Agilent P3111
pH Electrode
pH 电极

Operating Guide
用户手册

Agilent Technologies

Overview

The P3111 pH Electrode can measure pH values. It is used with the 3200P meter or similar meters, with the R8111 or similar reference electrode.

WARNING **Use this electrode according to the operating manual to avoid personal injury.**

WARNING **The electrode solution can cause chemical burns or illness if it is taken orally or contacted by human skin. Use protective clothing or gloves to avoid contact. In case of contact, rinse contacted area with tap water or deionized water thoroughly.**

CAUTION The electrode body material is glass. Handle with care to avoid damage to the instrument.

Specifications

Table 1 P3111 pH Electrode specifications

Specification	Value
pH range	0 to 14
Zero potential pH with R8111 reference electrode	7.00 ± 0.5
Temperature range	0 to 60 °C
Electrode impedance	< 250 MΩ
Body material	Glass
Electrode diameter	12 mm
Electrode length	120 mm
Cable interface	BNC
Cable length	1000 mm

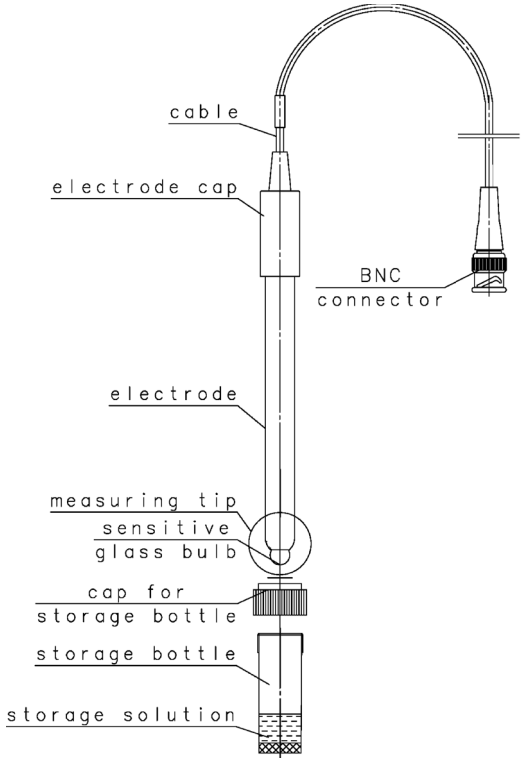

Figure 1 P3111 pH Electrode assembly

Operation

Preparing the electrode

1. Remove the storage bottle and cap from the electrode and store it upright for future use.
2. Rinse the measuring tip with distilled or deionized water.
3. Hold the electrode measuring tip downwards and swing it several times to remove air bubbles near the sensitive glass bulb.

Calibration

1. Connect the electrode and a reference electrode to the meter. Input the temperature of calibration solution according to the meter operating manual.
2. Soak the measuring tip in calibration solutions in sequence. Calibrate the electrode according to the procedures listed in the operating manual.

Measurement

1. Soak the measuring tip in sample solution. When the reading becomes stable, read the value from the meter.
2. Rinse the measuring tip.

Operating hints

- The main material of the measuring tip is glass. Ensure the sample solution will not damage the measuring tip before measurement. Solutions containing solids or crystals will damage the measuring tip.
- Keep calibration solution and sample solution flowing at a uniform speed around the electrode or the accuracy may be impacted.
- Do not soak the electrode in a sample solution for an extended time. After measurement, rinse the electrode carefully.
- White powder or crystals that collect on the electrode during measurement or transportation do not affect the performance of the electrode. Rinse the residue with tap or deionized water.
- The pH of a solution is affected by its temperature.
- For acidic sample solutions, use pH 4.00 and 7.00 standards for calibration. For alkaline sample solutions, use pH 7.00 and 10.01 standards.
- Do not apply force onto the electrode cap, cable or cable interface.
- Keep the cable interface dry.

Maintenance

Cleaning of inorganics

Soak the measuring tip in 0.1 mol/L HCl or EDTA for 15 minutes.

Cleaning of organics

Soak the measuring tip in ethyl alcohol or another solvent that can dissolve organics for 15 minutes.

Cleaning of grease

Soak the measuring tip in weakly alkaline detergent for 15 minutes.

Cleaning of protein precipitation

Soak the measuring tip in 0.1 mol/L HCl solution that contains 1% pepsin for 15 minutes.

Regeneration of the glass sensitive membrane

WARNING **HF is lethal. See the HF material safety data sheet before using it.**

1. Soak the sensitive membrane in 4% HF solution for 3 to 5 seconds.
2. Rinse the membrane in 0.1 mol/L HCl several times.
3. Rinse with distilled or deionized water.
4. After one or more cleaning procedures, thoroughly rinse the electrode with distilled or deionized water.
5. If necessary, empty the reference electrode and add fresh reference solution. Repeat this action 2 or 3 times.
6. Soak the electrode in pH 4.01 solution for at least one hour.

Troubleshooting

Meters

Refer to the meter operating manual. Check all related parts, such as the electrode, calibration solution, and samples.

Electrode

1. Connect the electrode and a reference electrode to the meter. Set the meter to display mV.
2. Soak the measuring tip in pH 4.00 and pH 10.01 calibration solutions. When the readings become stable, record mV values respectively.
3. When the electrode is used with a R8111 reference electrode, the absolute value of the difference between these two mV values should be 326–370 mV in total. This indicates that the electrode has a good performance. If not, perform maintenance on the electrode.

Accuracy

1. Choose any two calibration solutions to calibrate a electrode. Use effective calibration solution. Make sure the distilled or deionized water used to prepare the solutions meets requirements, and the solution is not contaminated or beyond its shelf life.
2. Use this electrode to measure the pH value in another calibration solution.
3. Compare the theoretical value of that calibration solution with the measured value.
4. Ensure the measuring accuracy of the electrode is sufficient for the application.

Samples

The electrode is only suitable for measuring the pH value of conventional solutions. Nonaqueous reagents or solutions with low conductivity or high viscosity may have long measurement times, which can affect measurement accuracy.

For any other problems during electrode use, contact your Agilent Technologies customer service representative.

Storage

1. Install the electrode storage bottle and cap onto the electrode body in sequence.
2. To protect the measuring tip, keep 5–10 mm between the bottom of the storage bottle and the measuring tip of the electrode.
3. Tighten the storage bottle cap.
4. Place the electrode in the storage box and store at ambient temperature and dry conditions.

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概述

实验室常规 pH 值测量用 pH 玻璃电极，与 R8111 参比电极或类似参比电极以及 3200P 仪器或类似仪器一起配套使用。

安全提示

1. 按使用说明使用电极。
2. 电极附带的填充液不宜口服或接触人体敏感器官，如意外接触，应立即用自来水或去离子水清洗。
3. 本电极主体材料为玻璃，没有成年人监管时，不要让十八岁以下人接触或使用本电极。
4. 在储运或使用过程中，电极上可能有少量白色粉末或晶体附着，这是由部分渗出的保存溶液失去水分引起，可用自来水或去离子水冲洗去除，不影响电极性能。

技术参数

测量范围	0–14 pH
零电位 pH （与 R8111 参比电极配套时）	7.00±0.5 pH
温度范围	0–60 °C
电极内阻	< 250 MΩ
外壳材质	玻璃
导线接口	BNC
电极直径	12 mm
电极长度	120 mm
导线长度	1000 mm

电极插图

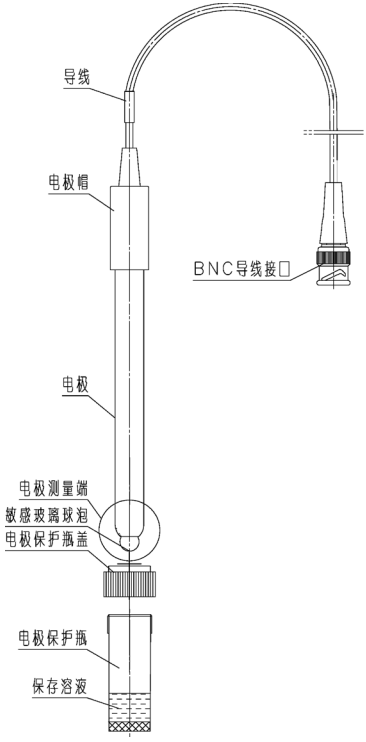

图 1 P3111 pH 电极插图

使用步骤

电极准备

1. 旋开电极保护瓶盖，依次取下电极保护瓶、电极保护瓶盖，将电极保护瓶开口向上水平放置待用。
2. 用蒸馏水或去离子水冲洗电极测量端，将电极测量端向下，空甩电极数次。

电极测量

1. 将电极以及配套的参比电极 （以下简称电极对）分别与仪器连接，按仪器说明输入校正溶液的温度值。
2. 将电极对的测量端依次浸于校正溶液中，按照仪器说明校正电极。
3. 电极校正完毕，将电极对的测量端浸于被测溶液中，待仪器读数稳定后，读取读数。
4. 测量完毕，冲洗电极测量端，依次将电极保护瓶盖、电极保护瓶安装在电极外壳上，安装时应使电极与电极保护瓶的底部保持 5-10 mm 距离以免造成电极损坏，并旋紧电极保护瓶盖。

储存方法

电极放回电极包装盒内，室温干燥保存。

注意事项

1. 电极测量端的主要材料为玻璃，测量前应确认被测溶液不会对电极测量端造成损伤。
2. 电极测量端易碎，使用时注意保护。避免与能划伤玻璃的含砂溶液或固体接触。
3. 保持校正溶液和被测溶液流速一致，否则会引起测量误差。
4. 请勿将电极长时间浸泡于被测溶液内，电极使用完毕，请仔细对电极进行清洗。

5 溶液的 pH 值受温度影响。例如，被测溶液的温度为 10 ℃，此时仪器显示的 pH 值是该溶液 10 ℃时的 pH 值。如需得到 25 ℃下的样品 pH 值，则需把样品温度升至 25 ℃后进行测量，仪器的温度补偿功能不能将溶液 10 ℃时测量的 pH 值转换为 25 ℃时的 pH 值。

6 校正电极时，若被测溶液的 pH 值为酸性，建议使用 pH 4.00 和 pH 7.00 校正溶液；若被测溶液的 pH 值为碱性，建议使用 pH 7.00 和 pH 10.01 校正溶液。

7 电极帽、导线以及导线接口部分应避免受力，以免损坏。

8 导线接口必须保持干燥。

电极维护

电极清洗和修复

1 无机物清洗：将电极测量端浸于 0.1 mol/L HCl 或 EDTA 溶液中 15 min。

2 有机物清洗：将电极测量端浸于无水乙醇 （或能够溶解该有机物的溶剂）中 15 min。

3 油脂类清洗：将电极测量端浸于温热的弱碱性洗涤剂中 15 min。

4 蛋白质沉淀的清洗：将电极测量端浸于含 1% 胃蛋白酶的 0.1mol/L 盐酸溶液中 15 min。

5 玻璃敏感膜修复 （注意：HF 是有毒物质，使用前阅读该物质 MSDS）：将电极测量端浸于 4 % HF 溶液中 3–5 s，然后用 0.1 mol/L HCl 漂洗数次，用蒸馏水或去离子水清洗。

疑难解答

电极使用中发现异常情况，请按下列步骤查找原因

仪器

参看仪器说明书的相关部分
查看仪器、电极、校正溶液、样品等相关部分之间的衔接。

电极

确认电极性能良好

1 将电极以及配套的参比电极分别与仪器连接，仪器显示调整为 mV 读数。

2 将电极测量端依次浸于pH 4.00和pH 10.01校正溶液中，待读数稳定后分别记录仪器显示的 mV 值。

3 与 R8111 参比电极配套使用时，两次记录的 mV 值绝对值之和应在 326-370 mV 之间，则电极性能良好，否则对电极进行维护。

检查电极测量准确度

1 用任意两种校正溶液对电极进行校正。

2 测量其他校正溶液的 pH 值，将测量值与被测校正溶液的理论值进行比对，查看电极测量准确度是否满足用户需求。

校正溶液

1 校正溶液来源有效。

2 配制校正溶液用的蒸馏水或去离子水应符合要求。

3 校正溶液应在有效期内，不污染或变质。

样品

该电极仅适合测量常规溶液 pH 值，测量低电导率溶液、粘度较大或非水

试剂等非常规溶液 pH 值时，电极响应时间会延长或测量结果会受影响。

如在电极使用过程中有其他疑问，请联系售后服务部门。

如需购买，请与安捷伦经销商联系或者登陆安捷伦官方网站。

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Printed in China 03/2012
First edition, March 2012

5973-1789

Agilent Technologies