



VICTORY / YSI INCORPORATED

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A YSI Company

VECO HERMETICALLY SEALED BEAD-IN-GLASS PROBE AND BEAD-IN-GLASS ROD THERMISTORS

VECO bead-in-glass probes and bead-in-glass rods consist of bead thermistors with sintered-in platinum alloy leads, embedded in solid glass structures so that no air or gas is in contact with the thermistor bead. Because of their construction, these units have excellent stability over long periods of time under continuous exposure to harsh environments. VECO hermetically sealed-in-glass thermistors are impervious to electrically conductive and/or corrosive mediums and they are not adversely affected by high density nuclear radiation fields.

VECO bead-in-glass probes and rods are characterized by fast time response and mod-

erate-to-high power sensitivity. They are ideally suited for applications involving the measurement and control of temperature, liquid level, and liquid or gas flow.

These units are well suited for applications demanding the utmost in reliability and durability as proven by their qualifications for and exemplary performance in such high-reliability programs as Apollo, Nike-X, Titan, Telstar and others.

Large quantity production on automatic machinery under a stringent quality control system makes it possible for VECO to offer these high quality units at competitive prices.

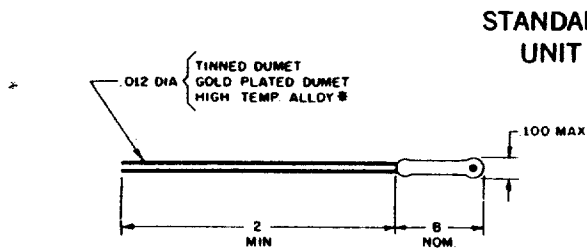
MAXIMUM OPERATING AND STORAGE TEMPERATURES FOR EXCEPTIONAL STABILITY:

Continuous Operation ----- 325°C (617°F)
Intermittent Operation ----- 550°C (1022°F)

NOMINAL DISSIPATION AND TIME CONSTANTS (Units supported by their leads in indicated ambients at 25°C):

MAXIMUM DIAMETER AND TYPE	TIME CONSTANT (SECONDS)			DISSIPATION CONSTANT (MW/°C)			PAGE NO.
	STILL AIR	STILL OIL	STILL WATER	STILL AIR	STILL OIL	STILL WATER	
	0.100" Glass Probes	22.0	2.0	1.0	1.0	3.5	
0.060" Glass Probes	6.0	0.50	0.25	0.6	2.0	3.0	6
0.020" Glass Probes	1.4	0.1	0.055	0.15	0.5	0.75	7
0.100" Glass Probes	20.0	2.0	1.0	1.0	3.5	5.0	8
0.100" Glass Mini-rods	20.0	2.0	1.0	1.0	3.5	5.0	9
0.060" Glass Mini-rods	6.0	0.50	0.25	0.6	2.0	3.0	9

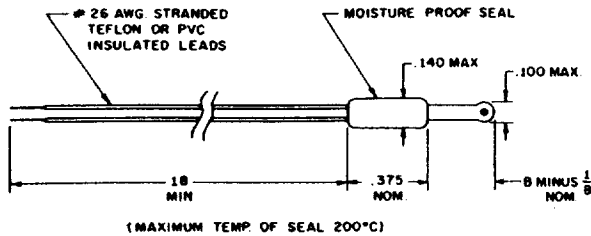
0.100" GLASS PROBES



STANDARD UNIT →

- Tinned Dumet leads: Order by VECO part number direct from Table I.
- Gold plated Dumet leads for improved solderability and weldability: Order by VECO part number from Table I with prefix U, as in U13A11.
- High temperature alloy leads* for continuous operation at temperatures in excess of 500°C: Order by VECO part number from Table I with prefix W, as in W13A11.

Figure 1



- Teflon or PVC insulated extension leads (Part rated at 105°C with PVC leads): Order by VECO part number from Table I with prefix T (for Teflon) or P (for PVC), as in T13A11 or P13A11. Note: See Figure 2.

Figure 2

OPTIONAL RESISTANCE TOLERANCES:

VECO bead-in-glass probes are available with other than listed resistance tolerances at 25°C. To order any special tolerance, add as a suffix to the VECO part number the percentage symbol and the

desired tolerance, as in 13A11%5, XU13A11%10 or W13A11%1, etc. When the tolerance shown in the accompanying table is acceptable, it is not necessary to augment the part number.

0.100" GLASS PROBES

TABLE I — STANDARD VECO 0.100" GLASS PROBES, 1/8" TO 1" LONG.* (SEE FIGURE 1)

VECO Part Number					Zero-Power Resistance R ₀ (ω 25°C (Ohms))	Temp. Coeff. α (ω 25°C (%/°C))	Ratio		R-T Curve (Page 5)
B = 1/8"	B = 1/4"	B = 1/2"	B = 3/4"	B = 1"			R ₀ (ω 0°C) R ₀ (ω 50°C)	R ₀ (ω 25°C) R ₀ (ω 125°C)	
13A17	13A5	13A11	13A7	13A8	30±20%	-3.0	4.5	10.9	A
14A13	14A1	14A11	14A3	14A4	40±20%	-3.0	4.5	10.9	A
15A17	15A5	15A11	15A7	15A8	50±20%	-3.0	4.5	10.9	A
18A13	18A1	18A11	18A3	18A4	75±20%	-3.1	4.7	11.5	A
21A18	21A5	21A3	21A10	21A6	100±20%	-3.2	5.1	12.9	A1
22A42	22A16	22A17	22A18	22A19	150±20%	-3.2	5.1	12.9	A1
22A43	22A24	22A25	22A26	22A27	200±20%	-3.5	5.7	15.0	B
23A29	23A13	23A14	23A15	23A16	250±20%	-3.5	5.7	15.0	B
23A30	23A3	23A4	23A5	23A6	300±20%	-3.5	5.7	15.0	B
24A16	24A4	24A11	24A10	24A9	400±20%	-3.6	6.1	16.5	B2
25A21	25A8	25A6	25A13	25A9	500±20%	3.6	6.1	16.5	B2
28A20	28A7	28A5	28A11	28A8	750±20%	3.8	6.9	19.7	C
31A73	31A53	31A42	31A54	31A55	1000±1%	3.8	6.9	19.7	C
31A74	31A18	31A11	31A48	31A13	1000±20%	-3.8	6.9	19.7	C
31A75	31A60	31A43	31A61	31A62	1300±5%	-3.9	7.1	20.6	D
32A225	32A177	32A178	32A179	32A180	1500±20%	-3.9	7.1	20.6	D
32A226	32A201	32A157	32A202	32A203	2000±1%	-3.9	7.1	20.6	D
32A227	32A207	32A160	32A208	32A158	2000±2%	-3.9	7.1	20.6	D
32A228	32A185	32A47	32A186	32A187	2000±5%	-3.9	7.1	20.6	D
32A229	32A192	32A193	32A194	32A195	2000±10%	-3.9	7.1	20.6	D
32A230	32A212	32A161	32A213	32A214	2000±15%	-3.9	7.1	20.6	D
32A231	32A75	32A11	32A58	32A38	2000±20%	-3.9	7.1	20.6	D
33A64	33A5	33A6	33A33	33A7	2500±5%	-3.9	7.1	20.6	D
33A65	33A46	33A47	33A48	33A49	2500±20%	-3.9	7.1	20.6	D
33A66	33A37	33A38	33A39	33A40	3000±20%	-3.9	7.2	21.0	D
34A44	34A24	34A25	34A26	34A27	3500±30%	3.9	7.2	21.0	D
34A45	34A31	34A10	34A32	34A33	4000±20%	-4.0	7.4	21.8	D3
35A41	35A18	35A11	35A32	35A8	5000±20%	4.0	7.4	21.8	D3
38A36	38A15	38A16	38A17	38A18	7500±20%	4.0	7.5	22.2	D3
38A37	38A24	38A2	38A25	38A26	8000±20%	-4.0	7.5	22.2	D3
41A41	41A29	41A30	41A31	41A32	10,000±5%	4.4	9.1	29.7	F
41A42	41A13	41A11	41A24	41A7	10,000±20%	-4.4	9.1	29.7	F
42A72	42A49	42A14	42A50	42A51	15,000±10%	-4.4	9.1	29.7	F
42A73	42A34	42A35	42A36	42A15	15,000±20%	-4.4	9.1	29.7	F
42A74	42A57	42A17	42A58	42A59	20,000±15%	-4.4	9.1	29.7	F
42A75	42A40	42A63	42A41	42A42	20,000±20%	-4.4	9.1	29.7	F
43A60	43A36	43A37	43A38	43A39	25,000±20%	-4.5	9.4	31.1	G
43A61	43A24	43A44	43A45	43A46	30,000±5%	-4.5	9.4	31.1	G
43A62	43A13	43A11	43A31	43A10	30,000±20%	-4.5	9.4	31.1	G
44A32	44A21	44A3	44A22	44A23	40,000±15%	-4.5	9.5	31.5	G
44A33	44A12	44A13	44A14	44A15	40,000±20%	4.5	9.5	31.5	G
45A57	45A32	45A63	45A37	45A38	50,000±5%	-4.5	9.5	31.5	G
45A58	45A42	45A43	45A44	45A46	50,000±15%	-4.5	9.5	31.5	G
45A59	45A18	45A11	45A31	45A7	50,000±20%	-4.5	9.5	31.5	G
47A14	47A7	47A11	47A8	47A9	70,000±20%	-4.6	10.3	35.8	H
48A24	48A12	48A11	48A13	48A14	75,000±20%	4.6	10.3	35.8	H
51A121	51A84	51A85	51A86	51A87	100,000±5%	-4.6	10.3	35.8	H
51A122	51A92	51A76	51A77	51A93	100,000±6%	-4.6	10.3	35.8	H
51A123	51A78	51A98	51A99	51A119	100,000±10%	-4.6	10.3	35.8	H
51A124	51A33	51A11	51A17	51A31	100,000±15%	-4.6	10.3	35.8	H
52A51	52A29	52A30	52A31	52A32	150,000±20%	4.7	10.9	39.4	Q
52A52	52A7	52A11	52A37	52A8	200,000±20%	-4.7	10.9	39.4	Q
53A36	53A18	53A19	53A20	53A21	250,000±20%	5.0	12.3	49.6	P
53A37	53A9	53A11	53A10	53A12	300,000±20%	-5.0	12.3	49.6	P
54A33	54A22	54A3	54A23	54A24	350,000±15%	-5.0	12.3	49.6	P
54A34	54A13	54A14	54A15	54A16	400,000±20%	-5.0	12.3	49.6	P
55A28	55A14	55A11	55A18	55A10	500,000±20%	-5.0	12.3	49.6	P
58A21	58A8	58A11	58A9	58A10	750,000±20%	-5.0	12.6	51.9	J
61A27	61A13	61A11	61A18	61A10	1 Meg±20%	-5.0	12.6	51.9	J
62A43	62A19	62A4	62A21	62A22	1.5 Meg±20%	-5.0	12.6	51.9	J
62A44	62A26	62A6	62A27	62A28	2 Meg±20%	-5.0	12.6	51.9	J
63A35	63A18	63A19	63A20	63A21	2.5 Meg±20%	-5.1	13.2	56.8	J
63A36	63A9	63A11	63A10	63A12	3 Meg±20%	-5.1	13.2	56.8	J
64A21	64A8	64A11	64A9	64A10	4 Meg±20%	-5.4	15.3	75.0	K
65A27	65A9	65A11	65A18	65A8	5 Meg±20%	-5.4	15.3	75.0	K
68A16	68A4	68A11	68A5	68A6	7.5 Meg±20%	-5.6	17.0	91.6	L
71A29	71A18	71A19	71A21	71A22	10 Meg±10%	-5.7	17.4	95.6	L
71A30	71A5	71A11	71A13	71A6	10 Meg±20%	-5.7	17.4	95.6	L
72A16	72A4	72A11	72A5	72A6	15 Meg±20%	-5.7	17.8	99.6	L

SEE FRONT PAGE FOR NOMINAL DISSIPATION AND TIME CONSTANTS

*See Page 4 for 1/4" to 2" Probe Lengths

0.100" GLASS PROBES

TABLE 1 — STANDARD VECO 0.100" GLASS PROBES, 1/4" TO 2" LONG.* (SEE FIGURE 1)

VECO Part Number				Zero-Power Resistance R ₀ (@ 25°C (Ohms))	Temp. Coeff. α (@ 25°C (%/°C))	Ratio		R-T Curve (Page 5)
B=1/4"	B=1/2"	B=3/4"	B=2"			R ₀ (@ 0°C R ₀ (@ 50°C)	R ₀ (@ 25°C R ₀ (@ 125°C)	
13A9	13A10	13A12	13A13	30±20%	-3.0	4.5	10.9	A
14A5	14A6	14A7	14A8	40±20%	-3.0	4.5	10.9	A
15A9	15A10	15A12	15A13	50±20%	-3.0	4.5	10.9	A
18A5	18A6	18A7	18A8	75±20%	-3.1	4.7	11.5	A
21A11	21A12	21A13	21A4	100±20%	-3.2	5.1	12.9	A1
22A20	22A21	22A22	22A23	150±20%	-3.2	5.1	12.9	A1
22A28	22A29	22A30	22A31	200±20%	-3.5	5.7	15.0	B
23A17	23A18	23A19	23A20	250±20%	-3.5	5.7	15.0	B
23A7	23A8	23A9	23A10	300±20%	-3.5	5.7	15.0	B
24A8	24A7	24A6	24A5	400±20%	-3.6	6.1	16.5	B2
25A14	25A15	25A16	25A7	500±20%	-3.6	6.1	16.5	B2
28A9	28A10	28A12	28A13	750±20%	-3.8	6.9	19.7	C
31A56	31A57	31A58	31A59	1000±1%	-3.8	6.9	19.7	C
31A49	31A50	31A51	31A6	1000±20%	-3.8	6.9	19.7	C
31A63	31A64	31A72	31A65	1300±5%	-3.9	7.1	20.6	D
32A181	32A182	32A183	32A184	1500±20%	-3.9	7.1	20.6	D
32A204	32A205	32A206	32A156	2000±1%	-3.9	7.1	20.6	D
32A209	32A210	32A211	32A159	2000±2%	-3.9	7.1	20.6	D
32A188	32A189	32A190	32A191	2000±5%	-3.9	7.1	20.6	D
32A196	32A197	32A198	32A24	2000±10%	-3.9	7.1	20.6	D
32A215	32A216	32A217	32A162	2000±15%	-3.9	7.1	20.6	D
32A40	32A106	32A41	32A1	2000±20%	-3.9	7.1	20.6	D
33A34	33A35	33A36	33A8	2500±5%	-3.9	7.1	20.6	D
33A50	33A51	33A52	33A53	2500±20%	-3.9	7.1	20.6	D
33A41	33A42	33A43	33A44	3000±20%	-3.9	7.2	21.0	D
34A28	34A29	34A30	34A3	3500±30%	-3.9	7.2	21.0	D
34A34	34A35	34A36	34A43	4000±20%	-4.0	7.4	21.8	E
35A33	35A34	35A35	35A3	5000±20%	-4.0	7.4	21.8	D3
38A19	38A20	38A21	38A22	7500±20%	-4.0	7.5	22.2	D3
38A27	38A28	38A29	38A30	8000±20%	-4.0	7.5	22.2	D3
41A33	41A34	41A35	41A36	10,000±5%	-4.4	9.1	29.7	F
41A25	41A26	41A27	41A1	10,000±20%	-4.4	9.1	29.7	F
42A53	42A54	42A55	42A56	15,000±10%	-4.4	9.1	29.7	F
42A37	42A38	42A39	42A16	15,000±20%	-4.4	9.1	29.7	F
42A60	42A61	42A62	42A18	20,000±15%	-4.4	9.1	29.7	F
42A43	42A44	42A45	42A46	20,000±20%	-4.4	9.1	29.7	F
43A40	43A41	43A42	43A43	25,000±20%	-4.5	9.4	31.1	G
43A47	43A48	43A49	43A25	30,000±5%	-4.5	9.4	31.1	G
43A32	43A33	43A34	43A3	30,000±20%	-4.5	9.4	31.1	G
44A24	44A25	44A26	44A27	40,000±15%	-4.5	9.5	31.5	G
44A16	44A17	44A18	44A19	40,000±20%	-4.5	9.5	31.5	G
45A39	45A40	45A33	45A41	50,000±5%	-4.5	9.5	31.5	G
45A47	45A48	45A49	45A50	50,000±15%	-4.5	9.5	31.5	G
45A61	45A62	45A34	45A1	50,000±20%	-4.5	9.5	31.5	G
47A10	47A12	47A13	47A5	70,000±20%	-4.6	10.3	35.8	H
48A15	48A16	48A17	48A18	75,000±20%	-4.6	10.3	35.8	H
51A89	51A90	51A91	51A75	100,000±5%	-4.6	10.3	35.8	H
51A94	51A95	51A96	51A97	100,000±6%	-4.6	10.3	35.8	H
51A117	51A102	51A103	51A104	100,000±10%	-4.6	10.3	35.8	H
51A18	51A49	51A19	51A1	100,000±15%	-4.6	10.3	35.8	H
52A33	52A34	52A35	52A36	150,000±20%	-4.7	10.9	39.4	Q
52A38	52A39	52A40	52A6	200,000±20%	-4.7	10.9	39.4	Q
53A22	53A23	53A24	53A25	250,000±20%	-5.0	12.3	49.6	P
53A13	53A14	53A15	53A16	300,000±20%	-5.0	12.3	49.6	P
54A25	54A26	54A27	54A28	350,000±15%	-5.0	12.3	49.6	P
54A17	54A18	54A19	54A20	400,000±20%	-5.0	12.3	49.6	P
55A19	55A21	55A22	55A1	500,000±20%	-5.0	12.3	49.6	P
58A12	58A13	58A14	58A15	750,000±20%	-5.0	12.6	51.9	J
61A19	61A20	61A21	61A1	1 Meg±20%	-5.0	12.6	51.9	J
62A23	62A24	62A25	62A5	1.5 Meg±20%	-5.0	12.6	51.9	J
62A29	62A30	62A31	62A32	2 Meg±20%	-5.0	12.6	51.9	J
63A22	63A23	63A24	63A1	2.5 Meg±20%	-5.1	13.2	56.8	J
63A13	63A14	63A15	63A16	3 Meg±20%	-5.1	13.2	56.8	J
64A12	64A13	64A14	64A15	4 Meg±20%	-5.4	15.3	75.0	K
65A19	65A20	65A21	65A7	5 Meg±20%	-5.4	15.3	75.0	K
68A7	68A8	68A9	68A10	7.5 Meg±20%	-5.6	17.0	91.6	L
71A23	71A24	71A25	71A10	10 Meg±10%	-5.7	17.4	95.6	L
71A14	71A15	71A16	71A4	10 Meg±20%	-5.7	17.4	95.6	L
72A7	72A8	72A9	72A10	15 Meg±20%	-5.7	17.8	99.6	L

SEE FRONT PAGE FOR NOMINAL DISSIPATION AND TIME CONSTANTS

* See Page 3 for 1/4" to 1" Probe Lengths

TABLE 5 — Resistance Versus Temperature Multipliers For Standard Materials

Material Type	A1	A	B	B2	C	D	D3	F	G	H	g	P	J	K	L
Temp Coeff. @ 25°C	-3.1%/°C	-3.3%/°C	-3.5%/°C	-3.7%/°C	-3.8%/°C	-3.9%/°C	-4.0%/°C	-4.4%/°C	-4.5%/°C	-4.6%/°C	-4.7%/°C	-4.9%/°C	-5.1%/°C	-5.3%/°C	-5.7%/°C
Base in K	2789K	2938K	3108K	3359K	3385K	3449K	3672K	3891K	4125K	4111K	4143K	4354K	4545K	4747K	5022K
0°C/50°C	4.80±10%	5.28±5%	5.81±5%	6.38±5%	6.80±5%	7.04±5%	7.44±5%	9.08±5%	9.60±5%	10.30±5%	10.45±5%	11.78±5%	13.12±5%	14.73±5%	17.20±10%
25°C/125°C	N/A	N/A	N/A	16.94	18.76	18.80	22.08	29.30	32.39	35.48	38.07	48.84	58.69	87.84	98.60
°C	°F	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
-55	2937	32.12	36.59	45.25	51.92	54.92	62.37	98.37	107.00	116.80	118.40	137.00	156.00	210.80	Mult.
-50	22.21	24.30	27.54	33.55	37.47	40.10	44.97	67.01	73.88	80.70	81.80	94.18	107.40	140.10	Mult.
-45	17.00	18.60	20.93	25.11	28.00	29.80	32.79	47.19	51.66	56.42	56.90	65.44	73.48	94.28	Mult.
-40	13.15	14.40	16.06	18.97	20.97	22.07	24.18	33.65	36.57	39.90	40.16	45.95	52.87	84.14	Mult.
-35	10.28	11.30	12.43	14.45	15.85	16.81	17.99	24.27	26.19	28.48	28.65	32.60	37.48	44.10	Mult.
-30	8.113	8.990	9.703	11.10	12.09	12.60	13.53	17.70	18.97	20.50	20.84	23.31	26.89	30.63	Mult.
-25	6.483	7.104	7.630	8.604	9.283	9.638	10.27	13.040	13.88	14.94	15.020	16.810	19.130	21.490	Mult.
-20	5.193	5.690	6.053	6.721	7.189	7.430	7.863	9.707	10.26	11.00	11.040	12.220	13.800	15.220	Mult.
-15	4.207	4.559	4.836	5.291	5.614	5.778	6.072	7.295	7.663	8.110	8.180	8.972	9.957	10.880	Mult.
-10	3.435	3.680	3.890	4.197	4.419	4.530	4.728	5.533	5.774	6.050	6.119	6.842	7.247	7.845	Mult.
-5	2.825	2.992	3.150	3.353	3.507	3.590	3.709	4.233	4.390	4.572	4.615	4.959	5.321	5.707	Mult.
0	2.340	2.450	2.568	2.698	2.801	2.850	2.932	3.265	3.364	3.480	3.510	3.733	3.942	4.187	Mult.
5	1.951	2.073	2.192	2.315	2.421	2.481	2.563	2.539	2.600	2.683	2.691	2.828	2.952	3.098	Mult.
10	1.637	1.690	1.731	1.781	1.821	1.839	1.870	1.990	2.027	2.060	2.078	2.157	2.227	2.308	Mult.
15	1.381	1.404	1.433	1.461	1.484	1.493	1.509	1.571	1.591	1.615	1.617	1.658	1.693	1.734	Mult.
20	1.172	1.180	1.194	1.206	1.215	1.219	1.224	1.249	1.258	1.270	1.267	1.284	1.297	1.312	Mult.
25	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	Mult.
30	0.8570	0.8540	0.8413	0.8344	0.8285	0.8265	0.8215	0.8057	0.8017	0.8010	0.7942	0.7860	0.7784	0.7686	Mult.
40	0.6400	0.6280	0.6040	0.5892	0.5791	0.5730	0.5633	0.5327	0.5240	0.5130	0.5105	0.4934	0.4772	0.4612	Mult.
45	0.5570	0.5395	0.5154	0.4987	0.4873	0.4805	0.4701	0.4370	0.4274	0.4154	0.4129	0.3944	0.3775	0.3609	Mult.
50	0.4890	0.4640	0.4417	0.4241	0.4118	0.4048	0.3942	0.3603	0.3505	0.3390	0.3359	0.3170	0.3004	0.2842	Mult.
55	0.4260	0.4024	0.3801	0.3623	0.3497	0.3427	0.3321	0.2986	0.2896	0.2790	0.2747	0.2568	0.2405	0.2251	Mult.
60	0.3752	0.3500	0.3283	0.3108	0.2984	0.2915	0.2811	0.2488	0.2396	0.2310	0.2259	0.2092	0.1938	0.1794	Mult.
65	0.3310	0.3053	0.2847	0.2677	0.2558	0.2491	0.2390	0.2063	0.1996	0.1923	0.1867	0.1713	0.1567	0.1437	Mult.
70	0.2939	0.2670	0.2477	0.2316	0.2202	0.2138	0.2040	0.1752	0.1670	0.1610	0.1550	0.1409	0.1275	0.1158	Mult.
75	0.2620	0.2355	0.2161	0.2011	0.1903	0.1843	0.1748	0.1479	0.1405	0.1354	0.1293	0.1184	0.1042	0.0938	Mult.
80	0.2394	0.2080	0.1893	0.1753	0.1651	0.1594	0.1504	0.1253	0.1186	0.1140	0.1084	0.0966	0.0856	0.0763	Mult.
85	0.2090	0.1840	0.1664	0.1533	0.1437	0.1384	0.1289	0.1070	0.1006	0.0960	0.0912	0.0806	0.0707	0.0625	Mult.
90	0.1877	0.1630	0.1470	0.1346	0.1255	0.1205	0.1126	0.0915	0.08572	0.0809	0.0771	0.0674	0.0586	0.0514	Mult.
95	0.1690	0.1453	0.1300	0.1185	0.1100	0.1053	0.09784	0.0787	0.07331	0.0694	0.0654	0.0567	0.0488	0.0424	Mult.
100	0.1527	0.1300	0.1153	0.1048	0.0966	0.0924	0.08547	0.0679	0.06294	0.0595	0.0557	0.0478	0.0408	0.0352	Mult.
105				0.09285	0.0893	0.0813	0.07484	0.0597	0.05424	0.0511	0.0476	0.0405	0.0342	0.0293	Mult.
110				0.08256	0.0756	0.0719	0.06573	0.0510	0.04691	0.0439	0.0408	0.0343	0.0288	0.0245	Mult.
115				0.07362	0.0671	0.0637	0.05791	0.0445	0.04071	0.0377	0.0351	0.0282	0.0244	0.0206	Mult.
120				0.06583	0.0597	0.0566	0.05117	0.0389	0.03545	0.0325	0.0300	0.0250	0.0207	0.0174	Mult.
125				0.05903	0.0533	0.0504	0.04594	0.0342	0.03097	0.0282	0.0263	0.0214	0.0176	0.0147	Mult.
130				0.05307	0.0477	0.0450	0.04029	0.0301	0.02714	0.0246	0.0228	0.0185	0.0151	0.0125	Mult.
135				0.04784	0.0427	0.0403	0.03569	0.0266	0.02366	0.0216	0.0199	0.0159	0.0132	0.0107	Mult.
140				0.04323	0.0384	0.0362	0.03209	0.0235	0.02104	0.0190	0.0173	0.0138	0.0114	0.0092	Mult.
145				0.039150	0.0346	0.0326	0.02872	0.0209	0.01860	0.0167	0.0152	0.0120	0.0098	0.0079	Mult.
150				0.03555	0.0312	0.0294	0.02577	0.0186	0.01649	0.0147	0.0133	0.0104	0.0083	0.0066	Mult.

0.060" GLASS PROBES

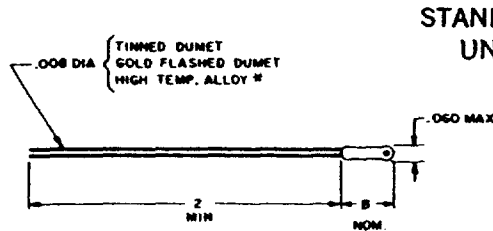


Figure 7

STANDARD UNIT → ■ Tinned Dumet leads: Order by VECO part number direct from Table III.

■ Gold plated Dumet leads for improved solderability and weldability: Order by VECO part number from Table III with prefix U, as in U13A6.

■ High temperature alloy leads* for continuous operation at temperatures in excess of 500°C: Order by VECO part number from Table III with prefix W, as in W13A6.

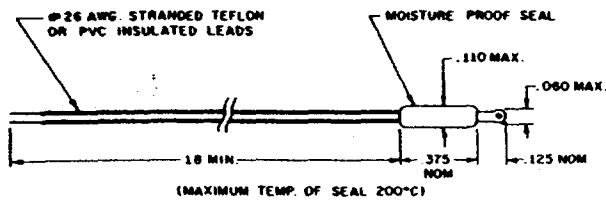


Figure 8

■ Teflon or PVC insulated extension leads (Part rated at 105°C with PVC leads): Order by VECO part number from Table III, (B=1/4"), with prefix T (for Teflon) or P (for PVC), as in T13A6 or P13A6. Note: See Figure 8.

OPTIONAL RESISTANCE TOLERANCES:

VECO bead-in-glass probes are available with other than listed resistance tolerances at 25°C. To order any special tolerance, add as a suffix to the VECO part number the percentage symbol and

the desired tolerance, as in 13A6%5, P13A6%10 or U13A6%1, etc. When the tolerance shown in the accompanying table is acceptable, it is not necessary to augment the part number.

TABLE III — STANDARD VECO 0.060" GLASS PROBES. (SEE FIGURE 7)

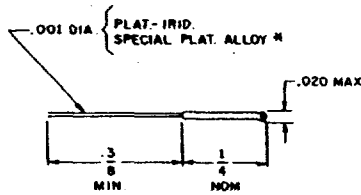
VECO Part Number	Zero-Power Resistance R ₀ @ 25°C (Ohms)	Temp. Coeff. α @ 25°C (%/°C)	Ratio		R-T Curve (Page 5)	VECO Part Number	Zero-Power Resistance R ₀ @ 25°C (Ohms)	Temp. Coeff. α @ 25°C (%/°C)	Ratio		R-T Curve (Page 5)		
			R ₀ @ 0°C	R ₀ @ 125°C					R ₀ @ 0°C	R ₀ @ 125°C			
13A19	13A6	30 ± 20%	-3.0	4.5	10.9	A	43A68	43A35	30,000 ± 20%	-4.5	9.4	31.1	G
14A15	14A2	40 ± 20%	-3.0	4.5	10.9	A	44A36	44A20	40,000 ± 20%	-4.5	9.5	31.5	G
15A19	15A6	50 ± 20%	-3.0	4.5	10.9	A	45A60	45A35	50,000 ± 20%	-4.5	9.5	31.5	G
18A15	18A2	75 ± 20%	-3.1	4.7	11.5	A	48A27	48A19	75,000 ± 20%	-4.6	10.3	35.8	H
21A20	21A14	100 ± 20%	-3.2	5.1	12.9	A1	51A129	51A58	100,000 ± 15%	-4.6	10.3	35.8	H
22A46	22A32	150 ± 20%	-3.2	5.1	12.9	A1	51A128	51A118	100,000 ± 20%	-4.6	10.3	35.8	H
22A44	22A33	200 ± 20%	-3.5	5.7	15.0	B	52A57	52A41	150,000 ± 20%	-4.7	10.9	39.4	Q
23A33	23A22	250 ± 20%	-3.5	5.7	15.0	B	52A58	52A42	200,000 ± 20%	-4.7	10.9	39.4	Q
23A34	23A12	300 ± 20%	-3.5	5.7	15.0	B	53A42	53A27	250,000 ± 20%	-5.0	12.3	49.6	R
24A18	24A12	400 ± 20%	-3.6	6.1	16.5	B2	53A43	53A17	300,000 ± 20%	-5.0	12.3	49.6	R
25A23	25A17	500 ± 20%	-3.6	6.1	16.5	B2	54A37	54A21	400,000 ± 20%	-5.0	12.3	49.6	J
28A21	28A14	750 ± 20%	-3.8	6.9	19.7	C	55A31	55A23	500,000 ± 20%	-5.0	12.3	49.6	J
31A77	31A52	1000 ± 20%	-3.8	6.9	19.7	C	58A24	58A16	750,000 ± 20%	-5.0	12.6	51.9	J
32A234	32A199	1500 ± 20%	-3.9	7.1	20.6	D	61A20	61A22	1 Meg ± 20%	-5.0	12.6	51.9	J
32A235	32A129	2000 ± 20%	-3.9	7.1	20.6	D	62A47	62A33	1.5 Meg ± 20%	-5.0	12.6	51.9	J
33A71	33A55	2500 ± 20%	-3.9	7.1	20.6	D	62A48	62A34	2 Meg ± 20%	-5.0	12.6	51.9	J
33A72	33A45	3000 ± 20%	-3.9	7.2	21.0	D	63A41	63A26	2.5 Meg ± 20%	-5.1	13.2	56.8	J
34A47	34A38	4000 ± 20%	-4.0	7.4	21.8	D3	63A42	63A17	3 Meg ± 20%	-5.1	13.2	56.8	J
35A43	35A36	5000 ± 20%	-4.0	7.4	21.8	D3	64A24	64A16	4 Meg ± 20%	-5.4	15.3	75.0	K
38A39	38A23	7500 ± 20%	-4.0	7.5	22.2	D3	65A30	65A22	5 Meg ± 20%	-5.4	15.3	75.0	K
41A44	41A28	10,000 ± 20%	-4.4	9.1	29.7	F	68A19	68A12	7.5 Meg ± 20%	-5.6	17.0	91.6	L
42A78	42A47	15,000 ± 20%	-4.4	9.1	29.7	F	71A31	71A17	10 Meg ± 20%	-5.7	17.4	95.6	L
42A79	42A48	20,000 ± 20%	-4.4	9.1	29.7	F	72A19	72A12	15 Meg ± 20%	-5.7	17.8	99.6	L
43A67	43A51	25,000 ± 20%	-4.5	9.4	31.1	G							

SEE FRONT PAGE FOR NOMINAL DISSIPATION AND TIME CONSTANTS

All dimensions in inches

* Pat. pend.

0.020" GLASS PROBES



STANDARD UNIT

- Platinum-Iridium leads: Order by VECO part number direct from Table IV.
- Alloy leads* for improved solderability and weldability: Order by VECO part number from Table IV with prefix S, as in S31A70.

Figure 9

OPTIONAL RESISTANCE TOLERANCES:

VECO bead-in-glass probes are available with other than listed resistance tolerances at 25°C. To order any special tolerance, add as a suffix to the VECO part number the percentage and the

desired tolerance, as in 31A70%5, S31A70%10 or ZS31A70%15, etc. When the tolerance shown in the accompanying table is acceptable, it is not necessary to augment the part number.

TABLE IV — STANDARD VECO 0.020" GLASS PROBES. (SEE FIGURE 9)

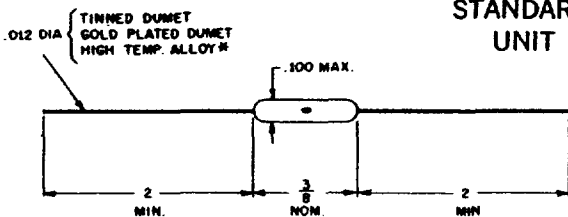
VECO Part Number	Zero-Power Resistance R_0 @ 25°C (Ohms)	Temp. Coeff. α @ 25°C (%/°C)	Ratio		R-T Curve (Page 5)	VECO Part Number	Zero-Power Resistance R_0 @ 25°C (Ohms)	Temp. Coeff. α @ 25°C (%/°C)	Ratio		R-T Curve (Page 5)
			R_0 @ 0°C	R_0 @ 25°C					R_0 @ 0°C	R_0 @ 25°C	
31A70	1000 ± 25%	-3.3	5.2	13.2	A	48A23	75,000 ± 25%	-4.4	9.2	30.1	F
32A224	1500 ± 25%	-3.4	5.6	14.6	B	51A108	100,000 ± 25%	-4.4	9.2	30.1	F
32A91	2000 ± 25%	-3.4	5.6	14.6	B	52A49	150,000 ± 25%	-4.4	9.4	31.1	G
33A62	2500 ± 25%	-3.4	5.6	14.6	B	52A50	200,000 ± 25%	-4.4	9.4	31.1	G
33A63	3000 ± 25%	-3.4	5.6	14.6	B	53A34	250,000 ± 25%	-4.5	9.6	32.1	G
34A42	4000 ± 25%	-3.6	6.0	16.1	B2	53A35	300,000 ± 25%	-4.5	9.6	32.1	G
35A40	5000 ± 25%	-3.6	6.0	16.1	B2	54A32	400,000 ± 25%	-4.6	10.3	35.8	H
38A34	7500 ± 25%	-3.8	6.8	19.3	C	55A27	500,000 ± 25%	-4.6	10.3	35.8	H
38A35	8000 ± 25%	-3.8	6.9	19.7	C	58A20	750,000 ± 25%	-4.7	10.9	39.4	I
41A40	10,000 ± 25%	-3.9	7.1	20.6	D	61A26	1 Meg ± 25%	-4.7	10.9	39.4	Q
42A70	15,000 ± 25%	-3.9	7.1	20.6	D	62A41	1.5 Meg ± 25%	-5.0	12.3	49.6	P
42A71	20,000 ± 25%	-3.9	7.2	21.0	D	62A42	2 Meg ± 25%	-5.0	12.3	49.6	P
43A58	25,000 ± 25%	-3.9	7.2	21.0	D	63A33	2.5 Meg ± 25%	-5.0	12.3	49.6	P
43A59	30,000 ± 25%	-3.9	7.3	21.4	D3	63A34	3 Meg ± 25%	-5.0	12.3	49.6	P
44A31	40,000 ± 25%	-4.0	7.4	21.8	D3	64A20	4 Meg ± 25%	-5.0	12.6	51.9	J
45A54	50,000 ± 25%	-4.0	7.4	21.8	D3	65A26	5 Meg ± 25%	-5.0	12.6	51.9	J

SEE FRONT PAGE FOR NOMINAL DISSIPATION AND TIME CONSTANTS

All dimensions in inches

* Pat. pend.

0.100" GLASS RODS



STANDARD UNIT

- Tinned Dumet leads: Order by VECO part number direct from Table V.
- Gold plated Dumet leads for improved solderability and weldability: Order by VECO part number from Table V with prefix U, as in U21A7.
- High temperature alloy leads* for continuous operation at temperatures in excess of 500°C: Order by VECO part number from Table V with prefix W, as in W21A7.

Figure 12

OPTIONAL RESISTANCE TOLERANCES:

VECO bead-in-glass rods are available with other than listed resistance tolerances at 25°C. To order any special tolerance, add as a suffix to the VECO part number the percentage symbol and

the desired tolerance, as in 21A7%5, U21A7%10 or W21A7%1, etc. When the tolerance shown in the accompanying table is acceptable, it is not necessary to augment the part number.

TABLE V — STANDARD VECO 0.100" GLASS RODS. (SEE FIGURE 12)

VECO Part Number	Zero-Power Resistance $R_0 @ 25^\circ\text{C}$ (Ohms)	Temp. Coeff. $\alpha @ 25^\circ\text{C}$ (%/°C)	Ratio		R-T Curve (Page 5)	VECO Part Number	Zero-Power Resistance $R_0 @ 25^\circ\text{C}$ (Ohms)	Temp. Coeff. $\alpha @ 25^\circ\text{C}$ (%/°C)	Ratio		R-T Curve (Page 5)
			$R_0 @ 0^\circ\text{C}$	$R_0 @ 25^\circ\text{C}$					$R_0 @ 0^\circ\text{C}$	$R_0 @ 25^\circ\text{C}$	
			$R_0 @ 50^\circ\text{C}$	$R_0 @ 125^\circ\text{C}$					$R_0 @ 50^\circ\text{C}$	$R_0 @ 125^\circ\text{C}$	
21A7	100±20%	-3.2	5.1	12.9	A	45A36	50,000±20%	-4.5	9.5	31.5	G
22A9	150±20%	-3.2	5.1	12.9	A	48A4	75,000±20%	-4.6	10.3	35.8	H
22A10	200±20%	-3.5	5.7	15.0	B	51A44	100,000±15%	-4.6	10.3	35.8	H
23A21	250±20%	-3.5	5.7	15.0	B	51A120	100,000±20%	-4.6	10.3	35.8	H
23A1	300±20%	-3.5	5.7	15.0	B	52A17	150,000±20%	-4.7	10.9	39.4	Q
24A1	400±20%	-3.6	6.1	16.5	B2	52A18	200,000±20%	-4.7	10.9	39.4	Q
25A12	500±20%	-3.6	6.1	16.5	B2	53A26	250,000±20%	-5.0	12.3	49.6	P
28A6	750±20%	-3.8	6.9	19.7	C	53A2	300,000±20%	-5.0	12.3	49.6	P
31A19	1000±20%	-3.8	6.9	19.7	C	54A6	400,000±20%	-5.0	12.3	49.6	P
32A168	1500±20%	-3.9	7.1	20.6	D	55A17	500,000±20%	-5.0	12.3	49.6	P
32A101	2000±20%	-3.9	7.1	20.6	D	58A1	750,000±20%	-5.0	12.6	51.9	J
33A54	2500±20%	-3.9	7.1	20.6	D	61A17	1 Meg±20%	-5.0	12.6	51.9	J
33A25	3000±20%	-3.9	7.2	21.0	D	62A7	1.5 Meg±20%	-5.0	12.6	51.9	J
34A11	4000±20%	-4.0	7.4	21.8	D3	62A8	2 Meg±20%	-5.0	12.6	51.9	J
35A29	5000±20%	-4.0	7.4	21.8	D3	63A25	2.5 Meg±20%	-5.1	13.2	56.8	J
37A1	7000±20%	-4.0	7.4	21.8	D3	63A2	3 Meg±20%	-5.1	13.2	56.8	J
38A8	7500±20%	-4.0	7.5	22.2	E	64A1	4 Meg±20%	-5.4	15.3	75.0	K
41A21	10,000±20%	-4.4	9.1	29.7	F	65A13	5 Meg±20%	-5.4	15.3	75.0	K
42A21	15,000±20%	-4.4	9.1	29.7	F	68A1	7.5 Meg±20%	-5.6	17.0	91.6	L
42A22	20,000±20%	-4.4	9.1	29.7	F	71A12	10 Meg±20%	-5.7	17.4	95.6	L
43A50	25,000±20%	-4.5	9.4	31.1	G	72A2	12 Meg±20%	-5.7	17.4	95.6	L
43A29	30,000±20%	-4.5	9.4	31.1	G	72A3	15 Meg±20%	-5.7	17.8	99.6	L
44A5	40,000±20%	-4.5	9.5	31.5	G						

† Note: Body length is 1/2 inch.

SEE FRONT PAGE FOR NOMINAL DISSIPATION AND TIME CONSTANTS

All dimensions in inches

* Pat. pend.

0.100" AND 0.060" GLASS MINIRODS

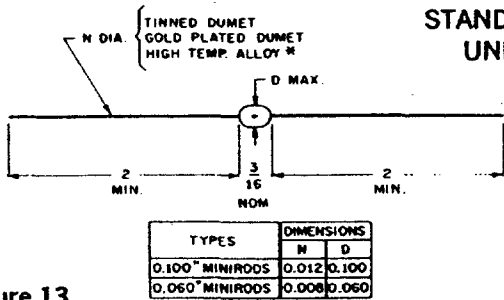


Figure 13

STANDARD UNIT

- Tinned Dumet leads: Order by VECO part number from Table VI.
- Gold plated Dumet leads for improved solderability and weldability: Order by VECO part number from Table VI with prefix U, as in U13A18 or U13A20.
- High temperature alloy leads* for continuous operation at temperatures in excess of 500°C: Order by VECO part number from Table VI with prefix W, as in W13A18 or W13A20.

OPTIONAL RESISTANCE TOLERANCES:

VECO bead-in-glass minirods are available with other than listed resistance tolerances at 25°C. To order any special tolerance, add as a suffix to the VECO part number the percentage symbol and the

desired tolerance, as in 13A18%5, U13A18%10 or W13A18%15, etc. When the tolerance shown in the accompanying tables is acceptable, it is not necessary to augment the part number.

TABLE VI — STANDARD VECO 0.100" AND 0.060" GLASS MINIRODS. (SEE FIGURE 13)

VECO Part Number		Zero-Power Resistance $R_0 @ 25^\circ\text{C}$ (Ohms)	Temp. Coeff. $\alpha @ 25^\circ\text{C}$ (%/°C)	Ratio		R-T Curve (Page 5)	VECO Part Number		Zero-Power Resistance $R_0 @ 25^\circ\text{C}$ (Ohms)	Temp. Coeff. $\alpha @ 25^\circ\text{C}$ (%/°C)	Ratio		R-T Curve (Page 5)
0.100"	0.060"			$R_0 @ 0^\circ\text{C}$	$R_0 @ 125^\circ\text{C}$		0.100"	0.060"			$R_0 @ 0^\circ\text{C}$	$R_0 @ 125^\circ\text{C}$	
13A18	13A20	30 ± 20%	-3.0	4.5	10.9	A	43A65	43A63	25,000 ± 20%	-4.5	9.4	31.1	G
14A14	14A16	40 ± 20%	-3.0	4.5	10.9	A	43A66	43A64	30,000 ± 20%	-4.5	9.4	31.1	G
15A18	15A20	50 ± 20%	-3.0	4.5	10.9	A	44A34	44A35	40,000 ± 20%	-4.5	9.5	31.5	G
18A14	18A16	75 ± 20%	-3.1	4.7	11.5	A	45A55	45A56	50,000 ± 20%	-4.5	9.5	31.5	G
21A19	21A21	100 ± 20%	-3.2	5.1	12.9	A1	48A26	48A25	75,000 ± 20%	-4.6	10.3	35.8	H
22A45	22A47	150 ± 20%	-3.2	5.1	12.9	A1	51A126	51A127	100,000 ± 20%	-4.6	10.3	35.8	H
22A41	22A40	200 ± 20%	-3.5	5.7	15.0	B	52A55	52A53	150,000 ± 20%	-4.7	10.9	39.4	Q
23A31	23A35	250 ± 20%	-3.5	5.7	15.0	B	52A56	52A54	200,000 ± 20%	-4.7	10.9	39.4	Q
23A32	23A36	300 ± 20%	-3.5	5.7	15.0	B	53A40	53A38	250,000 ± 20%	-5.0	12.3	49.6	P
24A17	24A19	400 ± 20%	-3.6	6.1	16.5	B2	53A41	53A39	300,000 ± 20%	-5.0	12.3	49.6	P
25A22	25A24	500 ± 20%	-3.6	6.1	16.5	B2	54A36	54A35	400,000 ± 20%	-5.0	12.3	49.6	P
28A18	28A19	750 ± 20%	-3.8	6.9	19.7	C	55A29	55A30	500,000 ± 20%	-5.0	12.3	49.6	P
31A76	31A78	1000 ± 20%	-3.8	6.9	19.7	C	58A23	58A22	750,000 ± 20%	-5.0	12.6	51.9	J
32A232	32A236	1500 ± 20%	-3.9	7.1	20.6	D	61A29	61A28	1 Meg ± 20%	-5.0	12.6	51.9	J
32A233	32A237	2000 ± 20%	-3.9	7.1	20.6	D	62A45	62A49	1.5 Meg ± 20%	-5.0	12.6	51.9	J
33A67	33A69	2500 ± 20%	-3.9	7.1	20.6	D	62A46	62A50	2 Meg ± 20%	-5.0	12.6	51.9	J
33A68	33A70	3000 ± 20%	-3.9	7.2	21.0	D	63A38	63A40	2.5 Meg ± 20%	-5.1	13.2	56.8	J
34A46	34A48	4000 ± 20%	-4.0	7.4	21.8	D3	63A37	63A39	3 Meg ± 20%	-5.1	13.2	56.8	J
35A42	35A44	5000 ± 20%	-4.0	7.4	21.8	D3	64A23	64A22	4 Meg ± 20%	-5.4	15.3	75.0	K
38A38	38A40	7500 ± 20%	-4.0	7.5	22.2	D3	65A29	65A28	5 Meg ± 20%	-5.4	15.3	75.0	K
41A43	41A45	10,000 ± 20%	-4.4	9.1	29.7	F	68A17	68A18	7.5 Meg ± 20%	-5.6	17.0	91.6	L
42A76	42A80	15,000 ± 20%	-4.4	9.1	29.7	F	71A32	71A33	10 Meg ± 20%	-5.7	17.4	95.6	L
42A77	42A81	20,000 ± 20%	-4.4	9.1	29.7	F	72A18	72A17	15 Meg ± 20%	-5.7	17.8	99.6	L

SEE FRONT PAGE FOR NOMINAL DISSIPATION AND TIME CONSTANTS

All dimensions in inches

* Pat. pend.

MATCHING AND CALIBRATION OPTIONS

1. VECO thermistor resistances can be recorded at one or more specified points over the range of -80°C and $+300^{\circ}\text{C}$ to within the accuracies defined in the following table:

TABLE 7 — Thermistor Calibration

Calibration Schedule Number	Tolerance on Resistance	Tolerance on Ambient Temperature
I	$\pm 0.01\%$	$\pm 0.01^{\circ}\text{C}$
II	$\pm 0.05\%$	$\pm 0.01^{\circ}\text{C}$
III	$\pm 0.05\%$	$\pm 0.02^{\circ}\text{C}$
IV	$\pm 0.05\%$	$\pm 0.03^{\circ}\text{C}$
V*	$\pm 0.10\%$	$\pm 0.05^{\circ}\text{C}$

*If calibration is requested without tolerances or schedule number, Schedule No. V will be supplied.

2. VECO thermistors can be supplied to meet close resistance tolerances at one or more temperature points and expanded tolerances (to allow for Beta variation) at distant points.

3. VECO thermistors can be supplied to track a nominal resistance vs. temperature curve to within a stated tolerance over a specified range. Unless special resistance vs. temperature curves (developed for this type of application) are cited, the actual curve that the units in this category will follow will be furnished by VECO. Subsequent units will meet the same specifications.

4. VECO thermistors can be supplied such that the units within a group (pairs, triplets, etc.) track each other at one or more discrete points or over a specified temperature range to within a given tolerance on resistance. In this option it is not required that units in different groups track each other. When ordering, specify the number of units in a group and the nominal resistance of the groups at the reference temperature(s).

5. VECO thermistors can be supplied such that their resistance ratio (resistance at temperature T divided by resistance at a reference temperature) vs. temperature characteristics follow a nominal curve over a specified temperature range to within a stated tolerance.

VECO offers *EXPERIENCE*

Bead thermistors have been designed and manufactured by VECO since 1942.

VECO offers *SERVICE*

Inquiries for special requirements are welcomed by VECO's staff of experienced engineers.

VECO offers *ACCURACY*

Unequaled investment in the most precise test equipment, standards, and controlled environmental baths and chambers provides unparalleled thermistor calibration accuracy. Calibrations are performed with accuracies of 0.01% or better on resistance and 0.01°C or better on temperature.

VECO offers unsurpassed *QUALITY CONTROL*

Every VECO thermistor undergoes a minimum of 17 tests and inspections during its manufacture. Stringent quality control has gained VECO an enviable reputation for high quality achievement.

VECO offers the ultimate in *RELIABILITY*

For example, a Bell Telephone Laboratories reliability group reported that VECO Titan I sensors compiled approximately 10^6 sensor hours of operation without a single failure.

VECO offers *FAST DELIVERY*

Ready for immediate shipment are a variety of thermistor beads, glass probes, glass rods, disks, rods, washers, and assemblies in a wide range of resistance values.



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Available VECO Technical Bulletins

MDRW031	Thermistor Disk, Rod, & Washer
SL2	Lax Thermistors
MMT102	Military Grade Thermistors
MTD131	Thermistor Terminology
MTM141	Isotherm Matched Thermistors
MSD82	Thermistor Sensor Assemblies
MGR061	Glass Probe and Rod Thermistors
VM2056	Thinistors-Thick film Flake Thermistors