



# TN400 Portable Turbidity Meter

## Instruction Manual



**APERA INSTRUMENTS LLC**  
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## 1 OVERVIEW

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Thank you for selecting our portable TN400 turbidity meter.

This meter is an outstanding combination of the most advanced electronic technology and software design, and is the most cost-effective portable turbidity meter. This meter operates on the nephelometric principle of turbidity measurement and is designed to meet the criteria specified in ISO7027 and DIN 27027 standards. TN400 allows you to measure the turbidity of an aqueous sample both in laboratory and in the field.

With built-in microprocessor chips, elegant design, easy to use, the meter has the following remarkable characteristics:

- Smart functions, such as automatic calibration, operating instructions, automatic power-off, low voltage display and etc.
- Large TFT color screen, with blue background in measuring mode, green background in calibration mode, and text and graphics in operational directive.
- With advanced digital processing technology, the accuracy of the meter is greatly improved.
- The structure design meets the requirements of IP67 level of protection and is suitable  
for use in field and on-site.
- Contained in customized portable case, calibration standards, sample vials and other  
necessary accessories are more convenient to use and carry.

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## 2 TECHNICAL SPECIFICATIONS

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### 2.1 Technical Parameters

Measuring Method	ISO 7027 compliant nephelometric method ( 90° )
Measuring Range	0 to 1000 NTU, automatic range selection: 0.01 to 19.99 NTU 20.0 to 99.9 NTU 100 to 1000 NTU
Resolution	0.01 / 0.1 / 1 NTU
Reading Error	≤ ±2 % of reading±stray light
Repeatability	≤ ±1% of reading or 0.02 NTU, whichever is greater
Calibration Standards	0.02 NTU, 20.0 NTU, 100 NTU, 800 NTU(Polymer)
Light Source	Infrared light emitting diode ( 850nm wavelength )
Detector	Silicon photovoltaic
Display	TFT Color screen
Sample Vials	Φ25×60 mm, high borosilicate glass with screw cap
Sample Volume	18 ml
Operating Temp. Range	0 to 50° (32°F to 122°F)

### 2.2 Others

Power Supply	4× AA Alkaline Batteries
IP Rating	IP67
Dimension/Weight	Meter : (90×203×80)mm / 385 g Portable Case : (310×295×110)mm / 1.5 kg
Quality and Safety Certificate	ISO9001:2008 & CE

### 3 INSTRUMENT DESCRIPTION

#### 3.1 Instrument Overview

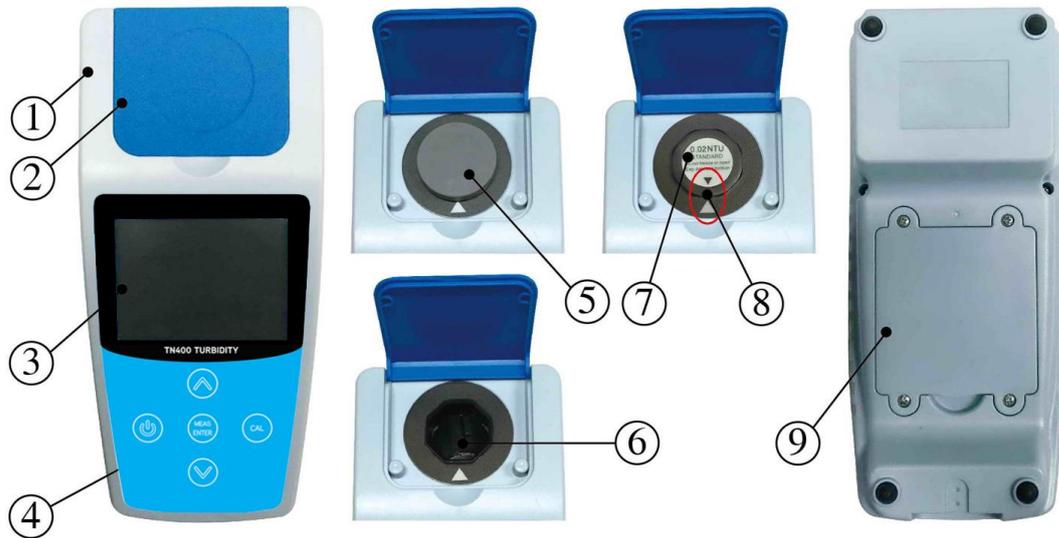


Diagram-1

①	Housing	⑥	Sampling well
②	Flip cover of the sampling well (Close the cover when measuring)	⑦	Calibration vials or sample vials
③	Display	⑧	Positioning mark (Align the mark with the mark on the calibration vial or the sample vial)
④	Keypad	⑨	Battery cover
⑤	Dust proof plug (Take off the plug when measuring)		

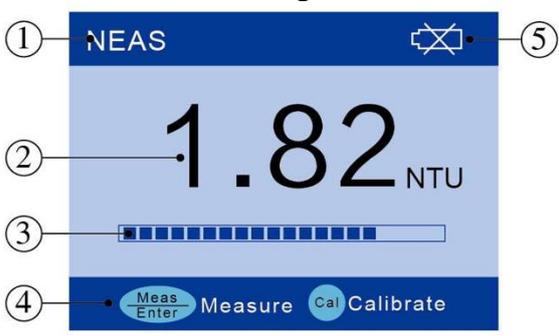
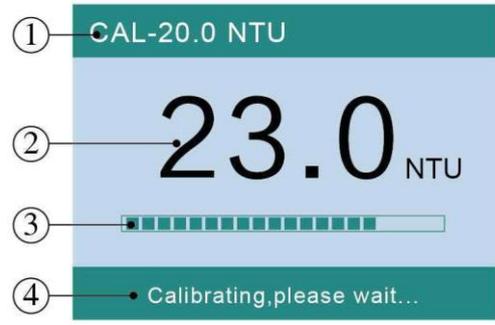
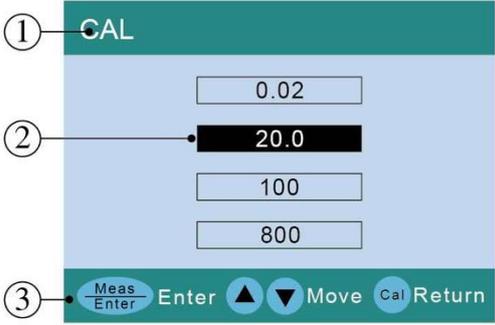
### 3.2 Meter and Accessories



Diagram-2

①	Standard solution: 0.02NTU, 20.0NTU, 100NTU, 800 NTU	⑥	Silicon oil (10 ml)
②	Portable case	⑦	Sample vial×3
③	TN400 Meter	⑧	Screwdriver (to remove battery cover)
④	Soft cloth	⑨	Instruction manual
⑤	“AA” Alkaline battery×4		

### 3.3 Display

<p style="text-align: center;"><b>Measuring Mode</b></p>  <p>The screenshot shows the Measuring Mode interface. At the top, there is a blue header with 'NEAS' on the left and a battery icon with a red 'X' on the right. Below the header, the reading '1.82 NTU' is displayed in large black font. Underneath the reading is a progress bar with approximately 10 segments, the first few of which are filled. At the bottom, there is a blue bar with two buttons: 'Meas Enter' and 'Cal Calibrate'.</p>	<ul style="list-style-type: none"> <li>① — Measuring mode icon</li> <li>② — reading/Unit</li> <li>③ — Progress bar</li> <li>④ — Operational directive</li> <li>⑤ — Low battery display</li> </ul>
<p style="text-align: center;"><b>Calibration Mode</b></p>  <p>The screenshot shows the Calibration Mode interface. At the top, there is a green header with 'CAL-20.0 NTU'. Below the header, the reading '23.0 NTU' is displayed in large black font. Underneath the reading is a progress bar with approximately 10 segments, the first few of which are filled. At the bottom, there is a green bar with the text 'Calibrating, please wait...'.</p>	<ul style="list-style-type: none"> <li>① — Calibration mode icon</li> <li>② — Reading/Unit</li> <li>③ — Progress bar</li> <li>④ — Operational directive</li> </ul>
<p style="text-align: center;"><b>Calibration Menu Mode</b></p>  <p>The screenshot shows the Calibration Menu Mode interface. At the top, there is a green header with 'CAL'. Below the header, there are four input fields containing the values '0.02', '20.0', '100', and '800'. The '20.0' field is highlighted with a black background. At the bottom, there is a green bar with buttons: 'Meas Enter', 'Enter', 'Move' (with up and down arrow icons), and 'Cal Return'.</p>	<ul style="list-style-type: none"> <li>① — Calibration mode Icon</li> <li>② — Standard solution value</li> <li>③ — Operational directive</li> </ul>

### 3.4 Keypad

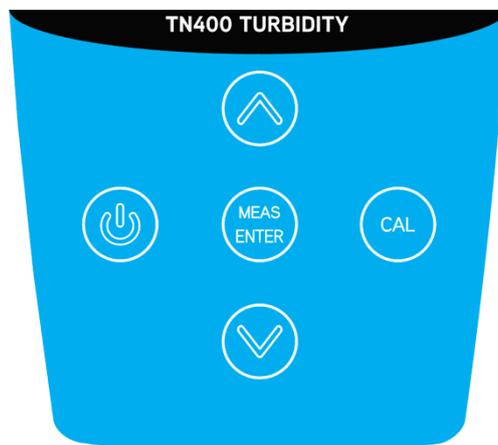


Diagram- 3

Key	Functions
	<ul style="list-style-type: none"> <li>● Power on/off</li> <li>● The meter will automatically shut off 10 mins after last key press</li> </ul>
	<ul style="list-style-type: none"> <li>● Initiate /Exit the calibration mode</li> </ul>
	<ul style="list-style-type: none"> <li>● In measuring mode : Short press the key to perform single-shot measurement; long press the key to perform continuous measurement.</li> <li>In calibration mode: press the key to confirm the calibration.</li> </ul>
	<ul style="list-style-type: none"> <li>● In calibration mode, press the key to select standard solution.</li> </ul>

### 3.5 Battery Installation

1. Use the screwdriver to remove the four screws on the battery cover and open the battery cover.
2. Insert 4 pieces of AA alkaline battery. Please make sure the polarity is correct.
3. Put on the battery cover and screw tightly.

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## 4 METER CALIBRATION

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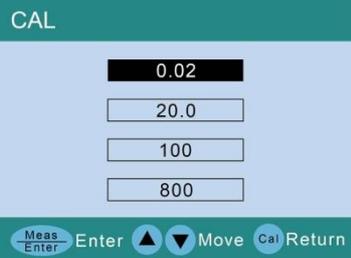
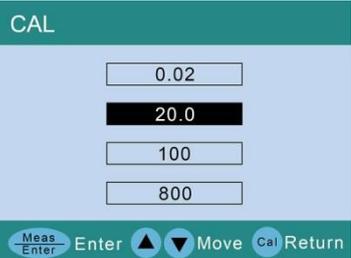
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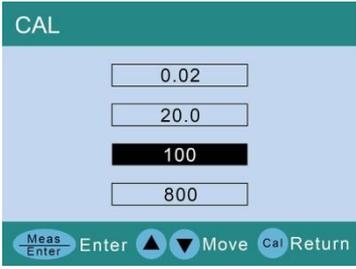
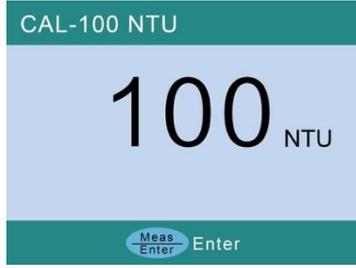
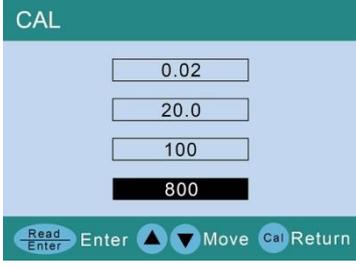
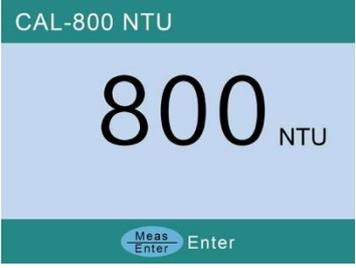
TN400 turbidity meter needs to be calibrated with the provided standard solution when used for the first time. For normal use, it is suggested to calibrate the meter monthly or weekly depending on the frequency of use; or the user can perform verification test, which is to test the standard solution that is close to the value of the test sample. If the error is big, it is necessary to calibrate the meter. To ensure the accuracy, 4 polymer standards included in the meter kit should be selected to calibrate the meter.

## 4.1 Calibration Standards

TN400 turbidity meter adopts US EPA certified Reagecon high molecular weight polymer turbidity standard solution. Compared with traditional Formazin standard solution, Reagecon standard solution has a lot of advantages, such as non-toxicity, high accuracy, long shelf-life, traceable to NIST and so on. The standard solution supplied in the TN400 turbidity meter kit has a shelf-life of 12 months (from the date of manufacture). Please check the date on the bottom of the vials before using.

## 4.2 Calibration Procedure

 <p>1) Apply a little silicone oil on the calibration vial and wipe with the soft cloth to obtain an even distribution. Turn the vial of 20.0, 100, 800 NTU upside down several times and set it still for 2 mins.(0.02 NTU doesn't need to be overturned)</p>	 <p>2) Press  key to turn on the meter. The meter indicates measuring mode.</p>	 <p>3) Open the flip cover and put in 0.02NTU calibration vial. Align the mark on the vial with the mark on the sample well and then close the cover.</p>
 <p>4) Press  key to enter into calibration menu, and press  key to perform calibration when cursor indicates on 0.02NTU.</p>	 <p>5) After calibration with 0.02NTU standard, press  key to return to calibration menu.</p>	 <p>6) When cursor indicates on 20.0NTU, put the calibration vial of 20.0 NTU into the sample well and press  key to calibrate.</p>

 <p>7) After calibration with 20.0 NTU standard, press  key to return to calibration menu.</p>	 <p>8) When cursor indicates on 100NTU, put the calibration vial of 100NTU into the sample well and press  key to calibrate.</p>	 <p>9) After calibration with 100 NTU standard, press  key to return to calibration menu.</p>
 <p>10) When cursor indicates on 800NTU, put the calibration vial of 800 NTU into the sample well and press  key to calibrate.</p>	 <p>11) After calibration with 800 NTU standard, press  key to confirm.</p>	 <p>12) The meter enters measuring mode.</p>

### 4.3 Calibration Notes

- 1) Place turbidimeter on a flat and level surface, and please do not hold the instrument in hand.
- 2) When a calibration vial is placed into measuring well, the mark on vial cap must be aligned with the arrow mark on the measuring well. See diagram-4
- 3) Apply 1-2 drops of silicone oil on the calibration vial and wipe even with soft cloth to improve light scattering. After wiping and cleaning, set the calibration vial still on the table for at least 2 minutes to eliminate micro bubble in solution. For 0.02 NTU calibration vial, the standing time should be at least 5 minutes.
- 4) Please perform 4 points calibration for first time use according to clause 4.3. 2 to 4 points of calibration can be selected for subsequent use according to requirement. Better result is obtained if it is in the range of the above two points. When calibrating, press  or  to select calibration standard. After calibrating, press  button to quit and enter measurement mode.



Diagram- 4

- 5) If Formazin standard is used to calibrate, note the diluted Formazin standard is not stable. Please make sure to use new prepared Formazin standard to ensure calibration precision.
- 6) Please do not open the cap of calibration vial. Inspect the expiration of calibration standard. Make sure the calibration vial free from dust, dirt, fingerprint and scratch.
- 7) Please use the same method to calibrate every time, and establish standard operating procedures (SOPs).

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## 5 TURBIDITY MEASUREMENT

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### 5.1 Sample Vial Handling

- 1) There are 3 sample vials contained in the case, marked 1#, 2# and 3# on the cap and bottom of the vial. Please note the number of sample vial should be same as that of vial cap, and do not mix up.
- 2) Sample vial has been meticulously cleaned and disinfected. It can be used directly for the first time. Before subsequent uses, sample vial should be thoroughly cleaned: wash the interior and exterior of the vial in a detergent solution → repeatedly rinse with clean distilled water or deionized water. Rinse sample vial with sample solution twice → fill sample vial with sample solution → screw the vial cap tightly.

### 5.2 Measurement Preparation

- 1) Collect sample solution in a clean vessel, fill sample solution to the 4/5 position of sample vial (approximately 18ml), see diagram-5, screw the vial cap tightly.

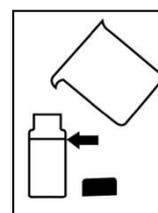


Diagram- 5

- 2) Before measuring, please make sure sample solution is uniform. Gently shake the sample vial to make sample solution uniform, and wait until air bubbles disappear.
- 3) Wipe the sample vial surface with the soft cloth. Ensure that the outside of the vial is dry, clean and free from smudges.
- 4) Apply 1 to 2 drops of silicone oil on the surface of the vial. Wipe with a soft cloth to obtain an even distribution over the entire surface in order to

ameliorate scratches and flaws and improve light scattering.

- 5) Place turbidimeter on a flat and level surface, please do not handheld the instrument.
- 6) Hold vial cap, align the arrow mark on vial cap with the arrow mark on the calibration well, and insert sample vial into the measuring well and close the cover

### 5.3 For Single Measurement

Press  button, the display shows progress bar(see diagram-6). It will display measured value after 8 seconds. Please press  button again for repeated measurement.



Diagram-6

### 5.4 For Continuous Measurement

- 1) Press and hold  button, release it until the display shows the wire frame of progress bar(see diagram-7).

The

instrument enters continuous measuring mode. The display is updated every 8 seconds with continuous measurements and display. Press  button again to exit and then the instrument enters single measurement mode.



Diagram-7

- 2) Continuous measuring mode can be used to observe the process of stabilizing turbidity values. It's also suitable for a sample solution which precipitates faster, since it records every measuring value and calculates the average value.

### 5.5 Measurement Notes

Turbidity is a very complex analytical measurement which can be affected by many factors. Some are inherent in the design of instrument. However, there are also other factors such as stray light, air bubbles, vial handling and other operating technique.

- 1) Sample Vial

Sample vial must be meticulously cleaned and free from spots and scratches. Its surface should be applied with some silicone oil to treat the outside with a uniform thin coating. This is to mask minor imperfections

and scratches that may contribute to stray light. Do not apply large quantity of oil as this may collect dirt and dust and extra oil should be wiped off with soft cloth. When wiping, user should grip the cap to avoid leaving fingerprints on the surface of glass vial.

## 2) Silicone Oil

The refractive index of silicone oil should be same with that of glass vial. It is

recommended to use silicone oil supplied with the instrument.

## 3) Match Sample Vials

Instrument is supplied with 3 sample vials which were optically matched when they are manufactured, so they have good consistency. If user needs to purchase more sample vials, please order a set of 3 pieces. Or user can perform optical match by himself, and the method is described as follows: clean the sample vial, fill about 0.5 NTU pure water or distilled water into vial. After cleaning the surface of vial, set aside for more than 5 minutes to eliminate air bubbles. For each vial, rotate 8 different angles, measure, collect data from 8 observations and record it. Find the position of these vials where the values of measurement are the closest and mark it.

## 4) Mixing and Degassing

Samples should not be violently shaken or agitated. It is recommended user gently shake sample vial to make solution uniform. Air bubbles in solution will cause big error to turbidity measurement. So air bubble must be eliminated before measuring. But mixing and degassing simultaneously is a difficult process to handle, especially for solution with precipitates, which requires some operating experience and experimental conditions. For example, same mixing condition and equilibrating time for degassing are required for two measurements to be comparable.

## 5) Low Turbidity Measurement

To measure sample with very low turbidity (<1 NTU), it's better to use the same sample vial to do calibration and testing. This can offer the best accuracy and repeatability. For details, please follow the steps below:

a) Take a sample vial (for example, 1#), use distilled water (not tap water or mineral water) to rinse the sample vial. Then pour distilled water to the sample vial, screw on the cap, and let the vial stand still for 3 minutes. In the meantime, turn over the 20.0 NTU calibration vial back and forth 5 times, and let it stand still for 3 minutes.

- b) Use 1# sample vial to calibrate 0.02 NTU; Use 20.0 NTU calibration vial to calibrate 20 NTU.
  - c) Dump the distilled water in 1# vial, and dry the vial (using a dryer).  
Pour your tested sample solution into the 1# vial; Screw on the cap and let it stand still for 3 minutes; Take measurements.
- 6) Other Requirements
- a) On the premise of ensuring uniform sample, sample should be measured immediately to prevent temperature changing and precipitates from affecting measuring values.
  - b) Avoid the sample dilution for measurement as much as possible.
  - c) Avoid operating under direct sunlight.
  - d) Do not pour solution into measuring well. Sample vial must be used for measurement.
  - e) Please do not try to wash the measuring well as this may damage its optical structure.

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## 6 WARRANTY

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We warrant this instrument to be free from defects in material and workmanship and agrees to repair or replace free of charge, at option of APERA INSTRUMENTS, LLC, any malfunctioned or damaged product attributable to responsibility of APERA INSTRUMENTS, LLC for a period of **two years** from the delivery (a **six-month** limited warranty applies to the calibration solutions). This warranty does not apply to defects resulting from actions such as misuse (violation of the instructions in this manual or operations in the manner not specified in this manual), improper maintenance, or unauthorized repairs. Warranty period is the time limit to provide free service for the products purchased by customers, not the service life of the product.

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