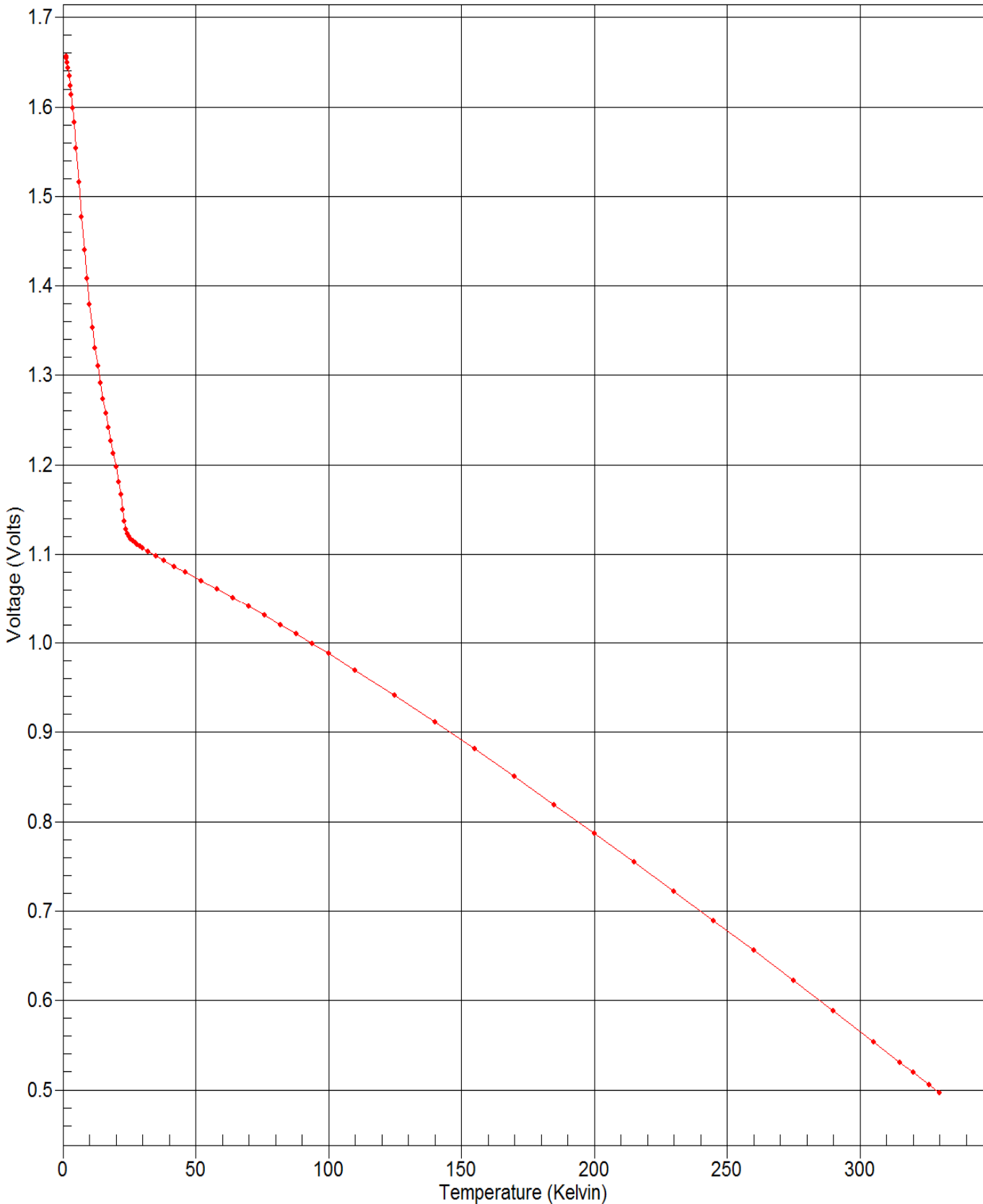


# DATA PLOT

Calibration Report: 674412  
Sensor Model: DT-670-SD-1.4L  
Sensor Type: Silicon Diode

Sales Order: 73928-D6028158  
Serial Number: D6028158  
Temperature Range: 1.40K to 325K



Lake Shore Cryotronics, Inc. • 575 McCorkle Boulevard • Westerville, OH 43082

Sales: (614) 891-2244 • Fax: (614) 891-1392 • sales@lakeshore.com • www.lakeshore.com

# TEST DATA

Calibration Report: 674412  
Sensor Model: DT-670-SD-1.4L  
Sensor Type: Silicon Diode

Sales Order: 73928-D6028158  
Serial Number: D6028158  
Temperature Range: 1.40K to 325K

Index	Temp. (K)	Voltage (V)	Excitation	Index	Temp. (K)	Voltage (V)	Excitation
1	1.20168	1.65673	10µA±0.1%	41	35.0300	1.09749	10µA±0.1%
2	1.29969	1.65554	10µA±0.1%	42	38.0268	1.09257	10µA±0.1%
3	1.40049	1.65420	10µA±0.1%	43	42.0241	1.08622	10µA±0.1%
4	1.69985	1.64946	10µA±0.1%	44	46.0274	1.07989	10µA±0.1%
5	2.00082	1.64352	10µA±0.1%	45	52.0318	1.07031	10µA±0.1%
6	2.39542	1.63432	10µA±0.1%	46	58.0254	1.06064	10µA±0.1%
7	2.79630	1.62399	10µA±0.1%	47	64.0180	1.05081	10µA±0.1%
8	3.19892	1.61306	10µA±0.1%	48	70.0128	1.04081	10µA±0.1%
9	3.70109	1.59860	10µA±0.1%	49	76.0088	1.03063	10µA±0.1%
10	4.20563	1.58258	10µA±0.1%	50	81.9985	1.02028	10µA±0.1%
11	5.02156	1.55361	10µA±0.1%	51	87.9967	1.00974	10µA±0.1%
12	6.02470	1.51557	10µA±0.1%	52	93.9950	0.999006	10µA±0.1%
13	7.04923	1.47699	10µA±0.1%	53	99.9953	0.988096	10µA±0.1%
14	8.09758	1.43973	10µA±0.1%	54	110.002	0.969524	10µA±0.1%
15	9.10515	1.40780	10µA±0.1%	55	124.985	0.940913	10µA±0.1%
16	10.1207	1.37931	10µA±0.1%	56	139.978	0.911438	10µA±0.1%
17	11.1400	1.35372	10µA±0.1%	57	154.986	0.881203	10µA±0.1%
18	12.1504	1.33073	10µA±0.1%	58	169.987	0.850358	10µA±0.1%
19	13.1558	1.30993	10µA±0.1%	59	184.980	0.818991	10µA±0.1%
20	14.1514	1.29102	10µA±0.1%	60	199.988	0.787113	10µA±0.1%
21	15.1403	1.27363	10µA±0.1%	61	214.991	0.754812	10µA±0.1%
22	16.1223	1.25735	10µA±0.1%	62	229.992	0.722116	10µA±0.1%
23	17.0936	1.24200	10µA±0.1%	63	244.989	0.689065	10µA±0.1%
24	18.0717	1.22698	10µA±0.1%	64	259.986	0.655682	10µA±0.1%
25	19.0473	1.21220	10µA±0.1%	65	274.992	0.621970	10µA±0.1%
26	20.0248	1.19719	10µA±0.1%	66	290.008	0.587959	10µA±0.1%
27	21.0113	1.18114	10µA±0.1%	67	305.018	0.553724	10µA±0.1%
28	21.8039	1.16656	10µA±0.1%	68	315.035	0.530752	10µA±0.1%
29	22.5952	1.14930	10µA±0.1%	69	320.036	0.519258	10µA±0.1%
30	23.1927	1.13649	10µA±0.1%	70	326.029	0.505454	10µA±0.1%
31	23.7863	1.12776	10µA±0.1%	71	330.037	0.496209	10µA±0.1%
32	24.3782	1.12272	10µA±0.1%				
33	24.9689	1.11951	10µA±0.1%				
34	25.5737	1.11709	10µA±0.1%				
35	26.3705	1.11459	10µA±0.1%				
36	27.1755	1.11247	10µA±0.1%				
37	27.9843	1.11059	10µA±0.1%				
38	28.9911	1.10846	10µA±0.1%				
39	29.9983	1.10646	10µA±0.1%				
40	32.0161	1.10271	10µA±0.1%				



# UNCERTAINTY ANALYSIS

Calibration Report: 674412  
 Sensor Model: DT-670-SD-1.4L  
 Sensor Type: Silicon Diode

Sales Order: 73928-D6028158  
 Serial Number: D6028158  
 Temperature Range: 1.40K to 325K

## Calibration Data Uncertainty

The uncertainties of the measured calibration data for Lake Shore's sensors are summarized in the table below. The values given are the combined uncertainty of the temperature measurement and the resistance or voltage measurement expressed as an equivalent temperature uncertainty in millikelvin (mK). Note that the values are the calibration uncertainty only and do not include the stability of the temperature sensor. The uncertainty analysis has followed the guidelines for determining measurement uncertainty as outlined in the ISO Guide to the Expression of Uncertainty in Measurement, NIST Technical Note 1297, and ANSI/NCSL Z540-2-1997. Since the uncertainty varies with temperature due to the variation of the sensor sensitivity and excitation, the table gives typical values at several different temperatures throughout the range of the calibration. The uncertainty is based on an approximate 95% confidence level with a coverage factor  $k = 2$ .

T (K)	Uncertainty ( $\pm$ mK)													
	GR	Cernox (CX)					RX			Platinum		RF-800	Diode	
		1010	1030	1050	1070	1080	102A	103A	202A	100 $\Omega$	25 $\Omega$	27 $\Omega$		
1.4	4	4	4	4			4	4	4				5	7
4.2	4	4	4	4	4		4	6	5				5	5
10	4	5	5	4	4		10	15	12				7	6
20	8	10	9	8	8	8	35	35	28	9	10		13	9
30	9	13	11	9	9	9	76	61	46	9	9		14	31
50	11	18	14	12	12	11				10	10		13	37
100	20	29	22	17	16	14				11	12		12	32
300		78	60	46	45	36				24	24		25	35
400		124	94	74	72	60				45	45		45	49
500										51	51			54

## Polynomial Fit Uncertainty

When a sensor is used to measure temperature, a polynomial fit to the measured calibration data is often used to convert the sensor resistance (R) or voltage (V) to a temperature (T). How well the polynomial represents the sensor calibration data is another source of uncertainty when using the sensor. In the polynomials provided with this set of calibration data, the standard deviation of the fit can be used as an estimate of this additional temperature uncertainty. The standard deviation of fit is determined from the following equation:

$$\sigma_{fit}^2 = \frac{\sum_{i=1}^N (T_i - T_{icalc})^2}{N - n} = \frac{N}{N - n} (\Delta T_{RMS})^2$$

where

- $\sigma_{fit}$  = standard deviation of the fit
- $T_i$  = measured temperature for point i
- $T_{icalc}$  = the temperature calculated from the polynomial equation for point i
- N = number of data points in fit range
- n = number of fit coefficients
- $\Delta T_{RMS}$  = root mean square deviation of fit

A value of  $\Delta T_{RMS}$  is given for each range of fit.

F008-04-00\_B (01/17/11)



# POLYNOMIAL EQUATION

Calibration Report: 674412  
Sensor Model: DT-670-SD-1.4L  
Sensor Type: Silicon Diode

Sales Order: 73928-D6028158  
Serial Number: D6028158  
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev  
Useful Range of Fit:

1.40 K to 12.1 K  
1.654 Volts to 1.331 Volts

Lower and Upper limits of Voltage used in computing Chebychev coefficients:  
ZL = 1.291019545      ZU = 1.656726646

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	7.482400	2.0201E-03	3704.00
1	-6.037119	2.9187E-03	-2068.45
2	0.301712	3.0013E-03	100.53
3	-0.382368	2.7977E-03	-136.67
4	-0.062876	2.6878E-03	-23.39
5	-0.027144	2.6362E-03	-10.30
6	-0.017018	2.6037E-03	-6.54
7	-0.013033	2.6008E-03	-5.01
8	-0.010156	2.6658E-03	-3.81
9	-0.010301	2.7890E-03	-3.69
10	-0.013201	2.7977E-03	-4.72

Z = Voltage

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

Temp. (K) =  $\sum A_i \cdot \text{COS}(i \cdot \text{ARCCOS}(k))$ , where  $0 \leq i \leq 10$   
and the  $A_i$ 's are the coefficients in the table above.

# POLYNOMIAL EQUATION

Calibration Report: 674412  
Sensor Model: DT-670-SD-1.4L  
Sensor Type: Silicon Diode

Sales Order: 73928-D6028158  
Serial Number: D6028158  
Temperature Range: 1.40K to 325K

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

	V Meas. (V)	T Meas. (K)	T Eq. (K)	T diff. (mK)
1	1.656727	1.20168	1.21090	-9.21
2	1.655544	1.29969	1.29915	0.54
3	1.654202	1.40049	1.39399	6.51
4	1.649456	1.69985	1.69128	8.57
5	1.643516	2.00082	2.00165	-0.83
6	1.634321	2.39542	2.40317	-7.76
7	1.623988	2.79630	2.80044	-4.15
8	1.613064	3.19892	3.19522	3.70
9	1.598601	3.70109	3.69367	7.42
10	1.582576	4.20563	4.20773	-2.10
11	1.553612	5.02156	5.02871	-7.14
12	1.515571	6.02470	6.01706	7.64
13	1.476991	7.04923	7.05228	-3.06
14	1.439725	8.09758	8.10110	-3.52
15	1.407796	9.10515	9.09883	6.32
16	1.379312	10.12069	10.12259	-1.90
17	1.353717	11.13999	11.14446	-4.48
18	1.330730	12.15038	12.14464	5.74
19	1.309925	13.15576	13.15858	-2.82
20	1.291020	14.15136	14.15083	0.53

Order of Fit = 10                      RMS error of fit = 5.42 mK  
Largest absolute error = -9.21 mK at data point no. 1



# POLYNOMIAL EQUATION

Calibration Report: 674412  
Sensor Model: DT-670-SD-1.4L  
Sensor Type: Silicon Diode

Sales Order: 73928-D6028158  
Serial Number: D6028158  
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev  
Useful Range of Fit:

12.2 K to 25.0 K  
1.331 Volts to 1.120 Volts

Lower and Upper limits of Voltage used in computing Chebychev coefficients:  
ZL = 1.114587277      ZU = 1.379312308

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	17.190300	9.1301E-03	1882.81
1	-7.704792	1.6659E-02	-462.50
2	0.471389	1.3983E-02	33.71
3	-0.003032	1.0777E-02	-0.28
4	0.205317	7.1677E-03	28.64
5	-0.270033	6.0718E-03	-44.47
6	0.221144	8.4324E-03	26.23
7	-0.116693	1.1740E-02	-9.94
8	0.106443	1.2722E-02	8.37
9	-0.024447	1.2210E-02	-2.00
10	0.045208	9.4244E-03	4.80

Z = Voltage

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

Temp. (K) =  $\sum A_i \cdot \text{COS}(i \cdot \text{ARCCOS}(k))$ , where  $0 \leq i \leq 10$   
and the  $A_i$ 's are the coefficients in the table above.

# POLYNOMIAL EQUATION

Calibration Report: 674412  
Sensor Model: DT-670-SD-1.4L  
Sensor Type: Silicon Diode

Sales Order: 73928-D6028158  
Serial Number: D6028158  
Temperature Range: 1.40K to 325K

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

	V Meas. (V)	T Meas. (K)	T Eq. (K)	T diff. (mK)
16	1.379312	10.12259	10.12081	-0.12
17	1.353717	11.14446	11.13857	1.41
18	1.330730	12.14464	12.15691	-6.54
19	1.309925	13.15576	13.14198	13.78
20	1.291020	14.15136	14.16117	-9.81
21	1.273627	15.14026	15.14769	-7.43
22	1.257351	16.12228	16.11403	8.25
23	1.241996	17.09361	17.08343	10.17
24	1.226981	18.07170	18.07669	-4.99
25	1.212198	19.04727	19.06056	-13.28
26	1.197189	20.02479	20.02441	0.38
27	1.181142	21.01126	20.99383	17.43
28	1.166562	21.80394	21.80515	-1.22
29	1.149302	22.59522	22.62106	-25.85
30	1.136494	23.19274	23.17244	20.30
31	1.127761	23.78629	23.76917	17.12
32	1.122721	24.37818	24.39108	-12.90
33	1.119509	24.96886	24.98482	-15.96
34	1.117092	25.57367	25.57613	-2.46
35	1.114587	26.37051	26.35880	11.71

Order of Fit = 10                      RMS error of fit = 12.25 mK  
Largest absolute error = -25.85 mK at data point no. 29



# POLYNOMIAL EQUATION

Calibration Report: 674412  
Sensor Model: DT-670-SD-1.4L  
Sensor Type: Silicon Diode

Sales Order: 73928-D6028158  
Serial Number: D6028158  
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev  
Useful Range of Fit:

25.0 K to 88.0 K  
1.120 Volts to 1.010 Volts

Lower and Upper limits of Voltage used in computing Chebychev coefficients:  
ZL = 0.9880956017      ZU = 1.127760838

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	60.009017	8.7799E-03	6834.79
1	-39.901604	1.5539E-02	-2567.81
2	1.066870	1.4700E-02	72.58
3	1.506978	1.0564E-02	142.65
4	0.854696	7.6616E-03	111.56
5	0.340004	3.5398E-03	96.05
6	0.069565	4.0030E-03	17.38
7	-0.025936	7.4484E-03	-3.48
8	-0.061352	1.0522E-02	-5.83
9	-0.022009	1.1407E-02	-1.93
10	-0.032446	1.1688E-02	-2.78
11	-0.002422	9.1539E-03	-0.26
12	-0.015996	6.4448E-03	-2.48

Z = Voltage

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

Temp. (K) =  $\sum A_i \cdot \text{COS}(i \cdot \text{ARCCOS}(k))$ , where  $0 \leq i \leq 12$   
and the  $A_i$ 's are the coefficients in the table above.



# POLYNOMIAL EQUATION

Calibration Report: 674412  
Sensor Model: DT-670-SD-1.4L  
Sensor Type: Silicon Diode

Sales Order: 73928-D6028158  
Serial Number: D6028158  
Temperature Range: 1.40K to 325K

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

	V Meas. (V)	T Meas. (K)	T Eq. (K)	T diff. (mK)
31	1.127761	23.76917	23.78536	0.92
32	1.122721	24.39108	24.38717	-8.99
33	1.119509	24.98482	24.95461	14.25
34	1.117092	25.57367	25.56829	5.38
35	1.114587	26.37051	26.37755	-7.04
36	1.112470	27.17552	27.18762	-12.09
37	1.110595	27.98433	27.98954	-5.21
38	1.108455	28.99112	28.98824	2.88
39	1.106459	29.99832	29.98847	9.85
40	1.102711	32.01609	32.00687	9.22
41	1.097491	35.02995	35.03657	-6.61
42	1.092573	38.02681	38.03663	-9.81
43	1.086222	42.02414	42.01808	6.06
44	1.079893	46.02745	46.02177	5.68
45	1.070315	52.03181	52.03871	-6.91
46	1.060635	58.02541	58.02373	1.68
47	1.050810	64.01799	64.01514	2.85
48	1.040812	70.01284	70.01657	-3.73
49	1.030635	76.00883	76.00648	2.35
50	1.020285	81.99850	81.99942	-0.92
51	1.009736	87.99669	87.99647	0.23
52	0.9990062	93.99497	93.99500	-0.03
53	0.9880956	99.99534	99.99534	0.00

Order of Fit = 12                      RMS error of fit = 6.64 mK  
Largest absolute error = 14.25 mK at data point no. 33



# POLYNOMIAL EQUATION

Calibration Report: 674412  
Sensor Model: DT-670-SD-1.4L  
Sensor Type: Silicon Diode

Sales Order: 73928-D6028158  
Serial Number: D6028158  
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev  
Useful Range of Fit:

88.0 K to 325. K  
1.010 Volts to 0.5078 Volts

Lower and Upper limits of Voltage used in computing Chebychev coefficients:  
ZL = 0.4962089665      ZU = 1.030634526

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	207.250848	1.3955E-04	1485106.86
1	-126.047004	2.0162E-04	-625169.00
2	-3.978192	1.9728E-04	-20164.97
3	-0.892384	2.0405E-04	-4373.32
4	-0.235557	2.0306E-04	-1160.02
5	-0.075138	1.9500E-04	-385.32
6	-0.015476	1.8770E-04	-82.45
7	-0.000570	1.8751E-04	-3.04
8	0.001388	1.9003E-04	7.30
9	0.000608	1.8983E-04	3.20

Z = Voltage

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

Temp. (K) =  $\sum A_i \cdot \text{COS}(i \cdot \text{ARCCOS}(k))$ , where  $0 \leq i \leq 9$   
and the  $A_i$ 's are the coefficients in the table above.

# POLYNOMIAL EQUATION

Calibration Report: 674412  
Sensor Model: DT-670-SD-1.4L  
Sensor Type: Silicon Diode

Sales Order: 73928-D6028158  
Serial Number: D6028158  
Temperature Range: 1.40K to 325K

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

	V Meas. (V)	T Meas. (K)	T Eq. (K)	T diff. (mK)
49	1.030635	76.00648	76.00852	0.31
50	1.020285	81.99942	81.99899	-0.49
51	1.009736	87.99647	87.99703	-0.34
52	0.9990062	93.99497	93.99468	0.29
53	0.9880956	99.99534	99.99478	0.56
54	0.9695243	110.00214	110.00212	0.02
55	0.9409133	124.98539	124.98616	-0.76
56	0.9114378	139.97794	139.97778	0.16
57	0.8812031	154.98624	154.98548	0.76
58	0.8503578	169.98672	169.98727	-0.55
59	0.8189906	184.98004	184.98031	-0.27
60	0.7871131	199.98836	199.98792	0.44
61	0.7548116	214.99090	214.99083	0.08
62	0.7221164	229.99169	229.99203	-0.34
63	0.6890648	244.98931	244.98945	-0.14
64	0.6556817	259.98608	259.98551	0.56
65	0.6219698	274.99202	274.99207	-0.05
66	0.5879591	290.00789	290.00867	-0.79
67	0.5537240	305.01792	305.01677	1.16
68	0.5307523	315.03487	315.03565	-0.78
69	0.5192578	320.03555	320.03552	0.03
70	0.5054543	326.02930	326.02912	0.18
71	0.4962090	330.03746	330.03750	-0.03

Order of Fit = 9                      RMS error of fit = 0.50 mK  
Largest absolute error = 1.16 mK at data point no. 67



# INTERPOLATION TABLE

Calibration Report: 674412  
Sensor Model: DT-670-SD-1.4L  
Sensor Type: Silicon Diode

Sales Order: 73928-D6028158  
Serial Number: D6028158  
Temperature Range: 1.40K to 325K

Temp (K)	Volts (V)	dV/dT (mV/K)	Temp (K)	Volts (V)	dV/dT (mV/K)
1.400	1.65421	-13.934	15.50	1.26756	-16.686
1.500	1.65275	-15.192	16.00	1.25933	-16.247
1.600	1.65117	-16.492	16.50	1.25131	-15.864
1.700	1.64945	-17.834	17.00	1.24345	-15.576
1.800	1.64760	-19.149	17.50	1.23572	-15.370
1.900	1.64563	-20.367	18.00	1.22807	-15.220
2.000	1.64353	-21.489	18.50	1.22049	-15.141
2.100	1.64133	-22.502	19.00	1.21291	-15.160
2.200	1.63904	-23.395	19.50	1.20530	-15.309
2.300	1.63666	-24.167	20.00	1.19758	-15.632
2.400	1.63421	-24.820	21.00	1.18133	-17.059
2.500	1.63170	-25.374	22.00	1.16250	-21.212
2.600	1.62914	-25.848	23.00	1.14032	-20.939
2.700	1.62653	-26.243	24.00	1.12562	-9.0295
2.800	1.62389	-26.558	25.00	1.11937	-4.4915
2.900	1.62122	-26.841	26.00	1.11568	-3.0990
3.000	1.61852	-27.133	27.00	1.11291	-2.5214
3.100	1.61579	-27.433	28.00	1.11056	-2.2106
3.200	1.61303	-27.742	29.00	1.10844	-2.0433
3.300	1.61024	-28.089	30.00	1.10646	-1.9300
3.400	1.60741	-28.502	31.00	1.10456	-1.8549
3.500	1.60454	-28.980	32.00	1.10274	-1.7968
3.600	1.60162	-29.524	33.00	1.10097	-1.7507
3.700	1.59863	-30.133	34.00	1.09924	-1.7115
3.800	1.59559	-30.776	35.00	1.09754	-1.6789
3.900	1.59248	-31.419	36.00	1.09588	-1.6520
4.000	1.58930	-32.061	37.00	1.09424	-1.6293
4.200	1.58276	-33.346	38.00	1.09262	-1.6109
4.400	1.57597	-34.544	39.00	1.09101	-1.5966
4.600	1.56896	-35.561	40.00	1.08942	-1.5865
4.800	1.56176	-36.397	42.00	1.08626	-1.5783
5.000	1.55441	-37.052	44.00	1.08310	-1.5802
5.200	1.54695	-37.546	46.00	1.07994	-1.5853
5.400	1.53940	-37.906	48.00	1.07676	-1.5920
5.600	1.53180	-38.133	50.00	1.07357	-1.5985
5.800	1.52416	-38.227	52.00	1.07037	-1.6047
6.000	1.51651	-38.189	54.00	1.06715	-1.6111
6.500	1.49752	-37.752	56.00	1.06392	-1.6183
7.000	1.47881	-37.019	58.00	1.06068	-1.6263
7.500	1.46056	-35.872	60.00	1.05742	-1.6348
8.000	1.44304	-34.140	65.00	1.04918	-1.6580
8.500	1.42649	-32.065	70.00	1.04083	-1.6824
9.000	1.41094	-30.141	75.00	1.03236	-1.7074
9.500	1.39632	-28.387	77.35	1.02833	-1.7194
10.00	1.38253	-26.817	80.00	1.02376	-1.7330
10.50	1.36947	-25.423	85.00	1.01503	-1.7587
11.00	1.35708	-24.180	90.00	1.00617	-1.7839
11.50	1.34527	-23.061	95.00	0.997191	-1.8087
12.00	1.33401	-21.986	100.0	0.988087	-1.8328
12.50	1.32328	-20.968	105.0	0.978865	-1.8560
13.00	1.31303	-20.050	110.0	0.969528	-1.8783
13.50	1.30321	-19.223	115.0	0.960083	-1.8997
14.00	1.29380	-18.452	120.0	0.950533	-1.9200
14.50	1.28475	-17.751	125.0	0.940885	-1.9392
15.00	1.27602	-17.168	130.0	0.931143	-1.9576



# INTERPOLATION TABLE

Calibration Report: 674412  
Sensor Model: DT-670-SD-1.4L  
Sensor Type: Silicon Diode

Sales Order: 73928-D6028158  
Serial Number: D6028158  
Temperature Range: 1.40K to 325K

<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>
135.0	0.921311	-1.9750	235.0	0.711118	-2.2000
140.0	0.911394	-1.9916	240.0	0.700099	-2.2077
145.0	0.901397	-2.0073	245.0	0.689041	-2.2152
150.0	0.891322	-2.0223	250.0	0.677947	-2.2225
155.0	0.881175	-2.0365	255.0	0.666816	-2.2296
160.0	0.870958	-2.0501	260.0	0.655651	-2.2366
165.0	0.860675	-2.0629	265.0	0.644451	-2.2434
170.0	0.850330	-2.0750	270.0	0.633217	-2.2499
175.0	0.839926	-2.0866	273.15	0.626124	-2.2539
180.0	0.829465	-2.0978	275.0	0.621952	-2.2563
185.0	0.818948	-2.1086	280.0	0.610655	-2.2623
190.0	0.808379	-2.1190	285.0	0.599330	-2.2679
195.0	0.797759	-2.1292	290.0	0.587977	-2.2731
200.0	0.787088	-2.1390	295.0	0.576599	-2.2782
205.0	0.776369	-2.1485	300.0	0.565195	-2.2834
210.0	0.765603	-2.1578	305.0	0.553765	-2.2887
215.0	0.754792	-2.1667	310.0	0.542309	-2.2935
220.0	0.743936	-2.1754	315.0	0.530832	-2.2969
225.0	0.733038	-2.1839	320.0	0.519340	-2.3005
230.0	0.722098	-2.1920	325.0	0.507827	-2.3045



## THERMAL CYCLE TESTING

Sensor Model: DT-670-SD-1.4L

Serial Number: D6028158

Sensor Type: Silicon Diode

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:

Approximately 305 K:	0.554 V
Liquid Nitrogen:	1.028 V
Liquid Helium:	1.583 V

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

### Recommended Operating Parameters:

For diode sensors calibrated by LSCI, the current is maintained at the constant values listed on the Test Data page. In order to minimize calibration offsets due to the nonlinear voltage-current relationship in the diode sensor, these same guidelines should be followed in using the sensor.



# BREAKPOINTS 340 FORMAT

Calibration Report: 674412

Sensor Model: DT-670-SD-1.4L

Sensor Type: Silicon Diode

Sales Order: 73928-D6028158

Serial Number: D6028158

Temperature Range: 1.40K to 325K

Name: DT-670-SD-1.4L

Serial number: D6028158

Format: 2 ;Volts/Kelvin

Limit: 325.0

Coefficient: 1 ;Negative

Point 1: 9.06000e-02,500.000	Point 56: 1.12136, 24.600
Point 2: .110239,491.000	Point 57: 1.12322, 24.300
Point 3: .136555,479.500	Point 58: 1.12475, 24.100
Point 4: .179181,461.500	Point 59: 1.12655, 23.900
Point 5: .265393,425.500	Point 60: 1.12874, 23.700
Point 6: .349522,390.000	Point 61: 1.13140, 23.500
Point 7: .452797,346.000	Point 62: 1.13455, 23.300
Point 8: .507852,325.000	Point 63: 1.14025, 23.000
Point 9: .552642,305.500	Point 64: 1.16260, 22.000
Point 10: .589135,289.500	Point 65: 1.17254, 21.500
Point 11: .623100,274.500	Point 66: 1.18310, 20.900
Point 12: .654553,260.500	Point 67: 1.19607, 20.100
Point 13: .684628,247.000	Point 68: 1.20067, 19.800
Point 14: .713338,234.000	Point 69: 1.21143, 19.100
Point 15: .740692,221.500	Point 70: 1.23033, 17.850
Point 16: .766702,209.500	Point 71: 1.24498, 16.900
Point 17: .791382,198.000	Point 72: 1.25687, 16.150
Point 18: .814746,187.000	Point 73: 1.26754, 15.500
Point 19: .836812,176.500	Point 74: 1.27858, 14.850
Point 20: .857597,166.500	Point 75: 1.28919, 14.250
Point 21: .877115,157.000	Point 76: 1.29937, 13.700
Point 22: .895379,148.000	Point 77: 1.31000, 13.150
Point 23: .912407,139.500	Point 78: 1.32012, 12.650
Point 24: .928219,131.500	Point 79: 1.33070, 12.150
Point 25: .943809,123.500	Point 80: 1.34180, 11.650
Point 26: .958198,116.000	Point 81: 1.35344, 11.150
Point 27: .971420,109.000	Point 82: 1.36564, 10.650
Point 28: .984430,102.000	Point 83: 1.37849, 10.150
Point 29: .994481, 96.500	Point 84: 1.39067, 9.700
Point 30: 1.00260, 92.000	Point 85: 1.40347, 9.250
Point 31: 1.01062, 87.500	Point 86: 1.41699, 8.800
Point 32: 1.01854, 83.000	Point 87: 1.43128, 8.350
Point 33: 1.02636, 78.500	Point 88: 1.44641, 7.900
Point 34: 1.03407, 74.000	Point 89: 1.46411, 7.400
Point 35: 1.04168, 69.500	Point 90: 1.48806, 6.750
Point 36: 1.04919, 65.000	Point 91: 1.55077, 5.100
Point 37: 1.05660, 60.500	Point 92: 1.56903, 4.600
Point 38: 1.06425, 55.800	Point 93: 1.58216, 4.220
Point 39: 1.07294, 50.400	Point 94: 1.59156, 3.930
Point 40: 1.08153, 45.000	Point 95: 1.59896, 3.690
Point 41: 1.09021, 39.500	Point 96: 1.60630, 3.440
Point 42: 1.09423, 37.000	Point 97: 1.61472, 3.140
Point 43: 1.09753, 35.000	Point 98: 1.62365, 2.810
Point 44: 1.10044, 33.300	Point 99: 1.63096, 2.530
Point 45: 1.10309, 31.800	Point 100: 1.63644, 2.310
Point 46: 1.10549, 30.500	Point 101: 1.64067, 2.130
Point 47: 1.10762, 29.400	Point 102: 1.64419, 1.970
Point 48: 1.10947, 28.500	Point 103: 1.64704, 1.830
Point 49: 1.11122, 27.700	Point 104: 1.64947, 1.700
Point 50: 1.11265, 27.100	Point 105: 1.65151, 1.580
Point 51: 1.11421, 26.500	Point 106: 1.65337, 1.460
Point 52: 1.11567, 26.000	Point 107: 1.65421, 1.400
Point 53: 1.11699, 25.600	
Point 54: 1.11849, 25.200	
Point 55: 1.11982, 24.900	

Note: Breakpoints outside of the calibration range were added from the standard curve. These extra points conform to reduced accuracy specifications and are added as a convenience to the customer.



Lake Shore Cryotronics, Inc. • 575 McCorkle Boulevard • Westerville, OH 43082

Sales: (614) 891-2244 • Fax: (614) 891-1392 • sales@lakeshore.com • www.lakeshore.com

F010-04-00\_B 06/21/2011

# BREAKPOINTS 91C/93C/330 FORMAT

Calibration Report: 674412  
Sensor Model: DT-670-SD-1.4L  
Sensor Type: Silicon Diode

Sales Order: 73928-D6028158  
Serial Number: D6028158  
Temperature Range: 1.40K to 325K

Interpolation Method: Straight Line  
Limit: 325.0 (Kelvin)  
Format: 2 (Volts/Kelvin)  
Number of Breakpoints: 35

No.	Units	Temperature (K)	No.	Units	Temperature (K)
1	0.147030	475.0	21	1.10840	29.0
2	0.218700	445.0	22	1.11287	27.0
3	0.326000	400.0	23	1.11568	26.0
4	0.490260	330.0	24	1.11937	25.0
5	0.507940	325.0	25	1.12562	24.0
6	0.588040	290.0	26	1.14032	23.0
7	0.655730	260.0	27	1.16250	22.0
8	0.722200	230.0	28	1.18133	21.0
9	0.776430	205.0	29	1.27525	15.0
10	0.829560	180.0	30	1.32268	12.5
11	0.871010	160.0	31	1.38142	10.0
12	0.911470	140.0	32	1.45882	7.5
13	0.940920	125.0	33	1.58441	4.2
14	0.969580	110.0	34	1.63768	2.3
15	0.997250	95.0	35	1.65480	1.4
16	1.02382	80.0			
17	1.04925	65.0			
18	1.07363	50.0			
19	1.09419	37.0			
20	1.10268	32.0			

Note: Breakpoints outside of the calibration range were added from the standard curve. These extra points conform to reduced accuracy specifications and are added as a convenience to the customer.

