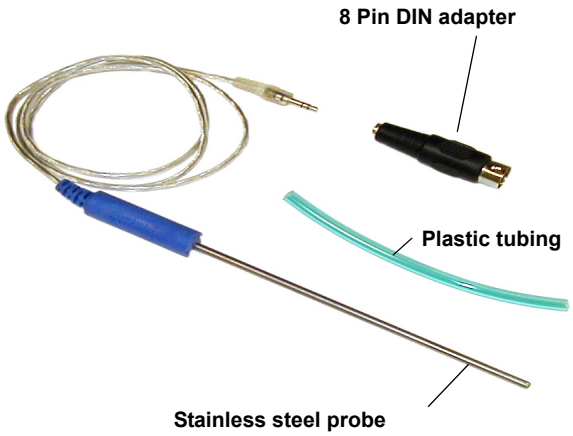
Stainless Steel Temperature Sensor

CI-6605A



Included Equipment

Stainless Steel Temperature Sensor

8 Pin DIN adapter

Plastic Tubing Cover, 0.5 ft.

Additonal equipment required	Part Number
ScienceWorkshop® Interface or a PASPORT® USB interface with an Analog Adapter	PS-2158
DataStudio® Software	

Introduction

The PASCO Model CI-6605A Stainless Steel Temperature Sensor is used for measuring the temperature of liquids (such as water and mild chemical solutions), air, and other materials. The temperature can be measured in degrees Celsius, Fahrenheit, or Kelvin. The sensor consists of a stainless steel probe, a 3-foot cable, and an 8-pin connector.

The CI-6605A consists of a thermistor built into a stainless steel tube. The thermistor allows for resistance measurements in Kohms. A precision voltage reference and reference resistor are built into the 8-pin DIN connector.

Sensor Electronics and Internal Circuitry

The Thermistor used is a typical 10K thermistor with a negative temperature coefficient. It is called a 10K thermistor because the resistance value at standard temperature (25°C) is 10K ohms. As the temperature increases, the resistance of the thermistor decreases.

Figure 1 illustrates a typical resistance vs. temperature curve for a thermistor.

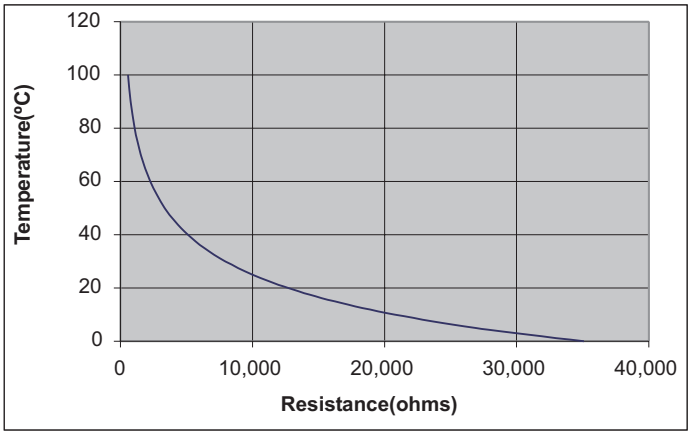


Figure 1: Temperature vs. Resistance Curve

The 10K thermistor circuit uses a precision voltage reference and a voltage divider to determine the thermistor's resistance. The thermistor (Rt) is one resistor and a 13K resistor (R_{ref}) is the other in a two-resistor voltage divider network.

The voltage reference is connected to the top of the divider network and the voltage output is taken from the middle of the divider.

The relationship of the 10K thermistor's resistance (Rt) to the voltage output (V_{out}) is

$$\frac{V_{out} \cdot R_{ref}}{V_{in} - V_{out}}$$

where V_{in} is the reference voltage, 10VDC and R_{ref} is 13K ohms.

The Steinhart-Hart equation is used to convert from resistance to temperature. Temperature (T) in degrees Celsius is:

$$\frac{1}{\left(3.35\times10^{-3}+2.56\times10^{-4}\cdot\ln(R10)+2.38\times10^{-6}\cdot\ln(R10)^2+8.37\times10^{-8}\cdot\ln(R10)^3\right)}-273.15$$

where R10=Rt/10,000.

DataStudio software converts the voltage to resistance and the resistance to temperature.

Equipment Setup

Note: *The sensor is very accurate and generally does not need to be calibrated.*

1. Plug the sensor's DIN 8-pin connector into any analog channel (A, B, or C) on a *ScienceWorkshop* interface or a PASPORT USB interface with an analog adapter (PS-2158).

2. Open DataStudio. In the Welcome to DataStudio window, double click "Create Experiment."

CAUTION: *Do not place the Stainless Steel Temperature Sensor in a direct flame or on a hot plate. To prevent damage to the sensor, do not exceed the range of -35°C to +135°C.*

3. In the Sensors list of the Experiment Setup window, click and drag the Stainless Steel Temperature icon ( ) to the analog channel in which you have your sensor connected.

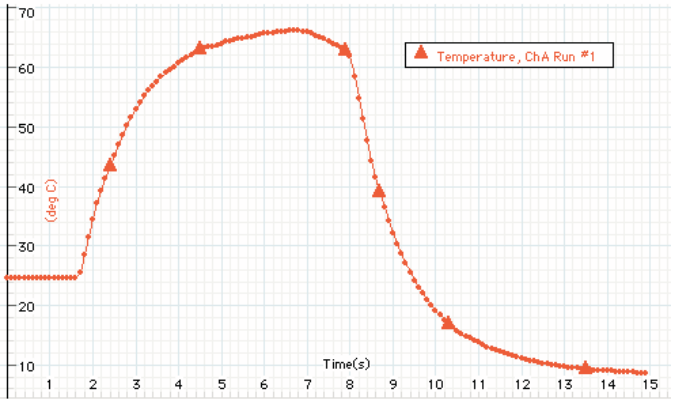
4. To change measurement units or view resistance values, double click on the Stainless Steel icon in the Setup window. In the Measurement tab, select the desired measurement unit (°C,°F, K, or Kohms) and click the OK button.

5. Place the end of the probe in the solution, gas, or object you are measuring.

WARNING: To avoid burns or bodily injury, do not touch the end of the probe with your hand, fingers, etc. when measuring temperatures of hot liquids, materials, etc.

6. In DataStudio, open a display and click the Start button.

Sample Temperature Data



Using the Temperature Sensor with DataStudio Workbook Activities

Note: *If you are using the Stainless Steel Temperature Sensor (SST) with a pre-existing DataStudio activity file or workbook for a different type of temperature sensor, do the following:*

1. In the Setup window, click on and delete the existing Temperature Sensor icon.

2. In the sensors list, scroll to the SST Sensor icon( ). Click and drag the SST icon to an analog channel on the picture of the interface.

3. From the Data list, drag the SST icon to any open displays.

Using the Temperature Probe in Chemical Solutions

The Stainless Steel Probe can be used in basic and mildly acidic solutions. Use an optional Teflon cover when placing the Stainless Steel Temperature (SST) probe in strong acids or chemical solutions that may damage the probe. When a Teflon cover is used, the probe can be placed in most chemical solutions. The Teflon cover will not change the temperature reading, but the sensor's response to changes in temperature will be slower than when the cover is not used.

A package of ten Teflon Sensor Covers is available from PASCO scientific (part number CI-6549). See the PASCO catalog for more information.

CAUTION: *Without the optional Teflon cover over the probe, do not use the probe in the following chemicals: Acetic Acid, Aluminum halides, Hydrochloric Acid, Iodine, Nitrating Acid, Phosphoric Acid, and*

Sulfuric Acid. For more information about chemical compatibility with #304 stainless steel, see the Cole-Parmer web site (www.coleparmer.com/techinfo).

Using the Temperature Sensor with a pH, Dissolved Oxygen, or Conductivity Sensor

The Stainless Steel Temperature Sensor is electrically grounded. Use an optional Teflon sleeve to isolate the probe of the Stainless Steel Temperature Sensor when it is used with electrically susceptible sensors, such as the pH (CI-6507A) and Conductivity Sensor (CI-6729)

Using the Temperature Probe in Air-Tight Containers

The diameter of the sensor's stainless steel probe is slightly smaller than the 1/4-inch hole found in many rubber and cork stoppers. If an airtight seal in a stopper is required, the diameter of the stainless steel probe must be increased. A 6-inch piece of plastic tubing is included with the Stainless Steel Temperature Sensor for this purpose.

The tubing may be trimmed as required. A little bit of glycerine may be used on the tubing to assist in the process of slipping the tubing over the probe. For the best temperature response, place the tubing and stopper as close to the probe handle as is practical.

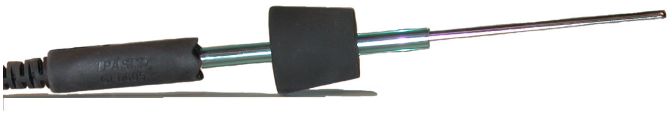


Figure 3: Probe with stopper and tubing

Specifications

Temperature range	-35ºC to +135ºC, -31ºF to +275ºF 238 to 408 K
Accuracy	±0.5ºC or better
Resolution	0.05ºC
Probe composition	#304 stainless steel

Technical Support

For assistance with any PASCO product, contact PASCO at:

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