Rat Muti Series

Portable Electrode Method Water Quality 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 Muti Series Portable Multi-Parameter Water Quality 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 Muti Series Portable Multi-Parameter Water Quality 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.

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1. Product Introduction

1.1 Overview

The **RAT Muti Series Portable Electrode Method Water Quality Analyzer** is a dual-channel, high-precision instrument designed for comprehensive pH, conductivity, and dissolved oxygen measurement in both laboratory and field environments. Using advanced electrode-based measurement technology, the analyzer delivers rapid, stable, and accurate readings across multiple water quality parameters. Its intelligent electrode recognition system ensuring reliable data integrity and minimizing operator error. With an IP67 waterproof rating, intuitive interface, one-touch operation, and flexible accessory configurations, the RAT Muti Series provides a professional-grade solution for environmental monitoring, aquaculture, wastewater treatment, and industrial process control.

Key Features:

- **Dual-Channel Multi-Parameter Measurement:**
  Simultaneously supports pH, conductivity, resistivity, TDS, salinity, and dissolved oxygen (DO) measurements with fast response and high accuracy.
- **Intelligent Electrode Management Technology:**
  Automatically identifies connected electrodes and transfers calibration data from the electrode's internal chip, ensuring secure data handling and reducing operational errors.
- **High Measurement Accuracy & Stability:**
  Designed for precise electrode-based testing with automatic temperature compensation and multi-point calibration.
- **User-Friendly Interface:**
  Intuitive menu navigation with quick parameter switching before or after

measurement for efficient, seamless operation.

- **Robust waterproof design:**

  Instrument rated IP67 suitable for indoor, outdoor, and harsh field environments.

- **One-Touch Operation & Data Storage:**

  Easy single-key operation for measurement, calibration, and storage; internal memory stores up to 999 data sets with fast recall.

- **Lightweight and portable:**

  Lightweight 0.4 kg body, comfortable grip, and anti-slip design enhance portability and on-site usability.

- **Flexible Accessory Options:**

  Compatible with electrode clips, anti-slip hand grips, device stands, protective frames, and optional carrying cases for improved mobility and operability.

- **Versatile Power Supply:**

  Operates on 4×AA batteries or Type-C charging, supporting long field sessions without interruption.

1.2 Technical Specifications

Item	Parameter
Dissolved Oxygen (DO)	
Measurement Range	0.00–20.00 mg/L (ppm)
Resolution	0.01 mg/L (ppm) / 0.1 %
Accuracy	±0.1 mg/L
Response Time	≤15 s (25°C, 90% response)
Residual Current	≤0.01 nA
Temperature Compensation Range	0–60°C (Automatic)
Pressure Compensation Range	0–200 kPa (Manual)
Salinity Compensation Range	0.00–80.00 ppt (Manual)
Salinity Compensation Error	2%
Calibration Functions	Zero Calibration, Air Calibration
Electrode Type	Polarographic Type
Conductivity	
Measurement Range	0.00–19.99 µS/cm 20.0–199.9 µS/cm 200–1999 µS/cm
TDS	0.00–2000.00 mg/L
Salinity	0.00–100.00 ppt
Resistivity	0.00–100.00 MΩ·cm
Resolution	0.001 / 0.01 / 0.1 µS/cm
Accuracy	±1.0% FS
Temperature Compensation Range	0–100°C (Automatic)
Electrode Constant	0.1 / 1 / 10 cm^{-1}
Calibration Function	Yes, 5-point calibration
pH	
Measurement Range	0.00–14.00 pH
Resolution	0.01 / 0.001 pH
Accuracy	±0.001 pH
Temperature Compensation Range	0–100°C (Automatic / Manual)
Calibration Function	Yes, 5-point calibration
ORP (Oxidation-Reduction Potential)	
Measurement Range	-1200.0 – 1200.0 mV
Resolution	0.1 mV
Temperature	
Measurement Range	-5–105°C
Resolution	0.1°C
Accuracy	±0.1°C

Calibration Function	Yes, 1-point calibration
Basic Parameters	
Data Storage	999 sets
Stored Data	ID number, measurement value, unit, and temperature
Power Supply	4 × AA batteries (1.5V × 4) or Type-C power input
Dimensions (L × W × H)	321 × 95 × 45 mm
Weight (kg)	0.4
Operating Temperature	5–45°C
Operating Humidity	⩽95%
Protection Rating	IP67 (Dustproof and Waterproof)

1.3 Instrument Appearance



Battery Installation:

Use the provided screwdriver to remove the battery compartment screw. Insert the batteries according to the polarity marks inside the compartment, close the cover, and secure it with the screw.

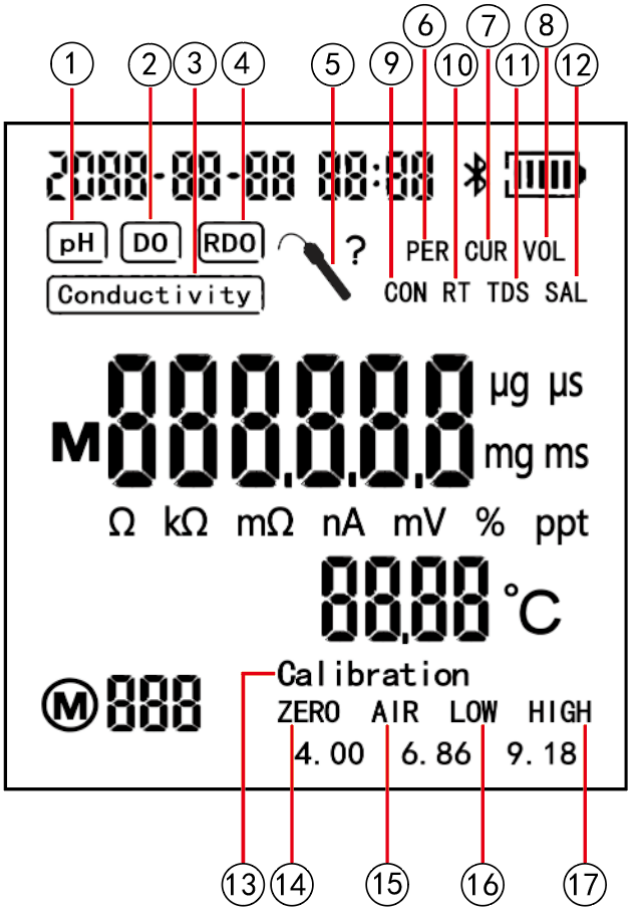
Since the meter meets the IP67 protection standard, the battery compartment must remain well sealed. If the “O-ring” around the compartment is damaged, please contact the manufacturer for replacement.

1.4 Key Control

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

Button	Name	Function
	Power Key	Long press (5s) to power ON/OFF; short press to turn backlight ON/OFF
MODE	Mode Key	Switch measurement modes: 1. Dissolved Oxygen: DO value, Air Saturation, Residual Current 2. pH Measurement: pH, mV 3. Conductivity: Conductivity, Resistivity, TDS, Salinity
ALT	Electrode Switch Key	Switch between electrodes
CAL	Calibration Key	Enter calibration mode
M+	Memory Key	Press to store the current reading
MR	Recall Key	Press repeatedly to review stored data
	Return Key	Press to return to the main reading screen
OK	Confirm Key	In calibration mode, long press to confirm calibration value

1.4 Display Description



① pH Measurement
② Dissolved Oxygen Measurement
③ Fluorescent Dissolved Oxygen Measurement
④ Conductivity Measurement
⑤ Electrode Recognition
⑥ Percentage
⑦ Current
⑧ Voltage
⑨ Conductivity
⑩ Resistivity
⑪ TDS (Total Dissolved Solids)
⑫ Salinity
⑬ Calibration Mode Active Indicator
⑭ Zero Calibration
⑮ Air Calibration
⑯ Low-Point Calibration
⑰ High-Point Calibration

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 Electrode Connecting

Press and twist to remove the BNC protective cap from the device and keep it properly (the BNC cap can be used for 0 mV calibration). Connect the electrode BNC plug by rotating it until fully secured to the meter. When connecting an aviation plug, align the red dot on the plug with the socket and insert until a “click” is heard, indicating it is locked in place.

3.2 Electrode Plug Selection

- The pH electrode uses a BNC plug and a 6-pin aviation plug.
- The conductivity electrode uses a 6-pin aviation plug — both are inserted into the corresponding central reserved socket on the device.
- The dissolved oxygen electrode uses a 6-pin aviation plug, connected to the leftmost reserved socket on the instrument.

3.3 Powering On the Device

Press and hold the “Power” key for 5 seconds until a “beep” sound is heard — the device will power on and automatically detect the connected electrodes.

Once detection is complete, the display shows:

Date, time, Bluetooth indicator, battery level, electrode type (pH, conductivity, dissolved oxygen), measured value, unit, temperature (°C), and data storage count.

Press the “Power” key briefly to turn on the backlight. The backlight automatically turns off after 10 seconds to conserve battery power.

3.4 Calibration

3.4.1 pH Calibration

The instrument supports 1-point, 2-point, and 3-point calibration using standard buffer solutions of pH 4.00, 6.86, and 9.18.

Temperature compensation for each buffer is automatically set in the device.

To calibrate:

1. Place the electrode into the buffer solution.
2. Press the “Calibration” key to enter calibration mode.
3. Press the “Mode” key to select the buffer type.
4. After selecting the appropriate buffer, press and hold “OK” until a “beep” confirms calibration is complete.

   For multi-point calibration, repeat the steps for the other buffers. If a wrong operation occurs, press “Return” to exit calibration mode.

3.4.2 Temperature Calibration

If there is a large deviation between the measured and actual temperature, calibrate the temperature sensor as follows:

Immerse the electrode in a stable medium (water/air) of known accurate temperature. In the temperature calibration interface, input the actual temperature and confirm to complete calibration.

3.4.3 Conductivity Calibration

The instrument supports 2-point calibration (LOW and HIGH) using standard conductivity solutions.

To calibrate:

1. Place the electrode in the standard solution.
2. Press “Calibration” to enter calibration mode.
3. Press “Mode” to select the standard solution.
4. After selection, press and hold “OK” until a “beep” confirms completion.

   Repeat for the second point if needed.

   If an error occurs, press “Return” to exit calibration mode.

3.4.4 Dissolved Oxygen Calibration

The instrument supports 2-point calibration:

- Air calibration (air-saturated water).
- Zero calibration (zero-oxygen water)

Before calibration, insert the electrode and allow it to polarize for 15–20 minutes. Press "Mode" to check the saturation value:

- If it is near 100%, calibration is not necessary.
- If deviation is large, perform Air Calibration.

3.4.4.1 Air Calibration

1) Check the probe membrane — if bubbles are present, gently flick or shake downward to remove them.
2) Place the probe in humid air close to 100% relative humidity (e.g., above a damp towel).
3) Ensure no water droplets are present on the membrane; if so, remove them with clean lint-free paper.
4) Leave the probe for at least 20 minutes until both dissolved oxygen and temperature readings stabilize.
5) Press "Calibration" to enter calibration mode, press "Mode" to select "AIR," then press and hold "OK" until a "beep" confirms completion.
6) Press "Mode" to view oxygen concentration and saturation after calibration.

3.4.4.2 Zero Calibration

During normal use and maintenance, zero drift rarely occurs. It is recommended to periodically verify zero using oxygen-free water, observing the readings without performing actual calibration. The procedure as below:

1) Power on and repeat the steps in 3.4.4.1 (Air Calibration).
2) Prepare a 5% sodium sulfite (Na_2SO_3) solution and stir well.
3) Immerse the electrode in the oxygen-free solution, ensure no air bubbles are on the membrane, and wait for stable readings (approx. 0.00 µg/L).
4) Then press "Calibration" to enter zero calibration mode, hold "OK", and confirm with a "beep."

3.5 Measurement

3.5.1 pH Measurement

Insert the pH electrode into the sample; the device will automatically start measurement. The indicator “pH” begins flashing, and the display will automatically read and show the sample’s pH value. When the flashing stops, the reading has stabilized. Press “Mode” to switch to the mV measurement mode.

3.5.2 Conductivity Measurement

Insert the conductivity electrode into the sample; the device will automatically start measurement. The indicator “Conductivity” begins flashing, and the display will automatically read and show the conductivity value of the sample. When the flashing stops, the reading has stabilized. Press “Mode” to switch between measurement modes such as resistivity, total dissolved solids (TDS), and salinity.

3.5.3 Dissolved Oxygen (DO) Measurement

Insert the DO electrode into the instrument, power on the device, and allow 15–20 minutes for polarization. After polarization is complete, immerse the electrode into the sample. The device will automatically start the measurement. The icon “DO” will remain steady, indicating that the DO electrode is in use. The display will automatically show the dissolved oxygen and temperature values. Wait for at least 20 minutes until the readings stabilize. Press “Mode” to switch display modes between oxygen saturation (%) and residual current (nA).

3.6 Data Storage

The instrument can store up to 999 measurement readings. Once the reading has stabilized, press “M+” to store the value. The screen will display M1 for the first stored record and M999 for the last one. When the memory is full, new readings will overwrite the oldest data automatically.

3.7 Viewing Stored Data

Press “MR” to recall the stored data from memory. Repeatedly pressing “MR” allows you to scroll through stored records (M1–M999). Press the “Return” key to return to the measurement screen.

3.8 Power Off and Storage

3.8.1 Power Off

After measurement, wipe the instrument body and probe surface with a clean tissue (avoid touching the DO membrane). Reattach the protective cap. Long-press the “Power” key for 3 seconds to shut down the device.

3.8.2 Instrument Storage

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

- pH electrode: Screw into the protective bottle containing storage solution (saturated KCl) to keep the electrode tip immersed in the liquid.
- Conductivity electrode: Wipe dry and store normally.
- Dissolved oxygen electrode: Store in a protective bottle with a moist sponge.

If the instrument is not used for 1–2 months, it is recommended to power on weekly to check stability and test with standard solutions monthly to maintain electrode performance.

For long-term storage (several months), drain and dry the electrolyte from the DO electrode before placing it into its protective cap, and remove the batteries from the instrument.

4. Maintenance and Care

Do not disassemble the instrument housing**.** The meter requires no special maintenance—only occasional cleaning of the outer casing with a damp cloth and replacement of depleted batteries.

The housing is made of ABS/PC (Acrylonitrile Butadiene Styrene / Polycarbonate). This material may be attacked by certain organic solvents such as toluene, xylene, and methyl ethyl ketone (MEK). If any of these solvents accidentally contact the housing, wipe them off immediately.

4.1 pH Electrode Maintenance

Always ensure that the pH electrode is stored in an appropriate filling solution. To maintain the highest measurement accuracy, remove any filling solution crystallized or attached on the electrode surface using distilled water. Always store the electrode according to the manufacturer's instructions—never allow it to dry out.

If the electrode slope drops rapidly or response time becomes slow, try one of the following treatments depending on the type of contamination:

Problem	Solution
Contamination by grease or oil	Wipe the membrane with cotton soaked in acetone or mild soap solution to remove grease.
Dried pH membrane	Immerse the electrode tip in 0.1 M HCl solution overnight.
Protein contamination in the diaphragm	Immerse the electrode in a pepsin–HCl cleaning solution to remove protein deposits.
Silver sulfide contamination	Immerse the electrode in a thiourea solution to remove silver sulfide deposits.

Note: After any of the above treatments, recalibrate the electrode before use. Handle all cleaning and filling solutions according to the safety regulations for toxic or corrosive materials.

4.2 Conductivity Electrode Maintenance

4.2.1 Cleaning Before and After Measurement

a) Prevent residual solution from contaminating subsequent samples or interfering with signal transmission.

b) For routine solutions: Rinse the electrode with distilled or deionized water and gently blot dry using a soft clean cloth (e.g., lens paper). Avoid scratching the surface.

c) For concentrated or viscous samples: After measuring strong acids, strong alkalis, oily samples, or saline water (e.g., seawater, brine), rinse first with ethanol or a dilute acid (e.g., 0.1 mol/L HCl), then thoroughly rinse with distilled water.

d) For special contaminants:

– For organic residues (oils), wipe gently with acetone.

– For inorganic crystal deposits, soak in warm water to dissolve, then rinse clean.

4.2.2 Avoid Mechanical Damage

Handle the electrode carefully. Avoid dropping or striking it against hard surfaces.

4.2.3 Storage Requirements

- Non-platinized electrodes: Store in a dry environment.
- Platinized electrodes: After cleaning, immerse in distilled water and replace the water weekly.

4.2.4 Regular Calibration

- For routine use: Calibrate once per week.
- For frequent use: Calibrate every 2–3 days.

4.2.5 Electrode Activation (for platinized platinum electrodes)

If the platinum black layer has detached, or the electrode responds slowly or inaccurately, activate it as follows:

a) Prepare a 10% dilute hydrochloric acid or special electrode activation solution.

b) Immerse the electrode for 10–15 minutes, then rinse thoroughly with distilled water.

c) If the performance does not improve, the electrode may require re-platinization at

the factory.

4.2.6 Common Issues and Troubleshooting

Problem	Possible Cause	Solution
Unstable readings	Contaminated surface or poor connection	Clean electrode; check cable and connector.
Large measurement deviation	Aging electrode or calibration expired	Recalibrate or replace electrode.
Slow response	Detached platinum black layer or high solution viscosity	Reactivate electrode or dilute sample (if compatible).
Precipitate at electrode bottom	Salt crystal formation	Soak in warm water to dissolve, then rinse clean.

4.2.7 Maintenance Precautions

- Do not touch the sensing end with bare hands to avoid contamination by oils or sweat.
- Do not dry the electrode using heat; high temperature may deform plastic or oxidize platinum.
- Do not use ultrasonic cleaners, which may damage internal structures or remove the platinum black layer.

4.3 Dissolved Oxygen (DO) Electrode Maintenance

Check and maintain the DO electrode under the following conditions:

a) Zero point drift (abnormally high readings in oxygen-free water);

b) Slower response time;

c) Shortened working life after membrane replacement.

Solutions:

- If the electrode is not filled with electrolyte, hold the probe downward and gently tap to allow the electrolyte to flow and fill the cavity.
- If tapping does not help, the membrane may have shifted, been punctured, or ruptured—replace the membrane.
- After long-term use, the electrode surface may accumulate microorganisms or other deposits. During membrane replacement, perform a deep cleaning using

one of the following methods:

1. Gently wipe the gold electrode surface with an alcohol wipe, then refill with fresh electrolyte.
2. Fill the electrode chamber with electrolyte, shake it out, then refill. Repeat at least twice.
3. Remove the membrane cap, install the calibration cap, immerse the probe in a beaker containing ultrapure water (or analytical-grade ethanol), and rinse three times before repeating step 2.

5. Packing List

Item	Number
Portable Electrode Method Water Quality Analyzer	1
pH Electrode	1
Conductivity Electrode	1
Dissolved Oxygen Electrode	1
Power Cable	1
User Manual	1
Certificate of Conformity	1
Warranty Card	1

6. Appendix

5.1 pH Values of Standard Buffer Solutions at Different Temperatures

Temperature (°C)	Oxalate Buffer	Tartrate Buffer	Phthalate Buffer	Phosphate Buffer	Borate Buffer	Calcium Hydroxide Buffer
0	1.67	N/A	4.00	6.98	9.46	13.42
5	1.67	N/A	4.00	6.95	9.40	13.21
10	1.67	N/A	4.00	6.92	9.33	13.00
15	1.67	N/A	4.00	6.90	9.27	12.81
20	1.68	N/A	4.00	6.88	9.22	12.63
25	1.68	3.56	4.01	6.86	9.18	12.45
30	1.69	3.55	4.01	6.85	9.14	12.30
35	1.69	3.55	4.02	6.84	9.10	12.14
40	1.69	3.55	4.04	6.84	9.06	11.98

5.2 Conductivity Values Corresponding to Potassium Chloride (KCl) Concentration

Solution Code	Approximate Concentration (mol/L)	Conductivity (S/cm)				
		15℃	18℃	20℃	25℃	35℃
A	1	0.09212	0.0978	0.1017	0.11131	0.1311
B	0.1	0.010455	0.011163	0.011644	0.012852	0.015353
C	0.01	0.0011414	0.00122	0.0012737	0.0014083	0.0016876
D	0.001	0.0001185	0.0001267	0.0001322	0.0001465	0.0001765