CH-PCV1930 VAV Controller Installation Instructions

Application

The CH-PCV1930 programmable digital controllers are designed for Variable Air Volume (VAV) applications that communicate over BACnet®/IP networks. These CH-PCV controllers feature combinations of an integral digital pressure sensor (DPT), 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 CH-PCV1930 controllers include an integral real-time clock, which enables the controllers to monitor and control schedules, calendars, and trends, and operate for extended periods of time as stand-alone controllers when offline from the BCPro™ system network. These CH-PCV controllers connect easily to the wired and wireless network sensors for zone and discharge air temperature sensing.

The BACnet protocol is a standard for ANSI, ASHRAE, and the International Standards Organization (ISO) for building controls. CH-PCV1930 controllers are BACnet Testing Laboratories (BTL) listed and certified BACnet Advanced Application Controllers (B-AACs).

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.

Part No. 24-10143-01663 Rev. B

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(barcode for factory use only)

CH-PCV1930-0

Installation

Observe the following guidelines when installing a CH-PCV1930 controller:

- Transport the CH-PCV1930 controller in the original container to minimize vibration and shock damage to the controller.
- Do not drop the CH-PCV1930 controller or subject it to physical shock.

Parts included

- One CH-PCV1930 controller with removable SA bus and power terminal blocks
- 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 for 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 CH-PCV
- Power screwdriver, 100 mm (4 in.) extension socket, punch, drill, and 3.5 mm (9/64 in.) drill bits to mount the CH-PCV
- Pliers to open and close the damper
- Required length of 3.97 mm (5/32 in.) ID pneumatic tubing and barbed fittings

CH-PCV1930 physical features

The following figure displays the physical features of CH-PCV1930, and the accompanying table provides a description of the physical features and a reference to further information where required.

Figure 1: CH-PCV1930 Controller wiring terminations and physical features

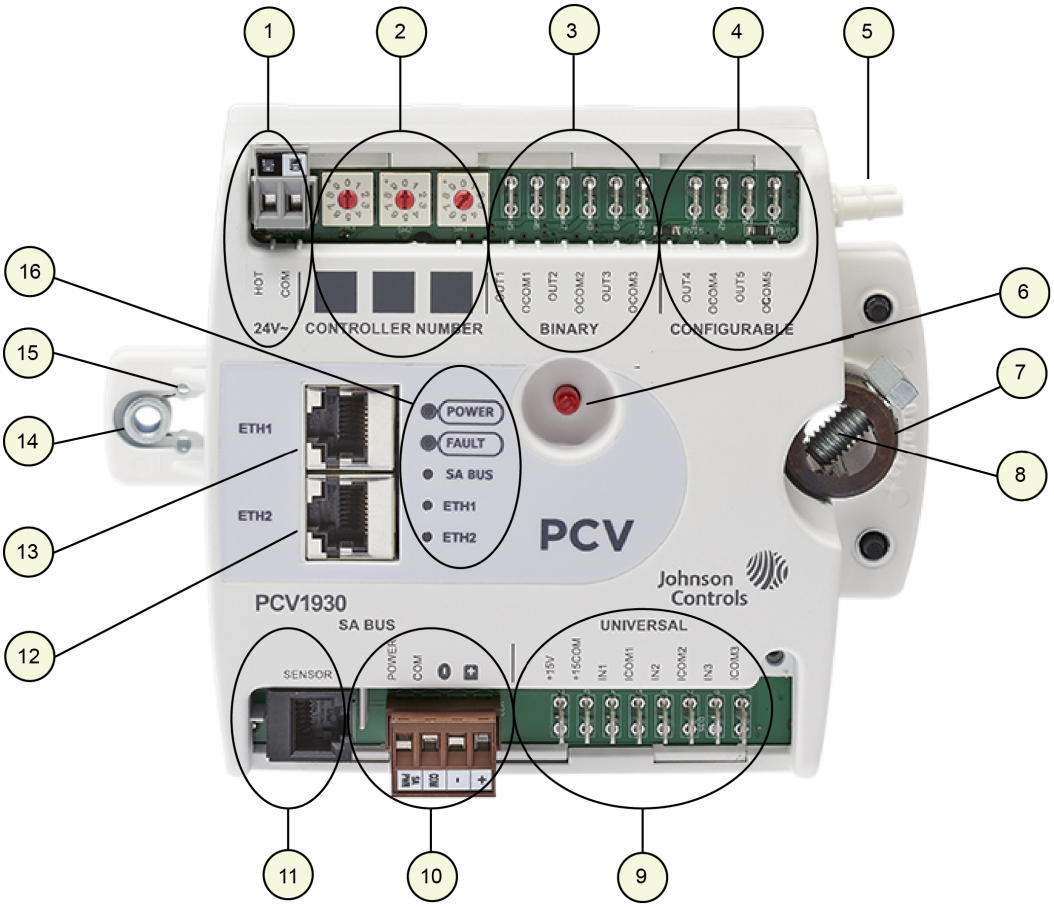


Table 1: CH-PCV1930 feature callout numbers and descriptions

Callout	Physical features: description and references
1	24 VAC, Class 2 Supply Power (see Supply power terminal block)
2	Controller Number Rotary Switches (see Setting the controller number): can be numbered from 000 to 999
3	Binary Outputs, 24 VAC Triacs (see Table 3)
4	Configurable Outputs: Voltage Analog Output (0–10 VDC) and Binary Output (24 VAC Triac) (see Table 3)
5	Dual Port Fitting
6	Manual Override Button (see Mounting for information about using manual override Button)
7	Controller Coupler (see Mounting for information about using the controller coupler)

Table 1: CH-PCV1930 feature callout numbers and descriptions

Callout	Physical features: description and references
8	Coupler Bolt (see Mounting for information about setting the coupler bolt)
9	Universal Input: Voltage Analog Input (0–10 VDC) Resistive Analog Inputs (0–600k Ω) (see Table 3): 0–2k Potentiometer RTD: 1k Nickel, 1k Platinum, or A99B SI NTC: 10K Type L (10K Johnson Controls Type II is equivalent to Type L) or 2.252K Type II Dry Contact Binary Input
10	SA Bus Terminal Block (see SA Bus terminal block)
11	Sensor Port (SA Bus) RJ-12 6-Pin Modular Jack (see Sensor port)
12	ETH2 Ethernet Port for BACnet/IP Communications
13	ETH1 Ethernet Port for BACnet/IP Communications
14	Captive Spacer and Screw
15	Alignment Marks
16	LED Status Indicators (see Table 7)

CH-PCV model information

Table 2: CH-PCV information (including point type counts per model)

Communication Protocol		BACnet/IP
Modular Jacks		6-pin SA Bus with four communicating sensors
Point Types	**Signals Accepted**	**Number of Points**
Universal Input (UI)	Analog Input, Voltage Mode, 0–10 VDC Analog Input, Current Mode, 4-20mA Analog Input, Resistive Mode, 0–2k ohm, RTD (1k NI [Johnson Controls], 1k PT, A998 SI), NTC (10k Type L, 2.252k Type 2) Binary Input, Dry Contact Maintained Mode	3
Binary Output (BO)	24 VAC Triac	3
Configurable Output (CO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac	2
Integrated Actuator	Internal	1

Table 2: CH-PCV information (including point type counts per model)

Differential Pressure Transducer (DPT)	Internal	1
Zone Sensor Input	On SA Bus	Up to 4 NS Series Network Zone Sensors
		Up to 5 WRZ sensors when using the one-to-one WRZ-78xx wireless configuration

Mounting

Observe the following guidelines when mounting CH-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 CH-PCV electronics. Mount the CH-PCV vertically above the damper shaft to allow any shaft condensation to fall away from the CH-PCV. Additional measures may be required in some installations.

- Ensure that the mounting surface can support the CH-PCV and any user-supplied enclosure.
- Mount the CH-PCV on a hard, even surface whenever possible.
- Use shims or washers to mount the CH-PCV securely and evenly on the mounting surface.
- Mount the CH-PCV in an area free of corrosive vapors that matches the ambient conditions specified in the Technical Specifications section.
- Provide sufficient space around the CH-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 CH-PCV in areas where electromagnetic emissions from other devices or wiring can interfere with controller communication.
- Avoid mounting the CH-PCV on surfaces with excessive vibration.

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

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

To mount the CH-PCV controllers, complete the following steps:

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

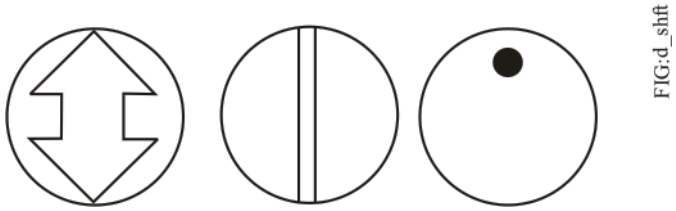
   ⓘ **Note:** Use the alignment marks to center the captive spacer to ensure sufficient movement in either direction.

3. Secure the self-drilling No. 10 screw through the captive spacer (Figure 1) 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 mounting to the 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 as shown in the following figure.

Figure 2: 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 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 CH-PCV controller at the full-open position, the CH-PCV controller provides the open stop for 45° and 60° boxes. The closed damper seal provides the full-closed stop.

8. All models are compact in size and can be easily installed on VAV boxes. The models have either a round shaft up to 13 mm in diameter or a 10 mm square shaft. 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 10.5 to 11.5 N·m (95 to 105 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 CH-PCV controller and the other ends of the tubing to the pressure transducer in the VAV box application).

   ⓘ **Note:** The CH-PCV uses a digital non-flow pressure sensor (all models except the) with bidirectional flow operation. You can connect the high- and low-pressure DP tubes to either barbed fitting on the CH-PCV controller. You do not need to make a specific high- or low-side connection when you attach the tubing to the barbed fittings on the CH-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 dégâts 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

⚠ CAUTION

Risk of Electric Shock
Disconnect the power supply before making electrical connections to avoid electric shock.

⚠ CAUTION

Risque de décharge électrique
Débrancher l'alimentation avant de réaliser tout raccordement électrique afin d'éviter tout risque de décharge électrique.

- **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.

For detailed information about configuring and wiring a SA Bus, refer to the *MS/TP Communications Bus for the BCPro™ System Technical Bulletin 912011908*.

Network topology

CH-PCV1930 controllers may be connected to a building automation network in multiple ways: as daisy-chained devices, as part of a star (also called home run) type network, or as part of a ring network.

To daisy-chain CH-PCV1930 controllers, connect the controllers to the bus supervisor in a chain with the Ethernet cable connecting to the CH-PCV1930 at the ETH1 or ETH2 port, and connecting to the next device from the other port. Benefits of daisy-chained networks are that they require less physical wiring and new devices can be added easily to the network.

In a star network, each CH-PCV1930 controller is connected by Ethernet cable directly back to a main switch. This configuration reduces the possibility of network failure but requires more wiring to install.

A ring network is a chain of controllers virtually closed by a software component in an Ethernet switch. Not all switches support the ring topology. The dual-port controller from Johnson Controls supports Media Redundancy Protocol (MRP). With MRP, a chain of Ethernet devices can overcome any single communication failure, with a recovery time faster than in a BACnet system.

Terminal blocks and bus ports

See Figure 1 for input and output terminal and bus port locations on the CH-PCV1930 controllers. Observe the following guidelines when wiring a CH-PCV controller.

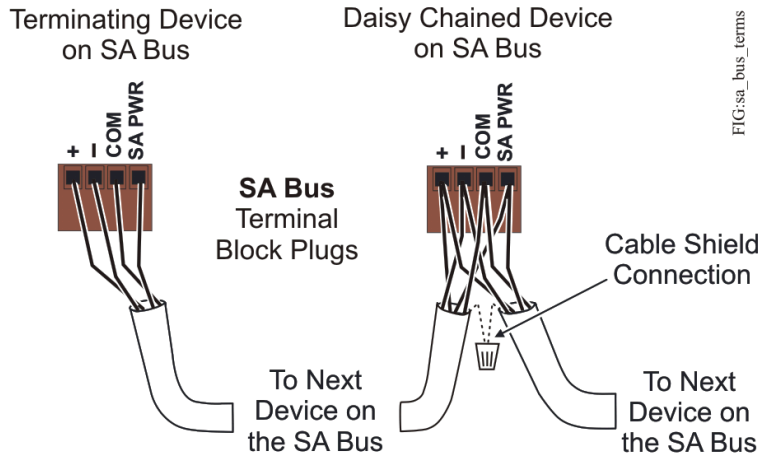
Input and Output terminal blocks

The input spade terminals are located on the side of the CH-PCV near the SA Bus terminal block. The output spade terminals are located on the opposite side of the controller near the power supply terminal block. See Table 3 for more information about I/O terminal functions, requirements, and ratings.

SA Bus terminal block

Wire the removable SA Bus terminal block plugs on the CH-PCV and other SA Bus devices in a daisy-chain configuration using 4-wire twisted, shielded cable as shown in Figure 3. For more information about SA Bus terminal functions, requirements, and ratings, see Table 5.

Figure 3: SA Bus terminal block wiring



Stranded, 4-Wire (2 Twisted Pair) Shielded Cable
(One twisted pair is the **+** and **-** leads.
The second pair is COM and SA PWR.)

Sensor port

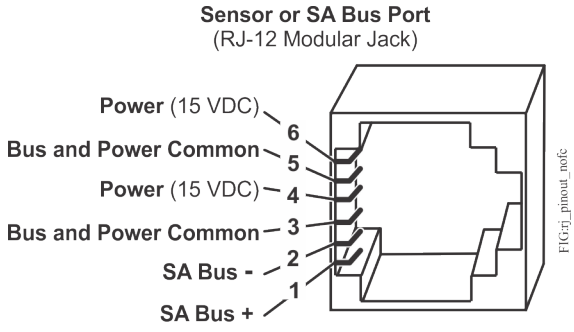
The Sensor (SA Bus) port on the bottom of the controller (Figure 1) is an RJ-12, 6-position modular jack that provides a connection for the Mobile Access Portal (MAP) Gateway, the Bluetooth Commissioning Converter (BTCVT), the VAV Balancing Tool, specified network sensors, or other SA Bus devices with RJ-12 plugs. A DIS1710 Local Controller Display can also be connected to the SA Bus port.

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.
- The MAP Gateway serves as a replacement for the BTCVT, which is no longer available for purchase, but continues to be supported.

The Sensor port is connected internally to the SA bus terminal block. For more information about Sensor port functions, requirements, and ratings, see Table 5.

Figure 4: Pin number assignments for Sensor (SA Bus) Port on CH-PCV1930

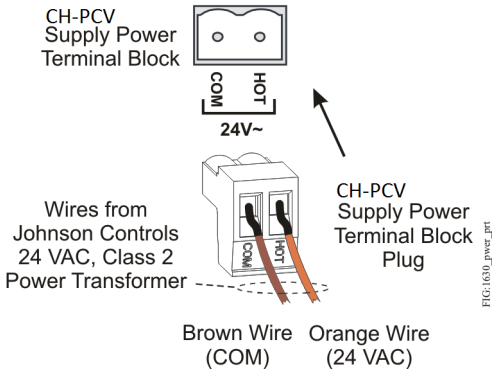


Supply power terminal block

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 CH-PCV controller.

Wire the 24 VAC supply power wires from the transformer to the HOT and COM terminals on the terminal plug as shown in Figure 5. For more information about Supply Power terminal functions, requirements, and ratings, see Table 5.

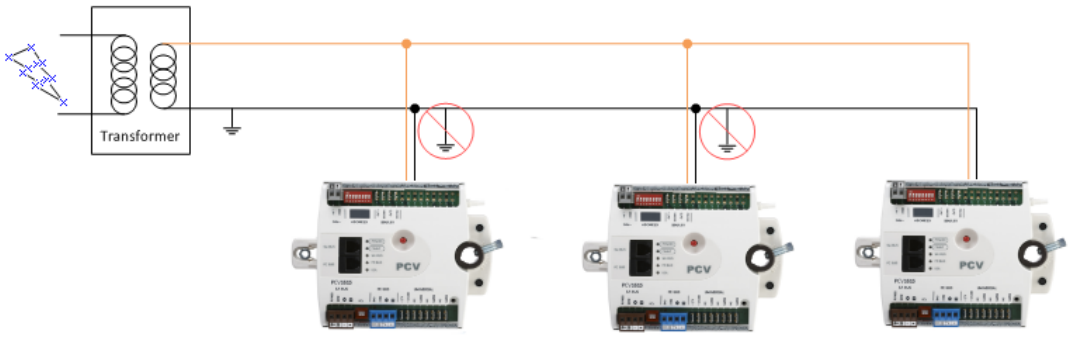
Figure 5: 24 VAC supply power terminal block wiring



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 CH-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 CH-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 for further details.

Figure 6: 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 CH-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 CH-PCV 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 CH-PCV controller, complete the following steps:

1. Terminate wiring according the appropriate figure in Termination diagrams.
2. Wire network sensors and other devices to the CH-PCV's SA Bus.
3. Ensure that the CH-PCV is assigned a controller number. Set the controller number using the rotary switches at the top of the controller. (See Setting the controller number).
4. Connect the CH-PCV controller to 24 VAC, Class 2 power.

Terminal wiring guidelines, functions, ratings, and requirements

Input and Output wiring guidelines

See Table 3 for information about the functions, ratings, and requirements for the CH-PCV input and output terminals, and Table 4 for wire sizes and cable lengths guidelines.

In addition to the wiring guidelines in Table 3, observe the following guidelines when wiring CH-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 not required for input or output cables but 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.

I/O terminal blocks, ratings and requirements

Table 3: 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
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 4.
		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 Johnson Controls Type II is equivalent to Type L) or 2.252K Type II	See Guideline A in Table 4.
		Binary Input - Dry Contact Maintained Mode 1 second minimum pulse width Internal 12 V, 15k ohm pull up	See Guideline A in Table 4.
	ICOM*n*	**Universal Input Common** for all Universal IN terminals ⓘ **Note:** All Universal ICOMn terminals are isolated from all other commons.	Same as (Universal) **IN***n*.

Table 3: 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
BINARY (Outputs)	**OUT***n*	**Binary Output - 24 VAC Triac (Internal Power)** Sources internal 24 VAC power (24~ HOT)	See Guideline C in Table 4.
	OCOM*n*	**Binary Output - 24 VAC Triac (Internal Power)** Connects OCOMn 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 4.
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 4.
		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 4.
	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 3: 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
		Binary Output Signal Common: All Configurable Outputs defined as Binary Outputs are isolated from all other commons, including other Configurable Output commons.	

Cable and wire length guidelines

The following table defines cable length guidelines for the various wire sizes that may be used for wiring low voltage (<30 V) input and outputs.

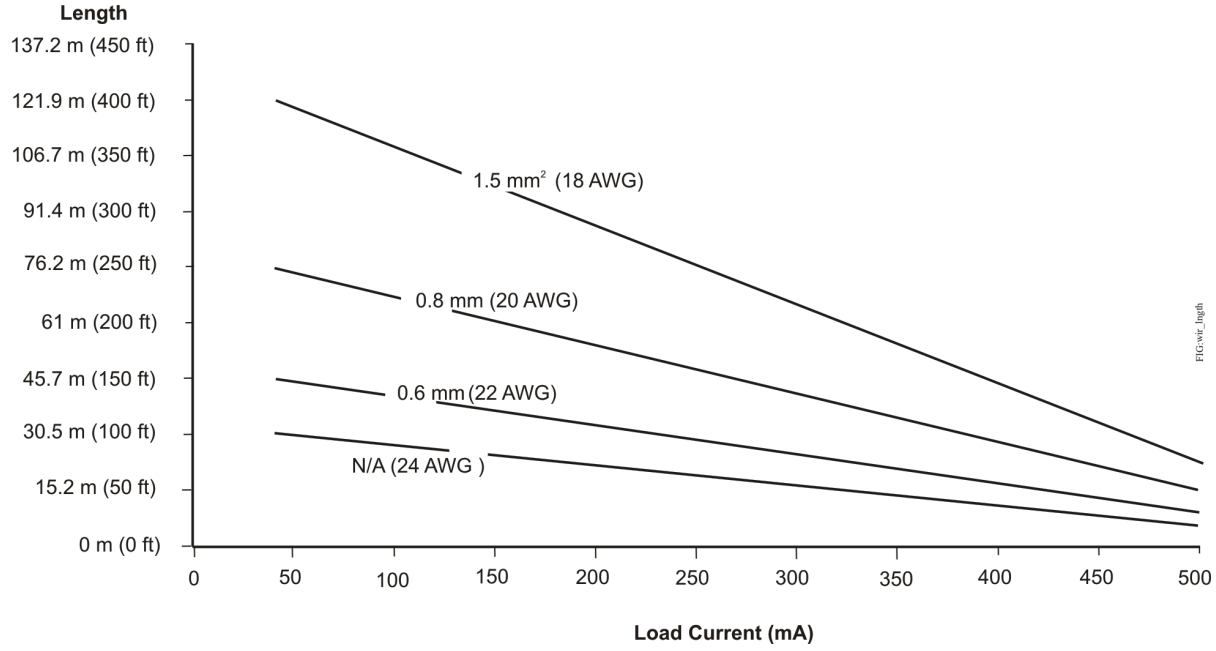
Table 4: Cable length guidelines

Guideline	Wire size/Gauge and type	Maximum cable length and type	Assumptions
A	1.0 mm (18 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	
	0.5mm (24 AWG) stranded copper 107 m (350 ft) twisted wire	107 m (350 ft) twisted wire	
B	1.0 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	
	0.5mm (24 AWG) stranded copper 107 m (350 ft) twisted wire	61 m (200 ft) twisted wire	
C	See Figure to select wire size/gauge. Use stranded copper wire.	See Figure to determine cable length. Use twisted wire cable.	N/A

Maximum cable length versus load current

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

Figure 7: Maximum Wire Length by Current and Wire Size



Communications 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 CH-PCV communication buses and supply power.

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

- Run **all** low-voltage wiring and cables separate from high-voltage wiring.
- All SA Bus cables, regardless of wire size, should be twisted, insulated, stranded copper wire.
- Shielded cable is strongly recommended for all SA Bus cables.
- Refer to the *MS/TP Communications Bus for the BCPro™ System Technical Bulletin 912011908)* for detailed information regarding wire size and cable length requirements for SA Buses.

Communication bus and supply power terminal blocks, ratings, and requirements

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]
SA BUS[2]	**+** **-**	SA Bus Communications	0.6 mm (22 AWG) stranded, 4-wire (2 twisted-pairs), shielded cable recommended
	COM	SA Bus Signal Reference and 15 VDC Common	

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]
	SA PWR	15 VDC Supply Power for Devices on the SA Bus	ⓘ **Note:** The + and - wires are one twisted pair, and the COM and SA PWR wires are the second twisted pair.
		• DIS1710 Local Controller Display • VAV Balancing Tool	24 AWG 3-pair CAT 3 Cable <30.5 m (100 ft)
24~	**HOT**	**24 VAC Power Supply - Hot** Supplies 20–30 VAC (Nominal 24 VAC)	0.8 mm to 1.0 mm (20 to 18 AWG) 2-wire
	COM	**24 VAC Power Supply Common** The terminal is isolated from the FC bus common.	

1 To determine wire size and cable lengths for cables other than the recommended cables, see Table 4.

2 The SA bus wiring recommendations are for MS/TP Bus communications at 38.4k baud. For more information, refer to the *MS/TP Communications Bus for the BCPro™ System Technical Bulletin 912011908)*..

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 6: Termination diagrams

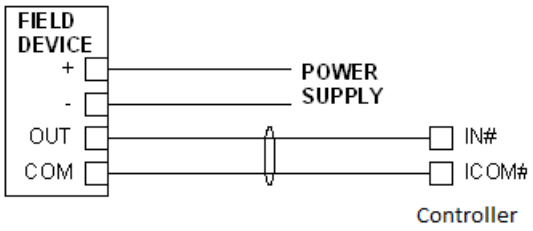
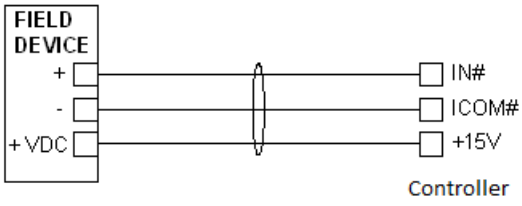
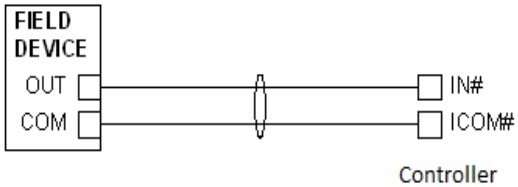
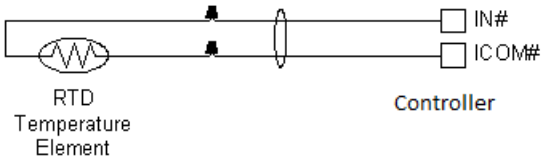
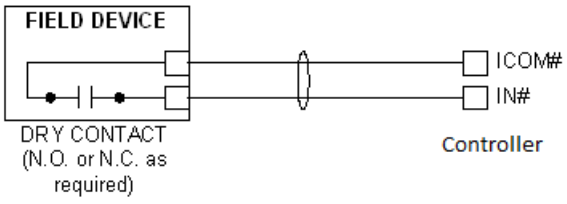
Type of field device	Type of Input/ Output	Termination diagrams
Voltage Input - External Source	UI	
Voltage Input - Internal Source	UI	
Voltage Input (Self-Powered)	UI	
Temperature Sensor	UI	
Dry Contact	UI	

Table 6: Termination diagrams

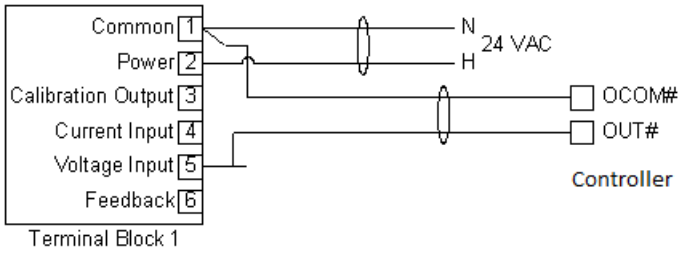
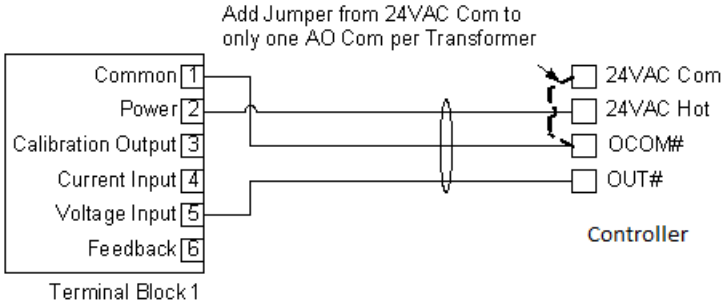
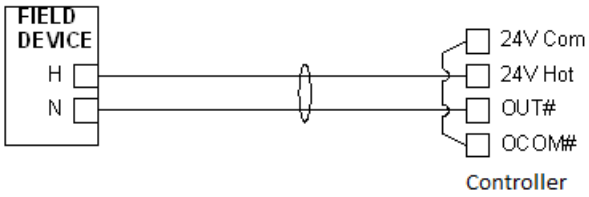
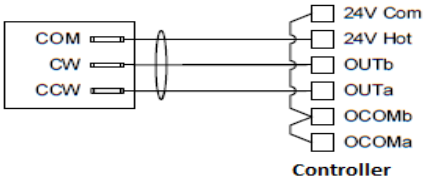
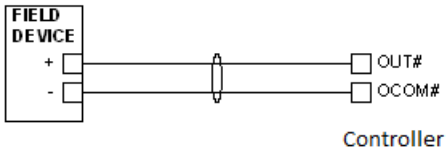
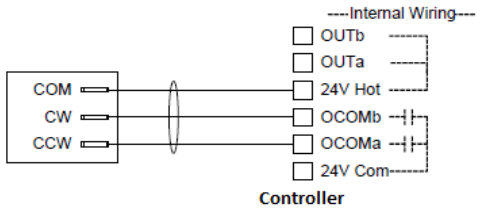
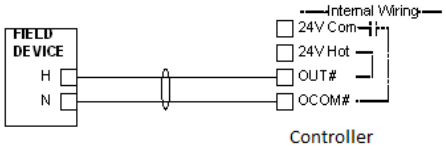
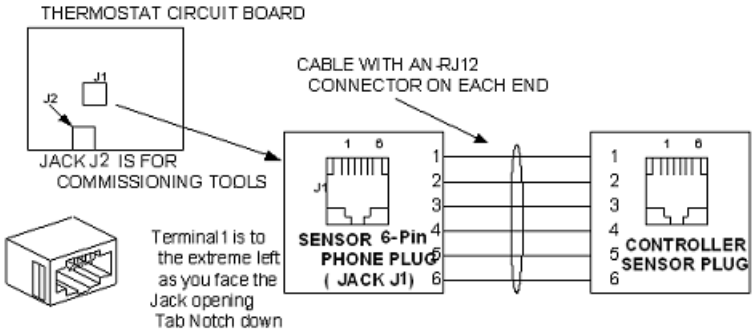
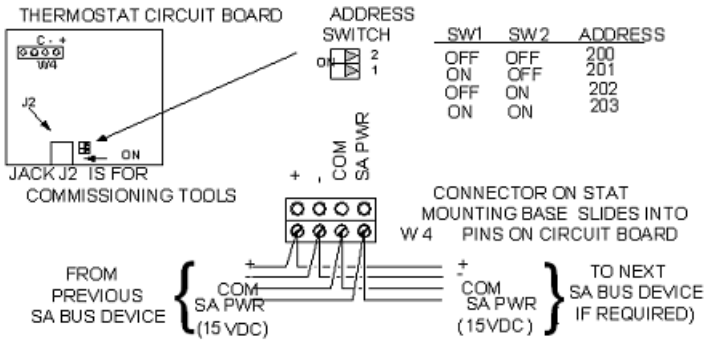
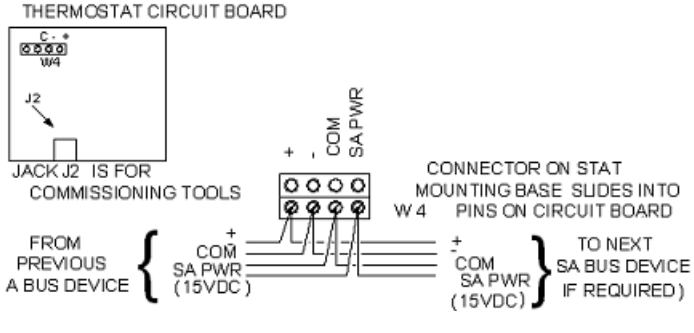
Type of field device	Type of Input/ Output	Termination diagrams
0–10 VDC Output to Actuator (External Source)	CO	
0–10 VDC Output to Actuator (Internal Source)	CO	
24 VAC Triac Output (Switch Low, External Source)	CO	 ⓘ **Note:** Applies to CO4 and CO5.
Incremental Control to Actuator (Switch Low, External Source)	CO	 ⓘ **Note:** Applies to CO4 and CO5.
Analog Output (Voltage)	CO	

Table 6: Termination diagrams

Type of field device	Type of Input/ Output	Termination diagrams
Incremental Control to Actuator (Switch Low, Internally Sourced)	BO	 ⓘ **Note:** Applies to BO3, BO1, and BO2.
24 VAC Binary Output (Switch Low, Internally Sourced)	BO	
Network Stat with Phone Jack (Fixed Address = 199)	SA Bus	
Network Stat with Terminals Addressable	SA Bus	
Network Stat with Terminals (Fixed Address = 199)	SA Bus	

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.

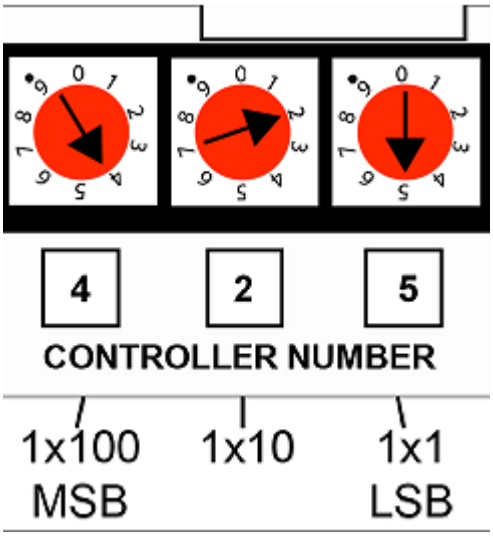
Setting the controller number

Each controller on a network must have a unique number on the subnet where it resides in order to identify it in the Controller Tool for uploading, downloading, and commissioning.

The controller number is set using three rotary switches and may be numbered from 000 to 999. The numbers are ordered from left to right, most significant bit (MSB) to least significant bit (LSB) when the controller is oriented as shown in Figure 1.

In the following figure the switches are set to 4 2 5, designating this controller as controller number 425. The controller number must match the controller number defined in Controller Configuration Tool (CCT) under **Define Hardware** > **Network Settings**. The number of the controller can be written in the white squares provided so the controller number can be more easily seen from a distance.

Figure 8: Rotary switch for setting controller numbers



Commissioning Field Controllers

To commission the CH-PCV1930 controller, use the following procedure:

1. Download the control application to the CH-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 Box Balancing Tool and Network Sensors Technical Bulletin (LIT-12011659)*.
4. Perform commissioning checkout procedures. Refer to the *Controller Tool Help (LIT-12011147)*.

Note:

- The MAP Gateway serves as a replacement for the BTCVT, which is no longer available for

purchase, but continues to be supported.

Troubleshooting the Controllers

Observe the Status LEDs on the front of the expansion module. Table 7 provides LED status indicator information for troubleshooting the expansion module.

General troubleshooting provides some additional troubleshooting information for possible problems.

Note: If you experience short circuits in the 24 VAC power supply causing protective devices such as breakers or fuses to trip, make sure that the power connections on theCH-PCV1930 are not reversed. The most common cause of this problem is when the 24 VAC power supply on the CH-PCV1930 is reversed but not reversed on a connected secondary device. Improper wiring of this power terminal may cause a short circuit across the 24 VAC power supply.

LED status and states

Table 7: 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) Rapid blink = SA Bus communications issue Off Steady = No faults On Steady = Device fault or no application loaded
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
ETH1	Green	Off	Off Steady = ETH1 is not connected Blinking = ETH1 connected and communicating

General troubleshooting

Table 8: 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 8: 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.

Repair information

If the CH-PCV1930 controller fails to operate within its specifications, replace the unit. For a replacement unit, contact the nearest Johnson Controls representative.

Accessories

Table 9: CH-PCV1930 Controller accessories (Order Separately)

Product code number	Description
CH-PCX Series Expansion Input/Output Modules	Refer to the *CH-PC Series Programmable Controllers and Related Products for the BCPro System Product Bulletin (LIT-12011914)* for a complete list of available CH-PCX Expansion I/O Modules.
Mobile Access Portal (MAP) Gateway	Refer to the *Mobile Access Portal Gateway Catalog Page* (LIT-1900869) to identify the appropriate product for your region. ⓘ **Note:** The MAP Gateway serves as a replacement for the BTCVT, which is no longer available for purchase, but continues to be supported.
FX-DIS1710-0	Local Controller Display

Table 9: CH-PCV1930 Controller accessories (Order Separately)

Product code number	Description
Y64T15-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 92 VA, Foot Mount, 72.2 cm (30 in.), Primary Leads and 76.2 cm (30 in.) Secondary Leads, Class 2
Y65A13-0	Transformer, 120 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AS), 20.32 cm (8 in.), Primary Leads and 76.2 cm (30 in.) Secondary Leads, Class 2
Y65T42-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Hub Mount (Y65SP+), 20.32 cm (8 in.), 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+), 20.32 cm (8 in.), Primary Leads and Secondary Screw Terminals, Class 2
AP-TBK1002-0	2-position Screw Terminal that plugs onto Output Point Spade Lugs
AP-TBK1003-0	3-position Screw Terminal that plugs onto Output Point Spade Lugs
AP-TBK4SA-0	Replacement MS/TP SA Bus Terminal, 4-Position Connector, Brown, Bulk Pack of 10
AP-TBK2PW-0	Replacement Power Terminal, 2-Position Connector, Gray, Bulk Pack of 10
MS-VMAACT-701	VMA Actuator Assembly Gearbox Replacement Kit
AS-CBLTSTAT-0	Cable adapter for connection to 8-pin TE-6700 Series sensors
F-1000-325	Replacement Barbed Fitting for use on CH-PCV1930 for Connecting Tubing, Bulk Pack of 10
F-1000-326	Flexible Tubing Extension with Barbed Fitting for CH-PCV1930, 35.56 cm (14 in.) Length, Bulk Pack of 20
TL-BRTRP-0	Portable BACnet/IP to MS/TP Router

Technical specifications

Table 10: CH-PCV Controllers

Product Code Numbers	**CH-PCV1930-0**: 32-bit, Integrated VAV Controller/Actuator/ Pressure Sensor - DPT, 3 UI and 3 BO, 2 CO, 24 VAC, and SA Bus, Includes 6-pin Sensor Port for use with TE-7xx Series Non-Communicating Sensors and two Ethernet Ports for BACnet/IP Communications
Communications Protocol	BACnet/IP
Power Requirement	24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, Power Supply Class 2 (North America), Safety Extra-Low Voltage (SELV) (Europe)
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 6.3 mm (1/4 in.) Spade Lugs SA Bus, and Supply Power: 4-Wire and 2-Wire Pluggable Screw Terminal Blocks SA Bus Modular Ports: RJ-12 6-Pin Modular Jacks
Communications Bus	10/100 Mbps; 8-pin RJ-45 connector SA Bus: 0.6 mm (22 AWG) stranded, 4-wire (2-twisted pairs) shielded cable recommended from the controller for network sensors and other sensor/actuator devices; includes a terminal to source 15 VDC supply power from the CH-PCV1930 to SA Bus devices ⓘ **Note:** For more information, refer to the *MS/TP Communications Bus for the BCPro™ System Technical Bulletin 912011908)*.
Processor	RX63N 32-bit Renesas microcontroller
Memory	16 MB serial flash memory and 8 MB of SDRAM
Universal Input (UI) Resolution/Configurable Output (CO) Accuracy	**UI Analog Input Mode:** 15-bit resolution on UIs **CO Analog Output Mode (only):** 0–10 VDC ± 200 mV

Table 10: CH-PCV Controllers

Air Pressure Differential Sensor	Range: -1.5 in. to 1.5 in. W.C. **Performance Characteristics:** Accuracy: ±1.3% Full Span Maximum. Combined error due to offset, non-linearity, and temperature variation. Combined error due to offset, non-linearity, and temperature variation. (±0.039 in. W.C.) Typical accuracy at zero (null) pressure is ±0.02 in. W.C. Includes error due to non-linearity. (if provided)
Actuator Rating	4 N·m (35 lb·in) minimum shaft length = 44 mm (1-3/4 in.) (if provided)
Mounting	Mounts 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)
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. Suitable for Use in Other Environmental Air Space (Plenums) in Accordance with Section 300.22 (C) of the National Electrical Code.
	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; RoHS Directive
	Australia and New Zealand: RCM Mark, Australia/NZ Emissions Compliant.
	BACnet International

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