IO-16-H Input/Output Module

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 4 analog outputs to proportionally control dampers, valves and other devices.

Up to 4 IO-16-H modules may be cascaded to a WEB-201 or WEB-600 controller, to provide a total of 32 UIs, 16 relays, and 16 analog output points.

BEFORE INSTALLATION

1. Unpack the IO-16-H Compact Direct Expansion Module.
2. Inspect contents of the package for damaged or missing components.
3. Check the equipment and report any damage to a Honeywell representative at once and return any damaged components for immediate repair or replacement. See RETURNING A DEFECTIVE UNIT section.
4. Read all of these instructions and ensure they are understood.

Included in this Package

The following items are included in this package:
- One IO-16-H module, with grounding wire having a quick-disconnect 0.187 in. (4.75 mm) female connector.
- INSTALLATION INSTRUCTIONS, literature no. 95-7723.
- Four 6-position terminal plugs, for I/O wiring.
- Eight 499-ohm resistors for 4-20 mA inputs.

Materials and Tools Required

The following tools and supplies are required for installation:
- DIN rail, type NS35/7.5 (1.4 in. x 0.3 in [35 mm x 7.5 mm]) recommended for mounting with a controller. The DIN rail should be of sufficient length to accommodate both the controller and all IO-16-H modules and other modules (Refer to Fig. 2).
- Suitable screw and screwdriver for mounting DIN rail, or if DIN rail not used, for mounting bases of the controller and IO-16-H module.
- Small flat-blade screwdriver: used for mounting or removing the IO-16-H module from DIN rail, also to screw terminals on I/O connectors

GENERAL

This document covers the mounting, wiring, and initial start-up of the IO-16-H 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 this entire document before beginning the installation procedures.

This document does not discuss software installation. For more information on these topics, refer to the documents listed in the RELATED DOCUMENTATION section.

PRODUCT DESCRIPTION

The Honeywell® IO-16-H is a compact direct I/O module for auxiliary monitoring and control when used with a WEB-201 and WEB-600 series controller or other controller platforms as identified in their respective data sheets. This option expands the controllers by an additional sixteen logic-controlled points. Included are 8 universal inputs, 4 form "A" (SPST) relay outputs and 4 analog (voltage only) outputs. This greatly expands the controllers monitoring and control capabilities with fast, reliable, direct inputs and outputs for monitoring power, temperature, humidity and status.

SAFETY INSTRUCTIONS

NOTES REGARDING DEVICE DESCRIPTION
These instructions include indications for use and mounting of the device. In case of questions that cannot be answered with these instructions, please consult the product supplier or manufacturer. It is the responsibility of the equipment installer to ensure that all federal, state and local codes are followed.

SAFETY INSTRUCTIONS
• Keep these Installation Instructions for industrial safety and the prevention of accidents.
• The information in these instructions must be read and understood by every person using this device.
• The following items share warnings of a general nature relating to the installation and start-up of the WEB-201 or WEB-600 series controller.
• Be sure to heed these warnings to prevent personal injury or equipment damage.

⚠ WARNING

A 24 Vac or 24 Vdc circuit powers the IO-16-H module and attached 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.

WEB 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 for any other purpose.

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-H 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.

I/O Module Connection Precautions.

⚠ CAUTION

Avoid "hot" plug-in or removal of any I/O module from the controller (or other I/O module), meaning first remove power from the unit. If the unit switches to battery operation, wait for all LEDs to go out.
Plugging or unplugging a I/O module from a powered controller should not cause damage to either the controller or I/O module hardware. However, note that all I/O modules are initialized upon station startup and if not (continuously) present following a power cycle, will be inoperable.

Do not plug in more than 4 IO-16-H modules into a single controller. 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 WEB-201 or WEB-600 controller 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, decreasing analog stability, and may introduce communication problems.

INSTALLATION AND START-UP OUTLINE

NOTE: If installing the controller and IO-16-H module at the same time, refer to the controller INSTALLATION INSTRUCTIONS document. A maximum of 4 IO-16-H modules are supported (Refer to Fig. 2).

The major steps to installing and starting the IO-16-H module are outlined as follows:
  1. Physically mount the IO-16-H module with the controller. See MOUNTING section. Make sure that the IO-16-H input connector is properly seated into the I/O connector on the controller (or if used, another IO-16-H module)

NOTE: Refer to the previous I/O Module Connector Precautions section.

  2. Make wiring connections for earth ground and I/O wiring. See WIRING section.
  3. Apply power and perform an initial checkout. See POWER UP AND INITIAL CHECKOUT section.

MOUNTING

The following applies to mounting a IO-16-H module with a controller:
• The units may be mounted in any orientation. It is not necessary to remove the covers before mounting.
• Mounting on a 1.4 in. (35 mm) wide DIN rail is recommended. Both the controller unit base and the IO-16-H unit base have a molded DIN rail slot and locking clip as does the NPB-PWR-H power supply module. Mounting a DIN rail ensures accurate alignment of connectors between all modules.
• If DIN rail mounting is impractical, use screws in mounting tabs on the controller then on the module. Mounting tab dimensions are shown in Fig. 1.
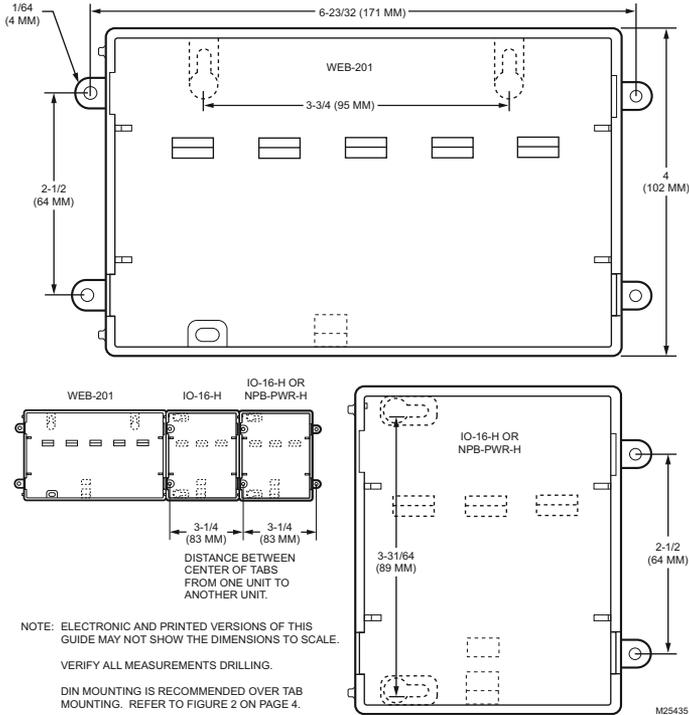
Fig. 1. Tab Mounting Dimensions in Inches (mm).

Procedure 1 provides step by step mounting instructions for the IO-16-H module on an existing installed DIN rail.

NOTES: If the WEB-201 or WEB-600 controller is already in use:
— Back up its configuration to your PC using Niagara AX™ Workbench 3.*n.nn.* This is done using a platform connection to the controller, using the backup command in the **Platform Administration** view.
— Turn off the power to the controller and disconnect the power cord. Be sure that all of the LEDs are off. Make sure that the controller is not running off of battery power.
If the controller is using a NPB-PWR-H module for power, remove it before mounting IO-16-H modules.

Procedure. 1. Din Rail Mount.

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Step 1	Remove the bottom I/O connector plug(s) that cover the plastic DIN locking clip.
Step 2	Position the IO-16-H module on the rail, tilting to hook DIN rail tabs over one edge of the DIN rail. (Refer to Figures 2 and 3)
Step 3	Use a screwdriver to pry down the plastic locking clip, and push down and in on the IO-16-H, to force the clip to snap over the edge of the DIN rail.
Step 4	Slide the IO-16-H along the DIN rail to connect its 20-position plug into controller connector (or if used, another IO-16-H module). If a NPB-PWR-H module is used it mounts last. Make sure that all modules are firmly seated.
Step 5	Continue to mount all IO-16-H modules and if used then mount the NPB-PWR-H module.
Step 6	To keep this assembly from sliding on the DIN rail, secure the last module with clips provided by the DIN rail vendor, or place a screw in one of the mounting tabs in the base of that module.
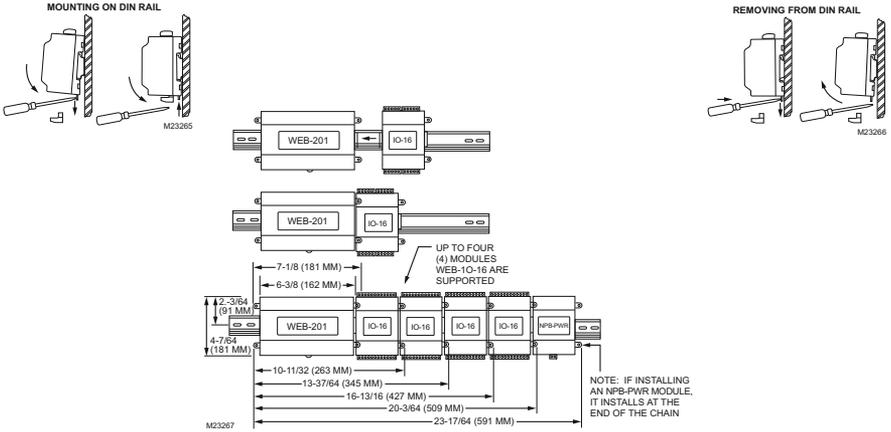
Fig. 2. IO-16-H Module Mounting Details.

NOTE: To remove IO-16-H 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 may be necessary to remove an I/O connector plug as shown at the top of Fig. 2.

BOARD LAYOUT AND TERMINAL LOCATIONS

The IO-16-H module provides 8 universal inputs supporting analog inputs (temperature, resistance, voltage and current) and digital inputs (contact closure, pulse count) and 8 outputs: 4 relay (24 Vac/cd, 0.5A max.) outputs and 4 analog outputs (0-10 Vdc). Wiring terminal positions are shown in Fig. 3, along with LED locations.
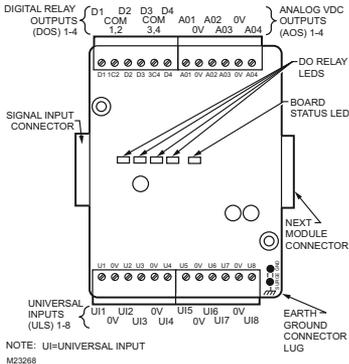

Fig. 3. IO-16-H Wiring Terminal Locations.

WIRING

See Fig. 3 to locate connectors and other components on the controller.

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

1. Connect the earth ground wire (with spade connector) from the earth ground lug on the IO-16-H module to a nearby earth ground point. See GROUNDING section for details.
2. Connect I/O wiring. See Inputs and Outputs sections.
3. Apply power to the unit. See POWER UP AND INITIAL CHECKOUT sections.

Grounding

An earth ground spade lug 0.187 in. (4.75 mm) is provided on the base of the IO-16-H module (as well as the controller, NPB-PWR-H connectors) for connection to earth ground. For maximum protection from electrostatic discharge or other forms of EMI, connect each earth ground using a 16 AWG (1.5 mm²) or larger wire. Keep these wires as short as possible. See Fig. 4 for the location of the earth grounding wire for the IO-16-H module.
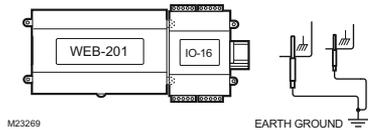

Fig. 4. IO-16-H Earth Ground Connection.

NOTE: Do not apply 24 V power (reapply power to the NPB-PWR-H or NPB-WPM-US) until all other wiring is completed, including IO-16-H inputs and outputs. See POWER UP AND INITIAL CHECKOUT section.

Inputs

Each of the 8 universal inputs (UI) can support any one of the following:
• Type-3 10K ohm Thermistor (also Resistive 0-100K ohms section)
• Resistive 0-100K ohms
• 0-0 Vdc
• 4-20 mA
• Binary Input

Thermistor

The inputs support 10K Thermistor temperature sensors using a **ThermistorInputPoint**. Input accuracy is in the range of ±1% of span. By default, conversion is for standard Type 3 thermistor sensor, with a sensor range of -10° to 135° F (23° to 57° C). Using a conversion type of "Tabular Thermistor", a different thermistor response curve can be specified 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. Customized thermistor xml files may be edited or exported (for reuse). See the Niagara AX Ndio Guide for more details. Fig. 5 shows the wiring diagram.
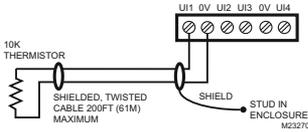

Fig. 5. Thermistor Wiring.

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 (See Fig. 5).

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 100-ohm or 1000-ohm type), resolution will be poor. To use such a sensor, it is recommended a transmitter that produces a Vdc or mA signal be installed. 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 ±2% of span, without user calibration. Fig. 6 shows the wiring diagram. 0-10 Vdc sensors requires a **VoltageInputPoint**.

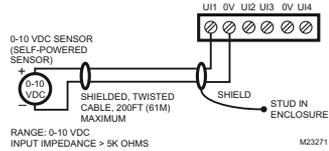**Fig. 6. 0-10 Vdc Wiring.**

4-20 mA

The inputs support self-powered 4-20 mA sensors. Input accuracy is ±2% of span, without user calibration. Fig. 7 shows the wiring diagram, which requires a 499 ohm resistor wired across the input terminals. 4-20 mA sensors also require the **VoltageInputPoint**.
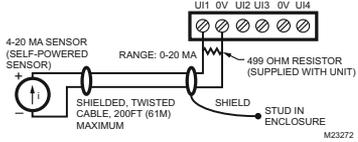

Fig. 7. 4-20 mA Wiring.

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 > 25 ms (contacts must remain open at least 25 ms and be closed at least 25 ms).

• Standard dry contacts must have a 1 Hz (or less) COS frequency, with minimum dwell time > 500 ms. (Contacts must remain open at least 500 ms and be closed at least 500 ms). Both types of dry contacts support 3.3 Vdc open circuits or 330 µA short-circuit current.

Fig. 8 shows the wiring diagram. For a pulse diagram contact use the **CounterInputPoint** in the station database. For other dry contacts, use the **BooleanInputPoint**.
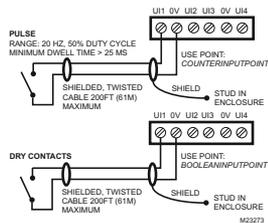

Fig. 8. Binary Input Wiring.

Outputs

The IO-16-H module has four digital relay outputs and four 0-10 volt analog outputs.

Relay Outputs

Each relay output is rated at 24 Vac or Vdc at 0.5 A. 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, 24 V maximum). Never use the controllers power transformer to power I/O loads. Using controller transformer introduces potentially damaging switching transients into the controller.

Use a **BooleanOutputWritable** in the station for each output. Fig. 9 shows an example wiring diagram.
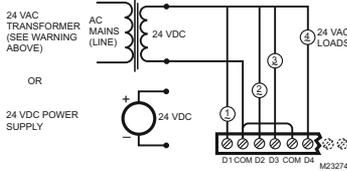

Fig. 9. Relay Output Wiring Diagram.

NOTE: 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 (Refer to Fig. 3), and also visible through the cover. Under normal operation, each digital status LED indicates activity as follows:
• **Off** - relay open/no current flows.
• **On** - relay closed/load current flows.
Therefore, an **On** status indicates that the load is powered.

Analog Outputs

Analog Outputs (AO) are referenced by the terminals labeled A*n* and 0 V (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 wiring for an AO is shown in Fig. 10. For each AO, use a **VoltageOutputWritable** in the station database.
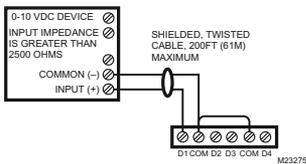

Fig. 10. Analog Output Wiring Diagram.

SOFTWARE DESCRIPTION

In the Niagara station interface to the controller, each I/O module appears as one **NdioBoard** under the station's **NdioNetwork**. If a controller has only one IO-16-H module, the **NdioNetwork** has a single **NdioBoard** component, where the "I/O Port" property of the **NdioBoard** is 1 (See Fig. 11).

Upon discovery, if the controller has multiple IO-16-H modules, the module closest to the controller is the first **NdioBoard** (property I/O Port **1**), the next module in the chain is **NdioBoard1** (property I/O Port **2**), and the third module is **NdioBoard2** (property I/O Port **3**) (See Fig. 11).
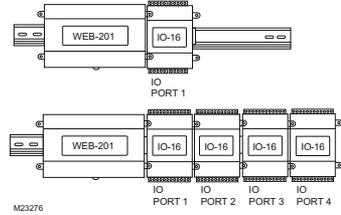

Fig. 11. WEB-201 Controller NdioBoard (Port) Assignment.

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 controller 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 WEB-I/O 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). Refer to Fig. 3 for location of the IO-16-H status LED.

Each type 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 needed for each input or output types 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

Step 1	Apply power to the WEB-201 or WEB-600 controller (e.g., NPB-PWR-H or NPB-WPM-US). The IO-16-H board status LED will initially be **Off** (Fig 3). Allow the controller sufficient time to boot (at least 2 minutes).
Step 2	Upgrade the controller firmware if necessary (if controller has a Niagara build earlier than the Workbench). Using a Workbench, open a platform connection to the controller. Use the **Commissioning Wizard** to do this. For more details, see the JACE® Niagara AX Install and Startup Guide, also available in the Workbench online HELP (doc Jace Startup). Make sure to install the Ndio software module.
Step 3	Verify that the IO-16-H 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 using **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 SOFTWARE DESCRIPTION section. For more details about Ndio components, refer to the Ndio Guide, also available in Workbench online Help (doc Ndio).

RELATED DOCUMENTATION

For more information on configuring and using WEB-201 and WEB-600 series controllers, consult the following documents:
• WEB-201 Installation Instructions.
• WEB-600 Installation Instructions.
• Niagara AX Ndio Guide
• Niagara AX User Guide
• JACE Niagara AX Installation and Startup Guide

REPLACEMENT PARTS

Servicing the IO-16-H modules may call for replacement parts. There are two categories of parts:
• Standard Replacement Parts
• New Replacement Units

New Replacement Units

To replace a faulty unit, order and install a new IO-16-H accessory module.

NOTE: WEB-201 and WEB-600 series products do not have special "field replacement units", or FRU's, with separate part numbers.

If the faulty IO-16-H module is still in warranty credit may be received by returning it to Honeywell. Be sure to contact Honeywell for a return authorization (RA) number before shipping an item for return credit. See RETURNING A DEFECTIVE UNIT section for details.

NOTE: Before ordering new IO-16-H module it is strongly recommended that normal technical support resources be used to eliminate the possibility of a software issue or mis-configuration problem.

MAINTENANCE

Module Replacement

⚠ **CAUTION**
Before handling circuit boards, discharge any accumulated static by touching the nearby earth grounding point. For details, see Static Discharge Precaution section.

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

Procedure. 2. Accessory Module Replacement

Step 1	Using the appropriate Niagara software tool, back up the station database to your PC.
Step 2	Remove power to the controller. The unit should power down automatically.
Step 3	Record positions of all controller wiring going to the IO-16-H module to be replaced, as well as for any other installed modules. If necessary, label connectors to avoid misconnection later (after IO-16-H module is replaced).
	The software that runs on the controller expects the terminal positions to be the same in the replacement IO-16-H module, in order to collect data from or to control the attached devices.
Step 4	If any I/O points have voltage, turn the devices off, or disconnect power to them.
Step 5	Unplug all connectors from the IO-16-H module, including all I/O connectors and earth ground wire.
Step 6	Remove any screws or DIN rail clips securing the IO-16-H module, removing it from its mounting.
Step 7	Mount the replacement IO-16-H module as it was previously, using the same DIN rail location and/or screws.
Step 8	Reconnect the earth ground wire to the IO-16-H grounding lug.
Step 9	Reconnect all I/O connectors to the IO-16-H module.
Step 10	If any of the I/O points have voltage, turn the devices back on, or reconnect power to them.
Step 11	Restore power to the IO-16-H module and perform a checkout using Niagara AX Workbench (see POWER UP AND INITIAL CHECKOUT section).
Step 12	For more details, see the Niagara AX Ndio Guide and JACE Niagara AX Install and Startup Guide.

RETURNING A DEFECTIVE UNIT

NOTES: If the defective unit is under warranty, follow return instructions provided in this section. If the unit is out of warranty, discard the unit.
— Do not return an out-of-warranty IO-16-H module to Honeywell.
— There is no "return for repair-and-return" service available for any of the WEB-201 or WEB-600 series products.

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

Prior to returning the unit, contact one of the Honeywell offices to obtain a return authorization (RA) number and other instructions. See last page of document for Honeywell contact information. Please provide:
• Product model
• Serial Number
• Number of the defect
• Nature of the defect

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CERTIFICATION AND DECLARATION OF CONFORMITY

⚠ WARNING

The IO-16-H module meets certification of the Federal Communications Commission (FCC), Canadian Department of Communications (DOC) and is included in an EC "Declaration of Conformity" for the WEB-201 or WEB-600 series controllers. For further details, please see these sections in the WEB-201 or WEB-600 Installation Instructions.

Honeywell