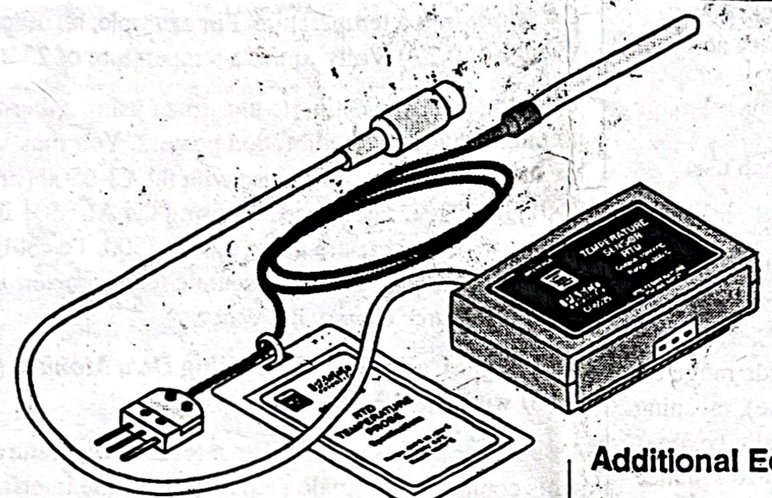
Instruction Sheet for the PASCO Model CI-6525

RTD (Resistance Temperature Device) Temperature Sensor



Introduction

The PASCO Model CI-6525 RTD (Resistance Temperature Device) Temperature Sensor is designed for use with a PASCO computer interface [such as the CI-6500 (IBM®), AI-6501 (Apple II®), or CI-6550 (Macintosh®)]. The range of the RTD Temperature Sensor is ±200 °C with an accuracy better than 0.5 °C over the full range. The RTD Temperature Sensor can be used in water and mild chemical solutions. The sensor comes with a removable Teflon* FEP sensor cover that is highly resistant to chemicals. (*Teflon is DuPont's registered trademark for its fluoropolymer resins.)

The sensor consists of the RTD probe and the sensor electronics box. The probe contains platinum wire and the resistance of the platinum wire increases with temperature in a very predictable way. The cable between the RTD probe and the electronics box is covered by flexible PVC tubing. The overall output-voltage-to-temperature ratio is 10 milliVolts per degree Celsius. The output voltage range is ±2.000 Volts.

Additional Equipment Needed:

- Signal Interface such as the CI-6500 (IBM) or AI-6501 (Apple II), or Signal Interface II such as the CI-6550 (Macintosh)

Operation

Connecting and Using the Sensor

Attach the sensor's three prong connector to the electronics box at the port marked RTD TEMPERATURE PROBE INPUT. The three prong connector can go into the port in only one way because one of the prongs is wider than the other two prongs. Connect the 8-pin DIN plug from the electronics box to Analog Channel A, B, or C on the computer interface box.

Touch the end of the sensor to the object to be measured or place the sensor end into the solution to be measured. DO NOT place the RTD Temperature Sensor in a direct flame or on a hot plate. To prevent damage to the internal components of the sensor, do not exceed the maximum operating range of -200 °C to +200 °C.

This instruction sheet written by: Dave Griffith

Using the Sensor in Mild Chemical Solutions

The RTD Temperature Sensor is designed to be used in water and mild chemical solutions when measuring the temperature of a liquid. The RTD probe 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

- Carefully rinse off any chemicals after each use.

Using the Teflon Sensor Cover

Use the Teflon FEP sensor cover when the RTD probe must be placed in strong chemical solutions that may damage the probe. The Chemical Resistance Classification for Teflon FEP is "E" (excellent) for a wide range of chemicals (from Acetaldehyde to Zinc Stearate), meaning that there is no damage during 30 days of constant exposure to the reagent at 20 °C. (See the Chemical Resistance Chart.)

The Teflon sensor cover is about twelve inches long, and one end is sealed. Carefully open the unsealed end and insert the sensor. (You may want to cut the Teflon sensor cover to a shorter length.) Minimize the amount of air that is between the end of the probe and the sensor cover by gently tapping the end of the probe against a rigid surface. The sensor cover will not change the temperature reading, but the sensor's response to changes in temperature will be slower than when the sensor cover is not used.

> ➤ **NOTE:** The temperature range for the Teflon sensor cover is not the same as the maximum range for the RTD probe.

Teflon Sensor Cover Specifications

Maximum Temperature:	205°C
Brittleness Temperature:	-270°C
Specific Gravity:	2.15
Water Absorption:	<0.01%

> ➤ **NOTE:** The sensor cover can be reused many times. Carefully rinse off any chemicals after each use.

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

Calibrating the Sensor

The sensor is designed to produce 0 Volts at 0 °C and 10 milliVolts (0.010 V) per degree C. Therefore, the sensor does not need to be calibrated using a thermometer. Instead, you can directly convert the output voltage from the sensor into a temperature. For example, an output voltage of 0.234 Volts equals a temperature of 23.4 °C.

However, you can calibrate the sensor using a thermometer and a two-point calibration process. You may want to create a calibration file for use with the CI-6500 (or AI-6501) interface. The procedure using the AI-6501 is very similar to the procedure using the CI-6500. To calibrate the sensor you will need an accurate thermometer, ice water, and a source of very hot water.

Creating a Calibration File Using *Data Monitor (MS-DOS)* with the CI-6500

Assume for this example that the RTD Temperature Sensor is connected to Analog Channel A of the interface and that you do not have any other sensors connected to the interface.

Start the *Data Monitor* program. Select "Other Options" from the Main Menu. Use "Select Channels" to turn off Channels B and C. Return to the Main Menu.

Select "Calibration" from the Main Menu. Pick "Calibrate Input" from the Calibration Menu. Select "Channel A". Enter "Temp." as the parameter and "Deg. C" as the units.

Calibration Point #1: Place the sensor in the ice water. Also put the thermometer in the ice water. The monitor screen will show the voltage value produced by the RTD sensor. When the voltage value is almost zero, press <return>. Enter the thermometer reading as the temperature that corresponds to the first voltage value.

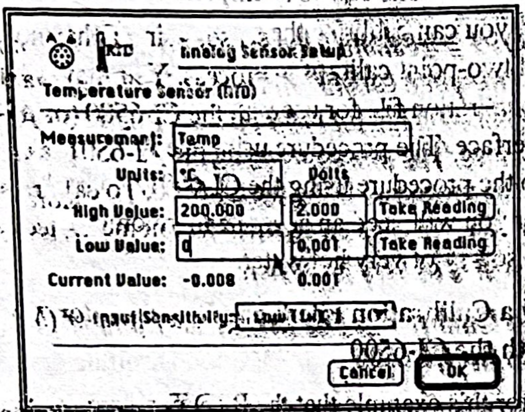
Calibration Point #2: Place the sensor and thermometer in the very hot water. The monitor screen will show the new voltage produced by the RTD sensor. When the voltage value reaches its peak, press <return> and enter the thermometer reading for the second voltage value.

Follow the on-screen instructions to save the calibration file.

Calibrating the RTD Sensor Using *Science Workshop* with the CI-6550

Start the *Science Workshop* program. Click-and-drag the analog sensor plug icon to Analog Channel A. Select "Temperature Sensor (RTD)" from the list of analog sensors.

Calibration Point #1: Place the sensor and thermometer in the ice water. In the Experiment Setup window, double-click on the RTD sensor icon to open the Analog Sensor Setup dialog box.

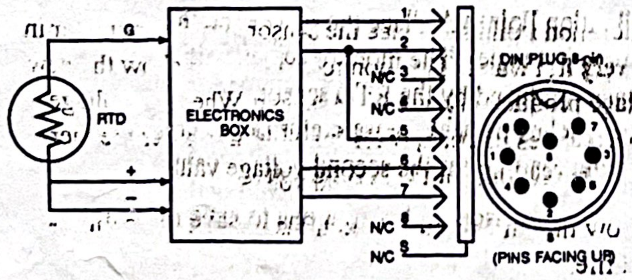


The dialog box will show the "Current Value" of the voltage produced by the RTD sensor. When the voltage value is almost zero, click on the bottom "Take Reading" button. Enter the thermometer reading in the box labeled "Low Value:".

Calibration Point #2: Place the sensor and thermometer in the very hot water. The "Current Value" will show the new voltage produced by the RTD sensor. When the voltage value reaches a peak, click on the top "Take Reading" button. Enter the thermometer reading in the box labeled "High Value:".

You can save your calibration as a *Science Workshop* document by selecting "Save As…" from the File menu.

Schematic Diagram



PIN	SIGNAL	PIN	SIGNAL
1	ANALOG INPUT (+)	5	POWER GROUND
2	ANALOG INPUT (-)	6	+12 V POWER
3	N/C	7	-12 V POWER
4	+5 V	8	ANALOG OUTPUT

Limited Warranty

PASCO scientific warrants this product to be free from defects in materials and workmanship for a period of one year from the date of shipment to the customer. PASCO will repair or replace, at its option, any part of the product which is deemed to be defective in material or workmanship. This warranty does not cover damage to the product caused by abuse or improper use. Determination of whether a product failure is the result of a manufacturing defect or improper use by the customer shall be made solely by PASCO scientific. Responsibility for the return of equipment for warranty repair belongs to the customer. Equipment must be properly packed to prevent damage and shipped postage or freight prepaid. (Damage caused by improper packing of the equipment for return shipment will not be covered by the warranty.) Shipping costs for returning the equipment, after repair, will be paid by PASCO scientific.

Equipment Return

Should this product have to be returned to PASCO scientific, for whatever reason, notify PASCO scientific by letter or phone BEFORE returning the product. Upon notification, the return authorization and shipping instructions will be promptly issued.

> ➤ NOTE: NO EQUIPMENT WILL BE ACCEPTED FOR RETURN WITHOUT AN AUTHORIZATION.

When returning equipment for repair, the units must be packed properly. Carriers will not accept responsibility for damage caused by improper packing. To be certain the unit will not be damaged in shipment, observe the following rules:

① The carton must be strong enough for the item shipped.

② Make certain there is at least two inches of packing material between any point on the apparatus and the inside walls of the carton.

③ Make certain that the packing material can not shift in the box, or become compressed, thus letting the instrument come in contact with the edge of the box.

Chemical Resistance Chart for Teflon Sensor Cover

This Chemical Resistance Chart is intended to be used as a general guide only. Since the ratings list is for ideal conditions, all factors affecting chemical resistance must be considered. Teflon FEP is rated "EE" (excellent at 20°C and at 50°C) for all the following chemicals except Fluorine and Perchloric Acid. It is rated "EG" for Fluorine and "GF" for Perchloric Acid.

E – No damage during 30 days of constant exposure.

G – Little or no damage after 30 days of constant exposure to the reagent.

F – Some effect after 7 days of constant exposure to the reagent. The effect may be crazing, cracking, loss of strength, or discoloration.

Acetaldehyde	Acetamide, Sat.	Acetic Acid, 5%	Acetic Acid, 50%
Acetone	Acetonitrile	Acrylonitrile	Adipic Acid
Alanine	Allyl Alcohol	Aluminum Hyroxide	Aluminum Salts
Amino Acids	Ammonia	Ammonium Acetate, Sat.	Ammonium Glycolate
Ammonium Hydroxide	Ammonium Oxalate	Ammonium Salts	n-Amyl Acetate
Amyl Chloride	Aniline	Benzaldehyde	Benzene
Benzoic Acid, Sat.	Benzyl Acetate	Benzyl Alcohol	Bromine
Bromobenzene	Bromoform	Butadiene	n-Butyl Acetate
n-Butyl Alcohol	sec-Butyl Alcohol	tert-Butyl Alcohol	Butyric Acid
Calcium Hydoxide, Conc.	Calcium Hypochlorite, Sat.	Carbazole	Carbon Disulfide
Carbon Tetrachloride	Cedarwood Oil	Cellosolve Acetate	Chlorine, 10%
Chloroacetic Acid	p-Chloroacetophenone	Chloroform	Chromic Acid, 50%
Cinnamon Oil	Citric Acid	Cresol	Cyclohexane
DeCalin	o-Dichlorobenzene	p-Dichlorobenzene	Diethyl Benzene
Diethyl Ether	Diethyl Ketone	Diethyl Malonate	Diethylene Glycol
Dimethyl Formamide	Dimethylsulfoxide	1,4-Dioxane	Dipropylene Glycol
Ether	Ethyl Acetate	Ethyl Alcohol, 40%	Ethyl Benzene
Ethyl Benzoate	Ethyl Butyrate	Ethyl Chloride, liquid	Ethyl Cyanoacetate
Ethyl Lactate	Ethylene Chloride	Ethylene Glycol	Ethylene Oxide
Fluorides	Fluorine (EG)	Formaldehyde, 40%	Formic Acid, 80-100%
Freon TF	Fuel Oil	Gasoline	Glacial Acetic Acid
Glycerine	n-Heptane	Hexane	Hydrochloric Acid, 35%
Hydrofluoric Acid, 48%	Hydrogen Peroxide, 90%	Isobutyl Alcohol	Isopropyl Acetate
Isopropyl Alcohol	Isopropyl Benzene	Kerosene	Lactic Acid, 85%
Methoxyethyl Oleate	Methyl Alcohol	Methyl Ethyl Ketone	Methyl Isobutyl Ketone
Methyl Propyl Ketone	Methylene Chloride	Mineral Oil	Nitric Acid, 70%
Nitrobenzene	n-Octane	Orange Oil	Ozone
Perchloric Acid (GF)	Perchloroethylene	Phenol, Crystals	Phosphoric Acid, 85%
Pine Oil	Potassium Hydroxide, Conc	Propane Gas	Propylene Glycol
Propylene Oxide	Resorcinol, Sat.	Salicylaldehyde	Salicylic Acid
Salt Solutions, Metallic	Silver Acetate	Silver Nitrate	Sodium Acetate, Sat.
Sodium Hydoxide, Sat.	Sodium Hypochlorite, 15%	Stearic Acid, Crystals	Sulfuric Acid, 98%
Sulfur Dioxide	Sulfur Salts	Tartaric Acid	Tetrahydrofuran
Thionyl Chloride	Toluene	Tributyl Citrate	Trichloroethane
Trichloroethylene	Triethylene Glycol	Tripropylene Glycol	Turpentine
Undecyl Alcohol	Urea	Vinylidene Chloride	Xylene
Zinc Stearate			