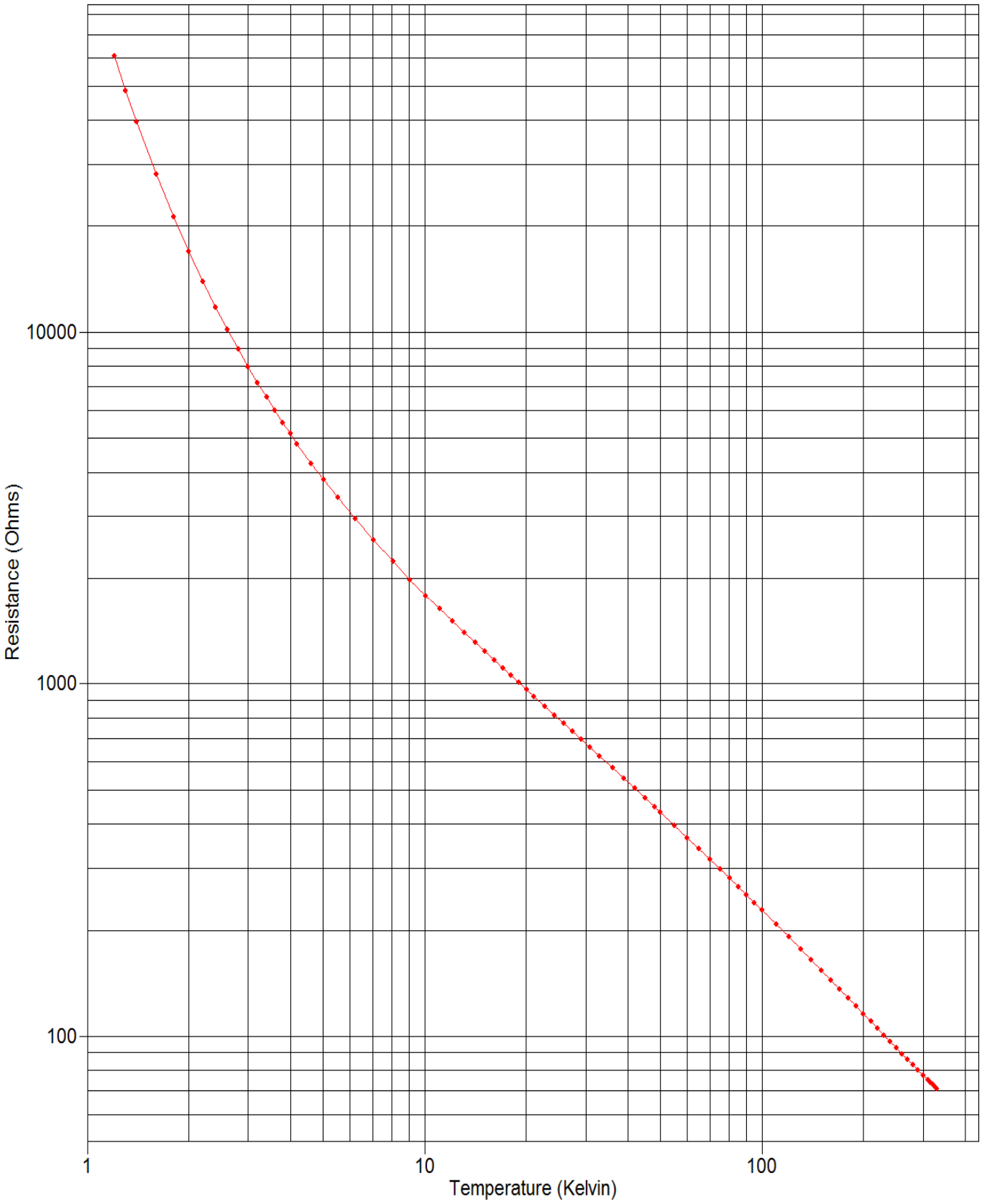
DATA PLOT

Calibration Report: 648103
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 68653
Serial Number: X73593
Temperature Range: 1.40K to 325K



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TEST DATA

Calibration Report: 648103
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 68653
Serial Number: X73593
Temperature Range: 1.40K to 325K

Index	Temp. (K)	Resistance (Ω)	Excitation	Index	Temp. (K)	Resistance (Ω)	Excitation
1	1.20245	60907.1	2mV±25%	46	42.0219	504.005	2mV±25%
2	1.29967	48590.9	2mV±25%	47	45.0167	473.928	2mV±25%
3	1.39964	39572.9	2mV±25%	48	48.0231	447.191	2mV±25%
4	1.59985	28086.5	2mV±25%	49	50.0178	431.077	2mV±25%
5	1.80038	21301.0	2mV±25%	50	55.0192	395.478	2mV±25%
6	2.00056	16934.0	2mV±25%	51	60.0249	365.373	2mV±25%
7	2.20049	13934.9	2mV±25%	52	65.0190	339.628	2mV±25%
8	2.40040	11779.2	2mV±25%	53	70.0136	317.323	2mV±25%
9	2.60048	10168.2	2mV±25%	54	75.0099	297.764	2mV±25%
10	2.80097	8929.10	2mV±25%	55	80.0068	280.482	2mV±25%
11	2.99933	7961.44	2mV±25%	56	85.0058	265.083	2mV±25%
12	3.19974	7173.61	2mV±25%	57	90.0031	251.289	2mV±25%
13	3.39966	6525.58	2mV±25%	58	94.9995	238.842	2mV±25%
14	3.59942	5989.73	2mV±25%	59	100.005	227.533	2mV±25%
15	3.79925	5534.49	2mV±25%	60	110.002	207.834	2mV±25%
16	4.00033	5142.60	2mV±25%	61	120.000	191.186	2mV±25%
17	4.19393	4815.62	2mV±25%	62	129.994	176.961	2mV±25%
18	4.61622	4238.33	2mV±25%	63	139.993	164.645	2mV±25%
19	5.01859	3808.24	2mV±25%	64	149.990	153.892	2mV±25%
20	5.52185	3387.19	2mV±25%	65	159.995	144.406	2mV±25%
21	6.22550	2944.95	2mV±25%	66	169.997	136.000	2mV±25%
22	7.04123	2570.37	2mV±25%	67	179.998	128.510	2mV±25%
23	8.05297	2230.40	2mV±25%	68	189.992	121.796	2mV±25%
24	9.05974	1980.08	2mV±25%	69	199.997	115.738	2mV±25%
25	10.0735	1786.00	2mV±25%	70	210.004	110.250	2mV±25%
26	11.0939	1630.38	2mV±25%	71	220.001	105.268	2mV±25%
27	12.1072	1503.71	2mV±25%	72	229.994	100.730	2mV±25%
28	13.1140	1398.30	2mV±25%	73	240.005	96.5697	2mV±25%
29	14.1139	1309.04	2mV±25%	74	249.997	92.7553	2mV±25%
30	15.1082	1232.38	2mV±25%	75	260.004	89.2416	2mV±25%
31	16.0953	1165.52	2mV±25%	76	270.005	85.9981	2mV±25%
32	17.0786	1106.56	2mV±25%	77	280.011	83.0050	2mV±25%
33	18.0638	1053.85	2mV±25%	78	290.022	80.2142	2mV±25%
34	19.0484	1006.41	2mV±25%	79	300.040	77.6323	2mV±25%
35	20.0322	963.435	2mV±25%	80	310.047	75.2267	2mV±25%
36	21.1196	920.368	2mV±25%	81	315.056	74.0815	2mV±25%
37	22.7099	864.394	2mV±25%	82	320.052	72.9748	2mV±25%
38	24.3086	814.986	2mV±25%	83	326.036	71.7036	2mV±25%
39	25.8940	771.555	2mV±25%	84	330.046	70.8847	2mV±25%
40	27.5093	732.022	2mV±25%				
41	29.1133	696.738	2mV±25%				
42	30.9262	660.908	2mV±25%				
43	33.0316	623.802	2mV±25%				
44	36.0347	577.729	2mV±25%				
45	39.0248	538.381	2mV±25%				

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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 (± mK)												
	GR	Cernox (CX)					RX			Platinum		RF-800	Diode
		1010	1030	1050	1070	1080	102A	103A	202A	100 Ω	25 Ω	27 Ω	
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

σ_{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
ΔT_{RMS} = root mean square deviation of fit

A value of ΔT_{RMS} is given for each range of fit.

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POLYNOMIAL EQUATION

Calibration Report: 648103 Sales Order: 68653
Sensor Model: CX-1050-SD-1.4L Serial Number: X73593
Sensor Type: Cernox Resistor Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

1.40 K	to	14.1 K
3.946e+4 Ohms	to	1309. Ohms

Lower and Upper limits of Log(Resistance) used in computing Chebychev coefficients:
ZL = 3.06651982934 ZU = 4.78466809516

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	5.414817	2.5734E-04	21041.61
1	-6.248705	4.1214E-04	-15161.50
2	2.857027	3.6281E-04	7874.66
3	-1.100785	3.7350E-04	-2947.25
4	0.361168	3.5460E-04	1018.52
5	-0.096770	3.2582E-04	-297.00
6	0.018585	3.2310E-04	57.52
7	-0.001004	3.2623E-04	-3.08
8	-0.002151	3.2847E-04	-6.55

Z = Log(Resistance)

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

Temp. (K) = ΣA_i* COS(i * ARCCOS(k)), where 0 <= i <= 8
and the A_i's are the coefficients in the table above.

POLYNOMIAL EQUATION

Calibration Report: 648103
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 68653
Serial Number: X73593
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Temp. (K) vs. Log(Resistance)

	R Meas. (Ω)	T Meas. (K)	T Eq. (K)	T diff. (mK)
1	60907.12	1.20245	1.20218	0.27
2	48590.93	1.29967	1.30076	-1.09
3	39572.93	1.39964	1.39858	1.06
4	28086.54	1.59985	1.59941	0.44
5	21300.98	1.80038	1.80124	-0.86
6	16934.00	2.00056	2.00116	-0.60
7	13934.90	2.20049	2.20052	-0.04
8	11779.16	2.40040	2.39991	0.49
9	10168.25	2.60048	2.59998	0.50
10	8929.100	2.80097	2.80047	0.50
11	7961.443	2.99933	2.99896	0.37
12	7173.612	3.19974	3.19936	0.38
13	6525.578	3.39966	3.40025	-0.60
14	5989.732	3.59942	3.59942	0.00
15	5534.489	3.79925	3.79951	-0.26
16	5142.602	4.00033	4.00099	-0.67
17	4815.619	4.19393	4.19527	-1.34
18	4238.326	4.61622	4.61583	0.39
19	3808.238	5.01859	5.01857	0.02
20	3387.185	5.52185	5.52194	-0.09
21	2944.954	6.22550	6.22512	0.38
22	2570.372	7.04123	7.03822	3.02
23	2230.402	8.05297	8.05259	0.37
24	1980.080	9.05974	9.06221	-2.47
25	1786.000	10.07349	10.07544	-1.96
26	1630.381	11.09390	11.09393	-0.03
27	1503.707	12.10724	12.10646	0.78
28	1398.300	13.11404	13.11312	0.91
29	1309.045	14.11391	14.11352	0.40
30	1232.378	15.10820	15.10712	1.07
31	1165.520	16.09534	16.09671	-1.37

Order of Fit = 8 RMS error of fit = 1.01 mK
Largest absolute error = 3.02 mK at data point no. 22

POLYNOMIAL EQUATION

Calibration Report: 648103 Sales Order: 68653
Sensor Model: CX-1050-SD-1.4L Serial Number: X73593
Sensor Type: Cernox Resistor Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

14.1 K	to	80.0 K
1309. Ohms	to	280.5 Ohms

Lower and Upper limits of Log(Resistance) used in computing Chebychev coefficients:
ZL = 2.40017414329 ZU = 3.17716321343

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	42.182824	2.1677E-04	194593.99
1	-37.729426	3.5316E-04	-106832.64
2	8.738045	3.2373E-04	26991.77
3	-1.210353	3.0051E-04	-4027.72
4	0.138108	2.8862E-04	478.51
5	-0.008686	2.7714E-04	-31.34
6	-0.005001	2.7489E-04	-18.19
7	0.000344	2.6609E-04	1.29
8	0.000520	2.6758E-04	1.95

Z = Log(Resistance)

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

Temp. (K) = ΣA_i* COS(i * ARCCOS(k)), where 0 <= i <= 8
and the A_i's are the coefficients in the table above.

POLYNOMIAL EQUATION

Calibration Report: 648103
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 68653
Serial Number: X73593
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Temp. (K) vs. Log(Resistance)

	R Meas. (Ω)	T Meas. (K)	T Eq. (K)	T diff. (mK)
27	1503.707	12.10646	12.10638	0.08
28	1398.300	13.11312	13.11334	-0.21
29	1309.045	14.11352	14.11392	-0.40
30	1232.378	15.10820	15.10708	1.12
31	1165.520	16.09534	16.09531	0.04
32	1106.562	17.07863	17.07927	-0.64
33	1053.850	18.06382	18.06385	-0.03
34	1006.405	19.04843	19.04840	0.04
35	963.4345	20.03223	20.03260	-0.36
36	920.3683	21.11963	21.12008	-0.45
37	864.3939	22.70988	22.70958	0.30
38	814.9859	24.30862	24.30795	0.66
39	771.5551	25.89403	25.89319	0.84
40	732.0220	27.50927	27.50907	0.20
41	696.7382	29.11335	29.11389	-0.54
42	660.9076	30.92623	30.92670	-0.48
43	623.8016	33.03161	33.03223	-0.63
44	577.7293	36.03473	36.03632	-1.59
45	538.3814	39.02482	39.02201	2.81
46	504.0047	42.02189	42.02313	-1.23
47	473.9285	45.01671	45.01555	1.17
48	447.1905	48.02307	48.02241	0.67
49	431.0771	50.01776	50.01889	-1.13
50	395.4778	55.01921	55.01960	-0.39
51	365.3731	60.02493	60.02458	0.35
52	339.6282	65.01896	65.02036	-1.39
53	317.3227	70.01356	70.01228	1.28
54	297.7640	75.00991	75.00954	0.37
55	280.4821	80.00676	80.00660	0.16
56	265.0832	85.00579	85.00686	-1.08
57	251.2894	90.00309	90.00262	0.47

Order of Fit = 8 RMS error of fit = 0.90 mK
Largest absolute error = 2.81 mK at data point no. 45

POLYNOMIAL EQUATION

Calibration Report: 648103 Sales Order: 68653
Sensor Model: CX-1050-SD-1.4L Serial Number: X73593
Sensor Type: Cernox Resistor Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

80.0 K	to	325. K
280.5 Ohms	to	71.92 Ohms

Lower and Upper limits of Log(Resistance) used in computing Chebychev coefficients:
ZL = 1.85055224026 ZU = 2.50150112667

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	176.387742	1.5472E-03	114003.83
1	-126.587865	2.3900E-03	-52966.63
2	23.010994	2.2939E-03	10031.20
3	-3.301852	2.1733E-03	-1519.28
4	0.605923	2.0708E-03	292.61
5	-0.116584	2.0779E-03	-56.11
6	0.017008	2.0505E-03	8.29
7	-0.003478	1.9805E-03	-1.76

Z = Log(Resistance)

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

Temp. (K) = ΣA_i* COS(i * ARCCOS(k)), where 0 <= i <= 7
and the A_i's are the coefficients in the table above.

POLYNOMIAL EQUATION

Calibration Report: 648103
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 68653
Serial Number: X73593
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Temp. (K) vs. Log(Resistance)

	R Meas. (Ω)	T Meas. (K)	T Eq. (K)	T diff. (mK)
53	317.3227	70.01228	70.01189	0.39
54	297.7640	75.00954	75.01035	-0.80
55	280.4821	80.00660	80.00659	0.01
56	265.0832	85.00579	85.00616	-0.37
57	251.2894	90.00309	90.00167	1.42
58	238.8424	94.99954	94.99913	0.41
59	227.5332	100.00496	100.00614	-1.18
60	207.8337	110.00159	109.99956	2.03
61	191.1862	120.00047	120.00413	-3.66
62	176.9612	129.99409	129.99502	-0.92
63	164.6449	139.99256	139.99172	0.84
64	153.8924	149.99016	149.98329	6.88
65	144.4057	159.99455	159.99579	-1.24
66	136.0002	169.99723	170.00288	-5.65
67	128.5104	179.99788	179.99916	-1.27
68	121.7956	189.99181	189.99090	0.91
69	115.7376	199.99651	199.99291	3.61
70	110.2499	210.00421	210.00360	0.61
71	105.2680	220.00124	220.00484	-3.60
72	100.7301	229.99386	229.99325	0.62
73	96.56968	240.00539	240.00120	4.18
74	92.75532	249.99674	249.99860	-1.85
75	89.24157	260.00436	260.00455	-0.19
76	85.99809	270.00546	270.01369	-8.22
77	83.00502	280.01125	279.99735	13.90
78	80.21420	290.02185	290.03730	-15.45
79	77.63232	300.04016	300.03331	6.85
80	75.22674	310.04678	310.03420	12.58
81	74.08154	315.05605	315.05127	4.79
82	72.97479	320.05231	320.06887	-16.56
83	71.70362	326.03566	326.04902	-13.35
84	70.88466	330.04579	330.03144	14.34

Order of Fit = 7 RMS error of fit = 6.94 mK
Largest absolute error = -16.56 mK at data point no. 82

INTERPOLATION TABLE

Calibration Report: 648103 Sales Order: 68653
Sensor Model: CX-1050-SD-1.4L Serial Number: X73593
Sensor Type: Cernox Resistor Temperature Range: 1.40K to 325K

Temp (K)	Res. (Ω)	dR/dT (Ω/K)	dlogR/dlogT	Temp (K)	Res. (Ω)	dR/dT (Ω/K)	dlogR/dlogT
1.400	39462.7	-77366.	-2.7447	15.50	1204.78	-68.464	-0.88082
1.500	32899.9	-55633.	-2.5365	16.00	1171.61	-64.274	-0.87775
1.600	28061.6	-42208.	-2.4066	16.50	1140.43	-60.489	-0.87517
1.700	24312.2	-33246.	-2.3247	17.00	1111.06	-57.051	-0.87291
1.800	21333.9	-26651.	-2.2486	17.50	1083.33	-53.920	-0.87101
1.900	18927.4	-21703.	-2.1786	18.00	1057.10	-51.058	-0.86940
2.000	16954.8	-17915.	-2.1132	18.50	1032.23	-48.437	-0.86809
2.100	15316.6	-14965.	-2.0518	19.00	1008.63	-46.026	-0.86702
2.200	13941.5	-12627.	-1.9925	19.50	986.176	-43.806	-0.86618
2.300	12775.7	-10756.	-1.9364	20.00	964.793	-41.753	-0.86554
2.400	11778.3	-9245.9	-1.8840	21.00	924.918	-38.089	-0.86481
2.500	10917.3	-8014.9	-1.8354	22.00	888.450	-34.918	-0.86466
2.600	10168.1	-7001.3	-1.7902	23.00	854.945	-32.154	-0.86501
2.700	9511.32	-6159.5	-1.7485	24.00	824.032	-29.723	-0.86568
2.800	8931.67	-5454.3	-1.7099	25.00	795.405	-27.575	-0.86670
2.900	8416.81	-4858.9	-1.6741	26.00	768.804	-25.664	-0.86792
3.000	7956.93	-4352.2	-1.6409	27.00	744.010	-23.954	-0.86928
3.100	7543.95	-3918.0	-1.6100	28.00	720.838	-22.418	-0.87080
3.200	7171.34	-3543.4	-1.5811	29.00	699.125	-21.031	-0.87237
3.300	6833.63	-3218.2	-1.5541	30.00	678.732	-19.774	-0.87401
3.400	6526.32	-2934.3	-1.5287	31.00	659.539	-18.630	-0.87567
3.500	6245.61	-2685.2	-1.5048	32.00	641.438	-17.586	-0.87734
3.600	5988.31	-2465.4	-1.4821	33.00	624.337	-16.630	-0.87902
3.700	5751.69	-2270.7	-1.4607	34.00	608.152	-15.753	-0.88068
3.800	5533.45	-2097.4	-1.4404	35.00	592.809	-14.943	-0.88225
3.900	5331.59	-1942.6	-1.4210	36.00	578.244	-14.197	-0.88385
4.000	5144.40	-1803.8	-1.4025	37.00	564.397	-13.506	-0.88543
4.200	4808.20	-1566.4	-1.3682	38.00	551.215	-12.865	-0.88692
4.400	4515.02	-1371.5	-1.3365	39.00	538.651	-12.270	-0.88839
4.600	4257.38	-1210.0	-1.3073	40.00	526.661	-11.716	-0.88984
4.800	4029.26	-1075.0	-1.2807	42.00	504.252	-10.716	-0.89254
5.000	3825.99	-960.90	-1.2558	44.00	483.715	-9.8404	-0.89511
5.200	3643.77	-863.80	-1.2327	46.00	464.821	-9.0695	-0.89755
5.400	3479.56	-780.37	-1.2111	48.00	447.378	-8.3866	-0.89981
5.600	3330.83	-708.64	-1.1914	50.00	431.224	-7.7795	-0.90202
5.800	3195.50	-646.06	-1.1726	52.00	416.218	-7.2365	-0.90409
6.000	3071.89	-591.28	-1.1549	54.00	402.241	-6.7489	-0.90602
6.500	2805.03	-481.77	-1.1164	56.00	389.189	-6.3106	-0.90802
7.000	2585.56	-400.06	-1.0831	58.00	376.971	-5.9137	-0.90987
7.500	2401.73	-337.81	-1.0549	60.00	365.510	-5.5540	-0.91172
8.000	2245.49	-289.15	-1.0302	65.00	339.726	-4.7885	-0.91618
8.500	2110.88	-250.65	-1.0093	70.00	317.374	-4.1738	-0.92058
9.000	1993.62	-219.46	-0.99075	75.00	297.799	-3.6725	-0.92491
9.500	1890.46	-193.98	-0.97481	77.35	289.412	-3.4683	-0.92696
10.00	1798.93	-172.80	-0.96056	80.00	280.504	-3.2586	-0.92935
10.50	1717.08	-155.07	-0.94827	85.00	265.101	-2.9121	-0.93372
11.00	1643.41	-140.02	-0.93718	90.00	251.294	-2.6189	-0.93794
11.50	1576.69	-127.17	-0.92754	95.00	238.840	-2.3689	-0.94224
12.00	1515.95	-116.08	-0.91889	100.0	227.546	-2.1539	-0.94660
12.50	1460.36	-106.47	-0.91131	105.0	217.254	-1.9674	-0.95086
13.00	1409.29	-98.021	-0.90419	110.0	207.833	-1.8045	-0.95507
13.50	1362.17	-90.596	-0.89787	115.0	199.176	-1.6613	-0.95920
14.00	1318.54	-84.065	-0.89259	120.0	191.193	-1.5346	-0.96315
14.50	1277.98	-78.293	-0.88832	125.0	183.807	-1.4218	-0.96692
15.00	1240.15	-73.116	-0.88435	130.0	176.955	-1.3210	-0.97046

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INTERPOLATION TABLE

Calibration Report: 648103
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 68653
Serial Number: X73593
Temperature Range: 1.40K to 325K

Temp (K)	Res. (Ω)	dR/dT (Ω/K)	dlogR/dlogT	Temp (K)	Res. (Ω)	dR/dT (Ω/K)	dlogR/dlogT
135.0	170.580	-1.2304	-0.97380	235.0	98.6033	-0.41552	-0.99030
140.0	164.635	-1.1488	-0.97688	240.0	96.5702	-0.39794	-0.98897
145.0	159.079	-1.0749	-0.97973	245.0	94.6223	-0.38138	-0.98748
150.0	153.876	-1.0077	-0.98231	250.0	92.7548	-0.36577	-0.98584
155.0	148.992	-0.94649	-0.98465	255.0	90.9632	-0.35103	-0.98407
160.0	144.402	-0.89053	-0.98673	260.0	89.2431	-0.33712	-0.98215
165.0	140.079	-0.83925	-0.98856	265.0	87.5907	-0.32396	-0.98011
170.0	136.002	-0.79212	-0.99014	270.0	86.0024	-0.31150	-0.97795
175.0	132.152	-0.74871	-0.99147	273.15	85.0330	-0.30400	-0.97653
180.0	128.510	-0.70863	-0.99256	275.0	84.4746	-0.29971	-0.97567
185.0	125.061	-0.67155	-0.99342	280.0	83.0043	-0.28853	-0.97329
190.0	121.790	-0.63718	-0.99404	285.0	81.5884	-0.27792	-0.97081
195.0	118.685	-0.60525	-0.99444	290.0	80.2242	-0.26785	-0.96823
200.0	115.734	-0.57555	-0.99462	295.0	78.9091	-0.25828	-0.96557
205.0	112.926	-0.54787	-0.99458	300.0	77.6406	-0.24918	-0.96282
210.0	110.252	-0.52204	-0.99434	305.0	76.4165	-0.24052	-0.96000
215.0	107.703	-0.49789	-0.99391	310.0	75.2347	-0.23228	-0.95711
220.0	105.270	-0.47528	-0.99327	315.0	74.0930	-0.22443	-0.95416
225.0	102.947	-0.45409	-0.99246	320.0	72.9897	-0.21695	-0.95115
230.0	100.727	-0.43420	-0.99146	325.0	71.9230	-0.20981	-0.94809

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THERMAL CYCLE TESTING

Sensor Model: CX-1050-SD-1.4L Serial Number: X73593
Sensor Type: Cernox Resistor

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

Approximately 305 K:	76.4 Ω
Liquid Nitrogen:	290 Ω
Liquid Helium:	4801 Ω

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 sensors calibrated by LSCI, the current to the sensor is adjusted to maintain the sensor output voltage or power at the values listed on the Test Data page.

BREAKPOINTS 340 FORMAT

Calibration Report: 648103 — Sales Order: 68653
Sensor Model: CX-1050-SD-1.4L — Serial Number: X73593
Sensor Type: Cernox Resistor — Temperature Range: 1.40K to 325K

Name: CX-1050-SD-1.4L
Serial number: X73593
Format: 4 ;Log Ohms/Kelvin
Limit: 325.0
Coefficient: 1 ;Negative

Point 1: 1.85685,325.000
Point 2: 1.86454,319.000
Point 3: 1.87174,313.500
Point 4: 1.87910,308.000
Point 5: 1.88661,302.500

Point 6: 1.89428,297.000
Point 7: 1.90212,291.500
Point 8: 1.91014,286.000
Point 9: 1.91833,280.500
Point 10: 1.92671,275.000

Point 11: 1.93528,269.500
Point 12: 1.94405,264.000
Point 13: 1.95303,258.500
Point 14: 1.96222,253.000
Point 15: 1.97162,247.500

Point 16: 1.98038,242.500
Point 17: 1.98933,237.500
Point 18: 1.99848,232.500
Point 19: 2.00784,227.500
Point 20: 2.01742,222.500

Point 21: 2.02722,217.500
Point 22: 2.03726,212.500
Point 23: 2.04754,207.500
Point 24: 2.05807,202.500
Point 25: 2.06887,197.500

Point 26: 2.07995,192.500
Point 27: 2.09131,187.500
Point 28: 2.10297,182.500
Point 29: 2.11373,178.000
Point 30: 2.12476,173.500

Point 31: 2.13606,169.000
Point 32: 2.14765,164.500
Point 33: 2.15955,160.000
Point 34: 2.17176,155.500
Point 35: 2.18431,151.000

Point 36: 2.19721,146.500
Point 37: 2.21047,142.000
Point 38: 2.22413,137.500
Point 39: 2.23663,133.500
Point 40: 2.24946,129.500

Point 41: 2.26266,125.500
Point 42: 2.27624,121.500
Point 43: 2.29024,117.500
Point 44: 2.30467,113.500
Point 45: 2.31957,109.500

Point 46: 2.33497,105.500
Point 47: 2.34889,102.000
Point 48: 2.35912, 99.500
Point 49: 2.36956, 97.000
Point 50: 2.38025, 94.500

Point 51: 2.39120, 92.000
Point 52: 2.40243, 89.500
Point 53: 2.41395, 87.000
Point 54: 2.42578, 84.500
Point 55: 2.43794, 82.000

Point 56: 2.45044, 79.500
Point 57: 2.46332, 77.000
Point 58: 2.47391, 75.000
Point 59: 2.48475, 73.000
Point 60: 2.49588, 71.000

Point 61: 2.50730, 69.000
Point 62: 2.51904, 67.000
Point 63: 2.53111, 65.000
Point 64: 2.54353, 63.000
Point 65: 2.55633, 61.000

Point 66: 2.56952, 59.000
Point 67: 2.58314, 57.000
Point 68: 2.59581, 55.200
Point 69: 2.60885, 53.400
Point 70: 2.62232, 51.600

Point 71: 2.63624, 49.800
Point 72: 2.65064, 48.000
Point 73: 2.66555, 46.200
Point 74: 2.68103, 44.400
Point 75: 2.69530, 42.800

Point 76: 2.71006, 41.200
Point 77: 2.72635, 39.500
Point 78: 2.74229, 37.900
Point 79: 2.75782, 36.400
Point 80: 2.77396, 34.900

Point 81: 2.79076, 33.400
Point 82: 2.80711, 32.000
Point 83: 2.82412, 30.600
Point 84: 2.84189, 29.200
Point 85: 2.85914, 27.900

Point 86: 2.87715, 26.600
Point 87: 2.89603, 25.300
Point 88: 2.91432, 24.100
Point 89: 2.93350, 22.900
Point 90: 2.95370, 21.700

Point 91: 2.97325, 20.600
Point 92: 2.98913, 19.750
Point 93: 3.00172, 19.100
Point 94: 3.01476, 18.450
Point 95: 3.02830, 17.800

Point 96: 3.04127, 17.200
Point 97: 3.05473, 16.600
Point 98: 3.06874, 16.000
Point 99: 3.08333, 15.400
Point 100: 3.09730, 14.850

Point 101: 3.11184, 14.300
Point 102: 3.12704, 13.750
Point 103: 3.14149, 13.250
Point 104: 3.15658, 12.750
Point 105: 3.17242, 12.250

Point 106: 3.18904, 11.750
Point 107: 3.20478, 11.300
Point 108: 3.22128, 10.850
Point 109: 3.23867, 10.400
Point 110: 3.25703, 9.950

Point 111: 3.27429, 9.550
Point 112: 3.29247, 9.150
Point 113: 3.31173, 8.750
Point 114: 3.33219, 8.350
Point 115: 3.35401, 7.950

Point 116: 3.37439, 7.600
Point 117: 3.39605, 7.250
Point 118: 3.41923, 6.900
Point 119: 3.44409, 6.550
Point 120: 3.47092, 6.200

Point 121: 3.49914, 5.860
Point 122: 3.52611, 5.560
Point 123: 3.55523, 5.260
Point 124: 3.58475, 4.980
Point 125: 3.61677, 4.700

Point 126: 3.65177, 4.420
Point 127: 3.68744, 4.160
Point 128: 3.71888, 3.950
Point 129: 3.74616, 3.780
Point 130: 3.77535, 3.610

Point 131: 3.80674, 3.440
Point 132: 3.83858, 3.280
Point 133: 3.87289, 3.120
Point 134: 3.90772, 2.970
Point 135: 3.94540, 2.820

Point 136: 3.98366, 2.680
Point 137: 4.02523, 2.540
Point 138: 4.07074, 2.400
Point 139: 4.11715, 2.270
Point 140: 4.16805, 2.140

Point 141: 4.22427, 2.010
Point 142: 4.28167, 1.890
Point 143: 4.34502, 1.770
Point 144: 4.40955, 1.660
Point 145: 4.48099, 1.550

Point 146: 4.54684, 1.460
Point 147: 4.59597, 1.400

BREAKPOINTS 91C/93C/330 FORMAT

Calibration Report: 648103 Sales Order: 68653
Sensor Model: CX-1050-SD-1.4L Serial Number: X73593
Sensor Type: Cernox Resistor Temperature Range: 1.40K to 325K

Interpolation Method: Lagrangian
Limit: 325.0 (Kelvin)
Format: 4 (Log Ohms/Kelvin)
Number of Breakpoints: 53

No.	Units	Temperature (K)	No.	Units	Temperature (K)
1	1.85687	325.0	31	3.22704	10.7
2	1.85814	324.0	32	3.29022	9.2
3	1.87776	309.0	33	3.35695	7.9
4	1.89855	294.0	34	3.41934	6.9
5	1.92061	279.0	35	3.47915	6.1
6	1.94407	264.0	36	3.54152	5.4
7	1.96905	249.0	37	3.60523	4.8
8	1.99573	234.0	38	3.66808	4.3
9	2.02427	219.0	39	3.72686	3.9
10	2.05491	204.0	40	3.79557	3.5
11	2.08789	189.0	41	3.85560	3.2
12	2.12354	174.0	42	3.92515	2.9
13	2.16226	159.0	43	3.97824	2.7
14	2.20456	144.0	44	4.03811	2.5
15	2.25112	129.0	45	4.10639	2.3
16	2.30287	114.0	46	4.14431	2.2
17	2.36120	99.0	47	4.18516	2.1
18	2.42821	84.0	48	4.22929	2.0
19	2.50732	69.0	49	4.27709	1.9
20	2.56621	59.5	50	4.32907	1.8
21	2.63470	50.0	51	4.38582	1.7
22	2.67585	45.0	52	4.51719	1.5
23	2.72153	40.0	53	4.59619	1.4
24	2.77291	35.0			
25	2.83170	30.0			
26	2.90059	25.0			
27	2.96610	21.0			
28	3.03261	17.6			
29	3.09604	14.9			
30	3.16131	12.6			

Temperature for Resistance Decades:

Res. (Ohms)	Temp. (K)
100	231.689
1000	19.186
10000	2.624

BREAKPOINTS 234 FORMAT

Calibration Report: 648103 Sales Order: 68653
Sensor Model: CX-1050-SD-1.4L Serial Number: X73593
Sensor Type: Cernox Resistor Temperature Range: 1.40K to 325K

Maximum Temperature Error:

1.4 - 10K:	0.008K
10 - 20K:	0.021K
20 - 40K:	0.007K
40 - 100K:	0.016K
> 100K:	0.065K

BP #	Temp. (K)	Res. (Ω)	Log10 Res.	BP #	Temp. (K)	Res. (Ω)	Log10 Res.
1	322.533	72.44360	1.860	46	36.198	575.4399	2.760
2	307.345	75.85776	1.880	47	34.358	602.5596	2.780
3	292.982	79.43282	1.900	48	32.606	630.9573	2.800
4	279.406	83.17638	1.920	49	30.938	660.6934	2.820
5	266.532	87.09636	1.940	50	29.351	691.8310	2.840
6	254.325	91.20108	1.960	51	27.840	724.4360	2.860
7	242.723	95.49926	1.980	52	26.404	758.5776	2.880
8	231.688	100.0000	2.000	53	25.039	794.3282	2.900
9	221.179	104.7129	2.020	54	23.742	831.7638	2.920
10	211.163	109.6478	2.040	55	22.512	870.9636	2.940
11	201.609	114.8154	2.060	56	21.344	912.0108	2.960
12	192.485	120.2264	2.080	57	20.237	954.9926	2.980
13	183.769	125.8925	2.100	58	19.189	1000.000	3.000
14	175.436	131.8257	2.120	59	17.259	1096.478	3.040
15	167.466	138.0384	2.140	60	15.537	1202.264	3.080
16	159.841	144.5440	2.160	61	14.003	1318.257	3.120
17	152.542	151.3561	2.180	62	12.642	1445.440	3.160
18	145.552	158.4893	2.200	63	11.436	1584.893	3.200
19	138.857	165.9587	2.220	64	10.368	1737.801	3.240
20	132.445	173.7801	2.240	65	9.423	1905.461	3.280
21	126.304	181.9701	2.260	66	8.587	2089.296	3.320
22	120.422	190.5461	2.280	67	7.847	2290.868	3.360
23	114.789	199.5262	2.300	68	7.191	2511.886	3.400
24	109.396	208.9296	2.320	69	6.608	2754.229	3.440
25	104.232	218.7762	2.340	70	6.089	3019.952	3.480
26	99.289	229.0868	2.360	71	5.628	3311.311	3.520
27	94.562	239.8833	2.380	72	5.215	3630.781	3.560
28	90.040	251.1886	2.400	73	4.846	3981.072	3.600
29	85.718	263.0268	2.420	74	4.513	4365.158	3.640
30	81.588	275.4229	2.440	75	4.214	4786.301	3.680
31	77.642	288.4032	2.460	76	3.944	5248.075	3.720
32	73.873	301.9952	2.480	77	3.699	5754.399	3.760
33	70.276	316.2278	2.500	78	3.476	6309.573	3.800
34	66.842	331.1311	2.520	79	3.274	6918.310	3.840
35	63.565	346.7369	2.540	80	3.090	7585.776	3.880
36	60.441	363.0781	2.560	81	2.921	8317.638	3.920
37	57.461	380.1894	2.580	82	2.766	9120.108	3.960
38	54.619	398.1072	2.600	83	2.624	10000.00	4.000
39	51.909	416.8694	2.620	84	2.318	12589.25	4.100
40	49.328	436.5158	2.640	85	2.065	15848.93	4.200
41	46.868	457.0882	2.660	86	1.855	19952.62	4.300
42	44.522	478.6301	2.680	87	1.676	25118.86	4.400
43	42.288	501.1872	2.700	88	1.525	31622.78	4.500
44	40.159	524.8075	2.720	89	1.396	39810.72	4.600
45	38.131	549.5409	2.740	90	1.287	50118.72	4.700

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