



TECHNICAL BULLETIN

No.	Title:	Issue date:
2010 - 01	Troubleshooting Combi Boiler with PCB Controller	08-01-2010

If the Combi boiler isn't working properly, don't just replace the PCB – diagnose the root cause of the problem!

NOTE: To undertake any diagnostic work on a Firebird Enviromax Combi boiler a calibrated digital gas analyser and multimeter are required

Firebird Enviromax condensing Combi boilers have been fitted with an electronic PCB controller since mid 2007. The PCB controller represents a vast improvement over previous electromechanical controls, providing accurate temperature measurement and reliable flow performance.

Contrary to popular belief PCBs have a very low failure rate (less than 0.1%), do not decay over time or partially function. Recent warranty returns to Firebird have shown that less than 1 in 5 PCBs returned as 'faulty' actually had a problem. This means that perfectly good PCBs were removed from boilers where the problem may have simply been a loose connection or system problem.

How does the Combi work?

The Firebird Enviromax Combi uses patented software to manage the hot water and central heating functions.

The boiler temperature is set by the user via the dial and is feed into the PCB and controls the max temperature that the boiler can reach. The lower setting temperature is 60 °C; upper limit is 85 °C

From a cold start, heat from the boiler is transferred by the DHW pump to the storage tank until it reaches 78°C. The tank is maintained at this temperature (within 2°). Even if the central heating system calls for heat, priority is given to 'topping up' the storage tank.

When a user turns on a hot tap the flow thermistor senses a temperature change and the burner and DHW pump are activated.

If the user switches off the tap the PCB will note a temperature change but it will keep the burner and DHW pump running until the storage tank reaches a store temperature of 78 °C

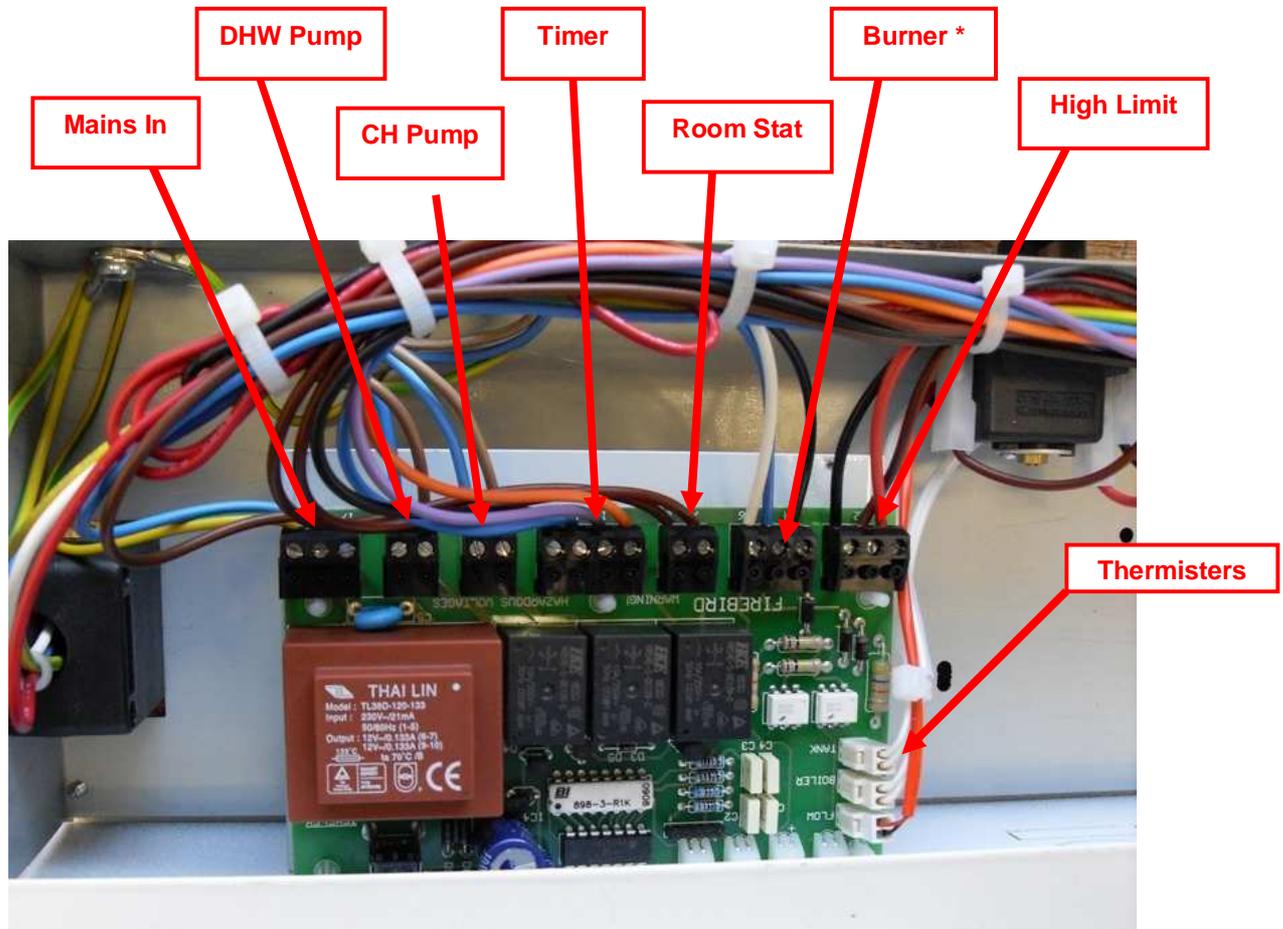
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PCB connections:

The PCB comes pre-wired so there is no need for the installer to make any connections. The picture below shows the main terminal connections on the board. * Note that the pressure switch is also wired into the burner terminal (black cable)



Thermistor connections:

- The flow thermistor probe (red) is inserted into a sleeve on the cold mains inlet pipe to the heat exchanger as shown right.
- The boiler thermistor probe (white with black band) is inserted into a pocket at the top of the boiler.
- The tank thermistor probe (white) is inserted into a pocket at the top of the storage tank



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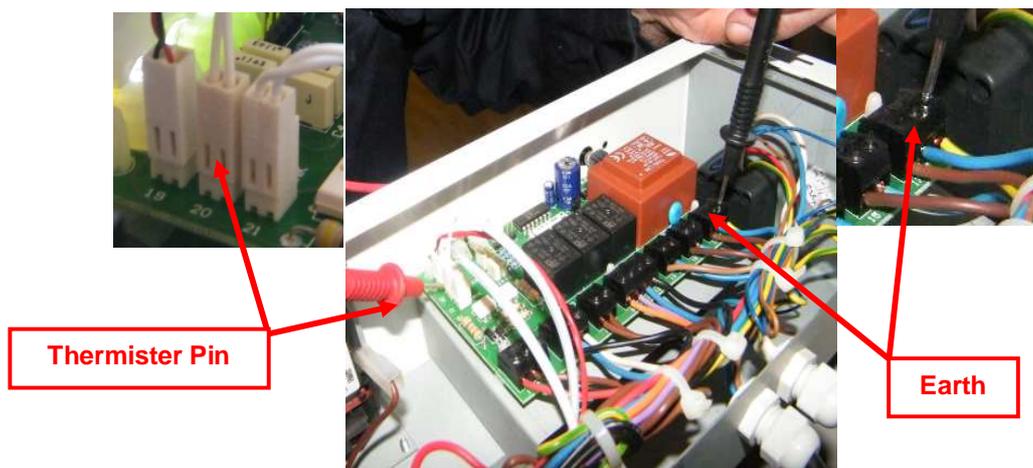
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Proceeds as follows when troubleshooting a Combi PCB;

1. First check that the limit switch hasn't tripped (limit LED flashing)
2. Check all connections onto the PCB to make sure that none are loose. This includes thermistor connections, mains power, timer/stat signals and pump relay connections.
3. Check that the three thermistors (boiler, tank and flow) are seated correctly. if a thermistor is malfunctioning the DHW and CH LED's will flash consecutively
4. Make sure that power is going to the PCB by placing the multimeter leads on the live and earth mains terminals on the PCB. It should read around 230V +/- 10% depending on the local network supply



5. With the power off, check for continuity from the pressure switch. Measure between the nearest pin to the front of the burner plug and the black wire on the burner terminal of the PCB.
6. To check the accuracy of the thermistor readings, set the multimeter to measure voltage in a low scale (0 to 10v). Place one of the multimeter probes on the PCB earth connection as shown in the picture below; place the second probe on connection pin for the thermistor you wish to check. Record the voltage. Then measure the actual temperature on the boiler part that the thermistor is measuring using an accurate thermometer. Using the temperature/voltage charts at the back of this bulletin check the voltage that you should read for this temperature, i.e. if the tank temperature is 78°C the voltage recorded should be around 2.44 volts.



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Temperature/Resistance Chart #1: Boiler & Tank Temperature Measurement

Thermistor type: NTC25-100K
Resistance @ 25°C 100,000 Ohms

Boiler



Tank



°C	Ohms	Voltage
0	381,900	4.87
1	360,470	4.87
2	341,360	4.86
3	322,630	4.85
4	304,820	4.84
5	288,060	4.83
6	273,010	4.82
7	258,210	4.81
8	244,310	4.80
9	231,950	4.79
10	220,060	4.78
11	204,310	4.77
12	193,640	4.75
13	183,520	4.74
14	174,220	4.73
15	165,490	4.72
16	157,310	4.70
17	149,370	4.69
18	141,940	4.67
19	134,890	4.65
20	128,200	4.64
21	121,790	4.62
22	115,930	4.60
23	110,230	4.58
24	104,770	4.56
25	100,000	4.55
26	95,300	4.53
27	90,750	4.50
28	86,340	4.48
29	82,230	4.46
30	78,340	4.43
31	74,610	4.41
32	71,070	4.38
33	67,740	4.36
34	64,600	4.33
35	61,550	4.30

°C	Ohms	Voltage
36	58,730	4.27
37	56,000	4.24
38	53,400	4.21
39	50,960	4.18
40	48,650	4.15
41	46,440	4.11
42	44,360	4.08
43	42,350	4.04
44	40,500	4.01
45	38,700	3.97
46	37,000	3.94
47	35,390	3.90
48	33,830	3.86
49	32,350	3.82
50	30,940	3.78
51	29,590	3.74
52	28,330	3.70
53	27,140	3.65
54	25,970	3.61
55	24,850	3.57
56	23,790	3.52
57	22,800	3.48
58	21,840	3.43
59	20,900	3.38
60	20,030	3.33
61	19,180	3.29
62	18,390	3.24
63	17,620	3.19
64	16,910	3.14
65	16,190	3.09
66	15,550	3.04
67	14,900	2.99
68	14,290	2.94
69	13,740	2.89
70	13,170	2.84
71	12,650	2.79

°C	Ohms	Voltage
72	12,140	2.74
73	11,660	2.69
74	11,200	2.64
75	10,750	2.59
76	10,330	2.54
77	9,920	2.49
78	9,520	2.44
79	9,160	2.39
80	8,810	2.34
81	8,470	2.29
82	8,150	2.25
83	7,840	2.20
84	7,550	2.15
85	7,270	2.10
86	6,990	2.06
87	6,740	2.01
88	6,490	1.97
89	6,250	1.92
90	6,010	1.88
91	5,800	1.84
92	5,580	1.79
93	5,380	1.75
94	5,190	1.71
95	5,000	1.67
96	4,820	1.63
97	4,640	1.58
98	4,480	1.55
99	4,310	1.51
100	4,150	1.47

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Temperature/Resistance Chart #2: Flow Sensor

Thermistor type
Resistance @ 25°C

NTC25-100K
100,000 Ohms



°C	Ohms	Voltage
0	351,017	4.19
1	332,620	4.15
2	315,288	4.11
3	298,954	4.07
4	283,555	4.03
5	269,034	3.99
6	255,335	3.95
7	242,408	3.90
8	230,206	3.86
9	218,684	3.81
10	207,801	3.77
11	197,518	3.72
12	187,799	3.67
13	178,610	3.62
14	169,921	3.57
15	161,700	3.52
16	153,921	3.47
17	146,558	3.42
18	139,586	3.36
19	132,983	3.31
20	126,727	3.25
21	120,799	3.20
22	115,179	3.14
23	109,850	3.09
24	104,795	3.03
25	100,000	2.98
26	95,449	2.92
27	91,129	2.86
28	87,027	2.81
29	83,131	2.75
30	79,430	2.69
31	75,913	2.64
32	72,569	2.58
33	69,390	2.53
34	66,367	2.47
35	63,491	2.41
36	60,755	2.36
37	58,150	2.30
38	55,670	2.25
39	53,309	2.20

°C	Ohms	Voltage
40	51,060	2.14
41	48,917	2.09
42	46,875	2.04
43	44,929	1.99
44	43,073	1.94
45	41,303	1.89
46	39,615	1.84
47	38,005	1.79
48	36,467	1.75
49	35,000	1.70
50	33,599	1.65
51	32,262	1.61
52	30,984	1.57
53	29,763	1.52
54	28,596	1.48
55	27,481	1.44
56	26,415	1.40
57	25,395	1.36
58	24,420	1.32
59	23,487	1.28
60	22,594	1.25
61	21,740	1.21
62	20,922	1.18
63	20,138	1.14
64	19,388	1.11
65	18,670	1.08
66	17,981	1.05
67	17,322	1.02
68	16,689	0.99
69	16,083	0.96
70	15,502	0.93
71	14,945	0.90
72	14,410	0.87
73	13,897	0.85
74	13,405	0.82
75	12,932	0.80
76	12,478	0.78
77	12,043	0.75
78	11,625	0.73
79	11,223	0.71

°C	Ohms	Voltage
80	10,837	0.69
81	10,466	0.67
82	10,109	0.65
83	9,767	0.63
84	9,437	0.61
85	9,121	0.59
86	8,816	0.57
87	8,523	0.56
88	8,241	0.54
89	7,970	0.52
90	7,708	0.51
91	7,457	0.49
92	7,215	0.48
93	6,982	0.47
94	6,758	0.45
95	6,541	0.44
96	6,333	0.43
97	6,132	0.41
98	5,939	0.40
99	5,753	0.39
100	5,573	0.38

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