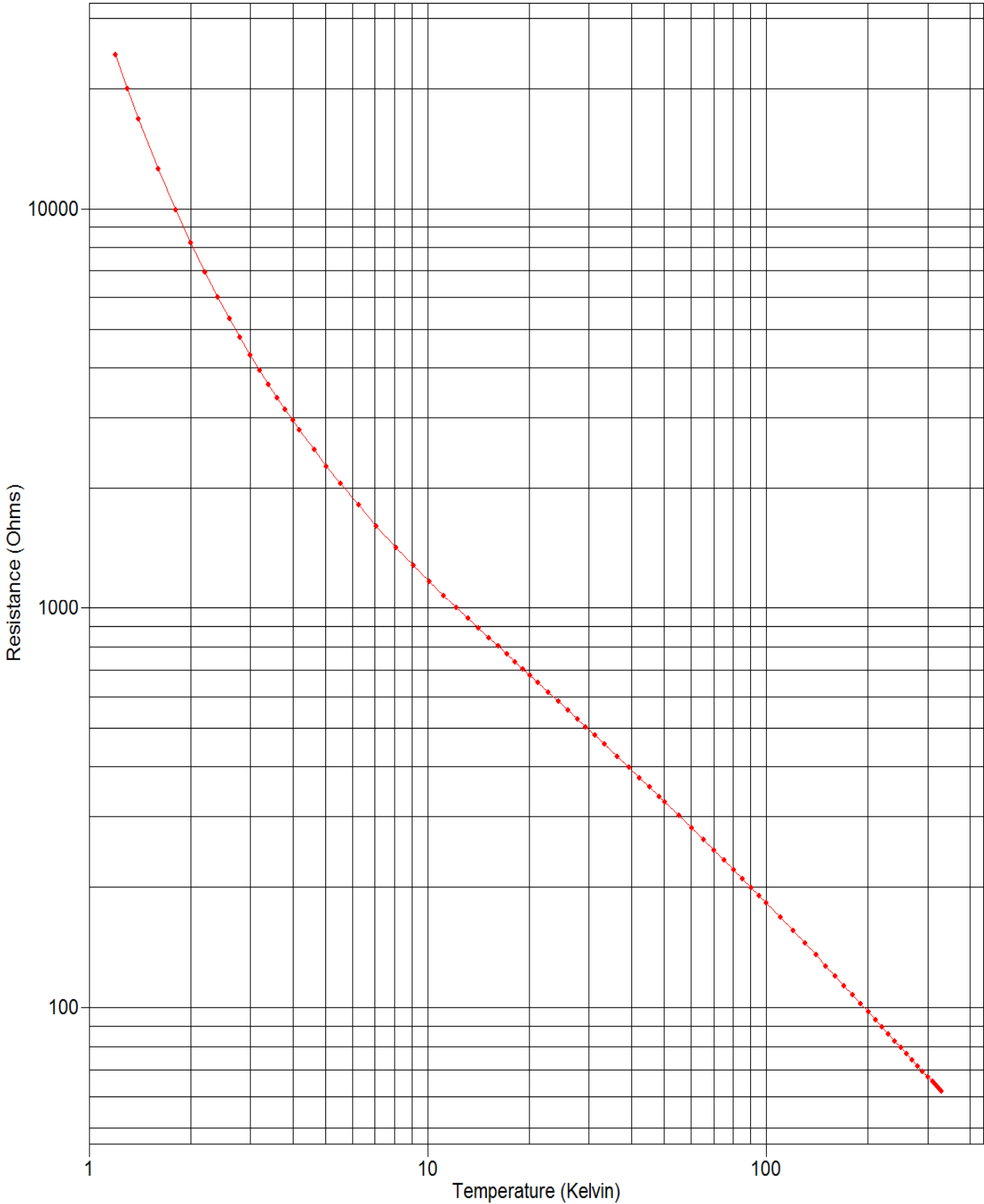


DATA PLOT

Calibration Report: 637801
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 66130
Serial Number: X70200
Temperature Range: 1.40K to 325K



TEST DATA

Calibration Report: 637801
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 66130
Serial Number: X70200
Temperature Range: 1.40K to 325K

| Index | Temp. (K) | Resistance (Ω) | Excitation | Index | Temp. (K) | Resistance (Ω) | Excitation |
|-------|-----------|-------------------------|---------------|-------|-----------|-------------------------|---------------|
| 1 | 1.19820 | 24341.0 | 2mV \pm 25% | 46 | 42.3461 | 375.849 | 2mV \pm 25% |
| 2 | 1.29968 | 19953.2 | 2mV \pm 25% | 47 | 45.3450 | 355.546 | 2mV \pm 25% |
| 3 | 1.40106 | 16758.7 | 2mV \pm 25% | 48 | 48.3324 | 337.516 | 2mV \pm 25% |
| 4 | 1.59921 | 12585.5 | 2mV \pm 25% | 49 | 50.3364 | 326.459 | 2mV \pm 25% |
| 5 | 1.79976 | 9956.47 | 2mV \pm 25% | 50 | 55.3245 | 302.028 | 2mV \pm 25% |
| 6 | 1.99928 | 8199.72 | 2mV \pm 25% | 51 | 60.3201 | 281.140 | 2mV \pm 25% |
| 7 | 2.19936 | 6951.73 | 2mV \pm 25% | 52 | 65.3130 | 263.071 | 2mV \pm 25% |
| 8 | 2.40099 | 6016.32 | 2mV \pm 25% | 53 | 70.3088 | 247.281 | 2mV \pm 25% |
| 9 | 2.59722 | 5319.15 | 2mV \pm 25% | 54 | 75.3014 | 233.364 | 2mV \pm 25% |
| 10 | 2.79718 | 4759.31 | 2mV \pm 25% | 55 | 80.2952 | 220.964 | 2mV \pm 25% |
| 11 | 2.99924 | 4304.83 | 2mV \pm 25% | 56 | 85.2896 | 209.862 | 2mV \pm 25% |
| 12 | 3.19894 | 3937.12 | 2mV \pm 25% | 57 | 90.2825 | 199.839 | 2mV \pm 25% |
| 13 | 3.39944 | 3629.01 | 2mV \pm 25% | 58 | 95.2758 | 190.743 | 2mV \pm 25% |
| 14 | 3.59967 | 3369.03 | 2mV \pm 25% | 59 | 100.277 | 182.439 | 2mV \pm 25% |
| 15 | 3.79944 | 3147.02 | 2mV \pm 25% | 60 | 110.261 | 167.875 | 2mV \pm 25% |
| 16 | 3.99964 | 2954.89 | 2mV \pm 25% | 61 | 120.253 | 155.454 | 2mV \pm 25% |
| 17 | 4.19488 | 2790.06 | 2mV \pm 25% | 62 | 130.242 | 144.728 | 2mV \pm 25% |
| 18 | 4.62757 | 2491.92 | 2mV \pm 25% | 63 | 140.234 | 135.394 | 2mV \pm 25% |
| 19 | 5.03310 | 2269.78 | 2mV \pm 25% | 64 | 150.228 | 127.179 | 2mV \pm 25% |
| 20 | 5.54122 | 2048.61 | 2mV \pm 25% | 65 | 160.228 | 119.889 | 2mV \pm 25% |
| 21 | 6.25313 | 1811.74 | 2mV \pm 25% | 66 | 170.226 | 113.399 | 2mV \pm 25% |
| 22 | 7.06849 | 1608.79 | 2mV \pm 25% | 67 | 180.220 | 107.574 | 2mV \pm 25% |
| 23 | 8.09150 | 1419.75 | 2mV \pm 25% | 68 | 190.208 | 102.328 | 2mV \pm 25% |
| 24 | 9.10964 | 1278.03 | 2mV \pm 25% | 69 | 200.211 | 97.5698 | 2mV \pm 25% |
| 25 | 10.1311 | 1166.74 | 2mV \pm 25% | 70 | 210.213 | 93.2510 | 2mV \pm 25% |
| 26 | 11.1552 | 1076.53 | 2mV \pm 25% | 71 | 220.208 | 89.3193 | 2mV \pm 25% |
| 27 | 12.1710 | 1002.28 | 2mV \pm 25% | 72 | 230.200 | 85.7117 | 2mV \pm 25% |
| 28 | 13.1801 | 940.024 | 2mV \pm 25% | 73 | 240.210 | 82.4018 | 2mV \pm 25% |
| 29 | 14.1832 | 886.815 | 2mV \pm 25% | 74 | 250.199 | 79.3530 | 2mV \pm 25% |
| 30 | 15.1720 | 840.894 | 2mV \pm 25% | 75 | 260.200 | 76.5377 | 2mV \pm 25% |
| 31 | 16.1617 | 800.284 | 2mV \pm 25% | 76 | 270.196 | 73.9438 | 2mV \pm 25% |
| 32 | 17.1417 | 764.465 | 2mV \pm 25% | 77 | 280.201 | 71.5228 | 2mV \pm 25% |
| 33 | 18.1245 | 732.098 | 2mV \pm 25% | 78 | 290.200 | 69.2753 | 2mV \pm 25% |
| 34 | 19.1037 | 702.761 | 2mV \pm 25% | 79 | 300.203 | 67.1801 | 2mV \pm 25% |
| 35 | 20.0842 | 676.134 | 2mV \pm 25% | 80 | 310.206 | 65.2304 | 2mV \pm 25% |
| 36 | 21.1635 | 649.298 | 2mV \pm 25% | 81 | 315.214 | 64.3021 | 2mV \pm 25% |
| 37 | 22.7461 | 614.051 | 2mV \pm 25% | 82 | 320.211 | 63.4008 | 2mV \pm 25% |
| 38 | 24.3545 | 582.355 | 2mV \pm 25% | 83 | 326.204 | 62.3671 | 2mV \pm 25% |
| 39 | 26.0247 | 553.097 | 2mV \pm 25% | 84 | 330.207 | 61.6963 | 2mV \pm 25% |
| 40 | 27.6984 | 526.842 | 2mV \pm 25% | | | | |
| 41 | 29.3468 | 503.506 | 2mV \pm 25% | | | | |
| 42 | 31.1912 | 479.879 | 2mV \pm 25% | | | | |
| 43 | 33.3287 | 455.375 | 2mV \pm 25% | | | | |
| 44 | 36.3456 | 425.017 | 2mV \pm 25% | | | | |
| 45 | 39.3590 | 398.717 | 2mV \pm 25% | | | | |



UNCERTAINTY ANALYSIS

Calibration Report: 637801
 Sensor Model: CX-1050-SD-1.4L
 Sensor Type: Cernox Resistor

Sales Order: 66130
 Serial Number: X70200
 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: 637801
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 66130
Serial Number: X70200
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

1.40 K to 14.2 K
1.676e+4 Ohms to 886.8 Ohms

Lower and Upper limits of Log(Resistance) used in computing Chebychev coefficients:
ZL = 2.90324394027 ZU = 4.38633800008

| Order | Coefficient | Std. Deviation of Coefficient | Ratio (Coeff./Std Dev.) |
|-------|-------------|-------------------------------|-------------------------|
| 0 | 5.475202 | 2.0986E-04 | 26089.71 |
| 1 | -6.322541 | 3.3715E-04 | -18752.71 |
| 2 | 2.851931 | 2.9657E-04 | 9616.42 |
| 3 | -1.072909 | 3.0405E-04 | -3528.67 |
| 4 | 0.340373 | 2.8720E-04 | 1185.14 |
| 5 | -0.086831 | 2.6463E-04 | -328.12 |
| 6 | 0.015065 | 2.6323E-04 | 57.23 |
| 7 | -0.000326 | 2.6536E-04 | -1.23 |
| 8 | -0.002042 | 2.6773E-04 | -7.63 |

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

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

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: 637801
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 66130
Serial Number: X70200
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 | 24340.98 | 1.19820 | 1.19792 | 0.28 |
| 2 | 19953.18 | 1.29968 | 1.30084 | -1.16 |
| 3 | 16758.74 | 1.40106 | 1.39994 | 1.12 |
| 4 | 12585.50 | 1.59921 | 1.59865 | 0.56 |
| 5 | 9956.469 | 1.79976 | 1.80065 | -0.88 |
| 6 | 8199.716 | 1.99928 | 2.00030 | -1.02 |
| 7 | 6951.728 | 2.19936 | 2.19911 | 0.25 |
| 8 | 6016.323 | 2.40099 | 2.40047 | 0.53 |
| 9 | 5319.152 | 2.59722 | 2.59658 | 0.64 |
| 10 | 4759.314 | 2.79718 | 2.79663 | 0.55 |
| 11 | 4304.826 | 2.99924 | 2.99892 | 0.32 |
| 12 | 3937.123 | 3.19894 | 3.19874 | 0.20 |
| 13 | 3629.010 | 3.39944 | 3.39961 | -0.18 |
| 14 | 3369.031 | 3.59967 | 3.60012 | -0.45 |
| 15 | 3147.020 | 3.79944 | 3.80014 | -0.69 |
| 16 | 2954.890 | 3.99964 | 4.00016 | -0.51 |
| 17 | 2790.062 | 4.19488 | 4.19638 | -1.50 |
| 18 | 2491.916 | 4.62757 | 4.62668 | 0.88 |
| 19 | 2269.782 | 5.03310 | 5.03279 | 0.31 |
| 20 | 2048.606 | 5.54122 | 5.54096 | 0.26 |
| 21 | 1811.740 | 6.25313 | 6.25219 | 0.94 |
| 22 | 1608.786 | 7.06849 | 7.06778 | 0.70 |
| 23 | 1419.746 | 8.09150 | 8.09146 | 0.05 |
| 24 | 1278.033 | 9.10964 | 9.11073 | -1.09 |
| 25 | 1166.739 | 10.13106 | 10.13159 | -0.52 |
| 26 | 1076.534 | 11.15518 | 11.15517 | 0.00 |
| 27 | 1002.283 | 12.17103 | 12.17208 | -1.05 |
| 28 | 940.0240 | 13.18007 | 13.18003 | 0.03 |
| 29 | 886.8152 | 14.18324 | 14.18120 | 2.05 |
| 30 | 840.8944 | 15.17205 | 15.17126 | 0.79 |
| 31 | 800.2836 | 16.16171 | 16.16314 | -1.42 |

Order of Fit = 8 RMS error of fit = 0.82 mK
Largest absolute error = 2.05 mK at data point no. 29



POLYNOMIAL EQUATION

Calibration Report: 637801
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 66130
Serial Number: X70200
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

14.2 K to 80.3 K
886.8 Ohms to 221.0 Ohms

Lower and Upper limits of Log(Resistance) used in computing Chebychev coefficients:
ZL = 2.30068031016 ZU = 3.00099052542

| Order | Coefficient | Std. Deviation of Coefficient | Ratio (Coeff./Std Dev.) |
|-------|-------------|-------------------------------|-------------------------|
| 0 | 42.521498 | 2.6818E-04 | 158558.17 |
| 1 | -37.916606 | 4.3646E-04 | -86873.39 |
| 2 | 8.587017 | 4.0076E-04 | 21427.04 |
| 3 | -1.133025 | 3.7215E-04 | -3044.50 |
| 4 | 0.123906 | 3.5725E-04 | 346.83 |
| 5 | -0.006392 | 3.4318E-04 | -18.63 |
| 6 | -0.005599 | 3.4048E-04 | -16.44 |
| 7 | 0.000372 | 3.2910E-04 | 1.13 |
| 8 | 0.000769 | 3.3126E-04 | 2.32 |

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

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

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: 637801
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 66130
Serial Number: X70200
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 | 1002.283 | 12.17208 | 12.17194 | 0.14 |
| 28 | 940.0240 | 13.18003 | 13.18011 | -0.07 |
| 29 | 886.8152 | 14.18120 | 14.18183 | -0.64 |
| 30 | 840.8944 | 15.17205 | 15.17166 | 0.38 |
| 31 | 800.2836 | 16.16171 | 16.16207 | -0.36 |
| 32 | 764.4652 | 17.14175 | 17.14067 | 1.08 |
| 33 | 732.0976 | 18.12450 | 18.12310 | 1.40 |
| 34 | 702.7609 | 19.10366 | 19.10575 | -2.10 |
| 35 | 676.1343 | 20.08424 | 20.08388 | 0.36 |
| 36 | 649.2982 | 21.16353 | 21.16368 | -0.15 |
| 37 | 614.0513 | 22.74605 | 22.74645 | -0.40 |
| 38 | 582.3549 | 24.35448 | 24.35550 | -1.03 |
| 39 | 553.0968 | 26.02472 | 26.02442 | 0.30 |
| 40 | 526.8421 | 27.69836 | 27.69726 | 1.10 |
| 41 | 503.5063 | 29.34685 | 29.34537 | 1.47 |
| 42 | 479.8788 | 31.19121 | 31.19268 | -1.46 |
| 43 | 455.3748 | 33.32873 | 33.32876 | -0.03 |
| 44 | 425.0167 | 36.34561 | 36.34507 | 0.54 |
| 45 | 398.7168 | 39.35903 | 39.35859 | 0.44 |
| 46 | 375.8486 | 42.34606 | 42.34716 | -1.10 |
| 47 | 355.5464 | 45.34498 | 45.34561 | -0.63 |
| 48 | 337.5157 | 48.33242 | 48.33203 | 0.39 |
| 49 | 326.4592 | 50.33637 | 50.33737 | -1.00 |
| 50 | 302.0283 | 55.32448 | 55.32352 | 0.96 |
| 51 | 281.1401 | 60.32009 | 60.31748 | 2.61 |
| 52 | 263.0705 | 65.31295 | 65.31464 | -1.68 |
| 53 | 247.2814 | 70.30881 | 70.31029 | -1.48 |
| 54 | 233.3636 | 75.30137 | 75.30024 | 1.13 |
| 55 | 220.9639 | 80.29515 | 80.29645 | -1.29 |
| 56 | 209.8615 | 85.28957 | 85.28771 | 1.86 |
| 57 | 199.8390 | 90.28250 | 90.28324 | -0.74 |

Order of Fit = 8 RMS error of fit = 1.11 mK
Largest absolute error = 2.61 mK at data point no. 51



POLYNOMIAL EQUATION

Calibration Report: 637801
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 66130
Serial Number: X70200
Temperature Range: 1.40K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

80.3 K to 325. K
221.0 Ohms to 62.57 Ohms

Lower and Upper limits of Log(Resistance) used in computing Chebychev coefficients:
ZL = 1.7902587718 ZU = 2.3931914689

| Order | Coefficient | Std. Deviation of Coefficient | Ratio (Coeff./Std Dev.) |
|-------|-------------|-------------------------------|-------------------------|
| 0 | 177.081750 | 1.7146E-03 | 103278.77 |
| 1 | -126.639681 | 2.6582E-03 | -47642.01 |
| 2 | 22.561825 | 2.5284E-03 | 8923.39 |
| 3 | -3.189174 | 2.3767E-03 | -1341.83 |
| 4 | 0.596324 | 2.2610E-03 | 263.74 |
| 5 | -0.112291 | 2.2674E-03 | -49.53 |
| 6 | 0.014491 | 2.2417E-03 | 6.46 |
| 7 | -0.004902 | 2.1867E-03 | -2.24 |
| 8 | 0.004062 | 2.2096E-03 | 1.84 |
| 9 | -0.002542 | 2.2037E-03 | -1.15 |

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

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

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



POLYNOMIAL EQUATION

Calibration Report: 637801
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 66130
Serial Number: X70200
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 | 247.2814 | 70.31029 | 70.30986 | 0.43 |
| 54 | 233.3636 | 75.30024 | 75.30162 | -1.38 |
| 55 | 220.9639 | 80.29645 | 80.29648 | -0.03 |
| 56 | 209.8615 | 85.28957 | 85.28696 | 2.60 |
| 57 | 199.8390 | 90.28250 | 90.28160 | 0.90 |
| 58 | 190.7432 | 95.27581 | 95.27792 | -2.11 |
| 59 | 182.4394 | 100.27662 | 100.28015 | -3.53 |
| 60 | 167.8745 | 110.26068 | 110.25821 | 2.47 |
| 61 | 155.4540 | 120.25279 | 120.24708 | 5.71 |
| 62 | 144.7276 | 130.24184 | 130.24890 | -7.07 |
| 63 | 135.3939 | 140.23412 | 140.23366 | 0.46 |
| 64 | 127.1795 | 150.22802 | 150.22487 | 3.15 |
| 65 | 119.8885 | 160.22804 | 160.23303 | -4.99 |
| 66 | 113.3991 | 170.22618 | 170.22141 | 4.77 |
| 67 | 107.5735 | 180.22041 | 180.21907 | 1.34 |
| 68 | 102.3280 | 190.20760 | 190.20749 | 0.11 |
| 69 | 97.56980 | 200.21055 | 200.21754 | -6.99 |
| 70 | 93.25099 | 210.21345 | 210.21648 | -3.03 |
| 71 | 89.31925 | 220.20796 | 220.19643 | 11.53 |
| 72 | 85.71165 | 230.20001 | 230.20256 | -2.55 |
| 73 | 82.40184 | 240.21045 | 240.20313 | 7.33 |
| 74 | 79.35303 | 250.19940 | 250.20868 | -9.28 |
| 75 | 76.53766 | 260.20039 | 260.21676 | -16.37 |
| 76 | 73.94382 | 270.19606 | 270.17726 | 18.80 |
| 77 | 71.52285 | 280.20097 | 280.19678 | 4.19 |
| 78 | 69.27531 | 290.20017 | 290.20205 | -1.88 |
| 79 | 67.18007 | 300.20316 | 300.21518 | -12.02 |
| 80 | 65.23036 | 310.20641 | 310.20000 | 6.41 |
| 81 | 64.30213 | 315.21366 | 315.20238 | 11.27 |
| 82 | 63.40084 | 320.21141 | 320.22541 | -14.00 |
| 83 | 62.36715 | 326.20353 | 326.19998 | 3.54 |
| 84 | 61.69625 | 330.20725 | 330.20704 | 0.20 |

Order of Fit = 9 RMS error of fit = 7.24 mK
Largest absolute error = 18.80 mK at data point no. 76



INTERPOLATION TABLE

Calibration Report: 637801
 Sensor Model: CX-1050-SD-1.4L
 Sensor Type: Cernox Resistor

Sales Order: 66130
 Serial Number: X70200
 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 | 16757.0 | -27634. | -2.3087 | 15.50 | 826.892 | -41.796 | -0.78347 |
| 1.500 | 14374.1 | -20545. | -2.1439 | 16.00 | 806.607 | -39.383 | -0.78120 |
| 1.600 | 12563.9 | -15998. | -2.0373 | 16.50 | 787.471 | -37.195 | -0.77936 |
| 1.700 | 11128.0 | -12873. | -1.9667 | 17.00 | 769.380 | -35.200 | -0.77778 |
| 1.800 | 9963.27 | -10531. | -1.9026 | 17.50 | 752.242 | -33.378 | -0.77650 |
| 1.900 | 9003.39 | -8741.2 | -1.8447 | 18.00 | 735.976 | -31.706 | -0.77545 |
| 2.000 | 8201.93 | -7345.3 | -1.7911 | 18.50 | 720.513 | -30.170 | -0.77465 |
| 2.100 | 7524.70 | -6239.1 | -1.7412 | 19.00 | 705.787 | -28.753 | -0.77404 |
| 2.200 | 6946.97 | -5347.4 | -1.6934 | 19.50 | 691.741 | -27.444 | -0.77365 |
| 2.300 | 6449.69 | -4622.1 | -1.6483 | 20.00 | 678.326 | -26.231 | -0.77340 |
| 2.400 | 6018.20 | -4027.4 | -1.6061 | 21.00 | 653.209 | -24.056 | -0.77338 |
| 2.500 | 5640.81 | -3535.3 | -1.5668 | 22.00 | 630.119 | -22.165 | -0.77386 |
| 2.600 | 5308.43 | -3124.5 | -1.5303 | 23.00 | 608.801 | -20.508 | -0.77477 |
| 2.700 | 5013.74 | -2778.8 | -1.4965 | 24.00 | 589.040 | -19.045 | -0.77596 |
| 2.800 | 4750.91 | -2485.8 | -1.4650 | 25.00 | 570.657 | -17.746 | -0.77745 |
| 2.900 | 4515.16 | -2235.5 | -1.4358 | 26.00 | 553.501 | -16.586 | -0.77909 |
| 3.000 | 4302.64 | -2020.3 | -1.4087 | 27.00 | 537.446 | -15.544 | -0.78089 |
| 3.100 | 4110.13 | -1834.1 | -1.3833 | 28.00 | 522.380 | -14.604 | -0.78280 |
| 3.200 | 3935.02 | -1671.9 | -1.3596 | 29.00 | 508.208 | -13.752 | -0.78475 |
| 3.300 | 3775.08 | -1529.9 | -1.3374 | 30.00 | 494.849 | -12.978 | -0.78677 |
| 3.400 | 3628.47 | -1404.9 | -1.3165 | 31.00 | 482.230 | -12.270 | -0.78877 |
| 3.500 | 3493.61 | -1294.4 | -1.2968 | 32.00 | 470.289 | -11.622 | -0.79080 |
| 3.600 | 3369.18 | -1196.2 | -1.2781 | 33.00 | 458.969 | -11.026 | -0.79279 |
| 3.700 | 3254.02 | -1108.6 | -1.2605 | 34.00 | 448.221 | -10.478 | -0.79479 |
| 3.800 | 3147.16 | -1030.1 | -1.2437 | 35.00 | 438.000 | -9.9700 | -0.79669 |
| 3.900 | 3047.74 | -959.50 | -1.2278 | 36.00 | 428.268 | -9.5000 | -0.79856 |
| 4.000 | 2955.03 | -895.81 | -1.2126 | 37.00 | 418.989 | -9.0643 | -0.80045 |
| 4.200 | 2787.21 | -785.97 | -1.1844 | 38.00 | 410.130 | -8.6584 | -0.80224 |
| 4.400 | 2639.40 | -694.82 | -1.1583 | 39.00 | 401.663 | -8.2801 | -0.80397 |
| 4.600 | 2508.30 | -618.48 | -1.1342 | 40.00 | 393.561 | -7.9272 | -0.80569 |
| 4.800 | 2391.20 | -554.14 | -1.1124 | 42.00 | 378.360 | -7.2871 | -0.80891 |
| 5.000 | 2286.02 | -499.21 | -1.0919 | 44.00 | 364.361 | -6.7239 | -0.81197 |
| 5.200 | 2191.00 | -452.10 | -1.0730 | 46.00 | 351.422 | -6.2252 | -0.81486 |
| 5.400 | 2104.76 | -411.28 | -1.0552 | 48.00 | 339.424 | -5.7812 | -0.81756 |
| 5.600 | 2026.12 | -375.92 | -1.0390 | 50.00 | 328.265 | -5.3846 | -0.82017 |
| 5.800 | 1954.11 | -344.87 | -1.0236 | 52.00 | 317.858 | -5.0286 | -0.82265 |
| 6.000 | 1887.93 | -317.49 | -1.0090 | 54.00 | 308.128 | -4.7073 | -0.82496 |
| 6.500 | 1743.69 | -262.17 | -0.97731 | 56.00 | 299.008 | -4.4173 | -0.82729 |
| 7.000 | 1623.55 | -220.30 | -0.94983 | 58.00 | 290.441 | -4.1538 | -0.82951 |
| 7.500 | 1521.79 | -188.02 | -0.92663 | 60.00 | 282.377 | -3.9141 | -0.83167 |
| 8.000 | 1434.42 | -162.47 | -0.90610 | 65.00 | 264.136 | -3.4010 | -0.83693 |
| 8.500 | 1358.46 | -142.07 | -0.88896 | 70.00 | 248.204 | -2.9858 | -0.84206 |
| 9.000 | 1291.73 | -125.38 | -0.87354 | 75.00 | 234.155 | -2.6447 | -0.84709 |
| 9.500 | 1232.58 | -111.63 | -0.86041 | 77.35 | 228.106 | -2.5050 | -0.84945 |
| 10.00 | 1179.73 | -100.11 | -0.84858 | 80.00 | 221.662 | -2.3611 | -0.85215 |
| 10.50 | 1132.17 | -90.407 | -0.83846 | 85.00 | 210.469 | -2.1224 | -0.85717 |
| 11.00 | 1089.09 | -82.105 | -0.82927 | 90.00 | 200.378 | -1.9193 | -0.86206 |
| 11.50 | 1049.86 | -74.983 | -0.82135 | 95.00 | 191.227 | -1.7454 | -0.86709 |
| 12.00 | 1013.95 | -68.799 | -0.81422 | 100.0 | 182.885 | -1.5949 | -0.87210 |
| 12.50 | 980.930 | -63.412 | -0.80806 | 105.0 | 175.246 | -1.4637 | -0.87697 |
| 13.00 | 950.439 | -58.648 | -0.80218 | 110.0 | 168.222 | -1.3483 | -0.88166 |
| 13.50 | 922.191 | -54.434 | -0.79686 | 115.0 | 161.740 | -1.2464 | -0.88622 |
| 14.00 | 895.923 | -50.714 | -0.79247 | 120.0 | 155.739 | -1.1558 | -0.89056 |
| 14.50 | 871.404 | -47.423 | -0.78911 | 125.0 | 150.166 | -1.0749 | -0.89473 |
| 15.00 | 848.445 | -44.464 | -0.78609 | 130.0 | 144.977 | -1.0022 | -0.89868 |



INTERPOLATION TABLE

Calibration Report: 637801
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 66130
Serial Number: X70200
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 | 140.132 | -0.93676 | -0.90246 | 235.0 | 84.0891 | -0.33139 | -0.92612 |
| 140.0 | 135.599 | -0.87752 | -0.90601 | 240.0 | 82.4664 | -0.31786 | -0.92506 |
| 145.0 | 131.348 | -0.82373 | -0.90935 | 245.0 | 80.9092 | -0.30510 | -0.92388 |
| 150.0 | 127.353 | -0.77469 | -0.91245 | 250.0 | 79.4141 | -0.29306 | -0.92257 |
| 155.0 | 123.594 | -0.72985 | -0.91531 | 255.0 | 77.9776 | -0.28168 | -0.92113 |
| 160.0 | 120.049 | -0.68870 | -0.91790 | 260.0 | 76.5963 | -0.27091 | -0.91958 |
| 165.0 | 116.701 | -0.65086 | -0.92023 | 265.0 | 75.2675 | -0.26072 | -0.91792 |
| 170.0 | 113.535 | -0.61595 | -0.92228 | 270.0 | 73.9883 | -0.25105 | -0.91615 |
| 175.0 | 110.537 | -0.58367 | -0.92405 | 273.15 | 73.2067 | -0.24522 | -0.91497 |
| 180.0 | 107.695 | -0.55375 | -0.92554 | 275.0 | 72.7561 | -0.24188 | -0.91426 |
| 185.0 | 104.996 | -0.52598 | -0.92676 | 280.0 | 71.5687 | -0.23317 | -0.91225 |
| 190.0 | 102.432 | -0.50014 | -0.92770 | 285.0 | 70.4237 | -0.22489 | -0.91012 |
| 195.0 | 99.9919 | -0.47606 | -0.92839 | 290.0 | 69.3191 | -0.21701 | -0.90786 |
| 200.0 | 97.6684 | -0.45359 | -0.92883 | 295.0 | 68.2530 | -0.20950 | -0.90548 |
| 205.0 | 95.4535 | -0.43258 | -0.92904 | 300.0 | 67.2236 | -0.20233 | -0.90296 |
| 210.0 | 93.3403 | -0.41293 | -0.92902 | 305.0 | 66.2291 | -0.19549 | -0.90029 |
| 215.0 | 91.3222 | -0.39451 | -0.92880 | 310.0 | 65.2681 | -0.18896 | -0.89748 |
| 220.0 | 89.3933 | -0.37723 | -0.92838 | 315.0 | 64.3391 | -0.18270 | -0.89451 |
| 225.0 | 87.5481 | -0.36100 | -0.92779 | 320.0 | 63.4406 | -0.17672 | -0.89137 |
| 230.0 | 85.7816 | -0.34575 | -0.92703 | 325.0 | 62.5715 | -0.17098 | -0.88806 |



THERMAL CYCLE TESTING

Sensor Model: CX-1050-SD-1.4L

Serial Number: X70200

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: | 66.2 Ω |
| Liquid Nitrogen: | 228 Ω |
| Liquid Helium: | 2792 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: 637801
Sensor Model: CX-1050-SD-1.4L
Sensor Type: Cernox Resistor

Sales Order: 66130
Serial Number: X70200
Temperature Range: 1.40K to 325K

Name: CX-1050-SD-1.4L
Serial number: X70200
Format: 4 ;Log Ohms/Kelvin
Limit: 325.0
Coefficient: 1 ;Negative

| | | |
|---------------------------|----------------------------|---------------------------|
| Point 1: 1.79636,325.000 | Point 56: 2.35503, 78.000 | Point 111: 3.11111, 9.000 |
| Point 2: 1.80357,319.000 | Point 57: 2.36703, 75.500 | Point 112: 3.12846, 8.600 |
| Point 3: 1.81032,313.500 | Point 58: 2.37692, 73.500 | Point 113: 3.14691, 8.200 |
| Point 4: 1.81721,308.000 | Point 59: 2.38703, 71.500 | Point 114: 3.16658, 7.800 |
| Point 5: 1.82426,302.500 | Point 60: 2.39741, 69.500 | Point 115: 3.18497, 7.450 |
| Point 6: 1.83145,297.000 | Point 61: 2.40807, 67.500 | Point 116: 3.20453, 7.100 |
| Point 7: 1.83881,291.500 | Point 62: 2.41902, 65.500 | Point 117: 3.22546, 6.750 |
| Point 8: 1.84632,286.000 | Point 63: 2.43029, 63.500 | Point 118: 3.24795, 6.400 |
| Point 9: 1.85400,280.500 | Point 64: 2.44188, 61.500 | Point 119: 3.27221, 6.050 |
| Point 10: 1.86186,275.000 | Point 65: 2.45443, 59.400 | Point 120: 3.29545, 5.740 |
| Point 11: 1.86989,269.500 | Point 66: 2.46677, 57.400 | Point 121: 3.31968, 5.440 |
| Point 12: 1.87810,264.000 | Point 67: 2.47952, 55.400 | Point 122: 3.34589, 5.140 |
| Point 13: 1.88650,258.500 | Point 68: 2.49137, 53.600 | Point 123: 3.37247, 4.860 |
| Point 14: 1.89511,253.000 | Point 69: 2.50358, 51.800 | Point 124: 3.40132, 4.580 |
| Point 15: 1.90391,247.500 | Point 70: 2.51619, 50.000 | Point 125: 3.43059, 4.320 |
| Point 16: 1.91293,242.000 | Point 71: 2.52923, 48.200 | Point 126: 3.46251, 4.060 |
| Point 17: 1.92132,237.000 | Point 72: 2.54273, 46.400 | Point 127: 3.48936, 3.860 |
| Point 18: 1.92989,232.000 | Point 73: 2.55671, 44.600 | Point 128: 3.51377, 3.690 |
| Point 19: 1.93867,227.000 | Point 74: 2.56960, 43.000 | Point 129: 3.53992, 3.520 |
| Point 20: 1.94764,222.000 | Point 75: 2.58292, 41.400 | Point 130: 3.56637, 3.360 |
| Point 21: 1.95683,217.000 | Point 76: 2.59761, 39.700 | Point 131: 3.59477, 3.200 |
| Point 22: 1.96623,212.000 | Point 77: 2.61196, 38.100 | Point 132: 3.62546, 3.040 |
| Point 23: 1.97586,207.000 | Point 78: 2.62688, 36.500 | Point 133: 3.65664, 2.890 |
| Point 24: 1.98572,202.000 | Point 79: 2.64143, 35.000 | Point 134: 3.69041, 2.740 |
| Point 25: 1.99583,197.000 | Point 80: 2.65655, 33.500 | Point 135: 3.72475, 2.600 |
| Point 26: 2.00619,192.000 | Point 81: 2.67231, 32.000 | Point 136: 3.76210, 2.460 |
| Point 27: 2.01682,187.000 | Point 82: 2.68765, 30.600 | Point 137: 3.80005, 2.330 |
| Point 28: 2.02773,182.000 | Point 83: 2.70364, 29.200 | Point 138: 3.84148, 2.200 |
| Point 29: 2.03892,177.000 | Point 84: 2.72036, 27.800 | Point 139: 3.88706, 2.070 |
| Point 30: 2.04926,172.500 | Point 85: 2.73662, 26.500 | Point 140: 3.93343, 1.950 |
| Point 31: 2.05985,168.000 | Point 86: 2.75362, 25.200 | Point 141: 3.98439, 1.830 |
| Point 32: 2.07070,163.500 | Point 87: 2.77009, 24.000 | Point 142: 4.04093, 1.710 |
| Point 33: 2.08184,159.000 | Point 88: 2.78734, 22.800 | Point 143: 4.09867, 1.600 |
| Point 34: 2.09326,154.500 | Point 89: 2.80551, 21.600 | Point 144: 4.15704, 1.500 |
| Point 35: 2.10499,150.000 | Point 90: 2.82308, 20.500 | Point 145: 4.21651, 1.410 |
| Point 36: 2.11704,145.500 | Point 91: 2.83649, 19.700 | Point 146: 4.22420, 1.400 |
| Point 37: 2.12943,141.000 | Point 92: 2.84776, 19.050 | |
| Point 38: 2.14218,136.500 | Point 93: 2.85943, 18.400 | |
| Point 39: 2.15530,132.000 | Point 94: 2.87154, 17.750 | |
| Point 40: 2.16732,128.000 | Point 95: 2.88412, 17.100 | |
| Point 41: 2.17966,124.000 | Point 96: 2.89620, 16.500 | |
| Point 42: 2.19237,120.000 | Point 97: 2.90875, 15.900 | |
| Point 43: 2.20545,116.000 | Point 98: 2.92183, 15.300 | |
| Point 44: 2.21894,112.000 | Point 99: 2.93433, 14.750 | |
| Point 45: 2.23287,108.000 | Point 100: 2.94735, 14.200 | |
| Point 46: 2.24725,104.000 | Point 101: 2.96095, 13.650 | |
| Point 47: 2.26026,100.500 | Point 102: 2.97389, 13.150 | |
| Point 48: 2.26981, 98.000 | Point 103: 2.98741, 12.650 | |
| Point 49: 2.27956, 95.500 | Point 104: 3.00158, 12.150 | |
| Point 50: 2.28954, 93.000 | Point 105: 3.01646, 11.650 | |
| Point 51: 2.29976, 90.500 | Point 106: 3.03054, 11.200 | |
| Point 52: 2.31024, 88.000 | Point 107: 3.04531, 10.750 | |
| Point 53: 2.32098, 85.500 | Point 108: 3.06087, 10.300 | |
| Point 54: 2.33202, 83.000 | Point 109: 3.07729, 9.850 | |
| Point 55: 2.34336, 80.500 | Point 110: 3.09470, 9.400 | |



BREAKPOINTS 91C/93C/330 FORMAT

Calibration Report: 637801
 Sensor Model: CX-1050-SD-1.4L
 Sensor Type: Cernox Resistor

Sales Order: 66130
 Serial Number: X70200
 Temperature Range: 1.40K to 325K

Interpolation Method: Lagrangian
 Limit: 325.0 (Kelvin)
 Format: 4 (Log Ohms/Kelvin)
 Number of Breakpoints: 52

| No. | Units | Temperature (K) | No. | Units | Temperature (K) |
|-----|---------|-----------------|-----|---------|-----------------|
| 1 | 1.79638 | 325.0 | 31 | 3.04369 | 10.8 |
| 2 | 1.79757 | 324.0 | 32 | 3.09879 | 9.3 |
| 3 | 1.81596 | 309.0 | 33 | 3.15668 | 8.0 |
| 4 | 1.83546 | 294.0 | 34 | 3.21047 | 7.0 |
| 5 | 1.85614 | 279.0 | 35 | 3.26877 | 6.1 |
| 6 | 1.87811 | 264.0 | 36 | 3.32320 | 5.4 |
| 7 | 1.90150 | 249.0 | 37 | 3.37862 | 4.8 |
| 8 | 1.92646 | 234.0 | 38 | 3.43313 | 4.3 |
| 9 | 1.95314 | 219.0 | 39 | 3.48398 | 3.9 |
| 10 | 1.98176 | 204.0 | 40 | 3.54327 | 3.5 |
| 11 | 2.01256 | 189.0 | 41 | 3.59495 | 3.2 |
| 12 | 2.04581 | 174.0 | 42 | 3.65467 | 2.9 |
| 13 | 2.08186 | 159.0 | 43 | 3.70016 | 2.7 |
| 14 | 2.12115 | 144.0 | 44 | 3.75134 | 2.5 |
| 15 | 2.16431 | 129.0 | 45 | 3.80954 | 2.3 |
| 16 | 2.21218 | 114.0 | 46 | 3.84180 | 2.2 |
| 17 | 2.26598 | 99.0 | 47 | 3.91392 | 2.0 |
| 18 | 2.32759 | 84.0 | 48 | 3.95441 | 1.9 |
| 19 | 2.40007 | 69.0 | 49 | 3.99840 | 1.8 |
| 20 | 2.45385 | 59.5 | 50 | 4.04642 | 1.7 |
| 21 | 2.51622 | 50.0 | 51 | 4.15758 | 1.5 |
| 22 | 2.55360 | 45.0 | 52 | 4.22420 | 1.4 |
| 23 | 2.59501 | 40.0 | | | |
| 24 | 2.64147 | 35.0 | | | |
| 25 | 2.69447 | 30.0 | | | |
| 26 | 2.75503 | 25.1 | | | |
| 27 | 2.81187 | 21.2 | | | |
| 28 | 2.87063 | 17.8 | | | |
| 29 | 2.92862 | 15.0 | | | |
| 30 | 2.98608 | 12.7 | | | |

Temperature for Resistance Decades:

| Res. (Ohms) | Temp. (K) |
|-------------|-----------|
| 100 | 194.981 |
| 1000 | 12.205 |
| 10000 | 1.797 |



BREAKPOINTS 234 FORMAT

Calibration Report: 637801
 Sensor Model: CX-1050-SD-1.4L
 Sensor Type: Cernox Resistor

Sales Order: 66130
 Serial Number: X70200
 Temperature Range: 1.40K to 325K

Maximum Temperature Error:

1.4 - 10K: 0.011K
 10 - 20K: 0.017K
 20 - 40K: 0.009K
 40 - 100K: 0.019K
 > 100K: 0.072K

| BP # | Temp. (K) | Res. (Ω) | Log10 Res. | BP # | Temp. (K) | Res. (Ω) | Log10 Res. |
|------|-----------|----------|------------|------|-----------|----------|------------|
| 1 | 321.960 | 63.09573 | 1.800 | 46 | 29.518 | 501.1872 | 2.700 |
| 2 | 305.816 | 66.06934 | 1.820 | 47 | 27.835 | 524.8075 | 2.720 |
| 3 | 290.628 | 69.18310 | 1.840 | 48 | 26.241 | 549.5409 | 2.740 |
| 4 | 276.301 | 72.44360 | 1.860 | 49 | 24.733 | 575.4399 | 2.760 |
| 5 | 262.755 | 75.85776 | 1.880 | 50 | 23.308 | 602.5596 | 2.780 |
| 6 | 249.936 | 79.43282 | 1.900 | 51 | 21.962 | 630.9573 | 2.800 |
| 7 | 237.787 | 83.17638 | 1.920 | 52 | 20.693 | 660.6934 | 2.820 |
| 8 | 226.257 | 87.09636 | 1.940 | 53 | 19.496 | 691.8310 | 2.840 |
| 9 | 215.310 | 91.20108 | 1.960 | 54 | 18.371 | 724.4360 | 2.860 |
| 10 | 204.892 | 95.49926 | 1.980 | 55 | 17.312 | 758.5776 | 2.880 |
| 11 | 194.983 | 100.0000 | 2.000 | 56 | 16.317 | 794.3282 | 2.900 |
| 12 | 185.540 | 104.7129 | 2.020 | 57 | 15.384 | 831.7638 | 2.920 |
| 13 | 176.537 | 109.6478 | 2.040 | 58 | 14.509 | 870.9636 | 2.940 |
| 14 | 167.945 | 114.8154 | 2.060 | 59 | 13.690 | 912.0108 | 2.960 |
| 15 | 159.742 | 120.2264 | 2.080 | 60 | 12.923 | 954.9926 | 2.980 |
| 16 | 151.907 | 125.8925 | 2.100 | 61 | 12.206 | 1000.000 | 3.000 |
| 17 | 144.424 | 131.8257 | 2.120 | 62 | 10.911 | 1096.478 | 3.040 |
| 18 | 137.267 | 138.0384 | 2.140 | 63 | 9.780 | 1202.264 | 3.080 |
| 19 | 130.433 | 144.5440 | 2.160 | 64 | 8.794 | 1318.257 | 3.120 |
| 20 | 123.901 | 151.3561 | 2.180 | 65 | 7.933 | 1445.440 | 3.160 |
| 21 | 117.664 | 158.4893 | 2.200 | 66 | 7.181 | 1584.893 | 3.200 |
| 22 | 111.702 | 165.9587 | 2.220 | 67 | 6.523 | 1737.801 | 3.240 |
| 23 | 106.009 | 173.7801 | 2.240 | 68 | 5.945 | 1905.461 | 3.280 |
| 24 | 100.576 | 181.9701 | 2.260 | 69 | 5.438 | 2089.296 | 3.320 |
| 25 | 95.392 | 190.5461 | 2.280 | 70 | 4.990 | 2290.868 | 3.360 |
| 26 | 90.446 | 199.5262 | 2.300 | 71 | 4.594 | 2511.886 | 3.400 |
| 27 | 85.731 | 208.9296 | 2.320 | 72 | 4.242 | 2754.229 | 3.440 |
| 28 | 81.238 | 218.7762 | 2.340 | 73 | 3.929 | 3019.952 | 3.480 |
| 29 | 76.960 | 229.0868 | 2.360 | 74 | 3.649 | 3311.311 | 3.520 |
| 30 | 72.888 | 239.8833 | 2.380 | 75 | 3.398 | 3630.781 | 3.560 |
| 31 | 69.012 | 251.1886 | 2.400 | 76 | 3.173 | 3981.072 | 3.600 |
| 32 | 65.328 | 263.0268 | 2.420 | 77 | 2.970 | 4365.158 | 3.640 |
| 33 | 61.824 | 275.4229 | 2.440 | 78 | 2.786 | 4786.301 | 3.680 |
| 34 | 58.495 | 288.4032 | 2.460 | 79 | 2.620 | 5248.075 | 3.720 |
| 35 | 55.331 | 301.9952 | 2.480 | 80 | 2.469 | 5754.399 | 3.760 |
| 36 | 52.325 | 316.2278 | 2.500 | 81 | 2.331 | 6309.573 | 3.800 |
| 37 | 49.473 | 331.1311 | 2.520 | 82 | 2.205 | 6918.310 | 3.840 |
| 38 | 46.764 | 346.7369 | 2.540 | 83 | 2.090 | 7585.776 | 3.880 |
| 39 | 44.191 | 363.0781 | 2.560 | 84 | 1.984 | 8317.638 | 3.920 |
| 40 | 41.750 | 380.1894 | 2.580 | 85 | 1.887 | 9120.108 | 3.960 |
| 41 | 39.434 | 398.1072 | 2.600 | 86 | 1.797 | 10000.00 | 4.000 |
| 42 | 37.235 | 416.8694 | 2.620 | 87 | 1.598 | 12589.25 | 4.100 |
| 43 | 35.150 | 436.5158 | 2.640 | 88 | 1.435 | 15848.93 | 4.200 |
| 44 | 33.171 | 457.0882 | 2.660 | 89 | 1.301 | 19952.62 | 4.300 |
| 45 | 31.296 | 478.6301 | 2.680 | | | | |

