

# SMART3 BLE Soil

## Colorimeter

# Operator's Manual

Warning! This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

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# CONTENTS

## GENERAL INFORMATION

■ Packaging & Delivery .....	5
■ General Precautions .....	5
■ Safety Precautions .....	5
■ Limits of Liability.....	5
■ Warranty .....	5
■ Specifications .....	6
■ Statistical and Technical Definitions .....	7
■ Contents and Accessories.....	8
■ EPA Compliance .....	8
■ Compliance.....	9
■ IP 67 Certification .....	9

## CHEMICAL TESTING

■ An Introduction to Colorimetric Analysis .....	9
■ Reagent Blank .....	9
■ Colorimeter Tubes & Chamber .....	10
■ Meter Care .....	10
■ Sample Dilution & Volumetric Measurements .....	10
■ Interferences .....	11
■ Stray Light Interference .....	11

## OPERATION OF THE SMART3 COLORIMETER

■ Overview .....	11
■ Components .....	12

## GENERAL OPERATING PROCEDURES

■ The Keypad .....	13
■ Sample Holders.....	13
■ The Display & the Menus .....	13

## TESTING

■ Testing Menu .....	15
■ General Testing Procedures .....	16
■ Testing With LaMotte Pre-Programmed Tests .....	16
■ Calibrating LaMotte Pre-Programmed Tests.....	18
■ Measuring in the Absorbance Mode .....	20

## SETUP MENU

■ Test Sequences.....	23
■ Editing a Sequence .....	23
■ Adding or Deleting a Test .....	24
■ Creating a Soil Sequence Test .....	27
■ Edit User Tests .....	34
■ Naming the Test .....	35
■ Selecting the Vial and Wavelength .....	37
■ Entering a Two Point Calibration .....	38
■ Entering a Multiple Point Calibration.....	41
■ Selecting the Numerical Format of the Result .....	43
■ Selecting Units of Concentration.....	44

▪ Setting the Clock .....	45
▪ Logging Data.....	45
▪ Factory Setup .....	46
▪ Setting Power Save.....	46
▪ Setting Backlight Time .....	47
▪ Bluetooth Menu.....	48
• Enabling Bluetooth Power .....	48
• Setting the Bluetooth Mode .....	50
• Setup Bluetooth Printing.....	51
• Set BT Timeout.....	53
▪ Selecting a Language .....	54
▪ Looping Menus.....	55
<b>DEVICE CONNECTION</b>	
▪ Computer Connection .....	56
▪ Connecting Via USB.....	56
▪ Connecting Via Bluetooth.....	56
▪ Waterlink Connect 2 .....	56
<b>FIRMWARE UPDATES</b>	
▪ Firmware Updates.....	56
<b>BATTERY</b>	
▪ Battery/AC Operation .....	56
▪ Battery Replacement.....	57
<b>MAINTENANCE</b>	
▪ Cleaning .....	57
▪ Returns .....	57
▪ Meter Disposal.....	57
<b>TROUBLESHOOTING</b>	
▪ Error Messages .....	58
▪ Troubleshooting Guide.....	58
<b>SMART3 BLE COLORIMETER SOIL TEST PROCEDURES</b>	
<b>APPENDIX</b>	

## GENERAL INFORMATION

### ■ PACKAGING & RETURNS

Experienced packaging personnel at LaMotte Company assure adequate protection against normal hazards encountered in transportation of shipments. After the product leaves the manufacturer, all responsibility for its safe delivery is assured by the transportation company. Damage claims must be filed immediately with the transportation company to receive compensation for damaged goods. Should it be necessary to return the instrument, pack the instrument carefully in a suitable container with adequate packing material. A return authorization number must be obtained from LaMotte Company by calling 1-800-344-3100 or 1-410-778-3100, ext. 3 or emailing [softwaresupport@lamotte.com](mailto:softwaresupport@lamotte.com). Attach a letter with the authorization number to the shipping carton which describes the kind of trouble experienced.

### ■ GENERAL PRECAUTIONS

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

The Smart3 BLE Colorimeter should not be stored or used in a wet or corrosive environment. Care should be taken to prevent water or reagent chemicals from wet colorimeter tubes from entering the colorimeter chamber.

NEVER PUT WET TUBES IN COLORIMETER.

### ■ SAFETY PRECAUTIONS

\*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](http://www.lamotte.com).

Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. 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 email, 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]

To order individual reagents or test kit components, use the specified code number.

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

Ensure that the protection provided by this equipment is not impaired. Do not install or use this equipment in a manner that is not indicated in this manual.

### ■ LIMITS OF LIABILITY


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

### ■ WARRANTY

LaMotte Company warrants this instrument to be free of defects in parts and workmanship for 2 years from the date of shipment. Keep the proof of purchase for warranty verification. If it should become necessary to return the instrument during or the warranty period, contact our Technical Service Department at 1-800-344-3100 or 1-410-778-3100, ext. 3 or [softwaresupport@lamotte.com](mailto:softwaresupport@lamotte.com) for a return authorization number or visit [www.lamotte.com](http://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 with a new or refurbished meter as determined by LaMotte Company. The warranty set forth above is inclusive and no other warranty, whether written or oral, is expressed or implied.

## ■ SPECIFICATIONS

INSTRUMENT TYPE: Colorimeter

Readout	160 x 100 backlit LCD, 20 x 6 line graphical display
Wavelengths	428 nm, 525 nm, 568 nm, 635 nm
Wavelength Accuracy	±2% FS
Readable Resolution	Determined by reagent system
Wavelength Bandwidth	10 nm typical
Photometric Range	-2 to +2 AU
Photometric Precision	± 0.001 AU at 1.0 AU
Photometric Accuracy	±0.005 AU at 1.0 AU
Sample Chamber	Accepts 25 mm diameter flat-bottomed test tubes, 10 mm square cuvettes†, 16 mm COD test tubes
Light Sources	4 LEDs
Detectors	4 silicon photodiodes
Response Time	< 2 seconds
Display	Graphic Liquid Crystal Display with Backlight
Auto Shut Off	5, 10, 30 min, disabled
Firmware	Internet updatable [new tests, new calibrations etc]. USB connection to Windows PC is required.
Modes	Pre-programmed tests, absorbance, %T
Pre-Programmed Tests	YES, with automatic wavelength selection
User Defined Tests	Up to 25 user tests can be input
Languages	English, Spanish, French, Portuguese, Italian, Chinese, Japanese [kana], Turkish
Temperature	Operation: 0-50 °C; Storage: -40-60 °C
Operation Humidity Range	0-90 % RH, non-condensing
Altitude	Up to 2000 m
Use	Indoor and outdoor
Pollution Degree	2
USB Port	Mini B
Power Requirements	USB wall adapter, USB computer connection or lithium ion rechargeable battery
Battery	Charge Life: Approximately 380 tests with backlight on to 1000 tests with backlight off. [Signal averaging disabled]. Battery Life: Approximately 500 charges.
Electrical Rating	Rated voltage 5V  , Rated power of input current [1.0A] at mini-USB input port
Data Logger	500 test results stored for download to a PC
Waterproof	IP67 with USB port plug in place

Certifications	EZ-BLE™ PProC™ Module, CYBLE-022001-00 RF Radio:	FCC [USA]:	FCC ID: WAP2001
		Industry Canada [IC] Certification:	7922A-200
		CE [European R & TTE]:	2014/S3/EU
		MIC [Japan]:	005-101007
		KC [Korea]:	MSIP-CRMCyp-2001
	EMC	EU:	2014/53/EU EN 61326-1, EN 300 328
		UKCA	
		US:	FCC CFR 47 Part 15, subpart B
		CAN:	ICES-003
		AS/NSZ:	CSPR 22
Safety		EU:	EN 61010-1
		AS/NSZ:	Differences
		US/Canadian:	UI/CSA 61010-1
RoHS		2011/65/EU + [EU] 2015/863	
Dimensions [LxWxH]	3.5 x 7.5 x 2.5 inches, 8.84 x 19.05 x 6.35 cm		
Weight	13 oz, 362 g [meter only]		

†525 nm and 568 nm only

## ■ 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.”<sup>1</sup> 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.’”<sup>2</sup>

**Accuracy:** Accuracy is the nearness of a measurement to the accepted or true value.<sup>3</sup> The accuracy can be expressed as a range, about the true value, in which a measurement occurs [i.e.  $\pm 0.5$  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.<sup>4</sup> For meters this is usually how many decimal places are displayed. [i.e. 0.01]. Note that the resolution may 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.<sup>5</sup> 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.<sup>6</sup>

**Detection Limit (DL):** The detection limit (DL) for the SMART3 BLE 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.

<sup>1</sup> CFR 40, part 136, appendix B

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

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

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

<sup>5</sup> 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.

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

■ CONTENTS AND ACCESSORIES

Contents

Smart3 BLE Colorimeter	
Test Tubes, with Caps	Code 0290
COD/UDV Adapter	Code 1724
USB Wall Adapter	Code 1721
USB Cable	Code 1720-01
Smart3 BLE Colorimeter Quick Start Guide	
Smart3 BLE Colorimeter Manual	

Accessories

Test Tubes, with Caps [6]	Code 0290-6
Replacement Chamber	Code 3-0038
USB Cable	Code 1720-01
USB Wall Adapter	Code 1721
COD/UDV Adapter	Code 1724
BLE Mobile Printer	Code 5-0067
Car Charger	Code 5-0132
Small Field Carrying Case [37.5 27.5 x 13.75 cm]	Code 1910-GCS150
Large Field Carrying Case [45 x 32.5 x 20 cm]	Code 1910-GCS440

WARNING: Only use the USB cable [1720-01] that is supplied with the kit. Make no substitutions.

■ EPA COMPLIANCE

The Smart3 BLE Colorimeter is an EPA-Accepted instrument. EPA-Accepted means that the instrument meets the requirements for instrumentation as found in test procedures that are approved for the National Primary Drinking Water Regulations [NPDRW] or National Pollutant Discharge Elimination System [NPDES] compliance monitoring programs. EPA-Accepted instruments may be used with approved test procedures without additional approval.



## ■ COMPLIANCE

The meter has earned the European CE Mark of Compliance for electromagnetic compatibility and safety. The Declaration of Conformity for the Smart3 BLE colorimeter is available at [lamotte.com](http://lamotte.com).

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions [1] This device may not cause harmful interference, and [2] this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interferences in which case the user will be required to correct the interference at his own expense.

## ■ IP67 CERTIFICATION

The Smart3 BLE 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](http://www.lamotte.com).

## ■ AN INTRODUCTION TO COLORIMETRIC ANALYSIS

Most test substances in water are colorless and undetectable to the human eye. To test for their presence we must find a way to “see” them. The Smart3 BLE Colorimeter can be used to measure any test substance that is itself colored or can be reacted to produce a color. In fact a simple definition of colorimetry is “the measurement of color” and a colorimetric method is “any technique used to evaluate an unknown color in reference to known colors”. In a colorimetric chemical test the intensity of the color from the reaction must be proportional to the concentration of the substance being tested. Some reactions have limitations or variances inherent to them that may give misleading results. Many such interferences are discussed with each particular test instruction. In the most basic colorimetric method the reacted test sample is visually compared to a known color standard. However, accurate and reproducible results are limited by the eyesight of the analyst, inconsistencies in the light sources, and the fading of color standards.

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

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

The Smart3 BLE Colorimeter passes one of four colored light beams through one of four optical filters which transmits only one particular color or band of wavelengths of light to the photodetector where it is measured. The difference in the amount of colored light transmitted by a colored sample is a measurement of the amount of colored light absorbed by the sample. In most colorimetric tests the amount of colored light absorbed is directly proportional to the concentration of the test factor producing the color and the path length through the sample. However, for some tests the amount of colored light absorbed is inversely proportional to the concentration.

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

## ■ REAGENT BLANK

Some tests will provide greater accuracy if a reagent blank is determined to compensate for any

color or turbidity resulting from the reagents themselves. A reagent blank is performed by running the test procedure on demineralized or deionized water. Use sample water to **Scan Blank**. Insert the reacted reagent blank in the colorimeter chamber and select **Scan Sample**. Note result of reagent blank. Perform the tests on the sample water as described. Subtract results of reagent blank from all subsequent test results. NOTE: Some tests require a reagent blank to be used to **Scan Blank**.

## ■ COLORIMETER TUBES AND CHAMBER

The colorimeter uses one type of tube [Code 0290] for all test factors. 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. 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.

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.

## ■ METER CARE

The optical system of the Smart3 BLE must be kept clean and dry for optimal performance. Dry the colorimeter tubes before placing them in the chamber to avoid introducing moisture. For best results store the instrument in a area that is dry and free from aggressive chemical vapors.

## ■ CALIBRATION

As with all pre-calibrated meters, it is highly recommended, even if not required by regulations, that the user periodically verify the performance of the meter by running standards with a predetermined concentration. Results outside of specification are an indication that the meter needs to be adjusted. This can be done following the Calibration procedure.

## ■ SAMPLE DILUTION TECHNIQUES & VOLUMETRIC MEASUREMENTS

If a test result using the Smart3 BLE Colorimeter gives an over range message then the sample must be diluted. The test should be repeated on the diluted sample to obtain a reading which is in the concentration range for the test. [Note: This is not true for colorimetric determination of pH.]

*Example:*

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

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

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

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

*Example:*

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

## ■ INTERFERENCES

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

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

Interferences due to high concentration of the substance being tested, can be overcome by sample dilution [see page 14].

## ■ STRAY LIGHT INTERFERENCE

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

## OPERATION OF THE SMART3 COLORIMETER

### ■ OVERVIEW

The Smart3 BLE is a portable, microprocessor controlled, direct reading colorimeter. It has a graphical liquid crystal display and 6 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 eight languages.

The test library consists of over 60 LaMotte tests and 25 "User Tests". The LaMotte tests are precalibrated for LaMotte reagent systems. The colorimeter displays the result of these tests directly in units of concentration. The 25 "User Tests" may be used to enter additional calibrations. All of these tests may be arranged in any of 3 sequences. These sequences can be modified a limitless number of times to meet changing testing needs.

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

A USB wall adapter, USB computer connection or lithium battery powers the Smart3 BLE.

Bluetooth wireless technology allows communication between the colorimeter and the BLE Mobile Printer [Code 5-0067 only] and firmware updates.

■ COMPONENTS

Figure 1 shows a diagram of the Smart3 BLE Colorimeter and its components.

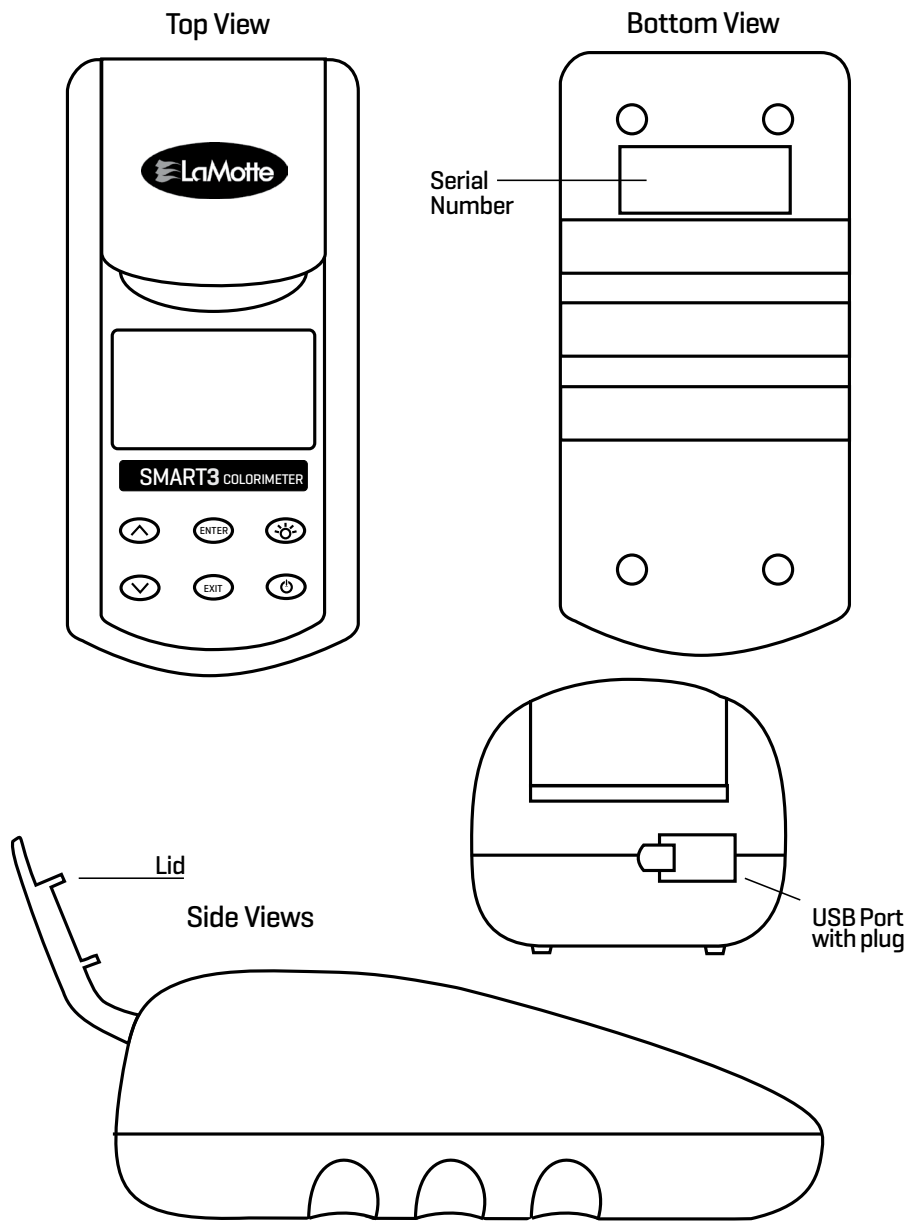








Figure 1

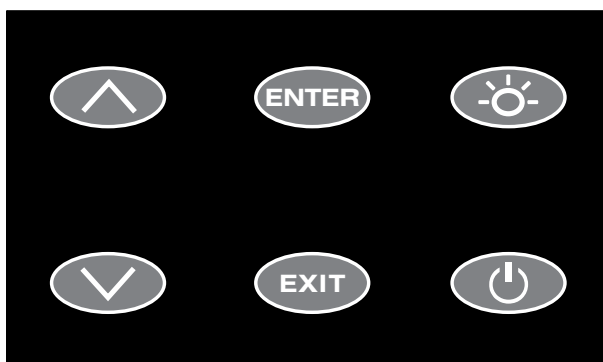
## GENERAL OPERATING PROCEDURES

The operation of the Smart3 BLE Colorimeter is controlled by a microprocessor. The microprocessor is programmed with menu driven software. A menu is a list of choices. This allows a selection of various tasks for the colorimeter to perform, such as, scan blank, scan sample, and edit test sequences. The keypad is used to make menu selections which are viewed in the display. There are two selections accessible from the Main Menu: Testing Menu and Setup Menu.

### ■ THE KEYPAD

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

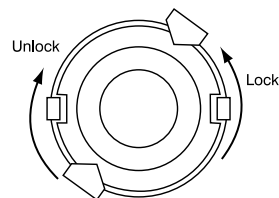
	This button will scroll up through a list of menu selections or go to the next character on a character selection line.
	The button is used to select choices in a menu viewed in the display and to add the selected character to the name and advance one character.
	This button controls the backlight on the display.
	This button will scroll down through a list of menu selections or go to the previous character selection line.
	This button exits to the previous menu on the name edit screen, the name will not be saved.
	This button turns the meter on or off.



### ■ SAMPLE HOLDERS

The sample chamber is designed for 25 mm round tubes. An adapter to hold 16 mm COD tubes and 10 mm square UDV cuvettes is included. 10 cm cuvettes can be scanned only at 525 nm and 568 nm. The light path is blocked at 428 nm and 635 nm with the use of the adapter. COD tubes can be scanned at all wavelengths.

Position the COD/UDV Adapter [Code 1724] so that the notches in the adapter fit around the posts on the chamber. Turn the adapter counterclockwise until the arrows are at the top and bottom of the chamber and the adapter is locked into place. Turn the adapter clockwise to unlock the adapter and remove it from the chamber.







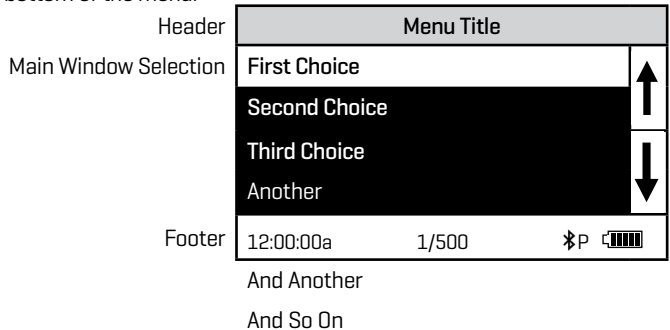
### ■ THE DISPLAY & THE MENUS


The display allows menu selections to be viewed and selected. These selections instruct the Smart3 Smart3 BLE Soil 07.22

BLE 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.

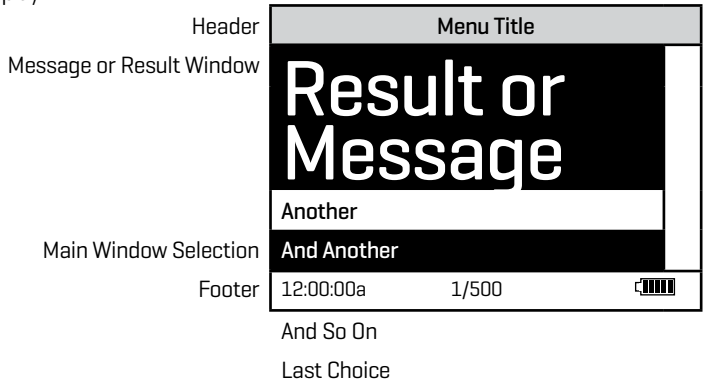
The display has a header line at the top and a footer line at the bottom. The header displays the title of the current menu. The footer line displays the time and the date, the data logger status, the bluetooth/ printer status and the battery status. The menu selection window is in the middle of the 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 Smart3 BLE 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  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  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  button. Pushing the  at any time will turn the Smart3 BLE 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

## TESTING

### ■ TESTING MENU

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

<p>1. Press and briefly hold  to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the <b>Main Menu</b> will appear.</p>	<table border="1"> <thead> <tr> <th colspan="2">Main Menu</th> </tr> </thead> <tbody> <tr> <td>Testing Menu</td> <td></td> </tr> <tr> <td>Setup Menu</td> <td></td> </tr> <tr> <td colspan="2">12:00:00a 1/500 </td> </tr> </tbody> </table>	Main Menu		Testing Menu		Setup Menu		12:00:00a 1/500 					
Main Menu													
Testing Menu													
Setup Menu													
12:00:00a 1/500 													
<p>2. Press  to select <b>Testing Menu</b>.</p>	<table border="1"> <thead> <tr> <th colspan="2">Testing Menu</th> </tr> </thead> <tbody> <tr> <td>All Tests Menu</td> <td></td> </tr> <tr> <td>Sequence 1</td> <td></td> </tr> <tr> <td>Sequence 2</td> <td></td> </tr> <tr> <td>Sequence 3</td> <td></td> </tr> <tr> <td colspan="2">12:00:00a 1/500 </td> </tr> </tbody> </table>	Testing Menu		All Tests Menu		Sequence 1		Sequence 2		Sequence 3		12:00:00a 1/500 	
Testing Menu													
All Tests Menu													
Sequence 1													
Sequence 2													
Sequence 3													
12:00:00a 1/500 													
<p>3. Press  or  to scroll to desired option. <b>All Tests</b> contains all of the available pre-programmed tests. The three sequences have user selected tests. Absorbance has %T/ABS tests.</p>	<table border="1"> <thead> <tr> <th colspan="2">Testing Menu</th> </tr> </thead> <tbody> <tr> <td>All Tests Menu</td> <td></td> </tr> <tr> <td>Sequence 1</td> <td></td> </tr> <tr> <td>Sequence 2</td> <td></td> </tr> <tr> <td>Sequence 3</td> <td></td> </tr> <tr> <td colspan="2">12:00:00a 1/500 </td> </tr> </tbody> </table>	Testing Menu		All Tests Menu		Sequence 1		Sequence 2		Sequence 3		12:00:00a 1/500 	
Testing Menu													
All Tests Menu													
Sequence 1													
Sequence 2													
Sequence 3													
12:00:00a 1/500 													

4. Press **ENTER** to select **All Tests**.

All Tests		
002 Alkalinity UDV		↓
005 Aluminum		
006 Ammonia-N LRF		
007 Ammonia-N LRS		
12:00:00a	1/500	🔋

## ■ GENERAL TESTING PROCEDURES

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

LaMotte Company continuously updates the list of pre-programmed tests as the calibrations become available. Call LaMotte Technical Services at 1-800-344-3100 (410-778-3100 outside the USA) or email at [tech@lamotte.com](mailto:tech@lamotte.com) for a current list of available calibrations.

## ■ TESTING WITH LaMOTTE PRE-PROGRAMMED TESTS

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		
Testing Menu		
Setup Menu		
12:00:00a	1/500	🔋




























2. Press **ENTER** to select **Testing Menu**.

Testing Menu		
All Test Menu		↓
Sequence 1		
Sequence 2		
Sequence 3		
12:00:00a	1/500	🔋

3. Press **ENTER** to select **All Tests Menu**.

All Tests		
001 Alkalinity T		↓
005 Aluminum		
006 Ammonia-N LRF		
007 Ammonia-N LRS		
12:00:00a	1/500	🔋



<p>4. Press  or  to scroll to the desired test.</p>	<div>All Tests</div> <div>001 Alkalinity T</div> <div>005 Aluminum</div> <div>006 Ammonia-N LRF</div> <div>007 Ammonia-N LRS</div> <div>12:00:00a 1/500 </div> <div> </div>
<p>5. Press  to select the test.</p>	<div>005 Aluminum</div> <div></div> <div>Scan Bank</div> <div>Scan Sample</div> <div>12:00:00a 1/500 </div> <div></div>
<p>6. Insert the blank into the chamber. Close the lid. Press  to scan the blank. The screen will display <b>Scan Blank Blank Done</b> for about 1 second and then return to the test menu.</p>	<div>005 Aluminum</div> <div></div> <div>Scan Blank</div> <div>Scan Sample</div> <div>12:00:00a 1/500 </div> <div></div>
<p>7. Insert the reacted sample into the chamber. Close the lid. Press  to scan the sample. The screen will display <b>Scan Sample Sample Done</b> for about 1 second. The result will appear on the screen.</p>	<div>005 Aluminum</div> <div>1.00 ppm</div> <div>Scan Blank</div> <div>Scan Sample</div> <div>12:00:00a 1/500 </div> <div> </div>
<p>8. To repeat the test, press  to scan the sample again. The last blank scanned is used by the colorimeter for repeated scans. A different blank can be used by pressing  or  to scroll to Scan Blank and then scanning another blank. Scroll with  or  and make another selection with . The %T or Absorbance of the last test can be viewed by scrolling down and choosing %T/Abs. Press  to escape to previous menus. NOTE: The menus loop in this screen so either  or  will lead to the menu selection needed.</p>	<div>005 Aluminum</div> <div>1.00 ppm</div> <div>Scan Bank</div> <div>Scan Sample</div> <div>12:00:00a 1/500 </div> <div> </div>

■ CALIBRATING LaMOTTE PRE-PROGRAMMED TESTS


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

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

For the SMART3 BLE Soil colorimeter, the standard should be used instead of the soil extract and prepared in distilled or deionized water for the range of the reagent system before the multiplication factor has been applied to the reading on the display. The following standards are recommended to standardize over the full range of the tests:

Ammonia Nitrogen	3.00 ppm Ammonia Nitrogen
Copper	4.00 ppm Copper
Iron	4.00 ppm Iron
Manganese	11.00 ppm Manganese
Nitrate Nitrogen	2.00 ppm Nitrate Nitrogen
Nitrite Nitrogen	0.60 ppm Nitrite Nitrogen
Phosphorus	2.00 ppm Phosphate
Potassium	7.00 ppm Potassium
Sulfur	75 ppm Sulfate
Zinc	2.00 ppm Zinc


In the following example, the Aluminum calibration will be standardized.  
Prepare a standard solution to be tested. In this example, 0.30 ppm aluminum.


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

Testing Menu

Setup Menu

12:00:00a1/500

2. Press  to select **Testing Menu**.


Testing Menu






All Test Menu



Sequence 1



Sequence 2


Sequence 3





12:00:00a1/500



<p>3. Press <b>ENTER</b> to select <b>All Tests Menu</b>.</p>	<div>All Tests</div> <div>001 Alkalinity T</div> <div>005 Aluminum</div> <div>006 Ammonia-N LRF</div> <div>007 Ammonia-N LRS</div> <div>12:00:00a 1/500 </div>
<p>4. Press <b>▲</b> or <b>▼</b> to scroll to the desired test factor.</p>	<div>All Tests</div> <div>001 Alkalinity T</div> <div>005 Aluminum</div> <div>006 Ammonia-N LRF</div> <div>007 Ammonia-N LRS</div> <div>12:00:00a 1/500 </div>
<p>5. Press <b>ENTER</b> to select the test.</p>	<div>005 Aluminum</div> <div>Scan Blank</div> <div>Scan Sample</div> <div>12:00:00a 1/500 </div>
<p>6. Follow the test procedure in the manual to test the prepared standard. Insert the blank into the chamber. Close the lid. Press <b>ENTER</b> to scan the blank. The screen will display <b>Scan Blank Blank Done</b> for about 1 second and then return to the <b>Test Menu</b>.</p>	<div>005 Aluminum</div> <div>Scan Blank</div> <div>Scan Sample</div> <div>12:00:00a 1/500 </div>
<p>7. Insert the reacted standard solution into the chamber. Close the lid. Press <b>ENTER</b> to scan the sample. The screen will display <b>Scan Sample Sample Done</b> for about 1 second. The result will appear on the screen.</p>	<div>005 Aluminum</div> <div>0.28 ppm</div> <div>Scan Blank</div> <div>Scan Sample</div> <div>12:00:00a 1/500 </div>





8. The displayed result can now be standardized.  
Press  or  to scroll to **Calibrate**.





005 Aluminum	
0.28 ppm	
%T/Abs	
Calibrate	
12:00:00a	1/500 



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

005 Aluminum	
0.28 ppm	
  =Edit, ENTER=Save	
 +ENTER=Default	
12:00:00a	1/500 

10. Press  or  to adjust the value shown to the concentration of the prepared standard, 0.30 in this example.  
NOTE: A maximum adjustment of 25% is possible.


005 Aluminum	
0.30 ppm	
  =Edit, ENTER=Save	
 +ENTER=Default	
12:00:00a	1/500 


11. Press  to save the value.  
To leave the Calibration procedure without saving the adjustment, press .  
Press  and  at any time to return to the default value.  
The calibration has now been standardized and can be used for testing. Scroll to **Scan Blank** and begin testing.





005 Aluminum	
0.30 ppm	
%T/Abs	
Calibrate	
12:00:00a	1/500 



## ■ MEASURING IN THE ABSORBANCE MODE





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	
Testing Menu	
Setup Menu	
12:00:00a	1/500 

2. Press <b>ENTER</b> to select <b>Testing Menu</b> .	Testing Menu		
	All Test Menu		
	Sequence 1		
	Sequence 2		
	Sequence 3		
	12:00:00a	001/500	


3. Press  or  to scroll to <b>Absorbance</b> .	Testing Menu		
	Sequence 1		
	Sequence 2		
	Sequence 3		
	Absorbance		
	12:00:00a	1/500	

4. Press <b>ENTER</b> to select <b>Absorbance</b> .	Absorbance		
	101 Absorbance 428		
	102 Absorbance 525		
	103 Absorbance 568		
	104 Absorbance 635		
	12:00:00a	1/500	


5. Press  or  to scroll to desired wavelength.	Absorbance		
	101 Absorbance 428		
	102 Absorbance 525		
	103 Absorbance 568		
	104 Absorbance 635		
	12:00:00a	1/500	

6. Press <b>ENTER</b> to select the wavelength.	102 Absorbance 525		
			
	Scan Blank		
	Scan Sample		
	12:00:00a	1/500	

7. Insert the blank. Close the lid. Press **ENTER** to scan the blank. The screen will display **Scan Blank** **Blank Done** for about 1 second and return to the Absorbance menu.

102 Absorbance 525	
Scan Blank	↑ ↓
Scan Sample	
12:00:00a	1/500 


8. Insert the reacted sample. Press **ENTER** to scan the sample. The screen will display **Scan Sample** **Sample Done** for about 1 second. The result will appear on the screen.

102 Absorbance 525	
0.425	↑ ↓
Scan Sample	
Next Test	
12:00:00a	1/500 

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

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

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

102 Absorbance 525	
0.425	↑ ↓
Scan Sample	
Next Test	
12:00:00a	1/500 
Previous Test	
%T/Abs	
Calibrate	
Print Test	

## SETUP MENU




The Setup Menu allows the user to edit sequences, edit user tests, set the clock, edit the logging function, access factory setting, set the power saving function, set the backlight time, select a language, and select the Bluetooth Settings.

The default factory settings are:

Logging	Enabled
Power Save	5 minutes
Backlight Time	10 seconds
Language	English
Bluetooth Power	Disabled
Bluetooth Timeout	15 min
Looping Menu	Enabled

## ■ TEST SEQUENCES

Sequence 1, Sequence 2, And Sequence 3 are alterable sequences. They may be edited using the Editing Menu. Any of the LaMotte pre-programmed tests or User Tests may be placed in these sequences in whatever testing order that is preferred. There are three initial sequences in the Smart3 BLE that can be customized by adding or deleting tests:

Sequence 1	Sequence 2	Sequence 3
025 Chlorine T DPD	005 Aluminum	006 Ammonia-N LF
080 Phosphate HR	025 Chlorine T DPD	036 Cu Thiocarbamate
010 Benzotriazole	056 Iron Phenanthro	065 Nitrate-N LR
075 pH UDV	060 Manganese LR	068 Nitrite-N LR
12:00:00a 1/500 	12:00:00a 1/500 	12:00:00a 1/500 
063 Molybdenum HR	065 Nitrate-N LR	075 pH PR
086 Silica HR	068 Nitrite-N LR	081 Phosphate LR
036 Cu Thicarbamate	079 Phenol	087 Silica LR
055 Iron Bipyridyl	081 Phosphate LR	
	090 Sulfide LR	

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

All Tests is a fixed sequence containing the LaMotte pre-programmed tests, User Tests, and Absorbance tests. Modification of the alterable sequences is accomplished through the Editing Menu. This menu is explained in greater detail in Editing Menu [page 36].



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




Pressing **POWER** the at any time will turn the colorimeter off.

NOTE: A sequence must contain at least one test.

## ■ EDITING A SEQUENCE

The Edit Sequence menu allows three alterable test sequences (Sequence 1, Sequence 2, Sequence 3) to be edited.

1. Press and briefly hold  to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the <b>Main Menu</b> will appear.	Main Menu		
	Testing Menu		
	Setup Menu		
	12:00:00a	1/500	

2. Press  or  to scroll to the <b>Setup Menu</b> .	Main Menu		
	Testing Menu		
	Setup Menu		
	12:00:00a	1/500	

3. Press <b>ENTER</b> to select <b>Setup Menu</b> .	<b>Setup Menu</b>		
	Edit Sequences		
	Edit User Test		
	Set Clock		
4. Press <b>ENTER</b> to select <b>Edit Sequences</b> .	Logging		↓
	12:00:00a	1/500	
5. Press <b>▲</b> or <b>▼</b> to scroll to the desired sequence.	<b>Edit Sequences</b>		
	Edit Sequence 1		
	Edit Sequence 2		
	Edit Sequence 3		
6. Press <b>ENTER</b> to select the sequence to be edited.	12:00:00a	1/500	
	<b>EDIT SEQUENCE 2</b>		
	005 Aluminum		
	025 Chlorine T DPD		
	056 Iron Phenanthro		
	060 Manganese LR		↓
	12:00:00a	1/500	
























## ■ ADDING OR DELETING A TEST

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

### ADDING A TEST

Below is a step-by-step example of how to add a test to SEQUENCE 2 starting from the EDIT SEQUENCE 2 menu.






























1. To add a test before or after an existing test, press  or  to scroll to the existing test.	<table><tr><th colspan="3">EDIT SEQUENCE 2</th></tr><tr><td>005 Aluminum</td><td></td><td></td></tr><tr><td>025 Chlorine T DPD</td><td></td><td></td></tr><tr><td>056 Iron Phenanthro</td><td></td><td></td></tr><tr><td>060 Manganese LR</td><td></td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	EDIT SEQUENCE 2			005 Aluminum			025 Chlorine T DPD			056 Iron Phenanthro			060 Manganese LR			12:00:00a	1/500	
EDIT SEQUENCE 2																			
005 Aluminum																			
025 Chlorine T DPD																			
056 Iron Phenanthro																			
060 Manganese LR																			
12:00:00a	1/500																		
2. Press  to select the existing test.	<table><tr><th colspan="3">Add or Delete</th></tr><tr><td>Insert Before</td><td></td><td></td></tr><tr><td>Insert After</td><td></td><td></td></tr><tr><td>Delete</td><td></td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	Add or Delete			Insert Before			Insert After			Delete			12:00:00a	1/500				
Add or Delete																			
Insert Before																			
Insert After																			
Delete																			
12:00:00a	1/500																		
3. Press  or  to scroll to <b>Insert Before</b> or <b>Insert After</b> .	<table><tr><th colspan="3">Add or Delete</th></tr><tr><td>Insert Before</td><td></td><td></td></tr><tr><td>Insert After</td><td></td><td></td></tr><tr><td>Delete</td><td></td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	Add or Delete			Insert Before			Insert After			Delete			12:00:00a	1/500				
Add or Delete																			
Insert Before																			
Insert After																			
Delete																			
12:00:00a	1/500																		
4. Press  to select the option, <b>Insert Before</b> , in this example. The <b>All Test Menu</b> will appear.	<table><tr><th colspan="3">All Tests</th></tr><tr><td>001 Alkalinity T</td><td></td><td></td></tr><tr><td>005 Aluminum</td><td></td><td></td></tr><tr><td>006 Ammonia-N LRF</td><td></td><td></td></tr><tr><td>007 Ammonia-N LRS</td><td></td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	All Tests			001 Alkalinity T			005 Aluminum			006 Ammonia-N LRF			007 Ammonia-N LRS			12:00:00a	1/500	
All Tests																			
001 Alkalinity T																			
005 Aluminum																			
006 Ammonia-N LRF																			
007 Ammonia-N LRS																			
12:00:00a	1/500																		
5. Press  or  to scroll to the test that will be added to the sequence. In this example, 006 Ammonia-N LRS.	<table><tr><th colspan="3">All Tests</th></tr><tr><td>001 Alkalinity T</td><td></td><td></td></tr><tr><td>005 Aluminum</td><td></td><td></td></tr><tr><td>006 Ammonia-N LRF</td><td></td><td></td></tr><tr><td>007 Ammonia-N LRS</td><td></td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	All Tests			001 Alkalinity T			005 Aluminum			006 Ammonia-N LRF			007 Ammonia-N LRS			12:00:00a	1/500	
All Tests																			
001 Alkalinity T																			
005 Aluminum																			
006 Ammonia-N LRF																			
007 Ammonia-N LRS																			
12:00:00a	1/500																		

6. Press <b>ENTER</b> to select the test. The sequence will appear in the Edit Sequence menu and the new test will be added to the sequence. All changes in the sequence will be automatically saved.	<table><tr><th colspan="3">EDIT SEQUENCE 2</th></tr><tr><td>005 Aluminum</td><td></td><td></td></tr><tr><td>025 Chlorine T DPD</td><td></td><td></td></tr><tr><td>006 Ammonia-N LF</td><td></td><td></td></tr><tr><td>056 Iron Phenanthro</td><td></td><td>↓</td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	EDIT SEQUENCE 2			005 Aluminum			025 Chlorine T DPD			006 Ammonia-N LF			056 Iron Phenanthro		↓	12:00:00a	1/500	
EDIT SEQUENCE 2																			
005 Aluminum																			
025 Chlorine T DPD																			
006 Ammonia-N LF																			
056 Iron Phenanthro		↓																	
12:00:00a	1/500																		
7. Press <b>EXIT</b> to exit the <b>Edit Sequence</b> menu and return to the <b>Editing Sequences Menu</b> .	<table><tr><th colspan="3">Edit Sequences</th></tr><tr><td>Edit Sequence 1</td><td></td><td></td></tr><tr><td>Edit Sequence 2</td><td></td><td></td></tr><tr><td>Edit Sequence 3</td><td></td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	Edit Sequences			Edit Sequence 1			Edit Sequence 2			Edit Sequence 3			12:00:00a	1/500				
Edit Sequences																			
Edit Sequence 1																			
Edit Sequence 2																			
Edit Sequence 3																			
12:00:00a	1/500																		
8. Press <b>ENTER</b> to select <b>Edit Sequences</b> to continue editing the sequences or press <b>EXIT</b> twice to return to the <b>Main Menu</b> .	<table><tr><th colspan="3">Main Menu</th></tr><tr><td>Testing Menu</td><td></td><td></td></tr><tr><td>Setup Menu</td><td></td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	Main Menu			Testing Menu			Setup Menu			12:00:00a	1/500							
Main Menu																			
Testing Menu																			
Setup Menu																			
12:00:00a	1/500																		

## DELETING A TEST

Below is a step-by-step example of how to delete a test in SEQUENCE 2 starting from the EDIT SEQUENCE 2 menu.





















1. To delete a test, press  or  to scroll to the test in the sequence.	<table><tr><th colspan="3">EDIT SEQUENCE 2</th></tr><tr><td>005 Aluminum</td><td></td><td></td></tr><tr><td>025 Chlorine T DPD</td><td></td><td></td></tr><tr><td>006 Ammonia-N LF</td><td></td><td rowspan="2"></td></tr><tr><td>056 Iron Phenathro</td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	EDIT SEQUENCE 2			005 Aluminum			025 Chlorine T DPD			006 Ammonia-N LF			056 Iron Phenathro		12:00:00a	1/500	
EDIT SEQUENCE 2																		
005 Aluminum																		
025 Chlorine T DPD																		
006 Ammonia-N LF																		
056 Iron Phenathro																		
12:00:00a	1/500																	
2. Press  to select the test.	<table><tr><th colspan="3">Add or Delete</th></tr><tr><td>Insert Before</td><td></td><td></td></tr><tr><td>Insert After</td><td></td><td></td></tr><tr><td>Delete</td><td></td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	Add or Delete			Insert Before			Insert After			Delete			12:00:00a	1/500			
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<p>3. Press <b>▲</b> or <b>▼</b> to scroll to <b>Delete</b>.</p>	<table> <tr><th colspan="2">Add or Delete</th></tr> <tr><td>Insert Before</td><td></td></tr> <tr><td>Insert After</td><td></td></tr> <tr><td>Delete</td><td></td></tr> <tr><td></td><td></td></tr> <tr><td>12:00:00a</td><td>1/500 </td></tr> </table>	Add or Delete		Insert Before		Insert After		Delete				12:00:00a	1/500 
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Insert Before													
Insert After													
Delete													
12:00:00a	1/500 												
<p>4. Press <b>ENTER</b> to select <b>Delete</b>. The sequence will appear in the <b>Edit Sequences</b> menu and the selected test will have been deleted. All changes to the sequence will automatically have been saved.</p>	<table> <tr><th colspan="2">EDIT SEQUENCE 2</th></tr> <tr><td>005 Aluminum</td><td></td></tr> <tr><td>025 Chlorine T DPD</td><td></td></tr> <tr><td>056 Iron Phenanthro</td><td></td></tr> <tr><td>060 Manganese LR</td><td></td></tr> <tr><td>12:00:00a</td><td>1/500 </td></tr> </table>	EDIT SEQUENCE 2		005 Aluminum		025 Chlorine T DPD		056 Iron Phenanthro		060 Manganese LR		12:00:00a	1/500 
EDIT SEQUENCE 2													
005 Aluminum													
025 Chlorine T DPD													
056 Iron Phenanthro													
060 Manganese LR													
12:00:00a	1/500 												
<p>5. Press <b>EXIT</b> to exit the <b>Edit Sequence</b> menu and return to the <b>Edit Sequences Menu</b>.</p>	<table> <tr><th colspan="2">Edit Sequences</th></tr> <tr><td>Edit Sequence 1</td><td></td></tr> <tr><td>Edit Sequences 2</td><td></td></tr> <tr><td>Edit Sequences 3</td><td></td></tr> <tr><td>12:00:00a</td><td>1/500 </td></tr> </table>	Edit Sequences		Edit Sequence 1		Edit Sequences 2		Edit Sequences 3		12:00:00a	1/500 		
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Edit User Test													
Set Clock													
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<p>7. Press <b>ENTER</b> to select <b>Edit Sequences</b> to continue editing the sequences or press <b>EXIT</b> to return to the <b>Main Menu</b>.</p>	<table> <tr><th colspan="2">Main Menu</th></tr> <tr><td>Testing Menu</td><td></td></tr> <tr><td>Setup Menu</td><td></td></tr> <tr><td></td><td></td></tr> <tr><td>12:00:00a</td><td>1/500 </td></tr> </table>	Main Menu		Testing Menu		Setup Menu				12:00:00a	1/500 		
Main Menu													
Testing Menu													
Setup Menu													
12:00:00a	1/500 												


## ■ CREATING A SOIL TEST SEQUENCE

To create a soil testing sequence specifically for the reagent systems in this SMART3 Soil Manual follow the step by step procedure below. The test sequence currently in the meter will be cleared and then the soil tests will be added to Sequence 1. Tests in the soil sequence will be arranged in the order in which they appear in the manual.



008 Ammonia-N HR  
 036 Cu Thiocarbamate  
 055 Iron Bipyrldyl  
 059 Manganese HR  
 065 Nitrate-N LR  
 068 Nitrite-N LR  
 081 Phosphate LR  
 085 Potassium  
 089 Sulfate HR  
 097 Zinc LR


<p>1. Press and briefly hold  to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the <b>Main Menu</b> will appear.</p>	<table border="1"> <thead> <tr> <th colspan="2">Main Menu</th> </tr> </thead> <tbody> <tr> <td>Testing Menu</td> <td></td> </tr> <tr> <td>Setup Menu</td> <td></td> </tr> <tr> <td colspan="2">12:00:00a 1/500 </td> </tr> </tbody> </table>	Main Menu		Testing Menu		Setup Menu		12:00:00a 1/500 					
Main Menu													
Testing Menu													
Setup Menu													
12:00:00a 1/500 													
<p>2. Press  or  to scroll to the <b>Setup Menu</b>.</p>	<table border="1"> <thead> <tr> <th colspan="2">Main Menu</th> </tr> </thead> <tbody> <tr> <td>Testing Menu</td> <td></td> </tr> <tr> <td>Setup Menu</td> <td></td> </tr> <tr> <td colspan="2">12:00:00a 1/500 </td> </tr> </tbody> </table>	Main Menu		Testing Menu		Setup Menu		12:00:00a 1/500 					
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Testing Menu													
Setup Menu													
12:00:00a 1/500 													
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Edit Sequences													
Edit User Test													
Set Clock													
Logging													
12:00:00a 1/500 													
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Edit Sequences													
Edit Sequence 1													
Edit Sequence 2													
Edit Sequence 3													
12:00:00a 1/500 													


5. Press  or  to scroll to the desired sequence. In this example, Edit Sequence 1.

Edit Sequences	
Edit Sequence 1	
Edit Sequence 2	
Edit Sequence 3	
12:00:00a	1/500 


6. Press  to select the sequence to be edited.

Edit Sequence 1	
025 Chlorine T DPD	
080 Phosphate HR	
010 Benzotriazole	
075 pH PR	
12:00:00a	1/500 



7. Press  to select the test to be edited. In this example, 025 Chlorine T DPD.
































Add or Delete	
Insert Before	
Insert After	
Delete	
12:00:00a	1/500 



8. Press  or  to scroll to **Delete**.



Add or Delete	
Insert Before	
Insert After	
Delete	
12:00:00a	1/500 

9. Press  to select **Delete**.



Edit Sequence 1	
080 Phosphate HR	
010 Benzotriazole	
075 pH UDV	
063 Molybdenum HR	
12:00:00a	1/500 

10. Press  or  and <b>ENTER</b> to select the next test to be edited. In this example, 080 Phosphate HR.	<table><tr><th colspan="3">Add or Delete</th></tr><tr><td>Insert Before</td><td></td><td></td></tr><tr><td>Insert After</td><td></td><td></td></tr><tr><td>Delete</td><td></td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	Add or Delete			Insert Before			Insert After			Delete			12:00:00a	1/500				
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Add or Delete																			
Insert Before																			
Insert After																			
Delete																			
12:00:00	001/500																		
12. Press <b>ENTER</b> to select <b>Delete</b> . Repeat the procedure to delete the tests in the series except for 055 Iron Bipyridal which will remain. Tests will be added to the sequence. NOTE: It is not possible to empty a test sequence completely. One test will remain. To remove the remaining test, add a new test and then delete the unwanted test. In creating the soil sequence, the last test—055 Iron Biryridal—will be included in the sequence and will not be deleted.	<table><tr><th colspan="3">Edit Sequence 1</th></tr><tr><td>055 Iron Bipyridyl</td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	Edit Sequence 1			055 Iron Bipyridyl						12:00:00a	1/500							
Edit Sequence 1																			
055 Iron Bipyridyl																			
12:00:00a	1/500																		
13. Press <b>ENTER</b> to begin adding tests to the sequence.	<table><tr><th colspan="3">Add or Delete</th></tr><tr><td>Insert Before</td><td></td><td></td></tr><tr><td>Insert After</td><td></td><td></td></tr><tr><td>Delete</td><td></td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	Add or Delete			Insert Before			Insert After			Delete			12:00:00a	1/500				
Add or Delete																			
Insert Before																			
Insert After																			
Delete																			
12:00:00a	1/500																		
14. Press <b>ENTER</b> to select <b>Insert Before</b> .	<table><tr><th colspan="3">All Tests</th></tr><tr><td>002 Aluminum UDV</td><td></td><td></td></tr><tr><td>005 Alumnium</td><td></td><td></td></tr><tr><td>006 Ammonia-N LRF</td><td></td><td></td></tr><tr><td>007 Ammonia-N LRS</td><td></td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	All Tests			002 Aluminum UDV			005 Alumnium			006 Ammonia-N LRF			007 Ammonia-N LRS			12:00:00a	1/500	
All Tests																			
002 Aluminum UDV																			
005 Alumnium																			
006 Ammonia-N LRF																			
007 Ammonia-N LRS																			
12:00:00a	1/500																		



15. Press  or  to scroll to the first test to be added to the sequence. In this example, 036 Cu Thiocarbamate because the tests will be added in the order that they appear in the manual.

Add or Delete		
003 Color		
034 Cu BCAT		
035 Cu Cuprizone		
036 Cu Thiocarbamate		
12:00:00a	1/500	



16. Press  to select the test to be added.




Edit Sequence 1		
036 Cu Thiocarbamate		
055 Iron Bipyridal		
12:00:00a	1/500	




17. Press  to select **036 Cu Thiocarbamate**.

Edit Sequence 1		
036 Cu Thiocarbamate		
055 Iron Bipyridal		
12:00:00a	1/500	


18. Press  or  to scroll to **Insert Before**.

Add or Delete		
Insert Before		
Insert After		
Delete		
12:00:00a	1/500	


19. Press  to select **Insert Before**. Press  or  to scroll to the next test to be added. In this example, 008 Ammonia-N HR.

Add or Delete		
006 Ammonia-N LRF		
007 Ammonia-N LRS		
008 Ammonia-N HR		
009 Barium		
12:00:00a	1/500	


20. Press **ENTER** to select 008 Ammonia-N HR test to be added.

Edit Sequence 1		
008 Ammonia-N HR		
036 Cu Thiocarbamate		
055 Iron Bipyrical		
12:00:00a	1/500	




21. Press **V** to scroll to the last test in the sequence. In this example, 055 Iron Bipyrical.

Edit Sequence 1		
008 Ammonia-N HR		
036 Cu Thiocarbamate		
055 Iron Bipyrical		
12:00:00a	1/500	


22. Press **ENTER** to select **055 Iron Bipyrical**. Press **^** or **V** to scroll to **Insert After**.

Add or Delete		
Insert Before		
Insert After		
Delete		
12:00:00a	1/500	

23. Press **ENTER** to select **Insert Before**.

All Tests		
002 Aluminum UDV		
005 Alumnium		
006 Ammonia-N LRF		
007 Ammonia-N LRS		
12:00:00a	1/500	

24. Press **ENTER** to select the test to be added.

Edit Sequence 1		
008 Ammonia-N HR		
036 Cu Thiocarbamate		
055 Iron Bipyrical		
059 Manganese HR		
12:00:00a	1/500	



25. Press **▼** to scroll to the last test in the sequence.  
In this example, 059 Manganese HR.

All Tests		
008 Ammonia-N HR		
036 Cu Thiocarbamate		
055 Iron Bipyridal		
059 Manganese HR		
12:00:00a	1/500	

26. Press **ENTER** to **059 Manganese HR**. Press **▲** or **▼** to scroll to **Insert After**.

Add or Delete		
Insert Before		
Insert After		
Delete		
12:00:00a	1/500	

27. Press **ENTER** to select **Insert After**. Repeat the procedure to add the remaining tests to the sequence.  
059 Manganese HR  
065 Nitrate-N LR  
068 Nitrate-N LR  
081 Phosphate LR  
085 Potassium  
089 Sulfate HR  
097 Zinc LR






All Tests		
081 Phosphate LR		
285 Potassium		
089 Sulfate LR		
099 Zinc LR		
12:00:00a	1/500	

28. Press **EXIT** to escape the **Sequences Menu**.




Setup Menu		
Edit Sequence 1		
Edit Sequence 2		
Edit Sequence 3		
12:00:00a	1/500	

29. Press **EXIT** to escape the **Setup Menu**.

Setup Menu		
Edit Sequences		
Edit User Test		
Set Clock		
Logging		
12:00:00a	1/500	

30. Press <b>EXIT</b> to escape to the <b>Main Menu</b> . Press  or  to scroll to the <b>Testing Menu</b> .	<b>Main Menu</b>		
	Testing Menu		 
	Setup Menu		
	12:00:00a	1/500	

31. Press <b>ENTER</b> to select <b>Testing Menu</b> . Press  or  to scroll to <b>Sequence 1</b> to begin testing.	<b>Testing Menu</b>		
	All Test Menu		
	Sequence 1		
	Sequence 2		
	Sequence 3		
	12:00:00a	1/500	



## ■ EDIT USER TESTS

If a test other than the LaMotte programmed tests is performed regularly, a calibration for it may be entered in one of the 25 User Tests. These tests are originally named "User Test 1 - 25". It will be possible to rename the test, select a wavelength, enter a new calibration, select the number of decimal places used to display the results, and select the units. A User Test may be added for a reagent system for which no precalibrated test exists. A calibration of a LaMotte reagent system may also be entered. The calibration of a User Test can be changed at any time.




The User Tests have the ability to handle 2 data points. The colorimeter will determine the absorbance of the standards and calculate a response that will be stored to determine the concentration of future samples of unknown concentration. These standards should cover all the concentrations for the range of the test being performed and be scanned beginning with the low concentration and finishing with the high concentration [for more information about this, see CALIBRATION CURVES, page 16]. Prepare these standards prior to entering a new calibration.
















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

The User Tests can be placed in any of the alterable sequences using Edit Sequences.



1. Press and briefly hold  to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the <b>Main Menu</b> will appear.	<b>Main Menu</b>		
	Testing Menu		
	Setup Menu		
	12:00:00a	1/500	


  



2. Press  or  to scroll to the <b>Setup Menu</b> .	<b>Main Menu</b>		
	Testing Menu		
	Setup Menu		
	12:00:00a	1/500	


<p>3. Press <b>ENTER</b> to select <b>Setup Menu</b>. Press  to scroll to <b>Edit User Test</b>.</p>	<table border="1"> <thead> <tr> <th colspan="2">Setup Menu</th> </tr> </thead> <tbody> <tr> <td>Edit Sequences</td> <td></td> </tr> <tr> <td><b>Edit User Test</b></td> <td></td> </tr> <tr> <td>Set Clock</td> <td></td> </tr> <tr> <td>Logging</td> <td></td> </tr> <tr> <td>12:00:00a</td> <td>1/500 </td> </tr> </tbody> </table>	Setup Menu		Edit Sequences		<b>Edit User Test</b>		Set Clock		Logging		12:00:00a	1/500 
Setup Menu													
Edit Sequences													
<b>Edit User Test</b>													
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12:00:00a	1/500 												
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Edit User Test													
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<b>108 USER TEST 04</b>													
12:00:00a	1/500 												
<p>5. Press  or  to scroll to the desired user test.</p>	<table border="1"> <thead> <tr> <th colspan="2">Edit User Test</th> </tr> </thead> <tbody> <tr> <td>108 USER TEST 04</td> <td></td> </tr> <tr> <td>109 USER TEST 05</td> <td></td> </tr> <tr> <td>110 USER TEST 06</td> <td></td> </tr> <tr> <td><b>111 USER TEST 07</b></td> <td></td> </tr> <tr> <td>12:00:00a</td> <td>1/500 </td> </tr> </tbody> </table>	Edit User Test		108 USER TEST 04		109 USER TEST 05		110 USER TEST 06		<b>111 USER TEST 07</b>		12:00:00a	1/500 
Edit User Test													
108 USER TEST 04													
109 USER TEST 05													
110 USER TEST 06													
<b>111 USER TEST 07</b>													
12:00:00a	1/500 												
<p>6. Press <b>ENTER</b> to select the <b>User Test</b>.</p>	<table border="1"> <thead> <tr> <th colspan="2">111 USER TEST 07</th> </tr> </thead> <tbody> <tr> <td>Name the Test</td> <td></td> </tr> <tr> <td>Select Vial/WL</td> <td></td> </tr> <tr> <td>STD Calibration</td> <td></td> </tr> <tr> <td>Enter Constants</td> <td></td> </tr> <tr> <td>12:00:00</td> <td>1/500 </td> </tr> </tbody> </table>	111 USER TEST 07		Name the Test		Select Vial/WL		STD Calibration		Enter Constants		12:00:00	1/500 
111 USER TEST 07													
Name the Test													
Select Vial/WL													
STD Calibration													
Enter Constants													
12:00:00	1/500 												


## ■ NAMING THE TEST



A User Test can be up to 16 characters long. The menu choices for each character are 26 upper case letters A to Z, 26 lower case letters a to z, ten numerals 0 to 9, a space, a dash [-] and a decimal point [.] . The existing name is displayed on the bottom line of the display. The character which is to be edited will blink and that character is also displayed in the center of the display. The character can be changed by using  or  to scroll to other characters. Use **ENTER** to select a character. The edited name is saved at any time by pressing **EXIT** or by pressing **ENTER** after selecting the sixteenth character.


- From the User Test menu, press  to scroll to **Name the Test**.


111 USER TEST 07		
Name the Test		
Select Vial/WL		
STD Calibration		
Enter Constants		
12:00:00a	1/500	


- Press  to select **Name the Test**. A blinking reverse font [dark background with a light character] will appear to indicate the character that will be adjusted. The same character will also appear in the center of the display.

Name the Test		
P Q R S T <b>U</b> V W X Z		
111	U	SER TEST 07
12:00:00a 1/500 		


- Press  or  to scroll to the desired character. In this example, the test name will be H<sub>2</sub>O. The character for a blank space is located after the lower case z.

Name the Test		
C D E F G <b>H</b> I J K L M		
111	U	SER TEST 07
12:00:00a 1/500 		

- Press  to save the character and move to the next character.

Name the Test		
N O P Q R <b>S</b> T U V W X		
111 H	S	ER TEST 07
12:00:00a 1/500 		

- Press  or  to scroll to the desired character.

Name the Test		
X Y Z . 0 1 <b>2</b> 3 4 5 6 7		
111 H	S	ER TEST 07
12:00:00a 1/500 		

6. Press **ENTER** to save the character and move to the next character.

Name the Test		
9 A B C D	<b>E</b>	F G H I J K
111 H2	E	R TEST 07
12:00:00a	1/500	

7. Press **▲** or **▼** to scroll to the desired character.

Name the Test		
J K L M N	<b>O</b>	P Q R S T
111 H2	O	R TEST 07
12:00:00a	1/500	

8. Press **ENTER** to save the character. Repeat the procedure until the test name is complete. After selecting the last character in the name: Hold down **▼** and press and release **ENTER** to save all selected characters and to delete all characters to the right of the cursor and exit the name edit screen. Hold down **▲** and press and release **ENTER** to save all remaining characters and exit the name edit screen. The meter will return to the **Edit Test** menu.

111 H2O		
Name the Test		
Select Vial/WL		
STD Calibration		
Enter Constants		<b>↓</b>
12:00:00	1/500	

## ■ SELECT THE VIAL AND WAVELENGTH



The Smart3 BLE Colorimeter accepts three different vials [the 25 mm Q290 tube, UDV's and COD tubes] at 4 different wavelengths [428, 525, 560, and 635 nm]. The colorimeter uses different settings for each of the twelve combinations of vial and wavelength.



1. From the **User Test** menu, press **▲** or **▼** to scroll to **Select Vial/WL**.


111 H2O		
Name the Test		
Select Vial/WL		
STD Calibration		
Enter Constants		<b>↓</b>
12:00:00a	1/500	



2. Press **ENTER** to select **Select Vial/WL**.

Select Vial/WL		
Ch1 428nm 25mm		
Ch2 525nm 25mm		
Ch3 635nm 25mm		
Ch4 568nm 25mm		<b>↓</b>
12:00:00a	1/500	

3. Press  or  to scroll to the channel with the desired wavelength and vial size combination. The screen will display **Storing...** for about 1 second and the meter will return to the **User Test** menu.



Select Vial/WL		
Ch1 428nm 25mm		
Ch2 525nm 25mm		
Ch3 635nm 25mm		
Ch4 568nm 25mm		
12:00:00a	1/500	




4. Press  to select the Vial/WL option. The screen will display **Storing...** for about 1 second and the meter will return to the **Edit Test** menu.


111 H2O		
Name the Test		
Select Vial/WL		
STD Calibration		
Enter Constants		
12:00:00a	1/500	


## ■ ENTERING A TWO POINT CALIBRATION



The Smart3 Colorimeter can scan two reacted standards and create a calibration curve. To create a calibration curve with multiple data points see Entering a Multiple Point Calibration Curve [pg. 54].


1. From the User Test menu, press  or  to scroll to STD [Standard] Calibration.

111 H2O		
Name the Test		
Select Vial/WL		
STD Calibration		
Enter Constants		
12:00:00a	1/500	


2. Press  to select STD Calibration. The values for the standards will be entered. The screen will display the **Low Standard** screen. A blinking reverse font [dark background with a light character] will appear to indicate the character that will be adjusted. The same character will also appear in the center of the display.

Low Standard	
6 7 8 9 . - <b>0</b> 1 2 3 4 5	
0 0.000000	
12:00:00a	1/500


3. Press  or  to scroll to the first character of the low concentration. In this example, 1.00 ppm.

Low Standard	
7 8 9 . - 0 <b>1</b> 2 3 4 5 6	
0 .000000	
12:00:00a	1/500


4. Press **ENTER** to save the character and move to the next character.

Low Standard	
5 6 7 8 9	0 1 2 3 4
1 .	000000
12:00:00a	1/500 


5. Press **▲** or **▼** to scroll to the desired character.

Low Standard	
5 6 7 8 9	0 1 2 3 4
1 .	000000
12:00:00a	1/500 


6. Press **ENTER** to save the character and move to the next character.



Low Standard	
6 7 8 9 . -	0 1 2 3 4 5
1. 0	00000
12:00:00a	1/500 


7. Press **▲** or **▼** to scroll to the desired character.

Low Standard	
6 7 8 9 . -	0 1 2 3 4 5
1. 0	00000
12:00:00a	1/500 


8. Press **ENTER** to save the character. Repeat the procedure until the low concentration value is complete. [the character for a blank space is located after the 9.] After the final character is complete the meter will save the low concentration value. The screen will display the **High Standard** screen. A blinking reverse font [dark background with a light character] will appear to indicate the character that will be adjusted. The same character will appear in the center of the display.

High Standard	
6 7 8 9 . -	0 1 2 3 4 5
0	.0000
12:00:00a	1/500 


9. Use  or  and **ENTER** to select the characters for the high concentration value. In this example, 7.5 ppm.

High Standard											
6	7	8	9	.	-	<b>0</b>	1	2	3	4	5
7.50000						0					
12:00:00a						1/500					


10. After the final character is entered the meter will save the high concentration value. The screen will display instructions for completing the calibration procedure.

STD Calibration											
Insert Blank											
<Enter> continue											
12:00:00a						1/500					


11. The standards will be scanned. Insert the blank. Press **ENTER** and the **Insert Low Standard** screen will appear.

STD Calibration											
Insert Low Standard											
<Enter> continue											
12:00:00a						1/500					

12. Insert the low standard. Press **ENTER**. The **Insert High Standard** screen will be displayed.

STD Calibration											
Insert Hi Standard											
<Enter> continue											
12:00:00a						1/500					

13. Insert the high standard. Press **ENTER**. The meter will display the constants for the calibration curve.

K0 = 0.57246											
K1 = 7.14547											
K2 = 0.00000											
K3 = 0.00000											
<Enter> Save											
12:00:00a						1/500					



14. Press **ENTER** to save the calibration curve and return to the **Edit User Test Menu**.

111 H2O		
Name the Test	↑	
Select Vial/WL		
STD Calibration	↓	
Enter Constants		
12:00:00a	1/500	

## ■ ENTERING A MULTIPLE POINT CALIBRATION

The Smart3 BLE can directly create a 2 point calibration curve. [See Entering a Two Point Calibration on page 45]. To create a multiple point calibration curve, constants obtained from a linear regression of multiple data points can be entered into the Smart3 BLE.

1. Scan reactions of multiple concentrations at the appropriate wavelength in the absorbance mode on the Smart3 BLE.
2. Plot the concentration [y axis] versus absorbance [x axis] in a program capable of linear regression such as Excel.

Enter the constants obtained from the linear regression equation into the Smart3 BLE.

For Example:

$$y = 0.001x^3 - 0.017x^2 + 0.181x - 0.049$$

$$K0 = -0.049$$

$$K1 = 0.181$$

$$K2 = -0.017$$

$$K3 = 0.001$$

$$OR \text{ (Over Range)} = 10$$


1. From the User Test menu, press or to scroll to **Enter Constants**.

111 H2O		
Name the Test	↑	
Select Vial/WL		
STD Calibration	↓	
Enter Constants		
12:00:00a	1/500	


2. Press **ENTER** to select **Enter Constants**.

K0=0.00000		
K1=1.00000		
K2=0.00000		
K3=0.00000		
OR=100.00000		
12:00:00a	1/500	


3. Press **ENTER** to begin entering the values for the constants. A reverse font (dark background with a light character) will appear to indicate the character that will be adjusted. The same character will also appear in the center of the display.

Enter Constants K0	
6 7 8 9 . - 0 1 2 3 4 5	0
0	.00000
12:00:00a	1/500 


4. Press **▲** or **▼** to scroll to the first character of K0. In this example, - 0.049.

Enter Constants K0	
6 7 8 9 . - 0 1 2 3 4 5	0
0	.00000
12:00:00a	1/500 


5. Press **ENTER** to save the character and move to the next character.

Enter Constants K0	
5 6 7 8 9 . - 0 1 2 3 4	-
-	. 00000
12:00:00a	1/500 

6. Press **▲** or **▼** to scroll to the next character.

Enter Constants K0	
6 7 8 9 . - 0 1 2 3 4 5	0
-	. 00000
12:00:00a	1/500 

7. Press **ENTER** to save the character and move to the next character. Press **▲** or **▼** to scroll to the next character.  
Note: The character for a blank space is located after the 9.

Enter Constants K0	
5 6 7 8 9 . - 0 1 2 3 4	-
- 0	0 0000
12:00:00a	001/500 

8. Press **ENTER** to save the character. Repeat the procedure until the K0 value is complete. After the final character is complete the meter will save the K0 value and the meter will display K1 screen.

Enter Constants K1	
6 7 8 9 . -	0 1 2 3 4 5
0 .00000	
12:00:00a 1/500	

9. Use **▲**, **▼** and **ENTER** to select the characters for the remaining values: K1, K2, K3, and over range. In this example, 10 ppm.

Constants QR	
6 7 8 9 . -	0 1 2 3 4 5
10.00000	0
12:00:00a 1/500	

10. After the final character is entered the meter will save the constants. The screen will display **Storing...** and return to the **Edit Test** menu.

111 H2O	
Name the Test	↑ ↓
Select Vial/WL	
STD Calibration	
Enter Constants	
12:00:00a 1/500	

## ■ SELECTING THE NUMERICAL FORMAT OF THE RESULT



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

1. From the User Test menu, press **▲** or **▼** to scroll to **Decimal Places**.

111 H2O	
Select Vial/WL	↑ ↓
STD Calibration	
Enter Constants	
Decimal Places	
12:00:00a 1/500	

2. Press **ENTER** to select **Decimal Places**.

Decimal Places	
None 0	
One 0.0	
Two 0.00	
Three 0.000	
12:00:00a 1/500	

3. Press  or  to scroll to the desired number of decimal places.

Decimal Places

None 0


One 0.0


Two 0.00

Three 0.000

12:00:00a

1/500



4. Press  to select the decimal places. The screen wil display **Storing...** for about 1 second and the meter will return to the **Edit Test** menu.

111 H2O

Select Vial/WL


STD Calibration

Enter Constants

Decimal Places


12:00:00a

1/500



■ **SELECTING THE UNITS OF CONCENTRATION**

The Smart3 BLE Colorimeter has seven options for units of concentration. They are No Units, ppm, pH, FAU, ppb, ppt and mg/L.

1. From the User Menu, press  to scroll to **Select Units**.

111 H2O

STD Calibration


Enter Constants


Decimal Places

Select Units

12:00:00a

1/500



2. Press  to select **Select Units**.

Select Units

No Units


ppm



pH

FAU

12:00:00a

1/500



3. Press  or  to scroll to the desired units.

Select Units

No Units


ppm

pH

FAU

12:00:00a

1/500



4. Press **ENTER** to select the units. The screen will display **Storing...** for about 1 second and the meter will return to the **Edit Test** menu.

111 H2O		
STD Calibration	↑	
Enter Constants		
Decimal Places		
Select Units		
12:00:00a	1/500	

## ■ SETTING THE CLOCK

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

1. From the **Setup Menu**, press **▲** or **▼** to scroll to **Set Clock**.

Setup Menu		
Edit Sequences	↑	
Edit User Test		
Set Clock	↓	
Logging		
12:00:00a	1/500	

2. Press **ENTER** to select **Set Clock**. The year is displayed. Press **▲** or **▼** to scroll to the appropriate character. Press **ENTER** to select the character. The month, day, hour, format hour, minute, second, AM/PM will be displayed. Repeat for each.



Set Time		
Year: 20 <u>00</u>		
12:00:00a	1/500	


3. Press **ENTER** to select the final character. The time and date will be saved and the meter will return to the **Setup Menu**.

Setup Menu		
Edit Sequences		
Edit User Test		
Set Clock		
Logging		
12:00:00a	1/500	


## ■ LOGGING DATA

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. From the **Setup Menu**, press  or  to scroll to **Logging**.


Setup Menu		
Edit Sequences		↑
Edit User Test		
Set Clock		↓
Logging		
12:00:00a	1/500	


2. Press  to select **Logging**.

Logging		
Display Test Log		
Logging Enabled		
Logging Disabled		
Erase Log		
12:00:00a	1/500	

3. Press  or  to scroll to desired function.

Logging		
Display Test Log		
Logging Enabled		
Logging Disabled		
Erase Log		
12:00:00a	1/500	

4. Press . The screen will display **Storing...** for about 1 second and return to the **Setup Menu**.



















Setup Menu		
Edit Sequences		↑
Edit User Test		
Set Clock		↓
Logging		
12:00:00a	1/500	

## ■ FACTORY SETUP

The Factory Setup menu is used in manufacturing of the Smart3 Colorimeter. This menu is not for use by the operator in the field.

## ■ 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 disabled. To change the setting:

1. From the <b>Setup Menu</b> , press  or  to scroll to <b>Set Power Save</b> .	<div>Setup Menu</div> <div> Set Clock  Logging  Factory Setup  Set Power Save </div> <div>    </div> <div>12:00:00a 1/500 </div>
2. Press  to select <b>Set PWR Save</b> .	<div>Set Power Save</div> <div> Disable  5 Minutes  15 Minutes  30 Minutes </div> <div>    </div> <div>12:00:00a 1/500 </div>
3. Press  or  to scroll to desired function.	<div>Set Power Save</div> <div> Disable  5 Minutes  15 Minutes  30 Minutes </div> <div>    </div> <div>12:00:00a 1/500 </div>
4. Press  . The screen will display <b>Storing....</b> for about 1 second and the meter will return to the <b>Setup Menu</b> .	<div>Setup Menu</div> <div> Set Clock  Logging  Factory Setup  Set Power Save </div> <div>    </div> <div>12:00:00a 1/500 </div>

## ■ SETTING THE BACKLIGHT TIME

The backlight illuminates the display for enhanced viewing. The default setting is 10 seconds. 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.

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 Adapter is not being used.

1. From the <b>Setup Menu</b> , press  or  to scroll to <b>Backlight Time</b> .	<table><tr><th colspan="3">Editing Menu</th></tr><tr><td>Logging</td><td></td><td rowspan="4"> </td></tr><tr><td>Factory Setup</td><td></td></tr><tr><td>Set Power Save</td><td></td></tr><tr><td>Set Backlight Time</td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	Editing Menu			Logging		 	Factory Setup		Set Power Save		Set Backlight Time		12:00:00a	1/500				
Editing Menu																			
Logging		 																	
Factory Setup																			
Set Power Save																			
Set Backlight Time																			
12:00:00a	1/500																		
2. Press  to select <b>Set Backlight Time</b> .	<table><tr><th colspan="3">Set Backlight Time</th></tr><tr><td>Button Control</td><td></td><td></td></tr><tr><td>10 seconds</td><td></td><td></td></tr><tr><td>20 seconds</td><td></td><td></td></tr><tr><td>30 seconds</td><td></td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	Set Backlight Time			Button Control			10 seconds			20 seconds			30 seconds			12:00:00a	1/500	
Set Backlight Time																			
Button Control																			
10 seconds																			
20 seconds																			
30 seconds																			
12:00:00a	1/500																		
3. Press  or  to scroll to desired option.	<table><tr><th colspan="3">Set Backlight Time</th></tr><tr><td>Button Control</td><td></td><td></td></tr><tr><td>10 seconds</td><td></td><td></td></tr><tr><td>20 seconds</td><td></td><td></td></tr><tr><td>30 seconds</td><td></td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	Set Backlight Time			Button Control			10 seconds			20 seconds			30 seconds			12:00:00a	1/500	
Set Backlight Time																			
Button Control																			
10 seconds																			
20 seconds																			
30 seconds																			
12:00:00a	1/500																		
4. Press  . The screen will display <b>Storing...</b> for about 1 second and the meter will return to the <b>Setup Menu</b> .	<table><tr><th colspan="3">Setup Menu</th></tr><tr><td>Logging</td><td></td><td rowspan="4"> </td></tr><tr><td>Factory Setup</td><td></td></tr><tr><td>Set Power Save</td><td></td></tr><tr><td>Set Backlight Time</td><td></td></tr><tr><td>12:00:00a</td><td>1/500</td><td></td></tr></table>	Setup Menu			Logging		 	Factory Setup		Set Power Save		Set Backlight Time		12:00:00a	1/500				
Setup Menu																			
Logging		 																	
Factory Setup																			
Set Power Save																			
Set Backlight Time																			
12:00:00a	1/500																		














## ■ BLUETOOTH MENU


### Enabling Bluetooth Power



Bluetooth wireless technology allows communication between the colorimeter and a BLE Mobile Printer [Code 5-0067 only]. Bluetooth Power must be enabled to use the BLE Mobile Printer [Code 5-0067]. When Bluetooth Power is enabled, the Bluetooth icon will flash next to the battery icon on the bottom line of the display.

If the Bluetooth feature is not being used to connect to the printer, Bluetooth Power should be disabled to conserve the battery life. The default Bluetooth Power setting is disabled.





<p>1. From the <b>Setup Menu</b>, press  or  to scroll to <b>Bluetooth Menu</b>.</p>	<div>Setup Menu</div> <div>Factory Setup</div> <div>Set Power Save</div> <div>Set Backlight Time</div> <div>Bluetooth Menu</div> <div>12:00:00a 1/500 </div>
<p>2. Press  to select <b>Bluetooth Menu</b>.</p>	<div>Bluetooth Menu</div> <div>Bluetooth Power</div> <div>Bluetooth Mode</div> <div>Set BT Timeout</div> <div>12:00:00a 1/500 </div>
<p>3. Press  or  to scroll to <b>Bluetooth Power</b>.</p>	<div>Bluetooth Menu</div> <div>Bluetooth Power</div> <div>Bluetooth Mode</div> <div>Set BT Timeout</div> <div>12:00:00a 001/500 </div>
<p>4. Press  to select <b>Bluetooth Power</b>.</p>	<div>Bluetooth Power</div> <div>Enable Bluetooth</div> <div>Disable Bluetooth</div> <div>12:00:00a 1/500 </div>
<p>5. Press  or  to scroll to desired option.</p>	<div>Bluetooth Power</div> <div>Enable Bluetooth</div> <div>Disable Bluetooth</div> <div>12:00:00a 1/500 </div>



6. Press **ENTER** to select the option. Bluetooth Power must be enabled to use the Bluetooth Mobile Printer [Code 5-0066]. The screen will display **Storing...** for about 1 second and the meter will return to the **Bluetooth Menu**.  
A flashing  P symbol will indicate that Bluetooth is enabled.

Bluetooth Menu		
Bluetooth Power		↑
Bluetooth Mode		
Set BT Timeout		↓
12:00:00a	1/500	 P 



### Setting The Bluetooth Mode

A Bluetooth connection is available for the BLE Mobile Printer [Code 5-0067].



1. From the **Setup Menu**, press  or  to scroll to **Bluetooth Menu**.

Setup Menu		
Factory Setup		↑
Set Power Save		
Set Backlight Time		↓
Bluetooth Menu		
12:00:00a	1/500	 P 



2. Press **ENTER** to select **Bluetooth Menu**.







Bluetooth Menu		
Bluetooth Power		↑
Bluetooth Mode		
Set BT Timeout		↓
12:00:00a	1/500	 P 

3. Press  or  to scroll to **Bluetooth Mode**.






Bluetooth Menu		
Bluetooth Power		↑
Bluetooth Mode		
Set BT Timeout		↓
12:00:00a	1/500	 P 

4. Press **ENTER** to select **Bluetooth Mode**.

Bluetooth Mode		
Mobile Device		↑
BT Printer		
		↓
12:00:00a	1/500	 P 







5. Press  or  to scroll to <b>BT Printer</b> .	<b>Bluetooth Mode</b>	
	Mobile Device	
	BT Printer	
	12:00:00a	1/500  






6. Press  . The screen will display <b>Storing... BT Setup...</b> for about 1 second and the meter will return to the <b>Bluetooth Menu</b> .	<b>Bluetooth Menu</b>	
	Bluetooth Power	
	Bluetooth Mode	
	Bluetooth Scan	
	Set BT Timeout	
	12:00:00a	1/500  

### Setup Bluetooth Printing







A Bluetooth connection is available for the BLE Mobile Printer [Code 5-0067].

1. From the <b>Setup Menu</b> , press  or  to scroll to <b>Bluetooth Menu</b> .	<b>Setup Menu</b>	
	Factory Setup	
	Set Power Save	
	Set Backlight Time	
	Bluetooth Menu	
	12:00:00a	1/500  


  

2. Press  to select <b>Bluetooth Menu</b> .	<b>Bluetooth Menu</b>	
	Bluetooth Power	
	Bluetooth Mode	
	Set BT Timeout	
	12:00:00a	1/500  

3. Press  or  to scroll to <b>Bluetooth Power</b> .	<b>Bluetooth Menu</b>	
	Bluetooth Power	
	Bluetooth Mode	
	Set BT Timeout	
	12:00:00a	1/500  


4. Press **ENTER** to select **Bluetooth Power**.

Bluetooth Power	
Enable Bluetooth	↑
Disable Bluetooth	
↓	
12:00:00a 1/500 ⌘P 	


5. Press **▲** or **▼** to scroll to **Enable Bluetooth**.

Bluetooth Power	
Enable Bluetooth	<div>↑</div> <div>↓</div>
Disable Bluetooth	
12:00:00a 1/500 ⌘P <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>	


6. Press **ENTER** to select **Enable Bluetooth**.

Bluetooth Menu	
Bluetooth Power	↑
Bluetooth Mode	
Set BT Timeout	↓
12:00:00a 1/500 ⌘P 	





7. Press **▲** or **▼** to scroll to **Bluetooth Mode**.



Bluetooth Menu			
Bluetooth Power	⬆		
Bluetooth Mode			
Set BT Timeout	⬇		
12:00:00a	1/500	\$P	





8. Press **ENTER** to select **Bluetooth Mode**.

Bluetooth Mode		
Mobile Device	<div>↑</div> <div>↓</div>	
BT Printer		
12:00:00a	1/500	\$P 

9. Press  or  to scroll to **BT Printer**.

Bluetooth Mode	
Mobile Device	
BT Printer	
	
12:00:00a	1/500  



10. Press  to select **BT Printer**. The meter is now ready to connect with a Bluetooth printer. When the meter is available for the Bluetooth connection the Bluetooth printer icon  next to the battery icon will flash.





Bluetooth Menu	
Bluetooth Power	
Bluetooth Mode	
Set BT Timeout	
12:00:00a	1/500  


11. Turn on the Bluetooth printer. Within a few seconds it will connect to the meter. If the Bluetooth printer connection to the meter is successful the Bluetooth printer icon will remain on and no longer flash.





### Set BT Timeout






The Bluetooth Timeout can be set to allow the Bluetooth feature to be on to allow data to be sent to the Bluetooth printer and then turn off after a specified amount of time.





1. From the **Setup Menu**, press  or  to scroll to **Bluetooth Menu**.






Setup Menu	
Factory Setup	
Set Power Save	
Set Backlight Time	
Bluetooth Menu	
12:00:00a	1/500  




2. Press  to select **Bluetooth Menu**.

Bluetooth Menu	
Bluetooth Power	
Bluetooth Mode	
Set BT Timeout	
12:00:00a	1/500  

3. Press  or  to scroll to <b>Set BT Timeout</b> .	Bluetooth Menu	
	Bluetooth Power	
	Bluetooth Mode	
	Set BT Timeout	
12:00:00a 1/500 *P 		






4. Press  to select <b>Set BT Timeout</b> .	Set BT Timeout	
	15 minutes	
	5 minutes	
	30 Seconds	
	Disable	
12:00:00a 1/500 *P 		

5. Press  or  to scroll to desired option.	Set BT Timeout	
	15 minutes	
	5 minutes	
	30 Seconds	
	Disable	
12:00:00a 1/500 *P 		


6. Press  . The screen will display <b>Storing...</b> for about 1 second and the meter will return to the <b>Bluetooth Menu</b> .	Bluetooth Menu	
	Bluetooth Power	
	Bluetooth Mode	
	Set BT Timeout	
12:00:00a 1/500 *P 		

## ■ SELECTING A LANGUAGE


There are eight languages available in the Smart3 BLE: English, Spanish, French, Portuguese, Italian, Chinese, Japanese, and Turkish.

1. From the <b>Setup Menu</b> , press  or  to scroll to <b>Select Language</b> .	Setup Menu	
	Set Power Save	
	Set Backlight Time	
	Bluetooth Menu	
	Select Language	
12:00:00a 1/500 		


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

Select Language	
English	↓
Spanish	
French	
Portugese	
12:00:00a	1/500 

3. Press **▲** or **▼** to scroll to desired language.

Select Language	
English	↓
Spanish	
French	
Portugese	
12:00:00a	1/500 

4. Press **ENTER**. The screen will display **Storing...** for about 1 second and the meter will return to the **Setup Menu**.

Setup Menu	
Set Power Save	↑
Set Backlight Time	
Bluetooth Menu	
Select Language	
12:00:00a	1/500 

## ■ LOOPING MENUS

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


AND SO ON

: : :  
: : :

THIRD TO LAST

SECOND TO LAST

LAST CHOICE

TESTING MENU	
FIRST CHOICE	↑
SECOND CHOICE	
THIRD CHOICE	↓
ANOTHER	
12:00:00a	1/500 


AND SO ON

: : :  
: : :

LAST CHOICE

AND SO ON

: : :

TESTING MENU	
: : :	↑
THIRD TO LAST	
SECOND TO LAST	↓
LAST CHOICE	
12:00:00a	1/500 


AND SO ON

: : :  
: : :

LAST CHOICE

AND SO ON

: : :

TESTING MENU	
: : :	↑
THIRD TO LAST	
SECOND TO LAST	↓
LAST CHOICE	
12:00:00a	1/500 

AND ANOTHER	FIRST CHOICE	FIRST CHOICE
AND SO ON	SECOND CHOICE	SECOND CHOICE
: : :	THIRD CHOICE	THIRD CHOICE
: : :	ANOTHER	ANOTHER
LAST CHOICE	AND ANOTHER	AND ANOTHER

The feature called **Looping Menu** can be turned on and off in the **Setup Menu**. The default setting is ON.

## DEVICE CONNECTION

The meter supports connections to a Windows® based PC over USB [Code 1720-01].

### ■ COMPUTER CONNECTION

USB Type A, USB mini B, Order Cable Code 1720-01.

### ■ CONNECTING VIA USB

Using the provided USB cable, the meter can be connected to a Windows based PC. Before connecting a meter via USB, download and install the free WaterLink Connect 2 Windows application from <http://softwarecenter.lamotte.com>.

### ■ CONNECTING VIA BLUETOOTH

The meter uses Bluetooth Low Energy technology to allow communication between the meter and the BLE Mobile Printer [Code 5-0067 only]. The meter will automatically connect to the nearest Bluetooth enabled printer. Barriers to wireless signals can reduce the range of wireless devices. The meter will work best if there are no walls between it and the receiving device.

### ■ WATERLINK CONNECT 2

The meter may be interfaced with any Windows-based 64-bit computer by using the LaMotte WaterLink Connect 2 program and a USB cable. The program will store test information and results in a local database and allow for exporting this data to a comma separated value [CSV] file. The meter will send the following data: name of test, sample value, sample units, time/date stamp, and meter name. To download WaterLink Connect 2 go to [softwarecenter.lamotte.com](http://softwarecenter.lamotte.com). Select "WaterLink Connect 2 FREE Download".

### ■ FIRMWARE UPDATES

Occasionally, the firmware in the meter will require updates. To do so:

1. Download and install the WaterLink Connect 2 application for Windows at <http://softwarecenter.lamotte.com/>.
2. Plug meter into the computer with the provided USB cable [1720-01 only] and launch WaterLink Connect 2 application from the Start Menu.
3. A prompt will appear if firmware updates are available. Select Update. Testing and data transfer will not be possible until firmware has been updated.

For assistance contact Software Support at 1-800-344-3100 option 2.

## BATTERY

### ■ BATTERY/AC OPERATION

The Smart3 BLE may be operated on battery power using a USB wall adapter or USB computer connection. If using the meter as a bench top unit, use the wall adapter if possible to extend the battery life. The meter will remain on when the USB adapter is used.

To charge the lithium ion 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 rubber USB port plug after charging. Failure to insert the USB port plug when the meter is not connected to a computer by USB or actively charging by USB could result in damage to internal components.

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 a computer. Reinsert the USB port plug after charging. Failure to insert the USB port plug when the meter



is not connected to a computer by USB or actively charging by USB could result in damage to internal components.

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 6 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 adapter will charge the unit continuously. Storing the meter above ambient room temperature will decrease the battery charge more quickly than storage at room temperature. If the meter does not turn on, it means that the battery is at a very low charge. Charging the battery with the wall adapter in this state may take up to 10 hours. At low temperatures, approaching 0 °C, the battery will charge more slowly. It will not charge at all below 0 °C.

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. When the battery icon simultaneously flashes bars 1 and 2 followed by bars 3 and 4, it is an indication that the battery is damaged and technical support should be contacted.

To extend the life of the battery:

- 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 at a moderate temperature.
- Fully charge the battery before storing the unit for extended periods of time.
- Fully charge the battery at least once per year. Failure to do so may result in a permanently drained battery.
- Limit backlight use. The unit consumes three times the normal power when the backlight is 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 should be replaced. Contact LaMotte Company by phone [1-800-344-3100] or email [tech@lamotte.com] for more information.

## 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.

### ■ RETURNS

Should it be necessary to return the meter, 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.

### ■ 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.

## TROUBLESHOOTING

### ■ ERROR MESSAGES

#### OVER RANGE

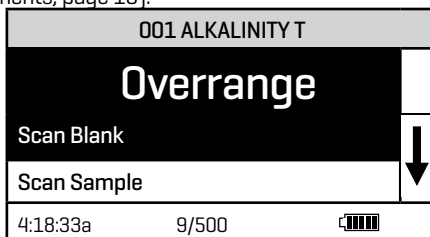
If the message **OVERRANGE** is displayed when scanning a sample, the sample may be over range or under range. If the sample is over range, the sample should be diluted and tested again [see Sample Dilution Techniques and Volumetric Measurements, page 18].

If overrange is displayed, scroll to **Calibrate** and press **ENTER** to view the result. The concentration is only an **approximation**.

Press **EXIT** and continue testing.

Note: If **EXIT** is not pressed the meter will calibrate on the over range result.

Note: Over range results will also be displayed in the test log.




#### CALIBRATION

As with all pre-calibrated meters, it is highly recommended, even if not required by regulations, that the user periodically verify the performance of the meter by running standards with a predetermined concentration. Results outside of specification are an indication that the meter needs to be adjusted. This can be done following the Calibration procedure.

#### STRAY LIGHT

The Smart3 BLE Colorimeter should have no problems with stray light. Make sure that the sample compartment lid is always fully closed, except when testing COD with the adapter.

### ■ TROUBLESHOOTING GUIDE

PROBLEM	REASON	SOLUTION
 Flashing	Low battery. Readings are reliable.	Charge battery or use USB wall/ computer adapter.
"Low Battery"	Battery voltage is very low. Readings are not reliable.	Charge battery or use USB wall/ computer adapter.
"Shut Down Low Batt" Shut Down	Battery is too low to operate the unit.	Charge battery or use USB wall/ computer adapter.
"Overrange"	Sample is outside of acceptable range.	Dilute sample and test again.
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.
Trouble connecting to Bluetooth device	Bluetooth not enabled. Too many Bluetooth devices near the meter.	Enable Bluetooth. Have only one Bluetooth device near the meter.
Trouble connecting to computer by USB	Broken connection.	Press and hold power button for 1 second.
Results not printing	Printer not on. The meter will only print to the BLE Mobile Printer [Code 5-0067]. The Bluetooth Pairing option is not set correctly.	Turn printer on. Connect to the BLE Mobile Printer [Code 5-0067]. See Setup Bluetooth Printing.

# SMART3 BLE Soil

Colorimeter

Test  
Procedures

# SMART3 BLE SOIL COLORIMETER REAGENT SYSTEMS

## SMART3 BLE REAGENT SYSTEMS LIST

LaMotte Company continuously updates the list of pre-programmed tests as the calibrations become available.

Call LaMotte Technical Services at 1-800-344-3100 (410-778-3100 outside the USA) or email at [tech@lamotte.com](mailto:tech@lamotte.com) for a current list of available calibrations and more information. Some reagent systems are not available for shipment to Canada.

Test Factor [Test #]	Range [ppm]	Test Method [# of Reagents]	# of Tests
Ammonia Nitrogen-High Range [008]	0.00-4.00	Nesslerization [2]	50
Calcium & Magnesium	0-4000 Calcium 0-2400 Magnesium	Schwarzenbach EDTA [8] Direct Reading Titrator	50
Chloride	0-1000	Direct Reading Titrator [2]	50
Copper-Thiocarbamate [036]	0.00-6.00	Diethyldithiocarbamate [1]	50
Iron-Bipyridyl [055] †	0.00-6.00	Bipyridyl [2]	50
Manganese-High Range [059] †	0.0-15.0	Periodate [2]	50
Nitrate Nitrogen-Low Range [065] †	0.00-3.00	Cadmium Reduction [2]	20
Nitrite Nitrogen-Low Range [068] †	0.00-0.80	Diazotization [2]	20
Phosphate-Low Range [081] †	0.00-3.00	Ascorbic Acid Reduction [2]	50
Potassium [085] †	0.0-10.0	Tetraphenylboron [2]	100
Sulfate High Range [089] †	0-100	Barium Chloride [1]	50
Zinc-Low Range [097] †	0.00-3.00	Zincon [6]	50

† available for shipment to Canada

## ■ SOLUBLE SALTS [TOTAL DISSOLVED SALTS]

Most plants will get along well at soluble salts concentrations of below 1000 parts per million. However, greenhouse and many sensitive garden plants may be damaged if the soluble salts are over 500 parts per million of chlorides, particularly some of the most sensitive legumes. If the soluble salts are greater than 1000 parts per million, the chlorides and sulfates should be determined to learn whether the soluble salts are chlorides or sulfates. In calcareous soils, the sulfates represent gypsum and have little effect on the production of plants.

### PROCEDURE

1. Fill a 50 mL beaker [0944] with the soil to be tested, tapping it lightly to eliminate any trapped air and then strike off the surface.
2. Empty the contents of the beaker into the 300 mL bottle [0991]. Add 100 mL of deionized water.
3. Cap the bottle and shake vigorously. Allow to stand for thirty minutes. During the thirty minute waiting period the bottle should be shaken vigorously three or four times.
4. Filter the contents of the bottle using funnel [0459] and filter paper [0463] and collect the filtrate in a 100 mL bottle [0990] which is then used as a conductivity chamber.
5. Determine the TDS reading of the sample by following the instructions for the TDS Meter.
6. To convert conductivity to Soluble Salts [Total Dissolved Solids], use the following formula.  
ppm Soluble Solids [Total Dissolved Solids] = Micromhos/cm @ 25°C x 0.7

### ■ EXTRACTION PROCEDURE

The following method of extraction is employed for obtaining the soil filtrate for the tests for Nitrate Nitrogen, Phosphorous, Potassium, Calcium, Magnesium, Ammonia Nitrogen, Nitrite Nitrogen, Manganese, Copper, Zinc, and Iron. Separate extractions are required for the Chloride and Sulfate tests. Consult the LaMotte Soil Handbook [1504] at [www.lamotte.com](http://www.lamotte.com) for information on sampling and preparation of sample for testing.

### MULTIPLE TEST PROCEDURE

1. Use the 1 mL pipet [0354] to add 5 mL of \*Acid Extracting Solution [6361] to the 100 mL graduated cylinder [0419]. Add deionized water to 75 mL graduation.
2. Pour this solution into the 100 mL bottle [0990].
3. Use the Soil Measure [1165] to add 15 g [one level measure] of the soil sample to the bottle.
4. Cap the bottle and shake for 5 minutes.
5. Use the funnel [0459] and filter paper [0463] to filter and collect all of the soil extract in a 100 mL bottle [0990].
6. The soil extract is used for all of the tests listed above, except Chloride and Sulfate.

### SINGLE TEST PROCEDURE

1. Use the 1 mL pipet [0354] to add 1 mL of \*Acid Extracting Solution [6361] to the test tube [0701], then add deionized water to fill to the 15 mL line.
2. Use the 1.0 g spoon [0697] to add 3 measures of soil to the extracting solution in the test tube.
3. Cap the tube and shake for 5 minutes.
4. Filter, using the funnel [0459] and filter paper [0463] and collect all of the soil extract.
5. The soil extract is used for all of the tests listed above except Chloride and Sulfate.

### NEUTRALIZATION OF SOIL FILTRATE

In the test procedures for Ammonia Nitrogen, Calcium & Magnesium, Copper, Iron, Manganese and Zinc require that the acidity of the soil extract be neutralized before the test procedure is performed. This is done by adding \*Sodium Hydroxide, 15% [7886] to the soil extract until Bromthymol Blue Test Paper [2931] indicates that the pH is in the proper range.

1. Add one drop of \*Sodium Hydroxide, 15% [7886] to the soil extract. Stir with the stirring rod.
2. Touch the stirring rod to the Bromthymol Blue Test Paper [2931].

3. If the test paper does not change from yellow to blue or green, continue adding \*Sodium Hydroxide, 15% to the soil extract, one drop at a time. Stir and test the pH after the addition of each drop until the test paper changes from yellow to green or blue.

**ELECTRONIC TEST METHODS**

**■ pH**

**PROCEDURE**

1. Use the 10 g Soil Measure [1164] to add one level measure of the soil sample to a 50 mL beaker [0944]. Use the graduated cylinder [0416] to add 10 mL of deionized water. Stir thoroughly.
2. Let stand for at least 30 minutes, stirring two or three times.
3. Stir mixture just prior to making the pH reading. Determine the pH reading of the sample by following the instructions for the pH Meter.

**■ LIME REQUIREMENT - WOODRUFF METHOD**

**PROCEDURE**

1. Use the 10 g Soil Measure [1164] to add one level measure of the soil sample to a 50 mL beaker [0944]. Use the graduated cylinder [0416] to add 10 mL of deionized water. Stir thoroughly.
2. Let stand for at least 15 minutes.
3. Add 20 mL of Woodruff Buffer Solution [5272]. Mix well, and let stand for at least 20 minutes, stirring two or three times.
4. Take reading using the pH meter. Stir mixture just prior to making reading.
5. Each 0.1 pH unit drop from pH 7.0 indicates a lime requirement equivalent to 1000 lbs calcium carbonate [CaCO<sub>3</sub>]/acre.

# AMMONIA NITROGEN

## NESSLERIZATION METHOD · CODE 3642-SC

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

\*Reagent is a potential health hazard. **READ SDS:**  
 lamotte.com. **Emergency information:**  
 Chem-Tel USA 1-800-255-3924  
 Int'l, call collect, 813-248-0585



To order individual reagents or test kit components, use the specified code number.



A fertile soil may be expected to give a low ammonia nitrogen test reading, unless there has been a recent application of nitrogenous fertilizer in forms other than the nitrate. The rapid disappearance of ammonia after fertilizer application indicates the desired transformation of the ammonia to the more available nitrate compounds. In forest soils, ammonia is the most abundant available form of nitrogen. If there is a satisfactory rate of nitrogen transformation, the humus layers of a forest soil will produce very high concentrations of ammonia nitrogen.

**RANGE:** 0.00-200.00 lb/acre Ammonia Nitrogen

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

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

**PROCEDURE**

1. Press and hold  until colorimeter turns on.
2. Press **ENTER** to select **Testing Menu**.
3. Scroll to and select **All Tests** (or another sequence containing **008 Ammonia-N HR**) from **Testing Menu**.
4. Scroll to and select **008 Ammonia-N HR** from menu.
5. Use the 1 mL pipet [0354] to transfer 2 mL of soil extract into a clean tube [0290]. Dilute to the 10 mL line with deionized waer. Mix and neutralize according to the procedure on page 84.
6. Insert tube into chamber, close lid and select **Scan Blank**. [See Note]
7. Remove tube from colorimeter. Add 12 drops of Ammonia Nitrogen Reagent #1 [V-4797]. Cap and mix. Wait 1 minute.
8. Use the 1.0 mL pipet [0354] to add 1.0 mL of \*Ammonia Nitrogen Reagent #2 [V-4798]. Cap and mix. Allow 5 minutes for maximum color development.
9. At end of the 5 minute waiting period, immediately mix, insert tube into chamber, close lid and select **Scan Sample**. Multiply the result by 50 to determine the ammonia-nitrogen concentration in lb/acre.
10. Press  to turn colorimeter off, select **Print Test** to print the results, or press **EXIT** to exit to a previous menu or make another menu selection.

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

**Ammonia Nitrogen Concentration Chart**

Pounds per Acre	Range
0-24 lb/acre	Low
25-68 lb/acre	Medium
Over 71 lb/acre	High



# CALCIUM & MAGNESIUM

## SCHWARZENBACH EDTA METHOD • CODE M-CAL-MAG

QUANTITY	CONTENTS	CODE
30 mL	*Calcium & Magnesium Buffer	*5126-G
60 mL	Standard EDTA Reagent	5254-H
50	Calcium Hardness Indicator Tablets	5250A-H
30 mL	Calcium Magnesium Inhibitor Reagent	3922-G
30 mL	*CM Indicator Reagent	*6522WT-G
30 mL	*Sodium Hydroxide w/Metal Inhibitors	*4259-G
15 mL	*Inhibitor Solution	*9258-E
15 mL	*Triethanolamine Reagent	*3921-E
2	Direct Reading Titrators, 0-1000 Range	0384
1	Pipet, transfer, plastic	0364
1	Test tube, 5-10-12.9-15-20-25 mL, glass, w/cap	0608

\*Reagent is a potential health hazard. **READ SDS:**

lamotte.com. **Emergency information:**

Chem-Tel USA 1-800-255-3924

Int'l, call collect, 813-248-0585



To order individual reagents or test kit components, use the specified code number.

The amount of total calcium in soils may range from as little as 0.1% to as much 25%. A calcium deficiency is rarely a problem due to widely accepted practice of applying lime to soil to raise the pH to the proper range for optimum plant growth. As an important mineral nutrient, calcium is a component of cell walls in plants and is known to stimulate root and leaf development as well as activate several enzyme reactions involved in plant metabolism. Indirectly, calcium influences crop yields by reducing soils acidity and by reducing the toxicity of several other soil minerals such as manganese, zinc, and aluminum.

The Schwarzenbach EDTA titration method, used to determine calcium and magnesium, involves two titrations. The first titration gives the calcium and magnesium content, the second only calcium. Magnesium is calculated from the difference between the titration values.

RANGE: 0-4000 lb/acre Calcium  
0-2400 lb/acre Magnesium

METHOD: Titration with Schwarzenbach EDTA

INTERFERENCE: Sample color and turbidity may interfere with endpoint.

## PROCEDURE

### I. DILUTION OF SOIL EXTRACT

Use the 30 mL graduated cylinder [0418] to measure 10 mL of the soil extract and transfer it to a 50 mL beaker [0944]. Add 10 mL of deionized water, mix and neutralize according to the procedure on page 84.

### II. TITRATION A, CALCIUM & MAGNESIUM

Carefully read the LaMotte Direct Reading Titrator Manual [1649] before performing the titrations described below.

1. Fill the test tube [0608] to the 5 mL line with the soil extract from above. Dilute to the 10 mL line with deionized water.
2. Add 5 drops of Calcium Magnesium Inhibitor Reagent [3922].
3. Wait 5 minutes.
4. Use a pipet [0364] to add 5 drops of \*Calcium & Magnesium Buffer [5126].
5. Add 10 drops of \*CM Indicator [6522WT].
6. Fill the Direct Reading Titrator [0384] with the Standard EDTA Reagent [5254]. Insert the tip of the Titrator into the center hole of the test tube cap.
7. While gently swirling the tube, slowly press the plunger to titrate until the color changes from red to blue and does not revert to red upon standing for 1 minute.
8. Read the test result from the scale where the large ring on the Titrator meets the Titrator barrel. Multiply by 5.16. This is Titration Value A.

### III. TITRATION B, CALCIUM

1. Fill the test tube [0608] to the 5 mL line with the diluted soil extract. Dilute to 10 mL with deionized water.
2. Add 2 drops of \*Inhibitor Solution [9258].
3. Add 2 drops of \*Triethanolamine Reagent [3921].
4. Add 8 drops of \*Sodium Hydroxide w/Metal Inhibitors [4259].
5. Add one Calcium Hardness Indicator Tablet [5250A] to the test sample. Cap and shake to dissolve the tablet. A red color will develop.
6. Immediately titrate the sample. Fill the Direct Reading Titrator with Standard EDTA Reagent [5254]. Insert the tip of the Titrator into the hole in the cap of the test tube.
7. While gently shaking the tube, slowly press the plunger to titrate until the red color changes to a clear blue and does not revert to red upon standing for 1 minute. Read the test result from the scale where the large ring on the Titrator meets the Titrator barrel. Multiply by 5.16. This is Titration Value B.

### IV. FINAL RESULTS

Calcium Content =  $0.4 \times \text{Titration Value B} = \text{ppm Ca}$

Magnesium Content =  $0.24 (\text{Value A} - \text{Value B}) = \text{ppm Mg}$

Multiply the results by 2 to obtain the content in pounds per acre.

EXAMPLE:

Titration Value A is 640 ppm  $\text{CaCO}_3$

Titration Value B is 520 ppm  $\text{CaCO}_3$

Calcium =  $0.4 \times 520 = 208 \text{ ppm Ca}$   
 =  $208 \times 2 = 416 \text{ lb/acre Ca}$

Magnesium =  $0.24 (640 - 520)$   
 =  $0.24 \times 120 = 29 \text{ ppm Mg}$   
 =  $29 \times 2 = 58 \text{ lb/acre Mg}$

CHLORIDE

DIRECT READING TITRATOR METHOD · CODE M7241

QUANTITY	CONTENTS	CODE
15 mL	*Chloride Reagent #1	*4504-E
60 mL	*Silver Nitrate, 0.141N	*3062DR-H
1	Test Tube, 5-10-15 mL, plastic, w/cap	0701
1	Spoon, 1g	0697
1	Test Tube, 5-10-12.9-15-20-25 mL, glass, w/cap	0608
1	Direct Reading Titrator, 0-1000 Range	0384

\*Reagent is a potential health hazard. **READ SDS:**  
lamotte.com. **Emergency information:**  
Chem-Tel USA 1-800-255-3924  
Int'l, call collect, 813-248-0585



To order individual reagents or test kit components, use the specified code number.

Chlorides are present in practically all soils. Application of fertilizer may increase chloride levels. Chlorides are removed from soil by leaching. Excessive concentrations are toxic to plants. A high test reading, particularly where stunted growth has been observed, may indicate poisoning due to high chloride levels in the soil. This test is valuable on saline soils or when contamination from sea water or sea spray is suspected. Normal soils of humid regions rarely give readable tests, except when recently receiving liberal amounts of fertilizers containing chlorides.

- RANGE:

0-1000 lb/acre Chloride
- METHOD:

In a neutral or slightly alkaline solution, potassium dichromate indicates the endpoint of the silver nitrate titration.
- INTERFERENCES:

Bromine, iodide and cyanide register as equivalent chloride concentrations.

## PROCEDURE

Carefully read the LaMotte Direct Reading Titrator Manual [1649] before performing the titration procedure described below. The Titrator is calibrated in terms of parts per million chloride and each minor division on the Titrator scale equals 20 ppm.

1. Fill a clean test tube [0701] to the 15 mL line with deionized water.
2. Add 3 measures of soil using the 1 g spoon [0697]. Cap tube and shake for five minutes.
3. Filter and collect all of the soil filtrate using the funnel [0459] and filter paper [0463]. The extract does not have to be clear since a slight turbidity does not interfere in the test.
4. Fill the test tube [0608] to the 10 mL line with the filtrate.
5. Add three drops of \*Chloride Reagent #1 [4504] to the sample. Cap and shake to mix. A yellow color will result.
6. Fill the Direct Reading Titrator [0384] with \*Silver Nitrate, 0.141 [3062DR] in the manner described in the instruction manual.
7. Titrate the test sample with \*Silver Nitrate, 0.141 [3062DR] until the yellow color changes permanently to pink. Read the test result from the scale where the large ring on the Titrator meets the Titrator barrel. If the plunger reaches the bottom mark [1000 ppm] on the Titrator scale before the endpoint color change occurs, refill the Titrator and continue the titration procedure. Be sure to include the value of the original amount added [1000 ppm] when recording the final result.

# COPPER

## DIETHYLDITHIOCARBAMATE METHOD • CODE M3639-46-65-SC

QUANTITY	CONTENTS	CODE
15 mL	*Copper 1	*6446-E

\*Reagent is a potential health hazard. **READ SDS:**  
 lamotte.com. **Emergency information:**  
 Chem-Tel USA 1-800-255-3924  
 Int'l, call collect, 813-248-0585





To order individual reagents or test kit components, use the specified code number.

Like many other micronutrients, the amount of available copper varies considerably with the type of soil. Well drained sandy soils are usually low in copper while heavily clay-type soils contain an abundant supply of copper. Like manganese, copper may be unavailable in soils that have a high organic make-up because it readily forms insoluble complexes with organic compounds.

Generally from 0.2-25 lb/acre of copper is added to the soil to correct a deficient level. Copper is another metal that is necessary in the formation of the chlorophyll molecule and like other metals, e.g. iron, manganese and zinc acts as a catalyst.

RANGE:	0.00-35.00 ppm Copper
METHOD:	Copper ions form a yellow colored chelate with diethyldithiocarbamate around pH 9-10 in proportion to the concentration of copper in the sample.
INTERFERENCES:	Bismuth, cobalt, mercurous, nickel and silver ions and chlorine (6 ppm or greater) interfere and must be absent.

**PROCEDURE**

1. Press and hold  until colorimeter turns on.
2. Press **ENTER** to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **036 Cu Thiocarbamate**) from **Testing Menu**.
4. Scroll to and select **036 Cu Thiocarbamate** from menu.
5. Fill a clean tube [0290] to the 10 mL line with the soil extract then neutralize according to the procedure on page 84.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter and add 5 drops of \*Copper 1 [6446]. Cap and mix. Solution will turn yellow if copper is present.
8. Insert tube into chamber, close lid and select **Scan Sample**. Multiply the result by 5 to determine the copper concentration in ppm.
9. Press  to turn colorimeter off, select **Print Test** to print the results, or press **EXIT** to exit to a previous menu or make another menu selection.

NOTE: The reaction may stain the tubes. Scrub the tubes thoroughly after each use.

Copper Concentration Chart

Parts Per Million	Range
0-1 ppm	Low
1-3 ppm	Marginal
3-4 ppm	Adequate

# IRON

## BIPYRIDYL METHOD • CODE 3648-SC

QUANTITY	CONTENTS	CODE
30 mL	*Iron Reagent #1	*V-4450-G
5 g	*Iron Reagent #2 Powder	*V-4451-C
1	Pipet, 0.5 mL, plastic	0353
1	Spoon, 0.1 g, plastic	0699

\*Reagent is a potential health hazard. **READ SDS:**  
 lamotte.com. **Emergency information:**  
 Chem-Tel USA 1-800-255-3924  
 Int'l, call collect, 813-248-0585



To order individual reagents or test kit components, use the specified code number.



Iron is essential to the formation of chlorophyll, and iron deficiency causes chlorosis. While most soils contain abundant iron, only a fraction is soluble and readily available to the growing plant. This is particularly true in neutral or alkaline soils. Acid soils contain higher levels of available iron.

RANGE: 0.00–30.00 ppm Iron

METHOD: Ferric iron is reduced to ferrous iron and subsequently forms a colored complex with bipyridyl for a quantitative measure of total iron.

INTERFERENCES: Strong oxidizing agents interfere, as well as copper and cobalt in excess of 5.0 mg/L.

## PROCEDURE

1. Press and hold  until colorimeter turns on.
2. Press **ENTER** to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **055 Iron Bipyridyl**) from **Testing Menu**.
4. Scroll to and select **055 Iron Bipyridyl** from menu.
5. Fill a clean tube [0290] to the 10 mL line with the soil extract then neutralize according to the procedure on page 84.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Use the 0.5 mL pipet [0353] to add one measure of \*Iron Reagent #1 [V-4450]. Cap and mix.
8. Use the 0.1 g spoon [0699] to add 0.1 g of \*Iron Reagent #2 Powder [V-4451]. Cap and shake vigorously for 30 seconds. Wait three minutes for maximum color development.
9. At the end of 3 minute waiting period, DO NOT MIX. Insert tube into chamber, close lid and select **Scan Sample**. Multiply results by 5 to determine the iron concentration in ppm.
10. Press  to turn colorimeter off, select **Print Test** to print the results, or press **EXIT** to exit to a previous menu or make another menu selection.

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

Iron Concentration Chart

Parts Per Million	Range
0.0-1.3 ppm	Very Low
1.4-3.0 ppm	Low
3.0-5.0 ppm	Medium
5.0-10.0 ppm	Medium High
Over 10.0 ppm	High



## MANGANESE

### PERIODATE METHOD • CODE 3669-SC

QUANTITY	CONTENTS	CODE
10 g	Manganese Buffer Reagent	6310-D
15 g	*Manganese Periodate Reagent	*6311-E
1	Spoon, 0.1 g, plastic	0699
1	Spoon, 0.15 g, plastic	0727

\*Reagent is a potential health hazard. **READ SDS:**  
 lamotte.com. **Emergency information:**  
 Chem-Tel USA 1-800-255-3924  
 Int'l, call collect, 813-248-0585





To order individual reagents or test kit components, use the specified code number.

The amount of manganese available to the plant is dependant upon the soil pH, the quantity of organic matter present, and the degree of aeration. Manganese deficiency is most likely to occur in neutral or alkaline soils because it is less soluble at elevated pH levels. In extremely acid soils, where manganese is more soluble, toxic levels may exist which may reduce crop yields. In slightly acid sandy soils, manganese may leach past the root zone and not be able for utilization by the plant. Also, it is believed that manganese may form insoluble organic complexes in some soils that have high humus content. All of the factors contribute to the availability of this essential element. Only soil or tissue tests can determine whether deficient or toxic levels of manganese exist.

Although manganese is known to play an important role in many of the metabolic processes in the plant, little is known about its function other than it is required in some enzyme reactions and is required for the formation of chlorophyll in the plant.

RANGE:	0.00–75.00 ppm Manganese
METHOD:	Periodate oxidizes soluble manganous compounds into permanganate.
INTERFERENCES:	Reducing substances capable of reacting with periodate or permanganate must be removed or destroyed before the periodate oxidation is attempted.

## PROCEDURE

1. Press and hold  until colorimeter turns on.
2. Press **ENTER** to select **Testing Menu**.
3. Select **All Tests** [or another sequence containing **059 Manganese HR**] from **Testing Menu**.
4. Scroll to and select **059 Manganese HR** from menu.
5. Fill a clean tube [0290] to the 10 mL line with the soil extract then neutralize according to the procedure on page 84.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Use the 0.1 g spoon [0699] to add two measures of Manganese Buffer Reagent [6310]. Cap and mix until powder dissolves.
8. Use the 0.15 g spoon [0727] to add one measure of \*Manganese Periodate Reagent [6311]. Cap and shake for one minute. An undissolved portion of the reagent may remain in the bottom of the tube without adversely affecting the test results. Wait two minutes for maximum color development. Solution will turn pink if manganese is present.
9. At the end of the two minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Multiply the result by 5 to determine the manganese concentration in ppm.
10. Press  to turn colorimeter off, select **Print Test** to print the results, or press **EXIT** to exit to a previous menu or make another menu selection.

Mangansese Concentration Chart

Parts Per Million	Range
0-5 ppm	Low
5-12 ppm	Medium
13-24 ppm	Medium High
25-40 ppm	High
Over 40	Very High

## NITRATE-NITROGEN

### CADMIUM REDUCTION METHOD • CODE 3649-SC

QUANTITY	CONTENTS	CODE
2 x 60 mL	*Mixed Acid Reagent	*V-6278-H
5 g	*Nitrate Reducing Reagent	*V-6279-C
1	Spoon, 0.1 g, plastic	0699
1	Dispenser Cap	0692

\*Reagent is a potential health hazard. **READ SDS:**  
 lamotte.com. **Emergency information:**  
 Chem-Tel USA 1-800-255-3924  
 Int'l, call collect, 813-248-0585



To order individual reagents or test kit components, use the specified code number.

Nitrogen is a component of the chlorophyll [green color] in plants, thus giving plants the rich green color characteristic of a healthy plant. Nitrogen promotes succulence in forage crops and leafy vegetables. When used at the recommended rates, nitrogen improves the quality of leaf crops. It also simulates the utilization of phosphorus, potassium and other essential nutrient elements. The above-ground growth of plants is enhanced with nitrogen. Nitrogen hastens crop maturity [assuming all other nutrients are adequately supplied and excessive nitrogen rates are not applied]. Nitrogen is very influential in fruit sizing.



**RANGE:** 0.00–300.00 lb/acre Nitrate Nitrogen

**METHOD:** Powdered cadmium is used to reduce nitrate to nitrite. The nitrite that is originally present plus reduced nitrate is determined by diazotization of sulfanilamide and nitrite followed by coupling with N-[1 naphthyl]-ethylenediamine dihydrochloride to form a highly colored azo dye which is measured colorimetrically.

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

## PROCEDURE

NOTE: Place Dispenser Cap [0692] on \*Mixed Acid Reagent [V-6278]. Save this cap for refill reagents.

1. Press and hold  until colorimeter turns on.
2. Press **ENTER** to select **Testing Menu**.
3. Select **All Tests** [or another sequence containing **065 Nitrate-N LR**] from **Testing Menu**.
4. Scroll to and select **065 Nitrate-N LR** from menu.
5. Use the 1 mL pipet [0354] to add 1 mL of soil extract to a clean tube [0290] and dilute to the 10 mL line with deionized water. Cap tube and mix.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter and pour off 5 mL of the diluted extract into graduated cylinder or similar. Discard the remaining diluted extract.
8. Pour the 5mL diluted extract from a graduated cylinder or similar into the tube. Use the graduated cylinder or similar to measure 5 mL of \*Mixed Acid Reagent [V-6278] and add to tube. Cap and mix. Wait 2 minutes.
9. Use the 0.1 g spoon [0699] to add two measures of \*Nitrate Reducing Reagent [V-6279]. Cap.
10. Hold tube by index finger and thumb and mix by inverting approximately 60 times a minute for four minutes. Wait 10 minutes for maximum color development.  
NOTE: At end of waiting period an undissolved portion of Nitrate Reducing Reagent may remain in bottom of the tube without affecting results.
11. At the end of the 10 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Multiply the result by 100 to determine the nitrate-nitrogen concentration in lb/acre.
12. Press  to turn colorimeter off, select **Print Test** to print the results, or press **EXIT** to exit to a previous menu or make another menu selection.

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

To convert Nitrate Nitrogen [NO<sub>3</sub>-N] results to ppm Nitrate [NO<sub>3</sub><sup>-</sup>], multiply by 4.4.

Nitrate-Nitrogen Concentration Chart

Pounds Per Acre	Range
0.0-9.0 lb/acre	Low
11-29 lb/acre	Medium
33-51 lb/acre	Medium High
53-100 lb/acre	High
Over 100 lb/acre	Very High

# NITRITE-NITROGEN

## DIAZOTIZATION METHOD • CODE 3650-SC

QUANTITY	CONTENTS	CODE
2 x 60 mL	*Mixed Acid Reagent	*V-6278-H
5 g	*Color Developing Reagent	*V-6281-C
1	Spoon, 0.1 g, plastic	0699
1	Dispenser Cap	0692

\*Reagent is a potential health hazard. **READ SDS:**  
 lamotte.com. **Emergency information:**  
 Chem-Tel USA 1-800-255-3924  
 Int'l, call collect, 813-248-0585



To order individual reagents or test kit components, use the specified code number.

Nitrites are formed as an intermediate step in the production of nitrate. Soils that are well drained and aerated contain only small amounts of nitrite nitrogen. Excessive nitrites, which are toxic to plants, may result from soil conditions unfavorable to the formation of nitrate, such as inadequate aeration. High nitrite readings may also be encountered in soils with large amounts of nitrates, where a portion of the nitrate nitrogen decomposes to form nitrites.



**RANGE:** 0.00–40.00 lb/acre Nitrite-Nitrogen

**METHOD:** The compound formed by diazotization of sulfanilamide and nitrite is coupled with N-[1-naphthyl]-ethylenediamine to produce a reddish-purple color, which is read colorimetrically.

**INTERFERENCES:** There are few known interfering substances at concentration less than 1000 times the nitrite-nitrogen concentration; however, the presence of strong oxidants or reductants may readily affect nitrite concentrations. High alkalinity [above 600 mg/L] will give low results due to a shift in pH.

## PROCEDURE

NOTE: Place Dispenser Cap [0692] on \*Mixed Acid Reagent [V-6278]. Save this cap for refill reagents.

1. Press and hold  until colorimeter turns on.
2. Press **ENTER** to select **Testing Menu**.
3. Select **All Tests** [or another sequence containing **068 Nitrite-N LR**] from **Testing Menu**.
4. Scroll to and select **068 Nitrite-N LR** from menu.
5. Use the 1 mL pipet [0354] to add 2 mL of soil extract to a clean tube [0290] and dilute to the 10 mL line with deionized water. Cap tube and mix.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter and pour off 5 mL of the diluted extract into a graduated cylinder or similar. Discard the remaining diluted extract.
8. Pour the 5 mL diluted extract from the graduated cylinder into the colorimeter tube. Use graduated cylinder or similar to measure 5 mL of \*Mixed Acid Reagent [V-6278] and add to tube. Cap and mix.
9. Use the 0.1 g spoon [0699] to add two measures of \*Color Developing Reagent [V-6281]. Cap and mix by gently inverting for 1 minute. Wait 5 minutes for maximum color development.
10. At the end of the 5 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Multiply the result by 50 to determine the nitrite-nitrogen concentration in lb/acre.
11. Press  to turn colorimeter off, select **Print Test** to print the results, or press **EXIT** to exit to a previous menu or make another menu selection.

NOTE: To convert nitrite-nitrogen [ $\text{NO}_2\text{-N}$ ] results to ppm nitrite [ $\text{NO}_2^-$ ], multiply results by 3.3.

Nitrite-Nitrogen Concentration Chart

Pounds Per Acre	Range
0.0-2.0 lb/acre	Low
2.5-4.0 lb/acre	Medium
4.5-10.0 lb/acre	Medium High
Over 10 lb/acre	High

# PHOSPHATE

## ASCORBIC ACID REDUCTION METHOD • CODE 3653-SC

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

\*Reagent is a potential health hazard. **READ SDS:**  
 lamotte.com. **Emergency information:**  
 Chem-Tel USA 1-800-255-3924  
 Int'l, call collect, 813-248-0585



To order individual reagents or test kit components, use the specified code number.

Phosphorus is necessary for the hardy growth of the plant and activity of the cells. It encourages root development, and by hastening the maturity of the plant, it increases the ratio of grain to straw, as well as the total yield. It plays an important part in increasing the palatability of plants and simulates the formation of fats, convertible starches and healthy seed. By stimulating rapid cell development in the plant, phosphorus naturally increases the resistance to disease. An excess of phosphorus does not cause the harmful effect of excessive nitrogen and has an important balancing effect upon the plant.



**RANGE:** 0.00–99.00 lb/acre Phosphorus

**METHOD:** Ammonium molybdate and antimony potassium tartrate react in a filtered acid medium with dilute solution of  $\text{PO}_4^{-3}$  to form an antimony-phosphomolybdate complex. This complex is reduced to an intense blue colored complex by ascorbic acid. The color is proportional to the amount of phosphate present. [Only orthophosphate forms a blue color in this test.] Polyphosphates [and some organic phosphorus compounds] may be converted to the orthophosphate form by sulfuric acid digestion. Organic phosphorus compounds may be converted to the orthophosphate form by persulfate digestion.

**INTERFERENCES:**

- No interference from copper, iron, or silicate at concentrations many times the concentration of sea water. However, high iron concentrations can cause precipitation and subsequent loss of phosphorus.
- Salt error for samples ranging from 5% to 20% salt content was found to be less than 1%.
- Mercuric chloride,  $\text{HgCl}_2$ , when used as the preservative, interferes when the chloride levels are low [less than 50 mg/L]. This interference is overcome by spiking samples with a minimum of 50 mg/L of sodium chloride.

## PROCEDURE

1. Press and hold  until colorimeter turns on.
2. Press **ENTER** to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **081 Phosphate LR**) from **Testing Menu**.
4. Scroll to and select **081 Phosphate LR** from menu.
5. Use the 1 mL pipet [0354] to add 1 mL of soil extract to a clean tube [0290] and dilute to the 10 mL line with deionized water. Cap tube and mix.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Use 1.0 mL pipet [0354] to add 1.0 mL of \*Phosphate Acid Reagent [V-6282]. Cap and mix.
8. Use the 0.1 g spoon [0699] to add one measure of Phosphate Reducing Reagent [V-6283]. Cap and mix until powder dissolves. Wait 5 minutes for full color development. Solution will turn blue if phosphates are present.
9. At end of 5 minute waiting period, mix, insert tube into chamber, close lid and select **Scan Sample**. Multiply the result by 32 to determine the phosphorus concentration in lb/acre.
10. Press  to turn colorimeter off, select **Print Test** to print the results, or press **EXIT** to exit to a previous menu or make another menu selection.

## PHOSPHORUS IN ALKALINE SOILS

A special extraction procedure is used for determining the available phosphorus content of Western U.S. alkaline soils where the pH value is above 7.0.

### EXTRACTION PROCEDURE

1. Use the 1 mL pipet [0354] to add 1 mL of the \*Special NF Extracting Solution [6362] to the test tube [0701] then add deionized water to the 15mL graduation.
2. Add 3 one gram measures of soil using the 1 g spoon [0697] to the extracting solution in the vial.
3. Cap the vial and shake for a period of 5 minutes.
4. Filter using the funnel [0459] and filter paper [0463]. Collect all of the filtrate.
5. Perform the Phosphorus test according to the Phosphorus procedure given above.

Phosphorus Concentration Chart

Pounds Per Acre	Range
0-14 lb/acre	Very Low
16-34 lb/acre	Low
35-67 lb/acre	Medium
Over 70 lb/acre	High



# POTASSIUM

## TETRAPHENYLBORON METHOD • CODE M3639-46-65-SC

QUANTITY	CONTENTS	CODE
30 mL	*Sodium Hydroxide, 1.0N	*4004WT-G
5 g	*Tetraphenylboron Powder	*6364-C
1	Spoon, 0.05 g, plastic	0696

\*Reagent is a potential health hazard. **READ SDS:**

lamotte.com. **Emergency information:**

Chem-Tel USA 1-800-255-3924

Int'l, call collect, 813-248-0585



To order individual reagents or test kit components, use the specified code number.

Potassium is not a component of the structural makeup of plants, yet it plays a vital role in the physiological and biochemical functions of plants. The exact function of potassium in plants is not clearly understood, but many beneficial factors, implicating the involvement and necessity of potassium in plant nutrition have been demonstrated. Some of these factors are: it enhances disease resistance by strengthening stalks and stems; activates various enzyme systems within plants; contributes to a thicker cuticle [waxy layer] which guards against disease and water loss; controls the turgor pressure within plants to prevent wilting; enhances fruit size, flavor, texture and development and is involved in the production of amino acids [the building blocks for protein], chlorophyll formation [ green-color], starch formation and sugar transport from leaves to roots.



When present in large amounts, ammonia salts will produce a precipitate similar to that produced by potassium. If fertilizer containing ammonia salts has recently been applied, or if the soil pH is below pH 5.0, perform the ammonia test before performing the potassium test. A high ammonia nitrogen test result will alert the operator to a probable false high reading in the potassium test; actual potassium tests will be somewhat lower.

**RANGE:** 0.0–500.0 ppm Potassium

**METHOD:** Potassium reacts with sodium tetraphenylborate to form a colloidal white precipitate in quantities proportional to the potassium concentration.

**INTERFERENCE:** Calcium and magnesium interfere at very high concentrations. Check for stray light interference [see p. 69].

## PROCEDURE

1. Press and hold  until colorimeter turns on.
2. Press **ENTER** to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **085 Potassium**) from **Testing Menu**.
4. Scroll to and select **085 Potassium** from menu.
5. Use the 1 mL pipet [0354] to add 2 mL of soil extract to a clean tube [0290] and dilute to the 10 mL line with deionized water. Cap tube and mix.
6. Insert tube into chamber, close lid and select **Scan Blank**.
7. Remove tube from colorimeter. Add 4 drops of \*Sodium Hydroxide, 1.0N [4004WT]. Cap and mix.
8. Use the 0.05 g spoon [0696] to add one measure of \*Tetraphenylboron Powder [6364]. Cap and shake vigorously for 20 seconds until all of the powder has dissolved. Wait 5 minutes.
9. At end of 5 minute waiting period, mix tube again to suspend any settled precipitate. Insert tube into chamber, close lid and select **Scan Sample**. Multiply the result by 50 to determine the potassium concentration in lb/acre.
10. Press  to turn colorimeter off, select **Print Test** to print the results, or press **EXIT** to exit to a previous menu or make another menu selection.

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

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

Potassium Concentration Chart

Pounds Per Acre	Range
0-44 lb/acre	Very Low
50-76 lb/acre	Low
82-143 lb/acre	Medium
144-281 lb/acre	High
Over 294 lb/acre	Very High

# SULFUR

## BARIUM CHLORIDE METHOD • CODE M3639-46-65-SC

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

\*Reagent is a potential health hazard. **READ SDS:**  
 lamotte.com. **Emergency information:**  
 Chem-Tel USA 1-800-255-3924  
 Int'l, call collect, 813-248-0585





To order individual reagents or test kit components, use the specified code number.

Sulfur is essential to the formation of protein and affects various aspects of plant metabolism. Sulfur-deficient plants are pale green in color with thin, reedy stems. Negatively charged sulfate ions are easily leached. The major sources of soil sulfate are fertilizer containing sulfate compounds and atmospheric sulfur dioxide carried into the soil by precipitation.

RANGE:	3-94 ppm Sulfur
METHOD:	Sulfate ion is precipitated in an acid medium with barium chloride to form a barium sulfate suspension in proportion to the amount of sulfate present.
INTERFERENCE:	Suspended matter and color interference may be removed by a filtration step. Silica in excess of 500 mg/L will interfere. Check for stray light interference [see page 69].

## PROCEDURE

1. Press and hold  until colorimeter turns on.
2. Press **ENTER** to select **Testing Menu**.
3. Select **All Tests** (or another sequence containing **089 Sulfate HR**) from **Testing Menu**.
4. Scroll to and select **089 Sulfate HR** from menu.
5. Use the 1 mL pipet [0354] to add 1 mL of \*Sulfate Extracting Solution [6363] to the test tube [0701] then add deionized water to the 15 mL line.
6. Add 3 one gram measures of soil using the 1 g spoon [0697]. Cap vial and shake for five minutes.
7. Filter and collect all of the soil filtrate using the funnel [0459] and filter paper [0463]. If the filtrate is not clear, filter a second time.
8. Fill a clean tube [0290] to the 10 mL line with the soil extract.
9. Insert tube into chamber, close lid and select **Scan Blank**.
10. Remove tube from colorimeter. Use the 0.1 g spoon [0699] to add one measure of \*Sulfate Reagent [V-6277]. Cap and shake until powder dissolves. A white precipitate will develop if sulfates are present. Wait 5 minutes.
11. Mix tube again. Insert tube into chamber, close lid and select **Scan Sample**. Multiply the results by 1.65 to determine the sulfur concentration in ppm.
12. Press  to turn colorimeter off, select **Print Test** to print the results, or press **EXIT** to exit to a previous menu or make another menu selection.

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

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

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

Sulfur Concentration Chart

Parts Per Million	Range
0-16 ppm	Low
17-30 ppm	Medium Low
31-50 ppm	Medium
52-75 ppm	High

# ZINC

## ZINCON METHOD • CODE 3667-01-SC

QUANTITY	CONTENTS	CODE
30 mL	*Zinc Indicator Solution	*6314-G
120 mL	*Methyl Alcohol	*6319-J
10 g	Sodium Ascorbate Powder	6316-D
25 g	*Zinc Buffer Powder	*6315-G
15 mL	*Sodium Cyanide, 10%	*6565-E
30 mL	*Formaldehyde Solution, 37%	*5128-G
1	Dilute Zinc Indicator Solution" Bottle, w/1 pipet assembly	6321-MT-G
1	Graduated Cylinder, 10 mL, glass	0416
1	Spoon, 0.5 g, plastic	0698
2	Pipets, plain, plastic	0352
1	Spoon, 0.1 g, plastic	0699

\*Reagent is a potential health hazard. **READ SDS:**  
 lamotte.com. **Emergency information:**  
 Chem-Tel USA 1-800-255-3924  
 Int'l, call collect, 813-248-0585



To order individual reagents or test kit components, use the specified code number.

The availability of zinc in soils decreases with an increase in soil pH. Some soils that are limited above pH 6.0 may show a zinc deficiency especially in well drained sandy soils. A nutrient interaction exists between soils that have a high phosphorous level and show a zinc deficiency even though zinc levels were sufficient. This interaction is due to the preferential uptake of phosphorus instead of zinc and the possible formation of insoluble zinc phosphates. Once zinc is applied to the soil, it is relatively immobile because it is readily absorbed by organic matter in the soil.

Zinc is essential in promoting certain enzyme reactions in the soil and is required for the production of chlorophyll and the formation of carbohydrates in plants.

**RANGE:** 0.00–15.00 ppm Zinc

**METHOD:** Zinc forms a blue colored complex with Zincon in a solution buffered at pH 9.0. Other heavy metals are complexed by cyanide and the zinc cyanide complex is released by the addition of formaldehyde before the other metal cyanide complexes are destroyed. Sodium ascorbate is added to reduce the interference of manganese.

**INTERFERENCES:** The following ions interfere in concentrations greater than those listed.



Ion	mg/L	Ion	mg/L
Cd(II)	1	Cr(III)	10
Al (III)	5	Ni(II)	20
Mn (II)	5	Co (II)	30
Fe (III)	7	CrO4(II)	50
Fe (II)	9		

## PROCEDURE

### A. PREPARATION OF DILUTE ZINC INDICATOR SOLUTION

1. Use a pipet [0352] to add exactly 5.0 mL of \*Zinc Indicator Solution [6314] to a 10 mL graduated cylinder [0416]. The bottom of the curved surface [the meniscus] of liquid should be at 5.0 mL mark. Pour this into the bottle labeled \*Dilute Zinc Indicator Solution" [6321-MT-G].
2. Use unrinsed graduated cylinder to add 10.0 mL and then 7.8 mL [total of 17.8 mL] of \*Methyl Alcohol [6319] to bottle labeled \*Dilute Zinc Indicator Solution [6321]. Cap and mix ingredients in this bottle. Do not leave this bottle uncapped.

### B. DETERMINATION OF ZINC

1. Press and hold  until colorimeter turns on.
2. Press **ENTER** to select **Testing Menu**.
3. Select **All Tests** [or another sequence containing **097 Zinc LR**] from **Testing Menu**.
4. Scroll to and select **097 Zinc LR** from menu.
5. Fill a clean tube [0290] to the 10 mL line with the soil extract then neutralize according to the procedure on page 84.
6. Insert tube into chamber, close lid and select **Scan Blank**. [See Note]
7. Remove tube from colorimeter. Use 0.1 g spoon [0699] to add one measure of Sodium Ascorbate Powder [6316]. Use 0.5 g spoon [0698] to add one measure of \*Zinc Buffer Powder [6315]. Cap and shake vigorously for 1 minute. Some undissolved buffer may remain in the bottom of the tube.
8. Add 3 drops of \*Sodium Cyanide, 10% [6565]. Cap and mix.
9. Use the 1 mL pipet assembly to add 1 mL of \*Dilute Zinc Indicator Solution [6321]. Cap and mix.
10. Use a second plain pipet [0352] to add 4 drops of \*Formaldehyde Solution, 37% [5128]. Cap and mix by inverting 15 times.
11. Insert tube into chamber, close lid and select **Scan Sample**. Multiply the result by 5 to determine the zinc concentration in ppm.
12. Press  to turn colorimeter off, select **Print Test** to print the results, or press **EXIT** to exit to a previous menu or make another menu selection.

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

Zinc Concentration Chart

Parts Per Million	Range
0.0-0.5 ppm	Low
0.6-1.0 ppm	Marginal
1.1-2.0 ppm	Adequate