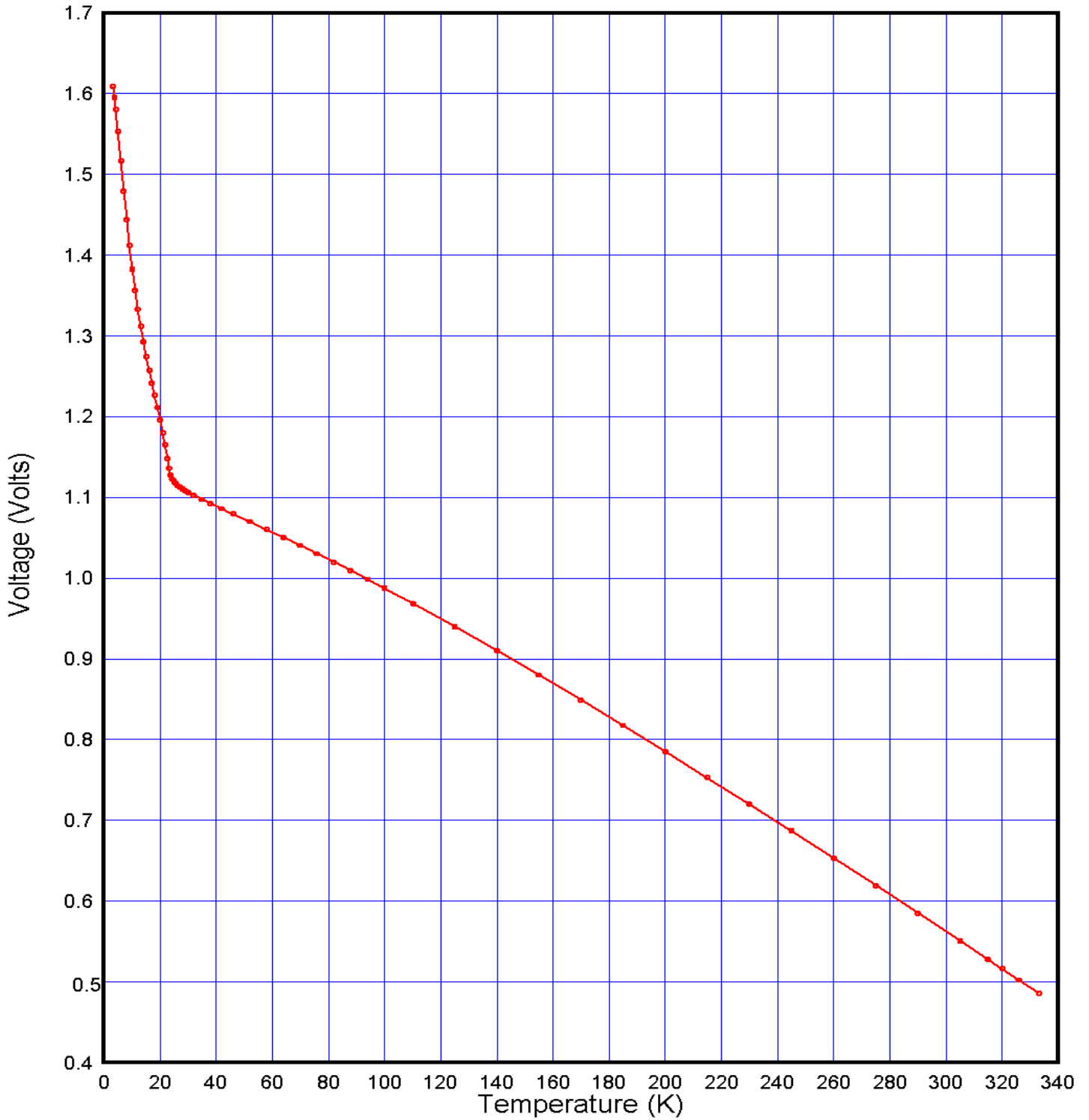


DATA PLOT

Calibration Report: 419116
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode
Temperature Range: 4.00K to 325K

Sales Order: 12176
Serial Number: D48910
Sensor Excitation: 10 μ A \pm 0.05%



TEST DATA

Calibration Report: 419116
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode
Temperature Range: 4.00K to 325K

Sales Order: 12176
Serial Number: D48910
Sensor Excitation: 10 μ A \pm 0.05%

Index	Temperature (K)	Voltage (V)	Index	Temperature (K)	Voltage (V)
1	3.20446	1.60886	36	41.8992	1.08616
2	3.71147	1.59513	37	45.8994	1.07981
3	4.19818	1.58057	38	51.9044	1.07021
4	5.00571	1.55352	39	57.8998	1.06051
5	6.01469	1.51697	40	63.9050	1.05064
6	7.02780	1.47967	41	69.9041	1.04062
7	8.04230	1.44426	42	75.9149	1.03038
8	9.06340	1.41189	43	81.9052	1.02000
9	10.0801	1.38290	44	87.9149	1.00939
10	11.0906	1.35682	45	93.9136	0.998609
11	12.0945	1.33323	46	99.9142	0.987639
12	13.0930	1.31182	47	110.017	0.968781
13	14.0881	1.29230	48	124.904	0.940189
14	15.0826	1.27431	49	139.923	0.910500
15	16.0693	1.25760	50	154.921	0.880121
16	17.0535	1.24178	51	169.926	0.849105
17	18.0375	1.22650	52	184.919	0.817565
18	19.0232	1.21143	53	199.909	0.785552
19	20.0099	1.19621	54	214.913	0.753075
20	21.0020	1.18006	55	229.942	0.720148
21	21.7934	1.16546	56	244.930	0.686949
22	22.5909	1.14824	57	259.935	0.653384
23	23.1831	1.13617	58	274.949	0.619482
24	23.7882	1.12761	59	289.951	0.585330
25	24.3819	1.12264	60	304.954	0.550927
26	24.9686	1.11946	61	314.962	0.527859
27	25.5535	1.11711	62	319.974	0.516275
28	26.3434	1.11459	63	325.985	0.502360
29	27.1282	1.11250	64	332.981	0.486132
30	27.9300	1.11061			
31	28.9272	1.10846			
32	29.9259	1.10646			
33	31.9222	1.10272			
34	34.9185	1.09748			
35	37.9063	1.09254			



POLYNOMIAL EQUATION

Calibration Report: 419116
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode
Temperature Range: 4.00K to 325K

Sales Order: 12176
Serial Number: D48910
Sensor Excitation: 10 μ A \pm 0.05%

Polynomial Type: Chebychev
Useful Range of Fit:

4.00K to 25.0K
1.587 Volt to 1.119 Volt

Lower and Upper limits of voltage used in computing Chebychev coefficients:
ZL = 1.114586426 ZU = 1.608859296

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	12.760964	3.6101E-03	3534.79
1	-10.790402	5.4310E-03	-1986.81
2	1.665381	5.0872E-03	327.37
3	-0.256579	5.1658E-03	-49.67
4	-0.140016	5.1675E-03	-27.10
5	-0.111128	5.0944E-03	-21.81
6	0.174574	4.9489E-03	35.28
7	-0.201769	4.8397E-03	-41.69
8	0.166125	4.7573E-03	34.92
9	-0.122285	4.7178E-03	-25.92
10	0.082565	4.7720E-03	17.30
11	-0.056750	4.9941E-03	-11.36
12	0.039178	5.1763E-03	7.57
13	-0.022842	5.0767E-03	-4.50
14	0.018260	4.7047E-03	3.88

Z = voltage

$$X = ((Z-ZL)-(ZU-Z))/(ZU-ZL)$$

Temp. (K) = $\sum A_i \cdot \text{COS}(i \cdot \text{ARCCOS}(X))$, where $0 \leq i \leq 14$
and the A_i 's are the coefficients in the table above.



POLYNOMIAL EQUATION

Calibration Report: 419116
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode
Temperature Range: 4.00K to 325K

Sales Order: 12176
Serial Number: D48910
Sensor Excitation: 10 μ A \pm 0.05%

Polynomial Type: Chebychev
Temp. (K) vs. voltage

	V Meas. (V)	T Meas. (K)	T Eq. (K)	T diff. (mK)
1	1.608859	3.20446	3.20527	-0.81
2	1.595127	3.71147	3.70728	4.19
3	1.580566	4.19818	4.20517	-6.99
4	1.553517	5.00571	4.99816	7.55
5	1.516967	6.01469	6.02351	-8.81
6	1.479667	7.02780	7.01890	8.90
7	1.444258	8.04230	8.04539	-3.09
8	1.411889	9.06340	9.07036	-6.96
9	1.382898	10.08013	10.07302	7.11
10	1.356824	11.09059	11.08455	6.04
11	1.333227	12.09453	12.10079	-6.26
12	1.311824	13.09302	13.10140	-8.37
13	1.292299	14.08812	14.08711	1.01
14	1.274311	15.08256	15.07266	9.90
15	1.257601	16.06935	16.06271	6.64
16	1.241779	17.05346	17.05767	-4.21
17	1.226497	18.03748	18.04917	-11.69
18	1.211428	19.02318	19.02932	-6.14
19	1.196207	20.00988	19.99944	10.44
20	1.180058	21.00202	20.98578	16.24
21	1.165457	21.79342	21.80496	-11.54
22	1.148244	22.59094	22.61514	-24.20
23	1.136174	23.18307	23.15620	26.87
24	1.127615	23.78824	23.77100	17.24
25	1.122643	24.38188	24.39762	-15.74
26	1.119459	24.96856	24.98740	-18.84
27	1.117107	25.55347	25.55656	-3.09
28	1.114586	26.34340	26.32879	14.61

Order of Fit = 14 RMS error of fit = 11.66 mK
Largest absolute error = 26.87 mK at data point no. 23



POLYNOMIAL EQUATION

Calibration Report: 419116
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode
Temperature Range: 4.00K to 325K

Sales Order: 12176
Serial Number: D48910
Sensor Excitation: 10 μ A \pm 0.05%

Polynomial Type: Chebychev
Useful Range of Fit:

25.0K to 87.9K
1.119 Volt to 1.009 Volt

Lower and Upper limits of voltage used in computing Chebychev coefficients:
ZL = 0.9876393752 ZU = 1.127614996

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	59.967268	5.0622E-03	11846.19
1	-39.823032	1.0046E-02	-3964.18
2	1.028498	8.1894E-03	125.59
3	1.530294	7.2405E-03	211.35
4	0.827920	4.8874E-03	169.40
5	0.334172	3.8068E-03	87.78
6	0.071622	3.9954E-03	17.93
7	-0.038931	5.5841E-03	-6.97
8	-0.036648	6.7016E-03	-5.47
9	-0.043613	7.8099E-03	-5.58
10	-0.007188	7.2051E-03	-1.00
11	-0.021709	5.9397E-03	-3.65

Z = voltage

$$X = ((Z-ZL)-(ZU-Z))/(ZU-ZL)$$

Temp. (K) = $\sum A_i \cdot \text{COS}(i \cdot \text{ARCCOS}(X))$, where $0 \leq i \leq 11$
and the A_i 's are the coefficients in the table above.



POLYNOMIAL EQUATION

Calibration Report: 419116
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode
Temperature Range: 4.00K to 325K

Sales Order: 12176
Serial Number: D48910
Sensor Excitation: 10 μ A \pm 0.05%

Polynomial Type: Chebychev
Temp. (K) vs. voltage

	V Meas. (V)	T Meas. (K)	T Eq. (K)	T diff. (mK)
24	1.127615	23.77100	23.78865	-0.41
25	1.122643	24.39762	24.38353	-1.65
26	1.119459	24.98740	24.95907	9.49
27	1.117107	25.55347	25.55253	0.94
28	1.114586	26.34340	26.35361	-10.21
29	1.112497	27.12824	27.13882	-10.58
30	1.110610	27.92995	27.93285	-2.90
31	1.108464	28.92715	28.92100	6.15
32	1.106462	29.92592	29.91319	12.73
33	1.102720	31.92219	31.91133	10.86
34	1.097482	34.91848	34.92961	-11.13
35	1.092539	37.90634	37.92175	-15.41
36	1.086156	41.89921	41.89240	6.82
37	1.079812	45.89943	45.88602	13.41
38	1.070212	51.90439	51.91193	-7.54
39	1.060509	57.89976	57.90613	-6.36
40	1.050642	63.90499	63.89760	7.40
41	1.040615	69.90410	69.90173	2.37
42	1.030383	75.91491	75.92353	-8.62
43	1.019999	81.90519	81.89827	6.91
44	1.009388	87.91494	87.91780	-2.86
45	0.9986093	93.91361	93.91297	0.63
46	0.9876394	99.91423	99.91429	-0.06

Order of Fit = 11 RMS error of fit = 8.11 mK
Largest absolute error = -15.41 mK at data point no. 35



POLYNOMIAL EQUATION

Calibration Report: 419116
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode
Temperature Range: 4.00K to 325K

Sales Order: 12176
Serial Number: D48910
Sensor Excitation: 10 μ A \pm 0.05%

Polynomial Type: Chebychev
Useful Range of Fit:

87.9K to 325.K
1.009 Volt to 0.5046 Volt

Lower and Upper limits of voltage used in computing Chebychev coefficients:
ZL = 0.4861322063 ZU = 1.030383424

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	208.735311	2.5137E-04	830392.16
1	-127.538261	3.6868E-04	-345935.40
2	-4.023793	3.6239E-04	-11103.39
3	-0.911301	3.7176E-04	-2451.32
4	-0.245613	3.6356E-04	-675.57
5	-0.080804	3.4490E-04	-234.28
6	-0.017930	3.3204E-04	-54.00
7	-0.003775	3.3290E-04	-11.34

Z = voltage

$$X = ((Z-ZL)-(ZU-Z))/(ZU-ZL)$$

Temp. (K) = $\sum A_i * \text{COS}(i * \text{ARCCOS}(X))$, where $0 \leq i \leq 7$
and the A_i 's are the coefficients in the table above.



POLYNOMIAL EQUATION

Calibration Report: 419116
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode
Temperature Range: 4.00K to 325K

Sales Order: 12176
Serial Number: D48910
Sensor Excitation: 10 μ A \pm 0.05%

Polynomial Type: Chebychev
Temp. (K) vs. voltage

	V Meas. (V)	T Meas. (K)	T Eq. (K)	T diff. (mK)
42	1.030383	75.92353	75.91383	1.08
43	1.019999	81.89827	81.90712	-1.93
44	1.009388	87.91780	87.91604	-1.10
45	0.9986093	93.91361	93.91198	1.63
46	0.9876394	99.91423	99.91271	1.52
47	0.9687806	110.01676	110.01701	-0.25
48	0.9401891	124.90376	124.90520	-1.45
49	0.9105000	139.92255	139.92290	-0.35
50	0.8801213	154.92136	154.92099	0.37
51	0.8491048	169.92604	169.92494	1.11
52	0.8175651	184.91856	184.91875	-0.20
53	0.7855524	199.90866	199.90869	-0.03
54	0.7530746	214.91326	214.91346	-0.20
55	0.7201479	229.94175	229.94273	-0.99
56	0.6869495	244.93028	244.93053	-0.25
57	0.6533843	259.93487	259.93318	1.69
58	0.6194817	274.94934	274.94925	0.10
59	0.5853304	289.95074	289.95142	-0.67
60	0.5509269	304.95380	304.95455	-0.75
61	0.5278592	314.96179	314.96161	0.18
62	0.5162748	319.97371	319.97358	0.14
63	0.5023596	325.98502	325.98404	0.98
64	0.4861322	332.98149	332.98212	-0.63

Order of Fit = 7 RMS error of fit = .96 mK
Largest absolute error = -1.93 mK at data point no. 43



INTERPOLATION TABLE

Calibration Report: 419116
 Sensor Model: DT-670-SD-4L
 Sensor Type: Silicon Diode
 Temperature Range: 4.00K to 325K

Sales Order: 12176
 Serial Number: D48910
 Sensor Excitation: 10 μ A \pm 0.05%

Temp (K)	Volts (V)	dV/dT (mV/K)	Temp (K)	Volts (V)	dV/dT (mV/K)
4.000	1.58667	-30.178	37.00	1.09402	-1.6394
4.200	1.58051	-31.416	38.00	1.09239	-1.6205
4.400	1.57411	-32.593	39.00	1.09077	-1.6058
4.600	1.56748	-33.602	40.00	1.08917	-1.5951
4.800	1.56068	-34.441	42.00	1.08600	-1.5854
5.000	1.55372	-35.112	44.00	1.08283	-1.5853
5.200	1.54664	-35.653	46.00	1.07965	-1.5897
5.400	1.53946	-36.106	48.00	1.07647	-1.5959
5.600	1.53220	-36.470	50.00	1.07327	-1.6021
5.800	1.52488	-36.748	52.00	1.07006	-1.6082
6.000	1.51751	-36.937	54.00	1.06683	-1.6148
6.500	1.49901	-36.953	56.00	1.06360	-1.6222
7.000	1.48067	-36.264	58.00	1.06035	-1.6304
7.500	1.46283	-35.051	60.00	1.05708	-1.6391
8.000	1.44567	-33.536	65.00	1.04882	-1.6618
8.500	1.42933	-31.866	70.00	1.04045	-1.6870
9.000	1.41380	-30.244	75.00	1.03195	-1.7132
9.500	1.39907	-28.702	77.35	1.02791	-1.7252
10.00	1.38508	-27.289	80.00	1.02332	-1.7392
10.50	1.37176	-25.997	85.00	1.01456	-1.7662
11.00	1.35906	-24.807	90.00	1.00566	-1.7921
11.50	1.34694	-23.699	95.00	0.996637	-1.8184
12.00	1.33536	-22.630	100.0	0.987481	-1.8435
12.50	1.32430	-21.608	105.0	0.978204	-1.8671
13.00	1.31374	-20.654	110.0	0.968812	-1.8895
13.50	1.30363	-19.766	115.0	0.959311	-1.9109
14.00	1.29396	-18.938	120.0	0.949706	-1.9311
14.50	1.28468	-18.187	125.0	0.940001	-1.9503
15.00	1.27576	-17.547	130.0	0.930204	-1.9686
15.50	1.26712	-17.000	135.0	0.920317	-1.9860
16.00	1.25874	-16.519	140.0	0.910345	-2.0026
16.50	1.25059	-16.109	145.0	0.900292	-2.0184
17.00	1.24262	-15.782	150.0	0.890163	-2.0333
17.50	1.23480	-15.536	155.0	0.879960	-2.0475
18.00	1.22707	-15.366	160.0	0.869689	-2.0610
18.50	1.21942	-15.276	165.0	0.859352	-2.0739
19.00	1.21178	-15.275	170.0	0.848950	-2.0864
19.50	1.20412	-15.394	175.0	0.838488	-2.0983
20.00	1.19636	-15.672	180.0	0.827968	-2.1097
21.00	1.18009	-17.111	185.0	0.817392	-2.1205
22.00	1.16116	-21.252	190.0	0.806764	-2.1308
23.00	1.13961	-19.734	195.0	0.796085	-2.1409
24.00	1.12554	-8.8865	200.0	0.785356	-2.1506
25.00	1.11932	-4.4962	205.0	0.774579	-2.1601
26.00	1.11561	-3.1287	210.0	0.763755	-2.1694
27.00	1.11282	-2.5332	215.0	0.752886	-2.1783
28.00	1.11045	-2.2322	220.0	0.741972	-2.1870
29.00	1.10831	-2.0577	225.0	0.731017	-2.1953
30.00	1.10632	-1.9441	230.0	0.720019	-2.2034
31.00	1.10441	-1.8659	235.0	0.708983	-2.2113
32.00	1.10258	-1.8083	240.0	0.697907	-2.2189
33.00	1.10079	-1.7631	245.0	0.686794	-2.2262
34.00	1.09905	-1.7239	250.0	0.675645	-2.2335
35.00	1.09734	-1.6908	255.0	0.664459	-2.2407
36.00	1.09567	-1.6628	260.0	0.653238	-2.2479



INTERPOLATION TABLE

Calibration Report: 419116
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode
Temperature Range: 4.00K to 325K

Sales Order: 12176
Serial Number: D48910
Sensor Excitation: 10 μ A \pm 0.05%

<u>Temp (K)</u>	<u>Volts (V)</u>	<u>dV/dT (mV/K)</u>	<u>Temp (K)</u>	<u>Volts (V)</u>	<u>dV/dT (mV/K)</u>
265.0	0.641981	-2.2549	285.0	0.596630	-2.2796
270.0	0.630690	-2.2615	290.0	0.585218	-2.2853
273.15	0.623560	-2.2654	295.0	0.573778	-2.2907
275.0	0.619367	-2.2677	300.0	0.562311	-2.2958
280.0	0.608013	-2.2737	305.0	0.550821	-2.3005
			310.0	0.539307	-2.3050
			315.0	0.527771	-2.3094
			320.0	0.516214	-2.3130
			325.0	0.504641	-2.3161



THERMAL CYCLE TESTING

Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode

Serial Number: D48910

This sensor was tested for repeatability through rapid thermal cycles from room temperature into liquid helium. During this test, the following four lead voltage values were recorded:

Room Temperature:	0.5507V
Liquid Nitrogen:	1.028V
Liquid Helium:	1.581V

The nitrogen and helium values were recorded in OPEN dewars, so precision comparisons with calibration values or other dip test values should not be made.

Recommended Operating Parameters:

For sensors calibrated by LSCI the current to the sensor is adjusted to maintain the sensor output voltage at the values listed below. In order to minimize possible self-heating errors, we suggest that these same guidelines be followed in using the sensor:

Above 1K:	1 to 3 mV
0.1 to 1K:	0.1 mV
Below 0.1K:	0.03 mV

Lead Identification:

NONE

To avoid possible damage to the sensor, do not exceed 1 Volt and do not exceed 100 mA current.



BREAKPOINTS 340 FORMAT

Calibration Report: 419116
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode
Temperature Range: 4.00K to 325K

Sales Order: 12176
Serial Number: D48910

Name: DT-670-SD-4L
Serial number: D48910
Format: 2 ;Volts/Kelvin
Limit: 325.

Coefficient: 1 ;Negative

Point 1: .504664,325.000 Point 56: 1.13954, 23.000
Point 2: .547391,306.500 Point 57: 1.15236, 22.400
Point 3: .585240,290.000 Point 58: 1.16336, 21.900
Point 4: .619388,275.000 Point 59: 1.17311, 21.400
Point 5: .651010,261.000 Point 60: 1.18353, 20.800

Point 6: .681245,247.500 Point 61: 1.19483, 20.100
Point 7: .710108,234.500 Point 62: 1.20952, 19.150
Point 8: .737615,222.000 Point 63: 1.22858, 17.900
Point 9: .763775,210.000 Point 64: 1.24259, 17.000
Point 10: .788599,198.500 Point 65: 1.25461, 16.250

Point 11: .812104,187.500 Point 66: 1.26540, 15.600
Point 12: .834306,177.000 Point 67: 1.27573, 15.000
Point 13: .855218,167.000 Point 68: 1.28557, 14.450
Point 14: .874851,157.500 Point 69: 1.29583, 13.900
Point 15: .893227,148.500 Point 70: 1.30658, 13.350

Point 16: .910362,140.000 Point 71: 1.31682, 12.850
Point 17: .926276,132.000 Point 72: 1.32753, 12.350
Point 18: .941969,124.000 Point 73: 1.33874, 11.850
Point 19: .956456,116.500 Point 74: 1.35048, 11.350
Point 20: .969772,109.500 Point 75: 1.36277, 10.850

Point 21: .982875,102.500 Point 76: 1.37564, 10.350
Point 22: .992998, 97.000 Point 77: 1.38915, 9.850
Point 23: 1.00117, 92.500 Point 78: 1.40335, 9.350
Point 24: 1.00924, 88.000 Point 79: 1.41831, 8.850
Point 25: 1.01721, 83.500 Point 80: 1.43408, 8.350

Point 26: 1.02507, 79.000 Point 81: 1.45068, 7.850
Point 27: 1.03282, 74.500 Point 82: 1.46983, 7.300
Point 28: 1.04046, 70.000 Point 83: 1.49525, 6.600
Point 29: 1.04800, 65.500 Point 84: 1.53081, 5.640
Point 30: 1.05544, 61.000 Point 85: 1.55308, 5.020

Point 31: 1.06296, 56.400 Point 86: 1.56889, 4.560
Point 32: 1.07135, 51.200 Point 87: 1.58056, 4.200
Point 33: 1.07998, 45.800 Point 88: 1.58667, 4.000
Point 34: 1.08949, 39.800
Point 35: 1.09352, 37.300

Point 36: 1.09683, 35.300
Point 37: 1.09974, 33.600
Point 38: 1.10239, 32.100
Point 39: 1.10478, 30.800
Point 40: 1.10690, 29.700

Point 41: 1.10872, 28.800
Point 42: 1.11044, 28.000
Point 43: 1.11207, 27.300
Point 44: 1.11359, 26.700
Point 45: 1.11500, 26.200

Point 46: 1.11658, 25.700
Point 47: 1.11805, 25.300
Point 48: 1.11931, 25.000
Point 49: 1.12076, 24.700
Point 50: 1.12251, 24.400

Point 51: 1.12466, 24.100
Point 52: 1.12646, 23.900
Point 53: 1.12859, 23.700
Point 54: 1.13115, 23.500
Point 55: 1.13417, 23.300



BREAKPOINTS 91C/93C/330 FORMAT

Calibration Report: 419116
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode
Temperature Range: 4.00K to 325K

Sales Order: 12176
Serial Number: D48910

Interpolation Method: Straight Line
Limit: 325. (Kelvin)
Format: 2 (Volts/Kelvin)
Number of Breakpoints: 29

No.	Units	Temperature (K)	No.	Units	Temperature (K)
1	0.504740	325.0	16	1.10435	31.0
2	0.573810	295.0	17	1.11039	28.0
3	0.642070	265.0	18	1.11282	27.0
4	0.709070	235.0	19	1.11561	26.0
5	0.763820	210.0	20	1.11932	25.0
6	0.817480	185.0	21	1.12554	24.0
7	0.869790	160.0	22	1.13961	23.0
8	0.910410	140.0	23	1.18062	21.0
9	0.949800	120.0	24	1.26638	15.5
10	0.978250	105.0	25	1.32322	12.5
11	1.00573	90.0	26	1.38418	10.0
12	1.03202	75.0	27	1.46135	7.5
13	1.05714	60.0	28	1.57569	4.4
14	1.08607	42.0	29	1.58640	4.0
15	1.09560	36.0			

