Green Tire ZPA Controller

Description

The ZL3.S-TH122 is a specialized Motorized Roller Driver Module that has custom firmware to control the Interroll EC110, 6 and 8 pole drive rollers and Holjeron Microrollers®. It includes the following features:

- 6 PNP configurable Auxiliary I/O points.
- Green tire rocking ZPA logic is pre-programmed on-board. The Rocking logic allows a tire to remain in motion to prevent sticking to the rollers. The controller moves the tire back and forth within the zone while accumulated based on an adjustable slower rocking speed and an adjustable time to travel in reverse. Once the time in reverse is reached, the tire uses the same slower speed to advance back to the Photosensor. If accumulation is still called for, it begins the cycle again. If the zone ahead is clear, the tire travels to the next zone in standard ZPA mode.
- RJ-11 quick connect Autosensing NPN/PNP sensor input.
- Snap-in mounting plate for easy installation available.
- 'Seek Mode' has been implemented at powerup to determine if a tire is in the zone but not blocking the sensor.

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

CE

Part Number	ZL3.S-TH122 Rev. 00		Green Tire Rocking ZPA Controller
Electrical Power	Termination		Plug-In, Lever Clamp Terminal
	Voltage Range		24 VDC (+/- 10%)
	Current Consumption, Max		100mA plus Powered Roller, Sensor and AUX I/O
Motor Connection	Type *		Microroller®
	Number		One (1)
	Termination		10-pin JST Connector
	Voltage Range		24 VDC
	Max Current	Continuous	2.5A (Interroll)/3.6A (Holjeron)
Sensor Input	Type		Autosensing NPN or PNP
	Number		One (1)
	Termination		RJ-11
	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		20 mA
Auxiliary I/O	See Wiring Section		6 PNP configurable as IN or OUT
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
Approvals			CE

*Interroll rollers require an adapter cable to the controller. Part Number ZL3-CBL101.

Wiring

Auxiliary (AUX) I/O Specifications

See AUX I/O Wiring Page for Equivalent Circuits and Wiring Examples

Inputs	
Type	PNP
Number	Configurable 0-6
Termination	Plug-in, lever clamp
Input Voltage Range	0 to 24VDC
Current	50 mA Max

Outputs	
Type	PNP
Number	Configurable 0-6
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*
2	Input	Run Reverse*
3	Input	Run Forward*
4	Output	Sensor State**
5	Output	Critical Fault (ON when no fault). See detailed description of operation in the Fault Section.
6	Output	Motor Running State (ON when running)***

*This command supersedes other control logic
**Sensor State reflects the actual sensor output but does not change during 'Rocking Mode.'
***Motor Running is OFF during 'Rocking Mode.'

24 VDC Power Wiring

1 2

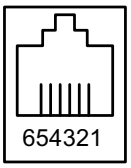
Pin	Signal
1	24 VDC
2	Common

The Power Connector is a 2-pin pluggable terminal block that accepts up to 14 gauge wire. Power to the ZoneLink® 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 Control Modules are compatible with both PNP and NPN sensors. Consult Holjeron or your sensor manufacturer for appropriate models.

RJ-11 Sensor Jack Connector

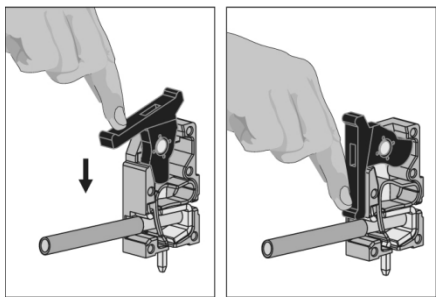


Pin	Signal
1	Reserved
2	24 VDC
3	Sensor Input 1
4	Sensor Input 2*
5	Ground
6	Reserved

*Not active in Rev. 00.

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.



Rotary Switch Speed Settings

Sample roller selections. Factory default setting is 0

ZL3.S-AK122-1001 Speed Chart							
Interroll 8 Pole (Yellow) 9:1		Interroll 6 Pole (Gray) 16:1 or Interroll 8 pole (Yellow) 16:1		Interroll 8 pole (Yellow) 24:1		Holjeron 35W 11:1 (Gearbox Designation -40)	
Setting	FPM	Setting	FPM	Setting	FPM	Setting	FPM
0	32	0	18	0	18	0	31
1	50	1	27	1	27	1	39
2	65	2	36	2	36	2	47
3	82	3	45	3	45	3	55
4	100	4	54	4	54	4	63
5	115	5	63	5	63	5	71
6	132	6	73	6	73	6	79
7	150	7	82	7	82	7	87
8	165	8	91	8	91	8	96
9	182	9	100	9	100	9	103
A	195	A	110	A	110	A	111
B	205	B	120	B	120	B	119
C	215	C	127	C	127	C	127
D	220	D	130	D	136	D	134
E	220	E	130	E	136	E	143
F	DotS	F	DotS	F	DotS	F	DotS

⚠ Setting the Rotary Switch to 'F' for DotS protocol sets the Control Mode and Speed to the current DotS value. Once in DotS mode, changes to the Rotary Switch only take effect after power cycling. It is recommended that the Rotary Switch only be changed when the device is not powered.

DIP Switch Settings

Factory default settings are all OFF

Switch	Function	OFF	ON
1	Roller Rotation	CCW	CW
2	Roller type	Holjeron	Interroll
3	Interroll Motor	6 Pole	8 Pole
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			

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.

Rotary Switch RPM Settings

The formula for determining Feet per Minute (FPM) from the RPM is as follows:
(Roller Diameter in inches x 3.14 x RPM) / (12 x Gear Ratio)

Factory default setting is 0

ZL3.S-TH122 RPM Chart		
Setting	Holjeron 35W	Interroll 31W
0	750	600
1	938	900
2	1125	1200
3	1313	1500
4	1500	1800
5	1688	2100
6	1875	2400
7	2063	2700
8	2250	3000
9	2438	3300
A	2625	3600
B	2813	3900
C	3000	4200
D	3188	4500
E	3375	4800
F	DotS	DotS

⚠ Setting the Rotary Switch to 'F' for DotS protocol sets the Control Mode and Speed to the current DotS value. Once in DotS mode, changes to the Rotary Switch only take effect after power cycling. It is recommended that the Rotary Switch only be changed when the device is not powered.

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.

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.

Indication

There are 2 LED's on a ZL3.S-AK121/AH122 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® 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® 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. The motor will attempt to restart after a ten second delay.
4	ZPA Thermistor Fault - the temperature inside the ZPA 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	ZoneLink COMM Failure. This fault is activated if the downstream RJ-45 cable fails or is not present. Disable .S property 5 if there is no downstream controller**

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

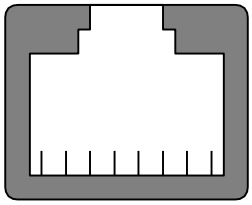
Fault Register	
Bit	**Description**
0	Commutation Fault
1	Photosensor Missing
2	Low Supply Voltage
3	ZoneLink COMM Failure
4	Motor Stall
5	Motor Thermistor Fault
6	Jam Fault
7	ZPA Thermistor Fault
Warning Register	
Bit	**Description**
0	Excessive Current Limit
1	High No-Load Current
2	Excessive Motor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

ZoneLink®

ZoneLink® is the communications layer between controllers that provides control signals, diagnostic data, and access to .S configuration attributes. ZoneLink .S Attributes are accessed using an RS-232 to ZoneLink interface, Part Number ZL.S-F32.

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® RJ-45 Connector



ZoneLink® 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 AK122 as an input.

TROUBLESHOOTING

Symptom	Potential Cause	Corrective Action
ZPA module Exit Zone will not release a package	Downstream RJ45 Cable is missing or damaged.	Check downstream RJ45 cable for proper connection to ZoneLink Interface module
	CTS signal is missing	Check ZoneLink Interface module and ensure that the CTS LED is ON indicating that the signal is active. 2nd LED from the left.
	ZoneLink Interface module DIP switches are not set correctly	Ensure that the ready and send DIP switches on the module, Switches #7&8 are turned on.

Symptom	Potential Cause	Corrective Action
ZPA module Entry Zone will not except a package	Upstream RJ45 Cable is missing or damaged.	Check upstream RJ45 cable for proper connection to ZoneLink Interface module
	RTS signal is missing	Check ZoneLink Interface module and ensure that the RTS LED is ON indicating that the signal is active. 1st LED from the left.

ZoneLink® .S Attributes Table - ZL3.S-TH122

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	TBD	Byte	-	TBD	N/A
1	Input variable		4 Bytes	-		N/A
2	Output variable		4 Bytes	-		N/A
4	Motor serial number	Smartroller E^2 only.				
5	Missing cable fault enable	'ZoneLink COMM Failure' in the Fault Table	Byte		0	0-1
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-TH122	Bytes	-		N/A
11	Software Version					
13	Motor power	31W Interroll / 35W Holjeron				
14	Motor poles	6 and 8 Interroll / 4 Holjeron				
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	Rocking speed in this application	Word	RPM	1200	1 - 10000
20	Current setpoint	2.5A Interroll / 3.6A Holjeron	Word	mA	3600	1 – 8000
21	Boosted current setpoint	4.1A Interroll / 4.7A Holjeron	Word	mA	4700	1 - 8000
22	Startup Transfer Enable	'Seek' on powerup. Default is Enabled	Byte		1	0-1
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	'ZPA 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
39	Rocking Delay	0+ OFF, 10 second intervals	Byte	10s	0	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	15000 Hrs Interroll / 25000 Hrs Holjeron	Word	Hrs	25000	1 - 40000
56	Min motor temp	Holjeron roller only	Word	0.1C		
57	Max motor temp	Holjeron roller only	Word	0.1C		
60	Line speed setpoint	SmartRoller E^2 only.	Word	Ft/Min		1 - 1000
61	Line speed	SmartRoller E^2 only.	Word	Ft/Min		
62	Minimum sensor current	0 = Disabled 'Photosensor Missing' in the Fault Table	Byte	0.1mA	50	0-255
63	Rocking Timer	0 = Disabled. Run Reverse time for Rocking Mode	Byte	0.1S	5	0-255

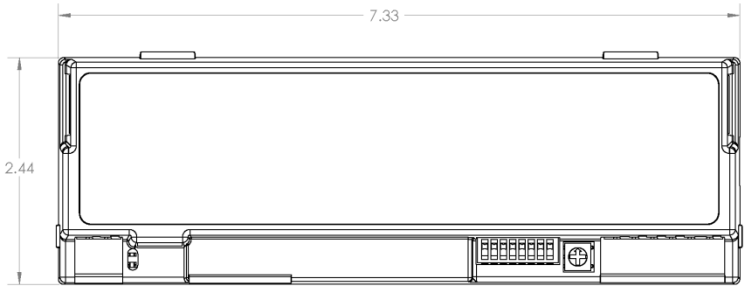
Timers

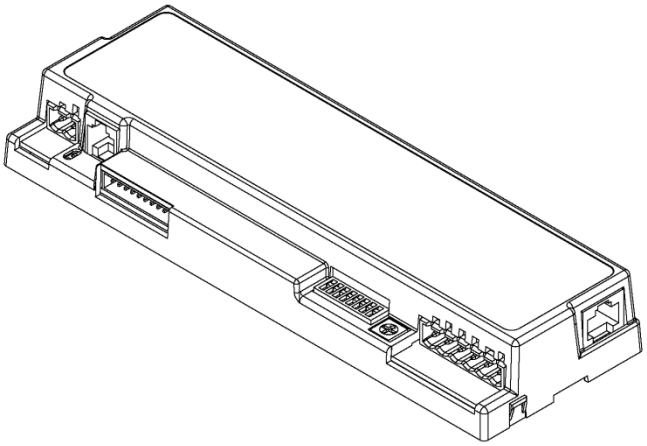
ZoneLink® ZPA modules are equipped with a set of timers that can be used to tailor functionality in certain applications. ZoneLink .S Attributes are accessed using an RS-232 to ZoneLink interface, Part Number ZL.S-F32. Listed below are the timer's functional descriptions, default values, ranges, and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

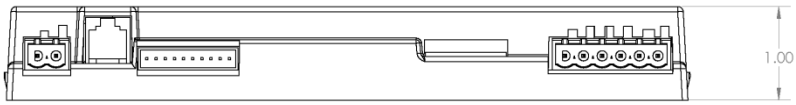
Timer	Description	Timer Default	Timer Units	Timer Range	.S Attribute#
Release Delay Timer	When a product is accumulated, the release timer delays how long a load is held before it is released downstream. This is used to ensure gaps between loads.	25	10ms	0-255	36
Gap Timer	When running, attempts to maintain 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
Rocking Timer	Sets the time to Run in reverse in Rocking Mode Accumulation. After it expires Run is forward to the sensor. A setting of zero (0) disables Rocking Mode.	5	.1 sec	0-255	63

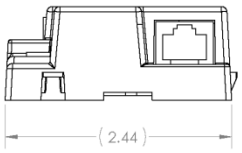
Dimensions (inches)

Controller

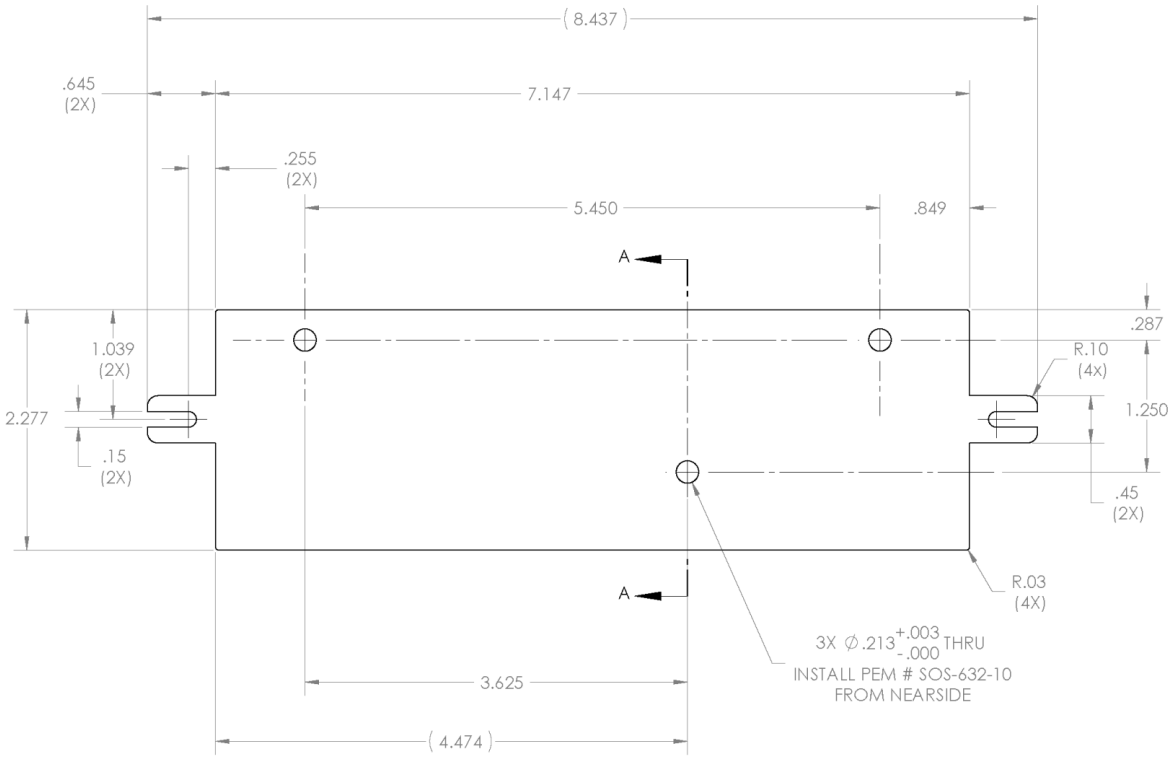






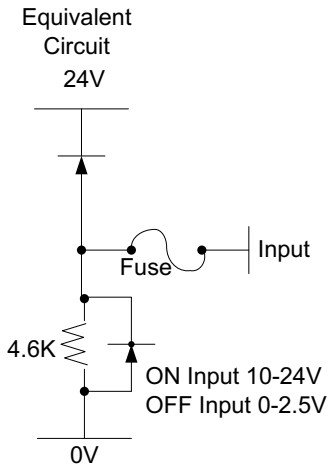


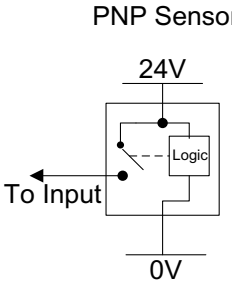
Rear Mounting Plate

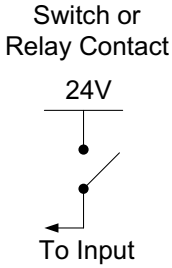


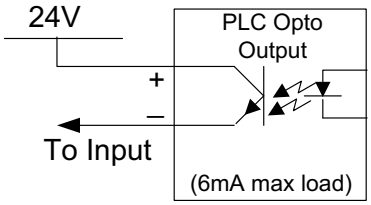
AUX I/O Wiring Diagrams

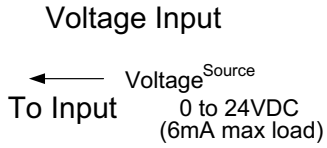
Inputs



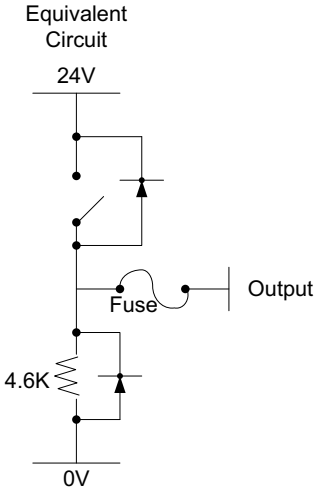


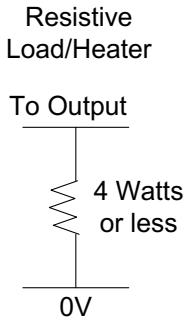


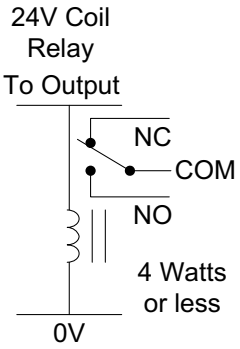


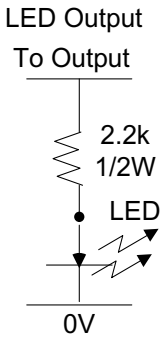


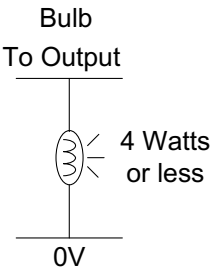
Outputs

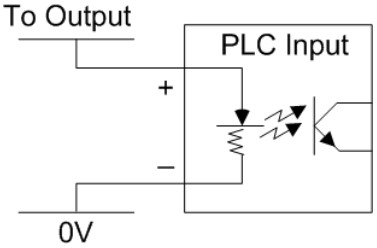












EMERGENCY STOPS AND SAFETY RELAYS

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.

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

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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.

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