CPU-1000 (Expandable Boiler Control)

Technical Data Sheet

Submittal: HBX CPU-1000

Project: [ ]

HBX Control Systems Inc. - Specification

Part 1: CPU-1000 Product

1. The Hydronic Control must be a full microprocessor control with at least a 16-bit, 20MHz integrated microprocessor chip.

2. The Control must be capable of utilizing an on-board real-time clock (Month, Day, Year and 24 hour clock) with a Lithium-Ion battery for back up during power outages.

3. A 7-day event history must be stored in EEPROM for viewing and troubleshooting.

4. The Control must be capable of the following Input/Output Functions

a. 3 (2-wire) optically isolated input demand signals from a 20-240VAC source:
i. Heat Demand
ii. High Temperature Heat Demand or Flow Switch Input
iii. DHW Demand

b. 3 (2-wire) Thermistor Inputs:
i. Boiler Temperature
ii. System or DHW Temperature
iii. Outside Temperature

c. 2 (2-wire) Programmable Relays for applications such as:
i. 2 independent boiler stages (and/or Cooling Sources)
ii. 2 optional valve controls

d. 1 (3-wire) power input rated for 120 vac ±10% and at least 30 amps. * Each wire and terminal to be labeled L, N & Grnd (Line, Neutral & Ground)

e. 3 (3-wire) 120 vac outputs rated at least 10 amps each capable of running auxiliary pumps or fans. * Each wire and terminal to be labeled L, N & Grnd (Line, Neutral & Ground)

5. The Control must use built in Arc-Suppression on all PMI (Pulse Modulated Injection) Output Control Relays.

6. The Control must be capable of using PMI (Pulse Modulated Injection) on at least 1 (2-wire) output relay and 1 (3-wire) output relay to modulate either a pump or valve for mixed injection.

7. The Control must have the ability to program and control for Warm Weather Shut Down.

8. The Control must be capable of automatically calculating and resetting the boiler target & system temperature based on Outdoor Temperature.

9. The Control must be modular in design. Capable of staging up to 14 boiler stages using optional Expansion Modules and one single microprocessor managing the control logic for potential future upgrades:

a. Multi-Stage Boilers can be selected for Hi/Lo or Lo/Lo stage configurations.
b. A fixed first or fixed last option must exist within the control menu.
c. Optional Boiler Rotation must be available to rotate boilers automatically every 48 hours of actual running time.
d. The control must directly interface, without any cross wiring, with expansion modules that provide:
    i. extra dry contacts (EXP-0100)
    ii. extra powered contacts (EXP-0300)
    iii. modulating output capability (MOD-0100)
    iv. zoning capability (ZON-0500)

10. The Control must have a built in Pump Sequencing feature to allow for system pump rotation based on user defined runtime hours. The control must have an input for flow-proofing the system. In addition the Control must have a pump exercise feature to run all pumps for 30 seconds every 72 hours of accumulated time if no running time has been recorded.

11. The Control must use a 128 x 64 pixel full graphic display. The display must be capable of showing the following information in one single screen:

a. Normal Heat Demand
b. High Temp Heat Demand
c. DHW Demand
d. 3 separate Set Point Demands
e. WWSD (Warm Weather Shut Down)
f. Boiler Temperature (Actual vs. Target)
g. System Temperature (Actual vs. Target)
h. Outdoor Temperature
i. Room Temp (or Set Point Temp)
j. Time, Month, Day and Year

12. In a separate single screen the Control must be capable of showing on/off status of each boiler (stage), pumps and valves with a cycles counter for each device.

13. A screen must be available to display and read each of the accumulated run times for each boiler (stage).

14. In addition to the 3 standard Thermistor/sensor inputs 3 more optional (requires expansion module) Thermistor values must be available for viewing in the standard control screen. The optional Thermistor/sensors may be used for; setpoint loads, return water temp, DHW, floor warming, Room/Zone sensing etc.

15. In the event of Thermistor sensor problems the main display with indicate an “open” or “short” condition in plain text.

16. The Control must be capable of retrieving from its memory both the minimum and maximum temperature extremes that each of the 6 Thermistors have been subjected to. The month, day, year and actual time of the recorded temperature must be displayed to assist in system diagnoses and troubleshooting.

17. A test function must be present to test and cycle each relay and modulating output channel independently for troubleshooting and commissioning purposes. Each relay and modulating output channel must be able to stay on for at least 30 seconds.

18. The Control must be capable of controlling DHW temperature via valve or pump, with or without priority, from a Thermistor or aquastat signal.

19. The Control must have a lock-out feature to avoid unauthorized tampering with the programming menu.

20. The control must be capable of staging 14 on/off boiler stages or modulating up to 5 Modulating Boilers, or a combination of both modulating and on/off stages. In addition, the control must capable of three, user selectable modulating process:

a. Series
b. Parallel
c. Progressive

21. The Control programming must have an option to allow for modulating output signals to be a direct function of water temperature (i.e. 165 ° F = 7 VDC).
22. The Control must have a standard RS232 communications port for optional remote communication.

23. The Control must be capable of interfacing with optional Communications software and capable of at least the following functions:

a. Real-Time Data Logging
b. System Status Viewing
c. Control Reconfiguration
d. Alarm function

24. The Control must be capable of operating in multiple application modes:

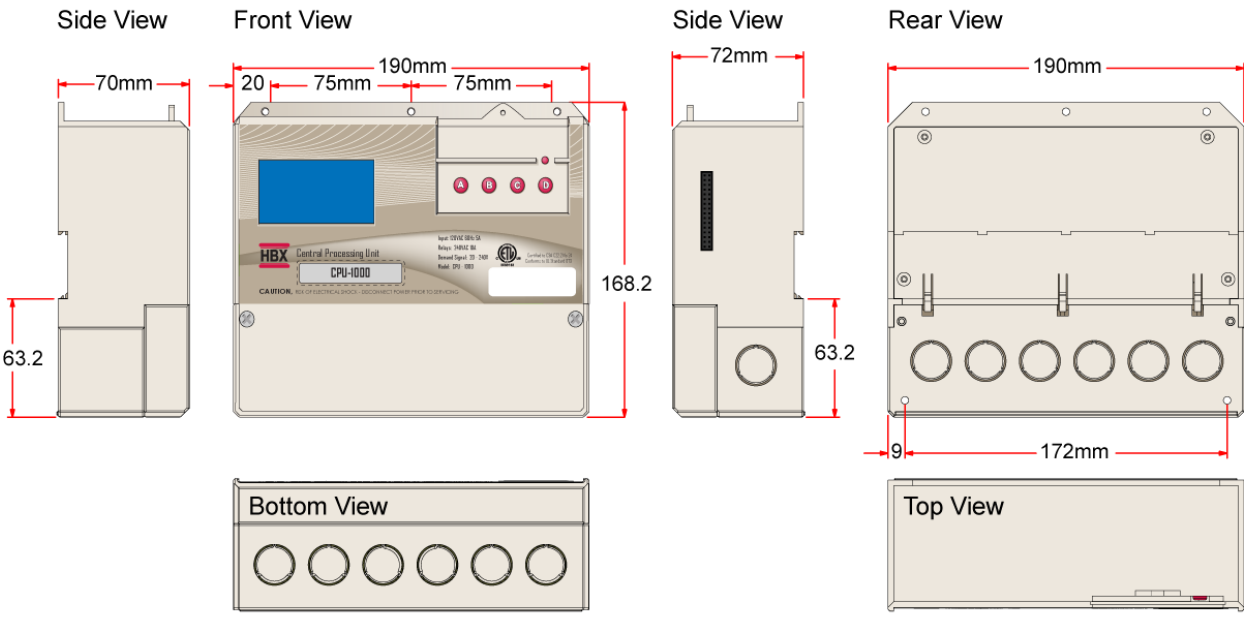
    a. Staging
    b. Mixing
    c. Dedicated DHW Production
    d. Dual System
    e. Dual Mixing

25. The Control must be ETL approved.

Part 2: Acceptable Products

1. HBX CPU 1000 Hydronic Control

Part 3: Physical Dimensions



Part 4: Technical Data, Main Parts & Labels

Inputs / Outputs:

3 x Thermistor Input (10K Ohm)
3 x Miscellaneous Optically Isolated Powered (Relay) Inputs (20-240 VAC)
2 x Relay Dry Contact (120VAC, 10A) Outputs
3 x Pump Output Relays (120 VAC, 10 A)
1 x RJ-11 (RS-232 Communication)

Power Supply:
120 VAC, ± 10%, 60Hz

Real Time Clock Battery:
Lithium-Ion

Microprocessor:
16Bit, 20MHz

Languages:
English

Graphic Display:
128 x 64 pixels (2.17” x 1.10” (55mm x 28mm) viewable area)

Weight:
0.95 KG (2.1 lbs)

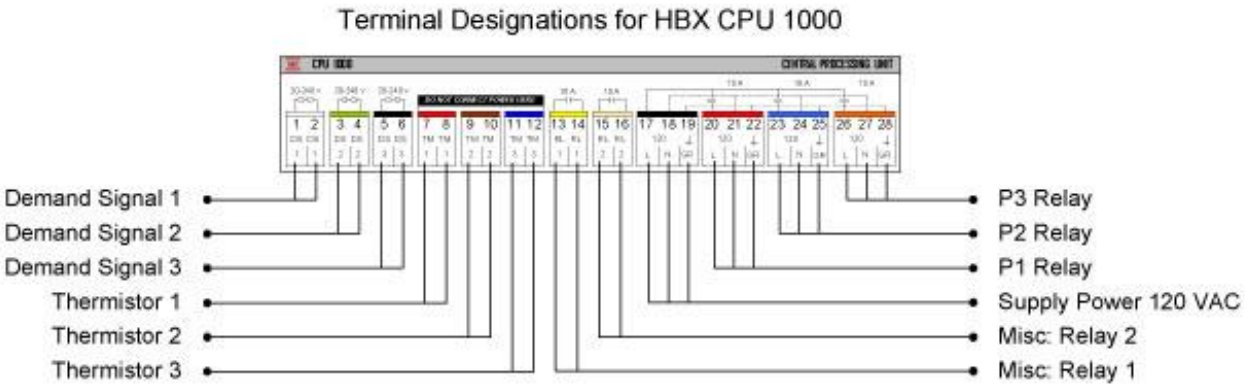
Supplied Parts:
2 x HBX 029-0022 – 10K Ohm Thermistor, 12” lead wire
1 x HBX OUT-0100 – 10K Ohm Outdoor Sensor
2 x Cable ties
1 x Terminal screwdriver (2.5mm)

Dimensions:
7.48” x 6.69” x 2.76” (190mm x 170mm x 70mm)

ETL Listings:
Meets CSA C22.2 No. 24
Meets UL Standard 873
ETL Control No. 3068143

Storage:
50°F to 104°F (10ºC to 40ºC)

Pin Out / Terminal Block Labels:



Wiring

Demand Signal 1 – Any heat demand signal powered by 20 – 240VAC. E.g. 24VAC Thermostat. This trigger will follow the Outdoor Reset Curve calculated by the control.

Demand Signal 2 – Any heat demand signal powered by 20 – 240VAC. E.g. 24VAC Thermostat. This trigger will not follow the Outdoor Reset Curve but stage the boiler to its maximum boiler temp programmed in the control. Demand 2 has an alternative function and can be programmed to be the default input for a flow proof switch (only available with applications using pump sequencing).

Demand Signal 3 – Any heat demand signal powered by 20-240VAC. E.g. 24VAC Thermostat/Aquastat. This trigger is designed to stage the boiler temp to satisfy the DHW settings programmed in the control.

Thermistor 1 – Boiler sensor

Thermistor 2 – System sensor (alternative position for DHW sensor, staging/DHW systems only)

Thermistor 3 - Outdoor sensor

TM1, TM2, & TM3 are designed for 10k Ohm Thermistors and must never be subjected to any external power supply (voltage or current).

Misc Relay 1 – This relay is the default replay for bringing on the 1st boiler or boiler stage.

Misc Relay 2 – This relay is the default relay for bringing on the 2nd boiler or boiler stage. It has an alternative function and can be used as an injection valve. This may be PMlv for radiant mixing or an on/off valve for DHW indirect storage tanks.

Misc Relays 1 and 2 are dry contacts and rated for a max of 10Amps.

P1 & P2 – The (2) dedicated relays when pump sequencing is selected in the controls program. P1 & P2 become the Hi Temp system pumps in a commercial applications requiring pump sequencing.

P1 Relay – Any pump (or fan) output rated to a max of 10Amps 120VAC. This relay is pre-programmed to be the default boiler or (High Temp) system pump.

P2 Relay – Any pump (or fan) output rated to a max of 10Amps 120VAC. This relay is pre-programmed to be the default (low temp) system pump. When programmed for a mixing system.

P3 Relay – Any pump (or fan) output rated to a max of 10Amps 120VAC. This relay is pre-programmed to be the default DHW pump supplying a DHW in-direct hot water tank. Its alternative function is to be an injection pump relay when PMlp is the injection mixing strategy.

Part 5: HBX Sensor Temperature Conversion / Resistance Table

Celsius	Fahrenheit	Ohms	Celsius	Fahrenheit	Ohms	Celsius	Fahrenheit	Ohms
-30	-22	177,000	15	59	15,714	60	140	2,488
-29	-20.2	166,342	16	60.8	15,000	61	141.8	2,400
-28	-18.4	156,404	17	62.6	14,323	62	143.6	2,315
-27	-16.6	147,134	18	64.4	13,681	63	145.4	2,235
-26	-14.8	138,482	19	66.2	13,071	64	147.2	2,157
-25	-13	130,402	20	68	12,493	65	149	2,083
-24	-11.2	122,807	21	69.8	11,942	66	150.8	2,011
-23	-9.4	115,710	22	71.6	11,418	67	152.6	1,943
-22	-7.6	109,075	23	73.4	10,921	68	154.4	1,876
-21	-5.8	102,868	24	75.2	10,449	69	156.2	1,813
-20	-4	97,060	**25**	**77**	**10,000**	70	158	1,752
-19	-2.2	91,588	26	78.8	9,571	71	159.8	1,693
-18	-0.4	86,463	27	80.6	9,164	72	161.6	1,637
-17	1.4	81,662	28	82.4	8,776	73	163.4	1,582
-16	3.2	77,162	29	84.2	8,407	74	165.2	1,530
-15	5	72,940	30	86	8,056	75	167	1,480
-14	6.8	68,957	31	87.8	7,720	76	168.8	1,431
-13	8.6	65,219	32	89.6	7,401	77	170.6	1,385
-12	10.4	61,711	33	91.4	7,096	78	172.4	1,340
-11	12.2	58,415	34	93.2	6,806	79	174.2	1,297
-10	14	55,319	35	95	6,530	80	176	1,255
-9	15.8	52,392	36	96.8	6,266	81	177.8	1,215
-8	17.6	49,640	37	98.6	6,014	82	179.6	1,177
-7	19.4	47,052	38	100.4	5,774	83	181.4	1,140
-6	21.2	44,617	39	102.2	5,546	84	183.2	1,104
-5	23	42,324	40	104	5,327	85	185	1,070
-4	24.8	40,153	41	105.8	5,117	86	186.8	1,037
-3	26.6	38,109	42	107.6	4,918	87	188.6	1,005
-2	28.4	36,182	43	109.4	4,727	88	190.4	974
-1	30.2	34,367	44	111.2	4,544	89	192.2	944
0	32	32,654	45	113	4,370	90	194	915
1	33.8	31,030	46	114.8	4,203	91	195.8	889
2	35.6	29,498	47	116.6	4,042	92	197.6	861
3	37.4	28,052	48	118.4	3,889	93	199.4	836
4	39.2	26,686	49	120.2	3,743	94	201.2	811
5	41	25,396	50	122	3,603	95	203	787
6	42.8	24,171	51	123.8	3,469	96	204.8	764
7	44.6	23,013	52	125.6	3,340	97	206.6	742
8	46.4	21,913	53	127.4	3,217	98	208.4	721
9	48.2	20,883	54	129.2	3,099	99	210.2	700
10	50	19,903	55	131	2,986	100	212	680
11	51.8	18,972	56	132.8	2,787	101	213.8	661
12	53.6	18,090	57	134.6	2,774	102	215.6	643
13	55.4	17,255	58	136.4	2,675	103	217.4	626
14	57.2	16,464	59	138.2	2,579	104	219.2	609