Laboratory Equipment Manufacturer
www.mrclab.com

INE-PHS-3E pH Meter
Operating Manual

PLEASE READ THIS MANUAL CAREFULLY BEFORE OPERATION

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MRC.12.16

ADVICE:

- Read this instruction carefully before operating the meter.
- The meter should be re-tested by metrological department when it is used for over one year. The meter can't be used until it is up to standard.
- The warranty of the glass PH electrode is one year. The electrode should be replaced in time after one year no matter whether it is used or not, since the performance of it will be influenced.
- When pH electrode is used for the first time, or if pH electrode is not used for a long time, it must be immerged in 3mol/L (KCl) solution for 24 hours before operating.

CONTENT

1. General

INE-PHS-3E pH meter is a precise digital display pH meter, which adopts double digits LCD display with a big screen and blue back light. It displays PH value and temperature value or mV value and temperature value simultaneously. It is suited for measuring pH value and potential (mV) of water solution in laboratories of universities, institutions and enterprise. Besides, it can also be used to measure electrode potential with various ion-selected electrode and measure oxy-reduction potential (ORP) value with ORP electrode.

2. MAIN SPECIFICATIONS AND PERFORMANCE

2.1 Range

	pH	mV	Temp.
Measuring range	(0~14.00)pH displaying range: -2.00~18.00pH	(0~±1999)mV automatic polar display	(0-99.9)□
Resolution	0.01pH	1mV	0.1□
Temp. compensation			(0~99.9)□

2.2 Accuracy

	pH	mV	Temp.
Electronic unit	±0.01pH±1bit	±1mV ±1 bit	±0.3□±1 bit
The meter	±0.02pH±1bit		±0.5□±1 bit
Temp. compensation	±0.01pH±1 bit		
Repetitive of the electronic units	0.01pH	1mV	
Repetitive of the meter	≤0.01pH		
Stability of the electronic unit	±0.01pH ±1bit/3h		

2.3 Electronic input current: ≤$2x10^{-12}$A

2.4 Electronic input impedance: ≥$1x10^{12}$Ω

2.5 External dimensions Lxbxh, mm 300x200x72

2.6 Weight: 1.5kg

2.7 Normal operating conditions:

a) Ambient temperature: (5~40)□

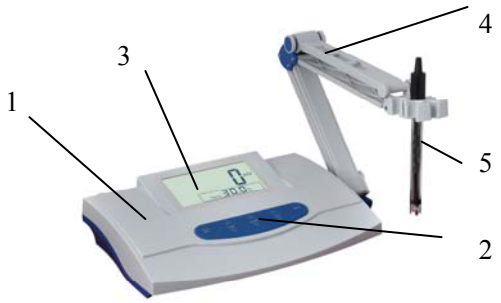
b)Relative humidity: ≤85%

c)Power supply: AC: 220V, Frequency: 50Hz

d) No strong electromagnetic interference to surrounding except the geomagnetic field

3. CONSTRUCTION

Front panel of the meter



1. Case cover

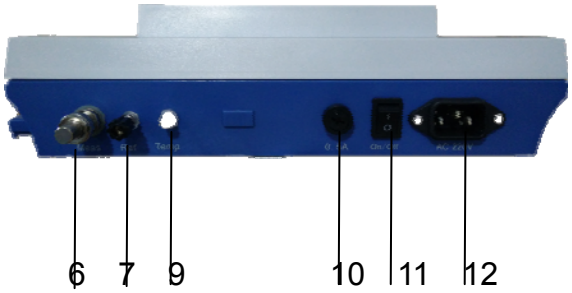
*1- Multi-function electrode support stand rack (it has been set up under bottom of the meter)

2. keyboard

3. Screen 5. Electrode

4. Multi-function electrode support stand

Back panel of the meter



6. Measuring electrode socket

7. Reference electrode terminal

9. Temperature electrode socket

10. Fuse

11. Power switch

12. Power socket

Descriptions of keyboard

Keyboard	Function
“pH/mV” button	Press this button to select mV measuring, pH measuring,
“Std” button “Slope” button	For calibration, slope adjusting function
“ENTER” button	Press this button to confirm the last one operation and then to the next state. The other function of the button is in case of mistaken operation in the course of calibration, users may switch off the meter, then hold “ENTER” button, switch on the meter again, the meter will be in the state of beginning.
“▲” button	This button is a increasing value key. Press the button to adjust the value larger. Press the button to adjust the temperature value larger manually at the pH measurement state; Press the button to adjust the calibration,slope pH value larger manually at the calibration,slope adjusting state.
"▼" button	This button is a reducing value key. Press the button to adjust the value smaller. Press the button to adjust the temperature value smaller manually at the pH measurement state; Press the button to adjust the calibration,slope pH value smaller manually at the calibration,slope adjusting state.

Descriptions of LCD display

-18.88—Displaying pH measurement and mV measurement value

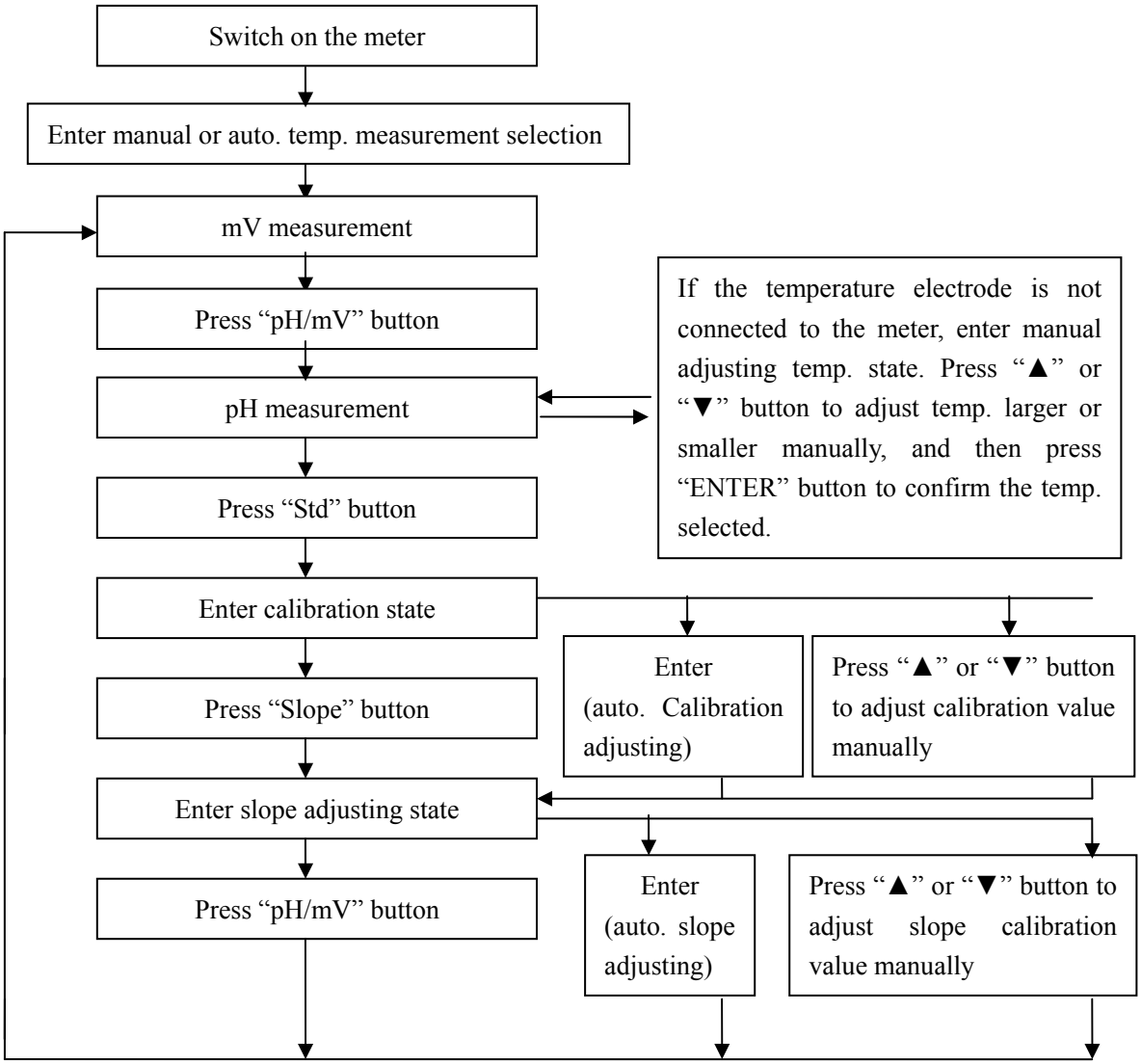
88.8 — Displaying temperature value. If the ATC probe connected to the meter, the displayed temperature value is the automatic measuring temperature, i.e. the temperature of measured solution; if the ATC probe is not connected to the meter, the meter will display temperature value which is set by manual.. Press this button to set temperature value larger or smaller at the pH measurement state and then press “ENTER” button to confirm the temperature value selected.

PHmV—Being pH and mV measurement value unit

□—Being temperature unit. The □ light is flashing, the meter enters adjusting temperature state manually.

Calibration/slope/measurement—Displaying corresponding working state.

INE-PHS-3E
Operating flow diagram



4. OPERATION

Preparations before start

a) Insert multi-function electrode support (4) in the seat of multi-function electrode support stand rack (*1).
b) Install pH combination electrode (12) on electrode support stand (4).
c) Take off the sleeve (13) of pH combination electrode, take off rubber sleeve, then small hole on tope of the electrode appears.
d) Clean the electrode with distilled water

4.1 Calibration

4.1.1 Automatic calibration

(Be suitable for calibrating pH 4.01、pH7.00、pH10.01 standard buffer solution)

You must calibrate before operating the meter. Generally, the meter should be calibrated once a day when it is for continuous use.

The meter have a auto recognition function that can certificate PH4.00, 7.00 and 10.01 three PH buffer solution. Do not press ▲▼ button to adjust data after pressed “STD” key or “Slope” button, it is direct to press “Enter” button and then finish calibration.

To press “STD” button to do one point calibration;

To press “Slope” button to do two point calibration

The meter can do other calibration that it is not PH 4.00, PH 7.00 and PH 10.01 PH buffer. Adjust PH value in the state of calibration to the PH value of the standard solution at this temperature, to press “Enter” button and then finish.

a) Pull out Q9 short-circuited plug(14) from the measuring electrode socket (6);
b) Insert combination electrode (12) into the measuring electrode socket (6);
c) If users don't use combination electrode, insert glass electrode plug into the electrode socket (6), insert reference electrode in reference electrode terminal (7);
d) Turn on the meter, the screen displays the model, slope and E0, enter the measuring state automatically. Press “ pH / mV” button, the meter will enter pH measuring state;

e) If the temperature electrode is connected to the meter, insert the temperature electrode into the solution, the meter will measure temperature value automatically; if the temperature electrode is not connected to the meter, the meter will display temperature value which is set by manual. Press "▲" or “▼” of Temp button to adjust temperature value larger or smaller manually at the pH measurement state (only at the pH measurement state), to make temperature value the same as the temperature of measured solution, then press “Enter” button.

One-point calibration:

One point calibration that is to calibrate EO with one standard buffer, the default slope is 100%.

Note: The meter will delete last data auto after done one point calibration. The default slope is 100% after one point calibration.

f) Insert PH electrode which has been cleaned with distilled water into pH7.00 standard buffer solution in the state of measurement. Press “Std” button once, the screen will display “Std yes”. Press “Enter” button to enter calibration state, press any button to exit and return the measuring state.
Enter the calibrating state, the meter recognizes the buffer automatically and displays the pH value of standard buffer solution at this temperature. When the value is stable, press "Enter" button, displays the slope and E0 and return the measuring state, if want to stop the calibration, press “pH / mV” button to exit.

Two-point calibration:

g) Prepare two standard buffer solutions. Insert the electrode which has been cleaned with distilled water into pH4.00, press “Std” button once, the screen will display “Std yes”. Press “Enter” button to enter calibration state, press any button to exit and return the measuring state.
Enter the calibrating state, the meter recognizes the buffer automatically and displays the pH value of standard buffer solution at this temperature. When the value is stable, press "Enter" button to finish and return the measuring state.

Insert the electrode which has been cleaned with distilled water into pH10.01, press “Slope” button once, the screen will display “Std yes”. Press “Enter” button to enter calibration state, press any button to exit and return the measuring state.
Enter the calibrating state, the meter recognizes the buffer automatically and displays the pH value of standard buffer solution at this temperature. When the value is stable, press "Enter" button to finish and return the measuring state.

4.1.2 Manual calibration

(Be suitable for calibrating any standard buffer solution from pH0.00 to 14.00)

The step a) to e) is the same as the automatic calibration

One-point calibration

f) Insert the electrode which has been cleaned with distilled water into pH7.00 standard buffer solution. Press “Std” button once, the screen will display “Std yes”. Press “Enter” button to enter calibration state, press any button to exit and return the measuring state.

Press "▲"or “▼” of “Std” button to adjust pH value larger or smaller according to your need, and then press “Enter” button again to finish.

Two-point calibration

g) Prepare two standard buffer solutions. Insert the electrode which has been cleaned with distilled water into pH4.00, press “Std” button once, the screen will display “Std yes”. Press “Enter” button to enter calibration state, press any button to exit and return the measuring state.

Press "▲"or “▼” of “Std” button to adjust pH value larger or smaller according to your need, and then press “Enter” button again to finish.

Insert the electrode which has been cleaned with distilled water into pH10.01, press “Slope” button once, the screen will display “Std yes”. Press “Enter” button to enter calibration state, press any button to exit and return the measuring state.

Enter the calibrating state, the meter recognizes the buffer automatically and displays the pH value of standard buffer solution at this temperature. When the value is stable, press "Enter" button to finish and return the measuring state.

4.1.3 Slope reset

If the slope is not correct, two ways could recover:

a) Calibrating the electrode again.

b) Under the measuring state, press “Enter” button more than 3 seconds, the meter displays “SYS rSt”, after a moment, screen blinks, press “Enter”, the meter reset (slope=100%, E0=0 mV).

Notes:

Generally the buffer solution used for 1st calibration is pH 7.00 solution, for the second calibration, use the solution that is close to pH value of measured solution. If measured solution appears to be acidity, pH 4.01 buffer solution should be selected;

if measured solution appears to be alkalinity, pH 10.01 buffer solution should be selected. In general situation, the meter needn't re-calibrating within 24 hours.

4.2 pH measurement

The calibrated meter (at the pH measuring state) is used to measure the measured solution.

If temperature electrode is connected to the meter, insert the temperature and pH measuring electrode into measured solution, stir the solution with glass stick to make

the solution even, pH value of solution will be displayed on screen. If temperature electrode is not connected to the meter, measuring procedure differs on whether temperature of measured solution is the same as the calibrated solution. The operating procedure is as follows:

(1) When temperature of measured solution and temperature of positioning temperature are same, measuring procedure is as follows:
   a) Rinse the electrode head with distilled water, then clean it with measured solution;
   b) Insert electrode into measured solution, stir the solution with glass stick to make the solution even, pH of solution will be displayed on screen.

(2) When temperature of measured solution is different from temperature of positioning solution, measuring procedure is as follows:
   a) Rinse the electrode head with distilled water, clean it with measured solution again;
   b) Measure temperature value of measured solution with thermometer;
   c) Press "▲" or "▼" "Temp" button to make the meter display temperature value of measured solution, then press "ENTER" button;
   d) Insert electrode into measured solution, stir the solution with glass stick to make the solution even, pH value of the solution is displayed on screen.

4.3 Electrode potential (mV) measurement

1) Turn on the meter to enter mV measurement state.
2) Clip ion selective electrode (or metal electrode) and reference electrode on the electrode support stand;
3) Rinse the electrode head with distilled water, clean it with measured solution once more;
4) Insert the plug of ion electrode into measuring electrode socket (6);
5) Insert reference electrode into reference electrode terminal (7) on back panel of the meter;
6) Insert above two electrodes into measured solution, stir the solution to be even, the electrode potential (mV value) of this ion selective electrode will be displayed on screen, ±polarity will also be displayed automatically;
7) If measured signal is over the measuring range of the meter, or measuring terminal is broken circuit, the screen won't be bright, it shows over load alarming Err.
8) When using metal electrode to measure electrode potential. Insert Q9 plug into measuring electrode socket (6), connect the clip and leading line of metal electrode; or using electrode transducer, one end of the electrode transducer is connected with electrode socket (6), metal electrode is connected with transducer. Reference electrode is connected with reference electrode terminal (7).

4.4 Temperature measurement

The meter displays the temperature value directly in the any state of measurement when temperature sensor is connected with the meter.

5 MAINTENANCE

The meter should be often maintained, pH meter must have very high input impedance. There are often chemical reagents in ambient surrounds, so necessary maintenance can guarantee the meter's normal working.

1) The input end of the meter (electrode socket 6) must be kept dry and clean. When the meter is not working, please insert Q9 short circuit plug into the socket to prevent from dirt and water
   steam.
2) Electrode transducer (purchased part) is fitted with other electrodes, please keep it waterproof and dirt proof.
3) While measuring, leading line of the electrode should be kept motionless so as to avoid unstable measurement.
4) Power supply of the meter must have good grounding.
5) The meter is designed with MOS integrated circuit, therefore the electric welding machine must have good grounding when servicing.
6) When calibrating with buffer solution, stability of buffer solution should be assured, don't make buffer solution by mistake, otherwise it will lead incorrect measuring results.

6 CAUTIONS FOR ELECTRODE OPERATION

1) Before measuring, the electrode must be made positioning calibration with buffer solution of known pH value, it would be better if the value is close to measured value.
2) After taking off electrode sleeve, the users must take care of the electrode, glass bulb must not be touched to hard substance, any damage will make the electrode cease to be effective.
3) After measurement, put on the electrode sleeve that has little supplementary liquid in it to keep bulb wet, but don't immerge it in distilled water.
4) Out reference supplementary liquid of the combination electrode is 3mol/L KCl solution, it can be added from the small hole on the top or electrode. When combination electrode is not working, put on rubber sleeve to prevent supplementary liquid from dry.
5) The output ends of the electrode must be kept clean and dry to prevent from two ends short circuit, otherwise measurement will not be correct and effective.
6) The electrode should be fitted with pH meter of high input impedance ($\geq 10^{12}\Omega$) to keep good performance.
7) Don't immerge electrode in distilled water, protein solution or acid fluoride solution for a long time.
8) Electrode can't be touched to organic silica oil.
9) After electrode is used for over a long period of time, if slope becomes lower, immerge the bottom part of the electrode in 4% HF solution for 3~5 seconds, wash it with distilled water, then immerge it in 0.1mol/L of hydrochloric acid solution to renew it.
10) If the electrode is inactivated because of the substance that pollutes sensitive bulb in measured solution, slope will be lower, the value will not be correct. If this happens, please clean the electrode with some solutions according to the property of polluting substance. The electrode is then renewed.

Notes:

1:Tetrachloro-methane, trichloroethylent, furnaidine etc. can't be selected as detergent, because they will dissolve polycarbonate resin, the shell of the electrode is made of polycarbonate resin, glass bulb will easily be polluted if the shell is dissolved. And the electrode will lose effectiveness. Combination electrode can't be used to measure the above solution, either.

2: When using pH combination electrode, the most possible problem will be liquid interface of out reference electrode, block in liquid interface is the main cause of measuring error.

3: when measured solution is PH 10.00, please select buffer solution pH 10.01.

4: when measured solution is PH 4.50, please select buffer solution pH 4.01.

7 COMMON PROBLEMS AND SOLVING

Polluting substance	detergent
Inorganic metal oxide	below 1 mol/L weak acid
Organic fat or oil substance	weak detergent (weak alkalinity)
Resin high polymer	alcohol, acetone, ether
Protein blood cell sediment	5% stomach proteinase + 0.1 mol/L HCl solution
Pigment substance	weak bleaching liquid, peroxy-hydrogen

If the users need to measure oxy-reduction potential (ORP) or measure relevant ion electrode potential, please select to purchase electrode transducer and relevant ion electrode.

Accessory information

Model	Name	Description
INE-PHS-3E	PH Meter	Standard
	Multi-function electrode stand	Standard
E-301-C	PH 3-in-1 combination electrode	Standard 0-14PH
Standard Buffer Solution	PH4.00,7.01,10.00	Standard 5 bags each
T-818-B-6	Temperature electrode	
E-201	PH sealed combination electrode	Optional 0-14PH
E-201-C	PH refillable combination electrode	Optional 0-14PH
E-201-Z	PH cone combination electrode	Optional 0-14PH
E-201--P	PH plate combination electrode	Optional 0-14PH
65-1C	pH glass combination electrode	Optional 0-14PH
232	Reference electrode	Optional 0-14PH
231-01	PH glass electrode	Optional 0-14PH
221	PH glass electrode	Optional 0-14PH
501	Refillable ORP combination electrode	Optional ±1999mV

Appendix

Appendix 1：Buffer solution's relationship between pH value and temperature

Temperature □	0.05mol/kg Potassium hydrogen phthalate	0.025mol/kg mixed phosphate	0.01mol/kg sodium tetraborate
5	4.00	6.95	9.39
10	4.00	5.92	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	9.11
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

Appendix 2：Instrument display comparison table

Display	Reason	Solution
1. Always displays "Err"	Instrument has self-check function, it will show this information when it is wrong with storage chip.	Shut down and turn it on after a while for a few times. If the problem is still exists, please contact our company.
2. It displays "Err" in mV area and temperature part is normal.	Instrument will show this information when input potential is over range.	Try to insert the short circuit plug into the electrode socket.If the problem is still exists, please contact our company.
3. In the measuring state, the instrument can not switch to pH measuring state.	When the measuring range is over ±20.00pH, the instrument will show"Err" first and then switch to mV measuring state	1. Reduce the input signal. 2. Try to insert the short circuit plug into the electrode socket.If the problem is still exists, please contact our company.
4. In the measuring state, press "ENTER" button and hold at least 3 seconds, instrument shows "SYS rst".	Calibration data reset function. It means "System reset?"	If user needs to reset, press "ENTER" button at this time, otherwise you can press any other key to exit.
5. Press "STD" or "Slope" button and instrument shows "std YES".	This is normal. It means "Standard yes?"	If user wants to calibrate the electrode, press "ENTER" button at this time, otherwise you can press any other key to exit.
6. Display error.		Please contact our company.

Appendix 3: Term explanation

pH slope: The variable quantity of potential caused by each 1 pH value, it is represented symbolically by mV/pH or %.

E_0 of pH: Also known as "zero-potential", it always means the potential value when pH is 7.

One-point calibration: Use one pH buffer solution to do calibration.

Two-point calibration: Use two pH buffer solution to do calibration.

Appendix 4: Way to make buffer solution

1. pH 4.00 solution: Dissolve 10.12g GR potassium acid phthalate dissolved in 1000ml high-purity deionized water.
2. pH 6.86 solution: Dissolve 3.387g GR monopotassium phosphate and 3.533g GR disodium hydrogen phosphate in 1000ml high-purity deionized water.
3. pH 9.18 solution: Dissolve 3.80g GR sodium tetraborate into 1000mL high-purity deionized water.

NOTE：The water used for configuring solution said above should be boiled for 15~30 min to get rid of the dissolved CO2. It also should be kept from air to avoid pollution.

Packing List

INE-PHS-3E

pH Meter

Number	Description	Quantity
1	INE-PHS-3E pH Meter	1 set
2	Power Line (universal)	1
3	Buffer Solution pH 4.7.10	5 bags for each
4	Fuse BGXP Φ5*20 0.5A	2
5	Protective Cover (small)	1
6	PH Combination Electrode	1
7	Operating Instruction	1