io.844 & io.16108 Mounting & Wiring Instructions

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Introduction

Novar's Opus™ io.844 and io.16108 (I/O expansion modules) are compact direct input/output modules that provide auxiliary monitoring and control when used with Opus™ Executive Controllers xcm.10 and xcm.20 (data server platform or xcm).

The io.844 option expands the xcm by an additional 16 logic-controlled points that include:

- 8 universal inputs.
- 4 form "A" (SPST) relay outputs.
- 4 analog (voltage only) outputs.

The io.16108 option expands the xcm by an additional 34 logic-controlled points that include:

- 16 universal inputs.
- 10 form "A" (SPST) relay outputs.
- 8 analog (voltage only) outputs.

This greatly expands the xcm's monitoring and control capabilities with fast, reliable, direct inputs and outputs for monitoring power, temperature, humidity, and status.

The onboard I/O can be used to monitor pulse contacts from power/demand meters, analog sensors, or transducers and to control energy-consuming devices such as fans, lights, or pumps with digital relay outputs. Also included are four analog outputs that can proportionally control dampers, valves, and other devices.

Up to four io.844 modules can be cascaded to an xcm to provide a total of 32 universal inputs (UI's), 16 relays, and 16 analog output points.

A maximum of one io.16108 module can be used with each xcm.10;

however, two additional io.844 modules can also be used to provide a total of 32 universal inputs (UI's), 18 relay outputs, and 16 analog output points.

This document covers mounting, wiring, and initial start-up of I/O expansion module. It assumes that an engineer, technician, or service person is performing control system installation using Niagara Framework®. Novar recommends that installers read through this entire document before beginning the installation procedures.

Specification

The following items are shipped with the io.844:

- One io.844 module with grounding wire having a quick-disconnect 0.187-inch female connector.
- Four 6-position terminal plugs for I/O wiring.
- Eight 499-ohm resistors for 4–20 mA inputs.

The following items are shipped with the io.16108:

- One io.16108 module with grounding wire having a quick-disconnect 0.187-inch female connector
- io.16108 Installation and Configuration Instructions
- One 15-position and three 12-position terminal plugs for I/O wiring.
- One 2-position terminal plug for 24-VAC power.
- Sixteen 499-ohm resistors for 4–20 mA inputs.

The following supplies and tools are required for installation:

One of the following power sources, as appropriate:

- UL–listed, Class 2, 24-VAC transformer rated a minimum of 8.5 VA to 20 VA (approximate range of xcm.10 with io.16108 alone, to fully-expanded unit with two additional io.844 modules).

NOTE!

A dedicated transformer is required. It cannot power additional equipment.

- 24-VDC power supply capable of supplying at least 1 A (24 W).

- DIN rail, Type NS35/7.5 (1.38 × 0.295-inches [35 mm × 7.5 mm]) and DIN rail end-clips (stop clips) recommended for mounting with the xcm The length of the DIN rail should be sufficient to accommodate both the xcm, I/O expansion modules, and other

modules.

- Suitable screws and screwdriver for mounting the DIN rail or, if a DIN rail is not used, for mounting bases of the xcm and I/O expansion module.
- Small flat-blade screwdriver used to mount or remove the I/O expansion module from the DIN rail and to tighten connections on the I/O connector-screw terminals.

NOTE!

If the xcm and I/O expansion modules are being installed at the same time, reference the *xcm.10 & xcm.20 Mounting & Wiring Instructions*, available online at www.novar.com/manuals.

Installing and starting an I/O expansion module involves:

- Physically mounting the module with the xcm (see “Mounting”). The I/O expansion module input connector must be properly seated in the IO connector on the xcm (or if used, another module).
- Making the wiring connections for earth ground and I/O wiring (see “Wiring”).
- Applying power and performing an initial checkout (see “Power Up and Initial Checkout”).

Precautions

The following precautions should be observed during installation and start-up of the xcm to prevent personal injury or equipment damage:

- Disconnect power before installation or servicing to prevent electrical shock or equipment damage. A 24-VAC or 24-VDC circuit powers the I/O expansion module and attached xcm
- Make all connections in accordance with national and local electrical codes. Use copper conductors only.
- Install the modules in a controlled environment relatively free of contaminants to reduce the risk of fire or electrical shock.
- Use the xcm and I/O modules as monitoring and control devices only. Using them for any other purposes can result in data loss or equipment damage.

Static Discharge Precautions

CAUTION!

Static charges produce voltages high enough to damage electronic components. The microprocessors and associated circuitry within an I/O expansion module are sensitive to static discharge.

The following precautions should be observed during installation, servicing, or operation to prevent equipment damage or loss of data:

- Work in a static-free area.
- Discharge accumulated 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 clamped securely to an earth ground when handling PCBs.

I/O Module Connection Precautions

- Remove power from a unit first to avoid “hot” plug-in or removal of any I/O module from the xcm (or other I/O module). If the unit switches to battery operation, wait for all LED's to go out.

Plugging an I/O module into or unplugging an I/O module from a powered xcm should not cause damage to either the xcm or I/O module hardware; however, all I/O modules are initialized upon station start-up and, if not (continuously) present following a power cycle, will be inoperable.

- Do not plug more than the specified number of modules into a single xcm. Doing so will have unexpected effects on the software and might overload the power supply.

- Plug the I/O modules directly into the xcm or directly attached modules. Do not use a ribbon cable or extend the length of the I/O cable. Doing so will increase radiated signal noise and decrease analog stability and can introduce communication problems.

Mounting

The following notes apply to mounting an I/O expansion module with an xcm:

- Units can be mounted in any orientation. It is not necessary to

remove the covers before mounting.

- Mounting on a 1.38-inch (35-mm) wide DIN rail is recommended. The xcm unit base, the I/O expansion module unit base, and the pwr.24V module have a molded DIN rail slot and locking clip. Mounting on a DIN rail ensures accurate alignment of connectors between all modules.

- If DIN rail mounting is impractical, screws and the xcm mounting tabs can be used to mount the xcm and I/O expansion module. Figure 1 and 2 show the mounting tab dimensions.

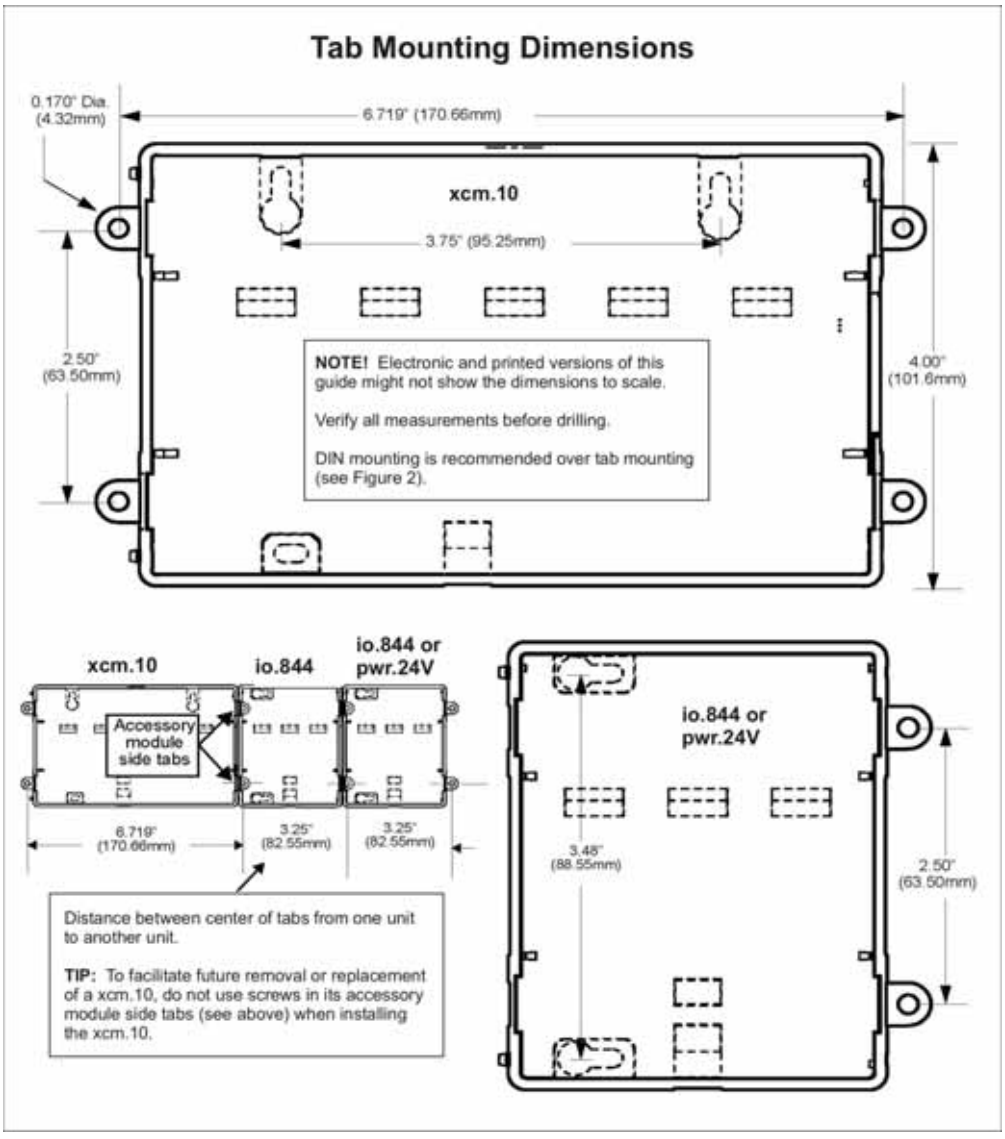

Figure 1. io.844 Tab mounting dimensions

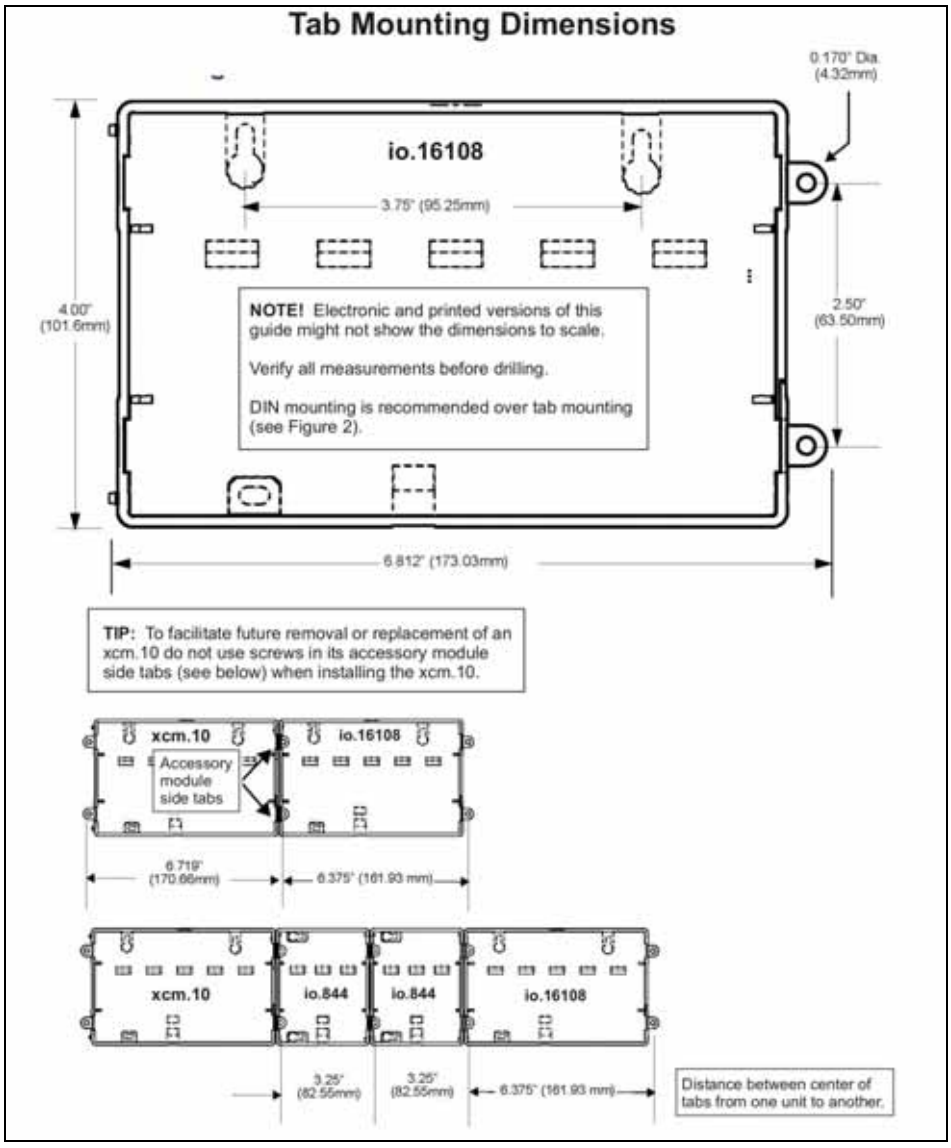

Figure 2. io.16108 Tab mounting dimensions

The procedure provided below can be used to mount the I/O expansion module on an existing installed DIN rail. Refer to Figure 1 and 2, as necessary, during mounting.

NOTE!

If the xcm is already in use:

Back-up its configuration to the PC using Opus Supervisor. This can be done via a platform connection to the xcm, using the **Backup** command in the Platform Administration view.

Turn off power to the xcm and disconnect the power cord. Be sure that all of the LED's are off. Make sure that the xcm is not running on battery power.

If the xcm is using a pwr.24V module for power, remove it before mounting modules.

Step Table

Step	Procedure
1	Remove the bottom I/O connector plug(s) that cover the plastic DIN locking clip.
2	Position the I/O expansion module on the rail, tilting to hook DIN rail tabs over one edge of the DIN rail.
3	Use a screwdriver to pry down the plastic locking clip and push down and in on the I/O expansion module to force the clip to snap over the other edge of the DIN rail.
4	Slide the I/O expansion module along the DIN rail to connect its 20-position plug with the xcm (or if used, another io.844). ▪ If a pwr.24V module is used, mount it last. ▪ Make sure that all modules are firmly seated.
5	Continue to mount all I/O expansion modules, mounting the pwr.24V module, if used, last.
6	Secure the assembly at both ends with DIN rail end-clips (provided by the DIN rail vendor) to keep the assembly together and to prevent it from sliding on the DIN rail.

NOTE!

To remove an I/O expansion module from DIN rail, slide it away from other modules. Insert a screwdriver in the center plastic locking tab and pull downwards, then lift the unit outwards. It might be necessary to remove an I/O connector plug first, as shown at the top of Figure 3 and 4.

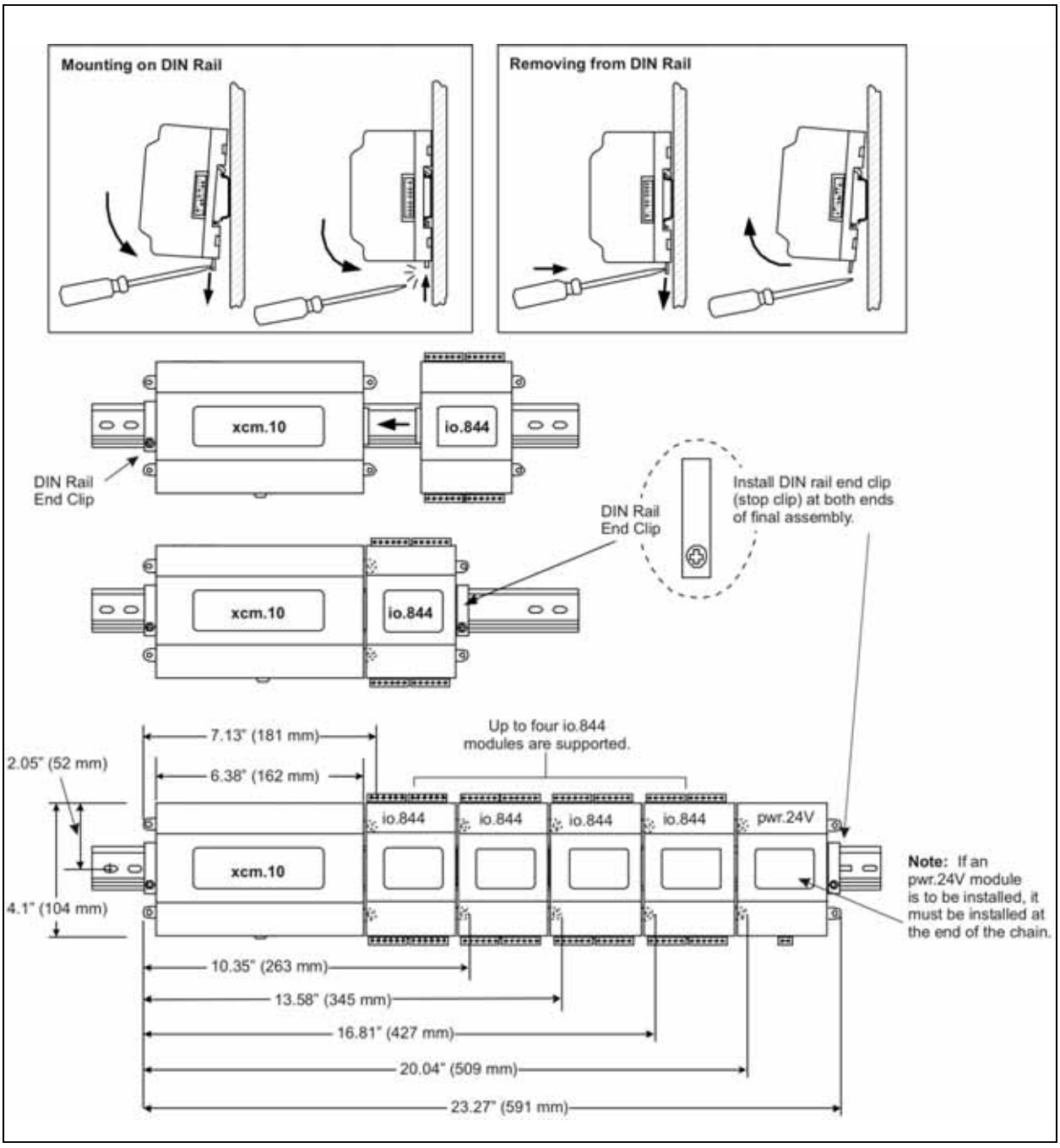

Figure 3. io.844 Module mounting details

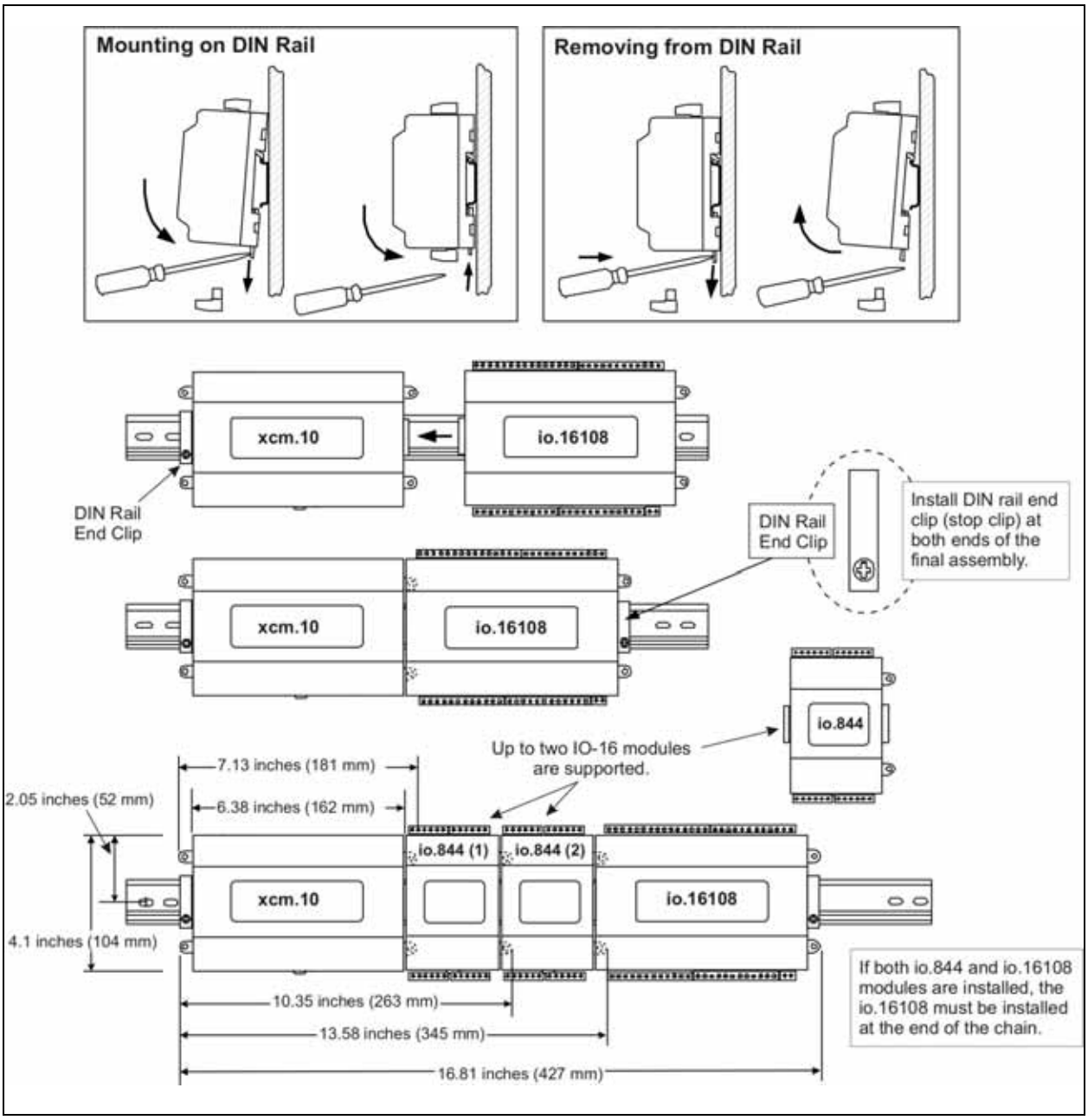

Figure 4. io.16108 Module mounting details

Wiring

Board Layout and Terminal Locations

The following procedure should be used to wire the I/O expansion modules. Refer to Figure 5 and 6, as necessary, to locate connectors and other components on the io.844 and io.16108 controllers.

Step Table

Step	Procedure
1	Connect the earth grounding wire (with spade connector) from the earth ground lug on the I/O expansion module to a nearby earth grounding point (see “Grounding” for details).
2	Prepare power wiring (leave the unit powered off; see “Power Wiring” below for details).
3	Connect the I/O wiring (see “Inputs” and “Outputs”).
4	Apply power to the unit (see “Power Up and Initial Checkout”).

The io.844 provides:

- 8 universal inputs supporting analog inputs (temperature, resistance, voltage, and current) and digital inputs (contact closure, pulse count)
- 8 outputs
  - 4 relay outputs (24-VAC/VDC, 0.5A maximum)
  - 4 analog outputs (0–10 VDC)

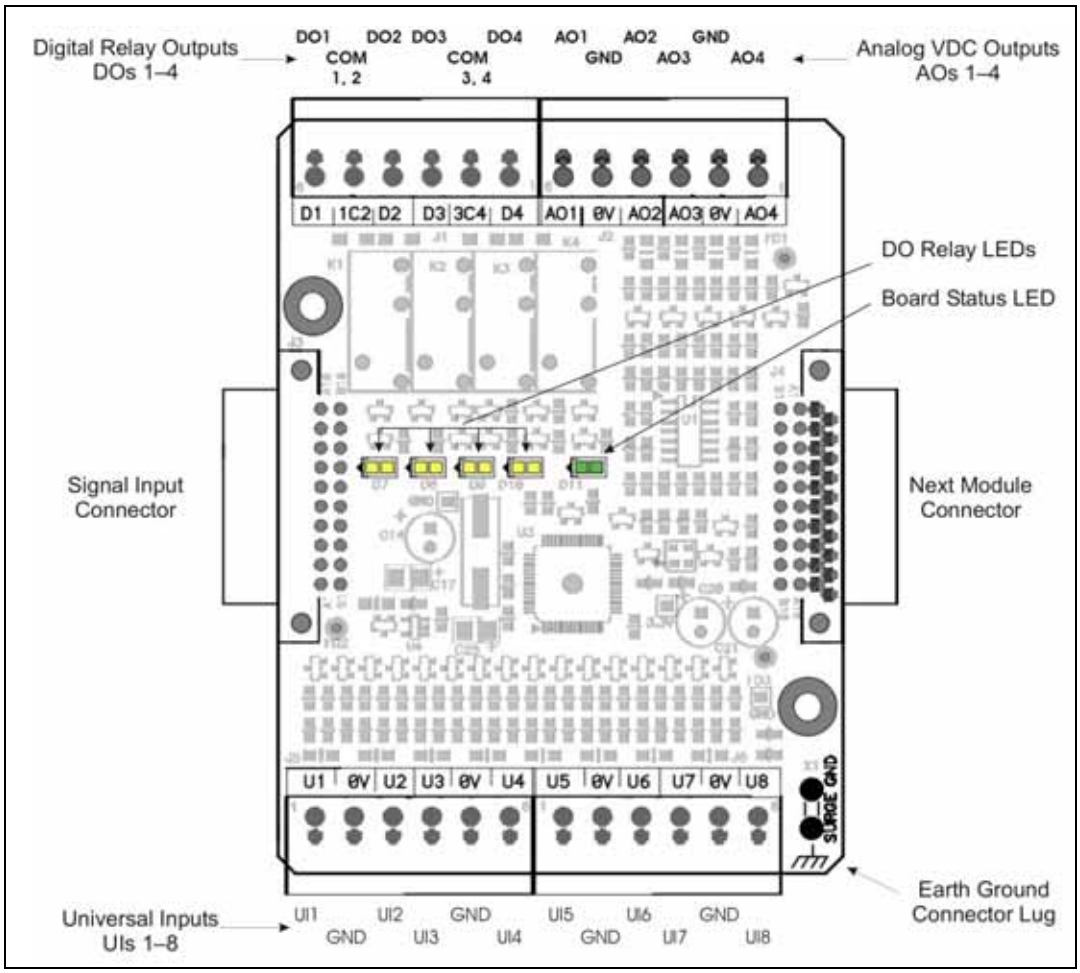

Figure 5. io.844 Wiring terminal positions and LED locations

The io.16108 provides:

- 16 universal inputs supporting analog inputs (temperature, resistance, voltage, and current) and digital inputs (contact closure, pulse count).

- 18 outputs.
  - 10 relay outputs (24-VAC/VDC, 0.5A maximum)
  - 8 analog outputs (0-10 VDC).

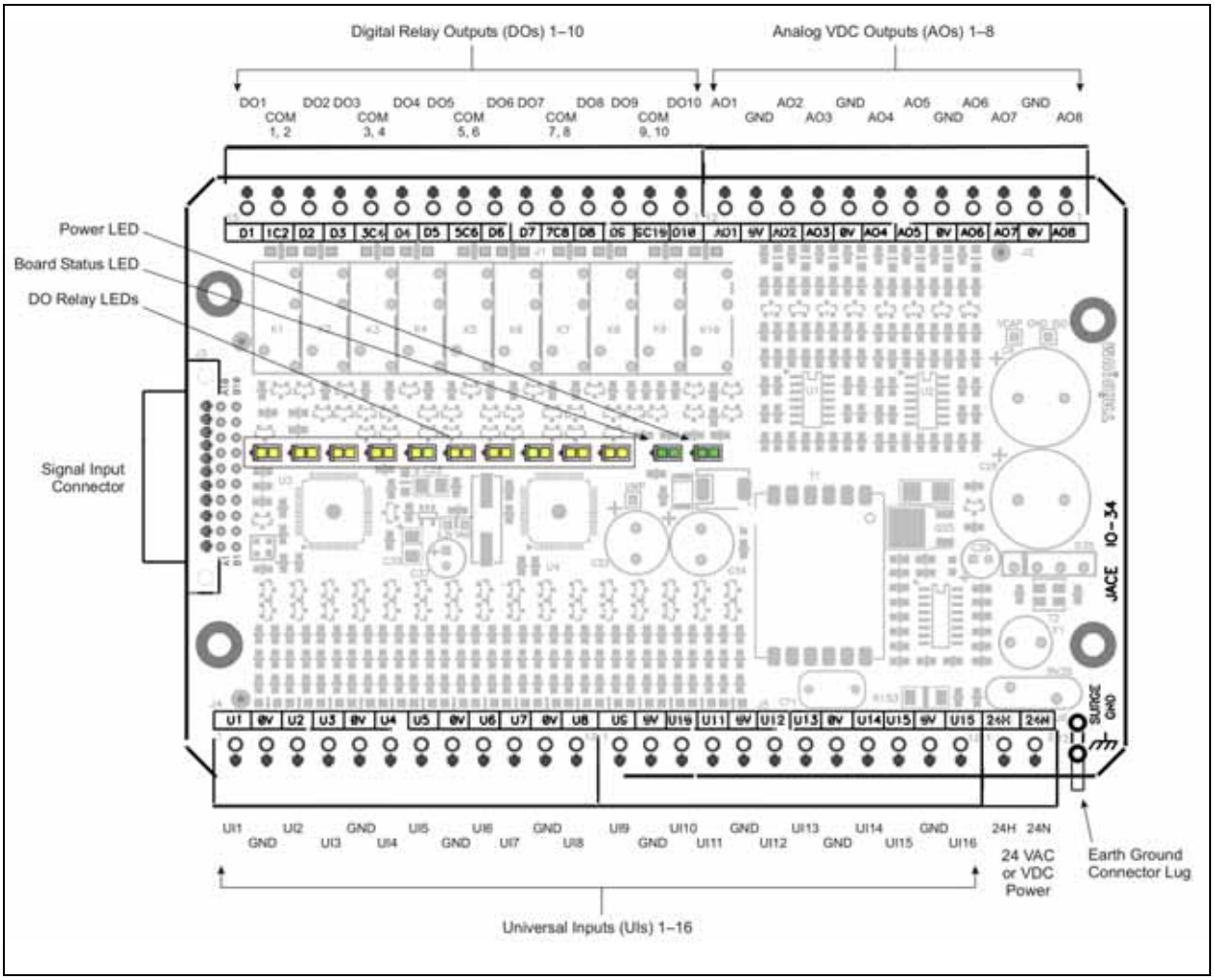

Figure 6. io.16108 Wiring terminal positions and LED locations

Grounding

An earth ground spade lug (0.187 inches) is provided on the base of the I/O expansion module (as well as the xcm and pwr.24V) for connection to earth ground. For maximum protection from electrostatic discharge or other forms of EMI, #16 AWG or larger wire should be used to connect each earth ground. These wires should be kept as short as possible. Figure 7 and 8 shows the location of the earth grounding wire for the I/O expansion module.

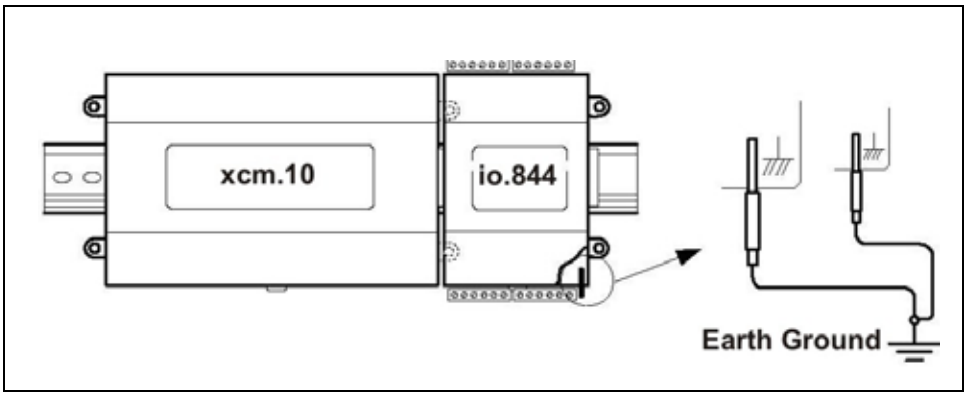

Figure 7. io.844 earth ground connection

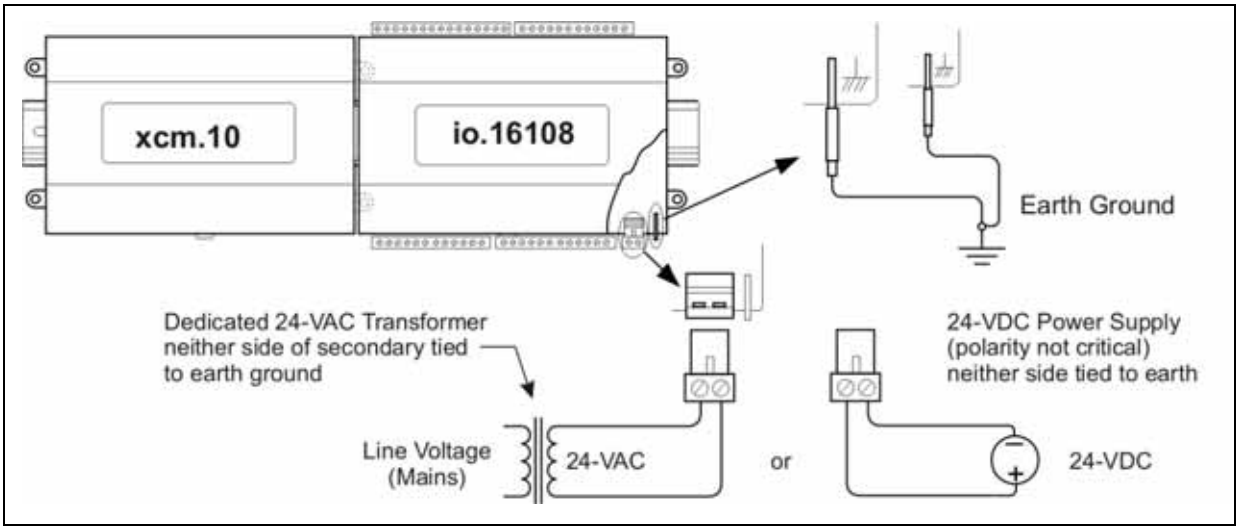

Figure 8. io.16108 earth ground connection

NOTE!

Do not apply 24-V power (i.e., do not reapply power to the pwr.24V) until all other wiring is completed, including I/O expansion module inputs and outputs (see “Power Up and Initial Checkout”).

Inputs

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

- Type 3 10K-ohm Thermistor

NOTE!

UI inputs are optimized to provide the best resolution around the 10K-ohm range. For a sensor with a range far from 10K ohms (such as a 100-ohm or 1000-ohm type), resolution will be poor. To use such a sensor, install a transmitter that produces a VDC or mA signal, then wire the transmitter to the UI according to the 0–10 VDC or 4–20 mA instructions.

- Resistive 0–100K ohms
- 0–10 VDC
- 4–20 mA
- Binary Input

Thermistor

The inputs support 10K thermistor temperature sensors using a Thermistor InputPoint. The input accuracy range is ±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). A conversion type of "Tabular Thermistor" can be used to specify a different thermistor response curve by importing a thermistor curve .xml file. Customized thermistor xml files can also be edited and exported (for reuse).

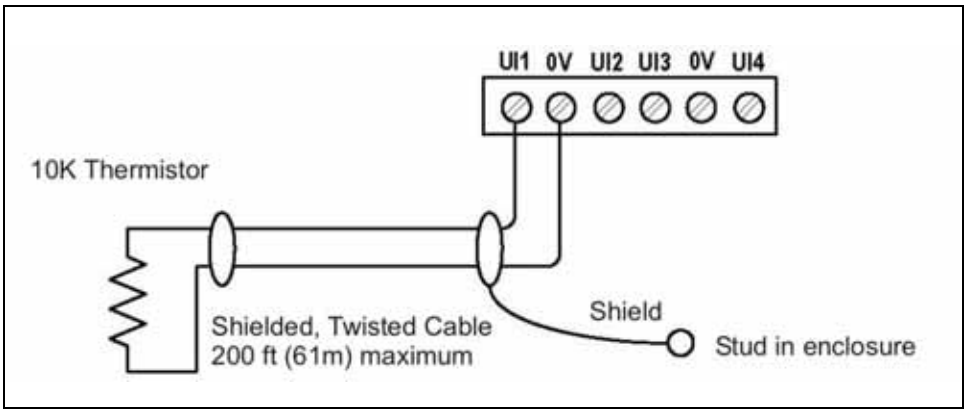

Figure 9. Thermistor wiring

Resistive 0–100K ohms

The 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 9).

Resistive signals require a ResistiveInputPoint.

NOTE!

UI inputs are optimized to provide the best resolution around the 10K-ohm range. For a sensor with a range far from 10K ohms (such as a 100-ohm or 1000-ohm type), resolution will be poor. To use such a sensor, install a transmitter that produces a VDC or mA signal, then wire the transmitter to the UI according to the 0–10 VDC or 4–20 mA instructions.

0–10 VDC

The inputs support self-powered 0–10 VDC sensors. Input impedance is greater than 5K ohms. The 0–10 volt accuracy is ±2% of span without user calibration. Figure 10 shows the wiring diagram. The 0–10 VDC sensors require a VoltageInputPoint.

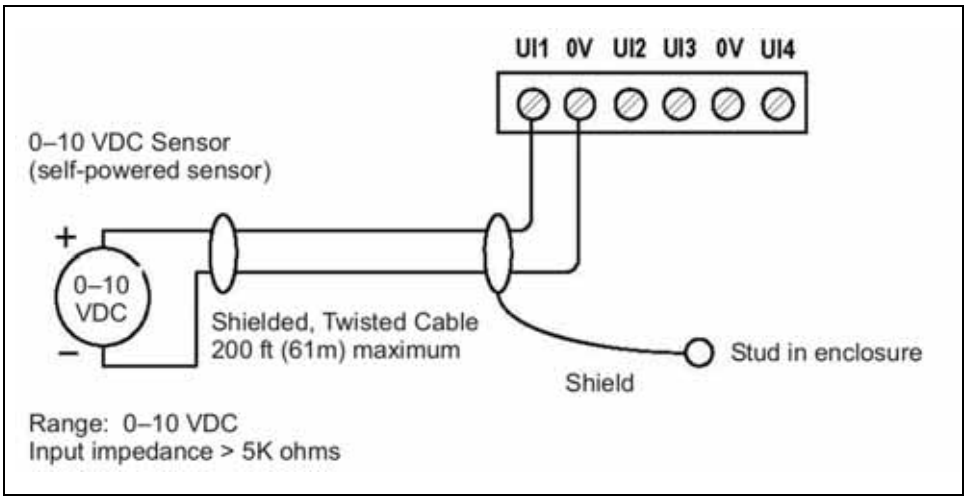

Figure 10. 0–10 VDC wiring

4-20 mA

The inputs support self-powered 4–20 mA sensors. Input accuracy is ±2% of span without user calibration. Figure 11 shows the wiring diagram, which requires a 499-ohm resistor wired across the input terminals. Figure 11 shows the 4–20 mA wiring. The 4–20 mA sensors also require the VoltageInputPoint.

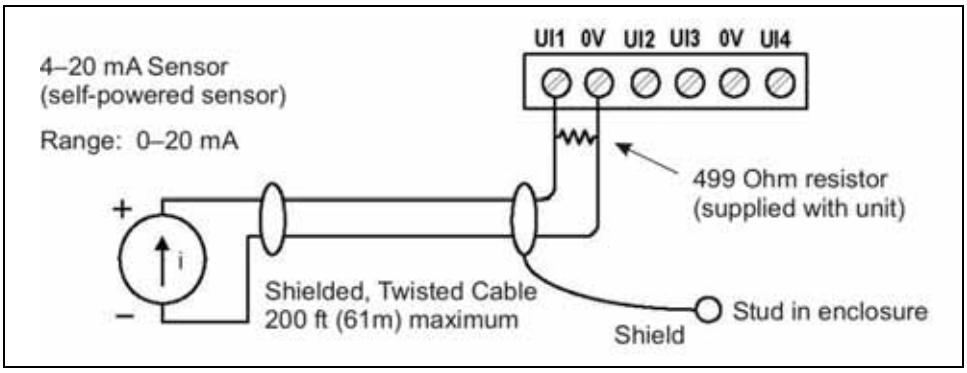

Figure 11. 4–20 mA wiring

Binary Input

The universal inputs support both pulse contacts and normal dry (equipment status) contacts.

- Pulse contacts can have a change-of-state (COS) frequency of up to 20 Hz with a 50% duty cycle.

NOTE!

Minimum dwell time must be greater than 25 milliseconds (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 greater than 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 330 microampere short-circuit current. Figure 12 shows the wiring diagram. The CounterInputPoint in the station database is used for a pulse contact. The BooleanInputPoint is used for other dry contacts.

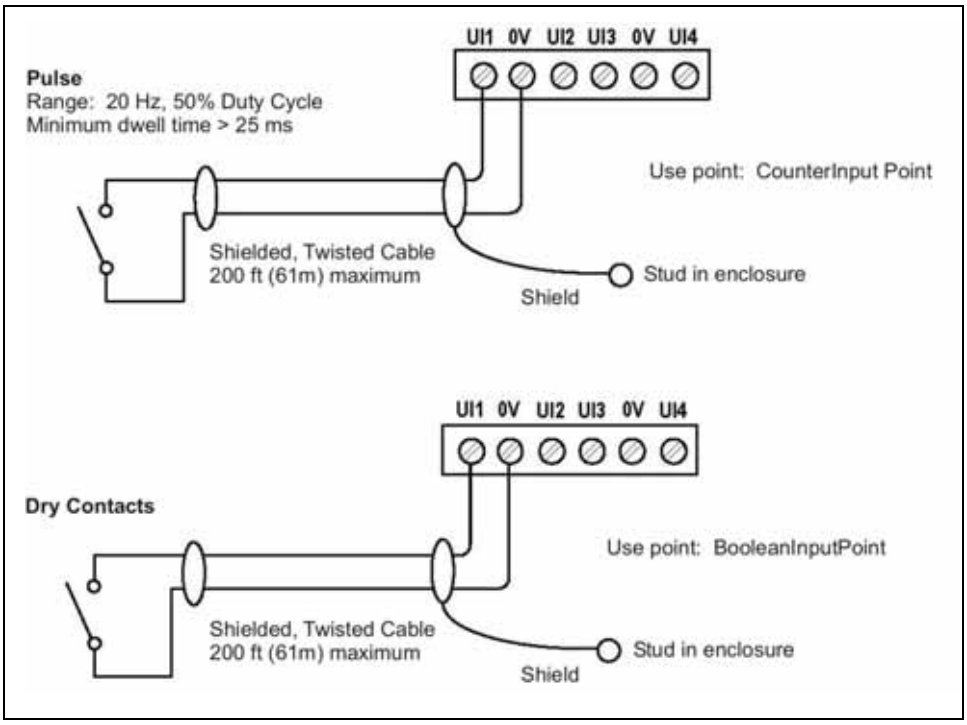

Figure 12. Binary input wiring

Outputs

An io.844 has four digital relay outputs and four 0–10 volt analog outputs. An io.16108 has ten digital relay outputs and eight 0–10 volt analog outputs.

Relay Outputs

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

CAUTION!

Relays are not rated for AC mains (line level) powered loads (instead, 24V maximum). Never use the xcm's power transformer to power I/O loads. Using the xcm transformer introduces potentially damaging switching transients within the device.

A BooleanOutputWritable should be used in the station for each output. Figure 13 provides a sample wiring diagram.

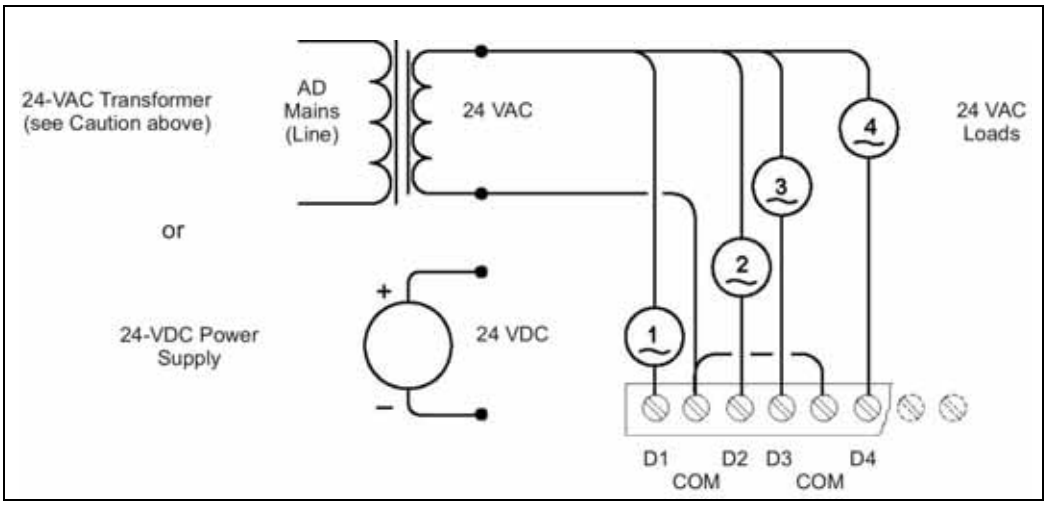

Figure 13. Relay output wiring diagram

The two common DO terminals 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 (see Figure 5 and 6) and 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 (i.e., the load is powered).

Analog Outputs

Analog outputs (AO) are referenced by the terminals labeled AO and 0V (ground). Each AO can supply a maximum of 4 mA over the entire 0- to 10-VDC range. The minimum input impedance of a device controlled by an AO must be greater than 2500 ohms. Typical AO wiring is shown in Figure 14. For each AO, a VoltageOutputWritable is used in the station database.

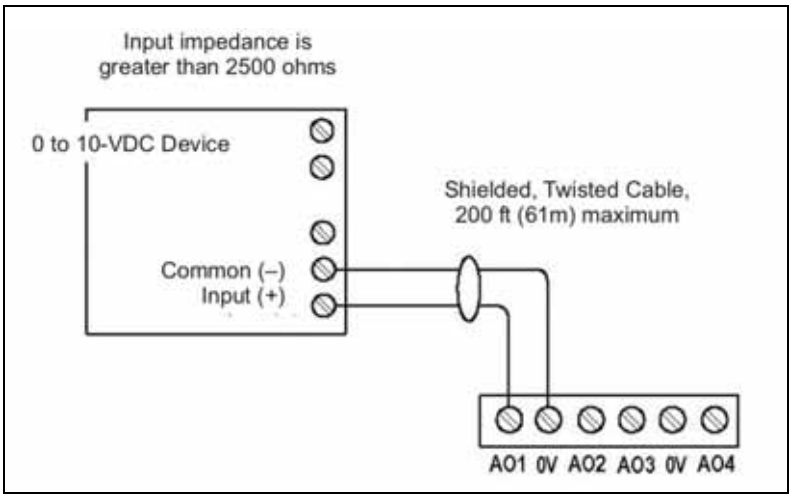

Figure 14. Analog output wiring diagram

NdioBoard (Software) Representation

In the Niagara station interface to the xcm, each I/O module appears as one NdioBoard under the station's NdioNetwork. If an xcm has only one io.844 module, the NdioNetwork has a single NdioBoard component, where the "Io Port" property of the NdioBoard is 1 (see Figure 15 and 16, top).

Upon discovery, if the xcm has multiple io.844 modules, the module closest to the xcm is the first NdioBoard (property Io Port 1), the next module in the chain is NdioBoard1 (property Io Port 2), and the third module is NdioBoard2 (property Io Port 3; see Figure 15 and 16, bottom).

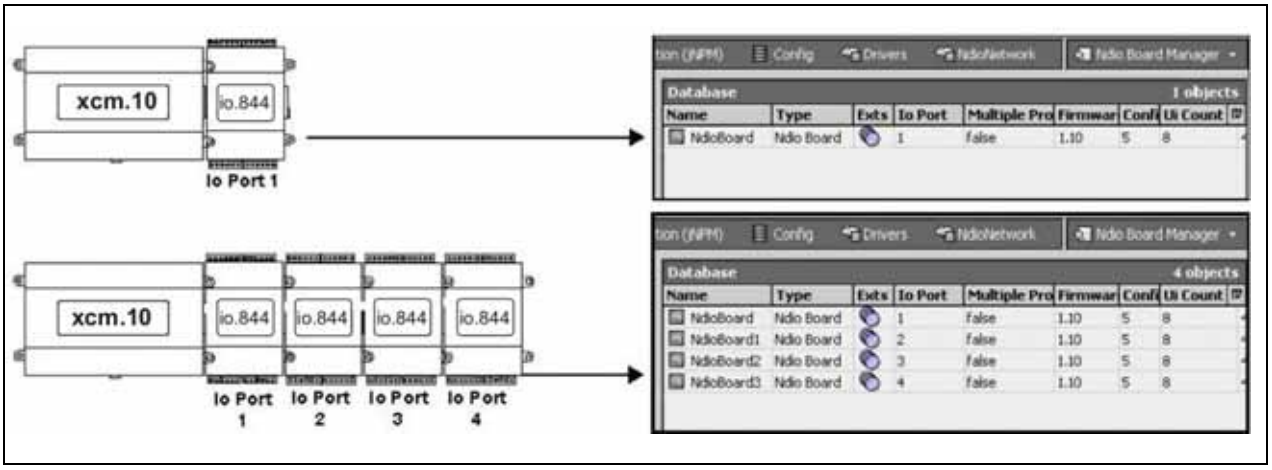

Figure 15. NdioBoard assignment (Io Port) determined by proximity to xcm.10

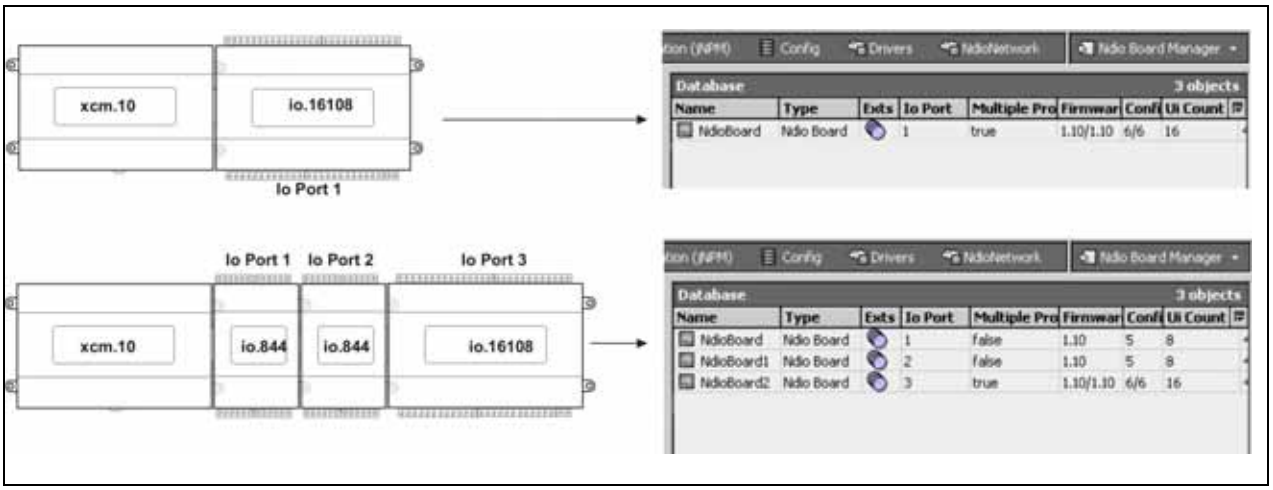

Figure 16. NdioBoard assignment (Io Port) determined by proximity to xcm.10

Once the operating system identifies the Ndio processors, the I/O board status LED on each I/O module turns green. The green status LED

means that the xcm is able to communicate with the I/O. It does not indicate anything about the status of the Niagara station or its Ndio components.

NOTE!

When a powered I/O module's status LED is not lit, all outputs are in fail-safe state (all relay outputs off, and all AOs are at a 0-volt level).

Each type of input or output used requires a special Ndio point to be added in the station database. These components act as the station interface to the physical I/O points. The Ndio points needed for each input or output type are noted in previous wiring sections.

Checking Installation

The following procedure should be used to apply power to the xcm and its modules and to check its operation.

Step Table

Step	Procedure
1	Apply power to the xcm (using pwr.24V). ▪ The I/O expansion module board status LED will initially be off (Figure 5 and 6). Allow the xcm sufficient time to boot (at least 2 minutes).
2	Upgrade the xcm firmware, if necessary (i.e., if the xcm has a Niagara build earlier than the Opus Supervisor being used). ▪ Use the Commissioning Wizard in Opus Supervisor to open a platform connection to the xcm (If necessary, refer to the *xcm.10 & xcm.20 Software Installation & Start-Up Guide*.) ▪ Be sure to install the Ndio software module.
3	Verify that the green I/O expansion module board status LED is lit.
4	Use Opus Supervisor to open the station (if running) or use the Station Director to open a platform connection and start the station.
5	(If not already present): Add an NdioNetwork component to the station's Drivers Container and use "Manager" views and "Learn Mode" to discover and add Ndio components to the station database (see "NdioBoard [Software] Representation").

Replacing I/O Expansion Module

CAUTION!

Before handling circuit boards, discharge any accumulated static by touching the nearby earth grounding point (refer to the "Static Discharge Precautions" listed in this document).

The following procedure should be used to replace the I/O expansion module in the field.

Step Table

Step	Procedure
1	Use the appropriate Opus Supervisor software tool to back up the xcm's configuration to a PC.
2	Remove power to the xcm ▪ The unit should power down automatically. **NOTE!** If any I/O points have voltage, turn the devices off or disconnect power to them.
3	Note the wiring connections of all wiring connected to the I/O expansion module that will be replaced and any other installed modules. ▪ If necessary, label connectors and accessory modules to avoid reconnecting them to the replacement module incorrectly. The software that runs on the xcm and collects data from or controls attached devices expects the terminal positions to be the same in the replacement I/O expansion modules.
4	Unplug all connectors from the I/O expansion module, including all I/O connectors and the earth ground wire.
5	Remove any screws or DIN rail clips securing the I/O expansion module and remove it from its mounting. ▪ See Figure 3 and 4 for details on removing the module from the DIN rail.
6	Mount the replacement I/O expansion module like the original was mounted, using the same DIN rail location and/or screws.

Model & Part Numbers

The part numbers provided in the table should be used to order the appropriate Novar parts.

Table: Novar Part Numbers

Product	Part No.
Executive modules: ▪ xcm.10 (BACnet, Fox) ▪ xcm.10 (BACnet, Fox, UI) ▪ xcm.10 (BACnet, Fox, MODBUS) ▪ xcm.10 (BACnet, Fox, UI, MODBUS) ▪ xcm.10 (LON, Fox, UI) ▪ xcm.10 Panel (xcm.10 not included) ▪ xcm.20(BACnet, Fox, UI) ▪ xcm.20 (BACnet, Fox, UI, Modbus) ▪ xcm.20 (LON, Fox, UI) ▪ xcm.20 (BACnet, LON, Fox, UI, Modbus) ▪ xcm.20 (BACnet, LON, Fox, UI, Modbus, Modbus TCP) ▪ xcm.20 (BACnet, Fox, UI, Modbus, Modbus TCP)	 XCM10-B-F XCM10-B-F-U XCM10-B-F-MB XCM10-B-F-U-MB XCM10-L-F-U XCM10-PNL XCM20-B-F-U XCM20-B-F-U-MB XCM20-L-F-U XCM20-B-L-F-U-MB XCM20-B-L-F-U-MB-I XCM20-B-F-U-MB-I
Controllers: ▪ io.844 Input/Output Module (8 universal inputs, 4 digital and 4 analog outputs) ▪ io.16108 Input/Output Module (16 universal inputs, 10 digital and 8 analog outputs) ▪ pwr.24V (xcm.20 power supply) ▪ tcu.Z Commercial Programmable Thermostat (zone mount)	 IO-844 IO-16108 PWR-24V TCU-Z-3H3C
Software: ▪ Opus Architect ▪ Opus Supervisor	 OPUS-A OPUS-S
Battery ▪ xcm.10 & xcm.20 Battery	 NPB-BATT

Certifications and Declaration of Conformity

The io.844 and io.16108 meet certifications of the Federal Communications Commission (FCC) and Canadian Department of Communications (DOC) and is included in an EC "Declaration of Conformity" for the xcm For further details, please see these sections in the xcm Mounting and Wiring Instructions.

Waste Electrical & Electronic Equip. (WEEE)

Customers are advised to dispose of this product at the end of its useful life according to applicable local laws, regulations, and procedures.

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