

TN420 Portable Turbidity Meter

Instruction Manual



APERA INSTRUMENTS (Europe) GmbH

www.aperainst.de

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***Please fully charge the battery before first-time use.**

1. INTRODUCTION

Thank you for purchasing Apera Instruments TN420 Turbidity Meter (hereafter referred to as the instrument). The instrument uses tungsten filament lamp (400 – 600nm) as the light source and 90° scattering method, which is compliant with U.S EPA 180.1 method for the determination of turbidity in drinking, ground, surface, and saline waters, domestic and industrial wastes. It is suitable for on-site and laboratory use.

The instrument provides accurate results with simple measurement and calibration, giving you unparalleled confidence in turbidity test results and easy of use. The main functions and features include:

- Intelligent functions such as automatic calibration, operation navigation, parameter setup, automatic power off, low voltage indication, and a replaceable tungsten filament lamp.
- Large TFT color screen with blue background for measurement mode, green background for calibration mode.
- Operation guidance and reminders in the process of calibration, measurement and parameter setting.
- Average measurement mode automatically takes multiple consecutive readings, and calculate the average from 10 times of measurement, which is ideal for sample solutions with rapid settling and continuous measurement changes.
- 3.7V rechargeable lithium battery can supply power for over 20 hours of continuous measurement. The battery life is 5 times longer compared with tungsten lamp turbidimeter in the market using AA alkaline batteries.
- Meets IP67 rating, ideal for use under harsh environment and field.
- Comes with a carrying case, which includes the meter, calibration solutions, and other accessories, convenient for use and carry.

2. TECHNICAL SPECIFICATIONS

Measurement Method	90° scattering measurement
Light Source	Tungsten (400 – 600nm) filament lamp, compliant with US EPA 180.1 Method
Measuring Range	0 to 1000 NTU (FNU), automatic range switch 0.01 to 19.99 NTU (FNU) 20.0 to 99.9 NTU (FNU) 100 to 1000 NTU (FNU)
Accuracy	≤ ±2% of reading+ stray light
Repeatability	≤ ±1% of reading or 0.02 NTU (FNU) (whichever is greater)
Resolution	0.01/0.1/1 NTU (FNU)
Stray Light	≤0.02 NTU (FNU)
Calibration Standard	AMCO Polymer solution or Formazin Solution: 0, 20, 100, 400 and 800 NTU (FNU)
Detector	Silicone photovoltaic
Measuring Mode	Normal measurement; Average Measurement
Display	TFT color screen
Sample Vial	Ø25×60 mm, high borosilicate glass with lid
Sample Vial Volume	18 ml
Power supply	3.7V Rechargeable lithium battery
Working Condition	Temperature: 0 to 50°C (32°F to 122°F) Relative humidity: 0 to 90% at 30°C; 0 to 80% at 40°C; 0 to 70% at 50°C; no condensation
Storage Condition	Instrument: -40 to 60°C (-40 to 140°F) Calibration Solution: 5 to 30°C (41 to 86°F)
Instrument sealing grade	IP67
Certificates	CE and RoHS
Limited Warranty	2 years
Dimension and Weight	Meter: (90×203×80) mm/ 385 g Test Kit: (310×295×110) mm/ 1.5 kg

3. INSTRUMENTATION ILLUSTRATION

3.1 Overview



Diagram-1

①	Flip cover of the sample vial holder (Close the cover when measuring)	⑦	Dust-proof plug (Take off the plug when measuring)
②	Housing	⑧	Sample vial holder
③	Display	⑨	Calibration vials or sample vials
④	Keypad	⑩	Positioning mark (Align the mark with the mark on the calibration vial or sample vial)
⑤	USB Port	⑪	Built-in lithium battery (Rechargeable)
⑥	Lamp cover		

3.2 Configuration

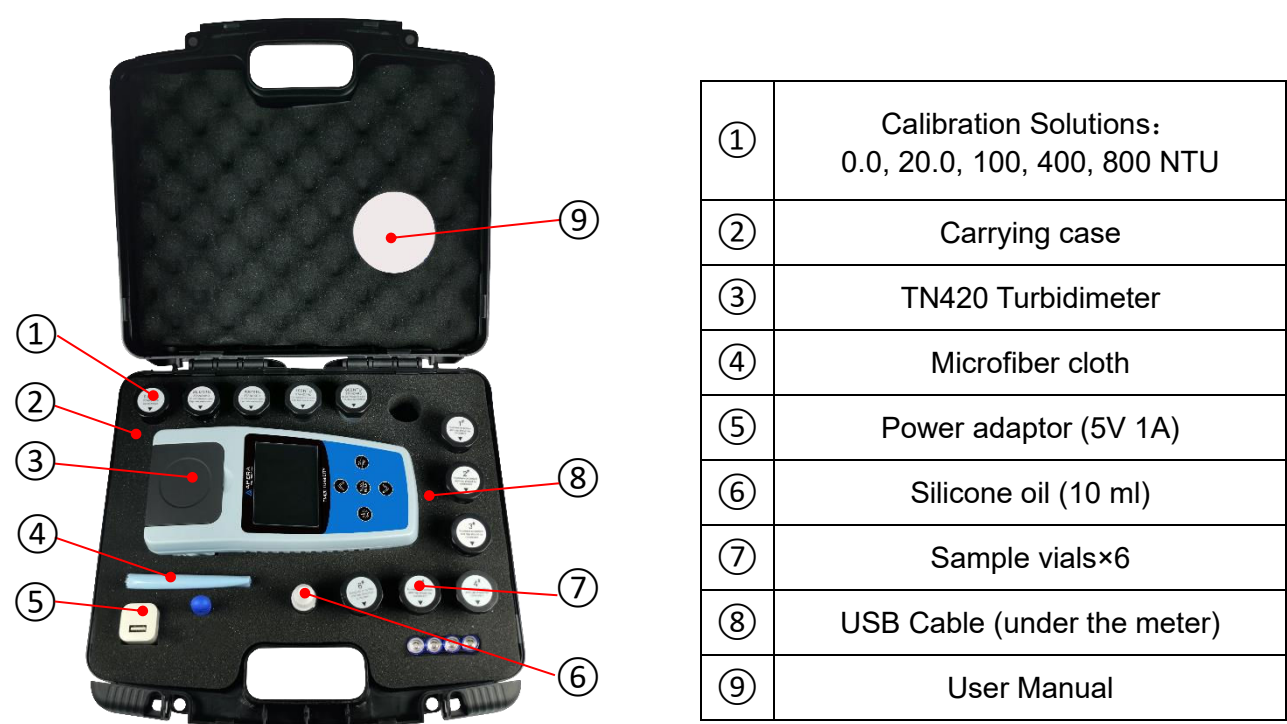
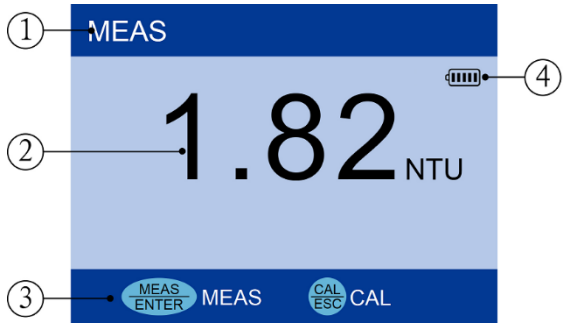
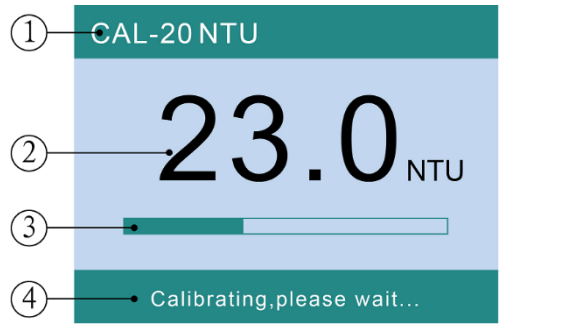


Diagram-2

3.3 Display Mode

Measuring Mode		① Measurement Mode ② Measurements and unit ③ Operation Guide ④ Battery icon
Calibration Mode		① Calibration solution ② Measurements and unit ③ Progress bar ④ Operation guide

Calibration Menu		① Calibration mode ② Standard values ③ Operation guide ④ Finished calibration indicator
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3.4 Keypad

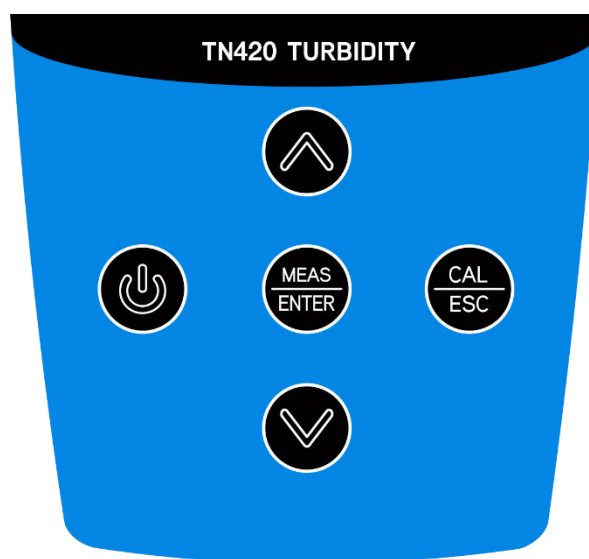


Diagram 3

Key	Functions
	● Power on/off
	● In measurement mode: press to enter calibration mode ● In calibration mode: press to exit calibration mode ● In measurement mode: long press to switch measurement units NTU-FTU
	● In measuring mode: short press the key to perform normal measurement; long press the key to perform average measurement ● In calibration mode: press the key to confirm the calibration.
	● In calibration mode, press the key to select standard solution.

3.5 Power Supply

The instrument adopts 3.7V rechargeable lithium battery. Fully charge the battery before first-time use.

a) Charging mode

- Charge via Power adaptor: connect instrument and power adaptor with a USB cable.

Adaptor specification: AC100 to 240V, 50/60Hz, output: 5V/1A.

*Note: Please use the power adapter we provide in the kit to charge your turbidimeter.

- Charge via Computer: connect instrument and a computer with a USB cable.

Under normal circumstances, it is recommended to use the power adapter to charge the lithium battery to ensure the performance. When the lithium battery voltage is lower than 3V, the instrument will shut down, and it's time to recharge it.

b) Battery capacity indication

- Battery capacity icon: , please recharge the battery when  icon displays to ensure measuring accuracy; when  icon displays, the battery must be recharged, otherwise the instrument cannot work properly.
- If charging the instrument when it is turned on,  icon will be displayed. Users can continue using the instrument while it is being charged.
- If charging the instrument when it is turned off, "Charging....." will be displayed, and "Charging is completed" will be displayed after a full charge.

4. METER CALIBRATION

4.1 Preparation for Calibration

a) Calibration Point

The instrument has 5 calibration points: 0 NTU, 20 NTU, 100 NTU, 400 NTU, and 800 NTU. Among them, 0 NTU point uses AMCO 0.0 NTU calibration solution or laboratory distilled water, and the remaining 4 calibration points use AMCO polymer solutions. Note that the cap of the 0.0 NTU solution vial can be unscrewed. After the solution is invalidated, users can replace the 0.0 NTU calibration solution or use fresh laboratory distilled water. The AMCO 0.0 NTU calibration solution refill can be purchased from the supplier; For the remaining 4 calibration solutions, their vial caps cannot be opened. Simply dispose the solutions after they are expired or invalidated and buy new ones from your supplier to replace. See the detail in Section 8 Replacement Parts.

b) Replace zero turbidity solution

- Open the 0.0 NTU vial cap, pour out the original solution, add 1/2 distilled water, screw on the cap and shake the vial to rinse it off and pour out the water. Repeat it 3 times. Shake off the distilled water in the vial. Pour in new AMCO 0.0 NTU calibration solution or fresh laboratory distilled water. Then close the vial cap.
- AMCO 0.0 NTU calibration solution has 6 to 12 months of shelf-life, distilled water is only valid for a couple of days.

AMCO 0.0 NTU solution is provided in the default kit. For purchase details, please refer to Section 8 Replacement Parts.

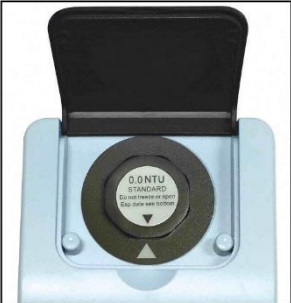
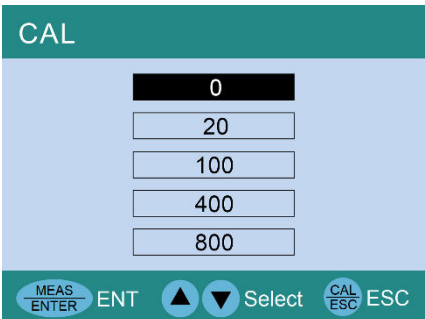
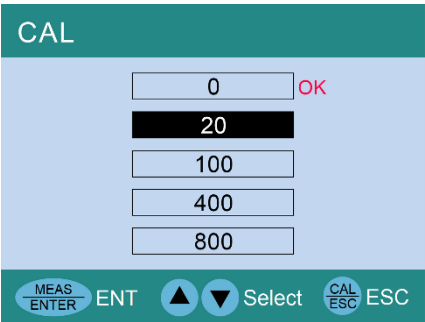
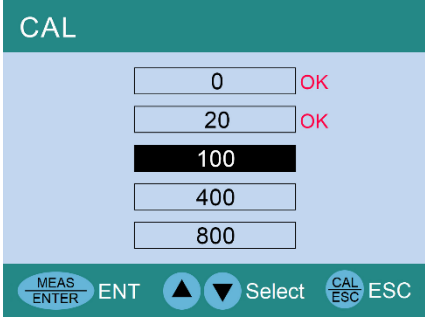
c) Clean vial surface

Apply a small drop of silicone oil on the surface of the vial and wipe it off with a lint-free cloth to evenly distribute the silicone oil on the surface in order to cover smudges and scratches, which helps light scattering. But please pay attention to the following points:

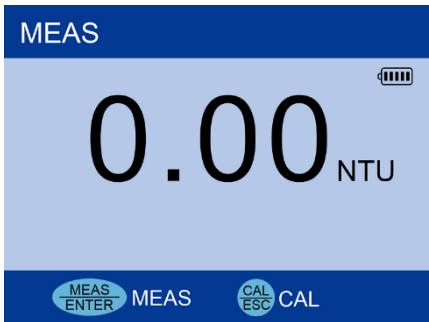
- ① The silicone oil applied should not be too much. After wiping with lint-free cloth, please wipe with filter paper or high-quality tissue paper to clean off. Excessive residual silicone oil on the vial surface will affect the measurement accuracy.
- ② It's not necessary to use silicone oil for each calibration and measurement. Apply silicone oil every several days or once a week. In between, just clean the surface with filter paper or high-quality tissue paper.
- ③ Clean the calibration vial and sample vial together and keep the steps and actions consistent to achieve same degree of cleanliness.
- ④ Stability of calibration solutions

The U.S EPA approved AMCO polymer standard calibration solution is very uniform and stable. It does not precipitate, drift or condense. Generally, it can be used directly without shaking or flipping the vial (to make the solution even). For AMCO polymer calibration solutions that have not been used for a long time, slowly flip the vial twice and let it stand for 2 minutes. Be careful not to shake the solution vigorously, as this will create air bubbles which will destabilize the measurement; For 0.0 NTU calibration solution, do NOT shake or flip. If using Formazin calibration solution, as it tends to precipitate easily, each time users must flip and shake the vial to make the solution even. But sediment can still occur during tests and would make the measurement unstable. Users need to have rich experience handling Formazin calibration solutions.

4.2 Calibration Procedure (Take 0 NTU and 20 NTU as an example)

1) Instrument warm up (only required for low-range or high-accuracy measurement): Power on the instrument. Long press  to start continuous measurement (don't insert the vial), then wait for 3 to 5 minutes. Then short press  to exit continuous measurement.	
2) Open the flip cover and place the 0.0 NTU calibration vial. Align the arrow on the vial lid with the arrow on the sample vial holder and close the flip cover.	
3) Press  to enter the calibration menu, the cursor is at 0 NTU. Press  to start calibration.	
4) After calibration is done, press  to confirm. The instrument will return to the calibration menu (see Diagram on the right side). The OK sign indicates that 0 NTU has been calibrated and prompt to calibrate 20 NTU.	
5) Place the 20.0 NTU calibration vial in the sample vial holder, press  to start 20 NTU calibration. After calibration is done, press  to confirm. The instrument will return to the calibration menu (see diagram on the right side). The OK sign indicates that 20 NTU has been calibrated.	
6) If you want to continue to calibrate 100, 400 and 800 NTU, place the 100 NTU calibration vial in the sample vial holder and press  to calibrate. After calibration is done, press  to confirm; repeat the steps to calibrate 400 NTU and 800 NTU. After calibration is done, press  to return to measurement mode.	

7) Press  to exit calibration mode, the instrument will return to measurement mode as shown in Diagram on the right side.



4.3 Notes for Calibration

- a) Calibration point verification: The calibration point can be verified after the calibration is completed. If the calibration point has a large error, enter the calibration mode and repeat the calibration. For calibration point accuracy, users can refer to the following standards:

Calibration point	Accuracy for reference
0 NTU	≤ 0.05 NTU
20 NTU	$\leq \pm 0.2$ NTU
100 NTU	$\leq \pm 2$ NTU
400 NTU and 800 NTU	$\leq \pm 5$ NTU

- b) Calibration point selection: The instrument has been calibrated at full range before leaving the factory. For subsequent use, you can select 2 or more points as needed, as long as the estimated measurement range is between the two calibration points. In calibration setup mode, press  or  to select the calibration point.
- c) Low turbidity calibration requirement
- For low turbidity measurements (measurement less than 2 NTU), please test 0.0 NTU calibration solution. If the accuracy is not meeting requirements, calibrate the instrument at 0.0 NTU and 20.0 NTU before test; then use 1[#] or 2[#] sample vial for measurement.
 - Using the same sample vial to calibrate and measure can eliminate the error caused by different vials, thus achieving higher accuracy. For example, add laboratory distilled water to 1[#] vial for calibration and then add sample solution to 1[#] vial for measurement. Note that the solution vial should be rinsed thoroughly when changing solutions.
- d) High turbidity calibration requirement: For turbidity measurement greater than 2 NTU, it is recommended to calibrate once a week, or to test a calibration solution close to the sample solution. If the error is large, the instrument needs to be recalibrated.
- e) The instrument does not automatically recognize the calibration solution. If the wrong solution is selected for calibration, the measurement will be completely wrong. In this case, it can be restored by recalibrating with the correct calibration solutions.

- f) Place the instrument on a flat and level surface. Do not hold the instrument in hand while operating.
- g) If using Formazin standards for calibration, please make sure to use the freshly made Formazin standard to ensure calibration accuracy.

5. Turbidity Measurement

5.1 Sample Vial Handling

- a) 6 sample vials are included in the test kit. The cap is marked with 1# to 6#, and the bottom of the vial also has the same number. The number of the vial and the cap should always be the same.
*Pay attention that 1# and 2# vials are only for low turbidity solution measurement. (< 2 NTU)
- b) The vial has been rigorously cleaned and sterilized. They can be used directly for the first time. For subsequent uses, follow the steps below to perform a thorough cleaning.
 - Clean the sample vial inside and outside with detergent → rinse with distilled water or deionized water multiple times → Rinse the vial twice with the sample solution → Pour the sample solution into the vial → Close the cap.

5.2 Measurement Preparation

- a) Collect the sample solution with a clean container and add the solution to the 4/5 of the vial (about 18ml), see Diagram 4. Then close the lid.
- b) Before the measurement, users can slowly flip the sample vial a few times and let it stand for 2 to 5 minutes to eliminate potential air bubbles (see Diagram 5).
- c) Clean off the surface of the vial to ensure it is dry, clean and free of stains. Apply a small drop of silicone oil on the surface of the vial and wipe it off with a micro-fiber cloth. Then wipe again with filter paper or high-quality tissue paper. See section 4.1(c) for details.

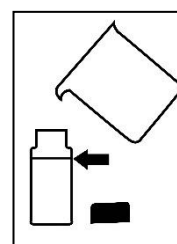


Diagram 4

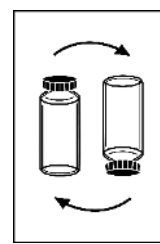


Diagram 5

5.3 Measurement Mode

- a) Normal Measurement Mode

Press , the screen will display the progress bar, and the measured value will be displayed in 20 seconds. To take the next measurement, press  again.

- b) Average Measurement Mode

Long press  button, release it until you hear a beep, then the instrument enters average reading mode. In this mode, the instrument will perform 10 times continuous measurement, measure and display 1 data every 20 seconds, and displays the average value at the end, see diagram 6. The average measurement mode can be used for observing the stabilizing process of turbidity and is ideal for testing rapid-settling solutions.



Diagram 6

5.4 Notes for Measurement

- a) **Keep the sample stable:** After the vial is placed into the sample cell, it is recommended to wait for 1 to 2 minutes before calibration, as the solution will experience some shaking when the vial moves, which may result in inaccurate measurements.
- b) **Sample Vial cleaning requirement:** Sample vial must be rigorously cleaned and free from smudges and scratches. When wiping, user should grip the cap and bottom to avoid leaving fingerprints on the surface of the vial. Its surface should be applied with a drop of silicone oil be wiped with a micro-fiber cloth. After that, please clean with filter paper or high-quality tissue paper. See section 4.1(c) for details.
- c) **Mixing and Degassing:** Samples should not be vigorously shaken or vibrated. It is recommended that users gently shake the sample vial to make solution evenly distributed. Air bubbles in solution will cause big error to turbidity measurement. So, the vial should be left stand still for 2 to 5 minutes to eliminate potential air bubbles before measuring. But mixing and degassing simultaneously is a difficult process to handle, especially for solution with precipitates, which requires some operating experience or making some limits in test conditions, for example, limiting the mixing condition and waiting time for degassing to be the same before comparing measurements.
- d) **Other Requirements**
 - On the premise of ensuring evenly distributed samples, sample solution should be measured immediately to prevent temperature changing and precipitates from affecting measurements.
 - Avoid sample dilution for measurement as much as possible.
 - Avoid operating under direct sunlight.
 - Do not pour solution into the vial holder. Sample vials must be used for measurement.
 - Please do not wash the vial holder as this may damage its optical structure.

6. Lamp replacement

6.1 Light Source Check

Observe the light source on the left side of the sample vial holder as in Diagram 11. Turn on the instrument, and press . The light source will light up for 5 seconds. If it's not lighting up or it's flashing, please replace the lamp.

6.2 Lamp Replacement

The tungsten filament lamp module (sold separately) is shown as in Diagram 12. The lamp hole and socket are as in Diagram 13. Diagram 14 shows you how to replace the lamp.

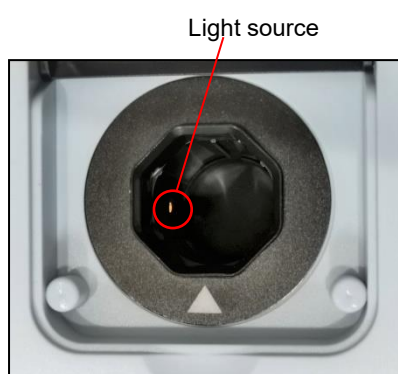


Diagram 11
Check light source

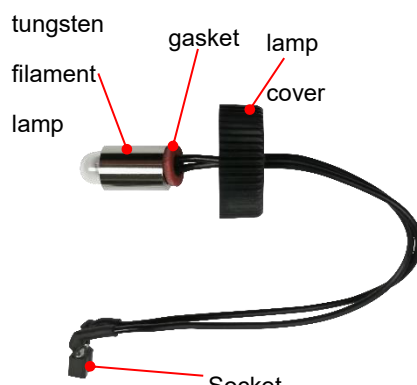


Diagram 12
Tungsten filament lamp module

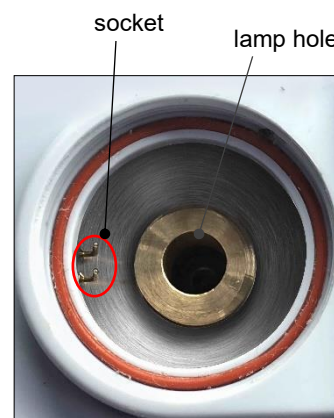
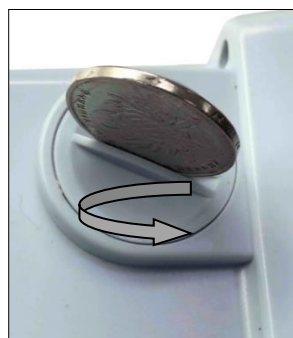
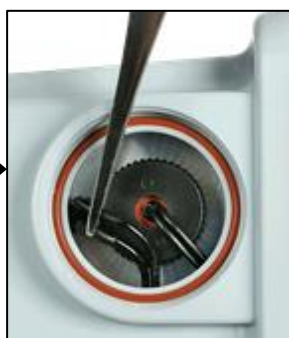


Diagram 13
Lamp hole and socket



Unscrew the lamp cover with a coin



Use a tweezer to unplug the socket



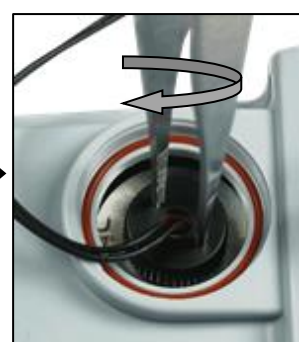
Use a tweezer to unscrew the lamp cover.



Take out the old tungsten filament lamp module



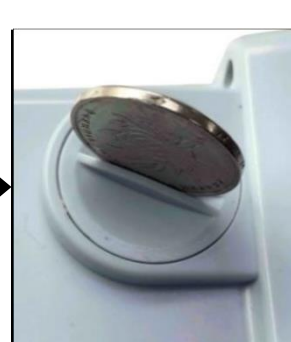
Install the new tungsten filament lamp module.



Close the lamp cover and screw tight with a tweezer.



Use a tweezer to plug wire into the gap and plug in the socket



Screw on the lamp cover tightly

7. WARRANTY

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

This limited warranty does not cover any damages due to:

Transportation, storage, improper use, failure to follow the product instructions or to perform any preventive maintenance, modifications, combination or use with any products, materials, processes, systems or other matter not provided or authorized in writing by us, unauthorized repair, normal wear and tear, or external causes such as accidents, abuse, or other actions or events beyond our reasonable control.

8. REPLACEMENT PARTS

Model	Name	Description	Quantity
T500-2	AMCO 0.0 NTU calibration solution	0.0 NTU/100mL	1 bottle
T500-1	20/100/400/800 NTU AMCO polymer	Compatible with TN500&TN420	4 bottles
T500-3	Sample vials with lid	ø25×60mm , 1# to 6#	6 pcs
T500-5	Tungsten filament lamp	/	1 pc
T500-4	Rechargeable lithium battery	3.7 V	1 pc
TN400-S3	Silicone oil	10mL	1 bottle

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