Phosphate Analyzer

User

Manual

CONTENT

1 Overview

This phosphate analyzer is one of the laboratory photoelectric colorimetric analytical instruments produced by our company, mainly used for the analysis and detection of phosphate content in water. The instrument housing is made of stainless steel, featuring high durability and water resistance.

The display adopts a high-resolution 480×272 dot matrix color LCD module. All data, interfaces and operation prompts are displayed in Chinese, with the characteristics of easy understanding and simple operation; the measured values can be saved as required.

1.1 Instrument Appearance

See Figure 1-1 for the instrument appearance. The phosphate analyzer consists of a main unit, power cord, drain pipe and sample cup (with bracket).

Figure 1-1

1.2 Applicable Standard

It refers to the national standard GB/T 6913-2007 *Analytical Methods for Boiler Water and Cooling Water* - Determination of Phosphate.

1.3 Main Functions and Features

(1) The instrument adopts an imported monochromatic cold light source, with excellent performance, stable signal, low power consumption and long service life.

(2) The measured data is direct-reading for easy reading.

(3) It is equipped with a unique blank calibration function that only requires pure water to complete blank calibration, greatly simplifying the calibration process.

(4) The concise full-Chinese prompt menu is easy to understand and operate.

(5) Press the storage key on the measurement interface, and the instrument will automatically store the phosphate concentration value and time on the measurement interface, with a storage capacity of 256 sets of data.

(6) It displays the current time to provide a time reference for the recording function.

Notes:

1. The product manual must be read in detail before operating the instrument.

2. All values in the pictures of this manual are illustrative examples and shall not be used as reference data.

3. In case of any discrepancy between the manual and actual operation, the instrument shall prevail.

2 Technical Specifications

Display: 480×272 dot matrix LCD, Chinese display

Repeatability: ≤ 1%

Measurement Range: (0.00～20.00) mg/L; (0.00～50.0) mg/L (optional)

Indicated Value Error: ±2%F.S

Resolution: 0.01mg/L

Stability: ±1%F.S/4h

Ambient Temperature: (5～45)℃

Ambient Humidity: ≤ 90%RH (no condensation)

Overall Dimension: 400mm×180mm×260mm

Power Supply: AC (220±22) V, Frequency (50±1) Hz

Power: 30W

Weight: 4kg

3 Working Principle

In an acidic medium, phosphate in the water sample reacts with vanadium molybdate to form a yellow phosphovanadomolybdate complex, and then the phosphate content is determined by the phosphate analyzer.

The instrument measures based on the photoelectric colorimetric principle. According to the Lambert-Beer Law: When a beam of monochromatic parallel light passes through a colored solution, part of the light energy is absorbed by the solution. If the thickness of the liquid layer remains unchanged, the degree of light energy absorption (absorbance A) is proportional to the concentration of the colored substance in the solution.

Its mathematical expression:

$$\lg \frac{I_0}{I} = K \cdot C \cdot L \text{ 或 } A = K \cdot C \cdot L$$

I0 — Incident light intensity

I— Transmitted light intensity

C — Concentration of colored substance

L — Thickness of colored solution

K — Constant (related to solution properties and incident light wavelength)

A — Absorbance

4 Instrument Installation

4.1 Accessory Inspection

After unpacking, check the instrument model, specification and the quantity of accessories according to the packing list. The accessories are listed in Table 1:

Name	**Model**	**Unit**	**Quantity**
Phosphate Analyzer	-	Set	1
Power Cord	-	Piece	1
Fuse	-	Piece	2
Drain Pipe	-	Meter	1
Sample Cup and Bracket	-	Set	1
Phosphate Standard Solution	-	Bottle	2
Operation Manual	-	Copy	1
Certificate of Conformity	-	Copy	1
Warranty Card	-	Copy	1

Notes:

1. Open the instrument packing box and check for damage to the instrument;

2. Verify the instrument model and accessories against the packing list.

4.2 Instrument Installation

1. Location Requirements

(1). The instrument shall be placed on a flat, clean and dust-free workbench;

(2). The installation location of the instrument shall be free from large vibrations;

(3). The instrument shall be placed away from harmful gases or areas with liquid dripping;

(4). Ensure that the power cord does not come into contact with high-temperature or abrasive objects.

2. Instrument Mounting

(1). Place the instrument steadily on the workbench, take out the instrument reagent cup assembly from the packing box, then loosen the fastening screw of the reagent cup bracket counterclockwise and remove the bracket, as shown in Figure 4.2.1:

Figure 4.2.1

2. Reverse the bracket by 180° and fasten it with the removed screw, as shown on the left of Figure 4.2.2; when installing the bracket, note that the side of the reagent cup cover with screws shall face left to facilitate reagent addition, as shown on the right of Figure 4.2.2:

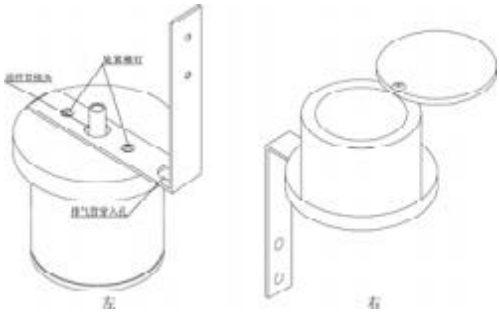

Figure 4.2.2

3. Connect the power cord to the AC 220V three-pin socket of the instrument; the instrument shall have a good grounding condition. After all preparations are completed, turn on the power switch of the instrument to start up, as shown in Figure 4.2.3:

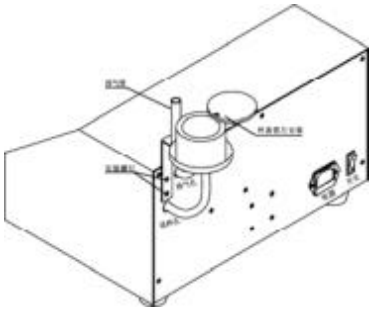

Figure 4.2.3

5 Instrument Operation

5.1 Display Description

After connecting the instrument power supply and turning on the power switch, a welcome screen will appear first, as shown in Figure 5.1.1:

Figure 5.1.1 (Phosphate Analyzer)

The main measurement interface will be entered after 2 seconds, as shown in Figure 5.1.2:

Figure 5.1.2

5.2 Key Description

There are 8 operation keys in total, as shown in Figure 5.2.1, which are: Up, Down, Left, Right, Return, Confirm, Drain, Store.

Figure 5.2.1 (Drain / Return / Store/ Confirm)

Up Key: Move the cursor up by one grid / Increase the value by one in digital mode;

Down Key: Move the cursor down by one grid / Decrease the value by one in digital mode;

Left Key: Move the cursor left by one grid;

Right Key: Move the cursor right by one grid;

Return Key: Enter menu options / Return to the upper interface / Exit the current operation;

Confirm Key: Enter the selected menu item in the menu interface / Save the current modification;

Drain Key: Discharge the measured water sample from the instrument;

Store Key: Store the currently displayed value on the measurement interface.

5.3 Function Menu and Settings

1. Operations on Main Measurement Interface

(1) Reagent Addition Timing

Since the addition of reagents during water sample color development requires a reaction waiting time, this function is set on the instrument.

Figure 5.3.1

On the interface of Figure 5.3.1, press the Confirm key directly to enter the reagent addition timing interface, as shown in Figure 5.3.2:

Note: Normally, after startup, the cursor automatically stays on the Reagent Addition Timing option; if not, move the cursor with the direction keys of the instrument.

Figure 5.3.2

On the interface of Figure 5.3.2, press the Confirm key and the instrument will enter the 180-second countdown interface (3 minutes of waiting is required after adding reagents), as shown in Figure 5.3.3:

Figure 5.3.3

When the countdown ends, the instrument displays "000" for timing, the buzzer starts automatically and keeps ringing continuously, as shown in Figure 5.3.4:

Figure 5.3.4

When the countdown ends, the instrument displays "000" for timing and the buzzer rings continuously. At this time, press the Confirm key to exit the timing interface and return to the main measurement interface (if the timing is not completed automatically, press the Confirm key directly to end the timing), as shown in Figure 5.3.5:

Figure 5.3.5

(2) Blank Calibration

This function is mainly used to correct the instrument's electrical drift, optical drift, temperature drift, etc., to ensure the accuracy of measured data.

Note: The user does not need to perform curve calibration frequently, only blank calibration in daily use is required.

On the interface of Figure 5.3.5, press the Down key to move the cursor to the Blank Calibration option, and press the Confirm key to enter the blank calibration interface, as shown in Figure 5.3.6:

Figure 5.3.6

On the interface of Figure 5.3.6, follow the prompts on the right side of the interface, add high-purity water or secondary distilled water from the instrument sample cup, wait for a moment after the instrument overflows, then press the Drain key to discharge the water. Repeat the operation three times and press the Confirm key to enter the next interface, as shown in Figure 5.3.7:

Figure 5.3.7

On the interface of Figure 5.3.7, follow the prompts on the right side of the interface, add high-purity water or secondary distilled water from the instrument sample cup, wait for a moment after the instrument overflows, then press the Confirm key to enter the next interface, as shown in Figure 5.3.8:

Figure 5.3.8

On the interface of Figure 5.3.8, press the Confirm key to enter the next interface, as shown in Figure 5.3.9:

Figure 5.3.9

The number displayed on the interface of Figure 5.3.9 is the voltage value detected at this time. After the voltage value is stable (generally, the fluctuation is no more than ±3mV), press the Confirm key to complete the blank calibration and automatically return to the measurement interface.

(3) Data Storage

On the interface of Figure 5.3.5, press the Store key, the words "Storage Successful" will be prompted at the top of the LCD screen and the data will be stored in the instrument's data records for viewing, as shown in Figure 5.3.10:

Figure 5.3.10

(4) Instrument Drainage

On the interface of Figure 5.3.5, press the Drain key, the instrument will automatically discharge the measured water sample, and the drainage time will be displayed in the upper left corner (10s drainage countdown). The interface will automatically return to the measurement interface after the countdown ends, as shown in Figure 5.3.11:

Figure 5.3.11

2. Operations on Main Menu

On the interface of Figure 5.3.5, press the Return key to enter the instrument's main menu interface, as shown in Figure 5.3.12:

Figure 5.3.12

(1) Parameter Setting

On the interface of Figure 5.3.12, press the Confirm key to enter the parameter setting menu, as shown in Figure 5.3.13:

Figure 5.3.13

Instrument Time

On the interface of Figure 5.3.13, press the Down direction key to move the cursor to the Instrument Time option, and press the Confirm key to enter the instrument time correction interface, as shown in Figure 5.3.14:

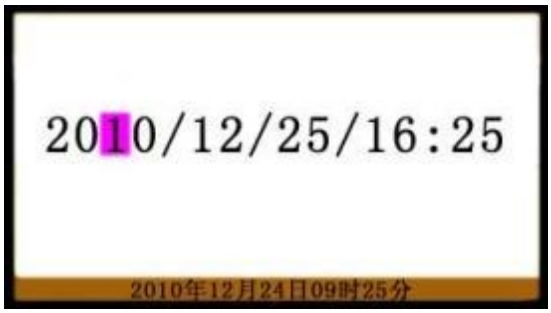

Figure 5.3.14

(2) Instrument Calibration

The instrument must be subjected to curve calibration when used for the first time or not used for a long time. This function can realize the calibration of the instrument. For the specific method, please refer to the Instrument Calibration section in the next chapter.

(3) Instrument Information

On the main menu (Figure 5.3.12), move the cursor to the Instrument Information option and press the Confirm key to enter, where the manufacturer information and software version can be viewed, as shown in Figure 5.3.15:

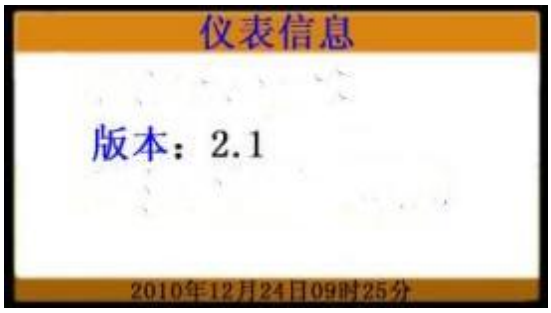

Figure 5.3.15

Note: This information can only be viewed and cannot be modified.

(4) Data Records

On the main menu (Figure 5.3.12), move the cursor to Data Records and press the Confirm key to enter the data record viewing interface. This item mainly provides viewing of stored data, as shown in Figure 5.3.16:

Figure 5.3.16

(5) Operation Records

Figure 5.3.17

On the main menu (Figure 5.3.12), move the cursor to the Operation Records option and press the Confirm key to enter the operation record viewing interface. Various operation records of the instrument such as startup, shutdown, time modification, instrument calibration can be viewed here, and the records are generated automatically, as shown in Figure 5.3.17:

(6) Calibration Records

On the main menu (Figure 5.3.12), move the cursor to the Calibration Records option and press the Confirm key to enter the calibration record viewing interface, where the instrument calibration records can be viewed and generated automatically, as shown in Figure 5.3.18:

Figure 5.3.18

Note: In the instrument's data records, operation records and calibration records, the last stored data is displayed in the first line. Press the Up and Down keys to view more data. The instrument can store a maximum of 256 records. If the number exceeds 256, the oldest data will be overwritten circularly. When there are no records in the instrument, press the Confirm key to display "No Records".

6 Instrument Calibration

6.1 Instrument Calibration

The instrument must be subjected to curve calibration when used for the first time or not used for a long time to ensure the accuracy and reliability of measured data.

After preparing the colored standard solution, press the Return key to enter the instrument's main menu, as shown in Figure 6.1.1:

Figure 6.1.1

Notes:

(1) For the preparation method of the standard solution and other solutions required for instrument calibration, please refer to the Solution Preparation section in the Appendix of Chapter 9.

(2) The two-point calibration method is usually used for instrument calibration, i.e., calibrating two concentration points of 0mg/L and 20mg/L.

On the interface of Figure 6.1.1, press the Down key to move the cursor to the Instrument Calibration menu, and press the Confirm key to enter the instrument blank calibration interface, as shown in Figure 6.1.2:

Figure 6.1.2

On the interface of Figure 6.1.2, press the Confirm key to enter the next interface, as shown in Figure 6.1.3:

Figure 6.1.3

On the interface of Figure 6.1.3, follow the prompts on the right side of the interface, add high-purity water or secondary distilled water from the instrument sample cup, wait for a moment after the instrument overflows, then press the Drain key to discharge the water. Repeat the operation three times and press the Confirm key to enter the next interface, as shown in Figure 6.1.4:

Figure 6.1.4

On the interface of Figure 6.1.4, follow the prompts on the right side of the interface, add high-purity water or secondary distilled water from the instrument sample cup, wait for a moment after the instrument overflows, then press the Confirm key to enter the next interface, as shown in Figure 6.1.5:

Figure 6.1.5

On the interface of Figure 6.1.5, follow the prompts on the instrument interface. After the voltage value is stable (generally, the fluctuation is no more than ±3mV), press the Confirm key and the cursor will automatically jump to the Calibration Standard Solution 1 option, as shown in Figure 6.1.6:

Figure 6.1.6

On the interface of Figure 6.1.6, prepare Standard Solution 1 (the default value of the instrument is 0mg/L and cannot be modified), then press the Confirm key to enter the Standard Solution 1 calibration interface, as shown in Figure 6.1.7:

Figure 6.1.7

On the interface of Figure 6.1.7, add the standard solution 1 with a concentration of 0mg/L from the sample cup until the instrument's drain pipe overflows, press the Drain key to discharge the standard solution 1, repeat the above operation 1-2 times, then add the standard solution 1 from the sample cup again, and press the Confirm key to enter the Standard Solution 1 calibration interface, as shown in Figure 6.1.8:

Figure 6.1.8

On the interface of Figure 6.1.8, follow the prompts on the right side of the interface, add high-purity water or secondary distilled water from the instrument sample cup, wait for a moment after the instrument overflows, then press the Confirm key to enter the next interface, as shown in Figure 6.1.9:

Figure 6.1.9

On the interface of Figure 6.1.9, after the voltage value is stable (generally, the fluctuation is no more than ±3mV), press the Confirm key to complete the calibration of Standard Solution 1 (0mg/L), and the cursor will automatically jump to the Calibration Standard Solution 2 option, as shown in Figure 6.1.10:

Figure 6.1.10

On the interface of Figure 6.1.10, press the Confirm key to enter the following interface, as shown in Figure 6.1.11:

Figure 6.1.11

Prepare Standard Solution 2 (the concentration can be modified arbitrarily, the default is 20mg/L. If you want to modify the concentration of Standard Solution 2 at this time, change the number 20 to the desired value with the direction keys), then press the Confirm key to enter the following interface, as shown in Figure 6.1.12:

Figure 6.1.12

On the interface of Figure 6.1.12, add the standard solution with a concentration of 20.00mg/L from the sample cup, press the Drain key to discharge the standard solution, repeat the above operation 1～2 times, then add the standard solution 2 from the sample cup again, and press the Confirm key to enter the Standard Solution 2 calibration interface, as shown in Figure 6.1.13:

Figure 6.1.13

On the interface of Figure 6.1.13, after the voltage value is stable (generally, the fluctuation is no more than ±3mV), press the Confirm key to complete the calibration of Standard Solution 2 (20mg/L). The instrument will automatically return to the main menu, and press the Return key to return to the measurement interface.

6.2 Water Sample Measurement

1. Color Development Method for Water Samples

Take 100mL of the water sample to be colored and pour it into a plastic cup, add 10mL of ammonium metavanadate solution, mix well and let stand for 3 minutes, then it can be used for measurement.

2. Measurement Method for Water Samples

(1). Perform blank calibration on the instrument before measuring the water sample, and then measure the water sample after the blank calibration is completed.

(2). On the main measurement interface, press the Drain key directly to discharge the water sample remaining in the instrument, then add the colored water sample to be tested directly into the sample cup until the drain pipe overflows, then drain the water. Repeat the above operation 2～3 times, then add the colored water sample to be tested until the drain pipe overflows, and read the value after the displayed value is stable.

Note: Perform blank calibration on the instrument before each water sample measurement, and then conduct the sample measurement.

7 Attention

1. Do not open and repair the instrument by yourself when there is an obvious fault; contact the manufacturer in a timely manner.

2. If there is no display when the instrument is turned on, check whether the fuse at the three-pin power cord interface on the back of the instrument (Figure 7.1) is intact; if the fuse is broken, replace it.

Note: The instrument is equipped with a spare fuse at the factory, located at the position shown in Figure 7.1. The fuse can be replaced only by taking out the fuse holder.

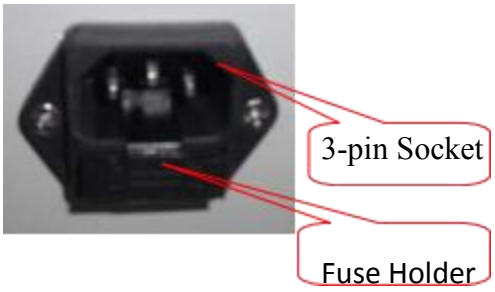

Figure 7.1 (Fuse Holder)

3. In case of any discrepancy between the manual and actual operation, the instrument shall prevail.

4. All reagents shall be stored in specially marked polyethylene plastic bottles. Before use, they must be thoroughly cleaned with detergent and water, and then rinsed several times with high-quality deionized water. All reagents shall be of analytical grade or higher and within the shelf life.

5. The Grade II reagent water used for preparing the solution must be high-purity pure water to minimize the measurement error caused by the contamination of Grade II reagent water.

6. If too much phosphate standard solution or color developing reagent is poured into the sample cup, the calibration solution shall be poured out, and the sample cup and the utensils used for preparing the solution shall be cleaned before preparation again.

7. Flush the sample injection system of the instrument with high-purity water after each instrument calibration. When no test is performed, the sample injection system of the instrument shall be filled with high-purity water to keep it moist.

8. When no test is performed, the instrument shall be placed in a dry environment to avoid unstable measurement caused by moisture.

8 Troubleshooting of Common Instrument Faults

Fault Phenomenon	**Fault Diagnosis**	**Troubleshooting Method**
1. No display when the instrument is turned on	1) Power not connected 2) Power fuse blown	1) Check if the power cord is connected 2) Replace the fuse (be sure to cut off the power first)
2. Unstable digital display	1) Short preheating time of the instrument 2) Unstable external voltage 3) Poor grounding of the	1) Improve the working environment of the instrument 2) Improve the grounding status of the instrument
3. Measured value is too high or too low	1) Contamination of the measurement system 2) Electrical drift	1) Flush the instrument measurement flow path with high-purity water 2) Perform curve calibration on the instrument

Fault Phenomenon	Fault Diagnosis	Troubleshooting Method
4. Poor drainage of the instrument	1) Clogged drainage connector 2) Folded drainage pipe	1) Flush the instrument measurement flow path with high-purity water 2) Check if the drainage pipe is folded

9 Solution Preparation

Caution: Use concentrated sulfuric acid with care. Especially when diluting concentrated sulfuric acid, add concentrated sulfuric acid slowly into water!

9.1 Preparation of Color Developing Reagent (Ammonium Vanadomolybdate Solution)

① Weigh 50g of ammonium molybdate and 2.5g of ammonium metavanadate and dissolve them in 400mL of demineralized water.

② Measure 195mL of concentrated sulfuric acid (specific gravity 1.84), add it slowly to 250mL of demineralized water with constant stirring, and cool to room temperature.

③ Add solution ② to solution ① and dilute to 1L with demineralized water.

All reagents shall be stored in specially marked polyethylene plastic bottles.

9.2 Phosphate Stock Solution (1mg/mL)

Weigh 1.433g of potassium dihydrogen phosphate dried at 105℃, dissolve it in a small amount of demineralized water, shake well and dilute to 1L.

9.3 Preparation of Calibration Solution (i.e., Standard Solution for Instrument Calibration)

Notes:

(1) The instrument is equipped with a bottle of 1mg/mL phosphate standard solution at the factory.

(2) The calculation formula for taking the 1mg/mL phosphate standard solution is as follows:

Cs×Vs=Ct×Vt

Cs— Concentration of phosphate standard solution (10μg/mL or 100μg/mL);

Vs— Volume of phosphate standard solution to be taken;

Ct — Concentration of the standard solution to be prepared;

Vt— Volume of pure water to be taken.

Preparation Method:

Take the preparation of 100mL standard solution with a concentration of 20mg/L as an example:

Note: According to Formula 1 above, 2mL of 1mg/mL phosphate standard solution is required for 100mL of water sample to be colored.

<1> First, inject a small amount of high-purity water into a 100mL volumetric flask, then take 2mL of 1mg/mL phosphate standard solution with a pipette and add it to the high-purity water, shake well and dilute to 100mL with high-purity water.

<2> Add 10mL of ammonium vanadomolybdate solution to the 100mL water sample prepared in <1> above, shake well and let stand for 3 minutes. The calibration solution preparation is completed.

Notes:

(1) The preparation method of calibration solutions with other concentrations is the same as above.

(2) The addition ratio of the color developing reagent is 10mL of ammonium vanadomolybdate solution for every 100mL of water sample.

About Zhongke Tk

Zhongke Tk (Shandong) Intelligent Technology Co., Ltd.

Founded in 2015, headquartered in Jinan, Shandong, is a high-tech enterprise specializing in the R&D, production, sales and service of water quality analysis equipment.

The company has a professional R&D team. With profound expertise and rich practical experience, team members continuously drive innovation and progress in water quality analysis technology, ensuring products remain at the industry-leading level.

Zhongke Tk's products cover various water quality analyzers, including pH meters, conductivity meters, dissolved oxygen meters, multiparameter water quality analyzers, etc. The company also provides customized solutions, tailoring suitable water quality analysis equipment and monitoring plans according to customer requirements.

Adhering to the business philosophy of "Technology Innovation, Quality First, Service Supreme", Zhongke Tk continuously improves product quality and service, provides customers with suitable water quality equipment and solutions, and contributes to the development of the water quality analysis industry.

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