FS-20 Quick Start Guide

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Contents

Important firmware notice 3
Overview 3
FS-20 dimensions 5
Parts included 5
Required tools and parts 5
Mounting guidelines 6
Mounting locations to avoid 6
Mounting the controller on a 35 mm DIN rail 6
Mounting the controller to an enclosure base plate 8
Removing the controller cover 8
Input, output, and 24 VAC Class 2 transformer power input wiring diagrams 9
FS-20 basic input, output, power, and serial device wiring 9
Power supply terminal wiring 14
Input and output terminal wiring considerations 14
RS-485 bus terminals 15
Universal jumper setting 16
Universal output jumper configuration 16
Universal input jumper configuration 17
Controller interfacing 18
Connecting to a controller with an Ethernet cable 18
Connecting to a controller with an Ethernet cable for Windows 18
Connecting to a controller with an Ethernet cable for MacOS 18
Connecting to a controller with an Ethernet cable for Linux 19
Primary network default IP address, subnet mask, and gateway 19
Interfacing with a controller's web server 19
Interfacing with controller objects using CPT 19
FS LED states 20
Micro SD card insertion and removal 20
Micro SD card specifications 21
Troubleshooting 22
Technical specifications 22
Compliance 23
Product warranty 24
Patents 24
Single point of contact 24
Contact information 24

Important firmware notice

Important: Verify the installed firmware version before installation, commissioning, or maintenance activities. Firmware updates can include bug fixes, security updates, performance and stability improvements, or other product enhancements. Customers are encouraged to review the applicable release information and use the latest officially released firmware version when operationally feasible and in accordance with site change-management procedures.

For more information on the latest firmware, release notes, and supporting documentation, visit Solution Navigator.

Overview

The FS-20 is an input/output controller with IP network and Ethernet connectivity. Use this guide to complete the following tasks:

- Understand the controller components.
- Mount the controller on a DIN rail or enclosure base plate.
- View a wiring diagram of the controller in a system.
- Connect to the controller with a LAN connection.
- Connect to the controller with the CPT application.
- Connect to the controller's web server dashboard with CPT Graphics.

Important: Use the FS-20 controller as an operating control only. Where failure or malfunction of the FS-20 could lead to personal injury or property damage to the controlled equipment or other property, design additional precautions into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the FS-20.

Figure 1: FS-20 front view

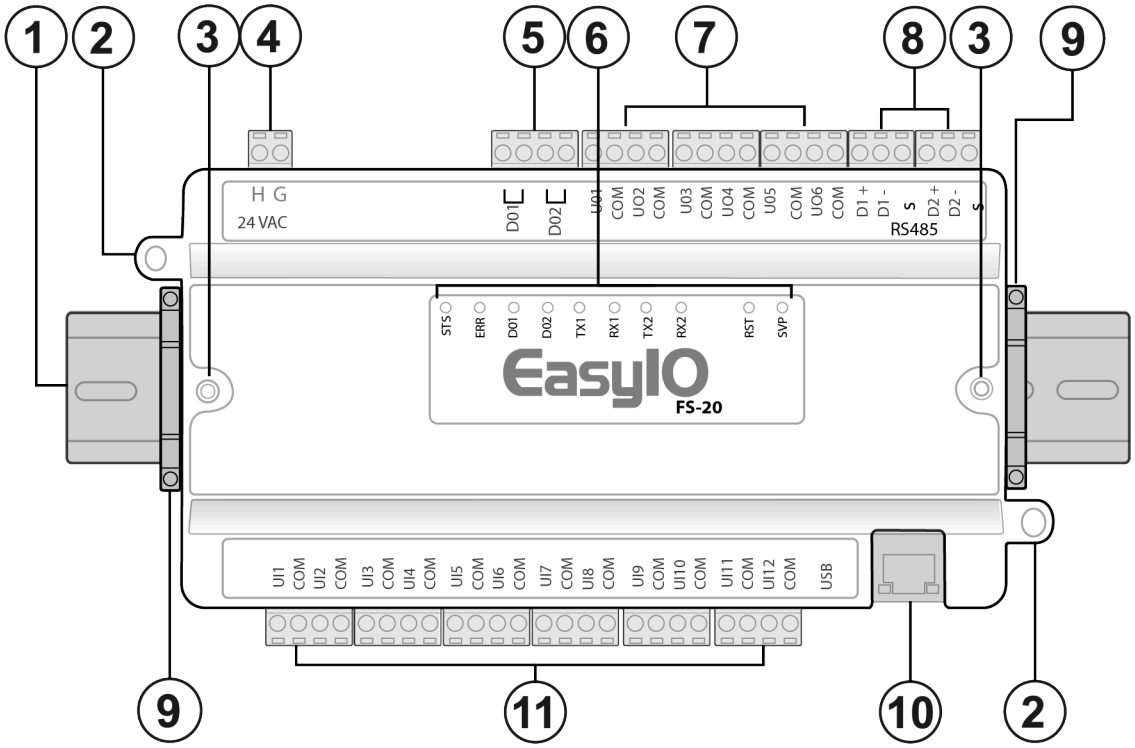
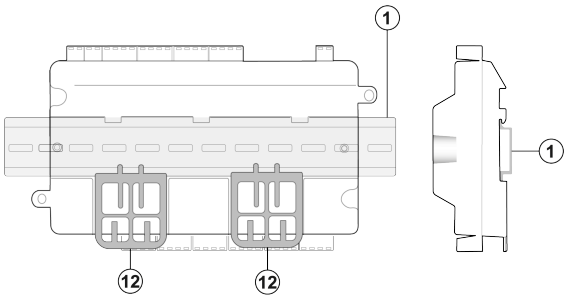


Figure 2: FS-20 back and side view

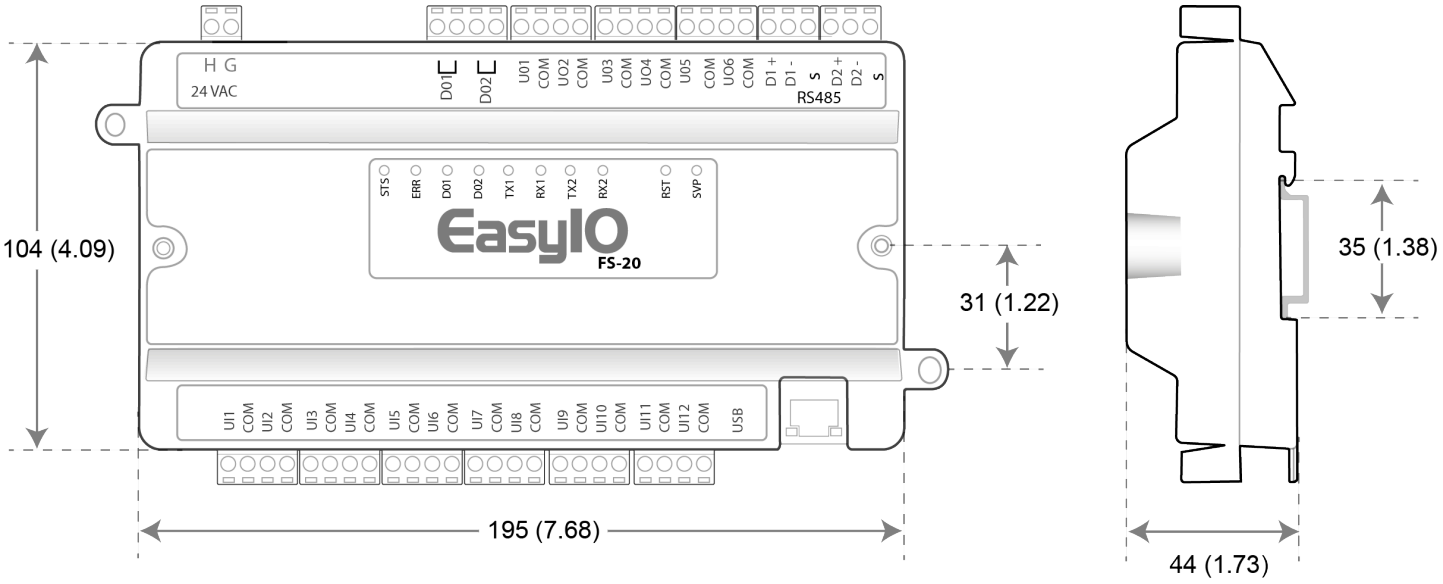


Callout	Description
1	DIN rail
2	Enclosure mounting holes
3	Cover screw
4	Hot and ground terminal
5	Digital output (DO) terminals

Callout	Description	
6	STS	Status LED
	ERR	Error LED
	DO1 to DO2	Digital output status LED
	TX1 and TX2	Transmitting communication LED
	RX1 and TX2	Receiving communication LED
	RST	Reset button. For more information about resetting the controller, refer to *EasyIO FS Series User Reference*.
	SVC	Service button
7	Universal output (UO) and COM terminals	
8	RS-485 serial port terminals	
9	DIN rail end clips	
10	Ethernet port	
11	Universal input (UI) and COM terminals	
12	Mounting clips	

FS-20 dimensions

Figure 3: FS-20 dimensions, mm (in.)



Parts included

- One FS-20 controller with removable terminal blocks
- One pack sheet

Required tools and parts

One small flathead screwdriver to secure wires to terminal blocks.

Mounting guidelines

The following section lists location considerations, mounting the controller on a DIN rail and mounting the controller on an enclosure base plate.

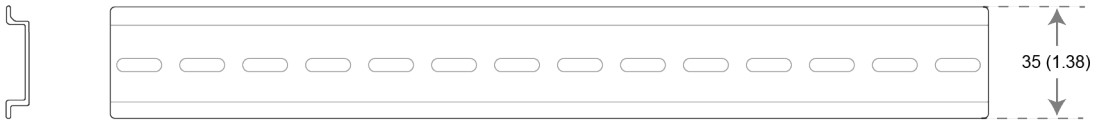
Mounting locations to avoid

- Areas with excessive moisture, corrosive fumes, or explosive vapors
- Locations where excessive vibration or shock occurs
- Locations with excessive electrical noise, such as large magnetic interference or variable speed drive modules

Mounting the controller on a 35 mm DIN rail

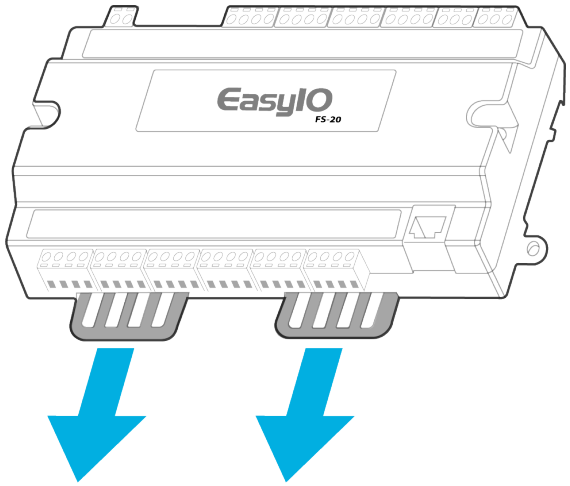
1. Mount a section of 35 mm (1.38 in.) DIN rail horizontally on the enclosure base plate.

Figure 4: 35 mm DIN rail



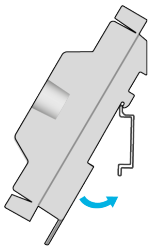
2. Pull the two bottom mounting clips outward from the controller to the extended position.

Figure 5: Extending the mounting clips



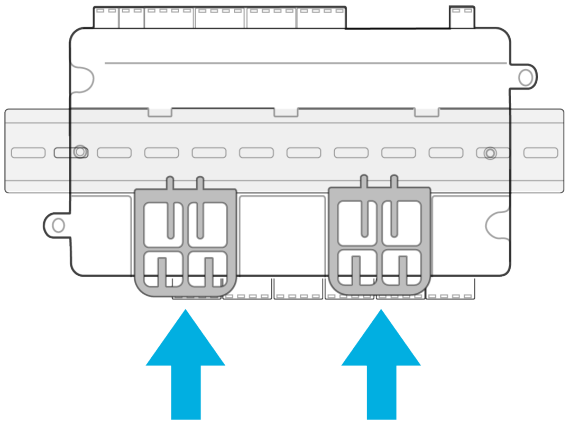
3. Hang the controller on the DIN rail by the hooks at the top of the DIN rail channel on the back of the controller and position the controller firmly against the DIN rail.

Figure 6: Placing the controller on the DIN rail



4. To secure the controller to the DIN rail, push the mounting clips up.

Figure 7: Closing the mounting clips (rear view)



5. **Optional:** For added security, use DIN rail end clips. For the location of the end clips, see DIN rail end clips in Figure 1.

Mounting the controller to an enclosure base plate

If a DIN rail mount is not practical, the controller features two mounting holes to screw mount the controller to an enclosure base plate.

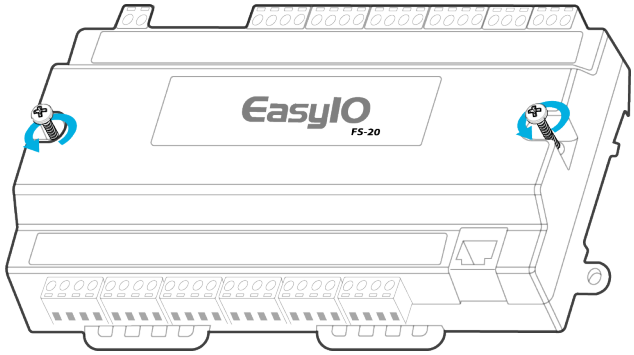
1. Place the controller on the enclosure surface and mark the enclosure mounting holes on the surface. For the enclosure mounting hole locations see Figure 1.
2. Drill both holes in the enclosure base plate.
3. Screw the controller to the enclosure base plate.

Removing the controller cover

Remove the controller cover to access the circuitry, jumpers, and to better access the reset and service buttons.

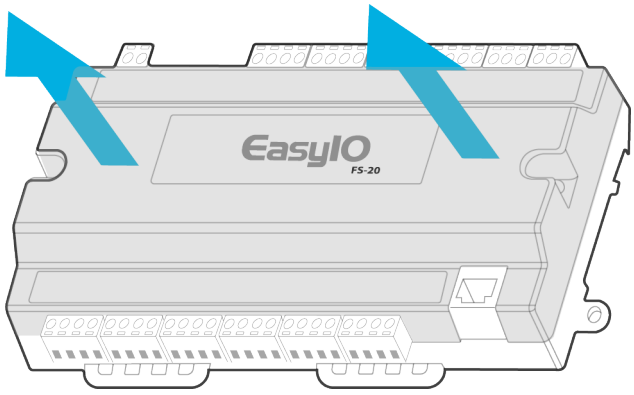
1. Use a Philips screwdriver to unscrew both of the top cover screws.

Figure 8: Unscrewing the cover



2. Hold both ends of the top cover and remove it. If the top cover is stuck, separate the cover with a flathead screwdriver.

Figure 9: Removing the cover



Input, output, and 24 VAC Class 2 transformer power input wiring diagrams

WARNING

Risk of Electric Shock

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

NOTICE

Risk of Property Damage.

Do not apply power to the controller before checking all wiring connections. Short circuited or improperly connected wires may result in permanent damage to the equipment.

Important

Do not exceed controller electrical ratings, this can result in permanent damage to the controller and void warranties.

Important

Only use copper conductors. Wire the controller in accordance with local, national, and regional regulations

Important

Use the correct electrostatic discharge precautions throughout installation, setup, and service to avoid damage to the controller and controller components.

FS-20 basic input, output, power, and serial device wiring

WARNING

Use Class 2 device wiring. Do not reclassify and install as Class 1, 3 or power and lighting wiring.

⚠ CAUTION

DO1 and DO2 are voltage free contacts. Use either an external 24 VAC or 24 VDC power source.

Figure 10: FS-20 wiring diagram

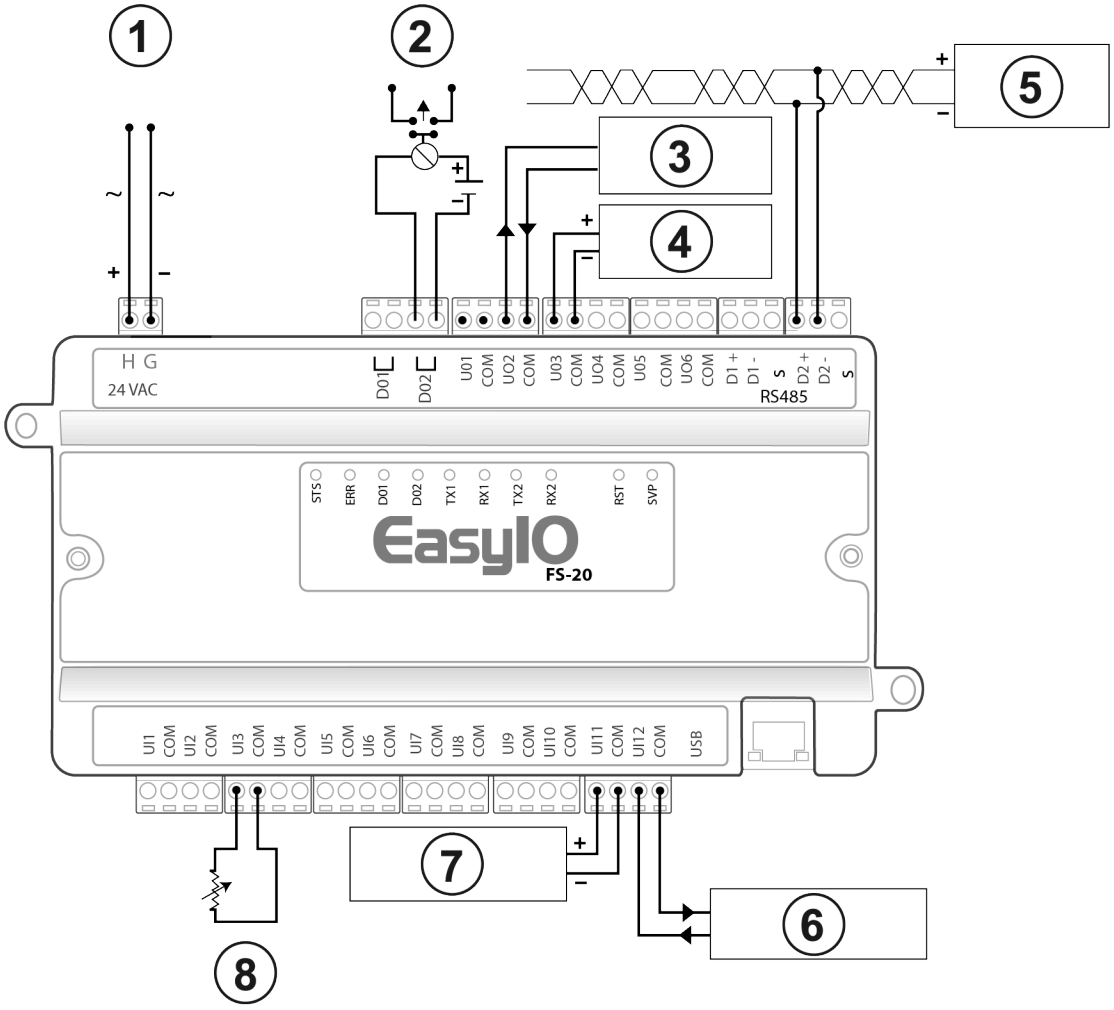


Table 1: FS-20 wiring inputs and outputs

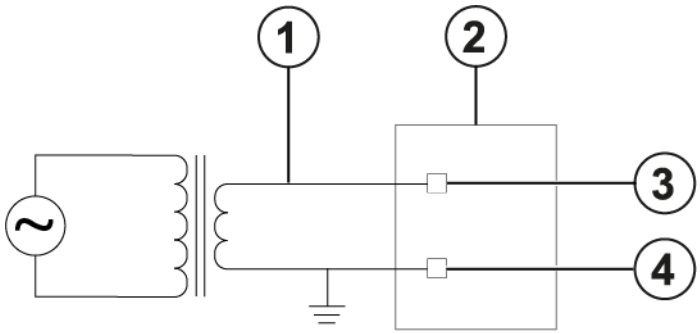
Callout	Description
1	Power input
	24 VAC or 24 VDC
2	Pilot duty output
3	Current-controlled VSD
4	Voltage-controlled actuator
5	Connection to serial devices
6	Current transmitter
	0 mA to 20 mA or 4 mA to 20 mA

Table 1: FS-20 wiring inputs and outputs

Callout	Description
7	Voltage transmitter
	0 V to 10 V or 0 V to 5 V
8	Thermistor, RTD, or potentiometer

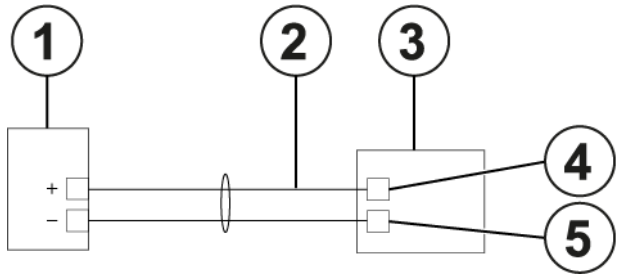
Note: If you configure the controller as a subordinate device and it is at the end of a daisy chain, install a 120 ohm resistor in parallel with the RS-485 terminal.

Figure 11: 24 VAC Class 2 transformer power input



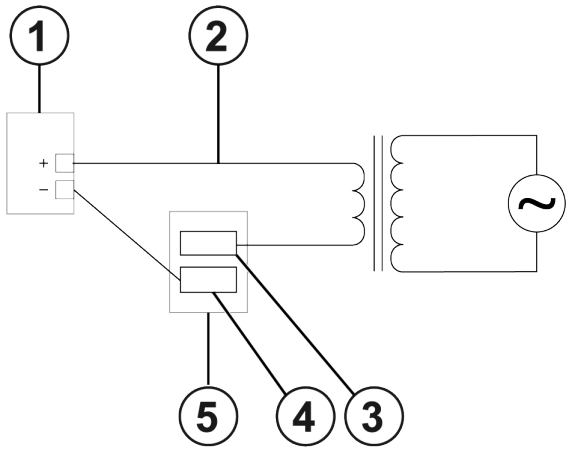
Callout	Description
1	20 AWG copper stranded wire
2	Controller
3	H terminal
4	G terminal

Figure 12: Analog output wiring



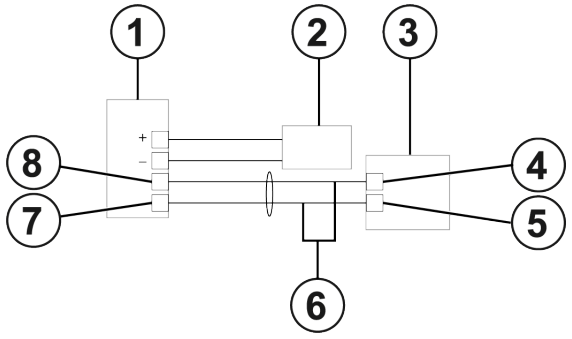
Callout	Description
1	Field device
2	22 AWG copper stranded twisted wire up to 100 m in length.
3	Controller
4	Analog output (AO) terminal
5	COM terminal

Figure 13: DO wiring



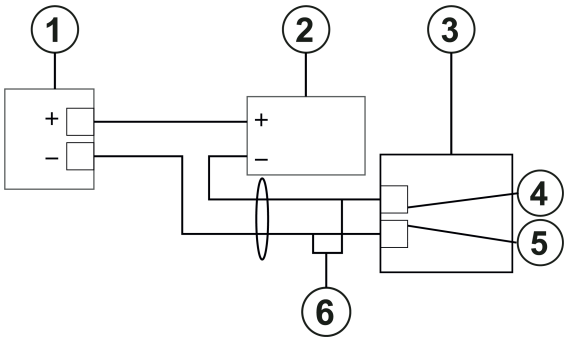
Callout	Description
1	Field device
2	20 AWG copper stranded twisted wire up to 100 m in length
3	DO terminal
4	COM terminal
5	Controller

Figure 14: UI voltage mode wiring isolated



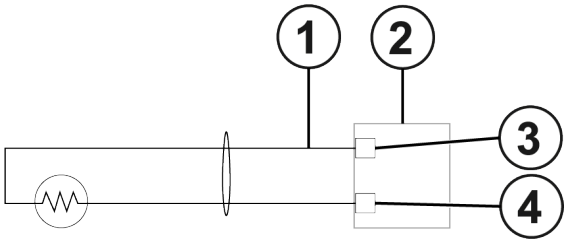
Callout	Description
1	Field device
2	Power supply
3	Controller
4	UI terminal
5	COM terminal
6	22 AWG copper stranded twisted wire up to 100 m in length
7	COM terminal
8	OUT terminal

Figure 15: UI current mode wiring in loop



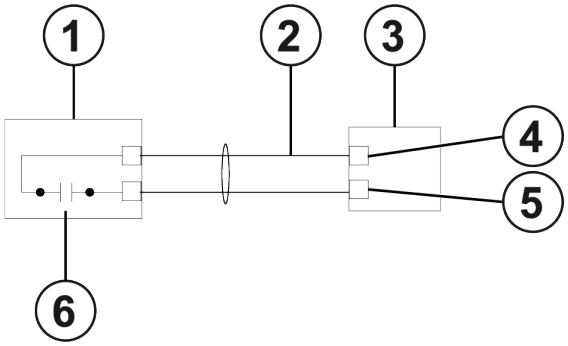
Callout	Description
1	Field device
2	Power supply
3	Controller
4	COM terminal
5	UI terminal
6	22 AWG copper stranded twisted wire up to 100 m in length

Figure 16: UI resistance mode



Callout	Description
1	22 AWG copper stranded twisted wire up to 100 m in length
2	Controller
3	UI terminal
4	COM terminal

Figure 17: UI digital dry contact input



Callout	Description
1	Field device
2	22 AWG copper stranded twisted wire up to 100 m in length
3	Controller
4	UI terminal
5	COM terminal
6	Dry contact
	Normally open or normally closed as required

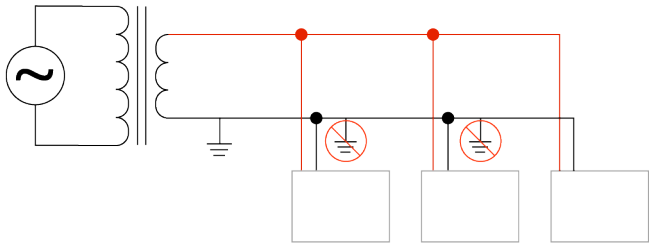
Power supply terminal wiring

Connect the 24 VAC supply power wires from the transformer to the HOT and COM power terminals as shown in Figure 18.

Note: The supply power wire colors may differ on transformers from other manufacturers. Refer to the transformer manufacturer's instructions and the project installation drawings for wiring details.

Important: To reduce noise, interference, and ground loop problems, connect a 24 VAC supply power to the controller and to all other network devices so that transformer phasing is uniform across network devices. The controller does not require an earth ground connection. However, when you need to ground the secondary of the 24 VAC transformer, make only one ground connection near the transformer. For more information, see the following figure.

Figure 18: Transformer grounding



CAUTION

To avoid property damage, check all wiring connections before you apply power to the system. If you wire this terminal incorrectly, a short circuit can occur across the 24 VAC power supply on the controller. A short circuit can cause a tripped circuit breaker or a blown fuse. If you use a transformer with a built-in fuse, you may need to replace the transformer.

Input and output terminal wiring considerations

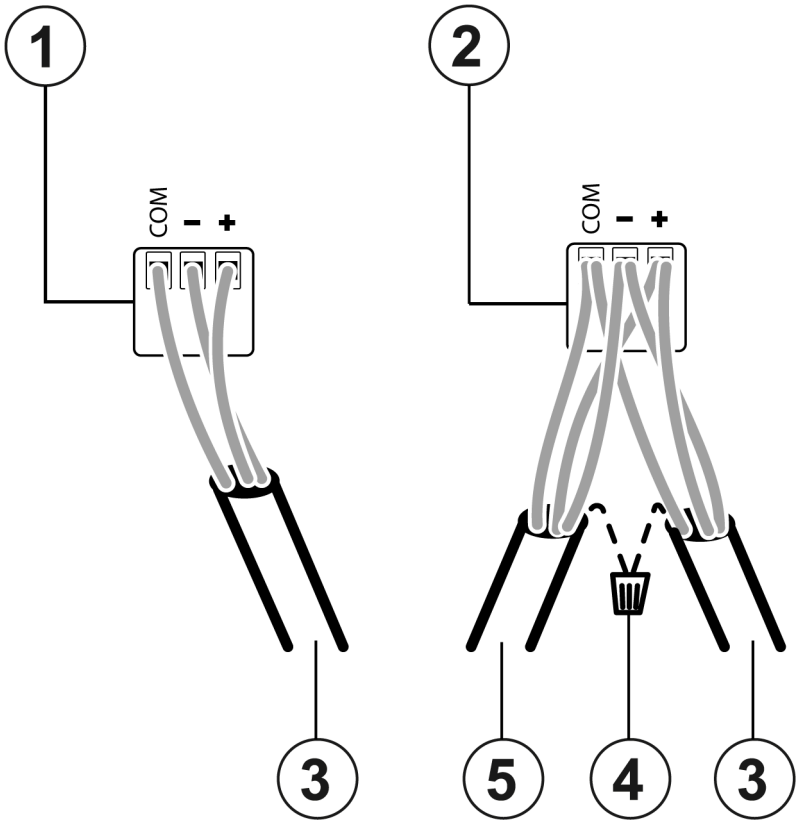
- Run all low-voltage wiring and cables separate from high-voltage wiring.
- For all input and output cables, use twisted, insulated, and stranded copper wires.
- Use shielded cables for input and output cables that are exposed to high electromagnetic or radio frequency noise.
- Cable runs over 30 m (100 ft) require an offset in the input and output software setup.

RS-485 bus terminals

Wire the RS-485 terminals in a daisy-chain configuration. Use a stranded three-wire twisted and shielded cable as shown in Figure 19. The three different wires are the positive bus, the negative bus, and the COM.

You can use the RS-485 positive and negative wires as sensor actuator (SA) bus +ve and SA bus -ve.

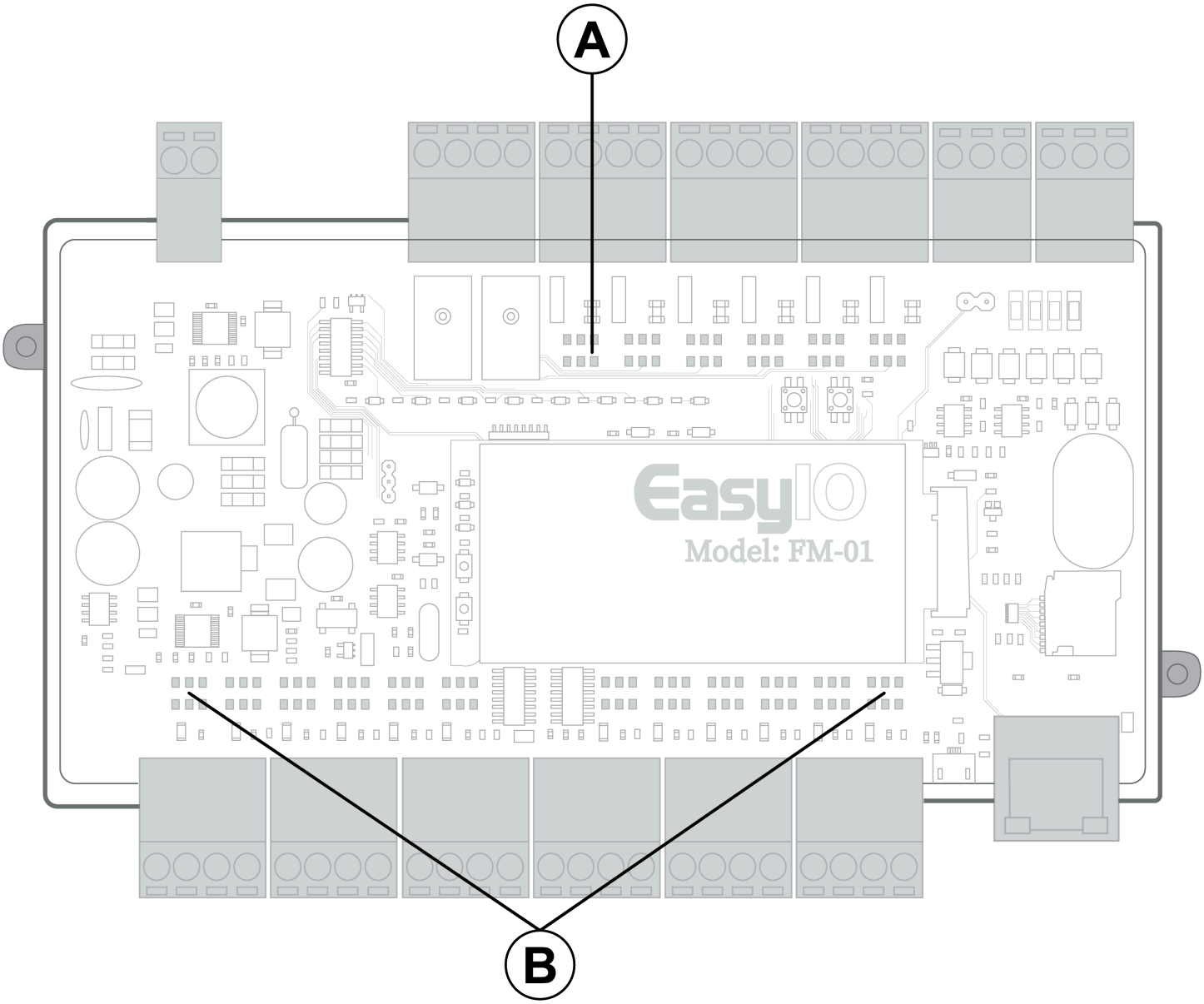
Figure 19: RS-485 wiring



Callout	Description
1	Terminal on the first device
2	Terminal on the daisy-chained device
3	Connection to another device on the RS-485 bus
4	Cable shield connection. You do not need to ground the cable shield.
5	Connection from another device on the RS-485 bus

Universal jumper setting

Figure 20: Universal jumpers



Callout	Component
A	Universal output jumper configuration
B	Universal input jumper configuration

Universal output jumper configuration

The FS-20 controller supports current, voltage, and digital field devices. For current mode, position the jumper on the two left pins. For voltage mode, position the jumper on the two center pins. For digital mode, position the jumper on the two right pins.

Note: You can configure each universal output individually.

Figure 21: Current mode

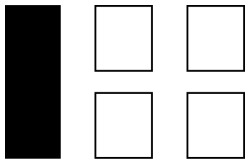


Figure 22: Voltage mode

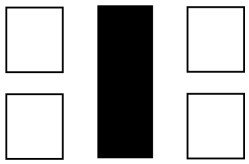
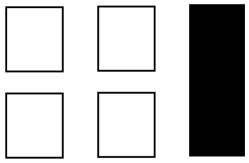


Figure 23: Digital mode



Universal input jumper configuration

The FS-20 controller supports resistance, voltage, and current field devices. For resistance mode, position the jumper on the two left pins. For voltage mode, position the jumper on the two center pins. For current mode, position the jumper on the two right pins.

Note: You can configure each universal input individually.

Figure 24: Resistance mode

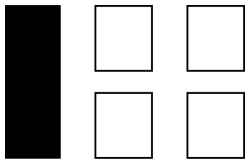


Figure 25: Voltage mode

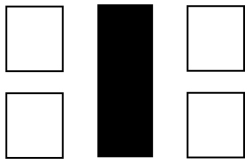
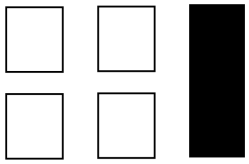


Figure 26: Current mode



Controller interfacing

To interface with a controller and its inputs and outputs with CPT and the controller's web server, establish a connection from your device. Use an Ethernet cable to connect to your controller with a computer or laptop.

Connecting to a controller with an Ethernet cable

1. Connect your computer to the controller with an Ethernet cable.
2. Set up your network adapter in the same range as the controller. To change your IP address, subnet mask, and gateway. Complete the steps as outlined in one of the following options, depending on your operating system.

   ⓘ **Note:** Use the same subnet mask and gateway as the controller. For the IP address, enter the same IP address as the controller, but change the last octet to a unique number. Use a high number that is less than 255 to avoid using an IP address that is already in use. For more information about your controller's IP address, subnet mask, and gateway, see Primary network default IP address, subnet mask, and gateway.

Connecting to a controller with an Ethernet cable for Windows

Complete one of the following two methods to connect the controller.

1. From the user interface, complete the following steps:
   a. Navigate to **Control Panel** > **Network and Internet** > **Network and Sharing Center** > **Change Adapter settings**.
   b. Right-click your Ethernet connection, then click **Properties**.
   c. On the **Networking** tab, select the **Internet Protocol Version 4 (TCP/IPv4)** check box, then click **Properties**.
   d. On the **General** tab, click **Use the following IP address**. In the **IP address**, **Subnet mask**, **Default gateway** fields, set the IP address, subnet mask, default gateway you want.
2. From the command prompt, complete the following steps:
   a. Enter the following command with the IP address, subnet mask, default gateway you want:

      ```
      netsh interface ipv4 set address
      name="Ethernet" static <IP address> <subnet mask>
      <gateway>
      ```

   b. Enter the `ping` command followed by the controller's IP address to confirm the connection.

Connecting to a controller with an Ethernet cable for MacOS

Complete one of the following two methods to connect the controller.

1. From the user interface, complete the following steps:
   a. Click the Apple menu icon, then **System Preferences** > **Network**.
   b. Click the network connection you want, then click **Advanced**.
   c. On the **TCP/IP** tab, from the **Configure IPv4** list, select **Manually**.
   d. In the **IPv4 address**, **Subnet Mask**, and **Router** fields, set the IP address, subnet mask, default gateway, then click **OK**.
2. From the terminal, complete the following steps:
   a. Enter the following command with the IP address, subnet mask, default gateway you want:

      ```
      networksetup -setmanual "Ethernet" <new IP address> <subnet mask> <gateway>
      ```

   b. Enter the `ping` command, followed by the controller's IP address to confirm the connection.

Connecting to a controller with an Ethernet cable for Linux

Complete one of the following two methods to connect the controller.

1. From the user interface, complete the following steps:
   a. From the toolbar, click **System** > **Preferences** > **Network Connections**.
   b. Find the network connection you want, then click the configure icon.
   c. On the **IPv4** tab, click **Manual**.
   d. In the **IPv4 address**, **Netmask**, and **Gateway** fields, set the IP address, subnet mask and default gateway you want, then click **Apply**.
2. From terminal, complete the following steps:
   a. Enter the following command with the IP address, subnet mask, default gateway you want:

      ```
      networksetup -setmanual "Ethernet" <new IP address> <subnet mask> <gateway>
      ```

   b. Enter the `ping` command, followed by the controller's IP address to confirm the connection.

Primary network default IP address, subnet mask, and gateway

Table 2: Default IP address, subnet mask, and gateway for a primary network setup

Item	Address
IP address	192.168.10.12
Subnet mask	255.255.255.0
Gateway	192.168.10.1

Interfacing with a controller's web server

To interface with a controller's web server, complete the following steps:

1. Launch a HTML5 web browser, such as Chrome™, Firefox®, Microsoft Edge®, or Safari®.
2. In the web browser's address bar, enter your controller's IP address, then press the Enter key or Return key.

Interfacing with controller objects using CPT

Use CPT to program EasyIO controller logic with the Sedona framework.

1. To download the CPT application, contact Support for the latest release.
2. Unzip the folder and double-click the `cpt.exe` file.

   Important: If the CPT is already installed on your computer and you want to update it to a new release, do not click and launch the `cpt.exe` file to avoid personal settings data loss. Unzip the package and drop all the files into the existing CPT folder to merge and overwrite outdated files.

3. To connect to a controller, click **File**, then click **Open App**.
4. In the **Project Management** window, on the **Recent** tab, click **New**.
5. In the **App Desc** field, enter a name for the controller.
6. In the **Host** field, enter the controller's IP address.

   Note: The default IP address is 192.168.10.12.

   Note: For more information about your controller's IP address, refer to the *Controller series IP address, subnet mask, and data folder* section of the *EasyIO CPT User Guide (LIT-12013978)*.

7. From the **Data Folder** list, select the folder for your controller type.

   Note: For FS Series controllers, select **SedonaFG**.

ⓘ **Note:** For more information about your controller's data folder, refer to the *Controller series IP address, subnet mask, and data folder* section of the *EasyIO CPT User Guide (LIT-12013978)*.

8. Click **Save**.
9. Click **Open**.
10. In the **Authentication** dialog, enter your password in the **Password** field.

ⓘ **Note:** By default, there is no password. To increase security, when you log on, complete the steps outlined in *Creating a new CPT admin password for a controller* in *EasyIO Hardening Guide (LIT-12013986)*.

For more information about CPT, refer to *EasyIO CPT User Guide (LIT-12013978)*.

FS LED states

The following table displays the LEDs blink rate descriptions:

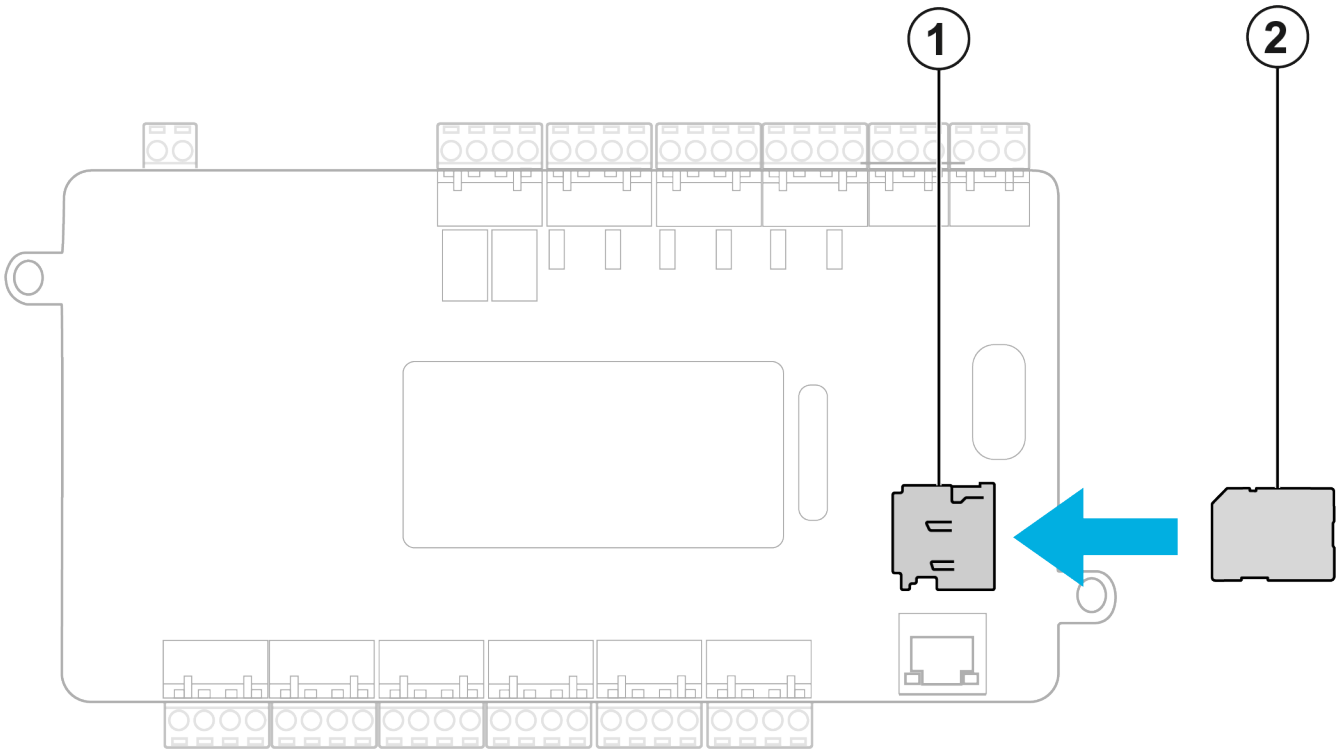
Table 3: FS LED states

LED label	LED color	Normal state	State	Description
PWR	Green	On steady	Off steady	No power
			On steady	Power is supplied by primary voltage
ERR	Red	Off steady	Constant rapid blinks	Communication error between the FM-01 module and the base board
			On steady	Firmware upgrade in process. Ensure no power loss occurs during this period.
			Off steady	No errors
STS	Green	1 Hz blinks	1 Hz blinks	Normal operation
			Off steady	Controller fault
TXRX	Yellow	1 Hz to 5 Hz blinks	1 Hz to 5 Hz blinks	Normal data communication
			Off steady	No data transmission

Micro SD card insertion and removal

To insert the card, first remove the cover. For more information about removing the cover, see Removing the controller cover. To remove the micro SD card, press the card to release it from the slot. To find the slot, see the following figure:

Figure 27: SD card and SD card slot



Callout	Component
1	Micro SD card slot
2	Micro SD card

Micro SD card specifications

You can use a micro SD card with FS controllers for extra backup storage. Use a micro SD card that meets the following specifications:

Table 4: Micro SD card specifications

Specification	Remark
Recommended tested brands	Transend
	Kingston
Capacity tested	2 GB
	4 GB
	8 GB
	16 GB
Class	Class 4
	Class 10

Troubleshooting

Table 5: FS troubleshooting

Problem	Cause	Solution
The controller does not turn on due to one of the following problems: • The transformer trips. Power is at the transformer primary and there is no voltage at the secondary. • The breaker or fuse trips. Power is at transformer primary. You find 24 V at secondary and 0 V at breaker or fuse.	• The transformer shorted. • The 24 VAC powered sensor is not wired with the same polarity as the controller. • The RS-485 bus device is not wired with the same polarity as the controller.	1. Ensure that the polarity of ~24 V COM, +15 V COM, and SA BUS COM on the controller, auxiliary devices, and input and output devices is the same. 2. Verify that the short circuit is resolved with an ohm-meter. 3. Reset the breaker or fuse, or replace the transformer. ⓘ **Note:** If you replace the transformer, replace it with a model that uses a resettable circuit breaker. A circuit breaker makes it easier to solve wiring problems. 4. To verify the connection, complete the following steps: a. Disconnect the secondary of the 24 VAC transformer. b. Use an ohm-meter to measure between ~24 V H and G at the controller. Ensure that no short circuit occurs. ⓘ **Note:** If your installation requires that you earth ground the transformer secondary, verify that the earth ground connection is valid and not shared between multiple pieces of equipment.
Analog output mode is invalid. 0 V to 10 V output is set to 100%, but output terminals are less than 10 V.	Load impedance is lower than 2,000 ohms.	1. Ensure that the voltage control device load impedance is higher than 2,000 ohms. For more information, refer to voltage device manufacturer specification. 2. Disconnect the connected device and verify that the value you require is present.
Analog mode for a configurable output is invalid. For example, 0 V to 10 V output results in an unwanted offset of up to 1 V. The Common Reference is incorrect.	The COM terminal is not connected.	1. Connect the COM terminal of the configurable output to the common of the connected end device. 2. Measure the output and verify that it matches the command. 3. Disconnect the connected device and verify the commanded value is present.

Technical specifications

Table 6: FS-20 UL input, output, and communication ratings

Description	Specification			Terminal
Power supply	• 24 VAC, plus or minus 5%, 20 VA • 24 VDC, plus 20% or minus 15%, 15 VA, Class 2			H and G
	12 VA, Class 2			
Universal inputs	Voltage	0 VDC to 10 VDC, Class 2	3% accuracy	UI1 and COM to UI12 and COM
	Current	0 mA to 20 mA		
	Resistance	500 ohm to 500,000 ohm		
Digital outputs	24 VAC, 0.5 A pilot duty, Class 2, dry-contact relay output			DO1 to DO2
	24 VDC, 0.5 A pilot duty, Class 2, dry-contact relay output			
Universal outputs	Voltage	0 VDC to 10 VDC, Class 2	3% accuracy	UO1and COM to UO6 and COM
	Minimum load impedance	2,000 ohm		
	Maximum current draw	5 mA		
	Current	0 mA to 20 mA		
	Open collector output	0.3 A max, Class 2		
Ethernet ports	Class 2			ETH

Table 6: FS-20 UL input, output, and communication ratings

Description	Specification	Terminal
EIA/RS-485 port 1	Class 2	D1+
		D1-
		S
EIA/RS-485 port 2	Class 2	D2+
		D2-
		S

Table 7: FS-20 Technical specifications

Description	Specification
Controller processor and memory specifications	
Main processor	1.2 GHz Quad Core ARM A7
Processor	ARM Cortex 48 MHz
Flash memory	8 GB
RAM	1 GB
Product temperature and humidity specifications	
Operating temperature	0°C to 50° (32°F to 122°F)
Storage temperature	-20°C to 65°C (-4°F to 150°F)
Operating humidity	10% to 90% relative humidity, non-condensing
Physical specifications	
Dimension	198 mm x 104 mm x 44 mm (7.8 in. x 4.1in. x 1.7 in)
Material	UL Approved
Weight	436 g (15.4 oz)

Compliance

Table 8: Compliance

North America: UL 916 Energy Management Equipment; FCC Class B, Part 15, Subpart C 15.247
FCC This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). This device complies with part 15 of the FCC Rules. Operation is subject to the follow-ing two conditions: (1) This device may not cause interference. (2) This device must accept any interference, including interference that may cause undesired operation of the device. L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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; 2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.
CE Compliant
UKCA Directive Electromagnetic Compatibility Regulations 2016: BS EN 55032:2015+A11:2020, BS EN IEC 61000-3-2:2019, BS EN 61000-3-3:2013+A1:2019, BS EN 55035:2017+A11:2020

Product warranty

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

Patents

Patents: https://jcipat.com

Single point of contact

APAC	EU	UK	NA/SA
JOHNSON CONTROLS C/O CONTROLS PRODUCT MANAGEMENT NO. 32 CHANGJIANG RD NEW DISTRICT WUXI JIANGSU PROVINCE 214028 CHINA	JOHNSON CONTROLS VOLTAWEG 20 6101 XK ECHT THE NETHERLANDS	JOHNSON CONTROLS TYCO PARK GRIMSHAW LANE MANCHESTER M40 2WL UNITED KINGDOM	JOHNSON CONTROLS 5757 N GREEN BAY AVE. GLENDALE, WI 53209 USA

Contact information

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

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

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