PCV1617 and PCV1632 VAV Box Controllers Installation instructions

Applications

The PCV1617 and PCV1632 are programmable digital controllers designed for VAV box applications that communicate through the BACnet® MS/TP protocol. The controllers feature an integral digital pressure sensor, a damper actuator, and a 32-bit microprocessor. The controllers' small package size facilitates quick field installation and efficient use of space without compromising high-tech control performance. The PCV controllers connect easily to either the networked or to the non-communicating sensor for zone air temperature sensing.

Communications Protocol

The PC family controllers and network sensors communicate using the standard BACnet protocol, based on the ANSI/ASHRAE 135-2008. The BACnet protocol is a standard for ANSI, ASHRAE, and the International Standards Organization (ISO) for building controls.

PCV field controllers are BTL-listed as BACnet Application Specific Controllers (B-ASCs).

North American Emissions Compliance

United States

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this 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 may cause harmful interference, in which case the users will be required to correct the interference at their own expense.

Canada

This Class (A) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe (A) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Installation

Observe these guidelines when installing the PCV1617 and PCV1632 controllers:

- Transport the PCV controller in the original container to minimize vibration and shock damage to the PCV controller.
- Do not drop the PCV controller or subject it to physical shock.

Part No. 24-10143-1299 Rev B

2019-03-22

(barcode for factory use only)

CH-PCV1617, CH-PCV1632

Parts included

- One PCV1617 or PCV1632 controller with removable FC terminal block
- One installation instructions sheet
- One self-drilling No. 10 x 25 mm (1 in.) screw

Materials and special tools needed

- Several 6 mm (1/4 in.) female spade terminals for input and output wiring and crimping tool or spade mounted terminal blocks
- Small, straight-blade screwdriver for securing wires in the terminal blocks
- 8 mm (5/16 in.) wrench or 10 mm (3/8 in.) 12-point socket to tighten the square coupler bolt
- Several shims or washers to mount the PCV
- Power screwdriver, 100 mm (4 in.) extension socket, punch, drill, and 3.5 mm (9/64 in.) drill bits to mount the PCV
- Pliers to open and close the damper
- Required length of 3.97 mm (5/32 in.) ID pneumatic tubing and barbed fittings

Mounting

Observe these guidelines when mounting a PCV:

➤ **Important:** When the air supply to the VAV box is below 10°C (50°F), make sure that any condensation on the VAV box, particularly on the damper shaft, does not enter the PCV electronics. Mount the PCV vertically above the damper shaft to allow any shaft condensation to fall away from the PCV. Additional measures may be required in some installations.

- Ensure the mounting surface can support the PCV and any user-supplied enclosure.
- Mount the PCV on a hard, even surface whenever possible.
- Use shims or washers to mount the PCV securely and evenly on the mounting surface.
- Mount the PCV in an area free of corrosive vapors that matches the ambient conditions specified in the Technical specifications section.
- Provide sufficient space around the PCV for cable and wire connections and adequate ventilation through the controller (at least 50 mm [2 in.] on the top, bottom, sides, and front of the controllers).
- Do not mount the PCV in areas where electromagnetic emissions from other devices or wiring can interfere with controller communication.
- When using the PCV1617 or PCV1632 to replace an existing controller, plug the unused open hole from the original controller mounting, if possible.
- Avoid mounting the PCV on surfaces with excessive vibration.

On panel or enclosure mount applications, observe these additional guidelines:

- Do not install the PCV in an airtight enclosure.
- Mount the PCV so that the enclosure walls do not obstruct cover removal or ventilation through the controller.
- Mount the PCV so that the power transformer and other devices do not radiate excessive heat to the controller.

To mount a PCV1617 or PCV1632 controller:

1. Set all the switches on the PCV controller to their known settings.
2. Place the PCV controller in the proper mounting position on the damper shaft so that the wiring connections are easily accessible. Make sure the PCV controller base is parallel to the VAV box (perpendicular to the damper shaft). If needed, use a spacer to offset tipping of the PCV controller caused by the shaft bushings.

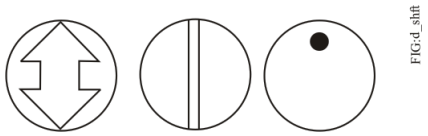
   ⓘ **Note:** Use the alignment marks to center the captive spacer to ensure sufficient PCV movement in either direction.

3. Secure the self-drilling No. 10 screw through the captive spacer with a power screwdriver and 100 mm (4 in.) extension socket. Otherwise, use a punch to mark the position of the shoulder washer, and then drill a hole into the VAV box using a 3.5 mm (9/64 in.) drill bit. Insert the mounting screw and tighten against the spacer.

   ➤ **Important:** Do not overtighten the screw, or the threads may strip. If you are mounting the controller to a VAV box, make sure the screws do not interfere with damper blade movement.

4. Locate the damper position using the typical marking on the end of the damper shaft (Figure 1).

Figure 1: Typical damper end shaft icons



5. Note the direction, clockwise (CW) or counterclockwise (CCW), required to close the damper. Grasp the damper shaft firmly with pliers, and either manually close the damper for 90° boxes or manually open the damper for 45° or 60° boxes.
6. Push down and hold the Manual Override button and turn the PCV controller coupler until it contacts the mechanical end-stop at either the full-closed (90° boxes) or full-open (45° and 60° boxes) position.
7. If the damper for a 90° box closes CCW, rotate the coupler to the CCW mechanical limit. If the damper for a 90° box closes CW, rotate the coupler to the CW mechanical limit. The open end-stop is automatically set for 90° boxes.

   For 45° and 60° boxes, hard stops must be provided at both full-closed and full-open damper positions. By installing the PCV controller at the full-open position, the PCV controller provides the open stop for 45° and 60° boxes. The closed damper seal provides the full-closed stop.

8. Tighten the square coupler bolt to the shaft using an 8 mm (5/16 in.) wrench or 10 mm (3/8 in.) 12-point socket. Tighten to 11 N·m , ±.5 N-m (100 lb·in, ±5 lb·in).
9. Loop the pneumatic tubing (supplied by field personnel) to include a trap for condensation. Attach the needed length of tubing (supplied and installed by field personnel) to the dual port fitting on the PCV controller and the other ends of the tubing to the pressure transducer in the VAV box application.

   ⓘ **Note:** The PCV uses a digital non-flow pressure sensor with bidirectional flow operation, which allows the high- and low-pressure DP tube connections to be made to either

barbed fitting on the PCV controller. There is no need to make a specific high- or low-side connection when attaching the tubing to the barbed fittings on the PCV.

10. Push the Manual Override button, and turn the actuator coupling manually to ensure that the actuator can rotate from full-closed to full-open positions without binding.
11. Complete the mounting by rotating the damper to the full-open position.

⚠ CAUTION

Risk of Property Damage:
Rotate the damper to the full-open position before starting the air handler. Failure to rotate the damper to the full-open position may result in damage to the VAV box or ductwork when the air handler is started.

⚠ CAUTION

Risque de dommages matériels:
Faire pivoter le registre pour le placer en position d'ouverture complète avant de démarrer l'unité de traitement d'air. Le non-respect de cette directive risque d'endommager le caisson de l'unité à volume d'air variable (VAV) ou le réseau de conduites au démarrage de l'unité de traitement d'air.

Wiring diagram

Figure 2: PCV1617/PCV1632 Controller wiring terminations and physical features

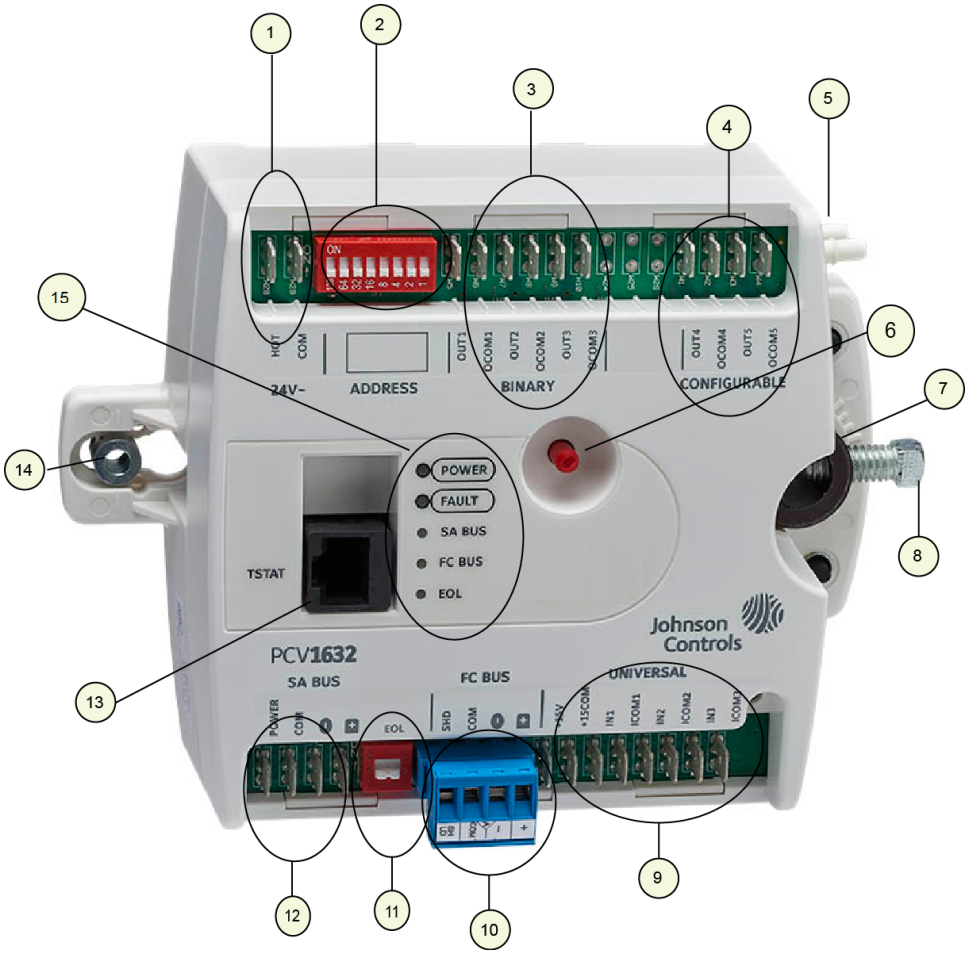


Table 1: PCV1617/PCV1632 features callout numbers and descriptions

Callout	Physical features: description and references
1	24 VAC, Class 2 Supply Power Spade Terminals (see Supply power terminal block)
2	Device Address DIP Switch Block (see Setting the device address)
3	Binary Outputs, 24 VAC Triacs (see Table 2)
4	Configurable Outputs: Voltage Analog Output (0–10 VDC) and Binary Output (24 VAC Triac) (PCV1632 only) (see Table 2)
5	Dual Port Fitting (see Figure 2)
6	Manual Override Button (see Mounting)
7	Controller Coupler (see Mounting)
8	Coupler Bolt (see Mounting)

Table 1: PCV1617/PCV1632 features callout numbers and descriptions

Callout	Physical features: description and references
9	Universal Input: Voltage Analog Input (0–10 VDC) Resistive Analog Inputs (0–600k ohm) (see Table 2): 0–2k Potentiometer RTD: 1k Nickel, 1k Platinum, or A99B SI NTC: 10K Type L (10K JCI Type II is equivalent to Type L) or 2.252K Type II Dry Contact Binary Input
10	FC Bus Pluggable Screw Terminal Block (see FC bus terminal block)
11	EOL (End-of-Line) Switch (see Setting the EOL switch)
12	SA Bus Spade Terminals (see SA bus terminal blocks)
13	TSTAT Modular Port: RJ-45 8-Pin Modular Jack (see Modular port)
14	Captive Spacer and Screw (see Figure 2)
15	LED Status Indicators (see Table 8)

Wiring

⚠ Warning

Risk of Electric Shock:
Disconnect or isolate all power supplies before making electrical connections. More than one disconnection or isolation may be required to completely de-energize equipment. Contact with components carrying hazardous voltage can cause electric shock and may result in severe personal injury or death.

- **Important:** Do not connect supply power to the controller before finishing wiring and checking all wiring connections. Short circuits or improperly connected wires can result in damage to the controller and void any warranty.
- **Important:** Do not exceed the controller electrical ratings. Exceeding controller electrical ratings can result in permanent damage to the controller and void any warranty.
- **Important:** Use copper conductors only. Make all wiring in accordance with local, national, and regional regulations.
- **Important:** Electrostatic Discharge can damage controller components. Use proper Electrostatic Discharge precautions during installation, setup, and servicing to avoid damaging the controller.

PCV terminals and bus ports

See Figure 2 for input and output terminal and bus port locations on the PCV1617 and PCV1632 controllers. Observe the following guidelines when wiring a PCV controller.

Input and Output terminals

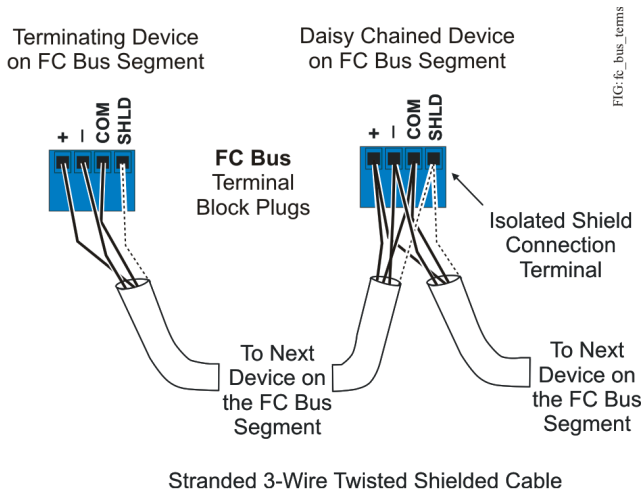
The input spade terminals are located on the side of the PCV near the FC Bus terminal block. The output spade terminals are located on the opposite side of the controller near the power supply spade terminals. See Table 2 for more information.

FC bus terminal block

The FC Bus terminal block is a blue, removable, 4-terminal plug that fits into a board-mounted jack.

Wire the removable FC Bus terminal block plugs on the PCV and other PC controllers in a daisy-chain configuration using 3-wire twisted, shielded cable as shown in Figure 3. See Table 5 for more information.

Figure 3: FC bus terminal block wiring

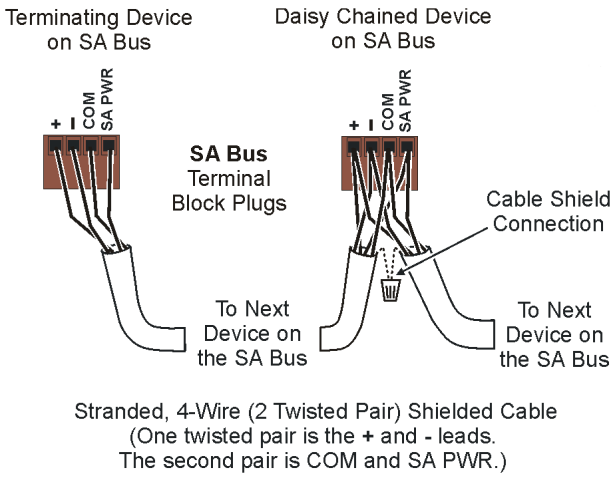


Note: The Shield terminal (SHLD) on the FC Bus terminal block is isolated and can be used to connect the cable shields on the bus (Figure 3).

SA bus terminal blocks

Wire the SA Bus terminal blocks on the PCV and other SA Bus devices, such as a communicating NS-family room sensor, in a daisy-chain configuration using 4-wire twisted, shielded cable as shown in the following diagram. . See Table 5 for more information.

Figure 4: SA bus terminal block wiring



Modular port

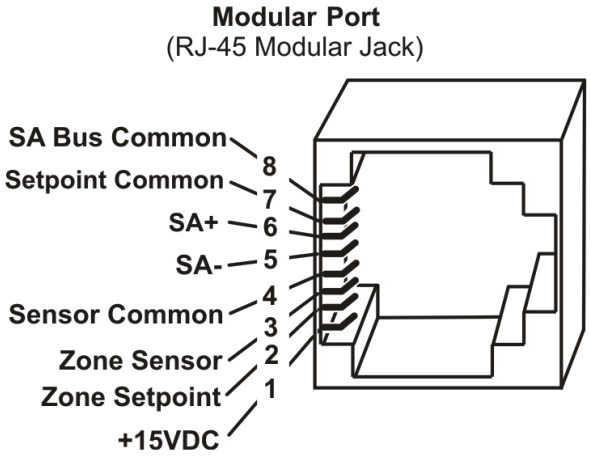
The modular (TSTAT) port on the face of the PCV (Figure 2) is an RJ-45, 8-position modular jack used to easily connect one TE-730 series analog (non-communicating) sensor to the PCV. The modular TSTAT port provides 15 VDC, SA Bus communications, and analog signals for zone temperature, zone setpoint, and temporary zone occupancy override.

ⓘ **Note:** On the TE-730 Series sensors, you can activate the occupancy override functionality by using a pushbutton to momentarily short the zone temperature AI.

The TSTAT pin assignment is shown in Figure 5.

ⓘ **Note:** Do not use the modular SA Bus port and the terminal block SA Bus simultaneously. Only use one of these connections at a time.

Figure 5: Pin number assignments for the modular port on PCV1617 and PCV1632 Controllers

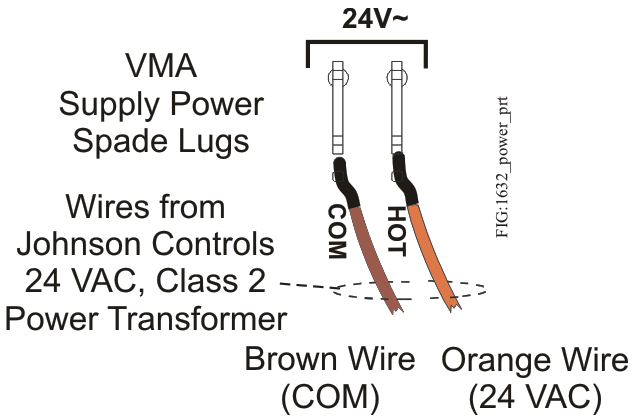


Supply power terminal block

The 24 VAC supply power terminal block is a gray, removable, 2-terminal plug that fits into a board-mounted jack on the upper left of the PCV controller.

Wire the 24 VAC supply power wires from the transformer to the HOT and COM terminals on the spade terminals as shown in Figure 6. See Table 5 for more information.

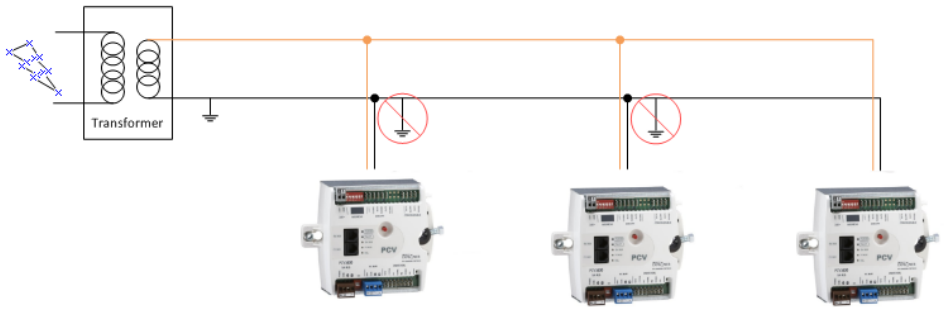
Figure 6: 24 VAC supply power spade terminal wiring



The supply power wire colors may be different on transformers from other manufacturers. Refer to the transformer manufacturer's instructions and the project installation drawings for wiring details.

➤ **Important:** Connect 24 VAC supply power to the PCV and all other network devices so that transformer phasing is uniform across the network devices. Powering network devices with uniform 24 VAC supply power phasing reduces noise, interference, and ground loop problems. The PCV does not require an earth ground connection. However, when grounding the secondary of the 24 VAC transformer is required, only one connection to ground should be made near the transformer. See the following figure.

Figure 7: Transformer grounding



⚠ CAUTION

Risk of Property Damage:
Do not apply power to the system before checking all wiring connections. Improper wiring of this terminal may cause a short circuit across the 24 VAC power supply on -1 PCV models. A short circuit may result in a tripped circuit breaker or blown fuse. If using a transformer with a built-in fuse, the transformer may need to be replaced.

⚠ CAUTION

Risque de dommages matériels:
Ne mettez pas l'appareil sous tension avant d'avoir vérifié toutes les connexions du câblage. Le câblage inadéquat de cette borne peut causer un court-circuit sur l'alimentation électrique de 24 V c.a. des PCV 16xx-1 modèles. Un court-circuit peut causer le déclenchement du disjoncteur ou le grillage d'un fusible. Si vous utilisez un transformateur avec un fusible intégré, vous pourriez devoir remplacer le transformateur.

To wire the PCV1617 or PCV1632 controller:

1. Terminate wiring according to the appropriate figure in Termination diagrams.
2. Wire network sensors and other devices to the PCV's SA Bus.
3. Wire the FC Bus in a daisy chain.
4. Ensure that the PCV's device address DIP switches are set to the appropriate device address. See Setting the device address. Also, activate the end-of-line (EOL) switch if necessary.
5. Connect the PCV controller to 24 VAC, Class 2 power.

PCV terminal functions, ratings, requirements, and wiring guidelines

Input and Output wiring guidelines

Table 2 provides information about the functions, ratings, and requirements for the PCV input and output terminals, and Table 3 provides guidelines for wire sizes and cable lengths.

In addition to the wiring guidelines in Table 2, observe these guidelines when wiring PCV inputs and outputs:

- Run all low-voltage wiring and cables separate from high-voltage wiring.
- All input and output cables, regardless of wire size or number of wires, should consist of twisted, insulated, and stranded copper wires.
- Shielded cable is recommended for input and output cables that are exposed to high electromagnetic or radio frequency noise.
- Cable runs of less than 30 m (100 ft) typically do not require an offset in the input/output software setup. Cable runs over 30 m (100 ft) may require an offset in the input/output software setup.

Maximum cable length versus load current

Use Figure 8 to estimate the maximum cable length relative to the wire size and the load current (in mA) when wiring inputs and outputs.

FC and SA bus and supply power wiring guidelines

Table 5 provides information about terminal block functions, ratings, and requirements.

Table 5 also provides wire size, cable type, and cable length guidelines for wiring the PCV communication buses and supply power.

In addition to the guidelines in Table 5, observe these guidelines when wiring the SA/FC Buses and supply power:

- Run **all** low-voltage wiring and cables separate from high-voltage wiring.
- All FC and SA Bus cables, regardless of wire size, should be twisted, insulated, stranded copper wire.
- Shielded cable is strongly recommended for all FC and SA Bus cables.

Input and Output wiring guidelines tables

Table 2: I/O terminal blocks, functions, ratings, requirements, and cables

Terminal block label	Terminal labels	Function, ratings, and requirements	To determine wire size and maximum cable length [1]
UNIVERSAL (Inputs)	**+15 V**	**15 VDC Power Source** for active (3-wire) input devices connected to the Universal INn terminals. Provides 35 mA total current.	Same as (Universal) **IN***n*. **Note:** Use 3-wire cable for devices that source power from the +15 V terminal.
	IN*n*	**Analog Input - Voltage Mode (0–10 VDC)** 10 VDC maximum input voltage Internal 75k ohm Pulldown	See Guideline A in Table 3.
		Analog Input - Resistive Mode (0–600k ohm) Internal 12 V, 15k ohm pull up Qualified Sensors: 0–2k potentiometer, RTD (1k Nickel [Johnson Controls® sensor], 1k Platinum, and A99B Silicon Temperature Sensor) Negative Temperature Coefficient (NTC) Sensor 10K Type L (10K JCI Type II is equivalent to Type L) or 2.252K Type II	See Guideline A in Table 3.
		Binary Input - Dry Contact Maintained Mode 1 second minimum pulse width Internal 12 V, 15k ohm pull up	See Guideline A in Table 3.

Table 2: I/O terminal blocks, functions, ratings, requirements, and cables

Terminal block label	Terminal labels	Function, ratings, and requirements	To determine wire size and maximum cable length [1]
	ICOM*n*	**Universal Input Common** for all Universal IN*n* terminals	Same as (Universal) **IN***n*.
BINARY (Outputs)	**OUT***n*	**Binary Output - 24 VAC Triac (Internal Power)** Sources internal 24 VAC power (24~ HOT)	See Guideline C in Table 3.
	OCOM*n*	**Binary Output - 24 VAC Triac (Internal Power)** Connects ICOM*n* to 24~ COM when activated. Internal Power Source: 30 VAC maximum voltage to load 0.5 A maximum output current 1.3 A at 25% duty cycle 40 mA minimum load current	See Guideline C in Table 3.
CONFIGURABLE (Outputs)	**OUT***n*	**Analog Output - Voltage Mode (0–10 VDC)** 10 VDC maximum output voltage 10 mA maximum output current External 1k to 50k ohm load required	See Guideline A in Table 3.
		Binary Output 24 VAC Triac Connects OUT to OCOM when activated. External Power Source: 30 VAC maximum voltage to load 0.5 A maximum output current 1.3 A at 25% duty cycle 40 mA minimum load current	See Guideline C in Table 3.
	OCOM*n*	**Analog Output Signal Common**: All Configurable Outputs defined as Analog Outputs share a common, which is isolated from all other commons except the Binary Input common.	Same as (Configurable) **OUT***n*.

Table 2: I/O terminal blocks, functions, ratings, requirements, and cables

Terminal block label	Terminal labels	Function, ratings, and requirements	To determine wire size and maximum cable length [1]
		Binary Output Signal Common: All Configurable Outputs defined as Binary Outputs are isolated from all other commons, including other Configurable Output commons.	

1 Table 3 defines cable length guidelines for the various wire sizes that may be used for input and output wiring.

Table 3: Cable length guidelines for recommended wire sizes

Guideline	Wire size/Gauge and type	Maximum cable length and type	Assumptions
A	1.5 mm (16 AWG) stranded copper	457 m (1,500 ft) twisted wire	100 mV maximum voltage drop Depending on the cable length and the connected input or output device, you may have to define an offset in the setup software for the input or output point.
	0.8 mm (20 AWG) stranded copper 297 m (975 ft) twisted wire	297 m (975 ft) twisted wire	
	0.6 mm (22 AWG) stranded copper 183 m (600 ft) twisted wire	183 m (600 ft) twisted wire	
	N/A (24 AWG) stranded copper 107 m (350 ft) twisted wire	107 m (350 ft) twisted wire	
B	1.5 mm (18 AWG) stranded copper	229 m (750 ft) twisted wire	100 mV maximum voltage drop Depending on the cable length and the connected input or output device, you may have to define an offset in the setup software for the input or output point.
	0.8 mm (20 AWG) stranded copper 297 m (975 ft) twisted wire	137 m (450 ft) twisted wire	
	0.6 mm (22 AWG) stranded copper 183 m (600 ft) twisted wire	91 m (300 ft) twisted wire	
	24 AWG stranded copper 107 m (350 ft) twisted wire	61 m (200 ft) twisted wire	
C	See Figure 8 to select wire size/gauge. Use stranded copper wire.	See Figure 8 to determine cable length. Use twisted wire cable.	N/A

Termination diagrams

A set of Johnson Controls termination diagrams provides details for wiring inputs and outputs to the controllers. See the figures in this section for the applicable termination diagrams.

Table 4: Termination details

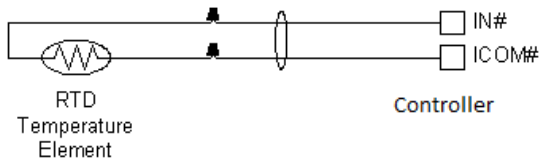
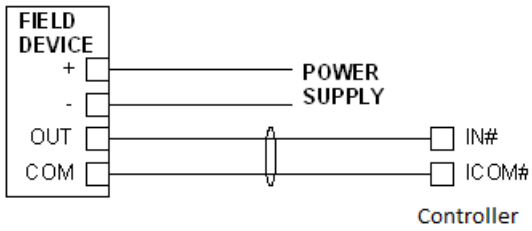
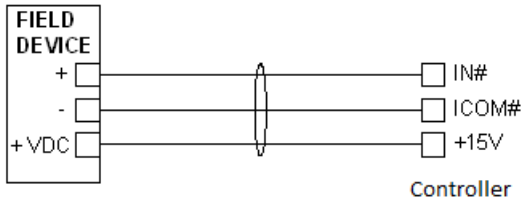
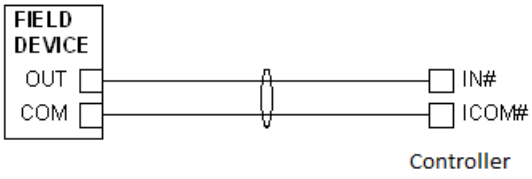
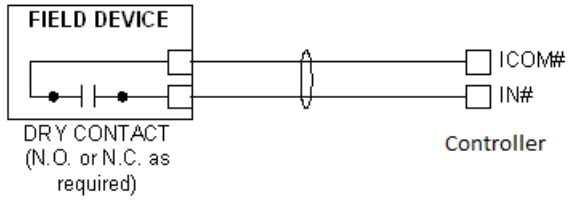
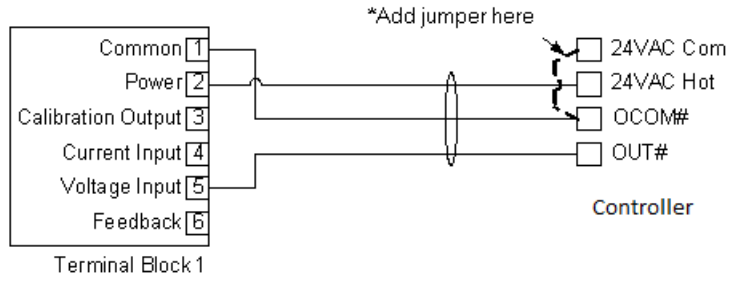
Type of field device	Type of termination diagrams	Input/Output
Temperature Sensor	UI	
Voltage Input - External Source	UI	
Voltage Input - Internal Source	UI	
Voltage Input (Self-Powered)	UI	
Dry Contact	UI	
0–10 VDC Output to Actuator (External Source)	CO	

Table 4: Termination details

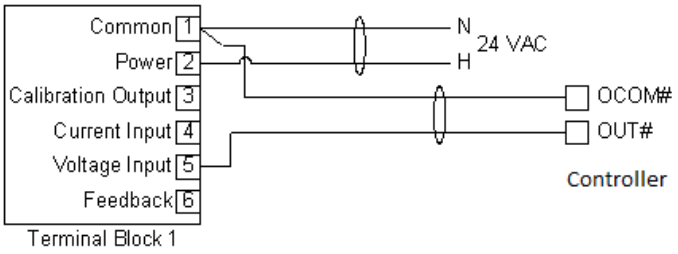
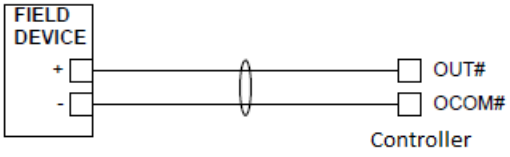
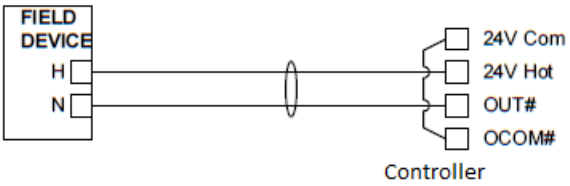
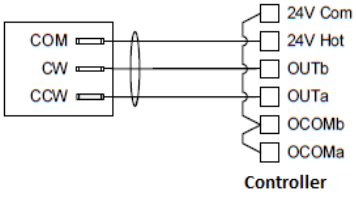
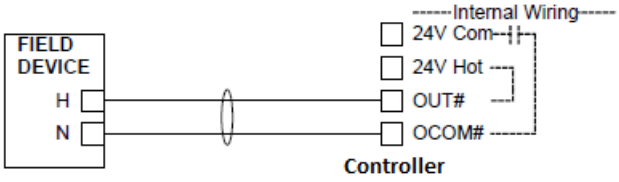
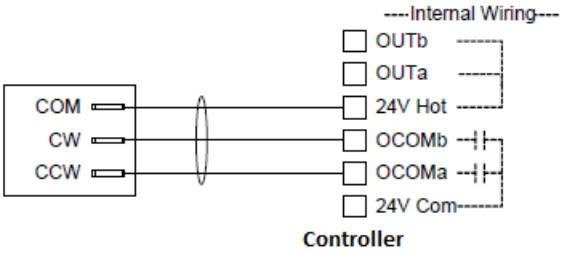
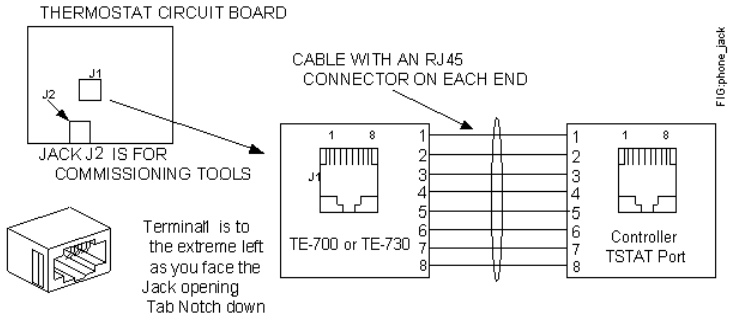
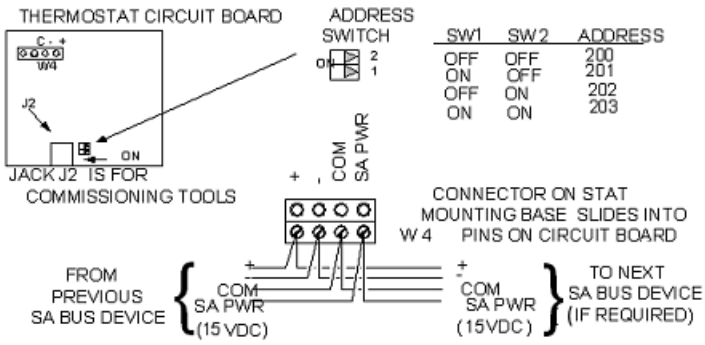
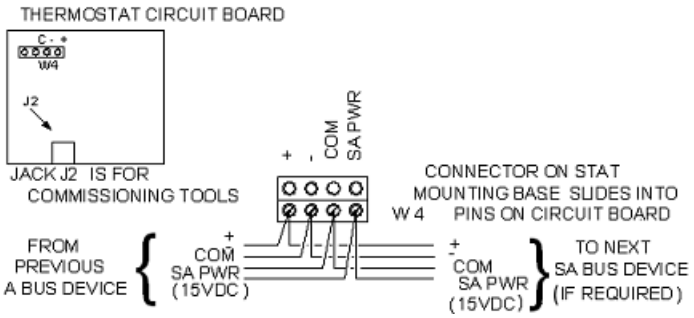
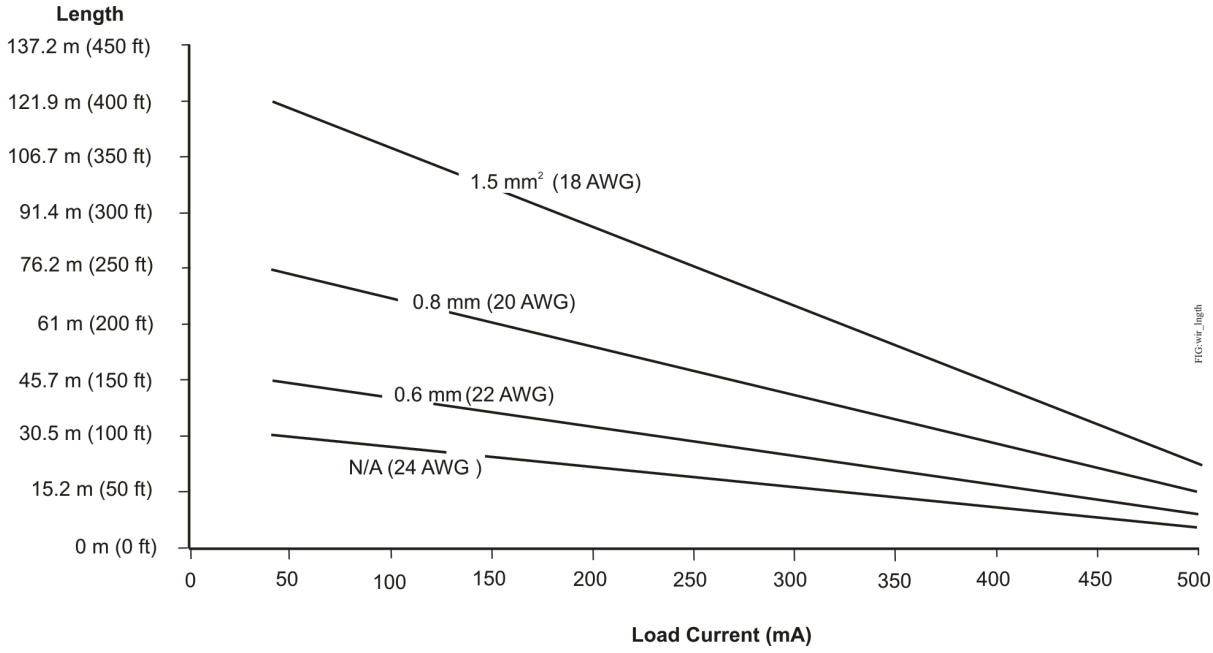
Type of field device	Type of termination diagrams	Input/Output
0–10 VDC Output to CO Actuator (Internal Source)	CO	
Analog Output (Voltage)	CO	
24 VAC Triac Output (Switch Low, External Source)	CO	
Incremental Control to Actuator (Switch Low, External Source)	CO	
24 VAC Binary Output (Switch Low, Internal Source)	BO	
Incremental Control to Actuator (Switch Low, Internal Source)	BO	

Table 4: Termination details

Type of field device	Type of termination diagrams	Input/Output
Temperature Sensor with Modular Jack	UI	 ⓘ **Note:** The bottom jack (J2) on the TE-700 and TE-6x00 Series Sensors is not usable as a zone bus or a SAB connection.
Network Stat with Terminals Addressable	SA Bus	
Network Stat with Terminals (Fixed Address = 199)	SA Bus	

Maximum wire length by current and wire size figure

Figure 8: Maximum wire length by current and wire size



Communication bus and supply power table

Table 5: Communication bus and supply power terminal blocks, functions, ratings, requirements, and cables

Terminal block/Port label	Terminal labels	Function, electrical ratings/Requirements	Recommended cable type [1]
FC BUS[2]	**+** **-**	FC Bus Communications	0.6 mm (22 AWG) stranded, 3-wire twisted, shielded cable recommended
	COM	Signal Reference (Common) for bus communications	
	SHLD	Isolated terminal (optional shield drain connection)	
SA BUS[2]	**+** **-**	SA Bus Communications	0.6 mm (22 AWG) stranded, 4-wire (2 twisted-pairs), shielded cable recommended **Note:** The + and - wires are one twisted pair, and the COM and SA PWR wires are the second twisted pair.
	COM	SA Bus Signal Reference and 15 VDC Common	
	SA PWR	15 VDC Supply Power for Devices on the SA Bus	

Table 5: Communication bus and supply power terminal blocks, functions, ratings, requirements, and cables

Terminal block/Port label	Terminal labels	Function, electrical ratings/Requirements	Recommended cable type [1]
TSTAT	**TSTAT**	RJ-45 8-Position Modular Connector provides +15 VDC Power for: • Wireless Commissioning Converter • VAV Balancing Tool • One-to-One Wireless Receiver • Network Sensor	24 AWG 4-pair CAT 5 Cable <30.5 m (100 ft)
24~	**HOT**	24 VAC Power Supply - Hot Supplies 20–30 VAC (Nominal 24 VAC)	0.8 mm to 1.5 mm (20 to 18 AWG) 2-wire
	COM	24 VAC Power Supply Common (	

1 See Table 3 to determine wire size and cable lengths for cables other than the recommended cables.
2 The SA Bus and FC Bus wiring recommendations in this table are for MS/TP Bus communications at 38.4k baud.

Setup and adjustments

➤ **Important:** Electrostatic discharge can damage controller components. Use proper electrostatic discharge precautions during installation, setup, and servicing to avoid damaging the controller.

Setting the device address

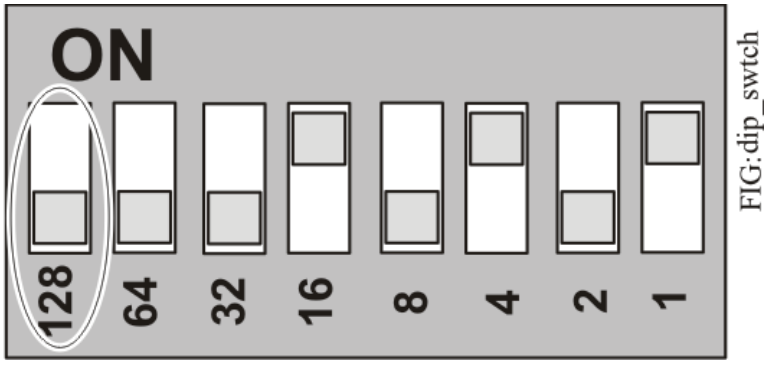
PC Series controllers are master devices on BACnet MS/TP (SA or FC) Buses. PC controllers connect easily to the non-communicating sensor for zone air controllers on a bus, but before operating you must set a valid and unique device address for each controller on the bus.

You set PC controller's device address by setting the positions of the switches on the Device Address DIP switch block at the top of the controller. Device addresses 4 through 127 are the valid addresses for these controllers.

The DIP switch block (Figure 9) has eight switches numbered 128, 64, 32, 16, 8, 4, 2, and 1. Switches 64 through 1 are device address switches. Switch 128 must be set to OFF for all hard-wired SA and FC Bus applications.

Figure 9: Device address switches set to 21

Note: Switch 128 is used to enable or disable a PCV for wireless operation.



Note: PC Series controllers ship with Switch 128 ON and the remaining address switches OFF. This renders the controllers wired subordinate devices, which do not interfere on MS/TP Buses and do not interfere with bus operation. Set a valid and unique device address on the PC controller before applying power to the controller on the bus.

To set the device addresses on PC Series Controller:

1. Set all of the switches on the PC controller's device address DIP switch block (128 through 1) to OFF.
2. Set one or more of the seven address switches (64 through 1) to ON, so that the sum of the switch numbers set to ON equals the intended device address. See Table 6 for valid PC controller addresses.

   Set the highest number switch that is less than or equal to the intended device address to ON. Then continue setting lower numbered switches until the total equals the intended address. For example, if the intended device address is 21, set Switch 16 to ON first, then set Switch 4 ON, followed by Switch 1 (16+4+1=21). See Figure 9.
3. Set a unique and sequential device address for each of the PC controllers connected on the SA or FC Bus, starting with device address 4.

   To ensure the best bus performance, set sequential device addresses with no gaps in the device address range (4, 5, 6, 7, 8, 9, and so on). The PC controllers do not need to be physically connected on the bus in their numerical device address order.
4. Write each PC controller's device address on the white label below the DIP switch block on the controller's cover.

Table 6 shows and describe the valid FC Bus and SA Bus device addresses for Johnson Controls MS/TP communications bus applications.

Table 6: FC bus device address descriptions

Device address	Address description
0 (Switch 128 OFF)	Reserved for PC controllers
1 to 3 (Switch 128 OFF)	Reserved for peripheral devices (not valid for PC controllers).
4 to 127 (Switch 128 OFF)	Valid for PC Series Controllers on a **hard-wired** SA Bus or FC Bus.

Setting the EOL switch

Each PC controller has an EOL switch, which when set to ON (up), sets the PC controller as a terminating device on the bus. See Figure 10 for the EOL switch location on the PC. The default EOL switch position is OFF (down). The amber EOL LED illuminates to show that the EOL is active.

Figure 10: EOL switch positions

To set the EOL switch on a PC controller:

1. Determine the physical location of the PC controller on the SA or FC Bus.
2. Determine if the PC controller must be set as a terminating device on the bus.
   ⓘ **Note:** The EOL termination rules for SA Buses and FC Buses are different.
3. If the PC is a terminating device on the FC Bus, set the EOL switch to ON. If the field controller is not a terminating device on the bus, set the EOL switch to OFF.
   ⓘ **Note:** When the EOL switch is set to ON, the LED light on the face of the controller is illuminated.

Commissioning

Use the following procedure to commission the PCV1617 or PCV1632 controller:

1. Download the control application to the PCV controller using the Controller Configuration Tool (CCT). Refer to the *Controller Tool Help (LIT-12011147)*.
2. Commission the VAV Box. Refer to the *Controller Tool Help (LIT-12011147)*.
3. Perform airflow balancing on the VAV box. Refer to the *VAV Balancing Tool and Network Sensors Technical Bulletin (LIT-12011087)*.
4. Perform commissioning checkout procedures. Refer to the *Controller Tool Help (LIT-12011147)*.

The CCT connects to the PCV through a laptop computer using different connection options: the Bluetooth® Commissioning Converter, or the wired BACnet Ethernet to MS/TP Router can be used when using the BACnet MS/TP protocol.

Repair information

If the PCV1617 or PCV1632 controller fails to operate within its specifications, replace the unit. For a replacement unit, contact the nearest Johnson Controls representative.

Troubleshooting

Table 8 provides LED status indicator information for troubleshooting the PCV1617 and PCV1632 controllers. Table 7 provides some additional troubleshooting information for possible problems.

Note: If you experience short circuits in the 24 VAC power supply that cause protective devices such as breakers or fuses to trip, make sure that the power connections on the PCV are not reversed. The most common cause of this problem is when the 24 VAC power supply on the PCV is reversed but it is not reversed on a connected secondary device. Improper wiring of this power terminal may cause a short circuit across the 24 VAC power supply.

General troubleshooting

Table 7: Troubleshooting

Problem	Possible cause and correction	Verification

Controller is OFF.
• Transformer has tripped:
  • Power is at Primary of Transformer, 0V at Secondary.
  •
• Breaker/Fuse has tripped:
  • Power is at Primary of Transformer, 24V at Secondary, 0V at Fuse/ Breaker.
	Cause:
	1. Transformer is shorted.
	2. 24 VAC powered sensor is not wired with the same polarity as the controller.
	3. SA Bus device is not wired with the same polarity as the controller.
	
	Correction:
	1. Ensure polarity of ~24 V COM / ICOM / + 15VCOM/SA BUS COM on the controller, auxiliary devices, and I/O is the same.
	2. Ensure OUT1-OUT3 terminals of binary outputs are not connected to ~24 VAC COM, and verify that OCOM1-OCOM3 are not connected to ~24 VAC HOT (these terminals are internally sourced).
	3. Verify the short circuit has been resolved with an ohm-meter.
	4. Reset the breaker/fuse or replace the transformer.
	ⓘ **Note:** When replacing the transformer, it is recommended to replace with a model that utilizes a resettable circuit breaker. A circuit breaker makes solving wiring problems easier.
		1. Disconnect the Secondary of the 24 VAC transformer.
		2. Use an ohm-meter to measure between ~24 V HOT and COM; there must be no short circuit.
		ⓘ **Note:** Some installations require the Secondary of the Transformer to be Earth Grounded. If this is the case, verify that the Earth Ground connection is valid and not shared between multiple pieces of equipment.

Table 7: Troubleshooting

Problem	Possible cause and correction	Verification
Configurable output - analog mode is invalid: 0–10 V output is set to 10–100%, but 0 V is at output terminals. **Output is in protection mode**, a state the analog portion of the configurable output goes into when it detects a wiring problem. The analog output is set to 0% regardless of the command whenever a wiring fault is detected.	**Cause:** There is a power polarity mismatch between the connected device and the configurable output. **Correction:** Ensure polarities of ~24 V COM/OCOM match and that the connected end device uses the same polarity.	1. Measure the output and verify that it matches the command. 2. Disconnect the connected device and verify the commanded value is present.
Configurable output - analog mode is invalid: 0–10V output has an undesirable offset of up to 1 V. **The Common Reference is incorrect.**	**Cause:** The OCOM terminal is not connected. **Correction:** Connect the OCOM terminal of the configurable output to the common of the connected end device.	1. Measure the output and verify that it matches the command. 2. Disconnect the connected device and verify the commanded value is present.

LED status and states

Table 8: Status LEDs and description of LED states

LED label	LED color	Normal state	Descriptions of LED states
POWER	Green	On Steady	Off Steady = no power On Steady = power is supplied by primary voltage
FAULT	Red	Off Steady	Blink - 2 Hz = download or startup in progress, not ready for normal operation, SA Bus devices offline (such as Netsensors) Off Steady = no faults On Steady = device fault or no application loaded

Table 8: Status LEDs and description of LED states

LED label	LED color	Normal state	Descriptions of LED states
FC BUS	Green	Blink - 2 Hz	Blink - 2 Hz = data transmission (normal communication) Off Steady = no data transmission (auto baud in progress) On Steady = communication lost, waiting to join communication ring
SA BUS	Green	Blink - 2 Hz	Blink - 2 Hz = data transmission (normal communication) Off Steady = no data transmission (N/A - auto baud not supported) On Steady = communication lost; waiting to join communication ring
EOL	Amber	Off	On Steady = EOL is active Off Steady = EOL is not active

Accessories

Table 9: PCV1617 and PCV1632 Controller accessories (order separately)

Product code number	Description
Y64T15-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 92 VA, Foot Mount, 30 in. Primary Leads and 30 in. (76 cm) Secondary Leads, Class 2
Y65A13-0	Transformer, 120 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AS), 8 in. Primary Leads and 30 in. (76 cm) Secondary Leads, Class 2
Y65T42-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Hub Mount (Y65SP+), 8 in. (20 cm) Primary Leads and Secondary Screw Terminals, Class 2
Y65T31-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AR+), 8 in. (20 cm) Primary Leads and Secondary Screw Terminals, Class 2

Table 9: PCV1617 and PCV1632 Controller accessories (order separately)

Product code number	Description
AP-TBK1002-0	2-position Screw Terminal that plugs onto PCV Output Point Spade Lugs
AP-TBK1003-0	3-position Screw Terminal that plugs onto PCV Output Point Spade Lugs
AP-TBK4SA-0	Replacement MS/TP SA Bus Terminal, 4-Position Connector, Brown, Bulk Pack of 10
AP-TBK4FC-0	Replacement MS/TP FC Bus Terminal, 4-Position Connector, Blue, Bulk Pack of 10
AP-TBK2PW-0	Replacement Power Terminal, 2-Position Connector, Gray, Bulk Pack
F-1000-325	Replacement Barbed Fitting for use with the PCV1617 and CH-PCV1632 for Connection Tubing (Bulk Pack of 10)
F-1000-326	Flexible Tubing Extension for use with the PCV1617 and PCV1632, 14 in. (36 cm) Length (Bulk Pack of 20)
NS-WALLPLATE-0	Network Sensor Wall Plate
TE730-29C-0	Sensor with Temperature Setpoint Adjustment
TE730-39C-0	Sensor with Temperature Setpoint Adjustment and Occupancy Button
CN-BRTR-0	BACnet IP to MS/TP Router
PCX Series Expansion Input/ Output Modules	Refer to the *PC Series Programmable Controllers and Related Products Product Bulletin (LIT-12011914)* for a complete list of available PCX Expansion I/O Modules.
NS Series Sensors	Refer to the *NS Series Network Sensors Product Bulletin (LIT-12011574)* for a complete list of available NS Series Sensors.

Technical specifications

Table 10: PCV1617 and PCV1632 Controllers

Product Code	**CH-PCV1617-1:** 32-bit, Integrated VAV Controller/Actuator/ Pressure Sensor - DPT, 3 UI and 2 BO, 24 VAC, FC and SA Bus, includes 8-pin TSTAT Port for use with TE-7xx Series Non-Communicating Sensors **CH-PCV1632-1:** 32-bit, Integrated VAV Box Controller/Actuator/ Pressure Sensor; 3 UI, 3 BO, and 2 CO; 24 VAC; FC and SA Bus; includes 8-pin TSTAT Port for use with TE-7xx Series Non-Communicating Sensor
Supply Voltage	24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, Power Supply Class 2 (North America), Safety Extra-Low Voltage (SELV) (Europe)

Table 10: PCV1617 and PCV1632 Controllers

Power Consumption	10 VA typical, 14 VA maximum ⓘ **Note:** The VA rating does not include any power supplied to the peripheral devices connected to Binary Outputs (BOs) or Configurable Outputs (COs), which can consume up to 12 VA for each BO or CO, for a possible total consumption of an additional 60 VA (maximum).
Ambient Conditions	**Operating:** 0°C to 50°C (32°F to 122°F) **Storage:** -40°C to 70°C (-40°F to 158°F)
Terminations	Inputs/Outputs, SA bus, and Supply Power: 6.3 mm (1/4 in.) Spade Lugs FC Bus Pluggable Screw Terminal Block TSTAT Modular Port: RJ-45 8-Pin Modular Jack
Controller Addressing for BACnet MS/TP	DIP switch set; valid PC controller device addresses 4–127 (Device addresses 0–3 and 128–255 are reserved and not valid PC controller addresses.)
Communications Bus	BACnet MS/TP, RS-485: FC Bus: 0.6 mm (22 AWG) standard 3-wire, twisted, shielded cable recommended between the supervisory controller and PC controllers SA Bus: 0.6 mm (22 AWG) stranded, 4-wire (2-twisted pairs) shielded cable recommended from the PCV controller for network sensors and other sensor/actuator devices; includes a terminal to source 15 VDC supply power from PCV to SA Bus devices.
Processor	RX630 32-bit Renesas microcontroller
Memory	1 MB Flash Memory and 512 KB Random Access Memory (RAM)
Universal Input Mode/ Configurable Output Mode Accuracy	**UI Analog Input Mode:** 15-bit resolution on UIs **CO Analog Output Mode (PCV1632 only):** 0–10 VDC ± 200 mV
Air Pressure Differential Sensor	Range: -1.5 in. to 1.5 in. W.C. **Performance Characteristics:** Accuracy: ±0.75% Full Span Maximum (±0.0225 in. W.C.) Typical accuracy at zero (null) pressure is ±0.003 in. W.C.
Actuator Rating	4 N·m (35 lb·in) minimum shaft length = 44 mm (1-3/4 in.)
Mounting	Mount to damper shaft using single set screw and to duct with single mounting screw
Dimensions (Height x Width x Depth)	165 mm x 125 mm x 73 mm (6.5 in. x 4.92 in. x 2.9 in.) **Center of Output Hub to Center of Captive Spacer:** 135 mm (5-5/16 in.)
Weight	0.65 kg (1.45 lb)

Table 10: PCV1617 and PCV1632 Controllers

Compliance CE	**United States:** UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment. FCC Compliant to CFR47, Part 15, Subpart B, Class A.
	Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment Industry Canada Compliant, ICES-003
	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.
	Australia and New Zealand: RCM Mark, Australia/NZ Emissions Compliant.
	BACnet International BACnet Testing Laboratories (BTL) Protocol Revision 7 Listed BACnet Application Specific Controller (B-ASC)

The performance specifications are nominal and conform to acceptable industry standard. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls shall not be liable for damages resulting from misapplication or misuse of its products.

Points of single contact

APAC	Europe	NA/SA
JOHNSON CONTROLS C/O CONTROLS PRODUCT MANAGEMENT NO. 32 CHANGJIJANG RD NEW DISTRICT WUXI JIANGSU PROVINCE 214028 CHINA	JOHNSON CONTROLS WESTENDHOF 3 45143 ESSEN GERMANY	JOHNSON CONTROLS 507 E MICHIGAN ST MILWAUKEE WI 53202 USA