

## Description

The Microroller® is an internally powered motor-driven conveyor roller with an amperage-protected 24 volt DC brushless motor and permanently lubricated planetary gear reduction drive.

These 24 volt DC powered motorized rollers are for plant managers and production engineers who strive to lower the total cost of ownership of their conveyor systems.

- Optimize system throughput
- Decrease installation costs
- Decrease maintenance costs
- Decrease power consumption
- Increase environmental safety



## Specifications

### 22 Watt Motor

Gearbox	Rated Torque (in-lbs.)	Starting Torque (in-lbs.)	Current (Amps)	Linear Speed (FPM)
-5	46	106	0.5-2.0	5-20
-10	24	54	0.5-2.0	14-60
-15	14	32	0.5-2.0	17-73
-20	10	24	0.5-2.0	24-100
-30	8	20	0.5-2.0	29-122
-35	6	15	0.5-2.0	42-180
-40	4	11	0.5-2.0	55-238

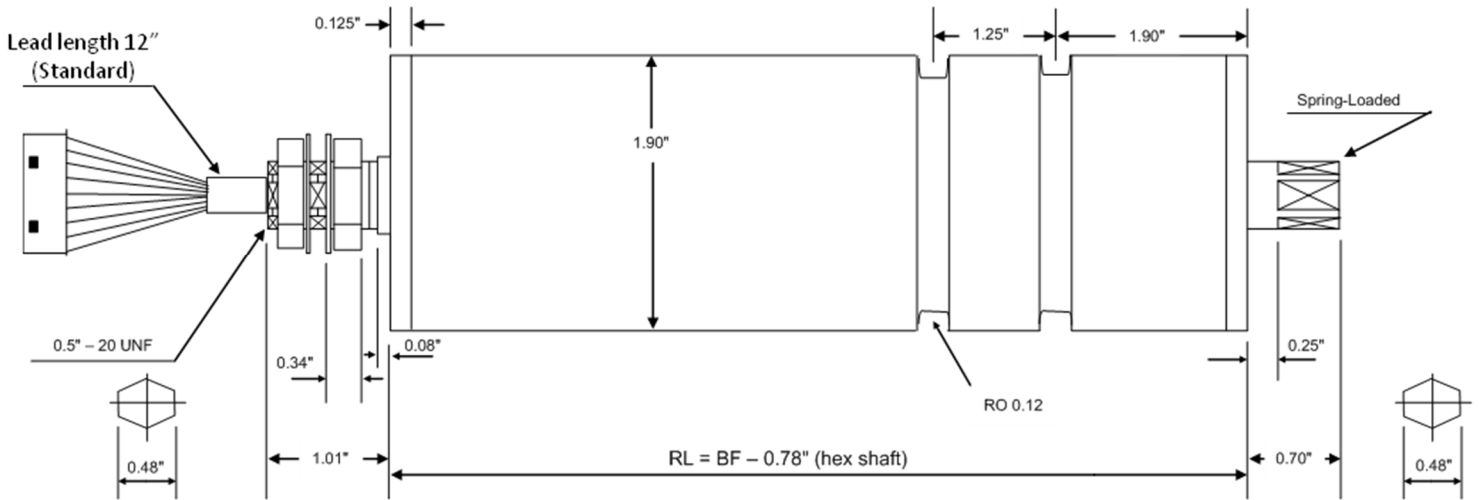
### 35 Watt Motor

Gearbox	Rated Torque (in-lbs.)	Starting Torque (in-lbs.)	Current (Amps)	Linear Speed (FPM)
-10	40	150	0.5-2.8	13-44
-20	19	82	0.5-2.8	26-88
30	15	67	0.5-2.8	31-107
-40	12	49	0.5-2.8	43-146
-60	7	32	0.5-2.8	65-229
-70	5	27	0.5-2.8	80-280
-80	4	22	0.5-2.8	94-328

The linear speed shown is for 1.9" diameter rollers. For 2.24" diameter rollers, multiply by 1.15. For 2.38" diameter rollers, multiply by 1.22.

## Product Nomenclature

MR	Roller Type -(X)	Power Source -D	Diameter -(XX)	Length -(XXX)	Gearbox -(XX)	Roller Cover -(X)	Output Power -(X)	Groove Type -(X)	-Q
Microroller	A=Standard B=Brake	24 VDC	(mm)	(mm)	4-80	Call for options	W=22 WATT Z=35 WATT	Call for options	N/A





## 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

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### Complementary Products

Mol Belting Systems distributes 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:

**Mol Belting Systems, Inc.**  
2532 Waldorf Ct NW  
Grand Rapids, MI 49544  
Phone: 800.729.2358  
Web: molbelting.com  
Email: sales@molbelting.com

## About Mol Belting Systems

***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***

Mol Belting Systems'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?***

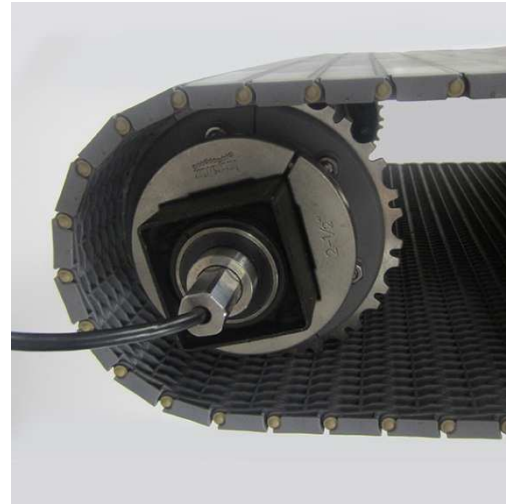
Call us. Where else are you going to find people who love talking about this stuff? And who know enough to be helpful? The number to connect you to someone who understands your business – **800.729.2358**

## Description

The SmartRoller® is an internally powered motor-driven conveyor roller with an amperage-protected 24 volt DC brushless motor and permanently lubricated planetary gear reduction drive.

These 24 volt DC powered motorized rollers are for plant managers and production engineers who strive to lower the total cost of ownership of their conveyor systems.

Mol Belting Systems manufactures 2.5" square bore sprocket SmartRollers for use with Intralox Series 900 belts in both round and square configurations. Use Intralox Part Number S3D9XXCVL4NG – Series 900, 6.1" (18T) Natural Acetal Sprocket with 2.5" square bore for square SmartRollers. Round SmartRollers have a welded keyway for use with round bore sprockets. Consult Intralox for sprocket specifications.



**2.5" Square Bore Sprocket SmartRoller**

## Specifications

Gearbox	Rated Torque (in-lbs.)	Starting Torque (in-lbs.)	Current (Amps)	Linear Speed (FPM)
-10	40	150	0.5-2.8	39-132
-14	30	115	0.5-2.8	60-198
-20	19	82	0.5-2.8	78-264
30	15	67	0.5-2.8	93-321
-40	12	49	0.5-2.8	130-438
-60	7	32	0.5-2.8	195-690
-70	5	27	0.5-2.8	240-840
-80	4	22	0.5-2.8	282-984

The linear speed shown is for 2.5" rollers with 6.1" diameter sprockets for Intralox Series 900 belts.



Mol Belting Systems does not recommend belt speeds above 300 FPM

## Product Nomenclature

	Roller Type	Power Source	Diameter	Length	Gearbox	Roller Cover	Output Power	Groove Type	
SR	-A	-D	-63	-(XXX)	-(XX)	-(X)	-Z	-(X)	-H
SmartRoller	A=Standard	24 VDC	63 (2.5")	(mm)	10-80	Call for options	Z=35 WATT	S = Square R = Round	

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- Stack Light Controllers for DeviceNet
- Light Stacks for DeviceNet
- Operator Panels for DeviceNet, Multiple function
- Push Button Controllers for DeviceNet, Multiple I/O
- DeviceNet™ Cables
- Low Profile I/O for DeviceNet, Multiple I/O
- Motor Starter Controllers for DeviceNet
- ZoneLink™ .S ZPA Module for 22W and 35W Microrollers w/ Auxiliary I/O
- ZoneLink™ .S Driver Module for 22W and 35W Microrollers
- ZoneLink™ .S 4 Zone Controllers for DeviceNet™

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## Description

The Microroller® Driver Module connects directly to a Microroller® motorized roller.

The Microroller® Driver Module uses microprocessor-based commutation of the brushless motor, which provides the following benefits:

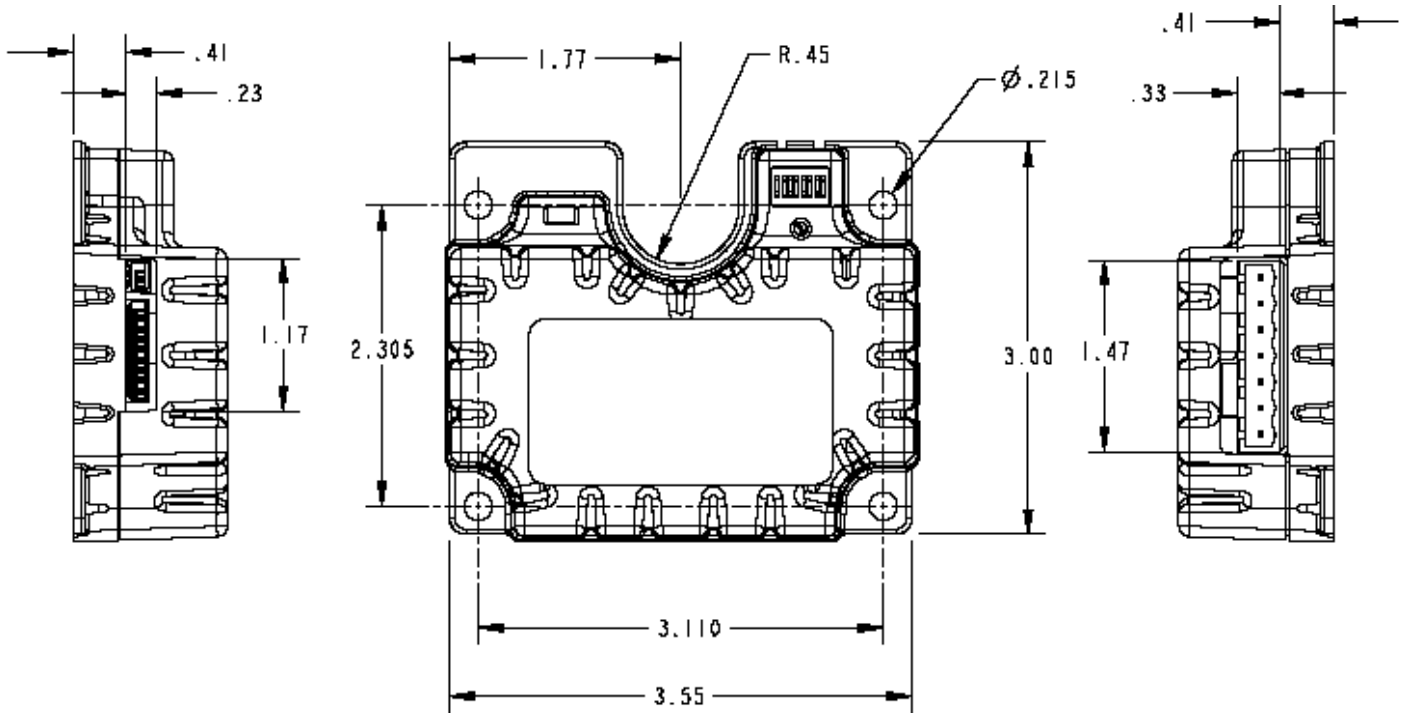
- Closed-loop speed control to hold roller speed at a constant value, improving the ability to tune a conveyor system.
- A single Driver Module for control of both 22W and 35W Microroller® motor driven rollers
- A single Driver Module for control of standard, electronic brake, and mechanical brake rollers.
- Discreet speed selection for accurate zone-to-zone speed control.
- Multiple fault indications for easy and thorough troubleshooting.



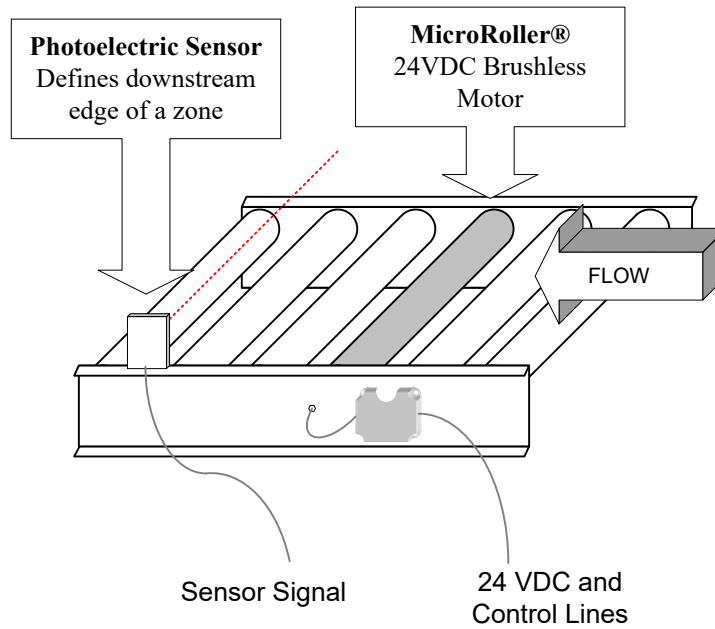
## Specifications

<b>Part Numbers</b>	ZL-DH100	Microroller® Driver for 22W and 35W Motors w/ Mechanical or Electric Brake Output (configured via DIP Switches)
<b>Electrical Power</b>	Termination Voltage Range Current Consumption	Plug-In Cage Clamp Terminal 24 VDC (+/- 10%) 100 mA plus Microroller®
<b>Motor Connection</b>	Type Number Termination Voltage Range Max Average Current	Microroller® One (1) 10-pin Connector 24 VDC 3.6 A
<b>Control Port</b>	Type Number Termination Voltage Range Max Continuous Avg Current Boost (Starting) Avg Current Self-Resetting Fuse	Current Sinking Inputs/Outputs Single 7-pin Connector Plug-in Cage Clamp Terminal 24 VDC 2.6 A (22W) / 3.6 A (35W) 3.4 A (22W) / 4.0 A (35W) 5A
<b>Potentiometer</b>	Internal External	600-3600 rpm (22W) 1000-4000 rpm (35 W) 0% - 100% of internal range
<b>Environmental</b>	Temperature Humidity Vibration Shock	Storage Operating -30° to 70° C (-22° to 158° F) 0° to 60° C (32° to 140° F) 5-95% RH, non-condensing 2G to 10 to 500 Hz 10G
<b>Physical</b>	Dimensions Weight Mounting Indication	3.70" L x 3.15" W x 1.10" D 4 oz Mounting base identical to V12/21 Solid Green – Normal Flashing Green/Red – Fault
	Status	

**Dimensions and Layout**



**Typical Installation**



## Wiring

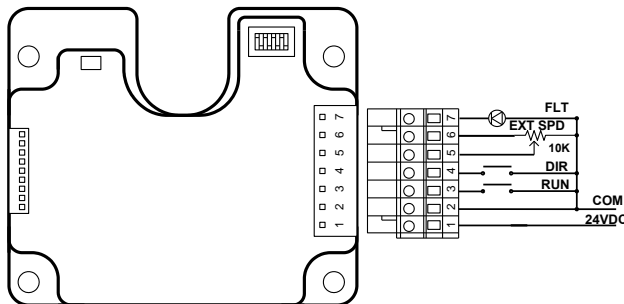
### Power and Control Wiring

The Power Connector is pin 1 on the driver control port. Power to the Microroller® Driver Module must be 24 VDC. Power supplies for systems driving 22W rollers should be sized to allow each motor-driven roller zone to draw 3.6 amps continuously. For installations utilizing 35W rollers should allow at least 4.2 amps per driver module.

A Microroller® can be signaled to run by sinking Control pin 3 to common. The run direction of the Microroller® can be changed by sinking Control pin 4 to common. When the Microroller® Driver Module or Microroller® experiences a FAULT Control pin 7 will be pulled to ground. The wiring diagram is shown in Error! Reference source not found..

**NOTE: The Microroller® Driver MUST share common with the Control I/O.**

### External Speed Control and Control Port Wiring



**Figure 1 Control Port Wiring**

Pin	Function
7	Fault
6	3.3V Reference
5	Analog Speed Input
4	Direction
3	Run
2	Common
1	24VDC

**Table 1 Control Port Wiring**

Control pin 5 can be used for speed control using an external potentiometer or the output of an analog output module of a PLC. The external speed control signal can be used to set motor run speed to approximately 0-100% of the motor speed range. If using a potentiometer, a higher turn version will provide more precise speed control. The external pot range will be the same as on-board input range, using a 10K pot. If using an external potentiometer, control pin 6 must be connected to the other side of the potentiometer. This pin is the 3.3VDC reference.

When connecting the output of an analog output module, you must configure the module to output 0-3.3VDC. Voltages over 3.3VDC WILL damage the driver. For proper operation, you must tie the DC common wires from the driver and analog output module together.



## Configuration

DIP switches to configure the functionality of the ZoneLink® Driver Module are located on the upper right of the module, above the control port receptacle. The switches are numbered 1-8, beginning with the switch on the left. The ON position for each switch is toward the top of the Driver Module.

**Please Note:** The ZL-DH100 can be used to drive both 22 Watt and 35 Watt Microroller® motor driven rollers using DIP switches 1-3 to set the power level appropriately. Previously, separate products were available from Microroller® to drive the different roller types. The ZL-DH100 replaces both all ZL-DK100 variants ZL-DK100, ZL-DK100B, ZL-Dk100EB, and ZL-DK100-35.

- DIP switches 1, 2, and 3 are used to set Power and Braking Modes as shown in Table 3.
- DIP switch 4 is used to set the default rotation of the Microroller® in normal use as shown in Table 2. This allows for the Microroller® Driver Module to be installed in various locations on a conveyor system.
- DIP switches 5 through 8 can be used to set the speed, as shown in tables 4 and 5.

DIP Switch	Function
1	Power/Braking Mode Table
2	
3	
4	Direction: OFF=CCW, ON=CW
5	Power Specific Speed Table
6	
7	
8	

Table 2 General Driver DIP Switch Assignment

DIP Switches			MDR	Braking Mode
1	2	3		
OFF	OFF	OFF	22W	Dynamic
ON	OFF	OFF	22W	Electronic Hold
OFF	ON	OFF	22W	Mechanical Hold (requires "Brake Roller")
ON	ON	OFF	35W	Dynamic
OFF	OFF	ON	35W	Electronic Hold
ON	OFF	ON	Reserved - Motor will not run	
OFF	ON	ON		
ON	ON	ON		

Table 3 Power and Braking Mode DIP Switch Assignments

## Braking Mode Application Notes

The ZL-DH100 also enables three different braking modes in one driver module. Previously, separate SKU's were available to achieve different braking modes. The ZL-DH100 Driver Module can be used in Electronic Braking, Mechanical Braking, and standard Dynamic Braking mode, replacing the legacy ZL-DK100EB, ZL-DK100B, and ZL-DK100 models.

**Dynamic Braking** is the default mode of operation for the driver module and is designed to work with standard Microroller® motor driven rollers. When the run power is removed from the MDR, it stops without electrical input from the controller due to the mechanical properties of the motor, gearbox, and other components of the MDR system. Power from the motor is fed back into the driver module while the system slows down and dissipated as heat.

**Electronic Hold Braking** mode is designed to work with both standard and mechanical brake Microrollers®. This is a 'brake and hold' function and is not designed to be a 'positioning' controller.

When used with a standard Microroller®, this feature gives the user the capability to apply braking functionality for less cost than mechanical brake solutions and allows for standardization on a single part number for both driver card and Microroller®. However, on power loss, braking capability is lost.

When used with a mechanical brake Microroller®, the Electronic braking feature saves wear on the brake mechanism while providing mechanical braking in case of power loss. When used with a mechanical brake, and with DIP switch 1 OFF and DIP switch 2 ON, the ZL-DH100 will function exactly like the legacy ZL-DK100B product.

**Mechanical Braking** mode is designed to be used in conjunction with a mechanical brake Microroller® which is equipped with a mechanically actuated brake that is intended to be used as a safety feature to hold loads on inclines or in other situations where holding a load stationary is critical in the case of loss of power.

**Speed Settings:** The ZL-DH100 offers three methods to set the speed: internal pot, external pot and DIP switches 5-8. The following table lists the possible motor rpm settings and their corresponding linear speeds by Microroller® motor-gearbox assembly.

Linear speeds are listed for 1.9 inch rollers. For 2.24 inch rollers, multiply by 1.16. For 2.38 inch rollers, multiply by 1.23. The ON position for each switch is toward the top of the Driver Module.

DIP Switch				22 Watt Motor-Gearbox
5	6	7	8	Motor RPM
OFF	OFF	OFF	OFF	<b>Internal Pot, range 300 to 3600 RPM</b>
ON	OFF	OFF	OFF	1100
OFF	ON	OFF	OFF	1200
ON	ON	OFF	OFF	1300
OFF	OFF	ON	OFF	1400
ON	OFF	ON	OFF	1500
OFF	ON	ON	OFF	1600
ON	ON	ON	OFF	1700
OFF	OFF	OFF	ON	1800
ON	OFF	OFF	ON	1900
OFF	ON	OFF	ON	2000
ON	ON	OFF	ON	2100
OFF	OFF	ON	ON	2200
ON	OFF	ON	ON	2300
OFF	ON	ON	ON	2400
ON	ON	ON	ON	<b>External Pot, range 300 to 3600 RPM</b>

**Table 4 DIP Switch 5-8 Settings for 22 Watt Driver**

DIP Switch				35 Watt Motor-Gearbox
5	6	7	8	Motor RPM
OFF	OFF	OFF	OFF	<b>Internal Pot, range 300 to 4200 RPM</b>
ON	OFF	OFF	OFF	1150
OFF	ON	OFF	OFF	1300
ON	ON	OFF	OFF	1450
OFF	OFF	ON	OFF	1600
ON	OFF	ON	OFF	1750
OFF	ON	ON	OFF	1900
ON	ON	ON	OFF	2050
OFF	OFF	OFF	ON	2200
ON	OFF	OFF	ON	2350
OFF	ON	OFF	ON	2500
ON	ON	OFF	ON	2650
OFF	OFF	ON	ON	2800
ON	OFF	ON	ON	2950
OFF	ON	ON	ON	3100
ON	ON	ON	ON	<b>External Pot, range 300 to 4200 RPM</b>

**Table 5 DIP Switch 5-8 Settings for 35 Watt Driver**

## Faults and Indicators

If the motor thermistor or the driver card thermistor senses that the motor is overheating, the Microroller® driver will restrict power to the motor. The driver will automatically reset the motor after the motor cools to below acceptable temperature for about 10 seconds.

### Indication

There is one dual color (red/green) LED on a Microroller® Driver Module upper left corner of the module.

Whenever 24 VDC power is applied and the driver is functioning normally, the LED will show solid green. If 24 VDC is present and the LED is not on, the unit needs to be replaced.

Flashing green followed by flashing red indicates a FAULT.

### Status LED States

Two types of faults occur in Microroller® Driver Modules: Application and Critical. Faults cause the motor to stop running and require intervention to return to proper operation.

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

*Application Faults (1 Red Flash, followed 1-4 by Green Flashes)*

Green Flashes	Indication
1	Motor Stall – the Driver Module is trying to run the motor, yet it hasn't moved for a full second. The motor will attempt to re-start after 10 seconds.
2	Motor Thermistor Fault – The motor has reached its temperature limit and has stopped. The motor will be ready to start again about 10 seconds after it cools below its overtemp limit.
4	Driver Thermistor Fault – The driver circuitry has reached its temperature limit and has cut off power to the motor. The driver will be ready supply power again about 10 seconds after it cools below its overtemp limit.

**Critical Faults** typically cannot be cleared, and usually require changing either the motor or Driver Module.

*Critical Faults (2 Red Flashes, followed by 1-4 Green Flashes)*

Green Flashes	Indication
1	Commutation Fault – the circuit that controls the motor commutation has failed, or that the motor connector is not fully inserted
2	Low Current – the Driver Module is reading a current that is below the normal No Load value. This is typically occurs when the mechanical link internal to the powered roller has broken. The remedy is to replace the roller.
3	Low Supply Voltage Fault – the fault activates if the supply voltage to the controller falls below 16VDC.



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## Description

The ZL3.S-AH121/ZL3.S-AH122 is a specialized Motorized Roller ZPA Driver Module for 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.
- \* A 'Seek Mode' can be implemented at power up to determine if a load is in the zone but not blocking the sensor.



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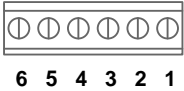
<b>Part Number</b>	ZL3.S-AH121 Rev. 01 ZL3.S-AH122 Rev. 01	ZPA Controller for 22W Microrollers  ZPA Controller for 35W Microrollers
<b>Electrical Power</b>	Termination Voltage Range Current Consumption, Max	Plug-In, Lever Clamp Terminal 24 VDC (+/- 10%) 100mA plus Powered Roller, Sensor and AUX I/O
<b>Motor Connection</b>	Type Number Termination Voltage Range Max Current	Microroller <sup>®</sup> One (1) 10-pin JST Connector (22W and 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 Humidity Vibration Shock	Storage Operating -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.



### 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)
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



Pin	Signal
1	24 VDC
2	Common

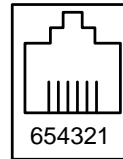
The Power connector is a 2-pin pluggable terminal block that accepts up to 14 gauge wire. Power to the ZoneLink<sup>®</sup> ZPA

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 Mol Belting or your sensor manufacturer for appropriate models.

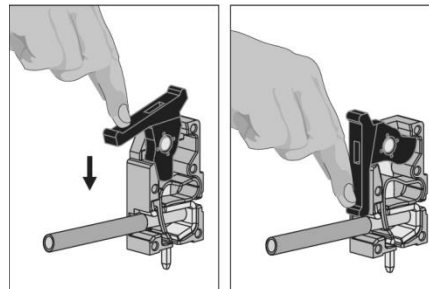
### RJ-11 Sensor Jack Connector



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. Mol Belting 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.

### 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-AH121	ZL3.S-AH122
0	600	750
1	900	938
2	1200	1125
3	1500	1313
4	1800	1500
5	2100	1688
6	2400	1875
7	2700	2063
8	3000	2250
9	3300	2438
A	3600	2625
B	3900	2813
C	4200	3000
D	4500	3188
E	4800	3375
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.

## 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	<b>WARNINGS</b> The unit is still functioning but has a condition that should be checked.
1 Red flash, followed by 1 or more Green flashes	<b>APPLICATION FAULT</b> The motor has stopped. The controller will try to clear the fault condition.
2 Red flashes, followed by 1 or more Green flashes	<b>CRITICAL FAULT</b> 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 Microroller <sup>®</sup> 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. (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.

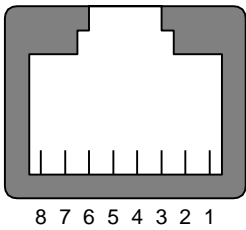
Fault Register	
Bit	Description
0	Commutation Fault
1	Photosensor Missing
2	Low Supply Voltage
3	Reserved
4	Motor Stall
5	Motor Thermistor Fault
6	Jam Fault
7	Controller Thermistor Fault
Warning Register	
Bit	Description
0	Excessive Current Limit
1	High No-Load Current
2	Excessive Motor Stalls
3	Design 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 are accessed using an RS-232 to ZoneLink interface, Part Number ZL.S-F32.

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



### 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-AH121/AH122

ZoneLink .S Attributes are accessed using an RS-232 to ZoneLink interface (ZL.S-F32) or F64 Multi-Protocol Configuration Tool (ZTC-F64-DOTS)

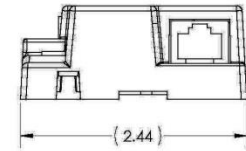
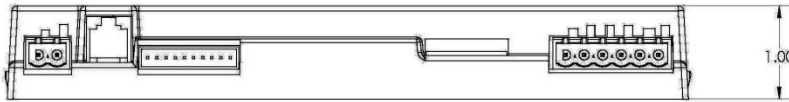
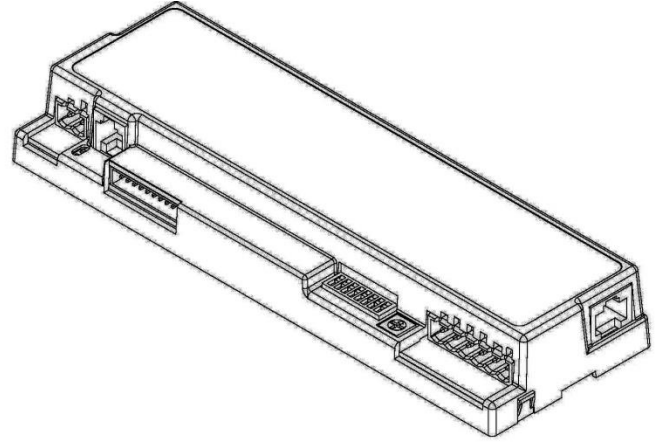
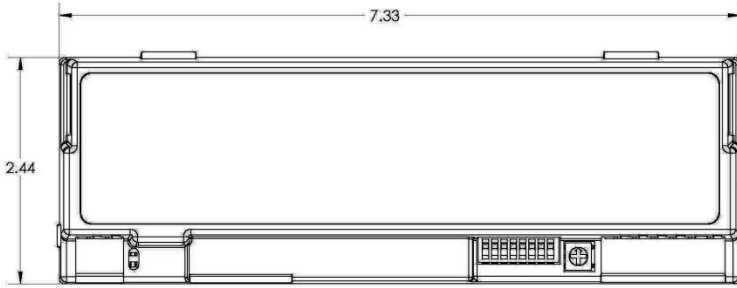
Attribute#	Attribute Name	Description/Notes	Type	Units	Default	Range
0	Product code	ZL3.S-AH121 = 16, ZL3.S-AH122 = 17	Byte	-	16/17	N/A
1	Input variable		4 Bytes	-		N/A
2	Output variable		4 Bytes	-		N/A
4	Motor serial number	Smartroller E <sup>2</sup> only.	-	-	-	-
7	Faults and warnings	Diagnostic Register - Instantaneous	2 Bytes	-		N/A
8	Faults and warnings	Diagnostic Register - Locked	2 Bytes	-		N/A
10	Catalog listing	ZL3.S-AH121 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
22	Startup Transfer Enable	'Seek' on power up. Default is Disabled	Byte		0	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	'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

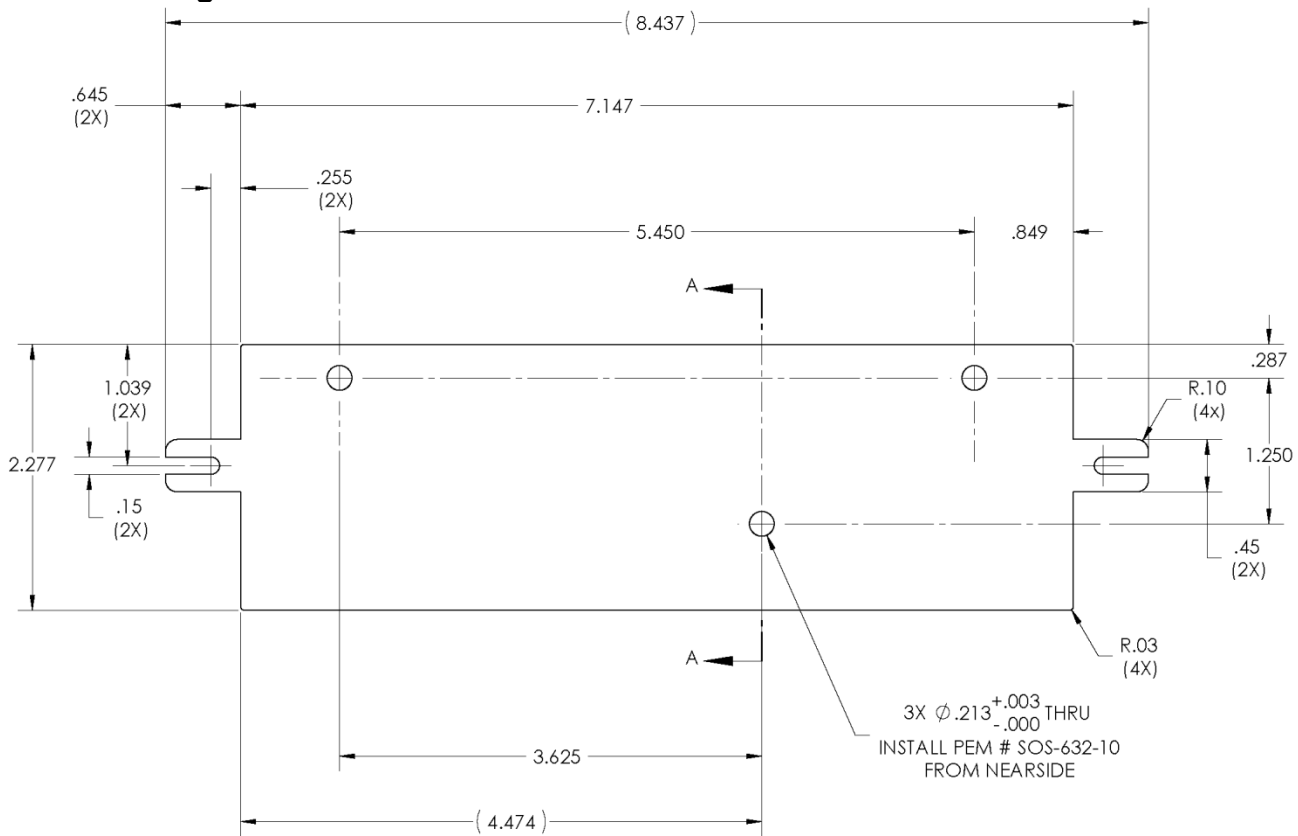
ZoneLink<sup>®</sup> ZPA modules are equipped with a set of timers that can be used to tailor functionality in certain applications. ZoneLink .S Attributes are accessed using an RS-232 to ZoneLink interface (ZL.S-F32) or F64 Multi-Protocol Configuration Tool (ZTC-F64-DOTS). Listed below are the timer's 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**

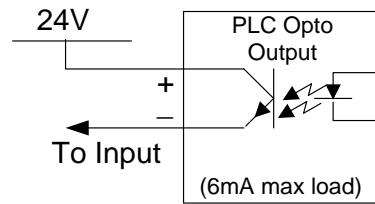
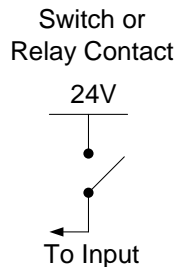
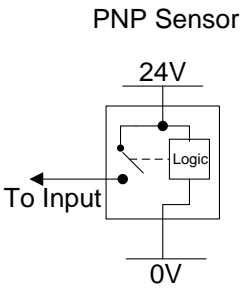
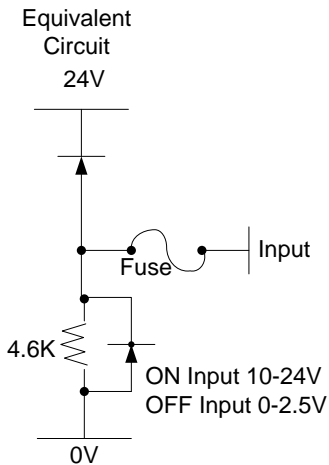


**Rear Mounting Plate**

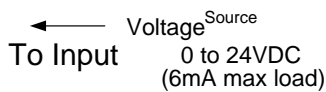


## AUX I/O Wiring Diagrams

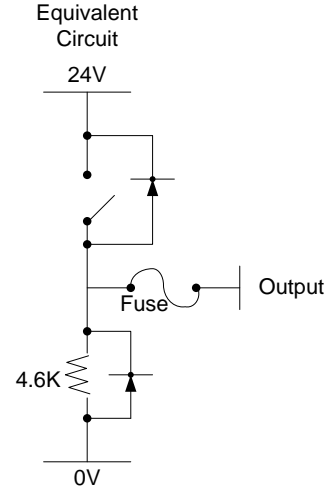
### Inputs



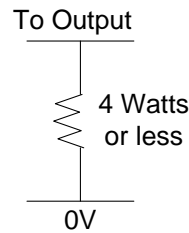
### Voltage Input



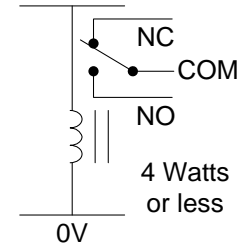
### Outputs



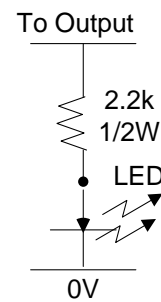
### Resistive Load/Heater



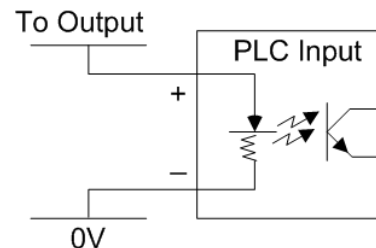
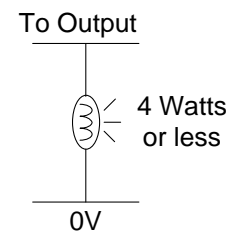
### 24V Coil Relay To Output



### LED Output



### Bulb





## 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 Mol Belting Systems 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

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

ZoneLink3 ZPA Controllers for Microrollers and SmartRollers

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

**Mol Belting Systems, Inc.**  
2532 Waldorf Ct NW  
Grand Rapids, MI 49544  
Phone: 800.729.2358  
Web: molbelting.com  
Email: sales@molbelting.com

## About Mol Belting Systems

*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*

Mol Belting Systems'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?*

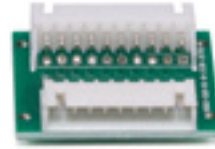
Call us. Where else are you going to find people who love talking about this stuff? And who know enough to be helpful? The number to connect you to someone who understands your business – **800.729.2358**



**Connector Types:  
Notice of Obsolescence**

Molex and JAE connector manufacturing has been discontinued and remaining supplies are dwindling. In an effort to extend the usable life of existing driver cards and motor driven rollers currently in use, Mol Belting Systems has purchased a limited supply of remaining connectors to create jumper boards.

All new driver cards and MDRs offered by Mol Belting Systems will have the new JST-10 connection. The jumper boards are a retrofit to connect newer units into existing systems - while supplies last.



**JAE-9**  
(discontinued)

**JST-10**  
(current)

**Molex-9 + 2**  
(discontinued)

**Connection Sequence**



Retrofit Type	Driver Card Part Number – Connector Type (female)	Jumper Cable (male to male)	Jumper Board (female to female)	Motor Driven Roller Connector Type (male)
<b>New Driver Card to Old Roller</b>	DH100 – JST-10	JST-10 to JST-10 JST-10 to JST-10 JST-10 to JST-10 Not Required	JST-10 to Molex JST-10 to Molex JST-10 to JAE Not Required	Molex-9 Molex-9 + 2 JAE-9 JST-10
<b>Old Driver Card to New Roller</b>	DK100 – Molex-9 DK100B – Molex-9 + 2 DK100-35 – JAE-9	Molex to JST-10 Molex to JST-10 JAE to JST-10	JST-10 to JST-10	JST-10