

CBT14 with Heat Pump strategy

User Manual



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CBT14 with Heat Pump strategy (MAN0128US rev 11)

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SECTION 1 : GETTING STARTED

How to use this manual

The **CBT14** manual provides users with the information needed to install and configure the controller for the various application specific requirements.

CBT14

The **CBT14** is a configurable BACnet MS/TP device designed to be used within a BACnet system including existing eBuilding systems. The **CBT14** is available with a preloaded Rooftop Unit strategy designed to control a wide variety of constant volume common Rooftop Units (RTU) used in commercial HVAC installations. It is also possible to load a custom strategy or to modify the preloaded strategy to meet any application specific needs.

CBT14 Strategy Version Information

This document (MAN0128US rev 11) applies to **CBT14 Rooftop Unit Strategy** version 1.0. The strategy version will be printed on the factory box label.

Physical specifications

Size	5.12 x 5.17 x 1.78" (130 x 131.2 x 45 mm)
Enclosure	Injection molded ABS
Mounting	DIN rail <ul style="list-style-type: none">• The housing base is designed for snap-mounting on DIN rails• The controller should not be freely accessible after mounting• Unit must be oriented such that powered relay terminals are at the bottom of unit

Environmental Specifications

Ambient Temperature	32°-122°F (0° - 50°C) ambient.
Ambient Humidity	0% - 90% RH non-condensing
EMC Immunity	EN 61326-1
EMC Emission	EN 61326-1
Approvals	UL Listed (CDN & US) UL916 Energy Management Equipment - File No. E176435
Safety	EN 60730-1:2011 Automatic Action type i.e. Type 1.B.Y
Pollution Degree	Class 2 (EN 60730-1)

Note: This equipment is intended for field installation within an enclosure.

Supporting Software

The following software is required to configure the **CBT14**.

Engineering Center 7.0 or later versions

The **Engineering Center** is used to configure the controller for installation. Users will be able to set MS/TP addresses, baud rate, and configuration values using this software. Users will also be able to change the strategy and download their changes to the controller.

For commissioning the controller, it is recommended to use **NetLink** software or **CBT-STAT** devices.

NetLink version 1.8 or later

NetLink is commissioning software for hand-held computers, available from the American Auto-Matrix Toolbox. **NetLink** software can be used to configure the controller for installation. Like the **Engineering Center**, users can set the MS/TP address, baud rate and configuration values with this software. Users will need the predefined **NetLink** screens that were developed for use with the preloaded strategy that comes shipped for the **CBT14**.

Supporting files

The following files are needed for configuring the **CBT14** with Heat Pump Strategy. These are available from the American Auto-Matrix Toolbox (<http://www.aamatrix.com/toolbox>)

Decoder Spreadsheet (CBT14HPDecoder.xlsx)

This spreadsheet is used to determine what configuration codes are needed to configure the **CBT14**. See *Configuring the CBT14 Heat Pump Strategy* on page 21 for instructions.

Netlink screens (IO_ConfigHP.nls)

These **NetLink** screens are used for configuration of the **CBT14**. See *Configuring the CBT14 Heat Pump Strategy* on page 21 for instructions.

SECTION 2 : INSTALLATION OVERVIEW

Preparing to install the CBT14

This section describes how to unpack the unit and how to prepare the site for installation of the **CBT14**. In order to ensure reliable operation of the controller, the installation site should meet the requirements listed in this section.

Environmental and Electrical Requirements

The controller's immediate environment must meet the following specifications and comply with all local, state and Federal rules and regulations.

Supply Voltage: 24 V AC, 50/60Hz

Note: One side of the 24 V AC transformer must be grounded; refer to *Connecting Power to the CBT14* on page 11 for more information.

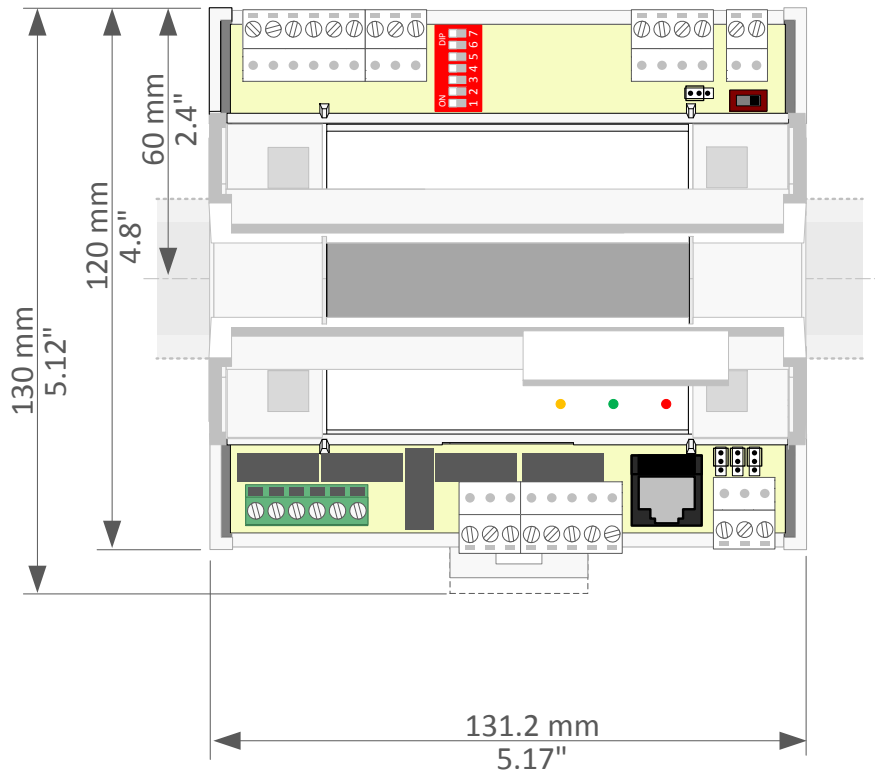
Temperature: Operating temperature is 32°... 122°F (0°... 50°C) ambient

Unpacking the CBT14

The **CBT14** is shipped from the factory in its own box. Multiple **CBT14** boxes may be packaged together in a larger box. Upon receiving the **CBT14** controller shipment, immediately open and inspect the contents. Check outside of the box for any physical damage. Contact the shipper immediately to report any shipping-related damage to the product. American Auto-Matrix is not responsible for damage to the product caused by shipping, either by an American Auto-Matrix selected shipper or by a customer-specified shipping company.

Physical Installation of the controller

The illustration below shows the mounting dimensions of the controller. Be sure to choose a location for the controller that allows the sufficient clearance for installation and servicing.

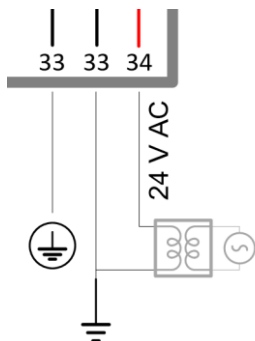


Wiring the CBT14

Once the location has been determined, the **CBT14** can be wired for the network, the room sensors, and the elements of the Roof Top Unit. This section will address the various wiring considerations for the **CBT14**.

Connecting Power to the CBT14

The **CBT14** requires 24 V AC +15% / -20% 50/60 Hz (SELV Power Source) at 55 VA maximum (up to 12 VA internal power plus up to 43 VA supplied to Triac loads) supplied from an externally mounted power transformer. One conductor of the 24 volt side of the transformer must be grounded to an earth ground to avoid damage to the controller. This conductor will be wired to the CMN (common) of the controller. The wiring diagram is shown below:

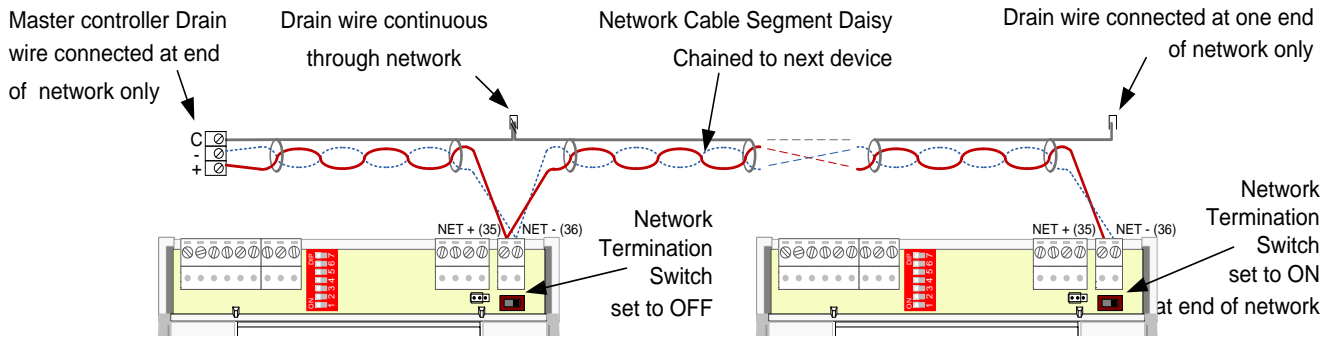


Wiring the RS-485 Communications Network

Wiring the RS-485 network involves connecting the NET+ (35) and NET- (36) terminals in a daisy-chained configuration. One end of the network will be connected to the fieldbus of the Network level controller or BACnet router. At the other end of the network, the last device must be “terminated” by either installing a 100 ohm to 120 ohm resistor or, if the last device is a CBT14, users can switch the “Network Termination Switch” (BACnet MS/TP Terminator) to on. This will effectively terminate the network. The shield, or drain wire, must be carried through the entire network.

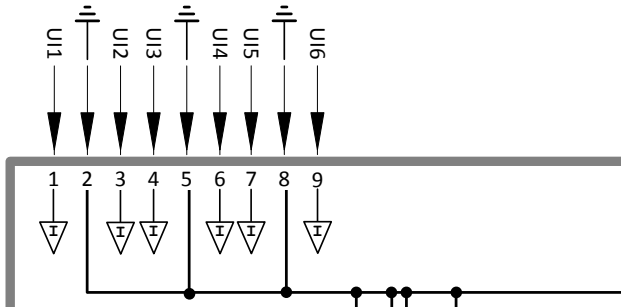
If the RS-485 network is wired to an eSC, then the shield will be grounded at the eSC.

If the RS-485 network is wired to a CBR, the shield must be grounded at one point on the network as shown below:



Wiring the Universal Inputs

The CBT14 comes with 6 universal inputs. UI1, UI2, UI3 and UI4 are used for wiring in-room sensors, setpoint adjust, discharge air sensors, CO₂ sensors, relative humidity sensors and motion sensors, depending on the application (see *Wiring the Room Sensor* on page 14 for an example).



The sequences for this wide range of applications are available within the preloaded strategy. See *CBT14 Heat Pump Control Sequences* on page 27 of this manual for selecting the sequence for specific applications.

- UI1 will typically be where the room temperature sensor or return air temperature sensor is wired. If you are controlling to Return Air Temperature, this is where the return air temperature sensor is to be wired. This input is pre-configured to support a 10K Type III thermistor. All room sensors purchased from American Auto-Matrix are 10K Type III.

Note: Room sensors that short the thermistor for push button occupancy are supported with this controller.

- **UI2** will typically be where the room setpoint adjust is wired. This input is pre-configured to support a 5K potentiometer. All room sensors purchased from American Auto-Matrix are of this sensor type.
- **UI3** is a dedicated input that has been configured to support a 10K Type III thermistor. In the pre-loaded strategy this input is used for a discharge air temperature sensor for control using discharge air temperature reset.
- **UI4** is a dedicated input that has been configured to support a 10K Type III thermistor. In the pre-loaded strategy this input is used for a mixed air temperature sensor.
- **UI5** is a dedicated input that has been configured to support a 10K Type III thermistor. In the pre-loaded strategy this input is used for an outside air temperature sensor.
- **UI6** is configured as a voltage input and have a range of 0 ... 10 V dc. This input can be used for wiring in a CO₂ sensor, relative humidity sensor, or a motion sensor (must be a dry contact closure).

Note: To adjust the span for the CO₂ sensor

[CO2SensorBase \(A253\)](#) Low range of sensor, default is 0.

[CO2SensorSpan \(A254\)](#) Total range of sensor, default is 2000.

Note: To adjust the span for the relative humidity sensor

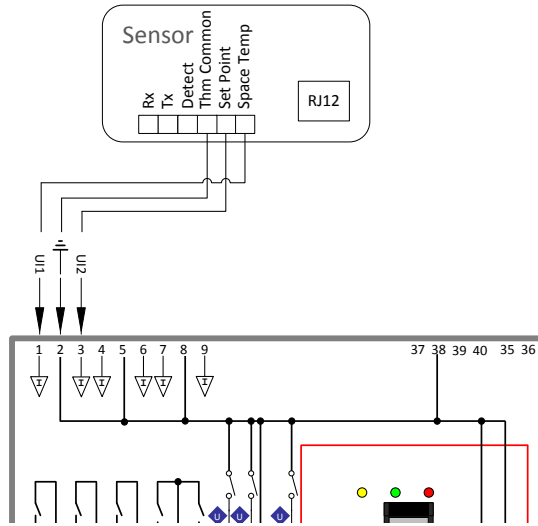
[CO2SensorBase \(A253\)](#) Low range of sensor, default is 0.

[CO2SensorSpan \(A254\)](#) Total range of sensor, default is 100.

IO POINTS	DESCRIPTION
UI1	Zone Temperature (with optional override button)
UI2	Setpoint Adjustment (optional 5K slider)
UI3	Discharge Temperature (optional)
UI3	Discharge Temperature (optional)
UI4	Mixed Air Temperature (optional)
UI5	Outdoor Air Temperature Sensor
UI6	CO ₂ , Humidity or occupancy signal (all optional)

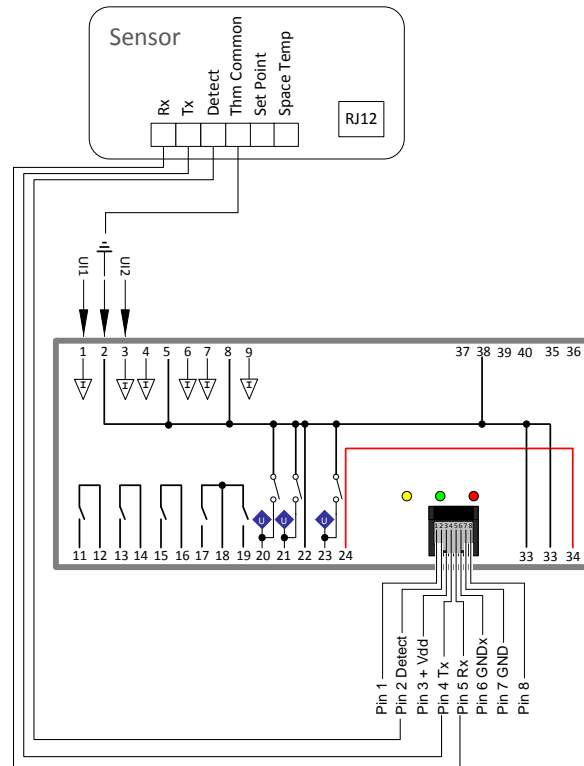
Wiring the Room Sensor

The diagram below illustrates the typical room sensor that can be ordered from American Auto-Matrix. This is a standard room sensor with a space temperature type III thermistor, including a 5K setpoint slide adjust.



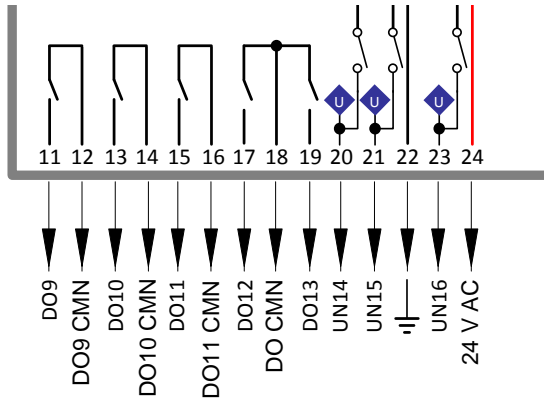
Wiring for Serial Communications through Room Sensor

In addition to the sensor connection illustrated above, the sensor can pass through serial communications connected to its RJ-45 serial port. To pass these comms to the **CBT14**, the Rx, Tx and Detect terminals must be connected to the RJ-45 port in addition to the sensor connections, as illustrated below:



Wiring the Digital and Analog Outputs

The **CBT14** comes with 5 digital outputs and 2 analog outputs for controlling a wide variety of possible elements. It is possible to control intermittent and continuous fans, staged heat, and tri-state heating valves depending on the application.



For the supplied strategy, the following are the output allocations:

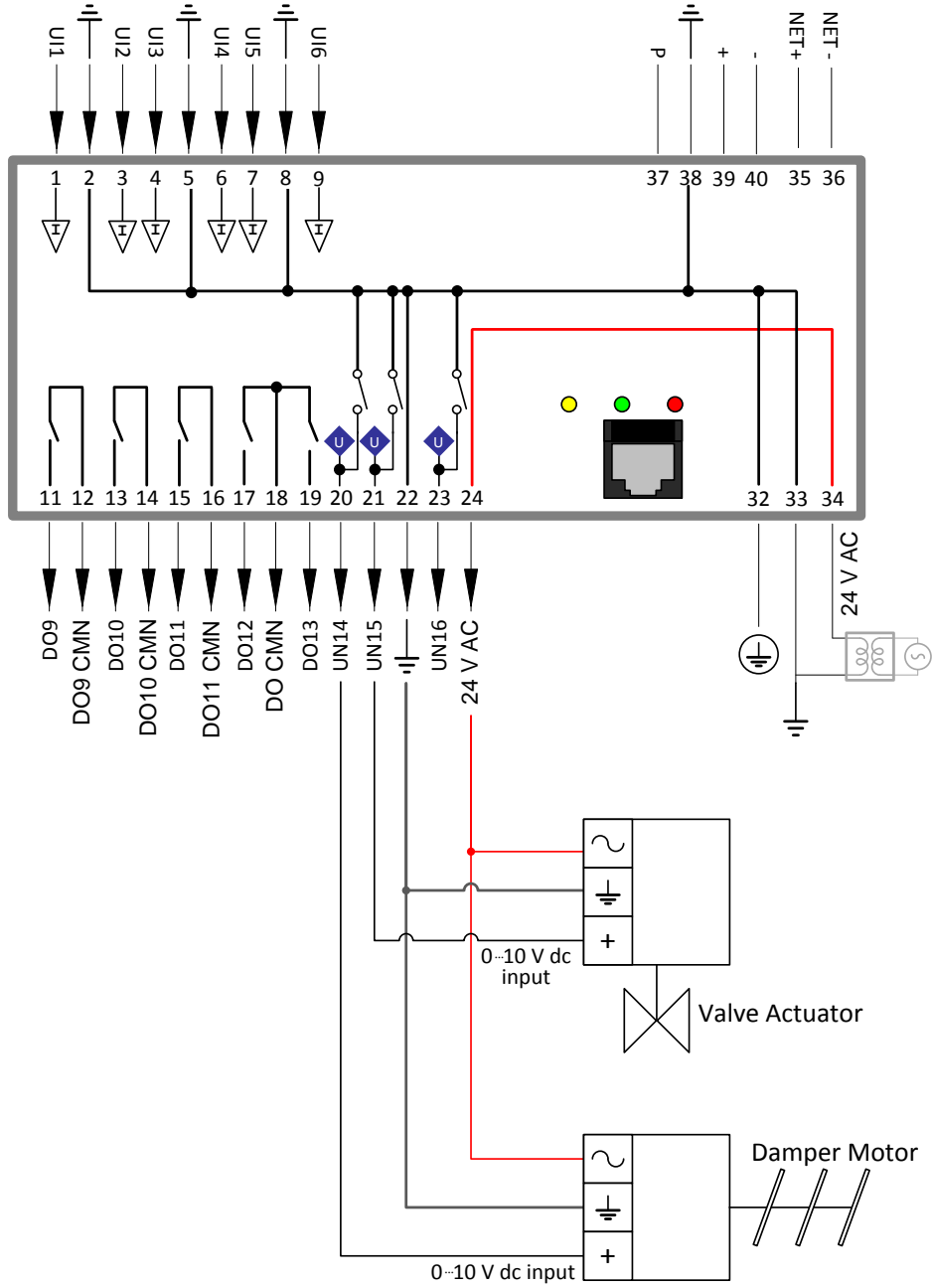
- DO9 is used to control the fan.
- DO10 is used to control compressor 1. This will be used for both heating and cooling as stage 1.
- DO11 is used to control compressor 2. This will be used for both heating and cooling as stage 2.
- DO12 is used to control the reversing valve. This will determine if the compressors are heating or cooling.
- DO13 can be used for auxiliary heating or Master Heat Pump reset.
- UN14 can be configured for controlling a modulating economizer damper.
- UN15 is Un-Configured
- UN16 is Un-Configured

Note: By default, UN14 (in Analog Output mode) is configured as direct acting 0 ... 10 V dc. However, it is possible to define any Analog Outputs as being reverse acting 10 ... 0 V dc. Depending on the actuator being controlled it is also possible to change the voltage range for 2 ... 10 V dc or 10 ... 2 V dc for any Analog Output.

IO POINTS	DESCRIPTION
DO9	Supply Fan Start/Stop
DO10	Compressor 1 Enable/Disable
DO11	Compressor 2 Enable/Disable
DO12	Reversing Valve On/Off
DO13	Auxiliary Heat / Master Heat Pump Reset
UN14	Modulating Economizer Dampers
UN15	Not Used
UN16	Not Used

Analog Output Terminals

The **CBT14** can be wired to control 0 ... 10 V dc devices with a current draw of less than 10 mA on UN14, UN15 and UN16. A typical wiring diagram for controlling valves and dampers is shown below:



Configuring the CBT14 for BACnet communications

The **CBT14** is shipped with the following default settings:

MS/TP Address:	01
BACnet Instance Number	(Instance Number Addressing is based on serial number from the factory)
MS/TP Baud Rate	38,400 bps
Serial to PC Baud Rate	9,600 bps

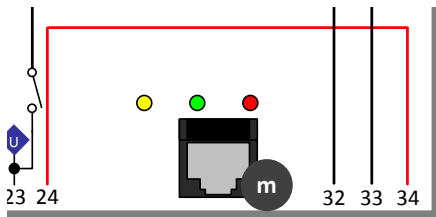
To communicate to other MS/TP devices on a BACnet MS/TP network, the MS/TP address must be set to a unique address within the MS/TP subnet. Where possible, there should be no gaps between addresses. The BACnet Instance Number must also be unique for the BACnet site. The MS/TP baud rate must match on all devices on the MS/TP subnet. The PC Baud Rate should be left at the default value of 9600 bps.

For the initial configuration of the device, the controller must first be powered on.

Note: ServicePort (serial connection) must not be connected until after the device is powered on.

Note: Ensure the 24 V AC and Common wires are correctly connected to the controller. If the wires are swapped, it may cause damage to anything connected to the controller.

If connecting directly to the **CBT14**, use a **UC32-PC commissioning cable** by inserting the 9-pin D-Type serial cable into a serial port of the PC on which **NetLink** is installed. Next, insert the RJ-45 connector into the RJ-45 socket **m** on the front of the **CBT14** controller.



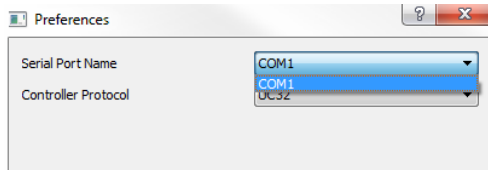
If connecting to the **CBT14** through a room sensor that has been wired for serial communications, insert the 9 pin D-Type serial cable into a serial port on the PC on which **NetLink** is installed, then insert the RJ-12 connector into the RJ-12 socket on the room sensor.

See *Wiring for Serial Communications through Room Sensor* on page 14 for more detail.

Once connected to the controller, it is possible to change the settings on the controller using the **Engineering Center** or, preferably, **NetLink**. For details on how to use the **Engineering Center**, please refer to the *Cylon BACnet Manual (MAN0106)* available from the American Auto-Matrix Toolbox (<http://www.aamatrix.com/toolbox>). For details on how to use **NetLink**, continue to the section below.

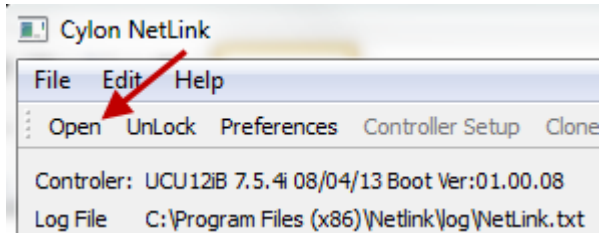
NetLink is available from the American Auto-Matrix Toolbox (<http://www.aamatrix.com/toolbox>). Once downloaded, **NetLink** must be installed. Follow the step by step installer and use the default settings where possible.

1. Start **NetLink** from the **Start** menu or shortcut on your desktop that was created during install.
2. Select **Preferences** and in the drop-down menu select the COM port that is assigned to the serial cable.

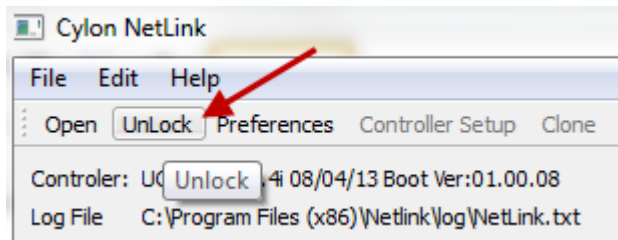


Controller Protocol must be set to "UC32".

3. Click open .

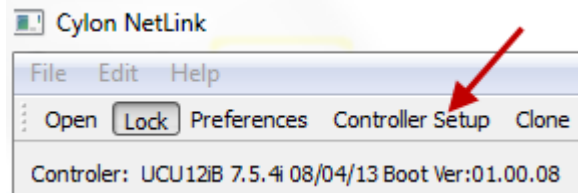


4. Navigate to where the **NetLink** screens are saved and select the "IO_configHP.nls" screen.
5. Click on **UnLock** and type in the password.

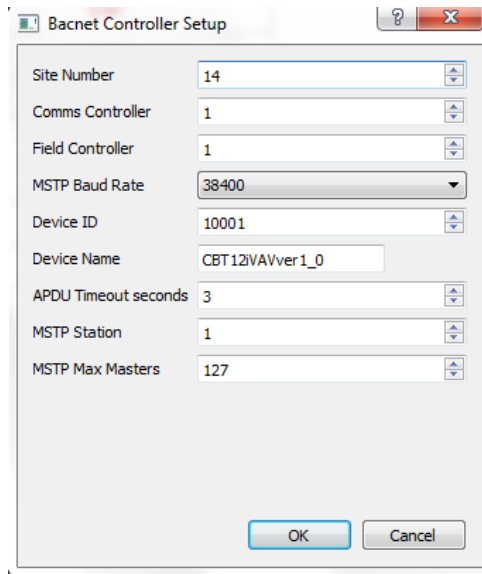


Note: The **NetLink** screens have been configured with a password of "*password*".

6. After unlocking the screens users can now select **Controller Setup** .



7. After selecting **Controller Setup** the following **BACnet Controller Setup** dialog will open:



8. From this window the BACnet MS/TP configuration settings can now be configured.

Note: It is not required to change the Site Number or Comms Controller preset values. It is however recommended to match the Field Controller address with the MSTP Station address (see below).

MSTP Baud Rate is the Baud rate at which all the other devices on the subnet (fieldbus) are communicating. All devices **must** be configured for the same baud rate for communications on the subnet.

Device ID is the BACnet device instance number. Every BACnet controller within the site must receive a unique BACnet instance number to ensure proper communications. This BACnet instance number should be unique even across subnets. See the *Cylon BACnet Manual (MAN0106US)* for further information.

Device Name is the user-assigned name for the controller. This is not necessary for BACnet communications, however, it is useful to name each controller for organizational purposes.

APDU Timeout seconds : leave this at the default setting of 3 seconds.

MSTP Station is the device MS/TP address. This is the unique address users must give each controller on the subnet (fieldbus).

MSTP Max Masters is the maximum address that this controller will poll when in the “poll for masters” state. Because this is a BACnet master device, it will go into this state to search for the next BACnet master device to pass the token to. To optimize the speed of the network, it is recommended that the last master device on the subnet be set at the maximum MS/TP address on the network. For example, if the last device on the subnet (fieldbus) is the **CBT14** at address 63, then users would set the **MSTP Max Masters** to 63. This will speed up communications as it will not go into the “poll for masters” state and immediately pass the token back to the **eSC** or **CBM** at MS/TP address 0.

See the *Cylon BACnet Manual (MAN0106US)* for more details regarding this functionality and for other tips on optimizing the BACnet network.

SECTION 3 : CONFIGURING THE CBT14 HEAT PUMP STRATEGY

The **CBT14** with Heat Pump Strategy (1M810115) has a pre-loaded strategy that is designed to be highly configurable for a wide variety of Heat Pump (HP) sequences.

The sequences can be selected by writing a value to the various input and output codes that are within the strategy. There are multiple ways to configure the **CBT14** for a specific sequence. Users are able to set these configuration values through a serial connection using **NetLink** or the **Engineering Center**.

If the BACnet configuration settings have been configured, users can also set these configuration variables using **NetLink** for setting these configuration variables.

The **CBT14** with Heat Pump Strategy comes configured from the factory as follows:

- in the occupied mode,
- intermittent fan,
- control from sensor on **UI1**,
- setpoint from **UI2** on,
- one stage of heat,
- one stage of cooling,
- reversing valve on in cooling,
- no economizer,
- auxiliary heat enabled,
- outside air sensor disabled.

The preset configuration variables from the factory are:

[InputConfigA \(A242\)](#) = 20.

[OutputConfigA \(A243\)](#) = 45

Setting CBT14 Heat Pump Configuration Codes using NetLink

To start, the [CBT14HPDecoder.xlsx](#) spreadsheet must be downloaded from the American Auto-Matrix Toolbox (<http://www.aamatrix.com/toolbox>). This spreadsheet will be used to determine the sequence for the **CBT14** controller with Heat Pump strategy. This spreadsheet contains all the configuration options for the **CBT14** rooftop unit strategy inputs and outputs, along with further configuration options.

Input Configuration Codes

The inputs for the Heat Pump strategy are selected using [InputConfigA \(A242\)](#).

There are multiple options which can be selected for each input.

- **Control Temp** - Selections include
 - **CBT-STAT** Zone Temperature – If a **CBT-STAT** is connected
 - Sensor On **UI1** – either a Space Temperature or Return Air Temperature Sensor using a 10K Type III thermistor. All room sensors purchased from American Auto-Matrix are a 10K Type III.
 - Discharge Air Reset – A discharge air Sensor is installed on **UI3** and control is from Supply air temperature.
- **Enable OAT** – Is Outside Air sensor connected to **UI5** and is this to be used in Economizer Lockout? Answer **Yes** or **No**.
- **Enable Temp Occupancy** – Is the System to use the Temporary Override features on either the **CBT-STAT** or the Stat connected to **UI1**? Answer **Yes** or **No**.
- **Enable Setpoint Adjust** – Is the System to use the Set point value from either the **CBT-STAT** or the Stat connected to **UI1**? Answer **Yes** or **No**.
- **Internal Schedule** – Is the system to use the schedule that is programmed as part of this strategy? A no answer will allow [OccupancyCommand \(D1\)](#) and [AspectScheduleOccupancyCmd \(A40\)](#) to control Occupancy. Answer **Yes** or **No**.
- **CO2 on UI6** – Is the system to use the CO₂ control portion that is programmed as part of this strategy? Answer **Yes** or **No**.

The user can generate an Input code without the use of the [CBT14HPDecoder.xlsx](#) spreadsheet using the following formula:

Use as a base number:

- 0 for control with the Discharge Air reset
- 8 for control with zone temperature from **CBT-STAT**
- 16 for control with sensor connected to **UI1**. (Space or Return)

Adding a 1 to the base number will allow you to use a remote outside air temperature.

Adding a 2 to the base number will allow for temporary occupancy from the stat.

Adding a 4 to the base number will allow for setpoint adjustment from the stat

Adding a 32 to the base number will allow for the use of an internal BACnet schedule.

Adding a 64 to the base number will enable CO₂ sequence.

- If the **CBT14** recognizes a **CBT-STAT**, it will use the stat for space temp, humidity if available, setpoint adjust and temporary occupancy. Setpoint adjustments are made by pressing the up and down arrows on the **CBT-STAT**. Temporary occupancy is achieved by pressing the forward arrow on the **CBT-STAT**.
- If there is no **CBT-STAT**, the **CBT14** can use an analog stat with a 10k type III sensor for space temperature with an option for a temporary occupancy override that shorts the temperature sensor and a 5k setpoint adjust slider.

Output Configuration Codes

The outputs for the strategy are selected using [OutputConfigA \(A243\)](#).

There are multiple options which can be selected for each input.

- **Number of Compressors** - Selections include:
 - **None** – no Compressors will be enabled
 - **One Compressor** – One compressor will be enable for both Cooling and Heating
 - **Two Compressors** - Two Compressors will be enabled for both Cooling and Heating
- **Fan Type** – Selections Include:
 - **None** – Fan relay will not be energized
 - **Intermittent** – Fan energizes with need for heating or cooling
 - **Continuous** – Fan On in Occupied Mode (Intermittent in Unoccupied Mode)
- **Aux Heat or Reset** – Selections Include:
 - **Aux Heat** – Aux Heat is connected to **DO13** and will be used when necessary.
 - **Master Reset** – Heat Pump Master Reset is connected to **DO13** and will be used when necessary.
- **Reversing Valve** – Selections Include:
 - **Cool On / Heat Off** – Reversing Valve is enabled in the Cooling Mode.
 - **Heat On / Cool Off** – Reversing Valve is enabled in the Heating Mode.
- **Economizer** – Is the System to use the Economizer dampers as a stage of cooling? Answer Yes or No.

The user can generate an Output code without the use of the [CBT14HPDecoder.xlsx](#) spreadsheet using the following formula:

Use as a base number:

- **0** for No Compressors
- **1** for One Compressor
- **2** for Two Compressors

Adding a **4** to the base number will allow the AuxHeat to be enabled.

Adding a **8** to the base number will energize the Reversing valve in cooling mode.

Adding a **16** to the base number will allow the EconomizerDampers to be used as a stage of cooling.

Adding a **32** to the base number will allow the Supply Fan to run intermittently.

Adding a **64** to the base number will allow the Supply Fan to run continually in the Occupied Mode.

Note: If neither SupplyFan number is added to the base calculation, the fan output will be disabled.

Adding a **128** to the base number will allow the Heat Pump's MasterUnit Reset to be used.

Defining AOs

By default, the **AOs** are configured as direct acting 0 ... 10 V dc. However, it is possible to define any **AOs** as being reverse acting 10 ... 0 V dc. Depending on the actuator being controlled it is also possible to change the voltage range for 2 ... 10 V dc or 10 ... 2 V dc for any **AO** output.

Writing the configuration codes to the CBT14

Now that the input and output codes have been determined, it is possible to use **NetLink** to change the configuration within the **CBT14** controller.

Connect to the controller using **NetLink** (if not already connected to controller refer to *Configuring the CBT14 for BACnet communications* on page 18). Open the `IO_configHP.nls` screen to be able to write to the various input/output codes.

Note: By default, the controller is configured as Intermittent Fan, 1 Compressor, reversing Valve on in Cooling, No Economizer.

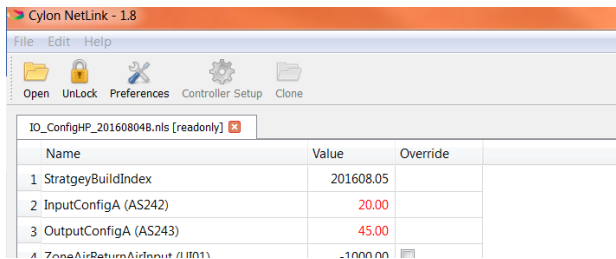
By default, `UI1` is configured with a room sensor without push button override and remote setpoint.

When first connecting to the controller using **NetLink**, the following are the configuration values that have been preconfigured at the factory:

Name	Value	Override
1 StratgeyBuildIndex	201608.05	
2 InputConfigA (AS242)	20.00	
3 OutputConfigA (AS243)	45.00	
4 ZoneAirReturnAirInput (UI01)	-1000.00	<input type="checkbox"/>
5 ZoneReturnAirCalibration (AS230)	0.00	
6 ZoneOccupiedCoolSetpoint (AS200)	73.00	
7 ZoneOccupiedHeatSetpoint (AS201)	73.00	
8 ZoneUnoccupiedCoolSetpoint (AS202)	80.00	
9 ZoneUnoccupiedHeatSetpoint (AS203)	60.00	
10 SetpointSliderResistance (UI02)	10000000.00	<input type="checkbox"/>
11 SetpointSliderSpan (AS231)	4.00	
12 SetpointSliderEffectiveOffset (A15)	2.00	
13 DischargeAirTemp (UI03)	-1000.00	<input type="checkbox"/>
14 MaxCoolingDischargeAirSetpoint (AS27)	55.00	
15 MinCoolingDischargeAirSetpoint (AS29)	80.00	
16 MinHeatingDischargeAirSetpoint (AS36)	70.00	
17 MaxHeatingDischargeAirSetpoint (AS42)	100.00	
18 MixedAirTemp (UI04)	-1000.00	<input type="checkbox"/>
19 MaxMixedAirTemperature (AS62)	80.00	
20 OutsideAirTemp (UI05)	-1000.00	<input type="checkbox"/>
21 CO2HumidityInput (UI06)	0.03	<input type="checkbox"/>
22 CO2SensorBase (AS253)	0.00	
23 CO2SensorSpan (AS254)	2000.00	
24 CO2Setpoint (AS255)	20.00	
25 OutsideAirDamper (AO14)	20.00 %	<input type="checkbox"/>
26 MixedAirEconomizerLockout (AS69)	30.00	
27 OutsideAirDamperMinimumPosition (AS79)	20.00	
28 OutsideAirEconomizerLockout (AS64)	30.00	

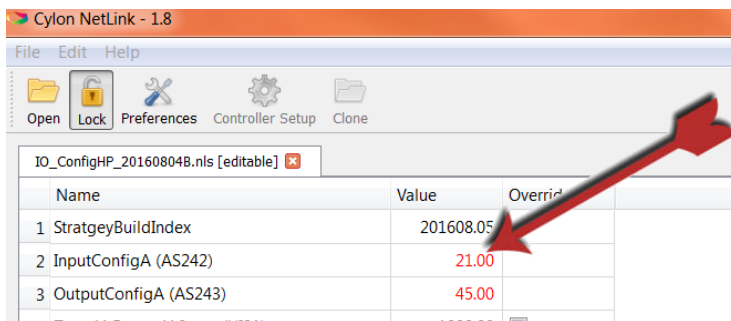
The values that are shown in red are values that can be changed and written to. All values that are shown in black are read only.

Having determined what the input and output configuration codes are for the desired specific application (using the `CBT14HPDecoder.xlsx` spreadsheet), those configuration codes will need to be written to the controller. To change the input and output configuration codes, simply double-click in the appropriate value box and type in the correct code as shown below.



Press [Enter] on the keyboard for the changes to take effect.

When the value is changed, it should now be displayed in red.



Change the rest of the input and output configuration codes.

Note: The **CBT14** must be powered on for these values to be written to flash. If changing these values through a serial connection using **NetLink** or **Engineering Center**, it may take up to 5 minutes before the new values are written to flash.

If the device is power cycled before this time, it could potentially revert back to the default input and output configuration values.

If these values are changed using **Edifice**, **Envoy**, or another master controller via BACnet MS/TP, the controller must be powered for 24 hours before the change in value is written to flash.

These conditions apply to any writable analog or binary values within this controller.

SECTION 4 : CBT14 HEAT PUMP CONTROL SEQUENCES

This section provides details of the typical control sequences used for most Heat Pump (HP) applications. The sequences covered in this manual include the following:

Occupancy Sequence

Occupancy can be achieved in 4 different ways:

0. Internal Schedule: When 32 is added to [InputConfigA \(A242\)](#) base number, then the Heat Pump unit will be commanded to the occupied mode when the BACnet schedule returns a `True` value. Otherwise the Heat Pump unit will be in unoccupied mode.
1. External schedule using [OccupancyCommand \(D1\)](#): When the point [AspectScheduleOccupancyCmd \(A40\)](#) is set to a value of 2, the Heat Pump unit will be commanded to the occupied mode when `OccupancyCmd` (a BACnet visible point that can be controlled from the front end) returns a `True` value, otherwise the Heat Pump unit will be in the unoccupied mode.
2. External schedule using [AspectScheduleOccupancyCmd \(A40\)](#): When the point [OccupancyCommand \(D1\)](#) is set to a true value, the Heat Pump unit will be commanded to the occupied mode when [AspectScheduleOccupancyCmd \(A40\)](#) (a BACnet visible point that can be controlled from the front end) returns a value of 2, otherwise the Heat Pump unit will be in the unoccupied mode. The point [AspectScheduleOccupancyCmd \(A40\)](#) is designed to work with Aspect schedules so that a value of 2 puts the Heat Pump unit into occupied mode and a value of 0 puts it into unoccupied mode.
3. Temporary occupancy: When a 2 is added to [InputConfigA \(A242\)](#) base number and during unoccupied times the Heat Pump unit will respond to temporary occupancy by pressing the forward button on the **CBT-STAT** or by shorting the space temperature sensor on an analog stat. Temporary occupancy time will be defined by the configuration [MinutesTempOccupancy \(A81\)](#) in minutes.

Fan Sequence

The Heat Pump sequence can accommodate three different fan settings: `No fan`, `Intermittent fan` and `continuous fan`.

1. **No fan**: In order to disable the fan command do not add anything to the calculation for [OutputConfigA \(A243\)](#). The fan output will not become active via the Heat Pump strategy.
2. **Continuous Fan**: In order to configure the Heat Pump unit for `continuous fan`, add 64 to [OutputConfigA \(A243\)](#). The fan will run continuously during occupied mode, and will run when calling for heating or cooling in the unoccupied mode. If deadband mode is entered from heating mode the fan will turn off after a total time of [FanOffTimerHeating \(A82\)](#) in seconds. If deadband mode is entered from cooling mode, the fan will turn off after a total time of [FanOffTimerCooling \(A28\)](#) in seconds.
3. **Intermittent fan**: In order to configure the Heat Pump unit for intermittent fan add 32 to [OutputConfigA \(A243\)](#). The fan will run when calling for heating or cooling in the occupied or unoccupied mode. If deadband mode is entered from heating mode, the fan will turn off after a total time of [FanOffTimerHeating \(A82\)](#) in seconds. If deadband mode is entered from cooling mode, the fan will turn off after a total time of [FanOffTimerCooling \(A28\)](#) in seconds.

Setpoint selection

1. The discharge air temperature setpoint [DischargeAirCoolingSetpoint \(A34\)](#) is reset based on how far the space temperature is off from the cooling setpoint [EffectiveCoolingSetpoint \(A23\)](#).
2. If the space temperature is higher than the cooling setpoint by the value of [ZoneSetpointOffset \(A9\)](#) the Discharge Air Cooling Setpoint [DischargeAirCoolingSetpoint \(A34\)](#) modulates to [MaxCoolingDischargeAirSetpoint \(A27\)](#). As the space temperature approaches the cooling setpoint

- the Discharge Air Cooling Setpoint [DischargeAirCoolingSetpoint \(A34\)](#) modulates to [MinCoolingDischargeAirSetpoint \(A29\)](#) in a linear fashion.
- The discharge air temperature setpoint [DischargeAirHeatingSetpoint \(A43\)](#) is reset based on how far the space temperature is off from the cooling setpoint [EffectiveHeatingSetpoint \(A22\)](#). If the space temperature is lower than the heating setpoint by the value of [ZoneSetpointOffset \(A9\)](#) the Discharge Air Heating Setpoint [DischargeAirHeatingSetpoint \(A43\)](#) modulates to [MaxHeatingDischargeAirSetpoint \(A42\)](#). As the space temperature approaches the heating setpoint, [DischargeAirHeatingSetpoint \(A43\)](#) modulates to [MinHeatingDischargeAirSetpoint \(A36\)](#) in a linear fashion.
 - The four setpoints: are Occupied Heating Setpoint ([ZoneOccupiedHeatSetpoint \(A201\)](#)), Occupied Cooling Setpoint ([ZoneOccupiedCoolSetpoint \(A200\)](#)), Unoccupied Heating Setpoint ([ZoneUnoccupiedHeatSetpoint \(A203\)](#)), and Unoccupied Cooling Setpoint ([ZoneUnoccupiedCoolSetpoint \(A202\)](#)). In the Unoccupied mode, setpoints ([ZoneUnoccupiedCoolSetpoint \(A202\)](#) and [ZoneUnoccupiedHeatSetpoint \(A203\)](#)) are used and in Occupied mode the setpoints ([ZoneOccupiedCoolSetpoint \(A200\)](#) and [ZoneOccupiedHeatSetpoint \(A201\)](#)) are used. Also, if so configured, the setpoint offset from the setpoint adjust, either from the **CBT-STAT** or the 5k analog slider are added to the occupied setpoints in occupied mode. If [LoadShedEnable \(D87\)](#) is enabled and the mode is occupied, the value of [LoadShedOccupiedSetpointOffset \(A98\)](#) will be added to the cooling setpoint and subtracted from the heating setpoint.

Cooling Calculation

When the Heat Pump unit is required to provide cooling, this is accomplished by one of three ways:

- [InputConfigA \(A242\)](#) base number of 0: The Discharge Air Temperature and the reset cooling setpoint is used in the direct acting PID calculation where
 - [CoolingDemand \(A51\)](#) is the process variable,
 - [DischargeAirPIDGain \(A37\)](#) is the proportional gain,
 - [DischargeAirPIDIntegral \(A38\)](#) is the integration time,
 - [DischargeAirPIDDerivative \(A39\)](#) is the derivative time and
 - [DischargeAirControlDB \(A131\)](#) is the control deadband for this PID.

The PID is enabled by the zone temperature rising above the active cooling setpoint [EffectiveCoolingSetpoint \(A23\)](#) + ½ [PIDEnableDeadband \(A19\)](#). The result of this calculation is then transferred to the configured cooling type to control the cooling for the unit.

- [InputConfigA \(A242\)](#) base number of 8: The **CBT-STAT** temperature and active cooling setpoint [EffectiveCoolingSetpoint \(A23\)](#) is used in the direct acting PID calculation where
 - [CoolingDemand \(A51\)](#) is the process variable,
 - [ZonePIDGain \(A232\)](#) is the proportional gain,
 - [ZonePIDIntegral \(A35\)](#) is the integration time,
 - [ZonePIDDerivative \(A43\)](#) is the derivative time and
 - [ZonePIDControlDB \(A133\)](#) is the control deadband for this PID.

The PID is enabled when:

$$\text{EffectiveCoolingSetpoint (A23)} - \text{EffectiveHeatingSetpoint (A22)} > \frac{1}{2} \text{SetpointSliderSpan (A231)}$$

and by the **CBT-STAT** temperature rising above [EffectiveCoolingSetpoint \(A23\)](#) + ½ [PIDEnableDeadband \(A19\)](#). The result of this calculation is then transferred to the configured cooling type to control the cooling for the unit.

- [InputConfigA \(A242\)](#) base number of 16: The sensor connected to UI1 (Zone or Return Air [ZoneAirReturnAirInput \(A11\)](#)) and active cooling setpoint [EffectiveCoolingSetpoint \(A23\)](#) is used in the direct acting PID calculation where
 - [CoolingDemand \(A51\)](#) is the process variable,

- [ZonePIDGain \(A232\)](#) is the proportional gain,
- [ZonePIDIntegral \(A35\)](#) is the integration time,
- [ZonePIDDerivative \(A43\)](#) is the derivative time and
- [ZonePIDControlDB \(A133\)](#) is the control deadband for this PID.

The PID is enabled when

$$\text{EffectiveCoolingSetpoint (A23)} - \text{EffectiveHeatingSetpoint (A22)} > \frac{1}{2} \text{SetpointSliderSpan (A231)}$$

and by the Sensor connected to UI1 ([ZoneAirReturnAirInput \(A11\)](#)) temperature rising above [EffectiveCoolingSetpoint \(A23\)](#) + $\frac{1}{2}$ [PIDEnableDeadband \(A19\)](#). The result of this calculation is then transferred to the configured cooling type to control the cooling for the unit.

Staged Cooling

When [SystemMode \(A106\)](#) = 2 the Current Control Mode is Cooling the strategy will sequence the Heat Pump compressors based on the number of stages configured in [OutputConfigA \(A243\)](#) and the value of the Calculated Percent Cooling.

Assuming there are two stages of cooling configured, the strategy sequence operates as described in the paragraphs that follow.

When [SystemMode \(A106\)](#) = 0 the Current Control Mode is [Deadband](#), the Calculated Percent is 0% and all Compressors are OFF.

As the configured sensor temperature rises above the configured temperature setpoint, [SystemMode \(A106\)](#) = 2 and the Current Control mode changes to [Cooling](#). The program will wait if the compressors are being disabled due to a prior heating load to stabilize the compressor load and then the Reversing valve is commanded to the configured state. After another unit stabilization delay the Calculated Percent Cooling [ZoneCoolCalc \(A78\)](#) value increments from 0 to 100% based on the configured cooling PID constants and the amount of Error between the configured sensor temperature and the configured temperature setpoint.

As the Calculated Percent Cooling [ZoneCoolCalc \(A78\)](#) value reaches 50% and the compressor minimum on/off delay timer expires, the first stage compressor turns ON.

As the Calculated Percent Cooling [ZoneCoolCalc \(A78\)](#) value increases to 100% and the compressor minimum on/off delay timer expires, the second stage compressor turns ON.

As the amount of Error decreases, the Calculated Percent Cooling [ZoneCoolCalc \(A78\)](#) decreases.

When the Calculated Percent Cooling [ZoneCoolCalc \(A78\)](#) falls to 49% and the compressor minimum on/off delay timer expires, the second stage compressor turns OFF.

As the Calculated Percent Cooling [ZoneCoolCalc \(A78\)](#) value decreases to 0% or the Current Control Mode [SystemMode \(A106\)](#) changes to [Deadband](#) and the compressor minimum on/off delay timer expires, the first stage compressor turns OFF.

The following table illustrates the percentage at which the mechanical cooling outputs (Cooling [ZoneCoolCalc \(A78\)](#)) are staged based on the number of stages configured.

Number of Heating Stages	Stage 1		Stage 2	
	ON	OFF	ON	OFF
1	100%	0%	----	----
2	50%	0%	100%	50%

Note: Discharge Air Temperature Control with staged cooling is NOT recommended. It is extremely difficult to maintain discharge air temperature with staged cooling. American Auto-Matrix recommends that Discharge Air Control be used only when necessary.

Heating Calculation

When the HP is required to provide heating, this is accomplished in one of three ways:

1. [InputConfigA \(A242\)](#) base number of 0: The Discharge Air Temperature and the reset heating setpoint is used in the reverse acting PID calculation where
 - [HeatingDemand \(A50\)](#) is the process variable,
 - [DischargeAirPIDGain \(A37\)](#) is the proportional gain,
 - [DischargeAirPIDIntegral \(A38\)](#) is the integration time
 - [DischargeAirPIDDerivative \(A39\)](#) is the derivative time and
 - [DischargeAirControlDB \(A131\)](#) is the control deadband for this PID.

The PID is enabled by the zone temperature falling below the active heating setpoint [DischargeAirHeatingSetpoint \(A43\)](#) – ½ [PIDEnableDeadband \(A19\)](#). The result of this calculation is then transferred to the configured heating type to control the heating for the unit.

2. [InputConfigA \(A242\)](#) base number of 8: The CBT-Stat temperature and active heating setpoint [EffectiveHeatingSetpoint \(A22\)](#) is used in the reverse acting PID calculation where:
 - [HeatingDemand \(A50\)](#) is the process variable,
 - [ZonePIDGain \(A232\)](#) is the proportional gain,
 - [ZonePIDIntegral \(A35\)](#) is the integration time,
 - [ZonePIDDerivative \(A43\)](#) is the derivative time and
 - [ZonePIDControlDB \(A133\)](#) is the control deadband for this PID.

The PID is enabled when the [EffectiveCoolingSetpoint \(A23\)](#) - ½ [SetpointSliderSpan \(A231\)](#) > [EffectiveHeatingSetpoint \(A22\)](#) and by the CBT-Stat temperature falling below the active heating setpoint [EffectiveHeatingSetpoint \(A22\)](#) – ½ [PIDEnableDeadband \(A19\)](#). The result of this calculation is then transferred to the configured cooling type to control the Heating for the unit.

3. [InputConfigA \(A242\)](#) base number of 16: The sensor connected to [UI1](#) (Zone or Return Air) and active heating setpoint [EffectiveHeatingSetpoint \(A22\)](#) is used in the reverse acting PID calculation where:
 - [HeatingDemand \(A50\)](#) is the process variable
 - [ZonePIDGain \(A232\)](#) is the proportional gain,
 - [ZonePIDIntegral \(A35\)](#) is the integration time,
 - [ZonePIDDerivative \(A43\)](#) is the derivative time and
 - [ZonePIDControlDB \(A133\)](#) is the control deadband for this PID.

The PID is enabled when

$$\text{EffectiveCoolingSetpoint (A23)} - \frac{1}{2} \text{SetpointSliderSpan (A231)} > \text{EffectiveHeatingSetpoint (A22)}$$

and by the Sensor connected to [UI1](#) temperature falling below the active heating setpoint [EffectiveHeatingSetpoint \(A22\)](#) – ½ [PIDEnableDeadband \(A19\)](#). The result of this calculation is then transferred to the configured heating type to control the cooling for the unit.

Staged Heating

When [SystemMode \(A106\)](#) = 1, the Current Control Mode is Heating. The strategy will sequence the Heat Pump compressors based on the number of stages configured in [OutputConfigA \(A243\)](#) and the value of the Calculated Percent Heating.

Assuming there are two stages of heating configured, the strategy sequence operates as described in the paragraphs that follow.

When [SystemMode \(A106\)](#) = 0, the Current Control Mode is Deadband. The Calculated Percent is 0% and all Compressors are OFF.

As the configured sensor temperature falls below the configured temperature setpoint, [SystemMode \(A106\)](#) = 1 and the Current Control mode changes to Heating. The program will wait if the compressors are being disabled due to a prior cooling load to stabilize the compressor load, and then the Reversing valve is commanded to the configured state. After another unit stabilization delay the Calculated Percent Heating [HeatingDemand \(A50\)](#) value increments from 0 to 100% based on the configured cooling PID constants and the amount of Error between the configured sensor temperature and the configured temperature setpoint.

As the Calculated Percent Heating [HeatingDemand \(A50\)](#) value reaches 50% and the compressor minimum on/off delay timer expires, the first stage compressor turns ON.

As the Calculated Percent Heating [HeatingDemand \(A50\)](#) value increases to 100% and the compressor minimum on/off delay timer expires, the second stage compressor turns ON.

As the amount of Error decreases, the Calculated Percent Heating [HeatingDemand \(A50\)](#) decreases.

When the Calculated Percent Heating [HeatingDemand \(A50\)](#) falls to 49% and the compressor minimum on/off delay timer expires, the second stage compressor turns OFF.

As the Calculated Percent Heating [HeatingDemand \(A50\)](#) value decreases to 0% or the Current Control Mode [SystemMode \(A106\)](#) changes to Deadband and the compressor minimum on/off delay timer expires, the first stage compressor turns OFF.

The following table illustrates the percentage at which the mechanical heating outputs ([HeatingDemand \(A50\)](#)) are staged based on the number of stages configured:

Number of Heating Stages	Stage 1		Stage 2	
	ON	OFF	ON	OFF
1	100%	0%	----	----
2	50%	0%	100%	50%

Note: Discharge Air Temperature Control with staged heating is NOT recommended. It is extremely difficult to maintain discharge air temperature with staged heating. It is recommended that Discharge Air Temperature control be used only when necessary.

Economizer

To configure the strategy for an economizer cycle, add 16 to the base number in [OutputConfigA \(A243\)](#). The economizer will work as a first stage of cooling when enabled. The economizer is enabled when the mixed air temperature is greater than the mixed air temperature lockout [MixedAirEconomizerLockout \(A69\)](#) and when the outside air is greater than the outside air temperature lockout [OutsideAirEconomizerLockout \(A64\)](#) and when the economizer is enabled [OutputConfigA \(A243\)](#) greater than 16. The economizer will modulate from 0 if the cooling PID is 0 up to 100 if the cooling PID reaches the [EconomizerStagingPercent \(A44\)](#). If the cooling PID rises above the [EconomizerStagingPercent \(A44\)](#), mechanical cooling will stage on as if the cooling PID minus the [EconomizerStagingPercent \(A44\)](#) was the cooling calculation. If the economizer is locked out or not configured, the cooling calculation will work directly off the cooling PID.

CO2

To configure the Heat Pump strategy for CO₂ control, add 64 to the base number in [OutputConfigA \(A243\)](#).

A 0 ... 10 V dc CO₂ sensor wired to UI6 will be rescaled to read between [CO2SensorBase \(A253\)](#) (initially set to 0 PPM) and [CO2SensorSpan \(A254\)](#) (initially set to 2000 PPM), and this reading will be sent to a forward-acting PID. If the CO₂ levels rise above [CO2Setpoint \(A255\)](#) (initially set to 500 PPM) the PID will ramp up and will open the outside air damper proportionally unless there is an economizer lockout condition or the economizer damper is being shut due to low mixed air temperature.

HP Master Alarm/Reset

To configure the Heat Pump strategy for a master alarm reset, add 128 to the base number in [OutputConfigA \(A243\)](#). Auxillary Heat capability will not be available when this is configured for use. From the Heat Pump unit, wire the master alarm Dry Contact into UN16.

When [UnitAlarmInput \(D16\)](#) is active, the unit will Activate [MasterAlarm \(D78\)](#). This point will remain Active as long as the unit is in Alarm.

When the Alarm clears, activating the point [MasterAlarm \(D78\)](#) will energize [AuxiliaryHeat \(DO13\)](#) which would be wired to reset the alarm condition of the Heat Pump equipment.

SECTION 5 : APPENDIX : LIST OF
CBT14 POINTS

The tables in this Appendix list and describe the points in the **CBT14** Heat Pump strategy, along with the units and the default value for each point.

Analog Points

Hardware (I/O)

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	UNITS
1	Analog Input	<i>ZoneAirReturnAirInput (AI1)</i>	Space or Return Air Temperature reading from sensor	°F
2	Analog Input	<i>SetpointSliderResistance (AI2)</i>	Value of Setpoint POT in Ohms	Ohms
3	Analog Input	<i>DischargeAirTemp (AI3)</i>	Discharge Air Temperature reading from sensor	°F
4	Analog Input	<i>MixedAirTemp (AI4)</i>	Mixed Air Temperature reading from sensor	°F
5	Analog Input	<i>OudsideAirTemp (AI5)</i>	Outside Air Temperature reading from sensor	°F
6	Analog Input	<i>CO2HumidityInput (AI6)</i>	CO2 or Humidity reading from sensor	%
14	Analog Output	<i>OutsideAirDamper (UN14)</i>	Economizer Damper Command Position	%
15	Analog Output	<i>AO_2 (UN15)</i>	Un-Used	%

Values

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	UNITS
10	Analog	<i>ZoneTemp (A10)</i>	Current zone temperature for control	°F
17	Analog	<i>SetpointSliderEffectiveOffset (A17)</i>	Current offset to setpoint from sensor POT	°F
22	Analog	<i>EffectiveHeatingSetpoint (A22)</i>	Active Heating Setpoint	°F
23	Analog	<i>EffectiveCoolingSetpoint (A23)</i>	Active Cooling Setpoint	°F
34	Analog	<i>DischargeAirCoolingSetpoint (A34)</i>	Discharge air cooling setpoint	°F
43	Analog	<i>DischargeAirHeatingSetpoint (A43)</i>	Discharge air heating setpoint	°F
50	Analog	<i>HeatingDemand (A50)</i>	Heating Demand	%
51	Analog	<i>CoolingDemand (A51)</i>	Cooling Demand	°F
73	Analog	<i>CO2Value (A73)</i>	Local CO ₂ Value	PPM
78	Analog	<i>ZoneCoolCalc (A78)</i>	Current zone heating command calculation. This point supports priority array	%
106	Analog	<i>SystemMode (A106)</i>	Heating, Cooling or Deadband	no-units
117	Analog	<i>StrategyBuildIndex (A117)</i>	Revision Number of Strategy	no-units

Setpoints

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	IMPERIAL		METRIC		MIN	MAX
				DEFAULT VALUE	UNIT	DEFAULT VALUE	UNIT		
1	Analog Setpoint	<i>SetpointAdjustStepSize (A1)</i>	Value of Adjustment to the CBT-STAT	5	°F	0.1	°C	0	100
6	Analog Setpoint	<i>AlarmResetOnTime (A6)</i>	Minimum time for Master Alarm to be on.	5	Sec	5	Sec	0	1000
9	Analog Setpoint	<i>ZoneSetpointOffset (A9)</i>	Deadband for Resetting of Discharge air Setpoint	4	°F	4	°C	0	100
14	Analog Setpoint	<i>StrategyBuildIndex (A14)</i>							
18	Analog Setpoint	<i>AuxHeatStagePercent (A18)</i>	At what percentage of the calculation do we bring on the aux heat.	75	%	75	%	0	100
19	Analog Setpoint	<i>PIDEnableDeadband (A19)</i>	Discharge Air Setpoint Enable Deadband	2	°F	4	°C	0	1000
20	Analog Setpoint	<i>AuxHeatDelay (A20)</i>	After compressor starts, how long before aux heat stages on	30	Sec	30	Sec	0	1000
27	Analog Setpoint	<i>MaxCoolingDischargeAirSetpoint (A27)</i>	Discharge Air Reset value for maximum Cooling Discharge air setpoint	55	°F	12	°C	0	100
28	Analog Setpoint	<i>FanOffTimerCooling (A28)</i>	If the state enters Deadband from cooling when in On Occupied delay fan from going off for this time	30	Sec	30	Sec	0	1000

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	IMPERIAL		METRIC		MIN	MAX
				DEFAULT VALUE	UNIT	DEFAULT VALUE	UNIT		
29	Analog Setpoint	<i>MinCoolingDischargeAirSetpoint (A29)</i>	Discharge Air Reset value for minimum Cooling Discharge air setpoint	80	°F	27	°C	0	100
35	Analog Setpoint	<i>ZonePIDIntegral (A35)</i>	Zone PID Integral Time	900	no-units	900	no-units	0	10000
36	Analog Setpoint	<i>MinHeatingDischargeAirSetpoint (A36)</i>	Discharge Air Reset value for minimum Heating Discharge air setpoint	70	°F	21	°C	0	100
37	Analog Setpoint	<i>DischargeAirPIDGain (A37)</i>	Discharge Air PID Proportional Gain	5	no-units	5	no-units	0	1000
38	Analog Setpoint	<i>DischargeAirPIDIntegral (A38)</i>	Discharge Air PID Integral Time	300	no-units	300	no-units	0	10000
39	Analog Setpoint	<i>DischargeAirPIDDerivative (A39)</i>	Discharge Air PID Derivative Time	0	no-units	0	no-units	0	1000
40	Analog Setpoint	<i>AspectScheduleOccupancyCmd (A40)</i>	Aspect Schedule Connection Point	2	no-units	2	no-units	0	100
42	Analog Setpoint	<i>MaxHeatingDischargeAirSetpoint (A42)</i>	Discharge Air Reset value for maximum Heating Discharge air setpoint	100	°F	36	°C	0	100
43	Analog Setpoint	<i>ZonePIDDerivative (A43)</i>	Zone PID Derivative Time	0	no-units	0	no-units	0	1000
44	Analog Setpoint	<i>EconomizerStagingPercent (A44)</i>	Staging Control Point	30	%	30	%	0	100
62	Analog Setpoint	<i>MaxMixedAirTemperature (A62)</i>	Mixed Air Temperature Setpoint	72	°F	27	°C	0	100
63	Analog Setpoint	<i>MixedAirPIDGain (A63)</i>	Mixed Air PID Proportional Gain	30	no-units	30	no-units	0	1000
64	Analog Setpoint	<i>OutsideAirEconomizerLockout (A64)</i>	Outside Air Temperature Lockout Setpoint for Economizer Dampers	0	°F	2	°C	0	100
69	Analog Setpoint	<i>MixedAirEconomizerLockout (A69)</i>	Mixed Air Temperature Lockout Setpoint for Economizer Dampers	30	°F	0	°C	0	100
70	Analog Setpoint	<i>RemoteOutsideAir (A70)</i>	Outside Air Temperature value if in remote mode	72	°F	25	°C	0	100
81	Analog Setpoint	<i>MinutesTempOccupancy (A81)</i>	Temporary Occupancy Over-Ride Time	1000	Min	1000	Min	0	10000
82	Analog Setpoint	<i>FanOffTimerHeating (A82)</i>	If the state enters Deadband from heating when in On Occupied delay fan from going off for this time	30	Sec	30	Sec	0	1000
98	Analog Setpoint	<i>LoadShedOccupiedSetpointOffset (A98)</i>	Number of degrees by which occupied setpoints are offset when load shed mode is enabled.	2	°F	4	°C	0	100
100	Analog Setpoint	<i>ReversingValveCompressorOffTime (A100)</i>	Time delay between compressor going off, reversing valve command and compressor being re-enabled	30	Sec	30	Sec	0	1000
127	Analog Setpoint	<i>OutsideAirDamperMinimumPosition (A127)</i>	Normal Modes Economizer Dampers Minimum Position	20	%	20	%	0	100
131	Analog Setpoint	<i>DischargeAirControlDB (A131)</i>	Deadband for Control of the Discharge Air PID	1	no-units	1	no-units	0	1000
133	Analog Setpoint	<i>ZonePIDControlDB (A133)</i>	Deadband for Control of the Zone PID	1	no-units	1	no-units	0	1000
200	Analog Setpoint	<i>ZoneOccupiedCoolSetpoint (A200)</i>	Occupied Cooling setpoint	75	°F	23	°C	0	100
201	Analog Setpoint	<i>ZoneOccupiedHeatSetpoint (A201)</i>	Zone Occupied heating setpoint	71	°F	21	°C	0	100
202	Analog Setpoint	<i>ZoneUnoccupiedCoolSetpoint (A202)</i>	Zone Unoccupied cooling setpoint	85	°F	26	°C	0	100
203	Analog Setpoint	<i>ZoneUnoccupiedHeatSetpoint (A203)</i>	Zone Unoccupied heating setpoint	65	°F	18	°C	0	100
230	Analog Setpoint	<i>ZoneReturnAirCalibration (A230)</i>	Calibration Point for Sensor on UI1	0	°F	0	°C	0	100
231	Analog Setpoint	<i>SetpointsSliderSpan (A231)</i>	Zone control slider range setpoint	4	°F	2	°C	0	100
232	Analog Setpoint	<i>ZonePIDGain (A232)</i>	Zone temperature PID gain	30	no-units	30	no-units	0	1000
242	Analog Setpoint	<i>InputConfigA (A242)</i>	Strategy Input configuration setpoint	20	no-units	20	no-units	0	255
243	Analog Setpoint	<i>OutputConfigA (A243)</i>	Strategy Output configuration setpoint	45	no-units	45	no-units	0	255
253	Analog Setpoint	<i>CO2SensorBase (A253)</i>	Base Value for conversion of UI6	0	no-units	0	no-units	0	100
254	Analog Setpoint	<i>CO2SensorSpan (A254)</i>	Range Value for conversion of UI6	2000	no-units	2000	no-units	0	10000
255	Analog Setpoint	<i>CO2Setpoint (A255)</i>	Setpoint when UI6 is used	500	P.P.M	500	P.P.M	0	1000

Digital Points

Hardware (I/O)

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	UNITS 0/OFF	UNITS 1/ON
9	Digital Output	<i>Fan (D09)</i>	Supply Fan Enable/Disable	On	Off
10	Digital Output	<i>Compressor1 (D10)</i>	Compressor 1 Enable/Disable	On	Off
11	Digital Output	<i>Compressor2 (D011)</i>	Compressor 2 Enable/Disable	On	Off
12	Digital Output	<i>ReversingValve (D012)</i>	Reversing Valve On/Off	On	Off
13	Digital Output	<i>AuxiliaryHeat (D013)</i>	Aux Heat or Master Reset On/Off	On	Off
16	Digital Input	<i>UnitAlarmInput (D16)</i>	Unit Alarm From Heat Pump	On	Off

Values

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	UNITS 0/OFF	UNITS 1/ON
2	Digital	<i>AuxHeatStartStop (D2)</i>	Aux Heat command	On	Off
6	Digital	<i>OccupancyStatus (D6)</i>	Occupancy mode status	On	Off
10	Digital	<i>InternalSchedule (D10)</i>	Internal BACnet Schedule Connection Point	On	Off
32	Digital	<i>ReversingValveReverseAct (D32)</i>	Action of Reversing Valve when commanded On	On	Off
35	Digital	<i>TwoCompressors (D35)</i>	Two Compressors command	On	Off
44	Digital	<i>EnableAuxHeat (D44)</i>	Is Aux Heat enable	On	Off
50	Digital	<i>EconomizerEnable (D50)</i>	Is Economizer Dampers enabled	On	Off
51	Digital	<i>Compressor1StartStop (D51)</i>	Compressor 1 command	On	Off
53	Digital	<i>Compressor2StartStop (D53)</i>	Compressor 2 command	On	Off
62	Digital	<i>CompressorStartStop (D62)</i>	One Compressor command	On	Off
78	Digital	<i>MasterAlarm (D78)</i>	Master Alarm Active	On	Off
91	Digital	<i>CoolingMode (D91)</i>	Cooling Mode Active	On	Off
94	Digital	<i>HeatingMode (D94)</i>	Heating Mode Active	On	Off
106	Digital	<i>IllegalSetpoint (D106)</i>	Is an Illegal Setpoint entered?	Normal	Alarm
339	Digital	<i>DischargeAirControl (D339)</i>	Is Discharge Air Control Enabled?	On	Off

Setpoints

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	DEFAULT VALUE	UNITS 0/OFF	UNITS 1/ON
1	Digital Setpoint	<i>OccupancyCommand (D1)</i>	Occupancy command	Occ	Occ	Non Occ
8	Digital Setpoint	<i>House (D8)</i>	CBT-Stat House Indicator	On	On	Off
79	Digital Setpoint	<i>MasterAlarmReset (D79)</i>	Reset Heat Pump Master Alarm	Off	On	Off
87	Digital Setpoint	<i>LoadShedEnable (D87)</i>	Load Shed Enable Command	Disable	Enable	Disable
249	Digital Setpoint	<i>EmergencyPurgeCmd (D249)</i>	Put Unit into Purge Mode	Off	On	Off
250	Digital Setpoint	<i>EmergencyStarveCmd (D250)</i>	Put Unit into Starve Mode	Off	On	Off
330	Digital Setpoint	<i>RemoteOutsideAirEnable (D330)</i>	Enable Remote Outside Air Setpoint	On	On	Off

Time Schedules

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	UNITS 0/OFF	UNITS 1/ON
130	BACnet Schedule	<i>UCxx Schedule (D130)</i>	BACnet Schedule		



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