FX-PCG26 General Purpose Programmable Controller Installation Guide

Application

The FX-PCG controller is part of the Facility Explorer® Programmable Controller (FX-PC) family. These controllers run pre-engineered and user-programmed applications and provide the inputs and outputs required to monitor and control a wide variety of HVAC and other facility equipment.

The FX-PCG controllers operate on an RS-485 BACnet® MS/TP Bus as BACnet Application Specific Controllers (B-ASCs) and integrate into Johnson Controls® and third-party BACnet systems.

The FX-PCG controller is available with or without an integral LCD and push button user interface.

Communications protocols

The *Modernization Guide for Legacy N2 Controllers (LIT-12012005)* and the controller-specific documentation provide installation and commissioning support including tips for efficient and safe replacement. For information about mapping N2 Objects in controllers with switchable communications protocols, refer to the N2 Compatibility Options chapter of the *Controller Tool Help (LIT-12011147)*.

The FX-PC Family Controllers and network sensors communicate using the standard BACnet protocol, based on the ANSI/ASHRAE 135-2016. The BACnet protocol is a standard for ANSI, ASHRAE, and the International Standards Organization (ISO) for building controls.

PCG, PCX, and PCV devices are BTL-listed as BACnet Application Specific Controllers (B-ASCs). The PCA controllers and the PCV1930 controller are BTL-listed as BACnet Advanced Application Controllers (B-AACs). The NS Series Sensors are BTL-listed as BACnet Smart Sensors (B-SSs).

Release 10.1 of the Controller Configuration Tool (CCT) 13.0 and later can be used to switch the Field Bus communications protocol in supported controllers to be either the standard BACnet MS/TP or the N2 protocol. All new controllers use either BACnet MS/TP as the default communications protocol, or BACnet/IP. Switchable communications protocols in the MS/TP models provide a cost-effective upgrade and modernization path for customers with existing N2 controllers.

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

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

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

The N2-capable FX-PC controllers:

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

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(barcode for factory use only)

FX-PCG2611-x, FX-PCG2621-x

- do not support wireless connection to the N2 bus

North American emissions compliance

United States

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference, in which case the users will be required to correct the interference at their own expense.

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.

Industry Canada Statement(s)

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage, et
2. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Installation

Observe these guidelines when installing a controller:

- 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 (Power, SA bus, and FC bus are removable)
- 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

Physical features

Figure 1: FX-PCG2621 physical features

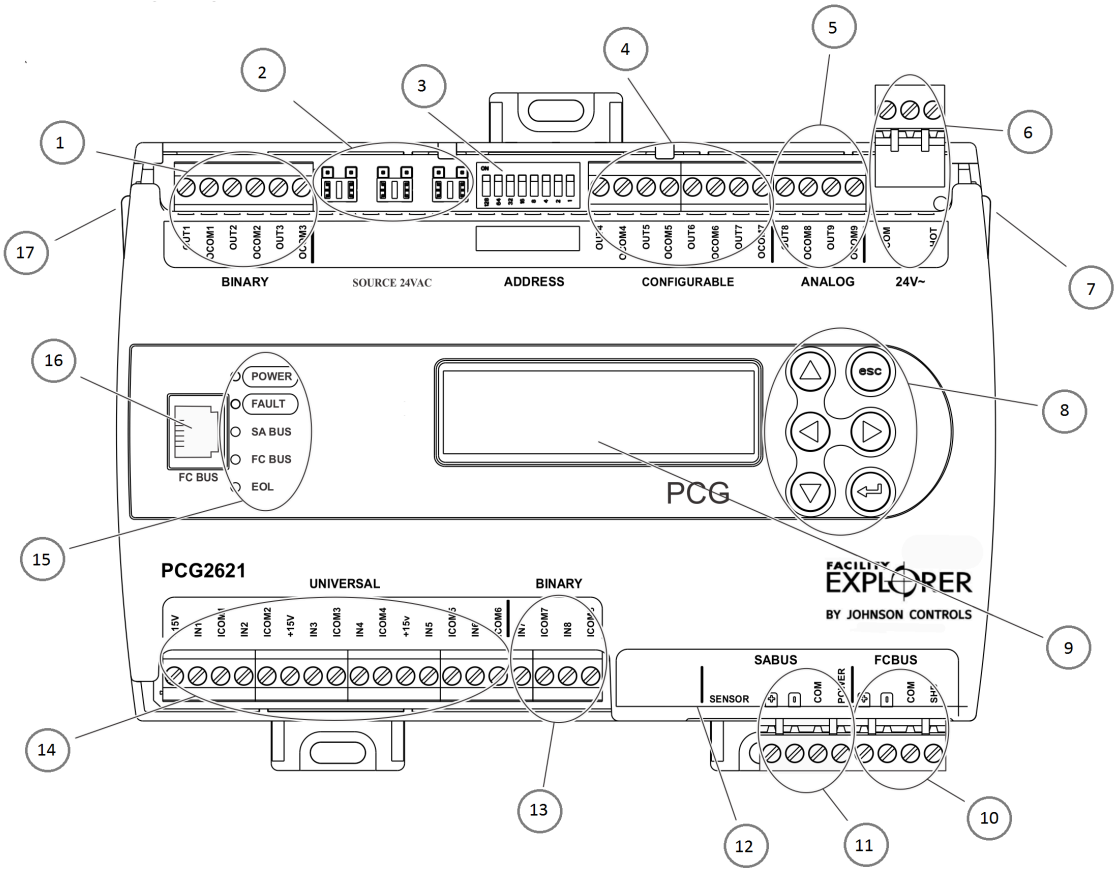


Table 1: FX-PCG2621 Physical Features

Callout	Physical Feature: Description and References
1	Binary Output (BO) Source Power Selection Jumper Pin Blocks, 3 – BO Jumper Pin Blocks. See Table 3 for more information.
2	Device Address DIP Switch Block. See Setting the device addresses for more information.
3	Mounting Clip. See Mounting for more information.
4	Configurable Output (COs) Terminal Blocks. See Table 3 for more information.
5	Analog Outputs (AOs) Terminal Block. See Table 3 for more information.
6	24 VAC, Class 2 Supply Power Terminal Block. See Table 5 for more information.
7	Cover Lift Tab (One of Two). See Removing the controller cover for more information.
8	Display Navigation Buttons. See Setting up an integral or local display. ⓘ **Note:** Not available on all FEC models.
9	Liquid Crystal Display (LCD) Display Area ⓘ **Note:** Not available on all FEC models.
10	Field Controller (FC) Bus Terminal Block. (See FC bus terminal block.)
11	Sensor Actuator (SA) Bus Terminal Block. (See SA bus terminal block.)
12	Sensor Actuator (SA) Bus (RJ-12 6-pin Modular Jack). See SA Bus port.
13	Binary Input (BI) Terminal Block, 2 – Binary Inputs. See Table 3 for more information.
14	Universal Input (UI) Terminal Blocks, 6 – Universal Inputs. See Table 3 for more information.
15	LED Status Indicators. See Table 10 for more information.

Table 1: FX-PCG2621 Physical Features

Callout	Physical Feature: Description and References
16	Field Controller (FC) Bus Port (RJ-12 6-pin Modular Jack). See FC bus port for more information.
17	Binary Output (BO) Terminal Blocks. See Table 3.

Mounting

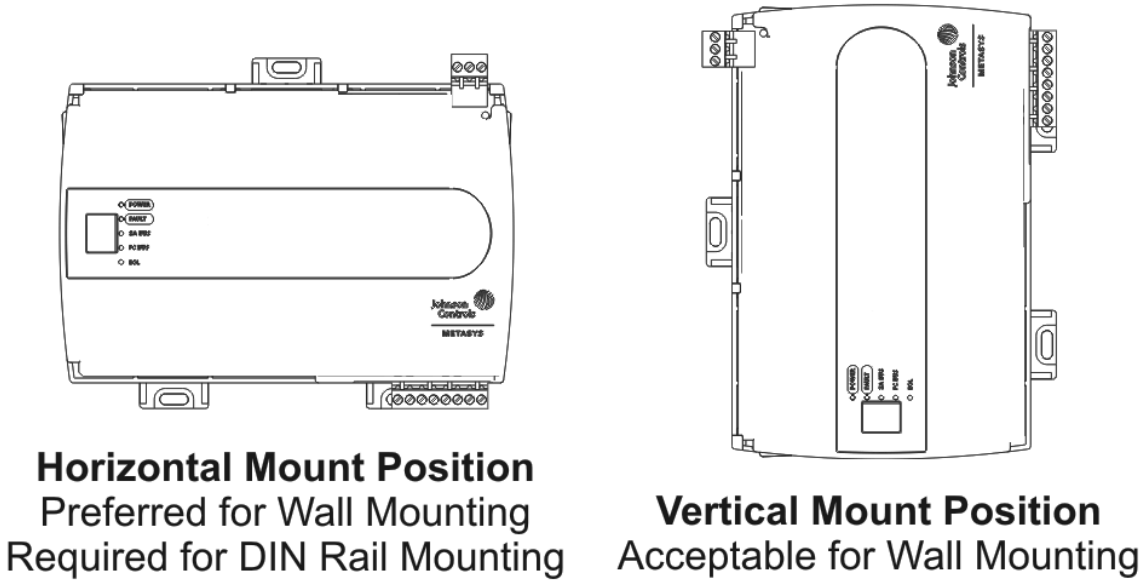
Observe these guidelines when mounting a controller:

- 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.
- 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.
- 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 a 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 2: Mounting positions



DIN rail mount applications

About this task:
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 appropriate location so that the controller mounts in the horizontal position.
2. Pull the two bottom mounting clips outward from the controller to the extended position.
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, 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

About this task:
To mount a 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.
2. Mark the mounting hole locations on the wall using the dimensions in and one of the mount positions shown in Figure 2. 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.

Mounting features and dimensions

Wiring

⚠ CAUTION

Risk of Electric Shock.

Disconnect the power supply before making electrical connections to avoid electric shock.

⚠ ATTENTION

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.

⚠ ATTENTION

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 BCPro System Technical Bulletin (LIT-12011908).*

Terminal blocks and bus ports

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

Input and Output terminal blocks

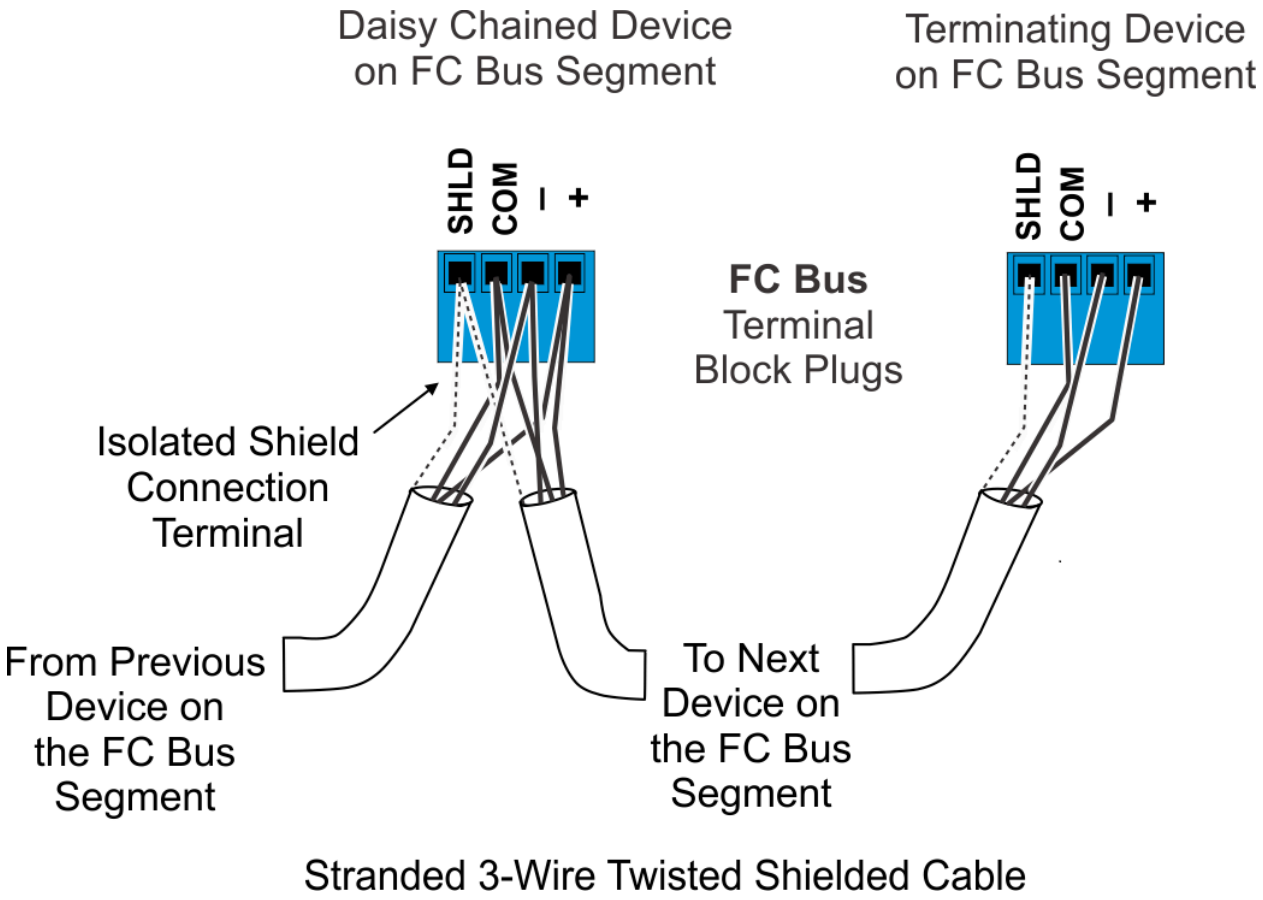
All of the fixed input terminal blocks are mounted on the bottom of the controller and the output terminal blocks are mounted on the top of the controller. See Table 3 for more information about I/O terminal functions, requirements, and ratings.

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 below. See Table 5 for more information.

Figure 3: FC bus terminal block wiring



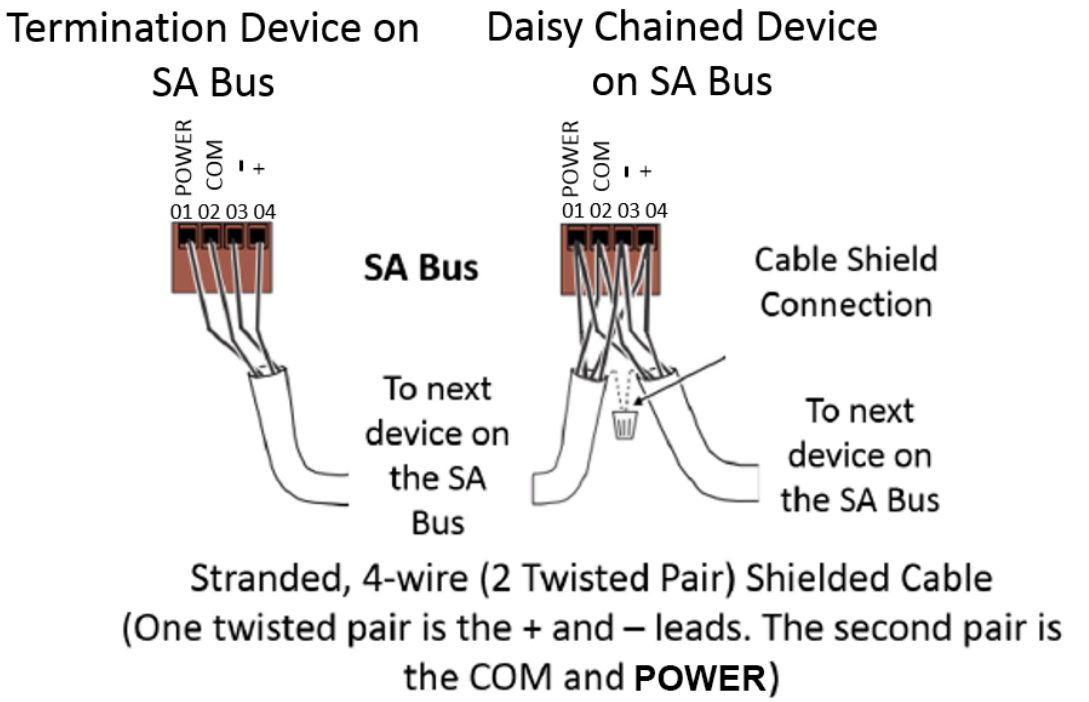
Note: The FC bus Shield (SHLD) terminal is isolated and can be used to connect (daisy chain) the shields for FC bus wiring.

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 the following figure. See Table 5 for more information.

Figure 4: SA bus terminal block wiring



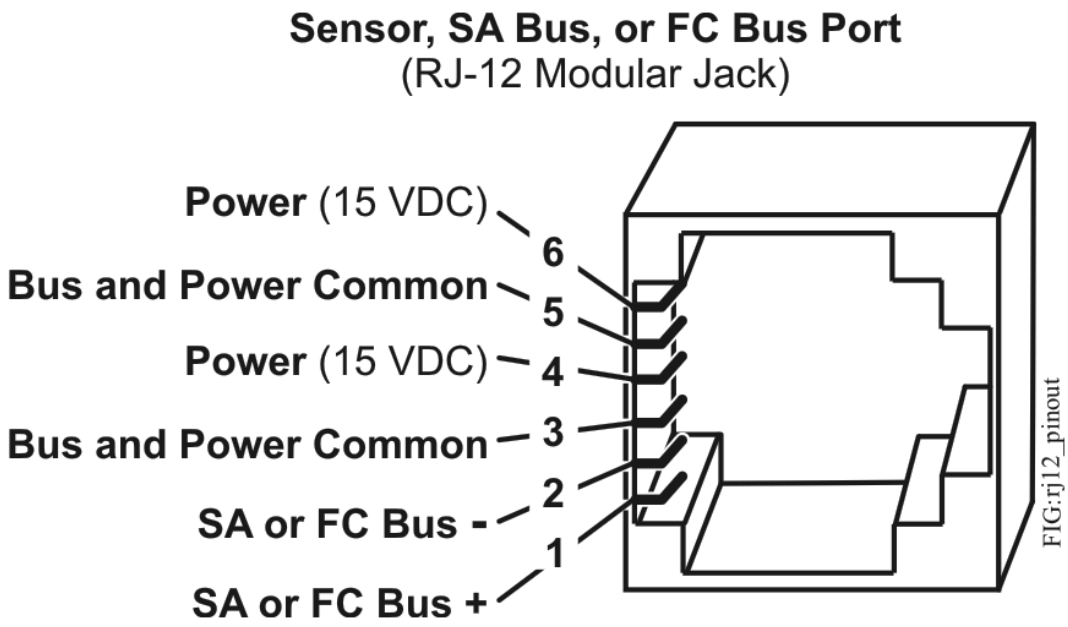
Note: The SA PWR terminal supplies 15 VDC. The SA PWR terminal can be used to connect (daisy chain) the 15 VDC power leads on the SA bus.

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, 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 5.

Figure 5: Pin number assignments for sensor, FC Bus, and SA bus ports on controllers



SA Bus port

The Sensor (SA Bus) port on the bottom of the controller 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.

When the FEC is configured for N2 communication, the SA Bus port must be used to download and commission the controller. An FX-DIS Local Controller Display also can be connected to the SA Bus port (but only on models without integral display and push buttons).

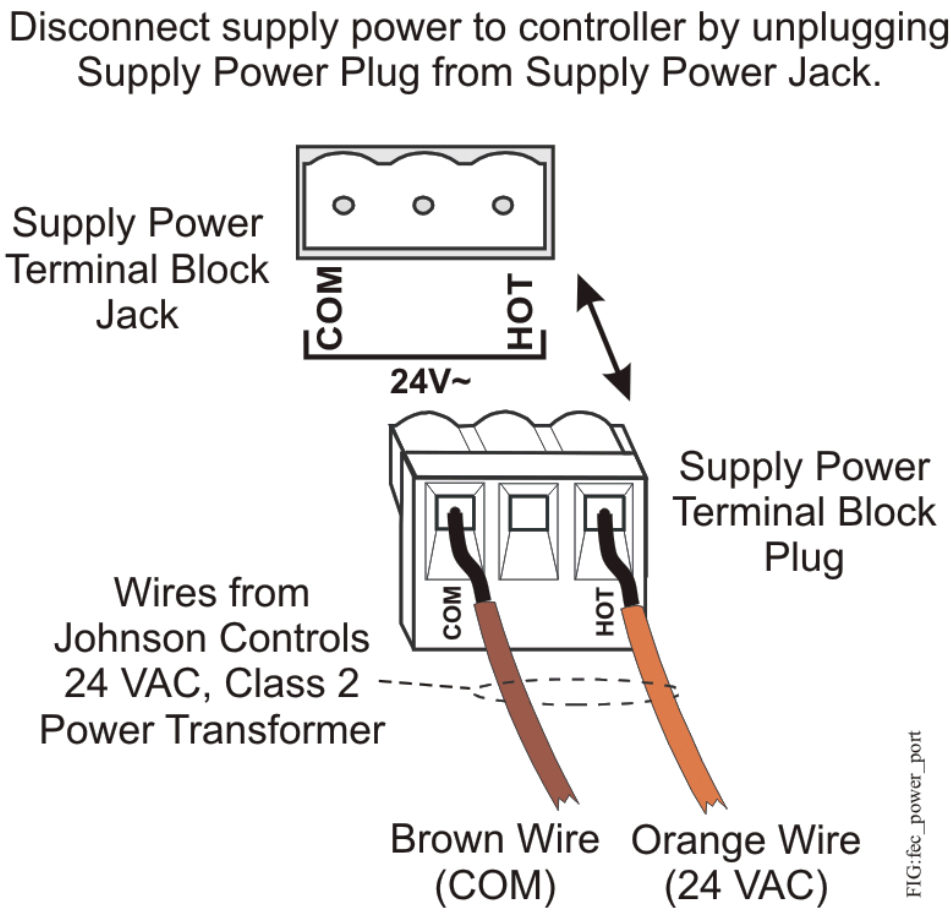
The Sensor port is connected internally to the SA bus terminal block. See Table 5 for more information. The Sensor Port pin assignment is shown in Figure 5.

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 below. The middle terminal on the supply power terminal block is not used. See Table 5 for more information about the Supply Terminal Block.

Figure 6: 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

About this task:
The controller can also be installed in a wireless application using an FX-ZFR 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 a PCX to an SA bus only.)

2. Connect the FX-ZFR181x or FX-ZFR182x 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.

Terminal wiring guidelines, functions, ratings, and requirements

Input and Output wiring guidelines

The next sections provide information and guidelines about the functions, ratings, and requirements for the controller input and output terminals; it also references guidelines for determining proper wire sizes and cable lengths.

In addition to the wiring guidelines, 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.

Point type counts per model

The following table shows the different point types and counts available in the controller.

Table 2: Point type counts per model

Point types	Signals accepted	FX-PCG2511 (Asia/Europe only model)	FX-PCG26
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	4 (Does not support Current Mode)	6
Binary Input (BI)	Dry Contact Maintained Mode Pulse Counter/Accumulator Mode (High Speed), 100 Hz	6	2
Analog Output (AO)	Analog Output, Voltage Mode, 0–10 VDC Analog Output, Current Mode, 4–20 mA	2 (Voltage Only)	2
Binary Output (BO)	24 VAC Triac	2 (Ext Power only)	3
Configurable Output (CO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac	2	4

Input/Output Terminal Blocks, ratings and requirements

The following table shows the input/output requirements and ratings for the controllers.

Table 3: Terminal blocks, functions, ratings, requirements, and cables

Terminal block label	Terminal label	Function, ratings, requirements	Determine wire size and maximum cable length
UNIVERSAL (Inputs)	**+15 V**	**15 VDC Power Source** for active (3-wire) input devices connected to the Universal 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.
	IN*n*	**Analog Input - Voltage Mode (0–10 VDC)** 10 VDC maximum input voltage Internal 75k ohms Pull-down	See Guideline **A** in Table 4.
		Analog Input - Current Mode (4–20 mA) Internal 100 ohms 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 the Universal Input current loop jumpers section.	See Guideline **B** in Table 4.
		Analog Input - Resistive Mode (0–600k ohms) Internal 12 V. 15k ohms pull up Qualified Sensors: 0–2k ohms 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 ohms pull up	See Guideline **A** in Table 4.
	ICOM*n*	**Universal Input Common** for all Universal Input terminals ⓘ **Note:** All Universal ICOM*n* terminals are isolated from all other commons.	Same as (Universal) **IN***n*

Table 3: Terminal blocks, functions, ratings, requirements, and cables

Terminal block label	Terminal label	Function, ratings, requirements	Determine wire size and maximum cable length
BINARY (Inputs)	**IN***n*	**Binary Input - Dry Contact Maintained Mode** 0.01 second minimum pulse width Internal 18 V. 3k ohms 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 ohms pull up	
	ICOM*n*	**Binary Input Common** for all Binary Input (IN) terminals ⓘ **Note:** All Binary ICOM*n* terminals are isolated from all other commons, except the Configurable Output (CO) common (OCOM*n*) when the CO is defined as an Analog Output.	
ANALOG (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 ohms or more. ⓘ **Note:** The Analog Output (AO) operates in the Voltage Mode when connected to devices with impedances greater than 1,000 ohms. Devices that drop below 1,000 ohms may not operate as intended for Voltage Mode applications.	See Guideline **C** in Table 4.
		Analog Output - Current Mode (4–20 mA) Requires and external load between 0–300 ohms. ⓘ **Note:** The AO operates in Current Mode when connected to devices with impedances less than 300 ohms. Devices that exceed 300 ohms may not operate as intended for Current Mode applications.	
	OCOM*n*	**Analog Output Signal Common** for all Analog OUT terminals. ⓘ **Note:** All Analog Output Common terminals (OCOM*n*) are isolated from all other commons.	

Table 3: Terminal blocks, functions, ratings, requirements, and cables

Terminal block label	Terminal label	Function, ratings, requirements	Determine wire size and maximum cable length
BINARY (Output)	**OUT***n*	**Binary Output - 24 VAC Triac** (External Power Source) 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*	**Binary Output Common** (for OUT*n* terminal) ⓘ **Note:** Each Binary Output Common terminal (OCOM*n*) is isolated from **all** other commons, including other Binary Output Common terminals.	
BINARY (Output) Power Selection Jumper positioned to Internal (**INT**) power.	**OUT***n*	**Binary Output - 24 VAC Triac** (Internal Power Source) Sources internal 24 VAC power (24~ HOT).	See Guideline **C** in Table 4.
	OCOM*n*	**Binary Output - 24 VAC Triac** (Internal Power Source) Connects OCOM*n* to 24~ when activated. Internal Power Source: 30 VAC maximum output voltage 0.5 A maximum output current 1.3 A at 25% duty cycle 40 mA minimum load current	

Table 3: Terminal blocks, functions, ratings, requirements, and cables

Terminal block label	Terminal label	Function, ratings, requirements	Determine wire size and maximum cable length
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 ohms 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) are isolated from all other commons except the Binary Input common.	Same as (Configurable) **OUT***n*.
		Binary Output Signal Common All Configurable Outputs (COs) defined as Binary Outputs are isolated from all other commons, including other CO commons.	

Cable length guidelines for recommended wire sizes table

Table 4: Cable length guidelines for recommended wire sizes for low-voltage (<30 V) Inputs and Outputs

Guideline	Wire size/Gauge and type	Maximum cable length and type	Assumptions
A	1.0 mm (18 AWG) stranded copper	457 m (1,500 ft) twisted wire	100 mV maximum voltage drop Depending on 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	
	0.5 mm (24 AWG) stranded copper	107 m (350 ft) twisted wire	
B	1.0 mm (18 AWG) stranded copper	229 m (750 ft) twisted wire	100 mV maximum voltage drop Depending on 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	
	0.5 mm (24 AWG) stranded copper	61 m (200 ft) twisted wire	
C	See Figure 7 to select wire size/ gauge. Use stranded copper wire	See Figure 7 to determine cable length. Use twisted wire cable.	N/A

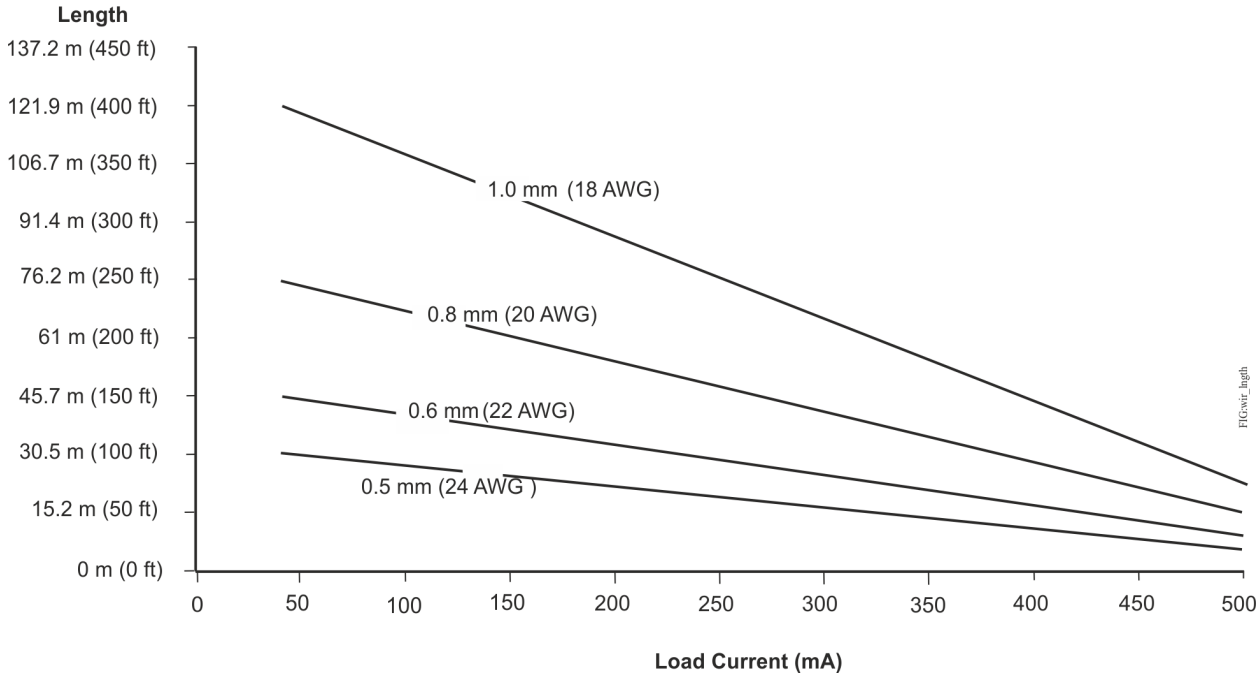
Maximum cable length versus load current

Use Figure 7 to estimate the maximum cable length relative to the wire size and the load current (in mA) when wiring inputs and outputs.

Note: Figure 7 applies to low-voltage (<30 V) inputs and outputs only.

Max wire length by current and wire size graphic

Figure 7: Maximum wire length for low-voltage (<30 V) Inputs and Outputs by current and wire size



Communications 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.

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 BCPro System Technical Bulletin (LIT-12011908)* for detailed information regarding wire size and cable length requirements for the SA and FC buses.

Comm bus and supply power terminal blocks rating and requirements

ⓘ **Note:** 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 BCPro System Technical Bulletin (LIT-12011908)*.

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	**+** **-**	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 (Port)	**FC Bus**	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-ZFR181x/FX-ZFR182x Wireless Router	Bluetooth Commissioning Converter retractable cable or 24 AWG 3-pair CAT 3 Cable <30.5 m (100 ft)
SA BUS	**+** **-**	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	**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 Wireless Commissioning Converter	24 AWG 3-pair CAT3 cable <30.5 m (100 ft)
24~	**HOT**	**24 VAC Power Supply - Hot** Supplies 20–30 VAC (Nominal 24 VAC)	0.8 mm to 1.0 mm (18 AWG) 2-wire
	COM	**24 VAC Power Supply Common** (Isolated from all other Common terminals on controller) 35 VA	

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 6: Termination details

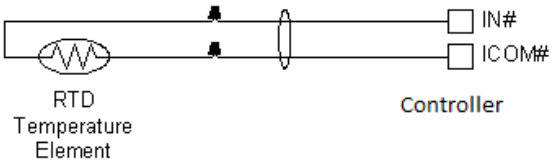
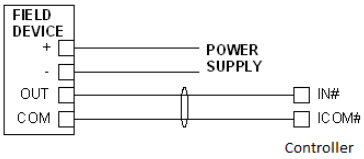
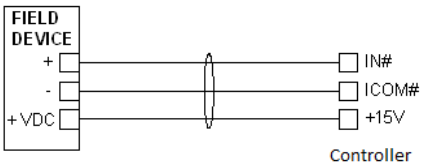
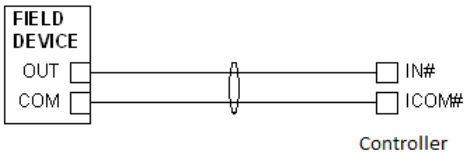
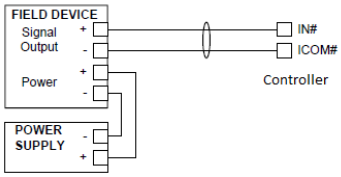
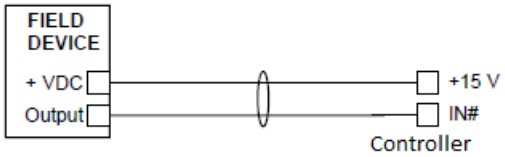
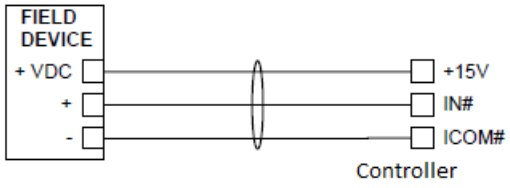
Type of field device	Type of Input/ Output	Termination diagrams
Temperature Sensor	UI	
Voltage Input - External Source	UI	
Voltage Input - Internal Source	UI	
Voltage Input (Self-Powered)	UI	
Current Input - External Source (Isolated)	UI	
Current Input - Internal Source (2-wire)	UI	
Current Input - Internal Source (3 wire)	UI	

Table 6: Termination details

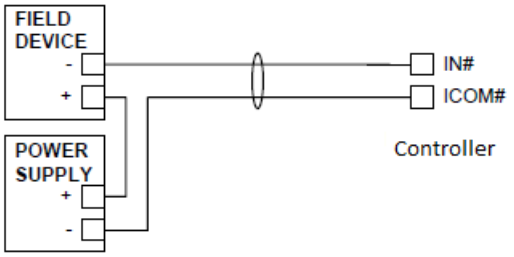
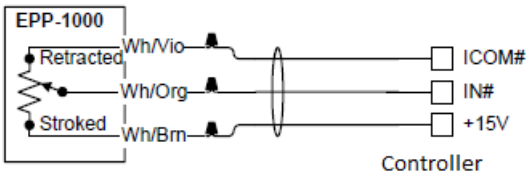
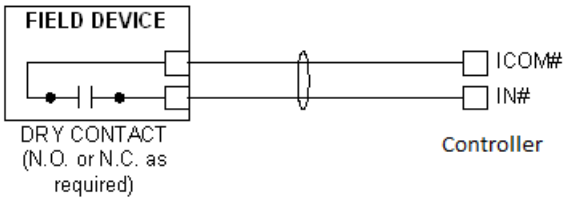
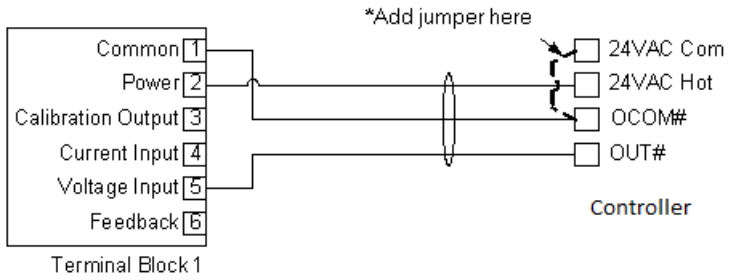
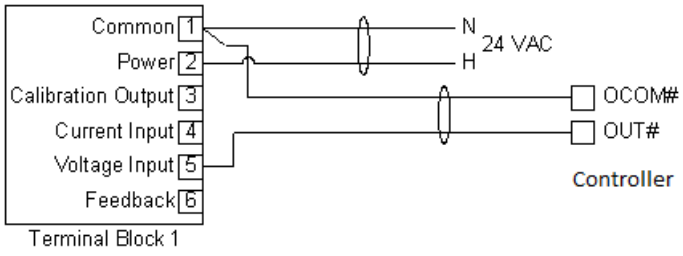
Type of field device	Type of Input/ Output	Termination diagrams
Current Input - External Source (in Loop)	UI	
Feedback from EPP-1000	UI	
Dry Contact (Binary Input)	UI or BI	
0–10 VDC Output to Actuator (External Source)	CO or AO	
0–10 VDC Output to Actuator (Internal Source)	CO or AO	

Table 6: Termination details

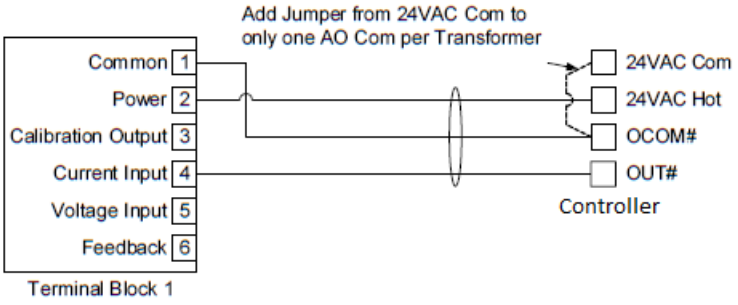
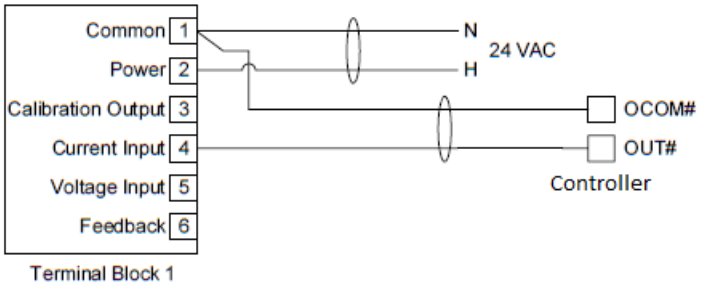
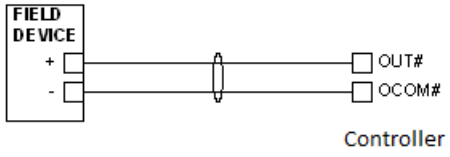
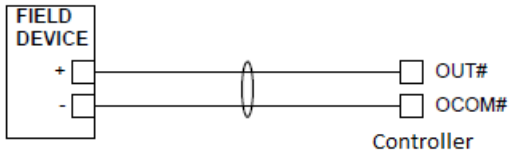
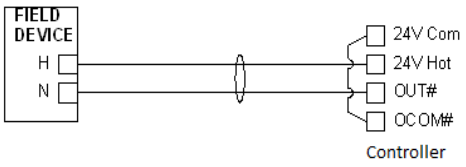
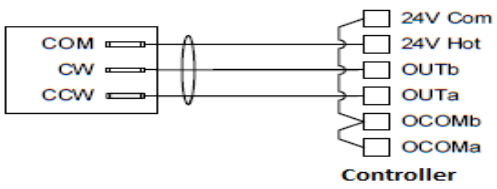
Type of field device	Type of Input/ Output	Termination diagrams
4–20 mA Output to Actuator	CO or AO	
4–20 mA Output to Actuator	CO or AO	
Voltage (Analog Output)	AO	
Analog Output (Current)	AO	
24 VAC Triac Output (Switch Low, External Source)	CO or AO	
Incremental Control to Actuator (Switch Low, Externally Sourced)	CO or AO	

Table 6: Termination details

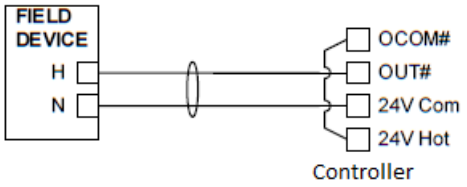
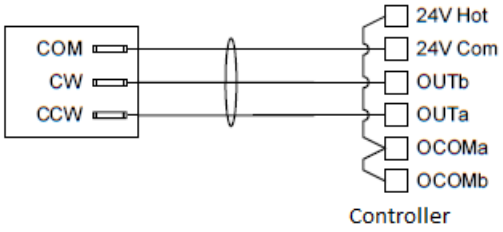
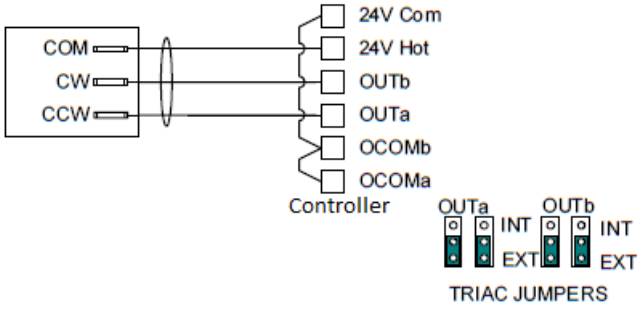
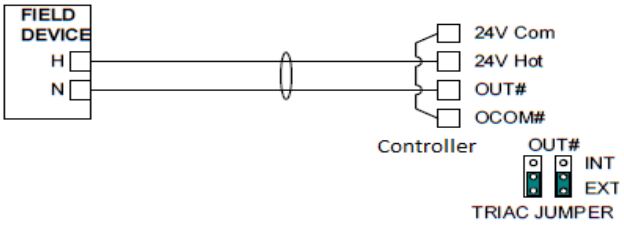
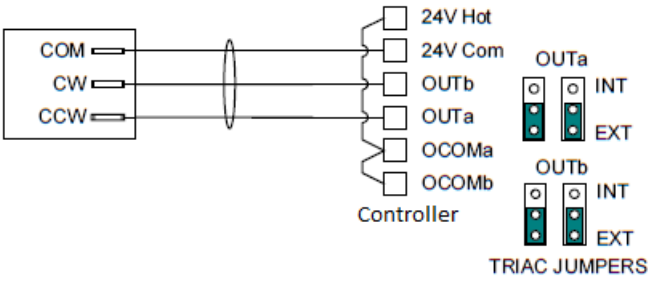
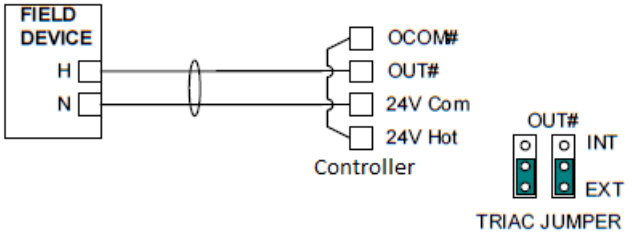
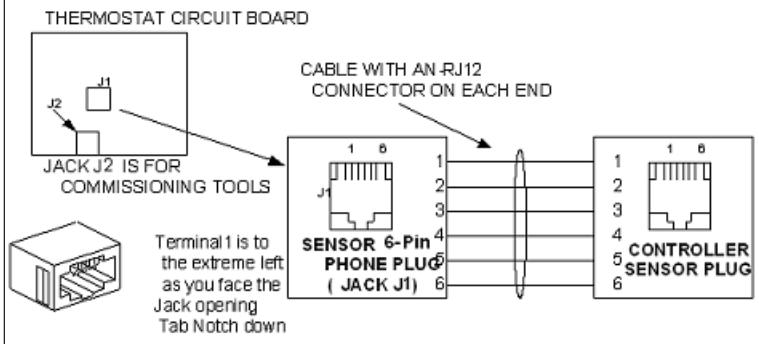
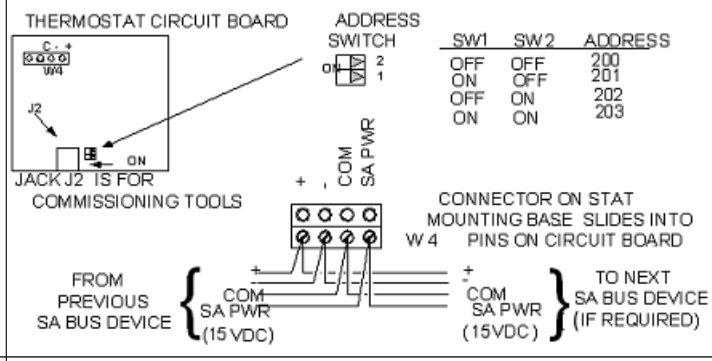
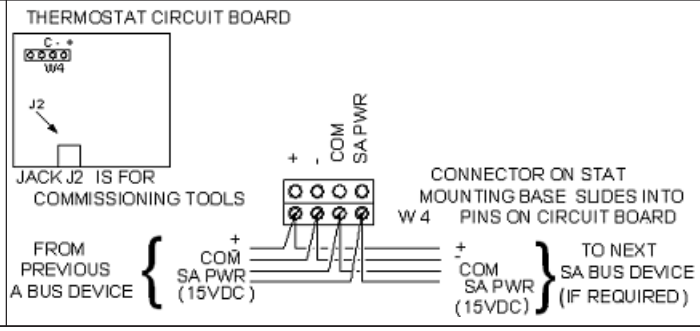
Type of field device	Type of Input/ Output	Termination diagrams
24 VAC Binary Output (Switch High, Externally Sourced)	CO or AO	
Incremental Control to Actuator (Switch High, Externally Sourced)	CO or AO	
Incremental Control to Actuator (Switch Low, Externally Sourced)	BO	
24 VAC Binary Output (Switch Low, Externally Sourced)	BO	
Incremental Control to Actuator (Switch High, Externally Sourced)	BO	
24 VAC Binary Output (Switch High, Externally Sourced)	BO	

Table 6: Termination details

Type of field device	Type of Input/ Output	Termination diagrams
Network Stat with Phone Jack (Fixed Address = 199)	SA Bus	
Network Stat with Terminals Addressable	SA Bus	
Network Stat with Terminals (Fixed Address = 199)	SA Bus	

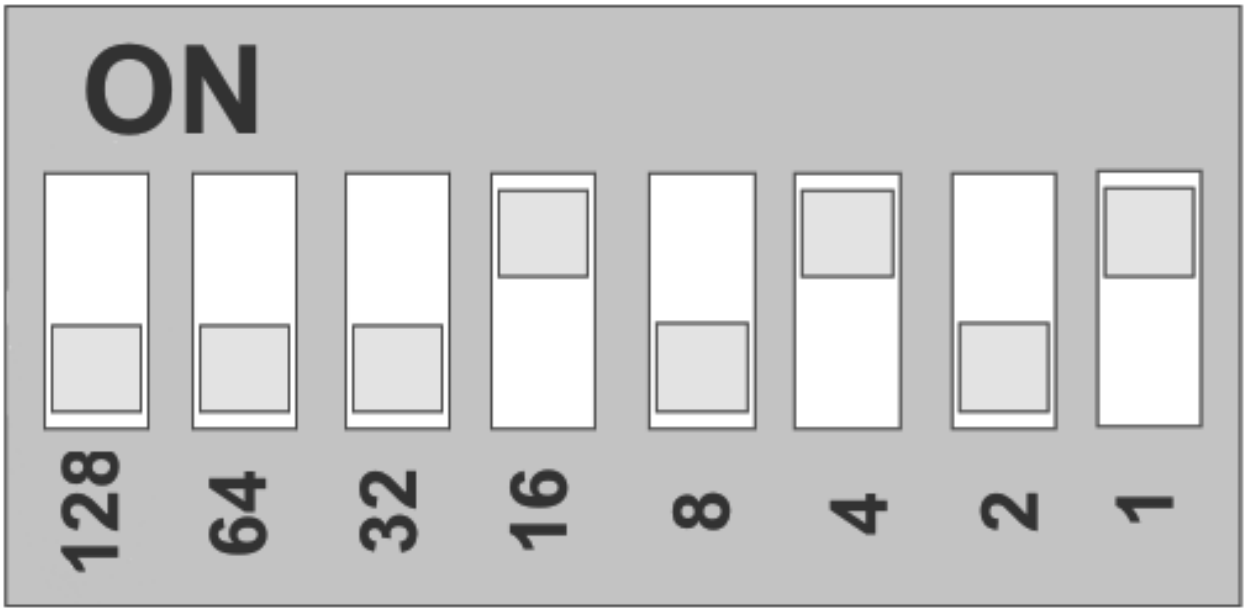
Setup and adjustments

Setting the device addresses

About this task:
The controllers are master devices on MS/TP (SA or FC) buses. Before operating the controllers on a bus, you **must** set a valid and unique device address for each controller on the bus. You set a controller's device address by setting the positions of the switches on the DIP switch block at the top of the controller (Figure 1) . 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. Switches 64 through 1 are device address switches. Switch 128 is a mode switch that enables a controller to operate on a ZFR/ZFR Pro Series Wireless Field Bus. Switch 128 must be set to off for all hard-wired SA and FC bus applications. Set switch 128 to ON for wireless FC bus applications **only**.

Figure 8: Device address DIP switch block set to address 21



Note: FX-PCGs 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 will not interfere with bus operation. Set a valid and unique device address on the controller before applying power to the controller on the bus.

To set the device addresses on the 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 through 1) to ON, so that the sum of the switch numbers set to ON equals the intended device address. See Table 7.
   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).
3. Set switch 128 to ON **only** for controllers on a ZFR/ZFR Pro Series Wireless Field Bus application. For all hard-wired SA and FC bus applications, ensure that switch 128 is set to OFF.

   Note: Do **not** connect a 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.

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

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

Table 7 describes the FC bus and SA bus devices addresses for Johnson Controls MS/TP communications bus applications.
Refer to the *FX-PC Series Controllers MS/TP Communications Bus Technical Bulletin (LIT-12011670)*or *MS/TP Communications Bus for BCPro System Technical Bulletin (LIT-12011908)* for more information on controller device addresses and how to set them on MS/TP buses.

Table 7: 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) that are hardwired to an SA Bus or FC Bus.
0 to 3 (Switch 128 ON)	Reserved addresses for wired subordinate devices (not for use on FX-PC controllers). ⓘ **Note:** The controllers ship with switch 128 ON and the remaining address switches off rendering the controllers wired subordinate 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 the 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.

Removing the controller cover

About this task:

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

⓵ **Attention:** Disconnect all power sources to the controller before removing cover and changing the position of any jumper or the EOL switch on the controller. Failure to disconnect power before changing a jumper or EOL switch position can result in damage to the controller and void any warranties.

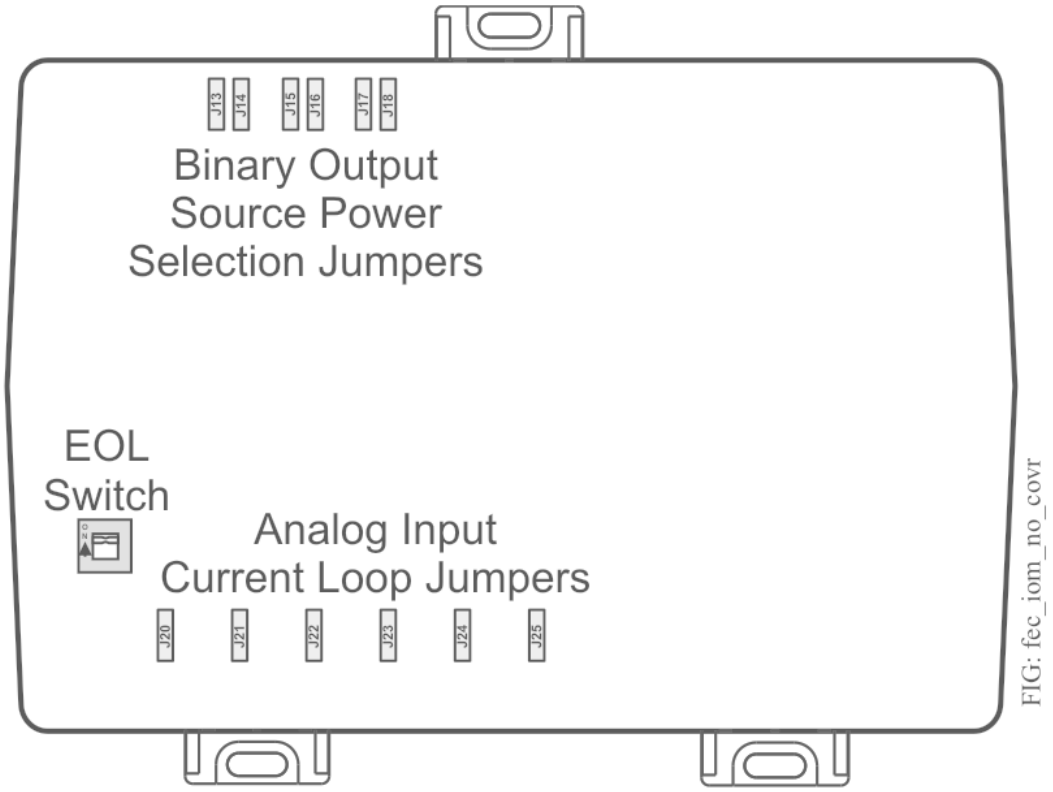
The controller cover is held in place by four plastic latches that extend from the base and snap into slots on the inside of the housing cover.

To remove the controller cover:

1. Place your fingernails under the two cover lift tabs on the sides of the housing cover and gently pry the top of the cover away from the base to release the cover from the two upper latches.
2. Pivot the top of the cover further to release it from the lower two latches.
3. Replace the cover by placing it squarely over the base, and then gently and evenly push the cover on to the latches until they snap into the latched position.

Controller cover removed showing EOL switch & current jumpers

Figure 9: Controller with cover removed showing EOL switch and jumper positions



Setting the End-of-Line (EOL) switch

About this task:
Each controller has an EOL switch, which, when set to ON, sets the controller as a terminating device on the bus. See the following figure for the EOL switch location. The default EOL switch position is OFF.

Figure 10: End-of-Line switch positions



To set the EOL switch on a 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 BCPro 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.

Setting the Input and Output jumpers

Binary Output (BO) source power selection jumpers

⚠ CAUTION

Risk of Electric Shock.

Disconnect supply power to the FX-PCG before attempting to adjust the Binary Output Source Power Selection Jumpers. Failure to disconnect the supply power may result in electric shock.

⚠ ATTENTION

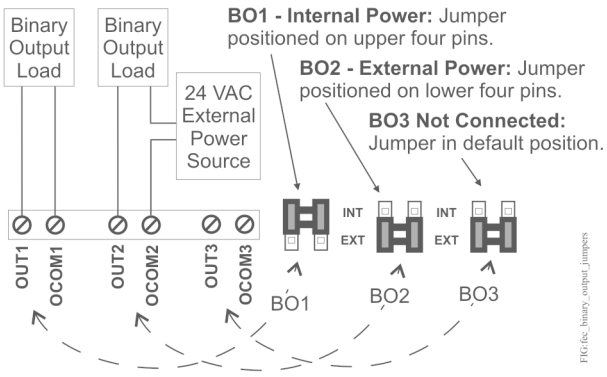
Risque de décharge électrique.

Débrancher l'alimentation de l'controller avant tout réglage du Binary Output Source Power Selection Jumpers. Le non-respect de cette précaution risque de provoquer une décharge électrique

➤ **Important:** Do **not** connect an external power source to a BO when the BO power source jumper is in the internal power (INT) position. Connecting external power to a BO that sources internal power can damage the controller and void any warranties.

The BO source power selection jumpers determine whether a BO provides internal power (sourced from the controller) to the output load (INT position) or requires an external power source (EXT position) for the output load. Figure 11 shows an example of a controller BOs and the associated power selection jumpers to the right of the BOs terminal block.

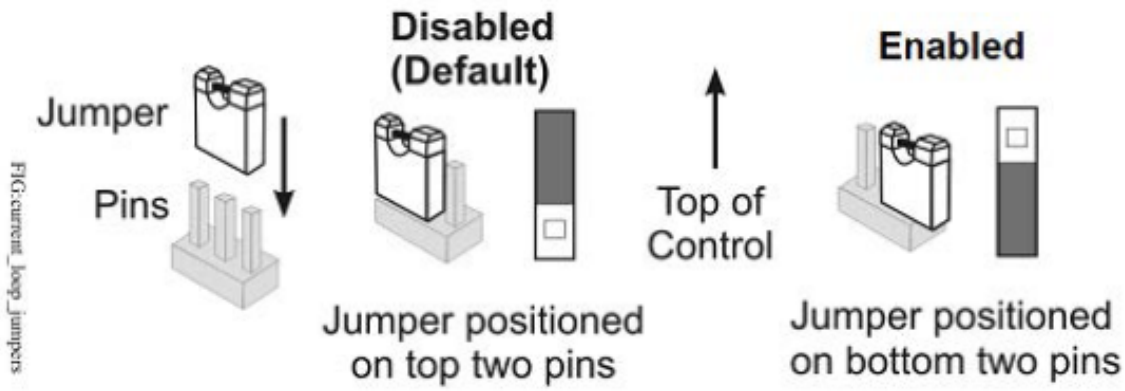
Figure 11: Example binary outputs and the associated source power jumper positions



Universal Input current loop jumpers

The Universal Input (UI) current loop fail-safe jumpers are on the circuit board under the controller cover near the UI terminals (Figure 9). When a UI is defined (in the system software) as a 4-20 mA Analog Input and the UI's current loop jumper is in the Disabled (default) position (Figure 12), the 4-20 mA current loop circuit opens whenever power to the controller is interrupted or off.

Figure 12: Current loop jumper positions



Setting the current loop jumper to the Enabled position (Figure 12) connects an internal 100 ohm resistor across the UI terminals, which maintains the 4-20 mA current loop circuit even when power to the controller is interrupted or off.

Important: Current Loop jumpers must be in the Disabled (default) position for all UIs that are not set up to operate as 4-20 mA analog inputs.

FX-PCG26 current loop jumper ID table

Table 8 identifies the current loop jumpers associated with each UI on the FX-PCG26.

Table 8: FX-PCG26 UI Inputs and jumper labels

Universal Input label	Jumper label on circuit board
IN1	J20
IN2	J21
IN3	J22
IN4	J23
IN5	J24
IN6	J25

Setting up an integral or local display

FX-PCG262x models have an integral LCD and push button user interface that allows you to set up and monitor the FX-PCG, the FX-PCG I/O points, and the modules and I/O points connected on the SA bus. FX-PCG261x 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)*.

Commissioning the Controllers

You commission the controllers with CCT software, using either a MAP gateway, a Bluetooth® Wireless Commissioning Converter (BCVT), a USB dongle with ZigBee®, Ethernet connection, or in BACnet router mode when connected to a FX Supervisory Controller . Refer to the *Controller Tool Help (LIT-12011147)* for detailed information on commissioning controllers.

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

Troubleshooting FX-PCG Controllers

Observe the Status LEDs on the front of the FX-PCG and see Table 10 to troubleshoot the controller.

ⓘ **Note:** To troubleshoot an integral or local controller display, refer to the *FX-DIS1710 Local Controller Display Technical Bulletin (LIT-12011666)*.

Table 9: 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-PCG and the FX-ZFR1811 Wireless Field Bus Router. Blink - 2 Hz = Download or Startup in progress, not ready for normal operation
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

LED status and description table

Table 10: 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-PCG and the FX-ZFR1811 Wireless Field Bus Router. Blink - 2 Hz = Download or Startup in progress, not ready for normal operation
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 a controller fails to operate within its specifications, replace the controller. For a replacement controller, contact your Johnson Controls representative.

Accessories

Table 11: Accessories Ordering Information

Product Code Number	Description
FX-BTCVT-1	Bluetooth Commissioning Converter, with Bluetooth® Technology
FX-DIS1710-0	Local Controller Display (for use with FX-PCG1611 model only)
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 of 10
AP-TBK4FC-0	Replacement FC Bus Terminal Blocks, 4-Position, Blue, Bulk Pack of 10
AP-TBK3PW-0	Replacement Power Terminal Blocks, 3-Position, Gray, Bulk Pack of 10
ZFR-USBHA-0	USB Dongle with ZigBee® Driver provides a wireless connection through CCT to allow wireless commissioning of the wirelessly enabled FX-PCG, FX-PCA, FX-PCX, and FX-PCV field controllers. Also allows use of the FX-ZFR Checkout Tool (FX-ZCT) in CCT. ⓘ **Note:** The ZFR-USBHA-0 replaces the IA OEM DAUBI_2400 ZigBee USB dongle. For additional information on the ZFR-USBHA-0 ZigBee 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 12: FX-PCG26 technical specifications

Product Code Numbers	FX-PCG2611-0: General Purpose Programmable Controller FX-PCG2621-0: General Purpose Programmable Controller with 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 only 20 VA maximum for FX-PCG2621 (with integral display) only ⓘ **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°C to 50°C (32°F to 122°F); 10% to 90% RH noncondensing **Storage:** -40°C to 80°C (-40°F to 176°F); 5% to 95% RH noncondensing
Addressing	**BACnet® MS/TP:** DIP switch set; valid field controller device addresses 4–127 (Device addresses 0–3 and 128–255 are reserved and not valid controller addresses.) **N2:** DIP switch set; valid controller device addresses 1–255
Communications Bus	**RS-485**, field selectable between BACnet MS/TP and N2 communications: 3-wire FC Bus between supervisory controller and field controllers. 4-wire SA Bus between field controller, network sensors, and other sensor/actuator devices, includes a lead to source 15 VDC supply power (from field controller) to bus devices.
Processor	H8SX/166xR Renesas® 32-bit microcontroller
Memory	640 KB flash memory and 128 KB RAM
Input and Output Capabilities	**FX-PCG26 Series:** **2 - Binary Inputs:** Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode **3 - Binary Outputs:** Defined as 24 VAC Triac (selectable internal or external source power) **4 - Configurable Outputs:** Defined as 0–10 VDC **2 - Analog Outputs:** Defined as 0–10 VDC or 4–20 mA
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:** Fixed Screw Terminal Blocks **SA/FC Bus and Supply Power:** 4-Wire and 3-Wire Pluggable Screw Terminal Blocks **SA 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, Rating V0 minimum Protection Class: IP20 (IEC529)
Dimensions(Height x Width x Depth)	**FX-PCG26 Series:** 150 mm x 190 mm x 53 mm (5-7/8 in. x 7-1/2 in. x 2-1/8 in.) including terminals and mounting clips
Weight	0.5 kg (1.1 lb)

Table 12: FX-PCG26 technical specifications

Compliance CE	**United States:** UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; UL Listed, File S4977, UUKL 864 - 10th Edition, Smoke Control Equipment (MS-FEC2611-0U and MS-FEC2621-0U models only) 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 declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.
	Australia and New Zealand: RCM Mark, Australia/NZ Emissions Compliant
	BACnet International: BACnet Testing Laboratories (BTL) Protocol Revision 9 Listed BACnet Application Specific Controller (B-ASC)

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

Product warranty

This product is covered by a limited warranty, details of which can be found at www.johnsoncontrols.com/buildingswarranty.

Single point of contact

APAC	EU	UK	NA/SA
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