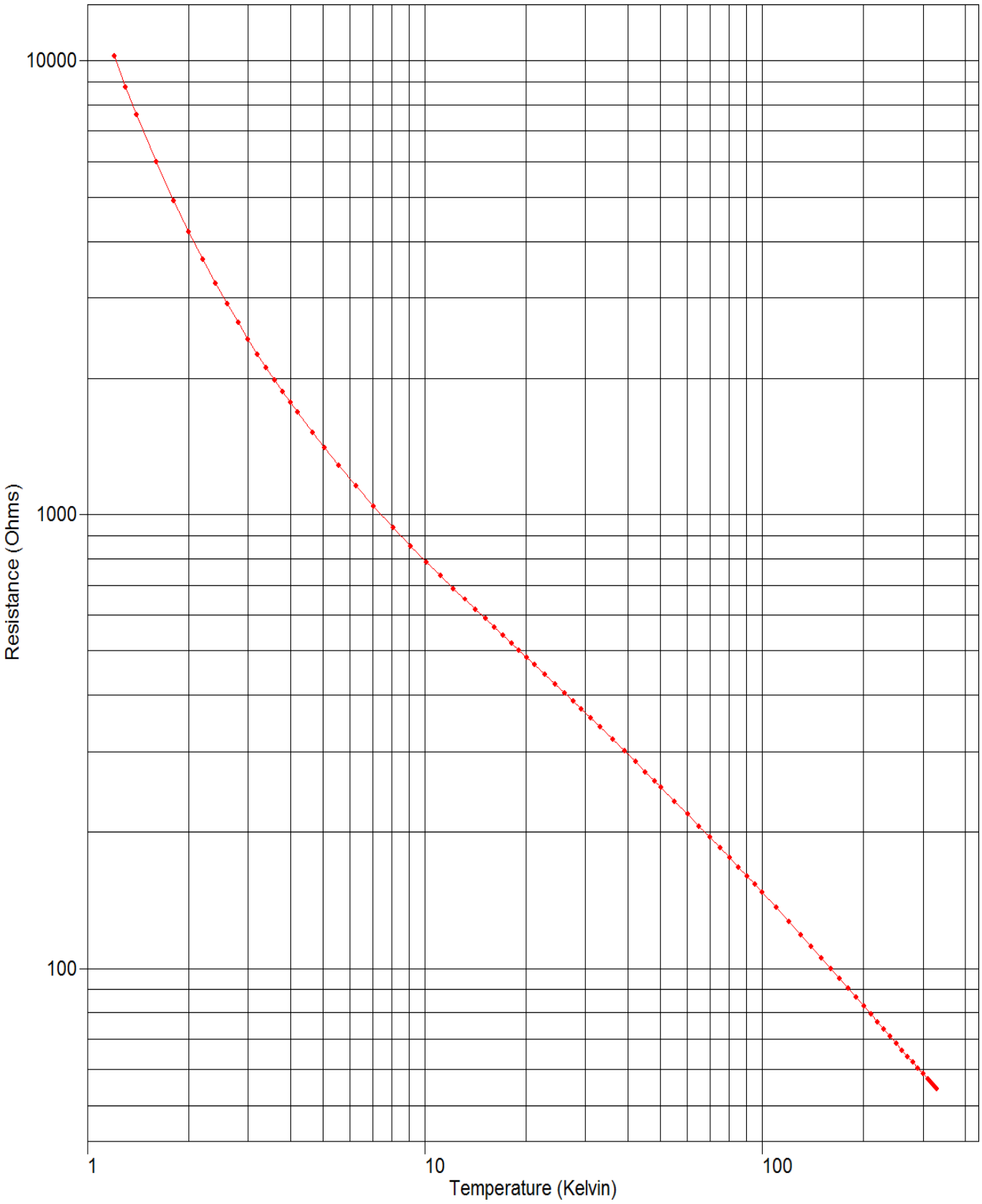
DATA PLOT

Calibration Report: 628719
Sensor Model: CX-1050-CU-1.4L
Sensor Type: Cernox Resistor

Sales Order: 64119
Serial Number: X68437
Temperature Range: 1.40K to 325K



LakeShore
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TEST DATA

Calibration Report: 628719
Sensor Model: CX-1050-CU-1.4L
Sensor Type: Cernox Resistor

Sales Order: 64119
Serial Number: X68437
Temperature Range: 1.40K to 325K

Index	Temp. (K)	Resistance (Ω)	Excitation	Index	Temp. (K)	Resistance (Ω)	Excitation
1	1.20148	10250.3	2mV±25%	46	42.1638	284.854	2mV±25%
2	1.30142	8741.27	2mV±25%	47	45.1577	270.781	2mV±25%
3	1.40047	7598.53	2mV±25%	48	48.1581	258.137	2mV±25%
4	1.59971	5985.83	2mV±25%	49	50.1481	250.470	2mV±25%
5	1.80063	4922.87	2mV±25%	50	55.1445	233.220	2mV±25%
6	1.99988	4190.06	2mV±25%	51	60.1443	218.374	2mV±25%
7	2.20149	3644.84	2mV±25%	52	65.1335	205.502	2mV±25%
8	2.40082	3234.11	2mV±25%	53	70.1296	194.168	2mV±25%
9	2.59967	2911.65	2mV±25%	54	75.1214	184.140	2mV±25%
10	2.80063	2649.20	2mV±25%	55	80.1140	175.152	2mV±25%
11	2.99822	2437.77	2mV±25%	56	85.1086	167.058	2mV±25%
12	3.19941	2257.72	2mV±25%	57	90.1015	159.725	2mV±25%
13	3.39407	2110.57	2mV±25%	58	95.0946	153.052	2mV±25%
14	3.59770	1978.24	2mV±25%	59	100.102	146.916	2mV±25%
15	3.79869	1865.38	2mV±25%	60	110.089	136.103	2mV±25%
16	3.99834	1767.18	2mV±25%	61	120.088	126.826	2mV±25%
17	4.20283	1678.68	2mV±25%	62	130.081	118.765	2mV±25%
18	4.64816	1519.11	2mV±25%	63	140.078	111.692	2mV±25%
19	5.05068	1402.81	2mV±25%	64	150.076	105.446	2mV±25%
20	5.55493	1284.53	2mV±25%	65	160.078	99.8782	2mV±25%
21	6.25872	1155.86	2mV±25%	66	170.077	94.8898	2mV±25%
22	7.07206	1042.38	2mV±25%	67	180.076	90.3941	2mV±25%
23	8.08575	934.792	2mV±25%	68	190.066	86.3382	2mV±25%
24	9.09931	852.397	2mV±25%	69	200.071	82.6432	2mV±25%
25	10.1170	786.619	2mV±25%	70	210.075	79.2751	2mV±25%
26	11.1351	732.702	2mV±25%	71	220.071	76.1948	2mV±25%
27	12.1478	687.729	2mV±25%	72	230.065	73.3645	2mV±25%
28	13.1577	649.460	2mV±25%	73	240.069	70.7562	2mV±25%
29	14.1581	616.518	2mV±25%	74	250.062	68.3543	2mV±25%
30	15.1461	587.951	2mV±25%	75	260.061	66.1275	2mV±25%
31	16.1357	562.510	2mV±25%	76	270.062	64.0626	2mV±25%
32	17.1154	539.853	2mV±25%	77	280.061	62.1401	2mV±25%
33	18.0983	519.277	2mV±25%	78	290.067	60.3516	2mV±25%
34	19.0755	500.622	2mV±25%	79	300.072	58.6848	2mV±25%
35	20.0557	483.524	2mV±25%	80	310.076	57.1212	2mV±25%
36	21.1400	466.128	2mV±25%	81	315.083	56.3779	2mV±25%
37	22.7207	443.309	2mV±25%	82	320.085	55.6588	2mV±25%
38	24.3286	422.620	2mV±25%	83	326.081	54.8267	2mV±25%
39	25.9409	404.011	2mV±25%	84	330.081	54.2883	2mV±25%
40	27.5776	386.959	2mV±25%				
41	29.2021	371.567	2mV±25%				
42	31.0347	355.784	2mV±25%				
43	33.1543	339.349	2mV±25%				
44	36.1639	318.677	2mV±25%				
45	39.1606	300.722	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)											
	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.

POLYNOMIAL EQUATION

Calibration Report: 628719 Sales Order: 64119
Sensor Model: CX-1050-CU-1.4L Serial Number: X68437
Sensor Type: Cernox Resistor Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

1.40 K	to	14.2 K
7603. Ohms	to	616.5 Ohms

Lower and Upper limits of Log(Resistance) used in computing Chebychev coefficients:
ZL = 2.75013005375 ZU = 4.01073727625

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	5.549989	1.4099E-04	39364.02
1	-6.382948	2.2895E-04	-27878.78
2	2.806002	2.0358E-04	13783.58
3	-1.013843	2.0669E-04	-4905.23
4	0.303848	1.9743E-04	1539.02
5	-0.071652	1.8204E-04	-393.61
6	0.010052	1.7508E-04	57.42
7	0.000848	1.8390E-04	4.61
8	-0.001577	1.8812E-04	-8.38
9	0.000741	1.8303E-04	4.05

Z = Log(Resistance)

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

Temp. (K) = ΣA_i* COS(i * ARCCOS(k)), where 0 <= i <= 9
and the A_i's are the coefficients in the table above.

POLYNOMIAL EQUATION

Calibration Report: 628719 Sales Order: 64119
Sensor Model: CX-1050-CU-1.4L Serial Number: X68437
Sensor Type: Cernox Resistor 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	10250.32	1.20148	1.20146	0.02
2	8741.271	1.30142	1.30149	-0.08
3	7598.526	1.40047	1.40044	0.03
4	5985.830	1.59971	1.59950	0.21
5	4922.869	1.80063	1.80090	-0.26
6	4190.057	1.99988	1.99995	-0.07
7	3644.835	2.20149	2.20154	-0.05
8	3234.108	2.40082	2.40065	0.16
9	2911.647	2.59967	2.59942	0.24
10	2649.196	2.80063	2.80059	0.04
11	2437.772	2.99822	2.99808	0.14
12	2257.720	3.19941	3.19963	-0.23
13	2110.566	3.39407	3.39400	0.07
14	1978.237	3.59770	3.59783	-0.13
15	1865.377	3.79869	3.79885	-0.16
16	1767.183	3.99834	3.99885	-0.51
17	1678.684	4.20283	4.20343	-0.60
18	1519.112	4.64816	4.64688	1.28
19	1402.815	5.05068	5.04995	0.72
20	1284.526	5.55493	5.55564	-0.71
21	1155.855	6.25872	6.25910	-0.38
22	1042.385	7.07206	7.07097	1.09
23	934.7922	8.08575	8.08663	-0.88
24	852.3968	9.09931	9.10020	-0.89
25	786.6188	10.11701	10.11667	0.34
26	732.7021	11.13509	11.13432	0.78
27	687.7286	12.14779	12.14752	0.26
28	649.4599	13.15769	13.15722	0.47
29	616.5183	14.15809	14.15905	-0.96
30	587.9509	15.14611	15.14663	-0.52
31	562.5097	16.13574	16.13517	0.57

Order of Fit = 9 RMS error of fit = 0.54 mK
Largest absolute error = 1.28 mK at data point no. 18

POLYNOMIAL EQUATION

Calibration Report: 628719 Sales Order: 64119
Sensor Model: CX-1050-CU-1.4L Serial Number: X68437
Sensor Type: Cernox Resistor Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

14.2 K	to	80.1 K
616.5 Ohms	to	175.2 Ohms

Lower and Upper limits of Log(Resistance) used in computing Chebychev coefficients:
ZL = 2.20337355089 ZU = 2.83741711101

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	42.569230	3.8420E-04	110799.09
1	-37.884809	6.3713E-04	-59461.48
2	8.440744	5.7447E-04	14693.19
3	-1.088061	5.4051E-04	-2013.02
4	0.120875	5.1210E-04	236.04
5	-0.005618	4.9251E-04	-11.41
6	-0.006284	4.9005E-04	-12.82
7	0.000894	4.7910E-04	1.87
8	-0.000346	4.7482E-04	-0.73
9	0.001033	4.8237E-04	2.14

Z = Log(Resistance)

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

Temp. (K) = ΣA_i* COS(i * ARCCOS(k)), where 0 <= i <= 9
and the A_i's are the coefficients in the table above.

POLYNOMIAL EQUATION

Calibration Report: 628719
Sensor Model: CX-1050-CU-1.4L
Sensor Type: Cernox Resistor

Sales Order: 64119
Serial Number: X68437
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	687.7286	12.14752	12.14766	-0.13
28	649.4599	13.15722	13.15665	0.57
29	616.5183	14.15905	14.15935	-0.30
30	587.9509	15.14611	15.14711	-1.00
31	562.5097	16.13574	16.13518	0.56
32	539.8528	17.11536	17.11484	0.52
33	519.2773	18.09833	18.09786	0.47
34	500.6216	19.07549	19.07631	-0.82
35	483.5238	20.05567	20.05489	0.78
36	466.1278	21.13997	21.14051	-0.54
37	443.3088	22.72067	22.72063	0.04
38	422.6196	24.32862	24.32911	-0.50
39	404.0114	25.94090	25.94132	-0.41
40	386.9589	27.57757	27.57706	0.51
41	371.5675	29.20205	29.20205	0.00
42	355.7842	31.03471	31.03560	-0.89
43	339.3492	33.15425	33.15136	2.90
44	318.6766	36.16388	36.16447	-0.59
45	300.7217	39.16060	39.16162	-1.01
46	284.8539	42.16382	42.16461	-0.80
47	270.7810	45.15773	45.15853	-0.80
48	258.1372	48.15812	48.16001	-1.89
49	250.4698	50.14812	50.14472	3.40
50	233.2200	55.14450	55.14188	2.62
51	218.3736	60.14433	60.14657	-2.24
52	205.5024	65.13350	65.13448	-0.99
53	194.1675	70.12961	70.13203	-2.42
54	184.1400	75.12143	75.11695	4.48
55	175.1520	80.11404	80.11433	-0.28
56	167.0585	85.10856	85.11052	-1.96
57	159.7252	90.10151	90.10078	0.73

Order of Fit = 9 RMS error of fit = 1.55 mK
Largest absolute error = 4.48 mK at data point no. 54

POLYNOMIAL EQUATION

Calibration Report: 628719 Sales Order: 64119
Sensor Model: CX-1050-CU-1.4L Serial Number: X68437
Sensor Type: Cernox Resistor Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

80.1 K	to	325. K
175.2 Ohms	to	54.97 Ohms

Lower and Upper limits of Log(Resistance) used in computing Chebychev coefficients:
ZL = 1.73470658973 ZU = 2.28817656626

Order	Coefficient	Std. Deviation of Coefficient	Ratio (Coeff./Std Dev.)
0	176.878060	1.0199E-03	173420.82
1	-126.587416	1.5804E-03	-80096.28
2	22.574869	1.5040E-03	15009.40
3	-3.258772	1.4142E-03	-2304.40
4	0.634015	1.3454E-03	471.25
5	-0.124240	1.3492E-03	-92.09
6	0.018859	1.3342E-03	14.13
7	-0.005160	1.3013E-03	-3.97
8	0.000463	1.3146E-03	0.35
9	0.001441	1.3113E-03	1.10

Z = Log(Resistance)

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

Temp. (K) = ΣA_i* COS(i * ARCCOS(k)), where 0 <= i <= 9
and the A_i's are the coefficients in the table above.

POLYNOMIAL EQUATION

Calibration Report: 628719
Sensor Model: CX-1050-CU-1.4L
Sensor Type: Cernox Resistor

Sales Order: 64119
Serial Number: X68437
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	194.1675	70.13203	70.13212	-0.09
54	184.1400	75.11695	75.11677	0.18
55	175.1520	80.11433	80.11387	0.46
56	167.0585	85.10856	85.10920	-0.64
57	159.7252	90.10151	90.10346	-1.95
58	153.0524	95.09456	95.09125	3.30
59	146.9156	100.10232	100.10264	-0.32
60	136.1029	110.08921	110.09224	-3.04
61	126.8259	120.08775	120.08352	4.23
62	118.7646	130.08146	130.08177	-0.31
63	111.6921	140.07782	140.08406	-6.24
64	105.4459	150.07591	150.07345	2.46
65	99.87821	160.07784	160.07301	4.82
66	94.88983	170.07727	170.07447	2.79
67	90.39414	180.07593	180.08444	-8.52
68	86.33818	190.06650	190.06540	1.10
69	82.64324	200.07118	200.07197	-0.80
70	79.27510	210.07475	210.07311	1.64
71	76.19478	220.07123	220.06627	4.96
72	73.36447	230.06500	230.06673	-1.72
73	70.75618	240.06950	240.07588	-6.38
74	68.35430	250.06220	250.05913	3.07
75	66.12751	260.06108	260.05923	1.86
76	64.06256	270.06168	270.05650	5.18
77	62.14008	280.06056	280.06966	-9.10
78	60.35156	290.06698	290.07133	-4.35
79	58.68480	300.07151	300.05855	12.95
80	57.12119	310.07598	310.07953	-3.55
81	56.37790	315.08303	315.08494	-1.90
82	55.65879	320.08475	320.08641	-1.66
83	54.82666	326.08078	326.07975	1.02
84	54.28834	330.08095	330.08041	0.53

Order of Fit = 9 RMS error of fit = 4.31 mK
Largest absolute error = 12.95 mK at data point no. 79

INTERPOLATION TABLE

Calibration Report: 628719 Sales Order: 64119
Sensor Model: CX-1050-CU-1.4L Serial Number: X68437
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	7603.03	-10168.	-1.8723	15.50	578.536	-26.142	-0.70040
1.500	6699.80	-8007.8	-1.7929	16.00	565.826	-24.717	-0.69894
1.600	5982.62	-6415.5	-1.7158	16.50	553.797	-23.417	-0.69771
1.700	5403.20	-5230.0	-1.6455	17.00	542.391	-22.228	-0.69668
1.800	4926.76	-4341.5	-1.5862	17.50	531.553	-21.138	-0.69590
1.900	4528.03	-3660.3	-1.5359	18.00	521.238	-20.134	-0.69530
2.000	4189.91	-3123.4	-1.4909	18.50	511.406	-19.209	-0.69490
2.100	3899.78	-2694.0	-1.4507	19.00	502.017	-18.354	-0.69466
2.200	3648.44	-2344.9	-1.4140	19.50	493.041	-17.563	-0.69461
2.300	3428.74	-2057.7	-1.3803	20.00	484.445	-16.827	-0.69470
2.400	3235.30	-1818.4	-1.3489	21.00	468.294	-15.505	-0.69532
2.500	3063.78	-1617.3	-1.3197	22.00	453.378	-14.351	-0.69639
2.600	2910.81	-1446.8	-1.2923	23.00	439.545	-13.337	-0.69786
2.700	2773.59	-1301.2	-1.2667	24.00	426.667	-12.437	-0.69957
2.800	2649.89	-1176.0	-1.2426	25.00	414.639	-11.635	-0.70153
2.900	2537.84	-1067.6	-1.2200	26.00	403.370	-10.916	-0.70362
3.000	2435.90	-973.29	-1.1987	27.00	392.783	-10.268	-0.70579
3.100	2342.79	-890.76	-1.1787	28.00	382.814	-9.6803	-0.70804
3.200	2257.42	-818.16	-1.1598	29.00	373.405	-9.1457	-0.71029
3.300	2178.87	-754.02	-1.1420	30.00	364.507	-8.6577	-0.71255
3.400	2106.38	-697.08	-1.1252	31.00	356.076	-8.2102	-0.71478
3.500	2039.25	-646.32	-1.1093	32.00	348.074	-7.7988	-0.71697
3.600	1976.93	-600.90	-1.0942	33.00	340.468	-7.4194	-0.71912
3.700	1918.92	-560.11	-1.0800	34.00	333.226	-7.0687	-0.72124
3.800	1864.78	-523.34	-1.0665	35.00	326.322	-6.7432	-0.72324
3.900	1814.13	-490.09	-1.0536	36.00	319.732	-6.4410	-0.72522
4.000	1766.66	-459.91	-1.0413	37.00	313.433	-6.1600	-0.72718
4.200	1680.08	-407.46	-1.0186	38.00	307.406	-5.8976	-0.72903
4.400	1603.11	-363.52	-0.99773	39.00	301.632	-5.6524	-0.73084
4.600	1534.22	-326.34	-0.97846	40.00	296.096	-5.4231	-0.73262
4.800	1472.19	-294.77	-0.96108	42.00	285.675	-5.0059	-0.73597
5.000	1416.03	-267.58	-0.94481	44.00	276.039	-4.6372	-0.73916
5.200	1364.91	-244.07	-0.92986	46.00	267.099	-4.3096	-0.74220
5.400	1318.20	-223.55	-0.91576	48.00	258.778	-4.0167	-0.74505
5.600	1275.32	-205.64	-0.90296	50.00	251.012	-3.7542	-0.74781
5.800	1235.81	-189.81	-0.89083	52.00	243.744	-3.5176	-0.75043
6.000	1199.28	-175.75	-0.87926	54.00	236.927	-3.3033	-0.75287
6.500	1118.92	-147.03	-0.85414	56.00	230.517	-3.1092	-0.75531
7.000	1051.16	-124.97	-0.83224	58.00	224.479	-2.9321	-0.75759
7.500	993.137	-107.75	-0.81370	60.00	218.779	-2.7704	-0.75978
8.000	942.841	-93.954	-0.79720	65.00	205.828	-2.4223	-0.76495
8.500	898.734	-82.827	-0.78335	70.00	194.449	-2.1383	-0.76976
9.000	859.693	-73.636	-0.77088	75.00	184.362	-1.9038	-0.77448
9.500	824.836	-66.007	-0.76023	77.35	180.003	-1.8076	-0.77676
10.00	793.489	-59.564	-0.75066	80.00	175.346	-1.7085	-0.77947
10.50	765.107	-54.102	-0.74248	85.00	167.227	-1.5437	-0.78463
11.00	739.260	-49.403	-0.73510	90.00	159.870	-1.4026	-0.78958
11.50	715.596	-45.349	-0.72878	95.00	153.169	-1.2807	-0.79436
12.00	693.826	-41.811	-0.72313	100.0	147.036	-1.1749	-0.79907
12.50	673.710	-38.715	-0.71831	105.0	141.398	-1.0823	-0.80367
13.00	655.052	-35.973	-0.71390	110.0	136.195	-1.0007	-0.80820
13.50	637.686	-33.542	-0.71010	115.0	131.376	-0.92841	-0.81268
14.00	621.467	-31.375	-0.70680	120.0	126.898	-0.86397	-0.81700
14.50	606.271	-29.442	-0.70417	125.0	122.725	-0.80622	-0.82117
15.00	591.992	-27.706	-0.70202	130.0	118.826	-0.75419	-0.82511

INTERPOLATION TABLE

Calibration Report: 628719
Sensor Model: CX-1050-CU-1.4L
Sensor Type: Cernox Resistor

Sales Order: 64119
Serial Number: X68437
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	115.175	-0.70712	-0.82884	235.0	72.0524	-0.26064	-0.85008
140.0	111.748	-0.66434	-0.83229	240.0	70.7752	-0.25036	-0.84897
145.0	108.525	-0.62532	-0.83548	245.0	69.5479	-0.24063	-0.84769
150.0	105.489	-0.58960	-0.83838	250.0	68.3680	-0.23143	-0.84625
155.0	102.624	-0.55682	-0.84101	255.0	67.2329	-0.22270	-0.84466
160.0	99.9166	-0.52665	-0.84334	260.0	66.1402	-0.21443	-0.84293
165.0	97.3539	-0.49881	-0.84541	265.0	65.0879	-0.20658	-0.84105
170.0	94.9251	-0.47306	-0.84720	270.0	64.0738	-0.19912	-0.83905
175.0	92.6201	-0.44920	-0.84874	273.15	63.4537	-0.19461	-0.83773
180.0	90.4302	-0.42705	-0.85003	275.0	63.0961	-0.19202	-0.83693
185.0	88.3471	-0.40643	-0.85108	280.0	62.1530	-0.18528	-0.83469
190.0	86.3635	-0.38723	-0.85190	285.0	61.2428	-0.17886	-0.83234
195.0	84.4727	-0.36930	-0.85249	290.0	60.3639	-0.17274	-0.82990
200.0	82.6686	-0.35253	-0.85288	295.0	59.5148	-0.16692	-0.82737
205.0	80.9456	-0.33683	-0.85305	300.0	58.6942	-0.16136	-0.82477
210.0	79.2986	-0.32211	-0.85303	305.0	57.9008	-0.15606	-0.82209
215.0	77.7230	-0.30829	-0.85281	310.0	57.1332	-0.15101	-0.81936
220.0	76.2143	-0.29530	-0.85240	315.0	56.3903	-0.14618	-0.81658
225.0	74.7688	-0.28306	-0.85181	320.0	55.6710	-0.14157	-0.81376
230.0	73.3826	-0.27153	-0.85103	325.0	54.9743	-0.13717	-0.81091

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Sensor Model: CX-1050-CU-1.4L Serial Number: X68437
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:	57.9 Ω
Liquid Nitrogen:	180 Ω
Liquid Helium:	1678 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: 628719 Sales Order: 64119
Sensor Model: CX-1050-CU-1.4L Serial Number: X68437
Sensor Type: Cernox Resistor Temperature Range: 1.40K to 325K

Name: CX-1050-CU-1.4L
Serial number: X68437
Format: 4 ;Log Ohms/Kelvin
Limit: 325.0
Coefficient: 1 ;Negative

Point 1: 1.74014,325.000	Point 56: 2.25028, 78.500	Point 111: 2.93429, 9.000
Point 2: 1.74673,319.000	Point 57: 2.26119, 76.000	Point 112: 2.94959, 8.600
Point 3: 1.75289,313.500	Point 58: 2.27017, 74.000	Point 113: 2.96585, 8.200
Point 4: 1.75918,308.000	Point 59: 2.27936, 72.000	Point 114: 2.98315, 7.800
Point 5: 1.76561,302.500	Point 60: 2.28879, 70.000	Point 115: 2.99931, 7.450
Point 6: 1.77219,297.000	Point 61: 2.29847, 68.000	Point 116: 3.01647, 7.100
Point 7: 1.77891,291.500	Point 62: 2.30841, 66.000	Point 117: 3.03480, 6.750
Point 8: 1.78578,286.000	Point 63: 2.31863, 64.000	Point 118: 3.05446, 6.400
Point 9: 1.79280,280.500	Point 64: 2.32915, 62.000	Point 119: 3.07564, 6.050
Point 10: 1.79999,275.000	Point 65: 2.33998, 60.000	Point 120: 3.09587, 5.740
Point 11: 1.80734,269.500	Point 66: 2.35115, 58.000	Point 121: 3.11692, 5.440
Point 12: 1.81487,264.000	Point 67: 2.36268, 56.000	Point 122: 3.13966, 5.140
Point 13: 1.82257,258.500	Point 68: 2.37338, 54.200	Point 123: 3.16434, 4.840
Point 14: 1.83046,253.000	Point 69: 2.38441, 52.400	Point 124: 3.18944, 4.560
Point 15: 1.83853,247.500	Point 70: 2.39579, 50.600	Point 125: 3.21481, 4.300
Point 16: 1.84605,242.500	Point 71: 2.40755, 48.800	Point 126: 3.24246, 4.040
Point 17: 1.85373,237.500	Point 72: 2.41970, 47.000	Point 127: 3.26568, 3.840
Point 18: 1.86159,232.500	Point 73: 2.43229, 45.200	Point 128: 3.28677, 3.670
Point 19: 1.86962,227.500	Point 74: 2.44534, 43.400	Point 129: 3.30934, 3.500
Point 20: 1.87784,222.500	Point 75: 2.45737, 41.800	Point 130: 3.33361, 3.330
Point 21: 1.88625,217.500	Point 76: 2.46981, 40.200	Point 131: 3.35823, 3.170
Point 22: 1.89487,212.500	Point 77: 2.48271, 38.600	Point 132: 3.38476, 3.010
Point 23: 1.90369,207.500	Point 78: 2.49610, 37.000	Point 133: 3.41169, 2.860
Point 24: 1.91272,202.500	Point 79: 2.50915, 35.500	Point 134: 3.44081, 2.710
Point 25: 1.92198,197.500	Point 80: 2.52270, 34.000	Point 135: 3.47037, 2.570
Point 26: 1.93147,192.500	Point 81: 2.53680, 32.500	Point 136: 3.50243, 2.430
Point 27: 1.94121,187.500	Point 82: 2.55050, 31.100	Point 137: 3.53749, 2.290
Point 28: 1.95120,182.500	Point 83: 2.56477, 29.700	Point 138: 3.57319, 2.160
Point 29: 1.96145,177.500	Point 84: 2.57966, 28.300	Point 139: 3.61229, 2.030
Point 30: 1.97093,173.000	Point 85: 2.59411, 27.000	Point 140: 3.65213, 1.910
Point 31: 1.98062,168.500	Point 86: 2.60919, 25.700	Point 141: 3.69603, 1.790
Point 32: 1.99057,164.000	Point 87: 2.62500, 24.400	Point 142: 3.74079, 1.680
Point 33: 2.00076,159.500	Point 88: 2.64033, 23.200	Point 143: 3.79062, 1.570
Point 34: 2.01123,155.000	Point 89: 2.65640, 22.000	Point 144: 3.84676, 1.460
Point 35: 2.02197,150.500	Point 90: 2.67334, 20.800	Point 145: 3.88097, 1.400
Point 36: 2.03301,146.000	Point 91: 2.68673, 19.900	
Point 37: 2.04436,141.500	Point 92: 2.69753, 19.200	
Point 38: 2.05603,137.000	Point 93: 2.70792, 18.550	
Point 39: 2.06805,132.500	Point 94: 2.71869, 17.900	
Point 40: 2.07905,128.500	Point 95: 2.72986, 17.250	
Point 41: 2.09034,124.500	Point 96: 2.74058, 16.650	
Point 42: 2.10195,120.500	Point 97: 2.75170, 16.050	
Point 43: 2.11391,116.500	Point 98: 2.76328, 15.450	
Point 44: 2.12623,112.500	Point 99: 2.77534, 14.850	
Point 45: 2.13895,108.500	Point 100: 2.78688, 14.300	
Point 46: 2.15208,104.500	Point 101: 2.79891, 13.750	
Point 47: 2.16395,101.000	Point 102: 2.81150, 13.200	
Point 48: 2.17265, 98.500	Point 103: 2.82349, 12.700	
Point 49: 2.18154, 96.000	Point 104: 2.83602, 12.200	
Point 50: 2.19064, 93.500	Point 105: 2.84917, 11.700	
Point 51: 2.19996, 91.000	Point 106: 2.86300, 11.200	
Point 52: 2.20951, 88.500	Point 107: 2.87611, 10.750	
Point 53: 2.21930, 86.000	Point 108: 2.88988, 10.300	
Point 54: 2.22935, 83.500	Point 109: 2.90442, 9.850	
Point 55: 2.23967, 81.000	Point 110: 2.91980, 9.400	

BREAKPOINTS 91C/93C/330 FORMAT

Calibration Report: 628719 Sales Order: 64119
Sensor Model: CX-1050-CU-1.4L Serial Number: X68437
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	1.74016	325.0	31	2.81867	12.9
2	1.74125	324.0	32	2.86880	11.0
3	1.75460	312.0	33	2.91987	9.4
4	1.77220	297.0	34	2.97015	8.1
5	1.79088	282.0	35	3.02167	7.0
6	1.81075	267.0	36	3.07263	6.1
7	1.83193	252.0	37	3.11998	5.4
8	1.85452	237.0	38	3.16796	4.8
9	1.87869	222.0	39	3.21498	4.3
10	1.90460	207.0	40	3.25867	3.9
11	1.93246	192.0	41	3.30947	3.5
12	1.96252	177.0	42	3.35361	3.2
13	1.99509	162.0	43	3.40446	2.9
14	2.03056	147.0	44	3.44304	2.7
15	2.06944	132.0	45	3.48626	2.5
16	2.11242	117.0	46	3.53513	2.3
17	2.16054	102.0	47	3.56211	2.2
18	2.21537	87.0	48	3.62220	2.0
19	2.27938	72.0	49	3.65591	1.9
20	2.33455	61.0	50	3.69256	1.8
21	2.36564	55.5	51	3.73265	1.7
22	2.39969	50.0	52	3.82606	1.5
23	2.43375	45.0	53	3.88099	1.4
24	2.47143	40.0			
25	2.51365	35.0			
26	2.56171	30.0			
27	2.61524	25.2			
28	2.66623	21.3			
29	2.71704	18.0			
30	2.76828	15.2			

Temperature for Resistance Decades:

Res. (Ohms)	Temp. (K)
100	159.843
1000	7.436

BREAKPOINTS 234 FORMAT

Calibration Report: 628719 Sales Order: 64119
Sensor Model: CX-1050-CU-1.4L Serial Number: X68437
Sensor Type: Cernox Resistor Temperature Range: 1.40K to 325K

Maximum Temperature Error:

1.4 - 10K:	0.011K
10 - 20K:	0.006K
20 - 40K:	0.011K
40 - 100K:	0.022K
> 100K:	0.083K

BP #	Temp. (K)	Res. (Ω)	Log10 Res.	BP #	Temp. (K)	Res. (Ω)	Log10 Res.
1	307.303	57.54399	1.760	46	21.744	457.0882	2.660
2	290.626	60.25596	1.780	47	20.351	478.6301	2.680
3	275.002	63.09573	1.800	48	19.045	501.1872	2.700
4	260.331	66.06934	1.820	49	17.824	524.8075	2.720
5	246.526	69.18310	1.840	50	16.684	549.5409	2.740
6	233.507	72.44360	1.860	51	15.619	575.4399	2.760
7	221.214	75.85776	1.880	52	14.627	602.5596	2.780
8	209.584	79.43282	1.900	53	13.703	630.9573	2.800
9	198.569	83.17638	1.920	54	12.845	660.6934	2.820
10	188.125	87.09636	1.940	55	12.048	691.8310	2.840
11	178.210	91.20108	1.960	56	11.308	724.4360	2.860
12	168.795	95.49926	1.980	57	10.622	758.5776	2.880
13	159.842	100.0000	2.000	58	9.986	794.3282	2.900
14	151.327	104.7129	2.020	59	9.396	831.7638	2.920
15	143.223	109.6478	2.040	60	8.849	870.9636	2.940
16	135.508	114.8154	2.060	61	8.343	912.0108	2.960
17	128.167	120.2264	2.080	62	7.873	954.9926	2.980
18	121.174	125.8925	2.100	63	7.437	1000.000	3.000
19	114.517	131.8257	2.120	64	6.657	1096.478	3.040
20	108.182	138.0384	2.140	65	5.983	1202.264	3.080
21	102.158	144.5440	2.160	66	5.400	1318.257	3.120
22	96.434	151.3561	2.180	67	4.893	1445.440	3.160
23	90.994	158.4893	2.200	68	4.451	1584.893	3.200
24	85.828	165.9587	2.220	69	4.064	1737.801	3.240
25	80.925	173.7801	2.240	70	3.724	1905.461	3.280
26	76.275	181.9701	2.260	71	3.425	2089.296	3.320
27	71.866	190.5461	2.280	72	3.160	2290.868	3.360
28	67.691	199.5262	2.300	73	2.925	2511.886	3.400
29	63.741	208.9296	2.320	74	2.715	2754.229	3.440
30	60.001	218.7762	2.340	75	2.528	3019.952	3.480
31	56.463	229.0868	2.360	76	2.359	3311.311	3.520
32	53.119	239.8833	2.380	77	2.208	3630.781	3.560
33	49.953	251.1886	2.400	78	2.070	3981.072	3.600
34	46.960	263.0268	2.420	79	1.946	4365.158	3.640
35	44.134	275.4229	2.440	80	1.833	4786.301	3.680
36	41.461	288.4032	2.460	81	1.731	5248.075	3.720
37	38.936	301.9952	2.480	82	1.637	5754.399	3.760
38	36.551	316.2278	2.500	83	1.552	6309.573	3.800
39	34.299	331.1311	2.520	84	1.474	6918.310	3.840
40	32.172	346.7369	2.540	85	1.402	7585.776	3.880
41	30.165	363.0781	2.560	86	1.335	8317.638	3.920
42	28.274	380.1894	2.580	87	1.274	9120.108	3.960
43	26.489	398.1072	2.600	88	1.216	10000.00	4.000
44	24.809	416.8694	2.620				
45	23.229	436.5158	2.640				

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