FX-PCA2612-1 Advanced Application Programmable Controller Installation Instructions

FX-PCA2612-1

Part No. 24-10143-268, Rev. D
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Refer to the QuickLIT website for the most up-to-date version of this document.

Application

The FX-PCA2612-1 Advanced Application Programmable Controller is part of the Facility Explorer Programmable Controller (FX-PC) family. The FX-PCA26 Series controllers run pre-engineered and user-programmed applications and provide the inputs and outputs required to monitor and control a wide variety of HVAC equipment.

FX-PCA26 controllers operate on an RS-485 BACnet® Master-Slave/Token-Passing (MS/TP) Bus as BACnet Advanced Application Controllers (B-AACs) integrate into Johnson Controls® and third-party BACnet systems.

FX-PCA26 controllers include an integral real-time clock, which enables the controllers to monitor and control schedules, calendars, and trends, and operate for extended periods of time as stand-alone controllers when offline from the system network.

Switchable Communications Protocols

Release 10.1 of FX-PCT can be used to switch the Field Bus communications protocol in FX-PC Field Controllers to be either the standard BACnet® Master-Slave/Token-Passing (MS/TP) or the N2 protocol. BACnet MS/TP is the default communications protocol for all new controllers. Switchable communications protocols 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 FX-PCT, 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) or XT-Bus (System 91) devices (for example, XT, XTM, and XP modules)
- do not support passthru in the commissioning mode

North American Emissions Compliance

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.

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.

Johnson Controls

Installation

Observe these guidelines when installing an FX-PCA2612:

- Transport the controller in the original container to minimize vibration and shock damage.
- Verify that all parts shipped with the controller.
- Do not drop the controller or subject it to physical shock.

Parts Included

- one controller with removable terminal blocks
- one installation instructions sheet

Materials and Special Tools Needed

- three fasteners appropriate for the mounting surface (M4 screws or #8 screws)
- one 20 cm (8 in.) or longer piece of 35 mm DIN rail and appropriate hardware for DIN rail mount (only)
- small straight-blade screwdriver for securing wires in the terminal blocks

Mounting

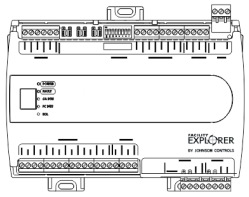
Observe these guidelines when mounting an FX-PCA2612 controller:

- Ensure the mounting surface can support the controller, DIN rail, and any user-supplied enclosure.
- Mount the controller horizontally on 35 mm DIN rail whenever possible.
- Mount the controller in the proper mounting position (*Figure 1*).
- Mount the controller on a hard, even surface whenever possible in wall-mount applications.
- Use shims or washers to mount the controller securely and evenly on the mounting surface.
- Mount the controller in an area free of corrosive vapors and observe the Ambient Conditions requirements in *Table 10*.
- Provide for sufficient space around the controller for cable and wire connections for easy cover removal and good ventilation through the controller (50 mm [2 in.] minimum on the top, bottom, and front of the controller).
- Do not mount the controller on surfaces prone to vibration, such as duct work.
- Do not mount the controller in areas where electromagnetic emissions from other devices or wiring can interfere with controller communication.

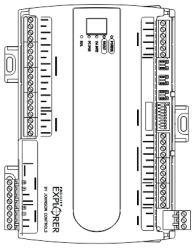
Observe these additional guidelines when mounting an FX-PCA2612 controller in a panel or enclosure:

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

Figure 1: Controller Mounting Positions



Horizontal Mount Position
Preferred for Wall Mounting
Required for DIN Rail Mounting



Vertical Mount Position
Acceptable for Wall Mounting

DIN Rail Mount Applications

Mounting the controller horizontal on 35 mm DIN rail is the preferred mounting method.

To mount a controller on 35 mm DIN rail:

1. Securely mount a 20 cm (8 in.) or longer section of 35 mm DIN rail horizontal and centered in the desired space so that the controller mounts in the horizontal position shown in *Figure 1*.
2. Pull the two bottom mounting clips outward from the controller to the extended position (*Figure 2*).
3. Hang the controller on the DIN rail by the hooks at the top of the (DIN rail) channel on the back of the controller (*Figure 2*), and position the controller snugly against the DIN rail.
4. Push the bottom mounting clips inward (up) to secure the controller on the DIN rail.

   To remove the controller from the DIN rail, pull the bottom mounting clips out to the extended position and carefully lift the controller off the DIN rail.

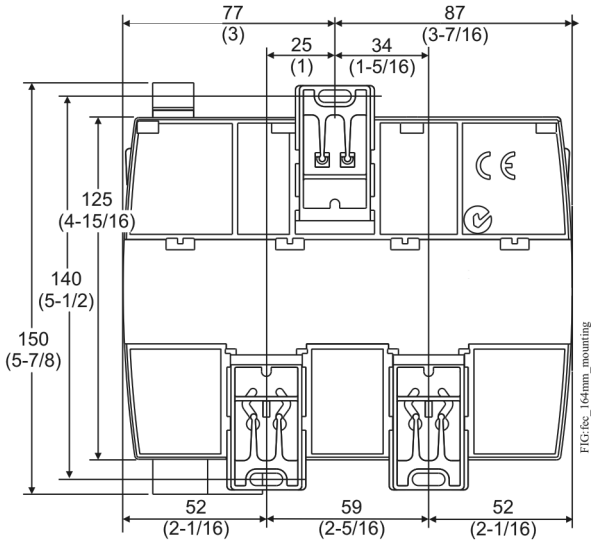
Wall Mount Applications

To mount an FX-PCA2612 controller directly on a wall or other flat vertical surface:

1. Pull the two bottom mounting clips outward and ensure they are locked in the extended position as shown in *Figure 2*.
2. Mark the mounting hole locations on the wall using the dimensions in *Figure 2* and one of the mount positions shown in *Figure 1*. Or hold the controller up to the wall or surface in a proper mount position and mark the hole locations through the mounting clips.
3. Drill holes in the wall or surface at the marked locations, and insert appropriate wall anchors in the holes (if necessary).
4. Hold the controller in place, and insert the screws through the mounting clips and into the holes (or anchors). Carefully tighten all of the screws.

Important:	Do not overtighten the mounting screws. Overtightening the screws may damage the mounting clips.

Figure 2: Back of Controller Showing Extended Mounting Clips, DIN Rail Channel, and Mounting Dimensions, mm (in.)



Wiring

Observe the following guidelines when wiring an FX-PCA2612 controller:

CAUTION

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

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

CAUTION

Risk of Property Damage: Do not apply power to the system before checking all wiring connections. Short circuited or improperly connected wires may result in permanent damage to the equipment.

Mise En Garde: Risque de dégâts matériels: Ne pas mettre le système sous tension avant d'avoir vérifié tous les raccords de câblage. Des fils formant un court-circuit ou connectés de façon incorrecte risquent d'endommager irrémédiablement l'équipement.

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, and SA bus, refer to the *FX-PC Series Controllers MS/TP Communications Bus Technical Bulletin (LIT-12011670)* or *MS/TP Communications Bus for BCM System Technical Bulletin (LIT-12011908).*

FX-PCA Terminal Blocks and Bus Ports

See *Figure 4* for terminal block and bus port locations on the FX-PCA2612-1 controller. Observe the following guidelines when wiring a controller.

Input and Output Terminal Blocks

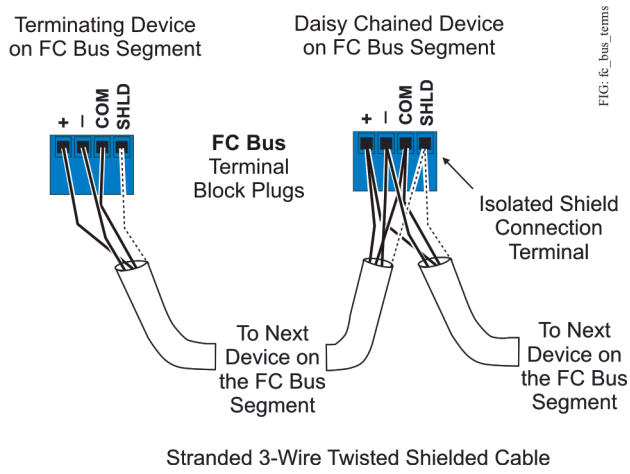
On most FX-PC Series controller models, all of the input terminal blocks are mounted on the bottom of the controller and the output terminal blocks are mounted on the top of the controller. See *Table 3* for more information about I/O terminal functions, requirements, and ratings.

FC Bus Terminal Block

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

Wire the removable FC bus terminal block plugs on the controller, 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



Note: The FC bus Shield (SHLD) terminal is isolated and can be used to connect (daisy chain) the shields for FC bus wiring.

Figure 4: FX-PCA2612-1 Physical Features

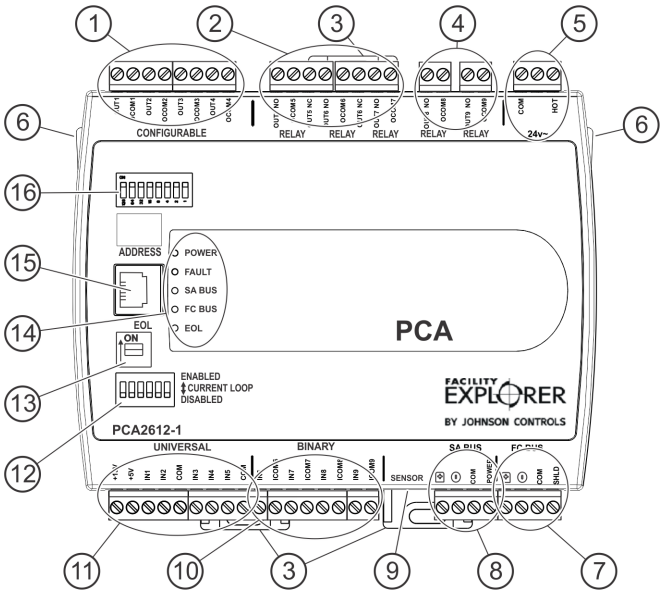


Table 1: FX-PCA2612-1 Physical Features

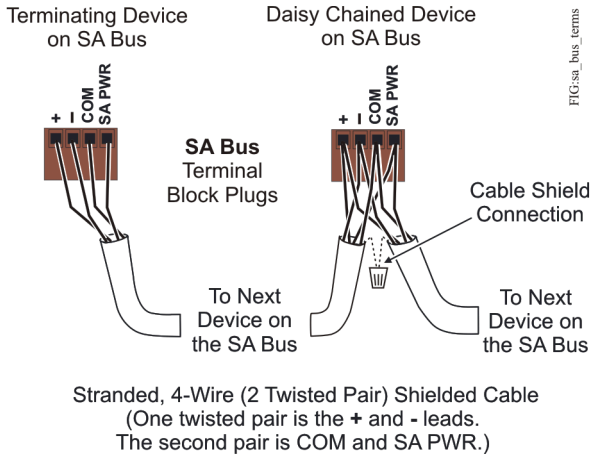
Callout	Physical Feature: Description and References
1	Configurable Output (COs) Terminal Blocks (Four COs). See *Table 3*.
2	SPDT Relay Terminal Blocks (Two). See *Table 3*.
3	Mounting Clips (Three). See *Figure 2*.
4	SPST Relay Terminal Blocks (Three). See *Table 3*.
5	24 VAC, Class 2 Supply Power Terminal Block. See *Supply Power Terminal Block*.
6	Cover Lift Tab (One of Two)
7	Field Controller (FC) Bus Terminal Block. See *FC Bus Terminal Block*.
8	Sensor Actuator (SA) Bus Terminal Block. See *SA Bus Terminal Block*.
9	Sensor Actuator (SA) Bus Port (RJ-12 6-pin Modular Jack). See *Sensor Port*.
10	Four Binary Input (BI) Terminal Blocks. Dry Contact Maintained or Pulse Counter/Accumulator Mode. See *Table 3*.
11	Five Universal Inputs (UI) Terminal Blocks. Can be defined as Voltage Analog Input (0–10 VDC), Current Analog Input (4–20 mA), Resistive Analog Inputs (0–600k ohm), or Dry Contact Binary Input. See *Table 3*.
12	Current Loop Mode DIP Switch Block for Universal Inputs that are defined as Current Analog Input (4–20 mA) in the system software. See *Setting the UI Current Loop DIP Switches*.
13	End-of-Line (EOL) Switch. See *Setting the End-of-Line (EOL) Switch*.
14	LED Status Indicators. See *Table 8*.
15	Field Controller (FC) Bus Port (RJ-12 6-pin Modular Jack). See *FC Bus Port*.
16	Device Address DIP Switch Block. See *Setting the Device Addresses*.

SA Bus Terminal Block

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

Wire the removable SA Bus terminal block plugs on the controller, and other SA bus devices in a daisy-chain configuration using 4-wire twisted, shielded cable as shown in *Figure 5*. See *Table 5* for more information.

Figure 5: SA Bus Terminal Block Wiring



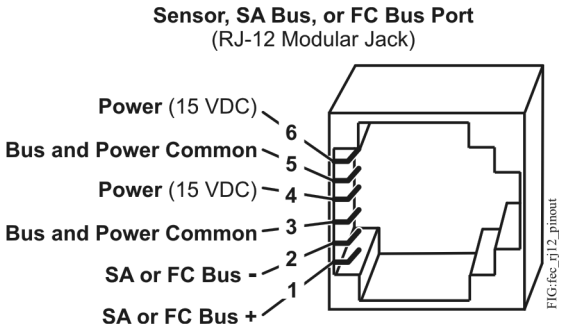
Note: The SA PWR terminal supplies 15 VDC. The SA PWR terminal can be used to connect (daisy chain) the 15 VDC power leads on the SA bus.

FC Bus Port

The FC bus port on the front of the controller is an RJ-12, 6-position modular jack that provides a connection for the FX-BTCVT Bluetooth® Commissioning Converter, ZFR-USBHA-0 ZFR wireless dongle, or FX-ZFR1811 Wireless Field Bus Router.

The FC bus port is connected internally to the FC bus terminal block. See *Table 5* for more information. The FC bus port pin assignment is shown in *Figure 6*.

Figure 6: Pin Number Assignments for Sensor, SA Bus, and FC Bus Ports on Controllers



Sensor Port

The Sensor (SA Bus) port on the bottom of the controller (*Figure 4*) is an RJ-12, 6-position modular jack that provides a connection for the Bluetooth Commissioning Converter, the VAV Balancing Tool, specified network sensors, or other SA Bus devices with RJ-12 plugs.

An FX-DIS1710 Local Controller Display also can be connected to the SA Bus port.

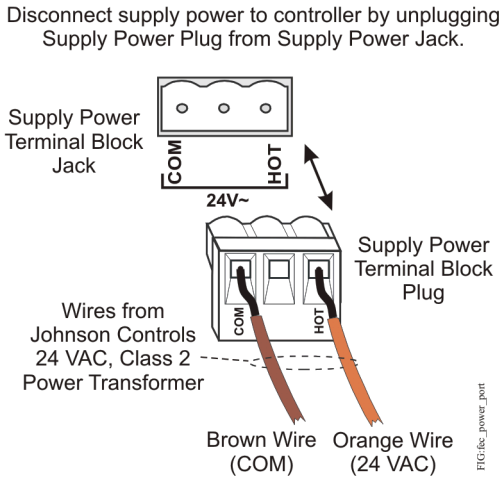
The Sensor port is connected internally to the SA bus terminal block. See *Table 5* for more information. The Sensor Port pin assignment is shown in *Figure 6*.

Supply Power Terminal Block

The 24 VAC supply power terminal block is a gray, removable, 3-terminal plug that fits into a board-mounted jack on the top right of the 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 7*. The middle terminal on the supply power terminal block is not used. See *Table 5* for more information about the Supply Terminal Block.

Figure 7: 24 VAC Supply Power Terminal Block Wiring



Note: 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 controller 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 controller does not require an earth ground connection.

Wireless Network Applications

The FX-PCA2612 controller can also be installed in a wireless application using an FX-ZFR1811 Wireless Field Bus Router.

To configure a controller for use with the FX-ZFR Series Wireless Field Bus system:

1. Wire the input/output terminals and SA bus.

   Note: In wireless network applications, do **not** connect any wires to the FC bus terminal block. (Connect the SA/FC terminal block on an FX-PCX to an SA bus only.)

2. Connect the FX-ZFR1811 Wireless Field Bus Router to the FC bus port (RJ-12 modular jack) on the front of the controller.
3. Ensure that the controller's device address DIP switches are set to the correct device address. See *Setting the Device Addresses*.
4. Set DIP switch 128 to ON, which enables wireless operation on the controller.

   For more information on installing a controller in a wireless configuration, refer to the *FX-ZFR1811 Wireless Field Bus Router Installation Instructions (Part No. 24-10325-29)*.

Termination Details

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

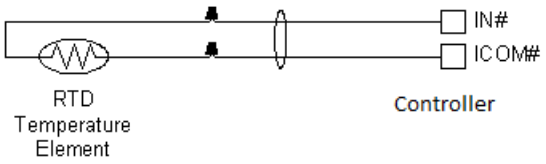
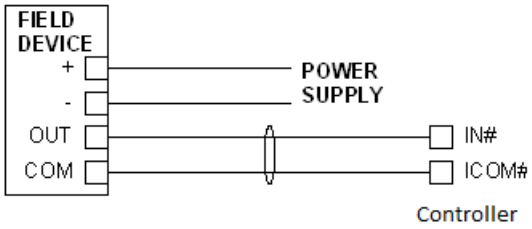
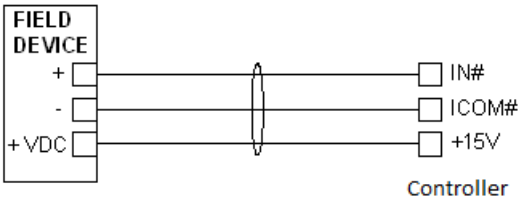
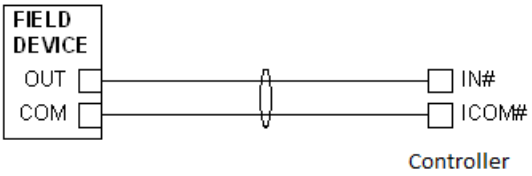
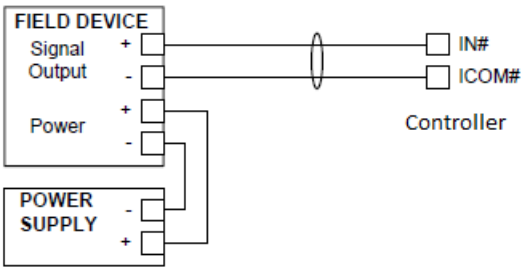
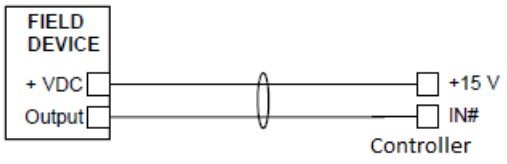
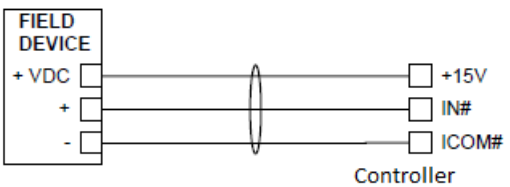
Type of Field Device	Type of Input/Output	Termination Diagrams
Temperature Sensor	UI	
Voltage Input - External Source	UI	
Voltage Input - Internal Source	UI	
Voltage Input (Self-Powered)	UI	
Current Input - External Source (Isolated)	UI	
Current Input - Internal Source (2 wire)	UI	
Current Input - Internal Source (3 wire)	UI	

Table 2: Termination Details

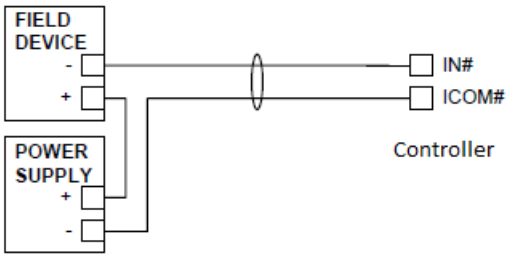
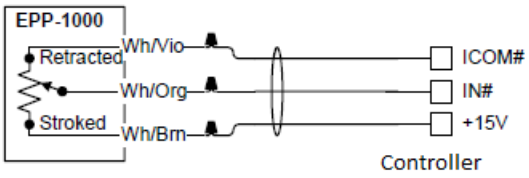
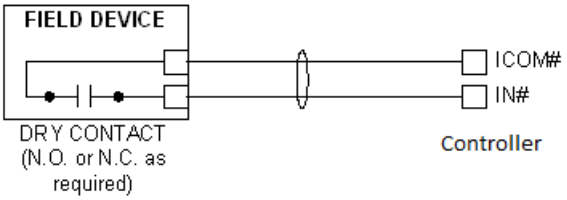
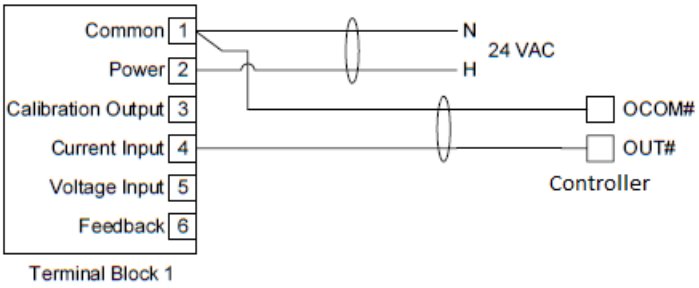
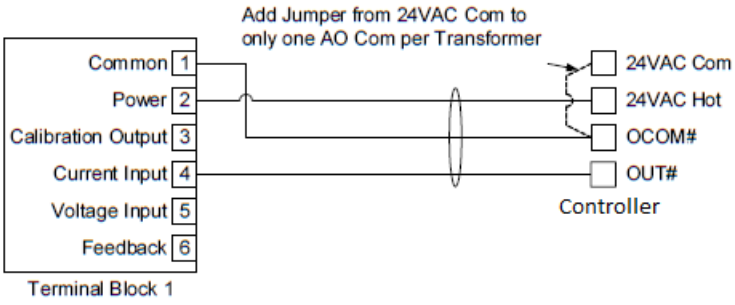
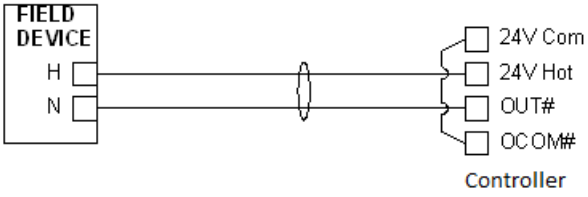
Type of Field Device	Type of Input/Output	Termination Diagrams
Current Input - External Source (in Loop)	UI	
Feedback from EPP-1000	UI	
Dry Contact (Binary Input)	UI	
0–20 VDC Output to Actuator (External Source)	CO	
0–10 VDC Output to Actuator (Internal Source)	CO	
24 VAC Triac Output (Switch Low, External Source)	CO	

Table 2: Termination Details

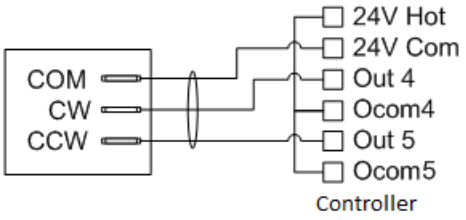
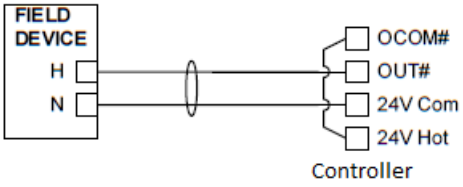
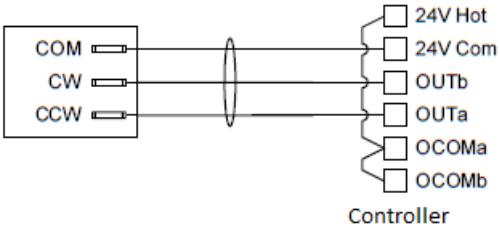
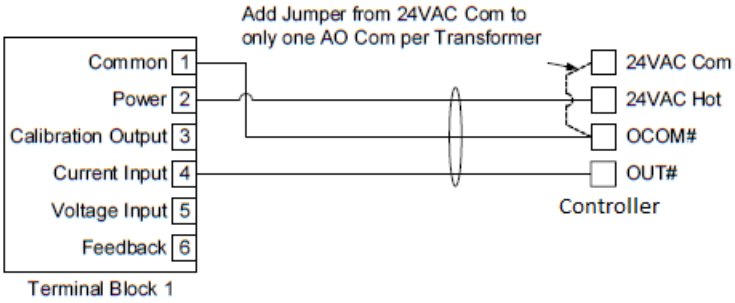
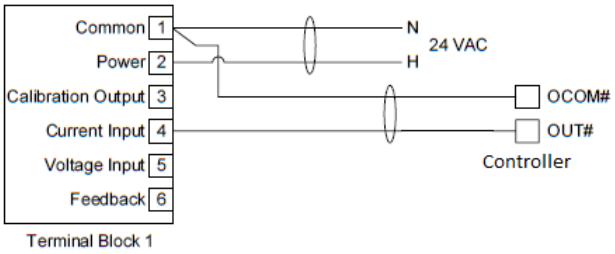
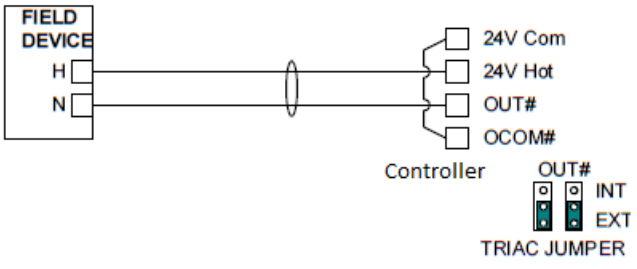
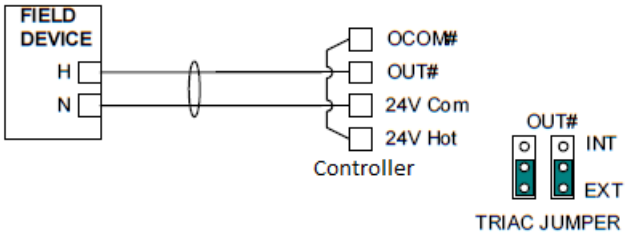
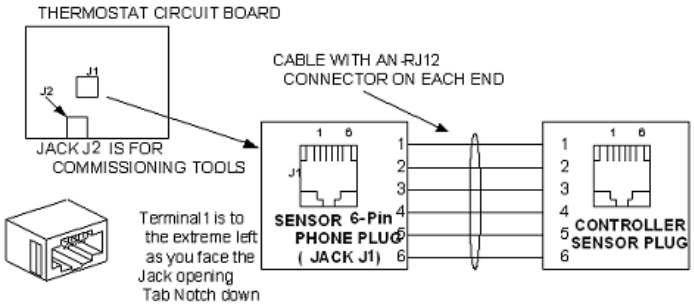
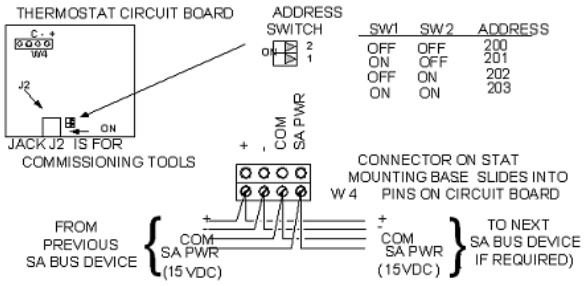
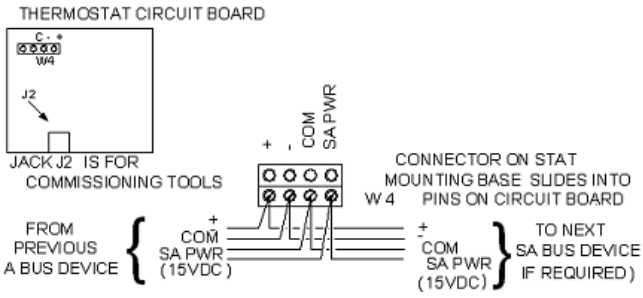
Type of Field Device	Type of Input/Output	Termination Diagrams
Incremental Control to Actuator (Switch Low, Externally Sourced)	CO	
24 VAC Binary Output (Switch High, Externally Sourced)	CO	
Incremental Control to Actuator (Switch High, Externally Sourced)	CO	
4-20 mA Output to Actuator	CO	
4-20 mA Output to Actuator	CO	
24 VAC Binary Output (Switch Low, Externally Sourced)	RO	

Table 2: Termination Details

Type of Field Device	Type of Input/Output	Termination Diagrams
24 VAC Binary Output (Switch High, Externally Sourced)	RO	
Network Stat with Phone Jack (Fixed Address = 199)	SA Bus	
Network Stat with Terminals Addressable	SA Bus	
Network Stat with Terminals (Fixed Address = 199)	SA Bus	

Terminal Wiring Guidelines, Functions, Ratings, and Requirements

Input and Output Wiring Guidelines

Table 3 provides information and guidelines about the functions, ratings, and requirements for the controller input and output terminals; and references guidelines for determining proper wire sizes and cable lengths.

In addition to the wiring guidelines in *Table 3*, observe these guidelines when wiring controller 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 stranded, insulated, and twisted copper wires.
- Shielded cable is not required for input or output cables.

- Shielded cable is recommended for input and output cables that are exposed to high electromagnetic or radio frequency noise.
- Inputs/outputs with cables less than 30 m (100 ft) typically do not require an offset in the software setup. Cable runs over 30 m (100 ft) may require an offset in the input/output software setup.

Table 3: FX-PCA2612-1 Controller Terminal Blocks, Functions, Ratings, Requirements, and Cables

Terminal Block Label	Terminal Label	Function, Ratings, Requirements	Determine Wire Size and Maximum Cable Length[1]
UNIVERSAL (Inputs)	**+15 V**	**15 VDC Power Source** for active (3-wire) input devices connected to the Universal IN*n* terminals. Provides 100 mA total current	Same as (Universal) **IN***n* **Note:** Use 3-wire cable for devices that source power from the +15V terminal.
	+5 V	5 VDC Power Source for active (3-wire) input devices connected to the Universal **IN***n* terminals. Provides 40 mA total current.	Same as (Universal) **IN***n*. **Note:** Use 3-wire cable for devices that source power from the +5 V terminal.
	IN*n*	**Analog Input - Voltage Mode (0–10 VDC)** 10 VDC maximum input voltage Internal 75k ohm Pull-down	See Guideline **A** in *Table 4*.
		Analog Input - Current Mode (4–20 mA) Internal 100 ohm load impedance **Note:** A current loop fail-safe jumper can be positioned to maintain a closed 4 to 20 mA current loop, even when the power to the controller is interrupted or off. See *Setting the UI Current Loop DIP Switches*.	See Guideline **B** in *Table 4*.
		Analog Input - Resistive Mode (0–600k ohm) Internal 12 V. 15k ohm pull up Qualified Sensors: 0-2k ohm potentiometer RTD (1k Nickel [Johnson Controls® sensor] 1k Platinum, and A99B Silicon Temperature Sensor) Negative Temperature Coefficient (NTC) Sensor (10k Type L, 10k JCI Type II, 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 Input terminals **Note:** All Universal ICOM*n* terminals share a common, which is isolated from all other commons.	Same as (Universal) **IN***n*

Table 3: FX-PCA2612-1 Controller Terminal Blocks, Functions, Ratings, Requirements, and Cables

Terminal Block Label	Terminal Label	Function, Ratings, Requirements	Determine Wire Size and Maximum Cable Length[1]
BINARY (Inputs)	**IN***n*	**Binary Input - Dry Contact Maintained Mode** 0.01 second minimum pulse width Internal 18 V. 3k ohm pull up	See Guideline **A** in *Table 4*.
		Binary Input - Pulse Counter/Accumulator Mode 0.01 second minimum pulse width (50 Hz at 50% duty cycle) Internal 18 V. 3k ohm pull up	
	ICOM*n*	**Binary Input Common** for all Binary Input (IN) terminals **Note:** All Binary ICOM*n* terminals share a common, which is isolated from all other commons, except the Configurable Output (CO) common (OCOM*n*) when the CO is defined as an Analog Output.	
CONFIGURABLE (Outputs)	**OUT***n*	**Analog Output - Voltage Mode (0–10 VDC)** 10 VDC maximum output voltage 10 mA maximum output current Required an external load of 1,000 ohm or more.	See Guideline **A** in *Table 4*.
		Binary Output - 24 VAC Triac (External Power Source only) Connects OUT*n* to OCOM*n* when activated. External Power Source Requirements: 30 VAC maximum output voltage 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 (COs) defined as Analog Outputs (AOs) share a common, which is isolated from all other commons except the Binary Input common. **Binary Output Signal Common** All Configurable Outputs (COs) defined as Binary Outputs are isolated from all other commons, including other CO commons.	Same as (Configurable) **OUT***n*.

Table 3: FX-PCA2612-1 Controller Terminal Blocks, Functions, Ratings, Requirements, and Cables

Terminal Block Label	Terminal Label	Function, Ratings, Requirements	Determine Wire Size and Maximum Cable Length[1]
RELAY (Outputs)	**OUT NO***n*	**Normal Open Contact** Connects OCOM to OUT NO when activated. **UL 916** 1/4 hp 120 VAC, 1/2 hp 240 VAC 360 VA Pilot Duty at 120/240 VAC (B300) 3 A Non-inductive 24-240 VAC **EN 60730** 6 (4) A N.O. or N.C. only 200 VA Pilot Duty at 120 VAC	The RELAY output terminals can accommodate the following maximum wire sizes: Two wires per terminal: 1.5 mm^2 (16 AWG) maximum **or** One wire per terminal: 2.5 mm^2 maximum (12 AWG or 2-16 AWG) **Note:** You must determine the **required** wire size for the high-voltage (>30 V) terminals according to relay ratings, the applied load, and the local, national, or regional electrical codes. Maximum loads stated require 12 AWG or 2-16 AWG wires.
	OCOM*n*	**Relay Common** Isolated from all other terminal commons, including other Relay Commons.	
	OUT NC*n*	**Normally Closed Contact** Disconnects OCOM to OUT NC when activated. **UL 916** 1/4 hp 120 VAC, 1/2 hp 240 VAC 360 VA Pilot Duty at 120/240 VAC (B300) 3 A Non-inductive 24-240 VAC **EN 60730** 6 (4) A N.O. or N.C. only 200 VA Pilot Duty at 120 VAC **Note:** Relay Outputs 5 and 6 (only) are SPDT relays and have a Normal Closed Contact terminal. Relay Outputs 7, 8, and 9 are SPST relays and do not have a Normal Closed Contact terminal.	

1 See *Table 4* to determine wire size and cable lengths for cables other than the recommended cables.

Cable and Wire Length Guidelines

Table 4 defines cable length guidelines for the various wire sizes that may be used for wiring low-voltage (<30 V) input and output wiring.

Table 4: Cable Length Guidelines for Recommended Wire Sizes for Low-Voltage (<30V) Inputs and Outputs

Guideline[1]	Wire Size/Gauge and Type	Maximum Cable Length and Type	Assumptions
A	1.5 mm^2 (18 AWG) stranded copper	457 m (1,500 ft) twisted wire	100 mV maximum voltage drop Depending on cable and the connected input or output device, you may have to define an offset in the setup software for the input or output point.
	0.8 mm (20 AWG) stranded copper	297 m (975 ft) twisted wire	
	0.6 mm (22 AWG) stranded copper	183 m (600 ft) twisted wire	
	N/A (24 AWG) stranded copper	107 m (350 ft) twisted wire	
B	1.5 mm^2 (18 AWG) stranded copper	229 m (750 ft) twisted wire	100 mV maximum voltage drop Depending on cable and the connected input or output device, you may have to define an offset in the setup software for the input or output point.
	0.8 mm (20 AWG) stranded copper	137 m (450 ft) twisted wire	
	0.6 mm (22 AWG) stranded copper	91 m (300 ft) twisted wire	
	N/A (24 AWG) stranded copper	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

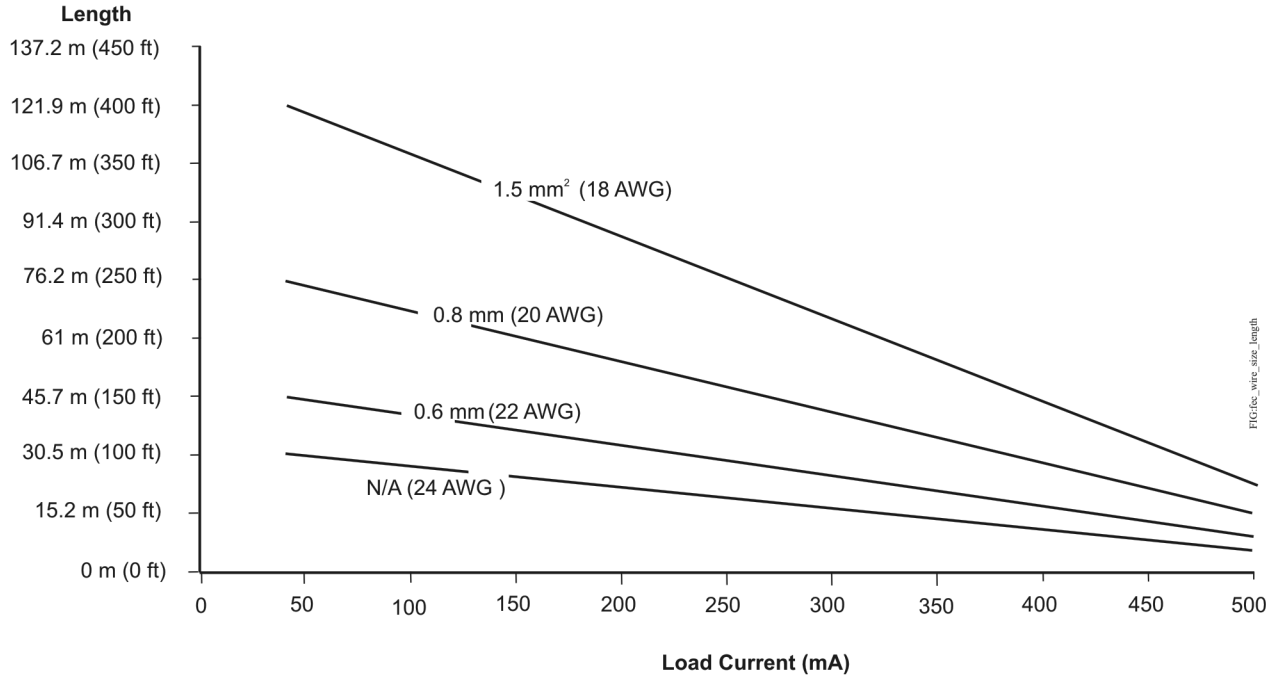
1 The required wire sizes and lengths for high-voltage (>30V) Relay Outputs are determined by the load connected to the relay, and local, national, or regional electrical codes. Except for relays and power supply, all device wiring is Class 2 only. Do not reclassify and install as Class 1, 3, or Power and Lighting Wiring. Maximum rated loads require a minimum wire size of 12 AWG or two (2) 16 AWG wires.

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.

Note: *Figure 8* applies to low-voltage (<30V) inputs and outputs only. The required wire size and length for high-voltage (>30V) Relay Outputs is determined by the load connected to the relay and local electrical codes.

Figure 8: Maximum Wire Length for Low-Voltage (<30V) Inputs and Outputs by Current and Wire Size



SA/FC Bus and Supply Power Wiring Guidelines

Table 5 provides information about the functions, ratings, and requirements for the communication bus and supply power terminals; and guidelines for wire sizes, cable types, and cable lengths when wiring the controller's communication buses and supply power.

Important: Please refer to the *Modernization Guide for Legacy N2 Controllers (LIT-12012045)* for guidelines when using this device on an N2 bus.

In addition to the guidelines in *Table 5*, observe these guidelines when wiring an SA or FC bus and the 24 VAC supply power:

- Run all low-voltage wiring and cables separate from high-voltage wiring.
- All SA and FC bus cables, regardless of wire size, should be twisted, insulated, stranded copper wire.
- Shielded cable is strongly recommended for all SA and FC bus cables.
- Refer to the *FX-PC Series Controllers MS/TP Communications Bus Technical Bulletin (LIT-12011670)* or *MS/TP Communications Bus for BCM System Technical Bulletin (LIT-12011908)* for detailed information regarding wire size and cable length requirements for the SA and FC buses.
- Refer to the *N2 Communications Bus Technical Bulletin (LIT-636018)* for detailed information regarding wire size and cable length requirements for the N2 bus.

Table 5: Communications Bus and Supply Power Terminal Blocks, Functions, Ratings, Requirements, and Cables

Terminal Block/Port Label	Terminal Labels	Function, Electrical Ratings/Requirements	Recommended Cable Type
FC BUS[1]	**+** **-**	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)	
FC BUS[1] (Port)		RJ-12 6-Position Modular Connector provides: FC Bus Communications FC Bus Signal Reference and 15 VDC Common 15 VDC, 180 mA, Power for Bluetooth Commissioning Converter or FX-ZFR1811 Wireless Router	Bluetooth Commissioning Converter retractable cable or 24 AWG 3-pair CAT 3 Cable <30.5 m (100 ft)
SA BUS[1]	**+** **-**	SA Bus Communications	0.6 mm (22 AWG) stranded, 4-wire (2 twisted-pairs), shielded cable recommended. **Note:** The + and - wire are one twisted pair, and the COM and SA PWR are the second twisted pair of wires.
	COM	SA Bus Signal Reference and 15 VDC Common	
	SA PWR	15 VDC Supply Power for Devices on the SA bus (Maximum total current draw for SA bus is 240 mA.)	
Sensor[1]	**Sensor**	RJ-12 6-Position Modular Connector provides: SA Bus Communications SA Bus Signal Reference and 15 VDC Common 15 VDC Power for devices on the SA bus and Bluetooth Commissioning Converter	24 AWG 3-pair CAT3 cable <30.5 m (100 ft)

Table 5: Communications Bus and Supply Power Terminal Blocks, Functions, Ratings, Requirements, and Cables

Terminal Block/Port Label	Terminal Labels	Function, Electrical Ratings/Requirements	Recommended Cable Type
24~	**HOT**	**24 VAC Power Supply - Hot** Supplies 20–30 VAC (Nominal 24 VAC)	0.8 mm to 1.5 mm^2 (18 AWG) 2-wire
	COM	**24 VAC Power Supply Common** (Isolated from all other Common terminals on controller) 30 VA	

1 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)*or *MS/TP Communications Bus for BCM System Technical Bulletin (LIT-12011908)*.

Setup and Adjustments

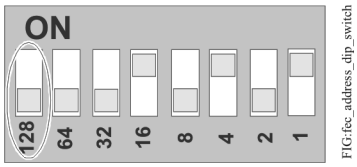
Setting the Device Addresses

FX-PC Series controllers are master devices on MS/TP (SA or FC) buses. Before operating FX-PCA2612 controllers on a bus, you **must** set a valid and unique device address for each controller on the bus. You set an FX-PCA2612 controller's device address by setting the positions of the switches on the DIP switch block at the top of the controller (*Figure 4*). Device addresses 4 through 127 are the valid addresses for these controllers.

The DIP switch block has eight switches numbered 128, 64, 32, 16, 8, 4, 2, and 1 (*Figure 9*). Switches 64 through 1 are device address switches. Switch 128 is a mode switch that enables a controller to operate on an FX-ZFR 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 DIP Switch Block Set to Address 21

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



Note: FX-PC Series controllers ship with switch 128 ON and the remaining address switches Off rendering the controllers wired slave devices, which do not operate on MS/TP buses, but 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.

Table 6 describes the FC bus and SA bus device addresses for FX-PC Series controllers communications bus applications.

Refer to the *FX-PC Series Controllers MS/TP Communications Bus Technical Bulletin (LIT-12011670)* or *MS/TP Communications Bus for BCM System Technical Bulletin (LIT-12011908)* for more information on FX-PC controller device addresses and how to set them on MS/TP buses.

To set the device addresses on FX-PC Series controllers:

1. Set **all** of the switches on the address DIP switch block (128 through 1) to Off.
2. Set one or more of the seven address switches (64 though 1) to ON, so that the sum of the switch numbers set to ON equals the intended device address. See *Table 1* for valid device addresses.
3. 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*.

   Refer to the *FX-ZFR Wireless Field Bus System Technical Bulletin (LIT-12011660)* for more information on device addresses in wireless applications.
4. Set switch 128 to ON **only** for controllers on an FX-ZFR 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 an FX-PC controller with switch 128 set to ON to an active (**hard-wired**) SA or FC bus. When a controller with switch 128 set to ON and a device address from 4 to 127 is connected to a wired field bus, the entire field bus is rendered inoperable until the controller is disconnected or switch 128 is set to Off.

5. Set a unique and sequential device address for each of the 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.

6. Write each controller's device address on the white label below the DIP switch block on the controller's cover.

   Table 1 describes the FC bus and SA bus devices addresses for Johnson Controls® MS/TP communications bus applications.

Table 6: SA/FC Bus Device Address Descriptions

Device Address	Use on Description
0 **(Switch 128 Off)**	Reserved for FC Bus Supervisory Controller (not for use on FX-PC controllers).
1 to 3 **(Switch 128 Off)**	Reserved for peripheral devices (not for use on FX-PC controllers).
4 to 127 **(Switch 128 Off)**	Used for MS/TP master devices (FX-PC controllers) that are hardwired to an SA bus or FC bus.

Table 6: SA/FC Bus Device Address Descriptions

Device Address	Use on Description
0 to 3 **(Switch 128 ON)**	Reserved addresses for wired slave devices (not for use on FX-PC controllers). **Note:** FX-PC controllers ship with switch 128 ON and the remaining address switches Off rendering the controllers wired slave devices, which do not operate on MS/TP buses.
4 to 127 **(Switch 128 ON)**	Valid for MS/TP Master controllers on **wireless FC Buses only**. **Note:** Do **not** connect an FX-PC controller with switch 128 ON to an active (**hard-wired**) SA or FC bus. When a controller with switch 128 ON and a device address from 4 to 127 is connected to a wired field bus, the entire 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 controllers greater than 127.

Note: Before you perform this procedure, make sure that your controller has been converted from BACnet to N2 protocol first. Refer to the *Modernization Guide for Legacy N2 Controllers (LIT-12012045)* for more information.

Note: This special configuration is required because controller addresses above 127 were originally intended for use with the Wireless Field Bus system.

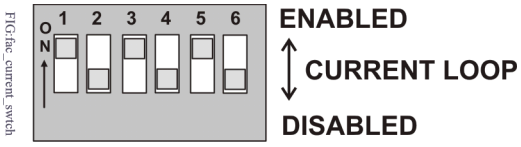
1. Disconnect the 24 VAC supply from the controller.
2. Remove the FC Bus connector from the controller.
3. Set the address switch set to the desired N2 address.
4. Set the address switch segment labeled 128 to OFF.
5. Reconnect the 24 VAC supply to the controller.
6. Using an FX-PCT tool connection 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 UI Current Loop DIP Switches

The five Universal Input (UI) current loop switches are on the (6-switch) DIP switch block on the controller cover near the UI terminals (*Figure 4*). When a UI is defined in the system software as a 4–20 mA Analog Input (AI) and the UI's current loop switch is in the DISABLED (default/Off/down) position (*Figure 10*), the 4–20 mA current loop circuit opens whenever power to the controller is interrupted or off. Setting a current loop switch to the ENABLED (ON/up) position maintains the 4–20 mA current loop circuit even when power to the controller is interrupted or off.

Figure 10: Current Loop DIP Switch Block with the Current Loops Enabled for UIs 1, 3, and 5



To set the Current Loop Mode switches:

1. Determine if the UI is intended to operate as a 4–20 mA AI (and configure the system software accordingly).
2. If the UI is not intended to be a 4–20 AI, set the UI's corresponding Current Loop Mode switch to the Off/down position.
3. If the UI is intended to be a 4–20 mA AI and the current loop is intended to be maintained, set the UI's corresponding Current Loop Mode switch to the ON/up position.

Important:	Current Loop switches must be in the DISABLED (Off/down) position for all UIs that are not set up to operate as 4–20 mA analog inputs.

Setting the End-of-Line (EOL) Switch

Each controller has an EOL switch, which, when set to ON, sets the controller as a terminating device on the bus. See *Figure 4* for the EOL switch location. The default EOL switch position is Off.

Figure 11: End-of-Line Switch Positions

To set the EOL switch on an FX-PCA2612 controller:

1. Determine the physical location of the controller on the FC bus.
2. Determine if the controller must be set as a terminating device on the bus.

   Note: Refer to the *FX-PC Series Controllers MS/TP Communications Bus Technical Bulletin (LIT-12011670)* or *MS/TP Communications Bus for BCM System Technical Bulletin (LIT-12011908)* for detailed information regarding EOL termination rules and EOL switch settings on 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.

   When a controller is connected to power with its EOL switch set to ON, the amber EOL LED on the controller cover is lit.

Table 7 identifies the current loop switches associated with each UI on the FX-PCA26 controller.

Table 7: FX-PCA2612-1 UI Inputs and Jumper Labels

Universal Input Label	Switch Label on Current Loop DIP Switch Block Board
IN1	1
IN2	2
IN3	3
IN4	4
IN5	5
Not Used	6

Setting Up a Local Display

FX-PCA2612-1 models do not have an integral display, but can be connected to an FX-DIS1710 Local Controller Display. For detailed information on setting up and operating either an integral user interface or a remotely connected FX-DIS1710 display, refer to the *FX-DIS1710 Local Controller Display Technical Bulletin (LIT-12011666)*.

Note: FAC devices do not support display of Schedules, Clock, Trend or Alarms on the DIS1710 Local Controller Display.

Commissioning the Controllers

You commission FX-PCA controllers with the FX-PCT software, either via a Bluetooth® Wireless Commissioning Converter, a ZigBee® wireless dongle, or in BACnet Router mode when connected to a Facility Explorer Supervisory Controller. Refer to the *Controller Tool Help (LIT-12011147)* for detailed information on commissioning controllers.

Troubleshooting the Controllers

Observe the Status LEDs on the front of the controller and see *Table 8* to troubleshoot the controller. To troubleshoot an integral or local controller display, refer to the *FX-DIS Local Controller Display Technical Bulletin (LIT-12011666)*.

Table 8: Status LEDs and Descriptions of LED States

LED Label	LED Color	Normal LED State	Description of LED States
POWER	Green	On Steady	Off Steady = No Supply Power or the controller's polyswitch/resettable fuse is open. Check Output wiring for short circuits and cycle power to controller. On Steady = Power Connected
FAULT	Red	Off Steady	Off Steady = No Faults On Steady = Device Fault; no application loaded; Main Code download required, if controller is in Boot mode, or a firmware mismatch exists between the FX-PCA and the FX-ZFR1811 Wireless Field Bus Router. Blink - 2 Hz = Download or Startup in progress, not ready for normal operation Blink Rapidly - 5 Hz = One or more defined SA Bus devices are offline. Check SA Bus devices for problems, including low batteries on wireless sensor.
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
FC BUS	Green	Blink - 2 Hz	Blink - 2 Hz = Data Transmission (normal communication) Off Steady = No Data Transmission (auto baud in progress) On Steady = Communication lost, waiting to join communication ring
EOL	Amber	Off (Except on terminating devices)	On Steady = EOL switch in ON position Off Steady = EOL switch in Off position

Repair Information

If an FX-PCA2612 controller fails to operate within its specifications, replace the controller. For a replacement controller, contact your Johnson Controls® representative.

Accessories

See *Table 9* for FX-PCA2612 controller accessories ordering information.

Table 9: Accessories Ordering Information

Product Code Number	Description
FX-BTCVT-1	Bluetooth Commissioning Converter
FX-DIS1710-0	Local Controller Display (FAC devices do not support display of Schedules, Clock, Trend or Alarms on the DIS1710 Local Controller Display)
FX-ZFR1811-0	Wireless Field Bus Router
TP-2420	Transformer, 120 VAC Primary to 24 VAC secondary, 20 VA, Wall Plug
Y65T31-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount, 8 in. Primary Leads and Secondary Screw Terminals, Class 2 **Note:** Additional Y6x-x Series transformers are also available. Refer to the *Series Y63, Y64, Y65, Y66, and Y69 Transformers Product Bulletin (LIT-125755)* for more information.
AS-XFR050-0	Power transformer (Class 2, 24 VAC, 50 VA maximum output), no enclosure
AP-TBK4SA-0	Replacement SA Bus Terminal Blocks, 4-Position, Brown, Bulk Pack
AP-TBK4FC-0	Replacement FC Bus Terminal Blocks, 4-Position, Blue, Bulk Pack
AP-TBK3PW-0	Replacement Power Terminal Blocks, 3-Position, 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 - 9 Pieces
MS-TBKUI05-0	Terminal Block Kit - FX-PCA 5-Position Universal Input - 3 Pieces
ZFR-USBHA-0	USB Dongle with ZigBee® Driver provides a wireless connection through FX-PCT to allow wireless commissioning of the wirelessly enabled FX-PCG, FX-PCA, FX-PCX, and FX-PCV controllers. Also allows use of the FX-ZFR Checkout Tool (FX-ZCT) in FX-PCT. **Note:** The ZFR-USBHA-0 replaces the IA OEM DAUBI_2400 ZFR USB dongle. For additional information on the ZFR-USBHA-0 ZFR dongle, refer to the *FX-ZFR Series Wireless Field Bus System Technical Bulletin (LIT-12011660)* or *FX-ZFR Series Wireless Field Bus System Quick Reference Guide (LIT-12011696).*

Technical Specifications

Table 10: FX-PCA2612-1 Advanced Application Programmable Controller

Product Code Numbers	FX-PCA2612-1 Advanced Application Programmable 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	25 VA maximum for FX-PCA2612-1 (no integral display) **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 84 VA (maximum).
Ambient Conditions	**Operating:** 0 to 50°C (32 to 122°F); 10 to 90% RH noncondensing; Pollution Degree 2 **Storage:** -40 to 80°C (-40 to 176°F); 5 to 95% RH noncondensing
Controller Addressing for BACnet MS/TP	DIP switch set; valid controller device addresses 4–127 (Device addresses 0–3 and 128–255 are reserved and not valid controller addresses.)
Controller Addressing for N2	DIP switch set; valid control device addresses 1-255 **Note:** Refer to the *Modernization Guide for Legacy N2 Controllers (LIT-12012045)* for address information when using the controller on an N2 bus.
Communications Bus	**RS-485: Selectable BACnet® MS/TP or N2:** 3-wire FC Bus between the supervisory controller and other controllers 4-wire SA Bus between controller, network sensors and other sensor/actuator devices, includes a lead to source 15 VDC supply power (from controller) to bus devices.
Processor	H8SX/166xR Renesas® 32-bit microcontroller
Memory	4 MB flash memory and 1 MB RAM
Input and Output Capabilities	**5 - Universal Inputs:** Defined as 0-5 VDC, 4-20 mA, 0-600k ohm, or Binary Dry Contact **4 - Binary Inputs:** Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode **4 - Configurable Outputs:** Defined as 0-10 VDC or 24 VAC Triac BO **2 - Relay Outputs:** (Single-Pole, Double-Throw); **UL 916:** 1/4 hp 120 VAC, 1/2 hp 240 VAC; 360 VA Pilot Duty at 120/240 VAC (B300); 3 A Non-inductive 24-240 VAC; **EN 60730:** 6 (4) A N.O. or N.C. only **3 - Relay Outputs:** (Single-Pole, Single-Throw) **UL 916:**1/4 hp 120 VAC, 1/2 hp 240 VAC; 360 VA Pilot Duty at 120/240 VAC (B300); 3 A Non-inductive 24-240 VAC; **EN 60730:** 6 (4) A N.O. or N.C. only
Analog Input/Analog Output Resolution and Accuracy	**Input:** 16-bit resolution **Output:** 16-bit resolution, +/- 200 mV accuracy in 0-10 VDC applications
Terminations	**Input/Output:** Pluggable 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
Housing	**Enclosure material:** ABS and polycarbonate UL94 5VB; Self-extinguishing Protection Class: IP20 (IEC529)

Table 10: FX-PCA2612-1 Advanced Application Programmable Controller

Dimensions (Height x Width x Depth)	150 x 164 x 53 mm (5-7/8 x 7-1/2 x 2-1/8 in.) including terminals and mounting clips **Note:** Mounting space 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	0.5 kg (1.1 lb)
Compliance CE	**United States:** UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment FCC Compliant to CFR47, Part 15, Subpart B, Class A
	Canada: UL Listed, File E107041, CCN PAZX7 CAN/CSA C22.2 No.205, Signal Equipment Industry Canada Compliant, ICES-003
	Europe: Johnson Controls, Inc. declares that this product is also in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC. Declared as Free Standing Operating Control Type 1.B 2,500 V rated impulse voltage. 100°C ball pressure test.
	Australia and New Zealand: C-Tick 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, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

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