LaMotte

TC3000we/wi TRI-METER

1969-EPA
1969-ISO

Turbidity • Chlorine • Color

CONTENTS

GENERAL INFORMATION

■ PACKAGING AND DELIVERY

Experienced packaging personnel at LaMotte Company assure adequate protection against normal hazards encountered in transportation of shipments.

After the product leaves LaMotte Company, all responsibility for safe delivery is assured by the transportation company. Damage claims must be filed immediately with the transportation company to receive compensation for damaged goods.

■ GENERAL PRECAUTIONS

READ THE INSTRUCTION MANUAL BEFORE ATTEMPTING TO SET UP OR OPERATE THE METER. Failure to do so could result in personal injury or damage to the meter. The meter should not be used or stored in a wet or corrosive environment. Care should be taken to prevent water from wet tubes from entering the meter chamber.

NEVER PUT WET TUBES IN THE METER.

■ SAFETY PRECAUTIONS

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

■ LIMITS OF LIABILITY

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

■ SPECIFICATIONS - TC3000we/wi

Instrument Type:	**Turbidity:** Nephelometer **Color:** Colorimeter **Chlorine:** Colorimeter
Standard:	**Turbidity:** EPA 180.1, TC3000we; ISO 7027, TC3000wi **Color:** Adapted from Standard Methods 2120 B **Chlorine:** Standard Methods 4500-Cl-G
Units of Measure:	**Turbidity:** NTU (Nephelometric Turbidity Units) (TC3000we only) FNU (Formazin Nephelometric Units) (TC3000wi only) ASBC (American Society of Brewing Chemists) EBC (European Brewery Convention) **Color:** Platinum Cobalt Color Units (cu) **Chlorine:** Parts Per Million (ppm), Milligrams Per Liter (mg/L)
Range:	**Turbidity:** 0-4000 NTU, 0-4000 FNU, 0-10,500 ASBC, 0-150 EBC **Color:** 0–1000 cu **Chlorine:** 0.00–10.00 ppm free and total chlorine
Range Selection:	**Turbidity:** Automatic **Color:** Automatic **Chlorine:** Automatic
Resolution: (display)	**Turbidity:** 0.01 NTU/FNU, 0.00–10.99 NTU/FNU Range 0.1 NTU/FNU, 11.0–109.9 NTU/FNU Range 1 NTU/FNU, 110–4000 NTU/FNU Range **Color:** 1 cu, 0-1000 cu Range **Chlorine:** 0.01 ppm, 0.00–5.00 ppm Range 0.1 ppm, 5.0–10.00 ppm Range

Accuracy:	**Turbidity:** From 0-2.5 NTU/FNU the accuracy is ±0.05 NTU/FNU. From 2.5-100 NTU/FNU the accuracy is ±2%. Above 100 NTU/FNU the accuracy is ±3%. **Color:** ±15 cu **Chlorine:** *TABLET:* 0-1.0 ppm Range: ±0.03 ppm 1.0-3.0 ppm Range: ±0.06 ppm 3.0-6.0 ppm Range: ±0.3 ppm 6.0-10.0 ppm Range: ±2.5 ppm *LIQUID:* 0-0.5 ppm Range: ±0.03 ppm 0.6-3.0 ppm Range: ±0.06 ppm 3.0-8.0 ppm Range: ±0.4 ppm 8.0-10.0 ppm Range: ±1.5 ppm
Detection Limit:	**Turbidity:** 0.05 NTU/FNU **Color:** 20 cu **Chlorine:** 0.03 ppm
Light Source:	**Turbidity:** Tungsten lamp 2300°C ±50 °C, TC3000we; IR LED 850 nm ±10 nm, spectral bandwidth 50 nm, TC3000wi **Color:** 428 ±2 nm UV LED **Chlorine:** 525 ±2 nm LED
Detector	**Turbidity:** Photodiode, centered at 90°, maximum peak 400-600 nm, TC3000we Photodiode, centered at 90°, TC3000wi **Color:** Photodiode **Chlorine:** Photodiode
Response Time:	<2 seconds
Signal Averaging:	Turbidity
Sample Chamber:	Accepts 25 mm flat-bottomed test tubes
Sample:	10 mL in capped tube
Display:	Graphic Liquid Crystal Display
Software:	*Auto Shut-off:* 5, 10, 30 min, disabled *Calibration:* Field adjustable, blank and 1 point *Data Logging:* 500 points
Languages:	English, Spanish, French, Portuguese, Italian, Chinese, Japanese (Kana)
Temperature:	Operation: 0–50 °C; Storage: -40–60 °C
Operation Humidity Range:	0–90 % RH, non-condensing
Auto Shut-off:	5, 10, 30 min, disabled

Waterproof:	IP67 with USB port plug in place.
Power Source†:	USB wall adapter, USB computer connection or lithium ion rechargeable battery 2200 mAH, 3.7V
Battery:	Charge Life: Approximately 380 tests with backlight on to 1000 tests with backlight off. (Signal averaging disabled). Battery Life: Approximately 500 charges.
Electrical Ratings:	Provided on nameplate label
Dimensions:	(W x L x H) 8.84 x 19.05 x 6.35 cm; 3.5 x 7.5 x 2.2 inches
Weight:	362 g, 13 oz (meter only)
USB Interface	mini B

†CE Mark: The device complies to the product specifications for the Low Voltage Directive.

■ STATISTICAL & TECHNICAL DEFINITIONS RELATED TO PRODUCT SPECIFICATIONS

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

Accuracy: Accuracy is the nearness of a measurement to the accepted or true value.[3] The accuracy can be expressed as a range, about the true value, in which a measurement occurs (i.e. ±0.5 ppm). It can also be expressed as the % recovery of a known amount of analyte in a determination of the analyte (i.e. 103.5 %).

Resolution: Resolution is the smallest discernible difference between any two measurements that can be made.[4] For meters this is usually how many decimal places are displayed. (i.e. 0.01). Note that the resolution many change with concentration or range. In some cases the resolution may be less than the smallest interval, if it is possible to make a reading that falls between calibration marks. A word of caution, that resolution has very little relationship to accuracy or precision. The resolution will always be less than the accuracy or precision but it is not a statistical measure of how well a method of analysis works. The resolution can be very, very good and the accuracy and precision can be very bad! This is not a useful measure of the performance of a test method.

Repeatability: Repeatability is the within-run precision.[5] A run is a single data set, from set up to clean up. Generally, one run occurs on one day. However, for meter calibrations, a single calibration is considered a single run or data set, even though it may take 2 or 3 days.

Reproducibility: Reproducibility is the between-run precision.[6]

Detection Limit (DL): The detection limit (DL) for the TC3000we/wi is defined as the minimum value or concentration that can be determined by the meter, which is greater than zero, independent of matrix, glassware, and other sample handling sources of error. It is the detection limit for the optical system of the meter.

[1] CFR 40, part 136, appendix B

[2] Statistics in Analytical Chemistry: Part 7 – A Review, D. Coleman and L Vanatta, American Laboratory, Sept 2003, P. 31.

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

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

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

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

CONTENTS & ACCESSORIES

	TC3000we Kit EPA Version Code 1969-EPA	TC3000wi Kit ISO Version Code 1969-ISO
Contents	*Code*	*Code*
0 NTU Standard, 60 mL	1480	1480
1 NTU/FNU Standard, 60 mL	1450	1453
10 NTU/FNU Standard, 60 mL	1451	1454
Chlorine DPD #1; Instrument Grade Tablets, 100	6903A-J	6903A-J
Chlorine DPD #3; Instrument Grade Tablets, 100	6197A-J	6197A-J
Water Sample Bottle, 60 mL	0688	0688
Tubes, 6	—	—
Cable, USB, 3 ft.	1720	1720
USB Wall Adapter	1721	1721

Accessories	
Code	*Description*
1452	100 NTU Standard, 60 mL (EPA)
1455	100 NTU Standard, 60 mL (ISO)
6903A-L	Chlorine DPD #1; Instrument Grade Tablets, 500
6903A-M	Chlorine DPD #1; Instrument Grade Tablets, 1,000
6197A-L	Chlorine DPD #3; Instrument Grade Tablets, 500
6197A-M	Chlorine DPD #3; Instrument Grade Tablets, 1,000
P-6740-G	DPD #1A, Free Chlorine Reagent, 30 mL
P-6740-H	DPD #1A, Free Chlorine Reagent, 60 mL
*P-6741-G	*DPD #1B, Free Chlorine Reagent, 30 mL
*P-6741-H	*DPD #1B, Free Chlorine Reagent, 60 mL
P-6743-G	DPD #3, Total Chlorine Reagent, 30 mL
P-6743-H	DPD #3, Total Chlorine Reagent, 60 mL
0290-6	Tubes, Code 0290, Set of 6
3-0038	Replacement Chamber
6973-H	Chlorine Standard, 250 ppm, 60 mL
3176-01	Chlorine Titration Kit, 0-10 ppm
4140-01	Chlorine Secondary Standards, set of 4
6058-H	Color Standard, 500 Color Units, 60 mL
4185	Turbidity-Free Water Kit
2-2097	Filters, 0.1 micron, Pack of 50
1901-CD	SMARTLink 3 Software
5-0132	Car Charger

*WARNING: Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed in the contents list. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by e-mail, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel (US, 1-800-255-3924) (International, call collect, 813-248-0585).

■ EPA COMPLIANCE

The TC3000we meter meets or exceeds EPA design specifications for NPDWR and NPDES turbidity monitoring programs as specified by the USEPA method 180.1.

■ ISO Compliance

This TC3000wi meter meets or exceeds ISO design criteria for quantitative methods of turbidity using optical turbidimeters as specified by ISO 7027.

■ CE COMPLIANCE

The TC3000we and TC3000wi meters have been independently tested and have earned the European CE Mark of compliance for electromagnetic compatibility and safety. To view certificates of compliance, go to the LaMotte website at www.lamotte.com.

NOTE: The device complies to the product specifications for the Low Voltage Directive.

■ IP67 Certification

The TC3000we/wi meets IP67 standards for protection against dust and immersion only when the USB port plug is in place. Documentation is available at www.lamotte.com.

■ WARRANTY

LaMotte Company warrants this instrument to be free of defects in parts and workmanship for 2 years from the date of shipment. If it should become necessary to return the instrument for service during or beyond the warranty period, contact our Technical Service Department at 1-800-344-3100 for a return authorization number or visit www.lamotte.com for troubleshooting help. The sender is responsible for shipping charges, freight, insurance and proper packaging to prevent damage in transit. This warranty does not apply to defects resulting from action of the user such as misuse, improper wiring, operation outside of specification, improper maintenance or repair, or unauthorized modification. LaMotte Company specifically disclaims any implied warranties or merchantability or fitness for a specific purpose and will not be liable for any direct, indirect, incidental or consequential damages. LaMotte Company's total liability is limited to repair or replacement of the product. The warranty set forth above is inclusive and no other warranty, whether written or oral, is expressed or implied.

■ REGISTER YOUR METER

To register your meter with the LaMotte Service Department, go to www.lamotte.com and choose SUPPORT on the top navigation bar.

COMPUTER CONNECTION

■ PC LINK

The TC3000we/wi may be interfaced with any Windows-based computer by using the LaMotte SMARTLink 3 Program and USB Cable. The program will store test information and results in a database.

To transfer data from the meter to a computer, plug the smaller end of the USB cable (USB mini B connector) into the meter and the larger end of the USB cable (USB Type A connector) into a USB port on a computer. The TC3000we/wi will send the following data: test name, wavelength, concentration, transmittance, absorbance, sample, blank, time of test, and date of test.

■ OUTPUT

USB

■ COMPUTER CONNECTION

USB Type A, USB mini B, Order Cable Code 1720.

BATTERY/AC OPERATION

The TC3000we/wi may be operated on battery power or using a USB wall adapter or USB computer connection. If using the meter as a bench top unit, use the AC wall adapter if possible to extend the battery life.

To charge the battery with the wall adapter, plug the smaller end of the USB cable (USB mini B connector) into the meter and the larger end of the USB cable (USB Type A connector) into the wall adapter. Plug the wall adapter into an AC outlet. Reinsert the USB port plug after charging.

To charge the battery from a computer, plug the smaller end of the USB cable (USB mini B connector) into the meter and the larger end of the USB cable (USB Type A connector) into a USB port on the computer. Reinsert the USB port plug after charging.

The battery icon will show no bars and flash when the unit first turns on. Then the indicator will indicate the battery status by showing 0, 1, 2, 3 or 4 bars.

It will take 5 hours to fully charge a low battery. The battery icon will flash when the battery is charging. The battery icon will show four bars and stop flashing when it is fully charged. The charging circuit will automatically switch to a float charge when the battery is fully charged. The charger may remain connected. Some computers will NOT supply power to their USB ports during standby operation. The wall charger will charge the unit continuously.

The battery icon will show no bars and continuously flash if the battery is getting low but the unit will still operate normally. A “Low Battery” message on the status bar of the display will replace the time when the battery voltage is too low for proper operation and accuracy may be degraded. A “Shutdown Low Batt” message on the display will appear for a few seconds before the power is switched off when the battery is too low to operate the unit.

To extend the battery life:

- Shut down the unit with the power switch when not taking measurements or use the power save option to have the unit automatically turn off after 5 minutes.

- Store the unit in a cool dry place.
- Fully charge the battery before storing the unit for extended periods of time.
- Limit backlight use. The unit consumes 3X normal power with the backlight on.

Set the backlight time option to 10 seconds, or select “Button Control” and keep the backlight off.

Battery replacement: The lithium-ion battery used in this unit should last for many years with normal use. When it no longer powers the unit long enough to meet testing requirements it will need to be replaced. Lithium-ion batteries that are properly charged and stored do not usually lose all capacity; they just have less capacity after hundreds of charge cycles. This unit uses a custom battery assembly that is only available from LaMotte Company. Battery replacement must be performed at a LaMotte authorized repair facility. The water resistant housing of this meter should not be opened by the user. Contact LaMotte Company by phone (1-800-344-3100) or email (tech@lamotte.com) for a return authorization number.

INTRODUCTION

■ TURBIDITY

WHAT IS TURBIDITY?

Turbidity is an aggregate property of the solution, which is water in most cases. Turbidity is not specific to the types of particles in the water. The particles could be suspended or colloidal matter, and they can be inorganic, organic, or biological. At high concentrations, turbidity is perceived as cloudiness, haze, or an absence of clarity in the water. Turbidity is an optical property that results when light passing through a liquid sample is scattered. The scattering of light results in a change in the direction of the light passing through the liquid. This is most often caused when the light strikes particles in solution and is scattered backward, sideways and forward. If the turbidity is low, much of the light will continue in the original direction. Light scattered by the particles allows the particle to be ”seen” or detected in solution, just as sunlight allows dust particles in the air to be seen.

In the past 10 years, turbidity has become more than just a measure of water clarity. Because of the emergence of pathogens such as Cryptosporidium and Giardia, turbidity now holds the key to assuring proper water filtration. In 1998, the EPA published the IESWTR (interim enhanced surface water treatment rule) mandating turbidities in combined filter effluent to read at or below 0.3 NTU. By doing so, the EPA hoped to achieve a 2 log (99%) removal of Cryptosporidium. There is presently consideration to lower this to 0.1 NTU. The trend has been to check the calibration of on-line turbidimeters with hand-held field units. The optical design and low detection limit of the TC3000we/wi allows very accurate readings for such calibrations.

The meter also allows the user to choose the units of measure for expressing turbidity. While nephelometric turbidity unit (NTU) has been the standard for years, FNU (formazin nephelometric unit) and FAU (formazin attenuation unit) are now being used in ISO 7027 units. American Society of Brewing Chemists (ASBC) units and European Brewery Convention (EBC) units allow the brewing industry to check process waters.

HOW IS TURBIDITY MEASURED?

Turbidity is measured by detecting and quantifying the scattering of light in water (solution). Turbidity can be measured in many ways. There are visual methods and instrumental methods. Visual methods are more suitable for samples with high turbidity. Instrumental methods can be used on samples with both high and low levels of turbidity.

Two visual methods are the Secchi Disk method and the Jackson Candle method. The Secchi Disk method is often used in natural waters. A black and white Secchi Disk is lowered into the water until it can no longer be seen. It is then raised until it can be seen again. The average of these two distances is known as the "Secchi Depth". The Jackson Candle method uses a long glass tube over a standard candle. Water is added or removed from the tube until the candle flame becomes indistinct. The depth of the water measured with a calibrated scale is reported as Jackson Turbidity Units (JTU). The lowest turbidity that can be determined with this method is about 25 NTU. There are two common methods for instruments to measure turbidity. Instruments can measure the attenuation of a light beam passing through a sample and they can measure the scattered light from a light beam passing through a sample. In the attenuation method, the intensity of a light beam passing through a turbid sample is compared with the intensity passing through a turbidity-free sample at 180° from the light source. This method is good for highly turbid samples. The most common instrument for measuring scattered light in a water sample is a nephelometer. A nephelometer measures light scattered at 90° to the light beam. Light scattered at other angles may also be measured, but the 90° angle defines a nephelometric measurement. The light source for nephelometric measurements can be one of two types to meet EPA or ISO specifications. The EPA specifies a tungsten lamp with a color temperature of 2,200–3,000 K. The units of measurement for the EPA method are nephelometric turbidity units (NTU). The ISO specifies a light emitting diode (LED) with a wavelength of 860 ± 30 nm and a spectral bandwidth less than or equal to 60 nm. The units of measurement for the ISO method are formazin nephelometric units (FNU). The TC3000we meets the EPA specification and the TC3000wi meets the ISO specification. The nephelometric method is most useful for low turbidity. The ISO compliant light source provides extended lifetime and better precision and accuracy of turbidity readings on colored samples and samples with high turbidity.

The TC3000we/wi is a nephelometer that is capable of measuring turbidity by both the attenuation method and the nephelometric method. It uses a detector placed at 180° to the light source for high turbidity samples. It uses a detector placed at 90° to the light source for the nephelometric method for low turbidity samples. The TC3000we/wi has a signal averaging option to improve the stability of readings on low turbidity samples.

The TC3000we/wi has two different turbidity calibrations, formazin and Japan Standard. The formazin calibration is the EPA and ISO approved method of calibrating nephelometers. This calibration can be used with user prepared formazin standards or commercially purchased formazin standards. LaMotte Company approved AMCO™ standards labeled for use with the TC3000we/wi can also be used with the formazin calibration. Stablcal® standards below 50 NTU should not be used to calibrate the TC3000we/wi.

The Japan Standard calibration is no longer supported.

TURBIDITY UNITS

Traditionally, turbidimeters designed for use in the United State were made to the specifications of EPA Method 180.1. This method defined the NTU, nephelometric turbidity unit, as a unit to measure turbidity in the range of 0 – 40 NTU using a nephelometer. According to the EPA a nephelometer was a turbidimeter that measured turbidity with a 90° detector. Also, if the turbidity was greater than 40 NTU, a dilution was necessary to bring the sample into the 0 – 40 NTU range. Today, many turbidimeters have additional detectors which increase the range of the turbidity measurement, eliminate interferences and generally improve the performance. Currently, many turbidimeters are capable of measuring above 40 NTU by using detectors other than a 90° detector. Even though they may use a 180° detector to measure the light that is attenuated by high turbidity samples they may continue to report the results as NTU.

Recently there has been an effort to use the units of turbidity measurements to indicate which type of detector and light source was used. For EPA compliant meters, measurements made with a 90° degree detector and an incandescent white light source are reported as NTU. When an attenuation measurement is made with a 180°detector, using the same meter, the results are reported as AU, attenuation units. ISO Method 7027, which specifies a 860 nm light source, also uses two turbidity units. When the 90° degree detector is used, the results are reported as FNU, formazin nephelometric units. When an attenuation measurement made with a 180°detector, the results are reported as FAU, formazin attenuation units. It should be noted that all units are numerically equivalent if the meters are calibrated to formazin and that the units only designate which detector was used to make the measurement. For example, 1 NTU = 1 AU = 1FNU = 1FAU.

Acronyms	Definitions	Notes	Regulatory Method
NTU	Nephelometric Turbidity Units	Incandescent white light between 400 and 600 nm, 90° detection, TC3000we	EPA 180.1
FNU	Formazin Nephelometric Units	IR LED (usually) 860 nm, bandwidth less than 60 nm, 90° detection, TC3000wi	ISO 7027
AU	Attenuation Units	Incandescent white light between 400 and 600 nm, 180° detection, TC3000we	Not applicable
FAU	Formazin Attenuation Units	IR LED (usually) 860 nm, bandwidth less than 60 nm, 180° detection, TC3000wi	ISO 7027
ASBC	American Society of Brewing Chemists	TC3000we/wi	Not applicable
EBC	European Brewery Convention	TC3000we/wi	Not applicable

The TC3000we and TC3000wi each use two turbidity units. The TC3000we reports the result as NTU when the 90° detector is used and AU when the 180° detector is used. The TC3000wi reports the result as FNU when the 90° detector is used and FAU when the 180° detector is used.

TAKING TURBIDITY WATER SAMPLES

Clean plastic or glass containers may be used for turbidity samples. Ideally, samples should be tested soon after collection and at the same temperature as when collected.

■ CHLORINE

WHAT IS CHLORINE

Chlorine is added to water systems to sanitize the water. There are various forms of chlorine that are added to water. These can be gas, liquid (commonly called bleach or sodium hypochlorite), calcium hypochlorite mixtures, stabilized chlorine products and chlorine generated from salt. When these forms of chlorine are added, they react with water to form free chlorine, hypochlorous acid. If free chlorine reacts with ammonia, it will form various types of combined chlorine (chloramines). Depending on the chlorine to ammonia ratio, these can be mono, di or tri chloramines.

Because free chlorine can react with precursors in the water to form carcinogenic trihalomethanes (THMs), many water systems have switched to chloramines. In these systems, free chlorine and ammonia are added together and controlled to form monochloramine. Although not as active a sanitizer as free chlorine, chloramine is less likely to form THMs. Since it is a slower sanitizer, the concentration of chloramine in water is higher than the concentration of free chlorine in water distribution systems.

The present EPA limit of chlorine in water systems is 4.0 ppm. The amount of chlorine used to process waste may be higher than this.

Many states also establish limits on the amount of chlorine that can be discharged into a body of water after waste processing. These usually are less than 0.1 ppm. The low detection limit of the TC3000we/wi makes it ideal for such measurements. Because of its wide range, the TC3000we/wi can be used to measure the water used in the wastewater process, in a distribution system and for many low level discharge requirements.

HOW IS CHLORINE MEASURED?

The most common methods for measuring chlorine are colorimetric methods. In colorimetric methods, chlorine reacts with reagents added to a water sample. The reaction of the chlorine with the reagents produces a color. The intensity of the color produced is proportional to the concentration of chlorine in the sample. The intensity of the color can be measured by visual comparison with a calibrated color chart or other types of visual color comparators. Visual methods suffer due to the subjective observations of the person judging the colors.

The TC3000we/wi uses EPA approved DPD reagents to react with chlorine. In the absence of iodide, free available chlorine reacts instantly with DPD to produce a pink color. Subsequent addition of potassium iodide (DPD 3) causes a reaction with the combined form of chlorine. The TC3000we/wi electronically measures the color produced in these reactions in comparison to a colorless water sample. First it measures the intensity of a light beam passing through a clear colorless sample, the blank. Then it measures the intensity of light passing through the pink reacted sample. The TC3000we/wi uses the ratio of these two measurements to calculate the concentration of chlorine and displays the result. The TC3000we/wi uses the EPA approved wavelength of
525 nm to make these measurements.

TAKING CHLORINE WATER SAMPLES

Chlorine solutions are not stable and should be analyzed immediately. Samples may be collected in glass. Amber or opaque bottles are recommended since exposure to sunlight or agitation will decrease chlorine concentrations. Since agitation will also decrease chlorine concentrations, it is best to fill bottles completely to assure there is no air space in the container. If sampling from a tap, allow the water to run for a minute to assure a representative sample.

■ COLOR

WHAT IS COLOR?

Many different dissolved or suspended materials contribute to the color of water. These can include industrial wastes, plant materials, metals and plankton. There are two terms used to define color. If one examines a water sample straight from a water source, the color of the water is its apparent color. The color of the water without the contribution of suspended substances is called true color. True color can decrease after precipitation and increase in drier weather.

Some bodies of water can change color quickly, depending on the runoff conditions and plant life around them. Wind can also stir up substances more in shallower bodies of water causing quick color change. Major contributors are tannins, hemic acids and inorganic minerals. Color can be critical, since as the color increases, the amount of light that penetrates the water decreases, and thus submerged plant life, that depend on this light for photosynthesis, will decrease.

HOW IS COLOR MEASURED?

Since most natural waters have color that is similar to a solution of chloroplatinate and cobalt, the APHA specifies the use of dilute chloroplatinate/cobalt color standards to define color values. In the APHA method, the color of a water sample is compared visually to 6 to 9 chloroplatinate/cobalt standards. However, visual methods suffer due to the subjective observations of the person judging the colors. To eliminate this source of error, color can be measured electronically with a spectrophotometer or a colorimeter like the TC3000we/wi.

The TC3000we/wi is calibrated with APHA color standards at 428 nm. The meter electronically measures color in comparison to a colorless water sample. First it measures the intensity of a light beam passing through a clear colorless sample, the blank. Then it measures the intensity of light passing through the colored sample. The TC3000we/wi uses the ratio of these two measurements to calculate the color and displays the result. The results are expressed in APHA color units (cu).

There is no standard wavelength for measuring color, and it is common for meters to use different wavelengths. Since chloroplatinate/cobalt standards will have different absorbance values at various wavelengths, comparing results from the TC3000we/wi to meters using wavelengths other than 428 nm is not valid.

Meters using different wavelengths will only give the same reading when measuring chloroplatinate/cobalt standards since they are both calibrated to those standards. When measuring natural water, meters using different

wavelengths should not be expected to give the same result because the absorbance spectrum of natural water is usually not identical to the absorbance spectrum of chloroplatinate/cobalt standards. The reading that the meter displays is a correlation between the color of the sample water and the color standards at a fixed wavelength. The correlation and reading will change as the wavelength changes.

TAKING COLOR WATER SAMPLES

Samples should ideally be collected in glass containers. Perform the analysis soon after sampling since the color may change with time. For true color determinations, remove turbidity by filtration or centrifugation.

■ SAMPLE DILUTION TECHNIQUES

If a test result is out of the range of the meter, it must be diluted. The test should then be repeated on the diluted sample. The following table gives quick reference guidelines for dilutions of various proportions.

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

All dilutions are based on a final volume of 10 mL, so several dilutions will require small volumes of the water sample. Graduated pipets should be used for all dilutions. If volumetric glassware is not available, dilutions can be made with the colorimeter tube. Fill the tube to the 10 mL line with the sample and then transfer it to another container. Add 10 mL volumes of deionized water to the container and mix. Transfer 10 mL of the diluted sample to the colorimeter tube and follow the test procedure. Repeat the dilution and testing procedures until the result falls within the range of the calibration. Multiply the test result by the dilution factor. For example, if 10 mL of the sample water is diluted with three 10 mL volumes of deionized water, the dilution factor is four. The test result of the diluted sample should be multiplied by four.

OPTIONS & SET UP

■ FACTORY DEFAULT SETTINGS

Settings that have user options have been set at the factory to default settings.

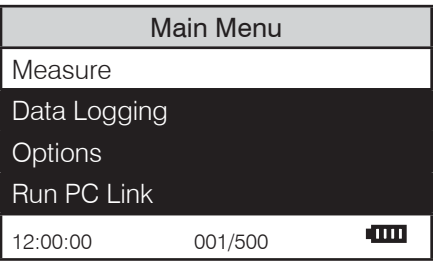
The factory default settings are:

Averaging	Disabled
Turbidity Units	NTU/FTU
Turbidity Calibration	Formazin
Chlorine Units	ppm
Chlorine Calibration	Tablet
Date Format	MM-DD-YYYY
Power Save	5 minutes
Backlight	10 seconds
Language	English

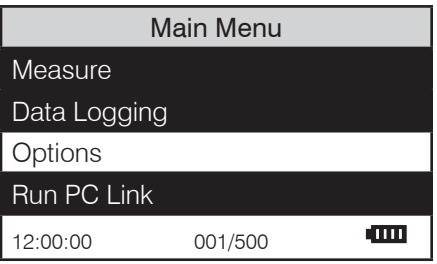
■ AVERAGING

The averaging option allows the user to average multiple readings. This option will improve the accuracy of samples with readings that may tend to drift with time. When the two, five or ten measurement option has been selected the final average is displayed. The averaging option is available only for turbidity. The default setting is disabled. To change the setting:

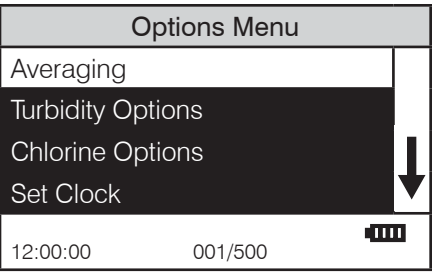
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



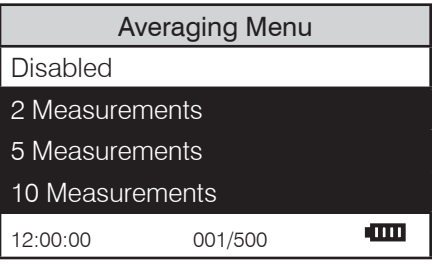
2. Press ⌄ to scroll to **Options**.



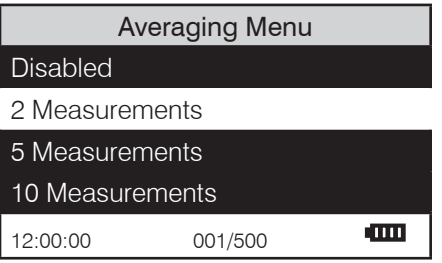
3. Press ENTER to select **Options**.



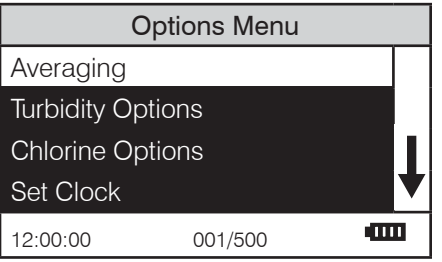
4. Press ENTER to select **Averaging**.



5. Press ^ or v to scroll to the desired option.



6. Press ENTER to save the selection. The screen will display **Storing...** for about 1 second and return to the **Options Menu**.



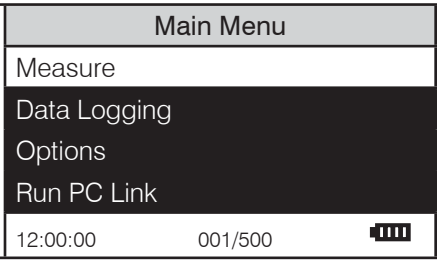
NOTE: When the **Averaging** option is enabled, more time will be required to display a reading and more power will be used.

■ TURBIDITY

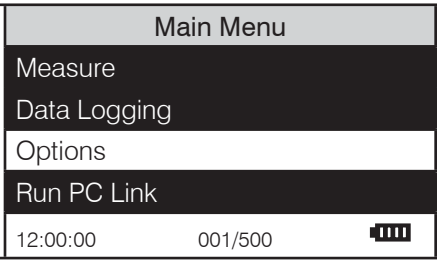
The default units are NTU and FNU and the default calibration curve is formazin. NTU will be used in this example. To change the settings:

SELECTING TURBIDITY UNITS

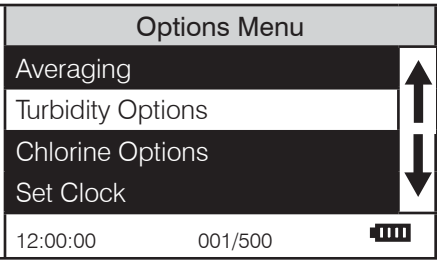
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



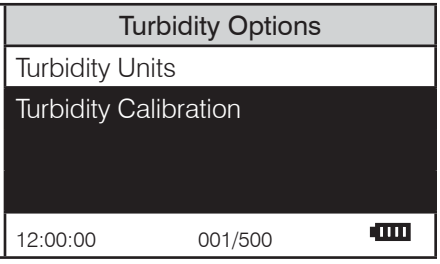
2. Press ▼ to scroll to **Options**.

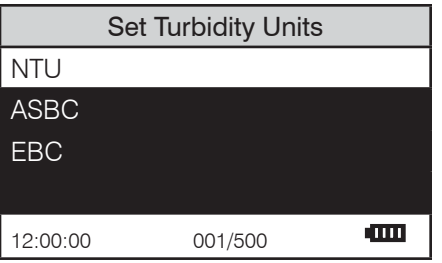


3. Press ENTER to select **Options**. Press ▼ to scroll to **Turbidity Options**.

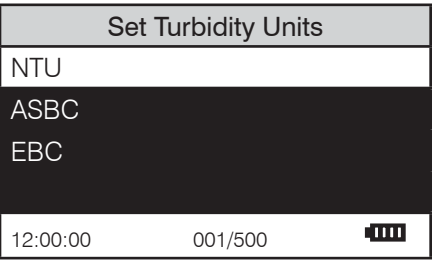
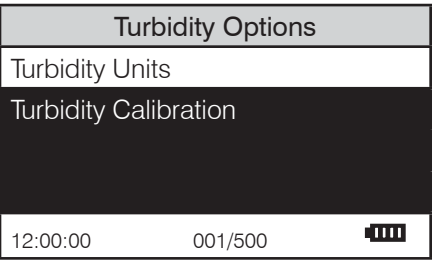


4. Press ENTER to select **Turbidity Options**.



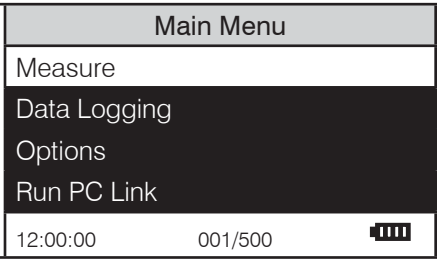
5. Press ENTER to select **Turbidity Units**.	

Available units are:
NTU (Nephelometric Turbidity Units)(TC3000we only)
FNU (Formazin Nephelometric Units) (TC3000wi only)
ASBC (American Society of Brewing Chemists)
EBC (European Brewery Convention)
NOTE: The meter will automatically switch to the attenuation mode above 600 NTU or FNU. In Attenuation mode, measurements will be made with the 180° detector only, as indicated by AU (attenuation units) or FAU (formazin anttenuation units) on the display. AU and FAU are numberically equivalent to NTU. See page 15 for definitions of turbidity units.

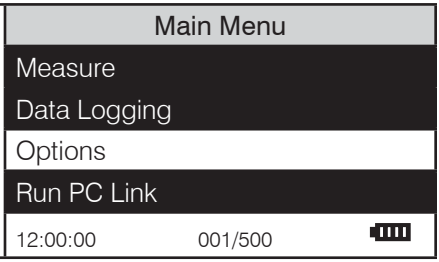
6. Press ^ or v to scroll to the desired units.	
7. Press ENTER to save the selection. The screen will display **Storing...** for about 1 second and return to the **Turbidity Options** menu. Press EXIT to return to a previous menu.	

Selecting a Turbidity Calibration Curve

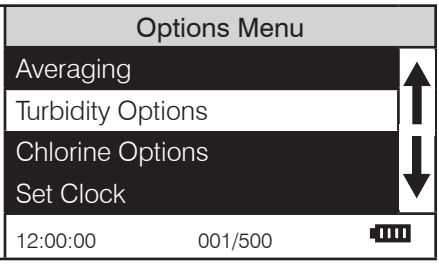
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



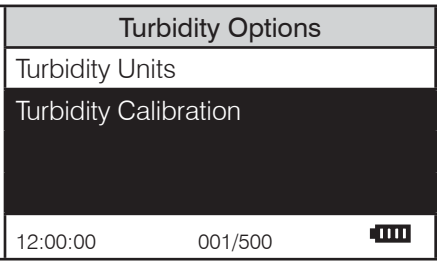
2. Press ▼ to scroll to **Options**.



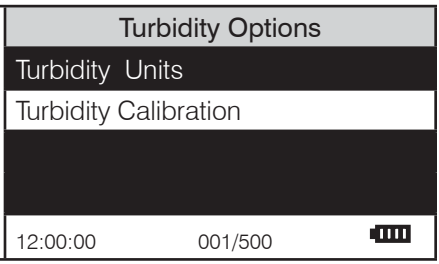
3. Press ENTER to select **Options**. Press ▼ to scroll to **Turbidity Options**.

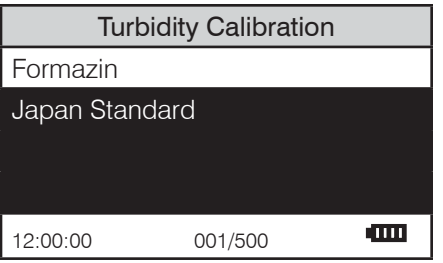


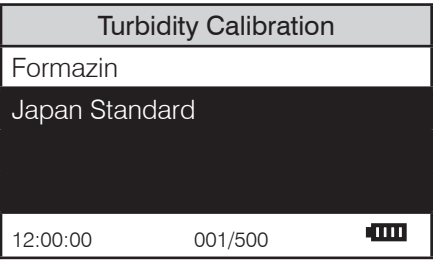
4. Press ENTER to select **Turbidity Options**.



5. Press ▼ to scroll to **Turbidity Calibration**.

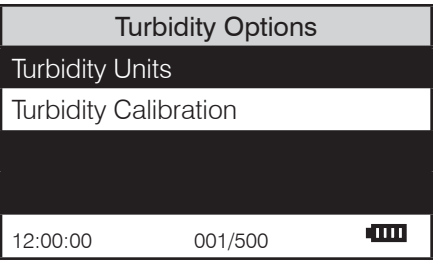


6. Press ENTER to select **Turbidity Calibration**.	

7. Scroll to the desired calibration option. Select a calibration option based on the composition of the standards that will be used to calibrate the meter.	

NOTE: Stablcal® standards below 50 NTU should not be used to calibrate the TC3000we/wi. The diluent has a different refractive index than traditional formazin standards and will affect the results.

NOTE: The Japan Standard calibration is no longer supported.

8. Press ENTER to save the selection. The screen will display **Storing...** for about 1 second and return to the **Turbidity Options** menu. Press EXIT to return to a previous menu.	

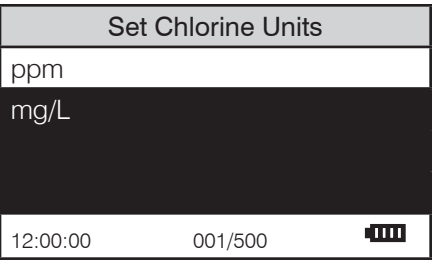
■ CHLORINE

The default units are ppm and the default calibration curve is for DPD Tablet reagents. To change the setting:

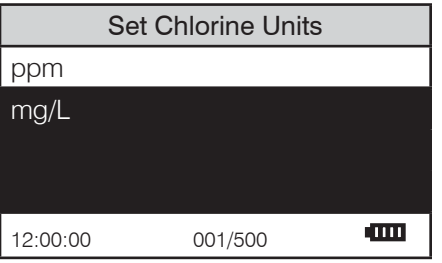
SELECTING CHLORINE UNITS

1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.	Main Menu Measure Data Logging Options Run PC Link 12:00:00 001/500
2. Press ⌄ to scroll to **Options**.	Main Menu Measure Data Logging Options Run PC Link 12:00:00 001/500
3. Press ENTER to select **Options**. Press ⌄ to scroll to **Chlorine Options**.	Options Menu Averaging Turbidity Options Chlorine Options Set Clock 12:00:00 001/500
4. Press ENTER to select **Chlorine Options**.	Chlorine Options Chlorine Units Chlorine Calibration 12:00:00 001/500

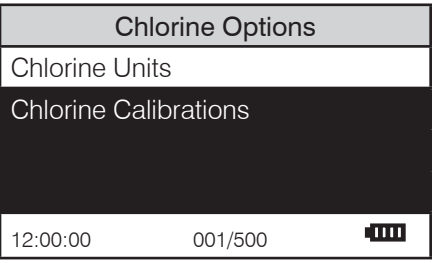
5. Press ENTER to select **Chlorine Units**. Available units are: ppm (parts per million) and mg/L (milligrams per liter).



6. Press ^ v to scroll to desired units.

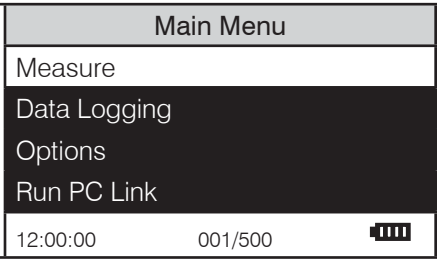


7. Press ENTER to save selection. The screen will display **Storing...** for about 1 second and return to the **Chlorine Options** menu. Press EXIT to return to a previous menu.

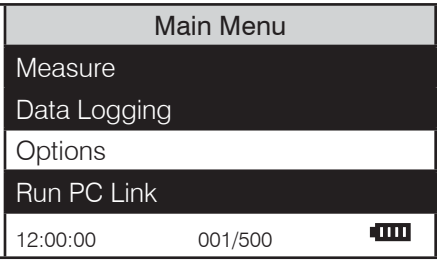


SELECTING A CHLORINE CALIBRATION REAGENT SYSTEM

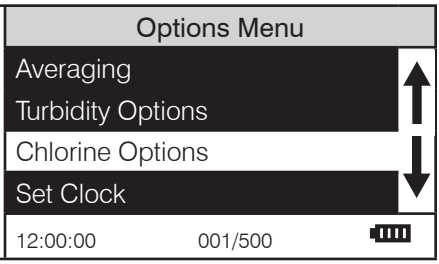
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



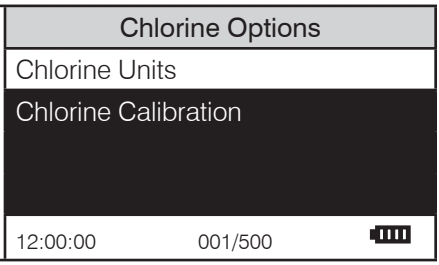
2. Press ▼ to scroll to **Options**.



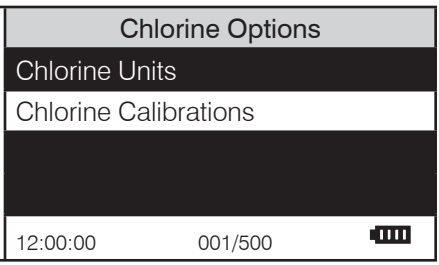
3. Press ENTER to select **Options**. Press ▼ to scroll to **Chlorine Options**.



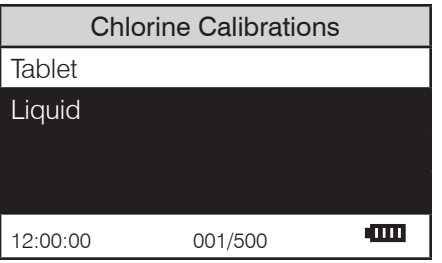
4. Press ENTER to select **Chlorine Options**.



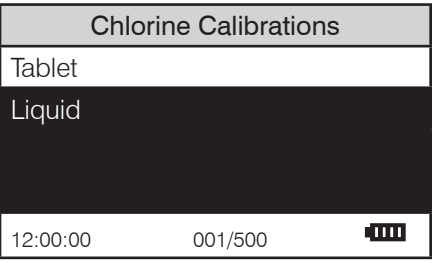
5. Press ▼ to scroll to **Chlorine Calibrations**.



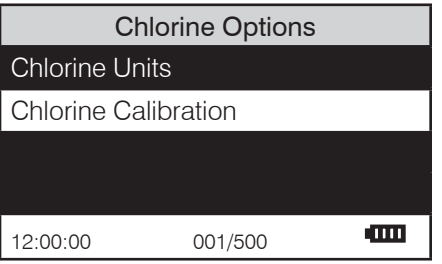
6. Press ENTER to select **Chlorine Calibration** method.



7. Press ▲ or ▼ to scroll to the desired option. Select a reagent option based on the reagent system that will be used to calibrate the meter and take readings of reacted samples.

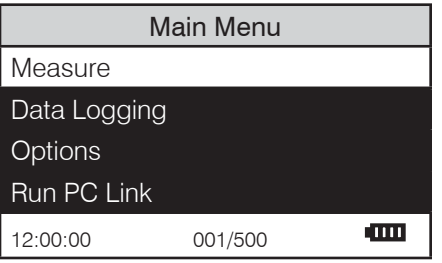


8. Press ENTER to save the selection. The screen will display **Storing...** for about 1 second and return to the **Chlorine Options** menu. Press EXIT to return to a previous menu.

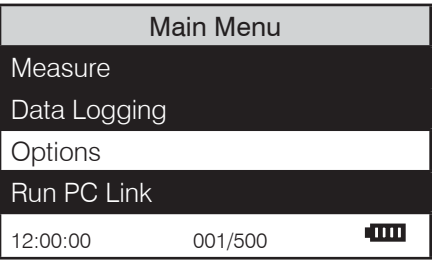


■ SETTING THE CLOCK

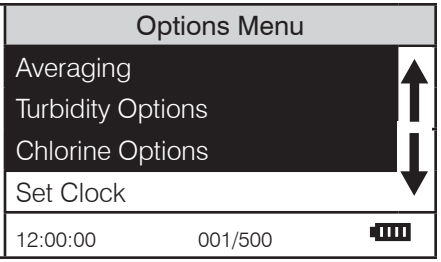
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



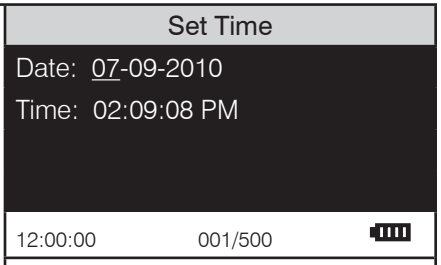
2. Press ▼ to scroll to **Options**.



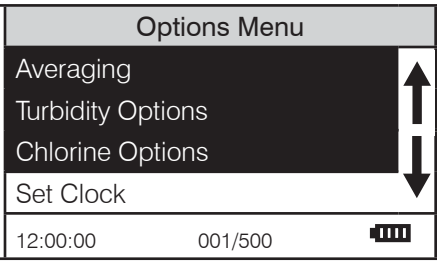
3. Press ENTER to select **Options**. Press ▼ to scroll to **Set Clock**.



4. Press ENTER to select **Set Clock**. The date is displayed as month-day-year. The time is displayed as hours:minutes:seconds AM/PM. Press ▲ or ▼ to the appropriate character and press ENTER to select. The cursor will move to the next character. Set all characters in the same manner. This is a scrolling menu.



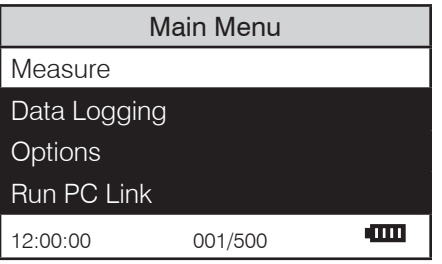
5. Press ENTER to select the final character. The time and date will be saved and the screen will return to the **Options Menu**.



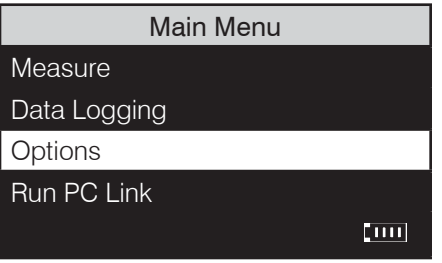
■ SETTING POWER SAVE

The power saving Auto Shutoff feature will turn the meter off when a button has not been pushed for a set amount of time. The default setting is 5 minutes. To change the setting:

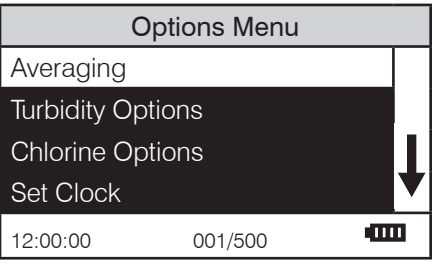
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



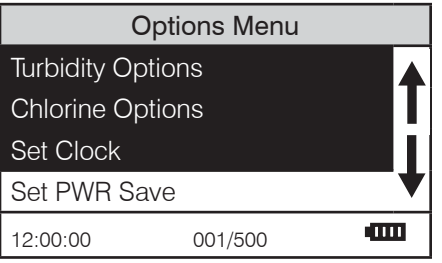
2. Press ▼ to scroll to **Options**.

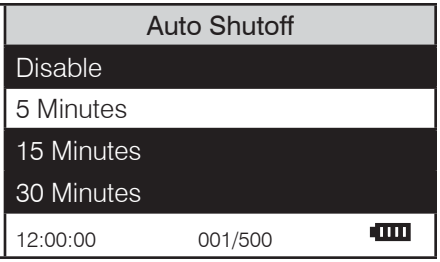
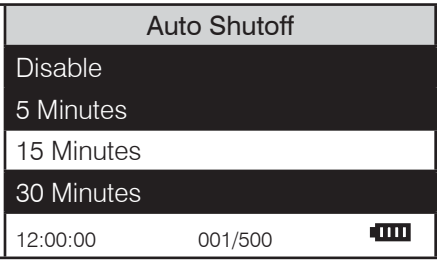
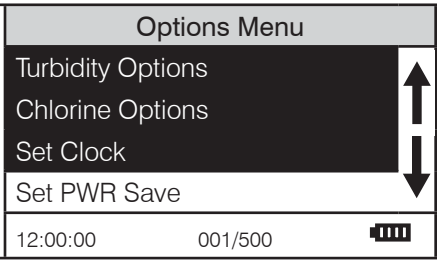


3. Press ENTER to select **Options**.



4. Press ▼ to scroll to **Set PWR Save.**



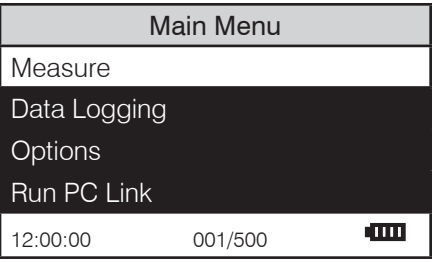
5. Press ENTER to select **PWR Save**.	
6. Press ▲ or ▼ to scroll to desired setting.	
7. Press ENTER to save the selection. The screen will display **Storing...** for about 1 second and return to the **Options Menu**.	

■ SETTING THE BACKLIGHT TIME

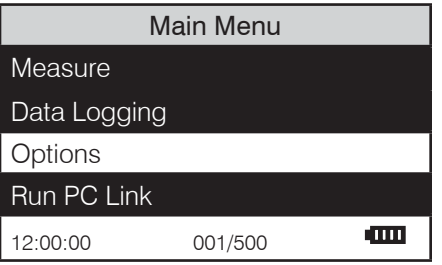
The backlight illuminates the display for enhanced viewing. If Button Control is chosen the backlight button on the key pad will act as an on/off switch and the backlight will remain on or off when the meter is being used. When one of the other settings – 10, 20 or 30 seconds – is chosen, the display will be illuminated for the specified amount of time after any button is pressed. As a precaution, the backlight will not illuminate during turbidity measurements to avoid interference from stray light.

NOTE: The backlight feature uses a significant amount of power. The longer the backlight is on, the more frequently the battery will have to be charged if the USB/Wall Charger is not being used.

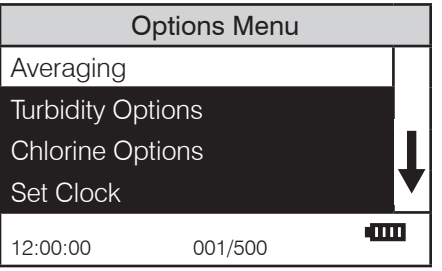
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



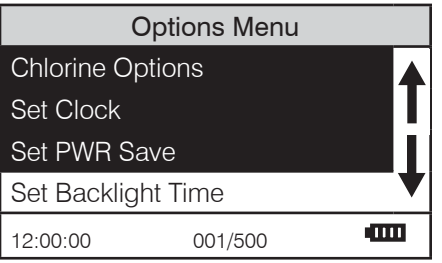
2. Press ▼ to scroll to **Options**.



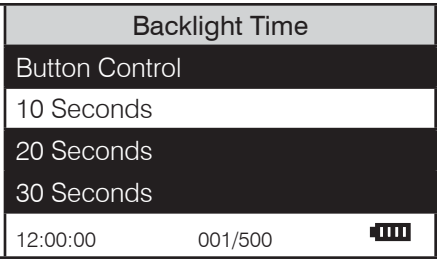
3. Press ENTER to select **Options**.



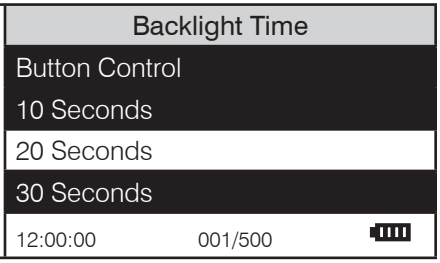
4. Press ▼ to scroll to **Set Backlight Time.**



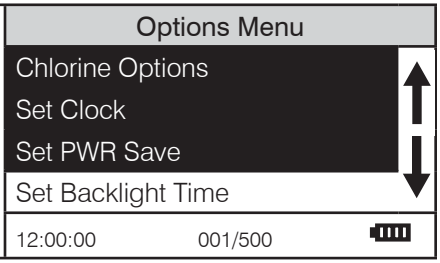
5. Press ENTER to select **Set Backlight Time.**



6. Press ▲ or ▼ to scroll to desired setting.



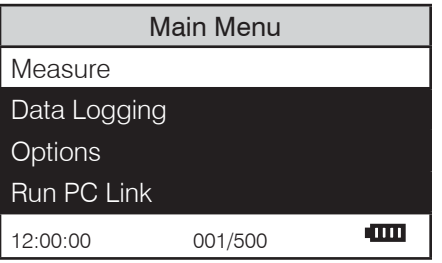
7. Press ENTER to save the selection. The screen will display **Storing...** for about 1 second and return to the **Options Menu**.



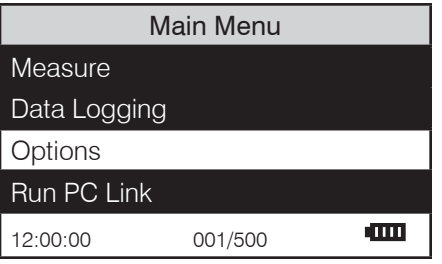
■ FACTORY RESET

Performing a Factory Reset will restore the factory default settings. All user-level calibrated settings will be lost.

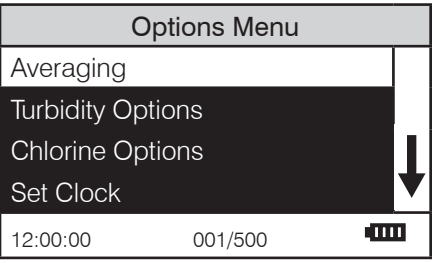
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



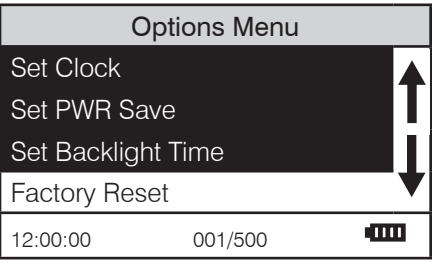
2. Press ▼ to scroll to **Options**.



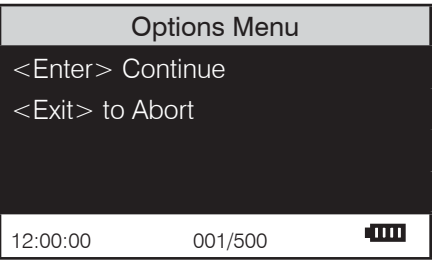
3. Press ENTER to select **Options**.



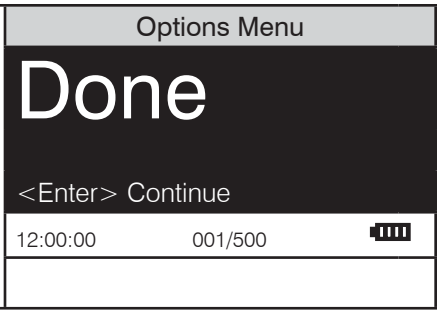
4. Press ▼ to scroll to **Factory Reset.**



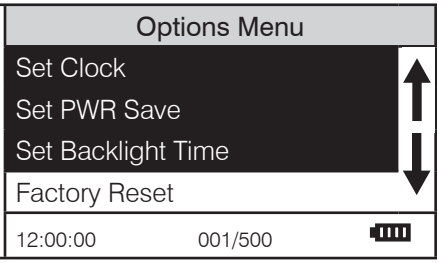
5. Press ENTER to select to **Factory Reset.**



6. Press ENTER to complete the Factory Reset. The screen will momentarily display **Writing**. The screen will display **Done** and return to the **Options Menu.** To retain the current user level calibration settings, press EXIT to abort the Factory Reset.



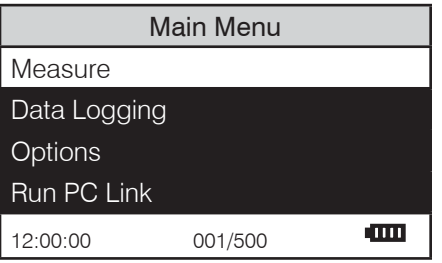
7. Press ENTER to return to the **Options Menu.**



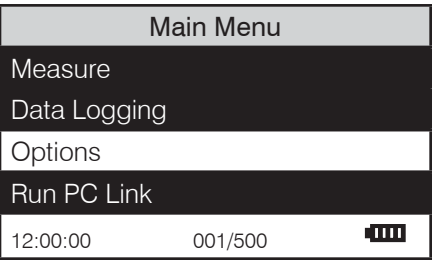
■ SELECTING A LANGUAGE

There are seven languages available in the TC3000we/wi: English, Spanish, French, Portuguese, Italian, Chinese, and Japanese (Kana).

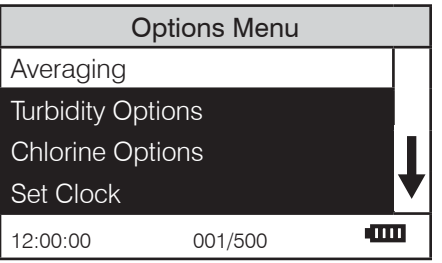
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



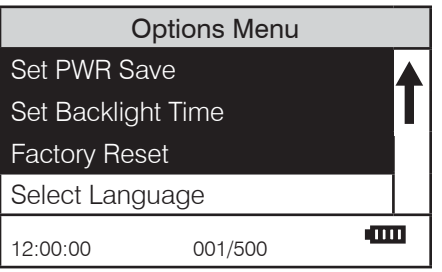
2. Press ▼ to scroll to **Options**.



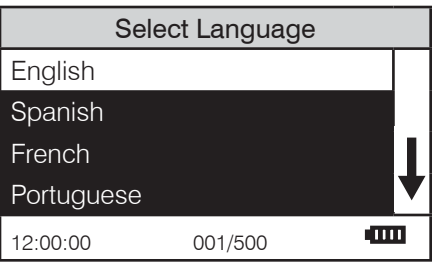
3. Press ENTER to select **Options**.

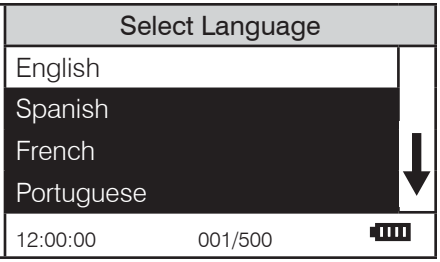


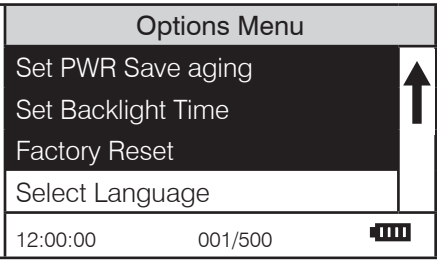
4. Press ▼ to scroll to **Select Language.**



5. Press ENTER to select to **Select Language**.



6. Press ^ or v to scroll to desired language.	

7. Press ENTER to select desired language. The screen will momentarily display, **Storing...**for about 1 second and return tot the **Options Menu**.	

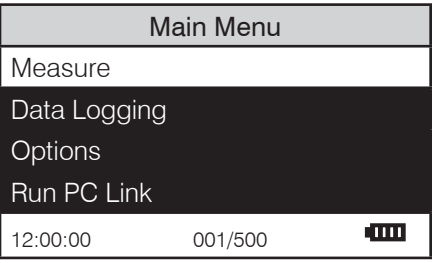
NOTE: If the meter unintentionally switches to another language, use the procedure above to reset the meter to the desired language. For example, to reset the meter to English:

1. Turn the meter on.
2. Press down arrow twice. Press ENTER.
3. Press down arrow seven times. Press ENTER.
4. Press ENTER.

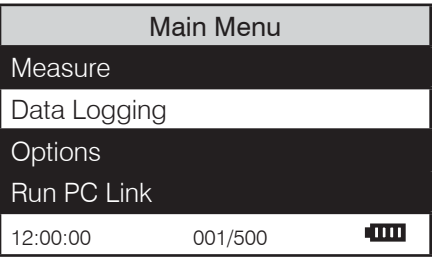
DATA LOGGING

The default setting for the data logger is enabled. The meter will log the last 500 data points. The counter in the center bottom of the display will show how many data points have been logged. The display will show 500+ when the data logger has exceeded 500 points and the data points are being overwritten.

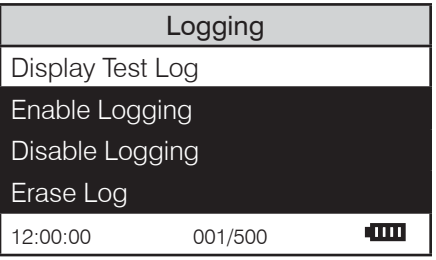
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



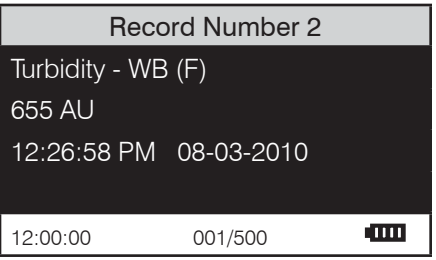
2. Press ▼ to scroll to **Data Logging**.

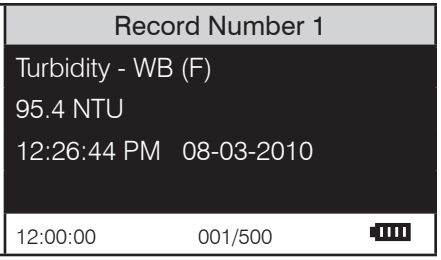


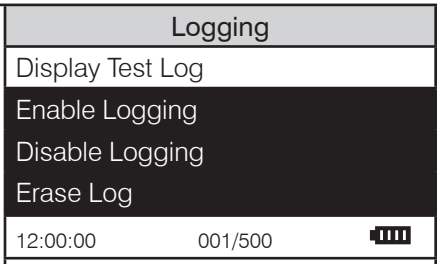
3. Press ENTER to select **Data Logging**.



4. Press ENTER to display the last data point and the time that it was logged.



5. Press ^ or v to scroll through the data points in the log.	

6. Press EXIT to return to the **Logging** menu. Press ^ or v to scroll to disable the logging options or erase the log. Press ENTER to select the option. The screen will display **Storing...** for about 1 second and return to the **Logging Menu**.	

■ TURBIDITY

CALIBRATION

Turbidity Standards

Only use AMCO or formazin standards with the TC3000we/wi. StablCal® standards below 50 NTU should not be used to calibrate the TC3000we/wi. The diluent used in the StablCal® standards has a different refractive index than traditional formazin standards and will affect the results. The concentration of the calibration standard should be similar to the expected concentration of sample that will be tested. The following standards are available from LaMotte Company:

1480 0 NTU/FNU Standard, 60 mL (EPA or ISO)

1450 1 NTU Standard, 60 mL (EPA)

1453 1 FNU Standard, 60 mL (ISO)

1451 10 NTU Standard, 60 mL (EPA)

1454 10 FNU Standard, 60 mL (ISO)

1452 100 NTU Standard, 60 mL (EPA)

1455 100 FNU Standard, 60 mL (ISO)

Turbidity Calibration Procedure

The default units are NTU or FNU and the default calibration curve is formazin as indicated by (F) in the Menu bar. A TC3000we, which uses NTU will be used in the following examples. For the most accurate results, a user calibration should be performed. The Japan Standard calibration mode, as indicated by (J) in the Menu bar, is no longer supported.

For the most accurate results, perform a calibration over the smallest range possible. **Use a calibration standard that, along with the blank, brackets the range of the samples that will be tested.** For example, if the samples that are to be tested are expected to be below 1 NTU, more accurate results will be obtained by calibration with a blank and a 1 NTU standard as opposed to a blank and a 100 NTU standard.

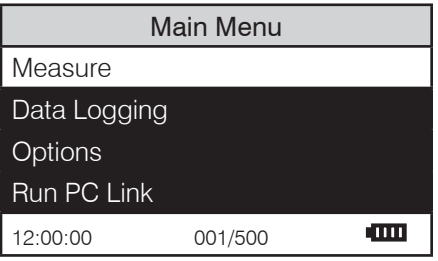
The meter has five measuring ranges:

0 – 11 NTU/FTU
11 – 110 NTU/FTU
110-300 NTU/FTU
300-600 NTU/FTU
600-4000 NTU/FTU

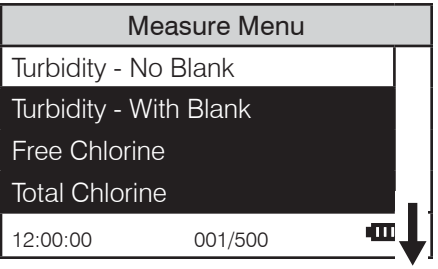
Each range can be calibrated with one point per range. (Six points total - a blank plus one point in each of the five ranges - if each range is calibrated.) New calibration points will replace old calibration points independently for each range. If one range is recalibrated, the meter will retain the old calibration data for the other ranges. It is recommended that the meter be calibrated for each range that will be used. The value of the standards chosen for the calibration should not be at the extremes of the ranges (11, 110, 300, 600 NTU/FTU). The meter is auto-ranging and will automatically select the appropriate range for the sample being tested.

It is recommended that the meter be calibrated daily.

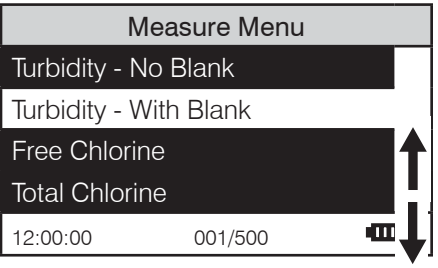
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



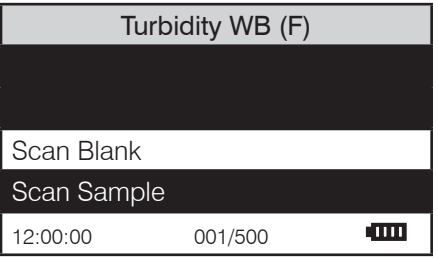
2. Press ENTER to select **Measure**.

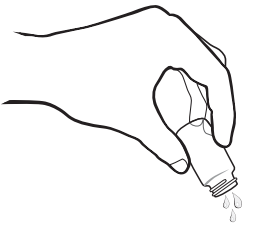
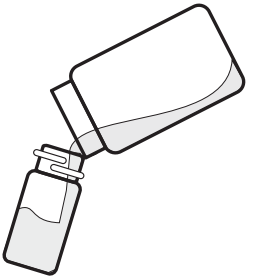
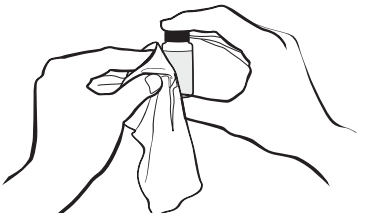
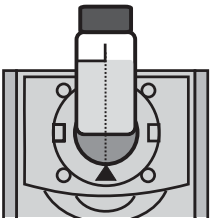


3. Press ▼ to scroll to **Turbidity - With Blank**.

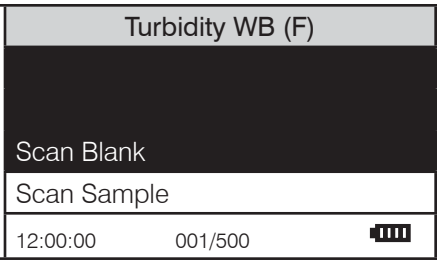


4. Press ENTER to select **Turbidity - With Blank.**

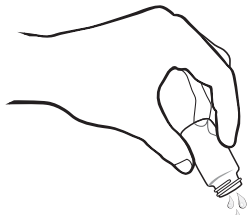


5. Rinse a clean tube (0290) three times with the blank. If samples are expected to read below 1 NTU the meter should be blanked with a 0 NTU Primary Standard or prepared turbidity-free (<0.1 NTU) water. For the most accurate results, use the same tube for the blank and the sample.	
6. Fill the tube to the fill line with the blank. Pour the blank down the inside of the tube to avoid creating bubbles. Cap the tube.	
7. Wipe the tube thoroughly with a lint-free cloth.	
8. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.	

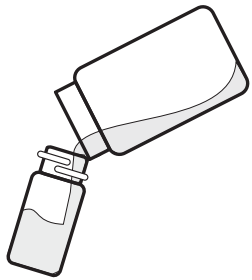
9. Press ENTER to scan the blank. The screen will display **Blank Done** for about 1 second and then return to the **Turbidity - With Blank Menu**.



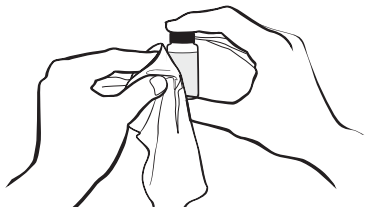
10. Rinse a clean tube (0290), or the same tube, three times with the standard.



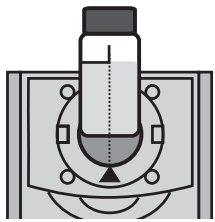
11. Fill the tube to the fill line with the standard. Pour the standard down the inside of the tube to avoid creating bubbles. Cap the tube.



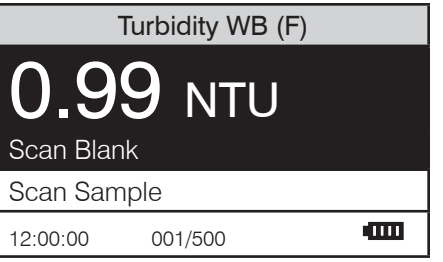
12. Wipe the tube thoroughly with a lint-free cloth.



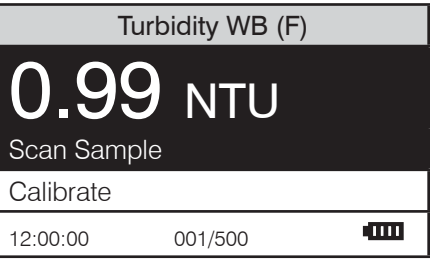
13. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.



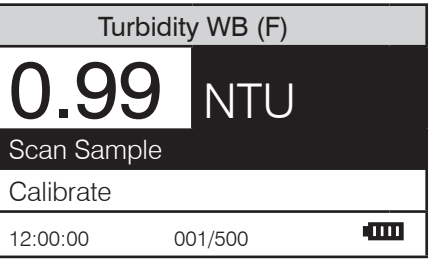
14. Press ENTER to scan the standard. The screen will display **Reading** for about 1 second. The result will appear on the screen.



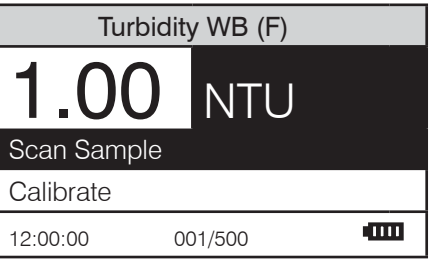
15. Press ▼ to scroll to **Calibrate**.



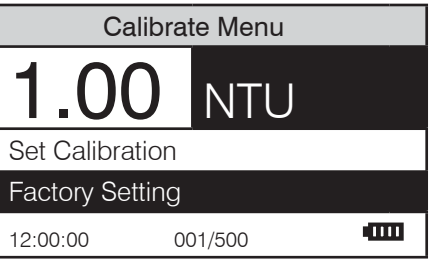
16. Press ENTER to select **Calibrate**. A reverse font (light background with dark characters) will appear to indicate that the reading can be adjusted.

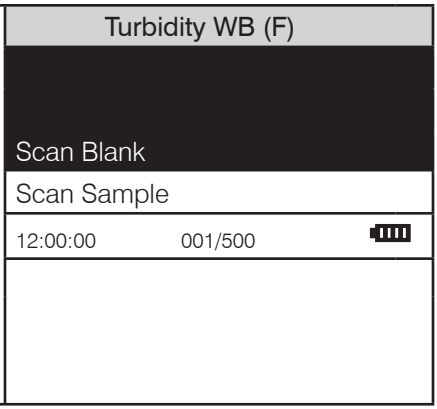


17. Press ▲ or ▼ to scroll to the concentration of the standard, 1.00 in the example. Note: The allowable adjustment is ±20%.



18. Press ENTER to select **Calibrate**. Two menu choices will be offered, **Set Calibration** and **Factory Setting**.

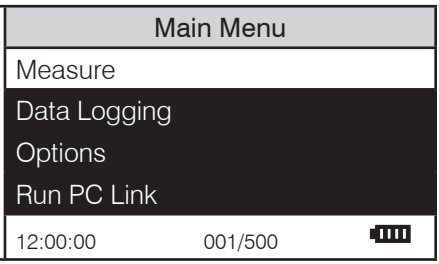
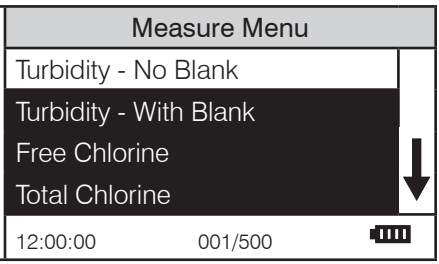


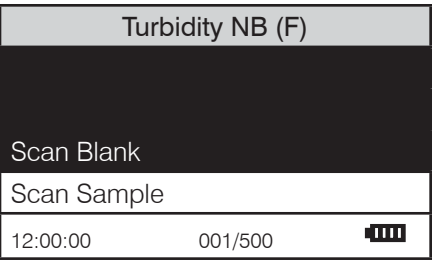
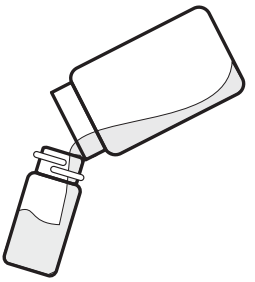
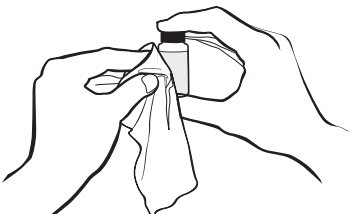
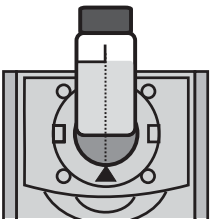
19. Press ENTER to select **Set Calibration** and save the calibration. Press ^ or v to scroll and select **Factory Setting** to revert to the factory calibration. The meter will momentarily display **Storing...** and return to the **Turbidity -With Blank** menu. The calibration has now been saved and the meter can be used for testing.	

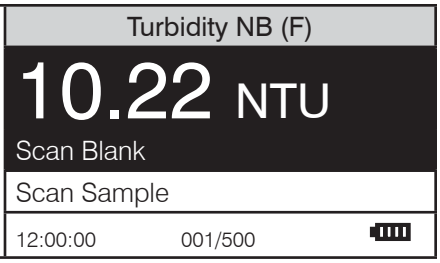
NOTE: For the greatest accuracy during the calibration procedure, be sure that after the meter is blanked and the blank is scanned as a sample, the reading is 0.00. If not, reblank the meter and scan the blank again until it reads 0.00. When scanning the calibration standards as the sample, scan the calibration standard three times removing the tube from the chamber after each scan and reinserting the tube in the chamber with the same orientation. The readings should be consistent. Use the last consistent reading to calibrate the meter. If the readings are not consistent, avoid using an aberrant reading to calibrate the meter.

ANALYSIS WITHOUT BLANKING PROCEDURE

To obtain the most accurate results the meter should be blanked before measuring a sample. The blanking step is not as critical for samples above 10 NTU. The meter should always be blanked before reading samples below 10 NTU.

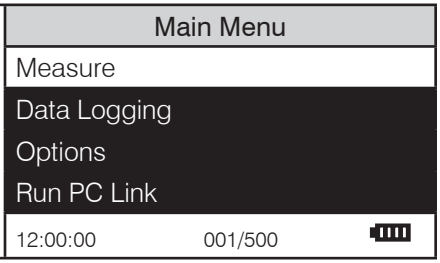
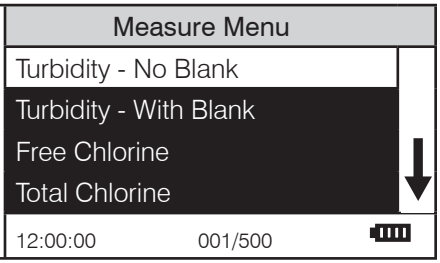
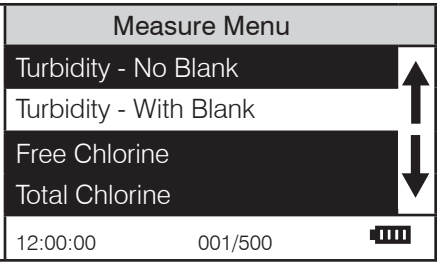
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.	
2. Press ENTER to select **Measure**.	

3. Press ENTER to select **Turbidity - No Blank**.	
4. Rinse a clean tube (0290) three times with the sample.	
5. Fill the tube to the fill line with the sample. Pour the sample down the inside of the tube to avoid creating bubbles. Cap the tube.	
6. Wipe the tube thoroughly with a lint-free cloth.	
7. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.	

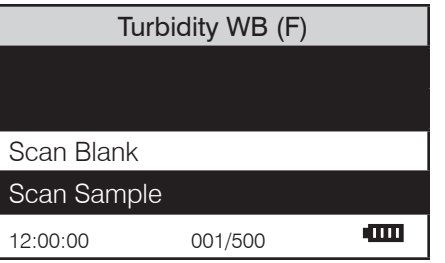
8. Press ENTER to select **Scan Sample**. The screen will display **Reading** for about 1 second. The result will appear on the screen.	

ANALYSIS WITH BLANKING PROCEDURE

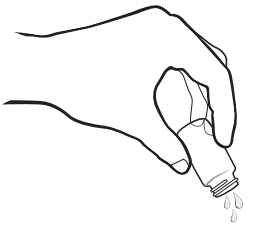
To obtain the most accurate results the meter should be blanked before measuring a sample. The blanking step is not as critical for samples above 10 NTU. The meter should always be blanked before reading samples below 10 NTU.

1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.	
2. Press ENTER to select **Measure**.	
3. Press ✓ to scroll to **Turbidity - With Blank**.	

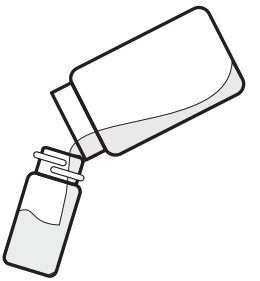
4. Press ENTER to select **Turbidity - With Blank**.



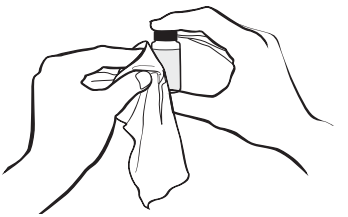
5. Rinse a clean tube (0290) three times with the blank. If samples are expected to read below 1 NTU the meter should be blanked with a 0 NTU Primary Standard or prepared turbidity-free (<0.1 NTU) water. For the most accurate results, use the same tube for the blank and the sample.



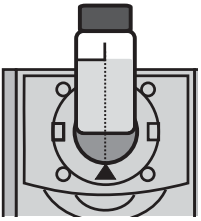
6. Fill the tube to the fill line with the blank. Pour the blank down the inside of the tube to avoid creating bubbles. Cap the tube.



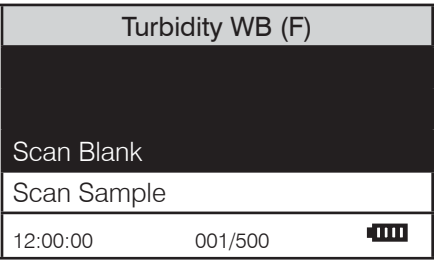
7. Wipe the tube thoroughly with a lint-free cloth.



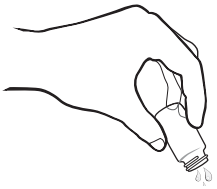
8. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.



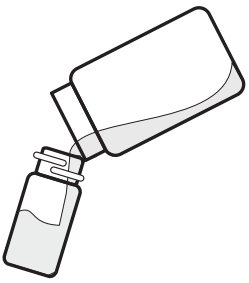
Press ENTER to scan the blank. The screen will display **Blank Done** for about 1 second and then return to the **Turbidity - With Blank** menu.



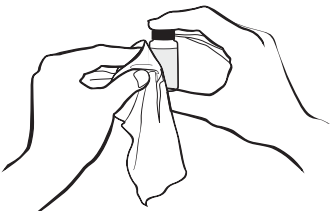
9. Rinse a clean tube (0290), or the same tube, three times with the sample.

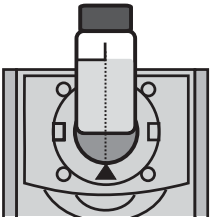


10. Fill the tube to the fill line with the standard. Pour the standard down the inside of the tube to avoid creating bubbles. Cap the tube.



11. Wipe the tube thoroughly with a lint-free cloth.



12. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.	

13. Press ENTER to scan the standard. The screen will display **Reading** for about 1 second. The result will appear on the screen.	Turbidity WB (F) 0.99 NTU Scan Blank Scan Sample 12:00:00 001/500

NOTE: The meter will remember the last scanned blank reading. It is not necessary to scan a blank each time the test is performed. To use the previous blank reading, instead of scanning a new one, scroll to Scan Sample and proceed. For the most accurate results, the meter should be blanked before each test and the same tube should be used for the blank and the reacted sample.

DILUTION PROCEDURES

If a sample is encountered that is more than 4000 NTU or FNU, a careful dilution with 0 NTU/FNU or very low turbidity water will bring the sample into an acceptable range. However, there is no guarantee that halving the concentration will exactly halve the NTU/FNU value. Particulates often react in an unpredictable manner when diluted.

Turbidity-Free Water

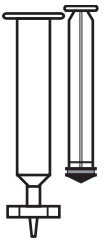
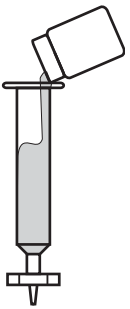
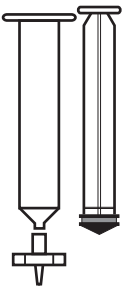
The definition of low turbidity and turbidity-free water has changed as filter technology has changed and nephelometric instruments have become more sensitive. At one time turbidity-free water was defined as water that had passed through a 0.6 micron filter. Now 0.1 micron filters are available and higher purity water is possible. Water that has been passed through a 0.1 micron filter could be considered particle free and therefore turbidity free, 0 NTU water. Turbidity is caused by scattered light. Therefore, low turbidity water is water without any particles that scatter a measurable amount of light. But water that passed through a 0.1 micron filter may still have detectable light scatter with modern instruments. This light scattering can be the result of dissolved molecules or sub-micron sized particles that can not be filtered out of the water. Because there may still be a small amount of scattered light from dissolved molecules, high purity water is often called low turbidity water and assigned a value of 0.01 or 0.02 NTU. However, because this water is used as a baseline to compare to sample water, the difference between the sample and the low turbidity or turbidity-free water will be the same whether it is called 0.00 NTU or 0.02 NTU. For

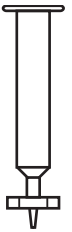
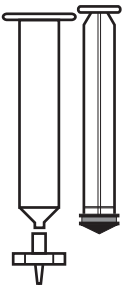
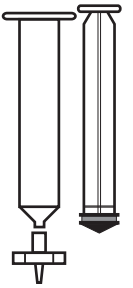
design simplicity the TC3000we/wi uses the term turbidity-free water and the value of 0.00 NTU.

PREPARATION OF TURBIDITY-FREE WATER

A 0 NTU/FNU Standard (Code 1480) is included with the meter. An accessory package (Code 4185) is available for preparing turbidity-free water for blanking the meter and dilution of high turbidity samples.

The preparation of turbidity-free water requires careful technique. Introduction of foreign matter will affect the turbidity reading. A filtering device with a special membrane filter is used to prepare turbidity-free water. The filter, filter holder and syringe must be conditioned by forcing at least two syringes full of deionized water through the filtering apparatus to remove foreign matter. The first and second rinses should be discarded. Turbidity-free water as prepared with the following procedure may be stored in the dark at room temperature in a clean glass bottle with a screw cap and used as required. The storage container should be rinsed thoroughly with filtered deionized water before filling. The water should be periodically inspected for foreign matter in bright light.

1. Remove the plunger from the syringe (0943). Attach the filter to the bottom of the syringe.	
2. Pour approximately 50 mL of deionized water into the barrel of the syringe. Insert the plunger. Exert pressure on the plunger to slowly force the water through the filter. Collect water in the clean storage container. Rinse walls of the container then discard this rinse water.	
3. Remove the filter from the syringe. Remove the plunger from the barrel. (This step is required to prevent rupturing the filter by the vacuum that would be created when the plunger is removed.)	

4. Replace the filter and repeat step 2 for a second rinse of the syringe and storage container.	
5. Remove the filter from the syringe. Remove the plunger from the barrel. Replace the filter and fill the syringe with approximately 50 mL of deionized water. Filter the water into the storage container and save this turbidity-free water.	
6. Repeat Step 5 until the desired amount of turbidity-free water has been collected.	

TESTING TIPS

1. Samples should be collected in a clean glass or polyethylene container.
2. Samples should be analyzed as soon as possible after collection.
3. Gently mix sample by inverting before taking a reading but avoid introducing air bubbles.
4. For the most precise results, follow the recommended procedure for wiping a filled tube before placing it in the meter chamber. Invert tube very slowly and gently three times to mix the sample. Surround the tube with a clean, lint-free cloth. Press the cloth around the tube. Rotate the tube in the cloth three times to assure that all areas of the tube have been wiped.
5. Discard tubes that have significant scratches and imperfections in the light pass zones. (Central zone between bottom and fill line).
6. When reading very low turbidity samples, do not use tubes or caps that have been used previously with high turbidity samples.
7. Use the averaging option for low level measurements of turbidity.

8. The meter should be placed on a surface that is free from vibrations. Vibrations can cause high readings.
9. Turbidity readings will be affected by electric fields around motors.
10. Carbon in the sample will absorb light and cause low readings.
11. Excessive color in a sample will absorb light and cause low readings. The user should verify if a certain level of color will cause a significant error at the level of turbidity being tested.
12. Observe shelf life recommendations for turbidity standards.
13. Do not use silicone oil on tubes when testing turbidity with the TC3000we/wi.
14. When testing at low concentrations use the same tube for the blank and the sample.
15. Always insert tube into the meter chamber with the same amount of pressure and to the same depth.
16. Occasionally clean the chamber with a damp lint-free wipe, followed by a Windex® dampened wipe. A clean chamber and tubes are essential for reliable results.
17. For the greatest accuracy during the calibration procedure, be sure that after the meter is blanked and the blank is scanned as a sample, the reading is 0.00. If not, reblank the meter and scan the blank again until it reads 0.00. When scanning the calibration standards as the sample, scan the calibration standard three times removing the tube from the chamber after each scan. The readings should be consistent. Use the last consistent reading to calibrate the meter. If the readings are not consistent, avoid using an aberrant reading to calibrate the meter.
18. Calibrate the meter daily.
19. Calibrate the meter with a standard that is closest to the expected range of the sample being tested. For example, if the sample is expected to be less than 1.0 NTU, calibrate with a 1.0 NTU standard and a blank (0 NTU standard). If the sample is expected to be around 2 NTU also calibrate with the 1.0 NTU standard but if the sample is expected to be around 8 NTU calibrate with a 10 NTU standard. If the sample is expected to be over 30 – 40 NTU it is recommended that the meter be calibrated with a 100 NTU standard.

■ CHLORINE

CALIBRATION

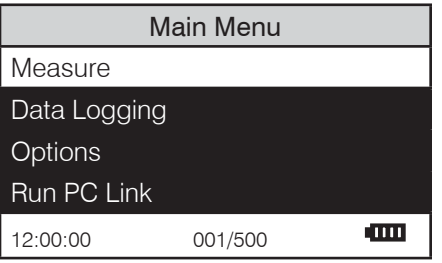
Chlorine Standards

The meter should be calibrated with free chlorine standards. The calibration should be done with a distilled or deionized water blank and one chlorine standard of known concentration. The concentration of the calibration standard should be similar to the expected concentration of the sample that will be tested. The default reagent system is DPD tablet reagents.

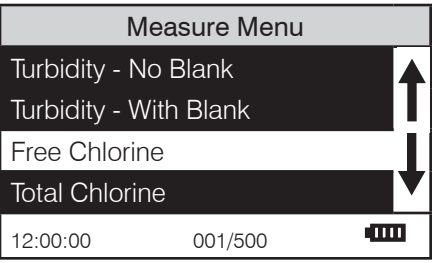
Chlorine Calibration Procedure
DPD Tablet Reagents

Select Tablet Calibration in the Options Menu.

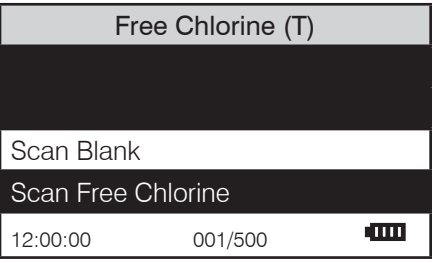
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



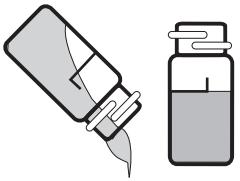
2. Press ENTER to select **Measure**. Press ⌄ to scroll to **Free Chlorine**.



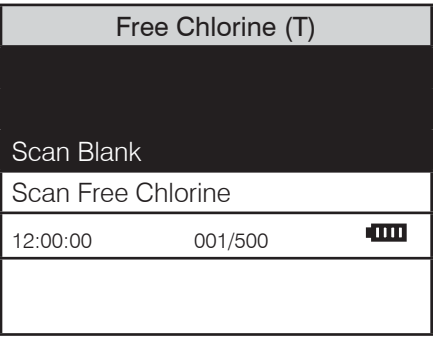
3. Press ENTER to select **Free Chlorine.**



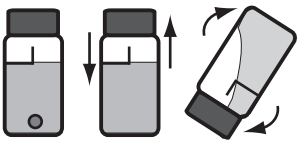
4. Rinse a clean tube (0290) three times with the chlorine standard. Fill the tube to the 10 mL line with the chlorine standard. Cap the tube. Dry the tube with a lint-free cloth.



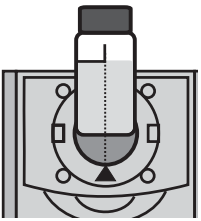
5. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid. Press ENTER to scan the blank. The screen will display **Blank Done** for about 1 second and then return to the **Free Chlorine** menu.



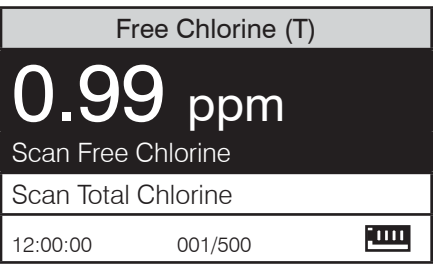
6. Remove the tube from the meter. Add one Chlorine DPD #1R Instrument Grade Tablet (6903A). Cap the tube. Shake for 10 seconds. Invert slowly 5 times. The solution will be pink if Free Chlorine is present.



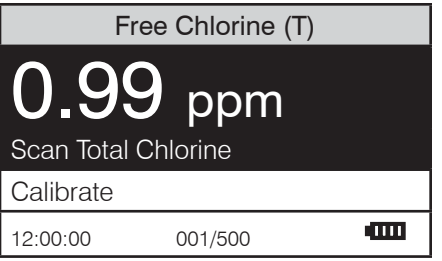
7. Immediately insert the tube into the meter. Align the index line on the tube with the index arrow on the meter. Close the lid.



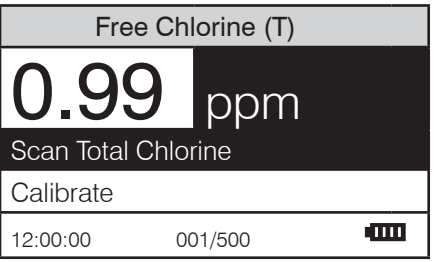
8. Press ENTER to scan the standard. The screen will display **Reading...** for about 1 second. The result will appear on the screen.



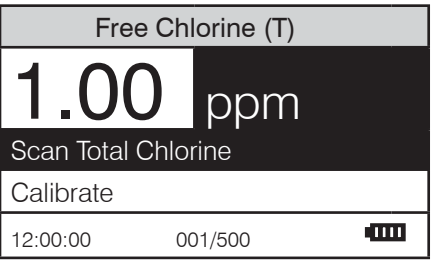
9. Press ▼ to scroll to **Calibrate**.



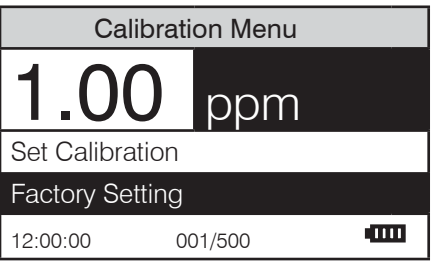
10. Press ENTER to select **Calibrate**. A reverse font (light background with dark characters) will appear to indicate that the reading can be adjusted.



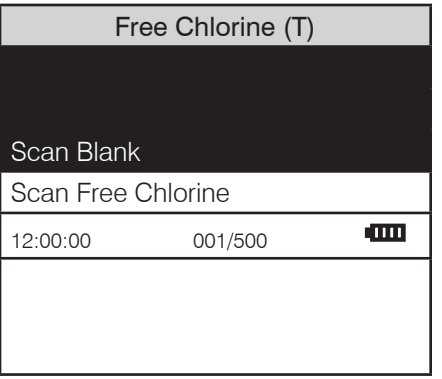
11. Press ▲ or ▼ to scroll to the concentration of the standard, 1.00 in this example.
Note: The allowable adjustment is ±25%.



12. Press ENTER to select **Calibrate**. Two menu choices will be offered, **Set Calibration** and **Factory Setting**.



13. Press ENTER to select **Set Calibration** and save the calibration. Press ▲ or ▼ to scroll to and select **Factory Setting** to revert to the factory calibration. The meter will momentarily display **Storing...** and return to the **Free Chlorine** Menu. The calibration has now been saved and the meter can be used for testing.



*WARNING: Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed in the contents list. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by e-mail, phone or fax.

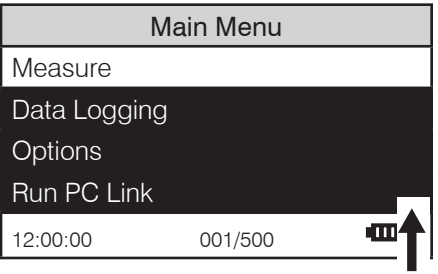
Emergency information for all LaMotte reagents is available from Chem-Tel (US, 1-800-255-3924) (International, call collect, 813-248-0585).

NOTE: The meter will remember the last scanned blank reading. It is not necessary to scan a blank each time the test is performed. To use the previous blank reading, instead of scanning a new one, scroll to Scan Sample and proceed. For the most accurate results, the meter should be blanked before each test and the same tube should be used for the blank and the reacted sample.

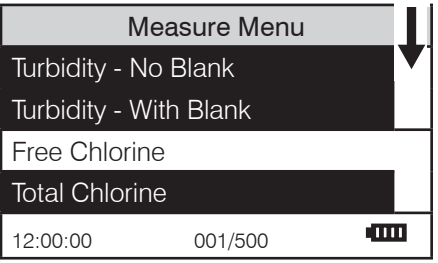
Chlorine Calibration Procedure
DPD Liquid Reagents

Select Liquid Calibration in the Options Menu.

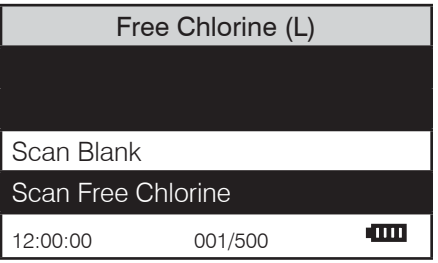
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



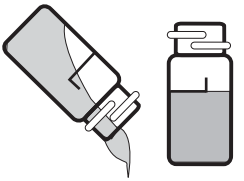
2. Press ENTER to select **Measure**. Press ⌄ to scroll to **Free Chlorine**.



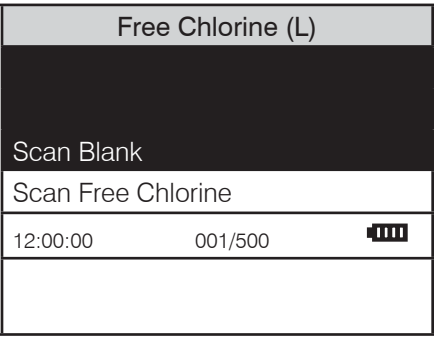
3. Press ENTER to select **Free Chlorine.**



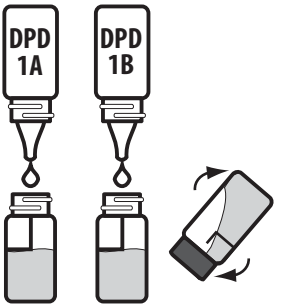
4. Rinse a clean tube (0290) three times with the chlorine standard. Fill the tube to the 10 mL line with the chlorine standard. Cap the tube. Dry the tube with a lint-free cloth. .



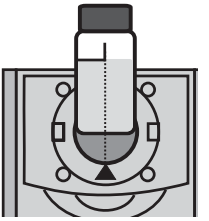
5. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid. Press ENTER to scan the blank. The screen will display **Blank Done** for about 1 second and then return to the **Scan Free Chlorine** Menu.



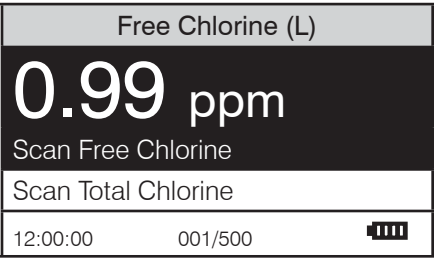
6. Remove the tube from the meter. Add 5 drops of DPD 1A Free Chlorine reagent (P-6740) and add 5 drops of *DPD 1B Free Chlorine reagent (P-6741). Cap and invert to mix. The solution will be pink if chlorine is present. Read within 30 seconds.



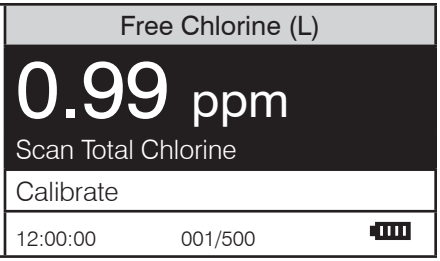
7. Immediately insert the tube into the meter. Align the index line on the tube with the index arrow on the meter. Close the lid.



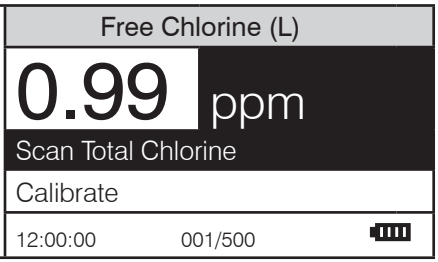
8. Press ENTER to scan the Standard. The screen will display **Reading...** for about 1 second. The result will appear on the screen.



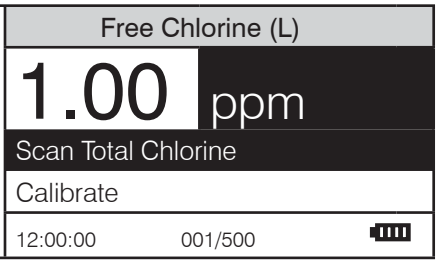
9. Press ▼ to scroll to **Calibrate**.



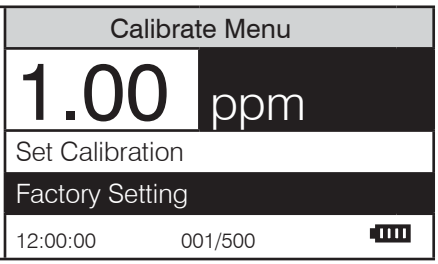
10. Press ENTER to select **Calibrate**. A reverse font (light background with dark characters) will appear to indicate that the reading can be adjusted.



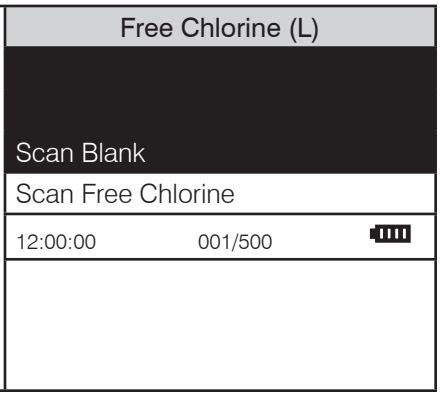
11. Press ▲ or ▼ to scroll to the concentration of the standard, 1.00 in this example. Note: The allowable adjustment is ±25%.



12. Press ENTER to select **Calibrate**. Two menu choices will be offered, Set Calibration and Factory Settings.



13. Press ENTER to select **Set Calibration** and save the calibration. Press ▲ or ▼ to scroll to and select **Factory Setting** to revert to the factory calibration. The meter will momentarily display **Storing...** and return to the **Free Chlorine** menu. The calibration has now been saved and the meter can be used for testing.



*WARNING: Reagents marked with an * are considered to be potential health hazards. See page 9 for further details.

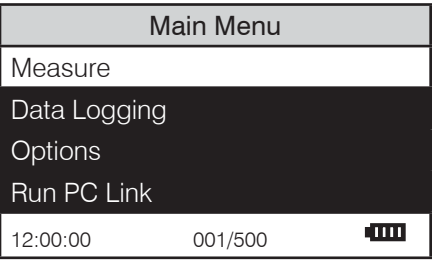
NOTE: The meter will remember the last scanned blank reading. It is not necessary to scan a blank each time the test is performed. To use the previous blank reading, instead of scanning a new one, scroll to Scan Sample and proceed. For the most accurate results, the meter should be blanked before each test and the same tube should be used for the blank and the reacted sample.

CHLORINE: ANALYSIS - DPD TABLET REAGENTS

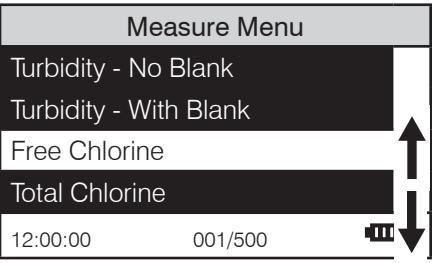
Free Chlorine, Combined Chlorine and Total Chlorine

The default units are ppm and the default calibration curve is for DPD Tablet reagents. For the most accurate results, a user calibration should be performed. The letter (**T**) in the menu bar indicates that the meter is in the tablet mode. To use liquid DPD reagents, see the Set Up instructions.

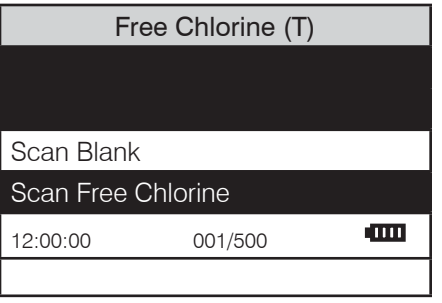
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



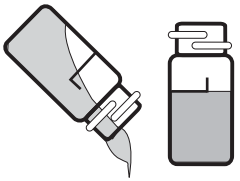
2. Press ENTER to select **Measure**. Press ▼ to scroll to **Free Chlorine**.



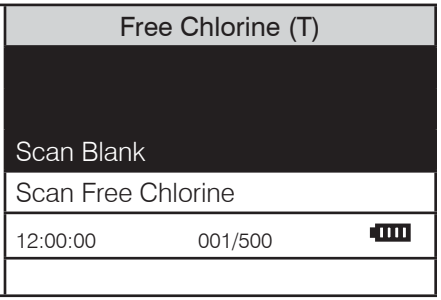
3. Press ENTER to select **Free Chlorine**.



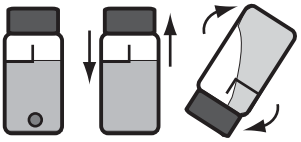
4. Rinse a clean tube (0290) three times with the sample. Fill the tube to the 10 mL line with the sample. Cap the tube. Dry the tube with a lint-free cloth.



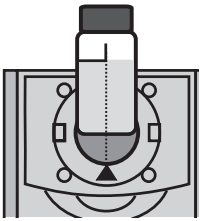
5. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid. Press ENTER to scan the blank. The screen will display **Blank Done** for about 1 second and then return to the **Free Chlorine** menu.



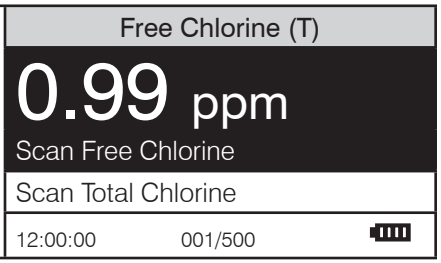
6. Remove the tube from the meter. Add one Chlorine DPD #1 Instrument Grade Tablet (6903A). Cap the tube. Shake for 10 seconds. Invert slowly 5 times. The solution will be pink if Free Chlorine is present.

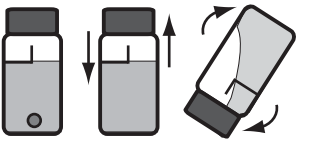


7. Immediately insert the tube into the meter. Align the index line on the tube with the index arrow on the meter. Close the lid.

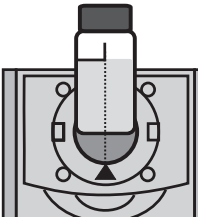


8. Press ENTER to scan the sample. The screen will display **Reading...** for about 1 second. The result will appear on the screen. Record the result as Free Chlorine.



9. Remove the tube from the meter. Add one *Chlorine DPD #3 Instrument Grade Tablet (6197A). Cap the tube. Shake for 10 seconds. Invert slowly 5 times. An increase in color represents Combined Chlorine.	

NOTE: For wastewater samples, ***Standard Methods for the Examination of Water and Wastewater*** recommends waiting 2 minutes for full color development when testing total chlorine.

10. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.	

11. Press ENTER to select **Scan Total Chlorine**. The screen will display **Reading...** for about 1 second. The result will appear on the screen. Record the result as Total Chlorine.	Total Chlorine (L) 1.25 ppm Scan Free Chlorine Scan Total Chlorine 12:00:00 001/500

12. Subtract the Free Chlorine reading from the Total Chlorine reading to obtain the concentration of Combined Chlorine.
Total Chlorine - Free Chlorine = Combined Chlorine

*WARNING: Reagents marked with an * are considered to be potential health hazards. See page 9 for further details.

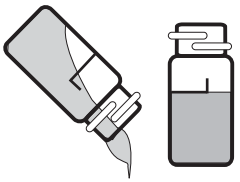
NOTE: For the most accurate results, samples over 6 ppm chlorine should be diluted with chlorine demand free water and re-tested.

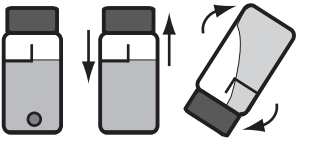
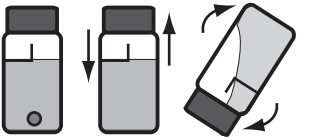
NOTE: The meter will remember the last scanned blank reading. It is not necessary to scan a blank each time the test is performed. To use the previous blank reading, instead of scanning a new one, scroll to Scan Sample and proceed. For the most accurate results, the meter should be blanked before each test and the same tube should be used for the blank and the reacted sample.

CHLORINE: ANALYSIS - DPD TABLET REAGENTS

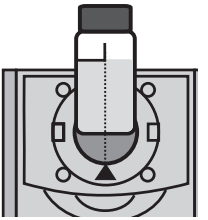
Total Chlorine

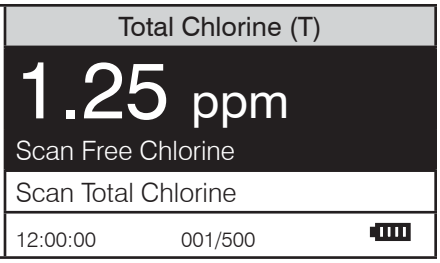
The default units are ppm and the default calibration curve is for DPD Tablet reagents. For the most accurate results, a user calibration should be performed. The letter **(T)** in the upper right corner of the display indicates that the meter is in the tablet DPD reagent mode. To use liquid DPD reagents, see the Set Up instructions.

1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.	Main Menu Measure Data Logging Options Run PC Link 12:00:00 001/500
2. Press ENTER to select **Measure**. Press ▼ to scroll to **Total Chlorine**.	Measure Menu Turbidity - No Blank Turbidity - With Blank Free Chlorine Total Chlorine 12:00:00 001/500
3. Press ENTER to select **Total Chlorine**.	Total Chlorine (T) Scan Blank Scan Free Chlorine 12:00:00 001/500
4. Rinse a clean tube (0290) three times with the sample. Fill the tube to the 10 mL line with the sample. Cap the tube. Dry the tube with a lint-free cloth.	

5. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid. Press ENTER to scan the blank. The screen will display **Blank Done** for about 1 second and then return to the **Total Chlorine** menu.	Total Chlorine (T) Scan Free Chlorine Scan Total Chlorine 12:00:00 001/500
6. Remove the tube from the meter. Add one Chlorine DPD #1 Instrument Grade Tablet (6903A). Cap the tube. Shake for 10 seconds. Invert slowly 5 times. The solution will be pink if Free Chlorine is present.	
7. Add one Chlorine DPD #3 Instrument Grade Tablet (6197). Cap the tube. Shake for 10 seconds. Invert slowly 5 times. The solution will be pink if Total Chlorine is present.	

NOTE: For wastewater samples, *Standard Methods for the Examination of Water and Wastewater* recommends waiting 2 minutes for full color development when testing total chlorine.

8. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.	

9. Press ENTER to select **Scan Total Chlorine**. The screen will display **Reading...** for about 1 second. The result will appear on the screen. Record the result as Total Chlorine.	

*WARNING: Reagents marked with an * are considered to be potential health hazards. See page 9 for further details.

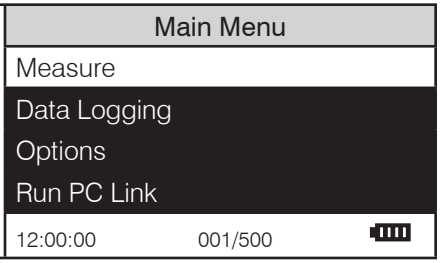
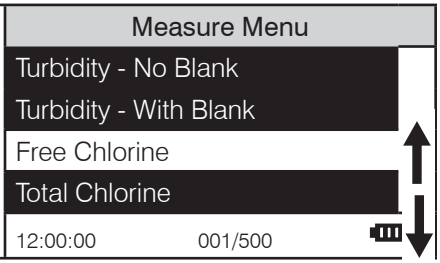
NOTE: For the most accurate results, samples over 6 ppm chlorine should be diluted with chlorine demand free water and re-tested.

NOTE: The meter will remember the last scanned blank reading. It is not necessary to scan a blank each time the test is performed. To use the previous blank reading, instead of scanning a new one, scroll to Scan Sample and proceed. For the most accurate results, the meter should be blanked before each test and the same tube should be used for the blank and the reacted sample.

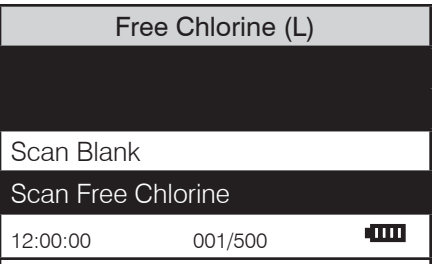
CHLORINE: ANALYSIS - DPD LIQUID REAGENTS

Free Chlorine, Combine Chlorine and Total Chlorine

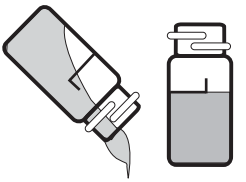
The default units are ppm and the default calibration curve is for DPD Tablet reagents. For the most accurate results, a user calibration should be performed. The letter **(L)** in the menu bar indicates that the meter is in the liquid DPD reagent mode. To use tablet DPD reagents, see the Set Up instructions.

1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.	
2. Press ENTER to select **Measure**. Press ▼ to scroll to **Free Chlorine**.	

3. Press ENTER to select **Free Chlorine**.

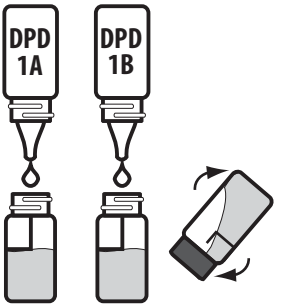


4. Rinse a clean tube (0290) three times with the sample. Fill the tube to the 10 mL line with the sample. Cap the tube. Dry the tube with a lint-free cloth.

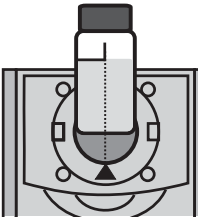


5. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid. Press ENTER to scan the blank. The screen will display **Blank Done** for about 1 second and then return to the **Free Chlorine** menu.

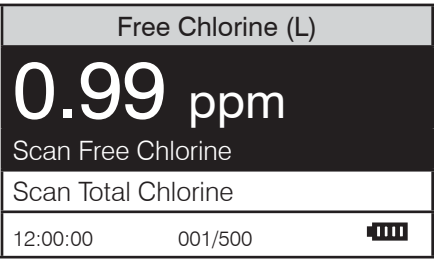
6. Remove the tube from the meter. Add 5 drops of DPD 1A Free Chlorine reagent (P-6740) and add 5 drops of *DPD 1B Free Chlorine reagent (P-6741). Cap and invert to mix. The solution will be pink if chlorine is present. Read within 30 seconds.



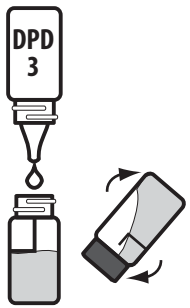
7. Immediately insert the tube into the meter. Align the index line on the tube with the index arrow on the meter. Close the lid.



8. Press ENTER to scan the sample. The screen will display **Reading...** for about 1 second. The result will appear on the screen. Record the result as Free Chlorine.

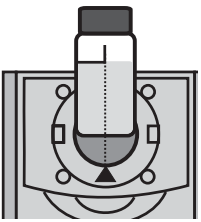


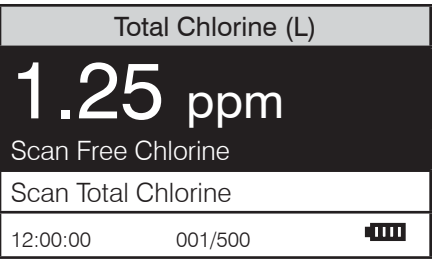
9. Remove the tube from the meter. Add 5 drops of *DPD 3 Total Chlorine Reagent (P-6743). Cap and invert to mix. An increase in color represents Combined Chlorine.



NOTE: For wastewater samples, *Standard Methods for the Examination of Water and Wastewater* recommends waiting 2 minutes for full color development when testing total chlorine.

10. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.



11. Press ENTER to select **Scan Total Chlorine**. The screen will display **Reading...** for about 1 second. The result will appear on the screen. Record the result as Total Chlorine.	

12. Subtract the Free Chlorine reading from the Total Chlorine reading to obtain the concentration of Combined Chlorine.
Total Chlorine - Free Chlorine = Combined Chlorine

*WARNING: Reagents marked with an * are considered to be potential health hazards. See page 9 for further details.

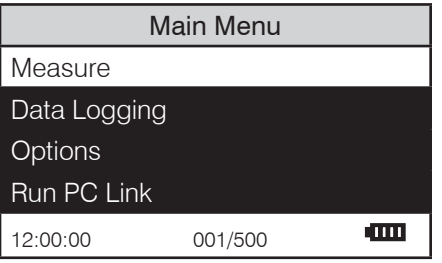
NOTE: For the most accurate results, samples over 6 ppm chlorine should be diluted with chlorine demand free water and re-tested.

NOTE: The meter will remember the last scanned blank reading. It is not necessary to scan a blank each time the test is performed. To use the previous blank reading, instead of scanning a new one, scroll to Scan Sample and proceed. For the most accurate results, the meter should be blanked before each test and the same tube should be used for the blank and the reacted sample.

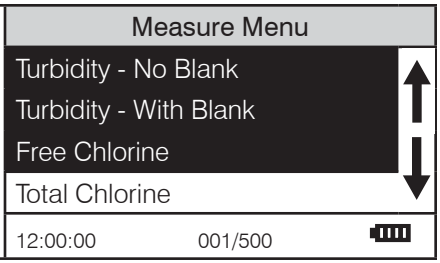
CHLORINE: ANALYSIS - DPD LIQUID REAGENTS

Total Chlorine

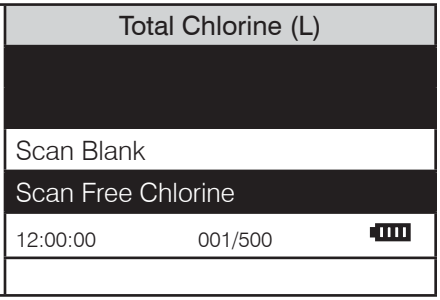
The default units are ppm and the default calibration curve is for DPD Tablet reagents. For the most accurate results, a user calibration should be performed. The letter **(L)** in the menu bar indicates that the meter is in the liquid mode. To use tablet DPD reagents, see the Set Up instructions.

1. Press and briefly hold to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.	

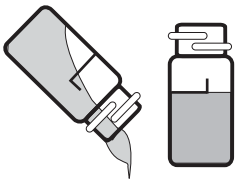
2. Press ENTER to select **Select Measure**. Press ▼ to scroll to **Total Chlorine**.



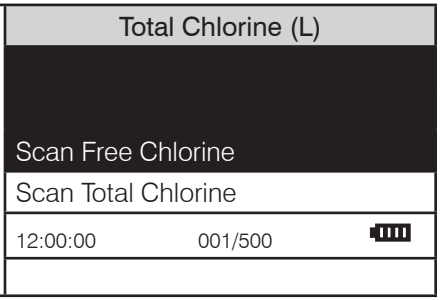
3. Press ENTER to select **Total Chlorine**.



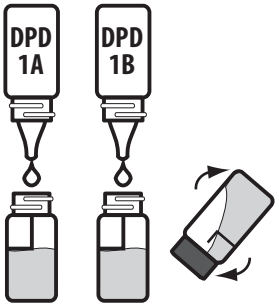
4. Rinse a clean tube (0290) three times with the sample. Fill the tube to the 10 mL line with the sample. Cap the tube. Dry the tube with a lint-free cloth.

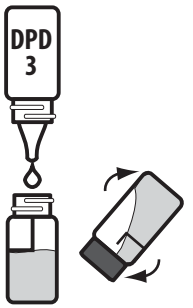


5. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid. Press ENTER to scan the blank. The screen will display **Reading...** for about 1 second and then return to the **Total Chlorine** menu.

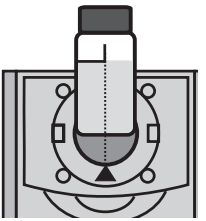


6. Remove the tube from the meter. Add 5 drops of DPD 1A Free Chlorine reagent (P-6740) and add 5 drops of *DPD 1B Free Chlorine reagent (P-6741). Cap and invert to mix. The solution will be pink if chlorine is present.



7. Add 5 drops of *DPD 3 Total Chlorine reagent (P-6743). Cap and invert to mix. An increase in color represents Combined Chlorine.	

NOTE: For wastewater samples, ***Standard Methods for the Examination of Water and Wastewater*** recommends waiting 2 minutes for full color development when testing total chlorine.

8. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.	

9. Press ENTER to select **Scan Total Chlorine**. The screen will display **Reading...** for about 1 second and then return to the **Total Chlorine** menu. Record the result as Total Chlorine.	Total Chlorine (L) 1.25 ppm Scan Free Chlorine Scan Total Chlorine 12:00:00 001/500

*WARNING: Reagents marked with an * are considered to be potential health hazards. See page 9 for further details.

NOTE: For the most accurate results, samples over 6 ppm chlorine should be diluted with chlorine demand free water and re-tested.

NOTE: The meter will remember the last scanned blank reading. It is not necessary to scan a blank each time the test is performed. To use the previous blank reading, instead of scanning a new one, scroll to Scan Sample and proceed. For the most accurate results, the meter should be blanked before each test and the same tube should be used for the blank and the reacted sample.

DILUTION PROCEDURE

Samples and standards should be diluted with chlorine demand free water.

TESTING TIPS

1. Wash tubes thoroughly after testing to prevent staining of tubes and contamination of future test reactions with DPD residue.
2. When using liquid DPD reagents, invert bottle in a completely vertical position to dispense uniform drops. Do not tilt bottle at an angle.
3. Follow instructions. Obey time limits.
4. In samples with extremely high chlorine concentrations, above 10 ppm, the reagent system will show an initial flash of dark pink color that will fade quickly. Dilute the sample and test again.
5. When testing salt water, double the amount of reagent used. Use ten drops of each DPD liquid reagent or two DPD tablets.
6. Oxidized manganese (permanganate) will interfere with this test. Iodine and bromine will give a positive interference.
7. A permanganate check standard is not recommended for calibration when using the liquid DPD reagent system.
8. The averaging option is not available for the chlorine test.
9. When testing at low concentrations use the same tube for the blank and the sample.
10. Always insert tube into the meter chamber with the same amount of pressure and to the same depth.
11. Occasionally clean the chamber with a damp lint-free wipe, followed by an alcohol dampened wipe. A clean chamber and tubes are essential for reliable results.

■ COLOR

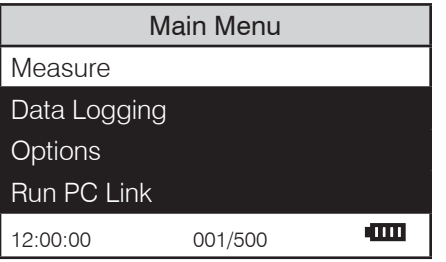
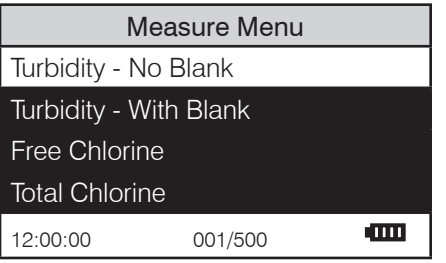
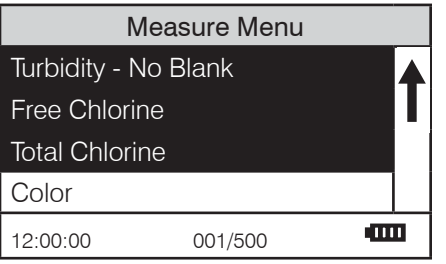
CALIBRATION

Color Standards

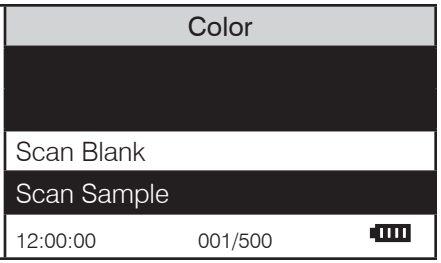
The meter has been calibrated with colored standards of known concentrations of platinum cobalt. One unit of color is equivalent to the color that is produced by 1 mg platinum/L in the form of the chloroplatinate ion. A 500 cu Color Standard (60 mL, Code 6058-H) is available from LaMotte.

Calibration Procedure

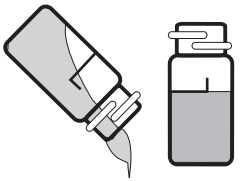
The meter should be calibrated with platinum cobalt color standards. For the most accurate results, a user calibration should be performed with LaMotte Color Standards. The calibration should be done with a distilled or deionized water blank and one color standard of known concentration. The concentration of the calibration standard should be similar to the expected concentration of samples that will be tested.

1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.	
2. Press ENTER to select **Measure**.	
3. Press ✓ to scroll to **Color**.	

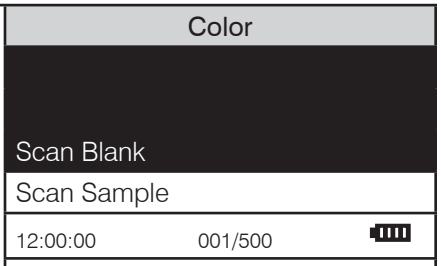
4. Press ENTER to select **Color**.



5. Rinse a clean tube (0290) with color-free (distilled or deionized) water. Fill the tube to the 10 mL line with the color-free water. Cap the tube. Dry the tube with a lint-free cloth.

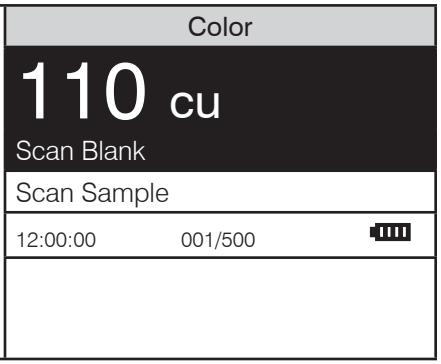


6. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid. Press ENTER to scan the blank. The screen will display **Blank Done** for about 1 second and then return to the **Color** menu.

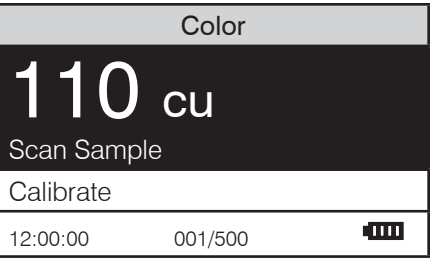


7. Remove the tube from the meter. Empty the tube. Rinse the tube with the color standard. Fill the tube to the 10 mL line with the color standard. Cap the tube. Dry the tube with a lint-free cloth.

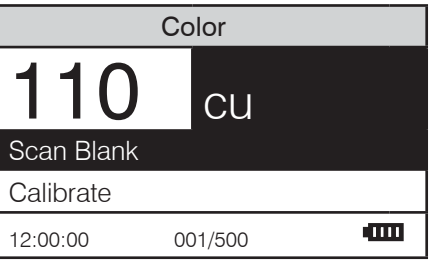
8. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid. Press ENTER to select **Scan Sample**. The screen will display **Reading...** for about 1 second. The result will appear on the screen and then return to the **Color** menu.



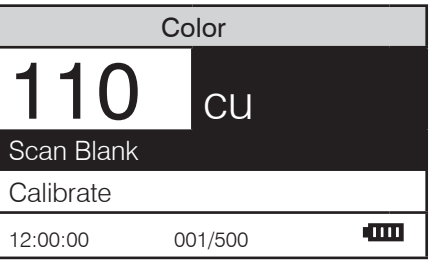
9. Press ▼ to scroll to **Calibrate**.



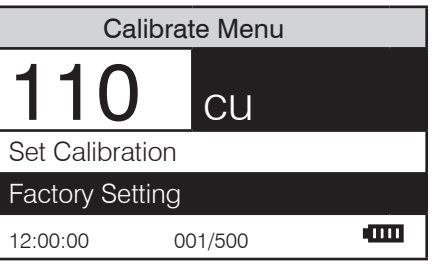
10. Press ENTER to select to **Calibrate**. A reverse font (light background with dark characters) will appear to indicate that the reading can be adjusted.



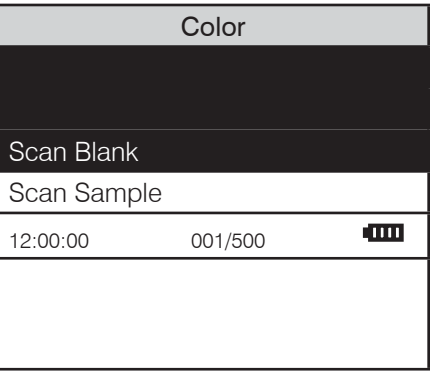
11. Press ▲ or ▼ to scroll to the concentration of the standard, 100 in this example. Note: The allowable adjustment is ±25%.



12. Press ENTER to select to **Calibrate**. Two menu choices will be offered, Set Calibration and Factory Settings.



13. Press ENTER to select **Set Calibration**. and save the calibration. Press ▲ or ▼ to scroll to and select **Factory Setting** to revert to the factory calibration. The meter will momentarily display **Storing...** and return to the **Color** menu. The calibration has now been saved and the meter can be used for testing.



■ COLOR ANALYSIS

Test results are reported as cu (Color Units)

1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.

Main Menu
Measure
Data Logging
Options
Run PC Link
12:00:00 001/500

2. Press ENTER to select **Measure**.

Measure Menu
Turbidity - No Blank
Turbidity - With Blank
Free Chlorine
Total Chlorine
12:00:00 001/500

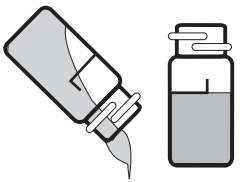
3. Press ▼ to scroll to **Color**.

Measure Menu
Turbidity - No Blank
Free Chlorine
Total Chlorine
Color
12:00:00 001/500

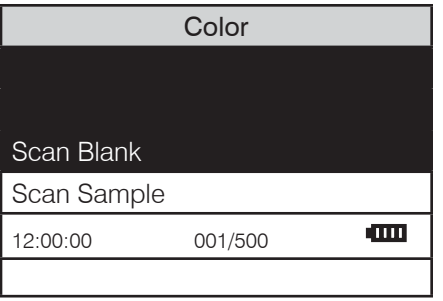
4. Press ENTER to select **Color**.

Color
Scan Blank
Scan Sample
12:00:00 001/500

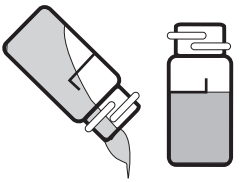
5. Rinse a clean tube (0290) with color-free (distilled or deionized) water. Fill the tube to the 10 mL line with the color-free water. Cap the tube. Dry the tube with a lint-free cloth.



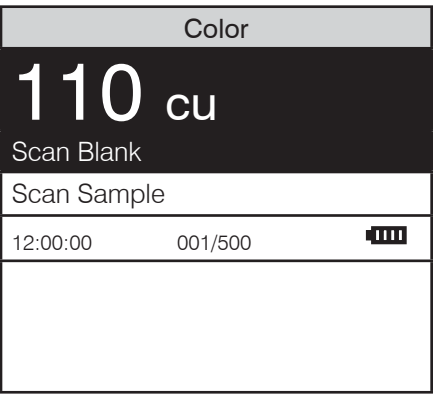
6. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid. Press ENTER to scan the blank. The screen will display **Blank Done** for about 1 second and then return to the **Color** menu.



7. Remove the tube from the meter. Empty the tube. Rinse the tube with the sample. Fill the tube to the 10 mL line with the sample. Cap the tube.



8. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid. Press ENTER to select **Scan Sample**. The screen will display **Reading...** for about 1 second. The result will appear on the screen and then return to the **Color** menu. Record the result as color.



NOTE: The meter will remember the last scanned blank reading. It is not necessary to scan a blank each time the test is performed. To use the previous blank reading, instead of scanning a new one, scroll to Scan Sample and proceed. For the most accurate results, the meter should be blanked before each test and the same tube should be used for the blank and the reacted sample.

DILUTION PROCEDURE

Samples and standards may be diluted with distilled or deionized water.

TESTING TIPS

1. Always use a clean test tube.
2. Turbidity will interfere with the color test. Sample may be filtered before testing but results will be as true color. (See ***What is Color?***, page 17)
3. When testing at low concentrations use the same tube for the blank and the sample.
4. Always insert tube into the meter chamber with the same amount of

pressure and to the same depth.

TROUBLESHOOTING GUIDE

■ TROUBLESHOOTING

PROBLEM	*REASON*	*SOLUTION*
"Blank?"	Sample is reading lower than the blank.	With samples of very low concentration reblank or record as zero. On samples of higher concentration reblank and read again.
Flashing	Low battery. Readings are reliable.	Charge battery or use USB wall/computer charger.
"Low Battery"	Battery voltage is very low. Readings are not reliable.	Charge battery or use USB wall/computer charger.
"Shut Down Low Batt" Shut Down	Battery is too low to operate the unit.	Charge battery or use USB wall/computer charger.
"Overrange"	Sample is outside of acceptable range.	Dilute sample and test again.
"Error1"	High readings with 90° and 180° detectors.	Dilute sample by at least 50% and retest.
Lost in meter menus	Reset to factory default settings.	Follow Procedure on page 34 or page 36.
Unusually large negative or positive readings when performing calibration	Incorrect standards used to calibrate meter.	Use fresh 0.0 standard in clean tube. Reset meter to factory default settings. Recalibrate meter.

■ STRAY LIGHT

The accuracy of readings on the TC3000we/wi should not be affected by stray light. Make sure that the sample compartment lid is always fully closed when taking readings. The backlight will interfere with turbidity readings. The meter will temporarily disable the backlight while turbidity measurements are being taken.

GENERAL OPERATING INFORMATION

■ OVERVIEW

The TC3000we/wi is a portable, microprocessor controlled, direct reading nephelometer. Turbidity is measured directly by either EPA Method 180.1 or ISO Method 7027. It has a graphical liquid crystal display and six button keypad. These allow the user to select options from the menu driven software, to directly read test results or to review stored results of previous tests in the data logger. The menus can be displayed in seven different languages.

The TC3000we/wi uses a state of the art, multi-detector optical configuration that assures long term stability of calibrations, high precision and accuracy and low detection limits. All readings are determined by sophisticated digital signal processing algorithms, minimizing fluctuations in readings and enabling rapid, repeatable measurements. The microprocessor and optics enable a dynamic range and auto-ranging over several ranges. Energy efficient LED light sources are used for ISO turbidity. EPA turbidity uses a tungsten filament light source that meets or exceeds EPA specifications and is designed for a uniform light spot image and stable output.

A USB wall adapter, USB computer connection or lithium battery powers the TC3000we/wi.

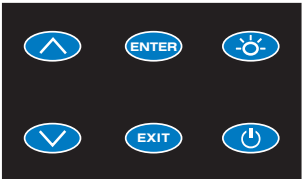
A USB port on the back of the meter allows an interface of the meter with a Windows-based computer for real-time data acquisition and data storage using a PC. The TC3000we/wi may be interfaced with any Windows-based computer by using the LaMotte SMARTLink 3 Program.

GENERAL OPERATING INFORMATION

The operation of the TC3000we/wi is controlled by the menu driven software and user interface. A menu is a list of choices. This allows a selection of various tasks for the TC3000we/wi to perform, such as scan blank and scan sample. The keypad is used to make menu selections that are viewed on the display.

■ The Keypad

	This button will scroll up through a list of menu selections.
	The button is used to select choices in a menu viewed on the display.
	This button controls the backlight on the display.
	This button will scroll down through a list of menu selections.
	This button exits to the previous menu.
	This button turns the meter on or off.

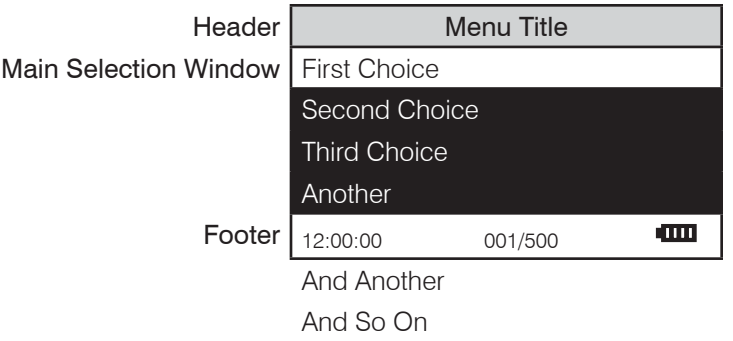


■ THE DISPLAY & MENUS

The display allows menu selections to be viewed and selected. These selections instruct the TC3000we/wi to perform specific tasks. The menus are viewed in the display using two general formats that are followed from one menu to the next. Each menu is a list of choices or selections.

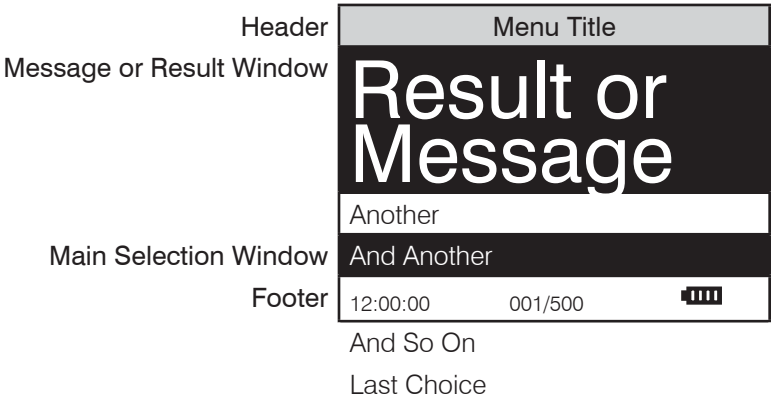
The display has a header line at the top and a footer line at the bottom. The header displays the title of the current menu. The footer line displays the time and the date, the data logger status and the battery status. The menu selection window is in the middle of the display between the header and the footer.

The menu selection window displays information in two general formats. In the first format only menu selections are displayed. Up to 4 lines of menu selections may be displayed. If more selections are available they can be viewed by pressing the arrow buttons  to scroll the other menu selections into the menu selection window. Think of the menu selections as a vertical list in the display that moves up or down each time an arrow button  is pressed. Some menus in the TC3000we/wi are looping menus. The top and bottom menu choices are connected in a loop. Scrolling down past the bottom of the menu will lead to the top of the menu. Scrolling up past the top of the menu will lead to the bottom of the menu.



A light bar will indicate the menu choice. As the menu is scrolled through, the light bar will highlight different menu choices. Pressing the ENTER button will select the menu choice that is indicated by the light bar.

In the second format the menu choice window takes advantage of the graphical capabilities of the display. Large format graphic information, such as test results or error messages or the LaMotte logo is displayed. The top two lines of the display are used to display information in a large, easy to read format. The menus work in the same way as previously described but two lines of the menu are visible at the bottom of the display.



As described previously, the EXIT button allows an exit or escape from the current menu and a return to the previous menu. This allows a rapid exit from an inner menu to the main menu by repeatedly pushing the EXIT button. Pushing ⏻ at any time will turn the TC3000we/wi off.

The display may show the following messages:

	Battery Status
	More choices are available and can be viewed by scrolling up and/or down through the display.
Header	Identifies the current menu and information on units and reagent systems if applicable.
Footer	In the data logging mode the number of the data point is displayed and the total number of data points in the memory will be shown. The footer also shows current time and battery status

■ NEGATIVE RESULTS

There are always small variations in readings with analytical instruments. Often these variations can be observed by taking multiple readings of the same sample. These variations will fall above and below an average reading. Repeated readings on a 0.00 sample might give readings above and below 0.00. Therefore, negative readings are possible and expected on samples with concentrations at or near zero. This does not mean there is a negative concentration in the sample. It means the sample reading was less than the blank reading. Small negative readings can indicate that the sample was at or near the detection limit. This is a normal variation that results in a negative reading. A large negative reading, however, is not normal and indicates a problem. Some instruments are designed to display negative readings as zero. In this type of instrument, if the meter displayed zero when the result was actually a large negative number there would be no indication that a problem existed. For this reason, the TC3000we/wi displays negative numbers for turbidity.

■ TUBES AND CHAMBERS

The TC3000we/wi uses one type of tube (Code 0290) for all test factors. There is no need for a special turbidity tube.

The handling of the tubes is of utmost importance. Tubes must be clean and free from lint, fingerprints, dried spills and significant scratches, especially the central zone between the bottom and the sample line.

Scratches, fingerprints and water droplets on the tube can cause stray light interference leading to inaccurate results when measuring turbidity. Scratches and abrasions will affect the accuracy of the readings. Tubes that have been scratched in the light zone through excessive use should be discarded and replaced with new ones.

Tubes should always be washed on the inside and outside with mild detergent prior to use to remove dirt or fingerprints. The tubes should be allowed to air-dry in an inverted position to prevent dust from entering the tubes. Dry tubes should be stored with the caps on to prevent

contamination.

After a tube has been filled and capped, it should be held by the cap and the outside surface should be wiped with a clean, lint-free absorbent cloth until it is dry and smudge-free. Handling the tube only by the cap will avoid problems from fingerprints. Always set the clean tube aside on a clean surface that will not contaminate the tube. It is imperative that the tubes and light chamber be clean and dry. The outside of the tubes should be dried with a clean, lint-free cloth or disposable wipe before they are placed in the meter chamber.

Tubes should be emptied and cleaned as soon as possible after reading a sample to prevent deposition of particulates on the inside of the tubes. When highly accurate results are required, reduce error by designating tubes to be used only for very low turbidity and very high turbidity testing.

Variability in the geometry of the glassware and technique is the predominate cause of variability in results. Slight variations in wall thickness and the diameter of the tubes may lead to slight variations in the test results. To eliminate this error the tubes should be placed in the chamber with the same orientation each time.

Chambers which have been scratched through excessive use should be discarded and replaced with a new one.

MAINTENANCE

CLEANING

Clean the exterior housing with a damp, lint-free cloth. Do not allow water to enter the light chamber or any other parts of the meter. To clean the light chamber and optics area, point a can of compressed air into the light chamber and blow the pressurized air into the light chamber. Use a cotton swab dampened with Windex® window cleaner to gently swab the interior of the chamber. Do not use alcohol; it will leave a thin residue over the optics when dry.

REPAIRS

Should it be necessary to return the meter for repair or servicing, pack the meter carefully in a suitable container with adequate packing material. A return authorization number must be obtained from LaMotte Company by calling 800-344-3100 (US only) or 410-778-3100, faxing 410-778-6394 or emailing tech@lamotte.com. Often a problem can be resolved over the phone or by email. If a return of the meter is necessary, attach a letter with the return authorization number, meter serial number, a brief description of problem and contact information including phone and FAX numbers to the shipping carton. This information will enable the service department to make the required repairs more efficiently.

METER DISPOSAL

Waste Electrical and Electronic Equipment (WEEE)

Natural resources were used in the production of this equipment. This equipment may contain materials that are hazardous to health and the environment. To avoid harm to the environment and natural resources, the use of appropriate take-back systems is recommended. The crossed out

wheeled bin symbol on the meter encourages the use of these systems when disposing of this equipment.

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

802 Washington Ave • Chestertown • Maryland • 21620 • USA
410-778-3100 • 800-344-3100
www.lamotte.com

1969-MN-V2 5.16