FX90 Supervisory Controller Installation Guide

FX-SC9BASE-0, FX-SC9WIFI-0

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Applications

Use this document for information on how to mount and wire the following applications:

- DIN-mount, 24 VAC/DC powered FX90 Supervisory Controller
- Wall-mount, Class 2 universal AC power adapter supplying 24 VA

Note: The non-Wi-Fi model of the FX90 Supervisory Controller requires FX Supervisory Release 14.13.2 or later. The Wi-Fi model of the FX90 Supervisory Controller requires FX Supervisory Release 14.15.1 or later. A maximum of four total option card modules are supported. The FX90 Supervisory Controller license determines the controller capacity and available protocols.

Installation

Unpack the FX90 Supervisory Controller and inspect the contents of the package for damaged or missing components. If the controller is damaged, contact the Johnson Controls® Product Sales Operations team and return any damaged components for repair or replacement.

Parts included

- One FX90 Supervisory Controller
- MicroSD card installed in the controller
- Single dual band 2.4/5.8 GHz antenna for Wi-Fi, two 3-position RS-485 connector plugs, and a grounding wire
- 2-position 24 VAC/DC connector plug
- FX90 Supervisory Controller Pack Sheet (A163829887)

Special tools needed

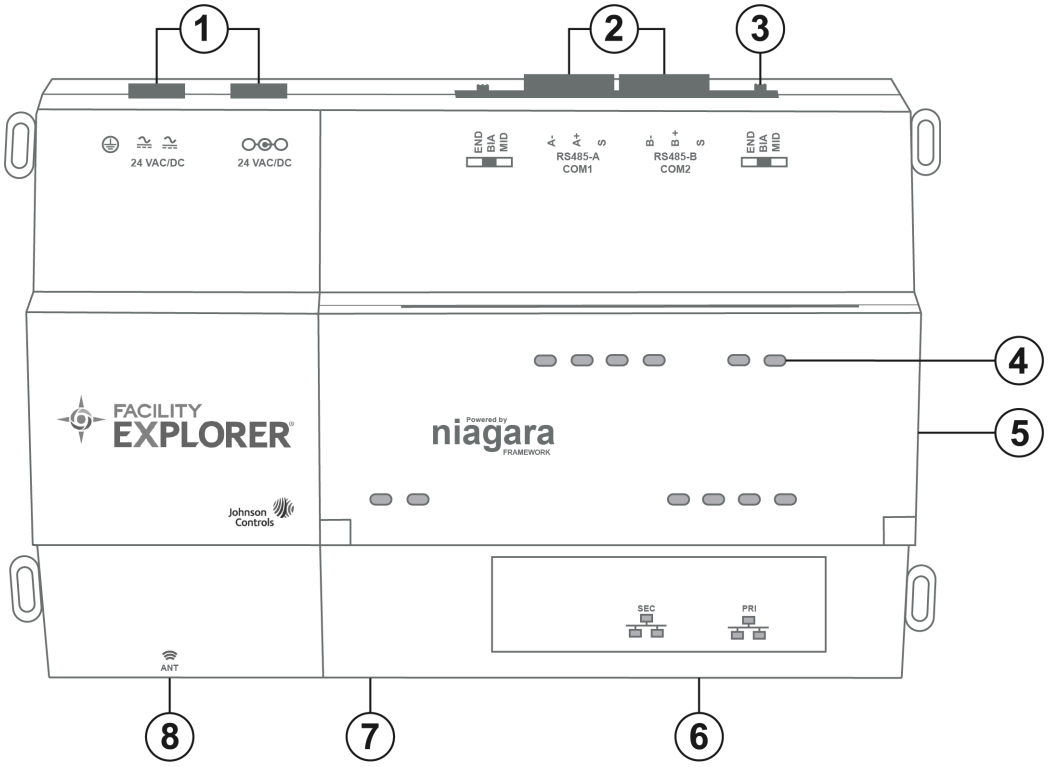
- One of the following tools:
  - UL listed, Class 2, 24 VAC transformer, rated at minimum of 20 VA

    Note: A dedicated transformer is required because it cannot power additional equipment.
  - 24 VDC power supply, capable of supplying at least 1A (24W)
  - FX-SC8XPS-0 wall-mount AC power adapter with barrel connector plug
- DIN rail, type NS35/7.5 (35 mm x 7.5 mm) and DIN rail end-clips or stop clips, recommended for any installation that includes option modules.
- Suitable tools and fasteners to mount the unit and any accessories.

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Device diagram

Figure 1: FX90 Supervisory Controller device diagram



Callout	Description
1	Earth ground and 24 V power input. See Wiring.
2	RS-485 ports. See RS-485 wiring.
3	RS-485 bias switches. See RS-485 bias switches.
4	LEDs. See LEDs.
5	Access panel that covers the USB port and switches. See USB port and switches.
6	Ethernet ports, 10/100/1000 Mbit, RJ-45. See Ethernet wiring.
7	MicroSD card slot. See Remove or replace the microSD flash memory card.
8	Wi-Fi antenna mount point: FX90 Supervisory Controller Wi-Fi model only

Precautions

General precautions

⚠ WARNING

Risk of Electric Shock.

Disconnect the power supply before making electrical connections. Contact with components carrying hazardous voltage can cause electric shock and may result in severe personal injury or death.

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⚠ AVERTISSEMENT

Risque de décharge électrique.

Débrancher l'alimentation avant de réaliser tout branchement électrique. Tout contact avec des composants conducteurs de tensions dangereuses risque d'entraîner une décharge électrique et de provoquer des blessures graves, voire mortelles.

- **Important:** Use copper conductors only. Make all wiring in accordance with local, national, and regional regulations. Do not exceed the FX90 Supervisory Controller's electrical ratings.
- **Important:** Remove all power to the controller before you attach and plug in or detach and unplug any option card module, to prevent possible equipment damage.

Static Discharge Precautions

Static charges produce voltages high enough to damage electronic components. The microprocessors and associated circuitry within the devices are sensitive to static discharge.

ⓘ **Note:** Removal of the cover is not required. The controller contains no configurable or user-serviceable items, such as jumpers.

Mounting

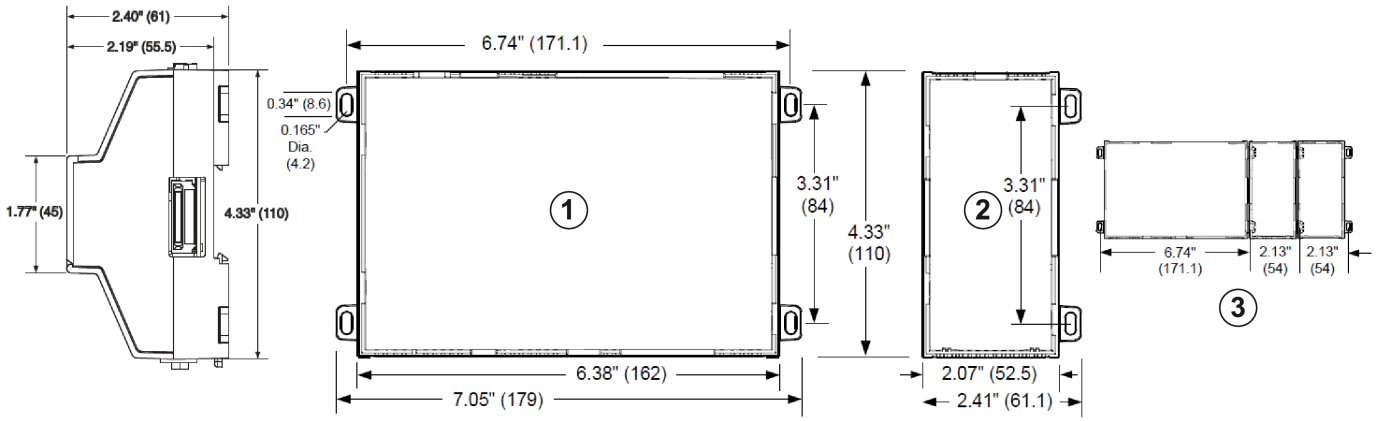
Mount the controller in a location that allows clearance for wiring, servicing, and module removal.

Location considerations

The following considerations apply when you physically mount the unit:

- To achieve maximum heat dissipation and meet the operating temperature upper limit, mount the FX90 Supervisory Controller horizontally. Any other mounting orientation reduces the upper limit.
- It is best practice to mount the FX90 Supervisory Controller on a 35 mm wide DIN rail. The controller's unit base features a molded DIN rail slot and locking clip, as do the option modules. DIN rail mounting ensures alignment of the connectors between the devices.
- Up to four option modules are supported.
- Dimensions of a unit appear in the following figure.

Figure 2: Mounting dimensions of FX90 Supervisory Controller and expansion modules



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Callout	Description
1	FX90 Supervisory Controller dimensions
2	Expansion module. Up to four may be used. See Expansion modules and IO configurations.
3	Distances between the center of the tabs from one unit to another unit

Expansion modules and IO configurations

Expansion modules can extend the IO capacity of the FX90 Supervisory Controller.

Table 1: Maximum expansion

Expansion module	Number of modules supported
NPB-8000-LON	4
NPB-8000-232	4
NPB-8000-2X-485	2

Table 2: Maximum IO

IO module	Number of modules supported
IO-R-16	16
IO-R-34	8

Table 3: Maximum Niagara Enterprise Security

Maximum Niagara Enterprise Security	Number of modules supported
T-SEC-R2R	16 total each or combined
T-SEC-RIO	16 total each or combined

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Figure 3: FX90 Supervisory Controller expansion modules and IO configurations

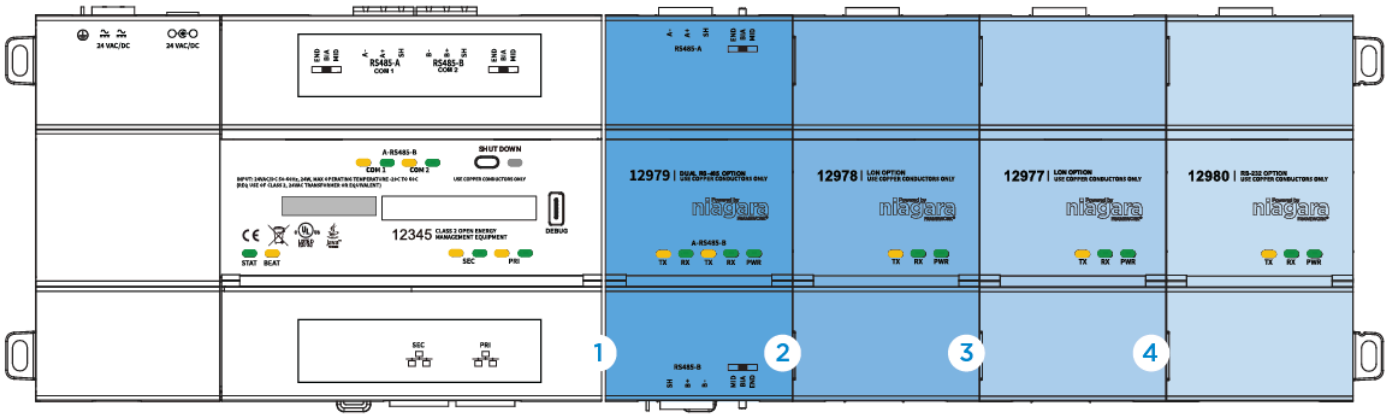


Table 4: Maximum combinations

Optional communication module position				
Maximum configuration option	**1**	**2**	**3**	**4**
A	RS-232 or LonWorks protocol	RS-232 or LonWorks protocol	RS-232 or LonWorks protocol	RS-232 or LonWorks protocol
B	Dual port RS-485	RS-232 or LonWorks protocol	RS-232 or LonWorks protocol	RS-232 or LonWorks protocol
C	Dual port RS-485	Dual port RS-485	RS-232 or LonWorks protocol	n/a
D	Dual port RS-485	Dual port RS-485	n/a	n/a

Note: Expandability is dependent on the type of expansion module you use.

Environmental requirements

Note: This product is for indoor use only, at a maximum altitude of 2,000 m (6,562 ft).

Ambient conditions must be within the following ranges:

- Operating temperature: -20°C to 60°C (-4°F to 140°F)
- Storage temperature: -40°C to 85°C (-40°F to 185°F)
- Relative humidity: 5% to 95% non-condensing. Pollution degree 3
- Supply or mains voltage requirements:
  - Allowable voltage fluctuation to -15%, +10%
  - Temporary overvoltages +/- 15%

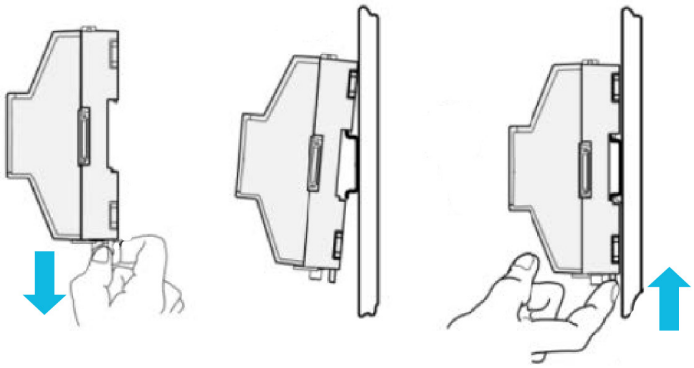
Note: To achieve maximum heat dissipation and meet the operating temperature upper limit, mount the FX90 Supervisory Controller horizontally. Any other mounting orientation reduces this upper limit.

DIN rail mounting

1. Pull the FX90 Supervisory Controller's locking clip down.

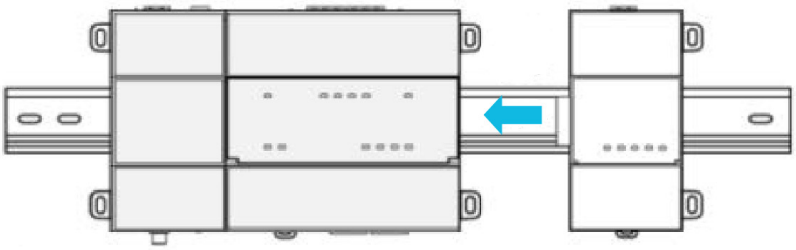
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Figure 4: Fastening to the rail



2. Tilt the module to hook over the DIN rail.
3. Push down and in on the unit. This fastens it to the rail.
4. Slide the module firmly into the FX90 Supervisory Controller's connector, or existing option module, to seat.
5. Mount any option card module onto the DIN rail in the same way.

Figure 5: Slide module into FX90 Supervisory Controller's connector



6. Slide the module firmly into the FX90 Supervisory Controller's connector to seat. Repeat for other modules as needed. Four is the maximum number of modules.
7. Secure both ends of the final assembly with DIN rail end-clips provided by the DIN rail vendor.

Wiring

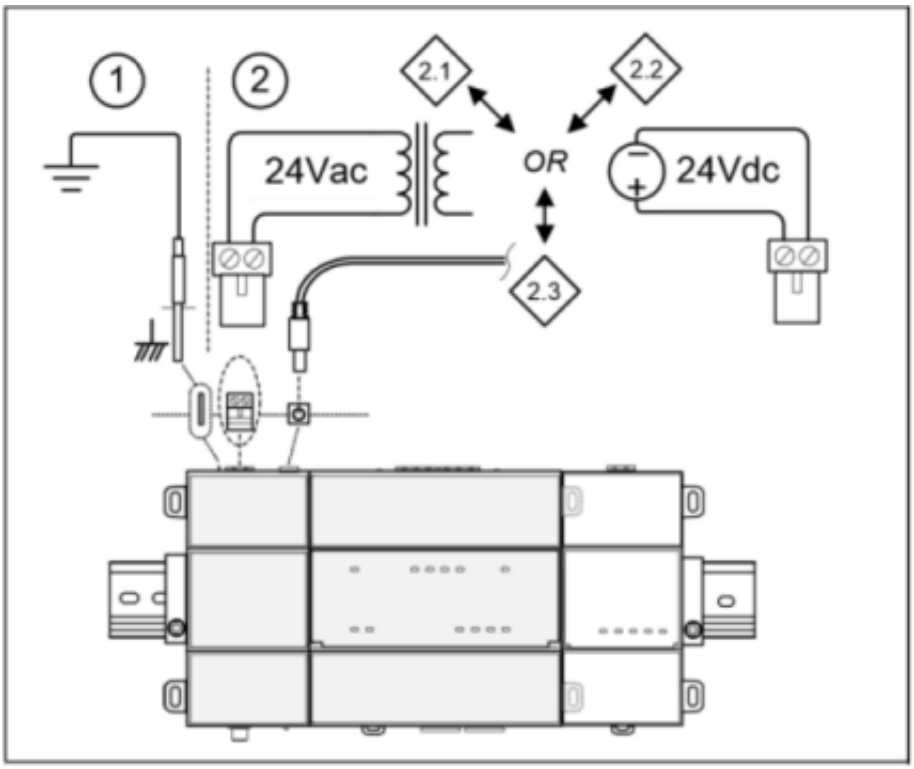
This section details how to earth ground and power the device, communications wiring, RS-485 wiring, and Ethernet wiring.

Earth ground and power

Earth grounding provides protection from electrostatic discharge or other forms of electromagnetic interference (EMI).

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Figure 6: Earth ground and power options



The power source determines the type of earth grounding you must perform:

- **2.1 (AC)**: Dedicated 24 V transformer required, with neither side of the transformer secondary tied to ground.
- **2.2 (DC):** Polarity is not important as it uses an onboard diode bridge, with neither leg tied to ground.
- **2.3**: Wall-mount AC adapter, FX-SC8XPS-0, instead of wiring 24 V to 2-position connector. Do not use the wall-mount AC adapter simultaneously with power wired 2-position connector.

Wiring earth ground and power

Important: Before making power terminations, de-energize the 24 V power source. Do not restore power until completing all other mounting and wiring.

Important: A grounding point must be present nearby.

1. Install the included earth ground wire to the controller's earth ground spade lug, and terminate the other end to a nearby earth ground.
2. Unplug the controller's 2-position power connector plug and terminate the 24 V supply source (AC or DC) to the connector. Leave the connector unplugged.

Communications wiring

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Figure 7: Communications ports on the FX90 Supervisory Controller

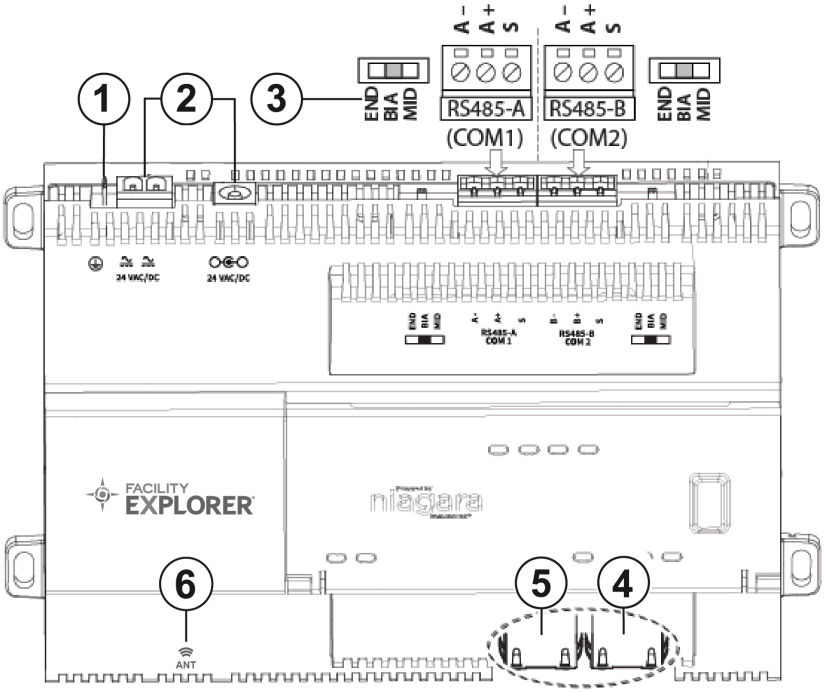


Table 5: Communications ports on the FX90 Supervisory Controller

Callout	Description
1	Ground
2	24 V power input
3	RS-485 ports and bias switches
4	Ethernet port, 10/100/1000-Mbit, RJ-45: Pri
5	Ethernet port, 10/100/1000-Mbit, RJ-45: Sec
6	Wi-Fi antenna: FX90 Supervisory Controller Wi-Fi model only

Wi-Fi

An integral Wi-Fi adapter provides wireless connectivity with the IEEE 802.11a/b/g/n/ac standard and provides an antenna connector.

Note: Set the Wi-Fi mode in platform properties in FX Workbench. For more information, refer to *FX90 Wi-Fi Technical Bulletin (LIT-12014587)*.

RS-485 wiring

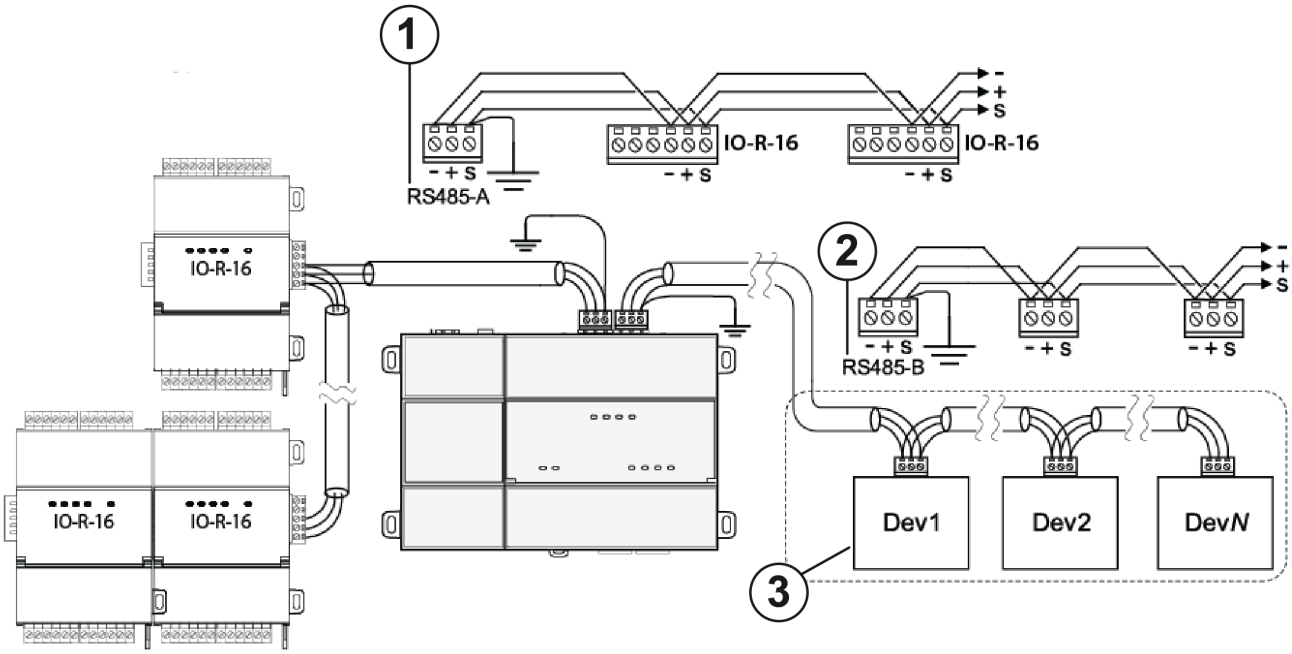
On the FX90 Supervisory Controller's top side, two RS-485 ports operate as COM1 and COM2. Each port is capable of up to 115,200 baud, and uses a 3-position, screw terminal connector.

Use shielded, twisted-pair, 18-22 AWG cabling to wire in a continuous daisy chain fashion to other RS-485 devices: minus-to-minus, plus-to-plus, and shield-to-shield. Connect the shield wire to earth ground at one end only.

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

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Figure 8: RS-485 wiring example



Callout	Description
1	RS-485 port A (COM1)
2	RS-485 port B (COM2)
3	A maximum of four total option modules are supported. The FX90 Supervisory Controller license determines the options available.

RS-485 bias switches

Each RS-485 port has an adjacent 3-position biasing switch with the following settings:

- **BIA**: The default middle switch. The controller provides RS-485 biasing without a termination resistor.
- **END**: The controller provides both RS-485 biasing and a termination resistor.
- **MID**: The controller does not provide RS-485 biasing or termination resistor.

RS-485 biasing can improve communications because this eliminates indeterminate idle states.

Note: FX-PC controllers implement biasing. When you use RS-485 for BACnet MS/TP with FX-PC controllers, use the **MID** position with FX-PC controllers at the ends of the trunks with their EOLs set. An all FX-PC controller trunk does not require the **BIA** position. For more information, refer to the *FX-PC Series Controllers MS/TP Communications Bus Technical Bulletin (LIT-12011670)*.

Ethernet wiring

Two RJ-45 10/100/1000-Mbit Ethernet connectors are labeled PRI (LAN1) for primary, and SEC (LAN2) for secondary. Use a standard Ethernet patch cable to an Ethernet switch.

The factory-default IP address for PRI is **192.168.1.140**. The default subnet mask is **255.255.255.0**. By default, the SEC (LAN2) port is disabled.

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Setup and adjustment

This section details how to turn on the device and perform an initial checkout.

Turning on and performing an initial checkout

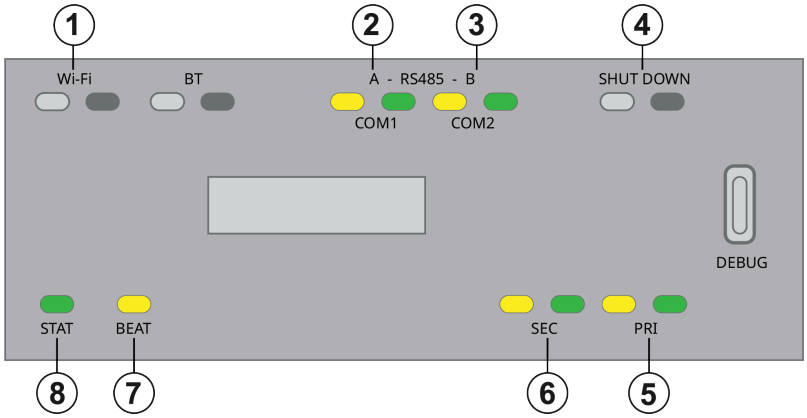
1. Apply power. To do this, perform one of the following options:
   - Insert the 2-position 24 V power connector plug.
   - Insert the barrel plug of the wall-mount AC adapter (FX-SC8XPS-0).
2. Check the **STAT** (Status) and **BEAT** (Heartbeat) LEDs. When power is applied, the green **STAT** LED flashes. This LED indicates that the system works, with power applied. During startup, the **BEAT** LED may blink at 1 Hz with a 90/10 percent on/off duty cycle. When startup completes, the platform daemon starts, and the normal 1 Hz flash at 50/50 percent on/off duty cycle of the **BEAT** LED returns.

   ⓘ **Note:** Keep the device powered for 3 hours to complete the initial charge. If the device loses power before the initial charge is complete, the system time may reset on reboot. This issue does not damage the device. Refer to the *FX90 Real Time Clock Issue Flash Sheet (LIT-2025F32)* for more details.

LEDs

The FX90 Supervisory Controller features a number of status LEDs.

Figure 9: LEDs and descriptions



Callout	Label	Color	Description
1	Wi-Fi	Green	Access point mode enabled. For information on blink patterns, see *FX90 Wi-Fi Technical Bulletin (LIT-12014587)*.
		Yellow	Client mode enabled. For information on blink patterns, see *FX90 Wi-Fi Technical Bulletin (LIT-12014587)*.
2	RS-485 A - COM1	Yellow	Transmit (TX)
		Green	Receive (RX)
3	RS-485 B - COM2	Yellow	Transmit (TX)
		Green	Receive (RX)
4	SHUTDOWN	Impressed	

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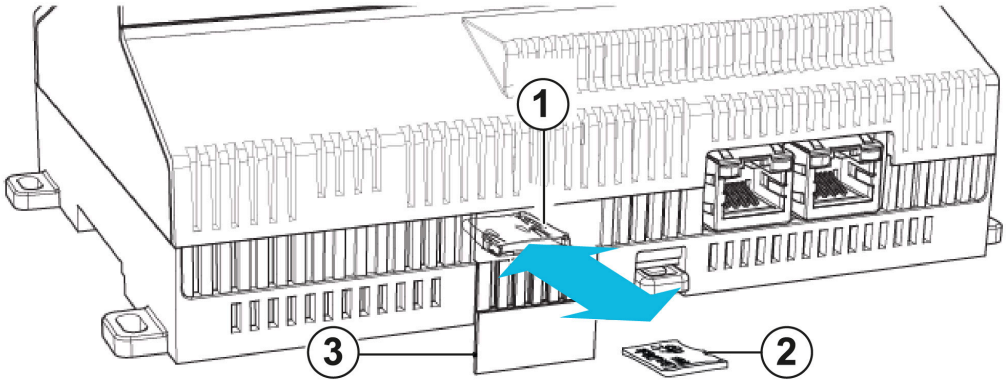
Callout	Label	Color	Description
5	PRI	Yellow	Primary Ethernet: LAN1. Activity
		Green	Primary Ethernet: LAN1. Link
6	SEC	Yellow	Secondary Ethernet: LAN2. Activity
		Green	Secondary Ethernet: LAN2. Link
7	BEAT	Yellow	Heartbeat, normally 1 Hz 50% duty cycle
8	STAT	Green	Remains lit when controller is on

If the **BEAT** LED stays on constantly, does not light, or blinks very fast, have your ABCS Distributor contact the FSC or your appropriate technical support group.

Important: The 1 Hz, 90/10 percent on/off **BEAT** flash at startup also occurs during other critical operations, such as a firmware upgrade to the controller or any attached modules. To be safe, do not remove power from the controller while its **BEAT** LED flashes with a 90/10 percent on/off duty cycle. Wait for the normal 50/50 percent flash to return before you remove power.

Remove or replace the microSD flash memory card

Figure 10: MicroSD card location in the controller



Callout	Description
1	Card carrier inside the controller
2	MicroSD card to insert or remove from the card carrier
3	Access shutter for the microSD card. Slide to open or close

Important: Disconnect all power to the controller before you remove or insert the microSD card. Otherwise, equipment damage is likely to occur.

Note: When you remove the microSD card, you must lightly press on the installed microSD card shutter to release it. Then carefully remove the card from the card carrier. When you replace a microSD card, place the card in the card carrier, and push the card carrier in the access shutter until it clicks.

Note: Data on the microSD card is encrypted by a special system password stored in the controller base. If you swap in a card from a previously configured unit, you must re-enter this same passphrase using a serial connection to the unit's debug port.

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Note: Third-party microSD cards are not supported.

USB port and switches

Figure 11: USB ports and switches behind the access panel

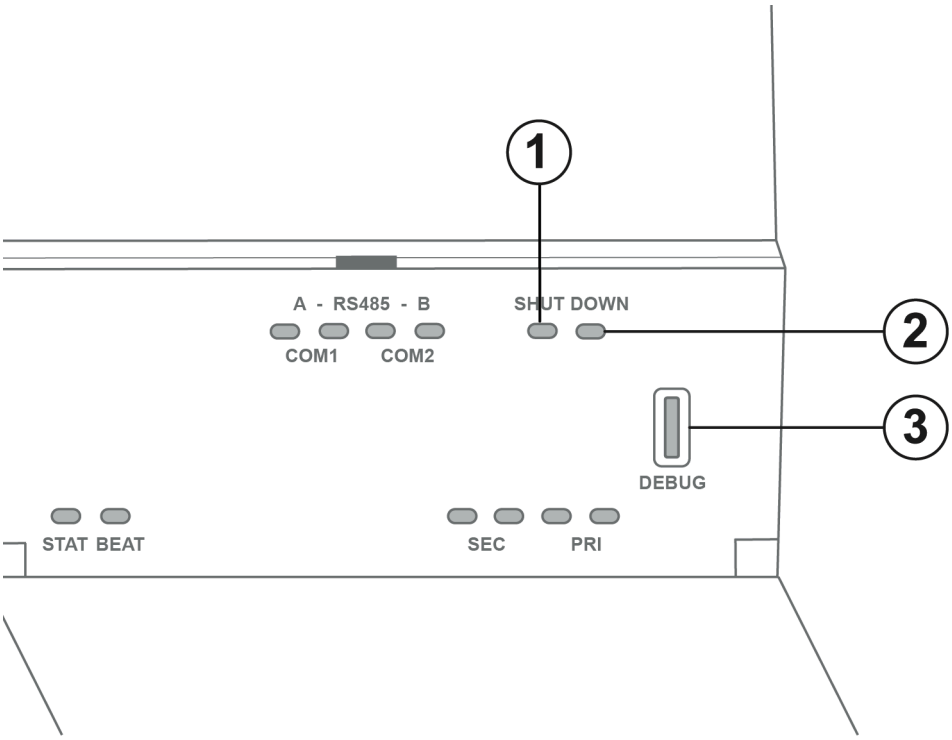


Table 6: USB ports and switches

Callout	Button	Description
1	**SHUTDOWN**	Recessed switch for controlled shutdown
2	**SHUTDOWN**	LED to indicate a job is in progress
3	**DEBUG**	USB type C for serial debug communication

The DEBUG port is a standard USB type C port for serial debug communications to the controller. Use a serial terminal program, for example PuTTY, to access the controller's system shell menu. The system shell menu provides access to a few basic platform settings.

The default DEBUG port settings are 115200, 8, N, 1 (baud rate, data bits, parity, stop bits).

Repair information

If the FX90 Supervisory Controller fails to operate within its specifications, replace the device. For a replacement unit, contact your local Johnson Controls representative.

Technical specifications

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Table 7: FX90 Supervisory Controller technical specifications

Specification	Description
Enclosure	Plastic
Mounting	DIN rail
Dimensions (w x h x d)	179 mm x 110 mm x 61 mm (7.05 in. x 4.33 in. x 2.40 in.)
Power supply	24 VAC rated at 24 VA minimum, or 24 VDC rated at 1 A (24 W) minimum
Processor	NXP iMX8M+ Quad Core CPU
RAM memory	2GB LPDDR4 RAM
Flash memory	8 GB onboard EMMC storage 8 GB micro-SD card: backup media
Environment	Operating temperature: -20°C to 60°C (-4°F to 140°F) Storage temperature: -40°C to 85°C (-40°F to 185°F) Humidity: 5% to 95%, non-condensing
Onboard	Two Ethernet ports: 10/100/1000 MB Two isolated RS-485 ports with selectable bias and termination USB type C Wi-Fi on the FX90 Wi-Fi Supervisory Controller only
Plug-in options	Two isolated RS-485 ports with selectable bias and termination
Network drivers	
Embedded	N2, BACnet, FX 14.13.2 or higher. Wi-Fi is supported from 14.15.1 or higher
Direct I/O	
Onboard	None
Optional	Up to 256 I/O when you use 16 remote I/O modules. The I/O module part numbers are IO-R-16 and IO-R-34
Local (NDIO)	None
Remote I/O	Up to 256 I/O when you use 16 remote I/O modules. The I/O module part numbers are IO-R-16 and IO-R-34
Compliance	**United States** UL Listed, File E207782, CCN PAZX, under UL 916, Energy Management Equipment FCC compliant to CFR 47, part 15, subpart C, Class B
	Canada UL Listed, File E207782, CCN PAZX7, under CSA C22.2 No. 205, Signal Equipment Industry Canada compliant to ICES-003
CE	**Europe** CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive

Table 8: FX Workbench requirements

Requirement	Description
Processor	Intel® Pentium® Core 2 Duo, 2 GHz
Operating System	**64-bit**: Windows® 10 and 11 Pro or Enterprise, Windows Server 2016 or higher
Memory	8 GB minimum

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Table 8: FX Workbench requirements

Requirement	Description
Hard disk	2 GB minimum. 10 GB minimum for any supervisor
Network support	Ethernet 100 Mbit or 1 Gbit network interface card (NIC) with TCP/IP support

Note: The information that relates to Processor in this table applies to the FX Supervisory Software Release 14.x.

North American Emissions Compliance

United States

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Canada

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.
Cet appareil numerique de la classe B respecte toutes les exigencies du Reglement sur le material broilleur du Canada.

Product warranty

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

Software terms

Use of the software that is in (or constitutes) this product, or access to the cloud, or hosted services applicable to this product, if any, is subject to applicable end-user license, open-source software information, and other terms set forth at www.johnsoncontrols.com/techterms. Your use of this product constitutes an agreement to such terms.

Patents

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Single point of contact

APAC	EU	UK	NA/SA
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Contact information

Contact your local Johnson Controls representative: www.johnsoncontrols.com/locations

Contact Johnson Controls: www.johnsoncontrols.com/contact-us

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