MODEL 061/063
TEMPERATURE SENSOR

OPERATION MANUAL
Document No 061-9800

Met One Instruments, Inc.
Corporate Sales & Service: 1600 Washington Blvd., Grants Pass, OR 97526, Phone (541) 471-7111, Fax (541) 471-7116
Distribution & Service: 3206 Main Street, Suite 106, Rowlett, TX 75088, Phone (972) 412-4747, Fax (972) 412-4716
http://www.metone.com

061/063 TEMPERATURE SENSORS
OPERATION MANUAL

1.0 GENERAL INFORMATION

1.1 Models 061 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 061 is designed for air temperature measurement. The Model 061 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 a 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	LINEARITY	ACCURACY	TIME CONSTANT	CABLE LENGTH	CONNECTOR
061	-30°C to +50°C	± 0.16°C	± 0.15°C	10 seconds	1 foot	none
063-2	0°C to +100° C	± 0.21°C	± 0.15°C	60 seconds	50 feet	none
063-3	-30°C to +50°C	± 0.16°C	± 0.15°C	10 seconds	1 foot	none

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 Bath (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. To create a precision ice bath (± 0.002°C), distilled water must be used for the bath and to make 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.

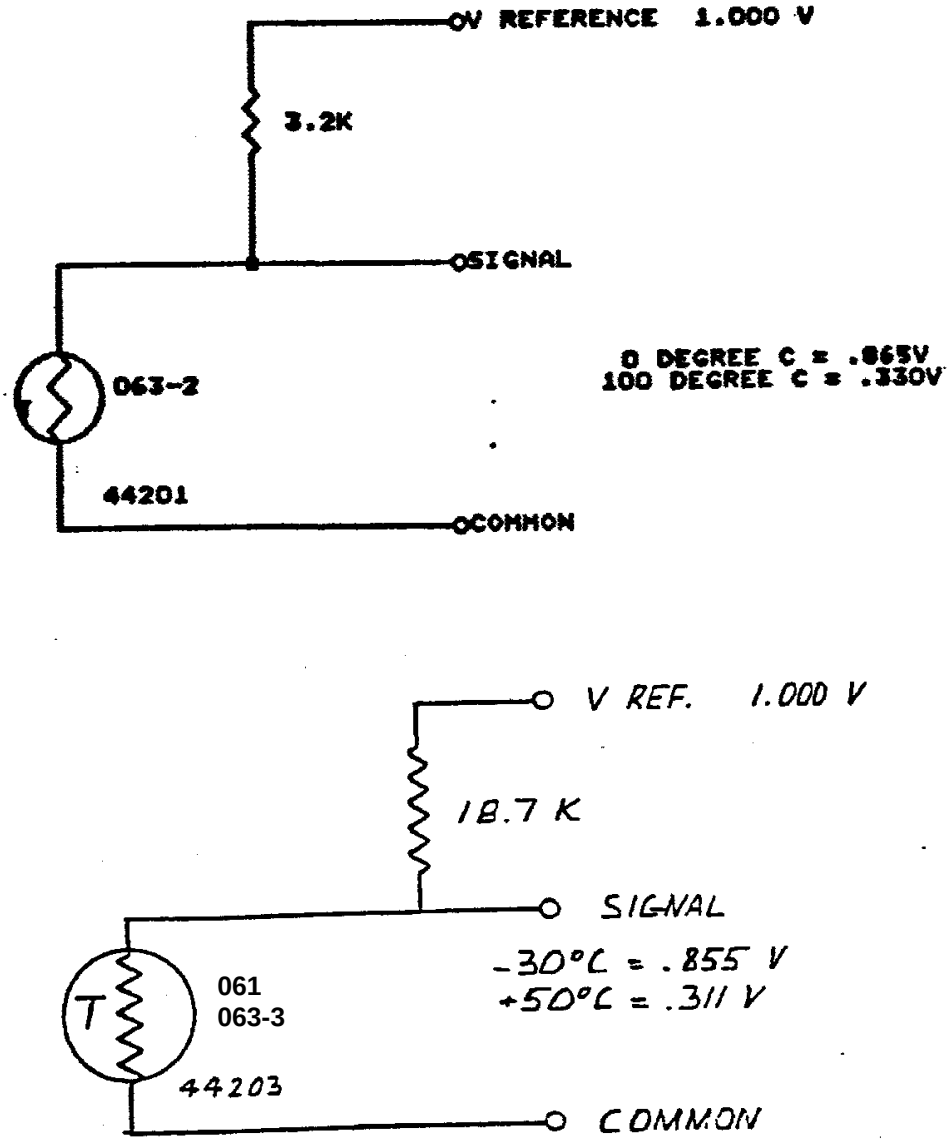

Figure 2-1
Connections of 061/063 Temperature Sensor
To Datalogger

Table 3-1A
Model 063-2 RESISTANCE CHART DEG C

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		

*VALUE WITH 3200 OHM RESISTOR IN PARALLEL WITH SENSOR
RANGE 0°C TO 100°C
THERMISTOR BEAD **44201**

Table 3-1B
Model 063-2 RESISTANCE CHART DEG F

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

*VALUE WITH 3200 OHM RESISTOR IN PARALLEL WITH SENSOR
RANGE 32°F TO 212°F
THERMISTOR BEAD **44201**

Table 3-1B (continued)
Model 063-2 RESISTANCE CHART DEG F

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		

*VALUE WITH 3200 OHM RESISTOR IN PARALLEL WITH SENSOR
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 3-1C
Model 061, 063-3 RESISTANCE CHART DEG C

TEMP DEG C	RCAL	TEMP DEG C	RCAL
-30	110236	10	26155
-29	104464	11	25436
-28	99187	12	24739
-27	94344	13	24064
-26	89882	14	23409
-25	85760	15	22775
-24	81939	16	22159
-23	78388	17	21561
-22	75079	18	20980
-21	71988	19	20416
-20	69094	20	19868
-19	66379	21	19335
-18	63827	22	18816
-17	61424	23	18311
-16	59157	24	17820
-15	57014	25	17342
-14	54986	26	16876
-13	53064	27	16421
-12	51240	28	15979
-11	49506	29	15547
-10	47856	30	15126
-9	46284	31	14715
-8	44785	32	14314
-7	43353	33	13923
-6	41985	34	13541
-5	40675	35	13167
-4	39421	36	12802
-3	38218	37	12446
-2	37065	38	12097
-1	35957	39	11756
0	34892	40	11423
1	33868	41	11097
2	32883	42	10777
3	31934	43	10465
4	31019	44	10159
5	30136	45	9859
6	29284	46	9566
7	28462	47	9279
8	27667	48	8997
9	26899	50	8450

*VALUE WITH 18.7K RESISTOR IN PARALLEL WITH SENSOR

RANGE –30°C TO +50°C
THERMISTOR BEAD **44203**

Table 3-1D
Model 061, 063-3 RESISTANCE CHART DEG F

TEMP DEG F	RCAL	TEMP DEG F	RCAL
-22	110236	33	34319
-21	106964	34	33757
-20	103855	35	33207
-19	100895	36	32669
-18	98075	37	32141
-17	95385	38	31625
-16	92816	39	31119
-15	90361	40	30622
-14	88011	41	30136
-13	85760	42	29659
-12	83602	43	29192
-11	81532	44	28733
-10	79543	45	28283
-9	77632	46	27841
-8	75794	47	27408
-7	74025	48	26983
-6	72321	49	26565
-5	70678	50	26155
-4	69094	51	25753
-3	67565	52	25357
-2	66088	53	24969
-1	64661	54	24587
0	63281	55	24212
1	61946	56	23843
2	60654	57	23481
3	59402	58	23125
4	58190	59	22775
5	57014	60	22430
6	55874	61	22091
7	54768	62	21758
8	53694	63	21430
9	52651	64	21108
10	51637	65	20790
11	50652	66	20478
12	49695	67	20170
13	48763	68	19868
14	47856	69	19570
15	46974	70	19276
16	46114	71	18987
17	45277	72	18703
18	44461	73	18422
19	43666	74	18146
20	42890	75	17874
21	42134	76	17606
22	41395	77	17342
23	40675	78	17081
24	39972	79	16825
25	39285	80	16572
26	38614	81	16322
27	37958	82	16076
28	37317	83	15834
29	36691	84	15595
30	36078	85	15359
31	35479	86	15126
32	34892	87	14897

Table 3-1D (Continued)
Model 061, 063-3 RESISTANCE CHART DEG F

TEMP DEG F	RCAL	TEMP DEG F	RCAL
88	14670	106	11061
89	14447	107	10883
90	14227	108	10707
91	14009	109	10534
92	13794	110	10362
93	13583	111	10193
94	13374	112	10025
95	13167	113	9859
96	12963	114	9696
97	12762	115	9534
98	12564	116	9374
99	12368	117	9215
100	12174	118	9059
101	11983	119	8904
102	11794	120	8751
103	11607	121	8600
104	11423	122	8450
105	11241		

*VALUE WITH 18.7K RESISTOR IN PARALLEL WITH SENSOR

RANGE -22˚F TO +122˚F
TERMISTOR BEAD 44203
Tc= -(R*18700/(18700+R)-12175)/127.096
Rt = -(127.096*Tc-12175)*18700/(127.096*Tc-12175+18700)