

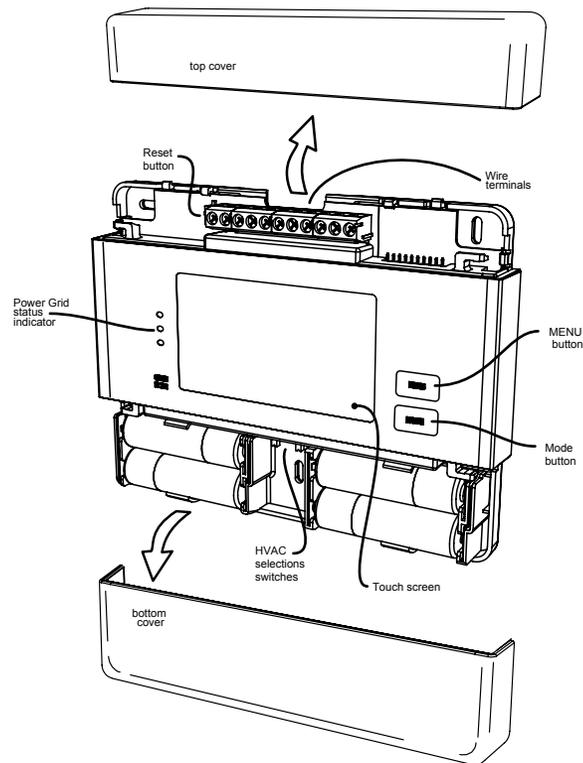
# Install Guide CT100

## ⚠ Caution

- Your thermostat is a precise instrument, handle it with care.
- Turn off electricity to the HVAC system before installing or servicing thermostat or any part of the system.
- Do not turn electricity back on until work is completed.
- Do not short (jumper) across electric terminals at the control on the furnace or air conditioner to test the system. This may damage the thermostat.
- All wiring must conform to local codes and ordinances.
- This thermostat is designed for use with 4AA alkaline batteries and/or 24 VAC C-wire (or a 12-24 AC or DC source) and millivolt gas systems. Each thermostat relay load should be limited to 1.0 amp; higher amperage may cause damage to the thermostat.

## ⚠ Caution

To avoid electrical shock and to prevent damage to the furnace, air conditioner, and thermostat, **disconnect the power supply** before beginning work. This can be done at the circuit breaker.



## TOOLS

You will need a small Phillips screwdriver and a drill with 3/16-in. (4.8mm) bit for wall mounts.

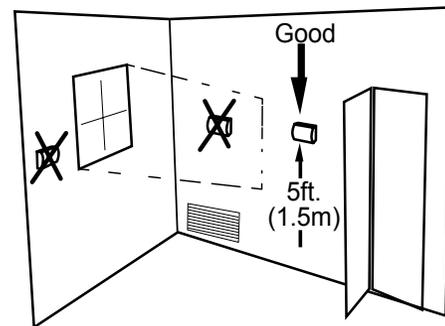
## LOCATION

Replacement installations - mount the CT100 in place of the old thermostat.

A new location will require moving your wiring.

For new installations and relocating the CT100 - follow the guidelines listed below:

- Locate the thermostat on an inside wall, about 5 ft. (1.5m) above the floor, and in a room that is used often.
- Do not install it where there are unusual heating conditions, such as: in direct sunlight; near a lamp, radio, television, radiator register, fireplace; near hot water pipes in a wall; or near a stove on the other side of a wall.
- Do not locate in unusual cooling conditions, such as: on a wall separating an unheated room; or in a draft from a stairwell, door, or window.
- Do not locate in a damp area. This can lead to corrosion that will shorten thermostat life.
- Do not locate where air circulation is poor, such as: in a corner, an alcove; behind an open door.
- Do not install the CT100 until all construction and painting has been completed.
- This thermostat does not require leveling.



## REMOVE OLD UNIT

**⚠ Switch OFF electricity to the HEATING and COOLING systems.**

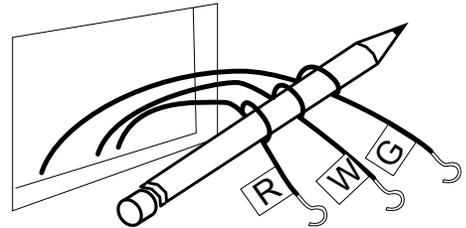
Then follow these steps:

- Remove cover from old thermostat. Most are snap-on types and simply pull off. Some have locking screws on the side or front. These must be loosened. DO NOT remove wires. Note the letters printed near the terminals. Attach labels (enclosed) to each wire for identification.

### **⚠ Caution**

Read instructions carefully before removing any wiring from existing thermostat. Wires must be labeled before they are removed. **THERE IS NO STANDARD COLOR CODE.** When removing wires from their terminals, ignore the color of the wires and **LABEL THEM** by the lettered terminal where they were screwed.

- Label the wires one at a time. You must label all the wires before you proceed.
- With all wires labeled, remove them from the old unit.
- Make sure the wires do not fall back inside the wall. You can wind them around a pencil to keep them from falling.
- Loosen all screws on the old thermostat and remove it from the wall.



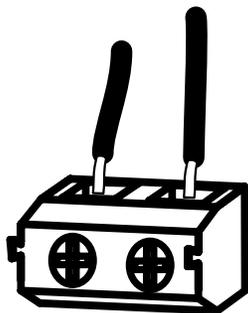
## What wires do you have?

Make sure your wires are labeled. This may require you to find the 'other end' connection for each wire on your heating or air conditioning equipment and read the label there. Refer to the Wire Reference page at end of install section for better understanding of wire labels from different HVAC system makers.

**⚠ IMPORTANT:** The CT100 runs on 4 AA alkaline batteries and/or the C wire if available. If you do not have a C wire you can run a new wire from the HVAC or use a standard 12-24V [AC or DC] wall transformer.

**⚠ IMPORTANT:** If you have *both* RH and RC you need to remove the jumper wire between these 2 terminals.

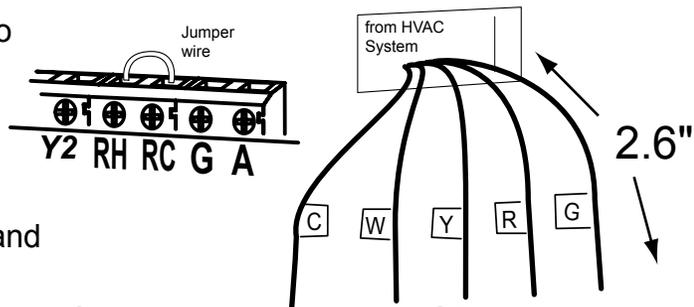
## Prepare Wires



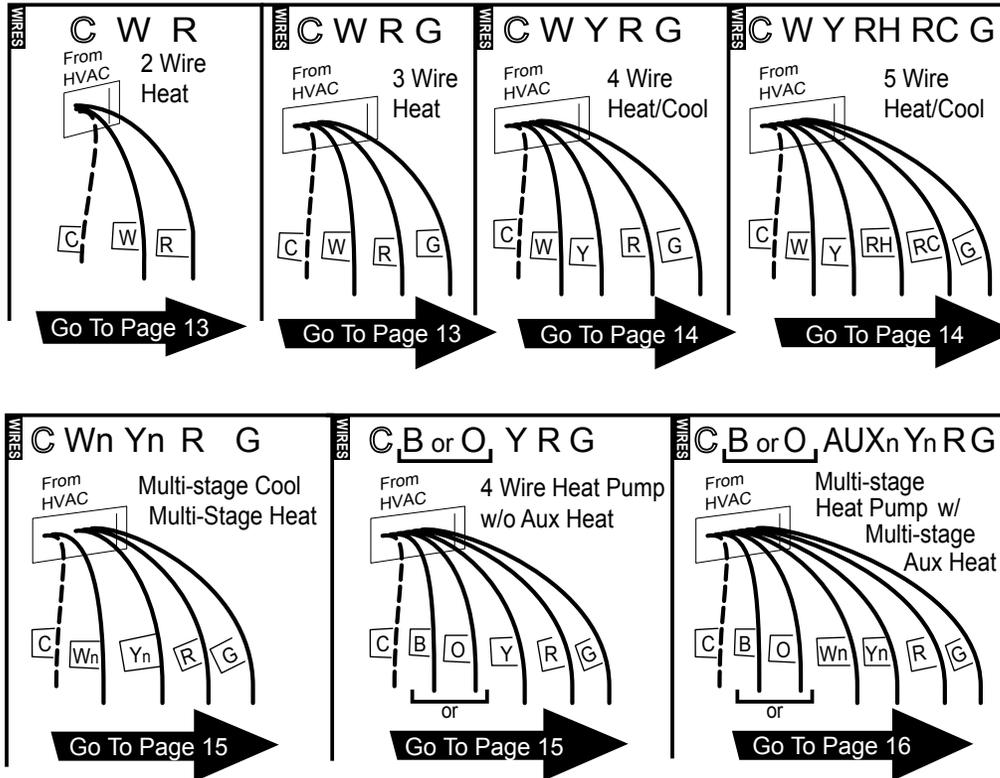
Wire Terminals

Please follow these guidelines for safe and secure wire connections:

- You will need at least 2.6" of wire for each of your connections to the CT100.
- If you do not have enough wire, splice additional wire to allow enough slack.
- Terminals accept wires from 16-22awg.
- Fan out wires below the hole as shown.
- Remove insulation 1/8" from the tip of each wire.
- When handling, take care not to damage the labels for each wire.



## Find the step-by-step diagram for your system



- Select the reference page with your wiring diagram and set-up information below.

- The C-wire is optional but preferred for all installations. It will make batteries last a long time. (This connection is shown as dotted in diagrams).

- Hot Water systems accessories are on Page 16.

- If your combination of wires is not shown, you can use the wiring table at the end of the install section to find your connections. If additional help is required, please contact customer service.

- “Fan out” wires as illustrated with CT100 below the wall opening. As in the example: fan out the wires so that the C wire is above the C terminal, the W above the W. This allows the CT100 to fit snug to the wall.

## **! Caution**

**Do not allow wires to touch each other or parts on thermostat.**

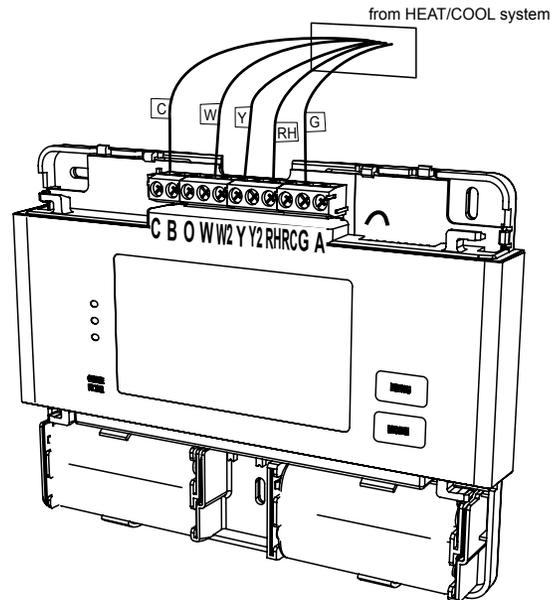
- Position the wires behind the CT100 and up over the terminal area.
- Do not bunch wires behind the CT100. Feed any slack back into the wall opening.

## **Connect Your Wires**

- Connect labeled wires only to a terminal with the same letter label.
- Insert the wire in the terminal well and tighten the screw securely.

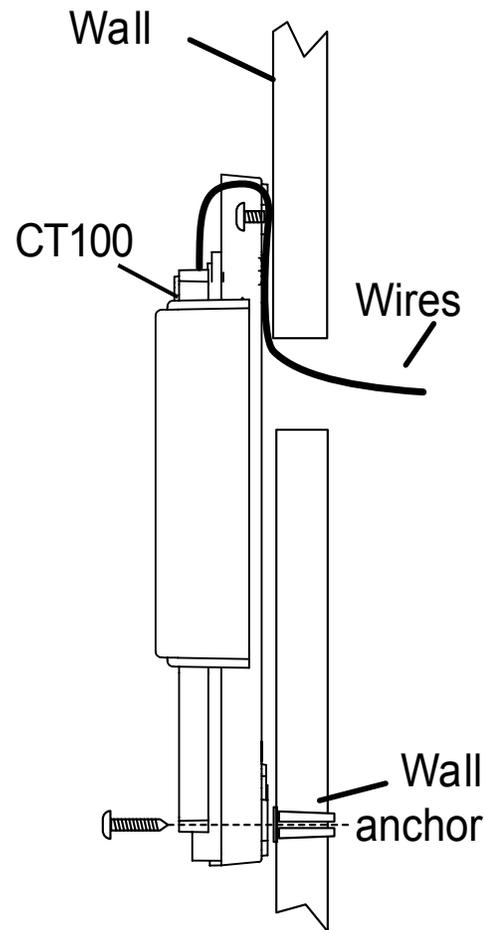
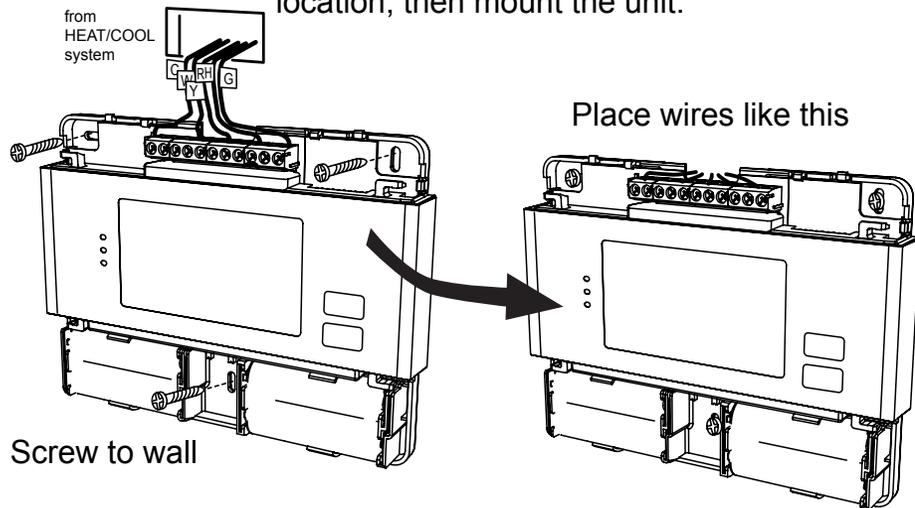
NOTE: If you wish you can mount the CT100 to the wall first, and then connect the wires.

- The CT100 can be externally powered with a power source rated from 12V to 24V, AC or DC, at 100ma or greater. If used, connect to the C and RH terminals (no polarity).



## Mount the CT100 to Wall

1. Hold the CT100 against the wall, with the wires coming over the top; above terminal block. The CT100 will cover the hole in the wall.
2. Position CT100 for best appearance.
3. Attach the CT100 to the wall with the screws provided.
4. If you are mounting the CT100 to sheet rock or if you are using the old mounting holes, use the plastic anchors provided.
5. Mark first and drill a 3/16-in.(4.8mm) hole for the insert at each screw location, then mount the unit.



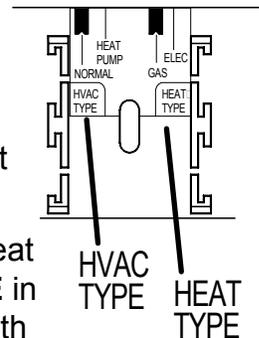
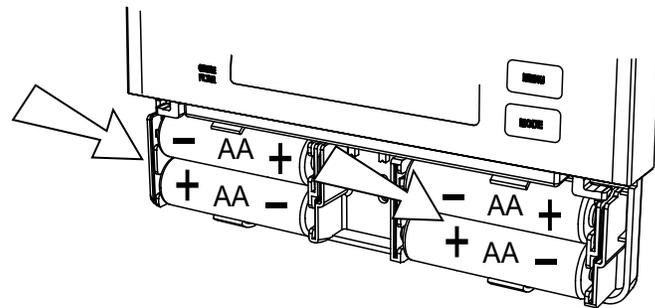
## HVAC Selection

- Set the **HVAC TYPE** switch in the **NORMAL** position if you have conventional natural gas, propane, oil, or electric heat. If you have a HEAT PUMP system, set the **HVAC TYPE** switch to **HEAT PUMP**. They are located in the battery area.
- Set the **HEAT TYPE** switch in the **GAS** position if you have normal gas or oil heat or if you have a heat pump with gas or oil auxiliary heat. Put the **HEAT SOURCE** in the **ELEC** position if you have normal electric heat or if you have a heat pump with electric auxiliary heat.

**⚠ IMPORTANT:** Press the RESET button (under top cover) to implement the HVAC switch selections.

## Install 4 AA Batteries

- Install 4 AA alkaline batteries [required] following the marked polarity in the battery compartment. Put the battery in negative end first against the spring, then push the positive end in.



- With all the wires connected it is time to turn the AC power back on. Do this at the breaker you used to switch it off. The CT100 will power-up in the OFF mode. Your CT100 is not configured to operate your HVAC system yet. You must now configure your thermostat for your HVAC system.



## Caution

### Special Battery Warning

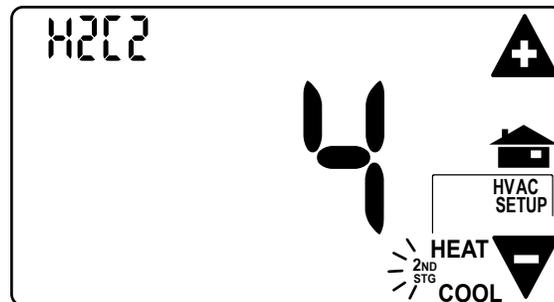
Always replace the batteries as soon as the “Low Batt” flashes. The thermostat is a battery powered device. You must be responsible to replace batteries before they run out. Failure to replace batteries can result in overheating or excessive cooling of your house.

- Even if the “Low Batt” indicator does not flash, you should always replace the batteries at least once a year. Replacing the batteries also helps to prevent leakage that can corrode and damage the thermostat.
- If you are leaving your home for a month or more, you should replace the batteries as a precaution against battery failure in your absence.
- Always use new alkaline batteries.
- Failing to replace the batteries, when necessary, could cause the thermostat to lose power or malfunction. If the thermostat loses power, then the thermostat will not control the temperature which could result in your HVAC system not functioning as you intended and lead to possible damage from overheating or excessive cooling.
- If the thermostat batteries fail with the heat OFF, this can result in NO HEAT and possible frozen or broken pipes and water damage.
- If the thermostat batteries fail with the cool OFF, this can result in NO COOL and could cause possible damage or excessive temperatures.

## HVAC Setup on Screen

**! IMPORTANT:** Make sure the CT100 is powered up and the mode is set to OFF. Remember that the two HVAC selection switches must be set first [pg 8].

- With mode in OFF press MENU and touch HVAC SETUP.
- Use +/- icons to select HVAC SET UP number on screen. The LCD display will show your selection and indicate the number of stages you have selected. During setup, **2nd STG** will blink when both heat and cool have 2nd stages.



**If you have a Normal HVAC system...**

- |                            |        |   |
|----------------------------|--------|---|
| HEAT and COOL              | select | 1 |
| 2 stage HEAT, 1 stage COOL | select | 2 |
| 1 stage HEAT, 2 stage COOL | select | 3 |
| 2 stage HEAT, 2 stage COOL | select | 4 |

**If you have a HEAT PUMP HVAC system...**

- |   |        |   |
|---|--------|---|
| HEAT PUMP with no AUX heat              | select | A |
| 2 stage HEAT PUMP with no AUX           | select | b |
| HEAT PUMP with AUX heat                 | select | C |
| HEAT PUMP with 2 stage AUX heat         | select | d |
| 2 stage HEAT PUMP with AUX heat         | select | E |
| 2 stage HEAT PUMP with 2 stage AUX heat | select | F |

## **!** Caution

Do not change

the HVAC setup or HVAC selection switches if the thermostat is included to Z-Wave network. The HVAC system must be changed, first EXCLUDE the thermostat from the network, change the HVAC setup, and INCLUDE the thermostat to the network.

## Test Installation

Follow these procedures to verify you have correctly installed the CT100.

### TO CHECK FAN (If you connected the G wire):

Touch the fan icon on the HOME screen to turn the fan **ON**.

Verify that air is blowing from the system.

Touch the fan icon again to return to **AUTO**.

### TO CHECK HEAT

Set the mode to **HEAT** by pressing the MODE button until **HEAT** is displayed.

Touch the temperature display to bring up the MANUAL screen.

Touch the **+** icon and raise the target temp to 90°F; allow the system 2 minutes to respond.

Verify that heat is blowing from the system. Return the Target Temperature to a normal setting. Return mode to **OFF** by pressing the mode button.

If you have a heat pump, leave in off for 4 minutes before checking COOL.

### TO CHECK COOL (do not operate AC if the outside temp is below 65°F)

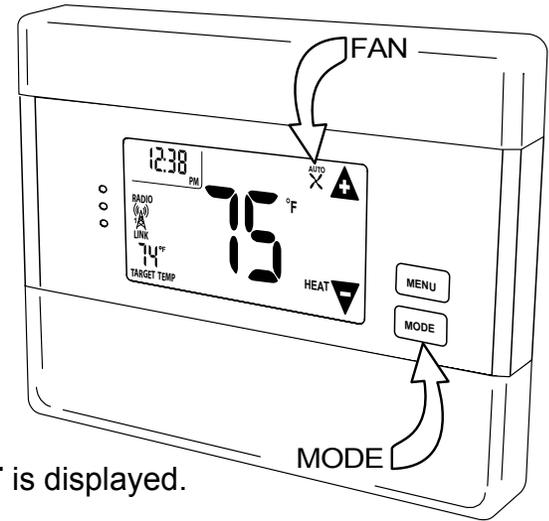
Set the mode to **COOL** by pressing the MODE button until **COOL** is displayed.

Touch the **-** icon and lower cool Target Temperature to 50°F.

Allow the system 5 minutes to respond.

Verify that cool air is blowing from the system. Return the Target Temperature to a normal setting.

Return mode to **OFF** by pressing the mode button.

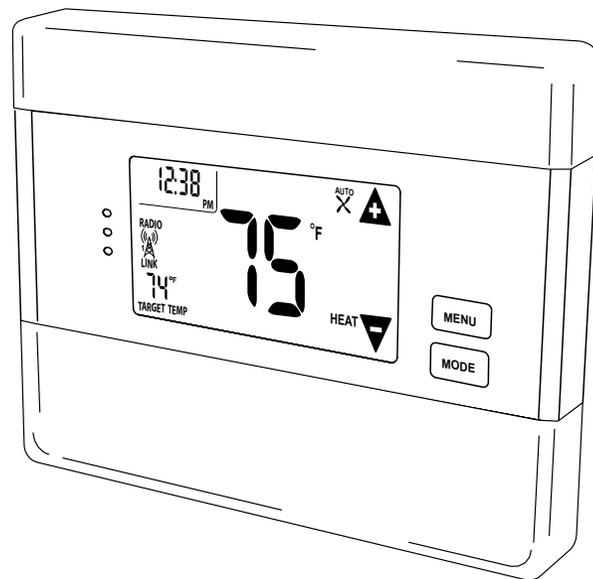


**Congratulations, you have successfully installed your unit. Please proceed to the OPERATING Guide to initialize the CT100.**

**⚠ IMPORTANT:** If you have labeled and connected your wires and followed the correct HVAC setup, and your system still does not operate, contact technical support.

**STATEMENT OF USE:** This thermostat can be used with 4AA batteries, 24VAC (C wire), 24VAC adapter, heating and cooling systems and also millivolt heating. It cannot be used with line voltage systems. This thermostat is digital and your desired heat or cool temperatures can easily be set on the large touch screen with the +/- buttons. A minimum 4 minute off time protects the compressor from damage.

This thermostat runs on 4AA batteries. The CT100 can be externally powered with a power source rated from 12V to 24V, AC or DC, at 100ma or greater. If used, connect to the C and RH terminals (no polarity). The 24VAC "C" wire is the other side of the 24VAC heating transformer and can be found where the other thermostat wires connect at the wall or at the furnace. Do not use the common or ground side of the line voltage.



## Step-by-step wiring diagrams

**C W R**

### 2 Wire Heat GAS MILLIVOLT or 24VAC system

STEP 1 - Connect the R wire to the RH terminal.

This connects the heat power.

STEP 2 - Connect the W wire to the W terminal.

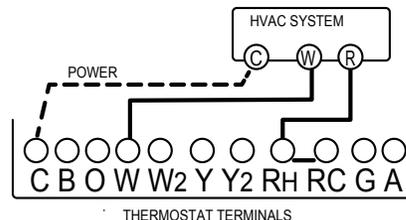
This connects the heat.

STEP 3 - Optional - Connect the C wire to the C terminal.

Your heater is now connected to the CT100.



Please Go To Page 6



**C W R G**

### 3 Wire Heat

STEP 1 - Connect the R wire to the RH terminal. This connects the heat power.

STEP 2 - Connect the W wire to the W terminal. This connects the heat.

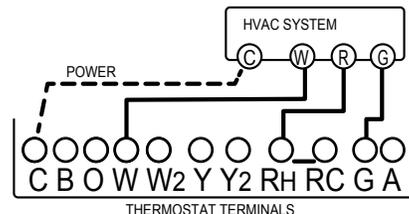
STEP 3 - Connect the G wire to the G terminal on the thermostat. This connects the fan.

STEP 4 - Optional - Connect the C wire to the C terminal.

Your system is now connected to the CT100.



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### WIRE C W Y R G 4 Wire Heat/Cool

STEP 1 - Connect the W wire to the W terminal. This connects the heat.

STEP 2 - Connect the Y wire to the Y terminal. This connects the cooling compressor.

STEP 3 - Connect the RH or R wire to the RH terminal. This connects the power.

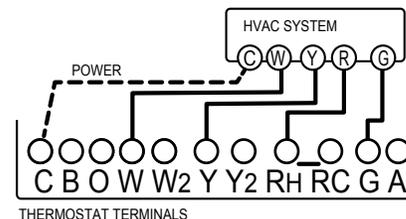
STEP 4 - Connect the G wire to the G terminal on the thermostat.

This connects the fan.

STEP 5 - Optional - Connect the C wire to the C terminal.

Your HVAC system is now connected to the CT100.

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### WIRE C W Y RH RC G 5 Wire HEAT/Cool

STEP 1 - Connect the W wire to the W terminal. This connects the heat.

STEP 2 - Connect the Y wire to the Y terminal. This connects to the cooling compressor.

STEP 3 - Remove the jumper between RC and RH terminals [small silver wire].

STEP 4 - Connect the RH wire to the RH terminal and the RC wire to the RC terminal.

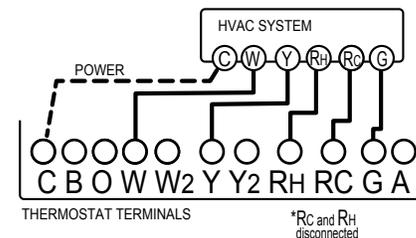
This connects the power.

STEP 5 - Connect the G wire to the G terminal. This connects the fan.

STEP 6 - Optional - Connect the C wire to the C terminal.

Your HVAC system is now connected to the CT100.

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WIRING © Wn Yn RG

### Multi-stage Heat and Multi-stage Cool

The CT100 can handle up to 2 stages of HEAT and 2 stages of COOL.

STEP 1 - Connect the W, W2 wires to the W terminals.

This connects the stages of HEAT.

STEP 2 - Connect the Y and Y2 wires to the Y terminals.

This connects the stages of COOL.

STEP 3 - Connect the RH or R wire to the RH terminal.

This connects the power.

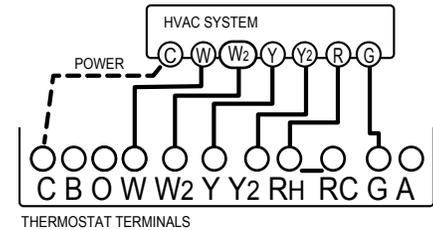
STEP 4 - Connect the G wire to the G terminal.

This connects the fan.

STEP 5 - Optional - Connect the C wire to the C terminal.

Your HVAC system is now connected to the CT100.

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THERMOSTAT TERMINALS

WIRING © B or O Yn RG

### Heat Pump (heat/cool) without Auxiliary Heat

STEP 1 - Connect O wire to the O terminal or B wire to the B terminal.

This connects the change-over valve.

**IMPORTANT NOTE:** If you have *both* O and B - connect only the O wire to the O terminal and DO NOT connect B to the B terminal (see wire reference under Trane for B wire terminal).

STEP 2 - Connect the Y wire to Y terminal. This connects the compressor.

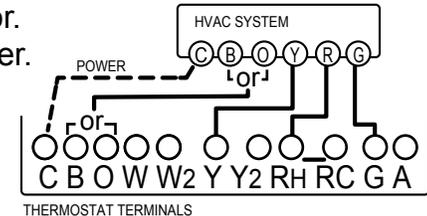
STEP 3 - Connect the R wire to the RH terminal. This connects the power.

STEP 4 - Connect the G wire to the G terminal. This connects the fan.

STEP 5 - Optional - Connect the C wire to the C terminal.

Your HVAC system is now connected to the CT100.

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THERMOSTAT TERMINALS

**WIRING** **C O or B AUX<sub>n</sub> Y<sub>n</sub> R G** **Multi-stage Heat Pump with Multi-stage Aux Heat**

The CT100 can handle up to 2 stages of Pump compression and 2 stages of AUX heat.

STEP 1 - Connect O wire to the O terminal **or** B wire to the B terminal. This connects the change-over valve.

If you have both O and B - connect only the O wire to the O terminal and DO NOT connect B to B terminal (see wire reference under Trane for B wire terminal).

STEP 2 - Connect the AUX 1, AUX 2, to the AUX 1 and 2 respectively.

This connects the auxiliary heat.

STEP 3 - Connect the Y and Y2 wires to the Y terminals.

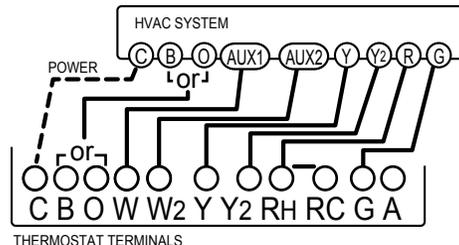
This connects the compressor.

STEP 4 - Connect the R wire to RH terminal. This connects the power.

STEP 5 - Connect the G wire to G terminal. This connects the fan.

STEP 6 - Optional - Connect the C wire to the C terminal.

Your HVAC system is now connected to the CT100.



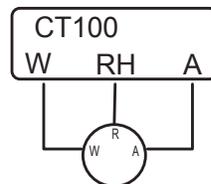
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**Accessory Wiring -**

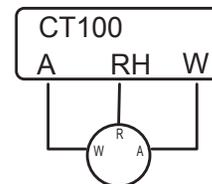
**3 Wire Zoned Hot Water Heat -**

For 3 wire solenoid or motor valves connect the wires shown to the correct terminals on the CT100. If you have different letters than shown, go to page 18 Wire Reference Table.

**FOR 3 WIRE ZONED HOT WATER**



MOTOR VALVE



SOLENOID VALVE

## Wire Reference Table

### *Possible Wires*

R or V or VR

RH or 4

RC

W

W2

AUX or AUX1

AUX2

Y

Y2

G or F

C or X

H

DH

EX

B

O

B and O

E

L

T

### *What They Control*

**RH** and **RC** Single power for HEAT and COOL

**RH** Power for HEAT (RH not connected to RC jumper wire removed)

**RC** Power for COOL (RH not connected to RC jumper wire removed)

**W** Heat control

**W2** 2nd stage HEAT

**AUX1** 1st stage of AUX heat in the CT100

**AUX2** 2nd stage of AUX heat in the CT100

**Y** COOL control or 1st stage compression for heat pump

**Y2** 2nd stage COOL control or 2nd stage compression for a heat pump

**G** FAN control

**C** 24VAC power (to power thermostat)

NOTE: TRANE, AMERICAN STANDARD and YORK often use the letter B for C

**H** External Humidifier

**DH** External Dehumidifier

**EX** external fresh air baffle

**B** Heat pump changeover (cool to heat, powered in heat)

**O** Heat pump changeover (heat to cool, powered in cool)

**⚠ IMPORTANT: If there are both B and O wires (Trane pump products) DO NOT CONNECT B to B terminal, connect B to C terminal.**

**E** n/a Emergency heat (do not connect, tape off)

**L** n/a System monitor (do not connect, tape off)

**T** n/a Outdoor sensor (do not connect, tape off)

## Wire Reference cont.

<i>Possible Wires</i>	<i>What They Control</i>
<b>Lennox Heat Pump</b>	
V or VR or R	RH Power for HEAT
M or Y	Y COOL control
Y or W or W2	W2 2nd stage HEAT
F or G	G Fan control
R or O	O
X or X2 or C	C

### Trane Products [American Standard]

B	C 24VAC power (to power thermostat)
X2	Emergency heat (do not connect, tape off)

### Zoned Hot Water

#### 2 wire

Your Wires	Thermostat Terminal
R	RH
W	W

#### 3 Wire

#### Motor Driven Valves

R or 5	RH (power)
W or 4	W (heat ON)
Y or G or 6 (the 3rd wire)	A (heat OFF)

#### 3 Wire

#### Solenoid Valves

R	RH (power)
W	A (heat ON)
Y or G (the 3rd wire)	W (heat OFF)

## **APPENDIX 1 Multi staged HVAC theory of operation for the CT100**

### **Staging for 2 stage normal or heat pump Cool**

**Target Temperature Maintenance in COOL** - If the room temperature is within the target temperature plus the DIFF setting, the first stage of cool will turn on. If the target temperature is not reached within 15 minutes, the second stage of cooling will turn on and join the first stage to reach the target temperature.

**Target Temperature Recovery in COOL**- If the room temperature is beyond the new target temperature plus the DIFF setting, the first stage will turn on. Ten seconds later, the second stage will turn on with the first stage to help reach the new target.

With FAST recovery, both stages stay on until the new target temperature is reached. With ECON recovery, both stages stay on until the DIFF setting is reached. Then, the second stage shuts off and the first stage stays on to the new target.

### **Staging for 2 stage normal Heat**

**Target Temperature Maintenance in HEAT** - If the room temperature is within the target temperature minus the DIFF setting, the first stage of heat will turn on. If the target temperature is not reached within 15 minutes, the second stage of heat will turn on and join the first stage to reach the target temperature. Example: Target temperature 70F, DIFF at 2F, maintenance occurs at room temperatures of 69F and 68F.

**Target Temperature Recovery in HEAT**- If the room temperature is beyond the new target temperature minus the DIFF, the first stage will turn on. Ten seconds later, the second stage will turn on and join the first stage to help reach the target temperature.. With FAST recovery, both stages stay on until the target temperature is reached.

With ECON recovery, both stages stay on until the DIFF setting is reached. Then, the second stage shuts off and the first stage stays on until the target temperature is reached.

### **Staging for a 2 stage Heat Pump with no auxiliary heat**

**Target Temperature Maintenance** - If the room temperature is within the target temperature minus the DIFF setting, the first stage heat pump will turn on. If the target temperature is not reached within 15 minutes, the

second stage of heat pump will turn on and join the first stage to reach the target.

**Target Temperature Recovery** - If the room temperature is beyond the new target temperature minus the DIFF setting, the first stage will turn on. Ten seconds later, the second stage will turn on and join the first stage to reach the target temperature.

With FAST recovery, both stages stay on until the new target temperature is reached. With ECON recovery, both stages stay on until the DIFF setting is reached. Then the second stage shuts off and the first stage stays on until the new target temperature is reached.

### **Staging for Heat Pump with 1 or 2 stages of compression and 1 or 2 stages of auxiliary heat**

**Target Temperature Maintenance** - If the room temperature is within the target temperature minus the DIFF setting, the auxiliary heat will not be used, just the heat pump (1 or 2 stages) as explained above in “target temperature maintenance”.

**Target Temperature Recovery** - If the room temperature is beyond the new target minus the DIFF setting, the first stage of heat pump will turn on, ten seconds later the second stage of heat pump will turn on, ten seconds later the first stage of auxiliary heat will turn on. If the new target temperature is then not reached after 15 minutes, the second stage of auxiliary heat will turn on. If the new target temperature is not reached 15 minutes after that, the third stage of auxiliary heat will turn on.

With FAST recovery all stages will stay on until the new target temperature is reached. With ECON recovery all stages will stay on until the DIFF setting is reached. Then only the heat pump stays on until the new target temperature is reached.

**ELECTRIC vs. GAS or OIL auxiliary heat** - With electric auxiliary heat, the heat pump stays on while the auxiliary heat is on. With gas or oil auxiliary heat, the heat pump will shut off while the auxiliary heat is on. This is required by heat pump design.