

DATA PLOT

Calibration Report: 536507
Sensor Model: CX-1050-SD-4L
Sensor Type: Cernox Resistor

Sales Order: 43415
Serial Number: X50666
Temperature Range: 4.00K to 325K



TEST DATA

Calibration Report: 536507
Sensor Model: CX-1050-SD-4L
Sensor Type: Cernox Resistor

Sales Order: 43415
Serial Number: X50666
Temperature Range: 4.00K to 325K

Index	Temp. (K)	Resistance (Ω)	Excitation	Index	Temp. (K)	Resistance (Ω)	Excitation
1	3.60088	4763.00	2mV \pm 25%	41	75.2918	235.234	2mV \pm 25%
2	3.80020	4409.27	2mV \pm 25%	42	80.2793	221.845	2mV \pm 25%
3	3.99970	4105.42	2mV \pm 25%	43	85.2731	209.901	2mV \pm 25%
4	4.19900	3841.88	2mV \pm 25%	44	90.2645	199.207	2mV \pm 25%
5	4.64237	3369.14	2mV \pm 25%	45	95.2509	189.560	2mV \pm 25%
6	5.03745	3040.07	2mV \pm 25%	46	100.248	180.786	2mV \pm 25%
7	5.53596	2711.93	2mV \pm 25%	47	110.245	165.495	2mV \pm 25%
8	6.24175	2360.14	2mV \pm 25%	48	120.236	152.602	2mV \pm 25%
9	7.04882	2063.44	2mV \pm 25%	49	130.228	141.562	2mV \pm 25%
10	8.05561	1792.32	2mV \pm 25%	50	140.220	132.014	2mV \pm 25%
11	9.06845	1589.75	2mV \pm 25%	51	150.207	123.679	2mV \pm 25%
12	10.0807	1433.27	2mV \pm 25%	52	160.201	116.337	2mV \pm 25%
13	11.0920	1308.01	2mV \pm 25%	53	170.200	109.807	2mV \pm 25%
14	12.1020	1205.47	2mV \pm 25%	54	180.194	103.986	2mV \pm 25%
15	13.1078	1120.06	2mV \pm 25%	55	190.186	98.7738	2mV \pm 25%
16	14.1087	1047.55	2mV \pm 25%	56	200.173	94.0734	2mV \pm 25%
17	15.1047	985.162	2mV \pm 25%	57	210.173	89.8175	2mV \pm 25%
18	16.0978	930.663	2mV \pm 25%	58	220.175	85.9298	2mV \pm 25%
19	17.0870	882.571	2mV \pm 25%	59	230.167	82.3989	2mV \pm 25%
20	18.0772	839.650	2mV \pm 25%	60	240.163	79.1694	2mV \pm 25%
21	19.0676	801.087	2mV \pm 25%	61	250.163	76.1925	2mV \pm 25%
22	20.0555	766.261	2mV \pm 25%	62	260.145	73.4635	2mV \pm 25%
23	21.1379	731.670	2mV \pm 25%	63	270.157	70.9349	2mV \pm 25%
24	22.7242	686.615	2mV \pm 25%	64	280.145	68.5986	2mV \pm 25%
25	24.3624	645.931	2mV \pm 25%	65	290.152	66.4359	2mV \pm 25%
26	26.0347	609.299	2mV \pm 25%	66	300.146	64.4216	2mV \pm 25%
27	27.6939	577.052	2mV \pm 25%	67	310.142	62.5443	2mV \pm 25%
28	29.3316	548.551	2mV \pm 25%	68	315.143	61.6494	2mV \pm 25%
29	31.1686	519.887	2mV \pm 25%	69	320.138	60.7923	2mV \pm 25%
30	33.2972	490.319	2mV \pm 25%	70	326.421	59.7538	2mV \pm 25%
31	36.3186	453.899	2mV \pm 25%	71	331.607	58.9243	2mV \pm 25%
32	39.3192	422.910	2mV \pm 25%				
33	42.3218	395.990	2mV \pm 25%				
34	45.3113	372.490	2mV \pm 25%				
35	48.3098	351.637	2mV \pm 25%				
36	50.3003	339.107	2mV \pm 25%				
37	55.2992	311.327	2mV \pm 25%				
38	60.3027	287.863	2mV \pm 25%				
39	65.3020	267.813	2mV \pm 25%				
40	70.2999	250.431	2mV \pm 25%				



UNCERTAINTY ANALYSIS

Calibration Report: 536507
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 Sensor Type: Cernox Resistor

Sales Order: 43415
 Serial Number: X50666
 Temperature Range: 4.00K 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 (+/- mK)											
	Ge (GR-200-X)		Cernox (CX-Y)		CGR	RX		Pt		RhFe		Diode
	X ≤ 100	X ≥ 250	Y ≤ 1030	Y ≥ 1050		-102	-103	100 Ω	25 Ω	27 Ω	100 Ω	
1.4	4	4	4	4	4	4	4			4	4	7
4.2	4	4	4	4	4	4	6			4	4	5
10	4	4	5	4	4	10	15			4	5	6
20	8	7	9	8	8	34	34	8	10	8	9	9
30	9	8	11	9	9	72	60	8	8	9	9	28
50	12	11	16	12	13			10	10	10	10	34
100	32	18	24	16	27			11	11	11	11	30
300			72	40	100			22	22	22	22	33
400			120	67				43	43	42		47
500								48	48			52

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.

F008-04-00 (08/06/04)



POLYNOMIAL EQUATION

Calibration Report: 536507
Sensor Model: CX-1050-SD-4L
Sensor Type: Cernox Resistor

Sales Order: 43415
Serial Number: X50666
Temperature Range: 4.00K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

4.00K to 24.4K
4105. Ohms to 645.9 Ohms

Lower and Upper limits of Log(resistance) used in computing Chebychev coefficients:

ZL = 2.76121493622 ZU = 3.67788080059

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	12.083735	1.1962E-04	101013.73
1	-11.316038	1.8516E-04	-61113.73
2	3.477016	1.7901E-04	19423.42
3	-0.731315	1.6870E-04	-4335.06
4	0.087871	1.6461E-04	533.81
5	0.001442	1.5800E-04	9.13
6	-0.001441	1.5313E-04	-9.41
7	-0.000467	1.5142E-04	-3.09

Z = Log(resistance)

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

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



POLYNOMIAL EQUATION

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Sales Order: 43415
Serial Number: X50666
Temperature Range: 4.00K to 325K

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

	R Meas. (Ω)	T Meas. (K)	T Eq. (K)	T diff. (mK)
1	4763.002	3.60088	3.60080	0.08
2	4409.272	3.80020	3.80021	-0.01
3	4105.423	3.99970	3.99969	0.01
4	3841.881	4.19900	4.19953	-0.53
5	3369.140	4.64237	4.64172	0.64
6	3040.071	5.03745	5.03725	0.21
7	2711.932	5.53596	5.53612	-0.16
8	2360.142	6.24175	6.24210	-0.34
9	2063.440	7.04882	7.04913	-0.31
10	1792.318	8.05561	8.05556	0.05
11	1589.746	9.06845	9.06827	0.18
12	1433.265	10.08067	10.07941	1.26
13	1308.011	11.09200	11.09208	-0.08
14	1205.466	12.10204	12.10308	-1.03
15	1120.060	13.10778	13.10821	-0.44
16	1047.550	14.10868	14.10903	-0.35
17	985.1617	15.10469	15.10432	0.37
18	930.6632	16.09781	16.09707	0.74
19	882.5708	17.08698	17.08727	-0.29
20	839.6500	18.07717	18.07757	-0.41
21	801.0870	19.06763	19.06732	0.30
22	766.2612	20.05548	20.05508	0.41
23	731.6699	21.13787	21.13763	0.25
24	686.6150	22.72416	22.72473	-0.57
25	645.9315	24.36236	24.36207	0.29
26	609.2987	26.03471	26.03534	-0.63
27	577.0520	27.69393	27.69356	0.37

Order of Fit = 7 RMS error of fit = 0.48 mK
Largest absolute error = 1.26 mK at data point no. 12



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Sales Order: 43415
Serial Number: X50666
Temperature Range: 4.00K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

24.4K to 110.K
645.9 Ohms to 165.5 Ohms

Lower and Upper limits of Log(resistance) used in computing Chebychev coefficients:

ZL = 2.15094725647 ZU = 2.86431521168

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	64.366715	5.6480E-04	113964.18
1	-53.043778	9.1962E-04	-57680.28
2	11.188989	8.3608E-04	13382.65
3	-1.501537	7.6380E-04	-1965.88
4	0.126236	7.3085E-04	172.73
5	0.001197	7.1347E-04	1.68
6	0.001226	7.0604E-04	1.74

Z = Log(resistance)

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

Temp. (K) = $\sum A_i \cdot \text{COS}(i \cdot \text{ARCCOS}(X))$, where $0 \leq i \leq 6$
and the A_i 's are the coefficients in the table above.

POLYNOMIAL EQUATION

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Sales Order: 43415
Serial Number: X50666
Temperature Range: 4.00K to 325K

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

	R Meas. (Ω)	T Meas. (K)	T Eq. (K)	T diff. (mK)
23	731.6699	21.13763	21.13905	-1.42
24	686.6150	22.72473	22.72338	1.35
25	645.9315	24.36207	24.36041	1.67
26	609.2987	26.03471	26.03452	0.19
27	577.0520	27.69393	27.69438	-0.45
28	548.5507	29.33159	29.33226	-0.68
29	519.8874	31.16865	31.16909	-0.44
30	490.3187	33.29715	33.29898	-1.83
31	453.8987	36.31860	36.32035	-1.75
32	422.9103	39.31917	39.31837	0.80
33	395.9902	42.32182	42.31972	2.10
34	372.4895	45.31129	45.30931	1.98
35	351.6368	48.30984	48.31045	-0.61
36	339.1075	50.30033	50.29831	2.02
37	311.3275	55.29915	55.29932	-0.17
38	287.8634	60.30267	60.30454	-1.87
39	267.8128	65.30200	65.30151	0.50
40	250.4307	70.29991	70.30202	-2.11
41	235.2343	75.29182	75.29680	-4.97
42	221.8451	80.27927	80.27900	0.27
43	209.9012	85.27307	85.27142	1.65
44	199.2068	90.26452	90.25864	5.88
45	189.5596	95.25090	95.24718	3.73
46	180.7856	100.24849	100.25139	-2.90
47	165.4954	110.24467	110.24845	-3.78
48	152.6019	120.23645	120.23675	-0.31
49	141.5622	130.22844	130.22728	1.16

Order of Fit = 6 RMS error of fit = 2.24 mK
Largest absolute error = 5.88 mK at data point no. 44



POLYNOMIAL EQUATION

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Sensor Type: Cernox Resistor

Sales Order: 43415
Serial Number: X50666
Temperature Range: 4.00K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

110.K to 325.K
165.5 Ohms to 59.98 Ohms

Lower and Upper limits of Log(resistance) used in computing Chebychev coefficients:

ZL = 1.77029440053 ZU = 2.27774567682

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	194.874858	2.2186E-03	87835.96
1	-115.622777	3.4448E-03	-33564.90
2	18.119715	3.0921E-03	5859.98
3	-2.485189	3.0182E-03	-823.41
4	0.422114	3.0202E-03	139.76
5	-0.070932	2.9881E-03	-23.74
6	0.010545	2.8821E-03	3.66

Z = Log(resistance)

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

Temp. (K) = $\sum A_i \cdot \text{COS}(i \cdot \text{ARCCOS}(X))$, where $0 \leq i \leq 6$
and the A_i 's are the coefficients in the table above.

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Sensor Type: Cernox Resistor

Sales Order: 43415
Serial Number: X50666
Temperature Range: 4.00K to 325K

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

	R Meas. (Ω)	T Meas. (K)	T Eq. (K)	T diff. (mK)
45	189.5596	95.24718	95.24833	-1.16
46	180.7856	100.25139	100.24982	1.57
47	165.4954	110.24845	110.24731	1.14
48	152.6019	120.23645	120.23680	-0.35
49	141.5622	130.22844	130.23234	-3.89
50	132.0140	140.22035	140.22256	-2.21
51	123.6791	150.20714	150.20487	2.27
52	116.3369	160.20066	160.18897	11.69
53	109.8074	170.19975	170.20106	-1.31
54	103.9865	180.19386	180.20480	-10.93
55	98.77376	190.18553	190.18917	-3.64
56	94.07335	200.17340	200.17352	-0.12
57	89.81747	210.17283	210.15537	17.46
58	85.92977	220.17536	220.18633	-10.98
59	82.39890	230.16694	230.17300	-6.07
60	79.16939	240.16342	240.15103	12.39
61	76.19250	250.16345	250.16924	-5.79
62	73.46346	260.14518	260.14495	0.23
63	70.93493	270.15732	270.15793	-0.61
64	68.59861	280.14453	280.15708	-12.55
65	66.43590	290.15154	290.13651	15.03
66	64.42161	300.14646	300.13527	11.19
67	62.54430	310.14165	310.14009	1.56
68	61.64944	315.14350	315.16490	-21.40
69	60.79231	320.13785	320.14447	-6.62
70	59.75382	326.42145	326.40911	12.34
71	58.92430	331.60690	331.60613	0.77

Order of Fit = 6 RMS error of fit = 8.85 mK
Largest absolute error = -21.40 mK at data point no. 68



INTERPOLATION TABLE

Calibration Report: 536507
 Sensor Model: CX-1050-SD-4L
 Sensor Type: Cernox Resistor

Sales Order: 43415
 Serial Number: X50666
 Temperature Range: 4.00K to 325K

Temp (K)	Res. (Ω)	dR/dT (Ω/K)	dlogR/dlogT	Temp (K)	Res. (Ω)	dR/dT (Ω/K)	dlogR/dlogT
4.000	4104.98	-1413.8	-1.3776	37.00	446.466	-10.750	-0.89087
4.200	3841.31	-1229.3	-1.3441	38.00	435.979	-10.231	-0.89177
4.400	3611.06	-1077.9	-1.3135	39.00	425.991	-9.7500	-0.89263
4.600	3408.40	-952.57	-1.2856	40.00	416.467	-9.3027	-0.89348
4.800	3228.62	-848.10	-1.2609	42.00	398.687	-8.4959	-0.89500
5.000	3068.09	-759.70	-1.2381	44.00	382.416	-7.7912	-0.89644
5.200	2923.86	-684.48	-1.2173	46.00	367.466	-7.1718	-0.89778
5.400	2793.60	-619.72	-1.1979	48.00	353.681	-6.6240	-0.89898
5.600	2675.37	-563.93	-1.1804	50.00	340.928	-6.1380	-0.90019
5.800	2567.57	-515.16	-1.1637	52.00	329.094	-5.7043	-0.90133
6.000	2468.91	-472.33	-1.1479	54.00	318.082	-5.3151	-0.90234
6.500	2255.34	-386.29	-1.1133	56.00	307.807	-4.9659	-0.90345
7.000	2079.11	-321.67	-1.0830	58.00	298.196	-4.6502	-0.90448
7.500	1931.15	-272.17	-1.0570	60.00	289.186	-4.3643	-0.90549
8.000	1805.18	-233.31	-1.0340	65.00	268.941	-3.7571	-0.90804
8.500	1696.50	-202.46	-1.0144	70.00	251.415	-3.2706	-0.91060
9.000	1601.75	-177.41	-0.99684	75.00	236.084	-2.8746	-0.91320
9.500	1518.33	-156.91	-0.98177	77.35	229.521	-2.7134	-0.91445
10.00	1444.27	-139.85	-0.96829	80.00	222.554	-2.5478	-0.91584
10.50	1378.02	-125.56	-0.95669	85.00	210.517	-2.2749	-0.91852
11.00	1318.36	-113.41	-0.94629	90.00	199.734	-2.0445	-0.92124
11.50	1264.31	-103.05	-0.93731	95.00	190.015	-1.8481	-0.92398
12.00	1215.08	-94.092	-0.92925	100.0	181.207	-1.6795	-0.92683
12.50	1170.02	-86.326	-0.92227	105.0	173.183	-1.5334	-0.92969
13.00	1128.59	-79.523	-0.91601	110.0	165.842	-1.4057	-0.93237
13.50	1090.35	-73.546	-0.91059	115.0	159.100	-1.2936	-0.93504
14.00	1054.93	-68.248	-0.90572	120.0	152.884	-1.1947	-0.93770
14.50	1022.01	-63.542	-0.90152	125.0	147.135	-1.1068	-0.94032
15.00	991.308	-59.330	-0.89776	130.0	141.801	-1.0282	-0.94265
15.50	962.604	-55.553	-0.89452	135.0	136.839	-0.95764	-0.94477
16.00	935.694	-52.143	-0.89163	140.0	132.213	-0.89400	-0.94666
16.50	910.406	-49.060	-0.88916	145.0	127.889	-0.83643	-0.94834
17.00	886.587	-46.258	-0.88698	150.0	123.840	-0.78414	-0.94978
17.50	864.106	-43.705	-0.88513	155.0	120.040	-0.73650	-0.95100
18.00	842.846	-41.370	-0.88351	160.0	116.468	-0.69298	-0.95200
18.50	822.703	-39.230	-0.88217	165.0	113.104	-0.65311	-0.95278
19.00	803.587	-37.262	-0.88101	170.0	109.931	-0.61648	-0.95334
19.50	785.416	-35.448	-0.88008	175.0	106.934	-0.58275	-0.95369
20.00	768.116	-33.772	-0.87934	180.0	104.099	-0.55162	-0.95382
21.00	735.879	-30.774	-0.87822	185.0	101.414	-0.52283	-0.95375
22.00	706.432	-28.184	-0.87770	190.0	98.8675	-0.49614	-0.95347
23.00	679.391	-25.953	-0.87861	195.0	96.4495	-0.47136	-0.95298
24.00	654.448	-23.966	-0.87890	200.0	94.1511	-0.44830	-0.95229
25.00	631.392	-22.182	-0.87830	205.0	91.9639	-0.42681	-0.95141
26.00	610.010	-20.618	-0.87878	210.0	89.8806	-0.40675	-0.95033
27.00	590.097	-19.232	-0.87996	215.0	87.8943	-0.38799	-0.94907
28.00	571.500	-17.982	-0.88101	220.0	85.9987	-0.37043	-0.94762
29.00	554.092	-16.854	-0.88209	225.0	84.1882	-0.35396	-0.94600
30.00	537.757	-15.833	-0.88330	230.0	82.4574	-0.33851	-0.94420
31.00	522.395	-14.905	-0.88447	235.0	80.8016	-0.32398	-0.94224
32.00	507.920	-14.057	-0.88563	240.0	79.2162	-0.31030	-0.94013
33.00	494.257	-13.281	-0.88675	245.0	77.6972	-0.29743	-0.93786
34.00	481.336	-12.570	-0.88788	250.0	76.2407	-0.28528	-0.93545
35.00	469.099	-11.914	-0.88889	255.0	74.8433	-0.27381	-0.93292
36.00	457.492	-11.309	-0.88987	260.0	73.5016	-0.26298	-0.93025



INTERPOLATION TABLE

Calibration Report: 536507
Sensor Model: CX-1050-SD-4L
Sensor Type: Cernox Resistor

Sales Order: 43415
Serial Number: X50666
Temperature Range: 4.00K 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>
265.0	72.2125	-0.25274	-0.92747	285.0	67.5291	-0.21688	-0.91534
270.0	70.9733	-0.24304	-0.92458	290.0	66.4644	-0.20904	-0.91210
273.15	70.2170	-0.23719	-0.92271	295.0	65.4380	-0.20159	-0.90878
275.0	69.7813	-0.23385	-0.92159	300.0	64.4479	-0.19451	-0.90541
280.0	68.6340	-0.22515	-0.91851	305.0	63.4924	-0.18777	-0.90198
				310.0	62.5697	-0.18135	-0.89851
				315.0	61.6783	-0.17524	-0.89499
				320.0	60.8168	-0.16942	-0.89145
				325.0	59.9837	-0.16387	-0.88787



THERMAL CYCLE TESTING

Sensor Model: CX-1050-SD-4L

Serial Number: X50666

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:	63.4 Ω
Liquid Nitrogen:	229 Ω
Liquid Helium:	3821 Ω

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 or power at the values listed on the Test Data page.



BREAKPOINTS 340 FORMAT

Calibration Report: 536507

Sensor Model: CX-1050-SD-4L

Sensor Type: Cernox Resistor

Sales Order: 43415

Serial Number: X50666

Temperature Range: 4.00K to 325K

Name: CX-1050-SD-4L

Serial number: X50666

Format: 4 ;Log Ohms/Kelvin

Limit: 325.0

Coefficient: 1 ;Negative

Point 1: 1.77802,325.000	Point 56: 2.34493, 80.500	Point 111: 3.16380, 9.900
Point 2: 1.78522,319.000	Point 57: 2.35495, 78.500	Point 112: 3.18353, 9.450
Point 3: 1.79198,313.500	Point 58: 2.36519, 76.500	Point 113: 3.20213, 9.050
Point 4: 1.79888,308.000	Point 59: 2.37570, 74.500	Point 114: 3.22178, 8.650
Point 5: 1.80594,302.500	Point 60: 2.38648, 72.500	Point 115: 3.24267, 8.250
Point 6: 1.81315,297.000	Point 61: 2.39756, 70.500	Point 116: 3.26494, 7.850
Point 7: 1.82053,291.500	Point 62: 2.40893, 68.500	Point 117: 3.28573, 7.500
Point 8: 1.82809,286.000	Point 63: 2.42063, 66.500	Point 118: 3.30783, 7.150
Point 9: 1.83581,280.500	Point 64: 2.43268, 64.500	Point 119: 3.33147, 6.800
Point 10: 1.84372,275.000	Point 65: 2.44509, 62.500	Point 120: 3.35681, 6.450
Point 11: 1.85182,269.500	Point 66: 2.45789, 60.500	Point 121: 3.38414, 6.100
Point 12: 1.86012,264.000	Point 67: 2.47043, 58.600	Point 122: 3.41111, 5.780
Point 13: 1.86784,259.000	Point 68: 2.48269, 56.800	Point 123: 3.43838, 5.480
Point 14: 1.87573,254.000	Point 69: 2.49532, 55.000	Point 124: 3.46780, 5.180
Point 15: 1.88380,249.000	Point 70: 2.50835, 53.200	Point 125: 3.49978, 4.880
Point 16: 1.89206,244.000	Point 71: 2.52183, 51.400	Point 126: 3.53234, 4.600
Point 17: 1.90050,239.000	Point 72: 2.53577, 49.600	Point 127: 3.56527, 4.340
Point 18: 1.90915,234.000	Point 73: 2.55020, 47.800	Point 128: 3.60125, 4.080
Point 19: 1.91800,229.000	Point 74: 2.56517, 46.000	Point 129: 3.61337, 4.000
Point 20: 1.92707,224.000	Point 75: 2.57898, 44.400	
Point 21: 1.93635,219.000	Point 76: 2.59326, 42.800	
Point 22: 1.94586,214.000	Point 77: 2.60807, 41.200	
Point 23: 1.95562,209.000	Point 78: 2.62441, 39.500	
Point 24: 1.96562,204.000	Point 79: 2.64043, 37.900	
Point 25: 1.97588,199.000	Point 80: 2.65607, 36.400	
Point 26: 1.98641,194.000	Point 81: 2.67232, 34.900	
Point 27: 1.99722,189.000	Point 82: 2.68925, 33.400	
Point 28: 2.00720,184.500	Point 83: 2.70575, 32.000	
Point 29: 2.01743,180.000	Point 84: 2.72293, 30.600	
Point 30: 2.02792,175.500	Point 85: 2.74089, 29.200	
Point 31: 2.03867,171.000	Point 86: 2.75833, 27.900	
Point 32: 2.04971,166.500	Point 87: 2.77656, 26.600	
Point 33: 2.06105,162.000	Point 88: 2.79568, 25.300	
Point 34: 2.07269,157.500	Point 89: 2.81422, 24.100	
Point 35: 2.08466,153.000	Point 90: 2.83370, 22.900	
Point 36: 2.09698,148.500	Point 91: 2.85422, 21.700	
Point 37: 2.10965,144.000	Point 92: 2.87407, 20.600	
Point 38: 2.12125,140.000	Point 93: 2.89019, 19.750	
Point 39: 2.13316,136.000	Point 94: 2.90299, 19.100	
Point 40: 2.14540,132.000	Point 95: 2.91624, 18.450	
Point 41: 2.15800,128.000	Point 96: 2.93000, 17.800	
Point 42: 2.17097,124.000	Point 97: 2.94318, 17.200	
Point 43: 2.18433,120.000	Point 98: 2.95686, 16.600	
Point 44: 2.19812,116.000	Point 99: 2.97109, 16.000	
Point 45: 2.21236,112.000	Point 100: 2.98591, 15.400	
Point 46: 2.22708,108.000	Point 101: 3.00009, 14.850	
Point 47: 2.24041,104.500	Point 102: 3.01485, 14.300	
Point 48: 2.25413,101.000	Point 103: 3.03027, 13.750	
Point 49: 2.26628, 98.000	Point 104: 3.04641, 13.200	
Point 50: 2.27667, 95.500	Point 105: 3.06179, 12.700	
Point 51: 2.28730, 93.000	Point 106: 3.07788, 12.200	
Point 52: 2.29822, 90.500	Point 107: 3.09478, 11.700	
Point 53: 2.30942, 88.000	Point 108: 3.11077, 11.250	
Point 54: 2.32093, 85.500	Point 109: 3.12752, 10.800	
Point 55: 2.33276, 83.000	Point 110: 3.14517, 10.350	



BREAKPOINTS 91C/93C/330 FORMAT

Calibration Report: 536507
Sensor Model: CX-1050-SD-4L
Sensor Type: Cernox Resistor

Sales Order: 43415
Serial Number: X50666
Temperature Range: 4.00K to 325K

Interpolation Method: Lagrangian
Limit: 325.0 (Kelvin)
Format: 4 (Log Ohms/Kelvin)
Number of Breakpoints: 47

No.	Units	Temperature (K)	No.	Units	Temperature (K)
1	1.77803	325.0	26	2.74226	29.1
2	1.77922	324.0	27	2.78681	25.9
3	1.79763	309.0	28	2.83046	23.1
4	1.81717	294.0	29	2.87414	20.6
5	1.83797	279.0	30	2.91732	18.4
6	1.86014	264.0	31	2.96158	16.4
7	1.88382	249.0	32	3.00410	14.7
8	1.90917	234.0	33	3.04647	13.2
9	1.93637	219.0	34	3.09140	11.8
10	1.96564	204.0	35	3.13532	10.6
11	1.99724	189.0	36	3.17691	9.6
12	2.03149	174.0	37	3.21935	8.7
13	2.06880	159.0	38	3.26218	7.9
14	2.10968	144.0	39	3.30469	7.2
15	2.15484	129.0	40	3.34585	6.6
16	2.20522	114.0	41	3.38429	6.1
17	2.26222	99.0	42	3.42738	5.6
18	2.32801	84.0	43	3.46596	5.2
19	2.40608	69.0	44	3.50902	4.8
20	2.46447	59.5	45	3.54489	4.5
21	2.52492	51.0	46	3.59863	4.1
22	2.56522	46.0	47	3.61331	4.0
23	2.61000	41.0			
24	2.65399	36.6			
25	2.69865	32.6			

Temperature for Resistance Decades:

Res. (Ohms)	Temp. (K)
100	187.744
1000	14.855



BREAKPOINTS 234 FORMAT

Calibration Report: 536507
 Sensor Model: CX-1050-SD-4L
 Sensor Type: Cernox Resistor

Sales Order: 43415
 Serial Number: X50666
 Temperature Range: 4.00K to 325K

Maximum Temperature Error:

1.4 - 10K: 0.008K
 10 - 20K: 0.016K
 20 - 40K: 0.008K
 40 - 100K: 0.017K
 > 100K: 0.082K

BP #	Temp. (K)	Res. (Ω)	Log10 Res.	BP #	Temp. (K)	Res. (Ω)	Log10 Res.
1	323.350	60.25596	1.780	41	44.288	380.1894	2.580
2	307.134	63.09573	1.800	42	42.068	398.1072	2.600
3	291.905	66.06934	1.820	43	39.957	416.8694	2.620
4	277.579	69.18310	1.840	44	37.948	436.5158	2.640
5	264.092	72.44360	1.860	45	36.036	457.0882	2.660
6	251.348	75.85776	1.880	46	34.216	478.6301	2.680
7	239.306	79.43282	1.900	47	32.486	501.1872	2.700
8	227.892	83.17638	1.920	48	30.839	524.8075	2.720
9	217.077	87.09636	1.940	49	29.272	549.5409	2.740
10	206.807	91.20108	1.960	50	27.782	575.4399	2.760
11	197.035	95.49926	1.980	51	26.366	602.5596	2.780
12	187.745	100.0000	2.000	52	25.020	630.9573	2.800
13	178.893	104.7129	2.020	53	23.742	660.6934	2.820
14	170.461	109.6478	2.040	54	22.530	691.8310	2.840
15	162.421	114.8154	2.060	55	21.378	724.4360	2.860
16	154.748	120.2264	2.080	56	20.286	758.5776	2.880
17	147.424	125.8925	2.100	57	19.252	794.3282	2.900
18	140.434	131.8257	2.120	58	18.272	831.7638	2.920
19	133.758	138.0384	2.140	59	17.344	870.9636	2.940
20	127.382	144.5440	2.160	60	16.467	912.0108	2.960
21	121.292	151.3561	2.180	61	15.638	954.9926	2.980
22	115.475	158.4893	2.200	62	14.855	1000.000	3.000
23	109.917	165.9587	2.220	63	13.417	1096.478	3.040
24	104.610	173.7801	2.240	64	12.138	1202.264	3.080
25	99.547	181.9701	2.260	65	11.001	1318.257	3.120
26	94.714	190.5461	2.280	66	9.992	1445.440	3.160
27	90.102	199.5262	2.300	67	9.096	1584.893	3.200
28	85.703	208.9296	2.320	68	8.301	1737.801	3.240
29	81.509	218.7762	2.340	69	7.596	1905.461	3.280
30	77.510	229.0868	2.360	70	6.968	2089.296	3.320
31	73.699	239.8833	2.380	71	6.410	2290.868	3.360
32	70.069	251.1886	2.400	72	5.911	2511.886	3.400
33	66.611	263.0268	2.420	73	5.465	2754.229	3.440
34	63.317	275.4229	2.440	74	5.064	3019.952	3.480
35	60.180	288.4032	2.460	75	4.705	3311.311	3.520
36	57.193	301.9952	2.480	76	4.382	3630.781	3.560
37	54.351	316.2278	2.500	77	4.090	3981.072	3.600
38	51.646	331.1311	2.520	78	3.827	4365.158	3.640
39	49.070	346.7369	2.540				
40	46.619	363.0781	2.560				

