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**Manufacturer: Sensus Metering Systems
Model: HANXCVR01**

Manual

Installation and Users Guide

HAN FlexNet™ Transceiver with HAI RC2000 Thermostat Series

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Sensus Metering Systems

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RC-2000 Thermostat Installation Instructions

DESCRIPTION

The RC-2000 is a precision digital thermostat designed for 24 VAC heating and cooling systems. The RC-2000 will support the following systems:

- Single Stage Heat/Cool Conventional
- Two Stage Conventional (2 Stage Heat / 2 Stage Cool)
- Heat Pump (2 Stage Heat / 1 Stage Cool)
- Two Speed Heat Pump (3 Stage Heat / 2 Stage Cool)
- Dual Fuel Heat Pump
- Humidifier and Dehumidifier Control

The RC-2000 has the capability of being controlled both locally and by remote control. It offers programmability, stand-alone operation, and robust, optically isolated communications with automation systems, utility control systems, and personal computers.

Electrical rating: 24 V; 2 A; 50/60 Hz
Maximum current: 2 A on any circuit, 3 A total

The following requirements must be observed for installation in Europe: CE

1. This equipment must be installed in accordance with National wiring rules for the country in which it is installed.
2. All product labels, instructions and markings relating to safety must be translated to a language, which is acceptable in the country in which this equipment is to be installed.

INSTALLATION

Before installing this thermostat:

1. Read all of the Installation Instructions carefully.
2. Read the Owner's Manual carefully.
3. Ensure that this product is suitable for your application.
4. Ensure that wiring complies with all codes and ordinances.
5. Disconnect power to the control transformer to prevent electrical shock and damage to equipment.
6. Select an appropriate location to ensure an accurate temperature reading.

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Location

When replacing an existing thermostat, install the RC-2000 in the same location. If the existing location doesn't meet the following criteria, choose a new location to mount the RC-2000. When choosing a location for the thermostat:

1. Ensure that the thermostat is mounted 5 feet above the floor and is at least 2 feet from an outdoor wall.
2. Ensure that the thermostat is located in an area where there is adequate air circulation.
3. Do not mount in the path of direct sunlight or of radiant heat generated by appliances.
4. Do not mount behind an outdoor wall, near a fireplace, or in the path of any air ducts.

Removing an existing thermostat

1. Disconnect the power to the control transformer.
2. Remove the cover to the existing thermostat.
3. Disconnect the wires going to each terminal on the thermostat. Label each wire with the letter or number at the terminal.
4. Remove the existing plate or base from the wall.

MOUNTING

When mounting the RC-2000, grasp the thermostat by the sides, avoiding the keys, and unsnap the base from the face. Holding the base to the wall so that the word "UP" is upright and facing you:

1. Mark the two mounting holes on the wall using a pencil.
2. Drill a hole using a 3/16" bit at each mounting hole marking.
3. Install the two wall anchors supplied.
4. Slide the system wires through the opening in the base.
5. Mount the base to the wall using the two #6 x 1/2" self-tapping screws supplied - See *Figure 1*.

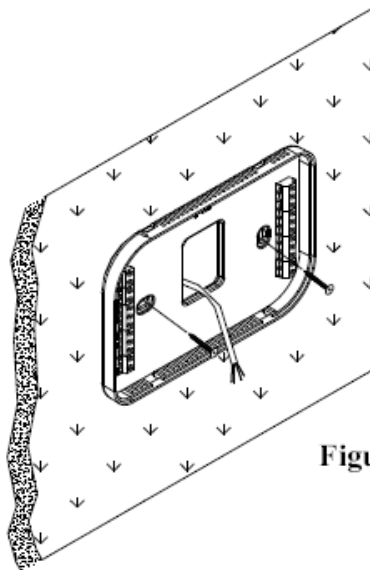


Figure 1

Connect each wire to the terminal strip(s) on the thermostat base per the wiring diagram for your system application - See *Figures 4 - 10*. Form the thermostat wiring so that the cable lies flat between the terminal strip(s) and the center of the base - See *Figure 2*.

If a remote system or temperature sensor is being used with the thermostat, connect the remote system or temperature sensor wiring per the diagram for the application - See *Figures 11 - 13*.

Upon completion of wiring the thermostat, push all excess wiring into the hole in the wall. Plug the hole with the supplied insulating foam to ensure an accurate temperature reading by the thermostat.

Align the tabs of the thermostat face with the slots of the thermostat base. Gently push the thermostat face into the thermostat base locking it into place - See *Figure 2*.

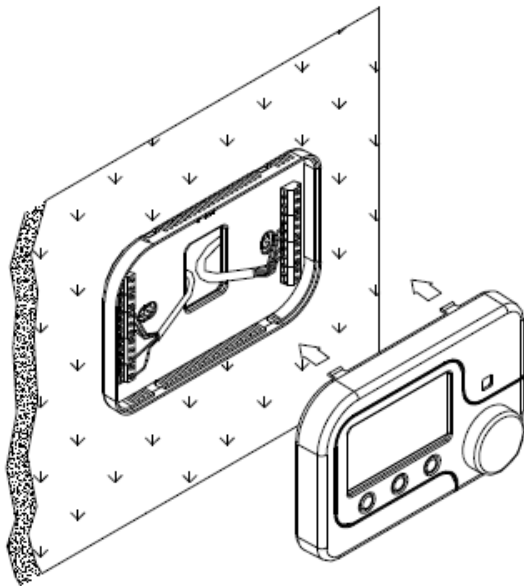


Figure 2

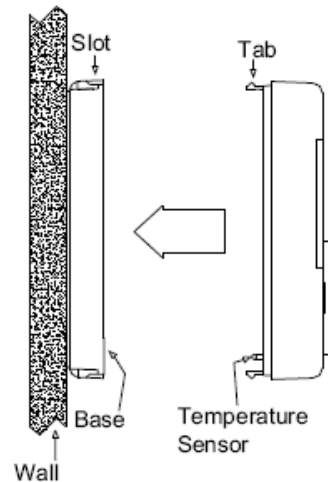


Figure 3

Note:

Be sure that the thermostat temperature sensor is standing up, and that it has not been damaged during installation - See *Figure 3*.

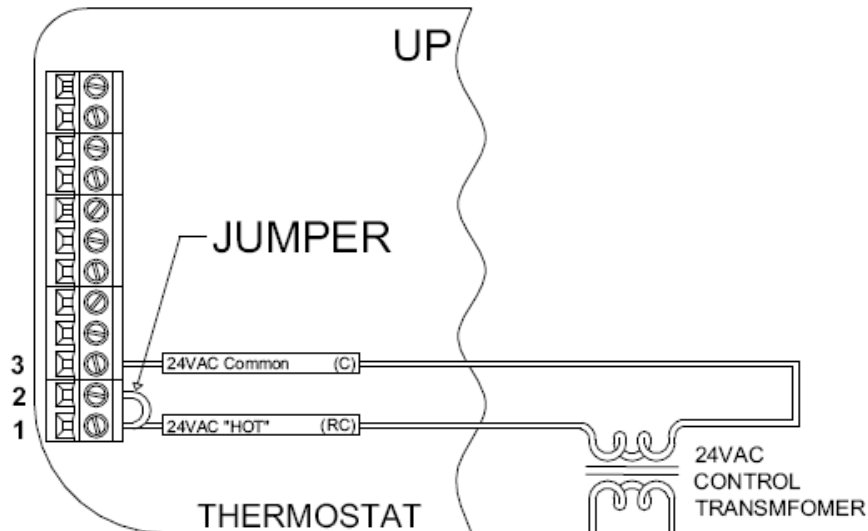
TYPICAL WIRING DIAGRAMS



CAUTION: Be sure to disconnect the power to the control transformer before removing or installing thermostat.

Do not short gas valve, fan, heat relay, or cool relay...even momentarily.

Do not attempt to hook up to live circuits. An accidental connection to a component on the thermostat circuit board could cause damage to the thermostat.



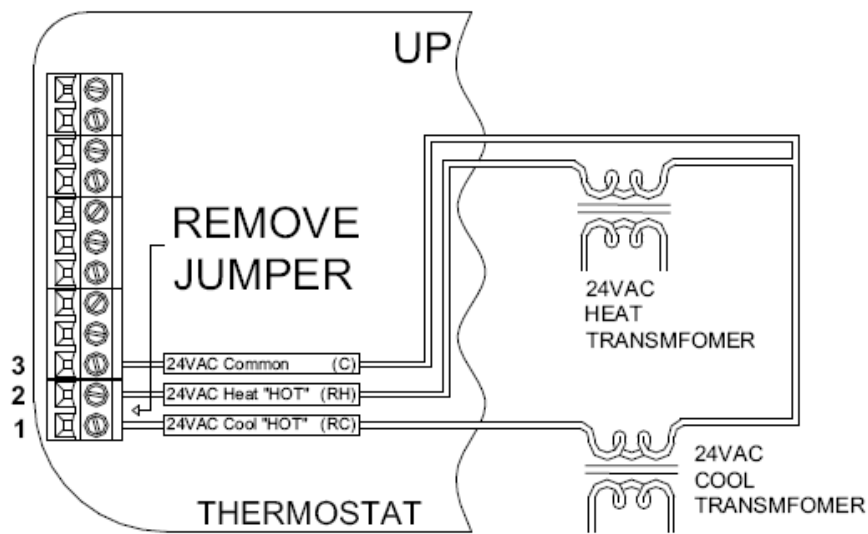
For HVAC systems with a single transformer, the metal jumper between Terminal 1 (RC) and Terminal 2 (RH) on the left terminal strip must remain in place.

Figure 4 – Thermostat power-up for test or configuration purposes

Important Notes:

1. For HVAC systems with a single transformer for heating and cooling, the metal jumper between Terminal 1 (RC) and Terminal 2 (RH) on the left terminal strip must remain in place – See *Figure 4*.
2. From the factory, the RC-2000 is configured to control a single stage conventional HVAC system.
 - If the HVAC system is a heat pump, dual fuel heat pump, or if the thermostat is connected to a zone control system that requires a sub-base, before operating the thermostat, the “System Type” settings under “System Options” must be configured – See *Installation Settings*.
 - If the HVAC system is a two stage conventional or two speed heat pump, before operating the thermostat (making a call for heat or cool), the “Cool Stages” and “Heat Stages” settings under “Stage Settings” must be configured – See *Installation Settings*.

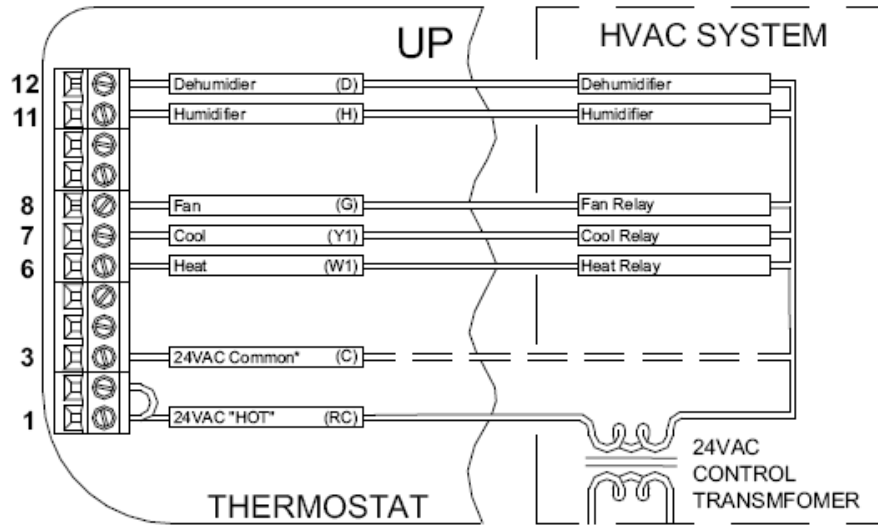
3. When configured as a conventional thermostat, by default this thermostat does not turn the fan on with a call for heat. If the furnace requires the thermostat to turn the fan on with a call for heat, configure the "System Mode" to "Fan On With Heat" under "System Options".
4. A conventional thermostat can be configured for automatic changeover heat/cool, manual changeover heat/cool, heat only, or cool only thermostat.
5. Refer to the "Configuration" steps under the wiring diagram for the respective HVAC system type.
6. If the thermostat or HVAC system does not perform as stated in the "Power Up" steps under the wiring diagram for the respective HVAC system, recheck all wiring - See *Troubleshooting Tips*.
7. For HVAC systems with separate heating and cooling transformers, the metal jumper between Terminal 1 (RC) and Terminal 2 (RH) on the left terminal strip must be removed – See *Figure 5*.



For HVAC systems with separate heating and cooling transformers, the metal jumper between Terminal 1 (RC) and Terminal 2 (RH) on the left terminal strip must be removed.

Figure 5 – *Connections for heat and cool transformers - applies to all systems*

Single Stage Conventional



* Common wire is required in "heat only" or "cool only" applications. Also use a common if heat, cool, or fan relay cannot supply 15mA to power thermostat, without activating.

Figure 6 – Connections for single stage heat/cool thermostat

CONFIGURATION

- From the factory, the RC-2000 is configured as a single stage conventional heat/cool thermostat.
- In the default configuration, this thermostat does not turn the fan on with a call for heat. If the furnace does not turn the fan on with a call for heat, the thermostat must be configured to do so under "System Options".

POWER UP

1. Double check wiring, be sure that there are no stray wires or wire strands at the connections.
2. Connect power to the transformer and system. The display will show the current thermostat settings.
3. Press [FAN] and select "On". The fan should come on.
4. Press [FAN] and select "Auto". The fan should go off.
5. Set the Mode to "Heat". Raise the desired heat setting above the current temperature. Ensure that the heating unit comes on. Set the mode to "Off". Ensure that the heating unit goes off.
6. Set the Mode to "Cool". Lower the desired cool setting below the current temperature. Ensure that the cooling unit comes on. Set the mode to "Off". Ensure that the cooling unit goes off.

The RC-2000 thermostat is designed to work with most single state conventional 4-wire HVAC systems (without a transformer common). However, if the RC-2000 "resets" when calling for heat or cool, or if the heat, cool, or fan relay cannot supply 15mA to power thermostat without the relay activating, the transformer common wire or the HAI Thermostat Power Supply Module (Part Number: 30A00-1) is required.

Single Stage Conventional for Zone Control Systems

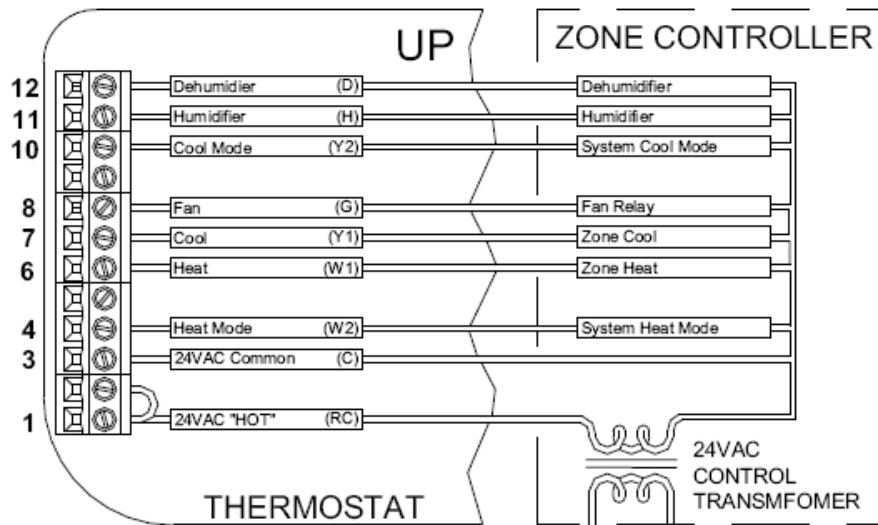


Figure 7 – Connections for single stage thermostat for zone control systems

CONFIGURATION

- The “System Type” for this thermostat must be set to “Zone Control” under “System Options”.

The two additional outputs (W2 and Y2) are use with zoned heating and cooling systems. The W2 and Y2 terminals control the mode of operation (heating or cooling) of the zone control panel. The zone control panel will recognize calls for heat (W) from the individual zones when the W2 terminal is energized, and calls for cool (Y) when the Y1 terminal is energized. Neither W2 nor Y2 is energized when the mode is set to “OFF”. Therefore, the RC-2000 can act as a Master to set the operating mode of the entire system.

POWER UP

1. Double check wiring, be sure that there are no stray wires or wire strands at the connections.
2. Connect power to the transformer and system. The display will show the current thermostat settings.
3. Press [FAN] and select “On”. The fan should come on.
4. Press [FAN] and select “Auto”. The fan should go off.
5. Set the Mode to “Heat”. Raise the desired heat setting above the current temperature. Ensure that the heating unit comes on. Set the mode to “Off”. Ensure that the heating unit goes off.
6. Set the Mode to “Cool”. Lower the desired cool setting below the current temperature. Ensure that the cooling unit comes on. Set the mode to “Off”. Ensure that the cooling unit goes off.

Two Stage Conventional (2 Stage Heat / 2 Stage Cool)

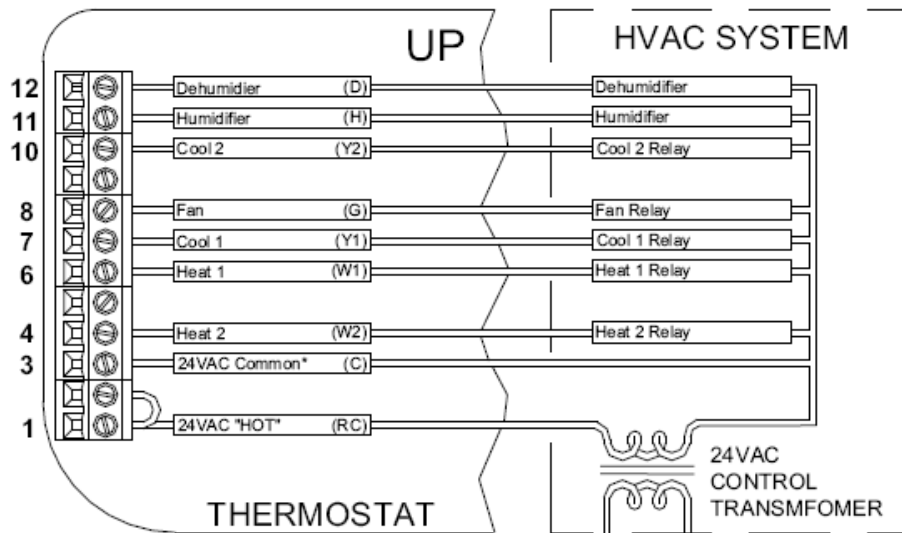


Figure 8 – Connections for two stage conventional thermostat

CONFIGURATION

- The “System Type” for this thermostat must be set to “Conventional” under “System Options”.
- In the default configuration, this thermostat does not turn the fan on with a call for heat. If the furnace does not turn the fan on with a call for heat, the thermostat must be configured to do so under “System Options”.
- The “Cool Stages” and “Heat Stages” settings must be configured under “Stage Settings”.

POWER UP

1. Double check wiring, be sure that there are no stray wires or wire strands at the connections.
2. Connect power to the transformer and system. The display will show the current thermostat settings.
3. Press [FAN] and select “On”. The fan should come on.
4. Press [FAN] and select “Auto”. The fan should go off.
5. Press [HOLD] and select “On” to override Energy Efficient Control.
6. Set the Mode to “Heat”. Raise the desired heat setting 1 degree above the current temperature. Ensure that Stage 1 heat comes on. After a few minutes, raise the desired heat setting 3 degrees above the current temperature. Stage 2 heat should come on. Set the mode to “Off”. Ensure that the heating unit goes off.
7. Set the Mode to “Cool”. Lower the desired cool setting 1 degree below the current temperature. Ensure that Stage 1 cool comes on. After a few minutes, lower the desired cool setting 3 degrees below the current temperature. Stage 2 cool should come on. Set the mode to “Off”. Ensure that the cooling unit goes off.
8. Press [HOLD] and select “Off” to enable Energy Efficient Control.

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About Heat Pump Systems

- 1) Terminal 5 (O) is energized for cooling
Terminal 6 (B) is energized for heating

In most applications, the reversing valve is energized for cooling and should be connected to the "O" terminal. If the heat pump requires the reversing valve to be energized for heating, connect the reversing valve to the "B" terminal.

- 2) With a call for Stage 2 on a two speed heat pump, **both** compressor outputs Y1 and Y2 are energized. When 2 stages of cooling and 2 stages of heating are configured for a heat pump, Stage 2 is considered high speed on the heat pump and not auxiliary heat. If auxiliary heat (or emergency heat) is needed, configure 3 stages of heating on the heat pump.
- 3) To temporarily disable Energy Efficient Control and heat as quickly as possible, press [HOLD] and select "On". The RC-2000 will use the Auxiliary Heat as needed to reach the heat setting.
- 4) Terminal 9 (L) is used to indicate a fault with the heat pump compressor. When there is a compressor fault, the display will flash red and the "Heat Pump Fault" error message is shown.
- 5) The Emergency Heat Relay (E Terminal) and outdoor thermostats (usually accessories to a heat pump), are not used. The RC-2000 automatically controls auxiliary heat efficiently. If the heat pump is equipped with an outdoor thermostat, it should be removed from the auxiliary heat circuit.

About Dual Fuel Heat Pump Systems

A dual fuel heat pump typically has a gas furnace combined with a heat pump. The gas furnace is used as auxiliary heat unless the outdoor temperature is very low, in which case it is used as the primary heat source.

- 1) When used with dual fuel heat pumps, the RC-2000 requires a method for obtaining the outdoor temperature. A temperature sensor can be physically connected to the "Remote Temp. Sensor" terminals on the thermostat or the RC-2000 can obtain the outdoor temperature from a remote system.

If the RC-2000 can not obtain the outdoor temperature, the heat pump compressor will not operate and the thermostat will only call for the auxiliary heat until the problem is resolved. When this occurs, the display will flash red and the "Problem With Outdoor Temperature Sensor. Some Heat Stages May Be Disabled" error message is displayed. After the error has been acknowledged, "Outdoor Sensor Fault" will be displayed in the Message Bar until the problem is resolved.

- 2) Balance Setpoint Limits:
 - If the outdoor temperature is above the "Upper Balance Setpoint" (45°F by default), the heat pump is used exclusively.
 - If the outdoor temperature falls below the "Upper Balance Setpoint" but is above the "Lower Balance Setpoint" (35°F by default) and if the heat pump is unable to heat at a rate of 5 degrees per hour or better, the heat pump will turn off and auxiliary heat will be used until the call for heat has been satisfied.
 - If the outdoor temperature falls below the "Lower Balance Setpoint", the heat pump will turn off and the auxiliary heat will be used until the call for heat has been satisfied.
 - The Balance Setpoint Limits can be adjusted according to the manufacturer's specifications under "Balance Setpoint" – See *Installation Settings*.
- 3) When the RC-2000 makes a call for auxiliary heat, the heat pump compressor is turned off and the auxiliary heat is used exclusively.

Heat Pump (2 Stage Heat / 1 Stage Cool)

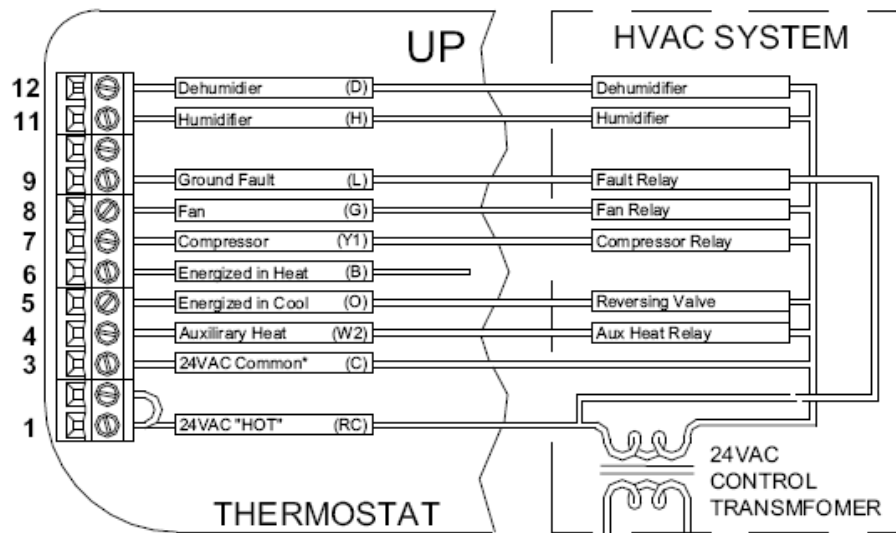


Figure 9 – Connections for heat pump thermostat

CONFIGURATION

- The “System Type” for this thermostat must be set to “Heat Pump” under “System Options”.
- The “System Type” for this thermostat must be set to “Dual Fuel Heat Pump” for a dual fuel system (Terminal “W2” is connected to the “W” or “W1” on the furnace).

POWER UP

1. Double check wiring, be sure that there are no stray wires or wire strands at the connections.
2. Connect power to the transformer and system. The display will show all of the thermostat settings.
3. Press [FAN] and select “On”. The fan should come on.
4. Press [FAN] and select “Auto”. The fan should go off.
5. Press [HOLD] and select “On” to override Energy Efficient Control.
6. Set the Mode to “Heat”. Raise the desired heat setting 1 degree above the current temperature. Ensure that the heat pump comes on, in heating mode. After a few minutes, raise the desired heat setting 3 degrees above the current temperature. Auxiliary heat should come on. After a few minutes, set the mode to “EM Heat”. The heat pump should stop but the auxiliary heat should remain on. Set the mode to “Off”. Ensure that both the heat pump and auxiliary heat go off.
7. Set the Mode to “Cool”. Lower the desired cool setting below the current temperature. Ensure that the heat pump comes on, in cooling mode. Set the mode to “Off”. Ensure that the cooling unit goes off.
8. Press [HOLD] and select “Off” to enable Energy Efficient Control.

Two Speed Heat Pump (3 Stage Heat / 2 Stage Cool)

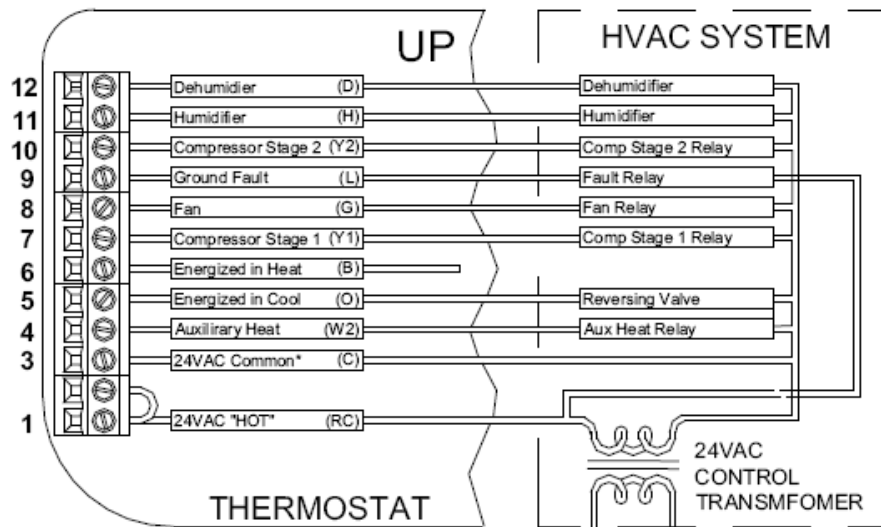


Figure 10 – Connections for two speed heat pump thermostat

CONFIGURATION

- The “System Type” for this thermostat must be set to “Heat Pump” under “System Options”.
- The “Cool Stages” and “Heat Stages” settings must be configured under “Stage Settings”.

POWER UP

1. Double check wiring, be sure that there are no stray wires or wire strands at the connections.
2. Connect power to the transformer and system. The display will show the current thermostat settings.
3. Press [FAN] and select “On”. The fan should come on.
4. Press [FAN] and select “Auto”. The fan should go off.
5. Set the Mode to “Heat”. Raise the desired heat setting 1 degree above the current temperature. Ensure that the heat pump comes on, in heating mode. Press [HOLD] and select “On” to override Energy Efficient Control. Stage 2 heat should come on.
6. Raise the desired heat setting 3 degrees above the current temperature. Auxiliary heat should come on.
7. After a few minutes, set the mode to “EM Heat”. Both stages of the heat pump should stop but the auxiliary heat should remain on. Set the mode to “Off”. Ensure that the auxiliary heat goes off.
8. Press [HOLD] and select “Off” to enable Energy Efficient Control. Set the Mode to “Cool”. Lower the desired cool setting 1 degree below the current temperature. Ensure that the heat pump comes on, in cooling mode. Press [HOLD] and select “On”. Stage 2 cool should come on.
9. Set the mode to “Off”. Ensure that both stages of the cooling unit go off.
10. Press [HOLD] and select “Off” to enable Energy Efficient Control.

REMOTE SYSTEM WIRING DIAGRAMS

This thermostat has been preprogrammed with energy saving program schedules in accordance with the ENERGY STAR[®] program. When used with a remote system, HAI recommends that the Program Mode be configured as "None" or "Occupancy". This will disable the internal program schedules.

HAI HOME CONTROL SYSTEMS

The thermostat can be connected to an HAI Home Control system. The controller can send commands to the thermostat to change mode, cool setting, heat setting, status of fan and hold, and other items.

Run a 3 (or 4) conductor wire from the HAI system to the thermostat location. All thermostats on an HAI Home Control system are connected to Ground, Zone +16, and Output 8 - See *Figure 11*.

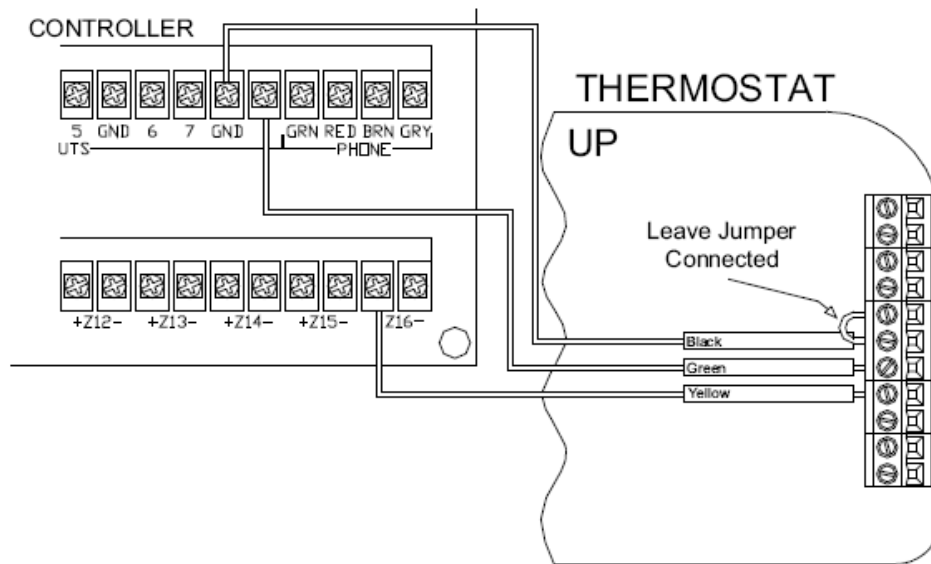


Figure 11 – *Connections to HAI Home Control System*

Notes:

1. Additional thermostats are connected in parallel. They may be connected in home-run or daisy chain configuration.
2. When connecting to an HAI Home Control System, the metal jumper between terminal labeled "N/C" and the terminal labeled "Black" on the right terminal strip must remain in place – See *Figure 11*.
3. All thermostats on an OmniLT controller are connected to the GRN (Green), BLK (Black), and YEL (Yellow) terminals under the section marked "TSTAT".

REMOTE SETBACK SWITCH

The thermostat can be connected to a remote switch to toggle the desired heat and cool temperature settings between preset setpoints. A signal can be sent from the remote switch location to change the thermostat temperature settings from the *Occupancy Day* temperature settings to the *Occupancy Night* temperature settings. To use this mode, the "Program Options" setting must be set to "Occupancy" - See *Program Options*.

Run a two-conductor wire from the remote switch to the thermostat location. Make the connections to the Black and Green terminals under the section marked "Comm" on the right terminal strip - See *Figure 12*.

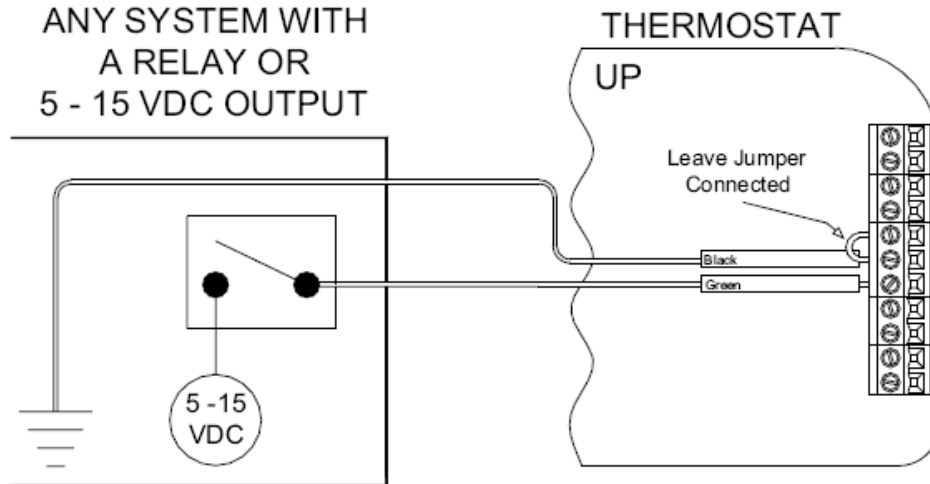


Figure 12 – Connections to a Remote Setback Switch

Notes:

1. When connecting to a remote setback switch, the metal jumper between terminal labeled "N/C" and the terminal labeled "Black" on the right terminal strip must remain in place - See *Figure 12*.
2. When 0VDC is applied, the desired temperature settings will change to the preset *Occupancy Day* temperature settings.
3. When 5-15VDC is applied, the desired temperature settings will change to the preset *Occupancy Night* temperature settings.

OTHER SYSTEMS

For connections to personal computers, utility management systems, and other automation systems, refer to connection diagrams provided with personal computer software package or other system.

REMOTE TEMPERATURE SENSOR

A remote temperature sensor can be installed to monitor the temperature from a remote location or can be combined with the onboard temperature sensor for the average temperature of two locations.

Run a twisted pair, shielded cable from the RC-2000 to the remote temperature sensor location. For distances up to 100 feet, typical twisted pair, PVC-insulated, shielded cable may be used. For distances from 100-150 feet, twisted pair with polypropylene insulated conductors, shielded must be used. For distances from 150-250 feet, twisted pair with foam-polyethylene insulated conductors, shielded must be used. Wire runs must not exceed 250 feet.

Make the connections to the Green and Black terminals under the section marked "Remote Temp Sensor" on the right terminal strip - See *Figure 13*.

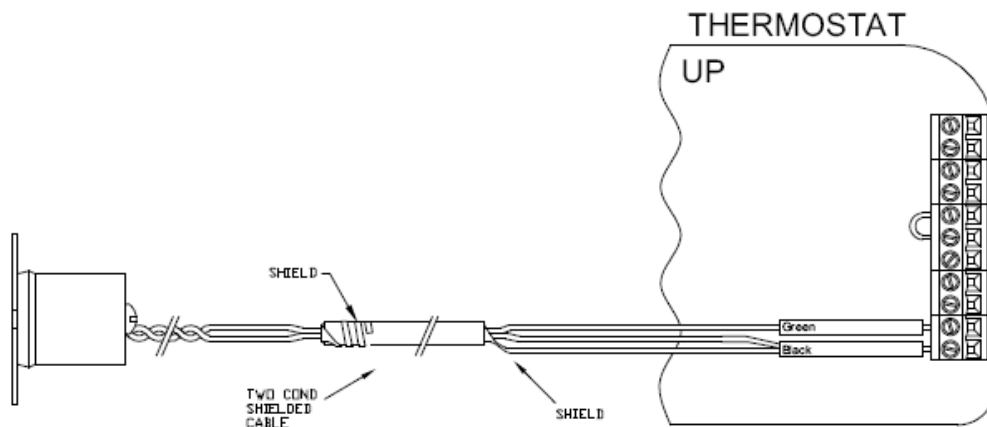


Figure 13 – Connections to a Remote Temperature Sensor

Notes:

1. When connecting a remote temperature sensor, the shield and one of the wires from the remote temperature sensor are tied together and get connected to the Black terminal – See *Figure 13*.
2. At the location of the temperature sensor, wrap the shield around the jacket of the cable and tape.
3. Configure the temperature sensor according to the application – See "Temperature Sensors" under *Installation Settings*.

SETUP AND CONFIGURATION

NOTE: For proper operation of the features of this thermostat, the Time and Date must be set. Even when connected to an HAI controller which sets the time and day, the Date must be manually set in the thermostat under the “Settings” menu.

INSTALLATION SETTINGS

This section describes the items that the installer must setup as part of the thermostat installation. The Installation Settings menu is used to configure the operating parameters of the thermostat.

To access the Installation Settings mode:

1. From the Home Page, press the Scroll Wheel.
2. Turn the Scroll Wheel until “Setup” is highlighted.
3. Press the Scroll Wheel or [Select] to select “Setup”.
4. Turn the Scroll Wheel until “Installation Settings” is highlighted.
5. Press the Scroll Wheel or [Select] to select “Installation Settings”.
6. Read the warning and then press [Continue] to proceed.
7. To exit Setup mode, press [Back] several times until the Home Page is displayed.

Notes:

1. The thermostat will automatically default to the Home Page after 3 minutes of no key activity.
2. The word “default” indicates the initial setting when the thermostat is delivered from the factory.
3. Unless otherwise noted, an asterisk (*) next to a setup item indicates the default setting.

Thermostat Address

If you are using remote communications and you are installing more than one thermostat, each must be set to a unique address. The default address setting is 1.

An address from 1- 127 may be selected.

Communications Mode

The thermostat can communicate with remote systems in different modes. The following modes are available:

Communications	*Serial: RS-232 mode for use with personal computers and automation systems.				
	Day/Night: The thermostat remotely communicates with a remote setback switch.				
System Baud	*100	300	1200	2400	9600
Expansion Baud	100	300	*1200	2400	9600

System Options

Note: Before operating the thermostat, the “System Type” and “System Mode” must be configured.

The thermostat can be configured with the following system options:

System Type	*Conventional	Dual Fuel Heat Pump ¹	Zone Control	Heat Pump
System Mode	*Auto Changeover No Fan With Heat	Auto Changeover Fan On With Heat	Auto Changeover No Fan With Heat	Auto Changeover Fan On With Heat
	Auto Changeover Fan On With Heat	Manual Changeover Fan On With Heat	Auto Changeover Fan On With Heat	Manual Changeover Fan On With Heat
	Manual Changeover No Fan With Heat		Manual Changeover No Fan With Heat	
	Manual Changeover Fan On With Heat		Manual Changeover Fan On With Heat	
	Heat Only No Fan With Heat		Heat Only No Fan With Heat	
	Heat Only Fan On With Heat		Heat Only Fan On With Heat	
	Cool Only		Cool Only	

¹When configured, an additional Installer Setup menu item (Balance Setpoints) is added to the list.

Program Options

This thermostat has been preprogrammed with energy saving program schedules in accordance with the ENERGY STAR[®] program. When used with a remote system, HAI recommends that the Program Mode be configured as “None” or “Occupancy”. This will disable the internal program schedules.

The program options setting sets the method for scheduling temperature change commands.

Program Mode	*Schedule: Program setpoints are based on time of day and day of week.
	None: The internal program schedule is disabled. Use this when connected to a remote system for temperature change commands.
	Occupancy: Program setpoints are based on the occupancy status of a remote system. Status options are Day, Night, Away, and Vacation. This mode is also used with a remote setback switch. Note: A remote system or switch is required.

Calibration Offset

This item is used to raise or lower the current temperature reading from the onboard temperature sensor by .5 degree Fahrenheit or .25 degree Celsius. The default setting is 0.00.

Cool/Heat Limit

These items are used to limit the desired temperature settings in cool and heat mode. The desired cool setting can never be set below the “Cool Setpoint Min” setting and the desired heat setting can never be set above the “Heat Setpoint Max” setting. The default setting for cool is 51°F. The default setting for heat is 91°F.

Cool/Heat Min On/Off

These items are used to limit the on and off times of the cooling and heating system (in minutes).

Cool Minimum On	The number of minutes the thermostat forces the cooling system to remain on before turning off. Raising this number will increase the total time the cooling system is on (saving energy), but may allow the temperature to drift farther from setpoint (decreasing comfort). When combined with Cool Minimum Off, cycles per hours can be obtained by using the following calculation: $60 / (\text{Cool Minimum On} + \text{Cool Minimum Off})$. The default time is 6 minutes.
Cool Minimum Off	The number of minutes the thermostat forces the cooling system to remain off before starting again. Raising this number will increase the total time that the cooling system is off (saving energy), but may allow the temperature to drift farther from the setpoint (decreasing comfort). When combined with Cool Minimum On, cycles per hours can be obtained by using the following calculation: $60 / (\text{Cool Minimum On} + \text{Cool Minimum Off})$. The default time is 6 minutes.
Heat Minimum On	The number of minutes the thermostat forces the heat to remain on before turning off. Raising this number will increase the total time the heating system is on (saving energy), but may allow the temperature to drift farther from the setpoint (decreasing comfort). When combined with Heat Minimum Off, cycles per hours can be obtained by using the following calculation: $60 / (\text{Heat Minimum On} + \text{Heat Minimum off})$. The default time is 6 minutes.
Heat Minimum Off	The number of minutes the thermostat forces the heat to remain off before starting again. Raising this number will increase the total time that the heating system is off (saving energy), but may allow the temperature to drift farther from the setpoint (decreasing comfort). When combined with Heat Minimum On, cycles per hours can be obtained by using the following calculation: $60 / (\text{Heat Minimum On} + \text{Heat Minimum off})$. The default time is 6 minutes.

Stage Settings

Note: Before operating the thermostat, the “Cool Stages” and “Heat Stages” must be configured.

The thermostat can be configured with the following stage settings:

Cool Stages	The number of cool stages the HVAC system can support. The default setting is 1.
Heat Stages	The number of heat stages the HVAC system can support. Auxiliary heat is included in this number for heat pumps. The default setting is 1.

EEC Control

The EEC Settings are used to configure Energy Efficient Control, Cool Anticipator, 2nd Stage Differential, and Auxiliary Heat Differential. Not all of these features apply to all thermostat configurations. Only the features that apply to the current configuration (based on the System Type and Stage Settings) of the thermostat will be available when this menu is selected.

This thermostat is equipped with Energy Efficient Control (EEC) that continually monitors the performance of the HVAC system and uses Stage 2 (heat or cool) and Stage 3 (auxiliary heat) only when necessary. If it determines that Stage 1 is able to heat or cool at a rate of 5 degrees per hour or better, Stage 2 will not be used. If Stage 1 is unable to heat or cool at this rate, the thermostat will use Stage 2 as needed. Under these conditions, Stage 1 will run continuously and Stage 2 will cycle on and off as needed. In extremely cold conditions, the auxiliary heating will be used when Stage 1 and/or Stage 2 is not heating at a sufficient rate.

EEC: This item turns on/off the Energy Efficient Control. On single state conventional HVAC systems, EEC enables the PID control algorithm.

Cool Anticipator: This adjusts the tendency of the HVAC to run the cooling system to refresh and dehumidify the air before the temperature rises to the desired cool settings. The recommended setting for most forced air cooling systems is 4. A higher number will decrease the tendency to run the cooling system below the cooling setting. A higher setting of 5 or 6 may be desired in dry climates.

2nd Stage Differential: This determines how far from the setpoint the temperature has to be before the second stage turns on.

Auxiliary Heat Differential: This determines how far from the setpoint the temperature has to be before the auxiliary heat turns on. This is only available for heat pump systems.

EEC Settings	Conventional (1 Cool / 1 Heat) Zone Control (1 Cool / 1 Heat)			Heat Pump (1 Cool / 2 Heat) Dual Fuel Heat Pump (1 Cool / 2 Heat)		
	EEC	*On	On / Off	EEC	*On	On / Off
	Cool Anticipator	*4	1 - 10	Aux Heat Differential	*2	1 - 10
	Conventional (2 Cool / 2 Heat)			Heat Pump (2 Cool / 3 Heat) Dual Fuel Heat Pump (2 Cool / 3 Heat)		
	EEC	*On	On / Off	EEC	*On	On / Off
	2nd Stage Differential	*2	1 - 10	2nd Stage Differential	*1	1 - 10
	2nd Stage Differential	*2	1 - 10	Aux Heat Differential	*2	1 - 10

Temperature Sensors

The Temperature Sensor settings are used to configure the internal temperature sensor and optional remote temperature sensors that are connected to the thermostat. Any temperature sensors that are set as the same type (i.e. indoor or outdoor) will display the average temperature reading among the sensors.

Internal Sensor: This will enable or disable the onboard temperature sensor for indoor use only. *Enabled

External Sensor 1: This will enable the external temperature sensor for indoor or outdoor use. All indoor and outdoor temperatures are averaged between all sensors of the same type. *Disabled

External Sensor 2: This will enable the expansion module temperature sensor for indoor or outdoor use. All indoor and outdoor temperatures are averaged between all sensors of the same type. *Disabled

External Sensor 3: This will enable the expansion module temperature sensor for indoor or outdoor use. All indoor and outdoor temperatures are averaged between all sensors of the same type. *Disabled

Humidity Options

The Humidity Options are used to configure the dehumidifier and/or humidifier output on the thermostat.

Not Used: Dehumidifier/Humidifier output is disabled.

Fan Speed Control: This option uses the dehumidifier output to control the fan speed on an HVAC system with a variable speed fan. When energized, the fan speed is reduced to augment the dehumidification process.

Dehumidifier: This option uses the dehumidifier output to control a stand alone dehumidifier.

Humidifier: This option uses the humidifier output to control a stand alone humidifier.

Dehumidifier Output	Humidifier Output
*Not Used	*Not Used
Dehumidifier	Humidifier
Fan Speed Control	

Balance Setpoints (Dual Fuel Heat Pump)

The Balance Setpoints are used to determine when the auxiliary heat is used in a dual fuel heat pump system

- If the outdoor temperature is above the “Upper Balance Setpoint” (45°F by default), the heat pump is used exclusively.
- If the outdoor temperature falls below the “Upper Balance Setpoint” but is above the “Lower Balance Setpoint” (35°F by default) and if the heat pump is unable to heat at a rate of 5 degrees per hour or better, the heat pump will turn off and the auxiliary heat will be used until the temperature rises above the “Upper Balance Setpoint” or the call for heat has been satisfied.
- If the outdoor temperature falls below the “Lower Balance Setpoint”, the heat pump will turn off and the auxiliary heat will be used until the call for heat has been satisfied.

Factory Default

This option will restore all system settings and programming to factory fresh configuration. Read the warning and then press [Yes] to proceed or [Cancel] to return to Installation Settings.

LIMITED WARRANTY

HAI warrants this product against defects in material and workmanship, under normal use and service, for a period of two (2) years from the date of purchase. During the warranty period, HAI will repair or replace, at its sole option, if this product fails due to defect. This warranty does not cover the cost of removal or reinstallation of any product. This warranty does not cover failure caused by normal wear, damage to the product while in your possession (other than damage caused by defect or malfunction), or by its improper installation, including failure to follow the written installation and operation instructions, alterations, misuse, or abuse. The remedies provided for in this warranty are the sole and exclusive remedies thereof. In no event shall HAI be liable for incidental expenses or consequential loss or damages. For the complete HAI Warranty for USA policy, see the HAI web site at www.homeauto.com.

Any implied warranties, including warranties of merchantability and fitness for particular use or purpose are limited to a period of two (2) years from purchase date. This warranty gives you specific legal rights, and you may have other legal rights, which vary from state to state. Some limitations may not apply to you.

For warranty and repair service within the continental United States, send defective unit carefully packaged, postage prepaid, along with description of trouble, name, return address, and phone number to: HAI, Repair Department, 4330 Michoud Blvd, New Orleans, LA, 70129. HAI will pay return shipping charges via normal ground service.

Outside of the continental United States: Contact an Authorized Distributor for repair/replacement instructions.

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Understanding the energy management features of your RC-2000 programmable communicating thermostat

Flex Net

This guide explains how to use the features of your new thermostat to get the most value from your participation in the Sensus FlexNet program.

To fully understand the information in this guide, you should first read the Omnistat2 user's guide. Once you are familiar with the various displays, it will be easier for you to understand how changing the settings can affect your energy use.

If you have questions about your Omnistat2 programmable communicating thermostat, or you feel the thermostat is malfunctioning, please call the thermostat manufacturer, HAI, at 800-229-7256, between the hours of 9:00 AM and 5:00 PM Central Time, Monday-Friday.

Please note that a very small percentage of cooling or heating problems are associated with a system's thermostat. If your system is not working or you feel it is not working properly, we suggest you contact a local repair service.

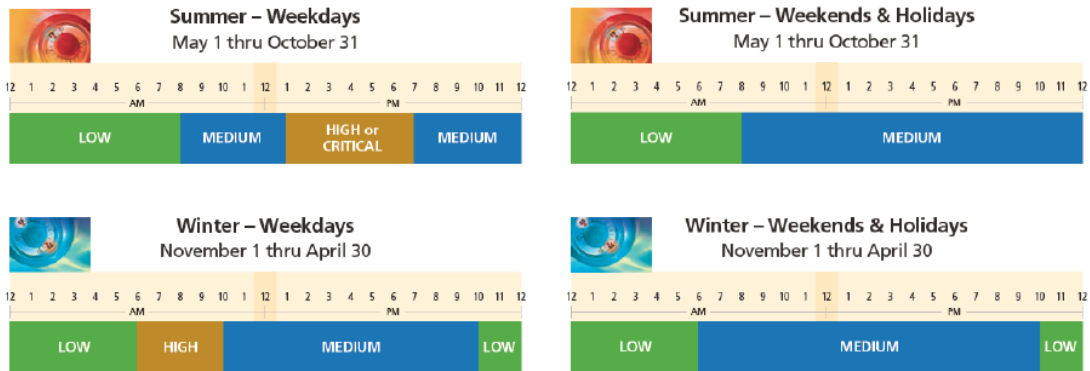
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Sensus FlexNet

This thermostat is designed to help you take advantage of the special rates offered through the Sensus FlexNet program. Below are charts showing FlexNet levels, rates for each level, and days and times corresponding to each rate.

Level	Energy Rate
Low	7.000 ¢/kWh
Medium	10.000 ¢/kWh
High	15.000 ¢/kWh
Critical	33.250 ¢/kWh



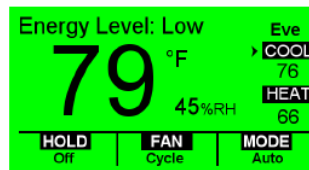
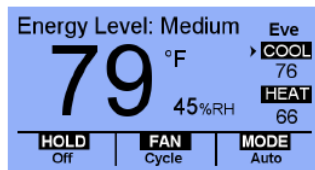
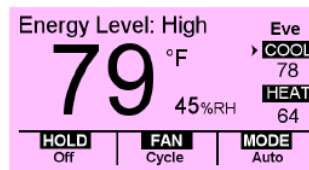
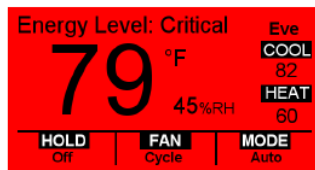
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Remote Energy Management Display

Color of Display

The background color on your thermostat's display panel indicates the current energy level.

Rate	Color
Critical (most expensive)	Red
High	Purple
Medium	Blue
Low (least expensive)	Green



2

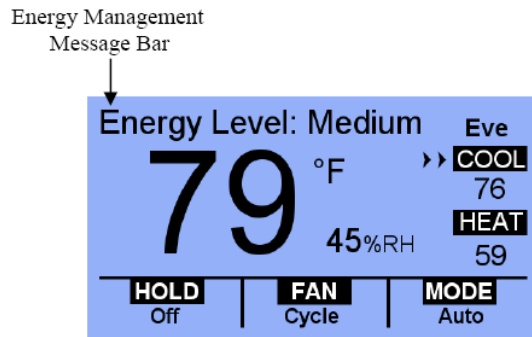
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Remote Energy Management Display

Energy Management Message Bar

This message on the main display indicates the current energy level and energy price. This is part of a 5-second cycle of messages enabled during setup. If both level and price are enabled, this message will scroll to display the entire message.



Energy Level

Energy level displays Low, Medium, High or Critical. If the energy features have been voluntarily overridden by you, this line will display "Energy Level Override."

3

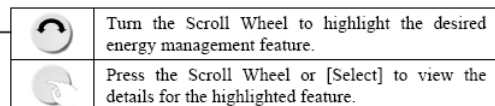
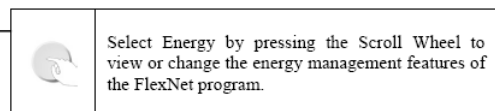
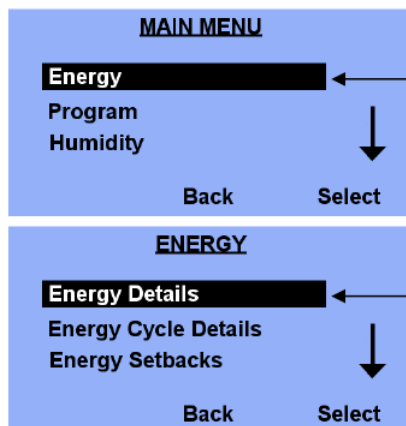
Energy Management Features

Your new thermostat has been preprogrammed with energy management features that are used in conjunction with the FlexNet program. You may view these settings at any time using the Energy menu. There are several items that you may modify to maximize energy savings and comfort based on your lifestyle.

When enabled, the following energy management pages are available: Energy Details, Energy Cycling Details, Energy Setbacks, Energy Cycle, Load Control Modules, and Energy Options.

Main Menu

To view or change the energy management features, press the Scroll Wheel once to display the Main Menu.



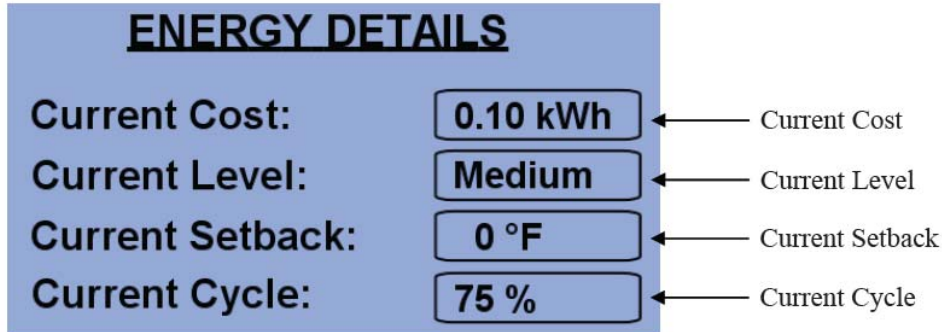
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Energy Details Display

Your thermostat has several “pages” of details that can be displayed. To access these pages, press the Scroll Wheel twice. The first page available is your Energy Details display.



Setback:

At each level, you will have the ability to program in a “Setback,” or number of degrees you would like your thermostat to adjust when the level changes. For example, if you have your thermostat set at 78° during the medium level and you wish it to change to 82° when the level changes to high, your degree setback would be 4.

Current Cost: This displays the current energy cost.

Current Level: This displays the current energy level.

Current Setback: This displays the current degree setback as it relates to the current energy level. This will automatically change with the change of current level.

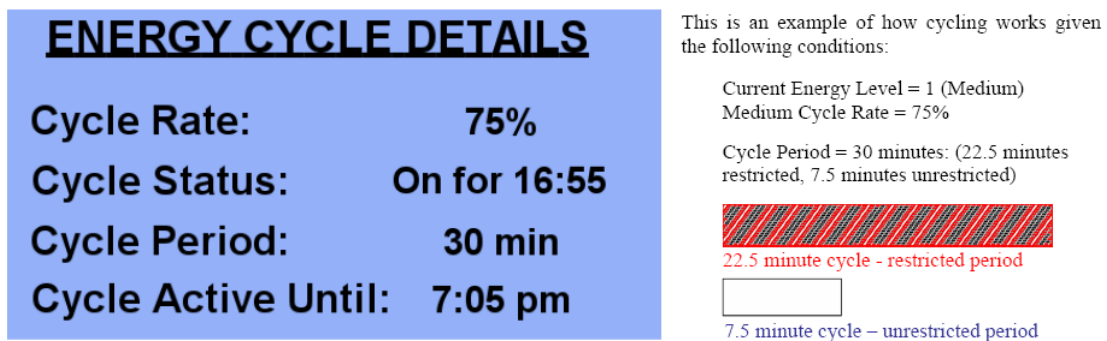
Current Cycle: This displays the percentage of the cycle length. The cycle length is the amount of time that the heating and air conditioning system is restricted.

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Energy Cycling

The cycling feature is an alternate way for controlling the energy demand of a heating and air conditioning system. When enabled, the heating and air conditioning system will follow a customizable cycle. This cycle will enforce a period of time that the heating and air conditioning system will be restricted. The goal is to have each heating and air conditioning system in a given area under a slightly different cycle so that a percentage of the heating and air conditioning systems are always off at any specific time.

Cycling can either be controlled by energy level or by one specific rate. Cycling consists of a cycle rate (0-85 percent) and a cycle period (15-60 minutes). This page displays specifics related to cycling:



Note: the cycling feature is independent of all energy setbacks and may be either used independently, or in combination with energy setbacks.

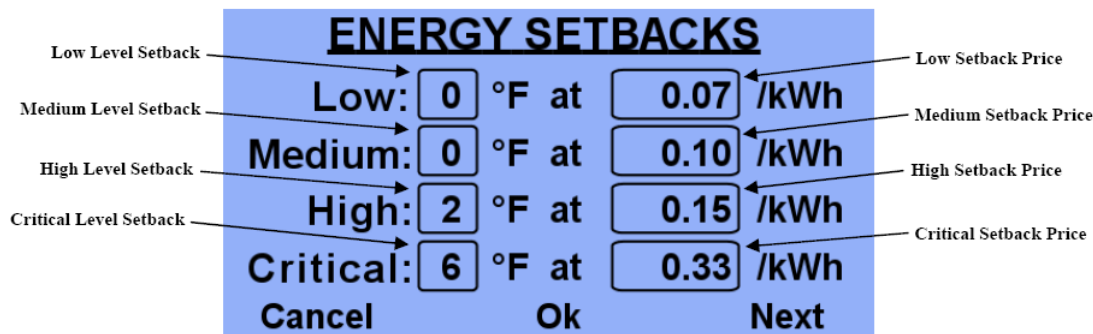
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Energy Setbacks Display

Although you may override your settings at any time, deviating from your programmed settings will usually cause your system to use more energy. Maximum benefits from the Sensus FlexNet program can best be achieved by allowing the thermostat to work using the programmed settings. The Energy Setbacks display shows your programmed setbacks for each level and the price per kilowatt hour for energy used in each level.



Low Level Setback: This displays the setback that corresponds with the low energy level.

Medium Level Setback: This displays the setback that corresponds with the medium energy level.

High Level Setback: This displays the setback that corresponds with the high energy level.

Critical Level Setback: This displays the setback that corresponds with the critical energy level.

Low Setback Price: This displays the energy price that corresponds with the low energy level.

Medium Setback Price: This displays the energy price that corresponds with the medium energy level.

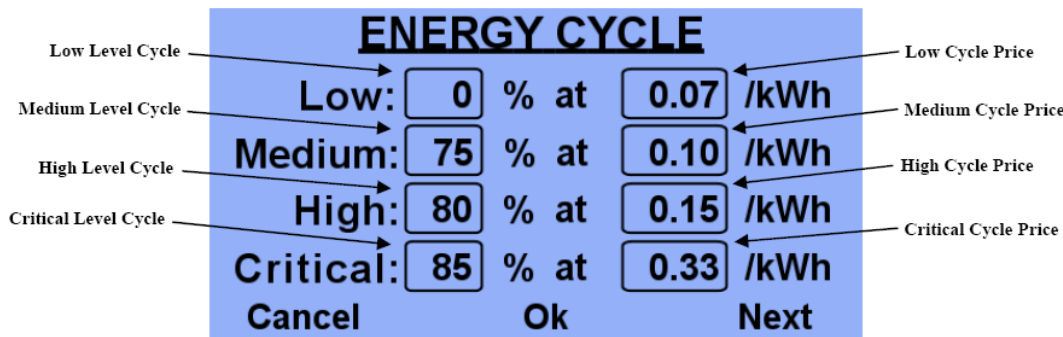
High Setback Price: This displays the energy price that corresponds with the high energy level.

Critical Setback Price: This displays the energy price that corresponds with the critical energy level.

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Energy Cycle Display

The Energy Cycle display shows your programmed cycles for each level and the price per kilowatt hour for energy used in each level. This page displays the cycle rates as it relates to the energy tier. You have the option of modifying these values.



Low Level Cycle: This displays the cycle that corresponds with the low energy level.

Medium Level Cycle: This displays the cycle that corresponds with the medium energy level.

High Level Cycle: This displays the cycle that corresponds with the high energy level.

Critical Level Cycle: This displays the cycle that corresponds with the critical energy level.

Low Cycle Price: This displays the energy price that corresponds with the low energy level.

Medium Cycle Price: This displays the energy price that corresponds with the medium energy level.

High Cycle Price: This displays the energy price that corresponds with the high energy level.

Critical Cycle Price: This displays the energy price that corresponds with the critical energy level.

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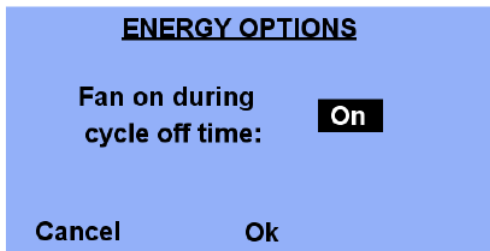
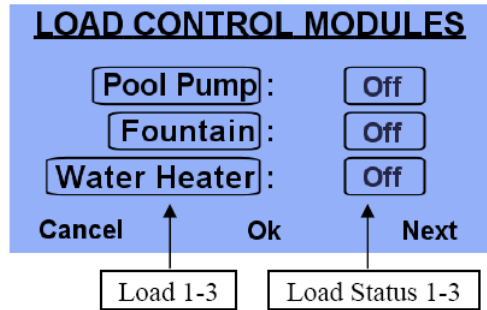
Energy Options

Load Control Modules

This page displays the enabled load control modules and the status of each. This page is only available when on or more load control modules are enabled.

Load 1-3: Displays a custom text label for the load control modules.

Load Status 1-3: Displays the status of corresponding load control module. You are able to toggle the state of each module.



Fan Cycle Option

This option is used to allow the fan to come on to circulate the air during the restricted portion of the cycle.

The fan will only come on when the thermostat is in cool mode.

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Worksheet

Use the worksheet below to note your programmed settings and setbacks for each energy level.

I. Temperature Settings

Sensus Suggested Settings			
	Time	Cooling	Heating
Morning	6 am to 8 am	73 deg	68 deg
Day	8 am to 6 pm	78 deg	60 deg
Evening	6 pm to 10 pm	73 deg	68 deg
Night	10 pm to 6 am	75 deg	62 deg

Your Personal Settings		
Time	Cooling	Heating

II. Temperature Setbacks

Energy Level	Sensus Suggested Settings	Your Personal Settings
Medium level	0 deg	
High level	2 deg	
Critical level	6 deg	

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Overriding Your Energy Management Features

If you wish to override (disable) your energy management features, press [HOLD] and select “Override”. Remember, this may result in higher energy costs. The thermostat will no longer change temperature settings or cycle restrictions based on energy cost.

HOLD



To change the hold setting, press [HOLD]. When first pressed, the Hold Setting Page is displayed:

	Turn the Scroll Wheel to scroll through the list of hold settings.
	Press the Scroll Wheel or [Select] to select the highlighted setting.
	Press [Cancel] to discard changes and return to the Home Page.



Note:

When Override is selected, you are prompted with a warning message. Read the warning and then press [Confirm] to proceed.

Restoring Your Energy Management Features:

To restore (enable) your energy management features, press [HOLD] and select “Off”. The thermostat will automatically change temperature settings and/or cycle restrictions based on energy cost.

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Energy Management Tips

To take full advantage of your time-of-use rates, implement the following:

Use timers on your water heater and pool pump to operate them during low level times.

Time use of appliances when possible.

- Wash and dry your clothes during lower energy-cost periods at night or weekends.
- Use your dishwasher at night or early morning during lower energy-cost periods.

Your thermostat has been programmed with the default settings below. Best results can be achieved by keeping these settings.

Time	Cool setting	Heat setting
6 am to 8 am	73 deg	68 deg
8 am to 6 pm	78 deg	60 deg
6 pm to 10 pm	73 deg	68 deg
10 pm to 6 am	75 deg	62 deg

High energy cost level offset 2 deg
Critical energy cost level offset 6 deg

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8 am to 6 pm	78 deg	60 deg
6 pm to 10 pm	73 deg	68 deg
10 pm to 6 am	75 deg	62 deg

High energy cost level offset 2 deg
Critical energy cost level offset 6 deg

12

Energy Management Tips

Follow these tips to use energy more efficiently in your home:

Summer tips

- Use fans where possible. Portable fans or ceiling fans can make the air feel about 10° cooler.
- Run appliances in the evening:
 - Run heat-producing appliances, like dishwashers and clothes dryers in the evening.
- Close drapes and blinds:
 - Close drapes and blinds to keep out the sun's rays during the day, and open them at night to allow the heat to escape through the glass.

Winter tip

- Open drapes and blinds:
 - Selectively open and close drapes and blinds during the day to maximize solar heat gain. Close them at night to keep the warm air in.

Monthly

- Change or clean the filters in your air returns.

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Energy Management Tips

Year-round

- Insulation:
 - Adequate insulation is essential for maximum energy efficiency in your home. Industry experts recommend R-30 for attic insulation and R-13 for wall insulation.
 - Insulate hot water pipes and ducts wherever they run through unheated areas.
- Eliminate air leaks:
 - Caulk and weather-strip around windows and doors wherever you can feel an air leak.
 - Check around pipes coming into your home and caulk or seal if necessary to eliminate air leaks.
- Water heater blankets and controls:
 - Wrap your electric water heater in an insulating blanket. These can be found at most home improvement stores.
 - Set the thermostat at the lowest temperature that meets your needs. In most cases 120° is sufficient and 140° allows for sterilization in kitchens.
- Lighting:
 - Replace your home's light bulbs with compact fluorescent light bulbs (CFLs). CFLs use 75 percent less energy and last much longer than standard incandescent bulbs.
 - Clean light bulbs regularly. This ensures that you will receive maximum light.

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Energy Management Tips

Year-round

- New appliances:
 - When purchasing new appliances, look for the ENERGY STAR label. The ENERGY STAR rating program, developed through a partnership between the EPA and the U.S. Department of Energy in 1996, designates certain appliances as energy efficient and environmentally friendly.
- Heating and Cooling:
 - Have your cooling and heating systems checked by a professional. Maintaining your home's systems will keep them running at maximum efficiency.
 - Be sure not to block your vents with furniture, plants, or other objects. Blocking air flow will decrease the efficiency of your system.

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About Sensus

Additional information about Sensus Metering Systems

Sensus North American Electricity provides a wide spectrum of solutions for residential, networking, and industrial applications. Our solutions include meter-to-mainframe data management, metering services, and billing solutions. Our meter solutions for single-phase and three-phase applications, coupled with our AMR/AMI technology, give our customers the advantage in reliability and efficiency.

With over 100 years of experience in the North America utility markets, Sensus is a leading provider of metering systems and innovative AMR/AMI products and services.

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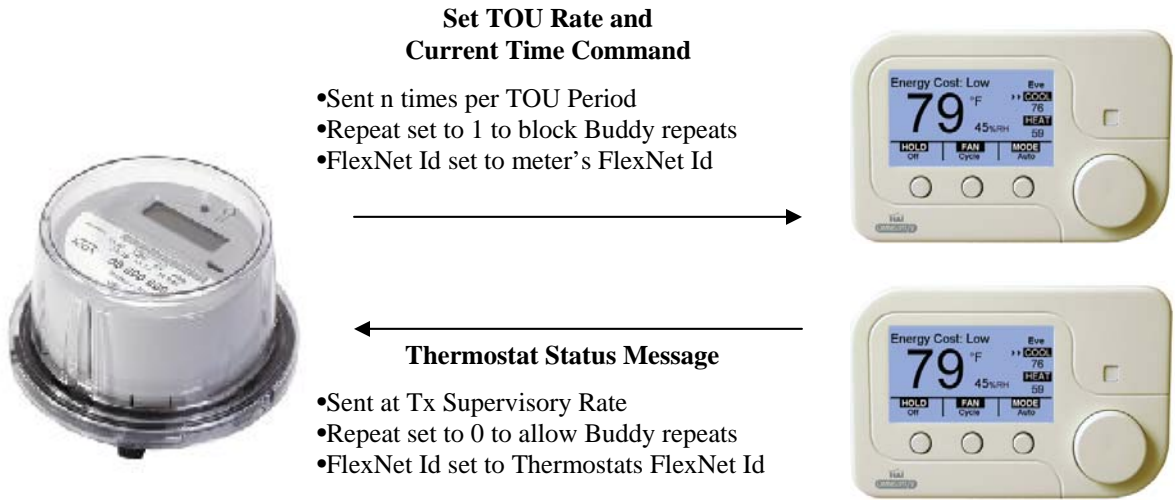
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FlexNet Activation Instructions:

Meter and Endpoint Interaction

In normal operation, the FlexNet meter will send Set TOU Rate and Current Time commands out periodically to Demand Response (DR) endpoints in the premises. The HANXCVR01 will transmit Thermostat Status Messages at the programmed Transmit Supervisory Rate.

Typical Interaction – The meter does not store the FlexNet Id's of devices communication with it, rather all of the DR equipment in a residence stores the FlexNet Id of the meter at the residence. The meter shall be a TOU meter that periodically sends out "Set TOU Rate and Current Time" commands addressed with the meter's own FlexNet Id. The DR equipment listens for the commands and responds accordingly.



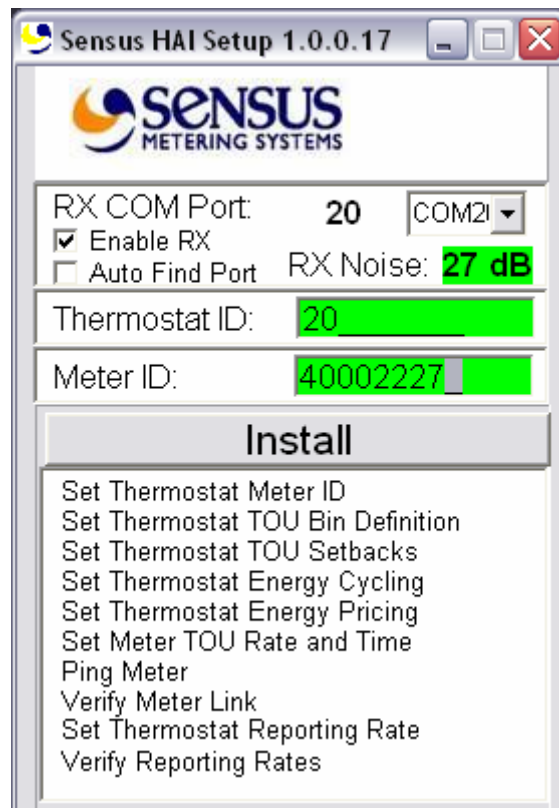
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Device Installation and Binding Process



- 1) User Runs Sensus Demand Response Installation Tool program
- 2) User enters Meter FlexNet Id and Thermostat FlexNet Id in each of the FlexNet ID fields.



- 3) User then presses the **Install** Button
 - Send "Set Associated Meter FlexNet Id" command to thermostat
 - i. Repeat n times until Ack received

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- Send “Set TOU Bin Definition” command to thermostat
 - i. Repeat n times until Ack received
 - Send “Set TOU Setbacks” command to thermostat
 - i. Repeat n times until Ack received
 - Send “Set Energy Pricing” or “Energy Cycling” command to thermostat
 - i. Repeat n times until Ack received
 - Send “Enable Set TOU Rate and Current Time” command to meter
 - i. Repeat n times until Ack received
 - Ping Meter for Set TOU Rate and Current Time command
 - i. Ping thermostat for Thermostat Status
 - ii. Repeat d. and i. n times until Thermostat Status shows “Received Set TOU Rate Command” flag is set
 - Send Static Setup to thermostat
 - i. Repeat n times until Ack received
 - Verify Meter – Thermostat Link and Setup information
- 4) Report Success or Failure, log results to file.

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APPENDIX A: REGULATORY INFORMATION:

COMPLIANCE INFORMATION:

FCC:

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet or circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING: Changes or modifications to this device not expressly approved by Sensus could void the user's authority to operate this equipment.

Industry Canada:

This Class B digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Cet appareillage numérique de la classe B répond à toutes les exigences de l'interférence canadienne causant des règlements d'équipement. L'opération est sujette aux deux conditions suivantes: (1) ce dispositif peut ne pas causer l'interférence nocive, et (2) ce dispositif doit accepter n'importe quelle interférence reçue, y compris l'interférence qui peut causer l'opération peu désirée.

RF Exposure:

In accordance with FCC requirements of human exposure to radiofrequency fields, the radiating element shall be installed such that a minimum separation distance of 20cm is maintained.

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APPENDIX B: REGULATORY LABELING:

FCC LABELING:

This device when used in an end product where the FCC label of the device is not visible must have an exterior label as shown below.

Sensus Metering Systems

Model: HANXCVR01

Contains FCC ID: SDBHANXCVR01

Contains IC: 2220A-HANXCVR01

This device complies with Part 15 of the FCC Rules and Industry Canada requirements. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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