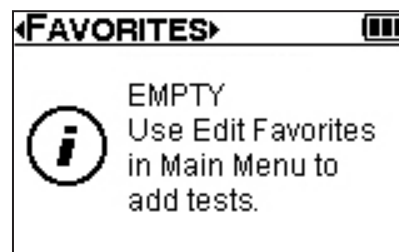
FAVORITES GROUPING

Tests may be arranged in any order.

FAVORITES EMPTY

Displayed when the FAVORITES menu is empty.

◀FAVORITES▶	
Molybdenum	3.3
Chlorine F&T DPD/P	4
Phosphate	70
Iron Total	4
Phosphonate	30
Oxygen Scav DEHA	1



INITIAL START-UP

Initial start-up consists of setting the date and time to allow the instrument to store, recall, and transfer test data with the correct date and time stamps. It is performed the first time the instrument is turned on and after a factory restore (see Part 3, Settings). Before initial start-up is performed, install the batteries or connect the instrument to a power supply (see Part 3, Battery Installation/Connection to a Power Supply).

STEP 1

Turn on the Colorimeter.

Press POWER button  for approximately 0.5 seconds.

The Taylor logo is displayed while the instrument performs start-up tasks.



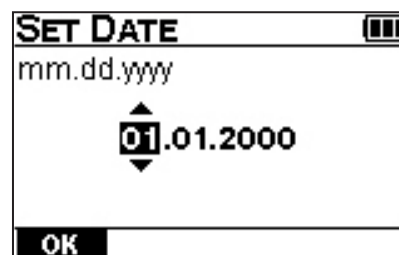
STEP 2

Set Date using ▲▼, ◀▶; then press ENTER ●.

The default format for the date is mm.dd.yyyy. To change to dd.mm.yyyy format, see Part 3, Settings.

Footer Option: OK

Accepts changes. Goes to the SET TIME screen.



STEP 3

Set Time using ▲▼, ◀▶; then press ENTER Ⓞ.

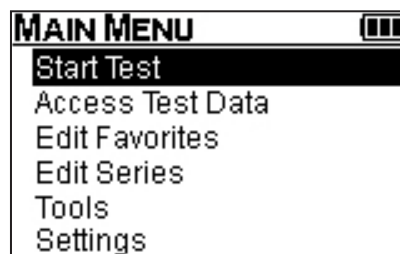
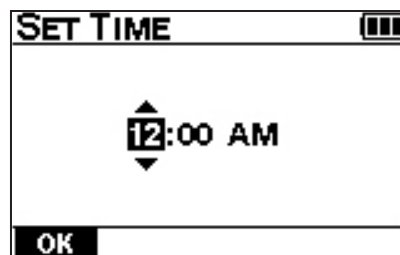
The default time is 12-Hour format. To change to 24-Hour format, see Part 3, Settings.

Footer Option: OK

Accepts changes. Goes to the MAIN MENU screen.

Initial start-up completed.

The MAIN MENU screen is displayed.



START TEST

Select Start Test to access the ALL TESTS, RECENT TESTS, and FAVORITES test menus and begin testing. Instructions supplied with Taylor's reagent packs provide all the information required to perform the particular test. In general, the following steps are required:

- Select a test menu (ALL TESTS, RECENT TESTS, or FAVORITES) that contains the test to be performed.
- Select the test from the test menu.
- Confirm test selection and sample cell size, and select a chemical form for expression of test results.
- Prepare a blank and ZERO the Colorimeter.
- Prepare sample and observe any timing steps.
- READ the sample.

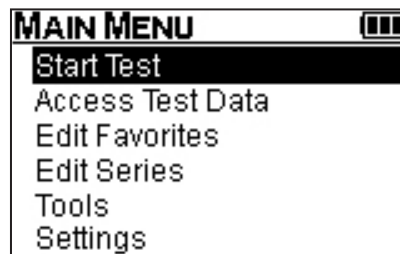
HOW TO PERFORM A TEST

The following example provides detailed information about test screens and test options while showing you how to perform a test.

STEP 1

Select **Start Test** from the MAIN MENU using ▲▼; then press ENTER Ⓞ.

NOTE: After initial start-up has been performed, the program will skip the MAIN MENU and open in the current test menu when the instrument is turned on.



Select a Test Menu (ALL TESTS, RECENT TESTS, or FAVORITES) containing the test to be performed using ◀▶.

◀ALL TESTS▶		▢▢▢
▲ Alkalinity Total	250	
Boron	2	
Bromine T DPD/P	10	
Bromine T DPD/P	20	
Chlorine F&T DPD/P	4	
▼ Chlorine F&T DPD/P	8	
Molybdenum	3.3	

STEP 2

Select the test from the test menu using ▲▼; then press ENTER ◉.

◀ALL TESTS▶		▢▢▢
▲ Hydrogen Peroxide	2	
Iron Ferrous	3	
Iron Total	0.3	
Iron Total	4	
Manganese	30	
▼ Molybdenum	3.3	

STEP 3

Confirm test name and range, and sample cell size.


The test name, range, and sample cell size will be displayed.

Test name and range (or range upper limit).

Sample cell size (sample cell graphic, size, and unit).

AND

Select a chemical form for expression of test results using ▲▼.

TEST		▢▢▢
Molybdenum 3.3		
Mo ◄		
 25 mm		
ZERO	TIMER	NEW

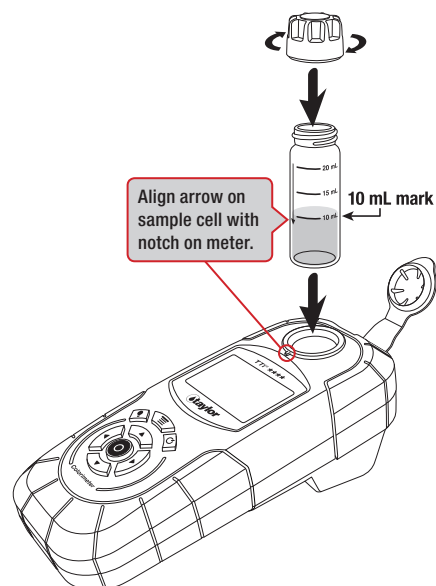
Optional chemical forms are available for most tests and can only be selected on this screen. If available, ▲▼ will appear to the right of the chemical form displayed. The test range (or range upper limit) will change to correlate with the selected chemical form. The selected form will remain the default for that test until changed again by the user.

STEP 4**Prepare blank.**

A blank is used to ZERO the instrument and establish a reference point for reading samples. A blank may or may not contain reagents depending on specific test requirements. Instructions supplied with each test will describe how to prepare the blank.

Here is a typical procedure for preparing a blank:

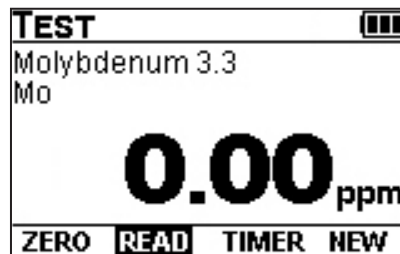
- Rinse and fill 25 mm sample cell to 10 mL mark with sample; then cap.
- Insert sample cell into sample cell compartment. Align marks.

**STEP 5****Zero the Colorimeter.**

Select **ZERO** using ◀▶; then press ENTER Ⓞ.

The ZEROING transition graphic will be displayed; then zero (0.00 for this example) will be displayed.

This zero reference point will be stored for all subsequent readings until the test is exited. The instrument can be re-zeroed at any time during the test procedure.

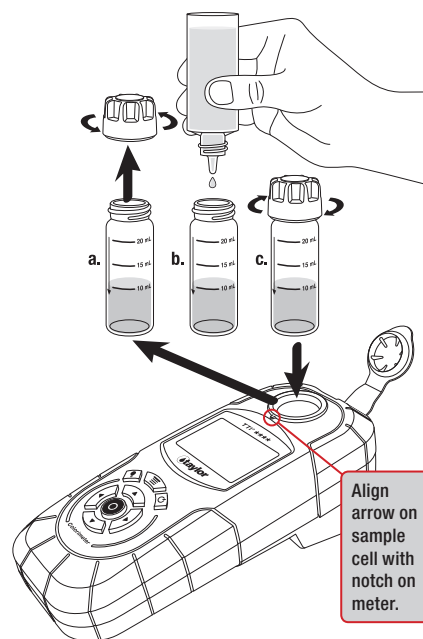


STEP 6**Prepare sample.**

Sample preparation varies for each test. Samples may need to be filtered to remove turbidity or diluted to adjust the concentration into a range that can be analyzed by the instrument. There may be specific techniques or timing steps required for reagent addition. Instructions supplied with each test specifically describe how to prepare samples.

Here is a typical procedure for preparing a sample:

- Remove sample cell from sample cell compartment; then remove cap.
- Add test reagents. Replace cap and swirl to mix thoroughly.
- Insert sample cell into sample cell compartment. Align marks.

**STEP 7****Read the sample.**

Select **READ** using ◀▶; then press ENTER Ⓞ.

The **READING** transition graphic will be displayed and the instrument will read the sample and display the result.

RESULT will be displayed in terms of the selected chemical form.

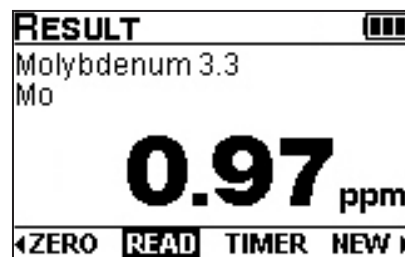
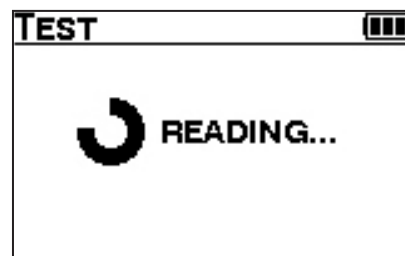
Re-zero/read more samples:

Select **ZERO** using ◀▶; insert blank; then press ENTER Ⓞ.

Select **READ** using ◀▶; insert sample; then press ENTER Ⓞ.

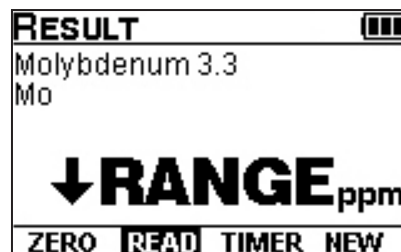
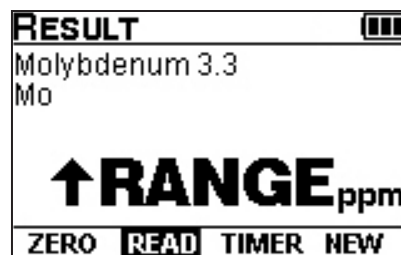
Return to current test menu:

Select **NEW** using ◀▶; then press ENTER Ⓞ.



Result above or below range of test:

When the result is above or below the range of the test, either
 ↑ RANGE or ↓ RANGE will be displayed (see Part 3, Test Alerts).



Footer Options: Select using ◀▶; then press ENTER ●.

ZERO

Zeros the instrument on a blank and displays zero.

READ

Reads the sample and displays a result.

TIMER

Goes to a preprogrammed timer if specified in the test procedure.
 Goes to a nonprogrammed timer that can be set by the user if a timing step is not specified in the test procedure. (See Part 3, Test Timers and Auto-Read Option.)

NEW

Ends test and returns to the current test menu.

AC

Goes to the Adjust Calibration screen and turns on the Adjust Calibration feature (see Part 3, Adjust Calibration).

AC/OFF

Turns off the Adjust Calibration feature. Only available if AC is currently on (see Part 3, Adjust Calibration).

NEXT

Continues to the next test in a Series Test (see Part 3, How to Perform a Series Test).

PREV

Returns to the previous test in a Series Test (see Part 3, How to Perform a Series Test).

WL

Returns to the wavelength selection screen when in the Absorbance and % Transmittance modes (see Part 3, Absorbance and Transmittance Tests).

TEST ALERTS

Test alerts are noncritical messages displayed during normal operation when certain test mode parameters are not met. If a test alert is triggered, refer to the table below to determine the cause and appropriate response.

Display Message	Cause	User Response
↑ RANGE and result alternately <i>flash</i>	Sample concentration exceeds upper range of the test. An approximate result is calculated and displayed.	Dilute the sample. Retest; then multiply result by the dilution factor (see Part 2, Diluting Samples for Test Procedures).
↑ RANGE	Sample concentration greatly exceeds upper range of the test. An approximate result cannot be calculated.	Dilute the sample. Retest; then multiply result by the dilution factor (see Part 2, Diluting Samples for Test Procedures).
↓ RANGE and result alternately <i>flash</i>	Sample concentration exceeds lower range of the test. An approximate result is calculated and displayed.	Clean the sample cells and retest to verify. Make sure the sample cells are capped and correctly aligned in the sample cell compartment.
↓ RANGE	Sample concentration greatly exceeds lower range of the test. An approximate result cannot be calculated.	Clean the sample cells and retest to verify. Make sure the sample cells are capped and correctly aligned in the sample cell compartment.
↑ LIMIT	The Adjust Calibration upper limit has been reached.	Make sure the concentration of the calibration standard (prepared standard of known concentration) is between 70%–80% of the upper test range provided in the test instruction. (See Part 3, Adjust Calibration.)
↓ LIMIT	The Adjust Calibration lower limit has been reached.	Make sure the concentration of the calibration standard (prepared standard of known concentration) is between 70%–80% of the upper test range provided in the test instruction. (See Part 3, Adjust Calibration.)
ZERO ?	A zero was not performed before starting the timer's auto-read feature.	Retest. Zero before the timer expires when using the auto-read feature. (See Part 3, Test Timers and Auto-Read Option.)
↑ LIGHT	Too much ambient light.	Retest. Make sure the sample cell is capped and correctly aligned in the sample cell compartment.

TEST TIMERS AND AUTO-READ OPTION

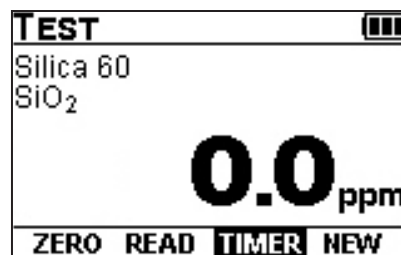
Test timers are included in the test screen footer for all tests. Test timers are either preprogrammed or nonprogrammed. Preprogrammed timers are used when a test requires timing steps between addition of reagents or to assure full color development of reagents. Up to four preprogrammed timers may be used in a test. Preprogrammed timers can be accessed and edited at any time during the test procedure. Test instructions will inform the user when to use a preprogrammed timer. If a preprogrammed timer is not required in a test, a nonprogrammed (general use) timer will be available in the footer. When a test timer expires, the device emits three sets of beeps. Each set consists of one long beep followed by two short beeps. The timer icon remains solid until a key is pressed.

The timer will count down as long as the user does not exit the test or move to the next test in a series. It will continue to count down during ZERO and READ operations.

AUTO-Read Option: The final preprogrammed timer in a test will include the AUTO-Read option in the test screen footer. When this option is selected, the device will automatically READ the sample when the timer countdown expires. The AUTO-Read option is not available for nonprogrammed timers.

STEP 1

Select **TIMER** using ◀▶; then press ENTER ●.



The **TIMER 1** screen will be displayed.

The timer will open to the preprogrammed time, even if the timer was previously set to a different time.

If multiple timers are used in a test, ▲▼ will appear to the right of each timer. Use ▲▼ to scroll between timers. All preprogrammed timers can be accessed and edited at any time during a test. If a test does not require a timed step, a nonprogrammed timer will be available for use.



Footer Options: Select using ◀▶; then press ENTER ●.

START

Starts the timer. The timer icon will be enabled and flash in the title bar until the timer countdown expires.

EXIT

Returns to the previous test screen:

- When the timer is exited while it is stopped, the timer resets to the preprogrammed time.
- When the timer is exited while it is running, the timer will continue to count down when the timer screen is reentered.
- When the timer is exited (using either AUTO or EXIT) and a ZERO has already been performed, the display returns to the test screen with READ highlighted.
- When the timer is exited (using either AUTO or EXIT) and a ZERO has not been performed, the display returns to the test screen with ZERO highlighted.

SET

Goes to editing mode (see Timer Edit below).

RESET

Resets the timer to the preprogrammed time. When the timer is RESET while it is running, the timer stops and then resets to the preprogrammed time.

STEP 2

Start timer.

Select **START** using ◀▶; then press ENTER ●.

Footer Options: Select using ◀▶; then press ENTER ●.

EXIT

Returns to the previous test screen:

- When the timer is exited while it is stopped, the timer resets to the preprogrammed time.
- When the timer is exited while it is running, the timer will continue to count down when the timer screen is reentered.

STOP

Stops the timer.

RESET

Resets the timer to the preprogrammed time. When the timer is RESET while it is running, the timer stops and then resets to the preprogrammed time.

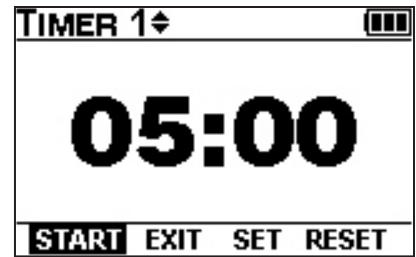
STEP 3

Proceed with timer countdown.

After **START** is selected, the timer will begin the countdown. When the countdown expires, the device will beep. Select a preferred option to proceed.

When the timer is exited, it will continue to count down until the countdown expires, the timer is stopped, or the test is exited.

When the timer expires before the **TIMER** screen is exited, the timer remains on the **TIMER** screen and resets to the preprogrammed time.



NOTE: If the timer is the final preprogrammed timer in a test (TIMER 2 in this example), **AUTO** will be available in the footer after starting the timer.

Select **AUTO** using ◀▶; then press ENTER ●.

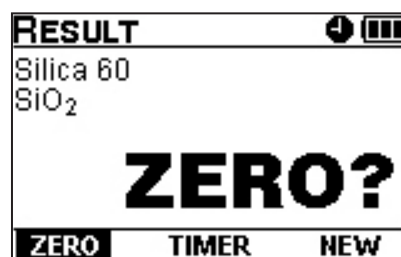
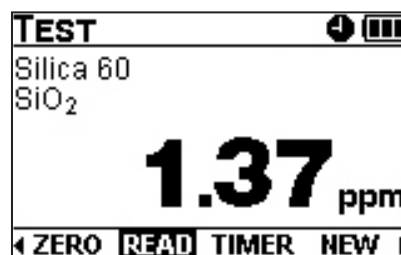
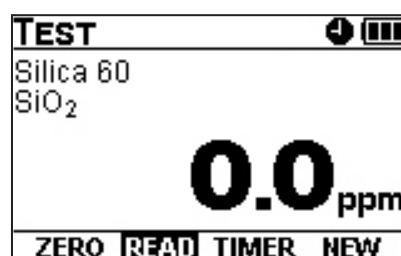
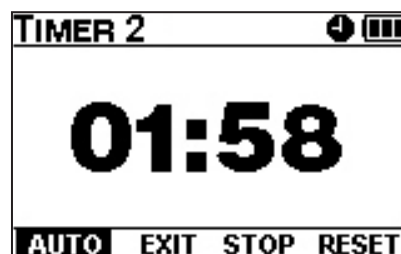
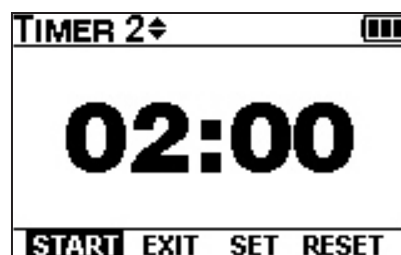
AUTO

Enables the AUTO-read option and returns to the previous test screen; the timer icon will flash.

The display returns to the previous test screen and the timer icon continues to flash. The device will automatically READ the sample when the timer countdown expires.

- When **AUTO** is selected and **ZERO** has not been performed, **ZERO?** will be displayed. A **ZERO** will need to be performed before the sample can be read.

- To see the timer countdown when **AUTO** has been selected, select **TIMER** using ◀▶; then press ENTER ●. The display will return to the timer screen and the device will automatically READ the sample when the timer countdown expires.
- When **AUTO** is selected and the test is exited, the timer will stop and reset to the preprogrammed time. No **AUTO**-read will occur.



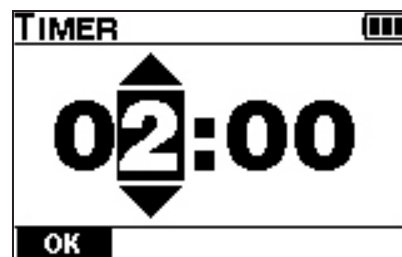
To edit the timer:

Edit Timer using ▲▼, ◀▶; then press ENTER ●.

The upper limit of the timer is 99:59 minutes.

Footer Option: OK

Saves changes and returns to TIMER screen.

**ADJUST CALIBRATION**

The Adjust Calibration option can be used to adjust preprogrammed calibrations when required by regulations, quality control protocol, or in rare circumstances where all samples show a consistent bias. This option is allowed for most, but not all, preprogrammed tests and there is a limit to the allowed adjustment. This option is not available for absorbance and transmittance tests.

An Adjust Calibration is performed by analyzing a prepared standard of known concentration (calibration standard). If the concentration displayed on the instrument differs from the calibration standard, the concentration displayed on the instrument is adjusted to agree with the calibration standard. The magnitude of the adjustment is used to calculate an adjustment factor that is applied to all subsequent test results until the feature is disabled. The same adjustment factor will be applied to all chemical forms selected for that particular test. If a preprogrammed calibration is adjusted for a particular test, then the range, estimated detection limit, and precision provided in the test instruction may not apply to the adjusted calibration. After performing an Adjust Calibration, the acceptability of the adjusted calibration should be determined by testing several standards of known concentration at various intervals covering the range of the test.

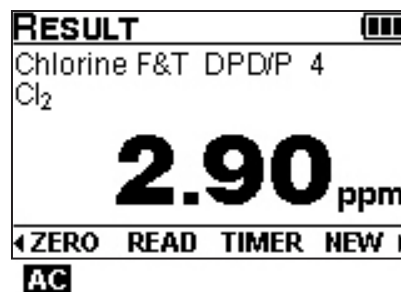
When an Adjust Calibration is performed and entered for a specific test, the Adjust Calibration icon **AC** will be enabled and displayed in the title bar on all test screens for that test. The AC icon indicates test results are being calculated using the adjust calibration factor, not the preprogrammed calibration. The Adjust Calibration option and the AC icon will remain enabled until disabled by the user.

To adjust the calibration of a test, prepare a standard of known concentration (calibration standard) which is between 70%–80% of the upper test range provided in the test instruction. Using the calibration standard as the sample, follow the test instruction to obtain a result. If the displayed result does not equal the concentration of the calibration standard, use the adjust calibration option to adjust the displayed result to agree with the concentration of the calibration standard.

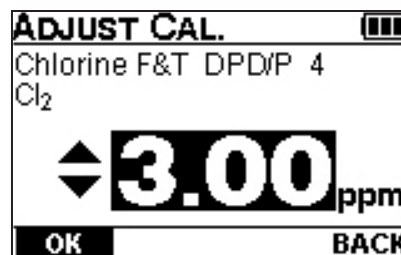
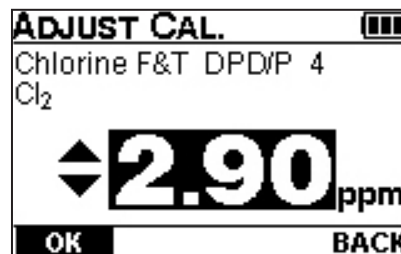
The following example shows how to use the Adjust Calibration option to adjust the preprogrammed calibration of the Chlorine F&T DPD/P 4 test. Since the range of this test is 0–4.00 ppm Cl₂, a calibration standard is prepared with a concentration of 3.00 ppm Cl₂ (i.e., between 70%–80% of the upper test range). A test is performed following the Chlorine F&T DPD/P 4 test instruction using the calibration standard as the sample. The result displayed is 2.90 ppm Cl₂.

STEP 1

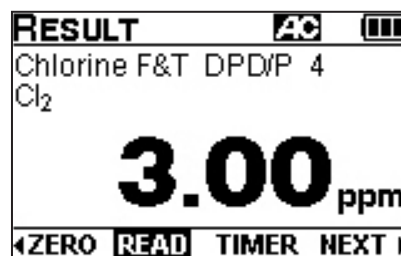
Select **AC** using ◀▶; then press ENTER ●.

**STEP 2**

Adjust the displayed result (2.90 ppm Cl₂) to the known concentration of the calibration standard (3.00 ppm Cl₂) using ▲▼; then press ENTER ●. The numbers will continuously scroll when ▲▼ arrows are held down.



The display will return to the RESULT screen and the displayed result will agree with the concentration of the calibration standard (3.00 ppm Cl₂). The AC icon will be displayed in the title bar and **all test results for this test will now be calculated using the Adjust Calibration factor until the Adjust Calibration option is turned off.**



Limit Alert: If the result is adjusted to a value beyond a predetermined limit, either ↑ LIMIT or ↓ LIMIT will be displayed. Reversing the scroll direction will return the display to a numeric value.

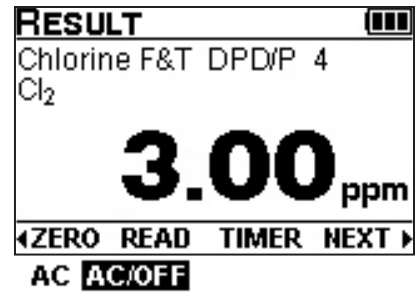


To turn off Adjust Calibration option/AC icon:

Select **AC/OFF** using ◀▶; then press ENTER Ⓞ.

The Adjust Calibration option and the AC icon will be disabled.
All test results for this test will now be calculated using the preprogrammed calibration.

NOTE: The AC/OFF option is only available when AC is currently on.



Footer Options: Select using ◀▶; then press ENTER Ⓞ.

AC

Turns on the Adjust Calibration option. Goes to ADJUST CAL screen.

AC/OFF

Option only available if AC is currently on. Turns off Adjust Calibration option. Disables AC icon.

OK

Accepts changes. Returns to previous screen with adjusted result. Enables AC icon.

BACK

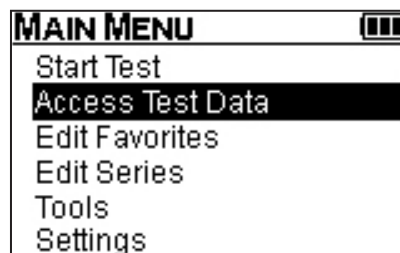
Cancels changes. Returns to previous screen with original result. The AC icon is not enabled unless it was on before entering the Adjust Calibration screen.

ACCESS TEST DATA

To recall or erase test data, select Access Test Data. Data for the last 100 tests performed are stored and sorted from newest to oldest. Test data for Series tests are stored and sorted in the order performed. If a test was performed using an optional chemical form, stored test data will show the original test name, the optional chemical form, and the result in terms of the optional chemical form. Test data can be transferred to a PC or laptop using the *TTi® Colorimeter Series PC App*. (See Part 1, Registration; Part 3, The *PC App*; and Part 4 in its entirety.)

STEP 1

Select **Access Test Data** from the MAIN MENU using ▲▼; then press ENTER ●.



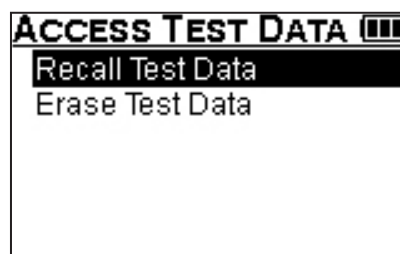
STEP 2

The ACCESS TEST DATA menu contains two options: Recall Test Data and Erase Test Data.

Recall test data.

Select **Recall Test Data** using ▲▼; then press ENTER ●. Scroll between test results using ▲▼.

Each **TEST DATA** screen displays one test and contains four or five lines:



First Line

The numerical position of the currently displayed test in the result list, followed by the total number of stored test results, both right-justified.

Second Line

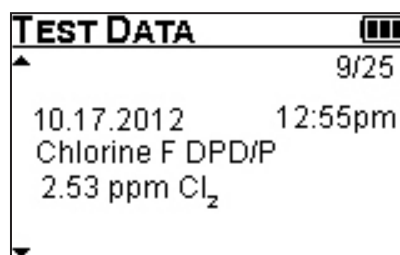
The date (left-justified) and time (right-justified) of the result is recorded. The date and time are displayed according to the current format settings. If date and time settings are modified, the format will change for all results in the list.

Third Line

The test name is displayed.

Fourth Line

The test result, test units, and selected chemical form are displayed.

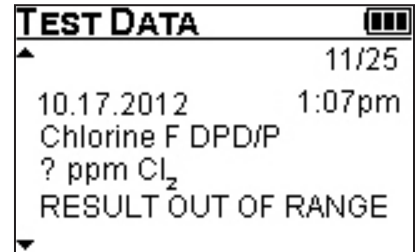
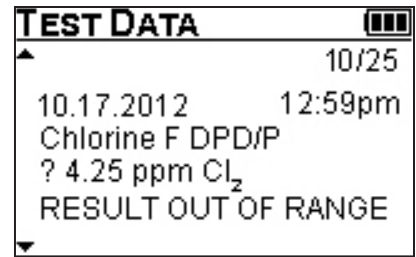


If the result is outside the test range but within a predetermined limit of the test range (i.e., ↑ RANGE or ↓ RANGE alternately displayed with the calculated approximate value), the test result will be prefixed with a question mark (i.e., ? 4.25 ppm Cl₂).

If the result is well outside the test range and an approximate value cannot be calculated, the result will be replaced by a question mark (i.e., ? ppm Cl₂). For Absorbance and Transmittance tests, the chemical form will be replaced with the wavelength used in the test.

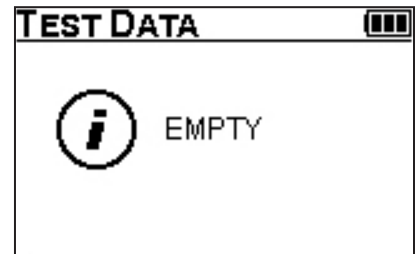
Fifth Line

If the test result is within the test range, this line will remain blank. If the test result is outside of the test range, RESULT OUT OF RANGE will be displayed.



If there is no stored test data, EMPTY will be displayed.

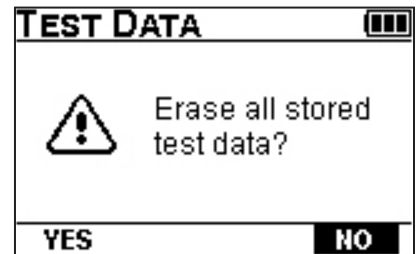
OR



Erase test data.

Select Erase Test Data using ▲▼.

WARNING: The Erase Test Data option is used to erase all test data stored in the Colorimeter. To prevent accidental erasure of stored data, the user must select the YES option in the footer before the Colorimeter will erase the stored test data from memory.



Footer Options: Select using ◀▶; then press ENTER ●.

YES

All stored test data will be erased from memory. After data is erased, the Colorimeter will return to the MAIN MENU.

NO

Returns to the ACCESS TEST DATA menu.

EDIT FAVORITES

Use to create or edit (add, remove, or sort) a FAVORITES menu establishing a shortcut to selected tests. A total of 120 favorite tests can be added to the FAVORITES menu and arranged in your order of preference. Once created, the FAVORITES menu will become the first test menu displayed in Start Test.

STEP 1

Select Edit Favorites from the MAIN MENU using ▲▼; then press ENTER ●.

MAIN MENU		☰
Start Test		
Access Test Data		
Edit Favorites		
Edit Series		
Tools		
Settings		

STEP 2

The EDIT FAVORITES screen will be displayed. The main window will be empty unless tests have been added previously.

Footer Options: Select using ◀▶; then press ENTER ●.

EDIT FAVORITES		☰
ADD	REMOVE	SORT BACK

ADD

Select ADD using ◀▶; then press ENTER ●.

Tests residing in the ALL TESTS menu will be displayed in the EDIT FAVORITES main window. If a test has already been added to the FAVORITES menu, a marker will appear to the left of that test name. A test can be added to the FAVORITES menu only once.

EDIT FAVORITES		☰
▲ Alkalinity Total	250	
Boron	2	
Bromine T DPD/P	10	
• Bromine T DPD/P	20	
▼ Chlorine F&T DPD/P	4	
ADD	CANCEL	BACK

Footer Options: Select using ◀▶; then press ENTER ●.

ADD

Select the test to be added using ▲▼; then press ENTER ●. A marker will be placed to the left of the selected test. Repeat until all choices are selected. A selection can be cancelled at any time. (See CANCEL below.)

EDIT FAVORITES		☰
▲ Alkalinity Total	250	
Boron	2	
• Bromine T DPD/P	10	
• Bromine T DPD/P	20	
◄ Chlorine F&T DPD/P	4	
ADD	CANCEL	BACK

CANCEL

Select the test to be cancelled using ▲▼; then press ENTER ●. The marker will be removed and the test selection will be cancelled.

BACK

Press ENTER ● to save selected tests and to return to the EDIT FAVORITES screen. Tests will be displayed in the order selected.

EDIT FAVORITES		☰
Alkalinity Total	250	
Bromine T DPD/P	10	
Bromine T DPD/P	20	
Chlorine F&T DPD/P	4	
ADD	CANCEL	BACK

REMOVE

Select **REMOVE** using ◀▶; then press ENTER ●.

Each test residing in the FAVORITES menu will be displayed in the EDIT FAVORITES main window.

EDIT FAVORITES		▢▢▢
Alkalinity Total	250	
Bromine T DPD/P	10	
Bromine T DPD/P	20	
Chlorine F&T DPD/P	4	
ADD REMOVE SORT BACK		

Footer Options: Select using ◀▶; then press ENTER ●.

REMOVE

Select the test to be removed using ▲▼; then press ENTER ●. The selected test will be removed from the EDIT FAVORITES screen.

EDIT FAVORITES		▢▢▢
Alkalinity Total	250	
Bromine T DPD/P	10	
Bromine T DPD/P	20	
Chlorine F&T DPD/P	4	
REMOVE BACK		

BACK

Press ENTER ● to return to the EDIT FAVORITES screen.

EDIT FAVORITES		▢▢▢
Alkalinity Total	250	
Bromine T DPD/P	10	
Chlorine F&T DPD/P	4	
REMOVE BACK		

SORT

Select **SORT** using ◀▶; then press ENTER ●.

Each test residing in the FAVORITES menu will be displayed in the EDIT FAVORITES main window.

Footer Options: Select using ◀▶; then press ENTER ●.

EDIT FAVORITES		▢▢▢
Alkalinity Total	250	
Bromine T DPD/P	10	
Chlorine F&T DPD/P	4	
ADD REMOVE SORT BACK		

MOVE

Select the test to be moved using ▲▼; then press ENTER ●. The footer options will change to PLACE and CANCEL.

EDIT FAVORITES		▢▢▢
Alkalinity Total	250	
Bromine T DPD/P	10	
Chlorine F&T DPD/P	4	
MOVE BACK		

PLACE

Use ▲▼ to move the selected test to the desired location and press ENTER ●. The selected test will be saved in its new location in the FAVORITES menu. The footer options will return to MOVE and BACK.

EDIT FAVORITES		▢▢▢
Bromine T DPD/P	10	
Chlorine F&T DPD/P	4	
Alkalinity Total	250	
PLACE		CANCEL

CANCEL

The selected test will return to its previous position in the FAVORITES menu. The footer options will return to MOVE and BACK.

BACK

Returns to the EDIT FAVORITES screen.

BACK


Select **BACK** using ◀▶; then press ENTER ●. Returns to MAIN MENU screen.

Favorites is full.

Displayed when the FAVORITES menu is full. A maximum of 120 tests can be added.

Footer Option: BACK

Returns to EDIT FAVORITES screen.

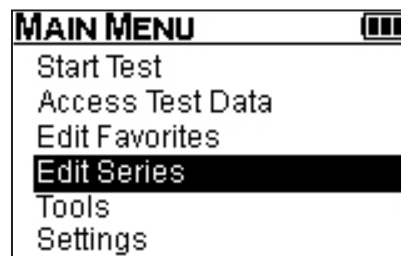
EDIT FAVORITES		▢▢▢
 Favorites is full.		
BACK		

EDIT SERIES

Select to create or edit (add, remove, or sort) a Series Test which will allow individual tests within this grouping to be performed in rapid succession without having to exit between tests to select a new test from another menu. A total of 10 series can be created. These will be stored in the ALL TESTS menu and can be added to the FAVORITES menu. Each series can contain as many as 25 individual tests arranged in any preferred order.

STEP 1

Select Edit Series from the MAIN MENU using ▲▼; then press ENTER ●.



STEP 2

The EDIT SERIES screen will be displayed. The main window will show Series 1 through Series 10. If a series already contains tests, a marker will appear to the left of that series name. The 10 series can be selected and populated in any order.

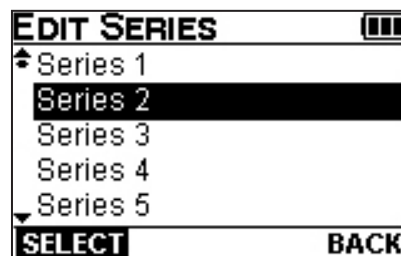
Footer Options: Select using ◀▶; then press ENTER ●.

SELECT

Select the series to be created or edited using ▲▼; then press ENTER ●.

BACK

Returns to MAIN MENU screen.

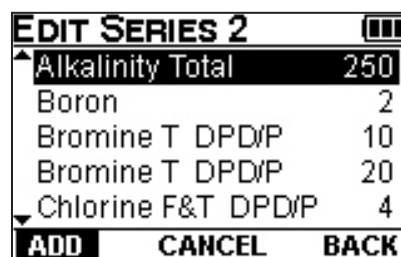
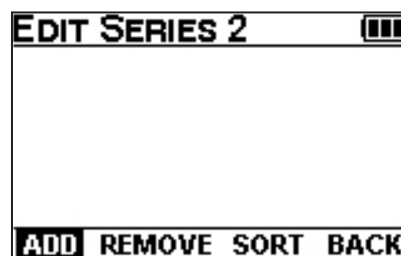


STEP 3

ADD

Select ADD using ◀▶; then press ENTER ●.

Tests residing in the ALL TESTS menu will be displayed in the EDIT SERIES main window. Tests can be selected and placed in the series in any preferred order. An individual test can be placed in the same series more than once.



Footer Options: Select using ◀▶; then press ENTER Ⓞ.

ADD

Select the test to be added using ▲▼; then press ENTER Ⓞ. A marker will be placed to the left of the selected test. Repeat until all choices are selected. A selection can be cancelled at any time. (See CANCEL below.)

CANCEL

Select the test to be cancelled using ▲▼; then press ENTER Ⓞ. The marker will be removed from the left of the selected test and the test selection will be cancelled.

BACK

Press ENTER Ⓞ to save selected tests and to return to the EDIT SERIES screen. Tests will be displayed in the order selected.

EDIT SERIES 2		▢▢▢
▲ Alkalinity Total	250	
Boron	2	
• Bromine T DPD/P	10	
• Bromine T DPD/P	20	
◄ Chlorine F&T DPD/P	4	
ADD	CANCEL	BACK

EDIT SERIES 2		▢▢▢
Alkalinity Total	250	
Bromine T DPD/P	10	
Bromine T DPD/P	20	
Chlorine F&T DPD/P	4	
ADD	CANCEL	BACK

REMOVE

Select REMOVE using ◀▶; then press ENTER Ⓞ.

Each test residing in the series will be displayed in the EDIT SERIES main window.

Footer Options: Select using ◀▶; then press ENTER Ⓞ.

EDIT SERIES 2		▢▢▢
Alkalinity Total	250	
Bromine T DPD/P	10	
Bromine T DPD/P	20	
Chlorine F&T DPD/P	4	
ADD	REMOVE	SORT BACK

REMOVE

Select the test to be removed using ▲▼; then press ENTER Ⓞ. The selected test will be removed from the SERIES menu.

EDIT SERIES 2		▢▢▢
Alkalinity Total	250	
Bromine T DPD/P	10	
Bromine T DPD/P	20	
Chlorine F&T DPD/P	4	
REMOVE		BACK

BACK

Press ENTER Ⓞ to return to the EDIT SERIES screen.

EDIT SERIES 2		▢▢▢
Alkalinity Total	250	
Bromine T DPD/P	10	
Chlorine F&T DPD/P	4	
REMOVE		BACK

SORT

Select **SORT** using ◀▶; then press ENTER Ⓞ.

Each test residing in the series will be displayed in the EDIT SERIES main window.

EDIT SERIES 2		▢▢▢
Alkalinity Total	250	
Bromine T DPD/P	10	
Chlorine F&T DPD/P	4	
ADD REMOVE SORT BACK		

Footer Options: Select using ◀▶; then press ENTER Ⓞ.

MOVE

Select the test to be moved using ▲▼; then press ENTER Ⓞ. The footer options will change to PLACE and CANCEL.

EDIT SERIES 2		▢▢▢
Alkalinity Total	250	
Bromine T DPD/P	10	
Chlorine F&T DPD/P	4	
MOVE		BACK

PLACE

Use ▲▼ to move the selected test to the desired location and press ENTER Ⓞ. The selected test will be saved in its new location in the SERIES menu. The footer options will return to MOVE and BACK.

EDIT SERIES 2		▢▢▢
Bromine T DPD/P	10	
Chlorine F&T DPD/P	4	
Alkalinity Total	250	
PLACE		CANCEL

CANCEL

The selected test will return to its previous position in the SERIES menu. The footer options will return to MOVE and BACK.

BACK

Returns to the EDIT SERIES screen.

BACK

Select **BACK** using ◀▶; then press ENTER Ⓞ.


Returns to MAIN MENU screen.

Series is full.

Displayed when the SERIES menu is full. A maximum of 25 tests can be added to one series.

Footer Option: BACK

Returns to EDIT SERIES screen.

EDIT SERIES 2		▢▢▢
 Series is full.		
BACK		

HOW TO PERFORM A SERIES TEST

Creating a series allows individual tests within this grouping to be performed in rapid succession without having to exit between tests to select a new test from another menu. A total of 10 series can be created. These will be stored in the ALL TESTS menu and can be added to the FAVORITES menu. Each series can contain as many as 25 individual tests arranged in any preferred order. For detailed information about creating and editing a series of tests, see Part 3, Edit Series.

In general, the steps required to perform a Series Test are the same as for an individual test with a few exceptions:

- Select a test menu (ALL TESTS, RECENT TESTS, or FAVORITES) that contains the series to be performed.
- Select the series number (1–10) from the test menu.
- Confirm the series selection.
- Confirm the first individual test selection and sample cell size, and select a chemical form for expression of test results.
- Prepare a blank and ZERO the Colorimeter.
- Prepare the sample and observe any timing steps.
- READ the sample.
- Continue to the next test in the series.

The following example provides detailed information about test screens and test options while showing you how to perform tests in a series.

STEP 1

Select **Start Test** from the MAIN MENU using ▲▼; then press ENTER Ⓞ.

Select a **test menu** (ALL TESTS, RECENT TESTS, or FAVORITES) containing the series to be performed using ◀▶.

MAIN MENU	
Start Test	
Access Test Data	
Edit Favorites	
Edit Series	
Tools	
Settings	

◀ALL TESTS▶	
▲ Alkalinity Total	250
Boron	2
Bromine T DPD/P	10
Bromine T DPD/P	20
Chlorine F&T DPD/P	4
▼ Chlorine F&T DPD/P	8
Series 1	

STEP 2

Select the **series number** from the test menu using ▲▼; then press ENTER ●.

◀ ALL TESTS ▶		▢▢▢
▲ Silica	60	
Sodium Chloride	80	
Sulfide	1	
Zinc	3	
Series 1		
▼ Absorbance		

STEP 3

Confirm Series Test selection.

After a series is selected, a confirmation screen is displayed which allows the user to see the tests in the series.

Footer Options: Select using ◀▶; then press ENTER ●.

SERIES 1		▢▢▢
Iron Total	4	
Molybdenum	60	
Chlorine F&T DPD/P	4	
Phosphate	70	
Copper Total	3	
OK		BACK

OK

Proceed to Test Screen to begin the test.

BACK

Returns to current test menu.

STEP 4

Confirm test selection and sample cell size.

The **individual test name and range, sample cell size, and test number within the series** will be displayed.


Test name and range (or range upper limit).

Sample cell size (sample cell graphic, size, and unit).

Test number - 1 of X (example: 1 of 5) is displayed below the chemical form to notify the user which test in the series is being performed.

AND

Select a **chemical form** for expression of test results using ▲▼.

TEST		▢▢▢
Iron Total 4		
Fe		
1 of 5		
 25 mm		
◀ ZERO	TIMER	NEXT ▶
		PREV ▶

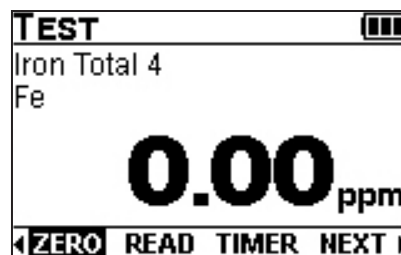
Optional chemical forms are available for most tests and can only be selected on this screen. If available, ▲▼ will appear to the right of the chemical form displayed. The test range (or range upper limit) will change to correlate with the selected chemical form. The selected form will remain the default for that test until changed again by the user.

STEP 5**Prepare blank.**

Follow procedure in test instruction.

AND**Zero the Colorimeter.**

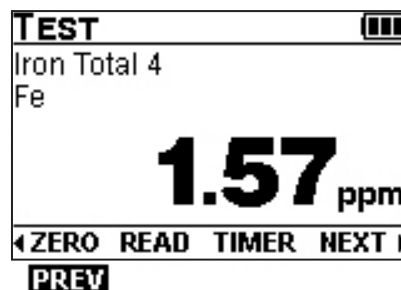
Select **ZERO** using ◀▶; then press ENTER Ⓞ.

**STEP 6****Prepare sample.**

Follow procedure in test instruction.

AND**READ the sample.**

Select **READ** using ◀▶; then press ENTER Ⓞ.

**RESULT**

Displayed in terms of the selected chemical form.

Select **NEXT** using ◀▶; then press ENTER Ⓞ to continue to the next test.

OR

Select **PREV** using ◀▶; then press ENTER Ⓞ to return to the previous test.

Return to current test menu:

Select **NEW** using ◀▶; then press ENTER Ⓞ.

WARNING: To prevent accidental exit from the series, this warning will be displayed when **NEW** is selected or when the **MAIN MENU** button is pressed.

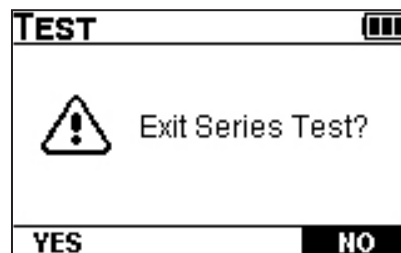
Footer Options: Select using ◀▶; then press ENTER Ⓞ.

YES

Returns to current test menu or the **MAIN MENU**.

NO

Returns to the previous test screen.



Footer Options: **Select** using ◀▶; then press ENTER ●.

ZERO

Zeros the instrument on a blank and displays zero.

READ

Reads the sample and displays result.

TIMER

Goes to a preprogrammed timer if specified in the test procedure.
Goes to a nonprogrammed timer that can be set by the user if a timing step is not specified in the test procedure. (See Part 3, Test Timers and Auto-Read Option.)

NEW

Ends test and returns to the current test menu.

AC

Goes to the Adjust Calibration screen and turns on the Adjust Calibration feature (see Part 3, Adjust Calibration).

AC/OFF

Turns off the Adjust Calibration feature. Only available if AC is currently on (see Part 3, Adjust Calibration).

NEXT

Continues to the next test in a Series Test.

PREV

Returns to the previous test in a Series Test.

WL

Returns to the wavelength selection screen when in the Absorbance and % Transmittance modes (see Part 3, Absorbance and Transmittance Tests).

TOOLS

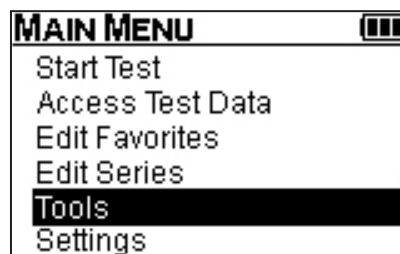
Select **TOOLS** to access the Data Transfer and the User Timer modes. The Data Transfer mode allows the instrument to communicate with a PC or laptop using the *TTi® Colorimeter Series PC App*. The *PC App* will prompt the user when to select Data Transfer.

The user timer is a general-purpose timer that can be used for any reason. When the user timer expires, four sets of five short beeps each will be heard. (**NOTE:** The user timer beep can be distinguished from the test timer beep. When a test timer expires, the device emits three sets of beeps. Each set consists of one long beep followed by two short beeps.)

DATA TRANSFER

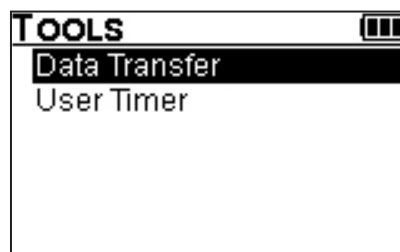
STEP 1

Select **Tools** from the MAIN MENU using ▲▼; then press ENTER ○.

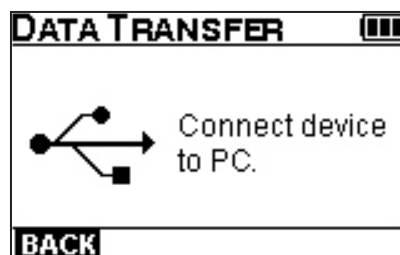


STEP 2

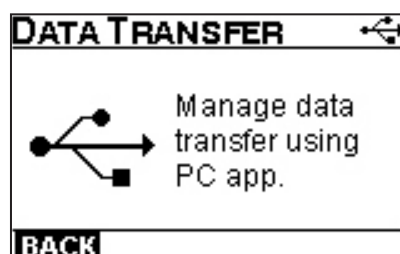
Select **Data Transfer** using ▲▼; then press ENTER ○.



Connect the device to the computer using the USB cable (supplied).



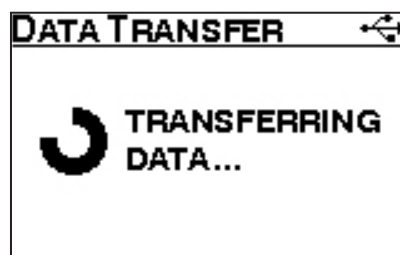
The USB symbol and “Manage data transfer using PC app” will be displayed in the main window. The USB icon will be displayed in the title bar. The device is now ready to transfer data using the *TTi® Colorimeter Series PC App* (see Section 4, Using the *PC App*).



When the transfer of data begins, the action symbol and “TRANSFERRING DATA...” will be displayed.

When a data transfer has been completed, the display returns to the “Manage data transfer using PC app.”

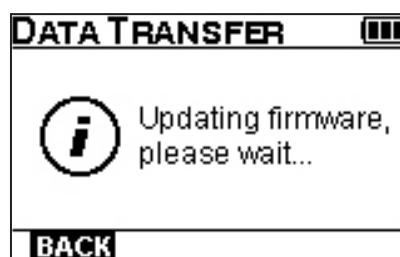
When multiple data transfers are performed, the display will cycle between “Manage data transfer using PC app” and “TRANSFERRING DATA...”.



When the meter’s operating software (firmware) is updated, the information symbol and “Updating firmware, please wait...” will be displayed.

Footer Option: BACK

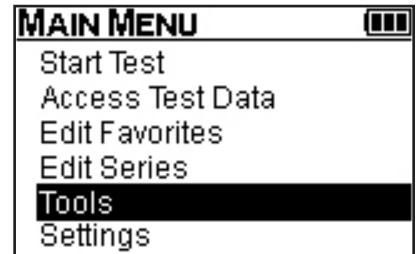
Returns to the Tools menu.



USER TIMER

STEP 1

Select tools from the MAIN MENU using ▲▼; then press ENTER ●.



STEP 2

Select **User Timer** using ▲▼; then press ENTER ●.

The USER TIMER screen will be displayed.

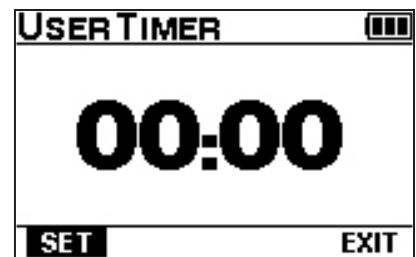
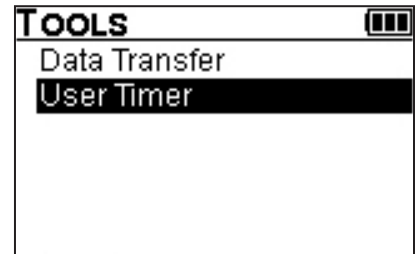
Footer Options: Select using ◀▶; then press ENTER ●.

SET

Goes to the edit mode.

EXIT

Returns to the Tools menu.



STEP 3

Set user timer.

Set Time using ▲▼, ◀▶; then press ENTER ●.

Footer Option: OK

Continues to User Timer Start.



STEP 4

Start user timer.

Select **START** using ◀▶; then press ENTER Ⓞ.

Footer Options: Select using ◀▶; then press ENTER Ⓞ.

SET

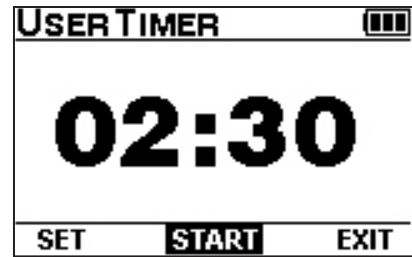
Goes to User Timer Set.

START

Begins timer countdown. When the countdown expires, the device beeps. If the timer is exited, it will continue to count down until the countdown expires or until the timer is stopped.

EXIT

Returns to the Tools menu.

**STEP 5**

Stop user timer.

Select **STOP** using ◀▶; then press ENTER Ⓞ.

Footer Options: Select using ◀▶; then press ENTER Ⓞ.

SET

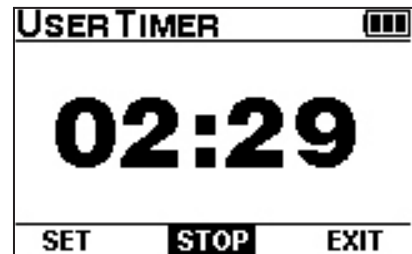
If timer has been started, stops the timer. Goes back to User Timer Set.

STOP

Stops timer. Goes to User Timer Start

EXIT

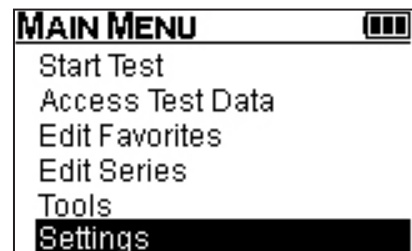
Returns to the Tools menu.



SETTINGS

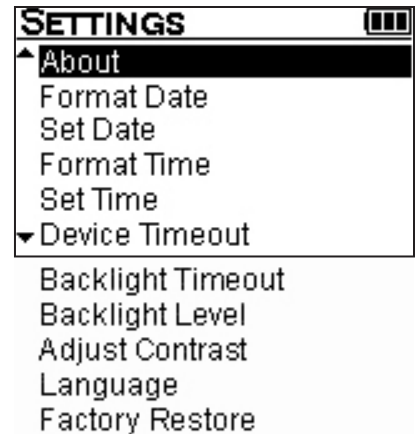
Select **SETTINGS** to access About (displays current Firmware, Test File, and Bootloader versions), or to modify instrument settings (Format Date, Set Date, Format Time, Set Time, Device Timeout, Backlight Timeout, Backlight Level, Adjust Contrast, Language, and Factory Restore).

Select **Settings** from the MAIN MENU using ▲▼; then press ENTER Ⓞ.



The SETTINGS screen will be displayed showing menu options in the main window.

Select Option using ▲▼; then press ENTER ●.

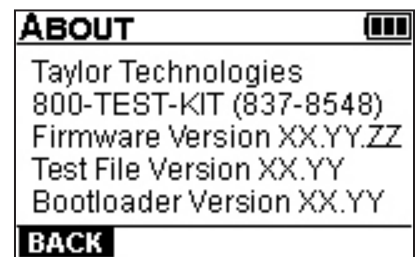


ABOUT

Display shows manufacturer name and telephone number plus current Firmware, Test File, and Bootloader versions installed on the instrument.

Footer Option: BACK

Returns to SETTINGS screen.

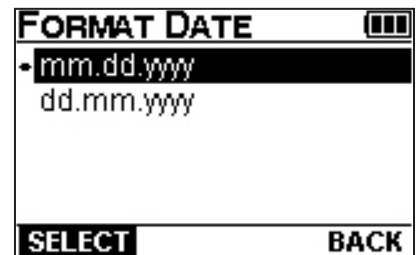


FORMAT DATE

A marker will appear to the left of the selected format. The default format is month, then date, then year, namely mm.dd.yyyy.

Select format using ▲▼; then press ENTER ●

Footer Options: Select using ◀▶; then press ENTER ●.



SELECT

Selects preferred choice and saves changes.

BACK

Returns to SETTINGS screen.

SET DATE

Set today's date using ▲▼, ◀▶; then press ENTER ●.

Footer Option: OK

Saves changes and returns to SETTINGS screen.



FORMAT TIME

A marker will appear to the left of the selected format. The default format is 12 Hour.

Select format using ▲▼; then press ENTER Ⓞ.

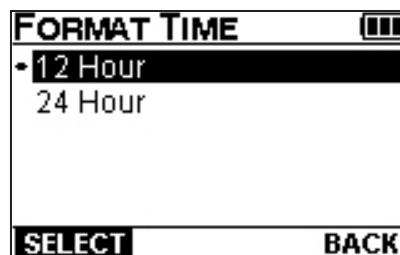
Footer Options: Select using ◀▶; then press ENTER Ⓞ.

SELECT

Selects preferred choice and saves changes.

BACK

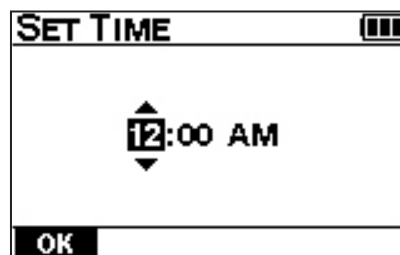
Returns to SETTINGS screen.

**SET TIME**

Set the current time using ▲▼, ◀▶; then press ENTER Ⓞ.

Footer Option: OK

Saves changes and returns to SETTINGS screen.

**DEVICE TIMEOUT**

A marker will appear to the left of the selected device timeout. The default timeout is 5 minutes. The timeout countdown starts after any running timers expire or, if no timers are running, after the most recent button press.

Select timeout using ▲▼; then press ENTER Ⓞ.

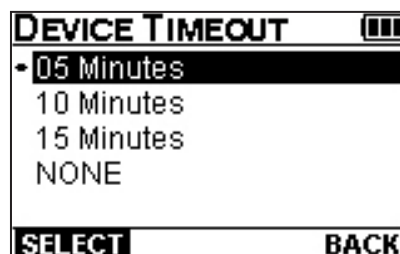
Footer Options: Select using ◀▶; then press ENTER Ⓞ.

SELECT

Selects preferred choice and saves change.

BACK

Returns to SETTINGS screen.

**BACKLIGHT TIMEOUT**

A marker will appear to the left of the selected backlight timeout. The default timeout is 3 minutes.

Select backlight timeout using ▲▼; then press ENTER Ⓞ.

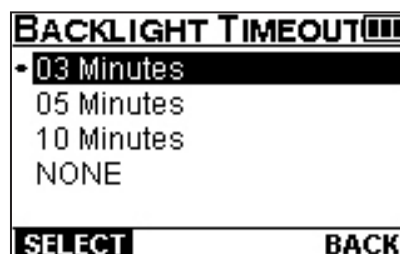
Footer Options: Select using ◀▶; then press ENTER Ⓞ.

SELECT

Selects preferred choice and saves change.

BACK

Returns to SETTINGS screen.



BACKLIGHT LEVEL

A marker will appear to the left of the selected backlight-intensity level. The default level is 50%.

Select intensity level using ▲▼; then press ENTER Ⓞ.

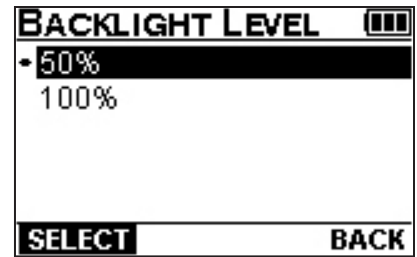
Footer Options: Select using ◀▶; then press ENTER Ⓞ.

SELECT

Selects preferred choice and saves change.

BACK

Returns to SETTINGS screen.



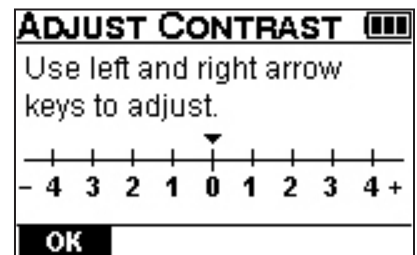
ADJUST CONTRAST

An arrow will appear above the selected contrast setting. The default setting is 0.

Select contrast setting using ◀▶; then press ENTER Ⓞ.

Footer Option: OK

Save change and returns to SETTINGS screen.



LANGUAGE

A marker will appear to the left of the selected language. The default language is English. Other options may become available in the future.

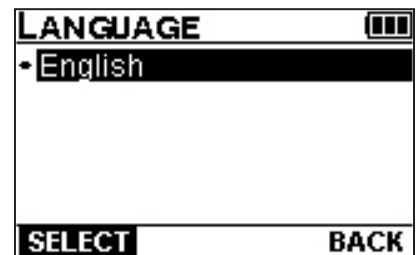
Footer Options: Select using ◀▶; then press ENTER Ⓞ.

SELECT

Selects preferred choice and saves change.

BACK

Returns to SETTINGS screen.



FACTORY RESTORE

WARNING: Choosing the Factory Restore option will erase all device data (including test data) and restore all settings (including optional chemical forms) to the factory default.

Footer Options: Select using ◀▶; then press ENTER Ⓞ.

YES

Erases all device data, restores factory settings, and restarts device.

NO

Returns to SETTINGS screen.



ABSORBANCE AND TRANSMITTANCE TESTS

Absorbance and transmittance tests are available in the ALL TESTS menu. These tests can be used in conjunction with user-developed methods to analyze samples and obtain results in terms of absorbance (ABS) or percent transmittance (% T), or to prepare user calibration curves. Wavelength choices are 420, 470, 520, 570, 620, and 660 nm. Sample cell viewdepth choices are 15 and 25 mm. A nonpreprogrammed timer is available as a footer option. In general, the following steps are required to perform absorbance and transmittance tests:

- Select Absorbance or Transmittance from the ALL TESTS menu.
- Select a wavelength.
- Confirm test name and wavelength.
- Prepare a blank and ZERO the Colorimeter.
- Prepare sample and READ the sample.

The following example shows how to perform an absorbance test with results expressed in terms of ABS. The same procedure is used to perform a transmittance test with results expressed in terms of % T.

STEP 1

Select **Start Test** from the MAIN MENU using ▲▼; then press ENTER ●.

MAIN MENU	
Start Test	
Access Test Data	
Edit Favorites	
Edit Series	
Tools	
Settings	

Select **ALL TESTS** menu using ◀▶; then press ENTER ●.

◀ALL TESTS▶	
▲ Alkalinity Total	250
Boron	2
Bromine T DPD/P	10
Bromine T DPD/P	20
Chlorine F&T DPD/P	4
▼ Chlorine F&T DPD/P	8

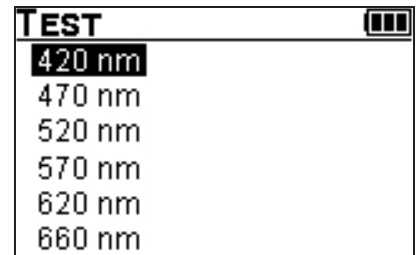
STEP 2

Select **Absorbance** using ▲▼; then press ENTER ●.

◀ALL TESTS▶	
▲ Silica	60
Sodium Chloride	80
Sulfide	1
Zinc	3
Absorbance	
▼ Transmittance	

STEP 3

Select wavelength using ▲▼; then press ENTER Ⓞ.



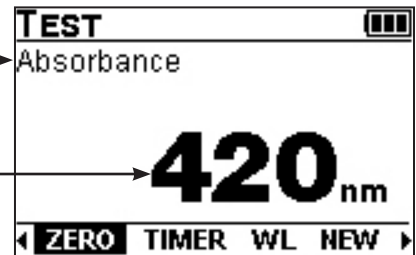
STEP 4

Confirm test name and wavelength.

The test name and wavelength will be displayed.

Test name. _____

Wavelength. _____



STEP 5

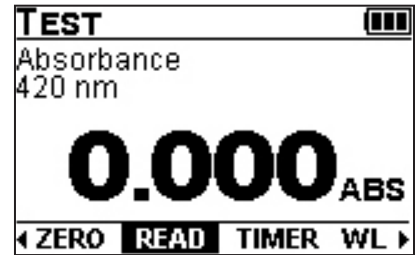
Prepare blank.

Follow the user-developed method.

AND

Zero the Colorimeter.

Select ZERO using ◀▶; then press ENTER Ⓞ.



STEP 6

Prepare sample.

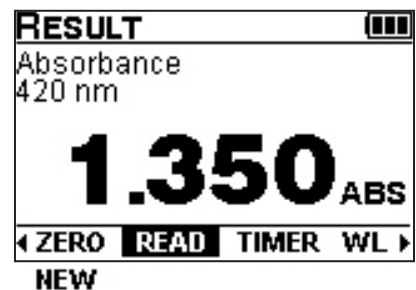
Follow the user-developed method.

AND

Read the sample.

Select READ using ◀▶; then press ENTER Ⓞ.

RESULT will be displayed in terms of absorbance (ABS).



Re-zero or read more samples:

Select ZERO using ◀▶; insert a blank; then press ENTER Ⓞ.

Select READ using ◀▶; insert a sample; then press ENTER Ⓞ.

Select new wavelength:

Select WL using ◀▶; then press ENTER Ⓞ.

Return to current test menu:

Select NEW using ◀▶; then press ENTER Ⓞ.

FOOTER OPTIONS: Select using ◀▶; then press ENTER Ⓞ.

ZERO

Zeros the instrument on a blank and displays 0.000 ABS in the absorbance mode and 100.0 % T in the transmittance mode.

READ

Reads the sample and displays result.

TIMER

Goes to a nonprogrammed timer that can be set by the user if a timing step is not specified in the test procedure. (See Part 3, Test Timers and Auto-Read Option.)

WL

Ends test and returns to the wavelength selection screen.

NEW

Ends test and returns to the current test menu.

USER-DEVELOPED TESTS

A total of 8 user-developed tests can be programmed and transferred to the instrument using the *TTi*[®] *Colorimeter Series PC App*. When transferred to the instrument, user-developed tests are stored in the ALL TESTS menu and can be added to the FAVORITES test menu or incorporated into a Series Test. Navigation and available options are the same as preprogrammed tests.

PROGRAM AND TRANSFER A USER-DEVELOPED TEST

Four actions are required to program and transfer a user-developed test to the Colorimeter.

- prepare a calibration curve

A calibration curve is prepared by measuring the absorbance of reacted standards (e.g., standards containing the substance to be measured plus test reagents) at various known concentrations. These absorbance vs. concentration data pairs (up to 12 data pairs for each test) are then entered into a table in the *PC App* and a graph of the calibration curve is automatically generated. The calibration curve can be linear or nonlinear with either a positive or negative slope. If the calibration curve is linear, only two data pairs are required (the lowest and highest concentration standard) to obtain accurate results throughout the range of the test. If the calibration curve is nonlinear, more data pairs may be needed in the area of nonlinearity to obtain accurate results throughout the range of the test.

When preparing a calibration curve, do not exceed 2.5 absorbance (ABS) units. For positive-sloped calibration curves, this will be the highest concentration standard. For negative-sloped calibration curves, this will be the lowest concentration standard. If the absorbance reading exceeds 2.5 ABS, try using the shorter sample cell viewdepth (15 mm). A sample dilution technique using a multiplication factor may also be incorporated into the test procedure for tests with a positive-sloped calibration curve. If the sample cannot be diluted or the ABS readings using the 15 mm sample cell still exceed 2.5 ABS, then the useable range of the test will need to be decreased for positive-sloped calibration curves. Negative-sloped calibration curves will require a modification to the test procedure that uses a lower indicator concentration, which may result in a decreased range for the test.

Prepare at least five or six standards from the lowest (usually 0 concentration) to the highest concentration in increments that cover the anticipated range of the test. For instance, if the anticipated range is 0–10 ppm, then prepare standards at 0, 2, 4, 6, 8, and 10 ppm.

Procedure

1. Turn on the Colorimeter.
2. Select a test menu (ALL TESTS, RECENT TESTS, or FAVORITES) containing Absorbance using ◀▶.
3. Select Absorbance using ▲▼; then press ENTER ●.
4. Select the best wavelength for the test using ▲▼; then press ENTER ●.
5. Rinse and fill a 25 mm sample cell to the 10 mL mark with deionized water; then cap.
6. Insert the sample cell into the sample cell compartment. Align marks.
7. Select ZERO using ◀▶; then press ENTER ●. Zero will be displayed.
8. Remove the sample cell from the sample cell compartment.
9. Rinse and fill a 25 mm sample cell to the 10 mL mark with the lowest concentration standard (usually 0 concentration).
10. Follow your test procedure for reagent addition, etc.; then cap and swirl to mix thoroughly.
11. Insert the sample cell into the sample cell compartment. Align marks.
12. Select READ using ◀▶; then press ENTER ●. Result will be displayed.
13. Record the ABS and concentration data pairs.
14. Repeat steps 9–13 for each concentration standard.

- enter test information and calibration curve data pairs into the user-developed test file located in the *PC App*

Procedure

1. Open the *TTi® Colorimeter Series PC App* and click on **Add** in the User-Developed Tests section.

(Note: If this is your first User-Developed Test, click on “Test 1” and then click **Edit**.)

Test Instruction	Test	Test Range
Prod. WT100		110 ppm
Prod. WT205		96.0 ppm

2. The User-Developed Test File/Add New Test screen will be displayed.

3. Enter all test information and calibration curve data pairs. **NOTE: Calibration curve data pairs must be entered in a particular order in the table. Begin at the left with the results from the lowest concentration standard (Standard #1) and move through each succeeding increment, entering the results from the highest concentration standard last.**

User-Developed Test File Fields	Description
Test Name	Any English name can be entered (number of characters may be limited). Subscripts cannot be entered. Colorimeter display will show exactly what is typed.
Chemical Form	Any chemical form, name, acronym, or abbreviation can be entered (number of characters is limited). An underscore is used to prefix a subscript ; e.g., H_20 will be displayed on the screen as H ₂ O. Superscripts cannot be entered.
Units	Units in which test results will be expressed. Choices are ppm, ppb, ppt, mg/L, µg/L, g/L, and no units.
Sample Cell Viewdepth	The sample cell viewdepth that will be used for the test. Choices are 15 and 25 mm for the TTi 2000 and TTi 3000 models.
Wavelength	The wavelength that will be used for the test. Choices are 420, 470, 520, 570, 620, and 660 nm for the TTi 2000 and TTi 3000 models.
Resolution	The number of decimal places used to display test results. Choices are 0, 0.0, 0.00, and 0.000.
Timers (Wait Time #1, #2, #3, #4)	The wait time in minutes and seconds (up to four timers can be preprogrammed for the test).
Calibration Curve Data Pairs	Absorbance (ABS) and Concentration data pairs used to prepare the calibration curve. Absorbance values can be entered in the table in increasing or decreasing order but must be sequential and cannot exceed 2.5 ABS. Concentration values must be entered in the table in increasing order (from lowest concentration standard to highest concentration standard, moving left to right) and cannot exceed 9999.

4. Click SAVE. The calibration curve will be displayed. Continue below.

- use the AUTO-GRAPH feature to view the calibration curve and determine whether additional data pairs are required

A graph of the calibration curve will be generated automatically. Examine the calibration curve. If the curve is linear, additional data pairs are not required. If the curve is slightly nonlinear, additional data pairs may be needed in the area of nonlinearity to obtain best results. Up to 12 data pairs may be entered.

User-Developed Tests

View 1 of 5

Test Name:

Chemical Form:

Units:

Sample Cell Viewdepth:

Wavelength:

Resolution:

Timers (Wait Time)

#1: minutes seconds

#2: minutes seconds

#3: minutes seconds

#4: minutes seconds

Calibration Curve Data Pairs

	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
ABS	0.0000	0.1000	0.2000	0.3000	0.4000	0.5000	0.6000	0.7000	0.8000	0.9000	1.0000	1.1000
CONC	0.0000	10.0000	20.0000	30.0000	40.0000	50.0000	60.0000	70.0000	80.0000	90.0000	100.0000	110.0000

Test Name Required

Any English name can be entered (number of characters may be limited). Subscripts cannot be entered. Colorimeter display will show exactly what is typed.

- save and transfer the test to the Colorimeter

Procedure

1. Click **X** to exit to the User-Developed Test File screen.
2. Click on the **!** next to **User-Developed Tests** to update the Colorimeter with the new test.
3. Follow screen prompts to continue.

Colorimeter Files

Click *Get Colorimeter Info* to display Current Colorimeter file versions.

Firmware v


Test File v

! User-Developed Tests

! = Click to Update Colorimeter.

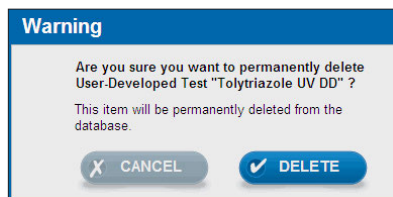
Get Colorimeter Info

EDIT A USER-DEVELOPED TEST

To edit a user-developed test, click on the test to be edited; then click on **Edit** in User-Developed Tests. Edit test information and **SAVE**. Click on the  icon next to **User Developed Test** to transfer the updated user-developed test file to the instrument.

DELETE A USER-DEVELOPED TEST









To delete a user-developed test, click on the test to be deleted; then click on **Delete** in User-Developed Tests. A warning that the selected test is about to be permanently deleted will appear on the screen.



Click on DELETE and transfer the updated user-developed test file to the instrument.


TEST INSTRUCTION EXAMPLE

FRONT

Colorimeter Series		Instruction #5078
Alkalinity Total 250 Range(s): 0-250 ppm CaCO ₃ , 0-305 ppm HCO ₃ ⁻ , 0-150 ppm CO ₃ ²⁻		
Procedure	<ol style="list-style-type: none"> Turn on the Colorimeter. Select a test menu (ALL TESTS, RECENT TESTS, or FAVORITES) containing Alkalinity Total 250 using . Select Alkalinity Total 250 using ; then press ENTER . Select a chemical form (CaCO₃, HCO₃⁻, CO₃²⁻) for expression of test results using . Rinse and fill 25 mm sample cell to 10 mL mark with sample; then cap. Insert sample cell into sample cell compartment. Align marks per User's Manual. Select ZERO using ; then press ENTER . Zero will be displayed. Remove sample cell from sample cell compartment; then remove cap. Add 1 drop Alkalinity Total 250 - Reagent A; then swirl to mix thoroughly. Add 1 mL Alkalinity Total 250 - Reagent B; then cap and swirl to mix thoroughly. Insert sample cell into sample cell compartment. Align marks. Select READ using ; then press ENTER . The instrument will read the sample and the result will be displayed. 	
Interferences	The following analytes were tested to the levels listed and found not to cause any interference up to the specified values: Bioguanide – 50 ppm Bromine – 10 ppm Chlorine – 10 ppm Copper – 0.5 ppm Cyanuric Acid – 200 ppm Hardness, Calcium (CaCO ₃) – 1000 ppm Iron, Ferric – 0.5 ppm Iron, Ferrous – 0.5 ppm	
Test Method	Bromocresol Green Bromocresol green, a pH-dependent indicator, is used to determine concentrations of alkalinity. Differing concentrations of alkalinity alter the pH and therefore change the color of the bromocresol green. This color change is proportional to the concentration of alkalinity in a sample.	
Estimated Detection Limit	2 ppm total alkalinity as CaCO ₃	
Precision	Using two lots of reagent and an alkalinity standard solution of 100 ppm total alkalinity as CaCO ₃ an individual analyst obtained a standard deviation with the instrument of ± 1 ppm total alkalinity as CaCO ₃ . (over)	

BACK

Application		Instruction #5078
Application	Recreational Water	
Ordering Info	Reagent Pack K-8024 Alkalinity Total 250 Formulated for exclusive use with Taylor's TTi™ Colorimeter. Reagent Pack Components R-8024A Alkalinity Total 250 - Reagent A R-8024B Alkalinity Total 250 - Reagent B	


 31 Loveton Circle, Sparks, MD 21152 U.S.A.
 800-TEST KIT (837-8548) • 410-472-4340
 customerservice@taylortechnologies.com

01/13

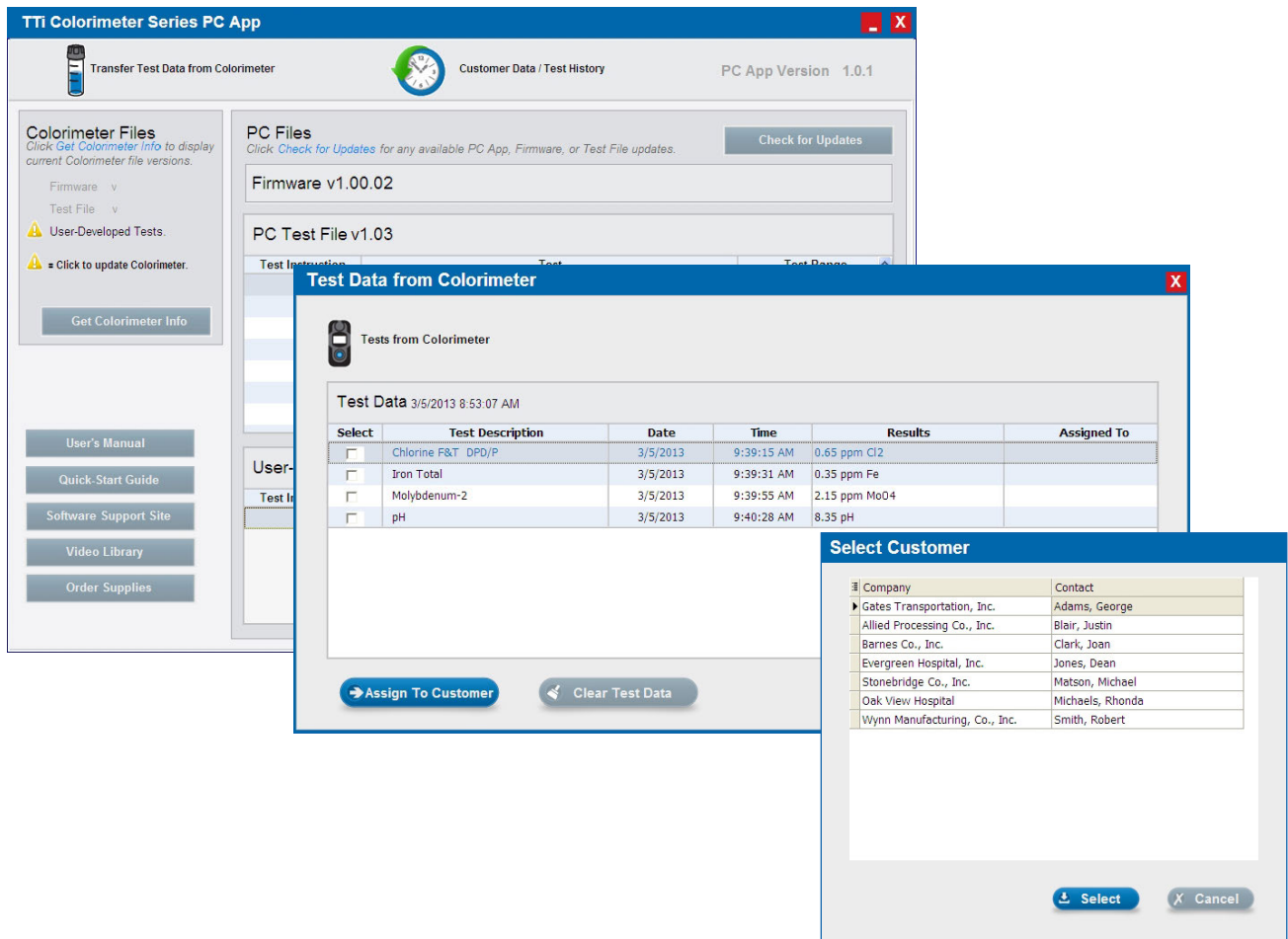
Part 4

Using the PC App

TRANSFERRING TEST DATA

To maintain an up-to-date customer database on your PC or laptop, it will be necessary to transfer test data from the Colorimeter on a regular basis.

Click on the **Transfer Test Data from Colorimeter** icon on the main screen of the *TTi® Colorimeter Series PC App*. (This software was installed upon registration as the owner of record. See Part 1, Registration.) You will be prompted to connect the Colorimeter to your computer with the USB cable provided. Click **PROCEED** to transfer the test data stored on the Colorimeter to the *PC App* and assign the records to a customer in the customer database. Test data that is not cleared from the Colorimeter will remain available for assignment (along with any new tests) the next time you transfer test data. **Note:** A customer must appear in the customer database before a test record can be assigned to their file. See the next section for how to add a customer to the customer database.



MAINTAINING A CUSTOMER DATABASE

To access the database containing customer information and test records, click on the **Customer Data/Test History** icon on the main screen of the *PC App*. Here you can add, edit, and delete customer profiles. To view a customer's test records, select the customer and then click the **View Test History** button. You can also manually add, edit, and delete test records from the Test History screen.

The screenshot displays the TTI Colorimeter Series PC App interface. The main window is titled "Customer Data / Test History" and shows the "Customer Data" screen. The interface includes a sidebar with "Colorimeter Files" and "PC Files" sections, and a main area with a table of customer data. A "View Test History" button is visible above the table. The table lists customer information, and the "Gates Transportation, Inc. (Adams, George)" entry is selected. A secondary window shows the "Test History for Gates Transportation, Inc. (Adams, George)" screen, displaying a table of test results.

Customer Data Table:


Company	Contact	Address	City	State
Allied Processing Co., Inc.	Blair, Justin	2456 Garden Terrace Road	Green Spring	MD
Barnes Co., Inc.	Clark, Joan	9864 Beverly Drive	Evergreen	MD
Evergreen Hospital, Inc.	Jones, Dean	9864 White Oak Street	Evergreen	MD
Gates Transportation, Inc.	Adams, George	1234 Orchard Avenue	Cold Spring	MD
Oak View Hospital	Michaels, Rhonda	2356 Falls Street	Green Spring	MD
Stonebridge Co., Inc.	Matson, Michael	245 Chestnut Street	Cold Spring	MD
Wynn Manufacturing Co., Inc.	Smith, Robert	1641 Maple Drive	Green Spring	MD

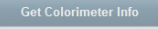


Test History for Gates Transportation, Inc. (Adams, George) Table:

Date	Time	Description	Results	Comments
3/01/2013	7:45 AM	Chlorine F&T DPD/P	0.65 ppm Cl2	
3/01/2013	7:53 AM	Iron Total	0.35 ppm Fe	
3/01/2013	7:56 AM	Molybdenum	2.15 ppm MoO4	
3/01/2013	7:59 AM	pH	8.35 pH	

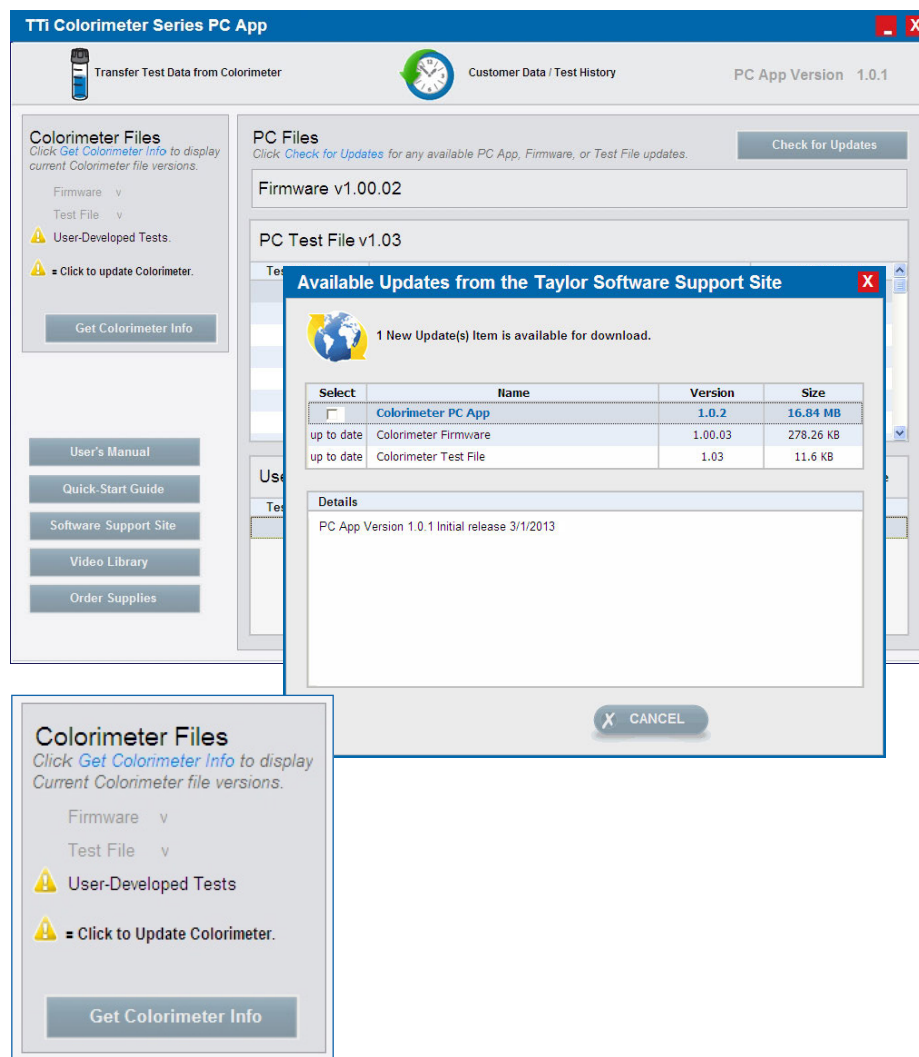
UPDATING THE PC APP, FIRMWARE, AND TEST FILES

You should occasionally check for updates to the *PC App*, Colorimeter firmware, and test files.

Click **Check for Updates** on the main screen of the *PC App*. The program will determine whether updates are available. These will be displayed in the Updates window, where you can review and download the files at your option. When updated Colorimeter firmware or an updated test file has been downloaded to the *PC App*, you will be prompted to install the file to the Colorimeter. Colorimeter files are installed by clicking the  symbol in the **Colorimeter Files** section of the *PC App*.

The *PC App* can be used to update firmware, Taylor tests, and user-developed tests on multiple Colorimeters. When you click , the attached Colorimeter's file versions are shown and the  symbol appears for files to be updated. Click on the  symbol to update the Colorimeter file(s).

Note: New test files for a particular meter model are supplied free of charge to the registered owner.



CREATING USER-DEVELOPED TESTS

In addition to the preprogrammed tests installed on the Colorimeter, a total of 8 user-developed (proprietary) tests can be programmed and transferred to the instrument using the *TTi® Colorimeter Series PC App*. (See Part 3, User-Developed Tests, for how to proceed.)

ACCESSING HELPFUL LINKS

The *TTi® Colorimeter Series PC App* contains links to digital editions of the *User's Manual* and *Quick-Start Guide*; plus a link to the *PC App* support website, **www.taylorsoftwaresupport.com**; and a link to the main Taylor website, **www.taylortechnologies.com**, where you can access a video library of Colorimeter test procedures as well as order testing supplies.

Part 5

Maintenance



ACCURACY CHECK

To verify instrument performance, an accuracy check should be performed at regular intervals using the K-8000 TTI® Colorimeter Series Accuracy Check Kit (available as an optional accessory). The kit contains five secondary absorbance standards. An accuracy check is performed using the Absorbance test, located in the ALL TESTS menu. The absorbance of each secondary standard is measured at specified wavelengths and the measured absorbance must fall within specific tolerances (provided with the kit) to verify instrument performance.

ROUTINE CARE

Do not use chemicals, solvents, or abrasives to clean or dry any part of the instrument. Clean and dry the enclosure, display, sample cell compartment, and sample cells after use or when needed as follows:

- Enclosure – Use a soft, nonabrasive cloth and water or mild detergent.
- Display – Be careful not to scratch the display. Use a soft, nonabrasive cloth or lens tissue and water or mild detergent.
- Sample Cell Compartment – Be careful not to scratch the sample cell compartment. Use the foam brush (supplied); a soft, nonabrasive cloth or lens tissue; and water or mild detergent.
- Sample Cells – Be careful not to scratch the sample cells. Use the foam brush (supplied) or a soft, nonabrasive cloth and water or mild detergent. Rinse thoroughly with deionized or distilled water.

WASTE DISPOSAL

As a chemical manufacturer, Taylor Technologies is required to prepare a Safety Data Sheet (SDS) for every reagent we produce. The Hazard Communication Standard promulgated by the U.S. Department of Labor's Occupational & Safety Health Administration (OSHA) specifies what information must be included in an SDS to provide workers and emergency personnel with procedures for handling the chemical in a safe manner, including disposal considerations. You may request an SDS for each of the reagents in your purchase at the time the order is placed. SDSs may also be printed from our corporate website, www.taylor technologies.com. They can be found under the **Product Info** button; from the drop-down menu, select "Documents" then "SDSs."

Please note that, beyond adding any new information within three months of awareness of a change affecting the content of a Safety Data Sheet, there currently is no specified time required by OSHA between revisions and/or updates to SDSs.

In Canada, our master distributor holds responsibility for Workplace Hazardous Materials Information System (WHMIS) compliance. Contact them directly, as follows:

Lowry & Associates
5-1151 Gorham Street
Newmarket, ON L3Y 8Y1

Phone: 905-836-0505
Fax: 905-895-4539
E-mail: info@lowryassociates.ca

It is the user's responsibility to abide by any local and state/provincial waste disposal requirements that supersede federal guidelines. Consult with a regulatory agency in your area to be certain you are in compliance with prevailing hazardous waste disposal guidelines. This Environmental Protection Agency website link may be helpful in locating these resources in the U.S.:

<http://www.epa.gov/wastes/wyl/stateprograms.htm>

WARRANTY INFORMATION

Instruments in the TTI® Colorimeter Series found to be defective within five years from the date of purchase will be repaired or replaced at the option of Taylor Technologies for any registered owner. The warranty does not cover batteries, nor damage caused by operator negligence or use of test chemistries not manufactured by Taylor or unauthorized repair work, nor the transportation and insurance costs to return the unit to our factory. The cost of all parts, labor, and return shipping to the owner will be borne by Taylor Technologies within the warranty period. All other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose, are excluded.

There are no user-serviceable parts of the Colorimeter besides the batteries. Should your meter display an Error Code message directing you to “Contact Tech Support” (see Part 6, Error Codes), or you have any other concerns about the device, please contact Taylor’s customer service group at **800-TEST KIT (837-8548)**. A representative will work with you to determine whether it is appropriate to return the Colorimeter for servicing. If so, a Return Authorization number and shipping label will be provided. You are responsible for insuring the unit and shipping it by a traceable means back to Taylor.

Part 6

Before You Call for Service

ERROR CODES

Error codes are displayed when the instrument detects misuse or failure of software, hardware, or batteries. When an Error Code message is displayed, use the table below to determine the likely cause and user action. **DO NOT attempt to service the instrument yourself, other than the User Action described in the table.** There are no user-serviceable parts other than the batteries. Any attempt to open the instrument will void the warranty.

To contact Tech Support, call **800-837-8548** between 8:00 a.m.–4:45 p.m. (Eastern Time), Monday through Friday, except major holidays.

Display Message	Likely Cause	User Action
Error: 001 420 nm error. See <i>User's Manual</i> .	Obstruction in the sample cell compartment during initialization. 420 nm LED or detector error.	Check for a sample cell or foreign object in the sample cell compartment. Remove; then restart device. Press any key to override and allow testing at other wavelengths. Contact Tech Support if necessary.
Error: 002 470 nm error. See <i>User's Manual</i> .	Obstruction in the sample cell compartment during initialization. 470 nm LED or detector error.	Check for a sample cell or foreign object in the sample cell compartment. Remove; then restart device. Press any key to override and allow testing at other wavelengths. Contact Tech Support if necessary.
Error: 003 520 nm error. See <i>User's Manual</i> .	Obstruction in the sample cell compartment during initialization. 520 nm LED or detector error.	Check for a sample cell or foreign object in the sample cell compartment. Remove; then restart device. Press any key to override and allow testing at other wavelengths. Contact Tech Support if necessary.
Error: 004 570 nm error. <i>User's Manual</i> .	Obstruction in the sample cell compartment during initialization. 570 nm LED or detector error.	Check for a sample cell or foreign object in the sample cell compartment. Remove; then restart device. Press any key to override and allow testing at other wavelengths. Contact Tech Support if necessary.
Error: 005 620 nm error. See <i>User's Manual</i> .	Obstruction in the sample cell compartment during initialization. 620 nm LED or detector error.	Check for a sample cell or foreign object in the sample cell compartment. Remove; then restart device. Press any key to override and allow testing at other wavelengths. Contact Tech Support if necessary.
Error: 006 660 nm error. See <i>User's Manual</i> .	Obstruction in the sample cell compartment during initialization. 660 nm LED or detector error.	Check for a sample cell or foreign object in the sample cell compartment. Remove; then restart device. Press any key to override and allow testing at other wavelengths. Contact Tech Support if necessary.

Display Message	Likely Cause	User Action
Error: 007 System error. Contact Tech Support.	Hardware or software malfunction.	Turn off device. Contact Tech Support.
Error: 008 Replace batteries or check power supply. See <i>User's Manual</i> .	Low power supply.	As applicable, replace batteries or check the AC power adapter or USB cable for faulty connection or function. Contact Tech Support if problem persists.
Error: 009 System error. Contact Tech Support.	Hardware malfunction.	Turn off device. Contact Tech Support.
Error: 010 System error. Contact Tech Support.	Hardware or software malfunction.	Turn off device. Contact Tech Support.
Error: 011 System error. Contact Tech Support.	Memory failure.	Turn off device. Contact Tech Support.
Error: 012 Check USB cable & connections. See <i>User's Manual</i> .	USB communication failure.	Check USB cable for damage. Verify that the USB cable connections to the device and computer are secure. (NOTE: Problem may be computer-related.) Contact Tech Support if problem persists.
Error: 013 Replace batteries or check power supply. See <i>User's Manual</i> .	Low power supply.	As applicable, replace batteries or check the AC power adapter or USB cable for faulty connection or function. Contact Tech Support if problem persists.
Error: 015 Procedure or System error. Contact Tech Support.	Sample cell may have been inserted or removed from sample cell compartment during the measurement process. or Hardware malfunction.	Retest. Make sure sample cell is properly aligned in the sample cell compartment before pressing ZERO or READ. Wait until result is displayed before removing sample cell. Turn off device and contact Tech Support if problem persists
Error: 016 System error. Contact Tech Support.	Hardware malfunction.	Turn off device. Contact Tech Support.
Error: 017 Invalid date. See <i>User's Manual</i> .	Invalid date entered.	Enter correct date under MAIN MENU/SETTINGS/SET DATE. Contact Tech Support if problem persists.
Error: 018 Replace batteries or check power supply. See <i>User's Manual</i> .	Low power supply.	As applicable, replace batteries or check the AC power adapter or USB cable for faulty connection or function. Contact Tech Support if problem persists.

RETURN POLICY

Should your meter display an Error Code message directing you to “Contact Tech Support,” or you have any other concerns about the device, please contact Taylor’s customer service group at **800-TEST KIT** (837-8548). A representative will work with you to determine whether it is appropriate to return the Colorimeter for servicing. Please be prepared to supply the Colorimeter serial number (S/N), found on the product label on the bottom of the meter, and proof of purchase. (You may have attached your proof of purchase to the *Quick-Start Guide* and filed it for future reference, as suggested in the guide.) Should a return be necessary, a Return Authorization number and shipping label will be provided. You are responsible for insuring the unit and shipping it by a traceable means back to Taylor.

Part 7

***Colorimeter
Specifications***

SPECIFICATIONS SUMMARY

General Description	
Instrument Type	The TTi® Colorimeter is a portable, multiwavelength, micro-processor-controlled, menu-driven, direct-readout instrument that employs light-emitting diodes (LEDs) as light sources and offers data-logging capabilities. It is well suited for performing multiparameter water analyses in the field or in the laboratory.
Number of Preprogrammed Test Methods (as of 10/19/2012)	TTi® 2000 for pool/spa waters: 12 TTi® 3000 for commercial/industrial waters: 30+
Performance	
Photometric Range	0–2 ABS
Readout Units	ABS, % T, and concentration (ppm, ppb, ppt, mg/L, µg/L, g/L)
Photometric Accuracy	±0.005 ABS @ 1.0 ABS nominal
Photometric Linearity	±0.002 ABS (0–1 ABS)
Repeatability	±0.005 ABS (0–1 ABS)
Resolution	0.001 ABS (0–1 ABS)
Wavelength Filters	420, 470, 520, 570, 620, 660 nm (filters manufactured using a process that provides enhanced thermal, environmental, and spectral stability)
Wavelength Selection	Automatic for preprogrammed and user-developed tests
Wavelength Accuracy	±1 nm
Wavelength Bandwidth	10 nm ±1 nm
Stray Light	< 1.0%
Physical Description	
Source Lamp	LED (light-emitting diode)
Detector	Silicon photodiode
Sample Cell Chamber	Accommodates 15 to 25 mm diameter round cells
USB Cable	Type A male to mini B male
AC Power Adapter	Wall adapter w/ mini B male – USB
Dimensions	3.5" W x 8.5" D x 3.5"H
Weight (w/ batteries)	21 oz. (595 g)
Functionality & User Interface	
Data Storage/Recall	100 date- and time-stamped test results
Data Transfer Mode	Transfer test results to and file updates from PC or laptop
User-Developed Test Capability	8 tests (comprising up to 12 data points each)
Keypad	8-button silicone rubber
Display/Resolution	Custom graphical LCD (liquid crystal display) w/ anti-glare screen and 160 x 100 resolution
Backlight	2 adjustable brightness levels and 4 timeout settings
Timers	Up to 4 preprogrammed test timers and 1 general-use timer
Adjust Calibration Capability	Adjust calibration curve of preprogrammed tests
Favorites Menu Feature	Create and edit a preferred test list
Series Test Feature	Create and edit a group of tests to be performed consecutively

Specifications Summary (cont'd)

Instrument Rating	
Power Source	4 x AA 1.5V alkaline or lithium batteries, AC power adapter, or USB cable
Battery Life (w/o backlight)	4 months (typical use, 12 tests/day, 5 days/week)
w/ low battery indicator	90% RH @ 122°F/50°C (non-condensing)
Max Current	100 mA @ 5VDC
AC Power Adapter Input	100–240 VAC, 50/60 Hz
Input and Output Connections	Mini-B female USB port for data transfer and connection to AC power adapter or USB cable
Environmental Conditions	Operational temperature range: 32°F–122°F (0°C–50°C)
Operational Humidity Limit	90% RH @ 122°F/50°C (noncondensing)
Dust and Water Ingress Protection	IP67: No ingress of dust; immersion in water of up to 1 meter for 30 minutes

Part 8

Compliance Synopsis

CERTIFICATION

The TTI® Colorimeter Series is certified to the following instrumentation Directives and Standards:

- Directive 2004/108/EC, Electromagnetic Compatibility Directive
- Directive 2006/95/EC, Low Voltage Directive
- FCC, Radio Frequency Devices, Unintentional Radiators, 47 CFR Part 15, Subpart B
- UL 61010-1 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements
- ICES-003 - Issue 4 February 2004 - Spectrum Management and Telecommunications Policy - Interference-Causing Equipment Standard - Digital Apparatus
- CSA C22.2 No. 61010-1 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements
- EN 61326-1:2006 - Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements – Part 1: General Requirements
- EN 61010-1:2001 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements
- IEC 61010-1 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements

INFORMATION TO THE USER

The user is cautioned that if the instrument is used in a manner not specified by Taylor Technologies, Inc., the protection provided by the instrument may be impaired.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

The user is cautioned that changes or modifications not expressly approved by Taylor Technologies, Inc., could void the user's authority to operate this equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

This Class B digital apparatus complies with Canadian ICES-003. (Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.) The CE mark indicates compliance with the following directives:

- Directive 2004/108/EC, Electromagnetic Compatibility Directive
- Directive 2006/95/EC, Low Voltage Directive



the most trusted name in water testing