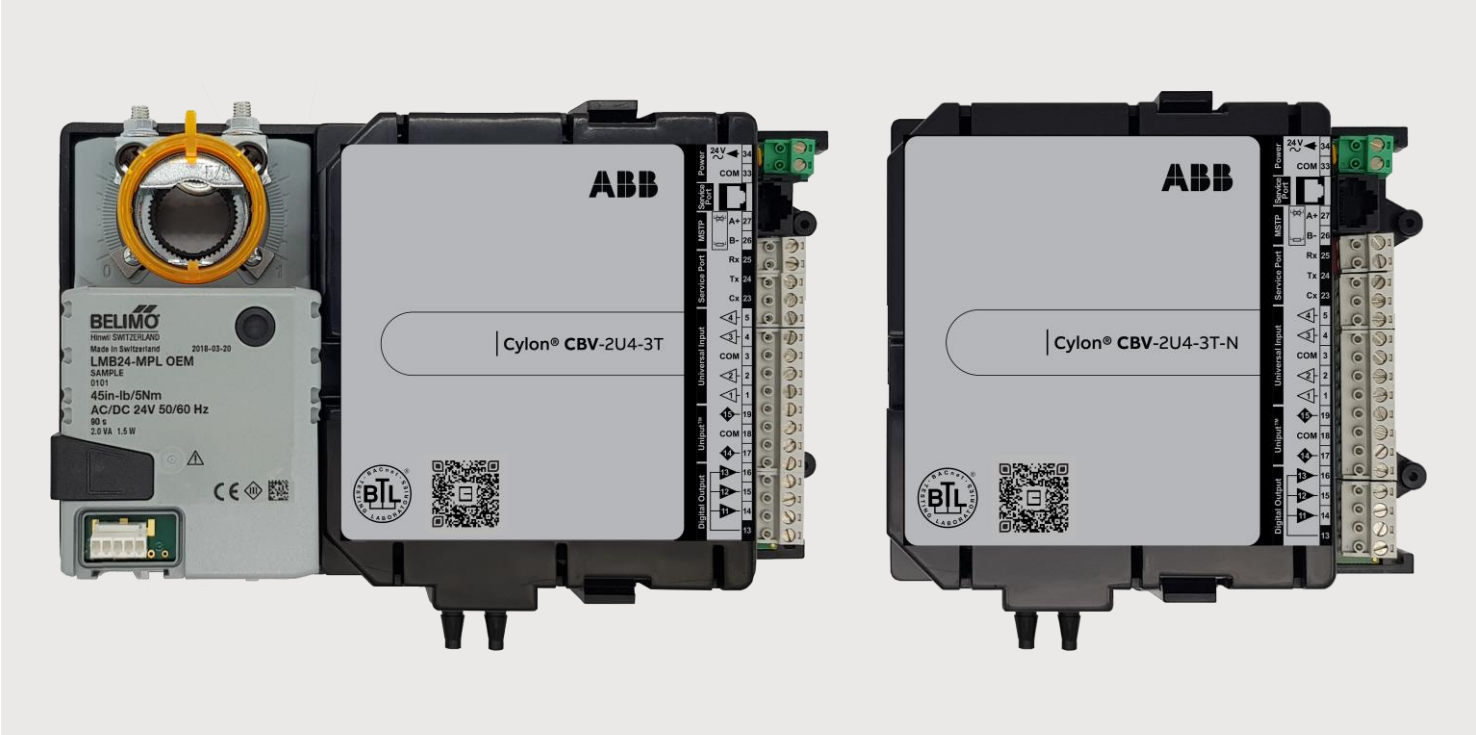
USER GUIDE

MAN0139 rev 14

CBV-2U4-3T(-N)



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]

table of contents

table of contents

1 Getting Started

HOW TO USE THIS MANUAL

The CBV-2U4-3T(-N) manual provides users with the information needed to install and configure the controller for all the various application specific requirements.

CBV-2U4-3T(-N)

The CBV-2U4-3T(-N) is a configurable BACnet MS/TP device designed to be used within a BACnet system to include existing eBuilding systems. The CBV-2U4-3T(-N) is designed to control a wide variety of VAV box types used in commercial HVAC installations. The controller comes preloaded with a strategy that will control most VAV applications; however, it is possible to load a custom strategy or to modify the preloaded strategy to meet any application-specific needs.

PHYSICAL SPECIFICATIONS

Size (excluding terminal plugs)	8.3 x 5.12 x 2.36” (210 x 130 x 60 mm)
Enclosure	Injection molded ABS
Mounting	DIN rail
Airflow Sensor Connection	Use rubber hose suitable for a 0.2” (5.1 mm) O.D. nozzle

ENVIRONMENTAL SPECIFICATIONS

Ambient Temperature	32°-122°F (0° - 50°C) ambient.
Ambient Humidity	0% - 90% RH non-condensing
EMC Immunity	EN 55024, 2010
EMC Emission	EN 55022, 2010 Class A
Approvals	UL Listed (CDN & US) UL916 Energy Management Equipment - File No. E176435

SUPPORTING SOFTWARE

To commission the controller, it is recommended to use CXpro^{HD} software, ABB FusionAir Smart Sensors or CBT-STAT devices.

SUPPORTING FILES

All files needed for configuring the CBV-2U4-3T(-N) are available from the ABB Cylon Community Toolbox https://abbcommunity.com/

2 Installation Overview

PREPARING TO INSTALL THE CBV-2U4-3T(-N)

This section describes how to unpack the unit and how to prepare the site for installation of the CBV-2U4-3T(-N). 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.

Supply Voltage: 24 V AC, 50/60Hz

Note: One side of the 24 volts transformer must be grounded; refer to *Connecting Power to the* on page 10 for more information.

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

UNPACKING THE CBV-2U4-3T(-N)

The CBV-2U4-3T(-N) is shipped in its own box. Multiple CBV-2U4-3T(-N) boxes may be packaged together in a larger box. Upon receiving the CBV-2U4-3T(-N) 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. ABB is not responsible for damage to the product caused by shipping, either by a ABB -selected shipper or by a customer-specified shipping company.

INSTALLATION OF CBV-2U4-3T(-N)

PHYSICAL INSTALLATION OF CONTROLLER

When installing the CBV-2U4-3T(-N) controller you should consider the following:

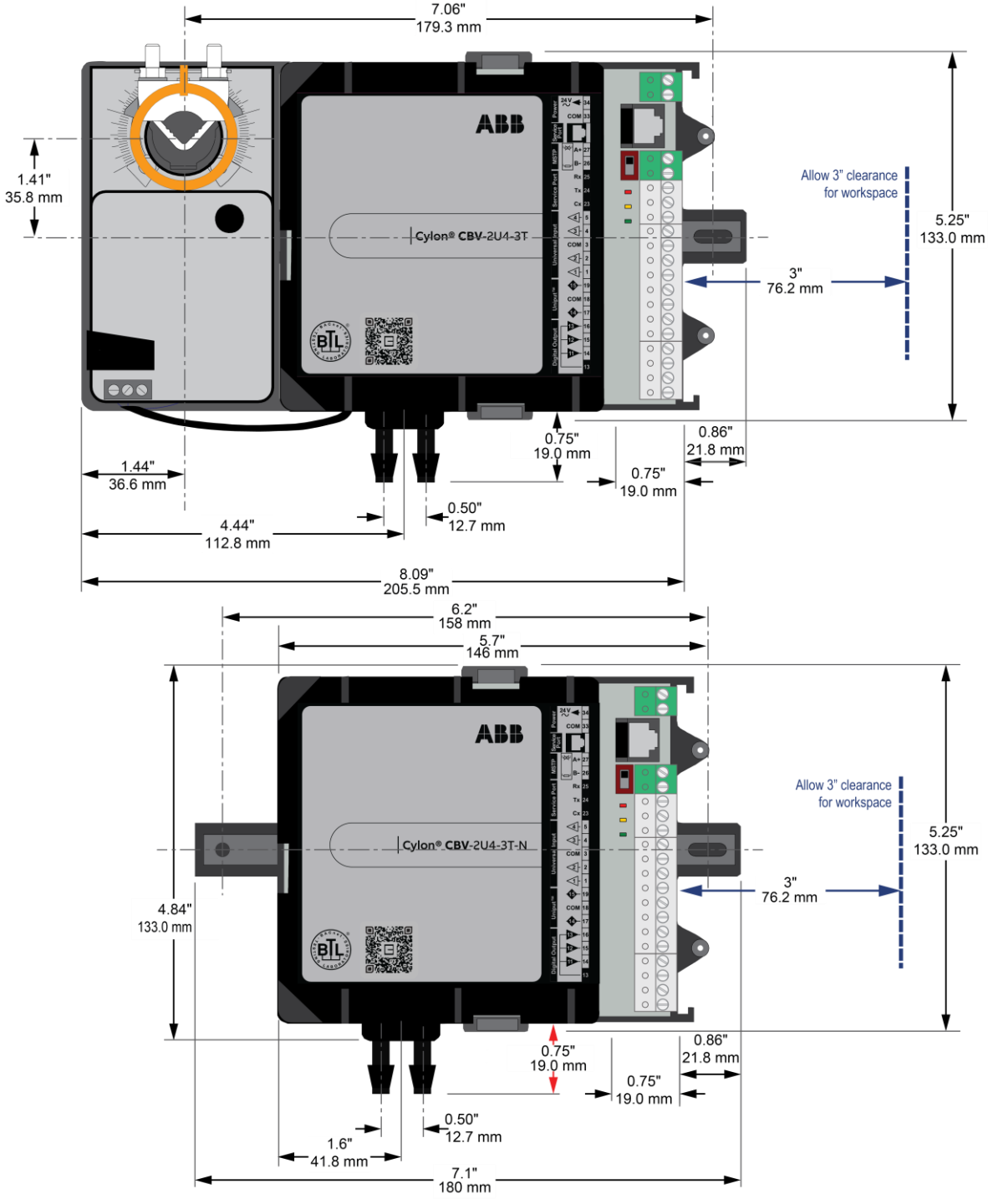
- Selecting a location with the appropriate clearance.
- Determining the damper shaft diameter.

Note: Shaft diameter must be no larger than 5/8" (15.8 mm).

- Determining the direction of rotation for the damper.
- Accommodating dampers with less than a 90° actuator stroke.
- Mounting controller.

Controller Dimensions and Clearances

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



Determining Damper Shaft Direction of Rotation

Before mounting the actuator onto the shaft, users will need to determine the direction the shaft rotates in order to open the damper (clockwise/cw or counter-clockwise/ccw). By default, the **CBV-2U4-3T(-N)** controller is configured to open the damper in a clockwise/cw rotation. To change the rotation, digital set point DampReverse (D230) R/W will need to be set to on (default off).

Damper Adaption (CBV-2U4-3T only)

Damper Adaption is a process whereby the actuator will drive one full cycle to its mechanical end-stop, after which the actuator's working range will be adapted to the actual mechanical angle of rotation. This can be initiated by either

1. toggling DamperAdaption(D225) to `ON` then `OFF`, or
2. pressing the manual override button on the actuator once.

In the VAV actuator block in the Strategy, the `damper synchronization` option will also modulate the damper from `0` … `100` based on a CW/CCW switch. The integrated actuator in **CBV-2U4-3T** does not have a CW/CCW switch, so this `damper synchronization` option simply cycles the damper from `0 %` to `100 %`. Toggling the DamperAdaption(D225) binary point will accomplish the same thing.

Mounting controller to VAV box

Use the following steps for mounting the **CBV-2U4-3T(-N)** on the VAV box.

1. The controller is designed for two-point mounting, with one point being the damper shaft. Attach the **CBV-2U4-3T(-N)** to the shaft of the VAV damper by slipping the damper shaft through the round hole containing the "U" mounting bracket.

Note: Do NOT tighten it to the shaft at this time.

2. The controller has a mounting tab to the right side of controller. Ensure that the controller is positioned correctly and is in its final position. When positioned correctly, finish fastening the controller to the VAV box by screwing in the supplied screw through the mounting tab into the VAV box.
3. Before tightening the controller to the damper shaft, rotate the VAV damper blade to the closed position.
4. While pushing in the Damper Manual Override button (located on the front of actuator), rotate the hub to the full closed position.
5. Tighten the "U" mounting bracket to the damper shaft.
6. Using Polyethylene plenum-rated pneumatic tubing (not supplied), connect the airflow sensor on the **CBV-2U4-3T(-N)** to the velocity pickup station on the VAV box. Be sure to connect the "high pressure/P1" side of the **CBV-2U4-3T(-N)** to the "High" or "Total Pressure" connection of the VAV box. The "low pressure/P2" side of the **CBV-2U4-3T(-N)** needs to be connected to the "Low" or "Static Pressure" connection of the VAV box.

Note: An inline filter should be installed between the "high pressure/P1" input and the high pressure of the airflow device.

Accommodating Dampers with Less than a 90° Actuator Stroke

Use the following procedure to set the actuator to accommodate dampers with less than a 90° stroke.

1. If the angle of the damper opening is either 45° or 60°, close the actuator by pushing in the Damper Manual Override button on the front of the actuator.
2. While holding the Damper Manual Override button in, rotate the hub until the damper is fully open.
3. Loosen the range stop screw and set range stop to appropriate position.
4. Tighten range stop screw so that the actuator will no longer be able to rotate beyond the point where range stop was set.

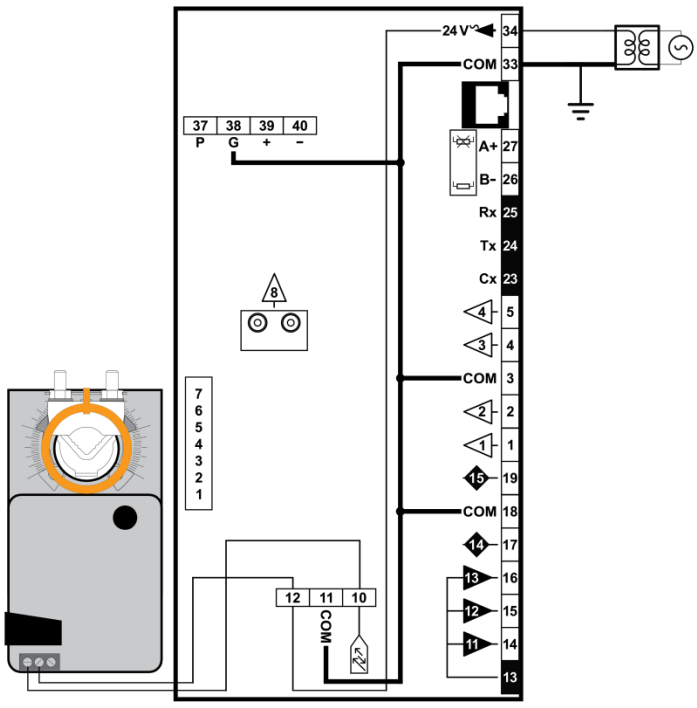
Wiring the CBV-2U4-3T(-N)

Once the box type has been determined, users can then wire the CBV-2U4-3T(-N) for the network, the room sensors, and the elements of the VAV box (fan, heating coils, valve, and so forth). This section will go over the various wiring considerations for the CBV-2U4-3T(-N).

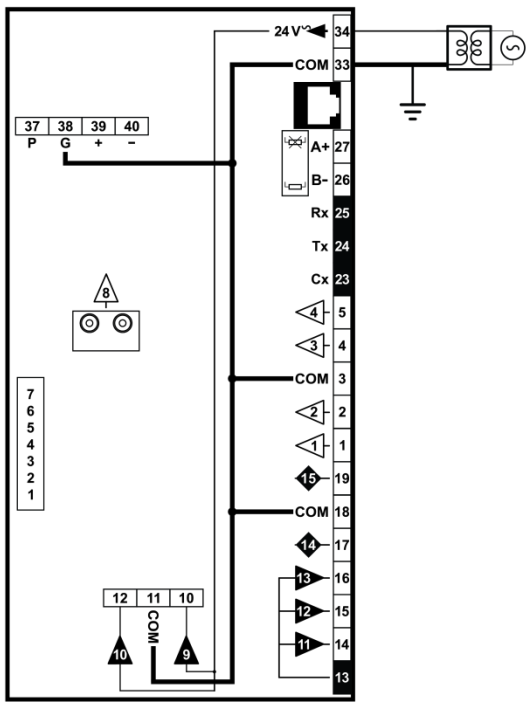
Connecting Power to the CBV-2U4-3T(-N)

The CBV-2U4-3T(-N) requires 24 V AC +/- 15% at 55 VA (up to 12 VA internal power plus up to 43 VA supplied to Triac loads) maximum supplied from an externally mounted power transformer. One conductor of the 24-volt side of transformer must be grounded to avoid damage to the controller. This conductor will be wired to the CMN (common) of the controller. The wiring diagram is shown below:

CBV-2U4-3T

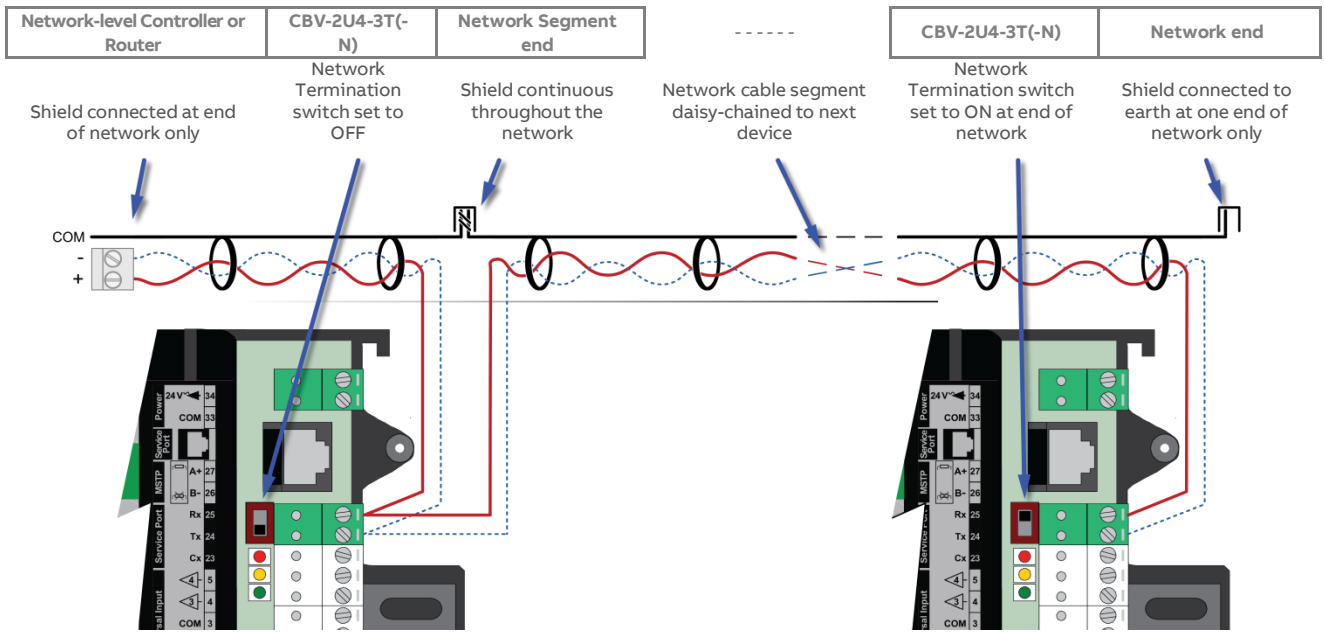


CBV-2U4-3T-N



Wiring the RS-485 Network

Wiring the RS-485 network involves connecting the A+ and B- terminals in a daisy-chained configuration. One end of the network will be connected to the subnet of the Target or fieldbus of 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 CBV-2U4-3T(-N), users can switch the "Fieldbus 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 a Target, then the shield will be grounded at the Target. If it is wired to a router, the shield must be grounded at one point on the network as shown below:



Wiring the Universal Inputs

The CBV-2U4-3T(-N) comes with 5 universal inputs. `U/I-8` is dedicated to the internal air flow sensor. `U/I-1` through `U/I-4` are used for wiring in room sensors, set point adjust, discharge air sensors, CO_2 sensors, relative humidity sensors, and motion sensors, depending on the application. The sequences for this wide range of applications are available within the preloaded strategy. See *Configuring the CBV-2U4-3T(-N) controller* on page 21 of this manual for selecting the sequence for specific applications.

- **U/I - 1** will typically be where the room temperature sensor is wired. This input is pre-configured to support a 10K Type III thermistor. All room sensors purchased from ABB-are 10K Type III.

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

- **U/I – 2** will typically be where the room set point adjust is wired. This input is pre-configured to support a 5K POT. All room sensors purchased from AAM are of this sensor type.

Note: It is possible to fine tune the set point adjusts or to change it to support a 10K POT by changing analog setpoints *SliderValAt_xx* (A385 ··· A389 e.g. SliderValAt_0) R/W to change the resistance table. See *Appendix : List of CBV-2U4-3T(-N) points* on page 61 for details on changing these values.

- **U/I – 3** is a dedicated input that has been configured to read a thermistor. In the pre-loaded strategy this input is used for a supply air temperature sensor for auto changeover. See *Primary Air State and Damper Control* on page 43 for more information on this feature.
- **U/I – 4** is configured as a voltage input. 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: For CO_2 or relative humidity sensors it must be a 0···10 V DC sensor type. To change the span for the CO_2 sensor that is installed, adjust the following:

- UI04CO2SensorBase (A253) Low range of sensor.
- UI04CO2SensorSpan (A254) Total range of senor.

To adjust the span for the relative humidity sensor that is installed, adjust the following:

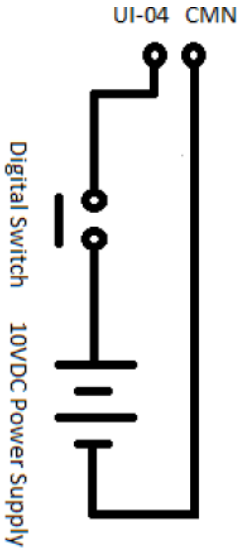
- UI04SensorBase (A256) Low range of sensor.
- UI04SensorSpan (A257) Total range of senor.

IO POINTS	DESCRIPTION
UI-01	Zone Temperature (with optional override button)
UI-02	Setpoint Adjustment (optional 5K slider)
UI-03	Discharge Temperature (optional)
UI-04	CO_2, Humidity, or occupancy signal (all optional)
UI-08	Flowrate Sensor

How to set up UI4 as a digital input

`UI-4` on the **CBV-2U4-3T** is configured by default as an analog input, reading voltage, suitable for a CO_2 or humidity sensor.

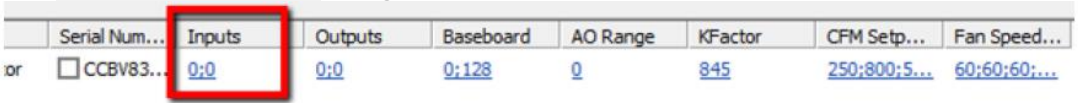
This UI can also be configured to register digital input for a `Local OCC sensor` (registering occupancy in a space using a PIR relay) or `Spare Digital Input` but to wire `UI-4` for a digital input, you will need to put a `10 V DC` power supply in series with the digital switch:



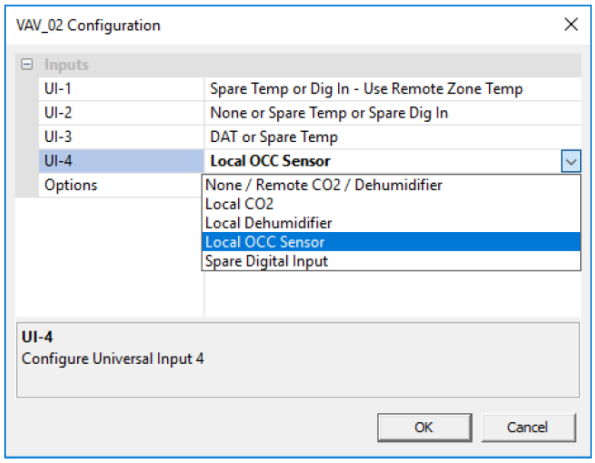
The **CBV** strategy defines thresholds for voltage levels that would be considered a digital `1` or a digital `0`.

To set up `UI-4` as an occupancy sensor,

1. open **CXpro**[HD],
2. Right-click on the Site or Network containing the **CBV** and select `Commission BACnet Devices`.
3. In the `Commission BACnet Devices` dialog, click on the Inputs column of the relevant **CBV**:



This opens the `VAV Configuration` dialog:



Select `Local OCC Sensor`

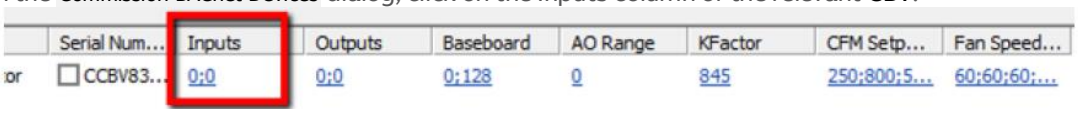
In the default **CBV** Strategy, the Local OCC Sensor setting expects the UI to be normally closed, i.e. when the sensor reads `10 V DC` the reading is interpreted as `unoccupied`.

When the sensor reads `0 V DC` and the box is otherwise commanded off the box will go occupied. It will revert to an `unoccupied` state after `30` seconds of reading `10 V DC` from the sensor.

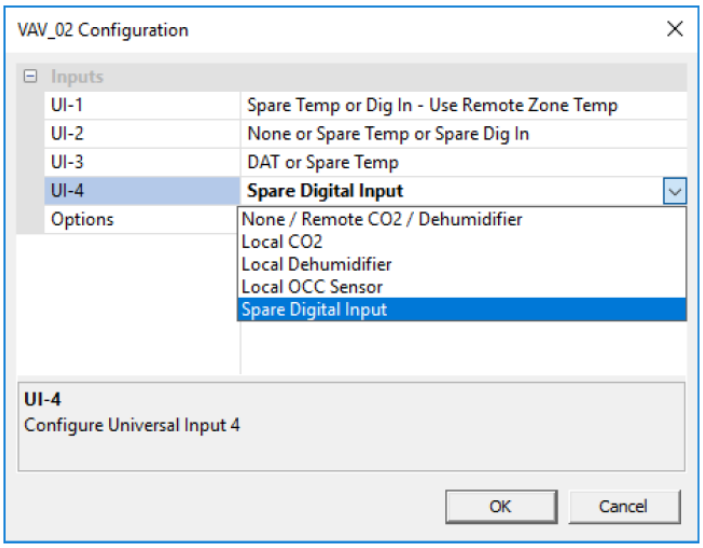
The threshold for `UI-4` to register occupancy as `ON` is `2 V DC` and the threshold for an `OFF` state is `4 V DC`.

To set up `UI-4` as a spare digital input:

1. open **CXpro**^{HD},
2. Right-click on the Site or Network containing the **CBV** and select Commission BACnet Devices.
3. In the Commission BACnet Devices dialog, click on the Inputs column of the relevant **CBV**:



This opens the VAV Configuration dialog:



Choose the option Spare Digital Input.

The digital point in the Strategy that will determine a digital status from `UI-4` is UI04DigitalStatusHost (D235).

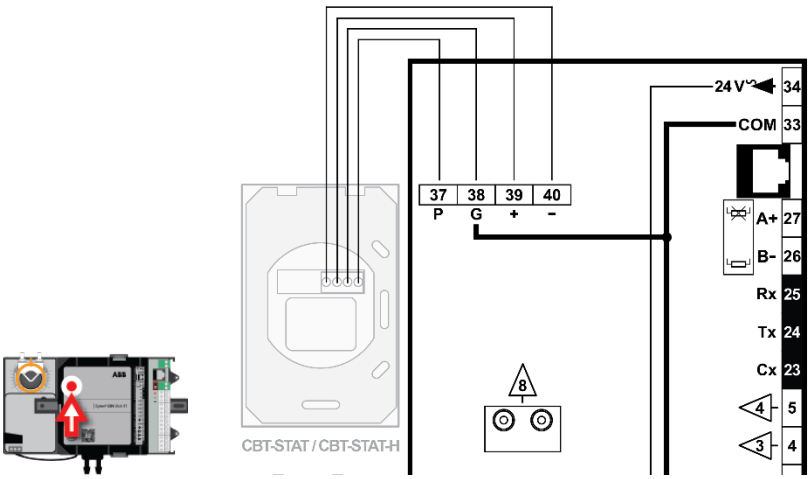
UI04DigitalStatusHost (D235) is configured in the Strategy to be normally closed, i.e. when `UI-4` detects `10 V DC` the point will report an `OFF` value.

When the sensor reads `0 V DC` the point will read an `ON` value.

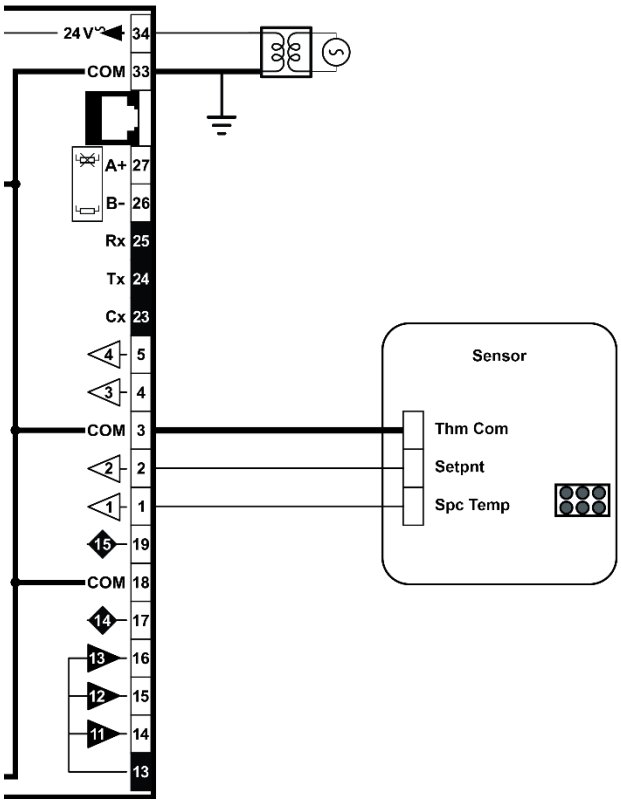
The threshold for `UI-4` to register the Spare Digital Input as `ON` is `2 V DC` and the threshold for an `OFF` state is `4 V DC`.

Wiring the Room Sensor

When using a Room Sensor with **CBV-2U4-3T(-N)** controllers, it is recommended that you use the **ABB FusionAir Smart Sensor** or the ABB Cylon **CBT-STAT(-H)**. There is a dedicated port designed for these on the **CBV-2U4-3T(-N)**, accessed by removing the top cover as illustrated below:



Alternatively, the diagram below illustrates the connection between **CBV-2U4-3T(-N)** and a typical standard room sensor with a space temperature type III thermistor, including a 5K setpoint slide adjust.



Wiring the Digital and Analog Outputs

Both **CBV-2U4-3T** and **CBV-2U4-3T-N** come with 3 digital outputs and 2 UniPuts™ (normally configured as analog outputs) for controlling a wide variety of possible elements of the VAV box. In addition the **CBV-2U4-3T-N** comes with 2 digital outputs for damper control (accessed by removing the top cover), and the **CBV-2U4-3T** includes integrated damper control. It is possible to control single speed and variable speed fans (both parallel and series), electric heat (optional pulse width modulation), proportional heating valves, and tri-state heating valves depending on the application.

- **DO-11** can be configured for controlling first stage electric heat (on-off or pulse width modulation optional), or to open a tri-state heating valve.
- **DO-12** can be configured for controlling second stage electric heat (on-off or pulse width modulation optional), or to close a tri-state heating valve.
- **DO-13** can be configured for controlling third stage (on-off or pulse width modulation optional), or to control a single speed fan (series or parallel).

  Note: It is also possible to define `DO-13` as a start command for a variable speed fan (series or parallel). Both `AO-15` and `DO-13` must be configured as either series or parallel for this feature.
- **AO-14** can be configured for controlling any first stage modulating heating valves, SCR (Silicone Controlled Rectifier), or EMC (Electronic Modulating Control) type controls depending on the heating elements of the VAV box.
- **AO-15** can be configured for controlling any second stage modulating heating valves, SCR (Silicone Controlled Rectifier), or EMC (Electronic Modulating Control) type controls depending on the heating elements of the VAV box. This output can also be configured for variable speed fan control (series or parallel).

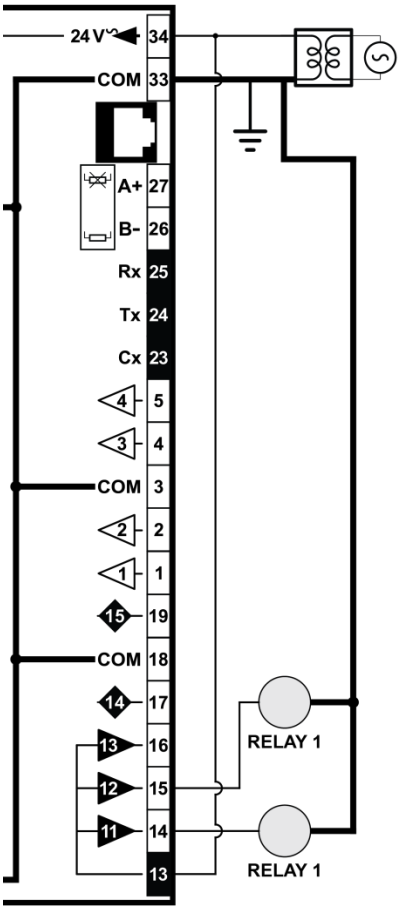
Note: `AO-14` and `AO-15` are preconfigured as a 0 ··· 10 V dc direct acting output. During configuration it is possible to configure either output or both outputs for reverse acting or 10 ··· 0 V dc. Either or both of these outputs can also be configured for 2 ··· 10 V dc or 10 ··· 2 V dc. In **CBV-2U4-3T-N** controllers the `DO`s can now be configured for reverse acting.

IO POINTS	DESCRIPTION
DO-09	Damper Open/Close CBV-2U4-3T-N ONLY
DO-10	Damper Close/Open CBV-2U4-3T-N ONLY
DO-11	1st Stage Electric Heat (optional PWM) or Tri-State Heat Valve Open
DO-12	2nd Stage Electric Heat (optional PWM) or Tri-State Heat Valve Closed
DO-13	3rd Stage Electric Heat (optional PWM) or Fan Command (Series or Parallel)
AO-14	1st Stage Modulating Heat Control
AO-15	2nd Stage Modulating Heat Control or Variable Fan Speed Control (Series or Parallel)

Wiring Digital Outputs

The CBV-2U4-3T & CBV-2U4-3T-N can be wired to switch either hot 24 V AC or common. In most applications users will be wiring the digital outputs to switch 24 V AC. **To switch 24 V AC, users must wire an externally sourced 24 V AC hot to TRI CMN (triac common) on the CBV-2U4-3T & -N, the 24 V AC can be sourced from the same power supply as the VAV, or an external 24 V AC source.**

The diagram below is a typical wiring diagram for controlling a relay by switching 24 V AC.



CONFIGURING THE CBV-2U4-3T(-N) FOR BACNET COMMUNICATIONS

The CBV-2U4-3T(-N) is shipped with the following default settings:

MS/TP Address:	01
BACnet Instance Number	17101
MS/TP Baud Rate	38,400 bps
Serial to PC Baud Rate	9600 bps

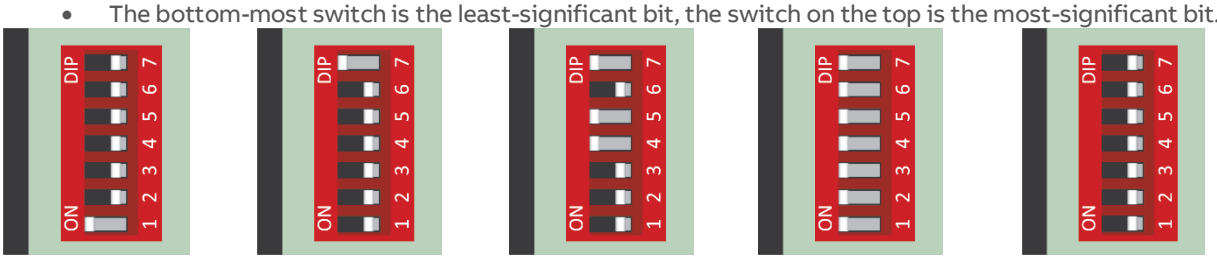
To communicate to other MS/TP devices on a BACnet MS/TP network, the MS/TP address must be set to a unique address within the MS/TP subnet. Where possible, there should be no gaps between MS/TP addresses. The BACnet Instance Number must also be unique for the BACnet site. The MS/TP baud rate must match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

The controller's BACnet MAC address can be set either electronically (USB or BACnet) or manually using the 8-way DIP switch.

- **Manual setting for ease of replacement**: Setting the 7-way DIP switch to an address between 1 and 254, and then cycling the power, will force the controller to update its MAC address to match the DIP settings. To replace a manually addressed controller in the field simply copy the DIP switch setting of the controller you are replacing.
- **Electronic setting for remote configuration**: Setting the 7-way DIP switch to all zeros will allow the MAC address to be set electronically either locally by USB or remotely over BACnet. It is also possible to use manual setting for initial commissioning, and then cycling the power to force the controller to update its MAC address to match the DIP settings. To enable subsequent electronic configuration, set the DIP switch to all zeros. The controller will retain the manually set address until it is electronically overwritten.

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 71 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.

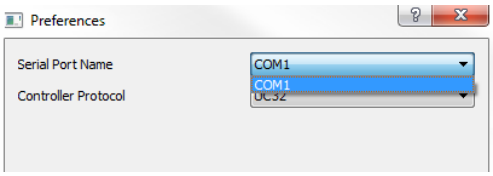
Note: Ensure the 24 V AC and Common wires are correctly connected to the controller. If the wires are swapped, it may cause damage to anything connected to the controller.

If connecting directly to the **CBV-2U4-3T(-N)**, 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 on the front of the **CBV-2U4-3T(-N)** controller.

If connecting to the **CBV-2U4-3T(-N)** 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.

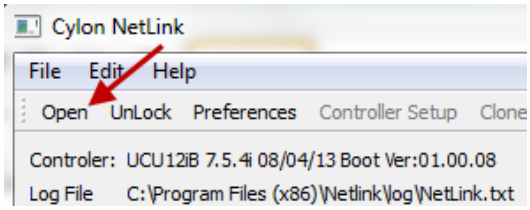
Once connected to the controller, it is possible to change the settings on the controller using the **CXproH**^{D} or, preferably, **NetLink**. For details on how to use the **CXproH**^{D}, please refer to the *Cxpro*^{HD} *User Guide (MAN0133)* available from the ABB Library. For details on how to use **NetLink**, continue to the section below.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 serial cable.

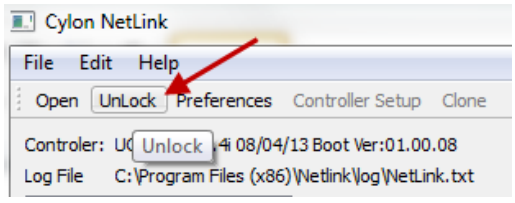


Controller Protocol must be set to “UC32”.

3. Click open.

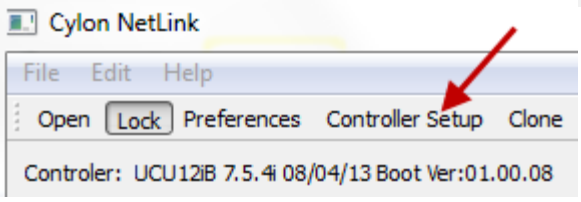


4. Navigate to where the **NetLink** screens are saved and select the “`IO_config.nls`” screen.
5. Click on UnLock and type in the password.

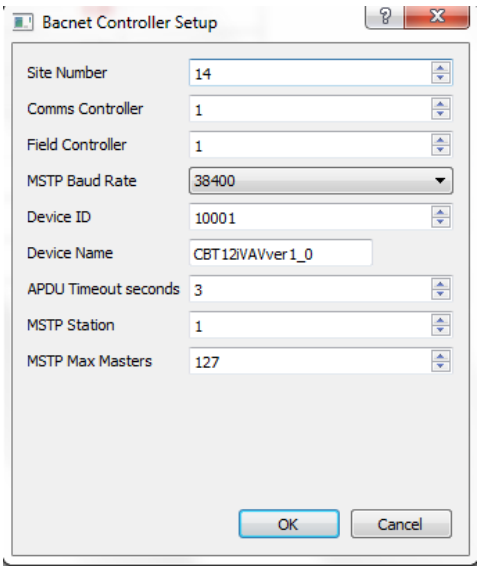


Note: The **NetLink** screens have been configured with a password of “***password***”.

5. After unlocking the screens users can now select Controller Setup.



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



7. 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 *BACnet Manual (MAN0106)* 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 MS/TP device 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 CBV-2U4-3T(-N) 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 device at MS/TP address `0`.

See the *BACnet Manual (MAN0106)* for more details regarding this functionality and for other tips on optimizing the BACnet network.

CONFIGURING THE CBV-2U4-3T(-N) CONTROLLER

The CBV-2U4-3T(-N) has a pre-loaded strategy that is designed to be highly configurable for a wide variety of VAV 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 CBV-2U4-3T(-N) for a specific sequence. Users are able to set these configuration values through CXpro^{HD}.

SETTING CBV-2U4-3T(-N) BACNET COMMISSIONING CONFIGURATION CODES IN CXpro^{HD}

When commissioning the CBV it is recommended to use the BACnet Commissioning option in CXpro^{HD}.

Input codes

By clicking into the field associated with each input users will notice that there are multiple options which can be selected:

- **UI-1** This input is typically going to be either local zone temperature or local zone temperature with push button override. The push button override option is the override button for occupying the VAV while in an unoccupied state. On any room sensors purchased from ABB this simply "shorts" the thermistor while the button is pushed.
- **UI-2** This input is typically going to be configured for set point slide adjust. This input will support a 5K POT to support room sensors ordered from ABB. If the room sensor does not have a slide adjust, then select none.
- **UI-3** There are no configurable options for this input. If there is a supply air sensor that will be used for determining "Primary Air State" (hot or cold air being supplied to VAV) wire the sensor to this input.

Note: Under "options" select "Switch Heat/Cool Primary Air State by SAT" to enable this feature. By default this feature is off and Primary Air State is set to cooling or heating from a master controller. See *Primary Air Setpoint Management* on page 50 for further information.

- **UI-4** This input can be configured for a variety of different options.
  - "Local CO2" is the option to select if there is a CO_2 sensor wired to this input. By selecting this option, the sequence will open the damper when CO_2 level gets above LocalCO2Stpt (A255). See *Primary Air Flow Reset CO2* on page 51 for further information.
    - "Remote CO2" is an option that can be selected to write a CO_2 command from a master controller.
  - Select "Local Dehumid" if there is a relative humidity sensor wired to this input. By selecting this option, the sequence will open the damper when the relative humidity level gets above LocalDehumidStpt (A258). See *Primary Air Flow Reset Dehumidification* on page 52 for further information.
    - "Remote Dehumid" is an option that can be selected to write a dehumidification command from a master controller.
  - Select "Local Occ Sensor" if there is a dry contact switch that will close for putting the VAV box in an occupied state. This is typically going to be used for a motion sensor. See *Occupancy State Command* on page 44 for further information.

Output codes

By clicking into the field associated with each output, multiple options can be selected:

- **DO-11** can be configured for first stage heat on/off control, PWM, or to open a tristate actuator.
- **DO-12** can be configured for second stage heat on/off control, PWM, or to close a tristate actuator.
- **DO-13** can be configured for third stage heat on/off control, PWM, parallel constant volume fan, or series single speed fan.
- **AO-14** can be configured for modulating heat control. By default, this will be first stage heat unless otherwise specified under options.
- **AO-15** can be configured for modulating heat control. By default, this will be second stage heat unless otherwise specified under options. This output can also be configured for parallel variable speed fan, or series variable speed fan.

OPTIONS

Defining baseboard heat

A variety of different options are available depending on the application. From the drop-down box select the appropriate heating output as being baseboard heat. By designating one output as baseboard heat it is then possible to select it as being first stage heat during unoccupied call for heat.

An example of this configuration is `DO-11` could be first stage electric heat in VAV box, `DO-12` can be second stage electric, and `DO-13` could be a thermal valve controlling baseboard heat. During normal occupied operation `DO-13` will be the last stage of heat to come on as the heating demand rises. However, by designating `DO-13` as baseboard heat it is possible to select only baseboard heat during unoccupied mode. This will effectively make this output stage 1 heat during an unoccupied call for heat. This will prevent needing to run the AHU associated with this VAV during an unoccupied call for heat.

Defining AOs and DOs heat stage sequence

With this option it is possible to assign AOs defined as heat to stage before DOs defined as heat. Conversely the DOs can be configured to stage before the AOs. By default, this sequence is disabled and both AOs and DOs will stage concurrently.

Defining AOs

By default, the AOs are configured as direct acting 0···10 Vdc. However, it is possible to define either/or `AO-14` and `AO-15` as being reverse acting 10···0 Vdc. Depending on the actuator being controlled it's also possible to change the voltage range for 2···10 Vdc or 10···2 Vdc for either AO output.

Setting DOs for reverse acting

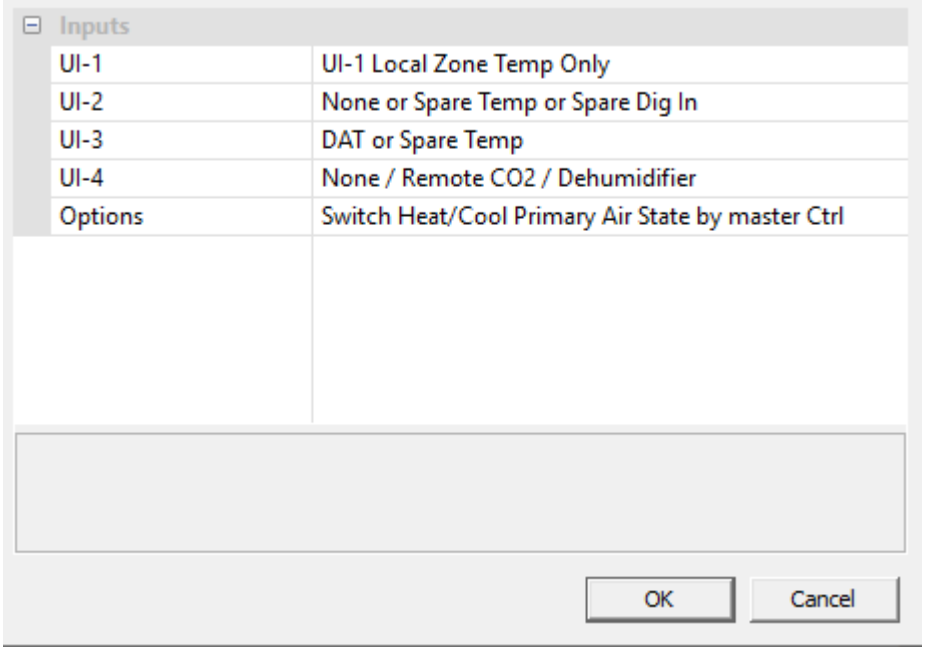
In the "`IO_Config`" **NetLink** screen you will find the following points:

- DO11RevAct (D313)
- DO13RevAct (D312)

Setting the correct corresponding point(s) to `On` will reverse the action of that DO(s).

Input Configuration

The inputs should be configured using the **CXPro**^{HD} BACnet commissioning tool. If changing the configuration in the field, use these values.



For UI1 Configuration, set InputConfigA(A242) analog setpoint to the following:

- 0 = Local Zone Temp Only (default)
- 2 = Local Zone Temp w/ Override Button
- 3 = Spare Temp or Dig In – Use Remote Zone Temp

For UI2 Configuration, set InputConfigA(A242) analog setpoint to the following:

- 0 = None or Spare Temp or Spare Dig In
- 12 = 5K Stpt Slide Adjust

For UI3 Configuration, set InputConfigA(A242) analog setpoint to the following:

- 0 = Discharge Air Temperature (default)

For UI4 Configuration, set InputConfigA(A242) analog setpoint to the following:

- 0 = None / Remote CO2 / Dehumidifier
- 32 = Local CO2

For UI4 Configuration, set InputConfigB(A260) analog setpoint to the following:

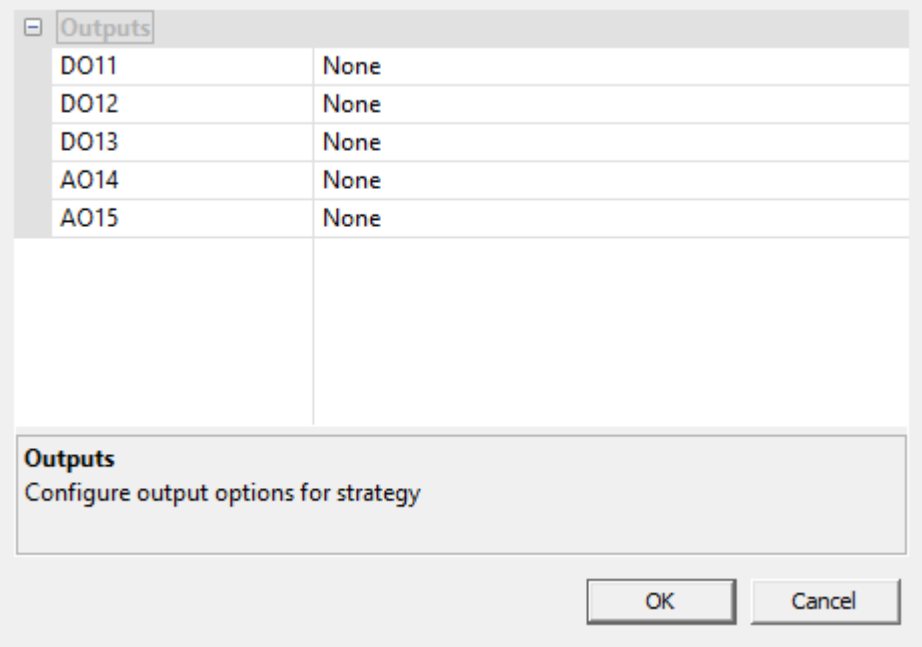
- 2 = Local Dehumidifier
- 1 = Local OCC Sensor
- 5 = Spare Digital Input

For the Primary State Options, set InputConfigA(A242) analog setpoint to the following:

- 0 = Switch Heat/Cool Primary Air State by Master Control
- 16 = Switch Heat/Cool Primary Air State by Supply Air Temperature

Note: To configure multiple UI settings, add numbers together for InputConfigA(A242). For example, to set UI1 for Local Zone Temp w/Override Button and UI2 with the 5K Stpt Slide adjust, InpugConfigA(A242) will be set to 14.

Output Configuration



DO11

- 0 = None
- 7 = Heat 1 On/Off - OutputConfigA(A243)
- 64 = TriState 11 Open/12 Close – OutputConfigB(A261)
- 3 = Heat 1 PWM – OutputConfigA(A243)

DO12

- 0 = None
- 56 = Heat 2 On/Off - OutputConfigA(A243)
- 0 = TriState 11 Open/12 Close (set at DO11)
- 24 = Heat 2 PWM - OutputConfigA(A243)

DO13

- 0 = None
- 64 = Parallel Constant Volume Fan
- -64 = Series Constant Volume Fan
- Heat 3 On/Off OutputConfigA(A243) = 192, OutputConfigB(A261) = 128
- 192 = Heat 3 PWM

AO14

- 0 = None
- 4 = Modulating Heat – OutputConfigB(A261)

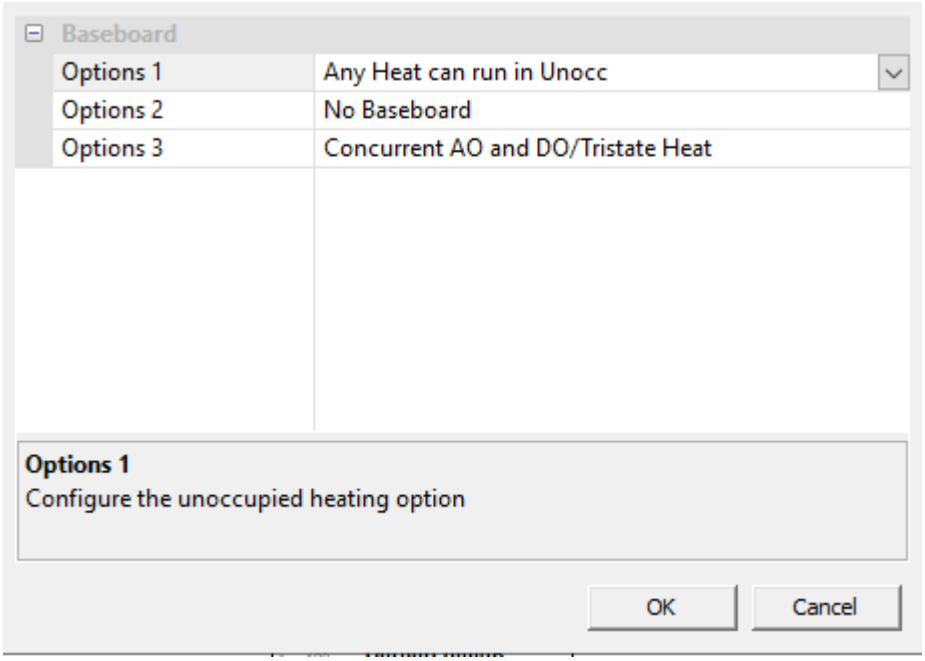
AO15

- 0 = None
- 16 = Modulating Heat – OutputConfigB(A261)
- 48 = Parallel Variable Speed Fan - OutputConfigB(A261)
- -48 = Series Variable Speed Fan - OutputConfigB(A261)

Note: To configure multiple output settings, add numbers together for OutputConfigA(A242) and OutputConfigB(A261). For example, to set 2 stages of on/off heat and parallel fan operation, OutputConfigA(A261) will be set to 127. If it was a series fan, it would be set to -127.

Note: For Series Fan configuration, add a negative sign before the final calculated number.

Baseboard Heat Configuration



Option 1

- 0 = Any Heat can run in Unoccupied Mode
- 1 = Only Baseboard heat in Unoccupied Mode – OutputConfigB(A261)

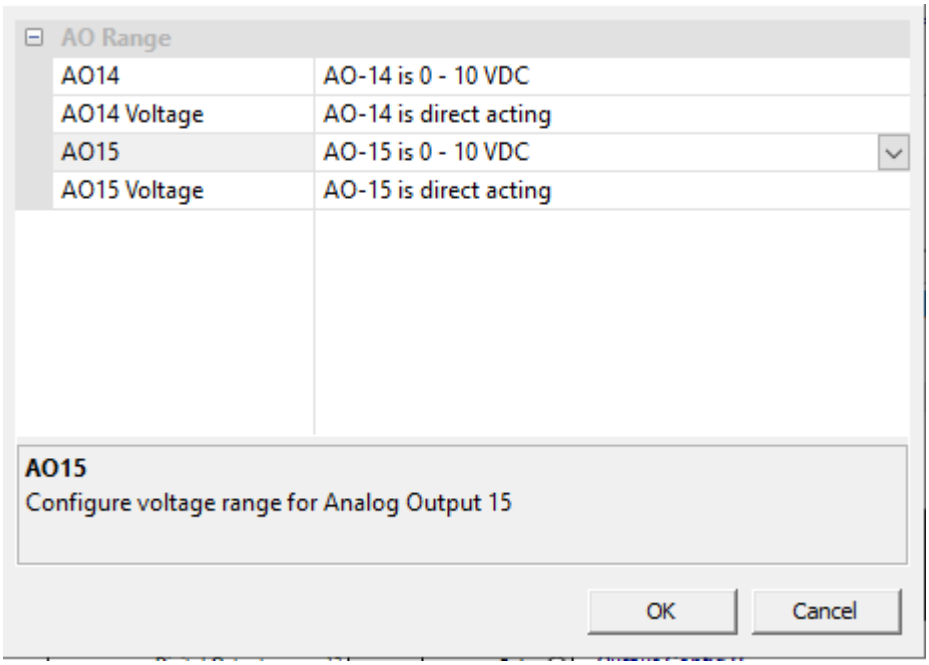
Option 2

- 0 = No Baseboard - OutputConfigC(A84)
- 129 = DO11 is baseboard – OutputConfigC(A84)
- 130 = DO12 is baseboard - OutputConfigC(A84)
- 132 = DO13 is baseboard - OutputConfigC(A84)
- 136 = AO14 is baseboard - OutputConfigC(A84)
- 144 = AO15 Is baseboard - OutputConfigC(A84)
- 160 – Tristate Heat is baseboard - OutputConfigC(A84)

Option 3

- 0 = DO/Tristate heat stages before AO heat - OutputConfigC(A84)
- 64 = AO heat before DO/Tristate heat stages - OutputConfigC(A84)
- 128 = ConcurrentAO and DO/Tristate heat - OutputConfigC(A84)

AO Range Configuration



AO14

- 0 = AO14 is 0-10 VDC – AOConfigD(A286)
- 1 = AO14 is 2-10 VDC – AOConfigD(A286)
- 2 = AO14 is custom open and closed voltage – AOConfigD(A286)

AO14 Voltage

- 0 = AO14 is direct acting - AOConfigD(A286)
- 4 = AO14 is reverse acting - AOConfigD(A286)

AO15

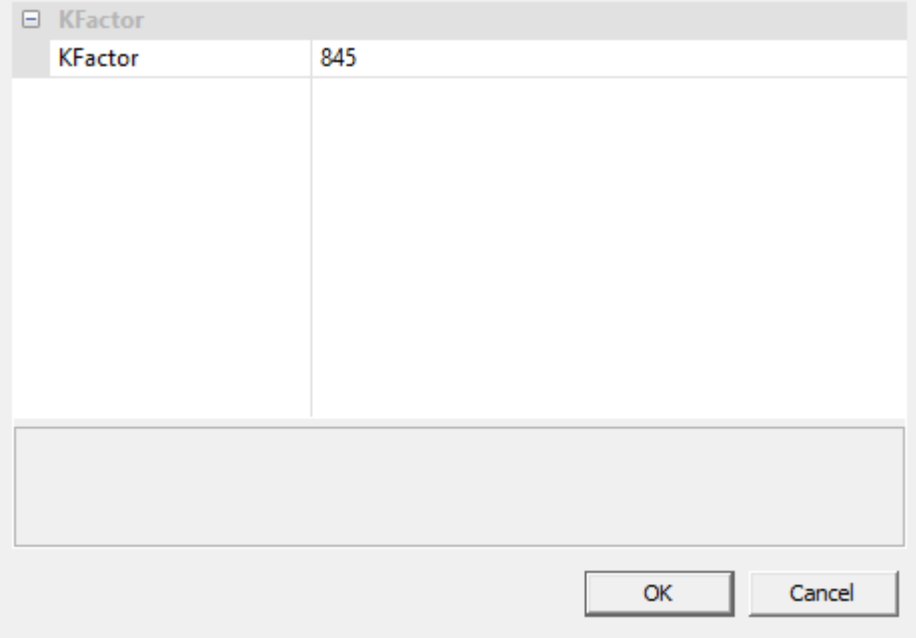
- 0 = AO15 is 0-10 VDC - AOConfigD(A286)
- 8 = AO15 is 2-10 VDC - AOConfigD(A286)
- 16 = AO15 enter custom open and closed voltage - AOConfigD(A286)

AO15 Voltage

- 0 = AO15 is direct acting - AOConfigD(A286)
- 32 = AO15 is reverse acting - AOConfigD(A286)

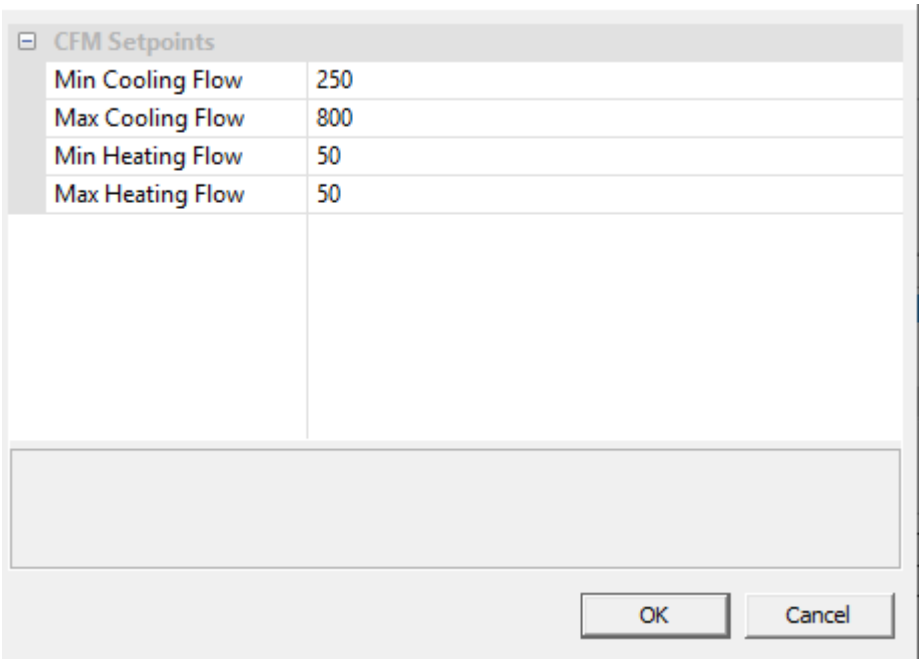
Note: To configure multiple output settings, add numbers together for AOConfigD(A286). For example, set AO14 to 2-10 VDC and AO15 to reverse acting, AOConfigD(A286) will be set to 33.

Initial K-Factor Configuration



Enter an initial K-Factor if available from the factory. Changes MeasuredFlow/K(A218).

CFM Setpoint Configuration



Set CFM flows:

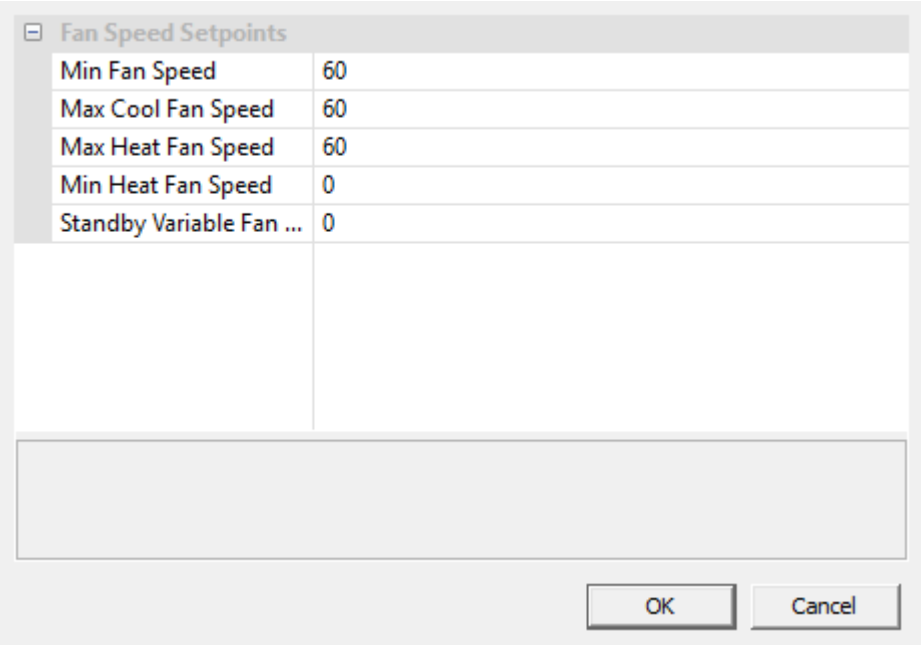
Min Cooling Flow = TABPriAirDbandStpt(A210)

Max Cooling Flow = TABPriAirMaxStpt(A211)

Min Heating Flow = TABPriAirMinHtgStpt(A153)

Max Heating Flow = TABPriAirMaxHgtStpt(A212)

Fan Configuration



Min Fan Speed = TABFanDbandStpt(A224)

Max Cool Fan Speed = TABFanMaxStpt(A225)

Max Heat Fan Speed = TABFanHtgMaxStpt(A226)

Min Heat Fan Speed = TABFanHtgMinStpt(A154)

Standby Variable Fan Speed = TABFanStandbyStpt(A227)

3 CBV-2U4-3T(-N) Control Sequences

CBV-2U4-3T(-N) CONTROL SEQUENCES

This section provides details of the typical control sequences used for most VAV applications. The sequences covered in this manual include the following:

- VAV Cooling only No Fan
- VAV Cooling only Single Speed Fan
- VAV Cooling only Variable Speed Fan
- VAV One to Three Stage Electric Reheat No Fan
- VAV One to Two Stage Electric Reheat Single Speed Fan
- VAV One to Three Stage Electric Reheat Variable Speed Fan
- VAV Modulating Hot Water Reheat No Fan
- VAV Modulating Hot Water Reheat Single Speed Fan
- VAV Modulating Hot Water Reheat Variable Speed Fan

VAV COOLING ONLY NO FAN

TEMPERATURE CONTROL

When the zone temperature is greater than, or equal to, the cooling temperature setpoint, the controller will enter the cooling mode. The primary air flow rate will be varied between its TABPriAirDbandStpt (A210), or deadband setpoint, and its maximum Flowrate setpoint TABPriAirMaxStpt (A211) as required to maintain the zone at the cooling temperature setpoint.

When the zone temperature falls to the heating setpoint, the controller will enter the heating mode and the primary air flow rate will be varied between its TabPriAirMinHtgStpt (A153) and its TabPriAirMaxHgtStpt (A212), or maximum heating Flowrate setpoint. Normally on a cooling-only VAV box both the TABPriAirDbandStpt (A210) and the TabPriAirMaxHgtStpt (A212) will be the same to maintain a minimum rate of flow into the space while in the heating mode.

INPUT / OUTPUT POINTS

VAV Cooling Only, no fan

IO POINTS	DESCRIPTION
UI-01	Zone Temperature (with optional override button)
UI-02	Setpoint Adjustment (optional 5K slider)
UI-03	Discharge Temperature (optional)
UI-04	CO_2, Humidity, or occupancy signal (all optional)
UI-08	Flowrate Sensor
DO-09	Damper Control (**CBV-2U4-3T-N** only)
DO-10	Damper Control (**CBV-2U4-3T-N** only)
DO-11	
DO-12	
DO-13	
AO-14	
AO-15	
AO-16	Damper Control (**CBV-2U4-3T** only)

VAV COOLING ONLY SINGLE SPEED FAN

TEMPERATURE CONTROL

When the zone temperature is greater than, or equal to, the cooling temperature setpoint, the controller will enter the cooling mode. The primary air flow rate will be varied between its TABPriAirDbandStpt (A210), or deadband setpoint, and its maximum Flowrate setpoint TABPriAirMaxStpt (A211) as required to maintain the zone at the cooling temperature setpoint.

When the zone temperature falls to the heating setpoint, the controller will enter the heating mode and the primary air flow rate will be varied between its TabPriAirMinHtgStpt (A153) and its TabPriAirMaxHgtStpt (A212), or maximum heating Flowrate setpoint. Normally on a cooling only VAV-box both the TabPriAirMinHtgStpt (A153) and the TabPriAirMaxHgtStpt (A212) will be the same to maintain a minimum rate of flow into the space while in the heating mode.

SERIES SINGLE SPEED FAN

The fan (DO 13) will operate continuously whenever the unit is in the occupied state, or in another state and in the cooling or heating mode. The fan control matrix is as follows:

MODE	COOLING	DEADBAND	HEATING
Occupied	*On*	On	*On*
Unoccupied	*On*	Off	*On*
Warm-up	*N/A*	Off	*On*
Standby	*On*	Off	*On*

INPUT / OUTPUT POINTS

VAV Cooling Only 1 speed fan

IO POINTS	DESCRIPTION
UI-01	Zone Temperature (with optional override button)
UI-02	Setpoint Adjustment (optional 5K slider)
UI-03	Discharge Temperature (optional)
UI-04	CO_2, Humidity, or occupancy signal (all optional)
UI-08	Flowrate Sensor
DO-09	Damper Control (**CBV-2U4-3T-N** only)
DO-10	Damper Control (**CBV-2U4-3T-N** only)
DO-11	
DO-12	
DO-13	Series Fan
AO-14	
AO-15	
AO-16	Damper Control (**CBV-2U4-3T** only)

VAV COOLING ONLY VARIABLE SPEED FAN

TEMPERATURE CONTROL

When the zone temperature is greater than, or equal to, the cooling temperature setpoint, the controller will enter the cooling mode. The primary air flow rate will be varied between its TABPriAirDbandStpt (A210), or deadband setpoint, and its maximum Flowrate setpoint TABPriAirMaxStpt (A211) as required to maintain the zone at the cooling temperature setpoint.

When the zone temperature falls to the heating setpoint, the controller will enter the heating mode and the primary air flow rate will be varied between its TabPriAirMinHtgStpt (A153) and its TabPriAirMaxHgtStpt (A212), or maximum heating Flowrate setpoint. Normally on a cooling only VAV box both the TabPriAirMinHtgStpt (A153) and the TabPriAirMaxHgtStpt (A212) will be the same to maintain a minimum rate of flow into the space while in the heating mode.

SERIES VARIABLE SPEED FAN

The variable fan speed will be controlled by modulating AO 15 (default 0 ··· 10 Vdc). As more cooling is required, the fan speed will increase. See *Fan Control* on page 58 for more detail.

INPUT / OUTPUT POINTS

VAV Cooling Only with variable speed fan

IO POINTS	DESCRIPTION
UI-01	Zone Temperature (with optional override button)
UI-02	Setpoint Adjustment (optional 5K slider)
UI-03	Discharge Temperature (optional)
UI-04	CO_2, Humidity, or occupancy signal (all optional)
UI-08	Flowrate Sensor
DO-09	Damper Control (CBV-2U4-3T-N only)
DO-10	Damper Control (CBV-2U4-3T-N only)
DO-11	
DO-12	
DO-13	
AO-14	
AO-15	Variable Speed Series Fan Speed Control (0···10 Vdc)
AO-16	Damper Control (**CBV-2U4-3T** only)

VAV ONE TO THREE STAGE ELECTRIC REHEAT NO FAN

TEMPERATURE CONTROL

When the zone temperature is greater than, or equal to, the cooling temperature setpoint, the controller will enter the cooling mode. The primary air flow rate will be varied between its TABPriAirDbandStpt (A210), or deadband setpoint, and its maximum Flowrate setpoint TABPriAirMaxStpt (A211) as required to maintain the zone at the cooling temperature setpoint.

When the zone temperature falls to the heating setpoint, the controller will enter the heating mode and the primary air flow rate will be varied between its TabPriAirMinHtgStpt (A153) and its TabPriAirMaxHgtStpt (A212), or maximum heating Flowrate setpoint. The stages of electric heat are then staged and optionally duty-cycled (PWM) as required to maintain the zone at the heating temperature setpoint.

INPUT / OUTPUT POINTS

VAV Electric Reheat, no fan

IO POINTS	DESCRIPTION
UI-01	Zone Temperature (with optional override button)
UI-02	Setpoint Adjustment (optional 5K slider)
UI-03	Discharge Temperature (optional)
UI-04	CO_2, Humidity, or occupancy signal (all optional)
UI-08	Flowrate Sensor
DO-09	Damper Control (CBV-2U4-3T-N only)
DO-10	Damper Control (CBV-2U4-3T-N only)
DO-11	Electric Heat1
DO-12	Electric Heat2 (optional)
DO-13	Electric Heat3 (optional)
AO-14	
AO-15	
AO-16	Damper Control (**CBV-2U4-3T** only)

VAV ONE TO TWO STAGE ELECTRIC REHEAT SINGLE SPEED FAN

TEMPERATURE CONTROL

When the zone temperature is greater than, or equal to, the cooling temperature setpoint, the controller will enter the cooling mode. The primary air flow rate will be varied between its TABPriAirDbandStpt (A210), or deadband setpoint, and its maximum Flowrate setpoint TABPriAirMaxStpt (A211) as required to maintain the zone at the cooling temperature setpoint.

When the zone temperature falls to the heating setpoint, the controller will enter the heating mode and the primary air flow rate will be varied between its TabPriAirMinHtgStpt (A153) and its TabPriAirMaxHgtStpt (A212), or maximum heating Flowrate setpoint. The stages of electric heat are then staged and optionally duty-cycled (PWM) as required to maintain the zone at the heating temperature setpoint.

FAN CONTROL

Parallel Single Speed Fan Option

During the occupied mode, the intermittent single speed fan will typically be energized in the heating mode. The typical fan control matrix is as follows, although other options are possible:

MODE	COOLING	DEADBAND	HEATING
Occupied	Off	Off	On
Unoccupied	Off	Off	On
Warm-up	Off	Off	Off
Standby	Off	Off	On

Series Single Speed Fan Option

The fan will operate continuously whenever the unit is in the occupied state, or in another state and in the cooling or heating mode. The fan control matrix is as follows:

MODE	COOLING	DEADBAND	HEATING
Occupied	On	On	On
Unoccupied	On	Off	On
Warm-up	N/A	Off	On
Standby	On	Off	On

INPUT / OUTPUT POINTS

VAV Electric Reheat with 1 speed fan

IO POINTS	DESCRIPTION
UI-01	Zone Temperature (with optional override button)
UI-02	Setpoint Adjustment (optional 5K slider)
UI-03	Discharge Temperature (optional)
UI-04	CO_2, Humidity, or occupancy signal (all optional)
UI-08	Flowrate Sensor
DO-09	Damper Control (CBV-2U4-3T-N only)
DO-10	Damper Control (CBV-2U4-3T-N only)
DO-11	Electric Heat1
DO-12	Electric Heat2 (optional)
DO-13	Parallel or Series Fan
AO-14	
AO-15	
AO-16	Damper Control (**CBV-2U4-3T** only)

VAV ONE TO THREE STAGE ELECTRIC REHEAT VARIABLE SPEED FAN

TEMPERATURE CONTROL

When the zone temperature is greater than, or equal to, the cooling temperature setpoint, the controller will enter the cooling mode. The primary air flow rate will be varied between its TABPriAirDbandStpt (A210), or deadband setpoint, and its maximum Flowrate setpoint TABPriAirMaxStpt (A211) as required to maintain the zone at the cooling temperature setpoint.

When the zone temperature falls to the heating setpoint, the controller will enter the heating mode and the primary air flow rate will be varied between its TabPriAirMinHtgStpt (A153) and its TabPriAirMaxHgtStpt (A212), or maximum heating Flowrate setpoint. The stages of electric heat are then staged and optionally duty-cycled (PWM), as required to maintain the zone at the heating temperature setpoint.

FAN CONTROL

Parallel Variable Fan Speed Option

The variable fan speed will be controlled by modulating `AO 15` (default 0 ··· 10 Vdc). The fan will run in heating mode only. As more heating is required, the fan speed will increase. See *Fan Control* on page 58 for more detail.

Series Variable Fan Speed Option

The variable fan speed will be controlled by modulating `AO-15` (default 0 ··· 10 Vdc). In deadband mode, the fan will run at a slower speed. As more heating or cooling is required, the fan speed will increase. See *Fan Control* on page 58 for more detail.

Input / Output Points

VAV Electric Reheat with variable speed fan

IO POINTS	DESCRIPTION
UI-01	Zone Temperature (with optional override button)
UI-02	Setpoint Adjustment (optional 5K slider)
UI-03	Discharge Temperature (optional)
UI-04	CO_2, Humidity, or occupancy signal (all optional)
UI-08	Flowrate Sensor
DO-09	Damper Control (CBV-2U4-3T-N only)
DO-10	Damper Control (CBV-2U4-3T-N only)
DO-11	Electric Heat1
DO-12	Electric Heat2 (optional)
DO-13	Electric Heat3 (optional)
AO-14	
AO-15	Variable Speed Parallel or Series Fan Speed Command (0 ··· 10 Vdc)
AO-16	Damper Control (**CBV-2U4-3T** only)

VAV MODULATING HOT WATER REHEAT NO FAN

TEMPERATURE CONTROL

When the zone temperature is greater than, or equal to, the cooling temperature setpoint, the controller will enter the cooling mode. The primary air flow rate will be varied between its TABPriAirDbandStpt (A210), or deadband setpoint, and its maximum Flowrate setpoint TABPriAirMaxStpt (A211) as required to maintain the zone at the cooling temperature setpoint.

When the zone temperature falls to the heating setpoint, the controller will enter the heating mode and the primary air flow rate will be varied between its TabPriAirMinHtgStpt (A153) and its TabPriAirMaxHgtStpt (A212), or maximum heating Flowrate setpoint. The modulating hot water reheat valve will then drive open to maintain the desired heating setpoint.

Typically, the modulating heating valve may be controlled by either `AO-14` or `DO-11` and `DO-12` in a tri-state control mode where `DO-11` drives the hot water valve open and `DO-12` drives it closed. There are additional options available such as having `AO-14` as first stage modulating heat and `AO-15` as second stage modulating heat.

Input / Output Points

VAV Modulating HW Reheat, no fan AO (0 ··· 10 Vdc)

IO POINTS	DESCRIPTION
UI-01	Zone Temperature (with optional override button)
UI-02	Setpoint Adjustment (optional 5K slider)
UI-03	Discharge Temperature (optional)
UI-04	CO_2, Humidity, or occupancy signal (all optional)
UI-08	Flowrate Sensor
DO-09	Damper Control (CBV-2U4-3T-N only)
DO-10	Damper Control (CBV-2U4-3T-N only)
DO-11	Tri-State Heat Valve Open
DO-12	Tri-State Heat Valve Closed
DO-13	
AO-14	Modulating Heat Control (0 ··· 10 Vdc)
AO-15	
AO-16	Damper Control (CBV-2U4-3T only)

VAV Modulating HW Reheat, no fan Tri-state

IO POINTS	DESCRIPTION
UI-01	Zone Temperature (with optional override button)
UI-02	Setpoint Adjustment (optional 5K slider)
UI-03	Discharge Temperature (optional)
UI-04	CO_2, Humidity, or occupancy signal (all optional)
UI-08	Flowrate Sensor
DO-09	Damper Control (CBV-2U4-3T-N only)
DO-10	Damper Control (CBV-2U4-3T-N only)
DO-11	Heat Valve Open
DO-12	Heat Valve Close
DO-13	
AO-14	
AO-15	
AO-16	Damper Control (CBV-2U4-3T only)

VAV MODULATING HOT WATER REHEAT SINGLE SPEED FAN

TEMPERATURE CONTROL

When the zone temperature is greater than, or equal to, the cooling temperature setpoint, the controller will enter the cooling mode. The primary air flow rate will be varied between its TABPriAirDbandStpt (A210), or deadband setpoint, and its maximum Flowrate setpoint TABPriAirMaxStpt (A211) as required to maintain the zone at the cooling temperature setpoint.

When the zone temperature falls to the heating setpoint, the controller will enter the heating mode and the primary air flow rate will be varied between its TabPriAirMinHtgStpt (A153) and its TabPriAirMaxHgtStpt (A212), or maximum heating Flowrate setpoint. The modulating hot water reheat valve will then drive open to maintain the desired heating setpoint.

Typically, the modulating heating valve may be controlled by either `AO-14` or `DO-11` and `DO-12` in a tri-state control mode where `DO-11` drives the hot water valve open, and DO 12 drives it closed. There are additional options available such as having `AO-14` as first stage modulating heat and AO 15 as second stage modulating heat.

FAN CONTROL

Parallel Single Speed Fan Option

During the occupied mode, the intermittent single speed fan will be energized in the heating mode. The fan control matrix is as follows:

MODE	COOLING	DEADBAND	HEATING
Occupied	Off	Off	On
Unoccupied	Off	Off	On
Warm-up	Off	Off	Off
Standby	Off	Off	On

Series Single Speed Fan Option

The fan will operate continuously whenever the unit is in the occupied state, or in another state and in the cooling or heating mode. The fan control matrix is as follows:

MODE	COOLING	DEADBAND	HEATING
Occupied	On	On	On
Unoccupied	On	Off	On
Warm-up	N/A	Off	On
Standby	On	Off	On

INPUT / OUTPUT POINTS

VAV Modulating HW Reheat with 1 speed fan `AO-14` (0 ··· 10 Vdc)

IO POINTS	DESCRIPTION
UI-01	Zone Temperature (with optional override button)
UI-02	Setpoint Adjustment (optional 5K slider)
UI-03	Discharge Temperature (optional)
UI-04	CO_2, Humidity, or occupancy signal (all optional)
UI-08	Flowrate Sensor
DO-09	Damper Control (CBV-2U4-3T-N only)
DO-10	Damper Control (CBV-2U4-3T-N only)
DO-11	
DO-12	
DO-13	Parallel or Series Fan
AO-14	Modulating Heat Control (0 ··· 10 Vdc)
AO-15	
AO-16	Damper Control (**CBV-2U4-3T** only)

VAV Modulating HW Reheat with 1 speed fan Tri-state

IO POINTS	DESCRIPTION
UI-01	Zone Temperature (with optional override button)
UI-02	Setpoint Adjustment (optional 5K slider)
UI-03	Discharge Temperature (optional)
UI-04	CO_2, Humidity, or occupancy signal (all optional)
UI-08	Flowrate Sensor
DO-09	Damper Control (CBV-2U4-3T-N only)
DO-10	Damper Control (CBV-2U4-3T-N only)
DO-11	Heat Valve Open
DO-12	Heat Valve Close
DO-13	Parallel or Series Fan
AO-14	
AO-15	
AO-16	Damper Control (**CBV-2U4-3T** only)

VAV MODULATING HOT WATER REHEAT VARIABLE SPEED FAN

TEMPERATURE CONTROL

When the zone temperature is greater than, or equal to, the cooling temperature setpoint, the controller will enter the cooling mode. The primary air flow rate will be varied between its TABPriAirDbandStpt (A210), or deadband setpoint, and its maximum Flowrate setpoint TABPriAirMaxStpt (A211) as required to maintain the zone at the cooling temperature setpoint.

When the zone temperature falls to the heating setpoint, the controller will enter the heating mode and the primary air flow rate will be varied between its TabPriAirMinHtgStpt (A153) and its TabPriAirMaxHgtStpt (A212), or maximum heating Flowrate setpoint. The modulating hot water reheat valve will then drive open to maintain the desired heating setpoint.

Typically, the modulating heating valve may be controlled by either `AO-14` or `DO-11` and `DO-12` in a tri-state control mode where `DO-11` drives the hot water valve open, and `DO-12` drives it closed. There are additional options available such as having `AO-14` as first stage modulating heat and AO 15 as second stage modulating heat.

FAN CONTROL

Parallel Variable Fan Speed Option

The variable fan speed will be controlled by modulating `AO-15` (default 0 ··· 10 Vdc). The fan will run in heating mode only. As more heating is required, the fan speed will increase. See *Fan Control* on page 58 for more detail.

Series Variable Fan Speed Option

The variable fan speed will be controlled by modulating AO 15 (default 0 ··· 10 Vdc). In deadband mode, the fan will run at a slower speed. As more heating or cooling is required, the fan speed will increase See *Fan Control* on page 58 for more detail.

INPUT / OUTPUT POINTS

VAV Modulating HW Reheat with variable speed fan AO 15 (0 ··· 10 Vdc)

IO POINTS	DESCRIPTION
UI-01	Zone Temperature (with optional override button)
UI-02	Setpoint Adjustment (optional 5K slider)
UI-03	Discharge Temperature (optional)
UI-04	CO_2, Humidity, or occupancy signal (all optional)
UI-08	Flowrate Sensor
DO-09	Damper Control (CBV-2U4-3T-N only)
DO-10	Damper Control (CBV-2U4-3T-N only)
DO-11	
DO-12	
DO-13	
AO-14	Modulating Heat Control (0 ... 10 Vdc)
AO-15	Variable Speed Parallel or Series Fan Speed Command (0 ··· 10 Vdc)
AO-16	Damper Control (CBV-2U4-3T only)

VAV Modulating HW Reheat with variable speed fan Tri-state

IO POINTS	DESCRIPTION
UI-01	Zone Temperature (with optional override button)
UI-02	Setpoint Adjustment (optional 5K slider)
UI-03	Discharge Temperature (optional)
UI-04	CO_2, Humidity, or occupancy signal (all optional)
UI-08	Flowrate Sensor
DO-09	Damper Control (CBV-2U4-3T-N only)
DO-10	Damper Control (CBV-2U4-3T-N only)
DO-11	Heat Valve Open
DO-12	Heat Valve Close
DO-13	
AO-14	
AO-15	Variable Speed Parallel or Series Fan Speed Command (0 ··· 10 Vdc)
AO-16	Damper Control (CBV-2U4-3T only)

4 Control Sequence Overview

This section provides an overview of the control features applicable to many of the CBV-2U4-3T(-N) control sequences. The sections that follow go into more depth on each subject.

OCCUPANCY STATES AND MODE COMMANDS

Occupied State

The default state of the controller is occupied. If set in this mode, the CBV-2U4-3T(-N) will control to the occupied temperature setpoints.

Unoccupied State

When indexed to the unoccupied state, the CBV-2U4-3T(-N) controllers will operate in a night setback mode and control to the unoccupied setpoints.

Warm-up/Heating State

When units are commanded into the warm-up mode (primary air state is hot), after 60 minutes, each CBV-2U4-3T(-N) controller will operate its associated box heat and any perimeter heat as required to return the zone to the occupied heating temperature setpoint.

Standby State of Operation

After the warm-up state is complete, the master controller may (optionally) set each terminal unit to the standby state. This state may be utilized to maintain a zone ready for occupancy with minimum energy utilization.

Primary Air State Command

The primary air state command tells the CBV-2U4-3T(-N) to expect hot or cold air. While in the off condition primary air state is cold.

Primary Air Mode

Primary Air Mode is either ON or OFF indicating the AHU fan status or command state. The unit will only operate when Primary Air Mode is set OFF

TEMPERATURE CONTROL

Control Modes

The CBV-2U4-3T(-N) continuously compares the zone temperature with the active setpoints. Heating demand and cooling demand calculations are constantly updated. These calculations are expressed as 0···100% heating needed and 0···100% cooling needed.

- **Heating Mode**

In the heating mode, stages of heat are energized, and/or valve positions are increased, as the heating demand increases. Primary supply air Flowrate is set to the current primary air heating flow setpoint. If the terminal unit includes a variable speed fan, its speed will increase with heating demand.

- **Cooling Mode**

In the cooling mode, the primary air Flowrate setpoint is modulated toward maximum as the cooling demand increases. If the terminal unit includes a series variable speed fan, its speed will increase with cooling demand.

- **Deadband Mode**

In the deadband mode, the primary air Flowrate setpoint is reduced to minimum. All heating is off, parallel fans are off, and series variable speed fans are set to minimum.

PRIMARY AIR STATE AND DAMPER CONTROL

Cooling Control

In normal operation, terminal units are provided with primary air, which is cooler than the zone temperature setpoint, therefore, the CBV-2U4-3T(-N) controller operates with a cold primary air state. In this mode, the primary air damper opens in direct proportion to the cooling load percentage calculated by the CBV-2U4-3T(-N) controller.

Heating Control

The hot primary air state is used when the Air Handler goes into a heating mode. Hot primary air state is used to put the box into Morning Warmup Mode. In this mode, the primary air damper opens in direct proportion to the heating load percentage calculated by the CBV-2U4-3T(-N) controller.

Primary Air Flow Reset CO_2

The primary air flow setpoint will increase as CO_2 increases above the local CO_2 setpoint.

Primary Air Flow Reset Dehumidification

The primary air flow setpoint will increase as relative humidity increases above the local dehumidification setpoint.

HEATING CONTROL

Terminal Unit Heat

The CBV-2U4-3T(-N) controller has both analog and digital outputs available to control modulating heating coils and discrete on/off stages of heat.

Baseboard Heat

The CBV-2U4-3T(-N) control outputs not being used for terminal unit heat may be used for baseboard heat. Like terminal unit heat, these may be either analog or digital outputs, depending on what type of point is available.

FAN CONTROL

The controller has routines for both parallel and series fans. Either type of fan may be controlled as a single speed on/fan or a variable speed fan. See the fan operation matrix specific to each CBV-2U4-3T(-N) sequence for details on its operation.

OCCUPANCY STATES AND MODE COMMANDS

OCCUPANCY STATE COMMAND

The Occupancy State Command is written by the master controller to the CBV-2U4-3T(-N). It is one of several commands in the GroupXOccCode (e.g. Group1OccCode) command. See *Writing the Command Mode to the* on page 46.

- Included in the GroupXOccCode command R/W

Occupied State

The default state of the controller is occupied. If commanded to this mode, the CBV-2U4-3T(-N) will control to the occupied temperature setpoints. Parallel fan powered terminal unit fans will be energized only as required to maintain the space temperature above the occupied heating setpoint. Series fan powered terminal unit fans will be energized in the occupied mode.

- OccModeSts (D186) RO point is on (occ), this indicates the CBV-2U4-3T(-N) is in the occupied state.

Unoccupied State

When commanded to the unoccupied state, the CBV-2U4-3T(-N) controllers will operate in a night setback mode and control to the unoccupied temperature setpoints. Parallel fan powered terminal unit fans will be energized only as required to maintain the space temperature above the unoccupied heating setpoint. Series fan powered terminal unit fans will energize whenever the space temperature falls below unoccupied heating or rises above unoccupied cooling setpoints (if unoccupied cooling is used).

- OccModeSts (D186) RO point is off (Non occ), this indicates the CBV-2U4-3T(-N) is in the unoccupied state.

PRIMARY AIR STATE COMMAND

The primary air state command tells the CBV-2U4-3T(-N) to expect hot or cold air. This command will typically be used in morning warm-up mode with the associated AHU providing hot air to the VAV boxes. If the CBV-2U4-3T(-N) is configured to use the local supply air temperature sensor to determine Primary Air State, this command will be ignored in favor of the local command.

- Included in the GroupXOccCode command R/W
- PriAirStateEffCmd (D123) RO (Off = Cool, On= Heat)

Normal Operation: Cool Air

Under normal circumstances the air handling unit is providing cooling air. This is the default value of the Primary Air State Command

Warm-up/Heating Operation: Hot Air

When the Primary Air State Command is set to Hot Air for morning warm-up or other air handler heating state, each CBV-2U4-3T(-N) controller will open its primary air damper as required to return its zone to the occupied heating temperature setpoint.

Note: While Primary Air State is commanded to hot air, accessory heat will not be commanded on.

The primary air damper will control within its minimum and maximum setpoints as described under *Primary Air State: Hot* on page 51.

STANDBY STATE OF OPERATION

After the warm-up state is complete, the master controller may (optionally) set the terminal unit to the standby state. This state may be utilized to maintain a zone ready for occupancy with minimum energy utilization.

When in the standby state, the occupied temperature setpoints will be used. When the unit is in a deadband mode, the primary air damper will be closed, or controlled to a reduced Flowrate setpoint.

Variable speed series and parallel fan powered terminal units will be controlled to the TABFanStandbyStpt (A227) setpoint when there is no heating or cooling demand.

- Included in the GroupXOccCode command R/W
- StandbyModeSts (D187) RO

PRIMARY AIR MODE

Primary Air Mode is either `ON` or `OFF`. Typically, the master controller writes this command to the CBV-2U4-3T(-N) box based on AHU fan status or similar start/stop logic. By default, the Primary Air Mode is OFF, and the CBV-2U4-3T(-N) will allow the damper to operate in unoccupied mode.

- Included in the GroupXOccCode command R/W
- PriAirModeEffCmd (D122) RO

LOAD SHED ENABLE

If the master controller commands load shed on to this CBV-2U4-3T(-N) or the group it is a member of, the effective cooling setpoint will be shifted up, and the effective heating setpoint shifted down, by LoadShedOccStptOffset (A198).

- Included in the GroupXOccCode command R/W
- LoadShedOccStptOffset (A198) R/W
- EffLoadShedOccStptOffset (A66) RO

FIRE STOP COMMAND

The fire stop command will close the primary air damper and de-energize all fans and stages of heat.

- Included in the GroupXOccCode command R/W
- FireStopEffCmd (D125) RO

PURGE COMMAND

The purge command will put primary airflow setpoint to max Flowrate setpoint and de-energizes all stages of heat.

- Included in the GroupXOccCode command R/W
- PurgeEffCmd (D226) RO

WRITING THE COMMAND MODE TO THE CBV-2U4-3T(-N)

The master controller must write an occupancy state to each CBV-2U4-3T(-N) or they will be left in the default occupied state at all times.

These writes are to one of the four GroupXOccCode points on each controller.

GroupAddress (A93) may be set to one of 4 groups: 0, 1, 2, or 3. With the default setting of group 0, this box will respond to writes to Group0OccCode (A90). If this box is set to a different group, it will respond to writes to the corresponding GroupOccCode – Group1OccCode (A91), Group2OccCode (A92), or Group3OccCode (A100).

These GroupXOccCodes now support the priority array in the CBV-2U4-3T(-N) controllers. This allows for multiple different values to be written to the specified GroupXOccCode point at various priorities. This is most commonly used for fire stop commands being written at priority 1 or purge command at priority 2.

Writing a 1 or 0 to the correct corresponding GroupXOccCode will enable or disable the occupancy mode, and in addition, may also contain several other commands as follows:

Group0OccCode (A90) - typical for each of the 4 groups

BIT	FUNCTION	OFF VALUE/ON VALUE	OFF STATE/ ON STATE
0	Occupancy Command	0,1	Unoccupied / Occupied
1	Primary Air Mode Command	0,2	Primary Air On / Off
2	Primary Air State Command	0,4	Primary Air State is Cold / Hot
3	Standby Command	0,8	Unoccupied / Standby
4	Load Shed Enable	0,16	Load Shedding is Disabled / Enabled
5	Fire Stop Command	0,32	Fire Alarm is OK /Fire Stop is Active
6	Purge Command	0,64	Normal Operation/ Purge Mode

Note: By default the controllers are set to Occupied with a GroupxOccCode of 1 in all groups.

Sending an Occupied or Unoccupied command

The easiest command to the CBV-2U4-3T(-N) box is simply to write either (1) for Occupied or (0) for Unoccupied. This will control occupancy but leave all other functions in their respective default modes.

Encoding multiple commands into one group occupancy code write

To pack more than one command into the group occupancy code, add the on values of all desired on commands.

To write Occupied and a Primary Air State of Hot Air, send the value 5 (1 for occupied + 4 for Primary Air State=hot).

To write Standby and a Primary Air State of Hot Air, send the value 12 (8 for Standby + 4 for Primary Air State=hot).

If the desired mode is the default mode ("off value"), users do not need to write anything as the value is always `0`. Only add that value to all other on values when "on value" is desired.

On a day to day basis, users might write occupied/unoccupied (by schedule), primary air mode command on/off (by AHU fan status) and, if there is morning warm up or other AHU heat, Primary air state command Cold/Hot (by AHU discharge air temp).

Note: There are other points that can be used to put the CBV-2U4-3T(-N) controller into these modes. To utilize these points the GroupXOccCode must be set for the default setting of 1. Conversely, to use the GroupXOccCode the following points must be set to default settings. **If the appropriate points are not set to default then CBV-2U4-3T(-N) may not go into the mode that it is being commanded to.** The following is a list of those points and their default settings.

POINT NAME	DEFAULT VALUE
OccCmd (D184)	1 / Occ
CmdPriAirMode (D160)	0 / Enable
CmdPriAirState (D161)	0 / Cooling
StandbyCmd (D185)	0 / Off
LoadShedEnable (D211)	0 / Disable
FireStopCmd (D199)	0 / Disable
Purge (D213)	0 / Disable

BACNET COMMUNICATIONS STATUS AND STAND-ALONE OPERATION

The CBV-2U4-3T(-N) has the ability to monitor its communication status with the master controller. If this feature is enabled, the box will be put into a failsafe mode if communications are lost.

To use this feature, set point OfflineTimerEnaBACnet (D257) to 1 (default is set to 0 or off). The master controller must write a value of 1 to point OfflineTimerCommTestValueBACnet (A2) more frequently than the time delay setting in point CommunicationsOfflineTimer (A259) (do not use less than 5 minutes, default is 15 minutes).

After the time delay expires, if no writes are seen, CommunicationsStatus (D10) will be set to a value of 1 indicating a communications loss.

During a communications loss state, the CBV-2U4-3T(-N) will be set to the following:

- Occupied
- Primary Air Mode: OFF
- Primary Air State: Cool
- Load Shed: Disabled
- CommunicationsStatus (D10) RO (0 = Communications OK, 1 = Communications loss)

Note: If the last command sent to the CBV-2U4-3T(-N) was firestop enabled before losing BACnet communications, it will stay in this state until firestop command has been disabled.

TEMPERATURE CONTROL

CONTROL MODES

The CBV-2U4-3T(-N) continuously compares the zone temperature with the active setpoints. Heating demand and cooling demand calculations are constantly updated. These calculations are expressed as 0···100% heating demand and 0···100% cooling demand.

Heating Mode

In the heating mode, stages of heat are energized, and/or valve positions are increased, as the heating demand increases. Primary supply air Flowrate is set to the current primary air heating flow setpoint; point TabPriAirMaxHgtStpt (A212). If the terminal unit includes a variable speed fan, its speed will increase with heating demand.

- ZoneTempCV (A193) *(Current Zone Temperature)*
- ZoneHeatEffCalc (A184) (*Calculated Heating Demand*)
- EffHeatStpt (A182) *(Current Active Heating Setpoint)*

Cooling Mode

In the cooling mode, the primary air Flowrate setpoint is modulated toward maximum Flowrate setpoint TABPriAirMaxStpt (A211) as the cooling demand increases. If the terminal unit includes a series variable speed fan, its speed will increase with cooling demand.

- ZoneTempCV (A193) *(Current Zone Temperature)*
- ZoneCoolEffCalc (A185) *(Calculated Cooling Demand)*
- EffCoolStpt (A183) *(Current Active Cooling Setpoint)*
- EnaUnoccCool (D231) R/W (*Enable Unocc Cooling*)

Deadband Mode

In the deadband mode, the primary air Flowrate setpoint is reduced to minimum. All heating is off, parallel fans are off, and series variable speed series fans are set to minimum.

COOLING AND HEATING OFFSETS

These points will offset the EffCoolStpt (A183) and the EffHeatStpt (A182) at the zone temperature cooling and heating PIDs. When value is entered into the CoolingOffsetPID (A39) point the zone temperature cooling control PID will enable when zone temperature rises above the EffCoolStpt (A183). The cooling zone temperature control PID will then control to the EffCoolStpt (A183) minus the value entered into CoolingOffsetPID (A39). PID will then disable putting controller into deadband mode once this modified setpoint is achieved. HeatingOffsetPID (32) will work in much the same way however it will add the value entered to the EffHeatStpt (A182). PID will enable when zone temperature drops below EffHeatStpt (A182) and disable when zone temperature rises above this modified value. This is typically used when there is a supply air temperature setpoint reset at AHU that is monitoring the number of VAVs in deadband mode to determine the setpoint for the supply air temperature. Utilitzing this feature will drive more VAVs in deadband mode resulting in increased energy cost savings.

- CoolingOffsetPID (A39) Default 0 *(Offset of Active Cooling Setpoint)*
- EffCoolStpt (A183) RO *(Current Active Cooling Setpoint)*
- HeatingOffsetPID (32) Default 0 *(Offset of Active Heating Setpoint)*
- EffHeatStpt (A182) RO *(Current Active Heating Setpoint)*

ZONE TEMPERATURE SETPOINTS

Zone temperature is controlled to these setpoints, as modified by other factors shown below.

- ZoneOccHeatStpt (A201) (Occupied heating temperature setpoint)
- ZoneOccCoolStpt (A200) (Occupied cooling temperature setpoint)

- ZoneUnoccHeatStpt (A203) (Unoccupied heating temperature setpoint)
- ZoneUnoccCoolStpt (A202) (Unoccupied cooling temperature setpoint)

Default temperature setpoints are 71°F/75°F for the occupied mode heating/cooling and 65°F/85°F for the unoccupied mode heating/cooling.

SETPOINT MODIFIERS

The Occupied setpoints may be modified by the position of the setpoint adjustment lever, load shed offset, standby offset, etc. The effective setpoints the CBV-2U4-3T(-N) will be controlling to are displayed by:

- EffCoolStpt (A183) *(Current Active Cooling Setpoint)*
- EffHeatStpt (A182) *(Current Active Heating Setpoint)*

ZATCONTRLMODEENUMERATION (A190) RO

The current control mode may be viewed or displayed using this point.

ZATContrlModeEnumeration (A190)

VALUE	FUNCTION
0	Deadband
1	Occupied Heating
2	Unoccupied Heating
4	Occupied Cooling
8	Unoccupied Cooling
16	Standby

ZONE TEMPERATURE ALARMS

If the zone temperature goes above the EffCoolStpt (A183) or below the EffHeatStpt (A182) by the DegreesAbvBlwSPAlarm (A371) setpoint, default 2 degrees, then a delay timer will be started TempAlarmOnDelay (A373), default 60 minutes. If the zone temperature has not corrected before the time delay, an alarm will be generated.

Additionally, during a low temp alarm condition point AlarmEncode (A41) will be set to 1. While in a high temp alarm condition AlarmEncode (A41) will be set to 2.

If the zone temperature sensor malfunctions and input 1 is reading above 100 or below 0, the controller will go into local temp fault alarm. CBV-2U4-3T(-N) will operate as it would in the deadband mode and no heating will be enabled. The point set to on during this alarm condition is:

- LocalTempSensorFault (D169) on is zone temperature sensor fault, off is no fault

When in this condition AlarmEncode (A41) will be set to 16.

PRIMARY AIR DAMPER CONTROL

PRIMARY AIRFLOW

The CBV-2U4-3T(-N) controller calculates air flow rate setpoints based on the space temperature deviation from zone setpoint and the duration of deviation. The primary inlet airflow rate is measured and compared to this control point. Any error greater than the deadband setting will cause the primary air damper to be driven open or closed as required to reduce the error to within an adjustable Flowrate deadband.

The primary airflow setpoint is read from point EffPriAirFlowStpt (A197) RO.

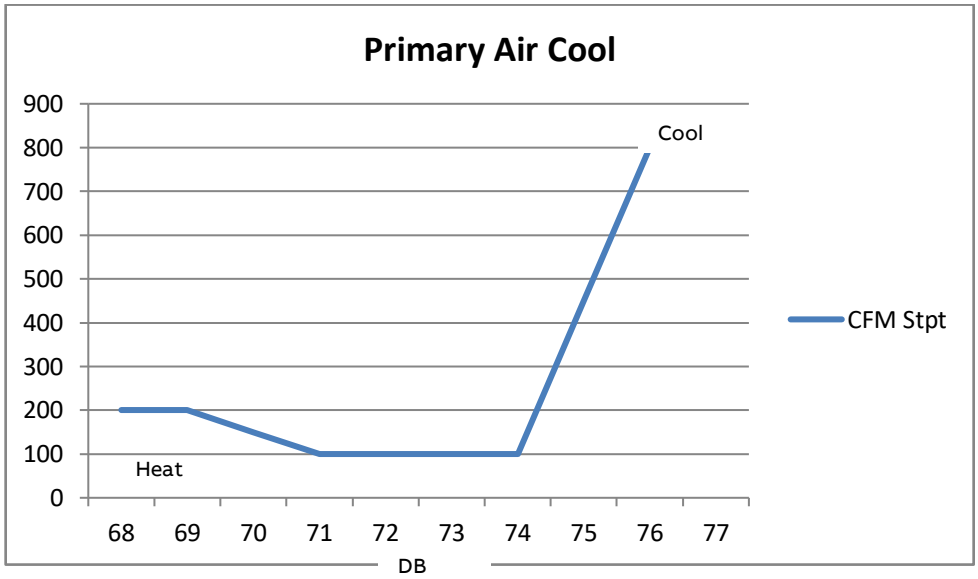
PRIMARY AIR SETPOINT MANAGEMENT

The PrimaryAirState is set by the GroupXOccupiedCode or by the on-board Supply Air temp sensor if enabled The normal and default primary air state is cold air.

Primary Air State: Cold

In normal operation, terminal units are provided with primary air, which is cooler than the zone temperature setpoint, therefore, the CBV-2U4-3T(-N) controller operates with a cold primary air state. In this mode, the primary air damper opens in direct proportion to the cooling load percentage calculated by the CBV-2U4-3T(-N) controller.

When the primary air state is cold, the primary air volume control is approximated below:



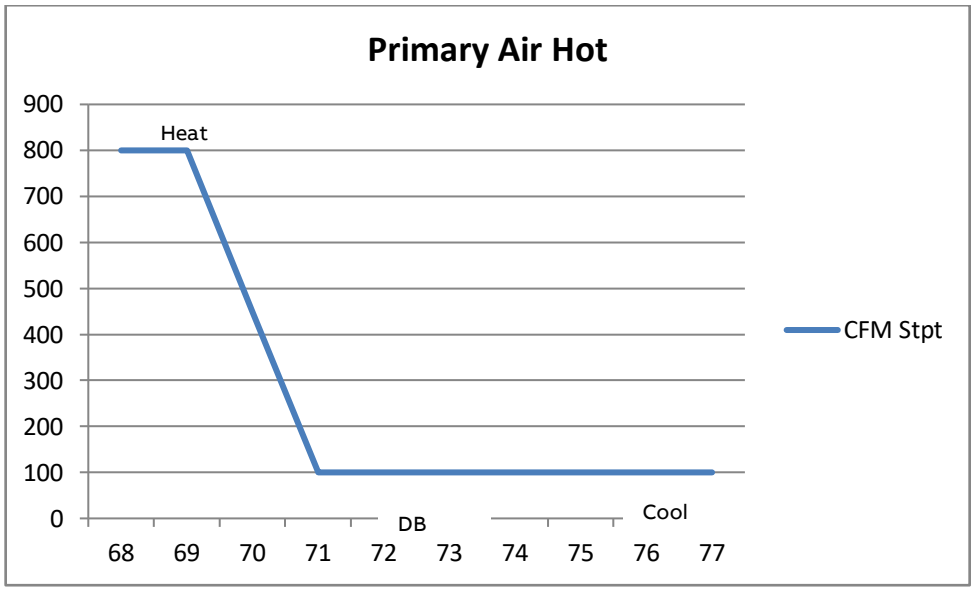
- Maximum Heat Flowrate Setpoint is TabPriAirMaxHgtStpt (A212).
  - The Max Heat Flowrate setpoint may be set the same as the Deadband Flowrate Stpt for fan powered heating boxes, or higher for heating applications without a fan.
- Minimum Heat Flowrate Setpoint is TabPriAirMinHtgStpt (A153).
  - The Min Heat Flowrate setpoint may be set the same as the Deadband Flowrate Stpt for fan powered heating boxes, or higher or lower for heating applications without a fan.
- Deadband Flowrate Setpoint is TABPriAirDbandStpt (A210).
- Cooling Flowrate Setpoint is TABPriAirMaxStpt (A211).

Primary Air State: Hot

The hot primary air state is used when the Air Handler goes into a heating mode. The hot primary air state is used to put the box into Morning Warmup Mode. In this mode the primary air damper opens in direct proportion to the heating load percentage calculated by the **CBV-2U4-3T(-N)** controller.

The PrimaryAirState may be set by the GroupXOccupiedCode or by the on-board Supply Air temp to hot air.

When the primary air state is hot, the primary air volume control is approximated below:



- Heat Flowrate Setpoint is TABPriAirMaxStpt (A211).
- Deadband Flowrate Setpoint is TABPriAirDbandStpt (A210).
- Cooling Flowrate Setpoint is also TABPriAirDbandStpt (A210).

Primary Air Flow Reset CO_2

Local CO_2 Sensor

If the local ZoneCO2ValueCV (A67) goes above the LocalCO2Stpt (A255), the primary air flow setpoint will modulate up to the TABPriAirMaxStpt (A211), or maximum Flowrate setpoint. CO_2 demand calculation can be determined from point LocalRemoteSlaveC02Calc (A76). If the **CBV-2U4-3T(-N)** is in heat mode, the heat will stage on accordingly. If heating demand is greater than 95%, however, the calculated LocalRemoteSlaveC02Calc (A76) will be limited to 70%.

Remote CO_2 Sensor

If the **CBV-2U4-3T(-N)** is a slave VAV box, and another controller is master and has a CO_2 sensor, users can write the CO_2 calculated demand to the RemoteSlaveCO2Cmd (A75). When configured for remote CO_2, this will calculate the Flowrate setpoint in the same manner as if it had a local CO_2 sensor.

Primary Air Flow Reset Dehumidification

- **Local Dehumidification Sensor**

If the local ZoneRHValueCV (A13) goes above the LocalDehumidStpt (A258), the primary air flow setpoint will modulate up to the TABPriAirMaxStpt (A211), or maximum Flowrate setpoint. Dehumidification demand calculation can be determined from point LocalRemoteSlaveDehumidCalc (A79). If the CBV-2U4-3T(-N) is in heat mode, the heat will stage on accordingly. If heating demand is greater than 95%, however, the calculated LocalRemoteSlaveDehumidCalc (A76) will be limited to 70%.

- **Remote Dehumidification Sensor**

If the CBV-2U4-3T(-N) is a slave VAV box and another controller is master and has a relative humidity sensor, users can write the dehumidification calculated demand to the RemoteSlaveDehumidCmd (A1). When configured for remote dehumidification, this will calculate the Flowrate setpoint in the same manner as if it had a local relative humidity sensor.

Calculated Flowrate Alarms

If the calculated Flowrate goes above or below the EffPriAirFlowStpt (197) by the CFMAbvBlwSPAlarm (A7) setpoint, default 75 Flowrate, then a delay timer will be started CFMAlarmOnDelay (A373), default 30 minutes. If the calculated Flowrate has not corrected before the time delay, an alarm will be generated.

Additionally, if there is a low Flowrate alarm condition AlarmEncode (A41) will be set to 4. In a high Flowrate alarm condition AlarmEncode (A41) will be set to 8.

TEST AND BALANCE

A point has been set up to allow test and balance commands to be sent to individual boxes, or groups of boxes, to set the primary air damper to max Flowrate, deadband Flowrate, full open, full closed, etc. These commands may be used to calibrate the air flow sensor and balance the boxes.

GroupXTABCode R/W

With the default GroupXOccCode of group 0, the box will respond to writes to Group0TABCode (A77). If the box is set to another GroupXOccCode group, the corresponding point will be used: *Group1TABCode* (A80), *Group2TABCode* (A85) or, *Group3TABCode* (A87).

The TAB code default value of 0 allows normal operation. Setting the point to any of the values below will override the Flowrate setpoint for the primary air damper to the indicated value.

- **Group0TABCode (A77) -typical for all 4 groups**

BIT	FUNCTION	OFF VALUE/ON VALUE	OFF STATE/ ON STATE
0	DampMaxManEff (D131)	0,1	normal, control damper to max Flowrate stpt
1	DampMinManEff (D132)	0,2	normal, control damper to deadband Flowrate stpt
2	DampAuxManEff (D133)	0,4	normal, control damper to aux (heat) Flowrate stpt
3	DampOpenManEff (D136)	0,8	normal, drive damper full open
4	DampCloseManEff (D137)	0,16	normal, drive damper full closed

Note: default value for each item is “Off Value”

PriAirModeEnumeration (A208) RO

This point displays the current On/Off Air State as commanded by the GroupXOccCode.

- **PriAirModeEnumeration (A208)**

VALUE	FUNCTION
0	On
1	Off: Normal
3	Off: Fire Stop

PriDamperCmdEnumeration (A219) RO

This point displays the primary air damper’s current control state as commanded by GroupXTABCode.

- **PriDamperCmdEnumeration (A219)**

VALUE	FUNCTION
0	Off
1	Open
2	Close
8	Open Manual
16	Close Manual
32	Close Fire Stop

Zeroing Airflow sensor

The CBV-2U4-3T(-N) comes from the factory with the airflow sensor zeroed. To compensate for possible air leakage around the damper, users are able to zero the airflow sensor in the field. To zero the airflow sensor, users will need to do the following:

1. Drive damper to the closed position by enabling DampCloseMan (D192).
2. After damper has fully shut, set TABPriAirZero (D150) to on.

After 10 seconds the TABPriAirZero (D150) will be automatically set back to off and the airflow sensor will now be zeroed. Be sure to disable DampCloseMan (D192) when finished with this step.

Airflow Calibration Procedure

1. Airflow sensor calibration sensor using flow selection in the firmware block VAV flow calculation.
   1.1 Set Max cfm flow at TABPriAirMaxStpt (A211).
   1.2 Set to DampMaxMan (D193) to TRUE.
   1.3 Set KFactSelect (D204) to TRUE.
   1.4 Allow airflow PriAirFlowCV (A194) to reach TABPriAirMaxStpt (A211)
   1.5 Enter balancers airflow reading in CFM in MeasuredFlow/K (A218).
   1.6 Again, allow airflow PriAirFlowCV (A194) to reach TABPriAirMaxStpt (A211)
   1.7 Repeat as necessary.
   1.8 Calculated K factor can be read at KFactorOut (A215)
   1.9 Set DampMaxMan (D193) to FALSE when complete.

2. Airflow sensor calibration sensor using the K- factor selection in firmware block VAV flow calculation.
   2.1 Set KFactSelect (D204) to FALSE.
   2.2 Set MeasuredFlow/K (A218) to the K-factor specified by the unit manufacturer.
   2.3 Calculated flow can be read at PriAirFlowCV (A194)

Note: If KFactSelect (D204)is TRUE and balancing is finished, toggling DampMaxMan (D193) or DampMinMan (D194) to FALSE will cause the MeasuredFlow/K (A218) to change to the new K Factor, and KFactSelect (D204) will be set back to FALSE. It is recommended to save final K Factor number to MeasuredFlow/K (A218) and set KFactSelect (D204) to FALSE after balancing. This will ensure the K Factor is not lost on a firmware upgrade.

HEATING CONTROL

TERMINAL UNIT HEAT

The CBV-2U4-3T(-N) has 3 Digital Outputs (DO) to control both fan or heat stages and 2 Analog Outputs (AO) to control modulating heat or fans. A tri-state heating valve may be configured using `DO-11` and `DO-12`.

On/Off Control

The CBV-2U4-3T(-N) may control on/off stages of electric terminal heat. On a fall in zone temperature below the controller heating setpoint, the CBV-2U4-3T(-N) controller will energize the heat stages in sequence from lowest output number to highest.

When using stages of Electric Heat without a fan, parameters are available to disable electric heat until airflow reaches a Flowrate setpoint ElecHeatCFMTestStpt (A3). Flowrate must stay above ElecHeatCFMTestStpt (A3) for the amount of time set in ElecHeatCFMTestTime (A112) before heat will be enabled.

- ElecHeatCFMTestStpt (A3) R/W
- ElecHeatCFMTestTime (A112)
- AirflowOKforElecHeat (D20) RO

Modulating Control

The CBV-2U4-3T(-N) may control modulating terminal heat. On a fall in zone temperature below the controller heating setpoint, the CBV-2U4-3T(-N) controller will modulate the hot water valve open. Various voltage ranges and direct or reverse action are available.

Note: If the CBV-2U4-3T(-N) has been configured for a series or parallel fan, heat will not be energized until the fan has been commanded on.

BASEBOARD HEAT

The CBV-2U4-3T(-N) control outputs not being used for terminal unit heat may be used for baseboard heat. Like terminal unit heat, these may be either analog or digital outputs, depending on what type of point is available.

In the occupied mode, the baseboard heat will be controlled in sequence with any terminal unit heat.

In the unoccupied mode, the baseboard heat may be configured to operate either in sequence with terminal unit heat or as the only source of heat.

On/Off Control

If DO point(s) are available, the CBV-2U4-3T(-N) may control on/off baseboard heat. On a fall in zone temperature below the controller heating setpoint, the CBV-2U4-3T(-N) controller will energize the associated baseboard heat.

Modulating Control

If AO or tri-state point(s) are available, the CBV-2U4-3T(-N) may control modulating baseboard heat. On a fall in zone temperature below the controller heating setpoint, the CBV-2U4-3T(-N) controller will modulate the associated baseboard section hot water valve.

Run Only Baseboard heat during unoccupied

In order to use this feature, first identify the output controlling baseboard heat, then select Run Only Baseboard heat during unoccupied. Any other heat stages will be skipped during unoccupied.

HEAT ORDER

Using the configuration spreadsheet, it is possible to choose how to stage baseboard heat in conjunction with any box heat. This is done by first determining which type of heat is used in the box (On/Off, modulating, or tri-state) and at the baseboard, then by making use of the following rules. A heating strategy may be configured to cover most cases:

1. Within digital and analog heat outputs, the lower output number is staged on first, and
2. The box may be configured to run AO or DO heat (including Tri-state outputs) first, last, or concurrently.

DIGITAL OUTPUT DIRECT/REVERSE ACTION

In the CBV-2U4-3T(-N) the digital outputs could also be set for reverse acting. This would be typically used for controlling normally-closed heating valves.

- DO11RevAct (DS313)
- DO12RevAct (DS314)
- DO13RevAct (DS312)

DIGITAL OUTPUT DISPLAY POSITION

These points will display the heat command for the various digital outputs regardless if digital output(s) are set for reverse or direct acting.

- DO11CmdDisplay (D284)
- DO12CmdDisplay (D305)
- DO13CmdDisplay (D306)

ANALOG OUTPUT RANGE OPTIONS

The range of the AOs include 0 ··· 10 V DC, 2 ··· 10 V DC, and custom ranges. If using custom ranges, enter them in the points listed below. For example, to give AO14 a closed position of 6.0 V DC and an open position of 9.0 V DC, 60 would be entered in A247 and 90 would be entered in A248.

- CustomClosedVX10_AO14 (A247)
- CustomOpenVX10_AO14 (A248)
- CustomClosedVX10_AO15 (A157)
- CustomOpenVX10_AO15 (A240)

ANALOG OUTPUT DIRECT/REVERSE ACTION

Direct or reverse action may be chosen from the spreadsheet for each AO.

ANALOG OUTPUT DISPLAY POSITION

These points will display the full range 0 ··· 100 % logical control signal to the output point no matter what the physical configuration is direct/reverse, 2 ··· 10 V DC, etc.

- AO14DisplayPos (A155)
- AO15DisplayPos (A241)

FAN CONTROL

PARALLEL SINGLE SPEED FAN

The intermittent single speed fan will be energized when the **CBV-2U4-3T(-N)** is in the heat mode. It will be off when not in the heat mode.

MODE	COOLING	DEADBAND	HEATING
Occupied	Off	Off	On
Unoccupied	Off	Off	On
Warm-up	Off	Off	Off
Standby	Off	Off	On

Note: If Flowrate is above the TABParallelDisableFanSP (A380) + TABParallelFanDB (A381) then parallel fan will be disabled. Once Flowrate drops below TABParallelDisableFanSP (A380) parallel fan will then be enabled. This is used to prevent high Flowrates at the diffusers.

SERIES SINGLE SPEED FAN

The terminal unit fan will operate continuously whenever the **CBV-2U4-3T(-N)** is in the occupied state. It will also run whenever the **CBV-2U4-3T(-N)** is in the unoccupied heating or unoccupied cooling mode.

OCCUPIED	ON	ON	ON
Unoccupied	On	Off	On
Warm-up	N/A	Off	On
Standby	On	Off	On

Note: If Flowrate is above the SeriesFanStartLckOutSP (A383) the damper will drive shut until Flowrate is below the setpoint before starting the fan. This prevents the fan from reverse rotation when starting.

VARIABLE SPEED FAN

The terminal unit fan speed will be controlled through `AO-15` (0 ··· 10 V dc, 2 ··· 10 V dc, or a custom range).

When initially powered up, or upon restoration of power after a power outage, the **CBV-2U4-3T(-N)** controller executes a fan startup sequence to prevent reverse rotation. The fan startup sequence drives the primary air damper closed, waits 30 seconds, and then sets the fan speed output to 100% for 2 seconds. The controller will then set the fan speed output to the current fan setpoint, EffFanSpeedCmd (A176.)

Fan Speed Calculation

For variable speed fans, EffFanSpeedCmd (A176) is determined by translating the current Cool or Heat demand percent to the range from min to max fan speed. For instance, with a Cooling demand of 50% and a series fan with a min (deadband) fan speed setpoint of 20% and a maximum (cool stpt) fan speed setpoint of 70%, EffFanSpeedCmd (A176) is calculated as follows:

Fan Speed Setpoint Range: 70 % max – 20 % min = 50 %

Cool Demand = 50 %

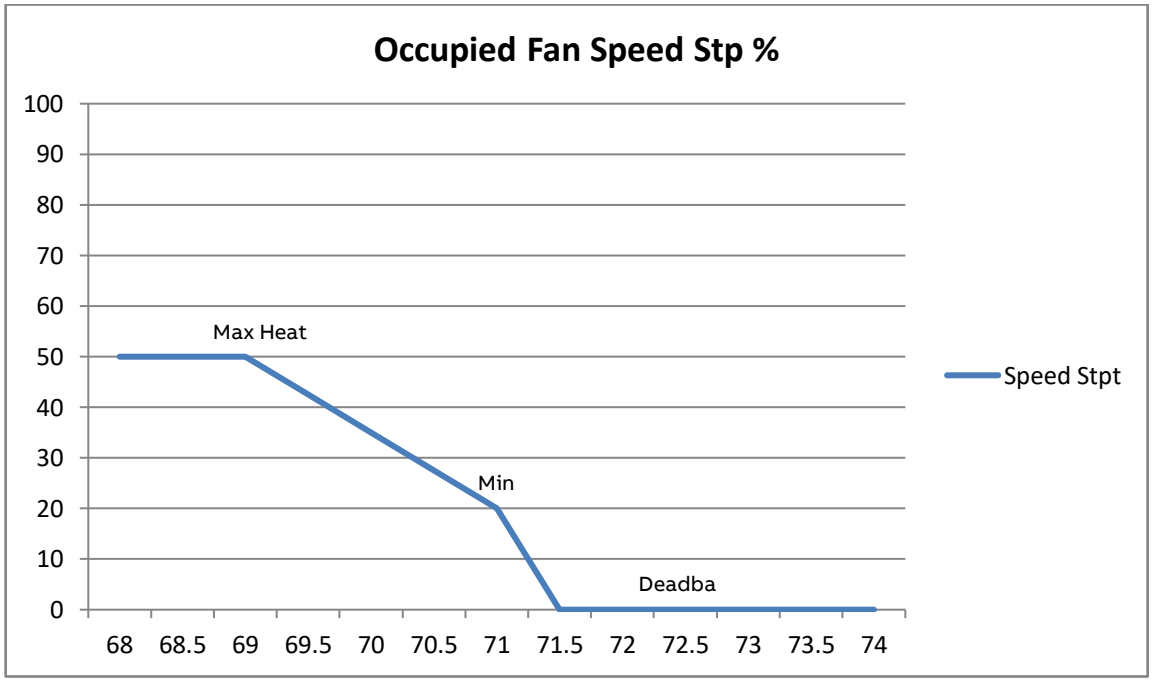
50 % demand X 50 % range = 25% signal

EffFanSpeedCmd (A176) = signal + min

EffFanSpeedCmd (A176) = 25% + 20% = 45%

PARALLEL VARIABLE SPEED FAN

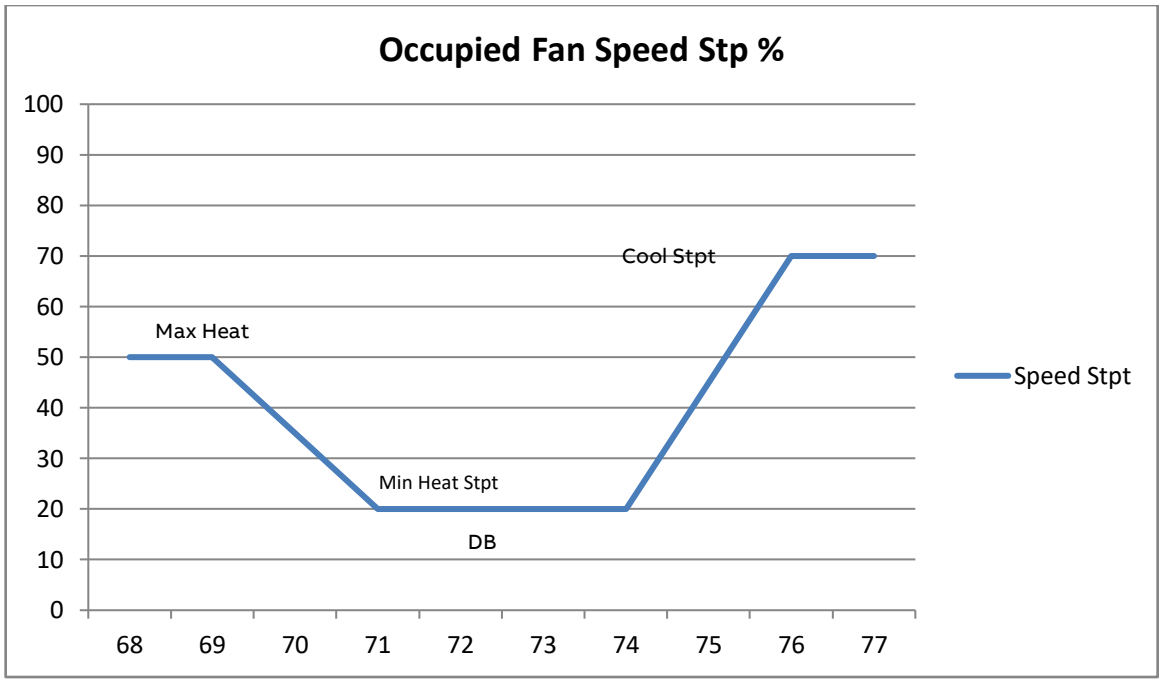
The Parallel Variable Speed fan will be energized when the **CBV-2U4-3T(-N)** is in the heat mode and off when not in the heat mode. Speed will modulate between the Minimum and Maximum Setpoints as shown below.



- Max Heat Fan Speed Setpoint is TABFanHtgMaxStpt (A226)
- Min Heat Fan Speed Setpoint is TabFanHtgMinStpt (A154)
- Min Fan Speed Setpoint is TABFanDbandStpt (A224)

SERIES VARIABLE SPEED FAN

The Series Variable Speed fan will operate continuously whenever the **CBV-2U4-3T(-N)** is in the occupied state. It will also run whenever the **CBV-2U4-3T(-N)** is in the unoccupied heating or unoccupied cooling modes.



- Max Heat Fan Speed Setpoint is TABFanHtgMaxStpt (A226)
- Min Heat Fan Speed Setpoint is TabFanHtgMinStpt (A154)
- Deadband Fan Speed Setpoint is TABFanDbandStpt (A224)
- Cooling Fan Speed Setpoint is TABFanMaxStpt (A225)

Appendix : List of CBV-2U4-3T(-N) points

The CBV-2U4-3T strategy is available in both Imperial and Metric units.

The tables in this Appendix list and describe the points in the Strategy, and gives the units in each Strategy type along with the default value in that Strategy type.

HARDWARE POINTS (I/O)

ANALOG

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	IMPERIAL UNITS	METRIC UNITS
1	Analog Input	UI01	Room/Zone Temperature Sensor	° F	° C
2	Analog Input	UI02	Setpoint Adjust Potentiometer	Ohms	Ohms
3	Analog Input	UI03	Supply or Discharge Air Temperature	° F	° C
4	Analog Input	UI04	CO2, Humidity, or Motion Detection	Volts	Volts
8	Analog Input	UI08	Flowrate Sensor	Pascals	Pascals
14	Analog Output	AO14	Modulating Heat Stage 1	%	%
15	Analog Output	AO15	Modulating Heat Stage 2 or Variable Fan Speed Control	%	%
16	Analog Output	AO16	Damper Command Position (CBV-2U4-3T ONLY)	%	%

DIGITAL

POINT	POINT TYPE	OBJECTNAME	DESCRIPTION	Active Text	Inactive Text
9	Digital Output	DO09	Actuator Clockwise Output (CBV-2U4-3T-N ONLY)	On	Off
10	Digital Output	DO10	Actuator Counter-Clockwise Output (CBV-2U4-3T-N ONLY)	On	Off
11	Digital Output	DO11	Heating Stage 1 or Tri-State Heating Valve Open	On	Off
12	Digital Output	DO12	Heating Stage 2 or Tri-State Heating Valve Close	On	Off
13	Digital Output	DO13	Heating Stage 3 or Single Speed Fan	On	Off

ANALOG VALUES

POINT	SETPOINT BLOCK	OBJECTNAME	DESCRIPTION	UNITS AND DEFAULT VALUES			
				IMPERIAL STG.		METRIC STG.	
1	yes	RemoteSlaveDehumidCmd (A1)	Remote dehumidification command setpoint 0 ⋯ 100 %	0	%	0	%
2	yes	OfflineTimerCommTestValueBACnet (A2)	Required to write a 1 to this point every 5 ⋯ 10 minutes when offline timer for BACnet communications point OfflineTimerEnaBACnet (D257) is enabled.	1	no-units	1	no-units
3	yes	ElecHeatCFMTestStpt (A3)	Minimum Flowrate setpoint to enable electric heat. Applicable only for VAV boxes configured for no fan or series fan.	0	cfm	0	l/sec
7	Yes	CFMAbvBlwSPAlarm (A7)	Flowrate error from current calculated Flowrate setpoint alarm	75	cfm	37.5	l/sec
10	No	UI04ScaledValueCO2 (A10)	Scaled value from local CO_2 sensor	0	ppm	0	ppm
12	No	UI04ScaledValue (A12)	Scaled value from local relative humidity sensor	0	%RH	0	%RH
13	No	ZoneRHValueCV (A13)	Local relative humidity reading from sensor	0	%RH	0	%RH
19	Yes	StuckDamperDB (A19) CBV-2U4-3T ONLY	The percentage difference between requested and actual Damper % where the damper will be considered close enough (Damper Requested – Deadband) > Damper Actual > (Damper Requested + Deadband)	20	%	20	%
20	Yes	StuckDamperDelay (A20) CBV-2U4-3T ONLY	The minimum amount of time in seconds before an alarm is raise for a stuck damper	60	sec	60	sec
22	No	AFS_PressurePa (A22)	Pressure Reading	0	pascals	0	pascals
24	No	Damper Feedback (A24)	Feedback Position of Damper actuator (CBV-2U4-3T ONLY)		%		%
28	No	AFS_PressureIn (A28)	Pressure Reading	0	inH_20	Imperial Only	Imperial Only
32	Yes	HeatingOffsetPID (A32)	Offsets effective heating setpoint at PID	0	°F	0	°c
39	Yes	CoolingOffsetPID (A39)	Offsets effective cooling setpoint at PID	0	°F	0	°c
40	No	Fusion_ZoneTemp (A40) without Actuator	The space temperature as detected by the FusionAir sensor. (FA Variants only)	0	°F	0	°C
41	No	AlarmEncode (A41)	Encodes various alarms as follows: 0=No Alarm 1=Low Temp Alarm 2=High Temp Alarm 4=Low Air Flow 8=High Air Flow 16=Local Temp Fault 32= No MSTP comms to master	0	no-units	0	no-units
47	Yes	AO15RemoteCmd (A47)	Remote command for AO15	0	%	0	%
62	No	Fusion_ZoneHumidity(A62) without Actuator	The space humidity as detected by the FusionAir sensor. (FA Variants only)	0	%rh	0	%rh
66	No	EffLoadShedOccStptOffset (A66)	Effective load shed occupied setpoint offset	0	°F	0	°C
67	No	ZoneCO2ValueCV (A67)	Local CO_2 reading from sensor	0	ppm	0	ppm
71	No	HiSelectCO2DehumidEffAFlowCmd (A71)	Maximum of CO_2 or dehumidification effective airflow setpoint	0	no-units	0	no-units
75	Yes	RemoteSlaveCO2Cmd (A75)	Remote CO_2 command setpoint 0⋯100%	0	%	0	%
76	No	LocalRemoteSlaveC02Calc (A76)	Current CO_2 command 0⋯100%	0	%	0	%
77	Yes	Group0TABCode (A77)	Group 0 TAB code	0	no-units	0	no-units

POINT	SETPOINT BLOCK	OBJECTNAME	DESCRIPTION	UNITS AND DEFAULT VALUES			
				IMPERIAL STG.		METRIC STG.	
79	No	LocalRemoteSlaveDehumidCalc (A79)	Current dehumidification command 0···100%	0	%	0	%
80	Yes	Group1TABCode (A80)	Group 1 TAB code	0	no-units	0	no-units
84	Yes	OutputConfigC_Bsbd (A84)	VAV box configuration setpoint	128	no-units	128	no-units
85	Yes	Group2TABCode (A85)	Group 2 TAB code	0	no-units	0	no-units
86	No	StptSliderEffOccOffset (A86)	Current slider setpoint offset	0	°F	0	°C
87	Yes	Group3TABCode (A87)	Group 3 TAB code	0	no-units	0	no-units
88	No	EffGroupAddress (A88)	Current group address	0	no-units	0	no-units
90	Yes	Group0OccCode (A90)	Group 0 command used to put VAV box in multiple modes of operation. This point supports priority array.	1	no-units	1	no-units
91	Yes	Group1OccCode (A91)	Group 1 command used to put VAV box in multiple modes of operation. This point supports priority array.	1	no-units	1	no-units
92	Yes	Group2OccCode (A92)	Group 2 command used to put VAV box in multiple modes of operation. This point supports priority array.	1	no-units	1	no-units
93	Yes	GroupAddress (A93)	Point used to set the group address	0	no-units	0	no-units
100	Yes	Group3OccCode (A100)	Group 3 command used to put VAV box in multiple modes of operation. This point supports priority array.	1	no-units	1	no-units
103	No	Fusion_ZoneTemp (A103) with Actuator	The space temperature as detected by the FusionAir sensor. (FA Variants only)	0	°F	0	°C
105	No	ZeroOffsetCalc	Measured offset after air flow sensor has been zeroed	0	no-units	0	no-units
106	No	Fusion_ZoneHumidity(A106) with Actuator	The space humidity as detected by the FusionAir sensor. (FA Variants only)	0	%rh	0	%rh
109	No	Fusion_CO2 (A109) with Actuator	The space CO2 as detected by the FusionAir sensor. (FA Variants only)	0	ppm	0	ppm
112	Yes	ElecHeatCFMTestTime (A112)	Amount of seconds current Flowrate needs to be above calculated Flowrate setpoint before enabling electric heat. Only applicable for VAV boxes configured for no fan or series fan	60	sec	60	sec
113	No	Fusion_CO2 (A113) without Actuator	The space CO_2 as detected by the FusionAir sensor. (FA Variants only)	0	ppm	0	ppm
120	Yes	UI03_10KSensorCal (A120)	UI03 sensor calibration offset	0	°F	0	°c
122	No	UI03_10KSensorHost (A122)	Current UI03 sensor reading with calibration offset	0	°F	0	°C
125	No	TABPriAirMaxHtgStpt	Maximum heating CFM Setpoint	0	CFM	0	l/sec
140	No	TABPriAirEffMaxStpt (A140)	Current effective maximum Flowrate setpoint	0	CFM	0	l/sec
141	Yes	heatStateOnStpt (A141)	Temperature setpoint for setting Primary Air State to hot when VAV box has been configured for local auto change over.	80	°F	27	°c
143	Yes	AO14RemoteCmd (A143)	AO14 remote command	0	%	0	%
153	Yes	TabPriAirMinHtgStpt (A153)	Primary air max heating Flowrate setpoint. This point supports priority array.	50	CFM	25	l/sec
154	Yes	TabFanHtgMinStpt (A154)	Minimum heating variable speed fan command setpoint	0	%	0	%
155	No	AO14DisplayPos (A155)	AO14 display value 0···100%	0	%	0	%
157	Yes	CustomClosedVX10_AO15 (A157)	AO15 Close Value Custom = Volts X 10	0	%	0	%
168	Yes	Remote_SlaveTemp (A168)	Remote control temperature written to from master controller	55	°F	21	°c
172	No	TotalHeatingStagesDefined (A172)	Amount of stages of heat defined	0	no-units	0	no-units

POINT	SETPOINT BLOCK	OBJECTNAME	DESCRIPTION	UNITS AND DEFAULT VALUES			
				IMPERIAL STG.		METRIC STG.	
174	No	HeatMasterCalc (A174)	Heat Master Calculated Percent	0	%	0	%
175	Yes	HeatCapacityLimit (A175)	Point used to limit heat capacity 0···100%	100	%	100	%
176	No	EffFanSpeedCmd (A176)	Current variable speed fan command 0···100%	0	%	0	%
177	No	FanSpeedCmdAuto (A177)	Calculated variable fan speed command	0	%	0	%
180	No	UI01_10KSensorHost (A180)	UI01 control value	0	°F	0	°C
182	No	EffHeatStpt (A182)	Active heating setpoint	0	°F	0	°C
183	No	EffCoolStpt (A183)	Active cooling setpoint	0	° F	0	°C
184	No	ZoneHeatEffCalc (A184)	Current zone heating command. Calculation.	0	%	0	%
185	No	ZoneCoolEffCalc (A185)	Current zone heating command calculation.	0	%	0	%
186	Yes	ManualSlaveHeatCmd (A186)	When point EnableManualHeatCmd (D178) is enabled this slave heating command point can be written to from master controller 0···100%.	0	%	0	%
187	Yes	ManualSlaveCoolCmd (A187)	When point EnableManualCoolCmd (D179) is enabled this slave cooling command point can be written to from master controller 0···100%.	0	%	0	%
190	No	ZATContrlModeEnumeration (A190)	Point can be used to determine zone control mode 0 = Deadband mode 1 = Occupied heating mode 2 = Unoccupied heating mode 4 = Occupied cooling mode 8 = Unoccupied cooling mode 16 = Standby mode	0	no-units	0	no-units
191	No	EffZoneUnoccCoolStpt (A191)	Active unoccupied cooling setpoint	0	°F	0	°C
192	No	EffZoneUnoccHeatStpt (A192)	Active unoccupied heating setpoint	0	°F	0	°C
193	No	ZoneTempCV (A193)	Current zone control temperature	0	°F	0	°C
194	No	PriAirFlowCV (A194)	Current primary airflow	0	CFM	0	l/sec
197	No	EffPriAirFlowStpt (A197)	Current primary airflow active setpoint	0	CFM	0	l/sec
198	Yes	LoadShedOccStptOffset (A198)	Amount of degrees that occupied setpoints are offset when load shed mode is enabled.	0	°F	0	°c
199	No	StrategyVer (A199)	Strategy version				
200	Yes	ZoneOccCoolStpt (A200)	Occupied cooling setpoint. This point supports priority array	75	°F	23	°c
201	Yes	ZoneOccHeatStpt (A201)	Occupied heating setpoint. This point supports priority array	71	°F	21	°c
202	Yes	ZoneUnoccCoolStpt (A202)	Unoccupied cooling setpoint	85	°F	26	°c
203	Yes	ZoneUnoccHeatStpt (A203)	Unoccupied heating setpoint	65	°F	18	°c
204	Yes	ZoneUnoccDiff (A204)	Degrees above unoccupied heating setpoint when heat is disabled	3	°F	3	°c
205	Yes	StandbyOffset (A205)	Amount of degrees that occupied setpoints are offset when standby mode is enabled.	0	°F	0	°c
206	Yes	OnBoardOccSensorOverrideTime (A206)	Amount of minutes that VAV box will be occupied when local push button override or motion sensor has been activated.	60	min	60	min
207	Yes	Fusion_occOvrTime (A207)	Amount of minutes that the VAV will be in occupied when the face of the FusionAir sensor has been touched	120	min	120	min

POINT	SETPOINT BLOCK	OBJECTNAME	DESCRIPTION	UNITS AND DEFAULT VALUES			
				IMPERIAL STG.		METRIC STG.	
			during unoccupied mode. (FA Variants only)				
208	No	PriAirModeEnumeration (A208)	Numerated value of primary air mode state. 0 = On 1 = Off 3 = Fire stop	0	no-units	0	no-units
210	Yes	TABPriAirDbandStpt (A210)	Primary air control dead band Flowrate setpoint. This point supports priority array.	50	CFM	25	l/sec
211	Yes	TABPriAirMaxStpt (A211)	Primary air maximum Flowrate setpoint. This point supports priority array.	800	CFM	400	l/sec
212	Yes	TabPriAirMaxHgtStpt (A212)	Primary air max heating Flowrate setpoint. This point supports priority array.	50	CFM	25	l/sec
214	Yes	Fusion_Offset(A214) with Actuator	The maximum adjustment of the setpoint range for the FusionAir sensor. (FA Variants only)	5	°F	5	°c
215		KFactorOut (A215)	Displays the current calculated K-factor		CFM@1”		l/sec@1Pa
216	Yes	Fusion_StptStepSize (A216) with Actuator	The amount of degrees the setpoint is adjusted with every button press on the FusionAir sensor. (FA Variants only)	.5	°F	.5.	°c
218	Yes	MeasuredFlow/K (A218)	When KFactSelect (D204) is True, input measured flow from balancer. When KfactSelect (D204) is False, input factory K-factor				
219	No	PriDamperCmdEnumeration (A219)	Enumerated value for damper command state 0 = Off 1 = Open 2 = Close 4 = Close Flowrate high for series fan 8 = Open manual 16 = Close manual 32 = Closed fire stop	0	no-units	0	no-units
221	Yes	CBT_STAT_CFG (A221)	Enumerated value for CBT-Stat operation 0-None 1-OccOvrd 2-Temp Setpoint Adj 3-OccOvrd & Temp Setpoint Adj 4-Perm Setpnt Adj 5-OccOvrd & Perm Setpnt Adj	3	no-units	3	no-units
224	Yes	TABFanDbandStpt (A224)	Minimum variable fan speed command setpoint	0	%	0	%
225	Yes	TABFanMaxStpt (A225)	Maximum cooling variable speed fan command setpoint	60	%	60	%
226	Yes	TABFanHtgMaxStpt (A226)	Maximum heating variable speed fan command setpoint	60	%	60	%
227	Yes	TABFanStandbyStpt (A227)	Variable fan speed command setpoint when in standby mode	0	%	0	%
230	Yes	UI01_10KSensorCal (A230)	UI01 calibration offset	0	°F	0	°c
231	Yes	SetptSliderSpan (A231)	Setpoint slider span	4	°F	4	°c
232	Yes	ZonePIDGain (A232)	Zone temperature PID gain	10	no-units	10	no-units
235	Yes	HeatStateOffStpt (A235)	Temperature setpoint for setting Primary Air State to cold when VAV box has been configured for local auto change over.	72	°F	21	°c
236	Yes	PriAirPIDGain (A236) with Actuator	Primary air PID gain	0.11	no-units	0.11	no-units
236	Yes	PriAirPIDGain (A236) without Actuator	Primary air PID gain	0.10	no-units	0.10	no-units

POINT	SETPOINT BLOCK	OBJECTNAME	DESCRIPTION	UNITS AND DEFAULT VALUES			
				IMPERIAL STG.		METRIC STG.	
237	Yes	PriAirPIDInteg (A237) with Actuator	Primary air PID integral	100	no-units	100	no-units
237	Yes	PriAirPIDInteg (A237) without Actuator	Primary air PID integral	180	no-units	180	no-units
238	Yes	Fusion_Offset(A238) without Actuator	The maximum adjustment of the setpoint range for the FusionAir sensor. (FA Variants only)	5	°F	5	°c
239	Yes	Fusion_StptStepSize (A239) without Actuator	The amount of degrees the setpoint is adjusted with every button press on the FusionAir sensor. (FA Variants only)	.5	°F	.5.	°c
240	Yes	CustomOpenVX10_AO15 (A240)	AO15 Open Value Custom = Volts X 10]	50	%	50	%
241	No	AO15DisplayPos (A241)	AO15 display value 0···100%	0	%	0	%
242	Yes	InputConfigA (A242)	VAV box configuration setpoint	0	no-units	0	no-units
243	Yes	OutputConfigA (A243)	VAV box configuration setpoint	-71	no-units	-71	no-units
244	Yes	PriAirMaxMult (A244)	Max Flowrate Air Multiplier	1	no-units	1	no-units
245	Yes	Fusion_altCO2Input	Analog value to send a remote CO_2 sensor value to the FusionAir Stat. (FA Variants only)	0	ppm	0	ppm
246	Yes	PriAirPIDDeriv (A246) with Actuator	Primary Air PID derivative	0	no-units	0	no-units
246	Yes	PriAirPIDDeriv (A246) without Actuator	Primary Air PID derivative	0	no-units	0	no-units
247	Yes	CustomClosedVX10_AO14 (A247)	AO14 Open Value Custom = Volts X 10	0	%	0	%
248	Yes	CustomOpenVX10_AO14 (A248)	AO14 Open Value Custom = Volts X 10	50	%	50	%
249	Yes	TABPriAirEffMinStpt (A249)	Current effective minimum CFM setpoint. Will read min heat CFM, min cool CFM, or 0.		cfm		L/s
253	Yes	UI04CO2SensorBase (A253)	CO_2 Sensor Reading at 0 V DC	0	ppm	0	ppm
254	Yes	UI04CO2SensorSpan (A254)	CO_2 Sensor Reading at 10 V DC	2000	ppm	2000	ppm
255	Yes	LocalCO2Stpt (A255)	Net Zone CO_2 Setpoint	500	ppm	500	ppm
256	Yes	UI04SensorBase (A256)	Relative Humidity Sensor Reading at 0 V DC	0	%RH	0	%RH
257	Yes	UI04SensorSpan (A257)	Relative Humidity Sensor Reading at 10 V DC	100	%RH	100	%RH
258	Yes	LocalDehumidStpt (A258)	Zone Dehumidification Setpoint	65	%RH	65	%RH
259	Yes	CommunicationsOfflineTimer (A259)	Amount of minutes before communication status has been considered off when BACnet communications point OfflineTimerEnaBACnet (D257) is enabled.	15	min	15	min
260	Yes	InputConfigB (A260)	VAV box configuration setpoint	0	no-units	0	no-units
261	Yes	OutputConfigB (A261)	VAV box configuration setpoint	0	no-units	0	no-units
263	No	EffZoneOccHeatStpt (A263)	Zone Effective Occupied Heat Setpoint	0	°F	0	°C
264	No	EffZoneOccCoolStpt (A264)	Zone Effective Occupied Cool Setpoint	0	°F	0	°C
271	No	ZATError (A271)	Zone Temp Error from Heating and Cooling Setpoints	0	°F	0	°C
281	No	TriStateHtVlvPos (A281)	Current valve position if tristate heat valve is used 0···100%	0	%	0	%
286	Yes	AOConfigD (A286)	VAV box configuration setpoint	0	no-units	0	no-units
296	Yes	DamperDegrees	CBV-2U4-3T-N only	90	deg	90	deg
297	Yes	DampActDriveTime	CBV-2U4-3T-N only	95	sec	95	sec
313	No	DamperPosition (A313)	Current damper position (CBV-2U4-3T-N only)	0	%	0	%
320	Yes	TriStateHtVlvDriveTime (A320)	Tristate valve travel time in seconds	95	sec	95	sec

327	No	SysMode (A327)	Enumerated value for System Mode state: 0 = DB 1 = Heat 2 = Cool	0	no-units	0	no-units
334	Yes	netOCC (A334)	Enumerated value for Aspect Schedule Point netOCC: 0 = Vacant 1 = Warmup 2 = Occupied 3 = Setback	2	no-units	2	no-units
369	Yes	TriStateHtVlvMinOnTime (A369)	Tristate valve minimum on time in seconds	2	sec	2	sec
371	Yes	DegreesAbvBlwSPAlarm (A371)	Zone temperature error from current temperature setpoints alarm	2	°F	2	°C
373	Yes	TempAlarmOnDelay (A373)	Amount of minutes before zone temperature alarms are triggered	60	min	60	min
379	Yes	CFMAlarmOnDelay (A379)	Amount of minutes before Flowrate alarms are triggered	30	min	30	min
380	Yes	TABParallelDisableFanSP (A380)	Parallel fan is enabled when Flowrate is below this setpoint	3000	cfm	1500	l/sec
381	Yes	TABParallelFanDB (A381)	Parallel fan will be disabled when Flowrate is above this point + TABParallelDisableFanSP (A380)	50	cfm	25	l/sec
383	Yes	SeriesFanStartLckOutSP (A383)	Series fan is disabled if Flowrate is above this setpoint when first energized. If this occurs, damper will drive shut and when Flowrate drops below this setpoint series fan will start	200	cfm	100	l/sec
385	Yes	SliderValAt_N2 (A385)	Resistance at UI02 when slider is all the way to the left	15	ohms	15	ohms
386	Yes	SliderValAt_N1 (A386)	Resistance at UI02 when slider is between all the way to left and middle	1315	ohms	1315	ohms
387	Yes	SliderValAt_0 (A387)	Resistance at UI02 when slider is in middle	2800	ohms	2800	ohms
388	Yes	SliderValAt_P1 (A388)	Resistance at UI02 when slider is between all the way to right and middle	4460	ohms	4460	ohms
389	Yes	SliderValAt_P2 (A389)	Resistance at UI02 when slider is all the way to the right	4989	ohms	4989	ohms

BINARY VALUES

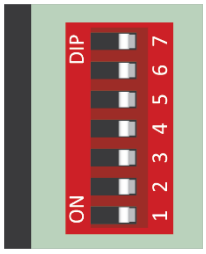
POINT	SETPOINT BLOCK	OBJECTNAME	DESCRIPTION	ACTIVE TEXT	INACTIVE TEXT	DEFAULT VALUES	
						IMP STG.	MET STG.
10	No	CommunicationsStatus (D10)	Communications with master controller failure if OfflineTimerEnaBACnet (D257) is enabled	On	Off	0	0
12	No	LocalDehumidControl (D12)	Enabled if local dehumidification control has been configured	Enable	Disable	0	0
20	No	AirflowOKforElecHeat (D20)	Enabled when airflow has proved for electric heat. Applies to VAVs with no fan or series fan	On	Off	0	0
23	Yes	DisableLocalSetptSliderViaEMS (D23)	Disables the local setpoint slider	On	Off	0	0
57	No	TerminalFanDefined (D57)	Enabled when controller has been configured for a series or parallel fan	Enable	Disable	0	0
58	No	LocalCO2Control (D58)	Enabled if local CO_2 control has been configured	Enable	Disable	0	0
65	No	LocalStptSlider (D65)	Enabled if local slide adjust has been configured and is not disabled by point DisableLocalSetptSliderViaEMS (D23)	Enable	Disable	0	0
78	No	FanCmdAnimation (D78)	Current fan command	On	Off	0	0
97	No	CO2ControlRemote_Slave (D97)	CO_2 control source	Enable	Disable	0	0
100	No	DamperOffline (D100)	Indicates bad communication for internal damper MPBus (CBV-2U4-3T only)	On	Off	0	0
122	No	PriAirModeEffCmd (D122)	Current Primary Air Mode Command	Enable	Disable	0	0
123	No	PriAirStateEffCmd (D123)	Current Primary Air State Command	Heating	Cooling	0	0
125	No	FireStopEffCmd (D125)	Primary Air Mode Fire Stop Command	Enable	Disable	0	0
127	No	DehumidControlRemote_Slave (D127)	Dehumidification Control Source ON=Remote, OFF=Local	Enable	Disable	0	0
128	No	DamperStuck CBV-2U4-3T ONLY	If after stuck damper delay (A20) seconds the actual damper % is not within +/- of stuck damper deadband (A19) this value is true, otherwise it is false.	On	Off	0	0
131	No	DampMaxManEff (D131)	Damper set to Max Flowrate Manual Mode	On	Off	0	0
132	No	DampMinManEff (D132)	Damper set to Min Flowrate Manual Mode	On	Off	0	0
133	No	DampAuxManEff (D133)	Damper set to Heat Flowrate Manual Mode	On	Off	0	0
136	No	DampOpenManEff (D136)	Damper set Full Open Manual Mode	On	Off	0	0
137	No	DampCloseManEff (D137)	Damper set Full Close Manual Mode	On	Off	0	0
150	Yes	TABPriAirZero (D150)	TAB Calibrate Zero Airflow	On	Off	0	0
160	Yes	CmdPriAirMode (D160)	Primary Air Mode Command	Enable	Disable	0	0
161	Yes	CmdPriAirState (D161)	Primary Air State Command	Heating	Cooling	0	0
163	Yes	DampAuxMan (D163)	Damper Command to Heat Flowrate Manual Mode	On	Off	0	0
166	No	UI01DigitalStatusHost (D166)	UI01 Digital Control value	On	Off	0	0
169	No	LocalTempSensorFault (D169)	If zone temperature has short or open circuit, this point will be triggered	Alarm	Normal	0	0
170	Yes	DO11RemoteCmd (D170)	DO11 override on command	On	Off	0	0
171	Yes	DO12RemoteCmd (D171)	DO12 override on command	On	Off	0	0
172	Yes	FanCoolMaxMan (D172)	Fan Commanded to Max Cool Speed Manual Mode	On	Off	0	0
173	Yes	FanDeadbandMan (D173)	Fan Commanded to Min Speed Manual Mode	On	Off	0	0

POINT	SETPOINT BLOCK	OBJECTNAME	DESCRIPTION	ACTIVE TEXT	INACTIVE TEXT	DEFAULT VALUES	
						IMP STG.	MET STG.
174	Yes	FanHeatMaxMan (D174)	Fan Commanded to Max Heat Speed Manual Mode	On	Off	0	0
175	Yes	FanStandbyMan (D175)	Fan Commanded to Standby Speed Manual Mode	On	Off	0	0
177	Yes	DO13RemoteCmd (D177)	DO13 override on command	On	Off	0	0
178	Yes	EnableManualHeatCmd (D178)	Manual Heat Enable Command	On	Off	0	0
179	Yes	EnableManualCoolCmd (D179)	Manual Cool Enable Command	On	Off	0	0
180	No	HeatModeSts	Heat mode status	On	Off	0	0
181	No	CoolModeSts	Cool mode status	On	Off	0	0
184	Yes	OccCmd (D184)	Occupancy command	Occ	Non Occ	1	1
185	Yes	StandbyCmd (D185)	Standby command	On	Off	0	0
186	No	OccModeSts (D186)	Occupancy mode status	Occ	Non Occ	0	0
187	No	StandbyModeSts (D187)	Standby mode status	On	Off	0	0
188	No	OccSensorEffCmdOnBoardSwitch (D188)	Occupancy effective command from push button override or motion sensor	On	Off	0	0
191	Yes	DampOpenMan (D191)	Set Damper Full Open Manual Mode	On	Off	0	0
192	Yes	DampCloseMan (D192)	Set Damper Full Close Manual Mode	On	Off	0	0
193	Yes	DampMaxMan (D193)	Damper set to Max Flowrate Manual Mode	On	Off	0	0
194	Yes	DampMinMan (D194)	Damper set to Min Flowrate Manual Mode	On	Off	0	0
199	Yes	FireStopCmd (D199)	Damper set to Fire Stop Cmd	Enable	Disable	0	0
204	Yes	KFactSelect (D204)	True will allow measured flow to be entered at (A218), False will allow factory K-factor to be entered at (A218)	On	Off	0	0
208	No	LoadShedEffCmd (D208)	Load Shed Enable Effective Command	Enable	Disable	0	0
210	Yes	FanHeatMinMan (D210)	Fan Commanded to Min Heat Speed Manual Mode	On	Off	0	0
211	Yes	LoadShedEnable (D211)	Load Shed Enable Command	Enable	Disable	0	0
213	Yes	Purge (D213)	Box damper will be overridden open.	Enable	Disable	0	0
222	No	OverrideStatus_Outputs (D222)	If any outputs have been overridden this point will be on	On	Off	0	0
223	No	ManualStatus_Application (D223)	If any TAB manual mode override points have been set to on this point will be on	On	Off	0	0
224	No	OverrideStatus_Inputs(D224)	If any inputs have been overridden this point will be ON	On	Off	0	0
225	Yes	DamperAdaption(D225) *CBV-2U4-3T ONLY*	When adaptation is selected, the actuator will drive one full cycle to its mechanical end-stop, and when it reaches that point the actuator's working range will be adapted to the actual mechanical angle of rotation. To initiate this process, toggle point D225 On, then toggle it Off.	On	Off	0	0
226	No	PurgeEffCmd (D226)	If commanded to Purge mode this point will be on	On	Off	0	0
230	Yes	DampReverse (D230)	Reverses damper action 0 = CW open, CCW close 1 = CW close, CCW open	On	Off	0	0
231	Yes	EnaUnoccCool (D231)	This point enables unoccupied cooling	Enable	Disable	1	1
232	No	IO_Application_Status (D232)	If any input, outputs, or manual status application mode is on, this point is on	On	Off	0	0
235	No	UI04DigitalStatusHost (D235)	UI04 digital status host	On	Off	0	0

POINT	SETPOINT BLOCK	OBJECTNAME	DESCRIPTION	ACTIVE TEXT	INACTIVE TEXT	DEFAULT VALUES	
						IMP STG.	MET STG.
241	No	UnoccHeatRequest (D241)	Unoccupied heat request	On	Off	0	0
242	No	UnoccCoolRequest (D242)	Unoccupied cool request	On	Off	0	0
251	Yes	Fusion_OvrReset (D251) with Actuator	When toggled, the FusionAir sensor will reset all override timers. (FA Variants only)	On	Off		
253	No	PriDamperOpenCmd (D253)	Primary Damper Open Command	On	Off	0	0
254	No	PriDamperCloseCmd (D254)	Primary Damper Close Command	On	Off	0	0
257	Yes	OfflineTimerEnaBACnet (D257)	Enables offline timer test. When set to on controller will be set to occupied when loss of BACnet MS/TP communication occurs	Enable	Disable	0	0
284	No	DO11CmdDisplay (D284)	If DO11 is used in strategy this point will display on when DO 11 is commanded on	On	Off	0	0
285	Yes	ParallelFanEnabPriAirHot (D285)	When this point is enabled, parallel fan will be allowed to run when primary air state is hot and there is a call for heat	Enable	Disable	0	0
296	Yes	EnabDamperPosReset (D296)	By default, when VAV is in unoccupied mode and there is less than 10 CFM the damper will drive shut for 100 seconds to zero out damper position calculation	Enable	Disable	1	1
297	Yes	FusionStatLockout (D297) with Actuator	When set to ON, temperature adjustment will be disabled on the FusionAir sensor. When set to OFF, temperature adjustment is enabled on the FusionAir sensor. (FA Variants only)	On	Off		
305	No	DO12CmdDisplay (D305)	If DO12 is used in strategy this point will display on when DO 12 is commanded on	On	Off	0	0
306	No	DO13CmdDisplay (D305)	If DO13 is used in strategy this point will display on when DO 13 is commanded on	On	Off	0	0
312	Yes	DO13RevAct (D312)	When this point is enabled, DO13 will be set for reverse acting	Enable	Disable	0	0
313	Yes	DO11RevAct (D313)	When this point is enabled, DO11 will be set for reverse acting	Enable	Disable	0	0
314	Yes	DO12RevAct (D314)	When this point is enabled, DO12 will be set for reverse acting	Enable	Disable	0	0
324	Yes	FusionStatLockout (D324) without Actuator	When set to ON, temperature adjustment will be disabled on the FusionAir sensor. When set to OFF, temperature adjustment is enabled on the FusionAir sensor. (FA Variants only)	On	Off		
335	Yes	Fusion_OvrReset (D335) without Actuator	When toggled, the FusionAir sensor will reset all override timers. (FA Variants only)	On	Off		

Appendix: List of DIP switch settings

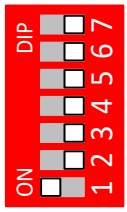
The following table illustrates the DIP switch settings for all possible controller MSTP address settings. See *Configuring the CBV-2U4-3T(-N) for BACnet communications* on page 18 for more details.



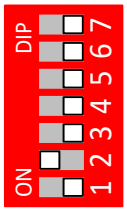
0000000
Software Selectable

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.

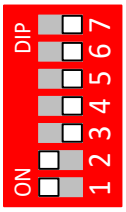
If no address had previously been set (e.g. when the device is received from the factory), then a device that is powered-on with the DIP switch set to all zeros will use the last 2 digits of its serial number as its initial address.



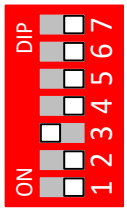
0000001
Address 1



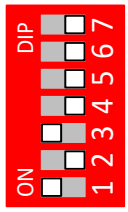
0000010
Address 2



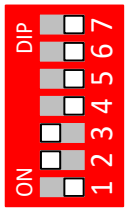
0000011
Address 3



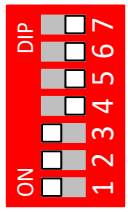
0000100
Address 4



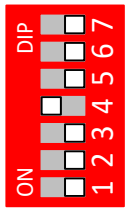
0000101
Address 5



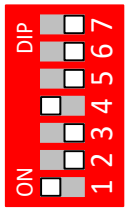
0000110
Address 6



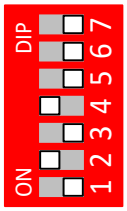
0000111
Address 7



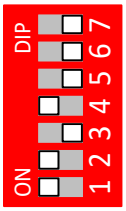
0001000
Address 8



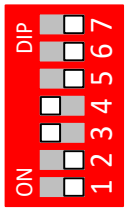
0001001
Address 9



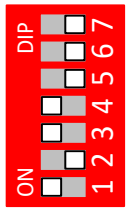
0001010
Address 10



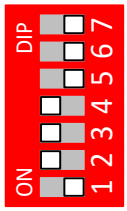
0001011
Address 11



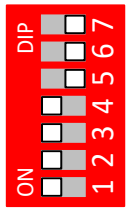
0001100
Address 12



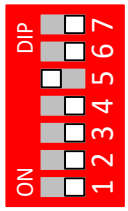
0001101
Address 13



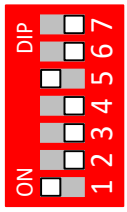
0001110
Address 14



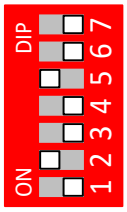
0001111
Address 15



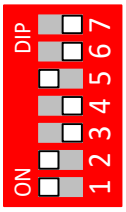
0010000
Address 16



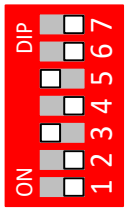
0010001
Address 17



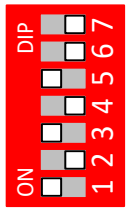
0010010
Address 18



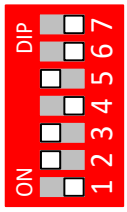
0010011
Address 19



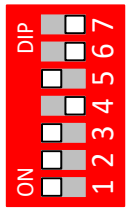
0010100
Address 20



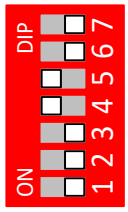
0010101
Address 21



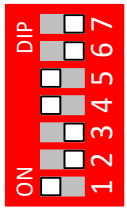
0010110
Address 22



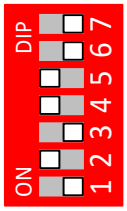
0010111
Address 23



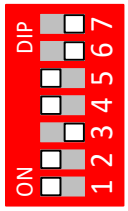
0011000
Address 24



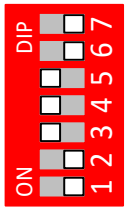
0011001
Address 25



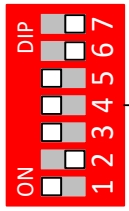
0011010
Address 26



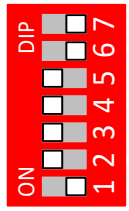
0011011
Address 27



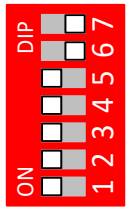
0011100
Address 28



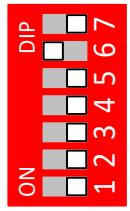
0011101
Address 29



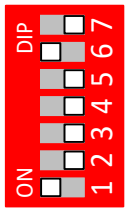
0011110
Address 30



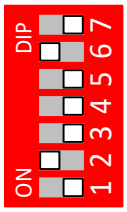
0011111
Address 31



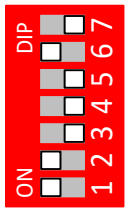
0100000
Address 32



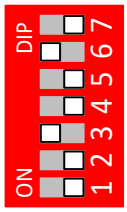
0100001
Address 33



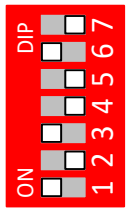
0100010
Address 34



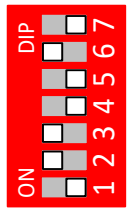
0100011
Address 355



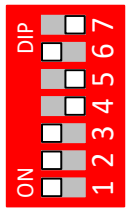
0100100
Address 36



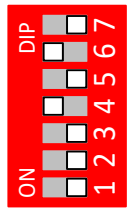
0100101
Address 37



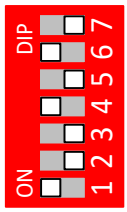
0100110
Address 38



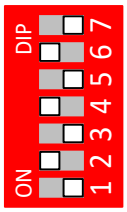
0100111
Address 39



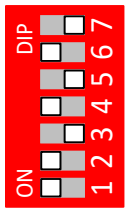
0101000
Address 40



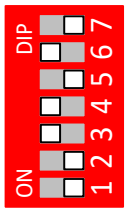
0101001
Address 41



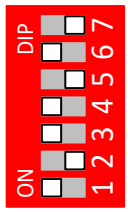
0101010
Address 42



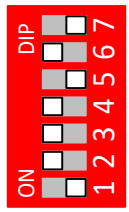
0101011
Address 43



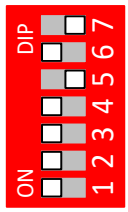
0101100
Address 44



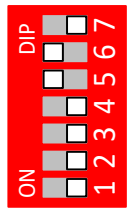
0101101
Address 45



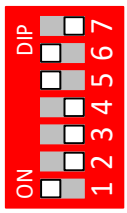
0101110
Address 46



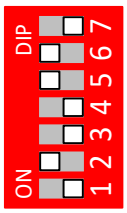
0101111
Address 47



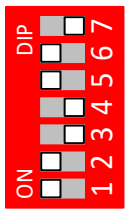
0110000
Address 48



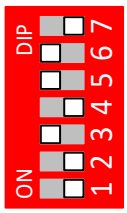
0110001
Address 49



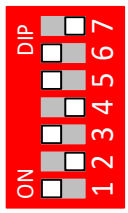
0110010
Address 50



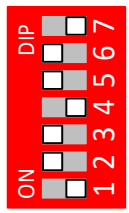
0110011
Address 51



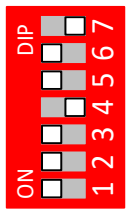
0110100
Address 52



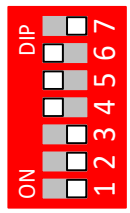
0110101
Address 53



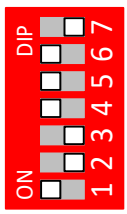
0110110
Address 54



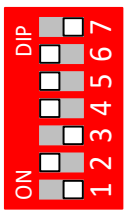
0110111
Address 55



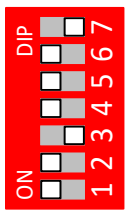
0111000
Address 56



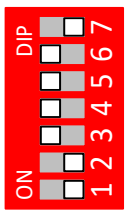
0111001
Address 57



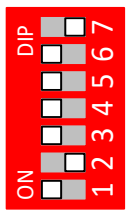
0111010
Address 58



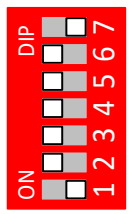
0111011
Address 59



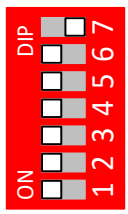
0111100
Address 60



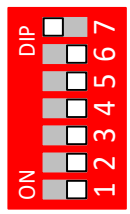
0111101
Address 61



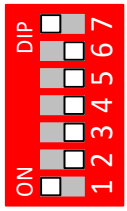
0111110
Address 62



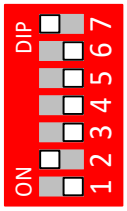
0111111
Address 63



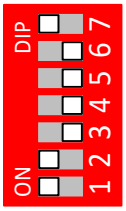
1000000
Address 64



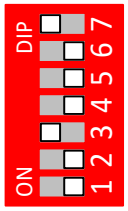
1000001
Address 65



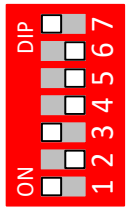
01000010
Address 66



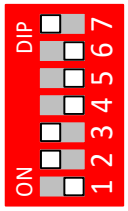
0100011
Address 67



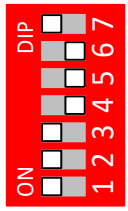
1000100
Address 68



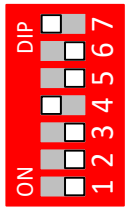
1000101
Address 69



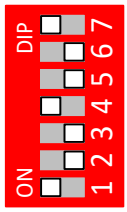
1000110
Address 70



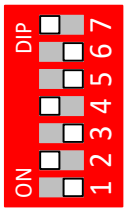
1000111
Address 71



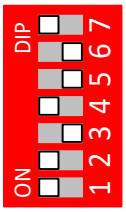
1001000
Address 72



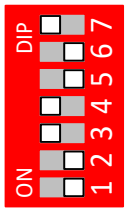
1001001
Address 73



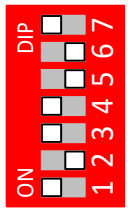
1001010
Address 74



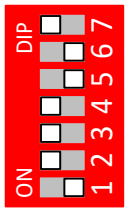
1001011
Address 75



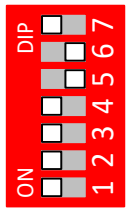
1001100
Address 76



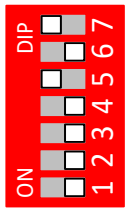
1001101
Address 77



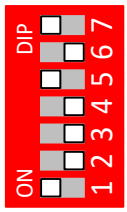
1001110
Address 78



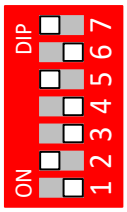
1001111
Address 79



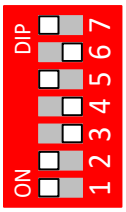
1010000
Address 80



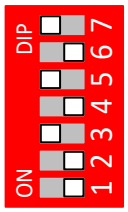
1010001
Address 81



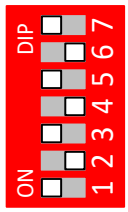
1010010
Address 82



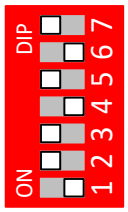
1010011
Address 83



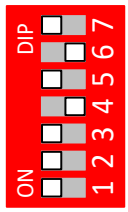
1010100
Address 84



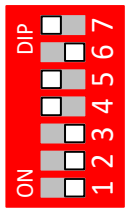
1010101
Address 85



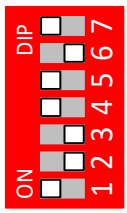
1010110
Address 86



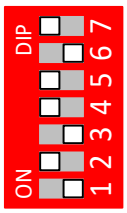
1010111
Address 87



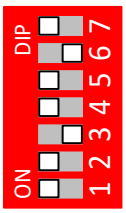
1011000
Address 88



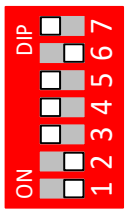
1011001
Address 89



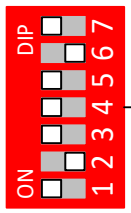
1011010
Address 90



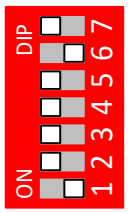
1011011
Address 91



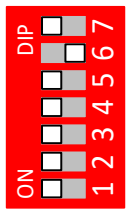
1011100
Address 92



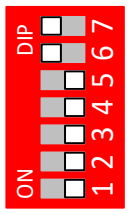
1011101
Address 93



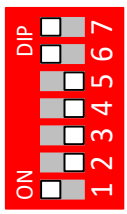
1011110
Address 94



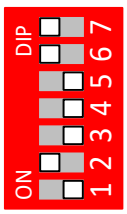
1011111
Address 95



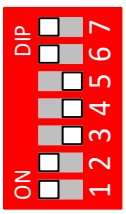
1100000
Address 96



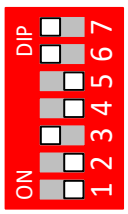
1100001
Address 97



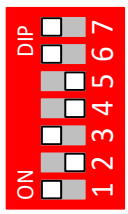
1100010
Address 98



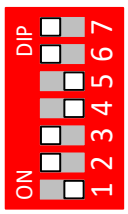
1100011
Address 99



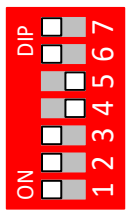
1100100
Address 100



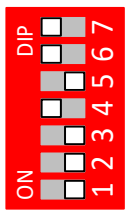
1100101
Address 101



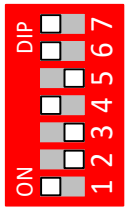
1100110
Address 102



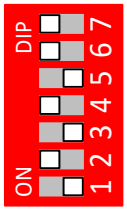
1100111
Address 103



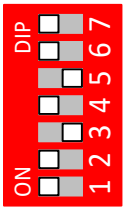
1101000
Address 104



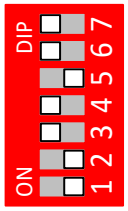
1101001
Address 105



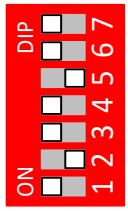
1101010
Address 106



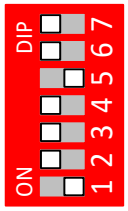
1101011
Address 107



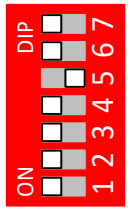
1101100
Address 108



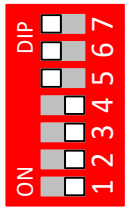
1101101
Address 109



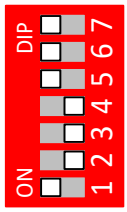
1101110
Address 110



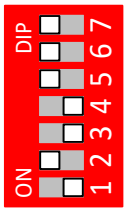
1101111
Address 111



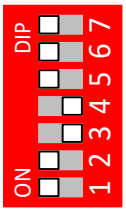
1110000
Address 112



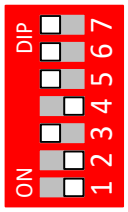
1110001
Address 113



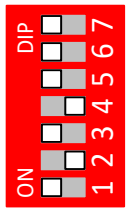
1110010
Address 114



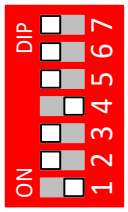
1110011
Address 115



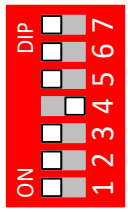
1110100
Address 116



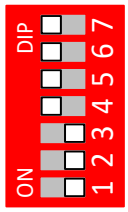
1110101
Address 117



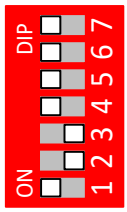
1110110
Address 118



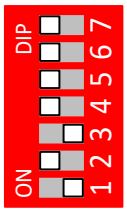
1110111
Address 119



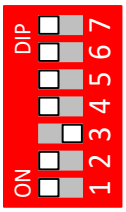
1111000
Address 120



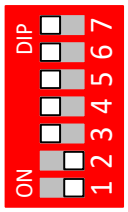
1111001
Address 121



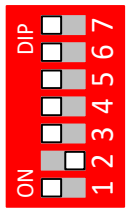
1111010
Address 122



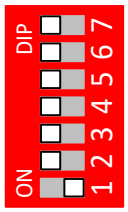
1111011
Address 123



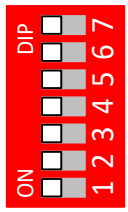
1111100
Address 124



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

WWW.CYLON.COM