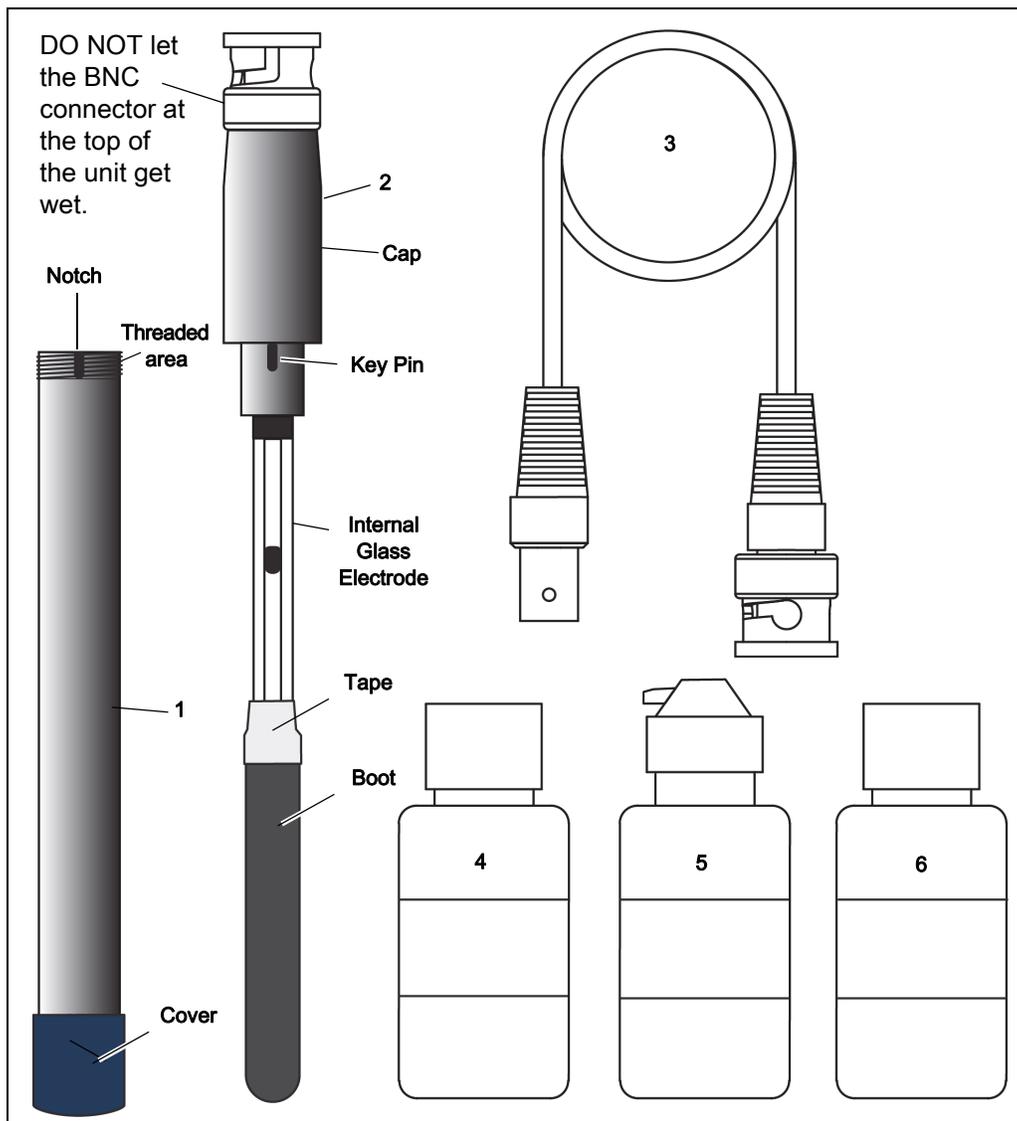


# Carbon Dioxide ISE Probe

PS-3517



Included Equipment	Item	Included Equipment	Item
Carbon Dioxide ISE Electrode Body (2)	1	CO2 Standard Solution 1000 ppm	4
Carbon Dioxide ISE Internal Electrode	2	CO2 Reference Fill Solution	5
BNC Male-to-Female Cable	3	CO2 Ionic Strength Adjuster (ISA)	6

## Introduction

This Carbon Dioxide Ion Selective Electrode (ISE) Probe is a gas-sensing electrode that allows fast, simple, economical, and accurate measurement of dissolved CO<sub>2</sub> in aqueous solutions.

**Technology:** Replaceable Electrode Body with PVC Membrane

## Overview

Size and Material	Body (Epoxy): 12 mm OD x 155 mm Length Cap (ABS): 16 mm OD x 47 mm Length
Range	4.4 to 400 ppm as CO <sub>2</sub>
Reproducibility	±2% of reading
Slope	52 to 60 mV at 25°C, typical
Minimum Sample	3 mL in a 30 mL beaker
pH Range	Samples and standards must be adjusted to below pH 4.00
Operating Temperature	0 to 50°C
Electrode resistance	less than 1,000 megaohms
Interferences	volatile weak acid (gaseous)

## Required Equipment

- PASCO Wireless pH/ISE/ORP Sensor (PS-3204)
- or
- PASPORT High Precision pH/Temperature with ISE/ORP Amplifier (PS-2107) with a PASCO interface (see [www.pasco.com](http://www.pasco.com) for information)
- or
- Ion meter or pH/mV meter
- PASCO data collection software (see [www.pasco.com](http://www.pasco.com))
- Wash bottle filled with distilled or de-ionized water
- pH Buffer Solution 4.01\*
- pH Buffer Solution 7.00\*
- Lab wipes

- Magnetic Stirrer with Stir Bar
- Clean beakers\*\*

(\*SC-2321 pH Buffer Capsule Kit)

(\*\*SE-7287 100 mL Beakers (12 pack) or SE-7288 1000 mL Beakers (6 pack))

## Included Required Solutions\*

- Reference Fill Solution
- 1000 ppm Carbon Dioxide Standard Solution
- Ionic Strength Adjuster (ISE)

(\*For replacement items, see the Technical Support section at the end of this document.)

## Electrode assembly

**Important. Please read these instructions before assembling the Carbon Dioxide ISE Probe**

- Carefully remove the internal glass electrode from the box. Remove the boot, which covers the tip of the internal glass electrode. Keep the boot for later use.
  - Note: Soaking the internal glass electrode in internal filling solution or pH 4.01 buffer for at least 1 hour before proceeding with the following steps will ensure fast response.
- Remove an electrode body from the box. Using the solution provided, fill the electrode body with about 3.5 mL of Reference Fill Solution.
- Rinse the internal glass electrode with DI water, blot dry. Place it into the electrode body, which has been filled with the filling solution.

IT IS VERY IMPORTANT TO MAKE SURE THAT THE KEY PIN ON THE INTERNAL GLASS ELECTRODE CAP MUST FIT INTO THE NOTCH AT THE TOP OPENING OF THE ELECTRODE BODY SO THAT THE INTERNAL GLASS ELECTRODE WILL NOT SPIN DURING FURTHER ASSEMBLY. THE INTERNAL GLASS ELECTRODE SPINNING DURING ASSEMBLY WILL DAMAGE THE MEMBRANE AT THE BOTTOM OF THE ELECTRODE BODY, WHICH IS NOT COVERED BY THE WARRANTY.

- Install the threaded top cap onto the threaded section at the top of the electrode body. Tighten the cap until snug. Do not over tighten.

## Software Help

See the SPARKvue Help or PASCO Capstone Help for information about collecting, displaying, and analyzing data.

- In SPARKvue, select the HELP button in any screen including the Home Screen.
- In PASCO Capstone, select PASCO Capstone Help from the Help menu, or press F1.

## Checking Electrode Operation (Slope)

1. Connect your electrode to the input connector on the Wireless pH /ISE/ORP Sensor (or other measuring device).
2. Place 100 mL of DI water into a 150 mL beaker. Add 1 mL Carbon Dioxide ISA to the DI water and stir thoroughly. Check the pH of the solution with the Wireless pH/ISE/ORP Sensor or a piece of lab pH paper.
  - The pH value must be below pH 4.0. Otherwise, add Carbon Dioxide ISA in 1 mL increments until the pH value is below pH 4.0.
3. Rinse the electrode with DI water, blot dry, and place it in the beaker with the prepared solution.
  - To prevent air entrapment on the membrane surface, use an electrode holder that keeps the electrode at a 20 degree angle.
4. Begin recording. Add 1 mL of 1000 ppm Carbon Dioxide Standard Solution into the beaker. Stir thoroughly, then record the potential ( $E_1$ ) in mV when a stable reading is displayed.
5. Pipet 10 mL of the same standard solution into the beaker. Stir thoroughly. When a stable reading is displayed, record the potential ( $E_2$ ) in mV.
6. The difference between the first and second potential readings, ( $E_2 - E_1$ ), is defined as the electrode slope. The normal range for the slope is 52 to 60 mV at 25°C.

## Troubleshooting

If the electrode slope is not within the normal range stated above, or the electrode mV reading drifts, the Reference Fill Solution may need to be replenished. Hold the electrode body with one hand, and then gently pull the cable. Release the cable. Fresh fill solution will now occupy the space between the tip of the inner glass

body and the membrane. If this procedure does not restore electrode response, follow the steps below:

1. Check the slope of the internal glass electrode. Remove the internal glass electrode from the electrode body. Connect the internal glass electrode to the Wireless pH Sensor or to a pH/mV meter. Put the internal glass electrode in pH 7.00 buffer. The annular ceramic junction should be immersed in the solution. Record the reading in mV when it is stable. Remove the internal glass electrode from pH 7.00 buffer. Rinse with DI water, blot dry and put it in pH 4.01 buffer. Record the reading in mV when it is stable. The reading in pH 7.00 should be 0 + 25 mV. The millivolt difference in the two buffers should be greater than 168 mV. (If the difference is less than 160 mV, contact the manufacturer).
2. If the internal glass electrode functions properly, but the completely assembled electrode does not function properly in the standards, replace the Electrode Body with a new one. Unscrew the Electrode Body from the cap. Get the extra Electrode Body from the plastic bag. Install the new Electrode Body. Follow the procedures described in "Electrode assembly" and "Checking electrode operation (slope)" again.

If the electrode still does not operate properly, contact the manufacturer.

3. Repeat "Checking Electrode Operation" procedure again. **Note:** All standard solutions should be prepared fresh. For best performance use ISA in all solutions.

## Reading a Sample with the Electrode

Various procedures may be used to determine the concentration of a sample. The most common is the Direct Calibration method, which is described below. Contact PASCO's Technical Support department for details of other methods.

In Direct Calibration a series of standard solutions of differing concentrations is used to calibrate the electrode. Then each sample requires only a single measurement device reading, which is compared with the calibration readings to obtain the sample concentration. ISA is added to all solutions to ensure the samples and the standards have the same ionic strength.

## Set up:

1. Prepare the electrode as described in "Electrode Assembly" and "Checking Electrode Operation".

Connect the electrode to the sensor or measuring device. Remove the cover from the electrode body.

2. Prepare two standard solutions that differ in concentration by a factor of ten and bracket the expected sample concentration range. For example, if your expected sample concentration is 50 mg/L Carbon Dioxide, you should use a 10 mg/L low Standard Carbon Dioxide Solution and a 100 mg/L high Standard Solution. Standards can be prepared in any concentration unit to suit the particular analysis requirement.
- NOTE: All standard solutions should be at the same temperature as the sample.

### Measurement:

If using a measuring device with direct concentration reading capability, see the software on-line help or the measuring device's instruction manual for specific information:

1. Place 100 mL of the low standard into a 150 mL beaker. Add 1 mL of ISA. Stir thoroughly. Check the pH value of the solution.
2. Rinse electrode with DI water, blot dry and place in the beaker. Wait for a stable reading, and then adjust the software or the measuring device to display the value of the standard. Refer to the software on-line help or the measuring device's instruction manual for the adjustment procedure.
3. Measure 100 mL of the high standard into a second 150 mL beaker. Add 1 mL of ISA and stir. Check the pH value of the solution.
4. Rinse electrode with DI water, blot dry and place in the second beaker. Wait for a stable reading, and then adjust the software measuring device to display the value of the second standard.
5. Measure 100 mL of the sample into a 150 mL beaker. Add 1 mL of ISA. Stir thoroughly. Check the pH value of the standard.
6. Rinse electrode with DI water, blot dry and place in the sample beaker. Wait for a stable reading and the sample concentration will be displayed on the measuring device.
7. Determine the sample concentration using the data analysis tools in the software.

### Electrode Storage

#### Short Term (over night):

Between measurements, keep the electrode tip immersed in a 10 ppm standard without ISA. For low-level measurements, keep the electrode in pH 7.00 buffer between measurements. For overnight storage, the electrode tip should be immersed in pH 7.00 buffer solution.

#### Long Term

For storage over one week, or if the electrode is stored indefinitely, disassemble completely and rinse the Internal Glass Electrode and Electrode Body with DI water. Dry all the parts. Do not re-insert the Internal Glass Electrode into the Electrode Body. Instead, cover the tip of the Internal Glass Electrode with the original boot. Store all the parts separately in the original box. When re-assembling, follow the procedure in the "Electrode Assembly" and "Checking Electrode Operation" sections.

### Life Span

The PS-3517 Carbon Dioxide ISE Probe is expected to last more than three years before it needs to be replaced.

### Replacement Items

- PS-3517 Carbon Dioxide ISE Probe
- SC-3528 Carbon Dioxide ISE Solutions: 60-mL Standard Solution, 30-mL Reference Fill Solution, 30-mL ISA Solution

### Technical Support

For assistance with any PASCO product, contact PASCO at:

**Address:** PASCO scientific  
10101 Foothills Blvd.  
Roseville, CA 95747-7100

**Phone:** 916-462-8384 (worldwide)  
800-772-8700 (U.S)

**Email:** techsupp@pasco.com

**Web:** www.pasco.com/support

#### Limited Warranty

For a description of the product warranty, see the PASCO catalog.

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