Total Organic Carbon (TOC) Analyzer

User Manual

Preface

Welcome to using our company's instrument, which will bring great convenience to your analytical work and create excellent economic benefits. Our company provides high-quality and reliable services.

Before using the instrument, please read this user manual carefully, especially the safety requirements! This operation guide aims to provide specific operational steps for operators using the Total Organic Carbon Analyzer to ensure correct usage and accurate analytical results.

Important notes

1. Before powering on, carefully read the user guide to prevent accidents that may harm the operator or damage the instrument.

2、 If the fuse blows when the instrument is powered on, replace the fuse under the guidance of the manufacturer. Use the same specifications to avoid short circuits or instrument damage.

3、During initial use, observe the liquid inflow and outflow status. If liquid leakage occurs, contact the manufacturer immediately.

4、Non-authorized personnel or non-professionals are prohibited from disassembling internal components or circuit boards of the instrument. Any damage caused by unauthorized disassembly will be the user's responsibility.

5、When replacing the UV lamp or peristaltic pump tube, ensure the power is disconnected before opening the rear panel to avoid electric shock hazards.

6、This product requires first-level safety protection. The power supply must be reliably grounded; otherwise, it may cause electric shock or damage the instrument.

7、If the water sample contains visible insoluble particles, a particle filter must be installed before the inlet tube to prevent clogging of the internal tubing. For online detection of water samples with high solid suspension content, replace the filter regularly.

8、If the organic carbon concentration of a previously tested sample exceeds the instrument's detection range, flush the tubing with high-purity water or deionized water with low organic carbon concentration before testing other samples with relatively low organic carbon concentrations. Refer to the manual for the flushing time.

9、If the instrument is used for online detection, flush the tubing and complete calibration in offline mode before connecting to the online detection device.

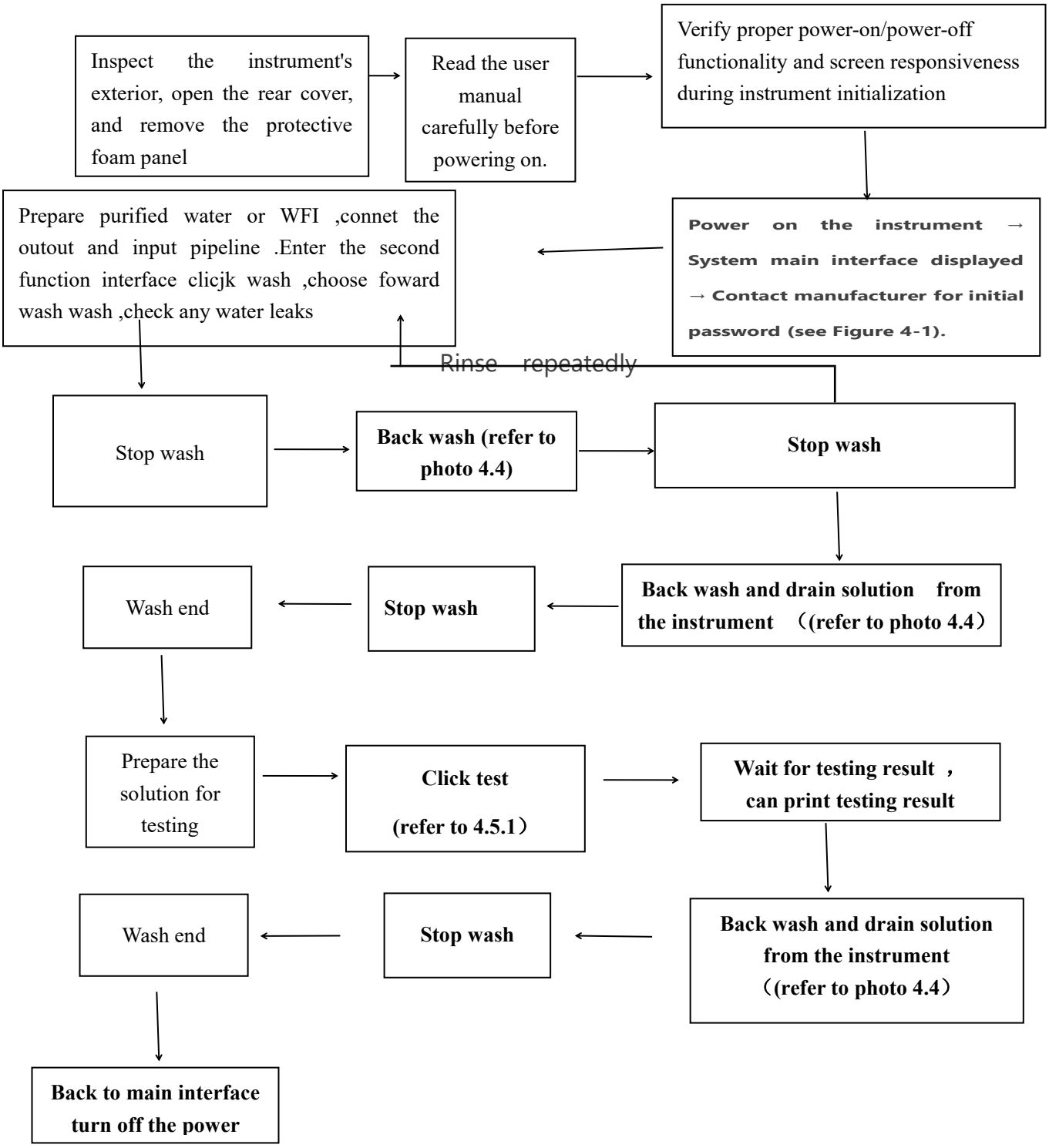

Inspect the instrument's exterior, open the rear cover, and remove the protective foam panel
Read the user manual carefully before powering on.
Verify proper power-on/power-off functionality and screen responsiveness during instrument initialization
Power on the instrument → System main interface displayed → Contact manufacturer for initial password (see Figure 4-1).
Prepare purified water or WFI ,connet the outout and input pipeline .Enter the second function interface clicjk wash ,choose foward wash wash ,check any water leaks
Rinse repeatedly
Stop wash
Back wash (refer to photo 4.4)
Stop wash
Back wash and drain solution from the instrument （(refer to photo 4.4）
Stop wash
Wash end
Prepare the solution for testing
Click test (refer to 4.5.1）
Wait for testing result ， can print testing result
Back wash and drain solution from the instrument （(refer to photo 4.4）
Stop wash
Wash end
Back to main interface turn off the power

Table of Contents

1. Product Introduction

The Total Organic Carbon (TOC) Analyzer is an independently developed product of our company, designed to measure the concentration of total organic carbon in water samples with high sensitivity and accuracy.

The working principle of the TOC Analyzer is as follows: Organic matter in the sample is oxidized into carbon dioxide under ultraviolet (UV) light, and the carbon dioxide is detected using conductivity detection technology. The total inorganic carbon (TIC or IC) concentration is measured in the sample without passing through the oxidation reactor, and the total carbon (TC) concentration is measured after oxidation. The total organic carbon concentration is calculated as the difference between the total carbon concentration and the total inorganic carbon concentration: TOC = TC - TIC.

The TOC Analyzer can detect water samples with TOC concentrations ranging from 0.001 mg/L to 1.600 mg/L. This product is easy to operate, has low maintenance costs, does not require chemical reagents, and does not require special training or professional chemical knowledge for operators.

1.1 System Components

The TOC Analyzer consists of the following seven main components:

① Online detection device (included in online models)

② Sample peristaltic pump

③ Splitter

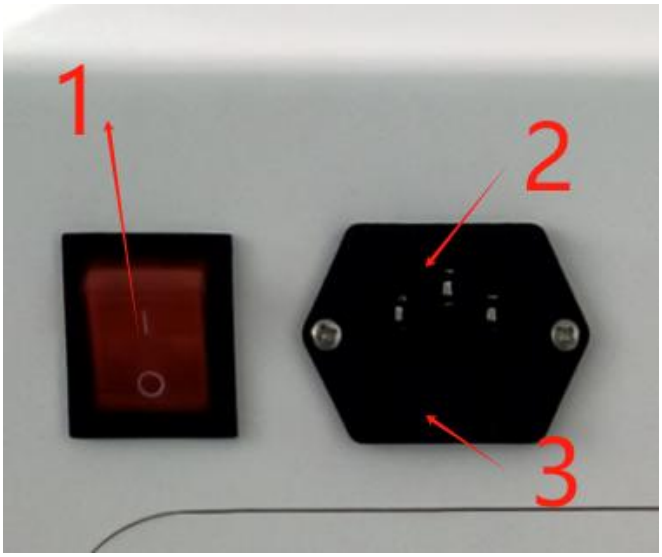
④ Oxidation reactor

⑤ Carbon dioxide sensor

⑥ Microprocessor controller and electronic circuit board

⑦ Output and input interfaces

1.2 Instrument Panel Introduction



1.Power switch: Controls the power supply to the entire instrument.

2.Power socket: Provides 220V AC power.

3.Fuse.

1.3 Offline Detection

In offline detection mode, the instrument can directly sample from sample bottles or other pressure-free containers. Tubing flushing and instrument calibration should be performed in offline mode. If the sample contains insoluble particles, it should be filtered through a membrane (pore size ≤60 μm) before entering the instrument to prevent clogging.

1.4 Splitter

The water sample entering the instrument is split into two equal flows. One flow passes through a delay coil into the carbon dioxide sensor to detect TIC, while the other flow passes through the oxidation reactor, where organic matter is decomposed into carbon dioxide under the photocatalytic oxidation of the UV lamp and titanium dioxide film, and then enters the carbon dioxide sensor to detect TC. The total organic carbon is calculated as: TOC = TC - TIC.

1.5 Oxidation Reactor

The instrument uses UV radiation under the action of a titanium dioxide photocatalyst to oxidize organic compounds into carbon dioxide. The oxidation reactor consists of a UV lamp wrapped in a spiral quartz tube. The UV lamp emits light at 185 nm and 254 nm, causing photolysis of water.

H~2~O + hν(185nm) (TiO~2~) → OH^-^ + H^+^

Hydroxyl radicals (OH^-^) can completely oxidize organic compounds into carbon dioxide.

Organic matter + OH^-^ → CO~2~ + H~2~O

The UV lamp has a lifespan of 6 months. When replacement is due, the instrument will display a warning message to remind the user.

1.6 Carbon Dioxide Sensor

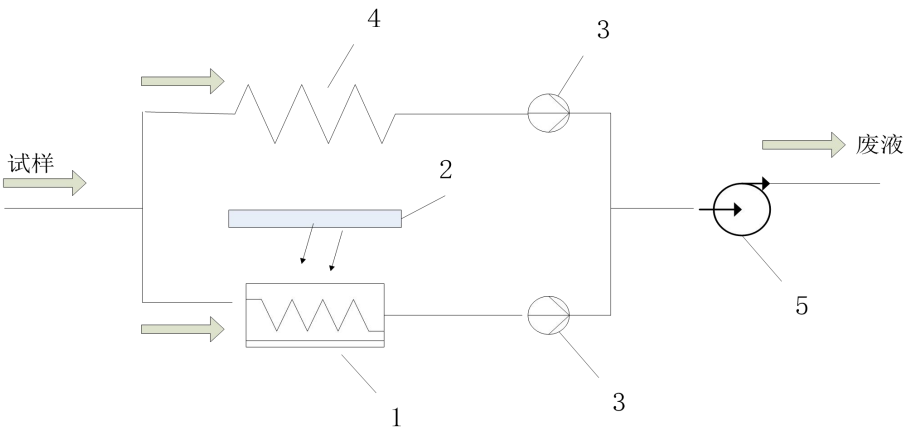
The instrument is equipped with two carbon dioxide sensors, each consisting of a conductivity sensor and a temperature sensor. Conductivity measurement uses dual-precision technology, enabling automatic calibration and temperature compensation. The TIC sensor detects the carbon dioxide concentration in unoxidized water samples and measures the sample's conductivity. The TC sensor detects the sum of the carbon dioxide naturally present in the water sample and the carbon dioxide produced by the decomposition of organic matter.

1.7 Carbon Dioxide Measurement Cycle

The instrument produces one data point (including TOC value and conductivity value) every 4 minutes. During the 4-minute measurement cycle, TC and TIC are detected independently.

2. Structural Features and Working Principle

2.1 Working Principle



1 — Spiral quartz glass tube coated with titanium dioxide

2 — UV lamp

3 — Conductivity sensor

4 — Delay coil

5 — Peristaltic pump

Figure 2-1: Schematic Diagram of the Working Principle

The water sample enters the instrument through the inlet and is split into two equal flows by the splitter. One flow passes through the delay coil (4) into the carbon dioxide sensor (3) to detect TIC, while the other flow passes through the spiral quartz glass tube coated with titanium dioxide (1), where organic matter is catalytically decomposed into carbon dioxide under the UV lamp (2), and then enters the conductivity sensor (3) to detect TC. The total organic carbon is calculated as: TOC = TC - TIC. The waste liquid is then pumped out through the peristaltic pump (5) and discharged from the outlet tube.

2.2 Application Scope

This instrument can be used to detect the organic carbon concentration in purified water, injection water, and deionized water in the pharmaceutical industry, as well as in ultrapure water in the semiconductor industry.

In the pharmaceutical and biochemical fields, it can be used for cleaning validation to verify cleaning effectiveness.

3. Technical Parameters and Features

3.1 Main Technical Parameters

Power Supply: 220V ± 22V

Power Frequency: 50Hz ± 1Hz

Rated Power: 100W

Dimensions: 35 cm × 25 cm × 35 cm

Detection Limit: 0.001 mg/L

Detection Accuracy: ±4%

Detection Range: 0.001 mg/L ~ 1.600 mg/L

Analysis Time: 6 minutes

Response Time: ≤15 minutes

Sample Temperature: 1–70°C

Ambient Temperature: 10–40°C (temperature change ≤±5°C/day)

Relative Humidity: ≤85%

Repeatability Error: ≤3%

3.2 Features

① No need to add acid reagents, oxidants, or any gases; no additional daily maintenance costs.

② Simple, fast, and reliable operation. No professional knowledge or specialized training is required.

③ Designed for detecting deionized water with TOC ≤1600 ppb.

④ Large-capacity memory automatically stores data from the last 12 months of continuous detection. Users can query records from any day and print the results.

⑤ Fast detection speed.

⑥ Simultaneously detects the conductivity of water samples, combining the functions of a TOC analyzer and a conductivity meter.

⑦ Compact size, lightweight, low energy consumption, and portable.

⑧ Automatic upper-limit alarm output alerts the operator when results exceed the set range.

⑨ Easy to perform system suitability validation as required by USP <643>, EP <2.2.44>, and the Chinese Pharmacopoeia 2020 Edition Appendix VIII R.

⑩ Large true-color display and user-friendly interface, equipped with data and printer interfaces.

4. Usage and Operation Methods

4.1 Preparations

Before testing samples, complete the following preparations:

1.Check if the instrument's power connection is stable.

2.Check if the detection system is clean and perform necessary cleaning.

3.Prepare samples and required reagents.

4.2 Menu Structure

When the power switch is turned on, the instrument displays the primary system interface (Figure 4-1). Click the corresponding user (this manual uses the super administrator as an example) and enter the password (initial password can be obtained from the manufacturer) to access the secondary function interface (Figure

4-1Interface

4-2Interface

4.3 Instrument Settings

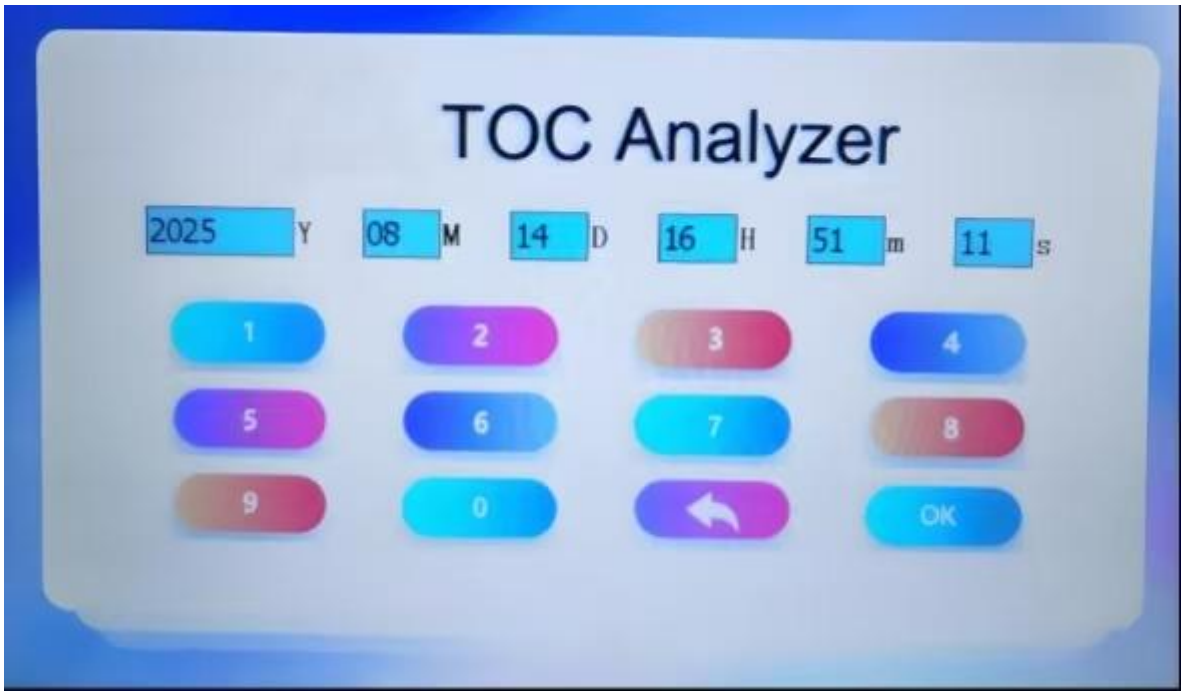
In the function interface (Figure 4-2), select the "Instrument Settings" menu button to enter the settings interface (Figure 4-3). Click the corresponding button to select the

parameter to be set, enter the specific settings menu, and complete the settings. Press "Return" to go back to the main menu.

4-3 Interface

Date and Time Settings

In the settings interface, click "Time Settings" to open the date and time settings interface (Figure 4-4). Click the parameter to be modified, use the on-screen keyboard to adjust, and click "OK" to confirm and return to the previous menu.



4-4 Date and time setting interface

User Settings

Permissions are divided into three levels: super administrator, administrator, and operator. The super administrator can manage permissions, add or remove administrators and operators.

Super Administrator Access: Permission management, instrument settings, cleaning, testing, and historical records.

Administrator Access: Instrument settings, cleaning, testing, and historical records.

Operator Access: Cleaning and testing.

Export

Insert a USB drive, click "Export" to transfer audit and historical records to the USB drive. The corresponding content on the instrument will be cleared. A restart is required after exporting.

Audit

Records the user's operations on the instrument after logging in.

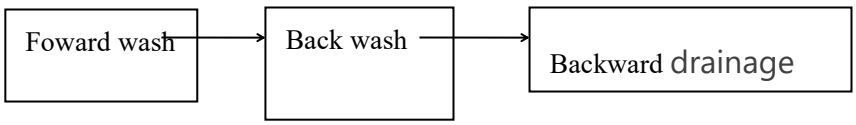
4.4 Tubing Flushing

In the "Secondary Function Interface," click "Cleaning" to enter the cleaning function page (Figure 4-5). Flush the tubing to remove residual reagents and bubbles. If the instrument has not been used for a long time or has tested high-TOC samples, flush the tubing with high-purity water for over 6 hours. Under normal circumstances, flush for 30 to 60 minutes.

Forward cleaning refers to liquid flowing from the inlet to the outlet. Reverse cleaning refers to liquid flowing from the outlet to the inlet, flushing the instrument internally. If the instrument will not be used for an extended period, perform reverse cleaning with ultrapure water for over 2 hours, then remove the ultrapure water and continue reverse cleaning to drain all liquid from the instrument.

4-5 water function interface

Washing process ：



1.For first-time use, alternate between forward and reverse cleaning with ultrapure water or injection water, 10 minutes each, for 3 cycles.

2.For weekly use, alternate between forward and reverse cleaning with ultrapure water or injection water, 5 minutes each, for 2 cycles.

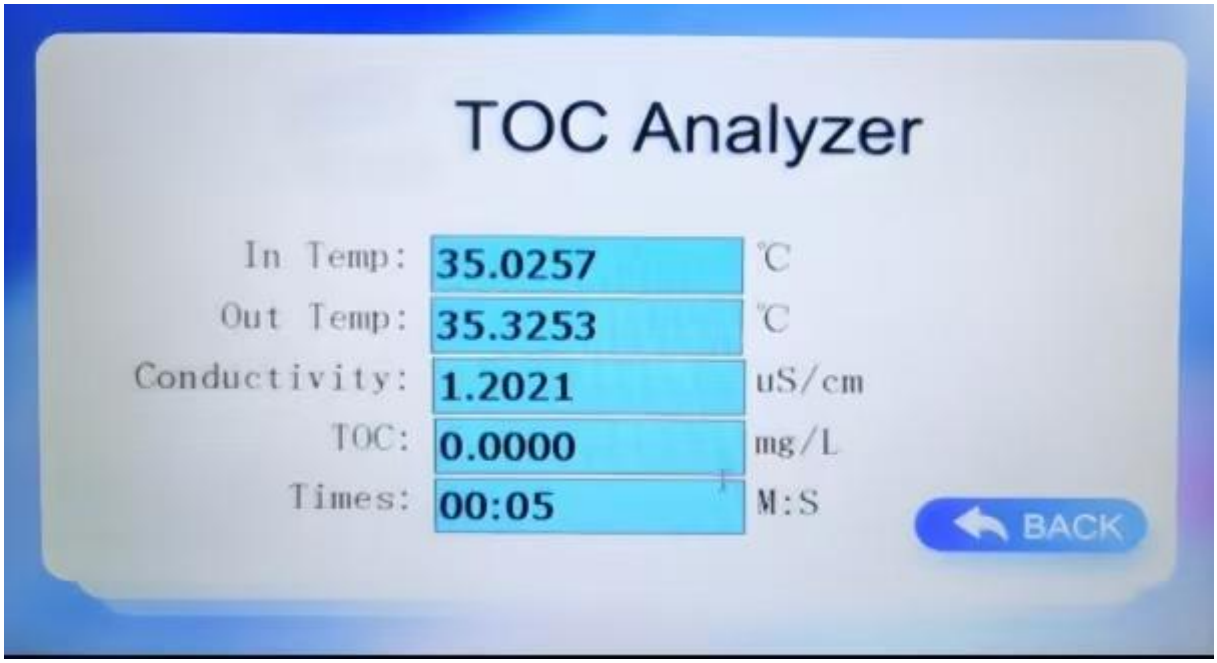
3.If contaminated water (e.g., tap water) is accidentally used, alternate between forward and reverse cleaning, 15 minutes each, for 6 cycles.

4.When testing different samples consecutively, perform reverse cleaning to drain the liquid after each sample test, flush with the next sample for 3 minutes in reverse, then perform forward cleaning for 3 minutes before testing.

4.5 Running Analysis

4.5.1 Online Mode

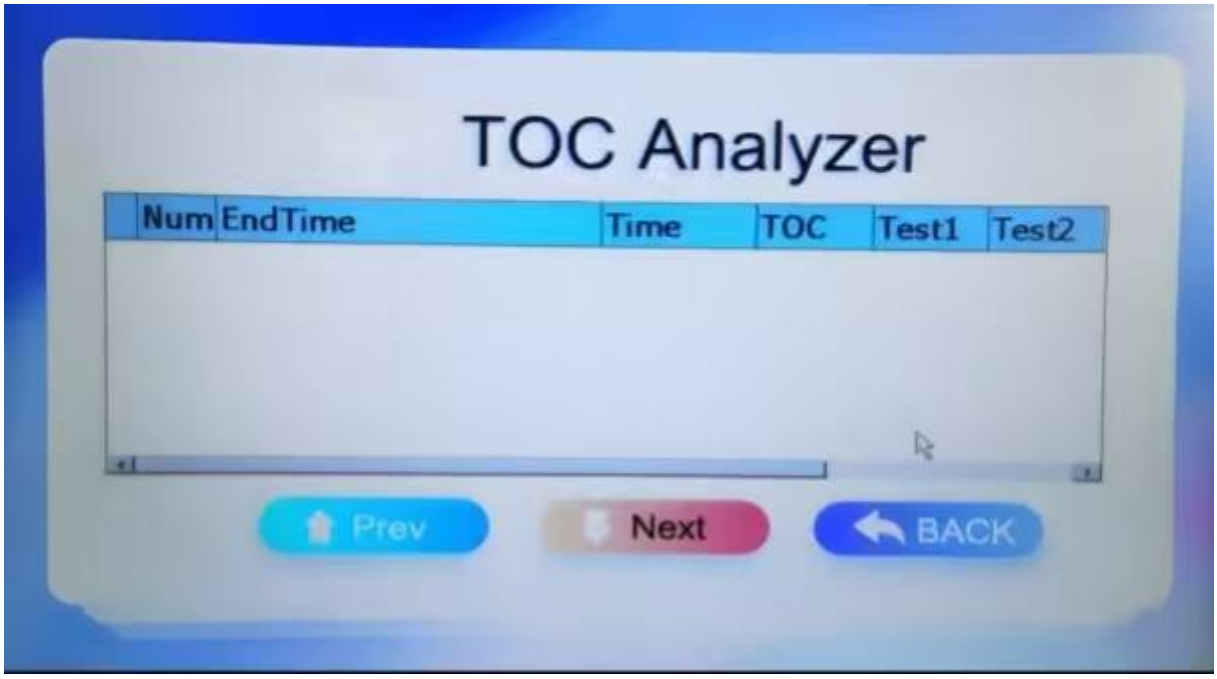
Adjust the tubing pressure and connect the inlet interface. In the secondary function interface , select the **"Test"** menu button to begin testing. After the test is completed, you may choose whether to print the results.



4-6 Analysis interface

4.6 Querying Historical Records

In the secondary function interface (Figure 4-2), select the "Historical Data" menu button to enter the historical records interface (Figure 4-7). Double-click the serial number to print. Scroll up or down to view historical data, with the latest data at the bottom.



4-7 Historital interface

Instrument Usage Procedure

1.Connect the power cable and turn on the switch.

2.Flush the tubing (see Section 4.4: Tubing Flushing).

3.Perform testing (see Section 4.5: Running Analysis).

5. Maintenance

5.1 Consumables Replacement Cycle

UV lamps and peristaltic pump tubes can be purchased from our company. The UV lamp is a dual-wavelength (185 nm and 254 nm) lamp, and the peristaltic pump tube is an imported high-quality tube with excellent stability. Refer to Table 5.1 for the replacement cycle of consumables.

Table 5.1: Consumables Maintenance/Replacement Table

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Part Number	Component Name	Replacement Cycle
19058Z	UV lamp	6 months
10062Z	Peristaltic Pump Tube	12 months

*The recommended replacement cycle is based on continuous operation (online use). For offline or intermittent use, the lifespan may be extended. The instrument will display a warning when the UV lamp exceeds its usage time.

5.2 Precautions

① If the water sample contains insoluble particles, use a filter with a pore size ≤60 μm.

② During operation, the inlet tube should be submerged below the liquid surface, with the opening near the bottom third of the container. When idle, keep the tubing immersed in pure water. For long-term storage, seal the inlet tube with film to prevent contamination.

③ Bubbles in the internal tubing may interfere with test results. If bubbles are observed in the transparent Teflon tube, flush with pure water until all bubbles are removed.

④ During normal operation, droplets should exit the outlet tube. If no liquid flows out, check for clogs or bubbles. Use a syringe to remove bubbles or clogs to restore flow.

⑤ Wait at least 3 minutes after powering off before restarting the instrument.

⑥ The TOC Analyzer is equipped with onboard flash memory, storing data from the

last 12 months of continuous operation. Users can query and print records from any day.

5.3 Replacing the UV Lamp

The intensity of the UV lamp, especially short-wavelength UV light, decreases over time. Therefore, regular replacement is necessary. Our company recommends replacement every 6 months for continuous use, or longer for intermittent use.

When replacing the UV lamp, handle it carefully to avoid damaging the lamp or the surrounding spiral quartz tube.

New UV lamps come with gloves for installation to prevent fingerprints on the lamp or quartz tube. Fingerprints absorb UV light and reduce the oxidation performance of the reactor. If fingerprints are left, clean them with ethanol.

Steps to Replace the UV Lamp:

① Turn off the main power switch and unplug the power cable.

② Unscrew the rear panel screws and open the panel.

③ Disconnect the lamp's power cable and loosen the locking nut. Slowly remove the lamp.

④ Install the new lamp, adjust its position in the spiral quartz tube, and tighten the locking nut.

⑤ Reconnect the power cable and secure the rear panel screws. Replacement is complete.

If issues arise during replacement, contact the manufacturer.

5.4 Replacing the Peristaltic Pump Tube

Peristaltic pump tubes wear out and age over time. Replacement is recommended every 12 months.

Steps to Replace the Pump Tube:

① Turn off the main power switch and unplug the power cable.

② Open the rear panel.

③ Loosen the hex screws on the pump pressure ring and the pump tube clamp block. Remove the pump tube from the pump ring.

④ Disconnect the pump tube from the conductivity sensor outlet and the waste tube. Remove the two pump tubes and the spacer block between them.

⑤ Attach the spacer block to the two new pump tubes and adjust its position. Place the middle section of the new pump tubes into the pump ring, tighten the hex screws on the pressure ring, and secure the pump tube clamp block. Adjust the spacer block near the conductivity sensor end.

⑥ Connect one end of the pump tube to the conductivity sensor outlet and the other end to the waste tube.

⑦ Secure the rear panel screws. Replacement is complete.

If issues arise during replacement, contact the manufacturer.

6. Troubleshooting and Solutions

No.	Issue	Possible Cause	Solution
1	No display after powering on	1. Check if the fuse is blown.	1. Replace the fuse.
		2. Check if the power cable is loose.	2. Reconnect the power cable.
2	Unstable or inaccurate test results	1. Check for bubbles or kinks in the inlet/outlet tubing.	1. Replace damaged tubing.
			2. Flush the tubing with pure water.
3	Test values are too low	UV lamp lifespan has expired.	Replace the UV lamp.
4	Buttons are unresponsive	1. Check for button damage or liquid ingress.	Replace the buttons.
		2. Long-term use or improper operation may cause button failure.	
5	Unusual noise inside the instrument	1. Check for foreign objects.	Contact a professional for repair.
		2. Check if the motor is functioning normally.	
6	Buzzer sounds	1. Short beep: Test value exceeds the set upper limit.	1. Check the water sample source.
		2. Long beep: Possible motherboard failure.	2. Contact a professional for

No.	Issue	Possible Cause	Solution
			repair.
7	Instrument freezes when querying data	"Print" is selected in settings, but no printer is connected.	1. Restart and set to "Do Not Print." 2. Connect a printer.
8	No liquid exits the outlet tube	1. Tubing is clogged. 2. Pump tube is worn out.	1. Use a syringe to clear the clog.

7. Installation and Storage/Transportation

7.1 Installation

7.1.1 Selecting the Installation Location

Place the instrument on a clean, flat surface capable of supporting at least 25 kg.

Ensure at least 16 cm of space on all sides for ventilation.

7.1.2 Power Requirements

Voltage: 220V ± 22V

Frequency: 50Hz ± 1Hz

7.1.3 Environmental Requirements

The instrument should operate in a stable, temperature-controlled environment.

Avoid direct sunlight and extreme temperatures. Temperatures above 40°C (104°F)

may cause malfunctions, while temperatures below 10°C (50°F) may lead to measurement errors.

7.2 Storage/Transportation

7.2.1 The packaged TOC Analyzer should be stored indoors with relative humidity ≤80%, free of corrosive gases, and in a cool, clean, and well-ventilated area.

7.2.2 Transport the instrument as per the contract requirements, avoiding collisions and moisture.

7.2.3 If disassembly or reinstallation is required, contact the manufacturer for professional assistance.

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ITEM NAME	UNIT	QUANTITY
Main Unit	PC	1
Power Cord	PC	1
Inlet Tube	Meter	1
Fuse	PC	1
User Manual	PC	1
Certificate	PC	1
Warantee card	PC	1
Printing Paper	Roll	1
Stylus	PC	1