T-100IR Portable Turbidity Meter

Instruction Manual

IP67 WATERPROOF

Table of Contents

1 INTRODUCTION

Thank you for purchasing the Oakton T-100IR Portable Turbidimeter (hereafter referred to as the instrument). The instrument is designed using the principle of scattering and conforms to the ISO 7027, (DIN EN 27027) methods for measuring the turbidity of aqueous solutions and is suitable for use in laboratories or on site.

The instrument provides accurate results with the simple calibration and testing, giving you unparalleled ease of use and accuracy.

- The instrument has intelligent functions such as automatic calibration, operation navigation, parameter Setup, real-time clock display, calibration date check, automatic power off, low voltage indication, and a replaceable tungsten light source.
- Large TFT color screen with blue background for measurement mode, green background for calibration mode, and operation guides for easy calibration and measurement, optional English & Spanish menu for convenient operation.
- 500 sets of data storage with USB data output to PC.
- Normal and continuous two kinds of measurement mode. Continuous measurement mode with the option to select the number of continuous measurements, automatically generating average, maximum and minimum measured values in a data storage interface, suitable for sample solutions with rapid settling and continuous measurement changes.
- It meets IP67 water-resistant grade requirements and is suitable for field use.
- Product comes in a rugged carrying case, including calibration solutions, sample test cuvettes, and more.

2 TECHNICAL SPECIFICATIONS

Specification	Description
Measurement Method	ISO 7027, (DIN EN 27027) compliant
Light Source	Infrared LED
Measuring Range	0 ~ 1000 NTU (FNU), automatic range switch 0.01~19.99 NTU(FNU) 20.0~99.9 NTU(FNU) 100~1000 NTU(FNU)
Accuracy	≤ ±2% of reading+ stray light
Repeatability	≤ ± 1% of reading or 0.02 NTU(FNU) (the greater of the two)
Resolution	0.01/0.1/1 NTU (FNU)
Stray Light	≤0.02 NTU (FNU)
Calibration Standard	Distilled water or deionized water: 0 NTU (FNU) Polymer or Formazin Solution： 20, 100, 400 and 800 NTU (FNU)
Detector	Silicon photovoltaic
Measuring Mode	Normal measurement and continuous measurement
Data Storage	500 groups
Data output	USB to PC
Calibration Record	Calibration date and time
Display	TFT color screen
Sample Vial	Φ25×60 mm，high borosilicate glass with cap
Vial Volume	18 ml
Working	Temperature: 0 to 50℃（32℉~122℉）; Relative humidity： 0~90% at 30℃, 0~80%at 40℃, 0~70% at 50℃, no condensation
Instrument sealing grade	IP67
Certificates	ISO9001:2015 and CE
Warranty	2 years
Dimension and Weight	Meter: (90×203×80) mm/385g Carrying case: (310×295×110) mm/1.5kg

3 INSTRUMENTATION ILLUSTRATION

3.1 Summary

Figure-1

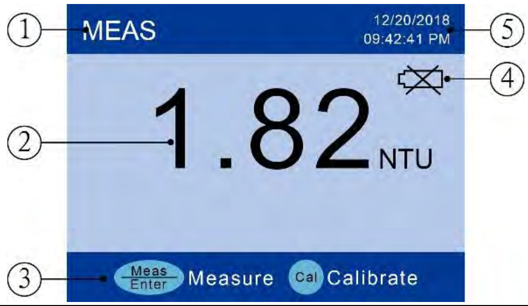
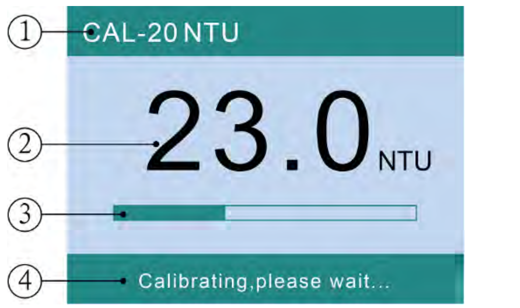
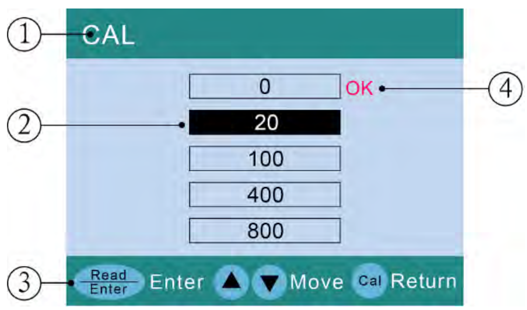
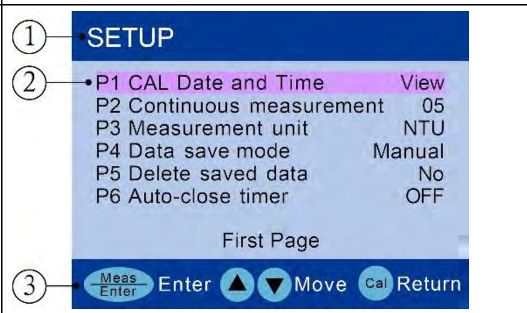
①	Flip cover of the sampling well (Close the cover when measuring)	⑦	Dust proof plug (Remove for measurements)
②	Housing	⑧	Sample well
③	Display	⑨	Calibration vials or sample vials
④	Keypad	⑩	Positioning mark (Align the mark with the mark on the calibration vial or the sample vial)
⑤	USB Port	⑪	Battery compartment
⑥	Lamp cover		

3.2 Configuration

Graph-2

①	0 NTU calibration vial（distilled water self-prepared by users） Calibration Solution：20, 100, 400, 800 NTU
②	Carrying case
③	T-100 Turbidimeter
④	Microfiber cloth
⑤	AA Alkaline batteries×4
⑥	Silicone oil (10 ml)
⑦	Sample vials×6
⑧	Screwdriver (for opening battery cap)
⑨	User Manual

3.3 Display Mode

Measuring Mode		① Measurement Mode ② Measured parameter, units ③ Operation Guide ④ Low battery indicator ⑤ Date and time
Calibration Mode		① Calibration Mode - Green ② Measured parameter ③ Progress bar ④ Operation guide
Calibration Menu		① Calibration Mode ② Standard values ③ Operation guide ④ Finished calibration indicator
Parameter Setup		① Parameter Setup ② Menu ③ Operation guide
Data Recall		① Data Recall Mode ② Data set numberings ③ Saved measurements ④ Operation guide

3.4 Keypad

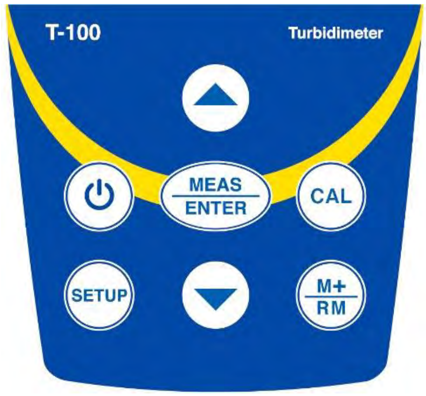


Figure -3

Keypad	Functions
⏻	● Power on/off
CAL	● In measurement mode, press to enter or exit calibration mode ● In parameter setup and recall mode, press to return to measurement mode
MEAS ENTER	● In measurement mode, short press to perform single measurement; long press (>3s) to perform continuous measurement. ● In calibration mode, press to confirm calibration. ● In parameter setup mode, press to confirm change.
▲ ▼	● In calibration mode, press to select which standard to calibrate. ● In parameter setup mode, press to scroll on the menu options. ● In recall mode, press to view different data
SETUP	● Press to enter parameter setup mode
M+ RM	● Short press to save measured data; long press (>3s) to enter data recall mode

3.5 Battery Installment

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

3.6 Data Save, Recall, and Deletion

3.6.1 ***Manual data saving and Automatic data saving***

In parameter setup P4, users can select manual or automatic save mode. In the manual save mode, after measurement is finished, press M+ RM to save the data (measurement interface); In automatic data save mode, the data (measurement interface) will be automatically saved after each measurement. The instrument has two types of measurement mode: normal measurement (as in graph 4) and continuous measurement (graph 5). 12 in figure 4 means that 12 sets of data have been saved. The storage number only indicates the number of measurement interfaces, which is not equal to the number of actual stored data. For a single measurement, one serial number corresponds to one measurement data. For continuous measurement, one serial number corresponds to multiple measurements in the measurement interface. The data, as shown in Figure 5, has 10 measurements. Therefore, the instrument can store 500 sets of data, but the storage number is often less than 500. If the stored value is full and M+ RM is pressed again or data is saved automatically, the icon FULL will flash to remind you that the storage is full, and you need to delete it before saving.

3.6.2 Data Recall

In measurement mode, long press M+ RM (>3s), the instrument will display the saved data. As shown in Figure 6, 9/15 means there are 15 saved measurement interfaces and it's currently showing the 9th one. Press ▲ ▼ to check other data. Hold ▲ or ▼ to quickly check other data. Press CAL to return to measurement mode.

Figure 4

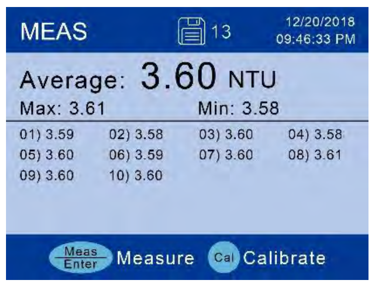


Figure 5

Figure 6

3.6.3 Data Deletion

Once the data storage is full, users need to delete the data in order to save new data. Select Yes in P5 in parameter setup and press MEAS ENTER to confirm the deletion (will delete all the saved data).

4 CALIBRATION

4.1 Preparation for Calibration

a) The instrument has 5 calibration points: 0 NTU, 20 NTU, 100 NTU, 400 NTU and 800 NTU, of which 0 NTU uses laboratory distilled or deionized water (high quality distilled water can also be used), and the remaining 4 calibration points are configured use high molecule polymer standard solution that come with the instrument.

b) Add distilled water to the cleaned 0 NTU calibration vial, then immediately screw the lid and let it stand for at least 5 minutes. Note that after the bottled distilled water is used, quickly tighten the bottle cap to prevent contact with air. The distilled water after opening the bottle can only be used on the same day. For high-precision calibration, the remaining water in the bottle should not be used for calibration. Only the water from first pour is suitable for calibration.

c) The polymer standard calibration solution configured in this instrument has the same accuracy as Formazin calibration solution, but other brands of polymer calibration solutions cannot be used. Otherwise the calibration accuracy will be affected. Compared with the Formazin standard solution, the polymer calibration solution has the advantages of non-toxicity, high precision, long shelf life and NIST traceability. The polymer calibration solution of the instrument configuration has a service life of ≥12 months (calculated from the date of manufacture). When using the product, please check the effective date on the bottom of the bottle.

d) The instrument has been calibrated at full range before leaving the factory. For subsequent use, you can select 2 or more points as needed, if the measured value is between the two calibration points.

e) For low turbidity measurements (measured values less than 5 NTU), calibrate the instrument with 0 NTU (distilled water) and 20.0 NTU polymer solution before each use, then use 1# or 2# vial for measurement.

f) For accurate measurements of samples with ultra-low turbidity (measured value less than 1 NTU), the same vial should be used for both calibration and measurement, i.e. Add distilled water to 1# vial for calibration and add sample solution to 1# vial for measurement. This way, the error caused by different vials can be eliminated.

g) For turbidity measurement greater than 5 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. For turbidity measurements greater than 5 NTU, use the vials from 3# to 6#.

h) Apply a small drop of silicone oil on the surface of the calibration vial and wipe it off with the micro-fiber cloth to evenly distribute the silicone oil on the surface of the vial so as to cover smudges or scratches on the surface of the vial, which helps light scattering. Note that the silicone oil applied should not be too much and must be wiped clean with a lint-free cloth. Otherwise, it will affect the measurement accuracy.

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

a) Power on the instrument and let it warm up for 3 minutes.

b) Apply a little silicone oil to the calibration vial, wipe it with the micro-fiber cloth, turn the vial upside down several times and let it stand for 2 minutes. For the distilled water calibration vial, users need to let it stand for at least 5 minutes to eliminate micro bubbles in the solution.

c) Open the flip cover and place the 0 NTU (distilled water) calibration vial.

d) Align the cover with the arrow on the sample well (see Figure 7) and close the flip.

e) Press CAL to enter the calibration menu, the cursor is at 0 NTU (see Figure 8.1).

f) Press MEAS ENTER to start 0 NTU calibration. After calibration is done, the instrument will return to the calibration menu (see Figure 8.2). The "OK" sign indicates that the 0 NTU has been calibrated and prompt to calibrate 20 NTU.

g) (e) Place the 20 NTU calibration vial in the sample well, press MEAS ENTER to start 20 NTU calibration. After calibration is done, the instrument will return to the calibration menu (see

Figure 8.3). The screen indicates that the 20 NTU has been calibrated. Press CAL to return to measurement mode as shown in Figure 8.4. If you want to continue to calibrate 100 NTU, place the 100 NTU calibration vial in the sample well and press MEAS ENTER to calibrate...., repeat the steps until 800 NTU calibration is completed, press to return to measurement mode.

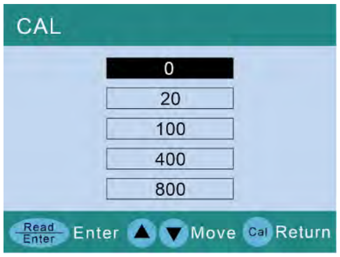


Figure 8.1

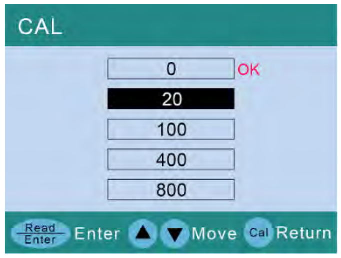


Figure 8.2

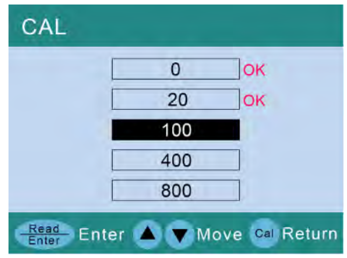


Figure 8.3

Figure 8.4

4.3 Notes for Calibration

a) Press or to select the calibration point, as shown in Figure 8.1.

b) When the calibration vial is moved into the sample well, it is recommended to wait for 1 minute for calibration, as the solution will shake when the solution vial moves, which may result in inaccurate calibration.

c) The calibration point can be tested 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
0 NTU	≤±0.05 NTU
20 NTU	≤±0.2 NTU
100 NTU/400 NTU/800 NTU	≤±5 NTU

d) If the wrong calibration standard is used, the measured value will be inaccurate. In this case, it can be restored by recalibrating it with the correct calibration solution.

e) Place the instrument on a flat, level surface. Do not hold the instrument in your hand.

f) If using Formazin standard calibration, please note that the diluted Formazin standard is unstable.

g) Please make sure to use the freshly made Formazin standard to ensure calibration accuracy.

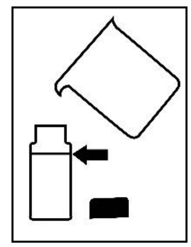
5.1 Sample Vial Handling

a) The instrument is equipped with 6 sample vials, 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 be the same, do not mix. pay attention that the $1^{\#}$ and $2^{\#}$ vials are only for low turbidity solution measurement.

b) The vial has been rigorously cleaned and sterilized for the first time. Follow the steps below to perform a thorough cleaning for subsequent use.

- Clean the inside and outside of the sample well 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 → Tighten the cap.

5.2 Measurement Preparation



Graph 9

a) Collect the sample solution into a clean container and add the solution to the 4/5 of the vial (about 18ml), see Graph 9, screw the cap.

b) Before the measurement, users can slowly invert the sample vial a few times and let it stand for 2 to 5 minutes to completely eliminate air bubbles.

c) Wipe the surface of the vial with a lint-free cloth to ensure it is dry, clean and free of stains.

d) Apply a small drop of silicone oil to the surface of the vial and wipe it off with a lint-free cloth.

e) Place the instrument on a flat, level surface without holding the instrument.

f) Hold the cap, align the arrow on the cap and sample slot, and place the vial into the sample well, then close the flip cover.

5.3 Normal Measurement

Press MEAS ENTER, the display shows the progress bar (see Figure 10), and the measured value will be displayed in 5 seconds. To repeat the measurement, press MEAS ENTER again.

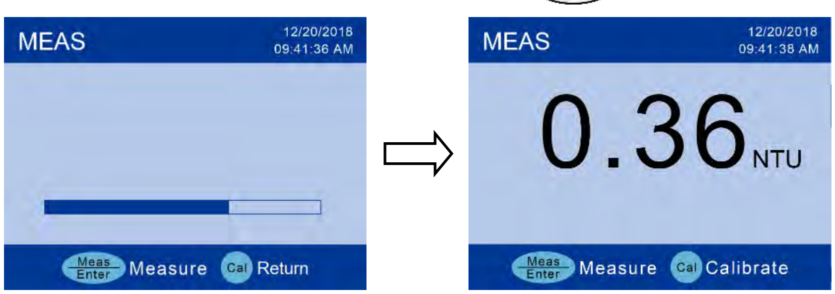


Figure 10

5.4 Continuous Measurement

Press and hold MEAS ENTER until the progress bar appears (see Figure 11.1), and enter the continuous measurement mode and get a measuring value per minute. If the number of continuous measurements has been selected 20 times in parameter setting P2, Figure 11.2 is the third measured value, Figure 11.3 is the display interface at the end of continuous measurement. The average, maximum and minimum values are displayed, along with a list of 20 measured values. The continuous measurement mode can be used to observe the stabilizing process of turbidity and can also be used for rapid settling solutions.

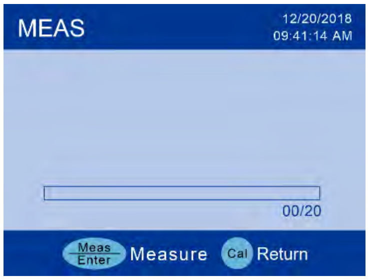


Figure 11.1

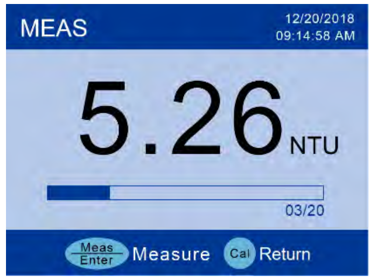


Figure 11.2

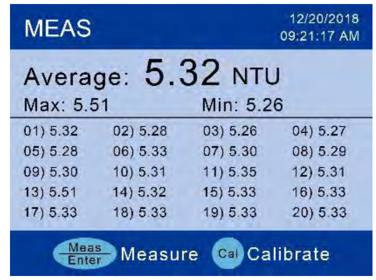


Figure 11.3

5.5 Notes for Measurement

Turbidity measurement is related to many factors and is a complicated analytical measurement, which is related to the design of the instrument as well as many other factors, such as stray light, air bubbles, sample vials and operating techniques.

a) After the vial is moved into the sample cell, it is recommended to wait for 1 minute before calibration, as the solution will have some shaking when the vial moves, which may result in inaccurate measurements.

b) Sample Vial: Sample vial must be meticulously cleaned and free from smudges and scratches. Its surface should be applied with some silicone oil to treat the outside with a lint-free cloth. 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 the cloth. When wiping, user should grip the cap to avoid leaving fingerprints on the surface of the vial.

c) Silicone Oil: The refractive index of silicone oil should be same with that of glass vial. It is recommended to use only silicone oil supplied with the instrument.

d) Mixing and Degassing: Samples should not be violently shaken or vibrated. It is recommended users gently shake the sample vial to make solution even. Air bubbles in solution will cause large errors to turbidity measurement. Air bubbles 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.

e) Other Requirements

- On the premise of ensuring even samples, sample solution should be measured immediately to prevent temperature changing and precipitates from affecting measuring values.
- Avoid the sample dilution for measurement as much as possible.
- Avoid operating under direct sunlight.
- Do not pour solution into the sample well. Sample vial must be used for measurement.
- Please do not try to wash the sample well as this may damage its optical structure.

6 PARAMETER SETUP

6.1 Operation

Press SETUP to enter the parameter setup mode → press ▲ or ▼ to switch P1-P2-...P9 → press MEAS ENTER to enter each parameter → press ▲ or ▼ to make changes → press MEAS ENTER to confirm → press CAL to return to measurement mode.

6.2 Parameter Setup Reference Table

Symbol	Parameter	Content
P1	Last calibration data and time	View
P2	Continuous measurements	5-10-15-20
P3	Measurement unit	NTU-FTU
P4	Data save mode	manual-automatic
P5	Delete saved data	No-Yes
P6	Auto-close timer	10-20-30-OFF
P7	Select language	English, Spanish
P8	Date setting	/
P9	Time setting	/

6.3 Parameters Description

P1 — calibration date and time: users can check the date and time of last calibration

P2 — Continuous measurement: users can select the number of times for continuous measurements (5, 10, 15 or 20 times).

P3 — Measurement Unit: users can select which unit to use: NTU or FTU

P4 — Data save mode: users can select automatic save mode or manual data save mode (see section 3.6 for details)

P5 — Delete saved data: select Yes to delete all the saved data

P6 — Auto close timer: users can select in how much time the instrument will turn off automatically if there is no operation, 10 minutes, 20 minutes, 30 minutes, or off; when selecting off, the instrument can only be turned off by pressing the power button.

P7 — select language: users can select English or Spanish as the system language.

P8 and P9 — set up date and time: in set up process icon ◀▶ means press ▲ or ▼ to select to position of date and time, icon ▲▼ means press ▲ or ▼ to change the digit of date and time.

7.1 Display Interface

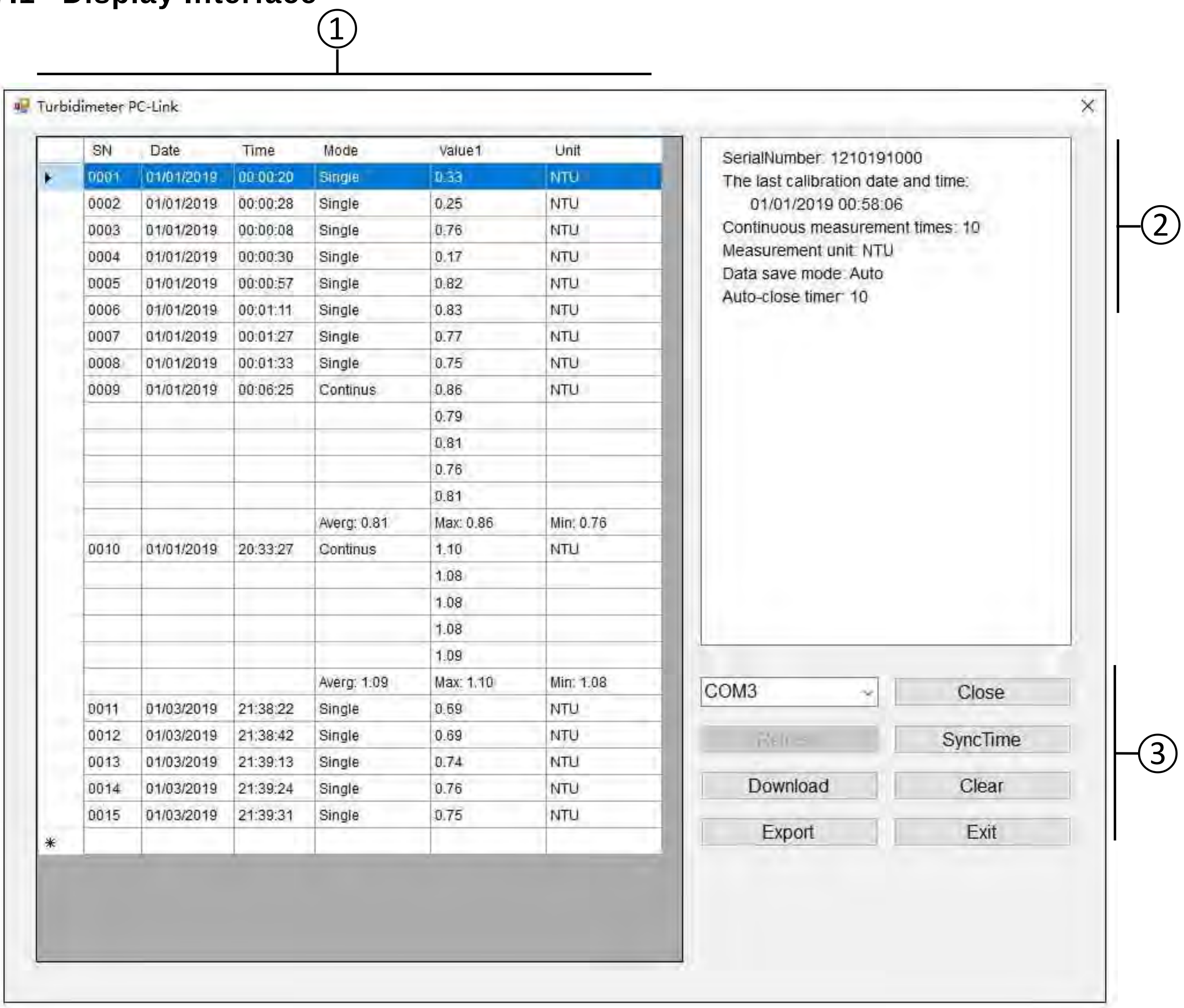


Figure 12

①— Display area for storage value

To display measuring number, date, time, measurement method (normal measurement or continuous measurement), measuring value and measurement unit. For continuous measurement, average, maximum and minimum measured values will also be displayed.

②— Serial number, last calibration information and parameter setting information.

③— Key

Port number— Port number is the number for program to connect with computer. Each computer has a different port number. The port number is COM3 (see figure 12).

Open/Close— Switch key, press "Open/Close" key to open or close the program. LCD will display icon when the program is opened (see figure 13).

Refresh— Port reset key.

SyncTime— Sync time key, press "SyncTime" key to sync computer time with instrument time.

Download— Download key, press "Download" key to send data from instrument memory to computer.

Clear— Clear key, press "Clear" key to delete data.

Export— Export key, press "Export" key to export the stored value to computer Microsoft Excel document.

Exit— Exit key, press "Exit" key PC-Link program will quit computer interface.

7.2 Install Software

Insert PCLink CD into computer, open PCLink folder, there are PCLink program folder and driver compressed file. Normally open PCLink program file to use it directly. If the instrument cannot connect with computer, please install USB driver at first.

7.3 Select Port

Connect USB cable to instrument and computer, open PCLink program and computer will display program interface. Click the arrow next to the port number COM3, click the port number in the bottom then press "Open" key. LCD will display icon (see figure 13). If port number can`t be confirmed, please check it in "Device Manager" of computer.

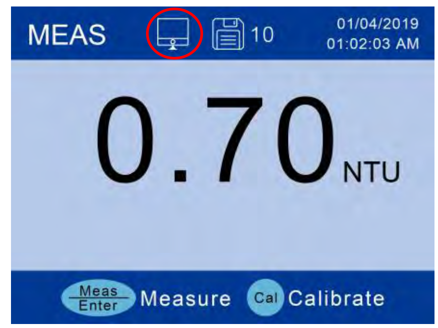


Figure 13

7.4 Run Software

Press "Download" key, all data in instrument memory will be sent to computer. When the program is running, all measurement information will be sent to computer via USB, it will not be stored in instrument. In "Manual" mode, press M+/RM key after measurement completed to save data in software interface; in "Auto" mode, data will be automatically saved in software interface after each measurement completed.

7.5 Data Processing

Press "Export" key to export stored value to Microsoft Excel document. The stored value can be analyzed, counted and printed.

8.1 Light source check

Observe the light source on the left of the sample cell as in Figure 13. Turn the instrument on, and press MEAS ENTER. The light source will light up for 5 seconds. If it's not lighting up or is flashing, please replace the lamp.

8.2 Lamp Replacement- White Light Lamp Only

The tungsten filament lamp module (sold separately) is as in Figure 14. The lamp hole and socket are as in Graph 15. Graph 16 shows you how to replace the lamp.

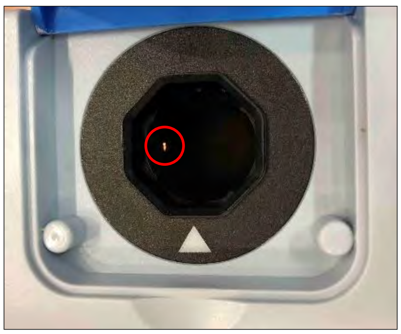


Figure 13
Check light source

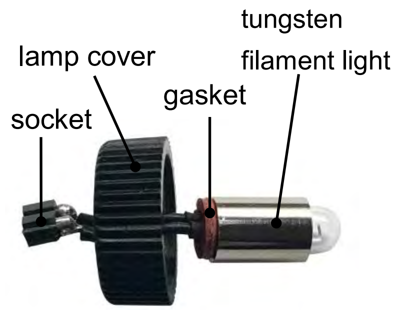


Figure 14
Tungsten filament lamp module

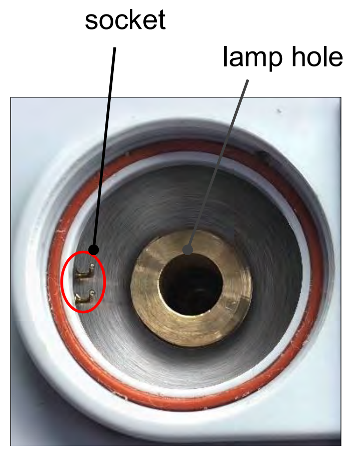
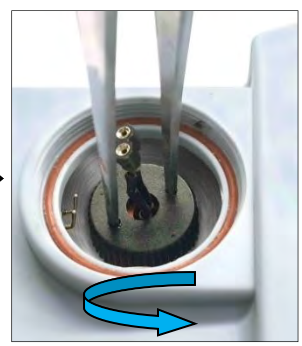


Figure 15
lamp hole and socket

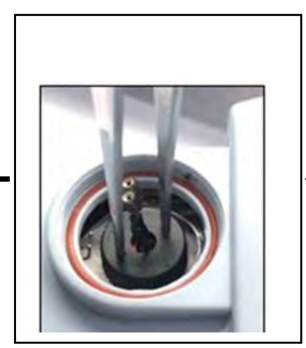
Unscrew the lamp cover with a coin

Use a tweezer to unplug the socket



Use a tweezer to unscrew the lamp

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.

Plug in the socket

Screw on the lamp cover tightly

9 WARRANTY

9.1 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 OAKTON INSTRUMENTS, any malfunctioned or damaged product attributable to responsibility of OAKTON INSTRUMENTS, for a period of TWO YEARS (SIX MONTHS for the standards) from the delivery.

9.2 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.

Oakton Turbidity	**Oakton Replacement Part Numbers**
Oakton T100 WL turbidimeter kit	35635-10
Oakton T100 IR turbidimeter kit	35635-15
Calibration kit (20,100,400,800 NTU cuvettes)	35635-20
Replacement turbidimeter cuvettes (6x) (25 x 60 mm)	35635-25