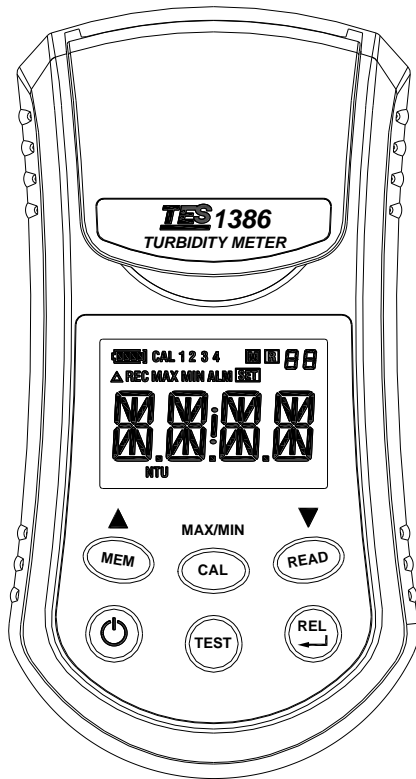# TES TURBIDITY METER

TES-1386

INSTRUCTION MANUAL

TES ELECTRICAL ELECTRONIC CORP.

CONTENTS

1. INSTRUCTION

❑ The meter is portable turbidimeter operate on the nephelometric principles of turbidity measurement based on ISO 7027, which is suitable for measurement in water solutions for institutes, industrial labs and production fields.

❑ The meter is waterproof turbidimeter with a rating of IP65 and can memory 99 data points that can later be read by the meter.

❑ Before using the meter, please note that all operators should be read this manual carefully prior to working with the meter, which will help you to operate and maintain the meter, as well as to avoid caused by unsuitable operation and maintenance.

2. FEATURES

❑ Auto-ranging from 0 to 1000 NTU (Nephelometric Turbidity Unit)

❑ Waterproof and dustproof with IP65-rated housing that floats

❑ Meets performance criteria as specified by ISO 7027 (DIN EN 27027) method

❑ Low battery alarm and auto shut off after 10 minutes of non use

❑ Large LCD display and backlight function

❑ Four point calibration for full-range accuracy

❑ Maximum/Minimum, Alarm and Relative function

❑ Manual data memory and read function

3. SPECIFICATIONS

Measurement Method: ISO 7027 compliant
nephelometric method (90°)

Measurement Range: 0 to 1000 NTU

Automatic Range Selection: 0.01 – 9.99 NTU
10.0 – 99.9 NTU
100 – 1000 NTU

Resolution: 0.01 NTU (0 – 9.99 NTU)
0.1 NTU (10 – 99.9 NTU)
1 NTU (100 – 1000 NU)

Accuracy: ±2% of reading ± 1 digit for 0.1 to 500 NTU
±3% of reading ± 1 digit for 501 to 1000 NTU

Repeatability: ± 0.01 NTU or ± 1% of reading, whichever
is greater

Response Time: < 12 seconds for full step change

Calibration Standards: 0.05 NTU
20 NTU
100 NTU
800 NTU

Standardization: Formazin primary standards

Light Source: Infrared LED (850 nm)

Light Source Life: > 1,000,000 tests

Detector: Silicon photodiode

Stray Light: < 0.02 NTU

Display: 4-digit 14-segments LCD

Sample Cells (Vials): Borosilicate glass with screw caps, fill line and indexing mark.
52.5 (H) x 25 (Dia) mm (2.07 x 1 in)

Sample Volume Required: 10 ml (0.33 oz)

Operating Temperature Range: 0°C to 50°C (32°F to 122°F)

Sample Temperature Range: 0°C to 50°C (32°F to 122°F)

Operating Humidity Range: 0 to 90% RH, non-condensing at 30°C (86°F)

Power Supply: 4 x "AAA" Batteries

Battery Life: > 800 readings
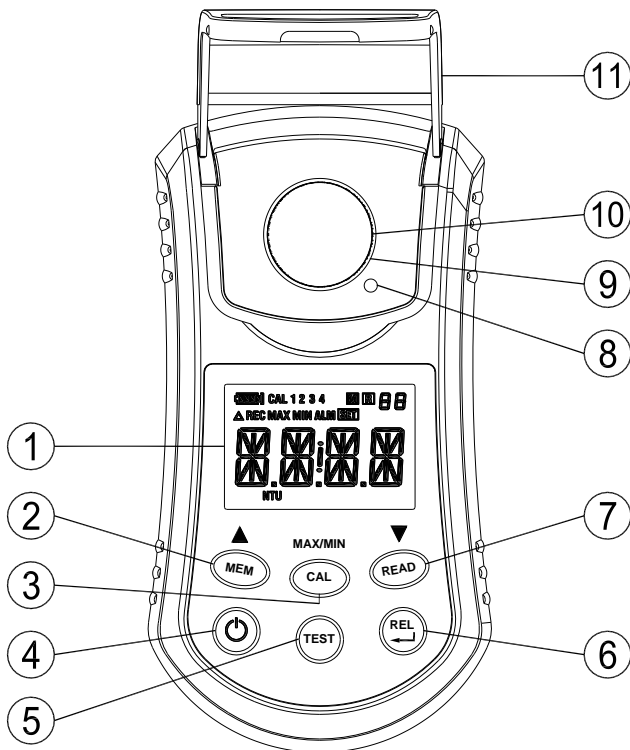
Enclosure Type & Rating: ABS Plastic / IP65 rated

Insulation Rating: Pollution Degree 2

Weight: 256g (9oz)

Size:148 (L)x78 (W)x64 (H) mm / 5.83"x3.07"x2.52"

Accessories: Hard carrying case, 10-mL silicone oil, lint-free cloth, four calibration standards, three sample vials, 4 AAA batteries, instruction manual.

4. NAME OF PARTS AND POSITIONS

1. LCD Display: 4-digital, 14-segment LCD is used for reporting the measured turbidity value and has several other marks to provide function guidance.

2. MEM key: Press this key one time to store one set LCD logging to memory.

3. CAL key:
  ① Press this key one time to enter the calibration mode and press this key for 3 seconds to exit this mode.
  ② Press this key for 3 seconds to enter or exit the Maximum (MAX) / Minimum (MIN) recording mode.

4

4. ⏻ **key**:
   ① Press this key one time to turn on the meter and press this key for 3 seconds to turn off the meter. The meter will automatically shuts off 10 minutes after last key press except in the MAX/MIN and REL functions.
   ② When power on the meter then press this key to turn on or off the LCD backlight. The backlight will automatically shuts off 30 seconds after turn on.

5. TEST key:
   ① Press this key one time to perform the single-shot measurements.
   ② Press this key for 3 seconds to enter or exit setting mode.

6. REL key:
   ① Press this key one time to enter or exit the Relative mode.
   ② Press this key for 3 seconds to enter the RTC display mode then press this key to switch the display Year, Month I Day, Hour : minute and second. Press this key for 3 seconds to exit this mode.

7. READ key:
   ① Press this key one time to enter the memory data reading mode.
   ② Press this key for 3 seconds to turn on the alarm mode and press this key one time to exit this mode.

8. Index Mark

9. Sample Well

10. Sample Vial

11. Light Shield Lid

5. OPERATING INSTRUCTIONS

5-1 Turbidity Calibration

The meter has been factory calibrated. For best accuracy and regulatory compliance, re-calibration is recommended at least once every month. In addition, it is recommended to use the prepared calibration standard vials daily as check standards prior to the measurement of samples.

For ensure full range accuracy, perform a full calibration using all 4 standards. However, the meter provides flexibility to calibrate at selected range for desired application. In addition, the meter comes with a light shield lid to shield off stray light during measurement and calibrations.

5-1-1 Calibration Standards

The 4 vials of calibration standards supplied with the meter.

- CAL1: 800 NTU calibration standard
- CAL2: 100 NTU calibration standard
- CAL3: 20.0 NTU calibration standard
- CAL4: 0.05 NTU calibration standard

If you use the supplied calibration standards to calibrate the meter, review the expiration (indicated on the vial cap label) to ensure the standards have not expired.

Note: It is important the calibration standards are not violently shaken or agitated because air entrapment in the fluid introduces an error factor during calibration which subsequently will lead to an inaccurate measurement.

Also, do not store in freezing temperature will cause irreversible shrinkage of the standards particles thus resulting to inaccurate calibration and measurements.

5-1-2 Index Mark

The United States Environmental Protection Agency (US EPA) recommends that vials used for turbidimeter calibration or sample measurement be indexed.
Insert the calibration standard vial to the meter sample well so the diamond or orientation mark aligns with the raised orientation index mark in front of the sample well.

5-1-3 Calibration Procedure

1. Gently invert each standard before inserting the standard.
2. Place the meter on a flat and level surface.
3. Open the meter light shield lid.
4. Insert the CAL1 800 NTU standard into the sample well, aligning the mark on the vial with the mark on the meter.
5. Press down the vial until it slides fully into the meter.
6. Close the meter light shield lid.
7. Press ⏻ key to turn on the meter. The meter goes to measurement mode after the power-up sequence.
8. Press "**CAL**" key once to enter the calibration mode, the "**CAL**" mark blinks momentarily then prompt for the first calibration standard "**CAL1 800 NTU**".
9. Press ↵ key to perform calibration of CAL 1 point, the "**800 NTU**" mark blinks for about 12 seconds. When the meter has completed calibration for this point will prompts you to insert the next calibration
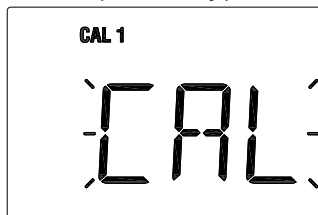
standard into the sample well "**CAL2 100 NTU**".

10. Repeat the calibration for CAL2, CAL3 and CAL4 calibration standards.

11. After successfully calibrate the CAL4 standard (0.05 NTU), the meter automatically exits the calibration mode and ready for measurement. The complete calibration sequence as follows figure:
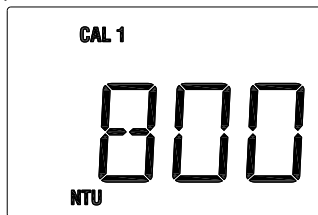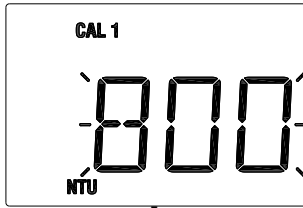
Measurement Mode

↓

(CAL key)
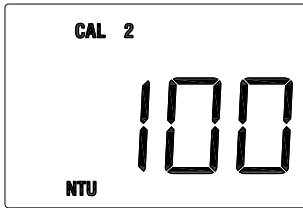

↓

(Flashes about 5 times)

↓

CAL1
800 NTU

Place the CAL1 standard into the sample well.

↓

(↵ key)

CAL 1

`800`

NTU

↓

(Flashes about 12 times)

CAL 2

100

NTU

↓

CAL2
100 NTU

Place the CAL2 standard into the sample well.

↓

(↵ key)

CAL 2

100

NTU

↓

(Flashes about 12 times)

CAL 3

20.0

NTU

9
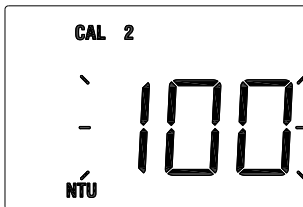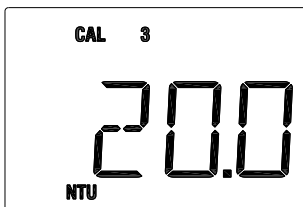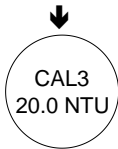
CAL3
20.0 NTU

Place the CAL3 standard into the sample well.

(↵ key)

CAL   3

20.0

NTU

(Flashes about 12 times)

CAL   4

0.05

NTU
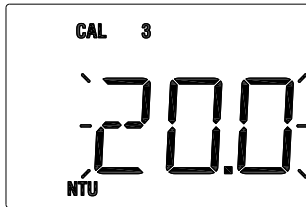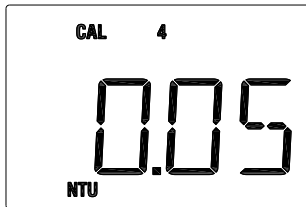
CAL4
0.05 NTU

Place the CAL4 standard into the sample well.

(↵ key)

CAL   4

0.05

NTU

10
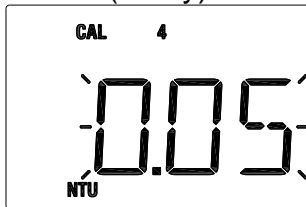
↓
(Flashes about 12 times)
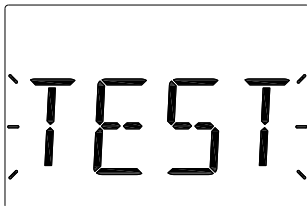
↓
Measurement Mode

NOTES:

  1. If you want to exit the calibration mode, may do so at the end of any step by press the "**CAL**" key for 3 seconds. The meter accepts only the values calibrated prior to exiting.

  2. You can skip a calibration point by pressing the "**CAL**" key and move on to the next calibration point.

5-1-4 Restoring the Factory Calibration

The meter allows you to reset the meter back to the factory default calibration values. This feature can be used when there are errors in calibration or when you have new calibration standards.

1. Press ⏻ key for 3 seconds to turn off the meter.

2. Press and hold down the "**CAL**" key then press ⏻ key to turn on the meter. Release "**CAL**" key when "**CAL1234 F.YES**" or "**CAL1234 F.No**" mark appears in the display.

3. Press "**CAL**" key to select between "**F.YES**" or "**F.No**".
   "**F.YES**" = To restore the factory calibration values.
   "**F.No**" = To retain last calibrated values.

4. Press ↵ key to confirm the selection and back to measurement mode.

5-2 Turbidity Measurement

5-2-1 General Information

The meter is waterproof allows you to measure the turbidity of a grab sample. The turbidity is reported in Nephelometric Turbidity Units (NTU). Reading above 1000 NTU are outside the range of this meter.

Before turn on the meter, a sample vial must be placed in the sample well. You can use any of the calibration standards for this purpose as check standards prior to the measurement of samples.

The light shield lid provided must be used to cover the vial during measurements to shield off stray light.

When the ⏻ key is pressed to turn on the meter, it goes through the power up sequence as shown in below.

Before switch on, place a sample vial or any of the calibration standards provided into the sample well.

Measurement Off

⬇

⏻ key
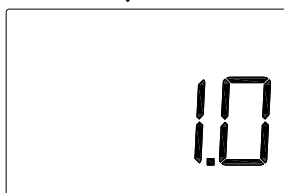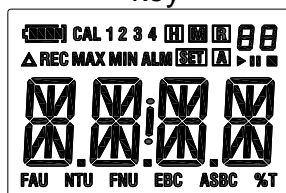
"x.x" is software revision number.
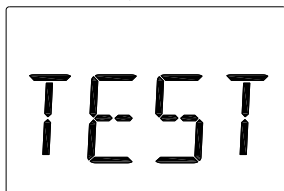
"**TEST**" flashes about 12 times indicating that the meter goes to measurement mode.

A reading is valid only if you placed a vial or any of the calibration standards provided into the sample well. Otherwise the reading has no meaning.

Note: Measure samples immediately to prevent temperature changes and setting. Before a measurement is taken always make sure that the sample is homogeneous throughout.

5-2-2 Turbidity Measurement Procedure
Preparation of Sample Vial

1. Use a clean and dry sample vial.
2. Take care to handle the sample vial by the top.
3. Rinse the sample vial with about 10mL of the sample water, capping the sample vial with screw cap and gently inverting it several times. Discard the used sample and repeat this procedure two more times.
4. Fill the rinsed sample vial with remaining portion (about 10mL) of the sample up to the mark indicated in the sample vial. Cap the sample vial with the screw cap.
5. Wipe the sample vial with a soft, lint-free cloth. Ensure that the outside of the sample vial is dry, clean and free from spots and fingerprints.
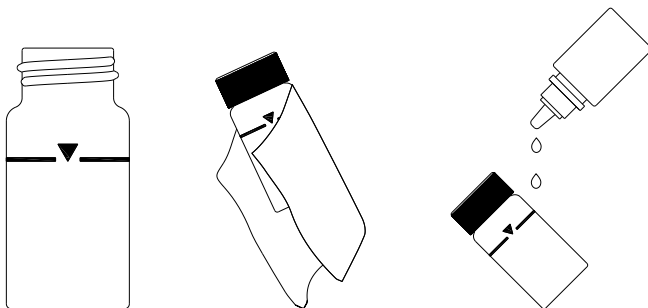
6. Apply a thin film of silicone oil on the sample vial.
7. Wipe with a soft cloth to obtain an even film over the entire sample vial's surface. Make sure that the sample vial is almost dry with little or no visible oil.

    The purpose of oiling the sample vial is to fill small scratches and to mask the imperfection in the glass.
8. The sample vial is now ready to be inserted into the sample well of the meter for measurement.

Measurement Procedure

1. Gently invert each sample vial before inserting the sample vial.

2. Place the meter on a flat and level surface.

3. Open the meter light shield lid.

4. Place the sample vial into the sample well and align the vial's index mark with the meter's index mark.
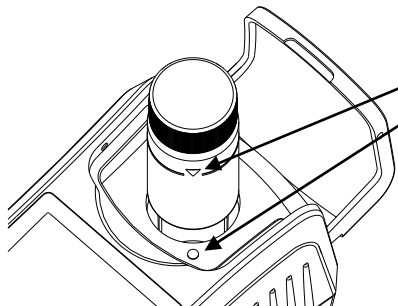
Align index mark on the sample vial with the index mark on the meter and slides fully into the meter sample well.
Note: Place the meter on a flat and level surface. Do not hold it on hands. It may lead to inaccuracy reading.

5. Push the sample vial until it is fully snapped in.

6. Close the meter light shield lid.

7. Press ⏻ key to turn on the meter. The meter goes to measurement mode after the power-up sequence.

8. The display blinks "**TEST**" for about 12 times.

9. The measured value appears in the display.

Measurement Off
↓
Place sample vial into the sample well

SAMPLE UNKNOWN NTU

↓
TEST key

$TEST$

↓
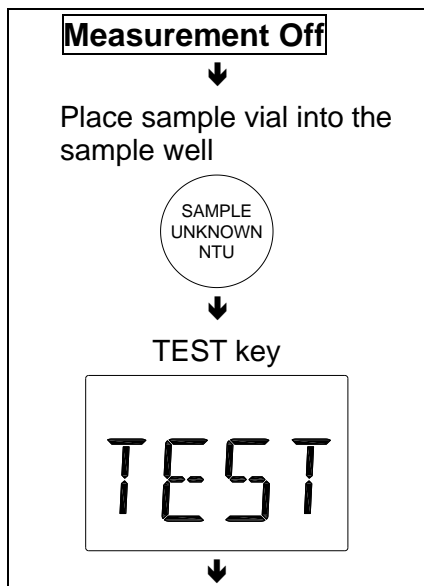
10. If necessary, place the second sample vial into the sample well. Remember to align the sample vial's index mark with the meter's index mark.

"TEST" flashes about 12 times.

	158
NTU	

11. Press "**TEST**" key, the display blinks "**TEST**" for 12 times and the measured value appears.

12. Repeat step 4 to step 9 for all samples.

Notes:

- Always cap the sample vial to prevent spillage of the sample into the meter.
- Never pour liquid directly into the sample well of the meter. Always use a sample vial.
- Always close the light shield lid during measurement, calibration and storage.
- Keep the light shield lid closed to prevent the entry of dust and dirt.
- Always use clean sample vial in good condition. Dirty, scratched or damaged vials can cause inaccuracy reading.
- Make sure that cold samples do not "**fog**" the sample vial.
- For battery conservation, the meter automatically powers off 10 minutes after the last key pressed.

5-3 Continuous Measurement for Capturing Maximum and Minimum Values

The MAX/MIN record mode captures maximum and minimum measured values. When the measured value goes above the recorded maximum value or below the recorded minimum value, the meter records the new value.

1. Perform the Measurement Procedure Section step 1 to step 9 until the measured value appears in the display.
2. Press "**MAX/MIN**" key for 3 seconds to enter MAX/MIN recording mode, the "**MAX**" mark is blink displayed, and the auto power off function is automatically disabled.
3. Press "**MAX/MIN**" key to circulate the display of the Maximum (MAX), Minimum (MIN) and Current (REC) measured readings.
4. Under the MAX or MIN display mode, press ▲ key in sequence display the MAX or MIN recording time as follows.

Year	month I day	hour:minute	:second
2019	0322	15:28	-- --:23

5. Press "**MAX/MIN**" key for 3 seconds to exit MAX/MIN recording mode.

5-4 Continuous Measurement for Making Relative Measurements

The meter displays calculated value that are based on a stored when set to Relative ($\triangle$) mode.

1. Perform the Measurement Procedure Section step 1 to step 9 until the measured value appears in the display.

2. Press "**REL**" key to enter this mode. Zero the display, the "△" mark is blink displayed, and the current measured value stored as the reference value.

3. If necessary, place the other sample vial into the sample well for test, the display value that is the stored reference value minus the current measured value.

4. Press "**REL**" key to exit this mode.

5-5 Alarm Function Operation

5-5-1 To Set the Alarm Limit Value

1. In the measurement mode, press "**TEST**" key for 3 seconds to enter the alarm limit value setting mode, the "**ALM SET**" mark and the previous setting value are displayed.

2. Press "**TEST**" key for 3 seconds to exit this mode or press ↵ key to setting the new alarm limit value.

3. Press "**CAL**" key to cycle select the desired setting range is "0.01" (0.01 to 9.99), 10.0 (10.0 to 99.9) or 100 (100 to 999) NTU.

4. Press ↵ key to confirm.

5. Press "**CAL**" key to move the flickering cursor to the desired position then press ▲ or ▼ key to set desired values, repeat this step to all digits.

6. Press ↵ key to stored the setting value and exit this mode.

5-5-2 To Turn-On and Turn-Off Alarm function

1. In the measurement mode, press ▼ key for 3 seconds to turn on the alarm function, the "**ALM**" mark is displayed.

2. When the measured value is upper to the alarm limit value the beep will sound 12 seconds then the "**ALM**" is blink displayed.

3. Press ▼ key one time to exit this mode.

5-6 Setting the Real-Time

1. In the measurement mode, press "**TEST**" key for 3 seconds to enter the alarm limit value setting mode, the "**ALM SET**" mark and the previous setting value are displayed.

2. Press "**TEST**" key one time to select the RTC setting mode, the "**SET** **20XX**" mark is displayed and the number of year are flickering.

3. Press "**CAL**" key to move the flickering cursor to the desired year element then press ▲ or ▼ key to set year of the real-time.

4. Press ↵ key to move the flickering cursor to the "month I day".

5. Press "**CAL**" key and ▲ or ▼ key to set the "**month I day**" to the real-time.

6. Press ↵ key to move the flickering cursor to the "**hour:minute**".

7. Press "**CAL**" key and ▲ or ▼ key to set the "**hour: minute**" to the real-time.

8. Press ↵ key to move the flickering cursor to the "**--:second**".

9. Press "**CAL**" key and ▲ or ▼ key to set the "**--:second**" to the real-time.

10. Press ↵ key to store the RTC setting and exit.

11. In the measurement mode, press ↵ key for 3 seconds to enter the RTC display mode then press ↵ key to cycle display the year "**20XX**", month I day (**XXIXX**), hour:minute (**XX:XX**) and second (**--:XX**). Press ↵ key for 3 seconds to exit.

5-7 Data Memory and Read Mode

5-7-1 To Memorize the Reading

1. In the measurement mode, press "**MEM**" key one time, one set of reading and the RTC will be stored to the memory. At this moment, LCD will show the "M" mark and the memory address number. Total memory size is 99 sets.

2. When the memory is full, the "**FULL**" mark is display one time.

5-7-2 To Recall and Read Memorized Reading

1. In the measurement mode, press "**READ**" key to enter the READ mode, the LCD will show "R" mark and the memory address number.

2. Press "**READ**" key to cycle select the desired memory address number data for display then press the ▲ key to cycle display the stored RTC.

3. Press "**READ**" key for 3 seconds to exit this mode.

5-7-3 To Clear the Memorized Data

1. Press ⏻ key for 3 seconds to turn off the meter.

2. Press and hold the "**MEM**" key then press ⏻ key to turn on the meter, LCD will show "**M** **CLER**" one time, it indicates that the memorized data is erased.

6. BATTERY CHECK-UP & REPLACEMENT

1. When operating the meter on batteries, periodically check this indicated to determine the remaining battery capacity. The number of black segments decreases as the batteries are used up. When the "⬚" symbol blink display, correct measurement is no longer possible. Replace the batteries with a fresh set.

2. Take care not to reverse the (+) and (-) polarity when inserting the batteries. Always replace all six batteries together. Do not mix old and new batteries or batteries of different type.

3. **Prevention of battery fluid leakage:**

   ① When the battery power is low, replace the new battery in order to avoid the further battery fluid leakage possibility.

   ② In long-term, when the instrument is not in use, to avoid the battery liquid leak damage, please remove battery out of the instrument.

21

7. MAINTENANCE

Turbidity meter maintenance

- Wipe the outside of the turbidimeter with a damp cloth.

- Use a lens tissue, a soft cloth, or clean compressed air can to remove dust and dirt from the sample well.

Vial maintenance

- Always wipe moisture off any vial before inserting to the meter.

- Always wipe fingerprints off any vial before inserting to the meter.

- To clean vials, wash vials well with laboratory detergent, rinse repeatedly with deionized water and allow to air dry.

- Use a light coating of silicone oil and lint-free cloth to fill in tiny scratches and optimize the vial surface.

- Discard vial if they become scratched or etched and silicone oil does not improve their performance.