



Features and Benefits

- Wide range of sensing element types
- Black bulb to measure radiant heat
- Greater comfort

Technical Overview

The TT-BB range of black bulb temperature sensors are used for radiant heat in indoor spaces. Black bulb temperature sensors are used to calculate comfort temperature which is specified as the average of the conductive and the radiant temperature. Units contain either a high quality thermistor, Nickel or Platinum sensing element.

Product Codes

TT-BB Internal Black Bulb Sensor

Sensing Element (add type to above code)

Passive output:

- A (10K3A1) Trend, Cylon, Distech
- B (10K4A1) Andover, Delta Controls
- C (20K6A1) Honeywell
- D (PT100a) Serck
- E (PT1000a) Cylon
- F (NI1000a) Sauter
- G (Ni1000a/TCR(LAN1)) Siemens
- H (SAT1) Satchwell
- K (STA1) Landis & Staefa
- L (TAC1) TAC
- M (2.2K3A1) Johnson Controls
- N (3K3A1) Alerton
- P (30K6A1) Drayton
- Q (50K6A1)
- S (SAT2) Satchwell
- T (SAT3) Satchwell
- W (SIE1) Siebe
- Y (STA2) Landis & Staefa
- Z (10K NTC) Carel

Interface Options (add to part code)

- SP Resistive set point 0-10kΩ or 11-1kΩ
- LEDG 24V green LED
- MS Momentary switch

Accessories

- DECOR** Decorators trim plate
- GASKET** Insulating gasket (pack of 10)

Specification

Output types:

Thermistor	Resistive
PT types	Resistive
NI types	Resistive
Set point	Resistive
Mom. switch	N/O push button

Accuracy:

Thermistor	±0.2°C 0 to 70°C
PT types	±0.2°C @ 25°C
NI types	±0.4°C @ 0°C

Housing:

Material	ABS (flame retardant)
Dimensions	115 x 85 x 30mm
Colour	RAL 9003 polished white finish

Black bulb:

Material	Anodised aluminium
Dimensions	17.5 x 37mm dia.

Protection

IP30

Environmental:

Temperature	-10 to 60°C
Humidity	0 to 95% non-condensing

Weight

120g

Country of origin

UK

Conformity (CVO types only)

EMC, CE & UKCA Marked

Comfort temperature measurement is best achieved by taking into account the radiant effect of surfaces within the controlled space. The comfort temperature is specified as the average of the conductive temperature and the radiant temperature.

$$T_{\text{comfort}} = \frac{T_{\text{radiant}} + T_{\text{conductive}}}{2}$$

WEEE Directive:



At the end of the products useful life please dispose as per the local regulations. Do not dispose of with normal household waste. Do not burn.



Installation

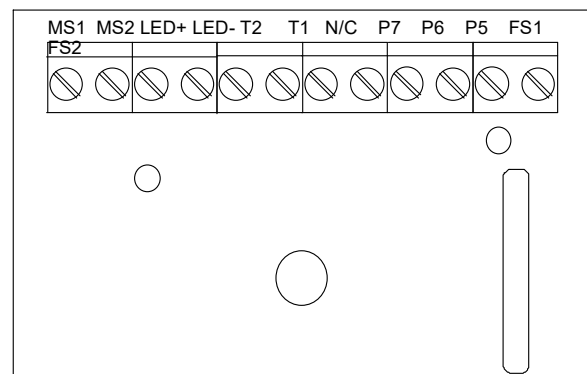
1. Select a location on a wall of the controlled space which will give a representative sample of the prevailing room condition. Avoid sitting the sensor in direct sunlight, on an outside wall or near heat sources. An idea mounting height is 1.5m from the floor.
2. Undo the tamperproof screw at the bottom of the housing.
3. Remove the front panel from the base.
4. Using the base as a template mark the hole centres and fix to the wall with suitable screws. Alternatively the base plate can be mounted on to a conduit box or standard recessed back box. The base plate is suitable for EU & North America fixings.
5. Feed cable through the hole in the base plate of the housing and terminate the cores at the terminal block as required. Leaving some slack inside the unit.
6. Replace the housing to the base plate and re-fit the tamperproof screw (if required) through the lug at the bottom of the base plate.

Connections

All connections to BEMS controllers, data recorders etc. should be made using screened cable. Normally, the screen should be earthed at one end only (usually the controller end) to avoid earth hum loops which can create noise. Low voltage signal and supply cables should be routed separately from high voltage or mains cabling. Separate conduit or cable trays should be used. Where possible, the controller's earth should be connected to a FUNCTIONAL EARTH, rather than the mains safety earth. This will provide better immunity to high frequency noise. Most modern buildings have a separate earth for this purpose.

All thermistor/RTD elements and options are polarity independent

- MS1 & MS2 Momentary switch
- LED+ & LED- 24V supply for LEDG
- T2 & T1 Temperature sensor
- P5 & P6 Set point, resistive 0-10k Ω
- P6 & P7 Set point, resistive 11-1k Ω
- FS1 & FS2 Not used



Set point, this is available in two standard values;

-	+	(legend markings on housing fascia)
0k Ω	10k Ω	
11k Ω	1k Ω	

Using an external 1k Ω resistor (not supplied) on the 0-10k terminals 1-11k Ω can be achieved if required. Potentiometer tolerances are $\pm 30\%$

Momentary switch, rated at 24Vac/dc @ 500mA max.

Temperature vs Resistance Charts

	A	B	C	D	E	F	G	H	K	L	M	N
	10K3A1	10K4A1	20K6A1	PT100A	PT1000A	NI1000	LAN1	SAT1	STA1	TAC1	2.2K3A1	3K3A1
°C	Ω	Ω	Ω	Ω	Ω	Ω	Ω	Ω	Ω	Ω	Ω	Ω
-50	6678528	441667	-	80.3	803	743	790.8	9719	-	-	150395	200348
-40	335671	239831	-	84.3	843	791	826.8	9584	-	-	75593	100701
-30	176683	135233	-	88.2	882	842	871.7	9349	-	-	39789	53005
-20	96974	78930	-	92.2	921	893	913.4	8968	-	-	21839	29092
-15	72895	61030	-	-	-	-	934.7	8708	-	-	16416	21868
-10	55298	47549	-	96.1	961	946	856.2	8396	-	-	12453	16589
-5	42314	37316	-	-	-	-	978.0	8031	-	-	9529	12694
0	32650	29490	70204	100.0	1000	1000	1000.0	7614	2226	5085	7353	9795
1	31030	28157	66525	-	-	-	1004.4	7525	2236	-	6988	9309
2	29500	26811	63059	-	-	-	1008.9	7434	2246	-	6643	8850
3	28054	25689	59793	-	-	-	1013.3	7341	2256	-	6318	8416
4	26688	24547	56713	-	-	-	1017.8	7246	2266	-	6010	8006
5	25396	23462	53809	-	-	-	1022.3	7150	2276	4078	5719	7619
6	24173	22430	51070	-	-	-	1026.7	7053	2286	-	5444	7252
7	23016	21450	48484	-	-	-	1031.2	6954	2298	-	5183	6905
8	21921	20517	46044	-	-	-	1035.8	6853	2306	-	4937	6577
9	20885	19631	43739	-	-	-	1040.3	6752	2316	-	4703	6266
10	19904	18787	41563	103.9	1039	1056	1044.8	6649	2326	3294	4482	5971
11	18974	17983	39506	-	-	-	1049.3	6545	2337	-	4273	5692
12	18092	17219	37562	-	-	-	1053.9	6440	2347	-	4075	5428
13	17257	16490	35724	-	-	-	1058.4	6334	2357	-	3886	5177
14	16465	15797	33986	-	-	-	1063.0	6228	2367	-	3708	4940
15	15714	15136	32342	-	-	-	1067.6	6121	2377	2676	3539	4714
16	15001	14507	30786	-	-	-	1072.2	6013	2388	-	3378	4500
17	14325	13906	29213	-	-	-	1076.8	5905	2398	-	3226	4297
18	13623	13334	27918	-	-	-	1081.4	5786	2408	-	3081	4105
19	13053	12788	26598	-	-	-	1086.0	5684	2418	-	2940	3916
20	12494	12268	25346	107.8	1078	1112	1090.7	5580	2429	2188	2814	3748
21	11943	11771	24160	-	-	-	1095.3	5471	2439	-	2690	3583
22	11420	11297	23036	-	-	-	1100.0	5362	2449	-	2572	3426
23	10923	10845	21970	-	-	-	1104.6	5254	2460	-	2460	3277
24	10450	10413	20959	-	-	-	1109.3	5147	2470	-	2353	3135
25	10000	10000	20000	109.8	1098	-	1114.0	5039	2480	1800	2252	3000
26	9572	9606	19090	-	-	-	1120.0	4933	2491	-	2156	2871
27	9165	9229	18226	-	-	-	1123.4	4827	2501	-	2064	2749
28	8777	8869	17405	-	-	-	1127.1	4721	2512	-	1977	2633
29	8408	8525	16626	-	-	-	1132.9	4617	2522	-	1893	2522
30	8056	8197	15886	111.7	1117	1171	1137.6	4513	2532	1488	1814	2417
35	6530	6754	12697	-	-	-	1161.5	4012	2585	1237	1471	1959
40	5325	5594	10211	115.5	1155	1230	1185.7	3545	2638	1034	1199	1598
45	4367	4656	8260	-	-	-	1210.2	3117	-	-	983.4	1310
50	3601	3893	6719	119.4	1194	1291	1235.0	2730	-	740	810.9	1080
55	2985	3271	5496	-	-	-	1260.1	2386	-	-	672.2	895.5
60	2487	2760	4518	123.2	1232	1353	1285.4	2082	-	540	560.1	746.2
65	2082	2339	-	-	-	-	1311.1	1816	-	-	468.9	624.7
70	1751	1990	-	127.1	1271	1417	1337.1	1585	-	400	394.5	525.5
75	1480	1700	-	-	-	-	1363.5	1385	-	-	333.3	444.0
80	1256	1458	-	130.9	1309	1483	1390.1	1213	-	300	282.9	376.9
85	1070	1255	-	-	-	-	1417.1	1064	-	-	241.1	321.2
90	916.1	1084	-	134.7	1347	1549	1444.4	937	-	230	206.3	274.8
95	787.0	939.6	-	-	-	-	1472.0	828	-	-	177.2	236.1
100	678.6	817.2	-	138.5	1385	1618	1500.0	734	-	180	152.8	203.6
105	587.3	713.0	-	-	-	-	1528.3	654	-	-	132.3	176.2
110	510.1	624.1	-	142.3	1423	1688	1557.0	585	-	-	114.9	153.0
115	444.5	547.9	-	-	-	-	1586.0	525	-	-	100.1	133.3
120	388.6	482.5	-	146.1	1461	1760	1625.4	474	-	-	87.51	116.6
125	340.8	426.0	-	-	-	-	-	429	-	-	76.75	102.2
130	300.0	377.2	-	149.8	1498	1833	-	391	-	-	67.52	89.95
140	234.1	298.1	-	153.6	1536	1909	-	329	-	-	52.72	70.23
150	184.8	238.0	-	157.3	1573	1987	-	281	-	-	41.61	55.44
200	-	-	-	157.8	1758	-	-	-	-	-	-	-
250	-	-	-	194.1	1941	-	-	-	-	-	-	-
300	-	-	-	212.0	2121	-	-	-	-	-	-	-
350	-	-	-	229.7	2297	-	-	-	-	-	-	-
400	-	-	-	247.0	2470	-	-	-	-	-	-	-

Temperature vs Resistance Charts (Continued)

	P	Q	S	T	W	Y	Z
	30K6A1	50K6A1	SAT2	SAT3	SIE1	STA2	10K NTC
°C	Ω	Ω	Ω	Ω	Ω	Ω	Ω
-50	2497k	4168k	-	-	10732	-	-
-40	1219k	2033k	-	-	10517	-	-
-30	622911	1038k	-	-	10172	-	-
-20	331876	553243	-	-	9654	-	-
-15	24785	409689	-	-	6320	-	-
-10	183697	306183	-	-	8933	-	42218
-5	138502	230842	-	-	8496	-	33784
0	105305	175508	2094	-	8044	7490	27197
1	99787	166310	2079	-	7910	-	-
2	94588	157644	2061	-	7807	-	-
3	89689	149480	2046	-	7702	-	-
4	85069	141779	2027	-	7596	-	-
5	80713	134521	2010	-	7489	6340	22023
6	76604	127669	1992	-	7381	-	-
7	72726	121207	1973	-	7271	-	-
8	69064	115105	1951	-	7161	-	-
9	65608	109344	1934	-	7050	-	-
10	62347	103903	1911	-	6938	5360	17933
11	59257	98761	1897	-	6825	-	-
12	56346	93901	1872	-	5712	-	-
13	53585	89307	1851	-	6598	-	-
14	50978	84962	1810	-	6485	-	-
15	45811	80851	1809	-	6370	4540	14684
16	46178	76961	1787	-	6256	-	-
17	43969	73280	1764	-	6141	-	-
18	41877	69794	1740	-	6028	-	-
19	39895	66492	1716	-	5913	-	-
20	38019	63364	1690	2708	5798	3840	12087
21	36240	60400	1667	2681	5686	-	-
22	34554	57589	1644	2659	5573	-	-
23	32955	54925	1621	2618	5461	-	-
24	31438	52398	1598	2616	5349	-	-
25	30000	50000	1574	2592	5238	3250	10000
26	28635	47724	1549	2567	5128	-	-
27	27339	45564	1524	2544	5019	-	-
28	26108	43513	1500	2520	4910	-	-
29	24939	41565	1476	2496	4803	-	-
30	23828	39714	1452	2474	4696	2750	8315
35	19046	31744	1336	2346	4135	2320	6947
40	15317	25529	1219	2216	3707	-	5831
45	12390	20650	1113	2086	3271	-	4916
50	10079	16799	1011	1850	2875	-	4163
55	8243	13740	-	1818	2521	-	3540
60	6777	11297	-	1694	2203	-	3023
65	5600	9334	-	1758	1929	-	2591
70	4650	7751	-	1461	1685	-	2230
75	3879	6466	-	1353	1472	-	1926
80	3251	5419	-	1258	1287	-	1669
85	2737	4560	-	1171	1127	-	1451
90	2313	3855	-	1089	986	-	1266
95	1963	3271	-	1020	866	-	1109
100	1672	2787	-	950	760	-	973
105	1430	22384	-	-	670	-	-
110	1228	2046	-	-	590	-	-
115	1058	1962	-	-	522	-	-
120	914.6	1523	-	-	462	-	-
125	793.2	1321	-	-	410	-	-
130	690.2	1149	-	-	365	-	-
140	527.4	878.2	-	-	290	-	-
150	407.7	678.8	-	-	233	-	-
200	-	-	-	-	-	-	-
250	-	-	-	-	-	-	-
300	-	-	-	-	-	-	-
350	-	-	-	-	-	-	-
400	-	-	-	-	-	-	-

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