FAC2513 Advanced Application Field Equipment Controller Installation Guide

Part No. 24-11023-6 Rev. B

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Application

The FAC2513 Advanced Application Field Equipment Controller (FAC) is part of the *Metasys*® system Field Equipment Controller (FEC) family. These controllers run pre-engineered and user-programmed applications and provides the inputs and outputs required to monitor and control a wide variety of HVAC and other facility equipment.

FAC25 field controllers operate on an RS-485 BACnet® MS/TP Bus as BACnet Application Specific Controllers (B-AACs) and integrate into Johnson Controls® and third-party BACnet systems. FAC25 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 *Metasys* system network. This model does not support wireless applications.test

Communications Protocols

The FAC2513 field controllers can communicate using BACnet MS/TP or N2. By default, the FAC2513 field controllers communicate using the standard BACnet MS/TP protocol based on the ANSI/ASHRAE 135-2016, Protocol Revision 15. The BACnet protocol is a standard for ANSI, ASHRAE, and the International Standards Organization (ISO) for building controls.

The FEC Family Controllers, including the FAC2513, can be used as functional replacements for legacy N2 controllers. The N2-capable MS/TP field controller models provide a cost-effective upgrade and modernization path for customers with existing N2 controllers. For installation and commissioning support, and tips for efficient and safe replacement, refer to the *Modernization Guide for Legacy N2 Controllers (LIT-12012005)* and the controller-specific documentation. 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)*.

For more details on configuring FAC2513 controllers to communicate using the N2 communications protocol, see Configuring N2 Communications.

North American emissions compliance

United States

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

Canada

This Class (A) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe (A) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Installation

Observe the following guidelines when installing a field controller:

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

Parts included

- One FAC 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

FAC2513 physical features

Figure 1: FAC2513 physical features

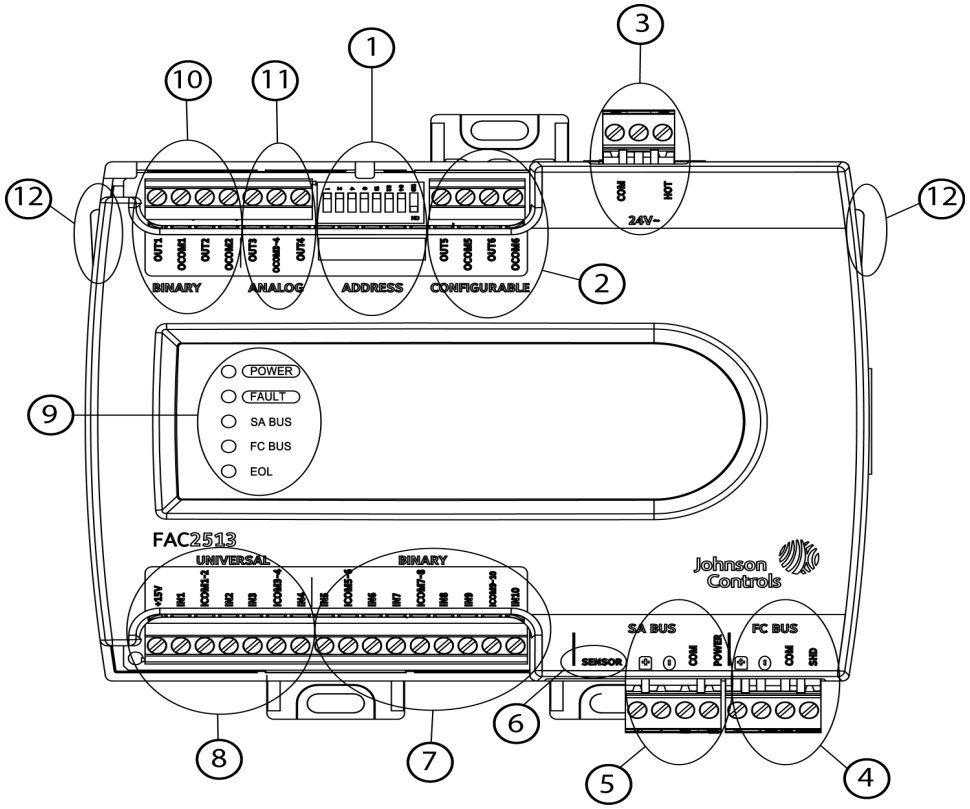


Table 1: Physical features

	Physical features: description and references
1	Device Address Dip Switch Block (see Setting the device address)
2	Configurable Output (CO) Terminal Block (see Table 3)
3	24 VAC, Class 2 Supply Power Terminal Block (see Supply power terminal block)
4	Field Controller (FC) Bus Terminal Block (see FC bus terminal block)
5	Sensor Actuator (SA) Bus Terminal Block (see SA bus terminal block)
6	Sensor Actuator (SA) Bus (RJ-12 6-pin Modular Jack) (see SA Bus port)
7	Binary Input (BI) Terminal Block (see Table 3)
8	Universal Inputs (UI) Terminal Block (see Table 3)
9	LED Status Indicators (see Table 8)
10	Binary Output (BO) Terminal Block (see Table 3)
11	Analog Outputs (AO) Terminal Block (see Table 3)
12	Cover lift tabs

FAC2513 point type counts

The following table shows the different point types and counts available in the FAC2513 and FAC26 Series controllers.

Note: The FAC2513 model is only available in certain regions. Contact your local Johnson Controls representative for more information.

Table 2: FAC2513 and FAC26 Series Point Type Counts per Model

Point Types	Signals Accepted	FAC2513	FAC2611
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 (Does not support Current Mode)	2
Binary Output (BO)	24 VAC Triac	2 (External Power only)	3
Configurable Output (CO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac	2	4

Mounting

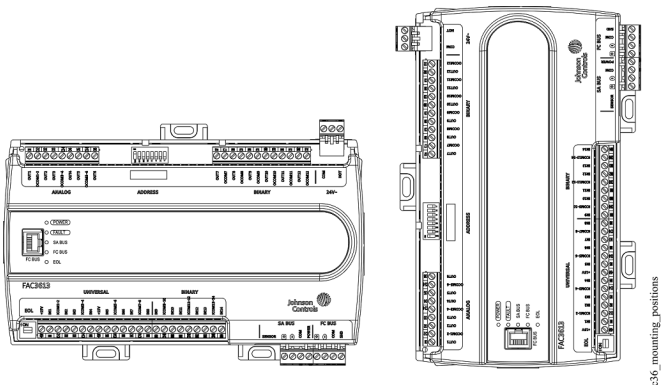
Observe the following guidelines when mounting a field controller:

- 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 2).
- 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 Technical specifications.
- 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 field controller in a panel or enclosure:

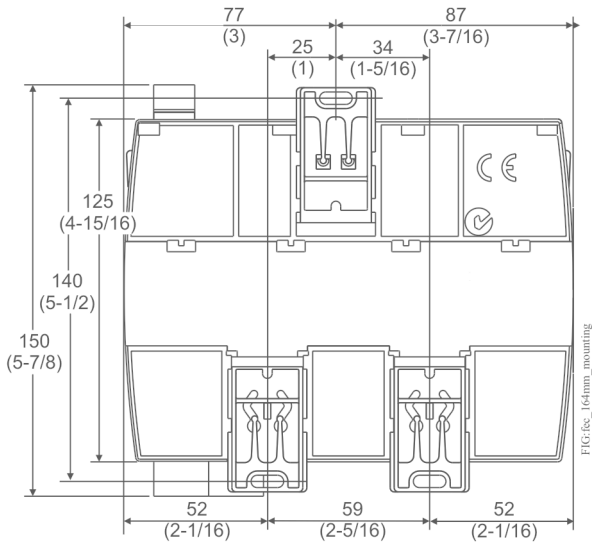
- Mount the controller so that the enclosure walls do not obstruct cover removal or ventilation through the controller.
- Mount the controller so that the power transformer and other devices do not radiate excessive heat to the controller.
- Do not install the controller in an airtight enclosure.

Figure 2: Mounting positions



Mounting features and dimensions

Figure 3: Back of Controller showing extended mounting clips, DIN rail channel, and mounting dimensions, mm (in.)



DIN rail mount applications

Mounting the field controller horizontally on 35 mm DIN rail is the preferred mounting method.
To mount a controller on 35 mm DIN rail, complete the following steps:

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

To mount a field controller directly on a wall or other flat vertical surface, complete the following steps:

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 in either the horizontal or vertical mounting position. Or hold the controller up to the wall or surface in a proper mount position and msark 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.

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 *MS/TP Communications Bus Technical Bulletin (LIT-12011034)*. For detailed information on wiring an N2 network, refer to the *N2 Communications Bus Technical Bulletin (LIT-636018)*

Terminal blocks and bus ports

See Figure 1 for a terminal block and bus port locations on the controller. Observe the following guidelines for terminal blocks and bus ports when you wire a controller.

Input and Output terminal blocks

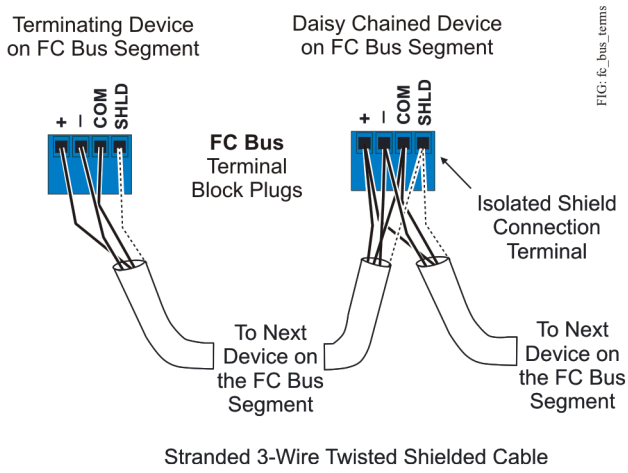
The fixed input terminal blocks are mounted on the bottom of the controller and the output terminal blocks are mounted on the top of the controller. See Figure 1 for more information about I/O terminal functions, requirements, and ratings.

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 4: FC bus terminal block wiring



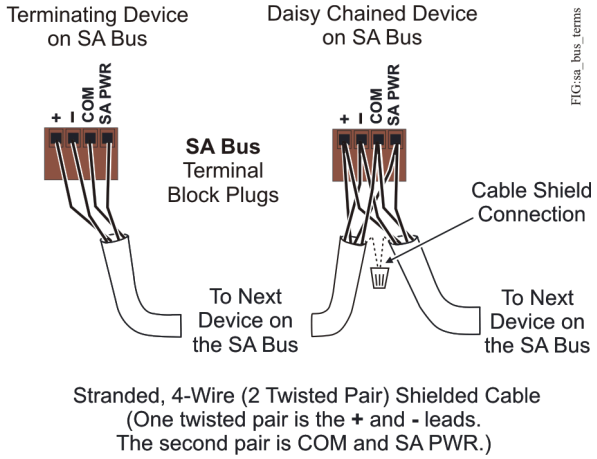
Note: The FC bus Shield (SHLD) terminal is isolated and can be used to connect (daisy chain) the shields for FC bus wiring.

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 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.

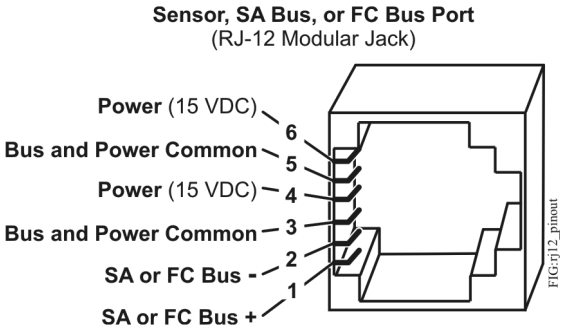
SA Bus port

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

The Sensor port is connected internally to the SA bus terminal block. See Table 5 for more information.

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

Figure 6: Pin number assignments for sensor and SA bus ports on Controllers

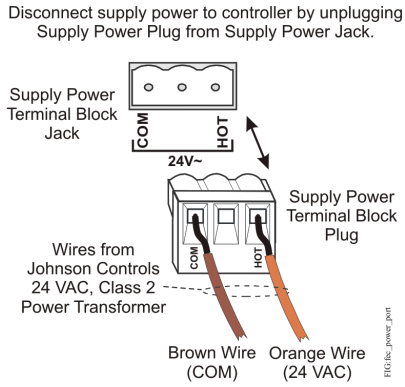


Supply power terminal block

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. Do not use the middle terminal on the supply power terminal block. 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 field controller does not require an earth ground connection.

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. This table also references guidelines for determining proper wire sizes and cable lengths.

In addition to the wiring guidelines in the table, observe the following guidelines when you wire 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.

Input and Output wiring guidelines table

Table 3: I/O 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 +15 V terminal.
	IN*n*	**Analog Input - Voltage Mode (0–10 VDC)**	See Guideline **A** in Table 4.
		10 VDC maximum input voltage Internal 75k ohms pull-down	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 share a common, which is isolated from all other commons, except the SA bus common.	Same as (Universal) **IN***n*
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 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.	
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.
	OCOM*n*	**Analog Output Signal Common** for all Analog OUT terminals. ⓘ **Note:** All Analog Output Common terminals (OCOM*n*) share a common, which is isolated from all other commons.	

Table 3: I/O 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** (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	
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) share a common, which is 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 and wire length guidelines

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

Note: The required wire sizes and lengths for high voltage (>30 V) Relay Outputs are determined by the load connected to the relay, and local, national, or regional electrical codes.

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	
	N/A (24 AWG) stranded copper	107 m (350 ft) twisted wire	

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

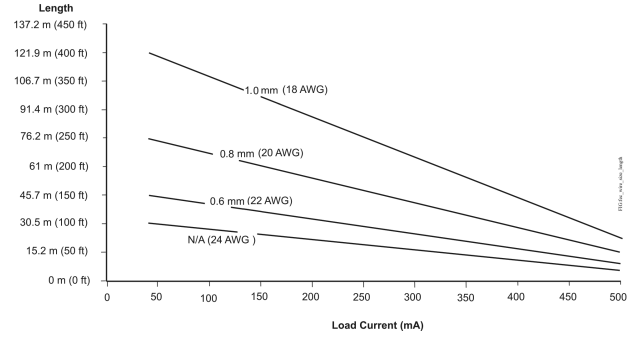
Guideline	Wire size/Gauge and type	Maximum cable length and type	Assumptions
B	1.0 mm (18 AWG) stranded copper	229 m (750 ft) twisted wire	100 mV maximum voltage drop Depending on cable and the connected input or output device, you may have to define an offset in the setup software for the input or output 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	
	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

Maximum cable length versus load current

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

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

Figure 8: 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. The table also provides guidelines for wire sizes, cable types, and cable lengths for when you wire the controller's communication buses and supply power.

In addition to the guidelines in Table 5, observe the following guidelines when you wire 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 *MS/TP Communications Bus Technical Bulletin (LIT-12011034)* for detailed information regarding wire size and cable length requirements for the SA and FC buses.

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

Note: The SA Bus and FC bus wiring recommendations in this table are for MS/TP bus communications at 38.4k baud.

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)	
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.)	

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
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	

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 MS/TP communications Bus Technical Bulletin (LIT-12011034).

See the figures in this section for the applicable termination diagrams.

Termination details

A set of Johnson Controls termination diagrams provides details for wiring inputs and outputs to the controllers.

Table 6: Termination details

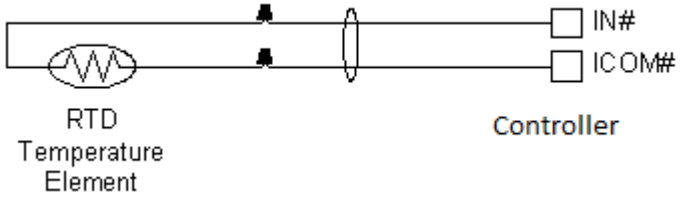
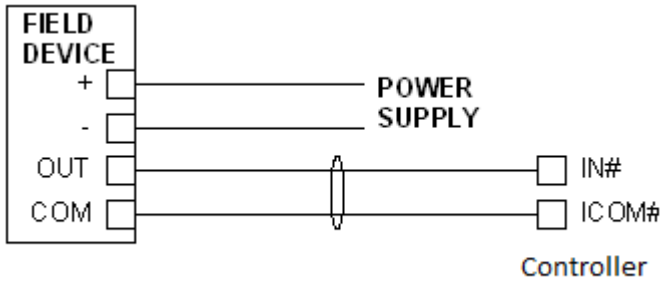
Type of field device	Type of Input/ Output	Termination diagrams
Temperature Sensor	UI	
Voltage Input - External Source	UI	

Table 6: Termination details

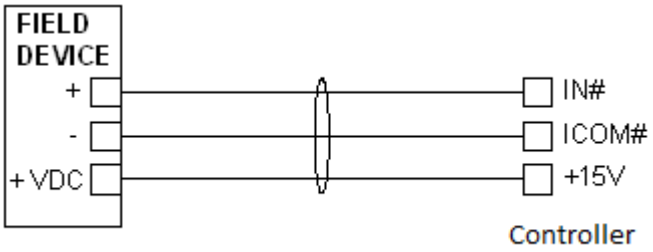
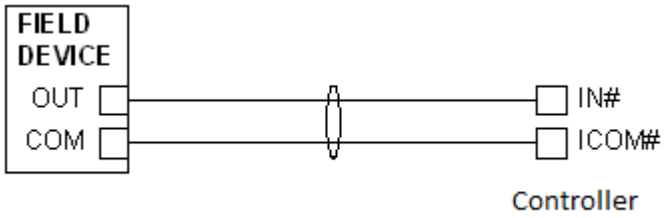
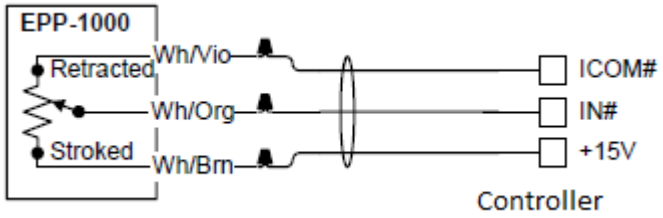
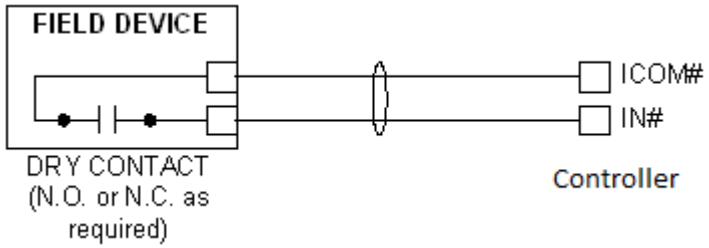
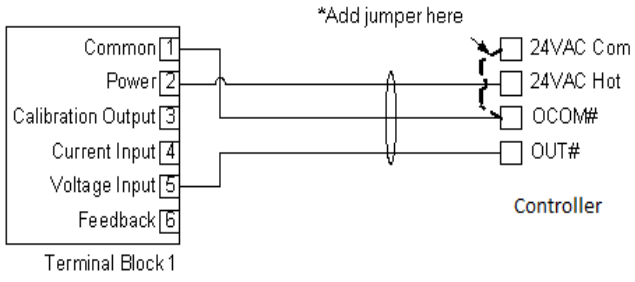
Type of field device	Type of Input/ Output	Termination diagrams
Voltage Input - Internal Source	UI	
Voltage Input (Self-Powered)	UI	
Feedback from EPP-1000	UI	
Dry Contact (Binary Input)	UI or BI	
0–10 VDC Output to Actuator (Internal Source)	CO or AO	

Table 6: Termination details

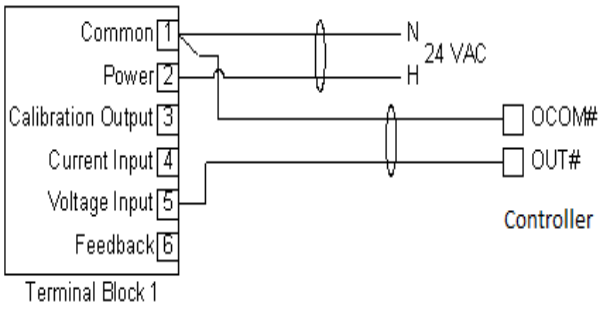
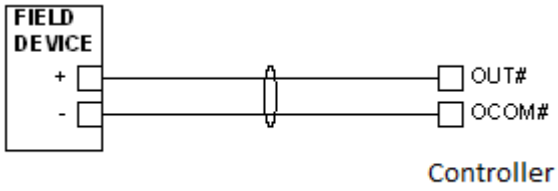
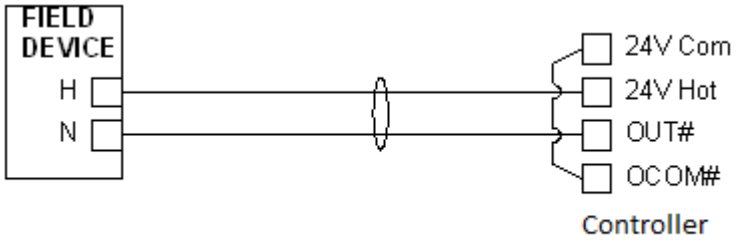
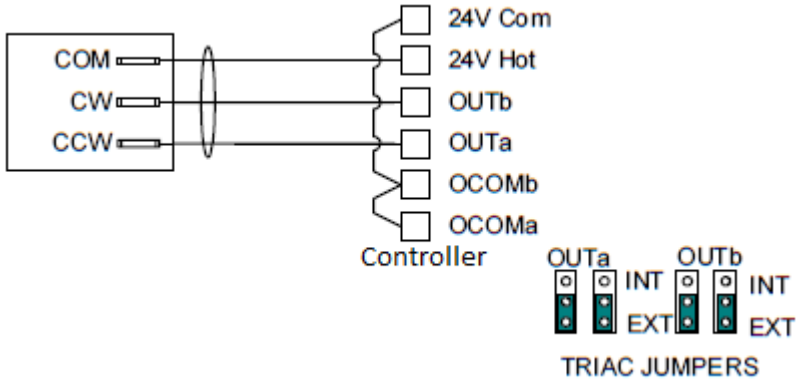
Type of field device	Type of Input/ Output	Termination diagrams
0–10 VDC Output to Actuator (External Source)	CO or AO	
Voltage (Analog Output)	AO	
24 VAC Triac Output (Switch Low, External Source)	CO	
Incremental Control to Actuator (Switch Low, Externally Sourced) (Triac Jumpers Where Applicable)	BO	

Table 6: Termination details

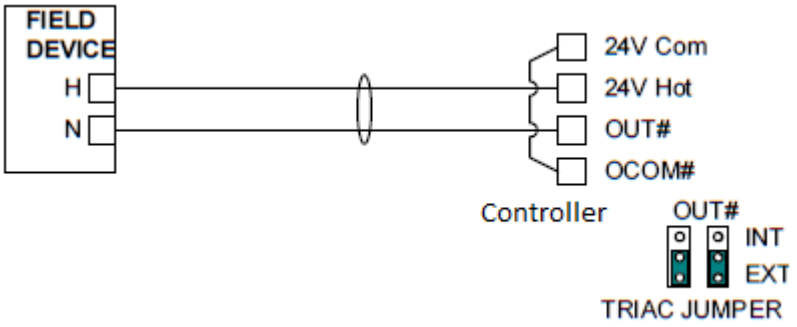
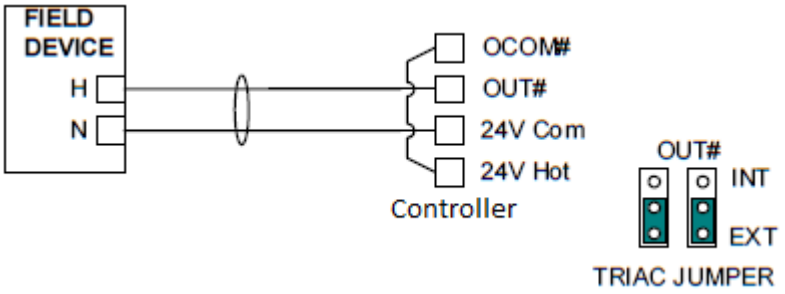
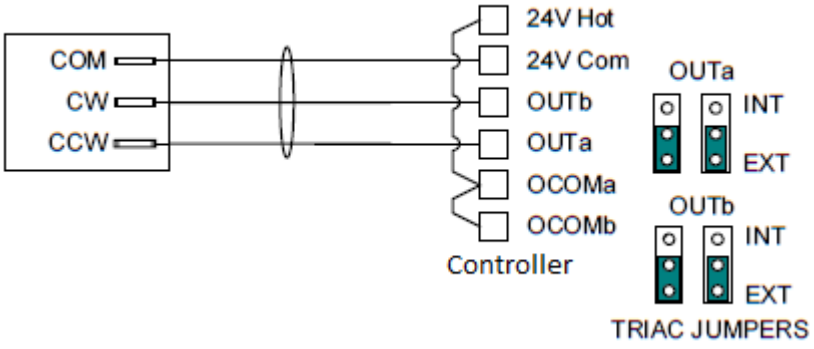
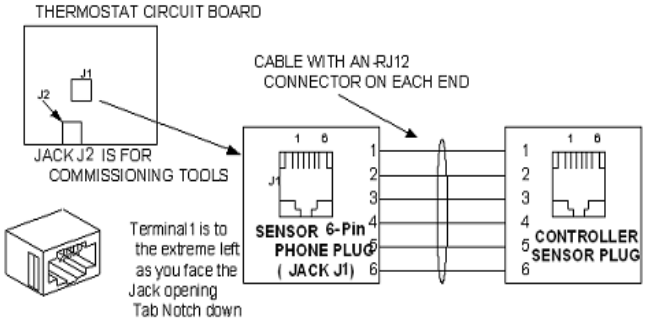
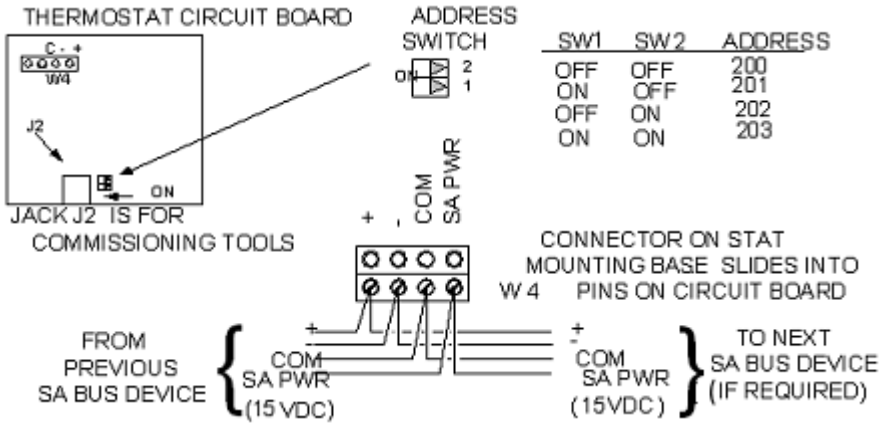
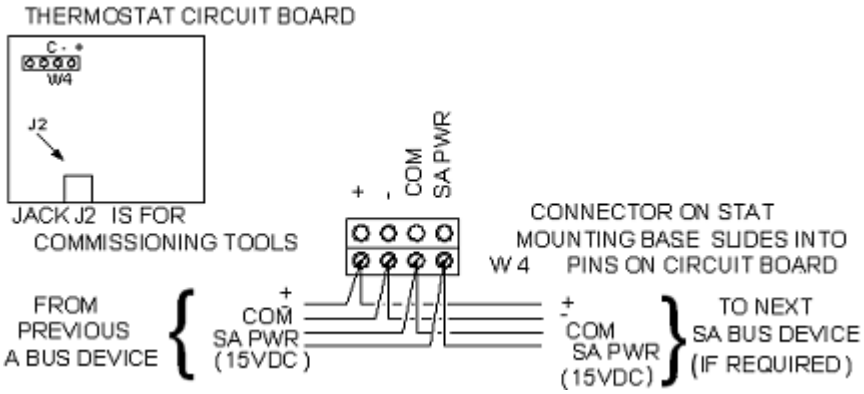
Type of field device	Type of Input/ Output	Termination diagrams
24 VAC Binary Output (Switch Low, Externally Sourced) (Triac Jumpers Where Applicable)	BO	
24 VAC Binary Output (Switch High, Externally Sourced) (Triac Jumpers Where Applicable)	BO	
Incremental Control to Actuator (Switch High, Externally Sourced) (Triac Jumpers Where Applicable)	BO	
Network Stat with Phone Jack (Fixed Address = 199)	SA Bus	 **Note:** The bottom jack (J2) on the TE-700 and TE-6x00 Series Sensors is not usable as a zone bus or a SAB connection.

Table 6: Termination details

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

Setup and Adjustments

Configuring N2 Communications

N2-capable controllers support the full range of possible N2 device addresses provided by the N2 protocol standard (1–254).
To configure a controller to communicate using the N2 protocol, complete the following steps:

1. Disconnect the 24 VAC supply from the controller.
2. Set the address switches to the desired N2 address. For details about setting a device address, see Setting the device address.
3. Reconnect the 24 VAC supply to the controller.
4. Using an SA bus connection, download the firmware and controller application file configured for N2 to the controller.

Switching the Communications Protocol from N2 to MS/TP

For N2 sites that are converting to BACnet MS/TP, you can switch the communications protocol of N2-configured MS/TP controllers back to BACnet MS/TP.
To switch an FAC2513 field controller operating in N2 mode back to BACnet MS/TP mode, complete the following steps:

1. Disconnect the 24 VAC supply from the controller.
2. Set the address switches to the desired BACnet MS/TP address. For details about setting a device address, see Setting the device address.
3. Ensure the DIP switch 128 is set to OFF.
4. Reconnect the 24 VAC supply to the controller.
5. Using an SA Bus connection, download a controller application file configured for BACnet MS/TP to the controller.

Setting the device address

Metasys field controllers are master devices on MS/TP (SA or FC) buses. Before you operate field controllers on

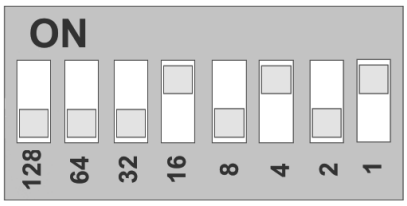
a bus, you **must** set a valid and unique device address for each controller on the bus. You set a controller's device address by setting the positions of the switches on the DIP switch block at the top of the controller. Device addresses 4 through 127 are the valid addresses for these controllers on an MS/TP FC bus.
The following table describes the FC bus and SA bus device addresses for Johnson Controls MS/TP communications bus applications.

Table 7: SA/FC bus device address descriptions

Device address	Use on descriptions
0 (Switch 128 Off)	Reserved for FC Bus Supervisory Controller (not for use on controllers or expansion modules).
1-3 (Switch 128 Off)	Reserved for peripheral devices (not for use on controllers or expansion modules).
4-127 (Switch 128 Off)	Used for MSTP master devices (controllers and expansion modules) that are hardwired to an SA bus or FC bus.

The DIP switch block has eight switches numbered 128, 64, 32, 16, 8, 4, 2, and 1. Switches 64 through to 1 are device address switches. Switch 128 must be set to **OFF** for all hard-wired SA and FC bus applications.

Figure 9: Device Address DIP Switch Block Set to Address 21



Note: *Metasys* field controllers ship with switch 128 **ON** and the remaining address switches off rendering the controllers wired subordinate devices, which do not operate on MSTP 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.

To set the device addresses on *Metasys* field controllers, complete the following steps:

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. Ensure that switch 128 remains set to **OFF**.

Note: 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 .

3. Set a unique and sequential device address for each of the field controllers connected on the SA or FC bus starting with device address 4.

Note: 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.

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

Removing the controller cover

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

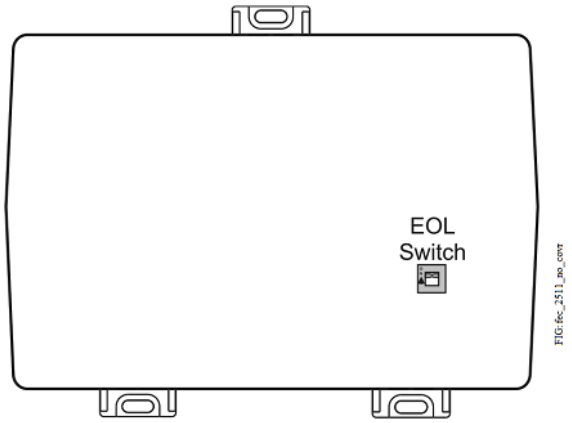
Important: Disconnect all power sources to the controller before you remove the cover and change the position of any jumper or the EOL switch on the controller. Failure to disconnect power before changing a jumper or EOL switch position can result in damage to the controller and void any warranties.

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, complete the following steps:

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.

Figure 10: FAC2513 with cover removed EOL switch



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 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 a field controller, complete the following steps:

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 *MS/TP Communications Bus Technical Bulletin (LIT-12011034)* 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 field controller is connected to power with its EOL switch set to **ON**, the amber EOL LED on the controller cover is lit.

Setting up a local display

The FAC2513 model does not have an integral display, but you can connect the controller to a DIS1710 Local Controller Display. For detailed information about setting up and operating either an integral user interface or a remotely connected DIS1710 display, refer to the *DIS1710 Local Controller Display Technical Bulletin (LIT-12011270)*

Input and Output validation

The FAC controllers ship with a default state that can assist in validating the wiring of the input and output terminals prior to download of an application file. When the controller is powered on in this state, the Fault LED will flash in a pattern of two quick blinks and then a long pause (see LED Status and States).

To make use of this feature, ensure the DIP switches are set to the desired address and wire the input and output terminals. Apply power to the FAC controller and connect to the device with either a MAP Gateway or MS-DIS1710-0 Local Display to view the points in the controller. The FAC controller will report an Operational status even though there is no true application loaded. CCT will not be able to commission or upload the device as a result until a true application is downloaded. The application name displayed will be the address of the controller followed by the model of the controller and “Default State”.

For example, a FAC controller whose DIP switches are set to 8 would have the default state application name of `8-FAC2513 Default State`.

The default state creates I/O points for all connections on the input and output terminals. It assumes all Universal Inputs (UIs) are Nickel temperature sensors. All Configurable Outputs (COs) are treated as Binary Outputs (BOs) with an initial value of 0. The default state also takes input from a Network Sensor at address 199. If there is no connected Network Sensor, the startup of this default state will be delayed by 30 seconds as the controller attempts to establish connection with the sensor.

Commissioning Field Controllers

You commission controllers with the Controller Configuration Tool (CCT) software.You can connect the controller using NxE Passthru (with network engines (NxEs) at release 9.0.2 or above), MAP 4.2+/BACnet Router (Mobile Access Portal (MAP) Gateway at version 4.2 or above), or through Bluetooth (using BTCVT). Refer to the *Controller Tool Help (LIT-12011147)* for detailed information about commissioning controllers.

ⓘ **Note:**

- You can use the Bluetooth connection to Transfer to Computer (Upload) and commission the controller, but you cannot use the Bluetooth connection to Transfer to Device (Download).
- The MAP Gateway serves as a replacement for the BTCVT, which is no longer available for purchase, but continues to be supported.

Firmware Package File

The MS-FCP-0 equipment controller firmware package files are required for CCT to configure and commission the controllers. The firmware package files also allow you to upgrade an existing controller to the latest firmware release available for that controller. Beginning at CCT Release 13, the firmware package files are orderable

separately; they are not included with CCT. They are obtained from the *Metasys* software licensing portal, and are loaded and licensed on the computer/server that is running CCT. For additional information about the firmware package files, refer to the *CCT Installation Instructions (LIT-12011259)*.

Troubleshooting Field Controllers

Observe the Status LEDs on the front of the field controller and see the following table to troubleshoot the controller. To troubleshoot a local controller display, refer to the *DIS1710 Local Controller Display Technical Bulletin (LIT-12011270)*.

LED status and states

Table 8: Status LEDs and description 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 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

See the following table for controller accessories ordering information.

Table 9: Accessories ordering information

Product Code Number	Description
IOM Series Controllers	Refer to the *Metasys® System Field Equipment Controllers and Related Products Product Bulletin (LIT-12011042)* for a complete list of available IOM Series Modules.
Mobile Access Portal (MAP) Gateway	Refer to the *Mobile Access Portal Gateway Catalog Page (LIT-1900869)* to identify the appropriate product for your region. ⓘ **Note:** The MAP Gateway serves as a replacement for the BTCVT, which is no longer available for purchase, but continues to be supported.
NS Series Sensors	Refer to the *NS Series Network Sensors Product Bulletin (LIT-12011574)* for a complete list of available NS Series Sensors.
TL-CCT-0	*Metasys* Controller Configuration Tool (CCT) Software
MS-FCP-0	*Metasys* Field Controller Firmware Package Files for CCT
MS-DIS1710-0	Local Controller Display
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. (20.32 cm) 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
AS-CBLTSTAT-0	Cable adapter for connecting to 8-pin TE-6700 Series sensors
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

Technical specifications

Table 10: FAC2513 technical specifications

Product Code Numbers	MS-FAC2513-0 Advanced Application Field Equipment Controller ⓘ **Note:** This model is only available in certain regions. Contact your local Johnson Controls representative for more information.
Supply Voltage	24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, power supply Class 2 (North America), Safety Extra-Low Voltage (SELV) (Europe)
Power Consumption	14 VA maximum ⓘ **Note:** VA 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 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 1–254
Communications Bus	**Selectable N2 or RS-485: BACnet® MS/TP** 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	RX631 Renesas®, 32-bit microcontroller
Real-Time Clock Backup Power Supply	Super capacitor maintains power to the onboard real-time clock for a minimum of 72 hours when supply power to the controller is disconnected.
Memory	16 MB flash memory and 8 MB SDRAM
Input and Output Capabilities	**4 - Universal Inputs:** Defined as 0–10 VDC, 0–600k ohm, or Binary Dry Contact **6 - Binary Inputs:** Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode **2 - Binary Outputs:** Does not have internal 24 VAC source, external power is required **2 - Configurable Outputs:** Defined as 0–10 VDC or 24 VAC Triac BO **2 - Analog Outputs:** Defined as 0–10 VDC
Analog Input/Analog Output Resolution and Accuracy	**Analog Input:** 15-bit resolution **Analog Output:** 0–10 VDC +/- 200 mV
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 Jack
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)	150 mm x 164 mm x 48 mm (5-7/8 in. x 6-7/16 in. x 1-7/8 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)

Table 10: FAC2513 technical specifications

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 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 15 Listed and Certified BACnet Advanced Application Controller (B-AAC)

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	Europe	NA/SA
JOHNSON CONTROLS C/O CONTROLS PRODUCT MANAGEMENT NO. 32 CHANGJIJANG RD NEW DISTRICT WUXI JIANGSU PROVINCE 214028 CHINA	JOHNSON CONTROLS WESTENDHOF 3 45143 ESSEN GERMANY	JOHNSON CONTROLS 507 E MICHIGAN ST MILWAUKEE WI 53202 USA

For more contact information, refer to www.johnsoncontrols.com/locations.

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