Rat-TDO

Portable Trace Dissolved Oxygen Analyzer

User Manual

The specifications and information mentioned in this manual are for reference only and are subject to change without notice. Unless otherwise agreed, this manual is for guidance only, and all statements and information herein do not constitute any form of warranty.

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Declaration

The functions described in this manual are specific to the RAT-TDO Portable Trace Dissolved Oxygen Analyzer. The specific functions and parameters available depend on the model you purchased and its configuration.

We have carefully compiled this manual, but we cannot guarantee that the content is entirely accurate. We are not responsible for any losses caused to users due to the information provided in this manual. Furthermore, our products, including this manual, are constantly being improved, and we reserve the right to modify the manual without prior notice.

User Notice

To ensure the design performance and longevity of this product, anyone using or maintaining this product must strictly follow the guidelines in this manual. By carefully reading and understanding this manual, you will be able to fully grasp the product's functions, operation, and maintenance methods.

Precautions

The RAT-TDO Portable Trace Dissolved Oxygen Analyzer is a precision testing instrument. Please adhere to proper usage and maintenance practices to ensure optimal instrument performance.

- The instrument should be used and stored in a suitable environment.
- Avoid severe shaking, collisions, and pulling during transport and use.

Contents

1. Product Introduction

1.1 Overview

The **Rat-TDO Portable Trace Dissolved Oxygen Analyzer** is a high-precision instrument designed for ultra-low oxygen measurement in water and gas samples. Using the electrochemical polarographic method (Clark electrode), it delivers fast response, excellent stability, and wide-range detection from trace μg/L levels to mg/L concentrations. Its rugged IP67/IP68 waterproof design, dual measurement modes, automatic temperature and pressure compensation, and long battery life make it ideal for field monitoring, environmental testing, laboratory analysis, aquaculture control, and industrial process applications.

Key Features:

- **High-precision trace oxygen measurement:**
  Detects dissolved oxygen from 0.10 μg/L to 20.0 mg/L with fast response and high accuracy for ultra-low oxygen monitoring.
- **Advanced polarographic Clark electrode:**
  Generates diffusion current proportional to oxygen concentration, ensuring stable, reliable measurement in both liquid and gas samples.
- **Automatic temperature and pressure compensation:**
  Built-in NTC temperature sensor and manual pressure compensation ensure accurate readings under varying environmental conditions.
- **Dual measurement modes:**
  Supports dissolved oxygen concentration (mg/L, μg/L) and saturation (%) for flexible applications in water and gas analysis.
- **Robust waterproof design:**
  Instrument rated IP67 and probe rated IP68, suitable for indoor, outdoor, and

harsh field environments.

- **Fast startup and simple calibration:**

  One-key air calibration and zero calibration streamline daily use and ensure long-term measurement stability.

- **Large data storage and Bluetooth transfer:**

  Stores up to 999 readings on the device and support Bluetooth data transfer.

- **Long battery life and multiple power options:**

  Powered by 4 × AA batteries or USB Type-C input, supporting up to 200 hours of continuous operation.

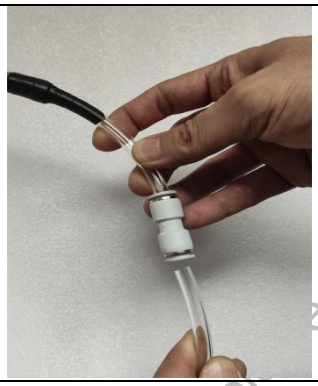
- **Lightweight and portable:**

  Compact 390 g design with optional protective frame, flow cell, and carrying case for efficient field testing.

1.2 Technical Specifications

Item	Parameter
Measurement Range	0.10 µg/L–100 µg/L, 100 µg/L–20.0 mg/L (auto switch)
Resolution	0.01 µg/L; 0.01 mg/L
Zero Drift	< 0.5 µg/L
Accuracy	±1% (FS) or ±0.5%
Response Time	< 15 s
Temperature Sensor	NTC thermistor; Accuracy: 0.1°C
Calibration	Air slope calibration, zero calibration, pressure calibration
Temperature Compensation	0–50°C (automatic)
Pressure Compensation	0–200 kPa (manual)
Salinity Compensation	0.00–80.00 ppt (manual)
Salinity Compensation Error	2%
Data Storage	999 sets
Power Supply	4 × AA batteries (1.5V × 4) or USB Type-C power input
Battery Life	Up to 200 hours continuous use
Protection Rating	Instrument: IP67; Probe: IP68
Display	LED with backlight
Dimensions (L × W × H)	231 × 95 × 45 mm
Weight	390 g
Storage & Transport Conditions	5–45°C; ≤95% RH (non-condensing)
Testing Conditions	Sample temperature: 0–45°C; Flow rate: 160–500 mL/min (constant)

1.3 Instrument Appearance

		
Front and back view	Electrode connection method	Flow cell installation
Use the screwdriver provided in the accessory kit to replace battery	Align the red dots on the plug and socket before insert Aviation connector	When screwing in or removing the flow cell, not to twist the connecting cables.
		
Quick adapter connection	Accessory kit: For electrode maintenance only	

1.4 Key Control

This product adopts a button-based operation mode with 8 control buttons.

Button	Name	Function
	Power Button	Long press (3 seconds) to turn on/off the device
	Mode Button	Press to switch measurement modes: 1. Dissolved Oxygen Saturation Mode (unit: %) 2. Dissolved Oxygen Concentration Mode (unit: mg/L μg/L)
	Air Calibration	Long press for 3 seconds to perform manual air calibration
	Zero Calibration	Long press for 3 seconds to perform zero-point calibration
	Save	Short press to store the current reading
	View	Short press repeatedly to browse stored data
	Back	Short press to return to the measurement screen
	Light	Short press to toggle backlight (auto-off after 10 seconds)

LCD Display Overview

	Low battery indicator
88-88-88 88:88	Time
mg μg %	Measurement unit
℃	Temperature
M	Stored data recall
88888.88 nA	Residual current reading
	Bluetooth indicator
Ⓜ 888	Data storage quantity

2. Disclaimer and Warranty

2.1 Disclaimer

1. The specifications and information mentioned in this manual are for reference only and are subject to change without notice.
2. Please read the safety instructions carefully before using the instrument. The company is not responsible for accidents caused by improper operation.
3. This product is intended for use in professional fields. Operators must have relevant knowledge and skills. Accidents caused by misuse are not covered.

2.2 Warranty

1. All products undergo strict inspection before shipment and are covered by a one-year free warranty for quality issues.
2. During the warranty period, if problems arise due to improper operation, unsuitable environment, human error, accidents, or improper storage/transportation, the company may charge repair costs.
3. For out-of-warranty instruments, paid repair and service are available.
4. Warranty does not apply under the following conditions：
    a. Unauthorized disassembly, modification, or repair.
    b. Repairs by non-authorized personnel.
    c. Tampering or breaking of anti-disassembly seals.
    d. Use of non-original consumables causing malfunctions.
    e. Products purchased through unauthorized channels.
    f. Improper use or operation in unsuitable environments.

3. Instrument Operation

3.1 Power On and Self-Check

Press and hold the “Power” button for about 3 seconds. After a “beep” sound, the instrument will perform a self-check process. During this period (approximately 15 seconds), the screen will flash continuously, and no operation other than shutdown is allowed.

Once the self-check is complete, the instrument will automatically enter the measurement mode, and the screen will stop flashing. You can then begin measurement directly.

Note: For accurate measurement, air calibration is required before use.

3.2 Sample Measurement

Depending on the type of sample, use different accessories to introduce the measurement target:

- The protective frame is used for direct measurement of dissolved oxygen in liquids or gases.
- The flow cell is suitable for measurement of flowing liquid.

Before use, inspect the membrane at the probe tip. If bubbles are visible inside the membrane, gently tap or shake the probe downward several times to remove them. Ensure the membrane interior is free of air bubbles before measurement.

3.2.1 Dissolved Oxygen (DO) Mode

1) DO Concentration Mode

When measuring the dissolved oxygen in water, the instrument displays readings in mg/L or μg/L (auto-switch). The instrument simultaneously measures water temperature for automatic compensation.

2) DO Saturation Mode

Press the “Mode” button to switch to dissolved oxygen saturation mode. In this mode, the display shows the saturation percentage (%) of dissolved oxygen in the sample, along with the DO mode icon.

3.2.2 Gas Mode

The Gas Mode is used for measuring the oxygen concentration in gas-phase samples.

During gas measurement:

- The DO mode icon will not be displayed.
- The unit automatically switches between % and ppm (0.0001%), depending on the detected concentration.

3.3 Power Off and Storage

3.3.1 Power Off

After measurement is complete:

1. Wipe the instrument and probe surface gently with a paper towel (avoid touching the membrane).
2. Screw on the protective cap.
3. Long press the Power button (3 seconds) to turn off the device.

3.3.2 Instrument Storage

Store the instrument in a clean, dry, and shaded environment. Avoid direct sunlight and temperatures below 0°C.

It is recommended to screw the electrode into the protective cap filled with deoxygenated water, ensuring the electrode tip remains immersed.

If unused for 1–2 months:

- Power on the device weekly to check for reading drift.
- Replace the deoxygenated water monthly to maintain electrode performance.

If stored for several months:

- Drain the electrolyte from the electrode chamber and let it dry completely.
- Wrap the instrument in a plastic bag.
- Remove the batteries before long-term storage.

4. Instrument Calibration

4.1 Air Calibration

Perform air calibration when using the instrument for the first time or after long periods of continuous/intermittent use. Press the “Mode” button to check if the saturation value deviates from 100%. If it is close to 100%, calibration is not required.

Air Calibration Steps:

1. Inspect the probe membrane.
    - If air bubbles are present, gently tap or shake the probe downward to remove them.
    - Place the probe in air with near-saturated humidity (e.g., above a damp towel).
    - Ensure no water droplets are present on the membrane surface (if present, absorb gently with clean tissue).
2. Allow the instrument to run for at least 20 minutes until the oxygen concentration and temperature readings stabilize.
    - Then press and hold the “Air” key for 3 seconds until a “beep” is heard to complete calibration.
    - You may then press “Mode” to view the measured oxygen concentration and saturation.

4.2 Zero Calibration

Under normal operation and maintenance, zero drift rarely occurs. It is recommended to periodically observe data trends and perform calibration if necessary.

Zero Calibration– Deoxygenated Water Method:

1. Power on the instrument and perform air calibration (see section 4.1).
2. Prepare a ≥5% sodium sulfite (Na_2SO_3) solution using pure or drinking water and stir well.
3. Attach the calibration cap to the probe and immerse it into the deoxygenated solution.
    - Ensure no bubbles on the membrane surface; if present, gently tap to remove.
    - Start timing once the probe is immersed.
4. Observe the response rate – normally the reading should be below 10 µg/L within 10 minutes. After 30 minutes or longer, when the reading approaches zero and stabilizes, press and hold the “Zero” key for 3 seconds until a “beep” sound to complete calibration.

Note: The zero point is a critical parameter. Incorrect calibration can cause unreliable measurements. Each zero calibration overwrites the previous one.

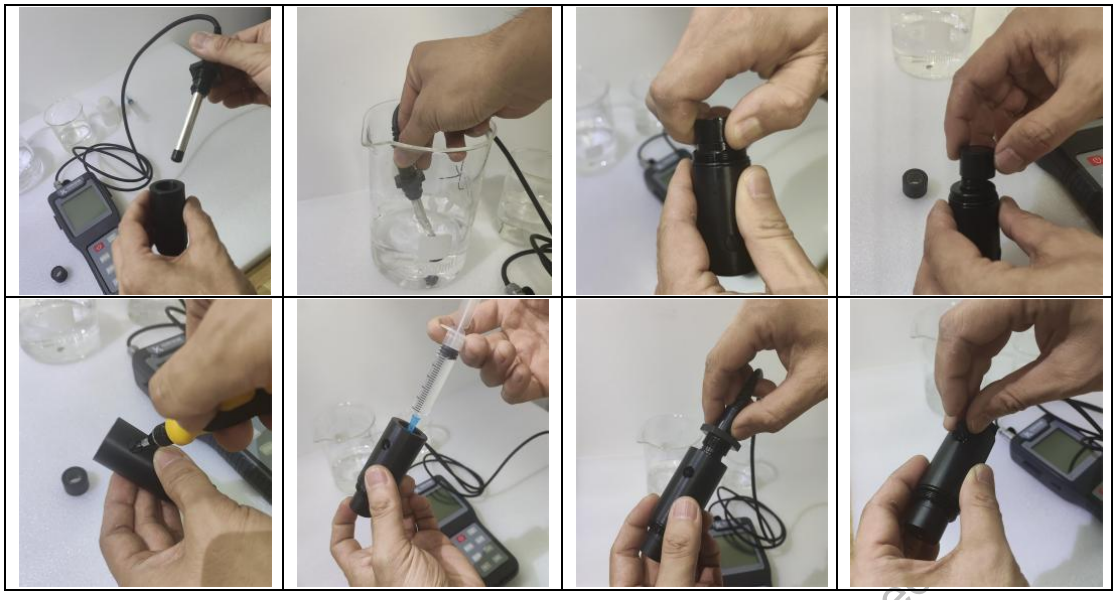
5. Maintenance and Care

5.1 Replacing the Membrane and Electrolyte

The electrode can be serviced whether the instrument is powered on or off.

Steps:

1. Prepare a new membrane cap and extract about 5.0 mL of electrolyte (use a syringe without the needle if necessary).
2. Unscrew and remove the rear knob of the electrode; take out the electrode and place it in pure water. Avoid touching the gold electrode tip or any hard contact with surfaces.
3. Pour out the old electrolyte from the electrode cavity.
4. Unscrew and remove the old membrane cap, then install the new membrane cap.
5. Open the side vent port and remove the vent plug.
6. Hold the electrode at a slight angle with the vent port upward.
    - Insert the syringe into the electrode chamber bottom and slowly inject the electrolyte (~5 mL).
    - Inject slowly to avoid bubble formation.
7. Screw the rear knob back on while keeping the vent port upward.
    - Gently tap the probe to release air bubbles and excess electrolyte through the vent.
    - Reinsert and tighten the vent plug.
    - Replace any damaged O-rings immediately.
8. Screw on the protective cap, power on the device, and polarize for several hours.
    - Perform a zero-point test in deoxygenated water to verify membrane replacement quality.



5.2 Electrode Maintenance

Check and maintain the electrode if any of the following occur:

- The zero point drifts (reading in deoxygenated water is abnormally high).
- The response speed decreases noticeably.
- The membrane replacement cycle shortens abnormally.

Solutions:

- The electrolyte doesn't cover the sensing surface, gently tap the probe downward to allow the electrolyte to flow. If this fails, the membrane may have shifted, torn, or punctured — replace it.
- After long-term use, microbial buildup may occur on the electrode surface. During membrane replacement (after step 3 in section 5.1), perform deep cleaning using one of the following methods:
  1) Gently wipe the gold electrode with an alcohol pad, then refill with fresh electrolyte.
  2) Fill the electrode chamber with electrolyte, shake out and refill — repeat at least twice.
  3) Remove the membrane cap, attach the calibration cap, and immerse

the probe in ultrapure water or analytical-grade alcohol. Rinse three times, then repeat cleaning method (2).

6. Troubleshooting

Problem	Possible Cause	Solution
Unable to power on	Batteries installed incorrectly or depleted	Check the batteries and replace them if necessary (use four AA alkaline batteries)
Battery icon appears on screen	Low battery level; the device can still operate for about 2 hours	Replace batteries soon
No sound	Buzzer malfunction	Does not affect normal operation
Temperature sensor displays “0” or “99”	Temperature sensor malfunction; temperature compensation defaults to 25 °C	Cable pulling or twisting has damaged the temperature sensor wire — replace the probe
Reading too high in oxygen-free water test	Oxygen-free water expired or invalid	Prepare oxygen-free water as required
	Air bubbles on electrode head	Stir to remove bubbles
	Electrode requires maintenance	Replace membrane and electrolyte
Readings too high when using flow cell on-site	Sensor linearity drift	Maintain and calibrate electrode
	Sampling system not airtight	Check system for leaks
	Air bubbles in sampling tube	Remove bubbles
	Membrane damaged or not in full contact with cathode	Replace membrane and electrolyte
Unstable readings in air or during measurement	Air bubbles inside membrane	Gently tap the probe downward
	Membrane not well attached to electrode	Replace membrane and electrolyte
	Membrane damaged	Replace membrane and electrolyte
Very low readings in air	Large air bubbles inside membrane	Gently tap the probe downward
	Probe cable broken	Replace the probe

7. Instrument Maintenance Checklist

Maintenance Item	Recommended Frequency
Polarization after power-on	Every 7–10 days
Check oxygen and temperature readings in air	
Rinse electrode with pure water	
Prepare zero-oxygen water and check electrode zero-point value	Every 15–30 days or as needed
Electrode maintenance (replace membrane and electrolyte)	Every 4–8 months or according to test requirements
Replace O-ring	Every 4–8 months or according to wear condition
Replace batteries (four AA alkaline batteries)	Every 1–2 months or as indicated on screen

8. Packing List

Item	Number	Remarks
Portable Trace Dissolved Oxygen Analyzer	1	
Trace Dissolved Oxygen Electrode	1	
Trace Dissolved Oxygen Membrane Maintenance Kit	1	Includes 4 membrane caps, 1 bottle of electrolyte, 1 bottle of anhydrous sodium sulfite, and maintenance tools
Portable Carrying Case	1	