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VWR®

sympHony Electrodes

Ag/AgCl pH Electrode Instruction Manual



sympHony™

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Table of Contents

Introduction 1

Required Equipment 3

Electrode Preparation 4

Gel-filled pH Electrode Preparation. 4
Refillable pH Electrode Preparation 4
Posi-pHlo™ pH Electrode Preparation 5
Double Junction pH Electrode Preparation 5

Sample Requirements. 6

Measuring Hints 7

Electrode Calibration 8

One Buffer Calibration. 8
Two Buffer Calibration 9

pH Measurements. 10

Electrode Storage 10

Short-Term Storage (up to one week) 10
Long-Term Storage (over one week) 10

Electrode Maintenance. 11

General Cleaning 11

Troubleshooting 12

VWR sympHony™ Help Line 12

Ordering Information 13

Specifications. 14

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Introduction

This user guide contains information on the preparation, operation and maintenance of the VWR sympHony™ Ag/AgCl pH electrodes, including the low maintenance gel-filled pH electrodes, refillable pH electrodes, 3-in-1 pH/ATC electrodes, Posi-pHlo™ pH electrodes and double junction pH electrodes.

sympHony Gel-Filled pH Electrodes

The sympHony low maintenance gel-filled combination pH electrodes are designed for routine pH measurements in rugged environments. The unbreakable body extends beyond the pH sensing glass bulb for protection. The sealed reference section is permanently filled with a KCl gel and never needs to be filled.

sympHony Refillable pH Electrodes

The sympHony refillable combination pH electrodes are designed for routine pH measurements in the laboratory or field, wherever accuracy and a wide temperature range are required.

sympHony 3-in-1 pH/ATC Electrodes

The sympHony 3-in-1 pH/ATC electrodes have a built-in thermistor for automatic temperature compensation (ATC) during pH measurements.

sympHony Posi-pHlo pH Electrodes

The sympHony Posi-pHlo combination pH electrodes are designed for general purpose pH measurements in the laboratory or field, wherever the best accuracy and widest temperature range is required. The liquid to liquid junction is ideal for pH measurements of difficult or dirty samples, such as soils, sludge and viscous solutions. The junction can be easily cleaned by simply pressing down on the electrode cap to flush the junction area.

sympHony Double Junction pH Electrodes

The sympHony double junction combination pH electrodes are designed for applications in which the sample cannot not come in contact with silver ions. These electrodes offer a mercury-free alternative to calomel pH electrodes.

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Cat. No.	Description
14002-760	Refillable pH electrode with glass body, semi-micro tip and BNC connector
14002-762	Refillable pH electrode with glass body, rugged bulb and BNC connector
14002-764	Gel-filled pH electrode with epoxy body and BNC connector
14002-766	Gel-filled pH electrode with epoxy body, semi-micro tip and BNC connector
14002-768	Gel-filled pH electrode with epoxy body, flask length and BNC connector
14002-770	Gel-filled pH electrode with epoxy body, flat surface bulb and BNC connector
14002-778	Gel-filled 3-in-1 pH/ATC electrode with epoxy body and BNC and 3.5 mm phono tip connectors
14002-780	Refillable pH electrode with epoxy body and BNC connector
14002-782	Posi-pHlo™ refillable pH electrode with glass body and BNC connector
14002-784	Posi-pHlo refillable pH electrode with epoxy body and BNC connector
14002-850	Refillable pH electrode with glass body and BNC connector
14002-860	Gel-filled 3-in-1 pH/ATC electrode with epoxy body and BNC and miniDIN connectors
14231-174	Double junction refillable pH electrode with glass body and BNC connector
14231-176	Double junction refillable pH electrode with glass body, semi-micro tip and BNC connector
14231-178	Double junction refillable pH electrode with glass body, micro tip and BNC connector
87000-078	Double junction gel-filled 3-in-1 pH/ATC electrode with epoxy body and BNC and miniDIN connectors
87000-080	Double junction gel-filled pH electrode with epoxy body and BNC connector
87000-082	accumet™ equivalent double junction gel-filled 3-in-1 pH/ATC electrode with epoxy body and BNC and 2.5 mm phono plug connectors
87000-084	accumet equivalent gel-filled 3-in-1 pH/ATC electrode with epoxy body and BNC and 2.5 mm phono plug connectors

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Required Equipment

1. sympHony™ pH meter or equivalent

    - The sympHony pH electrodes can be used on any pH meter with a BNC connection. The 3-in-1 electrodes have temperature connectors that are meter specific.

2. sympHony pH electrode

    - The 14002-778 3-in-1 electrode has a temperature connector that is compatible with the sympHony SB20, SB21, SB30I, SP20, SP21, SP30I, SR30I, SR40C and SR60IC meters

    - The 14002-860 and 87000-078 3-in-1 electrodes have a temperature connector that is compatible with the sympHony SB70P, SB80PI, SB80PD, SB80PC, SB90M5, SP70P, SP80PI, SP80PD, SP80PC and SP90M5 meters

    - The 87000-082 and 87000-084 3-in-1 electrodes have a temperature connector that is compatible with accumet™ pH meters with a 2.5 mm phono plug ATC input

3. pH electrode filling solution (for refillable electrodes only)

    - Use Cat. No. 14002-825 for the refillable pH electrodes (Cat. No. 14002-760, 14002-762, 14002-780, 14002-782, 14002-784, 14002-850)

    - Use Cat. No. 14004-260 for the double junction refillable pH electrodes (Cat. No. 14231-174, 14231-176 and 14231-178)

4. pH electrode storage solution, Cat. No. 14002-828

    - If storage solution is not available, a temporary solution can be prepared by adding 1 gram of potassium chloride (KCl) to 200 mL of pH 7 buffer

5. pH buffers – at least two pH buffers are recommended for precise measurements, one buffer should be near pH 7 and buffers should be one to three pH units apart

6. Beakers, plastic or glass

7. Magnetic stirrer or sympHony stirrer probe, Cat. No. 87000-090. The sympHony stirrer probe can be used with the sympHony SB70, SB80 and SB90 benchtop meters.

8. Distilled or deionized water

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Electrode Preparation

Gel-filled pH Electrode Preparation

1. Remove the protective shipping cap from the sensing element and save the cap for storage.

2. Clean any salt deposits from the exterior of the electrode by rinsing with distilled water.

3. Soak electrode in pH electrode storage solution, Cat. No. 14002-828, for at least one hour.

4. Connect the electrode to the meter.

Refillable pH Electrode Preparation

1. Remove the protective shipping cap from the sensing element and save the cap for storage.

2. Clean any salt deposits from the exterior of the electrode by rinsing with distilled water.

3. Uncover the filling hole by removing the tape and then add electrode filling solution, Cat. No. 14002-825, to the electrode. To maintain an adequate flow rate, the level of filling solution must always be above the reference junction and at least one inch above the sample level. The filling hole should be open whenever the electrode is in use.

4. Place the electrode in an electrode holder and suspend the electrode in air for 5 minutes to thoroughly wet the reference junction.

5. Shake the electrode downward (similar to a clinical thermometer) to remove air bubbles.

6. Soak electrode in pH electrode storage solution, Cat. No. 14002-828, for at least 30 minutes.

7. Connect the electrode to the meter.

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Posi-pHlo™ pH Electrode Preparation

1. Remove the protective shipping cap from the sensing element and save the cap for storage.

2. Clean any salt deposits from the exterior of the electrode by rinsing with distilled water.

3. Uncover the filling hole by removing the tape and then add electrode filling solution, Cat. No. 14002-825, to the electrode. To maintain an adequate flow rate, the level of filling solution must always be above the reference junction and at least one inch above the sample level. The filling hole should be open whenever the electrode is in use.

4. Wet the junction by pressing down on the electrode cap to let a few drops of the filling solution flow out of the electrode and then replenish any lost solution.

5. Shake the electrode downward (similar to a clinical thermometer) to remove air bubbles.

6. Soak electrode in pH electrode storage solution, Cat. No. 14002-828, for at least 30 minutes.

7. Connect the electrode to the meter.

Double Junction pH Electrode Preparation

1. Carefully remove the protective shipping cap from the sensing element and save the cap for storage.

2. Clean any salt deposits from the exterior of the electrode by rinsing with distilled water.

3. If using a refillable double junction electrode, uncover the filling hole by removing the tape and then add double junction electrode filling solution, Cat. No. 14004-260, to the electrode. To maintain an adequate flow rate, the level of filling solution must always be above the reference junction and at least one inch above the sample level. The filling hole should be open whenever the electrode is in use.

4. Soak electrode in pH electrode storage solution, Cat. No. 14002-828, for at least 30 minutes.

5. Connect the electrode to the meter.

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Sample Requirements

Electrodes that have an epoxy body and should not be used in samples that contain non-aqueous solutions or organic solvents.

Samples should be aqueous, however, pH measurements may be made in partially aqueous or some water-miscible solvents. The results must be interpreted with caution, because the entire pH scale is shifted when the solvent system changes. As a practical matter, readings in partially aqueous systems should be compared to a standard buffer system. The National Institute of Standards and Technology has published buffer values for 50% methanol solutions.

The refillable and gel-filled electrodes contain a single junction silver/silver chloride (Ag/AgCl) reference that is incompatible with solutions that contain silver complexing or binding agents such as TRIS, proteins and sulfides. To measure pH in these solutions, use a Posi-pHlo™ or double junction pH electrode.

Proteins cause the additional problem of coating the sensing bulb, so extra care should be taken to keep the electrode clean while measuring samples.

The low maintenance gel-filled pH electrodes should not be used in solutions with temperatures above 80 °C.

The double junction pH electrodes should not be used in solutions with temperatures above 60 °C.

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Measuring Hints

- Always use fresh buffers for calibration. Choose buffers that are one to three pH units apart.
- Check electrode slope daily by performing a two buffer calibration. The slope should be 92 to 102%.
- If using a refillable electrode, remove the filling hole cover during measurements to ensure a uniform flow of filling solution.
- Between measurements, rinse electrodes with distilled water and then with the next solution to be measured.
- Stir all buffers and samples at a uniform rate.
- Buffers and samples should be at the same temperature. If samples are at different temperatures, perform temperature compensation as described in the meter user guide.
- Place a piece of insulating material, such as Styrofoam or cardboard, between the magnetic stirrer and beaker to prevent measurement errors from the transfer of heat to the sample.
- To reduce the chance of error due to polarization, avoid rubbing or wiping the electrode bulb. Use a lint-free tissue and gently blot the bulb.
- Flat surface electrodes may be used on any moist surface or in liquids.

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Electrode Calibration

General Calibration Procedure

For detailed instructions on pH calibration, manual pH calibration and temperature compensation, consult your meter user guide.

One Buffer Calibration

1. Choose a buffer near expected sample pH.

2. The buffer should be at same temperature as the sample. If the buffer and samples are at varying temperatures, temperature compensation is recommended.

3. Prepare the meter according to the meter user guide.

4. Rinse the electrode first with distilled water and then with the buffer being used for calibration.

5. Place the electrode into the buffer. When the reading is stable, set the meter to the pH value of the buffer at the measured temperature. Refer to the meter user guide for a detailed procedure. **Table 1** provides pH values at various temperatures.

6. Proceed to the **pH Measurement** section.

Table 1
pH Values of Buffers at Various Temperatures

Nominal Buffer Value at 25 °C	Temperature				
	0 °C	5 °C	10 °C	20 °C	30 °C
1.68	1.67	1.67	1.67	1.67	1.68
3.78	3.86	3.84	3.82	3.79	3.77
4.01	4.00	4.00	4.00	4.00	4.02
6.86	6.98	6.95	6.92	6.87	6.85
7.00	7.11	7.08	7.06	7.01	6.98
7.41	7.53	7.50	7.47	7.43	7.40
9.18	9.46	9.40	9.33	9.23	9.14
10.01	10.32	10.25	10.18	10.06	9.97

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Two Buffer Calibration

This procedure is recommended for precise measurements.

1. Select two buffers that bracket the expected sample pH. The first buffer should be near the electrode isopotential point (pH 7) and the second should be near the expected sample pH (pH 4 or pH 10).

2. The buffers should be at same temperature as the sample. If the buffers and samples are at varying temperatures, temperature compensation is recommended.

3. Rinse the electrode first with distilled water and then with the first buffer.

4. Place the electrode into the first buffer. When the reading is stable, set the meter to the pH value of the buffer at the measured temperature. Refer to the meter user guide for a detailed procedure. **Table 1** provides pH values at various temperatures.

5. Rinse the electrode first with distilled water and then with the second buffer.

6. Place the electrode into the second buffer. When the reading is stable, set the meter to the pH value of the buffer at the measured temperature. Refer to the meter user guide for a detailed procedure. **Table 1** provides pH values at various temperatures.

7. Proceed to the **pH Measurement** section.

Temperature					
40 °C	**50 °C**	**60 °C**	**70 °C**	**80 °C**	**90 °C**
1.69	1.71	1.72	1.74	1.77	1.79
3.75	3.75				
4.04	4.06	4.09	4.13	4.16	4.21
6.84	6.83	6.84	6.85	6.86	6.88
6.97	6.97	6.97	6.99	7.03	7.08
7.38	7.37				
9.07	9.01	8.96	8.92	8.89	8.85
9.89	9.83				

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pH Measurements

1. Calibrate the electrode as described in the **Electrode Calibration** section.

2. Rinse the electrode with distilled water and then with the sample.

3. Place the electrode into the sample.

4. When the reading is stable, record the pH and temperature of the sample.

Electrode Storage

Short-Term Storage (up to one week)

Soak the electrode in pH electrode storage solution, Cat. No. 14002-828. If storage solution is not available, a temporary solution can be prepared by adding 1 gram of potassium chloride (KCl) to 200 mL of pH 7 buffer. Do not store the electrode in distilled or deionized water, as it will shorten the electrode life.

Long-Term Storage (more than one week)

Rinse off any salt buildup with distilled water and remove any membrane/junction deposits. If the electrode is refillable, fill the electrode with the appropriate filling solution and securely cover the fill hole. Cover the pH bulb with the protective cap containing a few drops of storage solution.

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Electrode Maintenance

1. Inspect the electrode for scratches, cracks, salt crystal buildup or membrane/junction deposits.

2. Rinse off any salt buildup with distilled water. Remove any membrane/junction deposits as directed in the **General Cleaning** section.

3. If the electrode is refillable, remove the old filling solution, flush the electrode with fresh filling solution and refill the electrode with fresh filling solution.

General Cleaning

1. Soak the electrode in 0.1 M HCl or HNO_3 for 15 to 30 minutes.

   To remove protein buildup, soak the electrode in 1% pepsin and 0.1 M HCl solution for 15 minutes.

   To remove inorganic buildup, soak the electrode in a 0.1 M tetrasodium EDTA solution for 15 minutes.

   To remove grease and oil, rinse the electrode with a mild detergent.

2. If the electrode is refillable, remove the old filling solution, flush the electrode with fresh filling solution and refill the electrode with fresh filling solution.

3. Soak the electrode in pH electrode storage solution for at least one hour.

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Troubleshooting

Follow a systematic procedure to isolate the problem. The pH measuring system can be divided into four components: pH meter, electrode, sample/application and technique.

pH Meter

The meter is the easiest component to eliminate as a possible cause of error. The sympHony™ pH meters include an instrument checkout procedure and shorting cap for convenience in troubleshooting. Consult the pH meter user guide for details.

Electrode

To test electrode operation:

1. Connect the electrode to a working meter that has a mV measuring mode and set the meter to the mV mode.

2. Rinse the electrode with distilled water and then insert the electrode into fresh pH 7 buffer. When the reading is stable, record the mV value of the pH 7 buffer. The mV value should be -30 to +30 mV.

3. Rinse the electrode with distilled water and then insert the electrode into fresh pH 4 buffer. When the reading is stable, record the mV value of the pH 4 buffer. The mV value should be +150 to +210 mV.

4. Calculate the absolute mV difference between the two buffers. The mV difference should be 160 to 180 mV. The actual mV values will change as the electrode ages, but the mV difference between the two buffers should always be 160 to 180 mV.

If the electrode fails this procedure, clean the electrode as directed in the **Electrode Maintenance** section. Replace the electrode if cleaning and maintenance fail to rejuvenate it.

Sample/Application

The electrode and meter may operate with buffers, but not with the sample. In this case, check the sample composition for interferences, incompatibilities or temperature effects.

Technique

If trouble persists, review operating procedures. Review calibration and measurement sections to be sure proper technique is followed.

VWR sympHony Help Line

After troubleshooting all components of your measurement system, contact us at 1-800-VWR-SUPP.

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Ordering Information

Cat. No.	Description
14002-825	pH electrode filling solution, 5 x 60 mL
14004-260	Double junction pH electrode filling solution, 5 x 60 mL
14002-828	pH electrode storage solution, 475 mL
14002-760	Refillable pH electrode with glass body, semi-micro tip and BNC connector
14002-762	Refillable pH electrode with glass body, rugged bulb and BNC connector
14002-764	Gel-filled pH electrode with epoxy body and BNC connector
14002-766	Gel-filled pH electrode with epoxy body, semi-micro tip and BNC connector
14002-768	Gel-filled pH electrode with epoxy body, flask length and BNC connector
14002-770	Gel-filled pH electrode with epoxy body, flat surface bulb and BNC connector
14002-778	Gel-filled 3-in-1 pH/ATC electrode with epoxy body and BNC and phono tip connectors
14002-780	Refillable pH electrode with epoxy body and BNC connector
14002-782	Posi-pHlo refillable pH electrode with glass body and BNC connector
14002-784	Posi-pHlo refillable pH electrode with epoxy body and BNC connector
14002-850	Refillable pH electrode with glass body and BNC connector
14002-860	Gel-filled 3-in-1 pH/ATC electrode with epoxy body and BNC and miniDIN connectors
14231-174	Double junction refillable pH electrode with glass body and BNC connector
14231-176	Double junction refillable pH electrode with glass body, semi-micro tip and BNC connector
14231-178	Double junction refillable pH electrode with glass body, micro tip and BNC connector
87000-078	Double junction gel-filled 3-in-1 pH/ATC electrode with epoxy body and BNC and miniDIN connectors
87000-080	Double junction gel-filled pH electrode with epoxy body and BNC connector
87000-082	accumet™ equivalent double junction gel-filled 3-in-1 pH/ATC electrode with epoxy body and BNC and 2.5 mm phono plug connectors
87000-084	accumet equivalent gel-filled 3-in-1 pH/ATC electrode with epoxy body and BNC and 2.5 mm phono plug connectors

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Specifications

Isopotential Point

pH 7

Slope

92 to 102% theoretical Nernst slope

Cable Length

1 meter

Electrode-Specific Specifications

Cat. No.	pH Range	Temp. Range	Fill Solution	Dimensions length x diameter
14002-760	0 to 14	0 to 90 °C	14002-825	140 mm x 6 mm
14002-762	0 to 14	0 to 90 °C	14002-825	120 mm x 12 mm
14002-764	0 to 14	0 to 80 °C	N/A	120 mm x 12 mm
14002-766	0 to 12	0 to 80 °C	N/A	145 mm x 6 mm
14002-768	0 to 12	0 to 80 °C	N/A	305 mm x 8 mm
14002-770	0 to 12	0 to 80 °C	N/A	120 mm x 12 mm
14002-778	0 to 14	0 to 80 °C	N/A	120 mm x 12 mm
14002-780	0 to 14	0 to 90 °C	14002-825	120 mm x 12 mm
14002-782	0 to 14	0 to 100 °C	14002-825	120 mm x 12 mm
14002-784	0 to 14	0 to 100 °C	14002-825	120 mm x 12 mm
14002-850	0 to 14	0 to 90 °C	14002-825	120 mm x 12 mm
14002-860	0 to 14	0 to 80 °C	N/A	120 mm x 12 mm
14231-174	0 to 14	0 to 60 °C	14004-260	120 mm x 12 mm
14231-176	0 to 14	0 to 60 °C	14004-260	150 mm x 7 mm
14231-178	0 to 14	0 to 60 °C	14004-260	90 mm x 4.5 mm
87000-078	0 to 14	0 to 60 °C	N/A	120 mm x 12 mm
87000-080	0 to 14	0 to 60 °C	N/A	120 mm x 12 mm
87000-082	0 to 14	0 to 60 °C	N/A	120 mm x 12 mm
87000-084	0 to 14	0 to 80 °C	N/A	120 mm x 12 mm

Specifications are subject to change product without notice.

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