

Small, Fast and Accurate Temperature Probes

Physitemp's miniature Type T thermocouple sensors provide the widest and most versatile selection of temperature probes available for bioscience and analytical chemistry applications in research application. All our preclinical probes and microprobes are made with Physitemp's proprietary copper-constantan thermocouple wire and are guaranteed accurate to 0.1°C within the physiological range. All probes are interchangeable and do not require individual calibration when used with any of our Type T thermocouple instruments.

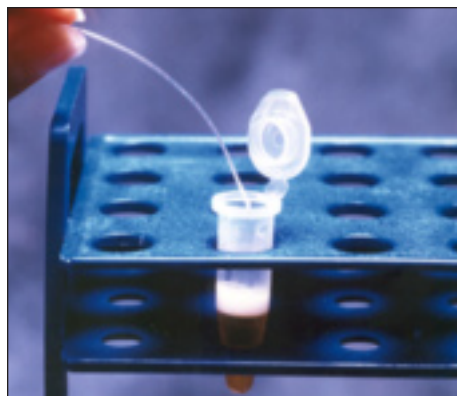
Our tiny sensors, welded under microscopes, are used to make needle probes as small as 29 gauge and flexible probes with a diameter of $.005''$. Small mass results in fast response times, with time constants as low as $.005$ seconds. Our miniature thermocouples cannot be matched for size, speed of response or price.

Our best selling probes, the flexible IT-18 series, are used in many scientific and industrial applications; for implantation in tissue in animal research application, in spectrophotometer cuvettes, rectally in neonatal mice, in water baths. They are fast reading, strong, completely sealed in flexible Teflon® and may be sterilized by gas (ETO) or autoclave.

Stainless steel needle probes as small as $.033\text{mm}$ diameter are available. There are surface probes, animal rectal probes in several sizes, heavy duty probes and a wide range of preclinical probes design for RUO-research use only. (see pages 6 and 7.) We also make custom probes in any quantity including multisensor microprobes with as many as 10 sensors (see page 8).

High accuracy is guaranteed

Physitemp specializes in the manufacture of Type T (copper-constantan) thermocouples. Small, flexible sensors are in demand for use in research applications where high accuracy and inter-



IT-18, Flexible Microprobe

changeability are required. Type T wire is widely recognized as being the most suitable thermocouple for these applications. Accuracy of $\pm 0.1^{\circ}\text{C}$ in the physiological range is possible and the probes are completely interchangeable. Wire with only $\pm 0.5^{\circ}\text{C}$ accuracy is readily available. This is known as "special limits" wire. However, Physitemp has pioneered the development of a "Proprietary" grade specification and is the only supplier of the premium grade with accuracy to 0.1°C .

Advantages of Thermocouples

There are currently six different common techniques for measuring temperature: thermal expansion, such as the bimetallic strip or liquid-in-glass thermometers, bulk resistance devices such as platinum RTD's and thermistors, semiconductor devices including diodes and transistors, thermocouples, liquid crystals and infrared non-contact devices. Of all the contact measurements techniques listed above the thermocouple is the smallest in size, fastest responding and lowest cost. This offers the least perturbation to the object being measured, and hence, the most accurate interpretation of its temperature. Their wide operating range and low relative cost make thermocouples ideal for most bioscience and industrial applications, as well a OEM applications of building a tiny thermocouple into a device.

What are thermocouples?

The thermocouple effect was first observed by Thomas Seebeck in 1821 while investigating electromagnetic phenomena associated with Bismuth Copper and Bismuth Antimony circuits.

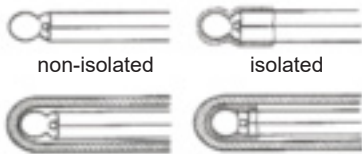
A thermocouple is a junction of two dissimilar metals and exhibits galvanic activity in response to a temperature gradient across the junction. Many conductors exhibit this effect, however in practice only eight or nine different types of thermocouples are used extensively in a vast array of industrial, commercial, medical and research applications. Selection of a thermocouple type for a specific application is related to cost, temperature range, accuracy, stability and operational life expectancy.

How are thermocouples manufactured?

A thermocouple sensor is created wherever the wires comprised of the two dissimilar metals are joined together electrically. The junction is usually a welded connection because this minimizes the size of the junction and provides the fastest response time. In addition, because the weld melts at such a high temperature it enables the probe to be used over a much wider temperature range. The sensor may also be formed by soldering or crimping, neither of which will affect the accuracy of the junction in measuring temperature although the response time may be slower and the melting point and corrosion resistance of the sensor junction may suffer when soldered. Since most of our thermocouples are made under a microscope, the quality and consistency of each weld is very high.

Isolated vs. Non-isolated

In a non-isolated sensor, the thermocouple bead is in direct contact with the object being measured, or it is in electrical contact with an outer and electrically conductive sheath that is in contact with the object. The advantage of the non-isolated sensor is the improved response time in both the sheathed and unsheathed forms.



An isolated sensor may be needed in an electrical application or one in which more than one sensor is present in a conductive medium. If the object being measured is electrically conductive and at an elevated potential, it is especially important in order to prevent an electric shock to the operator or damage to the measuring instrument.



BT-1, General Purpose Probe

In many animal research applications invasive sensors may be in contact with internal body fluids which are comprised of conductive electrolytes. Isolated sensors are required in these applications to avoid galvanic interaction between temperature sensors and other types of electrical sensors such as EKG electrodes.



MT-29/3, Needle Microprobe

Custom probe technologies

Many of the probes in Physitemp's standard product catalog were the result of individual customer's requests for small, accurate probes in unique applications. Physitemp's Engineers are always on hand to provide expert advice on which probes to use for a specific task and to suggest modifications to our existing designs, or completely new ones, when our standard probes do not fit the requirements. We try to maintain adequate stock of all our standard probes - custom designs may take a little longer.

OEM capabilities

Physitemp has many customers who supply sophisticated medical and scientific instrumentation which include our probes as an integral part of their system. We have years of experience supporting OEM's through prototype to clinical trials to market release phases of a new instrument system. Whether your need is for one probe or many thousands, we are interested in supplying thermocouples for a new program.

Wire available from stock

We keep many different types of "Ultra-Precision grade" 0.1° accuracy, wire in stock for immediate delivery. Some of these are listed on page 9. We also keep a large stock of bare Type T wire in several sizes, so that if you require some special insulation or configuration we can arrange to have it made within 3 - 4 weeks.

Stranded wire involves an extra process and will take longer. Custom wire can be supplied on rolls or made up into precut lengths with welded thermocouples.

Certified accuracy

Because we can guarantee the accuracy of this wire, our probes and instruments are often used in situations where accuracy must be certified. We can supply certificates as follows:

Certificates of Conformance are available on request. These simply state that the wire or probe is accurate to the limits of the specifications for that wire and will reference the customer P.O. number and the batch number of the wire or probe.

Customers needing to comply with ISO 9000 or similar standards should specify "C of C required" on their orders.

(For European customers, we automatically include a Declaration of Conformity with instruments that comply with CE requirements.)

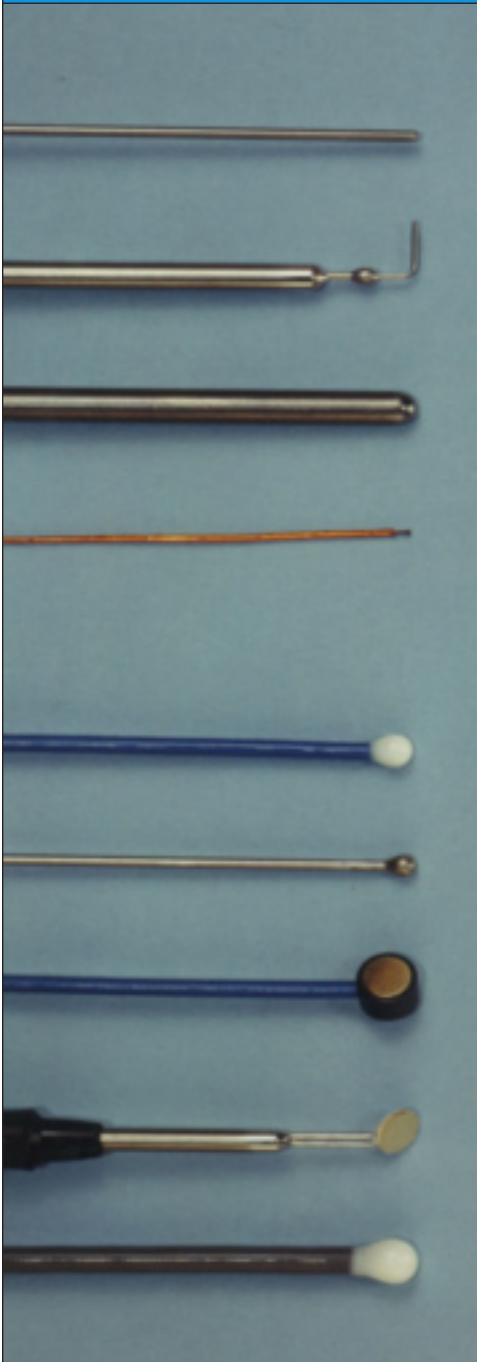
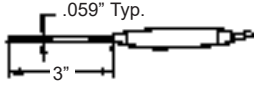
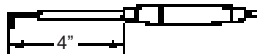
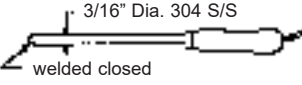
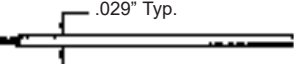
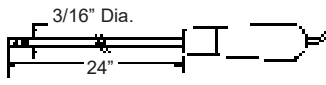
Certificates of Calibration are provided to NIST standards, and can be requested for an instrument only, for probes or for complete systems.

If certification is required for probes, please specify the temperatures you want certified. For instance, if you are working at low temperatures, you might want to certify the probe(s) at 0°C and at 25°C .

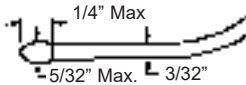
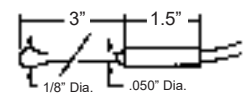
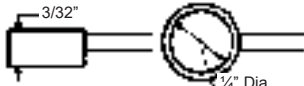
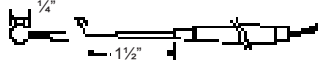
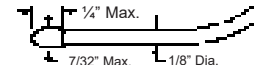
See page 34 for pricing on instrument and probe calibrations and certificates of calibration.

TEMPERATURE PROBES

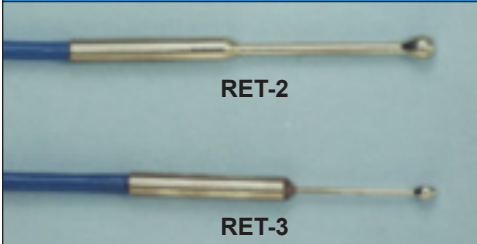
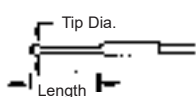
General Purpose Probes

		HT-1 - "Workhorse" probe for liquids, gases, semi-solids. Plastic handle with straight 3" stainless shaft. Not good for surface temps. Max. Temp. 400°C. Time constant 0.5 secs. 5 ft. lead. Not isolated. HT-2 - As HT-1 but with 9" shaft.
		BT-1 - For surface temperatures of solids, also for liquids, gases and semi-solids. Probably our best general purpose probe. Welded stainless-steel shaft, plastic handle. Tip is .028" diameter bent at right angle to probe to facilitate accurate surface measurements. 5 ft. lead. Immersible. Max tip temp. 240°C. Time constant 0.15 secs. Not isolated.
		DPT Series - Immersion probes for liquid. #304 stainless steel welded shaft, wooden handle. 5 ft. lead. Max. Temp. 400°C (750°F). Time constant 2 secs. Not isolated. TFT Series - Immersion probes for corrosive liquids. Similar to DPT series but shaft is Teflon® coated. Max. Temp. 150°C (300°F). Time constant 3 secs. Isolated. 5 ft lead.
		PT-6 - Sensor Six-Pack. For multi-point measurements. Inexpensive, flexible. Welded sensor beads, tough Kapton insulation, 5 ft. leads. Max. Temp. 400°C. Time constant 0.01 secs. Per package of six. Not isolated.
		GT-1 - Air and gas probe. 24" #304 stainless steel shaft, wooden handle. 5ft. lead. For instant readings of temperature gradients in environmental chambers, freezer boxes, etc. Max Temp. 200°C. Min. Temp. -200°C. Isolated.

Preclinical Probes

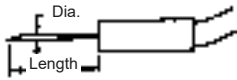
		RET-1 - Rectal probe for neonatal rabbits, and larger animals. Flexible, vinyl covered, soft tipped. Does not cause discomfort. Max. Temp. 90°C. Time constant 5.0 secs. 5 ft. lead. Isolated. For RUO-not for use in humans.
		OT-1 - For fast reading oral use in animal research applications. Ball-tipped stainless steel shaft, stainless handle. 5 ft. lead. Max. Temp. 125°C. Time constant 0.8 secs. Not isolated. For RUO-not for use in humans.
		SST-1 - Skin Surface probe, to be taped on. 1/4" dia. 10 Kt. gold sensor disc, 5 ft. lead. Max. Temp. 90°C. Time constant 0.15 secs. Not Isolated. For RUO-not for use in humans.
		SST-2 - as SST-1 with plastic handle. Isolated. For RUO-not for use in humans
		ESO-1 - Esophageal probe. Flexible vinyl covered 1/8" dia. Max. Temp. 90°C. Time constant 5.0 secs. 5 ft. lead. Isolated. For RUO-not for use in humans.

Animal Rectal Probes

		RET-2 - Rectal probe for rats. For fast intermittent measurements. Smooth ball tip. Stainless steel shaft - 1" long. 0.059" dia. Tip dia. .125". 5 ft. lead. Max Temp. 125°C. Time constant 0.8 secs. Not isolated. RET-3 - Rectal probe for mice, etc. As RET-2, with shaft 3/4" long. .028" dia. Tip diameter .065". Time constant 0.5 secs. Not isolated.

TEMPERATURE PROBES

Microprobes



Type	Dia.	Time Constant
MT-23	23 ga. (.025")	.15 secs.
MT-26	26 ga. (.018")	.1 secs.
MT-29	29 ga. (.013")	.025 secs.

Needle Microprobes- Not for use in Humans

Fast-response needle probes for instant readings in tissue, semi-solids, liquids. Also for very small specimens, powders and materials. Needle tip is sealed to ensure only stainless steel contacts specimen. Max. Temp. 200°C. 5ft. lead. Smallest microprobes give fastest reading. Short probes are easier to insert and last longer. Type #'s indicate needle gauge and needle length in cm.

Sizes Available (ga/cm.): MT-29/1, MT-29/2, MT-29/3, MT-29/5
MT-26/2, MT-26/4, MT-26/6
MT-23/3, MT-23/5, MT-23/8

MT-4- Similar to MT-29/1 but has blunt tip. Good for instant skin and surface temperatures, liquids. Time constant .025 secs. Not isolated.

All above probes are non-isolated. Isolated versions of 23 ga. and larger needles are available for special order.

MT-29/1

MT-23/3

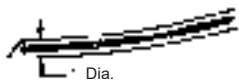
IT-18

IT-23

IT-1E

MT-D

ICT-4



Type	Dia.	Time Constant	Lead Length
IT-14	.050"	0.3 secs.	3 ft.
IT-18	.025"	0.1 secs.	3 ft.
IT-21	.016"	0.08 secs.	1 ft.

Flexible Implantable Microprobes- Not for use in Humans

IT Series - Implantable in semi-solids and tissue with needle. Ideal for accurate calibration testing of incubators and other instrumentation that requires calibration checks. Also for immersion in various solutions and rectal temperatures of small animals. Totally sheathed in chemical resistant Teflon™. Quite rugged. Max. Temp. 150°C. Isolated. Type # designates needle gauge. (or one gauge smaller in thin wall). For Research, industrial and laboratory use only

IT-23 - For ultra fast measurements and for use on micro-size specimens. max. diameter at tip 0.011". Tissue implantable with 23 ga. needle (supplied). Rather fragile. Max. Temp. 150°C. Time constant 0.005 secs. 3 ft. lead. Teflon™ coated. Isolated.

IT-1E - As IT-18 but sensor bead exposed. Combines the ultra-fast response of IT-23 with the Teflon™ sheath strength of IT-18. Time constant .005 secs. Isolated.

MT-D - Fast response surface probe for locating inflammation, arteries, etc. Also for dental use. Stainless steel. 5 ft. lead. Max. Temp. 200°C. Time constant 0.025 secs. Not isolated.
For RUO-not for use in humans

ICT-4 - For use on integrated circuits and other micro specimens. 0.013" dia. straight stainless steel shaft; slightly protruding sensor bead to facilitate temperature probing. 5" tubular handle fits micro-manipulators. Max. intermittent temp. 200°C, continuous use 100°C, Time constant 0.025 secs. 5 ft. lead. Not Isolated.

MT-29/1B - Insect Probe - Similar to MT-29/1 but sensor is swaged into tip for max heat transfer. Designed for high accuracy on extremely small specimens such as insects, seeds, etc. Max. insertion depth 1/8". Time constant 0.015 secs. 5 ft. lead. Max. Temp. 150°C. Other sizes made to special order. Not isolated.

MICROPROBES MAY BE STERILIZED BY GAS (ETO) OR GLUTERALDEHYDE SOLUTION.

Probe Sterilization Methods

Physitemp's needle microprobes, preclinical probes and animal rectal probes are all designed from materials to withstand sterilization by ETO gas and gluteraldehyde solution. Our flexible implantable microprobes are both ETO gas sterilizable and autoclavable. Researchers must follow established sterilization protocols set forth by their research facility.

Time constant is defined as the time required to reach 63% of final temperature in liquid. An accurate reading is obtained when the reading stops changing, typically 5-10 time constants.

Maximum Temperature refers to intermittent use of a probe. When probe is used for continuous measurements, max. temp. should be reduced by 25% unless specified.