

### Description

The ZL3.S-AK121/ZL3.S-AH122 is a specialized Motorized Roller ZPA Driver Module for Holjeron Microrollers<sup>®</sup>. It includes the following features:

- \* 6 PNP Auxiliary I/O points to provide enhanced diagnostic and control functions.
- \* ZPA logic is pre-programmed on-board. The controller can also be operated in Slave, Manual or Train modes.
- \* RJ-11 quick connect Autosensing NPN/PNP sensor input with sensor missing detection.
- \* Snap-in mounting plate for easy installation available.



### 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.

### Specifications

<b>Part Number</b>	ZL3.S-AK121 Rev. 01 ZL3.S-AH122 Rev. 01	ZPA Controller for 22W Microrollers  ZPA Controller for 35W Microrollers
<b>Electrical Power</b>	Termination Voltage Range Current Consumption, Max	Plug-In, Lever Clamp Terminal 24 VDC (+/- 10%) 100mA plus Powered Roller, Sensor and AUX I/O
<b>Motor Connection</b>	Type Number Termination  Voltage Range Max Current      Continuous	Microroller <sup>®</sup> One (1) 9-pin Standard and 2-pin brake Molex Connectors (22W) 10-pin JST Connector (35W) 24 VDC 2.5A 22W / 3.6A 35W
<b>Sensor Input</b>	Type Number Termination Sensor Power Voltage Sensor Input Voltage Range Maximum Sensor Power Current Sourcing Sensor Current Sinking Sensor Current	Autosensing NPN or PNP One (1) RJ-11 24 VDC 0 to 30VDC 50 mA 11 mA Max (Input pulled to 24V) 4.3mA Max (Input pulled to 0V)
<b>ZoneLink<sup>®</sup> Ports</b>	Type Number Termination Voltage Range Maximum Current	Current Sinking Inputs/Outputs Two (2) RJ-45 24 VDC 20 mA
<b>Auxiliary I/O</b>	See Wiring Section	6 PNP configured as 3 IN and 3 OUT
<b>Environmental</b>	Temperature      Storage Operating  Humidity Vibration Shock	-30° to 70° C (-22° to 158° F) 0° to 60° C (32° to 140° F) 5-95% RH, non-condensing 2G at 10 to 500 Hz 10G

## Wiring

### Auxiliary (AUX) I/O Specifications

#### Inputs

Type	PNP
Number	3
Termination	Plug-in, lever clamp
Input Voltage Range	0 to 24VDC
Current	5.3 mA Max

#### Outputs

Type	PNP
Number	3
Termination	Plug-in, lever clamp
Output Power Voltage	24 VDC
Output Voltage Range	0 to 24VDC
Current	250 mA Max @ 25° C

\* Self-resetting fuses for overcurrent.



6 5 4 3 2 1

### Auxiliary I/O Functions - Default

Pin	I/O	Function
1	Input	Workstation Hold (RUN in Manual Mode)
2	Input	RTS (SW3 OFF) or CTS (SW3 ON) (DIR in Manual Mode)
3	Input	Reserved (BYPASS in Manual Mode – see note on Speed Settings)
4	Output	RTS (SW3 ON) or CTS (SW3 OFF)
5	Output	Sensor State
6	Output	Critical Fault (ON when no fault). See detailed description of operation in the Fault Section.

### 24 VDC Power Wiring



1 2

Pin	Signal
1	24 VDC
2	Common

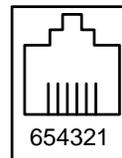
The Power connector is a 2-pin pluggable terminal block that accepts up to 14 gauge wire. Power to the ZoneLink<sup>®</sup> ZPA

module must be 24 VDC. Power supplies should be sized to allow each powered roller zone twice the continuous current rating of the roller. Consult the roller specifications to determine continuous current ratings.

### Sensor Wiring

The zone sensor plugs directly into an RJ-11 connection. The controllers are compatible with both PNP and NPN sensors. Consult Holjeron or your sensor manufacturer for appropriate models.

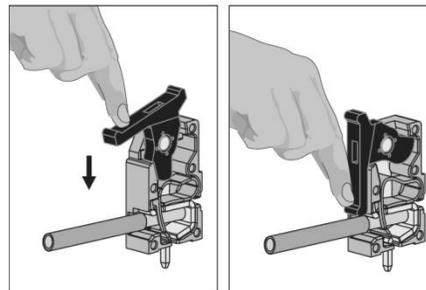
#### RJ-11 Sensor Jack Connector



Pin	Signal
1	Reserved
2	24 VDC
3	Sensor Input 1
4	Reserved
5	Ground
6	Reserved

### Lever Actuated Terminal Block – 2-pin Power and 6-pin Auxiliary I/O 5.08mm Pluggable Terminal Blocks

Operating the lever-actuated terminal blocks is very easy. Simply insert up to 14 gauge wire and lower the lever until it snaps. To release the wire, raise the lever.



## DIP Switch Settings

Factory default settings are all OFF

Switch	Function	OFF	ON
1	Roller Rotation	CCW	CW
2	Reserved		
3	External Interface	Upstream	Downstream
4	Sensor Type	Normally Open	Normally Closed
5	Control Mode	See Control Mode Table 1	
6			
7	Brake Mode	See Braking Options Table 2	
8			

### Note on Sensor Configuration (Switch 4):

Switch 4 can be used to invert the sensor signal. Holjeron provides an LED for photo sensor status on the controller. When the LED is ON, that is an indication that there is a load present. Adjust the switch such that the LED is on when a load is present for proper operation. Switch 4 in the OFF position is typically used for diffuse sensors where the signal is Normally Open (off) and the circuit is closed when the load is present. Switch 4 in the ON position is typically used for retroreflective sensors where the signal is Normally Closed (on) and the circuit is opened when the load is present.

### Control Mode Table 1

Control Mode	SW5	SW6
ZPA - Singulation	OFF	OFF
Train	ON	OFF
Slave*	OFF	ON
Manual**	ON	ON

\*If the direction of the Master is changed, the direction of the Slave must also be changed.

\*\***Manual Mode:** Activating the RUN input on Pin 1 will cause the motor to run. Activating the DIR signal (Pin2) and RUN simultaneously will cause the motor to reverse direction (Based on dip switch 1) and activating BYPASS signal (Pin 3) while RUN is active will change the speed from standard run speed (1800 RPM default) to bypass speed (2400 RPM default).

### Braking Options Table 2

Braking Option	SW7	SW8
Dynamic Braking	OFF	OFF
Electronic Brake	ON	OFF
Mechanical Brake	OFF	ON
Free Roll	ON	ON

Note: Dynamic Braking is employed to stop the roller under all conditions except Free Roll. Electronic or mechanical braking is employed to hold the roller after stopping (zero motion hold). When a mechanical brake roller is connected, the mechanical brake will engage on power loss in all braking modes.

## Rotary Switch RPM Settings

The formula for determining Feet per Minute (FPM) from the RPM is as follows:

$$(\text{Roller Diameter} \times 3.14 \times \text{RPM}) / (12 \times \text{Gear Ratio})$$

Factory default setting is 0

Setting	ZL3.S-AK121	ZL3.S-AH122
0	600	750
1	750	938
2	900	1125
3	1050	1313
4	1200	1500
5	1350	1688
6	1500	1875
7	1650	2063
8	1800	2250
9	1950	2438
A	2100	2625
B	2250	2813
C	2400	3000
D	2550	3188
E	2700	3375
F	DotS	DotS

 Setting the Rotary Switch to 'F' for DotS protocol sets the Control Mode and Speed to the current DotS value. It is recommended that the Rotary Switch setting only be changed when the device is not powered.

## Speed Settings

The Driver Module can drive the connected roller at two different speeds: **RUN** and **BYPASS**.

**RUN** is the normal operational speed setting that is controlled via the Rotary Switch or Zonelink dot S attribute 17. RUN speed is set to 1800 RPM by Default. In Manual mode the roller can be signaled to run at RUN speed using pin 1 of the Aux I/O terminal.

**BYPASS** is a secondary speed setting meant to be used to clear a slug of material or quickly move material through zones when accumulation is not required. The bypass speed is set to 2400 RPM by default and can only be changed using dot S attribute 18. In Manual mode the roller can be signaled to run at BYPASS speed by activating both pin 1 (RUN) and pin 3 (BYPASS) of the Aux I/O terminal.

## Indication

There are 2 LED's on the ZPA Controller next to the power terminal block. They are labeled SENSOR and STATUS.

The SENSOR LED illuminates amber when the connected sensor has 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 define 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. The controller will try to clear the fault condition.
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. While it is not possible to tell from the flashing green warning LED which warning is indicated, the controller can be queried via .S to determine which warning is active.

### 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 80% of the measurements are at the current limit level then a warning is activated.
Excessive Motor Stalls – each time the motor is forcibly stopped by external conditions, 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 Holjeron Microroller® has a design life of 25,000 hours. When the motor has run for more than the design life a warning is indicated.
Low Current – the ZPA Module is reading a current that is below the normal No Load value.

## Faults

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

Faults are reported over the AUX I/O (see chart). Any Application or Critical Fault will trigger the AUX I/O Fault.

**Application Faults** can be reset or cleared to get a system running. The controller will continuously try to run the motor based on the chart below.

**Critical Faults** typically cannot be cleared, and usually require changing either the motor or ZPA Module. When a critical fault occurs, there are no attempts to restart the motor.

Faults also cause the ZoneLink<sup>®</sup> 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 restart 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. (Holjeron Microrollers only)
3	Jam Fault – the sensor has been blocked for twice the length of the Jam Timer. The motor will stop
4	Controller Thermistor Fault - the temperature inside the electronics is too high. The motor will restart when the controller cools down.

 Application Faults are reported over the AUX I/O. When an Application Fault is attempting to restart the roller, the AUX I/O Fault is removed.

### 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	Photo Sensor Missing. The fault is based on no current being monitored to the photo sensor RJ-11 port. Motor will be stopped.*
3	Low Supply Voltage Fault – the fault activates if the supply voltage to the controller falls below 16VDC.
4	Reserved

\* This fault is disabled when the controller is in Slave or Manual mode.

 Critical Faults are reported over the AUX I/O and are maintained until the condition is cleared.

### Fault/Warning Register

The Fault Register maintains a record of faults and warnings in two records: a real-time instantaneous register and a locked register (historic). Each register consist of 2 bytes as shown below. They can be accessed over .S protocol.

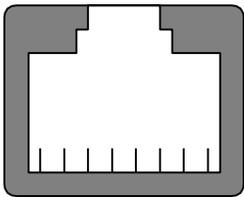
Fault Register	
Bit	Description
0	Commutation Fault
1	Photosensor Missing
2	Low Supply Voltage
3	Reserved
4	Motor Stall
5	Motor Thermistor Fault
6	Jam Fault
7	Controller Thermistor Fault
Warning Register	
Bit	Description
0	Excessive Current Limit
1	High No-Load Current
2	Excessive Motor Stalls
3	Design Life End
4	Jam Warning
5	Low Supply Voltage Warning
6	Motor Thermistor Warning
7	Controller Thermistor Warning

## ZoneLink<sup>®</sup>

ZoneLink<sup>®</sup> is the communications layer between controllers that provides control signals, diagnostic data, and access to .S configuration attributes. ZoneLink .S Attributes can be accessed using the F64 Multi-protocol Configuration Tool, available from Holjeron (Item Number ZTC-F64-DOTS)

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

### ZoneLink<sup>®</sup> RJ-45 Connector



8 7 6 5 4 3 2 1

### ZoneLink<sup>®</sup> Pin Assignments

Pin	Function	Upstream	Downstream
1	RTS	Input	Output
2	CTS	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	

### RTS/CTS Definitions:

I/O	Entry Zone Function	Exit Zone Function
Output to PLC	CTS ↑	RTS ↓
Input from PLC	RTS ↓	CTS ↑

### Entry Zone CTS/RTS Operation:

- CTS: Output to PLC. “Clear to Send” is always sent upstream as an output from the controller and received upstream by the PLC as an Input.
- RTS: Input from PLC. “Ready to Send” is always sent downstream by the PLC as an output and received downstream by the controller as an Input.

### Exit Zone CTS/RTS Operation:

- RTS: Output to PLC. “Ready to Send” is always sent downstream as an output from the controller and received downstream by the PLC as an input.
- CTS: Input from PLC. “Clear to Send” is always sent upstream by the PLC as an output and received upstream by the controller as an input.

### ZoneLink<sup>®</sup> .S Attributes Table - ZL3.S-AK121/AH122

ZoneLink .S Attributes are accessed using an RS-232 to ZoneLink interface, Part Number ZL.S-F32

Attribute#	Attribute Name	Description/Notes	Type	Units	Default	Range
0	Product code	ZL3.S-AK121 = 16, ZL3.S-AH122 = 17	Byte	-	16/17	N/A
1	Input variable		4 Bytes	-		N/A
2	Output variable		4 Bytes	-		N/A
4	Motor serial number	Smartroller E <sup>2</sup> only.	-	-	-	-
7	Faults and warnings	Diagnostic Register - Instantaneous	2 Bytes	-		N/A
8	Faults and warnings	Diagnostic Register - Locked	2 Bytes	-		N/A
10	Catalog listing	ZL3.S-AK121 or ZL3.S-AH122	Bytes	-		N/A
11	Software Version					
13	Motor power	22W/35W				
14	Motor poles				4	
16	Motor RPS	Revolutions per second/*60 for RPM	Word	RPS		N/A
17	Normal speed setpoint		Word	RPM	1800	1 - 10000
18	Override/Bypass speed setpoint		Word	RPM	2400	1 - 10000
20	Current setpoint	2.6A 22W / 3.6A 35W	Word	mA	2600/3600	1 – 8000
21	Boosted current setpoint	3.4A 22W / 4.7A 35W	Word	mA	3400/4700	1 - 8000
23	Motor current		Word	mA		N/A
24	Motor temperature	'Motor Thermistor Fault' in the Fault Table	Word	0.1C		N/A
25	FET temperature	'Controller Thermistor Fault' in the Fault Table	Word	0.1C		N/A
26	Acceleration rate	600 (RPM/10ms)	Word	RPM/*	600	1 - 8000
27	Deceleration rate	900 (RPM/10ms)	Word	RPM/*	3600	1 - 8000
29	Operating time	'Design Life' in the Warning Table	Word	Hrs	0	N/A
31	Control mode	0-Singulation /1-Train/2-Slave/3-Manual	Byte	-	0	0 – 3
32	Jam timer		Byte	0.1S	80	1 – 255
33	Transfer timer		Byte	0.1S	40	1 – 255
34	Gap timer		Byte	10mS	15	1 – 255
35	Sleep timer		Byte	0.1S	20	0 – 255
36	Release timer		Byte	10mS	25	0 – 255
42	Hold Timer		Byte	0.1S	40	0 – 255
43	Supply Voltage	'Low Supply Voltage' in the Fault Table	Word	0.1V		N/A
49	Max % current limit		Word	%*100	8000	1 - 10000
50	Max % stalled		Word	%*100	1000	1 - 10000
51	Max no-load current		Word	mA	700	1 - 5000
52	Operating life		Word	Hrs	25000	1 - 40000
56	Min motor temp		Word	0.1C		
57	Max motor temp		Word	0.1C		
60	Line speed setpoint	SmartRoller E <sup>2</sup> only.	Word	Ft/Min		1 - 1000
61	Line speed	SmartRoller E <sup>2</sup> only.	Word	Ft/Min		
62	Minimum sensor current	0 = Disabled 'Photosensor Missing' in the Fault Table	Byte	0.1mA	50	0-255

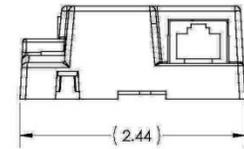
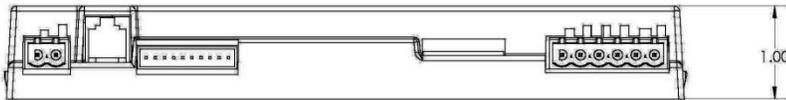
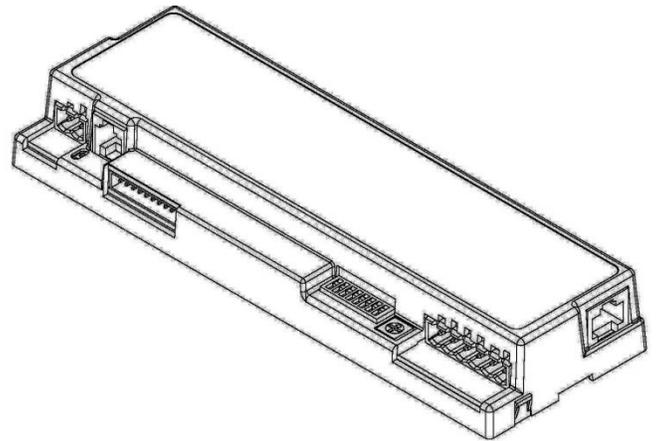
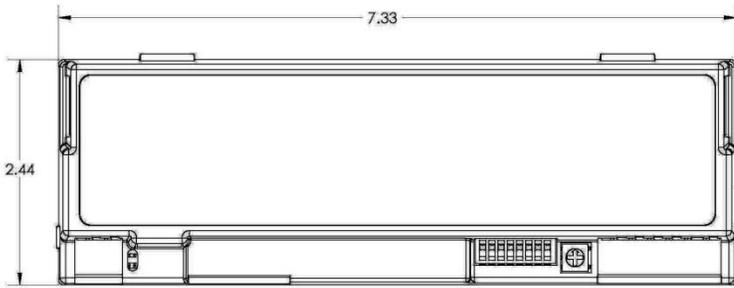
#### Timers

ZoneLink<sup>®</sup> ZPA modules are equipped with a set of timers that can be used to tailor functionality in certain applications. ZoneLink .S Attributes are accessed using an RS-232 to ZoneLink interface, Part Number ZL.S-F32. Listed below are the timer's functional descriptions, default values, ranges, and .S attribute numbers:

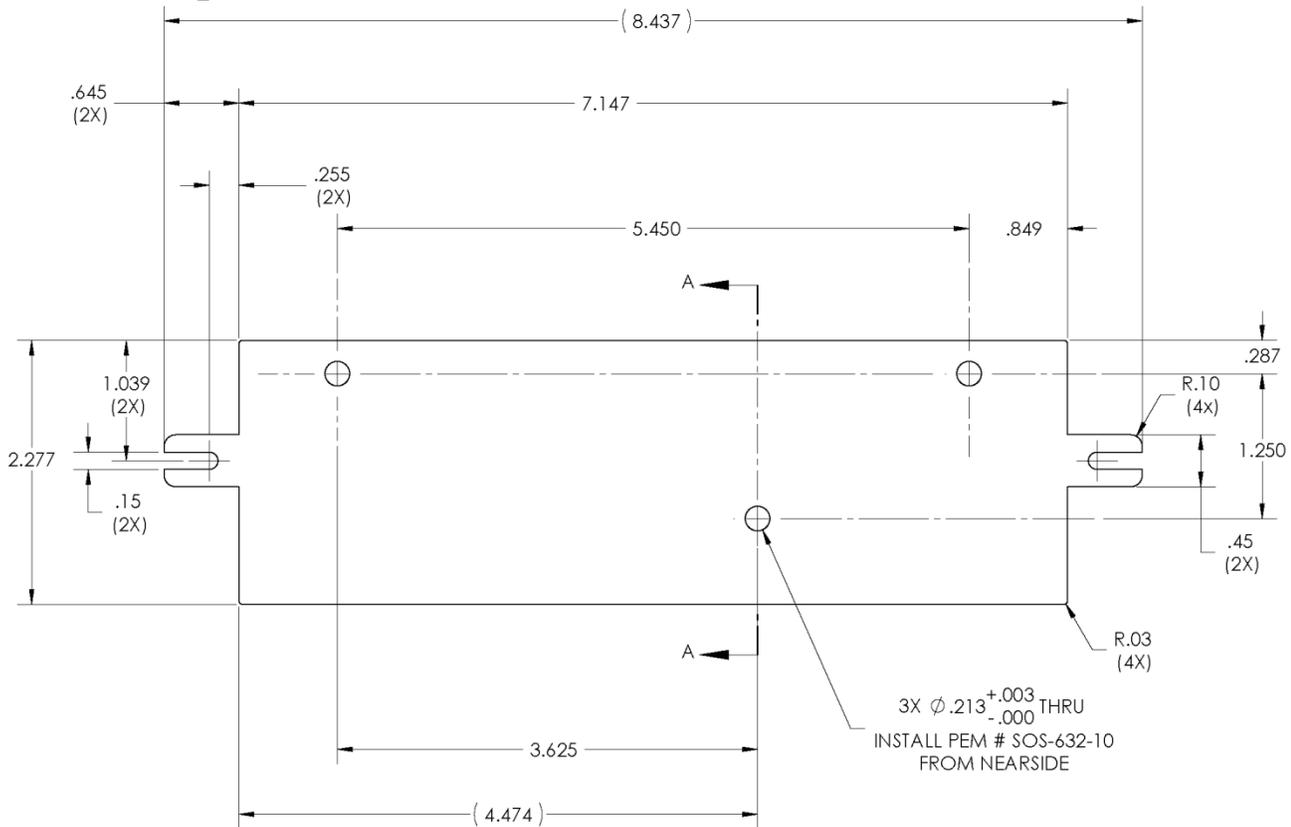
Timer	Description	Timer Default	Timer Units	Timer Range	.S Attribute#
Release Delay Timer	When a product is accumulated, the release timer delays how long a load is held before it is released downstream. This is used to ensure gaps between loads.	25	10ms	0-255	36
Gap Timer	When running, attempts to maintain a gap between units.	3	10ms	1-255	34
Transfer Timer	Once a load is released and cleared the upstream sensor, the transfer timer is used to ensure the load reaches the downstream sensor. If the Transfer Timer expires, the accumulation logic is reset.	40	.1sec	1-255	33
Sleep Timer	Once a load clears the downstream sensor, and there are no other loads being released into the zone, the zone will run for the length of the sleep timer before turning off.	20	.1sec	0-255	35
Jam Timer	If a zone is running to transfer a load, 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 controller will retry in approx. 10 seconds.	80	.1sec	1-255	32
Hold Timer	If the hold input is active and the sensor transitions from blocked to unblocked, the hold timer is started. The zone will not give a CTS to the upstream zone or start running until the hold timer expires.	40	.1sec	0-255	42

## Dimensions (inches)

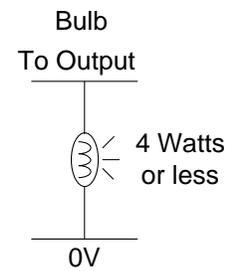
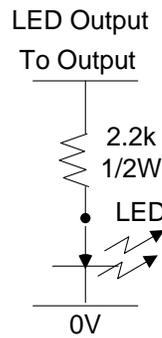
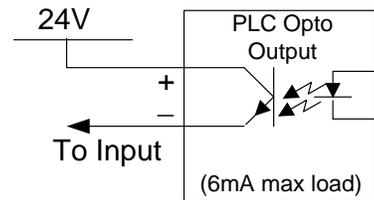
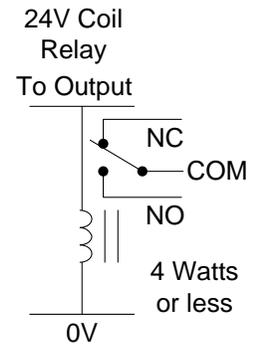
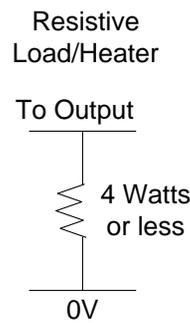
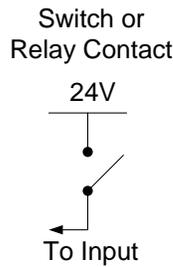
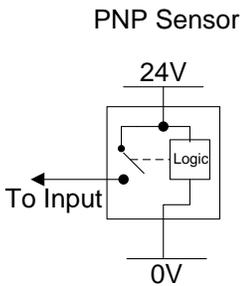
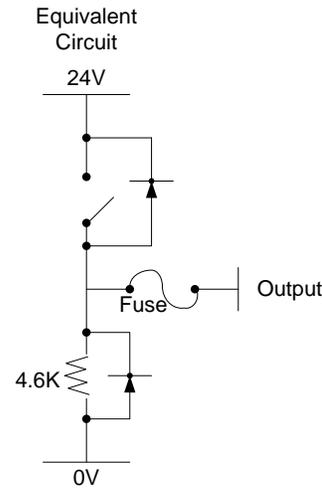
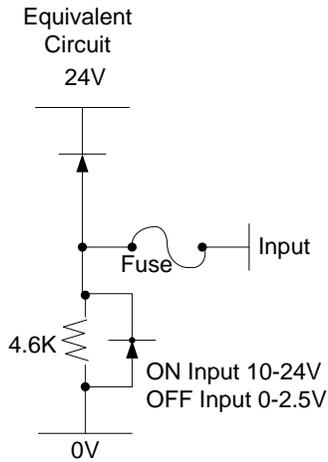
### Controller



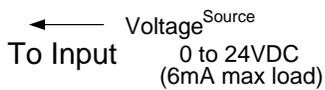
**Rear Mounting Plate**



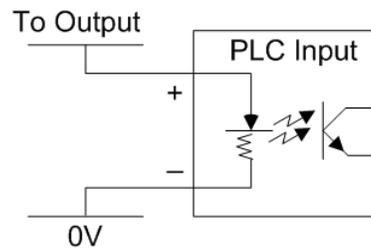
**AUX I/O Wiring Diagrams**  
**Inputs**



**Voltage Input**



**Outputs**





## 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.

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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

To request pricing and availability, or to place an order:

### Holjeron

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Wilsonville, Oregon 97070  
Phone 503.582.0820  
Fax 503.582.9166  
[www.holjeron.com](http://www.holjeron.com)

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General info: [info@holjeron.com](mailto:info@holjeron.com)  
Sales: [sales@holjeron.com](mailto:sales@holjeron.com)  
Support issues: [support@holjeron.com](mailto: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.



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[www.mhi.org](http://www.mhi.org)

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