ALERTON
Smarter Buildings Start Here

Modular VAV Controller

INSTALLATION AND OPERATIONS GUIDE

GENERAL

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Product Description

The modular VAV controllers is a freely programmable controller designed for pressure-independent control of any single duct and dual duct Variable Air Volume (VAV), Constant Air Volume (CAV) and Supply/Exhaust terminal units. These controllers are ideally suited for critical environment applications such as Laboratory Airflow Tracking, Critical Patient Rooms, Operating Rooms, and other applications requiring precise control of airflows.

These new controllers offer BACnet® IP (CAT5/6), BACnet® IP (T1L), and BACnet® MS/TP as their backbone communication protocol along with Microset Bus and Modbus RTU as embedded integration protocols, flexible Universal Input/Output (UIOs), Field replaceable air flow sensors, and solid-state relays (SSRs).

They offer performance-based engineering via Alerton's VAV programming tool. The optional integrated Bluetooth® Low Energy (BLE) capability enables an easy pairing with the BMS Startup app for efficient wiring validation as well as a Mobile VAV balancing experience with Honeywell Connect Mobile app.

Table 1 Part Numbers

Part Number	Pressure Sensor (SD/DD)	Universal IO	Solid State Relay (SSR)	Communication	MSET Bus	Bluetooth
VAV-SD6u5-IP	Single Duct	6	5	BACnet® IP (CAT5/6)	Yes	No
VAV-SD6u5-IP-BLE	Single Duct	6	5	BACnet® IP (CAT5/6)	Yes	Yes
VAV-SD6u5	Single Duct	6	5	BACnet® MS/TP	Yes	No
VAV-SD6u5-BLE	Single Duct	6	5	BACnet® MS/TP	Yes	Yes
VAV-SD6u5-T1L	Single Duct	6	5	BACnet® IP (T1L)	Yes	No
VAV-SD6u5-T1L-BLE	Single Duct	6	5	BACnet® IP (T1L)	Yes	Yes
VAV-DD8u8-IP	Dual Duct	8	8	BACnet® IP (CAT5/6)	Yes	No
VAV-DD8u8-IP-BLE	Dual Duct	8	8	BACnet® IP (CAT5/6)	Yes	Yes
VAV-DD8u8	Dual Duct	8	8	BACnet® MS/TP	Yes	No
VAV-DD8u8-BLE	Dual Duct	8	8	BACnet® MS/TP	Yes	Yes
VAV-DD8u8-T1L	Dual Duct	8	8	BACnet® IP (T1L)	Yes	No
VAV-DD8u8-T1L-BLE	Dual Duct	8	8	BACnet® IP (T1L)	Yes	Yes
Note: CAT5/6 cables are used primarily because they offer a connection speed of 100 Mbps while CAT6 cables support up to 10 Gbps. The network infrastructure is designed for 100 Mbps, therefore CAT6's higher capacity would not be fully utilized in the current setup.						

Table 2 Accessories / Replacement Part

Part Number	Description
SDPPF500PA	Replacement air flow sensor for use if the original sensor is damaged, or becomes inoperable. (Sold in pack of 2)
CW-COV-S-UNITARY	Terminal cover for the modular VAV controllers (sold in pack of 10)

Table 2 Accessories / Replacement Part

Part Number	Description
SCRW-TB-UNI-L	Set of removeable terminal blocks covering all models of Unitary & VAV Controllers.
10BASE-T1L-ADAPT-0	BACnet® IP (T1L) single pair media adapter that allows converting 10BASE-T traffic to 10BASE-T1L without including power supply.

Controller Part Numbers

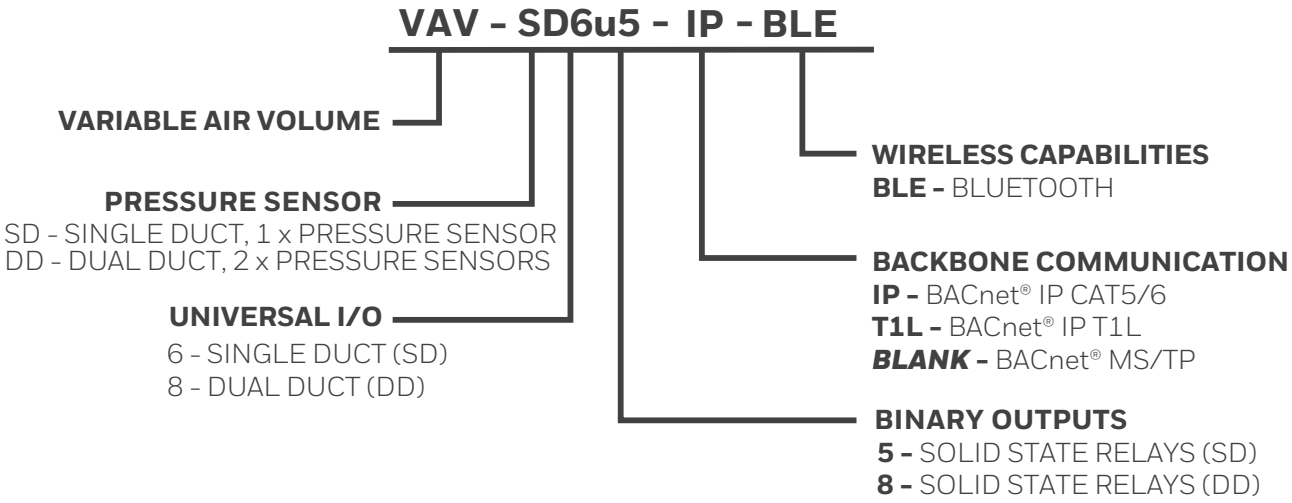


Fig. 1 Controller Part Numbers

Dimension

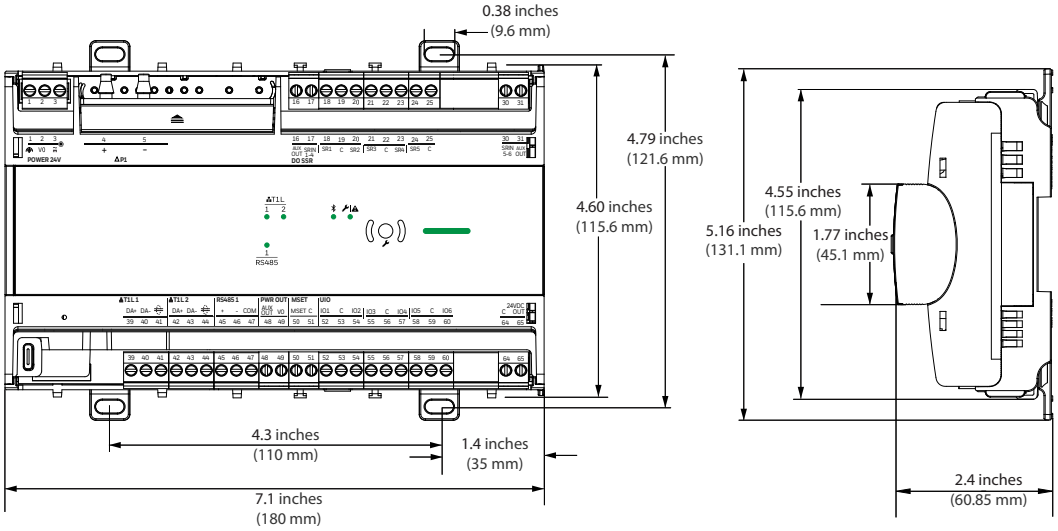


Fig. 2 Single Duct Dimensions

All the models have same dimensions in inches (mm).

Table 3 Dimension

Parameter	Specifications
Dimension (L x W x H)	7.1 x 4.79 x 2.4 inches (180 x 121.6 x 60.85 mm)
Weight	1.256 lbs. (570 g)
Mounting	Mounting in fuse boxes (DIN43880), on DIN rails or surface mounted with optional protection covers.

NETWORK SECURITY

⚠ WARNING

Alerton hereby states that the modular VAV controllers are not inherently protected against all cyber security risks from the Internet and are thus intended solely for use in private or protected networks.

Unprotected Internet connections can expose the Alerton Modular VAV Controllers to cyber security risks.

To ensure a safe and reliable operation, take necessary protective measures, such as locating BMS controls behind a firewall and using a VPN connection for remote maintenance. Numerous third-party manufacturers offer suitable VPN routers. For more details, refer Alerton Security Guide 31-00847.

General Safety Information and Installation Precaution

Follow the safety instructions provided by Alerton in this manual while doing any operation such as installation, mounting, or starting.

- The controllers must be installed and mounted by authorized and trained personnel.
- Except for Alerton, the operation and safety warranties become void in case of any modification.
- Observe all applicable local standards and regulations.
- Use only Alerton supplied or approved accessories.
- Before installing or dismantling the system, disconnect the power supply by removing the power terminal block from the controller or through local isolation.

⚠ CAUTION

You must disconnect the power before installing, removing, or replacing the Alerton Modular VAV Controller. Switch off the power before you install any jumpers.

Read all the instructions below

Follow all instructions to avoid equipment damage or hazardous condition. Read all instructions carefully before installing equipment.

High Voltage safety test

Experienced electricians, at first contact, always assume that hazardous voltages may exist in any wiring system. A safety check using a known, reliable voltage measurement or detection device should be made immediately before starting work and when work resumes.

Lightning and high-voltage danger

Most electrical injuries involving low-voltage wiring result from sudden, unexpected high voltages on normally low-voltage wiring. Low voltage wiring can carry hazardous high voltages under unsafe conditions. Never install or connect wiring or equipment during electrical storms. Improperly protected wiring can carry a fatal lightning surge for many miles. All outdoor wiring must be equipped with properly grounded and listed signal circuit protectors, which must be installed in compliance with local, applicable codes. Never install wiring or equipment while standing in water.

Wiring and equipment separations

All wiring and controllers must be installed to minimize the possibility of accidental contact with other potentially hazardous and disruptive power and lighting wiring. Never place 24 VAC or communications wiring near other bare power wires, lightning rods, antennas, transformers, or steam or hot water pipes. Never place the wire in any conduit, box, channel, duct, or other enclosure containing power or lighting circuits of any type. Always provide adequate separation of communications and another electrical wiring according to code. Keep wiring and controllers at least six feet from large inductive loads (power distribution panels, lighting ballasts, motors, etc.)

SPECIFICATIONS

Hardware

Table 4 Hardware Specification

Parameter	Specification
CPU	Crossover processor NXP I.MRT, Cortex M7
Memory Capacity	64 MB QSPI Flash, 16 MB SDRAM
IP CAT5/6 [1]	2 x RJ-45 ports, 10/100 Mbps with a protection that allows loop topology to continue the communication with other controllers even if one node fails, when used with an RSTP manage switch.
IP T1L [2]	2 x T1L with fail-safe, supporting up to 10 Mbps, and featuring a protection mechanism that ensures communication continues with other controllers even if one node fails.
MS/TP [3]	MS/TP operates over twisted pair cabling in a bus topology, facilitating communication with the controllers at speeds ranging from 9.6 kbps to 115.2 kbps through a master-slave configuration.
Real Time Clock	24 hours backup after power failure. After 24 hours, the time will reset to factory default time until the user performs time sync via BACnet® or Network Time Protocol (NTP)
Small LED	Transmission or reception of IP T1L/Modbus/Bluetooth signal (green) and service pin status.
Large LED	Controller status (green, yellow, and red).
NOTE: 1. Applicable for IP CAT5/6 variant only. 2. Applicable for IP T1L variant only. 3. Applicable for MS/TP variant only.	

Electrical

Table 5 Electrical Specifications

Parameter	Specification
Rated Input Voltage	20 - 30 VAC / 24 - 30 VDC
Nominal Power Consumption	• BACnet® IP CAT5/6: 10 VA • BACnet® MS/TP: 7 VA • BACnet® IP T1L: 9 VA

Table 5 Electrical Specifications

Full Load Power Consumption (Communication, Bluetooth, Universal IO, and 24 VDC, excluding the load on the SSRs). **NOTE:** For the current consumption of SSR, refer SSR section table below.	• BACnet® IP CAT5/6: 36 VA • BACnet® MS/TP: 33 VA • BACnet® IP T1L: 36 VA
Frequency Range	50 - 60 Hz
Auxilary Power Output	1 x 24 VAC/VDC at 300 mA
	1 x 24 VDC at 75 mA
Impulse Voltage	330 VAC
Type Of Loads	Resistive or inductive loads
Material Group	IIIb
Classes Of Control Function	Class A control
Type of Output Waveform	Sine wave or DC voltage

Supported Devices

Table 6 Supported devices

Parameter	Specification
Microset Wall Modules	Microset 4: MS4-TH, MS4-TH-NL, MS4-THC Microset II: MS-2000-BT, MS-2000-BT-NL, MS-2000H-BT
Microtouch Wall Modules	TS-1050-BT, TS-1050-BT-NL
Modbus Devices	Modbus RTU devices from any manufacturer including Honeywell Modbus devices. Example: TR100, TR50, TC300, DALI64MODPSUF/S

Operational Environment

Table 7 Operational Environment

Parameter	Specification
Storage Temperature	-40 °F to 150 °F (-40 °C to 66 °C)
Operating Temperature	-40 °F to 149 °F (-40 °C to 65 °C)
Humidity	5 % to 95 % non-condensing
Protection	IP20, NEMA 1
Pollution Level	2

Solid State Relay

Table 8 Solid State Relay Specification

Specification
SSR works with maximum 24 VAC / VDC
1.5 A constant current accross all 6 SD/ 8 DD outputs; 3.5 A inrush for 0.1 seconds per SSR output.
Factory installed jumper (pin 16 to 17 and 30 to 31) between 24 VAC or 24 VDC supply and SSR input shared by all SSRs.
The fuse should be 5 A, for example, 0AGC005.V, OAGW005.VP or BK/AGW-5, and the fuse folder, for example, 150603 or BK/HRK-R.

Wire Gauge

Table 9 Wire Gauge

Parameter	Specification
Power Input	12 - 14 AWG
SSR Output and SRIN	22 - 18 AWG
IP T1L	18 - 23 AWG, Twisted Pair, Shielded Al-Foil and Cubraid tinned
Note: 1. For more details about wiring, refer Selecting a power supply wire on page 17 2. For more details about IP T1L Cable Specifications refer IP T1L Cable Specifications on page 8	

Universal IO

Table 10 Universal IO Specification

Parameter	Specification
AI	• 16-bit universal inputs accept 10 k thermistor (type II and III), 3 thermistor, dry contact, 1k platinum RTD, 0-20 mA, 0-10 V, or dry-contact pulse. Pulse input maximum frequency of 100 Hz. Pulse input minimum duty cycle 5 ms ON / 5 ms OFF. • **Sensors:** 10K Ohm NTC Type II, 10K Ohm NTC Type III, PT1000, 100 Ohm to 100K Ohm resistive (custom characteristic).
BI	• Dry contact binary input. • Pulse input with maximum frequency 100 Hz, minimum pulse width 5 ms.

Table 10 Universal IO Specification

Parameter	Specification
AO	• Voltage output with 0-10 VDC • Current output with 0-20 mA. • 16-bit analog output.
DO	0...10 VDC at 20 mA binary output with direct/reverse.
NOTE: Some 4-20 mA input sensors may need an external resistor to function properly. Please refer to the sensor's documentation.	

Communication

Table 11 Communication Specification

Parameter	Specification
Protocol Supported	• BACnet®/Ethernet, BACnet®/IPv4, BACnet®/IPv6 • BACnet® MS/TP • Modbus RTU (Master) • Rapid Spanning Tree Protocol (RSTP) • Network Time Protocol (NTPv4) • Bluetooth (Optional)
IP Addressing Modes	• Dynamic: Full duplex (IPv4 and IPv6) addressing, DHCP, SLAAC, Link-Local addressing. • Static: Assigned

IP T1L Communication

Table 12 IP T1L Communication Specification

Parameter	Specification
10 BASE-T1L Standard	802.3cg-2019
Connection	Screw terminal, auto MDI-X
Cable Types	18 - 23 AWG, Twisted Pair, Shielded Al-Foil and Cubraid tinned. For more details about IP T1L Cable Specifications refer IP T1L Cable Specifications on page 8.
Distance	Maximum distance between controllers support upto 3281 ft. (1000 m) based on cables characteristics. For more details about cable type and characteristics refer to the IP T1L Network Specification Guide.
Transmission Rate	10 Mbps

IP T1L Cable Specifications

Table 13 IP T1L Cable Specifications

Cable	Typical Use	Cable Characteristics	Maximum distance (between working nodes)
74040NH – Belden [2]	IP T1L- Long distance harsh environments	2 cores solid 18 AWG,SF/UTP Shielded and foil, unshielded twisted pair.	1000 m
8471 – Belden [2]	LON	2 cores stranded/tinned 16 AWG, unshielded cable.	560 m
9841 – Belden [2] IP TP/1/1/24/200/HF- 600V	MS/TP (Serial)	2 cores stranded/tinned 24 AWG, Foil shield & drain wire, twisted pair.	400 m
8723NH – Belden [2] [3] IP TP/2/2/22/200/HF- 600V	Trend 4 wire LAN	4 cores, 2 pairs, stranded/tinned, 22 AWG, Foil shield & drain wire, twisted pairs.	200 m
8761NH – Belden [2] IP TP/1/1/22/200/HF- 600V	Trend 2 wire LAN	2 cores stranded/tinned, 22 AWG, Foil shield & drain wire, twisted pairs.	320 m
5501UE 0081000 – Belden/BAV	Security, speaker, PA, & telephone systems	3 cores stranded bare copper, 22 AWG, no shield or twist.	600 m
82836 – Helukabel [1]	Profibus - Industrial Ethernet	2 cores solid, 18 AWG Foil + braded screen twisted pair.	800 m
3076F – Belden [1]	Harsh environment digital and serial two-way communication	2 cores solid 18 AWG, Shielded and foil, unshielded twisted pairs.	428 m
Helukabel J-Y(ST)YLG [1]	Telecommunications & Fire Alarm Cable (Fire Warning Cable)	Multicore solid bare copper, 20 AWG (0.8 mm), foil wrapped.	320 m
Cat5/Cat6	Standard wired IT network cable	8 core, 4 pairs, solid bare copper, 23 AWG, twisted pairs.	720 m
0043280ALR - Windy City Wire	BACnet, Alerton Ascent & BACTALK MS/TP Plenum, VLXEXP Comm Bus, IBEX Alerton LAN Plenum	22 AWG 2 Conductor Tinned Copper, Shielded Plenum Lo-Cap	600 m
042002 - Windy City wire 24-1P OAS STR CMP LC Org Jkt/ 24AWG	BACnet/RS232/485/T1L	1 Pair, 24 AWG Tinned Copper Shielded RS-232, RS-422, RS-485 Low-Capacitance Communication, Instrumentation and Special Application Plenum Cable	300 m

Depending on the cable type and assuming the distance between functional nodes does not exceed the maximum stated above, the maximum number of offline IP T1L devices on the bus varies between 2 and 10 for daisy-chaining to remain functional.

1. Testing source - Analog Devices standard IP T1L cable testing.

2. Testing source - Analog Devices & Honeywell device testing.

3. Do not combine pairs as this impacts performance.

HARDWARE OVERVIEW

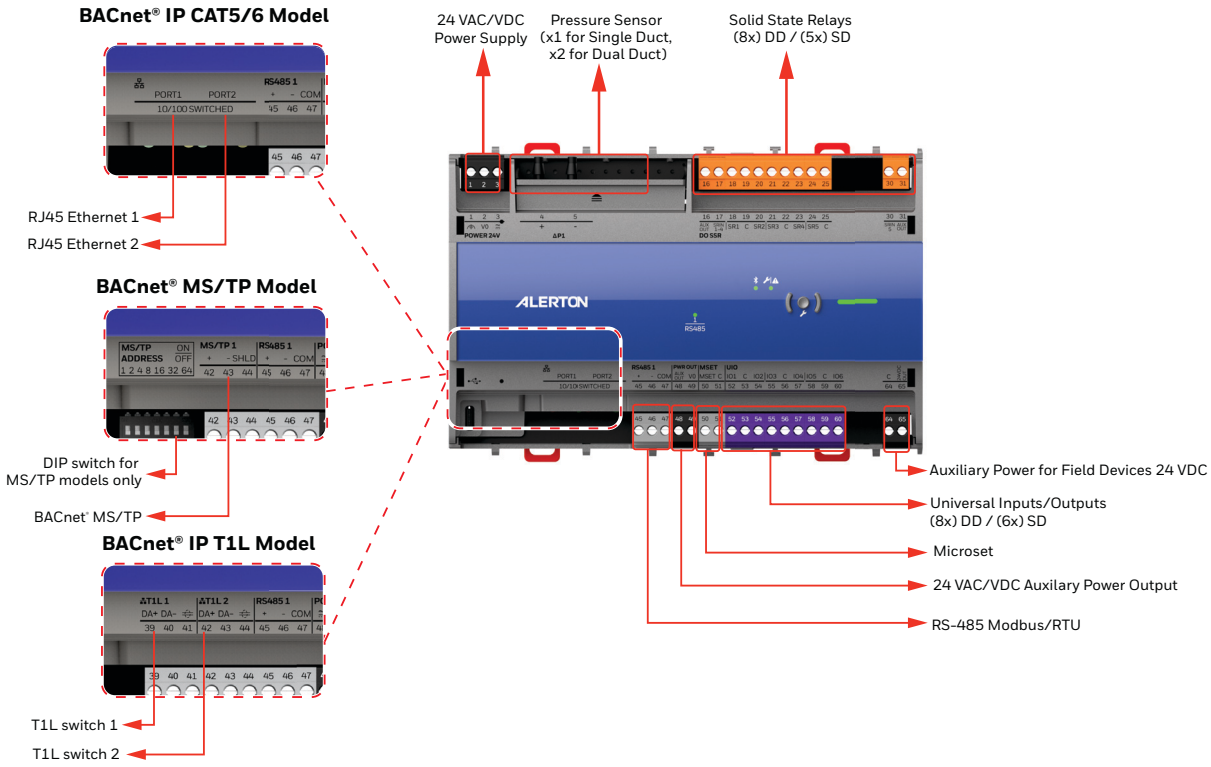


Fig. 3 Hardware Overview

System Overview

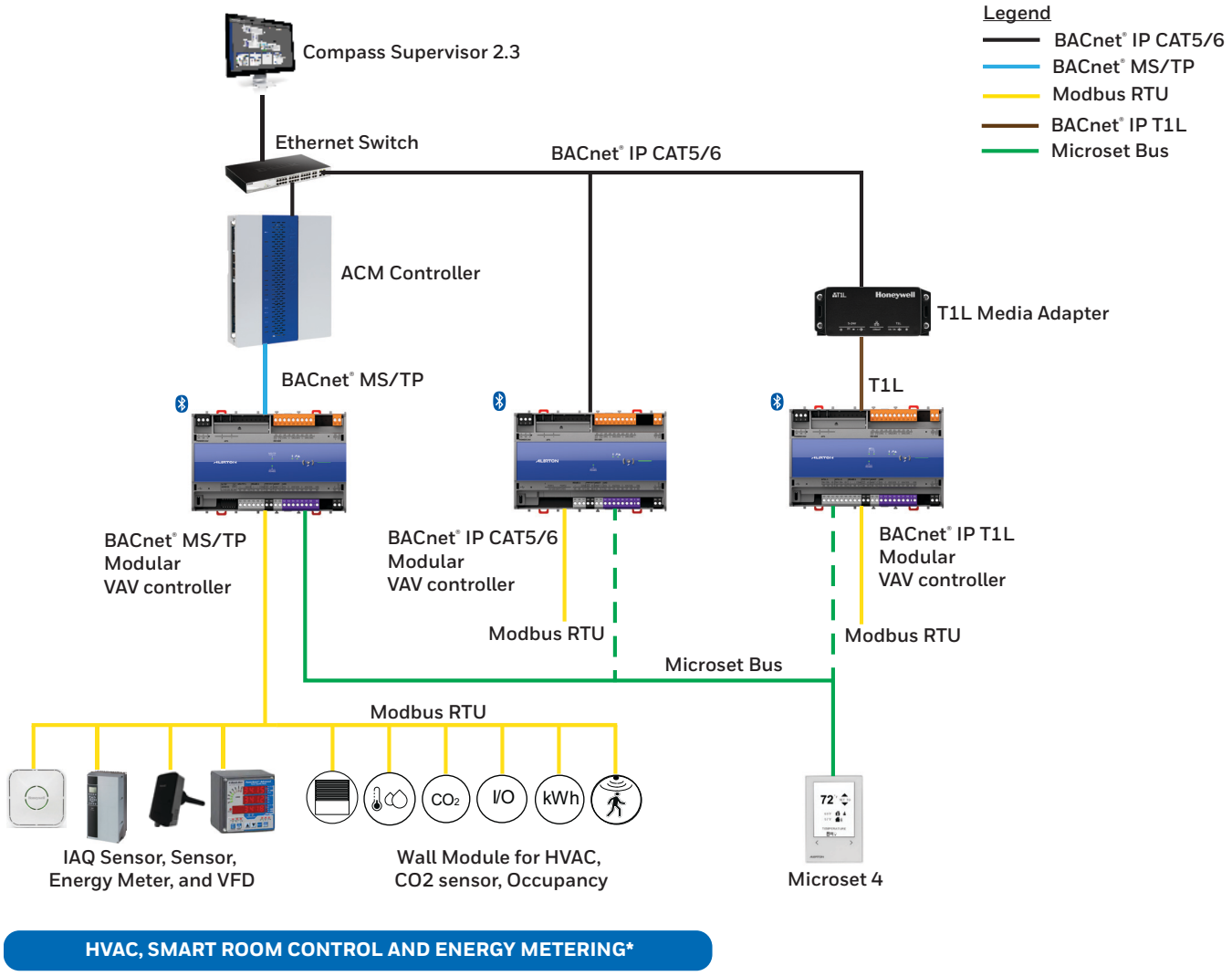


Fig. 4. System Overview

*Devices subject to local availability, Contact your local sales representative for information on available device on your region.

Service Button

Fig. 3 shows the hardware overview with the location of the service button, The service button is used to trigger dedicated events. It is important to distinguish different controller behaviors elicited depending on whether the service button is pressed when the controller is powering up or in normal operation.

See the following dedicated events:

To factory reset the controller, user must follow the below steps:

- Power-cycle the controller and simultaneously press the service button for 5 seconds until yellow status LED flashes twice.
- The device will erase each file stored in the controller. The time it takes to erase depends upon the amount of data stored in the controller, it can go from 15 to 90 seconds. During this period the status LED stays off.
    - The application is cleared from the controller.
    - The device instance will revert to its default 4194303.
    - The device name will revert to default.
      e.g: (1) For Single Duct Controller IP CAT5/6 with BLE, device name will revert to VAV-SD6u5-IP-BLE.
      (2) For Dual Duct Controller IP T1L without BLE, device name will revert to VAV-DD8u8-T1L.
    - The Ethernet, BACnet IPv4, and BACnet IPv6 settings will revert to their factory settings. The IP address will be reset to default 192.168.1.200 BACnet over Ethernet communication enabled.
- Status LED will flash yellow twice indicating that the factory reset has finished.
- Device will reboot.

NOTE:
Before performing a factory reset, user must remove the Device entry from The Compass Device Manager. If user fails to do, the device may reset, but it will change the default device instance from 4194303 to the actual instance in the Device Manager.

NOTE:
Pressing Service Button during normal operation will not result in any action. This feature is reserved for future use.

Mounting

Before Installation

IMPORTANT:
It is recommended that the unit be kept at room temperature for at least 24 hours before applying power. This is to allow the evaporation of any condensation resulting from low shipping / storage temperatures.

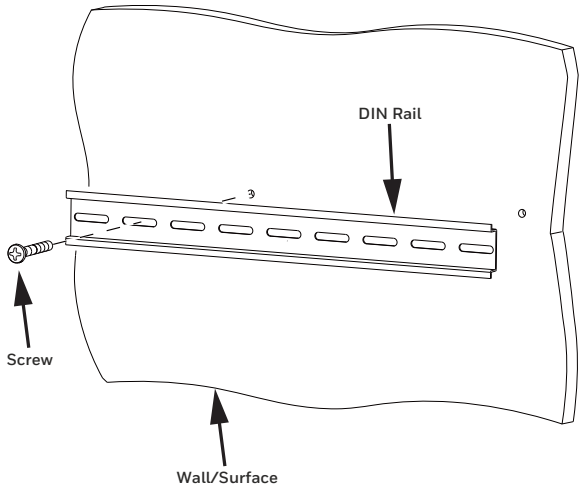
NOTE:
Avoid mounting in areas where acid fumes or other corrosive vapors can harm the metal parts of the controller or in areas where escaping gas or other explosive vapors are present.

IMPORTANT:
US requirement, only: This device must be installed in a UL-listed enclosure offering adequate space to maintain the segregation of the line voltage field wiring and Class 2 field wiring.

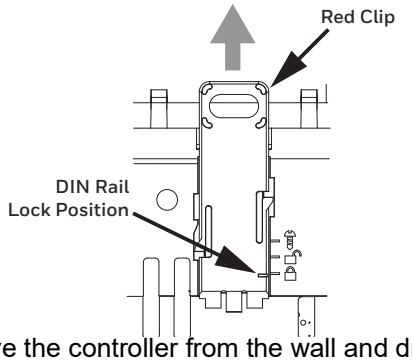
CAUTION
To avoid electrical shock or equipment damage, you must switch OFF the power supply before attaching or removing connections to or from any terminals.

DIN Rail Mounting

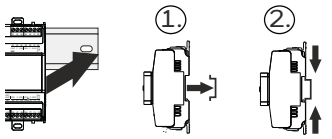
1. Mount the DIN rail on the wall/surface by using screws.



2. Extend all red mounting clips to the unlock position as shown in figure 7.



3. Remove the controller from the wall and drill four holes at the marked locations.

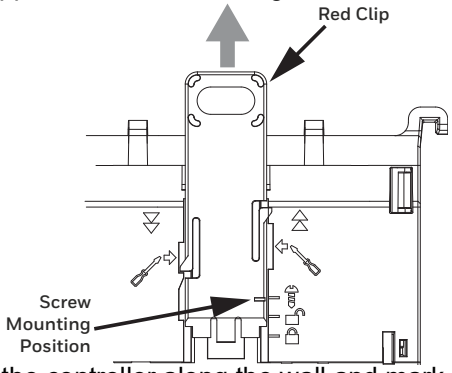


4. Insert anchors into the four mounting screw holes.
5. Place the controller on the wall/panel so that the holes are aligned. Insert the screws into the topside holes first and fasten them with a screwdriver
6. Insert the screws into the bottom hole and fasten them with a screwdriver.

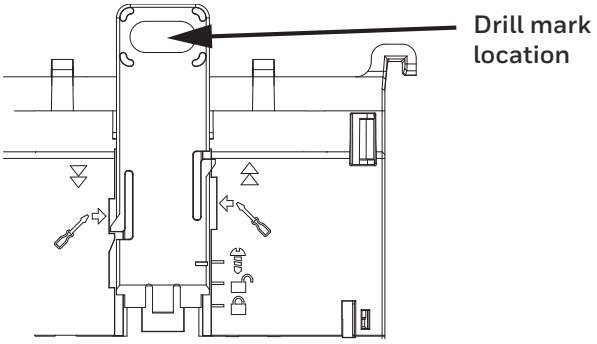
NOTE:
It is recommended to use the 6/18 1-inch pan head Phillips tapping screws.

Wall Mounting

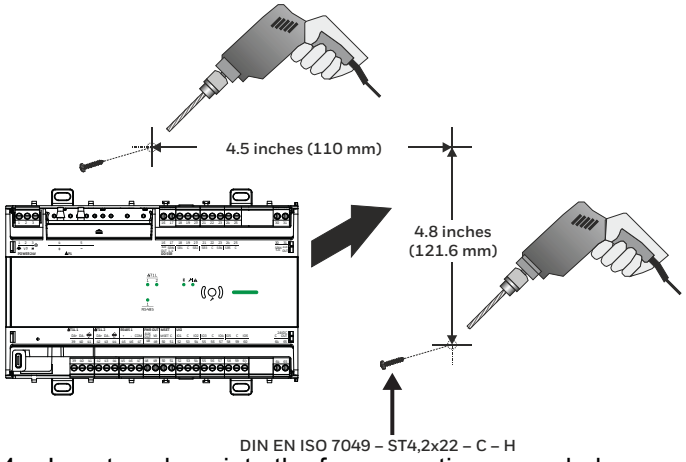
1. Extend all red clips to the screw mounting position by inserting the flat blade screwdriver at a marked location and move up the nod from the lower slot to the upper slot as shown in figure 9.



2. Hold the controller along the wall and mark drilling locations through the screw red clip slots, as shown in figure 10.



3. Remove the controller from the wall and drill four holes at the marked locations.



4. Insert anchors into the four mounting screw holes.
5. Place the controller on the wall/panel so that the holes are aligned. Insert the screws into the topside holes first and fasten them with a screwdriver.
6. Insert the screws into the bottom hole and fasten them with a screwdriver.

NOTE:
It is recommended to use the 6/18 1-inch pan head Phillips tapping screws.

Airflow Sensor Connection

Connect the airflow pickup to the two restrictor ports on the controller.

NOTE:

Use 1/4 in. (6 mm outside diameter and 5 mm inner diameter), with a 3/64 in. (1 mm) wall thickness, plenum-rated 1219 FR (94V-2) tubing.

You should always use a fresh cut on the end of the tubing that connects to the airflow pickups and the restrictor ports on the controller. Secure the connection using a zip tie (procured locally).

When twin tubing is used from the pickup, split the pickup tubing a short length to accommodate the connections.

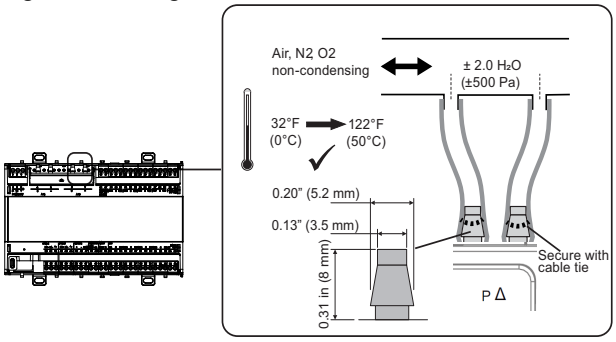


Fig. 5 Airflow Pickup Connections

NOTE:

The modular VAV controller is polarity sensitively and should be connected according to (+ and -).

Differential Pressure Installation Recommendations

Alerton Modular VAV controllers must be powered up for a minimum of an hour before performing the zero calibration.

The tubing from the airflow pickup to the controller should not exceed 3 ft (1 m). Any length greater than this will degrade the flow sensing accuracy.

Use caution when removing tubing from the connector. Always pull straight away from the connector or use diagonal cutters to cut the edge of the tubing attached to the connector. Never remove by pulling at an angle.

NOTE:

- Dust particle contamination may be present in some applications. Take appropriate steps to limit particulate contamination.
- The sensing element is parallel to the air stream and tends to direct the dust particles in the airflow stream past the sensing element away from the sensing bridge.
- The sensing element is a micro-structure-based device. Two platinum sensing elements and a heater are used in the bridge part of the sensing element assembly. The heater repels dust particles due to a thermophoretic action. It keeps the majority of the dust off the bridge structure. The heat effect, along with a simple filter, can help keep the dust from causing output shifts in the device's output.
- Although the sensor naturally repels dust, some dust and contamination can still collect on the micro-structure. Dust adherence to chip edges and channel surfaces can be prevented by using a simple filter. A disposable five-micron filter used in series on the upstream side of the airflow divide will provide adequate filtering in most applications.

Airflow Sensor Replacement

Procedure to replace the airflow sensor is as follows:

1. Gently pull the sensor cover outward and rotate it by 75 °.

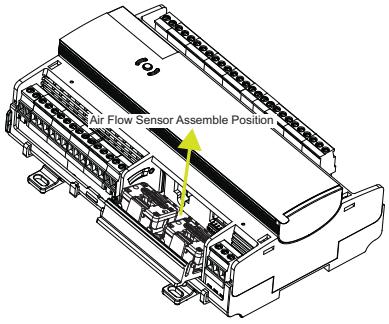


Fig. 6 Airflow Sensor Position

2. Disconnect the electrical connector by gently pulling it away from the differential pressure sensor.
3. Replace the airflow sensor.

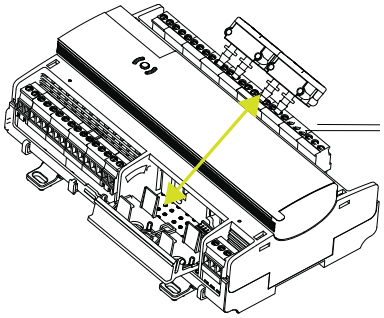


Fig. 7 Replace the Airflow Sensor

4. Attach the electrical connector.
5. Close the cover.

NOTE:

Replacement airflow sensor part available at SDPPF500PA.

POWER SUPPLY

General Information

To prevent a risk of injury due to electrical shock and/or damage to the device due to short-circuiting, low voltage and high-voltage lines must be kept physically separate. To prevent a risk of short-circuiting and damage to your modular VAV controllers, do not reverse the polarity of the power connection cables and avoid ground loops (connecting one field device to several controllers).

Before wiring the controller, determine the input and output device requirements for each controller used in the system. Select input and output devices compatible with the controller and the application. Consider the operating range, wiring requirements, and environmental conditions while selecting input and output devices.

Determine the location of controllers, sensors, actuators, other input, and output devices, and create wiring diagrams for illustrations of typical controller wiring for various configurations.

The application engineer must review the control job requirements. This includes the sequence of operation for the controller and the system as a whole. Usually, some variables must be passed between the controllers that are required for optimum system-wide operation. Typical examples are the TOD, occupied, unoccupied, outdoor air temperature, and demand limit control signal. Understanding these interrelationships early in the job engineering process is vital for proper implementation while configuring the controllers.

NOTE:
All wiring must comply with applicable electrical codes and ordinances. Refer to the job or manufacturers' drawings for details. Local wiring guidelines (for example, IEC 364-6-61 or VDE 0100) may take precedence over recommendations provide in these installation instructions.
To comply with CE requirements, devices having a voltage of 50-1000 VAC or 75-1500 VDC, but lacking a supply cord, plug, or other means for disconnecting from the power supply must have the means of disconnect incorporated in the fixed wiring. This type of disconnect must have a contact separation of at least 1/8 in. (3 mm) at all poles.

Power Wiring

All wiring must comply with applicable electrical codes and ordinances as specified on installation wiring diagrams. Controller wiring is terminated to the screw terminal blocks located on the device.

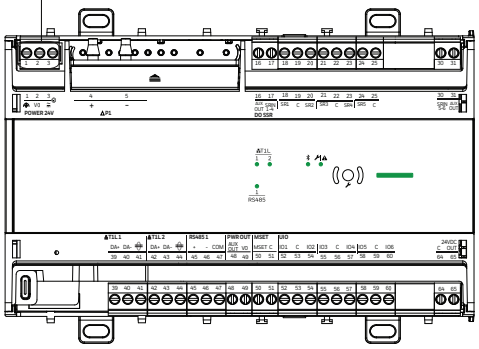
NOTE:
A single transformer can power more than one controller. The same side of the transformer secondary must be connected to the same power input terminal on each controller. Fig. 8 shows the power wiring details for multiple controllers. Controller and configuration are not necessarily limited to three devices, but the total power draw, including accessories, cannot exceed 100 VA when powered by the same transformer (U.S. only).

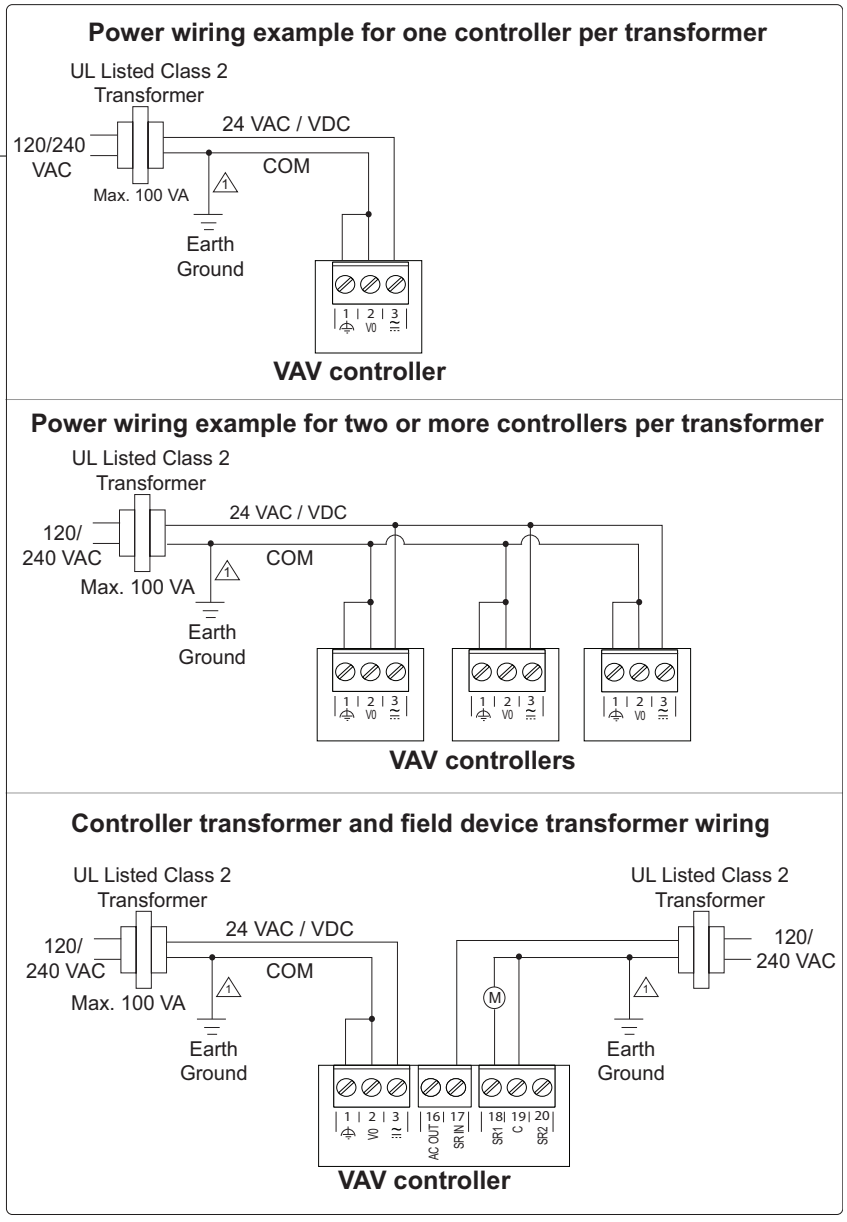
NOTE:
Power must be off prior to connecting or removing connections from the 24 VAC power (24 V~ / 24 V) and 20 VDC power terminals (PWR OUT, Aux out). Use the heaviest gauge wire available, up to 12 AWG (3.3 mm^2), with a minimum of 14 AWG (2.5 mm^2), for all power wiring.

CAUTION
To prevent a risk of short-circuiting and damage to your controller and external devices, do not reverse the polarity of the power supply connection cables.

IMPORTANT:
Power multiple controllers from a single transformer and connect the same transformer secondary side to each device's power input terminal. When connecting power, ensure that one leg of the 24 VAC/VDC secondary circuit and the grounded terminal on the device connect to a known earth ground at the panel or enclosure. Be cautious not to exceed the power consumption limit of the transformer. Limit the distance of the power wire running between the device and the transformer to 400 feet (122 meters) for 18 AWG wire (If the distance limit exceeds 400 feet (122 meters) it may lead to voltage drop, overheating, reduce efficiency and signal loss).
For installation purposes, the installer is responsible for appropriately selecting the AWG gauge to ensure safe and efficient operation. If there are any doubts, they can be resolved through our engineering technical support to avoid any misunderstandings. Restrict installations to the same room. The transformer must be UL Listed for smoke control and needs to be mounted and installed in an enclosure. Use a 15407287 series power supply.

Power Wiring Examples





⚠1 WHEN CONNECTING POWER TO THE VAV CONTROLLERS, CONNECT THE COM OF THE VAC SECONDARY CIRCUIT TO A KNOWN EARTH GROUND.

Fig. 8 Power Wiring Example

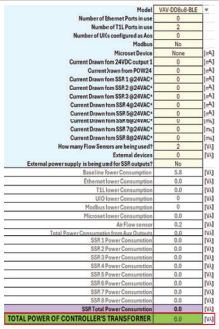
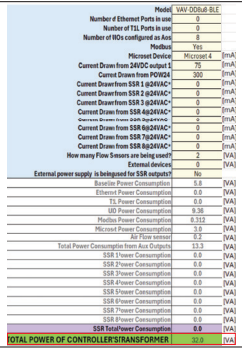
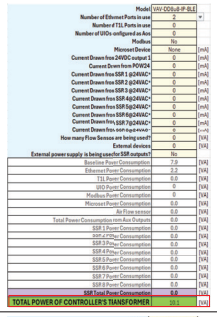
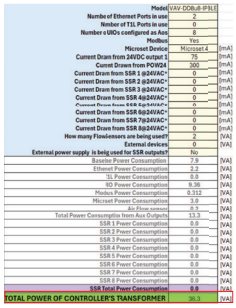
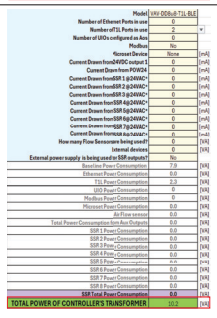
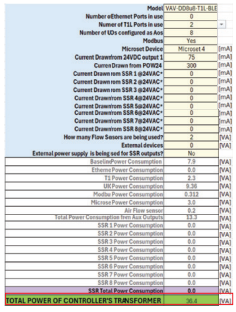
Total Power of Controller's Transformer	Nominal Power Consumption	Total Power of Controller's Transformer	Maximum Power Consumption
	**SKU:** VAV-8u8-BLE **Power:** 7 VA **Loads Exercised:** UIOs x 0 POW24 - 0 AUX OUT x 0 Flow Sensor x 0 Microset - 0 Modbus - 0 MS/TP Ports x 0		**SKU:** VAV-8u8-BLE **Power:** 33 VA **Loads Exercised:** UIOs x 8 POW24 24 VDC x 1 Flow Sensor x 2 Microset Modbus
	**SKU:** VAV-8u8-IP-BLE **Power:** 10 VA **Loads Exercised:** UIOs x 0 POW24 - 0 AUX OUT x 0 Flow Sensor x 0 Microset - 0 Modbus - 0 IP Ports x 0		**SKU:** VAV-8u8-IP-BLE **Power:** 36 VA **Loads Exercised:** UIOs x 8 POW24 24 VDC x 1 Flow Sensor x 2 Microset Modbus IP Ports x 2
	**SKU:** VAV-8u8-T1L-BLE **Power:** 9 VA **Loads Exercised:** UIOs x 0 POW24 - 0 AUX OUT x 0 Flow Sensor x 0 Microset - 0 Modbus - 0 T1L Ports x 2		**SKU:** VAV-8u8-T1L-BLE **Power:** 36 VA **Loads Exercised:** UIOs x 8 POW24 24 VDC x 1 Flow Sensor x 2 Microset Modbus T1L Ports x 2
Note: The Nominal Power Consumption does not include (SSR, Relay, UIO, AC/DC output). Only the controller is connected to transformer.		**Note:** The Maximum Power Consumption include (External Devices, Communication, Bluetooth Universal IO output and 24 VDC output, excluding the load on the SSRs and Relays).	

Fig. 9 Power Consumption Details

NOTE:
The Transformer sizing tool for each controller is available on the product page of the ASN.

⚠ CAUTION

Risk of Electric Shock: More than one disconnect switch may be required to de-energize the equipment before servicing. To Reduce the Risk of Fire or Electric Shock, Do Not Interconnect the Outputs of Different Class 2 Circuits.

Grounding

Building earth ground (terminal 1) is a functional grounding, and it does not offer shock protection from a hazardous voltage. Connect the building earth ground (terminal 1) to the panel ground using the proper cable as shown above. Ensure that the panel ground connects to a known earth ground.

Selecting a power supply wire

Using the correct wire size is critical for long power supply wiring runs. If the wire is too small, the resistance can be too high, resulting in a low voltage supply to the Modular VAV Controllers. This is known as line loss. The wire size is based on the length of the wire run and the current draw of the Modular VAV to be powered.

Figure below describes the wire size based on maximum current draw and distance between the transformer and the Modular VAV Controller.

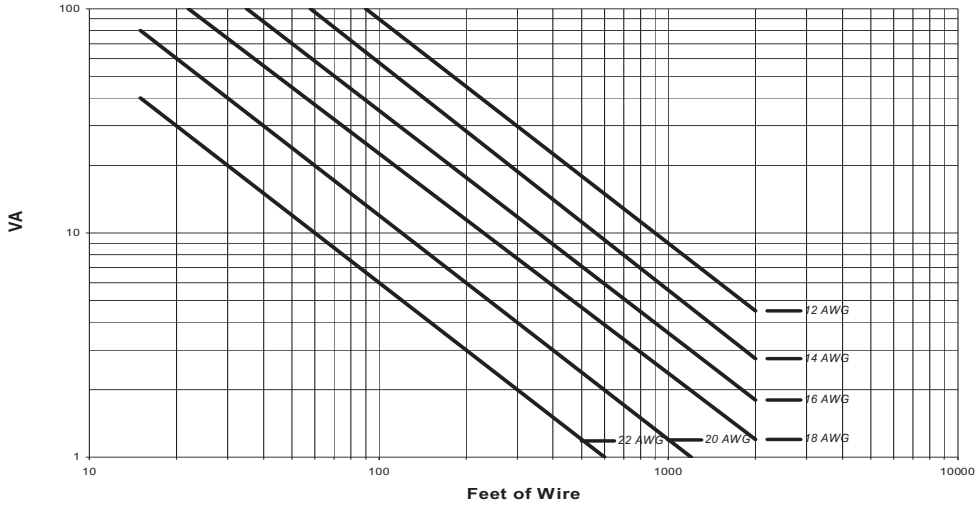


Fig. 10 Determining the appropriate wire size

For example, follow the below steps to determine the appropriate wire type to power a Modular VAV Controller with a transformer that is 110 feet from the Modular VAV Controller:

1. Find the maximum current drawn. For the Modular VAV Controller, the maximum current draw is 65 VA.
2. As shown in the above figure, find the intersection of the 65 VA line on the vertical axis (y) and 110 feet on the horizontal axis (x).
3. Read the diagonal line to the right of the intersection point.

In this example, use 12 AWG wire or larger. (A smaller AWG designation indicates larger wire.)

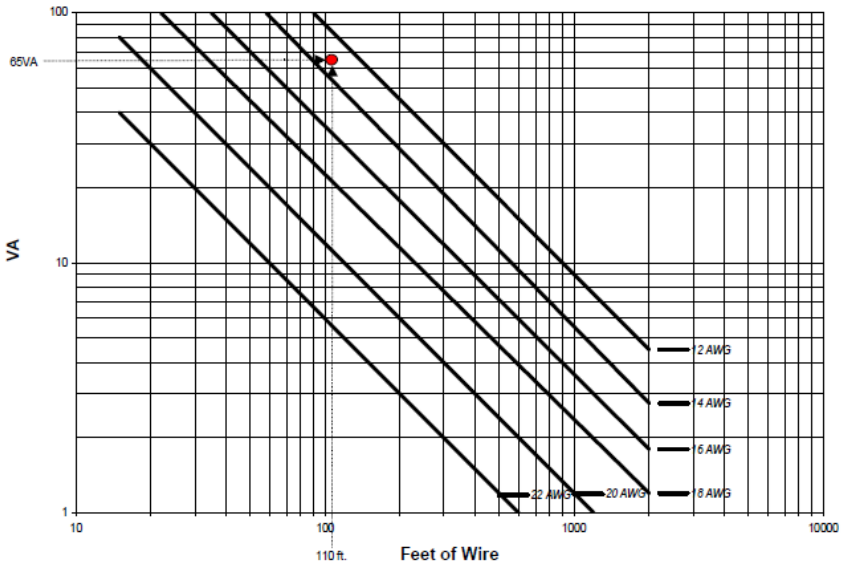


Fig. 11 Example of determining appropriate wire type

INPUT / OUTPUT WIRING

Wiring Requirements

NOTE:
When attaching two or more wires to the same terminal, other than 14 AWG (2.0 mm^2), be sure to twist them together. Deviation from this rule can result in improper electrical contact.

Each terminal can accommodate the following gauge of wire:

- **Single wire**: From 22 AWG (0.3 mm^2) to 18 AWG (1 mm^2) solid or stranded
- **Multiple wires**: Up to two 18 AWG (1 mm^2) stranded, with 1/4 watt wire-wound resistor
  - Prepare wiring for the terminal blocks, as follows:
  - Strip 1/2 in. (13 mm) insulation from the conductor.
  - Cut a single wire to 3/16 in. (5 mm). Insert the wire in the required terminal location and tighten the screw.
  - If two or more wires are being inserted into one terminal location, twist the wires together with a minimum of three turns before inserting them, see Fig. 12.
  - Cut the twisted end of the wires to 3/16 in. (5 mm) before inserting them into the terminal and tightening the screw.
  - Pull-on each wire in all terminals to check for good mechanical connection.

NOTE:
Do not over-tighten the terminal screws to avoid deformation and damage to the terminal block. The maximum torque for the terminal screws is 4.4 in-lb (0.5 Nm).

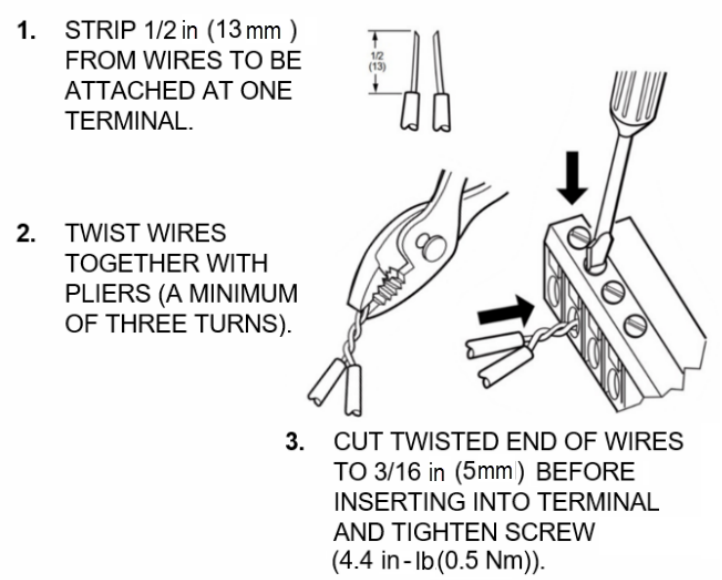


Fig. 12 Attaching Two or More Wires at Terminal Block

Internal Wiring Examples

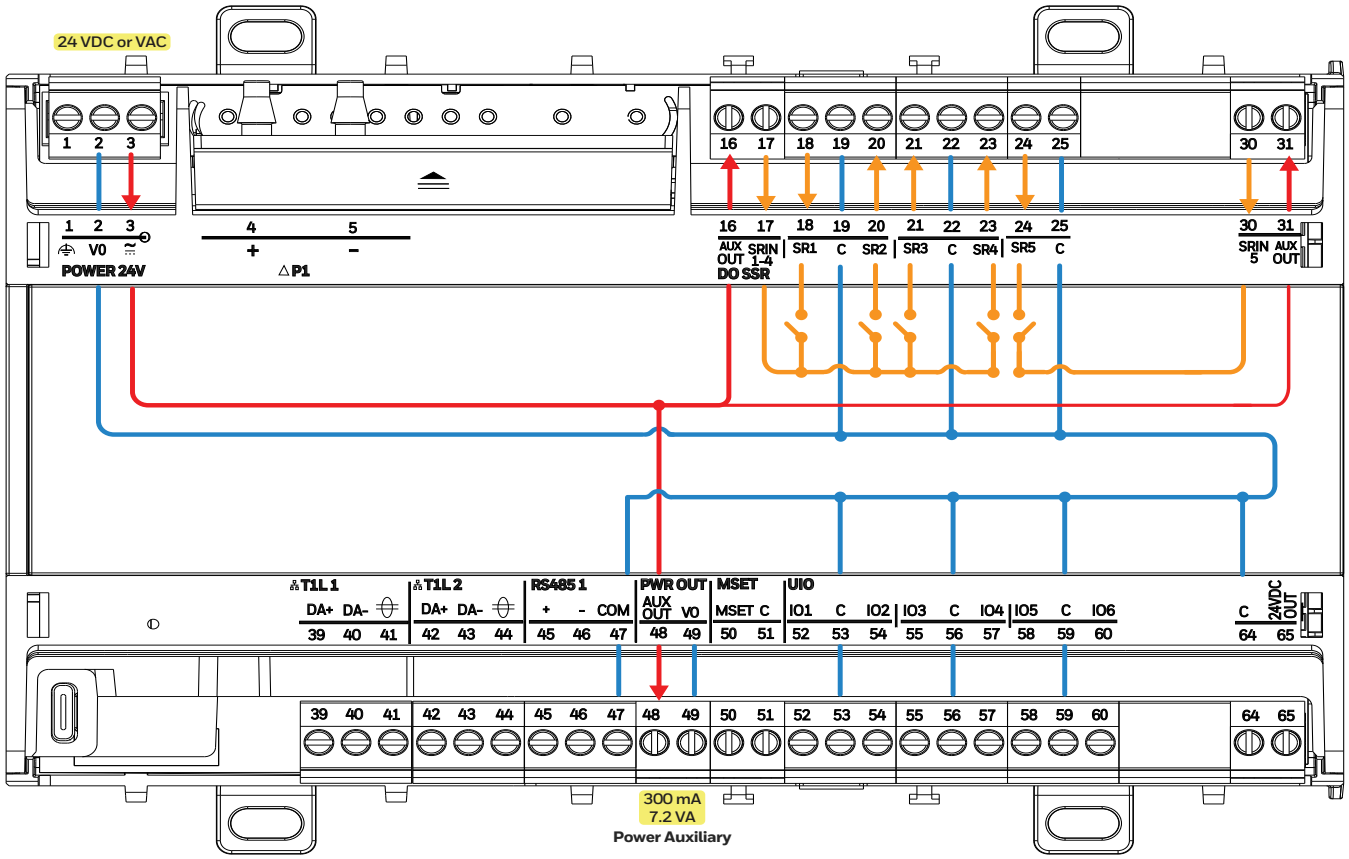


Fig. 13 Internal wiring

Identifying terminals and terminal wire

Each VAV Controller label identifies wiring terminals by number and function. Terminals are numbered from top to bottom, beginning with one on the upper left side of the controller and continuing top-to-bottom on the right side.

Power supply terminals

Three terminals (pin 1,2,3) are used to connect the 24 VAC power supply to the VAV Controller. These are always side-by-side and are usually located on the upper-left or right side of the controller.

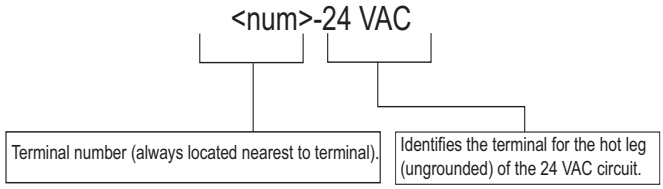


Fig. 14. Power wiring terminals

Grounded terminals

Ground (GND) terminal (pin 1) is used for terminating the grounded leg of the 24 VAC circuit or BO return grounds.

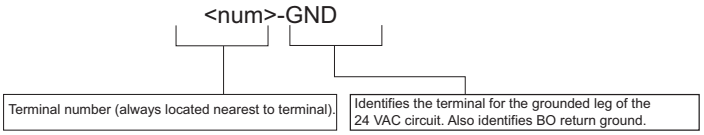


Fig. 15 Grounded terminals

IMPORTANT:
Never terminate input signals to a GND terminal.

Common terminals

Common (COM) terminals (pin 19, 22, 41, 44, 47, 51, 53, 56, 59, 62, 64) (common ground, or input signal return ground) provide a low-impedance connection for input circuitry to the VAV reference ground. Use these to terminate the return ground for inputs.

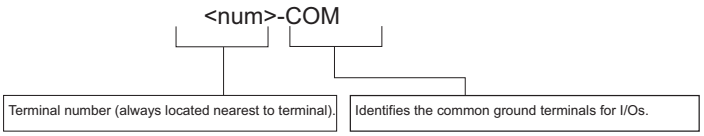


Fig. 16 Common terminals

IMPORTANT:
Input common terminals (those nearest to IN terminals) are internally connected to a separate input ground plane. To maximize input accuracy, always connect input return grounds only to these COM terminals. Do not connect outputs or power grounds to input COM terminals.

Universal inputs and outputs terminals

Use Universal Input terminals (32 to 38, 52 to 72) (in conjunction with adjacent COM terminals) to connect universal inputs.

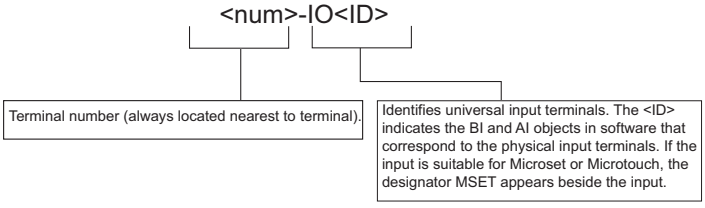


Fig. 17 UIO terminals

24 VDC Source

The 24 VDC source provides low-current 24 VDC to power transducers or other sensors. For non-Integrated VAV devices, this terminal provides a maximum 125 mA.

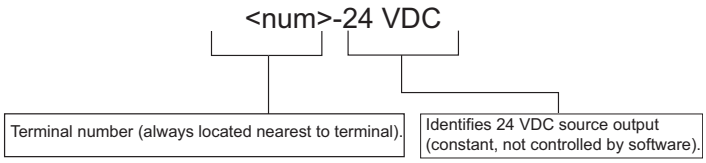


Fig. 18 24 VDC Source terminals

For more details refer Terminal Connections on page 22 and Input / Output Wiring on page 18.

TERMINAL CONNECTIONS

All the terminals for this controller are removable.

Table 14 Terminal Connections Single Duct (VAV-SD6u5)

Terminal	Label	Description
POWER 24V		
1	GND	Earth ground (Connected to building earth ground)
2	V0	Power supply voltage (connected to 24 V0)
3	≂	Power supply voltage (connected to 24 VAC or VDC)
FLOW SENSOR PORTS		
4	^P1 +	Port 1 +
5	^P1 -	Port 1 -
DO SSR		
16	AUX OUT	24 VAC or VDC output (depending on power supply)
17	SRIN	SSR power input
18	SR1	Solid State Relay Output 1
19	C	Common
20	SR2	Solid State Relay Output 2
21	SR3	Solid State Relay Output 3
22	C	Common
23	SR4	Solid State Relay Output 4
24	SR5	Solid State Relay Output 5
25	C	Common
30	SRIN 5	SSR power input for SSR 5
31	AUX OUT	24 VAC or VDC output (depending on power supply)
UIO		
52	IO1	Universal Input / Output 1 (AI-1/BI-1/AO-1/DO-1)
53	C	Common
54	IO2	Universal Input / Output 2 (AI-2/BI-2/AO-2/DO-2)
55	IO3	Universal Input / Output 3 (AI-3/BI-3/AO-3/DO-3)
56	C	Common
57	IO4	Universal Input / Output 4 (AI-4/BI-4/AO-4/DO-4)
58	IO5	Universal Input / Output 5 (AI-5/BI-5/AO-5/DO-5)
59	C	Common
60	IO6	Universal Input / Output 6 (AI-6/BI-6/AO-6/DO-6)
64	C	Common
65	24 VDC OUT	Supplies 24 VDC, 75 mA of current
BACnet® IP CAT5/6 Model		
Port 1	Port 1	Ethernet IP 1, 10/100 Switched

Table 14 Terminal Connections Single Duct (VAV-SD6u5)

Terminal	Label	Description
Port 2	Port 2	Ethernet IP 2, 10/100 Switched
BACnet® IP T1L Model		
39	DA+	T1L Port 1 +
40	DA-	T1L Port 1 -
41	COM	T1L Port 1 Common
42	DA+	T1L Port 2 +
43	DA-	T1L Port 2 -
44	COM	T1L Port 2 Common
BACnet® MS/TP Model		
45	+	MS/TP Port 1+
46	-	MS/TP Port 1-
47	SHLD	Shield
RS485 Bus		
45	+	RS485 Modbus +
46	-	RS485 Modbus -
47	COM	Connected to V0.
Power Output (PWR OUT)		
48	AUX OUT	24 VAC/VDC Auxiliary power output (connected to terminal 3)
49	V0	24 VAC/VDC Auxiliary Power output (connected to terminal 2)
Microset Bus (For Microset II and Microset 4)		
50	MSET	Microset/Microtouch (AI-0).
51	COM	Common

Table 15 Terminal Connections Dual Duct (VAV-DD8u8)

Terminal	Label	Description
		POWER 24V
1	GND	Earth ground (Connected to building earth ground)
2	V0	Power supply voltage (connected to 24 V0)
3	≂	Power supply voltage (connected to 24 VAC or VDC)
		FLOW SENSOR PORTS
4	^P1 +	Port 1 +
5	^P1 -	Port 1 -
6	^P2 +	Port 2 +
7	^P2 -	Port 2 +
		DO SSR
16	AUX OUT	24 VAC or VDC output (depending on power supply)
17	SRIN	SSR power input
18	SR1	Solid State Relay Output 1
19	C	Common
20	SR2	Solid State Relay Output 2
21	SR3	Solid State Relay Output 3
22	C	Common
23	SR4	Solid State Relay Output 4
24	SR5	Solid State Relay Output 5
25	C	Common
26	SR6	Solid State Relay Output 6
27	SR7	Solid State Relay Output 7
28	C	Common
29	SR8	Solid State Relay Output 8
30	SRIN 5-8	SSR power input for SSR 5 to 8
31	AUX OUT	24 VAC or VDC output (depending on power supply)
		UIO
52	IO1	Universal Input / Output 1 (AI-1/BI-1/AO-1/DO-1)
53	C	Common
54	IO2	Universal Input / Output 2 (AI-2/BI-2/AO-2/DO-2)
55	IO3	Universal Input / Output 3 (AI-3/BI-3/AO-3/DO-3)
56	C	Common
57	IO4	Universal Input / Output 4 (AI-4/BI-4/AO-4/DO-4)
58	IO5	Universal Input / Output 5 (AI-5/BI-5/AO-5/DO-5)
59	C	Common
60	IO6	Universal Input / Output 6 (AI-6/BI-6/AO-6/DO-6)

Table 15 Terminal Connections Dual Duct (VAV-DD8u8)

Terminal	Label	Description
61	IO7	Universal Input / Output 7 (AI-7/BI-7/AO-7/DO-7)
62	C	Common
63	IO8	Universal Input / Output 8 (AI-8/BI-8/AO-8/DO-8)
64	C	Common
65	24 VDC OUT	Supplies 24 VDC, 75 mA of current
BACnet® IP CAT5/6 Model		
Port 1	Port 1	Ethernet IP 1, 10/100 Switdched
Port 2	Port 2	Ethernet IP 2, 10/100 Switched
BACnet® IP T1L Model		
39	DA+	T1L Port 1 +
40	DA-	T1L Port 1 -
41	COM	T1L Port 1 Common
42	DA+	T1L Port 2 +
43	DA-	T1L Port 2 -
44	COM	T1L Port 2 Common
BACnet® MS/TP Model		
45	+	MS/TP Port 1+
46	-	MS/TP Port 1-
47	SHLD	Shield
RS485 Bus		
45	+	RS485 Modbus +
46	-	RS485 Modbus -
47	COM	Connected to V0.
Power Output (PWR OUT)		
48	AUX OUT	24 VAC/VDC Auxiliary power output (connected to terminal 3)
49	V0	24 VAC/VDC Auxiliary Power output (connected to terminal 2)
Microset Bus (For Microset II and Microset 4)		
50	MSET	Microset/Microtouch (AI-0).
51	COM	Common

UIO Wiring Examples

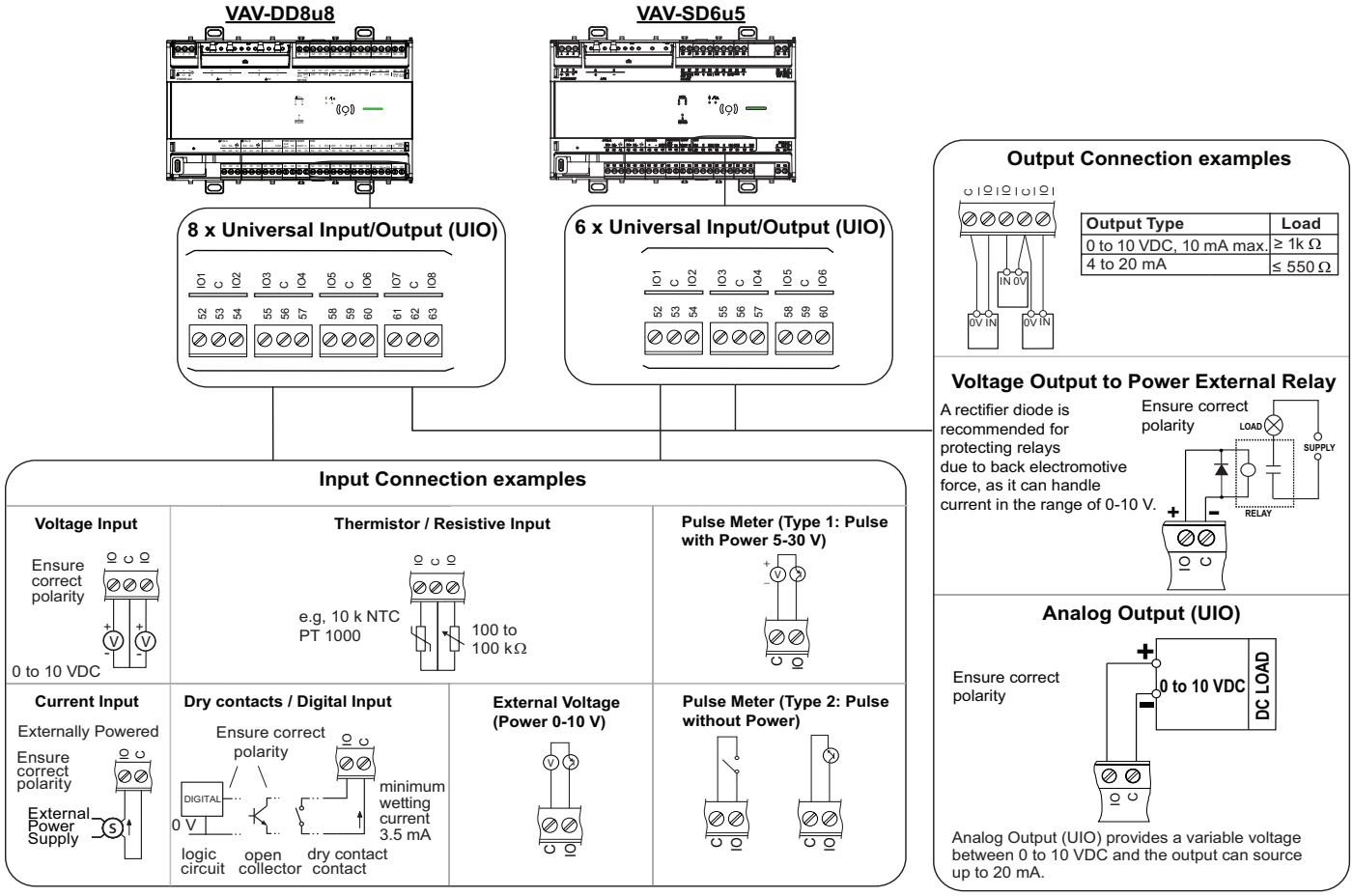


Fig. 19 Universal IO Wiring Examples

NOTE:

- UL Standards recommend all wiring connections for the IO, SSR, 24 VAC / VDC circuits are restricted to the same room.
- Use a protective diode for any circuit that allows the current to flow forward because the current will not flow in the reverse direction. The diode protects the components responsive to the current flow through them in the wrong direction.

SSR (DO) Wiring Examples

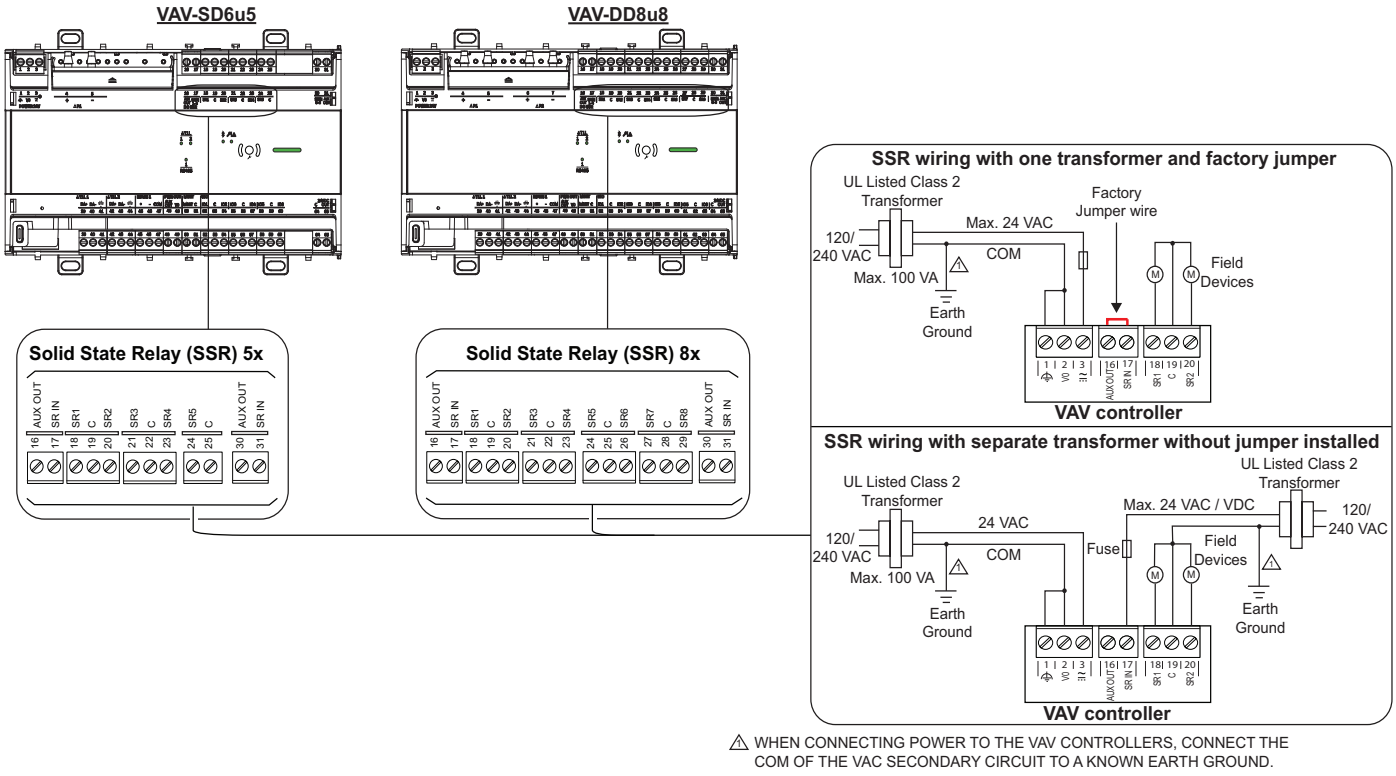


Fig. 20 SSR (DO) Wiring Examples

NOTE:

- SR IN (terminal 17, SSR power input) is connected to AUX OUT (terminal 16 / terminal 31, 24 VAC~ output) by a jumper wire provided by the factory.
- Remove the jumper if you want to power field devices with an external power supply - 24 VAC transformer or 20 VDC.
- All terminals are protected against short circuit and 24 VAC.
- Use wire only.

⚠ CAUTION

Risk of Electric Shock: More than one disconnect switch may be required to de-energize the equipment before servicing.

Auxiliary Wiring Examples

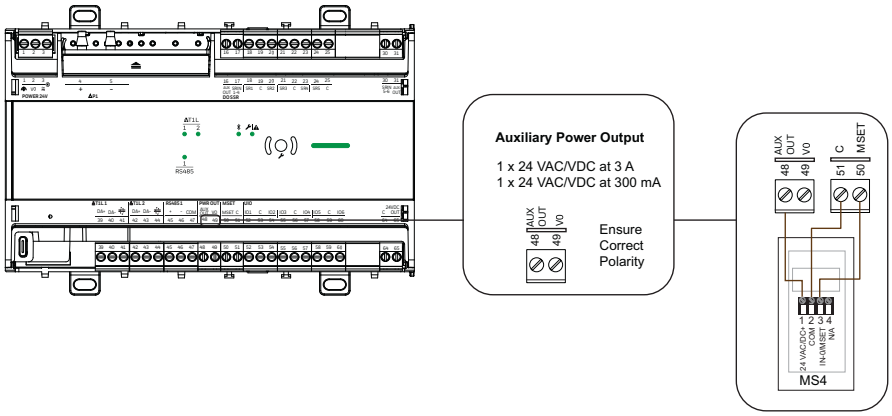


Fig. 21 Auxiliary Wiring Examples

NOTE:

The auxiliary power output (terminals 48 and 49) supplied by the controller is connected to the MS4 power supply at terminals 1 and 2. The polarity of the external devices must be checked with the controller input power supply. If the polarity is reversed, external devices may be damaged.

BACNET MS/TP CONNECTION

Each MS/TP controller communicates on the site-wide BACnet® system over a twisted-pair MS/TP LAN, which uses the TIA/EIA 485 signaling standard in a Master/Slave network. Controllers are master devices on the MS/TP LAN capable of the following baud rates: 9.6, 19.2, 38.4, 76.8 and 115.2 kbps, which uses a high-quality TIA/EIA 485 transceiver and exerts 1/8-unit load on the MS/TP network. The controller features a 2-wire non-isolated RS-485 interface (terminals 45, 46, and 47) suitable for BACnet® MS/TP communication. The terminal block containing it is grey. The cable length affects the baud rate.

MS/TP terminations (labeled Data + and Data -) are located on the lower left side of the controller. Maintain polarity of the MS/TP wire run throughout the MS/TP LAN.

Fig. 22 MAC Address

Table 16 Baud Rate vs Maximum Cable Length

Baud Rate	Maximum Cable Length (L)
9.6, 19.2, 38.4, 76.8, 115.2 kbps	4000 ft (1200 m)

NOTE:
The maximum length of a BACnet® Master/Slave network bus segment with recommended wiring is 4,000 ft (1200 m). Repeaters must be used when making runs longer than 4,000 ft (1200 m). Between any two devices, a maximum of three repeaters can be used.

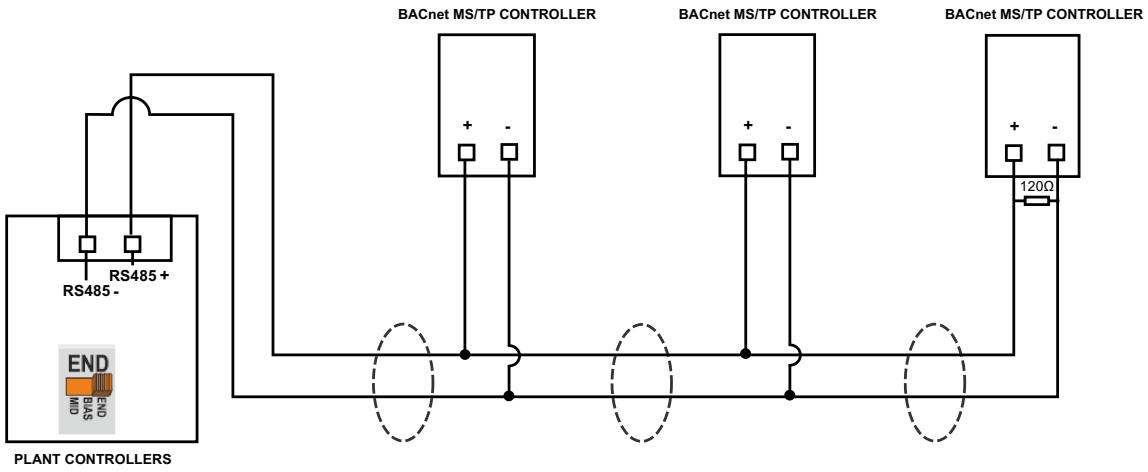


Fig. 23 MS/TP Controller Wiring

NOTE:
It is advised to limit the number of controllers on a single MS/TP network to 64 or fewer. Alerton MS/TP controllers function exclusively as masters, with each controller conducting periodic polling to detect new controllers. Each controller is aware of the identity of the next controller on the BACnet® MS/TP bus, to which it must pass the token. This polling process involves searching for new controllers with MAC addresses between its own MAC address and the MAC address of the next controller.

Auto Baud rate functionality

This functionality is enabled by configuring the MS/TP bps parameter in the DCF as auto.

The controller will listen to the MS/TP network for 4 minutes each time the supply voltage to the controller is turned on. Once the proper baud rate has been identified, the auto baud detection is finalized, and the new baud rate is used and stored in the controller as a successful baud rate.

If no baud rate is determined after 4 minutes, the controller will switch to the last successful baud rate known to the device. However, if the controller is new from the factory and no baud rate has been saved, then a 76.8 kbps baud rate is used but not stored as a successful baud rate in the controller. This causes the same process to start again next time the supply voltage is switched on.

NOTE:
When an ACM is used as the router on an MS/TP network and all MS/TP devices are connected through one of its communication ports, changing the ACM's baud rate will cause all controllers on the network to automatically adopt the new baud rate—provided they are configured for auto baud rate. This automatic synchronization is a feature unique to ACM devices. Attempting to set a different baud rate from a controller, inconsistent with the ACM's baud rate, may lead to communication errors across the network.

Manual Configuration of the MAC Address

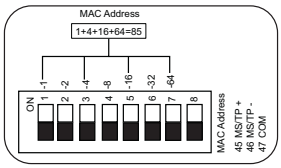
The MAC address for each device must be set to a unique value in the range of 1-127 on a MS/TP network segment. A seven-position DIP switch on the BACnet® controller sets the MAC address.

NOTE:
DIP switch setting of all its positions to OFF (MAC in 0) will enable the Auto MAC mode in the controller. See "Automatic MAC Addressing" section.

Fig. 24 DIP Switch

To set the MAC address of a controller:

1. Find an unused MAC address on the BACnet® MS/TP network to which the controller connects.
2. Locate the DIP switch bank on the controller for addressing.
3. Set the DIP switches for the MAC address you want. For example, if only DIP switches 1, 3, 5, and 7 are ON, the MAC address would be 85 (1 + 4 + 16 + 64 = 85).



Automatic MAC Addressing

In contrast to other controllers, the Alerton modular VAV controller features automatic MAC addressing.

When all the DIP switches are set to OFF, the controller will enable Auto MAC mode, and the DIP switches will no longer be used for MAC addressing.

The MAC addresses are not assigned in sequential order. Controllers are assigned MAC addresses that are not already in use by another BACnet MSTP device in the range of 64 to maxMaster value.

In the scenario depicted in Fig. 25, some of the controllers in the BACnet MSTP network could have their MAC addresses assigned manually. Thus, when a new Alerton MS/TP Controller is added to the network and its automatic MAC addressing function is triggered, it will assign itself an available (unused) MAC address within the range of 64 and Max Master value.

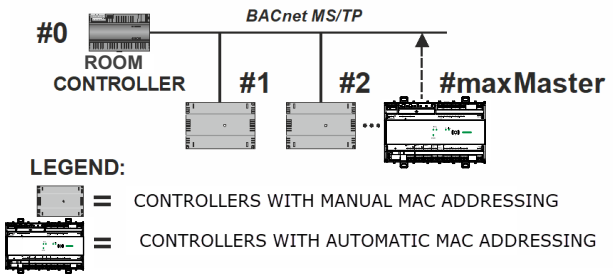


Fig. 25 AutoMAC addressing

The property maxMaster specifies the highest-allowable address for master nodes. The maxMaster is set to 127 by default.

NOTE:
The maxMaster parameter can be modified, but this is considered an advanced tuning technique. If a controller operating in automac mode has a MAC address greater than maxMaster, the automac process will be triggered and a new MAC address will be selected within the range of 64 to the updated maxMaster value.

Set the Device Instance Number

The Device Instance number must be unique across the entire BACnet® MS/TP network because it is used to identify the BACnet® devices uniquely. It may be used to identify the BACnet® device from other devices during installation conveniently.

VLC Renumbering

There is an Alerton proprietary method supported by our controller known as VLC renumbering which easily assigns device Instances to multiple controllers. This feature assigns sequential device instances based on the MS/TP MAC address of controllers.

BACnet® MS/TP Limitations

There are two limitations regarding the number of controllers per BACnet® Master/Slave network:

Physical Limitation

One Alerton MS/TP controller represents 1/8 load (32 loads per TIA/EIA-485 standard). The physical limitation is important if third party devices representing a full load are connected.

Automac Limitation

MaxMAC for Automac is the maxmaster value. It can be modified by the user.

A maxMaster value of 127 allows for the support of up to 125 BACnet MS/TP VAV controllers, in addition to one supervisor and one BACnet client (tool) for each BACnet MS/TP channel.

Termination Resistors

Matched terminating resistors are required at each end of a segment bus wired across (+) and (-). Use matched precision resistors rated ¼ W ±1 % / 80 = 120 Ω.

Ideally, the value of the terminating resistors should match the rated characteristic impedance of the installed cable.

Shield Termination

The shield terminal in a VAV controller serves an essential function for grounding and noise reduction. It is typically used to connect the shielded cables of sensors and communication lines to the ground, providing a path for any induced electromagnetic interference (EMI) to dissipate.

In the context of a VAV controller, proper grounding through the shield terminal helps ensure that the signals transmitted and received by the controller are not affected by external electrical noise, which can distort data and affect the performance. It also aids in enhancing the overall reliability and stability of the control system.

NOTE:
If any of the devices are electrically isolated, it is recommended that those devices be connected to a single ground.

The controller communicates via its BACnet™ Master/Slave interface with other BACnet™ Master/Slave capable devices. In doing so, the following considerations should be considered.

- Maximum BACnet™ Master/Slave bus length.
- Twisted-pair cable, for example,
  1. AWG 18 (1 mm^2)
  2. J-Y(ST)Y 4 x 2 x 0.8 mm2 or a special RS-485 cable.
  3. CAT5 and CAT6 cable use only one single pair for one bus.
  4. Belden 9842 or 9842NH.
  5. Daisy chain topology.
  6. Must conform to TIA/EIA RS-485 cabling guidelines and ANSI/ASHRAE Standard 135-2010.

MICROSET BUS

Alerton Modular VAV Controllers have dedicated Wall Modules bus compatible with Alerton wall modules such as Microtouch, Microset II & Microset 4. These compatible wall modules can be connected to the controller's wall module bus (terminals 50 and 51).

- The input from the Microset should always be connected to terminal 50.
- The maximum current provided at the Wall Module bus interface is 96 mA.

Microtouch

A Microtouch uses three conductor cable one for power supply and other two for input/common connections to all VAV Controllers.

Wiring for the Microtouch is as follows:

Yellow wire: Terminates to any UIO 1-6 or 1-8 (10 kΩ space temperature thermistor).
White wire: Terminated to COM (Ground).
Red wire: Terminates to any UIO 1-6 or 1-8 (Setpoint bias).

The setpoint bias potentiometer is a 5 kΩ single-turn potentiometer that reads 1.9 kΩ to 2.8 kΩ as the setpoint bias lever travels from the C to H position.

For Microtouch connections 18 AWG, two conductors twisted shield cable is required. With the Alerton-recommended wire, the maximum distance is 250 feet.

NOTE:
A jumper is recommended for Microtouch configuration, jumper is connected between Microtouch 10K thermistor terminal and MSET terminal. This allows for option of connecting a Field Service Tool. Temperature reading will not be correct without jumper installed unless MV Object Microtouch type is used.

Microset II

A Microset II has three conductor connection to all VAV Controllers.

Wiring for the Microset II is as follows:

Black wire: Terminal 1 on the MS4 to the terminal 50 labeled MSET.
White wire: Terminal 2 on the MS4 to the terminal 51 COM.
Orange wire: Terminal 3 on the MS4 to terminal 48 (Aux Out).

For Microset II connections, 18 AWG two conductor twisted shield cable is required. With Alerton-recommended wire, the maximum distance is 250 feet.

Microset 4

A Microset 4 has three conductor connection to all VAV Controllers.

Wiring for the microset 4 is as follows:

Red wire: Terminal 1 on the MS4 to terminal 48 (Auxiliary Output).
White wire: Terminal 2 on the MS4 to the terminal 51 COM.
Black wire: Terminal 3 on the MS4 to the terminal 50 labeled MSET.

For Microset 4 connections, use 18 AWG shielded, twisted-pair cable for best results. With Alerton-recommended wire, the maximum distance is 250 feet.

NOTE:
The Alerton Modular VAV Controllers also support legacy microset wall modules such as MS-1010-BT, MS-1010H-BT, MS-1030-BT, MS-1030H-BT.

Wire shields and shield grounding

Use 18 AWG two-conductor twisted shield cable for all inputs and analog outputs to reduce electrical interference (noise). A single-point grounding scheme that uses the transformer or panel ground is optimum. Ground only one end of the shield drain wire.

⚠ CAUTION

Do not ground shields to any terminal on the VAV Controller because any signal on the shield is routed through the VAV Controller circuit board to earth ground. Improper grounding can cause equipment damage.

Microset II/ Microset 4 / Microtouch Wiring Examples

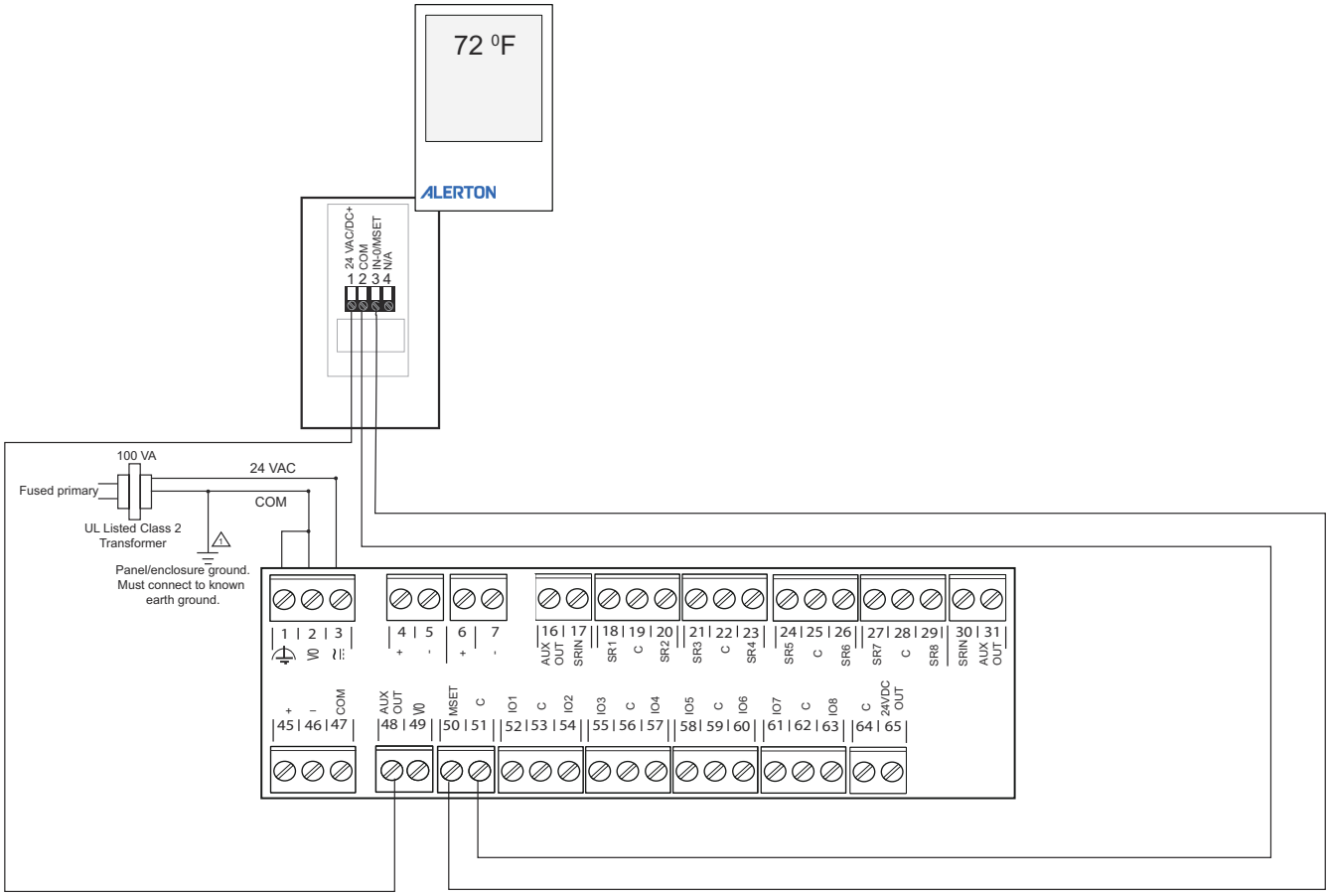


Fig. 26 Alerton Modular VAV Controller wiring with Microset 4

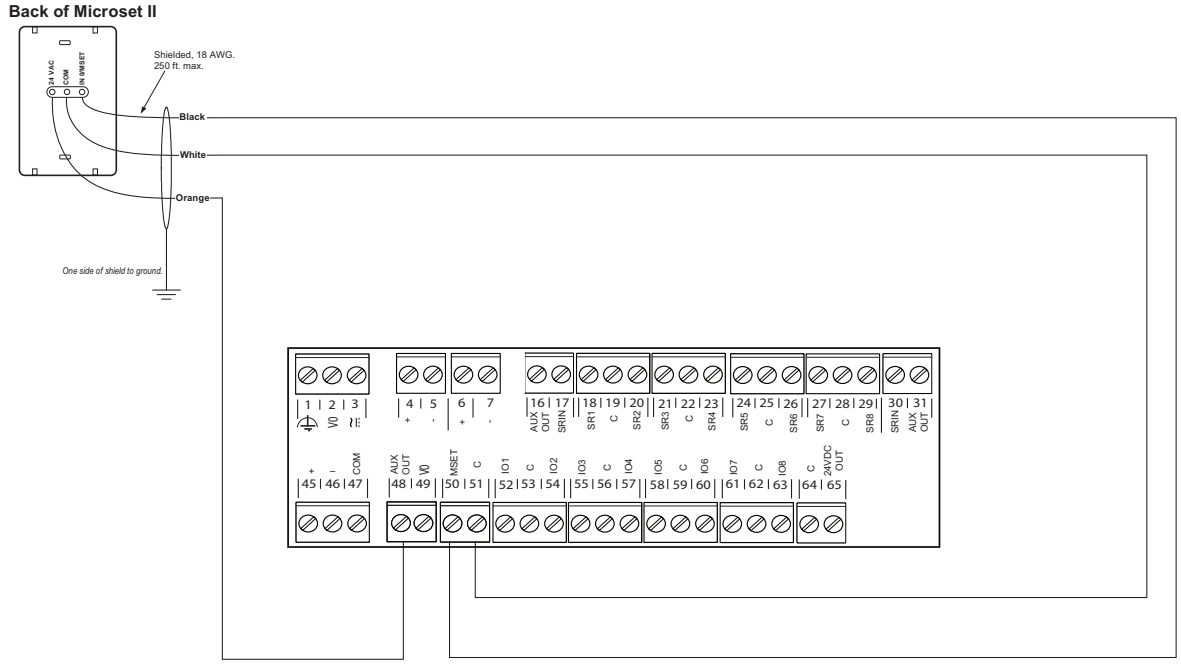


Fig. 27 Alerton Modular VAV Controller wiring with Microset II

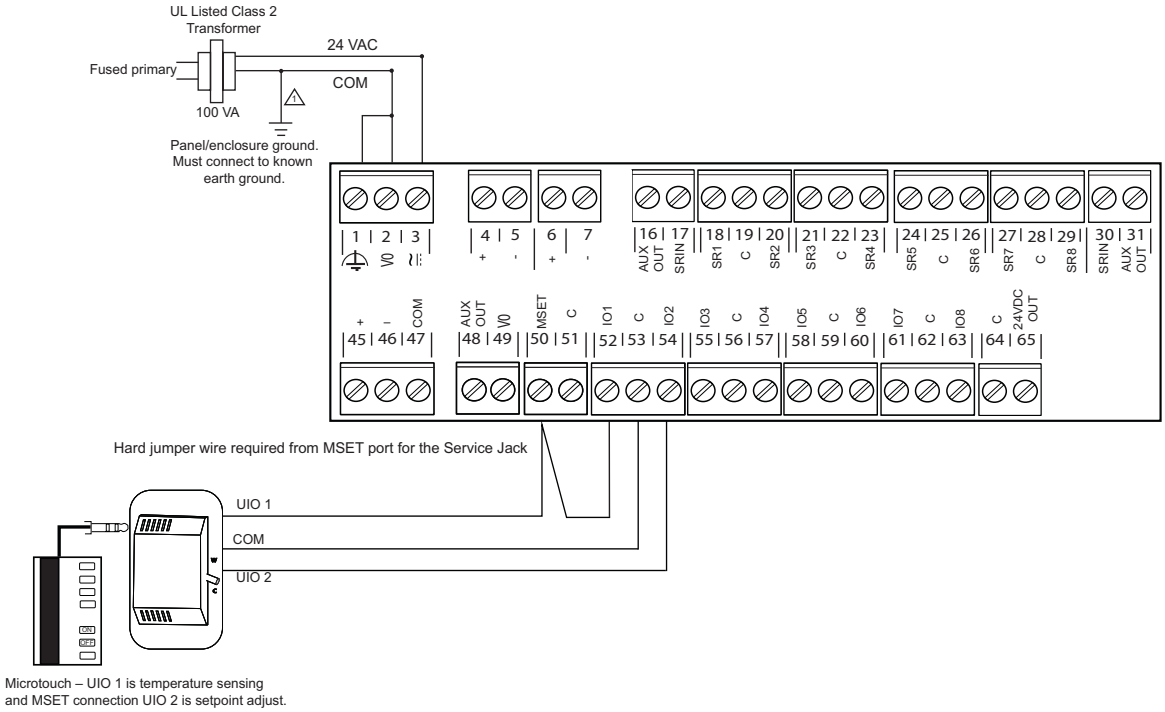


Fig. 28 Alerton Modular VAV Controller wiring with Microtouch

LED OPERATIONS

The controller features the following LEDs.

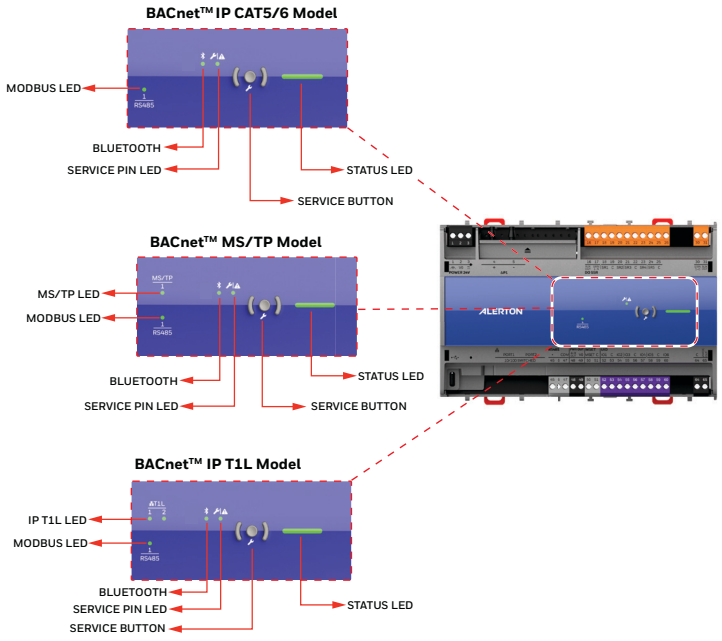


Fig. 29 LED Interface

Controller Status LED

Table 17 Controller Status LED

LED Status	Visual	Mode
Green LED permanent ON		Normal operation
Green LED blinks every 2 sec		Auto MAC
Green LED blinks every 0.2 sec		Firmware download
Yellow LED permanent ON		No Valid MAC
Red LED permanent ON		Broken sensor
		Short circuit
Red LED blinks every 1.5 sec		Microset communication error
Red, Green, Yellow blinks every 1 sec		No application
Red LED blinks every 0.2 sec		Fatal error in FW, reset imminent

Modbus LED Status

Table 18 Modbus LED Status

LED Status	Visual	Mode
Green LED permanent ON		Modbus Communication is healthy - Successful to read/write all of Modbus registers configured in the application.
Yellow LED permanent ON		Modbus Communication is not healthy - failure to read/write some of Modbus registers configured in the application.
Red LED permanent OFF		Modbus Communication failure - failure to read/write all of the Modbus registers configured in the application.
LED OFF		No Modbus registers have been configured or found on the application.

IP T1L LED Status

Table 19 IP T1L LED Status

LED Status	Visual	Mode
Green LED permanent ON		Link is up, Valid IP address is configured. Communication is healthy.
Yellow LED permanent ON		Link is up, no valid IP address is configured.
LED OFF		Link is down.

NOTE:
In the IP T1L network for example, 5 devices are connected in daisy chain like device 1, 2, 3 and so on. If the device 2 is powered off (Daisy chain connection not disturbed) the link from device 1 and device 3 is still up, and the IP T1L LED status also in solid green.

BACnet MS/TP LED Status

Table 20 BACnet MS/TP LED Status

LED Status	Visual	Mode
Green LED permanent ON		Controller MS/TP BACnet communication is normal.
Yellow LED permanent ON		Controller is sending MS/TP BACnet packets but not receiving any response.
Red LED permanent OFF		No communication from MS/TP BACnet.The controller is not in the MS/TP network.

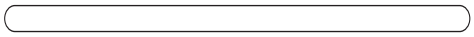
Service Pin LED Status

Table 21 Service Pin LED Status

LED Status	Visual	Mode
Green LED permanent ON		On Service PIN button Press
LED OFF		On release of Service PIN button

Bluetooth LED Status

Table 22 Bluetooth LED Status

LED Status	Visual	Mode
Green LED permanent ON		BLE normal operation and connected
LED OFF		BLE disabled
Green blinks every 200 ms.		BLE enabled but not connected
Red LED permanent OFF		BLE failure

MODULAR VAV CONTROLLERS CONFIGURATION

Compass Device Configuration

The configuration of the Modular VAV controller can be completed like most other Alerton controllers by doing the following:

NOTE:
A Compass Device Configuration of the Modular VAV Controller is compatible with version 2.3 and higher.

1. From the Compass menu, click **Device Manager**.
2. Click **Device Scan**.
3. Choose the option Scan configurable Alerton devices.
4. Click Scan.
5. As soon as the Modular VAV device appears, click Stop.
6. Click Configure.

Recovering from a Misconfiguration

If the communication with Modular VAV is not possible due to incorrect or unknown configuration, then the user can use Compass “Scan for configurable devices” feature via BACnet/Ethernet.

Initial Screen

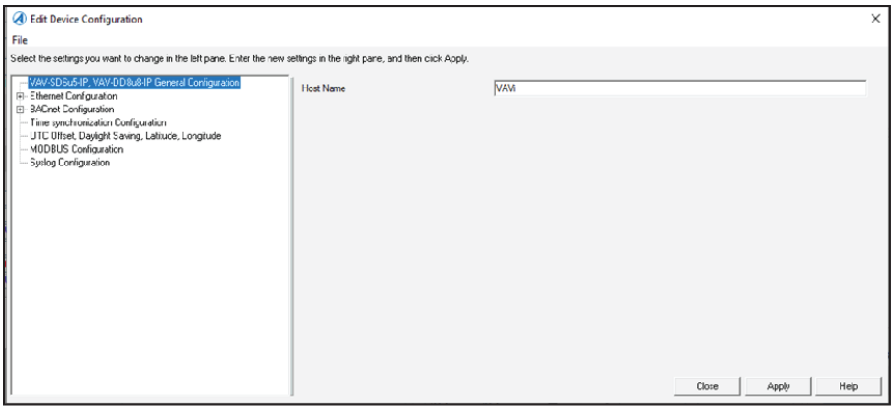


Fig. 30 Edit Device Configuration

Table 23 Device Configuration

Configuration Parameter	Values	Description	Default
Host name		Must be a valid host name, and special characters are also acceptable	VAVi

NOTE:
Every time a change in configuration is sent to the device, a reboot is expected before new configurations take place. Once device comes back online, all new configurations will be effective. User can observe bi-color LED during this process. When the LED turns off for a few seconds it means the device is rebooting. The complete process will vary in time and is in direct proportion to the number of existing objects (trendlogs, schedules, alarms, etc.) stored in the device. Therefore, even after the Tri-color LED comes back on, the device might still not be reachable for some time. Refer Factory Reset Using the Service Button on page 8 for more details.

NOTE:
All programmed objects (such as schedules, trendlogs, and alarms), BACnet data values changes execute in RAM and are periodically backed up in flash memory. Data is retained through power loss as follows:
VAV data is backed up every 5 minutes or less.

Ethernet and IP

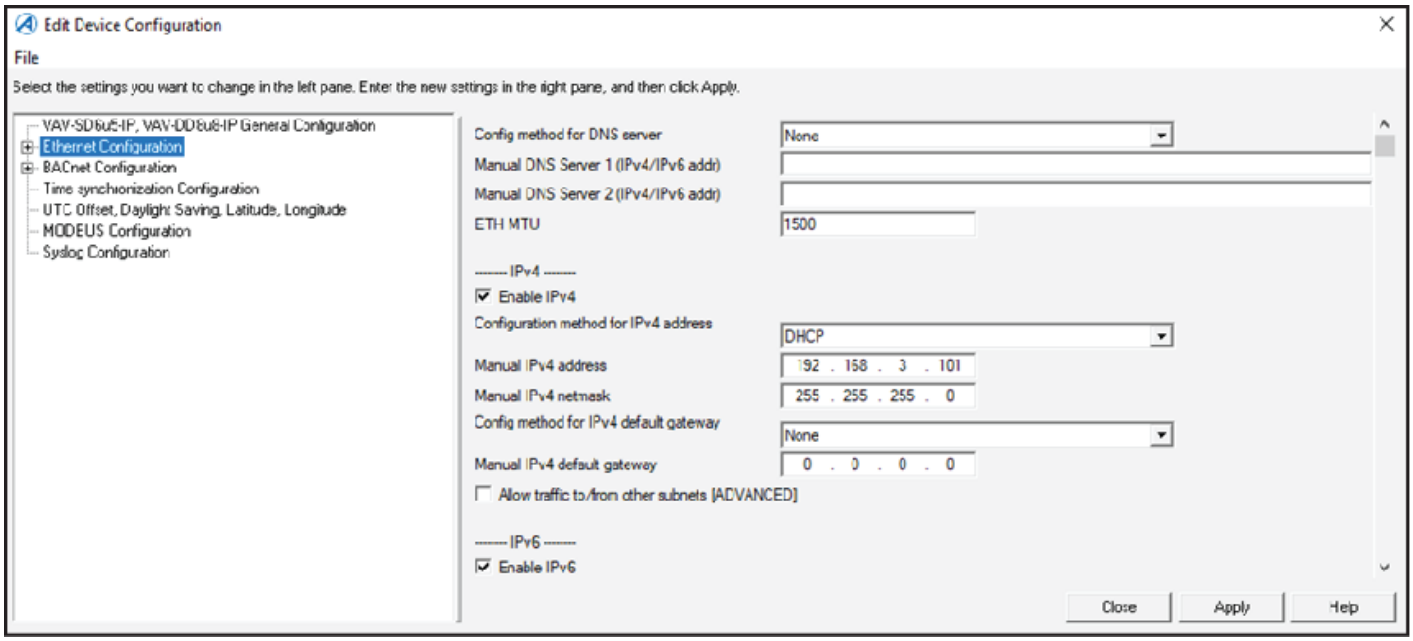


Fig. 31 Edit Device Configuration, Ethernet, and IP Settings

Table 24 Ethernet and IP Settings

Configuration Parameter	Values	Description	Default
Config method for DNS server	None DHCPv4 | SLAAC | Manual |	Method how DNS will be configured for this device.	None
Manual DNS Server 1 (IPv4/IPv6 addr)		Manual entry for DNS entry. Only valid if Manual was selected as the Config method for DNS server above.	
Manual DNS Server 2 (IPv4/IPv6 addr)		Manual entry for DNS entry. Only valid if Manual was selected as the Config method for DNS server above.	
ETH MTU		The Maximum Transmission Unit (MTU) in bytes. Default is 1500 (typical for Ethernet networks).	1500
IPv4 Info			
Enable IPv4	Y/N	Enable/Disable the IPv4 Protocol	Y
Configuration method for IPv4 address	DHCP | Manual	How will IPv4 address be obtained	Manual
Manual IPv4 address		IP address input by default configuration was selected above	192.168.1.200
Manual IPv4 netmask		Subnet mask input by default configuration was selected above.	255.255.255.0
Config method for IPv4 default gateway	DHCP | Manual | None	How will default gateway selection be set	None
Manual IPv4 default gateway		By default gateway input configuration was selected above.	0.0.0.0
Allow traffic to/from other subnets [ADVANCED]	Y/N	Security feature to prevent devices from another subnet from reaching this device.	N
IPV6 Info			

Table 24 Ethernet and IP Settings

Configuration Parameter	Values	Description	Default
Enable IPv6	Y/N	Enable/Disable the IPv6 Protocol	N
Configuration method for IPv6 address	SLAAC | Manual		SLAAC
Manual IPv6 address		IPv6 address input if manual IPv6 address configuration was selected above	: :
Manual IPv6 prefix bits		Manual entry for IPv6 network prefix	64
Allow traffic to/from other subnets [ADVANCED]	Y/N	Security feature to prevent devices from another subnet reaching this device.	N

Enable/Disable Ethernet Ports

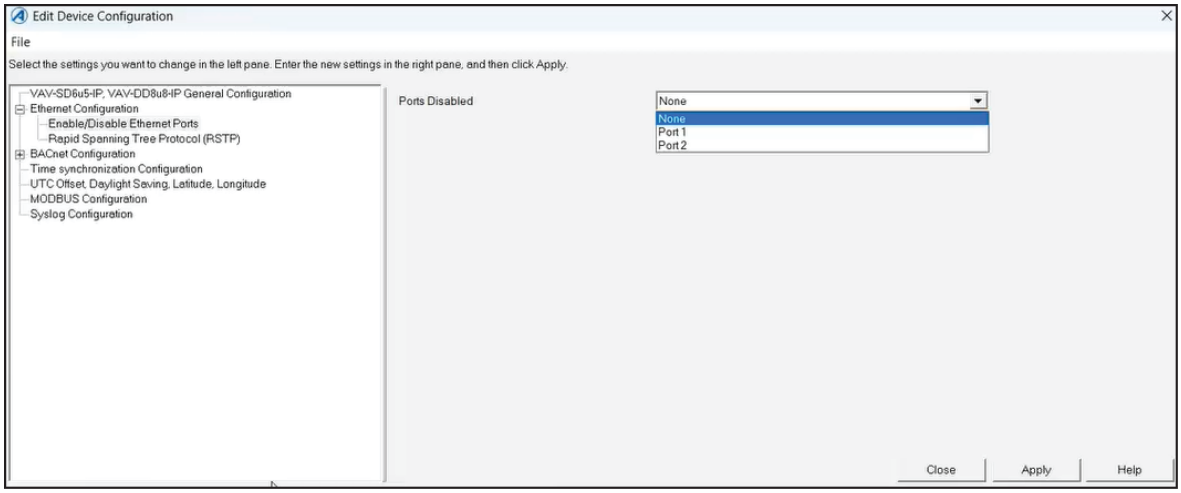


Fig. 32 Enable/Disable Ethernet Ports

Table 25 Enable/Disable Ethernet Port

Configuration Parameter	Values	Description	Default
Enable/Disable Ethernet Ports		Access the sub-menu to enable or disable the Ethernet ports 2, 3, and 4	

NOTE:
This Enable/disable Ethernet Ports is only supported for IP variants.

BACnet MS/TP Configuration

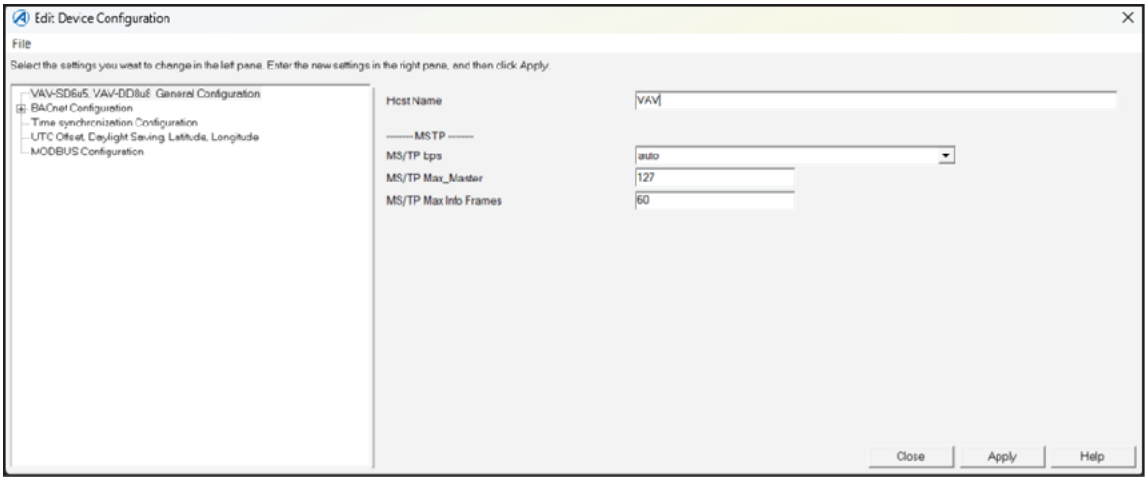


Fig. 33 BACnet MS/TP Configuration

Table 26 BACnet MS/TP Configuration

Configuration Parameter	Values	Description	Default
MS/TP Max_Master		This value sets the highest MS/TP MAC address that controller will consider in the network when communicating to other masters. To support detecting and adding new devices into the MS/TP token passing ring, all Master devices (that are not already passing the token to the next sequential MAC address) will periodically send out a "Poll for Master" (PFM) message to all the unused Master addresses between its address and the next used master address in the network (so if you had a device at MAC address 5 and the next used address was 8, the device at address 5 would periodically send PFM requests to addresses 6 and 7). Since a PFM requires the sending device to wait a minimum time of between 20-100ms, it can slow down the network if there are a lot of unused addresses. One way to optimize an MS/TP Network is to set all devices at sequential MAC's starting at 0 and having the ACM as the last used address. The value for Max Master can then be set to the controller's address and no time would then be wasted doing PFM requests. **NOTE:** Changing the Max Master is an advanced tuning technique and care should be taken when attempting this level of optimization (as it can limit being able to add new devices I the future). If you want to optimize the MS/TP performance, it is recommended to simply have all devices at sequential MAC addresses with as few gaps as possible (limiting how many devices will need to initiate PFM messages).	127

Configuration Parameter	Values	Description	Default
MS/TP bps		Sets the baud rate the controller will use to communicate on this MS/TP Network. Options are as follows: auto (default) - The MS/TP controller will listen to the current network baud rate. 9600- Sets the MS/TP controller to communicate at 9600 baud. 19200- Sets the MS/TP controller to communicate at 19200 baud. 38400- Sets the MS/TP controller to communicate at 38400 baud. 76800- Sets the MS/TP controller to communicate at 76800 baud. 115200- Sets the MS/TP controller to communicate at 115200 baud. **Warning:** Ensure that all devices in the MS/TP network are configured to the same baud rate value otherwise communication errors can occur.	auto
MS/TP Max Info Frames		Sets the value for Max Info Frames for the selected Network (range is 1-100). Default setting is 60. The Max Info Frames property identifies how many frames the controller can initiate once it receives the token. Initiated messages include ReadProperty and WriteProperty Requests, Broadcast messages, Poll for Master messages, and Atomic Read/Write Requests (for reading/Writing ROC or DDC files). Once the controller has initiated the number of frames indicated in Max Info Frames it MUST pass the token to the next Master device (regardless of whether it has additional requests). This setting is intended to ensure no one device can "hog" the token and not allow any other Master devices to talk. Once the token has made its way back around the token ring, the controller can initiate more Requests up to the value in Max Info Frames.	60

BACnet Configuration

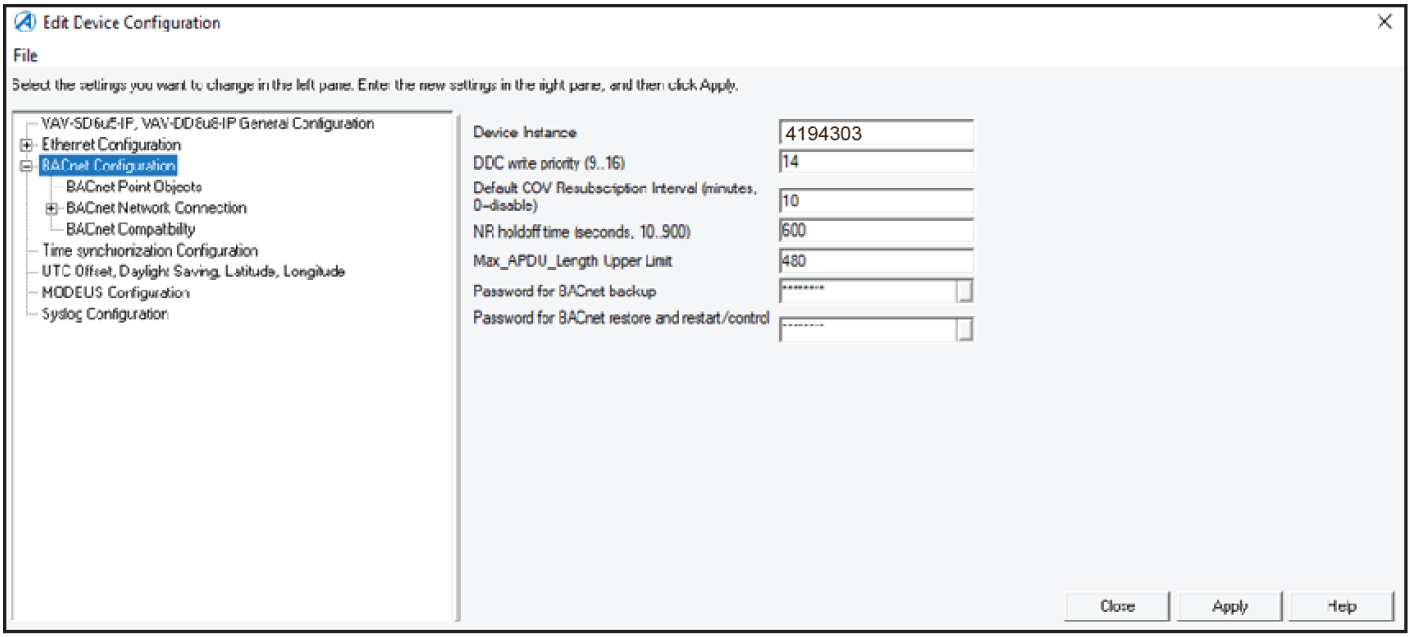


Fig. 34 BACnet Configuration

Table 27 BACnet Configuration

Configuration Parameter	Values	Description	Default
Device Instance	1 to 4194303	The numeric instance of the VAV as a device on the BACnet network (must be unique for the entire system).	4194303
DDC write priority (9…16)	9 to 16	A higher priority for writing takes precedence over lower priorities. The highest priority is 1, the lowest is 16. These are also called indexes of the priority array. This table depicts the typical priorities used.	14
Default COV Resubscription Interval (minutes, 0=disable)	0 to 10	This value is the interval in minutes that the VAV will use for re-subscribing to external points to be notified on changes of value (if the external device does not support the change of value notifications, the VAV will default to polling). **NOTE:** A value of 0 will disable the VAV ability to send COV Subscriptions.	10
NR holdoff time (seconds, 10...900)	10 to 900	To enhance performance and reduce wasted bandwidth when devices are not present, or temporarily offline, the VAV will fall back to a periodic communications check for devices to which it has stopped receiving responses. The NR Holdoff Time specifies the time in seconds the VAV will wait after determining a device is offline before trying to talk to it again. It is recommended to set this value low for the initial setup (1-2min), then bump it up once everything is up and working. Minimum of 10 seconds, maximum of 900 seconds (15 minutes) default is 600 seconds (10 minutes).	600
Max_APDU_Length Upper Limit	1024 to 1476	Maximum BACnet message size the device can/will accept. Typically associated with complex data or read property multiple requests. For IPv6 installations, it is recommended to drop this down to 1440 or lower.	480
Password for BACnet Backup **NOTE:** This setting is only available in the Device Configuration screens within Compass 2.3		This is the password used for the BACnet Device Communications Control (Backup Password limit is between 8 and 64 characters.	xxxxxxxxx
Password for BACnet Restore and Restart/Control: **NOTE:** This setting is only available in the Device Configuration screens within Compass 2.3		This is the password used for the BACnet Device Communications Control (Enable/Disable communications, and Restore), and Reinitialize Device (Reinitialize Warmboot and Reinitialize Coldboot) services. Password limit is between 8 and 64 characters.	xxxxxxxxx

BACnet Point Objects

Fig. 35 BACnet Point Objects

Table 28 BACnet Point Objects

Configuration Parameter	Values	Description	Default
Include diagnostic points in object list	Y/N	Diagnostic points in the 100,000+ range will be listed in the Object List property. **NOTE:** If enabled, diagnostic points will also be saved into the device's point data MDB file, which may not be desirable.	N

BACnet Network Configuration

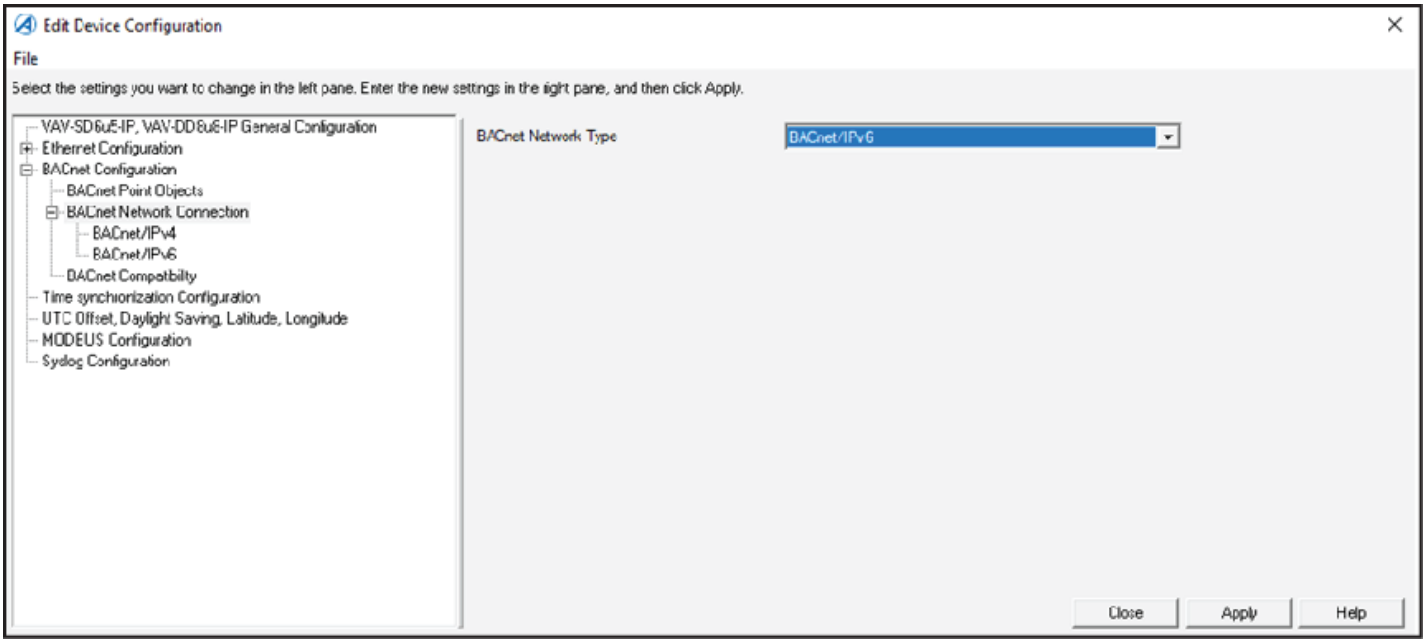


Fig. 36 BACnet Network Connection

Table 29 BACnet Network Configuration

Configuration Parameter	Values	Description
BACnet Network Type	BACnet IPv4 BACnet IPv6 BACnet/Ethernet	Select BACnet Network Connection and then from the BACnet Network Type, select required network from the drop-down list.

BACnet/IPv4

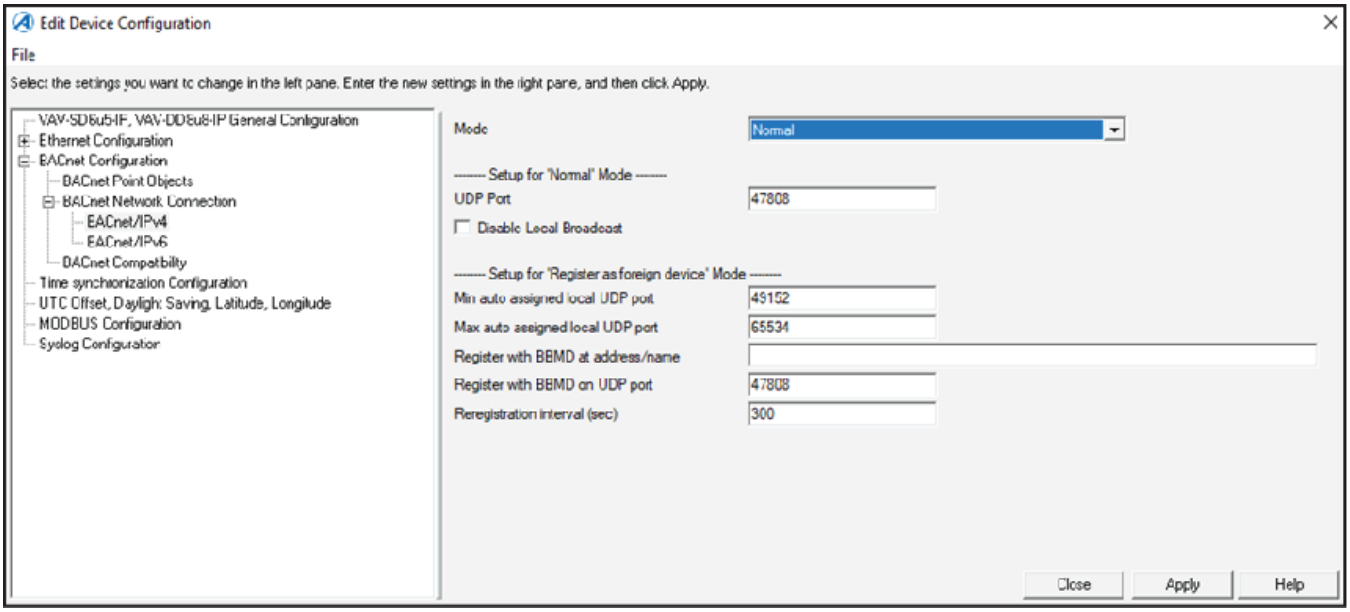


Fig. 37 BACnet/IPv4

Table 30 BACnet/IPv4

Configuration Parameter	Values	Description	Default
Mode	Normal | Register as foreign device	Controls the mode of participation on the BACnet network	Normal
Normal mode settings			
UDP Port		Specifies the UDP Port number to be used by BACnet/IPv4. The range is 1-65534, but many numbers are reserved or used for common services unrelated to BACnet (contact the site's IT department for any limitations and restrictions). The default value is 47808 (which corresponds to 0xBAC0 in hexadecimal).	47808
Disable Local Broadcast	Y/N	Prevent the VAV from sending and Broadcast messages on the specified IP network.	N
Register as foreign device mode settings			
Min auto-assigned local UDP port		Automatically assign the minimum UDP Port value to the Alerton controller while Registering as a Foreign Device.	49512
Max auto-assigned local UDP port		Defines the maximum UDP Port value for auto assigning to the Alerton controller when Registering as a Foreign Device.	65534

Configuration Parameter	Values	Description	Default
Register with BBMD at address/name		Input IP address or Host Name for BBMD to register with. **NOTE:** Host Name Lookup requires setting up a valid DNS Server reference.	
Register with BBMD on UDP port		Specifies the UDP Port number of the BBMD to which you want to register. The range is 1-65534, but many numbers are reserved, or used for common services unrelated to BACnet (contact the site's IT department for any limitations and restrictions). Default is the BACnet standard 47808 (which corresponds to 0 x BAC0 in hexadecimal).	47808
Reregistration interval (sec)	10-3600	Specifies frequency re-registration of the Alerton controller with the BBMD. Since Foreign Devices must register with a BBMD to enable broadcast traffic to be received from, and sent to the Foreign Device, and since Foreign device registration is not required to be persisted in the event of a BBMD reset, it is important to select a value for reregistration that balances data criticality with network performance. In most cases the default 300 sec (5 minutes), reregistration interval is more than adequate for ensuring the foreign device has connectivity into the system, but in some cases where you have critical data being passed to/from the foreign device, you may want to bump the reregistration up to 60 sec, or even the minimum value of 10 sec.	300

BACnet/IPv6

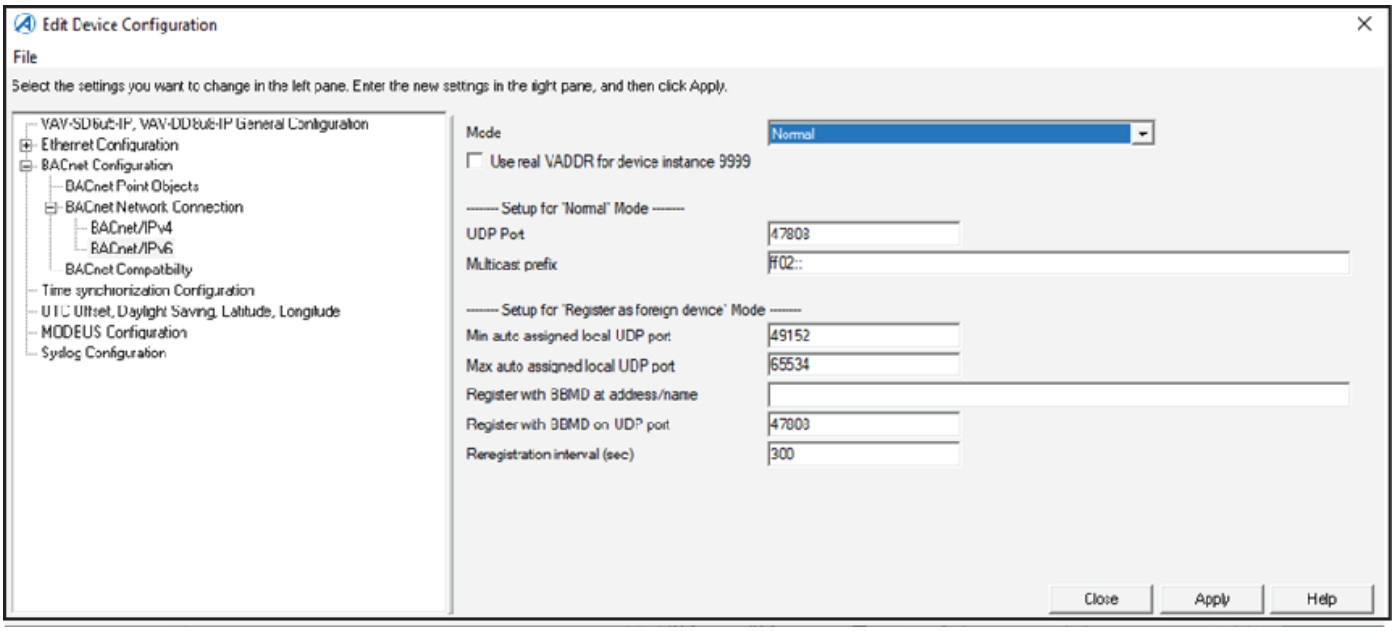


Fig. 38 BACnet/IPv6

Table 31 BACnet/IPv6

Configuration Parameter	Values	Description	Default
Mode	Normal | Register as foreign device	Control the mode of participation on the BACnet network.	Normal

Configuration Parameter	Values	Description	Default
Use real VADDR for device instance 4194303	Y/N	Enables/Disables the use of the device's real VADDR when the device instance is set to 4194303. The default setting is disabled. For IPv6 devices, the MAC address is a very large value. To shorten the values BACnet passes across the network and to simplify device identification a Virtual MAC is used that equals the devices Device Instance. In the event two IPv6 devices had the same device instance (as in the case of the default instance 4194303), this could result in difficulties communicating with and re-configuring the devices (as the devices Net and MAC would appear there same). For this reason, a random Virtual Address "VADDR" is chosen for devices with the default device instance 4194303 to ensure each device has a unique address. Enabling this feature will result in the VMAC getting set to the device's real instance of 4194303. **NOTE:** It is never recommended to use the default device instance, so enabling this feature should not be necessary.	N
Normal mode settings			
UDP Port		Specifies the UDP Port number to be used by BACnet/IPv6. The range is 1-65534, but many numbers are reserved or used for common services unrelated to BACnet (contact the site's IT department for any limitations and restrictions). The default value is 47808 (which corresponds to 0xBAC0 in hexadecimal).	47808
Multicast prefix		Specifies the multicast prefix to be used by your IPv6 network. This multicast prefix defines the scope of the multicast transmission, or how far the multicast address will propagate (this is dependent on the network configuration and the Site setup, so contact the local IT specialist for specifics).	ff02::
Register as foreign device mode settings			
Min auto-assigned local UDP port		Automatically assign the minimum UDP Port value to the Alerton controller while Registering as a Foreign Device.	49152
Max auto-assigned local UDP port		Defines the maximum UDP Port value for auto assigning to the Alerton controller when Registering as a Foreign Device.	65534
Register with BBMD at address/name		The name or IPv6 address of BBDM to register with can be used. If the name is used, DNS must be configured and working properly.	
Register with BBMD on UDP port		Specifies the UDP Port number of the BBMD to which you want to register. The range is 1-65534, but many numbers are reserved, or used for common services unrelated to BACnet (contact the site's IT department for any limitations and restrictions).	47808
Reregistration interval (sec)	10-3600	Specifies how often the Modular VAV Controller will re-register with the BBMD. Since Foreign Devices must register with a BBMD to enable broadcast traffic to be received from, and sent to the Foreign Device, and since Foreign device registration is not required to be persisted in the event of a BBMD reset, it is important to select a value for reregistration that balances data criticality with network performance. In most cases the default 300sec (5 minutes), reregistration interval is more than adequate for ensuring the foreign device has connectivity into the system, but in some cases where you have critical data being passed to/from the foreign device, you may want to bump the reregistration up to 60sec, or even the minimum value of 10 sec.	300

NOTE:
In rare cases some controllers may enter a Non-Responsive state when configuring for IPv6 if previously configured for IPv4. If this occurs, power cycle the controller and it will restart configured for IPv6.

BACnet Compatibility

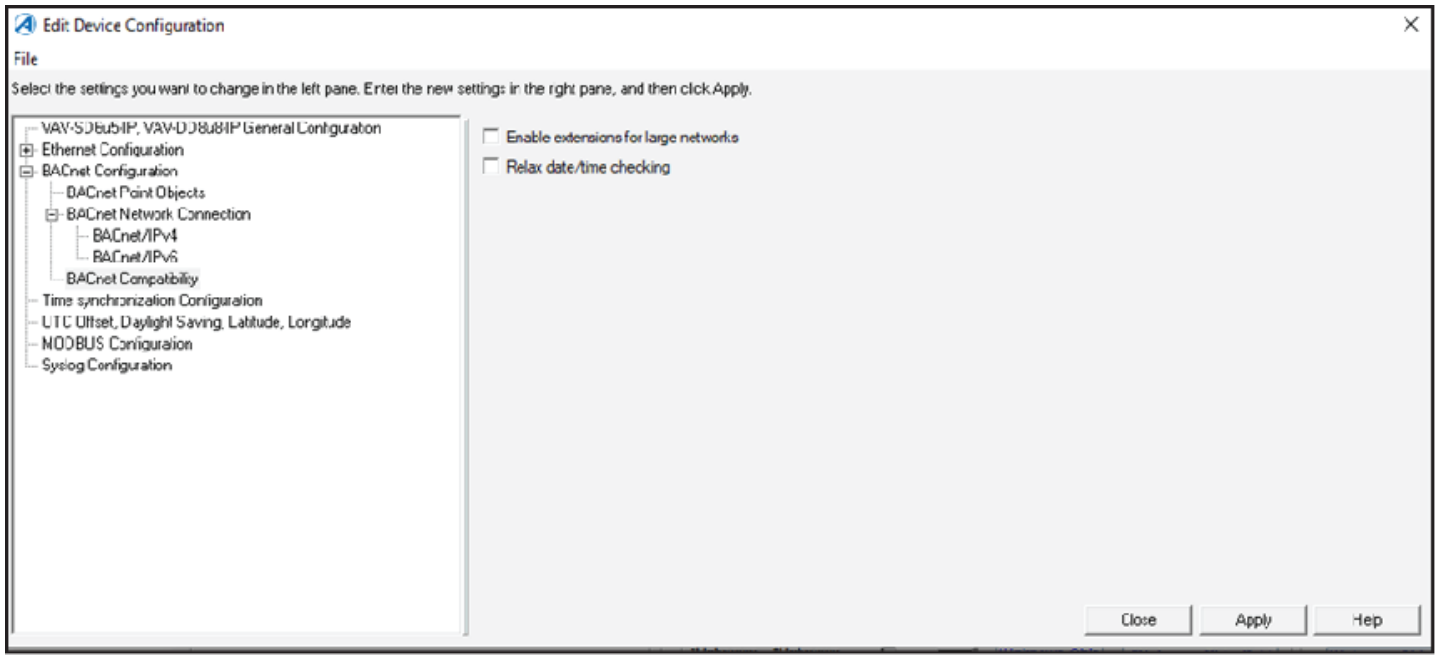


Fig. 39 BACnet Compatibility

Table 32 BACnet Compatibility

Configuration Parameter	Values	Description	Default
Enable extensions for large networks	Y/N	This feature attempts to space out initial Trendlog notifications on VAV that have many Trends setups with the same interval (to distribute the load on the server).	N
Relax date/time checking	Y/N	In BACnet Protocol Revision 13, the BACnet specification was updated to more closely define where wildcards can be used in Dates and Times. To meet the specification for a protocol beyond 13 the VAV had to enforce these new requirements, which made some of the default values use by Alerton Frontends to be no longer allowed. To maintain compatibility with Alerton workstation software older than Compass 1.4 Update 2.2.0, this option was added to disable the more restrictive wildcard checking.	N

Time Synchronization Configuration

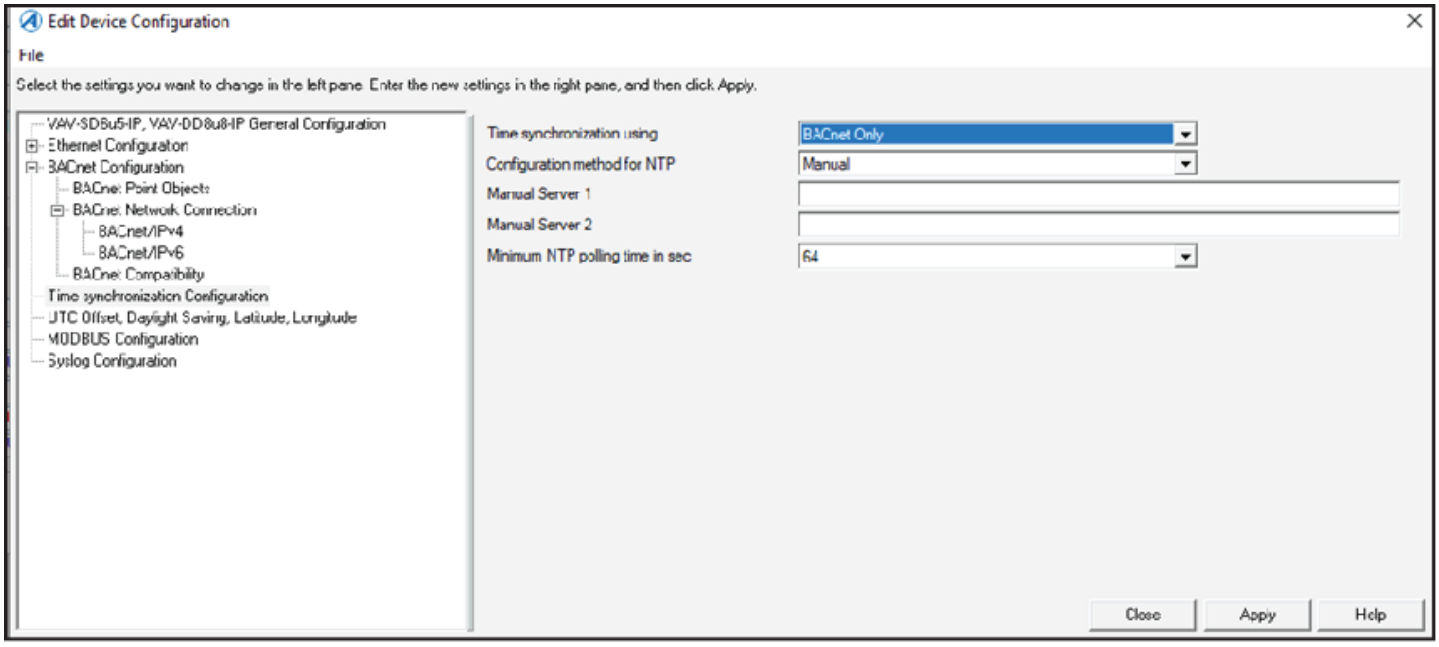


Fig. 40 Time Synchronization Configuration

Table 33 Time Synchronization Configuration

Configuration Parameter	Values	Description	Default
Time synchronization using	BACnet only NTP only	This configuration item determines whether time sync is done using the BACnet protocol or NTP only.	BACnet only
Configuration method for NTP	Manual DHCPv4	This allows for the automatic configuration of the NTP servers using DHCP. The adapter on which DHCP is enabled should be specified here. The NTP server information can also be entered manually by choosing the “Manual” option here.	Manual
Manual Server 1 Manual Server 2	Any NTP server name or IP address within the LAN. This field allows manual configuration.	Two NTP server names or IP address can be configured. Ideally, the server shall be within the LAN.Ensure that the DNS server and Default GW are configured correctly.	
Minimum NTP polling time in sec	64	The minimum duration in seconds between each request from the client after the first update. The first-time update happens within 2 seconds on startup. This configuration is used for both Manual and DHCP options.	64

UTC Offset, Daylight saving, Latitude, Longitude

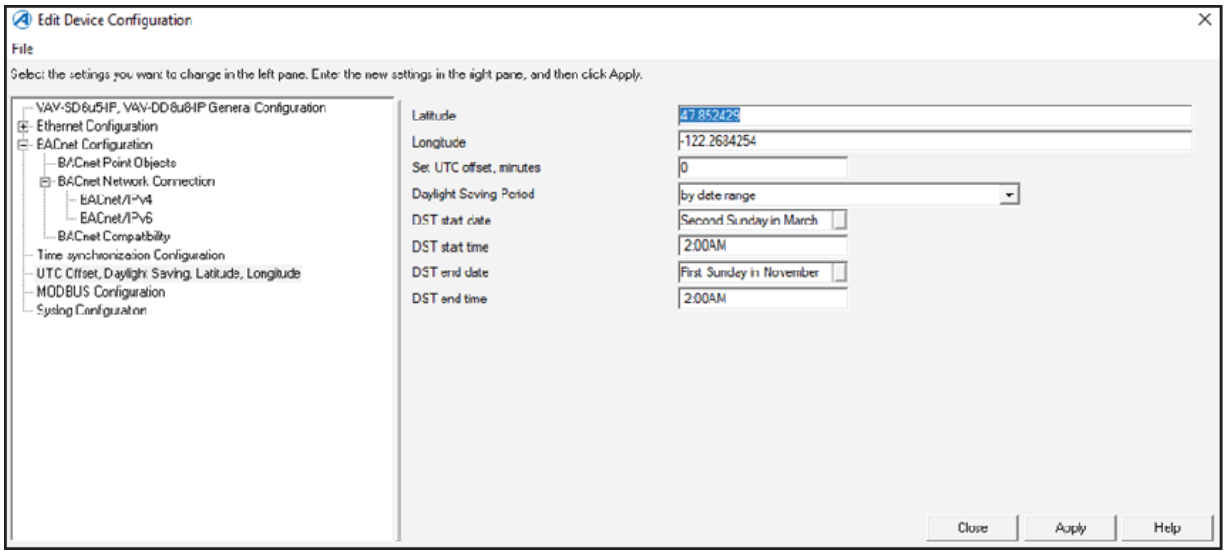


Fig. 41 UTC Offset, Daylight Savings, Lat & Lon

Table 34 TC Offset, Daylight Savings, Lat & Lon

Configuration Parameter	Values	Description	Default
Latitude	AV-101910	User input latitude of controller location	47.852429
Longitude	AV-101911	User input longitude of controller location	-122.2684254
Set UTC offset, minutes	.	Type the UTC offset, in minutes, that corresponds to the difference between	0
		UTC and local standard time where the Alerton operates. Time zones to the West of the zero-degree meridian are positive values and those to the East are negative values. Coordinated Universal Time (UTC) is equivalent to Greenwich Mean Time, which refers to time kept on zero-degree meridian (Greenwich meridian). Use the UTC offset to specify the time zone in which the VAV is operating. Typical UTC offsets for the US are listed. Atlantic Standard Time: +240 Eastern Standard Time: +300 Central Standard Time: +360 Mountain Standard Time: +420 Pacific Standard Time: +480 Alaska Standard Time: +540 Hawaii-Aleutian Standard Time: +600 Samoa Standard Time: +660	
Daylight Saving Period **NOTE:** Additional parameters, DST START DATE & TIME, and DST END DATE & TIME fields are not accessible via the serial configuration.	Disabled | By date range		By data range

Modbus

Modbus Overview:

This hardware has built-in support for integrating Modbus functionality, allowing for seamless communication and control of external devices. It supports up to 100 AV and 100 BV objects, with the AV range spanning from AV-800 through AV-899 and BV-800 through BV-899. Additionally, the system can handle up to 10 MV (Multistate Value) objects, specifically from MV-0 through MV-9.

A total of up to 10 Modbus slave devices, such as the TR50, TC300, and DALI, can be mapped directly to these allocated registers, enabling flexible and scalable integration of multiple devices into the controller. This feature ensures enhanced connectivity and functionality for diverse HVAC applications.

The performance of Modbus will depend on the baud rate configuration and how long the Modbus server device takes to respond.

For example, if the Modbus server responds fast and immediately, it will take 15 milliseconds to read one register with a baud rate of 9600, thus 64 registers can be read every 1 second if the poll rate is configured as 1 second.

If more registers are configured then for each register read time will take more than 1 second. For example, if 128 registers are configured to be polled every 1 second with a baud rate of 9600, then 128 registers will get read every 2 seconds due to baud rate throughout limitation. In such case increasing 9600 to 19200 will speed up read periodicity to 1 second.

Similarly, for 200 registers polled every 1 second ideal baud rate configured should be 38400.

Modbus Configuration:

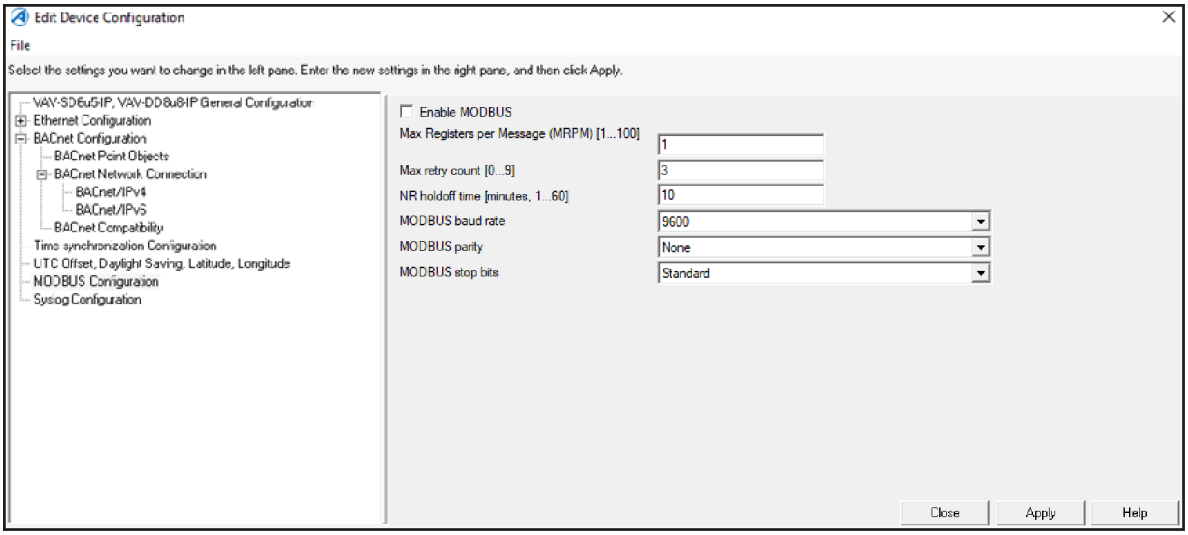


Fig. 42 Modbus Configuration

Table 35 Modbus Configuration

Configuration Parameter	Values	Description	Default
Enable Modbus		Enables for a Modbus serial network.	NO
Max retry count	0-9	Specifies the maximum number of retries that the VAV controller will use when attempting to talk to Modbus Slave Devices	3
NR holdoff time	1-60 min	Specifies the time in minutes the VAV controller will wait after determining a Modbus device is offline before trying to talk to it again.	10
Modbus baud rate		Specifies the baud rate for the Modbus serial network	9600
Modbus parity		Specifies the parity to be use on the Modbus serial network	None

Configuration Parameter	Values	Description	Default
Modbus stop bits		Specifies the number of stop bits to use on the Modbus serial network	Standard

NOTE:
For RSTP configuration, refer to the RSTP on page 79.

Sending Device Mapping CSV file to Modular VAV Device

1. Copy the CSV file to the DDC folder (typically C:\Alerton\Compass\2.0\<my REP>\<my JOB>\DDC).
2. Open **Compass Device Manager** and double click the particular modular VAV model.

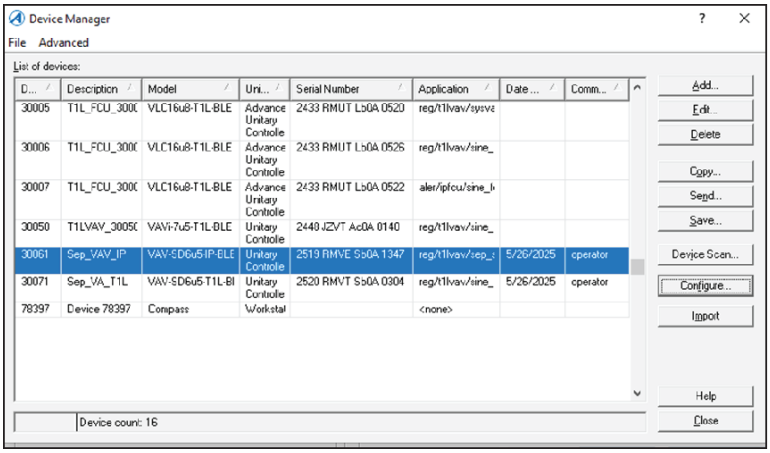


Fig. 43 Compass device manager

3. On the Add/Edit Device Profile dialog select the **Preferences** Tab.

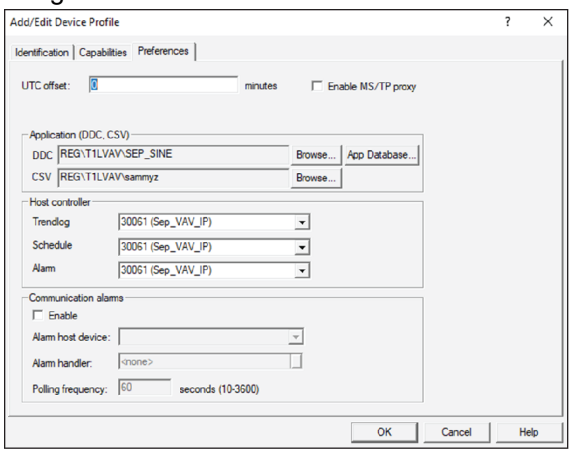


Fig. 44 Preference

4. Under Preferences, click on the **CSV application Browser** and select the required CSV file which need to be uploaded.

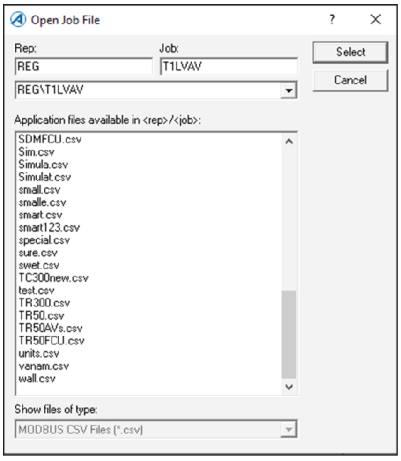


Fig. 45 CSV file selection

5. Click **OK**, and navigate to Compass device manager page.
6. Select the particular VAV model and send the **Modbus Application**.

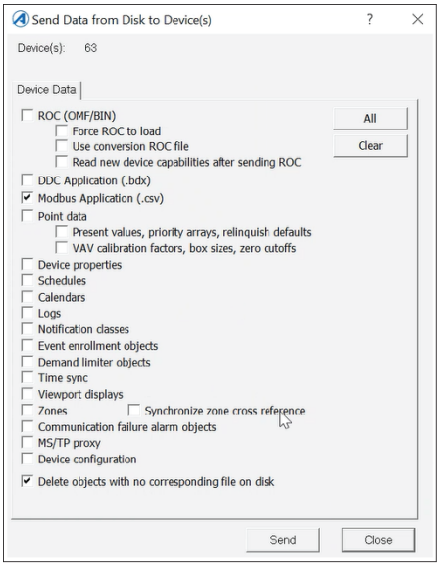


Fig. 46 Modbus application

Point Mapping CSV File Format

Refer to the below mentioned TR50 Modbus Register details, using these, CSV files can be created.

Category	RegType	Setup/ Runtime	Addr	Dir	Non-Volatile	Name	SKU	Typ/ Unit	Default Unit	Bits Num	Range	Scale	Default
Disp Values	Input	Runtime	1	R	V	Temperature	3N/3D/5N/ 5D	int16	^{o}F	16	32-122 ^{o}F 0-50 ^{o}C	0.1	
Disp Values	Input	Runtime	2	R	V	Humidity	3N/3D/5N/ 5D	int16	% RH	16	0-100	0.1	
Disp Values	Input	Runtime	3	R	V	CO2	3N/3D/5N/ 5D	int16	ppm	16	0-9999	0.1	
Disp Values	Input	Runtime	4	R	V	Particular PM2.5	5N/5D	int16	ug/m^3	16	0-5000	1	
Disp Values	Input	Runtime	5	R	V	TVOC	5N/5D	int16	ppb	16	8-2820 ppb 16-5640 ug/m^3	1	
Disp Values	Input	Runtime	14	R	V	Particular PM1	5N/5D	int16	ug/m^3	16	0-5000	1	
Disp Values	Input	Runtime	24	R	V	Particular PM10	5N/5D	int16	ug/m^3	16	0-5000	1	
Disp Values	Input	Runtime	30	R	V	Air quality score	3N/3D/5N/ 5D	int16	signed	16	0-100	1	
Disp Values	Input	Runtime	80	R	NV	TAG Identifier Data	3N/3D/5N/ 5D	int16	string	64	SS-TR50	-	
Disp Values	Input	Runtime	96	R	NV	Host Firmware version	3N/3D/5N/ 5D	int16	signed/int32	32	00 00 00 01 99 99 99 99	-	
Disp Values	Input	Runtime	98	R	NV	BLE Firmware version	3N/3D/5N/ 5D	int16	signed/int32	32	00 00 00 01 99 99 99 99	-	

The format for creating and mapping the VAV device to Modbus Registers is as follows:

Slave Address	Type	Inst	Descr	Name	Units	Gateway String	Poll Int	COV Incr	Enumerations	CFA
1	AV	800	Temperature	Temperature		I,3,1,*0.1	1			L
1	AV	801	Humidity	Humidity		I,3,2,*0.1	1			D
1	AV	802	CO2	CO2		I,3,3	1			D
1	AV	803	cfgLedRing Brightness	cfgLedRing Brightness		I,4,3001	1			D
1	AV	807	Particulates PM	Particulates PM		I,3,4	1			D
1	AV	808	TVOC	TVOC		I,3,5	1			D
1	AV	809	ParticulatesPM1	ParticulatesPM1		I,3,14	1			D
1	AV	810	BLEFirmwareVersion	BLEFirmwareVersion		I,3,98	1			D
1	AV	811	BLEFirmwareUpdateStatus	BLEFirmwareUpdateStatus		I,3,115	1			D
1	MV	800	TempOutOfRange	TempOutOfRange		O,4,2200	1		1: For normal 2: For offnormal	D
1	MV	801	HumiOutOf-Range	HumiOutOf-Range		O,4,2201	1		1: For normal 2: For offnormal	D
1	MV	802	CO2Out-OfRange	CO2Out-OfRange		O,4,2202	1		1: For normal 2:For high limit 3:For high high limit	D
1	MV	803	PM25OutOf-Range	PM25OutOf-Range		O,4,2203	1		1: For normal 2:For high limit 3:For high high limit	D
1	MV	804	TVOCOutOf-Range	TVOCOutOf-Range		O,4,2204	1		1: For normal 2:For high limit 3:For high high limit	D
1	MV	805	AQILevel	AQILevel		O,4,2205	1		1 = For normal 2 = For Moderate limit 3 = For Unhelthy limit	D
1	BV	800	cfgTemperature-Unit	cfgTemperature-Unit		O,0,4000	1			D
1	BV	801	cfgLEDAndLCDEnable	cfgLEDAndLCDEnable		O,0,4020	1			D
1	BV	802	cfgModbusAuto-Baudrate Enable	cfgModbusAuto-Baudrate Enable		O,0,5000	1			D
1	BV	803	cfgModbusFrameCntClear	cfgModbusFrameCntClear		O,0,5001	1			D
1	BV	804	cfgLocalDetectionEnable	cfgLocalDetectionEnable		O,0,5040	1			D

Type: This is the BACnet Point type in the modular VAV device to which the Modbus Register will get mapped (options are AV, BV,MV).

Inst: This is the BACnet Point instance in the modular VAV device to which the Modbus Register will get mapped.

Gateway String: This is the Mapping to the Modbus Register.
NOTE: Gateway String **DOES NOT** contain Node (Slave), address.

Name: This is the BACnet Point Name.

Descr: This is the BACnet Point Description.

Units: This is the BACnet Point Units.

Poll Int: This is the interval at which the Modbus Register will get polled on the Modbus Network. This can be set individually on a point by point basis, or if set to 0, it will use the Default Poll Interval defined for the modular VAV device (set in Device Mapping file).
NOTE: There are many items that determine the correct Polling Interval (Baud rate, number of devices and number of points per device). Starting with higher (slower) values is recommended.

COV Incr: This is the BACnet Change of Value (COV), Increment for the Point. This only applies for Analog points and is used for BACnet COV Notifications (see BACnet COV).

Enumerations: This is a list of Enumerations (and their associated State Text values), for mapping Modbus Register values to/from BACnet Multi-State points. If there is a Modbus Register that represents a set of specific States, you can define an enumeration for each state that will be shown in the BACnet multi-state point.
NOTE: If a Modbus Register returns a value that not match a defined enumeration, the multi-state point will remain at the last read state and change to a reliability of “Configuration Error”.

Sending Point Mapping CSV to VAV Device

1. Use VAV Builder tool and the instructions within the tool to create Modular VAV Modbus and related files and activities.

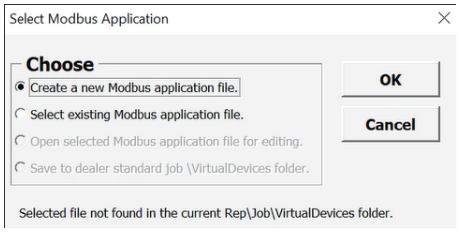


Fig. 47 Modbus Application

2. Give the required Device Instance, Gateway strings, Point Type values and **save** the Modbus application in DDC folder.
3. Open Compass Device Manager.
4. On the Add/Edit Device Profile dialog select the **Preferences** Tab.
5. On the Preferences Tab, click the “**Browse…**” button in the Application section.
6. Select the Point Mapping file with the same Device Instance you created above and click **OK**.
7. From the Main Device Manager dialog highlight Device Instance and click “**Send**…”.
8. On the Send Data from Disk to Device(s) dialog select the “DDC or CSV” option, and then click **Send**.

Syslog

Syslog is a standard protocol to send system log messages from the controller to a server, allowing the admin to collect and analyze logs from various network devices in a single location for monitoring, troubleshooting, and security analysis. Syslog is used to prevent the cyber attack. For example, if someone is trying to access the controller from a third-party tool then the Syslog feature will capture if there is any application change in the controller, trying to login via BLE, or trying to access the controller with the wrong Passcode. These messages are captured in the Syslog server.

Syslog Configuration:

Syslog Configuration enables the audit logging feature via an audit logging server. Whenever an audit event happens, the controller will send the information to the Syslog server.

To capture the audit logging event in the external Syslog server, run a Syslog server on the PC. Enable the IP address, either IPv4 or IPv6, in the controller. If the controller is in IPv4, then only IPv4 will work. If the controller is in IPv6, then only IPv6 will work. If the controller is already working on IPv4, then enable Syslog IPv4 as **YES**. Once the IP address is enabled, mention the UDP port number. The standard UDP port number is 514. If the user wants to change the port number, then use the same port number mentioned on the server side. This is the basic configuration to enable the Syslog server. Once this configuration is done, the audit logging events will be pushed to the Syslog server.
Example: Bluetooth connection, Bluetooth login failure

Below are the details about the logs that are supported by Syslog server:

SLno	Facility	Severity	ProcID	MsgID	message
1	LOG_FACILITY_AUTHPRIV	LOG_SEVERITY_WARNING	BLE_AUTHENTICATION	BLE_LOGIN_FAIL	BLE: Login Attempt failure!
2	LOG_FACILITY_AUTHPRIV	LOG_SEVERITY_ERR	BLE_AUTHENTICATION	BLE_LOGIN_LOCKED	BLE: Login Attempt max retry failure! retry after 30 mins
3	LOG_FACILITY_USER	LOG_SEVERITY_ERR	ROC_DOWNLOAD	ROC_DOWNLOAD_FAIL	ROC update: received invalid chunk!
4	LOG_FACILITY_USER	LOG_SEVERITY_ERR	ROC_DOWNLOAD	ROC_DOWNLOAD_FAIL	ROC update: Failed! File size is too big!
5	LOG_FACILITY_USER	LOG_SEVERITY_ERR	ROC_DOWNLOAD	ROC_DOWNLOAD_FAIL	ROC update: Flash partition failure!
6	LOG_FACILITY_USER	LOG_SEVERITY_ERR	ROC_DOWNLOAD	ROC_DOWNLOAD_FAIL	ROC Update: Communication Dropped! Timeout waiting on ROC file!
7	LOG_FACILITY_DAEMON	LOG_SEVERITY_INFO	LOAD_CONFIGURATION	LOAD_CONFIGURATION_REBOOT	New DCF file recevied, controller will reboot.
8	LOG_FACILITY_ALERT	LOG_SEVERITY_WARNING	WATCHDOG	WATCHDOG_TRIGGER_REBOOT	Watchdog not serviced by (specific thread name)
9	LOG_FACILITY_AUTHPRIV	LOG_SEVERITY_INFO	BLE_AUTHENTICATION	BLE_LOGIN_SUCCESS	BLE: Login success.

Fig. 48 Logs supported by Syslog server

Syslog server implementation is followed by RFC standard **5424**.

Syslog server running on a PC example, **Syslog watcher Manager**.

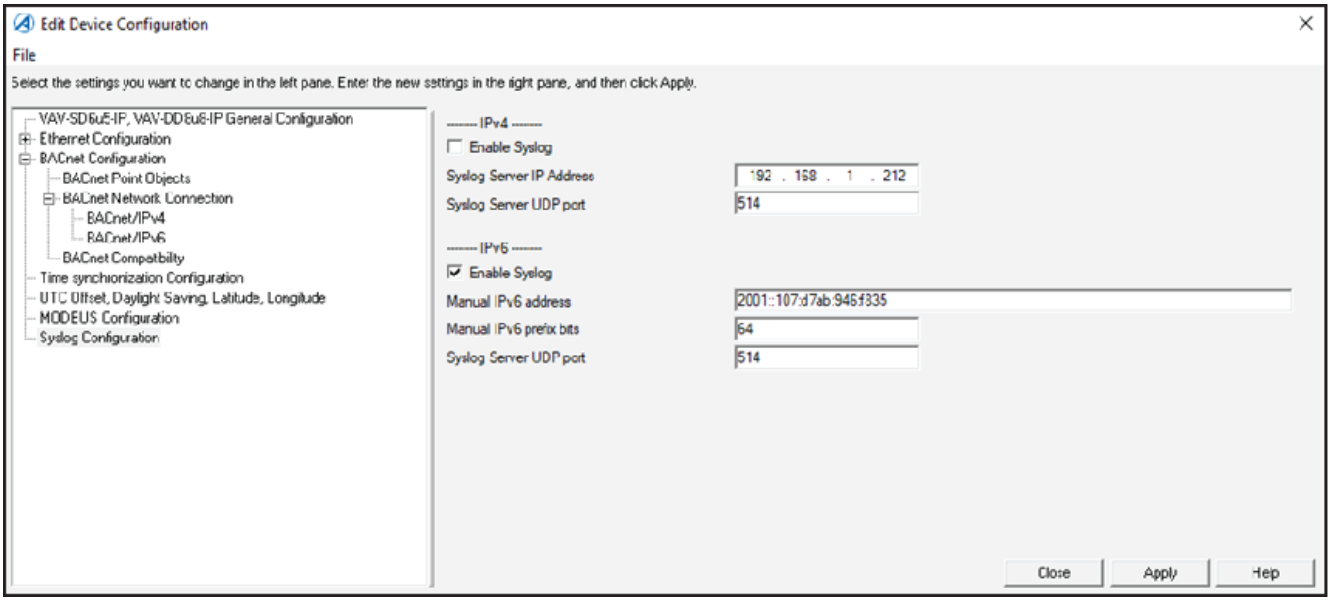


Fig. 49 Syslog Configuration

Table 36 Syslog Configuration

Configuration Parameter	Values	Description	Default
IPv4			
Enable Syslog	Y/N	Enable/Disable the IPv4 Syslog Protocol	N
Syslog server IP Address		IP address input by default configuration was selected above	192.168.1.212
Syslog server UPD port		Specifies the UDP Port number to be used by BACnet/IPv4	514
IPv6			
Enable Syslog	Y/N	Enable/Disable the IPv6 Syslog Protocol	N
Manual IPv6 address		IPv6 address input if manual IPv6 address configuration was selected above	2001::b53d:16c3:a748:5f04
Manual IPv6 prefix bits		Manual entry for IPv6 network prefix	64
Syslog server UPD port		Specifies the UDP Port number to be used by BACnet/IPv6	514

BLE Settings

The controllers that support BLE can be used to configure the BLE settings using the following steps. As part of BLE settings, the user can enable/disable the BLE, and set a Passcode within the range that the Passcode is valid for the BLE connection. This Passcode is used by the mobile application to log into the controller.

1. From the Device Manager, select the **Controller**, and click **Edit**.
2. On the **Capabilities** tab, select **Supports Bluetooth** for BLE controllers.

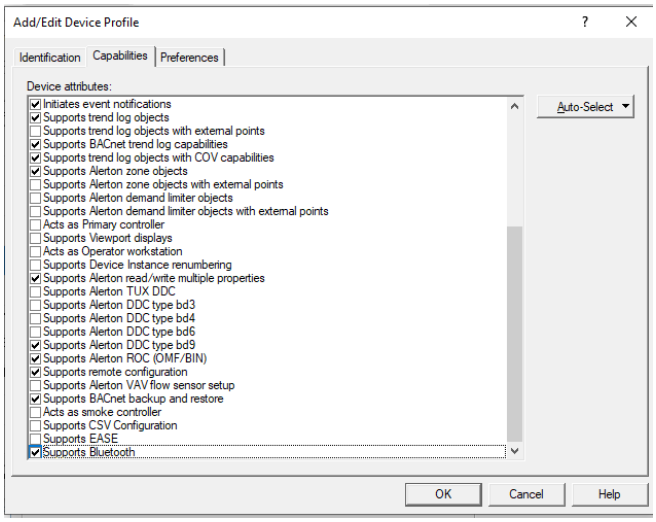


Fig. 50 BLE Supports

3. From the Device Manager, Select **Controllers** and Go to **Advanced** and then select **Set BLE PassCode**.

NOTE:
From the Compass Device Manager, the user can select a Controller in bulk or a single.

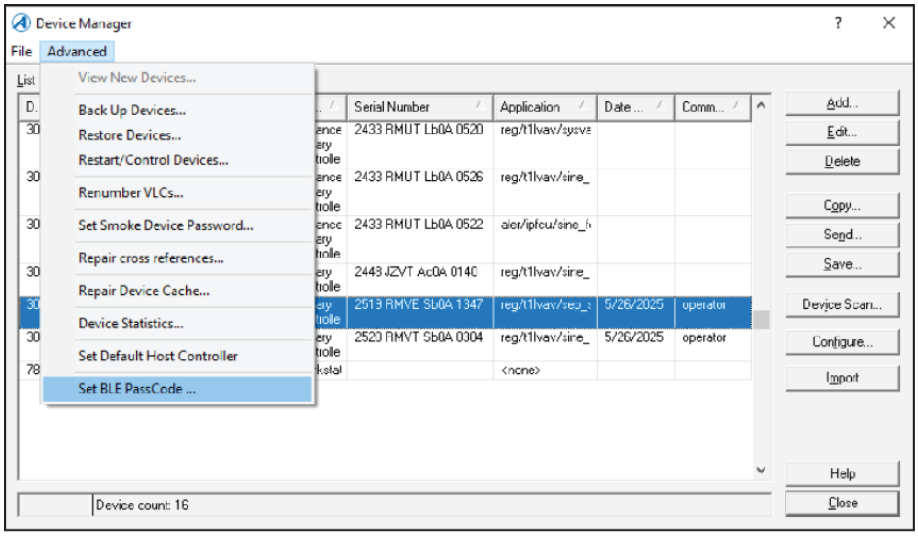
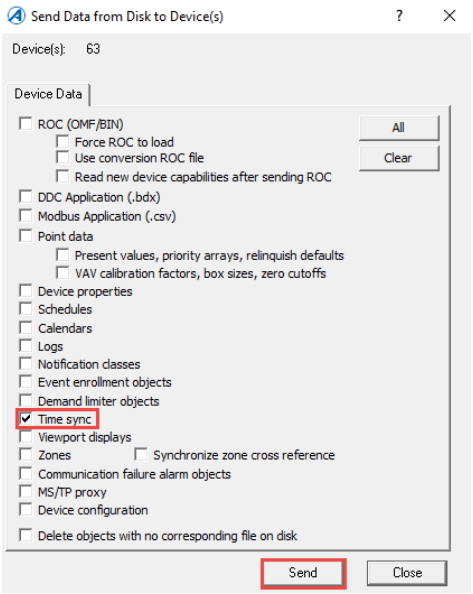


Fig. 51 BLE Settings

4. Before enabling or disabling the Bluetooth, a **Time sync** is required.



5. From Push Bluetooth Setting,
   Enable the Bluetooth, Select ☑ **Set BLE Pass Code.**
   Choose the **Start Date** and **End Date**.
   Set Pass Code and Click **Send**.

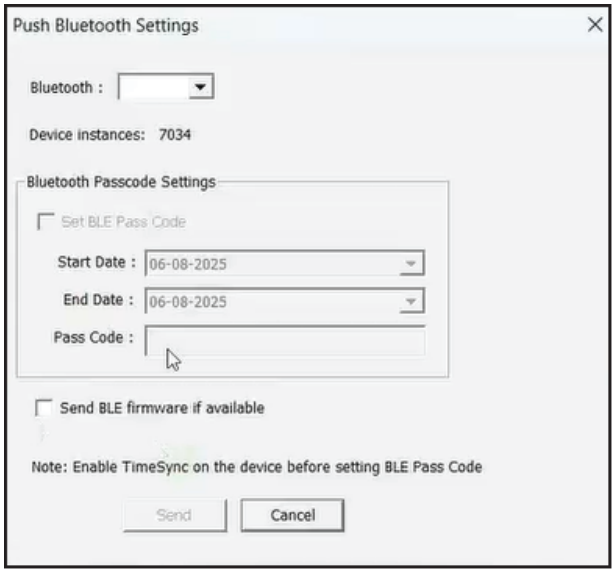


Fig. 52 Push Bluetooth Settings

NOTE:
From the Start Date, set the Pass Code End Date to the next day.
For example;
Start Date - 21/08/2024,
End Date - 22/08/2024.

If the Passcode expires or has expired by the end date, the user must perform the operation from step 3.

Table 37 BLE Configuration

Configuration Parameter	Values	Description	Default
Bluetooth	-	Enable or Disable	-
Set BLE Pass Code	-	Enable or Disable	Disable
Day of starting validity password	11-06-2024	-	-
Last day of validity password	11-06-2024	-	-
BLE Pass Code	-	8 number characters	None
Set BLE Firmware if available	Enable or Disable	To upgrade to the latest Bluetooth firmware, users must enable this field.	Disable

NOTE:
The correct time should be set in the controller using time sync from Compass before setting the BLE PIN. For more information about time sync, refer to Compass 2.3 Installation and Upgrade Guide 31-00314-05.

Configuring all Inputs and Outputs (Templates)

Configuring the I/O for the VAV controller is different from other Alerton products. Please be sure to read through this section in its entirety. The Alerton/Standard templates are used for configuring the I/O of the modular VAV controllers.

Follow the below steps for navigating to the VAV configuration page:

1. From the Compass, Click Device Manager.

Fig. 53 Compass page

2. Select the required VAV controller from the device manager list and Press **F12**.

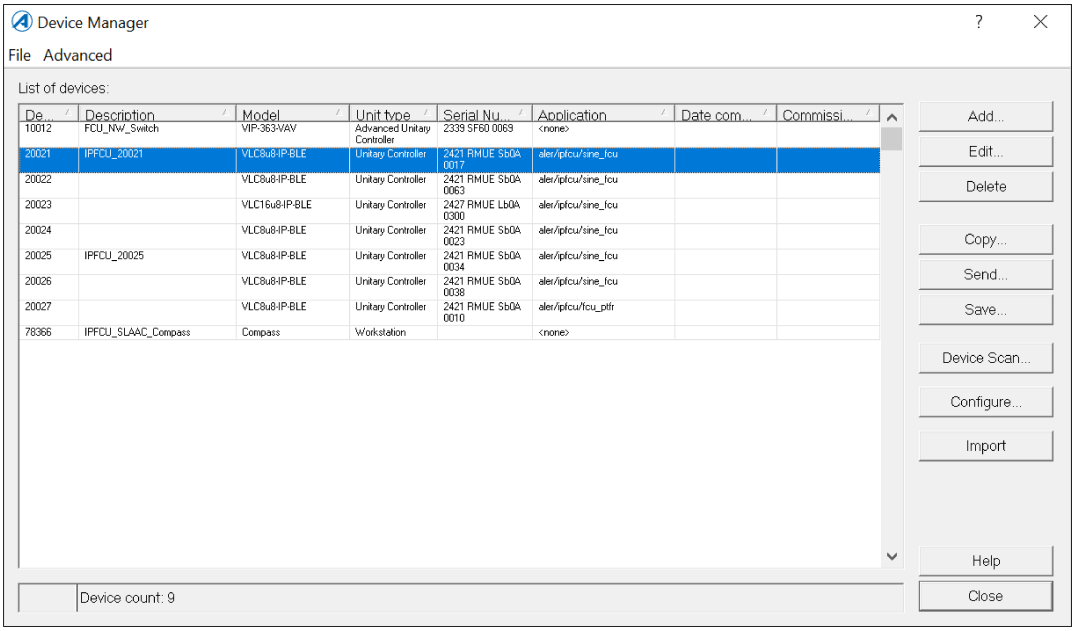


Fig. 54 Device Manager

3. It displays the device properties of the VAV-SD6u5-IP-BLE controller.

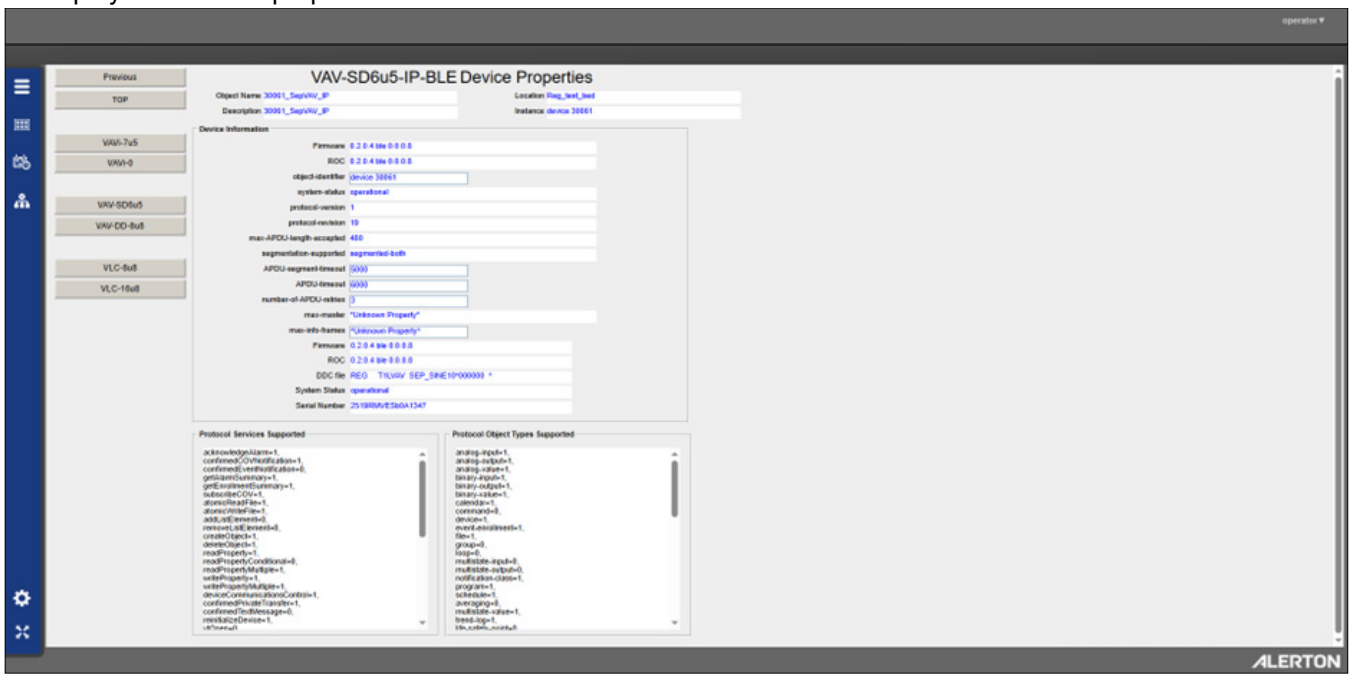


Fig. 55 VAV-SD6u5-IP-BLE device properties page

4. Navigate to the left and click **VAV-SD6u5/VAV-DD8u8.**

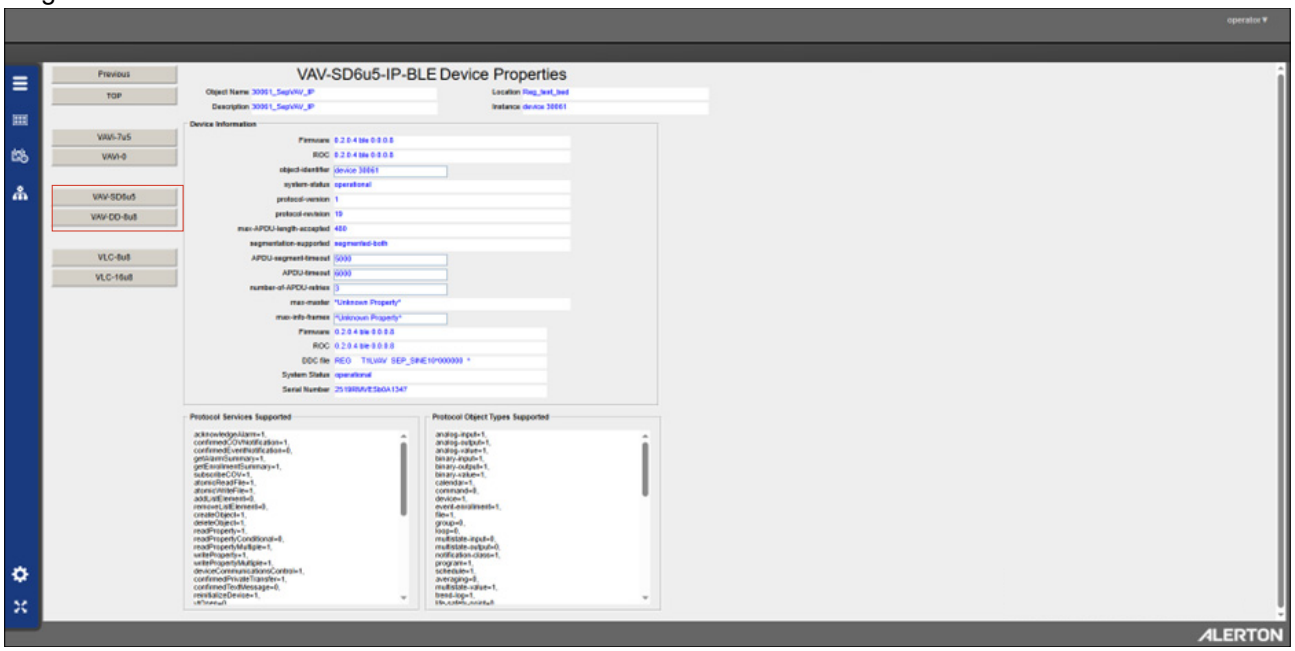


Fig. 56 VAV-SD6u5-IP-BLE device properties page

5. Click the **UIO Configurations (AI/BI)** and **(AO/BO)** on the top left display.

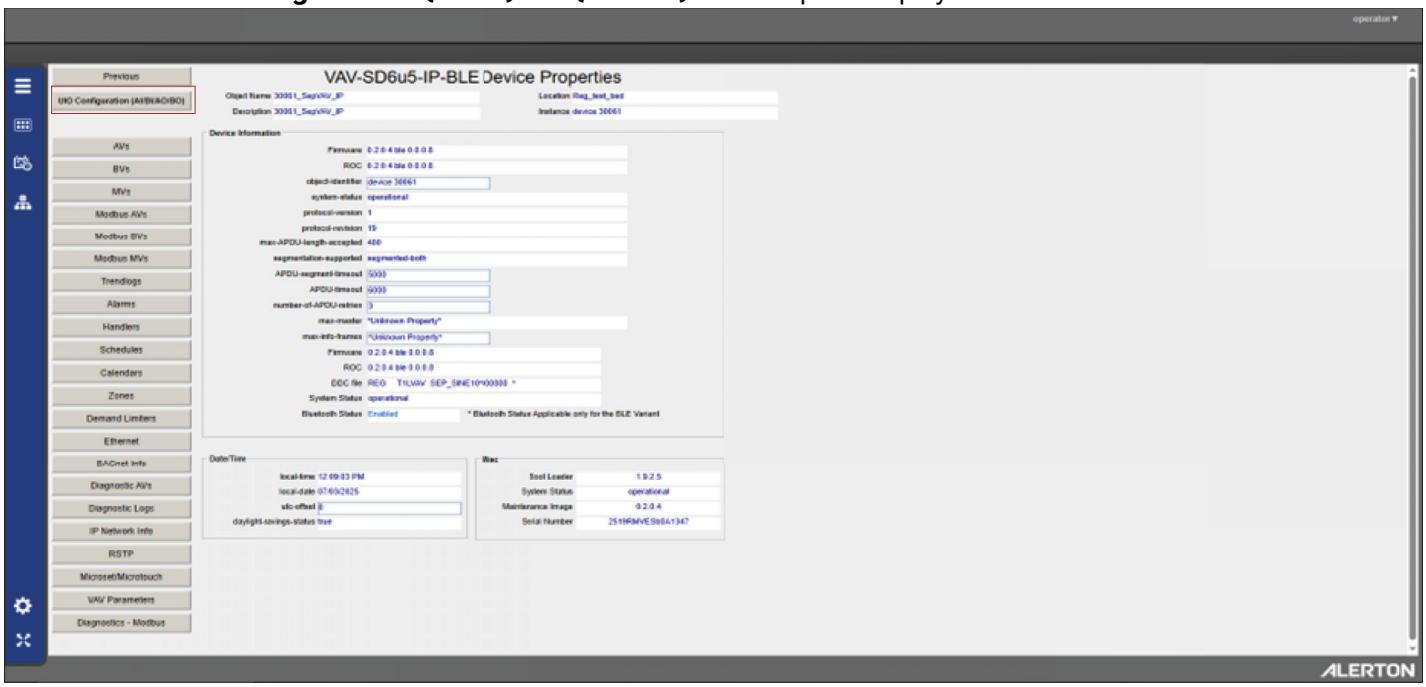


Fig. 57 VAV-SD6u5-IP-BLE device properties page

NOTE:
On the primary top display for the Modular VAV Controller the user can access to all related device templates (i.e., VAV Parameters, AVs, BVs, Alarms, Trendlogs etc.) for configuring the Modular VAV Controller.

NOTE:
The Hardware mode and Data Presentation mode (AI only) must be selected from the input configuration screen.

6. Clicking on UIO Configuration brings you to the I/O configuration screen for Modular VAV Controller.

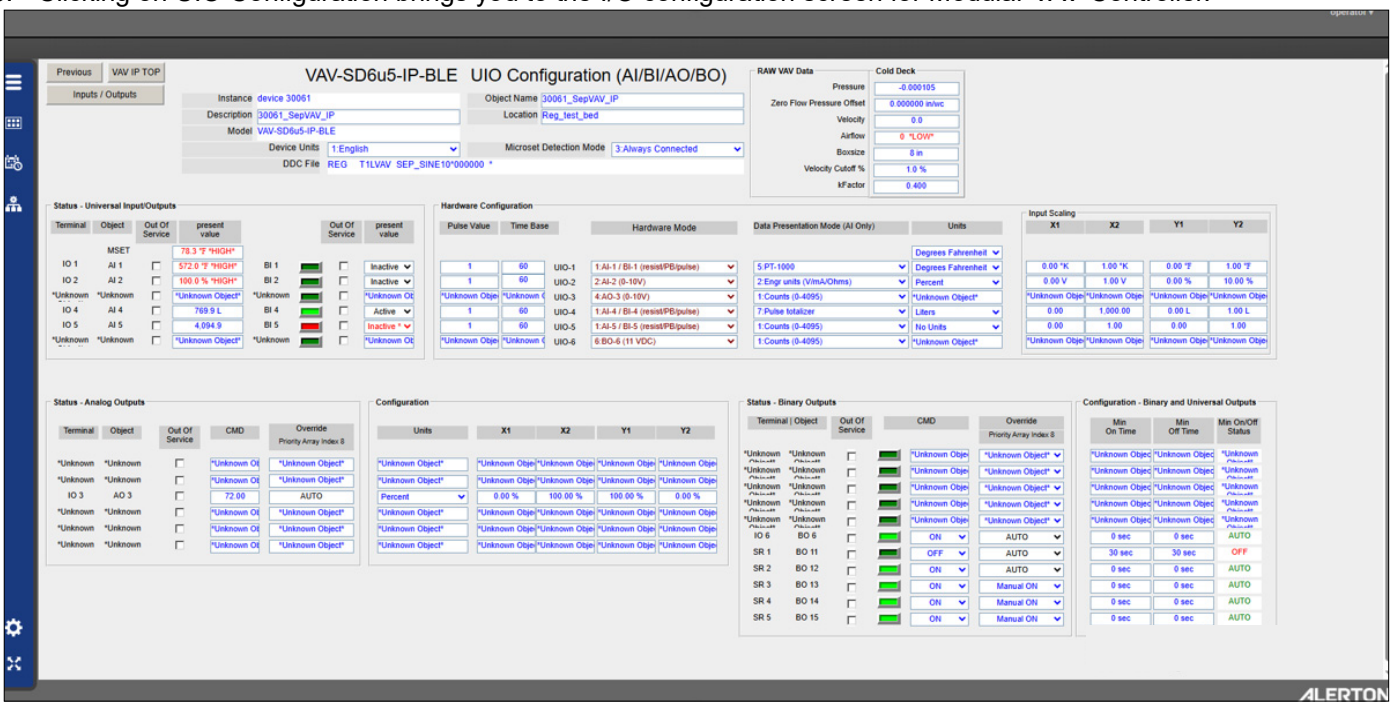


Fig. 58 Modular VAV I/O Configuration Screen

NOTE:
The usage of the UIO as an output is indicated by an Unknown Objects.

7. Navigate to the top left and select the **Inputs/Outputs** brings you to the I/O configuration page.

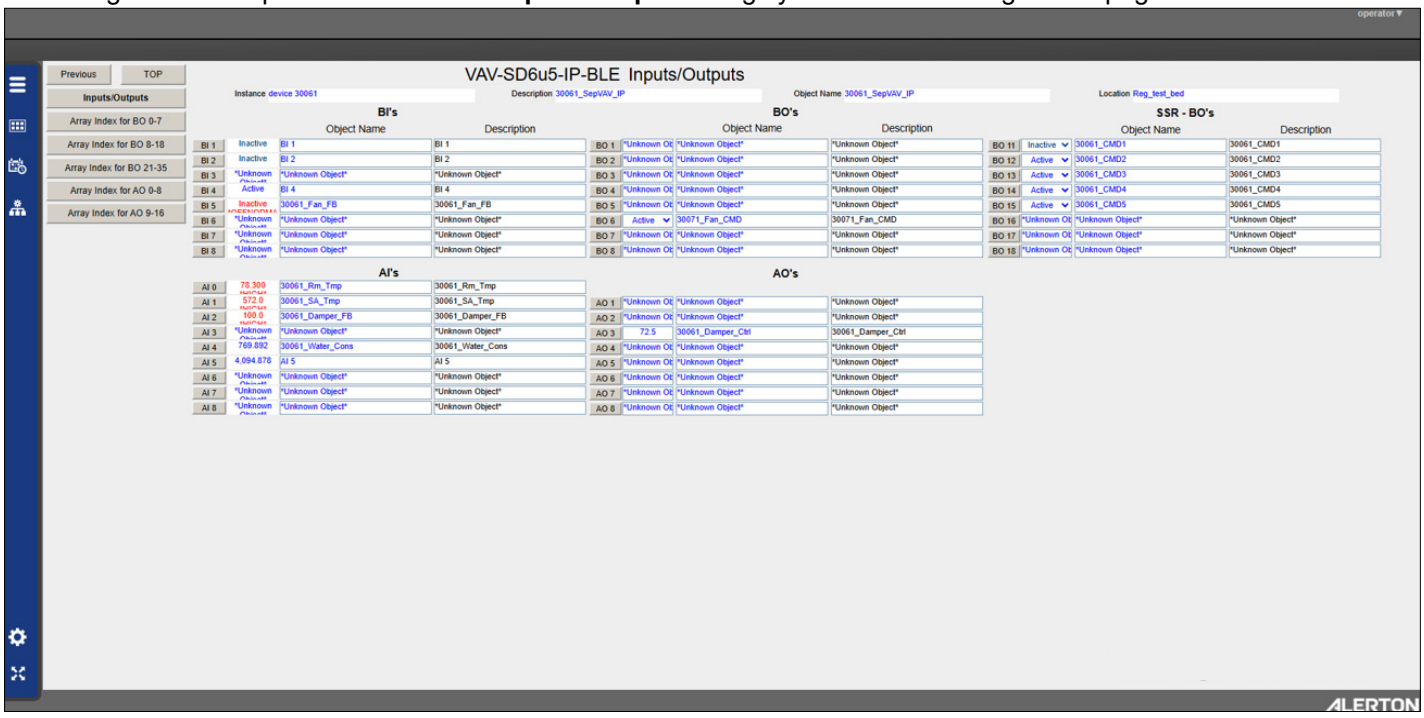


Fig. 59 Modular VAV I/O Configuration page (AI, AO, BI, BO)

Inputs

Device Units

A setting option of English or Metric that determines the scaling of the input and the input units. Example: (°F) for English and (°C) for Metric.

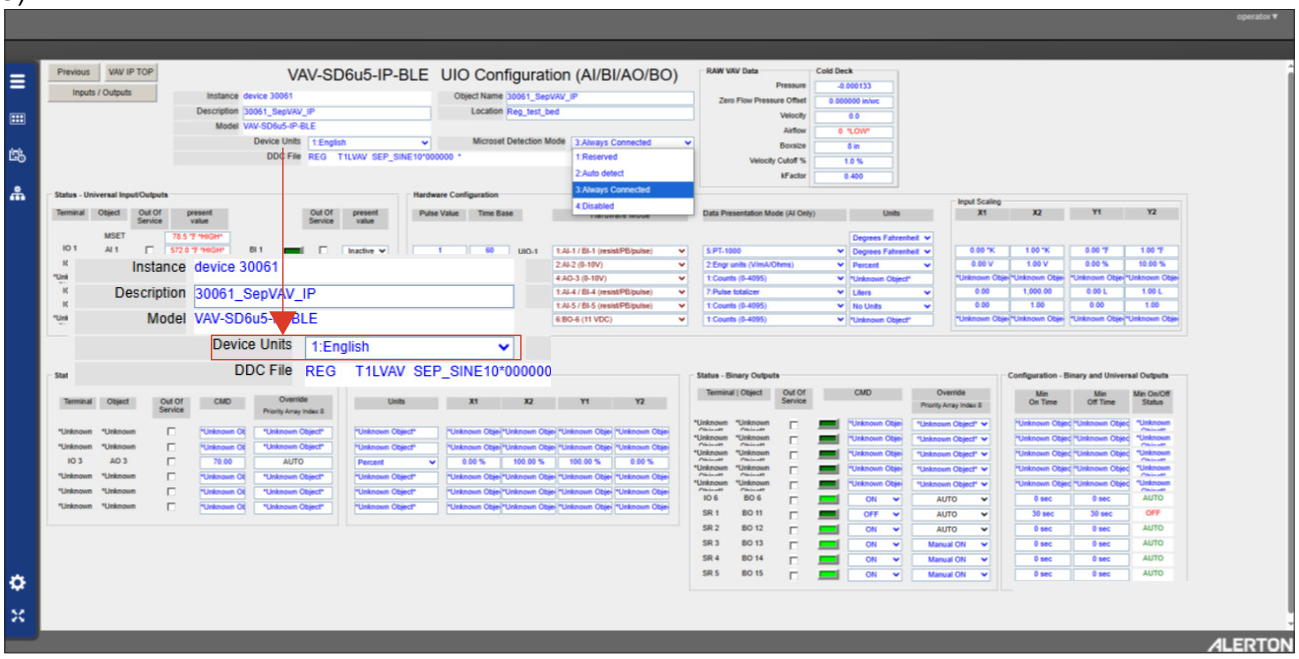


Fig. 60 Device Units

Microset Detection Mode

There are 4 options available in Microset Detection Mode: (1) Reserved, (2) Auto Detect, (3) Always Connected, (4) Disabled.

(1) Reserved: Reserved is for future use. Controller won't accept this value.

(2) Auto detect: (same as Microset AutoDetect = enabled in DDC headers) - this will poll every 12 seconds to see if a Microset is present.

NOTE:
For steady green status LED indication, Microset detection mode=Auto Detect is required. The only exception is if the Res(PB/Pulse)/10k Therm type is used, in which case "disabled" mode should be selected.

(3) Always Connected: (new setting) – Set if a Microset is present. This setting will switch AI-0 to be a temperature sensor and will attempt to talk to the sensor right away. This eliminates the state of power-up where the Microset hasn't yet been detected and odd numbers are displayed.

(4) Disabled: Users can set this option to prevent the "Status LED" from flashing Red when the Microset is disconnected from the controller. When this option is enabled, the "Status LED" will display green as long as no other active alarms exist.

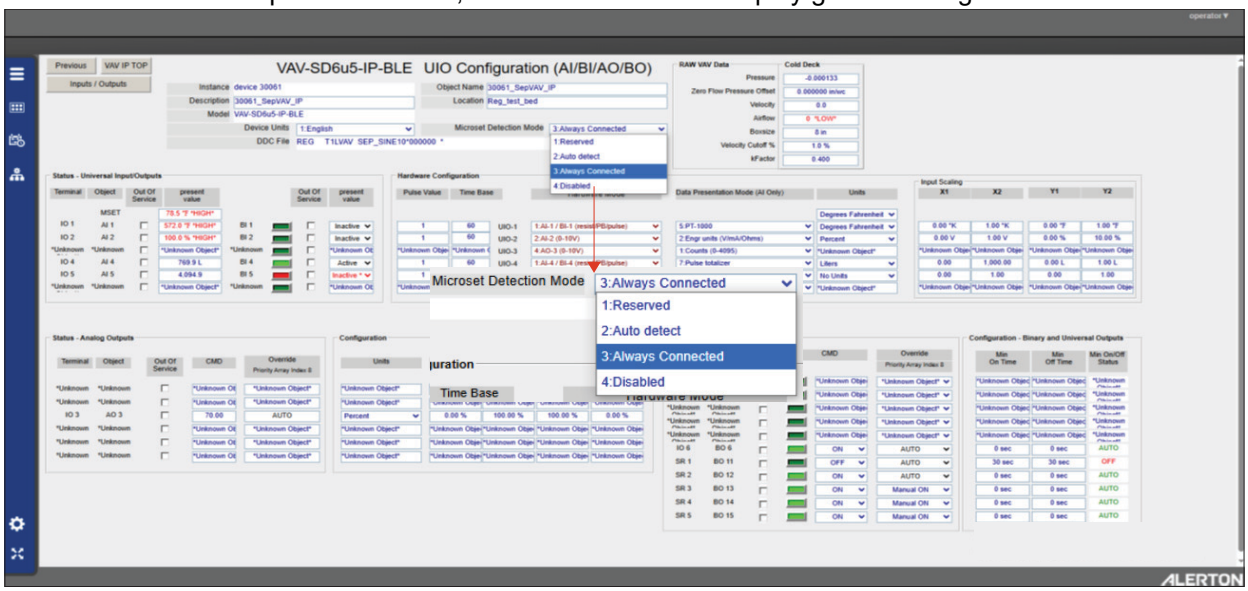


Fig. 61 Microset detection mode

NOTE:

If we are using Microtouch as a temperature sensor, there is no need to connect a jumper cable, and it cannot be used as an FST.

When Microtouch is configured with the Res(PB/Pulse)/10k Thermistor type, the capability to activate after-hours mode through a button press is not available.

Hardware Input Mode

Here the hardware mode of physical terminals can be set as analog input, binary input. The Universal Input (UIO) terminals on the VAV are input and can be set up for resistance, push-button, voltage
(0-10 V), or current (0-20 mA). Terminal IN0/MSET on the VAV is the only terminal to accept a Microtouch or Microset for input. Terminal IN0 on VAV is the only terminal that cannot be set for pulse input. All other Universal Input Terminals can be configured for pulse input.

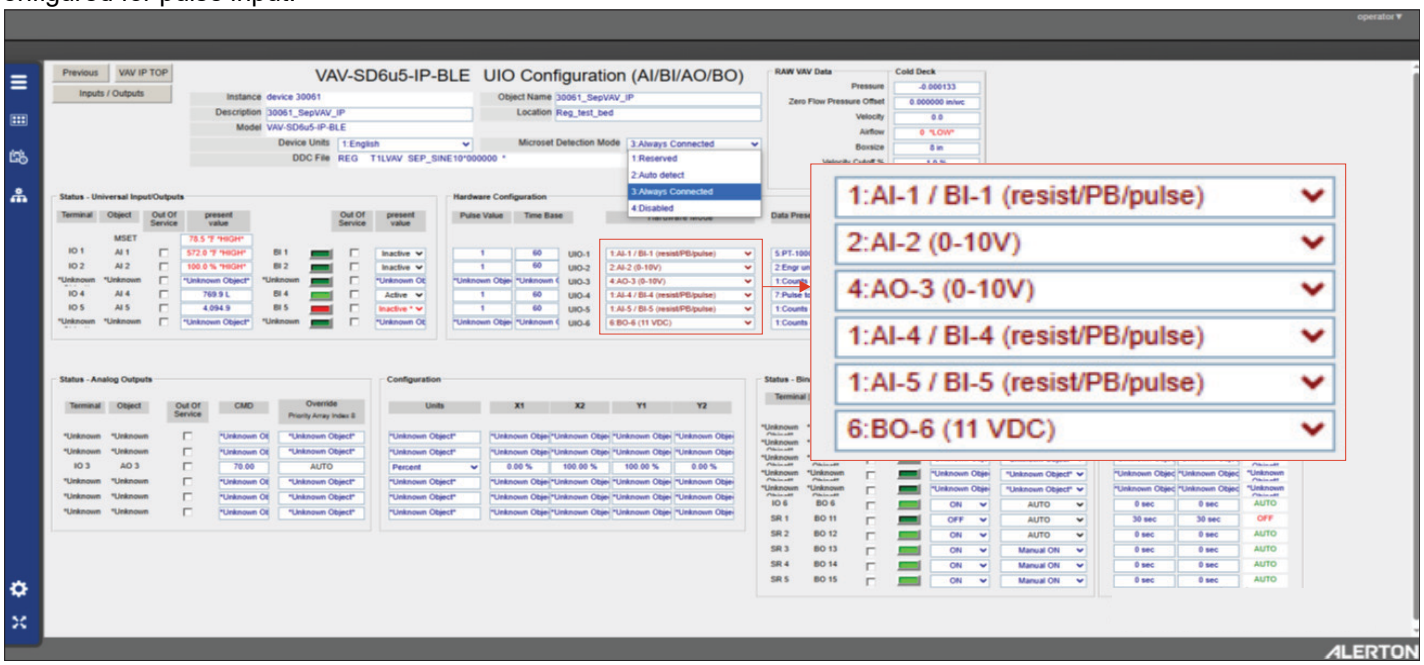


Fig. 62 Hardware input mode

NOTE:

The UIO present value will be retained if the user changes the hardware mode to some other type and reverts to the previous configuration (For example - If UIO-2 is configured as "Pulse Totalizer" and the present value is 34 and if the user now changes UIO-2 to AO and then reverts to "Pulse totalizer" again after some time, the present value is retained at 34 and continues from that point instead of starting from 0).

Data Presentation Mode

Defines how the input data is presented under Input Value for analog inputs. The default is counts like other VAVs but can be set to several other possible modes to provide a more user-friendly view of the input data reading.

Based on this setting, under the Input Values for Input Scaling, the low and high values will display the proper engineering unit. For example, if the input is set to a resistance input, and the data presentation mode is set to engineering units, the input values will display in Ohms. Likewise, if the input is set to voltage, setting the data presentation mode again to engineering units, the Input Values would be displayed as Volts.

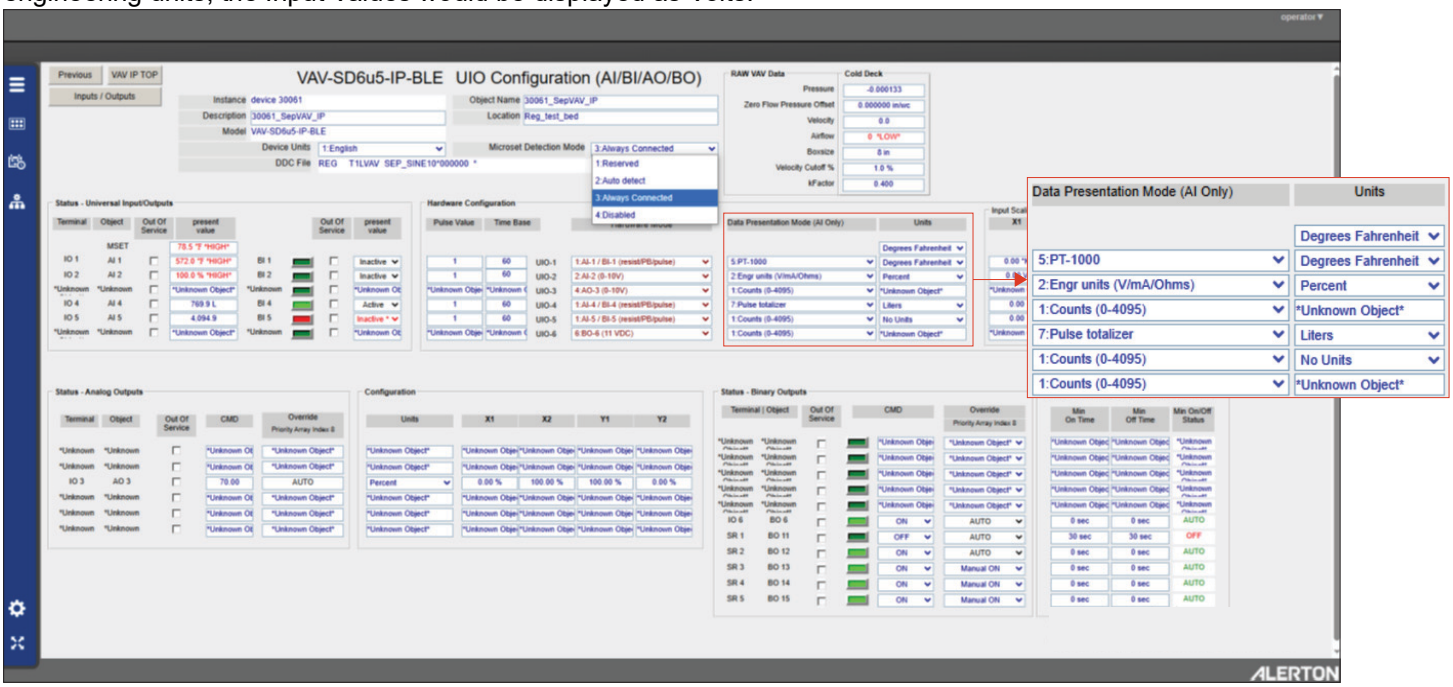


Fig. 63 Data Presentation Mode

NOTE:
The unknown objects listed indicates that the UIO is being used as an output.

Pulse Value

Pulse value is a configuration parameter when using a pulse input, this setting will provide the value for every pulse. For example, if the hardware mode is set to pulse totalizer it will count the number of pulses and multiply it against the pulse value. If a pulse value is set to 12 to indicate 12 gallons used every time it pulses, the totalizer will show how many gallons have been used over the total number of pulses counted.

Pulse Time Base

Pulse Time Base is used as a configuration parameter when using a pulse input of consumption rate. The pulse time base is indicated in seconds. In conjunction with pulse value, using the gallons example from above, a time interval can be applied. For example, if set to 60, every pulse will indicate gallons per minute, if set to 1, every pulse will indicate gallons per second.

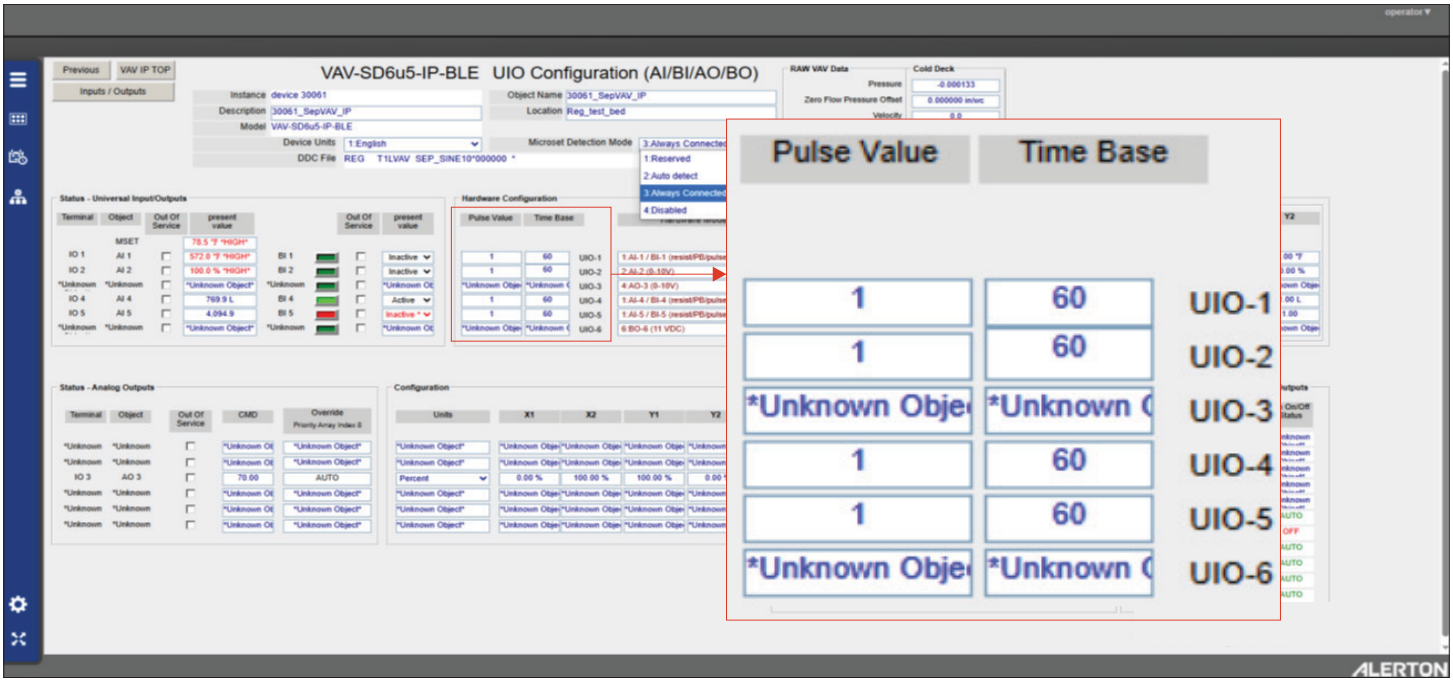


Fig. 64 Pulse Value and Time Base

Input Scaling

All inputs can be scaled via a 2-point scaling mechanism by defining Input Value – Low (X1), Input Value – High (X2), Output Value – Low (Y1), and Output Value – High (Y2). The default is X1=0, X2=1, Y1=0, Y2=1.

For example, an Analog Input (AI) is set to voltage (0-10 V) to measure inches water column and that setting is -0.5 to 1.5 you would set the input low value to 0, input high value to 10, then the output low value to -0.5 and the output high to 1.5 – the AI is now displaying inches water column.

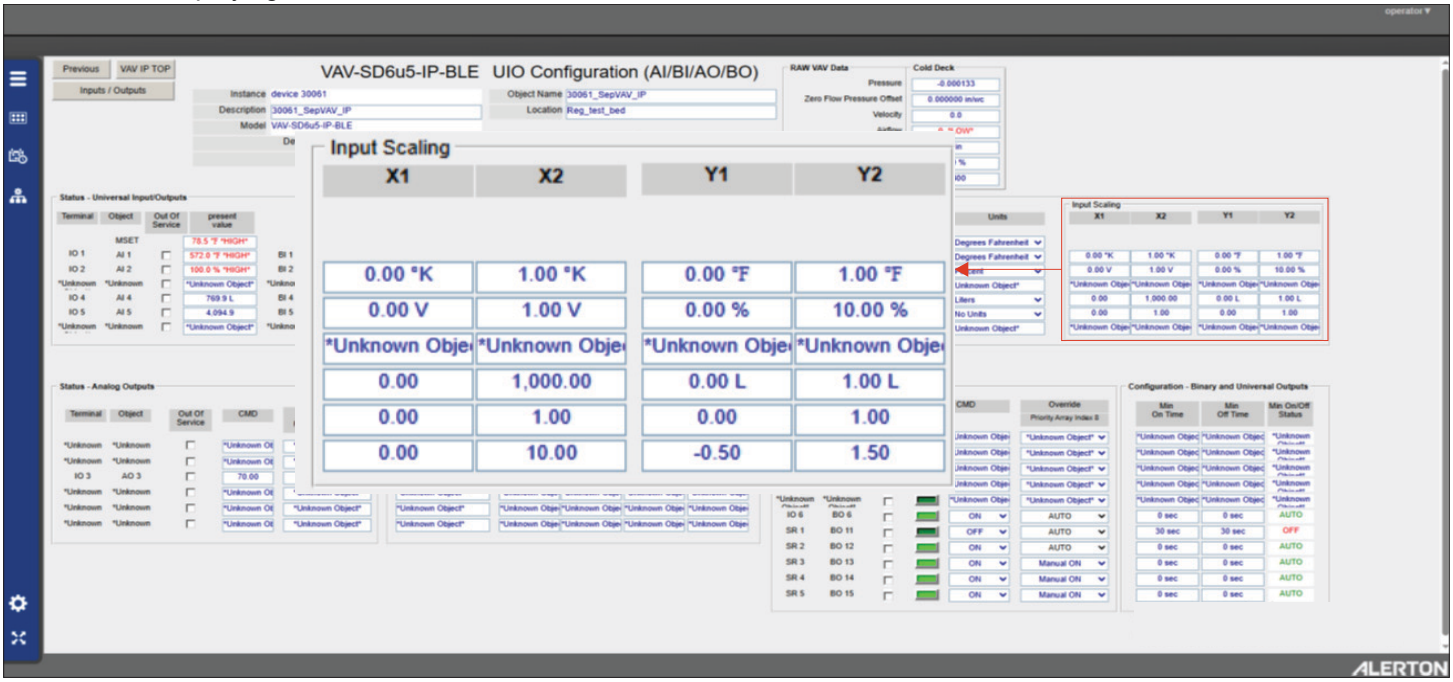


Fig. 65 Input scaling

Object Units

The object units display the desired units for an analog input present value. For example, if set to Liters, the values will display as Liters in the unit.

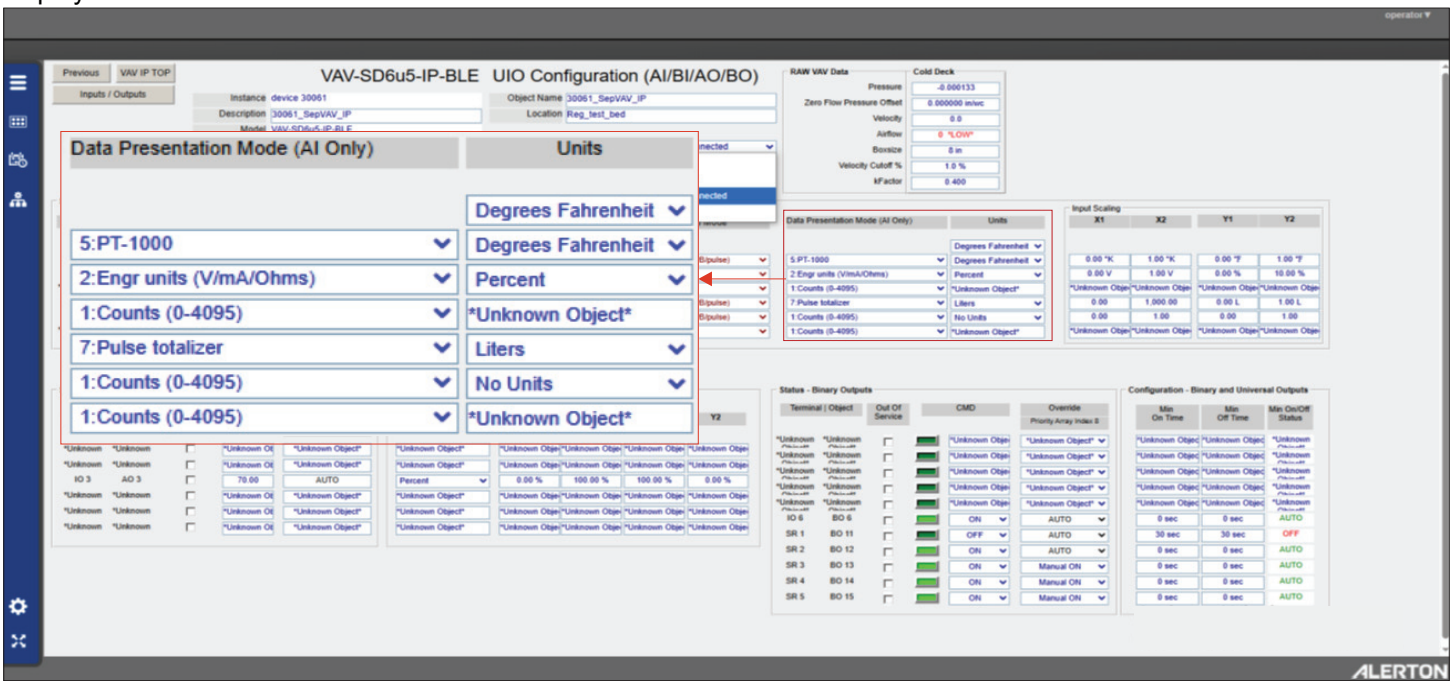


Fig. 66 Analog inputs units

Outputs

Hardware Mode

Universal Input / Output (UIO) Terminals in addition to the input modes supported by as noted above, can also support analog output and binary output. For more information on this BO type, see the section below on Binary Outputs.

NOTE:
The Present Value remains for some UIOs BACnet objects regardless of the hardware mode (specifically AOs and BOs). It's recommended to set present value to 0 prior to changing hardware mode.

Output Scaling

Like input scaling, outputs are scaled via a 2-point scaling mechanism as well. For example, if we set Input Value – Low (X1) to 0, Input Value – High (X2) to 100, and then Output Value – Low (Y1) to 0 and Output Value – High (Y2) to 100, as we command the AO from 0 to 100 percent DDC signal, it will take the output value and scale it between 2 and 10 VDC. So, if outputting a current output, it'll be between 4 and 20 milliamps. Outputs can be scaled however you want depending on the output type and range.

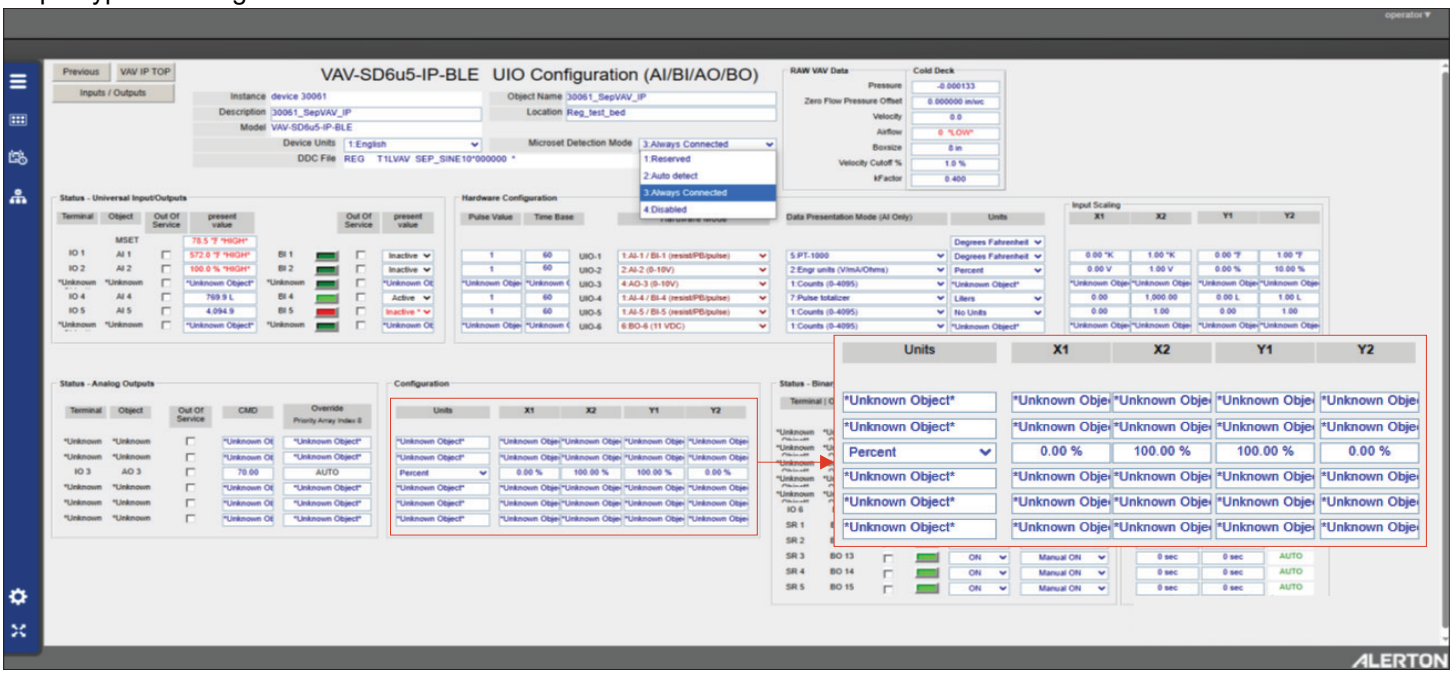


Fig. 67 Output scaling

NOTE:
The Hardware Status (HW Status) section values are calculated after all scaling and has been applied on the controller. This Output Scaling feature removes the need for using a two-point linear scaler in DDC.

Out of Service (For Inputs and Outputs)

Out of Service is now supported directly for AIs/AOs and BIs/BOs and useful as a troubleshooting aid. For inputs, setting Out of Service to TRUE decouples the physical input from what the device is reading. The input now behaves like an AV while in this state. This helps test control routines without having to re-write DDC.

While in **Out of Service** mode, the **Out of Service** flag is set to TRUE, the **Fault** flag is set to TRUE, and **Reliability** will be set to OPEN LOOP. For example, if a temperature sensor goes bad. The AI can be placed into Out of Service mode and the present value can be manually set to a typical running value and everything will run as normal until you replace the temperature sensor. Once the sensor is replaced, return the point to normal operation and the sensed value will now be used.

Out of Service mode for outputs behaves much the same as inputs, the software is decoupled from the hardware and the hardware settings will remain at their last value and allow for testing of control routines.

NOTE:
Ensure that any manually adjusted outputs are returned to a controlled state before returning to service as the adjusted outputs will be treated as the last value and controlled as such.

Placing an input or output into Out of Service

Placing an input or output into Out of Service mode is simple but performed a couple of different ways because available screen real estate of the template.

For inputs on the VAV, you can use the context menu to navigate to the object Properties template using the following steps:

8. Locate the terminal of the point to be put into Out of Service mode, in the image below it is AI 2 which is configured as an Analog Input.
9. Right-click on the present value of that **AI 2** to raise the context menu.
10. Select **Displays** and click **Analog Input Template**.

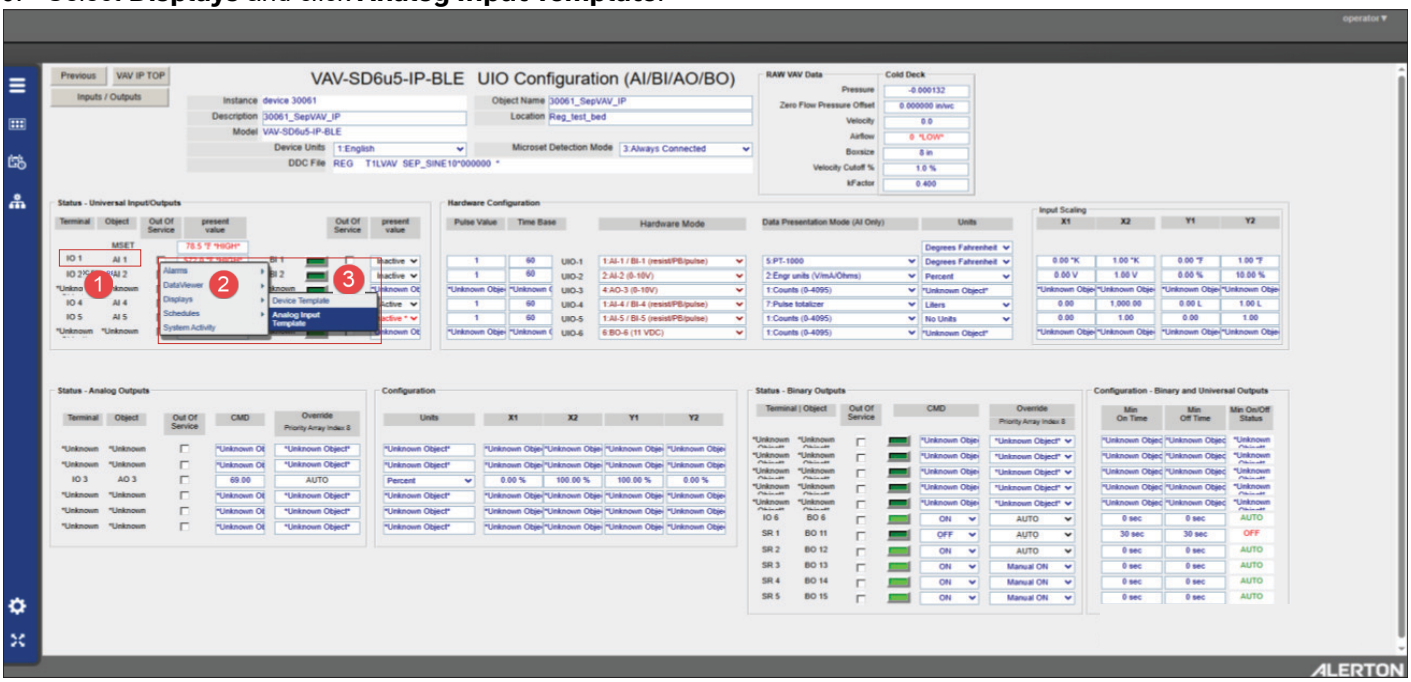


Fig. 68 Accessing the Analog Input Template

11. Navigate to Out_of_Service property and change False to True.

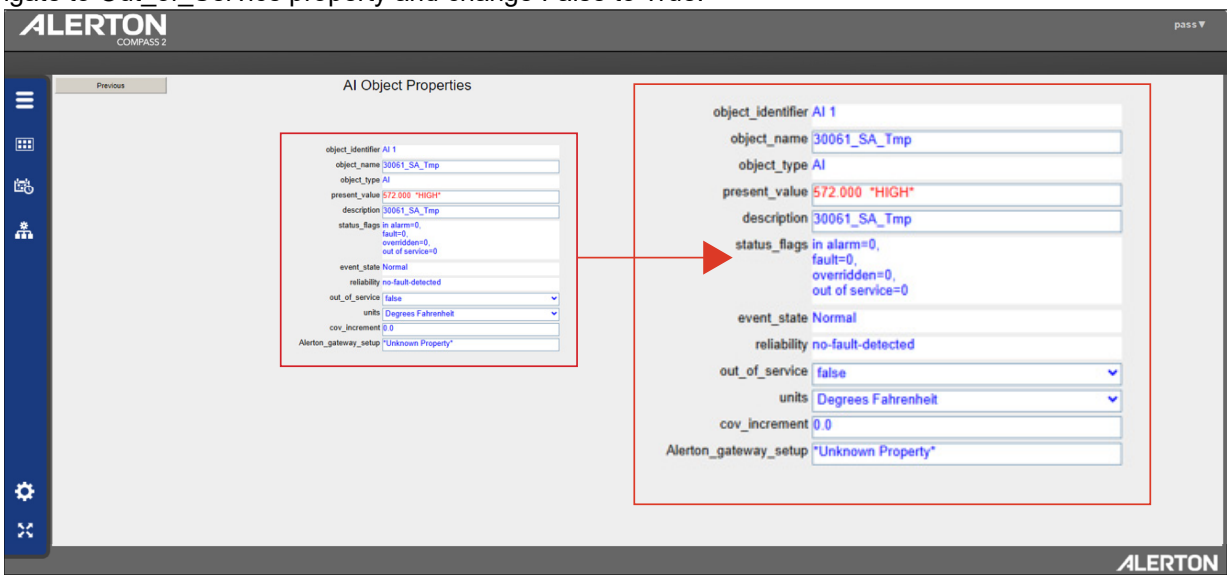


Fig. 69 AI 2 Object properties

To set the Out_of_Service property for the analog outputs, locate the output terminal AO 2 in Hardware status (HW), right-click to bring up the context menu, and navigate to the analog output Template to change the property from False to True.

Out_of_Service can also be Enabled/Disabled by selecting the “Out_of_Service” checkbox on the input and output configuration screens.

NOTE:
Out_of_Service is used when there is failure in the field sensor.

Binary Outputs

These binary outputs are different in that they switch between the minimum and maximum output values – or 0. Power for BO is only supplied by the base controller’s power. Typical usage for the BOs is controlling pilot relays.

When the Universal Inputs Outputs are configured as Binary Outputs using the Hardware Mode selection box, the rest of the configuration is done in the Output Config Page.

In the Output Config Page, you can view the status of the Binary Output is Off (shown as a Zero ~ Green Animation dim) or On (shown as a One ~ Green Animation bright). Binary Outputs can be configured with Minimum Off and On times and the status of these timers is shown.

NOTE:
The Minimum ON and OFF enforcement is done at Priority 6 in the priority array for the BO. As such, the present value should reflect this as long as the present value is not being commanded at a priority higher than 6 (in which case the Min ON/OFF would NOT be enforced).

Also shown is priority array index value 8 which is commonly placed on templates for operator overrides to quickly determine if the point is in override or not.

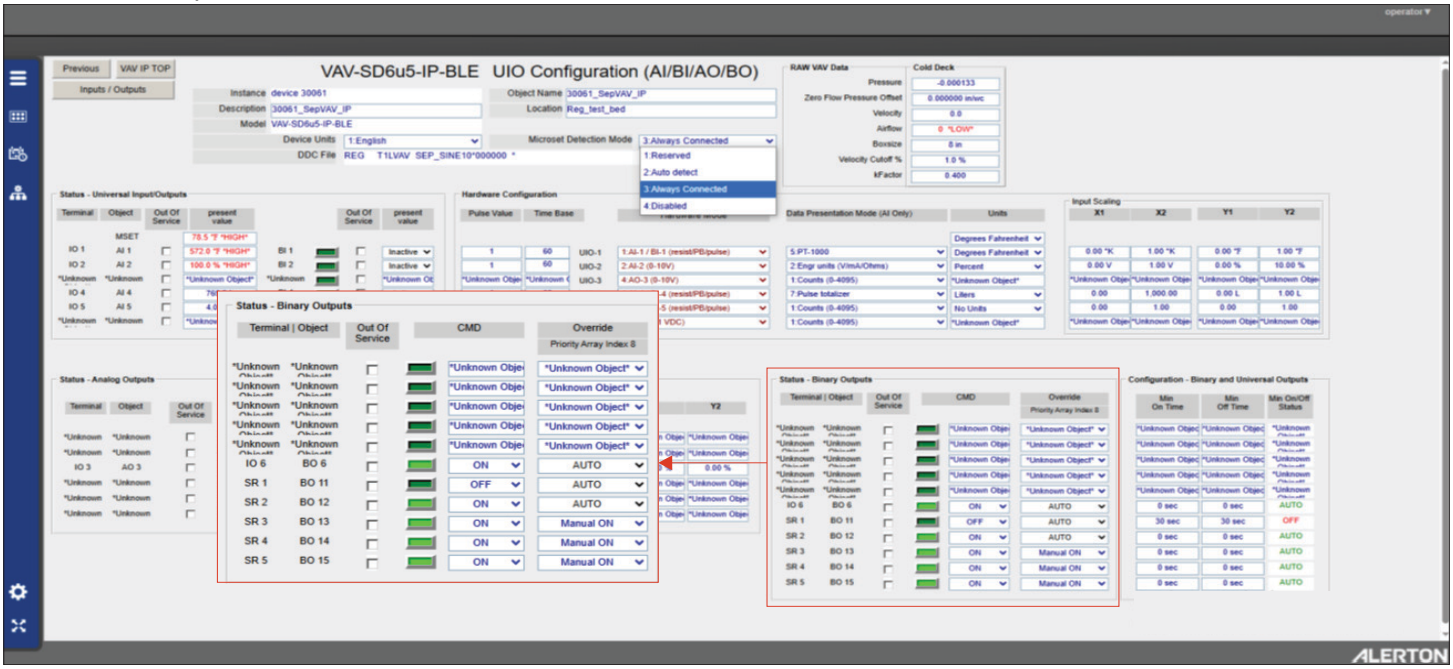


Fig. 70 Universal I/O - Binary Output - Configuration and Scaling

Output Scaling

Identical to input scaling except rather than scaling the input value, the scaling here applies to the output values. It is a 2-point linear scale.

NETWORK TOPOLOGIES

Ring topology can be a cost-effective solution for networks required to tolerate a single cable failure. To create a ring topology, only one Ethernet Switch (with RSTP support) and n cables are needed, where n is the total number of devices in the ring (including the Ethernet Switch).

Daisy Chain topology

There are two scenarios in daisy chain network topology:

(1) **Daisy Chain Topology in IP CAT5/6 Network:**

In the IP CAT5/6 network daisy chain connection type, if any of the devices in the network fails, the devices beyond the failed device also fail. For example, there are 10 devices in a network, and device number 1 is the client, connected to device number 2, and device number 2 is connected to device number 3, and so on. If the device 5 fails to function, device 6, 7, 8, 9, and 10 also fails to communicate with the client device.

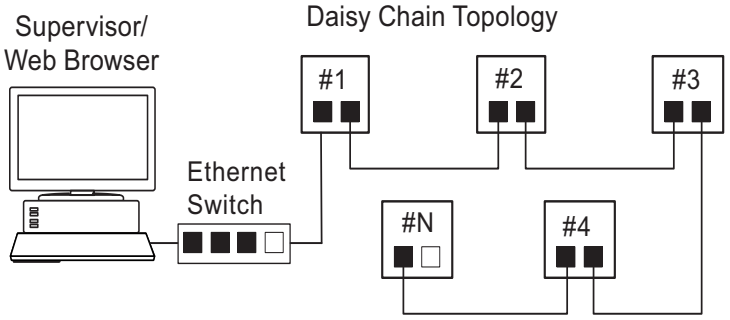


Fig. 71 IP CAT5/6 Daisy chain topology

(2) **Daisy Chain Topology in IP T1L Network:**

Daisy-chaining IP T1L VAV controllers offer a high level of network resiliency, even if case of device failure. As an example, if one controller in the network fails, the device beyond the failed device should be able to communicate with the other functional devices. Depending on the cable type and assuming the distance between functional nodes does not exceed the maximum stated above, the maximum number of offline IP T1L devices on the bus varies between 2 and 10 for daisy-chaining to remain functional.

Assuming that for the cable type used and based on the distance between functional devices, the fail-safe daisy-chaining stops to work beyond 2 offline controllers, then the devices downstream the failed controllers will not be able to communicate. For example, there are 10 devices in a network, and device number 1 is the client, connected to device number 2, and device number 2 is connected to device number 3, and so on. If the devices 5,6,7 fails to function, then the devices 8, 9, and 10 will also fail to communicate with the client device. This is because each controller in the power fail mode shortens the two IP T1L ports to make the connection resilient. However, shorting introduces internal resistance, which introduces attenuation to the signal. Thus, consecutive device failures add attenuation to the signal, such that the controller beyond it fails to communicate.

In a daisy chain configuration, A maximum of 100 Alerton VAV Controllers can be connected in a daisy chain configuration; However, it is recommended that the number of controllers daisy chained be limited to 25-30.

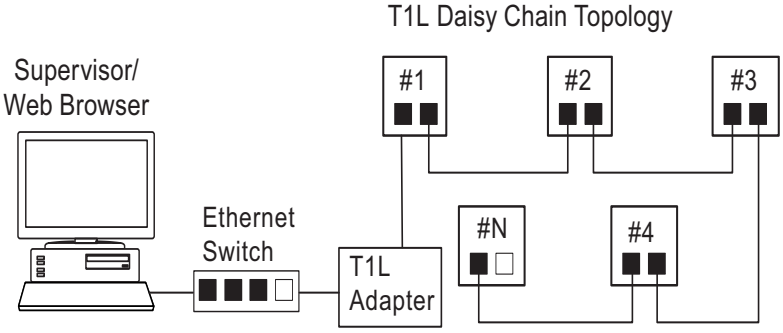


Fig. 72 IP T1L Daisy chain topology

NOTE:
Do not include RSTP enabled device in a non-RSTP daisy chain network. For example, if the user is using the controller in daisy chain network where RSTP is not enabled, the user should not include RSTP enabled devices in between the daisy chain network.

Ring network topology

If the VAV Controller is connected in a redundant ring, it requires one spanning tree protocol-supported Ethernet switch as a part of the ring. This switch will connect the VAV Controller to the IP network. The loop-free topology ensures that there aren't any broadcast storms or duplicate frame transmissions.

The maximum number of controllers connected in the ring network topology is 39 with one switch. The switch manages the connection of the loop.

For optimal performance and bus traffic, it is recommended to limit the number of controllers to less than 39.

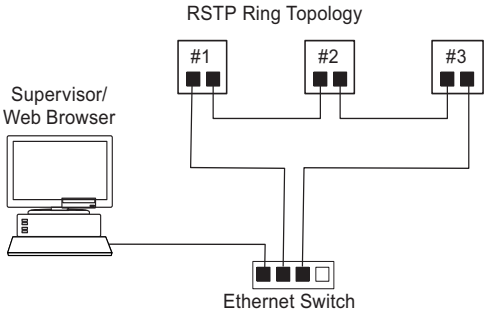


Fig. 73 IP CAT5/6 Ring Topology

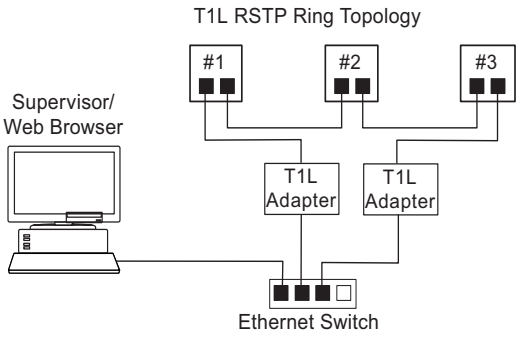


Fig. 74 IP T1L Ring Topology

NOTE:
Due to RSTP inherent nature, once the VAV Controller reboots there is a short period of time (less than 1 min) that the network topology requires to stabilize and assign proper port roles to each bridge. This characteristic may result in requiring an additional attempt at performing the ROC upgrade in RSTP topologies. Therefore, retry updating the device whenever this occurs. An alternative solution is to disable the bridge that creates the ring topology during the upgrade of the devices; the bridge can be re-enabled once the upgrade process is completed.

IMPORTANT:
Proper configuration of gateway parameters on IP devices is crucial for stable network functionality. Incorrect settings can lead to devices becoming unresponsive and disconnected from the network. When a device is placed on a network with multiple subnets, avoid setting the Gateway Method to None. If set to Manual, ensure the gateway's IP matches your network's gateway.

RSTP

Introduction

Rapid spanning Tree Protocol (RSTP) is a link layer network protocol that prevents bridge loops and flooding in local networks with redundant connections. To ensure a loop-free topology, RSTP disables some connections leaving a single active path between any two devices. These disabled connections can be used as a backup path in case of active connection failure. The former STP protocol has been superseded by RSTP – Rapid Spanning Tree Protocol, which can respond to topology changes faster than STP.

RSTP works by first nominating a single device to be the Root Bridge. The nominated Root Bridge device acts as an anchor point for the system. It gives all other bridges a reference point for choosing the best path to open and connect for routing. Bridge Protocol Data Units (or BPDUs), are passed between bridge ports to communicate Root Bridge and local port information. BPDUs are key to managing the RSTP network as they are used to assign the Port Roles of all the ports on the Bridge devices. The RSTP resides on layer 2 (data link) of the OSI 7-layer model.

⚠ CAUTION

When adding VAV Controllers with RSTP turned on, ensure that the entire network runs RSTP. Please note that if any link in the existing network runs just STP, then RSTP functions as STP on that single link. RSTP is backward compatible with STP; however, If there exists just a single link running STP, then the advantage of “rapid convergence” offered by RSTP is lost, and the network will take longer to converge (possibly up to 50 seconds) whenever there is a change in network topology. The best choice is always to segregate different protocols.

Only enable RSTP in the VAV controllers if there are redundant paths in the network. This has an impact on firmware download situations. When RSTP is enabled, all the switch ports are turned off when the VAV Controller reboots. This will result in a temporary loss of connectivity when there are no redundant links in the network.

To ensure that the RSTP protocol functions correctly within each network, RSTP must be turned ON for all VAV Controllers.

RSTP Scenario

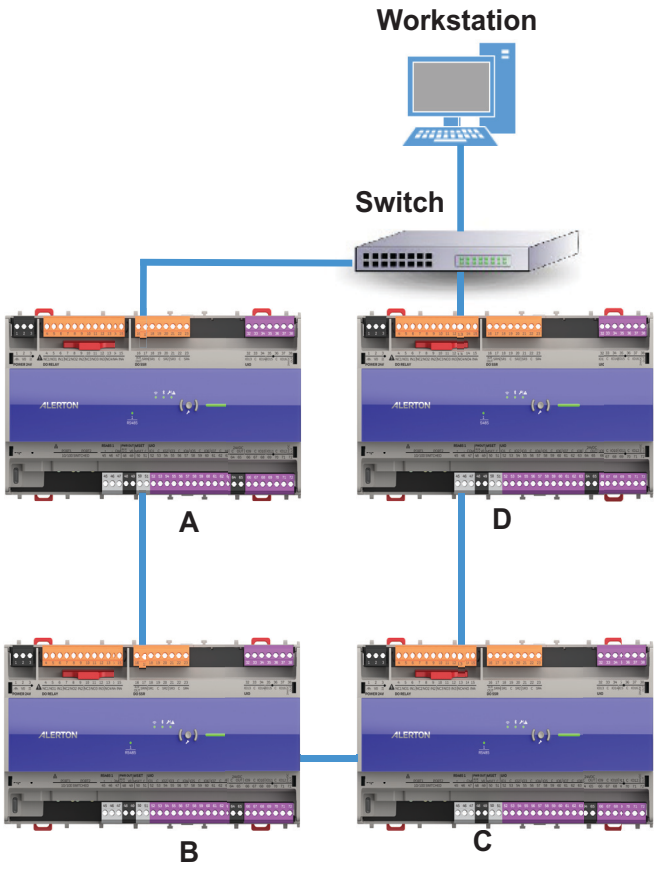


Fig. 75 RSTP Scenario

In the above scenario, the lines represent additional connections that facilitate an alternative path (loop) for the VAV Controllers labeled A through D. For example, if a device Alerton VAV Controller A fails, then it will check for the closest controller as a second NIC in the Workstation; in addition, the connection between other two controllers will establish a new path for the controllers on the bottom row. By adding a second NIC to the Workstation, the VAV Controller provides an alternative route if Alerton VAV Controller A fails; without this connection, VAV Controller a would be a risk. This simple network provides each controller with two different paths to the Workstation.

Root Bridge Features

1. Only one Root Bridge per network.
2. Automatically assigned to the device that has the lowest Bridge ID.
3. Bridge ID = Bridge Priority and MAC address (note the MAC address is used in the event of tied Bridge Priorities).
4. Bridge Priority is a configurable property, the default value is 49152 and is adjusted in increments of 4096.
5. MAC address is the NICs non-configurable MAC address.

Root Bridge Selection

There are both advantages and disadvantages if the Root Bridge is selected automatically. But, careful consideration must be taken when deciding which Ethernet Switch or VAV Controller is the nominated device to take on this responsibility. The risk of allowing the devices to select the Root Bridge automatically is the potential for the Root Bridge to get assigned to a device that may need to be in the most logical location on the network. Making the switch or VAV Controller closest to the Core Network connection, the Root Bridge would make the most sense. In addition, consider system redundancy and which device would be the most sensible backup in case the Root Bridge lost power; the whole point of RSTP is to facilitate redundancy.

Root Bridge Example 1

In this example, VAV Controller A takes on the responsibility of being the Root Bridge due to having a lower Root Priority (28672).

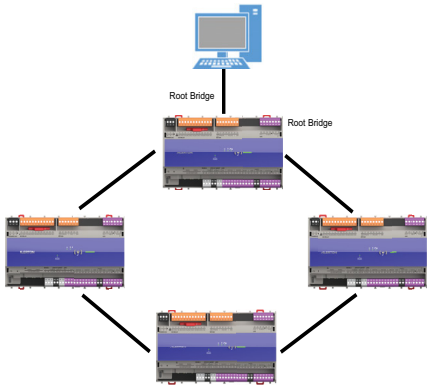


Fig. 76 Root Bridge Example 1

Root Bridge Example 2

In this example, VAV Controller B takes on the responsibility of the Root Bridge. With the Root Priority values equal, it compares MAC addresses and nominates the device with the lowest MAC address. This example highlights the impracticality of allowing the VAV Controllers to negotiate amongst themselves which device is the Root Bridge.

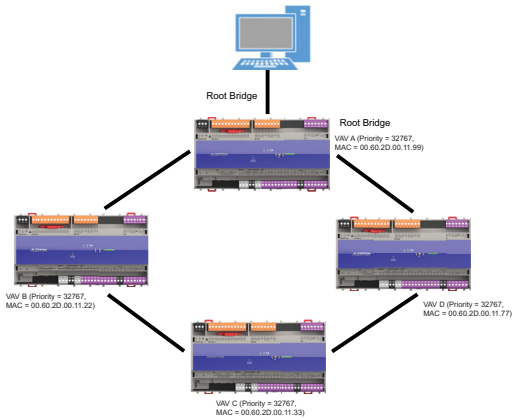


Fig. 77 Root Bridge Example 2

Port Roles

Once the Root Bridge device is determined, the selected device will set its ports to the Designated Port Role. Designated Ports will generate and receive Bridge Protocol Data Unit (BPDU) messages. BPDU messages are essential to all devices that make up the RSTP network. BPDU messages contain the Root Bridge device Bridge ID and a Cost to Path parameter that accumulates the further a device is from the Root Bridge. BPDU message generation is repetitive and created within 2 seconds of each other. When receiving the BPDU messages, the Non-Root Bridge devices will assign the Root Port role to the port closest to the Root Bridge device; this is determined by comparing the Cost to Path values on each connected port. In the root bridge example 2, if the VAV Controller B is declared the Root Bridge, its two populated ports default to Designated Ports. Via BPDU message, the VAV controllers A and C will assign Root Port (RP) roles to the ports directly connected to VAV Controller B. The remaining ports will default to the Designated Port (DP) role and generate their own BPDU messages. VAV Controller D will compare the BPDU messages received on both ports to determine the most efficient path to the Root Bridge. VAV Controller D could have a tied Cost to Path score for either of their ports as both have a valid path to the Root Bridge across an equal number of segments. If a Cost to Path is tied, the lowest Bridge ID will be nominated as the Root Port.

Port Status

The Port Status provides feedback on what condition the port is. Ports will be in one of three states:

1. **Learning:** Port is mapping but not sending data yet.
2. **Forwarding:** Port is functioning correctly and sending data.
3. **Discarding:** Port is not sending data, typically indicating that a loop has been detected and the Port Role is set to Alternative Port.

RSTP Configuration

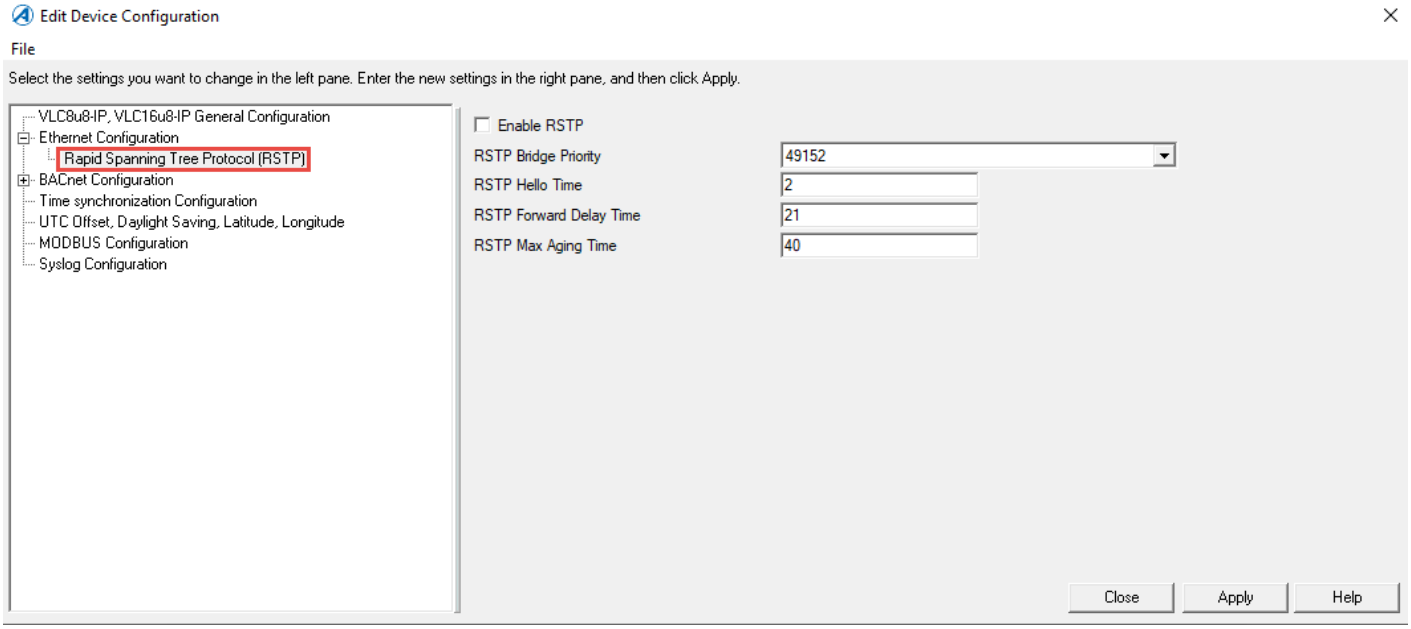


Fig. 78 RSTP Enable/Disable and set Bridge priority

The Ethernet and IP configuration contains:

4. Enable Rapid Spanning Tree Protocol.
5. RSTP Bridge Priority, select the Bridge Priority from the drop-down (values 0...61440), the Bridge Priority values are set in blocks of 4096.

Table 38 RSTP Configuration

Menu	Values	Description	Default
Enable/ Disable Rapid Spanning Tree Protocol	Enable / Disable	Enable / Disable RSTP	Disable
Bridge Priority	0...61440	Controls which VAV node / Managed switch is the root bridge. The Bridge Priority is set in increments of 4096 between the ranges of 0 to 61440 (For example 4096, 8192, 12288…)	49152

RSTP Diagnostics

The AV's 170000 to 170099 are reserved for RSTP Diagnostics regardless of whether RSTP has been enabled or not. Allocated Diagnostic AV's for the Modular VAV Controller are:

AVs	Description
AV 170000	Spanning Tree type. RSTP is supported by VAV. Displays "RSTP" when enabled and displays "None" when RSTP is disabled.
AV 170001	**Bridge ID**– Shows the Bridge priority followed by the MAC ID of the node. Example: 49152-00:60:2D:08:00:67
AV 170002	**Bridge Priority**– Priority of the Bridge. Lower values result in the node being elected Root Bridge
AV 170003	**Root Bridge ID**– Bridge priority followed by the MAC ID of the Root Bridge of the entire network.
AV 170004	**Hello Time**– Maximum time in seconds between consecutive BPDU messages (also called the heartbeat time). BPDU messages may come in faster during network Syncing. Hello time is always 2 seconds.
AV 170005	**Max Age**– Max age of VAV devices are dynamic and can be auto configured to root bridge's Max age setting.
AV 170006	**Forward Delay**– Forward delay of VAV devices are dynamic and can be auto configured to root bridge's forward delay setting.
AV 170007	Number of Days, Hours, Minutes, and Seconds since the last Topology Change in the network. Topology change happens when non-Edge ports move to a forwarding state.

NOTE:

Max age and Forward delay fields of VAV devices are dynamic and auto configures to root bridge's Max age and Forward delay setting.

For setups exceeding 20 devices in RSTP, users must configure the MaxAge and Forward-Delay as 40 and 21, respectively, on the root device. These settings will dynamically propagate to all connected VAV devices. If a VIP device is designated as the root device, it's advisable to limit connections to fewer than 20 devices to avoid conflicts with the default RSTP values configured in the VIP device, which could lead to connectivity issues.

Information for each port is represented in AVs and BVs:

AVs	Description
AV 170100	Spanning tree mode that the link works in. This can be "None" when RSTP is disabled or link is down "RSTP" when RSTP is enabled and the node connected is using RSTP or "STP" when RSTP is enabled and the node connected is using STP.
AV 170101	Adapter. Always eth0.
AV 170102	Port RSTP Role – Role that the port is playing in the Rapid Spanning Tree network. "Disabled" – Port is disabled. "Root" – Port leads to the "Root Bridge". "Designated" – Port connects other nodes to Root Bridge. "Alternate" – Port discarding traffic. "N/A" – Link is down.
AV 170103	Port RSTP status – Status of the port. "Learning" – Port is learning MAC address, but not forwarding traffic. "Discarding" – Port is discarding traffic as there is a loop in the network. "Forwarding" – Port is sending and receiving traffic. "N/A" – Link is down.

AVs	Description
AV 170104	Neighbor Bridge ID – The Bridge ID that this port is connected to. “N/A” – Link is down “Bridge ID” – The bridge ID of the neighbor sending traffic to this port is displayed. “Edge” – Neighbor is not participating in the RSTP network.

BVs	Description
BV 170100	Ethernet Link

Device Templates and Graphics can be used to display Diagnostic AV data to assist with troubleshooting or managing the RSTP network. When RSTP is disabled the STP Type shows “None” which indicates that RSTP has been disabled in the Device Configuration.

Troubleshooting RSTP

If it is determined that some Modular VAV controllers are responding very slowly or not at all, check the steps listed below:

1. Check that all VAV Controllers and other switches on the network have RSTP enabled. If using Diagnostic graphics (AV-170000) for each VAV Controller the “Spanning Tree Type” should display “RSTP” if RSTP is enabled.
2. If any managed switch is used ensure that “RSTP” is enabled.
3. Verify that all the VAV Controllers have the same Root Bridge ID (AV-170001).
4. Use AV-170007 to check the time elapsed since the last Topology change, use this as an indicator to see how frequently the RSTP structure is changing. This indicates how long the network has been stable.

Tested Network Switches

RSTP network testing has been performed with the following managed switches:

- Cisco: 500 Series
- D-Link: DGS-1010-28
- Netgear: GS108Tv2 and GS418TPP

DYNAMIC MAPPING USER CONFIGURATION

The Dynamic Mapping User Configuration describes how the VAV controller handles dynamic instance mapping for both cold and hot ducts, allowing users to establish dynamic balancing points if they have their own Direct Digital Control (DDC) systems with varying balancing points. In the past, balancing points were fixed; however, they can now be adjusted dynamically. For instance, users with their own DDC systems and different balancing points can dynamically configure these settings within the User Configurable BACnet Object List Range specified below.

Below are the Balancing points, which user can configure for cold and hot duct:

Default Present Values of User Configurable BACnet object	Balancing Parameter Object Description	User Configurable BACnet Object list Range	Present value of user configurable objects	User configurable object to Analog/ Binary value
AV-64	ColdDuct DriveTime (AV-64) - Analog Value	AV-260	64	AV
AV-66	ColdDuct Reheat Setpoint (AV-66) - Analog Value	AV-261	66	AV
AV-67	ColdDuct Setpoint Max Flow (AV-67) - Analog Value	AV-262	67	AV
AV-68	ColdDuct Setpoint Min Flow (AV-68) - Analog Value	AV-263	68	AV
AV-9	ColdDuct Damper Position (AV-9) - Analog Value	AV-264	9	AV
BV-9	ColdDuct Min Airflow CFM (BV-9) - Binary Value	AV-265	9	BV
BV-10	ColdDuct Reheat Control/Fan Airflow (BA-10) - Binary Value	AV-266	10	BV
BV-11	ColdDuct Max Airflow CFM (BV-11) - Binary Value	AV-267	11	BV
BV-12	ColdDuct Damper Close (BV-12) - Binary Value	AV-268	12	BV
BV-13	ColdDuct Damper Open (BV-13) - Binary Value	AV-269	13	BV
BV-16	ColdDuct Damper Lock (BV-16) - Binary Value	AV-270	16	BV
BV-193	ColdDuct Fan Command (BV-193) - Binary Value	AV-271	193	BV
AV-172	ColdDuct Reheat Override (AV-172) - Analog Value	AV-272	172	AV
AV-174	ColdDuct Fan Speed Override (AV-174) - Analog Value	AV-273	174	AV
AV-65	HotDuct Drive Time (AV-65) - Analog Value	AV-280	65	AV
AV-73	HotDuct Setpoint Max Flow (AV-73) - Analog Value	AV-282	73	AV
AV-14	HotDuct Damper Position (AV-14) - Analog Value	AV-284	14	AV
BV-18	HotDuct Min Airflow CFM (BV-18) - Binary Value	AV-285	18	BV

Default Present Values of User Configurable BACnet object	Balancing Parameter Object Description	User Configurable BACnet Object list Range	Present value of user configurable objects	User configurable object to Analog/ Binary value
BV-17	HotDuct Max Airflow CFM (BV-17) - Binary Value	AV-287	17	BV
BV-15	HotDuct Damper Close (BV-15) - Binary Value	AV-288	15	BV
BV-14	HotDuct Damper Open (BV-14) - Binary Value	AV-289	14	BV
BV-21	HotDuct Damper Lock (BV-21) Binary Value	AV-290	21	BV

Dynamic Point Mapping Procedure:

- Require new DDC application with new balancing points.
- DDC Files: Original_DDC.vsdx, Customized_DDC.vsdx

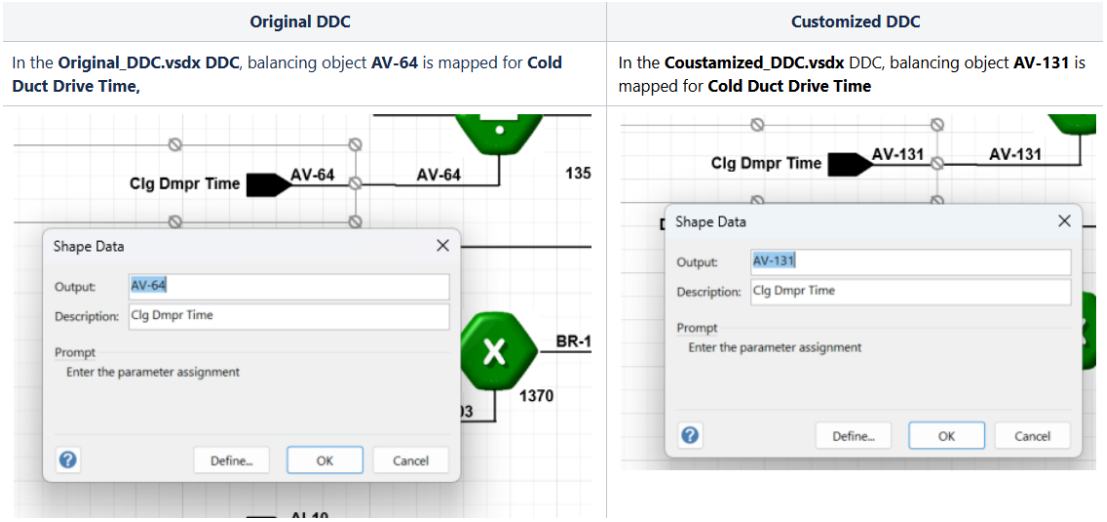


Fig. 79 Original and Customized DDC application

Users can also update the balancing points for each parameter, if different balancing points are configured in the Customized DDC:

Balancing Parameter Object Description	User Configurable BACnet Object list Range	Balancing Point for Original_DDC. vsdx	Balancing Point for Coustomized_ DDC.vsdx
ColdDuct DriveTime (AV-64) - Analog Value	AV-260	AV-64	AV-131
ColdDuct Reheat Setpoint (AV-66) - Analog Value	AV-261	AV-66	AV-132
ColdDuct Setpoint Max Flow (AV-67) - Analog Value	AV-262	AV-67	AV-133
ColdDuct Setpoint Min Flow (AV-68) - Analog Value	AV-263	AV-68	AV-134
ColdDuct Damper Position (AV-9) - Analog Value	AV-264	AV-9	BV-135
ColdDuct Min Airflow CFM (BV-9) - Binary Value	AV-265	BV-9	BV-131
ColdDuct Reheat Control/Fan Airflow (BA-10) - Binary Value	AV-266	BV-10	BV-132

Balancing Parameter Object Description	User Configurable BACnet Object list Range	Balancing Point for Original_DDC. vsdx	Balancing Point for Coustomized_ DDC.vsdx
ColdDuct Max Airflow CFM (BV-11) - Binary Value	AV-267	BV-11	BV-133
ColdDuct Damper Close (BV-12) - Binary Value	AV-268	BV-12	BV-134
ColdDuct Damper Open (BV-13) - Binary Value	AV-269	BV-13	AV-135
ColdDuct Damper Lock (BV-16) - Binary Value	AV-270	BV-16	BV-136
ColdDuct Fan Command (BV-193) - Binary Value	AV-271	BV-193	BV-137
ColdDuct Reheat Override (AV-172) - Analog Value	AV-272	AV-172	AV-136
ColdDuct Fan Speed Override (AV-174) - Analog Value	AV-273	AV-273	AV-137
HotDuct Drive Time (AV-65) - Analog Value	AV-280	AV-65	AV-141
HotDuct Setpoint Max Flow (AV-73) - Analog Value	AV-282	AV-73	AV-143
HotDuct Damper Position (AV-14) - Analog Value	AV-284	AV-14	AV-145
HotDuct Min Airflow CFM (BV-18) - Binary Value	AV-285	BV-18	BV-141
HotDuct Max Airflow CFM (BV-17) - Binary Value	AV-287	BV-17	BV-143
HotDuct Damper Close (BV-15) - Binary Value	AV-288	BV-15	BV-144
HotDuct Damper Open (BV-14) - Binary Value	AV-289	BV-14	BV-145
HotDuct Damper Lock (BV-21) Binary Value	AV-290	BV-21	BV-146

OBJECTS AND PROPERTY REFERENCES

Objects in the VAV-SD6u5 Controllers

Object (Instance Range)	Function
AI (0)	Analog input corresponding to physical UIO input IO0 (MSET Physical Input)
AI-1…6	Analog inputs corresponding to physical UIO inputs IO1 through IO6
AI-9, AI-10, AI-11	Analog inputs corresponding to Cold Duct airflow sensor (pressure, airflow, velocity)
AO-1…6	Analog outputs corresponding to physical UIO outputs IO1 through IO6
BI-1…6	Binary inputs corresponding to physical UIO inputs IO1 through IO6
BO-1…6	Binary outputs corresponding to physical UIO outputs IO1 through IO6
BO-11…15	Binary outputs corresponding to physical SSR outputs SR1 through SR5
BO-31…34	Binary outputs corresponding to physical SSR outputs SR1 through SR4
AV-0…89	General Purpose DDC
AV-90…110	Microset DDC – supports Microset, Microset-II, and Microset 4
AV-130…169	General Purpose DDC – without priority array
AV-170...177	General Purpose DDC – with priority array
AV-246	Cold Duct airflow sensor zero-flow pressure offset
AV-250, 251, 252	VAV box Cold Duct configuration parameters (box size, zero cutoff, calibration factor)
AV-260….290	User defined VAV parameters Objects for VAV Balancing Mobile App
BV-0…63	General Purpose DDC
BV-64…87	Microset DDC – supports Microset, Microset-II, and Microset 4
BV-99	Disables 0.5°F deadband between AV-95 & AV-96 (ON = AV-96 can equal AV-95)
BV-101	Enable/Disable Bluetooth (Active = Bluetooth Enabled, Inactive = Bluetooth Disabled)
BV-130…177	General Purpose DDC – without priority array
BV-178…193	General Purpose DDC – WITH priority array
MV-0…10	General Purpose DDC
MV-70	Microset/Microtouch Detect Mode
MV-71	Device English/Metric
MV-72	VAV Application Type
MV-101…106	UIO-1…6 Hardware Input Mode Selection
MV-201…206	AI-1…6 Data Presentation Mode
AV-301…306	AI-1…6 Input Scaling X1
AV-351…356	AI-1…6 Input Scaling X2
AV-401…406	AI-1…6 Input Scaling Y1
AV-451…456	AI-1…6 Input Scaling Y2
AV-501…506	AI-1…6 Pulse Value
AV-531…536	AI-1…6 Pulse Value (Time Base)
AV-561…566	AI-1…6 Pulse Value (Pulse Count)

Object (Instance Range)	Function
AV-601…606	AO-1…6 Output Scaling X1
AV-651…656	AO-1…6 Output Scaling X2
AV-701…706	AO-1…6 Output Scaling Y1
AV-751…756	AO-1…6 Output Scaling Y2
AV-800…899	Reserved for Modbus Integration
BV-800...899	Reserved for Modbus Integration
MV-800…809	Reserved for Modbus Integration
Calendar	Describes a list of calendar dates, special event dates, holiday dates, and date ranges.
Device	Provides general information about a device.
Event Enrollment(1)	Defines an event and connects the occurrence of the event to the transmission of an event notification. Primarily used for alarms in Compass 2.2.0
File (0)	Provides information about the real-time operating code (ROC) file.
File (1024)	Provides information about the current DDC file.
File (2048)	Provides information about the DDC trap file.
Notification Class	Stores a list of available recipients for the distribution of event notifications (alarms, trend-log gathering).
Program 0	Stores information about the ROC/controller program.
Program 1024	Stores program status information about the current DDC program.
Schedule(1)	Controls designated properties by periodic schedule that may recur during a range of dates.
Zones(1)	Proprietary Alerton object containing the individual properties and references required to support the optimum start and tenant activity features of Compass 2.2.0
Trendlogs(1)	BACnet Trendlog objects.

Objects in the VAV-DD8u8 Controllers

Object (Instance Range)	Function
AI-0	Analog input corresponding to physical UIO input IO0 (MSET Physical Input)
AI-1…8	Analog inputs corresponding to physical UIO inputs IO1 through IO8
AI-12, AI-13, AI-14	Analog inputs corresponding to Hot Duct airflow sensor (pressure, airflow, velocity)
AI-9, AI-10, AI-11	Analog inputs corresponding to Cold Duct airflow sensor (pressure, airflow, velocity)
AO-1…8	Analog outputs corresponding to physical UIO outputs IO1 through IO8
BI-1…8	Binary inputs corresponding to physical UIO inputs IO1 through IO8
BO-1…8	Binary outputs corresponding to physical UIO outputs IO1 through IO8
BO-11…18	Binary outputs corresponding to physical SSR outputs SR1 through SR8
AV-0…89	General Purpose DDC
AV-90…110	Microset DDC – supports Microset, Microset-II, and Microset 4
AV-130…169	General Purpose DDC – without priority array
AV-170-177	General Purpose DDC – WITH priority array
AV-246	Cold Duct airflow sensor zero-flow pressure offset
AV-247	Hot Duct airflow sensor zero-flow pressure offset
AV-253, 254, 255	VAV box Hot Duct configuration parameters (box size, zero cutoff, calibration factor)
AV-250, 251, 252	VAV box Cold Duct configuration parameters (box size, zero cutoff, calibration factor)
AV-260….290	User defined VAV parameters Objects for VAV Balancing Mobile App
BV-0…63	General Purpose DDC
BV-64…87	Microset DDC – supports Microset, Microset-II, and Microset 4
BV-99	Disables 0.5°F deadband between AV-95 & AV-96 (ON = AV-96 can equal AV-95)
BV-101	Enable/Disable Bluetooth (Active = Bluetooth Enabled, Inactive = Bluetooth Disabled)
BV-130…177	General Purpose DDC – without priority array
BV-178…193	General Purpose DDC – with priority array
MV-0…10	General Purpose DDC
MV-70	Microset/Microtouch Detect Mode
MV-71	Device Units Selection (English / Metrics)
MV-72	VAV Application Type
MV-101…108	UIO-1…8 Hardware Input Mode Selection
MV-201…208	AI-1…8 Data Presentation Mode
AV-301…308	AI-1…8 Input Scaling X1
AV-351…358	AI-1…8 Input Scaling X2
AV-401…408	AI-1…8 Input Scaling Y1
AV-451…458	AI-1…8 Input Scaling Y2
AV-501…508	AI-1…8 Pulse Value
AV-531…538	AI-1…8 Pulse Value (Time Base)
AV-561…568	AI-1…8 Pulse Value (Pulse Count)
AV-601…608	AO-1…8 Output Scaling X1

Object (Instance Range)	Function
AV-651…658	AO-1…8 Output Scaling X2
AV-701…708	AO-1…8 Output Scaling Y1
AV-751…758	AO-1…8 Output Scaling Y2
AV-800…899	Reserved for Modbus Integration
BV-800...899	Reserved for Modbus Integration
MV-800...809	Reserved for Modbus Integration
Calendar	Describes a list of calendar dates, special event dates, holiday dates, and date ranges.
Device	Provides general information about a device.
Event Enrollment(1)	Defines an event and connects the occurrence of the event to the transmission of an event notification. Primarily used for alarms in Compass 2.2.0
File (0)	Provides information about the real-time operating code (ROC) file.
File (1024)	Provides information about the current DDC file.
File (2048)	Provides information about the DDC trap file.
Notification Class	Stores a list of available recipients for the distribution of event notifications (alarms, trend-log gathering).
Program 0	Stores information about the ROC/controller program.
Program 1024	Stores program status information about the current DDC program.
Schedule(1)	Controls designated properties by periodic schedule that may recur during a range of dates.
Zones(1)	Proprietary Alerton object containing the individual properties and references required to support the optimum start and tenant activity features of Compass 2.2.0
Trendlogs(1)	BACnet Trendlog objects.

(1) Event Enrollment (Alarms), Schedule, Zones, and Trendlogs support only internal points. External points cannot be referenced.

NOTE:
It is not recommended to modify or add additional devices zone schedules under the VAV Controller.

NOTE:
If multiple notifications occur within a 1-second time frame, some COV notifications will be missed. Nevertheless, the DDC Engine will execute the DDC Logic within a time frame of 500 milliseconds which involves reading physical inputs (AI, BI, AO, BO, MV), processing the code, and writing to the outputs (AV, AO, BV, BO, MV).

During point data save operation, the user has to select "VAV calibration factors, box sizes, zero cutoffs" field in order to get proper commissioning report.
Point data write operation for VAV parameters using "VAV calibration factors, box sizes, zero cutoffs" field will be ignored and will not update. Instead "Present values, priority arrays, relinquish defaults" field helps in writing VAV parameters.

AV-105 Microtouch lever value should always be set to zero until user has configured and connected Microtouch.

Properties of VAV AI Objects

Property	W	Type	Example	Remarks
Description	Yes	Character string		Initially set to something like "AI n. "Example: Occupied Set Point
Object- Identifier		BACnet® Object Identifier		This property consists of the object- type property and the object instance, which is a numeric code that identifies the object of interest. Example: AI 1.
Object- Name	Yes	Character string		Initially set to "AI n" CANNOT BE SET BLANK. Example: AI 1
COV-Increment	Yes	Real	0	If the present value changes by this amount or greater, then a change-of- value notification is sent to sub- scribed devices.
Present- Value	Yes	Real		The range is 3 x 1038 (six significant digits of resolution) Example: 76.4
Units	Yes	Enumerated	no-units	Indicates the unit of measure, in BACnet® engineering units, that the AI is expressed in. Example: Deg F

Status Properties	W	Type	Default Value	Remarks
Event-State		Enumerated	“normal”	
Out-Of- Service	Yes	Boolean	FALSE	De-couples the Physical Input from the Logical Input, allowing the user to write to the present-value and reliability properties for Testing or Override.
Status-Flags		Bit string		A four-position bit string that indicates the status of the AI. If status bit=1, then the status is TRUE.

Properties of VAV AO Objects

Property	W	Type	Example	Remarks
Object- Identifier		BACnet® Object Identifie	AO n	This property consists of the object-type property and the object instance, which is a numeric code that identifies the object of interest.
Object- Name	Yes	Character string	AO n	CANNOT BE SET BLANK. Example: HGT CMD.
Object- Type		Enumerated	AO	
Present- Value	Yes	Real		Example: 76.4%
Description	Yes	Character string	AO n	Example: Heating Valve Command.
Status- Flags		Bit string		A four-position bit string that indicates the status of the AO. If status bit=1, then the status is TRUE.
Event- State		Enumerated	“normal”	
Reliability	[Yes]	BACnet® Reliability		Normally is Read-Only and reports “no fault detected”. Gets set to “Open Loop” (and is writable), when Out-of-Service is set to TRUE.
Out-Of- Service	Yes	Boolean	FALSE	Decouples the Physical Output from the Logical Output, allowing the user to Test the AO control logic without affecting the physical Output.

Property	W	Type	Example	Remarks
Units	Yes	Enumerated	no units	Indicates the unit of measure, in BACnet® engineering units, that the AO is expressed in. Example: Volts.
Priority- Array	Yes	BACnet® Priority Array	all null	16 index prioritized array of AO Commands.
Relinquish-Default	Yes	Real	0.0	Value of the AO Present-Value when the Priority-Array is all NULL.
Reliability-Evaluation- Inhibit	Yes		FALSE	Disables the Reliability reporting when set to OFF.
Property- List				List of all supported properties of an Object (except Object- Identifier, Object-Name, Object-Type, and Property-List, which are always required for ALL BACnet® Objects).
Aler-Interface-Value				Value of Physical AO.

Properties of VAV AV Objects

Property	W	Type	Example	Remarks
Description	Yes	Character string		Initially set to "AV n". Example: Occupied Set Point.
Object- Identifier		BACnet® Object Identifier		This property consists of the object-type property and the object instance, which is a numeric code that identifies the object of interest. Example: AV 1.
Object- Name	Yes	Character string		Initially set to something like "AV n" CANNOT BE SET BLANK. Example: AV 001.
Object- Type		Enumerated	AV	Example: AV.
Property- List				

Core Properties	Write	Type	Default Value	Notes
COV-Increment	Yes	Real	0	If the present value changes by this amount or greater, then a change-of-value notification is sent to subscribed devices.
Present- Value	Yes	Real	0	The range is 3 x 1038 (six significant digits of resolution) Example: 76.4
Priority- Array	Yes	BACnet® Priority Array	all null	Only present on user AVs with priority array (AV 170..177).
Relinquish-Default	Yes	Real	0	Only present on user AVs with priority array (AV 170..177).
Units	Yes	Enumerated	no-units	Indicates the unit of measure, in BACnet® engineering units, that the AV is expressed in. Example: Deg F.

Status Properties	Write	Type	Default Value	Remarks
Event-State		Enumerated		
Status-Flags		Bit String		A four-position bit string that indicates the status of the AV. If status bit=1, that status is TRUE.

Properties of Microset VAV AV Objects

Property	W	Type	Example	Remarks
Description	Yes	Character string		These are initially set (upon reset to factory defaults) to the default values shown in the section on Microset point allocations but can be changed to other values thereafter. Example: Occupied Set Point.
Object- Identifier		BACnet® Object Identifier		This property consists of the object-type property and the object instance, which is a numeric code that identifies the object of interest. Example: AV 1.
Object- Name	Yes	Character string		These are initially set (upon reset to factory defaults) to the default values shown in the section on Microset point allocations but can be changed to other values thereafter, CAN NOT BE SET TO BLANK. Example: AV 1.
Object- Type		Enumerated	AV	Example: AV
Property- List				

Core Properties	Write	Type	Default Value	Notes
COV-Increment	Yes	Real	0.0	If the present value changes by this amount or greater, then a change-of-value notification is sent to subscribed devices.
Present- Value	Yes	Real		The range is 3 x 1038 (six significant digits of resolution) Example: 76.4
Units	Yes	Enumerated		Indicates the unit of measure, in BACnet® engineering units, that the AV is expressed in. Example: Deg F.

Status Properties	Write	Type	Default Value	Remarks
Event-State		Enumerated		
Status-Flags		Bit String		A four-position bit string that indicates the status of the AV. If status bit=1, that status is TRUE.

Properties of VAV BI Objects

Property	W	Type	Example	Remarks
Object- Identifier		BACnet® Object Identifier	BI n	This property consists of the object-type property and the object instance, which is a numeric code that identifies the object of interest.
Object- Identifier		BACnet® Object Identifier	BI n	This property consists of the object-type property and the object instance, which is a numeric code that identifies the object of interest.
Object- Name	Yes	Character string	BI n	CANNOT BE SET BLANK. Example: Exh Fan.
Object- Type		BACnet® Object Type	BI	Example: BI
Present- Value	[Yes]	BACnet® Binary BV		Example: Active.
Description	Yes	Character string	BI n	Example: Exhaust Fan Status.
Status-Flags		Bit string		A four-position bit string that indicates the status of the BI. If status bit=1, then the status is TRUE.
Event-State		Enumerated	“normal”	
Reliability	[Yes]	BACnet® Reliability		Normally is Read-Only and reports “no fault detected”. Gets set to “Open Loop” (and is writable), when Out-of-Service is set to TRUE.
Out-Of- Service	Yes	Boolean	FALSE	Decouples the Physical Input from the Logical Input, allowing the user to write to the present-value and reliability properties for Testing or Override.
Polarity		BACnet® Polarity	“normal”	Indicates the polarity of the BI (normal or reversed).
Inactive- Text	Yes	Character string		Specifies Text that can be used when BI is Inactive.
Active-Text	Yes	Character string		Specifies Text that can be used when BI is Inactive.
Change-Of- State-Time		BACnet® Date Time		Indicates the Time of the last State Change.
Change-Of- State-Count	Yes	Unsigned		Indicates the total number of State Changes (can be reset to 0).
Time-Of- State-Count- Reset		BACnet® Date Time		Indicates the time of the last State Count reset.
Elapsed-Active-Time	Yes	Unsigned32		Indicates the total Elapsed Active Time in seconds (can be reset to 0).
Time-Of- Active-Time-Reset		BACnet® Date Time		Indicates the time of the last Elapsed Active Time reset.
Reliability-Evaluation- Inhibit	Yes	Boolean	FALSE	Does nothing for BI.
Property- List				List of all supported properties of an Object (except Object- Identifier, Object-Name, Object-Type, and Property-List, which are always required for ALL BACnet® Objects).

Properties of VAV BO Objects

Property	W	Type	Example	Remarks
Object- Identifier		BACnet® Object Identifier	BO n	This property consists of the object-type property and the object instance, which is a numeric code that identifies the object of interest.
Object- Name	Yes	Character string	BO n	CANNOT BE SET BLANK. Example: Exh Fan.
Object- Type		BACnet® Object Type	BO	
Present- Value	Yes	BACnet® Binary BV		Example: Active.
Description	Yes	Character string	BO n	Example: Circulation Pump Command.
Status-Flags		Bit string		A four-position bit string that indicates the status of the BO. If status bit=1, then the status is TRUE.
Event-State		Enumerated	“normal”	
Reliability	Yes	BACnet® Reliability		Normally is Read-Only and reports “no fault detected”. Gets set to “Open Loop” (and is writable), when Out-of-Service is set to TRUE.
Out-Of- Service	Yes	Boolean	FALSE	Decouples the Physical Input from the Logical Input, allowing the user to write to the present-value and reliability properties for Testing or Override.
Polarity		BACnet® Polarity	“normal”	Indicates the polarity of the BO (normal or reversed).
Inactive- Text	Yes	Character string		Specifies Text that can be used when BO is Inactive.
Active-Text	Yes	Character string		Specifies Text that can be used when BO is Inactive.
Change-Of- State-Time		BACnet® Date Time		Indicates the Time of the last State Change.
Change-Of- State-Count	Yes	Unsigned		Indicates the total number of State Changes (can be reset to 0).
Time-Of- State-Count- Reset		BACnet® Date Time		Indicates the time of the last State Count reset.
Elapsed-Active-Time	Yes	Unsigned32		Indicates the total Elapsed Active Time in seconds (can be reset to 0).
Time-Of- Active-Time-Reset		BACnet® Date Time		Indicates the time of the last Elapsed Active Time reset.
Minimum- Off-Time	Yes	Unsigned32	0	Specifies the Minimum Time the BO will be held OFF when transitioning from ON to OFF (minimum Time Enforced at Priority 6 in priority-array).
Minimum- On-Time	Yes	Unsigned32	0	Specifies the Minimum Time the BO will be held ON when transitioning from OFF to ON (minimum Time Enforced at Priority 6 in priority-array).
Priority- Array	Yes	BACnet® Priority Array	all null	16 index prioritized array of BO Commands.
Relinquish-Default	Yes	BACnet® Binary BV	Inactive	Value of the BO Present-Value when the Priority-Array is all NULL.
Reliability-Evaluation-	Yes	Boolean	FALSE	Disables the Reliability reporting when set to OFF.

Property	W	Type	Example	Remarks
Property- List				List of all supported properties of an Object (except Object- Identifier, Object-Name, Object-Type and Property-List, which are always required for ALL BACnet® Objects).
Aler-Inter- face-Value		BACnet® Binary BV		Value of Physical BO.

Properties of VAV BV Objects

Property	W	Type	Example	Remarks
Description	Yes	Character string	BV n	Initially set to "BV n".
Object- Identifier		BACnet® Object Identifier		This property consists of the object-type property and the object instance, which is a numeric code that identifies the object of interest. Example: BV 1.
Object- Name	Yes	Character string	BV n	Initially set to "BV n".
Present-Value	Yes	Enumerated	Inactive	
Priority- Array	Yes	BACnet® Priority Array	all null	Only present on user BV with priority array (BV 40 and BV 178..193).
Relinquish-Default	Yes	REAL	Inactive	Only present on user BV with priority array (BV 40 and BV 178..193).

Status Property	Write	Type	Default Value	Remarks
Event-State		Enumerated		Example: Normal
Status-Flags		Bit String		A four-position bit string that indicates the status of the object. If status bit=1, that status is TRUE. Example: In Alarm=0, Fault=0, Overridden=0, Out of Service=0

Property	W	Type	Example	Remarks
Change-Of- State-Count	Yes			Indicates the total number of State Changes (can be reset to 0).
Change-Of- State-Time				Indicates the Time of last State Change.
Elapsed-Active-Time	Yes			Indicates the total Elapsed Active Time in seconds (can be reset to 0).
Time-Of- Active- Time-Reset				Indicates the time of the last Elapsed Active Time reset.
Time-Of- State- Count- Reset				Indicates the time of the last State Count reset.

Properties of Microset VAV BV Objects

Property	W	Type	Example	Remarks
Description	Yes	Character string		These are initially set (upon reset to factory defaults) to the default values shown in the section on Microset point allocations but can be changed to other values thereafter.
Object- Identifier		BACnet® Object Identifier		
Object- Name	Yes	Character string		These are initially set (upon reset to factory defaults) to the default values shown in the section on Microset point allocations but can be changed to other values thereafter. CAN- NOT BE BLANK.
Object- Type		Enumerated	BV	
Property- List				

Core Properties	Write	Type	Default Value	Remarks
Present-Value	Yes	Enumerated	Inactive	

Status Property	Write	Type	Default Value	Remarks
Event-State		Enumerated		
Status-Flags		Bit String		A four-position bit string that indicates the status of the object. If status bit=1, that status is TRUE. Example: In Alarm=0, Fault=0, Overridden=0, Out of Service=0

Properties of the VAV Device Objects

Property	W	Type	Example	Remarks
apdu-segment-timeout	Yes	Unsigned	6000	The time after transmission of a “segment” until the lack of a reply means it was assumed to be lost (in milliseconds, 1000 = 1 sec). Default = 6000.
apdu- timeout	Y	Unsigned	6000	The time after transmission of an APDU until the lack of a reply means it was assumed to be lost. The APDU time-out value for this device in milliseconds (1000 = 1 sec). Default = 6000.
application-software- version		Character string	1.0.0	Indicates the ROC file version.
daylight- savings-status	Y	Boolean	FALSE	Indicates whether daylight savings is in effect (TRUE) or not (FALSE). Not used at present.
description	Y	Character string	Second floor controller	Assigned by the user to de- scribe the device’s function.

Property	W	Type	Example	Remarks
device-address-binding		List		Empty.
firmware- revision		Character string	1.0.0	Indicates the VAV boot code Version.
local-date	Y	Date	Sunday, 02/24/ 2002	Indicates date: day of the week, month/day/year. Writable through Time Sync.
local-time	Y	Time	10:15:56.00 am	Indicates the time stored in the device. Writable through Time Sync.
location	Y	Character string	East Wing	Indicates the physical location of the device.
max-apdu- length-accepted		Unsigned	1476	The maximum message packet size that the device can handle.
model- name		Character string	To be added	Assigned by the vendor to indicate the device model.
number-of- apdu-retries	Y	Unsigned	3	The number of times a message is resent after it is assumed to be lost.
object- identifier		BACnet® _ Object_Identifier	Device 4194303	This property consists of the object-type property and the device instance, which is a numeric code that identifies the device of interest.
object-list		Array		An array whose elements list the object-identifier properties of all objects the device supports.
object- name		Character string	Device 4194303	No two devices are permitted to have the same object name.
object-type		Enumerated	Device	
protocol- object-types-supported		Bit string	<Bit string>	An internally used bit string. Indicates which BACnet® object types reside in the device.
protocol- services-supported		Bit string	<Bit string>	An internally used bit string. Indicates which BACnet® services the device can process.
protocol- version		Unsigned	18	Indicates the version of the BACnet® protocol supported by the device.
segmentation-supported		Enumerated	segmented both	Device is capable of segmenting both transmission and reply messages.
system- status		Enumerated	Operational	Other possible values are operational - read-only, download-required, download-in-progress, non-operational.
utc-offset	Y	Signed	0	Coordinated Universal Time offset, in minutes. Not used at present.
vendor- identifier		Unsigned	18	A unique code assigned by ASHRAE to the manufacturer, in this case, Alerton.
vendor- name		Character string	Alerton	Indicates the device manufacturer.

Properties of VAV Event - Enrollment Objects

Property	W	Type	Example	Remarks
acked- transitions	Y	bit string	To-offnormal=1, To-fault=1, To -normal=1	Indicates whether the corresponding transitions have been acknowledged. A 1 indicates that the transition was acknowledged.
description	Y	Character string	Event enrollment 0	A description assigned to describe the object's function.
event- enable	Y	bit string	To-offnormal=1 , To-fault=1, To- normal=1	Indicates whether notifications are enabled for these event transition types. A 1 indicates that the transition is reported. Set in the Event Enrollment Editor at the operator workstation.
event- parameters		BACnet® Event Parameter	change_of_ bitstring	
event-state		Enumerated	NORMAL	Indicates the current state of the event.
event-type	Y	Enumerated	CHANGE_OF_ BITSTRING	Indicates the type of event algorithm to be used to detect events.
notification-class		Enumerated	1	Indicates the notification class to be used for event transitions. Set in the Event Enrollment Editor at the operator workstation.
notify-type		Unsigned	alarm	Indicates whether the object is set up for alarms or events.
object- identifier		BACnet_Ob- ject_Identifier	Event-enrollment 0	Consists of the object-type property and the object in- stance, which is a numeric code that identifies the object of interest.
object- name		Character string	Alarm	Assigned at the operator workstation.
object- property-reference	Y	Boolean	FALSE	Indicates whether the file has been saved for backup.
object-type		Event enrollment		

Properties of VAV File Objects

Property	W	Type	Example	Remarks
archive	Y	Boolean	FALSE	Indicates whether the file has been saved for backup.
description	Y	Character string	ROC File	A description assigned to describe the object's function.
file-access- method		Enumerated	stream access	
file-size		Unsigned	983040	The of the file, in bytes.
file-type		Character string	ROC	Also, DDC or TRAP.
modification-date		Time	4/29/2020 10:22:20:00a	The data and time the file was last modified.
object- identifier		BACnet_Ob- ject_Identifier	file 0	This property consists of the object-type property and the object instance, which is a numeric code that identifies the object of interest.

Property	W	Type	Example	Remarks
object- name		Character string	File 0	
object-type		Enumerated	file	
read-only		Boolean	TRUE	Indicates whether the file can be written to by BACnet® services.

Properties of VAV Notification-Class Objects

Property	W	Type	Example	Remarks
ack- required	Y	Bit string	To offnormal=1, to fault=1, to normal=1	Indicates whether an acknowledgment is required for event transitions. A 1 indicates that acknowledgment is required. Set up at the operator workstation.
description	Y	Character string	Alarm Handler	An editable description of the object's location and function.
object- identifier	Y	BACnet_Object_Identifier	Notification- class 1	This property consists of the object-type property and the object instance, which is a numeric code that identifies the object of interest.
object- name	Y	Character string	Alarm Handler 1	
object-type	Y	Enumerated	Notification- class	
recipient- list	Y	List	<List of BACnet Destination>	Lists the devices that receive notification when the notification class transitions. Set up at the operator workstation.
priority	Y	Array of Unsigned		Indicates the priority to be used for event notifications for TO-OFFNORMAL, TO-FAULT, and TO-NORMAL events, respectively.

Properties of VAV Program Objects

Property	W	Type	Example	Remarks
description	Y	Character string	Occupied Setpoint	A description assigned to describe the object's function.
description- of-halt		Character string	Program halted by request	
instance-of		Character string	MYREP MYJOB Sun- rise901*000000 *	Header information for the file. Program 0 does not support this property.
object- identifier		BACnet_ Ob- ject_Identifier	program 1024	This property consists of the object-type property and the object instance, which is a numeric code that identifies the object of interest.
object- name		Character string	Program Object 1024	
object-type		Enumerated	Program	
out-of- service		Boolean	FALSE	
program- change	Y	Enumerated	READY	Used to command the program state. A program can be stopped using the HALT com- mand, for example, and started again with RESTART.
program- location		Character string	DDC Sequence= 60	Set when program stops.
program- state		Enumerated	RUNNING	Possible states include RUNNING, IDLE, HALTED.
reason-for- halt		Enumerated	PROGRAM	
status-flag		Bit string	In alarm=0, fault=0, overrid- den=0, out of service=0	A four-position bit string that indicates the status of the object. If a status bit =1, that status is TRUE.

Properties of VAV Scheduled Objects

Property	W	Type	Example	Remarks
description	Y	Character string	Weekend Gym	A description assigned to describe the object's function.
effective- period	Y	Sequence	<BACnet Date Range>	Assigned in schedule setup at the operator workstation.
exception- schedule	Y	Sequence	<Array of BAC- net Special Event>	Assigned in schedule setup at the operator workstation.
list-of- property- references	Y	List	<List of BACnet Object Property Reference>	The list of objects that this schedule commands.
object- identifier		BACnet Object Identifier	schedule 0	This property consists of the object-type property and the object instance, which is a numeric code that identifies the object of the interest.
object- name	Y	Character string	schedule 000	Assigned in schedule setup at the operator workstation.
object-type	Y	Enumerated	schedule	
present- value	Y		ACTIVE	Indicates the value most recently written to a referenced object property. May be analog, binary, or other. depending on the controlled property.

Property	W	Type	Example	Remarks
priority-for- writing	Y	Unsigned	16	Assigned in schedule setup at the operator workstation.
weekly- schedule	Y	Sequence	<Array of BAC- net Daily Schedule>	Assigned in schedule setup at the operator workstation.

Properties of VAV Trendlog Objects

Property	W	Type	Example	Remarks
acked_ transitions		BACnet Event-TransitionBits	111	Conveys flags that indicate the receipt of acknowledgements for events.
buffer_size	Y	Unsigned32	256	The maximum number of records the log file can hold.
client_cov_ increment	Y	Double	1.00 {ok}	The amount of change required to cause a log record to be written. Only non-negative numbers allowed.
cov_resub-scription_ interval	Y	Integer	300	How often the trendlog resubscribes to the monitored point. Units are seconds. Valid values are 1 to 86,400 inclusive.
description	Y	Character-String	Device 65555, BODESC_0	Description of the trendlog.
event_ enable	Y	BACnet Event-Transition Bits	001	Enables or disables reporting of TO-FAULT and TO-NOR-MAL events.
event_state			Normal, Fault, Offnormal, HiLi- mit, LowLimit, Life Safety Alarm	
event_time_ stamps		BACnetAR-RAY [3] of BACnetTi-meStamp	[1] ****-**-**-*** **:**:**.** [2] ****-**-**-*** **:**:**.** [3] 2020- 03-25-Wed_ 13:22:28.00	The time an event occurred.
last_notify_ record		Unsigned32	441785	Sequence number of the log record that triggers a notification.
log_buffer		BACnetLog-MultipleRe-cord		A list of BACnetLog- MultipleRe- cord records. Only readable through ReadRange service
log_device_ object_ property	Y	BACnetAR-RAY of BAC-netDeviceOb-jectPropertyR-eference	BO 11,proprietary1135	Specifies the properties to be logged. May reference only internal objects.
log_interval	Y	Unsigned	0	The interval at which monitored properties are logged. Set to zero for TRIGGERED Log- ging_Type.
logging_ type	Y	BACnetLog-gingType	Polled, COV, Triggered	Specifies whether records are collected by polling or by triggered acquisition.
notification_class	Y	Unsigned	1	The notification class used when handling event notifications.

Property	W	Type	Example	Remarks
notification_ threshold	Y	Unsigned32	80	Specifies the number of records (since the last notification) at which a notification is sent.
notify_type	Y	BACnetNoti-fyType	Alarm, Event, Ack Notification	Defines if notifications will be events or alarms.
object_ identifier		BACnetOb-jectIdentifier	Trend-log 1	A numeric identifier for the associated object.
object_ name	Y	Character String	Trendlog 30	The name of the trendlog object. Default is “Trendlog n”.
object_type		BACnetOb-jectType	TREND- LOGMULTIPLE	The object type of the trendlog.
record_ count		Unsigned32	256	Represents the number of log records currently in the Log_ Buffer.
records_ since_ notification		Unsigned32	27	The number of log records since the last notification.
start_time	Y	BACnetDate-Time	****-**-**-*** **:**:**.**	The date and time that logging will start.
stop_time	Y	BACnetDate-Time	****-**-**-*** **:**:**.**	The date and time that logging will stop.
stop_when_ full	Y	Boolean	False	Specifies whether logging should stop when the log buffer is full. TRUE stops logging. FALSE causes the oldest log re-cords to be overwritten.
total_record_count		Unsigned32	441973	Total number of log records collected by the Trend Log Multiple object since creation. Wraps back to 1 after reaching 2(to the power 32) - 1.
trigger	Y	Boolean	False	Causes the trendlog to log a record when the value of the trigger property is changed from FALSE to TRUE.

Properties of VAV Zone Objects

Property	W	Type	Example	Remarks
Object- Identifier		BACnet Object Identifier	Zone n	This property consists of the object-type property and the object instance, which is a numeric code that identifies the object of interest.
Object- Name	Yes	Character string	Zone n	CANNOT BE SET BLANK. Example: Bob Off
Object- Type		BACnet Object Type	Zone	
Present- Value		Enumerated	UnOcc	Status Types: Occupied, Unoccupied, Warmup, Cooldown and Tenant Override
Description	Yes	Character string		Example: Bob’s Office
Status- Flags		Bit string		A four-position bit string that indicates the status of the BO. If status bit=1, that status is TRUE.
Units	Yes	Enumerated	Deg F	Indicates the unit of measure, in BACnet engineering units, that the Zone is expressed in. Example: Deg F
Aler-Ref- Device	Yes	BACnet Object Identifier		Device Instance to which the Zone is Linked.

Property	W	Type	Example	Remarks
Aler- Weekly-Sched- Inputs		Enumerated		Weekly Schedule Status
Aler- Weekly-Sched- Objects		BACnet Object Property Reference		Weekly Schedule Reference
Aler-Holiday-Sched-Inputs		Enumerated		Holiday Schedule Status
Aler-Holiday-Sched-Objects		BACnet Object Property Reference		Holiday Schedule Reference
Aler-Event- Sched-Inputs		Enumerated		Event Schedule Status
Aler-Event- Sched-Objects		BACnet Object Property Reference		Event Schedule Reference
Priority- for-Writing	Yes	Unsigned	13	Priority at which the Zone Object writes to Commanded Objects.
Aler-Persistence-Rate	Yes	Unsigned	300	Frequency (in seconds), at which the Zone Object writes to Commanded Points (range 60-300).
Aler-Re- fresh-Rate	Yes	Unsigned	300	Frequency (in seconds), at which the Zone Object reads Input Points (range 10-900).
Aler-Opti- mum-Start-Mode	Yes	Enumerated	“none”	Status Options: None, Standard, and Manual.
Aler-Maxi- mum-Ad-vance- Time	Yes	Unsigned	240	Maximum Time (in minutes), that Optimum Start may Start Zone.
Aler-OA- Temp-Reference	Yes	BACnet Object Property Reference	AV-103	Reference to BACnet Object containing OA Temp.
Aler-OA- Temp-Value		Real		Value of Outside Air Temp Sensor.
Aler-Humidity-Reference	Yes	BACnet Object Property Reference		Reference to BACnet Object containing Humidity.
Aler-Humidity- Value		Real		Value of Humidity Sensor
Aler-OA- Limit	Yes	Real	65	Used for Optimum Start
Aler-Building-Mass	Yes	Real	4	Used for Optimum Start
Aler- Warmup-Factor	Yes	Real	1	Used for Optimum Start
Aler-Cool- down-Factor	Yes	Real	1	Used for Optimum Start
Aler-Alt- Warmup-Factor	Yes	Real	0	Used for Optimum Start
Aler-Alt- Cooldown-Factor	Yes	Real	0	Used for Optimum Start
Aler-Tuning-Factor	Yes	Real	0.5	Used for Optimum Start
Aler-Cooling-Temp-Rate	Yes	Real	3	Used for Optimum Start

Property	W	Type	Example	Remarks
Aler-Heating-Temp-Rate	Yes	Real	3	Used for Optimum Start
Aler-Occupied-Cmd-Value		Enumerated		
Aler-Occupied-Cmd-Ref				
Aler-Occupied-Cmd-Ref	Yes	BACnet Object Property Reference		
Aler- Warmup- Cmd-Value		Enumerated		
Aler- Warmup- Cmd-Ref	Yes	BACnet Object_ Property Reference		
Aler-Cool- down-Cmd-Value		Enumerated		
Aler_Cool- down_ Cmd_Ref	Yes	BACnet Object Property Reference		
Aler-Zone- Temp-Value		Real		
Aler-Zone- Temp-Reference	Yes	BACnet Object Property Reference		
Aler-Occ- Htg-SP-Value		Real		
Aler-Occ- Htg-SP-Reference	Yes	BACnet Object Property Reference		
Aler-Occ- Clg-SP-Value		Real		
Aler-Occ- Clg-SP-Reference	Yes	BACnet Object Property Reference		
Aler-Tenant-Over-ride-Value		Enumerated		
Aler-Tenant-Over-ride- Reference	Yes	BACnet Object Property Reference		
Aler- Refresh	Yes	Boolean		Force Refresh
Aler- Diagnostics		Octet String		
Aler-Tenant-	Yes	BACnet Object Property Reference		
Activities- Recipient				
Aler-Zone- Main-Truth- Table		Octet String		
Aler-Zone-Command- Mode	Yes	Enumerated	Binary	Types: Binary or MultiState

DIAGNOSTIC AVS AND BVS

The present-value property of the diagnostic AVs and BVs listed are reserved to provide operating information about the VAV-DD8u8 and VAV-SD6u5. You can reference these present values on data displays or in DDC to assist in troubleshooting and fault detection.

VAV specific Diagnostic Templates are included in the Compass 2.2.3 Alerton/Standard library and the latest versions are available for download from the Alerton ASN.

Point		Property	Description Property	Pres Val	Units (Not BACnet)	Clearable
Misc. Global Items						
AV	100000	System reboot count				
AV	100006	System log				
AV	100007	Firmware update log				
AV	100010	Free Memory				
AV	100015	Device certificate				
DDC Status						
AV	100030	DDC State				
AV	100031	DDC Read/Exec/Write Time				
AV	100032	DDC Expanded Size				
AV	100033	DDC Temp RAM Storage				
AV	100034	DDC Branch Points Used				
AV	100035	DDC Temp Priority Arrays				
AV	100036	DDC Property Access - Total				
AV	100037	DDC Property Access - Reads				
AV	100038	DDC Property Access - Writes				
Property Requesting						
AV	100060	Property requests per second				
AV	100061	Property cycle time				
AV	100065	Total BACnet/IP Packets dropped				
Versions						
AV	100080	Boot loader version				
AV	100081	Maintenance image version				
AV	100082	Normal image (ROC) version				
AV	100088	Product serial number				
AV	100089	Reboot Log				
AV	100090	Hardfault Log				
AV	100091	WatchDog Log				
AV	100092	Free Memory Size Heap				
Ethernet Stats						
AV	100100	Ethernet Enabled				

Point		Property	Description Property	Pres Val	Units (Not BACnet)	Clearable
AV	100101	Ethernet Speed				
AV	100102	Ethernet Duplex				
AV	100103	Ethernet RX Frames				
AV	100104	Ethernet TX Frames				
AV	100105	Ethernet RX Bytes				
AV	100106	Ethernet TX Bytes				
AV	100107	Ethernet RX Errors				
AV	100108	Ethernet TX Errors				
AV	100109	Ethernet RX Dropped				
AV	100110	Ethernet TX Dropped				
AV	100111	Ethernet Collisions				
AV	100112	Ethernet MAC - A				
AV	100119	Ethernet DHCP Enabled				
AV	100120	IP Address				
AV	100124	Ethernet Net Mask				
AV	100128	Ethernet Default Gateway - A				
AV	100132	Ethernet DNS Server - A				
AV	100136	Ethernet DNS Server 2 - A				
AV	100140	Ethernet DHCPv4 Info Received				
BACnet/Ethernet						
AV	100300	BACnet/Ethernet Enabled				
AV	100301	BACnet/Ethernet Network number				
AV	100302	BACnet/Ethernet BACnet Port ID				
AV	100303	BACnet/Ethernet Frames Received				
AV	100304	BACnet/Ethernet Frames Transmitted				
AV	100305	BACnet/Ethernet bytes Received				
AV	100306	BACnet/Ethernet bytes transmitted				
AV	100307	BACnet/Ethernet Dropped packets				
BACnet/IP						
BV	101100	BACnet/IP Enabled				
BV	101101	BACnet/IP BBMD enabled				
BV	101102	BACnet/IP local broadcasts disabled				
BV	101103	BACnet/IP adapter open				

Point		Property	Description Property	Pres Val	Units (Not BACnet)	Clearable
BV	101104	BACnet/IP registered with foreign device				
AV	101100	BACnet/IP network number				
AV	101101	BACnet/IP mode				
AV	101102	BACnet/IP adapter				
AV	101103	BACnet/IP UDP port				
AV	101104	BACnet/IP foreign BBMD address				
AV	101108	BACnet/IP foreign F124BBMD UDP Port				
AV	101109	BACnet/IP foreign BBMD Re-registration interval				
AV	101116	BACnet/IP IP address				
AV	101120	BACnet/IP IP Netmask				
AV	101124	BACnet/IP frames received				
AV	101125	BACnet/IP frames transmitted				
AV	101126	BACnet/IP bytes received				
AV	101127	BACnet/IP bytes transmitted				
AV	101128	BACnet/IP dropped packets				
AV	101129	BACnet/IP BDT Entries				
AV	101130	BACnet/IP FDT Entries				
AV	101131	BACnet/IP BACnet Port ID				
Other Miscellaneous						
AV	101900	Local year4 - value in four digits, ex. 2024				
AV	101901	Local BACnet year - value based on 1900 as the base, ex. 124 = 2024				
AV	101902	Local year2 - value in two digits, ex. 24				
AV	101903	Local month - value in the range of 1-12, ex. Feb = 2				
AV	101904	Local date of month - value in the range 1-31				
AV	101905	Local BACnet day of week - Monday = 1…Sunday = 7				
AV	101906	Local day of week - Sunday = 1…Saturday = 7				
AV	101907	Local hours - value in the range of 0-23				
AV	101908	Local minutes - value in the range of 0-59				
AV	101909	Local seconds - value in the range of 0-59				

Point		Property	Description Property	Pres Val	Units (Not BACnet)	Clearable
AV	101910	Local latitude				
AV	101911	Local longitude				
AV	101912	Uptime total				
AV	101913	Uptime SS				
AV	101914	Uptime MM				
AV	101915	Uptime HH				
AV	101916	Uptime days				
BACnet Objects						
AV	106006	Calendar Object Count				
AV	106009	Event Enrollment Object Count				
AV	106015	Notification Class Object Count				
AV	106017	Schedule Object Count				
AV	106020	Trend Log Object Count				
AV	106205	Alerton Zone Object Count				
AV	106206	Alerton Device Comm Fail Count				
Modbus Configuration Points						
BV	130000	Present value	Modbus enable			
BV	139200	Description	Last Exception Received			
AV	130001	Present value	COM Baud Rate			
AV	130002	Description	COM Parity			
AV	130003	Present value	COM Bits			
AV	130004	Description	COM Mode			
AV	139003	Present value	Number of Mapped Points			
AV	139004	Present value	Number of Mapping Errors			
AV	139200	Present value	Messages Transmitted			
AV	139201	Present value	Messages Received			
AV	139202	Present value	NR Count			
AV	139204	Present value	Special Errors			
BACnet MS/TP Configuration Points						
AV	100403	MS/TP MAC Address				
AV	100404	MS/TP Baud				
AV	100405	MS/TP RX Frames				
AV	100406	MS/TP TX Frames				
AV	100407	MS/TP RX Bytes				
AV	100408	MS/TP TX Bytes				

Point		Property	Description Property	Pres Val	Units (Not BACnet)	Clearable
AV	100409	MS/TP RX Errors				
AV	100410	MS/TP RX Dropped				
AV	100411	MS/TP Devices Detected				
AV	100419	MS/TP TX Dropped				
AV	100420	MS/TP Token Pass Interval				
AV	100421	MS/TP RX UART Errors				
AV	100422	MS/TP RX Frame Errors				
AV	100423	MS/TP RX CRC Errors				
AV	100424	MS/TP RX Length Errors				
AV	100425	MS/TP Collisions				
AV	100426	MS/TP Automac Enabled				
AV	100427	MS/TP Automac Collisions				

When compass web user interface reports NR value or No Entry for a device then the following resolution will help them to get the data read from the device. This can also happen when the user is downloading a ROC file, restart the device or during maintenance of the device.

Symptoms	Cause	Resolution
No Entry	Appears if: • The device is not in device manager, or • The number of devices in device manager exceeds the license limit.	**1.** Perform a device scan and save results to device manager table from the device manager. Refer to the “Scanning for devices” section in the workstation interface user guide.
		2. Delete the devices from the device manager table until the device limit is no longer exceeded.
NR value	The device is not communicating: • When in offline, or • The device Net/Mac is incorrect due to renumbering.	Use reinitialize device icon from the vertical menu on the left within the web user interface. This allows the reinitialization of a single device and does not require one to be at the primary compass workstation. Refer the “Device Reinitialize” section in the browser interface user guide.

REGULATORY INFORMATION

FCC Regulation

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio
frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful
interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful
interference, in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or TV technician for help.

Canadian Regulatory Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:
(1) This device may not cause interference.
(2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
(1) L'appareil ne doit pas produire de brouillage;
(2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

CAN ICES-3 (B)/NMB-3(B).

FCC and ISED RF Exposure statement

This equipment complies with FCC and ISED RSS-102 radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. In order to avoid the possibility of exceeding the FCC and ISED RSS-102 radio frequency exposure limits, this equipment should be installed and operated with minimum distance 20 cm (7.9 inches) between the antenna and your body during normal operation. Users must follow the specific operating instructions for satisfying RF exposure compliance.

Cet équipement est conforme aux limites d'exposition aux rayonnements FCC et ISED CNR-102 établies pour un environnement non contrôlé. Cet émetteur ne doit pas être installé ou utilisé en conjonction avec une autre antenne ou un autre émetteur. Afin d'éviter la possibilité de dépasser les limites d'exposition aux radiofréquences FCC et ISED, cet équipement doit être installé et utilisé avec une distance minimale de 20 cm (7.9 pouces) entre l'antenne et votre corps pendant le fonctionnement normal. Les utilisateurs doivent suivre les instructions spécifiques d'utilisation pour respecter la conformité à l'exposition aux RF.

CE Statement

The WLAN function for this device is restricted to indoor use only when operating in the 5150 to 5350 MHz frequency range.

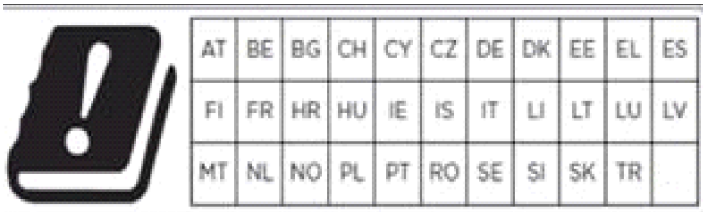


Fig. 80 CE Statement

Professional Installation Warning

- This device must be professionally installed, this should be noted on grantee.
- To maintain compliance, only the antenna types that have been tested shall be used, which is listed in Table 2 on page 3.
- This device requires significant technology engineering expertise to understand the tools and relevant technology, which is not readily available to the average consumer. Only a person professionally trained in the technology is competent.
- This device is not directly marketed or sold to general public.

Wireless Connectivity

The Bluetooth Low Energy (BLE) chip is used for the secure BLE communication with apps (wiring verification). It works at a frequency of ~2400 MHZ. A mobile app is used to establish a secure BLE connection to the controller via BLE. After establishing a secure connection with the controller's mobile app, the controller will exchange cable verification data over BLE in an encrypted format.

Table 39 Connectivity Frequency Range

Parameter	Specification
Connectivity	Bluetooth
Frequency Range	2.4 GHz
E.I.R.P for CE (Effective Isotropic Radiated Power)	20 mW
E.I.R.P for FCC/IC (Effective Isotropic Radiated Power)	20 mW

BLE Certifications

Table 40 BLE Certification Numbers

SKUs	FCC ID	IC ID
VAV-SD6u5-IP-BLE VAV-SD6u5-BLE VAV-SD6u5-T1L-BLE VAV-DD8u8-IP-BLE VAV-DD8u8-BLE VAV-DD8u8-T1L-BLE	2A8LT-24NM001	12252A-24NM001

Standards and Compliance

- CE mark
- UL916 Energy Management Equipment
- UL/ULC 60730-1
- FCC/IC Product Class B,
- Plenum tested (according to UL 2043)

Approvals and Certifications

- UL 60730-1, Standard for Automatic Electric Controls for Household and Similar Use, Part 1: General Requirements
- CAN/CSA-E60730-1:02, Standard for Automatic
- Electrical Controls for Household and Similar Use, Part 1: General Requirements
- Complementary listing for UL916, CSA C22.2 No. 205;
- IP CAT5/6, MS/TP and IP T1L Modular VAV models as BACnet® Advanced Application Controller (B-AAC); (BTL Certification is in progress)
- CE-approved
- FCC part 15B-Class B.
- ISED ICES-003 Class B
- RoHS conformity

WEEE Directive 2012/19/EC Waste Electrical and Electronic Equipment directive

At the end of the product life, dispose of the packaging and product in an appropriate recycling center. Do not dispose of the device with the usual domestic refuse. Do not burn the device.

NOTE:

- At the end of the product life, dispose of the packaging and product in an appropriate recycling center.
- Do not dispose of the device with the usual domestic refuse.
- Do not burn the device.

Article 33 Communication

REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006

Concerning the Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH) Honeywell takes compliance with REACH very seriously.

According to Article 33, “Duty to communicate information on substances in articles”:

- Any supplier of an article containing a substance meeting the criteria in Article 57 and identified in accordance with Article 59(1) in a concentration above 0.1% weight by weight (w/w) shall provide the recipient of the article with sufficient information, available to the supplier, to allow safe use of the article including, as a minimum, the name of that substance.
- On request by a consumer, any supplier of an article containing a substance meeting the criteria in Article 57 and identified in accordance with Article 59(1) in a concentration above 0.1% weight by weight (w/w) shall provide the consumer with sufficient information, available to the supplier, to allow safe use of the article including, as a minimum, thename of that substance. Our duty is to inform you that the substance(s) listed below may be contained in these products above the threshold level of 0.1% by weight of the listed article.

Table 41 Alerton Modular VAV Controllers Containing Lead (Pb)

Product / Part Name	Substance Name
VAV-SD6u5-IP VAV-SD6u5-IP-BLE VAV-SD6u5 VAV-SD6u5-BLE VAV-SD6u5-T1L VAV-SD6u5-T1L-BLE VAV-DD8u8-IP VAV-DD8u8-IP-BLE VAV-DD8u8 VAV-DD8u8-BLE VAV-DD8u8-T1L VAV-DD8u8-T1L-BLE	Lead (Pb)

- We confirm that our products do not use any other REACH restricted materials during the manufacturing, storage or handling process.

ABBREVIATIONS

Table 42 Abbreviations

Abbreviation	Definition
SD	Single Duct
DD	Dual Duct
SSR	Solid State Relay
IP	Internet Protocol
RTU	Remote Terminal Unit
BMS	Building Management Solutions
Modular VAV	Modular Variable Air Volume
UIO	Universal IO
NEMA	National Electrical Manufacturers Association
SDRAM	Synchronous dynamic random-access memory
QSPI	Quad Serial Peripheral Interface
DHCP	Dynamic Host Configuration Protocol
EIRP	Effective Isotropic Radiated Power
SMA	Sub miniature push
CMOS	Complementary Metal Oxide Semiconductor
TTL	Transistor Logic

RELATED TECHNICAL LITERATURE

Table 43 Related Technical Literature

Title	Reference
Alerton Modular VAV Controller Product Data sheet	31-00804
Alerton Modular VAV Controller Installation Instructions	31-00805

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