

modulating wall
thermostat

specifications:

power input:	24 vac $\pm 20\%$
power consumption:	2va minimum 17va maximum (all outputs used at maximum current output)
signal outputs:	0 -10 vdc, cooling 0 -10 vdc, cooling high demand 0 -10 vdc, heating 0 -10 vdc, heating high demand 2 TPM outputs, 1 or 24 to 29 vdc 0.5 - 5 vdc actual temperature
output impedance:	3 K Ω maximum, heating & cooling outputs 100 Ω maximum tpm output 1 250 Ω maximum tpm output 2 20 K Ω maximum actual temperature output
ambient temp:	-20 $^{\circ}$ to 50 $^{\circ}$ C (-4 $^{\circ}$ to 120 $^{\circ}$ F)
setpoint range:	0 $^{\circ}$ to 38 $^{\circ}$ C (32 $^{\circ}$ to 99 $^{\circ}$ F)
deadband:	0.3 $^{\circ}$ C ($\pm 0.5^{\circ}$ F)
proportional band:	1 $^{\circ}$ to 9 $^{\circ}$ C user programmable (2 $^{\circ}$ to 16 $^{\circ}$ F)
control algorithm:	P.I. integral and terms auto-tuned
nsb input:	contact closure, programmable for 0 to 15 $^{\circ}$ C (0 $^{\circ}$ to 27 $^{\circ}$ F) deadband expansion
nsb override:	2 hours
nsb algorithm:	deadband expansion around setpoint. Optimized soft start for peak electrical demand reduction. Warm up ramp time programmable over 0 to 99 minutes
minimum position:	0 to 75% independently adjustable for heating and cooling outputs. Does not affect high demand outputs.
tpm period:	2 seconds
tpm range:	tpm 1: 0 to 100% of heating demand tpm 2: 50% to 150% of heating demand
tpm 2 inhibit input:	contact closure to inhibit (set to zero) tpm 2 output regardless of demand
contact outputs:	2 independent dry contacts (1 amp maximum resistive load) independently programmable for heating or cooling with selectable switching points from 20% to 90% of demand
external sensor:	optional DS100 duct or WS100 wall
display type:	2 digit led (7 segment type)
default display:	actual temperature selectable in $^{\circ}$ C or $^{\circ}$ F.
programming:	menu driven directly from thermostat no external tools required.
memory retention:	10 years minimum

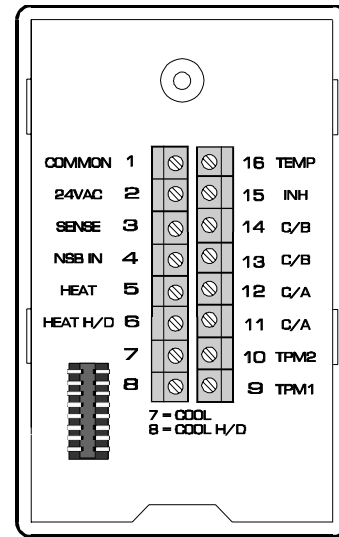


fig. #1

connections:

- | | |
|-------------------------------|-------------------------|
| 1. common | 9. tpm 1 output |
| 2. 24 vac | 10. tpm 2 output |
| 3. external sensor | 11. contact A |
| 4. nsb input | 12. contact A |
| 5. heating output | 13. contact B |
| 6. heating high demand output | 14. contact B |
| 7. cooling output | 15. tpm2 inhibit input |
| 8. cooling high demand output | 16. actual temp. output |

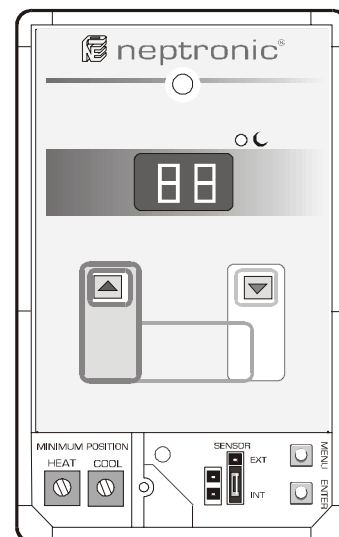


fig. #2



dimensions:

height:	(120 mm)	4.73 in.
width:	(74 mm)	2.91 in.
depth:	(23 mm)	0.90 in.

description:

The ptc is a powerful microprocessor based menu driven temperature controller for heating and cooling applications. Please read the following information to maximize the potential of this powerful thermostat. The following are some highlights of the ptc:

- * p.i. analog heating and cooling outputs
- * 2 sequential p.w.m. heating outputs to proportionally drive solid state relays
- * 2 fully programmable dry contact relays to be used in heating and/or cooling applications
- * high signal selections outputs from multiple ptc's to be used by a master system
- * individually programmable night set back/ set up
- * night set back override
- * intelligent self-optimizing morning self start
- * minimum position setting for heating and cooling output
- * programmable min and max allowable temperature setting
- * selectable internal/external sensor
- * led display
- * programmable Celcius or Fahrenheit display
- * plug in easily removable thermostat body
- * attractive flat casing

button functions:

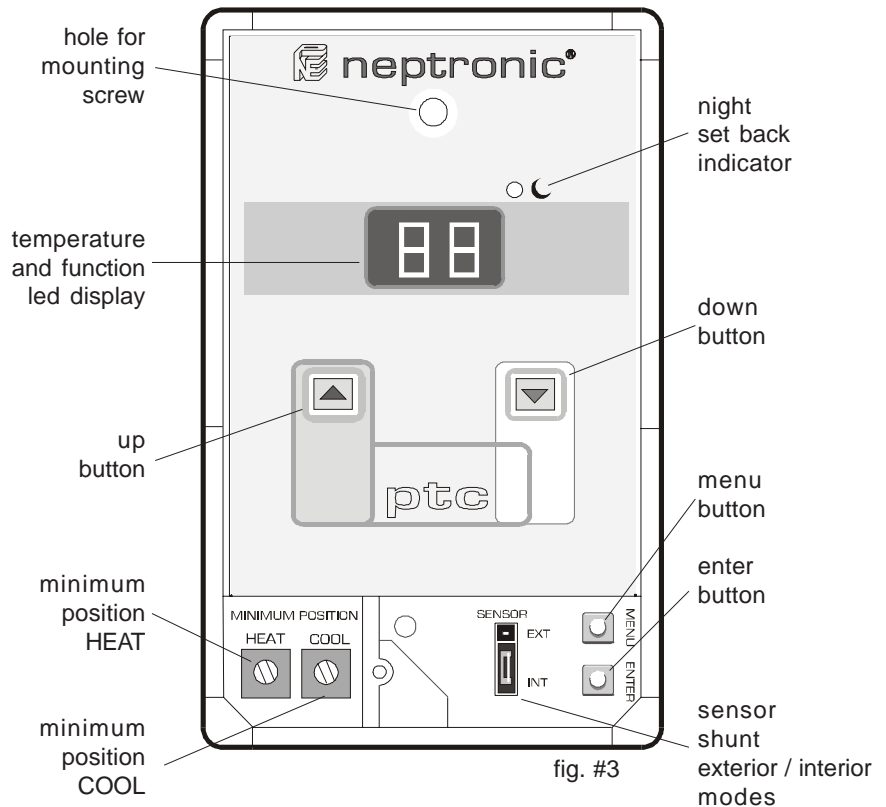
The up button is used to increase the temperature set point (warmer) while the thermostat is operating in user mode. The up button is also used to increase a given parameter when in program mode.

Similarly, the down button is used to decrease the temperature setpoint (cooler) or decrease a parameter in program mode.

The menu button is used to place the ptc into program mode, and to advance the program function to the next menu.

The enter button is used to store the program function parameter into memory. Once a value is stored in memory, the ptc will remember that value even if the power is turned off at the thermostat for several years.

When a parameter is being stored, the led display will flash in a circular fashion. You will notice that when changing the setpoint, the led display will do a circular flash. This is because a new setpoint is being entered into the memory of the ptc.



In program mode if this flash does not occur you have not stored that parameter into memory! if you do not wish to change the value in memory of a parameter, simply do not press the enter button and push the menu button to go to the next program level.

Night Set Back Indicator: When NSB is ON, the NSB Indicator will light. If you wish to locally override the NSB, momentarily push either the UP or DOWN button. NSB will be cancelled for 2 hours and the NSB light will turn off until the NSB is re-established.

ptc terminal connection descriptions:

1 common

2 24 vac

3 external temperature sensor. If an external temperature sensor is used, it must be connected between pins 1 and 3. When using an external temperature sensor, the sensor selection jumper must be placed in the ext position. Nepronic wall sensor ws100 or duct sensor ds100 must be used.

4 night set back input. To enlarge the deadband during unoccupied periods (night set back), short pins 4 and 1. The amount of deadband expansion is programmed at the thermostat.

5 heating output 0 to 10vdc. This is the analog proportional heating output. It may be used to control an actuator.

6 heating high demand output 0 to 10vdc. This output may be placed in parallel with many ptc heating high demand outputs to find the highest heating demand among many zones. This signal can be used to control a voltage sensitive relay (ie; nepronic vrc2 or vrc4) in order to turn on a heating system via stages.

7 cooling output 0 to 10vdc. This is the analog proportional cooling signal. It may be used to control an actuator.

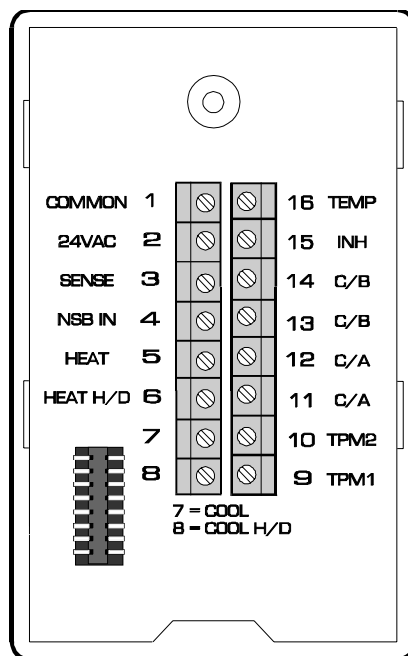


fig. #4

8 cooling high demand output 0 to 10vdc. This output may be placed in parallel with many ptc cooling high demand outputs to find the highest cooling demand among many zones. This signal can be used to control a voltage sensitive relay (ie, nepronic vrc or vrc4) in order to turn on a cooling unit via stages

9 time proportional modulation output 1; 1 or 24vdc. This heating output may be used to modulate heating elements via a triac switch or solid state relay. The output range is proportional to

0 to 100% of the heating demand. This output is capable of supplying up to 100mA of current so it may be used to actuate several triac switches, or even a thermo-electric valve directly.

10 time proportional modulation output 2: 1 or 24vdc output. This output is similar to pin 9 except that the output is proportional to 50 to 150% of the heating demand. In addition the maximum current output is 100mA.

11 & 12 contact A. This contact is normally open. It will close if the demand exceeds the programmed value. the contact rating is 120V 1A resistive.

13 & 14 contact B. This contact is normally open. It will close if the demand exceeds the programmed value. The contact rating is 120V 1A resistive.

15 tpm 2 inhibit. This input, when shorted to pin 1, will turn off time proportional modulation 2 regardless of the heating demand.

16 actual temperature output, 0.5 to 5vdc. This output is proportional to the actual temperature seen by the thermostat. A chart of temperature versus voltage is shown in fig #5. The output is high impedance and any attempt to draw more than 0.5mA from this output will result in incorrect readings and may result in improper function of the thermostat.

temp: vdc:

C°	F°	Vtemp
0	32	5.0
1	34	4.9
2	35.5	4.8
3	37.5	4.7
4	39	4.6
5	41	4.5
6	43	4.4
7	44.5	4.2
8	46.5	4.1
9	48	4.0
10	50	3.9
11	52	3.8
12	53.5	3.6
13	55.5	3.5
14	57	3.4
15	59	3.3
16	61	3.1
17	62.5	3.0
18	64.5	2.9
19	66	2.8
20	68	2.6
21	70	2.5
22	71.5	2.4
23	73.5	2.3
24	75	2.1
25	77	2.0
26	79	1.9
27	80.5	1.8
28	82.5	1.6
29	84	1.5
30	86	1.4
31	88	1.3
32	89.5	1.2
33	91.5	1.0
34	93	.96
35	95	.84
36	97	.73
37	98.5	.62
38	99	.52

fig. #5

programming:

All of the programming of the ptc is carried out at the thermostat. No programming tool is required, and the programming sequences are all menu driven.

Description of all programming steps is done in the order in which they appear while actually programming the thermostat. Please look at fig. #3 for the locations of up, down, menu, and enter buttons.

In many cases you will never need to program the ptc thermostat. The standard factory settings are suitable for most applications. A list of the standard factory settings are shown below. If you want to change any of these settings, follow the directions in the next section.

ptc thermostat function and factory settings

functions

setpoint maximum
 setpoint minimum
 contact A
 contact B
 night set back deadband
 proportional band
 soft start ramp time
 display type
 calibration

standard factory setting

30°C - 86°F
 15°C - 59°F
 close for >50% cooling demand
 close for >50% heating demand
 10°C - 18°F
 2°C - 3.5°F
 00 minutes (off)
 °C
 0

program level organization:

Each function is made of 2 steps:

Step 1 The function will be displayed for 2 seconds followed by message 2.

Step 2 is adjusted by pushing the **up** or **down** buttons. To change to the next function, press the **MENU** button.



If you wish to skip over a function, simply push and hold down the **MENU** button.



* Note: If you want to program all functions in °F skip to message #8 "d l"

step 1 of each function will be displayed (in order) for 2 seconds, and then the ptc will skip to the next function.

ptc thermostat programming modes

When the ptc is turned on, it automatically displays the actual temperature in °C. The thermostat is fully functional and it uses default factory settings

Setpoint change - To check the setpoint momentarily press the **UP** or **DOWN** button. The display will automatically show the setpoint.

To change setpoint press the **UP** or **DOWN** button until the required new set point is displayed.

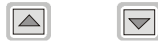


To change any other parameters of the thermostat, see all the programming levels as listed below in order of appearance along with the display messages.

	program function	1st display	2st display
	setpoint maximum	HI	0 to 38
	setpoint minimum	LO	0 to 38
	contact A setpoint	CA	H2, H3,...H9, C2...C9
	contact B setpoint	Cb	H2, H3,...H9, C2...C9
	night set back deadband	Sb	0 to 15
	proportional band	Pb	1 to 9
	soft start ramp time (min.)	r r	0 to 99
	display type	d l	C or F
	temperature calibration	CL	-5 to 5

program level organization: cont.

When the **ptc** is turned on, it is automatically in user mode. In this mode only the setpoint may be changed (within the limits set by the minimum and maximum setpoint settings) by pressing the **up** or **down** buttons.



To enter program mode, push the **MENU** button once.

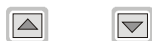


The first program level message (hi) will be displayed for 2 seconds, followed by the **maximum setpoint setting**. Pushing the **up** or **down** buttons, set the maximum setpoint you wish the user to have access to. Once that is done, push the **ENTER** button to store this value in memory.



Push **MENU** once again. The second program level message (Lo) will be displayed for 2 seconds, followed by the **minimum setpoint setting**.

Pushing the **up** or **down** buttons, set the minimum setpoint you wish the user to have access to.



Once that is done, push the **ENTER** button to store this value in memory.



Note that if you wish to fix the temperature setpoint to one value (ie; not adjustable by the user), set the (hi) and (Lo) values to the desired temperature setpoint.

Push **MENU** again. The third program level message (Ca) will be displayed for 2 seconds, followed by the setpoint of **contact A**. It is displayed in the following format:



message	contact setpoint
H2	heating at 20 % demand
H3	heating at 30 % demand
H4	heating at 40 % demand
H5	heating at 50 % demand
H6	heating at 60 % demand
H7	heating at 70 % demand
H8	heating at 80 % demand
H9	heating at 90 % demand
C2	cooling at 20 % demand
C3	cooling at 30 % demand
C4	cooling at 40 % demand
C5	cooling at 50 % demand
C6	cooling at 60 % demand
C7	cooling at 70 % demand
C8	cooling at 80 % demand
C9	cooling at 90 % demand

Pushing the **up** or **down** buttons will change the



contact setpoint. When you have arrived at the setpoint you wish, push the **ENTER** button to store this value in memory.



program level organization: cont.

Push **MENU** again. The fourth program level message (C b) will be displayed for 2 seconds, followed by the setpoint of **contact B**. The format is the same as described above for *contact A*, and adjustments to the setpoint are made in the same way.

Contact A and Contact B are totally independent. You may select two heating contacts, two cooling contacts, or one heating and one cooling contact. Their setpoints can be wherever you choose.

Push **MENU** again. The fifth program level message (S b) will be displayed for 2 seconds, followed by the **night set back deadband**. This is the total deadband (over and under the setpoint) applied when the night set back terminal is connected to common.

Using the **up** or **down** button, adjust the night set back deadband to the value required and press **ENTER** to store that value in memory.

Push **MENU** again. The sixth program level message (P b) will be displayed for 2 seconds, followed by the **proportional band**.

The **ptc** operates using a p.i. algorithm, with the integral terms optimized automatically by the thermostat. But since the proportional band has the greatest effect on the output, adjusting the proportional band

will allow you to tailor the response of the ptc to any given application. For most V.A.V applications, the usual proportional band is 2 to 3°C (3.5 to 5.5°F). For many applications where hot or chilled water coil is used, a typical proportional band is 3 to 6 degrees °C (5.5 to 10.5°F).

Using the **up** or **down** buttons, adjust the proportional band to the value required. Press the **ENTER** button to store the value in memory.

Push **MENU** again. The seventh program level message (r l c) will be displayed followed by the soft start ramp time. Since the soft start feature is only useful if modulating electric heating is used, you may disable this feature. To turn off the soft start function, set the soft start ramp time to 00. If modulating electric heating is used, normally the soft start ramp time is set the same as the morning warm up period.

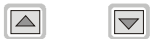
Push the **up** or **down** buttons to set the soft start ramp time to the number of minutes required.

Push the **ENTER** button to store this value in memory.

program level organization: cont.

Push **MENU** again. The eighth program level message (d l) will be displayed for 2 seconds, followed by the **display type** shown in user mode. There are two choices: either degrees Celsius (°C) or degrees Fahrenheit (°F).

To normally display the temperature setpoint in Celsius, press the **up** or **down** button until (C) is displayed. To normally display the actual temperature in Fahrenheit, press the **up** or **down** button until (F) is displayed.



Push the **ENTER** button to store this parameter in memory.



Push **MENU** again. The ninth program level message (C L) will be displayed followed by the **temperature calibration adjustment**.

The **ptc's** temperature sensor is factory calibrated. However you may wish to adjust this calibration, particularly if you are using an external temperature sensor. To do this, simply measure the actual temperature in the room and compare it to the actual temperature displayed by the **ptc**.

If, for example, the ptc was reading 2 degrees lower than the actual temperature, set the temperature calibration adjustment to -2.

Adjust the calibration value by pushing the **up** or **down** buttons.



When finished, push **ENTER** to store the calibration value in memory.



This is the last programming step. To put the **ptc** thermostat back into **user mode**, push **MENU** once again.



Note that if the ptc thermostat is left in program mode the control section of the thermostat is not functional. Therefore it is always a good idea to leave it in user mode when you are finished programming.

Restoring the standard factory settings

If you wish to restore the standard factory settings on the **ptc**, then follow these steps:

- 1) **turn off the power to the thermostat.** This may be done by unplugging the **ptc** from the sub-base.
- 2) **push and hold down the menu, enter, and up buttons at the same time.**
- 3) **turn the power back on to the ptc** (or plug it back into it's sub-base).

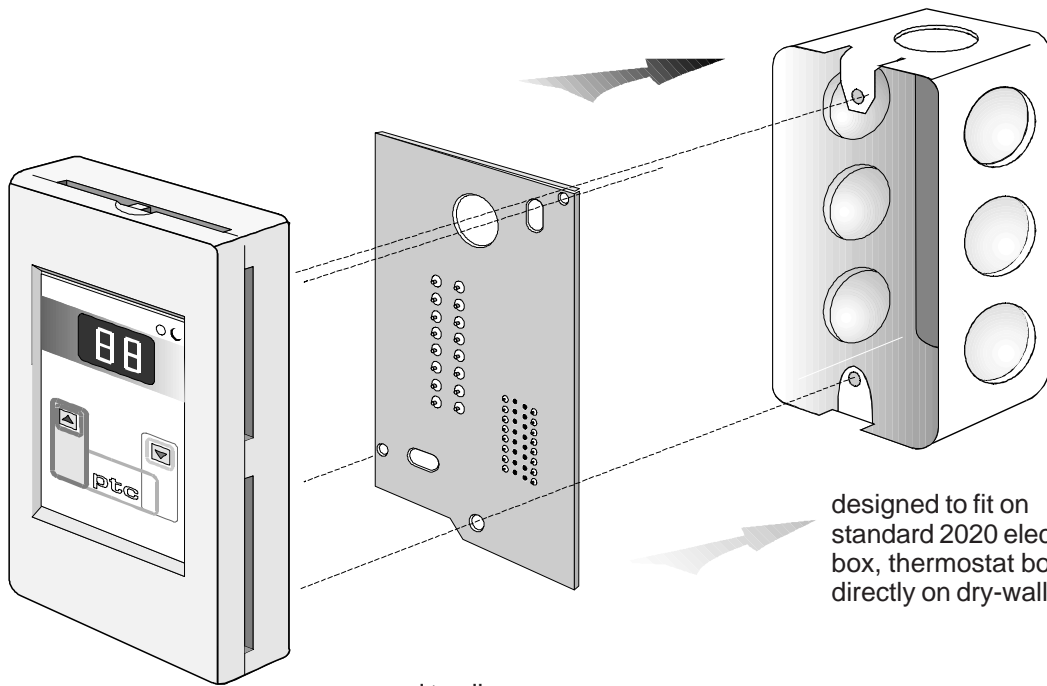
The thermostat must be at this point, in the program mode if the **MENU** button was held down for too long. To get back into **user mode**, push and hold down the **MENU** button until you see the display show (C L).



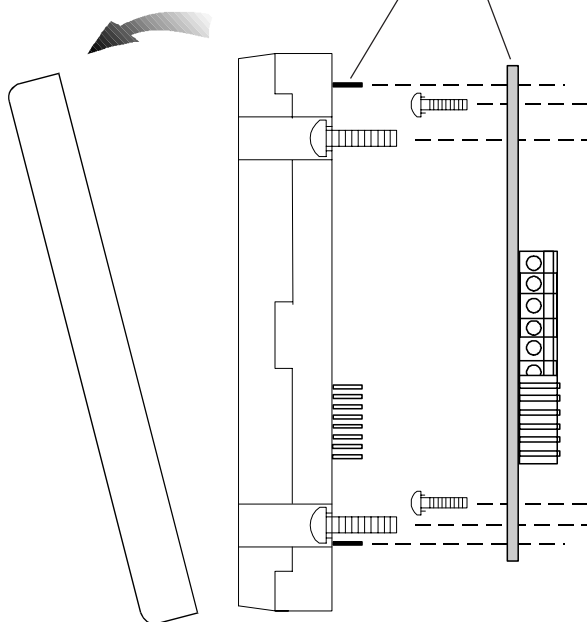
Then release the **MENU** button, and momentarily push the **MENU** button once again.



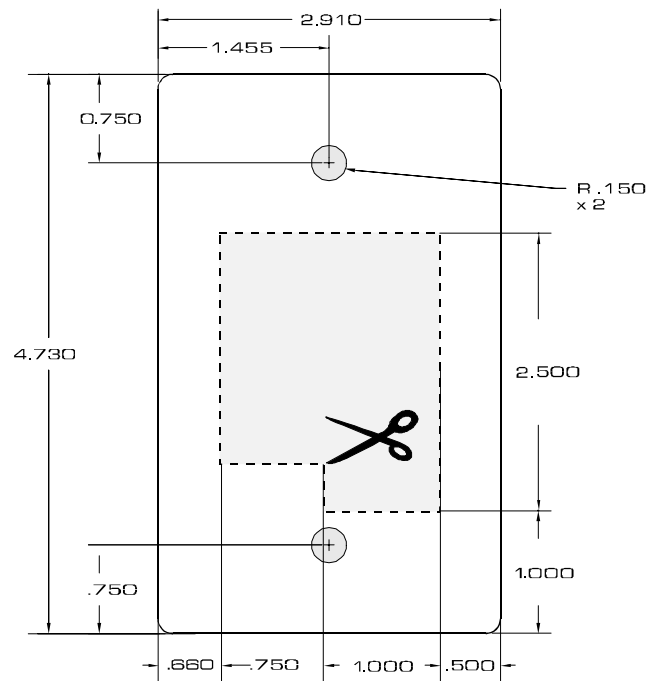
installation:



ensured to align pin guides with the base-board for proper fitting.



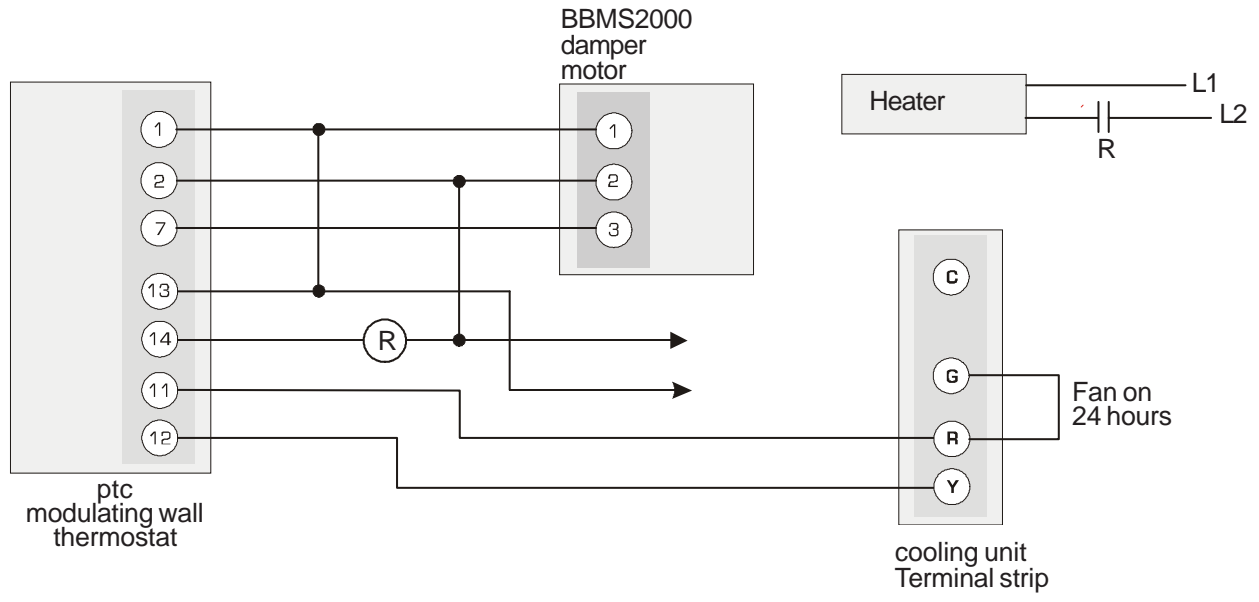
to open:
grab top and bottom of front cover and pull in a downward direction.



dimensions for wall mounting.
(Suggested cut-out for terminal block.)

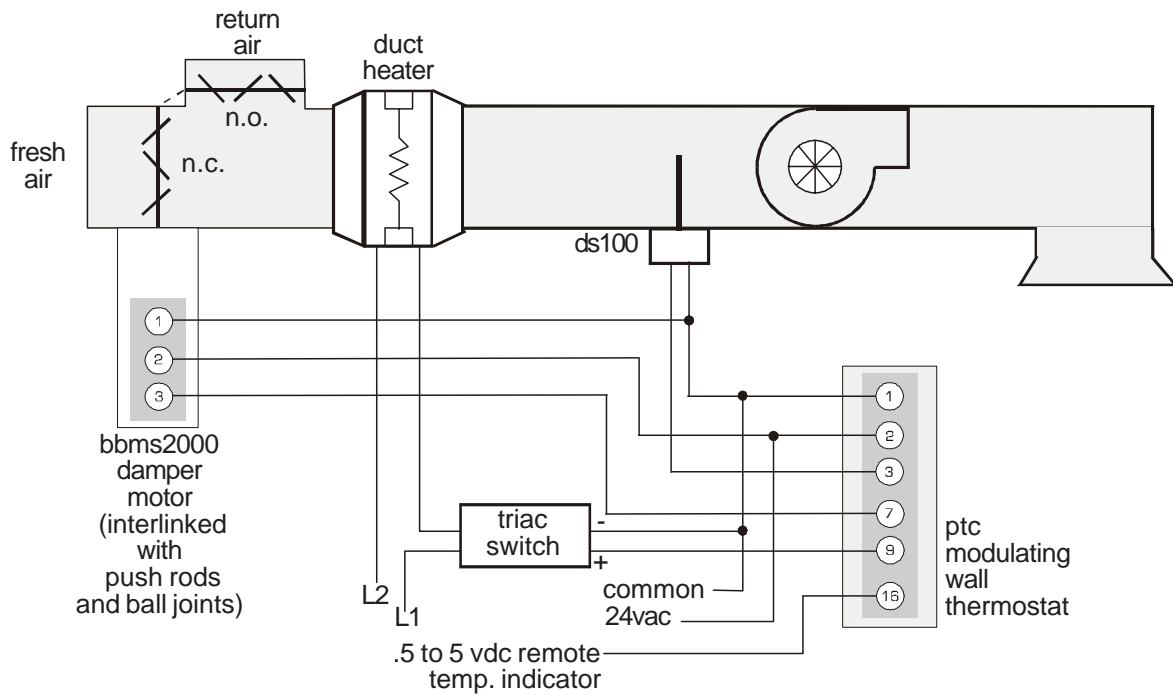
typical applications:

central cooling with baseboard heating (on/off)



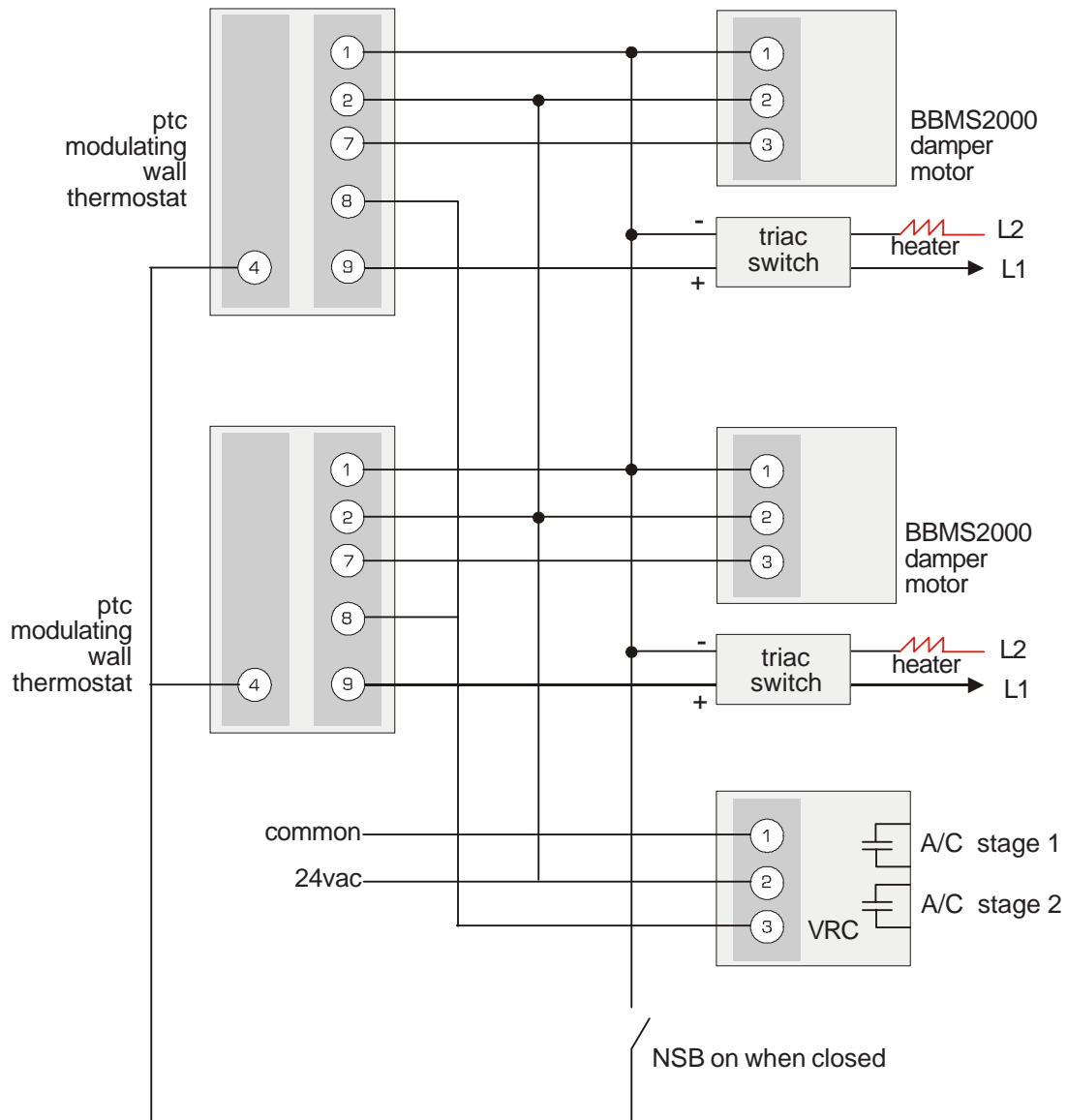
Notes:
use intermediate relay R for high current load (over 1A)

discharge air temp control with remote temp indicator



Notes: Set sensor select jumper to ext.

Two typical zone VAV box control. Cooling ramps modulates VAV Box actuator, heating ramps modulates terminal reheat, high cooling demand cycles A/C unit.
(For any number of zones)



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