



JAN 23 1982

Food and Drug Administration
5757 Georgia Avenue
Silver Spring, MD 20910

Henry E. Sostman, P.E.
Vice President
Product Integrity and
Regulatory Affairs
Yellow Springs Instrument Co., Inc.
Box 279
Yellow Springs, Ohio 45387

Re: K813639
Series 400 Disposable
Temperature Probes
Dated: December 23, 1981
Received: December 31, 1981
Regulatory class: II

Dear Mr. Sostman:

We have reviewed your premarket notification submission and have found the device to be substantially equivalent to devices introduced into interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments. You may, therefore, market your device subject to the general controls provisions of the Federal Food, Drug, and Cosmetic Act (FDCA). This product has been placed into the regulatory class shown above by a final regulation published in the Federal Register. Class I devices are regulated by the general control provisions of the Act applicable to all medical devices including annual registration, listing of devices, good manufacturing practice, labeling, and the misbranding and adulteration provisions of the Act; class II devices are those for which future performance standards will be developed; class III devices are those which will be required to undergo premarket approval at some time in the future.

Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Part 800. In addition, the Food and Drug Administration (FDA) may publish further announcements concerning your device in the Federal Register. We suggest you subscribe to this publication so that you can convey your views to FDA if you desire. Also, the Federal Register will notify you of any additional requirements subsequently imposed on your device. Subscriptions may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Such information also may be reviewed in the Dockets Management Branch (HFA-305), Food and Drug Administration, Room 4-62, 5600 Fishers Lane, Rockville, Maryland 20857.

This letter does not in any way denote official FDA approval of your device or its labeling. Any representation that creates an impression of official approval of this device because of compliance with the premarket notification regulations is misleading and constitutes misbranding. If you need further assistance on the labeling for your device, please contact the Bureau of Medical Devices, Division of Compliance Operations, 8500 Georgia Avenue, Silver Spring, Maryland 20910.

Sincerely yours,

Robert S. Kennedy, Ph.D.
Associate Director
for Device Evaluation
Bureau of Medical Devices



Memorandum

Date: 1/15/82
From: Reviewer(s) - Name(s): Richard J. Williams
Subject: 510(K) Notification K813639
To: The Record

It is my recommendation that the subject 510(K) Notification;

- (A) Is substantially equivalent to marketed devices.
- (B) Requires premarket approval. NOT substantially equivalent to marketed devices.
- (C) Requires more data.
- (D) Is an incomplete submission. (See Submission Sheet)

Additional Comments:

Class Code w/ Panel:

CLINICAL ELECTRONIC THERMOMETER Class # 80 FLL

Temperature probe, considered to be an accessory to an electronic thermometer

REVIEW: Pratt / 1/14/82
BRANCH CHIEF DATE

FINAL REVIEW: P. S. Sawyer / 1/14/82
DIVISION DIRECTOR DATE

OPTIONAL REVIEW: _____
ASSOC. DIRECTOR FOR DEVICE EVAL. DATE

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YELLOW SPRINGS INSTRUMENT CO., INC.

Box 279, Yellow Springs, Ohio 45387, U.S.A.

Phone 513-767-7241

Telex 20-5437

December 23, 1981

Food and Drug Administration
Bureau of Medical Devices and Diagnostic Products
Document Control Center (HFK-20)
8757 Georgia Avenue
Silver Spring, Maryland 20910

K813639

510(k) NOTIFICATION: SERIES 400 DISPOSABLE TEMPERATURE PROBES

Gentlemen:

This submission is notice of our intent to market devices subject to the provisions of Section 510(k) of the Medical Device Amendments of 1976.

Models 491 and 499 Disposable Temperature Probes, together with Model 4900 Reusable Instrument Cable, are electrical temperature sensors designed for use with Yellow Springs Instrument Co, Inc, temperature indicating instruments, in general-purpose and medical situations.

I trust that the enclosed material is sufficient for your determination. Please feel free to call me if it is not.

Sincerely,

Henry E. Sostman, P.E,
Vice President
Product Integrity and
Regulatory Affairs

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YELLOW SPRINGS INSTRUMENT CO., INC.

Box 279, Yellow Springs, Ohio 45387, U.S.A.

Phone 513-767-7241

Telex 20-5437

December 23, 1981

INFORMATION IN SUPPORT OF 510(k) NOTIFICATION

SERIES 491 AND 499 DISPOSABLE TEMPERATURE PROBES AND SERIES
4900 EXTENSION CABLE

(Section letters below follow paragraph identification letters
of 21CFR 807.87)

(a) The proprietary names of the devices are Yellow Springs Instrument Co., Inc., (YSI) Model 491 and Model 499 Disposable Temperature Probe and Model 4900 Extension Cable. These devices are temperature sensors which, in combination with instruments currently marketed, are under the classification number 4024, Thermometer, Battery Powered, assigned by the General Hospital Classification Panel.

(b) YSI is a registered manufacturer of medical devices. Its registration number is 1550101. A manufacturing subsidiary, YSI Sensors, is separately registered and its registration number is 1627452.

(c) The General Hospital Device Classification Panel has classified such devices in Class II, Performance Standards (per letter of May 3, 1981, from Charles H. Kuyper, Office of Small Manufacturers Assistance, Bureau of Medical Devices).

(d) No performance standard for medical electronic thermometers has been promulgated by the Commissioner of the Food and Drug Administration. The Bureau of Medical Devices Standards Survey (1977) cites three voluntary standards in preparation and not yet complete. To the best of our knowledge they are still not complete. These are:

ASTM E20.08.02A, Electronic Clinical Thermometers. This standard, when complete, will be not pertinent to this product, since it relates to devices for uses similar to those of mercury-in-glass fever thermometers.

ASTM E20.08.03, Continuous Clinical Temperature Monitoring Systems. This standard is not complete. The committee responsible for it is inactive.

ASTM E20.08.04, Clinical Laboratory Temperature Measuring Systems. This standard has not yet been adopted by ASTM and is not pertinent to this product, since it relates only to clinical laboratory practice.

The author of this letter has knowledge of only one additional standards effort in relation to medical electronic thermometers. This is an effort of Pilot Secretariat 12, Reporting Secretariat 3, of the Organisation International Metrologie Legal, an international standards organization of which treaty the United States is a signator. The Secretariat resides with the Physikalisch-Technische Bundesanstalt, West Berlin. The author has the honor to represent the United States (by appointment of the National Bureau of Standards) on this committee. Its work is just beginning and is expected to be complete late in this decade.

(e) Copies are enclosed of the labeling which will appear on the packaging of the probes and of the extension cable and on the case. Advertising and promotional material issued to date are also enclosed.

(f) YSI believes that Models 491, 499 and 4900 are substantially equivalent to products which were in commercial distribution prior to May 26, 1976, for the following reasons:

(1) YSI has been a manufacturer of electronic thermometers used in general-purpose, biological, medical, ecological, industrial and scientific applications for more than 25 years. A brochure is attached which describes other electronic thermometers of the current YSI product line. The separate sheet which describes the probes which are the subject of this notification shows also a Model 2100 Dual Display Tele-Thermometer. This thermometer has recently been the subject of a 510(k) notification (Reference K-813409) approved by FDA on December 18, 1981.

(2) In particular, Models 491, 499 and 4900 are substantially equivalent to (indeed, are interchangeable with) thermistor temperature probes of the YSI 400 Series, shown in the material furnished. Models 491 and 499 differ from probes previously produced in that they are intended for one-time use and as furnished are sterile products.

Considerations for sterile packaging

Models 491 and 499 Disposable Temperature Probes will be produced at a wholly-owned subsidiary, YSI Sensors, Tesuque, New Mexico. Quality Assurance surveillance and audit will be controlled by the Product Integrity Department, Yellow Springs Instrument Co., Inc. Model 4900 Extension Cables will also be produced by YSI Sensors, Inc., but are not sterile products.

Probes will be produced in a section of the YSI Sensors facility dedicated to these probes and used for no other purpose. Probes as produced will be individually packaged in (b)(4) pouches (of which samples are attached) and heat-sealed. Samples selected at random and representative of a production lot will be sealed to include test strips of known biological agents and will be uniquely marked for identification.

Probes of a given type will be packaged in shelf-pack cases of 25 probes. Shelf-pack cases will be packaged in cartons each containing 48 cases. A lot number will be placed on each pouch, case and carton. The lot number will be the sterilization lot.

Cartons of probes of 1 sterilization lot will be transported to an independent sterilization facility and will be sterilized by exposure (b)(4) This [radiation] level represents an overkill dosage as established by

experiment. Following sterilization, the samples containing test strips will be forwarded to an independent laboratory for confirmation of sterility. The sterilization lot, other than these samples, will be forwarded to Yellow Springs Instrument Co., Yellow Springs, Ohio, where it will be held in Quality Assurance quarantine until assurance of sterility is received.

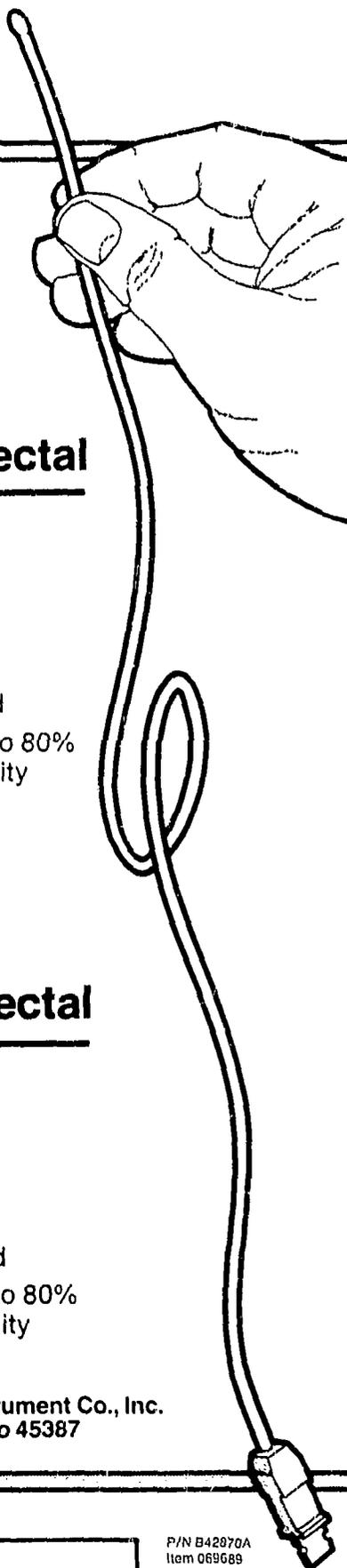
In November, 1981, (b)(4) lots of probes were submitted to (b)(4) 3rd Party Sterilization Testing. The (b)(4) lots aggregated approximately (b)(4) assemblies. Each lot contained approximately the same number of assemblies. (b)(4) 3rd Party Sterilization Testing was instructed to irradiate one lot at 1 to 1.5Mrad minimum, and the other lot at 2.5Mrad minimum. Following sterilization the actual sterilization levels were found to be 1.8 to 1.9Mrad and 3.1 to 3.4Mrad respectively.

(b)(4) samples were withdrawn from each lot, identified as being from Lot 1 or Lot 2, and forwarded to (b)(4) 3rd Party Sterilization Testing for sterility testing and bacteriostatic and fungistatic testing. On December 7, 1981, incubation was completed with no failures. Because no failures were encountered the North-view report, a copy of which is attached, does not distinguish between lots.

On this basis, we are confident that the radiation level which will be used for production units will achieve sterilization per POC Test Procedure 1, for both 491 and 499 probes.

When a lot has been sterilized, it will be held in quarantine at the sterilizer's facility until sterility assurance has been received by Yellow Springs Instrument Co, and then the lot will be transferred to YSI. At YSI it will be sampled for verification of electrical and mechanical performance. Reserve samples will be withdrawn and maintained in quarantine. The remaining units will then be released for distribution by YSI Quality Assurance.

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YSI 491-25
Esophageal/Rectal

Disposable
Temperature
Probes

Contents: 25 Probes,
Sterile Packed
Storage: 15 to 40°C, 20 to 80%
Relative Humidity



YSI 491-25
Esophageal/Rectal

Disposable
Temperature
Probes

Contents: 25 Probes,
Sterile Packed
Storage: 15 to 40°C, 20 to 80%
Relative Humidity

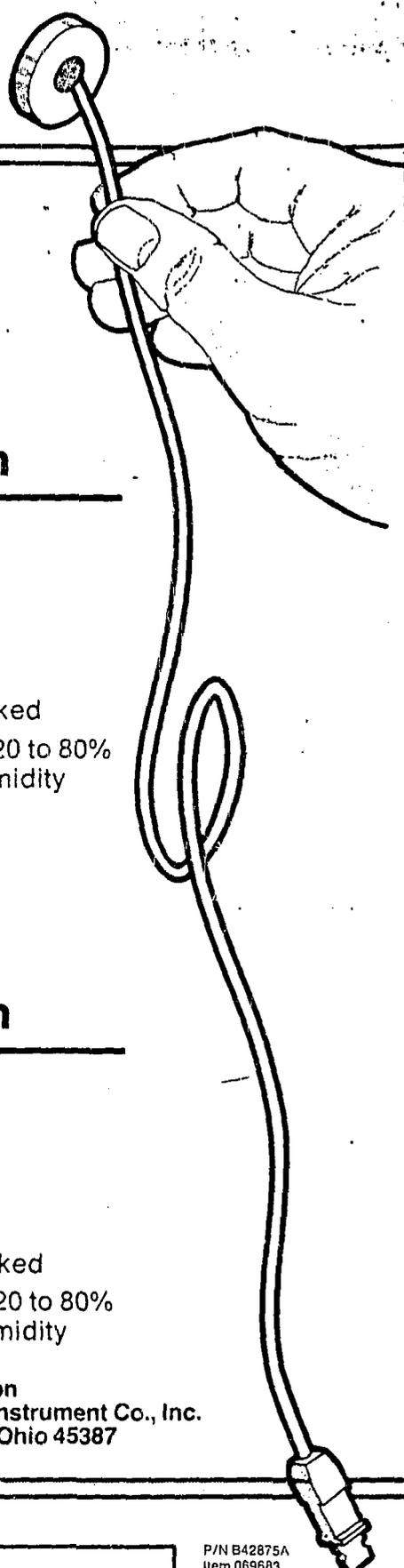


Scientific Division
Yellow Springs Instrument Co., Inc.
Yellow Springs, Ohio 45387

LOT NO.

P/N B42970A
Item 069669

Questions? Contact FDA/CDRH/OCE/DID at CDRH-FOISTATUS@fda.hhs.gov or 301-796-8118



YSI 499-25
Surface, Skin

Disposable
Temperature
Probes

Contents: 25 Probes,
Sterile Packed
Storage: 15 to 40°C, 20 to 80%
Relative Humidity



YSI 499-25
Surface, Skin

Disposable
Temperature
Probes

Contents: 25 Probes,
Sterile Packed
Storage: 15 to 40°C, 20 to 80%
Relative Humidity



Scientific Division
Yellow Springs Instrument Co., Inc.
Yellow Springs, Ohio 45387

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LOT NO.

P/N B42875A
Item 069683

Questions? Contact FDA/CDRH/OCE/DID at CDRH-FOISTATUS@fda.gov

Available
Soon

YSI SERIES 400

Disposable Temperature Probes



Disposable Temperature Probes for Critical Care Patient Monitoring and Control

YSI Series 400 Temperature Probes have long been considered the "standard" in most surgical and critical care units. They're used in almost every American hospital, and in thousands more around the world.

New Disposable Probes

Now, to make your job easier, we've added two new probe styles for critical care patient monitoring . . . and they're disposable.

The YSI 191 Esophageal/Rectal Probe, suitable for infants or adults, provides measurements from several hours to several days in applications such as surgery, critical care units, incubators, hypo- or hyperthermia controls, and rescue vehicles.

The YSI 499 Skin Surface Probe, mounted on an adhesive-backed foam pad, attaches easily to skin or other surfaces, and is suitable for many medical/surgical applications.

No Muss, No Fuss

Each single-use probe consists of a precision interchangeable thermistor temperature sensor attached to a 3-foot vinyl-covered lead. A positive-action plug securely connects the probe to an 8-foot non-sterile reusable instrument cable. The cable plugs into any YSI Tele-Thermometer or temperature controller, old or new, or other instrument designed to use YSI Series 400 Temperature Probes.

The probes are sterile-packed in sealed pouches ready to use. After use, simply unplug the probe and throw it away. The risk of cross-contamination present with reusable probes is eliminated.

Lower Cost

These new disposable probes are accurate to 0.1°C in the biomedical range, 20 to 43°C, and are electrically isolated to prevent accidental patient electrical shock. They are manufactured to the same high quality as reusable YSI Series 400 probe styles, all of which are still readily available.

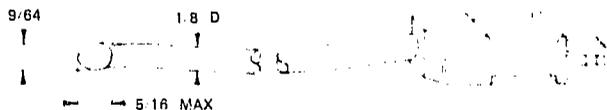
When you consider the time and expense of cleaning and sterilizing reusable probes after each use, you'll find that not only are these new YSI medical/surgical disposable probes more convenient for critical care patient temperature monitoring . . . they'll also cost you less.



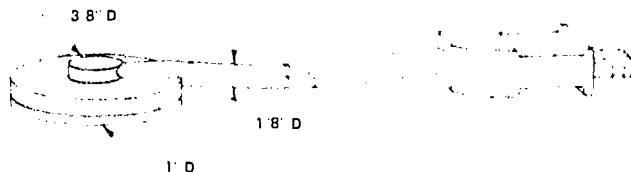
Scientific Division
Yellow Springs Instrument Co., Inc.
Yellow Springs, Ohio 45387 • Phone 513-767-7241 • Telex 20-5437

Style No.	Probe Description
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491	ESOPHAGEAL/RECTAL Sterilized, disposable vinyl probe with flexible 3-foot lead. For short to medium term (several hours to several days) temperature measurement and control in adults, infants and animals. Usable in surgical, critical care, hypo- or hyperthermia controls, rescue vehicle and general medical applications. Time constant 7.0 sec.
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499	SKIN, SURFACE. Sterilized, disposable vinyl probe with flexible 3-foot lead. Sensor mounted on adhesive foam pad for ease in attaching to skin or other surfaces. Foam pad provides some thermal isolation from environment. For short to medium term (several hours to several days) temperature measurement and control in adults, infants and animals. Usable in surgical, critical care, hypo- or hyperthermia controls, incubators, physiological testing, rescue vehicle and general medical applications. Time constant 9.0 sec.
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4900	REUSABLE INSTRUMENT CABLE. Not sterilized. Connects disposable probe to measurement device. 8-foot flexible vinyl cable terminated with probe connector and phone plug. Non-autoclavable.
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Temperature Range:
0 to 65°C (32 to 150°F)

Interchangeability:
Probe interchangeability is $\pm 0.1^\circ\text{C}$ between 20 and 43°C, decreasing to $\pm 0.4^\circ\text{C}$ at 0 and 65°C.

Time Constant:
The time required to read 63% of a newly impressed temperature in water at 3"/sec. Approximately five time constants are required to read 99% of a temperature change.

Electrical Isolation:
Thermistors are electrically isolated from outer probe surfaces for maximum patient safety.

Packaging:
Probes are sterile-packed in sealed pouches ready for use. Instrument cable is not sterilized.

HOW TO ORDER:
Order by style number directly from YSI franchised dealers.

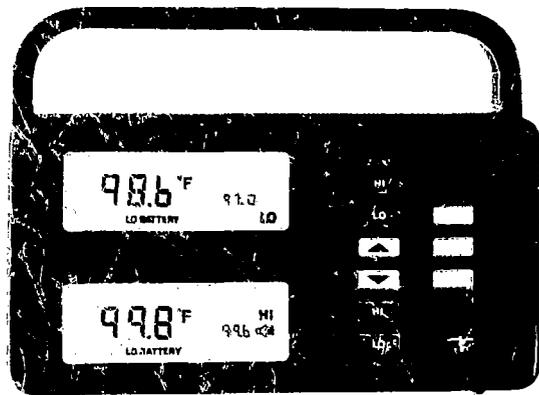
Caution — In the presence of RF energy sources, local heating, temperature errors and probe damage may occur. Remove probe from patient before activating electro-surgical or other direct-coupled RF energy sources.

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YSI MODEL 2100

Dual-Channel, Dual-Display Tele-Thermometer

Available
Soon



- Simultaneously monitors two probes
- Separate display for each probe
- High-Low alarm set points for each probe
- Selectable visible and audible alarm modes
- Selectable C or F readouts
- Uses YSI Series 400 Temperature Probes

Medical/Surgical Thermometer For Critical Care Patient Monitoring

Among the unique features of this dual-channel thermometer is its dual-display. Patient temperature can be monitored *simultaneously* from two points, or two patients can be monitored with the same instrument. Each channel has its own continuous display. You don't have to switch back and forth between channels.

In addition, each channel has its own selectable high and low alarm set points and alarm modes. For each channel the high and low set points are alternately displayed every two seconds. The user selects the alarm mode: beeper plus flashing display; flashing display only; or no alarm.

Temperature units are also selectable: 0 to 50°C or 32 to 122°F. An optional recorder accessory permits continuous recording of temperature data from both channels.

Safe and Convenient

A safety feature is the LO BATTERY warning that indicates when approximately four hours of battery life remain. The six common "C" size batteries can be replaced quickly, and no recalibration is necessary when they are replaced or as they age.

To prevent accidental patient shock, the plastic case is electrically isolated to UL 544 minimum. The handle can be used to support the instrument for easier reading on a bench top, or an optional bracket is available to pole-mount the instrument on an anesthesiology cart or at the patient's bedside.

Uses YSI Series 400 Probes

YSI Series 400 Thermistor Temperature Probes, both disposable and reusable styles, provide direct temperature readout. Because the probes are interchangeable and accurate to 0.1°C, no recalibration is necessary when changing probes.

YSI Series 500 Probes also may be used, but accuracy is reduced and conversion charts are necessary to correct indicated temperature to actual temperature.

The YSI Model 2100 is the latest addition to YSI's long-established line of medical/surgical thermometers.

Temperature Range:

0 to 50°C or 32 to 122°F, switch-selectable.

Accuracy:

±0.2°C plus probe from 20 to 43°C, ±0.3°C outside that range.

Resolution:

0.1°C or F, switch-selectable.

Digital Readouts:

Two, 3 1/2-digit LCD displays, 1/2 in. high.

Alarms:

User-settable, independent high and low limits for each channel. High and low settings displayed alternately every two seconds. User selects alarm mode: beeper and flashing display; flashing display only; no alarms.

Power Supply:

Six "C" cells provide approximately 240 hours operation. Low battery indicator flashes when four hours of battery life remain.

Temperature Probes:

Direct reading with any disposable or reusable YSI Series 400 Temperature Probe. Usable with YSI Series 500 Temperature Probes from 20 to 43°C, with reduced accuracy and conversion chart to correct indicated reading.

Case:

Plastic; electrically isolated to UL 544 minimum.

Size:

22.3 x 7.6 x 11.5 cm, 1.6 kg (8 3/4 x 3 x 4 1/2 inches, 3.5 lbs.)

Pole-Mounting Bracket:

Optional

Recorder Adaptor:

Optional. Requires recorder with minimum 10k ohms input impedance. Adaptor is fiber-optically isolated from the Model 2100 to maintain patient isolation.

HOW TO ORDER:

Order directly from YSI franchised dealers using the following part numbers:

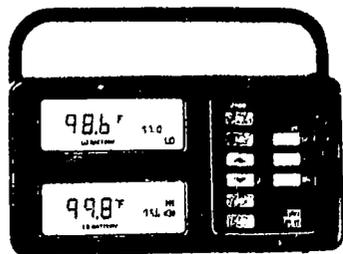
YSI Model 2100 Tele-Thermometer

YSI 2110 Pole-Mounting Bracket

YSI 2120 Recorder Adaptor



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Yellow Springs Instrument Co., Inc.
Yellow Springs, Ohio 45387 • Phone 513-767-7241 • Telex 20-5437



**YSI
Dual-Channel
Dual-Display
Tele-Thermometer
... Versatile**

Among the unique features of the new Model 2100 dual-channel thermometer is the dual-display. Monitor patient temperature from two points simultaneously, or monitor two patients at once. Each channel has its own continuous display.

In addition, each channel has high-low alarm set points. You select the set points and alarm mode: beeper plus flashing display; flashing display only; or no alarm.

You also select the temperature units: 0 to 50°C or 32 to 122°F. And an accessory permits continuous recording of both channels. Another accessory is a bracket for instrument mounting on an anesthesiology cart or at the patient's bedside.

Safe A LO BATTERY indicator warns when four hours of battery life remain, and the common "C" size batteries can be replaced quickly. Also, to prevent patient shock, the plastic case is electrically isolated.

YSI Series 400 Probes Direct temperature readout is provided by YSI Series 400 Thermistor Probes, accurate to 0.1°C. No recalibration is necessary when changing probes.

The YSI Model 2100 is the latest addition to YSI's long-established line of medical/surgical thermometers for safe, accurate, convenient critical care patient temperature monitoring.

AVAILABLE
SOON!



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Yellow Springs Instrument Co., Inc.**

Yellow Springs, Ohio 45387 • Phone 513-767-7241

**YSI
Disposable
Temperature
Probes**

... No Muss, No Fuss

Chances are your surgical and critical care units use YSI Series 400 Thermistor Temperature Probes and Tele-Thermometers... most hospitals do. Now, to make your job easier, we've added two new probe styles for critical care patient monitoring... and they're disposable.

The 491 is an esophageal/rectal probe and the 499 is an adhesive-backed skin surface temperature probe. They're made with the same top quality workmanship of all YSI probes and have an accuracy of 0.1°C. Sterile-packed in sealed pouches, they're ready to use with any YSI Tele-Thermometer... old or new.

Lower Cost When you consider the time and expense of cleaning and sterilizing reusable probes after each use, you'll find these new YSI disposable probes are not only more convenient, they'll also cost you less, and there's no worry about cross contamination.

Of course, all the other YSI probe styles you've been using for years are still readily available.

Free Samples We'd like you to try these two new YSI Series 400 Disposable Probes at our expense. Answer this ad and we'll tell you how to obtain your free sample probes for easier patient temperature monitoring.

AVAILABLE
SOON!



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Yellow Springs Instrument Co., Inc.**

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PLASTIPEEL®

10781

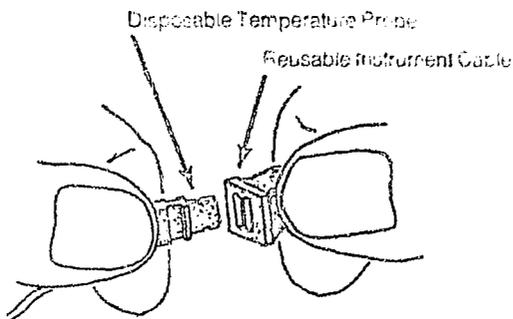


STERILIZED -- PEEL APART TO OPEN

YSI Series 400
Disposable Temperature Probe
Style 491 -- Esophageal/Rectal

- o Disposable probe, for single use only. DO NOT REUSE.
- o Contents sterile unless package is opened, damaged, or wet.
- o Use ONLY with YSI Cole-Thermometers or other instruments designed to use YSI Series 400 Disposable Temperature Probes.

Insert probe connector into instrument cable until it snaps firmly into place. DISPOSE OF PROBE AFTER USE. Instrument cable, YSI Part No. 4900, is reusable and is not sterile.



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PATENT PENDING P/N C.42301A ITEM 069598

LOT NO.

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PRICE INCLUDING HANDLING \$1.00

INSTRUCTIONS FOR YSI SERIES 400 STERILIZED DISPOSABLE TEMPERATURE PROBES AND THE YSI 4900 REUSABLE INSTRUMENT CABLE

APPLICATION

YSI Series 400 Sterilized Disposable Probes are recommended for direct temperature measurement and control with YSI Tele-Thermometers, temperature controllers or with other instruments designed for use with YSI Series 400 Probes

MAXIMUM OPERATING TEMPERATURE

YSI Series 400 Disposable Probes are designed for measurements below 65°C. The vinyl covered lead wires, connectors, and instrument cables may not be exposed to temperatures above 100°C.

CONSTRUCTION

YSI Series 400 Disposable Probes consist of a thermistor temperature sensing element attached to a vinyl-jacketed lead 3 feet long. This is plugged into an 8-foot reusable instrument cable (YSI 4900) terminated with a phone plug.

Disposable probes are constructed with the thermistor electrically isolated from the outer probe surfaces to prevent an accidental ground path or shock from other instruments when the probes are used in contact with the body (out see RF energy caution, below).

Calibration of all YSI probes is traceable to NBS reference standards or to accepted values of natural physical constants.

RF ENERGY CAUTION

All patient connected transducer assemblies are subject to interference and possible damage from high intensity sources of RF energy. YSI temperature probes are no exception. Should a probe conduct RF current, local heating, measurement errors and probe damage may occur. Inadequately grounded electro-surgical units represent one potential source of high-intensity RF. In medical use, remove the probe from patient contact before activating electro-surgical apparatus or other direct-coupled RF energy source.

INTERCHANGEABILITY

YSI disposable probes are interchangeable. The temperature sensing elements are manufactured by a patented method for producing thermistors with matching temperature resistance characteristics (see table below). Interchangeability tolerances are $\pm 0.1^\circ\text{C}$ between 20°C and 43°C, increasing linearly to $\pm 0.4^\circ\text{C}$ at 0°C and 65°C.

TEMPERATURE/RESISTANCE CHARACTERISTICS OF YSI SERIES 400 PROBES

Temp. C	Res. Ohms						
0	7355	14	3708	28	1977	42	1108
1	6990	15	3539	29	1894	43	1065
2	6645	16	3379	30	1815	44	1024
3	6319	17	3226	31	1740	45	984.2
4	6011	18	3082	32	1668	46	946.6
5	5720	19	2944	33	1599	47	910.6
6	5444	20	2814	34	1534	48	876.2
7	5184	21	2690	35	1471	49	843.2
8	4937	22	2572	36	1412	50	811.7
9	4704	23	2460	37	1355	55	672.9
10	4483	24	2354	38	1301	60	560.7
11	4273	25	2253	39	1249	65	469.4
12	4075	26	2157	40	1200		
13	3887	27	2065	41	1153		

STEM EFFECT

Stem effect on YSI disposable probes becomes negligible beyond 6 inches from the sensing tip. Stem Effect refers to the potential inaccuracy of measurement caused by heat transfer through the probe lead. Stem effect may be lessened by minimizing the difference between probe tip temperature and lead temperature with appropriate insulation or isolation, depending on the application.



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X

Each YSI Series 400 Disposable Probe is shipped in a sealed pouch, sterilized and ready for use. Each probe is designed for a single use only. Do not reuse in medical applications.

**CLEANING AND STERILIZING
REUSABLE INSTRUMENT CABLES**

The YSI 4900 Reusable Instrument Cable may be gently wiped clean with 70% isopropanol or with a mild detergent solution. Be sure that the receptacle of the cable is dry and free of foreign matter. Excessive pressure in cleaning or continued flexing in use may break the internal wires.

STERILIZATION Ethylene oxide sterilization does not damage the reusable cable, but cables must be safely and thoroughly ventilated after gas sterilization. The directions given by the manufacturer of the sterilizer must be followed, and assurance secured that sterility has been achieved. **NEVER BOIL OR AUTOCLAVE THIS CABLE**

STORAGE

Store probe and reusable cables at 20 to 80% relative humidity, 15 to 40° C.

TIME CONSTANT (see probe descriptions)

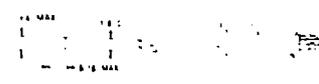
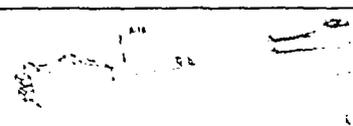
Time constant, the standard measure of probe response time, is the time required for a probe to read 63% of a newly impressed temperature change. YSI time constants express optimum response times and are obtained by transferring the probe from a well stirred water at 68° F to a like bath at 108° F. Approximately five constants are required for a probe to read 99% of the change. Time constants are representative values and subject to variations due to small differences in location of the thermistor component within the probe.

WARRANTY

All YSI Series 400 Disposable Probes are warranted to be functional for one year from date of purchase for single use applications only. Sterility is warranted unless package is opened, damaged or wet.

YSI 4900 Instrument Cables carry a one year warranty on workmanship and components. Damage through misuse or tampering is not covered. Cable life will vary from a few months to many years depending on the amount of flexing. Normal life exceeds one year.

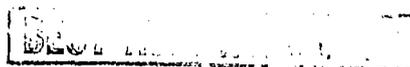
YSI Series 400 Disposable Probe Styles and the YSI 4900 Instrument Cable

Probe No.	Description	Time Const.	Configuration
491	ESOPHAGEAL, RECTAL Used for short to medium term (several minutes to several days) temperature measurements and control in adults and infants for surgical, ICU, CCU, ER, hypo- and hyperthermia and rescue vehicle applications. Also useful for veterinary research. Vinyl tip with flexible 3-foot lead. Usable to 65° C.	7.0 sec	
499	SKIN Used for short to medium term (several minutes to several days) temperature measurements and control in adults and infants for surgical, ICU, CCU, ER, hypo- and hyperthermia, rescue vehicle, infant incubator and physiological testing applications. Sensor disc is mounted on adhesive foam pad for ease in attaching to skin or to other surfaces. Foam pad provides some thermal isolation from environment. Flexible 3-foot lead. Usable to 65° C.	9.0 sec	
4900	REUSABLE INSTRUMENT CABLE Used with YSI Series 400 Disposable Probes to connect with measurement device. 8-foot long vinyl cable terminated with probe lead connector and phone plug. May be sterilized according to instructions; do not boil or autoclave. Not for internal use.		



Scientific Division
Yellow Springs Instrument Co., Inc.
Yellow Springs, Ohio 45387 • Phone 513-767-7241 • Telex 20-5437

ITEM 069591 P N A42867A OCTOBER 1981 PRINTED IN U.S.A. BK



(b)(4) 3rd Party Sterilization Testing

Records Processed under FOIA Request 2015-5752, Released by CDRH on 09/30/2015

(b)(4) 3rd Party Sterilization Testing

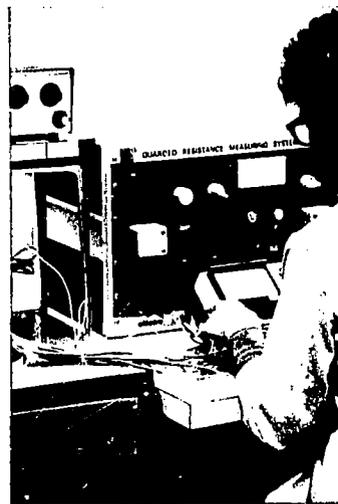
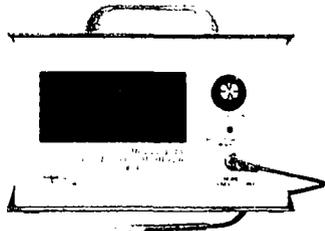
Records Processed under FOIA Request 2015-5752, Released by CDRH on 09/30/2015

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YSI-Scientific Temperature Instruments

for Medicine, Science and Industry



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YSI Series 500 Temperature Probes page 4
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 YSI Laboratory Temperature Standards 20
 YSI Temperature Scale Calibration 23
 YSI Custom Temperature Equipment 23

YSI Series 500 Temperature Probes
 YSI Series 600 Temperature Probes
 YSI Series 700 Thermilinear® Probes



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CERTIFICATE OF TRACEABILITY

We certify that this product was calibrated during manufacturing using standards whose calibrations are traceable to the National Bureau of Standards or are derived from accepted values of natural physical constants. As manufactured, it met or exceeded its current specifications.

Henry E. Sostman *Geron E. Smith*
 Henry E. Sostman, PE Geron E. Smith
 Vice President Manager of Metrology

Product Integrity MHD0016 AMYKA

All data furnished is based on
 the approval of the
 manufacturer's standards
 Association



In almost every hospital in America today, and in thousands more throughout the world, you will find an anesthesiologist using a YSI Tele-Thermometer to monitor a patient's body temperature. Outside the operating room, you will find YSI precision temperature instruments and components being used in scores of other medical and research applications.

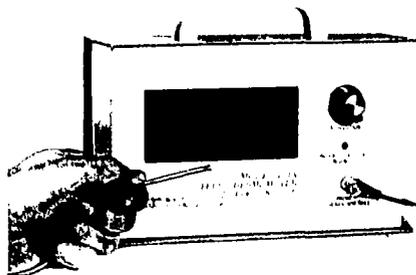
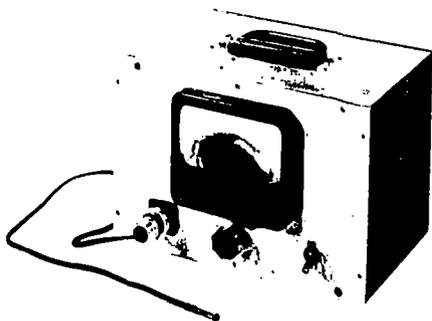
YSI achieved its prominent position as a world leader in the design and production of sophisticated thermometry instrumentation through a series of achievements spanning three decades.

The initial step occurred in 1952 when YSI developed the first practical, direct-reading thermistor thermometer for recording deep human body temperature electronically. Along with the advent of an accurate temperature monitoring instrument, progress accelerated in heart research. YSI contributed doubly to this leap in medical progress by producing the first five commercially-manufactured heart/lung machines, three of which remained in service for 15 years. And, at the same time, YSI redesigned its original thermistor thermometer. It became the standard monitor used by leading heart research specialists.

YSI's involvement in America's space program started in the early 1950s, and continued with NASA's manned space flight program. Every Mercury, Gemini and Apollo astronaut's body temperature was monitored by YSI temperature probes. Even the moon-walking astronauts' body temperatures were checked constantly by YSI precision temperature sensors. YSI remains NASA's standard supplier of "space qualified" thermistors.

YSI's continuing developments in temperature measurement are supported by a state-of-the-art capability in thermometric and electrical standards. In 1977, YSI announced the development of a new basic temperature standard, the melting point of gallium, the first constant-of-nature fixed point in the biological range, and offered it as a product in 1978.

Today, YSI is truly international in scope, marketing its products in more than 50 countries. YSI thermometers monitor temperatures in nuclear power plants. Production of synthetic fibers for clothing and industrial use is controlled by YSI temperature sensors and instruments. Scientists, biologists, physicians and other researchers depend upon YSI temperature instruments for critical investigations into man's physiologic response to his sometimes threatening environment.



The Tele-Thermometer is the most accurate and reliable body temperature monitor available. YSI's precision temperature instruments are used in scores of other medical and research applications.

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YSI Series 400 Temperature Probes

YSI Series 400 Thermistor Probes offer the exclusive feature of "true interchangeability" between probes. The temperature sensing elements used in these probes are precision thermistors manufactured under YSI Patent 2970411, a unique method of producing thermistors with matching temperature/resistance characteristics. Probes using conventional thermistors have uncontrolled characteristics and often require padding, adjustable resistors, or calibration with a specific instrument.

The interchangeability of YSI thermistors eliminates these restrictions, allowing any YSI Series 400 Probe to provide direct temperature readings on any YSI Tele-Thermometer.

The following table lists the temperature/resistance characteristics for YSI Series 400 Probes. All probes undergo a carefully programmed, accelerated aging process during manufacture which allows us to guarantee that these probes will stay within tolerance for one year. Additionally, independent tests have shown standard probes to remain within tolerance for many years.

Temp. °C	Res. Ohms						
-80	1660K	6	5444	28	1977	50	811.7
-75	1071K	7	5184	29	1894	55	672.9
-70	702.6K	8	4937	30	1815	60	560.7
-65	468.1K	9	4704	31	1740	65	469.4
-60	316.6K	10	4483	32	1668	70	394.9
-55	187.5K	11	4273	33	1599	75	333.5
-50	151.6K	12	4075	34	1534	80	283.1
-45	106.3K	13	3887	35	1471	85	241.3
-40	75.79K	14	3708	36	1412	90	206.5
-35	54.66K	15	3539	37	1355	95	177.5
-30	39.86K	16	3379	38	1301	100	153.2
-25	29.38K	17	3226	39	1249	105	132.7
-20	21.87K	18	3082	40	1200	110	115.4
-15	16.43K	19	2944	41	1153	115	100.6
-10	12.46K	20	2814	42	1108	120	88.1
-5	9534	21	2690	43	1065	125	77.4
0	7355	22	2572	44	1024	130	68.2
1	6990	23	2460	45	984.2	135	60.2
2	6645	24	2354	46	946.6	140	53.4
3	6319	25	2253	47	910.6	145	47.4
4	6011	26	2156	48	876.2	150	42.3
5	5720	27	2065	49	843.2		

The above data are for probes with standard 10' leads. Probes can be provided with leads hundreds of feet long, but when length exceeds 100' it will be necessary to consider possible errors introduced by lead resistance. Generally, these are significant only at higher temperatures. On request YSI will provide temperature correction data for long leads.

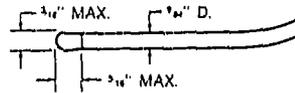
For maximum safety, all YSI Series 400 Probes manufactured after January 1, 1970, are electrically isolated, unless otherwise specified, with the thermistor sensing element and its lead wires electrically isolated from all outer surfaces of the probes. This prevents an accidental ground path or shock from other instruments when the probes are used in contact with the body.

CAUTION: In the presence of RF energy sources, local heating, temperature errors and probe damage may occur. In medical use remove the probe from the patient before activating electro-surgical or other direct-coupled RF energy sources.

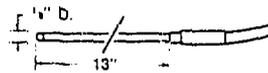
YSI Series 400 Thermistor Probes may be used with all YSI Tele-Thermometers and temperature controllers. Special probe styles can be designed for unusual applications. Please contact YSI for further information.

Style No. Probe Description

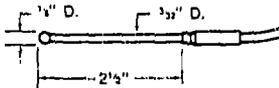
- 401 GENERAL PURPOSE. Rugged, vinyl probe. Esophageal or rectal temperature in humans and animals. Used in air when fast response not required, and for short-term water and sub-soil readings. Useable to 100°C (212°F). Time constant 7.0 sec.



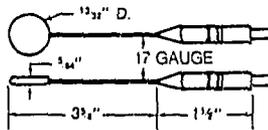
- 402 SMALL FLEXIBLE VINYL. Rectal temperatures of small animals. Esophageal temperatures of infants. Cuvette temperatures. Vinyl sheath and tip. Useable to 100°C (212°F). Time constant 3.2 sec.



- 423 SMALL SEMI-FLEXIBLE NYLON. Frozen food package temperatures. Oral and rectal readings. Cuvette temperatures. Nylon with epoxy tip. Useable to 100°C (212°F). Time constant 1.4 sec.

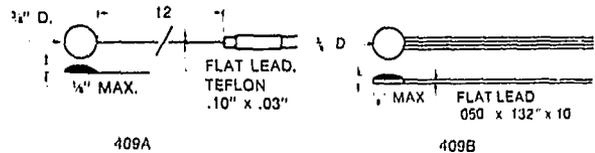


- 408 "BANJO" SURFACE TEMPERATURE. Skin, oral, axillary, water bath, and flat surface temperatures. Excellent for many air temperature applications. Handle aids in probe use. Stainless steel. Useable to 150°C (300 F). Time constant 0.6 sec.



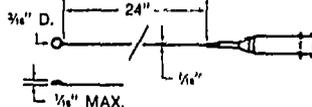
- 409A ATTACHABLE SURFACE TEMPERATURE. Tape on flat surfaces. Stainless steel cup, epoxy backed. Useable to 150°C (300°F). Time constant 1.1 sec.

- 409B ATTACHABLE SURFACE TEMPERATURE. Similar to 409A, but less flexible and more rugged with 10' vinyl covered parallel leads. Recommended for skin temperature measurements. Useable to 100°C (212°F). Time constant 1.1 sec.



- PH09 PROBE HOLDER. Holder with Velcro straps for securing the YSI 409B probe to arm or leg for skin temperature measurements over extended periods of time. Autoclavable. (See page 10.)

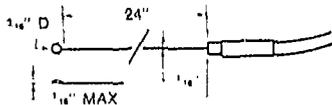
- 421 SMALL SURFACE TEMPERATURE. Cuvette, water bath, leaf and other surfaces. 24\"/>



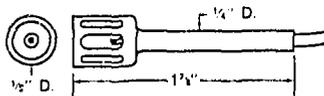
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Style No. **Probe Description**

427 **SMALL SURFACE TEMPERATURE.** Like YSI 421, but with YSI 402 type junction. Non-detachable lead, non-autoclavable. Useable to 150°C (300°F). Time constant 0.3 sec.

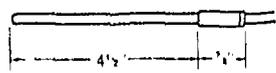


405 **AIR TEMPERATURE.** Test rooms, incubators, remote air readings, gas streams, etc. Stainless steel cage around epoxy encapsulated thermistor. Useable to 150°C (300°F). Time constant 0.6 sec

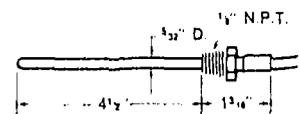


403 **TUBULAR.** For rugged duty in liquid immersion. Fast response oral or rectal. Stainless steel 3/32" dia. Useable to 150 C (300 F). Time constant 3.4 sec.

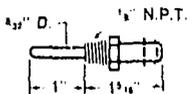
406 **THIN TUBULAR.** Same as YSI 403, except diameter is 1/8" and probe is less rugged, but response is faster. Useable to 150°C (300 F). Time constant 2.5 sec.



410 **TUBULAR WITH FITTING.** For readings in pipes or closed vessels. Stainless steel. Fitting withstands 500 psi. Useable to 150 C (300 F). Time constant 3.4 sec



416 **TUBULAR-AUTOCLAVABLE.** Like YSI 410, but with detachable lead. Useful in biological apparatus such as heart-lung, heat exchanger, etc. Stainless steel. Fitting withstands 500 psi. Useable to 150 C (300 F) Not electrically isolated. Time constant 3.4 sec.

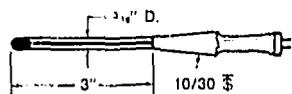


404 **TUBULAR-GLASS.** Chemically inert for liquid immersion use. Thermometric titration. Freezing point determination. Pyrex, 5" long. Useable to 150°C (300°F). Time constant 4.2 sec.

415 **TUBULAR-LONG GLASS.** Same as YSI 404 but with a length of 15". Pyrex. Useable to 150°C (300°F). Time constant 4.2 sec.

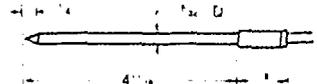


417 **GROUND GLASS JOINT.** For temperature monitoring and control in all-glass systems. Pyrex. Useable to 150°C (300°F). Time constant 4.2 sec.

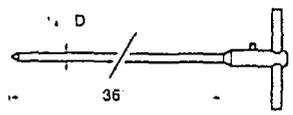


Style No. **Probe Description**

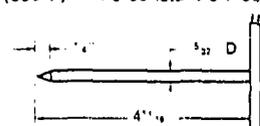
418 **TUBULAR-POINTED METAL.** To penetrate fruit, soil, tobacco, etc. Stainless steel. Useable to 150°C (300°F). Time constant 3.7 sec



419 **TUBULAR-LONG POINTED METAL.** Same as YSI 418 for deep insertion in semi-solids. Hard handle. Stainless steel. Useable to 150°C (300°F). Time constant 4.3 sec



433 **TUBULAR-POINTED METAL.** Stainless steel. For use in solids. Useful in processing of food products. For use to 150°C (300 F) High temperature Teflon lead with 500 F (500 F). Time constant 3.7 sec



Recommended range -40 to +150 C (-40 to +300 F) except as specified; low limit is -80 C. Vinyl lead wire may be subjected to 100°C (212 F). Vinyl probes and leads become increasingly brittle below 0°C.

Probe interchangeability is ±0.40 C at -80 C, ±0.25 C at -40 C, ±0.10 C from 0 to 70 C, ±0.21 C at 100 C, ±0.40 C at 150 C

Derived from measurements in water at 3 ft./sec., except 405 measured in moving air at 10 ft./sec. Approximately five time constants are required for a probe to read 99% of a total temperature change.

Non-detachable 10' vinyl covered shielded wire except YSI 421, 416 and 419 which have detachable leads. Water resistant junctions between probe and lead wire should not be immersed. Detachable leads are not water resistant. Extension leads are available as follows; junctions are not water resistant:

- Style No. YSI 4010 — 10' Extension
- Style No. YSI 4025 — 25' Extension
- Style No. YSI 4050 — 50' Extension

Right angle molded phone plug.

Except as noted sensing elements and lead wires are electrically shielded from the outer probe surfaces to provide maximum safety for medical and biomedical applications. Not for use in radio frequency fields.

- 402 — Tubing length to 24"; Teflon instead of vinyl tubing
- 403, 410, 416, 418 — Length to 36", bends to 90° with 1/2" bend radius (specify angle, radius and location)
- 404 — Lengths from 1' to 5'
- 405 — Probe without cage; length to 15'
- 406 — Same as 403 except 1/8" to 3/8" bend radius
- 408 — Bends to 90° (specify angle and location), length to 15'
- 415 — Lengths from 5' to 24'
- 419 — Lengths from 6' to 60'
- 409A, 421, 427 — Teflon covered lead to 60' (consult factory for possible temperature error); epoxy encapsulated thermistor without stainless steel disc
- 423 — Length to 5'
- Longer leads to 250'

Order probes and extension leads by style number directly from YSI franchised dealers. If you require a probe or lead modification, place an "X" after the style number and describe the desired modification. Standard probes without modifications are generally available off-the-shelf from your YSI dealer.

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YSI Series 500 Temperature Probes

YSI Series 500 Probes can be used with YSI Tele-Thermometers for temperature measurement applications requiring extremely small probes. They are ideal for intramuscular, heart chamber, and major vessel measurements, blood flow and thermal dilution studies, implantation in biological tissue, and other measurements where rapid time constants and small physical size are important.

As indicated by the individual probe descriptions, only certain probes are constructed with the thermistor sensing element and lead wires electrically isolated from the outer surfaces of the probes.

CAUTION: In the presence of RF energy sources, local heating, temperature errors and probe damage may occur. In medical use remove the probe from the patient before activating electro-surgical or other direct-coupled RF energy sources.

Because the small size of the thermistors used in YSI Series 500 Probes prevents use of the YSI process for interchangeability, each probe has a different temperature/resistance track. With the aid of conversion charts the probes can be used for reading true temperature with YSI thermometers. The conversion charts show indicated temperature against true temperature for each specific probe, directing the user how to correct temperature indicated on the thermometer to arrive at true temperature.

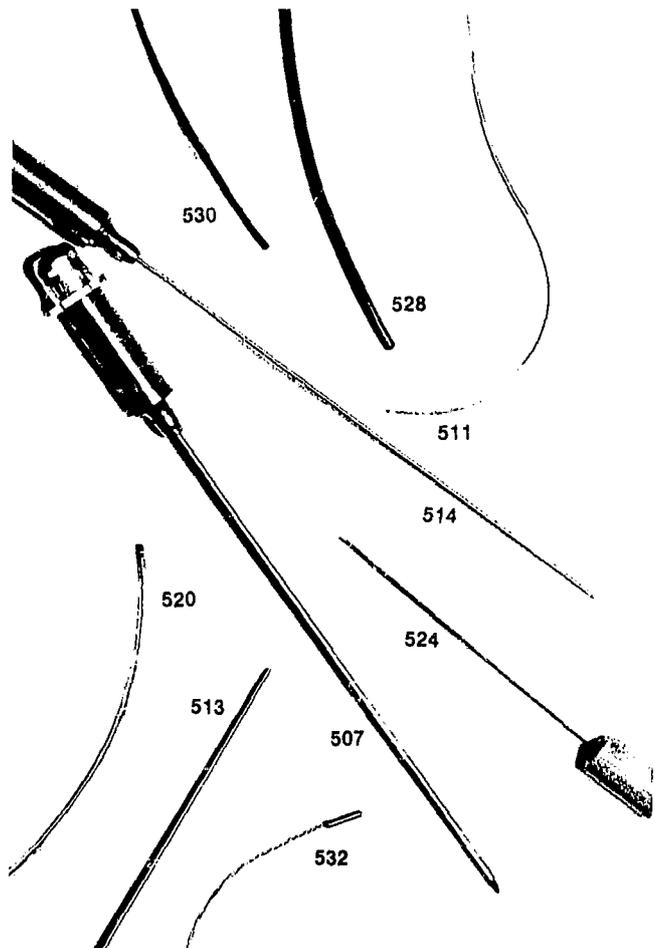
YSI provides a conversion chart covering a range of -5 to $+50^{\circ}\text{C}$ with each probe purchased. Conversion charts are individually prepared for each probe and can only be used with the probe serial number shown on the chart.

Conversion charts are not required when YSI Series 500 Probes are used with the YSI Model 41 Tele-Thermometer. This special instrument provides the convenience of direct reading of true temperature with YSI Series 500 Probes when calibrated at the YSI factory. (See page 15.)

Measurement accuracy using YSI Series 500 probes is conditioned by the need for data conversion and by errors associated with thermistor self-heating. Thermistors used in these probes have very low thermal dissipation, and therefore the measurement current itself can produce a small but significant temperature offset. Measurement currents differ with instrument model and instrument range. The error due to self-heating must be determined in the specific measurement circumstance.

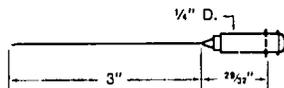
As with other YSI probe series special configurations can be designed for specific applications. Please consult YSI with your requirements.

Selection of YSI Series 500 Temperature Probes shown full size.

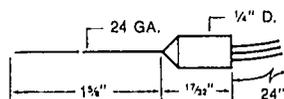


Style No. Probe Description

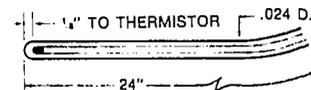
- 507 HYPODERMIC PROBE, 18 gauge
- 513 HYPODERMIC PROBE, 20 gauge
- 514 HYPODERMIC PROBE, 22 gauge. Stainless steel, solder sealed. For subcutaneous intra-muscular, intravenous, or small area measurements, monitoring gas streams. Autoclavable. Not electrically isolated. Time constant 0.2 sec.



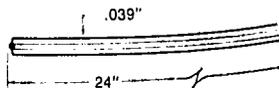
- 524 HYPODERMIC PROBE. 24 gauge, stainless steel, epoxy sealed. Same applications as YSI 507. Autoclavable. Not electrically isolated. Time constant 0.1 sec.



- 511 TISSUE IMPLANTATION. Non-toxic polyethylene tubing for tissue implant for long-term subcutaneous measurement. Non-autoclavable. Electrically isolated. Time constant 0.2 sec.

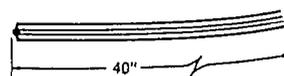


- 520 TISSUE IMPLANTATION. Teflon tubing, with partially exposed epoxy encapsulated thermistor suitable for thermal dilution and flow measurement. Can be fed through 17 gauge or 18 gauge thinwall hypodermic needles. Autoclavable. Probe electrically isolated, connector not isolated. Time constant 0.1 sec

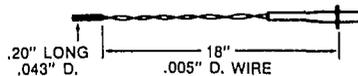


- 528 RADIO OPAQUE CATHETER (large). Partially exposed epoxy encapsulated thermistor in French #4 Radio Opaque Teflon Tubing, 40" long, .052" diameter. Autoclavable. Probe electrically isolated, connector not isolated. Time constant 0.1 sec.

- 530 RADIO OPAQUE CATHETER (small). Like 528 but .041" diameter, 40" long. Autoclavable. Probe electrically isolated, connector not isolated. Time constant 0.1 sec.



- 532 IMPLANTABLE BRAIN PROBE. Developed in conjunction with Mt. Zion Hospital for RF brain lesions. Can be used for other applications. Stainless steel with Teflon covered silver leads. Not autoclavable. Not electrically isolated. Time constant 0.2 sec.



-40° to +150°C (-40° to +300° F); lead wire may be subjected to 100 C (212°F).

Probes are *not* interchangeable.

Derived from measurements in water at 3 ft./sec

Detachable 10' vinyl covered shielded wire, except YSI 511 non detachable; may be subjected to 100 C (212 F). All probes are autoclavable except YSI 511 and YSI 532. Extension leads are available as follows; junctions are not water resistant:

- Style No. YSI 4010 — 10' Extension
- Style No. YSI 4025 — 25' Extension
- Style No. YSI 4050 — 50' Extension

Right angle molded phone plug.

See individual probe descriptions. Not for use in radio-frequency fields.

Temperature conversion charts covering a range of -5 to +50 C are provided with each probe. Replacement charts, as well as charts for temperature outside the -5° to +50° C range, may be purchased through your YSI dealer. You must specify the probe style number and serial number for which the chart is required. We recommend probes over one year old be sent to the YSI Service Department for checking before conversion charts are made.

- YSI 507, 513, 514 — Lengths from 1" to 6"; tip rounded; bends to 90° with minimum 1/4" radius (specify angle, radius and location).
- YSI 511, 520, 528, 530 — Lengths from 1" to 36"; probe without lead.
- YSI 524 — Lengths from 1" to 4"; tip rounded.
- YSI 532 — Available without 10' detachable lead
- Longer leads to 250'

Order probes and extension leads by style number directly from YSI franchised dealers. If you require a probe or lead modification, place an "X" after the style number and describe the desired modification.

If you are ordering a YSI Series 500 probe for use with medical recorders, such as E & M, Beckman-Offner, Sanborn and others, contact the recorder manufacturer concerning its use with these systems. Some medical recorders require modification or adaptation for use with these probes. Special probe selection, 1200 ohms, ±5% at 40 C may be required.

If you are ordering YSI Series 500 probes for use with a YSI Model 41 Tele-Thermometer, the probes and thermometer should be ordered together to assure proper instrument calibration. If the probe is a replacement, the Model 41 and all probes used with it should be returned to the YSI factory for calibration. (See YSI Model 41 page 15)

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YSI Series 600 Temperature Probes

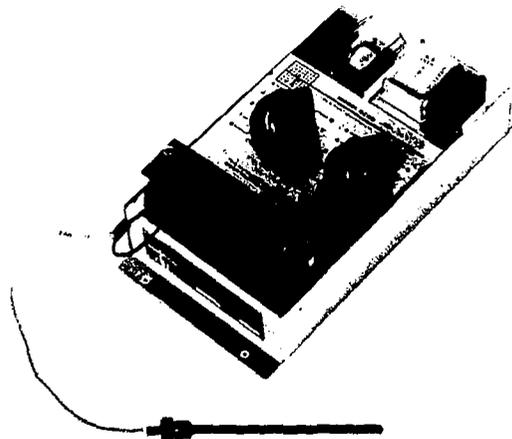
Probes in the YSI Series 600 are primarily intended for use with the YSI Model 63RC temperature controller; however, they may also be used with some YSI temperature controllers under certain conditions.

Due to the wide temperature span covered by this probe series, -75 to $+260^{\circ}\text{C}$ (-100 to $+500^{\circ}\text{F}$), a single probe design cannot accurately measure over the entire temperature range. Therefore, each probe configuration is offered in three ranges of -20 to $+125^{\circ}\text{C}$, $+100$ to $+260^{\circ}\text{C}$, and -75 to $+40^{\circ}\text{C}$.

This wide temperature range prohibits the use of YSI interchangeable thermistors as the temperature sensing elements, consequently the probes are not interchangeable. When these probes are used, the controllers require use of an external temperature reference making lack of interchangeability irrelevant.

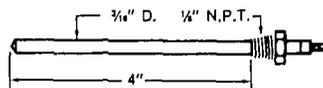
The YSI Series 600 probes are heavy duty laboratory and industrial style probes designed to give many years of dependable, repeatable performance. Special configurations can be manufactured when standard probe designs will not meet your needs. Consult the YSI factory for further information.

YSI Model 63RC Temperature Controllers
use YSI Series 600 Temperature Probes for
heavy duty laboratory and
industrial applications.

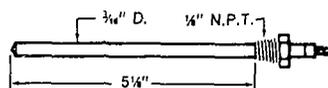


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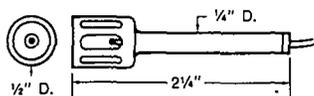
Style No.	Temperature Range	Probe Description
601	-20 to +125°C	TUBULAR WITH FITTING. Stainless steel immersible probe with pipe plug fitting for temperature control in closed vessels and pipes. Fitting withstands 500 psi.
602	+100 to +260°C	
603	-75 to +40°C	



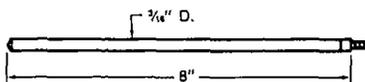
611	-20 to +125°C	TUBULAR WITH SPRING LOADED FITTING. Stainless steel with spring loaded pipe plug fitting for measurement at bottom of drilled hole in solid material.
612	+100 to +260°C	
613	-75 to +40°C	



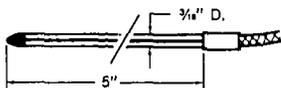
621	-20 to +125°C	AIR TEMPERATURE. Stainless steel probe for control of air temperature in test rooms, incubators, ovens, gas streams, etc.
622	+100 to +260°C	
623	-75 to +40°C	



631	-20 to +125°C	TUBULAR. Stainless Steel, Immersible, rugged duty probe well suited for temperature control in liquids.
632	+100 to +260°C	
633	-75 to +40°C	



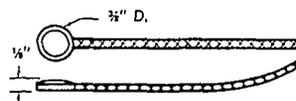
641	-20 to +125°C	TUBULAR-GLASS. For liquid Immersion control situations requiring chemical inertness. YSI 641 and 643 are Pyrex.
642	+100 to +260°C	
643	-75 to +40°C	



Style No.	Temperature Range	Probe Description
651	-20 to +125°C	TUBULAR-GLASS LONG. For liquid immersion control situations requiring long, chemically inert probe. YSI 651 and 653 are Pyrex.
652	+100 to +260°C	
653	-75 to +40°C	



661	-20 to +125°C	SURFACE TEMPERATURE. Flat, stainless steel cup with epoxy back for surface temperature control.
662	+100 to +260°C	
663	-75 to +40°C	



Style numbers ending in "1" -20 to +125°C (0 to 250°F)
 Style numbers ending in "2" +100 to +260°C (+212 to 500°F)
 Style numbers ending in "3" -75 to +40°C (-100 to +100°F)

Probes are *not* interchangeable.

Non-detachable 4' long high temperature leads (to 260°C). Water resistant junction between probe and lead wires should not be immersed.

Probe leads are terminated with two spade lugs.

Sensing elements and lead wires are *not* electrically isolated from the outer probe surfaces.

- 601, 602, 603, 611, 612, 613 — Lengths from 2" to 15".
- 621, 622, 623 — Protective cage removed; additional length to 12".
- 631, 632, 633 — Lengths from 2" to 36".
- 641, 642, 643 — Lengths from 2" to 5".
- 651, 652, 653 — Lengths from 5" to 24".
- Longer probe leads in lengths to 25'.

Order probes by style number directly from YSI franchised dealers. If you require a probe or lead modification, place an "X" after the style number and describe the desired modification. Standard probes without modifications are generally available off-the-shelf.

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YSI Series 700 Thermilinear Probes

YSI Series 700 Probes, used with suitable instrumentation, produce a linear response to temperature change. The sensing element consists of two YSI precision thermistors in one probe. When connected in a signal conditioning network, the output signal is a varying voltage or resistance linear with temperature.

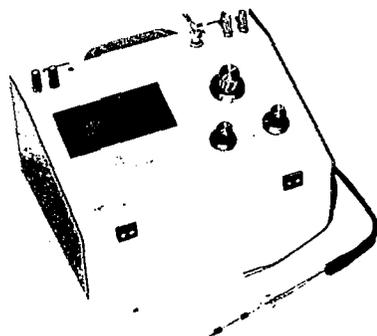
YSI Series 700 Probes are not useable with the YSI thermometers and temperature controllers discussed in this catalog. Their primary application is with YSI Thermivolt Signal Conditioners or equivalents. When output voltage of these systems is applied to a digital voltmeter or recorder, the result is a precise, sensitive, direct-reading digital thermometer. YSI Series 700 Probes are also used with other YSI instruments, including the YSI Model 91 Dew Point Hygrometer and the YSI Model 32 Digital Conductance Meter. A detailed technical discussion on the application of YSI Series 700 Probes is contained in the YSI Thermistor Products Catalog available on request.

All probes are interchangeable with $\pm 0.15^{\circ}\text{C}$ over the range of -30° to $+100^{\circ}\text{C}$. YSI Series 700 Probes are constructed with the sensing elements and lead wires electrically isolated from outer probe surfaces, except as noted, to provide maximum safety in medical and biomedical applications.

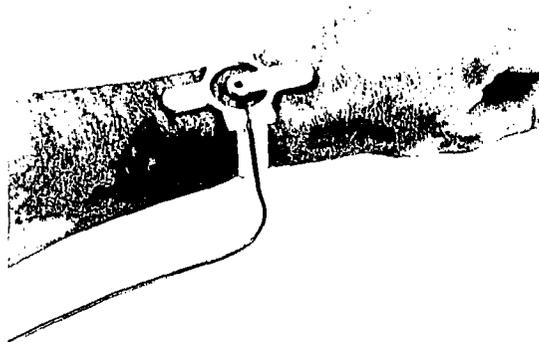
CAUTION: In the presence of RF energy sources, local heating, temperature errors and probe damage may occur. In medical use remove the probe from the patient before activating electro-surgical or other direct-coupled RF energy sources.

When cataloged probe styles are not suitable, custom probe designs can be engineered to your specifications. Please call the YSI factory to discuss your particular requirements.

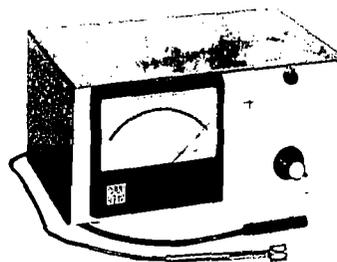
The YSI Model 32 Digital Conductance Meter uses YSI Series 700 Temperature Probes and YSI Conductivity Cells.



The YSI Model 91 Dew Point Hygrometer uses YSI Series 700 Temperature Probes for monitoring ambient temperature.



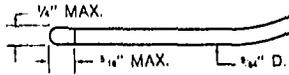
YSI Model 91 Dew Point Hygrometer uses YSI Series 700 Temperature Probes for monitoring ambient temperature.



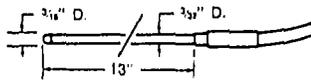
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Style No. Probe Description

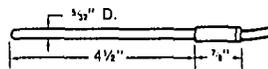
701 GENERAL PURPOSE FLEXIBLE. Vinyl insulated probe. Useable for short-term water and sub-soil readings. Time constant 9.0 sec.



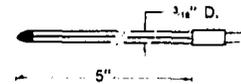
702A SMALL FLEXIBLE GENERAL PURPOSE. Small diameter vinyl insulated probe. Often used for esophageal, or cuvette temperatures. For short-term liquid immersion. Time constant 3.6 sec.



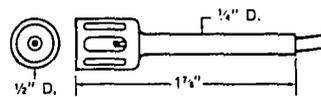
703 TUBULAR. Stainless steel probe with vinyl cable. Stainless steel portion often used for continuous liquid immersion. Time constant 3.6 sec.



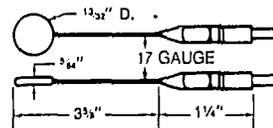
704 TUBULAR PYREX GLASS. Glass portion is chemically inert for continuous liquid immersion. Thermometric titration. Freezing point determination. Time constant 5.0 sec.



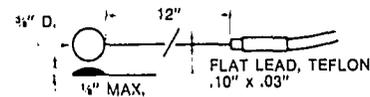
705 AIR TEMPERATURE. Stainless steel probe suitable for test rooms, incubators, remote air readings, monitoring of gas streams, etc. Time constant 0.6 sec.



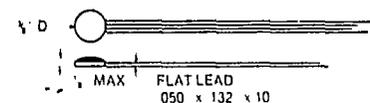
708 "BANJO" SURFACE TEMPERATURE. Skin, oral, axillary, water bath, air surface temperatures. Stainless Steel. Time constant 1.0 sec.



709A ATTACHABLE SURFACE TEMPERATURE. Stainless steel cup, epoxy backed. Easy to tape on flat surfaces. Good for heat loss or compression efficiency study of piping. Time constant 1.1 sec.



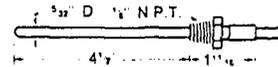
709B ATTACHABLE SURFACE TEMPERATURE. Similar to 709A, but less flexible and more rugged with 10' vinyl covered parallel leads. Recommended for skin temperature measurements. Useable to 100°C (212°F). Time constant 1.1 sec.



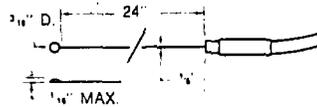
Style No. Probe Description

PH09 PROBE HOLDER Holder with Velcro straps for securing the YSI 709B probe to arm or leg for skin temperature measurements over extended periods of time. Autoclavable (See page 10)

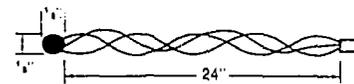
710 TUBULAR WITH FITTING. Rugged, stainless steel probe with 1/2" fitting. Suitable for taking readings in pipes or other restricted areas. Time constant 3.6 sec.



729 SMALL SURFACE TEMPERATURE Cuvette, water bath, or other surfaces. 24" Teflon-covered flexible wire. Stainless steel cup with epoxy back. Time constant 0.3 sec



731 GENERAL PURPOSE. Non-immersible, epoxy tipped probe. Can be propped in place. Probe is suitable for temperature measurements of surfaces. Not electrically isolated. Time constant 0.6 sec



-30° to 100°C (-22° to +212°F); lead wire may be subjected to 100°C (212°F).

±0.15°C from -30° to +100°C (-22° to +212°F) when used with appropriate Thermilinear circuits and instruments. (Consult the factory for further information.)

Derived from measurements in water at 3 ft./sec., except 705 and 731 measured in moving air.

Non-detachable 10 ft. vinyl covered shielded wire; may be subjected to 100°C (212°F). Water resistant junction between probe and lead wire should not be immersed. Extension leads are available as follows; junctions are not water resistant:

- Style No. YSI 7010 — 10' Extension
- Style No. YSI 7025 — 25' Extension
- Style No. YSI 7050 — 50' Extension

3-wire 0.250 O.D. right angle molded phone plug

Sensing elements and lead wires are electrically isolated from the probe surfaces to provide maximum safety for medical and biomedical applications, except for 731. Probes should not be used in radio frequency fields.

- 702A — Lengths to 24"; Teflon instead of vinyl tubing
- 703, 710 — Lengths to 36"; bends to 90° with 3/4" to 1" radius (specify angle, radius and location)
- 704 — Lengths 1" to 24"
- 705 — Probe without cage; longer probe to 12"
- Longer leads to 250'

Order probes and extension leads by style number directly from YSI franchised dealers. If you require a probe or lead modification, place an "X" after the style number and describe the desired modification. Standard probes without modifications are generally available off-the-shelf.

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YSI Thermistor Tele-Thermometers

YSI electronic thermometers are precision laboratory instruments designed to deliver precise, continuous temperature measurements in the range of -80° to $+150^{\circ}\text{C}$. They are rugged, remote-reading devices that can be used with probes hundreds of feet away when required. Most models are completely portable and battery powered for convenient use in field and lab studies. Except as noted, the instruments indicate temperature in both $^{\circ}\text{C}$ and $^{\circ}\text{F}$, and have recorder outputs.

All YSI Tele-Thermometers are direct reading with YSI Series 400 interchangeable temperature probes, which permit probes to be changed or replaced without thermometer recalibration. YSI Series 500 non-interchangeable probes also may be used, but with reduced accuracy and correction of the temperature reading as explained in the YSI Series 500 probe discussion.

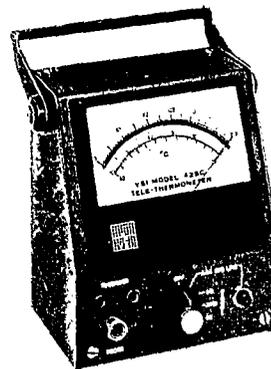
The various thermometers are available in a variety of temperature ranges, as shown in the Temperature Range Selection Chart, for precise medical, scientific and industrial measurements.

When ordering a YSI Tele-Thermometer, the Range Code letters must be placed directly after the instrument model number. "Stock" temperature ranges are generally available from YSI franchised dealer inventories. "Semi-Stock" ranges also are available from YSI dealers; however, these units will be manufactured-to-order by YSI.

Temperature Range Selection Chart

Range Code	Temperature $^{\circ}\text{C}$	Ranges $^{\circ}\text{F}$	Accuracy $^{\circ}\text{C}$	Readability $^{\circ}\text{C}$	Available on Models
(Stock Temperature Ranges)					
TA	20 to 42	68 to 108	0.2	0.1	41, 43, 44, 47
TA	20 to 43	68 to 109	*0.05	*0.01	49
TD	0 to 50	32 to 122	0.5	0.2	41, 43, 44, 47
TC	15 to 100	60 to 212	0.8	0.4	41, 43, 44, 47
TF	35 to 46	95 to 115	0.1	0.05	41, 43, 44, 47
SC	-40 to $+150$	—	*0.5	*0.2	42
SF	—	-40 to $+302$	*1.0 ($^{\circ}\text{F}$)	*0.25 ($^{\circ}\text{F}$)	42
TUC	0 to 51	—	0.15	0.05	46
TU	—	30 to 110	0.25 ($^{\circ}\text{F}$)	0.1 ($^{\circ}\text{F}$)	46
(Semi-Stock Temperature Ranges)					
TV	-45 to $+10$	-50 to $+50$	0.5	0.2	47
TIY	-40 to -13	-40 to $+10$	0.3	0.2	43, 44, 47
TE	-23 to $+40$	-10 to $+105$	0.6	0.3	41, 43, 44, 47
TZ	-17 to $+48$	0 to 120	0.6	0.3	41, 43, 44, 47
TH	-4 to $+37$	25 to 100	0.4	0.2	41, 43, 44, 47
TB	0 to 40	32 to 105	*0.4	0.5	41, 43, 44, 47
TS	0 to 66	32 to 152	0.6	0.3	41, 43, 44, 47
TJ	10 to 40	50 to 104	0.3	0.2	41, 43, 44, 47
TW	24 to 146	70 to 300	1.2	0.5	43, 44, 47
TG	25 to 45	77 to 113	0.2	0.1	41, 43, 44, 47
TK	27 to 43	80 to 110	0.2	0.1	41, 43, 44, 47
TI	30 to 41	86 to 106	0.1	0.05	43, 44
TP	35 to 60	95 to 140	0.3	0.2	41, 43, 44, 47
TQ	70 to 100	158 to 212	0.3	0.2	41, 43, 44, 47
TIZ	88 to 150	190 to 302	0.6	0.3	43, 44, 47
SL	-80 to $+40$	—	*0.5	*0.2	42
SE	—	-20 to $+80$	*1.0 ($^{\circ}\text{F}$)	*0.25 ($^{\circ}\text{F}$)	42

*These are "Mid" range statements. Accuracy and readability are slightly less for "Hi" and "Low" ranges.



YSI MODEL 42

... rugged, portable, wide range

The solidly built YSI Model 42 Tele-Thermometer is a general purpose instrument for field and laboratory monitoring of temperature from a single probe. It is available in two $^{\circ}\text{C}$ and two $^{\circ}\text{F}$ ranges, each covered by three overlapping scales selected by a front panel switch. This is our widest temperature range instrument with models available to cover the total span from -80° to $+150^{\circ}\text{C}$.

Ambient Temperature

YSI Model 42SE -20° to $+80^{\circ}\text{F}$; YSI Model 42SC 0° to 50°C
 YSI Model 42SL -40° to $+50^{\circ}\text{C}$; YSI Model 42SF 0° to 50°C

Probes:

Direct reading with YSI Series 400 Probes; useable with YSI Series 500 Probes with reduced accuracy and temperature correction (see probe discussion).

Recorder Output:

120 to 0 mV; 50k ohm minimum input impedance recorder.

Power

YSI Models 42SC, SF and SE powered by two 6.75 V mercury cells; YSI Model 42SL powered by three cells. 1000 hour life.

Size:

16.5 X 11.4 X 16.5 cm; 1.4 kg (6.5 X 4.5 X 6.5 inches; 3 lbs).

HOW TO ORDER:

Order directly from YSI franchised dealers using the following part number:
 YSI Model 42 (plus Range Code)

YSI MODEL 4002

... 12-channel switch box

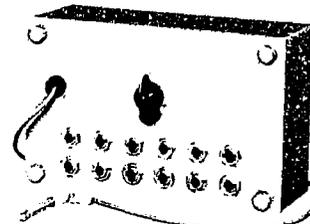
When plugged into a YSI Tele-Thermometer probe jack, the switch box provides 12 probe inputs selected by a panel switch. This device is particularly useful for converting YSI Models 42 and 43 single channel thermometers into multi-channel instruments. It is also useable with multi-channel instruments to expand capacity.

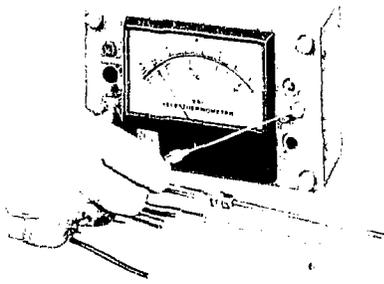
Size:

19 X 9 X 12 cm; 0.9 kg (7.5 X 3.5 X 4.75 inches; 2 lbs).

HOW TO ORDER:

Order directly from YSI franchised dealers using the following part number:
 YSI Model 4002





YSI MODEL 43

... compact, versatile, reads in °C and °F

This is our basic single-channel Tele-Thermometer available in 18 temperature ranges, all reading in °C and °F. The Model 43 is widely used in anesthesiology, critical care, and many other general purpose medical, scientific and industrial applications. Readout is on a mirror-scale, 4½" taut band meter. A recorder output facilitates preparation of permanent records. A panel adjustment compensates for battery aging. The front panel is easily removed for battery replacement. Battery life is approximately 1000 hours. Add the YSI 4002 to make this a versatile 12-channel instrument.

Temperature Range:
0° to 50°C (32° to 120°F)

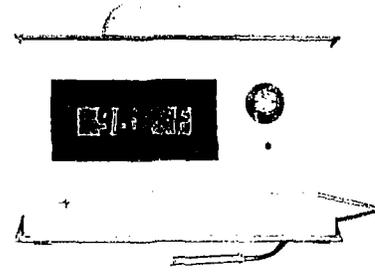
Probes:
Direct reading with YSI Series 400 Probes; useable with YSI Series 500 Probes with reduced accuracy and temperature correction (see probe discussion).

Recorder Output:
100 to 0 mV; 50k ohm minimum input impedance recorder.

Power:
All models use one 1.5 V "D" cell, except TIY range which uses one 6.75 V mercury cell. 1000 hour life.

Size:
19 X 9 X 12 cm; 1.2 kg (7.5 X 3.5 X 4.75 inches; 2.75 lbs).

HOW TO ORDER:
Order directly from YSI franchised dealers using the following part number:
YSI Model 43 (plus Range Code)



Model 49TA

The digital (LCD) Model 49TA is a precision thermometer primarily intended for use in the operating room similar to the analog Model 43TA. It is also useful as a field and lab thermometer for general purpose measurements from 20° to 43°C (68° to 109°F). Special features include a trend indicator to warn of rapidly rising or falling temperature, selectable resolution of 0.1° or 0.01°, accuracy to ±0.05°C, use of interchangeable temperature probes, electrical isolation and other safety features. The only normal maintenance is annual battery replacement. (No recorder output.)

±0.05°C from 30 to 40°C (at 25 ±10°C instrument ambient), ±0.1°F from 86 to 104°F (at 77 ±18°F instrument ambient). In measuring temperatures from 20° to 30°C and 40 to 43°C (68° to 86°F and 104° to 109°F) errors will be not greater than three times those stated above. At instrument ambient temperatures of -10° to +15°C and 35° to 50°C (14° to 59°F and 95° to 122°F) errors will be not greater than twice those stated above for the appropriate measurement temperature. All above are ±1 digit resolution. Add temperature probe tolerance (±0.1°C) to calibrated accuracy.

0.01° or 0.1°C; 0.01° or 0.1°F selected by front panel switch.

Liquid crystal display. Entire display blanks if operating outside calibrated range, or if the probe becomes shorted, open, or has a large resistance shift, or if an improper probe is being used. Letter C or F remains on to show that instrument is functional.

Flashing arrow in upper left of display indicates upward temperature change of as little as 0.01°C per minute, providing there is a continuous trend for at least 20 seconds. A step-change of less than 20 seconds duration will not be indicated, regardless of magnitude. Flashing lower arrow indicates downward trend in the same manner.

Temperature Range:
-10° to +50°C (14° to 122°F).

Power:
Four "D" cells provide approximately one year of continuous operation. Red warning light indicates less than four hours of battery use remaining.

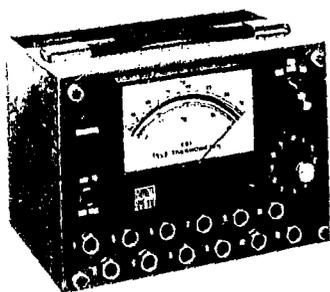
Probes:
Direct reading with any YSI Series 400 interchangeable thermistor temperature probe. Useable with YSI Series 500 non-interchangeable probes, with reduced accuracy, and with conversion chart to correct indicated reading (see probe discussion).

Electrical Isolation:
Leakage not more than 5µA RMS (at 120 VAC RMS between probe leads and case (110 picofarads circuits to case capacitance); 2500 Volts breakdown.

Size:
23.5 x 13 x 18 cm; 1.6 kg (9.25 x 5 x 7 inches; 3.5 lbs).

HOW TO ORDER:
Order directly from YSI franchised dealers using the following part number:
YSI Model 49TA Digital Thermometer

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Model 44

Combined single channel thermometer and 12-channel switch box

Combined in this one compact package are all the features of the YSI Model 43 single channel thermometer and the 12-channel YSI Model 4002 Switch Box. The Model 44 will measure and provide a recordable signal from up to 12 temperature probes, with a manual panel switch selecting the probe being read or recorded. When YSI Series 400 Probes are used readings are direct and probes can be changed or replaced without recalibration. The instrument is portable, battery powered, and available in any of 18 individual temperature ranges, all reading in both °C and °F.

Operating temperature

0° to 50°C (32° to 120°F)

Features

Direct reading with YSI Series 400 Probes; useable with YSI Series 500 Probes with reduced accuracy and temperature correction (see probe discussion).

Dynamic range

100 to 0 mV; 50k ohm minimum input impedance recorder.

Power

Powered by one 1.5 V "D" cell, except TIY range which uses one 6.75 V mercury cell. 1000 hour life.

Size

22 X 16.5 X 16.5 cm; 2 kg (8.75 X 6.5 X 6.5 inches; 4.5 lbs).

Ordering information

Order directly from YSI franchised dealers using the following part number:

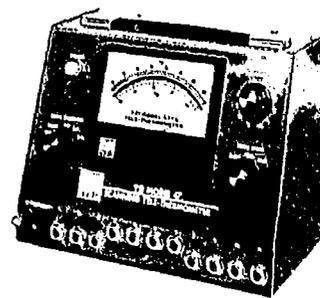
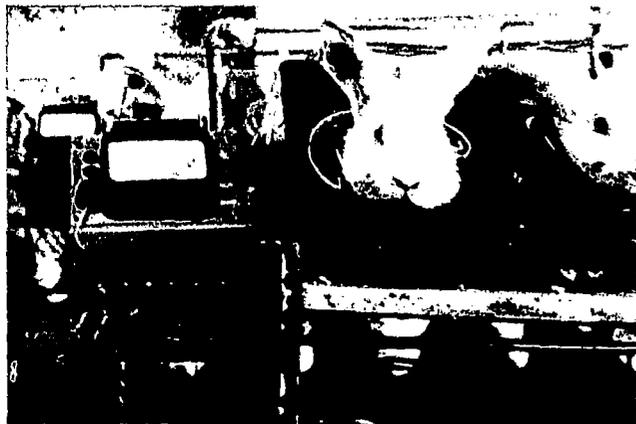
YSI Model 44 (plus Range Code)

Temperature of the instrument is

is mentioned with

YSI reference materials

dummy pyrolog test



Model 47

Multi-channel automatic scanning thermometer

Applications requiring multi-channel automatic scanning often can be met with this instrument which will automatically scan 3, 7 or 11 probes in sequence with 20 second, 1 minute, or 5 minute readings per probe. A motorized rotary switch, which also may be operated manually, switches to the channel being indicated or recorded. The instrument is designed so that all data can be recorded on a single channel recorder. After completion of an automatic scan sequence, the selector switch goes to an identification channel whose input drives the indicator and recorder off scale. To identify the recorded input from the particular probe it is only necessary to find the gap in the recorder chart and count forward to the desired channel number.

Operating temperature

0° to 50°C (32° to 120°F)

Direct reading with YSI Series 400 Probes; useable with YSI Series 500 probes with reduced accuracy and temperature correction (see discussion).

Dynamic range

100 to 0 mV, 50k ohm minimum input impedance recorder.

Power

Available with 115 or 230 VAC, 50/60 Hz power.

Size

25 X 15 X 19.7 cm; 3.4 kg (10 X 6 X 7.75 inches; 7.5 lbs).

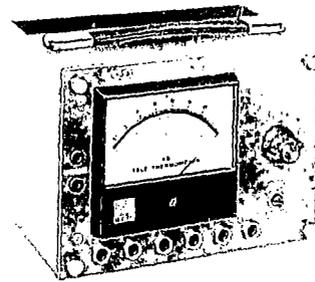
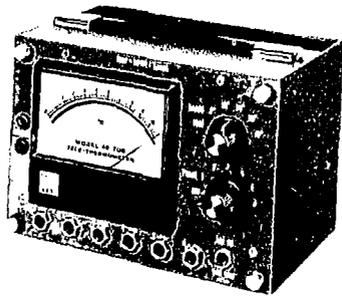
Ordering information

Order directly from YSI franchised dealers using the following part numbers:

YSI Model 47 (plus Range Code) 115 VAC operation

YSI Model 47-230 (plus Range Code) 230 VAC operation

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The YSI Model 46TUC offers excellent readability and accuracy by using a meter with full-scale deflection of just 11°C (20°F on the Model 46TU). A panel switch selects any of 5 overlapping temperature scales in a total range of 0° to 50°C (30° to 110°F on the Model 46TU), while a second switch allows reading temperature input from any of 6 probes. In addition to increased accuracy and readability the YSI Model 46 also features a linear recorder output signal. Linearity is ±0.03°C (±0.05°F) for accurate temperature readings directly from linear recorder traces. This instrument is particularly suited for precise laboratory temperature measurement with YSI Series 400 interchangeable temperature probes.

0° to 50°C (32° to 120°F)

Direct reading with YSI Series 400 Probes; useable with YSI Series 500 Probes with reduced accuracy and temperature correction (see probe discussion).

80 to 0 mV, 50k ohm minimum input impedance recorder; linearity ±0.03°C Model 46TUC, ±0.05°F Model 46TU.

One 6.75 V mercury cell. 1000 hour life.

22 x 16.5 x 16.5 cm; 2.5 kg (8.75 x 6.5 x 6.5 inches; 5.5 lbs).

Order directly from YSI franchised dealers using the following part number:

YSI Model 46 (plus Range Code)

This is the only YSI Tele-Thermometer specifically designed to permit direct reading of true temperature when using miniature, non-interchangeable YSI Series 500 Probes. The instrument has six separate probe circuits, each of which can be individually calibrated for use with a specific probe. When the instrument is ordered with YSI Series 500 Probes, YSI will calibrate each individual channel for use with a specific probe and engrave that channel number on the probe. Only that probe can be used in that channel for true temperature indication. Channels not calibrated for specific YSI Series 500 Probes will be calibrated for use with interchangeable YSI Series 400 Probes. When ordering additional probes the instrument and ALL probes being used with it should be returned to the YSI Service Department to assure proper calibration. Only factory calibration can assure that a new probe will indicate on the scale of the instrument. Due to the calibration requirement this instrument is not normally carried in YSI franchised dealer inventories; however, it is available through our dealers with an approximate four-week delivery time.

0° to 50°C (32° to 120°F)

Direct reading with both YSI Series 500 and Series 400 Probes when factory calibrated. To assure proper calibration, probes must be ordered at the same time as the instrument. When ordering additional probes return the instrument and all probes used with it to the YSI factory for recalibration.

0 to 100 mV; 50k ohm minimum input impedance recorder.

All models use one 1.5 V "D" cell, except TF range which uses one 6.75 V mercury cell. 1000 hour life.

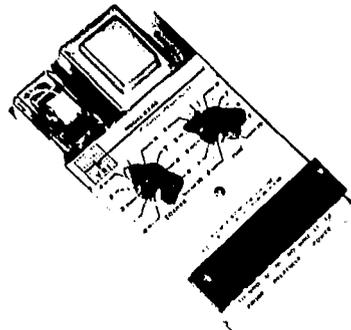
2 X 16.5 X 16.5 cm; 2.5 kg (8.75 X 6.5 X 6.5 inches; 5.5 lbs)

Order directly from YSI franchised dealers using the following part number:

YSI Model 41 (plus Range Code) see probe statement above

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YSI Temperature Controllers



The five YSI temperature controllers are electronic instruments designed to maintain a set temperature within narrow limits. Temperature is sensed by YSI Thermistor Probes which form one leg of a bridge. When probe temperature deviates from the controller's setting, the bridge becomes unbalanced, and the unbalanced voltage or error signal is used to activate heating, cooling, alarming, or other devices.

YSI temperature controllers are of both on-off and proportional types, available in a variety of temperature control ranges as shown in the following table.

YSI Model	Temperature Range	Mid-Range Sensitivity	Settability	Stability of Control Point
63RC	-70° to +260°C	0.05°C	±0.05°C	±0.04°C
71A	-10° to +120°C	0.03°C	±0.01°C	±0.04°C
72	0° to 120°C	0.001°C	±0.01°C	±0.01°C
73A	See 73A Range Selection Chart page 18	0.02°C	±0.05% of Range	±0.02°C
74	-10° to +80°C	0.05°C	±0.05°C	±0.04°C

YSI Model 63RC

On-Off Temperature Controller

This low-cost, compact on-off controller with its -70° to +260°C temperature range is designed to take advantage of the excellent sensitivity of YSI Series 600 Thermistor Temperature Probes.

Coarse and fine controls facilitate precise settling of the control temperature using a separate thermometer for temperature reference. When the probe senses a temperature different from the control temperature, a relay is activated to turn equipment on or off until the probe temperature returns to opposite side of the "dead band."

Thousands of Model 63RCs are being used to accurately control baths, ovens, incubators, and laboratory and industrial processes. This controller is also frequently used in OEM equipment and as an inexpensive replacement for built-in controllers which have been inoperative or do not provide desired sensitivity.

Temperature Range: -70° to +260°C (-94° to +500°F)

Sensitivity: Better than 0.05°C (0.1°F)

Stability: Settable to ±0.05°C (0.1°F) with external reference; stability better than ±0.04°C with ±20 VAC line voltage variation.

Temperature Range: -20° to +50°C (-4° to +120°F)

Stability: Settable to ±0.05°C (0.1°F); stability better than ±0.04°C with ±20 VAC line voltage variation.

Power: 115 VAC, 50/60 Hz, 5 watts; total load 1000 watts. Factory wired for 115 VAC, easily converted by user to 230 VAC, 50/60 Hz. 8-terminal barrier strip, supplied without power cord.

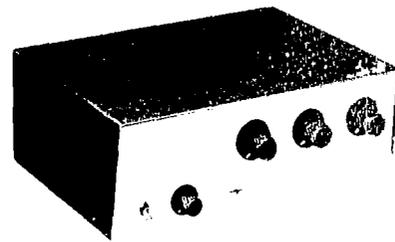
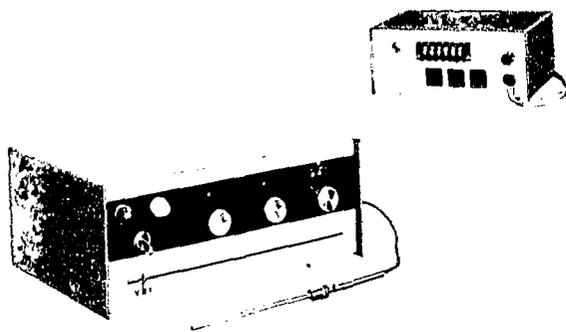
Size: 22 X 11.5 X 7 cm, 2.5 kg (9 X 4 1/2 X 2 3/4 inches, 5 lbs.)

Notes: Designed for use with YSI Series 600 probes; may be used with YSI Series 400 and 500 within the temperature ranges given for the specific probes. YSI 400 and 500 Series probes have a phone plug termination which must be replaced with spade lugs for use with the Model 63RC.

HOW TO ORDER

Order directly from YSI franchised dealers using the following part numbers:

- YSI Model 63RC Temperature Controller
- YSI 41603 Spare Relay



YSI MODEL 71A

... direct dial on of voltage...

Temperature to be controlled is easily set and accurately maintained by this highly sensitive, direct dialing temperature controller. Using YSI Series 400 Interchangeable temperature probes, control temperature from -10° to $+120^{\circ}\text{C}$ is "dialed in" on easy-to-read digital controls.

If the probe senses a temperature other than the control temperature, a signal from the solid-state amplifier operates a relay. One pole of the double pole-double throw power relay supplies AC line power to back panel heat and cool convenience outlets. The other pole is wired to a terminal strip for switching line or other voltages. Either set of contacts can operate heaters, cooling devices, alarms, or other devices.

Red and white panel lights indicate the "heat" or "cool" control mode. An uncontrolled convenience outlet is available to power auxiliary equipment.

Temperature Range

-10° to $+120^{\circ}\text{C}$ by direct dial using YSI Series 400 Probes; expandable to -80° to $+260^{\circ}\text{C}$ using YSI Series 600 Probes with an external temperature reference.

Control Rate

0.05°C below 30°C, 0.1°C from 30° to 90°C, 0.2°C above 90°C.

Control Point

Set by dials calibrated in tens, units, and hundredths of a degree. Settable to 0.01°C with absolute accuracy of $\pm 0.5^{\circ}\text{C}$, including YSI Series 400 Probe. Stable to 0.04°C with ± 20 VAC line voltage variation.

Adjustable Temperature

-25° to $+50^{\circ}\text{C}$ (-4° to $+120^{\circ}\text{F}$)

Relay

Heavy duty double pole-double throw plug-in relay with both sets of contacts rated at 1000 watts, non-inductive load.

Power

Available 115 or 230 VAC, 50/60 Hz, 7 watts. Load up to 1000 watts. Outlets fused for 10 Amps on 115 VAC model; 5 Amps on 230 VAC model. Terminal strip not fused.

Size

17.8 X 25 X 11.4 cm, 3.2 kg (7 X 10 X 4½ inches, 7 lbs.)

Probes

Designed for use with YSI Series 400 probes; useable with YSI Series 600 probes with an external temperature reference. In certain situations 500 Series probes can be used. Consult factory for details.

HOW TO ORDER

Order directly from YSI franchised dealers using the following part numbers:

- YSI Model 71A Temperature Controller (115 VAC)
- YSI Model 71A — 230 Temperature Controller (230 VAC)
- YSI 41604 Spare Relay

Control capability of the YSI Model 72 Proportional Temperature Controller exceeds that of on-off type controllers. It can maintain uniform temperature as closely as $\pm 0.001^{\circ}\text{C}$ within a range of 0 to $+120^{\circ}\text{C}$, without the "hunting" usually associated with on-off controllers.

Three dials directly set the control point while a YSI Thermistor Probe senses the temperature of the medium being controlled. As temperature drops below the control point, the controller output supplies just the required amount of power to hold the controlled zone at temperature.

Band width (sensitivity), the temperature drop of the controlled medium required a cause power to the heater to go from off to full on, is adjustable from 0.1° to 3°C to allow "tuning" the controller to various situations. Panel lights indicate by brightness the proportion of power being applied to the heater outlet. In situations requiring control below ambient, a heater opposing some source of continuous cooling is normally used.

0° to 120°C by direct dial using YSI Series 400 Probes.

Adjustable from 0.1° to 3°C. At 0.1°C band width setting, controller output will vary 0 to 100% power for a 0.1°C drop of the sensed temperature.

Set by direct dial. Short-term stability $\pm 0.001^{\circ}\text{C}$, long term $\pm 0.01^{\circ}\text{C}$. Will not vary more than $\pm 0.02^{\circ}\text{C}$ with $\pm 10^{\circ}\text{C}$ change in ambient and ± 20 VAC variation in line voltage with band width set at 0.1°C.

0° to $+50^{\circ}\text{C}$ ($+32^{\circ}$ to $+120^{\circ}\text{F}$)

Max. load 10 Amps.

115 or 230 VAC, 18 watts. Total non-inductive load 1.1 kw for 115 VAC. 2.2 kw for 230 VAC 10 Amp fuse.

24 X 31 X 11.5 cm, 3 kg (9½ X 12¼ X 4½ inches, 7 lbs.)

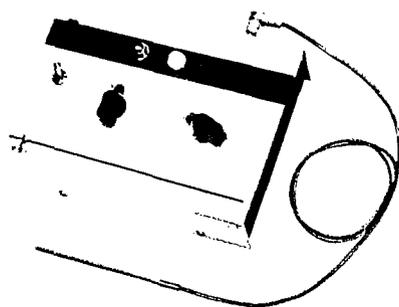
Designed for use with YSI Series 400 probes. In certain situations 500 and 600 Series probes can be used. Consult factory for details.

Order directly from YSI franchised dealers using the following part numbers:

- YSI Model 72 Temperature Controller (115 VAC)
- YSI Model 72-230 Temperature Controller (230 VAC)

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YSI MODEL 74

Temperature Controller

The speed and convenience of direct dialing the temperature set point anywhere from -10° to +80°C, plus thermistor sensitivity add up to make the YSI Model 74 a low cost and versatile temperature controller. This precision instrument is designed for accurate, continuous performance in both laboratory and industrial settings.

Temperature is sensed by a YSI Series 400 interchangeable probe. If the probe senses a temperature other than the selected control temperature, a signal from the amplifier operates a relay. This relay activates heat and cool outlets, providing power to turn on and off heaters, alarms, and other devices. Red and white lights indicate if probe temperature is above or below the set point, and which outlet is receiving power. A convenience outlet can be used to operate auxiliary equipment.

Control Range
-10° to +80°C

Precision
Better than 0.05°C below 45°C and better than 0.1 C above 45°C

Control Method
Set by direct dials readable to 0.05°C. Settable to ±1.0°C absolute accuracy, including probe. Stable to ±0.04°C with ±20 VAC line voltage variation.

Operating Temperature
-25° to +50°C (-13° to 120°F)

Relay
Single pole-double pole plug-in relay with contacts rated at 10 Amps at 115 VAC, non-inductive load, and 5 Amps at 230 VAC. Relay can be used to power auxiliary relay for inductive loads.

Power
Available 115 or 230 VAC, 50/60 Hz, 7 watts. Load up to 1000 watts. Outlets protected by 10 Amp fuse on 115 VAC models, 5 Amp fuse on 230 VAC models.

Size
21.6 X 16.5 X 6.4 cm, 2.3 kg (8½ X 6½ X 3½ inches, 5 lbs.)

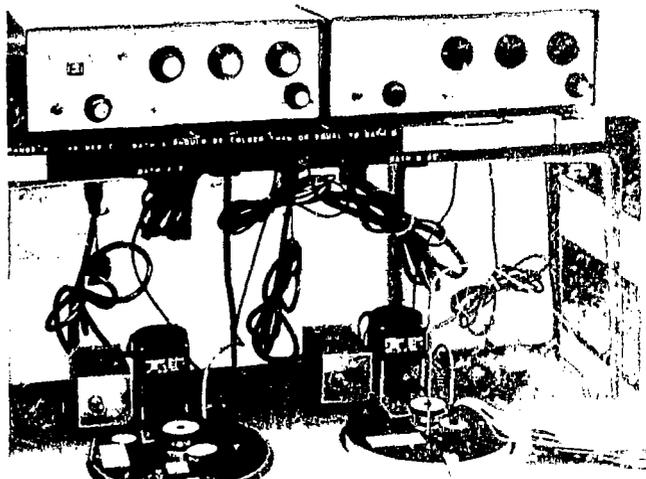
Notes
Designed for use with YSI Series 400 probes. In certain situations 500 and 600 Series probes can be used. Consult factory for details.

How to Order
Order directly from YSI franchised dealers using the following part numbers:

- YSI Model 74 Temperature Controller (115 VAC)
- YSI Model 74 — 230 Temperature Controller (230 VAC)
- YSI 41603 Spare Relay

MODEL 73A RANGE SELECTION CHART

YSI Model	Temperature		Accuracy of Readout °C	Readability °C
	°C	°F		
(Stock Ranges)				
73ATA	20 to 42	68 to 108	0.2	0.1
73ATD	0 to 50	32 to 122	0.5	0.2
73ATC	15 to 100	60 to 212	0.8	0.4
73ATF	35 to 46	95 to 115	0.1	0.05
(Semi-Stock Ranges)				
73ATV	-45 to +10	-50 to +50	0.5	0.2
73ATIY	-40 to -13	-40 to +10	0.3	0.2
73ATE	-23 to +40	-10 to +105	0.6	0.3
73ATZ	-17 to +48	0 to 120	0.6	0.3
73ATH	-4 to +37	25 to 100	0.4	0.2
73ATB	0 to +40	32 to 105	0.4	0.5
73ATS	0 to +66	32 to 152	0.6	0.3
73ATJ	10 to 40	50 to 104	0.3	0.2
73ATW	24 to 146	70 to 300	1.2	0.5
73ATG	25 to 45	77 to 113	0.2	0.1
73ATK	27 to 43	80 to 110	0.2	0.1
73ATP	35 to 60	95 to 140	0.3	0.2



This versatile temperature controller has the unique capability of simultaneously maintaining temperature within precise limits, accurately indicating temperature, and providing a continuous signal for temperature recording. It is one of the few controllers to incorporate a DC probe to eliminate interference often caused by AC control systems. These features make the YSI Model 73A ideal for medical applications, as well as many research and industrial tasks.

Models are available in 16 temperature ranges from -45° to $+146^{\circ}\text{C}$. Control temperature can be dialed directly without external reference, sensitivity can be varied from 0.02° to 0.4°C for optimum control, panel lights indicate operation in "heat" or "cool" mode, and any YSI Series 400 interchangeable probe can be used for temperature sensing.

16 temperature ranges available from -45° to $+146^{\circ}\text{C}$. (See Temperature Range Selection Chart.)

Adjustable from at least $.02$ to $.4^{\circ}\text{C}$

Settable by direct dial to $\pm 0.5\%$ of control range using YSI Series 400 Probes. Stability $\pm 0.02^{\circ}\text{C}$ with 5% (6 VAC) line voltage variation and $\pm 2^{\circ}\text{C}$ ambient change.

-25° to $+50^{\circ}\text{C}$ (-13 to $+120^{\circ}\text{F}$)

Double pole-double throw plug-in relay. Both sets of contacts rated at 1000 watts, non-inductive load. One set connects line voltage to outlets, second set accessible by a terminal strip on rear panel.

105-125 to 0 mV full scale for each temperature range. Recorder should have minimum 100K ohm impedance.

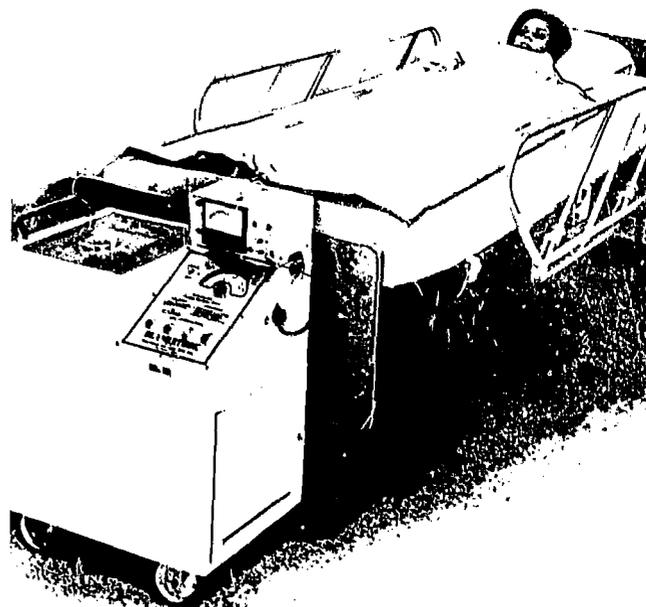
Available 115 or 230 VAC, 50/60 Hz, 6 watts. Total load to 1000 watts non-inductive. Outlets protected by 10 Amp fuse on 115 VAC models, 5 Amp fuse on 230 VAC models. Terminal strip contacts not fused.

14 X 22.5 X 23.5 cm, 3 kg ($5\frac{1}{2}$ X $8\frac{1}{2}$ X $9\frac{1}{4}$ inches, 7 lbs.)

Designed for use with YSI Series 400 probes. In certain situations 500 Series probes can be used. Consult factory for details.

Order directly from YSI franchised dealers using the following part numbers:

- YSI Model 73A (plus Range Code) for 115 VAC operation
- YSI Model 73A (plus Range Code) — 230 for 230 VAC operation
- YSI 41604 Spare Relay

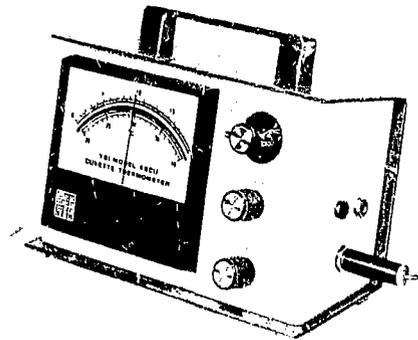


YSI Temperature Standards Instrumentation

YSI temperature instruments are calibrated during manufacture against working standards whose calibration is maintained by the YSI Metrology Laboratory, and which are traceable to temperature and electrical standards calibrated by the National Bureau of Standards. The Metrology Laboratory also maintains a number of primary thermometric standards in which it realizes temperatures which are accepted values of the International Practical Temperature Scale, verified by NBS-calibrated Laboratory Standard Platinum Thermometers.

Field Instrumentation will, in time, drift from its factory calibration. On the following pages will be found several products of exceptional stability which can be maintained as working standards and used to verify the calibration of field instruments, and one product (The Model 60 Gallium Standard) which is a true constant-of-nature fixed point standard developed at YSI. Larger gallium cells for the standardization of primary laboratory thermometers are also offered.

YSI is actively pursuing the development of other thermometric standards at useful temperatures, and these will be announced as they become available.



YSI MODEL 45CU

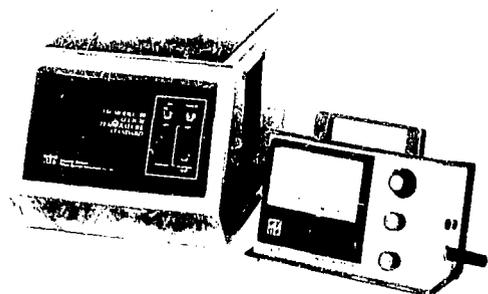
... cuvette thermometer and temperature standard

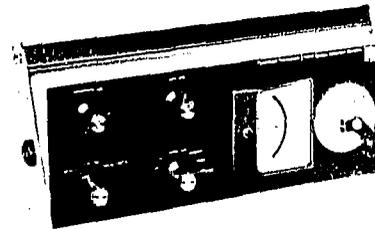
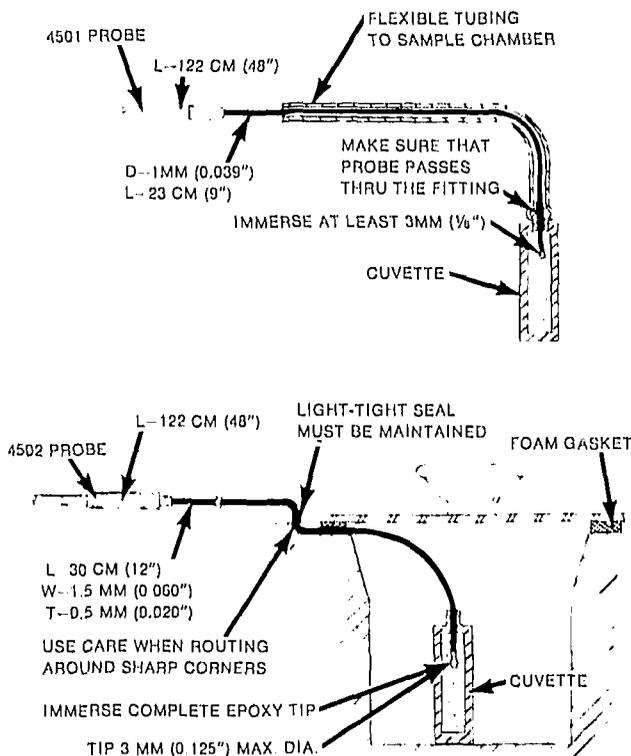
To achieve accurate data during spectrophotometric enzyme measurements it is critical that true substrate temperature be known, not only as indicated by built-in or auxiliary thermometers, but as measured by a thermometer of laboratory standard quality with an accuracy traceable to NBS. It is for this reason that YSI developed the Model 45CU Cuvette Thermometer.

This clinical laboratory tool has a readability and precision of $\pm 0.01^\circ\text{C}$ and an absolute accuracy of $\pm 0.05^\circ\text{C}$, traceable to NBS. Four high accuracy ranges have center points representing temperatures most frequently associated with diagnostic enzymology: 25° , 30° , 32° , and 37°C . By establishing these at the midpoints of the meter dial, full scale deviations of $\pm 1^\circ\text{C}$ can be measured. A fifth range of 20° to 40°C acts as a survey range providing continuous coverage of the four high accuracy ranges, plus the ability to monitor and record rapidly varying temperatures.

Although primarily designed for use with spectrophotometers, the portable Model 45CU is also useful as a temperature standard to calibrate and verify accuracy of laboratory thermometers and other temperature related equipment and processes.

The YSI Model 60 Gallium Temperature Standard can be used to calibrate the YSI Model 45CU Cuvette Thermometer for use as a transfer standard (see page 27).





The YSI Model 777 Thermilinear® Thermometer is a portable temperature measuring system rugged enough for field use, yet with an accuracy normally associated only with laboratory instruments. Its unusual accuracy and resolution combine to make this a highly useful tool for the standards laboratory.

Temperature is measured in three ranges covering a span of -60° to +130°C and read on concentric dials calibrated in tens, units, and hundredths of a degree. A null meter indicates ±0.5° C deviation from the temperature indicated on the dials. Resolution is 0.003°C. Measuring from -40° to +100°C, system absolute accuracy, including probe, is ±0.05°C traceable to NBS. Above and below this range accuracy is ±0.2°C using correction charts supplied with each instrument. Probes are not interchangeable.

Power is provided by rechargeable batteries with built-in line operated charger. A recorder output facilitates preparation of permanent records.

Since the instrument is direct-reading in °C and may be located adjacent to or remotely from the temperature sensing probe, it is useful both as a transfer standard and for general purpose, high-accuracy temperature measurements in field and lab.

-60° to 0°, 0° to 100°, 100° to 130°C.

±0.05°C or better from -40° to +100°C; ±0.2°C or better from -60° to -40°C and 100° to 130°C using correction charts. Accuracy traceable to NBS.

0.003°C

0 to 50°C

-25 to +25 mV, -0.5° to +0.5°C

5 ea. 1.25V Nickel cadmium rechargeable batteries with built-in charger for 115 or 230 VAC, 50/60 Hz.

31.5 X 13 X 18 cm, 5 kg (13 X 5 X 7 inches, 11 lbs).

0.148" dia. by 12" long stainless steel, 10' lead wire; 5 sec time constant in well-stirred water.

ORDER INFORMATION

Order directly from YSI using the following part numbers
 YSI Model 777 Thermilinear Thermometer
 YSI 727 Probe
 Underwater probe for lake and stream work available on special order. Consult factory

The YSI 4501 Probe is designed to measure cuvette temperature in spectrophotometers with flow-through sample handling capability. First, flush the cuvette and fill with distilled water. Then replace the tubing going to the cuvette with a section of flexible tubing and route the probe through the tubing until the tip is immersed at least 3 mm (1/8") in the water.

In applications where the cuvette is not accessible via flexible tubing, the YSI 4502 Probe may be useful. The thin, flat, flexible probe lead wire can usually be passed under the sample chamber cover, and into the cuvette without light leakage.

Temperature Ranges: 24° to 26°C, 29° to 31°C, 31° to 33°C, 36° to 38°C; readability, precision, and reproducibility 0.01°C; absolute accuracy traceable to NBS, including probe, ±0.05°C within ±0.1°C from center of scale and ±0.1°C for remainder of scale.

Temperature Range: 20° to 40°C; readability, precision, and reproducibility 0.12°C, absolute accuracy traceable to NBS, including probe, ±0.25°C.

Apparent Temperature: 15° to 40°C

Recorder Output: +60 mV full scale right, -60 mV full scale left from center zero; minimum recorder input impedance 1000 ohms.

Power: Eveready #222 9 VDC battery or equivalent; approximate 60 day life operated two hours/day.

Size: 21.5 X 11.5 X 15 cm, 1.5 kg (8 1/2 X 4 1/4 X 6 inches, 3 lbs).

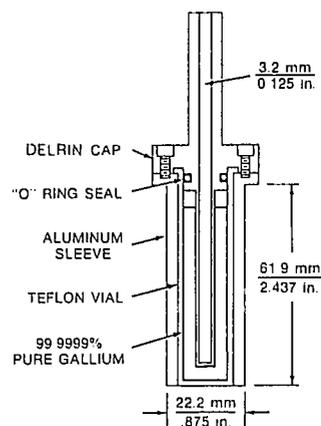
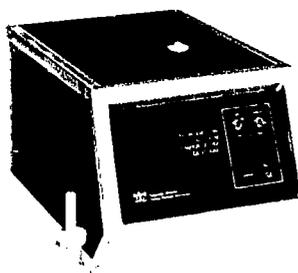
Probes: YSI 4501 for flow-through spectrophotometers and general purpose use; 1 mm dia, 23 cm length, flexible tubing, 4' lead; YSI 4502 general purpose probe; 1.5 mm wide, 0.5 mm thick, 30 cm long flat flexible wire, 4' lead.

HOW TO ORDER

Order directly from YSI franchised dealers using the following part numbers:

- YSI Model 45CU Cuvette Thermometer
- YSI 4501 Probe
- YSI 4502 Probe

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YSI MODEL 60
Gallium Temperature Standard

This Instrument provides the laboratory with a primary temperature calibration standard at 29.770°C, near the center of the biological range. It is based on a constant of nature, the melting point of 99.9999% pure gallium. By maintaining the gallium at the melt temperature of 29.770°C for several hours, the system becomes an in-lab primary temperature standard for calibrating temperature probes, transfer standards, and various other temperature related devices. It also provides an accurate fixed point to aid with developing calibration curves in the manufacture of thermistors and thermocouples.

The system consists of the YSI 6010 Gallium Cell containing approximately 35g of 99.9999% pure gallium, mounted in the Model 60, an automated device for controlling the cell's thermal environment. The Model 60 utilizes a solid-state thermoelectric heat pump for freezing and melting the gallium. The gallium will reach the melting point in approximately one hour and the melt plateau temperature can be maintained for eight to ten hours.

A probe to be calibrated is inserted directly into the gallium cell and its apparent temperature is compared to the Model 60's known temperature of 29.770 ± 0.002°C. Likewise, a point on a calibration curve can be established by observing the probe's resistance at 29.770°C. A temperature monitor, controller, or transfer standard is calibrated by placing the probe in the gallium cell and then adjusting the device's readout or set point to 29.770°C. Thermistor and thermocouple probes to 3.2 mm (0.125") can be inserted directly into the gallium cell.

The YSI Model 45 CU Cuvette Thermometer is an ideal transfer standard for use with the YSI Model 60 Gallium Temperature Standard. This battery-powered and completely portable thermistor thermometer, described on page 20, has a readability of ±0.01°C with absolute accuracy of ±0.05°C traceable to NBS. The instrument is calibrated by placing the probe in the gallium cell, comparing the meter reading to 29.770°C and, if necessary, adjusting the reading accordingly. The 45CU can then be used as a transfer standard to calibrate and verify the accuracy of laboratory thermometers, controllers, built-in cuvette temperature readouts, and other temperature related equipment and processes.

A larger gallium temperature standard is available from the YSI Industrial Division. It accommodates thermometers not more than 11.4mm in diameter with stem length not less than 37cm, such as Leeds & Northrup Models 8163 and 8167, YSI Models 8163 and 8167, and Hewlett-Packard Models 18111A and 18112A. YSI Model 17402 is a cell in a melt environment enclosure for fully automatic operation. The larger cell alone is available as YSI Model 17401. The cell contains 500g of 99.9999+% gallium.

The cell is prepared for use by storage for a few hours in the laboratory refrigerator to solidify the gallium. It is then transferred

to the melt environment, which automatically controls heat to bring the cell rapidly to its melt plateau, and holds the plateau for 12 hours or more, constant within ±0.002°C. The cell may also be operated in a controlled stirred liquid bath, and with careful bath control, the plateau of constant temperature can be extended for several days.

Although the melting point of gallium as a reference point on the IPTS₆₈ is a recent development, it has received considerable attention in technical publications. Reprints of several journal articles of special interest to individuals considering use of the YSI Model 60 Gallium Temperature Standard are available from YSI on request.

- Standard Temperature: 29.770°C (on the IPTS₆₈ scale) accurate to ±0.002°C
- Temperature Range: 18° to 28°C (64° to 82°F)
- Power: Available 115 VAC, 50/60 Hz, 1.2 A or 230 VAC, 50/60 Hz, 0.6 A
- Size: 39.6 X 23.6 X 21.1 cm, 10 kg (15.6 X 9.3 X 8.3 inches, 22 lbs.)

- HOW TO ORDER**
- Order directly from YSI using the following part numbers:
 - YSI Model 60 Gallium Temperature Standard (115 VAC) (Controller only)
 - YSI Model 60-230 Gallium Temperature Standard (230 VAC) (Controller only)
 - YSI 6010 Gallium Cell
 - YSI 6022 NBS Cell Adaptor (Adapts National Bureau of Standards SRM 1968 Gallium Cell for use in YSI Model 60)
 - YSI Model 17401 Gallium Cell (consult factory)

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YSI Temperature Scale Calibration

The International Practical Temperature Scale 1948 (IPTS₄₈) was in almost universal use for thermometer calibration until 1968. In 1968, the IPTS₄₈ was modified to bring it into closer conformity with the thermodynamic Kelvin temperature scale, resulting in IPTS₆₈.

Converting to IPTS₆₈ would require rescaling and recalibration of temperature devices throughout industry. Therefore, calibration issued by YSI are given in IPTS₄₈.

The YSI Standards Laboratory maintains calibration capacity of primary and secondary fixed points of IPTS₄₈. YSI manufactures both thermistors (150°C max.) and Platinum Resistance Thermometers. The standards capability outlined below has been developed to satisfy both sensor types. These standards are inter-compared with NBS.

°C, IPTS ₄₈	Material and equilibrium
-38.867	Triple point of mercury
0.010	Triple point of water
156.611	Liquid and solid indium
231.913	Liquid and solid tin
327.426	Liquid and solid lead
419.505	Liquid and solid zinc

Fixed points are employed in calibrating factory standards, which in turn are used to verify working standards. Fixed point temperatures are realized with an accuracy of ±0.005°C at the mercury point, ±0.0005°C at the triple point of water, and better than ±0.002°C at the indium, tin, lead and zinc points.

Conversion from IPTS₄₈ to IPTS₆₈

To obtain a value of temperature in IPTS₆₈ from a calibration given in IPTS₄₈ add the tabular value shown to the IPTS₄₈ value. A table in 1°C intervals is also available.

t, °C	add	t, °C	add
-80	+0.237	50	-0.103
-70	+0.336	60	-0.096
-50	+0.286	70	-0.081
-40	+0.237	80	-0.059
-30	+0.179	90	-0.032
-20	+0.117	100	.0000
-10	+0.055	110	+0.036
0	.0000	120	+0.075
10	-0.043	130	+0.116
20	-0.074	140	+0.159
30	-0.094	150	+0.204
40	-0.103		

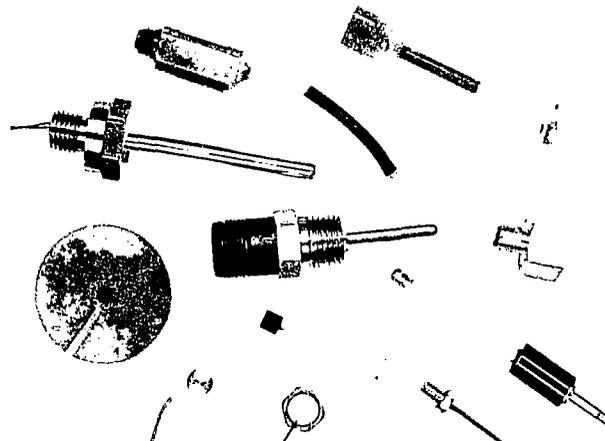
Values for the Thermometric Functions of the 1948 Scale

The following table indicates the values YSI accepts as defining the equilibrium points in the scale of 1948.

Fixed Point	Value	Fixed Point	Value
CO ₂ sublim	-78.5097	Indium fr.	156.611
CO ₂ triple	-56.572	Tin fr.	231.913
Hg freeze	-38.859	Lead fr.	327.426
Hg triple	-38.867	Zinc fr.	419.505
H ₂ O triple	0.01	Alum fr.	660.462

YSI Custom Design Instrumentation

In the custom group of temperature instrumentation YSI offers a variety of special products. Sometimes these are one-off devices for a specific task, such as a special range thermometer or a unique temperature probe. In other cases they are produced in small run items for OEM applications. A few YSI custom designed built products are illustrated below. We build custom products on a regular basis and welcome your inquiry for temperature products designed and manufactured for your special requirements.



Temperature Measurement Systems

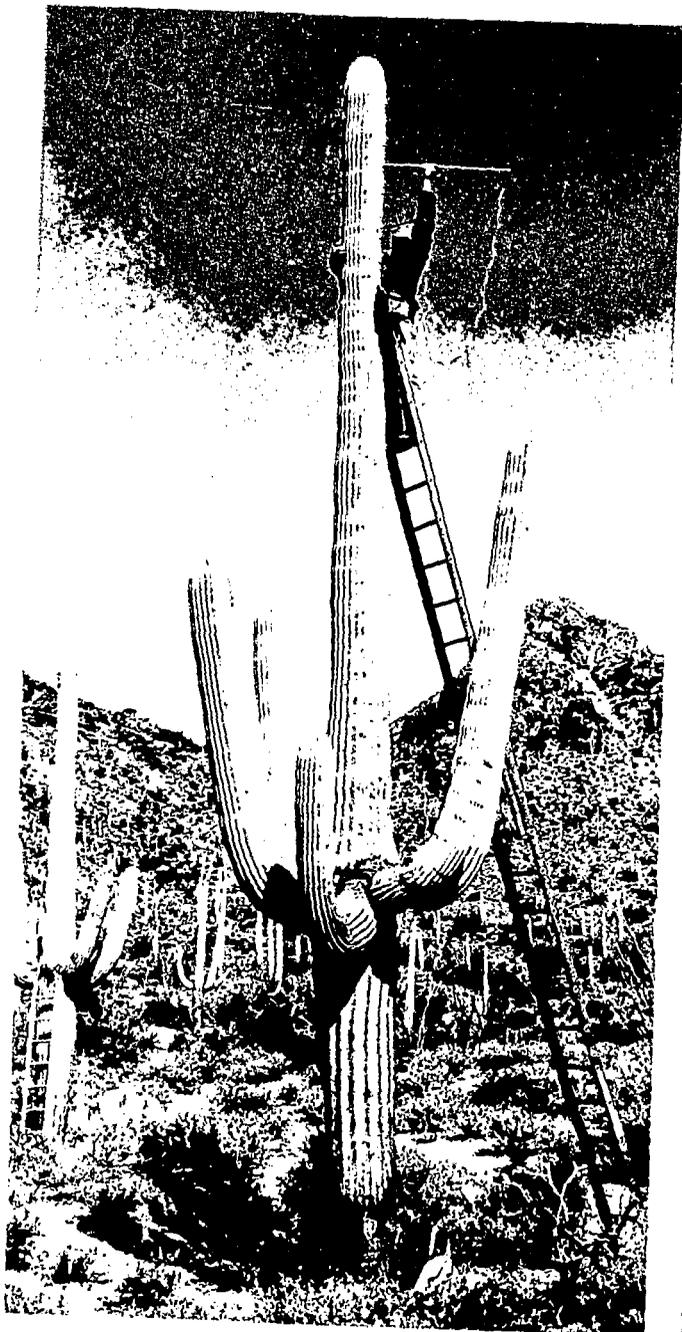


The temperature measurement systems shown are available in a variety of configurations and are designed to meet your special requirements.



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Thermopist uses YSI T-100 Thermometer to measure temperature of the saguaro to learn if the plant cactus has become infected.



These additional
YSI-Scientific
Instrument Catalogs
are available
on request:

- Dissolved Oxygen/BOD
- Oxygen Uptake
- Conductivity/Salinity
- Radiometer
- Dew Point Hygrometer
- Sugar and Starch Analyzer
- Blood Glucose Analyzer
- Cholesterol Analyzer
- Heat Stress



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