

Mounting and Wiring Guide

This document covers the mounting and wiring of a Remote I/O Module (IO-R-16), for expanding an EC-BOS-8 and EC-BOS-9. It assumes that you are an engineer, technician, or service person who is performing control system design or installation. Please read through this entire document before beginning the installation procedures.

Product Description

The IO-R-16 expands an EC-BOS¹ with 16 I/O points that can be remotely located, including:

- 8 Universal inputs (UIs), compatible with 0–10Vdc, 0–20mA, dry contacts, pulsing dry contacts, 0–100K ohm resistive, or Type 3 thermistor temperature sensors.
- 4 Digital outputs with Form-A relay contacts, for on/off control of loads up to 24Vac/dc, at 0.5A max.
- 4 Analog outputs (AOs) for 0–10Vdc analog control of loads at 2.5K ohm minimum, or 4mA drain maximum.

The IO module uses DIN rail mounting and has two end-mounted 5-pin connectors that support direct-chaining (in-line attachment) to other IO-R-16 modules or IO-R-34 modules.

Communications to an EC-BOS use RS-485 multidrop on 3 wires of an end-mounted 5-pin connector. The other 2 wires on that connector are for INPUT power (15Vdc) which can be supplied from a DIN-mountable option (IO-R-34) or a third party 13.5-15.75 Vdc power supply. The RS-485 bus is wired back to Com 1 or Com 2 of the EC-BOS.

Related Documentation

For more information on mounting, wiring and configuring a system, refer to the *EC-BOS Mounting & Wiring Guides*, *Remote IO-R-34 Mounting and Wiring Guide*, and the *NRIO Guide*.

System Planning

System planning requires consideration of options regarding power, RS-485 communications, mounting and wiring. The following sections describe communications and power variables to consider before mounting and wiring your hardware.

Number of Supported Expansion Modules

An EC-BOS can support up to a maximum of 16 IO-R-16 modules via a single RS-485 bus. If an IO-R-34 is included, the IO-R-34 counts as two modules. So, for example, the EC-BOS could support 2 IO-R-34 modules and 12 IO-R-16 modules. [Table 1](#) shows possible options for combinations of IO-R-16 and IO-R-34 modules.

Power Supply Options and Considerations

You can provide power to the IO-R-16 from the 5-pin connector of an IO-R-34. Each IO-R-34 module can power up to 4 IO-R-16 modules. You can also use a third-party 13.5-15.75 Vdc power supply (output regulated to within ±4%) wired to the P+ and P- terminals of an IO-R-16 module's 5-position end connector.



¹ EC-BOS-8 and EC-BOS-9 with EC-Net 4.13 and later and an available RS-485 port.
See "System Planning," page 1 for more details.

Power Supply Options and Considerations

Table 1 shows possible combinations. For example, Option 2 includes a total of 14, IO-R-16s and 1, IO-R-34. Four of the IO-R-16s are powered by the IO-R-34. The remaining 10 IO-R-16s must be powered by an external source.

Table 1 IO Module Combinations and IO-R-16 Power Options

Combinations	Module	Number of Devices	Powered by IO-R-34(s)	Powered by External Supply
Option 1	IO-R-16	16	0	16
	IO-R-34	0		
Option 2	IO-R-16	14	4	10
	IO-R-34	1		
Option 3	IO-R-16	12	8	4
	IO-R-34	2		
Option 4	IO-R-16	10	10	0
	IO-R-34	3		
Option 5	IO-R-16	8	8	0
	IO-R-34	4		
Option 6	IO-R-16	6	6	0
	IO-R-34	5		
Option 7	IO-R-16	4	4	0
	IO-R-34	6		
Option 8	IO-R-16	2	2	0
	IO-R-34	7		
Option 9	IO-R-16	0	0	0
	IO-R-34	8		

Both IO-R-16 and IO-R-34 should have a UPS power backup if continuous operation during power failures is a requirement. These modules do not support the battery powered configurations provided on some legacy hardware. The 5 pin power/comm connectors do not include a battery pin, preventing connection to (and possible damage from) legacy controllers.



Note When cabling power to modules located some distance from the EC-BOS, you should allow for voltage drops introduced by cabling distances. See [“Voltage drop considerations”](#) on page 3.

Operation without power backup

If an IO-R-16 module is powered locally, with an IO-R-34, for example, and a momentary AC power loss occurs, note that a number of *undesirable things can result*, including:

- Load cycling from IO-R-16 relays dropping out, including several seconds lag to first re-establish communications with the EC-BOS (Nrio driver) before relays can pull in again, as needed.
- Totalized “counts” zeroed out.
- History (logging) entries for associated IO points as “down,” as well as Nrio “device down” alarms.

Further, loss of power without backup makes an IO firmware upgrade a risky operation. Such an upgrade is initiated from the “Nrio Device Manager” view (in a station connection to the EC-BOS). If this upgrade process is interrupted by a IO-R-16 power cycle, the module may be rendered inoperable—and will likely need to be replaced. Therefore, consider providing UPS backup power.

Configure default settings for comm loss scenarios—You can use EC-Net Pro to configure default AO and DO values to be set in case of a power outage or other communications-loss situations. The feature is configurable for timing and function. You can choose to use it on Powerup, CommLoss, both or neither. See the *Nrio Driver Guide* for details.

Voltage drop considerations

You should be aware of potential voltage drops in the connecting “trunk power” cabling. Typically, this applies only if modules are located in different locations—that is, not near the power supply.

Note that each IO-R-16 draws (at most, when all four relays are pulled in) 0.133A, and thus can introduce voltage drop when long cabling distances are used for power/backup. [Table 2](#) provides a summary of IO-R-16 power consumption for these purposes.

Table 2 IO-R-16 Power Consumption.

Device	Max per System	Amps / W used @ 15Vdc (each)	Notes
IO-R-16	see Table 1	0.133 A / 2.00 W	Has 4 on-board relays.

Undersized selection of power cabling can result in unacceptably high voltage drops, and remotely located IO-R-16 modules may not operate correctly—especially during emergency (battery backup) operation.

The maximum allowable voltage drop due to wiring is 1.5V. This equates to the difference in voltage measured across the P+ and P- at the source power supply, and the P+ and P- at the furthest expansion module (IO-R-16). [Table 3](#) provides a voltage drop chart, showing voltage drops per 100 feet of paired wire of different gauges (AWG), at different load amps.

Table 3 Voltage Drop Per 100 Feet Run (30m) of Paired Wire.

Gauge (AWG)	Load Current						
	0.10A	0.25A	0.5A	1.0A	1.5A	2.0A	4.0A
10	0.020	0.05	0.10	0.20	0.30	0.40	0.80
12	0.032	0.08	0.16	0.32	0.48	0.64	1.27
14	0.050	0.13	0.25	0.50	0.75	1.01	2.02
16	0.080	0.20	0.40	0.80	1.20	1.60	3.20
18	0.127	0.32	0.64	1.27	1.91	2.54	5.08
20	0.202	0.50	1.01	2.02	3.03	4.03	8.07
22	0.320	0.80	1.60	3.20	4.80	6.40	12.81

For an example, consider a system where two IO-R-16 modules are mounted remotely in a location 500 feet (152m) away. In this example, worst-case amps used by each remote IO-R-16 is 0.133A. Looking at [Table 3](#) at the 0.25A column, a #16 AWG cable pair drops 0.20V per 100 feet, meaning a 500 foot run would drop 1V. This would be a good choice over an #18 AWG cable, which would drop 1.6V (above the 1.5V maximum allowable drop).

Preparation

Unpack the IO-R-16 module and inspect the contents of the package for damaged or missing components. If damaged, notify the appropriate carrier at once, and return for immediate replacement (see “[Returning a Defective Unit](#),” page 19). See the next sections “[Included in this Package](#)” and “[Material and Tools Required](#)”.

Included in this Package

Included in this Package

Included in this package you should find the following items:

- IO-R-16 module with quick disconnect female connectors.
- *Remote I/O Module (IO-R-16) Mounting and Wiring Guide*.
- Hardware bag containing the following items:
 - One (1) grounding wire, with quick-disconnect 0.187" female connector.
 - Eight (8) 499-ohm resistors, used for 4–20mA inputs.

Material and Tools Required

The following supplies and tools are required for installation:

- IO-R-34 or other 13.5 -15.75 Vdc power supply source (see “[Power Supply Options and Considerations](#)” on page 1).
- If DIN mounting, a DIN rail, type NS35/7.5 (35mm x 7.5mm) and DIN rail end-clips (stop clips), and screws for mounting. Low-profile end clips are preferred to avoid contacting module connectors. See [Figure 1](#). If DIN rail is not used, suitable screws for mounting base of Remote I/O Module module.
- Suitable tools and supplies for making all wiring terminations.

Precautions

This document uses the following warning and caution conventions:



Caution

Cautions remind the reader to be careful. They alert readers to situations where there is a chance that the reader might perform an action that cannot be undone, might receive unexpected results, or might lose data. Cautions contain an explanation of why the action is potentially problematic.



Warning

Warnings alert the reader to proceed with extreme care. They alert readers to situations where there is a chance that the reader might do something that can result in personal injury or equipment damage. Warnings contain an explanation of why the action is potentially dangerous.

Safety Precautions

The following items are warnings of a general nature relating to the installation and start-up of a compatible EC-BOS. Be sure to heed these warnings to prevent personal injury or equipment damage.



Warning

- **A 15Vdc circuit powers the IO-R-16 module. Disconnect power before installation or servicing to prevent electrical shock or equipment damage.**
- **Make all connections in accordance with national and local electrical codes. Use copper conductors only.**
- **To reduce the risk of fire or electrical shock, install in a controlled environment relatively free of contaminants.**
- **EC-BOS and I/O modules are only intended for use as monitoring and control devices. To prevent data loss or equipment damage, do not use them for any other purposes.**

Static Discharge Precautions

These items are cautionary notes to help prevent equipment damage or loss of data caused by static discharge.

**Caution**

- Static charges produce voltages high enough to damage electronic components. The microprocessors and associated circuitry within a Remote I/O Module are sensitive to static discharge. Follow these precautions when installing, servicing, or operating the system:
- 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

**Caution**

Do not connect more than the maximum number of IO-R-16 modules to the RS-485 port of the parent EC-BOS—note that *16 is the maximum number supported in software*. However, less IO-R-16 modules may be supported. See “[Number of Supported Expansion Modules](#),” page 1.

**Caution**

Do not connect more than maximum allowed (see [Table 1](#)) IO-R-16 modules to a single power source. Overloading may cause overheating or blowing an internal, non-replaceable fuse.

**Caution**

Connect S terminal wiring as shown in [Figure 7](#) or communication errors may result. S terminal serves as reference ground between isolated RS-485 ports on EC-BOS and IO-R-16 and IO-R-34 modules.

WEEE (Waste of Electrical and Electronic Equipment)



Recycling of Electronic Products: (International Installations):

In 2006 the European Union adopted regulations (WEEE) for the collection and recycling of all waste electrical and electronic equipment. It is no longer allowable to simply throw away such equipment. Instead, these products must enter the recycling process. To properly dispose of this product, please take it to a local recycling center. If a local recycling center cannot be found, please return it to one of these offices:

<https://www.distech-controls.com/contact-us>

Installation and Start-up Outline


Note

If installing the EC-BOS and IO-R-16 module at the same time, please refer to the *EC-BOS Mounting & Wiring Guides* document to install.

The major steps to installing and starting the IO-R-16 module are outlined as follows:

1. Physically mount the IO-R-16 module onto DIN rail. See [“Physical Mounting.”](#) If directly attaching to other modules, ensure that the 5-position end connector(s) are properly seated into the end connectors of the other units. Note the previous [“Module Connection Precautions”](#) on page 5.
2. Make wiring connections for grounding, power, RS-485 communications, and I/O points. See [“Wiring Details,”](#) page 9.
3. Apply power and perform an initial checkout. See [“Power up and Initial Checkout”](#) on page 17.

Physical Mounting

The following applies to mounting a IO-R-16 Remote I/O Module:

- Horizontal mounting is preferred to facilitate heat dissipation. It is not necessary to remove the cover before mounting.
- Mounting on a 35mm wide DIN rail is recommended. The IO-R-16 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 IO-R-16.

[Procedure 1](#) provides step-by-step instructions for mounting the IO-R-16 module on an installed DIN rail.

Procedure 1 To mount on DIN rail.

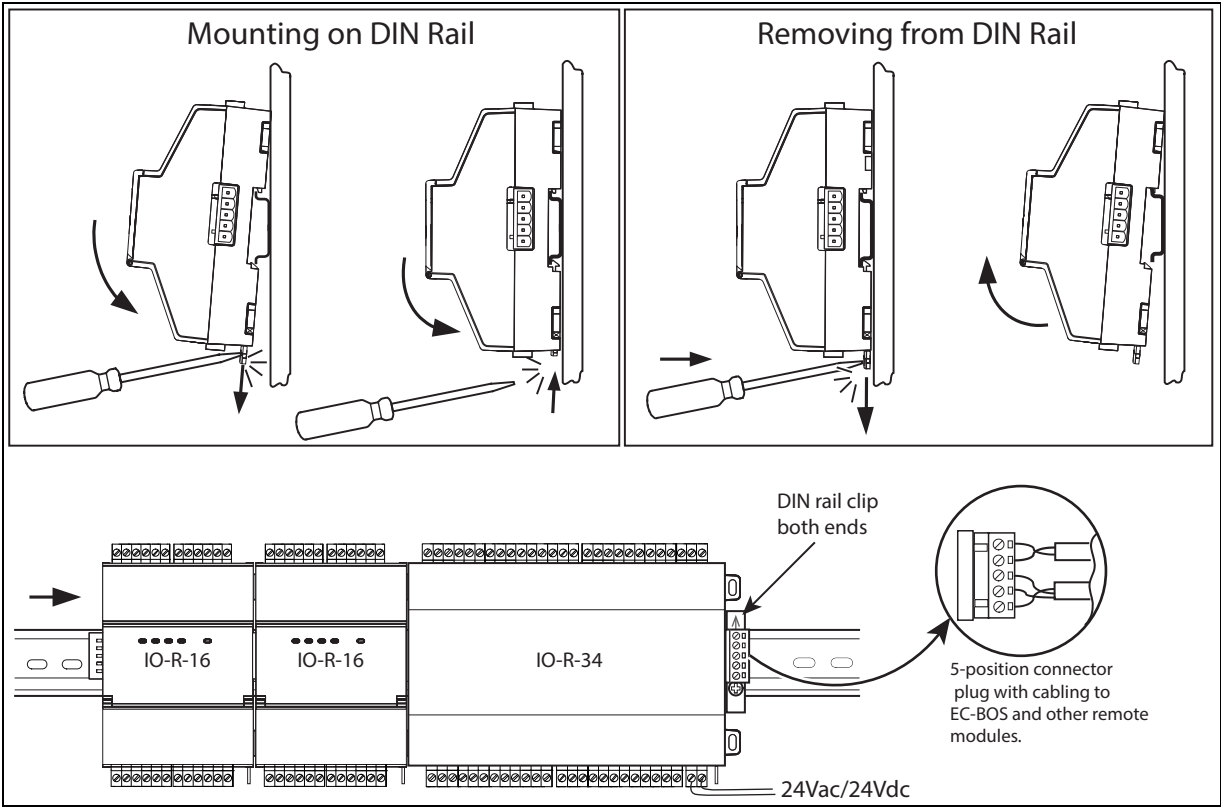
- Step 1** Pull or pry down the plastic locking clip until it snaps into the open (down) position.
- Step 2** Position the IO-R-16 module on the rail, tilting to hook the top DIN rail tab over the upper edge of the DIN rail ([Figure 1](#)). Rotate the module flush against the DIN rail and then press the locking clip upward to release it and secure the module to the rail.
- Step 3** Slide the IO-R-16 module along the DIN rail to its intended location. If connecting to another mounted module, seat the 5-position plug into that module’s connector socket.
- Step 4** Carefully install DIN rail end clips to secure the assembly. Make sure that the DIN rail stops do not press against the end connectors on the IO-R-16.


Caution

- 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 controller and modules.
- Do not mount DIN rail stops so that they press against IO-R-16 end connectors. If possible, use low-profile rail stops to eliminate possibility of contact and damage to the connectors.

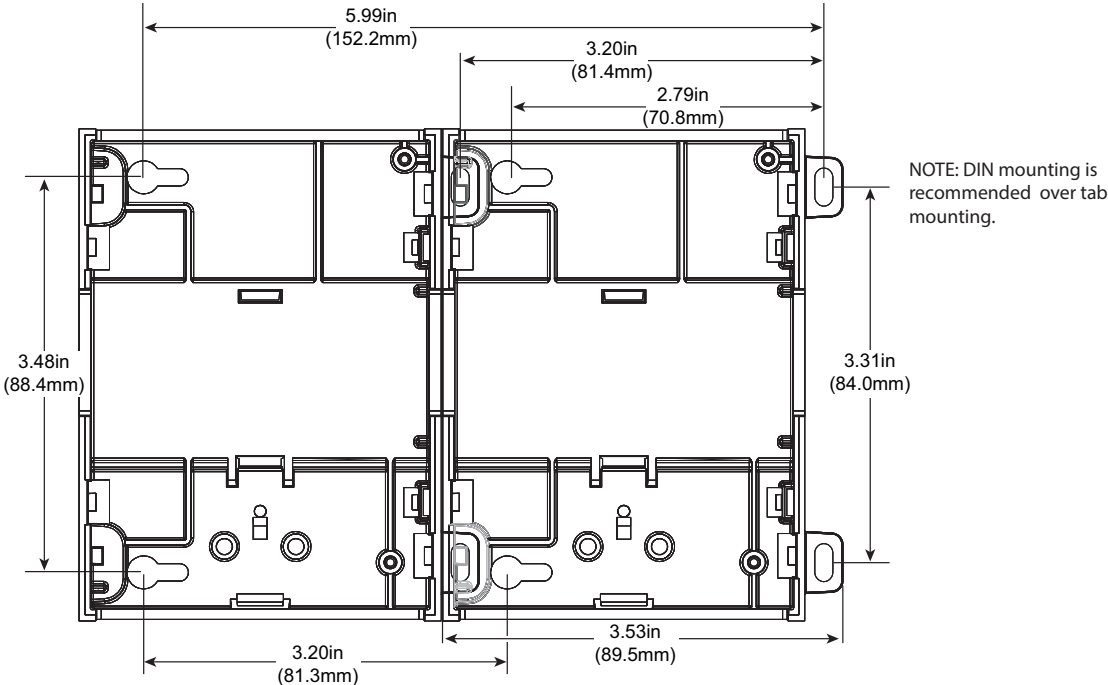
- Step 5** Repeat this for all items, until all are mounted on the DIN rail(s), firmly connected to each other, and secured with DIN rail end clips.

Figure 1 IO-R-16 module DIN mounting details.



Note To remove an IO-R-16 module from a DIN rail, remove DIN rail end clips and (if applicable) slide it away from other modules. Move the plastic locking tab down to open position then lift unit outwards.

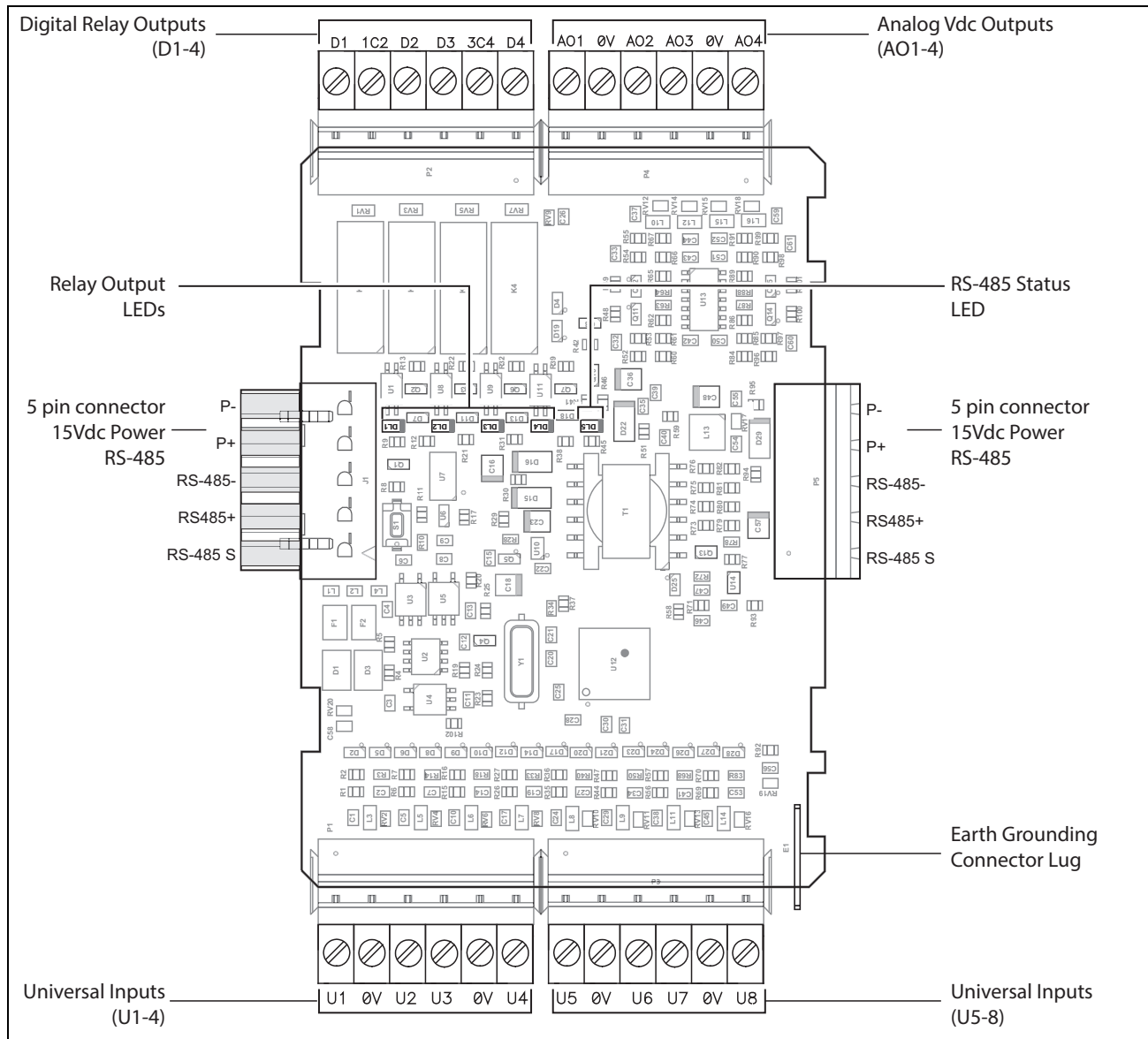
Figure 2 Tab Mounting Dimensions.



IO-R-16 Board Layout and Terminals

The IO-R-16 module provides 8 universal **inputs**, 4 digital **relay outputs**, and 4 0–10Vdc **analog outputs**. Wiring terminal positions are shown below (Figure 3), along with LED locations.

Figure 3 Remote I/O Module Wiring Terminal Locations (screw terminal connectors shown installed).



Wiring Details

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 spade connector) from the earth ground lug on the IO-R-16 to a nearby earth grounding point. See the [“Grounding”](#) section on page 9 for details.
2. Wire the supply power to the IO-R-16, but *do not energize the power source* until all other wiring is completed. Depending on how you are powering the IO-R-16, methods differ:
 - a. If powering the IO-R-16 from an IO-R-34, slide the two modules together to mate the connectors.
 - b. If powering the IO-R-16 from a third-party 13.5-15.75 Vdc power supply, wire the positive and negative lines from the power supply to the P+ and P– terminals of the 5-position end connector plug. See [“Power from third party 13.5-15.75 Vdc power supply”](#) on page 10.
3. Connect RS-485 wiring between the IO-R-16 and the EC-BOS, and (if applicable) to other remote IO-R-16, or IO-16-485 modules, in a continuous multidrop fashion. See [“RS-485 Communications”](#) on page 11.



Caution

Connect S terminal wiring as shown in [Figure 7](#) or communication errors may result. S terminal serves as reference ground between isolated RS-485 ports on EC-BOS and IO-R-16 and IO-R-34 modules.

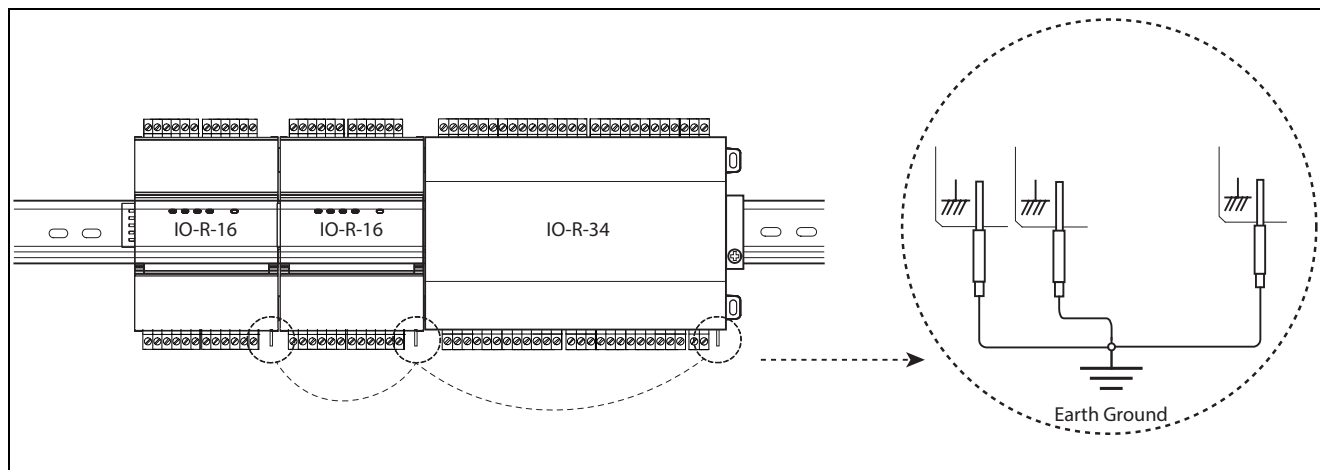
4. Connect I/O wiring. See sections [“Inputs”](#) on page 12, and [“Outputs”](#) on page 15.
5. Apply power to the unit. See [“Power up and Initial Checkout,”](#) page 17.

Grounding

An earth ground spade lug (0.187") is provided on the circuit board of the IO-R-16 for connection to earth ground. For maximum protection from electrostatic discharge or other forms of EMI, connect **each** device's earth ground using a #16 AWG or larger wire. Keep these wires as short as possible.

See [Figure 3](#) for the location of the earth grounding wire.

Figure 4 Earth ground connection required to each IO-R-16 module as well as IO-R-34, if used.



Note

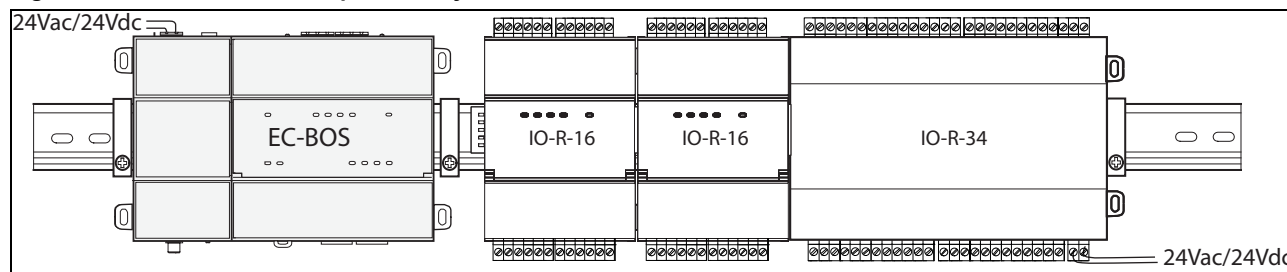
Connect any remote IO-R-16 modules to a nearby earth ground in the same manner.

Power from IO-R-34

If powering one or more IO-R-16 modules from a IO-R-34 module, simply connect the modules as shown in [Figure 5](#). Power and RS-485 communication connection is provided through the 5-position “Powered RS-485” connector.

- Each IO-R-34 can power up to four (4) IO-R-16 modules.
- Do not apply power (at any location) until all other wiring is completed. See [“Power up and Initial Checkout,”](#) page 17.

Figure 5 IO-R-16 modules powered by IO-R-34 connection.



In some cases, some number of IO-R-16 modules may be powered this way (from IO-R-34), while others may be powered locally using a third-party 13.5-15.75 Vdc power supply. This may be advisable when IO modules are located long distances from the IO-R-34 providing power, to avoid excessive voltage drops due to wiring resistances. See the following sections:

- [“Power from third party 13.5-15.75 Vdc power supply,”](#) page 10

Power from third party 13.5-15.75 Vdc power supply

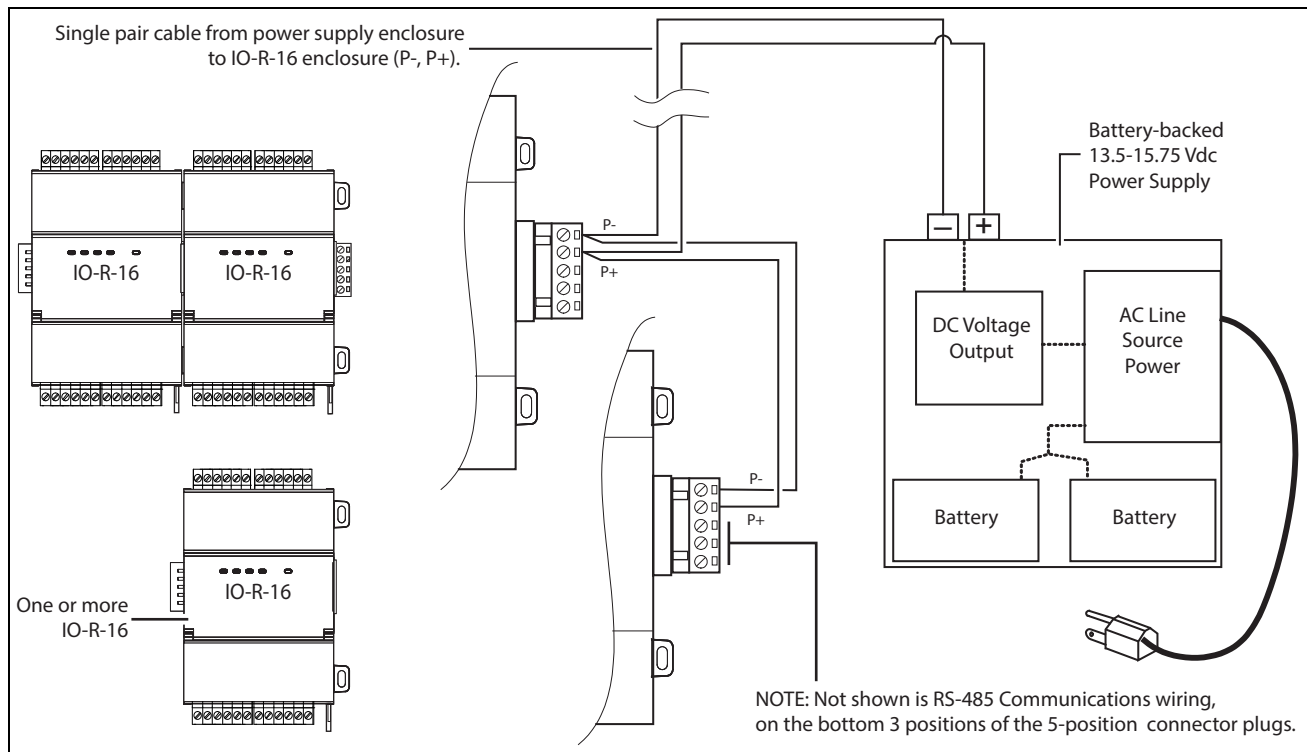
IO-R-16 modules can be powered by a third-party, 13.5V–15.75Vdc power supply. A “battery backed” power supply is recommended. This provides power to the IO module(s) during AC power loss scenarios.

[Figure 6](#) shows wiring for two assemblies of IO-R-16 modules powered by a battery-backed power supply.



Notes

- For power budgeting purposes, estimate each IO-R-16 module to consume 2W nominal (0.133 A @15V). Typical current will be less— as this estimate factors in all four relays being pulled in.
- Be aware of potential voltage drops when connecting via “trunk power” cabling. Voltage drops are more typical when modules are not located near the power supply. See [“Voltage drop considerations,”](#) page 3.
- For other wiring on the 5-position end connector, see [“RS-485 Communications,”](#) page 11.
- Do not apply power (energize the power supply) until all other wiring is completed. See [“Power up and Initial Checkout,”](#) page 17.

Figure 6 Third-party 12Vdc, battery backed, power supply powering IO-R-16 modules.**Notes**

- Power must be regulated to within $\pm 4\%$.
- Power supply models furnishing 15Vdc output are the most commonly available.
- Only remote *IO-R-16 modules* can be powered by a 15Vdc power supply—the EC-BOS and the IO-R-34 requires 24Vdc. See the appropriate *Mounting & Wiring Guide* for details.

RS-485 Communications

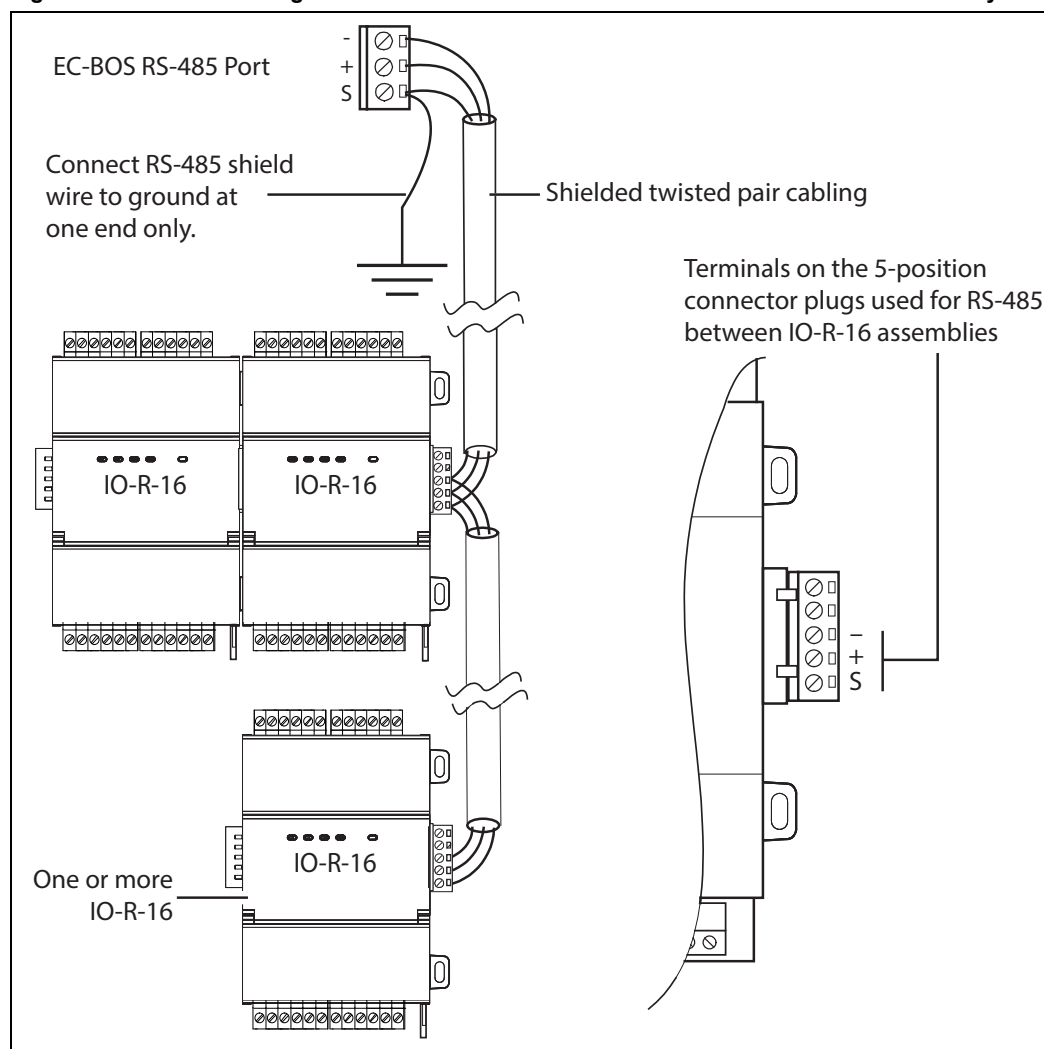
RS-485 communications from the EC-BOS to each IO module (or assembly of modules) requires a continuous “daisy-chain” wiring topology using a shielded, twisted-pair cable. Wire between the IO-R-16 assemblies using the 5-position end connectors. At the EC-BOS, wire to either of its 3-position RS-485 connectors.

Use shielded 18-22AWG 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 wire (reference ground) to earth ground at one end only, such as at the EC-BOS. See [Figure 7](#).

**Caution**

Connect S terminal wiring as shown in [Figure 7](#) or communication errors may result. S terminal serves as reference ground between isolated RS-485 ports on EC-BOS and IO-R-16 and IO-R-34 modules.

Inputs

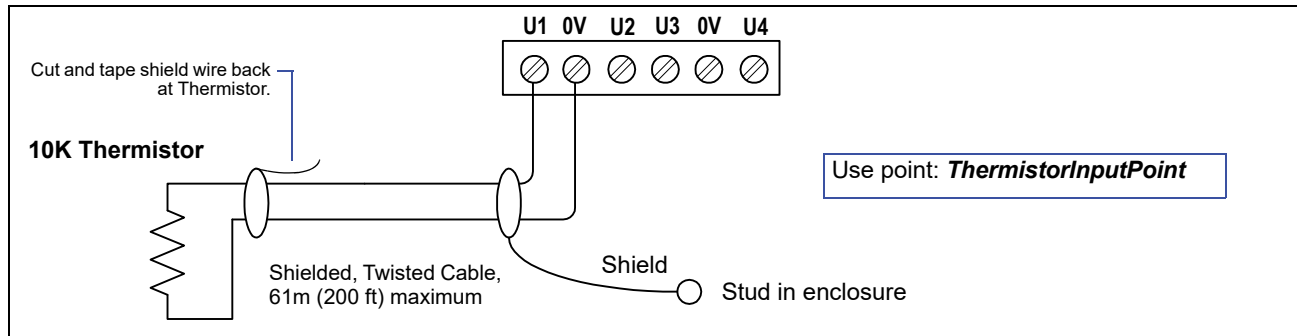
Figure 7 RS-485 wiring from the EC-BOS to one or more IO-R-16 modules uses a “daisy-chain” connection.**Inputs**

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

- Type-3 10K ohm [Thermistor](#) (also see [Caution](#) on page 13)
- [Resistive](#) 0—100K ohms
- [0–10 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° to 135°F (-23.3° to 57.2°C). Using a conversion type of “Tabular Thermistor,” you can specify a different thermistor response curve, by importing a thermistor curve .xml file. The *kitlo* module contains an xml folder with thermistor curves for a various thermistor temperature sensors. You can also edit and export (for reuse) *customized* thermistor curve xml files. See the *NRIO Driver Guide* for details. [Figure 8](#) shows the wiring diagram.

Figure 8 Thermistor wiring.

Resistive 0—100K ohms

Inputs can read a resistive signal within a range from 0 to 100,000 ohms. Wiring is the same as shown for a Thermistor temperature sensor (Figure 8).

Resistive signals require a **ResistiveInputPoint**.



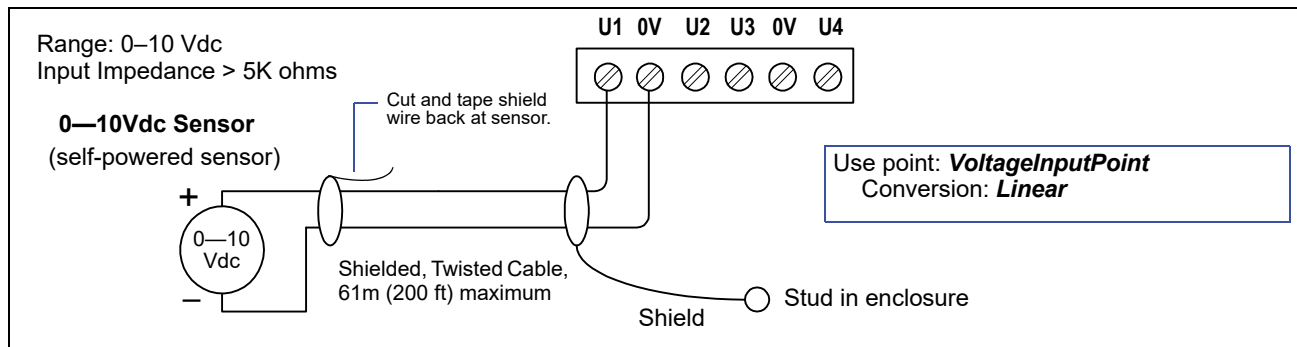
Caution

UI inputs provide optimum resistive-to-temperature resolution in the 10K ohm range. For a sensor with a range far from 10K ohms (such as a **100-ohm** or **1000-ohm sensor**), resolution is **so poor as to be unusable!** To successfully use such a sensor, install a *transmitter* that produces a Vdc or mA signal, and then wire the transmitter to the UI 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 5K ohms. 0–10 volt accuracy is $\pm 2\%$ of span, without user calibration. Figure 9 shows the wiring diagram for a 0–10 Vdc sensor.

0–10 Vdc sensors require a **VoltageInputPoint**.

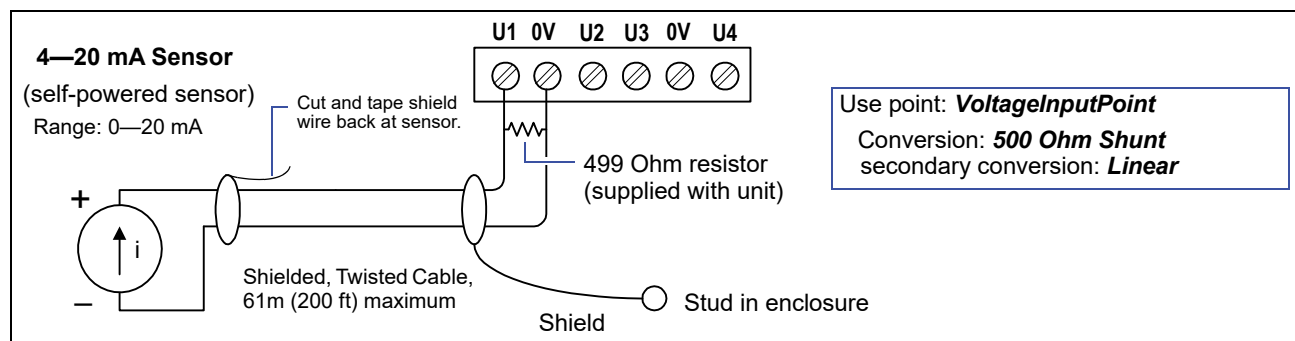
Figure 9 0–10 Vdc wiring.

4–20 mA

Inputs support self-powered 4–20 mA sensors. Input accuracy is $\pm 2\%$ of span, without user calibration. Figure 10 shows the wiring diagram, which requires a 499 ohm resistor wired across the input terminals.

4–20 mA sensors also require the **VoltageInputPoint**.

Inputs

Figure 10 4 to 20 mA wiring.**Caution**

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 IO-R-16 module. This is in addition to removing power from the IO-R-16 module.

It is important to not apply external power to the UI inputs without the 499 ohm resistor in place. Otherwise, even a momentary application of power (say, 24Vdc) to the UI terminals without the resistor may damage circuitry on the IO-R-16. Only *after* completing all input wiring should you restore power to such external power supplies.

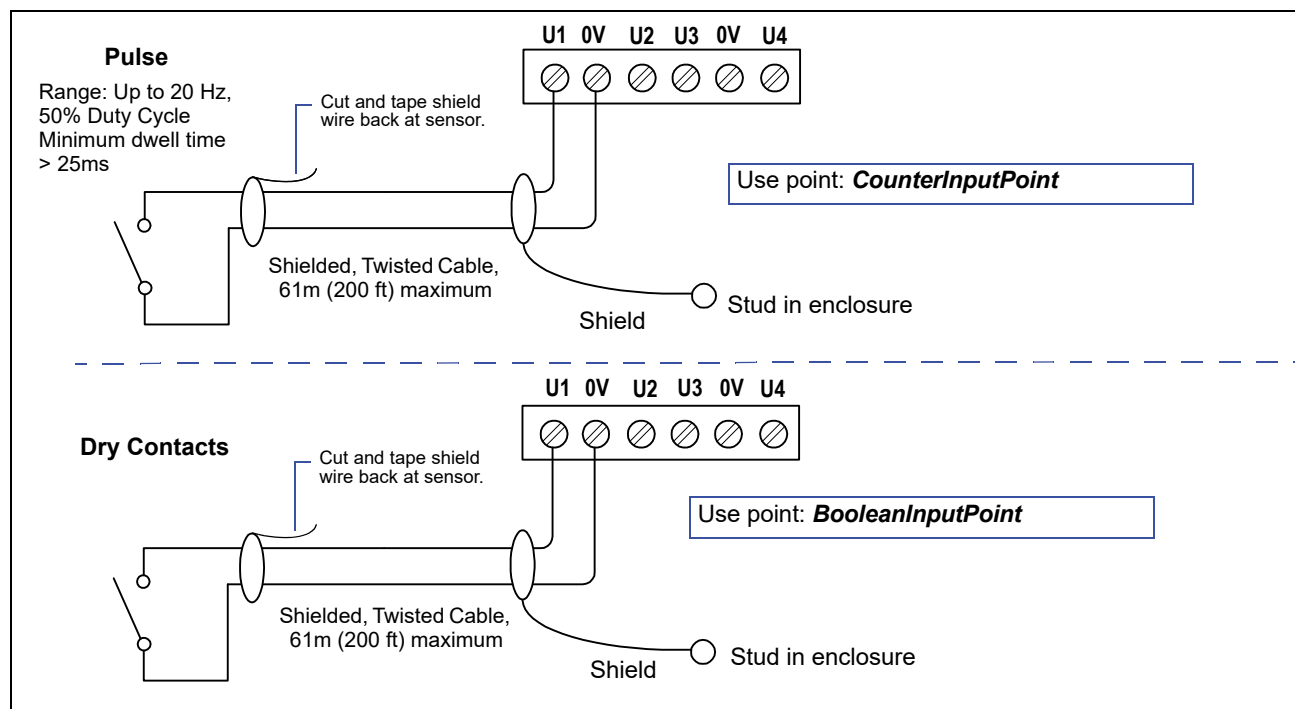
Binary Input

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 > 25ms. (Contacts must remain open at least 25ms and be closed at least 25ms.)
- Standard dry contacts must have a 1 Hz. (or less) COS frequency, with minimum dwell time > 500ms. (Contacts must remain open at least 500ms and be closed at least 500ms.)

Both types of dry contacts support 3.3 Vdc open circuits or 330 μ A short-circuit current. For a pulse contact, use the **CounterInputPoint** in the station database. For other dry contacts, use the **BooleanInputPoint**.

Figure 11 shows the wiring diagram (which is identical for both uses), but with different types of Nrio software points used for either application.

Figure 11 Binary input wiring.

Outputs

A IO-R-16 module has four (4) digital [relay outputs](#) and four (4) 0–10 volt [analog outputs](#).

Relay Outputs

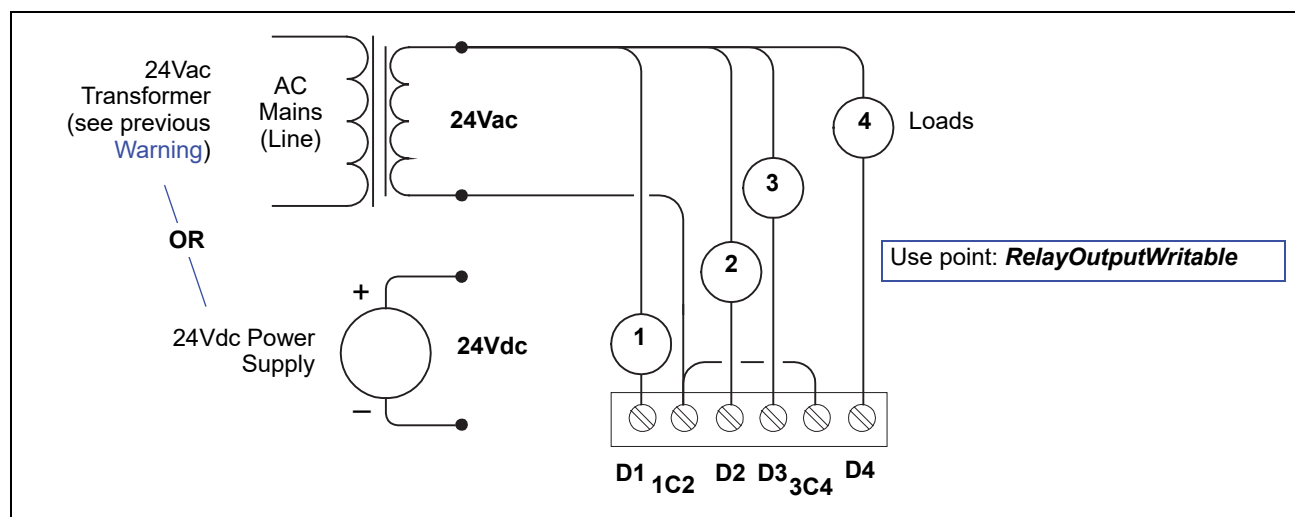
Each relay output is rated at 24 Vac or Vdc at 0.5A. Relay outputs have MOV (metal oxide varistor) suppressors to support inductive-type loads such as heavy-duty relay coils.



Warning

Relays are not rated for AC mains (line level) powered loads (instead, 24V maximum). Use an external 24V transformer or a 24Vdc power supply to power loads.

Use a **RelayOutputWritable** in the station for each output. [Figure 12](#) on page 15 shows an example wiring diagram.

Figure 12 Relay output wiring diagram.

Nrio16Module (Software) Representation

Note that the two common DO terminals (1C2, 3C4) are isolated from each other. This is useful if controlled loads are powered from different circuits.

An LED status indicator for each relay (D1—D4) is located on the board (Figure 3 on page 8), 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.

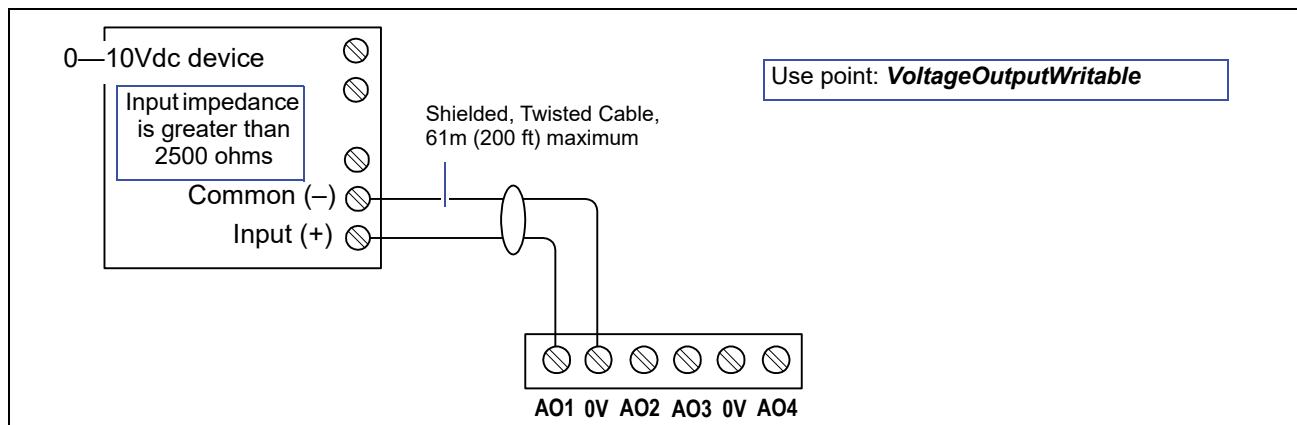
Analog Outputs

Analog outputs (AO) are referenced by the terminals labeled AO n and 0V (ground). Each AO can supply a maximum of 4 mA over the entire 0 to 10Vdc range. For this 0–10V full range, the minimum input impedance of a device controlled by the AO must be greater than 2500 ohms.

If the device's input impedance is less than 2500 ohms, the 4 mA “max. current” limits the voltage output range. For example, if a device with a 1000 ohm input impedance, the AO would work as a 0–4Vdc analog output.

Figure 13 shows typical wiring for an AO. For each AO, use a **VoltageOutputWritable** in the station database.

Figure 13 Analog output wiring diagram.



Nrio16Module (Software) Representation

In the EC-Net station interface to the EC-BOS and IO-R-16 module, the module's I/O is modeled in the station's **NrioNetwork** (copied from the *nrio* palette), under a child **Nrio16Module** “device level” component. This Nrio16Module has a default name of “io16_ n ”.



Note After a remote I/O module is discovered and added to the station under this NrioNetwork (each one as an Nrio16Module), the serial status LEDs for the EC-BOS's RS-485 port continually flash, reflecting polling activity. At this time, the “STATUS” LED on that IO-R-16 module lights solid green.

When an IO-R-16 module's status LED is blinking, that is an indication that the unit is NOT Online.

Each input or output used requires a 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. The Nrio points you need for each input or output type are noted in previous wiring sections in **boldface**. For Nrio software details, see the *Nrio Driver Guide*.

Power up and Initial Checkout

-
- Step 1** Apply power to the IO-R-16.
The IO-R-16 module's board status LED ([Figure 3](#) on page 8) will initially be blinking.
- Step 2** Using EC-Net Pro, open a station connection to the EC-BOS. If not already present, add an **NrioNetwork** component to the station's Drivers Container.
- Step 3** Configure the NrioNetwork's "Port Name" property to match the EC-BOS's RS-485 port COM assignment (for example, **COM2**), and set its "Trunk" property to a unique number Nrio-wide (i.e., 2).
- Step 4** From the NrioNetwork's **Nrio Device Manager** view, perform a **Discover**.
Each discovered remote I/O module will be listed in the top "Discovered" pane in the view, with each IO-R-16 appearing as an "Io16V1" device type.



Note

To associate a discovered device to a specific IO-R-16, issue a right-click "Wink Device" action—this cycles a relay output on that IO-R-16 several times, which you can hear or see if nearby. This action is available both *before* and after a discovered device is added to the station.

-
- Step 5** Add each discovered IO-R-16 to the station, renaming to reflect its actual location (see Note above). Each IO module is represented by an Nrio16Module component.
- Step 6** Verify that each IO-R-16 module's board status LED is now lit solid green.



Note

If an Nrio16Module is selected in the Nrio Device Manager view, and the **Upgrade Firmware** button is active, it is recommended that you upgrade its firmware. After selecting this, **do not interrupt power to the IO-R-16 and EC-BOS, or the communications between them**, until the firmware upgrade job finishes. Typically, this takes less than 2 minutes, with job completion signaled in the EC-Net Pro view.

-
- Step 7** You can now discover, add, and configure IO points under each Nrio16Module's Points device extension. For more details about Nrio components, refer to the *NRIO Guide*.
-

Replacement Parts and New Units

Servicing the IO-R-16 may call for replacement parts or new units.

You can order standard replacement parts from stock without restriction. Standard replacement parts cannot be returned for credit and should be disposed of in an appropriate manner.

To replace a faulty IO-R-16 unit, order and install a *new* IO-R-16 accessory module. If the faulty IO-R-16 is still in warranty, you can receive credit by returning it. Be sure to contact the vendor for a return material authorization (RMA) number before shipping an item for return credit. See ["Returning a Defective Unit,"](#) page 19, for details.



Note

Before ordering a new IO-R-16, be sure to contact your normal technical support resource to eliminate the possibility of a software issue or mis-configuration problem.

The following table lists the part numbers and descriptions for items that you can order.

Table 4 **Parts Listing for IO-R-16**

Part Number	Item	Description
32327153-001	Replacement Unit	IO-R-16 option module, model #14006
10429	Connector plug	6-position screw terminal, 180 deg.

Replacing the IO-R-16

Table 4 Parts Listing for IO-R-16

32330828	Connector plug	5-position screw terminal, 180 deg.
32327802	Accessory Kit, IO-R-16	<ul style="list-style-type: none"> – One (1) grounding wire, with quick-disconnect 0.187" female connector. – Eight (8) 499-ohm resistors, used for 4–20mA inputs.

Replacing the IO-R-16

**Caution**

Before handling circuit boards, discharge any accumulated static by touching the nearby earth grounding point. For details, see the [“Static Discharge Precautions”](#) section on page 5.

To replace the IO-R-16 accessory module in the field, proceed as follows:

Procedure 2 Replacing the IO-R-16 accessory module.

Step 1 Using the appropriate Niagara software tool, back up the EC-BOS's configuration to your PC.

Step 2 Remove power to the IO-R-16. The unit should power down automatically.

**Note**

If any I/O points have voltage, turn the devices off or disconnect power to them.

Step 3 Note positions of all I/O wiring going to the IO-R-16 module to be replaced, as well as for any other installed modules. If necessary, label connectors and accessory modules to avoid mis-connection later (after IO-R-16 is replaced). The software that runs on the EC-BOS expects terminal positions to be the same in the replacement IO-R-16 in order to collect data from or to control the attached devices.

Step 4 Unplug all connectors from the IO-R-16, including all I/O connectors and earth ground wire.

Step 5 Remove any DIN rail clips or screws securing the IO-R-16, removing it from its mounting. See [Figure 1](#) on page 7 for details on removal from (and mounting onto) DIN rail.

Step 6 Mount the replacement IO-R-16 as it was previously, using the same DIN rail location and/or screws.

Step 7 Reconnect the earth ground wire to the IO-R-16 grounding lug.

Step 8 Reconnect all I/O connectors to the IO-R-16.

Step 9 If any of your I/O points have voltage, turn the devices back on, or reconnect power to them.

Step 10 Reconnect the 5-position end-mount connector, and ensure that power is applied to the IO-R-16 as well as the EC-BOS. For related details, see [“Power up and Initial Checkout”](#).

Step 11 For more details, see the *NRIO Guide* and *EC-BOS Install and Startup Guides*.

Returning a Defective Unit

Returning a Defective Unit

For proper credit on an in-warranty unit, ship the defective unit per the vendor's return material procedure.

**Note**

If the defective unit is under warranty, please follow return instructions provided in this section.

If the unit is out of warranty, please discard it, observing all recycling regulations (see [“WEEE \(Waste of Electrical and Electronic Equipment\),”](#) page 5).

- Do not return an out-of-warranty IO-R-16 module.

Prior to returning the unit, contact your vendor to obtain a return materials authorization (RMA) number and other instructions.

Please provide:

- Product model
- Nature of defect
- PO number to secure the RMA

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