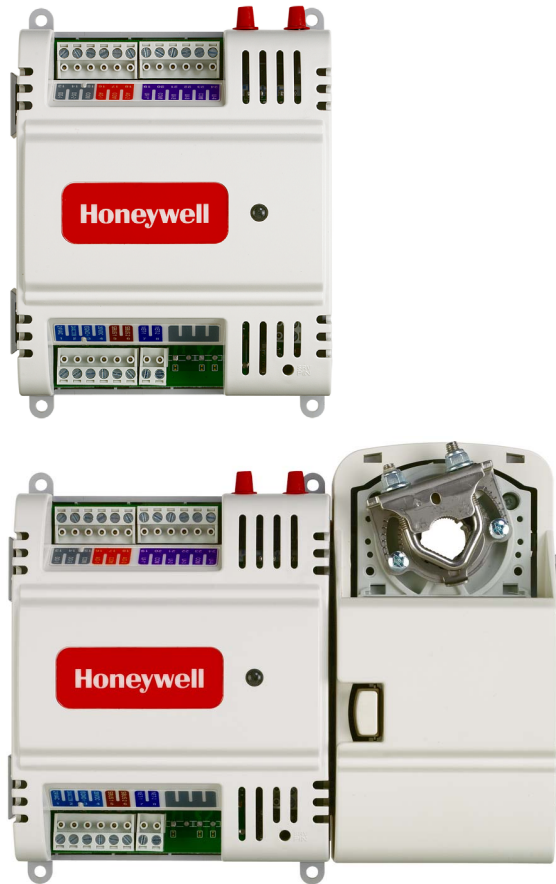




# Stryker™ BACnet® Configurable VAV Controllers

## INSTALLATION INSTRUCTIONS



## APPLICATION

The Stryker™ configurable, direct digital controllers are used for either pressure-independent or pressure single-duct VAV terminal unit control solutions. VAV controllers feature preprogrammed heat/cooling or reheat algorithms for VAV box control applications and can be configured to match a wide range of VAV applications. The Stryker™ controllers use BACnet MS/TP network for great installation flexibility.

Two models (CVB4022AS-VAV1 and CVB4024NS-VAV1) are available. The CVB4022AS-VAV1 model consists of a VAV controller and a floating actuator. The CVB4024NS-VAV1 VAV controller model does not include an actuator. Both models contain an integral microbridge air flow sensor that provides flow measurement for pressure independent applications.

The CVB controller controls the space temperature in a given zone by modulating a damper and/or regulating a reheat coil in a Variable Air Volume Box that delivers air to one space.

The controllers are capable of stand-alone operation; however, optimum functional benefits are achieved when the network communication capabilities are used.

The Zio (TR71/75) wall modules are used in conjunction with the CVB controllers. Zio is an LCD Wall Module to communicate via a two-wire, polarity insensitive bus with the Honeywell Spyder and Stryker™ controller families. The CVB controllers can be configured in Zio.

Each controller communicates via an EIA-485 BACnet MS/TP network communications network, capable of baud rates between 9.6 and 115.2 kilobits. Controllers are field-mountable to either a panel or a DIN rail.

The configurable VAV/Unitary controllers are available as described in Table 1.

**Table 1. Controller Configurations.**

| <b>Controller Model</b> | <b>Programmable Type</b> | <b>Universal Inputs (UI)</b> | <b>Digital Inputs (DI)</b> | <b>Analog Outputs (AO)</b> | <b>Digital Outputs (DO)</b> | <b>Velocity Pressure Sensor (Microbridge)</b> | <b>Series 60 Floating Actuator</b> |
|-------------------------|--------------------------|------------------------------|----------------------------|----------------------------|-----------------------------|-----------------------------------------------|------------------------------------|
| CVB4022AS-VAV1          | VAV                      | 4                            | 0                          | 2                          | 2                           | YES                                           | YES                                |
| CVB4024NS-VAV1          | VAV                      | 4                            | 0                          | 2                          | 4                           | YES                                           | NO                                 |



## SPECIFICATIONS

### General Specifications

**Rated Voltage:** 20–30 Vac; 50/60 Hz

**Power Consumption:**

100 VA for controller and all connected loads; model CVB4022AS-VAV1.

**Controller Only Load:** 5 VA maximum; model CVB4024NS-VAV1.

**Controller and Actuator Load:** 9 VA maximum; model CVB4022AS-VAV1.

**External Sensors Power Output:** 20 Vdc  $\pm 10\%$  @ 75 mA maximum.

**VAV Operating & Storage Temperature Ambient Rating (models CVB4022AS-VAV1 and CVB4024NS-VAV1):**

Minimum 32 °F (0 °C); Maximum 122 °F (50 °C)

**Relative Humidity:** 5% to 95% non-condensing

**LED:** Provides status for normal operation, controller download process, alarms, manual mode, and error conditions

## BEFORE INSTALLATION

Review the power, input, and output specifications on page 2 before installing the controller.

- Hardware driven by Triac outputs must have a minimum current draw, when energized, of 25 mA and a maximum current draw of 500 mA.
- Hardware driven by the analog current outputs must have a maximum resistance of 550 Ohms, resulting in a maximum voltage of 1.1 volts when driven at 20 mA. If resistance exceeds 550 Ohms, voltages up to 18 Vdc are possible at the analog output terminal.

## WARNING

**Electrical Shock Hazard.**

**Can cause severe injury, death or property damage.**

Disconnect power supply before beginning wiring or making wiring connections to prevent electrical shock or equipment damage.

## INSTALLATION

The controller must be mounted in a position that allows clearance for wiring, servicing, removal, connection of the BACnet MS/TP Molex connector and access to the MS/TP MAC address DIP switches.

The controller may be mounted in any orientation.

### IMPORTANT

*Avoid mounting in areas where acid fumes or other deteriorating vapors can attack the metal parts of the controller, or in areas where escaping gas or other explosive vapors are present.*

## Mount Actuator onto Damper Shaft (CVB4022AS-VAV1)

CVB4022AS-VAV1 controller includes the direct-coupled actuator with Declutch mechanism, which is shipped hard-wired to the controller.

The actuator mounts directly onto the VAV box damper shaft and has up to 44 lb-in. (5 Nm) torque, 90-degree stroke, and 90 second timing at 60 Hz. The actuator is suitable for mounting onto a 3/8 to 1/2 in. (10 to 13 mm) square or round VAV box damper shaft. The minimum VAV box damper shaft length is 1-9/16 in. (40 mm).

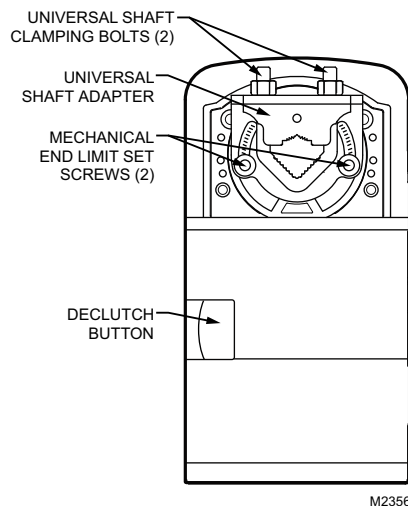
The two mechanical end-limit set screws control the amount of rotation from 12° to 95°. These set screws must be securely fastened in place. To ensure tight closing of the damper, the shaft adapter has a total rotation stroke of 95° (see Fig. 1).

### NOTES:

- The actuator is shipped with the mechanical end-limit set screws set to 95 degrees of rotation. Adjust the two set screws closer together to reduce the rotation travel. Each “hash mark” indicator on the bracket represents approximately 6.5° of rotation per side.
- The Declutch button, when pressed, allows you to rotate the universal shaft adapter (see Fig. 1).

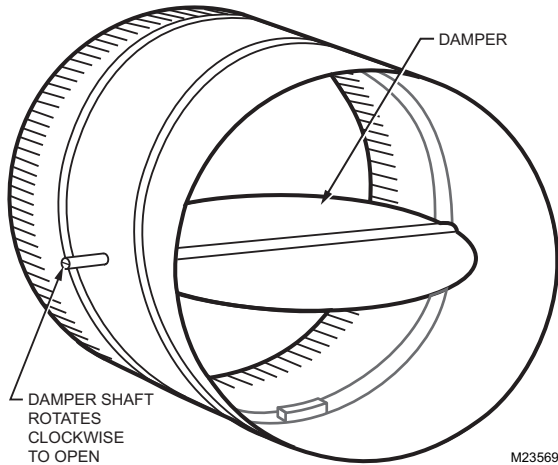
### IMPORTANT

*Determine the damper rotation and opening angle prior to installation. See Fig. 2 below and Fig. 3 on page 3 for examples.*



M23568

**Fig. 1. Series 60 Floating Actuator.**



**Fig. 2. Damper with 90 degree CW rotation to open.**

**IMPORTANT**

*Mount actuator flush with damper housing or add a spacer between the actuator mounting surface and damper box housing.*

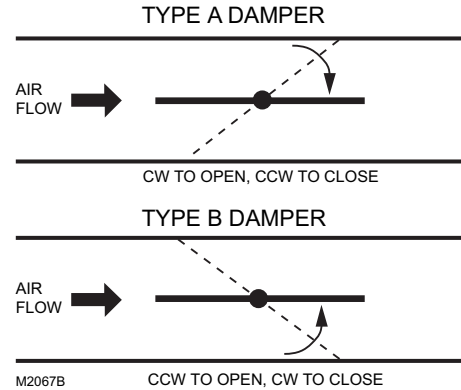
**Before Mounting Actuator onto Damper Shaft (CVB4022AS-VAV1)**

Tools required:

- Phillips #2 screwdriver - end-limit set screw adjustment
- 8 mm wrench - centering clamp

Before mounting the actuator onto the VAV box damper shaft, determine the following:

1. Determine the damper shaft diameter. It must be between 3/8 in. to 1/2 in. (10 to 13 mm).
2. Determine the length of the damper shaft. If the length of the VAV box damper shaft is less than 1-9/16 in. (40 mm), the actuator cannot be used.
3. Determine the direction the damper shaft rotates to open the damper (CW or CCW) (see Fig. 3). Typically, there is an etched line on the end of the damper shaft that indicates the position of the damper. In Fig. 2, the indicator shows the damper open in a CW direction.
4. Determine the damper full opening angle (45, 60, or 90 degrees). In Fig. 2, the damper is open to its full open position of 90 degrees.



**Fig. 3. Determining the rotation direction (CW or CCW) for damper opening.**

**Mounting Actuator onto Damper Shaft (CVB4022AS-VAV1)**

The unit is shipped with the actuator set to rotate open in the clockwise (CW) direction to a full 95 degrees. The extra 5 degrees ensures a full opening range for a 90 degree damper. The installation procedure varies depending on the damper opening direction and angle:

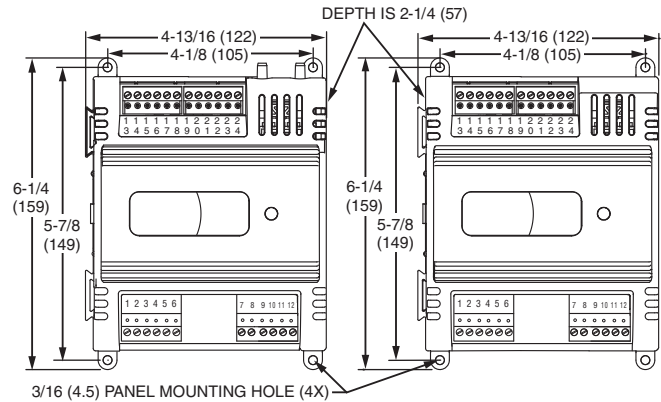
1. If the damper rotates clockwise (CW) to open, and the angle of the damper open-to-closed is 90 degrees:
  - a. Manually open the damper fully (rotate clockwise).
  - b. Using the Declutch button, rotate the universal shaft adapter fully clockwise.
  - c. Mount the actuator to the VAV damper box and shaft.
  - d. Tighten the two bolts on the centering clamp (8 mm wrench; 70.8–88.5 lb-in. [8–10 Nm] torque). When the actuator closes, the damper rotates CCW 90 degrees to fully close.
2. If the damper rotates clockwise (CW) to open, and the angle of the damper open-to-closed is 45 or 60 degrees:
  - a. Manually open the damper fully (rotate clockwise).
  - b. The actuator is shipped with the mechanical end-limits set at 95 degrees. Adjust the two mechanical end-limit set screws to provide the desired amount of rotation. Adjust the two set screws closer together to reduce the rotation travel.
  - c. Tighten the two mechanical end-limit screws (Phillips #2 screwdriver; 26.5–31 lb-in. [3.0–3.5 Nm] torque).
  - d. Using the Declutch button, rotate the universal shaft adapter fully clockwise.
  - e. Mount the actuator to the VAV damper box and shaft.
  - f. Tighten the two bolts on the centering clamp (8 mm wrench; 70.8–88.5 lb-in. [8–10 Nm] torque).
  - g. When the actuator closes, the damper rotates CCW either 45 or 60 degrees to fully close.

3. If the damper rotates counterclockwise (CCW) to open, and the angle of the damper open-to-closed is 90 degrees:
  - a. Manually open the damper fully (rotate counterclockwise).
  - b. Using the Declutch button, rotate the universal shaft adapter fully counterclockwise.
  - c. Mount the actuator to the damper box and shaft.
  - d. Tighten the two bolts on the centering clamp (8 mm wrench; 70.8–88.5 lb-in. [8–10 Nm] torque). When the actuator closes, the damper rotates CW 90 degrees to fully close.
4. If the damper rotates counterclockwise to open, and the angle of the damper open-to-closed is 45 or 60 degrees:
  - a. Manually open the damper fully (rotate counterclockwise).
  - b. The actuator is shipped with the mechanical end-limits set at 95 degrees. Adjust the two mechanical end-limit set screws to provide the desired amount of rotation. Adjust the two set screws closer together to reduce the rotation travel.
  - c. Tighten the two mechanical end-limit screws (Phillips #2 screwdriver; (26.5–31 lb-in. [3.0–3.5 Nm] torque).
  - d. Using the Declutch button, rotate the universal shaft adapter fully counter-clockwise.
  - e. Mount the actuator to the VAV damper box and shaft.
  - f. Tighten the two bolts on the centering clamp (8 mm wrench; 70.8–88.5 lb-in. [8–10 Nm] torque).
  - g. When the actuator closes, the damper rotates CW either 45 or 60 degrees to fully close.

## Mount Controller

NOTE: The controller may be wired before mounting to a panel or DIN rail.

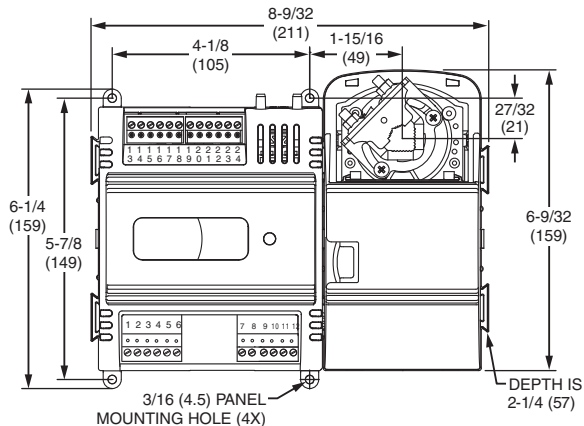
Terminal blocks are used to make all wiring connections to the controller. Attach all wiring to the appropriate terminal blocks (see “Wiring” on page 5).



NOTE: CONTROLLER CAN BE MOUNTED IN ANY ORIENTATION.

M33228A

**Fig. 4. Panel Mounting - controller dimensions in inches (mm) for CVB4024NS-VAV1**



NOTE: CONTROLLER CAN BE MOUNTED IN ANY ORIENTATION.

M33229B

**Fig. 5. Panel mounting - controller and actuator dimensions in inches (mm) for CVB4022AS-VAV1.**

## Panel Mounting

The controller enclosure is constructed of a plastic base plate and a plastic factory-snap-on cover.

NOTE: The controller is designed so that the cover does not need to be removed from the base plate for either mounting or wiring.

The controller mounts using four screws inserted through the corners of the base plate. Fasten securely with four No. 6 or No. 8 machine or sheet metal screws.

The controller can be mounted in any orientation. Ventilation openings are designed into the cover to allow proper heat dissipation, regardless of the mounting orientation.

## DIN Rail Mounting (CVB4024NS-VAV1)

To mount the CVB4024NS-VAV1 controller on a DIN rail [standard EN50022; 1-3/8 in. x 9/32 in. (7.5 mm x 35 mm)], refer to Fig. 6 and perform the following steps:

1. Holding the controller with its top tilted in towards the DIN rail, hook the two top tabs on the back of the controller onto the top of the DIN rail.
2. Push down and in to snap the two bottom flex connectors of the controller onto the DIN rail.

### IMPORTANT

To remove the controller from the DIN rail, perform the following:

1. Push straight up from the bottom to release the top tabs.
2. Rotate the top of the controller out towards you and pull the controller down and away from the DIN rail to release the bottom flex connectors.

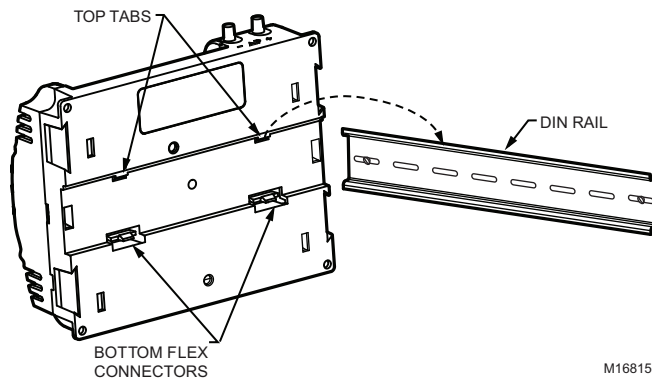


Fig. 6. Controller DIN rail mounting CVB4024NS-VAV1.

## Piping (CVB4024NS-VAV1 and CVB4022AS-VAV1)

### Air flow Pickup

For CVB4024NS-VAV1 and CVB4022AS-VAV1, connect the air flow pickup to the two restrictor ports on the controller (see Fig. 7).

#### NOTES:

- Use 1/4 inch (6 mm) outside diameter, with a 0.040 in. (1 mm) wall thickness, plenum-rated 1219 FR (94V-2) tubing.
- Always use a fresh cut on the end of the tubing that connects to the air flow pickups and the restrictor ports on the controller.

Connect the high pressure or upstream tube to the plastic restrictor port labeled (+), and the low pressure or downstream tube to the restrictor port labeled (-). See labeling in Fig. 7. When twin tubing is used from the pickup, split the pickup tubing a short length to accommodate the connections.

#### NOTES:

- If controllers are mounted in unusually dusty or dirty environments, an inline, 5-micron disposable air filter (use 5-micron filters compatible with pneumatic controls) is recommended for the high pressure line (marked as +) connected to the air flow pickup.
- The tubing from the air flow pickup to the controller should not exceed three feet (0.914 m). Any length greater than this will degrade the flow sensing accuracy.
- Use caution when removing tubing from a 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.

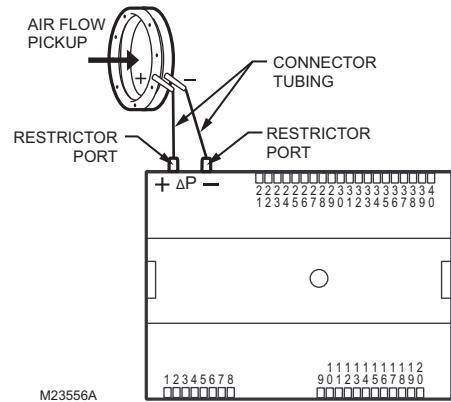


Fig. 7. Air flow pickup connections CVB4024NS-VAV1 and CVB4022AS-VAV1.

## Wiring

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



## WARNING

**Electrical Shock Hazard.**

**Can cause severe injury, death or property damage.**

Disconnect power supply before beginning wiring

NOTES:

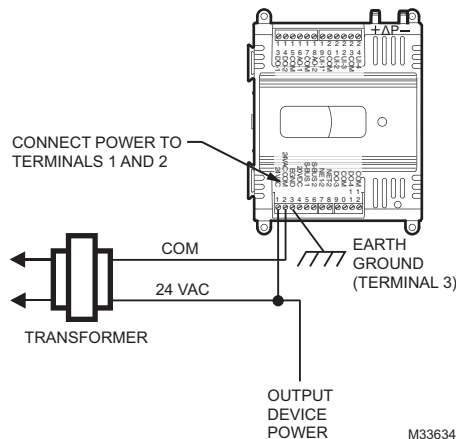
- For multiple controllers operating from a single transformer, the same side of the transformer secondary must be connected to the same power input terminal in each controller. Controller configurations will not necessarily be limited to three devices, but the total power draw, including accessories, cannot exceed 100 VA when powered by the same transformer (U.S. only). The earth ground terminal (terminal 3) must be connected to a verified earth ground for each controller in the group (see Fig. 10 on page 7).
- All loads on the controller must be powered by the same transformer that powers the controller itself. A controller can use separate transformers for controller power and output power.
- Keep the earth ground connection (terminal 3) wire run as short as possible.
- Do not connect the universal input COM terminals, analog output COM terminals or the digital input/output COM terminals to earth ground.

The 24 Vac power from an energy limited Class II power source must be provided to the controller. To conform to Class II restrictions (U.S. only), the transformer must not be larger than 100 VA.

Fig. 8 depicts a single controller using one transformer.

**IMPORTANT**

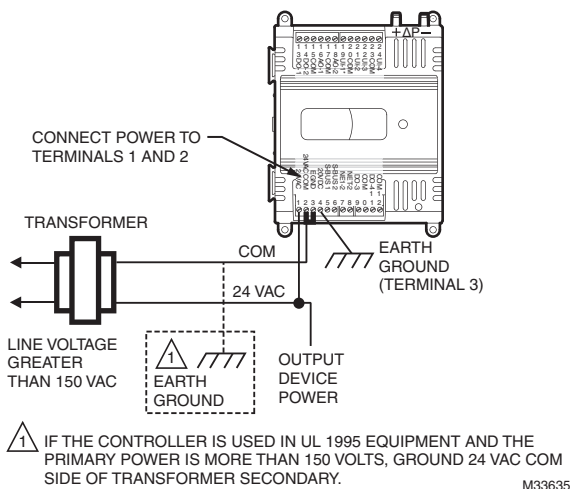
- Power must be off prior to connecting to or removing connections from the 24 Vac power (24 Vac/ 24 Vac COM), earth ground (EGND), and 20 Vdc power (20 Vdc) terminals.
- Use the heaviest gauge wire available, up to 14 AWG (2.0 sq mm), with a minimum of 18 AWG (1.0 sq mm), for all power and earth ground wiring.
- Screw-type terminal blocks are designed to accept up to one 14 AWG (2.0 sq mm) conductor or up to two 18 AWG (1.0 sq mm) conductors. More than two wires that are 18 AWG (2.0 sq mm) can be connected with a wire nut. Include a pigtail with this wire group and attach the pigtail to the terminal block.
- Connect terminal 2, (the 24 Vac common [24 VAC COM] terminal) to earth ground (see Fig. 8).



**Fig. 8. Power wiring details for one controller per transformer.**

**IMPORTANT**

- If the controller is used on **Heating and Cooling Equipment (UL 1995, U.S. only)** and the transformer primary power is more than 150 volts, connect terminal 2, (the 24 Vac common [24 VAC COM] terminal) to earth ground (see Fig. 9). For these applications, only one controller can be powered by each transformer.



**Fig. 9. Transformer power wiring details for one controller used in UL 1995 equipment (U.S. only).**

More than one controller can be powered by a single transformer. Fig. 10 shows power wiring details for multiple controllers.

NOTE: Controller configurations 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).

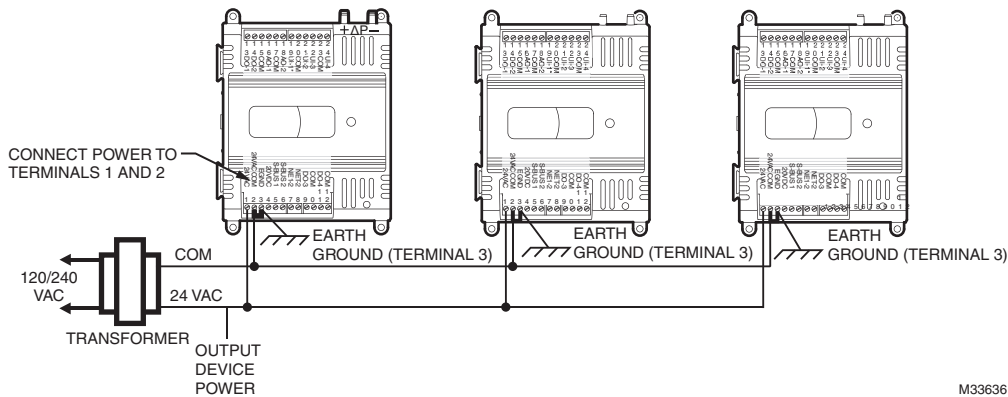


Fig. 10. Power wiring details for two or more controllers per transformer.

Power Budget

A power budget must be calculated for each device to determine the required transformer size for proper operation. A power budget is simply the summing of the maximum power draw ratings (in VA) of all the devices to be controlled. This includes the controller itself and any devices powered from the controller, such as equipment actuators (ML6161 or other motors) and various contactors and transducers.

IMPORTANT

- If a controller is used on Heating and Cooling Equipment (UL 1995, U.S. only) and transformer primary power is more than 150 volts, connect the transformer secondary common to earth ground (see Fig. 9 on page 6).
- When multiple controllers operate from a single transformer, connect the same side of the transformer secondary to the same power input terminal in each device. The earth ground terminal (terminal 3) must be connected to a verified earth ground for each controller in the group (see Fig. 10).

Power Budget Calculation Example

Table 2 is an example of a power budget calculation for a typical CVB controller.

The system example above requires 30.7 VA of peak power. Therefore, a 100 VA AT92A transformer could be used to power one controller of this type. Because the total peak power is less than 50 VA, this same transformer could be on page 11 for illustrations of controller power wiring. See Table 3 for VA ratings of various devices.

For contactors and similar devices, the in-rush power ratings should be used as the worst case values when performing power budget calculations. Also, the application engineer must consider the possible combinations of simultaneously energized outputs and calculate the VA ratings accordingly.

The worst case, which uses the largest possible VA load, should be determined when sizing the transformer. Each controller requires 24 Vac power from an energy-limited Class II power source. To conform to Class II restrictions (U.S. only), transformers must not be larger than 100 VA. A single transformer can power more than one controller.

Table 2. Power budget calculation example.

| Device                                                                 | VA Information | Obtained From                                                                                                           |
|------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------|
| CVB4022AS-VAV1 controller (include Series 60 Floating Damper Actuator) | 9.0            | See "Specifications" on page 2.                                                                                         |
| R8242A Contactor fan rating                                            | 21.0           | TRADELINE® Catalog inrush rating                                                                                        |
| D/X Stages                                                             | 0.0            | For example, assume cooling stage outputs are wired into a compressor control circuit and have no impact on the budget. |
| M6410A Steam Heating Coil Valve                                        | 0.7            | TRADELINE® Catalog, 0.32A 24 Vac                                                                                        |
| TOTAL                                                                  | 30.7           |                                                                                                                         |

**Table 3. VA ratings for transformer sizing.**

| Device                                                                     | Description                 | VA   |
|----------------------------------------------------------------------------|-----------------------------|------|
| CVB4022AS-VAV1<br>controllers and<br>Series 60 Floating<br>Damper Actuator | Controller and Actuator     | 9.0  |
| CVB4024NS-VAV1                                                             | Controller                  | 5.0  |
| ML684                                                                      | Versadrive Valve Actuator   | 12.0 |
| ML6161                                                                     | Damper Actuator, 35 lb-in.  | 2.2  |
| ML6185                                                                     | Damper Actuator SR 50 lb-in | 12.0 |
| ML6464                                                                     | Damper Actuator, 66 lb-in.  | 3.0  |
| ML6474                                                                     | Damper Actuator, 132 lb-in. | 3.0  |
| R6410A                                                                     | Valve Actuator              | 0.7  |
| R8242A                                                                     | Contacto                    | 21.0 |

## Line-Loss

Controllers must receive a minimum supply voltage of 20 Vac. If long power or output wire runs are required, a voltage drop due to Ohms Law ( $I \times R$ ) line-loss must be considered. This line-loss can result in a significant increase in total power required and thereby affect transformer sizing. The following example is an  $I \times R$  line-loss calculation for a 200 ft. (61m) run from the transformer to a controller drawing 37 VA and using two 18 AWG (1.0 sq mm) wires.

### THE FORMULA IS:

Loss = [length of round-trip wire run (ft.)] x [resistance in wire (ohms per ft.)] x [current in wire (amperes)]

### FROM SPECIFICATION DATA:

18 AWG twisted pair wire has a resistance of 6.52 ohms per 1000 feet.

Loss = [(400 ft.) x (6.52/1000 ohms per ft.)] x [(37 VA)/(24V)] = 4.02 volts

This means that four volts are going to be lost between the transformer and the controller. To assure the controller receives at least 20 volts, the transformer must output more than 24 volts. Because all transformer output voltage levels depend on the size of the connected load, a larger transformer outputs a higher voltage than a smaller one for a given load.

Fig. 11 shows this voltage load dependence.

In the preceding  $I \times R$  loss example, even though the controller load is only 37 VA, a standard 40 VA transformer is not sufficient due to the line-loss. Looking at Fig. 11 a 40 VA transformer is just under 100 percent loaded (for the 37 VA controller) and has a secondary voltage of 22.9 volts. (Use the lower edge of the shaded zone in Fig. 11 that represents the worst case conditions.) When the  $I \times R$  loss of four volts is subtracted, only 18.9 volts reaches the controller. This is not enough voltage for proper operation. In this situation, the engineer has three alternatives:

1. Use a larger transformer. For example, if an 80 VA model is used, an output of 24.4 volts, minus the four volt line-loss, supplies 20.4V to the controller (see Fig. 11).

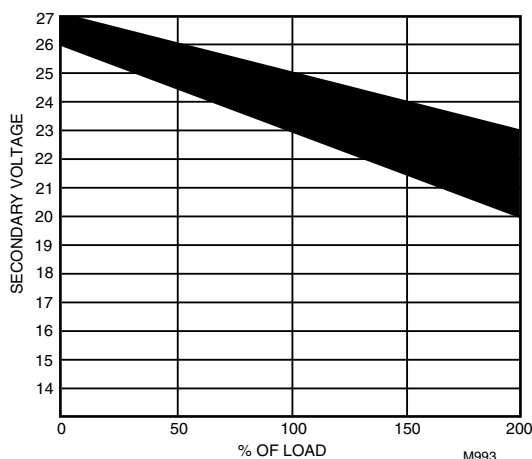
Although acceptable, the four-volt line-loss in this example is higher than recommended.

### IMPORTANT

*No installation should be designed where the line-loss is greater than two volts. This allows for nominal operation if the primary voltage drops to 102 Vac (120 Vac minus 15 percent).*

2. Use heavier gauge wire for the power run. 14 AWG (2.0 sq mm) wire has a resistance of 2.57 ohms per 1,000 ft. Using the preceding formula results in a line-loss of only 1.58 volts (compared with 4.02 volts). This would allow a 40 VA transformer to be used. 14 AWG (2.0 sq mm) wire is the recommended wire size for 24 Vac wiring.
3. Locate the transformer closer to the controller. This reduces the length of the wire run, and the line-loss. The issue of line-loss is also important in the case of the output wiring connected to the Triac digital outputs. The same formula and method are used. Keep all power and output wire runs as short as practical. When necessary, use heavier gauge wire, a bigger transformer, or install the transformer closer to the controller.

To meet the National Electrical Manufacturers Association (NEMA) standards, a transformer must stay within the NEMA limits. The chart in Fig. 11 shows the required limits at various loads. With 100 percent load, the transformer secondary must supply between 23 and 25 volts to meet the NEMA standard. When a purchased transformer meets the NEMA standard DC20-1986, the transformer voltage regulating ability can be considered reliable. Compliance with the NEMA standard is voluntary.



**Fig. 11. NEMA Class 2 transformer voltage output limits.**

The Honeywell transformers listed in Table 4 meet the NEMA standard DC20-1986.

**Table 4. Honeywell transformers that meet NEMA standard DC20-1986.**

| Transformer Type | VA Rating |
|------------------|-----------|
| AT40A            | 40        |
| AT72D            | 40        |
| AT87A            | 50        |
| AK3310 Assembly  | 100       |

## Communications

Each controller uses a BACnet MS/TP communications port. The controller's data is presented to other controllers over a twisted-pair MS/TP network, which uses the EIA-485 signaling standard capable of the following baud rates: 9.6, 19.2, 38.4, 76.8 or 115.2 Kilobits per second (configured at global controller). The Stryker BACnet controllers are master devices on the MS/TP network. Each Stryker BACnet controller uses a high-quality EIA-485 transceiver and exerts 1/4 unit load on the MS/TP network.

Cabling should be selected that meets or exceeds the BACnet Standard which specifies the following: An MS/TP EIA-485 network shall use shielded, twisted-pair cable with characteristic impedance between 100 and 130 ohms. Distributed capacitance between conductors shall be less than 100 pF per meter (30 pF per foot). Distributed capacitance between conductors and shield shall be less than 200 pF per meter (60 pF per foot). Foil or braided shields are acceptable. The Honeywell tested and recommended MS/TP cable is Honeywell Cable 3322 (18 AWG, 1-Pair, Shielded, Plenum cable), alternatively Honeywell Cable 3251 (22 AWG, 1-Pair, Shielded, Plenum cable) is available and meets the BACnet Standard requirements ([www.honeywellcable.com](http://www.honeywellcable.com)).

The maximum BACnet MS/TP network Bus segment length is 4,000 ft. (1,071 m) using recommended wire. Repeaters must be used when making runs longer than 4,000 ft. (1,071 m). A maximum of three repeaters can be used between any two devices.

## Setting the MS/TP MAC address

The MS/TP MAC address for each device must be set to a unique value in the range of 0-127 on an MS/TP network segment (address 0, 1, 2, & 3 should be avoided as they are commonly used for the router, diagnostic tools, and as spare addresses). DIP switches on the Stryker BACnet controller are used to set the controller's MAC address.

To set the MS/TP MAC address of a Stryker BACnet controller:

1. Find an unused MAC address on the MS/TP network to which the Stryker BACnet controller connects.
2. Locate the DIP switch bank on the Stryker BACnet for addressing. This is labeled MAC Address
3. With the Stryker BACnet Controller powered down, set the DIP switches for the MAC Address you want. Add the value of DIP switches set to ON to determine the MAC address. See Table 5. Example, if only DIP switches 1, 3, 5, and 7 are enabled the MAC address would be 85 (1 + 4 + 16 + 64 = 85).

**Table 5. DIP Switch Values For MS/TP MAC Address.**

| DIP   | 7  | 6  | 5  | 4 | 3 | 2 | 1 |
|-------|----|----|----|---|---|---|---|
| VALUE | 64 | 32 | 16 | 8 | 4 | 2 | 1 |

## Setting the Device Instance Number

The Device Instance Number must be unique across the entire BACnet system network because it is used to uniquely identify the BACnet devices. It may be used to conveniently identify the BACnet device from other devices during installation. The Stryker BACnet Controllers Device Instance Number is automatically set when it is added to a WEBStation-AX project. The Device Instance Number can be changed by the user, which may be necessary when integrating with a third party or when attempting to replace an existing controller and it is desired to maintain the existing Device Instance Number.

## Termination Resistors

Matched terminating resistors are required at each end of a segment bus wired across (+) and (-). Use matched precision resistors rated 1/4W ±1% / 80 - 130 Ohms. Ideally, the value of the terminating resistors should match the rated characteristic impedance of the installed cable. For example, if the installed MS/TP cable has a listed characteristic impedance of 120 Ohm, install 120 Ohm matched precision resistors.

## Shield Terminating

Following proper MS/TP cabling shield grounding procedures is important to minimize the risk of communication problems and equipment damage caused by capacitive coupling. Capacitive coupling is caused by placing MS/TP cabling close to lines carrying higher voltage. The shield should be grounded on only one end of the MS/TP segment (typically the router end). Tie the shield through using the SHLD (terminal 4) on the Stryker BACnet Controller.

## Sylk™ Bus

Sylk is a two wire, polarity insensitive bus that provides both 18 VDC power and communications between a Sylk-enabled sensor and a Sylk-enabled controller. Using Sylk-enabled sensors saves I/O on the controller and is faster and cheaper to install since only two wires are needed and the bus is polarity insensitive. Sylk sensors are configured using the latest release of the Stryker Tool for WEBPro and WEBStation.

## Wiring Method



## WARNING

**Electrical Shock Hazard.**

**Can cause severe injury, death or property damage.**

Disconnect power supply before beginning wiring, or making wiring connections, to prevent electrical shock or equipment damage.

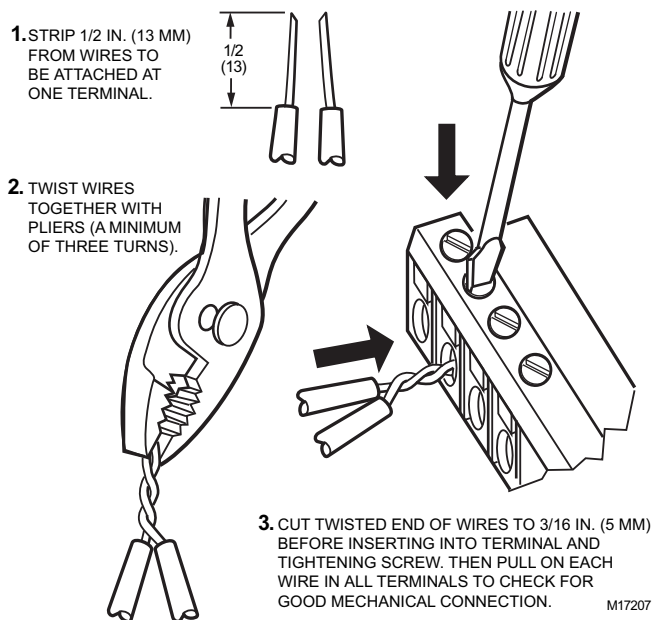
**NOTE:** When attaching two or more wires to the same terminal, other than 14 AWG (2.0 sq mm), be sure to twist them together. Deviation from this rule can result in improper electrical contact (see Fig. 12).

Each terminal can accommodate the following gauges of wire:

- Single wire: from 22 AWG to 14 AWG solid or stranded
- Multiple wires: up to two 18 AWG stranded, with 1/4 watt wire-wound resistor

Prepare wiring for the terminal blocks, as follows:

1. Strip 1/2 in. (13 mm) insulation from the conductor.
2. Cut a single wire to 3/16 in. (5 mm). Insert the wire in the required terminal location and tighten the screw.
3. If two or more wires are being inserted into one terminal location, twist the wires together a minimum of three turns before inserting them (see Fig. 12).
4. Cut the twisted end of the wires to 3/16 in. (5 mm) before inserting them into the terminal and tightening the screw.
5. Pull on each wire in all terminals to check for good mechanical connection.



**Fig. 12. Attaching two or more wires at terminal blocks.**

## Controller Replacement (CVB4022AS-VAV1)

For CVB4022AS-VAV1 controller, which is hard-wired to an actuator, perform the following actions to replace the complete assembly (controller and actuator):

1. Remove all power from the controller.
2. Remove the two air flow pickup connections from the pressure sensor.

3. Remove the terminal blocks.
4. Remove the old controller and actuator assembly from its mounting.
  - Loosen the two bolts on the actuator clamp to release the actuator from the shaft.
  - Remove the controller's mounting screws.
  - Gently pull the controller and actuator assembly straight out, until the assembly is clear of the actuator shaft.
5. Mount the new controller and actuator assembly (See "Installation" on page 2.).
6. Reconnect the two air flow pickup tubes to the pressure sensor (See "Piping (CVB4024NS-VAV1 and CVB4022AS-VAV1)" on page 4).
7. Replace the terminal blocks:
  - Insert each terminal block onto its alignment pins.
  - Press straight down to firmly seat it.
  - Repeat for each terminal block.
8. Restore power to the controller.

## Controller Replacement (CVB4024NS-VAV1)

Perform the following to replace the CVB4024NS-VAV1 controller:

1. Remove all power from the controller.
2. Remove the two air flow pickup connections from the pressure sensor.
3. Remove the terminal blocks.
4. Remove the old controller from its mounting.

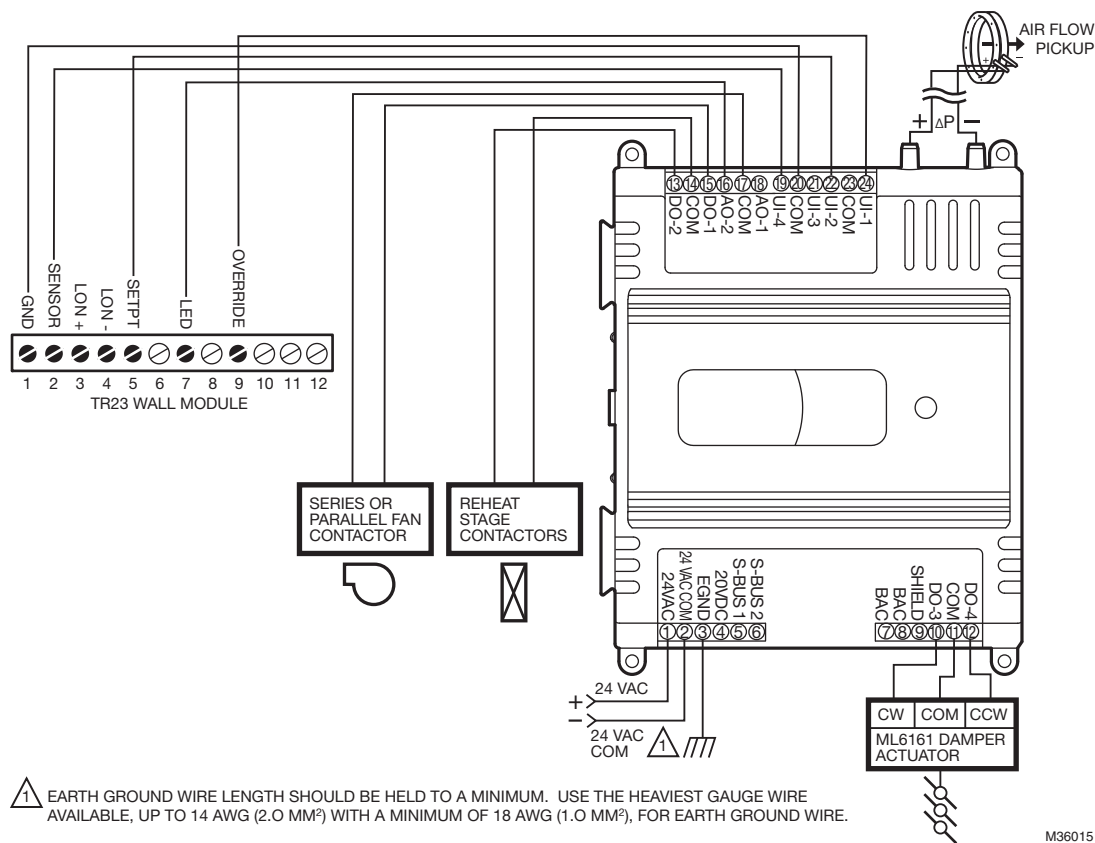
### IMPORTANT

**(FOR CONTROLLERS MOUNTED TO A DIN RAIL):**

1. Push straight up from the bottom to release the top pins.
  2. Rotate the top of the controller outwards to release the bottom flex connectors (see Fig. 6 on page 5).
5. Mount the new controller. See "Installation" on page 2.
  6. Reconnect the two air flow pickup tubes to the pressure sensor (See "Piping (CVB4024NS-VAV1 and CVB4022AS-VAV1)" on page 5).
  7. Replace the terminal blocks:
    - Insert each terminal block onto its alignment pins.
    - Press straight down to firmly seat it.
    - Repeat for each terminal block.
  8. Restore power to the controller.

## Wiring Applications (Examples)

Typical controller wiring for VAV applications (see Fig. 13 and 14).



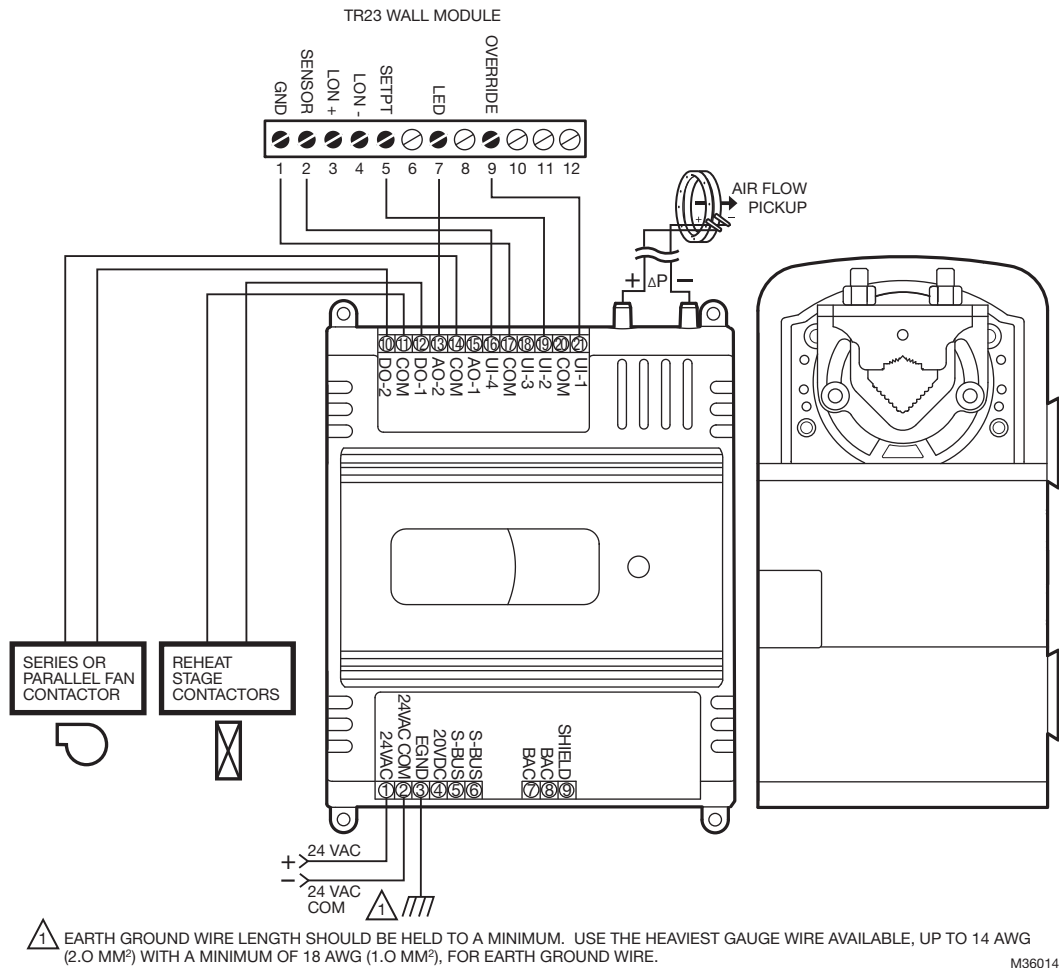
**Fig. 13. Controller wiring diagram for typical VAV application, using the TR23 wall module.**

## Automation and Control Solutions

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**Fig. 14. Controller wiring diagram for typical VAV application with staged reheat.**

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