

# INSTRUCTION MANUAL



## 108-LC Temperature Probe for MetData1

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# **Model 108-LC Temperature Probe for MetData1**

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## **1. General**

The 108 Air/Soil/Water Temperature Probe uses thermistors to measure temperature. Custom lead lengths are available up to 1000 ft.

For air temperature measurement, a 41303 radiation shield is needed to mount the 108 Probe and limit solar radiation loading of the 108. The 108 probe is designed to be buried or submerged in water up to 100 feet.

### **1.1 Specifications**

Temperature Measurement Range:  $-5^{\circ}$  to  $+95^{\circ}\text{C}$

Thermistor Interchangeability Error: Typically  $<\pm 0.2^{\circ}\text{C}$  over  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C} \pm 0.3$  @  $95^{\circ}\text{C}$ .

Polynomial Linearization Error:  $<\pm 0.5^{\circ}\text{C}$  over  $-7^{\circ}\text{C}$  to  $+90^{\circ}\text{C}$ .

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#### **NOTE**

The black outer jacket of the cable is Santoprene<sup>®</sup> rubber. This compound was chosen for its resistance to temperature extremes, moisture, and UV degradation. However, this jacket will support combustion in air. It is rated as slow burning when tested according to U.L. 94 H.B. and will pass FMVSS302. Local fire codes may preclude its use inside buildings.

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## **2. Accuracy**

The overall probe accuracy is a combination of the thermistor's interchangeability specification, the precision of the bridge resistors, and the polynomial error. In a "worst case" all errors add to an accuracy of  $\pm 0.3^{\circ}\text{C}$  over the range of  $-3^{\circ}$  to  $90^{\circ}\text{C}$  and  $\pm 0.7^{\circ}\text{C}$  over the range of  $-7^{\circ}\text{C}$  to  $95^{\circ}\text{C}$ . The major error component is the interchangeability specification of the thermistor, tabulated in Table 2-1. For the range of  $0^{\circ}$  to  $50^{\circ}\text{C}$  the interchangeability error is predominantly offset and can be determined with a single point calibration. Compensation can then be done with an offset entered in the measurement instruction. The bridge resistors are 0.1% tolerance with a 10 ppm temperature coefficient. Polynomial errors are tabulated in Table 2-2 and plotted in Figure 2-1.

**TABLE 2-1. Thermistor Interchangeability Specification**

<u>Temperature (°C)</u>	<u>Temperature Tolerance (±°C)</u>
-10	0.25
0 to +50	0.20
+70	0.20
+90	0.31

**TABLE 2-2. Polynomial Error**

-10 to +95	<±1.0°C
-7 to +95	<±0.5°C
-3 to +90	<±0.1°C

**TABLE 2-3. Actual Temperature, Sensor Resistance, and Computed Temperature**

<u>Temperature °C</u>	<u>Resistance OHMS</u>	<u>Output °C</u>
-10.00	612366	-9.02
-8.00	546376	-7.36
-6.00	488178	-5.63
-4.00	436773	-3.83
-2.00	391294	-1.97
0.00	351017	-0.05
2.00	315288	1.91
4.00	283558	3.91
6.00	255337	5.93
8.00	230210	7.96
10.00	207807	10.00
12.00	187803	12.04
14.00	169924	14.07
16.00	153923	16.09
18.00	139588	18.10
20.00	126729	20.09
22.00	115179	22.07
24.00	104796	24.05
26.00	95449	26.02
28.00	87026	27.99
30.00	79428	29.97
32.00	72567	31.94
34.00	66365	33.93
36.00	60752	35.93
38.00	55668	37.93
40.00	51058	39.94
42.00	46873	41.96
44.00	43071	43.98
46.00	39613	46.00
48.00	36465	48.02
50.00	33598	50.03

52.00	30983	52.03
54.00	28595	54.03
56.00	26413	56.03
58.00	24419	58.02
60.00	22593	60.01
62.00	20921	61.99
64.00	19388	63.98
66.00	17981	65.97
68.00	16689	67.96
70.00	15502	69.96
72.00	14410	71.97
74.00	13405	73.98
76.00	12479	75.99
78.00	11625	78.01
80.00	10837	80.02
82.00	10110	82.03
84.00	9438.1	84.04
86.00	8816.9	86.03
88.00	8241.9	88.00
90.00	7709.7	89.96
92.00	7216.3	91.89
94.00	6758.9	93.80
96.00	6334.5	95.67
98.00	5940.5	97.51
100.00	5574.3	99.31

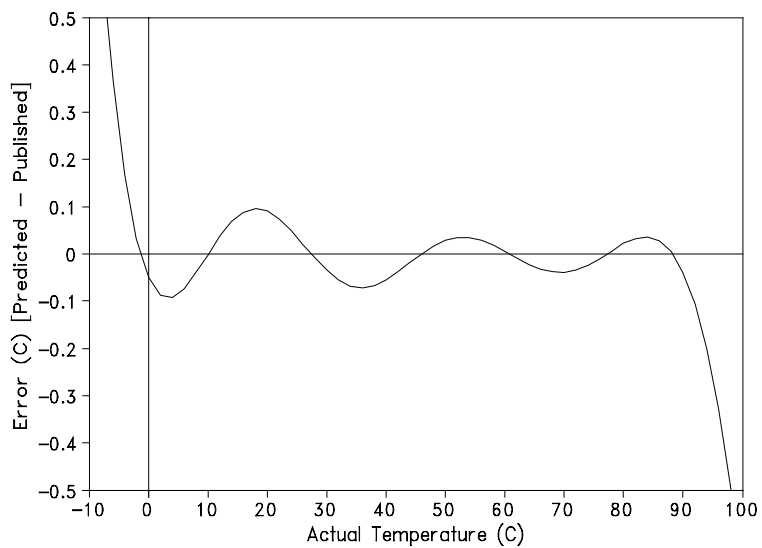
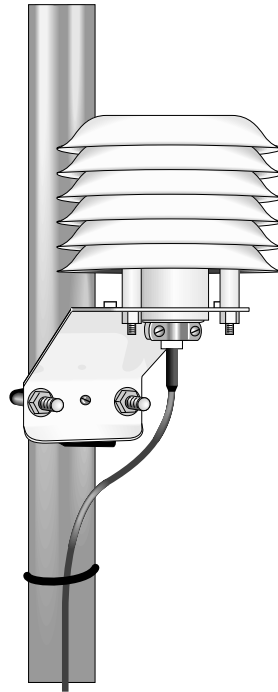


FIGURE 2-1. 108 Probe Polynomial Error Curve

### 3. Installation and Wiring

The 108 must be housed inside a radiation shield when used in the field for air temperature measurement. The 41303 Radiation Shield (see Figure 3-1) mounts to a CM6 or CM10 tripod. The UT018 mounting arm and UT6P Radiation Shield are used to mount the 108 to a UT30 tower.

The standard lead length of 6 feet and 9 feet allow the 108 to be mounted at a 2 meter height on the CM6/CM10 tripod or the UT30 tower respectively.



*FIGURE 3-1. 108 and 41303 Radiation Shield on a CM6/CM10 Tripod Mast*

### 4. Connection

The 108 cable is attached to the MetData1 connector #4 or #7. Connector #4 uses single-ended input 4L (channel 8) and connector #7 uses single-ended input 5H (channel 9). The probe is measured by a single-ended analog input channel.



## 5. Programming

### NOTE

Information in this section is not necessary when programming the MetData1 with the Short Cut Program Builder software.

Instruction 5 (AC Half Bridge) is used to measure the 108 temperature probe. Instruction 55 (polynomial) is used to find the temperature in degrees Celsius.

### MetData1 Datalogger Program Example

```

01: AC Half Bridge (P5)
  1: 1      Repts
  2: 3      ± 25 mV Slow Range
  3: 8 or 9** In Chan
  4: 3      Ex Chan Option
  5: 1000   mV Excitation
  6: 11*    Loc [ Tmp108C ]
  7: 200    Mult
  8: 0      Offset

02: Polynomial (P55)
  1: 1      Repts
  2: 11*    X Loc [ Tmp108C ]
  3: 11*    F(X) Loc [ Tmp108C ]
  4: -26.97 C0
  5: 69.635 C1
  6: -40.66 C2
  7: 16.573 C3
  8: -3.455 C4
  9: .301   C5

```

\* Proper entries will vary with input location assignments.

\*\* Specify input channel #8 for connector #4. Specify input channel #9 for connector #7.

**TABLE 5-1. Polynomial Coefficients**

<u>Coefficient</u>	<u>Value</u>
C0	-26.97
C1	69.635
C2	-40.66
C3	16.573
C4	-3.455
C5	0.301

## 6. Maintenance and Calibration

The 108 Probe requires minimal maintenance. Check monthly to make sure the radiation shield is free from debris.

For most applications it is unnecessary to calibrate the 108 to eliminate the thermistor offset. However, for those users that are interested, the following briefly describes calibrating the 108 probes.

A single point calibration can be performed to determine the 108 temperature offset (thermistor interchangeability). This calibration will not remove the polynomial error. The value of the offset must be chosen so that the probe outputs the temperature calculated by the polynomial, not the actual calibration temperature. For example, a 108 is placed in a calibration chamber that is at 0°C and the probe outputs 0.1°C. The offset is -0.15, because at 0°C the polynomial calculates a temperature of -0.05°C (Table 5-2).



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