Two-Wire Industrial PH Transmitter

Instruction Manual

Table of contents

Chapter 1 Overview

The explosion-proof two-wire industrial pH transmitter is one of our company's intelligent online chemical analyzers. Its strong environmental adaptability, ease of operation, and excellent testing performance make it highly cost-effective, accurately measuring the pH value of solutions. It can be widely used for continuous pH monitoring of solutions in thermal power plants, chemical fertilizer plants, metallurgical plants, environmental protection plants, pharmaceutical plants, biochemical plants, food processing plants, and tap water treatment plants. The transmitter uses a cast aluminum housing with excellent sealing performance and a protection rating of up to IP67, making it particularly suitable for harsh industrial environments where prolonged personnel presence is not advisable.

The transmitter uses a two-wire, 24VDC power supply, simplifying wiring. It can output 4-20mA to supply display, recording, control, and regulating instruments or PLC, DCS, and FCS systems.

1.1 Basic Functions

High Intelligence: The explosion-proof industrial pH/ORP transmitter employs high-precision AD conversion and single-chip microprocessor technology, enabling it to perform multiple functions such as pH measurement, temperature measurement, automatic temperature compensation, and instrument self-testing.

High Reliability: Highly integrated components eliminate complex function switches and adjustment knobs.

Strong Anti-interference Capability: Utilizing the latest components, its impedance reaches up to $10^{12}\Omega$; the current output exhibits strong anti-interference capability, enabling long-distance transmission. It also possesses excellent electromagnetic compatibility.

Waterproof and Dustproof Design: IP67 protection rating, suitable for outdoor use.

25℃ Conversion: A 25℃ reference temperature conversion is performed for pure water and ammonia-added ultrapure water, enabling the display of pH values at 25℃. This is particularly suitable for measuring low-conductivity water qualities such as demineralized water in power plants or chemical plants.

Chapter 2 Technical Specifications

2.1 Technical Specifications

1.Measurement range: pH: 0–14.00 pH, resolution: 0.01 pH;

Temperature: 0–100℃, resolution: 0.3℃;

2. Automatic temperature compensation range: 0 ～ 100℃, with 25℃ as the reference;

3. Test water sample: 0～130℃ (depending on the electrode), 0.3MPa;

4. Stability: ±0.02pH/24h;

5. Input impedance: $\geq 10^{12}\Omega$;

6. Current output: 4 ～ 20mA; Input, output, and power supply triple isolation (powered through a safety barrier);

7. Output current error: ≤±0.5%FS; Analog signal load <=500ohm;

8. Protection rating: IP65, up to IP67;

9. Class: ExiaIIBT6 Ga;

10. Operating conditions: Ambient temperature: -25 ～ 85℃; Relative humidity: <85%;

11. Intrinsically safe parameters: Ui=28VDC, Ii=93mA, Pi=0.65W, Ci=0. 0.44μF, Li=0mH

12. Dimensions: 82.5 x 108 mm (W x D)

13. Installation method: Tube mounting, wall-mounted

Chapter 3 Instrument Installation

Installation shall be carried out in accordance with the relevant provisions of GB3836.15-2010 "Electrical Apparatus for Explosive Gas Atmospheres - Part 15: Electrical Installations in Hazardous Locations (excluding Coal Mines)".

3.1 Unboxing

The PH2000 explosion-proof industrial pH transmitter consists of four parts: pH transmitter, pH electrode, pH calibration solution, and connecting cable.

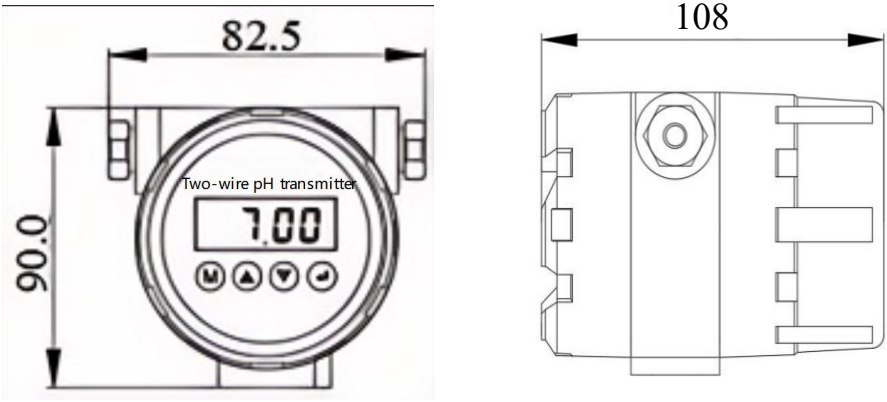
After unpacking, please check the quantity, specifications, and accessories of the instruments against the packing list, including the following:

1. Explosion-proof transmitter (one unit)
2. pH electrode (one unit)
3. Instruction manual (one copy)
4. Packing list (one copy)
5. Certificate of conformity (one copy)
6. pH standard buffer solution (one set)

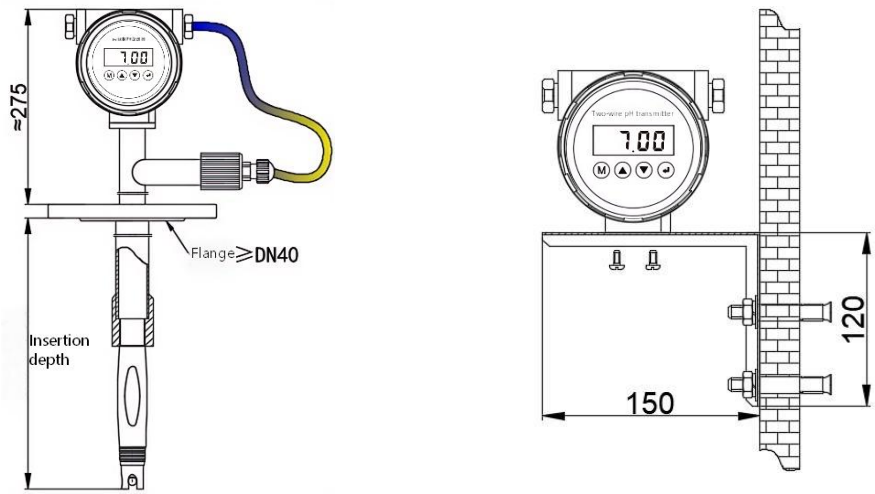
If there is any damage, incorrect quantity, or non-compliance with specifications, please contact the company or the seller.

3.2 Transmitter Installation

The PH2000 explosion-proof transmitter can be installed separately from the electrode mounting structure or as a single unit. When installed separately, the transmitter can be fixed to the pipeline or wall using the mounting accessories provided by our company, depending on the site conditions. Details are as follows:



Transmitter dimensions, integrated structure



Integrated mounting structure

Bracket mounting structure

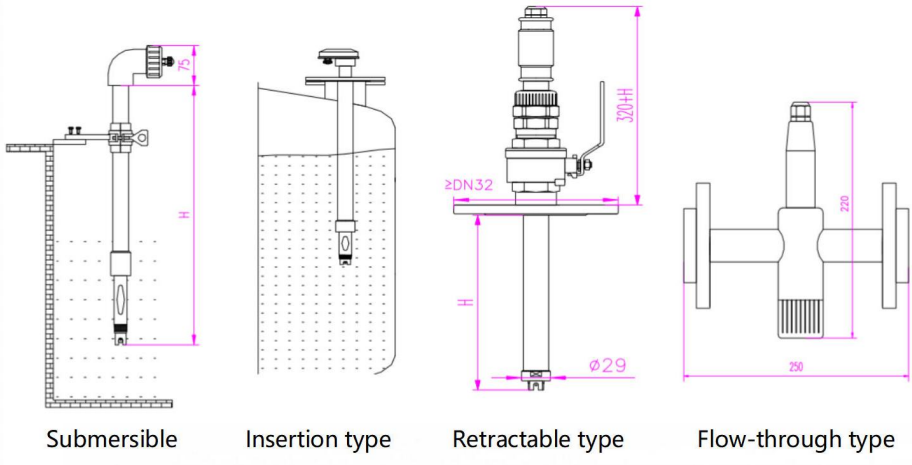
3.3 Installation Precautions

1. The distance between the transmitter and the electrode should be as close as possible. Generally, it should not exceed 20 meters. If it exceeds 20 meters, an impedance converter should be installed to reduce signal loss due to the long transmission distance and ensure measurement accuracy.

2. The connecting cable between the electrode and the transmitter should not be laid parallel to AC power lines, power cables, or other RF communication cables at close range to avoid adverse effects on the signal.

3.4 Installation of pH Electrode

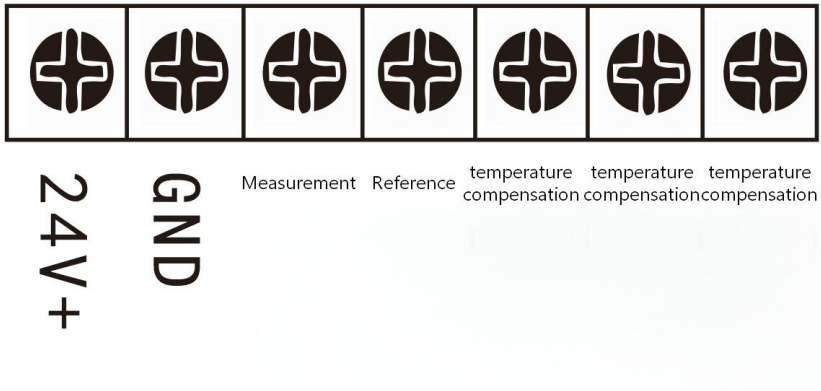
Sensors equipped with pH electrodes can be installed in various structural forms, including submersible, insertion, telescopic, and flow-through types.



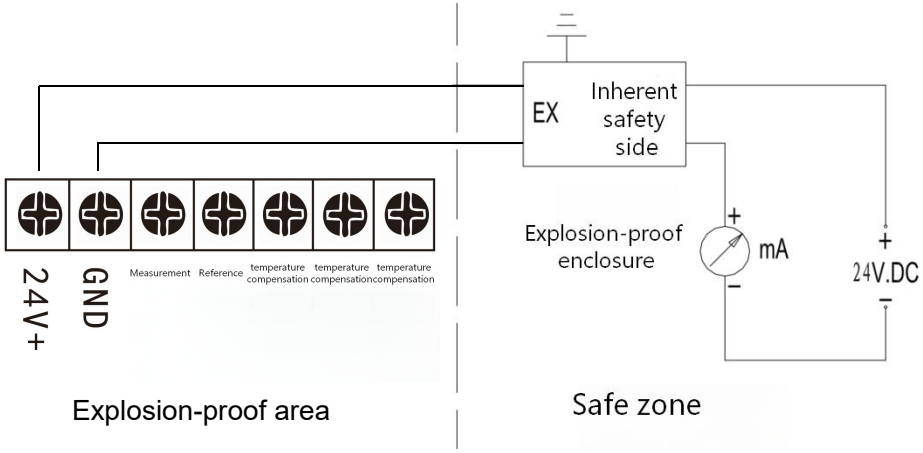
Chapter 4 Electrical Wiring

4.1 Transmitter Wiring

When wiring, open the transmitter cover; the terminal block indicates the wiring method. See the diagram below for transmitter wiring instructions:



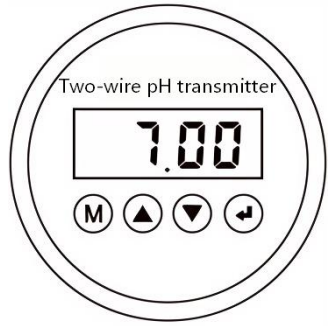
4.2 Intrinsically Safe Wiring Diagram



Chapter 5 Basic Operation of Instruments

5.1 Function Operation Instructions

This explosion-proof pH transmitter features an LED digital display for clear visibility on-site. The panel has four buttons, described below:



The main functions of the instrument include: pH calibration, temperature compensation setting, manual temperature compensation setting, 20mA current output calibration, and 4mA current output calibration.

5.2 Button Instructions

M	Menu key/Return to Home key
▲	Up key: Increases the numerical value of a number
▼	Down key: Decreases the numerical value of a number
↵	OK key:

5.3 Button Function Description

Short press M: Return to measurement display interface

Long press M: Enter calibration mode

Short press ▲: Adjust parameter +

Long press ▲: Display current temperature.

Short press ▼: Adjust parameter -

Long press ▼: Query current software version

Short press ↵: Confirm

Long press ↵: Display current output value

Keyboard shortcuts M+▲: Enter temperature compensation mode settings

Keyboard shortcuts M+▼: Enter manual temperature setting

Keyboard shortcuts ▲+↵: Enter 4mA output calibration state

Keyboard shortcuts ▼+↵: Enter 20mA output calibration state

Keyboard shortcuts ▲+▼: Enter pH compensation value settings

5.4 Menu Interface Code Overview

The first display upon power-on is the main page, which shows the currently measured pH value.

Display	7--4	7--9	P1-0	P1-1	⊢ 25.0	C20.0	C04.0
Description	Two-point calibration at 6.86 and 4.01	Two-point calibration at 6.86 and 9.18	Manual temperature mode	Automatic temperature mode	Manual temperature setting	20mA current calibration	4mA current calibration

5.5 Calibration

Because the zero potential of each pH electrode is not exactly the same, and the conversion coefficient (i.e., slope) of the electrode to the pH value of the solution cannot be precisely achieved to the theoretical value, there is a certain degree of error. More importantly, the zero potential and slope will continuously change during use, resulting in aging. Therefore, it is necessary to periodically

determine the actual zero potential E0 and slope S of the electrode by measuring a standard buffer solution, i.e., to perform "calibration". This table shows two methods: one-point standard solution calibration and two-point standard solution calibration.

When using the electrode for the first time, it must be calibrated with two-point standard solution, and then calibrated periodically thereafter. To ensure the measurement accuracy of the instrument, two-point standard solution calibration is also necessary.

The following three points should be noted during calibration:

(1) Wait for the values to stabilize, which generally takes 1-3 minutes.

(2) Before each addition of standard buffer solution, the electrode to be calibrated must be rinsed with deionized water at least twice. Then, gently blot the water droplets from the bottom of the electrode with clean filter paper. Do not wipe the electrode with filter paper, as this may cause static electricity and unstable readings.

(3) The instrument has an automatic standard buffer solution identification function.

5.5.1 Automated Calibration of Two-Buffer Solutions

Press and hold the“M”key for 2-3 seconds while in main display mode, then release to enter automatic calibration mode.， Use the“▲▼”key to select the calibration solution group. The calibration solution group is determined based on the pH range the user needs to test. This table offers two ranges: "7-4 pH" and "7-9 pH". The first standard solution must be 6.86.

For the "7-4 pH" calibration, when the display shows "7-4 pH", clean the electrode thoroughly and place it in a 6.86 pH standard buffer solution.， press “↵”key to enter the calibration program, and wait for the value to stop flashing and stabilize before pressing the“↵”key ， The reading is 4.01. Remove the electrode, clean it thoroughly, and place it in a 4.01 pH standard buffer

solution,press “  ”key ， after the value stops flashing and stabilizes.Press the“  ”key ， The calibration is now complete. After calibration, the digital display will flash to show the current slope, for example, 59.16. Wait 3-5 seconds for it to automatically return to the main display measurement interface.， You can also use the“  ”key to return to the main measurement interface.

During the "7-9 pH" calibration, when the display shows "7-9 pH", clean the electrode thoroughly and place it in a 6.86 pH standard buffer solution.， press “  ”key Enter the calibration program, wait for the values to stop flickering and stabilize, then press the“  ”key ，it shows 9.18。Remove the electrode, clean it thoroughly, and place it in a 9.18 pH standard buffer solution,press “  ”key ， after the value stops flashing and stabilizes.Press the“  ”key ， The calibration is now complete. After calibration, the digital display will flash to show the current slope, for example, 59.16. Wait 3-5 seconds for it to automatically return to the main display measurement interface.，You can also use the“  ”key to return to the main measurement interface.

5.6 Temperature Compensation Settings

In the main display state, press the“  ”key simultaneously to enter the temperature compensation setting. The digital tube will display: P1-0 or P1-1. The last digit indicates that 0 indicates automatic temperature mode and 1 indicates manual temperature mode. This digit will flash,press the“  ”key can modify the last number, press the "OK" button to confirm and return to the main page to complete the settings.

5.7 Manual Temperature Setting

In the main display state, press the“  ”key simultaneously to enter the temperature compensation setting. The digital tube displays: ⊦ 25.0, and the last three digits flash to show the manual temperature value. For example, when the

manual temperature is 25.0℃, it will be displayed as: 25.0.Press the“▲▼”key to modify the temperature value,press the“↵” key to confirm and return to the main page, completing the settings.

5.8 Current Calibration Mode

First, connect a DC ammeter in series with the 24V power supply;

In main display mode, press the“▲+↵”key simultaneously to enter 4mA current calibration; the digital display on the panel will flash "C04.0",At this time, pressing the“▲▼”key will adjust the current output value to the standard 4.00mA.Press the“↵” key to confirm and return, thus completing the calibration of the 4.00mA current output.

In main display mode, press the“▼+↵”key simultaneously to enter 20mA current calibration; the digital display on the panel will flash "C20.0".At this time, pressing the“▲▼”key will adjust the current output value to the standard 20.0mA.Press the“↵” key to confirm and return, thus completing the calibration of the 20.0mA current output.

5.9 pH Compensation Settings

Press the“▲+▼”key simultaneously while in main display mode to enter pH measurement compensation.Pressing the“▲or▼”key at this point will adjust the pH compensation value.Press the“↵” key to confirm and return, thus completing the pH compensation value setting.

Chapter 6 Selection and Maintenance of Electrodes

6.1 Selection of Electrodes

The accuracy and stability of the electrode are key factors determining the stability and precision of a pH meter measurement. This is especially true for water with low conductivity, where the requirements for the electrode are even higher. Ordinary electrodes suffer from poor stability and short lifespan, failing to meet the requirements.

Industrial pH electrodes are available in various models and specifications. Please specify the application when ordering. If the user specifies the electrode, its sheath and measuring cell can be custom-made.

Triple-electrode: The measuring electrode, reference electrode, and temperature compensation electrode are integrated into one unit, facilitating installation and cleaning.

Dual-electrode: The measuring electrode and reference electrode are integrated into one unit. Zero potential (isopotential point): 7.00 pH.

6.2 Electrode Maintenance

The proper use of a pH meter largely depends on electrode maintenance. First, the electrodes should be cleaned frequently to ensure they are not contaminated, and recalibrated periodically to correct slope errors that may develop over time. Calibration procedures are detailed in later chapters. Second, the electrodes must always be immersed in the solution being tested, both during the reaction and after discharging; otherwise, their lifespan will be shortened. Cable connectors must also be kept clean and protected from moisture and water. If the instrument is indeed malfunctioning, do not attempt to repair it yourself; contact us immediately.

Activation: If the electrode is stored in a dry environment, it must be soaked for at least 24 hours before use to activate it; otherwise, calibration and measurement will produce significant errors. Soaking in a 3 mol KCl solution is recommended.

Cleaning: If the electrode is found to be contaminated, affecting measurement accuracy, gently brush the electrode head with a soft brush, then rinse with clean water. Cleaning methods for various types of contamination are as follows:

Grease or oily substances can be cleaned with surfactants; calcium precipitates or metal hydroxides can be cleaned with 10% dilute hydrochloric acid; sulfide precipitates (such as in wastewater treatment processes) can be cleaned with a mixture of 10% dilute hydrochloric acid and saturated thiourea; protein deposits can be cleaned with a mixture of 10% dilute hydrochloric acid and pepsin.

Regeneration: When the pH electrode response is found to be slow, almost sluggish, it can be regenerated by soaking in a mixture of 10% HNO3 and NH4F (50 g/L). This regeneration should generally take less than ten seconds. For ORP electrodes, the following methods can be used for regeneration:

1) For inorganic contamination, immerse the electrode in 0.1 mol/L dilute hydrochloric acid for 30 minutes, rinse with pure water, and then immerse in electrode soaking solution for 6 hours before use.

2) For organic oil stains and oil film contamination, clean the platinum surface with detergent, rinse with pure water, and then immerse in electrode soaking solution for 6 hours before use.

3) For severe platinum surface contamination forming an oxide film, polish the platinum surface with toothpaste, then rinse with pure water, and then immerse in electrode soaking solution for 6 hours before use.

At the factory, the electrode has a protective cap containing a sponge soaked in a special solution to maintain the moisture of the sensitive membrane.

When not in use, rinse the electrode thoroughly with water and reinsert it into the protective cap containing 3 mol KCl solution, or immerse the electrode in KCl solution.

Chapter 7 Precautions and Maintenance

1. The instrument generally does not require routine maintenance. If an obvious malfunction occurs, please do not attempt to repair it yourself; contact us immediately!

2. After powering on, the instrument should display a value. If there is no display or the display is abnormal, immediately turn off the power and check if the power supply is normal.

3. The electrode cable connectors must be kept clean and protected from moisture or water ingress; otherwise, the measured values will be significantly inaccurate, and the instrument may not function properly at all.

4. The electrodes should be cleaned regularly to ensure they are not contaminated. See section 6.2 for cleaning methods.

5. The electrodes should be recalibrated periodically, the specific time interval depending on the medium conditions at the site. See section 5.5 for calibration methods.

6. During non-operational periods, if the electrode membrane cannot be immersed in the measured solution or water, the electrode should be removed and immersed in a 1 mol KCl solution. Do not allow the electrode membrane to dry out, as this will shorten its lifespan.

7. Before using the electrode, if the electrode membrane bubble is dry, it should be soaked in a 3 mol KCl solution for a period of time, generally at least 24 hours.

8. The electrode membrane bubble is a very thin layer of special glass. Extreme care must be taken during electrode installation, calibration, or cleaning to avoid damaging the membrane bubble.

9. Replacement of components or structures is not permitted, as this may affect performance.

10. The safety barrier must have a valid certificate, and its installation and use

should be performed according to its instruction manual.

11. Do not install the sensor cable in the same terminal block as the AC or DC power supply. Excessively long cables should not be coiled and placed near motors or other equipment, as this may generate electromagnetic fields. During installation, trim excess cable to ensure an appropriate length, thereby avoiding unwanted induced signals (“electrical noise” may interfere with the sensor signal).

Chapter 8 Preparation of pH Standard Solutions

Instructions for preparing pH standard solution: Cut open the plastic bag, pour the powder into a 250mL volumetric flask, rinse the inside of the plastic bag with a small amount of CO_2-free distilled water, and dilute to the mark at 20℃. Shake well before use. The pH value of the solution (accuracy ±0.01pH)

Temperature ℃	0.05M potassium hydrogen phthalate pH value	0.025M Mixed Phosphate pH Value	0.01M Borax pH value
0	4.01	6.98	9.46
5	4.00	6.95	9.39
10	4.00	6.92	9.33
15	4.00	6.90	9.28
20	4.00	6.88	9.23
25	4.00	6.86	9.18
30	4.01	6.85	9.14
35	4.02	6.84	9.10
40	4.03	6.84	9.07
45	4.04	6.83	9.04
50	4.06	6.83	9.02
55	4.07	6.83	8.99
60	4.09	6.84	8.97
70	4.12	6.85	8.93
80	4.16	6.86	8.89
90	4.20	6.88	8.86
95	4.22	6.89	8.84