OPERATING MANUAL

THERMALERT MONITORING THERMOMETER

TH-5

CONTENTS

OPERATING INSTRUCTIONS
THERMALERT MONITORING THERMOMETER, TH-5

1.0 The Physitemp Clinical Monitoring Instruments, Thermalerts TH-5 and TH-8, are compact, portable, battery operated digital readout thermometers for continuous clinical temperature monitoring.

2.0 INITIAL INSTALLATION

2.1 Plug any Physitemp type T thermocouple probe into the blue polarized socket on the rear of the instrument.

2.2 The TH-5 thermometer is designed to mount as follows:
(a) Flat, on rubber feet provided.
(b) Bench mounting with optional tilt stand (TTS-4).

3.0 PRECAUTIONS

3.1 As with any temperature monitoring system, use suitable accepted technique during eletro-surgical procedures to minimize the possibility that the probe cable will serve as an alternate path for radio frequency current and burn the patient.

- Properly locate an adequate electrosurgical dispersive electrode close to the active surgical site.
- Do not drape the probe cable over grounded metallic surfaces or intertwine it with the cables of the electrosurgical generator.

3.2 Never pull directly on the probe cable to disconnect.

3.3 Gas sterilization or autoclaving of the instrument is not recommended.

3.4 Do not immerse the instrument in liquids for cleaning. If necessary, clean the instrument case with a cloth moistened with a mild non-staining germicidal detergent and warm water.

4.0 DIRECTIONS FOR USE

4.1 Connect any Physitemp type T thermocouple probe to the blue polarized socket on the rear of the instrument.

4.2 Switch ON by depressing switch on front of unit - switch shows orange when in ON position. For several seconds the digital display should read “1888” as a segment check. Do not use if any display segment is inoperative. A calibration check is not necessary before each use.

4.3 Read temperature. Leave on for monitoring as long as desired.

4.4 Switch off after use.

4.5 Special Display Indications

1	A single digit 1 to the left signifies reading is outside instrument range.
0	A single digit 0 to the left indicates an open cable or probe. Check connection. If this is good, replace probe.
:	A flashing colon in the center of the display signifies low battery alert. Accurate readings will still be obtained, and it is not necessary to discontinue use immediately. Install new batteries the next time the unit is turned off.
:	A non-flashing colon signifies imminent battery failure. Install new batteries to ensure accurate readings.

5.0 REPLACING BATTERIES

5.1 CAUTION: Use only alkaline “C" cell batteries. Switch instrument OFF.

5.2 Grasp "squeeze release" on back panel and pull off battery retainer.

5.3 Remove battery connectors and slide out battery holder.

5.4 Discard old batteries and replace with fresh “C" cells.

5.5 Replace battery holder and refit connectors.

5.6 Insert top edge of battery retainer into lip of case. While grasping "squeeze release" push retainer in until flush with back of case.

6.0 CHECKING CALIBRATION

6.1 The Thermalert TH-5 thermometer incorporates an automatic zeroing amplifier which produces near-perfect stability of calibration. A calibration check is not necessary before each use. Under normal circumstances, the instrument will provide years of service without requiring recalibration.

6.2 Should it be suspected that the instrument is out of calibration, it may be checked with the Physitemp type T calibrator (Model CT-3), or if this is unavailable, with an NIST calibrated thermometer. Verifying instrument calibration with an NIST calibrated thermometer requires extremely careful technique, an accurate reference standard thermometer, and a reasonably draft-free location. The following apparatus and supplies are needed:

1 - quart thermos flask with 2-hole cork
Stirrer
NIST traceable mercury in glass thermometer, 0.05° graduations, partial immersion, 25-50°C (78-122°F) with ice point scale.
Physitemp type T temperature probe
Ice made from distilled water
Distilled water

6.3 Preparation:

a) Crush the ice and place it in the thermos flask, at least 3/4 full. Add distilled water. Leave for 30 minutes to allow temperature to stabilize, stirring periodically.

b) Immerse the standard mercury-in-glass thermometer in the ice bath to the immersion mark on the stem. Stir the bath well and compare with thermometer reading at 0°C with the correction table supplied with the thermometer. If the error is greater than 0.0°C, wait 10 minutes, stir the water bath and remeasure. If the error remains greater, test with another standard thermometer.

6.4 A complete calibration check requires two different measurements, one for each of the temperature ranges of the TH-5.

6.5 Checking low end of temperature range:

Fill a thermos flask with a mixture of hot and cold water to produce a temperature of approximately 25°C. Attach any Physitemp type T thermocouple probe to the standard mercury thermometer so that the sensor is at the same level as the mercury bulb, and immerse in the flask to the immersion depth marked on the stem. Do not allow probe or thermometer to touch the sides of the flask. Connect the probe to the TH-5 and switch it ON. Stir the bath well and wait 5 - 10 minutes. Ensure the flashing colon (battery warning) is not visible before reading the instrument and then the mercury thermometer to .05°C. Make a note of both readings.

6.6 Checking high end of temperature range:

Prepare a water bath at approximately 45°C. Follow measurement instructions given in Section 6.5.

6.7 Allowing for some reading error in the mercury thermometer (there can be none in reading the digital instrument display) and possible probe error, readings should agree within the limits noted in Section 9.7) This means, as an approximate rule-of-thumb, that differences between standard and instrument readings should not exceed 0.2°C. The exact error limits depend on the actual temperature at which the calibration is checked.

6.8 If the instrument appears to be out of calibration based on the foregoing checks, it should be returned for service (see Section 10).

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7.0 USE OF THERMALERT WITH A CHART RECORDER

7.1 Analog output is optional on Model TH-5.

WARNING: Use of AC-powered equipment with Physitemp Thermometers. As it is powered entirely by low-voltage batteries, Physitemp Thermometer TH-5 presents no safety hazard to patients. However, caution is advised when using the TH-5 with a chart recorder for recording patient temperature. Such auxiliary equipment, when AC-powered and in faulty condition, can create a potential shock hazard.

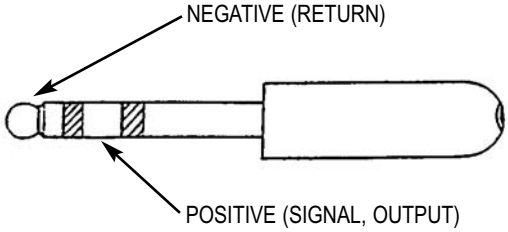
Hazard to a Grounded Patient
The circuit of the TH-5 is such that a low-impedance path exists from the analog output socket to the probe input socket. The TH-5 with sensor probe could therefore act as an electrical conductor between a faulty AC-powered recorder and the patient. Leakage current could exceed safe limits.

Hazard to an Ungrounded Patient
Some chart recorders have a permanently grounded input binding post. If a patient is connected to faulty AC-powered equipment and becomes live, a leakage path to ground would exist between the sensor probe and the recorder. Current safety limits could be exceeded.

If recording is essential: Use a recorder which meets AAMI safe current limit standards. Before connecting thermometer to recorder, consult a competent engineer about shock hazard. Remove connector plug from thermometer analog output when not in use.

7.2 A DC output with amplitude approximately proportional to instrument reading is provided from a stereo-type jack on the back panel. A mating plug is supplied for connection to the recorder. This plug may be left in the socket until it is required for use. The output of the TH-5 is 2 kilohms impedance, so connection to a potentiometric recorder will not affect either the calibration or accuracy.

Connection diagram for the plug:



7.3 Recorder sensitivity and pen zero must be adjusted so that the lines on the chart correspond to the desired range of temperatures

8.0 SPECIFICATIONS

Temperature Range	25°C - 45°C
Resolution	0.1°C
Repeatability	0.1°C
Calibration	Conforms to National Institute of Standards and Technology tables (Monograph 125).
Instrument Accuracy	0.1°C digit
Sensors	Any Physitemp type T thermocouple probe.
Ambient Operating Range	15°C - 45°C
Readout	3 1/2 digits, LCD 0.5" high
Display check	Automatic "1888" displayed after switch-on tests all segments.
Batteries	4 "C" cells. Alkaline or Mercury may be used. Carbon-Zinc cells are not recommended.
Battery Life Expectancy	1200 hours continuous (alkaline)
Analog Output	Optional extra, approx. 25mV/°C
Size	3" H x 6"1 W x 6 1/4" D
Weight	2 1/2 lbs.
Leakage Current	Instrument is isolated from ground and from mounting supports to 5000 volts DC. Low capacitance design minimizes risk caused by faulty patient grounding during electrosurgery. Leakage is less than lOμA at 6OHz.
Safety Features	Conforms to NFPA 99 Inhalation Anesthetics 1984 (operating voltage less than lOV), battery operated, suitable for use with flammable anesthetics. ANSI/AAMI Safe Current Limits for Electronic Apparatus,1978

9.0 TEMPERATURE MEASUREMENT WITH THERMOCOUPLE SENSORS

9.1 The thermocouple is a simple and widely accepted device for measuring temperature. It comprises two wires of dissimilar metals fused together to form a junction which produces an electrical output proportional to temperature. The National Institute of Standards and Technology (NIST Monograph 125, 1974) has tabulated the voltage/temperature relationships of many commonly used thermocouple pairs; their tables on copper/constantan form the basis for calibration of Physitemp thermometers.

9.2 At one time, accurate thermocouple temperature measurements needed elaborate potentiometers and reference to a source of known temperature, such as an ice bath. The advent of modern solid state devices has made possible the design of an inexpensive thermocouple thermometer which is direct reading. The first of these was Bailey thermometer BAT-4, which was designed in 1969 and is now in use throughout the world. Your Thermalert is an advanced version of the original equipment using the latest low power digital technology and compensated electronic reference circuitry.

9.3 As compared with thermistor sensors which were formerly used exclusively in portable thermometers, thermocouples have these advantages:

(a) wide temperature range, e.g. -200°C to over +1300°C.
(b) High stability of output.
(c) Interchangeability - no recalibration required.
(d) Accuracy traceable to NIST calibrations.
(e) Low cost; users can even make their own sensors.
(f) Microscopic size when needed, as in Physitemp microprobes.
(g) Nearly instant response.
(h) Better measurement accuracy due to low mass with smaller heat loss.

9.4 The main disadvantage of the thermocouple low sensitivity was overcome by the development of auto zeroing amplifiers which are now used in all Physitemp thermometers. This typeof amplifier is essentially drift-free. It makes possible an electronic thermometer which is permanently calibrated, just like a mercury thermometer. The following notes may help the user to avoid some of the errors most frequently made in temperature measurement.

9.5 Faulty measurement technique with any type of thermometer can produce errors of several degrees. Errors attributed to "out of calibration" equipment can often be corrected by a simple change of technique.

9.6 Thermocouple probes, like all other temperature sensing devices, must be placed so that they reach, as closely as possible, the temperature of the material to be measured. Probes are tip-sensitive, but when measuring the temperatures of liquids, semi-solids or hard surfaces, it is not sufficient to bring only the tip into contact with the material being measured. his is because there will be loss of heat along both the thermocouple wires and their sheath, so readings will be low. The effect can be greatly reduced if part of the metal sheath is also placed in contact with the material. In liquids and semi-solids, the tip and sheath are simply immersed; on solid surfaces, the sheath is laid against the surface.

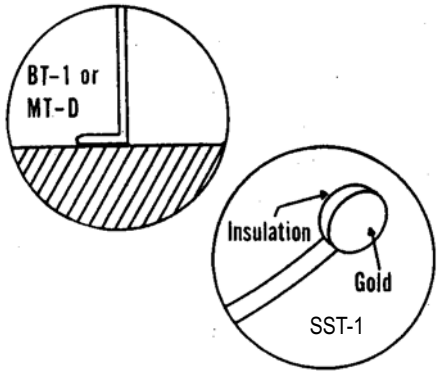
Here is a useful rough rule: Heat leakage effects are substantially reduced when an amount of probe equal to 10 or more sheath diameters is immersed or laid on the suface. For example, with a probe of 1/16" diameter, 10 x 1/16" = 10/16 = .625 = the minimum immersion depth.

9.7 Errors between thermocouple probes. All Physitemp probes and sensors are made with thermocouple wire that has been specially tested to meet our own stringent standards. Our probes are guaranteed accurate to within 0.1°C in the range 0-50°C. Copper-Constantan (type T) thermocouples from other manufacturers are normally close to this accuracy provided they are ordered to "special limits of error," and so are suitable for use with our thermometer. This interchangeability of sensor, including microprobes, is a major advantage of Physitemp thermocouple thermometers.

9.8 Measurements in Liquids. These are quite easy to make, because there is good thermal contact between liquid and probe. The latter quickly reaches liquid temperature and readings can be taken within a few seconds. However, a liquid which has been heated above or cooled below ambient will be losing or gaining heat, and convection currents will give rise to temperature variations of up to several degrees. These variations can be reduced by vigorous stirring. This simple precaution must always be taken.

9.9 Measurements of Air Temperature. Temperature can vary widely in different parts of a room; differences of at least several degrees will usually be noted. When a microprobe is used to indicate air temperature, readings will often fluctuate rapidly, responding to actual temperature changes caused by air currents. Breathing near the microprobe will produce wide fluctuations. These effects indicate the sensitivity of the Thermalert/microprobe combination, due to high discrimination of the instrument and almost instant response of the probe. Fluctuations can easily be eliminated by bringing the probe into contact with a metallic object, thus increasing its effective mass and slowing the response. Using a larger probe will have the same results.

9.10 Measurements on Solid Surfaces. These are most easily made with surface probes such as our BT-1 and MT-D. The right-angled tip provides the 10 diameters of probe contact specified in Section 9.6. Straight probes may also be used, provided that sufficient shaft length is in contact with the surface to be measured. In general, the smaller the probe, the more accurately it will measure the surface temperature of a solid. For instance, an MT-29 microprobe, because of its small size, needs to be in contact with the surface for as little as 1/8". SST-1 has a 1/4" gold disc sensor. Gold is an excellent conductor, and is non-allergenic and non-polluting. It makes a fine skin surface probe.



10.0 REPAIRS AND RECALIBRATION

10.1 In the event that a Thermalert Monitoring Thermometer is to be returned for repair and recalibration, please pack it with care and send it prepaid to:

Physitemp Instruments, Inc.
Service Department
154 Huron Avenue
Clifton, NJ 07013 USA

Please include with the instrument:

(1) A note describing any problems encountered.
(2) The name and telephone number of the user or other person we can contact.
(3) The complete return address for shipping.

10.2 A Service Manual for the TH-5 is available at additional charge. It includes schematic, component locator, trouble-shooting guide and complete calibration instructions. Specified test equipment is required for recalibration or other servicing. Consult Physitemp Inc. for further service information by telephone at:

Tel: 973-779-5577
Fax: 973-779-5954
E-mail: physitemp@aol.com

10.3 Physitemp Instruments Inc. warrants this instrument to be free from defects in material and workmanship for 12 months from date of shipment. Repair or replacement will be made at no charge at the discretion of Physitemp if the defect is not the result of misuse or abuse. Physitemp accepts no consequential liabilty for delay in delivery, alleged faulty performance of the product, or for any other cause.

Cables and probes are considered expendable and are not covered by this warranty. See separate warranty enclosed with probe.

For your protection, please pack returned items carefully, and insure them against possible damage or loss in transit. Physitemp will not be responsible for damage resulting from careless or inadequate packaging. Pleasereturn freight prepaid.

During the warranty period, the instrument may also be returned for a free calibration check.