

IO-16

INSTALLATION AND CONFIGURATION INSTRUCTIONS

This document covers the mounting, wiring, and initial start-up of an IO-16 I/O expansion module. It assumes that you are an engineer, technician, or service person who is performing control system installation using the Niagara Framework[®]. Please read through this entire document before beginning the installation procedures.

These are the main topics included in this document:

- “Product Description,” page 1
- “Preparation,” page 2
- “Precautions,” page 2
- “Installation and Start-up Outline,” page 4
- “Physical Mounting,” page 4
- “IO-16 Board Layout and Terminal Locations,” page 6
- “Wiring Details,” page 6
- “NdioBoard (Software) Representation,” page 11
- “Power up and Initial Checkout,” page 12
- “Related Documentation,” page 12
- “Replacement Parts,” page 12
- “Replacing an IO-16,” page 13
- “Certifications and Declaration of Conformity,” page 15



This document does not discuss software installation or station configuration. For more information on these topics, refer to the documents listed in the “Related Documentation” section.

Product Description

The Vykon[®] IO-16 is a compact direct I/O module for auxiliary monitoring and control when used with a JACE-2 or JACE-6 series controller (JACE-2/6) or other JACE[®] platforms as identified in their respective data sheets. This option expands the JACE by an additional sixteen logic-controlled points. Included are eight universal inputs, four form “A” (SPST) relay outputs, and four analog (voltage only) outputs. This greatly expands the JACE’s monitoring and control capabilities with fast, reliable, direct inputs and outputs for monitoring power, temperature, humidity, and status.

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

Up to four IO-16 modules may be cascaded to a JACE-2/6, to provide a total of 32 UIs, 16 relays, and 16 analog output points.

Information and specifications published here are current as of the date of publication of this document. Tridium, Inc. reserves the right to change or modify specifications without prior notice. The latest product specifications can be found by contacting our corporate headquarters, Richmond, Virginia. Products or features contained herein may be covered by one or more U.S. or foreign patents. © 2006 Tridium, Inc

Preparation

Unpack the IO-16 and inspect the contents of the packages for damaged or missing components. If damaged, notify the appropriate carrier at once and return any damaged components for immediate repair or replacement. See “[Returning a Defective Unit](#)” on page 14.

- [Included in this Package](#)
- [Material and Tools Required](#)

Included in this Package

Included in this package you should find the following items:

- One IO-16 module, with grounding wire having a quick-disconnect 0.187” female connector.
- These *IO-16 Installation and Configuration Instructions*, Part Number 10556, Rev. 1.1.
- Four (4) 6-position terminal plugs, for I/O wiring.
- Eight (8) 499-ohm resistors for 4-20 mA inputs.

Material and Tools Required

The following supplies and tools are required for installation:

- DIN rail, type NS35/7.5 (35mm x 7.5mm) and DIN rail end-clips (stop clips), recommended for mounting with the JACE-2/6 controller. The DIN rail should be sufficient length to accommodate both the JACE and all IO-16s and other modules. See [Figure 1](#) on page 5.
- Suitable screws and screwdriver for mounting DIN rail, or if DIN rail not used, for mounting bases of JACE-2/6 controller and IO-16 module.
- Small flat-blade screwdriver: used for mounting or removing the IO-16 from DIN rail, also for screw terminals on I/O connectors.

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 the JACE-2/6 series controller. Be sure to heed these warnings to prevent personal injury or equipment damage.



Warning

- Depending on installation, a 90–263Vac, 24Vac, or 24Vdc circuit powers the attached JACE controller. 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.
- JACE controllers 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.

I/O Module Connection Precautions



Warning

- Remove power from the unit before plugging or unplugging I/O accessory modules. If the unit switches to battery operation, wait for all LEDs to go out.
- Do not connect live voltages to the inputs or outputs of an IO-16 or IO-34 while it is in an “un-powered state” before plugging the module into a JACE-2/6. Otherwise, damage to the I/O module and/or the JACE controller may result!
- Do not plug in more than four (4) IO-16 modules into a single JACE-2/6. Doing so will have unexpected effects on the software, and may overload the power supply.
- I/O modules are designed to be directly plugged into the JACE-2/6 or directly attached modules. Do not use a ribbon cable or extend the length of the I/O cable as this will increase radiated signal noise, decreases analog stability, and may introduce communication problems.

Static Discharge Precautions

The following items are cautionary notes that will 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 IO-16 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.**

Installation and Start-up Outline



Note If installing the JACE-2/6 and IO-16 at the same time, please refer to the appropriate JACE installation document, for example the *JACE-2 Mounting and Wiring Instructions* document (part number 10555). Note that a maximum of four IO-16 modules are supported—see [Figure 1](#) on page 5.

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

1. Physically mount the IO-16 module with the JACE-2/6. See “[Physical Mounting](#).” Make sure that the IO-16 input connector is properly seated into the IO connector on the JACE (or if used, another IO-16 module). Note the previous “[I/O Module Connection Precautions](#)” on page 3.
2. Make wiring connections for earth ground and I/O wiring. See “[Wiring Details](#),” page 6.
3. Apply power and perform an initial checkout. See “[Power up and Initial Checkout](#)” on page 12.

Physical Mounting

The following applies to mounting an IO-16 module with a JACE-2/6 series controller:

- You can mount the units in any orientation. It is not necessary to remove the covers before mounting.
- Mounting on a 35mm wide DIN rail is recommended. Both the JACE-2/6 unit base and IO-16 unit base have a molded DIN rail slot and locking clip, as does the NPB-PWR module. 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 JACE-2/6, then in the IO-16 module. Mounting tab dimensions are on the [last page](#) of this document.

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



Note If the JACE is already in use:

- a. Back up its configuration to your PC using NiagaraAX Workbench 3.n.nn. You can do this with a platform connection to the JACE, using the **Backup** command in the **Platform Administration** view.
- b. Turn off power to the JACE and disconnect the power cord. Be sure that all of the LEDs are off. Make sure that the JACE is not running off of battery power.

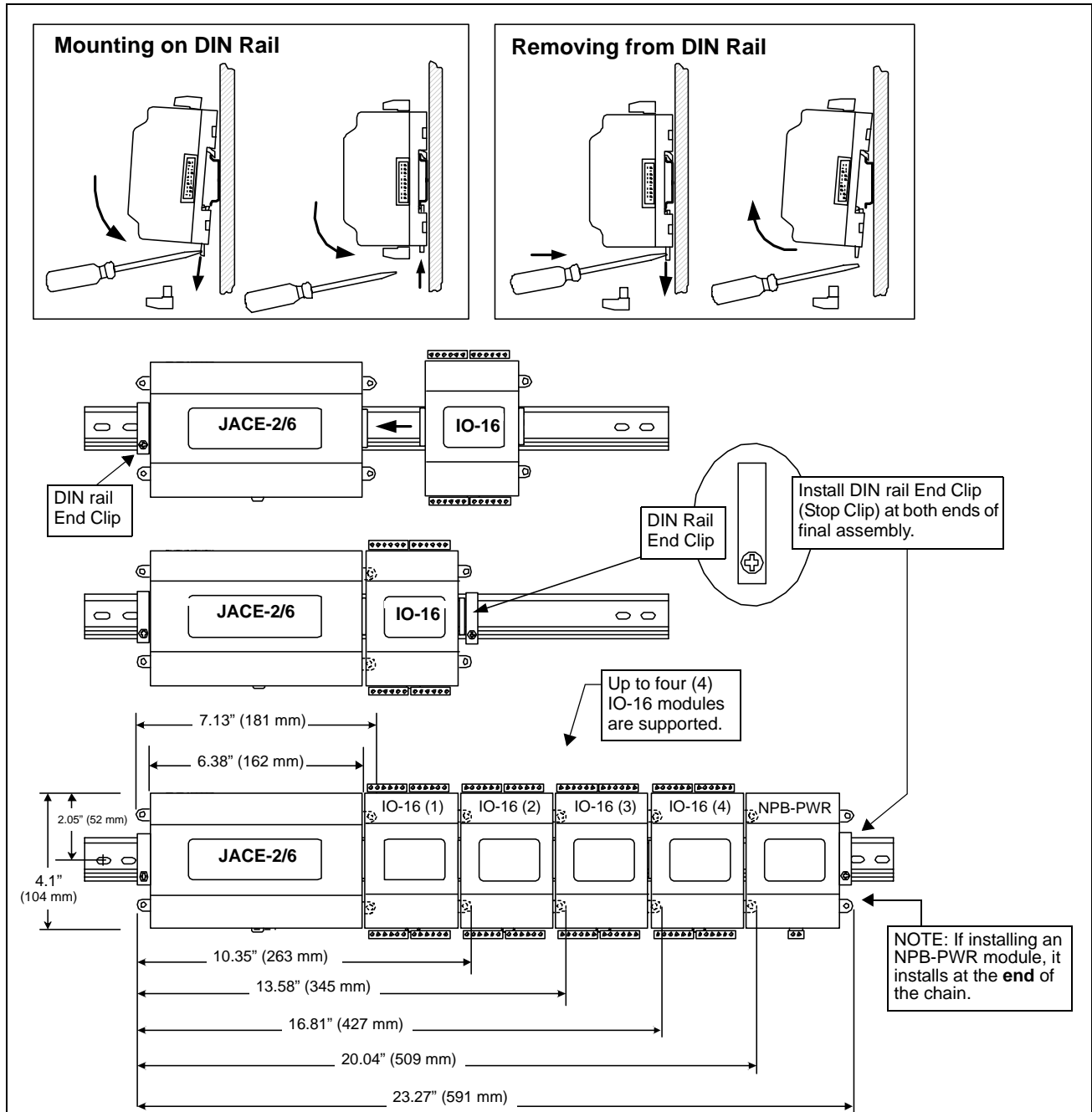
If the JACE-2/6 is using an NPB-PWR module for power, remove it before mounting IO-16 modules.

Procedure 1 To mount on DIN rail

- Step 1** Remove the bottom I/O connector plug(s) that cover the plastic DIN locking clip.
- Step 2** Position the IO-16 on the rail, tilting to hook DIN rail tabs over one edge of the DIN rail ([Figure 1](#)).
- Step 3** Use a screwdriver to pry down the plastic locking clip, and push down and in on the IO-16, to force the clip to snap over the other edge of the DIN rail.
- Step 4** Slide the IO-16 on the DIN rail to connect its 20-position plug into the JACE-2/6 (or if used, another IO-16). If an NPB-PWR module is used, it mounts last. Make sure that all modules are firmly seated.
- Step 5** Continue to mount all IO-16 modules, and if used, then the NPB-PWR module.

Step 6 To keep the final assembly together, secure at both ends with DIN rail end-clips provided by the DIN rail vendor. This also prevents the assembly from sliding on the DIN rail. See [Figure 1](#).

Figure 1 IO-16 module mounting details.

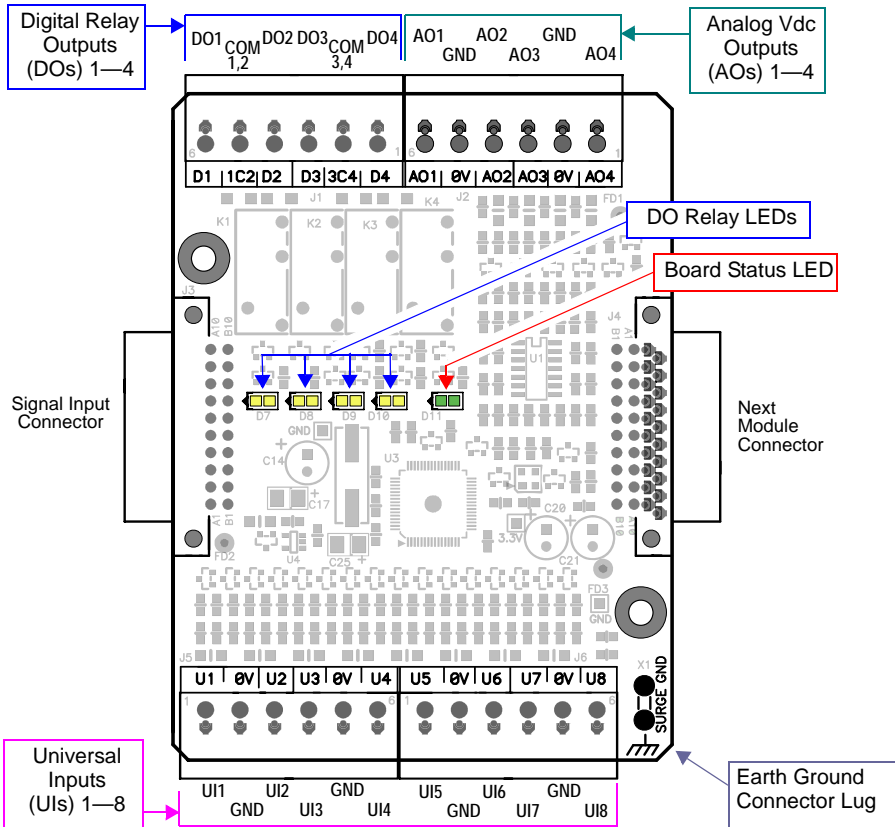


Note To remove an IO-16 module from DIN rail, slide it away from other modules. Insert a screwdriver in the center plastic locking tab and pull downwards, then lift the unit outwards. You may need to first remove an I/O connector plug, as shown at the top of [Figure 1](#).

IO-16 Board Layout and Terminal Locations

The IO-16 provides 8 universal **inputs** supporting analog inputs (temperature, resistance, voltage, and current) and digital inputs (contact closure, pulse count), and 8 **outputs**: 4 relay (24Vac/dc, 0.5A max.) outputs and 4 analog outputs (0–10 Vdc). Wiring terminal positions are shown below (Figure 2), along with LED locations.

Figure 2 IO-16 Wiring Terminal Locations.



Wiring Details

See Figure 2 above to locate connectors and other components on the IO-16 controller.

Make connections to the IO-16 in the following order.

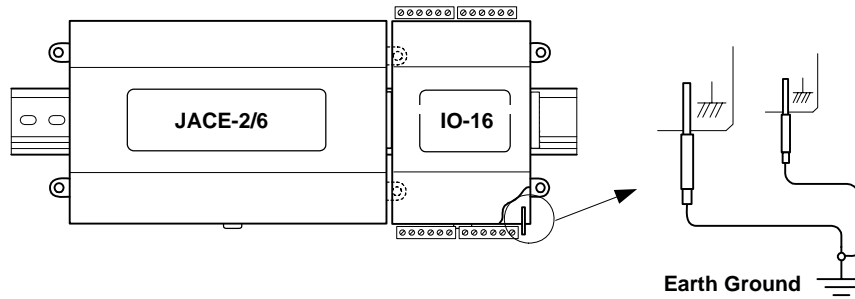
1. Connect the earth grounding wire (with spade connector) from the earth ground lug on the IO-16 to a nearby earth grounding point. See “Grounding” for details.
2. Connect I/O wiring. See sections “Inputs” on page 7, and “Outputs” on page 10.
3. Apply power to the unit. See “Power up and Initial Checkout,” page 12.

Grounding

An earth ground spade lug (0.187") is provided on the base of the IO-16 (as well as the JACE-2/6, NPB-PWR) for connection to earth ground. For maximum protection from electrostatic discharge or other forms of EMI, connect each 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 for the IO-16.

Figure 3 IO-16 earth ground connection.



Note Do not apply 24V power (reapply power to the NPB-PWR or WPM-XXX) until all other wiring is completed, including IO-16 [inputs](#) and [outputs](#). See [“Power up and Initial Checkout,”](#) page 12.

Inputs

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

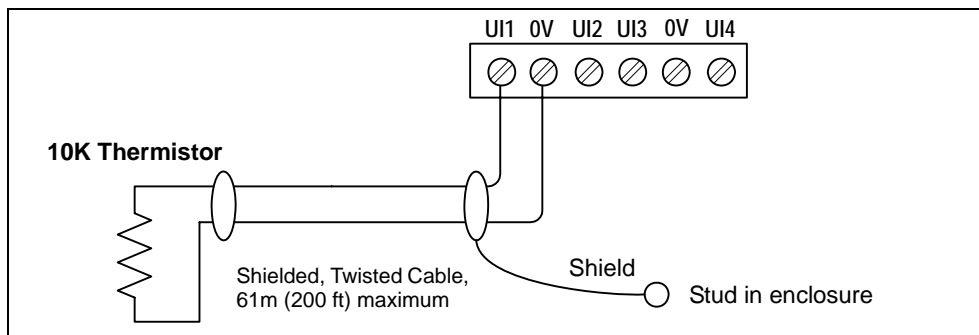
- Type-3 10K ohm [Thermistor](#) (also see [Note](#) on page 8)
- [Resistive 0—100K ohms](#)
- [0–10 Vdc](#)
- [4–20 mA](#)
- [Binary Input](#)

Thermistor

The inputs support 10K Thermistor temperature sensors using a **ThermistorInputPoint**. 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. Currently, the ndio module contains an xml folder with thermistor curves for a Radio Shack sensor model 271-0110 and TE-6300 10K type sensor. You can also edit and export (for reuse) *customized* thermistor xml files. See the *NiagaraAX Ndio Guide* for more details.

[Figure 4](#) shows the wiring diagram.

Figure 4 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 4).

Resistive signals require a **ResistiveInputPoint**.



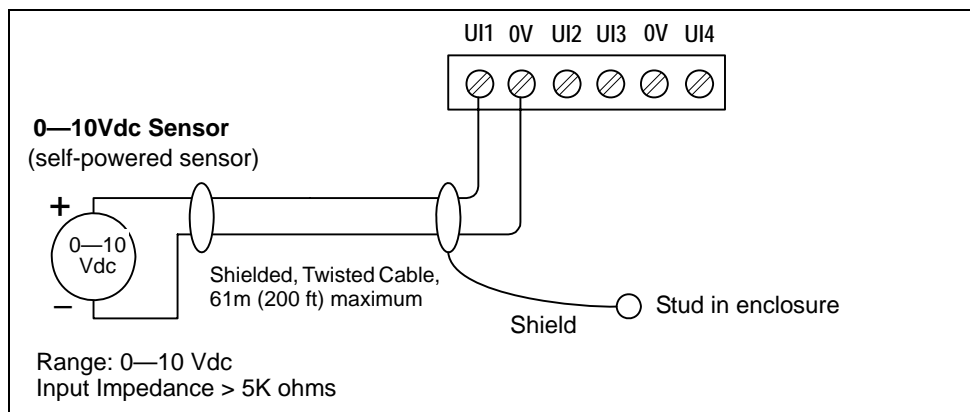
Note UI inputs are optimized to provide the best resolution around the 10K ohm range. For a sensor with a range far from 10K ohms (such as a 100-ohm or 1000-ohm type), resolution will be poor. To use such a sensor, it is recommended you install a transmitter that produces a Vdc or mA signal, and then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

0–10 Vdc

The 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 5 shows the wiring diagram.

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

Figure 5 0–10 Vdc wiring.

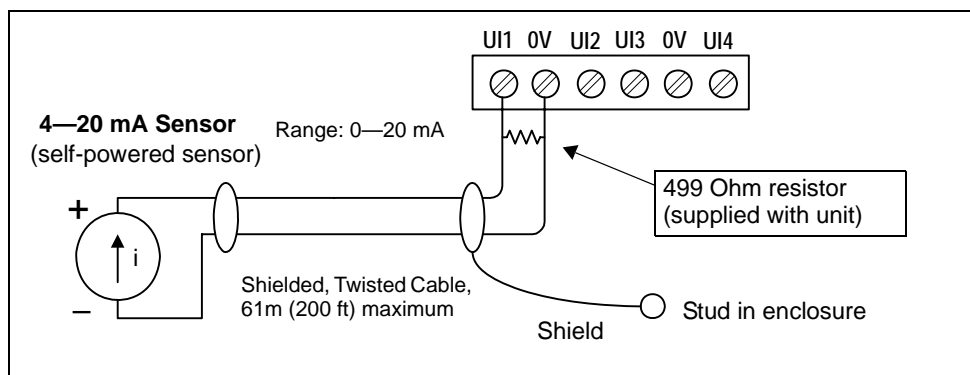


4–20 mA

The inputs support self-powered 4–20 mA sensors. Input accuracy is $\pm 2\%$ of span, without user calibration. Figure 6 shows the wiring diagram, which requires a 499 ohm resistor wired across the input terminals.

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

Figure 6 4 to 20 mA wiring.



Binary Input

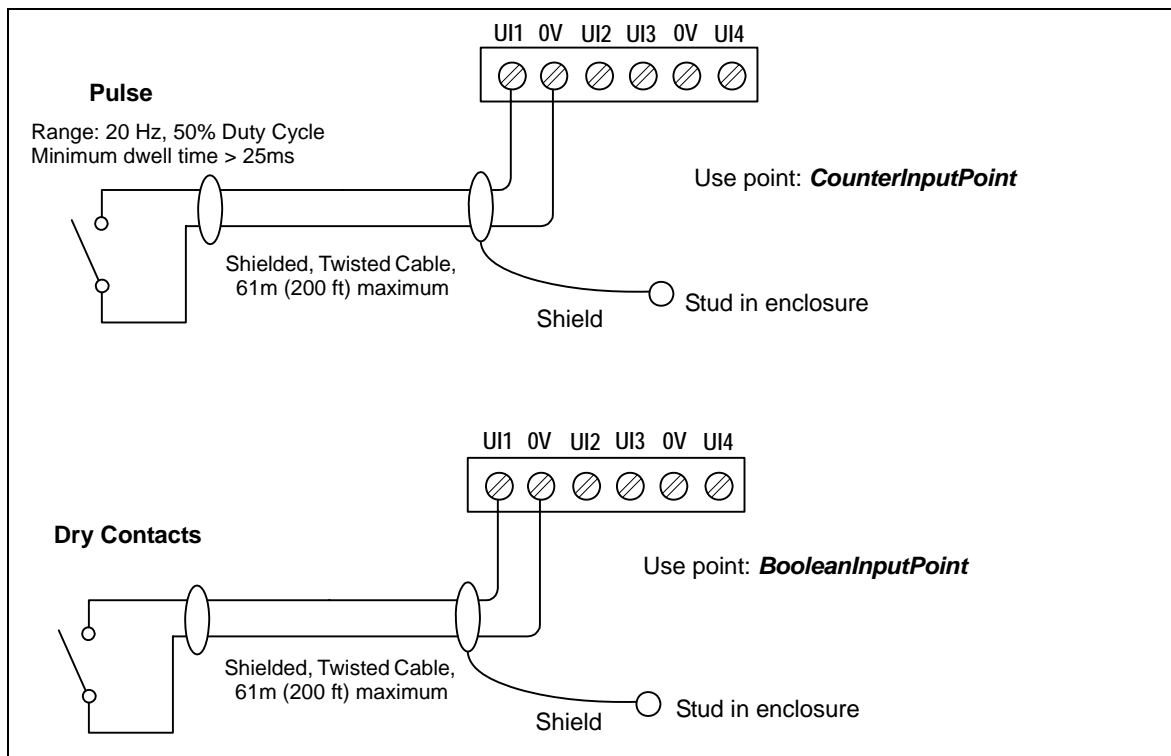
The universal inputs support both pulse contacts and normal dry (equipment status) contacts.

- 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.

Figure 7 shows the wiring diagram. For a pulse contact, use the **CounterInputPoint** in the station database. For other dry contacts, use the **BooleanInputPoint**.

Figure 7 Binary input wiring.



Outputs

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

Relay Outputs

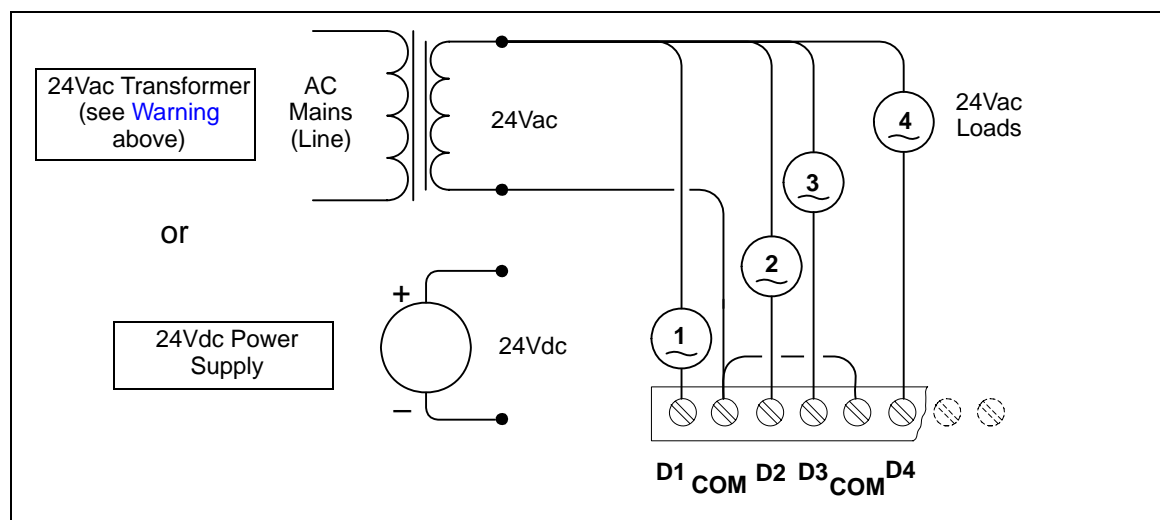
Each relay output is rated at 24 Vac or Vdc at 0.5A. Relay outputs have MOV (metal oxide varistor) suppressors to support inductive-type loads such as heavy-duty relay coils.



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

Use a `BooleanOutputWritable` in the station for each output. [Figure 8](#) shows an example wiring diagram.

Figure 8 Relay output wiring diagram.



Note that 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 ([Figure 2](#) on page 6), 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.

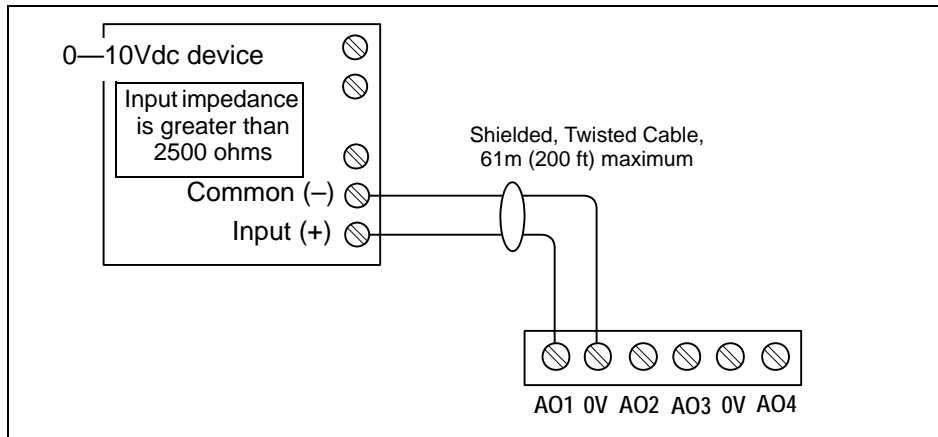
Therefore, an **On** status indicates that the load is powered.

Analog Outputs

Analog outputs (AO) are referenced by the terminals labeled A_n and 0V (ground). Each AO can supply a maximum of 4 mA over the entire 0 to 10Vdc range. The minimum input impedance of a device controlled by an AO must be greater than 2500 ohms. Typical wiring for an AO is shown in Figure 9.

For each AO, use a **VoltageOutputWritable** in the station database.

Figure 9 Analog output wiring diagram.

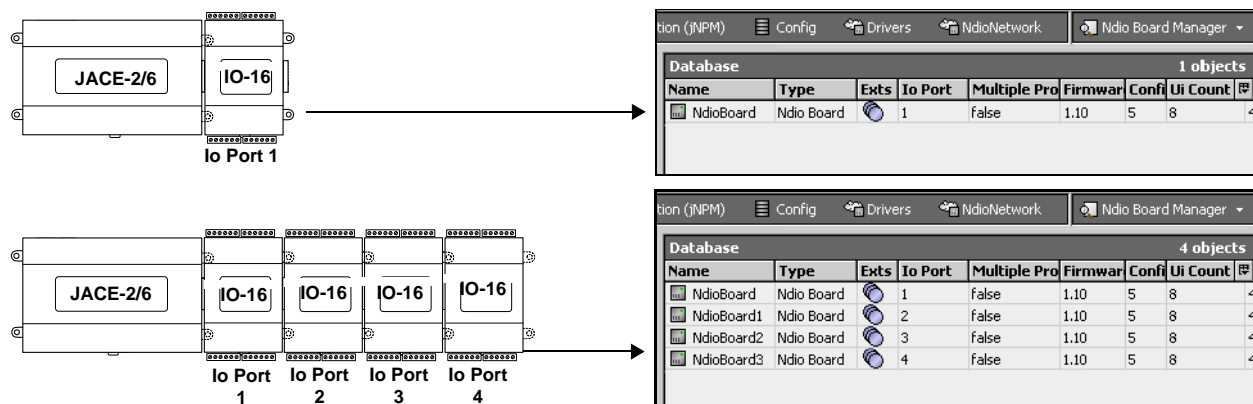


NdioBoard (Software) Representation

In the Niagara station interface to the JACE-2/6, each IO module appears as one **NdioBoard** under the station's **NdioNetwork**. If a JACE has only *one* IO-16 module, the NdioNetwork has a single NdioBoard component, where the "Io Port" property of the NdioBoard is 1. See Figure 10, top.

Upon discovery, if the JACE has *multiple* IO-16 modules, the module closest to the JACE 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 10, bottom.

Figure 10 NdioBoard assignment (Io Port) is determined by proximity order to JACE.



Once the operating system identifies the NDIO processors, the I/O board status LED on each IO module turns green. The green status LED means that the JACE 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 Any time a powered IO module's status LED is not lit, all outputs are in "failsafe" state (all relay outputs OFF, and all AOs are at a 0-volt level). See [Figure 2](#) on page 6 for location of the IO-16 status LED.

Each type of input or output used requires a special Niagara Direct Input/Output (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 you need for each input or output type are noted in previous wiring sections in **boldface**.

For Ndio component details, see the *Ndio Guide* in Workbench online Help, or the same document in PDF.

Power up and Initial Checkout

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- Step 1** Apply power to the JACE-2/6 (e.g., NPB-PWR or WPM-XXX). The IO-16 board status LED will initially be Off ([Figure 2](#) on page 6). Allow the JACE sufficient time to boot (at least 2 minutes).
- Step 2** Upgrade the JACE firmware if necessary (if JACE has a Niagara build earlier than your Workbench). Using Workbench, open a platform connection to the JACE. Use the **Commissioning Wizard** to do this. For more details, see the *JACE NiagaraAX Install and Startup Guide*, also available in Workbench online Help (doc Jace Startup). Make sure to install the **ndio** software module.
- Step 3** Verify that the IO-16 board status LED is now lit green.
- Step 4** Using Workbench, open the station (if running), or open a platform connection and start the station with using the **Station Director**.
- Step 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](#)," page 11. For more details about Ndio components, refer to the *Ndio Guide*, also available in Workbench online Help (doc Ndio).
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Related Documentation

For more information on configuring and using JACE-2/6 series controllers, consult the following documents:

- *JACE-2 Mounting and Wiring Instructions*
- *JACE-6 Mounting and Wiring Instructions*
- *JACE NiagaraAX Install & Startup Guide*
- *NiagaraAX Ndio Guide*
- *NiagaraAX User Guide*

Replacement Parts

Servicing the IO-16 may call for replacement parts. There are two categories of parts:

- [Standard Replacement Parts](#)
- [New Replacement Units](#)

Standard Replacement Parts

Standard replacement parts are listed in [Table 1](#) and can be ordered from stock without restriction. Standard replacement parts cannot be returned for credit and should be disposed of in an appropriate manner.

Table 1 Standard replacement parts.

Part Number	Description
10149	Resistor, 499 ohm, 1%, 0.6w
10429	Connector plug, 6-position screw terminal, 180 deg. (4 used for I/O)
10370	Grounding wire with quick-disconnect 0.187" female connector

New Replacement Units

To replace a faulty unit, order and install a *new* IO-16 accessory module—please note that JACE-2/6 series products do *not* have special “field replacement units,” or FRUs, with separate part numbers.

If the faulty IO-16 is *still in warranty*, you can receive credit by returning it to Tridium. Be sure to contact Tridium for a return authorization (RA) number before shipping an item for return credit. See “[Returning a Defective Unit](#),” page 14, for more details.



Note Before ordering a new IO-16, it is strongly recommended that you contact your normal technical support resource to eliminate the possibility of a software issue or mis-configuration problem.

Replacing an IO-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 3.

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

Procedure 2 Replacing an IO-16 accessory module.

Step 1 Using the appropriate NiagaraAX software tool, back up the JACE’s configuration to your PC.

Step 2 Remove power to the JACE. 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-16 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-16 is replaced). The software that runs on the JACE-2/6 expects the terminal positions to be the same in the replacement IO-16, in order to collect data from or to control the attached devices.

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

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

Returning a Defective Unit

- Step 6** Mount the replacement IO-16 as it was previously, using the same DIN rail location and/or screws.
- Step 7** Reconnect the earth ground wire to the IO-16 grounding lug.
- Step 8** Reconnect all I/O connectors to the IO-16.
- Step 9** If any of your I/O points have voltage, turn the devices back on, or reconnect power to them.
- Step 10** Restore power to the JACE-2/6, and perform a checkout using NiagaraAX Workbench (see “[Power up and Initial Checkout](#),” page 12).
- Step 11** For more details, see the *Niagara^{AX} Ndio Guide* and *JACE Niagara^{AX} Install and Startup Guide*.

Returning a Defective Unit



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.

- Do not return an out-of-warranty IO-16 to Tridium.
- There is no “return for repair-and-return” service available for any of the JACE-2/6 series products.

For proper credit on an in-warranty unit, ship the defective unit to Tridium within 30 days.

Prior to returning the unit, contact one of the following Tridium offices to obtain a return authorization (RA) number and other instructions. Please provide:

- Product model
- Serial number
- Nature of the defect

United States

Phone: 804-254-7086, ext. 11

Return to:

Tridium, Inc.
 2256 Dabney Road, Suite C
 Richmond, VA 23230
 Attn: Return Department RA# _____

Europe

Phone: +44 (0) 1403 740290

Fax: +44 (0) 1403 741804

Return to:

Tridium Europe Ltd
 1, The Grainstore
 Brooks Green Road
 Coolham
 West Sussex
 RH13 8GR
 United Kingdom
 Attn: Return Department RA# _____

Email for technical support:

supportuk@tridium.com

Email for product orders:

ordersuk@tridium.com

Asia/Pacific

Phone: +65 6887 5154

Fax: +65 6887 5342

Mobile: +65 9665 6024

Address:

Tridium Asia Pacific Pte Ltd
101 Cecil Street,
#10-11, Tong Eng Building,
Singapore 069533

Email for technical support:

hclim@tridium.com

Attn: Mr Lim Hoon Chiat, Engineering Manager RA# _____

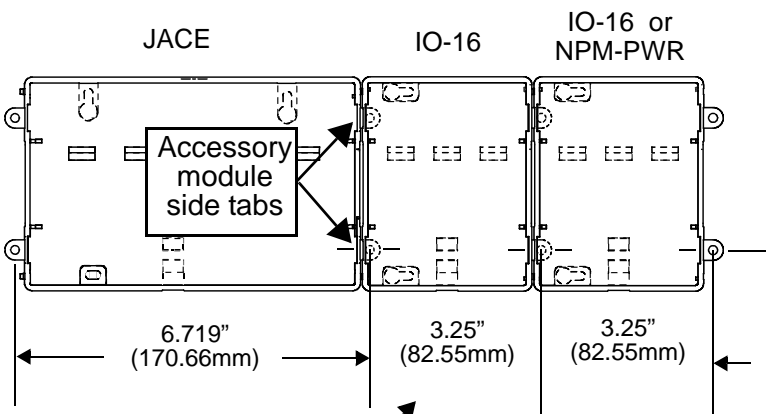
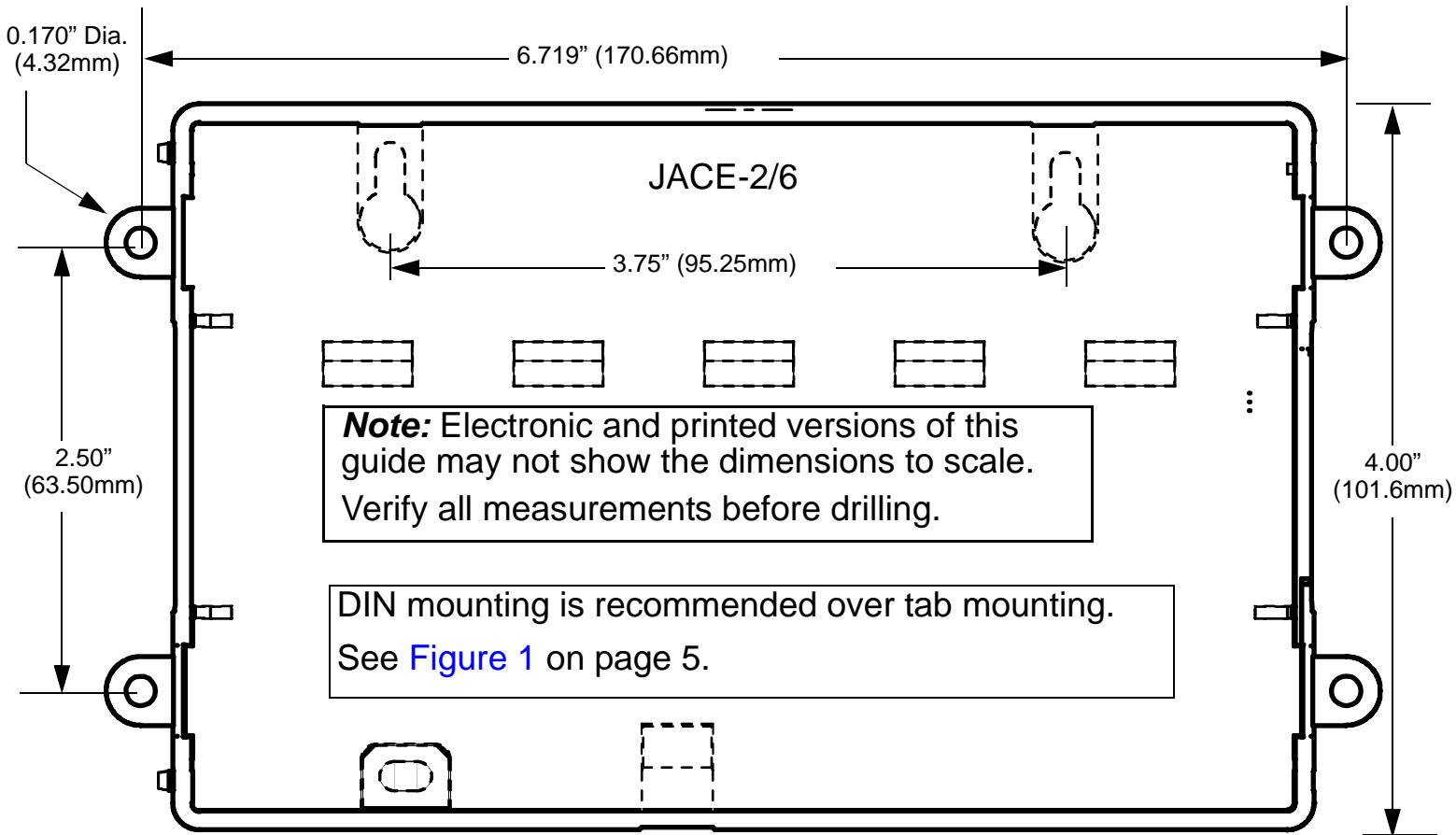
Sales: (Australia): **Phone:** +61 7 5539 1211 **Fax:** +61 7 5597 2334

(Japan): **Phone:** +81 044 829 1750

Certifications and Declaration of Conformity

The IO-16 meets certifications of the Federal Communications Commission (FCC), Canadian Department of Communications (DOC), and is included in an EC “Declaration of Conformity” for the JACE. For further details, please see these sections in the *JACE-2 Mounting and Wiring Instructions*, part number 10555, and the *JACE-6 Mounting and Wiring Instructions*, part number 10821.

Tab Mounting Dimensions



Distance between center of tabs from one unit to another unit.

Tip: When mounting the JACE, you can simplify any future removal or replacement of it by **not** installing screws in its "accessory module side" tabs (see above).

