

FX-PC Series Programmable Controllers and Related Products Product Bulletin

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Overview

The FX-PC Series Programmable Controller family comprises a group of versatile controllers and accessories designed to monitor and operate a wide variety of commercial HVAC equipment and other building systems.

The FX-PC family includes the FX-PCV Programmable VAV Box Controller, the FX-PCG General Purpose Programmable Controller, and the FX-PCA Advanced Application Programmable Controller. All of these controllers are powered by 32-bit microprocessors and are fully programmable using the FX-PCT Programming and Commissioning Tool.

Modular add-on accessories, such as the FX-PCX Expansion I/O Modules and NS Series Network Sensors, extend the capabilities of the FX-PC controllers by providing additional I/O interfaces.

FX-PC controllers feature BACnet® Master-Slave/Token-Passing (MS/TP) networking capabilities and can be seamlessly integrated with FX Supervisory Controllers. FX-PC controllers are BACnet Testing Laboratories™ (BTL) tested and listed, which ensures their interoperability with other third-party BACnet devices as well. The FX-PC family also includes optional ZigBee™ technology components for wireless or wired/wireless hybrid network installations.

Figure 1: FX-PC Series Programmable Controllers

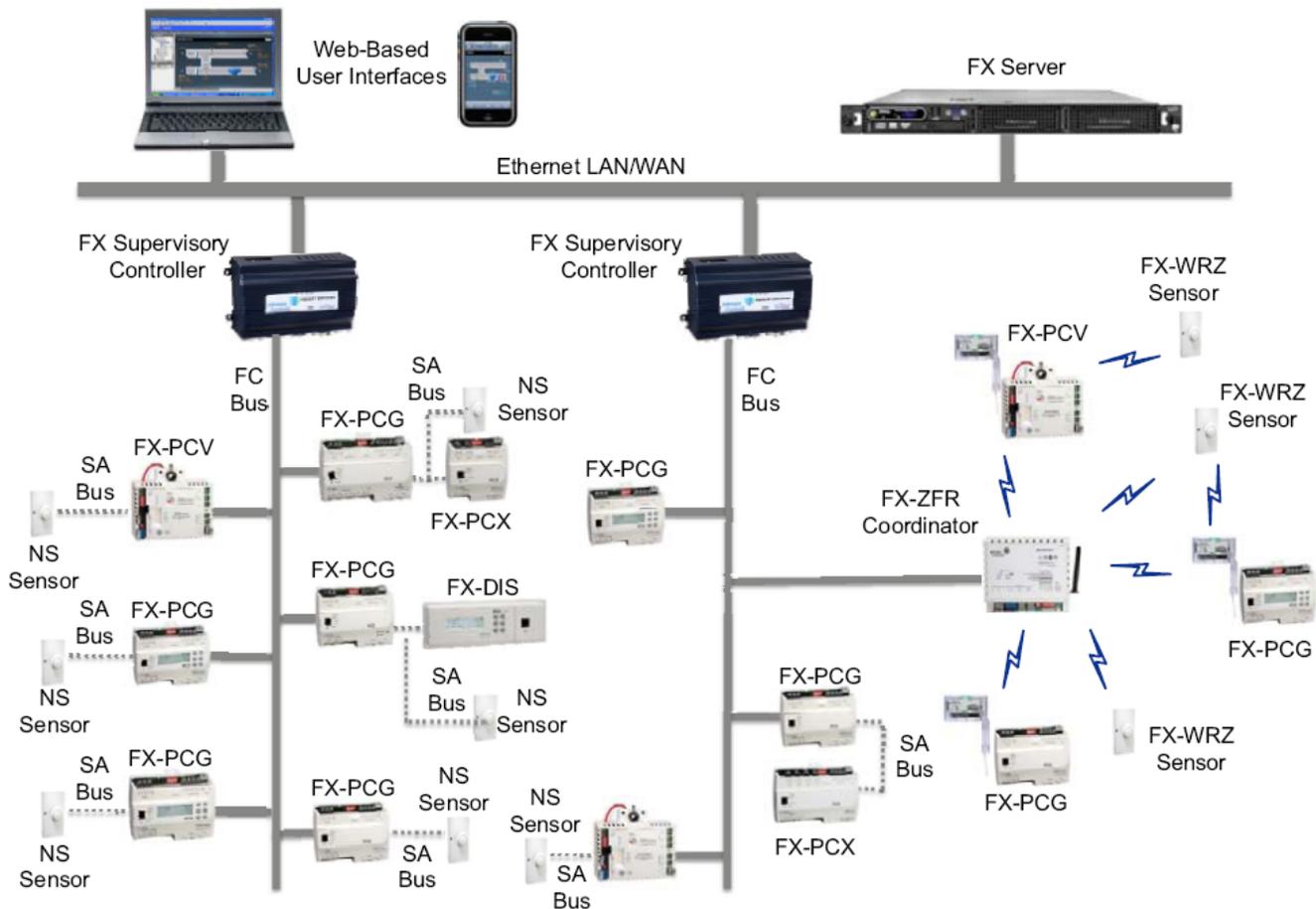


FX-PC controllers are housed in enclosures suitable for surface, DIN rail, and VAV box mounting and feature easy field access to power, network, and I/O terminations. FX-PCGs include an optional intuitive user interface with push buttons and LCD for local monitoring and adjustment of your controlled equipment.

Table 1: Features and Benefits

Features	Benefits
Standard BACnet Protocol with BTL Listing	Provides interoperability with FX Supervisory Controllers as well as other third-party Building Automation System (BAS) products that use the widely accepted BACnet standard.
Standard Hardware and Software Platform	Uses a common hardware design throughout the family line to support standardized wiring practices and installation workflows. Also uses a common software design to support use of a single tool for control applications, commissioning, and troubleshooting to minimize technical training.
ZigBee Wireless Field Controller (FC)/Sensor/Actuator (SA) Bus Interface	Provides a wireless alternative to hard-wired system counterparts, providing application flexibility, mobility, and minimal disruption to building occupants.
State-Based Application Control Logic with Adaptive, Automatically Tuned Control Loops	Prevents simultaneous heating and cooling, reduces commissioning time, eliminates change-of-season re-commissioning, and reduces wear and tear on mechanical devices.
Universal Inputs and Configurable Outputs	Allow multiple signal options per channel to provide input/output flexibility.
Complete Product Family with Modular Components	Meets any HVAC equipment or building system control requirement using only the needed components.

Figure 2: Facility Explorer System with FX-PC Controllers



Integration to the Facility Explorer (FX) Supervisory Controllers

The FX-PC family is designed to integrate seamlessly into the FX system by connecting and communicating directly with FX Supervisory Controllers. This seamless integration enables building operators to monitor and adjust FX-PC controllers directly from the FX system UI.

In addition, service personnel can view FX-PC controller information locally via the integral LCD (included on some FX-PCG models) or via an optional local controller display (FX-DIS1710-0).

BACnet Protocol Compatible

The FX-PC controllers, expansion I/O modules, and network sensors communicate using standard BACnet protocol, based on the American National Standards Institute (ANSI)/American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 135-2004.

BACnet protocol is a standard for ANSI, ASHRAE, and the International Standards Organization (ISO) for building controls.

FX-PCV, FX-PCG, and FX-PCX controllers are BTL tested and listed as BACnet Application Specific Controller (B-ASC). FX-PCA controllers are BTL listed as BACnet Advanced Application Controller (B-AAC). The NS Series Sensors are BTL listed as BACnet Smart Sensor (B-SS).

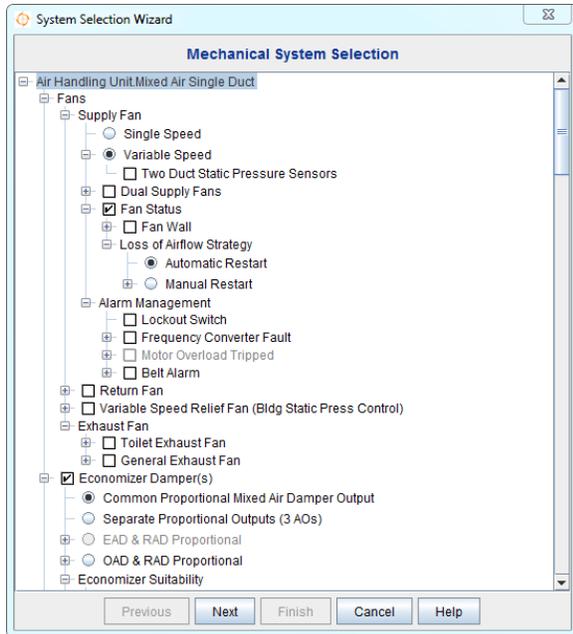
Programming and Commissioning Tool

The Programming and Commissioning Tool (FX-PCT) is used to configure, simulate, and commission the FX-PC Series Controllers (FX-PCV, FX-PCG, FX-PCA, and FX-PCX) on an MS/TP Bus.



The **Configuration** mode allows you to select a number of mechanical and control logic options through System Selection Trees for typical air handling, terminal unit, VAV box, and central plant mechanical systems. When required, you can customize the standard logic provided by the system selection process to meet your specialized control logic requirements. Configuration mode also allows you to customize certain display options available to FX-PC controllers that use a local controller display (Figure 3).

Figure 3: Mechanical System Selection in FX-PCT



The **Simulation** mode allows you to review, run, or simulate the application logic as if you were commissioning a live system. You can make adjustments to setpoints, inputs, or sensors during a simulation session to validate the logic before assigning the configuration to a specific controller.

The **Commissioning** mode manages the downloading of files to the FX-PC controllers through two different network connection points. You can connect locally using the Bluetooth® Commissioning Converter (FX-BTCVT) or portable BACnet router (TL-BRTRP-0) between your laptop and the MS/TP Bus or remotely using the BACnet routing mode through an FX Supervisory Controller.

After downloading the controllers, you can use the FX-PCT Commissioning mode to validate the sensor and control point interfaces and adjust key setpoints and setup parameters (Figure 4).

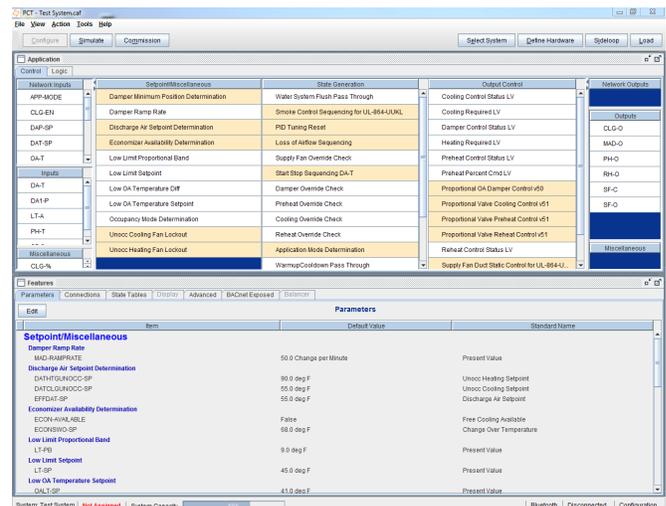
FX-PCT includes integrated productivity features with utilities to facilitate mass application uploads and downloads, including upgrades of entire trunks of controllers with just a few mouse clicks. Template files provide an intuitive method of reading and writing configuration parameters to multiple controllers, reducing the time it takes to commission your controller networks.

For VAV box applications, FX-PCT features an optional box flow test to automatically exercise all the VAV boxes to ensure correct mechanical installation and proper configuration of the key flow setup parameters. Additionally, multiple configurations of room network sensors and a handheld VAV box balancing tool are available for you to perform VAV balancing tasks.

In addition, the Commissioning wizard has a Balancer tab for VAV box applications to easily auto-calibrate VAV boxes and set flow constants in one location.

A Commissioning mode only version of the FX-PCT software is available for jobs or individuals having only commissioning tasks (for example, balancing contractors). The Configuration and Simulation modes are disabled in the FX-PCT Commissioning software.

Figure 4: FX-PCT User Interface



Features

- capability to customize standard control system logic that is created from simple system selection trees
- consistent user interface across the Configuration, Simulation, and Commissioning modes
- flexible connection capabilities for loading and commissioning controllers

FX-PC Programmable Controller Family

The FX-PC Programmable Controller Family includes the FX-PCV, FX-PCG, FX-PCA, and FX-PCX Series Programmable Controller models.

All FX-PC controllers run pre-engineered and user-programmed applications and provide the I/O required to monitor and control a wide variety of HVAC equipment.

This large family of diverse controllers is designed to install easily and communicate via standard RS-485 BACnet MS/TP protocol, enabling you to build an almost endless variety of HVAC equipment and building system control applications, ranging from simple fan coil, heat pump, or VAV box control applications to air handling units to very advanced central plant management and stand-alone applications.

FX-PC Controller Features

Features and benefits common to the FX-PCV, FX-PCG, FX-PCA, and FX-PCX Series controllers include the following:

- BACnet MS/TP Protocol supports seamless integration into FX Supervisory Controllers as well as integration with third-party BACnet devices.
- Integral End-of-Line (EOL) switch enables FX-PC controller as a terminating device on the communications bus.
- Wireless capabilities via an FX-ZFR Series Wireless Field Bus System enable wireless mesh connectivity between FX-PC controllers to FX-WRZ Series Wireless Room Temperature Sensors and to FX Supervisory Controllers, facilitating easy initial location and relocation.

Additional features and benefits common to FX-PCV, FX-PCG, and FX-PCA controllers include the following:

- Patented proportional adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies provide continuous loop tuning.
- Writable flash memory allows standard or customized applications to be downloaded from the FX-PCT and enables persistent application data.
- Large product family provides a wide range of point mix to meet application requirements and allows for the addition of one or more FX-PCXs or NS Series Network Sensors to provide even more I/O capacity.

Hardware and Installation

FX-PC controllers are encased in a durable, plenum-rated, plastic housing. The plastic housing may eliminate the need for a separate enclosure for plenum-rated construction. Check regional, national, and local code requirements for appropriate applications.

FX-PC controllers feature bright, color-coded LEDs, visible on the controller cover, that indicate the supply power, communications bus, and EOL switch status, as well as a variety of fault conditions to aid troubleshooting the controller and bus.

An integral EOL switch on each FX-PC controller allows you to enable the controller as a bus terminating device, which when properly configured, reduces reflected noise on the bus and improves bus communication.

Each FX-PC controller has an easily accessible, eight-position DIP switch that allows you to set a valid and unique device address for each controller on the bus. A blank space is included on the controller cover for recording the device address.

FX-PC controllers feature removable, color-coded, keyed, and labeled terminal block plugs for the supply power and communications bus terminations. Most models have fixed, color-coded, and labeled terminal blocks for the input and output terminations, which facilitate installing and servicing the controllers.

The I/O terminations on the FX-PCV models are spade lugs. Screw terminal adapters that connect to the I/O spade terminations are also available as optional accessories.

FX-PCA2612 models have removable, color-coded, and labeled terminal block plugs for the I/O terminations.

On FX-PCG, FX-PCA, and FX-PCX Series Controllers, integral mounting clips and a DIN rail track on the controller back-plate allow you to easily mount the controller either on a horizontal section of 35 mm DIN rail or directly to a wall or flat vertical surface.

Some FX-PCG models have a backlit user interface display with adjustable brightness and contrast to ensure readability in low-light environments. The easy-to-use display provides convenient local monitoring and adjusting of key setpoints and control parameters. For the FX-PCG and FX-PCA models without a display, a stand-alone FX-DIS1710 Local Controller Display module is available that connects directly to the SA Bus port. For details, refer to the *FX-DIS Local Controller Display Product Bulletin (LIT-12011667)*.

General Purpose Programmable Controller (FX-PCG)

The FX-PCGs are programmable controllers with integral MS/TP communications. FX-PCG models include the 10-point FX-PCG16 Series and the 17-point FX-PCG26 Series.

FX-PCGs feature 32-bit microprocessor architecture, patented continuous tuning adaptive control, peer-to-peer communications, and are available with an optional built-in LCD screen local UI.

A full range of FX-PCG models combined with the FX-PCX Expansion I/O Modules can be applied to a wide variety of HVAC equipment control applications ranging from simple fan coil or heat pump control to air handlers to advanced central plant management.

All FX-PCG Series Controllers support wireless communications using the ZigBee Field Router (FX-ZFR) Series accessories.

Figure 5: FX-PCG2621 General Purpose Programmable Controller with Integral Local Display

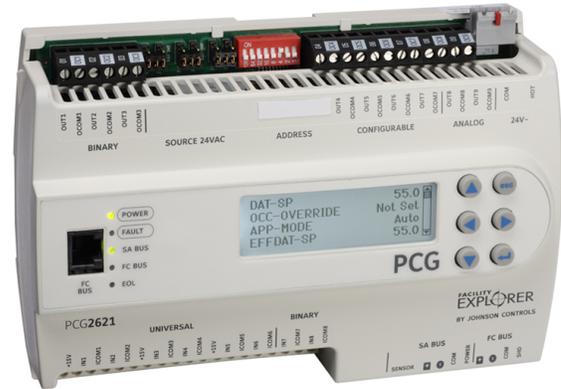


Table 2: FX-PCG Series Point Type Counts per Model

Point Types	Signals Accepted	FX-PCG16	FX-PCG26
Universal Input (UI)	Analog Input, Voltage Mode, 0–10 VDC Analog Input, Current Mode, 4–20 mA ¹ Analog Input, Resistive Mode, 0–2k ohm, Resistance Temperature Device (RTD) (1k NI [Johnson Controls], 1k PT, A99B SI), Negative Temperature Coefficient (NTC) (10k Type L, 2.252k Type 2) Binary Input, Dry Contact Maintained Mode	2	6
Binary Input (BI)	Dry Contact Maintained Mode Pulse Counter/Accumulator Mode (High Speed), 100 Hz	1	2
Analog Output (AO)	Analog Output, Voltage Mode, 0–10 VDC Analog Output, Current Mode, 4–20 mA		2
Binary Output (BO)	24 VAC Triac	3	3
Configurable Output (CO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac	4	4

1 Analog Input, Current Mode is set by hardware for the FX-PCG26, and by software for the FX-PCG16.

Advanced Application Programmable Controller (FX-PCA)

The FX-PCAs are advanced application controllers with integral RS-485 MS/TP communications.

FX-PCA Series Controllers feature an integral real-time clock and support time-based tasks, which enables these controllers to monitor and control schedules, calendars, alarms, and trends. FX-PCAs can continue time-based control and monitoring when offline for extended periods of time from an FX system network.

FX-PCA Series Controllers can also operate as stand-alone controllers in applications that do not require a networked supervisory device or for network applications where it is preferred to have the scheduling, alarming, or trending performed locally in the field controllers.

FX-PCA2612 controller models feature line-voltage relay outputs, making these controllers well suited for use in terminal units. The FX-PCA2612-2 model uses a line-voltage power supply, eliminating the need for a 24 VAC transformer in line-voltage applications.

A full range of FX-PCA and FX-PCG models combined with the FX-PCX models can be applied to a wide variety of building applications ranging from simple fan coil or heat pump control to air handlers to advanced central plant management.

All FX-PCA controllers support wireless communications using the FX-ZFR Series accessories.

Figure 6: FX-PCA Series Advanced Application Programmable Controllers



Features

In addition to the features and benefits listed in [FX-PC Controller Features](#), FX-PCAs also provide:

- support for the FX-DIS17 remote display for monitoring and commanding of I/O and configuration parameters

Table 3: FX-PCA Series Point Type Counts Per Model

Point Types	Signals Accepted	FX-PCA2611	FX-PCA2612-1, -2
Universal Input (UI)	Analog Input, Voltage Mode, 0–10 VDC Analog Input, Current Mode, 4–20 mA Analog Input, Resistive Mode, 0–2k ohm, RTD (1k NI [Johnson Controls], 1k PT, A99B SI), NTC (10k Type L, 2.252k Type 2) Binary Input, Dry Contact Maintained Mode	6	5
Binary Input (BI)	Dry Contact Maintained Mode Pulse Counter/Accumulator Mode (High Speed), 100 Hz	2	4
Analog Output (AO)	Analog Output, Voltage Mode, 0–10 VDC Analog Current Mode, 4–20 mA	2	
Binary Output (BO)	24 VAC Triac	3	
Configurable Output (CO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac	4	4
Relay Output (RO)	Relay Output: Single-Pole, Double-Throw (SPDT) Relay Output: Single-Pole, Single-Throw (SPST)		2 - SPDT 3 - SPST

Expansion Input/Output Module (FX-PCX)

The FX-PCXs are expansion I/O modules with integral RS-485 MS/TP communications.

FX-PCXs can serve in one of two capacities, depending on where they are installed in the FX system. When installed on the SA Bus of an FX-PCV, FX-PCG, or FX-PCA controller, the FX-PCXs expand the point count of these controllers. When installed on the FC Bus, FX-PCXs can be used as I/O point multiplexors to support monitoring and control from an FX Supervisory Controller. The point multiplexor can also be useful for sharing points between other FX-PC controllers on the FC Bus using peer-to-peer connectivity.

A full range of FX-PCV, FX-PCG, and FX-PCA models combined with the FX-PCX models can be applied to a wide variety of building applications ranging from simple fan coil or heat pump control to air handlers to advanced central plant management.

Figure 7: FX-PCX1711



Features

In addition to the features and benefits listed in [FX-PC Controller Features](#), FX-PCXs provide the following:

- ability to reside on the FC Bus or SA Bus provides application flexibility

Table 4: FX-PCX Series Point Type Counts Per Model

Point Types	Signals Accepted	FX-PCX 1711	FX-PCX 2711	FX-PCX 2721	FX-PCX 3711	FX-PCX 3721	FX-PCX 3731	FX-PCX 4711
Universal Input (UI)	Analog Input, Voltage Mode, 0–10 VDC Analog Input, Current Mode, 4–20 mA Analog Input, Resistive Mode, 0–2k ohm, RTD (1k NI [Johnson Controls], 1k PT, A99B SI), NTC (10k Type L, 2.252k Type 2) Binary Input, Dry Contact Maintained Mode		2	8	4			6
Binary Input (BI)	Dry Contact Maintained Mode Pulse Counter/Accumulator Mode (High Speed), 100 Hz	4				16	8	2
Analog Output (AO)	Analog Output, Voltage Mode, 0–10 VDC Analog Output, Current Mode, 4–20 mA			2				2
Binary Output (BO)	24 VAC Triac						8	3

Table 4: FX-PCX Series Point Type Counts Per Model

Point Types	Signals Accepted	FX-PCX 1711	FX-PCX 2711	FX-PCX 2721	FX-PCX 3711	FX-PCX 3721	FX-PCX 3731	FX-PCX 4711
Universal Output (UO)	Analog Output, Voltage Mode, 0–10 VDC		2		4			
	Binary Output Mode, 24 VAC/DC FET							
	Analog Output, Current Mode, 4–20 mA							
Configurable Output (CO)	Analog Output, Voltage Mode, 0–10 VDC							4
	Binary Output Mode, 24 VAC Triac							
Relay Output (RO)	120/240 VAC		2		4			

FX-PCV1610/1620 Programmable VAV Box Controller Series

FX-PCV1610/1620 are 16-bit, programmable VAV box controllers with RS-485 MS/TP communications. FX-PCV1610/1620 controllers feature an integral 4 N•m damper actuator and Differential Pressure Transducer (DPT) with models for cooling only or cooling with reheat applications and fan control.

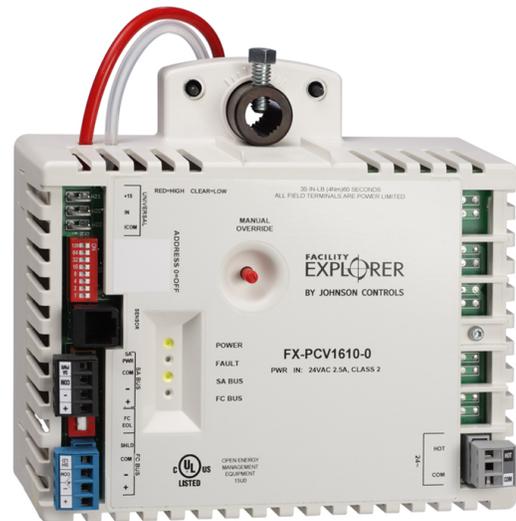
The differential pressure sensor in the FX-PCV1610/1620 controllers provides consistent flow readings with minimal drift and requires minimal auto-zero calibration. There are no filters to change, which helps to ensure very close tolerance to published accuracy.

The FX-PCV1610/1620 controllers can be configured single-duct, dual-duct, and supply/exhaust applications. Note that some of these applications may require an additional actuator and DPT.

FX-PCV1610/1620 controllers support NS and FX-WRZ Series Communicating Network Sensors for temperature sensing, fan override, and occupancy override control.

FX-PCV1610/1620 Series Controllers support wireless communications using the FX-ZFR Series accessories.

Figure 8: FX-PCV1610/1620 Controller



Features

In addition to the features and benefits listed in [FX-PC Controller Features](#), FX-PCV1610/1620s provide the following:

- Integrated differential air-pressure sensor and actuator reduces installation time.
- Fast response actuator drives the damper from full open to full closed (90°) in 60 seconds to reduce commissioning time.
- Point capacity can be expanded by adding FX-PCXs to the SA Bus, providing further application flexibility.

Installation

Field mounting the FX-PCV1610/1620 controllers is straightforward. The FX-PCV1610/1620 controllers require minimal wiring and are mounted to the terminal box using a single sheet metal screw and a single set screw to lock the actuator to the damper shaft. The set screw has a self-locking cup point end to resist loosening due to vibration.

The actuator coupling is serrated, providing additional damper shaft grip and minimizing shaft slippage during operation. The coupling accommodates shafts from 10 mm (3/8 in.) square and up to 13 mm (1/2 in.) diameter round. A gear release lever allows easy resetting of the damper to full open or full close.

The housing dimensions of the FX-PCV1610/1620 controllers meet industry mounting requirements and make the controllers easy to handle.

The controller address can be unique for each FX-PCV1610/1620 using the DIP switches that are accessible through the FX-PCV1610/1620 controller housing.

FX-PCV1615/1630 Programmable VAV Box Controller Series

FX-PCV1615/1630s are programmable, 32-bit digital controllers tailored for VAV box control applications that communicate via the BACnet MS/TP protocol. The FX-PCV1615/1630 controllers feature an integral digital pressure sensor, an integral damper actuator, and a 32-bit microprocessor. The controllers' small package size facilitates quick field installation and efficient use of space, while not compromising high-tech control performance. The FX-PCV1615/1630 controllers connect easily to the NS Series Network Sensors for zone and discharge air temperature sensing.

These features make the FX-PCV1615/1630 the product of choice for VAV box control. The wide variety of network sensor models provides options for measuring and displaying zone temperature, occupancy detection, duct temperature, zone humidity and dewpoint determination, carbon dioxide (CO₂) level, setpoint adjustments, VAV box fan speed control, and discharge air temperatures.

The FX-PCV1615 model is designed for cooling only VAV box control applications, while the FX-PCV1630 model is better suited for cooling with reheat VAV and fan control applications.

Figure 9: FX-PCV1615 Controller



FX-PCV1615/1630 Features

In addition to the features and benefits listed in [FX-PCV Controller Features](#), FX-PCV1615/1630s provide the following:

- 33 percent smaller package than the FX-PCV1610/1620.
- two additional Universal Inputs (three total) that allow an increased number of low cost sensor options.
- state-of-the-art, digital non-flow pressure sensor to provide 14-bit resolution with bidirectional flow operation that supports automatic correction for polarity on high- and low-pressure DP tube connections. This pressure sensor eliminates high- and low-pressure connection mistakes.
- ZigBee Wireless FC/SA Bus Interface to provide a wireless alternative to hard-wired FX systems, while providing application flexibility, mobility, and minimal disruption to building systems.
- phone jack-style connector on FC Bus and SA Bus to support quick connection to the FX-BTCVT Bluetooth Commissioning Converter, FX-ZFR1811 wireless router, and NS Series Network Sensors.
- fast response actuator that drives the damper from full open to full closed (90°) in 60 seconds to reduce commissioning time.

Table 5: FX-PCV1610 and FX-PCV1620 Series Point Type Counts per Model

Point Types	Signals Accepted	FX-PCV1610	FX-PCV1620
Universal Input (UI)	Analog Input, Voltage Mode, 0–10 VDC 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	1	1
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	1
Integrated Flow Sensor	Internal	1	1
Zone Sensor Input	On SA Bus ¹	Up to 4 NS Series Network Sensors Up to 9 FX-WRZ sensors when using the FX-ZFR1811 wireless router configuration and up to 5 FX-WRZ sensors when using the one-to-one FX-WRZ7860 wireless receiver	

¹ A total of 10 MS/TP master addresses (FX-PCXs), not including sensor addresses (MS/TP slaves), can be used in a single FX-PCV controller.

Table 6: FX-PCV1615 and FX-PCV1630 Series Point Type Counts per Model

Point Types	Signals Accepted	FX-PCV1615	FX-PCV1630
Modular Jacks		6-pin SA Bus with four communicating sensors and 6-pin FC Bus for tool support.	
Universal Input (UI)	Analog Input, Voltage Mode, 0–10 VDC 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	3
Binary Output (BO)	24 VAC Triac	2	3
Configurable Output (CO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac		2
Integrated Actuator	Internal	1	1
Integrated Flow Sensor	Internal	1	1
Zone Sensor Input	On SA Bus ¹	Up to 4 NS Series Network Zone Sensors Up to 9 FX-WRZ sensors when using the FX-WFR1811 wireless router configuration and up to 5 FX-WRZ sensors when using the one-to-one FX-WRZ7860 wireless receiver	

¹ A total of 10 MS/TP master addresses (FX-PCXs), not including sensor addresses (MS/TP slaves), can be used in a single FX-PCV controller.

Panel and Sub-Panel Assembly Options

FX-PCG, FX-PCA, and FX-PCX controllers are also available in pre-wired panels and sub-panel assemblies. The panelized controller options provide all of the controllers necessary for a complete application solution, including a pre-wired power source and a latching or lockable door.

Note: FX-PC controllers in pre-built panels and sub-panel assemblies are available for purchase **only** in North America.

Bluetooth Commissioning Converter (FX-BTCVT)

The Bluetooth Commissioning Converter (FX-BTCVT) provides a temporary Bluetooth connection between FX-PC Series Controllers and the laptop computer used to commission them. It allows technicians to commission and service the controllers over a wireless connection ([Figure 10](#)).

The FX-BTCVT Bluetooth Commissioning Converter provides communication from the BACnet MS/TP FC Bus or the SA Bus to a Bluetooth-enabled computer running the FX-PCT software. Any FX-PC controller on an FC Bus can be commissioned by connecting to any other FX-PC controller, any NS Series Sensor, or any FX-PCX connected to any FX-PC controller on the bus.

The 2.4 GHz Bluetooth connection allows for you to be up to 10 m (33 ft) away while you commission the controller with a laptop computer and the FX-PCT software.

Figure 10: Bluetooth Commissioning Converter



Features

The Bluetooth Commissioning Converter (FX-BTCVT) provides the following features:

- Bluetooth wireless communication provides a secure and reliable untethered connection between the laptop and the FX-PC controllers.
- Standard connection jacks on both the NS Series Sensors and FX-PC controllers provide multiple connection points to the system.
- The Bluetooth Commissioning Converter allows online access to controllers while the technician is using the Bluetooth-enabled laptop.
- Standard Bluetooth technology allows you to use a Bluetooth-enabled laptop or any laptop with a commercial off-the-shelf Bluetooth adapter.

Handheld VAV Box Balancing Tool (FX-ATV7003)

The Handheld VAV Box Balancing Tool (FX-ATV7003) lets you set the parameters for VAV box applications that reside on FX-PC Series Controllers.

The VAV box balancing parameters appear on the tool's LCD. A dial and two buttons let you navigate through intuitive menus to balance the VAV box. The menus are customized to the type of application residing in the controller. The balancing operation features an adjustable time-out parameter that returns the tool and controller to normal operation if you leave the controller in balancing mode.

The Handheld VAV Box Balancing Tool is lightweight and portable. It can plug into any model of network sensor to access the VAV box controller.

The Handheld VAV Box Balancing Tool is compatible with the following FX-PC Series devices:

- FX-PCV loaded with a VAV application
- FX-PCG or FX-PCA loaded with a VAV application
- NS Series Network Sensor connected to an FX-PCV, FX-PCG, or FX-PCA loaded with a VAV box application

Figure 11: Handheld VAV Box Balancing Tool



Features

The Handheld VAV Box Balancing Tool provides the following features:

- Allows VAV box balancing and commissioning without a laptop.
- Connects directly to the controller or the controller NS Series Network Sensor via standard RJ-12 plug.
- Intuitive, menu-driven operation simplifies balancing tasks.

Network Sensors

The NS Series Network Sensor offering includes NS Series Network Zone Sensors and NS Series Network Discharge Air Sensors ([Figure 12](#)).

Figure 12: Network Zone Sensors and Discharge Air Sensors



The NS Series Network Zone Sensors are designed to function directly with FX-PC Series Controllers. Several models of network zone sensors monitor room temperature. Options are available to also monitor zone humidity, carbon dioxide (CO₂), occupancy local temperature setpoint adjustments, and other variables. This data is transmitted to an FX-PC controller on the SA Bus.

The NS Series Network Zone Sensors include models with a temperature setpoint dial and LCD that allows occupants to view the zone temperature and view and adjust the zone temperature setpoint. A fan mode push button is included to set the desired fan speed (AUTO-OFF-low-medium-high). An occupancy override function allows the user to signal the controller that the zone is occupied to override the scheduled mode. Some models have DIP switches to set a unique address for applications that require multiple sensors.

For communication wiring flexibility, the wires connecting the network zone sensor to a controller can be terminated using a modular jack or screw terminals.

Each network zone sensor includes an SA Bus access port to allow accessories to access the SA Bus. This plug allows accessories to service or commission the connected controller or gain access to any other controller on the same FC Bus.

The NS Series Network Discharge Air Sensors are electronic duct sensors designed to function directly with the FX-PC controllers. Models in this series monitor the duct temperature, typically at the discharge of the VAV box, and transmit this data to an FX-PC controller on the SA Bus using the 10 ft (305 cm) wiring lead included with the unit. The 10 ft (305 cm) wiring lead consists of four 22 AWG trade size color-coded wires encased in a plenum-rated jacket. Each of the wires is stripped and tinned for easy connection to the SA Bus screw terminal block.

The NS Series Network Discharge Air Sensors are available with either a 4 or 8 in. (102 or 203 mm) temperature probe. All models include DIP switches for applications requiring multiple discharge air sensors, each with a unique DIP switch address.

Refer to the *NS Series Network Sensors Product Bulletin (LIT-12011574)* for important product application information, ordering information, and technical specifications.

FX-ZFR Series Wireless Field Bus System

The FX-ZFR Wireless Field Bus System provides wireless monitoring and control of HVAC equipment within multiple levels of an FX system using BACnet protocol over 2.4 GHz ZigBee Wireless to communicate between FX Supervisory controllers and room temperature sensors.

Any FX-PC controller can be wirelessly enabled using an FX-ZFR1811 Wireless Field Bus Router. One router is required per FX-PC controller. This pairing is referred to as a Wireless Enabled Programmable Controller (WEPC).

Figure 13: FX-ZFR Field Bus System Components



An FX-ZFR Wireless Field Bus System consists of:

- up to 8 FX-ZFR1810 Wireless Field Bus Coordinators per field bus
- up to 35 WEPCs per coordinator
- up to 9 FX-WRZxxx Series wireless sensors per controller
- additional FX-ZFR1811 Wireless Field Bus Routers connected to FX-ZFRRPT-0, as required, acting as repeaters

Together, these components create a wireless mesh network that allows the exchange of data between the collection of devices within the FX-ZFR Wireless Field Bus System's wireless network and wired BACnet MS/TP devices.

Use the FX-ZFRRPT-0 optional repeater power supply with an FX-ZFR1811 router to serve as a repeater to extend wireless mesh networks and provide multiple wireless transmission pathways.

Features

The FX-ZFR Wireless Field Bus System provides the following features:

- Wireless communications for an FX system provides a wireless platform for FX-PC controllers across multiple levels of an FX system – from FX Supervisory Controllers, to FX-PC controllers, to room sensors. Enables wireless devices to coexist with hard-wired devices on the same FX network. Offers simple add-on hardware to seamlessly enable standard hard-wired FX-PC controllers to function wirelessly.
- Wireless mesh network enables quick, economical, and low-maintenance installation; minimizes MS/TP BACnet hard wiring; enhances reliability through automatically forming wireless links and redundant wireless data transmission paths.
- Support of up to nine wireless room sensors per wirelessly enabled programmable controller facilitates temperature averaging and high/low selection to optimize comfort in larger zones.

Refer to the *FX-ZFR Wireless Field Bus System Product Bulletin (LIT-12011686)* for additional information.

ZigBee Wireless USB Dongle

Figure 14: ZigBee Wireless USB Dongle



The ZigBee Wireless USB Dongle allows a laptop computer to connect to a ZigBee Field Router (FX-ZFR1811) wireless field bus for the purpose of commissioning and downloading applications to wirelessly enabled programmable controllers using the FX-PCT or for analyzing an FX-ZFR wireless mesh using the FX-ZFR Checkout Tool (FX-ZCT). The ZigBee Wireless USB Dongle requires a USB software driver which is installed automatically with FX-PCT Version 5.3 or higher. No user configuration is required.

Repair Information

If an FX-PC Series Controller, network sensor, or any related product fails to operate within its specifications, replace the product. For replacement products, contact the nearest Johnson Controls® representative.

Ordering Information

Contact your Johnson Controls representative to order FX-PC Series Controllers and related products. See [FX-PCG Series Ordering Information](#), [FX-PCA Series Ordering Information](#), [Input/Output Module \(IOM\) Series Ordering Information](#), [FX-PCV1610 and FX-PCV1620 Series Ordering Information](#), and [FX-PCV1615 and FX-PCV1630 Series Ordering Information](#) for product code numbers and product descriptions.

Table 7: FX-PCG Series Ordering Information

Product Code Number	Description
FX-PCG1611-0	10-Point General Purpose Programmable Controller with 2 UI, 1 BI, 3 BO, and 4 CO; 24 VAC; FC and SA Bus Support
FX-PCG1611-0ET	FX-PCG1611 Extended Temperature Controller for Rooftop Applications. Supports Operational Temperature Range of -40 to 70°C.
FX-PCG1621-0	10-Point General Purpose Programmable Controller with 2 UI, 1 BI, 3 BO, and 4 CO; 24 VAC; FC and SA Bus Support; Integral Display and 6-Button Navigation Touch Pad
FX-PCG2611-0	17-Point General Purpose Programmable Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC; FC and SA Bus Support
FX-PCG2611-0ET	FX-PCG2611 Extended Temperature controller for rooftop applications. Supports Operational Temperature Range of -40 to 70°C.
FX-PCG2621-0	17-Point General Purpose Programmable Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC; FC and SA Bus Support; Integral Display and 6-Button Navigation Touch Pad

Table 8: FX-PCA Series Ordering Information

Product Code Number	Description
FX-PCA2611-0	17-Point Advanced Application Programmable Controller with 6 UI, 2 BI, 4 CO, 3 BO, and 2 AO; 24 VAC; SA Bus; FC Bus; Integral Real-time Clock
FX-PCA2612-1	18-Point Advanced Application Programmable Controller with 5 UI, 4 BI, 4 CO, 2 SPDT RO, and 3 SPST RO; 24 VAC; SA Bus; FC Bus; Integral Real-time Clock
FX-PCA2612-2	18-Point Advanced Application Programmable Controller with 5 UI, 4 BI, 4 CO, 2 SPDT RO, and 3 SPST RO; 100-250 VAC; SA Bus; FC Bus; Integral Real-time Clock

Table 9: FX-PCV1610 and FX-PCV1620 Series Ordering Information

Product Code Number	Description
FX-PCV1610-0	16-bit, 1-Point Programmable VAV Box Controller with Integrated Actuator and Pressure Sensor; 1 UI; 24 VAC; FC and SA Bus Support (Cooling only)
FX-PCV1620-0	16-bit, 6-Point Programmable VAV Box Controller with Integrated Actuator and Pressure Sensor; 1 UI, 3 BO, and 2 CO; 24 VAC; FC and SA Bus (for Reheat and Fan Control)

Table 10: FX-PCV1615 and FX-PCV1630 Series Ordering Information

Product Code Number	Description
FX-PCV1615-0	32-bit, 5-Point Programmable VAV Box Controller with Integrated Actuator and Pressure Sensor: 3 UI and 2 BO; 24 VAC; FC and SA Bus
FX-PCV1630-0	32-bit, 8-Point Programmable VAV Box Controller with Integrated Actuator and Pressure Sensor: 3 UI, 3 BO, and 2 CO; 24 VAC; FC and SA Bus

Table 11: FX-PCX Series Ordering Information

Product Code Number	Description
FX-PCX1711-0	4-Point Expansion I/O Module with 4 BI, FC and SA Bus Support
FX-PCX2711-0	6-Point Expansion I/O Module with 2 UI, 2 UO, 2 BO, FC and SA Bus Support

Table 11: FX-PCX Series Ordering Information

Product Code Number	Description
FX-PCX2721-0	10-Point Expansion I/O Module with 8 UI, 2 AO, FC and SA Bus Support
FX-PCX3711-0	12-Point Expansion I/O Module with 4 UI, 4 UO, 4 BO, FC and SA Bus Support
FX-PCX3721-0	16-Point Expansion I/O Module with 16 BI, FC and SA Bus Support
FX-PCX3731-0	16-Point Expansion I/O Module with 8 BI, 8 BO, FC and SA Bus Support
FX-PCX4711-0	17-Point Expansion I/O Module with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, 24 VAC, FC and SA Bus Support

Table 12: FX-PC Family Accessories (Order Separately)

Product Code Number	Description
FX-DIS1710-0	Local Controller Display
FX-BTCVT-1	Bluetooth Commissioning Converter
TL-BRTRP-0	Portable BACnet/IP to MS/TP Router
FX-ATV7003-0	Handheld VAV Box Balancing Tool
FX-ZFR1810-0	Wireless Field Bus Coordinator, 10 mW Transmission Power. Functions with FX Supervisory Controllers Enabled with BACnet MS/TP
FX-ZFR1811-0	Wireless Field Bus Router, 10 mW Transmission Power. Functions with FX-PC controllers and FX-WRZTx Series Wireless Sensors
FX-ZFRCBL-0	Wire Harness which allows an FX-PCV1610/1620 to be connected to an SA Bus device (Bluetooth Commissioning Converter, Local Controller Display, or NS Series Sensor) when its SA Bus RJ-12 jack is occupied by an FX-ZFR1811 router.
FX-BTCVTCBL-700	Cable Replacement Set for the FX-BTCVT-1 or the FX-ATV7003-0; Includes One 5 ft (1.5 m) Retractable Cable
FX-WRZ Series Wireless Sensors	FX-WRZ Series Wireless Sensors: Refer to the <i>FX-WRZ Series Wireless Room Sensors Product Bulletin (LIT-12011687)</i> for specific sensor model descriptions.
NS Series Sensors	NS Series Network Sensors: Refer to the <i>NS Series Network Sensors Product Bulletin (LIT-12011574)</i> for specific sensor model descriptions.
Y64T15-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 92 VA, Foot Mount, 30 in. Primary Leads and 30 in. Secondary Leads, Class 2
Y65A13-0	Transformer, 120 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AS), 8 in. Primary Leads and 30 in. Secondary Leads, Class 2
Y65T42-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Hub Mount (Y65SP+), 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+), 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 Lug
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
AP-TBK4FC-0	Replacement MS/TP FC Bus Terminal, 4-Position Connector, Blue, Bulk Pack
AP-TBK3PW-0	Replacement Power Terminal, 3-Position Connector, Gray, Bulk Pack
MS-TBKLV03-0	Terminal Block Kit - FX-PCA Line Voltage AC Power - 3 Pieces
MS-TBKRO02-0	Terminal Block Kit -FX-PCA 2-Position Relay Output - 9 Pieces
MS-TBKRO03-0	Terminal Block Kit - FX-PCA 3-Position Relay Output - 6 Pieces
MS-TBKCO04-0	Terminal Block Kit - FX-PCA 4-Position Configurable Output - 6 Pieces
MS-TBKUI04-0	Terminal Block Kit - FX-PCA 4-Position Universal Input - 3 Pieces
MS-TBKUI05-0	Terminal Block Kit - FX-PCA 5-Position Universal Input - 3 Pieces
FX-PCVACT-701	FX-PCV1615/1630 Actuator Assembly Gearbox Replacement Kit (Canada Only)

Table 12: FX-PC Family Accessories (Order Separately)

Product Code Number	Description
NS-WALLPLATE-0	Network Sensor Wall Plate
FX-WRZ7860-0	One-to-One ZigBee Wireless Receiver for Wireless Sensor Only Applications
FX-WRZSST-120	Wireless Sensing System Tool Kit
ZFR-USBHA-0	USB dongle with ZigBee driver to provide a wireless connection through FX-PCT to allow wireless commissioning of the wirelessly enabled FX-PC controllers. The dongle is used with the FX-ZFR Checkout Tool to troubleshoot and validate FX-ZFR wireless meshes using a laptop computer.

FX-PCG Series Technical Specifications

Table 13: FX-PCG Series Technical Specifications

Product Code Numbers	FX-PCG1611-0 – 10-Point General Purpose Programmable Controller FX-PCG2611-0 – 17-Point General Purpose Programmable Controller FX-PCG1621-0 – 10-Point General Purpose Programmable Controller with Integral Display and Push Button User Interface FX-PCG2621-0 – 17-Point General Purpose Programmable Controller with Integral Display and Push Button User Interface
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	14 VA maximum for FX-PCG1611 and FX-PCG2611 (no integral display) 20 VA maximum for FX-PCG1621 and FX-PCG2621 (with integral display) Note: VA ratings do 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 84 VA (maximum).
Ambient Conditions	Operating: 0 to 50°C (32 to 122°F); 10 to 90% RH noncondensing Storage: -40 to 80°C (-40 to 176°F); 5 to 95% RH noncondensing Note: FX-PCG models with an -0ET suffix have an operating temperature range of -40 to 70°C (-40 to 158°F).
Controller Addressing	DIP switch set; valid controller device addresses 4–127 (Device addresses 0–3 and 128–255 are reserved and not valid controller addresses.)
Communications Bus¹	BACnet MS/TP, RS-485: 3-wire FC Bus between the FX Supervisory Controller and FX-PC controllers 4-wire SA Bus between FX-PC controller, NS Series Network Sensors, and other sensor/actuator devices, includes a lead to source 15 VDC supply power (from FX-PC controller) to bus devices
Processor	H8SX/166xR Renesas® microcontroller
Memory	1 MB Flash Memory and 512 KB Random Access Memory (RAM)

Table 13: FX-PCG Series Technical Specifications

Input and Output Capabilities	<p>FX-PCG16 Models:</p> <p>2 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact</p> <p>1 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode</p> <p>3 - Binary Outputs: Defined as 24 VAC Triac (selectable internal or external source power)</p> <p>4 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO</p> <p>FX-PCG26 Models:</p> <p>6 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact</p> <p>2 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode</p> <p>3 - Binary Outputs: Defined as 24 VAC Triac (selectable internal or external source power)</p> <p>4 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO</p> <p>2 - Analog Outputs: Defined as 0–10 VDC or 4–20 mA</p>
Analog Input/Analog Output Resolution and Accuracy	<p>Analog Input: 16-bit resolution</p> <p>Analog Output: 16-bit resolution and ± 200 mV in 0–10 VDC applications</p>
Terminations	<p>Input/Output: Fixed Screw Terminal Blocks</p> <p>FC Bus, SA Bus, and Supply Power: 3-wire and 4-wire Pluggable Screw Terminal Blocks</p> <p>FC Bus Port and Sensor Port: RJ-12 6-pin Modular Jacks</p>
Mounting	<p>Horizontal on single 35 mm DIN rain mount (preferred), or screw mount on flat surface with three integral mounting clips on controller</p>
Housing	<p>Enclosure material: ABS and polycarbonate UL94 5VB; self-extinguishing; Plenum-rated protection class: IP20 (IEC529)</p>
Dimensions (Height x Width x Depth)	<p>FX-PCG16 Models: 150 x 164 x 53 mm (5-7/8 x 6-7/16 x 2-1/8 in.) including terminals and mounting clips</p> <p>FX-PCG26 Models: 150 x 190 x 53 mm (5-7/8 x 7-1/2 x 2-1/8 in.) including terminals and mounting clips</p> <p>Note: Mounting space for all FX-PC controllers requires an additional 50 mm (2 in.) space on top, bottom, and front face of controller for easy cover removal, ventilation, and wire terminations.</p>
Weight	<p>FX-PCG16 Models: 0.4 kg (0.9 lb)</p> <p>FX-PCG26 Models: 0.5 kg (1.1 lb)</p>
Compliance	<p>United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; FCC Compliant to CFR47, Part 15, Subpart B, Class A</p> <p>Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003</p> <p>Europe: CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.</p> <p>Note: For FX-PCG26 models, conducted RF Immunity within EN 61000-6-2 meets performance criteria B.</p> <p>Australia and New Zealand: C-Tick Mark, Australia/NZ Emissions Compliant</p> <p>BACnet International: BACnet Testing Laboratories™ (BTL) 135-2004 Protocol Revision 4 Listed BACnet Application Specific Controller (B-ASC)</p>

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

FX-PCA Series Technical Specifications

Table 14: FX-PCA Series Technical Specifications

Product Code Numbers	<p>FX-PCA2611-0 – 17-Point Advanced Application Programmable Controller with Integral Real-Time Clock and 24 VAC Supply Power</p> <p>FX-PCA2612-1 – 18-Point Advanced Application Programmable Controller with Integral Real-Time Clock and 24 VAC Supply Power</p> <p>FX-PCA2612-2 – 18-Point Advanced Application Programmable Controller with Integral Real-Time Clock and 100–250 VAC Supply Power</p>
Supply Voltage	<p>FX-PCA2611-0 and FX-PCA2612-1: 24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, Power Supply Class 2 (North America), SELV (Europe)</p> <p>FX-PCA2612-2: 100–250 VAC 50/60 Hz</p>
Power Consumption	<p>25 VA maximum</p> <p>Note: VA ratings do 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 84 VA (maximum).</p>
Ambient Conditions	<p>Operating: 0 to 50°C (32 to 122°F); 10 to 90% RH noncondensing</p> <p>Storage: -40 to 80°C (-40 to 176°F); 5 to 95% RH noncondensing</p>
Controller Addressing	<p>DIP switch set; valid controller device addresses 4–127</p> <p>(Device addresses 0–3 and 128–255 are reserved and not valid controller addresses.)</p>
Communications Bus	<p>BACnet MS/TP, RS-485:</p> <p>3-wire FC Bus between the FX Supervisory Controller and FX-PC controllers</p> <p>4-wire SA Bus between FX-PC controller, NS Series Network Sensors, and other sensor/actuator devices, includes a lead to source 15 VDC supply power (from FX-PC controller) to bus devices.</p>
Processor	H8SX/166xR Renesas microcontroller
Memory	4 MB Flash Memory and 1 MB Random Access Memory (RAM)

Table 14: FX-PCA Series Technical Specifications

<p>Input and Output Capabilities</p>	<p>FX-PCA2611-0:</p> <p>6 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact</p> <p>2 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode</p> <p>2 - Analog Outputs: Defined as 0–10 VDC or 4–20 mA</p> <p>3 - Binary Outputs: Defined as 24 VAC Triac (selectable internal or external source power)</p> <p>4 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO</p> <p>FX-PCA2612-1 and FX-PCA2612-2:</p> <p>5 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact</p> <p>4 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode</p> <p>4 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO</p> <p>2 - Relay Outputs: (Single-Pole, Double-Throw) Rated as:</p> <ul style="list-style-type: none"> • 240 VAC maximum voltage • 1/3 hp 125 VAC, 1/2 hp 250 VAC • 400 VA Pilot Duty at 240 VAC • 200 VA Pilot Duty at 120 VAC • 3 A Noninductive 24–240 VAC <p>3 - Relay Outputs: (Single-Pole, Single-Throw) Rated as:</p> <ul style="list-style-type: none"> • 240 VAC maximum voltage • 1/3 hp 125 VAC, 1/2 hp 250 VAC • 400 VA Pilot Duty at 240 VAC • 200 VA Pilot Duty at 120 VAC • 3 A Non-inductive 24–240 VAC
<p>Analog Input/Analog Output Resolution and Accuracy</p>	<p>Analog Input: 16-bit resolution</p> <p>Analog Output: 16-bit resolution and ± 200 mV in 0–10 VDC applications</p>
<p>Terminations</p>	<p>Input/Output: Fixed Terminal Blocks on FX-PCA2611-0 and Pluggable Terminal Blocks on FX-PCA2612-1 and FX-PCA2612-2</p> <p>FC Bus, SA Bus, and Supply Power: 3-wire and 4-wire Pluggable Screw Terminal Blocks</p> <p>FC Bus and SA Bus: RJ-12 6-pin Modular Jacks</p>
<p>Mounting</p>	<p>Horizontal on single 35 mm DIN rain mount (preferred), or screw mount on flat surface with three integral mounting clips on controller</p>
<p>Housing</p>	<p>Enclosure material: ABS and polycarbonate UL94 5VB; self-extinguishing; Plenum-rated Protection Class: IP20 (IEC529) (except the FX-PCA2612 controller)</p>
<p>Dimensions (Height x Width x Depth)</p>	<p>FX-PCA2611-0: 150 x 190 x 53 mm (5-7/8 x 7-1/2 x 2-1/8 in.) including terminals and mounting clips</p> <p>FX-PCA2612-x Models: 150 x 164 x 53 mm (5-7/8 x 6-7/16 x 2-1/8 in.) including terminals and mounting clips</p> <p>Note: Mounting space for FX-PCA26 models requires an additional 50 mm (2 in.) space on top, bottom, and front face of controller for easy cover removal, ventilation, and wire terminations.</p>
<p>Weight</p>	<p>0.5 kg (1.1 lb)</p>

Table 14: FX-PCA Series Technical Specifications

	United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; FCC Compliant to CFR47, Part 15, Subpart B, Class A
	Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003
	Europe: CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC. Johnson Controls, Inc., declares that the FX-PCA2612-2 model is also in compliance with the essential requirements and other relevant provisions of the Low Voltage Directive 2006/95/EC.
	Australia and New Zealand: C-Tick Mark, Australia/NZ Emissions Compliant
	BACnet International: BACnet Testing Laboratories™ (BTL) 135-2004 Protocol Revision 7 Listed BACnet Advanced Application Specific Controller (B-AAC)

FX-PCX Series Technical Specifications

Table 15: FX-PCX Series Technical Specifications

Product Code Numbers	FX-PCX1711-0 - 4-Point Expansion Input/Output Module with 4 BI, FC Bus and SA Bus Support FX-PCX2711-0 - 6-Point Expansion Input/Output Module with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support FX-PCX2721-0 - 10-Point Expansion Input/Output Module with 8 UI, 2 AO, FC Bus, and SA Bus Support FX-PCX3711-0 - 12-Point Expansion Input/Output Module with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support FX-PCX3721-0 - 16-Point Expansion Input/Output Module with 16 BI, FC Bus, and SA Bus Support FX-PCX3731-0 - 16-Point Expansion Input/Output Module with 8 BI, 8 BO, FC Bus, and SA Bus Support FX-PCX4711-0 - 17-Point Expansion Input/Output Module with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, 24 VAC, and SA Bus Support with Mounting Base
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	14 VA maximum Note: VA ratings do 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 84 VA (maximum), depending on the FX-PCX model.
Ambient Conditions	Operating: 0 to 50°C (32 to 122°F); 10 to 90% RH noncondensing Storage: -40 to 80°C (-40 to 176°F); 5 to 95% RH noncondensing
Addressing	DIP switch set; valid controller device addresses 4–127 (Device addresses 0–3 and 128–255 are reserved and not valid FX-PCX addresses).
Communications Bus¹	BACnet MS/TP, RS-485 3-wire FC Bus between the FX Supervisory Controller and FX-PC controllers 4-wire SA Bus between FX-PC controller, NS Series Network Sensors, and other sensor/actuator devices. includes a lead source 15 VDC supply power (from FX-PC controller) to bus devices.
Processor	H8SX/166xR Renesas 32-bit microcontroller
Memory	512 KB Flash Memory and 128 KB Random Access Memory (RAM)

Table 15: FX-PCX Series Technical Specifications

Input and Output Capabilities	FX-PCX1711: 4 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/ Accumulator Mode
	FX-PCX2711: 2 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 2 - Universal Outputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode 2 - Relay Outputs (Single-Pole, Double-Throw) Rated as: • 240 VAC maximum voltage • 1/3 hp 125 VAC, 1/2 hp 250 VAC • 400 VA Pilot Duty at 240 VAC • 200 VA Pilot Duty at 120 VAC • 3 A Noninductive 24–240 VAC
	FX-PCX2721: 8 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 2 - Analog Outputs: Defined as 0–10 VDC or 4–20 mA
	FX-PCX3711 4 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 4 - Universal Outputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode 4 - Relay Outputs (Single-Pole, Double-Throw) Rated as: • 240 VAC maximum voltage • 1/3 hp 125 VAC, 1/2 hp 250 VAC • 400 VA Pilot Duty at 240 VAC • 200 VA Pilot Duty at 120 VAC • 3 A Noninductive 24–240 VAC
	FX-PCX3721: 16 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode
	FX-PCX3731 8 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode 8 - Binary Outputs: Defined as 24 VAC Triac (Require external low-voltage power source.)
	Input and Output Capabilities (Cont.)
Analog Input/Analog Output Resolution and Accuracy	Analog Input: 16-bit resolution Analog Output: 16-bit resolution and ± 200 mV in 0–10 VDC applications
Terminations	Input/Output: Fixed Screw Terminal Blocks SA/FC Bus and Supply Power: 4-wire and 3-wire Pluggable Screw Terminal Blocks SA/FC Bus Port: RJ-12 6-Pin Modular Jacks
Mounting	Horizontal on single 35 mm DIN rail mount (preferred), or screw mount on flat surface with three integral mounting clips on controller

Table 15: FX-PCX Series Technical Specifications

Housing	Enclosure material: ABS and polycarbonate UL94 5VB; self-extinguishing, Plenum-rated protection class: IP20 (IEC529)
Dimensions (Height x Width x Depth)	<p>FX-PCX171x-x and FX-PCX271x-x Models: 150 x 120 x 53 mm (5-7/8 x 4-3/4 x 2-1/8 in.) including terminals and mounting clips</p> <p>FX-PCX2721, FX-PCX3721, and FX-PCX3731 Models: 150 x 164 x 53 mm (5-7/8 x 6-7/16 x 2-1/8 in.) including terminals and mounting clips</p> <p>FX-PCX371x-x and FX-PCX471x-x Models: 150 x 190 x 53 mm (5-7/8 x 7-1/2 x 2-1/8 in.) including terminals and mounting clips</p> <p>Note: Mounting space for all controllers requires an additional 50 mm (2 in.) space on top, bottom, and front face of controller for easy cover removal, ventilation, and wire terminations.</p>
Weight	0.5 kg (1.1 lb) maximum
Compliance	<p>United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; FCC Compliant to CFR47, Part 15, Subpart B, Class A</p> <p>Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003</p> <p>Europe: CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.</p> <p>Note: For FX-PCX47xx Models, Conducted RF Immunity within EN 61000-6-2 meets performance criteria B.</p> <p>Australia and New Zealand: C-Tick Mark, Australia/NZ Emissions Compliant</p> <p>BACnet International: BACnet Testing Laboratories™ (BTL) 135-2004 Protocol Revision 4 Listed BACnet Application Specific Controller (B-ASC)</p>

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

FX-PCV1610 and FX-PCV1620 Series Technical Specifications

Table 16: FX-PCV1610 and FX-PCV1620 Series Technical Specifications

Product Code Numbers	<p>FX-PCV1610-0: 1-Point Programmable VAV Box Controller (Cooling Only)</p> <p>FX-PCV1620-0: 6-Point Programmable VAV Box Controller (Cooling with Reheat and Fan Control)</p>
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	<p>10 VA typical, 14 VA maximum</p> <p>Note: 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).</p>
Ambient Conditions	<p>Operating: 0 to 50°C (32 to 122°F)</p> <p>Storage: -40 to 70°C (-40 to 158°F)</p>
Terminations	<p>Inputs/Outputs: 6.3 mm (1/4 in.) Spade Lugs</p> <p>FC Bus, SA Bus, and Supply Power: 4-Wire and 3-Wire Pluggable Screw Terminal Blocks</p> <p>Sensor Port: RJ-12 6-Pin Modular Jacks</p>
Controller Addressing	<p>DIP switch set; valid controller device addresses 4–127</p> <p>(Device addresses 0–3 and 128–255 are reserved and not valid controller addresses.)</p>

Table 16: FX-PCV1610 and FX-PCV1620 Series Technical Specifications

Communications Bus¹	BACnet MS/TP, RS-485: 3-wire FC Bus between the FX Supervisory Controller and FX-PC controllers 4-wire SA Bus from the FX-PC controller, NS Series Network Sensors, and other sensor/actuator devices, includes a terminal to source 15 VDC supply power from FX-PCV to SA Bus devices
Processor	Renesas® 16-Bit H8S/166xR Microcontroller
Memory	1 MB Flash Memory and 512 KB Random Access Memory (RAM)
Input and Output Capabilities	FX-PCV1610: 1 - Universal Input: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact FX-PCV1620: 1 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 3 - Binary Outputs: Defined as 24 VAC Triac (internal power source) 2 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO
Analog Input/Analog Output Resolution and Accuracy	Analog Input: 15-bit resolution Analog Output: 16-bit resolution and ±200 mV in 0–10 VDC applications
Air Pressure Differential Sensor	Setra transducer, differential pressure to electrical, 0 to 0.375 kPa (0 to 1.5 in. WC) , 0.5 to 4.5 VDC output, 5 VDC supply, aluminum plated. Performance Characteristics Combined Repeatability and Hysteresis Error: ±0.05% of Full Span Maximum Non-linearity Errors (Best Fit Method): ±1.0% of Full Span Maximum Response Time (to within 63% of Full Scale Pressure with Step Change on Input): 15 ms Temperature Error from 15.6 to 48.9°C (60 to 120°F) Null: ±0.06% of Full Span per °F Maximum Span: ±1.5% of Full Span Maximum Stability, Null: ±0.5% of Full Scale Maximum, 1 Year Minimum Stability, Span: ±2.0% of Full Scale Maximum, 1 Year Minimum
Mounting	Mounts to damper shaft using single set screw and to duct with single mounting screw.
Actuator Rating	4 N•m (35 lb•in.) minimum shaft length = 44 mm (1-3/4 in.)
Dimensions	(Height x Width x Depth): 182 x 182 x 64 mm (7-3/16 x 7-3/16 x 2-1/2 in.) Center of Output Hub to Center of Anti Rotation Slot: 160 mm (6-5/16 in.) Note: Mounting space for all field controllers requires an additional 50 mm (2 in.) space on top, bottom, and front face of controller for easy cover removal, ventilation, and wire terminations.
Weight	0.86 kg (1.9 lb)

Table 16: FX-PCV1610 and FX-PCV1620 Series Technical Specifications

	United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; FCC Compliant to CFR47, Part 15, Subpart B, Class A
	Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003
	Europe: CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC and the Low Voltage Directive 2006/95/EC.
	Australia and New Zealand: C-Tick Mark, Australia/NZ Emissions Compliant
	BACnet International: BACnet Testing Laboratories™ (BTL) 135-2004 Listed BACnet Application Specific Controller (B-ASC)

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

FX-PCV1615 and FX-PCV1630 Series Technical Specifications

Table 17: FX-PCV1615 and FX-PCV1630 Series Technical Specifications

Product Code Numbers	FX-PCV1615-0: 5-point Programmable VAV Box Controller FX-PCV1630-0: 8-point Programmable VAV Box Controller
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 Note: 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 to 50°C (32 to 122°F) Storage: -40 to 70°C (-40 to 158°F)
Terminations	FX-PCV1615 and FX-PCV1630: 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 FC and SA Bus Modular Ports: RJ-12 6-Pin Modular Jacks
Controller Addressing	DIP switch set; valid controller device addresses 4–127 (Device addresses 0–3 and 128–255 are reserved and not valid controller addresses.)
Communications Bus ¹	BACnet MS/TP, RS-485: 3-wire FC Bus between the FX Supervisory Controller and FX-PC 4-wire SA Bus from the FX-PCV controller, NS Series Network Sensors, and other sensor/actuator devices, includes a terminal to source 15 VDC supply power from FX-PCV to SA Bus devices.
Processor	RX630 32-bit Renesas microcontroller
Memory	1 MB Flash Memory and 512 KB Random Access Memory (RAM)
Analog Input/Analog Output Accuracy	Analog Input: 15-bit resolution on UIs Analog Output: 0–10 VDC ± 200 mV
Air Pressure Differential Sensor	Range: -1.5 inches to 1.5 inches H ₂ O Performance Characteristics: Total Error Band: ±1.3% Full Span Maximum Accuracy: ±0.25% Full Scale Best Fit
Mounting	Mounts to damper shaft using single set screw and to duct with single mounting screw.
Actuator Rating	4 N•m (35 lb•in.) minimum shaft length = 44 mm (1-3/4 in.)

Table 17: FX-PCV1615 and FX-PCV1630 Series Technical Specifications

Dimensions	(Height x Width x Depth): 165 x 125 x 73 mm (6.5 x 4.92 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; FCC Compliant to CFR47, Part 15, Subpart B, Class A
	Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003
	Europe: CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.
	Australia and New Zealand: C-Tick Compliant (N1813), Australia/NZ Emissions Compliant.
	BACnet International: BACnet Testing Laboratories (BTL) 135-2010 Protocol Revision 4 Listed BACnet Application Specific Controller (B-ASC)

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

Bluetooth Commissioning Converter Technical Specifications

Table 18: Bluetooth Commissioning Converter Technical Specifications

Product Code	FX-BTCVT-1
Power Requirement	Nominal 15 VDC, supplied by the FX-PC controller SA/FC Bus Port
Power Consumption	1.35 watts maximum
Ambient Conditions	Operating: 0 to 50°C (32 to 122°F) 5 to 95% RH, Noncondensing, 30°C (86°F) Maximum Dew Point
	Storage: -40 to 85°C (-40 to 185°F), 5 to 95% RH, Noncondensing
Transmission Power	2.5 mW maximum
Transmission Speed	Wireless Communication: 115.2 bits per second (bps)
	Serial Communication (SA/FC Bus): 9600, 19.2k, 38.4k, or 76.8k bps
Transmission Range (Typical)	Wireless Communication: 10 m (33 ft) Line-of-Sight
Wireless Security	Security Mode 3 - Link Level Enforced Security
Network and Serial Interfaces	Bluetooth Wireless Technology
	One RS-485 Bus
Dimensions	116 x 75 x 35 mm (4.6 x 3.0 x 1.4 in.)
Housing	Black ABS Plastic Housing
	Blue PVC Protective Boot
Weight	0.165 kg (0.365 lb) without hanging components
Compliance 	United States: UL 916 Energy Management; Plenum-rated per UL1995 UL94-5VB Flammability Rating Transmitter complies with FCC Part 15.247 regulations for low-power unlicensed transmitters (Transmitter FCC Identification: CB2-MS-BTCVT-0) Receiver complies with FCC Part 15.109 regulations for low-power unlicensed receivers (Transmitter FFC Identification: CB2-MS-BTCVT-0)
	Canada: Industry Canada (IC: 279A-MSBTCVT0)
	Europe: CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the R&TTE Directive 1999/05/EC.
	Japan: Telecommunications Certification - 003NY05068 0000

Handheld VAV Box Balancing Tool Technical Specifications

Table 19: Handheld VAV Box Balancing Tool Technical Specifications

Product Code	FX-ATV7003-0
Supply Voltage	9.8 to 16.5 VDC; 15 VDC Nominal, supplied by the Sensor Actuator (SA) Bus Port
Current Consumption	90 mA maximum
Terminations	RJ-12, 6-Position Modular Jack
Transmission Speed	Serial Communication (SA Bus) 9600, 19.2k, 38.4k, or 76.8k bps
Sensor Addressing	Fixed address of 198
Ambient Conditions	Operating: 0 to 50°C (32 to 122°F); 5 to 95% RH, Noncondensing; 30°C (86°F) Maximum Dew Point Storage: -40 to 85°C (-40 to 185°F); 5 to 95% RH, Noncondensing
Dimensions	80 x 80 x 25 mm (3.2 x 3.2 x 1.0 in.)
Weight	0.165 kg (0.365 lb)
Compliance	<div style="display: flex; align-items: center;">  <p> United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; FCC Compliant to CFR47, Part 15, Subpart B, Class A Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment Industry Canada, ICES-003 Europe: CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC. Australia and New Zealand: C-Tick Mark, Australia/NZ Emissions Compliant BACnet International: BACnet Testing Laboratories™ (BTL) 135-2004 Listed BACnet Smart Sensor (B-SS) </p> </div>

North American Emissions Compliance for FX-PCG Series, FX-PCX Series, and FX-PCV Series Controllers

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.

North American Emissions Compliance for Bluetooth Commissioning Converters

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 Federal Communications Commission (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.

RF Transmitters: Compliance Statement (Part 15.19)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: This device may not cause harmful interference, and this device must accept any interference received, including interference that may cause undesired operation.

Warning (Part 15.21)

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

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.

RF Transmitters: Industry Canada Statement

The term IC before the certification/registration number only signifies that the Industry Canada technical specifications were met. Le terme «IC» précédant le numéro d'accréditation/inscription signifie simplement que le produit est conforme aux spécifications techniques d'Industry Canada.

Section 5.5 of RSS-210

This device has been designed to operate with an antenna having a maximum gain of 2 dBi. Antenna having a higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is 50 ohms. Cet appareil a été conçu pour fonctionner avec une antenne d'un gain maximum de 2 dBi. En application des réglementations d'Industry Canada, l'utilisation d'une antenne de gain supérieur est strictement interdite. L'impédance d'antenne requise est de 50 ohms.

Section 5.11 of RSS-210

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that required for successful communication. Pour réduire les interférences radio potentielles avec les dispositifs d'autres utilisateurs, le type d'antenne et son gain doivent être choisis de façon à ce que la puissance isotrope rayonnée équivalente (PIRE) ne soit pas supérieure à la puissance nécessaire pour une bonne communication.



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