Description

ZoneLink® is Holjeron's method for linking adjacent zones in a conveyor system. This is accomplished using two electrical lines between each ZoneLink® ZPA Module: one to signal the neighboring upstream zone it is READY to receive a unit and one to let the downstream zone know it is SENDING a unit.

The ZoneLink®.S ZPA Module connects directly to a Holjeron Microroller™ motor-driven roller, and is linked to adjacent ZoneLink® ZPA Modules using standard category 5 patch cables (RJ-45).

The ZoneLink®.S ZPA Module uses microcontroller-based commutation of the brushless motor, which provides the following benefits:

- Predictive diagnostics embedded in the ZPA Module will flag when a motor-driven roller should be replaced, in advance of the roller failing.

- Closed-loop speed control will hold roller speed at a constant value, improving the ability to tune a conveyor system.

Further, the ZL.S-AK11x family executes Zero Pressure Accumulation (ZPA) logic in the ZoneLink® ZPA Module, reducing the need for additional programming. The ZoneLink® ZPA Module has input terminals for a sensor, keeping all wiring local to a zone, reducing wiring cost and complexity. The ZL.S-AK112 has an additional I/O interface for a manual work station release or for operating a mechanical brake.

The ZL.S-AK11x family is a drop-in replacement for the ZL-AK10x family with enhanced functionality.

Specifications

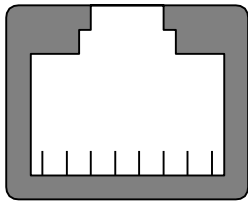| Part Numbers	ZL.S-AK111		ZoneLink® ZPA Module for 22W motor
	ZL.S-AK111-35		ZoneLink® ZPA Module for 35W motor
	ZL.S-AK112		ZoneLink® ZPA Module for 22W Aux I/O
	ZL.S-AK112-35		ZoneLink® ZPA Module for 35W Aux I/O
Electrical Power	Termination		Plug-In, Spring Clamp Terminal
	Voltage Range		24 VDC (+/- 10%)
	Current Consumption, Max		100mA plus Powered Roller and Sensor
Motor Connection	Type		Microroller™
	Number		One (1)
	Termination		9-pin Connector
	Voltage Range		24 VDC
	Max Current	Continuous	2.0 a (22W motor)/2.8 a (35W)
Sensor Input	Type		NPN or PNP
	Number		One (1)
	Termination		Plug-in, Spring Clamp Terminal
	Sensor Power Voltage		24 VDC
	Sensor Input Voltage Range		0 to 30VDC
	Maximum Sensor Power Current		50 mA
	Sourcing Sensor Current		11 mA Max (Input pulled to 24V)
	Sinking Sensor Current		4.3mA Max (Input pulled to 0V)
ZoneLink® Ports	Type		Current Sinking Inputs/Outputs
	Number		Two (2)
	Termination		RJ-45
	Voltage Range		24 VDC
	Maximum Current		2 amps
Environmental	Temperature	Storage	-30° to 70° C (-22° to 158° F)
		Operating	0° to 60° C (32° to 140° F)
	Humidity		5-95% RH, non-condensing
	Vibration		2G at 10 to 500 Hz
	Shock		10G
Physical	Dimensions		4.41" H x 2.81" W x 1.13" D
	Weight		12 oz
	Mounting		Mounting base
	Indication	Power LED	Green
		Active LED	Green
		Status LED	Green/Red

Dimensions and Layout
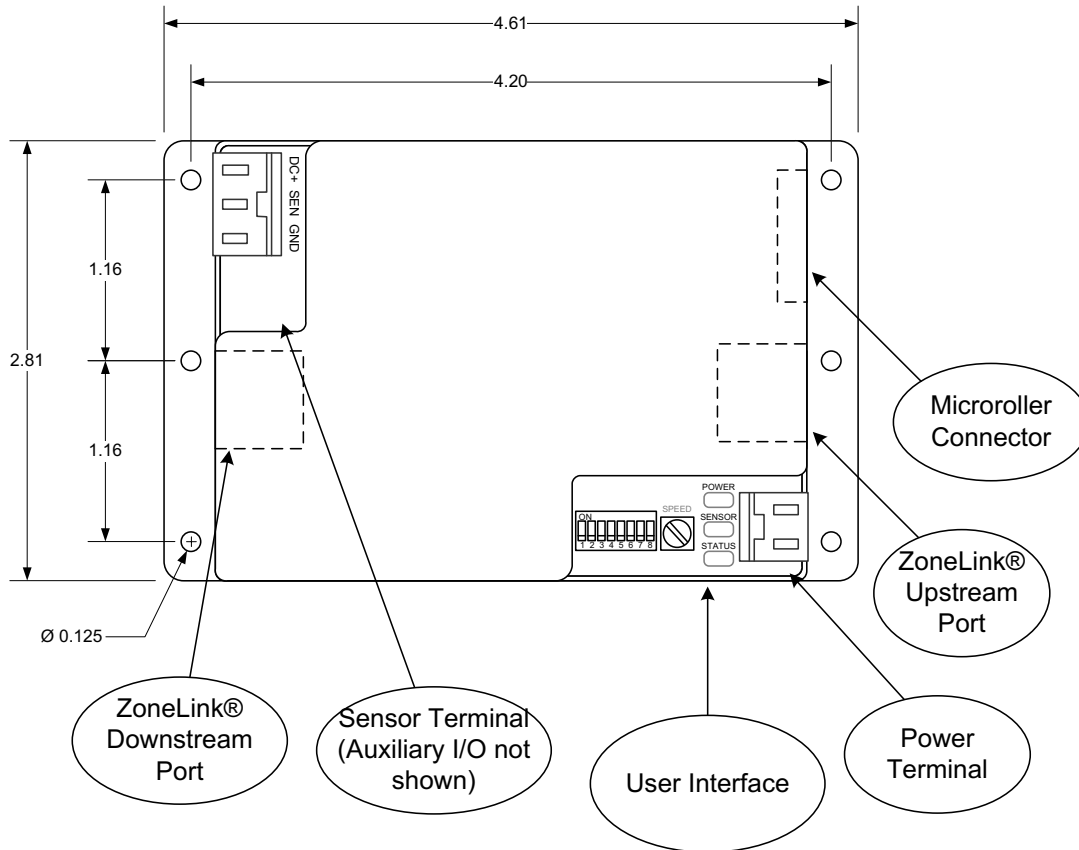
Typical Installation
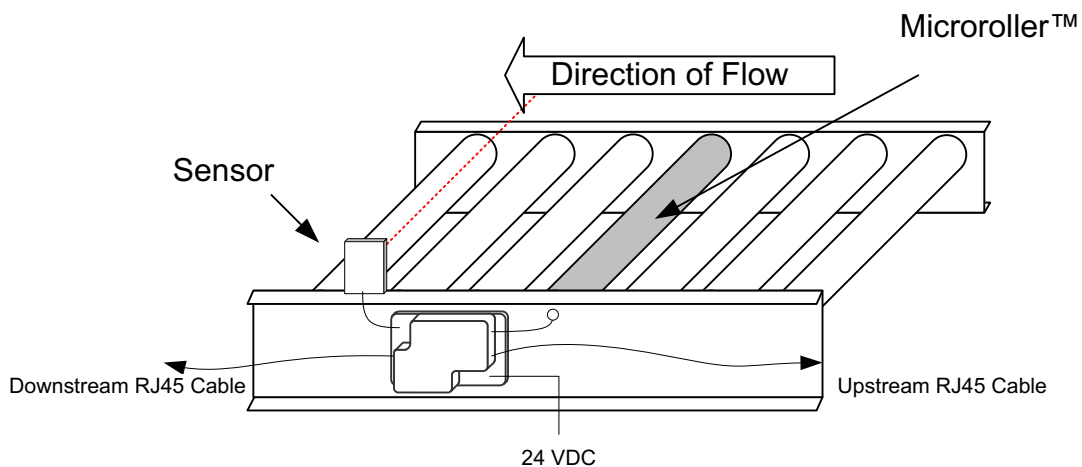
ZoneLink®

The ZoneLink® connections are RJ-45 jacks with pin assignments as defined in the diagram below. ZoneLink® is designed to use standard Ethernet patch cables (Category 5, 5e or 6).
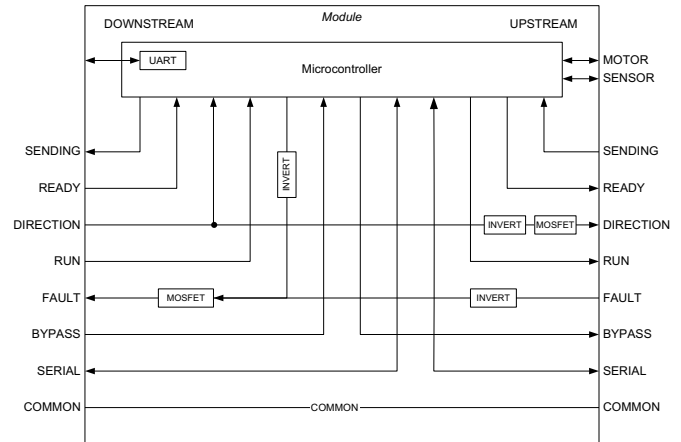
ZoneLink®.S RJ-45 Connector

8 7 6 5 4 3 2 1

ZoneLink® Block Diagram

The DIRECTION and FAULT lines have circuits that echo the input state to the output. This provides direct input-to-output, allowing unlimited number of units in a system.

ZoneLink® Pin Assignments

Pin	Function	Upstream	Downstream
1	SENDING	Input	Output
2	READY	Output	Input
3	DIRECTION	Input	Output
4	RUN	Input	Output
5	FAULT	Output	Input
6	BYPASS	Input	Output
7	.S COMMUNICATIONS	Bidirectional	Bidirectional
8	COMMON	Pass-Through	

Microroller™ Selection

The information provided regarding the sizing of Microroller™ is for reference only. Other output force and speed parameters are available. Each application should be reviewed regarding the suitability of a Microroller™ for that application.

Roller P/N (nnn=roller length)	Rated Speed (FPM)		Tangential Force (Lbs)	Maximum Load (Lbs)		
	1000 RPM	2400 RPM		Card-board	Wooden Pallet	Plastic Tote
MR-AD-48-xxx-4-x	6	16	66.7	667	834	953
MR-AD-48-xxx-5-x	8	22	48.6	486	608	694
MR-AD-48-xxx-7-x	12	33	39.8	398	498	569
MR-AD-48-xxx-10-x	15	43	26.8	268	335	383
MR-AD-48-xxx-15-x	26	72	18.1	181	226	259
MR-AD-48-xxx-20-x	35	98	13.2	132	165	189
MR-AD-48-xxx-30-x	43	120	9.7	97	121	139
MR-AD-48-xxx-40-x	77	216	4.8	48	60	69

All Data Based on 1.9 Inch Diameter Roller

Wiring

24 VDC Power

Power Wiring Diagram
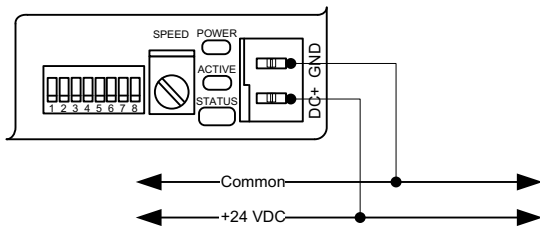
The Power Connector is a 2-pin pluggable terminal block that accepts up to 14 gauge wire. Power to the ZoneLink® ZPA module must be 24 VDC. Power supplies should be sized to allow each powered roller zone to draw 2.0 amps continuously, with a 4.5 amp in-rush for up to 300 milliseconds.

NOTE

Systems that have multiple power supplies MUST have the commons of each power supply tied together.

There is no limit to the number of ZoneLink® ZPA Modules in a system.

Sensor Wiring

Terminal block for the sensor is a 3-pin plug-in style with locking header that accepts up to 14 gauge wire. Use leverage from a small screwdriver to release the terminal block. The ZoneLink® ZPA Modules are compatible with both PNP and NPN sensors.

ZL.S-AK112 5 Pin Terminal Block
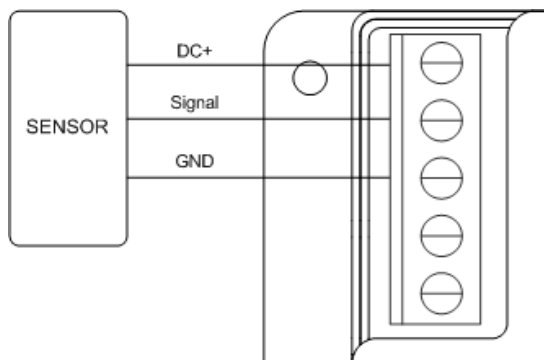

I/O Wiring

Auxiliary Input	
Type	NPN
Termination	Plug-in, Spring Clamp Terminal
Input Voltage Range	0 to 30VDC
Sinking Current	5mA Max (Input pulled to 0V)

Auxiliary Output	
Type	NPN
Number	One (1)
Termination	Plug-in, Spring Clamp Terminal
Output Power Voltage	24 VDC
Output Voltage Range	0 to 30VDC
Sinking Current	250 mA Max (Input pulled to 0V)

The ZL.S-AK112 can accommodate a 5-pin terminal block to connect to a sensor and an external input signal, to enable work station hold mode, or to an output signal, which could be used to operate an external device such as a brake roller. Full I/O functionality is described in the Configuration section. The terminal block has a locking header that accepts up to 14 gauge wire. The 5-pin terminal operates similarly to the 3-pin terminal.
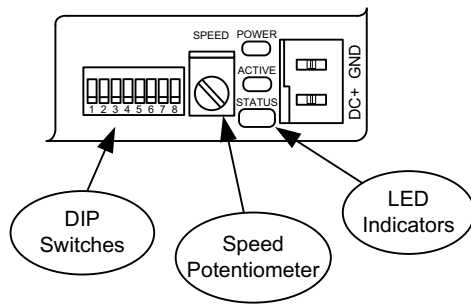
ZL.S-AK112 Input/Output Wiring Examples
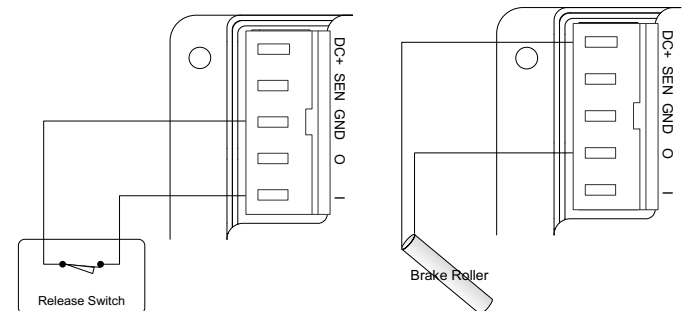
Configuration

Configuring a ZoneLink® ZPA MODULE requires setting eight (8) DIP switches to positions to match those application requirements, and then setting the desired speed. There are also three LED's to indicate the status of the CARD.

ZPA Module Configuration Options

DIP Switches

DIP switches to configure the functionality of the ZoneLink® ZPA MODULE are located near the power terminal block. The switches are numbered 1 through 8 beginning with the switch furthest from the speed adjustment. The ON position for each switch is away from the edge of the module.

DIP Switch Assignment

Switch	Function	OFF	ON
1	Direction of Rotation	CCW	CW
2	Configuration Mode	DIP/Pot	.S
3	Control Mode	Auto	Manual
4	Sensor Type	Normally Open	Normally Closed
5	Operating Mode	See Mode Selection Table	
6			
7*	Auxiliary I/O Functionality*	See Auxiliary I/O Functionality Table	
8*			

Inoperative on non-aux I/O products

The **Direction of Rotation** is used to set the default rotation of the Microroller™ in normal use. This allows for the ZoneLink® ZPA module to be mounted on either side of the conveyor.

The **Configuration Mode** ON disables the potentiometer for speed control and defaults to the motor speed set over the .S communications protocol. ON allows setting the **Operating Mode** over .S as well. The OFF position allows manual adjust of roller speed using the potentiometer.

With the **Control Mode** set ON to manual, the unit responds to RUN, DIR, and BYP signals and disables all upstream accumulation logic control signals. Control should be set to Manual when the module is used with an external controller. Otherwise, the **Control Mode** switch should be set to OFF.

The **Sensor Type** allows selection between Normally Open (NO) and Normally Closed (NC) sensors.

The **Operating Mode** (see section on Operating Modes for description of operation) is set using DIP Switches 5 and 6. DIP switches 5 and 6 have no effect with switches 2 and 3 set to ON. The table below shows how to select the desired mode.

Mode Selection

Mode	SW 5	SW 6
Automatic Singulation	OFF	OFF
High-Throughput Singulation	ON	OFF
Train Mode	OFF	ON
Slave Mode	ON	ON

When using the ZoneLink® ZPA module with **Auxiliary I/O** (part number ZL.S-AK112), DIP Switches 7 and 8 define the functionality of the input and output.

Auxiliary I/O Functionality

Input	Output	SW 7	SW 8
Hold	Sensor State	OFF	OFF
READY	SENDING	ON	OFF
Hold	Brake Control	OFF	ON
SENDING	READY	ON	ON

Speed Adjustment

Between the DIP Switches and the power terminals is a potentiometer for adjusting the speed of the attached Microroller™.

The brushless motors in the Microroller™ deliver a constant torque from 0 to 2400 RPM. However, the Microroller™ operates most efficiently between 1000 and 2400 rpm, dissipating less heat, and leading to longer motor operation. The ZoneLink® ZPA module is set to limit the speed of the motor to no less than 800 RPM, and can be set to the maximum motor speed (approximately 3600 RPM for the 22 watt motor and 4400 RPM for the 35 watt motor.)

ZoneLink™ ZPA Module
For use with Holjeron Microroller™

Indication

There are three LED's on a ZoneLink® ZPA Module next to the power terminal block. They are labeled POWER, ACTIVE and STATUS.

The POWER LED is green, and will illuminate whenever 24 VDC is applied to the ZPA module and the module is healthy. If 24 VDC is present and the POWER LED is not on then the unit needs to be replaced.

The ACTIVE LED is illuminates green when the connected sensor has is actuated.

The STATUS LED is dual color (red/green). A steady green light indicates normal operation. Warnings and Faults are indicated through a series of red and green flashes. Consecutive green flashes indicate a Warning. Red flashes indicate Faults. The number of red flashes denotes the severity of the condition, while subsequent green flashes defined the specific condition.

STATUS LED States

Status LED	Indication
Solid Green	The unit is operating properly.
Solid Red	On for 0.5 seconds on startup. After startup, a solid red STATUS may mean the unit has failed and needs to be replaced.
Flashing Green	WARNINGS The unit is still functioning but has a condition that should be checked.
1 Red flash, followed by 1 or more Green flashes	APPLICATION FAULT The motor has stopped and a condition must be cleared before the motor can run again.
2 Red flashes, followed by 1 or more Green flashes	CRITICAL FAULT The motor has stopped. Depending on the fault, the motor and/or ZPA module may need to be replaced.

Warnings

There are two (2) types of warnings: Application and Predictive. Warnings do not stop the motor from running. Instead, they are an indicator that some form of corrective action is needed.

Warnings also cause the ZoneLink® Fault Output to toggle state every 0.5 seconds.

Warnings (All Green Flashes)

Indication
Excessive Current Limit – when the motor is running, every 10 milliseconds the current being consumed by the powered roller is measured and a moving average is updated. If more than 30% of the measurements are at the current limit level then a warning is activated.
High No Load Current – when a roller is instructed to stop and its sensor is not blocked then, prior to stopping, a current reading is taken. If the average No Load Current increases 20% over the life of the roller then a High No Load Current warning is issued. Note: No Load Current Enabled must be set to 1 for this diagnostic to be active. See Serial Configuration Section for more detail.
Excessive Motor Stalls – each time the motor is stopped, the Motor Stall Fault is checked and a moving average is updated. If the motor stops due to a stall more than 10% of the time then a warning is activated.
Design Life – a Microroller™ has a design life of 25,000 hours. When the motor has run for more than the design life a warning is indicated.

Faults

Two (2) types of faults occur in ZoneLink® ZPA Modules: Application and Critical. Faults cause the motor to stop running, and require intervention to get a system back operational.

Application Faults can be reset or cleared to get a system running.

Critical Faults typically can not be cleared, and usually require changing either the motor or ZPA Module.

Faults also case the ZoneLink® Fault Output to be ON.

Application Faults (1 Red Flash, followed by Green Flashes)

Green Flashes	Indication
1	Motor Stall – the ZPA Module is trying to run the motor, yet it hasn't moved for a full second. The motor will attempt to start after a ten second delay.
2	Motor Thermistor Fault – the temperature inside the motor is too high. The motor will restart when the motor cools down.
3	Jam Fault – the sensor has been blocked for twice the length of the Jam Timer. The motor will not run until the sensor has been cleared.
4	ZPA Thermistor Fault - the temperature inside the ZPA electronics is too high. The motor will restart when the motor cools down.

Critical Faults (2 Red Flashes, followed by Green Flashes)

Green Flashes	Indication
1	Commutation Fault – the circuit that controls the motor commutation has failed.
2	Low Current – the ZPA Module is reading a current that is below the normal No Load value. This is typically due to the mechanical link internal to the powered roller has broken. The remedy is to replace the roller.

ZoneLink™ ZPA Module
For use with Holjeron Microroller™

Operating Modes

Automatic Singulation (Zero Pressure Accumulation)

Singulation mode only allows one unit in a zone at any given time. In other words, a zone is not ready to receive another unit until the zone is completely empty.

ZoneLink® ZPA modules are equipped with a transfer timer. When a unit clears the upstream sensor the ZPA module begins timing. If the unit doesn't reach the downstream sensor in 16 seconds then the unit is presumed to be missing and the zone will stop running or will accept another unit.

High-Throughput Singulation (Zero Pressure)

High-Throughput Singulation mode allows a unit to be released to the next zone 250 milliseconds after the receiving zone begins transferring a unit downstream.

Train Mode (Low Pressure Accumulation)

When in train mode, the ZoneLink® ZPA module will accept another unit as long as downstream is available. The ZPA module does not wait to clear the zone.

The ZoneLink® ZPA module tries to maintain a 250 millisecond gap while running. When starting after being accumulated, the zone becomes READY immediately. The upstream zone, however, will delay starting per the Release Delay Timer.

Slave Mode

When the load being transported is heavier than a single Microroller™ is rated to move then additional powered rollers can be added in the zone. A ZoneLink® ZPA module in slave mode can be placed between the main zone ZPA module and the upstream zone ZPA module. The slave ZPA module will run only when the main ZPA module for that zone is running, and will pass all control signals through to the upstream ZPA module.

Auto-Slave

Some conveyor systems handle multiple load sizes, with some loads larger than a single zone. In singulation and quick-release modes, if the load does not clear the upstream sensor before the leading edge of the package gets to the downstream sensor, the ZPA module recognizes that the package is longer than the zone and needs special handling. In this case, whenever the ZPA module runs the motor, it also signals the upstream zone that it is clear to run. When the downstream zone is clear, the run signal is removed from both zones.

Manual Mode

A ZoneLink® ZPA module can have internal logic disabled by setting the DIP switches to manual mode. The Microroller®

can be controlled directly through the RUN and DIRECTION signals on the downstream ZoneLink® port. The SENDING line on the downstream port will transmit the sensor state.

Auxiliary I/O Functions

Workstation Hold

The ZoneLink® ZPA module with Auxiliary I/O is equipped with a feature that allows product to be stopped at a zone, regardless of whether the downstream zone is able to accept a unit. This is done by connecting the Input Terminal to GND.

A practical method for the connecting a HOLD circuit is through a normally closed contact on a foot switch or push button.

HOLD Switch Example
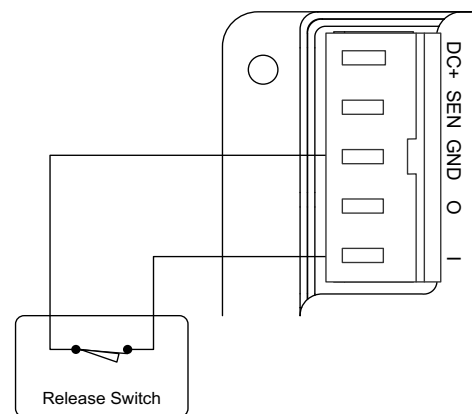
Timers

ZoneLink® ZPA modules are equipped with a set of timers that function differently, depending on whether in singulation or train mode. The table below describes each timer, and how it functions in each mode.

Timer	Description	Timer Values		
		Singulation	**High-Throughput Singulation**	**Train**
Release Delay Timer	When a product is accumulated, the release timer delays how long a product is held before it is released downstream. This is used to ensure gaps in the product.	N/A	250 milliseconds	250 milliseconds
Gap Timer	When running, attempts to maintain a gap between units.	N/A	N/A	150 milliseconds
Transfer Timer	Once a product is released and cleared the upstream sensor, the transfer timer is used to ensure a product reaches the downstream sensor. If the Transfer Timer expires, the accumulation logic is reset.	4 seconds	4 seconds	N/A
Sleep Timer	Once a product clears the downstream sensor, and there are no other packages being released into the zone, the zone will run for the length of the sleep timer before turning off.	2 seconds	2 seconds	N/A
Jam Timer	If a zone is running to transfer product, and the downstream sensor remains blocked for the length of the Jam Timer, then the module will stop the zone and indicate a fault. The zone can not run again until the sensor that is jammed has been cleared.	8 seconds	8 seconds	8 seconds, plus 8 seconds to clear.
Stall Timer	If the motor RPM drops below 300 RPM for the period of the Stall Timer, the ZoneLink® ZPA module will stop the roller and indicate a fault condition. After 10 seconds, the ZPA module will attempt to re-start the roller. This cycle will continue until the fault condition causing the stall is cleared.	1 second stall 8 second re-start	1 second stall 8 second re-start	1 second stall 8 second re-start

Serial Configuration

Serial configuration of a ZoneLink® ZPA Module requires connection to a ZoneLink®.S Controller capable of configuring ZoneLink®.S products, or using one of the ZoneLink®.S configuration tools available from Holjeron. Consult the documentation for the specific tool being used.

Product Information (Required in all products)

ID	Description	R/W	Default/Notes
0	Product ID	R	4 = 22 Watt
			5 = 35 Watt
			6-7 = Reserved
1	Hardware Version	R	
2	Software Version	R	
3-5	Reserved		
7	Diagnostic Register (Instantaneous)	R	See Diagnostic Register
8	Diagnostic Register (Locked)	R	See Diagnostic Register

Motor Properties

ID	Description	R/W	Default/Notes
16	Motor RPS	R	
17	Normal Speed Setpoint	W	1800 (rpm)
18	Bypass (w/Run) Speed Setpoint	W	2400 (rpm)
19	Bypass (wo/Run) Speed Setpoint	W	0 (rpm)
20	Reserved		
21	Reserved		
22	No-Load Current Enable	W	0 = No-load current not enabled
23	Motor Current	R	
24	Motor Temperature	R	
25	Reserved		

26	Acceleration	W	600 (rpm/10ms)
27	Deceleration	R	3600 (rpm/10ms)
28	Reserved		
29	Operating Time	R	
30	Reserved		

Diagnostic Register

Faults		Warnings	
Description	Bit	Description	Bit
Commutation Fault	0	Excessive Current Limit	8
Low Current	1	High No Load Current	9
Reserved	2	Excessive Motor Stalls	10
Reserved	3	Motor Design Life Exceeded	11
Motor Stall Fault	4	Jam Warning	12
Motor Thermistor Fault	5	Reserved	13
Jam Fault	6	Reserved	14
Driver Thermistor Fault	7	Reserved	15

⚠ EMERGENCY STOPS AND SAFETY RELAYS

It is generally considered good safety practice to have E-stop and/or safety relays/controllers installed in any conveyor system, especially one with multiple control system voltages. Many state and local regulations/codes require them. Please consult qualified personnel who plan and design safety equipment for machines and systems and are familiar with the regulations governing safety in the workplace and accident prevention.

Warranty/Remedy

Seller warrants its products to be free from defects in design, material and workmanship under normal use and service. Seller will repair or replace without charge any such products it finds to be so defective on its return to Seller within 18 months after date of shipment by Seller. **The foregoing is in lieu of all other expressed or implied warranties (except title), including those of merchantability and fitness for a particular purpose.** The foregoing is also purchaser's sole remedy and is in lieu of all other guarantees, obligations, or liabilities or any consequences incidental, or punitive damages attributable to negligence or strict liability, all by way of example.

While Holjeron provides application assistance, personally and through our literature, it is up to the customer to determine the suitability of the product in the application.

All information contained herein, including illustrations, specifications and dimensions, is believed to be reliable as of the date of publication, but is subject to change without notice.

Complementary Products

Holjeron manufactures a complete line of smart conveyor control equipment. To complete your system, have you considered:

Stack Light Controllers for DeviceNet

Push Button Controllers for DeviceNet, Multiple I/O

Low Profile I/O for DeviceNet, Multiple I/O

ZoneLink® .S Driver Module for 22W and 35W Microrollers w/ Auxiliary I/O

ZoneLink® 4 Zone Controllers with DeviceNet™

4 Zone Controllers for MAC Valves and VFDs

ZoneLink3 ZPA Controllers for Microrollers and SmartRollers

ZoneLinkTC EtherNet/IP controls

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Support issues: support@holjeron.com

About Holjeron

Our products are all designed and produced by us

If you need customized solutions, we can do it. We give you the technology that best suits your needs. We understand Common Industrial Protocols (CIP) such as DeviceNet and Ethernet/IP, as well as CANOpen and Smart Distributed System (SDS.) Our engineers can supply the distributed I/O solutions that meet your specific needs.

We push intelligence to the process

Holjeron's smart quick-connect products can reduce wiring and give you diagnostics designed for your material handling system. Our products are designed with your system in mind. Using industry standards, we explore new ways to make things work in industrial automation. We apply the requisite technology to deliver the solution your system needs.

Want to kick around options?

Call us. Where else are you going to find people who love talking about this stuff? And who know enough to be helpful?
The number to connect you to someone who understands your business – **503.582.0820**

Membership

Holjeron is an active participant in key industry organizations and standards bodies.

DeviceNet   MATERIAL HANDLING INDUSTRY OF AMERICA®
www.odva.org   www.mhi.org

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