NorthAmCon INC

MECH-ROLLER

N24 Controller

Technical Specifications

Description

The N24 Controller is a specialized Motorized Roller Driver Module for NorthAmCon Mech-Rollers. 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 been implemented at power up to determine if a load is in the zone but not blocking the sensor.

Specifications

Controller #	N24-22		Controller for 22W Mech-Roller
	N24-35		Controller for 35W Mech-Roller
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		Mech-Roller
	Number		One (1)
	Termination		9-pin Standard and 2-pin brake Molex Connectors (22W) 10-pin JST Connector (35W)
	Voltage Range		24 VDC
	Max Current	Continuous	2.5A 22W / 3.6A 35W
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)
Communication 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 configured as 3 IN and 3 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

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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 Transportation Mode)
2	Input	RTS (SW3 OFF) or CTS (SW3 ON) (DIR in Transportation Mode)
3	Input	Reserved (BYPASS in Transportation 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

1 2

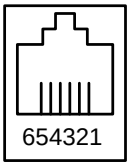
Pin	Signal
1	24 VDC
2	Common

The Power connector is a 2-pin pluggable terminal block that accepts up to 14 gauge wire. Power to the N24 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 NorthAmCon, Inc. or your sensor manufacturer for appropriate models.

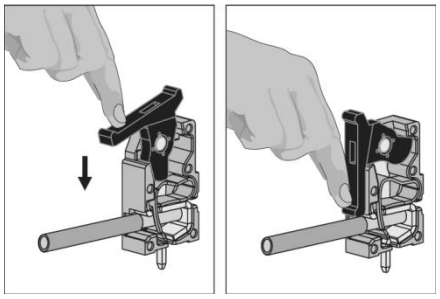
RJ-11 Sensor Jack Connector



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.



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DIP Switch Settings

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. NorthAmCon 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
Transportation	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:
(Roller Diameter x 3.14 x RPM) / (12 x Gear Ratio)

Factory default setting is 0

Setting	N24-22	N24-35
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.

Technical Specifications

Indication

There are 2 LED's on the 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 Mech-Roller 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 Module is reading a current that is below the normal No Load value.

Technical Specifications

Faults

Two (2) types of faults occur in N24 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 Module. When a critical fault occurs, there are no attempts to restart the motor.

Faults also cause the Mech-Roller Fault Output to be ON.

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

Green Flashes	Indication
1	Motor Stall – the 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.
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

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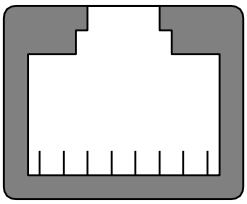
N24 Logic

N24 is the communications layer between controllers that provides control signals, diagnostic data, and access to .S configuration attributes. N24 Logic .S Attributes are accessed using an RS-232 to Mech-Connect interface, Part Number MEC-IM1.

The N24 connections are RJ-45 jacks with pin assignments as defined in the diagram below. N24 is designed to use standard Ethernet patch cables (Category 5, 5e or 6).

Mech-Connect RJ-45 Connector



8 7 6 5 4 3 2 1

Mech-Connect 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.

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N24 .S Attributes Table – N24-22/N24-35

N24 .S Attributes are accessed using an RS-232 to Mech-Connect interface, Part Number MEC-IM1

Attribute#	Attribute Name	Description/Notes	Type	Units	Default	Range
0	Product code	**N24-22=16, N24-35=17**	Byte	-	16/17	N/A
1	Input variable		4 Bytes	-		N/A
2	Output variable		4 Bytes	-		N/A
4	Motor serial number	Select Mech-Roller 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	N24-22 or N24-35	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-Transportation	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	Select Mech-Roller only.	Word	Ft/Min		1 - 1000
61	Line speed	Select Mech-Roller only.	Word	Ft/Min		
62	Minimum sensor current	0 = Disabled 'Photosensor Missing' in the Fault Table	Byte	0.1mA	50	0-255

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Timers

N24 .S modules are equipped with a set of timers that can be used to tailor functionality in certain applications. N24 .S Attributes are accessed using an RS-232 to Mech-Connect interface, Part Number MEC-IM1. 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 down-stream 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

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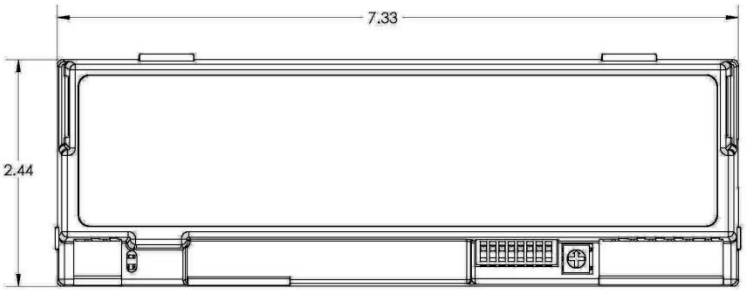
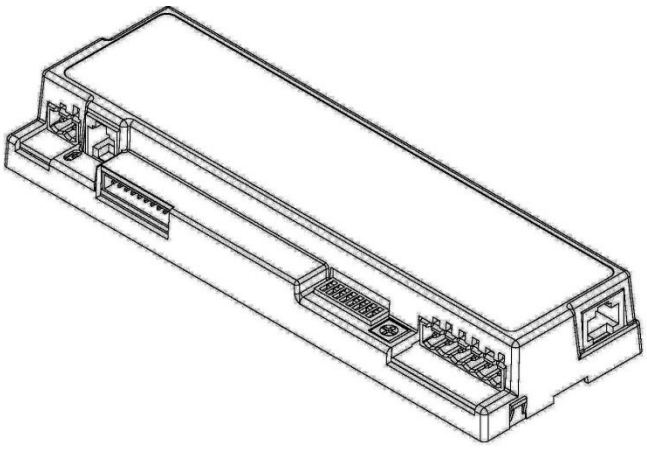
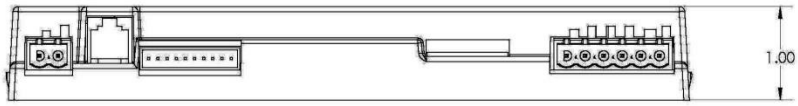
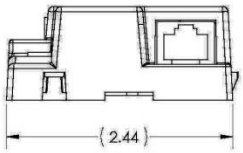
Dimensions (inches)

Controller









Rear Mounting Plate

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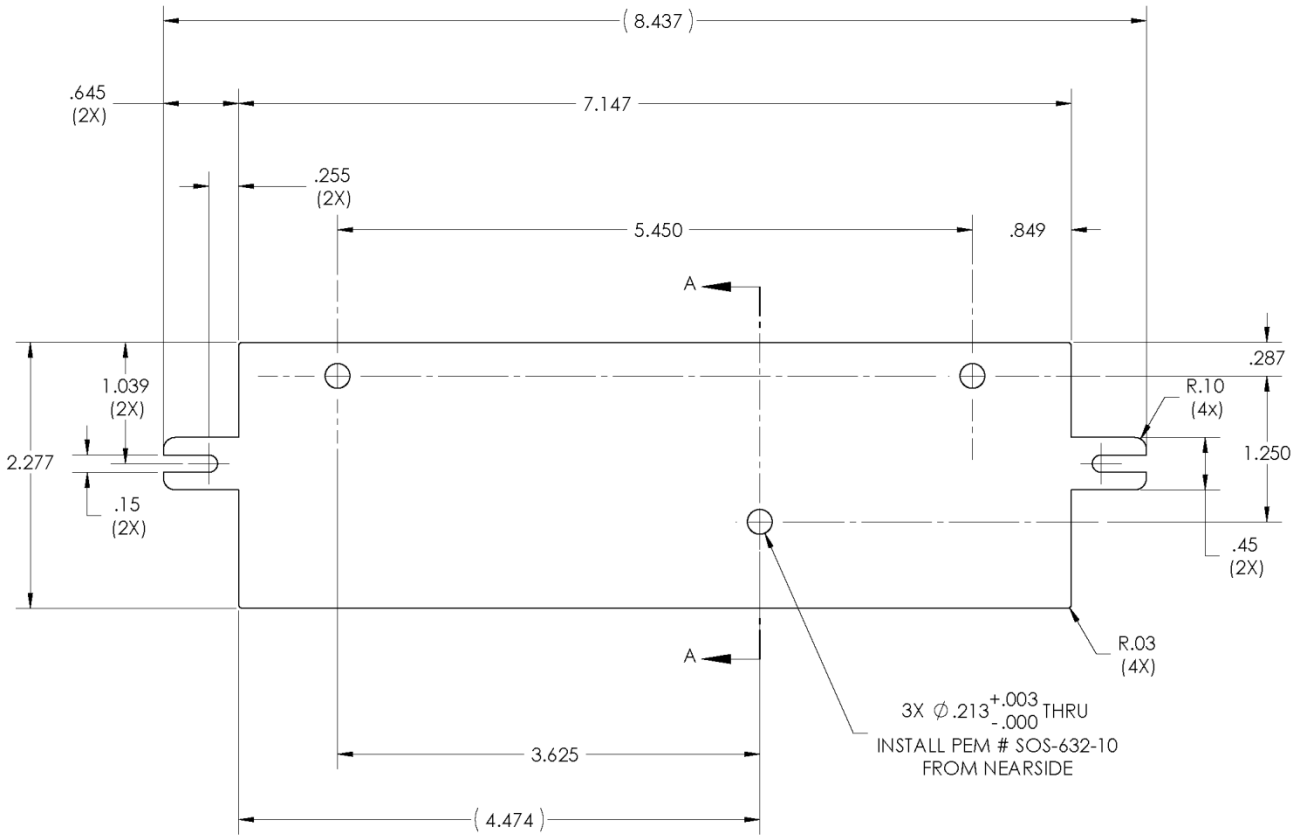
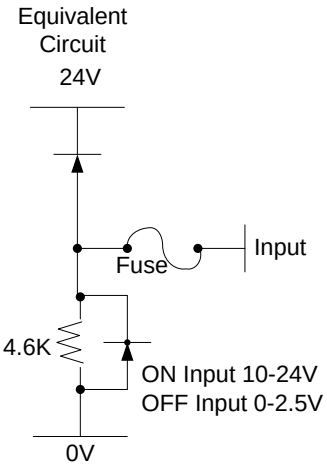
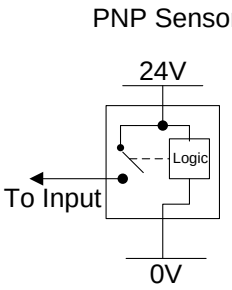
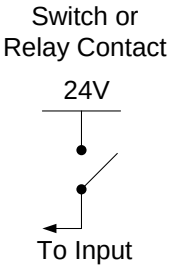


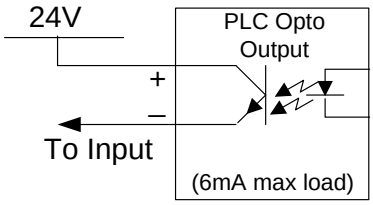
AUX I/O Wiring Diagrams

Inputs









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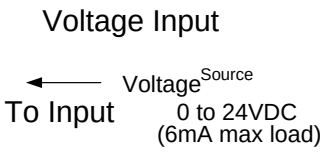
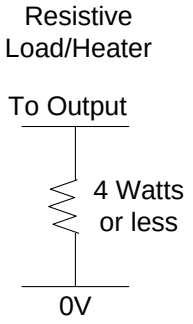
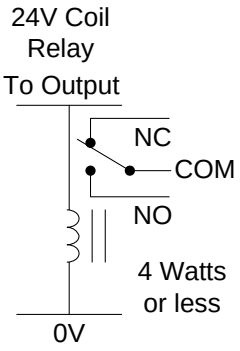
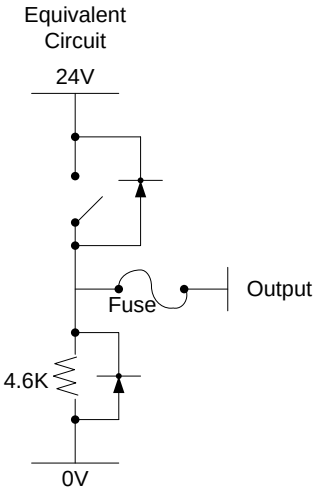
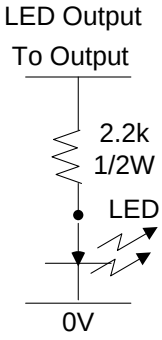


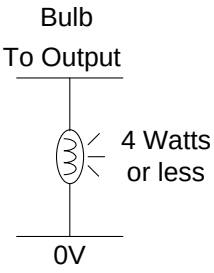


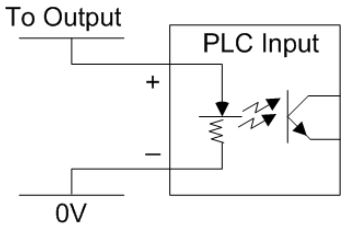


Outputs









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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.