DAIKIN
AIR INTELLIGENCE

BACnet™ Thermostat

INSTALLATION MANUAL

Group: **Light Commercial**

WARNING

Only personnel that have been trained to install, adjust, service or repair(hereinafter, "service") the equipment specified in this manual should service the equipment. The manufacturer will not be responsible for any injury or property damage arising from improper service or service procedures. If you service this unit, you assume responsibility for any injury or property damage which may result. In addition, in jurisdictions that require one or more licenses to service the equipment specified in this manual, only licensed personnel should servise the equipment. Improper installation, adjustment, servicing or repair of the equipment specified in this manual, or attempting to install, adjust, service or repair the equipment specified in this manual without proper training may result in product damage, property damage, personal injury or death.

Table of Contents

Reference Documents

Number	Title	Company	Source
DG-DAPPS	BACnet™ AppStat™ Thermostat Design Guide	Daikin North America LLC	www.Daikinac.com

Limited Warranty

Consult you local Daikin representative for warranty details. To find you local Daikin representative, go to www.daikinac.com

General Information

This manual provides general information about the *BACnet* thermostats. The controllers are space mounted devices that combine a *BACnet* controller with temperature sensors.
The controllers include programs for the following applications.

- Roof top units, both single or multi-stage
- Heat pumps

The *BACnet* thermostats are native *BACnet*, Application Specific Controllers. *BACnet* communication parameters, device instance, MAC address, baud rate, user adjustments, and application configuration values are set from password protected front panel controls.

All models feature an integrated *BACnet* schedule and hardware real-time clock with 72-hour capacitor backup for standalone operation or network time synchronization.

A two-piece mechanical design, featuring a removable backplate, facilitates easy wiring and installation.

Hazardous Information Messages

⚠ CAUTION

Cautions indicate potentially hazardous situations, which can result in personal injury or equipment damage if not avoided.

⚠ WARNING

Warnings indicate potentially hazardous situations, which can result in property damage, severe personal injury, or death if not avoided.

⚠ DANGER

Dangers indicate a hazardous situation which will result in death or serious injury if not avoided.

NOTICE

Notices give important information concerning a process, procedure, special handling or equipment attributes.

User Interface

The user interface is a color display and has five push buttons. Through the menu driven display, an operator can do the following.

- Add or change user passwords
- Change setpoints
- Set *BACnet* addressing
- Set up and commission the installation
- Configure any available options

Security

Separate passwords for users and controls technicians.

Display Type

- 128 × 128 pixels
- Active color LCD with LED back lighting
- 1.00 × 1.04 inches (25 × 26 mm)

Inputs and Outputs

All inputs and outputs are pre-programmed and application specific. No field configuration is required for most installations. For details on input and output connections see the section Application Drawings on page 31.

Analog Inputs

Analog inputs represent *BACnet* analog input objects and are configured for discharge air temperature, remote temperature sensor, water temperature sensor, and fan status. Not all input sensors are applicable or required for all models.

- Sensors are automatically detected
- Inputs accept industry-standard 10,000Ω, Type II thermistor sensors
- Input overvoltage protection up to 24 volts AC, continuous
- 12-bit analog-to-digital conversion
- Short-circuit protected
- Loads up to 10 mA at 0-12 volts DC
- 8-bit PWM digital-to-analog conversion

Relay Outputs

Relay outputs are configured to represent *BACnet* binary objects. The outputs control ON/OFF valves, speeds for three-speed fans, fan start circuits, or other equipment that requires an on or off input signal.

- All relay outputs are normally open, SPST, Form "A" relays
- 1 Ampere maximum per relay at 24 volts AC or DC for each output. Maximum for all relay outputs is 3 amperes (72VA)

Connectors

- Screw terminal block mounted to backplate
- Wire size 14-22 AWG

Communications – BACnet™ MS/TP

- Integral peer-to-peer *BACnet* MS/TP network communications
- Network speeds from 9600 to 76,800 baud
- Front panel configurable device instance, MAC address, and baud
- Automatic baud detection
- Screw terminal block mounted to backplate; wire size 14-22 AWG
- Meets or exceeds ANSI/ASHRAE *BACnet* Standard 135-2008 for Application Specific Controllers

Accuracy

Type	Thermistor
Accuracy	±0.36°F (±0.2°C)
Resistance	10,000Ω at 77°F (25°C)
Operating Range	48 to 96°F (8.8 to 35.5°C)

Regulatory

- UL 916 Energy Management Equipment
- FCC Class A, Part 15, Subpart B and complies with Canadian ICES-003 Class B
- SASO PCP Registration KSA R-103263

This device complies with part 15 of the FCC Rules. 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.

- This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
- The FCC responsible party is KMC Controls, Inc. and may be contacted at 19476 Industrial Drive, New Paris, IN 46553

Environmental Limits

Operating	32 to 120°F (0 to 49°C)
Shipping	-40 to 140°F (-40 to 60°C)
Humidity	0-95% relative humidity (non-condensing)

Installation

Supply Voltage	24 volts AC (-15%, +20%), 50-60 Hz, 12 VA, Class 2 only, non-supervised. All circuits, including supply voltage, are power limited circuits.
Weight	Approx 6 ounces (170 grams)
Case Material	Flame retardant plastic

Dimensions

Figure 1: BACnet Thermostat Dimensions

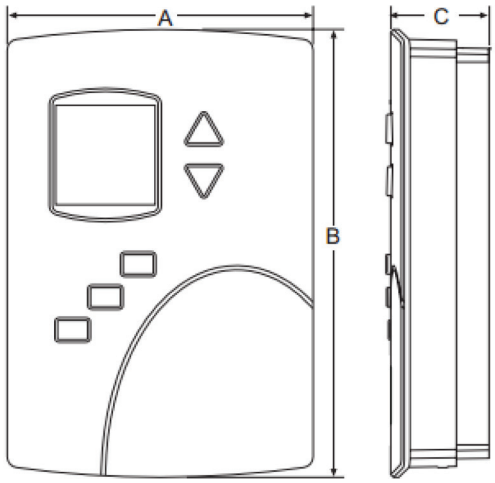


Table 1: BACnet Thermostat Dimensions

A	B	C
3.50 in (89 mm)	5.12 in (130 mm)	1.12 in (29 mm)

BACnet™ Thermostat Product Numbers

Description	Product Number
Roof Top Unit	
Modulating or ON/OFF valves One or two-stages heat One or two stages cooling Fan control Economizer	2508034
Heat Pump Unit	
3 heat, 2 cool Fan Control Economizer	2508036

Installing the BACnet™ Thermostat

This section provides important instructions and guidelines for installing the *BACnet* Thermostat. Carefully review this information before installing the controllers.

Mounting the *BACnet* Thermostat

For the most accurate performance, install the *BACnet* Thermostat on an inside wall where it can sense the average room temperature. Avoid locations with direct sunlight, heat sources, windows, air vents, and air circulation or obstructions such as curtains, furniture, etc.

The *BACnet* Thermostat must not be:

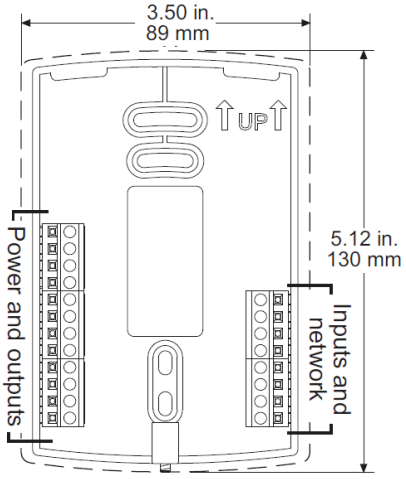
- Mounted on an exterior wall
- Mounted on or near an object with a large thermal mass such as a concrete block wall
- Blocked from normal air circulation by obstructions
- Exposed to heat sources such as lights, computers, copiers, or coffee makers, or to direct sunlight at any time of the day
- Exposed to drafts from windows, diffusers, or returns
- Exposed to air flow through connecting conduits or empty spaces behind walls

Rough-in Preparation

Complete rough-in wiring at each location before mounting a *BACnet* Thermostat. This includes the following steps.

- Install the supplied mounting base directly to a wall, a vertical electrical box, or a box with a wall plate kit
- Routing the connecting cable or cables from the *BACnet* Thermostat to the equipment it is controlling
- Block leaks and airflow from conduits with plumber's putty or similar material
- If replacing an existing thermostat, label existing wires for reference when removing the existing thermostat

Figure 2: BACnet Thermostat Mounting Base Details



Installing the *BACnet* Thermostat

⚠ CAUTION

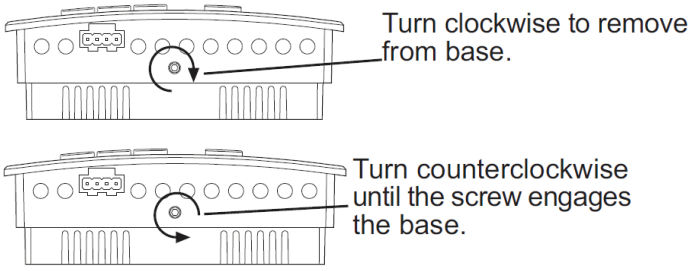
Can cause equipment damage.

To prevent mounting screw heads from touching the circuit board in the controller, use only the mounting screw supplied by Daikin. Using screws other than the type supplied may damage the *BACnet* Thermostat.

To install the controller on a mounting base, do the following:

1. Turn the Allen screw in the base of the sensor clockwise until it clears the case.
2. Swing the *BACnet* Thermostat away from the mounting base to remove it.
3. Route wiring for the *BACnet* Thermostat through the mounting base.
4. Position the base with the embossed UP toward the ceiling and fasten it directly to a vertical 2 × 4 inch electrical box.
5. Connect the wires for the *BACnet* Thermostat to the terminals in the mounting base.
6. Place the top of the sensor over the top of the mounting base and swing it down over the Allen screw bracket. Be careful not to pinch any wiring.
7. Turn the Allen screw counterclockwise until it backs out of the mounting base and engages the case.

Figure 3: Allen Head Directions



Connecting Inputs

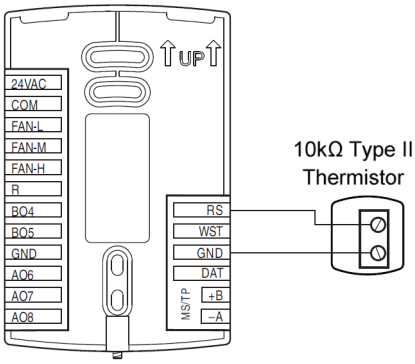
The inputs for the BACnet™ Thermostat are configured for specific functions and do not require set up in the field. Not all inputs are required for every application.

Remote Space Temperature Sensor (optional)

Connect a 10kΩ, Type II thermistor temperature sensor to the remote space temperature (RS) input and ground (GND) terminals. The input includes the internal pull-up resistor. Follow the instructions supplied with the sensor for installation.

When a remote space temperature input is connected to the *BACnet* Thermostat, the remote temperature is used instead of the internal temperature sensor.

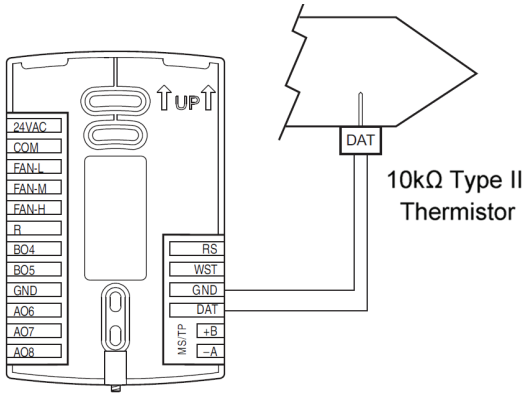
Figure 4: Wiring for Remote Space Temperature Sensor



Discharge Air Temperature

Connect a 10kΩ, Type II thermistor temperature probe to the discharge air temperature (DAT) input. The input includes the internal pull-up resistor. Follow the instructions supplied with the sensor for installation.

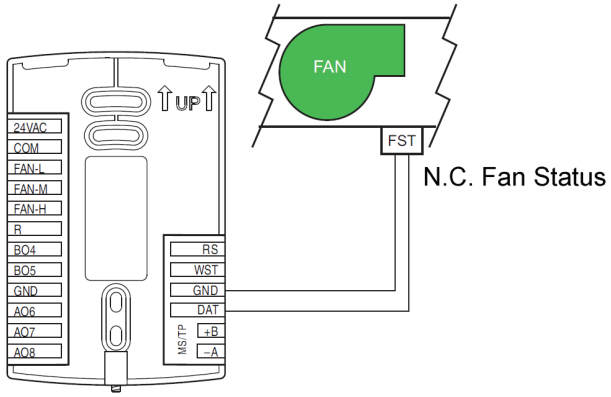
Figure 5: Wiring for Discharge Air Temperature Sensor



Fan Status Switch (optional)

Connect a Normally Closed Fan Status switch to the Discharge Air Temperature (DAT) input and ground (GND) terminals. The input includes the internal pull-up resistor. Follow the instructions supplied with the switch for installation.

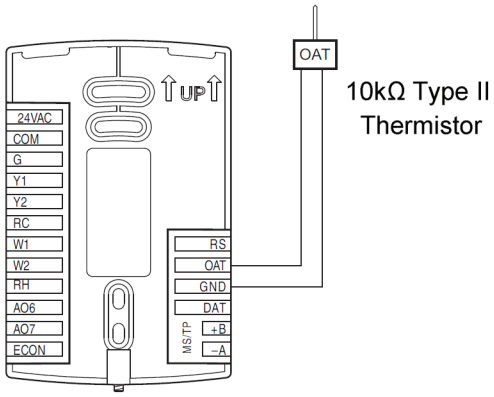
Figure 6: Wiring for a Fan Status Switch



Outside Air Temperature

Connect a 10kΩ, Type II thermistor temperature probe to the outside air temperature (OAT) input. The input includes the internal pull-up resistor. Follow the instructions supplied with the sensor for installation.

Figure 7: Wiring for an Outside Air Temperature Sensor



Connecting Outputs

⚠ CAUTION

Can cause equipment damage.

Improperly connecting loads or equipment to output terminals may damage the equipment. Connect only as shown in the following diagrams or application drawings.

The BACnet™ Thermostat outputs are product dependent and are configured for specific applications.

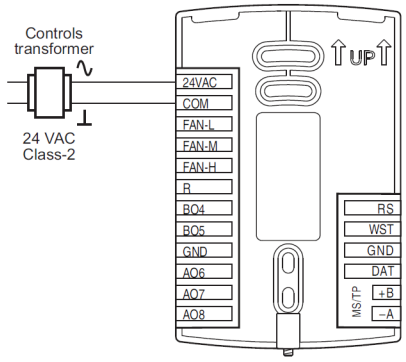
- No field programming or set up is required or possible
- Depending on model and application, the *BACnet* Thermostat outputs are designed for either 24 volt AC or 0-10 volt DC loads
- The outputs may represent analog or digital signals

Connecting Power

The *BACnet* Thermostat requires an external, 24 volt AC power source. Use the following guidelines when choosing and wiring transformers.

- Use only a Class-2 transformer of the appropriate size to supply power
- Daikin recommends powering the *BACnet* Thermostat from a dedicated controls transformer
- Connect the transformer's neutral lead to the COM terminal
- Connect the AC phase lead to the 24VAC terminal
- Power is applied to the controller when the transformer is powered

Figure 8: Wiring for BACnet Thermostat Power



Maintenance

Remove dust as necessary from the holes in the top and bottom. Clean the display with a soft, damp cloth and mild soap.

User Functions

This section covers topics for the end user in a facility.

BACnet™ Thermostat user functions are limited to changing the following functions.

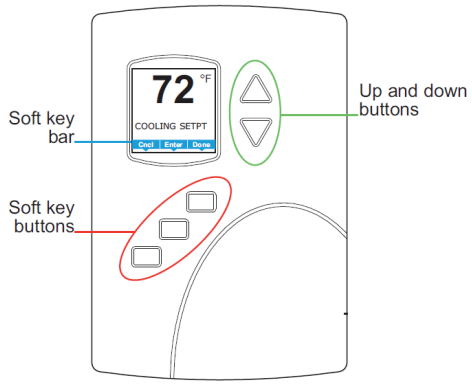
- Active temperature setpoints
- Fan operation
- Changing between heating and cooling
- Override scheduled occupancy or occupancy based on the schedule in the *BACnet* Thermostat
- Change the display between Fahrenheit and Celsius

Operating the *BACnet* Thermostat

BACnet Thermostat functions are accessible through a user interface consisting of simple, context sensitive menus. The menus are opened and options are selected by using the buttons and a color display on the front of the *BACnet* Thermostat.

- Pressing either the up button ▲ or down button ▼ changes a selection, setting, or value
- Pressing the Enter button saves the selected setting or value. The Enter button is the middle of the three buttons below the display
- Saving a selection also advances to the next display

Figure 9: BACnet Thermostat Display and Buttons



The three buttons below the display are defined by labels in the soft key bar. The buttons are designated for the following functions.

- Back – Returns to the previous menu
- Cncl – Cancels current changes
- Done – Push this button at any point while entering a value. For example, if you have entered the first two digits of a password and the remaining two digits are correct, pushing Done completes the entry of the password
- Enter – Pushing this button enters the selection and advances to the next step
- Exit – Returns to temperature display

The operating modes of the *BACnet* Thermostat are represented by the display icons.

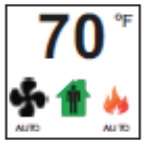
Table 2: Operating Mode Icons

Icon	Description	Mode
	The **FAN** icon rotates when the system fan is operational. In systems with multispeed fans the icon rotation is the same regardless of speed. When fan operation is set to automatic, the word “Auto” is placed under the icon.	Fan
	**Occupied** – Occupancy is set to occupied by the schedule maintained in the controller or through the network.	Occupancy
	**Unoccupied** – Occupancy is set to unoccupied by the schedule maintained in the controller or through the network.	Occupancy
	**Override** – A user has entered temperature setpoints that override the unoccupied setpoints.	Occupancy
	**Cooling** – The system will cool the space until the cooling setpoint is reached. The icon is in motion when cooling is taking place.	Heating/Cooling
	**Heating** – The system will heat the space until the heating setpoint is reached. The icon is in motion when heating is taking place.	Heating/Cooling
Off	System is **OFF.**	Heating/Cooling

Entering a User Password

User functions may require a password consisting of four numbers. Once a user password is entered it will remain active for 60 seconds after the last button is pushed.

Table 3: Entering a User Password

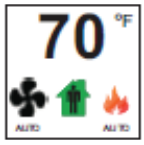
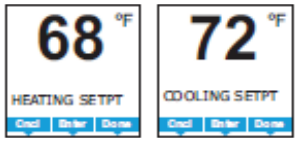
Procedure	Steps	Display
Starting display	Start at the temperature display	
Enter the Level 1 password	1. Press any button on the BACnet™ Thermostat. The display changes to the Security User Level display. 2. Press either the ▲ or ▼ button to change the first digit of the password. 3. Press the Enter button to select the next digit. Repeat for all four digits. 4. If the password is correct, the display will advance to the first menu.	

Changing the Active Setpoints

To enter or change the active temperature setpoints you may need to enter a user password.

NOTE: In the following procedure the current active setpoint – either cooling or heating – is the first setpoint to change. Once that setpoint is entered, the display advances to the next setpoint.

Table 4: Changing the Active Setpoints

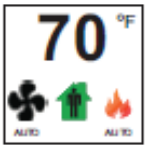
Procedure	Steps	Display
Starting display	Start at the temperature display **NOTE:** The next step may require a user password.	
Change the active setpoints	1. Press either the ▲ or ▼ button to change the active temperature setpoint. **NOTE:** A user password may be required after pushing the first button. 2. Press the Enter button to save the value. The display will advance to the next setpoint. 3. Press the ▲ or ▼ button to change the next setpoint. 4. Press the Enter button to save the value. The display will return to the temperature display.	

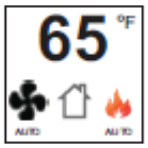
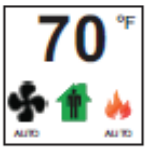
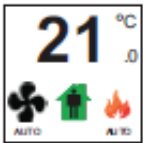
Setting the Operating Modes

The operating modes set the following functions.

- Fan operation
- Changing between heating and cooling
- Override scheduled occupancy or occupancy that has been set by a schedule
- Change the display units from Fahrenheit to Celsius

Table 5: Setting the Operating Modes

Procedure	Steps	Display
Starting display	Start at the temperature display **NOTE:** The next step may require a user password.	
Change the heating or cooling mode	1. Push the button under the heating/cooling icon. **NOTE:** If a user password has previously been entered or if the BACnet™ Thermostat has not been set up with a user password, entering a password is not required. 2. Press either the ▲ or ▲ button to select the heating/cooling mode. The mode may be one of the following. • **Emergency** – (Option) Turns on the auxiliary heating in a heat pump unit • **Heat** – The system will only heat the space • **Cool** – The system will only cool the space • **Auto** – The system will switch between heating and cooling • **Off** – The system is turned OFF 3. Press the Enter button to save the setting. The display returns to the temperature display.	    Heating/cooling icons
Set the fan mode	1. Push the button under the fan icon. **NOTE**: If a user password has previously been entered or if the *BACnet* Thermostat has not been set up with a user password, entering a password is not required. 2. Press the Enter button to select the next digit. Repeat for all f our digits. 3. Press either the ▲ or ▲ button to select the fan mode from the following options. • **Auto** – Sets the fan to run only when there is a call for heating or cooling. The word AUTO will be placed under the fan icon • **On** – Sets a single speed fan to run continuously • **Low, Med, High** – Sets the speed at which 3-speed or modulating fans will run continuously. 4. Press the Enter button to save the setting. The display returns to the temperature display.	 Fan icon  1-speed fan option  Multi-speed fan option

Procedure	Steps	Display
Change the override setpoint	Entering an override setpoint can only take place if the BACnet™ Thermostat is in the unoccupied mode. 1. Push the button under unoccupied icon . **NOTE:** If a user password has previously been set up with a user password, entering a password is not required. 2. Press either the ▲ or ▼ button to change the first digit of the password. 3. Press the Enter button to select the next digit of the password. 4. Press either the ▲ or ▼ button to turn the override ON or OFF. • **Override Off** – The controller uses the unoccupied setpoint as the active setpoint • **Override On** – The controller changes to the occupied setpoint which can then be temporarily changed 5. Press the Enter button to save the setting. **NOTE:** When the system is in the unoccupied mode, changing the active setpoint will automatically place the system in the override mode.	 
Change the display units	To temporarily change the display units to either Celsius or Fahrenheit, press and hold the middle button under the display until the units change.	 

Commissioning Functions

The topics in this section are advanced topics for control technicians and engineers. These topics cover procedures for the initial BACnet™ Thermostat setup.

The *BACnet* Thermostat commissioning functions are values and settings that are entered during the installation and commissioning of a controller and the equipment it is controlling. Typically these functions do not change after the installation and commissioning process.

To set up the commissioning functions, you will need the following information.

- Information about the equipment
- The sequence of operation for the equipment
- The building automation plans for controllers that are part of a network

Users may change the occupied heating and cooling setpoints without accessing the commissioning functions.

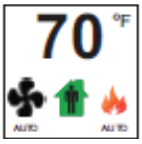
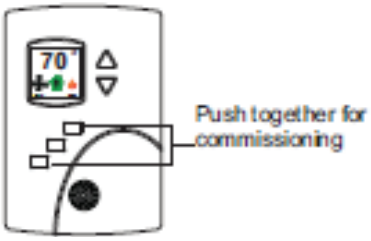
NOTE: The instructions for the *BACnet* Thermostat commissioning functions cover all of the functions that can be set in the controller. Not all functions are available on every model of controller.

Enter the Commissioning Mode

For access to the commissioning functions you will need to know Password 2.

- If the controller has not been previously set up, no password is required
- A new Password 2 can be entered in the advanced commissioning functions

Table 6: Enter the Commissioning Mode

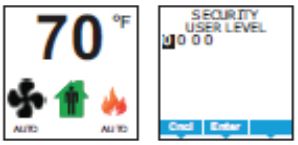
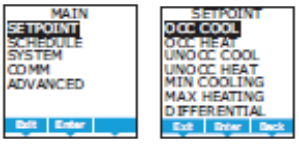
Procedure	Steps	Display
Starting display	Start from the temperature display	
Enter the commissioning password	1. Press the left and right buttons below the display at the same time and hold them until the display changes to the SECURITY USER LEVEL display. **NOTE:** If Password 2 has not previously been entered, the display will change to the MAIN menu. 2. Press either the ▲ or ▼ button to change the first digit of Password 2. 3. Press the Enter button to select the next digit. Repeat for all four digits. The Enter button is the middle of the three buttons below the display.	 
Select a commissioning function	Access to the commissioning functions always starts at the MAIN menu display.	

Setting the Commissioning Setpoints

The commissioning setpoints set the operational setpoints and limits for the BACnet™ Thermostat. Setting commissioning setpoints requires entering Password 2.

NOTE: Not all setpoints in the following procedure are applicable to all models of *BACnet* Thermostat. Those setpoints are marked as (optional).

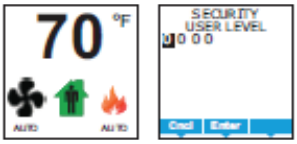
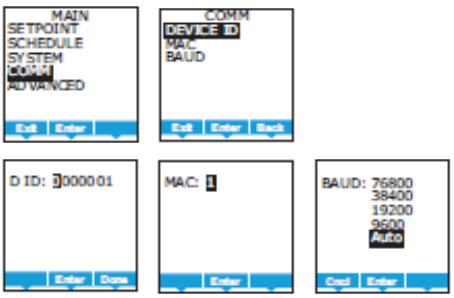
Table 7: Setting the Commissioning Setpoints

Procedure	Steps	Display
Starting display	1. Start at the temperature display. 2. Enter Password 2. The display changes to the MAIN menu display.	
Choose and set the setpoints	1. From the MAIN menu, press either the ▲ or ▼ button to select SETPOINT. 2. Press Enter. The SETPOINT menu opens. 3. Choose and set each of the following setpoints. • **OCC COOL** – The cooling setpoint that is used as the active setpoint when the system is occupied • **OCC HEAT** – The heating setpoint that is used as the active setpoint when the system is occupied • **UNOCC COOL** – The cooling setpoint that is used as the active setpoint when the system is unoccupied • **UNOCC HEAT** – The heating setpoint that is used as the active setpoint when the system is unoccupied • **MIN COOLING** – The minimum cooling setpoint that a user can select as the active setpoint • **MAX HEATING** – The maximum heating setpoint that a user can select as the active setpoint • **DIFFERENTIAL** – The minimum value between the cooling or heating setpoints. The *BACnet* Thermostat will always maintain this difference between setpoints	

Set Up Communications

Setting BACnet™ communications properties is required only if the *BACnet* Thermostat is integrated into a network with other *BACnet* controllers. Entering the communications properties requires entering Password 2.

Table 8: Set Up Communications

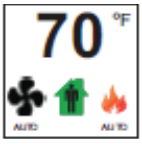
Procedure	Steps	Display
Starting display	1. Start at the temperature display. 2. Enter Password 2. The display changes to the MAIN menu display.	
Change the network communication properties	1. From the MAIN menu, press either the ▲ or ▼ button to select COMM. 2. Press Enter. The COMM menu opens up. 3. Choose and set the following properties. • **DEVICE ID** – This is the *BACnet* device instance. The device instance must be within the range of 1 to 4,194,302. • **MAC** – The MAC address must be in the range of 1 – 127. • **BAUD** – Set to match other devices on the *BACnet* MS/TP network. The choices are Auto, 9600, 19200, 38400, or 76800. **NOTE:** After changing a communication property the *BACnet* Thermostat will reset. **NOTE:** If setting up with the MicroTech Integrated System contact a Daikin representative for the appropriate values.	

Set the Time and Date

Setting the time and date requires entering Password 2.

NOTE: If the BACnet™ Thermostat is connected to a *BACnet* network that includes a time service master, the time and date are automatically set to the network time and date.

Table 9: Set the Time and Date

Procedure	Steps	Display
Starting display	1. Start at the temperature display. 2. Enter Password 2. The display changes to the MAIN menu display.	 
Select the SCHEDULE menu	1. From the MAIN menu, press either the ▲ or ▼ button to select SCHEDULE. 2. Press Enter. The SCHEDULE menu opens. 3. Choose SET CLOCK and then press Enter. The SET CLOCK menu opens.	 
Choose a clock function to set.	Choose one of the features in the SET CLOCK menu to change the date, time, or Daylight Saving Time (DST) setting. • **DATE** – The current calendar date. • **TIME** – Time is set according to a 12-hour clock. • **DST ENABLE** – Set to TRUE to enable Daylight Saving Time and FALSE to use standard time year-round. • **DST AUTO** – When set to TRUE, the *BACnet* Thermostat automatically calculates the start and end dates from relative dates. For example, set DST START to the first Sunday in March instead of a calendar date. • **DST START** and **DST END** – Enter the dates and time to begin observing DST. If DST AUTO is set to TRUE the dates are relative; if set to FALSE the date is a calendar date.	

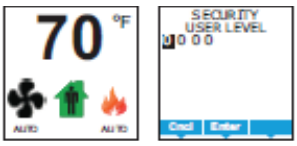
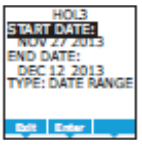
Setting the Occupancy Schedule

The schedule in the BACnet™ Thermostat controls the occupancy mode. If the schedule is set to ON, the *BACnet* Thermostat uses the occupied setpoint as the active setpoint. If the schedule is OFF, the unoccupied setpoint is used.

NOTE: The schedule in the *BACnet* Thermostat is a *BACnet* schedule object. If the *BACnet* Thermostat is connected to a *BACnet* network the schedule can be set up with a *BACnet* operator workstation.

Setting the occupancy schedule requires entering Password 2.

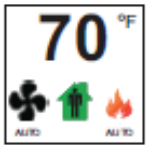
Table 10: Setting the Occupancy Schedule

Procedure	Steps	Display
Starting display	1. Start at the temperature display. 2. Enter Password 2. The display changes to the MAIN menu display.	
Select the SCHEDULE menu	1. From the MAIN menu, press either the ▲ or ▼ button to select SCHEDULE. 2. Press Enter. The SCHEDULE menu opens.	
Choose and set a weekly schedule	1. From the SCHEDULE menu, choose one of the following schedule entry methods to enter a weekly schedule. • **ENTIRE WEEK** – Sets the schedule for all seven days of the week at one time • **WEEKDAYS** – Sets the schedule for Monday to Friday. Saturday and Sunday are not changed • **WEEKEND** – Sets the schedule for Saturday and Sunday. Monday to Friday remain unchanged • **INDIVIDUAL DAYS** – Sets the schedule for just the selected day of the week 2. Change the daily times and values in the schedule to set the occupancy mode to either ON or OFF. • When finished with each pair push Enter or Done • When finished with the schedule push Exit to return to the SCHEDULE menu.	 
Choose and set a holiday schedule	Use a holiday schedule to override the values in the weekly schedule. Months and years can be entered as follows: • To choose ANY as the year, select the year and push the down arrow past the current year. • For month, the choices are any of the twelve months of the year, ANY, EVEN, and ODD. 1. From the SCHEDULE menu, choose HOLIDAYS. 2. From the HOLIDAYS list, choose a holiday to edit. 3. From the menu for the holiday, choose • **DATE** – Enter a single date on which the holiday schedule will override the values of the weekly schedule • **DATE RANGE** – Enter a range of dates on which the values and times listed in the holiday schedule will override the values of the weekly schedule • **WEEK N DAY** – A day of the week and month on which the values and times listed in the holiday schedule will override the values of the weekly schedule.	   

Set Rooftop Unit System Options

The items in the system menu control application specific functions for roof top units. Entering the system options requires entering Password 2.

Table 11: Set Roof Top Unit System Options

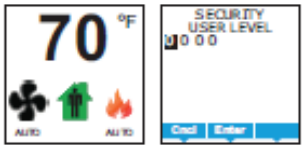
Procedure	Steps	Display
Starting display	1. Start at the temperature display. 2. Enter Password 2. The display changes to the MAIN menu display.	
Choose and set the roof top system options	1. From the MAIN menu, press either the ▲ or ▼ button to select SYSTEM. 2. Press Enter. The SYSTEM menu opens. 3. Choose any of the following items. • **LOCAL OVRD TIME** • **FAN DELAY OFF** • **OCCUPIED FAN** • **MIN OFF TIME** • **STAGE DELAY** • **ECON ENABLE** • **MIN ECON DAMPER** • **ECON ENABLE TEM** • **MIN DAT** • **HEATING FAN**	
Set the local override time	From the SYSTEM menu choose LOCAL OVRD TIME to set the time the BACnet™ Thermostat will hold an override temperature setpoint as the active setpoint. At the end of the period, the *BACnet* Thermostat will use either an occupied or unoccupied setpoint as the active setpoint.	
Set the fan delay	From the SYSTEM menu choose FAN DELAY OFF to set the time the system fan will continue to run after the last heating or cooling stage is turned OFF.	
Set the occupied fan control	From the SYSTEM menu choose OCCUPIED FAN to choose the following: • When ON, the fan will run continuously when the *BACnet* Thermostat schedule is ON (occupied) • When the *BACnet* Thermostat schedule is OFF (Unoccupied) the fan will run only when there is a call for heating or cooling.	

Procedure	Steps	Display
Set up staged cooling and heating	To set up staged cooling and heating do the following: 1. From the SYSTEM menu choose MIN OFF TIME to enter the time a stage must remain turned off before it can be turned on again. 2. From the SYSTEM menu choose STAGE DELAY to enter the time the first stage must remain turned on before the second stage can be turned on.	 
Enable the economizer	To set up the economizer do the following: 1. From the SYSTEM menu choose ECON ENABLE to enable the economizer application. 2. From the SYSTEM menu choose MIN ECON DAMPER to set the minimum position for the economizer damper. 3. From the SYSTEM menu choose ECON ENABLE TEM. Enter the value that the outside air temperature must fall below before the economizer damper can open. 4. From the SYSTEM menu choose MIN DAT. Enter the minimum discharge air temperature that will be allowed during cooling when the economizer is enabled.	   
Set heating fan control	From the SYSTEM menu choose HEATING FAN and then choose one for the following. • **AUTO** – The fan runs only on a call for heat. • **OFF** – The BACnet™ Thermostat will not command the fan to run. Typically this setting used for systems with baseboard heat or some similar split system configuration.	

Set Heat Pump Unit Systems Options

The items in the system menu control application specific functions for heat pump units. Entering the system options requires entering Password 2.

Table 12: Set Heat Pump Unit Systems Options

Procedure	Steps	Display
Starting display	1. Start at the temperature display. 2. Enter Password 2. The display changes to the MAIN menu display.	
Choose and set the heat pump system options	1. From the MAIN menu, press either the ▲ or ▼ button to select SYSTEM. 2. Press Enter. The SYSTEM menu opens. 3. Choose any of the following items. • **LOCAL OVRD TIME** • **FAN DELAY OFF** • **OCCUPIED FAN** • **MIN OFF TIME** • **STAGE DELAY** • **ECON ENABLE** • **MIN ECON DAMPER** • **ECON ENABLE TEM** • **MIN DAT (optional)** • **REV VLV PLRTY** • **AUX HEAT (optional)** • **AUX HT LOCKOUT (optional)** • **COMP LOCK TEMP**	
Set the local override time	From the SYSTEM menu choose LOCAL OVRD TIME to set the time the BACnet™ Thermostat will hold an override temperature setpoint as the active setpoint. At the end of the period, the *BACnet* Thermostat will use either an occupied or unoccupied setpoint as the active setpoint.	
Set the fan delay	From the SYSTEM menu choose FAN DELAY OFF to set the time the system fan will continue to run after the last heating or cooling stage is turned OFF.	
Set the occupied fan control	From the SYSTEM menu choose OCCUPIED FAN to choose the following: • When ON, the fan will run continuously when the *BACnet* Thermostat schedule is ON (occupied). • When the *BACnet* Thermostat schedule is OFF (Unoccupied) the fan will run only when there is a call for heating or cooling.	
Set up staged cooling and heating	To set up staged cooling and heating do the following: 1. From the SYSTEM menu choose MIN OFF TIME to enter the time a stage must remain turned off before it can be turned on again. 2. From the SYSTEM menu choose STAGE DELAY to enter the time the first stage must remain turned on before the second stage can be turned on.	

Procedure	Steps	Display
Enable the economizer	To set up the economizer do the following: 1. From the SYSTEM menu choose ECON ENABLE to enable the economizer application. 2. From the SYSTEM menu choose MIN ECON DAMPER to set the minimum position for the economizer damper. 3. From the SYSTEM menu choose ECON ENABLE TEM. Enter the value that the outside air temperature must fall below before the economizer damper can open. 4. From the SYSTEM menu choose MIN DAT. Enter the minimum discharge air temperature that will be allowed during cooling when the economizer is enabled.	
Set the reversing valve polarity	From the SYSTEM menu choose REV VLV PLRTY. Select one of the polarity settings. • **Active Heating** – The O/B output terminal is active on a call for heating. • **Active Cooling** – The O/B output terminal is active on a call for cooling.	
Set up auxiliary heat (Optional feature)	From the SYSTEM menu choose AUX HEAT. • **Comp Lockout** – The BACnet™ Thermostat will enable auxiliary heat only when the compressors are locked out because of low outside air temperature. • **3rd Stage** – The *BACnet* Thermostat uses the auxiliary heat as a third stage of heating. • **None** – No auxiliary heat is enabled.	
Set the lockout temperature for auxiliary heat	From the SYSTEM menu choose AUX HT LOCKOUT to set the minimum outside air temperature for auxiliary heat lockout. Auxiliary heat will not operate above this temperature.	
Set the compressor low temperature lockout.	From the SYSTEM menu choose COMP LOCK TEMP to set the minimum outside air temperature for compressor operation. Compressors will not operate below this temperature.	

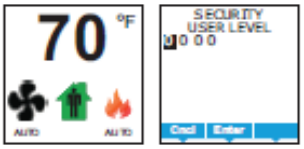
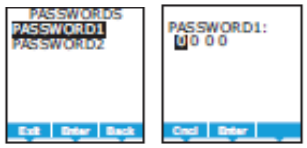
Advanced Options

Use the advanced options to set up the following items.

- Choosing an application and units of measure.
- Adjusting the PID loops
- Changing passwords
- Calibrating inputs
- Setting the display banking
- Modifying access to users with Password 1.

Setting the advance options requires entering Password 2.

Table 13: Advanced Options

Procedure	Steps	Display
Starting display	1. Start at the temperature display. 2. Enter Password 2. The display changes to the MAIN menu display.	
Choose the ADVANCED menu	1. From the MAIN menu, press either the ▲ or ▼ button to select ADVANCED. 2. Press Enter. The ADVANCED menu opens. 3. Choose any of the following functions • **RESTORE APP** • **LOOPS** • **PASSWORDS** • **CALIBRATION** • **DISPLAY** • **KEY LOCKOUT**	
Reset the application and choose units of measure	Choose RESTORE APP from the ADVANCED menu to reset the BACnet™ Thermostat to the original configuration and settings. Use it also to change the *BACnet* Thermostat application program and the units of measure to display. There are two version of each application program in every *BACnet* Thermostat. • The Metric version displays temperature in Celsius and uses metric values for units of measure • The English version displays temperature in Fahrenheit and uses English values for units of measure **NOTE:** Choosing an application will reset the *BACnet* Thermostat.	
Adjust the PID loops	Choose LOOPS from the ADVANCED menu to adjust the values for the cooling or heating PID loops. Only the proportional and integral properties can be changed from the display. • The proportional default is 2°F. • The integral default is zero (0).	
Enter or change passwords	Choose PASSWORDS from the ADVANCED menu to set either Password 1 or Password 2 • Password 1 is for a facility user and limits changes to active setpoints, fan operation, occupancy, and heating and cooling modes • Password 2 is for a controls technician to set up and commission the *BACnet* Thermostat **NOTE:** Entering four zeros (0000) removes the password. The *BACnet* Thermostat is supplied without passwords. 1. From the PASSWORD1 or PASSWORD2 menu press either the ▲ or ▼ button to change the first digit of the password. 2. Press the Enter button to select the next digit. Repeat for all four digits. 3. When the Enter button is pressed for the last digit, the new password is saved and the display advances.	

Procedure	Steps	Display
Calibrate the inputs	Choose CALIBRATION from the ADVANCED menu to calibrate an input. The BACnet™ Thermostat includes two calibration entries; one for the internal temperature sensor and one for the optional remote temperature sensor connected to the RS terminal. Enter a calibration factor to adjust either input for sensor inaccuracies. • For a low input reading enter a positive correction value • For a high input reading enter a negative correction value	
Set the display blanking	Choose DISPLAY from the ADVANCED menu to set the display appearance after the last button is pushed. • **BLANKING** – Choose one of the blanking options — **CLOCK** – An analog clock replaces the temperature and mode icons — **BACKLIGHT OFF** – The display brightness changes to the level set by DIM LEVEL after the last button interaction — **NONE** – The temperature and mode icons always remain visible • **DIM LEVEL** – Sets the level of brightness of the display back light if BACKLIGHT OFF is the selected blanking option	
Lockout user buttons	Choose KEY LOCKOUT from the ADVANCED menu to limit the accessibility to users with only Password 1, the user password. • **MODE/SETPOINT** – Users with Password 1 cannot change any value or mode • **MODE** – Users with Password 1 cannot change the heating/cooling, fan, or occupancy modes • **NONE** – Users with Password 1 have full access to active setpoints, heating/cooling, fan, and occupancy modes	

Topics in this section cover the sequences of operation for the BACnet™ Thermostat. These are advanced topics for control's technicians and engineers.

Room Temperature Setpoints

There are three temperature setpoints each for heating and cooling for a total of six setpoints.

- Active cooling
- Occupied cooling
- Unoccupied cooling
- Active heating
- Occupied heating
- Unoccupied heating

Types of Setpoints

Active setpoint – The active setpoint is the current setpoint. The active setpoint is determined by the following.

- If the space is occupied, the controller uses the occupied setpoint
- If the space is unoccupied the controller uses the unoccupied setpoint
- A user with Password 1 can enter an active setpoint from the display. This change is for a limited time or until the next time the space status changes from unoccupied to occupied

Occupied setpoint – A temperature setpoint entered by the controls technician during controller setup and system commissioning. This is the setpoint used when the system is occupied which is usually controlled by the schedule in the controller.

Unoccupied setpoint – A temperature setpoint entered by the controls technician during controller setup and system commissioning. This is the setpoint used when the system is unoccupied which is usually controlled by the schedule in the controller.

Setpoint Limits

No cooling setpoint can be higher than any heating setpoint.

If a user is adjusting a setpoint and it comes with the range set by Minimum Setpoint Differential, the corresponding setpoint will be changed to maintain the differential. For example, the Minimum Setpoint Differential is 4°F and the Occupied Heating setpoint is 70°F. If the user lowers the Occupied Cooling setpoint to 71°F, the controller recalculates the Occupied Heating setpoint and changes it to 67°F.

Occupancy

The *BACnet* Thermostat is designed to operate as a stand-alone controller and can determine occupancy based on its internal occupancy schedule. The two occupancy states of the *BACnet* Thermostat are Occupied and Unoccupied. An occupancy state can also be commanded by another *BACnet* controller on the building automation network.

Occupied

If the internal schedule is enabled, the state of the schedule is set to either occupied or unoccupied as the initial state.

Unoccupied

The unoccupied state is entered only if the internal occupancy schedule is enabled and if the schedule is inactive.

Automatic Cooling and Heating Changeover

The *BACnet* Thermostat can be set to automatically change between the heating and cooling modes.

- If the space temperature rises above the active cooling setpoint, the mode is set to cooling
- If the space temperature falls below the active heating setpoint, the mode is set to heating

Schedules

The internal occupancy schedule changes the *BACnet* Thermostat between the occupied (active) and unoccupied (inactive) states.

PID Control Loops

A PID control loop calculates an error value from the difference between the measured room temperature and the active setpoint. The error value is expressed as a percentage and is typically used in a BAS controller to control the state of an output. When the difference between the setpoint and room temperature is large, the error is large. As the system reduces the difference between the setpoint and space temperature, the error becomes smaller. In a simple example, if the output of the PID loop that is controlling a modulating valve is 50% the valve would be opened half way; if the output of the loop is 100% the valve position is fully open.

The BACnet™ Thermostat heating and cooling PID loops are implemented in all models.

The *BACnet* Thermostat uses a PID loop for the discharge air temperature. The discharge air loop controls the position of the economizer. For this loop the setpoint is the measured temperature of the air that is discharged by a roof top or heat pump unit.

The PID loops in the *BACnet* Thermostat are standard *BACnet* objects.

Staged Heating and Cooling for Rooftop and Heat Pump Units

Staged heating and cooling is used for application other than chilled or hot water systems. Typically the *BACnet* Thermostat controls gas heat, electric heat, or direct expansion (DX) cooling with stage heating and cooling. Staged cooling or heating can be mixed with a modulating valve for cooling or heating.

Staged Cooling

As the demand for cooling increases, the *BACnet* Thermostat starts the first stage of cooling when the cooling PID loop rises above 95% and the first stage of cooling has been turned off for at least the time set by the value of MINIMUM OFF TIME. The second stage of cooling is turned on when the cooling loop rises above 99% and the first stage has been turned on for the period set by STAGE DELAY and the second stage has been turned off for at least as long as the value of MINIMUM OFF TIME.

As the demand for cooling is satisfied, the second stage is turned off when the cooling PID loop drops below 50%. This first stage is turned off when the cooling loop drops below 5%.

Staged Heating

As the demand for heating increases, the *BACnet* Thermostat starts the first stage of heating when the heating PID loop rises above 95%. The second stage of heating is turned on when the heating loop rises above 99% and the first stage has been turned on for the period set by STAGE DELAY.

As the demand for heating is satisfied, the second stage is turned off when the heating PID loop drops below 50%. This first stage is turned off when the heating loop drops below 5%.

Fan Control for Rooftop and Heat Pump Units

A user with Password 1 can set the BACnet™ Thermostat controlled fan to either run continuously or to start automatically on a call for cooling or heating.

Auto – When Auto is selected, the fan runs only when there is a call for heating or cooling. It continues to run for the period set by the fan delay timer after the call for heating or cooling.

ON – The fan will run continuously regardless of the heat/cool modes or occupied state.

Economizer Cooling for Rooftop and Heat Pump Units

Some models of the *BACnet* Thermostat include programming for an economizer. This programming controls an economizer outside air damper connected to the output terminal (ECON).

NOTE: The economizer can be enabled only if outside air temperature and discharge air temperature sensor are connected to the *BACnet* Thermostat.

The economizer mode is enabled for cooling when the outside air temperature (OAT) is 2°F below the value of the limit set by Economizer Enable Temperature and disabled if the OAT is 2°F above the value of Economizer Enable Temperature.

Once enabled, the economizer outside air damper opens to the larger value of either the minimum damper position limit (Minimum Econ Damper) or the Discharge Air Temperature loop. The Discharge Air Temperature loop modulates from 0% to 100% as the Discharge Air Temperature rises above the Discharge Air Temperature setpoint.

The Discharge Air Temperature setpoint resets between room temperature and the limit for minimum discharge air temperature as the cooling loop varies between 0 and 50%. If the Discharge Air Temperature decreases below 55°F, the Outside Air Damper returns to the minimum damper position.

Heat Pump Unit Specific Functions

The heat pump unit fan and staging is similar to the roof top unit fan and staging principles.

Reversing Valve Action

The *BACnet* Thermostat reversing valve output (O/B) is energized on a call for cooling ('O' function). The action can be changed from the user interface to be active on a call for heating ('B' function). The 'O' function is the default.

Auxiliary or Emergency Heat Action

The heat pump unit AUX/E output is for auxiliary or emergency heat. Operation can be configured for one of three modes.

Compressor lockout – The AUX/E output is active only on a call for heating when the compressors are locked out because the outside air temperature has dropped below the value of the Compressor OAT Low Limit. The lockout is cleared when the outside air temperature rises 2°F above the value of Compressor OAT Low Limit.

Third stage – The AUX/E output functions as the output for a third stage of heat.

None – This function is a manual operation that can only be turned on from the user interface. When emergency heat is turned on, the AUX/E output is used to maintain the active heating setpoint and both compressor outputs are locked-out.

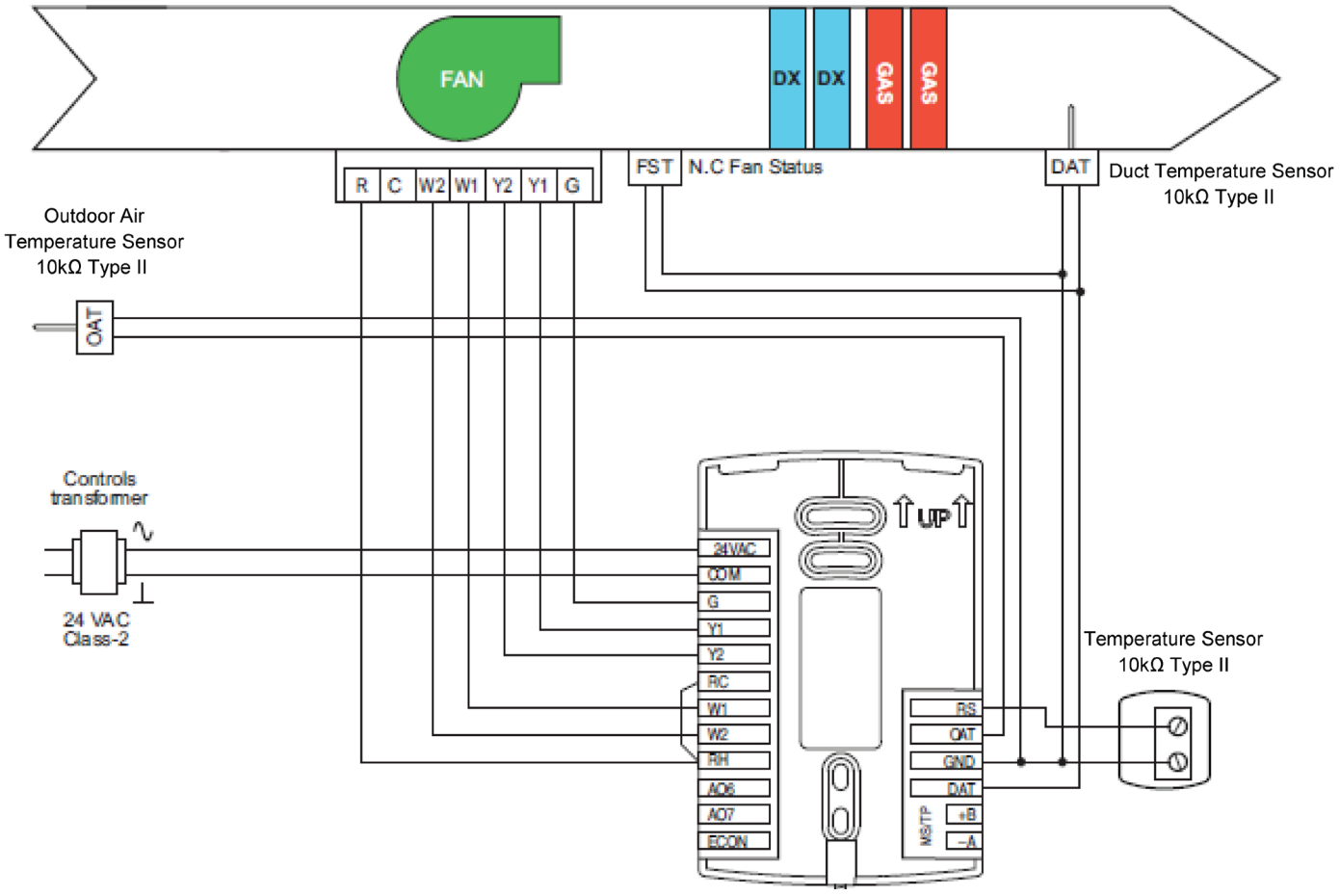
Rooftop Unit Applications

This section covers applications for rooftop units.

Roof Top Unit – Two-Stage Gas Heat and Two-Stage DX Cooling

- Fan status switch (FST) and discharge air temperature (DAT) and outdoor air temperature (OAT) sensors are optional. They are typically used only when the BACnet™ Thermostat is connected to a network.
- The remote temperature sensor (RS) is optional.
- For single stage heating, do not connect W2.
- For single stage cooling, do not connect Y2.
- Connect outputs to 24 volt AC pilot duty inputs.
- For additional details on connecting sensors, see Connecting Inputs on page 7.
- For additional details on connecting the fan and valves, see Connecting Outputs on page 8.

Figure 10: Rooftop Unit Wiring Details—Two-Stage Gas Heat And Two-Stage DX Cooling



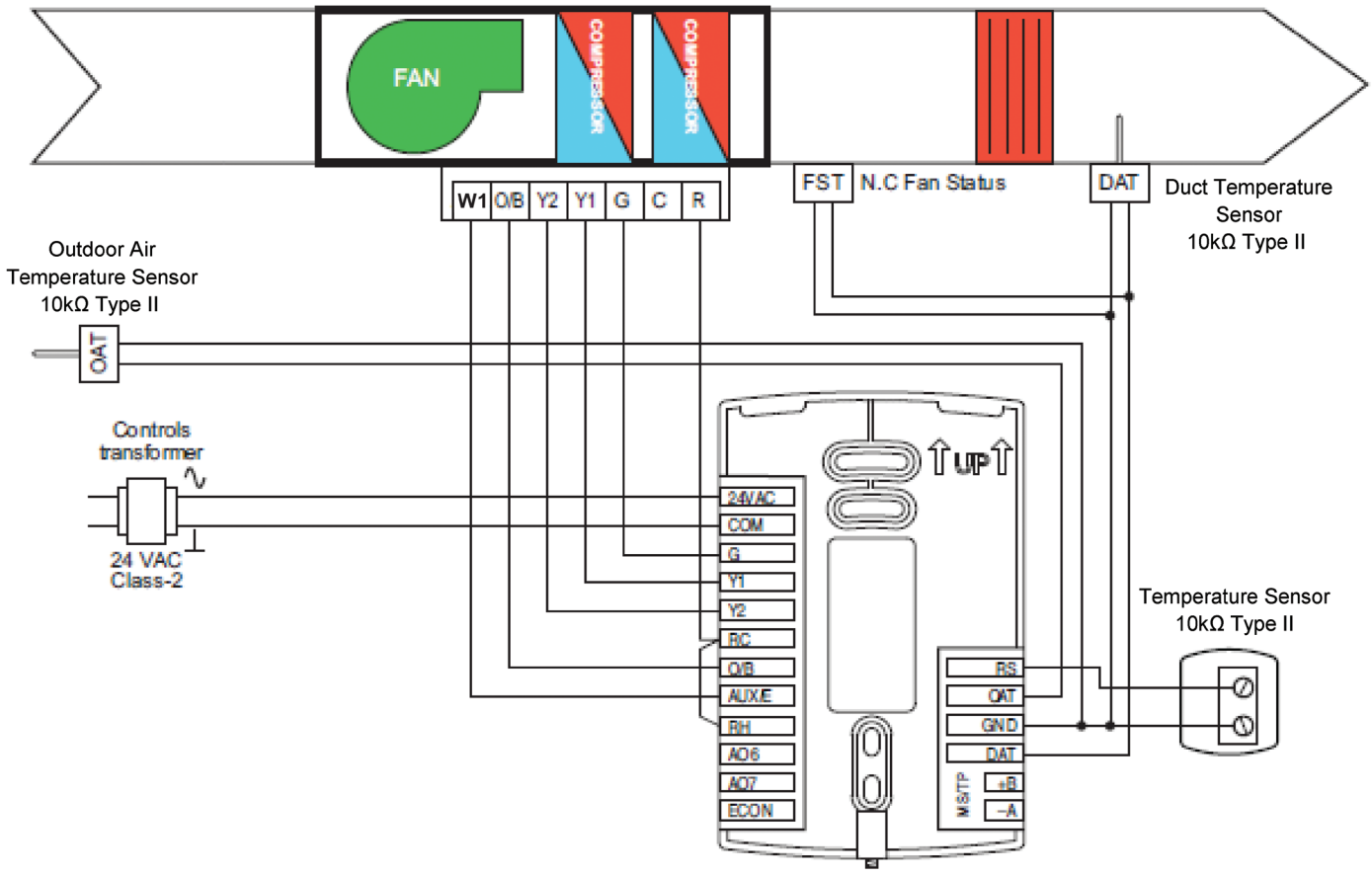
Heat Pump Unit Applications

This section covers applications for heat pump units.

Heat Pump Unit – Three Heat, Two Cool

- Fan status switch (FST) and discharge air temperature sensor (DAT) are optional. They are typically used only when the BACnet™ Thermostat is connected to a network.
- The outdoor air temperature sensor (OAT) is required for compressor lockout based on outside air temperature.
- The remote temperature sensor (RS) is optional.
- For single compressor installations do not connect Y2.
- If auxiliary heat is not required do not connect AUX/E.
- Connect outputs only to 24 volt AC pilot duty inputs.
- For additional details on connecting sensors, see Connecting Inputs on page 7.

Figure 11: Heat Pump Unit Wiring Details—Three Heat, Two Cool



Topics in this section cover integrating BACnet™ Thermostat controllers into a building automation network. These are advanced topics for control technicians and engineers. The *BACnet* Thermostat can function as a stand-alone controller or it can be connected to a *BACnet* MS/TP network. The topics in this section are reference material for control technicians or engineers that will be installing and setting up a *BACnet* Thermostat that is connected to a network.

Connecting to a Network

Before connecting the *BACnet* Thermostat to a *BACnet* MS/TP network, configure the network properties. See the topic Set Up Communications on page 15 for the procedure to set the following.

- Device Instance
- MAC address
- Baud

Use the following principles when wiring the *BACnet* Thermostat to an MS/TP network:

- Connect no more than 128 addressable *BACnet* devices to one MS/TP network.
- Use 18 gauge, twisted pair, shielded cable for all network wiring.
- Connect the (–A) terminal in parallel with all other (–) terminals.
- Connect the (+B) terminal in parallel with all other (+) terminals.
- Connect the shield to an earth ground at only one location on the network.

The controllers or devices on the physical ends of the MS/TP wiring segment must have end-of-line (EOL) termination installed for proper network operation. Set the end-of-line termination to 'On' using the EOL switches. A 120Ω resistor across the positive and negative communication wires will also work as an EOL termination.

Figure 12: BACnet MS/TP Network Wiring

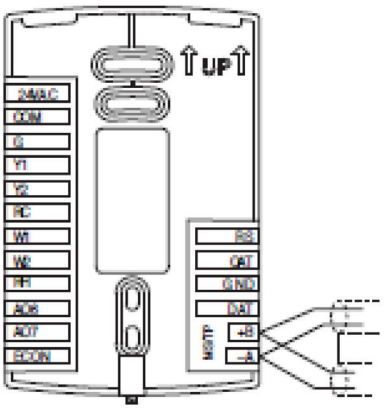
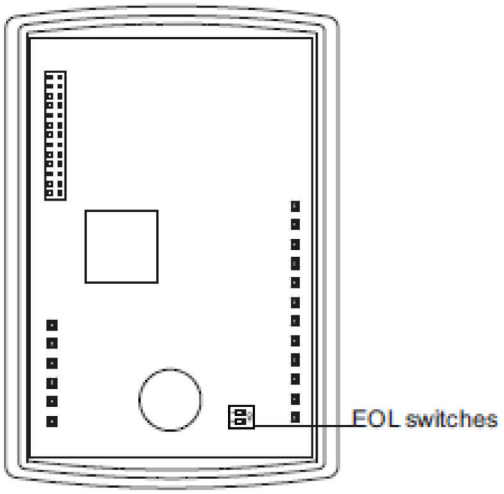


Figure 13: Location of EOL switch



Training and Development

Now that you have made an investment in modern, efficient Daikin equipment, its care should be a high priority. For training information on Daikin HVAC products, please visit us at www.daikinac.com and click on Training.

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