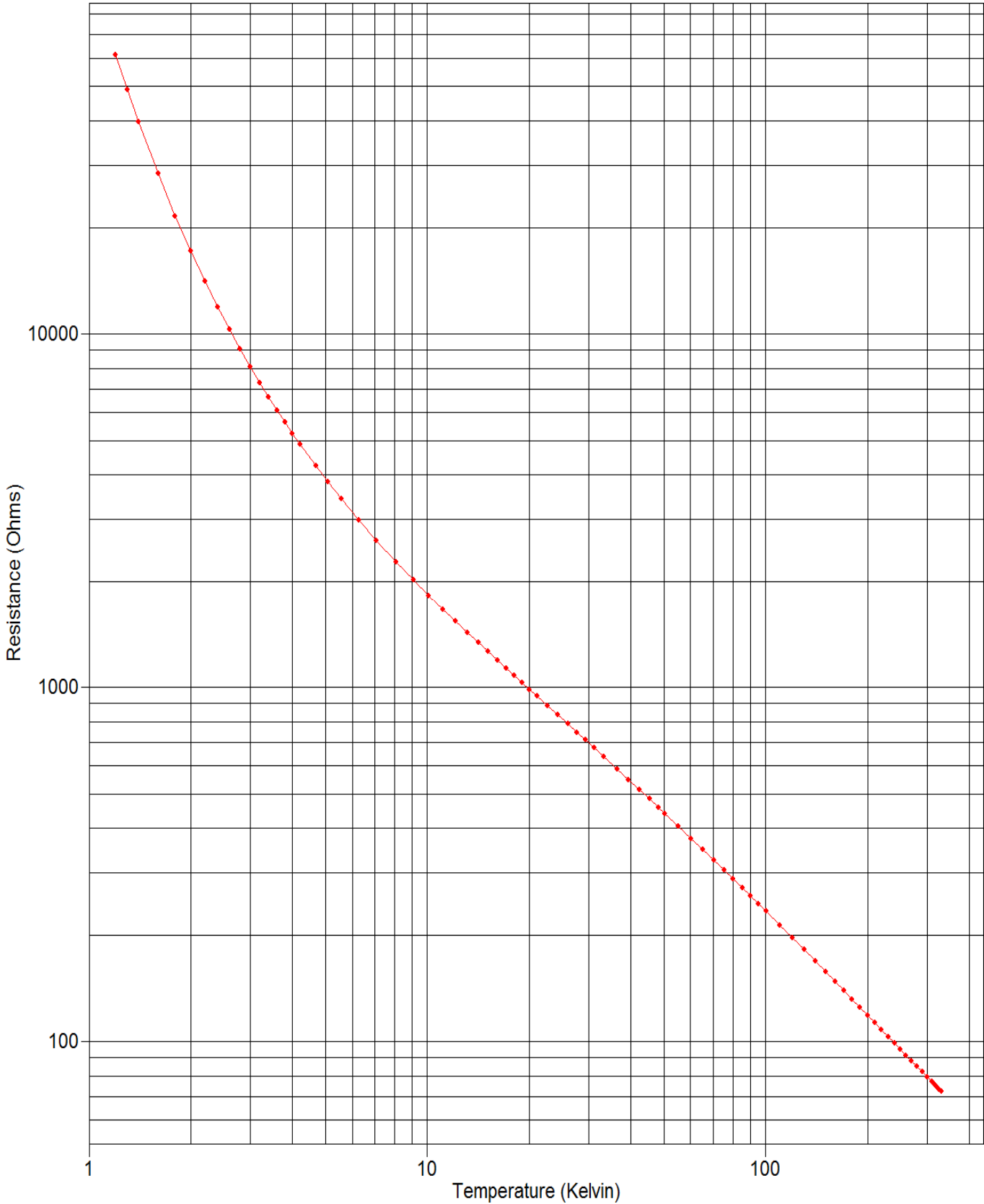


DATA PLOT

Calibration Report: 646117
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 68653
Serial Number: X72725
Temperature Range: 1.40K to 325K



TEST DATA

Calibration Report: 646117
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 68653
Serial Number: X72725
Temperature Range: 1.40K to 325K

Index	Temp. (K)	Resistance (Ω)	Excitation	Index	Temp. (K)	Resistance (Ω)	Excitation
1	1.19961	61536.7	2mV \pm 25%	46	42.3400	514.071	2mV \pm 25%
2	1.29886	48932.4	2mV \pm 25%	47	45.3332	483.677	2mV \pm 25%
3	1.40184	39693.3	2mV \pm 25%	48	48.3326	456.644	2mV \pm 25%
4	1.59936	28343.5	2mV \pm 25%	49	50.3222	440.381	2mV \pm 25%
5	1.80002	21513.3	2mV \pm 25%	50	55.3232	404.261	2mV \pm 25%
6	2.00013	17123.3	2mV \pm 25%	51	60.3207	373.751	2mV \pm 25%
7	2.20001	14103.2	2mV \pm 25%	52	65.3186	347.524	2mV \pm 25%
8	2.40043	11929.1	2mV \pm 25%	53	70.3126	324.812	2mV \pm 25%
9	2.60099	10302.3	2mV \pm 25%	54	75.3028	304.896	2mV \pm 25%
10	2.79965	9061.71	2mV \pm 25%	55	80.2944	287.288	2mV \pm 25%
11	3.00004	8073.22	2mV \pm 25%	56	85.2814	271.616	2mV \pm 25%
12	3.19912	7282.63	2mV \pm 25%	57	90.2766	257.516	2mV \pm 25%
13	3.40036	6626.08	2mV \pm 25%	58	95.2654	244.807	2mV \pm 25%
14	3.60051	6082.16	2mV \pm 25%	59	100.260	233.280	2mV \pm 25%
15	3.80006	5623.03	2mV \pm 25%	60	110.257	213.088	2mV \pm 25%
16	4.00032	5228.67	2mV \pm 25%	61	120.248	196.060	2mV \pm 25%
17	4.21565	4863.97	2mV \pm 25%	62	130.235	181.476	2mV \pm 25%
18	4.68590	4231.30	2mV \pm 25%	63	140.229	168.856	2mV \pm 25%
19	5.07768	3822.24	2mV \pm 25%	64	150.220	157.807	2mV \pm 25%
20	5.57206	3414.02	2mV \pm 25%	65	160.214	148.098	2mV \pm 25%
21	6.27413	2976.56	2mV \pm 25%	66	170.210	139.471	2mV \pm 25%
22	7.08294	2605.95	2mV \pm 25%	67	180.204	131.788	2mV \pm 25%
23	8.08875	2267.12	2mV \pm 25%	68	190.195	124.893	2mV \pm 25%
24	9.10315	2013.52	2mV \pm 25%	69	200.182	118.666	2mV \pm 25%
25	10.1173	1817.93	2mV \pm 25%	70	210.184	113.027	2mV \pm 25%
26	11.1335	1661.60	2mV \pm 25%	71	220.185	107.904	2mV \pm 25%
27	12.1405	1534.25	2mV \pm 25%	72	230.176	103.239	2mV \pm 25%
28	13.1491	1427.35	2mV \pm 25%	73	240.171	98.9687	2mV \pm 25%
29	14.1453	1337.25	2mV \pm 25%	74	250.172	95.0410	2mV \pm 25%
30	15.1369	1259.46	2mV \pm 25%	75	260.156	91.4350	2mV \pm 25%
31	16.1214	1191.79	2mV \pm 25%	76	270.167	88.0946	2mV \pm 25%
32	17.1062	1131.62	2mV \pm 25%	77	280.157	85.0183	2mV \pm 25%
33	18.0904	1078.23	2mV \pm 25%	78	290.161	82.1554	2mV \pm 25%
34	19.0719	1030.01	2mV \pm 25%	79	300.157	79.5018	2mV \pm 25%
35	20.0554	986.357	2mV \pm 25%	80	310.155	77.0282	2mV \pm 25%
36	21.1338	942.787	2mV \pm 25%	81	315.158	75.8524	2mV \pm 25%
37	22.7235	885.747	2mV \pm 25%	82	320.154	74.7154	2mV \pm 25%
38	24.3606	834.102	2mV \pm 25%	83	326.436	73.3488	2mV \pm 25%
39	26.0364	787.484	2mV \pm 25%	84	331.621	72.2550	2mV \pm 25%
40	27.6966	746.499	2mV \pm 25%				
41	29.3440	709.950	2mV \pm 25%				
42	31.1830	673.281	2mV \pm 25%				
43	33.3157	635.390	2mV \pm 25%				
44	36.3397	588.675	2mV \pm 25%				
45	39.3437	548.718	2mV \pm 25%				



UNCERTAINTY ANALYSIS

Calibration Report: 646117
 Sensor Model: CX-1050-SD-1.4L
 Sensor Type: Cernox Resistor

Sales Order: 68653
 Serial Number: X72725
 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 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:

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

where

- σ_{fit} = standard deviation of the fit
- T_i = measured temperature for point i
- $T_{i,calc}$ = 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.

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



POLYNOMIAL EQUATION

Calibration Report: 646117
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 68653
Serial Number: X72725
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

1.40 K to 14.1 K
3.974e+4 Ohms to 1337. Ohms

Lower and Upper limits of Log(Resistance) used in computing Chebychev coefficients:
ZL = 3.07619921593 ZU = 4.78913396931

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	5.417530	2.5737E-04	21049.43
1	-6.258785	4.1294E-04	-15156.62
2	2.864735	3.6356E-04	7879.65
3	-1.104800	3.7243E-04	-2966.45
4	0.362374	3.5272E-04	1027.37
5	-0.097056	3.2500E-04	-298.63
6	0.018450	3.2314E-04	57.10
7	-0.000973	3.2648E-04	-2.98
8	-0.002165	3.2798E-04	-6.60

$Z = \text{Log}(\text{Resistance})$

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

Temp. (K) = $\sum A_i \cdot \text{COS}(i \cdot \text{ARCCOS}(k))$, where $0 \leq i \leq 8$
and the A_i 's are the coefficients in the table above.



POLYNOMIAL EQUATION

Calibration Report: 646117
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 68653
Serial Number: X72725
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	61536.67	1.19961	1.19931	0.30
2	48932.39	1.29886	1.30012	-1.26
3	39693.28	1.40184	1.40054	1.29
4	28343.54	1.59936	1.59896	0.40
5	21513.28	1.80002	1.80101	-0.99
6	17123.25	2.00013	2.00077	-0.64
7	14103.15	2.20001	2.20015	-0.13
8	11929.11	2.40043	2.39972	0.71
9	10302.30	2.60099	2.60019	0.80
10	9061.710	2.79965	2.79906	0.59
11	8073.224	3.00004	2.99990	0.13
12	7282.630	3.19912	3.19913	-0.02
13	6626.085	3.40036	3.40060	-0.24
14	6082.162	3.60051	3.60077	-0.26
15	5623.028	3.80006	3.80053	-0.47
16	5228.666	4.00032	4.00108	-0.76
17	4863.966	4.21565	4.21682	-1.17
18	4231.299	4.68590	4.68506	0.83
19	3822.236	5.07768	5.07735	0.34
20	3414.018	5.57206	5.57255	-0.49
21	2976.561	6.27413	6.27375	0.38
22	2605.952	7.08294	7.08025	2.69
23	2267.120	8.08875	8.08821	0.55
24	2013.518	9.10315	9.10526	-2.11
25	1817.932	10.11734	10.11951	-2.17
26	1661.597	11.13345	11.13365	-0.20
27	1534.251	12.14054	12.14012	0.41
28	1427.349	13.14913	13.14804	1.09
29	1337.252	14.14526	14.14383	1.43
30	1259.462	15.13690	15.13684	0.06
31	1191.789	16.12141	16.12254	-1.12

Order of Fit = 8 RMS error of fit = 1.00 mK
Largest absolute error = 2.69 mK at data point no. 22



POLYNOMIAL EQUATION

Calibration Report: 646117
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 68653
Serial Number: X72725
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

14.1 K to 80.3 K
1337. Ohms to 287.3 Ohms

Lower and Upper limits of Log(Resistance) used in computing Chebychev coefficients:
ZL = 2.41080449461 ZU = 3.18589647792

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	42.333087	3.2700E-04	129459.07
1	-37.858681	5.3252E-04	-71093.51
2	8.744787	4.8844E-04	17903.53
3	-1.202418	4.5340E-04	-2651.99
4	0.135310	4.3551E-04	310.69
5	-0.007459	4.1843E-04	-17.83
6	-0.005022	4.1440E-04	-12.12
7	-0.000068	4.0184E-04	-0.17
8	0.000544	4.0369E-04	1.35

$Z = \text{Log}(\text{Resistance})$

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

Temp. (K) = $\sum A_i * \text{COS}(i * \text{ARCCOS}(k))$, where $0 \leq i \leq 8$
and the A_i 's are the coefficients in the table above.

POLYNOMIAL EQUATION

Calibration Report: 646117
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 68653
Serial Number: X72725
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	1534.251	12.14012	12.14008	0.04
28	1427.349	13.14804	13.14820	-0.16
29	1337.252	14.14383	14.14390	-0.07
30	1259.462	15.13690	15.13634	0.56
31	1191.789	16.12141	16.12075	0.66
32	1131.619	17.10616	17.10858	-2.42
33	1078.232	18.09041	18.08917	1.24
34	1030.013	19.07189	19.07242	-0.53
35	986.3568	20.05539	20.05444	0.95
36	942.7865	21.13381	21.13403	-0.22
37	885.7468	22.72347	22.72202	1.44
38	834.1017	24.36063	24.36164	-1.01
39	787.4838	26.03645	26.03855	-2.10
40	746.4988	27.69662	27.69571	0.91
41	709.9504	29.34395	29.34289	1.06
42	673.2808	31.18299	31.18315	-0.16
43	635.3905	33.31572	33.31659	-0.87
44	588.6752	36.33971	36.33837	1.34
45	548.7181	39.34367	39.34433	-0.66
46	514.0709	42.33998	42.34013	-0.16
47	483.6771	45.33322	45.33115	2.08
48	456.6438	48.33263	48.33448	-1.85
49	440.3810	50.32224	50.32304	-0.80
50	404.2610	55.32318	55.32457	-1.39
51	373.7513	60.32067	60.31700	3.68
52	347.5243	65.31855	65.31987	-1.32
53	324.8125	70.31259	70.31171	0.88
54	304.8957	75.30285	75.30454	-1.69
55	287.2885	80.29442	80.29517	-0.75
56	271.6161	85.28139	85.27929	2.09
57	257.5162	90.27656	90.27733	-0.77

Order of Fit = 8 RMS error of fit = 1.35 mK
Largest absolute error = 3.68 mK at data point no. 51



POLYNOMIAL EQUATION

Calibration Report: 646117
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 68653
Serial Number: X72725
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

80.3 K to 325. K
287.3 Ohms to 73.65 Ohms

Lower and Upper limits of Log(Resistance) used in computing Chebychev coefficients:
ZL = 1.85886770101 ZU = 2.51163267942

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	177.284541	1.3196E-03	134352.16
1	-127.233735	2.0401E-03	-62365.77
2	23.057092	1.9626E-03	11748.31
3	-3.301326	1.8618E-03	-1773.17
4	0.608583	1.7728E-03	343.29
5	-0.119463	1.7748E-03	-67.31
6	0.018400	1.7486E-03	10.52
7	-0.001828	1.6860E-03	-1.08

$Z = \text{Log}(\text{Resistance})$

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

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

POLYNOMIAL EQUATION

Calibration Report: 646117
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 68653
Serial Number: X72725
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	324.8125	70.31171	70.31226	-0.55
54	304.8957	75.30454	75.30369	0.85
55	287.2885	80.29517	80.29490	0.27
56	271.6161	85.28139	85.28002	1.37
57	257.5162	90.27656	90.27829	-1.73
58	244.8071	95.26542	95.26916	-3.75
59	233.2796	100.26042	100.25669	3.74
60	213.0880	110.25700	110.25916	-2.16
61	196.0597	120.24845	120.24547	2.98
62	181.4758	130.23541	130.23579	-0.38
63	168.8564	140.22915	140.22203	7.12
64	157.8072	150.21952	150.22964	-10.12
65	148.0980	160.21352	160.21417	-0.64
66	139.4713	170.21022	170.21612	-5.90
67	131.7880	180.20412	180.19859	5.52
68	124.8929	190.19548	190.18276	12.72
69	118.6663	200.18180	200.18413	-2.33
70	113.0268	210.18399	210.19021	-6.23
71	107.9037	220.18548	220.19198	-6.50
72	103.2395	230.17554	230.17510	0.43
73	98.96869	240.17074	240.16333	7.40
74	95.04099	250.17246	250.17152	0.94
75	91.43501	260.15570	260.15431	1.38
76	88.09458	270.16676	270.17571	-8.95
77	85.01825	280.15707	280.15230	4.77
78	82.15543	290.16070	290.16483	-4.13
79	79.50181	300.15660	300.15227	4.33
80	77.02817	310.15504	310.14974	5.30
81	75.85244	315.15754	315.15714	0.40
82	74.71536	320.15391	320.16857	-14.66
83	73.34883	326.43608	326.42385	12.23
84	72.25497	331.62125	331.62497	-3.72

Order of Fit = 7 RMS error of fit = 5.91 mK
Largest absolute error = -14.66 mK at data point no. 82



INTERPOLATION TABLE

Calibration Report: 646117
 Sensor Model: CX-1050-SD-1.4L
 Sensor Type: Cernox Resistor

Sales Order: 68653
 Serial Number: X72725
 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	39735.4	-77512.	-2.7310	15.50	1233.46	-69.811	-0.87727
1.500	33155.9	-55814.	-2.5251	16.00	1199.64	-65.543	-0.87416
1.600	28299.4	-42386.	-2.3964	16.50	1167.85	-61.688	-0.87156
1.700	24533.2	-33403.	-2.3146	17.00	1137.90	-58.186	-0.86928
1.800	21540.3	-26788.	-2.2385	17.50	1109.61	-54.998	-0.86739
1.900	19120.9	-21822.	-2.1684	18.00	1082.85	-52.085	-0.86579
2.000	17137.2	-18020.	-2.1030	18.50	1057.49	-49.416	-0.86450
2.100	15489.0	-15059.	-2.0417	19.00	1033.40	-46.963	-0.86345
2.200	14105.0	-12711.	-1.9826	19.50	1010.49	-44.703	-0.86265
2.300	12931.2	-10832.	-1.9267	20.00	988.671	-42.614	-0.86205
2.400	11926.5	-9315.3	-1.8745	21.00	947.967	-38.885	-0.86141
2.500	11058.9	-8078.1	-1.8262	22.00	910.733	-35.658	-0.86136
2.600	10303.6	-7059.1	-1.7813	23.00	876.514	-32.843	-0.86182
2.700	9641.29	-6212.6	-1.7398	24.00	844.934	-30.368	-0.86259
2.800	9056.55	-5503.1	-1.7014	25.00	815.682	-28.181	-0.86371
2.900	8537.00	-4903.9	-1.6658	26.00	788.494	-26.233	-0.86500
3.000	8072.80	-4393.7	-1.6328	27.00	763.147	-24.491	-0.86648
3.100	7655.83	-3956.5	-1.6021	28.00	739.454	-22.925	-0.86807
3.200	7279.52	-3579.1	-1.5733	29.00	717.248	-21.510	-0.86970
3.300	6938.37	-3251.4	-1.5464	30.00	696.389	-20.228	-0.87142
3.400	6627.86	-2965.2	-1.5211	31.00	676.753	-19.061	-0.87312
3.500	6344.16	-2714.0	-1.4973	32.00	658.233	-17.996	-0.87486
3.600	6084.07	-2492.4	-1.4747	33.00	640.732	-17.020	-0.87657
3.700	5844.85	-2296.0	-1.4534	34.00	624.167	-16.124	-0.87830
3.800	5624.16	-2121.1	-1.4332	35.00	608.462	-15.297	-0.87992
3.900	5420.00	-1965.0	-1.4139	36.00	593.552	-14.534	-0.88152
4.000	5230.64	-1824.8	-1.3955	37.00	579.374	-13.829	-0.88316
4.200	4890.47	-1585.1	-1.3613	38.00	565.877	-13.174	-0.88468
4.400	4593.73	-1388.4	-1.3299	39.00	553.010	-12.566	-0.88617
4.600	4332.88	-1225.0	-1.3006	40.00	540.731	-12.000	-0.88766
4.800	4101.89	-1088.8	-1.2741	42.00	517.777	-10.977	-0.89043
5.000	3895.98	-973.48	-1.2493	44.00	496.737	-10.082	-0.89308
5.200	3711.35	-875.36	-1.2265	46.00	477.377	-9.2942	-0.89559
5.400	3544.92	-790.98	-1.2049	48.00	459.501	-8.5957	-0.89792
5.600	3394.17	-718.37	-1.1852	50.00	442.942	-7.9748	-0.90021
5.800	3256.95	-655.17	-1.1667	52.00	427.557	-7.4197	-0.90239
6.000	3131.58	-599.74	-1.1491	54.00	413.226	-6.9209	-0.90441
6.500	2860.86	-488.89	-1.1108	56.00	399.840	-6.4724	-0.90650
7.000	2638.09	-406.13	-1.0776	58.00	387.308	-6.0665	-0.90847
7.500	2451.42	-343.12	-1.0498	60.00	375.549	-5.6984	-0.91041
8.000	2292.70	-293.79	-1.0251	65.00	349.089	-4.9150	-0.91516
8.500	2155.90	-254.78	-1.0045	70.00	326.143	-4.2856	-0.91981
9.000	2036.70	-223.15	-0.98606	75.00	306.040	-3.7723	-0.92447
9.500	1931.78	-197.31	-0.97032	77.35	297.424	-3.5632	-0.92668
10.00	1838.67	-175.81	-0.95617	80.00	288.272	-3.3474	-0.92895
10.50	1755.38	-157.82	-0.94402	85.00	272.451	-2.9916	-0.93332
11.00	1680.40	-142.53	-0.93303	90.00	258.263	-2.6917	-0.93802
11.50	1612.47	-129.49	-0.92351	95.00	245.461	-2.4357	-0.94267
12.00	1550.61	-118.22	-0.91491	100.0	233.847	-2.2153	-0.94733
12.50	1494.00	-108.45	-0.90741	105.0	223.260	-2.0239	-0.95184
13.00	1441.96	-99.885	-0.90051	110.0	213.568	-1.8565	-0.95621
13.50	1393.94	-92.357	-0.89446	115.0	204.661	-1.7093	-0.96049
14.00	1349.46	-85.710	-0.88921	120.0	196.447	-1.5790	-0.96453
14.50	1308.10	-79.824	-0.88483	125.0	188.847	-1.4630	-0.96840
15.00	1269.53	-74.548	-0.88081	130.0	181.796	-1.3593	-0.97204



INTERPOLATION TABLE
 Calibration Report: 646117
 Sensor Model: CX-1050-SD-1.4L
 Sensor Type: Cernox Resistor

Sales Order: 68653
 Serial Number: X72725
 Temperature Range: 1.40K to 325K

<u>Temp (K)</u>	<u>Res. (Ω)</u>	<u>dR/dT (Ω/K)</u>	<u>dlogR/dlogT</u>	<u>Temp (K)</u>	<u>Res. (Ω)</u>	<u>dR/dT (Ω/K)</u>	<u>dlogR/dlogT</u>
135.0	175.236	-1.2662	-0.97547	235.0	101.130	-0.42803	-0.99462
140.0	169.119	-1.1822	-0.97866	240.0	99.0356	-0.40991	-0.99336
145.0	163.401	-1.1062	-0.98162	245.0	97.0291	-0.39284	-0.99193
150.0	158.045	-1.0371	-0.98433	250.0	95.1056	-0.37675	-0.99034
155.0	153.019	-0.97420	-0.98681	255.0	93.2601	-0.36156	-0.98861
160.0	148.294	-0.91668	-0.98904	260.0	91.4886	-0.34721	-0.98674
165.0	143.844	-0.86396	-0.99103	265.0	89.7867	-0.33364	-0.98473
170.0	139.647	-0.81551	-0.99276	270.0	88.1509	-0.32080	-0.98259
175.0	135.683	-0.77088	-0.99426	273.15	87.1526	-0.31306	-0.98119
180.0	131.933	-0.72967	-0.99552	275.0	86.5776	-0.30864	-0.98034
185.0	128.381	-0.69155	-0.99654	280.0	85.0635	-0.29711	-0.97798
190.0	125.013	-0.65619	-0.99731	285.0	83.6055	-0.28617	-0.97551
195.0	121.815	-0.62336	-0.99787	290.0	82.2009	-0.27578	-0.97295
200.0	118.775	-0.59280	-0.99819	295.0	80.8468	-0.26592	-0.97031
205.0	115.883	-0.56432	-0.99829	300.0	79.5409	-0.25654	-0.96758
210.0	113.129	-0.53773	-0.99818	305.0	78.2806	-0.24762	-0.96478
215.0	110.503	-0.51287	-0.99786	310.0	77.0640	-0.23912	-0.96191
220.0	107.998	-0.48959	-0.99733	315.0	75.8887	-0.23103	-0.95898
225.0	105.605	-0.46777	-0.99662	320.0	74.7530	-0.22332	-0.95600
230.0	103.318	-0.44728	-0.99571	325.0	73.6549	-0.21597	-0.95297



THERMAL CYCLE TESTING

Sensor Model: CX-1050-SD-1.4L

Serial Number: X72725

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:	78.2 Ω
Liquid Nitrogen:	297 Ω
Liquid Helium:	4855 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: 646117

Sensor Model: CX-1050-SD-1.4L

Sensor Type: Cernox Resistor

Sales Order: 68653

Serial Number: X72725

Temperature Range: 1.40K to 325K

Name: CX-1050-SD-1.4L

Serial number: X72725

Format: 4 ;Log Ohms/Kelvin

Limit: 325.0

Coefficient: 1 ;Negative

Point 1: 1.86718,325.000	Point 56: 2.46485, 79.000	Point 111: 3.29036, 9.400
Point 2: 1.87492,319.000	Point 57: 2.47780, 76.500	Point 112: 3.30884, 9.000
Point 3: 1.88215,313.500	Point 58: 2.48845, 74.500	Point 113: 3.32845, 8.600
Point 4: 1.88954,308.000	Point 59: 2.49935, 72.500	Point 114: 3.34930, 8.200
Point 5: 1.89709,302.500	Point 60: 2.51055, 70.500	Point 115: 3.37156, 7.800
Point 6: 1.90480,297.000	Point 61: 2.52203, 68.500	Point 116: 3.39239, 7.450
Point 7: 1.91268,291.500	Point 62: 2.53384, 66.500	Point 117: 3.41456, 7.100
Point 8: 1.92074,286.000	Point 63: 2.54598, 64.500	Point 118: 3.43831, 6.750
Point 9: 1.92897,280.500	Point 64: 2.55848, 62.500	Point 119: 3.46386, 6.400
Point 10: 1.93739,275.000	Point 65: 2.57136, 60.500	Point 120: 3.49147, 6.050
Point 11: 1.94600,269.500	Point 66: 2.58396, 58.600	Point 121: 3.51794, 5.740
Point 12: 1.95481,264.000	Point 67: 2.59627, 56.800	Point 122: 3.54558, 5.440
Point 13: 1.96383,258.500	Point 68: 2.60895, 55.000	Point 123: 3.57553, 5.140
Point 14: 1.97306,253.000	Point 69: 2.62202, 53.200	Point 124: 3.60594, 4.860
Point 15: 1.98251,247.500	Point 70: 2.63551, 51.400	Point 125: 3.63900, 4.580
Point 16: 1.99131,242.500	Point 71: 2.64945, 49.600	Point 126: 3.67259, 4.320
Point 17: 2.00029,237.500	Point 72: 2.66388, 47.800	Point 127: 3.70928, 4.060
Point 18: 2.00949,232.500	Point 73: 2.67882, 46.000	Point 128: 3.74020, 3.860
Point 19: 2.01889,227.500	Point 74: 2.69432, 44.200	Point 129: 3.76833, 3.690
Point 20: 2.02850,222.500	Point 75: 2.70862, 42.600	Point 130: 3.79850, 3.520
Point 21: 2.03835,217.500	Point 76: 2.72341, 41.000	Point 131: 3.82905, 3.360
Point 22: 2.04843,212.500	Point 77: 2.73973, 39.300	Point 132: 3.86189, 3.200
Point 23: 2.05875,207.500	Point 78: 2.75572, 37.700	Point 133: 3.89517, 3.050
Point 24: 2.06932,202.500	Point 79: 2.77129, 36.200	Point 134: 3.93107, 2.900
Point 25: 2.08016,197.500	Point 80: 2.78747, 34.700	Point 135: 3.97008, 2.750
Point 26: 2.09127,192.500	Point 81: 2.80432, 33.200	Point 136: 4.00977, 2.610
Point 27: 2.10267,187.500	Point 82: 2.82071, 31.800	Point 137: 4.05300, 2.470
Point 28: 2.11436,182.500	Point 83: 2.83778, 30.400	Point 138: 4.09700, 2.340
Point 29: 2.12637,177.500	Point 84: 2.85561, 29.000	Point 139: 4.14510, 2.210
Point 30: 2.13747,173.000	Point 85: 2.87291, 27.700	Point 140: 4.19812, 2.080
Point 31: 2.14883,168.500	Point 86: 2.89099, 26.400	Point 141: 4.25212, 1.960
Point 32: 2.16049,164.000	Point 87: 2.90995, 25.100	Point 142: 4.31152, 1.840
Point 33: 2.17244,159.500	Point 88: 2.92832, 23.900	Point 143: 4.37748, 1.720
Point 34: 2.18472,155.000	Point 89: 2.94759, 22.700	Point 144: 4.44478, 1.610
Point 35: 2.19733,150.500	Point 90: 2.96790, 21.500	Point 145: 4.51269, 1.510
Point 36: 2.21030,146.000	Point 91: 2.98756, 20.400	Point 146: 4.58180, 1.420
Point 37: 2.22363,141.500	Point 92: 3.00258, 19.600	Point 147: 4.59929, 1.400
Point 38: 2.23736,137.000	Point 93: 3.01522, 18.950	
Point 39: 2.24992,133.000	Point 94: 3.02832, 18.300	
Point 40: 2.26282,129.000	Point 95: 3.04192, 17.650	
Point 41: 2.27608,125.000	Point 96: 3.05496, 17.050	
Point 42: 2.28974,121.000	Point 97: 3.06849, 16.450	
Point 43: 2.30381,117.000	Point 98: 3.08259, 15.850	
Point 44: 2.31831,113.000	Point 99: 3.09728, 15.250	
Point 45: 2.33329,109.000	Point 100: 3.11134, 14.700	
Point 46: 2.34877,105.000	Point 101: 3.12600, 14.150	
Point 47: 2.36277,101.500	Point 102: 3.14133, 13.600	
Point 48: 2.37305, 99.000	Point 103: 3.15591, 13.100	
Point 49: 2.38355, 96.500	Point 104: 3.17116, 12.600	
Point 50: 2.39430, 94.000	Point 105: 3.18715, 12.100	
Point 51: 2.40531, 91.500	Point 106: 3.20396, 11.600	
Point 52: 2.41659, 89.000	Point 107: 3.21988, 11.150	
Point 53: 2.42817, 86.500	Point 108: 3.23659, 10.700	
Point 54: 2.44006, 84.000	Point 109: 3.25421, 10.250	
Point 55: 2.45228, 81.500	Point 110: 3.27283, 9.800	



BREAKPOINTS 91C/93C/330 FORMAT

Calibration Report: 646117
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 68653
Serial Number: X72725
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	1.86720	325.0	31	3.23666	10.7
2	1.86848	324.0	32	3.29954	9.2
3	1.88820	309.0	33	3.36596	7.9
4	1.90909	294.0	34	3.42804	6.9
5	1.93126	279.0	35	3.48754	6.1
6	1.95483	264.0	36	3.54961	5.4
7	1.97993	249.0	37	3.61298	4.8
8	2.00672	234.0	38	3.67552	4.3
9	2.03539	219.0	39	3.73400	3.9
10	2.06614	204.0	40	3.80237	3.5
11	2.09924	189.0	41	3.86210	3.2
12	2.13500	174.0	42	3.93131	2.9
13	2.17382	159.0	43	3.98414	2.7
14	2.21620	144.0	44	4.04371	2.5
15	2.26284	129.0	45	4.11164	2.3
16	2.31468	114.0	46	4.14937	2.2
17	2.37306	99.0	47	4.19002	2.1
18	2.44008	84.0	48	4.23394	2.0
19	2.51915	69.0	49	4.28151	1.9
20	2.57797	59.5	50	4.33325	1.8
21	2.64635	50.0	51	4.38976	1.7
22	2.68740	45.0	52	4.52056	1.5
23	2.73298	40.0	53	4.59918	1.4
24	2.78423	35.0			
25	2.84285	30.0			
26	2.91152	25.0			
27	2.97502	21.1			
28	3.04089	17.7			
29	3.10620	14.9			
30	3.17121	12.6			

Temperature for Resistance Decades:

Res. (Ohms)	Temp. (K)
100	237.669
1000	19.734
10000	2.644



BREAKPOINTS 234 FORMAT

Calibration Report: 646117
 Sensor Model: CX-1050-SD-1.4L
 Sensor Type: Cernox Resistor

Sales Order: 68653
 Serial Number: X72725
 Temperature Range: 1.40K to 325K

Maximum Temperature Error:

1.4 - 10K: 0.008K
 10 - 20K: 0.021K
 20 - 40K: 0.008K
 40 - 100K: 0.016K
 > 100K: 0.062K

<u>BP #</u>	<u>Temp. (K)</u>	<u>Res. (Ω)</u>	<u>Log10 Res.</u>	<u>BP #</u>	<u>Temp. (K)</u>	<u>Res. (Ω)</u>	<u>Log10 Res.</u>
1	315.134	75.85776	1.880	46	35.390	602.5596	2.780
2	300.422	79.43282	1.900	47	33.583	630.9573	2.800
3	286.508	83.17638	1.920	48	31.864	660.6934	2.820
4	273.329	87.09636	1.940	49	30.227	691.8310	2.840
5	260.831	91.20108	1.960	50	28.670	724.4360	2.860
6	248.959	95.49926	1.980	51	27.188	758.5776	2.880
7	237.672	100.00000	2.000	52	25.779	794.3282	2.900
8	226.923	104.7129	2.020	53	24.441	831.7638	2.920
9	216.680	109.6478	2.040	54	23.171	870.9636	2.940
10	206.909	114.8154	2.060	55	21.964	912.0108	2.960
11	197.581	120.2264	2.080	56	20.821	954.9926	2.980
12	188.670	125.8925	2.100	57	19.737	1000.0000	3.000
13	180.147	131.8257	2.120	58	17.742	1096.478	3.040
14	171.994	138.0384	2.140	59	15.960	1202.264	3.080
15	164.195	144.5440	2.160	60	14.374	1318.257	3.120
16	156.725	151.3561	2.180	61	12.965	1445.440	3.160
17	149.572	158.4893	2.200	62	11.717	1584.893	3.200
18	142.722	165.9587	2.220	63	10.613	1737.801	3.240
19	136.161	173.7801	2.240	64	9.635	1905.461	3.280
20	129.872	181.9701	2.260	65	8.771	2089.296	3.320
21	123.848	190.5461	2.280	66	8.006	2290.868	3.360
22	118.079	199.5262	2.300	67	7.329	2511.886	3.400
23	112.552	208.9296	2.320	68	6.728	2754.229	3.440
24	107.260	218.7762	2.340	69	6.194	3019.952	3.480
25	102.194	229.0868	2.360	70	5.718	3311.311	3.520
26	97.342	239.8833	2.380	71	5.294	3630.781	3.560
27	92.700	251.1886	2.400	72	4.915	3981.072	3.600
28	88.262	263.0268	2.420	73	4.574	4365.158	3.640
29	84.018	275.4229	2.440	74	4.267	4786.301	3.680
30	79.961	288.4032	2.460	75	3.990	5248.075	3.720
31	76.086	301.9952	2.480	76	3.740	5754.399	3.760
32	72.387	316.2278	2.500	77	3.513	6309.573	3.800
33	68.854	331.1311	2.520	78	3.306	6918.310	3.840
34	65.482	346.7369	2.540	79	3.118	7585.776	3.880
35	62.265	363.0781	2.560	80	2.946	8317.638	3.920
36	59.196	380.1894	2.580	81	2.789	9120.108	3.960
37	56.269	398.1072	2.600	82	2.644	10000.00	4.000
38	53.478	416.8694	2.620	83	2.332	12589.25	4.100
39	50.818	436.5158	2.640	84	2.077	15848.93	4.200
40	48.282	457.0882	2.660	85	1.863	19952.62	4.300
41	45.866	478.6301	2.680	86	1.683	25118.86	4.400
42	43.563	501.1872	2.700	87	1.529	31622.78	4.500
43	41.368	524.8075	2.720	88	1.399	39810.72	4.600
44	39.278	549.5409	2.740	89	1.289	50118.72	4.700
45	37.287	575.4399	2.760				

