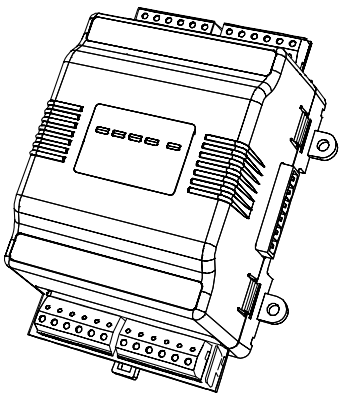
Honeywell

Remote I/O Module (IO-16-REM-H)

INSTALLATION INSTRUCTIONS



APPLICATION

This document covers the mounting and wiring of a Remote I/O Module (IO-16-REM-H), for expanding a WEBs-AX or ComfortPoint 200, 600, or 700 series controller or SEC-H-600 controller. It assumes that you are an engineer, technician, or service person who is performing system design or installation. Please read through this entire document before beginning the installation procedures.

NOTE: This document does not discuss mounting and wiring of other components, or software configuration. For more information on these topics, refer to documents listed in "Related Documentation," page 2.

FEATURES

- **The IO-16-REM-H expands a WEBs-AX controller (controller with NiagaraAX-3.4.51 or later and an available RS-485 port; see "System Planning," page 2 for more details) with 16 I/O points that can be remotely located, including:**
  - **8 – universal inputs (UIs), compatible with 0–10Vdc, 4–20mA, 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 – 0–10Vdc analog outputs for analog control of loads at 2.5K ohm minimum, or 4mA drain maximum.**
- **The IO-16-REM-H modules use DIN rail mounting, and have two end-mounted 6-pin connectors that support direct-chaining (in-line attachment) to other IO-16-REM-H modules.**
- **Communications to the remote controller are accomplished using RS-485 multidrop on 3 wires of an end-mounted 6-pin connector or from an RS-458 Option Card. The other 3 wires on the end-mount connector are primary DC power and battery backup for the module, which can be supplied from that same controller if that controller is equipped with external battery backup. Alternatively, you can power the IO-16-REM-H locally with a DIN-mountable NPB-PWR-UN-H universal AC power supply, or a third-party 12–15Vdc power supply, and wire only the RS-485 bus back to the parent controller.**

Contents

95-7768-03

RELATED DOCUMENTATION

For more information on mounting and wiring a system, refer to appropriate

- WEB-201, CP-201, WEB-600, CP-600 Installation Instructions, Form # 95-7722.
- WEB-202-XPR, CP-202-XPR, WEB-602-XPR, CP-602-XPR Installation Instructions, Form # 95-7775.
- WEB-700, CP-700 Installation Instructions, Form # 95-7776.
- SEC-H-600 Installation Instructions, Form # 95-7759.

For software configuration details on the I/O points provided by the IO-16-REM-H module, refer to:

- *NiagaraAX NRIO Guide*.

SYSTEM PLANNING

The maximum number of IO-16-REM-H modules supported by a controller differs according to its model type. In addition, depending on the station resource usages in a controller, the IO-16-REM-H modules may be limited to fewer than the maximum specified in order to retain acceptable system operation. See “Supported numbers of IO-16-REM-H” on page 2.

Other considerations also apply when adding IO-16-REM-H modules. For example, a IO-16-REM-H module under a WEB-201, CP-201, WEB-600, or CP-600 series controller will *not have* the inherent “battery backup” feature provided by the WEB or CP 700 controller platform. See “About battery-backup operation” on page 3.

Finally, when cabling power to IO-16-REM-H modules located in locations other than the controller, allowances must be made for “voltage drops” introduced by cabling distances. See “Voltage drop considerations” on page 3.

Supported numbers of IO-16-REM-H

Table 1 below provides a quick comparison of controller models compatible with IO-16-REM-H modules, including the maximum possible number of IO-16-REM-H modules supported.

NOTE: Station operation of each controller at maximum limits below with *only* the necessary NiagaraAX software components (Nrio driver and associated points) is roughly at 50% resource usage, without other driver networks, control logic, and so on. Therefore, maximum numbers *may be less* for a controller, particularly if an existing WEB-201, CP-201, WEB-600 or CP-600 is connected to one or more “Ndio based” (IO-34-H, IO-16-H) modules.

Currently, only controller models listed below, at NiagaraAX-3.4 or later, support IO-16-REM-H modules.

Table 1. Maximum number of IO-16-REM-H modules supported, by compatible controller platform models.

Controller model	Max. Number of IO-16-REM-H[a]	6-Position Power/RS-485
WEB-201, CP-201	4	On-board RS-485 port or NPB-2X-RS485 Option Card [b]
WEB-202-XPR, CP-202-XPR	3	6 Position Connector w/ Power and Battery Avail.[c]
WEB-600, CP-600	16	On-board RS-485 port or NPB-2X-RS485 Option Card [b]
WEB-602-XPR, CP-602-XPR	15	6 Position Connector w/ Power and Battery Avail. [c]
WEB-700, CP-700	16	6 Position End Connector w/ Power and Battery Avail. [c]
SEC-H-600	4[d]	NPB-2X-RS485 Option Card [b]
SEC-H-201	N/A	No connection to SEC-H-201

[a] Maximum number of IO-16-REM-H modules may be reduced due to utilization of controller resources.

[b] Provide power to modules from an NPB-PWR-UN-H module or a battery-backed 12-15V DC Power Supply.

[c] Approximately 4 IO-16-REM-H modules may be powered by the controller power supply. Calculate total current draw of the controller and powered devices to determine the actual count. Additional IO-16-REM-H modules may be powered by an NPB-PRW-UN-H power supply or a battery-backed 12-16 V DC Power Supply.

[d] A total of 15 Modules may be connected to an SEC-H-600 controller. Connecting IO-16-REM-H will reduce the number of Security Modules that can be connected.

About battery-backup operation

When IO-16-REM-H modules are powered by controller platforms with 6-position power/RS-485 connectors, that is, wired to the PS+, PS-, and BB terminals, they can benefit from "battery backed" protection against system power events. Note this requires the controller to have the optional (external) sealed lead acid battery installed—as the controller's internal NiMH battery provides "power blip" backup only for its on-board circuitry, as well as a "graceful shutdown" of its running station, if a longer power outage occurs.

NOTE: The other "direct attachment type" I/O expansion modules (IO-16-H, IO-34-H, using Ndio driver) already provide this type of "shutdown protection" described above.

An IO-16-REM-H with battery backup can provide *continuous system operation* during a power event—essentially making it a "non event" for both the controller and the IO-16-REM-H module. Depending on the capacity of the external battery(ies), this backup operation can extend over many minutes of AC power loss, and/or over multiple successive power blips. An IO-16-REM-H wired this way is often described as "powered by the controller", although during normal operation, sometimes power is actually supplied by the NPB-PWR-UN-H module attached to, and powering, the controller itself.

Note this "supplied by controller" battery-backup operation is *not available* when using IO-16-REM-H modules with WEB-201/600 or CP-201/600 series controllers, that is controllers *without* the 6-position power/RS-485 connector. Or, in any scenarios where IO-16-REM-H modules must be located many hundreds of feet away from the controller (cabling "voltage drop" issues). In these cases, you must *locally power* those IO-16-REM-H modules, using one of two methods:

- Local NPB-PWR-UN-H attachment to the IO-16-REM-H module(s). Although convenient, be aware that this invites power event issues. See "Operation without battery-backup."
- Third party, battery-backed 12-15Vdc power supply, wired to the PS+ and PS- terminals of the IO-16-REM-H module's 6-position end connector. This is *typically recommended*, for reasons noted below.

Note that power wiring for all different scenarios is included in this document. See "Wiring Details," page 9.

Operation without battery-backup

If a IO-16-REM-H module is powered locally with a NPB-PWR-UN-H (for example, a WEB-600 or CP-600 controller), and a momentary AC power loss occurs, a number of *undesirable things can result*, including:

- Load cycling from IO-16-REM-H relays dropping out, including several seconds lag to first re-establish communications with the controller (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.

Additionally, loss of power without battery 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 controller). If this upgrade process is interrupted by a IO-16-REM-H power cycle, the module may be rendered inoperable—and will likely need to be replaced.

Therefore, consider powering IO-16-REM-H modules with a battery-backed 12V power supply, as necessary.

Voltage drop considerations

When using the controller and its backup battery to power IO-16-REM-H modules, and some modules are not in the same enclosure with the controller, you must be aware of voltage drops in the connecting "trunk power" cabling. Typically, this applies only if modules are located in different locations—that is, not near the controller.

NOTE: The 15Vdc power supply and the backup battery(ies) charged by the controller must **always** be located nearby the controller, either in the same enclosure (typical), or in an adjacent enclosure.

Note that each IO-16-REM-H draws (at most, when all four relays are pulled in) 0.125A, and thus can introduce voltage drop when long cabling distances are used for power/backup battery. In addition, when sizing the sealed lead-acid battery(ies) for a controller, you should factor in additional Ah capacity according to the numbers of IO-16-REM-H modules. Table 2 provides a summary of IO-16-REM-H power consumption for these purposes.

Table 2. Amps/Watts, and Recommended Minimum 12V SLA battery A-Hr capacities, per IO-16-REM-H.

Device	Max per System	Amps / W used @ 15Vdc (each)	12V Backup Battery (4 hours) min. recommended Ah (each)	Notes
IO-16-REM-H	See Table 1.	0.125 A / 1.88 W	0.65 Ah	Has 4 on-board relays.

Undersized selection of power cabling can result in unacceptably high voltage drops, and remotely located IO-16-REM-H 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 PS+ and PS- at the source controller power supply, and the PS+ and PS- at the furthest expansion module (IO-16-REM-H). Or, when powered by battery backup, the difference in voltage measured across the BB and PS- at the source controller, and the BB and PS- at the furthest expansion module (IO-16-REM-H).

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-16-REM-H modules are mounted remotely in a location 500 feet (366m) away. In this example, worst-case amps used by each remote IO-16-REM-H is 0.125A. 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 slightly over 1V—this would be a good choice over an #18 AWG cable, which would drop over 2V (above the 1.5V maximum allowable drop).

PREPARATION

Unpack the IO-16-REM-H 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 20). See the next sections “Included in this Package” and “Material and Tools Required”.

Included in this Package

Included in this package you should find the following items:

- a Remote I/O Module (IO-16-REM-H).
- this Remote I/O Module (IO-16-REM-H) Mounting and Wiring Instructions, Form Number 95-7768.
- a hardware bag containing the following items:
  - — Four (4) pin-mount, 6-position, screw-terminal connectors for connection of universal inputs, analog outputs, and relay outputs. For more details, see “About Screw Terminal Connectors,” page 8.
  - — One (1) 6-position screw terminal end-plug, for wiring RS-485 communications from the parent controller, as well as 15Vdc power and battery backup.
  - — 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:

- Approved 12–15Vdc power supply source and (optional) 12Vdc backup battery source, by either:
  - — Wiring to the remote parent controller’s 6-position “Powered RS-485” connector, such as on a SEC-H-600 controller. This is the recommended method.
  - — Using a DIN-mountable NPB-PWR-UN-H power supply to furnish 15Vdc power to the IO-16-REM-H.
  - — Using a third-party 12–15Vdc power supply, with output regulated to within ± 4%.
- 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. See Fig. 1. If DIN rail 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 controller. Be sure to heed these warnings to prevent personal injury or equipment damage.

⚠ WARNING

A 15Vdc circuit powers the IO-16-REM-H module from the 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.

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.

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-16-REM-H modules to the RS-485 port of the parent controller. See "Supported numbers of IO-16-REM-H," page 2.

INSTALLATION AND START-UP OUTLINE

NOTE: If installing the controller and IO-16-REM-H module at the same time, please refer to the appropriate *controller Mounting & Wiring Guide* document to install the controller.

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

1. Physically mount the IO-16-REM-H module onto DIN rail. See "Physical Mounting." If directly attaching to other modules, ensure that the 6-position end connector(s) are properly seated into the end connectors of the other units. Note the previous "Module Connection Precautions" on page 6.
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 18.

PHYSICAL MOUNTING

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

- You can mount the unit in any orientation. It is not necessary to remove the cover before mounting.
- Mounting on a 35mm wide DIN rail is recommended. The IO-16-REM-H unit base has a molded DIN rail slot and locking clip, which simplifies mounting 2 or more units together, and/or to a NPB-PWR-UN-H power supply. 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-16-REM-H. Mounting tab dimensions are on page 22 of this document.

TO MOUNT IO-16-REM-H MODULE ON INSTALLED DIN RAIL

1. Position the IO-16-REM-H module on the rail, tilting to hook DIN rail tabs over one edge of the DIN rail (Fig. 1).
2. Use a screwdriver to pry down the plastic locking clip, and push down and in on the IO-16-REM-H, to force the locking clip to snap over the other edge of the DIN rail.
3. Slide the IO-16-REM-H module along the DIN rail to its intended location.
4. If connecting to another module already mounted, seat its 6-position plug into that module's connector socket.
5. Install DIN rail end clips to secure the assembly, or install screws in mounting tabs.
6. 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 or mounting tab screws.

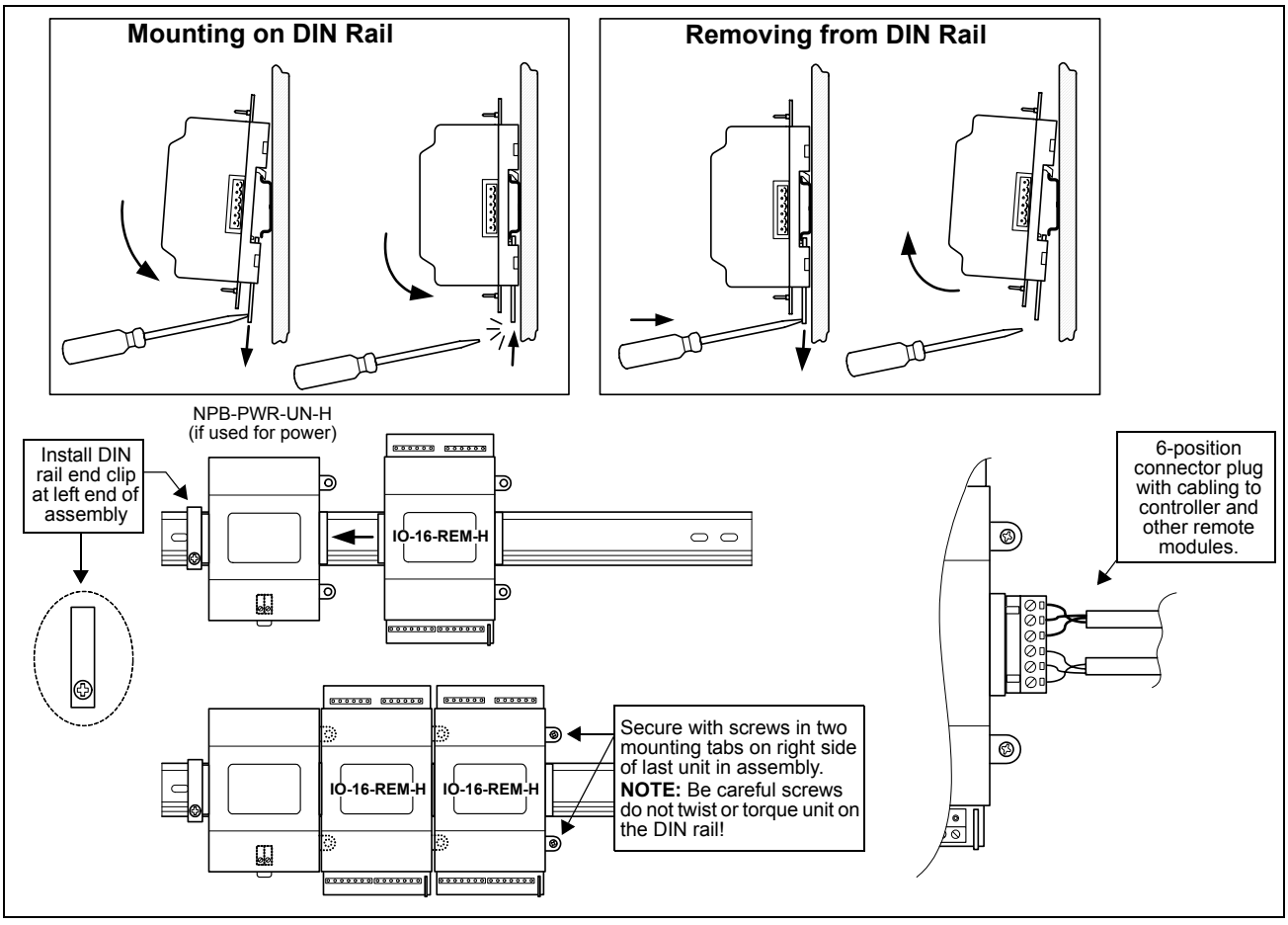


Fig. 1. IO-16-REM-H module DIN mounting details.

NOTE: To remove a IO-16-REM-H module from DIN rail, remove DIN rail end clips or mounting tab screws, and (if applicable) slide it away from other modules. Insert a screwdriver in the center plastic locking tab and pull downwards, then lift the unit outwards.

IO-16-REM-H BOARD LAYOUT AND TERMINALS

The IO-16-REM-H module provides 8 universal Inputs, 4 digital Relay Outputs, and 4 0–10Vdc Analog Outputs. Wiring terminal positions are shown below (Fig. 2), along with LED locations.

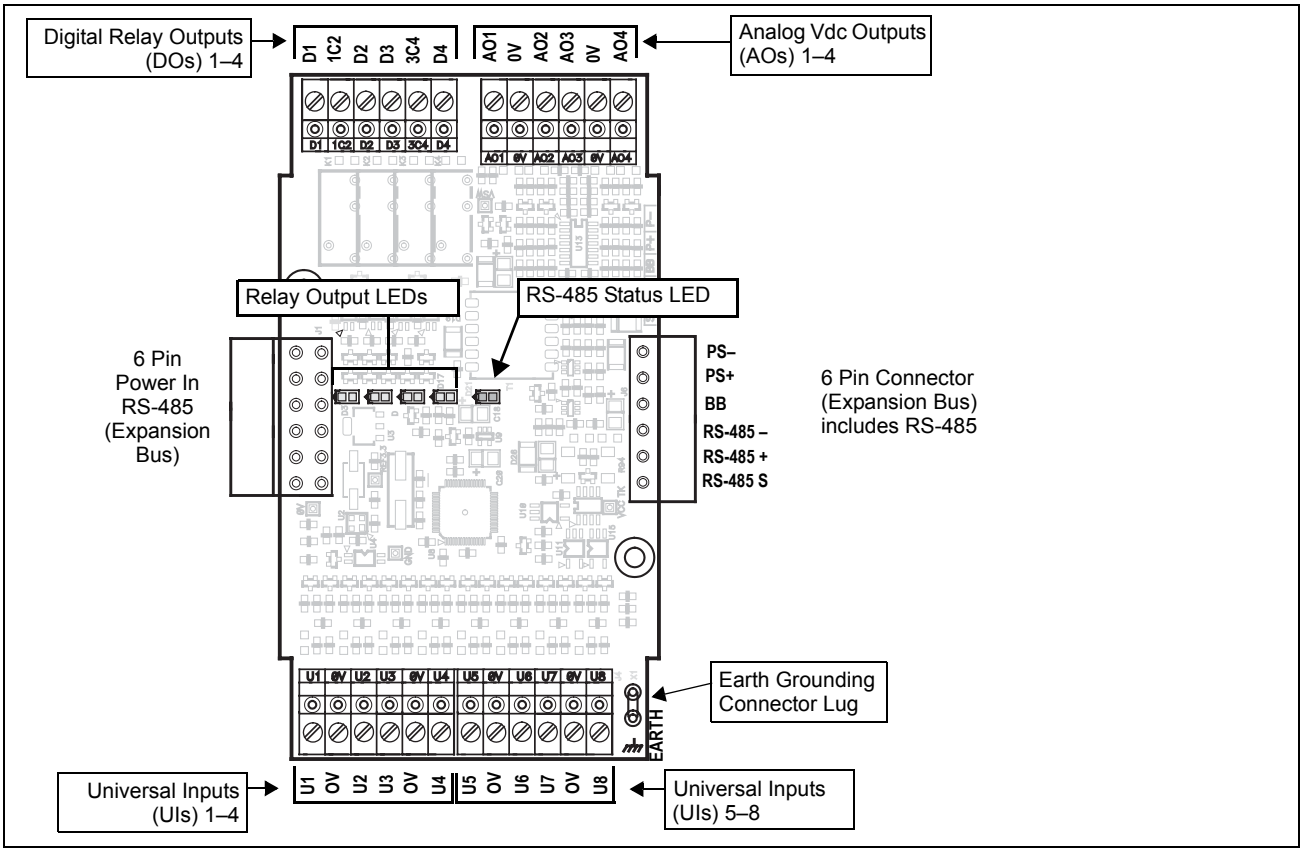


Fig. 2. Remote I/O Module Wiring Terminal Locations (screw terminal connectors shown installed).

About Screw Terminal Connectors

Screw-terminal connectors are shipped loose in a separate hardware bag. If desired, you can make wiring terminations to connectors *before* installing on the IO-16-REM-H circuit board pins. Removal of the pin-mounted connectors may be difficult, especially if they are pushed all the way down and wiring has been landed.

In general, it may be easiest to wire to *loose* connectors (held next to pins), then install them after completing.

⚠ CAUTION

Before using the method below to remove connectors, remove all power to the IO-16-REM-H, and remove power to any other connected external devices. Otherwise, a short circuit will result!

To remove a pin-mounted connector plug using *needle nose pliers*, with **all power removed** (see Caution above).

- Insert the tips of the pliers into the *outermost* wiring termination ports of the connector. Note that if wiring is already landed in those ports, you may need to remove those wires first.
- With a gentle rocking motion, pull upwards, perpendicular to the circuit board.
- The connector will come free from the circuit board pins. If you removed wiring from the outermost connector ports, reconnect that wiring as it was before.

WIRING DETAILS

See Fig. 2 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-16-REM-H to a nearby earth grounding point. See the “Grounding” section on page 9 for details.
2. Wire to supply power to the IO-16-REM-H, but *do not energize the power source* until all other wiring is completed. Depending on how you are powering the IO-16-REM-H, methods differ:
   a. If powering the IO-16-REM-H from a controller with a 6-position “Powered RS-485” connector (supplies 15Vdc and battery backup on 3 wires of this connector), **unplug** this connector at the controller. Then wire to the 6-position connector plug for each assembly of IO-16-REM-H modules, in a “shortest route” fashion. See “Power from controller 6-position connector,” page 10.
   b. If powering the IO-16-REM-H from a local NPB-PWR-UN-H power supply module, wire the **disconnected** AC line circuit to the 2-position terminal block under the NPB-PWR-UN-H’s cover. See “Power from local NPB-PWR-UN-H module” on page 11.
   c. If powering the IO-16-REM-H from a third-party 12–15Vdc power supply, wire the positive and negative lines from the power supply to the PS+ and PS– terminals of the 6-position end connector plug. See “Power from third party 12–15Vdc power supply” on page 12.
3. Connect RS-485 wiring between the IO-16-REM-H and the controller, and (if applicable) to other remote IO-16-REM-H modules, in a continuous multidrop fashion. See “RS-485 Communications” on page 13.
4. Connect I/O wiring. See sections “Inputs” on page 13, and “Outputs” on page 16.
5. Apply power to the unit. See “Power up and Initial Checkout,” page 18.

Grounding

An earth ground spade lug (0.187") is provided on the circuit board of the IO-16-REM-H (and NPB-PWR-UN-H) 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 Fig. 3 for the location of the earth grounding wire for both the IO-16-REM-H and NPB-PWR-UN-H.

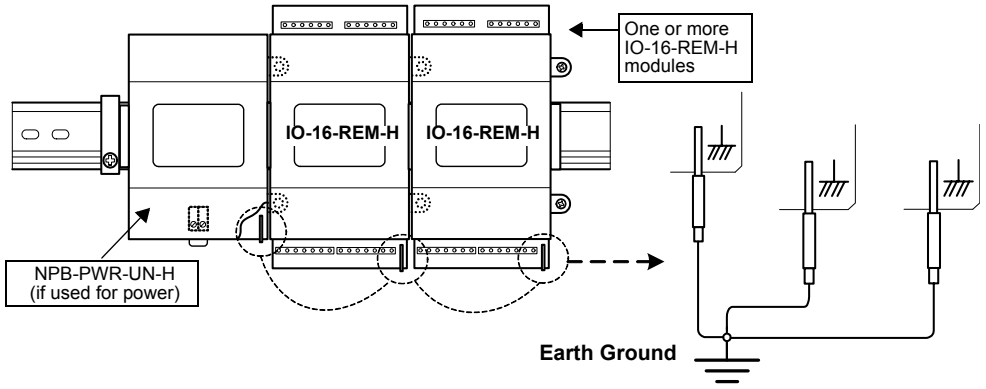


Fig. 3. Earth ground connection required to each IO-16-REM-H module as well as NPB-PWR-UN-H (if using).

NOTE: Connect any remote IO-16-REM-H modules to a nearby earth ground in the same manner.

Power from controller 6-position connector

If powering one or more IO-16-REM-H modules from a controller equipped with a 6-position “Powered RS-485” connector, the 15Vdc and 12V backup battery (BB) is typically routed to remote modules using a 3-conductor with shield cable. The remaining 3 conductors are used for RS-485 communications between the controller and the IO modules, using a separate shielded twisted pair cable. See Fig. 5

NOTE: If the controller is not connected to a (optional, external) sealed lead-acid battery, the “BB” wire is not required. This permits use of a *single pair* shielded cable, versus a 3-conductor with shield cable.

For power budgeting purposes, estimate each IO-16-REM-H module to consume 2W nominal (125mW @ 15V). Typical current will be less— as this estimate factors in all four relays being pulled in.

Do not apply power (plug in the 6-position connector at the controller) until all other wiring is completed. See “Power up and Initial Checkout,” page 18.

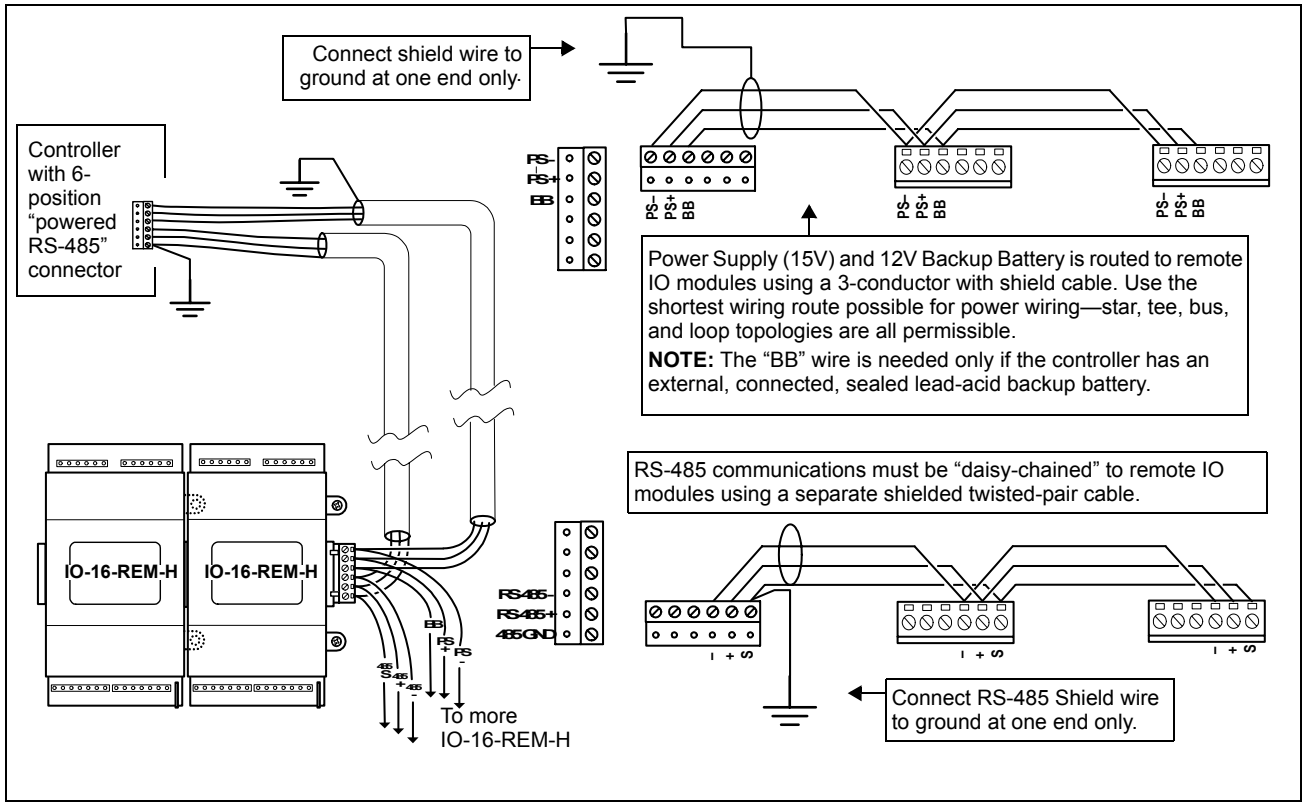


Fig. 4. IO-16-REM-H modules powered by controller connection (RS-485 wiring also shown).

In some cases, some number of IO-16-REM-H modules may be powered this way (from controller), while others may be powered locally using either a NPB-PWR-UN-H power supply module or a third-party 12–15Vdc power supply. This may be advisable when IO modules are located long distances from the controller, to avoid excessive voltage drops due to wiring resistances. See the following sections:

- “Power from local NPB-PWR-UN-H module,” page 11
- “Power from third party 12–15Vdc power supply,” page 12

Power from local NPB-PWR-UN-H module

If powering IO-16-REM-H modules from a directly-attached AC power supply (NPB-PWR-UN-H module), wire the AC circuit to the NPB-PWR-UN-H's 2-position terminals (must remove cover). See Fig. 5, left.

⚠ WARNING

A 120Vac or 240Vac circuit powers the NPB-PWR-UN-H. Disconnect power to this circuit before installation to prevent electrical shock of equipment damage.

Make all connections in accordance with national and local electrical codes. Use copper conductors only.

Do not exceed the 30W capacity of NPB-PWR-UN-H by the powered devices.

NOTE: For power budgeting purposes, estimate each IO-16-REM-H module to consume 2W nominal (125mW @ 15V). Typical current will be less— as this estimate factors in all four relays being pulled in.

For other wiring on the 6-position end connector, see "RS-485 Communications," page 13.

Do not apply power (energize the NPB-PWR-UN-H) until all other wiring is completed. See "Power up and Initial Check-out," page 18.

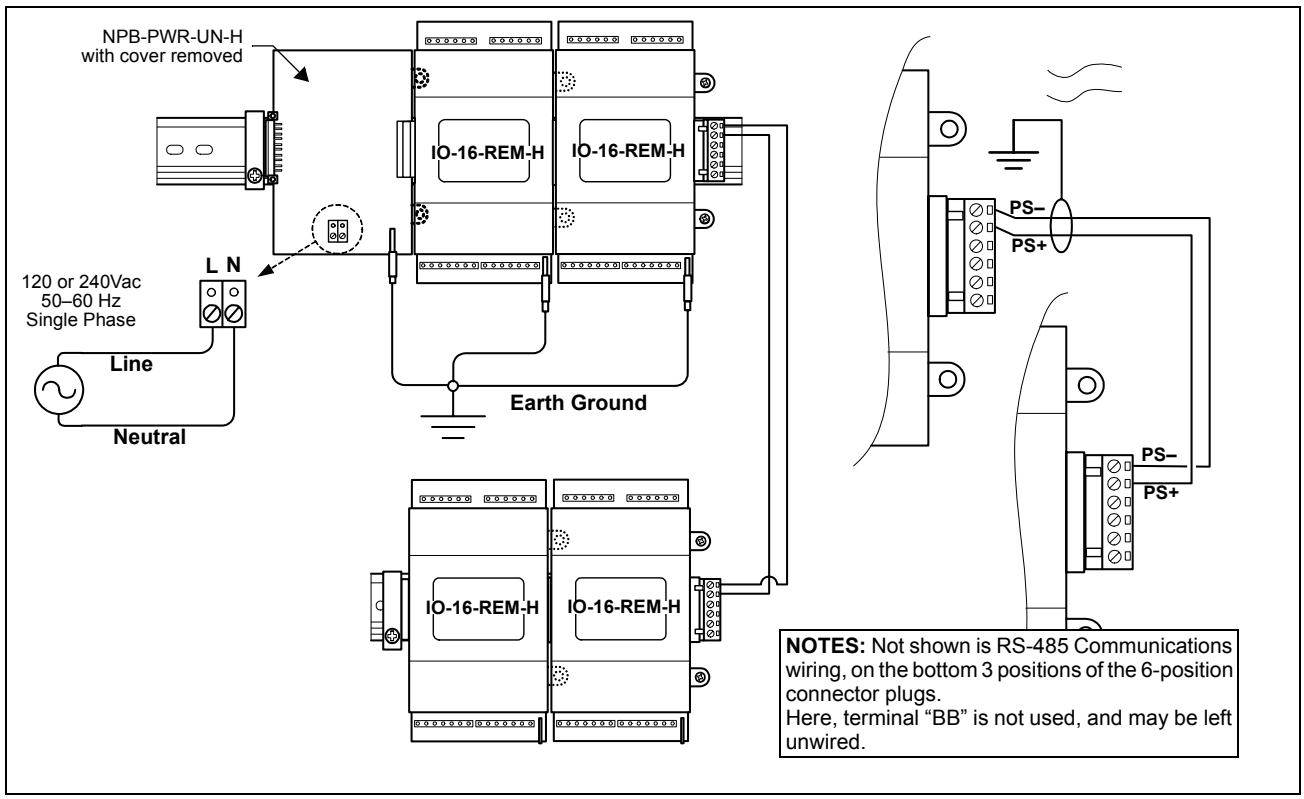


Fig. 5. NPB-PWR-UN-H power supply module used to power IO-16-REM-H modules.

If the NPB-PWR-UN-H powers additional IO-16-REM-H modules (not attached in same assembly), wire a single pair cable with shield between assemblies, connecting PS– to PS–, and PS+ to PS+ in a "shortest route" fashion. See Fig. 5, right.

Power from third party 12–15Vdc power supply

IO-16-REM-H modules can be powered by a third-party, 12V–15Vdc power supply, as an alternative to using a NPB-PWR-UN-H power supply module. A “battery backed” power supply is recommended. This provides power to the IO module(s) during AC power loss scenarios.

Fig. 6 shows wiring for two assemblies of IO-16-REM-H modules powered by a battery-backed power supply.

NOTE: For power budgeting purposes, estimate each IO-16-REM-H module to consume 2W nominal (125mW @ 15V). Typical current will be less— as this estimate factors in all four relays being pulled in.

For other wiring on the 6-position end connector, see “RS-485 Communications,” page 13.

Do not apply power (energize the power supply) until all other wiring is completed. See “Power up and Initial Checkout,” page 18.

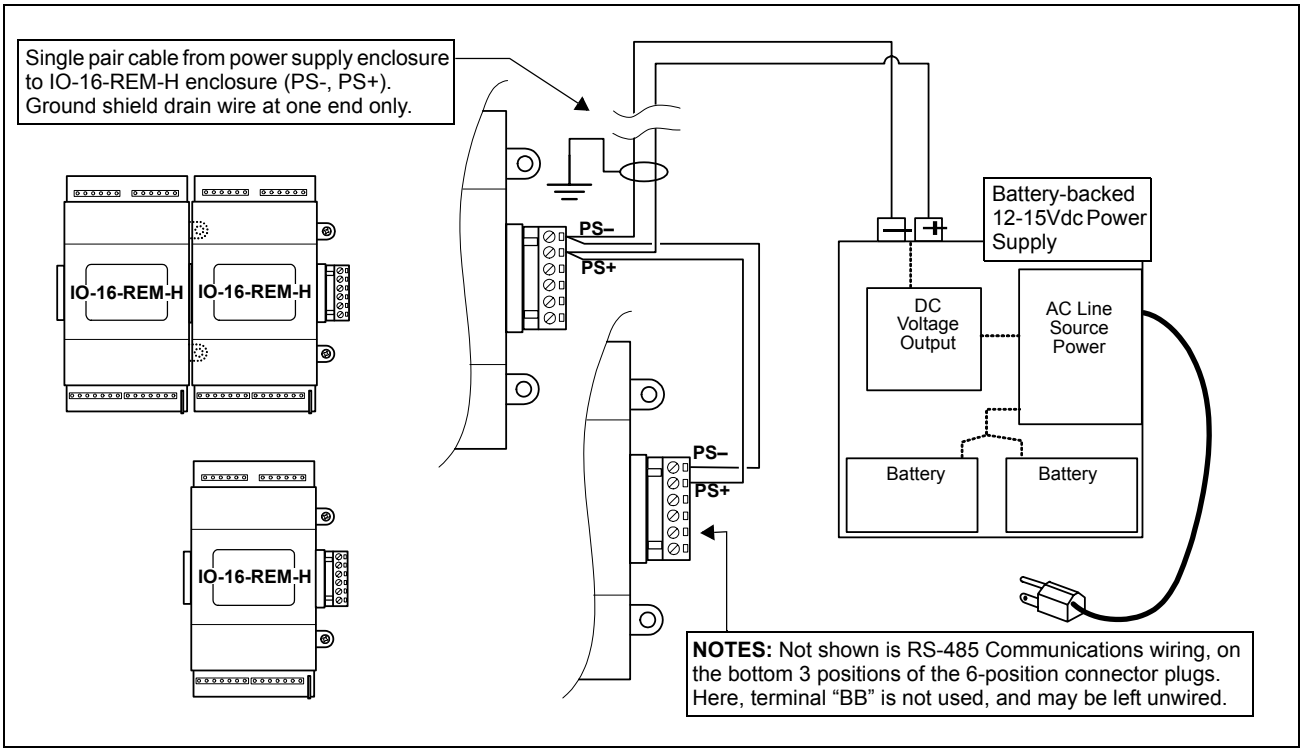


Fig. 6. Third-party 12Vdc, battery backed, power supply powering IO-16-REM-H modules.

NOTE: Power must be regulated to within ± 4%.

The power supply and its enclosure must be UL 294 approved.

Power supply models furnishing 12Vdc output are the most commonly available.

Only remote *IO-16-REM-H modules* can be powered by a 12Vdc power supply—the controller requires 15Vdc. Depending on controller model, this 15Vdc may be furnished by an integral power supply, or from an external power supply module, such as the NPB-PWR-UN-H. See the appropriate *controller (model) Mounting & Wiring Guide* document for details.

RS-485 Communications

RS-485 communications from the controller to each IO-16-REM-H module (or assembly of modules) requires a continuous "daisy-chain" wiring topology using a shielded, twisted-pair cable. Wire between device assemblies using the 6-position end connector plugs. 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 to earth ground at one end only, such as at the controller. See Fig. 7.

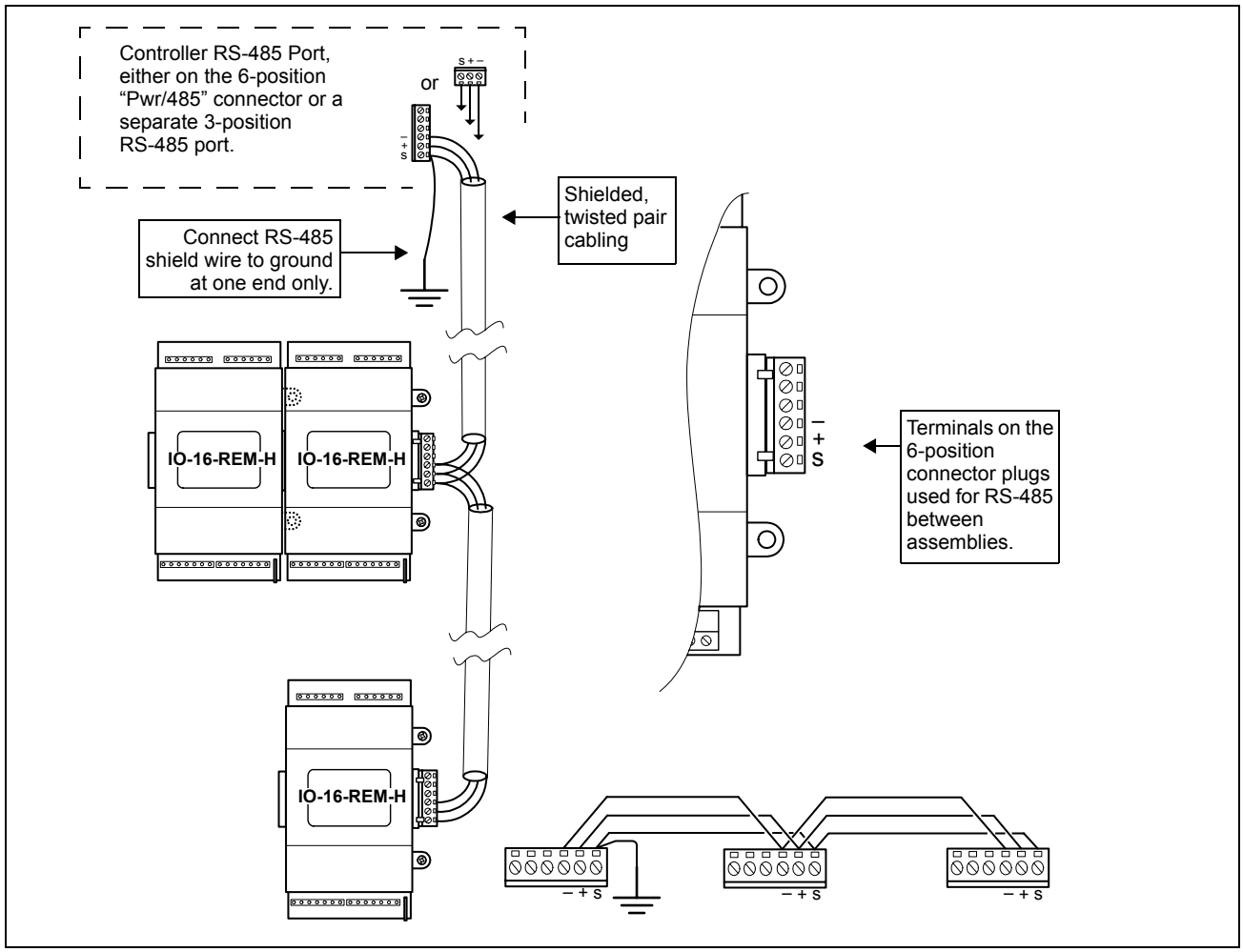


Fig. 7. RS-485 wiring from the controller to one or more IO-16-REM-H modules uses a "daisy-chain" connection.

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 14)
- 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 ±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 *kitIo* 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 *NiagaraAX NRIO Guide* for details.

Fig. 8 shows the wiring diagram.

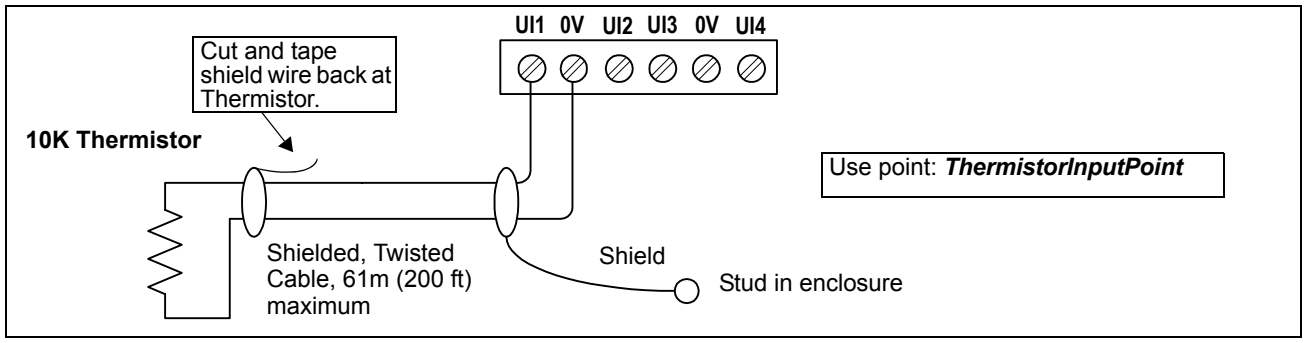


Fig. 8. Thermistor wiring.

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 (Fig. 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 ±2% of span, without user calibration. Fig. 9 shows the wiring diagram for a 0–10 Vdc sensor.

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

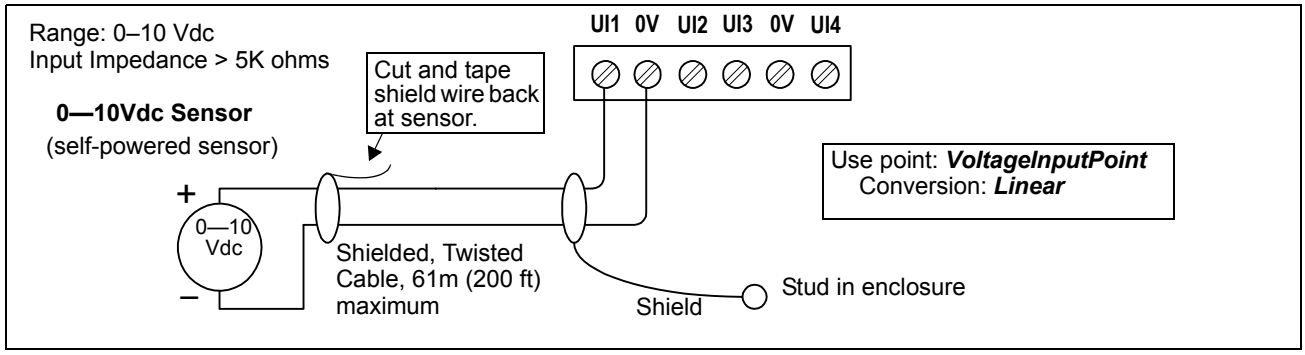


Fig. 9. 0–10 Vdc wiring.

4–20 mA

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

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

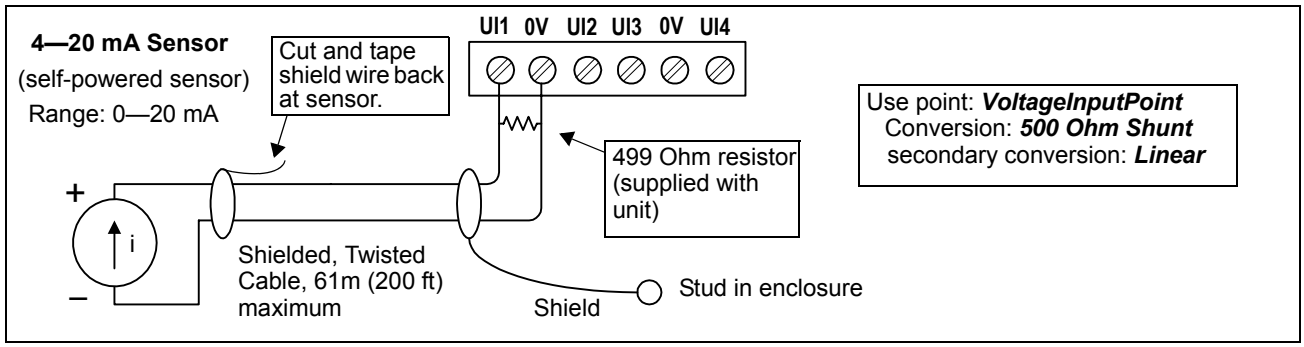


Fig. 10. 4 to 20 mA wiring.

⚠ 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-16-REM-H module. This is in addition to removing power from the IO-16-REM-H 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-16-REM-H. 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 µA short-circuit current. For a pulse contact, use the **CounterInputPoint** in the station database. For other dry contacts, use the **BooleanInputPoint**.

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

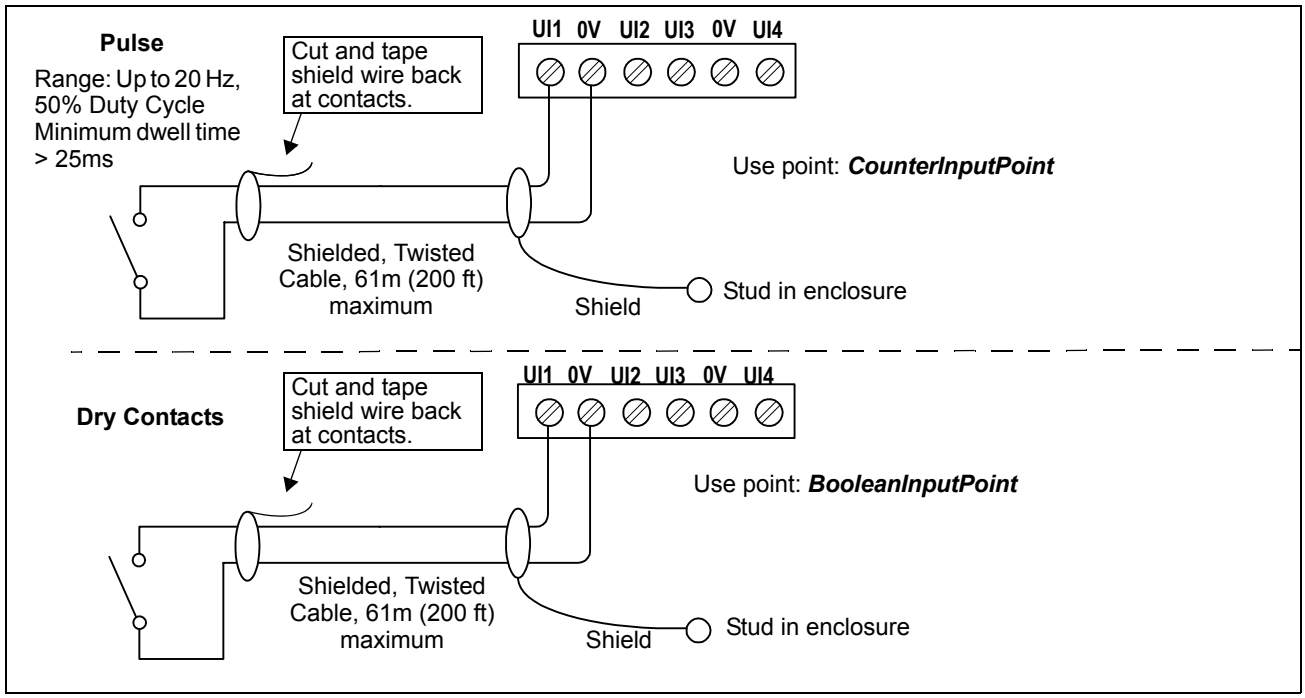


Fig. 11. Binary input wiring.

Outputs

A IO-16-REM-H 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. Fig. 12 shows an example wiring diagram.

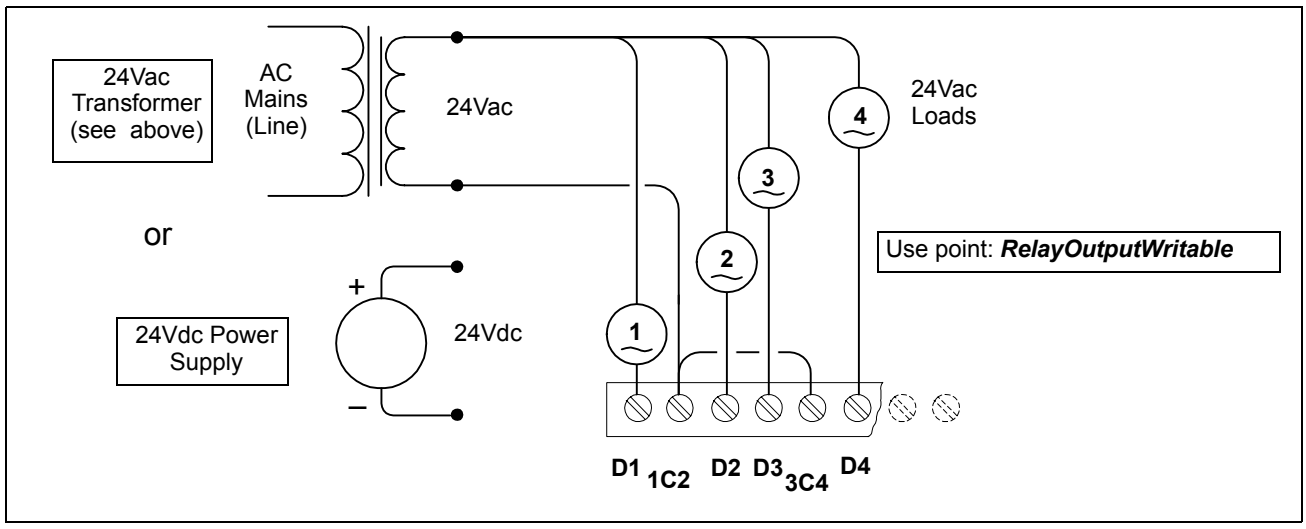


Fig. 12. Relay output wiring diagram.

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 (see Fig. 2), 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. 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.

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

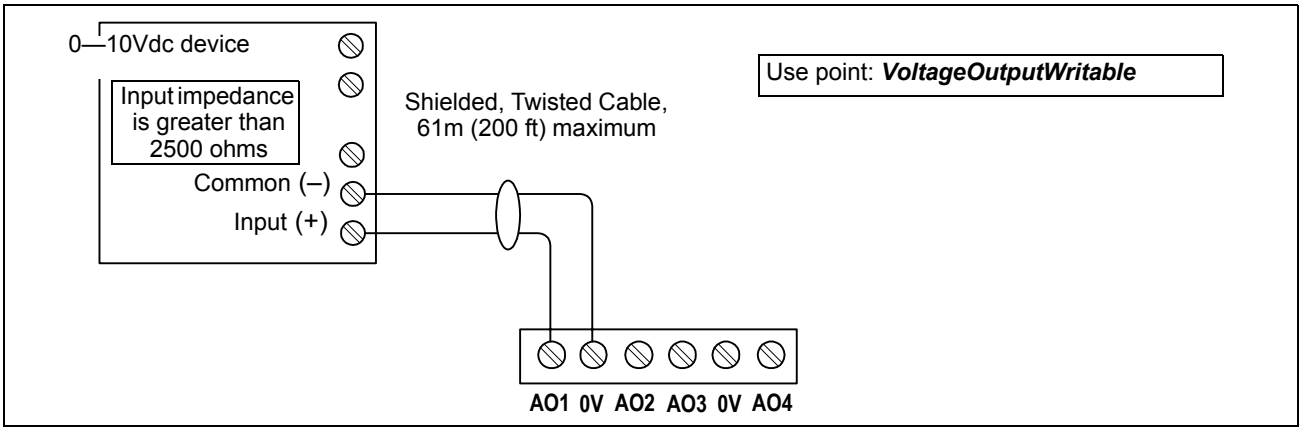


Fig. 13. Analog output wiring diagram.

NRIO16 MODULE (SOFTWARE) REPRESENTATION

In the NiagaraAX station interface to the controller and IO-16-REM-H 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 as one as an Nrio16Module), the serial status LEDs for the controller's RS-485 port continually flash, reflecting polling activity. At this time, the "STATUS" LED on that IO-16-REM-H module lights solid green.
Any time a IO-16-REM-H module's status LED is *not lit solid green*, all of its outputs are in "fail-safe" state (all relay outputs OFF, and all AOs are at a 0-volt level).

Blinking of a remote I/O module's status LED occurs for two reasons, shown at different rates:

Rapid flash (low duty cycle), meaning the unit is *unconfigured*. Discovery and addition to the station database is required.

Equal time on and off (50% duty cycle), meaning the unit is configured, but currently *offline* with the controller. Check RS-485 wiring between the controller and remote I/O module.

Each input or output used requires a special 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. 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 *NiagaraAX NRIO Guide* in Workbench online Help, or that document in PDF.

POWER UP AND INITIAL CHECKOUT

1. Apply power to the IO-16-REM-H (depending on power source, this may mean plugging in a 6-position end connector, energizing a NPB-PWR-UN-H power supply module, or powering on the connected controller or third-party 12–15Vdc power supply).
   The IO-16-REM-H module's board status LED (Fig. 2) will initially be blinking.
2. Using Workbench, open a station connection to the controller. If not already present, add an **NrioNetwork** component to the station's Drivers Container.
3. Configure the NrioNetwork's "Port Name" property to match the controller's RS-485 port COM assignment (for example, **COM2**), and set its "Trunk" property to a unique number Nrio-wide (say, 2).
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-16-REM-H appearing as an "Io16" device type.

NOTE: To associate a discovered device to a specific IO-16-REM-H, issue a right-click "Wink Device" action—this cycles a relay output on that IO-16-REM-H 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.

5. Add each discovered IO-16-REM-H to the station, renaming to reflect its actual location (see Note above). Each IO module is represented by an Nrio16Module component.
6. Verify that each IO-16-REM-H 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-16-REM-H and controller, or the communications between them,** until the firmware upgrade job finishes. Typically, this takes less than 2 minutes, with job competition signaled in the Workbench view.

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 *NiagaraAX NRIO Guide*, also available in Workbench online Help (doc Nrio).

REPLACEMENT PARTS

Servicing the IO-16-REM-H 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 Standard IO-16-REM-H replacement parts. 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 4. Standard IO-16-REM-H replacement parts.

Part Number	Description
H10716	6 position pin-mount screw terminal block
H10429	6 position end-mount screw terminal plug

New Replacement Units

To replace a faulty unit, order and install a *new* IO-16-REM-H accessory module—please note that controller accessories do *not* have special "field replacement units," or FRUs, with separate part numbers.

If the faulty IO-16-REM-H 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 20, for more details.

NOTE: Before ordering a new IO-16-REM-H, 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 THE IO-16-REM-H

⚠ 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 6.

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

REPLACING THE IO-16-REM-H ACCESSORY MODULE.

1. Using the appropriate NiagaraAX software tool, back up the controller's configuration to your PC.
2. Remove power to the IO-16-REM-H. 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 positions of all I/O wiring going to the IO-16-REM-H 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-16-REM-H is replaced). The software that runs on the controller expects the terminal positions to be the same in the replacement IO-16-REM-H, in order to collect data from or to control the attached devices.
4. Unplug all connectors from the IO-16-REM-H, including all I/O connectors and earth ground wire.

NOTE: Removal of the four pin-mounted I/O connector plugs **may be difficult.** For related details about removing them, see "About Screw Terminal Connectors," page 8.

5. Remove any screws or DIN rail clips securing the IO-16-REM-H, removing it from its mounting. See Fig. 1 for details on removal from (and mounting onto) DIN rail.
6. Mount the replacement IO-16-REM-H as it was previously, using the same DIN rail location and/or screws.
7. Reconnect the earth ground wire to the IO-16-REM-H grounding lug.
8. Reconnect all I/O connectors to the IO-16-REM-H.
9. If any of your I/O points have voltage, turn the devices back on, or reconnect power to them.
10. Reconnect the 6-position end-mount connector, and ensure that power is applied to the IO-16-REM-H as well as the controller. For related details, see the "Power up and Initial Checkout" section on page 18.
11. For more details, see the *Niagara^{AX} NRIO Guide* and *Controller 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-REM-H module to Tridium.

There is no “return for repair-and-return” service available for any controller accessory 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# _____

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

Email for technical support:
hclim@tridium.com

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

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

CERTIFICATIONS

Federal Communications Commission (FCC)

This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause interference with radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference, in which case, users at their own expense will be required to take whatever measures may be required to correct the interference. Any unauthorized modification of this equipment may result in the revocation of the owner's authority to continue its operation.

Canadian Department of Communications (DOC)

- This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.
- Cet appareil numerique de la classe A respecte toutes les exigencies du Reglement sur le material broilleur du Canada.

RoHS Compliance

This product meets RoHS (Restriction of Hazardous Substances) requirements of Directive EU 2002/95/EC.

CE Declaration of Conformity

Date:	June 19, 2009		
Application of Council Directive:	EU/EMC 2004/108/EC		
Manufacturer:	Tridium Inc. 3951 Westerre Parkway, Suite 350 Richmond, Virginia 23233 United States of America		
Manufacturer's Representative:	Steve Fey, President Tridium Inc.		
Product Model Numbers:	IO-16-REM-H, with the following: MDR-20-15, 10722, 10903, 10724, 10723,		
Type of Equipment:	Electrical Equipment for Measurement, Control and Laboratory Use		
EMS Standards Applied:	**Standard**	**Description**	**Criteria Met**
	EN 61000-6-4	Electro-Magnetic Compatibility Emissions, Generic	Compliant
	EN 61000-6-2	Electro-Magnetic Compatibility Immunity	Compliant, as noted below
	CISPR 22: 2006	Conducted Emissions - Telecom	Compliant
	CISPR 16-2-1 and CISPR 16-2-2	Limits of Radio Disturbance - Conducted Emissions	Pass Class A Pass Class A
	CISPR 16-2-3	Radiated Emissions	Compliant
	IEC 61000-4-2	Electrostatic Discharge Immunity	Pass Class B
	IEC 61000-4-3	Radiated Field Immunity	Pass Criteria A
	IEC 61000-4-4	Electrical Fast Transient Immunity (Signal Ports) Electrical Fast Transient Immunity (AC Power)	Pass Criteria B Pass Criteria B
	IEC 61000-4-5	Surge Immunity	Pass Criteria B
	IEC 61000-4-6	Conducted Immunity	Pass Criteria B
	ICES-003, Issue 4	Conducted Emissions - Voltage, Class A	Compliant
	ICES-003, Issue 4	Radiated Emissions - Class A	Compliant
	IEC 61000-4-11	Voltage Dips Voltage Interrupts	Pass Criteria A Pass Criteria C
	IEC 61010-10-1: 90 +A1:92 + A2:95	Safety requirement for electrical equipment for measurement, control and laboratory use	Pass

I, **Steve Fey**, President of Tridium Inc., hereby declare that the equipment specified above conforms to the above Directives and Standards.

NOTE: For CE compliance, the NPB-PWR-H power supply *cannot be used* to power the IO-16-REM-H or a WEBs-AX Controller. In its place, use the DIN-mountable **Tridium** model **MDR-20-15**. This CE-approved power supply is 100-240Vac input, with 15Vdc output at 20W.

Or, power the IO-16-REM-H using another third-party, CE approved, battery backed 12Vdc power supply.

A WEBs-AX Controller must be powered by a **15Vdc** power supply with CE approval.

TAB MOUNTING DIMENSIONS

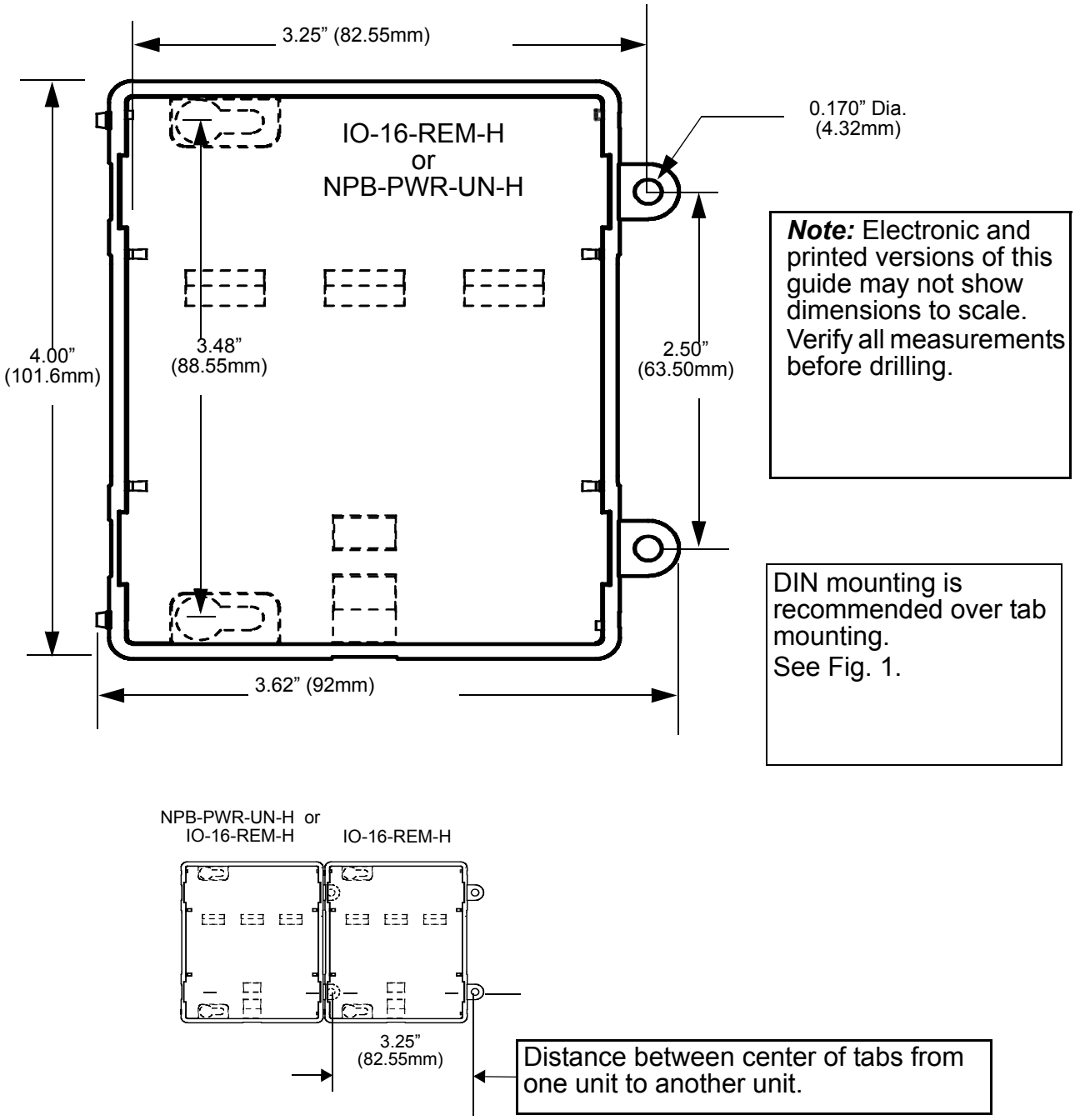


Fig. 14. Tab mounting dimensions.

Automation and Control Solutions
Honeywell International Inc.
1985 Douglas Drive North
Golden Valley, MN 55422

Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Toronto, Ontario M1V 4Z9
customer.honeywell.com

Honeywell

95-7768—03 M.S. Rev. 04-10
Printed in U.S.A.