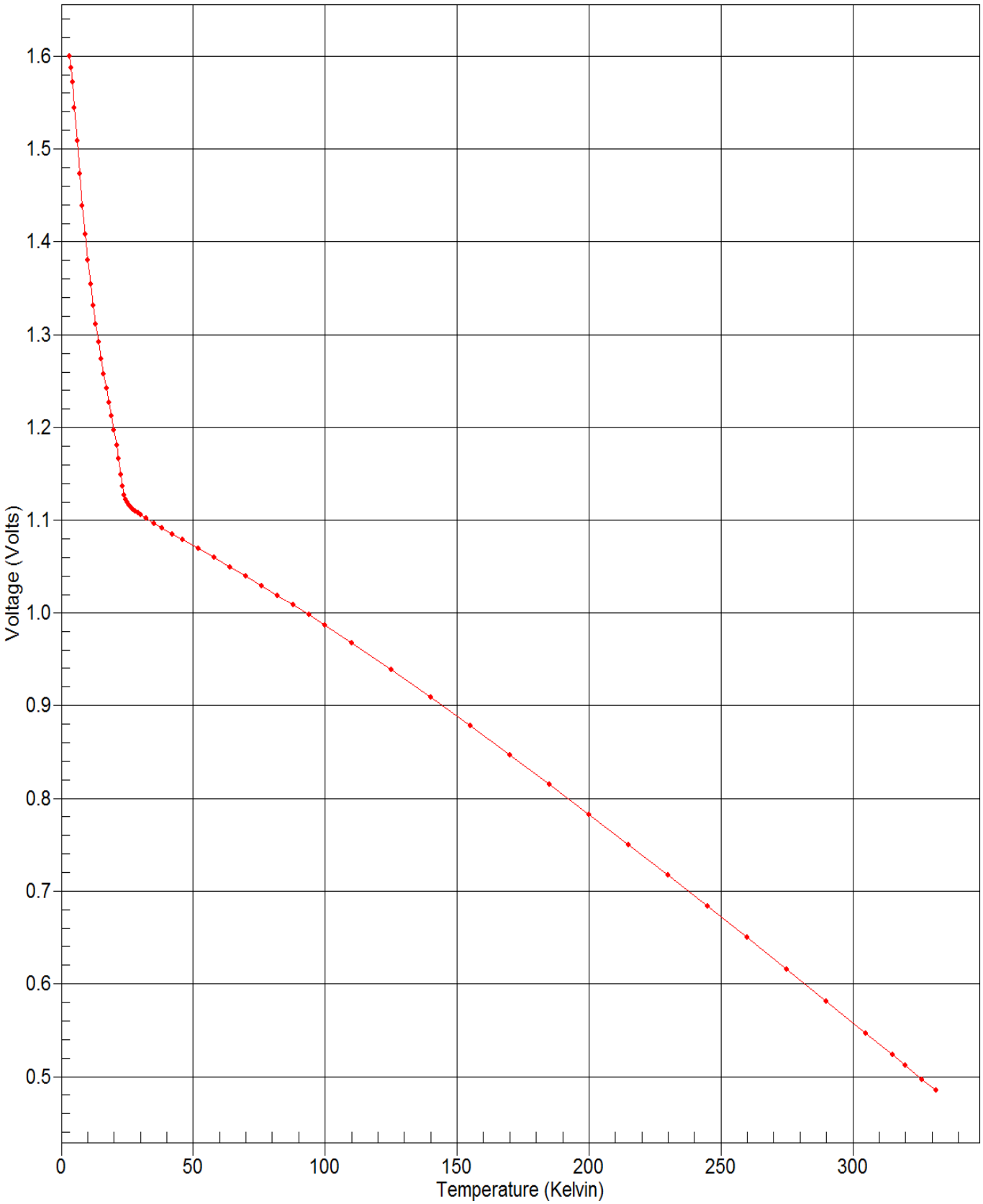
# DATA PLOT

Calibration Report: 677817
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode

Sales Order: 74204
Serial Number: D6026747
Temperature Range: 4.00K to 325K



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F010-04-00_B 06/21/2011

# TEST DATA

Calibration Report: 677817
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode

Sales Order: 74204
Serial Number: D6026747
Temperature Range: 4.00K to 325K

| Index | Temp. (K) | Voltage (V) | Excitation | Index | Temp. (K) | Voltage (V) | Excitation |
|---|---|---|---|---|---|---|---|
| 1 | 3.19943 | 1.60002 | 10µA±0.1% | 36 | 42.1308 | 1.08552 | 10µA±0.1% |
| 2 | 3.69898 | 1.58688 | 10µA±0.1% | 37 | 46.1204 | 1.07918 | 10µA±0.1% |
| 3 | 4.21086 | 1.57198 | 10µA±0.1% | 38 | 52.1226 | 1.06955 | 10µA±0.1% |
| 4 | 5.05618 | 1.54419 | 10µA±0.1% | 39 | 58.1175 | 1.05981 | 10µA±0.1% |
| 5 | 6.05575 | 1.50884 | 10µA±0.1% | 40 | 64.1194 | 1.04990 | 10µA±0.1% |
| 6 | 7.06657 | 1.47286 | 10µA±0.1% | 41 | 70.1202 | 1.03981 | 10µA±0.1% |
| 7 | 8.07358 | 1.43877 | 10µA±0.1% | 42 | 76.1112 | 1.02954 | 10µA±0.1% |
| 8 | 9.09057 | 1.40765 | 10µA±0.1% | 43 | 82.1006 | 1.01907 | 10µA±0.1% |
| 9 | 10.1077 | 1.37980 | 10µA±0.1% | 44 | 88.1024 | 1.00839 | 10µA±0.1% |
| 10 | 11.1229 | 1.35461 | 10µA±0.1% | 45 | 94.0947 | 0.997538 | 10µA±0.1% |
| 11 | 12.1324 | 1.33172 | 10µA±0.1% | 46 | 100.087 | 0.986496 | 10µA±0.1% |
| 12 | 13.1356 | 1.31088 | 10µA±0.1% | 47 | 110.090 | 0.967671 | 10µA±0.1% |
| 13 | 14.1319 | 1.29182 | 10µA±0.1% | 48 | 125.075 | 0.938644 | 10µA±0.1% |
| 14 | 15.1223 | 1.27424 | 10µA±0.1% | 49 | 140.075 | 0.908727 | 10µA±0.1% |
| 15 | 16.1095 | 1.25775 | 10µA±0.1% | 50 | 155.065 | 0.878091 | 10µA±0.1% |
| 16 | 17.0911 | 1.24215 | 10µA±0.1% | 51 | 170.066 | 0.846812 | 10µA±0.1% |
| 17 | 18.0720 | 1.22706 | 10µA±0.1% | 52 | 185.053 | 0.815018 | 10µA±0.1% |
| 18 | 19.0548 | 1.21216 | 10µA±0.1% | 53 | 200.045 | 0.782740 | 10µA±0.1% |
| 19 | 20.0385 | 1.19704 | 10µA±0.1% | 54 | 215.047 | 0.750010 | 10µA±0.1% |
| 20 | 21.0217 | 1.18109 | 10µA±0.1% | 55 | 230.047 | 0.716899 | 10µA±0.1% |
| 21 | 21.8145 | 1.16652 | 10µA±0.1% | 56 | 245.044 | 0.683435 | 10µA±0.1% |
| 22 | 22.6114 | 1.14917 | 10µA±0.1% | 57 | 260.032 | 0.649660 | 10µA±0.1% |
| 23 | 23.2149 | 1.13643 | 10µA±0.1% | 58 | 275.047 | 0.615526 | 10µA±0.1% |
| 24 | 23.8202 | 1.12766 | 10µA±0.1% | 59 | 290.049 | 0.581142 | 10µA±0.1% |
| 25 | 24.4244 | 1.12253 | 10µA±0.1% | 60 | 305.039 | 0.546543 | 10µA±0.1% |
| 26 | 25.0308 | 1.11925 | 10µA±0.1% | 61 | 315.048 | 0.523313 | 10µA±0.1% |
| 27 | 25.6312 | 1.11685 | 10µA±0.1% | 62 | 320.044 | 0.511689 | 10µA±0.1% |
| 28 | 26.4477 | 1.11426 | 10µA±0.1% | 63 | 326.329 | 0.497035 | 10µA±0.1% |
| 29 | 27.2596 | 1.11212 | 10µA±0.1% | 64 | 331.516 | 0.484921 | 10µA±0.1% |
| 30 | 28.0764 | 1.11020 | 10µA±0.1% | | | | |
| 31 | 29.0903 | 1.10801 | 10µA±0.1% | | | | |
| 32 | 30.1011 | 1.10598 | 10µA±0.1% | | | | |
| 33 | 32.1171 | 1.10218 | 10µA±0.1% | | | | |
| 34 | 35.1332 | 1.09690 | 10µA±0.1% | | | | |
| 35 | 38.1390 | 1.09191 | 10µA±0.1% | | | | |



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**Calibration Data Uncertainty**

The uncertainties of the measured calibration data for Lake Shore's sensors are summarized in the table below. The values given are the combined uncertainty of the temperature measurement and the resistance or voltage measurement expressed as an equivalent temperature uncertainty in millikelvin (mK). Note that the values are the calibration uncertainty only and do not include the stability of the temperature sensor. The uncertainty analysis has followed the guidelines for determining measurement uncertainty as outlined in the ISO Guide to the Expression of Uncertainty in Measurement, NIST Technical Note 1297, and ANSI/NCSL Z540-2-1997. Since the uncertainty varies with temperature due to the variation of the sensor sensitivity and excitation, the table gives typical values at several different temperatures throughout the range of the calibration. The uncertainty is based on an approximate 95% confidence level with a coverage factor k = 2.

| T (K) | Uncertainty (± mK) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GR | Cernox (CX) | | | | | RX | | | Platinum | | RF-800 | Diode |
| | | 1010 | 1030 | 1050 | 1070 | 1080 | 102A | 103A | 202A | 100 Ω | 25 Ω | 27 Ω | |
| 1.4 | 4 | 4 | 4 | 4 | | | 4 | 4 | 4 | | | 5 | 7 |
| 4.2 | 4 | 4 | 4 | 4 | 4 | | 4 | 6 | 5 | | | 5 | 5 |
| 10 | 4 | 5 | 5 | 4 | 4 | | 10 | 15 | 12 | | | 7 | 6 |
| 20 | 8 | 10 | 9 | 8 | 8 | 8 | 35 | 35 | 28 | 9 | 10 | 13 | 9 |
| 30 | 9 | 13 | 11 | 9 | 9 | 9 | 76 | 61 | 46 | 9 | 9 | 14 | 31 |
| 50 | 11 | 18 | 14 | 12 | 12 | 11 | | | | 10 | 10 | 13 | 37 |
| 100 | 20 | 29 | 22 | 17 | 16 | 14 | | | | 11 | 12 | 12 | 32 |
| 300 | | 78 | 60 | 46 | 45 | 36 | | | | 24 | 24 | 25 | 35 |
| 400 | | 124 | 94 | 74 | 72 | 60 | | | | 45 | 45 | 45 | 49 |
| 500 | | | | | | | | | | 51 | 51 | | 54 |

**Polynomial Fit Uncertainty**

When a sensor is used to measure temperature, a polynomial fit to the measured calibration data is often used to convert the sensor resistance (R) or voltage (V) to a temperature (T). How well the polynomial represents the sensor calibration data is another source of uncertainty when using the sensor. In the polynomials provided with this set of calibration data, the standard deviation of the fit can be used as an estimate of this additional temperature uncertainty. The standard deviation of fit is determined from the following equation:

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

where

$\sigma_{fit}$ = 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
$\Delta T_{RMS}$ = root mean square deviation of fit

A value of $\Delta T_{RMS}$ is given for each range of fit.




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# POLYNOMIAL EQUATION

Calibration Report: 677817 Sales Order: 74204
Sensor Model: DT-670-SD-4L Serial Number: D6026747
Sensor Type: Silicon Diode Temperature Range: 4.00K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

| | | |
|---|---|---|
| 4.00 K | to | 25.0 K |
| 1.578 Volts | to | 1.119 Volts |

Lower and Upper limits of Voltage used in computing Chebychev coefficients:
ZL = 1.114264282 ZU = 1.600018894

| Order | Coefficient | Std. Deviation of Coefficient | Ratio (Coeff./Std Dev.) |
|---|---|---|---|
| 0 | 12.850314 | 3.2860E-03 | 3910.58 |
| 1 | -10.870248 | 4.9390E-03 | -2200.92 |
| 2 | 1.617924 | 4.6098E-03 | 350.98 |
| 3 | -0.209405 | 4.6919E-03 | -44.63 |
| 4 | -0.142564 | 4.7166E-03 | -30.23 |
| 5 | -0.130334 | 4.6733E-03 | -27.89 |
| 6 | 0.187945 | 4.5511E-03 | 41.30 |
| 7 | -0.207262 | 4.4367E-03 | -46.72 |
| 8 | 0.167841 | 4.3460E-03 | 38.62 |
| 9 | -0.124164 | 4.3147E-03 | -28.78 |
| 10 | 0.081653 | 4.3856E-03 | 18.62 |
| 11 | -0.054985 | 4.5504E-03 | -12.08 |
| 12 | 0.038140 | 4.6439E-03 | 8.21 |
| 13 | -0.021673 | 4.5303E-03 | -4.78 |
| 14 | 0.017018 | 4.2825E-03 | 3.97 |

Z = Voltage

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

Temp. (K) = $\Sigma A_i$* COS(i * ARCCOS(k)), where 0 <= i <= 14
and the $A_i$'s are the coefficients in the table above.

# POLYNOMIAL EQUATION

Calibration Report: 677817
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode

Sales Order: 74204
Serial Number: D6026747
Temperature Range: 4.00K to 325K

Polynomial Type: Chebychev
Temp. (K) vs. Voltage

| | V Meas. (V) | T Meas. (K) | T Eq. (K) | T diff. (mK) |
|---|---|---|---|---|
| 1 | 1.600019 | 3.19943 | 3.20020 | -0.77 |
| 2 | 1.586880 | 3.69898 | 3.69527 | 3.72 |
| 3 | 1.571982 | 4.21086 | 4.21702 | -6.16 |
| 4 | 1.544186 | 5.05618 | 5.04903 | 7.15 |
| 5 | 1.508840 | 6.05575 | 6.06471 | -8.96 |
| 6 | 1.472864 | 7.06657 | 7.05742 | 9.15 |
| 7 | 1.438774 | 8.07358 | 8.07660 | -3.03 |
| 8 | 1.407648 | 9.09057 | 9.09778 | -7.22 |
| 9 | 1.379799 | 10.10766 | 10.10088 | 6.78 |
| 10 | 1.354607 | 11.12293 | 11.11659 | 6.34 |
| 11 | 1.331723 | 12.13242 | 12.13784 | -5.42 |
| 12 | 1.310883 | 13.13560 | 13.14400 | -8.41 |
| 13 | 1.291816 | 14.13194 | 14.13210 | -0.16 |
| 14 | 1.274241 | 15.12225 | 15.11299 | 9.26 |
| 15 | 1.257749 | 16.10954 | 16.10258 | 6.96 |
| 16 | 1.242145 | 17.09113 | 17.09398 | -2.85 |
| 17 | 1.227060 | 18.07198 | 18.08262 | -10.64 |
| 18 | 1.212157 | 19.05477 | 19.06133 | -6.55 |
| 19 | 1.197039 | 20.03851 | 20.03111 | 7.40 |
| 20 | 1.181092 | 21.02170 | 21.00583 | 15.87 |
| 21 | 1.166517 | 21.81453 | 21.82174 | -7.21 |
| 22 | 1.149170 | 22.61142 | 22.63556 | -24.14 |
| 23 | 1.136427 | 23.21492 | 23.19198 | 22.94 |
| 24 | 1.127661 | 23.82017 | 23.80316 | 17.01 |
| 25 | 1.122532 | 24.42440 | 24.44011 | -15.70 |
| 26 | 1.119254 | 25.03080 | 25.04678 | -15.98 |
| 27 | 1.116854 | 25.63119 | 25.63196 | -0.77 |
| 28 | 1.114264 | 26.44773 | 26.43634 | 11.39 |

Order of Fit = 14 RMS error of fit = 10.69 mK
Largest absolute error = -24.14 mK at data point no. 22


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F010-04-00_B 06/21/2011

# POLYNOMIAL EQUATION

Calibration Report: 677817 | Sales Order: 74204
Sensor Model: DT-670-SD-4L | Serial Number: D6026747
Sensor Type: Silicon Diode | Temperature Range: 4.00K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

| | | |
|---|---|---|
| 25.0 K | to | 88.1 K |
| 1.119 Volts | to | 1.008 Volts |

Lower and Upper limits of Voltage used in computing Chebychev coefficients:
ZL = 0.9864955455 ZU = 1.12766061

| Order | Coefficient | Std. Deviation of Coefficient | Ratio (Coeff./Std Dev.) |
|---|---|---|---|
| 0 | 60.083211 | 8.4541E-03 | 7106.96 |
| 1 | -39.949186 | 1.4956E-02 | -2671.07 |
| 2 | 1.058912 | 1.4153E-02 | 74.82 |
| 3 | 1.536019 | 1.0154E-02 | 151.27 |
| 4 | 0.857573 | 7.3597E-03 | 116.52 |
| 5 | 0.327137 | 3.3820E-03 | 96.73 |
| 6 | 0.059427 | 3.8482E-03 | 15.44 |
| 7 | -0.027638 | 7.1720E-03 | -3.85 |
| 8 | -0.058825 | 1.0132E-02 | -5.81 |
| 9 | -0.017985 | 1.0974E-02 | -1.64 |
| 10 | -0.030726 | 1.1242E-02 | -2.73 |
| 11 | -0.002001 | 8.7839E-03 | -0.23 |
| 12 | -0.016628 | 6.1802E-03 | -2.69 |

Z = Voltage

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

Temp. (K) = $\Sigma A_i$* COS(i * ARCCOS(k)), where 0 <= i <= 12
and the $A_i$'s are the coefficients in the table above.

# POLYNOMIAL EQUATION

Calibration Report: 677817
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode

Sales Order: 74204
Serial Number: D6026747
Temperature Range: 4.00K to 325K

Polynomial Type: Chebychev
Temp. (K) vs. Voltage

| | V Meas. (V) | T Meas. (K) | T Eq. (K) | T diff. (mK) |
|---|---|---|---|---|
| 24 | 1.127661 | 23.80316 | 23.81929 | 0.88 |
| 25 | 1.122532 | 24.44011 | 24.43301 | -8.60 |
| 26 | 1.119254 | 25.04678 | 25.01714 | 13.67 |
| 27 | 1.116854 | 25.63119 | 25.62568 | 5.51 |
| 28 | 1.114264 | 26.44773 | 26.45584 | -8.11 |
| 29 | 1.112116 | 27.25958 | 27.26980 | -10.23 |
| 30 | 1.110195 | 28.07643 | 28.08168 | -5.26 |
| 31 | 1.108013 | 29.09029 | 29.08749 | 2.80 |
| 32 | 1.105981 | 30.10115 | 30.09171 | 9.44 |
| 33 | 1.102185 | 32.11707 | 32.10838 | 8.69 |
| 34 | 1.096896 | 35.13322 | 35.13973 | -6.51 |
| 35 | 1.091914 | 38.13899 | 38.14805 | -9.06 |
| 36 | 1.085520 | 42.13081 | 42.12549 | 5.33 |
| 37 | 1.079178 | 46.12041 | 46.11453 | 5.89 |
| 38 | 1.069551 | 52.12263 | 52.12930 | -6.67 |
| 39 | 1.059808 | 58.11753 | 58.11622 | 1.31 |
| 40 | 1.049898 | 64.11935 | 64.11623 | 3.12 |
| 41 | 1.039805 | 70.12020 | 70.12404 | -3.84 |
| 42 | 1.029537 | 76.11124 | 76.10888 | 2.36 |
| 43 | 1.019074 | 82.10056 | 82.10147 | -0.90 |
| 44 | 1.008393 | 88.10245 | 88.10223 | 0.22 |
| 45 | 0.9975377 | 94.09471 | 94.09474 | -0.03 |
| 46 | 0.9864955 | 100.08660 | 100.08660 | 0.00 |

Order of Fit = 12 RMS error of fit = 6.35 mK
Largest absolute error = 13.67 mK at data point no. 26

# POLYNOMIAL EQUATION

Calibration Report: 677817 | Sales Order: 74204
Sensor Model: DT-670-SD-4L | Serial Number: D6026747
Sensor Type: Silicon Diode | Temperature Range: 4.00K to 325K

Polynomial Type: Chebychev
Useful Range of Fit:

| | | |
|---|---|---|
| 88.1 K | to | 325. K |
| 1.008 Volts | to | 0.5001 Volts |

Lower and Upper limits of Voltage used in computing Chebychev coefficients:
ZL = 0.484920586 ZU = 1.029537109

| Order | Coefficient | Std. Deviation of Coefficient | Ratio (Coeff./Std Dev.) |
|---|---|---|---|
| 0 | 208.035667 | 1.4398E-04 | 1444896.08 |
| 1 | -126.714854 | 2.0866E-04 | -607287.27 |
| 2 | -3.952193 | 2.0530E-04 | -19250.93 |
| 3 | -0.904332 | 2.1114E-04 | -4283.04 |
| 4 | -0.252443 | 2.0904E-04 | -1207.64 |
| 5 | -0.081156 | 1.9953E-04 | -406.74 |
| 6 | -0.018669 | 1.9233E-04 | -97.07 |
| 7 | -0.002578 | 1.9190E-04 | -13.43 |
| 8 | 0.000565 | 1.9463E-04 | 2.90 |
| 9 | 0.000427 | 1.9446E-04 | 2.19 |
| 10 | 0.000421 | 1.9208E-04 | 2.19 |

Z = Voltage

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

Temp. (K) = $\Sigma A_i$* COS(i * ARCCOS(k)), where 0 <= i <= 10
and the $A_i$'s are the coefficients in the table above.

# POLYNOMIAL EQUATION

Calibration Report: 677817
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode

Sales Order: 74204
Serial Number: D6026747
Temperature Range: 4.00K to 325K

Polynomial Type: Chebychev
Temp. (K) vs. Voltage

| | V Meas. (V) | T Meas. (K) | T Eq. (K) | T diff. (mK) |
|---|---|---|---|---|
| 42 | 1.029537 | 76.10888 | 76.11085 | 0.39 |
| 43 | 1.019074 | 82.10147 | 82.10132 | -0.76 |
| 44 | 1.008393 | 88.10223 | 88.10271 | -0.26 |
| 45 | 0.9975377 | 94.09471 | 94.09399 | 0.72 |
| 46 | 0.9864955 | 100.08660 | 100.08616 | 0.44 |
| 47 | 0.9676707 | 110.08989 | 110.09025 | -0.36 |
| 48 | 0.9386442 | 125.07471 | 125.07541 | -0.70 |
| 49 | 0.9087267 | 140.07460 | 140.07395 | 0.65 |
| 50 | 0.8780907 | 155.06543 | 155.06535 | 0.07 |
| 51 | 0.8468117 | 170.06559 | 170.06558 | 0.01 |
| 52 | 0.8150178 | 185.05290 | 185.05341 | -0.51 |
| 53 | 0.7827396 | 200.04527 | 200.04488 | 0.39 |
| 54 | 0.7500097 | 215.04742 | 215.04750 | -0.07 |
| 55 | 0.7168987 | 230.04650 | 230.04656 | -0.06 |
| 56 | 0.6834347 | 245.04408 | 245.04375 | 0.34 |
| 57 | 0.6496598 | 260.03217 | 260.03263 | -0.46 |
| 58 | 0.6155256 | 275.04666 | 275.04644 | 0.22 |
| 59 | 0.5811419 | 290.04885 | 290.04906 | -0.21 |
| 60 | 0.5465433 | 305.03887 | 305.03812 | 0.75 |
| 61 | 0.5233127 | 315.04785 | 315.04894 | -1.09 |
| 62 | 0.5116895 | 320.04362 | 320.04341 | 0.21 |
| 63 | 0.4970348 | 326.32913 | 326.32858 | 0.55 |
| 64 | 0.4849206 | 331.51560 | 331.51584 | -0.24 |

Order of Fit = 10 RMS error of fit = 0.49 mK
Largest absolute error = -1.09 mK at data point no. 61


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# INTERPOLATION TABLE

Calibration Report: 677817 Sales Order: 74204
Sensor Model: DT-670-SD-4L Serial Number: D6026747
Sensor Type: Silicon Diode Temperature Range: 4.00K to 325K

| Temp (K) | Volts (V) | dV/dT (mV/K) | Temp (K) | Volts (V) | dV/dT (mV/K) |
|---|---|---|---|---|---|
| 4.000 | 1.57831 | -29.358 | 37.00 | 1.09378 | -1.6474 |
| 4.200 | 1.57231 | -30.621 | 38.00 | 1.09214 | -1.6275 |
| 4.400 | 1.56607 | -31.840 | 39.00 | 1.09052 | -1.6120 |
| 4.600 | 1.55959 | -32.870 | 40.00 | 1.08891 | -1.6004 |
| 4.800 | 1.55293 | -33.708 | 42.00 | 1.08573 | -1.5891 |
| 5.000 | 1.54612 | -34.356 | 44.00 | 1.08255 | -1.5888 |
| 5.200 | 1.53920 | -34.839 | 46.00 | 1.07937 | -1.5931 |
| 5.400 | 1.53219 | -35.224 | 48.00 | 1.07618 | -1.6000 |
| 5.600 | 1.52512 | -35.515 | 50.00 | 1.07297 | -1.6069 |
| 5.800 | 1.51799 | -35.713 | 52.00 | 1.06975 | -1.6136 |
| 6.000 | 1.51084 | -35.817 | 54.00 | 1.06651 | -1.6207 |
| 6.500 | 1.49293 | -35.715 | 56.00 | 1.06327 | -1.6284 |
| 7.000 | 1.47520 | -35.144 | 58.00 | 1.06000 | -1.6368 |
| 7.500 | 1.45787 | -34.111 | 60.00 | 1.05672 | -1.6458 |
| 8.000 | 1.44117 | -32.622 | 65.00 | 1.04843 | -1.6707 |
| 8.500 | 1.42529 | -30.873 | 70.00 | 1.04001 | -1.6970 |
| 9.000 | 1.41028 | -29.196 | 75.00 | 1.03146 | -1.7242 |
| 9.500 | 1.39608 | -27.635 | 77.35 | 1.02739 | -1.7373 |
| 10.00 | 1.38261 | -26.266 | 80.00 | 1.02277 | -1.7519 |
| 10.50 | 1.36978 | -25.061 | 85.00 | 1.01394 | -1.7791 |
| 11.00 | 1.35754 | -23.950 | 90.00 | 1.00498 | -1.8058 |
| 11.50 | 1.34582 | -22.917 | 95.00 | 0.995881 | -1.8322 |
| 12.00 | 1.33461 | -21.933 | 100.0 | 0.986656 | -1.8575 |
| 12.50 | 1.32388 | -21.001 | 105.0 | 0.977308 | -1.8816 |
| 13.00 | 1.31360 | -20.137 | 110.0 | 0.967842 | -1.9047 |
| 13.50 | 1.30373 | -19.336 | 115.0 | 0.958263 | -1.9266 |
| 14.00 | 1.29425 | -18.581 | 120.0 | 0.948578 | -1.9474 |
| 14.50 | 1.28514 | -17.889 | 125.0 | 0.938791 | -1.9670 |
| 15.00 | 1.27635 | -17.303 | 130.0 | 0.928909 | -1.9856 |
| 15.50 | 1.26782 | -16.806 | 135.0 | 0.918936 | -2.0033 |
| 16.00 | 1.25954 | -16.352 | 140.0 | 0.908877 | -2.0202 |
| 16.50 | 1.25146 | -15.953 | 145.0 | 0.898736 | -2.0361 |
| 17.00 | 1.24357 | -15.637 | 150.0 | 0.888518 | -2.0512 |
| 17.50 | 1.23581 | -15.401 | 155.0 | 0.878226 | -2.0653 |
| 18.00 | 1.22816 | -15.232 | 160.0 | 0.867865 | -2.0788 |
| 18.50 | 1.22057 | -15.148 | 165.0 | 0.857439 | -2.0917 |
| 19.00 | 1.21299 | -15.177 | 170.0 | 0.846950 | -2.1040 |
| 19.50 | 1.20537 | -15.327 | 175.0 | 0.836400 | -2.1158 |
| 20.00 | 1.19764 | -15.607 | 180.0 | 0.825793 | -2.1270 |
| 21.00 | 1.18146 | -16.994 | 185.0 | 0.815131 | -2.1377 |
| 22.00 | 1.16267 | -21.180 | 190.0 | 0.804417 | -2.1479 |
| 23.00 | 1.14065 | -20.770 | 195.0 | 0.793652 | -2.1579 |
| 24.00 | 1.12584 | -9.3208 | 200.0 | 0.782838 | -2.1677 |
| 25.00 | 1.11939 | -4.5924 | 205.0 | 0.771975 | -2.1771 |
| 26.00 | 1.11561 | -3.1874 | 210.0 | 0.761067 | -2.1862 |
| 27.00 | 1.11277 | -2.5728 | 215.0 | 0.750114 | -2.1950 |
| 28.00 | 1.11037 | -2.2636 | 220.0 | 0.739118 | -2.2034 |
| 29.00 | 1.10820 | -2.0832 | 225.0 | 0.728080 | -2.2116 |
| 30.00 | 1.10618 | -1.9668 | 230.0 | 0.717002 | -2.2196 |
| 31.00 | 1.10425 | -1.8877 | 235.0 | 0.705884 | -2.2274 |
| 32.00 | 1.10240 | -1.8262 | 240.0 | 0.694728 | -2.2351 |
| 33.00 | 1.10060 | -1.7779 | 245.0 | 0.683534 | -2.2426 |
| 34.00 | 1.09884 | -1.7362 | 250.0 | 0.672302 | -2.2500 |
| 35.00 | 1.09712 | -1.7011 | 255.0 | 0.661034 | -2.2570 |
| 36.00 | 1.09544 | -1.6719 | 260.0 | 0.649733 | -2.2637 |


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# INTERPOLATION TABLE

Calibration Report: 677817
Sensor Model: DT-670-SD-4L
Sensor Type: Silicon Diode

Sales Order: 74204
Serial Number: D6026747
Temperature Range: 4.00K to 325K

| Temp (K) | Volts (V) | dV/dT (mV/K) |
|---|---|---|
| 265.0 | 0.638398 | -2.2702 |
| 270.0 | 0.627031 | -2.2766 |
| 273.15 | 0.619853 | -2.2806 |
| 275.0 | 0.615632 | -2.2830 |
| 280.0 | 0.604202 | -2.2891 |
| 285.0 | 0.592742 | -2.2948 |
| 290.0 | 0.581254 | -2.3001 |
| 295.0 | 0.569741 | -2.3053 |
| 300.0 | 0.558201 | -2.3107 |
| 305.0 | 0.546633 | -2.3162 |
| 310.0 | 0.535039 | -2.3212 |
| 315.0 | 0.523424 | -2.3248 |
| 320.0 | 0.511791 | -2.3287 |
| 325.0 | 0.500136 | -2.3330 |



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Sensor Model: DT-670-SD-4L Serial Number: D6026747
Sensor Type: Silicon Diode

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

| | |
|---|---|
| Approximately 305 K: | 0.547 V |
| Liquid Nitrogen: | 1.027 V |
| Liquid Helium: | 1.573 V |

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 diode sensors calibrated by LSCI, the current is maintained at the constant values listed on the Test Data page. In order to minimize calibration offsets due to the nonlinear voltage-current relationship in the diode sensor, these same guidelines should be followed in using the sensor.


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# BREAKPOINTS 340 FORMAT

Calibration Report: 677817 Sales Order: 74204
Sensor Model: DT-670-SD-4L Serial Number: D6026747
Sensor Type: Silicon Diode Temperature Range: 4.00K to 325K

Name: DT-670-SD-4L
Serial number: D6026747
Format: 2 ;Volts/Kelvin
Limit: 325.0
Coefficient: 1 ;Negative

| | |
|---|---|
| Point 1: 9.06000e-02,500.000 | Point 56: 1.12088, 24.700 |
| Point 2: .110239,491.000 | Point 57: 1.12267, 24.400 |
| Point 3: .136555,479.500 | Point 58: 1.12491, 24.100 |
| Point 4: .179181,461.500 | Point 59: 1.12680, 23.900 |
| Point 5: .265393,425.500 | Point 60: 1.12904, 23.700 |
| Point 6: .349522,390.000 | Point 61: 1.13173, 23.500 |
| Point 7: .452797,346.000 | Point 62: 1.13490, 23.300 |
| Point 8: .500162,325.000 | Point 63: 1.14057, 23.000 |
| Point 9: .544338,306.000 | Point 64: 1.16275, 22.000 |
| Point 10: .581276,290.000 | Point 65: 1.17270, 21.500 |
| Point 11: .616796,274.500 | Point 66: 1.18322, 20.900 |
| Point 12: .649754,260.000 | Point 67: 1.19614, 20.100 |
| Point 13: .681312,246.000 | Point 68: 1.20073, 19.800 |
| Point 14: .710356,233.000 | Point 69: 1.21226, 19.050 |
| Point 15: .738036,220.500 | Point 70: 1.23041, 17.850 |
| Point 16: .764364,208.500 | Point 71: 1.24432, 16.950 |
| Point 17: .789352,197.000 | Point 72: 1.25625, 16.200 |
| Point 18: .813011,186.000 | Point 73: 1.26696, 15.550 |
| Point 19: .835361,175.500 | Point 74: 1.27805, 14.900 |
| Point 20: .856412,165.500 | Point 75: 1.28871, 14.300 |
| Point 21: .876178,156.000 | Point 76: 1.29891, 13.750 |
| Point 22: .894676,147.000 | Point 77: 1.30957, 13.200 |
| Point 23: .911922,138.500 | Point 78: 1.32071, 12.650 |
| Point 24: .927933,130.500 | Point 79: 1.33238, 12.100 |
| Point 25: .943716,122.500 | Point 80: 1.34463, 11.550 |
| Point 26: .958280,115.000 | Point 81: 1.35749, 11.000 |
| Point 27: .971659,108.000 | Point 82: 1.36975, 10.500 |
| Point 28: .984815,101.000 | Point 83: 1.38256, 10.000 |
| Point 29: .994973, 95.500 | Point 84: 1.39603, 9.500 |
| Point 30: 1.00318, 91.000 | Point 85: 1.40878, 9.050 |
| Point 31: 1.01127, 86.500 | Point 86: 1.42217, 8.600 |
| Point 32: 1.01926, 82.000 | Point 87: 1.43626, 8.150 |
| Point 33: 1.02714, 77.500 | Point 88: 1.45272, 7.650 |
| Point 34: 1.03490, 73.000 | Point 89: 1.47339, 7.050 |
| Point 35: 1.04256, 68.500 | Point 90: 1.53436, 5.340 |
| Point 36: 1.05010, 64.000 | Point 91: 1.55299, 4.800 |
| Point 37: 1.05837, 59.000 | Point 92: 1.56612, 4.400 |
| Point 38: 1.06620, 54.200 | Point 93: 1.57659, 4.060 |
| Point 39: 1.07458, 49.000 | Point 94: 1.57830, 4.000 |
| Point 40: 1.08446, 42.800 | Point 95: 1.59690, 3.580 |
| Point 41: 1.08955, 39.600 | Point 96: 1.60756, 3.180 |
| Point 42: 1.09344, 37.200 | Point 97: 1.62125, 2.620 |
| Point 43: 1.09661, 35.300 | Point 98: 1.62945, 2.260 |
| Point 44: 1.09953, 33.600 | Point 99: 1.63516, 1.980 |
| Point 45: 1.10221, 32.100 | Point 100: 1.63943, 1.740 |
| Point 46: 1.10462, 30.800 | Point 101: 1.64261, 1.530 |
| Point 47: 1.10677, 29.700 | Point 102: 1.64430, 1.400 |
| Point 48: 1.10861, 28.800 | |
| Point 49: 1.11036, 28.000 | |
| Point 50: 1.11201, 27.300 | |
| Point 51: 1.11355, 26.700 | |
| Point 52: 1.11498, 26.200 | |
| Point 53: 1.11626, 25.800 | |
| Point 54: 1.11770, 25.400 | |
| Point 55: 1.11937, 25.000 | |

Note: Breakpoints outside of the calibration range were added from the standard curve. These extra points conform to reduced accuracy specifications and are added as a convenience to the customer.

# BREAKPOINTS 91C/93C/330 FORMAT

Calibration Report: 677817 Sales Order: 74204
Sensor Model: DT-670-SD-4L Serial Number: D6026747
Sensor Type: Silicon Diode Temperature Range: 4.00K to 325K

Interpolation Method: Straight Line
Limit: 325.0 (Kelvin)
Format: 2 (Volts/Kelvin)
Number of Breakpoints: 37

| No. | Units | Temperature (K) | No. | Units | Temperature (K) |
|---|---|---|---|---|---|
| 1 | 0.147030 | 475.0 | 21 | 1.10816 | 29.0 |
| 2 | 0.218700 | 445.0 | 22 | 1.11273 | 27.0 |
| 3 | 0.326000 | 400.0 | 23 | 1.11561 | 26.0 |
| 4 | 0.490260 | 330.0 | 24 | 1.11939 | 25.0 |
| 5 | 0.500240 | 325.0 | 25 | 1.12584 | 24.0 |
| 6 | 0.569780 | 295.0 | 26 | 1.14065 | 23.0 |
| 7 | 0.638490 | 265.0 | 27 | 1.16267 | 22.0 |
| 8 | 0.705970 | 235.0 | 28 | 1.18146 | 21.0 |
| 9 | 0.761130 | 210.0 | 29 | 1.26737 | 15.5 |
| 10 | 0.815220 | 185.0 | 30 | 1.31299 | 13.0 |
| 11 | 0.857490 | 165.0 | 31 | 1.36888 | 10.5 |
| 12 | 0.898810 | 145.0 | 32 | 1.43974 | 8.0 |
| 13 | 0.938880 | 125.0 | 33 | 1.56715 | 4.4 |
| 14 | 0.967880 | 110.0 | 34 | 1.57815 | 4.0 |
| 15 | 0.995950 | 95.0 | 35 | 1.59237 | 3.8 |
| 16 | 1.02283 | 80.0 | 36 | 1.63785 | 1.9 |
| 17 | 1.04850 | 65.0 | 37 | 1.64411 | 1.4 |
| 18 | 1.07304 | 50.0 | | | |
| 19 | 1.09371 | 37.0 | | | |
| 20 | 1.10234 | 32.0 | | | |

Note: Breakpoints outside of the calibration range were added from the standard curve. These extra points conform to reduced accuracy specifications and are added as a convenience to the customer.