



# I/O Modules

## EXPANSION MODULES AND WIRING ADAPTER

### INSTALLATION INSTRUCTION AND COMMISSIONING GUIDE



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# GENERAL SAFETY INFORMATION

- When performing any work (installation, mounting, start-up), all manufacturer instructions and in particular these Installation and Commissioning Instructions are to be observed. Refer to the I/O modules mounting guide (31-00555).
- I/O module may be installed and mounted only by authorized and trained personnel.
- Rules regarding electrostatic discharge should be followed.
- If the I/O module is modified in any way, except by the manufacturer, all warranties concerning operation and safety are invalidated.
- Make sure that the local standards and regulations are observed at all times. Examples of such regulations are VDE 0800 and VDE 0100 or EN 60204-1 for earth grounding.
- It is recommended that devices be kept at room temperature for at least 24 hours before applying power. This is to allow any condensation resulting from low shipping/storage temperatures to evaporate.
- The I/O module must be installed in a manner (e.g., in a lockable cabinet) ensuring that unauthorized persons have no access to the terminals.
- Investigated according to United States Standard UL-60730-1, UL-916, and UL60730-2-9.
- Investigated according to Canadian National Standard(s) C22.2, No. 205-M1983 (CNL-listed).
- Do not open the I/O module, as it contains no user-serviceable parts inside.
- CE declarations according to LVD Directive 2014/35/EU and EMC Directive 2014/30/EU.
- Product standards are EN 60730-1 and EN 60730-2-9 for indoor use only.

## Professional Installation

- This device must be professionally installed, this should be noted on grantee.
- This device requires a significant technology engineering expertise towards understanding of the tools and relevant technology, not readily available to average consumer. Only a person professionally trained in the technology is competent.
- This device is not directly marketed or sold to general public.

## Safety Information as per EN60730-1

The I/O module is intended for residential, commercial, and light-industrial environments.

The I/O module is an independently mounted electronic control system with fixed wiring.

The I/O module is suitable for mounting in fuse boxes conforming with standard DIN43880 and DIN19, and having a slot height of max. 45 mm.

It is suitable for panel rail mounting on 35 mm standard panel rail (both horizontal and vertical rail mounting possible).

The I/O module is used for the purpose of building HVAC control and is suitable for use only in non-safety controls for installation on or in appliances.

**Table 1. Safety Information as per EN60730-1**

Electric Shock Protection	SELV
Pollution Degree	Pollution Degree 2, suitable for use in industrial environments.
Installation	Safety class: Evaluated in final product
Overvoltage Category	AC 230V for relay: Category II
Rated Impulse Voltage	330 V AC for Category I (SELV) 2500V AC for Relay output (DO)
Automatic Action	Type 1.B(micro-disconnection for relay)
Software Class	Class A
Enclosure	According to final product evaluation, meet requirements of IP20
Ball-pressure Test Temperature	>167 °F (75 °C) for all housing and plastic parts > 257 °F (125 °C) in the case of devices applied with voltage-carrying parts, connectors, and terminals.
Electromagnetic Interference	Tested at 230 Vac, with the modules in normal condition.
System Transformer	Europe: safety isolating transformers according to IEC61558-2-6 U.S.A. and Canada: NEC Class-2 transformers

## WEEE



### WEEE Directive 2012/19/EC Waste Electrical and Electronic Equipment Directive

- At the end of the product life, dispose of the packaging and product in an appropriate recycling center.
- Do not dispose of the device with the usual domestic refuse.
- Do not burn the device.

## Regulation (EC) No 1907/2006

According to Article 33 of REACH Regulation, be informed that this product may contain components with lead (CAS: 7439-92-1) content above the threshold level of 0.1% by weight.

# TECHNICAL SPECIFICATION

## Electrical Data

**Table 2. Electrical Data**

Operating Voltage (AC)	19 to 29 Vac (50/60Hz)
Operating Voltage (DC)	19 to 29 Vdc
Overvoltage Protection	Protected against overvoltages of max. 29 Vac or 40 Vdc. Terminals protected against short-circuiting.

## Power Consumption

**Table 3. Power Consumption**

Device	Device Status	Current (Max)		Power (Max)	
		24 Vac (mA)	24 Vdc (mA)	24 Vac (VA)	24 Vdc (W)
16DI	All inputs ON	380	125	9	3
16UIO - HOA/NO N HOA	All channels set to AO 20mA	1000	500	24	12
8DO - HOA/NO N HOA	All relays ON	330	120	8	3
16UI	All inputs ON	760	340	18	8

## Operating Environment

**Table 4. Operating Environment**

Ambient Operating Temperature	-40 to 150 °F (-40 to 65.5°C) for non-HOA variants, Wiring Adapter, and Auxiliary terminal block. -4 to 150 °F (-20 to 65.5°C) for HOA variants.
Ambient Operating Humidity	5 to 95% relative humidity (non-condensing)
Shipping and Storage Temperature	-40 to 158 °F (-40 to 70 °C) for I/O modules, Wiring Adapter, and Auxiliary terminal block.
Vibration Under Operation	0.024" double amplitude (2 to 30 Hz), 0.6 g (30 to 300 Hz)
Dust, Vibration	According to EN60730-1

**Table 4. Operating Environment (Continued)**

RFI, EMI	Commercial, light, industrial, residential environments
Elevation	Up to 13123 ft (4000 meters) from sea level.
MTBF (Mean Time Between Failure)	11.5 years

## Standards

**Table 5. Standards**

Protection Class	According to final product evaluation, meet requirements of IP20
Emission & Electrical Compliance	<ul style="list-style-type: none"> <li>CE               <ul style="list-style-type: none"> <li>EMC - EN61326-1:201X Immunity: Table 2 - For equipment intended use in industrial location Emission: Class B</li> <li>EMC- Immunity and Emission EN60730-1</li> <li>EMC- EN55032 Class B</li> <li>EMC- Emission EN61000-6-3</li> <li>EMC- Immunity EN61000-6-2</li> </ul> </li> <li>Safety - EN61010-1:201X; EN60730-1;</li> <li>America               <ul style="list-style-type: none"> <li>UL - UL916, UL60730-1, UL60730-2-9</li> <li>Emission - FCC Part 15B-Class B</li> </ul> </li> </ul>
Certification	<ul style="list-style-type: none"> <li>IEC68</li> <li>EN 60730-1</li> <li>EN 60730-2-9</li> <li>FCC Part 15, Subpart B</li> <li>CAN ICES-3 (B)/NMB-3(B)</li> <li>EN 61326-1</li> <li>EN 61010-1</li> <li>EN 301 489-1</li> <li>EN 301 489-17</li> <li>EN 300 328 V2.2.2:2019</li> <li>RoHS II: 2011/65/EU</li> <li>REACH 1907/2006</li> <li>EN ISO 16484-2:2004, section 5.4.3</li> <li>UL 916</li> <li>CSA C22.2 No. 205</li> <li>UL 60730-1</li> <li>CAN/CSA E60730-1</li> <li>UL 60730-2-9</li> <li>CAN/CSA-E60730-2-9:18</li> <li>CAN/CSA-E60730-1:02</li> </ul>
System Transformer	The system transformer(s) must be safety isolating transformers according to IEC 61558-2-6. In the U.S.A. and Canada, NEC Class 2 transformers must be used.
Mounting compliances	DIN43880 and DIN19



# INTERFACES

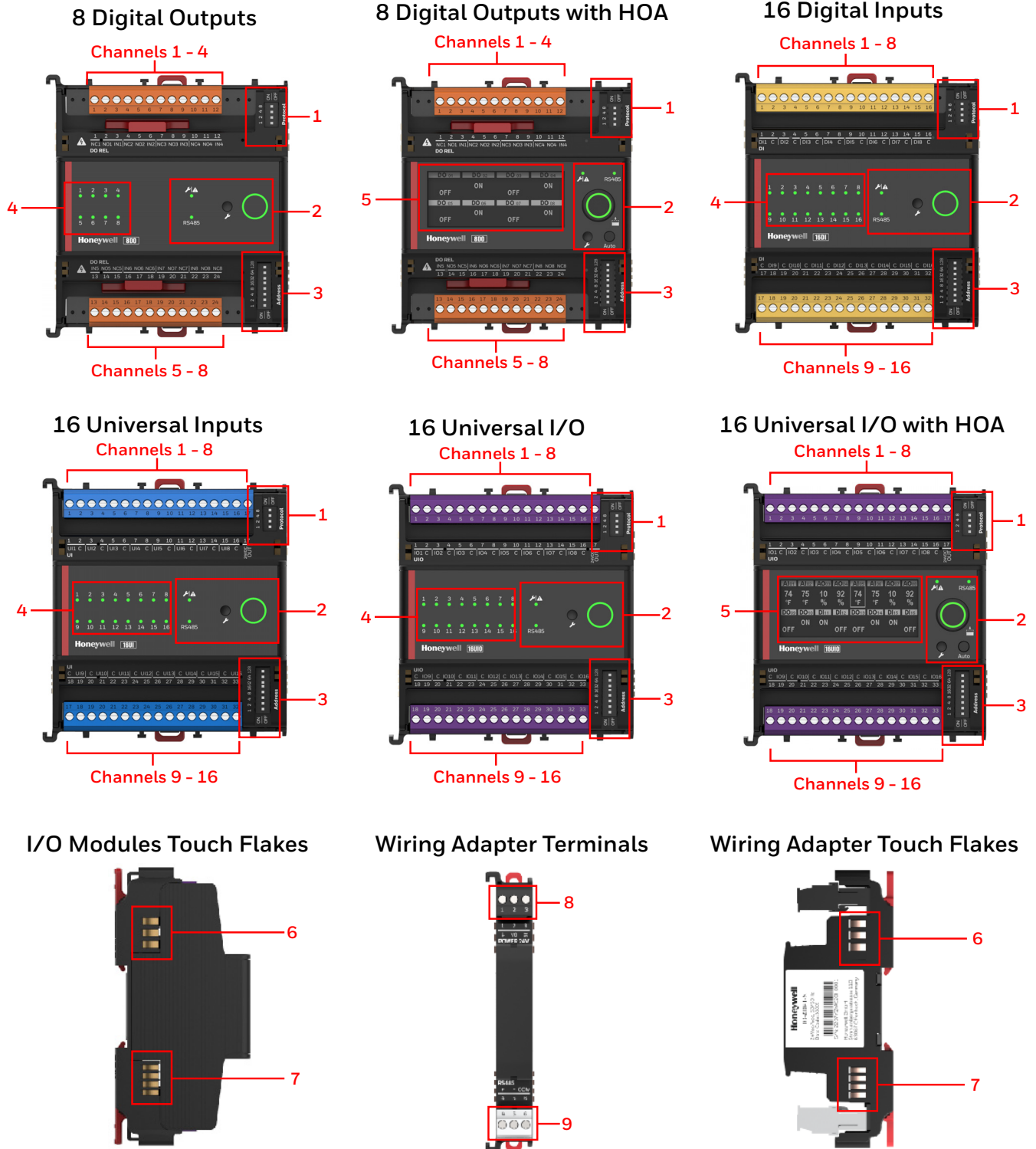







Fig. 1. I/O Modules and Wiring Adapter

Table 6. I/O Module and Wiring Adapter Terminals

Type	Legend	Signal	Description
Protocol	1		Protocol DIP Switch (4-bit)
LED/Button	2	Service LED	Service status of the I/O module.
		RS485 LED	Transmit and receive indication for RS485 communication.
		Ring LED	Indicates the operational status of the I/O module.
		Auto button	Auto button returns the selected channel to the Auto mode. NOTE: HOA I/O modules only
		Rotary dial	Rotate to the desired channel; then press to select the channel. Rotate to manually override the channel; press to exit to the main screen. DO channels can be set to ON or OFF. AO channels can be set between 0 to 100%. NOTE: HOA I/O modules only
		Service button	Reset the device to factory default.
Address	3		Address DIP switch (8-bit)
LED	4	LED	Transmit and receive signal of Input/Output (Off, Green, Yellow, and Red)
Hand-Off-Auto	5	Backlit Display	Displays the status of each channel, the type of point (AO, DO, AI, DI) and an indication if the channel is manually overridden (hand icon) with reverse background.
Wiring Adapter / I/O Module (Touchflakes - Power Terminals) NOTE: Touchflake connections extend power to the I/O modules	6		Power supply (24 Vac/dc)
		V0	Power supply common
			Connect to earth ground in the field
Wiring Adapter / I/O Module (Touchflakes - Comm Terminals)	7	T1L(+)	Pass through connection to T1L I/O modules (future).
		T1L(-)	
		RS485(+)	Touch flake connections extend RS485 communications from the Advanced Plant Controller to the I/O modules.
		RS485(-)	
Wiring Adapter Power Supply Terminals	8		Connect to earth ground in the field
		V0	Power supply common
			Power supply (24 Vac/dc)
Wiring Adapter RS485 Interface Terminals	9	COM	Common
		RS485(-)	(-) for RS485 interface
		RS485(+)	(+) for RS485 interface

## Service Button

The I/O module has a physical service button  to reset the device to factory default.

In most cases, a factory reset can be achieved while keeping power on to the I/O module. This is the recommended method as it is easier to perform the reset.

In some side cases (i.e. - application locked up), the only way that a device will reset is if power is interrupted to the I/O module first. If the I/O module did not reset with the recommended method, only then try resetting using the alternative method.

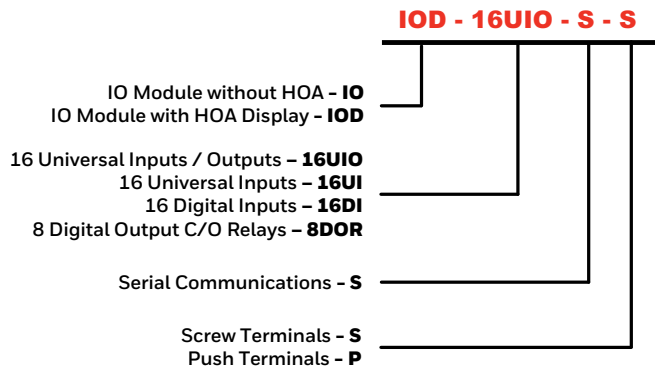
**With Power On (Recommended method):** Press and hold the service button for 10-15 seconds until the service LED blinks Green, then release the button and short press the service button within 5 seconds to confirm the reset to factory default.

**With Power Off (Alternative method):** Press and hold the service button, continue to press and hold the service button while turning power on to the I/O module. Continue holding the service button for 10-15 seconds until the service LED blinks Green, then release the button and short press the service button within 5 seconds to confirm the reset to factory default.

The reset performs the following operations:

- Resets the local I/O configuration
- Keeps the current firmware version
- Erases historical data

## Nomenclature



## I/O Module Part Numbers

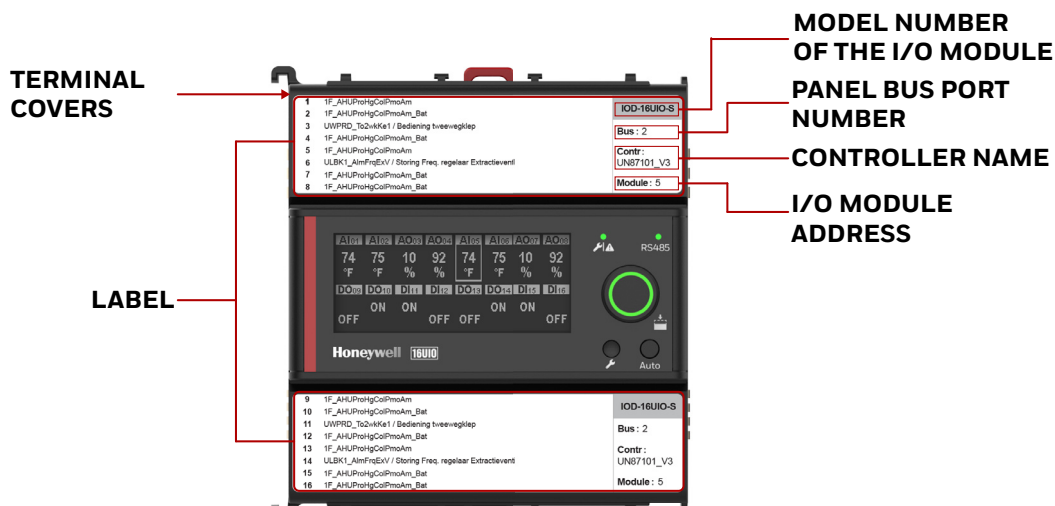
Table 7. I/O Module Part Numbers

Part Number	Description
IO-16UIO-S-S	16UIO I/O Module without HOA, Serial Comms, Screw Terminals
IOD-16UIO-S-S	16UIO I/O Module with HOA Display, Serial Comms, Screw Terminals
IO-16UI-S-S	16UI I/O Module, Serial Comms, Screw Terminals
IO-16DI-S-S	16DI I/O Module, Serial Comms, Screw Terminals
IO-8DOR-S-S	8DO I/O Module without HOA, C/O Relays, Serial Comms, Screw Terminals
IOD-8DOR-S-S	8DO I/O Module with HOA Display, C/O Relays, Serial Comms, Screw Terminals
IO-16UIO-S-P	16UIO I/O Module without HOA, Serial Comms, Push Terminals
IOD-16UIO-S-P	16UIO I/O Module with HOA Display, Serial Comms, Push Terminals
IO-16UI-S-P	16UI I/O Module, Serial Comms, Push Terminals
IO-16DI-S-P	16DI I/O Module, Serial Comms, Push Terminals
IO-8DOR-S-P	8DO I/O Module without HOA, C/O Relays, Serial Comms, Push Terminals
IOD-8DOR-S-P	8DO I/O Module with HOA Display, C/O Relays, Serial Comms, Push Terminals

## I/O Terminal Cover Labels

CPO Studio and Niagara Workbench provide the option to print out I/O Terminal Labels. The printed labels include:

- Model number of the IO module
- Panel Bus port number
- Controller name
- I/O module address
- Point name
- Option to include or not include the description of the point



**Fig. 2. Terminal Cover Labels**

The labels can be applied to the terminal covers of the I/O module. The labels can be created from the CPO Studio engineering tool (refer to CPO Studio user guide (en2b0001-ie10)), or from the Niagara workbench (refer to Panel Bus Driver user guide (31-00591-01)).

### PRINT STANDARD FOR LABEL

- Template Number: Avery label Presta® 94202.
- Paper Size: 1"x4" (25.4mm x 101.6mm) Blank Rectangle Labels.
- Material: Removable Matte White Paper

## Supported Sensors (Sensor Scaling in the I/O Module)

**Table 8. Supported Sensors**

Type	Sensor	Model/Type	Range
Thermistor Input	Temperature	NTC2K ohm	-49 to 125.6 °F (-45 to 52 °C)
	Temperature	NTC3K ohm	-34.6 to 240 °F (-37 to 115.5 °C)
	Temperature	10K3A1	-40 to 257 °F (-40 to 125 °C)
	Temperature	NTC10K ohm Type 2	-40 to 230 °F (-40 to 110 °C)
	Temperature	NTC10K ohm PRECON Type 2	-34.6 to 240 °F (-37 to 115.5 °C)
	Temperature	NTC10K ohm Type 3	-34.6 to 240 °F (-37 to 115.5 °C)
	Temperature	NTC20K ohm	-58 to 302 °F (-50 to 150 °C)
	Temperature	NTC20K ohm PRECON Type 4	-9.4 to 230 °F (-23 to 110 °C)
	Temperature	PT100	-58 to 482 °F (-50 to 250 °C)
	Temperature	PT1000 (IEC751 3850)	-40 to 199.4 °F (-40 to 93 °C)
	Temperature	PT1000-1	-58 to 302 °F (-50 to 150 °C)
	Temperature	PT1000-2	32 to 752 °F (0 to 400 °C)
	Temperature	PT3000	-58 to 302 °F (-50 to 150 °C)
	Temperature	NI1000TK5000	-22 to 266 °F (-30 to 130 °C)
	Temperature	NI1000TK6180	-40 to 302 °F (-40 to 150 °C)
	Temperature	Nickel Class B DIN 43760	-76 to 336.2 °F (-60 to 169 °C)
	Temperature	BALCO 500	-40 to 302 °F (-40 to 150 °C)
	Temperature	Johnson A99	-40 to 248 °F (-40 to 120 °C)
Current Input	Light Sensor	ALS-300 (708100000); 19.25 to 4.25 mA	0 to 300 fc
	Light Sensor	ALS-1.5K (708101000); 19.25 to 4.25 mA	0 to 1500 fc
	Space Light Sensor	LLO; 4 to 20 mA	0 to 1000 lux
	Space Light Sensor	LLO; 4 to 20 mA	0 to 2000 lux
	Space Light Sensor	LLO; 4 to 20 mA	0 to 4000 lux
	Space Light Sensor	LLO; 4 to 20 mA	0 to 8000 lux
	Space Light Sensor	LLO; 4 to 20 mA	0 to 20000 lux
	Outdoor Light Sensor	LLS; 4 to 20 mA	0 to 1000 lux
	Outdoor Light Sensor	LLS; 4 to 20 mA	0 to 2000 lux
	Outdoor Light Sensor	LLS; 4 to 20 mA	0 to 4000 lux

**Table 8. Supported Sensors (Continued)**

<b>Type</b>	<b>Sensor</b>	<b>Model/Type</b>	<b>Range</b>
Current Input	Outdoor Light Sensor	LLS; 4 to 20 mA	0 to 8000 lux
	Outdoor Light Sensor	LLS; 4 to 20 mA	0 to 20000 lux
	Pressure	MLH050PSCDJ1235; 4 to 20 mA	0 to 50 psig
	Pressure	MLH150PSCDJ1236; 4 to 20 mA	0 to 150 psig
	Pressure	MLH300PSCDJ1237; 4 to 20 mA	0 to 300 psig
	Pressure	MLH500PSCDJ1240; 4 to 20 mA	0 to 500 psig
	Pressure	MLH01KPSCDJ1241; 4 to 20 mA	0 to 1000 psig
Voltage Input	CO2	0 to 10 Vdc	0 to 2000 ppm
	Relative Humidity	0 to 10 Vdc	0 to 100%
	Relative Humidity	2 to 10 Vdc	0 to 100%
	Pressure	0 to 10 Vdc	0 to 5 inches of WC
	Pressure	0 to 10 Vdc	0 to 2.5 inches of WC
	Pressure	0 to 10 Vdc	0 to 0.25 inches of WC
	Pressure	7330900; 1 to 5 Vdc	0 to 100 psig
	Pressure	7330910; 1 to 5 Vdc	0 to 400 psig
	Pressure	RCC-SP150-2; 0.5 to 4.5 Vdc	0 to 150 psig
	Pressure	RCC-SP150-5; 0.5 to 4.5 Vdc	0 to 150 psig
	Pressure	RCC-SP150-M; 0.5 to 4.5 Vdc	0 to 150 psig
	Pressure	RCC-SP300-2; 0.5 to 4.5 Vdc	0 to 300 psig
	Pressure	RCC-SP300-5; 0.5 to 4.5 Vdc	0 to 300 psig
	Pressure	RCC-SP300-M; 0.5 to 4.5 Vdc	0 to 300 psig
	Pressure	RCC-SP500-2; 0.5 to 4.5 Vdc	0 to 500 psig
	Pressure	RCC-SP500-5; 0.5 to 4.5 Vdc	0 to 500 psig
	Pressure	RCC-SP500-M; 0.5 to 4.5 Vdc	0 to 500 psig

## I/O Characteristics

**Table 9. I/O Characteristics**

I/O Type	Sensor Type
Analog input	<ul style="list-style-type: none"> <li>• Software configurable as a Voltage Input, Current Input or as a Thermistor Input</li> <li>• Voltage Input: <ul style="list-style-type: none"> <li>— 0 to 10 Vdc (Direct/Reverse)</li> <li>— 2 to 10 Vdc (Direct/Reverse)</li> <li>— 16 bit resolution</li> <li>— Custom characteristic available in the tool</li> <li>— Minimum resolution of 0.01 volts for 0-10 and 2-10 volt types</li> <li>— +/-0.4% of FSR for voltage input</li> </ul> </li> <li>• Current Input: <ul style="list-style-type: none"> <li>— 0 to 20 mA (Direct/Reverse)</li> <li>— 4 to 20 mA (Direct/Reverse)</li> <li>— 0 to 10 mA (Direct/Reverse)</li> <li>— 4 to 10 mA (Direct/Reverse)</li> <li>— 16 bit resolution</li> <li>— Custom characteristic available in the tool</li> <li>— +/- 0.5% of FSR (Full Scale Range)</li> </ul> </li> <li>• Accuracy <ul style="list-style-type: none"> <li>— 0 ohm to 80 ohm, 0.5%, +/- 0.5 ohm</li> </ul> </li> <li>• Thermistor Input: <ul style="list-style-type: none"> <li>— 16 bit resolution</li> <li>— Input range 0 to 1M ohm</li> <li>— Custom characteristic available in the tool</li> <li>— &lt;= 1% of accuracy</li> </ul> </li> <li>• Configurable offset per Input</li> </ul>
UIO/Digital Input	<ul style="list-style-type: none"> <li>• UIO/DI channels work with volt-free contacts, logic circuits, open collector (transistor), or open-drain (FET).</li> <li>• MSI and Accumulator points are displayed as DI points on the HOA display.</li> </ul> <p><b>Dry contact 0 to 10Vdc typical (40Vdc maximum) - Direct/Reverse</b></p> <ul style="list-style-type: none"> <li>— Closed contact: &lt;= 500 ohm. Voltage: 0 to 2 Vdc. Short circuit current: &gt;= 4mA</li> <li>— Wetting current: 3.5mA</li> <li>— Open contact: &gt;= 3K ohm. Voltage: 4 to 40 Vdc</li> </ul> <p><b>Voltage input 0 to 10 Vdc typical (40 Vdc maximum) - Direct/Reverse</b></p> <ul style="list-style-type: none"> <li>— Voltage: 0 to 2 Vdc. Short circuit current: &gt;= 4mA</li> <li>— Voltage: 4 to 40 Vdc or open circuit</li> </ul> <p><b>Pulse inputs with totalizing</b></p> <ul style="list-style-type: none"> <li>— 100Hz max. Minimum duty cycle (50%/50%) = 5ms ON / 5ms OFF</li> </ul>

**Table 9. I/O Characteristics (Continued)**

I/O Type	Sensor Type
Digital Output	<ul style="list-style-type: none"> <li>• Supports a mix of low voltage and line voltage loads in the same I/O module. Channels 1-4 are Relay Block 1 and Channels 5-8 are Relay Block 2. Wire low voltage to Relay Block 1 and line voltage to Relay Block 2 or vice versa. Do not mix low and line voltage in the same Relay Block. For wiring drawing, see “DO Module Wiring Connection” section on page 32.</li> <li>• Max Load for 8DO Module (Total): <ul style="list-style-type: none"> <li>— 19 to 250 Vac: 12A</li> <li>— 12 to 29 Vdc: 12A</li> </ul> </li> <li>• <b>Channels 1-4; 6-8 Relay Rating:</b> <ul style="list-style-type: none"> <li>— Rating per Relay for Normally Open and Normally Closed Contacts</li> </ul> </li> <li>• 19 to 250 Vac <ul style="list-style-type: none"> <li>— 5 Amp Max Resistive</li> <li>— 3 Amp Max Inductive</li> <li>— Inrush - 7.5A</li> <li>— Minimum Load 10mA</li> </ul> </li> <li>• 12 to 29 Vdc <ul style="list-style-type: none"> <li>— 5 Amp Max Resistive</li> <li>— 3 Amp Max Inductive</li> <li>— Inrush - 7.5A</li> <li>— Minimum Load 10mA</li> </ul> </li> <li>• <b>Channel 5 Relay Rating:</b> <ul style="list-style-type: none"> <li>— Rating per Relay for Normally Open and Normally Closed Contacts</li> </ul> </li> <li>• 19 to 250 Vac <ul style="list-style-type: none"> <li>— 10 Amp Max Resistive</li> <li>— 6 Amp Max Inductive</li> <li>— Inrush - 15A</li> <li>— Minimum Load 10mA</li> </ul> </li> <li>• 12 to 29 Vdc <ul style="list-style-type: none"> <li>— 10 Amp Max Resistive</li> <li>— 6 Amp Max Inductive</li> <li>— Inrush - 15A</li> <li>— Minimum Load 10mA</li> </ul> </li> <li>• Any two DO channels are software configurable for floating control (one channel in the open direction and the other channel in the close direction). Open Run Time and Close Run Time are set in the Niagara tool. Not available in the CPO Studio tool.</li> <li>• Supports a software configurable safety position per DO channel in the event of a communication loss with the controller.</li> <li>• MSO points are displayed as DO points on the HOA display.</li> </ul>
UIO/Analog Output	<ul style="list-style-type: none"> <li>• Software configurable as a Voltage Output, Current Output or as a Floating Output</li> <li>• Voltage Output: (+/- 1mA) <ul style="list-style-type: none"> <li>— 0 to 11 Vdc (Direct/Reverse)</li> <li>— 0 to 10 Vdc (Direct/Reverse)</li> <li>— 1 to 10 Vdc (Direct/Reverse)</li> <li>— 2 to 10 Vdc (Direct/Reverse)</li> <li>— 13 bit resolution</li> </ul> </li> <li>• Current Output: <ul style="list-style-type: none"> <li>— 0 to 20 mA (Direct/Reverse)</li> <li>— 4 to 20 mA (Direct/Reverse)</li> <li>— 13 bit resolution</li> </ul> </li> <li>• Supports a software configurable safety position per UIO (AO) channel in the event of a communication loss with the controller.</li> </ul>
UIO	<ul style="list-style-type: none"> <li>• AI, AO, DI, and DO option per UIO channel</li> <li>• Digital Output Option of 0 to 10 Vdc with a max output of 20mA.</li> <li>• Any two of the UIO channels are software configurable as Digital Outputs for floating control (one channel in the open direction and the other channel in the close direction). Open Run Time and Close Run Time are set in the Niagara tool. Not available in the CPO Studio tool.</li> <li>• Supports a software configurable safety position per UIO (AO/DO) channel in the event of a communication loss with the controller</li> <li>• 24VDC/GND for externally powered sensors</li> </ul>



## General Information on the RS485 Standard

According to the RS485 standard (TIA/EIA-485: "Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems"), only one driver communicating via an RS485 interface may transmit data at a time. Further, according to U.L. requirements, each RS485 interface may be loaded with a max. of 32 unit loads.

RS485 systems frequently lack a separate signal reference wire. However, the recommended wiring is to provide a solid signal ground (signal reference) connection in order to ensure error-free communication between drivers and receivers – unless all of the devices are electrically isolated and no earth grounding exists.

**Table 10. Baud rate vs. max. cable length for RS485**

Baud Rate	Max. Cable Length (L)
115.2 kbps	2625 ft (800 m)
In the case of configuration of RS485 interface of an I/O module for Panel Bus, the communication rate will be automatically set to 115.2 Kbps.	

For information on wire gauge, max. permissible cable length, possible shielding and grounding requirements, and the max. number of devices which can be connected to a bus, refer to standard EIA-485.

## POWER SUPPLY (EXTERNAL)



### WARNING

Risk of electric shock or equipment damage!

## Transformers

### Honeywell Transformers

A transformer can power the I/O module. When determining total current consumption and selecting the appropriate transformer, take into account the number of connected modules, accessories, and field devices.

NOTE: In Europe, system transformer(s) must be safety isolating transformers according to IEC61558-2-6. In the U.S.A. and Canada, NEC Class-2 transformers must be used.

**Table 11. Honeywell CRT Series Transformers (Europe)**

Part No.	Primary Side	Secondary Side
CRT 2	220/230 Vac	24 Vac, 50 VA, 2 A
CRT 6	220/230 Vac	24 Vac, 150 VA, 6 A
CRT 12	220/230 Vac	24 Vac, 300 VA, 12 A

**Table 12. Honeywell 1450 Series Transformers (N. America)**

Part No. 14507287	Primary Side	Secondary Side
-001	120 Vac	24 Vac, 50 VA
-002	120 Vac	2 x 24 Vac, 40 VA; 100 VA from separate transformer
-003	120 Vac	24 Vac, 100 VA; 24 Vdc; 600 mA
-004	240/220 Vac	24 Vac, 50 VA
-005	240/220 Vac	2 x 24 Vac, 40 VA; 100 VA from separate transformer
-006	240/220 Vac	24 Vac, 100 VA; 24 Vdc, 600 mA

NOTE: Standard commercially available transformers can power the I/O module.

## Switch Mode Power Supply

To reduce overall current consumption, the I/O module can be powered by a switch mode dc power supply (rather than by a transformer). For Europe, refer to the below table.

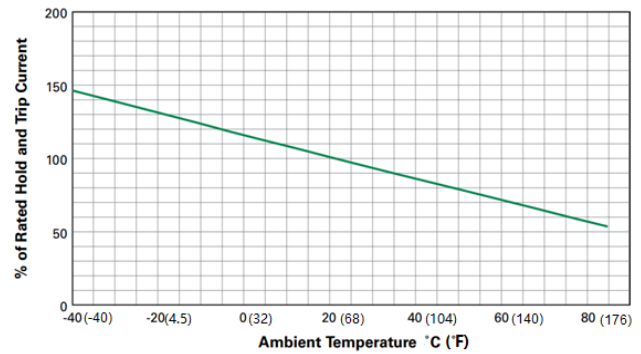
**Table 13. Recommended Power Supply**

Model Number	DCPSU-24-1.3	DCPSU-24-2.5	DCPSU-24-4
Derating input voltage	Max. 1 A (<100 Vac)	Max. 2 A (<100 Vac) 1.8 A (<90 Vac)	Max. 3.5 A (<100 Vac) 3 A (<90 Vac)
Rated input current (nominal load) 110/230 Vac	0.7/0.5 A	1.4/0.6 A	1.6/0.9 A
Internal fuse	2 AT		4 AT
Mains drop compensation at nominal load 110/230 Vac	10/80 ms		18/100 ms
Rated output current	1.3 A <113 °F (45 °C) 0.9 A <131 °F (55 °C)	2.5 A <113 °F (45 °C) 1.75 A <131 °F (55 °C)	4 A <113 °F (45 °C) 2.8 A <131 °F (55 °C)
Efficiency	82% typ.		88% typ.

## I/O MODULE POWER CONSUMPTION

**Table 14. Plant controller & Wiring Adapter Resettable Fuse Current Rating vs Temperature**

Device		Temperature	Current Rating (A)
Wiring Adapter	NA	-40 °F (-40 °C)	5.1
	Controller	-22 °F (-30 °C)	4.8
		-4 °F (-20 °C)	4.5
		-14 °F (-10 °C)	4.2
		32 °F (0 °C)	3.9
		50 °F (10 °C)	3.6
		68 °F (20 °C)	3.4
		86 °F (30 °C)	3
		104 °F (40 °C)	2.6
		140 °F (60 °C)	2.2
	NA	150 °F (65.5 °C)	2



**Fig. 3. Temperature Derating Curve**

## I/O Module Basic Power Consumption

**Table 15. I/O Module Basic Current Consumption per I/O Module**

I/O Module Types	Basic Current Consumption		
	Input/Output Status	Current @24VAC (A)	Current @ 24VDC (A)
IO-16UIO-S-S IOD-16UIO-S-S IO-16UIIO-S-P IOD-16UIO-S-P	No channels enabled	0.31	0.1
IO-16DI-S-S IO-16DI-S-P	No channels enabled	0.14	0.045
IO-8DOR-S-S IOD-8DOR-S-S IO-8DOR-S-P IOD-8DOR-S-P	No channels enabled	0.135	0.04
IO-16UI-S-S IO-16UI-S-P	No channels enabled	0.31	0.1

## Power Consumption of 1 (single) Channel

**Table 16. Power Consumption of 1 (single) Channel**

I/O Module Types	1 Channel Current Consumption		
	Input/Output Status	Current @ 24VAC (A)	Current @ 24VDC (A)
IO-16UIO-S-S IOD-16UIO-S-S IO-16UIIO-S-P IOD-16UIO-S-P	1 Channel Configured as AO/DO (max 10V&20mA)	0.035	0.02
	1 Channel Configured as AI (Thermistor/Voltage sensor/Current sensor)	0.02	0.01
	1 Channel Configured as DI - Contact Closed	0.02	0.01
IO-16DI-S-S IO-16DI-S-P	1 DI Contact Closed	0.015	0.005
IO-8DOR-S-S IOD-8DOR-S-S IO-8DOR-S-P IOD-8DOR-S-P	1 Relay Output Enabled	0.025	0.01
IO-16UI-S-S IO-16UI-S-P	1 Channel Configured as AI (Thermistor/Voltage sensor/Current sensor)	0.02	0.01
	1 Channel Configured as DI - Contact Closed	0.02	0.01

## Current Consumption Calculation

Add Basic Current Consumption (Table 15) + 1 Channel Current Consumption (Table 16) \* Number of channels.

NOTE: If UIO 24VDC/75mA output interface are full loaded, add +0.12A for 24VAC power and +0.08A for 24VDC power;

## I/O Module Maximum Current Consumption

Table 17. I/O Module Maximum Current Consumption per I/O Module

I/O Module Types	Maximum Current Consumption from All Channels including the IO Module		
	Input/Output Status	Current @24VAC (A)	Current @ 24VDC (A)
IO-16UIO-S-S IOD-16UIO-S-S IO-16UIIO-S-P IOD-16UIO-S-P	All 16 Channels Configured as AO/DO (max 10V&20mA)	1	0.5
	All 16 Channels Configured as AI (Thermistor/Voltage sensor/Current sensor)	0.76	0.34
	All 16 Channels Configured as DI - Contacts Closed	0.76	0.34
IO-16DI-S-S IO-16DI-S-P	All 16 DI Contacts Closed	0.38	0.125
IO-8DOR-S-S IOD-8DOR-S-S IO-8DOR-S-P IOD-8DOR-S-P	All 8 Relay Outputs Enabled	0.33	0.12
IO-16UI-S-S IO-16UI-S-P	All 16 Channels Configured as AI (Thermistor/Voltage sensor/Current sensor)	0.76	0.34
	All 16 Channels Configured as DI - Contacts Closed	0.76	0.34

## WIRING AND SET-UP

### General Safety Considerations

- When connecting the I/O module, VDE, National Electric Code (NEC) or equivalent, and any local regulations concerning grounding must be observed.
- Only qualified electricians may carry out electrical work.
- The electrical connections must be made at the terminals of the I/O module.
- For Europe, only: To comply with CE requirements, devices with a voltage in the range of 50 to 1000 Vac or 75 to 1500 Vdc and which are not provided with a supply cord and plug or with other means for disconnection from the supply having a contact separation of at least 3 mm in all poles must have the means for disconnection incorporated in the fixed wiring.
- Only copper conductors should be used for electrical connection.
- Only electrical cables/wires with operating temperature at least 75° C should be used for electrical connection.

### WARNING

#### Risk of electric shock or equipment damage!

- The controller and other devices on the DIN Rail must be powered off before mounting the I/O modules.
- Do not touch any live parts in the cabinet.
- Disconnect the power supply before making connections to or removing connections from I/O module terminals.
- Do not use spare terminals as wiring support points.
- Do not reconnect the power supply until you have completed the power supply.



## CAUTION

Observe the precautions for handling electrostatic devices.

## Wiring Terminals

The I/O modules features both screw-type terminals and push-in terminals.

**Table 18. Wiring and Power Supply Terminals Specifications for DI/DO/UIO/UI Modules & Wiring Adapter**

Terminal Type	Stripping Length	Torque Value	Max.Plug Gauge
Screw	0.236-0.275" (6-7mm)	4.425 lb-in (0.5 N-m)	12(3.33mm <sup>2</sup> )-26AWG(0.13mm <sup>2</sup> ) (UL) 0.2mm <sup>2</sup> - 2.5mm <sup>2</sup> (IEC)
Push-in	0.314-0.354" (8-9mm)	N/A	Solid wiring: 14(2.08mm <sup>2</sup> )-26AWG(0.13mm <sup>2</sup> ) (UL) 0.2 mm <sup>2</sup> -2.5 mm <sup>2</sup> (IEC) Stranded wiring: 14(2.08mm <sup>2</sup> )-24AWG(0.20mm <sup>2</sup> ) (UL) 0.2 mm <sup>2</sup> -2.5 mm <sup>2</sup> (IEC)

Terminals support both flexible and solid cables. Wires can be equipped additionally with ferrules.

## Connecting Power Supply

Connect the power supply to the power supply terminals of the I/O module.

## Earth Grounding

The I/O module comply with SELV (Safety Extra-Low Voltage), so protective earth grounding is not required. However, a functional earth grounding for EMC is mandatory. For more information, see "Appendix: Earth Grounding" section on page 44.

## Cable Specifications

### Power Supply Cable Specifications

The length of the power supply cable includes the length of the cables to connected modules.

**Table 19. Power Supply Cable Specifications**

Type of signal	Cross-sectional area	
	≤328 ft (100m) Single transformer	≤328 ft (100m) Separate transformers
24V Power	1.5mm <sup>2</sup> -2.5mm <sup>2</sup> (16AWG-12AWG)	not allowed for > 328 ft (100 m)
High Current Signals - DO Relay version	5A terminal: 1.5mm <sup>2</sup> -2.5mm <sup>2</sup> (16AWG-12AWG)  10A terminal: 2.5mm <sup>2</sup> (14AWG-12AWG)	Not applicable
Low Current Signals - UIO, DI	0.5mm <sup>2</sup> -2.5mm <sup>2</sup> (26AWG - 12AWG)	

#### NOTES:

- Copper wire only for the terminal block.
- Suggested maximum tighten torque for screw terminal block is 5.0 lb/in or 0.56N/m.

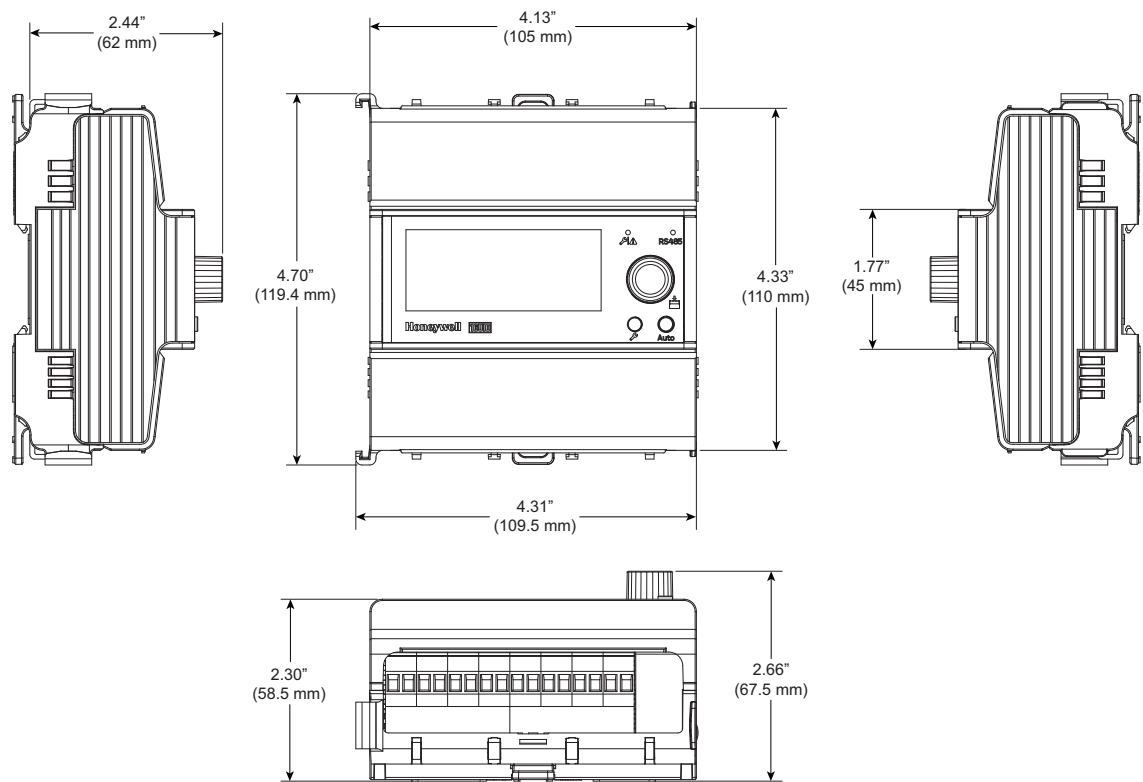
### Panel Bus Cable Specifications

Maximum distance between controller and Panel Bus I/O is 131 ft (40m) with any type of cabling and daisy chain topology.

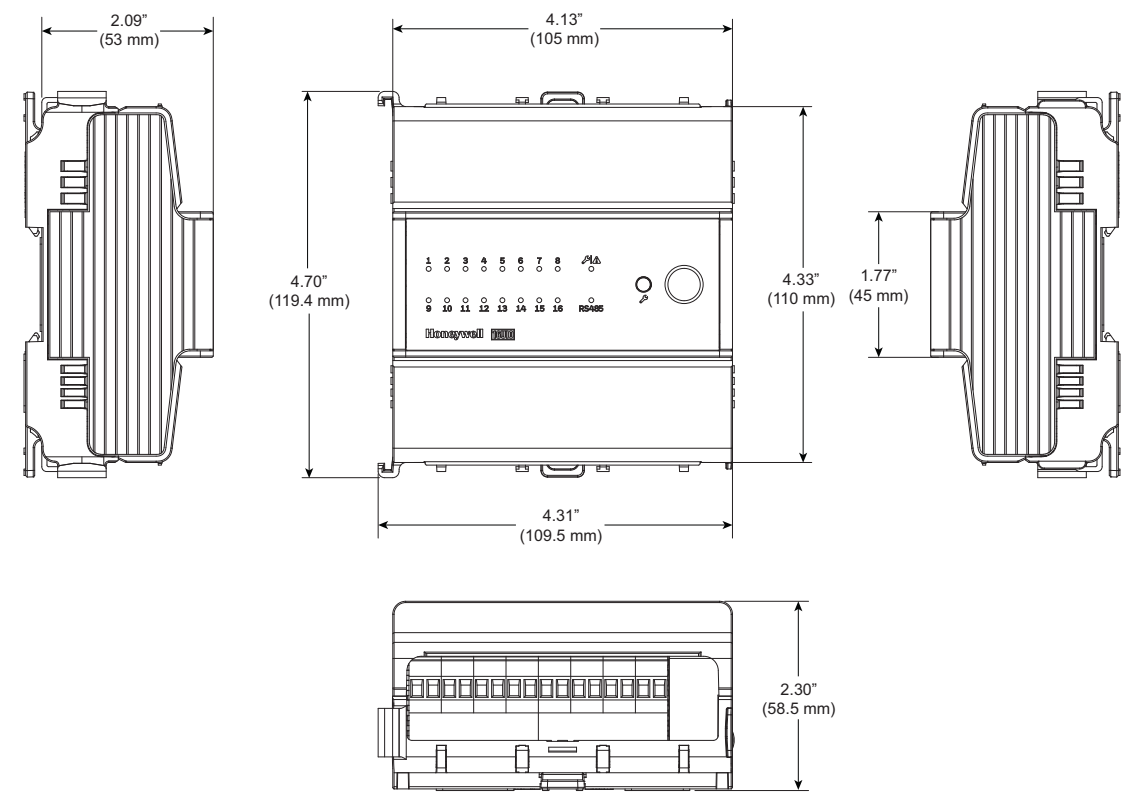
Maximum distance between controller and Panel Bus I/O is 2625 ft (800m) with twisted pair or telephone cable and daisy chain topology.

Controller must be positioned at one end of the Panel Bus and an end termination of 120 ohms positioned at the other end or Protective End Cover which has a built in end of line resistor to terminate the RS485 bus (ENDCOVER-10). Panel Bus Communications is polarity insensitive.

Dimensions - I/O Module with HOA



I/O Module Without HOA



# I/O MODULES MOUNTING

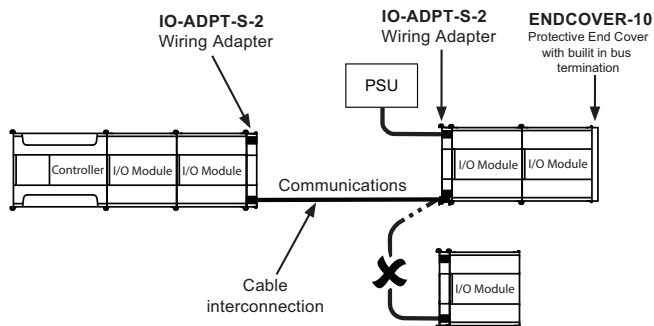
The I/O modules can be mounted by snapping on the controller or mounted remotely. See the example diagrams to understand the local and remote mounting and its connections. For more detailed diagrams see from Fig. 4 to Fig. 10.

The max allowed power cable length is 328 ft (100m).

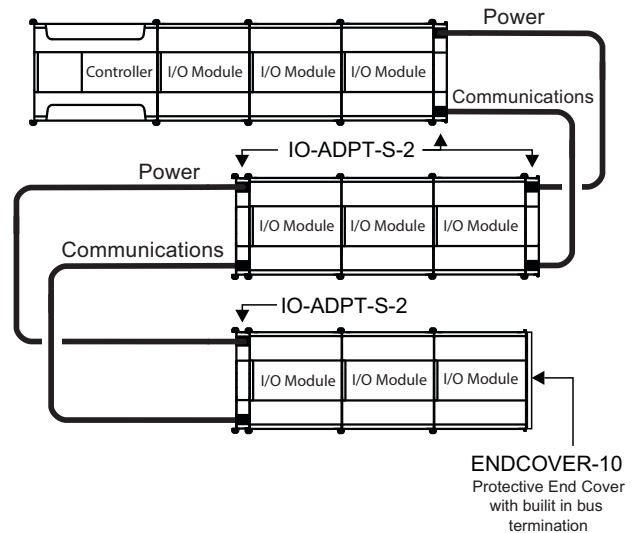
The max allowed communications cable length for connecting room 1 and room 2 is:

- 131 ft (40m) - any type of cabling and daisy chain topology
- 2625 ft (800m) - twisted pair or telephone cable and daisy chain topology.
- The controller must be positioned at one end of the Panel Bus and bus termination at the other end. The Protective End Cover has a built in end of line resistor to terminate the RS485 bus (ENDCOVER-10).

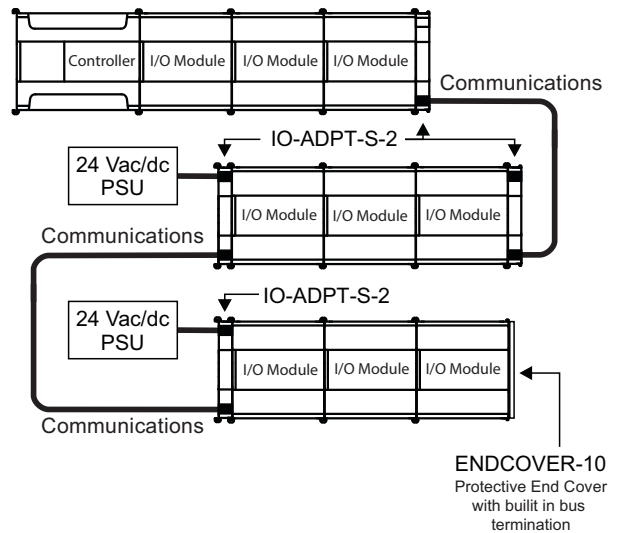
**Example 1:** The I/O modules should be connected in series, not in parallel.



**Example 2:** Both the communication bus and power are extended to an additional row of I/O modules on a separate DIN rail.

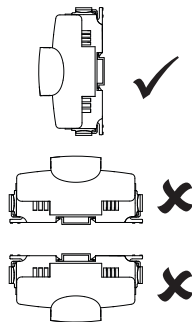
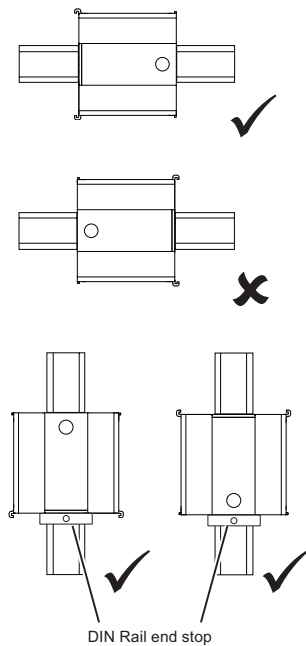


**Example 3:** The communication bus is extended to an additional row of I/O modules on a separate DIN rail. Power is supplied separately to the I/O modules.



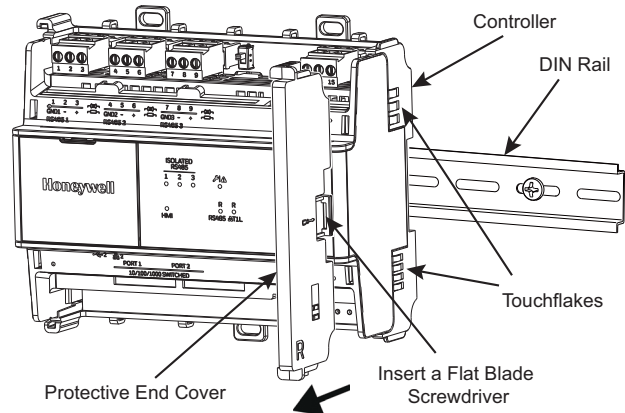
## Mounting Precautions

I/O Modules and Wiring Adapter support both Horizontal and Vertical DIN rail mounting on a vertical surface. Do not mount on a horizontal surface.



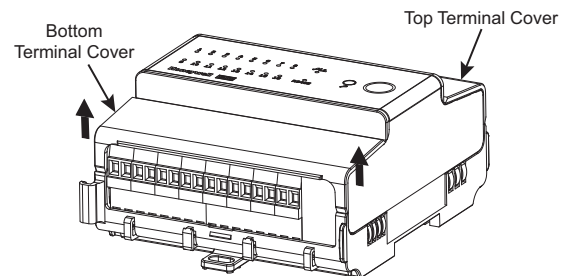
## Mounting the I/O Module on a Wall/Panel using DIN Rail

The I/O module mounts to the side of the controller. Remove the protective end cover from the controller to reveal the touchflakes.

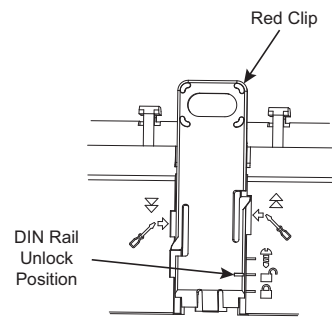


The I/O module connects to the controller touchflakes for the power and communications. To mount the I/O module next to a Wiring Adapter, see "Mounting Wiring Adapter on the DIN Rail" section on page 21.

1. Remove the bottom Terminal Cover from the I/O module. Use your fingers to push the cover upwards as shown in the below figure.

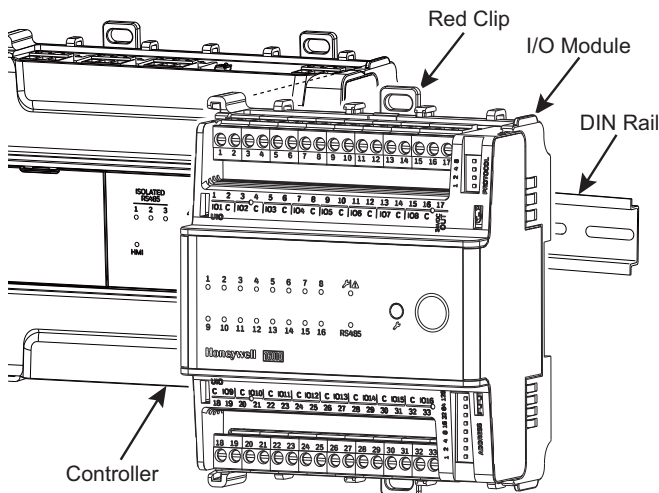


2. Remove the top Terminal Cover as described in the previous step.
3. Extend both red clips to the unlock position as shown in the below figure.





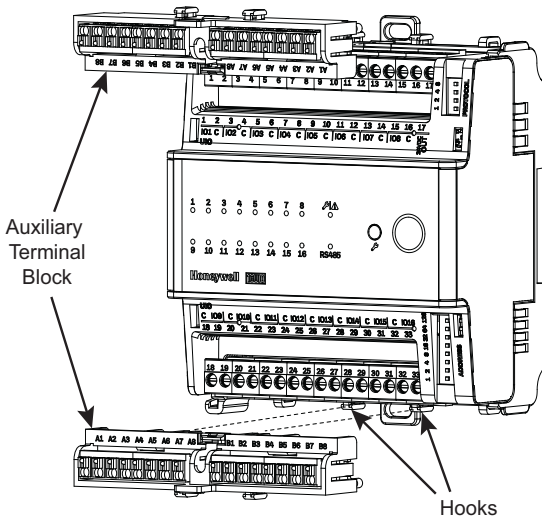
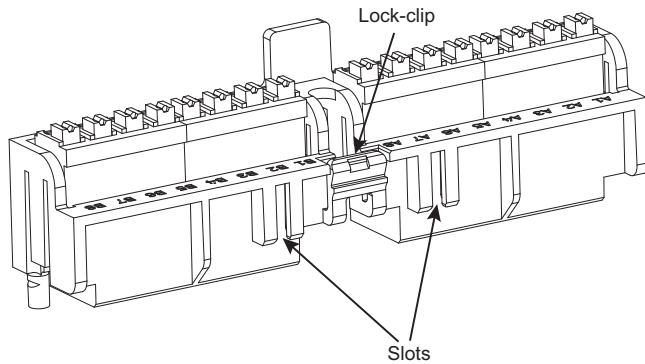
4. Hold the I/O module in an orientation such that the red clip is facing toward the DIN rail.



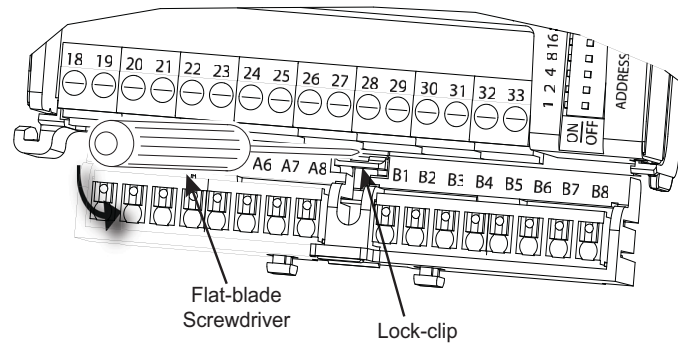
5. Mount the I/O module onto the DIN rail and push both red clips in to secure it in place.
6. Replace the terminal covers.

## Installing the Auxiliary Terminal Block (optional)

1. Install the Auxiliary terminal block onto the I/O module by inserting the slots of the auxiliary terminal block into the two hooks of the I/O module and push it till the lock-clip is locked with the I/O module.



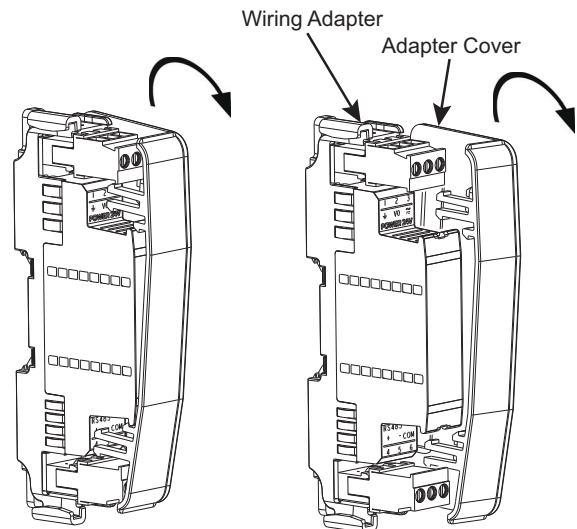
2. Remove the insulation 5mm from the wires' end by using a stripping tool.
3. Refer to the I/O Module Installation Guide (31-00589) for wiring connections and insert the wires into the auxiliary terminal blocks.
4. To remove the auxiliary terminal block, insert a flat blade screwdriver into the lock-clip and release it.



## Mounting Wiring Adapter on the DIN Rail

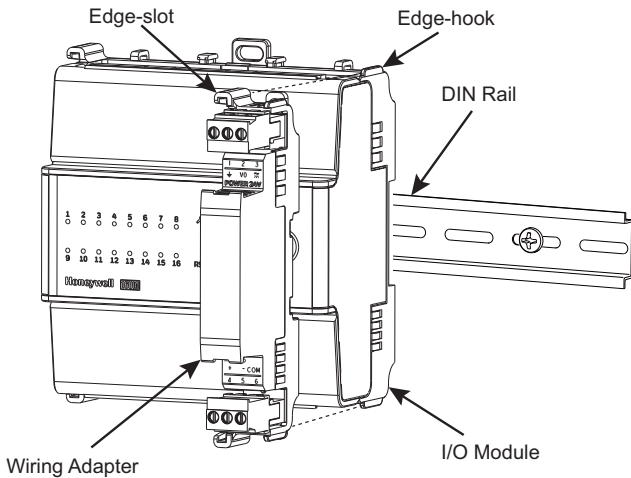
**NOTE:** Use the Wiring Adapter to extend Power and Comms to the next DIN rail or to extend Power and Comms to a remote I/O module.

1. Remove the adapter cover by pulling out the cover as shown in the below image.

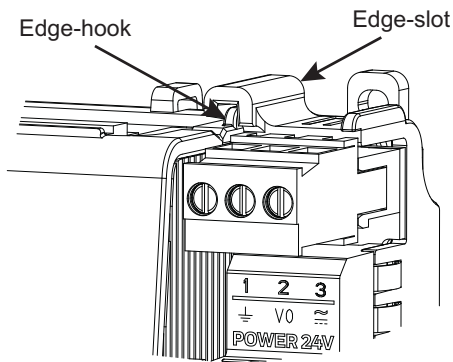


2. Extend the red clips on the wiring adapter to the last position.

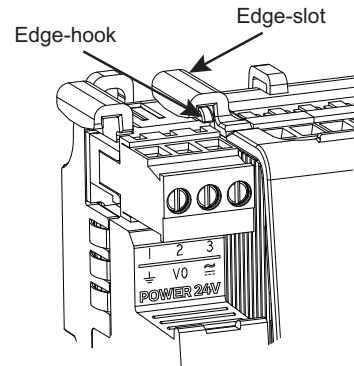
3. Hold the wiring adapter in the position as shown below.



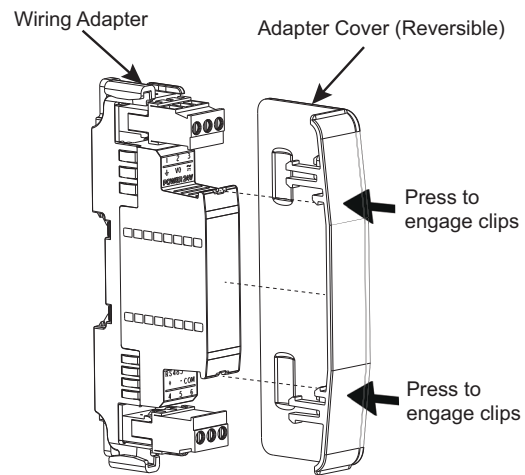
4. For the **right side mounting**, mount the adapter in a way that the edge-slot of the adapter aligns with the axis of the edge-hook of the I/O module to attach and secure them together.



For the **left side mounting**, mount the adapter in a way that the edge-hook of the adapter aligns with the axis of the edge-slot of the I/O module to attach and secure them together.



5. The wiring adapter has a reversible cover to safeguard the touchflakes. Place the adapter cover on the side of the wiring adapter to cover the touchflakes that are not being used. Attach the adapter cover by pressing at the location of the clips until both clips are engaged.



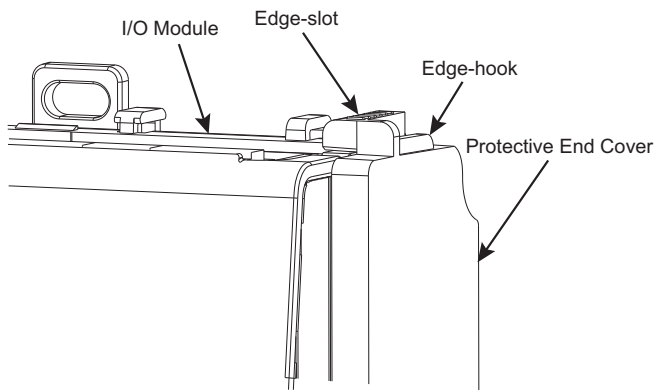
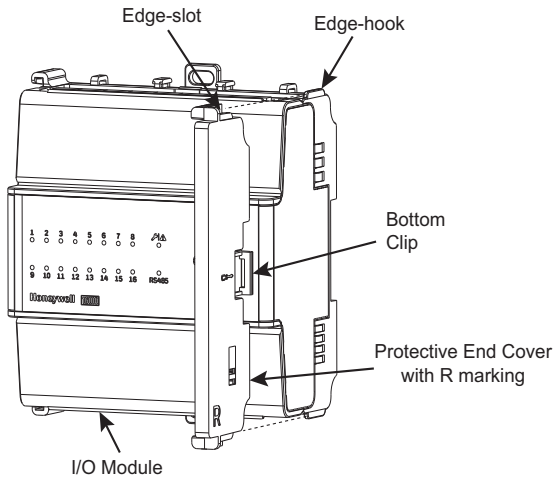
6. On the last I/O module in the panel, mount the protective end cover. Refer to "Protective End Cover" section on page 23.

## Protective End Cover

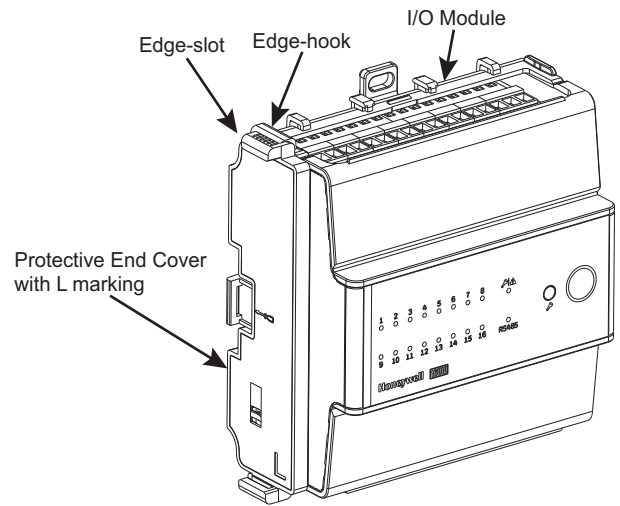
The protective end cover comes factory installed on the controller. Remove the protective end cover from the controller and mount on the last I/O module in the panel. The protective end cover safeguards the touchflakes and has a built in end of line resistor to terminate the RS485 bus.

### Mounting Protective End Cover on the last I/O Module

1. For the **right side mounting**, hold the Protective end cover (marked with R) in a way that the edge-slot of the cover aligns with the axis of the edge-hook of the I/O module, and slide along till the bottom clip is locked with the I/O module.



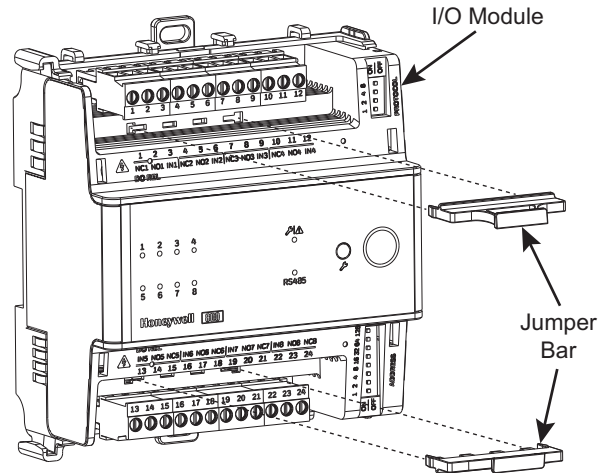
For the **left side mounting**, hold the Protective end cover (marked with L) in a way that the edge-hook of the cover aligns with the axis of the edge-slot of the I/O module, and slide along till the bottom clip is locked with the I/O module.



## Mounting Jumper Bars on the I/O Module (only for DO relay variants)

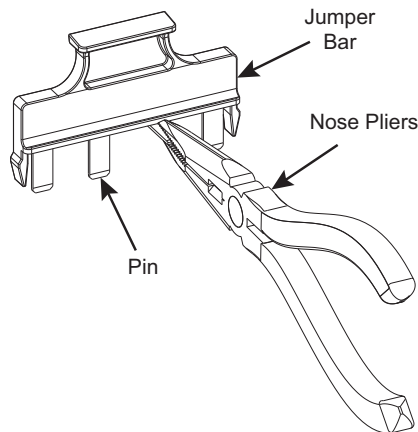
The DO variants of I/O modules include two jumper bars in the carton. One jumper bar is used for the top row of terminals and the other is used for the bottom row of terminals. Each jumper bar connects the "IN" terminals internally.

1. Insert the pins of the jumper into the slots as shown in the below image.



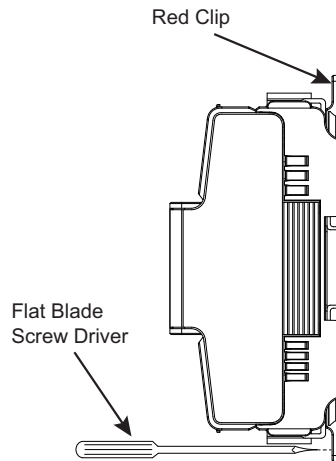
The jumper connects all four "IN" terminals into a single terminal. It enables a single power source connection to one terminal.

If two different power supplies are required to connect, use a needle nose pliers to break off a pin on the jumper bar by bending it back & forth until it breaks and then insert the jumper bar into the slot. This connects only three terminals and the fourth terminal is available for another power supply.

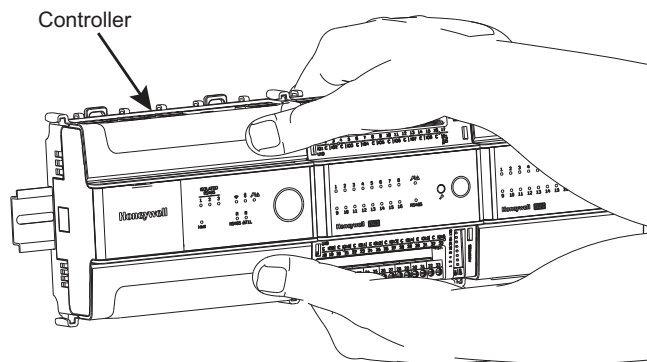


## Removing the I/O Module from the DIN Rail

1. Power off the I/O modules before proceeding.
2. Disconnect all the input/output terminals from the I/O module.
3. Remove the protective end cover if you are removing the last I/O module in the panel. Set the protective end cover aside.
4. Hold the I/O module with one hand and insert a flat blade screwdriver into the bottom red clip slot and pull downward. Insert a flat blade screwdriver into the top red clip slot and pull upward.

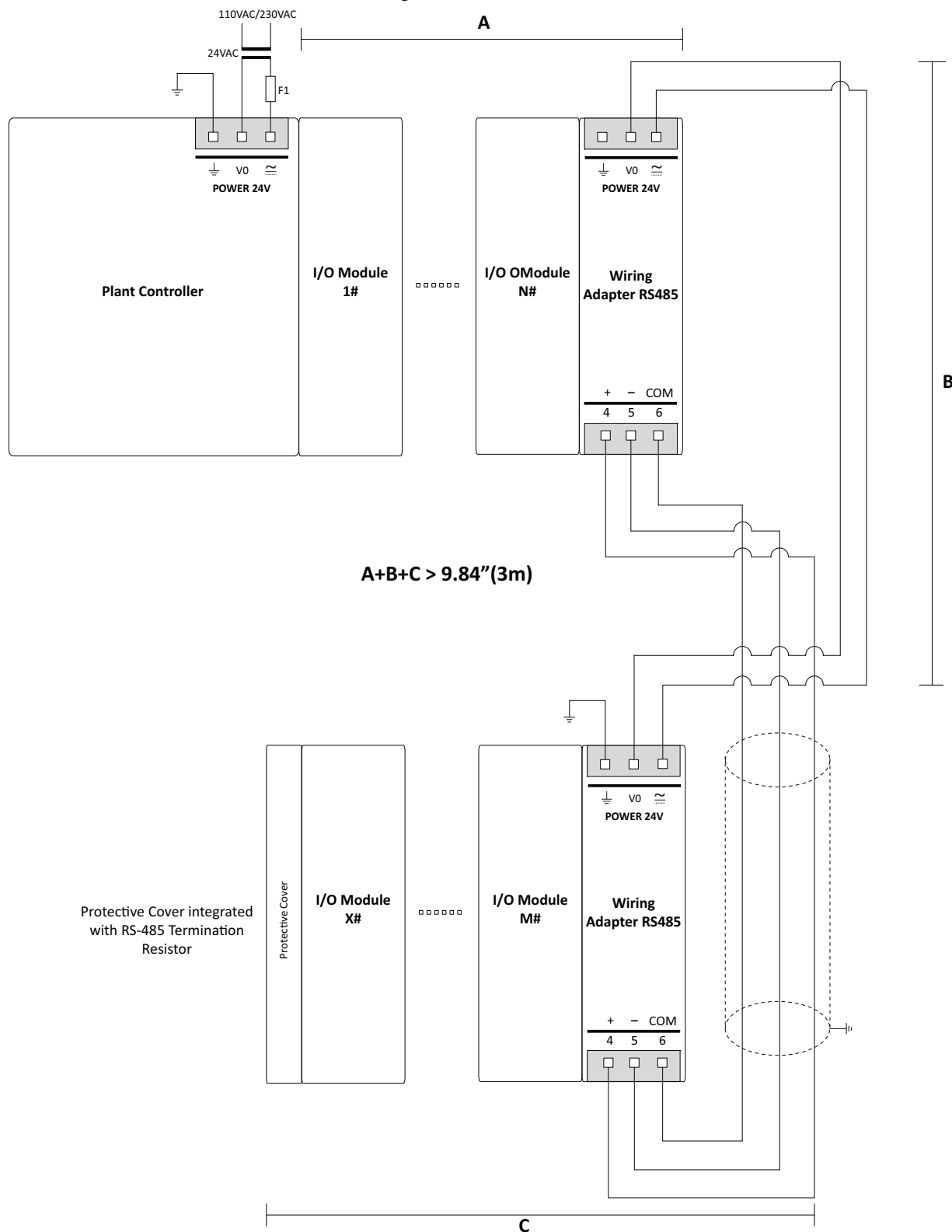


5. After the I/O module is released from the DIN rail, push the edge-slots of the I/O module on four corners.



6. After all corners are released, grasp the I/O module and pull straight out.

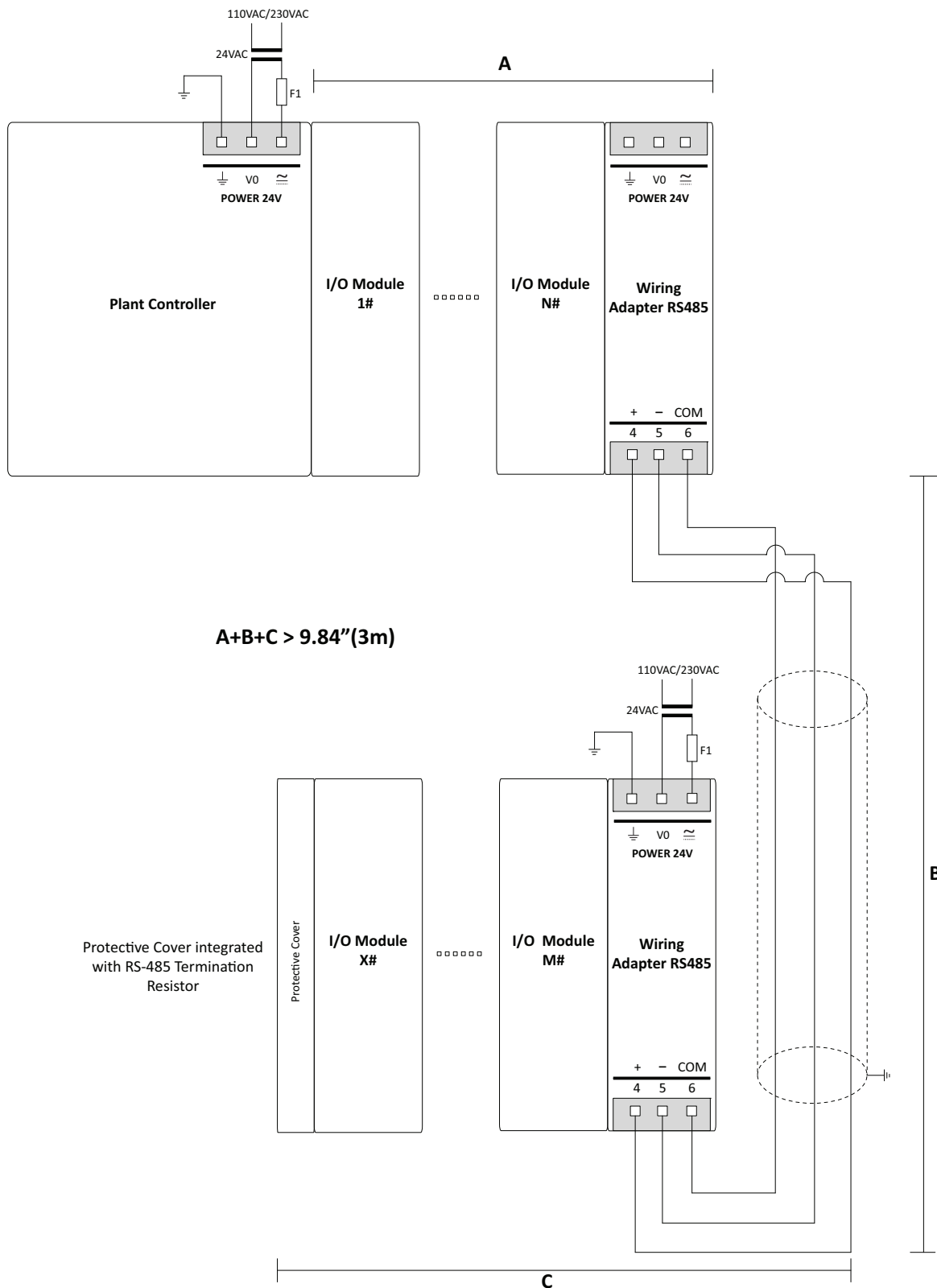
## Connection to I/O Modules Powered by Same Transformer



**Fig. 4. Power supply via Same Transformer**

NOTE: For communication cable lengths, transmission speeds, and termination "General Information on the RS485 Standard" section on page 13. For wiring, see "I/O Module Power consumption" section on page 14. For power, see "Power Supply (External)" section on page 13.

## Power supply via External Power Source



**Fig. 5. Power Supply via Separate Transformer**

NOTE: For communication cable lengths, transmission speeds, and termination “General Information on the RS485 Standard” section on page 13. For wiring, see “I/O Module Power consumption” section on page 14. For power, see “Power Supply (External)” section on page 13.

Auxiliary Terminal Block Terminals

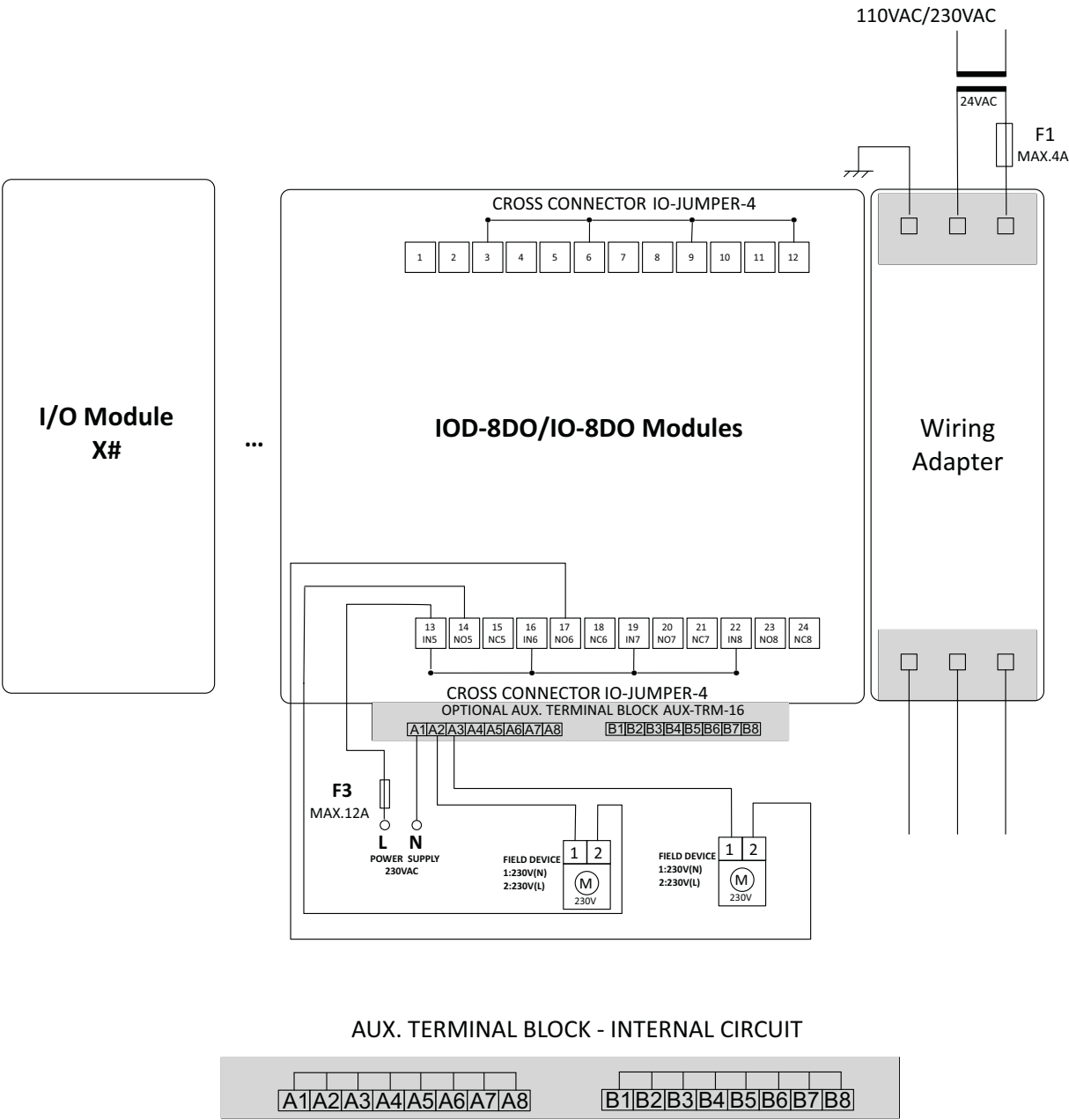
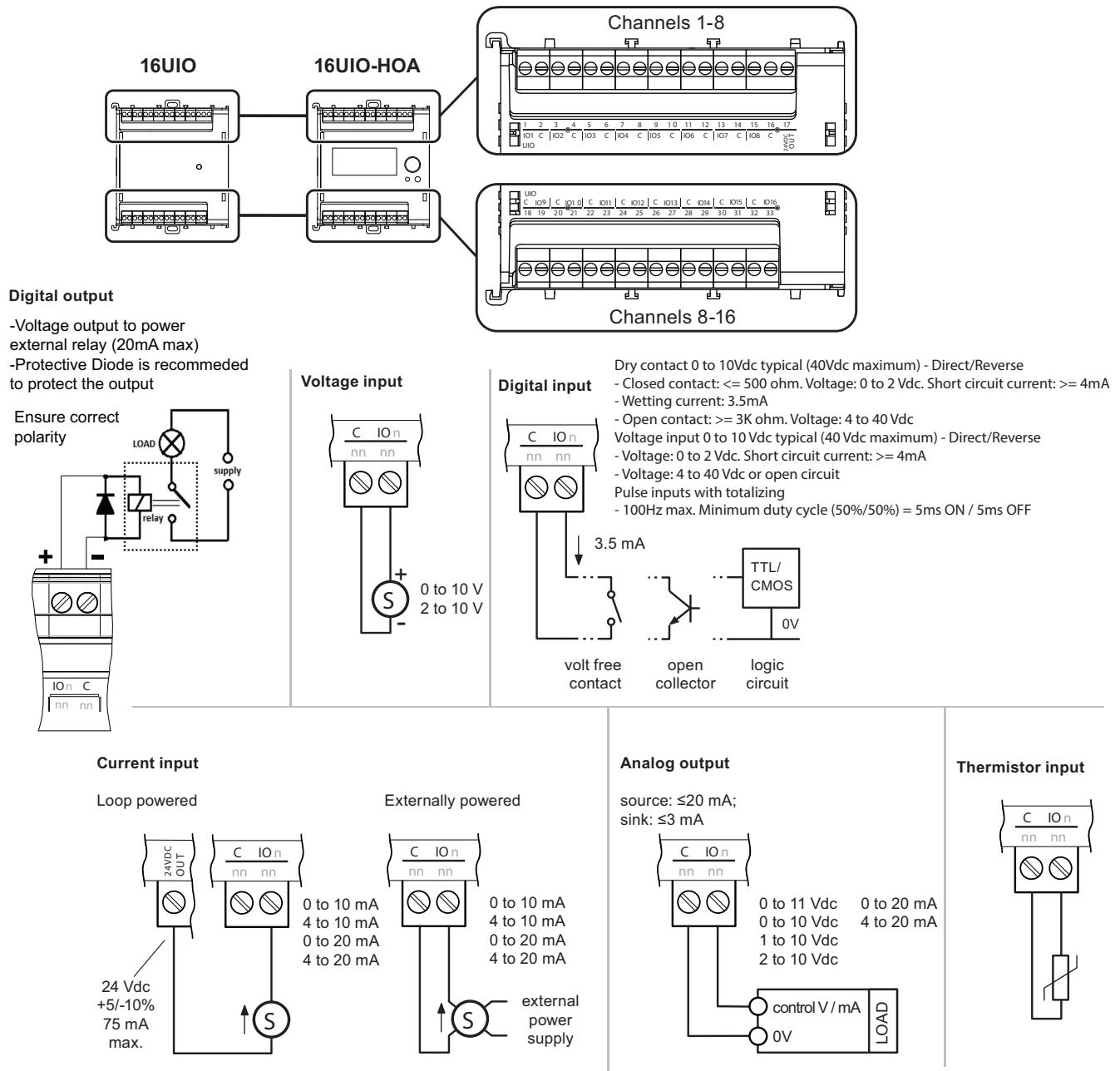


Fig. 6. Auxiliary Terminal Block Terminal Description



# CONNECTION EXAMPLES

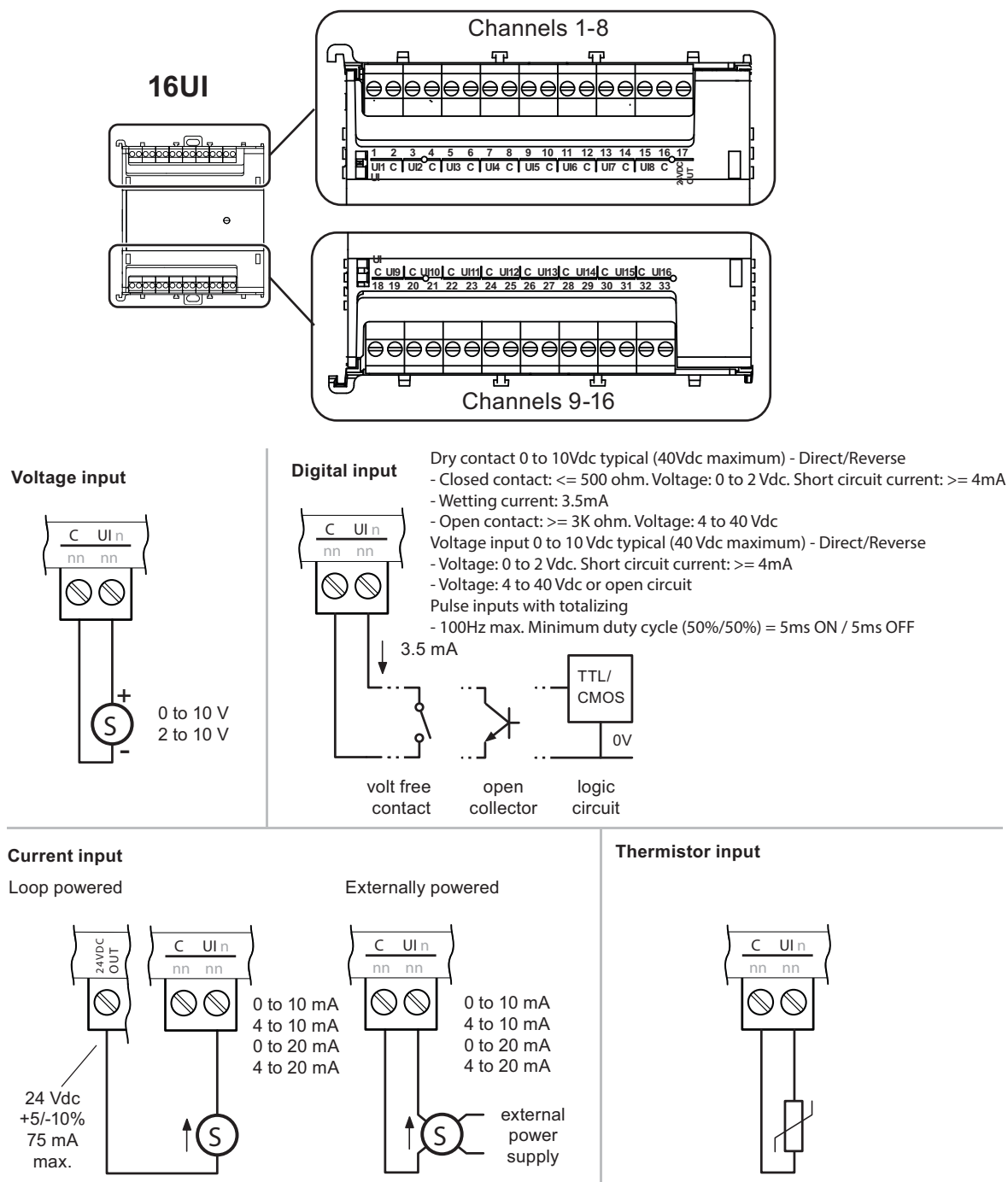
## Universal Input/Output (UIO Module)



**Fig. 7. UIO Module Wiring Connection**

NOTE: For communication cable lengths, transmission speeds, and termination, see "General Information on the RS485 Standard" section on page 13. For wiring, see "I/O Module Power consumption" section on page 14. For power, see "Power Supply (External)" section on page 13.

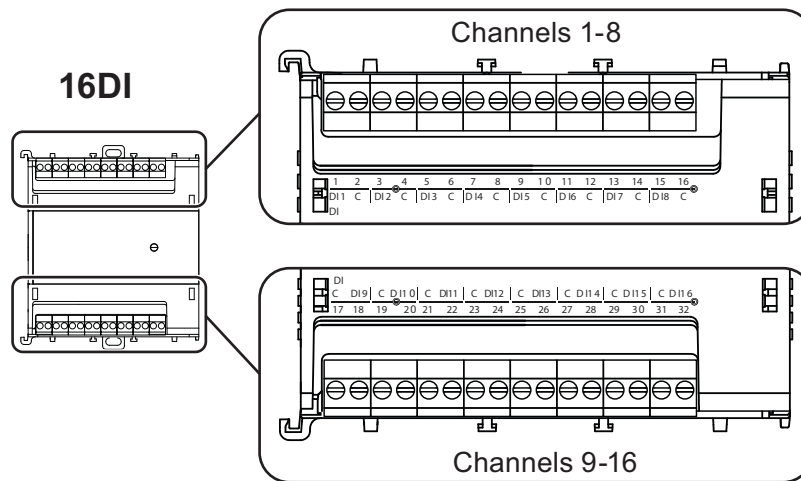
## Universal Input (UI Module)



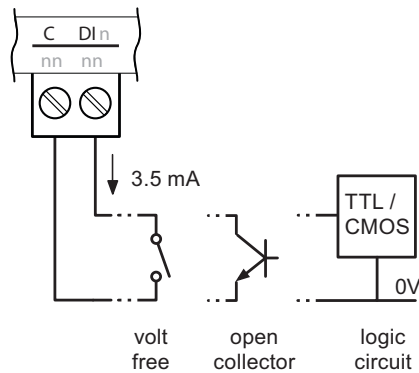
**Fig. 8. UI Module Wiring Connection**

NOTE: For communication cable lengths, transmission speeds, and termination, see “General Information on the RS485 Standard” section on page 13. For wiring, see “I/O Module Power consumption” section on page 14. For power, see “Power Supply (External)” section on page 13.

## Digital Input (DI Module)



Connecting to volt-free, open collector or logic devices

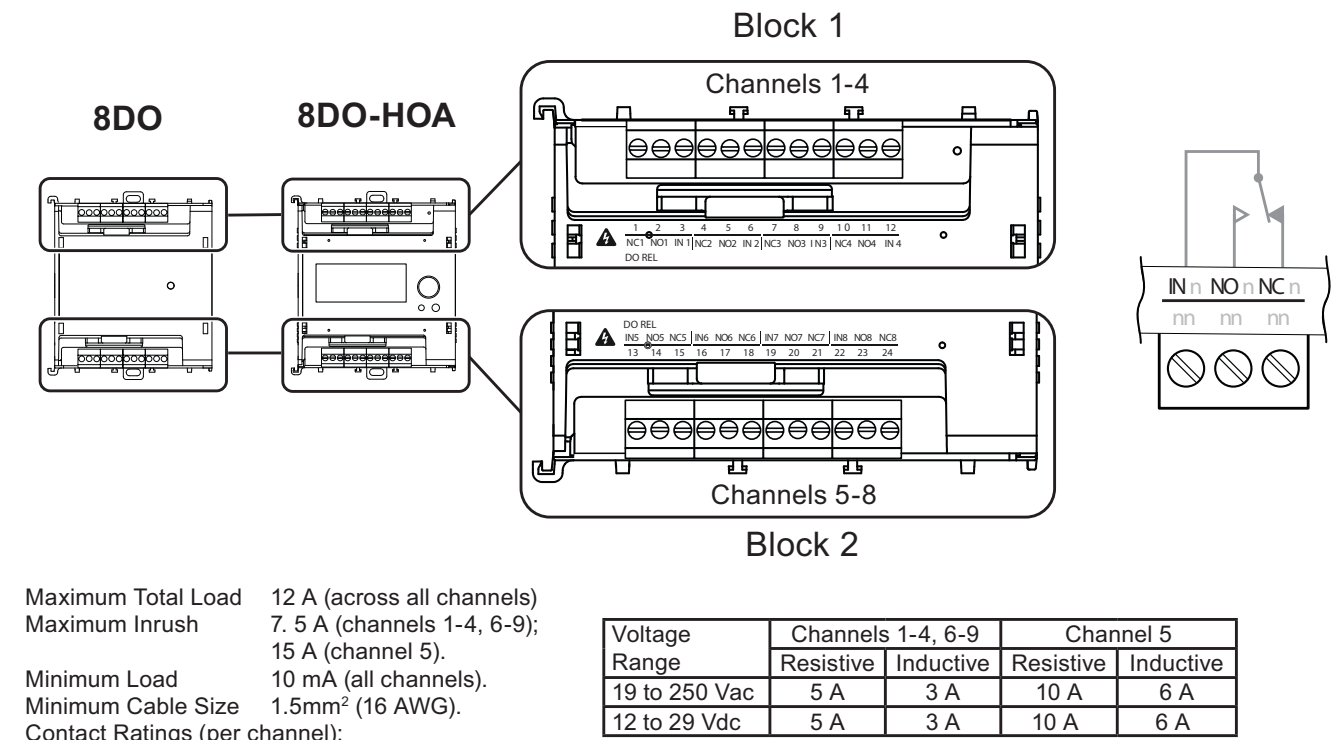


- Dry contact 0 to 10Vdc typical (40Vdc maximum) - Direct/Reverse
- Closed contact:  $\leq 500 \text{ ohm}$ . Voltage: 0 to 2 Vdc. Short circuit current:  $\geq 4 \text{ mA}$
- Wetting current: 3.5mA
- Open contact:  $\geq 3 \text{ K ohm}$ . Voltage: 4 to 40 Vdc
- Voltage input 0 to 10 Vdc typical (40 Vdc maximum) - Direct/Reverse
- Voltage: 0 to 2 Vdc. Short circuit current:  $\geq 4 \text{ mA}$
- Voltage: 4 to 40 Vdc or open circuit
- Pulse inputs with totalizing
- 100Hz max. Minimum duty cycle (50%/50%) = 5ms ON / 5ms OFF

**Fig. 9. DI Module Wiring Connection**

NOTE: For communication cable lengths, transmission speeds, and termination, see “General Information on the RS485 Standard” section on page 13. For wiring, see “I/O Module Power consumption” section on page 14. For power, see “Power Supply (External)” section on page 13..

Digital Relay Output



Ensure that external circuits are suitably protected against fault currents that would exceed the ratings for the switching circuits provided in this product.

Example wiring

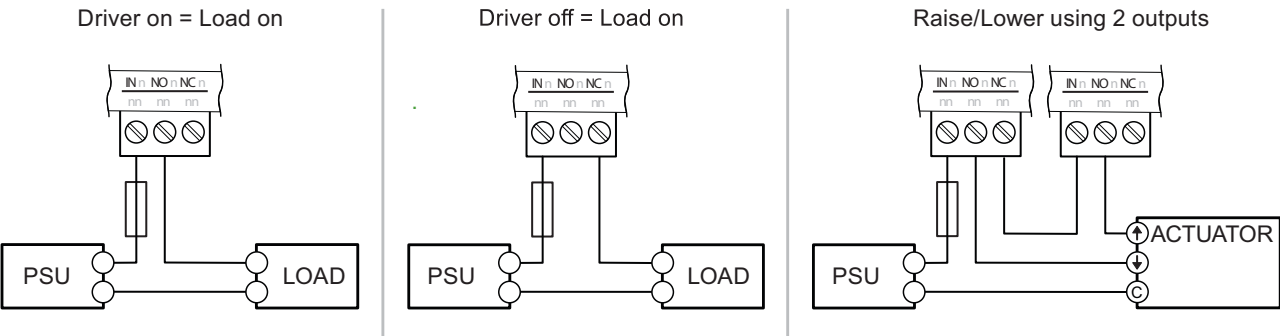


Fig. 10. DO Module Wiring Connection

NOTE: For communication cable lengths, transmission speeds, and termination see “General Information on the RS485 Standard” section on page 12. For wiring, see “Wiring and Set-up” section on page 16. For power, see “Power Supply (External)” section on page 12.

## DIP Switches

### Setting up the Address of the I/O Module

All I/O modules have 2 two dip-switches. The Protocol DIP switch is for communication and the Addressing DIP switch is to set the I/O module address.

#### Protocol DIP Switch (4-bit)

0 (Default) - Panel Bus. 1 to 15 - Reserved. Keep all switches off to set the Panel bus protocol.

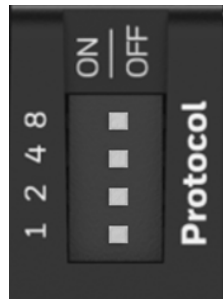


Fig. 11. Protocol DIP Switch

#### Address DIP Switch (8-bit)

Slide the dip switch on the I/O module to match the address given in the configuration.



Fig. 12. Address DIP Switch

The I/O module supports the address value range from 0 to 255. However, the Panel Bus protocol only supports addresses from 0 to 15, and must set between 0 and 15.

Only use DIP switches 1, 2, 4, and 8 to set the Panel Bus address. DIP switches 16, 32, 64 and 128 are ignored for Panel Bus.

- The Niagara controllers support 64 I/O modules in one Panel Bus channel.
- The CPO controllers support 16 I/O modules in one Panel Bus channel.

### Niagara Controllers

For the Niagara controllers, the same address setting can be configured for different I/O module types on a Panel Bus channel. For example, an 8DOR without HOA is a different I/O module type than an 8DOR with HOA and therefore can have the same address setting. A different address setting is required for the same I/O module type - for example, 2 of the 8DOR with HOA. If I/O modules of the same type have the same address setting, the RS485 LED on the controller will change to Yellow and the engineering tool will show these modules with an Offline status.

For the Niagara controllers, a maximum of 64 I/O modules are supported on a Panel Bus channel. 16 devices of each I/O module type are allowed up to the maximum of 64 devices on a bus. For example, you can have 16 of the 8DOR with HOA, 16 of the 16UIO without HOA, 16 of the 16UIO with HOA, and 16 of the 16DI.

### CPO Controllers

For the CPO controllers, the same address setting can be configured for different I/O module types on a Panel Bus channel. For example, an 8DOR without HOA is a different I/O module type than an 8DOR with HOA and therefore can have the same address setting. A different address setting is required for the same I/O module type - for example, 2 of the 8DOR with HOA. If I/O modules of the same type have the same address setting, the RS485 LED on the controller will change to Yellow and the engineering tool will show these modules with an Offline status.

For the CPO controllers, a maximum of 16 I/O modules are supported on a Panel Bus channel. 16 devices of the same I/O module type are allowed on a Panel Bus channel but the maximum is 16 devices on a bus. For example, you can have 16 of the 8DOR with HOA on the Panel Bus channel but no more I/O modules can be on that Panel Bus channel. A separate RS485 port will need to be configured for Panel Bus if more than 16 I/O modules are required.

Table 20. Dip Switch Combination Matrix to set the Panel Bus Address

SW1 (1)	SW2 (2)	SW3 (4)	SW4 (8)	SW5 (16)	SW6 (32)	SW7 (64)	SW8 (128)	Value (Hex)	Valid Address (Panel bus)
0	0	0	0	0	0	0	0	0x0	0
1	0	0	0	0	0	0	0	0x1	1
0	1	0	0	0	0	0	0	0x2	2
1	1	0	0	0	0	0	0	0x3	3
0	0	1	0	0	0	0	0	0x4	4
1	0	1	0	0	0	0	0	0x5	5
0	1	1	0	0	0	0	0	0x6	6
1	1	1	0	0	0	0	0	0x7	7
0	0	0	1	0	0	0	0	0x8	8
1	0	0	1	0	0	0	0	0x9	9
0	1	0	1	0	0	0	0	0xA	10

SW1 (1)	SW2 (2)	SW3 (4)	SW4 (8)	SW5 (16)	SW6 (32)	SW7 (64)	SW8 (128)	Value (Hex)	Valid Address (Panel bus)
1	1	0	1	0	0	0	0	0xB	11
0	0	1	1	0	0	0	0	0xC	12
1	0	1	1	0	0	0	0	0xD	13
0	1	1	1	0	0	0	0	0xE	14
1	1	1	1	0	0	0	0	0xF	15

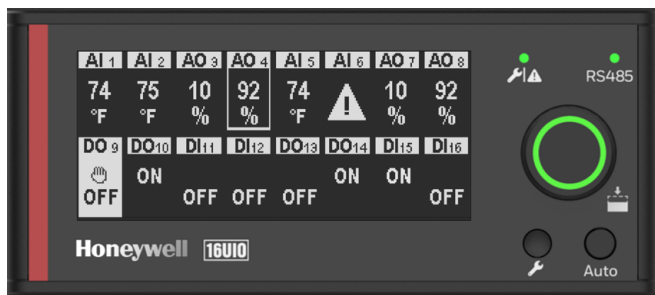
## HOA (HAND-OFF-AUTO)

The HOA (Hand-Off-Auto) feature with back-lit LCD display is available on the following variants.

- IOD-16UIO-S-S
- IOD-8DOR-S-S
- IOD-16UIO-S-P
- IOD-8DOR-S-P

The HOA display shows the main screen and the channel screen.

### Main screen



**Fig. 13. HOA Display - Main Screen**

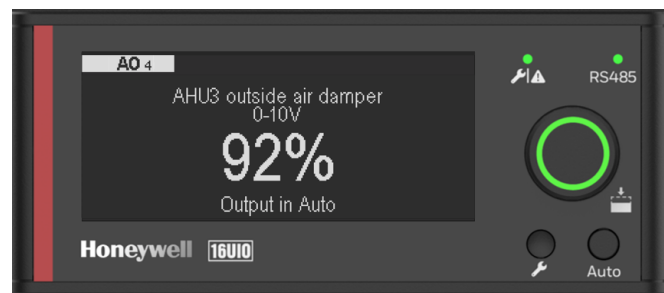
The above image is example of main screen of 16 UIO I/O module. Typically, a main screen displays the following elements.

- Status of the Input channels - On or Off status for DI channels; Sensor readings for AI channels.
- Status of the Output channels - On or Off for DO channels; 0-100% for AO channels.
- The type of point (AO, DO, AI, DI).
- Indication if the channel is auto or manually overridden (hand icon) with reverse background.

Each output channel can be manually overridden to On or Off for DO channels and 0 to 100% for AO channels. The selected channel can also be returned to the Auto mode by pressing the Auto button.

Rotate the button dial to highlight a channel (box outline around the channel, see AO 4 on the above screen). After the desired channel is highlighted, a short press of the button dial allows the user to select the desired channel.

### Channel screen



**Fig. 14. Channel Screen - Analog Output**



**Fig. 15. Channel Screen - Digital Output**

The above screens are examples of channel screens of AO 4 and DO 9. When a channel is selected, the HOA display shows the status of the channel, the point name, the sensor type (for inputs only) and alarm status. The channel screen allows the user to manually override the channel or set the channel to Auto with a short press of the Auto button.

## Dial and Buttons Functions

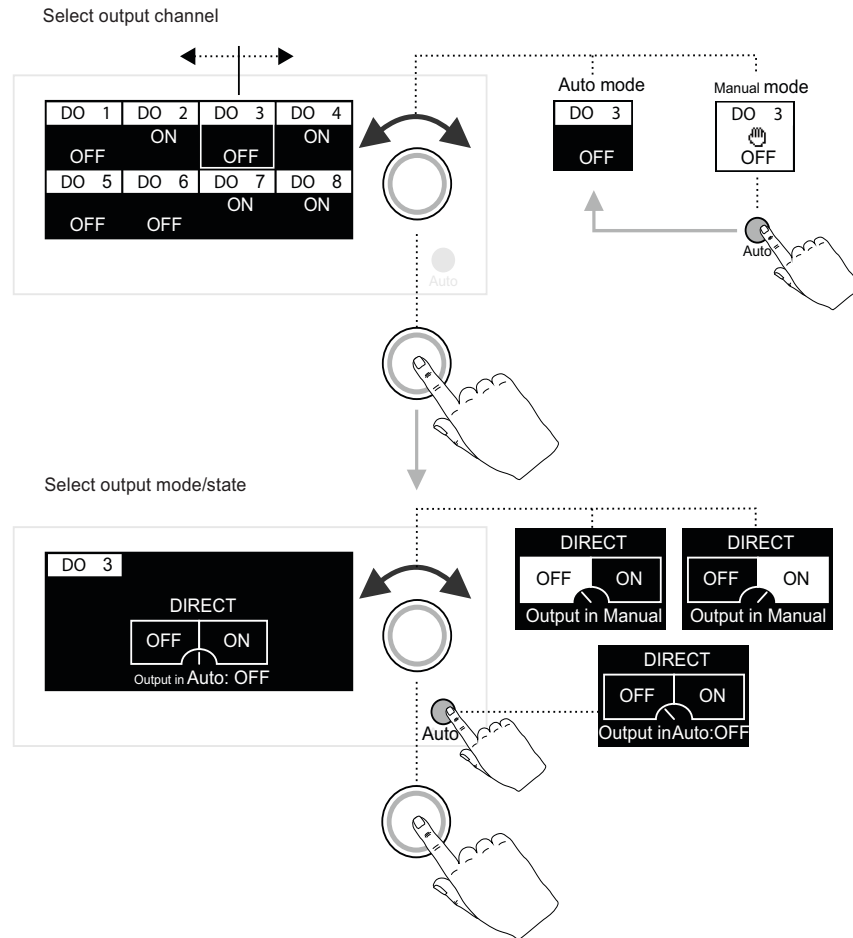


Fig. 16. HOA Display Navigation Gesture

Table 21. Dial & Button Functions



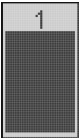


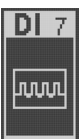

Dial/ Button	Command	Function
Rotating dial	Rotate	<b>On the main screen:</b> Toggle between the channels. <b>On the channel screen:</b> Settings/values adjustment
	Short press	<b>On the main screen:</b> Entering/existing channel screen. <b>On the channel screen:</b> Confirm settings/value.
Service button	Long press (10~15s)	Factory reset. Refer to "Service Button" section on page 7.

Table 21. Dial & Button Functions

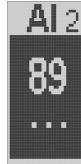

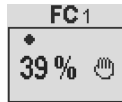
Dial/ Button	Command	Function
Auto button	Short press	<b>Normal mode, on the main /channel screen:</b> Sets the selected channel parameter to auto mode. <b>Offline setup mode, on the main/channel screen:</b> Stops the override.
	Long press (3s)	<b>Normal mode, on the main screen:</b> Sets all parameter to auto mode. <b>Offline setup mode, on the channel screen:</b> Clears the parameter setup. <b>Offline setup mode, on the main screen:</b> Exits offline mode.

## Channel Icons Description

**Table 22. Channel Icons**

	Description
	A box around the channel means the channel is selected.
	A hand icon means the channel is in manual mode.
	No configuration. Channel is not configured.
	Channel with a warning message.
	Channel with alarm. (Displays only datapoint alarms, see BACnet tool to view EE alarms)
	Channel configured for accumulated usage (total pulse contact).
	Channel icon when a custom sensor is used and communication is lost between the controller and I/O module. The Channel Screen will display the Raw Data of the Sensor (i.e. - 1200 ohms). Point Name of the Analog Input will not be displayed.  NOTE: When using a sensor from “Table 8, Supported Sensors”, the HOA display continues to show the value of the sensor during a communication loss as the scaling is in the I/O module for these sensors.

**Table 22. Channel Icons**

	Description
	The unit of measure exceeds the allotted space on the Main Screen. Full unit can be seen on the Channel Screen.
 	A flashing dot in the respective channel indicates the actuator is currently opening or closing.

**NOTES:**

- If there is no activity on the channel screen, it automatically navigates back to the main screen
- While adjusting the values, the text keeps blinking till the set value is confirmed.
- Whatever the State text configured in the application will appear as either ON or OFF on the IO module's HOA display. For more information, refer to the CPO Studio user guide (en2b0001-ie10).

## Setting up the Device

The controller application includes the I/O module configuration. It contains channel configuration, terminal assignment, point properties, safety position of the corresponding devices, floating output, etc.,

For the ComfortPoint Open devices, the controller application is engineered using the CPO Studio engineering tool, and push the configuration to the I/O module via the CPO Online tool. For more information, refer to the CPO Studio user guide (en2b0001-ie10), and the CPO Online tool user guide (en2b0002-ie10).

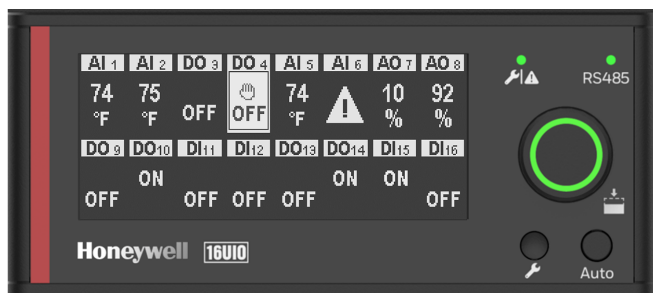
The controller pushes the application to the I/O modules when address of the I/O modules is set to match the address given in the configuration. To set the DIP switches, refer to “DIP Switches” section on page 33.

For the Niagara controllers, the application engineering and download to the controller are performed via the Niagara workbench. For more information, refer to the Panel Bus Driver user guide (31-00591-01).



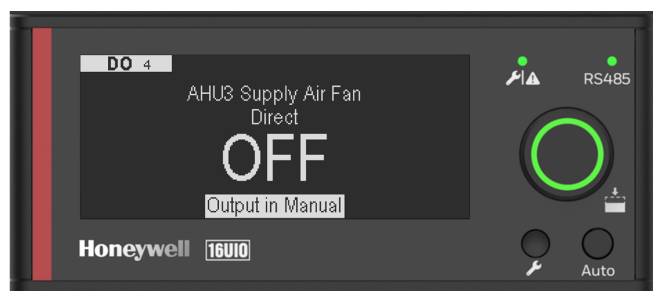
## Switching a Channel to Auto Mode and Vice Versa

1. On the main screen, a hand symbol appears on the channel to indicate the channel is in manual mode.



**Fig. 17. Main Screen with a Channel in Manual Mode**

2. Rotate the dial to navigate to that channel.  
You can return a channel to Auto two different ways.
3. Short press the **Auto** button.  
OR
4. Short press the dial.  
The channel's main screen appears with **Output in Manual** mode.



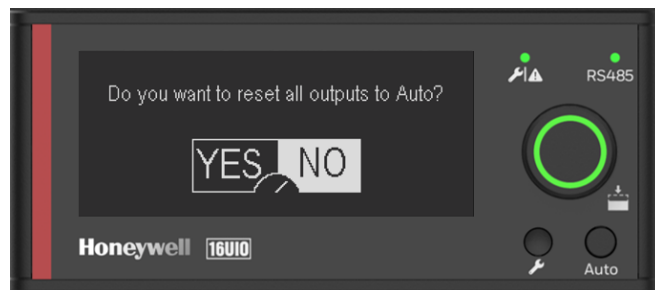
**Fig. 18. Channel Screen in Manual Mode**

5. Press the **Auto** button.  
The channel's screen appears with **Output in Auto** mode
6. To switch back to the manual mode, again rotate the dial to the desired value (the value blinks till the confirmation), and short press the dial to confirm the selection.

**NOTE:** The controller can push the point values only if the new point values matches the existing point values of the I/O module in manual mode. Set the I/O module to Auto mode to get the new point values from the controller.

## Resetting all outputs to auto mode

1. On the main screen, long press the Auto button (about 3 seconds).  
The Yes or No confirmation screen appears.



**Fig. 19. Channel Screen - Auto Mode Selection**

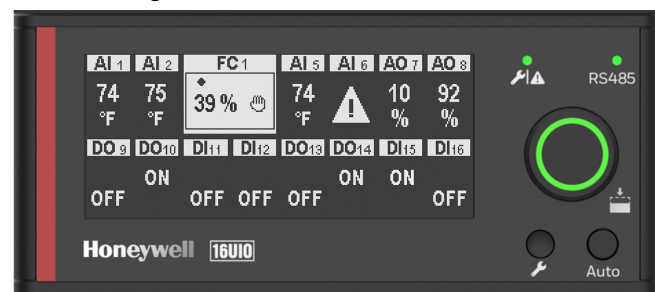
2. Rotate the dial to toggle between **YES** or **NO**.
3. Select an option and press the dial.  
If selected **NO**, the **No outputs were changed** message appears.  
If selected **YES**, the **SET YES** message appears, and all channels will display auto values on the main screen.

## Overriding a Floating Control (FC) Channel

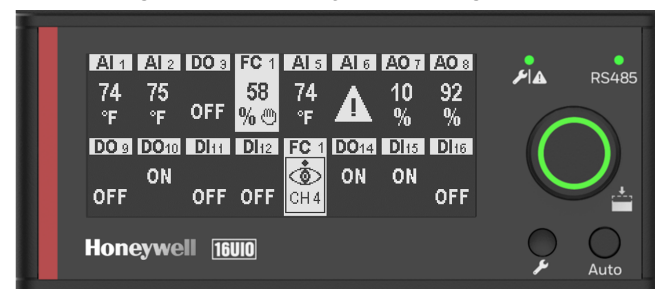
Two DO channels can be configured to control a floating actuator. These channels can be side-by-side or non side-by-side configurations.

**NOTE:** Overriding a Floating Control Channel is only available with the Niagara Advanced Controller (Not the CPO Advanced Controller).

1. On the main screen, Rotate the dial to navigate to the floating control channel (FC).



**Fig. 20. FC - Side by side Configuration**



**Fig. 21. FC - Non Side by side Configuration**

2. Short press the dial.
3. Rotate the dial to set the desired position (0-100%).
4. Short press the dial to confirm the selection.  
Depending on the current position of the actuator and whether it is opening or closing, a flashing dot will appear on the respective floating control channel

to indicate the actuator is moving. The flashing dot disappears once the actuator reaches the override setting.

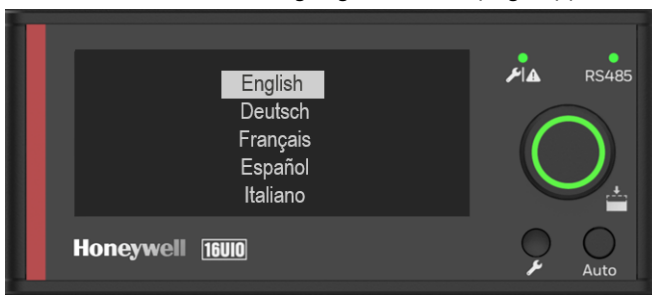
5. Short press the **Auto** button to return the FC channel to Auto.

## I/O Modules Offline Configuration

For the I/O modules with HOA display, in absence of the online configuration from the controller, the channels of the I/O module can be configured offline in order to drive outputs for pre-commissioning. The I/O module only shows the following screens when there is no online configuration from the controller.

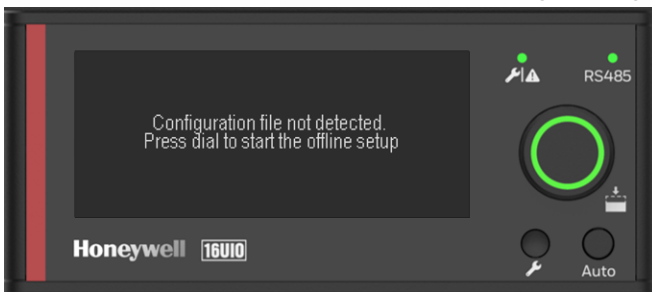
### Language Selection

1. Connect the I/O module to power.  
All LEDs turn on, language selection page appears.



**Fig. 22. Language Page**

2. Rotate the dial to select a language and short press the dial to confirm the selection.  
The main screen appears with the following message.



**Fig. 23. Main Screen with No Configuration**

3. Press the dial to start the channel configuration.  
Main LED breaths green.

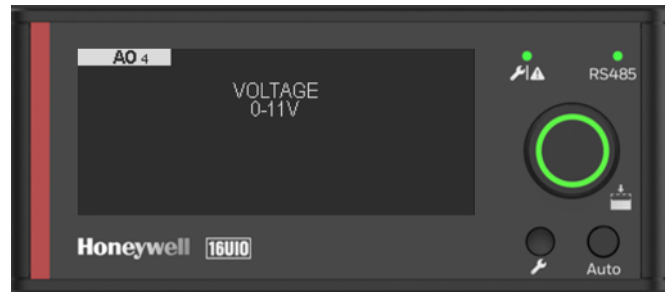
## Manual Channel Configuration

The relevant main screen of the I/O device with channels with no values appears. For example, IOD-16UIO-S-S, HOA display is given below.



**Fig. 24. Main Screen with Channels Not Configured**

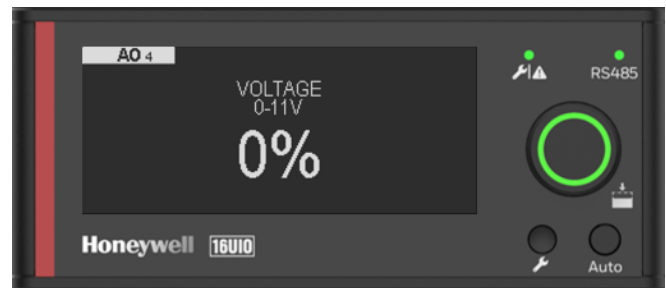
4. Rotate the dial, then press the dial.  
The channel screen appears.



**Fig. 25. Channel Type Configuration**

5. Rotate the dial to choose the channel type (N/A, DO, AO 0-11V, AO 0-20mA).
6. Press the dial to confirm the channel type selection.  
The output value parameter of the selected channel appears.

NOTE: After channel type is configured (for example AO4), use that terminal for the AO assignment. If N/A is selected, the terminal cannot be used.



**Fig. 26. Setting up Channel's Value**

7. Rotate the dial to set an output value for the channel type and press the dial to confirm the selection.
8. To reset the channel type and output selection, rotate the dial to the desired channel and short press the Auto button.  
This clears the channel's parameter. Once the channel output is configured, the channel screen returns to the main screen.

## Safety Position Configuration

In the event of a communication loss between the controller and the I/O module, the I/O module reverts to the safety position that is setup in the tool. This includes options to follow the last state or a configurable value after a specified period of time.

To configure safety position in the CPO Studio tool, refer to the CPO Studio user guide (en2b0001-ie10).

To configure safety position for the Niagara controller, refer to the Panel Bus Driver user guide (31-00591-01).

## Floating Control Synchronization

In order to regularly update the real actuator position with the calculated position and thus ensure that the actuator definitely reaches its end position, a synchronization process is performed by the UIO I/O module. During the synchronization process, the UIO I/O module will continue running for the configured runtime once it reaches the calculated end position.

This updating (synchronization) is performed:

- If the calculated position of the actuator < lower synchronization threshold (2%) = synchronization towards 0%
- If the calculated position of the actuator > upper synchronization threshold (98%) = synchronization towards 100%
- Following any power-up or any reset

## MANAGING FIRMWARE/CONFIGURATION OF I/O MODULES

### For Niagara Advanced Controller

The controller's firmware/configuration file includes the firmware/configuration for the I/O modules. Thus, whenever the controller's firmware/configuration is updated, the firmware/configuration of the I/O modules is automatically updated, if connected.

### For CPO Advanced Controller

I/O module firmware is downloaded to the controller separately from the CPO Studio tool. After the download, the CPO Advanced Controller will check if the I/O module firmware version is different compared to the current firmware. If the two firmware versions are different, the CPO Advanced Controller will automatically download the new firmware/configuration to the I/O module.

## Rules for Configuration Update

If the I/O module is set to the same address of the original device, the controller will download the configuration file and the module will start operating.

If the I/O Module has one or more channels in Manual (Hand) and the configuration of the channels is the same as the previous configuration, then controller will continue with the download. The Manual (Hand) position is maintained.

If the I/O Module has one or more channels in Manual (Hand) and the configuration of any channel is different than the previous configuration, the controller will not download the configuration and stops the read/write until all channels of the I/O module are set back to Auto.

**NOTE:** If multiple I/O modules are connected in the network, then the firmware upgrade is performed in parallel. If any I/O module is misconfigured or not configured in the network, then the upgrade will not be performed. However, the RS485 LED of that I/O module will turn green due to a common broadcast.

For more information on firmware/configuration file download/update, refer to the CPO Online tool user guide (en2b0002-ie10) or Niagara Supervisor engineering guide (31-00591-01).

## LED PATTERNS








All LED patterns are common to I/O modules.

**Table 23. LED Patterns**

Channel Type	Characteristics	Value on the tools	Actual physical value	I/O LED Indication
Channel not configured	N/A	N/A	N/A	Off
AO	0-10V (direct)	0%	0V	Off
		100%	10V	Solid green with fixed intensity
	0-10V (reverse)	0%	10V	Solid green with fixed intensity
		100%	0V	Off
AI	0-10V (direct)	0%	0V	Off
		100%	10V	Solid green with fixed intensity
	0-10V (reverse)	0%	10V	Solid green with fixed intensity
		100%	0V	Off
DO	DO (direct)	State(Off)	Contact is open	Off
		State(On)	Contact is closed	Green On
	DO (reverse)	State(Off)	Contact is closed	Off
		State(On)	Contact is open	Green On
DI	DI (direct)	State0(Off)	Contact is open	Off
		State1(On)	Contact is closed	Green On (status mode)
	DI (reverse)	State0(Off)	Contact is closed	Off
		State1(On)	Contact is open	Green On (Status mode)


## Main LED (On Dial)

Table 24. Main LED

LED behavior	Visual	Description
Off		Device is powered Off.
Green-Yellow-Red cycling, Alternate Green, Yellow, Red in every 1.5 Second (0.2S on / 0.3S off)		Factory default. No application loaded / No configuration.
Green-Solid		Power On, working properly, receiving data from the controller and connection is good. Or High or Low Alarm at an IO channel
Green - Breathing		Out of box. Offline configuration mode.
Green - Blink every 0.2 s		Application/firmware download or configuration in progress.
Yellow - Solid		Communication loss/cannot parse package/address error/OTA packet loss in the Panel bus. Or Input failure (channel input failure). Or A channel has a READ alarm (i.e. out of range). Or IO database points not setup (communication to IO is working).
Red - Solid		Hardfault/Fatal error/Assert error.




## Service LED

Table 25. Service LED

LED behavior	Visual	Description
Green-Solid		Solid green when press and holding the service button. See “Service Button” section on page 7 to reset the I/O module.

## RS485 LED




Table 26. RS485 Communication LED

LED behavior	Visual	Description
Green - Solid		Power On, working properly, receiving data from the controller and connection is good.
Yellow - Solid		RS485 communication frame error.
Red-Solid		Communication failed.

## Channel LEDs




### Universal Input Channel - Configured as AI

Table 27. UI Channel LED

LED behavior	Visual	Description
Off		Not configured.  For current and voltage input, if the physical input value equals 0, LED brightness intensity equals 0 or Off.
Green-Solid		Working properly.
Red-Solid		Alarm; Out-of-range; sensor break; sensor shorted; High / Low or READ condition.




### Universal Input / Output Channel - Configured as AI or AO

Table 28. UIO Channel LED

LED behavior	Visual	Description
Off		Not configured.  For current and voltage input/output, if the physical input/output value equals 0, LED brightness intensity equals 0 or Off.
Green-Solid		Working properly.
Red-Solid		Alarm; Out-of-range; High / Low or READ condition.  Not applicable for AO.

## Digital Input Channel - UIO, UI and DI I/O Modules

Table 29. DI Channel LED

LED behavior	Visual	Description
Off		Not configured. Off = Inactive/Stopped
Green-Solid		On: Active Running.  Pulse: solid green for high level, off for low level. If frequency is greater than 10Hz, then it will be solid green.
Red-Solid		On = Alarm; High / Low or READ condition



## Digital Input Channel - UIO, UI and DI I/O Modules

Table 30. Digital Input & UIO configured as DI

	Normal Polarity		Reverse Polarity		Description
	Open	Closed	Open	Closed	
LED behavior	Off	Solid-Green	Solid-Green	Off	Status
	Off	Solid-Red	Solid-Red	Off	Alarms
	Off	Solid-Yellow	Solid-Yellow	Off	Status or warnings
	Solid-Green	Solid-Red	Solid-Red	Solid-Green	Alarms

## Digital Output Channel

Table 31. DO Channel LED

LED behavior	Visual	Description
Off		OFF = Inactive/Stopped/OFF or not configured.
Green-Solid		On = Active/Running/ON  For Floating Control using Digital Outputs, LED is On when the actuator is moving and the LED is Off when the actuator is not moving.

## APPENDIX: EARTH GROUNDING

### I/O Module and SELV

In order to avoid distribution of noise or earth ground potential differences over networks or other connections, the I/O module is designed to comply with SELV (Safety Extra Low Voltage).

Furthermore, SELV offers the greatest possible safety against electrical impact.

To support SELV, all Honeywell external (CRT series) or internal transformers comply with standard EN60742. Earth grounding is therefore not recommended.

### I/O Module and EN60204-1

However, if compliance with the standard EN60204-1 is required, note the following:

#### General Information about EN60204-1

EN60204-1 defines electrical safety for a complete application/machine including I/O modules, sensors, actuators and any connected/controlled electrical device.

EN60204-1 requires I/O modules to be powered by PELV (Protective Extra-Low Voltage) and earth grounding of the secondary side of the used transformers or earth grounding of the system ground.

Earth grounding is prescribed to prevent the unexpected start-up of connected rotating/moving machines due to an insulation fault and double earth grounding somewhere in the plant.

The use of an earth leakage monitor is also possible to fulfill PELV if earth grounding is prohibited.

### When is EN60204-1 Applicable to I/O module?

#### SAFETY AGAINST ELECTRICAL IMPACT

EN60204-1 is not mandatory; this is because electrical safety is provided by the use of SELV and transformers according to standard EN60742.

#### SAFETY AGAINST UNEXPECTED START-UP OF ROTATING/MOVING MACHINES

If the application/plant does not contain machines that can be harmful to the operator due to an unexpected start-up, the standard EN60204-1 is not applicable. If such machines are encountered, then EN60204-1 must be followed. Grounding is required.

### Functional EMC Grounding

- Use a cable as short as possible for grounding: min 1.5 mm<sup>2</sup> (16 AWG).
- For connection details, refer to the following example.

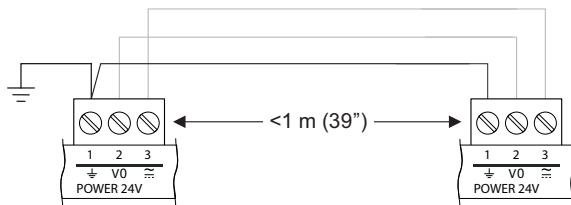
#### EXAMPLE

Connecting a single transformer with multiple I/O module I/O modules earth-grounded as per EN60204-1.

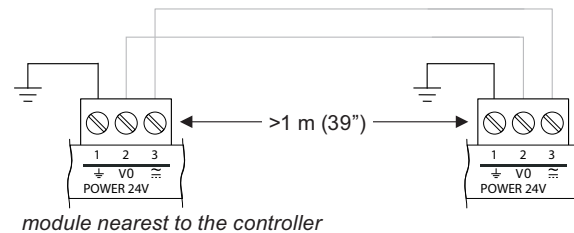
- Connect earth ground to FGND of the I/O module.

#### Earth / ground Connections

For cables <1 m (39") and where modules are in the same secondary enclosure, ground terminals may be linked:



For cables >1 m (39") or where modules are in different secondary enclosures, ground terminals **must be separated**:



**Fig. 27. Connecting and earth grounding multiple I/O module (single transformer)**

#### NOTES:

- Use a noise-free earth ground inside the cabinet.
- Use one star-point to split power for I/O modules and field devices.
- If the transformer is used for several I/O modules, each I/O module ground has to be wired separately to the star point.

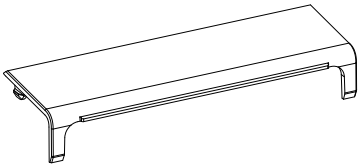
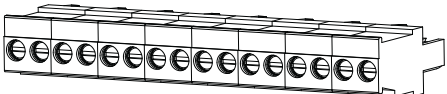
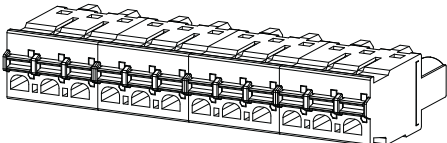
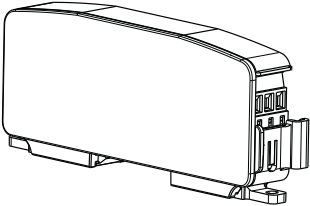
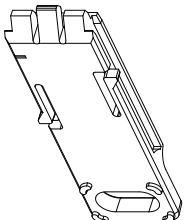
- If a field device that prohibits earth grounding is connected to the system ground, an isolation monitoring device must be used instead of earth grounding.
- If the field device transformer is physically far away from the I/O module, earth grounding must still be performed for the I/O module.



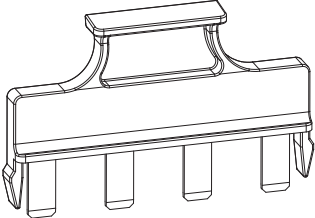
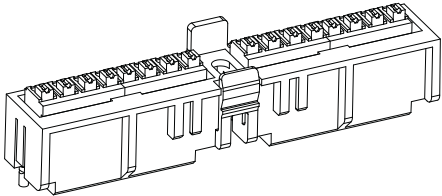
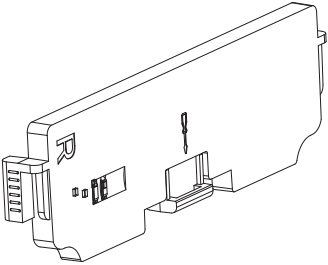
## Accessories Part Numbers

These accessories are available by separate order.

**Table 32. Accessories Part Numbers**

	Part Number	Description
	TCVR-105-10	Terminal covers for 105mm size I/O modules - pack of 10. Each I/O module includes 2 terminal covers. Point name labels can be printed out from the CPO Studio Tool and Niagara tool and attached to the terminal covers.
	SCRW-TB-2-PUR-50	Screw terminals - 2 way - purple - pack of 50
	SCRW-TB-3-PUR-50	Screw terminals - 3 way - purple - pack of 50
	SCRW-TB-2-BLU-50	Screw terminals - 2 way - blue - pack of 50
	SCRW-TB-3-BLU-50	Screw terminals - 3 way - blue - pack of 50
	SCRW-TB-2-YEL-50	Screw terminals - 2 way - yellow - pack of 50
	SCRW-TB-R-3-ORN-50	Screw terminals for line voltage relays - 3 way - orange - pack of 50
	SCRW-TB-3-BLK-50	Screw terminals - 3 way - black - pack of 50
	SCRW-TB-3-GRY-50	Screw terminals - 3 way - grey - pack of 50
	PUSH-TB-2-PUR-50	Push terminals - 2 way - purple - pack of 50
	PUSH-TB-3-PUR-50	Push terminals - 3 way - purple - pack of 50
	PUSH-TB-2-BLU-50	Push terminals - 2 way - blue - pack of 50
	PUSH-TB-3-BLU-50	Push terminals - 3 way - blue - pack of 50
	PUSH-TB-2-YEL-50	Push terminals - 2 way - yellow - pack of 50
	PUSH-TB-R-3-ORN-50	Push terminals for line voltage relays - 3 way - orange - pack of 50
	PUSH-TB-3-BLK-50	Push terminals - 3 way - black - pack of 50
	PUSH-TB-3-GRY-50	Push terminals - 3 way - grey - pack of 50
	IO-ADPT-S-2	I/O Wiring Adapters - pack of 2 IO-ADPT-S. Provides wiring connections for power and communications which are used to extend I/O modules to another DIN rail or to remotely locate the I/O modules.
	DIN-CLIP-10	DIN rail clip - pack of 10

**Table 32. Accessories Part Numbers**

	<b>Part Number</b>	<b>Description</b>
	IO-JUMPER-4-10	4 pin relay output jumper - pack of 10. Connects 4 relay commons.  Each DO relay module includes 2 jumpers.
	AUX-TRM-16-10	Auxiliary terminal block - 16 way - pack of 10 AUX-TRM-16. Each auxiliary terminal block has two groups of eight internally connected push in terminals for distributing signals/power.
	ENDCOVER-10	Protective end covers to cover the power and comms touch flake connections - pack of 10. The protective end cover is attached to the Advanced Plant Controller when used without an I/O module or the protective end cover is attached to the last I/O module in the panel. The protective end cover has a built in end of line resistor to terminate the RS485 bus. Each Advanced Plant Controller includes one end cover.

## TECHNICAL LITERATURE

**Table 33. Technical Literature**

<b>Title</b>	<b>Product Literature Number</b>	<b>Contents</b>
ComfortPoint™ Open PC500 Plant Controller - Data Sheet	en0b0310-ie10	Product data including technical specification, ordering information, and product description.
ComfortPoint™ Open PC500 Plant Controller - Mounting Guide	mu1b0312-ie10	Describes the mechanical mounting of the device.
ComfortPoint™ Open PC500 Plant Controller - Installation Instruction	en1b0311-ie10	Describes the electrical, wiring, and commissioning information.
ComfortPoint™ Open PC600 Plant Controller - Data Sheet	en0b0313-ie10	Product data including technical specification, ordering information, and product description.
ComfortPoint™ Open PC600 Plant Controller - Mounting Guide	mu1b0315-ie10	Describes the mechanical mounting of the device.
ComfortPoint™ Open PC600 Plant Controller - Installation Instruction	en1b0314-ie10	Describes the electrical, wiring, and commissioning information.
ComfortPoint™ ComfortMan – User Guide	en2b0003-ie10	Describes managing the firmware of the controller such as collecting, analyzing diagnostic data, and so on.

**Table 33. Technical Literature (Continued)**

<b>Title</b>	<b>Product Literature Number</b>	<b>Contents</b>
ComfortPoint™ Open Studio tool - User Guide	en2b0001-ie10	Describes creating logical controllers, plants, data points, control logic, plant systems, facilities for the controller applications and download the configuration setting to controllers.
ComfortPoint™ Open Online tool - User Guide	en2b0002-ie10	Describes all commissioning activities such as performing uploading and downloading application & firmware, monitoring datapoints, licensing PDA devices, and VAV balancing configuration.
Niagara Advanced Plant Controller - Product Datasheet	31-00583	Product data including technical specification, ordering information, and product description.
Niagara Advanced Plant Controller - Mounting Instructions	31-00553	Describes the mechanical mounting of the device.
Niagara Advanced Plant Controller - Installation Instruction & Commissioning Guide	31-00584	Describes the electrical, wiring, and commissioning information.
PANELBUS DRIVER 4.10.xx - User Guide	31-00591	Describes creating logical controllers, plants, data points, control logic, plant systems, facilities for the controller applications and download the configuration setting to controllers.
Optimizer Advanced Plant Controller - Product Datasheet	31-00631	Product data including technical specification, ordering information, and product description.

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