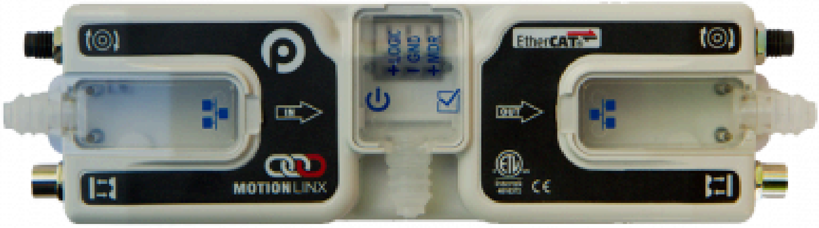
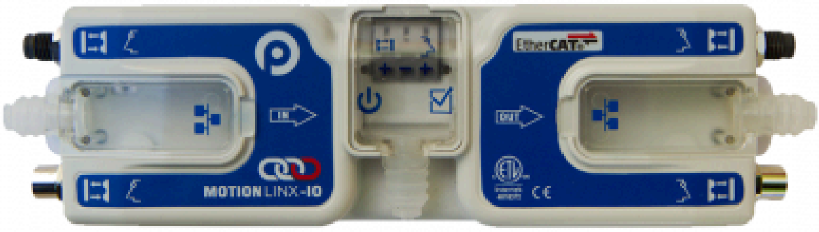
PULSEROLLER

MotionLinx Family Complete Guide

Version 1 — 12 September 2023





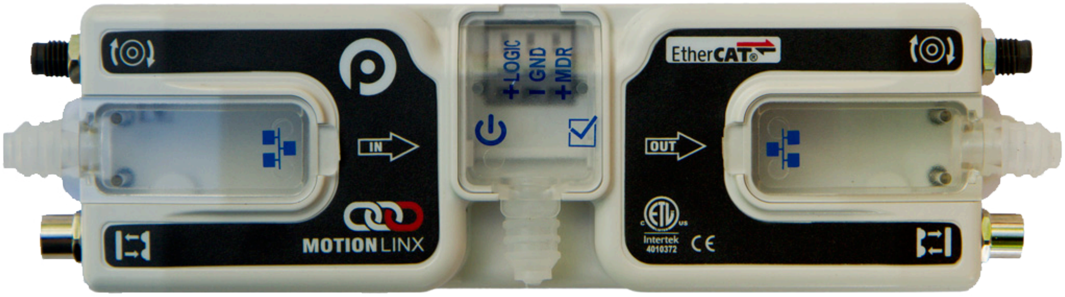
For MotionLinx-Ai2 and MotionLinx-IO

Table of Contents

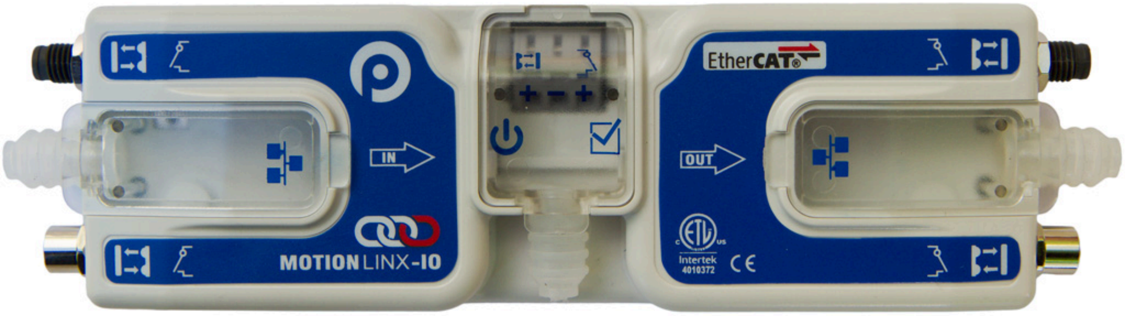
1. About This Manual

Products Covered in this Manual

MotionLinx-Ai2 Article Number 4022-0000



ConveyLinx-IO Article Number 4081-0000



Symbol Conventions

! This symbol indicates that special attention should be paid in order to ensure correct use as well as to avoid danger, incorrect application of product, or potential for unexpected results

✱ This symbol indicates important directions, notes, or other useful information for the proper use of the products and software described herein

Important User Information

! Modules contain ESD (Electrostatic Discharge) sensitive parts and components. Static control precautions are required when installing, testing, servicing or replacing these modules. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference any applicable ESD protection handbook. Basic guidelines are:

- Touch a grounded object to discharge potential static
- Wear an approved grounding wrist strap
- Do not touch connectors or pins on component boards
- Do not touch circuit components inside the equipment
- Use a static-safe workstation, if available
- Store the equipment in appropriate static-safe packaging when not in use

! Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes, and standards

! The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Pulseroller does not assume responsibility or liability (to include intellectual property liability) for actual use based on the examples shown in this publication

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Not Included in this Manual

! Because system applications vary; this manual assumes users and application engineers have properly sized their power distribution capacity per expected motor loading and expected operational duty cycle. Please refer to conveyor equipment and/or motor roller manufacturer’s documentation for power supply sizing recommendations

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2. Glossary of Terms

Term	Definition
Ai Technology	The patented technology used to control a DC motor with external commutation over a standard M8 4-pin connector
Beckhoff Automation GmbH & Co. KG	The developer of the EtherCAT protocol and the TwinCAT software.
ConveyLinx	Conveyor controls architecture based upon modular distributed devices connected via Ethernet network.
MotionLinx-Ai	A member of the ConveyLinx family running the EtherCAT industrial protocol for communication. This module uses the Ai technology to control up to two Senergy-Ai MDRs. Profnet IO, EthernetIP and ModBus TCP are not supported by MotionLinx-Ai
EtherCAT	An industrial protocol developed by Beckhoff Automation. Requires a special EtherCAT switch
Hall Effect Sensor	Special sensor embedded within the brushless DC motor of an MDR used to provide motor rotor position feedback to the motor controller
IP54	The IP Code (International Protection Marking) specifies the device’s degree of resistance to intrusions, dust and water. IP54 certified device must be fully protected from splashed water, dust particles and completely protected from contact
LED	Light Emitting Diode – In the context of this document, LED’s are used on the ConveyLinx-Ai2 to provide visual indication of module status
Light / Dark Energized	Term used to describe how the signaling output circuit of a photo-sensor is configured when it detects its reflected light. A photo-sensor that is light energized will activate its output circuit when it detects its reflected light. A dark energized photo-sensor will activate its output circuit when it does not detect its reflected light
M8	This is the type of a connector, which has four connector pins and is used on the ConveyLinx Ai2 modules for both sensor connectors and MDR connectors
MDR	Motorized Drive Roller or Motor Driven Roller – Brushless DC motor and gearbox assembly integrated into a single conveyor roller
Normally Open / Normally Closed	Control logic terminology to define the state of the output of a Boolean “on” or “off” device. The term specifically describes the state of the output circuit when the device’s sensing circuit is un-energized. In the context of photo-

	sensors; a normally open wired sensor would have its output circuit energized when it detected its reflected light and its output circuit would be de-energized when it did not detect its reflected light. Conversely a photo-sensor wired normally closed would energize its output circuit when it did not see its reflected light and it would de-energize its output circuit when it did detect its reflected light
NPN / PNP	Electronics term that indicates the type of transistor circuit used for a logical input or output for controllers. NPN devices will provide a common or ground connection when activated and a PNP device will provide a logic voltage connection when activated
Photo-sensor	A device, mounted near the end of the conveyor zone to sense the presence of a carton on the zone
Pulse Gear Drive (PGD)	Senergy-Ai motor and gearbox assembly with standard mounting face and universal shaft. PGD device can be used for more general purpose applications compared to MDR.
PLC	Programmable Logic Controller – A wide variety of industrial computing devices that control automatic equipment
PWM	Pulse Width Modulation – a control scheme that utilizes high speed switching transistors to efficiently deliver power in a controlled fashion from the ConveyLinx controller to MDR
Retro-reflective / Reflex	Term used to describe the two basic types of photo-sensors. Retro-reflective photo-sensors utilize a reflective target that must be aligned with the photo-sensor such that the light emitted by the photo-sensor is reflected back to it. ‘Reflex (or sometimes known as proximity) type photo-sensors emit light to be reflected back from an object located sufficiently close to the sensor. ‘For both types of photo-sensors, when they detect their reflected light source, their signaling output circuit changes state.
Senergy-Ai	PulseRoller brand proprietary motor control platform that provides electronic intelligence inside the motor that can be read by ConveyLinx-Ai Family and MotionLinx-Ai Family control modules. The connection from the motor to the controller is via 4-Pin M8 style connector
TwinCAT	The integrated engineering and runtime PC based programming environment created and distributed by Beckhoff. It allows the user to create hardware configuration and PLC tasks. The engineering part of the environment is PC-based and runs on almost any system. The runtime (PLC tasks) part, however runs only on 32 bit Intel CPUs or 64 bit Intel CPUs with enabled VT-X feature. For our examples we use TwinCAT3.

3. Getting Started

Purpose of this Manual

The purpose of this manual is to:

- Identify the components and ports available on a module
- Provide guidelines for proper installation and wiring
- Provide examples on basic inter-module connections
- Introduce TwinCAT software tool and provide instructions to configure and modify parameters

Who Should Use this Manual?

This manual is intended for users who need basic product information and simple application procedures to implement *MotionLinx-Ai modules with Senergy Ai motors* and/or *MotionLinx-IO* modules with digital I/O.
You should have a basic understanding of electrical circuitry and familiarity with relay logic, BLDC motors, etc. If you do not, obtain the proper training before using this product.

4. Module Hardware

MotionLinx-Ai modules are designed to be installed and integrated typically into a conveyor's mechanical side frame assembly. The *MotionLinx-Ai* module is a controller for up to 2 *Senergy-Ai* technology Motorized Drive Roller (*MDR*) or Pulse Gear Drive (PGD) units. Each *MotionLinx-Ai* also provides connection points for 2 photo-sensors (or other 24V digital I/O devices) as well as upstream and downstream network interconnections to form a complete control system.

MotionLinx-IO modules utilize the same form factor and mounting dimensions as the MotionLinx-Ai module as well as the same network interconnections. The *MotionLinx-IO* is used for general purpose 24V digital I/O and does not contain any motor ports.

Both *MotionLinx-Ai* and *MotionLinx-IO* modules integrate seamlessly together in any *EtherCAT* based control system.

> ✻ The “left” and “right” naming convention for the module ports is based upon facing the front of the MotionLinx-Ai/MotionLinx-IO and is not to be confused with direction of product flow for a conveyor application. For conveyor applications, product flow will be designated as “upstream” and “downstream”

Learn more:

Identifying Module Components
Mounting Dimensions
Motor Ports
Sensor Ports
I/O Ports
Ethernet Ports
Power Connections
Power Supply Sizing
LED Status Indicators
Technical Specifications

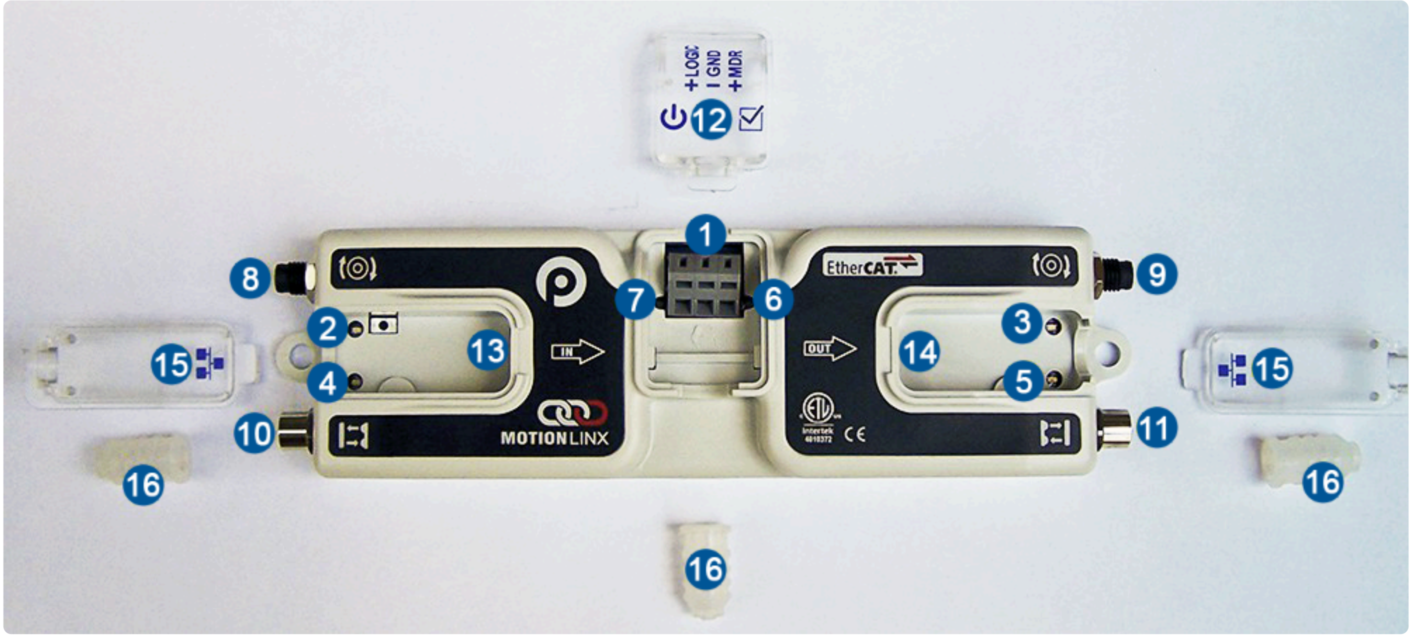
4.1. Identifying Module Components

The MotionLinx Family of controllers have very similar module components, but there are small differences between the different models, so each module has its own page for component identification.

MotionLinx-Ai

MotionLinx-IO

4.1.1. MotionLinx-Ai

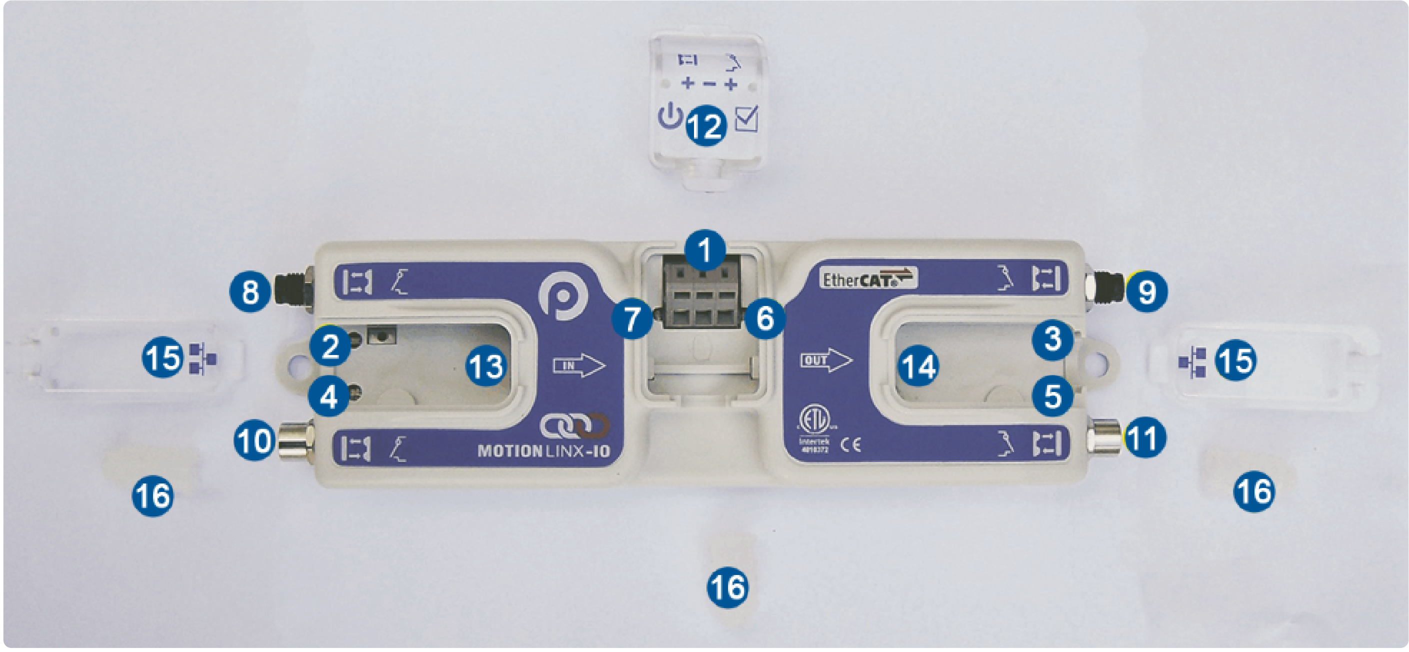


Item	Description
1	24VDC Power Terminals with separate connections for Logic and Motors
2 & 3	Motor Left LED & Motor Right LED – Motor status indicators
4 & 5	Left Sensor & Right Sensor Status LED Indicators
6	Module EtherCAT Status LED Indicator
7	Module Power LED Indicator
8 & 9	Motor Left and Motor Right Port – 4-pin M8 style connector for Senergy-Ai Motor connection
10 & 11	Sensor Left and Sensor Right Port – M8 style connector for zone photo-sensor connection
12	Removable IP54 Power Compartment Cover
13 & 14	Link-IN and Link OUT – RJ-45 style network connection between modules including LED Indicators

15	Removable IP54 RJ-45 Port Compartment Cover – Left and Right
16 *	IP54 Protection Shrouds for Ethernet cabling and power wiring

- Indicates items shipped unattached to the module but are included in the module’s box

4.1.2. MotionLinx-IO



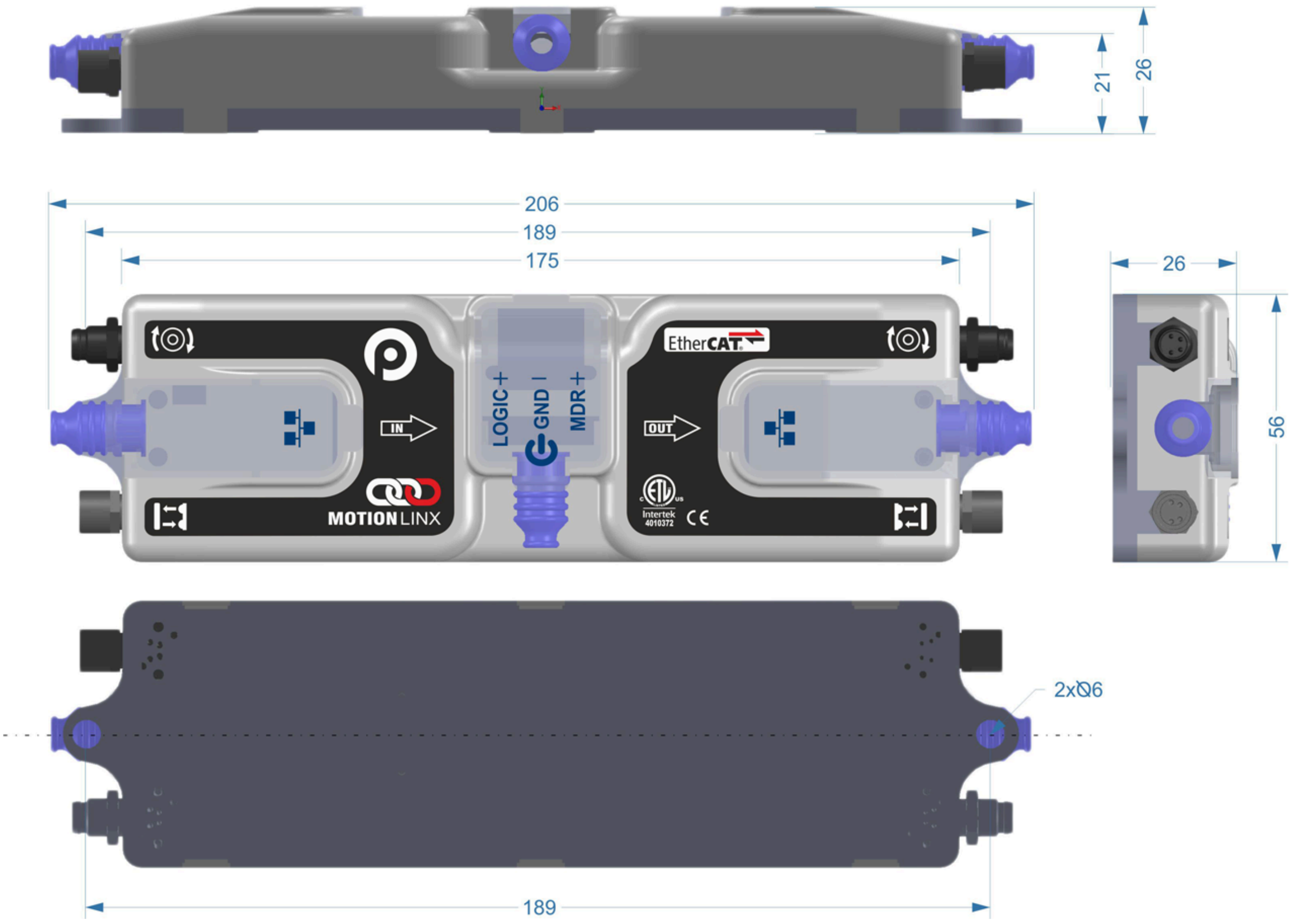
Item	Description
1	24VDC Power Terminals with separate connections for Logic and Motors
2 & 3 & 4 & 5	IO Port LED status indicators
6	Module EtherCAT Status LED Indicator
7	Module Power LED Indicator
8 & 9	Left and Right Male IO Ports – 4-pin M8 style connector
10 & 11	Left and Right Female IO Ports – 4-pin M8 style connector
12	Removable IP54 Power Compartment Cover
13 & 14	EtherCAT Link-IN and Link OUT – RJ-45 style network connection between modules including LED Indicators
15	Removable IP54 RJ-45 Port Compartment Cover – Left and Right

16 *	IP54 Protection Shrouds for Ethernet cabling and power wiring

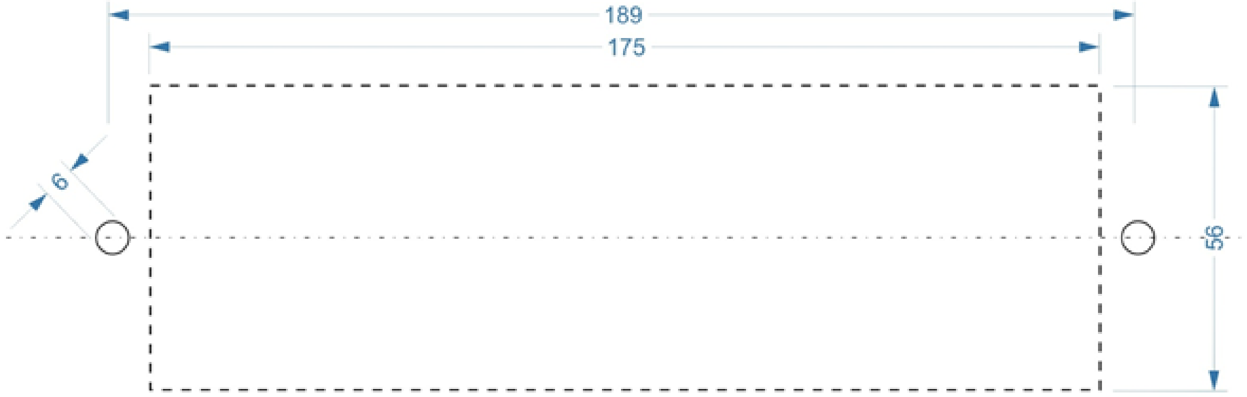
- Indicates items shipped unattached to the module but are included in the module’s box

4.2. Mounting Dimensions

> Dimensions and Mounting Hole Dimensions are identical for MotionLinx-Ai and MotionLinx-IO



Mounting Hole Dimensions

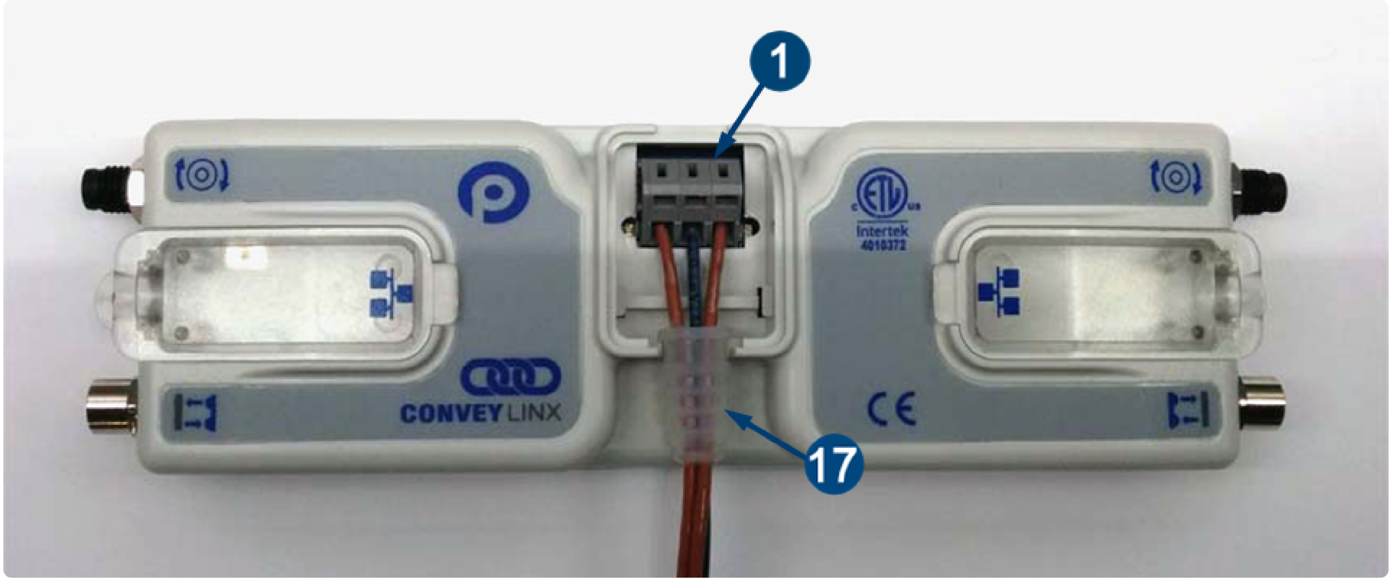


4.3. Module Power Connections

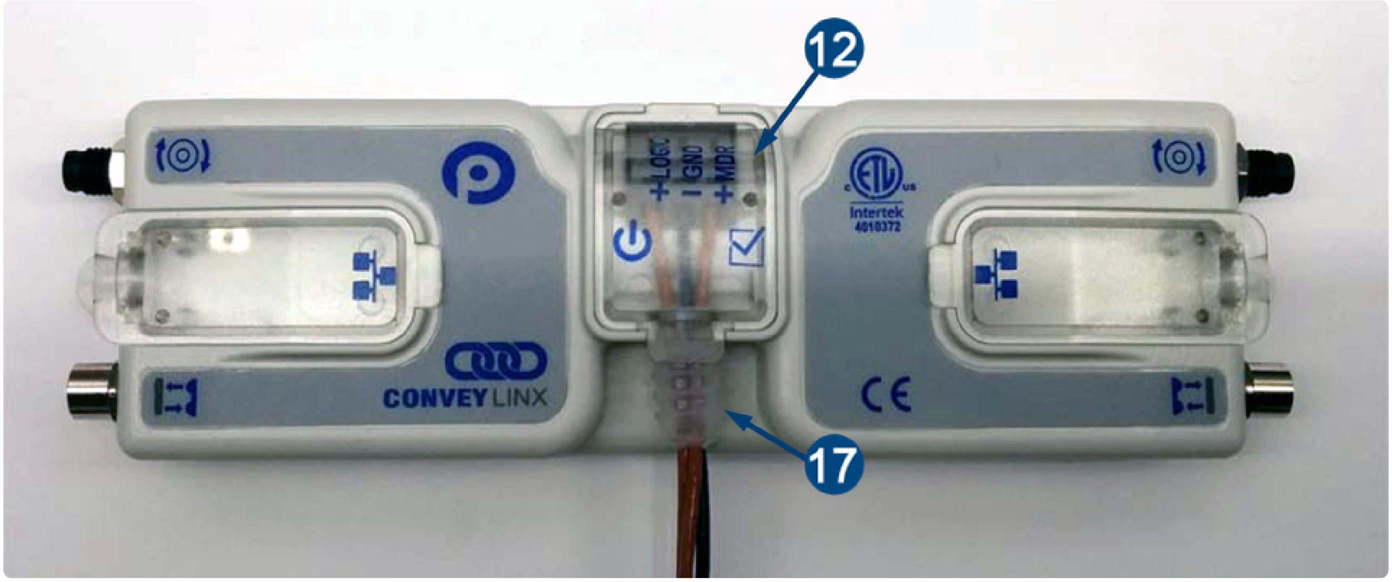
The protective shrouds (Item 17 as depicted in *Identifying Module Components*) will be unattached to the module when shipped and are included in the module’s shipping box. These shrouds are used to maintain an IP54 installation of the power and Ethernet wiring.

✻ 12 AWG (3.31 mm ^{2}) Max wire size, 5-6 mm strip length

✻ Please note the photos below depict Pulseroller ConveyLinx-Ai2 modules. The power terminals, connections, IP54 shrouds, etc. are all identical for MotionLinx-Ai and MotionLinx-IO



Power wires are fed through the protective shroud (Item 17). The wire terminals (Item 1) are standard cage-clamp style



Once wiring has been completed the power wiring compartment is then sealed by snapping into place the Power Compartment Cover (Item 12)

4.4. Motor and Logic Power

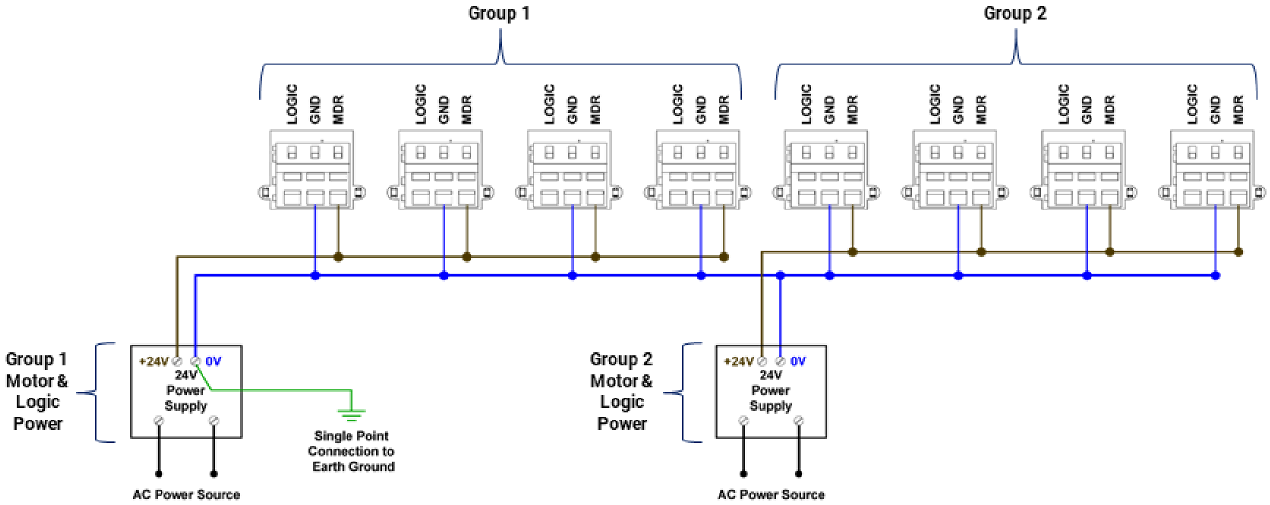
Both *MotionLinx-Ai* and *MotionLinx-IO* each are equipped with the ability to separate the *MDR Power* or *Digital Output Power* (MotionLinx-IO only) from the *Logic Power*.

! Please note that in all power connection situations it is recommended to tie all DC common terminals together and a single connection to earth ground.

Connecting only MDR Power

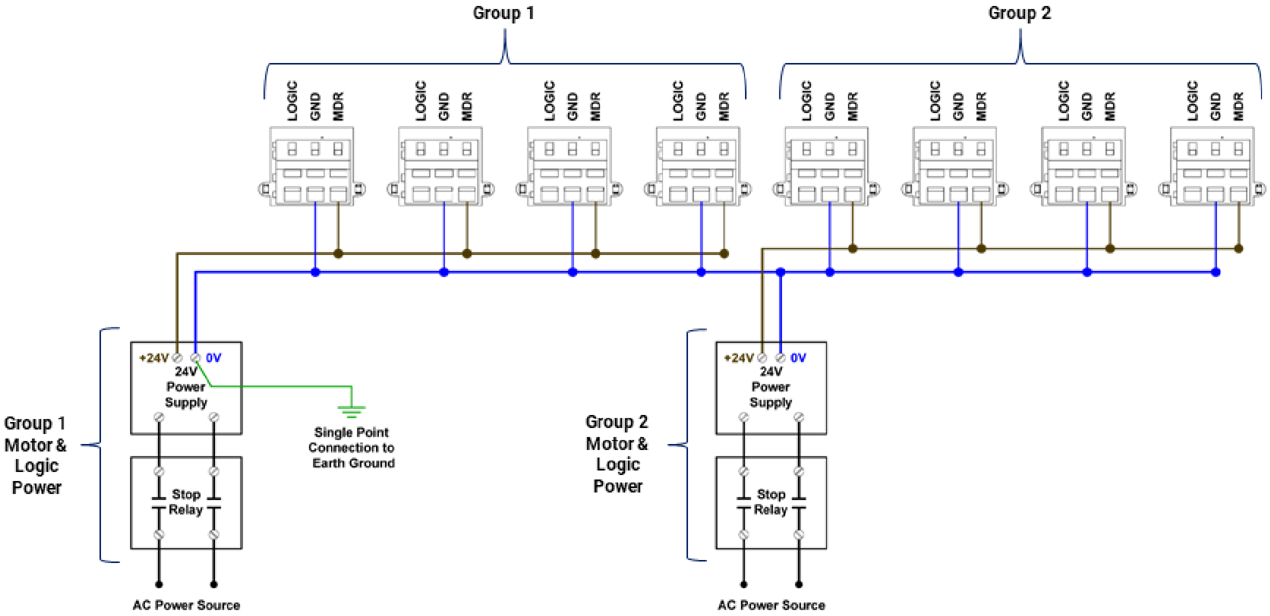
The diagram shows the Power Terminal connections for 8 total modules separated into two groups of 4 modules powered by 2 separate power supplies.

Connecting only to *MDR Power* will provide power to *both* the motor/digital output circuits and the logic circuits.



Connecting only Switched MDR Power

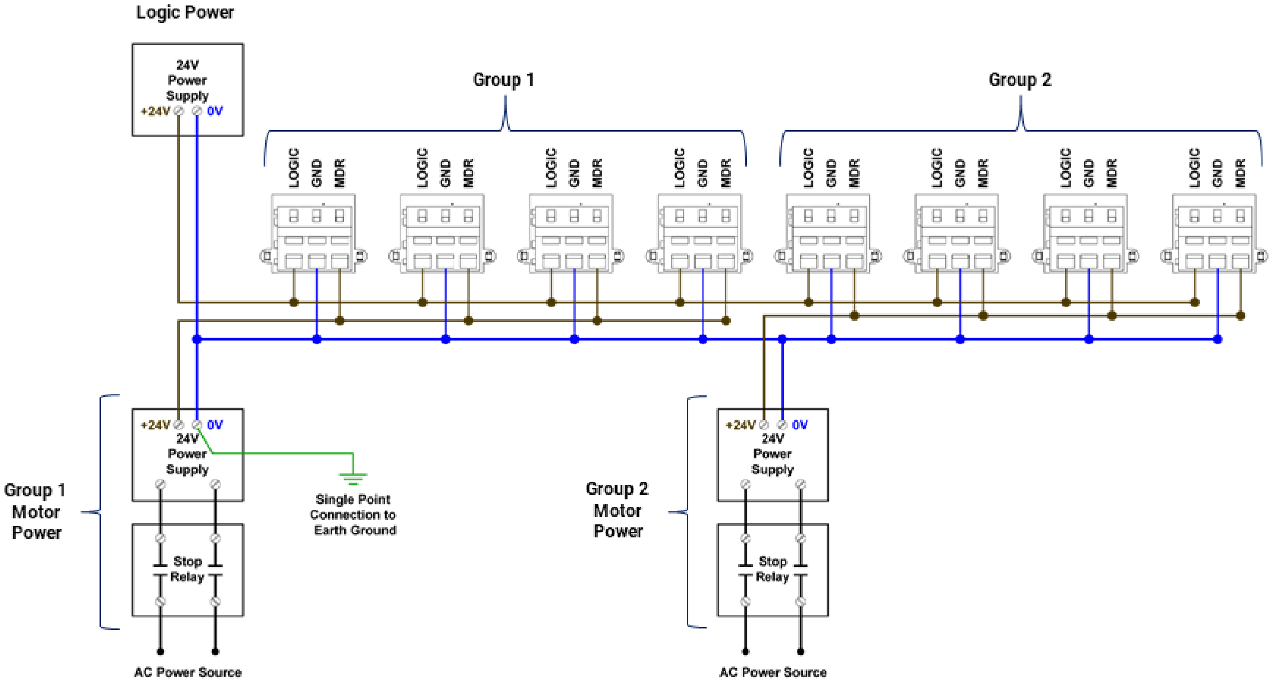
This diagram depicts the same example shown above with the exception of the power supplies being included in an externally controlled switching circuit such as would be used for an E-Stop.



Connecting Separate Logic and Switched MDR Power

The diagram shows the connection for when Logic Power is coming from a separate power supply than the MDR Power. Please note that the Logic Power supply is connected to the Logic terminals for all 8 modules.

> ✻ Providing a separate power connection to the Logic Power, you can keep the logic and communications powered and active and disconnect the MDR Power to assure all motors/digital outputs are disconnected such as in an E-Stop situation


Logic Power
24V
Power
Supply
+24V
0V
Group 1
Group 2
LOGIC
GND
MDR
Group 1
Motor
Power
+24V
0V
24V
Power
Supply
Stop
Relay
AC Power Source
Single Point
Connection to
Earth Ground
Group 2
Motor
Power
+24V
0V
24V
Power
Supply
Stop
Relay
AC Power Source

4.5. Power Supply Sizing

The current loading on the power supply for a group of MotionLinx-Ai Modules depends upon the *Motor Type* selected. Each of the motor types available has an associated rated current that the motor will draw at rated torque and maximum speed. Each *Motor Type* also has an associated allowed current draw that is available for a period of time upon the initial starting of the motor. Theses current values and starting times are shown in the following chart:

	ECO	ECO+	BOOST	BOOST 8
Power supply load **per Motor Port** at rated torque at maximum speed	2.5 A	4.1 A	3.5 A	3.5 A
Power supply load **per Motor Port** during motor starting period	3.0 A	4.1 A	5.0 A	8.0 A
Duration of motor starting period	5.0 sec	N/A	1.5 sec	3.0 sec

Please note that the current values shown are per Motor Port, so if both Motor Ports are being used on a given MotionLinx-Ai, the current load seen by the power supply for that module will be double the value shown.

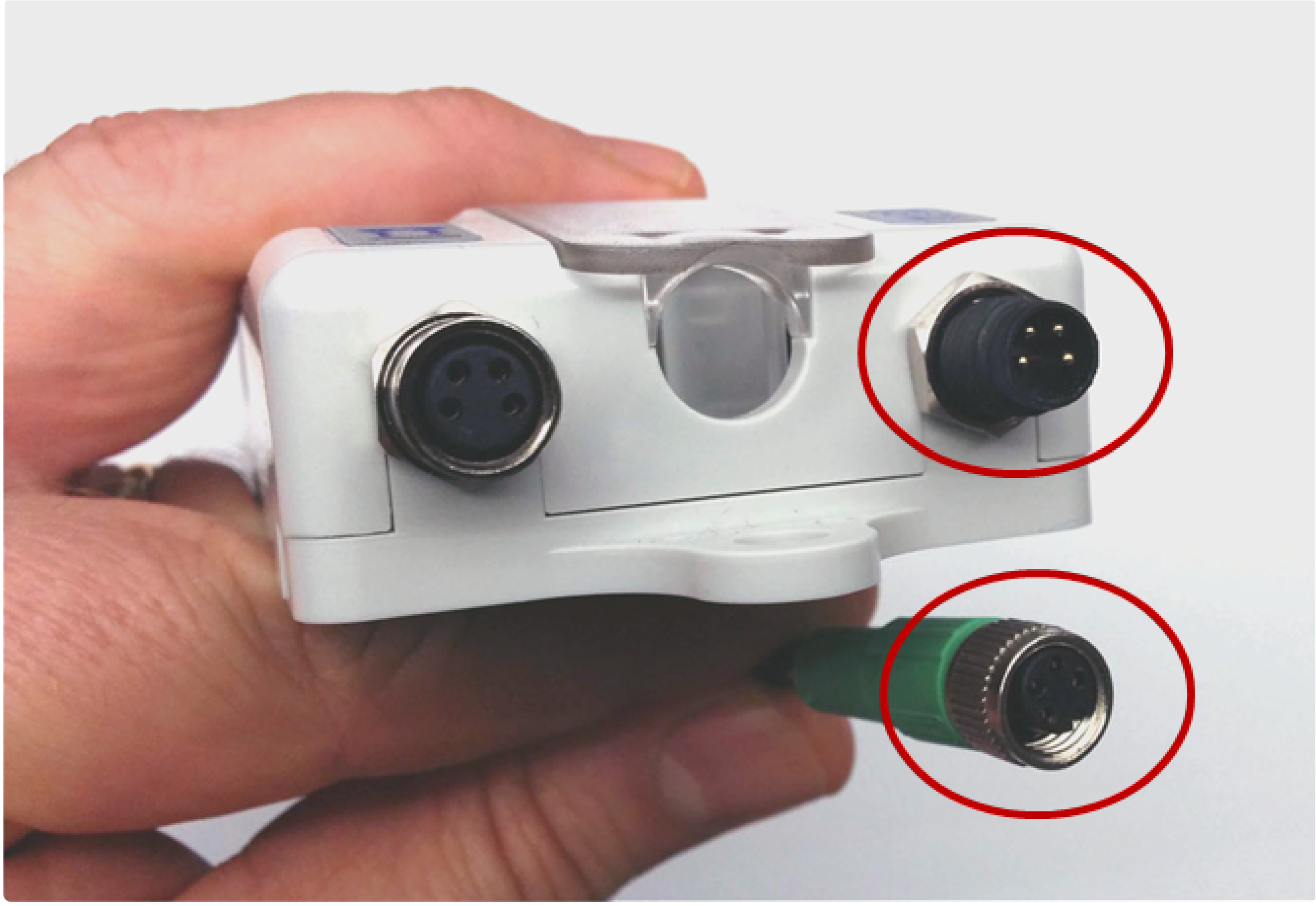
The current values are at rated speed and at rated torque. The current will be less if rated torque is not required by the motor.

See MotionLinx-Ai SDOs Configuration Topic for details on selecting ***Motor Type***

! Pulseroller assumes the user is aware of MDR power requirements for the application and that the user and/or installer have properly sized 24VDC power supplies and wiring based upon all applicable codes and standards. Pulseroller also assumes installation will follow proper equipment grounding practices. “DC common or -”on all power supplies should always be connected to ground. Improper power supply sizing and/or improper grounding practices may produce unexpected results

4.6. Motor Ports (MotionLinx-Ai Only)

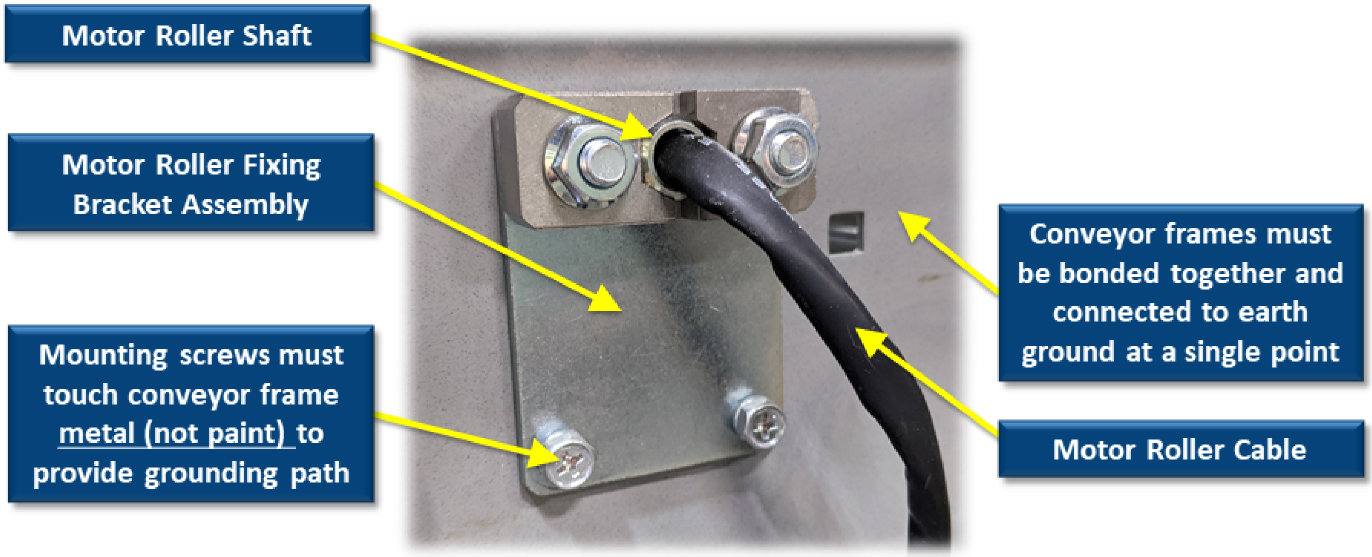
Both ports utilize a 4-pin M8 male receptacle. Each receptacle is mechanically keyed to assure proper orientation upon plugging in.



M8 4 Pin Male Motor Port with Senergy Ai Motor Female Connector

4.6.1. Proper Motor Grounding Practice

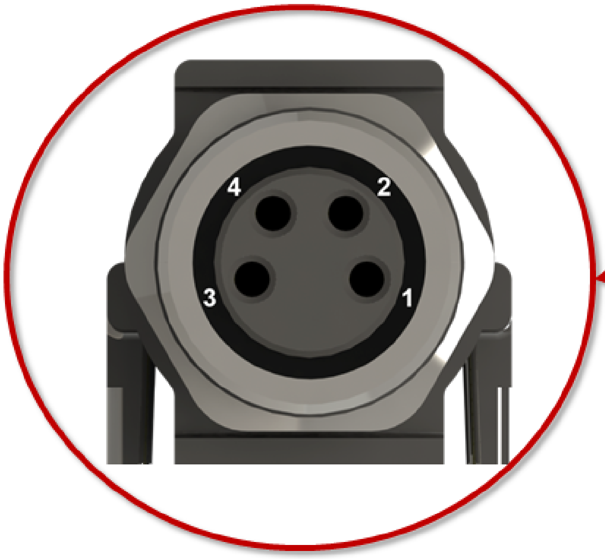
Motor roller drive end shaft and/or fixing bracket must be electrically bonded to the conveyor frame and conveyor frame connected to electrical ground.

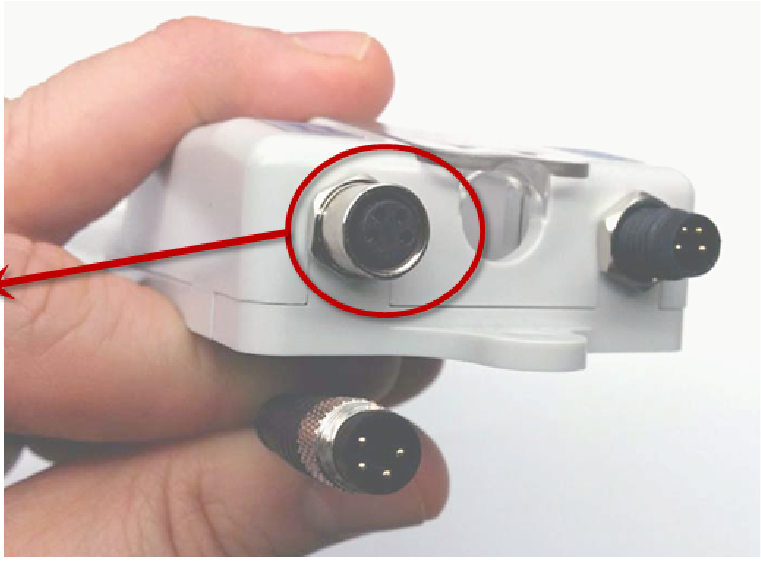

Motor Roller Shaft
Motor Roller Fixing Bracket Assembly
Mounting screws must touch conveyor frame metal (not paint) to provide grounding path
Conveyor frames must be bonded together and connected to earth ground at a single point
Motor Roller Cable

! Improper grounding of MDR and/or Power Supply Common may result in premature MDR and/or MotionLinx-Ai module failure. Proper grounding techniques MUST be observed for all applications

4.7. Sensor Ports (MotionLinx-Ai Only)

Each sensor port is a standard M8 Female receptacle with standard pin-out:



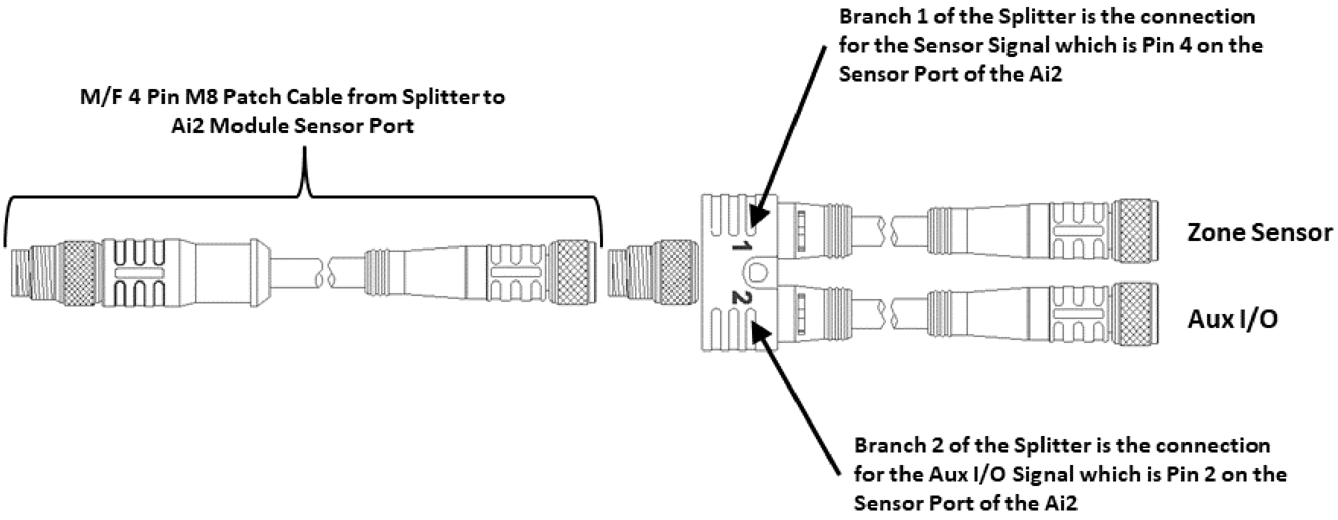


Pin	Signal	Description
1	24VDC	Module’s 24VDC Supply
2	Aux I/O	I/O Signal – Input or Output Function configured by Master Controller SDO
3	GND	Module’s DC Common
4	Sensor Signal	Logical Input for Sensor’s state output – Auto detect for NPN or PNP

4.7.1. Electrical Connections for Sensor Port Aux I/O

When connecting to either Sensor port with an M8 connector to access Pin 2 signal; you typically will use a standard parallel type splitter cable assembly that breaks out each of the available pins on the Module to their own M8 connection port. These splitter cables wire the +24V and Common connections in parallel

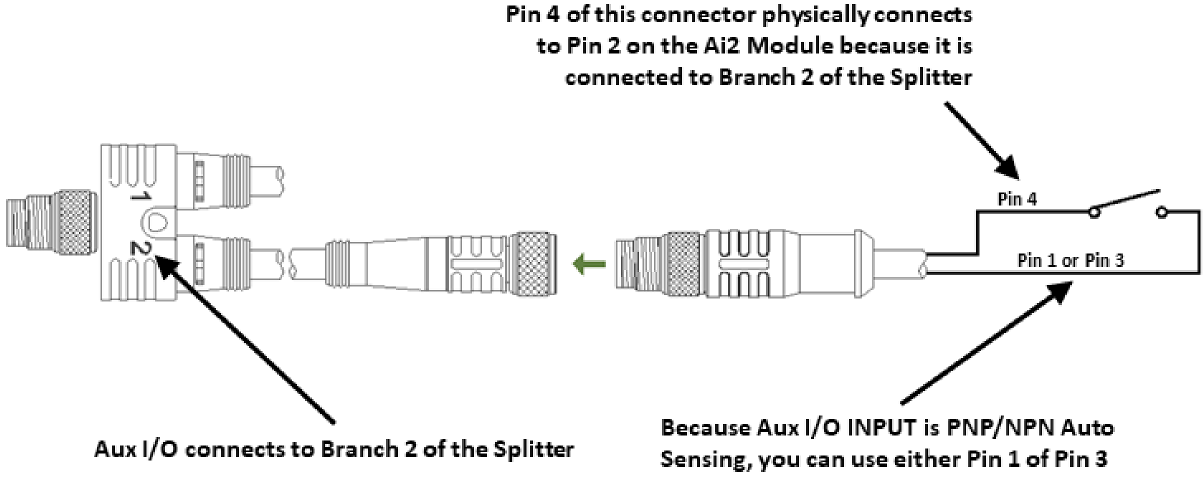
Splitter cables are commercially available from multiple sources. Click here for information for Pulseroller IOX-2 Breakout/Splitter Module


Branch 1 of the Splitter is the connection for the Sensor Signal which is Pin 4 on the Sensor Port of the Ai2
M/F 4 Pin M8 Patch Cable from Splitter to Ai2 Module Sensor Port
1
2
Zone Sensor
Aux I/O
Branch 2 of the Splitter is the connection for the Aux I/O Signal which is Pin 2 on the Sensor Port of the Ai2

Typical Parallel Splitter Cable Usage

Aux I/O Pin 2 as Input

When the Aux I/O Pin 2 is configured as an input, the circuit is NPN/PNP auto-sensing. The signal can be connected to either +24V or 0V to operate.

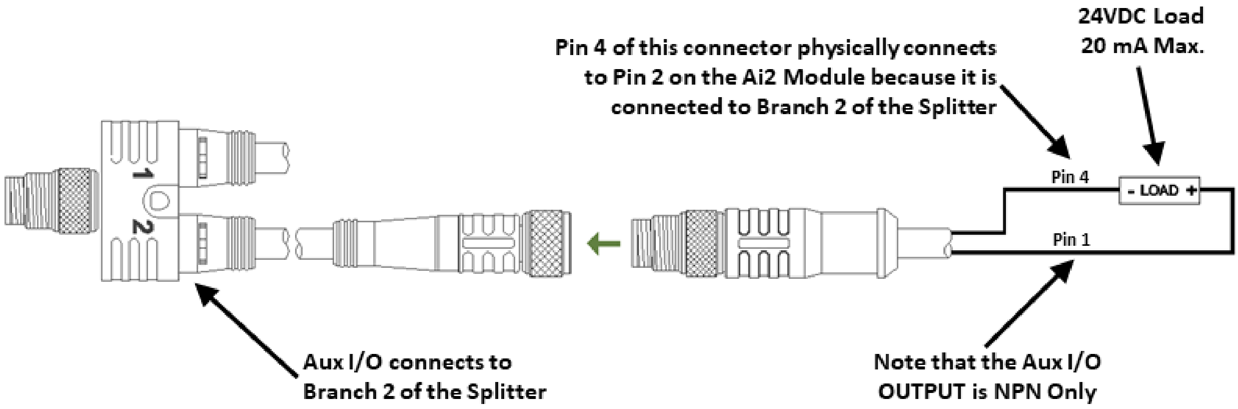

Pin 4 of this connector physically connects to Pin 2 on the Ai2 Module because it is connected to Branch 2 of the Splitter
1
2
Pin 4
Pin 1 or Pin 3
Aux I/O connects to Branch 2 of the Splitter
Because Aux I/O INPUT is PNP/NPN Auto Sensing, you can use either Pin 1 of Pin 3

Aux I/O Pin 2 Input Connection Diagram

! Because the auto-sensing circuit requires a nominal voltage in order to operate, there will be some small amount of leakage current possible between Module Pin 2 and Pin 3 (GND). Please use caution if you connect a load between Module Pin 2 and Pin 3.

Aux I/O Pin 2 as Output

When the Aux I/O Pin 2 is configured as an output, the circuit is NPN only and requires the load to be connected to Pin 1 (+24V)


24VDC Load
20 mA Max.
Pin 4 of this connector physically connects to Pin 2 on the Ai2 Module because it is connected to Branch 2 of the Splitter
1
2
Pin 4
- LOAD +
Pin 1
Aux I/O connects to Branch 2 of the Splitter
Note that the Aux I/O OUTPUT is NPN Only

Aux I/O Pin 2 Output Connection Diagram

! Please note that MotionLinx-Ai Pins configured as outputs are NPN (sinking) which is UNLIKE MotionLinx-IO outputs which are PNP (sourcing)

4.8. IO Ports (MotionLinx-IO Only)

MotionLinx-IO Ports operate similar to *MotionLinx-Ai Sensor Ports* in that commercially available M8 splitter cables and/or *IOX-2 Breakout/Splitter Modules* can be used. Please refer to the Sensor Ports wiring details topic.

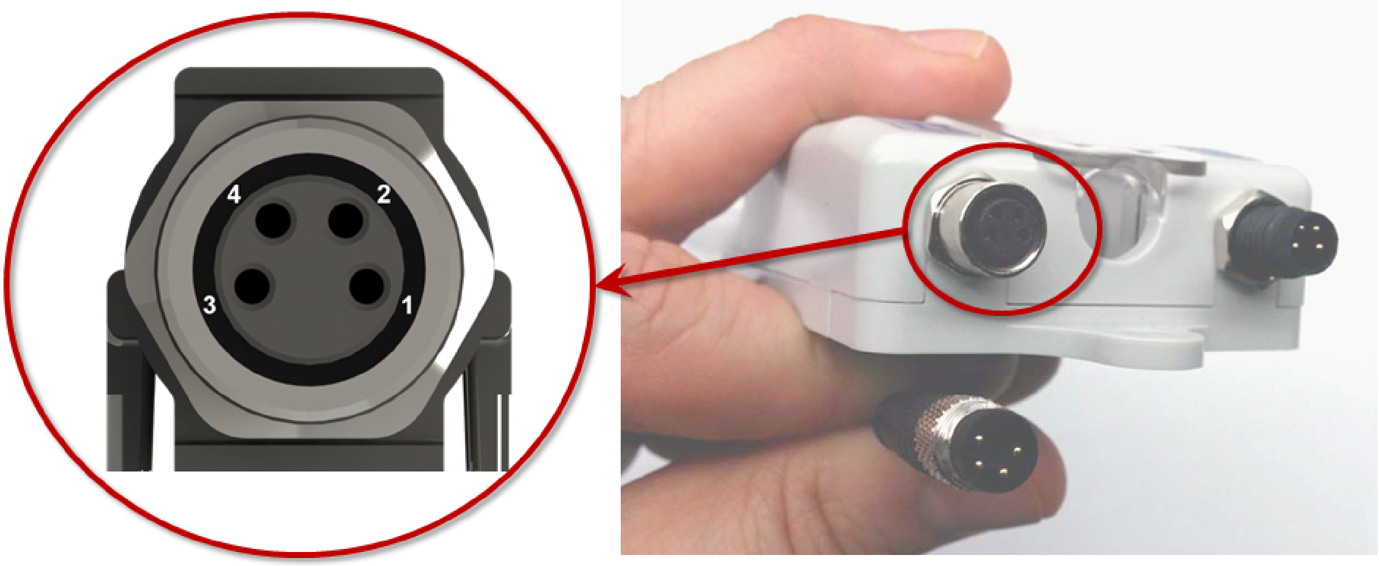
> ✻ Splitter cables are commercially available from multiple sources. Click here for information for Pulseroller IOX-2 Breakout/Splitter Module

> ! Please note that for MotionLinx-IO modules, the Pulseroller IOX-2 Breakout/ Splitter will only function as a passive splitter. The active breakout circuitry is not applicable.

Left and Right Female M8 Ports

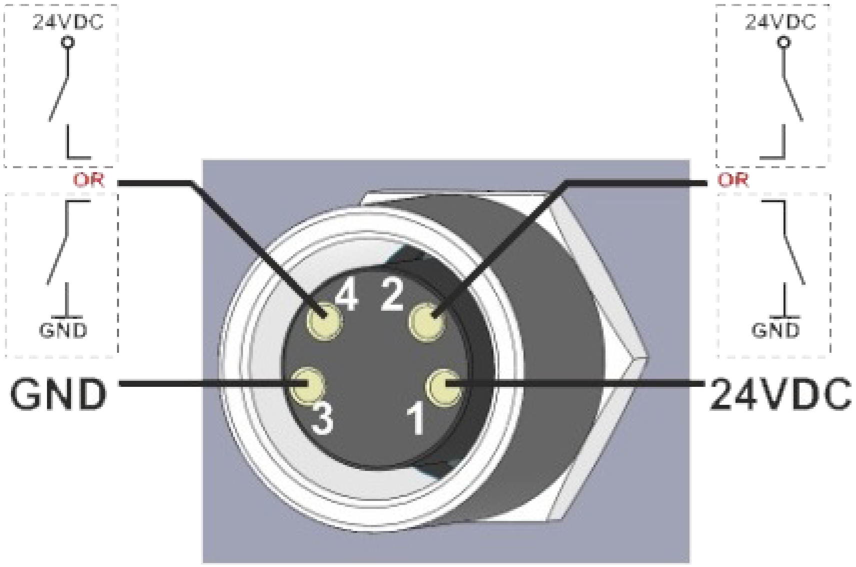
Left and Right Male M8 Ports

4.8.1. Left & Right Female Ports



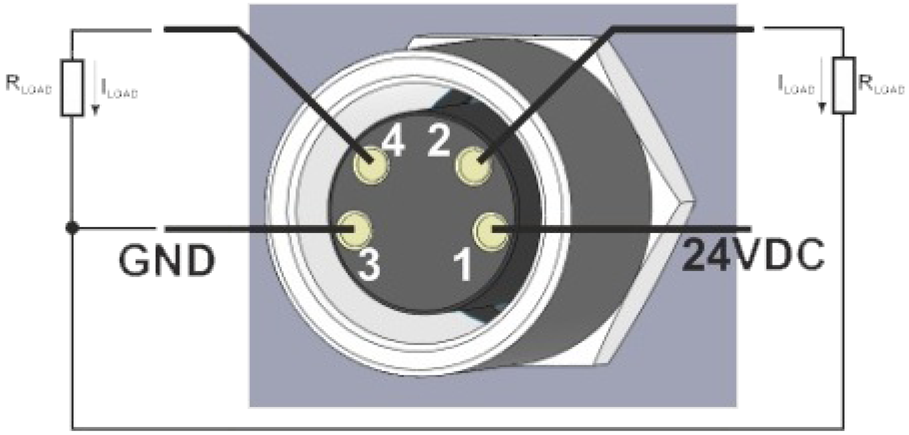
Input Wiring

Note that each Input Pin can be wired NPN or PNP independently



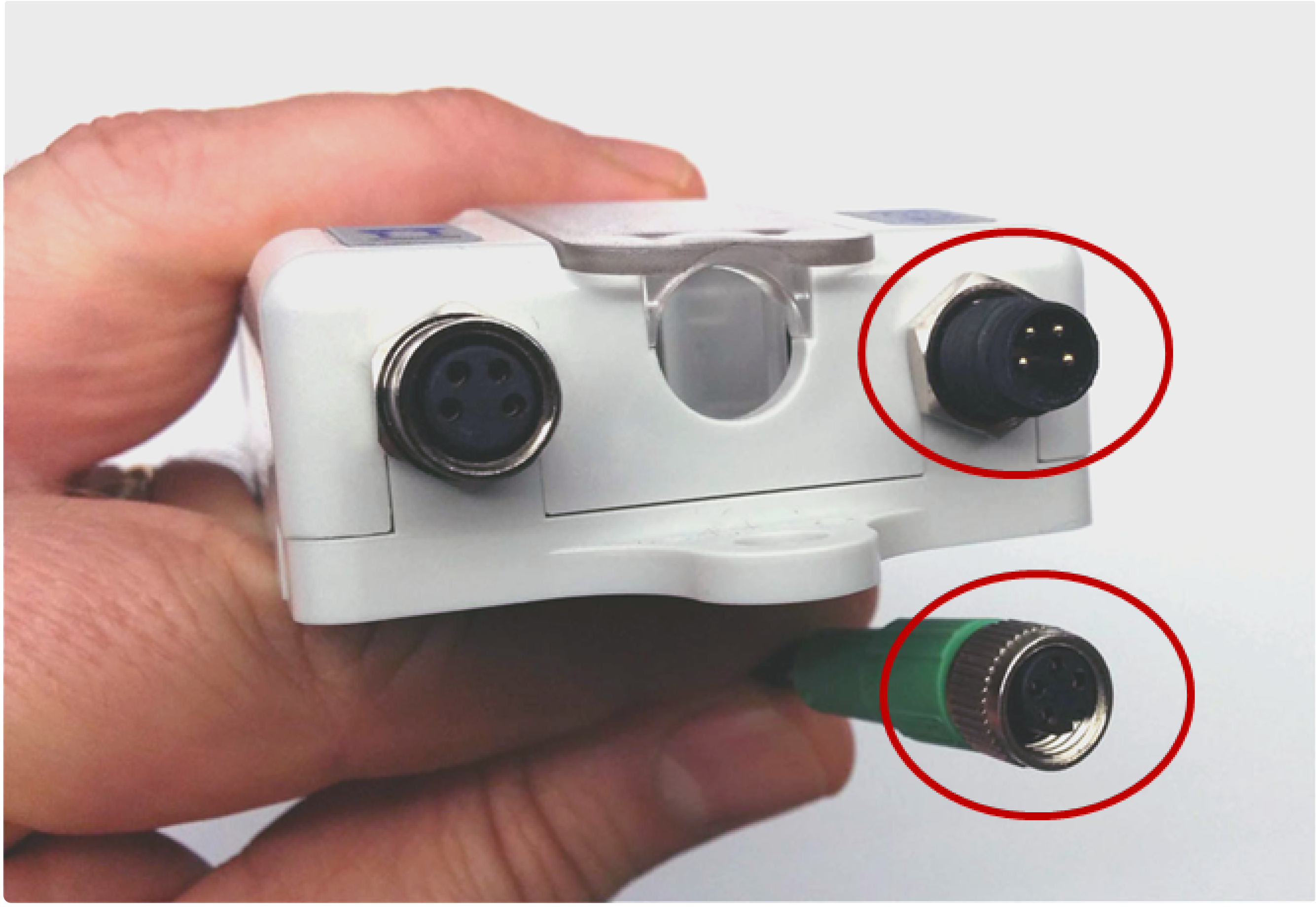
Output Wiring

Note that the total current is limited to 400 mA for BOTH Output Pins



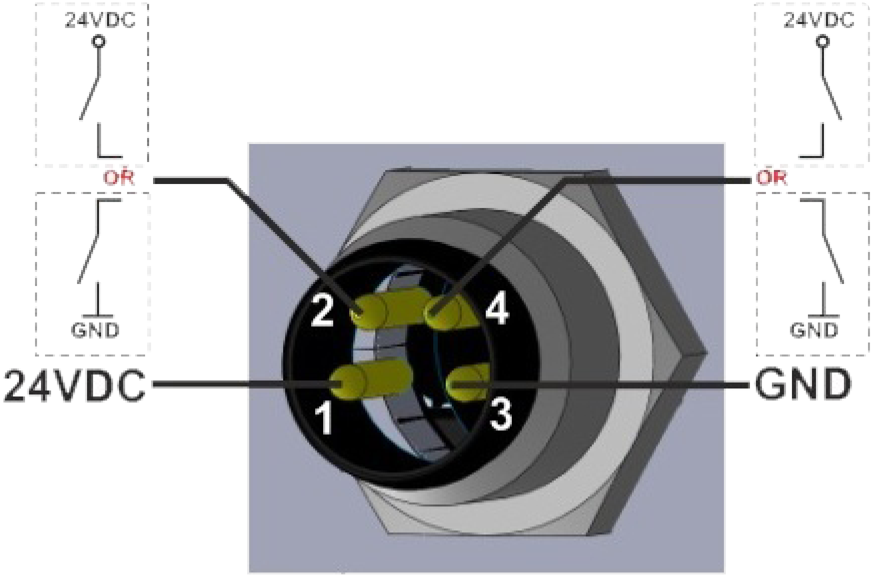
Please note that MotionLinx-IO Pins configured as outputs are PNP (sourcing) which is UNLIKE MotionLinx-Ai outputs which are NPN (sinking)

4.8.2. Left & Right Male Ports



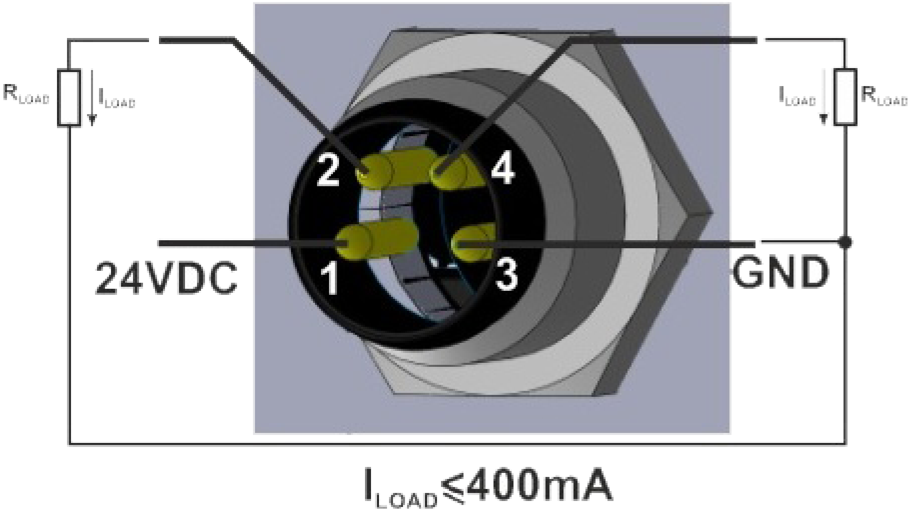
Input Wiring

Note that each Input Pin can be wired NPN or PNP independently



Output Wiring

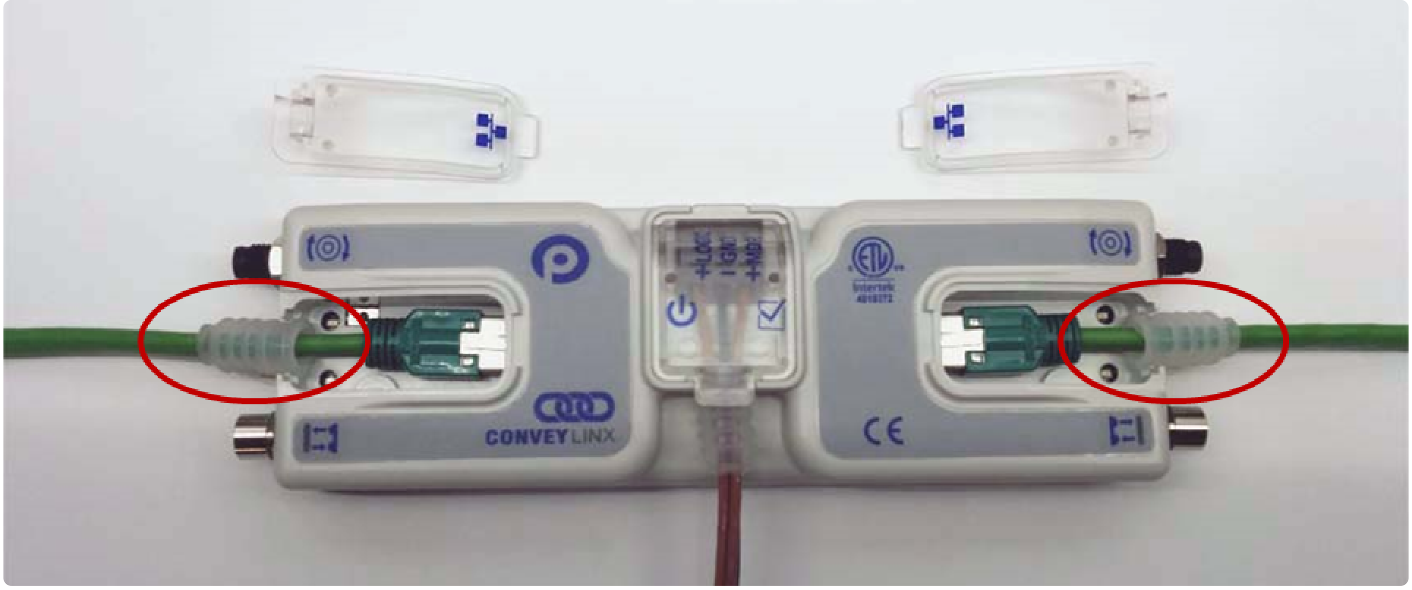
Note that the total current is **limited** to 400 mA for BOTH Output Pins

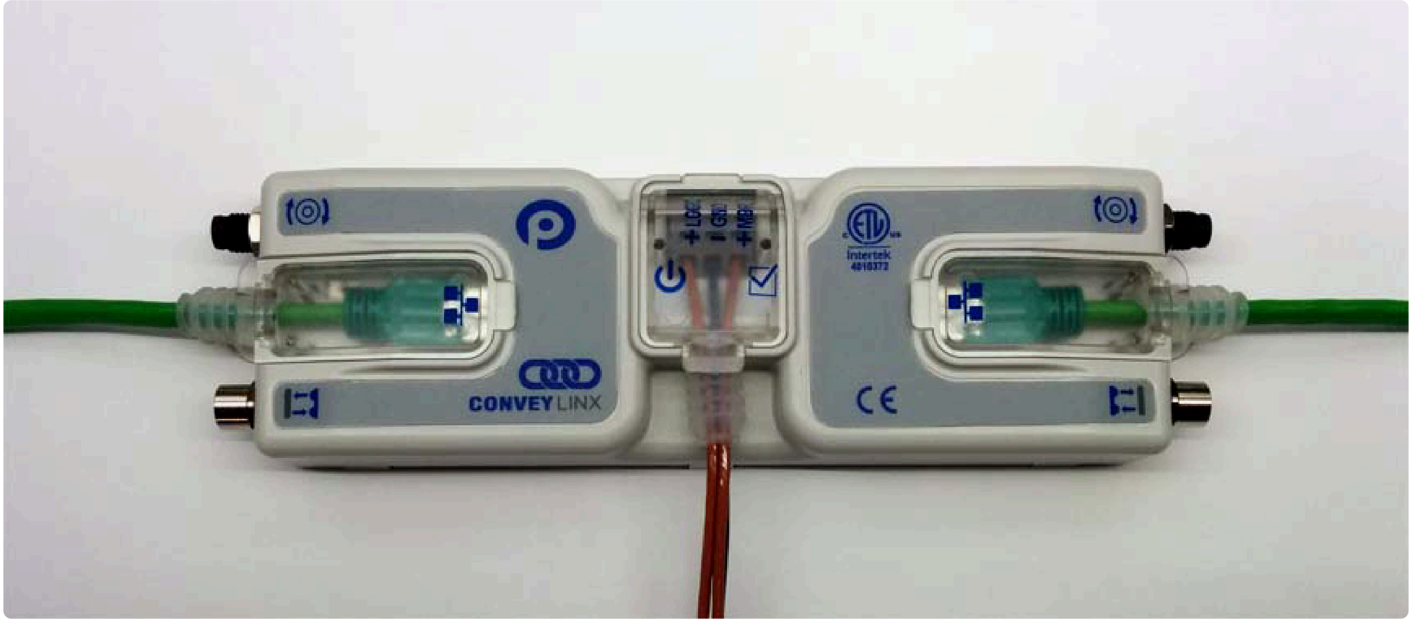


! Please note that MotionLinx-IO Pins configured as outputs are PNP (sourcing) which is UNLIKE MotionLinx-Ai outputs which are NPN (sinking)

4.9. EtherCAT Ports

Both ports are standard RJ-45 jacks conforming to standard EtherCAT connection pin-out. In order to maintain IP54 rating; the EtherCAT cables need to be equipped with protective shrouds. Shown below are the EtherCAT cables installed using shrouds to protect the RJ-45 connectors on the cables. Each module is shipped with 3 shrouds – 2 for the EtherCAT Cables and 1 for the power wiring.



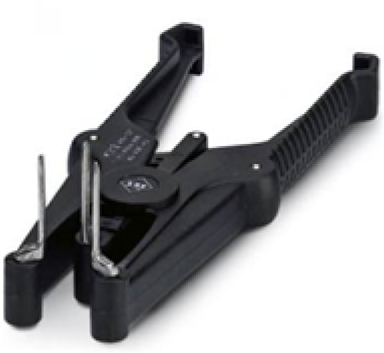


✻ Even though the images depict Pulseroller *ConveyLinx-Ai2* modules, both the *MotionLinx-Ai* and *MotionLinx-IO* modules utilize the exact same protective shrouds and covers

How to install shrouds on EtherCAT cables

Assembly Tool

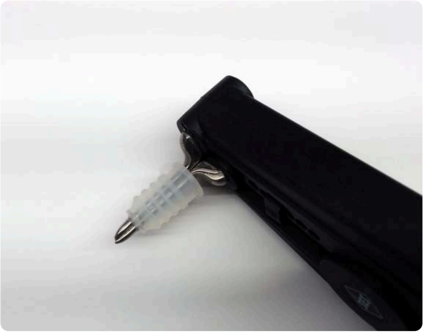
Phoenix Contact Part Number 2891547 FL IP 54
or SS TOOL-MET 621-80008



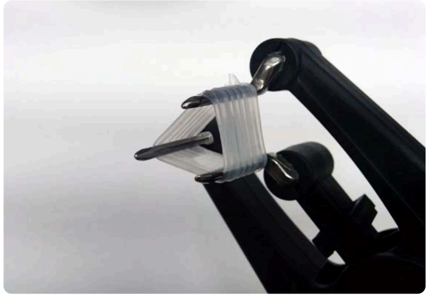
Tool must be purchased separately

Putting the shroud on the cable

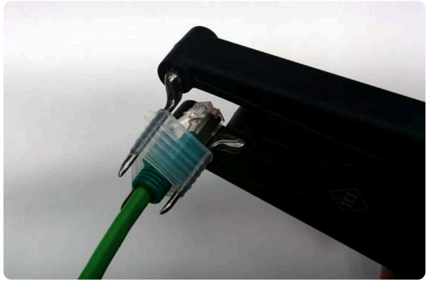
1: With tool closed, place shroud on the pins



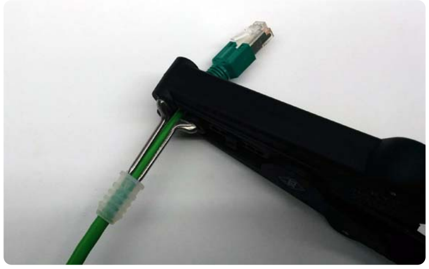
2: Grip the handle to open the pins to stretch open the shroud



3: While continuing to grip the handle, insert the RJ-45 cable through the shroud opening as shown



4: Release the handle and the pins close allowing them to be removed from the shroud



4.10. LED Status Indicators

MotionLinx-Ai and MotionLinx-IO module status is indicated by several LED’s. All LED’s with the exception of the Ethernet Link and Activity LEDs are multi-colored and context sensitive. The following sections indicate the various meanings of all LED indicators.

Indicator States

Indication	Rate	Visible Action
Slow Blink	1 Hz	500 msec. ON / 500 msec OFF
Fast Blink	2.5 Hz	200 msec. ON / 200 msec OFF
Slow Flash	2 Hz	250 msec. ON / 250 msec OFF
Fast Flash	10 Hz	50 msec. ON / 50 msec OFF
Single Flash		200 msec. ON / 1000 msec OFF
Double Flash		200 msec. ON / 200 msec OFF/ 200 msec ON/ 1000 msec OFF

If you need help finding where LED Items are located on the MotionLinx-Ai module
If you need help finding where LED Items are located on the MotionLinx-IO module

Communications (Same for both MotionLinx-Ai and MotionLinx-IO)

Indicator	Item	LED State	Description
EtherCAT IN (Left) Link EtherCAT OUT (Right) Link	⑬ & ⑭	OFF	No connection established
		Solid ON GREEN	Connection is established
		Blinking GREEN	When data transmission activity is occurring

Motors (MotionLinx-Ai Only)

Indicator	Item	LED State	Description
Motor Left & Motor Right	❷ & ❸	OFF	Motor is not running and no faults detected
		Solid ON GREEN	Motor is running
		Solid ON RED	If Motor is running – indicates current limit If Motor is stopped – indicates motor is not connected properly or is overheated Power supply is under 18V or above 30V
		Slow Blink RED	Motor is overloaded and the module is limiting current to reduce temperature
		Slow Flash RED	Motor short circuit detected between at least two of the phase windings or Motor Power supply is less than 10V

Network & Module Status (Same for both MotionLinx-Ai and MotionLinx-IO)

Indicator	Item	LED State	Description
Module Status	❻	OFF	EtherCAT is in INIT State
		Fast Blink GREEN	EtherCAT is in PRE-OP State
		Single Flash GREEN	EtherCAT is in SAFE-OP State
		Solid ON GREEN	EtherCAT is in OPERATIONAL State
		Fast Flash GREEN	EtherCAT is in BOOTSTRAP State
		Fast Blink RED	General Configuration Error
		Single Flash RED	Local Error
		Double Flash RED	An application watchdog timeout has occurred
		Solid ON RED	Critical Communication or application error
		Fast Flash RED	Boot Error

Sensors (MotionLinx-Ai Only)

Indicator	Item	LED State	Description
Sensors Left & Right	❹ & ❺	Solid ON AMBER	Module is booting up
		Solid ON GREEN	Sensor input is energized
		Solid ON RED	Aux Input is energized
		Slow Blink RED	Missing sensor

Inputs (MotionLinx-IO Only)

Indicator	Item	LED State	Description
Left & Right IO LEDs	❷❸❹ ❺	OFF	Inputs are OFF
		Solid GREEN	Input Pin 4 is ON
		Solid RED	Input Pin 2 is ON
		Solid AMBER	Both Input Pin 2 and Input Pin 4 are ON

Outputs (MotionLinx-IO Only)

Indicator	Item	LED State	Description
Left & Right IO LEDs	❷❸❹ ❺	OFF	Inputs are OFF
		Flash GREEN	Input Pin 4 is ON
		Flash RED	Input Pin 2 is ON
		Flash AMBER	Both Input Pin 2 and Input Pin 4 are ON

Power (Same for both MotionLinx-Ai and MotionLinx-IO)

Indicator	Item	LED State	Description
Power	7	Solid ON BLUE	Power supply is connected and voltage is within acceptable range
		Slow Blink BLUE	Motor power supply is less than 18V

4.11. Technical Specifications

Certifications & Standards (common to both MotionLinx-Ai and MotionLinx-IO)

BDS EN 61131-2:2008	Programmable controllers — Part 2: Equipment requirements and tests
BDS EN 61000-6-2:2006	Electromagnetic compatibility (EMC) — Part 6-2: Generic standards – Immunity for industrial environments
BDS EN 61000-6-4:2007+A1:2011	Electromagnetic compatibility (EMC) — Part 6-4: Generic standards – Emission standard for industrial environments
BDS EN 55016-2-1:2009+A1:2011	Specification for radio disturbance and immunity measuring apparatus and methods Part 2-1 Methods of measurement of disturbances and immunity. Conducted disturbance measurements
BDS EN 55014-1:2007+A1:2009 +A2:2011	Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus — Part 1: Emission
BDS EN 61000-4-2:2009	Electromagnetic compatibility (EMC) Part 4-2: Electromagnetic discharge Immunity test
BDS EN 61000-4-4:2012	Electromagnetic compatibility (EMC) Part 4-4 Electrical fast transient/burst immunity test.
BDS EN 61000-4-5:2007	Electromagnetic compatibility (EMC) Part 4-5 Surge immunity test.
BDS EN 61000-4-6:2009	Electromagnetic compatibility (EMC) Part 4-6 Immunity to conducted disturbances, induced by radio-frequency field
BDS EN 61000-4-11:2009	Electromagnetic compatibility (EMC) Part 4-11 Voltage dips, short interruptions and voltage variations immunity tests

Ethernet (common to both MotionLinx-Ai and MotionLinx-IO)

- 2 port integrated EtherCAT switch (Port A and Port B indicated on chassis)
- 100 Mb network speed
- Back pressure flow control support

Supported Protocols (common to both MotionLinx-Ai and MotionLinx-IO)

- EtherCAT

4.11.1. MotionLinx-Ai

Power Connection

Power connector is Degson DG245-5.0, 12 AWG (3.31 mm ^{2}) Max wire size, 5-6 mm strip length

Electrical and Environmental Ratings

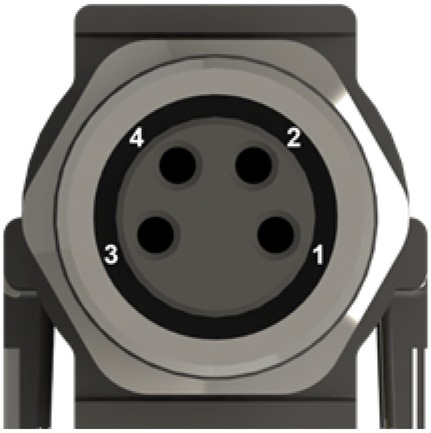
! Operating outside these parameters may result in permanent MotionLinx-Ai failure or unexpected device behavior

Power supply voltage	24.0V +/- 10%
Input Protection Rating	Class III
Standby current consumption	< 120mA
Minimum Operating Voltage	21
Maximum Operating Voltage	30V
Storage temperature	-25ºC to 70º C (-13ºF to 160ºF)
Ambient Operating temperature	Standard Module: 0ºC to 40ºC (32°F to 104°F) Freezer Rated Module: -30ºC to 40ºC (-22°F to 104°F)
Humidity	5% to 95% non-condensing
Vibration	0.152 mm (0.006 in.) displacement, 1G peak
Mechanical Shock	20G peak for 10ms duration (1.0 ms)
Enclosure IP Rating	IP54
Motor Starting Current	≤ 8A per Motor
Motor Rated Current	≤ 3A per Motor
Maximum peak current	21.5A*

*This is the maximum current that will be allowed by the hardware over current protection circuitry. On board firmware limits the amount of current based on the quantity and motor types connected

Sensor Port I/O

Each *MotionLinx-Ai* module is equipped with two 4-pin female M8 style Sensor I/O ports primarily used to connect a photo-electric sensor to the module. Each of these ports has one pin dedicated as an input for the sensor (Pin 4) and one Aux I/O pin (Ppin 2) that is configurable to be either an input or an output.



Pin 1 – 24VDC

Pin 2 – Configurable Aux I/O Pin

Pin 3 – GND

Pin 4 – Input

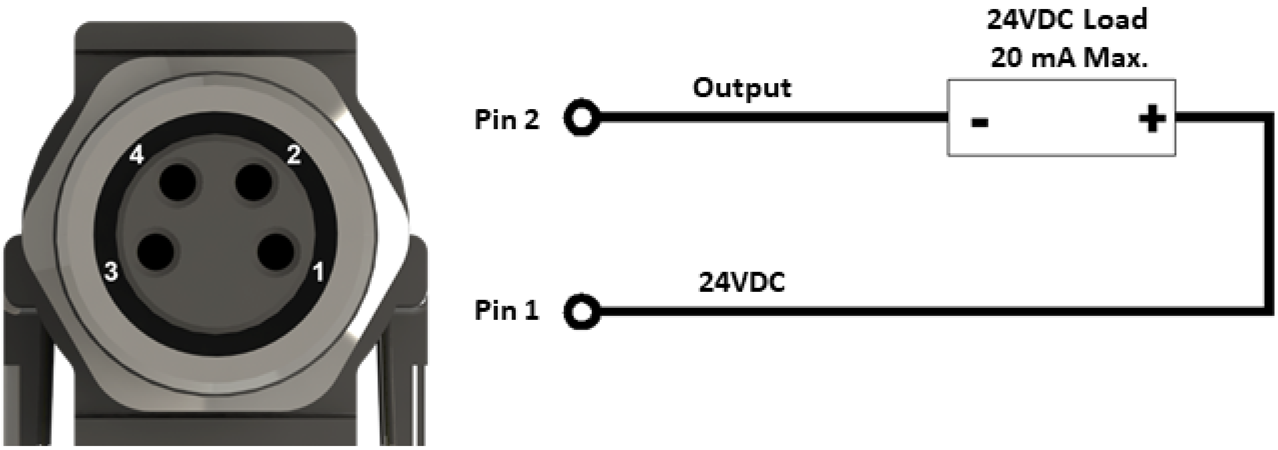
Input Signals

For the *MotionLinx-Ai* module, this applies to each Sensor Port's Pin 4 signal and to the Pin 2 signal when configured as an Input. Pins configured as Inputs are by default auto-sensing for PNP or NPN circuit type such that both sourcing and sinking current will activate the input based upon the following conditions:

Minimum ON Current	1.5 mA
Maximum OFF Current	0.4 mA

Output Signals Aux I/O Signal (Pin 2) when configured as an OUTPUT

For the *MotionLinx-Ai* module, this applies to each Sensor Port's Pin 2 signal when configured as an Output. Pin 2 only provides an NPN circuit as illustrated below.



Sensor Port 24VDC (Pin 1) and GND (Pin 3)

Pin 1 of each Sensor Port provides 24V for powering up an input device (such as a sensor) and/or for supplying the load when Pin 2 is configured as an output. The available current for the two control ports on the module is limited internally by a solid-state fuse. The maximum combined current consumption for the two sensor ports is 100 mA.

> Current in excess of 100mA drawn from the sensor port’s 24V pin may cause permanent damage to the sensor detection circuit. Care should be taken to avoid excess loads, short circuits and miss-wiring of the sensor port.

Motor Port

Supported motor types	Senergy Ai
PWM frequency*	25 kHz +/- 0.1%
Maximum starting current	8A
Maximum rated current	3A
Motor Protection**	Coil-to-coil short, coil-to-Vcc short, overheating, over-voltage, under-voltage, stall sensing and protection

- The PWM frequency is firmware version dependent

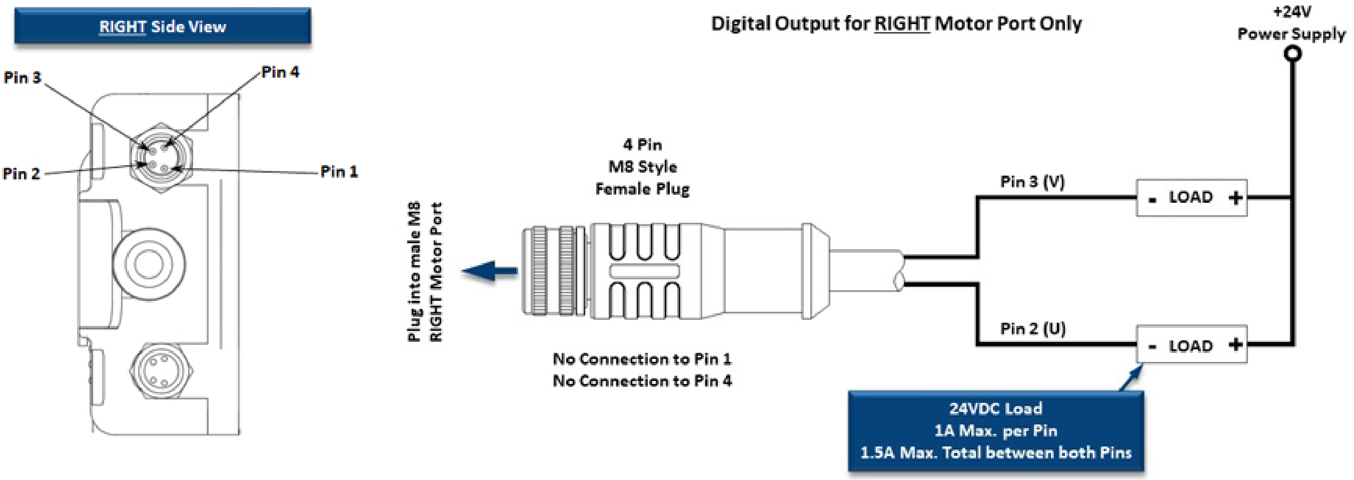
> **During normal operation as an MDR port, the internal protection circuitry is not

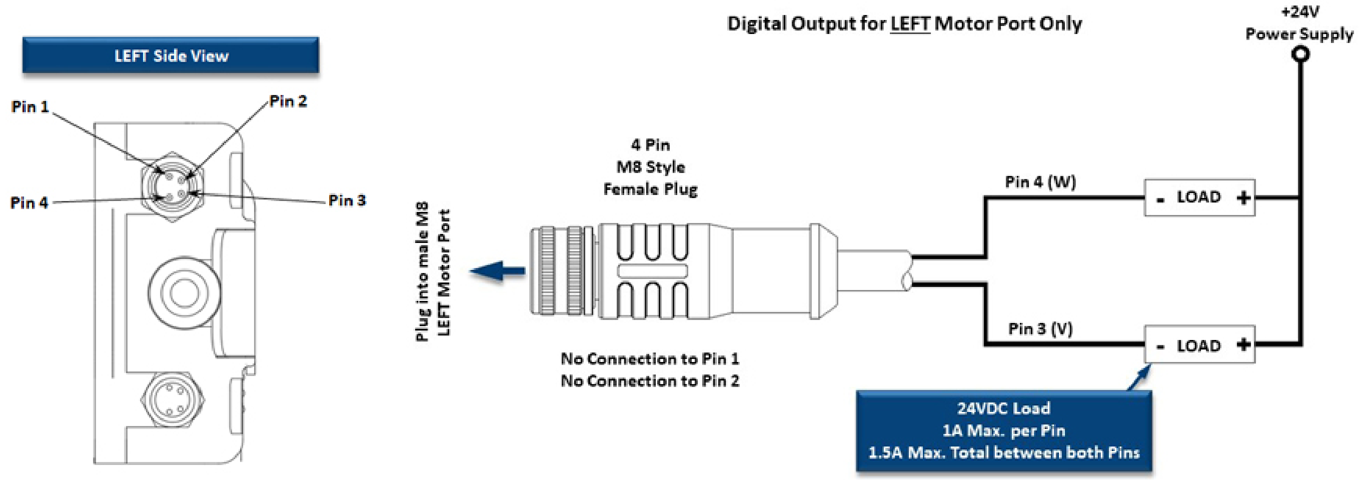
capable of detecting a short-circuit between a BLDC coil output and ground. Such a short-circuit will cause damage to the high-side bridge transistors. When operating these outputs as general purpose outputs, the high-side transistors are disabled, so a pin-to-ground short-circuit is not an issue

Motor Ports in Digital Output Mode

Either the Left or Right (or both) Motor Ports can be configured to operate their respective motor coil output transistors as 24V DC digital output signals. These digital output signals are sinking type only and will accommodate up to 1A on a given output pin, but restricted to a total of 1.5A for both pins on a given port.

For each of the Motor Ports, only 2 out of the 3 total motor coil output pins are available as digital outputs for a total of 4 Motor Port digital outputs available per module. Please note that these 2 available motor coil pins are <u>different between the Left and Right Motor Ports</u> as illustrated:




LEFT Side View
Pin 1
Pin 2
Pin 4
Pin 3
Digital Output for LEFT Motor Port Only
+24V
Power Supply
4 Pin
M8 Style
Female Plug
Plug into male M8
LEFT Motor Port
Pin 4 (W)
- LOAD +
Pin 3 (V)
- LOAD +
No Connection to Pin 1
No Connection to Pin 2
24VDC Load
1A Max. per Pin
1.5A Max. Total between both Pins

4.11.2. MotionLinx-IO

Power Connection

Power connector is Degson DG245-5.0, 12 AWG (3.31 mm ^{2}) Max wire size, 5-6 mm strip length

Electrical and Environmental Ratings

! Operating outside these parameters may result in permanent MotionLinx-Ai failure or unexpected device behavior

Power supply voltage	24.0V +/- 10%
Minimum Operating Voltage	21
Input Protection Rating	Class III
Standby current consumption	< 70mA
Maximum Operating Voltage	30V
Storage temperature	-40ºC to 120º C (-40ºF to 248ºF)
Ambient Operating temperature	0ºC to 50ºC (32°F to 122°F)
Humidity	5% to 95% non-condensing
Vibration	0.152 mm (0.006 in.) displacement, 1G peak
Mechanical Shock	20G peak for 10ms duration (1.0 ms)
Enclosure IP Rating	IP54
Maximum peak current	2.4A

I/O Port Inputs

Each *MotionLinx-IO* module is equipped with two 4-pin female and two 4-pin male M8 style I/O Ports. Pin 2 and Pin 4 of each of these is master controller configurable to be either an input or an output. Any I/O Port pins configured as inputs by default are auto-sensing for the connected circuit type of either PNP or NPN such that both sourcing and sinking current will activate the input.

Both Left and Right Sensor ports utilize load detection circuits between the +24V (Pin 1) and Gnd (Pin 3). This circuit provides input to the processor such that sensor detected status can be known.

Inputs	● PNP/NPN Auto-Sensing (Default) ● Up to 2 Inputs per Port – Up to 8 Inputs per module ● Master controller configurable for Push-Pull operation
Minimum ON current	1.5mA
Maximum OFFcurrent	0.4mA
Leakage current	< 0.2 mA
Short Circuit protection (per side)	500mA max

! Short circuit between Pin 1 (24V) and Pin 3 (Gnd) can damage the Auto-Sensing circuit and render this function inoperable

I/O Port Outputs

Each *MotionLinx-IO* module is equipped with two 4-pin female and two 4-pin male M8 style I/O Ports. Pin 2 and Pin 4 of each of these is master controller configurable to be either an input or an output. When configured as an Output, the following chart applies:

Outputs	PNP Sourcing Only
Output count	Up to 8
Maximum current per Output	300mA
Short Circuit protection threshold per Output	500mA

5. Integrating MotionLinx with TwinCAT

MotionLinx-Ai and *MotionLinx-IO* modules require an *EtherCAT master controller* for operation. The *EtherCAT master controller* contains all program logic and configuration data to instruct each individual *MotionLinx-Ai* module to operate its connected motor(s) and to read digital input data from connected sensor devices and to read/write IO to *MotionLinx-IO* modules. This guide uses the *TwinCAT* IDE from *Beckoff Automation* for all examples shown. However, any compatible EtherCAT Integrated Development Environment (IDE) software should follow the same basic steps for module identification and configuration.

! This guide assumes you have some working knowledge of EtherCAT systems and the TwinCAT IDE software. Please consult Beckoff’s TwinCAT documentation for further details.

5.1. EtherCAT Slave Information (ESI) Files

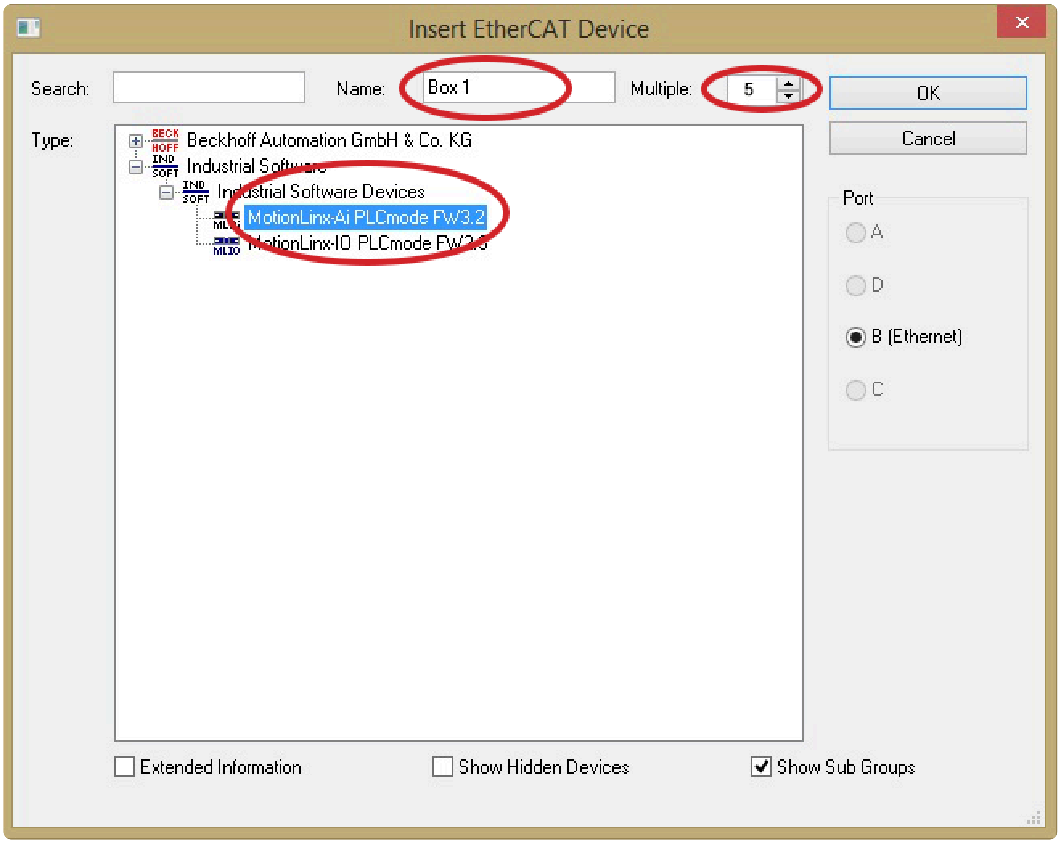
Any EtherCAT IDE software will require an *EtherCAT Slave Information (ESI)* file for any *MotionLinx-Ai* or *MotionLinx-IO* module to be installed in order to have the proper configuration data. The latest *MotionLinx-Ai* and *MotionLinx-IO* ESI files will be available in the downloads section of pulseroller.com. Once downloaded from the website; you must place the file(s) in proper folder in the the TwinCAT installation. In our example, the TwinCAT installation on our PC was made to the default location:

C:\TwinCAT\3.1\Config\IO\EtherCAT

5.2. Adding Modules to TwinCAT Project

Once you have installed the *ESI* file(s) in your *TwinCAT* IDE and created your project solution; the next step is to add an instance of the ESI for each individual MotionLinx device you need to control. In our example, we called our solution “Test project”.

From the *Insert EtherCAT Device* window, you select the device type you want to insert and then enter the name you want to give the device. In this example we selected the *MotionLinx-Ai* type device and entered “Box1” as the device name. We also want to create multiple modules at the same time, so we entered “5”.



Insert EtherCAT Device

Search:

Name: Box 1

Multiple: 5

OK

Cancel

Type:

- Beckhoff Automation GmbH & Co. KG
- Industrial Software
  - Industrial Software Devices
    - MotionLinx-Ai PLCmode FW3.2
    - MotionLinx-IO PLCmode FW2.6

Port

○ A

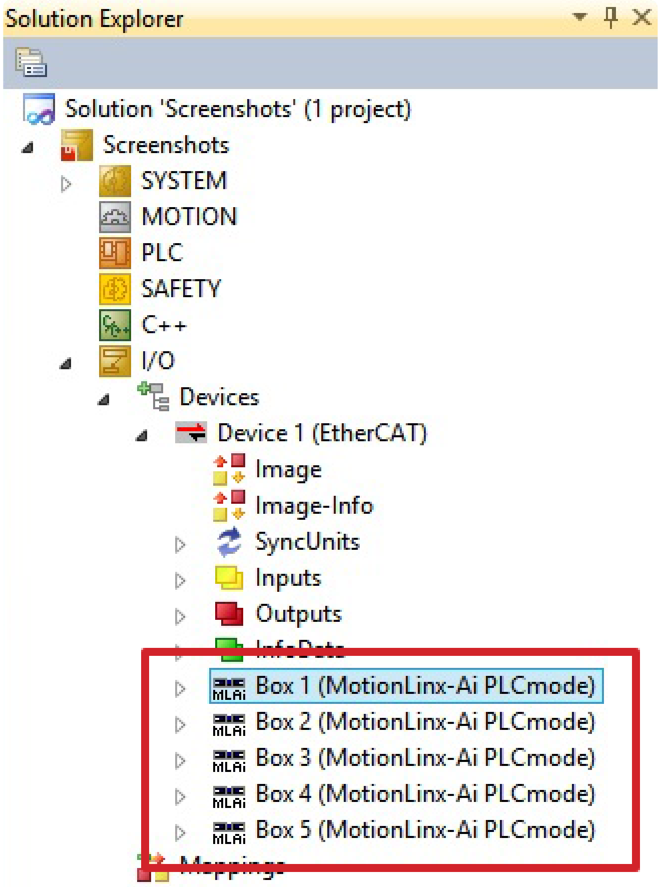
○ D

● B (Ethernet)

○ C

☐ Extended Information ☐ Show Hidden Devices ☑ Show Sub Groups

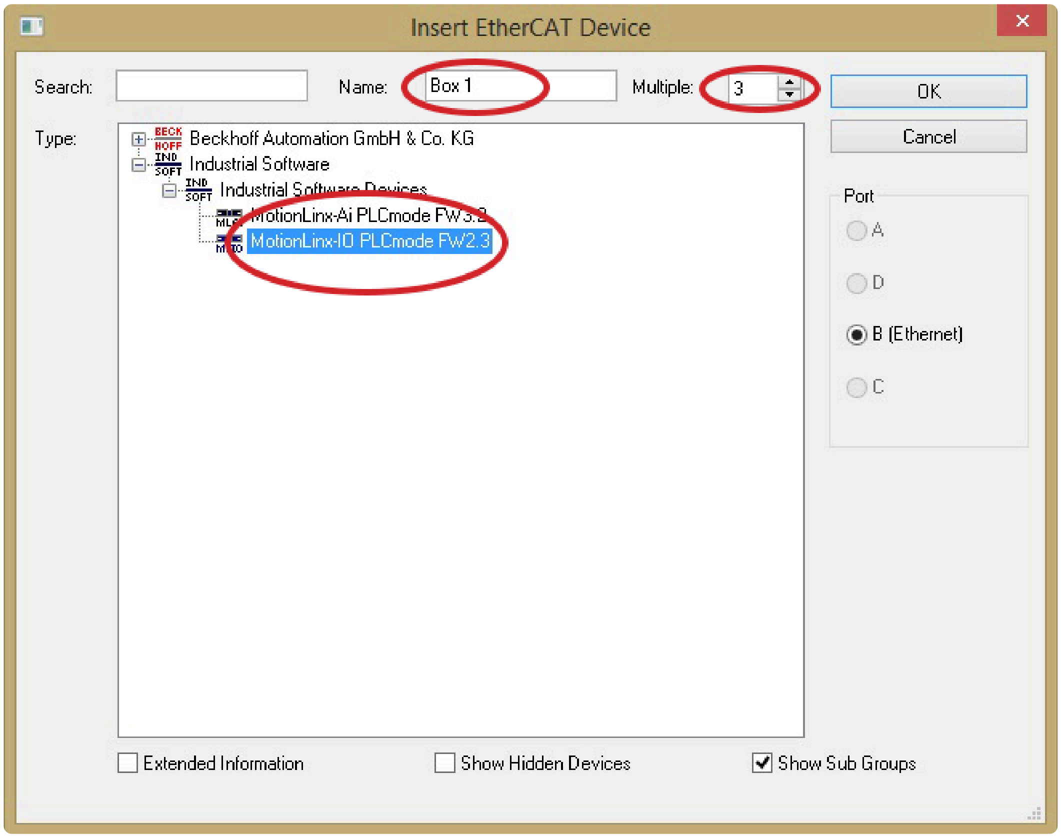
When you have inserted the desired quantity of individual *MotionLinx-Ai* modules, you can expand your project tree to see the individual devices. In our example we inserted 5 MotionLinx-Ai modules. When the modules are entered, note that *TwinCAT* automatically increments a numerical suffix so each device has a unique name.



Solution Explorer

- Solution 'Screenshots' (1 project)
  - Screenshots
    - SYSTEM
    - MOTION
    - PLC
    - SAFETY
    - C++
    - I/O
      - Devices
        - Device 1 (EtherCAT)
          - Image
          - Image-Info
          - SyncUnits
          - Inputs
          - Outputs
          - InfoData
          - Box 1 (MotionLinx-Ai PLCmode)
          - Box 2 (MotionLinx-Ai PLCmode)
          - Box 3 (MotionLinx-Ai PLCmode)
          - Box 4 (MotionLinx-Ai PLCmode)
          - Box 5 (MotionLinx-Ai PLCmode)
      - Mappings

You follow the same procedure for inserting *MotionLinx-IO* modules into your *TwinCAT* project. In this example, in a different project, we want to insert 3 MotionLinx-IO modules.



Insert EtherCAT Device

Search: Name: Box 1 Multiple: 3

Type:

- Beckhoff Automation GmbH & Co. KG
- Industrial Software
  - Industrial Software Devices
    - MotionLinx-Ai PLCmode FW3.2
    - MotionLinx-IO PLCmode FW2.3

Port

○ A

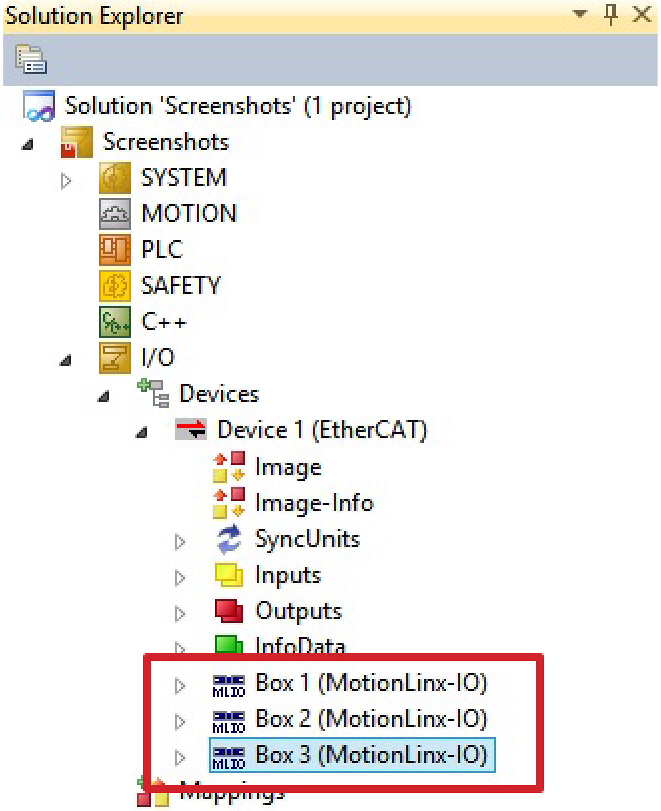
○ D

● B (Ethernet)

○ C

□ Extended Information □ Show Hidden Devices ☑ Show Sub Groups

When you expand your project tree, you can see the 3 MotionLinx-IO modules. Note that *TwinCAT* automatically increments a numerical suffix so each device has a unique name.



On-Line Method

You can also connect your *TwinCAT* PC to a physical network or devices and scan the physical network for devices and they will be automatically added to your project solution in the order they are connected in the network topology. Please refer to your *TwinCAT* documentation on the details of scanning your network for devices.

5.3. MotionLinx Data Objects

The data exchange between remote *MotionLinx-Ai* and *MotionLinx-IO* devices and the PC based *TwinCAT* controller is *CANOpen over EtherCAT (CoE)*. This protocol provides for cyclic data exchange between a “Master” controller (PC based TwinCAT) and multiple “Slave” devices (MotionLinx-Ai / MotionLinx-IO modules). The data object types supported by MotionLinx-Ai and MotionLinx-IO modules are CoE Process Data Objects (**PDOs**) and Service Data Objects (**SDOs**).

> ✻ Please consult CoE documentation for further details of the CANOpen network protocol.

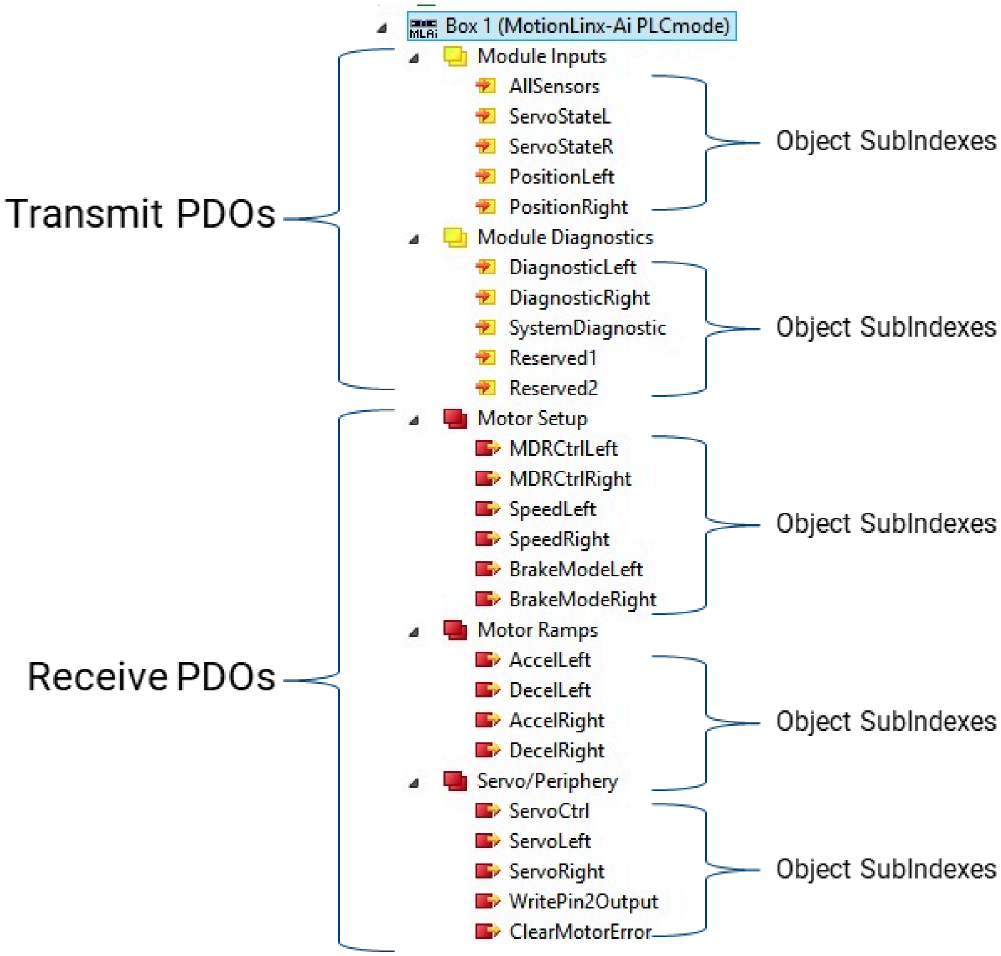
Process Data Objects (PDO)

PDOs are subdivided into *Transmit* and *Receive* types:

- Transmit PDOs send data from the MotionLinx-Ai / MotionLinx-IO modules to the Master Controller
- Receive PDOs send data from the Master Controller to the MotionLinx-Ai / MotionLinx-IO modules

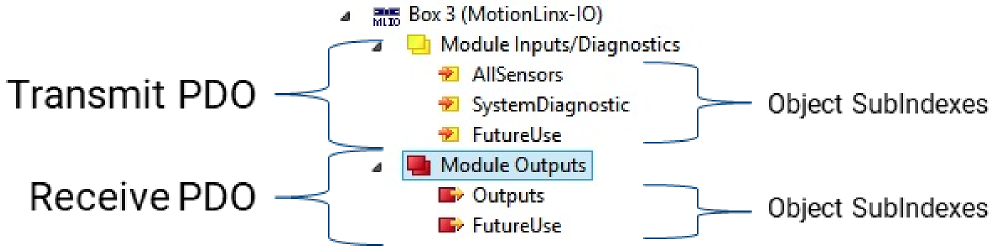
For the *MotionLinx-Ai* module there are 2 *Transmit PDOs* and 3 *Receive PDOs*. Each *PDO* has a number of *SubIndex* objects that are fundamental *data types* such as SINT, INT, DINT, etc. It is these *SubIndexes* that are assigned to variable tags and used in your program logic.

For more details see: MotionLinx-Ai Transmit PDOs MotionLinx-Ai Receive PDOs



For the *MotionLinx-IO* module there are 1 *Transmit PDO* and 1 *Receive PDO*.

For more details see: MotionLinx-IO Transmit PDO MotionLinx-IO Receive PDO



Service Data Objects (SDO)

SDOs are used for data that is not intended to be cyclic like PDOs. The use of *SDOs* can be thought of as “lower priority” and are invoked on an “as needed” basis. For example, setting up the initial configuration or the reading of non-transitory data from the module are typical SDOs provided. SDOs can be read or write.

> ✻ Please consult your TwinCAT or other IDE for details on specific instructions to read/write SDO data.

MotionLinx-Ai SDOs
MotionLinx-IO SDO

5.3.1. MotionLinx-Ai Transmit PDOs

There are two transmit PDOs provided by the MotionLinx-Aimodule. This is the data that originates from theMotionLinx-Ai module that is made available as input to the master controller.

Transmit PDO0 – Module Inputs (Object 0×1A00)

Subindex	Index	Data Type	Data Description
SubIndex 1 All Sensors	Index 0×3000 SubIndex 0	INT	Bitwise Value – Read Only: bit 00 = Left Sensor Port – Aux Input bit 01 = Reserved bit 02 = Right Sensor Port – Aux Input bit 03 = Reserved bit 04 = Left Sensor Port – Sensor Input bit 05 = Reserved bit 06 = Right Sensor Port – Sensor Input bit 07 thru bit 14 = Reserved bit 15 = 2 sec on / 2 sec off heartbeat
SubIndex 2 Servo State Left Motor	Index 0×3001 SubIndex 0	SINT	Bit 0: Servo Command Status 1 = Last Servo Run Command Complete 0 = Servo Command in Process Bit 01: Servo Reset Status Echoes state Left/Right Motor Servo Command Bit 0 Bit 2: Servo Command Status Echoes state of Left/Right Motor Servo Command bit 1
SubIndex 3 Servo State Right Motor	Index 0×3006 SubIndex 0		
SubIndex 4 Servo Position Left Motor	Index 0×3002 SubIndex 0	INT	Signed integer value that indicates the current position of the Left/Right Motor in relation to its “0” position • For MDR the value is in mm • For PGD the value is in motor pulses
SubIndex 5 Servo Position Right Motor	Index 0×3003 SubIndex 0		

Transmit PDO1 – Module Diagnostics (Object 0×1A01)

Subindex	Index	Data Type	Data Description	
SubIndex 1 Module Diagnostic Left Motor	Index 0×3001 SubIndex 0	INT	Bitwise Value – Read Only: bit 00 = Motor Status* bit 01 = Motor Status* bit 02 = Port in Digital Mode bit 03 = Reserved bit 04 = Reserved bit 05 = Board Overheat bit 06 = Over-Voltage bit 07 = Low Voltage	bit 08 = Overheated bit 09 = MaxTorque bit 10 = Short Circuit bit 11 = Motor Not Connected bit 12 = Overloaded bit 13 = Motor Stalled bit 14 = Hall Sensor Error bit 15 = Motor Not Used
SubIndex 2 Module Diagnostic Right Motor	Index 0×3005 SubIndex 0	INT		
SubIndex 3 System Diagnostic	Index 0×3013	Byte	Bitwise Value – Read Only: bit 00 = Logic voltage is below 14V bit 01 = Left Motor set speed is greater than the max. allowed speed for the attached motor bit 02 = Left Motor set speed is less than the min. allowed speed for the attached motor bit 03 = Right Motor set speed is greater than the max. allowed speed for the attached motor bit 04 = Right Motor set speed is less than the min. allowed speed for the attached motor bit 05 = Reserved bit 06 = Reserved bit 07 = Reserved	

Motor Status Bits

Bits 0 and 1 are used in combination to provide 4 possible states for motor status. The following chart defines the bit values for these states:

Bit 1	Bit 0	Description
0	0	Motor not running, standard or servo braking applied
0	1	Motor running in CCW Direction

1	0	Motor running in CW Direction
1	1	Motor not running and no braking applied (free to spin)

5.3.2. MotionLinx-Ai Receive PDOs

There are 3 receive PDOs utilized by the MotionLinx-Ai module. This is the data that originates from the master controller that is received by the MotionLinx-Ai module.

Receive PDO0 – Motor Setup (Object 0×1600)

Subindex	Index	Data Type	Data Description

SubIndex 1
Motor
Control Left
	Index
	0×2000
	SubIndex 0
		SINT	Bit 0:
			ON = Run Command
			OFF = Stop Command
			Bit 1:
			OFF = Run in Configured Direction
			ON = Run opposite of Configured Direction

SubIndex 2 Motor Control Right	Index 0×2000 SubIndex 0	SINT	
SubIndex 3 Motor Speed Left	Index 0×2001 SubIndex 0	INT	Integer value to set the motor speed • For MDR the value is in mm/sec • For PGD the value is in motor RPM
SubIndex 4 Motor Speed Right	Index 0×2001 SubIndex 0	INT	
SubIndex 5 Motor Brake Mode Left	Index 0×200F SubIndex 0	SINT	Integer value to set the motor braking method • See Motor Braking Methods Chart
SubIndex 6 Motor Brake Mode Right	Index 0×2010 SubIndex 0	SINT	

Motor Braking Methods Chart

> ✻ Please note that in all cases, the motor's deceleration ramp controls the stopping of the motor. **These braking methods only apply after the module has finished its deceleration control.**

Value	Method	Data Description
0	Normal	Once the controls have decelerated the rotor to a stop, the motor coils are internally connected. The permanent magnet forces in the rotor and the

		mechanical inertia of the gearbox holds the rotor in place. This is the industry standard holding brake method and is often termed short circuit or shunt. *Normal* is the default factory setting for all Pulseroller control modules.
1	Free	Once the controls have decelerated the rotor to a stop, the motor coils are internally disconnected and only the mechanical gearbox inertia holds the rotor in place.
2	Servo	When the controls have decelerated the rotor to a stop, the processor notes the *Hall Effect* sensor status. If the *Hall Effect* sensor status changes indicating a change in rotor position, the controls will inject current into the motor coils in the proper sequence to move the rotor back to its original stop position

> ! Please note that for Servo Brake mode, the motor circuitry supplies power to the motor to keep it in position. The more torque required to hold the motor rotor position will result in more current being supplied. Prolonged braking at higher torque values can result in motor over current and/or over heating conditions.

Receive PDO1 – Motor Ramps (Object 0×1601)

Subindex	Index	Data Type	Data Description
SubIndex 1 Motor Acceleration Left	Index 0×2003 SubIndex 0	INT	Integer value to set the acceleration/deceleration ramps for Left/Right motor • For MDR the value is in mm • For PGD the value is in motor pulses
SubIndex 2 Motor Deceleration Left	Index 0×2004 SubIndex 0	INT	
SubIndex 3 Motor Acceleration Right	Index 0×2005 SubIndex 0	INT	
SubIndex 4 Motor	Index 0×2006	INT	

Deceleration Right	SubIndex 0		

Receive PDO2 – Servo/Periphery (Object 0×1602)

Subindex	Index	Data Type	Data Description
SubIndex 1 Servo Control	Index 0×2007 SubIndex 0	INT	Bit 0: Reset Command Left Motor 0 to 1 = Set Current Position as “0” Bit 1: Servo Run Command Left Motor 1 = Run motor from current position value to value in *Set Motor Servo Left* SubIndex Bit 8: Reset Command Right Motor 0 to 1 = Set Current Position as “0” Bit 9: Servo Run Command Right Motor 1 = Run motor from current position value to value in *Set Motor Servo Right* SubIndex
SubIndex 2 Set Motor Servo Left	Index 0×2008 SubIndex 0	INT	Signed integer value to move to on the next Servo Run Command Left/Right Motor • Values are in mm for MDR • Values are in motor pulses for PGD • Valid values are from -32767 to +32767
SubIndex 3 Set Motor Servo Right	Index 0×2009 SubIndex 0	INT	
SubIndex 4 Set Sensor Port Pin 2 Outputs	Index 0×2011 SubIndex 0	Byte	If either or both Sensor ports have been configured as Outputs this numerical value controls their digital state: 0 = Both OFF 1 = Energize Left Sensor Port Pin 2 Only 2 = Energize Right Sensor Port Pin 2 Only 3 = Energize Both
SubIndex 5 Clear Motor Error	Index 0×2012 SubIndex 0	Byte	Numerical value to clear a motor error on either or both Motor Ports: 0 to 1 = Clear Motor Error If there is a motor error present, the module must see a transition from 0 to 1 to clear the error. Maintaining a constant value of 1 will not automatically clear a motor error if it occurs.

5.3.3. MotionLinx-IO Transmit PDO

There is one transmit PDO provided by the MotionLinx-IO module. This is the data that originates from the MotionLinx-IO module that is made available as input to the master controller.

Transmit PDO0 – Object 0×1A00

Subindex	Index	Data Type	Data Description
SubIndex 1 All Sensors	Index 0×3000 SubIndex 0	INT	Bitwise Value – Read Only: bit 00 = Left Male Pin 2 bit 01 = Left Female Pin 2 bit 02 = Right Male Pin 2 bit 03 = Right Female Pin 2 bit 04 = Left Male Pin 4 bit 05 = Left Female Pin 4 bit 06 = Right Male Pin 4 bit 07 = Right Female Pin 4 *bit 08 = Error Left Male Pin 2 *bit 09 = Error Left Female Pin 2 *bit 10 = Error Right Male Pin 2 *bit 11 = Error Right Female Pin 2 *bit 12 = Error Left Male Pin 4 *bit 13 = Error Left Female Pin 4 *bit 14 = Error Right Male Pin 4 *bit 15 = Error Right Female Pin 4 *See *Output Error* topic below
SubIndex 2 System Diagnostic	Index 0×3002 SubIndex 0	SINT	Bit 0: Under 14V Flag 1 = Module Logic Power is under 14V 0 = Module Logic Power is over 14V Bit 01- Bit 07: Reserved
SubIndex 3 Future Use	Index 0×3001 SubIndex 0	SINT	Reserved for future use

Output Error

Bits 08 through 15 indicate error conditions for each port pin when they are configured as outputs. If any of these bits are set, it indicates that there is an over-current or short circuit detected on its respective port’s power supply.

5.3.4. MotionLinx-IO Receive PDO

There is one receive PDO utilized by the MotionLinx-IO module. This is the data that originates from the master controller that is received by the MotionLinx-IO module

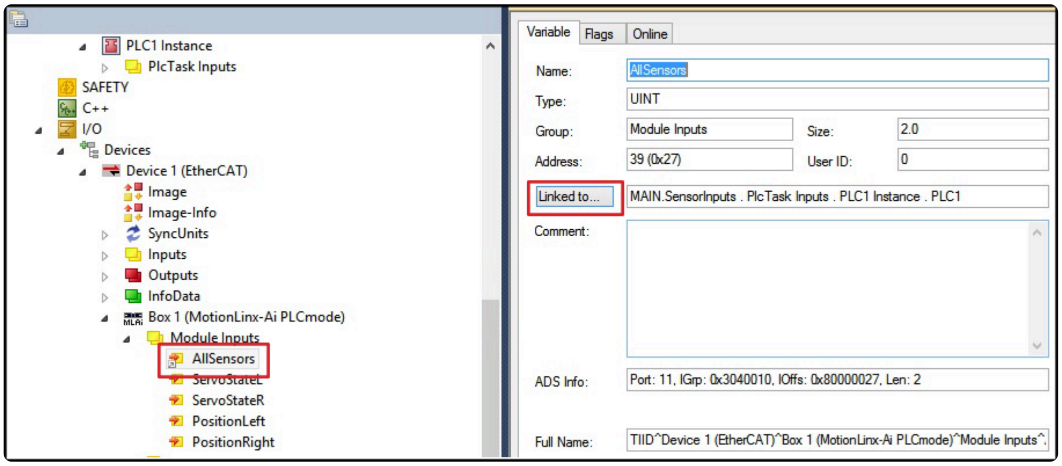
Receive PDO0 – Object 0×1600

Subindex	Index	Data Type	Data Description
SubIndex 1 Outputs	Index 0×2000 SubIndex 0	SINT	Set bit to energize Output – Reset bit to de-energize Output bit 0 : Left Male Pin2 bit 1 : Left Female Pin2 bit 2 : Right Male Pin2 bit 3 : Right Female Pin2 bit 4 : Left Male Pin4 bit 5 : Left Female Pin4 bit 6 : Right Male Pin4 bit 7 : Right Female Pin4 These bits are only recognized for a given port pin if it has been configured as an Output
SubIndex 2 Future Use	Index 0×200C SubIndex 0	SINT	Reserved for future use

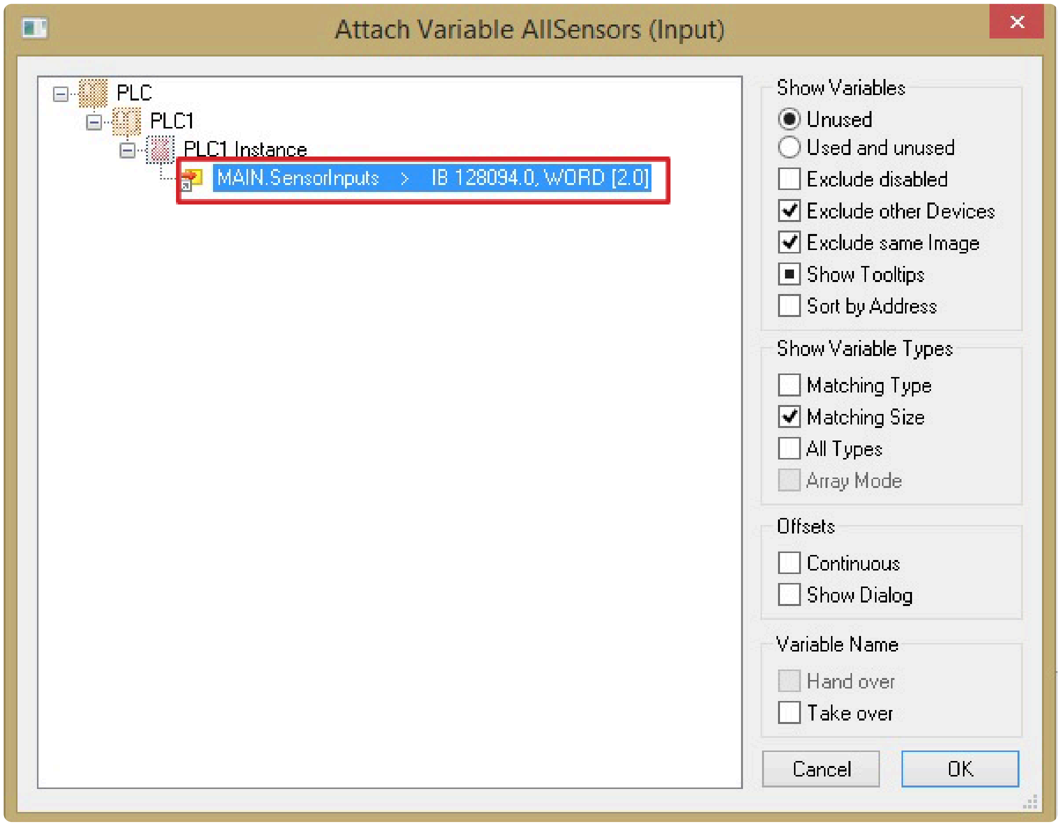
5.3.5. Using PDO Data

Once each device has been added to your project; you need to link the desired ***PDO SubIndex objects*** from the desired ***MotionLinx-Ai*** or ***MotionLinx-IO*** device to ***Tag variables*** you create in your ***PLC task***. You then read/write to your ***PLC Tag Variables*** to access and control each module’s functions.

For this example we are wanting to read the *AllSensors* SubIndex from the *Module Inputs* PDO of a *MotionLinx-Ai* module and place the data into a *Tag* in our PLC. Double click the *AllSensors* SubIndex from the tree and click the *Linked To:* button to open the *Attach Variable* dialog



Name: AllSensors
Type: UINT
Group: Module Inputs Size: 2.0
Address: 39 (0x27) User ID: 0
Linked to... MAIN.SensorInputs . PlcTask Inputs . PLC1 Instance . PLC1
Comment:
ADS Info: Port: 11, IGrp: 0x3040010, IOffs: 0x80000027, Len: 2
Full Name: TIID^Device 1 (EtherCAT)^Box 1 (MotionLinx-Ai PLCmode)^Module Inputs^


Attach Variable AllSensors (Input)

MAIN.SensorInputs > IB 128094.0, WORD [2.0]

Show Variables
● Unused
○ Used and unused
☐ Exclude disabled
☑ Exclude other Devices
☑ Exclude same Image
■ Show Tooltips
☐ Sort by Address

Show Variable Types
☐ Matching Type
☑ Matching Size
☐ All Types
☐ Array Mode

Offsets
☐ Continuous
☐ Show Dialog

Variable Name
☐ Hand over
☐ Take over

In our example we created a Tag called SensorInputs and this Tag will receive the data from the *AllSensors* SubIndex object

5.3.6. MotionLinx-Ai SDOs

The SDOs provided by the MotionLinx-Ai module are:

- Configuration
- Service Read Object
- Left Motor Data
- Right Motor Data

5.3.6.1. Configuration

Configuration SDO – Index 0×4000

Subindex	Data Type	Data Description
SubIndex 01 Sensor Polarity	INT	Bitwise Value: bit 00 = Left Sensor Port – Aux Input bit 01 = Reserved bit 02 = Right Sensor Port – Aux Input bit 03 = Reserved bit 04 = Left Sensor Port – Sensor Input bit 05 = Reserved bit 06 = Right Sensor Port – Sensor Input bit 07 thru bit 15 = Reserved See *Sensor Polarity* Topic below
SubIndex 02 Sensor Debounce	INT	Value in msec Specifies the time after a leading or trailing edge of the signal for which any other transitions are ignored.
SubIndex 03 Push-Pull Sensor Type	INT	Bitwise Value: bit 00 = Left Sensor Port Inputs bit 01 = Right Sensor Port Inputs bit 02 thru bit 15 = Reserved ON = Both Inputs on the port are set to accept Push-Pull type device OFF = Both Inputs on the port are set for NPN/PNP Auto Detect
SubIndex 04 Motor Type Left	INT	Integer value to set the *Motor Performance* type 0 = ECO Plus 1 = ECO 2 = BOOST 3 = BOOST 8 Refer to the Power Supply Sizing Topic for more details
SubIndex 05 Motor Type Right	INT	
SubIndex 06 Brake Mode Left	INT	Integer value to set the motor braking method See Motor Braking Methods Chart

SubIndex 07 Brake Mode Right	INT	
SubIndex 08 Motor Speed Left	INT	Integer value to set the motor speed: • For MDR the value is in mm/sec • For PGD the value is in motor RPM
SubIndex 09 Motor Speed Right	INT	
SubIndex 0A InOrOutPin2	INT	Integer value to set the function of the Left and/or Right Sensor Port Pin2 1 = Use Left Sensor Port Pin 2 as OUTPUT 2 = Use Right Sensor Port Pin 2 as OUTPUT 3 = Use Both Left and Right Sensor Port’s Pin 2 as OUTPUT
SubIndex 0B Left Motor Slave	INT	Integer value to set the function of the Left Motor 0 = Left Motor will maintain its own separate control from the Right Motor 1 = Left Motor will “slave” to Right Motor
SubIndex 0C Right Motor Slave	INT	Integer value to set the function of the Right Motor 0 = Right Motor will maintain its own separate control from the Left Motor 1 = Right Motor will “slave” to Left Motor
SubIndex 0D P2 Voltage Limit	INT	Integer value in mV for the motor generated voltage during deceleration at which the control will stop the motor and short the power transistors to dissipate the motor energy within the module’s power circuits. This internal dissipated energy is prevented from being fed back to the module’s power supply. Valid range = 26000 to 30000. Any value outside of this range will cause the default value of 27000 (27V) to be used
SubIndex 0E P1OnOff	SINT	Motor Complimentary Mode Disable 0 = Motors are in default Complimentary Mode 1 = Complimentary Mode Disabled See *Motor Complimentary Mode* topic below

Sensor Polarity

In this SDO register, when a given bit is set to 1; the logical state of the corresponding bit in the *All Sensors object of PDO0* is inverted. This also inverts the LED state displayed on the module.

This is provided as a convenience for the master controller programmer. For example, the master controller could have re-useable code or routines that expect a photo sensor to have its electrical signal ON when it is "blocked". Let's say on a given module, you need to connect a photo sensor whose electrical signal is OFF when "blocked". Instead of modifying the program logic in each and every place this input is used; you can simply change its logical polarity with this SDO register. This logical polarity setting also affects the LED state.

For example, by default when the Left Sensor input is electrically energized, its corresponding LED illuminates green and bit 4 of the *All Sensors PDO* register is a 1. If you set bit 4 in the *SDO Sensor Polarity* register; when the Left Sensor input is electrically energized, bit 4 of the *All Sensors PDO* is 0 and its corresponding LED is off.

Motor Complimentary Mode

The *P1OnOff* object is used for to help abate over-voltage situations for the power supply feeding the module. With Complementary Mode *disabled*, excess motor generated back EMF during deceleration is dissipated as heat instead of fed back into the DC power supply. Doing this reduces the overall motor efficiency. Complementary Mode enabled (default) provides the highest motor efficiency available from the module.

> ! Please note that if the motor generated back EMF reaches 25V or higher, the Complimentary Mode is automatically disabled regardless of the setting of the P1OnOff object.

5.3.6.2. Service Read Object

Service Read Object SDO – Index 0×4001

Subindex	Data Type	Data Description
SubIndex 01 Motor Voltage	INT	Value in mV for the Motor Power input to the module _Example: 24100 = 24.1V
SubIndex 02 Logic Voltage	INT	Value in mV for the Logic Power input to the module _Example: 23500 = 23.5V
SubIndex 03 Sensor Detect	INT	Integer value indicating if Sensor Port circuitry detects a device connected 0 = No devices detected on either Left or Right Sensor Ports 1 = Device detected on Left Sensor Port 2 = Device detected on Right Sensor Port 3 = Device detected on both Left and Right Sensor Ports
SubIndex 04 Left Motor Temperature	INT	Numerical value of temperature in °C: • High Byte = Motor Sensor Temperature • Low Byte = Controller Driver Sensor Temperature
SubIndex 05 Right Motor Temperature	INT	
SubIndex 06 Left Motor Current	INT	Motor current value in mA
SubIndex 07 Right Motor Current	INT	
SubIndex 08 Left Motor Max Speed	INT	Numerical value of maximum speed: • For Motor Rollers the value is in mm/sec • For PGD value is in RPM x 10
SubIndex 09 Right Motor Max Speed	INT	
SubIndex 0A Left Motor	INT	Numerical value of current motor running speed: • For Motor Rollers the value is in mm/sec

Real Speed		• For PGD value is in RPM x 10
SubIndex 0B Right Motor Real Speed	INT	
SubIndex 0C Left Motor Frequency	INT	Numerical value of current motor running frequency in Hz
SubIndex 0D Right Motor Frequency	INT	
SubIndex 0E Left Motor PWM	INT	Current motor running PWM in % of maximum allowed *Example: 800 = 80%*
SubIndex 0F Right Motor PWM	INT	

5.3.6.3. Motor Data Left and Motor Data Right

Motor Data Left & Motor Data Right SDO – Indexes 0×4100 and 0×4101

The Motor Data SDOs make the Ai motor data available to the master controller. Each Ai motor (MDR or PGD) has internal memory that is written upon final manufacturing. This data includes serial number, manufacture date, roller dimensions, etc. The following table identifies each element available in these SDOs. Please note that the data for the *Left Motor is at Index 0×4100* and the data for the *Right Motor is at index 0×4101*.

Subindex	Item	Data Type	Data Description
1	Production ID	INT	Sequence number for the items manufactured on the manufacture day
2	Customer ID	SINT	Customer code
3	Roller Type	SINT	ASCII value indicating roller type: • A = Standard • T = Tapered • W = Wash down rated (IP66) • Z = Freezer rated (-30°C)
4	Motor Type	SINT	Value indicating Motor Type: • 0 = MDR • 1 = PGD
5	Tube Diameter	SINT	Tube diameter in millimeters (not applicable for PGD)
6	Speed Code/ Gearbox	SINT	Value indicating gear reduction: • If MDR the value is the catalog Speed Code • If PGD the value is the catalog Gear Ration
7	Interlock	SINT	ASCII value indicating roller to roller interlocking method: • A = Straight (No interlocking) • B = V Pulley • G = Dual Groove • H = Micro-V Pulley
8	Manufacture Month	SINT	Numerical value of the month of manufacture (1 thru 12)

9	Manufacture Month	SINT	Numerical value of the last two digits of the year of manufacture
10	Shaft	SINT	Internally coded numerical value
11	Tube Material	SINT	ASCII value indicating tube material/covering option: • A = Plain Steel • B = 3mm Black Rubber option • J = Stainless Steel • Q = 2mm PVC Sleeve option • W = 3mm Urethan Coating option • Z = Zinc (Standard ZAM Tube)
12	Motor Length	INT	MDR length in mm
13	Manufacture Day	SINT	Day of the month when manufactured (1 thru 31)
14	Manufacture Country	SINT	ASCII value indicating place of final assembly: • 0 = Europe • 1 = Japan • 2 = USA
15	Time	DINT	The amount of elapsed time in minutes the motor has been running
16	Time Current Limit	DINT	The amount of elapsed time in minutes the motor has been running
17	Time Overheat	DINT	The amount of time in minutes the motor has been running overheated
18	On/Off Cycles	DINT	The number of times the motor has been cycled on and off
19	Over Voltage Count	DINT	The number of times the module voltage has exceeded 30V
20	Under Voltage Count	DINT	The number of times the module voltage has fell below 18V

5.3.7. MotionLinx-IO SDO

Configuration SDO – Index 0×4000

Subindex	Data Type	Data Description
SubIndex 1 InOrOut	INT	Input/Output Configuration 1 = set pin as Output 0 = set pin as Input bit 0 : Left Male Pin2 bit 1 : Left Female Pin2 bit 2 : Right Male Pin2 bit 3 : Right Female Pin2 bit 4 : Left Male Pin4 bit 5 : Left Female Pin4 bit 6 : Right Male Pin4 bit 7 : Right Female Pin4 bit 8 to bit 15 – reserved
SubIndex 2 Sensor Polarity	INT	Inputs Polarity Configuration 0 = Input signal and interpreted logic state equal 1 = Invert logic state form signal state bit 0 : Left Male Pin2 bit 1 : Left Female Pin2 bit 2 : Right Male Pin2 bit 3 : Right Female Pin2 bit 4 : Left Male Pin4 bit 5 : Left Female Pin4 bit 6 : Right Male Pin4 bit 7 : Right Female Pin4 bit 8 to bit 15 – reserved See *Sensor Polarity* topic below
SubIndex 3 Outputs Polarity	INT	Outputs Polarity Configuration 0 = Output signal and interpreted logic state equal 1 = Invert logic state form signal state bit 0 : Left Male Pin2 bit 1 : Left Female Pin2 bit 2 : Right Male Pin2 bit 3 : Right Female Pin2

		bit 4 : Left Male Pin4 bit 5 : Left Female Pin4 bit 6 : Right Male Pin4 bit 7 : Right Female Pin4 bit 8 to bit 15 – reserved See *Outputs Polarity* topic below
SubIndex 4 PushPull	INT	Push/Pull Inputs Configuration 0 = Input circuit NPN/PNP auto detect 1 = Input circuit is Push/Pull type bit 0 : Left Male Pin2 bit 1 : Left Female Pin2 bit 2 : Right Male Pin2 bit 3 : Right Female Pin2 bit 4 : Left Male Pin4 bit 5 : Left Female Pin4 bit 6 : Right Male Pin4 bit 7 : Right Female Pin4 bit 8 to bit 15 – reserved Note that this data is ignored if the Pin is configured as an Output
SubIndex 5 StateOnDisconnect	INT	Output State on Disconnect Configuration 0 = Output Pin de-energizes upon communication loss with master controller 1 = Output Pin remains in last state upon communication loss with master controller bit 0 : Left Male Pin2 bit 1 : Left Female Pin2 bit 2 : Right Male Pin2 bit 3 : Right Female Pin2 bit 4 : Left Male Pin4 bit 5 : Left Female Pin4 bit 6 : Right Male Pin4 bit 7 : Right Female Pin4 bit 8 to bit 15 – reserved Note that this data is ignored if the Pin is configured as an Input
SubIndex 6	INT	Sensor Debounce Time Configuration

Sensor Debounce		Value in msec Minimum value = 2 msec Maximum value = 2000 msec Default value = 20 msec
SubIndex 7 thru 9 Reserved	INT	Reserved for future use

Sensor Polarity

This SubIndex is only used for Pins configured as Inputs in the *InOrOut SubIndex*. If a given Pin’s corresponding bit is 0 in this SubIndex, the logical state of the Pin’s data seen in the *Transmit PDO0 – Object 0×1A00 SubIndex SensorInputs* will match the logical state of the electrical signal on the Pin. If a given Pin’s corresponding bit is 1 in this SubIndex, the logical state of the Pin’s data seen in the *Transmit PDO0 – Object 0×1A00 SubIndex SensorInputs* will be inverted from the logical state of the electrical signal on the Pin.

This is provided as a convenience for the master controller programmer. For example, the master controller could have re-useable code or routines that expect a photo sensor to have its electrical signal ON when it is “blocked”. Let’s say on a given module, you need to connect a photo sensor whose electrical signal is OFF when “blocked”. Instead of modifying the program logic in each and every place this input is used; you can simply change its logical polarity with this SDO.

Please note that this SubIndex also controls the state of the LED indicators for the given Pin. The LED state will match the logical state of the pin.

For example, by default when the Left Sensor input is electrically energized, its corresponding LED illuminates green and bit 4 of the *Transmit PDO0 – Object 0×1A00 SubIndex SensorInputs* is a 1. If you set bit 4 in the SDO SensorPolarity; when the Left Sensor input is electrically energized, bit 4 of the *Transmit PDO0 – Object 0×1A00 SubIndex SensorInputs* is 0 and its corresponding LED is off.

Outputs Polarity

This SubIndex is only used for Pins configured as Outputs in the *InOrOut SubIndex*. If a given Pin’s corresponding bit is 0 in this SubIndex, when the master controller sets the logical state of the Pin in the *Receive PDO0 – Object 0×1600 SubIndex Outputs*, the electrical signal on the Pin will match this logical state. If a given Pin’s corresponding bit is 1 in this SubIndex, the electrical signal on the Pin will be inverted from the logical state.

! Upon power-up, all I/O Pins default to being inputs. Because these input pins are NPN/PNP auto-sensing, there is a voltage (approx. 12V) on the circuit that will produce up to a 2 mA leakage current. When using a given Pin as an output, there may be a time delay between module boot-up and the master controller configuring the Pin as an output. During this time delay, if you have a device connected to the Pin, it may receive the auto-detect circuit’s voltage and leakage current

5.4. MotionLinx File over EtherCAT (FoE)

MotionLinx-Ai and MotionLinx-IO modules support the FoE (File-over-EtherCAT) protocol for file transfer over EtherCAT network. This protocol is used for two purposes:

- To upgrade the firmware of the module
- To upload/upgrade the ESI file of the on board EtherCAT slave controller switch

! Please note that the firmware version of your MotionLinx modules must match the firmware version referenced in the ESI file in order for the modules to operate properly.

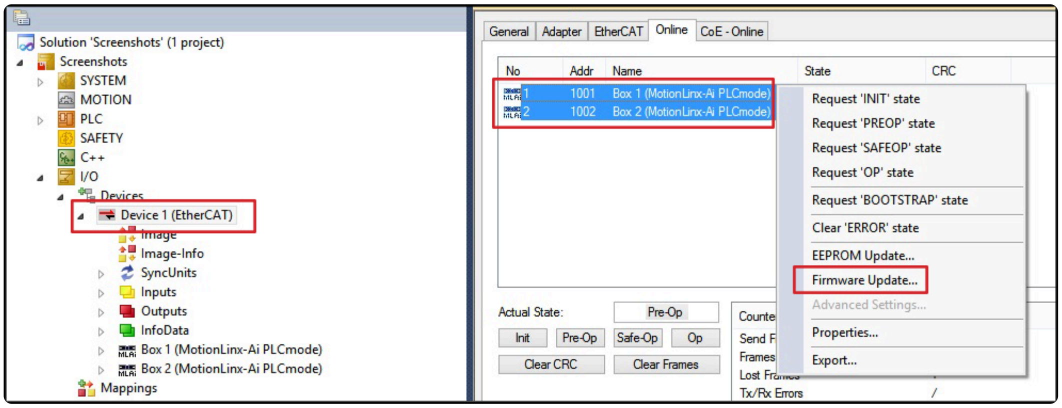
MotionLinx Firmware Upgrade

The TwinCAT software will allow you to upgrade one, several, or all modules on your network.

✻ Firmware upgrade files, when available, can be downloaded from Pulseroller.com

Once you have downloaded the firmware file (it will always have a .bin file extension); place it in an accessible folder on your PC. In TwinCAT, select the device or devices you want to upgrade and perform “Firmware Update” as shown below.

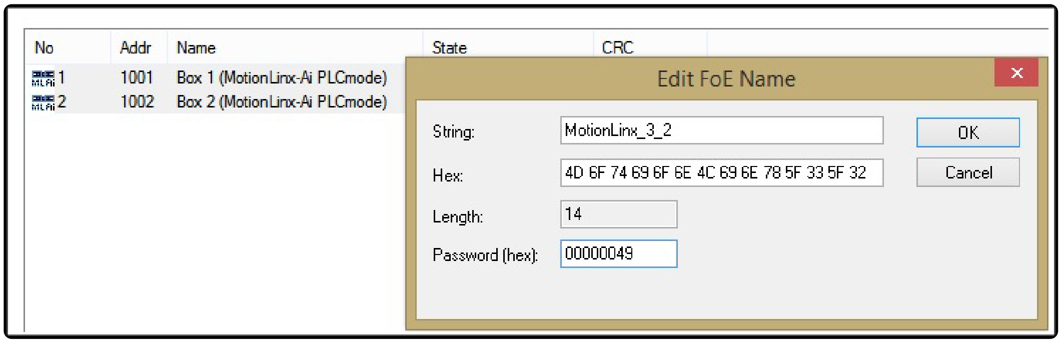
Click on your EtherCAT master and from the Online Tab, select one or more devices and right click the “Firmware Upgrade” selection from the menu.



No	Addr	Name	State	CRC
1	1001	Box 1 (MotionLinx-Ai PLCmode)		
2	1002	Box 2 (MotionLinx-Ai PLCmode)		

Actual State: Pre-Op

When you select “Firmware Upgrade” a browsing window will appear. Navigate to where you placed the downloaded file and select. Please note you will have to enter



No	Addr	Name	State	CRC
1	1001	Box 1 (MotionLinx-Ai PLCmode)		
2	1002	Box 2 (MotionLinx-Ai PLCmode)		

String: MotionLinx_3_2

Hex: 4D 6F 74 69 6F 6E 4C 69 6E 78 5F 33 5F 32

Length: 14

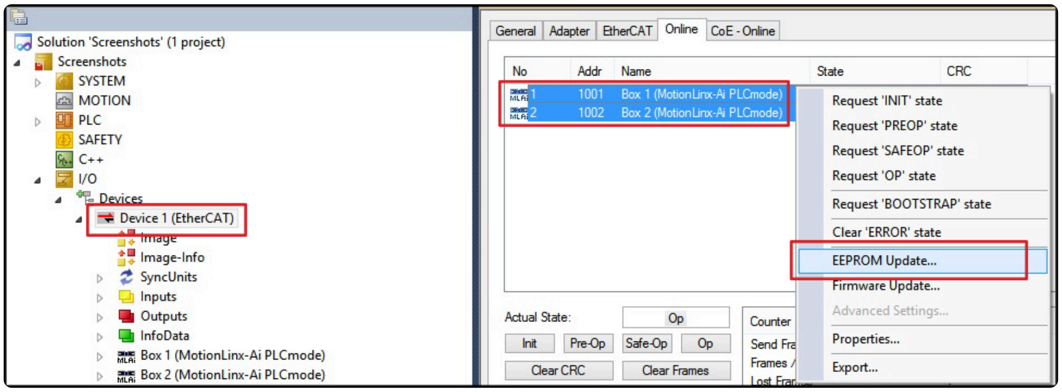
Password (hex): 00000049

a password (49) to complete the upgrade as shown .

MotionLinx ESI File Upgrade

Similar to the module firmware upgrade, the ESI upgrade follows the same procedure except you select “EEPROM Update” from the menu as shown

Click on your EtherCAT master and from the Online Tab, select one or more devices and right click the “EEPROM Upgrade” selection from the menu.



5.5. Customizing MotionLinx-Ai PDOs

The *MotionLinx-Ai* module's' *CoE* definition contains the capacity for 6 Receive PDOs (RxPDO) and 6 Transmit PDOs (TxPDO). By default 3 of the RxPDOs are pre-defined and enabled leaving 3 spare and by default 2 of the TxPDOs are pre-defined and enabled leaving 4 spare.

> ✻ Please note there are no customizable PDOs for *MotionLinx-IO*

The *TwinCAT* IDE provides the tools to allow you to edit and/or disable any of the pre-defined RxPDOs or TxPDOs as well as assign previously defined and select *SDO Dictionary Items* into your RxPDOs and/or TxPDOs. This allows you to get automatic and cyclical updates to data through the PDO mechanism for the SDO items without having to explicitly initiate a separate SDO read/write for this same data.

Customizing PDO Guidelines and Limitations

When you configure one of the spare PDOs and/or modify one of the pre-defined PDOs, there are some basic guidelines you need to follow:

- Maximum of 10 objects per PDO
- Maximum of 200 bytes total for all enabled TxPDOs
- Maximum of 200 bytes total for all enabled RxPDOs
- Total length of mapped objects must align on 4-byte boundaries

5.5.1. Object Dictionary Items Available for Custom PDOs

OD Items Available for TxPDOs

Dictionary Object	Index	Data Type	Data Description
0×3007 ConveyStop Status	SubIndex 0	INT	Integer value indicating the current status of the ConveyStop function 0 = No Stopped Condition Active 2 = Stopped Condition is Active and is caused by either a ConveyStop Command or the module has been placed in PreOP or SafeOP state by the external controller. Disconnect of Motor Power to the module will NOT result in an Active Stopped Condition. All other values reserved
0×3008 CPU Load Percentage	SubIndex 0	SINT	Unsigned value from 0 to 100 indicating the percent loading on the module's CPU
0×4001 Service Read Object	SubIndex 01 thru 0F		All SubIndexes of the *Service Read Object SDO*

OD Items Available for RxPDOs

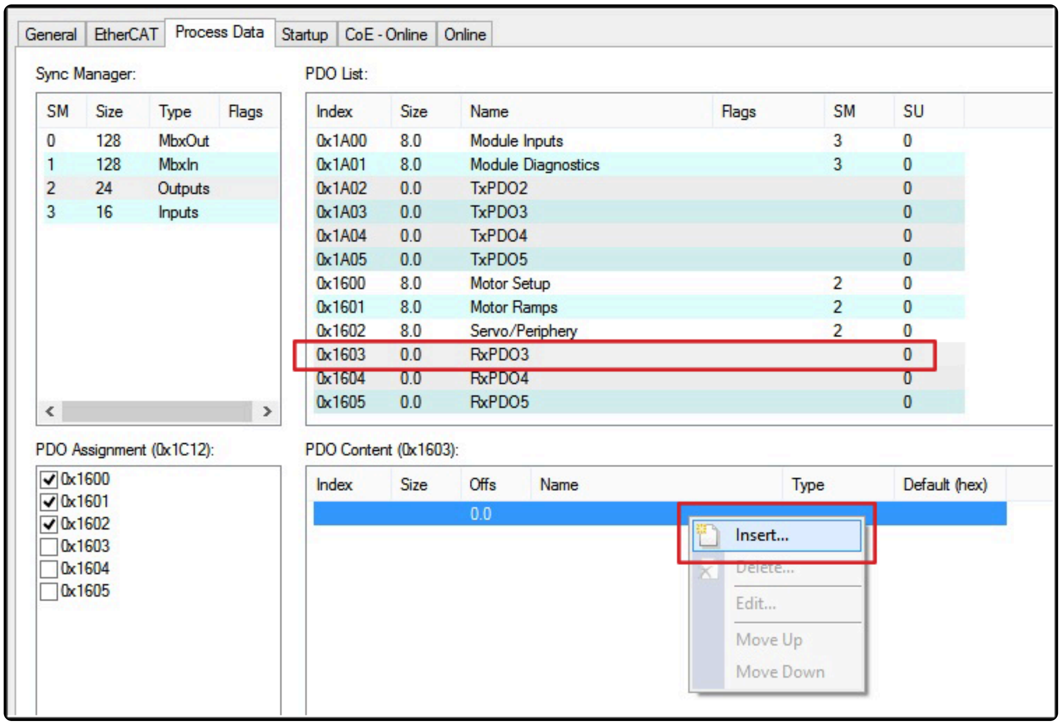
Subindex	Index	Data Type	Data Description
0×2013 ConveyStop Command	SubIndex 0	INT	Integer Value 0 = Clear Stopped State 1 = Set Stopped State
0×4000 Sensor Polarity	SubIndex 01	INT	Bitwise Value: bit 00 = Left Sensor Port – Aux Input bit 01 = Reserved bit 02 = Right Sensor Port – Aux Input bit 03 = Reserved bit 04 = Left Sensor Port – Sensor Input

			bit 05 = Reserved bit 06 = Right Sensor Port – Sensor Input bit 07 thru bit 15 = Reserved
0×4000 Left Motor Slave	SubIndex 0B	INT	Integer value to set the function of the Left Motor 0 = Left Motor will maintain its own separate control from the Right Motor 1 = Left Motor will “slave” to Right Motor
0×4000 Right Motor Slave	SubIndex 0C	INT	Integer value to set the function of the Right Motor 0 = Right Motor will maintain its own separate control from the Left Motor 1 = Right Motor will “slave” to Left Motor
0×2014 Reserved1Byte	SubIndex 0	SINT	One Byte Object used to align PDO to a 4-byte boundary
0×2015 Reserved2Byte	SubIndex 0	INT	Two Byte Object used to align PDO to a 4-byte boundary

5.5.2. How to Customize PDOs in TwinCAT

Creating a New PDO

In this example we are going to configure the unused and available RxPDO3. Select it from the PDO List and in the PDO Content window right click the first line and select insert



Sync Manager:

SM	Size	Type	Flags
0	128	MbxOut	
1	128	MbxIn	
2	24	Outputs	
3	16	Inputs	

PDO List:

Index	Size	Name	Flags	SM	SU
0x1A00	8.0	Module Inputs		3	0
0x1A01	8.0	Module Diagnostics		3	0
0x1A02	0.0	TxPDO2			0
0x1A03	0.0	TxPDO3			0
0x1A04	0.0	TxPDO4			0
0x1A05	0.0	TxPDO5			0
0x1600	8.0	Motor Setup		2	0
0x1601	8.0	Motor Ramps		2	0
0x1602	8.0	Servo/Periphery		2	0
0x1603	0.0	RxPDO3			0
0x1604	0.0	RxPDO4			0
0x1605	0.0	RxPDO5			0

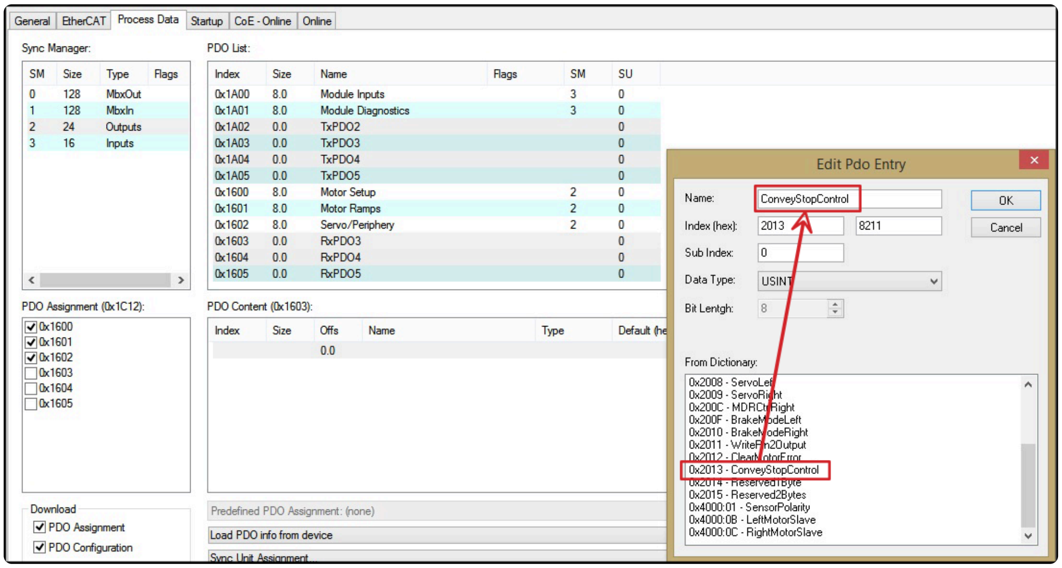
PDO Assignment (0x1C12):

- ☑ 0x1600
- ☑ 0x1601
- ☑ 0x1602
- ☐ 0x1603
- ☐ 0x1604
- ☐ 0x1605

PDO Content (0x1603):

Index	Size	Offs	Name	Type	Default (hex)
		0.0			

The Edit PDO Entry window pops up and you select the particular Dictionary item you want to include in your PDO. In this example we selected the ConveyStopControl entry at index 0×2013



Sync Manager:

SM	Size	Type	Flags
0	128	MbxOut	
1	128	MbxIn	
2	24	Outputs	
3	16	Inputs	

PDO List:

Index	Size	Name	Flags	SM	SU
0x1A00	8.0	Module Inputs		3	0
0x1A01	8.0	Module Diagnostics		3	0
0x1A02	0.0	TxPDO2			0
0x1A03	0.0	TxPDO3			0
0x1A04	0.0	TxPDO4			0
0x1A05	0.0	TxPDO5			0
0x1600	8.0	Motor Setup		2	0
0x1601	8.0	Motor Ramps		2	0
0x1602	8.0	Servo/Periphery		2	0
0x1603	0.0	RxPDO3			0
0x1604	0.0	RxPDO4			0
0x1605	0.0	RxPDO5			0

PDO Assignment (0x1C12):

- ☑ 0x1600
- ☑ 0x1601
- ☑ 0x1602
- ☐ 0x1603
- ☐ 0x1604
- ☐ 0x1605

Download

- ☑ PDO Assignment
- ☑ PDO Configuration

PDO Content (0x1603):

Index	Size	Offs	Name	Type	Default (he
		0.0			

Predefined PDO Assignment: (none)

Load PDO info from device

Sync Unit Assignment...

Edit Pdo Entry

Name: ConveyStopControl

Index (hex): 2013 8211

Sub Index: 0

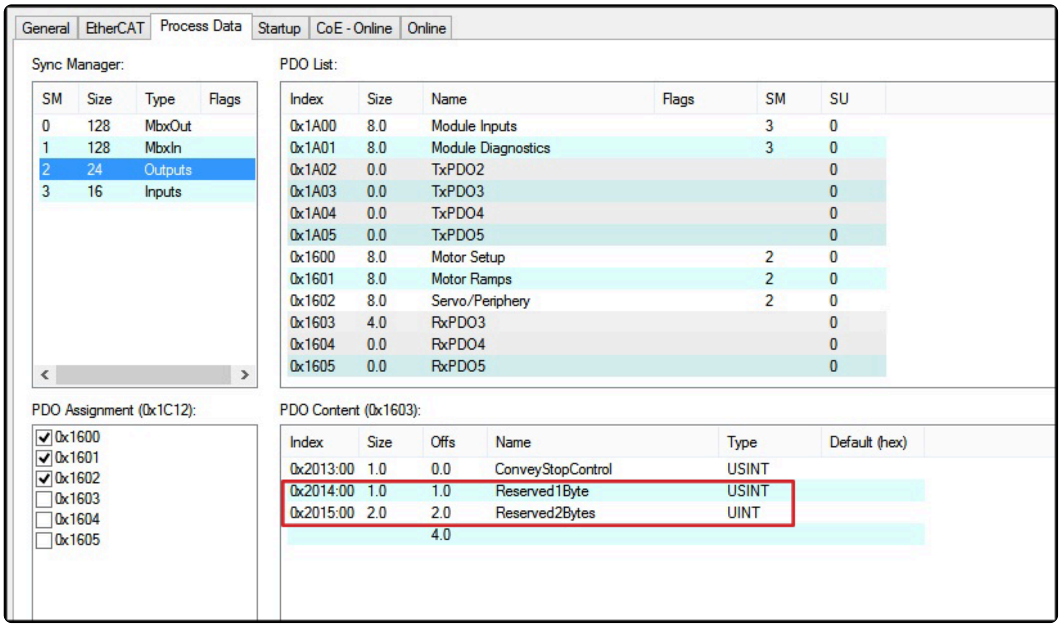
Data Type: USINT

Bit Lentgh: 8

From Dictionary:

- 0x2008 - ServoLeft
- 0x2009 - ServoRight
- 0x200C - MDRCtrlRight
- 0x200F - BrakeModeLeft
- 0x2010 - BrakeModeRight
- 0x2011 - WritePin2Output
- 0x2012 - ClearMotorError
- 0x2013 - ConveyStopControl
- 0x2014 - Reserved1Byte
- 0x2015 - Reserved2Bytes
- 0x4000:01 - SensorPolarity
- 0x4000:0B - LeftMotorSlave
- 0x4000:0C - RightMotorSlave

For our example, we only want the ConveyStopControl object in our PDO. This object is only 1 byte in length (USINT). The length of a PDO has to be in multiples of 4 bytes, so we have to add 3 more bytes of data. This is where we use the Reserved1Byte and Reserved2Byte objects to add to our PDO to make it 4 bytes in length.



Sync Manager:

SM	Size	Type	Flags
0	128	MbxOut	
1	128	MbxIn	
2	24	Outputs	
3	16	Inputs	

PDO List:

Index	Size	Name	Flags	SM	SU
0x1A00	8.0	Module Inputs		3	0
0x1A01	8.0	Module Diagnostics		3	0
0x1A02	0.0	TxPDO2			0
0x1A03	0.0	TxPDO3			0
0x1A04	0.0	TxPDO4			0
0x1A05	0.0	TxPDO5			0
0x1600	8.0	Motor Setup		2	0
0x1601	8.0	Motor Ramps		2	0
0x1602	8.0	Servo/Periphery		2	0
0x1603	4.0	RxPDO3			0
0x1604	0.0	RxPDO4			0
0x1605	0.0	RxPDO5			0

PDO Assignment (0x1C12):

☑ 0x1600
☑ 0x1601
☑ 0x1602
☐ 0x1603
☐ 0x1604
☐ 0x1605

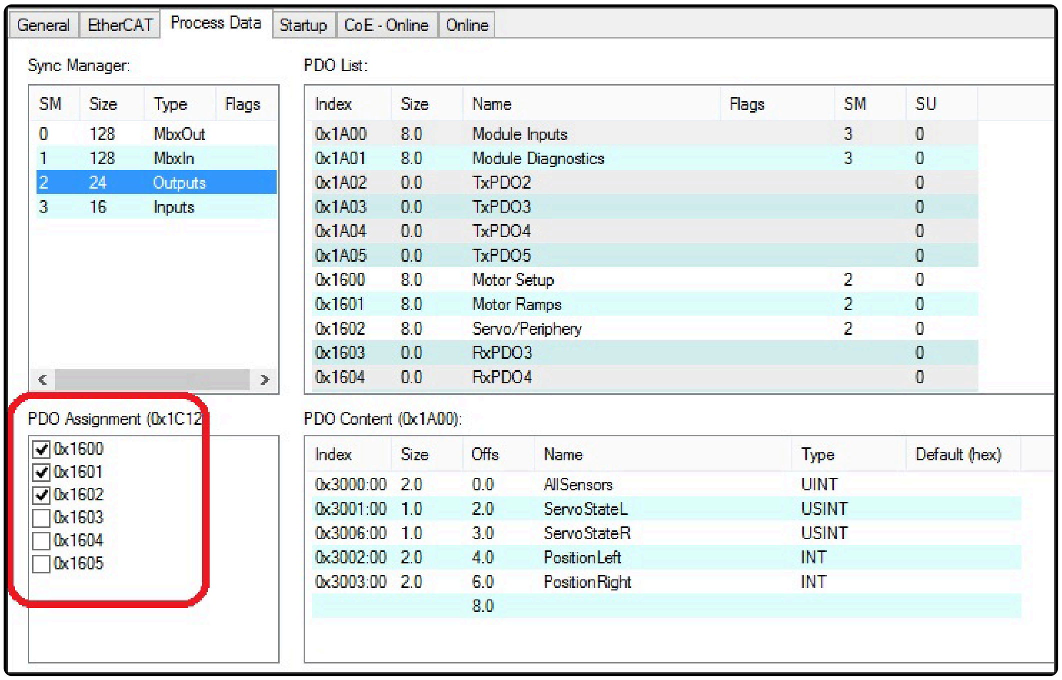
PDO Content (0x1603):

Index	Size	Offs	Name	Type	Default (hex)
0x2013:00	1.0	0.0	ConveyStopControl	USINT	
0x2014:00	1.0	1.0	Reserved1Byte	USINT	
0x2015:00	2.0	2.0	Reserved2Bytes	UINT	
		4.0			

! DO NOT duplicate any object entries between any of the available RxPDOs or TxPDOs because you will get unexpected results. Please note the TwinCAT software will not provide any warning and will allow you to do this. If you want to include an object from one of the pre-defined PDO in one of your custom created PDOs, you must first remove it from the pre-defined PDO.

Enabling and Disabling PDOs

You can see in the highlighted area that there are 3 checkboxes checked for the 3 default pre-defined RxPDOs at indexes 0×1600 thru 0×1602. In our example, to enable the operation of the new PDO we created for RxPDO3, we need to click the checkbox for 0×1603. To disable a PDO, uncheck its



Sync Manager:

SM	Size	Type	Flags
0	128	MbxOut	
1	128	MbxIn	
2	24	Outputs	
3	16	Inputs	

PDO List:

Index	Size	Name	Flags	SM	SU
0x1A00	8.0	Module Inputs		3	0
0x1A01	8.0	Module Diagnostics		3	0
0x1A02	0.0	TxPDO2			0
0x1A03	0.0	TxPDO3			0
0x1A04	0.0	TxPDO4			0
0x1A05	0.0	TxPDO5			0
0x1600	8.0	Motor Setup		2	0
0x1601	8.0	Motor Ramps		2	0
0x1602	8.0	Servo/Periphery		2	0
0x1603	0.0	RxPDO3			0
0x1604	0.0	RxPDO4			0

PDO Assignment (0x1C12

☑ 0x1600
☑ 0x1601
☑ 0x1602
☐ 0x1603
☐ 0x1604
☐ 0x1605

PDO Content (0x1A00):

Index	Size	Offs	Name	Type	Default (hex)
0x3000:00	2.0	0.0	AllSensors	UINT	
0x3001:00	1.0	2.0	ServoStateL	USINT	
0x3006:00	1.0	3.0	ServoStateR	USINT	
0x3002:00	2.0	4.0	PositionLeft	INT	
0x3003:00	2.0	6.0	PositionRight	INT	
		8.0			

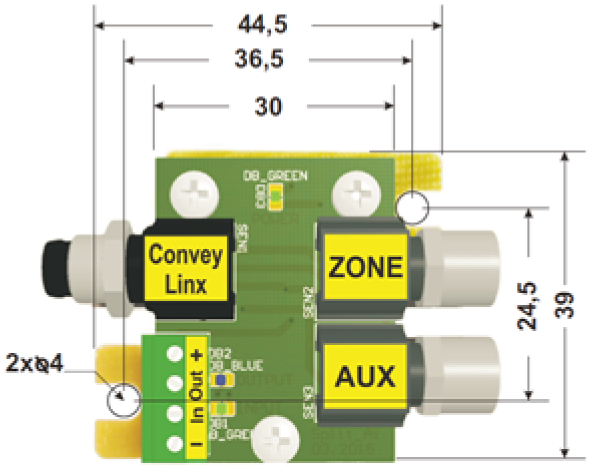
corresponding checkbox

6. IOX Interface Module

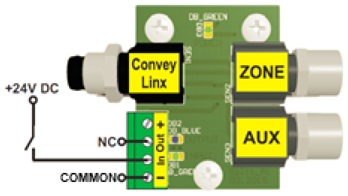
In the section Electrical Connections for Sensor Port Aux I/O, it is shown how to use off the shelf commercially available M8 cable accessories to gain access to the Aux I/O pin on the sensor ports. Pulseroller offers a Breakout/Splitter Module Accessory that offers the same cable splitter functionality as the commercially available M8 units along with breaking out some of the signals to convenient wire terminal access for flying lead devices.

The *IOX-2 Interface Module* provides a convenient plug and play means to separate the zone sensor and Aux I/O signals on the Module’s sensor port. The *IOX-2* utilizes M8 style connection headers so you can connect your M8 style zone sensor as well as M8 style cable (or additional sensor) for access to the Aux I/O Pin 2 signal. The *IOX-2* also contains wire terminal access for the Aux I/O Pin 2 signals for complete flexibility.

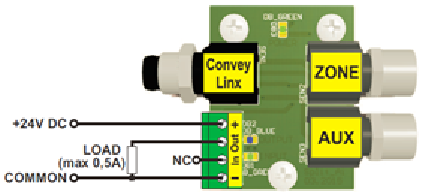
Mounting Dimensions



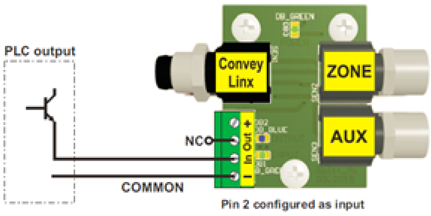
Wiring Diagrams



Pin 2 configured as input



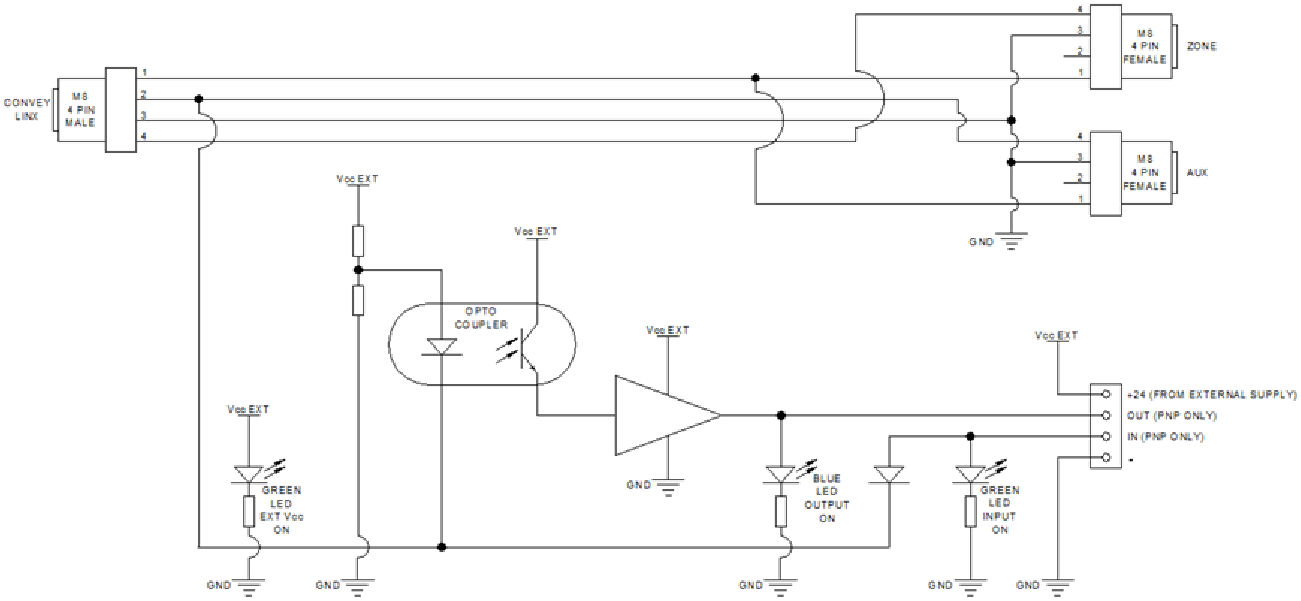
Pin 2 configured as output



Pin 2 configured as input

Electrical Schematic

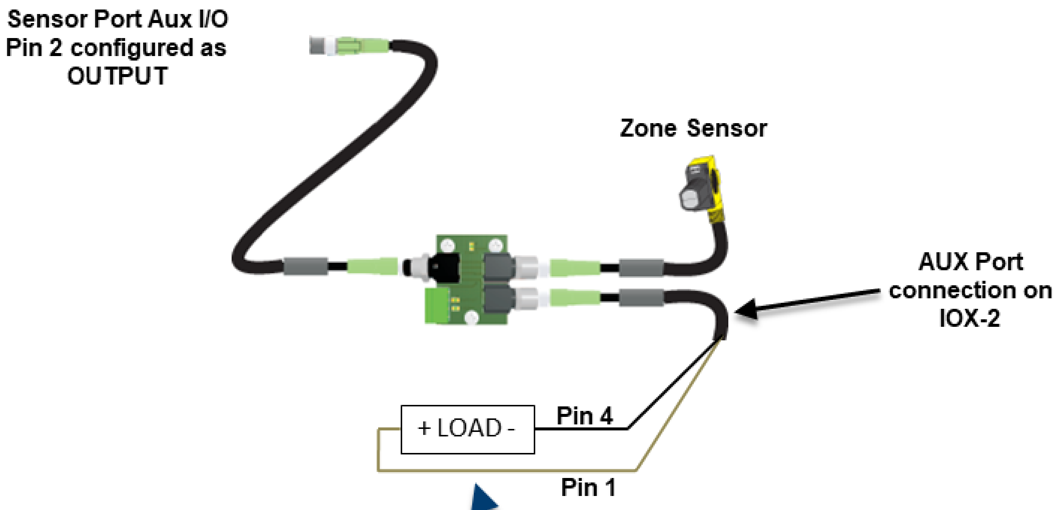
Electrical Schematic of IOX-2 Module



6.1. Pin 2 Output on Aux I/O M8

! Please note: Diagram shown is for MotionLinx-Ai module. It is not recommended to use the IOX-2 for use with any MotionLinx-IO ports configured as Outputs

Using AUX M8 Port to Connect Sensor Port AUX I/O Pin when Aux I/O is configured as an OUTPUT

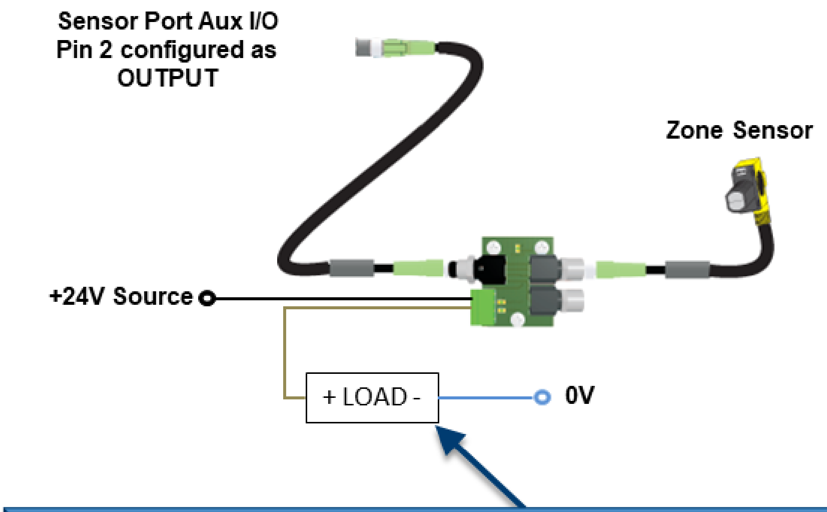

Sensor Port Aux I/O Pin 2 configured as OUTPUT
Zone Sensor
AUX Port connection on IOX-2
+ LOAD -
Pin 4
Pin 1

When the AUX M8 Port on the IOX-2 is used to connect the Sensor Port's AUX I/O Pin 2 signal as an output, the output signal is NPN and appears on PIN 4 of the AUX M8 Port

6.2. Pin 2 Output on Wired Terminals

! Please note: Diagram shown is for MotionLinx-Ai module only. The IOX-2 breakout terminals will not work at all for any MotionLinx-IO ports configured as Outputs

Using Wired Terminals to Connect Sensor Port AUX I/O Pin when Aux I/O is configured as an OUTPUT



When the Wired Terminals on the IOX-2 are used to connect the Sensor Port's AUX I/O Pin 2 signal as an output, 24V source must be connected to the "+" terminal and a PNP signal is provided on the "OUT" terminal.