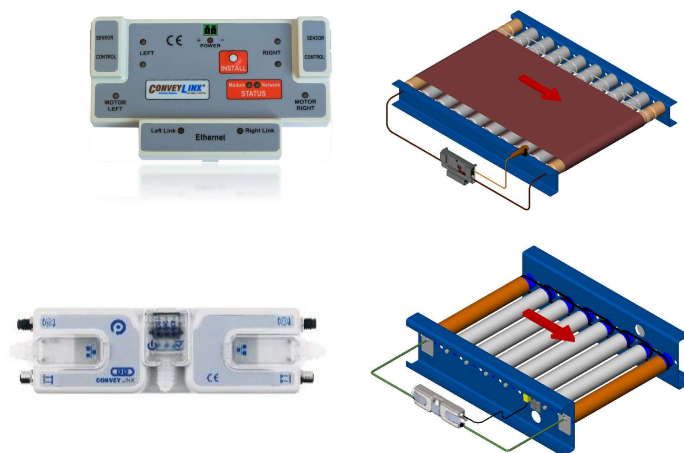


Setting Up Dual Motor Zones

Version 1.0

April 2019



**For ConveyLinx ERSC Firmware version 4.25 and higher
ConveyLinx-Ai2 Firmware versions 4.19 and higher**

*ConveyLinx module firmware and functionality is protected by U.S. and international patents.
For complete patent information visit www.pulseroller.com/patents*

Publication ERSC-1700

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

ConveyLinx Ai2 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, Insight Automation Inc. 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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SUMMARY OF CHANGES

The following table summarizes the changes and updates made to this document since the last revision

Revision	Date	Change / Update
1.0	April 2019	Initial Release

GLOBAL CONTACT INFORMATION



PULSE ROLLER

WWW.PULSEROLLER.COM
SALES@PULSEROLLER.COM
SUPPORT@PULSEROLLER.COM

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PREFACE

WHO SHOULD USE THIS MANUAL?

This manual is intended for users who need to properly configure 2 Pulse rollers in a single zone or a dual motor Pulse roller when controlled with either a ConveyLinX ERSC module or ConveyLinX-Ai2 module.

PREREQUISITES

You should have reviewed and understood the following publications:

- *ConveyLinX User's Guide* (Publication ERSC-1000)
- *ConveyLinX-Ai2 User's Guide* (Publication ERSC-1006)
- *ConveyLinX-ERSC PLC Developer's Guide* (Publication ERSC-1500)
- *ConveyLinX-Ai2 PLC Developer's Guide* (Publication ERSC-1506)

This manual also assumes you have a solid working knowledge of both Rockwell PLC's and the RSLogix 5000 / RSLogix Designer development environments, if applicable based upon whether PLC control of modules is desired.

NOT INCLUDED IN THIS MANUAL



Because system applications vary; this manual assumes users and application engineers have properly sized their Pulseroller drive capacity and mechanical drive train design to accommodate the material handling requirements. The conveyor examples shown herein are for illustration only and not necessarily intended to be interpreted fully functional conveyor equipment.



INTRODUCTION

This document will provide basic instructions and guidelines on setting up dual motor zones with either Conveylinx-ERSC or ConveyLinx-Ai2 modules. The modules mode of operation, control options, and mechanical configuration of the zone and motor roller itself all play into how to properly set-up this functionality.

CONFIGURATION MATRIX

The following matrix shows lists 3 common mechanical zone types with the module's possible operational modes for each and a short description of the solution. Each solution in turn will be covered in a following section.

Module	Zone Type	Operational Mode	Solution
ConveyLinx ERSC	2 MDR – Coupled	ZPA	Requires set up in EasyRoll
		PLC I/O	Requires program code to set up proper PLC Output Assembly values
		ConveyLogix	Requires program code to set up proper register values
	2 MDR – Non-Coupled	ZPA	Should be but not required to be set-up in EasyRoll
		PLC I/O	No special adjustments required – Use Program code to run independently or together as desired
		ConveyLogix	No special adjustments required – Use Program code to run independently or together as desired
	2 Motors in 1 MDR	ZPA	Requires set up in EasyRoll
		PLC I/O	Requires program code to set up proper PLC Output Assembly values
		ConveyLogix	Requires program code to set up proper register values
ConveyLinx-Ai2	2 MDR – Coupled	ZPA	Automatic – No Adjustments required
		PLC I/O	Requires program code to set up proper PLC Output Assembly values
		ConveyLogix	Requires program code to set up proper register values
	2 MDR – Non-Coupled	ZPA	Will Not Work Properly
		PLC I/O	No special adjustments required – Use Program code to run independently or together as desired
		ConveyLogix	No special adjustments required – Use Program code to run independently or together as desired
	2 Motors in 1 MDR	ZPA	Not Possible
		PLC I/O	Requires program code to set up proper PLC Output Assembly values
		ConveyLogix	Requires program code to set up proper register values

CONVEYLINX-ERSC MODULE

MECHANICALLY COUPLED 2 MOTOR ROLLER

This scenario is perhaps the most common in that this would be the case for a two-motor roller belted zone used in an incline or decline application as depicted in Figure 1 . Please note that mechanically the two motor rollers can be coupled with just O-bands, Poly-V belts, etc. The concept is that the upstream motor roller is there to assist the downstream motor roller.

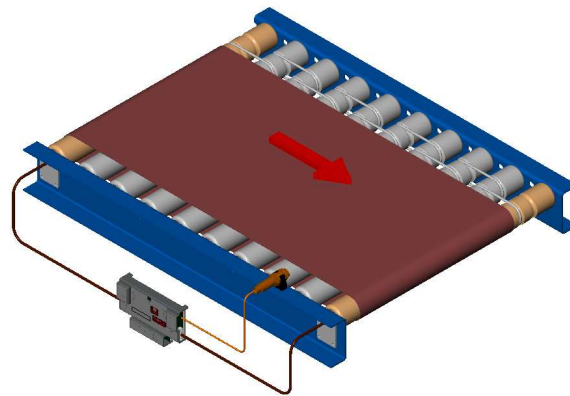


FIGURE 1 - 1 LOGICAL ZONE WITH TWO MECHANICALLY COUPLED MOTOR ROLLERS

ZPA MODE

In general, when you perform an Auto-Configure procedure, ERSC modules will configure in ZPA mode. If one sensor is connected (either Left or Right) and two motors are connected, the module is automatically configured as a single logical zone and will run both motors at the same time. If the modules are at factory default, both motors will be at factory default settings. Otherwise, the motor settings will be the ones last set by EasyRoll.

Auto-Configuration of a two Pulse roller logical zone with an ERSC does not automatically cause both motors to adopt the same motor settings.

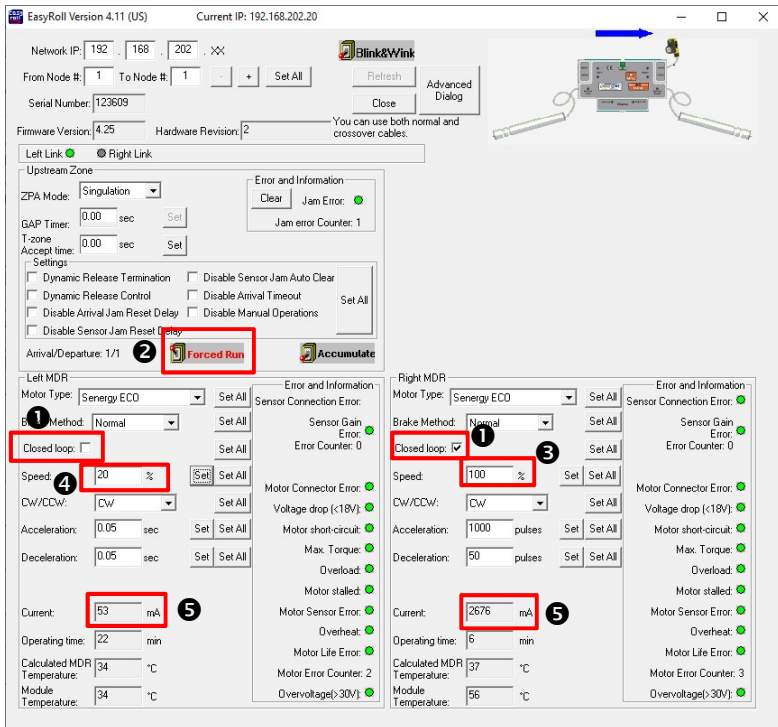
OPEN LOOP CONTROL

If open loop speed control is desired; then set both motors to the same settings in EasyRoll.

CLOSED LOOP CONTROL

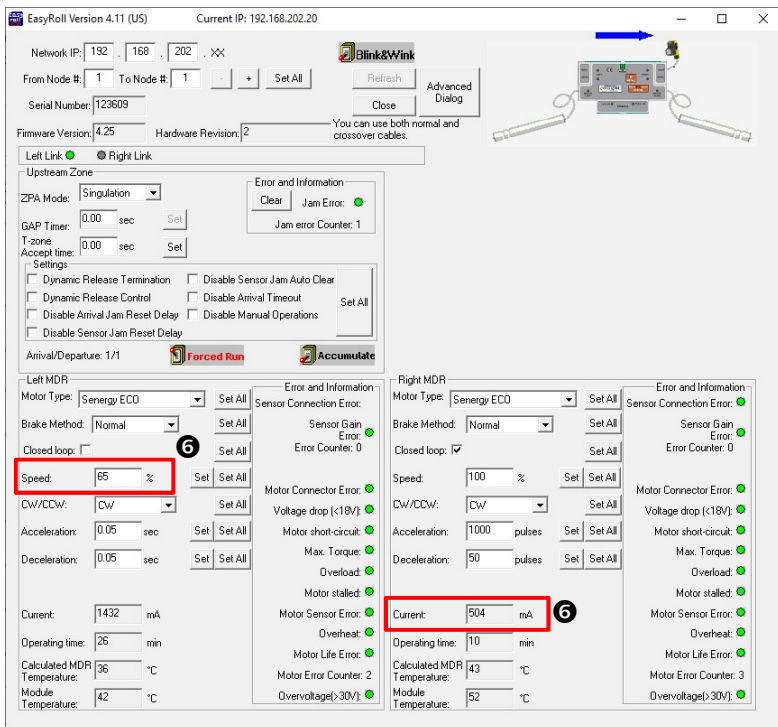
When using closed loop control, it is important to never place both motors into closed loop control because they will “fight” each other particularly when accelerating and decelerating. Perform the following basic steps in EasyRoll for the selected ERSC module:

- ❶ Place discharge end motor in closed loop and infeed end motor in open loop
- ❷ Force Run and both motors should run
- ❸ Enter desired speed for the zone for the closed loop motor
- ❹ Enter slow speed in open loop motor
- ❺ Verify that the open loop motor current is non zero and that closed loop current is in the range of the rated current



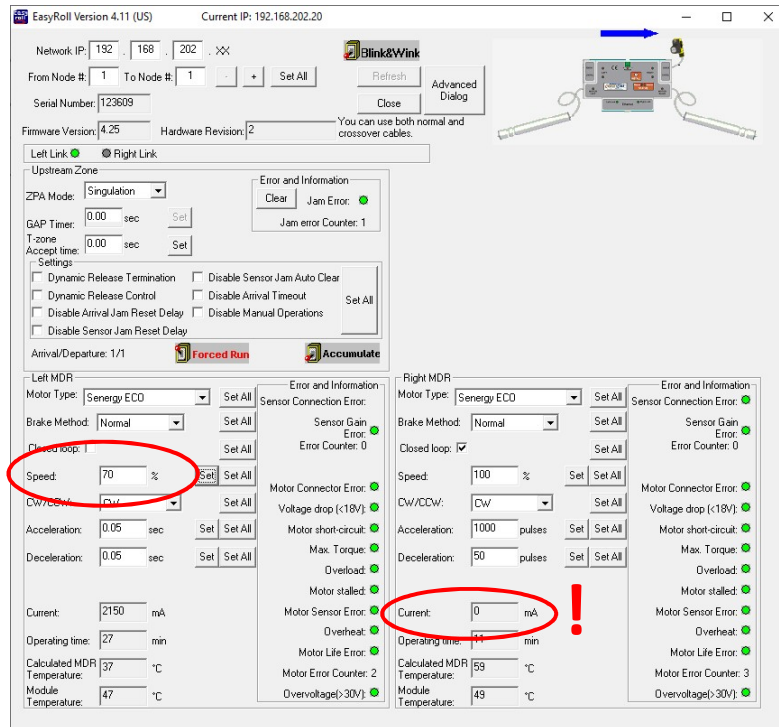
- ❻ Adjust the open loop motor's speed until the closed loop motor's current is approximately 500 to 800 mA

Please note that the values shown are examples only. The actual speed and current values you see may be different.



It is important to not set the open loop motor's speed so high as to make the closed loop motor's current draw be 0 mA

In this example, 65% speed on the open loop motor was OK, but 70% as shown caused the closed loop motor current to drop to 0.



PLC I/O MODE

In PLC I/O mode there is no ZPA logic operating in the module, so the motors are independently controlled by default when the module is placed in PLC I/O mode. With a remote PLC you can connect to the PLC I/O Assemblies and either control each motor independently with your logic or utilize some specific specialized programming to couple the motors together so that the on-board firmware manages the master/slave control of the motors.

For more details on PLC I/O Mode PLC Assemblies, please refer to publication ERSC-1500 ConveyLinx ERSC PLC Developer's Guide

OPEN LOOP

If open loop control is acceptable for your application, simply set both motors to open loop and use the same settings in EasyRoll and write your PLC logic to run both motors at the same time and in the same direction.

CLOSED LOOP

You have two choices if you wish to use closed loop speed control: Independent and Master/Slave.

INDEPENDENT

With this method you set up closed loop as described above for ZPA mode. In your PLC logic, you must run both motors at the same time and in the same direction.

MASTER/SLAVE

The ERSC firmware has the capability when in PLC I/O mode to operate both motors at the same time by setting one motor as a master and its settings will be used for both motors. With this method, your PLC logic first configures the functionality and then only logically controls the master motor.

Unfortunately, the register to configure this functionality (4:0015) is not included in any of the PLC I/O mode assemblies. Your PLC code must utilize a MSG instruction to write to this configuration register.

For information on how to write to an ERSC register with a MSG instruction, please refer to publication ERSC-1520 Connecting ConveyLinX to Rockwell PLC's

The data is to be written to Register 4:0015 based on the following:

- Bit 0: Set for Left motor to be Master
- Bit 1: Set to make Right motor rotate opposite direction when Left is Master
- Bit 2: Set Right motor to be Master
- Bit 3: Set to make Left motor rotate opposite direction when Right is Master
- Bit 4: Always set to enable the functionality



Programming Tip: You can set up your MSG instruction to continually write to Register 15, even though the ERSC only needs to get written to once. If continually sending a MSG instruction is of concern for conservation of PLC resources; you can monitor the module's Reset Counter register or AOI Module Enable bit to trigger the MSG write to register 15 only when you detect the module has power cycled or re-booted

You should use these bits as pairs. Either use bits 0 and 1 or use bits 2 and 3. Setting both bits 0 and 2 will not work.

For example, if you set bit 0, then your program logic only needs to control the Left motor in the PLC I/O instance assembly and the Right motor will have its settings internally controlled by the module.

Please note when using Master/Slave motor control, the ERSC ignores the EasyRoll settings for the slave motor

In 2 motor coupled conveyor application, always remember to never set bits 1 or 3

CONVEYLOGIX PROGRAM

You follow the same procedure as described for PLC I/O mode. You use the *FirstLadderExec* controller tag Boolean in a rung that executes a WRC block that writes the desired data to Register 4:0015. By using the *FirstLadderExec* in

this rung, it makes sure the data is written upon any power up or re-boot of the ERSC module and that it is not continuously writing the data every program scan and using up unnecessary module resources.

TWO MOTORS IN ONE MDR TUBE

Some Pulseroller models are available with two motors in one tube. Figure 2 shows a typical configuration.

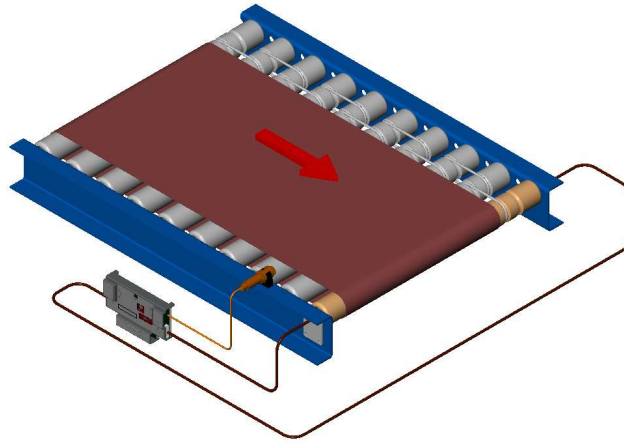
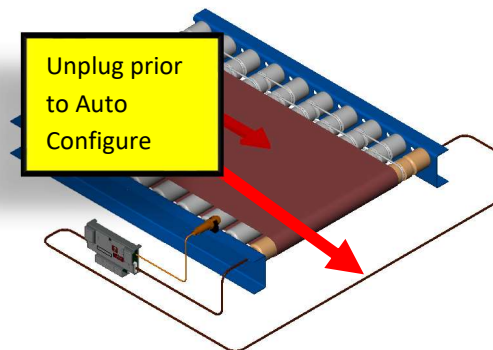


FIGURE 2 - 1 LOGICAL ZONE WITH TWO MOTORS IN ONE ROLLER TUBE

Regardless of whether you will use ZPA Mode or PLC I/O Mode, prior to performing the Auto-Configuration Procedure, unplug the motor cable opposite the ERSC module

During Auto-Configure, all zones become ZPA mode and motors will run. The ERSC does not know the opposite motor is in the same tube and will try to rotate the motors in the same direction and they will be in a mechanical bind. Unplugging the opposite motor will keep this from happening



ZPA MODE

Once Auto-Configure is complete with the opposite motor cable unplugged, you can reconnect this motor cable. You follow the same procedures as described above for ZPA Mode in section *Mechanically Coupled 2 Motor Roller - ZPA Mode* on page 9 for both Open Loop and Closed Loop control.

Be sure to change the rotation direction in EasyRoll for the opposite motor

PLC I/O MODE

After Auto-Configuration is complete, you can reconnect the opposite motor cable and place the ERSC into PLC I/O mode with EasyRoll. You have the same options as described above in section *Mechanically Coupled 2 Motor Roller - PLC I/O Mode* on page 11. For Open Loop control and Closed Loop – Independent control, remember to change the direction of the opposite motor in EasyRoll. For Master/Slave control, be sure to remember to set either bit 1 or bit 3 in Register 4:0015 to change the direction of the slave motor.

Be sure to change the opposite motor's direction either in EasyRoll or Register 15 depending on the method you choose

CONVEYLOGIX PROGRAM

Follow the exact procedure as described in section *Mechanically Coupled 2 Motor Roller - ConveyLogix Program* on page 12.

TWO MOTOR ROLLERS IN ONE LOGICAL ZONE NOT MECHANICALLY COUPLED

In this mechanical scenario, the motor rollers are not coupled together as shown in Figure 3. Because the motors are not mechanically coupled, set the motor settings the same in EasyRoll and there are no other special things to do regardless of ZPA or PLC I/O mode.

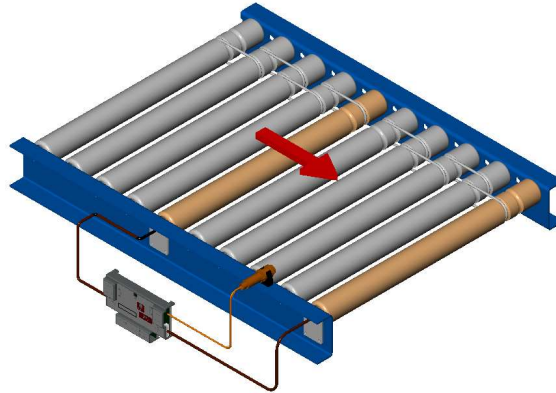


FIGURE 3 - 1 LOGICAL ZONE WITH 2 UNCOUPLED MOTOR ROLLERS

CONVEYLINX-Ai2 MODULE

Please note that ConveyLinx-Ai2 module motor speed control is always Closed Loop and thus there are not configurations or options for Open Loop as described for the ERSC module.

MECHANICALLY COUPLED WITH 2 AI MOTOR ROLLERS

This scenario is perhaps the most common in that this would be the case for a two-motor roller belted zone used in an incline or decline application as depicted in Figure 4 . Please note that mechanically the two motor rollers can be coupled with just O-bands, Poly-V belts, etc. The concept is that the upstream motor roller is there to assist the downstream motor roller.

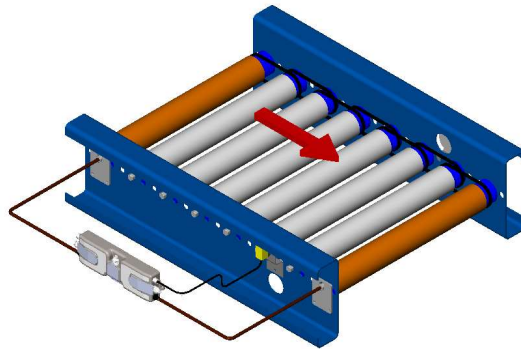


FIGURE 4 - 1 LOGICAL ZONE WITH TWO MECHANICALLY COUPLED MOTOR ROLLERS

ZPA MODE

In general, when you perform an Auto-Configure procedure, Ai2 modules will configure in ZPA mode. If one sensor is connected (either Left or Right) and two motors are connected, the module is automatically configured as a single logical zone and will run both motors at the same time. The side (Left or Right) that the sensor is connected will automatically configure that side's motor as the "master" and the other motor is the "slave". The master motor's PI regulation and PWM output is applied to the "slave" motor. Please note that any settings for the slave motor that may have been in place in EasyRoll are ignored and only the master motor settings can be changed.

PLC I/O MODE

In PLC I/O mode there is no ZPA logic operating in the module, so the motors are independently controlled by default when the module is placed in PLC I/O mode. With a remote PLC you can connect to the PLC I/O Assemblies and configure either the Left or the Right motor to be the "master" and command only the master and the "slave" motor will operate along with the master.

For more details on PLC I/O Mode PLC Assemblies, please refer to publication ERSC-1506 ConveyLinx-Ai2 PLC Developer's Guide

In the PLC I/O Output Assembly, there is *Left Motor Slave Mode* (4:0262) and *Right Motor Slave Mode* (4:0272) registers. Depending on which single motor (Left or Right) you want to command, you select the opposite's corresponding slave mode register to instruct the opposite motor to follow the master motor's commands. Also, when you do this, the slave motor takes on the master motor's speed and settings.

Let's use the conveyor example shown in Figure 4 and select the Right motor as the master and the Left motor as the slave. In this case you populate the Left Motor Slave Mode register with a value of 2 to tell the Left motor to use the settings of the Right motor and operate when the Right motor is instructed to operate.

CONVEYLOGIX PROGRAM

Similar to PLC I/O Mode, you populate Registers 4:0262 and/or 4:0272 according to the desired control. It is recommended you use the *FirstLadderExec* controller tag Boolean in a rung that executes a WRC block that writes the desired data to Register 262 or 272. By using the *FirstLadderExec* in this rung makes sure the data is written upon any power up or re-boot of the Ai2 module and that it is not continuously writing the data every program scan and using up unnecessary module resources.

TWO AI MOTORS IN ONE TUBE

Some Pulseroller-Ai models are available with two motors in one tube. Figure 5 shows a typical configuration.

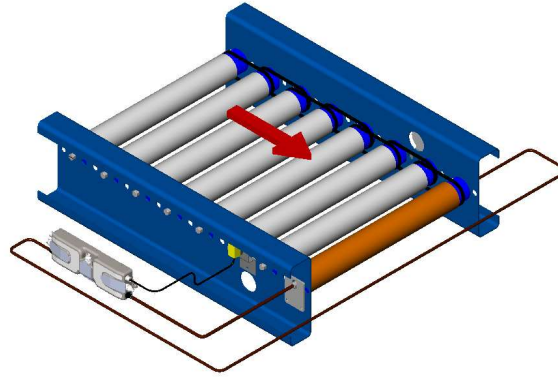


FIGURE 5 - 1 LOGICAL ZONE WITH ONE MOTOR ROLLER WITH TWO MOTORS IN ROLLER TUBE

ZPA MODE

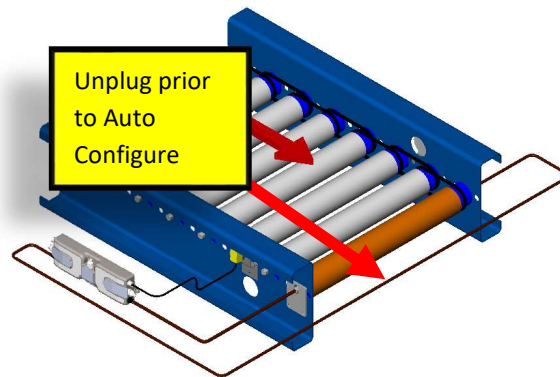
This mechanical configuration is not supported with ConveyLinX-Ai2 controls.

Attempting to use ZPA Mode with ConveyLinX-Ai2 with a 2 motor drive roller could result in damage to the roller assembly

PLC I/O MODE

Prior to performing the Auto-Configuration Procedure, unplug the motor cable opposite the ConveyLinX-Ai2 module

During Auto-Configure, all zones become ZPA mode and motors will run. The ConveyLinX-Ai2 does not know the opposite motor is in the same tube and will try to rotate the motors in the same direction and they will be in a mechanical bind. Unplugging the opposite motor will keep this from happening



PLC I/O MODE

After Auto-Configuration is complete, you can reconnect the opposite motor cable and place the Conveylinx-Ai2 into PLC I/O mode with EasyRoll. You have the same options as described above in section *Mechanically Coupled with 2 Ai Motor Rollers - PLC I/O Mode* on page 17

Be sure to change the opposite motor's direction in the proper slave mode register (4:262 / 4:272) in the PLC I/O Instance Assembly

CONVEYLOGIX PROGRAM

Follow the exact procedure as described in section *Mechanically Coupled with 2 Ai Motor Rollers - ConveyLogix Program* on page 18.

Be sure to change the opposite motor's direction in the proper slave mode register (4:262 / 4:272) in your ConveyLogix program code

TWO AI MOTOR ROLLERS IN ONE LOGICAL ZONE NOT MECHANICALLY COUPLED

In this mechanical scenario, the motor rollers are not coupled together as shown in Figure 6.

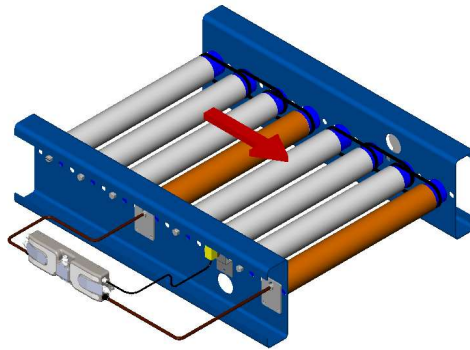


FIGURE 6 - 1 LOGICAL ZONE WITH 2 MECHANICALLY UN-COUPLED MOTOR ROLLERS

ZPA MODE

In ZPA Mode with this mechanical configuration, it will not work properly because the module will never monitor and adjust the slave motor's speed. Because they are un-coupled; both motors will vary their speed based upon their respective loads when the module is only paying attention to the load on the master.

Even though this configuration is logically allowed, it is recommended that you do not use ZPA mode for this mechanical configuration.

PLC I/O MODE AND CONVEYLOGIX PROGRAM

You can set the motors to the same settings in EasyRoll and logically run both motors at the same time in your PLC logic program or ConveyLogix program.

Even though you can attempt to use the Master/Slave functionality as previously described, you will have the same situation as just described for ZPA mode where uncoupled motors will vary their speed.

It is not recommended to use Master/Slave motor control for this mechanical configuration

NOTES:



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WWW.PULSEROLLER.COM
SALES@PULSEROLLER.COM
SUPPORT@PULSEROLLER.COM