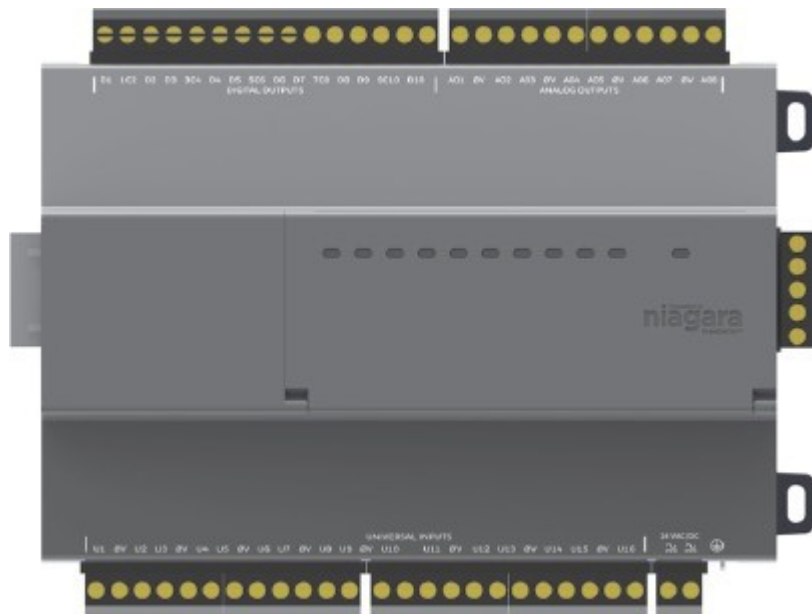


## Applications

This document describes how to mount and wire an FX-SC8XIOR34-0 (IOR-34) option module for an FX80 controller. The IOR-34 is designed for remote monitoring and control of applications to facilitate end-to-end automation and device-to-enterprise integration. It expands an FX80 Supervisory Controller with 34 I/O points consisting of the following:

- Sixteen universal inputs (UIs) compatible with 0-10 VDC, 0-20 mA, dry contacts, pulsing dry contacts, 0-100KΩ resistive, or Type 3 thermistor temperature sensors
- Ten digital outputs (DO) with Form-A relay contacts for on and off control of loads up to 24 VAC or DC, at 0.5A max
- Eight analog outputs (AO) for 0-10 VDC analog control of loads at 2.5KΩ minimum, or 4 mA drain maximum

**Figure 1: FX-SC8XIOR34-0 Module**



The IO module uses DIN rail mounting and has two end-mounted five-pin connectors that support direct-chaining to other FX-SC8XIOR16-0 (IOR-16) modules. Communications to an FX80 Controller use RS-485 multidrop on three wires of an end-mounted five-pin connector.

The other two wires on that connector are for OUTPUT power (15 VDC) used to power the IOR-16s modules. A two position connector is provided for primary power input of 24 VAC or DC to the module. The RS-485 bus is wired back to COM1 or COM2 of the FX80 controller.



# 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 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

Unpack the FX-SC8XIOR 34-0 and inspect the contents of the package for damaged or missing components. If the module is damaged, contact the Johnson Controls® Product Sales Operations team and return any damaged components for repair or replacement.

## Power supply options

An FX80 controller can support up to a maximum of eight IOR-34s or a maximum of sixteen IOR-16s modules on a single RS-485 bus. If an IOR-34 is included, it counts as two modules. The IOR-34 is a 24 VAC or DC powered device compatible with FX80 input power requirements.

❶ **Note:** Use a dedicated transformer to supply 21.6 VAC or DC to 26.4 VAC or DC power to the module. Only the FX80 and IOR-34 modules should be powered from the same transformer.

Wire the input voltage to the module's 2-pin 24 VAC or DC power connector, located on the right corner of the unit.

Table 1 shows possible options for combinations of IOR 16-0 and IOR 34-0 modules. For example, Option 2 includes a total of fourteen IOR-16s and one IOR-34. The IOR-34 powers four of the IOR-16s. The remaining ten IOR-16s must be powered by an external source.

**Table 1: IO Module combinations and IOR-16 power options**

Combinations	Modules	Number of Devices	Powered by IOR-34s	Powered by External Supply
<b>Option 1</b>	IOR-16	16	0	16
	IOR-34	0		
<b>Option 2</b>	IOR-16	14	4	10
	IOR-34	1		
<b>Option 3</b>	IOR-16	12	8	4
	IOR-34	2		
<b>Option 4</b>	IOR-16	10	10	0

**Table 1: IO Module combinations and IOR-16 power options**

Combinations	Modules	Number of Devices	Powered by IOR-34s	Powered by External Supply
	IOR-34	3		
<b>Option 5</b>	IOR-16	8	8	0
	IOR-34	4		
<b>Option 6</b>	IOR-16	6	6	0
	IOR-34	5		
<b>Option 7</b>	IOR-16	4	4	0
	IOR-34	6		
<b>Option 8</b>	IOR-16	2	2	0
	IOR-34	7		
<b>Option 9</b>	IOR-16	0	0	0
	IOR-34	8		

① **Note:** Both IOR-16s and IOR-34s must have a UPS power backup if continuous operation during power failures is a requirement. See [Operations without power backup](#)

## Operations without power backup

Consider providing UPS backup power to the IOR-34 module. If the module is powered locally and an AC power loss occurs, the following might occur:

- Load cycling from module relays drop out.
- Totalized counts zeroed out.
- History (logging) entries for each IO module and Nrio alarm shown as down.

## Parts included

- FX-SC8XIOR 34-0 module with quick disconnect female connectors.
- Hardware bag containing the following items:
  - One grounding wire, with a quick-disconnect 0.187 in. female connector.
  - Eight 499-Ω resistors, that are used for 4-20 mA inputs.

## Special tools needed

- A suitable power source, as one of the following:
  - UL listed, Class 2, 24 VAC transformer, rated a minimum of 21.6 VAC to 26.4VAC and 28 VA. Note that a dedicated transformer is required. Only a FX80 and the IOR-34 module may be powered from the same transformer.
  - 22 VDC to 26.4 VDC power supply capable of supplying at least 916mA (22 Watts). This is sufficient to power a fully loaded IOR-34 (four IOR-16 modules plus the IOR-34).

- A DIN rail, type NS35/7.5 (35mm x 7.5mm) and DIN rail end-clips (stop clips), recommended for mounting with the controller. The DIN rail should be of sufficient length to accommodate both the FX80 and any other modules.
- Suitable screws and screwdriver for mounting DIN rail, or if DIN rail not used, for mounting the bases of the controller and the module. A small flat-bladed screwdriver is needed for the wiring terminals.

## 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

### Warning

#### **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.

### General precautions

- **Important:** Use copper conductors only. Make all wiring in accordance with local, national, and regional regulations. Do not exceed the IOR-34s electrical ratings.
- **Important:** Use this IOR-34 Module only as an operating control. Where failure or malfunction of the IOR-16 could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to ward off or protect against failure or malfunction of the IOR-34.

### 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. Following these precautions when installing, servicing or operating the system:

- **Important:** Work in a static-free area. Discharge any static electricity you may have accumulated. Discharge static electricity by touching a known, securely grounded object. Do not handle the printed circuit board (PCB) without proper protection against static discharge. Use a wrist strap when handling PCBs, with the wrist strap clamp secured to earth ground.

## Module connection precautions

Do not connect more than the maximum number of IOR-34 modules to the RS-485 port of the parent FX80 Supervisory Controller. Sixteen is the maximum number supported in the software. However, fewer IOR-34 modules can be supported. See [Power supply options](#).

- **Important:** Connect S terminal wiring as shown in Figure 6 or communication errors may result. S terminal serves as reference ground between isolated RS-485 ports on FX80 Supervisory Controllers and IOR-16 and IOR-34 modules.

# Mounting

The IOR34 modules support mounting on EN 50022 standard 7.5mm x 35mm DIN rail or panel mounting.

## CAUTION

### **Risk of Property Damage**

Do not mount hardware on both a DIN rail and with tab mounts to another surface. This causes physical stress on equipment and prevents good connections between the FX80 controller and modules.

## CAUTION

### **Risk of Property Damage**

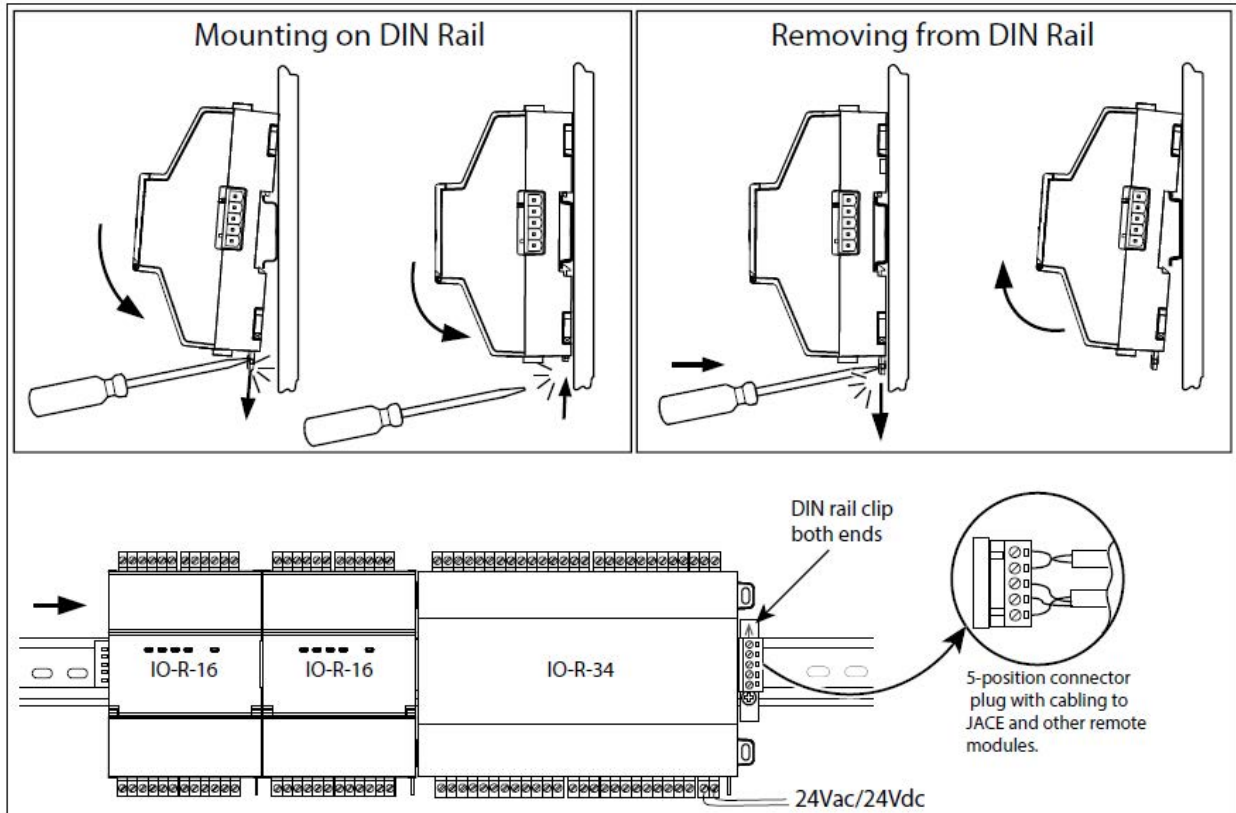
Do not mount DIN rail stops so that they press against IOR-34 end connectors. If possible, use low-profile rail stops to eliminate possibility of contact and damage to the connectors.

## Mounting on a DIN Rail

The following applies to mounting an IOR-34 module:

- Use horizontal mounting as it is the preferred method to facilitate heat dissipation.
  - Mounting on a 35mm wide DIN rail is recommended. The IOR-34 unit base has a molded DIN rail slot and locking clip, which simplifies mounting with other modules. Mounting on a DIN rail ensures accurate alignment of connectors between all modules.
  - If DIN rail mounting is impractical, you can use screws in mounting tabs on the IOR-34
1. Pull the option module's locking clip down.

Figure 2: Fastening to the Rail



2. Tilt the module to hook over the DIN rail. Rotate the module flush against the DIN rail and then press the locking clip upwards to release it and secure the module to the rail.
3. Slide the IO-R-34 module along the DIN rail to its intended location. If you want to connect another mounted module, seat the five-position plug into that module's connector socket.
4. Carefully install the DIN rail end clips to the DIN rail to secure the assembly. Make sure that the DIN rail stops do not press against the end connectors on the IO-R-34.
5. Repeat this for all items, until all are mounted on the DIN rails, firmly connected to each other, and secured with DIN rail end clips.

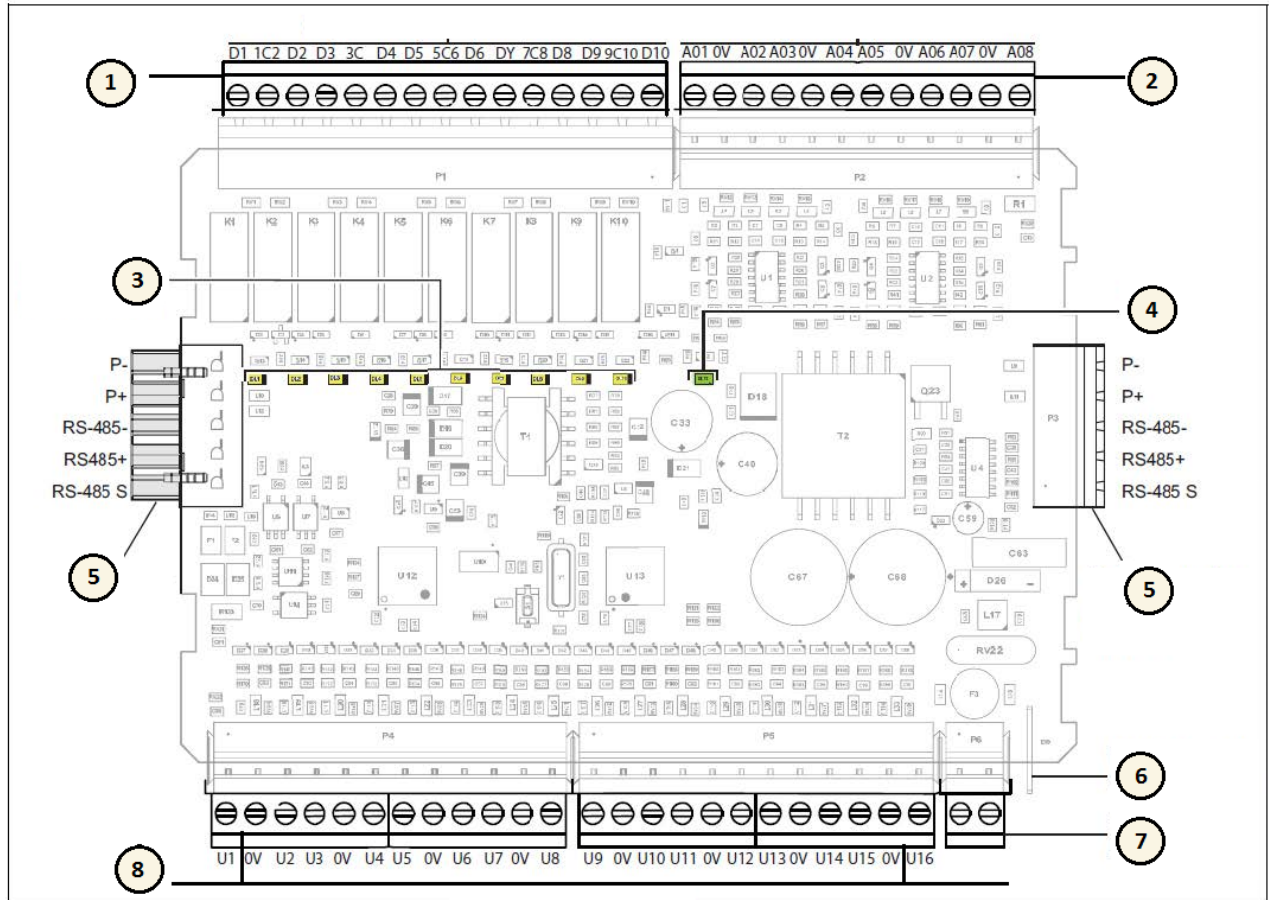
## IOR-34 board layout and terminals

The IOR-34 module provides sixteen universal inputs, compatible with the following:

- 0 VDC to 10 VDC
- 0-20mA
- Dry contacts
- Pulsing dry contacts
- 0-100K $\Omega$  resistive
- Type 3 thermistor temperature sensors

The IOR-34 module provides eighteen outputs: ten relay (24 VAC or DC, 0.5A max.) outputs and eight analog outputs (0 VDC -10 VDC). The following figure shows the wiring and LED locations.

**Figure 3: Remote I/O Module wiring terminal locations**



**Table 2: I/O Module wiring terminal**

Number	Description
1	Digital Relay Outputs (D1 to D10)
2	Analog VDC Outputs (A01 to A08)
3	Relay Output LEDs (Yellow)
4	Status LED (Green)
5	Five-pin connector 15 VDC Power RS-485
6	Earth Ground Connector Lug
7	24 VAC or VDC Power
8	Universal Inputs (U1 to U16)

## Wiring

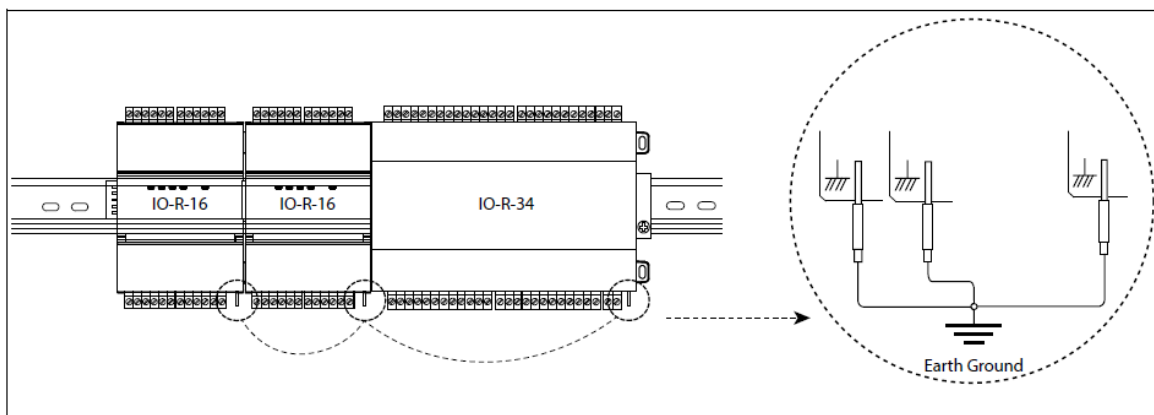
See Figure 3 to locate connectors and other components on the Remote I/O Module. Make connections to the Remote I/O Module in the following order:

1. Connect the earth grounding wire with the spade connector from the earth ground lug on the IOR-34 to a nearby earth grounding point. See [Grounding](#).
2. Wire the supply power to the IOR-34.
  - **Important:** Do not energize the power source until all other wiring is completed.
3. Connect RS-485 wiring between the IOR-34 module and the FX80 Supervisory Controller, and (if applicable) to other remote IOR-16 modules, in a continuous multidrop fashion. See [RS-485 Communications](#).
4. Connect I/O wiring. See sections [Inputs](#) and [Outputs](#).
5. Apply power to the unit. See [Power Up and Initial Checkout](#).

## Grounding

An earth ground spade lug (0.187 in.) is provided on the circuit board of the IOR-34 module for connection to earth ground. For maximum protection from electrostatic discharge or other forms of electromagnetic interference, connect each device's earth ground using a 16 AWG or larger wire. Keep these wires as short as possible. See Figure 4 for the location of the earth grounding wire.

**Figure 4: Earth Ground Connections Required to Each IOR-34**



## Power wiring

The IOR-34 is powered by wiring to a dedicated Class 2, 24V transformer, or to a 24 VDC power source.

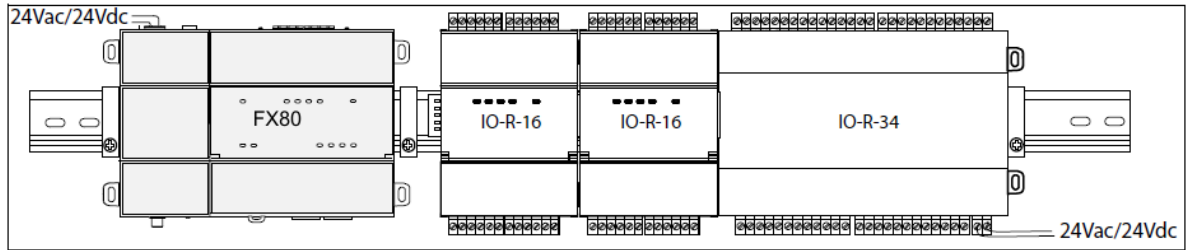
- ⓘ **Note:** If powering from a 24V transformer, do not also power equipment (other than a FX80) with the same transformer. Otherwise, conducted noise problems may result. Also, do not ground either side of the transformer's 24V secondary.

As shown in Figure 5, the IOR-34 two-position power connector is located at the lower corner of the unit. Unplug the connector from the module and install wire connections to the connector as shown.

- ⓘ **Note:** Do not apply 24V power (reinsert connector plug into the IOR-34) until all other wiring is completed, including IOR-34 inputs and outputs. See [Power Up and Initial Checkout](#)
- ⓘ **Note:** Do not connect two or more IOR-34 modules together. Connecting IOR-34 modules directly to each other may allow for hardware configurations that lead to equipment damage.



**Figure 5: IOR-16 Modules Powered by IOR-34 Connection**



## RS-485 Communications

RS-485 communications from the FX80 controller to each IO module (or assembly of modules) requires a continuous daisy-chain wiring topology using a shielded, twisted-pair cable. Wire between the IOR-34 assemblies using the 5-position end connectors. At the controller, wire to either of its three-position RS-485 connectors.

Use shielded 18-22 AWG wiring (refer to the TIA/EIA 485 standard). Wire in a continuous multidrop fashion, meaning plus to plus, minus to minus, and shield to shield. Connect the shield to earth ground at one end only, such as at the FX80 Supervisory Controller.

### Bias Settings

Each RS485 port on the FX80 has an adjacent three-position switch, with the following settings:

- **BIA** - (default, middle) RS485 biasing and termination: 2.7 $\Omega$  bias resistors with no terminal resistor
- **END** - RS485 biasing and a termination: 562 $\Omega$  bias resistors and 150 $\Omega$  termination resistor
- **MID** - RS485 biasing or termination: 47.5K bias resistors with no termination resistor

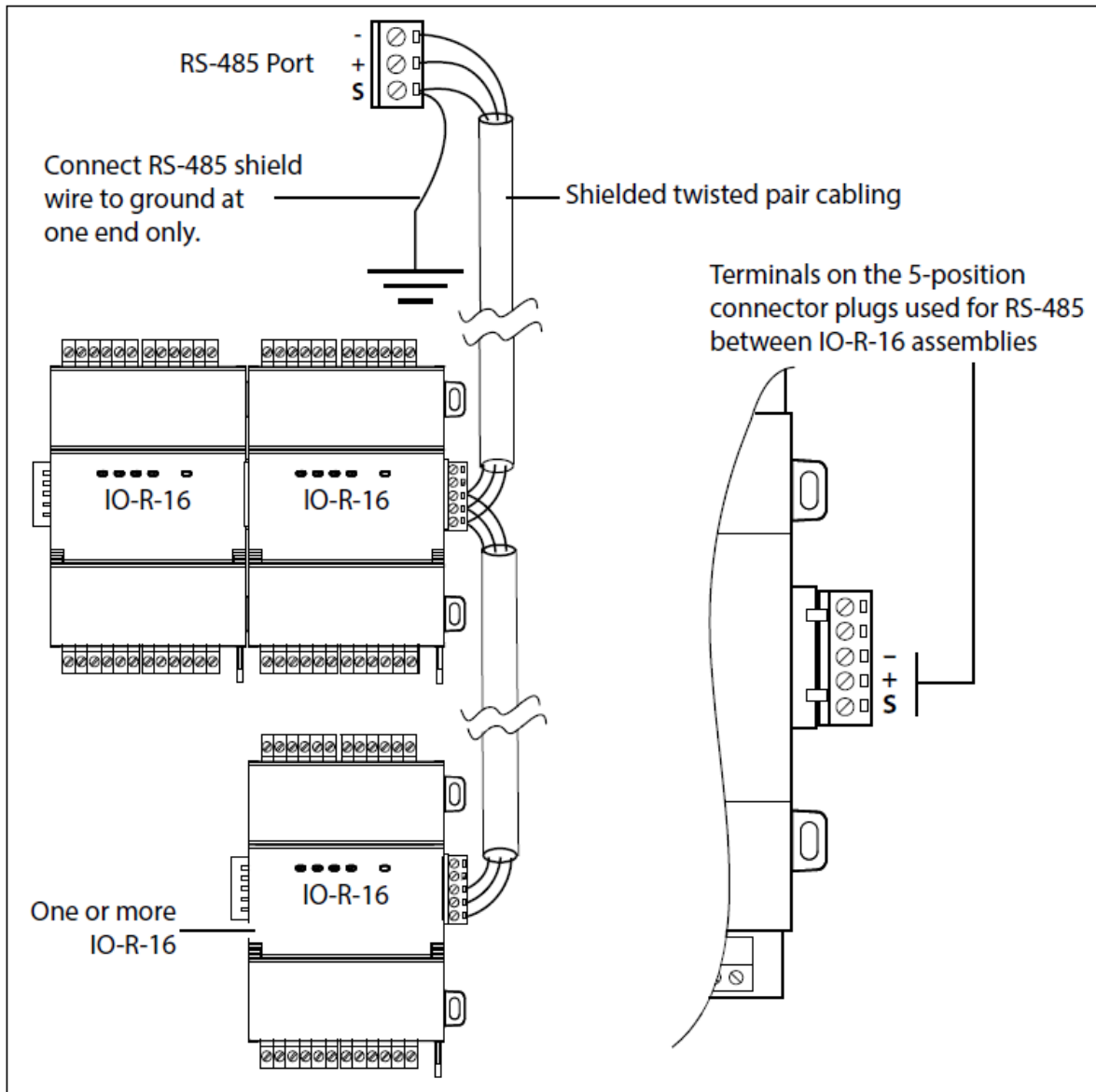
The following list contains best practice for the switch settings:

- **BIA** - (Default, middle) Often best if the RS485 trunk needs biasing, but when the controller is not installed at the end of the trunk
- **END** - Often best if the controller is installed at the end of an RS485 trunk of devices that is already not biased
- **MID** - Often best if the controller is put in the middle of an already-biased trunk

You can change the position of an RS485 port's bias switch while the controller is running.

- **Important:** Connect S terminal wiring as shown in Figure 6 or communication errors may result. S terminal serves as reference ground between isolated RS-485 ports on the FX80 controller and IOR-16 and IOR-34 modules.

**Figure 6: RS-485 Wiring From the FX80 to One or More IO-R-16 Modules Using Daisy-Chain Connection**



# Inputs

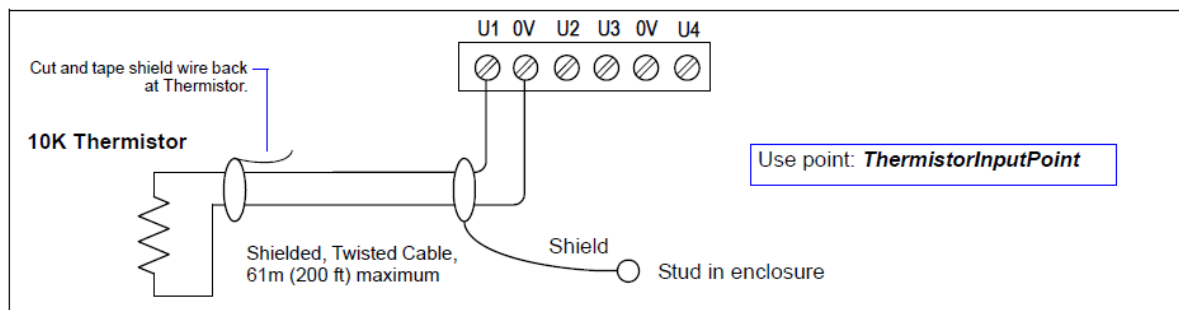
Each of the 8 universal inputs (UI) can support any of the following:

- **Type-3 10KΩ Thermistor**
- **Resistive 0-100kΩ**
- **0 to 10 VDC**
- **4-20 mA**
- **Binary Input**

## Thermistor

Inputs support 10k Thermistor temperature sensors. Input accuracy is in the range of  $\pm 1\%$  of span. By default, conversion is for a standard, Type 3 thermistor sensor, with a sensor range of  $-10^{\circ}\text{F}$  to  $135^{\circ}\text{F}$  ( $23.3^{\circ}\text{C}$  to  $57.2^{\circ}\text{C}$ ). Using a conversion type of Tabular Thermistor, you can specify a different thermistor response curve by importing a *thermistor curve.xml* file. Currently, the kitIo module contains an .xml folder with thermistor curves for various thermistor temperature sensors. You can also edit and export customized thermistor curve .xml files for reuse.

**Figure 7: Thermistor wiring**



## Resistive 0-100KΩ

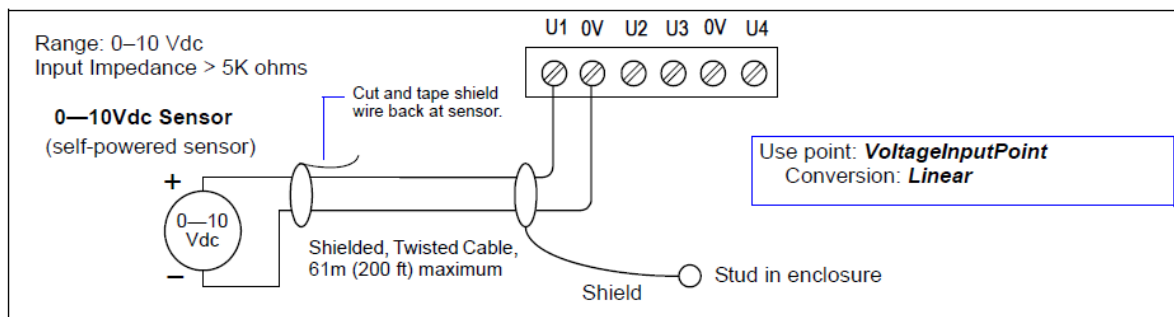
Inputs can read a resistive signal within a range from 0 to 100,000Ω. Wiring is the same as shown in Figure 7. Resistive signals require a Resistive Input Point.

- **Important:** Universal inputs provide optimum resistive-to-temperature resolution in the 10kΩ range. For a sensor with a range far from 10kΩ (such as a 100-Ω or 1,000-Ω sensor), resolution is so poor that it becomes unusable. To successfully use such a sensor, install a transmitter that produces a VDC or mA signal, and then wire the transmitter to the universal input according to the 0-10 VDC or 4-20 mA instructions.

## 0-10 VDC

Inputs support self-powered 0-10 VDC sensors. Input impedance is greater than 5kΩ. 0-10 V accuracy is  $\pm 2\%$  of span, without user calibration. Then following image shows the wiring diagram for a 0-10 VDC sensor. 0-10 VDC sensors require a Voltage Input Point.

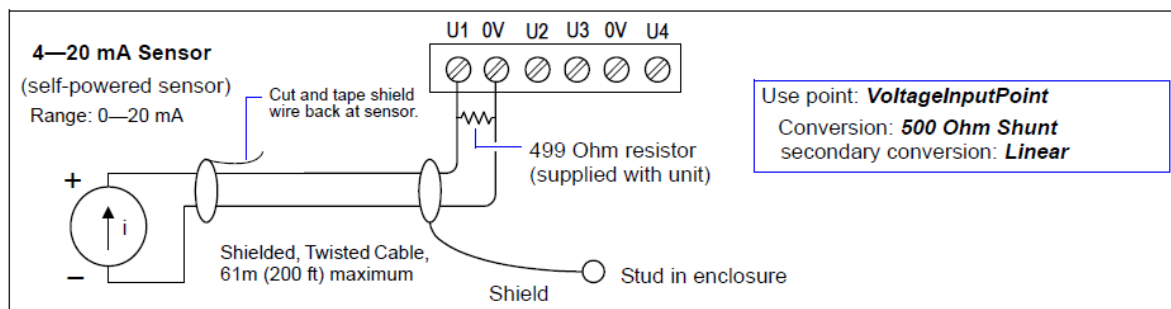
**Figure 8: 0-10 VDC**



### 4-20 mA

Inputs support self-powered 4–20 mA sensors. Input accuracy is  $\pm 2\%$  of span, without user calibration. The following image shows the wiring diagram, which requires a 499- $\Omega$  resistor wired across the input terminals. 4–20 mA sensors also require the Voltage Input Point.

**Figure 9: 4-20 mA**



## **⚠ CAUTION**

### **Risk of Property Damage**

When using an externally powered 4–20 mA sensor, be sure to de-energize its power supply before making or changing any wiring connections to the IOR-34 module, and remove power from the IOR-34 module. It is important not to apply external power to the universal inputs without the 499- $\Omega$  resistor in place. Even a momentary application of power (say, 24 VDC) to the universal input terminals without the resistor may damage circuitry on the IOR-34. Only after completing all input wiring should you restore power to such external power supplies.

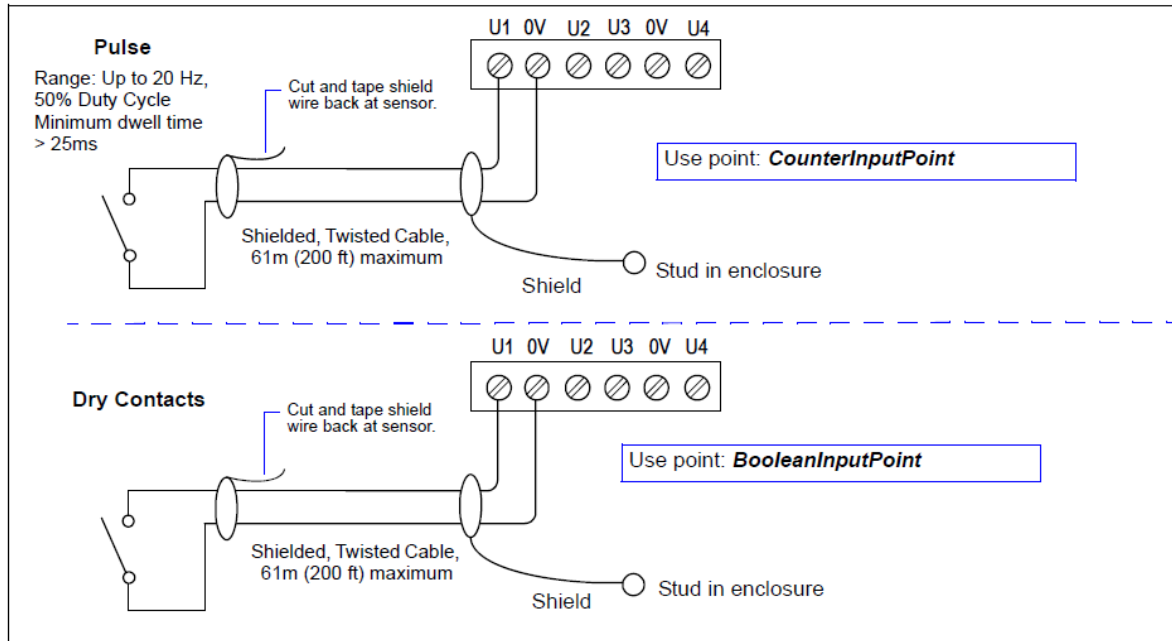
### **Binary Input**

Inputs support both pulse contacts and normal dry (equipment status) contacts.

- Pulse contacts may have a change-of-state (COS) frequency of up to 20 Hz with a 50% duty cycle.
  - ⓘ **Note:** Minimum dwell time must be  $>25$  ms. (Contacts must remain open at least 25 ms and be closed at least 25 ms.)
- Standard dry contacts must have a 1 Hz (or less) COS frequency, with minimum dwell time  $>500$  ms. (Contacts must remain open at least 500 ms and be closed at least 500 ms.)

Both types of dry contacts support 3.3 VDC open circuits, or 330µA short-circuit current. For a pulse contact, use the **CounterInputPoint** in the station database. For other dry contacts, use the **BooleanInputPoint**. The following image shows the wiring diagram (which is identical for both uses), but with different types of Nrio software points used for either application.

**Figure 10: Binary inputs**



## Outputs

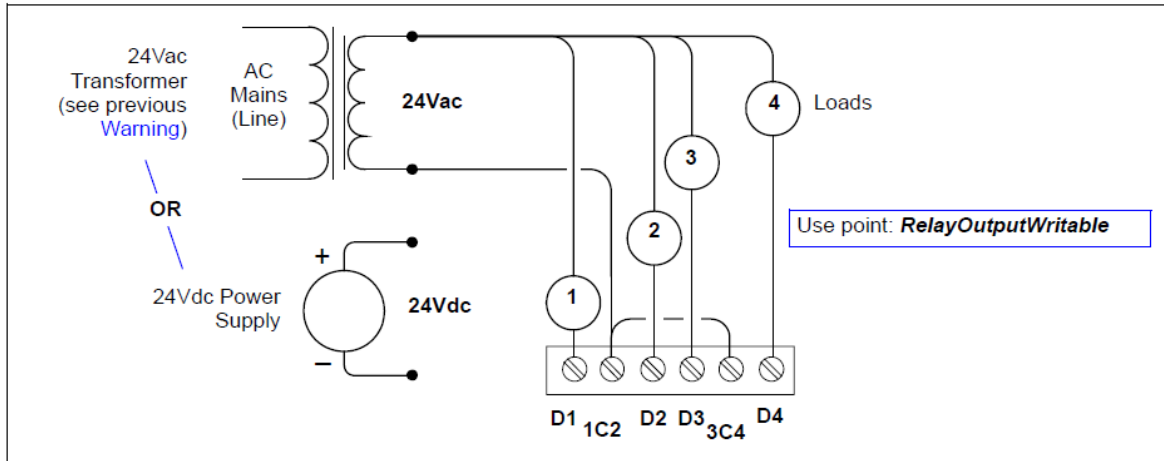
An IOR-34 module has four digital relay outputs and four 0-10 volt analog outputs.

### Relay Outputs

Each relay output is rated at 24 VAC or 24 VDC at 0.5 A. Relay outputs have metal oxide varistor (MOV) suppressors to support inductive-type loads such as heavy-duty relay coils.

- **Important:** Relays are not rated for AC mains (line level) powered loads (instead, 24 V maximum). Use an external 24 V transformer or a 24 VDC power supply to power loads. Use a **RelayOutputWritable** in the station for each output.

**Figure 11: Relay output wiring diagram**



Note that the two common DO terminals (1C2, 3C4) are isolated from each other. This method is useful if controlled loads are powered from different circuits. An LED status indicator for each relay (D1 to D4) is located on the board (see Figure 3), and also visible through the cover. Under normal operation, each digital status LED indicates activity as follows:

- **Off**—relay open. No current flows.
- **On**—relay closed. Load current flows.

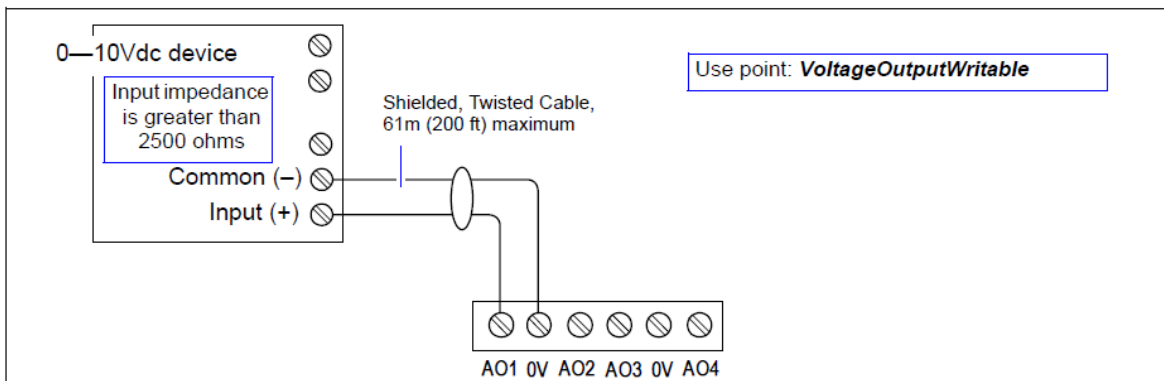
Therefore, an **On** status indicates that the load is powered.

### Analog Outputs

Analog outputs (AOs) are referenced by the terminals labeled **An** and **0V** (ground). Each AO can supply a maximum of 4 mA over the entire 0 VDC to 10 VDC range. For this 0 VDC to 10 VDC full range, the minimum input impedance of a device controlled by the AO must be greater than 2,500Ω.

If the device's input impedance is less than 2,500Ω, the 4 mA maximum current limits the voltage output range. For example, for a device with a 1,000Ω input impedance, the AO would work as a 0 VDC to 4 VDC analog output. For each AO, use a Voltage Output Writable in the station database. The following image shows typical wiring for an AO:

**Figure 12: Analog output wiring diagram**



# Nrio34Module (Software) representation

In the Niagara station interface to the FX80 and IOR-34 module, the module's I/O is modeled in the station's NrioNetwork (copies from the Nrio palette), under a child Nrio34Module device level component. This Nrio16Module has a default name of **Nrio34Modulen**

- ④ **Note:** After a remote I/O module is discovered and added to the station under this NrioNetwork (each one as a Nrio34Module), the serial status LEDs for the FX80s RS-485 port continually flash, which indicates polling activity. At this time, the **Status** LED on the IOR-34 module lights solid green. When an IOR-34 module's status LED is blinking, it is an indication that the unit is not online. Each input or output used requires a Niagara Remote Input/Output (Nrio) point to be added in the station database. These components act as the station interface to the physical I/O points.

## Power Up and Initial Checkout

1. Apply power to the IOR-34. The IOR-34 module's board status LED (Figure 3) are initially blinking.
2. Open a station connection to the FX80 controller using Workbench. If not already present, add a NrioNetwork component to the station's Driver Container.
3. Configure the NrioNetwork's Port Name property to match the FX Supervisory Controller's RS-485 port COM assignment.
4. Perform a **Discover** action from the NrioNetwork's Nrio Device Manager view. Each discovered remote I/O module appears in the top part of the Discovered pane in the view, with each IOR-34 module appearing as an Io34 type.
5. Add each discovered IOR-34 module to the station, renaming it to reflect its actual location. Each I/O module is represented by an Nrio34Module component.
6. Verify that each IOR-34 module's board status LED is now lit solid green.
7. You can now discover, add, and configure I/O points under each Nrio34Module's Points device extension.
  - ④ **Note:** To associate a discovered device to a specific IOR-34 module, right-click Wink Device action. This cycles a relay-output on that IOR-34 several times, which you can see or hear if nearby. This action is available both before and after a discovered device is added to the station.
  - ④ **Note:** If you select an Nrio34Module in the Nrio Device Manager view, and the **Upgrade Firmware** button is active, it is best practice that you upgrade its firmware. After clicking **Upgrade Firmware**, do not interrupt power to the IOR-34 module and FX Supervisory Controller, or to the communications between them, until the firmware upgrade job finishes. Typically, this takes less than two minutes, with job completion signaled in the FX Workbench view.

