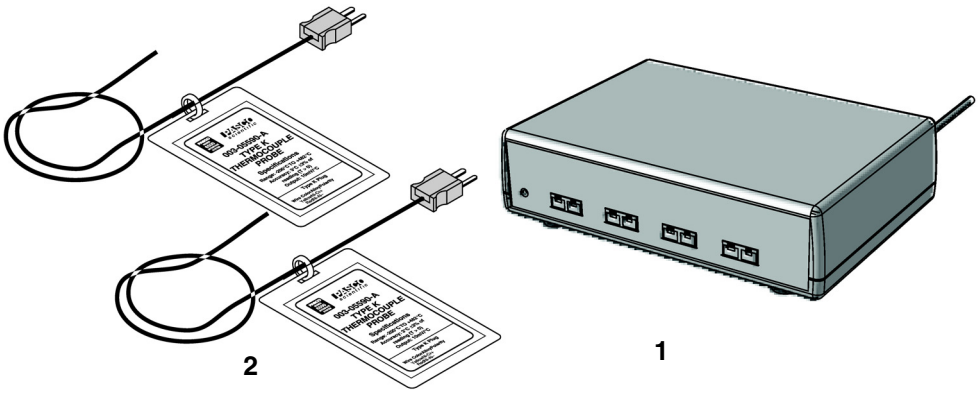
PASPORT Type K 4-Port Temperature Sensor

PS-2127



Included Equipment	Part Number
1. Type K 4-Port Temperature Sensor	PS-2127
2. Type K Thermocouple Probe (qty. 2)	PS-2155
Compatible Temperature Probe	
High Temperature Thermocouple Type K	CI-6536
Compatible PASPORT Interfaces	
Xplorer GLX	PS-2002
Xplorer	PS-2000
Power Link	PS-2001
USB Link	PS-2100

Introduction

The PASPORT Type K 4-Port Temperature Sensor works with up to four Type K Thermocouple Probes and a PASPORT interface to collect multiple streams of temperature data at up to 250 samples per second per channel.

Separate Type K Thermocouple Probes (such as the two included) can be connected to the individual input ports, numbered 1 through 4.

The sensor box accepts any Type-K thermocouple, such as the CI-6536 High Temperature Type-K Thermocouple Probe. The High Temperature Type-K Thermocouple Probe is housed in a 30.5 cm (12”) inconel metal cover

(maximum temperature = +1148°C). Therefore, it can be used in an open flame or for other high temperature measurements.

Range

The tip of the Type K Thermocouple Probe has a temperature range .between -200°C and +1000°C. However, the insulation material that covers all but the tip of the probe has a maximum temperature of +482°C. You can use the probe to measure high temperatures such as those in a candle flame if you keep the insulated portion of the probe out of the flame.

The High Temperature Type K Thermocouple Probe (CI-6536) is housed in an inconel metal cover. Its temperature range is -200 to +1,000 °C.

Background

In 1821, Thomas Johann Seebeck (1770-1831), a Russian-German physicist, discovered that if two different metals were joined at two places, and the two points of junction were kept at different temperatures, an electric current would flow continuously through the circuit. The "Seebeck Effect" explains how a thermocouple works. Junctions between dissimilar metals or alloys in an electrical circuit give rise to a voltage if they are at different temperatures. The Type K thermocouple is made from a chromel and alumel wire junction.

Because the thermocouple is a differential rather than absolute measuring device, a known reference temperature such as the 0 degree Celsius water-ice point is usually needed. However, in most practical applications, the reference junction temperature is allowed to change with the environment, but is carefully measured by a temperature sensitive integrated circuit (IC). A measurement of the thermocouple voltage plus knowledge of the reference junction temperature is used to calculate the measurement junction temperature.

The sensor box has sockets that are mounted very close to the integrated circuit. The IC provides the cold junction compensation as long as the IC temperature is equal to the junction temperature at the socket/thermocouple connection. The overall output voltage-to-temperature ratio is 10 millivolts per degree Celsius.

Using the Probes in Mild Chemical Solutions

The Type K Thermocouple Probe is designed to be used in water and mild chemical solutions when measuring the temperature of a liquid. The bare wire end of the thermocouple has been tested for several minutes in the following chemicals without damage:

acetone	sodium hydroxide (lye)
household bleach	ethylene glycol butyl ether
isopropyl alcohol	ethylene glycol (antifreeze)
naphtha	sulfuric acid (battery acid)
vinegar	glacial acetic acid
paradichlorobenzene	water

Using the optional Teflon Sensor Cover

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

Use the optional Teflon FEP sensor cover when the thermocouple probe must be placed in strong chemical solutions that may damage the probe.

Setup

Hardware Setup

The following three steps can be performed in any order.

1. Connect up to four separate Type K Thermocouple Probes to the individual input ports of the sensor box.

Probes can be connected to the individual ports in any order (you don't have to start with port 1), and any of the ports can be left unconnected.

The two prong connector on the Type K Thermocouple Probe fits into the sensor box in only one way because one ot its prongs is wider than the other prong.

2. Connect the cable of the Type K 4-Port Temperature Sensor to a PASPORT interface.

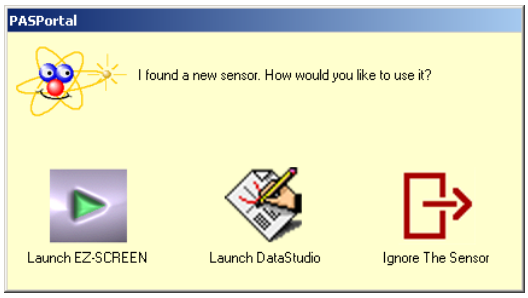
3. If you will be using a computer, connect the PASPORT interface to the computer's USB port.

DataStudio Setup

If you will be using the Type K 4-Port Temperature Sensor with a computer, install the latest version of DataStudio first. Check the PASCO web site at www.pasco.com for information.

1. When you connect the Type K 4-Port Temperature Sensor to the computer through a PASPORT interface, the PASPortal window will launch automatically (if DataStudio is not already running).

2. Select *Launch DataStudio* in the PASPortal window.



A Graph display for temperature versus time will open automatically.

3. Click Start to begin data collection.

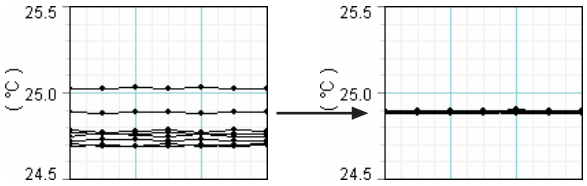
To view and change the sample rate, units of measure, and other sensor properties, click Setup.

Xplorer and Xplorer GLX Setup

If you will be using an Xplorer or Xplorer GLX in logging mode (not connected to a computer), connect the Type K 4-Port Temperature Sensor to the Xplorer or Xplorer GLX and press ▶ to begin data collection.

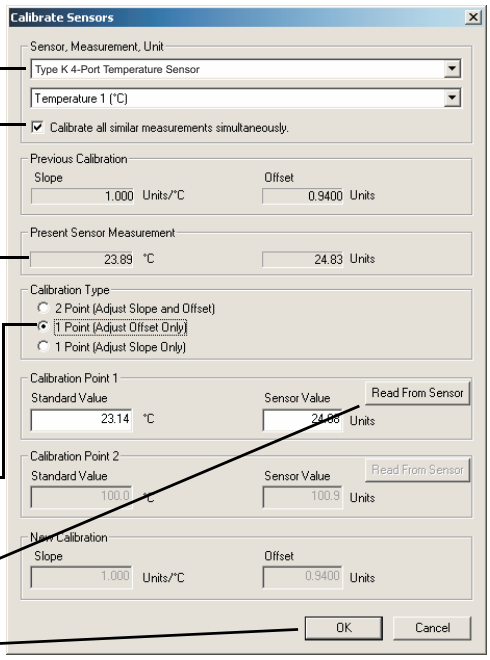
Multiple-measurement Alignment

When you are using multiple temperature probes, you may find that their readings differ slightly when they are measuring the same thing. In the example illustrated (right), measurements from four probes in the same container of water vary by about 0.3 °C. The multiple-measurement alignment procedure adjusts the calibrations of the probes so they agree more closely.



The procedure described here for DataStudio can also be performed on the Xplorer GLX. See the Xplorer GLX Users' Guide for detailed instructions.

1. Click Setup to open the Experiment Setup window. Click Calibrate Sensors... to open the calibration dialog box.
2. From the Sensor field, select the Type K 4-Port Temperature Sensor.
3. Select the "Calibrate all similar measurements simultaneously" option.
4. Place all of the probes in a container of room-temperature water. (If you are calibrating thermistors embedded in a device, allow the thermistors to come to equilibrium at room temperature.)
5. Observe the Present Sensor Measurement and wait until it has stabilized.
6. From the Calibration Type menu, select 1 Point (Adjust Offset Only).
7. Click the Read From Sensor button for Point 1.
8. Click OK to accept the new calibration; or click Cancel to revert to the previous or default calibration.



Two-point calibration

Though it is usually not necessary, a two-point calibration can be performed on a single probe, or on all probes simultaneously, to make the measurements more accurate. For step-by-step instructions refer to the documentation for DataStudio, the Xplorer, or the Xplorer GLX.

Oversampling

Oversampling occurs at low sampling rates when several measurements are recorded and averaged over a short interval of time and the averaged value is displayed. The degree of oversampling that takes place within the Type K 4-Port Temperature Sensor depends on the sample rate and the number of connected probes. To maximize the oversampling, set the sample rate as low as possible and disconnect any unused probes. In many cases, increased oversampling reduces noise, produces smoother data, and improves the measurement resolution. This effect is especially noticeable when very small temperature changes are measured.

Measurement Repetition

At high sample rates, the Type K 4-Port Temperature Sensor may occasionally repeat a measured value in order to maintain the flow of data without exceeding its processing capacity. The maximum sample rate at which this does *not* occur depends on the number of connected probes, as shown in the table (right).

Maximum Sample Rate without Measurement Repetition

Number of Probes	Rate (Hz)
1	250
2 or 3	100
4	50

At sample rates above these thresholds, you may notice that a rapidly changing temperature graph has occasional plateaus where the sampled temperature remains constant for two or more points in a row. To reduce the effect of measurement repetition, use the smooth(n, x) function in DataStudio's calculator. (For information about the smooth function, open the Help menu in DataStudio and search for "smooth.")

Specifications

Measurement Range	-200 °C to +1000 °C (probe dependent)
Accuracy	±3°C or ± 3% of the reading, whichever is greater
Resolution	0.0025 °C
Repeatability	0.01 °C
Maximum Sample Rate	250 Hz per Type K thermocouple probe
Unit Options	°C, °F, K

Technical Support

For assistance with any PASCO product, contact PASCO at:

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10101 Foothills Blvd.
Roseville, CA 95747-7100

Phone: 916-786-3800 (worldwide)
800-772-8700 (U.S.)

Fax: (916) 786-3292

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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