LaMotte

2020we/wi TURBIDIMETER

1970-EPA
1970-ISO

To extend the battery life:

- Shut down the unit with the power switch when not taking measurements or use the power save option to have the unit automatically turn off after 5 minutes.
- Store the unit in a cool dry place.
- Fully charge the battery before storing the unit for extended periods of time.
- Limit backlight use. The unit consumes 3X normal power with the backlight on. Set the backlight time option to 10 seconds, or select "Button Control" and keep the backlight off.

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

TURBIDITY

■ WHAT IS TURBIDITY?

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

In the past 10 years, turbidity has become more than just a measure of water clarity. Because of the emergence of pathogens such as Cryptosporidium and Giardia, turbidity now holds the key to assuring proper water filtration. In 1998, the EPA published the IESWTR (interim enhanced surface water treatment rule) mandating turbidities in combined filter effluent to read at or below 0.3 NTU. By doing so, the EPA hoped to achieve a 2 log (99%) removal of Cryptosporidium. There is presently consideration to lower this to 0.1 NTU. The trend has been to check the calibration of on-line turbidimeters with hand-held field units. The optical design and low detection limit of the 2020we/wi allows very accurate readings for such calibrations.

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

■ HOW IS TURBIDITY MEASURED?

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

Two visual methods are the Secchi Disk method and the Jackson Candle method. The Secchi Disk method is often used in natural waters. A black and white Secchi Disk is lowered into the water until it can no longer be seen. It is then raised until it can be seen again. The average of these two distances is known as the "Secchi Depth". The Jackson Candle method uses a long glass tube over a standard candle. Water is added or removed from the tube until the candle flame becomes indistinct. The depth of the water measured with a calibrated scale is

reported as Jackson Turbidity Units (JTU). The lowest turbidity that can be determined with this method is about 25 NTU. There are two common methods for instruments to measure turbidity. Instruments can measure the attenuation of a light beam passing through a sample and they can measure the scattered light from a light beam passing through a sample. In the attenuation method, the intensity of a light beam passing through a turbid sample is compared with the intensity passing through a turbidity-free sample at 180° from the light source. This method is good for highly turbid samples. The most common instrument for measuring scattered light in a water sample is a nephelometer. A nephelometer measures light scattered at 90° to the light beam. Light scattered at other angles may also be measured, but the 90° angle defines a nephelometric measurement. The light source for nephelometric measurements can be one of two types to meet EPA or ISO specifications. The EPA specifies a tungsten lamp with a color temperature of 2,200–3,000 K. The units of measurement for the EPA method are nephelometric turbidity units (NTU). The ISO specifies a light emitting diode (LED) with a wavelength of 860 ± 30 nm and a spectral bandwidth less than or equal to 60 nm. The units of measurement for the ISO method are formazin nephelometric units (FNU). The 2020we meets the EPA specification and the 2020wi meets the ISO specification. The nephelometric method is most useful for low turbidity.

The 2020we/wi is a nephelometer that is capable of measuring turbidity by both the attenuation method and the nephelometric method. It uses a detector placed at 180° to the light source for high turbidity samples. It uses a detector placed at 90° to the light source for the nephelometric method for low turbidity samples. The 2020we/wi has a signal averaging option to improve the stability of readings on low turbidity samples.

The 2020we/wi has two different turbidity calibrations, formazin and Japan Standard. The formazin calibration is the EPA and ISO approved method of calibrating nephelometers. This calibration can be used with user prepared formazin standards or commercially purchased formazin standards. LaMotte Company approved AMCO™ standards labeled for use with the 2020we/wi can also be used with the formazin calibration. Stablcal® standards below 50 NTU should not be used to calibrate the 2020we/wi.

The Japan Standard calibration is a calibration for a Japanese Water Works standard. It is based on Japanese formulated polystyrene turbidity standards. This calibration should only be used to meet Japanese Water Works requirements. The Japanese polystyrene standards can only be purchased in Japan. Formazin, AMCO and Stablcal® standards cannot be used with this calibration.

■ TURBIDITY UNITS

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

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

CALIBRATION & ANALYSIS

■ CALIBRATION

Turbidity Standards

Only use AMCO or formazin standards with the 2020we/wi. StablCal® standards below 50 NTU should not be used to calibrate the 2020we/wi. The diluent used in the StablCal® standards has a different refractive index than traditional formazin standards and will affect the results. The concentration of the calibration standard should be similar to the expected concentration of sample that will be tested. The following standards are available from LaMotte Company:

1480 0 NTU/FNU Standard, 60 mL (EPA or ISO)
1450 1 NTU Standard, 60 mL (EPA)
1453 1 FNU Standard, 60 mL (ISO)
1451 10 NTU Standard, 60 mL (EPA)
1454 10 FNU Standard, 60 mL (ISO)
1452 100 NTU Standard, 60 mL (EPA)
1455 100 FNU Standard, 60 mL (ISO)

Turbidity Calibration Procedure

The default units are NTU and FNU and the default calibration curve is formazin as indicated by (F) in the Menu bar. A 2020we, which uses NTU, will be used in the following examples. For the most accurate results, a user calibration should be performed. The Japan Standard calibration mode, as indicated by (J) in the Menu bar, should be used only with Japanese Polystyrene Standards (0-100 NTU). To change the settings see the Set Up Instructions on page 9.

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

The meter has five measuring ranges:

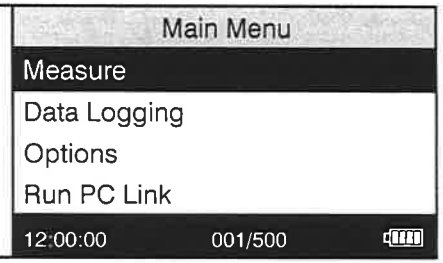
0 – 11 NTU/FTU
11 – 110 NTU/FTU
110-300 NTU/FTU
300-600 NTU/FTU
600-4000 NTU/FTU

Each range can be calibrated with one point per range. (Six points total - a blank plus one point in each of the five ranges - if each range is calibrated.) New calibration points will replace old calibration points independently for each range. If one range is recalibrated, the meter will

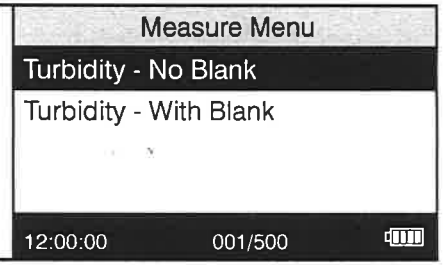
retain the old calibration data for the other ranges. It is recommended that the meter be calibrated for each range that will be used. The value of the standards chosen for the calibration should not be at the extremes of the ranges (11, 110, 300, 600 NTU/FTU). The meter is auto-ranging and will automatically select the appropriate range for the sample being tested.

It is recommended that the meter be calibrated daily.

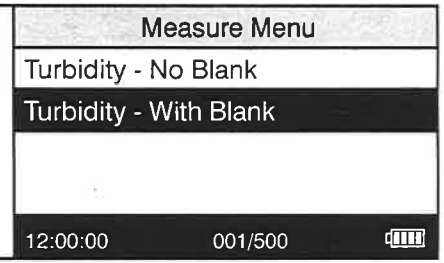
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



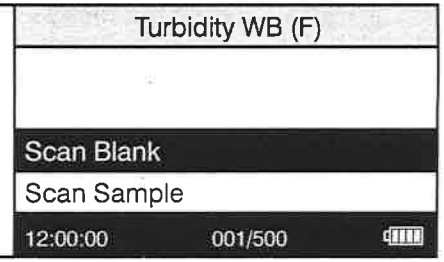
2. Press ENTER to select **Measure**.



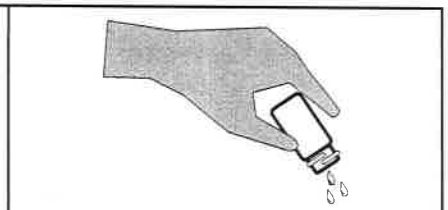
3. Press ▼ to scroll to **Turbidity - With Blank.**



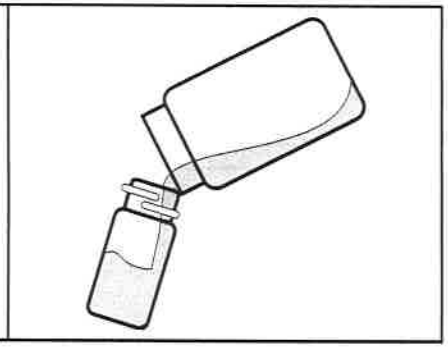
4. Press ENTER to select **Turbidity - With Blank.**



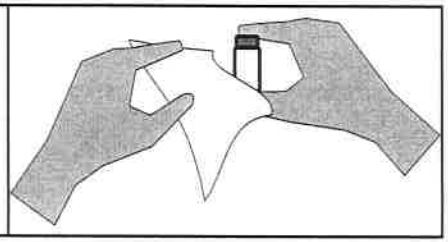
5. Rinse a clean tube (0290) three times with the blank. If samples are expected to read below 1 NTU the meter should be blanked with a 0 NTU Primary Standard or prepared turbidity-free (<0.1 NTU) water. For the most accurate results, use the same tube for the blank and the sample.



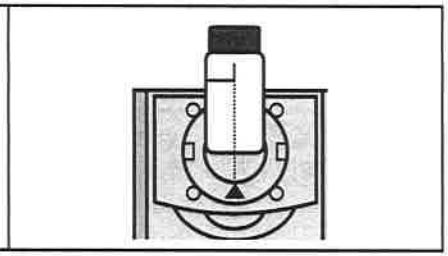
6. Fill the tube to the fill line with the blank. Pour the blank down the inside of the tube to avoid creating bubbles. Cap the tube.



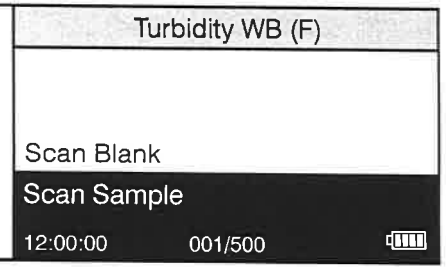
7. Wipe the tube thoroughly with a lint-free cloth.



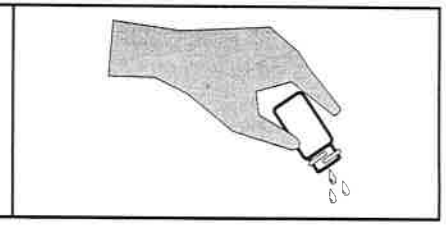
8. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.



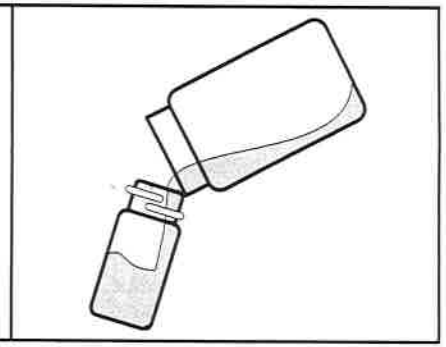
9. Press ENTER to scan the blank. The screen will display **Blank Done** for about 1 second and then return to the **Turbidity - With Blank Menu**.



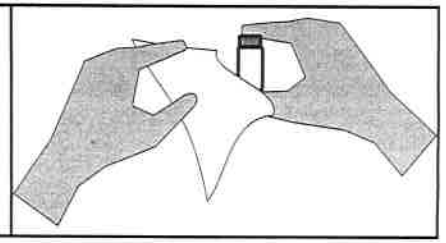
10. Rinse a clean tube (0290), or the same tube, three times with the standard.



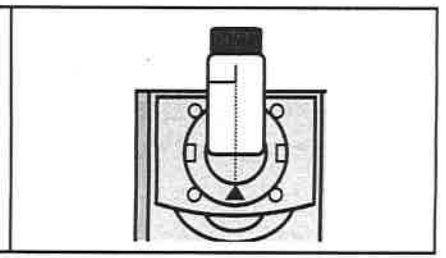
11. Fill the tube to the fill line with the standard. Pour the standard down the inside of the tube to avoid creating bubbles. Cap the tube.



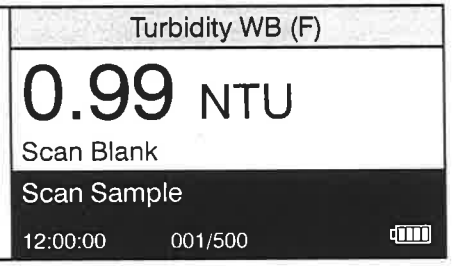
12. Wipe the tube thoroughly with a lint-free cloth.



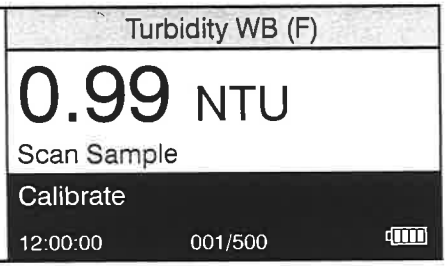
13. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.



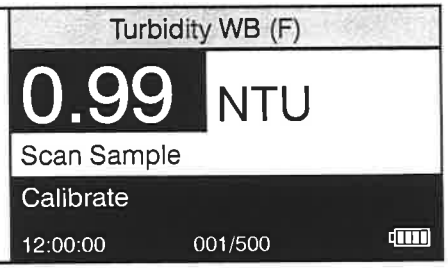
14. Press ENTER to scan the standard. The screen will display **Reading** for about 1 second. The result will appear on the screen.



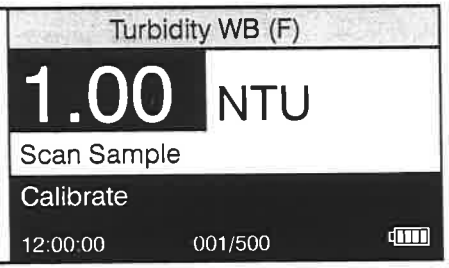
15. Press ▼ to scroll to **Calibrate**.



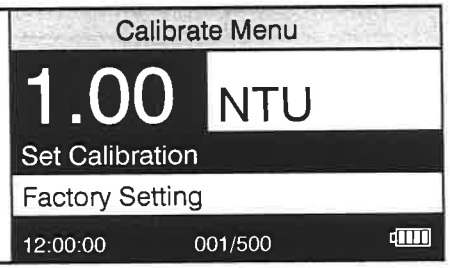
16. Press ENTER to select **Calibrate**. A reverse font (dark background with light characters) will appear to indicate that the reading can be adjusted.



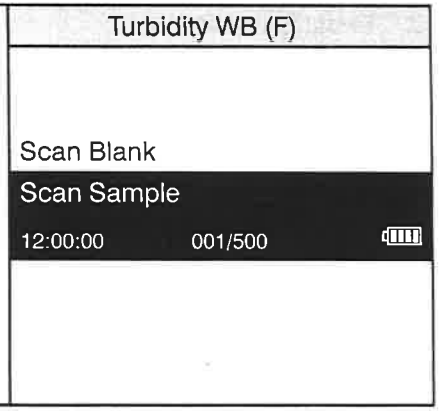
17. Press ▲ or ▼ to scroll to the concentration of the standard, 1.00 in the example. Note: The allowable adjustment is ±20%.



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



19. Press ENTER to select **Set Calibration** and save the calibration. Press ▲ or ▼ to scroll and select **Factory Setting** to revert to the factory calibration. The meter will momentarily display **Storing...** and return to the **Turbidity -Without Blank** menu. The calibration has now been saved and the meter can be used for testing.

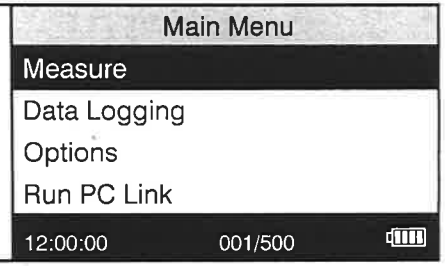


NOTE: For the greatest accuracy during the calibration procedure, be sure that after the meter is blanked and the blank is scanned as a sample, the reading is 0.00. If not, reblank the meter and scan the blank again until it reads 0.00. When scanning the calibration standards as the sample, scan the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

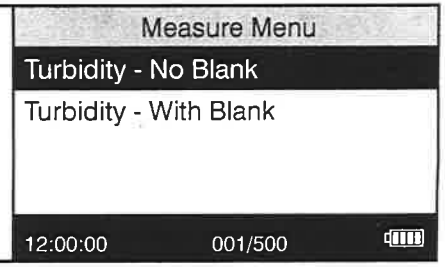
■ ANALYSIS WITHOUT BLANKING PROCEDURE

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

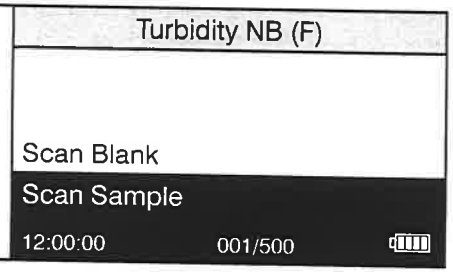
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



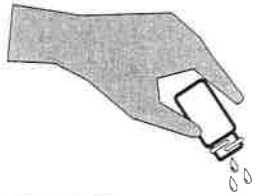
2. Press ENTER to select **Measure**.



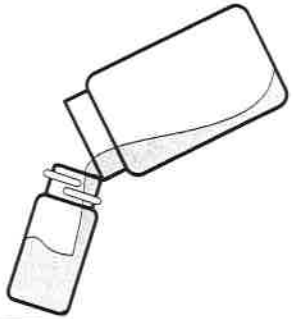
3. Press ENTER to select **Turbidity - No Blank**.



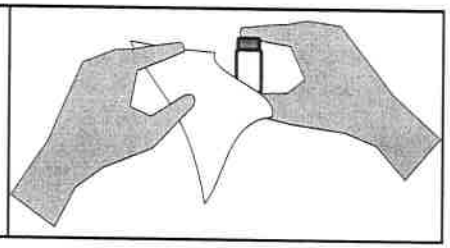
4. Rinse a clean tube (0290) three times with the sample.



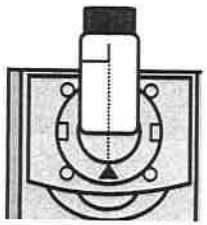
5. Fill the tube to the fill line with the sample. Pour the sample down the inside of the tube to avoid creating bubbles. Cap the tube.



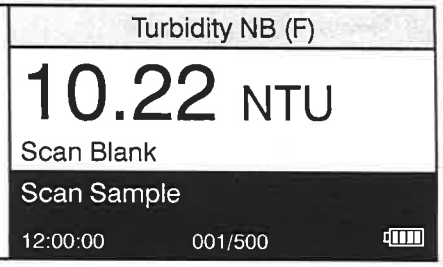
6. Wipe the tube thoroughly with a lint-free cloth.



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



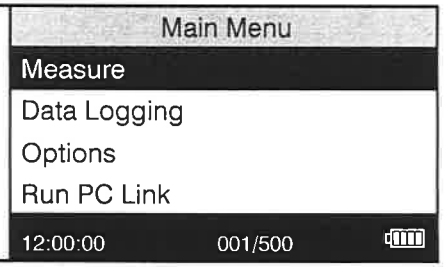
8. Press ENTER to select **Scan Sample**. The screen will display **Reading** for about 1 second. The result will appear on the screen.



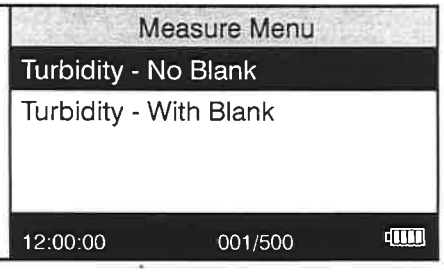
■ ANALYSIS WITH BLANKING PROCEDURE

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

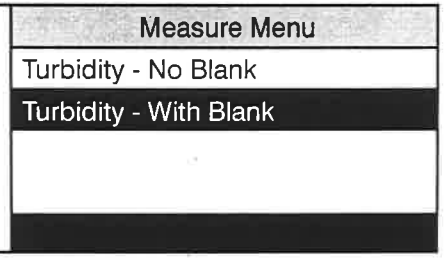
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



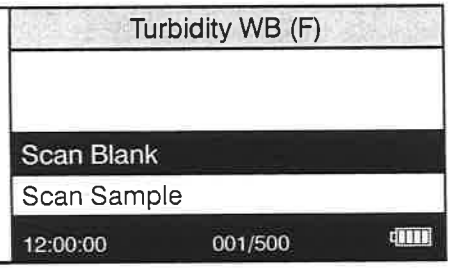
2. Press ENTER to select **Measure**.



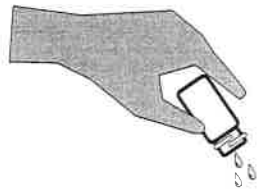
3. Press ▼ to scroll to **Turbidity - With Blank**.



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

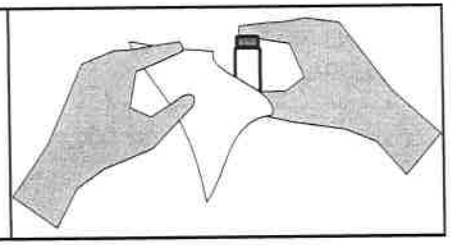


5. Rinse a clean tube (0290) three times with the blank. If samples are expected to read below 1 NTU the meter should be blanked with a 0 NTU Primary Standard or prepared turbidity-free (<0.1 NTU) water. For the most accurate results, use the same tube for the blank and the sample.

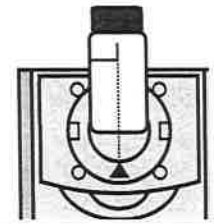


6. Fill the tube to the fill line with the blank. Pour the blank down the inside of the tube to avoid creating bubbles. Cap the tube.

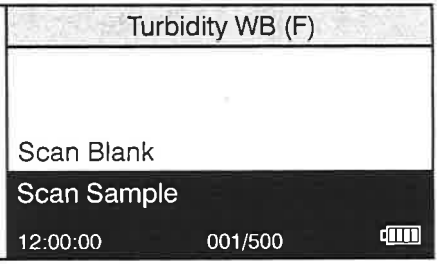
7. Wipe the tube thoroughly with a lint-free cloth.



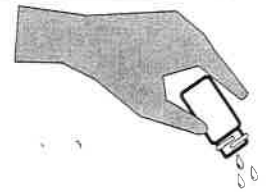
8. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.



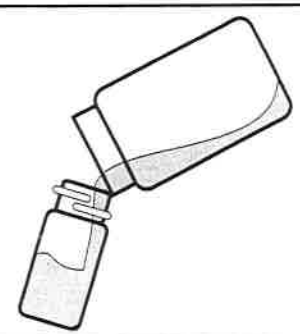
9. Press ENTER to scan the blank. The screen will display **Blank Done** for about 1 second and then return to the **Turbidity - With Blank** menu.



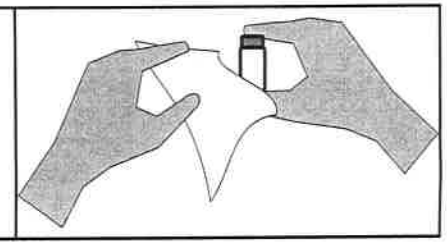
10. Rinse a clean tube (0290), or the same tube, three times with the sample.

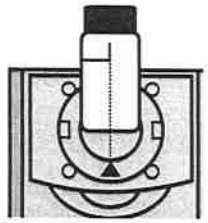


11. Fill the tube to the fill line with the standard. Pour the standard down the inside of the tube to avoid creating bubbles. Cap the tube.



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



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

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

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

■ DILUTION PROCEDURES

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

Turbidity-Free Water

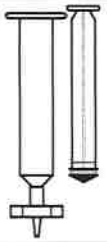
The definition of low turbidity and turbidity-free water has changed as filter technology has changed and nephelometric instruments have become more sensitive. At one time turbidity-free water was defined as water that had passed through a 0.6 micron filter. Now 0.1 micron filters are available and higher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

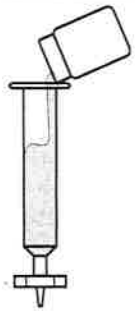
be the same whether it is called 0.00 NTU or 0.02 NTU. For design simplicity the 2020we/wi uses the term turbidity-free water and the value of 0.00 NTU.

■ PREPARATION OF TURBIDITY-FREE WATER

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

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

1. Remove the plunger from the syringe (0943). Attach the filter to the bottom of the syringe.	

2. Pour approximately 50 mL of deionized water into the barrel of the syringe. Insert the plunger. Exert pressure on the plunger to slowly force the water through the filter. Collect water in the clean storage container. Rinse walls of the container then discard this rinse water.	

TROUBLESHOOTING GUIDE

■ TROUBLESHOOTING

PROBLEM	*REASON*	*SOLUTION*
"Blank?"	Sample is reading lower than the blank.	With samples of very low concentration reblank or record as zero. On samples of higher concentration reblank and read again.
Flashing	Low battery. Readings are reliable.	Charge battery or use USB wall/computer charger.
"Low Battery"	Battery voltage is very low. Readings are not reliable.	Charge battery or use USB wall/computer charger.
"Shut Down Low Batt" Shut Down	Battery is too low to operate the unit.	Charge battery or use USB wall/computer charger.
"Over range"	Sample is outside of acceptable range.	Dilute sample and test again.
"Error1"	High readings with 90° and 180° detectors.	Dilute sample by at least 50% and retest.
Lost in meter menus	Reset to factory default settings.	Follow Procedure on page 9 or page 26.
Unusually large negative or positive readings when performing calibration	Incorrect standards used to calibrate meter.	Use fresh 0.0 standard in clean tube. Reset meter to factory default settings. Recalibrate meter.

■ STRAY LIGHT

The accuracy of readings on the 2020we/wi should not be affected by stray light. Make sure that the sample compartment lid is always fully closed when taking readings. The backlight will interfere with turbidity readings. The meter will temporarily disable the backlight while turbidity measurements are being taken.

GENERAL OPERATING INFORMATION

■ OVERVIEW

The 2020we/wi is a portable, microprocessor controlled, direct reading nephelometer. Turbidity is measured directly by either EPA Method 180.1 or ISO Method 7027. It has a graphical liquid crystal display and six button keypad. These allow the user to select options from the menu driven software, to directly read test results or to review stored results of previous tests in the data logger. The menus can be displayed in seven different languages.

The 2020we/wi uses a state of the art, multi-detector optical configuration that assures long term stability of calibrations, high precision and accuracy and low detection limits. All readings are determined by sophisticated digital signal processing algorithms, minimizing fluctuations in readings and enabling rapid, repeatable measurements. The microprocessor and optics enable a dynamic range and auto-ranging over several ranges. Energy efficient LED light sources are used for ISO turbidity. EPA turbidity uses a tungsten filament light source that meets or exceeds EPA specifications and is designed for a uniform light spot image and stable output.

A USB wall adapter, USB computer connection or lithium battery powers the 2020we/wi.

A USB port on the back of the meter allows an interface of the meter with a Windows-based computer for real-time data acquisition and data storage using a PC. The 2020we/wi may be interfaced with any Windows-based computer by using the LaMotte SMARTLink 3 Program.

GENERAL OPERATING INFORMATION

The operation of the 2020we/wi is controlled by the menu driven software and user interface. A menu is a list of choices. This allows a selection of various tasks for the 2020we/wi to perform, such as, scan blank and scan sample. The keypad is used to make menu selections that are viewed on the display.

■ The Keypad

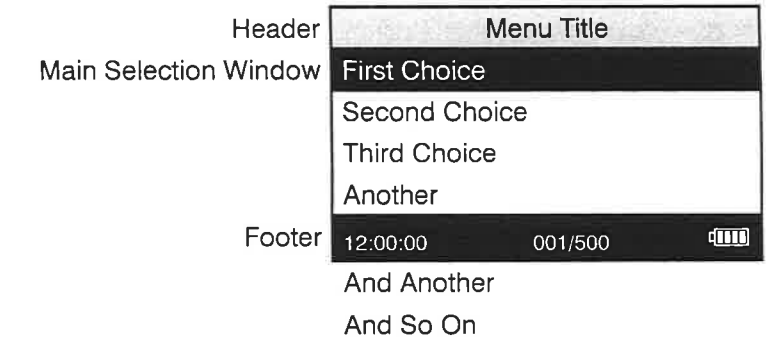
^	This button will scroll up through a list of menu selections.
ENTER	The button is used to select choices in a menu viewed in the display.
☼	This button controls the backlight on the display.
v	This button will scroll down through a list of menu selections.
EXIT	This button exits to the previous menu.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

■ THE DISPLAY & MENUS

The display allows menu selections to be viewed and selected. These selections instruct the 2020we/wi to perform specific tasks. The menus are viewed in the display using two general formats that are followed from one menu to the next. Each menu is a list of choices or selections.

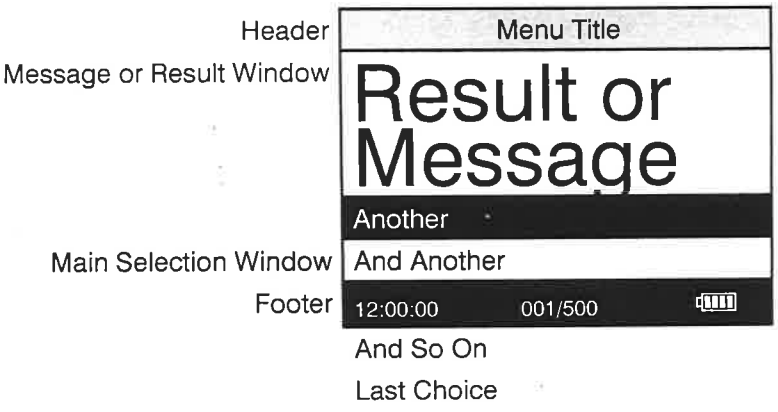
The display has a header line at the top and a footer line at the bottom. The header displays the title of the current menu. The footer line displays the time and the date, the data logger status and the battery status. The menu selection window is in the middle of the display between the header and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

The menu selection window displays information in two general formats. In the first format only menu selections are displayed. Up to 4 lines of menu selections may be displayed. If more selections are available they can be viewed by pressing the arrow buttons ^ v 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 ^ v is pressed. Some menus in the 2020we/wi are looping menus. The top and bottom menu choices are connected in a loop. Scrolling down past the bottom of the menu will lead to the top of the menu. Scrolling up past the top of the menu will lead to the bottom of the menu.



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

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



As described previously, the EXIT button allows an exit or escape from the current menu and a return to the previous menu. This allows a rapid exit from an inner menu to the main menu by repeatedly pushing the EXIT button. Pushing ⏻ at any time will turn the 2020we/wi off.

The display may show the following messages:

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

■ NEGATIVE RESULTS

There are always small variations in readings with analytical instruments. Often these variations can be observed by taking multiple readings of the same sample. These variations will fall above and below an average reading. Repeated readings on a 0.00 sample might give readings above and below 0.00. Therefore, negative readings are possible and expected on samples with concentrations at or near zero. This does not mean there is a negative concentration in the sample. It means the sample reading was less than the blank reading. Small negative readings can indicate that the sample was at or near the detection limit. This is a normal variation that results in a negative reading. A large negative reading, however, is not normal and indicates a problem. Some instruments are designed to display negative readings as zero. In this type of instrument, if the meter displayed zero when the result was actually a large negative number there would be no indication that a problem existed. For this reason, the 2020we/wi displays negative numbers for turbidity.

■ TUBES AND CHAMBERS

The 2020we/wi uses one type of tube (Code 0290). There is no need for a special turbidity tube.

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

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

Tubes should always be washed on the inside and outside with mild

detergent prior to use to remove dirt or fingerprints. The tubes should be allowed to air-dry in an inverted position to prevent dust from entering the tubes. Dry tubes should be stored with the caps on to prevent contamination.

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

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

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

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

MAINTENANCE

■ CLEANING

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

■ REPAIRS

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