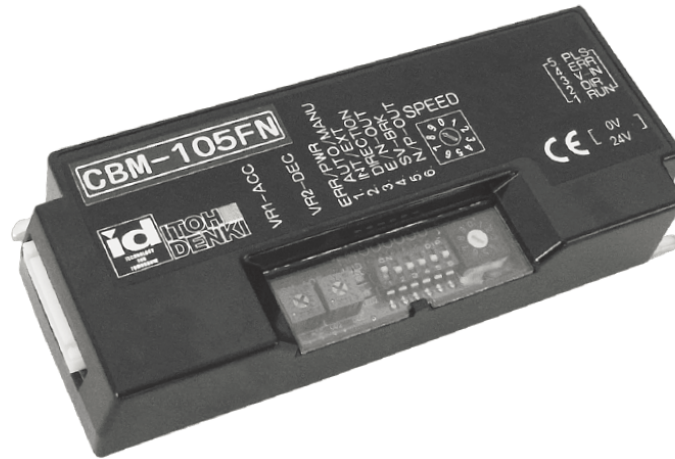


# CBM-105FN/FP Circuit Board



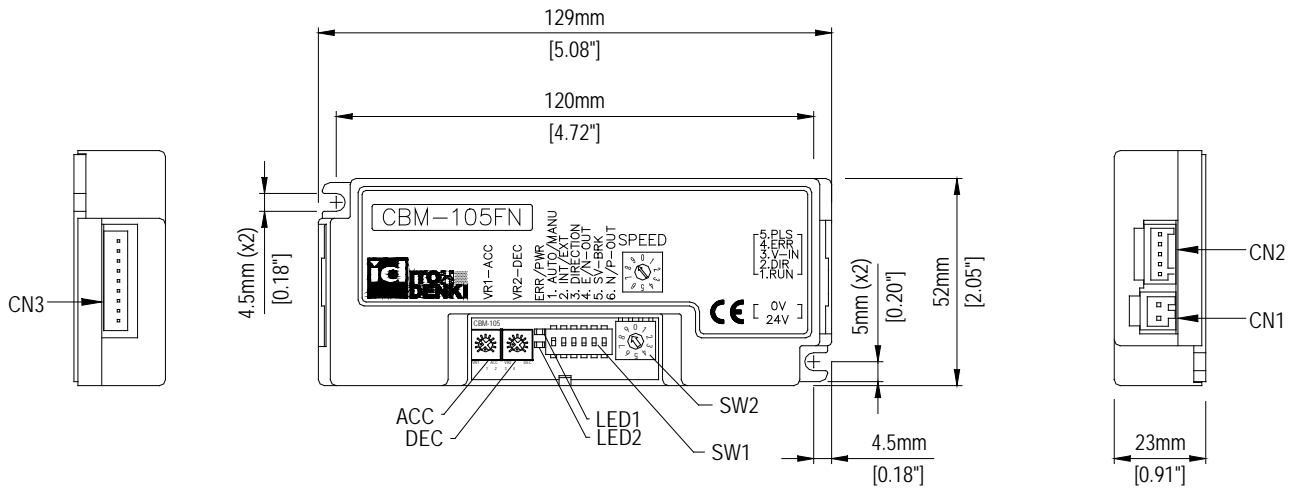
## Features

- Adjustable acceleration and deceleration time (0 to 2.5s)
- Stable speed operation
- Manual or automatic recovery of the thermal overload device
- One (1) rotary switch to select up to 10 different fixed speeds or external voltage input for up to 20 fixed speeds
- Forcibly stops the motor if motor lock last for 4 seconds or thermal overload error lasts for 1 second or more.
- Two (2) LEDs (red & green) to identify the type of error and power
- Back EMF error for overspeeding protection
- Pulse signal output to indicate motor revolution
- Servo brake control allows product to maintain its position after run signal is removed
- Error output selection for output in normal or abnormal status
- Lead free design; RoHS compliant
- Low Voltage Protection reacts when
  - Sustained low voltage (less than 15V DC) for at least 1 second
  - Fluctuating voltage dropping below 15V DC, 5 times within 0.5 second
- External Direction control
  - When external DIR signal is changed while motor is running, the motor stops for 0.5 second, then runs again in opposite direction

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# SPECIFICATIONS

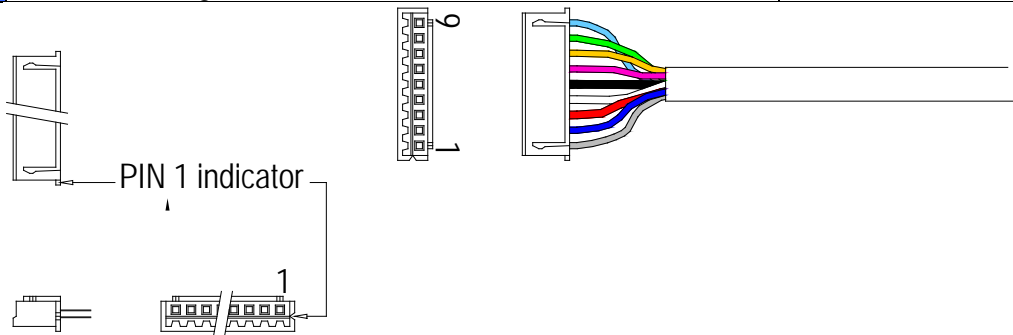
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## Connections

CN1		Male Connector on Card	Female Connector for Wiring
2 PIN connector <b>POWER</b>		WAGO #734-162	WAGO #734-102
PIN	Description		
1	+24V DC		Wire size 28~14AWG
2	0V		

CN3		Male Connector on Card	Female Connector for Wiring
9 PIN connector <b>MOTOR</b>		JST #S9B-XH-A(9P)	JST #XHP-9
PIN	Description		
1	GND – Grey		Wire size: 28~22 AWG signal lines & 24~22 AWG phase lines  Terminal pins: JST #SXH-001T-P0.6
2	+12V DC – Blue		
3	Motor phase U – Red		
4	Motor phase V – White		
5	Motor phase W – Black		
6	Hall sensor U - Violet		
7	Hall sensor V – Orange		
8	Hall sensor W – Green		
9	Thermistor – Light Blue		



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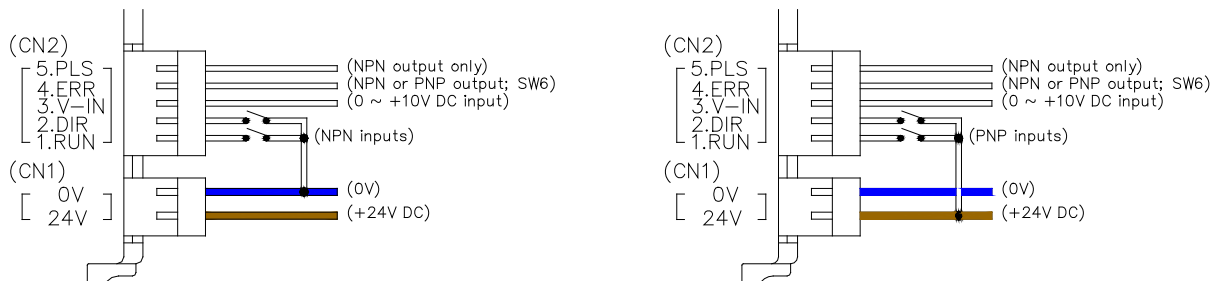
# SPECIFICATIONS

## Connections

<b>CN2</b> 5 PIN connector <b>CONTROL</b>		<b>Male Connector on Card</b> WAGO #733-365	<b>Female Connector for Wiring</b> WAGO #733-105
<b>PIN</b>	<b>Description</b>		
1	+24V DC or 0V input (RUN)		Wire size: 28~20AWG
2	+24V DC or 0V input (DIR)		
3	0 ~ +10V DC input (V-IN)		
4	+24V DC or 0V output (ERR)		
5	0V output (PLS)		

## Control Wiring

**Power to CN1 (24V DC) remains ON, control motor through CN2**



Press down spring clamp in connector with a small screwdriver.

Insert leads in proper order.

Lead should be stripped approx: 0.31~0.35"



WAGO connector (included) must be inserted and/or pulled out carefully, so as not to damage other parts.

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# SPECIFICATIONS

<b>Electrical</b>	<p>24V DC <math>\pm 10\%</math> input</p> <ul style="list-style-type: none"><li>- Battery</li><li>- Power Supply: fullwave rectified with smoothed current and <math>&lt; 10\%</math> Ripple</li><li>- Supply should be rated at 5 A or more and should not be effect by peak current of 20 A for 1 msec.</li></ul> <p>Power ON delay <math>&lt; 1s</math> 4A locking current Input signal level for activation</p> <ul style="list-style-type: none"><li>- 0V (3V or less) for NPN</li><li>- 24V (18V or greater) for PNP</li></ul> <p>Output (Error and Motor Pulse) signals</p> <ul style="list-style-type: none"><li>- Open collector 24V, 25mA or less</li><li>- NPN</li><li>- PNP (selectable for Error only)</li></ul> <p>Servo brake mode</p> <ul style="list-style-type: none"><li>- 0.2s delay between stop signal and servo brake reaction</li><li>- 1.0A maximum brake current</li><li>- Servo brake is not active with run signal applied or during error conditions</li></ul>
<b>Applicable PM Models</b>	<p>PM486/500FS PM486/500/570/605FE PM486/500FP PM635FS</p>
<b>Brake</b>	<p>Dynamic (Electric) Servo (Power Moller holds its position)</p>
<b>Protection</b>	<p>Thermal protection reaction</p> <ul style="list-style-type: none"><li>- 85° C (185° F) on the PCB</li><li>- 105° C (221° F) in the motor</li></ul> <p>Built-in 5A fuse for power supply protection Built-in diode for incorrect wiring protection</p>
<b>Applicable Environment</b>	<p>Temperature 0~40° C (32~104° F) <math>&lt; 90\%</math> Relative Humidity (No condensation) No corrosive gas Vibration <math>&lt; 0.5G</math></p>

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# OPERATION

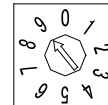
## DIP Switches (SW1) – User Settings

DIP-SW	Function	ON setting	OFF setting	Initial setting
1	Thermal device / low voltage / back EMF recovery	Manual	Automatic (Thermal restarts 1min after cool down)	ON
2	Speed change selection	External (0~10V DC applied)	Internal (Rotary switch)	OFF
3	DIR* (no external DIR signal; viewed from cable side)	FS/FP – CCW FE – CW	FS/FP – CW FE – CCW	OFF
4	Error signal activity	Active during normal status	Active during abnormal status	ON
5	Brake mode	Servo	Dynamic	OFF
6	Error output (FN type)	PNP	NPN	OFF
	Error output (FP type)	PNP	NPN	ON

\*External direction signal only - If a direction change signal should occur while the motor is running, the motor will first stop for 0.5s. Then, the motor will start in the new direction.

### Rotary switch (SW2)

Applicable when using internal speed control (DIP-SW2 OFF)  
Factory default position 9 (highest speed)



### Potentiometers\*

VR1 – Acceleration

Adjust acceleration time from 0~2.5s after the RUN signal is applied

VR2 – Deceleration

Adjust deceleration time from 0~2.5s after the RUN signal is removed

\* VRs turn 270°

### Brake

Servo Brake mode with DIP-SW 1-5 ON

- Holds Power Moller in position 0.2s after the RUN signal is removed
- If external force moves the Power Moller it will return back to its initial stopped position
- Maximum holding force is 17.7 lb-in at 1.0 A (Based on a PM486FE-60)
- Servo brake does not function during an error condition

### Motor pulse output signal

- NPN (0V) output from CN2-5
- Two (2) pulses per motor revolution

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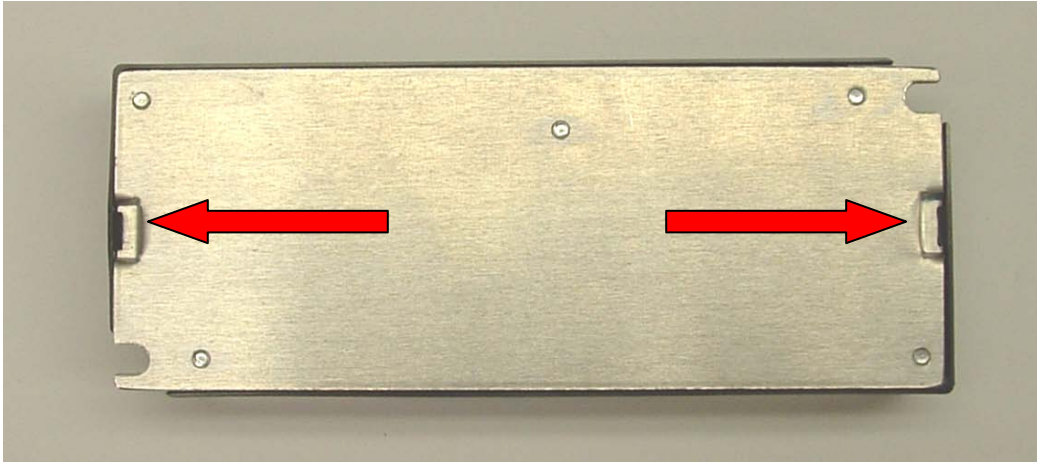
### NPN (0V) / PNP (24V) inputs

The card(s) are ordered with the inputs preset from the factory – ALL NPN or ALL PNP. The model designation will show the factory preset.

- **CBM-105FN – NPN input type (Default)**
- **CBM-105FP – PNP input type**

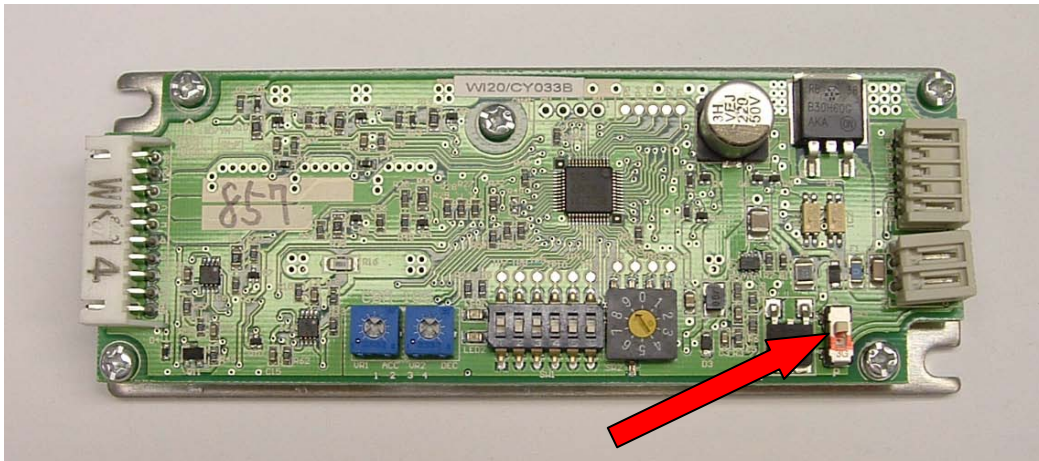
If it is necessary to change the input type, the internal dip switch will need to be changed as shown below:

1. Pry open plastic cover at screwdriver slots on back of card



2. Change internal dip switch to appropriate setting and replace cover

Position for Signal Type		Initial Setting
NPN Setting	PNP Setting	
Up	Down	Up



Note – the output can be manually switched by **DIP switch SW1-6** – Output signal type for both CN2-4

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## LED and ERROR Indications

LED 1 – Green (power)

LED 2 – Red (error condition)

### Green LED, Red LED, and Error Indication

Status	LED 1 (Green)	LED 2 (Red)	ERR Output (DIP-SW4 setting)		Error Condition*	Result
			OFF	ON		
Normal operation	●	○	○	●	-	-
No power	○	○	○	○	-	Supply power (24V DC)
Fuse blown	○	Flashes (6Hz) ●○●○●○ ●○●○●○	●	○	Current overload	Card must be replaced
Back EMF	●	Flashes/off (6Hz) ●○●○●○ ○○○○○○	●	○	Supply voltage >40V DC for 2s. or 60V DC for 0.1s	Motor stops
Low voltage (<15V)	●	Flashes (6Hz) ●○●○●○ ●○●○●○	●	○	≤15V DC (>1s or 5x in 0.5s)	Motor does not operate
Thermal protection**	●	●	●	○	Motor or PCB overheated	Motor stops 1s after reaction
Motor lock	●	Flashes (1Hz) ● ○	●	○	Motor does not turn for 4s	Motor stops
Motor not plugged in	●	●	●	○	-	Motor does not operate

\*To reset an error condition: Remove input signals; then reapply an input signal to either CN2-1 (RUN) or CN2-2 (DIR)

\*\*If thermal device recovery is set for automatic, the error will reset 1min after the temperature has reached operating range, and as long as no external input has been applied.

### Back EMF error

If card detects back EMF over 40V DC for 2sec or 60V DC for 0.1sec the motor will stop running and go into dynamic brake condition to slow the product down.

#### Automatic Recovery

- The roller will automatically restart 1sec after the voltage goes below 30V DC with a run signal active

#### Manual Recovery

- Can only be reset 1sec after the voltage goes below 30V DC
- To reset an error condition: Remove input signals; then reapply an input signal to either CN2-1 (RUN) or CN2-2 (DIR)

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## Speed Change Tables

Internal Control Rotary Switch	Surface Speed* ft/min ±5%		
	PM486FE-17 (3-stage)	PM486FE-60 (2-stage)	PM486FE-100 (1-stage)
9	55.4	196.8	433.6
8	50.5	180.4	433.6
7	43.6	155.8	433.6
6	41.3	147.6	433.6
5	36.7	131.2	433.6
4	27.6	98.4	350.3
3	18.4	65.6	233.5
2	13.8	49.2	175.2
1	9.2	32.8	116.8
0	6.9	24.6	87.6

External Control 0~10V DC	Surface Speed* ft/min ±5%		
	PM486FE-17 (3-stage)	PM486FE-60 (2-stage)	PM486FE-100 (1-stage)
9.6~9.9	55.4	196.8	433.6
9.1~9.4	50.5	180.4	433.6
8.6~8.9	48.2	172.2	433.6
8.1~8.4	45.9	164.0	433.6
7.6~7.9	43.6	155.8	433.6
7.1~7.4	41.3	147.6	433.6
6.6~6.9	36.7	131.2	433.6
6.1~6.4	34.4	123.0	433.6
5.6~5.9	32.1	114.8	408.7
5.1~5.4	29.8	106.6	379.5
4.6~4.9	27.6	98.4	350.3
4.1~4.4	25.3	90.2	321.1
3.6~3.9	23.0	82.0	291.9
3.1~3.4	20.7	73.8	262.7
2.6~2.9	18.4	65.6	233.5
2.1~2.4	16.1	57.4	204.3
1.6~1.9	13.8	49.2	175.2
1.1~1.4	11.5	41.0	146.0
0.6~0.9	9.2	32.8	116.8
0.1~0.4	6.9	24.6	87.6

- The listed speed steps are based on our 1.9" (48.6mm) diameter roller tube, FE motors, and 3 different gear stages. Shaded speeds represent no-load speeds. Any speed settings (for the corresponding gear stage) above the model's maximum speed will have no effect. Also, FS and FP models will operate slightly faster.

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# Troubleshooting

<b>Power Moller does not run</b>	
Power	<p>Check that the green LED 1 illuminated to indicate the card is receiving 24 V DC</p> <p>Check that the voltage to the card is stable 24V DC, see page 4</p> <p>Check the wiring to CN1 is properly wired and in the correct position, see page 3</p>
Run signal	<p>Check the run signal is properly wired and in the correct position of CN2-1, see page 3</p> <p>Check the signal injected into CN2-1 is the proper voltage: 0V for NPN or 24V for PNP</p> <p>Check if 0V DC is used for CN2-1 run signal that it is common to 0V DC in CN1-2, see page 3</p> <p>Check that the internal dip switch under the black plastic cover is set to the proper position: up for NPN (0V) and down for PNP (24V)</p>
Error	<p>Check the red LED 2 is illuminated or blinking; if so remove the cause of the error, see page 6. See also page 9 in troubleshooting "Error signal is frequently discharged"</p>
Power Moller	<p>Check that the Power Moller is properly inserted into the frame.</p> <p>Check that the end caps are not contacting the frame and that the motor side shaft has been secured by the applicable mounting bracket. If using an FS or FP type motors then both shafts, motor and spring loaded shaft, must also be secured by the applicable mounting bracket. Proper mounting is required for tube rotation.</p> <p>Check that the Power Moller's connector is properly inserted into the driver card.</p> <p>In belt applications check the belt tension is not too strong for the Power Moller type.</p> <p>When slaving idler rollers check that the number of idlers slaved is adequate for the Power Moller type being used.</p> <p>Check that the Power Moller's cable is in good condition, with no twisting or severe kinks in the cable that would indicate broken wires. Also check for any cuts in the power cable or wires near the connector.</p>

<b>Speed variation not achieved or speed is slower than expected</b>	
Power Moller	<p>Check the speed of the Power Moller to see if it is the correct model to achieve the speed variation or the speed expected</p>
SW1-2 Setting	<p>Check the dip switch SW1-2 is set properly for your speed adjustment, ON for external speed and OFF for internal speed, see page 5. If set for external speed and there is no voltage input to CN2 Power Moller will run at its slowest speed.</p>
External Speed	<p>Check when using external voltage to vary the speed that the 0V line is common with the 0V connected to CN1-2 or Power Moller will remain at its slowest speed.</p> <p>Check that the 24V DC power to the card is stable</p> <p>Check the analog voltage input is between 0V and 10V DC.</p>
CN2-3	<p>Check the wiring to CN2-3 is properly inserted in the correct position in the connector and the connector is properly inserted into the card. See page 3</p>

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<b>Reversing not achieved</b>	
CW / CCW Using external signal	If using 0V DC inserted into CN2-2 to change direction, check that the 0V DC is common to the 0V DC on CN1-2, see page 3 for wiring Check the wiring is properly connected and inserted into CN2-2 Check that the internal dip switch under the black plastic cover is set to the proper position: up for NPN (0V) and down for PNP (24V).
SW1-3 Using the dip switch on card	Direction will not change with a run signal active using the dip switch SW1-3. Only with an external signal will the direction change with the run signal active. Turn off the run signal first then select the direction from SW1-3.

<b>Error signal is not discharged</b>	
SW1-4	Check your dip switch setting for signal discharge during normal status or discharge only in error status. See page 5
Voltage	Check the external voltage is 24V DC or less and its 0V DC is common to the 0V DC input for CN1-2
CN2-4	Check the wiring to CN2-4 is properly made in the correct connector, see page 3
SW1-6	Check dip switch 1-6 is properly set for the output type you require, see page 5.

<b>Error signal is discharged frequently</b>	
Red LED2	If LED2 is illuminated or blinking this indicates an error which can be identified from the table on page 6 Check the wire gauge from the power supply is sufficiently large enough so there isn't a significant voltage drop causing a low voltage error Check the power supply is large enough with sufficient amperage, see page 4
Environment	Check that the Power Moller and CBM-105FN are used in an ambient temperature range between 32°F and 104°F Make sure the CBM-105FN's back plate is against a metal surface to maximize heat dissipation
Power Moller	Check that the roller is not contacting the frame and there is nothing caught between the roller and frame that would increase friction. Also check there is nothing caught in an O-ring drive band or belt drive that would increase the force on the roller. Check that the Power Moller's cable is properly inserted into the driver card Check that the Power Moller's cable is in good condition, with no twisting or severe kinks in the cable that would indicate broken wires. Also check for any cuts in the power cable or wires near the connector.



### Installation Precautions – IMPORTANT, PLEASE READ BEFORE INSTALLATION

Precaution	Action	Reason
<b>Power supply</b>	If the power supply is not sized appropriately for the number of cards/rollers it provides power to, then a low voltage condition may occur.	<ul style="list-style-type: none"> <li>• If the voltage drops below 15V DC and remains low for 1s, then the low voltage error will appear</li> <li>• If the voltage drops below 15V DC five times in 0.5s, then the low voltage error will appear</li> <li>• If the voltage drops below 15V DC less than five times in 0.5s or does not remain low for 1s, the roller may stutter – quickly turning off then on</li> </ul>
<b>Multiple power supplies</b>	0V line of the power supply for the card must be common to the 0V line of the power supply for the controls (RUN, DIR, etc.).	This completes the signal path from the controller (PLC, etc.) to the motor driver card.
<b>Voltage drop across the power bus</b>	Use suitable gauge wire in relation to distance and current draw to prevent voltage drop.  <u>Operating</u> DC voltage is 24V ±10%	When running long distances from a DC power supply, the voltage drop during motor operation across the power bus may be significant (may drop below 15V!). If there is a large enough drop in voltage, the roller(s) may behave in a strange manner. In order to prevent this, a larger gauge wire must be used.
<b>Grounding</b>	Ensure the control card is securely grounded to the conveyor frame. The conveyor frame should also be at the same potential reference as earth ground. Standard grounding practices should be followed.	Static discharge may interfere and damage internal components.
<b>Electrical</b>	24V DC ±10% 4A maximum current limiter (motor lock is 4A) Diode protection for mis-wiring Sensor power short circuit protection 5A fuse for power supply protection	Improper power will damage the card. The motor/card should not be subject to locked conditions repeatedly. Internal fuse is not replaceable. If the fuse has blown, more serious damage has occurred within the card/motor. If inputs are subjected to a low potential the card may see this as a signal, use of a diode inline is recommended to prevent this.
<b>Environment</b>	Ambient temperature is 32~104°F Ambient humidity is < 90%RH Atmosphere has no corrosive gas Vibration is < 0.5G Indoor use only	Extreme environmental variables may cause poor or no performance and damage the card.

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## Revision History

Revision Number	Change
12-0508	Initial document
12-0723	Added trouble shooting section
12-0810	Changed analog voltage inputs
12-1025	Spelling correction
13-0314	Added auto-sensing input diode recommendation
13-0513	Removed auto-sensing feature
14-1119	Added internal input type switch

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