Spartan Peripheral Devices

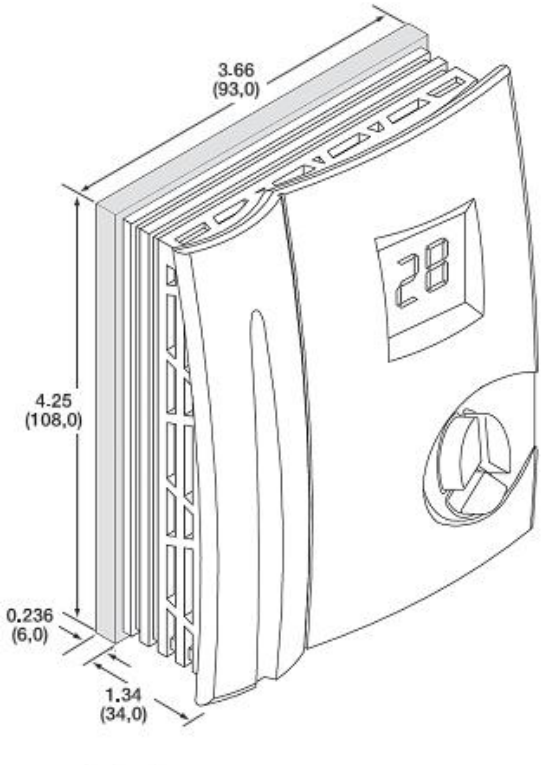
TE150 Thermostat Application

Revision 1.2

Feature List

- Power Supply: 24 Vac ±10%,50Hz/60Hz
- Measurable temperature range: 0.0-40.0˚C(0.5 ˚C resolution) / 32-99 ˚F (1˚F resolution)
- Controllable temperature range: 10.0-32.0˚C (0.5˚C resolution) /50-90 ˚F (1˚F resolution)
- LCD display:
  - Ambient temperature
  - Set point
  - Heat and Cool Mode icon
  - Backlight
- 3 Button keys
- Suitable for Heating or Cooling operation
- Suitable for controlling Modulating type actuators
- Internal or External sensor selection
- US/EU Output setting Direct acting 0/2-10V/ Reverse acting 10-0/2V
- Selectable 0/2-10V proportional output
- EEPROM memory retaining set point on power disconnect
- Economy override mode when hand is flashing
- Limited temperature range
- Support Two Stage output
- One Heat and One Cool system or 2 cooling or 2 heating in sequence

Appearance

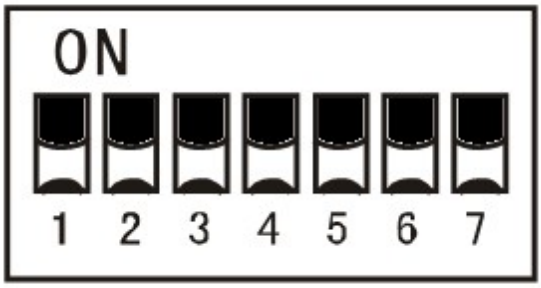


User Interface

Rubber key	Normal mode	Economy mode
Up ▲	Increase set point	Economy override
Down ▼	Decrease set point	Economy override
Hand	Backlight	Economy override

Dip switch Selections

Pole	ON	OFF (default setting)
1	□ F	□ C
2	US/ Direct Acting	EU/ Reverse Acting
3	External Sensor	Internal Sensor
4	2-10V	0-10V
5	Normal temperature range	Limited temperature range
6	Two stage output	One stage output
7	One heat and one cool system	Connect one system only

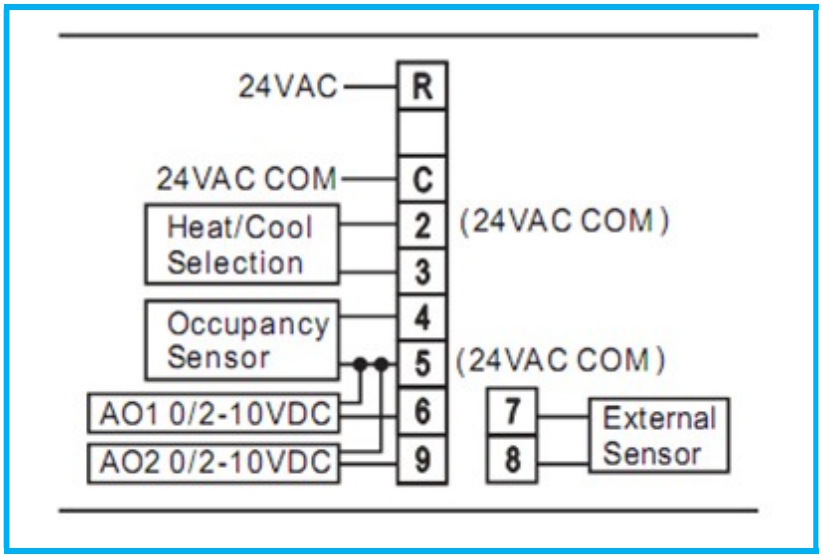


*Please reset power after changing the dip switch selection

Input and Output Terminal:

Terminals	Description	Terminal
Power Supply	24 Vac	R
	24 Vac common	C
Input / Output		
	24 Vac common	2,5
	Heat Cool selection(Open: Heat, Close: Cool)	2,3
	Occupancy sensor(open: occupied)	4,5
	0-10Vdc analog output 1 (AO1)	6
	0-10Vdc analog output 2 (AO2)	9
	External Sensor	7
	External Sensor	8

For modulating type actuators:



Operation:

Normal mode and Economy mode

Occupancy sensor represents occupied mode when terminal 4 and 5 are open, thermostat will run normal mode.
Occupancy sensor represents unoccupied mode when terminal 4 and 5 are closed or #4 grounded, thermostat will run economy mode.
When thermostat is running in the economy mode, LCD will display

Economy override:

- Hold ▲or ▼ or key for 2 seconds to enable economy override, LCD display will flash
- The override function will go back to economy mode after 2 hours and will stop flashing.
- During 2 hour override mode, user can hold ▲or ▼ or key 2 seconds to disable the override and go back to the economy mode, will stop flashing.

Adjusting the Set point(Dip switch 5)

Dipswitch number 5 can set the set point into normal or limited range. See table below:

Normal Controllable range:

Temperature unit	Economy (Unoccupied) and Heat	Normal (Occupied)	Economy (Unoccupied) and cool
˚F (1˚F resolution)	42-82˚F	50-90˚F	58-98˚F
˚C(0.5˚C resolution)	6.0-28.0 ˚C	10.0 – 32.0 ˚C	14.0 – 36.0 ˚C

Limited temperature range (default setting)

Temperature unit	Economy (Unoccupied) and Heat	Normal (Occupied)	Economy (Unoccupied) and cool
˚F (1˚F resolution)	56-68˚F	64-76˚F	72-84˚F
˚C(0.5˚C resolution)	14.0-20.0 ˚C	18.0-24.0 ˚C	22.0 – 28.0 ˚C

EEPROM memory

Set point will be saved in the EEPROM. The set point will be loaded back when the thermostat is reset.

Backlight:

Backlight will illuminate after pressing ▲or ▼ or  . It will turn off after 10 seconds once the keys are released.

Signal Range output selection(Dip switch 4):

For 0-10V output version switch # 4 OFF

Output percentage	EU version RA	US version DA
0% Flow	0V	10V
100% Flow	10V	0V

For 2-10V output version switch # 4 ON

Output percentage	EU version RA	US version DA
0% Flow	2V	10V
100% Flow	10V	2V

Heat /Cool Selection

Heat mode is selected when Terminal 2 and 3 are disconnected.  will display on LCD

Cool mode is selected when Terminal 2 and 3 are connected.  will display on LCD

The thermostat can be set to heating or cooling mode by manual jumper or by external aquastat connected to terminal 2 and 3. When terminal 2 and 3 are open we are in a heating mode.

When Thermostat is in the Heating Mode:

On demand for heating the  will be flashing, and if the dipswitch # 2 is in the OFF position (EU) the output will rise to 10Vdc. When the dipswitch # 2 is in the ON position (US) the output will drop to 0/2Vdc.

Heat mode 2-3 open Dipswitch # 2 Position

	ON – US (DA)	OFF EU (RA)
Demand for heating increase set point	0/2Vdc	10Vdc
Decrease set point	10Vdc	0/2Vdc

When terminal 2 and 3 are closed we are in a cooling mode.

On demand for cooling the  will be flashing, and if the dipswitch # 2 is in the OFF position (EU) the output will rise to 10Vdc. When the dipswitch # 2 is in the ON position (US) the output will drop to 0/2Vdc.

Cooling mode 2-3 closed dipswitch # 2

	ON – US (DA)	OFF- EU (RA)
Demand for cooling decrease set point	0/2Vdc	10Vdc
Increase set point	10Vdc	0/2Vdc

Control Type Selection:
Dip Switch 6&7
Selection of a single or dual stage control

Dip switch 6	Output
OFF	Single output
ON	Dual output

Dip switch 7	
OFF	Single Output or Dual Output of same direction
ON	One Heat / One Cool

If dipswitch 6 and 7 is set to the OFF position, single stage operation is selected, AO1 will be in output for heating or cooling (as selected by jumper 2-3)

If dipswitch 6 is ON and dipswitch 7 is OFF the dual output is selected with 2 outputs in sequence but in same direction: two cooling or two heating as selectable by jumper 2-3.

If dipswitch 6 is ON and dipswitch 7 is ON dual output is selected with 2 outputs in sequence but in opposite direction: one cooling and one heating

Dip switch 6	Dip switch 7	System
OFF	OFF	Single stage output, heat/cool is selected by terminal 2-3
ON	OFF	Dual output, heat/cool is selected by terminal 2-3
OFF	**ON**	Dual output, thermostat change mode according to the room temp. and set point.
ON	**ON**	

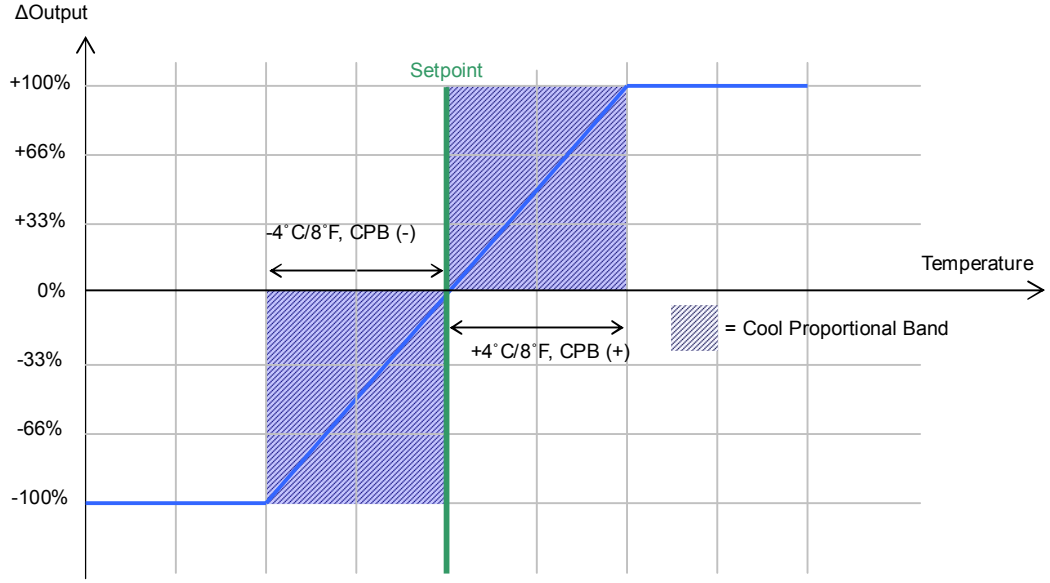
Output connection is specified as follow:
Heat output is AO1 and Cool output AO2.

Terminals	Description	Terminal
	0-10Vdc analog output (AO1) (Heat)	6
	0-10Vdc analog output2 (AO2) (Cool)	9

Temperature Control

Measurable temperature range:
0.0 – 40.0 ˚C (0.5˚C resolution) / 32 – 99 ˚F (1˚F resolution)
“HI” will be displayed if measured temperature is higher than 40.0˚C /99 ˚F
“LO” will be displayed if measured temperature is lower than 0.0˚C /32 ˚F
will be displayed if measured temperature is equal or lower 5˚C /41 ˚F

Single Output Cooling: Output: AO1
CPB: ±4˚C/8˚F

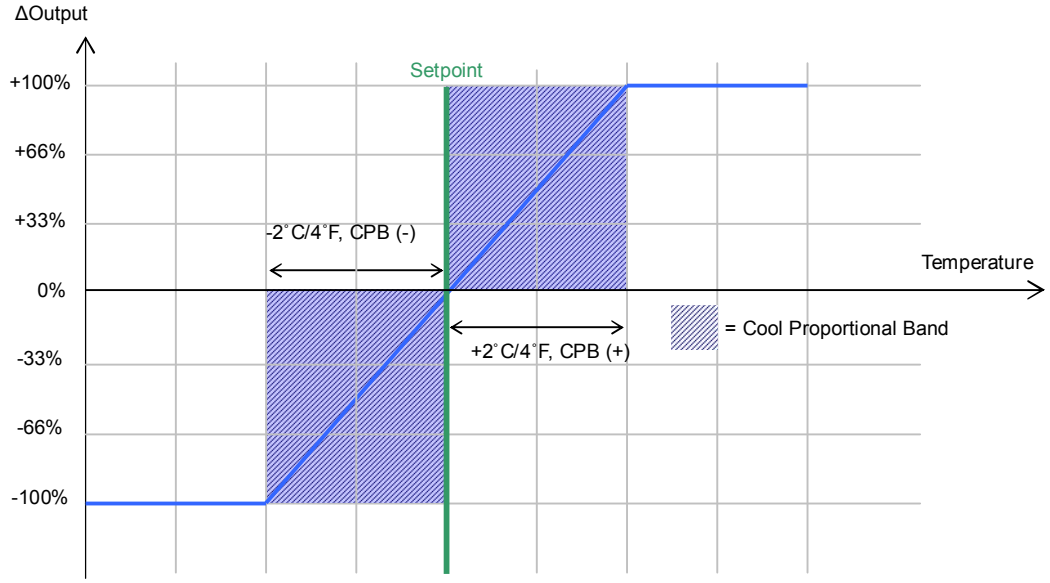


Percentage	0-10V selection	2-10V selection
0%	0V	2V
25%	2.5V	4V
50%	5.0V	6V
75%	7.5V	8V
100%	10V	10V

When the ambient temperature between CPB. The percentage output is calculated by a PI algorithm. The percentage output is updated every 30 seconds.

If the ambient temperature is within +/- 0.4 ˚C (0.6ºF) of set point, the percentage output will keep constant.

Dual Output Cooling:
1st stage output: AO1
2nd stage output: AO2
CPB: ±4˚C/8˚F



When percentage within 0-50%, AO1 opens proportionally, it fully opens when percentage over 50%.

Percentage	0-10V selection	2-10V selection
0%	0V	2V
15%	3V	4.4
35%	7V	7.6
50%	10V	10V
>50%	10V	10V

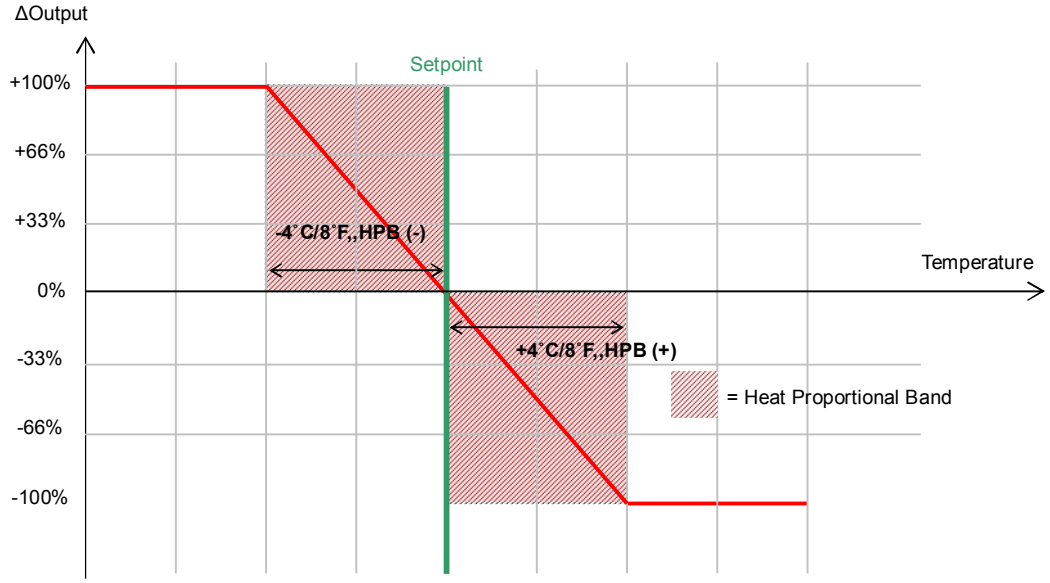
When percentage is between 51%-100%, AO2 opens proportionally, it is off when percentage ≤50%.

Percentage	0-10V selection	2-10V selection
0%	0V	2V
15%	0V	2V
35%	0V	2V
50%	0V	2V
55%	1V	2.8V
75%	5V	6V
85%	7V	7.6
100%	10V	10V

When the ambient temperature between CPB. The percentage output is calculated by a PI algorithm. The percentage output is updated every 30 seconds.

If the ambient temperature is within +/- 0.4 ˚C (0.6ºF) of set point, the percentage output will keep constant.

Single Output Heating:
Output: AO1
HPB: ±4˚C/8˚F

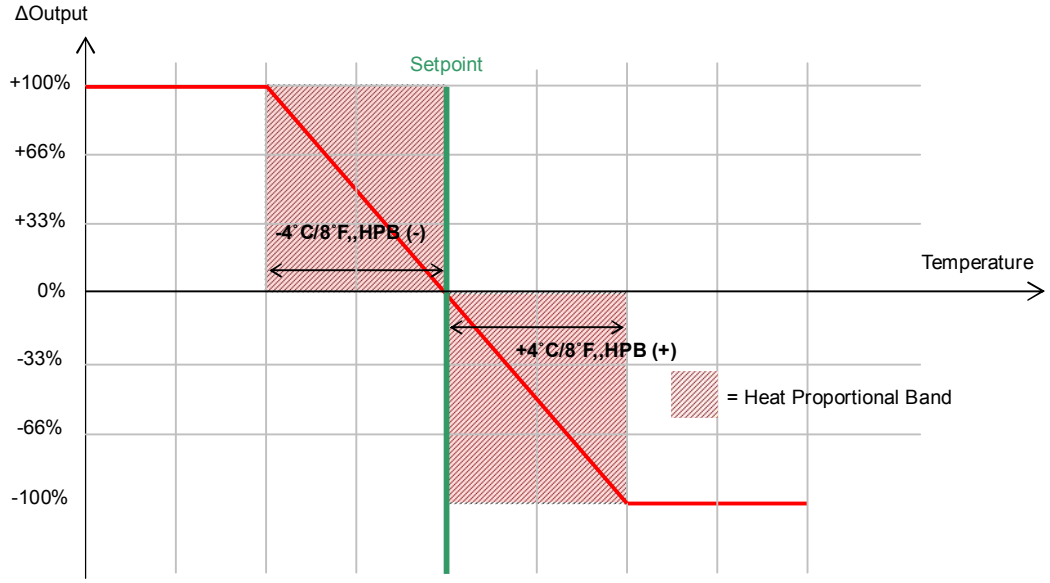


Percentage	0-10V selection	2-10V selection
0%	0V	2V
25%	2.5V	4V
50%	5.0V	6V
75%	7.5V	8V
100%	10V	10V

When the ambient temperature between HPB. The percentage output is calculated by a PI algorithm. The percentage output is updated every 30 seconds.

If the ambient temperature is within +/- 0.4 ˚C (0.6ºF) of set point, the percentage output will keep constant.

Dual Output Heating:
1st stage Output: AO1
2nd stage output: AO2
HPB: ±4˚C/8˚F



When percentage within 0-50%, AO1 opens proportionally, it fully opens when percentage over 50%.

Percentage	0-10V selection	2-10V selection
0%	0V	2V
15%	3V	4.4
35%	7V	7.6
50%	10V	10V
>50%	10V	10V

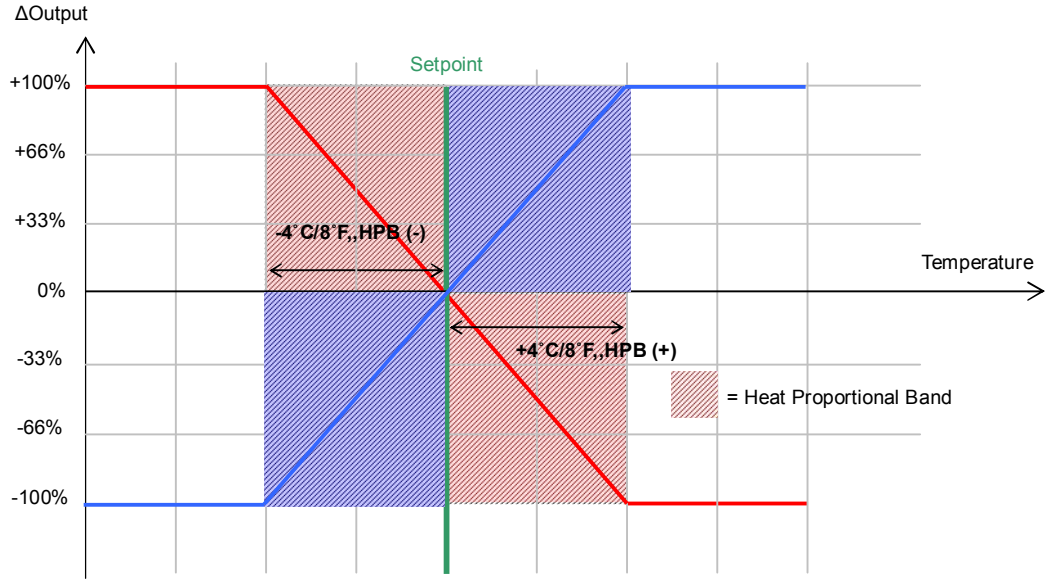
When percentage is between 51%-100%, AO2 opens proportionally, it is off when percentage ≤50%.

Percentage	0-10V selection	2-10V selection
0%	0V	2V
15%	0V	2V
35%	0V	2V
50%	0V	2V
55%	1V	0.8V
75%	5V	6V
85%	7V	7.6
100%	10V	10V

When the ambient temperature between HPB, the percentage output is calculated by a PI algorithm. The percentage output is updated every 30 seconds.

If the ambient temperature is within +/- 0.4 C (0.6ºF) of set point, the percentage output will keep constant.

Heating and Cooling System(Dip switch 7 is ON), Dip switch 2 is ON
Heating Output: AO1
Cooling output: AO2
HPB: ±4˚C/8˚F



When room temp. is below the set point , AO1 open, AO2 off.

AO1		
Percentage	0-10V selection	2-10V selection
0%	10V	10V
25%	7.5V	8V
50%	5.0V	6V
75%	2.5V	4V
100%	0V	2V

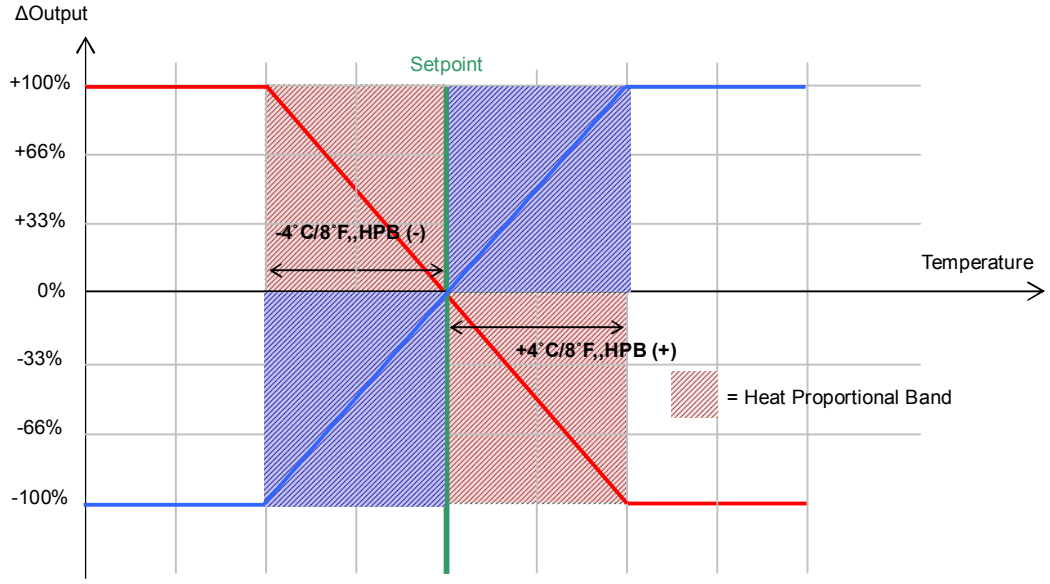
When room temp is larger than the set point, AO1 off, AO2 open

AO2		
Percentage	0-10V selection	2-10V selection
0%	0V	2V
25%	2.5V	4V
50%	5.0V	6V
75%	7.5V	8V
100%	10V	10V

When the ambient temperature between HPB, the percentage output is calculated by a PI algorithm. The percentage output is updated every 30 seconds.

If the ambient temperature is within +/- 0.4 C (0.6ºF) of set point, the percentage output will keep constant.

Heating and Cooling System(Dip switch 7 is ON), Dip switch 2 is OFF
Heating Output: AO1
Cooling output: AO2
HPB: ±4˚C/8˚F



When room temp. is below the set point , AO1 open, AO2 off.

AO1		
Percentage	0-10V selection	2-10V selection
0%	0V	2V
25%	2.5V	4V
50%	5.0V	6V
75%	7.5V	8V
100%	10V	10V

When room temp is larger than the set point, AO1 off, AO2 open

AO2		
Percentage	0-10V selection	2-10V selection
0%	10V	10V
25%	7.5V	8V
50%	5.0V	6V
75%	2.5V	4V
100%	0V	2V

When the ambient temperature between HPB, the percentage output is calculated by a PI algorithm. The percentage output is updated every 30 seconds.

If the ambient temperature is within +/- 0.4 C (0.6ºF) of set point, the percentage output will keep constant.