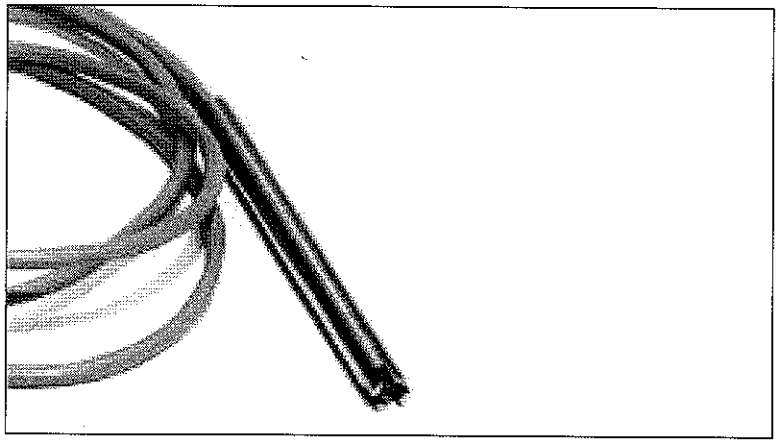
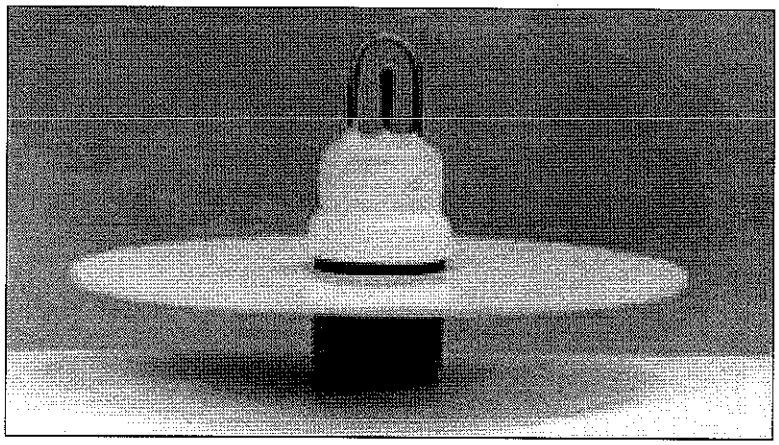
Air Temperature Sensors

060
062
064

Met One Instruments' Temperature Sensors are precision, extended range thermistor devices that are used for the accurate measurement of ambient air temperature. They are particularly well suited for field applications, as they exhibit a very high resistance sensitivity. Problems associated with line lead length, noisy environments, and poor connections are virtually eliminated. Sensors may be interchanged without requiring system recalibration. Difference among these sensors are associated with packaging and accuracy, allowing for the precise solution to sensor selection.



Model 060A, Model 062



Model 060A, Model 062

Features

- Rapid response time
- Calibration traceable to NIST
- Interchangeable without recalibration
- High resistance values to minimize signal line resistance
- 'Free air' suspension of thermistor bead
- Several ranges available

Operation

The solid state multi-element thermistor produces a relatively large resistance change per degree of temperature change, allowing the use of normal signal voltages without self-heating of the sensor. When used with signal conditioning modules, the resultant output is a precise analog voltage.

Construction

The thermistor has a speed of response of 10 seconds in still air. In order to insure this response time, the thermistor bead is supported in free air and protected by the sensor body. In addition to providing minimum response time, this mounting configuration prohibits the sensor from measuring the strain that may be caused by potting compounds.

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Specifications

Common Specifications

Sensing Element:	Multi-stage solid state thermistor, highly linearized
Time Constant:	Less than 10 seconds in still air
Self-Heating:	None

Model 060A

The Model 060A-2 is designed for general purpose measurements of ambient air temperature.

Housing:	3/8 in (9.5 mm) OD x 6 in (152.4 mm)
Range:	-50°C to +50°C (Other ranges available to meet special requirements)
Accuracy:	±0.1°C throughout range, PSD compliant
Cable:	1 ft pigtails (for use with 076 or 077 Radiation Shield) Additional length may be supplied, specify length

Model 062

The Model 062 is a highly accurate version of the Model 060A-2. It is used in pairs for the measurement of differential temperature (ΔT), or singly for highly critical ambient temperature measurement.

Housing:	3/8 in (9.5 mm) OD x 6 in (152.4 mm)		
Range:	-50°C to +50°C		
Accuracy:	±0.05°C, PSD Compliant		
Linearity Deviation:	For a system range of:	Max. error per degree of differential temperature:	Max. error over range:
	-5°F to +5°F	.02°F	.05°F
	-5°C to +5°C	.02°C	.05°C
	-5°F to +10°F	.02°F	.1°F
	-5°C to +10°C	.02°C	.1°C
	-10°F to +20°F	.02°F	.2°F
Cable:	1 ft pigtails (for use with 076 or 077 Radiation Shield) Additional length may be supplied, specify length		

Model 064

The Model 064 utilizes the same sensing network as the Model 060, but is configured to mount directly to the Model 073B or o75B Radiation Shield. The sensor is supplied with a screw-type connector which allows the direct connection of the signal cable. Thermistor bead is protected by a stainless steel bumper.

Housing:	Mounting plate, white epoxy finished aluminum, 4" diameter, with screw connector for sensor cable. Thermistor bead is protected by a stainless steel bumper.	
Range:	064-1	-30°C to +50°C
	064-2	-50°C to +50°C
	Other ranges available to meet special requirements	
Accuracy:	064-1	±0.15°C
	064-2	±0.1°C, PSD compliant
Cable:	PN 1958-xx (xx=length in ft)	

MODEL 060/063
TEMPERATURE SENSOR

OPERATION MANUAL

Document No 060-9800 Rev B

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060/063 TEMPERATURE SENSORS
OPERATION MANUAL

1.0 GENERAL INFORMATION

1.1 Models 060 and 063 are precision thermistor temperature sensors. For the most accurate air temperature measurements, the sensors are always mounted in a radiation shield, which minimizes errors caused by solar and terrestrial radiation heating. Sensors produce resistance change inversely proportional to temperature.

Model 060 is designed for air temperature measurement. The Model 060 has a time constant of only 10 seconds.

Model 063 is designed for the direct measurement of air, soil, and water temperature. The 063 sensor is completely sealed in stainless steel housing, filled with silicone oil. The Model 063 has a time constant of 60 seconds.

1.2 Sensor Cable and Connections

All sensors are supplied with signal leads one foot in length. Dependent on particular applications, longer cable length and cable connectors may be provided as an option.

2.0 INSTALLATION

2.1 Temperature Sensor Installation

A. AIR TEMPERATURE

For maximum accuracy, it is desirable to mount the temperature sensor in a radiation shield. The radiation shield will minimize effects of solar and terrestrial radiation and will additionally provide adequate air flow over the sensor. Mechanical mounting information is given in the radiation shield manual.

B. SOIL TEMPERATURE

The Model 063 is used for soil temperature measurements. Installation of the soil temperature probe requires the digging of a small hole to the required measurement depth in firm, undisturbed soil. The probe is inserted horizontally into this firm soil, and the soil is replaced in the hole and packed firmly.

C. WATER TEMPERATURE

The Model 063 Temperature Sensor should be placed in water, free from heat radiation sources.

D. These sensors are durable, field proven devices; however,

DO NOT DROP OR EXPOSE THE SENSOR TO HEAVY SHOCK!!!

2.2 Wiring Connections

The output of the thermistor sensor is a relatively high resistance that varies according to temperature. It is important not to introduce any parallel resistance paths. A parallel resistance path may be established by a dirt/moisture build-up between two sensor leads. This may occur in poorly made splices and unprotected connections. It is advisable to always use a protective coating on exposed sensor connections. Use a coating such as silastic rubber (RTV).

2.3 Direct Wiring to a Met One Instruments Translator

When the sensor is connected directly to a Met One Instruments Translator Module the sensor is loaded with the appropriate resistor to provide a linear output.

2.4 Direct Connection to a Data Logger

When the sensor is connected to a data logger the data logger must have a terminating resistor to provide a linear output. Refer to Figure 2-1.

3.0 OPERATIONAL CHECK-OUT AND CALIBRATION

3.1 Temperature Sensor Check-out

Compare sensor readings against a precision mercury thermometer. Use either 1760 Translator Module or Lo Current Digital Ohmmeter and compare readings of temperature vs. resistance.

4.0 MAINTENANCE AND TROUBLESHOOTING

4.1 General Maintenance Schedule*

6 – 12 Month Intervals:

A. Inspect sensor for proper operation per Section 3.1.

*Schedule is based on average to adverse environments.

4.2 Troubleshooting Procedures

A. Incorrect sensor signal: check sensor input connections: check temperature vs. sensor output signal using Table 3-1. Verify that the sensor has the correct terminating resistor if not used with a Met One Translator.

Table 1-1
Sensor Specifications

MODEL	MAXIMUM RANGE	LINERARITY	ACCURACY	TIME CONSTANT	CABLE LENGTH	CONNECTOR
064-2	-50°C to +50°C	± 0.15°C	± 0.1°C	10 seconds	1 foot	none
060A-4	0°C to +100°C	± 0.21°C	± 0.15°C	10 seconds	1 foot	none
063-1	-50°C to +50°C	± 0.15°C	± 0.1°C	60 seconds	1 foot	none
063-2	0°C to +100° C	± 0.21°C	± 0.15°C	60 seconds	1 foot	none

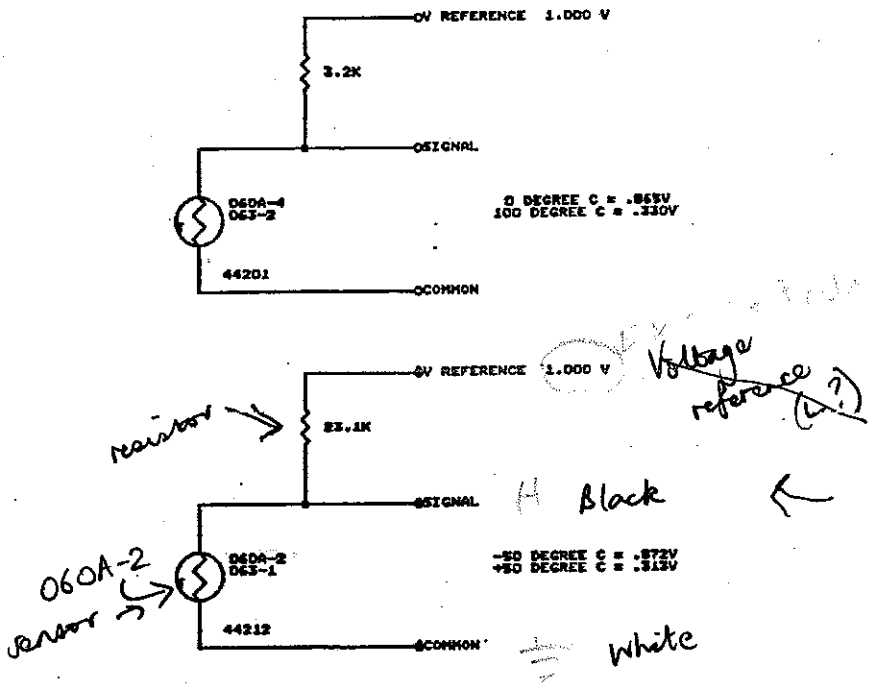
→ no see specs sheet

4.3 Temperature Sensor Calibration

The sensors are tested for calibration conformity at the factory. Field calibration may be verified by testing and sensors against themselves or against a known standard. It is not possible to make alterations to the sensor's calibration, as it is fixed.

4.4 Ice Bathe (0°C Calibration Test

This calibration test requires that a practical reference point of 0°C be obtained by the preparation of a mixture of shaved or finely cracked ice and enough water to cover but not float the ice. This mixture is made and contained in a large wide-mouth Dewar flask with a capacity of about one quart or more. The Dewar flask is stopped up with a cork or other suitable material, with two holes provided for the insertion of both the temperature and a glass thermometer. Both the probe and thermometer are inserted into the Dewar flask so that the tips of each are at least 4 ½ inches below the surface of the mixture, ½ inch from the sides of the Dewar with a minimum of one inch remaining below. Using a precision volt-ohmmeter: measure the resistance vs. temperature as given in Table 3-1.



See Brhalf function (or CR Basic)

Figure 2-1
Connections of 060/063 Temperature Sensor
To Datalogger

Table 3-1A
Model 060A-4, 0623-2 RESISTANCE CHART

TEMP DEG C	RCAL	TEMP DEG C	RCAL
0	20516	51	4649
1	19612	52	4547
2	18774	53	4448
3	17996	54	4352
4	17271	55	4258
5	16593	56	4166
6	15960	57	4076
7	15365	58	3989
8	14806	59	3903
9	14280	60	3820
10	13784	61	3739
11	13315	62	3659
12	12872	63	3581
13	12451	64	3505
14	12052	65	3431
15	11673	66	3358
16	11312	67	3287
17	10969	68	3218
18	10641	69	3150
19	10328	70	3083
20	10029	71	3018
21	9743	72	2954
22	9469	73	2891
23	9206	74	2830
24	8954	75	2769
25	8712	76	2710
26	8479	77	2653
27	8256	78	2596
28	8041	79	2540
29	7833	80	2486
30	7633	81	2432
31	7441	82	2380
32	7255	83	2328
33	7075	84	2278
34	6902	85	2228
35	6734	86	2179
36	6572	87	2131
37	6415	88	2084
38	6263	89	2038
39	6115	90	1992
40	5973	91	1948
41	5834	92	1904
42	5700	93	1861
43	5569	94	1818
44	5443	95	1776
45	5320	96	1735
46	5200	97	1695
47	5084	98	1655
48	4970	99	1616
49	4860	100	1578
50	4753		

RANGE 0°C TO 100°C
THERMISTOR BEAD **44201**

Table 3-1B
Model 060A-4, 0623-2 RESISTANCE CHART

TEMP DEG F	RCAL	TEMP DEG F	RCAL

32	20516	84	7856
33	20005	85	7744
34	19516	86	7633
35	19047	87	7526
36	18596	88	7420
37	18164	89	7316
38	17748	90	7214
39	17349	91	7115
40	16964	92	7017
41	16593	93	6921
42	16236	94	6827
43	15892	95	6734
44	15559	96	6643
45	15238	97	6554
46	14928	98	6467
47	14627	99	6381
48	14337	100	6296
49	14056	101	6213
50	13784	102	6132
51	13520	103	6051
52	13265	104	5973
53	13017	105	5895
54	12776	106	5819
55	12543	107	5744
56	12316	108	5670
57	12095	109	5598
58	11881	110	5527
59	11673	111	5456
60	11470	112	5387
61	11273	113	5320
62	11081	114	5253
63	10894	115	5187
64	10712	116	5122
65	10535	117	5058
66	10362	118	4995
67	10193	119	4933
68	10029	120	4873
69	9868	121	4812
70	9712	122	4753
71	9559	123	4695
72	9409	124	4638
73	9263	125	4581
74	9121	126	4525
75	8981	127	4470
76	8845	128	4416
77	8712	129	4362
78	8582	130	4310
79	8454	131	4258
80	8329	132	4206
81	8207	133	4156
82	8088	134	4106
83	7971	135	4057

RANGE 32°F TO 212°F
THERMISTOR BEAD **44201**

Table 3-1B (continued)
Model 060A-4, 0623-2 RESISTANCE CHART

TEMP DEG F	RCAL	TEMP DEG F	RCAL
136	4008	178	2426
137	3960	179	2397
138	3913	180	2368
139	3866	181	2340
140	3820	182	2311
141	3775	183	2283
142	3730	184	2255
143	3685	185	2228
144	3642	186	2201
145	3599	187	2174
146	3556	188	2147
147	3514	189	2121
148	3472	190	2094
149	3431	191	2069
150	3390	192	2043
151	3350	193	2018
152	3311	194	1992
153	3272	195	1967
154	3233	196	1943
155	3195	197	1918
156	3157	198	1894
157	3120	199	1870
158	3083	200	1846
159	3046	201	1823
160	3010	202	1800
161	2975	203	1776
162	2940	204	1754
163	2905	205	1731
164	2870	206	1708
165	2836	207	1686
166	2803	208	1664
167	2769	209	1642
168	2737	210	1621
169	2704	211	1599
170	2672	212	1578
171	2640		
172	2608		
173	2577		
174	2547		
175	2516		
176	2486		
177	2456		

RANGE 32°F TO 212°F
THERMISTOR BEAD **44201**

For RCAL:

$$Tc = ((((Rt^{-1}) + 3200^{-1}))^{-1} - 2768.23)/-17.115$$

$$Rt = ((((-17.115Tc) + 2768.23)^{-1}) - (3200)^{-1})^{-1}$$

Where: Tc = Temp (deg C)
RT = RCAL

Table 3-1B
Model 060A-2, 063-1 RESISTANCE CHART

TEMP DEG C	RCAL	TEMP DEG C	RCAL
-50	158181	1	32888
-49	150561	2	32139
-48	143555	3	31410
-47	137093	4	30700
-46	131114	5	30009
-45	125564	6	29335
-44	120400	7	28677
-43	115583	8	28037
-42	111079	9	27411
-41	106858	10	26801
-40	102895	11	26206
-39	99166	12	25624
-38	95651	13	25056
-37	92333	14	24501
-36	89196	15	23959
-35	86224	16	23429
-34	83406	17	22911
-33	80729	18	22404
-32	78183	19	21908
-31	75760	20	21423
-30	73449	21	20949
-29	71245	22	20484
-28	69138	23	20029
-27	67124	24	19583
-26	65195	25	19147
-25	63348	26	18719
-24	61576	27	18300
-23	59875	28	17889
-22	58242	29	17487
-21	56671	30	17092
-20	55160	31	16705
-19	53705	32	16325
-18	52303	33	15952
-17	50952	34	15586
-16	49648	35	15227
-15	48389	36	14875
-14	47173	37	14529
-13	45997	38	14190
-12	44861	39	13856
-11	43761	40	13528
-10	42696	41	13206
-9	41665	42	12890
-8	40665	43	12579
-7	39696	44	12274
-6	38755	45	11974
-5	37843	46	11678
-4	36957	47	11388
-3	36097	48	11102
-2	35260	49	10822
-1	34447	50	10545
0	33657		

RANGE –50°C TO +50°C OR -58°F to +122°F
THERMISTOR BEAD **44212**

Table 3-1C
Model 060A-2, 063-1

TEMP DEG F	RCAL	TEMP DEG F	RCAL
-58	158181	1	51248
-57	153867	2	50512
-56	149754	3	49790
-55	145827	4	49083
-54	142075	5	48389
-53	138486	6	47708
-52	135049	7	47040
-51	131756	8	46385
-50	128597	9	45741
-49	125564	10	45110
-48	122650	11	44490
-47	119849	12	43881
-46	117153	13	43283
-45	114556	14	42696
-44	112054	15	42119
-43	109642	16	41552
-42	107314	17	40995
-41	105066	18	40447
-40	102895	19	39909
-39	100795	20	39379
-38	98765	21	38859
-37	96800	22	38347
-36	94898	23	37843
-35	93055	24	37348
-34	91268	25	36860
-33	89536	26	36381
-32	87855	27	35909
-31	86224	28	35444
-30	84640	29	34987
-29	83101	30	34537
-28	81606	31	34093
-27	80152	32	33657
-26	78738	33	33227
-25	77362	34	32803
-24	76023	35	32386
-23	74719	36	31975
-22	73449	37	31570
-21	72212	38	31171
-20	71006	39	30778
-19	69830	40	30391
-18	68683	41	30009
-17	67564	42	29632
-16	66472	43	29261
-15	65406	44	28895
-14	64365	45	28534
-13	63348	46	28178
-12	62354	47	27826
-11	61384	48	27480
-10	60435	49	27138
-9	59507	50	26801
-8	58599	51	26469
-7	57711	52	26140
-6	56842	53	25816
-5	55992	54	25497
-4	55160	55	25181
-3	54345	56	24870
-2	53547	57	24562
-1	52765	58	24259
0	51998	59	23959

Table 3-1C (continued)
Model 060-2, 063-1

TEMP DEG C	RCAL	TEMP DEG C	RCAL
60	23663	101	14078
61	23371	102	13893
62	23082	103	13710
63	22797	104	13528
64	22516	105	13349
65	22238	106	13171
66	21963	107	12995
67	21691	108	12821
68	21423	109	12648
69	21158	110	12477
70	20896	111	12308
71	20638	112	12140
72	20382	113	11974
73	20129	114	11809
74	19879	115	11646
75	19632	116	11484
76	19388	117	11324
77	19147	118	11165
78	18908	119	11008
79	18672	120	10853
80	18439	121	10698
81	18208	122	10545
82	17980		
83	17754		
84	17531		
85	17310		
86	17092		
87	16876		
88	16662		
89	16451		
90	16241		
91	16034		
92	15829		
93	15627		
94	15426		
95	15227		
96	15031		
97	14836		
98	14644		
99	14453		
100	14265		

RANGE -58°F to +122°F
THERMISTOR BEAD **44212**
Tc = ((((Rt ¯1) + (23100 ¯1)) ¯1) – 13698.3)/¯129.163
Rt = ((((¯129.163Tc) + 13698.3) ¯1) – 23100 ¯1) ¯1