Example Campbell Scientific Datalogger Program for Temperature Measurements with Apogee Model SI-111(Infrared Radiometer). All comments are in bold text.

;{CR10X}

*Table 1 Program
01: 1 Execution Interval (seconds)

Instruction string to measure the resistance of the thermistor and calculate the sensor body temperature. See the Instruction Manual for Campbell Sci. Model 109 Temperature Probe for details.

```
1:  AC Half Bridge (P5)
 1: 1          Reps
 2: 25         2500 mV 60 Hz Rejection Range
```
(the range should at least match the excitation)
```
 3: 1          SE Channel
 4: 1          Excite all reps w/Exchan 1
 5: 2500       mV Excitation
 6: 1          Loc [ mV_thrm   ]
 7: 1.0        Mult
 8: 0.0        Offset

2:  Z=1/X (P42)
 1: 1          X Loc [ mV_thrm    ]
 2: 2          Z Loc [ 1_mV_thrm ]

3:  Z=X+F (P34)
 1: 2          X Loc [ 1_mV_thrm ]
 2: -1.0       F
 3: 3          Z Loc [ 2_mV_thrm]

4:  Z=X*F (P37)
 1: 3          X Loc [ 2_mV_thrm ]
 2: 24900      F
 3: 4          Z Loc [ R_thrm        ]

5:  Z=LN(X) (P40)
 1: 4          X Loc [ R_thrm       ]
 2: 5          Z Loc [ lnR_thrm   ]

6:  Z=X*F (P37)
 1: 5          X Loc [ lnR_thrm  ]
 2: 0.001      F
 3: 6          Z Loc [ Scaled_R     ]

7:  Polynomial (P55)
 1: 1          Reps
 2: 6          X Loc [ Scaled_R  ]
 3: 7          F(X) Loc [ SH_Coeffs ]
 4: .001129      C0
 5: .234108      C1
 6: 0.0          C2
 7: 87.7547      C3
 8: 0.0          C4
 9: 0.0          C5

8:  Z=1/X (P42)
 1: 7          X Loc [ SH_Coeffs ]
 2: 8          Z Loc [ SB_Temp_K ]

9:  Z=X+F (P34)
 1: 8          X Loc [ SB_Temp_K ]
 2: -273.15    F
 3: 9          Z Loc [ SB_Temp_C ]
```

Instruction to measure the mV output of the thermopile.

10: Volt (Diff) (P2)
 1: 1   Reps
 2: 21   2.5 mV 60 Hz Rejection Range
 3: 2   DIFF Channel
 4: 11   Loc [mV_tpile]
 5: 1.0   Mult
 6: 0.0   Offset

Calculation of m (slope) and b (intercept) coefficients for target temperature calculation.

11: Polynomial (P55)
 1: 1   Reps
 2: 9   X Loc [SB_Temp_C]
 3: 12   F(X) Loc [m_slope]
 4: 23253   C0
 5: 133.16   C1
 6: 1.1846   C2
 7: 0.0   C3
 8: 0.0   C4
 9: 0.0   C5

12: Z=X*F (P37)
 1: 12   X Loc [m_slope   ]
 2: 99999   F
 3: 12   Z Loc   [m_slope   ]

13: Polynomial (P55)
 1: 1   Reps
 2: 9   X Loc [SB_Temp_C]
 3: 13   F(X) Loc [b_inter]
 4: 115.92   C0
 5: -5.3421   C1
 6: 0.22859   C2
 7: 0.0   C3
 8: 0.0   C4
 9: 0.0   C5

14: Z=X*F (P37)
 1: 13   X Loc [b_inter   ]
 2: 99999   F
 3: 13   Z Loc   [b_inter   ]

Target temperature calculation based on m and b coefficients.

15: Z=F x 10^n (P30)
 1: 0.4   F
 2: 1   n, Exponent of 10
 3: 14   Z Loc [Exponent1   ]

16: Z=F x 10^n (P30)
 1: 0.025   F
 2: 1   n, Exponent of 10
 3: 15   Z Loc [Exponent2   ]

17: Z=X^Y (P47)
 1: 8   X Loc [SB_Temp_K]
 2: 14   Y Loc [Exponent1   ]
 3: 16   Z Loc   [1_SB_4Pow   ]

18: Z=X*Y (P36)
 1: 11   X Loc [mV_tpile   ]
 2: 12   Y Loc [m_slope   ]
 3: 17   Z Loc   [2_mVxm   ]

```
19:  Z=X+Y  (P33)
 1:  16        X  Loc  [  1_SB_4Pow   ]
 2:  17        Y  Loc  [  2_mVxm      ]
 3:  18        Z  Loc  [  3_Sum1      ]

20:  Z=X+Y  (P33)
 1:  13        X  Loc  [  b_inter     ]
 2:  18        Y  Loc  [  3_Sum1      ]
 3:  19        Z  Loc  [  4_Sum2      ]

21:  Z=X^Y  (P47)
 1:  19        X  Loc  [  4_Sum2      ]
 2:  15        Y  Loc  [  Exponent2   ]
 3:  20        Z  Loc  [  T_Temp_K  ]

22:  Z=X+F (P34)
 1: 20         X Loc [ T_Temp_K ]
 2: -273.15    F
 3: 21         Z Loc [ T_Temp_C ]

*Table 2 Program
02:  0.0       Execution Interval (seconds)

*Table 3 Subroutines
End Program
```

Explanation of Labels Used in the Program

mV_thrm = mV output of the thermistor.
1_mV_thrm = first step in converting the mV output of the thermistor to resistance.
2_mV_thrm = second step in converting the mV output of the thermistor to resistance.
R_thrm = resistance of the thermistor.
lnR_thrm = natural log of the resistance of the thermistor.
Scaled_R = intermediate step in converting the natural log of the resistance to temperature.
SH_Coeff = application of the Steinhart and Hart coefficients to convert the scaled resistance to the reciprocal of temperature.
SB_Temp_K = sensor body temperature in Kelvin.
SB_Temp_C = sensor body temperature in degrees Celsius.
mV_tpile = mV output of the thermopile (dependent on the temperature difference between the target and the sensor body).
m_slope = slope of the equation relating target and sensor body temperature to mV output of the thermopile.
b_inter = y-intercept of the equation relating target and sensor body temperature to mV output of the thermopile.
Exponent1 = exponent used to raise the sensor body temperature to the 4^{th} power.
Exponent2 = exponent used to calculate the 4^{th} root of the sum of the terms used to calculate the target temperature.
1_SB_4Pow = first calculation step; sensor body temperature (Kelvin) raised to the fourth power.
2_mVxm = second calculation step; mV output of the thermopile multiplied by m (slope).
3_Sum1 = third calculation step; sum of calculation steps one and two.
4_Sum2 = fourth calculation step; the sum of calculation step 3 and b (intercept).
T_Temp_K = target temperature in Kelvin; calculated by adding the temperature difference between the target and sensor body to the sensor body temperature.
T_Temp_C = target temperature in degrees C.

Wiring Instructions for Apogee Model IRR-P (Infrared Radiometer).

Wiring for SI-100 Series with Serial Numbers range 0-7282
Red Wire = high side of differential channel (positive lead for thermopile)
Black Wire = low side of differential channel (negative lead for thermopile)
Clear Wire = analog ground (thermopile ground)
Green Wire = Single-ended channel (positive lead for thermistor)
Blue Wire = analog ground (negative thermistor lead)
White Wire = excitation channel (excitation for thermistor)

Wiring for SI-100 Series with Serial Numbers range 7283 and above or has a cable connector
Red Wire = excitation channel (excitation for thermistor)
Black Wire = low side of differential channel (negative thermopile lead)
Clear Wire = Shield/Ground
Green Wire = single-ended channel (positive thermistor lead)
Blue Wire = analog ground (negative thermistor lead)
White Wire = high side of differential channel (positive thermopile lead)