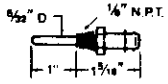
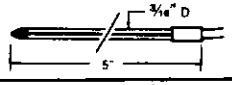
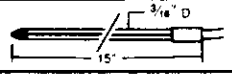
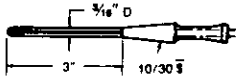
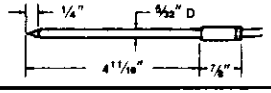
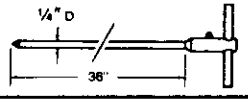
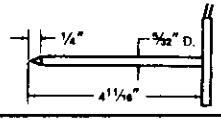
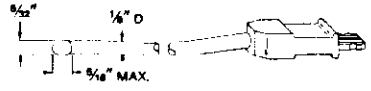
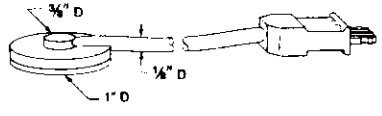
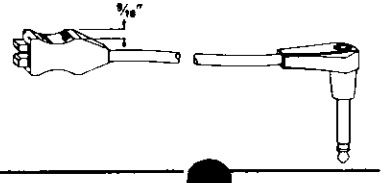
Probe No.	Description & Applications	Time Constant / Maximum Temperature	Configuration
416	TUBULAR-AUTOCLAVABLE: Like YSI 410, but with detachable lead. Useful in biological apparatus such as heart-lung, heat exchanger, etc.	3.4 sec. 150°C (300°F)	
404	TUBULAR-GLASS: Chemically inert for liquid immersion use. Thermometric titration. Freezing point determination. Pyrex.	4.2 sec. 150°C (300°F)	
415	TUBULAR-LONG GLASS: Like YSI 404 but longer. Pyrex.	4.2 sec. 150°C (300°F)	
417	GROUND GLASS JOINT: For temperature monitoring and control in all-glass systems. Pyrex.	4.2 sec. 150°C (300°F)	
418	TUBULAR-POINTED METAL: To pierce semi-solids such as meat, fruit, soil, tobacco, etc. Stainless steel.	3.7 sec. 150°C (300°F)	
419	TUBULAR-LONG POINTED METAL: Similar to YSI 418, but longer for deep insertion in semi-solids. Has handle and detachable lead. Stainless steel. Not electrically isolated.	4.3 sec. 150°C (300°F)	
433	TUBULAR-POINTED METAL: Stainless steel. For piercing semi-solids. Useful in processing of food products. Pointed tip. High temperature Teflon covered lead wire.	3.7 sec. 150°C (300°F)	

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

Probe No.	Description & Applications	Time Constant / Temperature Range	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.	7.0 sec. 0 to 65°C	
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.	9.0 sec. 0 to 65°C	
4900	REUSABLE INSTRUMENT CABLE: Used with YSI Series 400 Disposable Probes to connect with measurement device. 6-foot 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.		

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PRICE INCLUDING HANDLING $1.00

INSTRUCTIONS FOR YSI SERIES 400 TEMPERATURE PROBES

GENERAL DESCRIPTION

YSI Series 400 probes are recommended for direct temperature measurement and control with YSI Tele-Thermometers, temperature controllers, or with other instruments specifically designed for use with these probes. Three classes of probes are offered: Standard, Disposable, and Super-Stable. All YSI Series 400 probes are electrically interchangeable.

Standard Series 400 probes come in many designs for a wide variety of applications. Probe modifications to suit specific purposes may be specially ordered for many of these probes.

Disposable probes are designed for single-use applications. They are furnished in packages of 25 probes, each in a separate sterile pouch.

Super-Stable probes are usable as secondary or transfer standards and for those applications where long-term stability is essential. See individual descriptions.

Maximum measurement temperatures or measurement temperature ranges are indicated in the individual descriptions for each probe.

Construction

The thermistor, which is the temperature sensing element in each probe, is a small sintered metallic oxide disk that decreases in electrical resistance as the temperature increases. Thermistors are located within the tips of the flexible and tubular probes. In probes with a disk-shaped tip, the thermistors are near the centers of the disks: some of these probes have epoxy on one side of the disk; the other, metal side should be used for making measurements.

Probes have vinyl-jacketed leads, unless otherwise specified. Leads are terminated with a phone plug, except for the disposable models which plug into an 8' reusable instrument cable. Standard probe leads are 10' long. Disposable probe leads are 3', and Super-Stable probe leads are 5' long. The vinyl-covered lead wires and phone plugs should not be exposed to temperatures above 100°C.

Except as otherwise indicated in the individual descriptions, probes are constructed with the thermistor electrically isolated from the outer probe surfaces. However, since this isolation could be lost if the probe is damaged by abuse or mishandling, the instrument with which it is used must provide ground fault isolation. (Consult instrument specifications.) In medical use, the patient should be isolated from accidental electrical grounds.

PROBE CHARACTERISTICS

Interchangeability and Stability

YSI's unique manufacturing process produces thermistors with matching temperature/resistance characteristics. Standard Series 400 probes are interchangeable to within 0.1°C at measurement temperatures between 0 and 70°C, increasing to 0.25°C at -40°C and 0.4°C at +150°C. All probes are warranted to remain within interchangeability tolerances for a year.

Super-Stable probe models are typically stable within 0.015°C, and warranted to an interchangeability within 0.05°C, for a year at use and storage temperatures between 0 and 70°C. At temperatures between 70 and 150°C, their stability is typically within 0.03°C for at least a year.

Disposable probe models are interchangeable within 0.1°C between 20°C and 43°C, increasing linearly to ±0.4°C at 0°C and 65°C.

Time Constant

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 are derived from measurements in water moving past the probe at 3 ft/sec, except in the case of air or gas temperature probes which are measured in moving dry air at 3 ft/sec (equivalent to 12 to 15 L/min. through a standard 22 mm respiratory airway). The time constant in air decreases as humidity increases. Approximately five time constants are required for a probe to reach 99% of the total change. Time constants are representative values and are subject to variation because of small differences in production.

Stem Effect

Stem effect refers to the potential error in measurement caused by heat transfer through the body or leads of a probe. The leads of some probes are relatively more massive for the sake of handling ruggedness; such leads introduce potentially greater stem effects. These effects may be lessened by minimizing the difference between probe tip temperature and lead temperature by means of appropriate insulation, isolation or immersion as each application dictates.

Temperature/Resistance Characteristics

The table below lists the temperature/resistance characteristics for YSI Series 400 probes with standard leads. Probes with leads hundreds of feet long can be provided, but it may then be necessary to consider errors introduced by lead resistance, which is approximately 1.6 ohms per hundred feet. Generally, this is only significant at high temperatures.

YSI probes are calibrated against reference standards traceable to NBS or to accepted values of natural physical constants.

Temperature Versus Resistance: -40 to +150°C

Temp. °C	Res. Ohms	Temp. °C	Res. Ohms	Temp. °C	Res. Ohms	Temp. °C	Res. Ohms
-40	75.80K	+10	4484	+ 60	560.5	+110	115.2
39	70.94K	11	4275	61	540.7	111	112.0
38	66.42K	12	4076	62	521.7	112	109.0
37	62.22K	13	3888	63	503.5	113	106.1
36	58.31K	14	3710	64	486.1	114	103.2
35	54.66K	15	3540	65	469.3	115	100.5
34	51.27K	16	3380	66	453.1	116	97.8
33	48.11K	17	3227	67	437.7	117	95.2
32	45.17K	18	3083	68	422.8	118	92.7
31	42.42K	19	2945	69	408.5	119	90.3
-30	39.86K	+20	2815	+ 70	394.8	+120	87.9
29	37.47K	21	2691	71	381.5	121	85.6
28	35.23K	22	2573	72	368.8	122	83.4
27	33.15K	23	2461	73	356.6	123	81.3
26	31.20K	24	2354	74	344.9	124	79.2
25	29.37K	25	2253	75	333.5	125	75.2
24	27.67K	26	2157	76	322.7	126	75.2
23	26.07K	27	2065	77	312.2	127	73.3
22	24.57K	28	1978	78	302.1	128	71.5
21	23.17K	29	1894	79	292.4	129	69.7
-20	21.86K	+30	1815	+ 80	283.1	+130	68.0
19	20.63K	31	1740	81	274.1	131	66.3
18	19.48K	32	1668	82	265.4	132	64.7
17	18.40K	33	1599	83	257.1	133	63.1
16	17.38K	34	1534	84	249.0	134	61.5
15	16.43K	35	1472	85	241.3	135	60.0
14	15.53K	36	1412	86	233.8	136	58.6
13	14.69K	37	1355	87	226.6	137	57.2
12	13.90K	38	1301	88	219.7	138	55.8
11	13.16K	39	1249	89	213.0	139	54.5
-10	12.46K	+40	1200	+ 90	206.5	+140	53.2
9	11.80K	41	1153	91	200.3	141	51.9
8	11.18K	42	1108	92	194.3	142	50.7
7	10.60K	43	1065	93	188.5	143	49.5
6	10.05K	44	1023	94	182.8	144	48.4
5	9534	45	984.1	95	177.4	145	47.3
4	9045	46	946.5	96	172.2	146	46.2
3	8586	47	910.4	97	167.2	147	45.1
2	8152	48	876.0	98	162.3	148	44.1
1	7742	49	843.0	99	157.6	149	43.1
0	7356	+50	811.5	+100	153.1	+150	42.1
+ 1	6991	51	781.3	101	148.7		
2	6646	52	752.4	102	144.4		
3	6320	53	724.7	103	140.3		
4	6012	54	698.1	104	136.4		
5	5721	55	672.7	105	132.5		
6	5446	56	648.3	106	128.8		
7	5185	57	625.0	107	125.3		
8	4939	58	602.6	108	121.8		
9	4705	59	581.1	109	116.4		

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