



FX-PCV1615/1626/1628/1630 Programmable VAV Box Controllers Installation Instructions

Applications

The FX-PCV1615/1626/1628/1630 programmable digital controllers are designed for controlling Variable Air Volume (VAV) boxes. These FX-PCV Variable Air Volume Modular Assembly (VMA) controllers feature combinations of an integral digital pressure sensor (DPT), a damper actuator, and a 32-bit microprocessor. The FX-PCV1626 has an actuator but does not contain a DPT. The FX-PCV1628 model has a DPT but does not contain an actuator. The controllers' small package size facilitates quick field installation and efficient use of space without compromising high-tech control performance. These FX-PCV controllers connect easily to the wired and wireless network sensors for zone and discharge air temperature sensing.

Communications protocol

The FX-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.

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

The Controller Configuration Tool (CCT) can be used to switch the Field Bus communications protocol in supported FX-PC Controllers to be either the standard BACnet MS/TP or the N2 protocol. All new controllers use either BACnet MS/TP as the default communications protocol, or BACnet/IP. Switchable communications protocols in the MS/TP models provide a cost-effective upgrade and modernization path for customers with existing N2 controllers.

The *Modernization Guide for Legacy N2 Controllers (LIT-12012045)* and the controller-specific documentation provide installation and commissioning support and include tips for efficient and safe replacement. Refer to the *N2 Compatibility Options* chapter of the *Controller Tool Help (LIT-12011147)* for information about mapping N2 Objects in controllers with switchable communications protocols.

The N2-capable FX-PC Controllers can be used as functional replacements for legacy N2 controllers. The N2-capable FX-PC Controllers:

- have the I/O quantities and characteristics of the FX-PC family controllers
- must be programmed with CCT, which has programming capabilities that are similar (but not identical) to HVACPro, GX9100, GPL, and other legacy tools
- support SA Bus devices
- support FX-WRZ wireless sensors from the controller using the FX-WRZ7860 receiver when configured for BACnet MS/TP communication

The N2-capable FX-PC controllers:

- do not support Zone Bus (for example, TMZ sensors and M100 actuators)
- do not support passthrough in the commissioning mode
- do not support remote downloading or commissioning using BACnet routing
- do not support wireless connection to the N2 bus



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 an FX-PCV1615/1626/1628/1630 controller:

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

Parts included

- One FX-PCV1615/1626/1628/1630 controller with removable SA bus and power terminal blocks.
- One installation instructions sheet.
- One self-drilling No. 10 x 25 mm (1 in.) screw.
- The FX-PCV1628 model includes a 1.25 inch extended length 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 FX-PCV.
- Power screwdriver, 100 mm (4 in.) extension socket, punch, drill, and 3.5 mm (9/64 in.) drill bits to mount the FX-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 an FX-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 FX-PCV electronics. Mount the FX-PCV vertically above the damper shaft to allow any shaft condensation to fall away from the FX-PCV. Additional measures may be required in some installations.
- Ensure that the mounting surface can support the FX-PCV and any user-supplied enclosure.
- Mount the FX-PCV on a hard, even surface whenever possible.
- Use shims or washers to mount the FX-PCV securely and evenly on the mounting surface.
- Mount the FX-PCV in an area free of corrosive vapors that matches the ambient conditions specified in the [Technical specifications](#) section.
- Provide sufficient space around the FX-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 FX-PCV in areas where electromagnetic emissions from other devices or wiring can interfere with controller communication.
- Avoid mounting the FX-PCV on surfaces with excessive vibration.
- When using the FX-PCV1615/1626/1628/1630 to replace an FX-PCV1610 or FX-PCV1620 controller, plug the unused open hole in the duct work from the original FX-PCV mounting if possible. Plug the hole using the sheet metal screw from the original installation (preferred option).

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

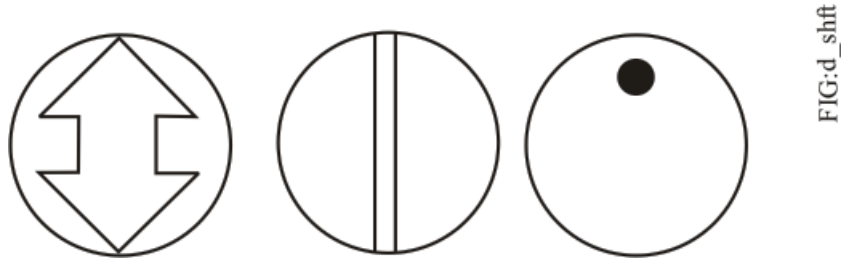
- Do not install the FX-PCV in an airtight enclosure.
- Mount the FX-PCV so that the enclosure walls do not obstruct cover removal or ventilation through the controller.
- Mount the FX-PCV so that the power transformer and other devices do not radiate excessive heat to the controller.

To mount the FX-PCV1615/1626/1628/1630 controllers:

1. Set all the switches on the controller to their known settings.
2. Place the FX-PCV controller in the proper mounting position on the damper shaft so that the wiring connections are easily accessible. Make sure the FX-PCV controller base is parallel to the VAV box (perpendicular to the damper shaft). If needed, use a spacer to offset tipping of the FX-PCV controller caused by the shaft bushings.
 - ① **Note:** Use the alignment marks to center the captive spacer to ensure sufficient FX-PCV movement in either direction.
3. Secure the self-drilling No.10 screw through the captive spacer (Figure 2) with a power screwdriver and 100mm (4in.) 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 3.5mm (9/64in.) drill bit. Insert the mounting screw and tighten against the spacer. For the FX-PCV1628 models, use the additional 1.25 inch screw to mount to one of the two holes provided near the actuator opening (Figure 2) to mount the controller.
 - **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 figure below.

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 (Figure 2) and turn the FX-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.
 8. For 45° and 60° boxes, hard stops must be provided at both full-closed and full-open damper positions. By installing the FX-PCV controller at the full-open position, the FX-PCV controller provides the open stop for 45° and 60° boxes. The closed damper seal provides the full-closed stop.
9. All models are compact in size and are easily installed on VAV boxes. The FX-PCV1615/1626/1630 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).
10. Skip this step if you are installing the FX-PCV1626 model. 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 FX-PCV controller and the other ends of the tubing to the pressure transducer in the VAV box application (Figure 2).
 - ⓘ **Note:** The FX-PCV uses a digital non-flow pressure sensor (all models except the FX-PCV1626) with bidirectional flow operation, which allows you to connect the high- and low-pressure DP tubes to either barbed fitting on the FX-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 FX-PCV.
11. 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.
12. 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 diagram

Figure 2: PCV1615/1626/1628/1630 Controller wiring terminations and physical features

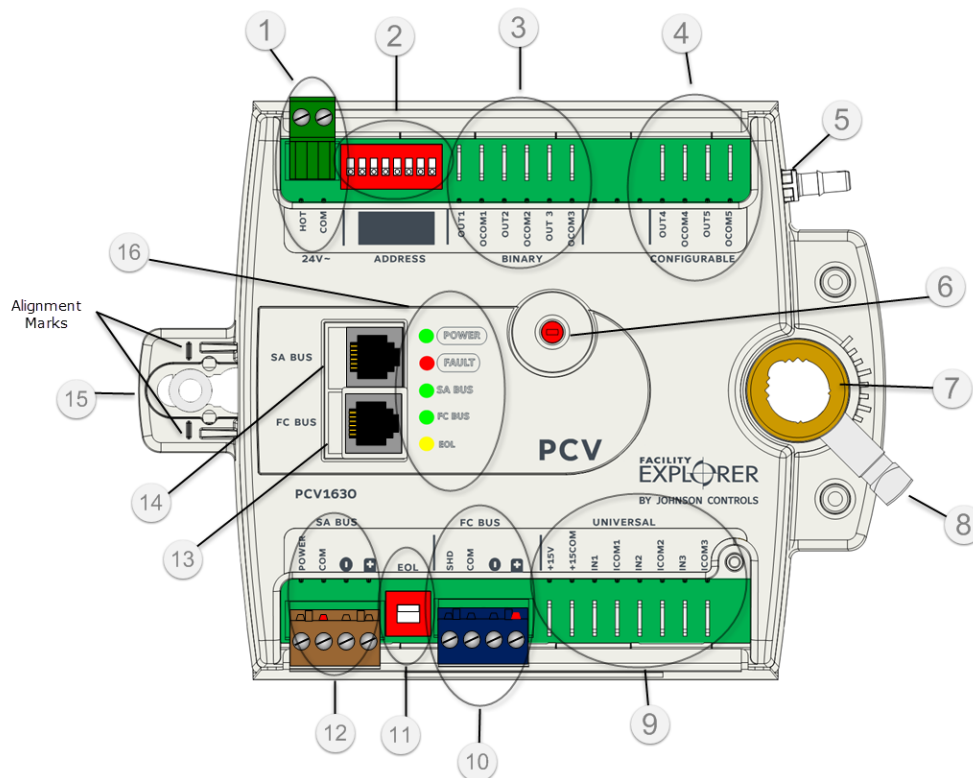


Table 1: FX-PCV1615/1626/1628/1630 Programmable VAV Box feature callout numbers and descriptions

Callout	Physical features: description and references
1	24 VAC, Class 2 Supply Power Terminal Block (see Supply power terminal block)
2	Device Address DIP Switch Block
3	Binary Outputs, 24 VAC Triacs (see Table 3)
4	Configurable Outputs: Voltage Analog Output (0–10 VDC) and Binary Output (24 VAC Triac) FX-PCV1630, 1626, and 1628 only) (see Table 3)
5	Dual Port Fitting
6	Manual Override Button (see Mounting)
7	Coupler Bolt (see Mounting)
8	Controller Coupler (see Mounting)
9	Universal Input: Voltage Analog Input (0–10 VDC) Resistive Analog Inputs (0–600k ohm) (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	FC Bus Terminal Block. May also be used for N2 connections.
11	EOL (End-of-Line) Switch (see Setting the EOL switch)
12	SA Bus Terminal Block
13	Modular Port (FC Bus) RJ-12 6-Pin Modular Jack (see Modular ports)
14	Modular Port (SA Bus) RJ-12 6-Pin Modular Jack (see Modular ports)
15	Captive Spacer and Screw
16	LED Status Indicators (see Table 8)

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 on configuring and wiring an MS/TP Bus, FC Bus, or SA Bus, refer to the *FX-PC Series Controllers MS/TP Communications Bus Technical Bulletin (LIT-12011670)*.

FX-PCV terminals and bus ports

See [Input and Output terminals](#) for input and output terminal and bus port locations on the FX-PCV1615/1626/1628/1630 controllers. Observe the following guidelines when wiring an FX-PCV controller.

Input and Output terminals

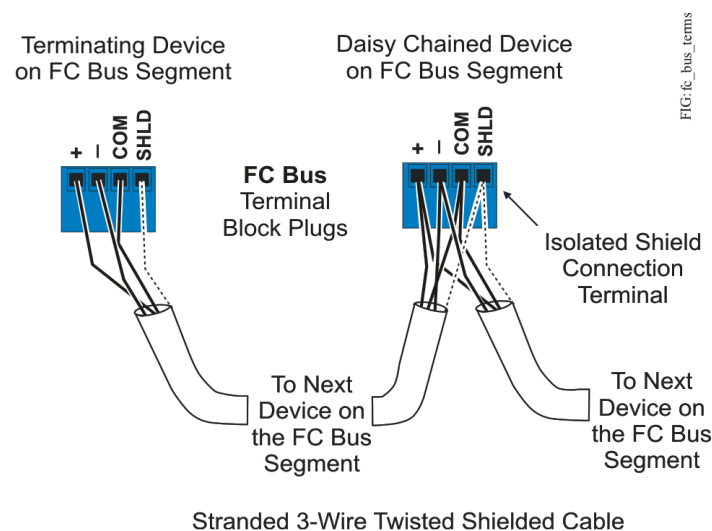
The input spade terminals are located on the side of the FX-PCV near the terminal block. The output spade terminals are located on the opposite side of the controller near the power supply terminal block. See Table 3 for more information.

FC bus terminal block (Or N2 protocol as required)

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 FX-PCV and other 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

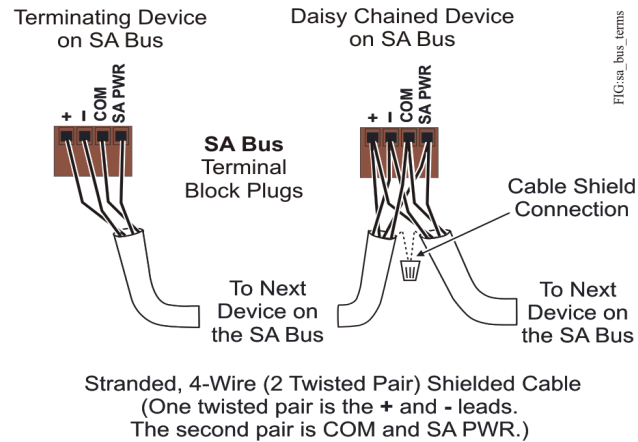


- ① **Note:** The Shield terminal (SHLD) on the FC Bus terminal block is isolated and can be used to connect the cable shields on the bus (Figure 3).

SA bus terminal block

The SA Bus terminal block is a brown, removable, 4-terminal plug with +15 VDC that fits into a board-mounted jack. Wire the removable SA Bus terminal block plugs on the FX-PCV and other SA Bus devices in a daisy-chain configuration using 4-wire twisted, shielded cable as shown in Figure 4. See Table 5 for more information.

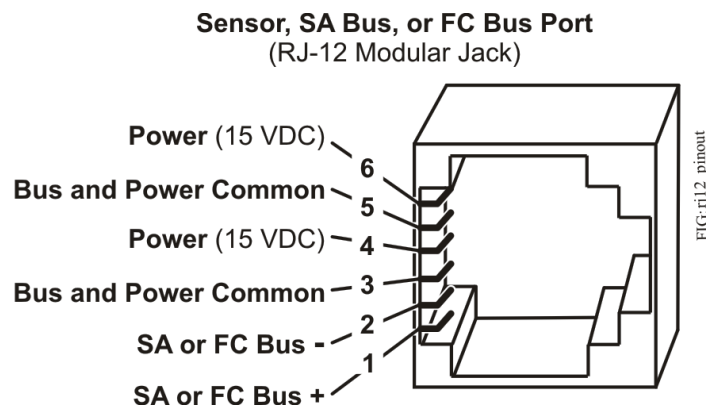
Figure 4: SA bus terminal block wiring



Modular ports

The modular and FC Bus ports on the face of the FX-PCV (Figure 2) are RJ-12 (6-position) modular jacks as shown in Figure 5.

Figure 5: Pin number assignments for sensor (SA bus and FC bus) ports on FX-PCV1615/1626/1628/1630 Controllers



The modular SA Bus port provides a connection for the Bluetooth Commissioning Converter (FX-BTCVT), FX-ATV7003 VAV Balancing Tool, FX-DIS1710 Local Controller Display, FX-WRZ78xx Series One-to-One Wireless Transmitter, and NS Series sensors. The modular FC Bus port provides a connection for the Bluetooth Commissioning Converter and the FX-ZFR Wireless Router.

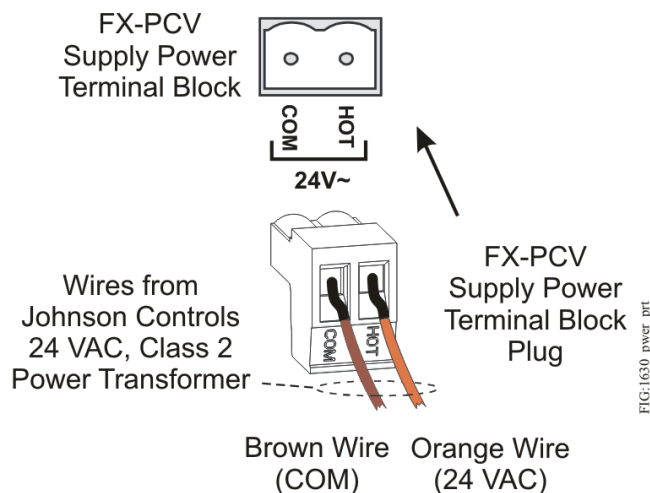
Note: Do not use the modular SA Bus port and the terminal block SA Bus simultaneously. Only use one of these connections at a time.

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 FX-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 6. See Table 5 for more information.

Figure 6: 24 VAC supply power terminal block wiring

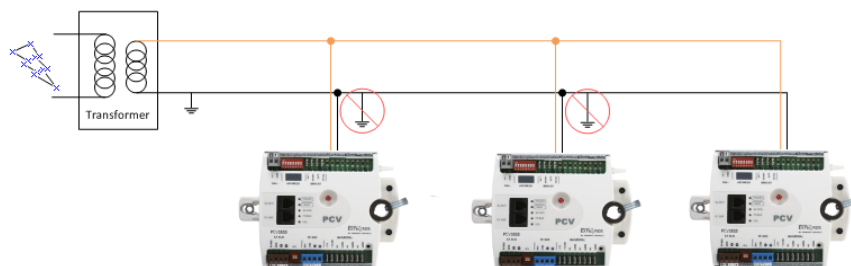


- **Important:** Exercise caution while rewiring the power plug when replacing an FX-PCV1610 or FX-PCV1620 controller with an FX-PCV1615/1626/1628/1630 controller. The supply power terminal on a new FX-PCV is a two-position terminal block (Figure 6). An FX-PCV1610 or FX-PCV1620 controller uses a three-position terminal block, and the center position is not used. Stray wire strands may make contact and cause a short circuit across the 24 VAC power supply.

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 FX-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 FX-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 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 FX-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 FX-PCV16xx-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 FX-PCV1615/1626/1628/1630 controller:

1. Terminate wiring according the appropriate figure in [Termination diagrams](#).
 2. Wire network sensors and other devices to the FX-PCV's SA Bus.
 3. Ensure that the FX-PCV's device address DIP switches are set to the appropriate device address. (See [Setting the device address](#).) Also, activate the EOL switch if necessary.
 4. Connect the FX-PCV controller to 24 VAC, Class 2 power.
- ① **Note:** If you are using the FX-PCV1615/1626/1628/1630 controller with the Wireless Field Bus System, refer to the *WNC1800/FX-ZFR182x Pro Series Wireless Field Bus System Bulletin (LIT-12012378)* or the *FX-ZFR1800 Series Wireless Field Bus System Bulletin (LIT-12011660)*.

FX-PCV terminal functions, ratings, requirements, and wiring guidelines

Input and Output wiring guidelines

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

In addition to the wiring guidelines in Table 3, observe these guidelines when wiring FX-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.

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.

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 FX-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 *FX-PC Series Controllers Communications Bus Technical Bulletin (LIT-12011670)* for detailed information regarding wire size and cable length requirements for the SA Buses.

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 2: Termination details

Type of field device	Type of Input/Output	Termination diagrams
Voltage Input - External Source	UI	The diagram shows a FIELD DEVICE with four terminals: +, -, OUT, and COM. The + and - terminals are connected to a POWER SUPPLY. The OUT terminal is connected to IN# and the COM terminal is connected to ICOM# on the Controller.
Voltage Input - Internal Source	UI	The diagram shows a FIELD DEVICE with three terminals: +, -, and +VDC. The + terminal is connected to IN#, the - terminal is connected to ICOM#, and the +VDC terminal is connected to +15V on the Controller.

Table 2: Termination details

Type of field device	Type of Input/ Output	Termination diagrams
Voltage Input (Self-Powered)	UI	
Temperature Sensor	UI	
Dry Contact	UI	
0–10 VDC Output to Actuator (External Source)	CO	Add Jumper from 24VAC Com to only one AO Com per Transformer
0–10 VDC Output to Actuator (Internal Source)	CO	

Table 2: Termination details

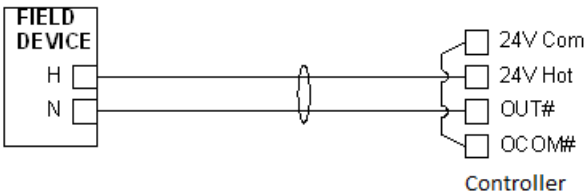
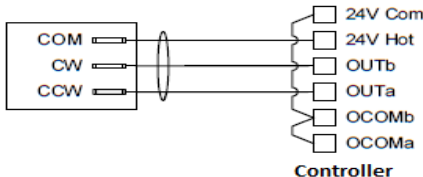
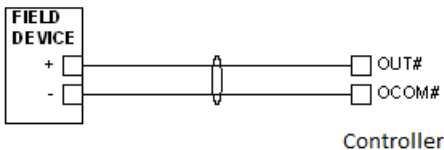
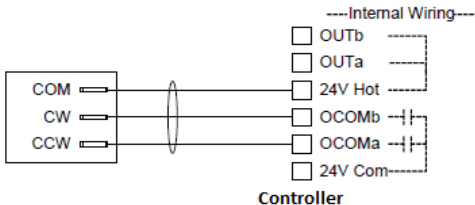
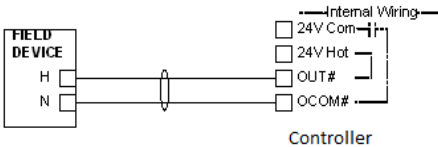
Type of field device	Type of Input/Output	Termination diagrams
24 VAC Triac Output (Switch Low, External Source)	CO	 ① Note: Applies to CO4 and CO5.
Incremental Control to Actuator (Switch Low, External Source)	CO	 ① Note: Applies to CO4 and CO5.
Analog Output (Voltage)	CO	
Incremental Control to Actuator (Switch Low, Internally Sourced)	BO	 ① Note: Applies to BO3 (for FX-PCV1630 only), BO1, and BO2.
24 VAC Binary Output (Switch Low, Internally Sourced)	BO	

Table 2: Termination details

Type of field device	Type of Input/ Output	Termination diagrams															
Network Stat with Phone Jack (Fixed Address = 199)	SA Bus	THERMOSTAT CIRCUIT BOARD JACK J2 IS FOR COMMISSIONING TOOLS Terminal 1 is to the extreme left as you face the Jack opening Tab Notch down CABLE WITH AN-RJ12 CONNECTOR ON EACH END SENSOR 6-Pin PHONE PLUG (JACK J1) CONTROLLER SENSOR PLUG															
Network Stat with Terminals Addressable	SA Bus	THERMOSTAT CIRCUIT BOARD JACK J2 IS FOR COMMISSIONING TOOLS ADDRESS SWITCH <table border="1"> <thead> <tr> <th>SW1</th> <th>SW2</th> <th>ADDRESS</th> </tr> </thead> <tbody> <tr> <td>OFF</td> <td>OFF</td> <td>200</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>201</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>202</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>203</td> </tr> </tbody> </table> CONNECTOR ON STAT MOUNTING BASE SLIDES INTO PINS ON CIRCUIT BOARD FROM PREVIOUS SA BUS DEVICE { COM SA PWR (15VDC) } TO NEXT SA BUS DEVICE IF REQUIRED { COM SA PWR (15VDC) }	SW1	SW2	ADDRESS	OFF	OFF	200	ON	OFF	201	OFF	ON	202	ON	ON	203
SW1	SW2	ADDRESS															
OFF	OFF	200															
ON	OFF	201															
OFF	ON	202															
ON	ON	203															
Network Stat with Terminals (Fixed Address = 199)	SA Bus	THERMOSTAT CIRCUIT BOARD JACK J2 IS FOR COMMISSIONING TOOLS CONNECTOR ON STAT MOUNTING BASE SLIDES INTO PINS ON CIRCUIT BOARD FROM PREVIOUS A BUS DEVICE { COM SA PWR (15VDC) } TO NEXT SA BUS DEVICE IF REQUIRED { COM SA PWR (15VDC) }															

Input and Output wiring guidelines tables

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) INn. <i>ⓘ</i> Note: Use 3-wire cable for devices that source power from the +15 V terminal.

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
	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 ① Note: All Universal ICOM _n terminals are isolated from all other commons on the -0 models. The -1 model ICOM _n terminals are isolated from FC BUS COM terminals only.	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 4.

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
	OCOM_n	Binary Output - 24 VAC Triac (Internal Power) Connects OCOM _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 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

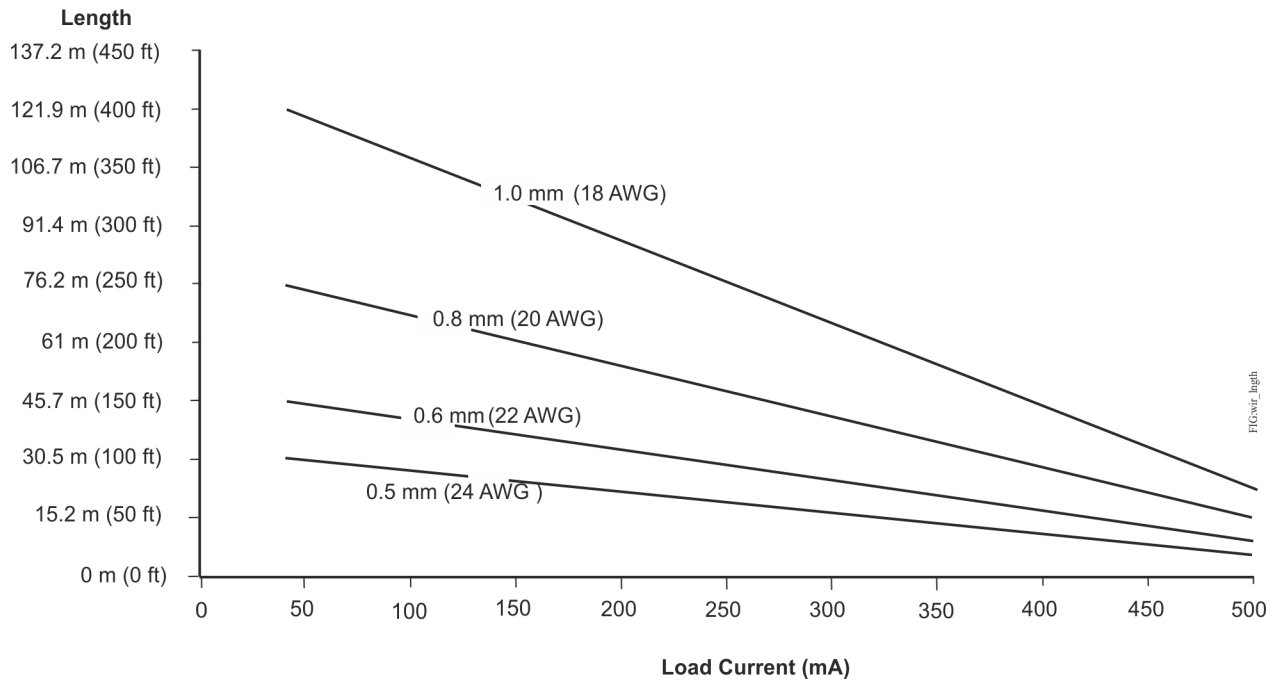
Terminal block label	Terminal labels	Function, ratings, and requirements	To determine wire size and maximum cable length
		Binary Output Signal Common: All Configurable Outputs defined as Binary Outputs are isolated from all other commons, including other Configurable Output commons.	

Table 4: Cable Length Guidelines for Recommended Wire Sizes

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
	0.8 mm (20 AWG) stranded copper 297 m (975 ft) twisted wire	297 m (975 ft) twisted wire	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.
	0.6 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
	0.8 mm (20 AWG) stranded copper 297 m (975 ft) twisted wire	137 m (450 ft) twisted wire	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.
	0.6 mm (22 AWG) stranded copper 183 m (600 ft) twisted wire	91 m (300 ft) twisted wire	
	0.5 mm (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

Maximum wire length by current and wire size

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 BUS²	+	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 BUS²	+	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	
	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.

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	FC BUS	RJ-12 6-Position Modular Port provides FC Bus Communications FC Bus provides 15 VDC Power for: • Wireless Bluetooth Commissioning Converter • Wireless ZigBee Field Bus Router	24 AWG 3-pair CAT 3 Cable <30.5m (100 ft)
SA BUS²	SA BUS	RJ-12 6-Position Modular Port provides SA Bus Communications SA Bus provides 15 VDC Power for: • NS Series Sensors • Wireless ZigBee FX-ZFR-7860 Series One-to-One Wireless Receiver • Bluetooth Commissioning Converter (FX-BTCVT) • FX-DIS1710 Local Controller Display • FX-ATV VAV Balancing Tool	24 AWG 3-pair CAT 3 Cable <30.5m (100 ft)
24~	HOT	24 VAC Power Supply - Hot Supplies 20–30 VAC (Nominal 24VAC)	0.8 mm to 1.0 mm (20 to 18 AWG) 2-wire
	COM	24 VAC Power Supply Common The -0 models isolate this terminal from all other commons. The -1 models only isolate this terminal from the FC bus common.	

¹ See Table 4 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. For more information, refer to the *FX-PC Series Controllers MS/TP Communications Bus Technical Bulletin (LIT-12011670)*.

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.

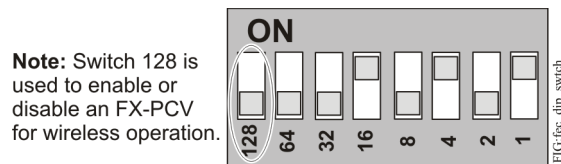
Setting the device address

FX-PC Series Controllers are master devices on BACnet® MSTP (SA or FC) Buses. Before operating FX-PC controllers on a bus, you must set a valid and unique device address for each controller on the bus.

Set an FX-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 (Figure 2). 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 is a mode switch that enables an FX-PC controller to operate on an FX-ZFR/ZFR Pro Series Wireless Field Bus. Switch 128 must be set to OFF for all hard-wired SA and FC Bus applications. Set Switch 128 to ON for wireless FC Bus applications only.

Figure 9: Device address switches set to 21



- ❗ **Note:** FX-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 MSTP Buses and do not interfere with bus operation. Set a valid and unique device address on the controller before applying power to the controller on the bus.

To set the device addresses on a an FX-PC Series Controller:

1. Set all of the switches on the 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 and Table 7 for valid FX-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 Switch 128 to ON only for controllers on an FX-ZFR/ZFR Pro Series Wireless Field Bus application. For all hard-wired SA and FC Bus applications, ensure that Switch 128 is set to OFF.
- ❗ **Note:** Do not connect a wirelessly enabled FX-PC controller to a wired FC Bus.

Refer to the *FX-ZFR Series Wireless Field Bus System Technical Bulletin (LIT-12011660)* for more information on device addresses in wireless applications.

4. Set a unique and sequential device address for each of the FX-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 FX-PC controllers do not need to be physically connected on the bus in their numerical device address order.
5. Write each FX-PC controller's device address on the white label below the DIP switch block on the controller's cover.

Refer to the *FX-PC Series Controllers MSTP Communications Bus Technical Bulletin (LIT-12011670)* for more information on FX-PC controller device addresses and how to set them on MSTP Buses.

Table 6 and Table 7 show and describe the valid FC Bus and SA Bus device addresses for Johnson Controls MSTP communications bus applications.

Table 6: FC Bus device address descriptions

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

Table 7: Wireless field bus device address

Device address	Address description
0 to 3 (Switch 128 ON)	Reserved addresses for wired subordinate devices (not valid for FX-PC controllers). ① Note: FX-PC Series Controllers ship with 128 ON and the remaining address switches OFF, rendering the controllers wired subordinate devices, which do not operate on FX-PC Series Controller field buses.
4 to 127 (Switch 128 ON)	Valid for FX-PC Series Controllers on wireless FC Buses only . ① Note: Do not connect a an FX-PC Series controller with these device addresses to an active wired SA or FC Bus. When a controller with one of these device address is connected to a wired field bus, the field bus is rendered inoperable until the controller is disconnected or Switch 128 is set to OFF.

Setting the N2 Controller address to be greater than 127

N2-configured controllers support the full range of possible N2 device addresses provided by the N2 protocol standard (1-255). However, these controllers require special configuration for addresses above 127.

Use the following instructions for controller addresses greater than 127.

Notes:

- Prior to performing this procedure, be sure the controller has been converted from BACnet to N2 protocol first.
 - This special configuration is required because controller addresses above 127 were originally intended for use with the Wireless Field Bus system.
1. Disconnect the 24 VAC supply from the controller.
 2. Remove the FC Bus connector from the controller.
 3. Set the address switch set to the desired N2 address.
 4. Set the address switch segment labeled 128 to OFF.
 5. Reconnect the 24 VAC supply to the controller.
 6. Using an CCT tool connection at the FX-PC controller's SA bus, download the firmware and controller application file. The download process asks to confirm switching the communication protocol to N2.
 7. Click **OK**.
 8. After the download is finished, disconnect the 24 VAC supply to the FX-PC controller.
 9. Set the address switch segment labeled 128 to ON.
 10. Reattach the FC Bus connector to the FX-PC controller.
 11. Reconnect the 24 VAC supply to the FX-PC controller.

Setting the EOL switch

Each FX-PC controller has an EOL switch, which, when set to ON (up), sets the FX-PC controller as a terminating device on the bus. See Figure 2 for the EOL switch location on the FX-PC controller. The default EOL switch position is OFF (down). The amber EOL LED illuminates to show the EOL is active.

Figure 10: EOL switch positions



To set the EOL switch on an FX-PC controller:

1. Determine the physical location of the controller on the SA or FC Bus.
2. Determine if the controller must be set as a terminating device on the bus.
 - ① **Note:** The EOL termination rules for SA Buses and FC Buses are different. Refer to the *FX-PC Series Controllers MSTP Communications Bus Technical Bulletin (LIT-12011670)* for detailed information regarding EOL termination rules and EOL switch settings on SA and FC Buses.
3. If the controller is a terminating device on the FC Bus, set the EOL switch to ON. If the controller is not a terminating device on the bus, set the EOL switch to OFF.
 - ① **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 FX-PCV 1615/1626/1628/1630 controller:

1. Download the control application to the controller using the 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)*.

You commission controllers with the CCT software. The controller can be connected in one of four ways; either NxE Passthru, Bluetooth (using BTCVT), through MAP 4.2+/BACnet Router (Mobile Access Portal (MAP) Gateway at version 4.2 or above), or Direct Ethernet connection to the controller. Refer to *Controller Tool Help (LIT-12011147)* for detailed information on commissioning field controllers.

- ① **Note:** The Bluetooth connection can be used to Transfer to Computer (Upload) and commission the controller, but cannot be used to Transfer to Device (Download).

The CCT connects to the FX-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. These connection options require additional hardware listed in Table 9.

Repair information

If the FX-PCV 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 FX-PCV1615/1626/1628/1630 controllers. The table below provides some additional troubleshooting information for possible problems.

- ① **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 the FX-PCV are not reversed. The most common cause of this problem is when the 24 VAC power supply on the FX-PCV 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.

Troubleshooting scenarios

Controller is Off

Power at Primary of Transformer, 0V at Secondary **or** the Power at Primary Transformer, 24V at Secondary, 0V at Fuse/Breaker **and** Breaker/Fuse has tripped.

Possible Cause:

1. Transformer is shorted.
2. 24VAC 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, verify that OCOM1-OCOM3
 3. are not connected to ~24 VAC HOT (these terminals are internally sourced).
4. Verify the short circuit has been resolved with an ohm-meter.
5. Reset the breaker/fuse or replace the transformer.
 - ① **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.

Verification:

1. Disconnect the secondary of the 24 VAC transformer.
2. Use an ohm-meter to measure between ~24 VAC HOT and COM; there should be no short circuit.
 - ① **Note:** That 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.

Configurable output - analog mode is invalid

0–10 V output is set to 10–100%, but 0 V is at output terminals **and** 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.

Possible Cause: Power polarity mismatch between connected device and configurable output.

Correction: Ensure polarities of ~24 V COM/OCOM match and that the connected end device uses the same polarity.

Verification:

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 **and** Common Reference is incorrect.

Possible Cause: OCOM terminal is not connected.

Correction: Connect OCOM terminal of the configurable output to the common of the connected end device.

Verification:

1. Measure the output and verify that it matches the command.
2. Disconnect the connected device and verify the commanded value is present.

LED table

Table 8: FX-PCV Controller status LEDs

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
ETH2	Green	Off	Off Steady = ETH2 is not connected Blinking = ETH2 connected and communicating

Accessories

Use Table 9 to order accessories.

Table 9: FX-PCV1615/1626/1628/1630 Controller Accessories (Order Separately)

Product code number	Description
FX-PCX Series Expansion Input/Output Modules	Refer to the <i>FX-PC Series Programmable Controllers and Related Products Product Bulletin (LIT-12011657)</i> for a complete list of available FX-PCX Expansion I/O Modules.

Table 9: FX-PCV1615/1626/1628/1630 Controller Accessories (Order Separately)

Product code number	Description
Mobile Access Portal (MAP) Gateway	Refer to the <i>Mobile Access Portal Gateway Catalog Page</i> (LIT-1900869) to identify the appropriate product for your region.
FX-DIS1710-0	Local Controller Display
FX-BTCVTCBL-700	Cable Replacement Set for the FX-BTCVT-1 or the NS-ATV7003-0; includes One 1.5 m (5 ft) Retractable Cable
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 FX-PCV Output Point Spade Lugs
AP-TBK1003-0	3-position Screw Terminal that plugs onto FX-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 of 10
AS-CBLTSTAT-0	Cable adapter for connection to 8-pin TE-6700 Series sensors
F-1000-325	Replacement Barbed Fitting for use on FX-PCV1615, FX-PCV1630, and FX-PCV1832 for Connecting Tubing, Bulk Pack of 10
F-1000-326	Flexible Tubing Extension with Barbed Fitting for FX-PCV1615, FX-PCV1630, and FX-PCV1832, 35.56 cm (14 in.) Length, Bulk Pack of 20
FX-PCVACT-701	FX-PCV Actuator Assembly Gearbox Replacement Kit
TL-BRTRP-0	Portable BACnet/IP to MS/TP Router

Technical specifications

Table 10: FX-PCV1615/1626/1628/1630 Controllers

Product Code Numbers	FX-PCV1615-x: Integrated VAV Box Controller, Actuator and Pressure Sensor: 3 UI, 2 BO, 24 VAC; FC and SA Bus FX-PCV1626-x: Integrated VAV Box Controller/Actuator (No Pressure Sensor - DPT); 3 UI, 3 BO, and 2 CO; 24 VAC; FC and SA Bus FX-PCV1628-x: Integrated VAV Box Controller/ (No Actuator) Pressure Sensor - DPT; 3 UI, 3 BO, and 2 CO; 24 VAC; FC and SA Bus FX-PCV1630-x: 32-bit, Integrated VAV Controller/Actuator/ Pressure Sensor - DPT; 3 UI, 3 BO, and 2 CO; 24VAC; FC and SA Bus
Communications Protocol	BACnet MSTP, N2
Supported Supervisors	FX80, FX Server
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)
Power Consumption	10 VA typical, 14 VA maximum ① 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 FC Bus, SA Bus, and Supply Power: 4-Wire and 2-Wire Pluggable Screw Terminal Blocks SA Bus Modular Ports: RJ-12 6-Pin Modular Jacks

Table 10: FX-PCV1615/1626/1628/1630 Controllers

Communications Bus	RS-485: selectable between BACnet MSTP or N2 FC Bus: 0.6 mm (22 AWG) standard 3-wire, twisted, shielded cable recommended between the supervisory controller and 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 FX-PCV controller for network sensors and other sensor/actuator devices; includes a terminal to source 15 VDC supply power from FX-PCV to SA Bus devices ① Note: For more information, refer to the <i>FX-PC Series Controllers MS/TP Communications Bus Technical Bulletin (LIT-12011670)</i>.
Processor	RX63N 32-bit Renesas microcontroller
Memory	1 MB flash memory and 512 KB RAM
Universal Input Mode/ Configurable Output Mode Accuracy	UI Analog Input Mode: 15-bit resolution on UIs CO Analog Output Mode (FX-PCV1626/FX-PCV1628/FX-PCV1630 only): 0–10 VDC $\pm$ 200 mV
Air Pressure Differential Sensor	Range: -1.5 in. to 1.5 in. W.C. Performance Characteristics: Accuracy: $\pm$1.3% Full Span Maximum ($\pm$0.039 in. W.C.) ① Note: Combined error due to offset, non-linearity, and temperature variation. Typical accuracy at zero (null) pressure is $\pm$0.02 in. W.C.(if provided) ① Note: Includes error due to non-linearity.
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	United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; Suitable for use in other environmental air space (plenums) in accordance with Section 300.22(C) of the National Electric Code. FCC Compliant to CFR47, Part 15, Subpart B, Class A.

Table 10: FX-PCV1615/1626/1628/1630 Controllers

	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

