EMERSON.
Climate Technologies

Overview

The Network Thermostat is specifically designed for single stage and multi-stage control of heating/cooling equipment such as rooftop and self-contained units. The Network Thermostat provides control of heat and cool stage activation, fans, lighting, and economizer dampers.

The Network Thermostat is designed to network with an E2 BX Building Controller and E2 CX Convenience Store Controller via the Echelon® LonWorks® network. As a networked device, the Network Thermostat handles control of the HVAC unit while the E2 provides occupancy scheduling, logging, alarm control, and remote communication.

Network Thermostat Models

|	Part Number (w/o E2 License)	Part Number (with E2 License*)
Network Thermostat; 2 heat, 2 cool	810-1300	810-1310
Network Thermostat; 2 heat, 2 cool, with Economizer Control	810-1301	810-1311
Network Thermostat; 3 heat, 2 cool, heat pump control	810-1302	810-1312

Table 1: Network Thermostat Part Numbers

* Network Thermostats must be purchased with a license key to enable E2 communications. Network Thermostats can not be used as stand-alone devices without a central E2 - time scheduling, night set back, and other time-related thermostat functions will not work without connection to an E2.

Installation

Before installing:

1. Remove security screw on the bottom of the thermostat cover (if present).
2. Use a screwdriver on the two holes in the bottom sides of the cover to unlatch the rear enclosure tabs. Remove the cover (*Figure 1*).
3. *Carefully* remove all stickers and wiring terminals from the circuit board.
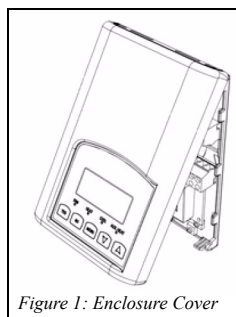
Location

The Network Thermostat should be mounted on a wall or riser in the area to be controlled by the thermostat's HVAC unit, 4-6 feet above the floor.

Figure 1: Enclosure Cover

Do not install the Network Thermostat

- on an outside wall,
- near any source of heat,
- near an air discharge grill,
- in any area that receives direct sunlight,
- in any place that restricts air circulation into the thermostat's enclosure.

Required Cable

Before installing the Network Thermostat, run the thermostat wire from the HVAC unit, the Echelon network cable(s), and the external sensor wiring through a hole in the wall or riser at the point you wish to mount. Allow enough slack in all wiring to extend the cables at least 8" out of the wall.

The Echelon cable specified for use with E2 and all its peripherals is shielded Level 4 twisted-pair cable, available only from Emerson Climate Technologies Retail Solutions (*P/N 135-2300* non-plenum, *P/N 135-2301* plenum). Refer to the E2 Controller User's Guide (*P/N 026-1610*) for information about Echelon networking and termination.

Network Thermostat Mounting

1. With the cover removed, detach the right side of the circuit board from the rear plastic enclosure by pressing the two circuit board locking tabs as shown in *Figure 2*. Swing the circuit board open to the left, exposing the inside of the rear enclosure.
2. Hold the back of the rear enclosure against the wall in the place you wish to mount it, centering the hole in the enclosure over the hole through which the cable will be run. Pull the cables through the enclosure hole, and make sure the thermostat enclosure lays flat against the mounting surface.

Location of PCB retaining tabs

Figure 2: Circuit Board & Rear Enclosure

3. Mark with a pencil the locations of the mounting holes (one on top, two on the bottom).
4. Remove the enclosure and install anchors in the wall or riser where marked.
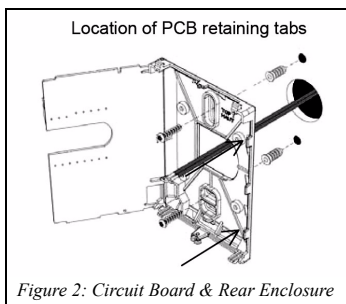
5. **If and only if the Network Thermostat will be an end device on the Echelon network daisy-chain**, before fastening the thermostat to the wall, install an Echelon Termination Block (P/N 535-2715) on the Echelon cable as shown in *Figure 3*.

Figure 3: Echelon Termination Block
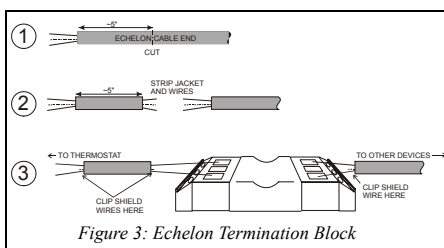
   1. Cut the Echelon cable about 5 inches from its end.
   2. Strip the cable jacket and leads on both ends of the cable 0.25".
   3. Wire the cable leading from the E2 and other devices on the daisy chain to one side of the Echelon Termination Block, and the cut end of the cable to the other side. Screw the two signal leads into the terminals on either end of the block. Clip the cable shields - do not connect them to the center screw terminal. Make sure all screw terminal connections are tight.

   Carefully push the Echelon Termination Block into the hole in the wall or riser, so that only the end of the cable extending from the termination block extends through the hole.
6. Align the thermostat's mounting holes with the anchors. Pull the cables through the enclosure hole (note: if an Echelon Termination Block is present, do NOT pull the block through the enclosure hole). Use screws to firmly attach the rear of the enclosure to the wall or riser as shown in *Figure 2*.
7. Swing the circuit board closed, and push on the right side of the circuit board until the locking tabs snap into place.
8. Strip 1/4" off all thermostat wires and Echelon cable end(s). You are now ready to begin wire connection.

Outdoor Air Temperature Sensor Mounting

If using an outdoor air temperature sensor with the Network Thermostat, use a standard CPC 10k temperature sensor (P/N 501-1121 or 501-1122).

The outside or ambient temperature sensor should be located on the north side of the building (for locations in the northern hemisphere), preferably under an eave to prevent sun-heated air from affecting the temperature at the sensor. For locations in the southern hemisphere, the temperature sensor should be mounted on the south side of a building in a similar fashion.

Figure 4 - Outdoor Air Sensor w/Shield
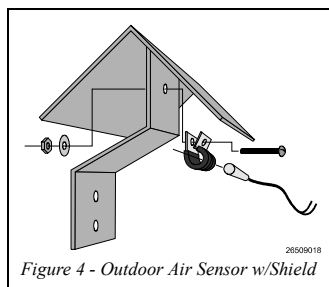
The temperature sensor may be mounted using a rubber-lined tubing clamp. CPC also offers an aluminum cover and clamp (P/N 303-1111) which may be mounted as shown in *Figure 4* (fasteners are not provided).

Mixed Air (Duct Mounted) Temperature Probe Mounting

CPC supplies two insertion probe temperature sensors for use as duct-mounted air temperature sensors: a 12-inch probe (P/N 201-2112) and an 8-inch probe (P/N 201-2009).

The probe may be mounted in any orientation within the duct and should be secured using self-tapping screws. A 0.250" diameter hole is required for the probe. *Figure 5* shows the installation of the insertion probe (self-tapping screws are not provided).
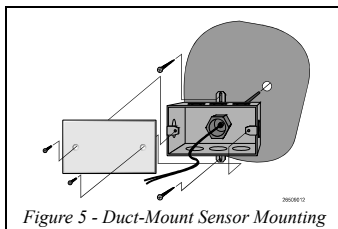
Echelon Network Wiring

Figure 5 - Duct-Mount Sensor Mounting

The Echelon network connector is located on the circuit board as shown in *Figure 6*. The Echelon cable is wired differently depending on whether or not the device is at the end of a daisy-chain.
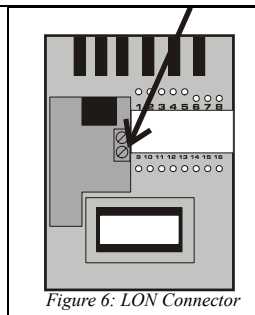
If the Network Thermostat is at the end of a daisy-chain, an Echelon Termination Block (*P/N 535-2715*) must be placed in-line on the Echelon cable before connection to the thermostat (see "Mounting," step 5). Connect the BLUE and WHITE/ BLUE leads from the end of the Echelon cable to the Echelon screw terminal connection as shown in *Figure 7*. Clip the SHIELD wire.

Figure 6: LON Connector

If the Network Thermostat is not at the end of a daisy-chain, connect both Echelon cables to the Echelon screw terminal connection as shown in *Figure 8*. Tie the shield wires together with a wire connector (recommended: Super B Wire Connectors from Dolphin Components Corp, *P/N 110-1000*).
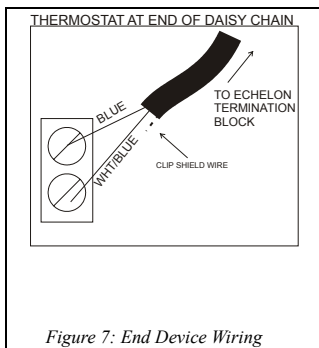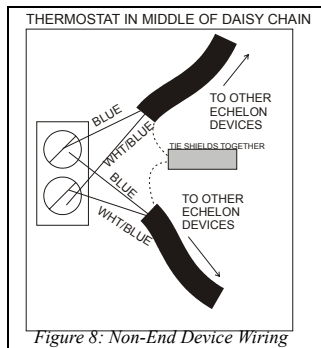

Figure 7: End Device Wiring

Figure 8: Non-End Device Wiring

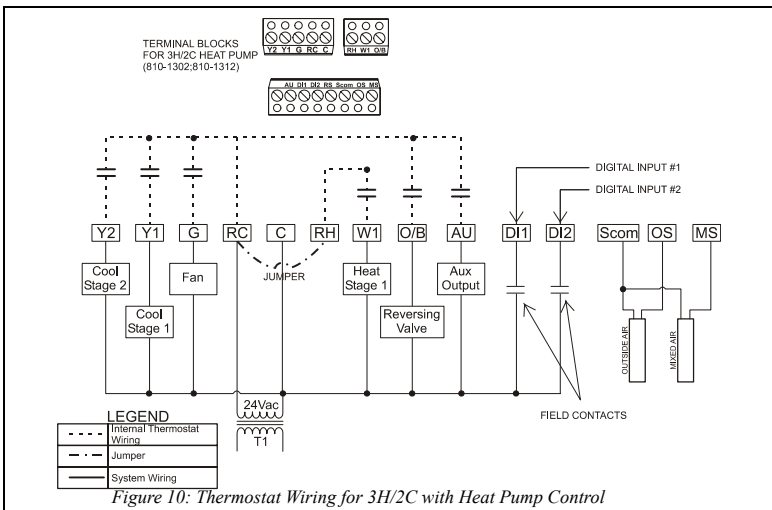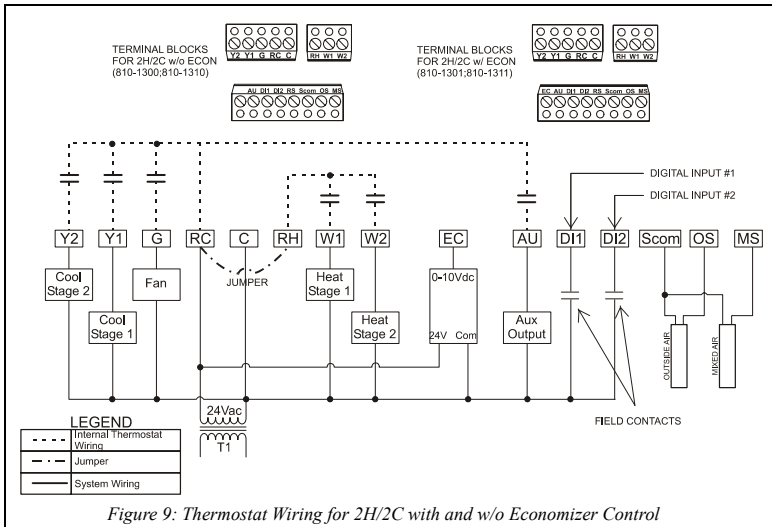### Thermostat Wiring

Wiring from the HVAC unit to the Network Thermostat will be slightly different depending on the model of Network Thermostat being used. For non-heat pump models, follow the wiring diagram in *Figure 9*. Note: the EC terminal is only present on the 810-1301 and 810-1311 models that have economizer control. For the heat pump model, follow the wiring diagram in *Figure 10*.

For all models, it is recommended wire connections be made to the screw terminal blocks before placing the terminal blocks on the circuit board pins (see "Terminal Block Mounting and Cover Replacement" on page 6).

Figure 9: Thermostat Wiring for 2H/2C with and w/o Economizer Control

Figure 10: Thermostat Wiring for 3H/2C with Heat Pump Control

Wiring Notes

1. If the same power source is used for the heating stages, install jumper across RC & RH. Maximum current is 2.0 amps.

2. If auxiliary output is used to toggle occupancy of the electronic control card inside the equipment, configure the relay parameter (Aux cont) to the N.O. setting. A second relay can be added for additional functionality of the occupancy output.
3. Economizer output uses a half bridge rectifier. Reference of the control signal is the common of the power supply of the thermostat. (terminal C)
4. Electromechanical contacts are to be used with the digital inputs. Electronic triacs cannot be used as mean of switching for the input. The switched leg to the input for the input to activate is terminal C (common)
5. The transformer of the unit provides power to the thermostat and the additional loads that will be wired to the thermostat.

Terminal Block Mounting and Cover Replacement

When all terminal wiring is complete, mount the terminal blocks on the numbered pins on the circuit board, as shown in *Figure 11*. Insert the pins into the small holes in the notch on the bottom of the terminal blocks. Press firmly until the terminal blocks are flush with the circuit board.

Carefully push excess wiring through the enclosure hole before replacing the Network Thermostat front cover. To replace the cover, place the two holes on the sides of the cover top on the mounting tabs, and press the bottom part of the cover until it snaps into place.

Figure 11: Terminal Block Placement
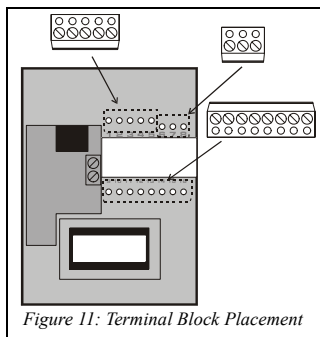
Network Setup and Commissioning

The Network Thermostat communicates with E2 through its "Open Echelon" networking feature. To enable this, the E2 must have both a license key and a description file that must be loaded into the E2 to enable communication.

Description files and license keys are typically pre-loaded into the E2 when ordered from Emerson Climate Technologies Retail Solutions. If retrofitting one or more Network Thermostats into a site with an existing E2 controller, you will need to obtain and install the proper description files and license keys from Retail Solutions. The process for installing description files and license keys is outlined in *Technical Bulletin 026-4118, E2 License Key and Open Echelon Installation*.

The instructions in this section will assume the description file and license keys are already installed.

Adding Open Echelon Devices

1. Log on to the E2 with level 4 access.

2. Press - Connected I/O Boards and Controllers.

3. Open Echelon devices must be added by entering the number of devices in the "Open Echelon" field in the box titled "Third Party Devices." This screen does not show the specific name of the Open Echelon device(s) enabled by license key. If you need to add multiple Open Echelon device types, enter the total number of all Open Echelon devices in this field.
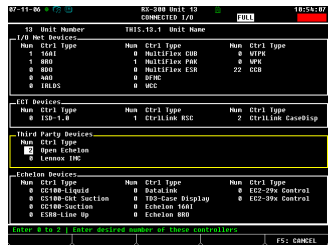
4. Press to save changes and return to the Network Setup menu.

5. From the Network Setup menu, press - Controller Setup. The Open Echelon devices you added will be in the controller list, with a model type "LONMARK® Device" and a default name beginning with "LM." These records are not yet associated with a particular device; they are simply placeholders. Therefore, you do not need to worry about the order in which you commission Network Thermostat devices, and you do not have to assign a specific device to a specific node.

6. Using the arrow keys, highlight the name of the Network Thermostat device you wish to set up. If you wish, you may rename this device by entering the name in this field.

7. Commission the device by highlighting the name and pressing - Set Address. You may either commission by pressing the service pin or button on the device, or you may manually enter the LONMARK® ID number.

• **Service Pin Method -** Select option from the Set Address menu. Enter the amount of time the E2 will wait while listening for a service pin message, and press . When the "Press Service Pin" message appears, press and hold the **Yes** and **No** buttons on the Network Thermostat front cover for 5 seconds. If successful, the E2 will display "Controller Detected" and proceed with commissioning the Network Thermostat.

• **Manual Entry Method -** Locate the 12-character Neuron ID number for the device. This should be located on a sticker on the box the thermostat was shipped in, and also on a sticker on the Echelon chip on the circuit board. Press option 2 from the Set Address menu, and enter the Neuron ID in the given field. If the ID was entered correctly and the Network Thermostat is powered and on-line, the E2 will commission the Network Thermostat.

8. After successfully commissioning the device, the LONMARK® ID number will be displayed in the far right column. Repeat steps 6-7 for the remaining devices.
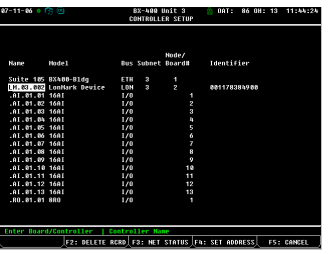
9. When all devices are commissioned, press to return to the Network Setup menu, and press to access the Online Status screen. Verify that all Network Thermostat devices are Online. If one or more devices have "Unknown" in their status column, there may be a problem with wiring or commissioning.

Accessing the Network Thermostat through E2

After commissioning, allow 10-15 minutes for the Network Thermostat to "bind" with the E2. When the Network Thermostat is finished binding, you may view its status or change setup parameters by navigating to its status screen:

- Press ⬤Menu ⬤5 - Configured Applications.
- From the list of Configured Applications, select "Network Thermostat," then press ⬤Enter.
- If multiple Network Thermostats are configured, you will see the Summary Screen for all Network Thermostats. To view the Status Screen of a particular Network Thermostat, highlight it using the arrow keys, then press ⬤Enter.

From the Status Screen, you may view the temperature, output states, and other information about the current operation of the Network Thermostat, or press ⬤F5: SETUP to change set point configuration.

Programming through E2 and Using E2 Online Help

Most set points that may be changed from the Network Thermostat's front panel may also be changed from the E2. Press ⬤F5: SETUP from the Network Thermostat's Status Screen to access the Setup Screens.

For assistance in setting Network Thermostat setpoints through the E2 interface, use the E2 Online Help. For each parameter you wish to know more about, highlight the parameter value using the arrow keys, then press the ⬤? : HELP key. Changes to Network Thermostat set-points from the E2 will also be changed in the Network Thermostat's configuration.

In particular, there are several setpoints and input definitions you will most likely need to make in the E2 before programming the Network Thermostat:

Application Naming (Screen C1: General)
Because the E2 status, summary, and setup screens are the same for all models of Network Thermostats, and also because there is no status field to indicate the model type of Network Thermostat being viewed, you may wish to choose a name for the Network Thermostat application that indicates the number of heat/cool stages being used and whether or not the Network Thermostat is controlling an economizer or heat pump. Doing this will allow you and others to better read the staus and summary screen for this device.
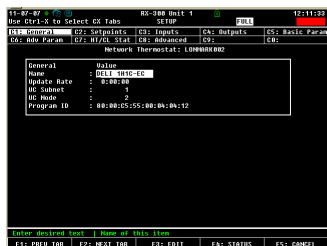
For example, if a Network Thermostat is controlling 1 heat stage, 1 cool stage, and an economizer, you may choose a name such as "DELI 1H1C-EC". This will inform other technicians and store personnel that only heat stage #1 and cool stage #1 is being used and all other stage outputs may be ignored.

Setpoint Limits (Screen C2: Setpoints)

The Min Cooling Setpoint and Max Heating Setpoint parameters limit the values of the cooling and heating setpoints respectively. You may wish to set these parameters so that the Network Thermostat's set-points cannot be set to values that compromise building comfort and/or energy efficiency.
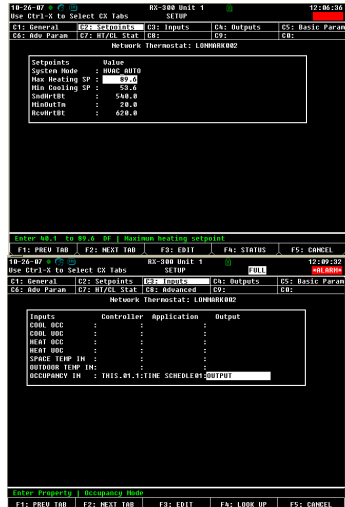
Occupancy Input (Screen C3: Inputs)

The Network Thermostat has no internal clock or scheduling capabilities. The E2 is responsible for communicating the occupancy mode to the Network Thermostat. Connect the OCCUPANCY IN input with the output of a Time Schedule application set up with the building occupancy times. Refer to the E2 User's Guide for information on Time Schedules and defining input definitions.

Overview of Network Thermostat Operation

The Network Thermostat uses an adaptive logic algorithm to control the space temperature. This algorithm controls the heating / air conditioning system to minimize overshoot while still providing comfort. It provides exceptional accuracy due to its unique PI time proportioning control algorithm, which virtually eliminates temperature offset associated with traditional, differential-based on/off thermostats.

Figure 12: PI Temperature Control vs. Conventional Thermostats
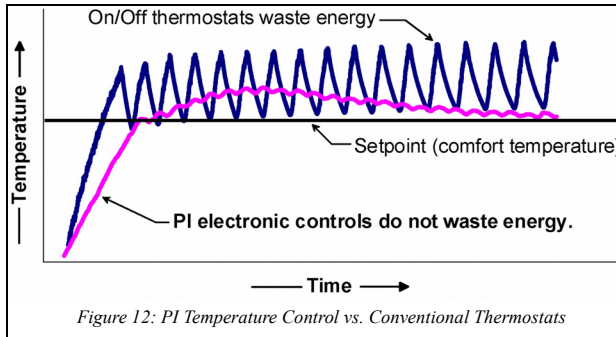
Feature Overview

• Gas/oil or electric system compatibility for all type of applications
• System mode lock out
• Heat pump balance point settings
• System efficiency feedback
• Lockable keypads for tamper proofing. No need for thermostat guards
• Automatic frost protection to prevents costly freeze damage

- Anti short cycle and minimum on/off run time protection. Reduces wear and maximizes life span of mechanical equipment.
- 2 programmable digital inputs for added flexibility. Each input can be programmed as a service alarm input, a filter alarm input, remote NSB input, or remote override input.
- Non volatile EEPROM memory prevents loss of parameters during power shortage
- Built in default profile set-up for easier start up and commissioning
- Configurable SPST output relay on programmable models for lighting, exhaust fan or fresh air control
- 0 to 10 Vdc economizer output

Heat Pump Model Specific Features

- Selectable single or dual stage compressor stages
- High balance point: Locks out auxiliary heating when outside air temperature is above this value
- Low balance point: Locks out heat pump compressor operation when outside air temperature is below this value
- Comfort/economy mode: In economy mode, heat pump use is maximized before turning ON auxiliary heating
- Compressor/auxiliary interlock: Adds flexibility by locking out heat pump operation during auxiliary heating to prevent high pressure trip when the coil is downstream of the auxiliary heat source.

Programming and Status Display Instructions

NOTE: Prompts may not all be present depending on model selected.
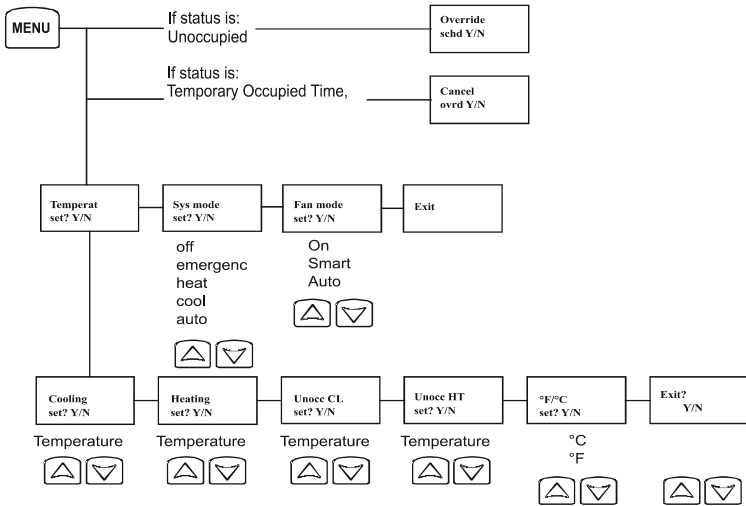
Status display

The thermostat features a two-line, eight-character display. There is a low level back-light level that is always active and can only be seen at night. When left unattended, the thermostat has an

auto scrolling display that shows the actual status of the system. Each item is scrolled one by one with the back lighting off. Pressing any key will cause the back light to come on.

Sequence of Auto-Scroll Status Display:

Room temperature	System mode	Schedule status	Alarms
`RoomTemp` `x.x °C or °F`	`Sys mode` `auto`	`Occupied`	`Service`
	`Sys mode` `off`	`Occupied` `hold`	`Frost ON`
	`Sys mode` `heat`	`Unoccup`	`SetClock`
	`Sys mode` `cool`	`Unoccup` `hold`	`Filter`
	`Sys mode` `emergenc`	`Override`	

Manual scroll of each menu item is achieved by pressing the Yes (scroll) key repetitively. The last item viewed will be shown on the display for 30 seconds before returning to automatic scrolling. Temperature is automatically updated when scrolling is held.

If alarms are detected, they will automatically be displayed at the end of the status display scroll. During an alarm message display, the back lit screen will light up at the same time as the message and shut off during the rest of the status display. Two alarms maximum can appear at any given time. The priority for the alarms is as follows:

Frost ON	Indicates that the heating is energized by the low limit frost protection room temperature setpoint 5.6 °C (42 °F)
Service	Indicates that there is a service alarm as per one of the programmable digital input (DI1 or DI2)
Filter	Indicates that the filters are dirty as per one of the programmable digital input (DI1 or DI2)

Status LEDs

Three status LEDs on the thermostat cover are used to indicate the status of the fan, a call for heat, or a call for cooling.

Multistage and single stage models
- When the fan is on, the FAN LED will illuminate.
- When heating is on, the HEAT LED will illuminate.
- When cooling is on, the COOL LED will illuminate.

Heat pump models
- When the fan is on, the FAN LED will illuminate.
- When auxiliary heat is on, the AUX HEAT LED will illuminate.
- When compressor is on, the HEAT-PUMP LED will illuminate.
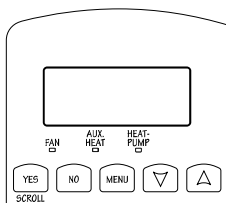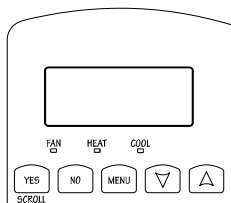
User Programming instructions menu

The Network Thermostat features an intuitive, menu-driven, back-lit LCD display that walks users through the programming steps, making the programming process extremely simple. This menu is typically accessed by the user to set the parameters such as temperature and time events, system mode, fan mode, etc.

It is possible to bring up the user menu at any time by depressing the MENU key. The status display automatically resumes after exiting the user-programming menu.

If the user pauses at any given time during programming, Auto Help text is displayed to help and guide the user through the usage and programming of the thermostat.

Ex.:	**Press Yes key to change cooling temperature setpoint** **Use the UP or DOWN arrow to adjust cooling setpoint**

Each of the sections in the menu are accessed and programmed using 5 keys on the thermostat cover. The priority for the alarms is as follows:

|	
YES	The YES key is used to confirm a selection, to move onto the next menu item and to manually scroll through the displayed information.
NO	The NO key is used when you do not desire a parameter change, and to advance to the next menu item. Can also be used to toggle between heating and cooling setpoints.
MENU	The MENU key is used to access the Main User Menu or exit the menu.
▽	The down arrow key is used to decrease temperature setpoint and to adjust the desired values when programming and configuring the thermostat.
△	The up arrow key is used to increase temperature setpoint and to adjust the desired values when programming and configuring the thermostat.

When left unattended for 45 seconds, the display will resume automatic status display scrolling. To turn on the back light, press any key on the front panel. The back lit display will turn off when the thermostat is left unattended for 45 seconds.

Sequence of user menu:

Override Resume	Temp Setpoints	System mode setting	Fan mode setting
`Override` `schd Y/N`	`Temperat` `set   Y/N`	`Sys mode` `set  Y/N`	`Fan mode` `set  Y/N`
Appears only in unoccupied mode			

`Cancel` `ovrd Y/N`
Appears only in override mode

System Defaults

The Network Thermostat is shipped with a default set of setpoints.

Programmed default temperature setpoints:
Occupied cooling setpoint = 24 °C (75 °F)
Occupied heating setpoint = 22 °C (72 °F)
Unoccupied cooling setpoint = 28 °C (82 °F)
Unoccupied heating setpoint = 18 °C (65 °F)
Fahrenheit scale
Setpoint type = permanent

Programmed default modes:
System mode = Auto
Fan mode = Smart

Override an Unoccupied Period

```
Override
schd Y/N
```

This menu option will appear only when the thermostat is in unoccupied mode. The unoccupied mode is enabled either by the OCCUPANCY IN input of the Network Thermostat application on the E2 being set to "OFF," or by a remote NSB contact via DI1 or DI2.

If DI1 or DI2 is configured to operate as a remote temporary override contact, this menu will be disabled. Answering yes to this prompt will cause the thermostat to go into occupied mode for an amount of time equal to the parameter "TOccTime" (1 to 12 hours).

Resume regular scheduling

```
Cancel
ovrd Y/N
```

This menu does not appear in regular operation. It will appear only when the thermostat is in Unoccupied override mode. Answering "Yes" to this question will cause the thermostat to resume the regular programmed setpoints & scheduling.

Change Temperature setpoints

Permanent setpoint changes

```
Temperat
set    Y/N
```

This menu option permits the adjustment of all permanent temperature setpoints (occupied and unoccupied) as well as the desired temperature units (°F or °C). Permanent setpoints are written to RAM and EEPROM.

Cooling setpoint Occupied mode		Heating setpoint Occupied mode		Cooling setpoint Unoccupied mode		Heating setpoint Unoccupied mode		°F or °C display setting	
`Cooling set? Y/N`	No next → Yes down ↓	`Heating set? Y/N`	No next → Yes down ↓	`Unocc CL set? Y/N`	No next → Yes down ↓	`Unocc HT set? Y/N`	No next → Yes down ↓	`°F or °C set? Y/N`	No next → Yes down ↓
Use ▲▼ keys to set value. Yes key to confirm									
`Cooling 70.0 °F`	Use ▲▼ To set value	`Heating 68.00 °F`	Use ▲▼ To set value	`Unocc CL 80.0 °F`	Use ▲▼ To set value	`Unocc HT 60.0 °F`	Use ▲▼ To set value	`Units °F`	Use ▲▼ To set value

Temporary setpoint changes

To make temporary changes to the heating or cooling setpoint, use the Up arrow key (▲) and the Down arrow key (▼) when the display is auto-scrolling through the status display screens. Depending on whether the thermostat is in heating or cooling mode, you will be presented with either the Heat or Cool setpoint, which you may change in 0.5 degree (F or C) increments with the arrow keys. Press the Yes key to accept the new setpoint.

Local changes to the heating or cooling setpoints made by the user directly using the up or down arrow are temporary and will remain effective only for the duration specified by the "TOcc-Time" parameter. Setpoints will revert back to their default value after internal timer ToccTime expires.

If a permanent change to the setpoints is required, use the Temperat set ? menu

System mode setting

```
Sys mode
set  Y/N
```

This menu is accessed to set system mode operation
Use ▲ ▼ to set value, Yes key to confirm

Sys mode auto	**Automatic mode** Automatic changeover mode between heating and cooling operation
Sys mode cooling	**Cooling mode** Cooling operation mode only
Sys mode heating	**Heating mode** Heating operation mode only
Sys mode emergency	**Emergency heat mode (heat pump models only)** Forced auxiliary heat operation mode only
Sys mode off	**Off mode - Normal cooling or heating operation disabled** If enabled in installer parameters, only the automatic heating frost protection at 50 °F (10 °C) is enabled

Fan mode setting

```
Fan mode
set  Y/N
```

This section of the menu is permits the setting of the fan mode operation.
Use ▲ ▼ to set value, Yes key to confirm

Fan mode On	**Always On fan mode** Fan is on continuously, even when system mode is OFF.
Fan mode Auto	**Automatic fan mode** Fan cycles on a call for heating or cooling for both occupied & unoccupied periods.
Fan mode Smart	**Smart fan mode** During occupied periods, fan is on continuously. In unoccupied mode, fan cycles on a call for heating or cooling.

Installer Configuration Parameter Menu

Configuration can be done through the network or locally at the thermostat.
- To enter configuration, press and hold the Menu button for 8 seconds
- Press the Menu button repetitively to scroll between all the available parameters
- Use the up and down key to change the parameter to the desired value.
- To acknowledge and save the new value, press the Menu button again. The value will be saved and the next listed parameter will be displayed.

Config Parameters	Significance Default Value	Adjustments
`DI 1 *`	Digital input no.1 configuration Open contact input = function not energized Closed contact input = function energized **Default value** = None	**None**, No function will be associated with the input **Rem NSB**, remote NSB timer clock input. Will disable the internal scheduling of the thermostat. The scheduling will now be set as per the digital input. The time is still displayed as information, but the menu part related to scheduling is disabled and no longer accessible. • Open contact = occupied setpoints • Closed contacts = unoccupied setpoints **RemOVR** Temporary override remote contact. Disables all override menu function of the thermostat. The override function is now controlled by a manual remote momentarily closed contact. When configured in this mode, the input operates in a toggle mode. With this function enabled it is now possible to toggle between unoccupied & occupied setpoints for the amount of time set by parameter (TOccTime) temporary occupancy time. When Override is enabled, an Override status message will be displayed. **Filter**, a back-lit flashing Filter alarm will be displayed on the thermostat LCD screen when the input is energized. **Service**, a back-lit flashing Service alarm will be displayed on the thermostat LCD screen when the input is energized
`DI 2 *`	Digital input no. 2 configuration Default value = **None**	Same as above. It is possible to configure both inputs to have the same function.
`lockout`	Keypad lockout levels Default value = **0 No lock**	0 = No lock 1 = Low level 2 = High level

Level	Resume/ Override scheduling	Permanent Occupied and Unoccupied Setpoints	Temporary setpoints using arrows	System mode setting	Fan mode setting	Schedules setting	Clock setting	Permanent hold
	Resume sched Y/N	RoomTemp set Y/N	Up key (▲) Down key (▼)	Sys mode set Y/N	Fan mode set Y/N	Schedule set Y/N	Clock set Y/N	Schedule hold Y/N
0	Yes access	Yes access	Yes access	Yes access	Yes access	Yes access	Yes access	Yes access
1	Yes access	No access	Yes access	No access	No access	No access	Yes access	No access
2	No access	No access	No access	No access	No access	No access	Yes access	No access

`pwr del *`	Power-up delay Default value = **10 seconds**	On initial power up of the thermostat (each time 24 VAC power supply is removed & re-applied) there is a delay before any operation is authorized (fan, cooling or heating). This can be used to sequence start up multiple units / thermostat in one location. 10 to 120 seconds

Frost pr *	Frost protection enabled Default value = **Off** On **heat pump** models the system mode will be forced to EMERGENCY mode if frost protection is activated	**Off:** no room frost protection **On:** room frost protection enabled in all system mode at: 42 °F (5.6 °C) Frost protection is enabled even in system **Off** mode Off or On
heat max *	Maximum heating setpoint limit Default value = **90 °F (32 °C)**	Maximum occupied & unoccupied heating set-point adjustment. Heating setpoint range is: 40 to 90 °F (4.5 to 32.0 °C)
cool min *	Minimum cooling setpoint limit Default value = **54 °F (12 °C)**	Minimum occupied & unoccupied cooling setpoint adjustment. Cooling setpoint range is: 54 to 100 °F (12.0 to 37.5 °C)
Anticycle *	Minimum on/off operation time for stages Default value = **2 minutes** Anti-short cycling can be set to 0 minutes for equipment that posses their own anti cycling timer. Do not use that value unless the equipment is equipped with such internal timer. Failure to do so can damage the equipment.	Minimum On/Off operation time of cooling & heating stages. **IMPORTANT,** anti-short cycling can be set to 0 minutes for equipment that posses their own anti cycling timer. Do <u>not</u> use this value unless the equipment is equipped with such internal timer. Failure to do so can damage the equipment. 0, 1, 2, 3, 4 & 5 minutes
Heat cph *	Heating stages cycles per hour Default value = **4 C.P.H.** For multi stage models, heat cph applies to W1 & W2 For heat pump models, heat cph applies to W1 only (Emergency heat)	Will set the maximum number of heating stage cycles per hour under normal control operation. It represents the maximum number of cycles that the equipment will turn ON and OFF in one hour. Note that a higher C.P.H will represent a higher accuracy of control at the expense of wearing mechanical components faster. 3, 4, 5, 6,7 & 8 C.P.H.
cool cph *	Cooling stages cycles per hour Default value = **4 C.P.H.** For multi stage models, cool cph applies to Y1 & Y2 For heat pump models, cool cph applies to Y1 & Y2 in cooling and heating independently of the reversing valve position	Will set the maximum number of cooling stage cycles per hour under normal control operation. It represents the maximum number of cycles that the equipment will turned on and off in one hour. Note that a higher C.P.H will represent a higher accuracy of control at the expense of wearing mechanical components faster. 3 or 4 C.P.H.
Deadband *	Minimum deadband Default value = **2.0 °F (1.1 °C)**	Minimum deadband value between the heating and cooling setpoints. If modified, it will be applied only when any of the setpoints are modified. 2, 3 or 4 °F (1.0 to 2.0 °C)
fan cont *	Fan control Default value = **On** For multi stage models, fan control applies to W1 & W2 For heat pump models, fan control applies to W1 only (Emergency heat)	Fan control in heating mode. When selecting **On**; the thermostat in all cases will always control the fan (terminal G). Valid for On or Auto fan mode When selecting **Off**; the fan (terminal G), when heating stages (terminals W1 & W2) are solicited, will not be energized. The fan in this case will be controlled by the equipment fan limit control. Valid only for Auto fan mode. On fan mode will leave the fan always on. On or Off

fan del *	Fan delay Default value = **Off**	Fan delay extends fan operation by 60 seconds after the call for heating or cooling ends. Valid only for Auto fan mode. "On" fan mode will leave the fan always on. Off or On
ToccTime *	Temporary occupancy time Default value = **3 hours**	Temporary occupancy time with occupied mode setpoints when override function is enabled When the thermostat is in unoccupied mode, function is enabled with either the menu or DI1 or DI2 configured as remote override input. 0,1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 & 12 hours
cal RS	Room air temperature sensor calibration Default value = **0.0 °F or °C**	Offset that can be added/subtracted to actual displayed room temperature ± 5.0 °F (± 2.5 °C)
cal OS	Outside air temperature sensor calibration Default value = **0.0 °F or °C**	Offset that can be added/subtracted to actual displayed outside air temperature ± 5.0 °F (± 2.5 °C)
H stage *	Number of heating stages. Applicable to 2 stage models only Default value = **2 stages** For heat pump models, H stage is limited to 1 stage only (W1 – Aux. Heat)	Will revert the operation of 2 stages thermostat to single stage operation only when the second heating step is not needed. 1 or 2 stages
C stage * Or **HP stage ***	Number of cooling stages 2 stages model only Default value = **2 stages** For heat pump models, HP stage selects the number of compressor stages	Will revert the operation of 2 stage thermostat to single stage operation only when the second cooling step is not needed. 1 or 2 stages
H lock *	Outside air temperature heating lockout Default value = **120 °F (49 °C)**	Disables heating stage operation based on outdoor air temperature. Function will only be enabled if OS (outside air temperature sensor) is connected. From -15 °F up to 120 °F (-26 °C up to 49 °C)
C lock *	Outside air temperature mechanical cooling lockout. Default value = **-40 °F (-40 °C)**	Disables cooling stage operation based on outdoor air temperature. On economizer model, free cooling will not be disabled by this function. Function will only be enabled if OS (outside air temperature sensor) is connected. From -40 °F up to 95 °F (-40 °C up to 35 °C)
aux cont *	Auxiliary contact configuration Default value = **N.O. normally open**	This contact can be used to energize peripheral devices such as: lighting equipment, exhaust fans, economizers, etc. This contact will operate in parallel with the internal occupied/unoccupied schedule of the thermostat or the remote NSB contact if DI1 or DI2 is used. When the system is in **OFF mode**, the contact will remain in its unoccupied status independently of the occupied / unoccupied schedule.

Configured	Contact occupied status	Contact unoccupied status
N.O.	Closed	Opened
N.C.	Opened	Closed

Heat Pump models only		
`high bp *`	High balance point Default value = **90 °F (32.0 °C)** Function will only be enabled if OS (outside air temperature sensor) is connected.	In *Heating or Auto mode*, it is the outside air temperature value at which the auxiliary heat will be cut off. Above that value, only the heat pump will be used to maintain the heating setpoint 34 to 90 °F (1.0 to 32.0 °C)
`low bp *`	Low balance point Default value = **-12 °F (-24 °C)** Function will only be enabled if OS (outside air temperature sensor) is connected.	In *Heating, Cooling or Auto mode*, it is the outside air temperature value at which the heat pump operation will be cut off. Below that value, only the auxiliary heat will be used to maintain the heating setpoint -40 to 30 °F (-40 to -1.0 °C)
`comf/eco *`	Comfort or economy mode Default value = **Comfort**	Sets the operation and interaction mode of the heat pump with the auxiliary heat. **Comfort mode**. In *Heating mode.* If the heat pump is not able to satisfy the heating setpoint, the auxiliary heat will be energized to satisfy the same heating setpoint. **Economy mode**. In *Heating mode.* If the heat pump is not able to satisfy the heating setpoint, the auxiliary heat will be energized to satisfy only when the temperature has dropped 2.0 °F (1.1 °C) below the heating setpoint. Selecting economy mode will add a deadband between the heat pump & auxiliary heat in heating mode. The actual temperature maintained will be lower than the true heating setpoint to maximize the heat pump operation. When the outdoor air temperature drops below the *low balance point,* the deadband will be eliminated and the auxiliary heat will maintain the true heating setpoint alone. **Economy mode**. In *Emergency mode.* If *Emergency heat mode* is selected, the setpoint maintained, will be the heating setpoint.
`re valve *`	Reversing valve operation O/B Default value = **O**	Heat pump reversing valve operation **O** will energize the valve in cooling operation. **B** will energize the valve in heating operation O or B
`comp/aux *`	Compressor/auxiliary interlock Default value = **Off**	Sets the operation and interaction mode of the heat pump with the auxiliary heat. **Interlock Off**. In *Heating mode.* If the heat pump is not able to satisfy the heating setpoint, the auxiliary heat will be energized at the same time as the heat pump stage. Typically applies when the air handler heat pump coil is installed before the auxiliary heat. (all electric systems) **Interlock On**. In *Heating mode.* If the heat pump is not able to satisfy the heating setpoint, the auxiliary heat will be energized and the heat pump will be cut off. Typically applies when the air handler heat pump coil is installed after the auxiliary heat. (add on systems) There is a 2 minute delay to restart the heat pump, when the auxiliary heat is shut down Off or On

Notes for Heat Pump models:
Heat Pump model when set in Emergency mode bypasses heating lockout and permits auxiliary heating whenever a heating demand occurs.

Economizer Model only		
Chngstpt *	Changeover setpoint Default value = **55 °F (13.0 °C)**	In *Cooling* mode. The outside air temperature value at which the cooling will be switched over from mechanical (compressor) to free cooling (economizer) 14 to 70 °F (-10.0 to 21.0 °C)
min pos *	Minimum position Default value = **0%** Outside Air %: 0%, 5%, 10%, 15%, 20%, 25%, 30% Setting for 0-10Vdc Actuator: 0%, 5%, 10%, 15%, 20%, 25%, 30% Setting for 2-10Vdc Actuator: 0 to 20%, 24%, 28%, 32%, 36%, 40%, 44%	Outside air damper minimum position. Will be active only when fan is on (G terminal) and the internal or remote scheduling is in occupied mode. When internal or remote scheduling is in unoccupied mode and/or fan is off, minimum position will be set to 0% **0 to 100 %** = 0 to 10 VDC output range
C mech *	Mechanical cooling allowed Default value = **Off**	In *Cooling* mode. Allows the operation of the mechanical cooling if the free cooling (economizer) cannot maintain the cooling setpoint. **Off** Typically applies when the MS (mixed air temperature sensor) is installed after the mechanical cooling refrigeration coils. In this case, mechanical cooling will never operate at the same time as free cooling. **On** Typically applies when the MS (mixed air temperature sensor) is installed before the mechanical cooling refrigeration coils in the mixing plenum. In this case, mechanical cooling is allowed when the free cooling (economizer operation) cannot maintain the cooling setpoint. Off or On
mix stpt *	Mixed air setpoint Default value = **55 °F (13.0 °C)**	Free cooling mixed air setpoint when economizer mode is enabled. 50 to 90 °F (10.0 to 32.0 °C)
MS dis	Display mixed air temperature Economizer model only, only if sensor is installed	Used as diagnostic / service help to troubleshoot and diagnose economizer operation.

Troubleshooting guide

Symptom	Possible Cause	Corrective Action
No display on the thermostat	Absent or incorrect supply voltage	Check power supply voltage between C & RC to be from 19-30 VAC Check for tripped fuse or circuit breaker
	Overloaded power transformer	Verify that the transformer used is powerful enough (enough VA's) to supply all controlled devices including the thermostat
Keyboard menu does not access all functions	Keyboard locked	Change configuration parameter LOCKOUT to value "0" to access all levels of the menu
Temperature setpoints revert to original value after a certain time period	Temporary setpoint option selected	The thermostat needs to be in Permanent setpoint mode for the new setpoint to be kept and memory and used all the time Go to the Set temperature menu. The last prompt is setpoint type. Set it to Permanent setpoint
Thermostat will not call for heating	Wrong mode selected	Select heating mode
	Thermostat in Unoccupied mode	Select Occupied Hold in Schedule hold or Override to force the thermostat Occupied heating setpoint
	Anticycle delay active	Wait, the anticycling period will end and the equipment will start
	Heating setpoint is satisfied	Raise the Heating setpoint
	Heating lockout attained	Mode is locked out based on outside air temperature Change configuration parameter H Lock to value 120 °F (49 °C) to by-pass lockout
	Wiring error	Start the Fan by forcing the Fan ON mode Put a jumper across terminals RH & W1. The heating should come ON. If it does not, verify wiring and check if a jumper is required between RC & RH
Thermostat will not call for cooling	Wrong mode selected	Select cooling mode
	Thermostat in Unoccupied mode	Select Occupied Hold in Schedule hold or Override to force the thermostat Occupied cooling setpoint
	Anticycle delay active	Wait, the anticycling period will end and the equipment will start
	Cooling setpoint is satisfied	Lower the cooling setpoint
	Cooling lockout attained	Mode is locked out based on outside air temperature Change configuration parameter C Lock to value -40 °F (-40 °C) to by-pass lockout
	Wiring error	Start the Fan by forcing the Fan ON mode Put a jumper across terminals RC & Y1. The cooling should come ON. If it does not, verify wiring
The thermostat will not turn on the fan	Wrong mode selected	Start the Fan by forcing the Fan ON mode Put a jumper across terminals RC & G. The fan should come ON. If it does not, verify wiring
	Wiring error	
Digital display shows missing digits or erratic segments	Defective display	Replace thermostat

Troubleshooting guide

Heat pump models

Auxiliary heat does not operate	Wrong mode selected	Select emergency heat mode
	Thermostat in Unoccupied mode	Select Occupied Hold in Schedule hold or Override to force the thermostat Occupied heating setpoint
	Anticycle delay active	Wait, the anticycling period will end and the equipment will start
	Heating setpoint is satisfied	Raise the Heating setpoint
	High Balance point attained	Mode is locked out based on outside air temperature Change configuration parameter High BP to value 90 °F (32 °C) to by-pass lockout
	Heating lockout attained	Mode is locked out based on outside air temperature Change configuration parameter H Lock to value 120 °F (49 °C) to by-pass lockout
	Wiring error	Start the Fan by forcing the Fan ON mode Put a jumper across terminals RH & W1. The heating should come ON. If it does not, verify wiring and check if a jumper is required between RC & RH
Heat pump does not operate in heating mode	Wrong mode selected	Select heating mode
	Thermostat in Unoccupied mode	Select Occupied Hold in Schedule hold or Override to force the thermostat Occupied heating setpoint
	Anticycle delay active	Wait, the anticycling period will end and the equipment will start
	Heating setpoint is satisfied	Raise the Heating setpoint
	Low Balance point attained	Mode is locked out based on outside air temperature Change configuration parameter Low BP to value -12 °F (-24 °C) to by-pass lockout
	Heating lockout attained	Mode is locked out based on outside air temperature Change configuration parameter H Lock to value 120 °F (49 °C) to by-pass lockout
	Wiring error	Start the Fan by forcing the Fan ON mode Put a jumper across terminals RH & W1. The heating should come ON. If it does not, verify wiring and check if a jumper is required between RC & RH
	Wrong reversing valve configuration	Wrong selection of parameter Re Valve Select O will energize the valve in cooling operation. Valve is normally heat. Select B will energize the valve in heating operation. Valve is normally cool.

Specifications

Thermostat power requirements:	19-30 VAC 50 or 60 Hz; 2 VA (RC & C) Class 2
	RC to RH jumper 2.0 Amps 48 VA maximum
Operating conditions:	0 °C to 50 °C (32 °F to 122 °F)
	0% to 95% R.H. non-condensing
Storage conditions:	-30 °C to 50 °C (-22 °F to 122 °F)
	0% to 95% R.H. non-condensing
Sensor:	Local 10 K NTC thermistor
Resolution:	± 0.1 °C (± 0.2 °F)
Control accuracy:	± 0.5 ° C (± 0.9 °F) @ 21 °C (70 °F) typical calibrated
Occupied and unoccupied setpoint range cooling:	12.0 to 37.5 °C (54 to 100 °F)
Occupied and unoccupied setpoint range heating:	4.5 °C to 32 °C (40 °F to 90 °F)
Room and outdoor air temperature range	-40 °C to 50 °C (-40 °F to 122 °F)
Proportional band for room temperature control:	Both outputs: 1.1°C (2.0°F)
Digital inputs:	Relay dry contact only across C terminal to DI1 or DI2
Contact output rating:	Each relay output: (Y1, Y2, G, W1, W2 & AU)
	30 VAC, 1 Amp. maximum
	30 VAC, 3 Amp. in-rush
Economizer analog output rating:	0 to 10 VDC into 2KW resistance min.
Economizer analog output accuracy:	± 3% typical
Wire gauge	18 gauge maximum, 22 gauge recommended
Dimensions:	4.94" x 3.38" x 1.13"
Approximate shipping weight:	0.75 lb (0.34 kg)
Agency Approvals:	
UL	UL 873 (US) and CSA C22.2 No. 24 (Canada), File E27734 with CCN XAPX (US) and XAPX7 (Canada)
FCC	Compliant to CFR 47, Part 15, Subpart B, Class A (US)
Industry Canada	ICES-003 (Canada)
CE	EMC Directive 89/336/EEC (Europe Union)
C-Tick	AS/NZS CISPR 22 Compliant (Australia / New Zealand) Supplier Code Number N10696

Mounting Dimensions