

TN400 Portable Turbidity Meter

Instruction Manual



ISO 9001:2015



APERA INSTRUMENTS LLC

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1 OVERVIEW

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, 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.

2 TECHNICAL SPECIFICATIONS

2.1 Technical Parameters

Measuring Method	ISO 7027 compliant nephelometric method (90°)
Measuring Range	0 ~ 1000 NTU, automatic range selection: 0.01~19.99 NTU 20.0~99.9 NTU 100~1000 NTU
Resolution	0.01 / 0.1 / 1 NTU
Reading Error	≤ ±2 % of reading ± stray light
Repeatability	≤ ± 1% of reading or 0.02 NTU, the greater of the two

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	0~50°C (32°F~122°F)

2.2 Others

Power Supply	4x "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	ISO9001:2015 & CE

3 INSTRUMENT DESCRIPTION

3.1 Instrument Overview

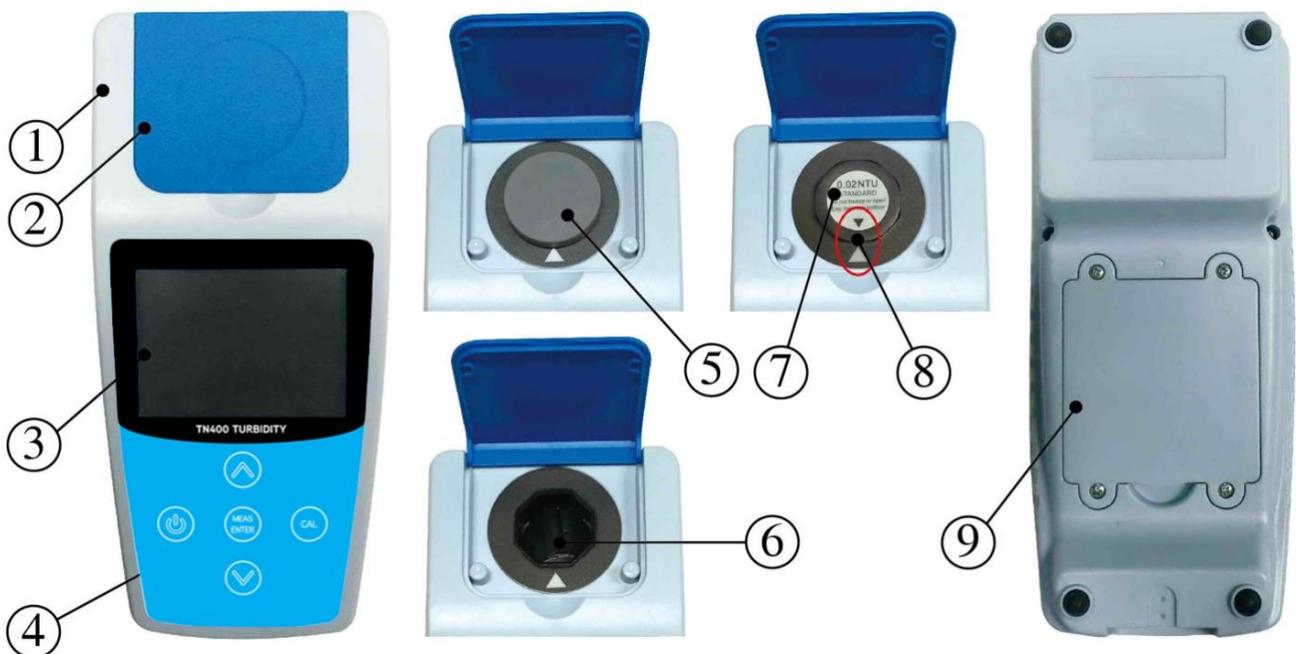


Diagram-1

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

3.2 Meter and Accessories



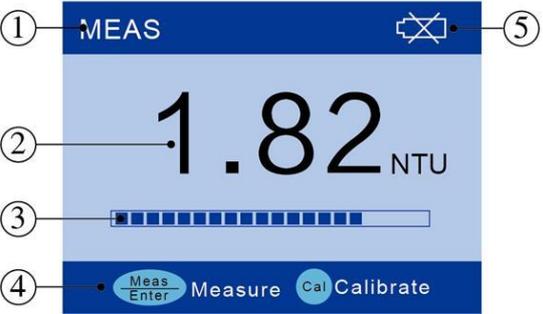
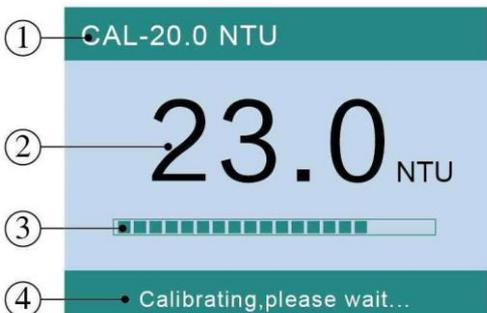
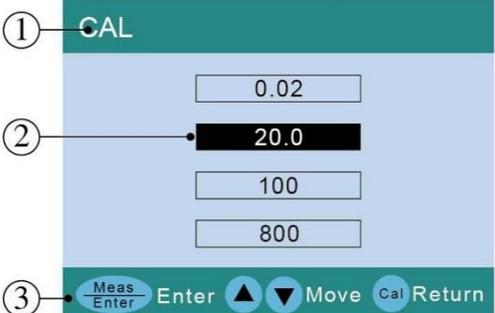
Diagram-2

- ① — Standard solution: 0.02NTU, 20.0NTU, 100NTU, 800 NTU
- ② — Portable case
- ③ — TN400 Meter
- ④ — Soft cloth
- ⑤ — “AA” Alkaline battery×4
- ⑥ — Silicon oil (10 ml)
- ⑦ — Sample vial×3

⑧ — Screwdriver (to remove battery cover)

⑨ — Instruction manual

3.3 Display

<p>Measuring Mode</p>  <p>The image shows the Measuring Mode display. At the top, it says 'MEAS' with a battery icon to the right. The main display shows a large reading of '1.82' followed by 'NTU'. Below the reading is a progress bar. At the bottom, there are two buttons: 'Meas Enter Measure' and 'Cal Calibrate'.</p>	<p>① — Measuring mode icon ② — Reading/Unit ③ — Progress bar ④ — Operational directive ⑤ — Low battery display</p>
<p>Calibration Mode</p>  <p>The image shows the Calibration Mode display. At the top, it says 'CAL-20.0 NTU'. The main display shows a large reading of '23.0' followed by 'NTU'. Below the reading is a progress bar. At the bottom, it says 'Calibrating, please wait...'.</p>	<p>① — Calibration mode icon ② — Reading/Unit ③ — Progress bar ④ — Operational directive</p>
<p>Calibration Menu Mode</p>  <p>The image shows the Calibration Menu Mode display. At the top, it says 'CAL'. Below that are four input fields with values: '0.02', '20.0', '100', and '800'. The '20.0' field is highlighted. At the bottom, there are four buttons: 'Meas Enter Enter', an up arrow, a down arrow, and 'Cal Return'.</p>	<p>① — Calibration mode Icon ② — Standard solution value ③ — Operational directive</p>

3.4 Keypad

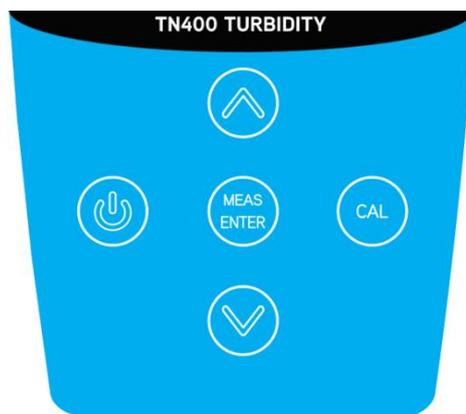


Diagram- 3

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

3.5 Battery Installation

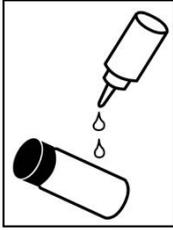
1. Use the screwdriver to remove the four screws on the battery cover and open the battery cover.
2. Insert 4 pieces of “AA” alkaline battery. Please make sure the polarity is correct.
3. Put on the battery cover and screw tightly.

4 METER CALIBRATION

4.1 Calibration Frequency

- 1) Please turn on the meter and let it stand for 3 minutes to warm up. Please perform 4 points calibration for first time use. For normal use, 2 to 4 points of calibration can be selected for subsequent use according to requirement. Better result is obtained if the sample measurement is in the range of the two calibration points. When calibrating, press  or  to select calibration standard. After calibrating, press  button to confirm. Press  button to quit and enter measurement mode.
- 2) To measure low turbidity less than 5 NTU, please perform calibration with 0.02 and 20.0 NTU standard solutions before using the meter every time, or perform verification test with 0.02 NTU standard solution. If the error is significant, it is necessary to calibrate the meter. To measure sample with turbidity value lower than 5NTU, only 1# sample vial should be used.
- 3) To measure turbidity higher than 5 NTU, it is suggested to calibrate the meter weekly or monthly; or users 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 significant, it is necessary to calibrate the meter. Please use 2# and 3# sample vials for measuring turbidity higher than 5 NTU.

4.2 Calibration Procedure



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 minutes.



2) Press key to turn on the meter. The meter indicates measurement mode.



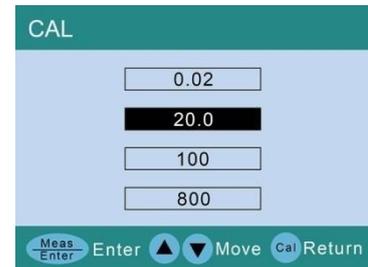
3) Open the flip cover and put in 0.02 NTU calibration vial. Align the arrow on the vial with the arrow on the sample well and then close the cover.



4) Press key to enter calibration menu, and press key to perform calibration when cursor is on 0.02.



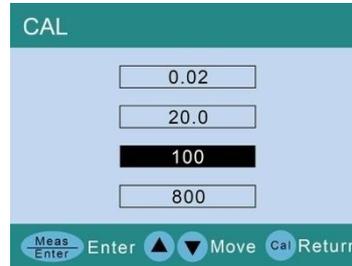
5) After calibration with 0.02 NTU standard, press key to return to calibration menu.



6) When cursor is on 20.0 NTU, put the calibration vial of 20.0 NTU into the sample well, close the cover and press to calibrate.



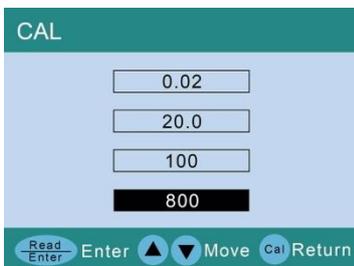
7) After calibration with 20.0 NTU standard, press key to return to calibration menu.



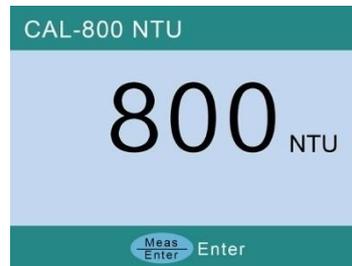
8) When cursor is on 100, put the calibration vial of 100 NTU into the sample well, close the cover and press to calibrate.



9) After calibration with 100 NTU standard, press key to return to calibration menu.



10) When cursor is on 800, put the calibration vial of 800 NTU into the sample well, close cover, and press key to calibrate.



11) After calibration with 800 NTU standard, press key to confirm.



12) The meter goes back to measurement mode.

4.3 Calibration Standards

TN400 turbidity meter adopts high molecular polymer turbidity standard solution, which is U.S EPA approved primary standard for calibration of turbidity sensors that is safe, non-toxic and disposable. It is NIST traceable to particle size/distribution and optical density, and its inherent stability means it does not settle from suspension. 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 expiration date on the bottom of the vials before using.

4.4 Calibration Notes

- 1) Place turbidity meter 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 arrow mark on vial cap must be aligned with the arrow mark on the measuring well. See diagram-4
- 3) Apply small drop of silicone oil on the calibration vial and wipe even with soft cloth to improve light scattering. Please don't apply too much silicone oil, and the vial must be wiped evenly, otherwise it will affect measuring accuracy. 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) If Formazin standard is used to calibrate, note the diluted Formazin standard is not stable. Please make sure to use freshly prepared Formazin standard to ensure calibration precision.
- 5) Please do not open the black cap of calibration vials. Check the expiration of calibration standard. Make sure the calibration vial is free from dust, dirt, fingerprint and scratch.
- 6) Please use the same method to calibrate every time and establish standard operating procedures.



Diagram- 4

5 TURBIDITY MEASUREMENT

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. Please always use 1# sample vial to measure samples with turbidity less than 5 NTU.

- 2) Sample vials have been meticulously cleaned and disinfected before they leave factories. They can be used directly for the first time. Before subsequent uses, sample vials 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 then 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.

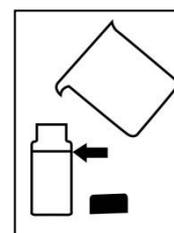


Diagram- 5

- 2) Before measuring, gently shake the sample vial to make sample solution even, and wait for air bubbles to 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 1~2 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 eliminate scratches and flaws and improve light scattering.
- 5) Place turbidity meter on a flat and level surface. Please do not hold the instrument in hand.
- 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 an empty progress bar (see diagram-7). The instrument enters continuous measurement mode. The display is updated every 8 seconds with continuous measurements and display. Press  button again to exit and then the instrument goes back to single measurement mode.



Diagram-7

- 2) Continuous measurement 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 measurement and calculates the average value.

5.5 Measurement Notes

Turbidity is a very complex analytical measurement which can be affected by many factors, some of which are inherent in the design of instrument, other factors include stray light, air bubbles, vial handling and other operating techniques.

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 the 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 (SKU# AI4203) supplied with the instrument.

3) Mixing and Eliminating Air Bubbles

Samples should not be forcefully shaken. It is recommended users gently shake a sample vial to make solution even. Air bubbles in solution will cause significant error to turbidity measurement so air bubbles must be eliminated before measuring. However, mixing and eliminating air bubbles is contradictive at some extent, especially for solution with precipitates, which requires some operating experience and experimental conditions. For example, same mixing condition and equilibrating time for eliminating air bubbles are required for two measurements to be comparable.

4) Other Requirements

- a) Samples should be measured immediately after it's mixed and settled to prevent temperature changes and precipitates from affecting measurements.
- b) Avoid sample dilution as much as possible.
- c) Avoid operating under direct sunlight.
- d) Never pour solution into the measuring well. Sample vials must be used for measurement.
- e) Never wash the measuring well as it may damage its optical structure.

6 WARRANTY

We warrant this instrument to be free from defects in material and workmanship and agree to repair or replace free of charge, at the option of APERA INSTRUMENTS, LLC, any malfunctioned or damaged product attributable to the responsibility of APERA INSTRUMENTS, LLC for a period of TWO YEARS for the instrument from the delivery.

This limited warranty does NOT cover any issues due to:

- Accidental damage
- Improper use
- Normal wear and tear
- Transportation
- Storage
- Failure to follow the product instructions
- Unauthorized maintenance, modifications, combination or use with any products, materials, processes, systems or other matter
- Unauthorized repair
- External causes such as accidents, abuse, or other actions or events beyond our reasonable control.

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