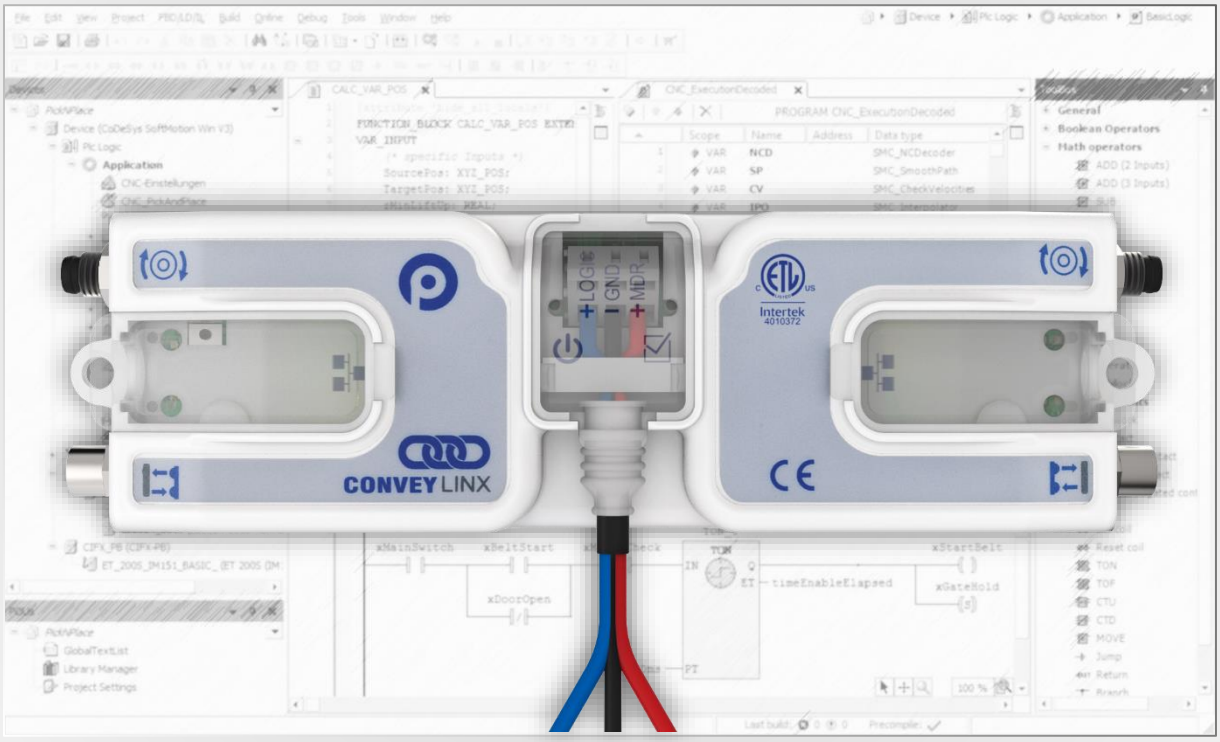
# CONVEYLINX Ai2

# PLC DEVELOPERS GUIDE




ROBOTUNITS®

THE MODULAR AUTOMATION SYSTEM

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# 1. Overview

Each and every ConveyLinx Ai module on a conveyor system functions in only one of two possible operational modes:

- ZPA Mode
- PLC I/O Mode

| ConveyLinx-Ai2 Control Strategy Quick Reference | | |
|---|---|---|
| **Any Mode** | Read Status | • Available to any Modbus TCP, Profinet I/O, or Ethernet I/P networked device regardless of Module Mode<br>• Read Sensor & Control port inputs<br>• Read MDR diagnostics |
| **ZPA Mode** | Default | • No PLC required<br>• Hard-wired connections available to control zone stop/release<br>• Some electrical connections will require additional M8 splitter devices to access all signals |
| | Interface PLC | • Ethernet I/P, Profinet I/O, or Modbus TCP Networks supported<br>• PLC can control over the network: zone accumulate/release, tracking data read/write, zone speed, monitor sensor & control port inputs |
| **PLC I/O Mode** | Interface PLC | • Default Out of the Box Mode<br>• Suspends ALL ZPA functionality<br>• PLC has complete access and control of Sensor Port I/O<br>• PLC has complete control of both MDR ports (speed, accel/decel, braking method, etc.)<br>• One or both MDR ports can be changed to provide up to 2 high powered digital outputs (1A each) per MDR port for a total of 4 digital outputs available. |

This chart shows the data sent to the PLC from the module when connected. All registers in the module are 16-bit integer data type.

| Register Chart Legend | |
|---|---|
| **M: 4:1502** | Indicates Modbus TCP Addressing Notation |
| **E: I.Data[2]** | Indicates EtherNet/IP Addressing Notation |
| **P: Byte 4 (Hi) Byte 5 (Lo)** | Indicates PROFINET® Addressing Notation |

# 2. ZPA Mode

## 2.1 ZPA Mode Assembly Inputs for PLC

| Register Name / Module Address | Assembled Address for PLC | Description |
|---|---|---|
| **Local Status Upstream Zone Forward Direction 4:0116** | M: 4:1500 (Low Byte)<br>E: I.Data[0] (Low Byte)<br>P: Byte 1 | **Unsigned Value of Byte**<br><br>0x01 = Zone sensor clear and motor stopped<br>0x02 = Zone sensor clear, motor running, accepting from upstream zone<br>0x04 = Zone sensor blocked, motor running, discharging to downstream zone<br>0x05 = Zone sensor blocked and motor stopped<br>0x06 = Busy (state during Convey Stop active mode)<br><br>See ZPA Mode Note ① for further details. |
| **Local Status Upstream Zone Reverse Direction 4:0116** | M: 4:1500 (High Byte)<br>E: I.Data[0] (High Byte)<br>P: Byte 0 | |
| **Local Status Downstream Zone Forward Direction 4:0196** | M: 4:1501 (Low Byte)<br>E: I.Data[1] (Low Byte)<br>P: Byte 3 | |
| **Local Status Downstream Zone Reverse Direction 4:0196** | M: 4:1501 (High Byte)<br>E: I.Data[1] (High Byte)<br>P: Byte 2 | |
| **Arrival Count Local Upstream Zone 4:0106** | M: 4:1502<br>E: I.Data[2]<br>P: Byte 4 (Hi) Byte 5 (Lo) | **Unsigned Integer Value**<br><br>• Increments by 1 each time a Carton arrives in the zone<br>• Value rolls over from 65,535 back to 0 |
| **Departure Count Local Upstream Zone 4:0107** | M: 4:1503<br>E: I.Data[3]<br>P: Byte 6 (Hi) Byte 7 (Lo) | **Unsigned Integer Value**<br><br>• Increments by 1 each time a Carton departs the zone<br>• Value rolls over from 65,535 back to 0 |
| **Arrival Count Local Downstream Zone 4:0186** | M: 4:1504<br>E: I.Data[4]<br>P: Byte 8 (Hi) Byte 9 (Lo) | **Unsigned Integer Value**<br><br>• Increments by 1 each time a Carton arrives in the zone<br>• Value rolls over from 65,535 back to 0 |
| **Departure Count Local Downstream Zone 4:0187** | M: 4:1505<br>E: I.Data[5]<br>P: Byte 10 (Hi) Byte 11 (Lo) | **Unsigned Integer Value**<br><br>• Increments by 1 each time a Carton departs the zone<br>• Value rolls over from 65,535 back to 0 |

| | | |
|---|---|---|
| **Module Status Word 1 4:0088** | M: 4:1506<br>E: I.Data[6]<br>P: Byte 12 (Hi) Byte 13 (Lo) | **Bitwise Value - Read only**<br><br>bit 0 = Module Reset Flag – 1 when module resets, 0 when PLC connected<br>bit 1 = Reserved<br>bit 2 = Over-Voltage – Module power supply has exceeded 30V<br>bit 3 = Left Motor Error – bits 7 thru 15 indicate specific error<br>bit 4 = Ethernet Connections NOT OK<br>bit 5 = Upstream Jam Error<br>bit 6 = Left Sensor Error<br>bit 7 = Low Voltage Error – Module Power Supply less than 18V<br>bit 8 = Left Motor Over-heated – Calculated temperature over 105°C<br>bit 9 = Left Motor at Max. Torque<br>bit 10 = Left Motor Short Circuit<br>bit 11 = Left Motor Not Connected<br>bit 12 = Left Motor Overload – Motor has been stalled for more than 20 seconds<br>bit 13 = Left Motor Stalled – Motor running slower than 10% of selected speed<br>bit 14 = Left Motor Hall Sensor Error<br>bit 15 = Left Motor Not Used |
| **Module Status Word 2 4:0089** | M: 4:1507<br>E: I.Data[7]<br>P: Byte 14 (Hi) Byte 15 (Lo) | **Bitwise Value - Read only**<br><br>bit 0 = Reserved<br>bit 1 = Reserved<br>bit 2 = Over-Voltage – Motor power supply has exceeded 30V<br>bit 3 = Right Motor Error<br>bit 4 = Reserved<br>bit 5 = Downstream Jam Error<br>bit 6 = Right Sensor Error<br>bit 7 = Low Voltage Error - Motor Power Supply less than 18V<br>bit 8 = Right Motor Over-heated - Calculated temperature over 105°C<br>bit 9 = Right Motor at Max. Torque<br>bit 10 = Right Motor Short Circuit<br>bit 11 = Right Motor Not Connected<br>bit 12 = Right Motor Overload – Motor has been stalled for more than 20 seconds<br>bit 13 = Right Motor Stalled – Motor running slower than 10% of selected speed<br>bit 14 = Right Motor Hall Sensor Error<br>bit 15 = Right Motor Not Used |
| **Current Upstream Zone Tracking Word 1 4:0119** | M: 4:1508<br>E: I.Data[8]<br>P: Byte 16 (Hi) Byte 17 (Lo) | **When Carton is accumulated in UPSTREAM zone:**<br><br>Value = Tracking data word #1 (16-bit integer) for the Carton currently accumulated and stopped in the module's Upstream zone. |
| **Current Upstream Zone Tracking Word 2 4:0120** | M: 4:1509<br>E: I.Data[9]<br>P: Byte 18 (Hi) Byte 19 (Lo) | **When Carton is accumulated in UPSTREAM zone:**<br><br>Value = Tracking data word #2 (16-bit integer) for the Carton currently accumulated and stopped in the module's Upstream zone. |
| **Current Downstream Zone Tracking Word 1 4:0199** | M: 4:1510<br>E: I.Data[10]<br>P: Byte 20 (Hi) Byte 21 (Lo) | **When Carton is accumulated in DOWNSTREAM zone:**<br><br>Value = Tracking data word #1 (16-bit integer) for the Carton currently accumulated and stopped in the module's Downstream zone. |

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|---|---|---|
| **Current Downstream Zone Tracking Word 2 4:0200** | M: 4:1511<br>E: I.Data[11]<br>P: Byte 22 (Hi) Byte 23 (Lo) | **When Carton is accumulated in DOWNSTREAM zone:**<br><br>Value = Tracking data word #2 (16-bit integer) for the Carton currently accumulated and stopped in the module's Downstream zone. |
| **Current Release Count for Upstream Zone 4:0105** | M: 4:1512<br>E: I.Data[12]<br>P: Byte 24 (Hi) Byte 25 (Lo) | Copy of the current value in the Release Upstream output register which can be used by PLC logic to confirm release count prior to writing new data to the Release Upstream output register. |
| **Current Release Count for Downstream Zone 4:0185** | M: 4:1513<br>E: I.Data[13]<br>P: Byte 26 (Hi) Byte 27 (Lo) | Copy of the current value in Release Downstream which can be used by PLC logic to confirm release count prior to writing new data to the output Release Downstream register. |
| **Get Tracking Forward Direction Word 1 4:0201** | M: 4:1514<br>E: I.Data[14]<br>P: Byte 28 (Hi) Byte 29 (Lo) | **When module is discharging to Non-ConveyLinx controlled conveyor:**<br><br>Value = Tracking data word #1 (16-bit integer) for the Carton that has just discharged from the local downstream zone when local conveyor is operating in default or "forward" direction. |
| **Get Tracking Forward Direction Word 2 4:0202** | M: 4:1515<br>E: I.Data[15]<br>P: Byte 30 (Hi) Byte 31 (Lo) | **When module is discharging to Non-ConveyLinx controlled conveyor:**<br><br>Value = Tracking data word #2 (16-bit integer) for the Carton that has just discharged from the local downstream zone when local conveyor is operating in default or "forward" direction. |
| **Get Tracking Reverse Direction Word 1 4:0121** | M: 4:1516<br>E: I.Data[16]<br>P: Byte 32 (Hi) Byte 33 (Lo) | **When module is discharging to Non-ConveyLinx controlled conveyor:**<br><br>Value = Tracking data word #1 (16-bit integer) for the load that has just discharged from the local downstream zone when local conveyor is operating in opposite of default or "reverse" direction. |
| **Get Tracking Reverse Direction Word 2 4:0122** | M: 4:1517<br>E: I.Data[17]<br>P: Byte 34 (Hi) Byte 35 (Lo) | **When module is discharging to Non-ConveyLinx controlled conveyor:**<br><br>Value = Tracking data word #2 (16-bit integer) for the Carton that has just discharged from the local downstream zone when local conveyor is operating in opposite of default or "reverse" direction. |
| **Sensor Port Inputs 4:0035** | M: 4:1518<br>E: I.Data[18]<br>P: Byte 36 (Hi) Byte 37 (Lo) | **Bitwise Value - Read only**<br><br>bit 00 = Left Sensor Port – Aux I/O (M8 Pin2)<br>bit 02 = Right Sensor Port – Aux I/O (M8 Pin2)<br>bit 04 = Left Sensor Port – Signal (M8 Pin4)<br>bit 06 = Right Sensor Port - Signal (M8 Pin4)<br>bit 15 = 2 sec on / 2 sec off heartbeat<br><br>All other bits reserved.<br><br>See ZPA Mode Note ②. |

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|---|---|---|
| **Reserved** | M: 4:1519<br>E: I.Data[19]<br>P: Byte 38 (Hi) Byte 38 (Lo) | |
| **Convey Stop Status 4:0019** | M: 4:1520<br>E: I.Data[20]<br>P: Byte 40 (Hi) Byte 41 (Lo) | **Bitwise Value - Read only**<br><br>bit 00 – bit04 = Reserved<br>bit 05 = Stop active on another module in Stop Group<br>bit 06 = Stop active due to lost communication connection<br>bit 07 = Stop active due to lost PLC connection<br>bit 08 = Reserved<br>bit 09 = Reserved<br>bit 10 = Stop active due to Stop Command from PLC<br>bit 11- bit 15 = Reserved<br><br>Refer to Insight Automation publication ERSC-1800 Convey Stop User's Guide for details on using Convey Stop. |

## 2.2 ZPA Mode Assembly Outputs for PLC

These registers are written by the PLC to the module when the module is in ZPA mode. All registers are 16-bit Integer data type.

| Register Name / Module Address | Assembled Address for PLC | Description |
|---|---|---|
| **Set Local Upstream Zone Tracking Word 1 4:0132** | M: 4:1600<br>E: O.Data[0]<br>P: Byte 0 (Hi) Byte 1 (Lo) | Write value for 16-bit integer tracking data word #1 for the Carton accumulated in the Upstream Zone.<br><br>See ZPA Mode Note ③ for special reserved values |
| **Set Local Upstream Zone Tracking Word 2 4:0133** | M: 4:1601<br>E: O.Data[1]<br>P: Byte 2 (Hi) Byte 3 (Lo) | Write value for 16-bit integer tracking data word #2 for the Carton accumulated in the Upstream Zone.<br><br>See ZPA Mode Note ③ for special reserved values |
| **Set Local Downstream Zone Tracking Word 1 4:0212** | M: 4:1602<br>E: O.Data[2]<br>P: Byte 4 (Hi) Byte 5 (Lo) | Write value for 16-bit integer tracking data word #1 for the Carton accumulated in the Downstream Zone.<br><br>See ZPA Mode Note ③ for special reserved values |
| **Set Local Downstream Zone Tracking Word 2 4:0213** | M: 4:1603<br>E: O.Data[3]<br>P: Byte 6 (Hi) Byte 7 (Lo) | Write value for 16-bit integer tracking data word #2 for the Carton accumulated in the Downstream Zone.<br><br>See ZPA Mode Note ③ for special reserved values |
| **Accumulation Control for Local Upstream Zone 4:0104** | M: 4:1604<br>E: O.Data[4]<br>P: Byte 8 (Hi) Byte 9 (Lo) | **Bitwise Values**<br><br>bit 0 = Set/Clear Accumulation Mode for Local Zone<br>bit 8 = Accumulate adjacent upstream zone<br>bit 9 = Set Arrival Confirmation for adjacent downstream zone<br>bit 10 = Jog zone in default direction<br>bit 11 = Jog zone in opposite of default direction<br>bit 12 = Wake up Local Zone<br>bit 13 = Enable Maintenance Mode<br>All other bits reserved<br><br>See ZPA Mode Note ⑤ for further details |
| **Accumulation Control for Local Downstream Zone 4:0184** | M: 4:1605<br>E: O.Data[5]<br>P: Byte 10 (Hi) Byte 11 (Lo) | |
| **Set Left MDR Speed 4:0040** | M: 4:1606<br>E: O.Data[6]<br>P: Byte 12 (Hi) Byte 13 (Lo) | **Value in mm/sec for MDR or RPM x 10 for PGD**<br><br>Range: depends upon the Ai MDR or PGD connected<br>MDR Example: 400 = 0.40 m/s<br>PGD Example: 400 = 40 RPM<br>0 = Remain at last non zero value entered<br><br>See ZPA Mode Note ④ for further details |
| **Set Right MDR Speed 4:0064** | M: 4:1607<br>E: O.Data[7]<br>P: Byte 14 (Hi) Byte 15 (Lo) | |

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| **Release and Accumulate on Next Arrival for Local Upstream Zone 4:0105** | M: 4:1608<br>E: O.Data[8]<br>P: Byte 16 (Hi) Byte 17 (Lo) | **When bit 0 of Accumulation Control for Local Upstream Zone is set:**<br><br>Changing the value in this register will cause the Carton accumulated in this zone to release and the zone will be armed to automatically accumulate the next Carton that arrives. |
| **Release and Accumulate on Next Arrival for Local Downstream Zone 4:0185** | M: 4:1609<br>E: O.Data[9]<br>P: Byte 18 (Hi) Byte 19 (Lo) | **When bit 0 of Accumulation Control for Local Downstream Zone is set:**<br><br>Changing the value in this register will cause the Carton accumulated in this zone to release and the zone will be armed to automatically accumulate the next Carton that arrives |
| **Set Status for Upstream Induct 4:0134** | M: 4:1610<br>E: O.Data[10]<br>P: Byte 20 (Hi) Byte 21 (Lo) | **Only used when local module is accepting loads from Non-ConveyLinx controlled conveyor:**<br><br>Set value to 4 to cause the local upstream zone to run to accept the Carton being delivered by the non-ConveyLinx controlled conveyor. Set value to 1 to cause the local upstream zone to accept the tracking data written in Set Induct Tracking Word 1 / Word 2 |
| **Set Status for Downstream Discharge 4:0232** | M: 4:1611<br>E: O.Data[11]<br>P: Byte 22 (Hi) Byte 23 (Lo) | **Only used when local module is discharging loads to Non-ConveyLinx controlled conveyor:**<br><br>• Set value to 5 to cause the local downstream zone to accumulate and hold any Carton that arrives.<br>• Set value to 1 to allow the local downstream zone to release the Carton |
| **Set Induct Tracking Forward Direction Word 1 4:0139** | M: 4:1612<br>E: O.Data[12]<br>P: Byte 24 (Hi) Byte 25 (Lo) | **Only used when local module is accepting loads from Non-ConveyLinx controlled conveyor:**<br><br>Set value for 16-bit integer tracking word #1 for Carton leaving non-ConveyLinx controlled conveyor that is in transit to arrive on the local upstream zone when conveyor is running in default or “forward” direction. |
| **Set Induct Tracking Forward Direction Word 2 4:0140** | M: 4:1613<br>E: O.Data[13]<br>P: Byte 26 (Hi) Byte 27 (Lo) | **Only used when local module is accepting loads from Non-ConveyLinx controlled conveyor:**<br><br>Set value for 16-bit integer tracking word #2 for Carton leaving non-ConveyLinx controlled conveyor that is in transit to arrive on the local upstream zone when conveyor is running in default or “forward” direction. |
| **Set Induct Tracking Reverse Direction Word 1 4:0237** | M: 4:1614<br>E: O.Data[14]<br>P: Byte 28 (Hi) Byte 29 (Lo) | **Only used when local module is accepting loads from Non-ConveyLinx controlled conveyor:**<br><br>Set value for 16-bit integer tracking word #1 for Carton leaving non-ConveyLinx controlled conveyor that is in transit to arrive on the local upstream zone when conveyor is running in opposite of default or “reverse” direction. |

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|---|---|---|
| **Set Induct Tracking Forward Direction Word 2 4:0238** | M: 4:1615<br>E: O.Data[15]<br>P: Byte 30 (Hi) Byte 31 (Lo) | **Only used when local module is accepting loads from Non-ConveyLinx controlled conveyor:**<br><br>Set value for 16-bit integer tracking word #2 for Carton leaving non-ConveyLinx controlled conveyor that is in transit to arrive on the local upstream zone when conveyor is running in opposite of default or "reverse" direction. |
| **Clear Motor Error 4:0022** | M: 4:1616<br>E: O.Data[16]<br>P: Byte 32 (Hi) Byte 33 (Lo) | **Logical 0 or 1**<br><br>0 = Stop Reset<br>1 = Send Reset<br><br>See ZPA Mode Note ⑥ for further details |
| **Set Aux I/O Outputs 4:0063** | M: 4:1617<br>E: O.Data[17]<br>P: Byte 34 (Hi) Byte 35 (Lo) | **Bitwise Value**<br><br>bit 8 = Left Aux I/O (Pin 2) Usage: 0 = Use as Input / 1 = Use as Output<br>bit 9 = Right Aux I/O (Pin 2) Usage: 0 = Use as Input / 1 = Use as Output<br><br>bit 12 = Left Aux I/O (Pin 2) as Output: 1 = ON, 0 = OFF (only if bit 8 is ON)<br>bit 13 = Right Aux I/O (Pin 2) as Output: 1 = ON, 0 = OFF (only if bit 9 is ON)<br>All other bits reserved<br><br>See ZPA Mode Note ⑦ for further details |
| **Reserved** | M: 4:1618<br>E: O.Data[18]<br>P: Byte 36 (Hi) Byte 37 (Lo) | |
| **Convey Stop Command 4:0020** | M: 4:1619<br>E: O.Data[19]<br>P: Byte 38 (Hi) Byte 39 (Lo) | **Integer Value**<br><br>0 = No Command<br>1 = Command local module's Stop Group to go to Stopped State<br>2 = Command local module's Stop Group to Clear Stopped State |
| **Clear Sensor Jam Command for Local Upstream Zone 4:0109** | M: 4:1620<br>E: O.Data[20]<br>P: Byte 40 (Hi) Byte 41 (Lo) | **Use when PLC has detected a local Upstream jam in Module Status Word #1 Bit 5:**<br><br>PLC creates transition from 0 to 1 to send command to local upstream zone to clear the jam condition.<br><br>See ZPA Mode Note ⑧. |
| **Clear Sensor Jam Command for Local Downstream Zone 4:0189** | M: 4:1621<br>E: O.Data[21]<br>P: Byte 42 (Hi) Byte 43 (Lo) | **Use when PLC has detected a local Downstream jam in Module Status Word #2 Bit 5:**<br><br>PLC creates transition from 0 to 1 to send command to local downstream zone to clear the jam condition.<br><br>See ZPA Mode Note ⑧. |

<table>
<tr><td>Direction & Accumulation Mode Control for Local Upstream Zone<br>4:0365</td><td>M: 4:1622<br>E: O.Data[22]<br>P: Byte 44 (Hi) Byte 45 (Lo)</td><td rowspan="2">Used to change direction of flow or accumulation mode for a contiguous group of zones beginning with the local upstream / downstream zone<br><br>Value for Low Byte of Register<br><br>0 = Normal Function<br>1 = Accumulate Zones<br>2 = Accumulate Zones<br>3 = Change Accumulation Release mode<br>4 = Return Release Mode to Configured Default<br>10 = Set Direction to Configured Default Direction (Forward)<br>11 = Set Direction to opposite of Configured Direction (Reverse)<br><br>Value for High Byte of Register<br><br>Number of ZONES beginning with the local Upstream / Downstream Zone for which the Low Byte value is applied – from 1 to 220. If ALL ZONES in the subnet need to be controlled then leave the High Byte = “0”.</td></tr>
<tr><td>Direction & Accumulation Mode Control for Local Downstream Zone<br>4:0375</td><td>M: 4:1623<br>E: O.Data[23]<br>P: Byte 46 (Hi) Byte 47 (Lo)</td></tr>
<tr><td>Convey Merge Interface<br>4:0387</td><td>M: 4:1624<br>E: O.Data[24]<br>P: Byte 48 (Hi) Byte 49 (Lo)</td><td>Used to dynamically modify a Convey Merge configuration already established with EasyRoll.<br><br>Bitwise values:<br><br>Bit 15: set to enable PLC modification<br>Bit 4: set to disable release from Center line<br>Bit 5: set to disable release from Left line<br>Bit 6: set to disable release from Right line<br><br>Bits 0 thru 3 are interpreted as a numerical value to change the release priority:<br>Value:<br><br>0 = First come, first served release<br>1 = Center line has priority<br>2 = Left line has priority<br>3 = Right line has priority</td></tr>
</table>

# 3. ZPA Mode Notes

## 3.1 Note ①

The values 0xXX01 thru 0xXX06 are shown because these are the possible logical values used for inter-module communication. External networked devices (PLC or PC) monitoring these registers may; depending on their scan rate, not actually see each of these values change in sequence as a Carton is conveyed from zone to zone, even though the inter-module communications and ZPA is functioning normally.

Status register values utilize both the HIGH BYTE and the LOW BYTE of the 16-Bit integer value. The HIGH BYTE is used for zone status for reversing conveyor applications and MAY CONTAIN DATA. PLC/PC programmers working with single direction conveyor applications MUST MASK THE HIGH BYTE or otherwise ignore the high byte in processing status data from these registers.

For PLC/PC programming purposes, you can only depend on seeing values 0xXX01 and 0xXX05 in program logic for determining zone status. The values 0xXX02 and 0xXX04 may not always be visible to PLC/PC from inter-module communication depending upon speed of the conveyor, length of the zone, and/or location of the zone sensors.

## 3.2 Note ②

The values for the signals on the Sensor port's bit 4 and bit 6 are determined by the module's initial Auto-Configuration results and the bit values are set to a 1 when sensor is blocked and 0 when sensor is clear regardless of the sensor type used. For example, each Sensor port Pin 4 signal is for the sensor's output. If the sensor is light energized, Normally Open (N.O.) then the electrical signal on Pin 4 is ON when the sensor is clear and OFF when the sensor is blocked. However, when reading bit 4 or bit 6 in this register, the bit will be a 1 when the sensor is blocked and 0 when the sensor is clear.

## 3.3 Note ③

Because the module is connected as I/O, the PLC inherently is always trying to update the Output image on (at least) RPI intervals. In order to prevent the PLC from inadvertently overwriting the "real" tracking data registers; the Assembly Output implementation utilizes the holding register locations shown and automatically updates the "real" tracking registers with this new data only upon release of the Carton from the zone. Included in this automatic functionality are two special reserved values that can be used for convenience:

- Set both tracking registers shown to 0: This will instruct the module to not modify the existing "real" tracking data and allow it to continue downstream "as-is" when the Carton is released.

- Set both tracking registers shown to 0xFFFF: This will instruct the module to clear the “real” tracking data and when the Carton is released, the “real” tracking data will be “0” in both registers.

Both word 1 and word 2 of the tracking data in question must have 0xFFFF written to it in order to signal the module to clear the tracking data. If only one word has 0xFFFF written to it and the other does not, the value of 0xFFFF will be the new tracking data for that word.

## 3.4 Note ④

Leaving these registers at “0” will instruct the module to use its configured speed. Any non-zero value will instruct the module to use this non-zero value as the speed reference as long as the value is within the maximum and minimum limits as defined for the connected motor. If the value is higher than the maximum limit, the motor’s speed will be set to the maximum allowed speed. Similarly, if the value provided is lower than the minimum limit, the motor’s speed will be set to the minimum allowed speed. The speed will stay at this reference until this register is changed to a new non zero value or set to “0”. When this register is set to “0”, the module continues to use the last non zero value it was given. Please note that setting this value to “0” will not cause the motor to run at “0” speed.

## 3.5 Note ⑤

**BIT 8 – ACCUMULATE ADJACENT UPSTREAM ZONE**
Setting this bit will cause the next upstream zone of the local module to accumulate. This next upstream zone can be either on the local module or the downstream zone of the adjacent upstream module.

**BIT 9 – SET ARRIVAL CONFIRMATION FOR DOWNSTREAM ZONE**
By default for ZPA operation, ConveyLinx requires a confirmation from the downstream zone when a Carton is discharged. Without this confirmation, the releasing zone will detect a jam condition. This bit is used in applications where the Carton is removed from the conveyor (either manually or say by a PLC controlled external mechanism such as a pusher or diverter) and the PLC needs to “confirm” the removal of the Carton in order to satisfy the ZPA confirmation logic.

**BITS 10 & 11 – JOG CONTROLS**
These bits can be used by the PLC to jog the local zone for specialized applications when local movement of the Carton on a zone is required. An example would be once a Carton has arrived in the local zone, the PLC determines that the Carton needs to be repositioned or perhaps squared up against a PLC controlled pop-up stop.

Jog control bits DO over-ride ZPA logic control and should be used with caution! Improper usage of jog controls can produce unexpected results and/or damage to product and equipment.

**BIT 12 – WAKE UP LOCAL ZONE**
Setting this bit will cause the local zone to “wake up” and run to accept a carton the same as if its upstream module had written a status value of “4”. This function would be useful for a merge onto a main line of ZPA conveyor.

**BIT 13 – ENABLE MAINTENANCE MODE**
Setting this bit will place the local zone in maintenance mode. In this mode the motor will not run regardless of zone conditions. The zone upstream of this local zone will receive a “busy” status to inhibit release of any item into this local zone. While in this state, the Sensor and Motor LEDs will flash on and off in green color.

## 3.6 Note ⑥

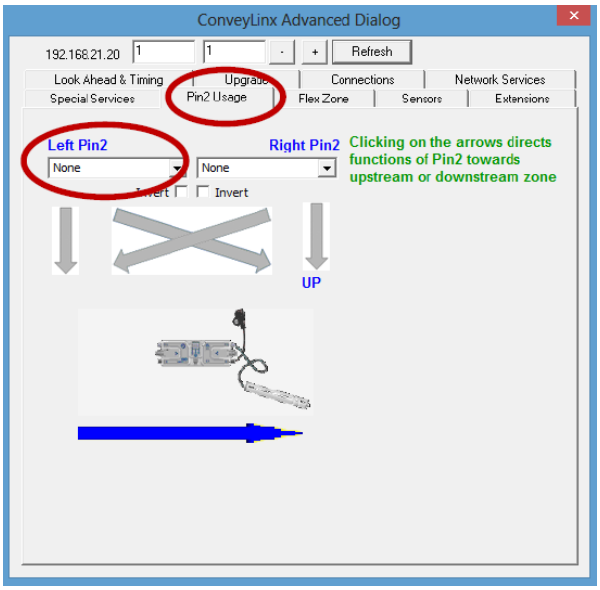
Errors deemed “fatal” for the module (motor short circuit and Hall Effect sensor fault) require either removal of power to reset or remote reset by PLC. Setting bit 0 of this register to 1 will initiate this remote error reset from the PLC to the local module. Setting this bit will reset a fatal error on either (or both) the left or right MDR.

External controller must continuously set bit 0 = 1 in the Clear Motor Error register for at least 500 msec for the module to recognize the reset command.

## 3.7 Note ⑦

In certain applications, it may be desired to have the PLC actuate a device along the conveyor (i.e. illuminate a light or energize a solenoid coil, etc.). With the ConveyLinx network this can be done without installing a separate PLC I/O system to do this.

By default in ZPA mode, the PLC does not have control of the local connected module's Aux I/O (Pin 2) signals. The function of the module's Aux I/O signal is set in EasyRoll. In order for the PLC to use an Aux I/O Pin2 as an output, the setting in EasyRoll for the particular Aux I/O Pin 2 must be set to "None" in order for the bit wise settings in this register to be recognized.




To use the Left or Right Pin 2 signals with a PLC when the module is in ZPA mode, you first have to select "None" from the drop-down box on the "Pin 2 Usage" tab in the Advance Dialog from EasyRoll. Once this has been set, then the bit-wise functionality in the Set Aux I/O Outputs register is enabled.

Please refer to the ConveyLinx-Ai2 User's Guide for electrical connection details before using PLC control for Aux I/O Pin outputs.

## 3.8 Note ⑧

Refer to ConveyLinx Ai2 User's Guide (publication ERSC-1006) and/or EasyRoll software on screen help for description of various jam conditions. These registers are applicable only to a Sensor Jam condition. By default in ZPA mode, the module will attempt 3 times to automatically clear a sensor jam and if the sensor is still blocked, the module will stop the zone. To reset this condition the Carton must be manually removed after the 3rd attempt and the sensor cleared before the zone will return to normal operation.

These registers allow the PLC to remotely attempt another auto-clear cycle in an attempt to clear the jam condition. Please note that this function requires the PLC to make a transition from 0 to 1 in the register to initiate another auto-clear cycle. Holding

the value to 1 will not cause the retry to continue indefinitely. Each attempt requires a new transition from 0 to 1.

# 4. PLC I/O Mode

## 4.1 PLC I/O Mode Assembly Inputs

This chart shows the data sent by a ConveyLinx-Ai2 in PLC I/O mode to the PLC when connected. All registers in the module are 16-bit integer data type.

| Register<br>Name / Module Address | Address | Data Description |
|---|---|---|
| **ConveyStop Status**<br>**4:0019** | M: 4:1700<br>E: I.Data[0]<br>P: Byte 0 (Hi) Byte 1 (Lo) | **Bitwise Value - Read only**<br>bit 00 = Reserved<br>bit 01 = Reserved<br>bit 02 = Reserved<br>bit 03 = Reserved<br>bit 04 = Reserved<br>bit 05 = Stop active on another module in Stop Group<br>bit 06 = Stop active due to lost communication connection<br>bit 07 = Stop active due to lost PLC connection<br>bit 08 = Reserved<br>bit 09 = Reserved<br>bit 10 = Stop active due to Stop Command from PLC<br>bit 11 = Reserved<br>bit 12 = Reserved<br>bit 13 = Reserved<br>bit 14 = Reserved<br>bit 15 = Reserved<br><br>Refer to Insight Automation publication ERSC-1800 ConveyStop User's Guide for details on using ConveyStop. |
| **Sensor Port Inputs**<br>**4:0035** | M: 4:1701<br>E: I.Data[1]<br>P: Byte 2 (Hi) Byte 3 (Lo) | **Bitwise Value - Read only**<br>bit 00 = Left Sensor Port – Auxiliary (M8 Pin2)<br>bit 02 = Right Sensor Port - Auxiliary (M8 Pin2)<br>bit 04 = Left Sensor Port – Signal (M8 Pin4)<br>bit 06 = Right Sensor Port - Signal (M8 Pin4)<br>bit 15 = 2 sec on / 2 sec off heartbeat<br>All other bits reserved<br><br>See PLC I/O Mode Note ④ |
| **Sensor Detect**<br>**4:0036** | M: 4:1702<br>E: I.Data[2]<br>P: Byte 4 (Hi) Byte 5 (Lo) | **Bitwise Value - Read only**<br>bit 0 = Device is connected to Right Sensor Port<br>bit 1 = Device is connected to Left Sensor Port |
| **Motor Voltage**<br>**4:0024v** | M: 4:1703<br>E: I.Data[3]<br>P: Byte 6 (Hi) Byte 7 (Lo) | Value in mV of MDR Power Supply<br>Range: 0 to 35000<br>Example:23500 = 23.5 Volts |
| **Left Motor Current**<br>**4:0055** | M: 4:1704<br>E: I.Data[4]<br>P: Byte 8 (Hi) Byte 9 (Lo) | Integer Value in mA – Current that motor is currently drawing<br>Example: 1900 = 1.9 Amps |

<table>
<tr><td>Left Motor Frequency<br>4:0056</td><td>M: 4:1705<br>E: I.Data[5]<br>P: Byte 10 (Hi) Byte 11 (Lo)</td><td colspan="2">Integer Value in Hz – Current frequency that motor is currently running<br>Example: 300 = 300 Hz<br><br>See PLC I/O Mode Note ②</td></tr>
<tr><td>Left Motor Temperature<br>4:0057</td><td>M: 4:1706<br>E: I.Data[6]<br>P: Byte 12 (Hi) Byte 13 (Lo)</td><td colspan="2">High Byte / Low Byte Value of temperatures in °C<br>High Byte = Calculated motor temperature<br>Low Byte = Temperature reading from on-board sensor</td></tr>
<tr><td rowspan="2">Left Motor Status<br>4:0058</td><td rowspan="2">M: 4:1707<br>E: I.Data[7]<br>P: Byte 14 (Hi) Byte 15 (Lo)</td><td colspan="2">Bitwise Value – See PLC I/O Mode Note ③</td></tr>
<tr><td>bit 00 = Motor Status<br>bit 01 = Motor Status<br>bit 02 = Port in Digital Mode<br>bit 03 = Reserved<br>bit 04 = Reserved<br>bit 05 = Board Overheat<br>bit 06 = Over-Voltage<br>bit 07 = Low Voltage</td><td>bit 08 = Overheated<br>bit 09 = At Max. Torque<br>bit 10 = Short Circuit<br>bit 11 = Motor Not Connected<br>bit 12 = Overloaded<br>bit 13 = Motor Stalled<br>bit 14 = Hall Sensor Error<br>bit 15 = Motor Not Used</td></tr>
<tr><td>Right Motor Current<br>4:0079</td><td>M: 4:1708<br>E: I.Data[8]<br>P: Byte 16 (Hi) Byte 17 (Lo)</td><td colspan="2">Integer Value in mA – Current that motor is currently drawing<br>Example: 1900 = 1.9 Amps</td></tr>
<tr><td>Right Motor Frequency<br>4:0080</td><td>M: 4:1709<br>E: I.Data[9]<br>P: Byte 18 (Hi) Byte 19 (Lo)</td><td colspan="2">Integer Value in Hz – Current frequency that motor is currently running<br>Example: 300 = 300 Hz<br><br>See PLC I/O Mode Note ②</td></tr>
<tr><td>Right Motor Temperature<br>4:0081</td><td>M: 4:1710<br>E: I.Data[10]<br>P: Byte 20 (Hi) Byte 21 (Lo)</td><td colspan="2">High Byte / Low Byte Value of temperatures in °C<br>High Byte = Calculated motor temperature<br>Low Byte = Temperature reading from on-board sensor</td></tr>
<tr><td rowspan="2">Right Motor Status<br>4:0082</td><td rowspan="2">M: 4:1711<br>E: I.Data[11]<br>P: Byte 22 (Hi) Byte 23 (Lo)</td><td colspan="2">Bitwise Value - See PLC I/O Mode Note ③</td></tr>
<tr><td>bit 00 = Motor Status<br>bit 01 = Motor Status<br>bit 02 = Port in Digital Mode<br>bit 03 = Reserved<br>bit 04 = Reserved<br>bit 05 = Reserved<br>bit 06 = Over-Voltage<br>bit 07 = Low Voltage</td><td>bit 08 = Overheated<br>bit 09 = At. Max. Torque<br>bit 10 = Short Circuit<br>bit 11 = Motor Not Connected<br>bit 12 = Overloaded<br>bit 13 = Motor Stalled<br>bit 14 = Hall Sensor Error<br>bit 15 = Motor Not Used</td></tr>
<tr><td>Left Motor Port Digital I/O Status<br>4:0060</td><td>M: 4:1712<br>E: I.Data[12]<br>P: Byte 24 (Hi) Byte 25 (Lo)</td><td colspan="2" rowspan="2">Bitwise Value – Read Only<br>bit 12 = Short Circuit Error on one or more outputs<br>bit 14 = Over Current – More than 1A detected on one or more outputs<br>See Appendix A - Motor Port as Digital I/O for usage details</td></tr>
<tr><td>Right Motor Port Digital I/O Status<br>4:0084</td><td>M: 4:1713<br>E: I.Data[13]<br>P: Byte 26 (Hi) Byte 27 (Lo)</td></tr>
</table>

| | | |
|---|---|---|
| **Upstream Module Status**<br>**4:0134** | M: 4:1714<br>E: I.Data[14]<br>P: Byte 28 (Hi) Byte 29 (Lo) | Integer Value of Low Byte<br>0x01 = Sensor clear and motor stopped<br>0x02 = Sensor clear, motor running, accepting from upstream<br>0x03 = Reserved<br>0x04 = Sensor blocked, motor running, discharging to downstream<br>0x05 = Sensor blocked and motor stopped<br>0x06 = ConveyLinx-Ai2 Busy<br>See PLC I/O Mode Note ① for details |
| **Downstream Module Status**<br>**4:0232** | M: 4:1715<br>E: I.Data[15]<br>P: Byte 30 (Hi) Byte 31 (Lo) | |
| **Current Tracking Word 1 for Adjacent Upstream Module**<br>**4:0139** | M: 4:1716<br>E: I.Data[16]<br>P: Byte 32 (Hi) Byte 33 (Lo) | Value = Tracking data word #1 (16-bit integer) for the Carton that has just discharged from the ConveyLinx-Ai2 Adjacent to this local ConveyLinx-Ai2 module.<br><br>See PLC I/O Mode Note ① for Details |
| **Current Tracking Word 2 for Adjacent Upstream Module**<br>**4:0140** | M: 4:1717<br>E: I.Data[17]<br>P: Byte 34 (Hi) Byte 35 (Lo) | Value = Tracking data word #2 (16-bit integer) for the Carton that has just discharged from the ConveyLinx-Ai2 Adjacent to this local ConveyLinx-Ai2 module.<br><br>See PLC I/O Mode Note ① for Details |
| **Reserved** | M: 4:1718<br>E: I.Data[18]<br>P: Byte 36 (Hi) Byte 37 (Lo) | |
| **Left Motor Servo Position**<br>**4:0062** | M: 4:1719<br>E: I.Data[19]<br>P: Byte 38 (Hi) Byte 39 (Lo) | Signed integer value that indicates the current position of the Left Motor in relation to its “0” position |
| **Right Motor Servo Position**<br>**4:0086** | M: 4:1720<br>E: I.Data[20]<br>P: Byte 40 (Hi) Byte 41 (Lo) | Signed integer value that indicates the current position of the Right Motor in relation to its “0” position |
| **Left Motor Servo Status**<br>**4:0011** | M: 4:1721<br>E: I.Data[21]<br>P: Byte 42 (Hi) Byte 43 (Lo) | Bit 0: Servo Command Status<br>1 = Last Servo Run Command Complete<br>0 = Servo Command in Process<br>Bit 1: Servo Reset Status<br>Echoes state of Left Motor Servo Command bit 0<br>Bit 2: Servo Command Status<br>Echoes state of Left Motor Servo Command bit 1 |
| **Right Motor Servo Status**<br>**4:0016** | M: 4:1722<br>E: I.Data[22]<br>P: Byte 44 (Hi) Byte 45 (Lo) | Bit 0: Servo Command Status<br><br>1 = Last Servo Run Command Complete<br>0 = Servo Command in Process<br>Bit 1: Servo Reset Status<br>Echoes state of Right Motor Servo Command bit 0<br>Bit 2: Servo Command Status<br>Echoes state of Right Motor Servo Command bit 1 |

| | | |
|---|---|---|
| **Left Motor Real Speed**<br>**4:0507** | M: 4:1723<br>E: I.Data[23]<br>P: Byte 46 (Hi) Byte 47 (Lo) | Motor Speed and Set Speed Status<br>Bit 0 thru Bit 13: Numerical value of speed.<br>• For Motor Roller the value is in mm/s<br>• For PGD the value is in RPM x 10<br>Bit 14: 1 = Set Speed is above motor's maximum speed<br>Bit 15: 1 = Set Speed is below motor's minimum speed<br>Refer to PLC I/O Mode Note ⑧ for details |
| **Right Motor Real Speed**<br>**4:0508** | M: 4:1724<br>E: I.Data[24]<br>P: Byte 48 (Hi) Byte 49 (Lo) | |

## 4.2 PLC I/O Mode Assembly Outputs

These registers are written by the PLC to the Module when the module is in PLC I/O mode. All registers are 16-bit Integer data type.

| Register<br>Name / Module Address | PLC Address | Data Description |
|---|---|---|
| **ConveyStop Command**<br>**4:0020** | M: 4:1800<br>E: O.Data[0]<br>P: Byte 0 (Hi) Byte 1 (Lo) | Integer Value<br>0 = No Command<br>1 = Command local module's Stop Group to go to Stopped State<br>2 = Command local module's Stop Group to Clear Stopped State |
| **Set Left Motor Port Digital Control**<br>**4:0060** | M: 4:1801<br>E: O.Data[1]<br>P: Byte 2 (Hi) Byte 3 (Lo) | **Bitwise Values**<br>bit 0: Reserved<br>bit 1: Energize Motor Port Pin 4<br>bit 2: Energize Motor Port Pin 3<br>bit 3 thru bit 14 = Reserved<br>bit 15 = Digital Output Enable<br>0 = Use port as Motor Control<br>1 = Use port as Digital Output |
| **Set Right Motor Port Digital Control**<br>**4:0084** | M: 4:1802<br>E: O.Data[2]<br>P: Byte 4 (Hi) Byte 5 (Lo) | **Bitwise Values**<br>bit 0: Energize Motor Port Pin 2<br>bit 1: Reserved<br>bit 2: Energize Motor Port Pin 3<br>bit 3 thru bit 14 = Reserved<br>bit 15 = Digital Output Enable<br>0 = Use port as Motor Control<br>1 = Use port as Digital Output |

| | | |
|---|---|---|
| **Sensor Port Digital Output Control 4:0037** | M: 4:1803<br>E: O.Data[3]<br>P: Byte 6 (Hi) Byte 7 (Lo) | **Bitwise Values**<br><br>bit 0: 1 = Left Pin 2 ON, 0 = Left Pin 2 OFF<br>bit 1: 1 = Right Pin 2 ON, 0 = Right Pin 2 OFF<br>bit 2 thru bit 4: Reserved<br>bit 5: 1 = Enable Left Pin 2 as Output, 0 = Disable Left Pin 2 as Output<br>bit 6: 1 = Enable Right Pin 2 as Output, 0 = Disable Right Pin 2 as Output<br>bit 7 thru bit 15: Reserved |
| **Left Motor Run / Reverse 4:0260** | M: 4:1804<br>E: O.Data[4]<br>P: Byte 8 (Hi) Byte 9 (Lo) | Bit 0:<br>1 = Run Command<br>0 = Stop Command<br>Bit 8:<br>0 = Run in Configured Direction<br>1 = Run opposite of Configured Direction |
| **Left Motor Brake Method 4:0261** | M: 4:1805<br>E: O.Data[5]<br>P: Byte 10 (Hi) Byte 11 (Lo) | Integer Value<br><br>0 = Use Configured Brake Method<br>1 = Use Standard Brake Method<br>2 = Use Free Coast Brake Method<br>3 = Use Servo Brake Method |
| **Left Motor Slave Mode 4:0262** | M: 4:1806<br>E: O.Data[6]<br>P: Byte 12 (Hi) Byte 13 (Lo) | Integer Value<br><br>0 = Ignore<br>1 = Slave Mode OFF – Left motor independently controlled<br>2 = Slave Mode ON – Left motor mirrors Right motor control<br>3 = Slave Mode ON – Left motor runs in opposite direction of Right motor<br><br>Refer to PLC I/O Mode Note ⑨ for details |
| **Right Motor Run / Reverse 4:0270** | M: 4:1807<br>E: O.Data[7]<br>P: Byte 14 (Hi) Byte 15 (Lo) | Bit 0:<br>1 = Run Command<br>0 = Stop Command<br>Bit 8:<br>0 = Run in Configured Direction<br>1 = Run opposite of Configured Direction |
| **Right Motor Brake Method 4:0271** | M: 4:1808<br>E: O.Data[8]<br>P: Byte 16 (Hi) Byte 17 (Lo) | Integer Value<br><br>0 = Use Configured Brake Method<br>1 = Use Standard Brake Method<br>2 = Use Free Coast Brake Method<br>3 = Use Servo Brake Method |
| **Right Motor Slave Mode 4:0272** | M: 4:1809<br>E: O.Data[9]<br>P: Byte 18 (Hi) Byte 19 (Lo) | Integer Value<br><br>0 = Ignore<br>1 = Slave Mode OFF – Right motor independently controlled<br>2 = Slave Mode ON – Right motor mirrors Left motor control<br>3 = Slave Mode ON – Right motor runs in opposite direction of Left motor<br><br>Refer to PLC I/O Mode Note ⑨ for details |

| | | |
|---|---|---|
| **Left Motor Speed Reference 4:0040** | M: 4:1810<br>E: O.Data[10]<br>P: Byte 20 (Hi) Byte 21 (Lo) | Integer value to set motor speed<br>For MDR value is in mm/s<br>For PGD value is in RPM x 10<br>Value = 0 Remain at last non zero value entered<br><br>Refer to PLC I/O Mode Note ⑧ for details |
| **Right Motor Speed Reference 4:0064** | M: 4:1811<br>E: O.Data[11]<br>P: Byte 22 (Hi) Byte 22 (Lo) | |
| **Left Motor Acceleration Ramp 4:0043** | M: 4:1812<br>E: O.Data[12]<br>P: Byte 24 (Hi) Byte 25 (Lo) | Integer Value<br><br>For MDR value is in mm<br>For PGD value is in motor pulses*<br>Deceleration Range: 0 to 10000 (Both MDR and PGD)<br>Acceleration Range: 30 to 10000 (Both MDR and PGD)<br>Value = 0: Remain at last non-zero value entered<br><br>**Please consult PGD documentation for gear ratio to equate motor pulses to shaft revolution** |
| **Left Motor Deceleration Ramp 4:0044** | M: 4:1813<br>E: O.Data[13]<br>P: Byte 26 (Hi) Byte 27 (Lo) | |
| **Right Motor Acceleration Ramp 4:0067** | M: 4:1814<br>E: O.Data[14]<br>P: Byte 28 (Hi) Byte 29 (Lo) | |
| **Right Motor Deceleration Ramp 4:0068** | M: 4:1815<br>E: O.Data[15]<br>P: Byte 30 (Hi) Byte 31 (Lo) | |
| **Clear Motor Error 4:0022** | M: 4:1816<br>E: O.Data[16]<br>P: Byte 32 (Hi) Byte 33 (Lo) | Logical 0 or 1<br>0 = Stop Reset<br>1 = Send Reset<br><br>Refer to ZPA Mode Note ⑥ for details. |
| **Set Status to Downstream Module 4:0196** | M: 4:1817<br>E: O.Data[17]<br>P: Byte 34 (Hi) Byte 35 (Lo) | Used to write ConveyLinx-Ai2 ZPA Status data to downstream ConveyLinx-Ai2:<br><br>4 = Instruct Downstream ConveyLinx-Ai2 to “wake-up” and run its most upstream zone<br>1 = Instructs Downstream ConveyLinx-Ai2 that carton has exited local zone and to accept any tracking data written in Set Discharge Tracking Word 1 / Word 2 registers when carton arrives.<br><br>See PLC I/O Mode Note ⑥ |
| **Set Status to Upstream Module 4:0116** | M: 4:1818<br>E: O.Data[18]<br>P: Byte 36 (Hi) Byte 37 (Lo) | Used to write ConveyLinx-Ai2 ZPA Status data to next upstream ConveyLinx-Ai2:<br><br>5 = Instructs Upstream ConveyLinx-Ai2’s discharge zone to accumulate and hold any carton that arrives at its discharge zone.<br>1 = Instructs Upstream ConveyLinx-Ai2’s discharge zone to release any carton that arrives at its discharge zone.<br><br>See PLC I/O Mode Note ⑥ |

| | | |
|---|---|---|
| **Sensor Port Input Signal Condition Mask 4:0034** | M: 4:1819<br>E: O.Data[19]<br>P: Byte 38 (Hi) Byte 39 (Lo) | **Bitwise Value**<br><br>bit 00 = Left Sensor Port – Auxiliary (M8 Pin2)<br>bit 02 = Right Sensor Port - Auxiliary (M8 Pin2)<br>bit 04 = Left Sensor Port – Signal (M8 Pin4)<br>bit 06 = Right Sensor Port - Signal (M8 Pin4)<br>All other bits reserved<br><br>See PLC I/O Mode Note ⑦ |
| **Set Discharge Tracking Word 1 4:0201** | M: 4:1821<br>E: O.Data[21]<br>P: Byte 42 (Hi) Byte 42 (Lo) | Only used when local PLC I/O Mode ConveyLinx-Ai2 needs to pass tracking data to a downstream connected ConveyLinx-Ai2. Used in conjunction with Set Status to Downstream Module register<br><br>See PLC I/O Mode Note ⑥ |
| **Set Discharge Tracking Word 2 4:0202** | M: 4:1821<br>E: O.Data[21]<br>P: Byte 42 (Hi) Byte 42 (Lo) | |
| **Reserved** | M: 4:1822<br>E: O.Data[22]<br>P: Byte 44 (Hi) Byte 44 (Lo) | |
| **Left Motor Servo Command Distance 4:0008** | M: 4:1823<br>E: O.Data[23]<br>P: Byte 46 (Hi) Byte 47 (Lo) | Signed integer value in mm of the distance to move to on the next Left Motor Servo Run Command<br>Valid values are from -32767 to +32767<br><br>See section Servo Motor Control Example |
| **Left Motor Servo Command Word 4:0009** | M: 4:1824<br>E: O.Data[24]<br>P: Byte 48 (Hi) Byte 49 (Lo) | Bit 0: Reset Command<br>1 = Set Current Distance Count as “0”<br>Bit 1: Servo Run Command<br>1 = Run in Motor from current count to the set mm count in Left Motor Servo Command Distance Register<br><br>See section Servo Motor Control Example |
| **Right Motor Servo Command Distance 4:0013** | M: 4:1825<br>E: O.Data[25]<br>P: Byte 50 (Hi) Byte 51 (Lo) | Signed integer value in mm of the distance to move to on the next Left Motor Servo Run Command<br><br>Valid values are from -32767 to +32767<br><br>See section Servo Motor Control Example |
| **Right Motor Servo Command Word 4:0014** | M: 4:1826<br>E: O.Data[26]<br>P: Byte 52 (Hi) Byte 52 (Lo) | Bit 0: Reset Command<br>1 = Set Current Distance Count as “0”<br>Bit 1: Servo Run Command<br>1 = Run in Motor from current count to the set mm count in Left Motor Servo Command Distance Register<br><br>See section Servo Motor Control Example |

# 5. PLC I/O Mode Notes

## 5.1 Note ①

These registers only contain meaningful data if the ConveyLinx connections between upstream and/or downstream ConveyLinx-Ai2s are preserved when placing the local ConveyLinx-Ai2 into PLC I/O mode from within EasyRoll. If connections are cleared in EasyRoll, these registers will not contain any pertinent data and will not be updated by adjacent ConveyLinx-Ai2s. Refer to section Optional "Clear Connections" Choice for further details.

## 5.2 Note ②

Motor frequency is determined by a combination of motor RPM and the number of poles the motor contains and these will be different depending on the particular MDR used. Please consult MDR documentation to determine meaningful values for motor frequency

## 5.3 Note ③

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

| Motor Status bit 0 and bit 1 | | |
|---|---|---|
| **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) |

## 5.4 Note ④

The electrical logic state of the signal on the Sensor/Control Port pins are bit-wise exclusive OR (XOR) with the bits set in the Sensor & Control Port Input Signal Condition Mask register to arrive at the bit values seen in the Sensor & Control Port Inputs register. This allows the PLC programmer to control whether an electrically energized condition results in a logical 1 or a logical 0 in the Sensor & Control Port Inputs register. This same relationship is also mirrored by the state of the input's corresponding LED indicator.

See PLC I/O Mode Note ⑦ for further details.

## 5.5 Note ⑤

The data in this register is only valid when a given motor port is placed into Digital I/O mode by the PLC. When a given motor port is being used as Digital I/O the only meaningful bits are bits 12 and 14 as shown. Other bits in this register may contain values and should be ignored as valid input data.

Refer to Appendix A - Motor Port as Digital I/O for wiring details for using a motor port as digital I/O.

## 5.6 Note ⑥

For registers involving status and tracking to upstream or downstream ConveyLinx-Ai2's in ZPA mode, the connections must be preserved when placing the ConveyLinx-Ai2 in question into PLC I/O mode from within EasyRoll. Refer to section Optional "Clear Connections" Choice on page 47 for further details.

## 5.7 Note ⑦

For a ConveyLinx-Ai2 in standard ZPA mode, the Auto-Configuration procedure sets values in this register to allow the ConveyLinx-Ai2 to correctly display the Sensor and Control port Input circuit LEDs to facilitate diagnostics. This is done, for example, to make visual LED diagnostics the same for "zone blocked" regardless of the sensor type.
For example, suppose the zone photo sensors used are "Light Operate, Normally Open". This means that the sensor's output is energizing the ConveyLinx-Ai2's sensor input pin 4 when the zone is clear. The ConveyLinx-Ai2 Sensor port LED indicator for pin 4 (green) should illuminate when the zone is blocked; so, the Auto-Configuration procedure sets a bit in the Sensor & Control Port Input Signal Condition Mask register to correspond to the pin 4 signal on the appropriate sensor port. If the sensor is electrically opposite such that its output energizes pin 4 of the sensor port when the zone is blocked, then the bit corresponding to pin 4 for this sensor port is clear such that the sensor port's LED illuminates green when pin 4 is energized.

When a ConveyLinx-Ai2 is placed in PLC I/O mode; the Sensor & Control Port Input Signal Condition Mask register is cleared of the values set during the Auto-Configure procedure. The Sensor & Control Port Input Signal Condition Mask register is made available for PLC I/O mode Sensor port inputs to give the PLC programmer the same flexibility for configuring which electrical state (on or off) of the input will cause a logical 1 to appear in the Sensor & Control Port Inputs register and illuminate the pin's corresponding LED. By setting or clearing the corresponding bit for a given port's sensor or aux I/O signal, the PLC programmer can determine which physical state (on or off) of the input signal will cause its corresponding pin's bit in the Sensor & Control Port Inputs register to be set and its corresponding LED to illuminate.

The following is an example that shows the bit patterns and signals for one of the ConveyLinx-Ai2's inputs. The same pattern applies to all available ConveyLinx-Ai2 inputs:

| Right Sensor Port - Pin 4 Signal | | | |
|---|---|---|---|
| **Electrical Signal** | **Sensor Port Input Signal Condition Mask Register bit 6** | **Sensor Port Inputs Register bit 6** | **LED State** |
| **OFF** | 0 | 0 | Green = OFF |
| **ON** | 0 | 1 | Green = ON |
| **OFF** | 1 | 1 | Green = ON |
| **ON** | 1 | 0 | Green = OFF |

Be careful when changing the Sensor & Control Port Input Signal Condition Mask in your Ethernet I/P PLC program. The input bit values in the Sensor & Control Port Inputs register can show unexpected or opposite values from expected until the PLC has updated the Sensor & Control Port Input Signal Condition Mask data. This update could take several program scans depending upon the Ethernet IP RPI settings. Take care to be sure that the Sensor & Control Port Input Signal Condition Mask data is written to the ConveyLinx-Ai2 Before acting on any input values in the Sensor & Control Port Inputs register.

Please note that the Sensor/Control Port LEDs are tri-colored. In applications where both Pin 4 and Pin 2 are used on the same Sensor Port; please note that when the green and red LEDs are illuminated at the same time, the color will be amber.

## 5.8 Note ⑧

The Ai motor technology encodes the specific motor data into a memory chip inside the motor. This data is read by the ConveyLinx-Ai2 module. Included in this data are the mechanical characteristics for the motor including the minimum and maximum speed settings. You can enter values in the speed reference registers that are outside the allowable range for the connected motor. If you enter a value greater than the maximum; the speed will be set to the maximum. If you enter a value lower than the minimum, the speed will be set to the minimum.

For the Motor Real Speed input registers, you can know if the value entered in the Speed Reference register is outside the allowable range by monitoring bits 14 and 15 of these registers.

For example, let's say we have an MDR whose maximum speed is 1.34 m/s. At this speed, the value in the Real Speed input register will show a decimal value very close or equal to 1340 (which is the speed in mm/s). If we enter a value of 2.0 m/s for the speed reference (value of 2000 in Speed Reference register) and then run the motor, in the Real Speed input register for that motor you will see a decimal value very close or equal to 17724. Analyzing this value at the bit level, you will see that bit 14 is set indicating that the Speed Reference value is above the maximum value. If you strip off bit 14 from this value, the remaining decimal value (i.e. the binary value of bits 0 thru 13) will be very close or equal to 1340; which is the maximum speed allowed for the MDR. Similarly, if the Speed Reference value entered is below the minimum value, bit 15 will be set in the motor's Real Speed register. Stripping out bit 15, the binary value of bits 0 thru 13 will indicate a value very close or equal to the motor's minimum allowed speed.

## 5.9 Note ⑨

When enabling Slave Mode for a given motor (Left or Right), the motor type, speed, acceleration, deceleration, and braking mode settings used for the opposite motor are applied to the Slave Mode motor. The Slave Mode motor then runs and stops in unison with the control of the opposite or Master motor. For example, if Slave Mode is ON for the Left motor; then the Right motor's settings will be copied to the Left motor. In your PLC logic, you only need to start/stop the Right motor and the Left motor will automatically follow the Right motor.

Please note that if you enable Slave Mode for both the Left and Right motors at the same time, then the ConveyLinx-Ai2 will default to the Left motor being in Slave Mode and the Right motor will provide the master control.

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