MDPH 4081 Industrial Online PH Meter

User Manual

Chapter 1. Overview

MDPH4081industrial pH meter is a new pH analyzer developed by our Company. It is a highly intelligent on-line continuous monitoring instrument consisting of sensor and secondary meter. It can be used together with triplex or duplex electrodes to meet various applications. With pure water and hyperpure water electrode, it can be used to measure the pH value of water with an electric conductivity less than 3μS/cm (such as chemical supply water, saturated vapor, condensate, etc.). It can be widely used for continuous pH monitoring of various water in many industries such as power, chemical engineering, environmental protection, medicine, food, and so on.

Basic functions

Highly intelligent: industrial pH meter uses high precision AD conversion and single chip micro-processing technology, and has such functions as measuring pH value and temperature, automatic temperature compensation, and self-check of the instrument.

High reliability: The components are integrated onto a circuit board, without complex function switches, knobs or potential devices.

Double high-resistance inputs: It introduces the latest components, and the impedance of the double high-resistance inputs is up to $10^{12}\Omega$, providing high protection against interference.

Solution grounding: The interference from ground circuit can be eliminated.

Isolated current outputs: It introduces light electric coupling technology, providing high protection against interference and realizing long-distance transmission.

RS485 communication interface: With this interface it can be conveniently connected to PC for monitoring and communication.

Automatic temperature compensation: It provides automatic temperature compensation at the range between 0～99.9℃.

Waterproof and dust-proof design: The protection grade is IP65, and it is suitable for outdoor use.

Main features

Display, menu: It uses menus similar as PCs, providing simple operation; Tips in are provided for each operation step, and users can conveniently use it even without a user manual.

Multi-parameter display in the same screen: It displays several parameters in the same screen, including pH value, input mV (or output current), temperature, time, status, and so on.

History curve: It can save the measurement data automatically every 5 minutes, and can store the pH data of one consecutive month. It provides “history curve” display and “specified time/point” inquiry on the same screen.

Monitoring electrode: The method, time and results of each calibration are recorded for convenient inquiry and analysis of the changing laws of electrode.

Digital clock: It provides several time bases.

High-quality display: It uses graph-type LCD display with backlight 192 x 64 lattice, realizing display of both graphs. It has adjustable uniform backlight, so it can be operated and read even in outdoor dark environment.

25℃ conversion: It provide 25℃ base temperature conversion for pure water and ammonified hyperpure water, so the pH value at 25℃ can be directly displayed. This is particularly suitable for measurement of water quality in power plants.

Stable operation and no crash: The watchdog program ensures continuous operation of the instrument without crash.

Manual current source: User can check and set freely the input current, providing convenience for checking recorder and lower computer.

Software-set current output: The software selects 0～10mA or 4～20mA, and user don't need not touch to any switch.

Four calibration manners: Except the traditional one-point and two-point calibration, it also provides calibration by manual input zero-point E_0, slope S and known pH value, so that various needs of users can be met.

Chapter 2. Technical specifications

1. Measurement range: pH value: 0～14.00pH, precision 0.01pH;

   Temperature: 0～99.9℃, precision 0.1℃;

   Electric potential: –999.9～+999.9mV, precision 0.1mV.

2. Range of automatic temperature compensation: 0～99.9℃, 25℃ is the base;

3. Tested water sample: 0～99.9℃, 0.6MPa;

4. Automatic temperature compensation error of electronic unit: ±0.03pH;

5. Repetition error of electronic unit: ±0.02pH

6. Stability: ±0.02pH/24h;

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

8. Clock precision: ±1 minute/month;

9. Isolated current output: 0～10mA (load <1.5 kΩ), 4～20 mA (load <750 Ω);

10. Output current error: ≤±1%FS;

11. Data storage quantity: data of 1 month (1 point per 5 minutes);

12. High and low alarming relay: AC220V, 3A;

13. RS485 communication interface;

14. Power supply: AC220V±22V, 50Hz±1Hz;

15. Protection grade: IP65;

16. Outline dimension: 146mm x 146mm x 180mm;

    Opening dimension: 138mm x 138mm;

17. Weight: 3kg;

18. Working condition: Ambient temperature 0～60℃; Relative humidity <85%;

Chapter 3. Selection and maintenance of electrode

Selection of electrode

The accuracy and stability of electrodes is one of the determinant factors of pH meter's performance. Especially, low conductivity water has higher requirement for electrode. If common electrode is used for measurement, it will have low stableness and short service life, not meet the use requirements.

Structure and dimension

Industrial pH electrode has many types and specs, and users need to specify the application when ordering electrodes. When electrodes are specified, their jackets and measurement pool can be customized.

Triplex electrode: Integrated electrode of measurement electrode, reference electrode and temperature compensation electrode, with convenient installation and cleaning.

Duplex electrode: Integrated electrode of measurement electrode and reference electrode.

Zero potential (equipotential point): 7.00pH

Membrane: Being made of porous fiber, with good isolation and protection against contamination. Double liquid connection structure, providing low resistance and high suitability for most industrial applications.

Sensitive glass membrane: Acid sensitive part, with four options suitable for various applications.

Length: 150mm, 107mm or 77mm; Outer diameter: φ28±0.2; Pressure: 6 atmos. at most.

Electrode for pure water and hyperpure water

For pH measurement of pure water, These types of electrodes use solid electrolyte inside, providing convenience in use; They have rapid response, and can generally become stable in 10 seconds; They have long service life; They have unique membrane structure and high protection against contamination; They can be used in applications without extremely low conductivity.

pH electrode for waste water and general industrial processes

As for electrode for waste water and general industrial processes, these electrodes use imported annular large-section Teflon membrane, providing stable liquid connection potential, low resistance, anti-clogging and protection against contamination. They can be used for measurement in harsh conditions, suitable for environmental protection, waste water, colloid and general industrial processes.

PH8010 is a duplex electrode requiring additional temperature compensation electrode, while MDPH4081is a triplex electrode providing convenient use and maintenance.

MDPH 00 electrode for high-temperature application

For applications above 80.0℃. this type of electrodes use imported annular large-section Teflon membrane, providing stable liquid connection potential, low resistance, anti-clogging and protection against contamination, and can be used in high temperature conditions.

pH electrode for special environment

In some special applications, we can produce customized electrodes according to the particular use environment and requirements, for example 316L stainless steel electrode for organic solvent, antimony or high polymer membrane electrode for HF, and so on.

Note: If domestic electrodes cannot meet users' requirements, our instruments can be used together with imported electrodes. According to our experiences in these years, generally domestic electrodes can fully have equivalent performance of imported electrodes.

Maintenance of electrodes

To a great extent the performance of a pH meter depends on maintenance of electrodes. Electrodes should be cleaned frequently to ensure no contamination or blockage; They should be calibrated regularly; During the period of no water supply, Make sure that the electrodes are soaked in the tested liquid, or their service life may be shortened; Keep the wire connection heads clean and keep them from humidity or water. If there are indeed problems of the instrument, please do not repair it by yourself, contact us instead.

Activation: If electrodes are stored in a dry environment, they must be soaked for 24 hours before use to activate them. Otherwise there may be great error in calibration and measurement.

Cleaning: When an electrode is found contaminated or blocked, use a soft brush to gently clean the head of the electrode and then wash it in clean water. Cleaning methods against various contaminations are as follows: surface activating agent for grease or oily contamination; 10% dilute hydrochloric acid for calcium sediment or metal hydroxides; mixture of 10% dilute hydrochloric acid and saturated thiourea for sulfide sediment (for example during waste water treatment); mixture of 10% dilute hydrochloric acid and pepsin for protein attachment.

Recovery: When an electrode has slow response, soak it in the mixture of 10% HNO_3 and NH_4F (50g/l) for recovery. Generally it can recover within 10 seconds.

When leaving the factory, electrode has a protective cap containing a KCl solution soaked sponge to maintain the wetness of the sensitive membrane. Before leaving an electrode unused, wash it clean and insert it back to the protective cap containing 1mol KCl solution, or directly soak it in KCl solution.

Chapter 4. Instrument installation

Online industrial pH meter consists of four parts, that is secondary meter, pH electrode, measurement pool and connecting wire.

4.1 Unpacking

After unpacking the product, check the quantity, specs and accessories of the instrument according to the packing list, which includes the following parts:

1. One secondary meter.

2. One electrode.

3. One operating manual.

5. Three bags of standard buffer solution, one for pH 4, 7 and 9 each.

If there is any damage or incorrect quantity or specs, please contact this Company or the dealers.

4.2 Installation of pH electrode

Generally electrode can be installed in five manners: circulation type, immersion type, pipe type, side wall type, and flange type. Do install the electrode vertically and not horizontally, otherwise the reference liquid cannot penetrate.

I. Circulation type installation: The measurement pool uses circulation structure, suitable for water channel connected via soft-hard pipe or hard pipe. Full stainless steel shell is used to enclose the water sample and electrode and form a complete shielding. The water pipes have three outer diameters, that is ϕ 8, ϕ 10 and ϕ 12, to meet customers' different needs. When installing the electrode, firstly loosen the wire connector, insert the electrode into the measurement pool, and then tighten the connector using appropriate force. Insert the electrode into the measurement pool or pipe, and turn it for 1/4 circle. The stainless steel lock-up pin on the electrode shell can safely fix the electrode into the installation connector. The three O-shaped ring can prevent the liquid from leakage.

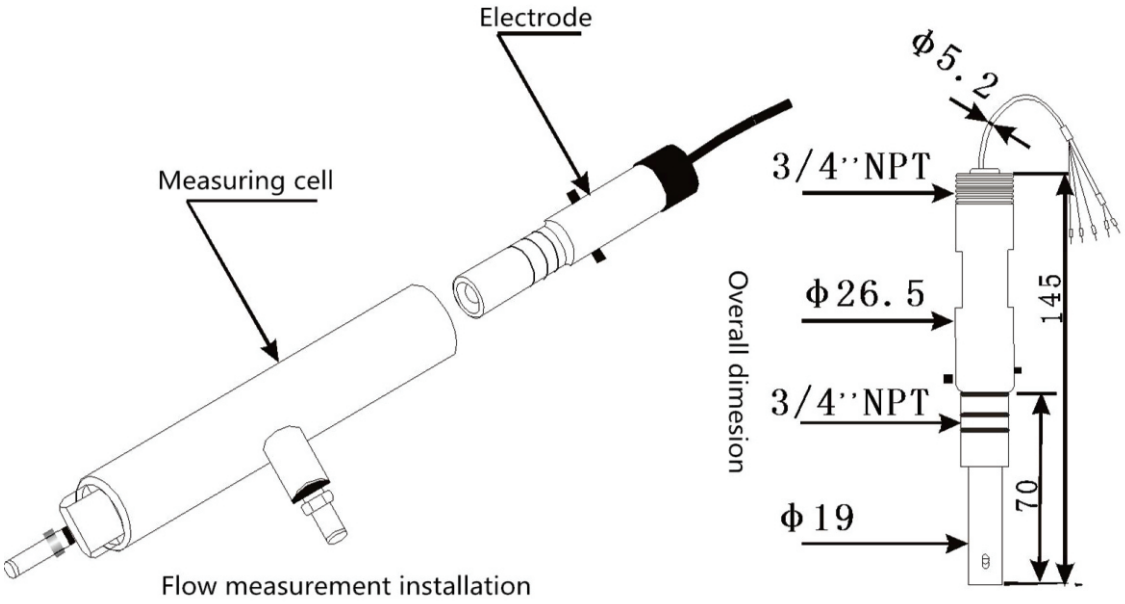
II. Immersion type installation: pH electrode leads from stainless steel tube piercing, pH electrode on top of the 3/4 thread and stainless steel 3/4 thread is connected with PTFE TAPE. Ensure that the electrode tip and electrode line without water.

Note: under normal circumstances according to circulation type installation configuration. By measuring pool adopt circulation type structure, suitable for soft and hard pipe connecting Waterways (see 4.3.1). Made of stainless steel, installed according to the site, with clamps and the pad can be used as a wear plate installation and hanging installation.

III. Side wall installation: The manufacturer provides a 316L full stainless steel jacket with slope, and the pH electrode can be installed simply by putting it into the jacket.

IV. Pipe installation: Connect the 3/4 screw threads of the electrode with the stainless steal pipe.

V. Side wall installation: Firstly fix the jacket, and then connect the 3/4 screw threads of the electrode with the stainless steal pipe.



Digram 4.3.1 Measuring cell installation digram

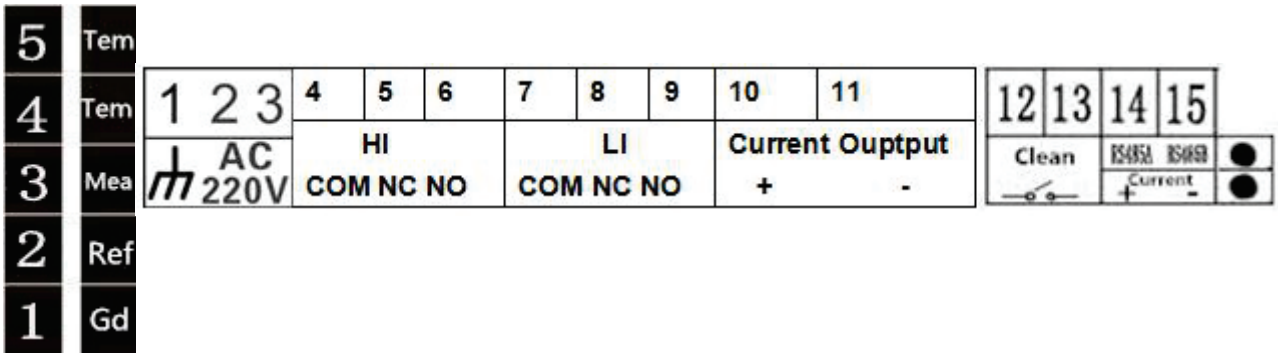
Caution for installation:

1. Keep the distance from the instrument to the measurement pool as close as possible, and generally no more than 20m. If not, additional impedance converter should be used to reduce the loss of signal due to long distance and thus to ensure accurate measurement and reduce the cost of changing electrode.

2. Do not lay the connection wire between the electrode and the instrument near and in parallel to the power wires, otherwise there will be signal interference.

220V Power supply

After the instrument is opened, the front cover board has five white PTFE high impedance terminals, terminal on the right label (such as black wiring diagramt), Put the electrode corresponding wire to the access terminal. After the instrument is opened, the bottom surface of the circuit board has the following terminals, when used first access to 220V AC terminals 2 and 3, regardless of the N and L, the ground access on the No.1 terminal. According to the need, will require the alarm contact terminal (terminal No. 4-9, passive contacts) and current output (terminal No. 10, 11) Terminal access control and other systems. Before the instrument is powered, please carefully check the wiring is correct!



Chapter 5. Basic operation

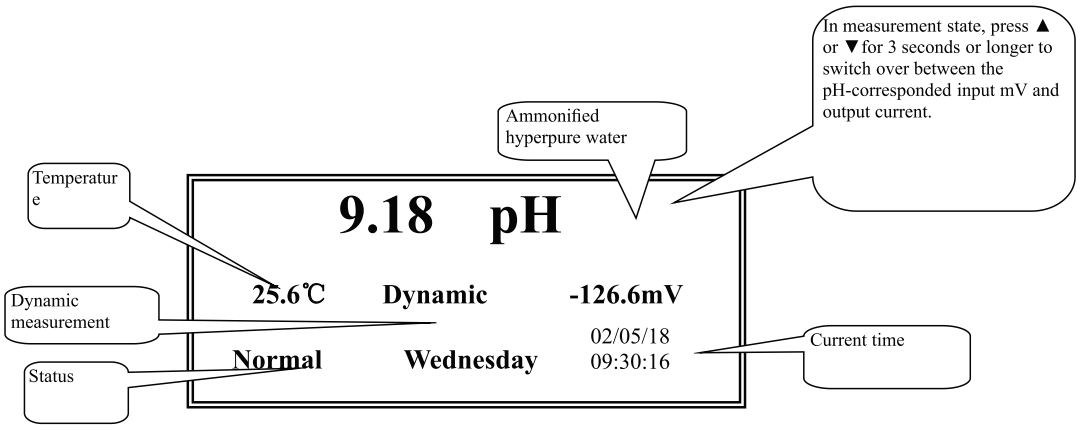
5.1 Function keys

industrial pH meter uses graph-type LCD display with back light 192x64 lattice.

"Menu" key	In measurement state, press "Menu" key to enter the main menu and the operation screen (status).
▲▼◀▶ keys	①These four keys are all direction keys, respectively used to go up, down, left and right to select intended item (menu) or parameter; ②In value modifying state, press ▲▼ key to increase/decrease the number, and hold the pressing to quicken the number changing; press ◀ or ▶ to initialize the value. ③In measurement state, press ▲ or ▼for 3 seconds or longer to switch over between the pH-corresponded input mV and output current.
"Enter" key	Press "OK" key to confirm the selected item (menu) or parameter. ①When the cursor points at an item (menu), press "OK" key to enter this item (menu) and then to modify the parameters there. ②When the cursor points at a parameter in an item, press "OK" (or "Exit") key to confirm the value and complete the parameter setting, then the cursor will return to the upper level. ③In the "history curve" sub-menu, when history curve is displayed, press "OK" key to enter the screen for modifying upper/lower limits and inquire the number of advance days.
"Esc" key	Press "Exit" key to return the previous operation status (screen). In any level of menu, press "Exit" key to return to the upper level, and press continuously to return till the measurement status. After modifying a parameter, the modified value can be saved automatically and then the screen returns to the upper level by directly pressing "Exit" key.

5.2 Measurement status and display

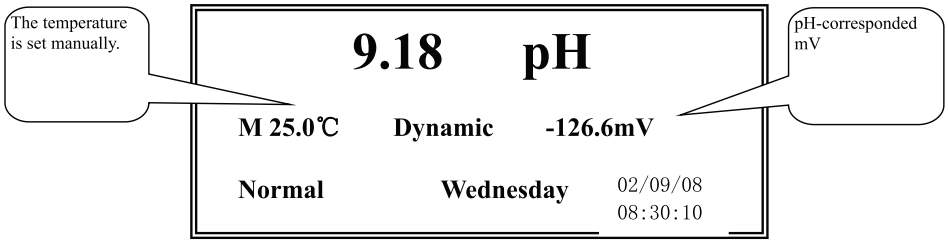
1. After powering on, the instrument automatically enter the measurement status and display the following:



The status line displays the following information: normal, high limit alarming, low limit alarming, too high slope, and too low slope. Except “normal”, the others are displayed in flashing manner to attract user attention.

Note: “High slope” means a rate of slope (S) exceeding 1.200, and “Low slope” means a rate of slope (S) less than 0.700.

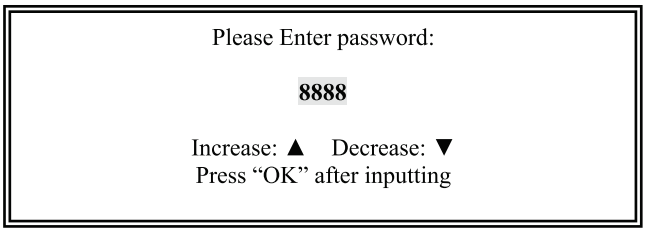
2. Measurement mode with manual temperature setting: In order to meet various applications, the temperature can be set manually from 0℃ to 99.9℃. Once the temperature is set to “manual”, the instrument will no longer detect the actual temperature of the tested liquid, and the main screen will display a “M” before the temperature. See the “parameter” sub-menu for detailed setting methods.



3. Automatically return to measurement status upon time-out: Press “menu” key to enter the main menu. After entering the main menu (except electrode calibration item), the internal timer will start to function after each pressing, and the instrument will automatically return to measurement status if there is no operation in 2 minutes, thus it can be avoided that measurement cannot be performed for long for that it is not in measurement status due to improper operation.

5.3 Password inputting and changing

To avoid access of unauthorized persons, some significant menu items such as parameter setting, calibration, password changing, manual current source and system maintenance require password for access. Other operations with no effect on the instrument are not protected by passwords. The password inputting screen is as follows:



This system has only one password, which is 8888 at default. In the password inputting screen, press ▲▼ to increase/decrease the password number, and press the other two direction keys to initialize the password to 8100. Press "Exit" key to return to upper level. Press "OK" key, the system will automatically check the password, and if it is correct the system will enter the next level, otherwise it will give a prompt and return to the upper level after 3 seconds.

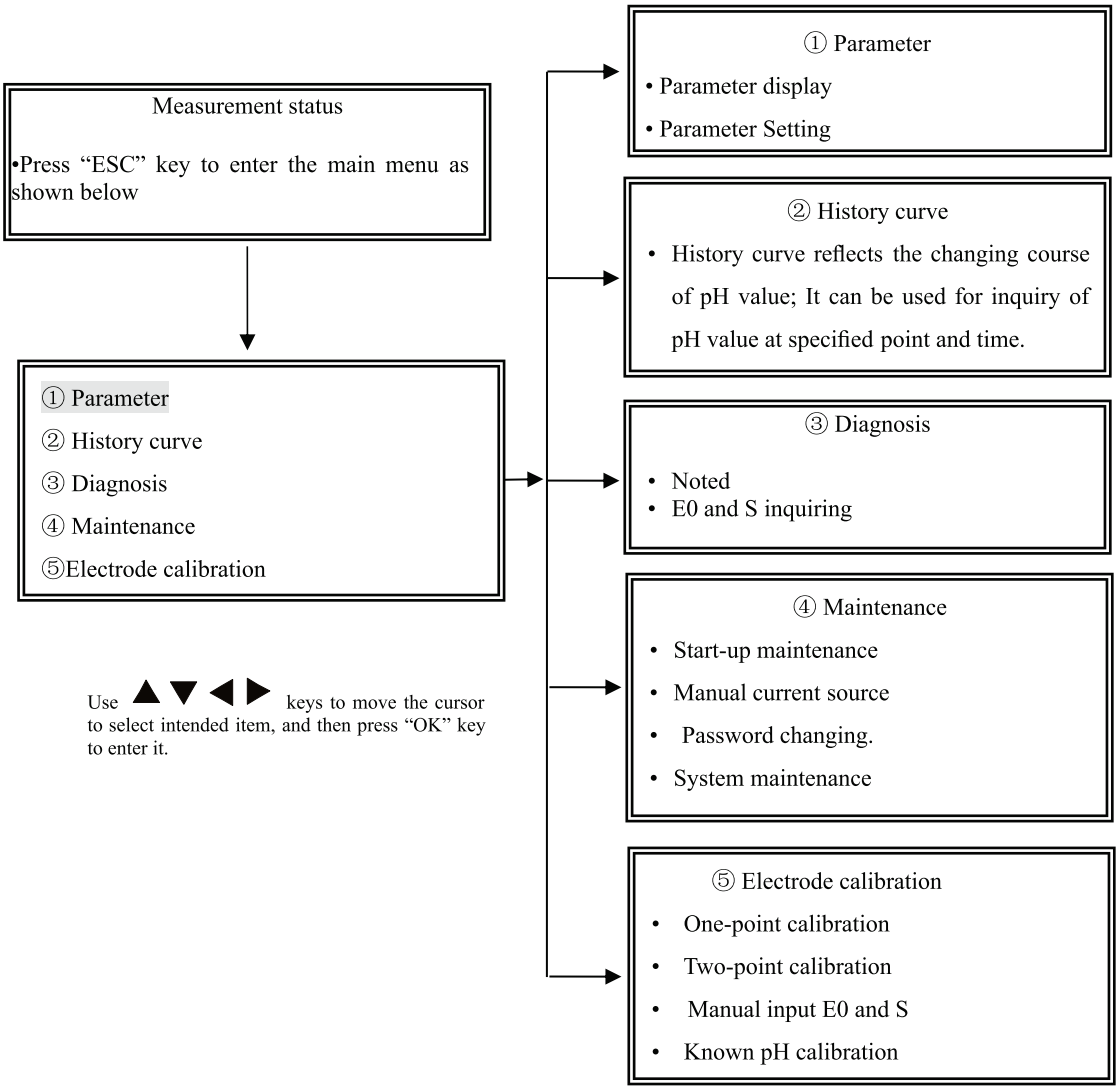
To change password, select "change password" sub-menu under the "maintenance" menu. First input the original password, the system will check it and display the password changing screen only if the password is correct. Input a new password following the prompt on the screen, and press "OK" to complete. If you forget your password, please contact us.

5.4 Temperature and temperature compensation

pH value of tested solution is greatly impacted by temperature change. This instrument has the function of automatic temperature compensation, and can convert the slope got by the electrode under calibration temperature to the slope under current temperature using Nernst Formula, and thus give the right pH value under current temperature. For pure water and ammonified hyperpure water, this instrument can also convert the pH value to that under 25℃, so that the requirement of the *Guide for Chemical Supervision of Water and Steam in Thermal Power Plants* for power industry, that is all pH values should be numbers under 25℃.

When "automatic" is selected in "temperature measurement", and the temperature compensation electrode is well connected, this instrument displays the temperature measured by the temperature compensation electrode, and it will automatically perform temperature compensation. When "manual" in "temperature measurement" is selected, the instrument in under manual temperature setting mode, which means it does not detect the actual temperature of the tested liquid but uses and displays the temperature value set by the user. In this case the word "manual" will be displayed and the instrument performs manual temperature compensation.

Chapter 6. Detailed explanation of menus and functions

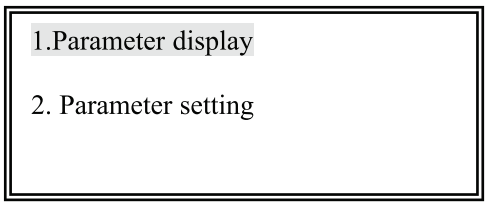


6.1 “Parameter” sub-menu

In the main menu, when the cursor points at “parameter” sub-menu, press “OK” key to enter this sub-menu.

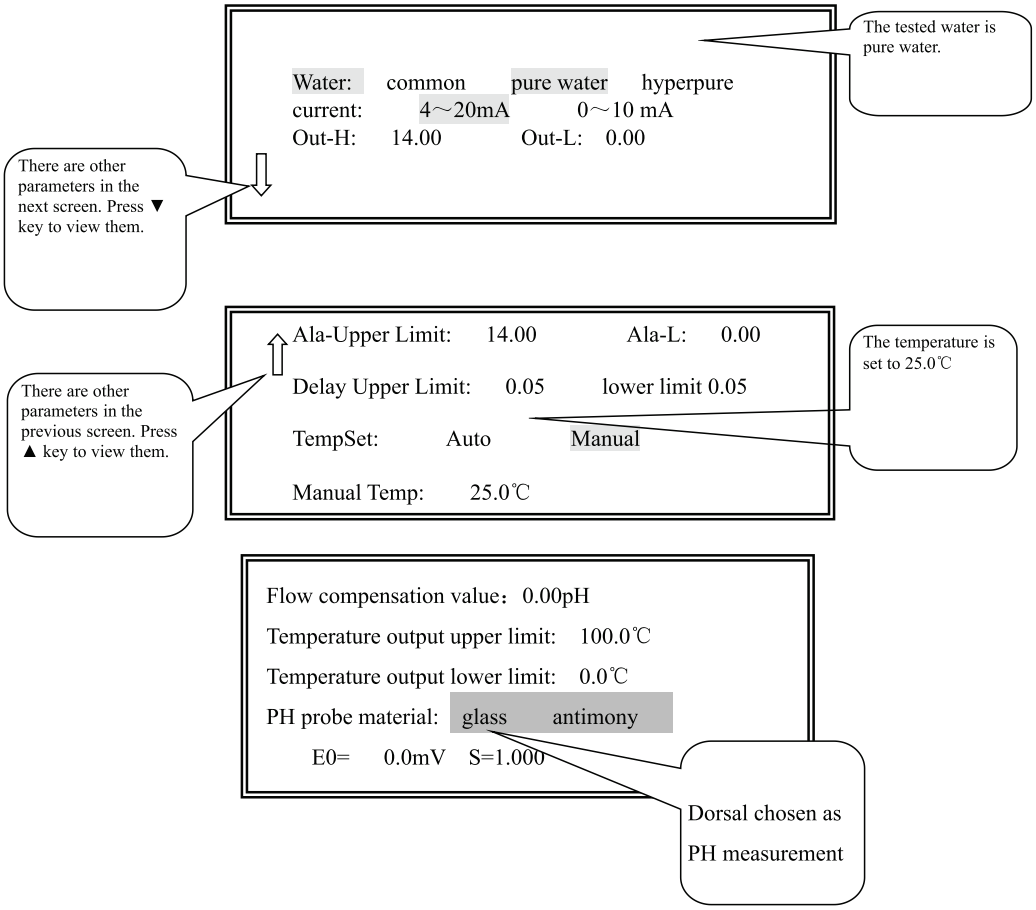
This sub-menu is used for parameter display and setting. If “parameter display” is selected, parameters can be viewed only there but not modified. To avoid access of unauthorized persons, password is required to enter the “parameter setting” item.

Before measurement, parameters should be set according to the site conditions. If not, the default settings (for new instrument) or previous settings (for instrument used before) will apply.

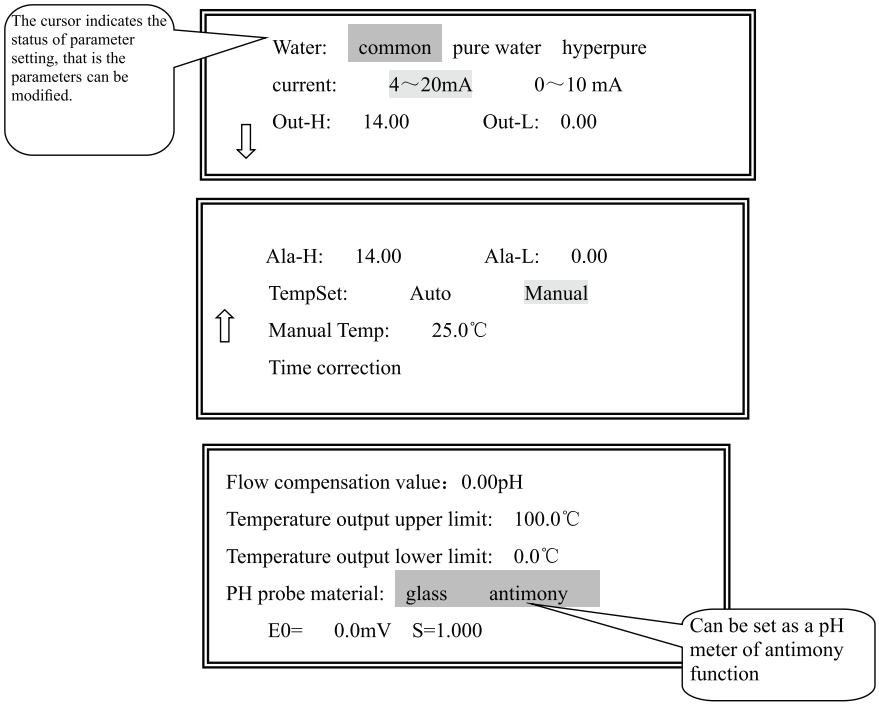


6.1.1 Parameter display: Current values of all parameters are displayed here in two screens, and they can be viewed only but not modified.

Press “OK” key to view the parameters. See the following example.



6.1.2. Parameter setting: This screen can be accessed only after entering a correct password. Here the cursor stays at a parameter, indicating this parameter can be modified. There are two screens, shown as follows:



Example 1. Setting of water quality

When the cursor points at “water quality”, press “OK” key, the cursor will point at the water quality selected last time. Press ▲▼◀▶ keys to move the cursor from one quality to another, and when it moves to the desired one, press “OK” (or “Exit”) key to complete the setting. Then the cursor will go back to “water quality”. Press “Exit” key to exit parameter setting and return the upper lever.

Note: For pure water and ammonified hyperpure water, MDPH4081 industrial pH meter displays the pH value at 25℃ based on conversion. These two water qualities are special. We obtained their features after calculating and testing the weak-dissociation electrolyte -- ammonia. Users of pure water or ammonified hyperpure water must specify this item.

Example 2. Setting of output upper/lower limit

When the cursor points at “output upper limit”, press “OK” key, the cursor will point at the upper limit value. Press ▲ key to increase the value, ▼ to decrease, and ◀▶ to initialize the value to 14.00pH. When the displayed value is the desired value, press “OK” (or “Exit”) key to complete such setting. Then the cursor will go back to the “output upper limit”. Setting of output lower limit is similar.

Example 3. Time correction

The secondary meter stores data with time. If the time is incorrect, the records will be wrong and the “history curve” will not get correct data. The screen of “time correction” is as follows:

Year：02	month：05	day：18
Hour： 10	minute：18	second：58
	week: Sat	

6.2 “Electrode calibration” sub-menu

6.2.1. General

The zero potentials of each pH electrodes varies, and the conversion factor (i.e. the slope) of electrode for pH value cannot be exactly the theoretical value. Moreover, zero potential and slope may change during use, called aging. Thus, the actual zero potential E_0 and slope S of an electrode should be calculated by testing standard buffer solution. This is called calibration of electrode.

This MDPH4081 industrial pH meter has four optional calibration methods, that is one-point calibration, two-point calibration, manual input E_0 and S, and known pH calibration.

One-point calibration: Only one kind of standard buffer solution is used for calibration. The slope remains unchanged and the zero potential can be calculated. This simplified method is suitable for applications without high requirement for precision.

Two-point calibration: Any two of the three kinds of standard buffer solution provided are used. Two-point calibration must be performed when the electrode is used for the first time, and should be performed regularly later. If the precision requirement is not high, one-point calibration can be used, otherwise two-point calibration must be used. If the results of one-point calibration are not satisfying, two-point calibration should be used for verification.

At the time of two-point calibration, user should choose two kinds of standard buffer solution with close pH values to the pH value of the tested water under normal operation. For example, if the tested solution is acidic(pH <7), the pH 4.00 and pH 6.86 buffer solution should be used; if the tested solution is alkaline (pH >7), the pH 6.86 and pH 9.18 buffer solution should be used; if the tested solution is between acidic and alkaline, the pH 4.00 and pH 9.18 buffer solution should be used. This helps to improve the measurement accuracy.

Manual input E_0 and S: If the zero point and slope of the electrode is known, E_0 and S can be directly specified.

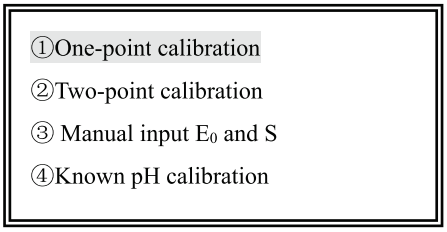
Known pH calibration: When the pH value of the tested solution is known, this value can be entered to get the E_0 of the electrode, with the slope S remaining unchanged.

When calibrating, follow the prompts on the screen. After completion of calibration, enter the “parameter” sub-menu to view the E_0 and S.

Theoretical mV value of the three standard buffer solution (25℃)	4.00 pH ———	+177.5 mV	±20mA
	6.86 pH ———	+8.3 mV	±20mA
	9.18 pH ———	-129.0 mV	±20mA

The table on the left gives the theoretical mV value of the three standard buffer solution at 25℃. This can be used to determine: ① whether the electrode is placed into correct buffer solution; ② whether the electrode is stable; ③ the performance of the electrode.

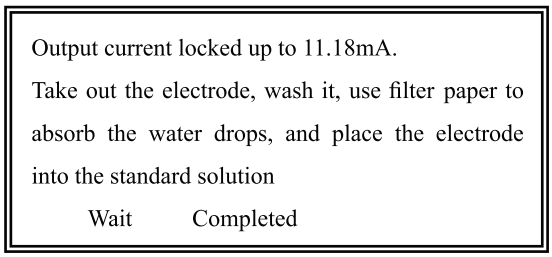
Correct password is required for entering “electrode calibration” sub-menu. The screen of this sub-menu is shown as follows:



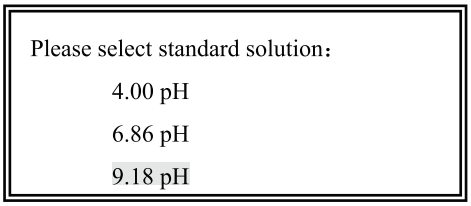
No matter which calibration solution is to be used, the electrode to be calibrated should be washed by deionized water for two or more times. Then use a clean filter paper to gently absorb the water drops on the bottom of the electrode. Never wipe the electrode using the filter paper, otherwise it will have static electricity, resulting in unstable readings. Pour the standard buffer solution into a beaker, and insert the pH electrode and temperature electrode. Follow the prompts on the screen for the next steps.

6.2.2. One-point calibration

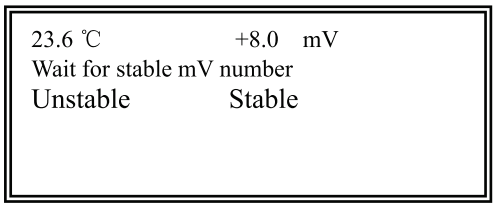
Choose the standard buffer solution with a pH value close to the pH value of the tested water. For example, for pure water or ammonified hyperpure water in power plants, the pH 9.18 standard buffer solution (at 25℃) should be used.



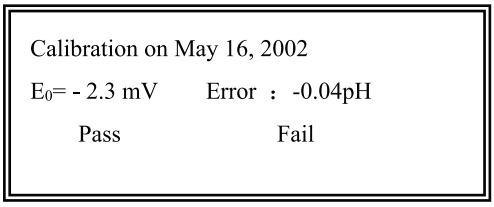
For duplex electrode, the pH electrode and the temperature electrode should be placed into the standard solution at the same time. After preparation is completed, select the “completed” button, the screen as shown in the figure below will appear.



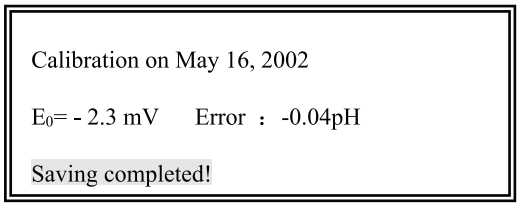
Use ▲▼ keys to select standard solution, and press “OK” key to start calibration. For example, if pH 6.86 solution is selected, the screen will be as follows:



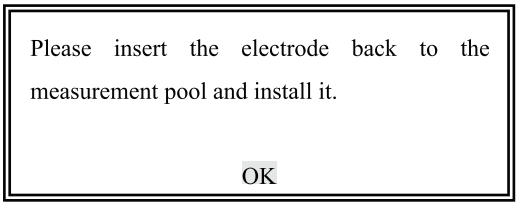
After mV number becomes stable, check whether the mV displayed is significantly different from the theoretical mV value. If yes, find the causes, for example whether the tested solution is indeed the selected solution, or whether the wires of the electrode are correctly and tightly connected. If the difference is not significant, select "stable" and press "OK" key, then the calibration results will be displayed, as shown in the following figure.



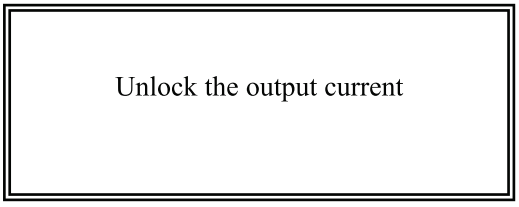
Check whether the error of E_0 meets the requirement. If the calibration determined by user is failed, select "fail" to return to the "electrode calibration" sub-menu. If "pass" is selected, the calibration results will be saved automatically. See the figure below. These data can be viewed in "E_0 and S inquiring" item under "diagnosis" sub-menu and "parameter display" item under "parameter" sub-menu.



After three seconds, the screen as shown in the figure below will appear:



After complete the post-calibration steps, press "OK" key, the screen as shown below will appear:



The instrument will automatically return to measurement status after 3 seconds of prompting. **At this time the instrument displays the pH value of the standard solution under current temperature.** See Appendix 1 for the change of pH value of the standard solution along with temperature.

6.2.3. Two-point calibration

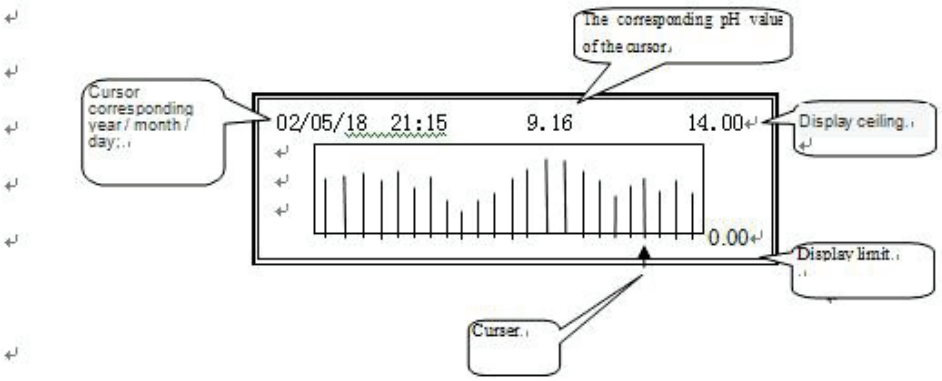
Press ▲▼ key to enter the pH value of the tested solution, and press "OK" to start calibration. The calibration procedures are the same as the one-point calibration described above.

6.3 "History curve" sub-menu

This sub-menu is functioned as a digital recorder of the instrument, and can realize the following at the same time on the same screen: history curve display and inquiry of pH value at specified point or time.

"History curve" generally reflects the changing tendency and course of the water quality, and can help identify and solve problems. "Specified point/time" is used to obtain the pH value at specified point/time.

The secondary meter can store the data of the last 30 days, one point every 5 minutes. Data beyond this period will be automatically replaced. After entering this sub-menu, the curve the last half day is shown as follows:



Press "OK" key to enter the screen for modifying the display upper limit and lower limit and inquiring the days. Points without data are displayed as 0.00pH.

Note: There is a cursor below the graph, and press ◀▶ key to move it to select specific point. Above the graph there displays time and pH value corresponding to the cursor position, which is very useful for positioning. For example:

Example 1. Inquiring pH value at specified time point

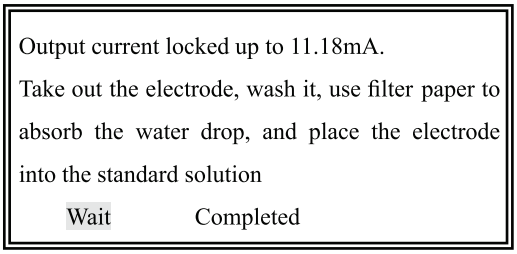
Backward inquiring: press ▶ key, the cursor will move to the right and the time displayed above the graph will become closer to the current time. When the cursor has moved to the rightest position, press ▶ key to display the curve of the next half day.

Forward inquiring: press ◀ key, the cursor will move to the left and the time displayed above the graph will become farther from the current time. When the cursor has moved to the leftest position, press ◀ key to display the curve of the previous half day.

Example 2. Quick inquiry of pH curve of a specified period or

After entering "history curve" sub-menu, and the screen displays history curve, press "OK" key to enter the screen for modifying the upper/lower limit and the advance days. The screen is shown as follows:

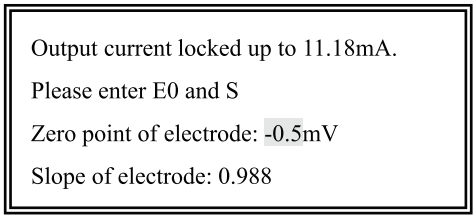
Two-point calibration must be performed when the electrode is used for the first time or the requirement for precision is high. The following will be displayed after entering the two-point calibration screen:



The calibration procedures are the same as the procedures described above, except that two kinds of standard solution should be used according to the prompts on the screen, and the instrument will calculate the E_0 and S automatically. See Section 6.5.1 for the principles of selecting the two kinds of standard solution. The electrode should be first placed into the solution with higher pH value and then that with lower pH value. For example, if pH 4.00 and pH 9.18 solution is used, first place the electrode into the pH 9.18 solution and then the pH 4.00 solution. This is because the former has lower hydrogen ion concentration than the latter.

6.2.4 Manual input E_0 and S

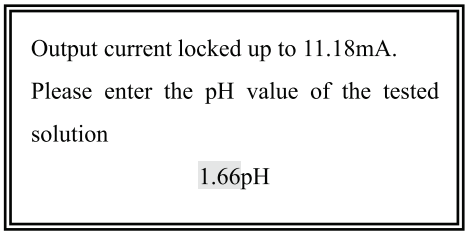
If the zero point and slope of the electrode is known by the user, E_0 and S can be directly entered. The screen as shown below will appear after entering the calibration screen:

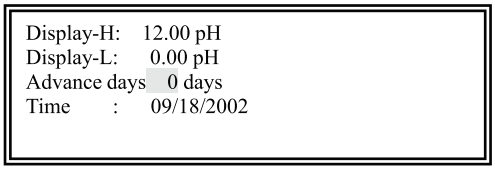


Press “OK” key, the cursor will move around between “zero point of electrode” and “slope of electrode”. Press ▲▼ key to modify the values. When the cursor points at “zero point of electrode”, press ◀▶ key to initialize the value to 0.0mV; when the cursor points at “slope of electrode”, press ◀▶ key to initialize the value to 1.000; After entering the values, press “Exit” key to go back to the upper level.

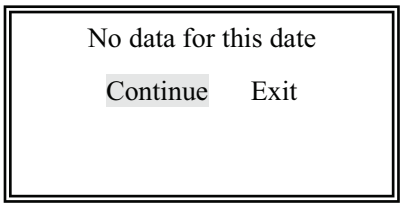
6.2.5 Known pH calibration

This calibration method is particularly suitable for measurement of pH values at 1~3 or 10~14. First determine the slope of the electrode using two-point calibration, and then use a standard solution with a pH value of 1~3 or 10~14 to determine the zero point. For example, if the pH value of the water to be tested is 1~3, use pH 1.68 standard solution for calibration; if 10~14, use pH 12.46 standard solution. The following screen appear when entering the calibration screen:





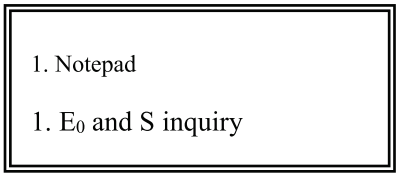
Use the direction keys to select the item to be changed, press "OK" key to enter the modifying screen, and press ▲▼ keys to modify the values. Items that can be modified include display upper/lower limit and advance days. The time of inquiring is automatically displayed on the bottom line. Press "Exit", the second half day curve of the selected date will be displayed. Then, use ◀▶ to inquire specified points. If the time specified is beyond the effective range, the following will be displayed:



At this time, select "continue" to go back to date entering screen. If "exit" button is pressed, the display date will remain unchanged while the modified display upper/lower limit will be effective. Different measurement points have different values, and the "display upper limit" and "display lower limit" of the "history curve" should be appropriate. If the upper limit is too low, all lines will take up the whole screen, without showing the change tendency. If the lower limit is too high, there will be no line in the screen. So appropriate upper limit and lower limit should be set according to the range of the measured values. See the previous section for the steps of setting. After modification is completed, press "Exit" key to apply the new display upper limit and lower limit.

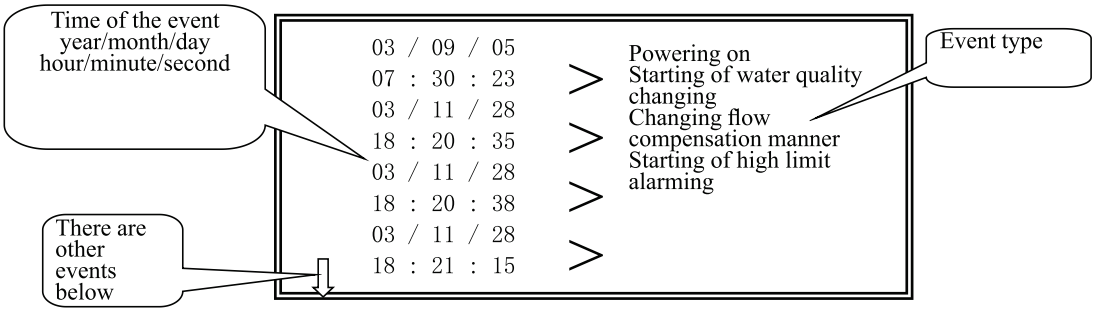
6.4 "Diagnosis" sub-menu

"Diagnosis" sub-menu is used to monitor and inquire the conditions of the instrument and the electrode.



6.4.1. Notepad

The instrument can record 200 latest events, including starting of high limit alarming, end of high limit alarming, starting of low limit alarming, end of low limit alarming, powering on, powering off, changing system time, changing water quality, changing current output manner, changing output upper limit, changing output lower limit, changing alarming upper limit, changing alarming lower limit, changing temperature measurement manner, changing manual temperature value, starting of start-up maintenance, end of start-up maintenance, starting of manual current source, end of manual current source, changing system password, starting of one-point calibration, end of one-point calibration, starting of two-point calibration, end of two-point calibration, manually inputting E_0 and S, starting of known pH calibration, end of known pH calibration, reset or instant power failure, changing flow compensation value and changing flow compensation manner. See the example below:



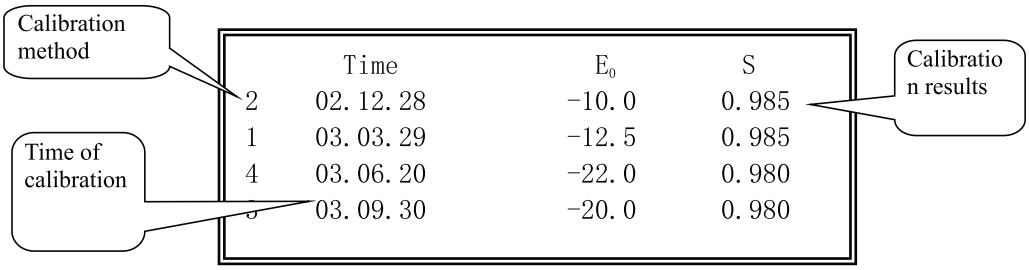
Use ▲ key to view earlier events and use ▼ key view later events.

6.4.2. E_0 and S inquiry

E_0 is the zero potential of the electrode and S is the slope rate of the electrode.

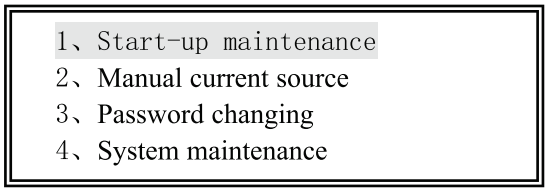
This function of inquiring E_0 and S can faithfully record the changing course and aging degree of the electrode, helpful for estimation of electrode performance and life.

The secondary meter stores the calibration results of the last 50 calibrations. In the inquiring screen, there are only 7 calibration results in one screen. Use ▲ key to move forward and inquire earlier calibration results, and use ▼ key to move backward. These data can be viewed only but not modified.



Note: Calibration method --- “1” means one-point calibration; “2” means two-point calibration; “3” means manual input of E_0 and S; “4” means known pH calibration. Time is the time of calibration.

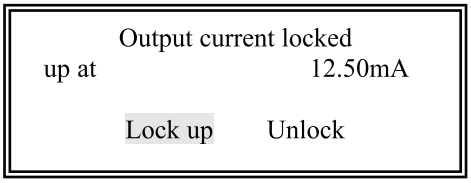
6.5 “Maintenance” sub-menu



6.5.1. Start-up maintenance

During operation of the instrument, when the electrode or measurement pool is being maintained, the sample supply is interrupted or the electrode has been taken out, the data collected, the output current and the data saved

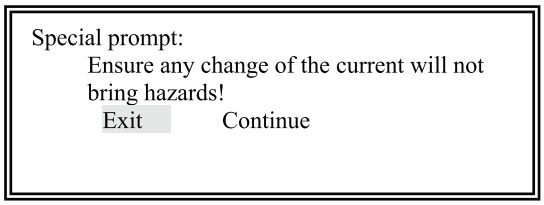
are false data. To avoid such condition, this instrument is provided with the function of start-up maintenance to lock up the output current. When it is used on-line, computer will detect that this instrument is under maintenance and thus stop recording data and automatically follow up the duration of the maintenance. Entering the “start-up maintenance” item, the screen will display the following:



The current is locked up at current value, and a signal indicating start-up maintenance is sent to the computer. After completion of the start-up maintenance, press ▶ to select “unlock” button and then press “OK” (or “Exit”) key.

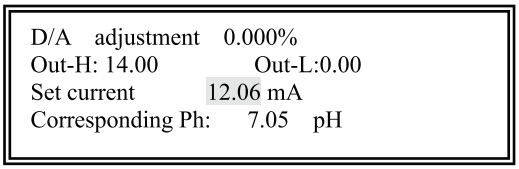
6.5.2 Manual current source

Correct password is required for entering this item. Here the output current range is the range specified in the “Parameter setting” item. The purpose of this function is that user can check the accuracy of output current of the instrument within specified output range. The following will be displayed:



Special prompt: When using this function, the output current is set by user and can vary in full range, so do ensure such change will not bring any adverse effect.

Press ▶ key to select “continue” button, and then press “OK” key. Then the following will be displayed:



If the displayed current is not equal to the output current, press “OK” key, the cursor will point at the value of the “D/A base adjustment” parameter, then press ▲▼ to change it. Such change can make the displayed current equal to the output current. If the cursor does not go to that value after pressing “OK” key, change the “D/A off” to “D/A on” in the “system maintenance” sub-menu.

There are at least three checking methods:

I. Connect a multimeter to the output end, and check the output current;

II. Connect a recorder for comparison checking;

III. Connect the output to a computer sampling system for comparison checking.

Attachment: Calculation of output current

The instrument provides two grades of current output, that is 0～10mA or 4～20mA, but the corresponding pH value range can be defined by user. The correspondence between the measured pH value and the output current is as follows:

For 0～10mA output: I={ (D-DL)/(DH-DL)}×10mA (Formula I)

For 4～20mA output: I=4mA+{(D-DL)/(DH-DL)}×16 mA (Formula II)

Where: I – pH- corresponding to output current;

D – currently measured pH value;

DH – pH value corresponding to 10mA or 20mA output current defined by user, that is the output upper limit;

DL -- pH value corresponding to 0mA or 4mA output current defined by user, that is the output lower limit.

Temperature current output formula: I=4.00mA+0.2tmA (Formula III)

Where: I –output current corresponding to temperature;
t – Temperature displayed by the secondary meter.

6.5.3. Password changing

See Section 5.3.

6.5.4. System maintenance

"System maintenance" is a function reserved for the manufacturer. Generally user should not access this item, otherwise it may influence the normal operation of the instrument.

When the cursor points at a serial number, press up/down key to move, and press "OK" key to enter the corresponding sub-menu. For "password restoring, emptying notepad, emptying curves and emptying E_0 and S, the cursor will automatically return after pressing ▼ key.. If there is any mistake in "History curve", "Notepad" and "E_0 and S inquiring" functions, they can be restored by emptying them correspondingly.

Chapter 7 Delayed cancellation of alarm

The contacts of the alarming relay of the instrument are designed to form a control system by connecting relevant controlling devices (such as electromagnetic valve). To avoid shaking of relay contacts near alarming points, the secondary meter adopts delayed cancellation of alarm.

When the pH value reaches the preset alarming upper/lower limits, the relay closes immediately and the screen displayed “high/low limit alarming” in flashing. However, when the pH value falls/rises below/above the upper/lower limit, the alarm will not stop immediately until it continues to fall/rise by ΔpH (generally 0.05pH).

Chapter 8. Caution and maintenance

1. The secondary meter generally needs no daily maintenance. When there is an obvious fault, please do not open and repair it by yourself , contact us as soon as possible.

2. After powering on the instrument should display related information, so if there is no display or the display is abnormal, immediately turn off the power and check whether the power source functions normally.

3. Keep the wire connection heads clean, away from moisture or water, otherwise the instrument may give inaccurate measurement results.

4. Clean the electrode frequently and ensure it is not contaminated.

5. Calibrate the electrode regularly.

6. During the period of no water supply, ensure the electrodes are soaked in the tested liquid, or their service life may be shortened.

Performance of a pH meter depends on maintenance of electrodes to a great extent.

Chapter 9 Notice of ordering

1. Product ordering

(1) When ordering products please specify the quality of the water to be tested (pure water, hyperpure water or waste water), as this determines selection of electrodes.

(2) Please specify whether triplex or duplex electrodes are desired.

(3) Please tell us the distance between the measurement pool and the secondary meter, and the connector and outer diameter of water pipes (three specs available, respectively φ8, φ10 and φ12. φ10 if not specified).

(4) Please specify the length of the electrode wire (5m if not specified).

(5) If the electrode wire exceeds 20m, a impedance converter is required.

(6) Please specify the installation manner of the electrode and the secondary meter.

(7) Please specify other special requirements (if any).

Appendix 1

Instructions on preparation of standard pH solution: Cut the plastic bag, put the powder into a 250mL volumetric flask, flush the inner wall of the plastic bag with a little CO_2-free distilled water, add distilled water to the flask at 20℃ till the scale mark of the flask, and shake up the solution.

pH value of the solution (accuracy: ±0.01pH)

Temperature ℃	pH value of 0.05M potassium acid phthalate	pH value of 0.025M phosphate mixture	pH value of 0.01M borax
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

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