CBT-3T6-5R with Heat Pump strategy

Style conventions used in this document:

UI Text: Text that represents elements of the UI such as button names, menu options etc. is presented with a grey background and border, in Tahoma font which is traditionally used in Windows UIs. For example:

Ok

Standard Terms (Jargon): Text that is not English Language but instead refers to industry standard concepts such as Strategy, BACnet, or Analog Input is represents in slightly condensed font. For example:

BACnet

Code: Text that represents File paths, Code snippets or text file configuration settings is presented in fixed-width font, with a grey background and border. For example:

```
$config_file = c:\CYLON\settings\config.txt
```

Parameter values: Text that represents values to be entered into UI fields or displayed in dialogs is represented in fixed-width font with a shaded background. For example

`10°C`

Product Names: Text that represents a product name is represented in bold colored text. For example

INTEGRA™

Company Brand names: Brands that are not product names are represented by bold slightly compressed text:

ABB Active Energy

PC Keyboard keys: Text representing an instruction to press a particular key on the keyboard is enclosed in square brackets and in bold font. For example:

[Ctrl]+[1]

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6   APPENDIX: LIST OF DIP SWITCH SETTINGS

1 Getting Started

HOW TO USE THIS MANUAL

The CBT-3T6-5R manual provides users with the information needed to install and configure the controller for the various application specific requirements.

CBT-3T6-5R

The CBT-3T6-5R is a configurable BACnet MS/TP device designed to be used within a BACnet system including existing eBuilding systems. The CBT-3T6-5R 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.

CBT-3T6-5R STRATEGY VERSION INFORMATION

This document (MAN0128US rev 18) applies to CBT-3T6-5R 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
	• 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 **CBT-3T6-5R**.

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 **CBT-3T6-5R**.

SUPPORTING FILES

The following files are needed for configuring the **CBT-3T6-5R** with Heat Pump Strategy. These are available from the American Auto-Matrix Toolbox (http://www.aamatrix.com/toolbox)

Decoder Spreadsheet (CBT-3T6-5RHPDecoder.xlsx)

This spreadsheet is used to determine what configuration codes are needed to configure the **CBT-3T6-5R**. See *Configuring the CBT-3T6-5R Heat Pump Strategy* on page 19 for instructions.

Netlink screens (IO_ConfigHP.nls)

These **NetLink** screens are used for configuration of the **CBT-3T6-5R**. See *Configuring the CBT-3T6-5R Heat Pump Strategy* on page 19 for instructions.

2 Installation Overview

PREPARING TO INSTALL THE CBT-3T6-5R

This section describes how to unpack the unit and how to prepare the site for installation of the **CBT-3T6-5R**. 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 CBT-3T6-5R* on page 8 for more information.

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

UNPACKING THE CBT-3T6-5R

The **CBT-3T6-5R** is shipped from the factory in its own box. Multiple **CBT-3T6-5R** boxes may be packaged together in a larger box. Upon receiving the **CBT-3T6-5R** 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.
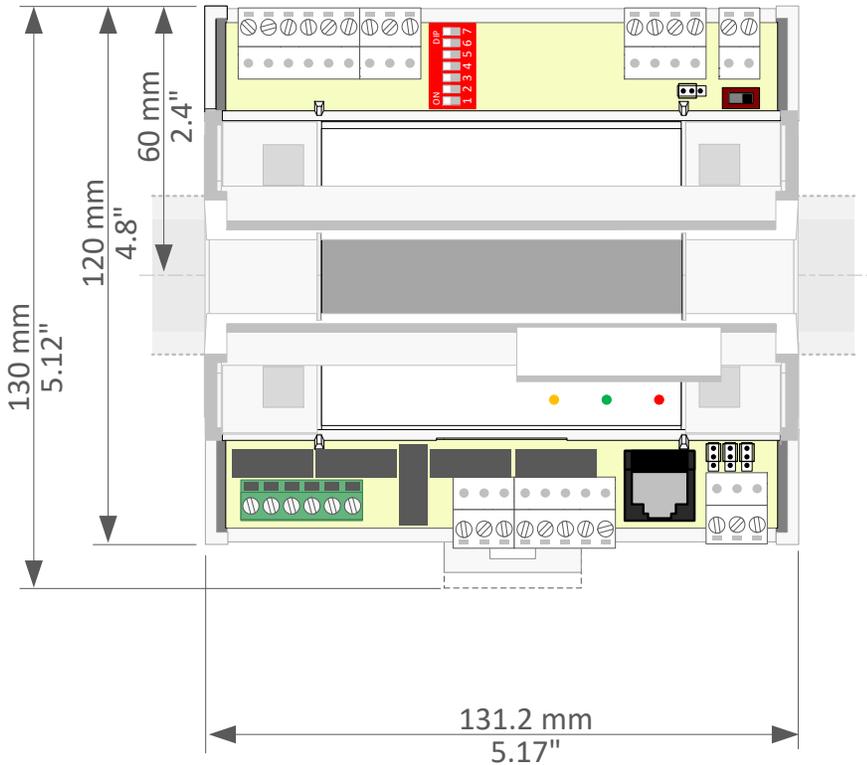
WIRING THE CBT-3T6-5R

Once the location has been determined, the CBT-3T6-5R 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 CBT-3T6-5R.

CONNECTING POWER TO THE CBT-3T6-5R

The CBT-3T6-5R 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:
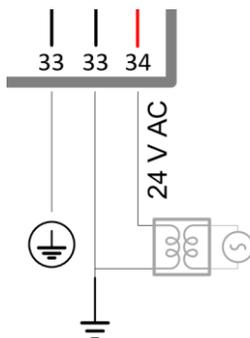
WIRING THE RS-485 COMMUNICATIONS NETWORK

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 **CBT-3T6-5R**, users can switch the "Network Termination Switch" (BACnet MS/T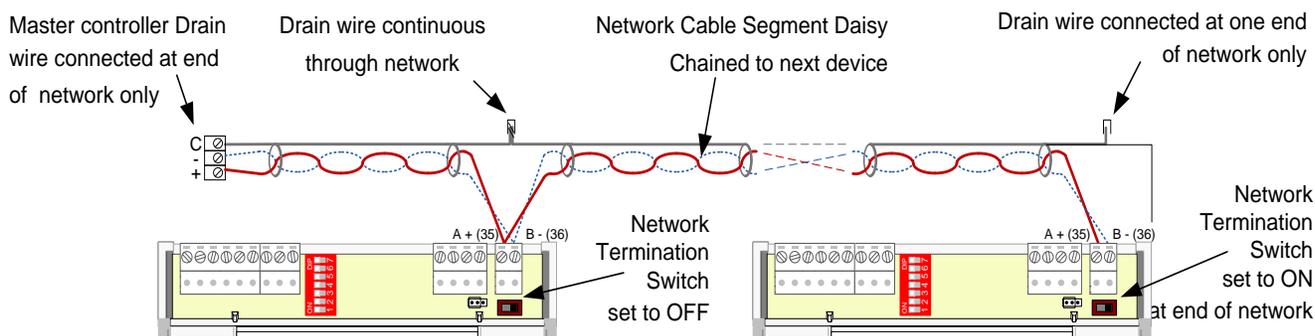P Terminator) to on. This will effectively terminate the network. The shield, or drain wire, must be carried through the entire network.

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:

Master controller Drain wire connected at end of network only

Drain wire continuous through network

Network Cable Segment Daisy Chained to next device

Drain wire connected at one end of network only

A + (35)   B - (36)

Network Termination Switch set to OFF

A + (35)   B - (36)

Network Termination Switch set to ON at end of network

WIRING THE UNIVERSAL INPUTS

The **CBT-3T6-5R** comes with 6 universal inputs. UI1, UI2, UI3 and UI4 are used for wiring in-room sensors, setpoint adjust, discharge air sensors, CO_2 sensors, relative humidity sensors and motion sensors, depending on the application (see *Wiring the Room Sensor* on page 11 for an example).
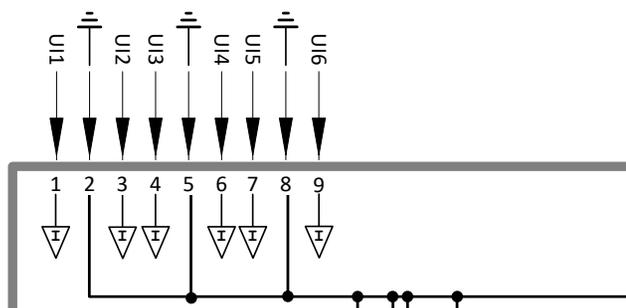
The sequences for this wide range of applications are available within the preloaded strategy. See *CBT-3T6-5R Heat Pump* Control Sequences on page 25 of this manual for selecting the sequence for specific applications.

- 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 potentiomenter. 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.

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- `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 CO_2 sensor, relative humidity sensor, or a motion sensor (must be a dry contact closure).

Note:	To adjust the span for the CO_2 sensor
	CO2SensorBase (A253) Low range of sensor, default is 0.
	CO2SensorSpan (A254) Total range of senor, 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 senor, 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.
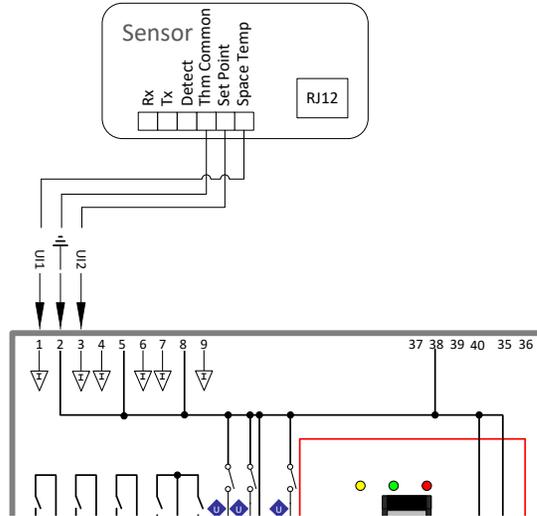
WIRING FOR SERIAL COMMUNICATIONS THROUGH ROOM SENSOR

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 **CBT-3T6-5R**, the `Rx`, `Tx` and `Detect` terminals must be connected to the RJ-45 port in addition to the sensor connections, as illustrated below:
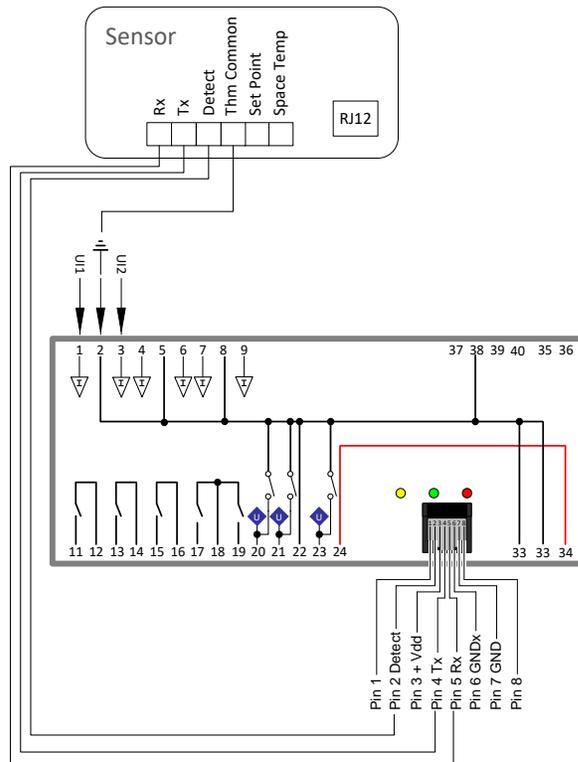
WIRING THE DIGITAL AND ANALOG OUTPUTS

The **CBT-3T6-5R** 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.
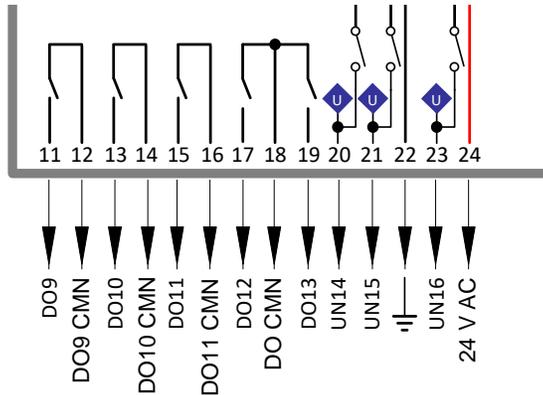* `DO11` is used to control compressor 2. This will be used for both heating and cooling as stage 2.
* `DO12` is used to control the reversing valve. This will determine if the compressors are heating or cooling.
* `DO13` can be used for auxiliary heating or Master Heat Pump reset.
* `UN14` can be configured 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

Digital Output Terminals

The **CBT-3T6-5R** can be wired to switch up to 240 V AC on Digital Outputs `DO9`, `DO10` and `DO11`, and up to 24 V AC on `DO12` and `DO13`. The relay outputs are Normally-Open dry-contact only and can be wired to switch hot or common.

To switch 24 V AC, users must wire an externally-sourced 24 V AC hot to terminal 18 `DO CMN` (triac common) on the **CBT-3T6-5R**. The 24 V AC can be sourced from the same power supply as the controller, or an external 24 V AC source. A typical wiring diagram for controlling a relay by switching 24 V AC is shown below:
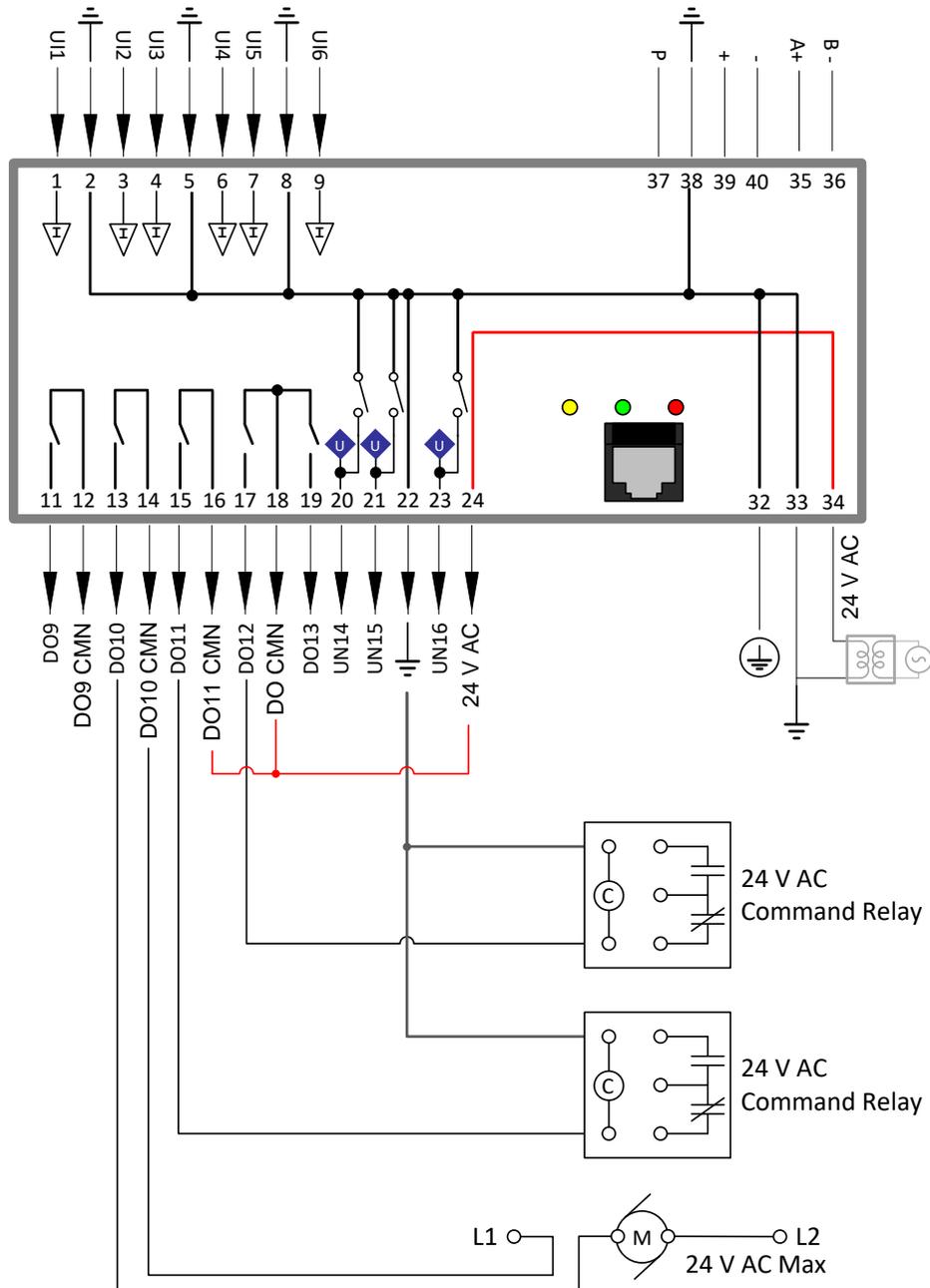
Analog Output Terminals

The **CBT-3T6-5R** 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:
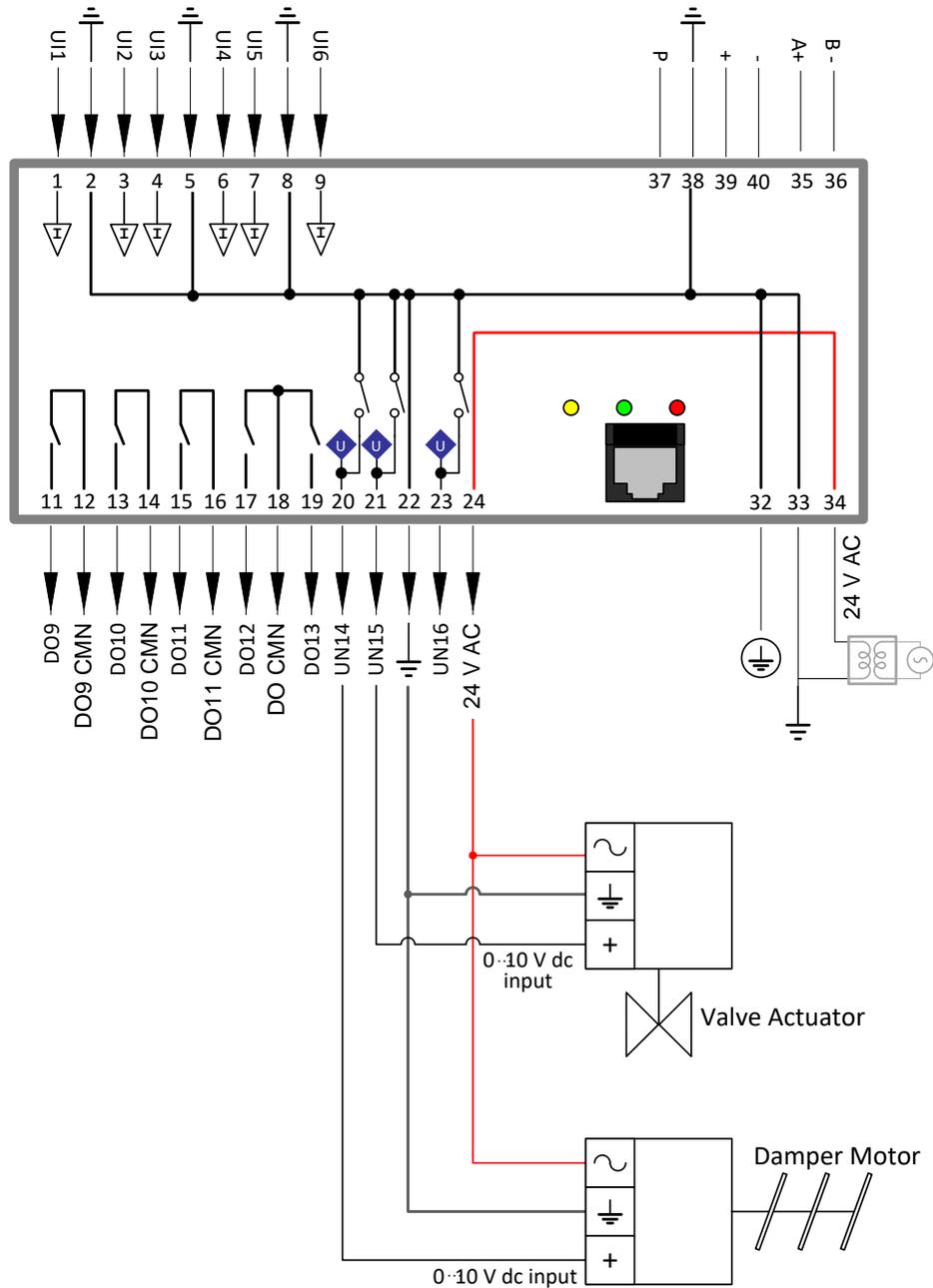
CONFIGURING THE CBT-3T6-5R FOR BACNET COMMUNICATIONS

The **CBT-3T6-5R** is shipped with the following default settings:

MS/TP Address:	**(last 2 digits of the serial number)**
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.
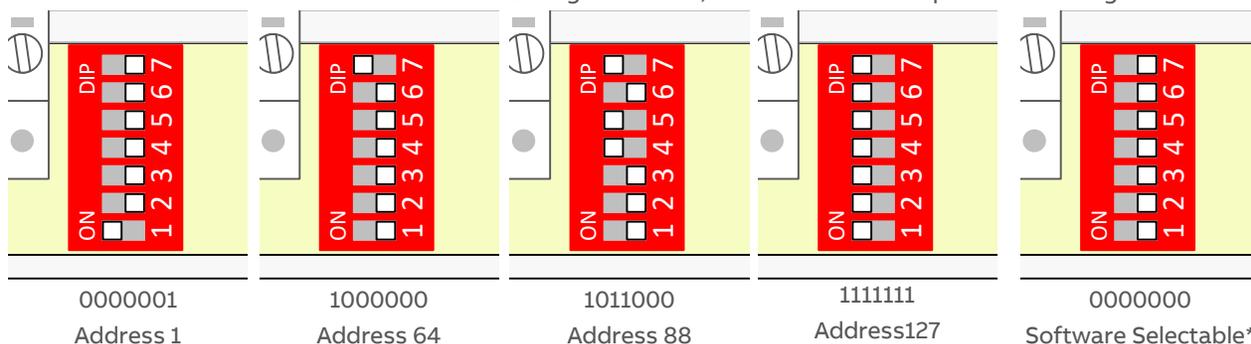
The DIP switch can be used to set the MS/TP address when the device is first powered on.

- The address is set in binary, from 1 (0000001) to 127 (1111111).
- A switch moved to the left (towards the 'ON' mark) represents 1, moved to the right represents 0.
- The bottom-most switch is the least-significant bit, the switch on the top is the most-significant bit.

0000001	1000000	1011000	1111111	0000000
Address 1	Address 64	Address 88	Address127	Software Selectable*

For convenience, *Appendix: List of DIP switch settings* on page 36 shows a diagram for every address**.**

*Note: If the DIP switch is set to all zeros, the device will retain the address to which it was last set, but that address can be subsequently overridden by software.

If no address had previously been set (e.g. when the device is received from the factory), then a device that is powered-on with the DIP switch set to all zeros will use the last 2 digits of its serial number as its initial address.

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: Service Port (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 **CBT-3T6-5R**, 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 **CBT-3T6-5R** controller.
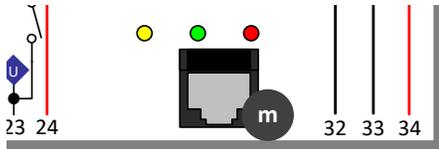
If connecting to the **CBT-3T6-5R** through a room sensor that has been wired for serial communications, insert the 9 pin D-Type serial cable into a serial port on the PC on which **NetLink** is installed, then insert the RJ-12 connector into the RJ-12 socket on the room sensor.

See *Wiring for Serial Communications through Room Sensor* on page 11 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.
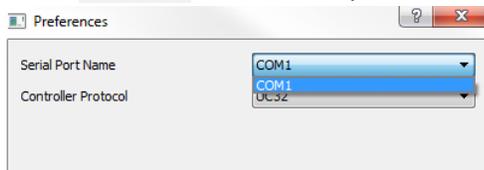
    Controller Protocol must be set to "UC32".

3. Click open.
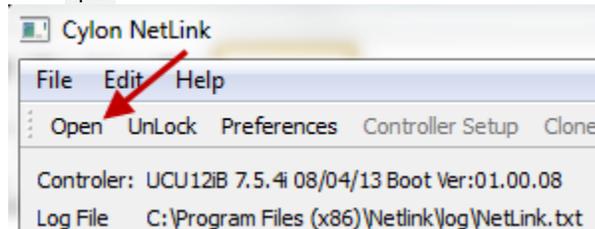
4. Navigate to where the **NetLink** screens are saved and select the "`IO_configHP.nls`" screen.

5. Click on **UnLock** and type in the password.
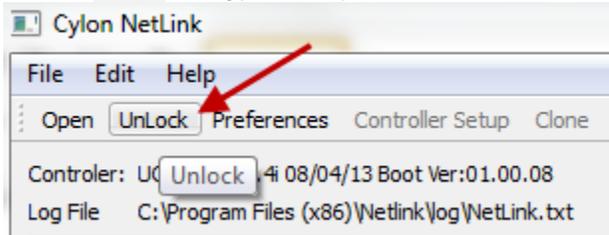
Note: The **NetLink** screens have been configured with a password of "*password*".

6. After unlocking the screens users can now select **Controller Setup**.
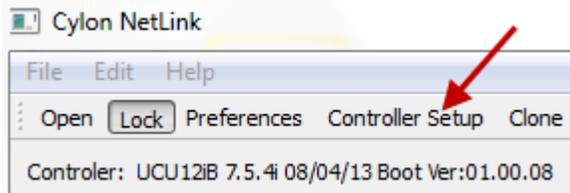
7. After selecting **Controller Setup** the following **BACnet Controller Setup** dialog will open:
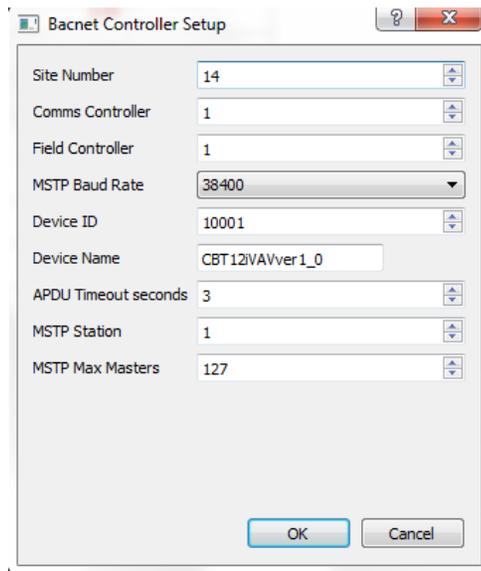
8. From this window the BACnet MS/TP configuration settings can now be configured.

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 CBT-3T6-5R 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.

3   Configuring the CBT-3T6-5R Heat Pump Strategy

The CBT-3T6-5R 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 CBT-3T6-5R 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 CBT-3T6-5R 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 CBT-3T6-5R HEAT PUMP CONFIGURATION CODES USING NETLINK

To start, the `CBT-3T6-5RHPDecoder.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 CBT-3T6-5R controller with Heat Pump strategy. This spreadsheet contains all the configuration options for the CBT-3T6-5R 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 (CBT-Stat strategy only)
    - FusionAir Zone Temperature – If a FusionAir Smart Sensor is connected (FusionAir Strategy only)
    - 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**, **FusionAir Smart Sensor**, 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, FusionAir Smart Sensor** 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 CO_2 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 `CBT-3T6-5RHPDecoder.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** or **FusionAir Smart Sensor**
- `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 CO_2 sequence.
- If the **CBT-3T6-5R** 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 **CBT-3T6-5R** 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.

- If the **CBT-3T6-5R** recognizes a **FusionAir Smart Sensor**, 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 **FusionAir touchscreen**. Temporary occupancy is achieved by touching the screen.

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 `CBT-3T6-5RHPDecoder.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 Aux Heat 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 Economizer Dampers 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 Supply Fan 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 Master Unit Reset to be used.

DEFINING AOS

By default, the `AO`s are configured as direct acting 0 ⋯ 10 V dc. However, it is possible to define any `AO`s 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 CBT-3T6-5R

Now that the input and output codes have been determined, it is possible to use **NetLink** to change the configuration within the **CBT-3T6-5R** controller.

Connect to the controller using **NetLink** (if not already connected to controller refer to *Configuring the CBT-3T6-5R for BACnet communications* on page 15). 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	☐
5	ZoneReturnAirCalibration (AS230)	0.00	
6	ZoneOccupiedCoolSetpoint (AS200)	73.00	
7	ZoneOccupiedHeatSetpoint (AS201)	73.00	
8	ZoneUnoccupiedCoolSetptoint (AS202)	80.00	
9	ZoneUnoccupiedHeatSetpoint (AS203)	60.00	
10	SetpointSliderResistance (UI02)	10000000.00	☐
11	SetpointSliderSpan (AS231)	4.00	
12	SetpointSliderEffectiveOffset (A15)	2.00	
13	DischargeAirTemp (UI03)	-1000.00	☐
14	MaxCoolingDischargeAirSetpoint (AS27)	55.00	
15	MinCoolingDischageAirSetpoint (AS29)	80.00	
16	MinHeatingDischargeAirSetpoint (AS36)	70.00	
17	MaxHeatingDischargeAirSetpoint (AS42)	100.00	
18	MixedAirTemp (UI04)	-1000.00	☐
19	MaxMixedAirTemperature (AS62)	80.00	
20	OutsideAirTemp (UI05)	-1000.00	☐
21	CO2HumidityInput (UI06)	0.03	☐
22	CO2SensorBase (AS253)	0.00	
23	CO2SensorSpan (AS254)	2000.00	
24	CO2Setpoint (AS255)	20.00	
25	OutsideAirDamper (AO14)	20.00 %	☐
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 `CBT-3T6-5RHPDecoder.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.
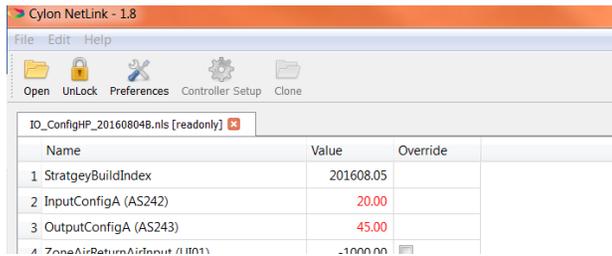
Press [Enter] on the keyboard for the changes to take effect.

When the value is changed, it should now be displayed in red.
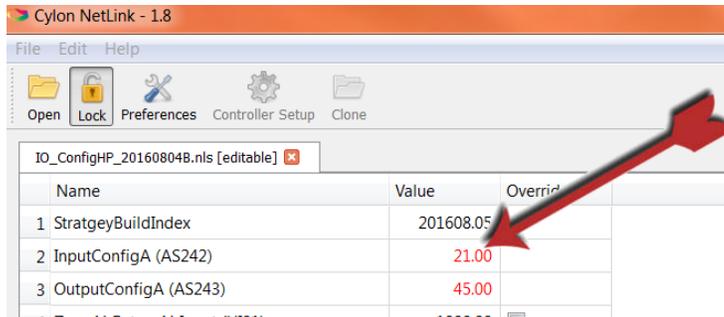
Change the rest of the input and output configuration codes.

Note:	The **CBT-3T6-5R** 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.

4 CBT-3T6-5R 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:

1. 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.

2. 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.

3. 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.

4. 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, tapping the touchscreen on the FusionAir Smart Sensor, 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

4. The discharge air temperature setpoint DischargeAirCoolingSetpoint (A34) is reset based on how far the space temperature is off from the cooling setpoint EffectiveCoolingSetpoint (A23).

5. 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.

6. 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.

7. 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, FusionAir Smart Sensor 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:

8. 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.

9. InputConfigA (A242) base number of `8`: The CBT-STAT or FusionAir Smart Sensor 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:

    > EffectiveCoolingSetpoint (A23) - EffectiveHeatingSetpoint (A22) > ½ SetpointSliderSpan (A231)

    and by the CBT-STAT or FusionAir Smart Sensor 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.

10. InputConfigA (A242) base number of `16`: The sensor connected to `UI1` (Zone or Return Air ZoneAirReturnAirInput (AI1)) 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

    > EffectiveCoolingSetpoint (A23) - EffectiveHeatingSetpoint (A22) > ½ SetpointSliderSpan (A231)

    and by the Sensor connected to `UI1` (ZoneAirReturnAirInput (AI1)) 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.

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:

11. InputConfigA (A242) base number of `0`: The Discharge Air Temperature and the reset heating setpoint is used in the reverse acting PID calculation where

    o   HeatingDemand (A50) is the process variable,

    o   DischargeAirPIDGain (A37) is the proportional gain,

    o   DischargeAirPIDIntegral (A38) is the integration time

    o   DischargeAirPIDDerivative (A39) is the derivative time and

    o   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.

12. InputConfigA (A242) base number of `8`: The CBT-Stat or FusionAir Smart Sensor temperature and active heating setpoint EffectiveHeatingSetpoint (A22) is used in the reverse acing PID calculation where:

    o   HeatingDemand (A50) is the process variable,

    o   ZonePIDGain (A232) is the proportional gain,

    o   ZonePIDIntegral (A35) is the integration time,

    o   ZonePIDDerivative (A43) is the derivative time and

    o   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 or FusionAir Smart Sensor 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.

13. 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 acing PID calculation where:

    o   HeatingDemand (A50) is the process variable

    o   ZonePIDGain (A232) is the proportional gain,

    o   ZonePIDIntegral (A35) is the integration time,

    o   ZonePIDDerivative (A43) is the derivative time and

    o   ZonePIDControlDB (A133) is the control deadband for this PID.

    The PID is enabled when

    EffectiveCoolingSetpoint (A23) - ½ SetpointSliderSpan (A231) > 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.

CO$_2$

To configure the Heat Pump strategy for CO$_2$ control, add `64` to the base number in OutputConfigA (A243).

A 0 ⋯ 10 V dc CO$_2$ 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 CO$_2$ 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.

5 Appendix : List of CBT-3T6-5R points

The tables in this Appendix list and describe the points in the **CBT-3T6-5R** 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	ZoneAirReturnAirInput (AI1)	Space or Return Air Temperature reading from sensor	°F
2	Analog Input	SetpointSliderResistance (AI2)	Value of Setpoint POT in Ohms	Ohms
3	Analog Input	DischargeAirTemp (AI3)	Discharge Air Temperature reading from sensor	°F
4	Analog Input	MixedAirTemp (AI4)	Mixed Air Temperature reading from sensor	°F
5	Analog Input	OudsideAirTemp (AI5)	Outside Air Temperature reading from sensor	°F
6	Analog Input	CO2HumidityInput (AI6)	CO2 or Humidity reading from sensor	%
14	Analog Output	OutsideAirDamper (UN14)	Economizer Damper Command Position	%
15	Analog Output	AO_2(UN15)	Un-Used	%

VALUES

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	UNITS
10	Analog	ZoneTemp (A10)	Current zone temperature for control	°F
14	Analog	StratgeyBuildIndex (A14)	Revision Number of Strategy	no-units
15	Analog	Fusion_Temp(A15)	Temperature sensor reading (FusionAir variants only)	
17	Analog	SetpointSliderEffectiveOffset (A17)	Current offset to setpoint from sensor POT	°F
22	Analog	EffectiveHeatingSetpoint (A22)	Active Heating Setpoint	°F
23	Analog	EffectiveCoolingSetpoint (A23)	Active Cooling Setpoint	°F
34	Analog	DischargeAirCoolingSetpoint (A34)	Discharge air cooling setpoint	°F
43	Analog	DischargeAirHeatingSetpoint (A43)	Discharge air heating setpoint	°F
50	Analog	HeatingDemand (A50)	Heating Demand	%
51	Analog	CoolingDemand (A51)	Cooling Demand	°F
73	Analog	CO2Value (A73)	Local CO_2 Value	PPM
78	Analog	ZoneCoolCalc (A78)	Current zone heating command calculation. This point supports priority array	%
75	Analog	Fusion_StatLockout	Status of user-access lockout feature (FusionAir variants only)	
79	Analog	Fusion_Humidity(A79)	Humidity Sensor reading (FusionAir variants only)	
106	Analog	SystemMode (A106)	Heating, Cooling or Deadband	no-units
113	Analog	Fusion_CO2(A113)	Local CO_2 Sensor reading (FusionAir variants only)	
117	Analog	StratgeyBuildIndex (A117)	Revision Number of Strategy	no-units
120	Analog	Fusion_ActiveOccCoolStpt(A120)	Ccalculated occupied cooling setpoint (FusionAir variants only)	
121	Analog	Fusion_ActiveOccHeatStpt(A121)	Calculated occupied heating setpoint (FusionAir variants only)	

SETPOINTS

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	IMPERIAL		METRIC		MIN	MAX
				DEFAULT VALUE	UNIT	DEFAULT VALUE	UNIT		
1	Analog Setpoin	SetpointAdjustStepSize (A1)	Value of Adjustment to the CBT-STAT (CBT-STAT variants only)	5	°F	0.1	°C	0	100
1	Analog Setpoin	Fusion_StptStepSize (A1)	Value of Adjustment to the FusionAir Setpoint step size (FusionAir variants only)	.5	°F	0.5	°C	0	100
6	Analog Setpoin	AlarmResetOnTime (A6)	Minimum time for Master Alarm to be on.	5	Sec	5	Sec	0	1000
9	Analog Setpoin	ZoneSetpointOffset (A9)	Deadband for Resetting of Discharge air Setpoint	4	°F	4	°C	0	100

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	IMPERIAL		METRIC		MIN	MAX
				DEFAULT VALUE	UNIT	DEFAULT VALUE	UNIT		
18	Analog Setpoin	AuxHeatStagePercent (A18)	At what percentage of the calculation do we bring on the aux heat.	75	%	75	%	0	100
19	Analog Setpoin	PIDEnableDeadband (A19)	Discharge Air Setpoint Enable Deadband	2	°F	4	°C	0	1000
20	Analog Setpoin	AuxHeatDelay (A20)	After compressor starts, how long before aux heat stages on	30	Sec	30	Sec	0	1000
27	Analog Setpoin	MaxCoolingDischargeAirSetpoint (A27)	Discharge Air Reset value for maximum Cooling Discharge air setpoint	55	°F	12	°C	0	100
28	Analog Setpoin	FanOffTimerCooling (A28)	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
29	Analog Setpoin	MinCoolingDischargeAirSetpoint (A29)	Discharge Air Reset value for minimum Cooling Discharge air setpoint	80	°F	27	°C	0	100
35	Analog Setpoin	ZonePIDIntegral (A35)	Zone PID Integral Time	900	no-units	900	no-units	0	10000
36	Analog Setpoin	MinHeatingDischargeAirSetpoint (A36)	Discharge Air Reset value for minimum Heating Discharge air setpoint	70	°F	21	°C	0	100
37	Analog Setpoin	DischargeAirPIDGain (A37)	Discharge Air PID Proportional Gain	5	no-units	5	no-units	0	1000
38	Analog Setpoin	DischargeAirPIDIntegral (A38)	Discharge Air PID Integral Time	300	no-units	300	no-units	0	10000
39	Analog Setpoin	DischargeAirPIDDerivative (A39)	Discharge Air PID Derivative Time	0	no-units	0	no-units	0	1000
40	Analog Setpoin	AspectScheduleOccupancyCmd (A40)	Aspect Schedule Connection Point	2	no-units	2	no-units	0	100
42	Analog Setpoin	MaxHeatingDischargeAirSetpoint (A42)	Discharge Air Reset value for maximum Heating Discharge air setpoint	100	°F	36	°C	0	100
43	Analog Setpoin	ZonePIDDerivative (A43)	Zone PID Derivative Time	0	no-units	0	no-units	0	1000
44	Analog Setpoin	EconomizerStagingPercent (A44)	Staging Control Point	30	%	30	%	0	100
62	Analog Setpoin	MaxMixedAirTemperature (A62)	Mixed Air Temperature Setpoint	72	°F	27	°C	0	100
63	Analog Setpoin	MixedAirPIDGain (A63)	Mixed Air PID Proportional Gain	30	no-units	30	no-units	0	1000
64	Analog Setpoin	OutsideAirEconomizerLockout (A64)	Outside Air Temperature Lockout Setpoint for Economizer Dampers	0	°F	2	°C	0	100
69	Analog Setpoin	MixedAirEconomizerLockout (A69)	Mixed Air Temperature Lockout Setpoint for Economizer Dampers	30	°F	0	°C	0	100
70	Analog Setpoin	RemoteOutsideAir (A70)	Outside Air Temperature value if in remote mode	72	°F	25	°C	0	100
81	Analog Setpoin	MinutesTempOccupancy (A81)	Temporary Occupancy Over-Ride Time	1000	Min	1000	Min	0	10000
82	Analog Setpoin	FanOffTimerHeating (A82)	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 Setpoin	LoadShedOccupiedSetpointOffset (A98)	Number of degrees by which occupied setpoints are offset when load shed mode is enabled.	2	°F	4	°C	0	100
100	Analog Setpoin	ReversingValveCompressorOffTime (A100)	Time delay between compressor going off, reversing valve command and compressor being re-enabled	30	Sec	30	Sec	0	1000
127	Analog Setpoin	OutsideAirDamperMinimumPosition (A127)	Normal Modes Economizer Dampers Minimum Position	20	%	20	%	0	100
131	Analog Setpoin	DischargeAirControlDB (A131)	Deadband for Control of the Discharge Air PID	1	no-units	1	no-units	0	1000
133	Analog Setpoin	ZonePIDControlDB (A133)	Deadband for Control of the Zone PID	1	no-units	1	no-units	0	1000
200	Analog Setpoin	ZoneOccupiedCoolSetpoint (A200)	Occupied Cooling setpoint	75	°F	23	°C	0	100
201	Analog Setpoin	ZoneOccupiedHeatSetpoint (A201)	Zone Occupied heating setpoint	71	°F	21	°C	0	100

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	IMPERIAL		METRIC		MIN	MAX
				DEFAULT VALUE	UNIT	DEFAULT VALUE	UNIT		
202	Analog Setpoint	ZoneUnoccupiedCoolSetpoint (A202)	Zone Unoccupied cooling setpoint	85	°F	26	°C	0	100
203	Analog Setpoint	ZoneUnoccupiedHeatSetpoint (A203)	Zone Unoccupied heating setpoint	65	°F	18	°C	0	100
230	Analog Setpoint	ZoneReturnAirCalibration (A230)	Calibration Point for Sensor on UI1	0	°F	0	°C	0	100
231	Analog Setpoint	SetpointSliderSpan (A231)	Zone control slider range setpoint	4	°F	2	°C	0	100
232	Analog Setpoint	ZonePIDGain (A232)	Zone temperature PID gain	30	no-units	30	no-units	0	1000
242	Analog Setpoint	InputConfigA (A242)	Strategy Input configuration setpoint	20	no-units	20	no-units	0	255
243	Analog Setpoint	OutputConfigA (A243)	Strategy Output configuration setpoint	45	no-units	45	no-units	0	255
253	Analog Setpoint	CO2SensorBase (A253)	Base Value for conversion of UI6	0	no-units	0	no-units	0	100
254	Analog Setpoint	CO2SensorSpan (A254)	Range Value for conversion of UI6	2000	no-units	2000	no-units	0	10000
255	Analog Setpoint	CO2Setpoint (A255)	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	Fan (DO9)	Supply Fan Enable/Disable	On	Off
10	Digital Output	Compressor1 (D10)	Compressor 1 Enable/Disable	On	Off
11	Digital Output	Compressor2 (DO11)	Compressor 2 Enable/Disable	On	Off
12	Digital Output	ReversingValve (DO12)	Reversing Valve On/Off	On	Off
13	Digital Output	AuxiliaryHeat (DO13)	Aux Heat or Master Reset On/Off	On	Off
16	Digital Input	UnitAlarmInput (D16)	Unit Alarm From Heat Pump	On	Off

VALUES

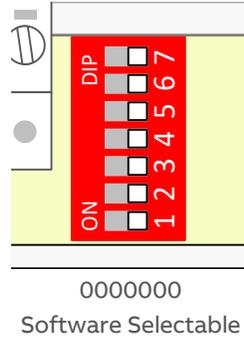| POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	UNITS 0/OFF	UNITS 1/ON
2	Digital	AuxHeatStartStop (D2)	Aux Heat command	On	Off
6	Digital	OccupancyStatus (D6)	Occupancy mode status	On	Off
10	Digital	InternalSchedule (D10)	Internal BACnet Schedule Connection Point	On	Off
32	Digital	ReversingValveReverseAct (D32)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

SETPOINTS

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	DEFAULT VALUE	UNITS 0/OFF	UNITS 1/ON
1	Digital Setpoint	OccupancyCommand (D1)	Occupancy command	Occ	Occ	Non Occ
8	Digital Setpoint	House (D8)	CBT-Stat House Indicator	On	On	Off
79	Digital Setpoint	MasterAlarmReset (D79)	Reset Heat Pump Master Alarm	Off	On	Off
87	Digital Setpoint	LoadShedEnable (D87)	Load Shed Enable Command	Disable	Enable	Disable
107	Digital Setpoint	Fusion_OvrReset(D107)	Resets the overrides in the Fusion Air device (FusionAir variants only)	Off	On	Off
249	Digital Setpoint	EmergencyPurgeCmd (D249)	Put Unit into Purge Mode	Off	On	Off
250	Digital Setpoint	EmergencyStarveCmd (D250)	Put Unit into Starve Mode	Off	On	Off
330	Digital Setpoint	RemoteOutsideAirEnable (D330)	Enable Remote Outside Air Setpoint	On	On	Off

TIME SCHEDULES

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	UNITS 0/OFF	UNITS 1/ON
130	BACnet Schedule	UCxx Schedule (D130)	BACnet Schedule	Unoccupied	Occupied

6   Appendix: List of DIP switch settings

The following table illustrates the DIP switch settings for all possible controller MSTP address settings. See *Configuring the CBT-3T6-5R for BACnet communications* on page *15* for more details.

0000000
Software Selectable

Note: If the DIP switch is set to all zeros, the device will retain the address to which it was last set, but that address can be subsequently overridden by software.

If no address had previously been set (e.g. when the device is received from the factory), then a device that is powered-on with the DIP switch set to all zeros will use the last 2 digits of its serial number as its initial address.

0000001	0000010	0000011	0000100	0000101	0000110	0000111	0001000
Address 1	Address 2	Address 3	Address 4	Address 5	Address 6	Address 7	Address 8

0001001	0001010	0001011	0001100	0001101	0001110	0001111	0010000
Address 9	Address 10	Address 11	Address 12	Address 13	Address 14	Address 15	Address 16

0010001	0010010	0010011	0010100	0010101	0010110	0010111	0011000
Address 17	Address 18	Address 19	Address 20	Address 21	Address 22	Address 23	Address 24

0011001
Address 25

0011010
Address 26

0011011
Address 27

0011100
Address 28

0011101
Address 29

0011110
Address 30

0011111
Address 31

0100000
Address 32

0100001
Address 33

0100010
Address 34

0100011
Address 355

0100100
Address 36

0100101
Address 37

0100110
Address 38

0100111
Address 39

0101000
Address 40

0101001
Address 41

0101010
Address 42

0101011
Address 43

0101100
Address 44

0101101
Address 45

0101110
Address 46

0101111
Address 47

0110000
Address 48

0110001
Address 49

0110010
Address 50

0110011
Address 51

0110100
Address 52

0110101
Address 53

0110110
Address 54

0110111
Address 55

0111000
Address 56

0111001
Address 57

0111010
Address 58

0111011
Address 59

0111100
Address 60

0111101
Address 61

0111110
Address 62

0111111
Address 63

1000000
Address 64

1000001
Address 65

01000010
Address 66

0100011
Address 67

1000100
Address 68

1000101
Address 69

1000110
Address 70

1000111
Address 71

1001000
Address 72

1001001
Address 73

1001010
Address 74

1001011
Address 75

1001100
Address 76

1001101
Address 77

1001110
Address 78

1001111
Address 79

1010000
Address 80

1010001
Address 81

1010010
Address 82

1010011
Address 83

1010100
Address 84

1010101
Address 85

1010110
Address 86

1010111
Address 87

1011000
Address 88

1011001
Address 89

1011010
Address 90

1011011
Address 91

1011100
Address 92

1011101
Address 93

1011110
Address 94

1011111
Address 95

1100000
Address 96

1100001
Address 97

1100010
Address 98

1100011
Address 99

1100100
Address 100

1100101
Address 101

1100110
Address 102

1100111
Address 103

1101000
Address 104

1101001
Address 105

1101010
Address 106

1101011
Address 107

1101100
Address 108

1101101
Address 109

1101110
Address 110

1101111
Address 111

1110000
Address 112

1110001
Address 113

1110010
Address 114

1110011
Address 115

1110100
Address 116

1110101
Address 117

1110110
Address 118

1110111
Address 119

1111000
Address 120

1111001
Address 121

1111010
Address 122

1111011
Address 123

1111100
Address 124

1111101
Address 125

1111110
Address 126

1111111
Address 127

ABB CYLON CONTROLS

Clonshaugh Business & Technology Park
Clonshaugh
Dublin 17
Ireland

Tel.:   +353 1 245 0500
Fax: +353 1 245 0501
Email: info@cylon.com

ABB CYLON CONTROLS

ONE TECHNOLOGY LANE
EXPORT,
PA 15632

Tel.:   +1 724 733-2000
Fax: +1 724 327-6124