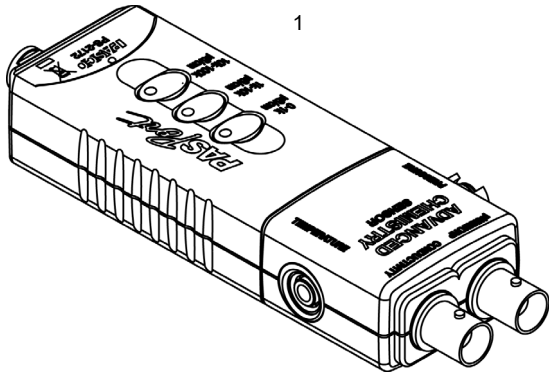
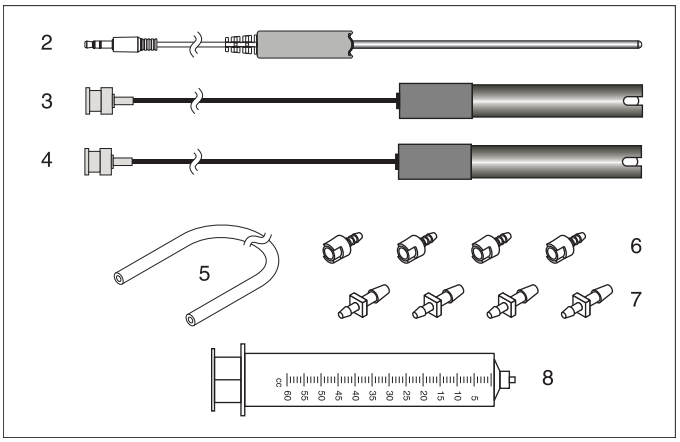
Advanced Chemistry Sensor

PS-2172



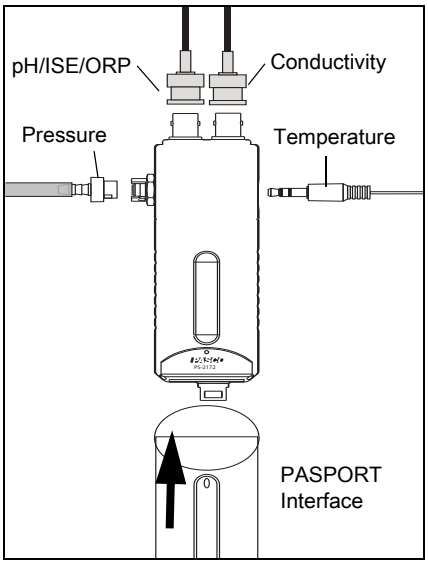


Included Equipment	Part Number
1. Advanced Chemistry Sensor	PS-2172
2. Stainless Steel Temperature Probe	PS-2153
3. Conductivity Probe (10x)	PS-2571
4. pH Electrode	PS-2573
5. Polyurethane Tubing (60 cm long, ⅛ inch ID)	
6. Quick-release Connectors (qty. 4)	
7. Tubing Connectors (qty. 4)	
8. Syringe (60 cc)	

Required Items	
PASPORT Interface PASCO Data Collection Software	See PASCO catalog or www.pasco.com

Optional Equipment	
Fast-response Temperature Probe	PS-2135 (3-pack)
Skin/surface Temperature Probe	PS-2131
Various Ion-selective Electrodes (ISE)	See PASCO catalog or www.pasco.com
Oxidation Reduction Potential (ORP) Electrode	CI-6716

Introduction



The PS-2172 Advanced Chemistry Sensor combines four sensors in a single unit:

- Temperature
- pH, ORP and ion-selective electrode voltage
- Absolute gas pressure
- Conductivity

When connected to a PASPORT interface, the Advanced Chemistry Sensor collects data at up to 100 samples per second from each component sensor. You can use just one component sensor at a time or any combination simultaneously. If you have a PASPORT interface that supports multiple sensors, or if you have more than one interface connected to your computer, you can use the Advanced Chemistry Sensor in combination with other PASPORT sensors.

Sensor, Interface, and Software Setup

Connect any or all of the included probes to the multi-sensor. (You can leave any of the probes disconnected if you do not plan to use it.) If you will be using an ion-selective electrode or oxygen reduction potential electrode, connect it to the pH/ISE/ORP port. If you plan to measure pressure in an apparatus or the included syringe, connect it to the sensor's pressure port using the included tubing and a quick-release connector.

Interface Setup

Connect the multi-sensor to your PASPORT interface. Connect the interface to a computer or Bluetooth device that is compatible with the PASCO data collection software. (See www.pasco.com/wireless for more information about PASCO wireless devices.)

Software Setup

See the Online Help or User's Guide for information about setup, collecting, displaying, and analyzing data with the PASCO data collection software.

Use the software to build one or more displays for data. Use the software to set the sampling rate. If desired, use the software to calibrate the sensor for a specific probe.

Note that the multi-measure sensor will collect data for probes that may not be connected. These data are ldisplayed if selected on one or more displays. Use the software to define the sensor parameters are defined using the software.

(Xplorer GLX Setup: If you are using an Xplorer GLX in standalone mode, refer to the GLX User's Guide.)

Temperature

Use this component of the multi-sensor to measure the temperature of a fluid or object. The measurement can be displayed in units of °C, °F, or K. You can use the included stainless steel probe

or a different probe, such as the Fast-response Probe (PS-2135) or Skin/Surface Probe (PS-2131). PASCO apparatus containing an embedded 10 kΩ thermistor can also be connected to the multi-sensor. The multi-sensor automatically detects the presence of a temperature probe, and it will only collect temperature data if a probe is connected.

Measuring Temperature

To measure temperature, connect the probe and start data collection. Immerse the tip of the probe in a fluid or place it in contact with an object. The included stainless steel probe can be used in both dry conditions and in liquids, such as water and other mild chemicals and solutions.

Tip: For better chemical resistance, use a Teflon® probe cover.

Temperature Calibration

The temperature measurement can be calibrated; however, for most applications calibration is not necessary. Use a two-point calibration with two standards of known temperature. Refer to the PASCO data collection software Online Help or User's Guide for calibration instructions.

pH/ISE/ORP

The pH/ISE/ORP input of the multi-sensor is a specialized voltage sensor. Its BNC connector accepts the included pH electrode, as well as ISE and ORP electrodes. The sensor measures the voltage produced by any of these electrodes. When used with a pH probe, the sensor also computes the pH based on the measured voltage.

Connect the pH electrode (or other electrode) to the pH/ISE/ORP port and start data collection. On your computer or interface, display pH measurement for the calculated **pH** (assuming that the pH electrode is connected). For other electrodes, display **ISE Voltage** (this is valid for ISE, ORP, and pH.)

Measuring pH

The pH electrode produces a voltage proportional to the pH of the solution that it is immersed in. This voltage is measured by the multi-sensor, which computes pH.

Unscrew and remove the storage bottle from the electrode (be careful not to spill the storage solution). Push the O-ring and bottle cap up the electrode handle (or remove if using the Drop Counter). Rinse the electrode tip with distilled water. If you see bubbles in the electrode bulb, gently shake the electrode downward (similar to shaking down a thermometer). Start data collection. Place the tip of the electrode in the solution to be measured and wait for the reading on your computer or interface to stabilize. Rinse the electrode with distilled water before measuring another solution.

pH Calibration

The pH measurement can be calibrated; however, for most applications calibration is not necessary. Perform a two-point calibration with two buffer solutions of known pH. Refer to the PASCO data collection software Online Help or User's Guide for calibration instructions.

pH Electrode Maintenance and Storage

Cleaning

If the pH electrode becomes contaminated, use one of these methods to clean and restore it. After any of these procedures, soak the electrode in a pH 7 buffer solution for 30 minutes.

- **General Contamination:** Soak the electrode in 0.1 molar hydrochloric acid (HCl) for 15 minutes.

- **Protein Deposits:** Soak the electrode in a solution of 1% pepsin in 0.1 molar HCl.
- **Inorganic Deposits:** Rinse the electrode with 0.1 molar ethylene diamine tetra-acetic acid (EDTA) tetrasodium solution.
- **Oil and Grease Film:** Wash the electrode carefully in a mild detergent or a solvent known to be effective for the particular film.
- **Unknown Contamination:** Soak the electrode alternately in 12 molar sodium hydroxide (NaOH) and 1 molar HCl. Leave it in each solution for one minute. Rinse completely between soakings. End with HCl. (The NaOH etches the glass and the HCl reestablishes hydrogen ions on the surface.)

If these steps fail to improve the response of the electrode, replace it.

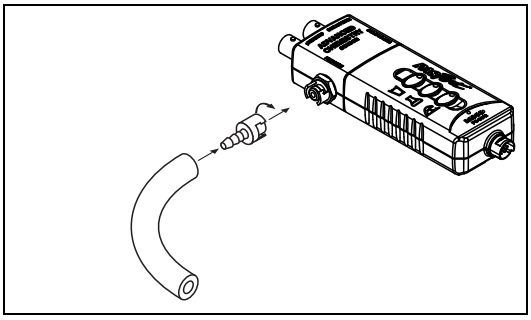
Storage

Store the pH electrode in the included electrode storage bottle with one of the following solutions. (Never store the electrode in distilled water.)

- **Short-term** (up to one week): pH 4 buffer solution or tap water.
- **Long-term** (over one week): 4 molar KCl solution (included with the electrode).

Pressure

This component of the multi-sensor measures absolute gas pressure from 20 kPa to 400 kPa. The measurement can be displayed in units of kPa, N/m^2, pounds per square inch (p.s.i.), atmospheres (atm), or torr.



With nothing connected to pressure port, the sensor measures atmospheric pressure.

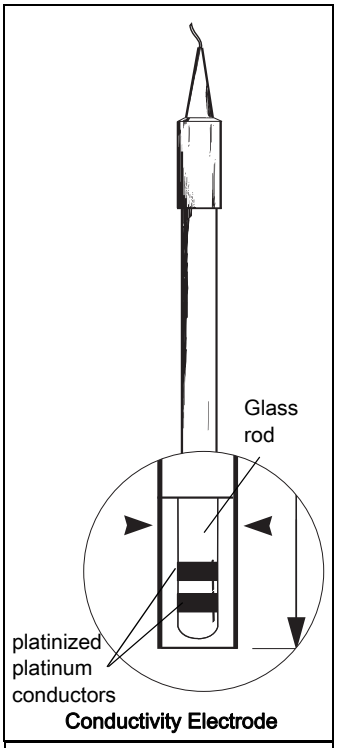
To measure the pressure in an apparatus or the included syringe, connect it to the sensor using the included tubing and connectors. Insert the barbed end of a quick-release connector into a piece of tubing. Push the quick-release connector onto the sensor's pressure port and twist it clockwise to secure it. If your apparatus has a barbed or tapered connector (such as the included syringe), plug it directly into the other end of the tubing. If the apparatus has a quick-release pressure port, use another quick-release connector on the other end of the tubing. Use one of the included tubing connectors to connect the tubing to larger-diameter tubing or to a rubber stopper with a hole.

Note: Do not allow liquid to enter the pressure port.

Conductivity

The conductivity component sensor measures the electrolytic conductivity of aqueous solutions. It determines the conductivity by applying an alternating voltage to the electrode cell at the end of the probe and measuring the resulting current. Use the included 10x electrode. In the software or on the interface select **Conductivity (10x)**.

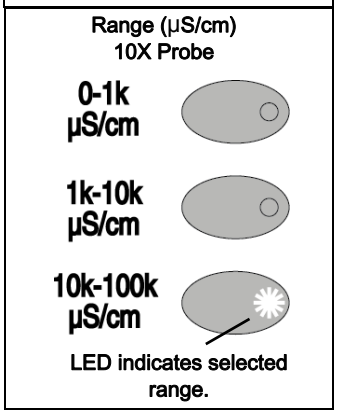
Note: The 10x probe can be used to measure conductivity up to 100000 µS/cm.



Conductivity Electrode

Measuring Conductivity

Before using the conductivity electrode, soak the end in distilled water for 5 to 10 minutes. Connect the electrode to the multi-sensor and start data collection. Immerse the end of the electrode in the solution to be measured and wait for the reading to stabilize. Rinse the electrode with deionized water before measuring a different solution.



The conductivity sensor has three ranges, which you select using the three buttons on the multi-sensor. To select a range, push one of the buttons: 0 µS/cm to 1000 µS/cm, 1000 µS/cm to 10000 µS/cm, or 10000 µS/cm to 100000 µS/cm. Light emitting diodes (LEDs) on the buttons indicate which range is selected. To determine which range is appropriate, look at the data (on a Graph display, for instance) while it is being collected; if the measurement appears to be "railed" at the top of the selected range (1000 µS/cm or 10000 µS/cm), select the next higher range. You can push a button to change the range without stopping data collection.

The conductivity electrode is sensitive to very low concentrations of dissolved solids, so you will probably never measure a sample with a conductivity of zero. A reading of 25 µS/cm for "pure" water is typical. True pure water is difficult to obtain and store. The table (right) lists typical conductivity values for common aqueous solutions at 25 °C.

As a rule of thumb, to estimate total dissolved solids (TDS) in parts per million (ppm), divide the conductivity in µS/cm by 2:

$$\text{TDS (ppm)} = \frac{\text{Conductivity (µS/cm)}}{2}$$

Solution	Conductivity (µS/cm)
Ultra-pure Water	0.05 to 0.75
Drinking Water	50 to 1500
Ocean Water	~53000

Conductivity Calibration

The conductivity measurement can be calibrated; however, for most applications calibration is not necessary. Use a one-point calibration with a standard solution of known conductivity. For instructions on preparing a standard solution, refer to the data collection software Online Help and User's Guide for calibration instructions.

Conductivity Electrode Maintenance And Storage

To ensure accurate and reproducible results, the electrode must be clean. Substances on the electrode may contaminate the solution being tested and change the conductivity. To clean the electrode, dip the end into a detergent solution or dilute nitric acid (1%) and stir for three minutes, then rinse with deionized water.

For storage, dry the electrode and return it to its box. Before use, soak the electrode in distilled water for at least 5 minutes.

Specifications

General	
Component Sensors	Temperature, pH/ISE/ORP probe voltage, Absolute Pressure, Voltage
Max. Sampling Rate	100 samples per second (for each component sensor)
Default Sampling Rate	10 samples per second
Temperature	
Range	−35 °C to +135 °C
Accuracy	±0.5 °C
Resolution	0.01 °C or better
Sensing Element	10 kΩ thermistor located in probe tip
pH/ISE/ORP probe voltage	
Electrode Connector	standard BNC
Voltage Range	−2000 mV to +2000 mV
Voltage Resolution	0.1 mV
pH Range	0 to 14
pH Resolution	0.001
Absolute Pressure	
Range	20 kPa to 700 kPa
Accuracy	2 kPa
Resolution	0.1 kPa
Repeatability	1 kPa
Conductivity	
Range	three user-selectable ranges: 0 to 1000 µS/cm, 1000 to 10000 µS/cm, 10000 to 100000 µS/cm with included 10x probe
Accuracy	±10% of full scale without calibration
Resolution	better than 0.05% of full scale

Appendix A: Reference Solutions for Conductivity Calibration

Reference Solution	Approximation Normality of Solution	Method of Preparation	Temperature (°C)	Electrical Conductivity[1] (µS/cm)
A	1	74.2480 g of KCl weighed in air per 1 L of solution at 20 °C	0	65176
			18	97838
			25	111342
B	0.1	7.4365 g of KCl weighed in air per 1 L of solution at 20 °C	0	7138
			18	11167
			25	12856
C	0.01	0.7440 g of KCl weighed in air per 1 L of solution at 20 °C	0	773.6
			18	1220.5
			25	1408.6
D	0.001	Dilute 100 mL of solution C to 1 L at 20 °C	0	77.69
			18	127.54
			25	148.93

[1]Excluding the conductivity of the water used to prepare the solutions. These tabulated conductivity values are in international units. When using measuring instruments calibrated in absolute units, multiply the tabular values by 0.999505

Technical Support

For assistance with any PASCO product, contact PASCO at:

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

Phone: 916-462-8343 (worldwide)
877-373-0300 (U.S.)

Web: www.pasco.com

Email: support@pasco.com

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

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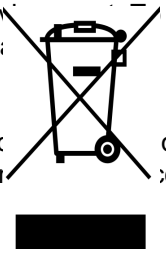

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