



**DC Brushless Motor
Power Roller
Intelligent Control Card
User's Manual**

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CHAPTER I Overview

This user's manual is mainly to introduce the method of installation and related notices of DC Brushless Power Roller and Intelligent Control Card. Please study carefully before installation.

1-1 Safety Notice

1. Please follow the safety rule for installation.
2. Please place WWL products in the environment within temperature 0 ~ 40°C (32°F~104°F), humidity under 90% RH.
3. Please distant WWL products from dangerous environments (e.g. environments with exploding, inflammable, and corrosive gas, or much moisture)
4. Please do not move or examine WWL products while plugged in. Execute any checking and moving operation after unplugged.
5. For avoiding any possible injury and damage, please do not overload with power roller and control card.
- 6. Please ground the power of conveyor.**
- 7. For external PLC control system, please ensure the power supplies of control cards are all well-grounded.**
- 8. Please ensure the common modes (0V DC) of each card are well-connected.**
- ※ To avoid rollers slipped and damaged by axle loosing, WWL patent fixture MUST BE fastened with power rollers.**

CHAPTER II DC Brushless Motor Power Roller

2-1 Selection of Power Roller Models

Necessary tangent direction force Calculation: F (N)

$$F = 9.8\mu W$$

F : Necessary tangent direction force of power roller.

μ : Base friction coefficient of goods (please refer to Table 2)

W : Weight of goods in movement (kg)

Example:

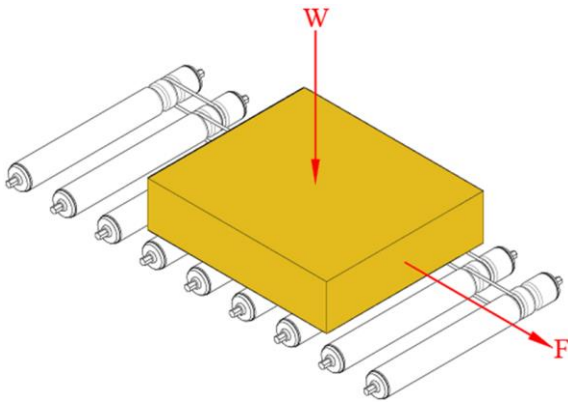
Weight of goods: 40kg

Material and size of goods:

Paper Box: 400x350x100mm

Roller Length: 400mm

Roller Pitch: 100mm



(1) Static Load weight calculation:

$$40\text{Kg} \div 4 \text{ rollers} = 10\text{Kg}$$

According to Table 1, load 10kg is fit to 400mm power roller.

(2) Calculation of F :

$$F = 9.8 \times \mu \times W$$

$$= 9.8 \times 0.1 \times 40 = 39.2\text{N}$$

(3) Calculation of quantity of power roller used:

Please refer to **2-2** data sheet to decide the quantity and specification of roller.

Table 1: Load Limit and Length of Roller

Roller	(mm)	300	400	500	600	700	800	900	1000
Length	(in)	11.811	15.748	19.685	23.622	27.559	31.496	35.433	39.37
Load	(Kg)	65	55	45	35	30	25	20	20
Limit	(N)	637.4	539.3	441.3	343.2	294.2	245.1	196.1	196.1

✧ Remark:

The maximum load should not exceed the static load limit as specified in the table.

If there is any impact on the load during transportation, the calculation of impact load will be varied according to the materials / weight of the products and the degree of impact; it is therefore necessary to keep the load weight within allowable limit.

Table 2: Base Friction Coefficient of Different Materials

Metal	Plastic	Wood	Paper Box	Rubber
0.01~0.02	0.02~0.04	0.02~0.05	0.05~0.1	0.2

2-2 Specification of Power Roller

Motor Type	Speed (M/min)	Tangential Force (N)		Torque (N.m)		Current(A)			Rated Output (W)
		Rated	Starting	Rated	Starting	Unloaded	Rated	Starting	
Standard DA-060	60	20.7	82.8	0.5	2.0	0.6	1.8	4.0	20
Standard Brake DB-060	60	20.7	82.8	0.5	2.0	0.6	1.8	4.0	20
High Torque DH-060	60	29	107.6	0.7	2.6	0.6	2.5	4.0	28
Low Speed DA-018	18	70.4	260.8	1.7	6.3	0.6	1.8	4.0	20
Low Speed Brake DB-018	18	70.4	260.8	1.7	6.3	0.6	1.8	4.0	20
High Speed DH-100	100	17.4	49.7	0.42	1.2	1.0	2.3	4.0	28

1N \approx 0.1kg 1N.m=10kgf.cm

2-3 Power Supply (24VDC)

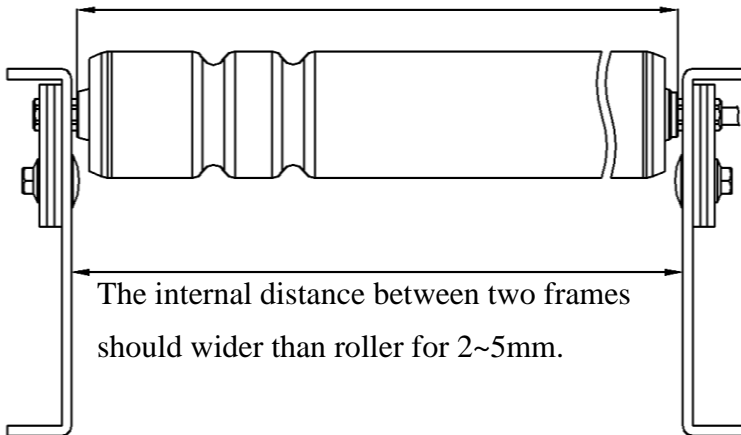
1. Switching power supply (Cable's Dia.: 28-14 AWG)
2. Rectifier filter (should include wave filter; ripple ratio should below 10%)

2-4 Notice of Installation

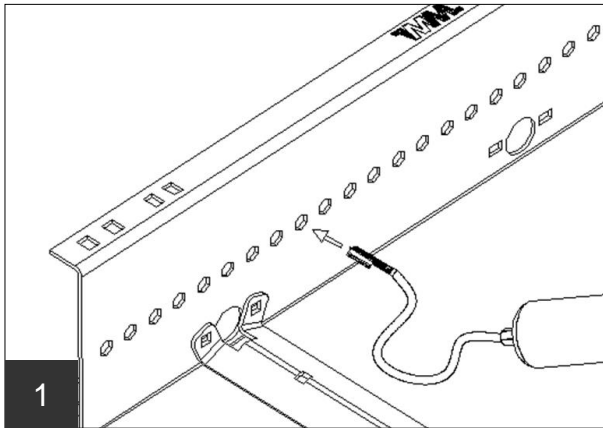
1. To avoid product's damage, please do not drag cable or install rollers by punching or knocking.
2. Please must use standard tool and WWL patent fixture to properly install rollers into the frame of conveyor.
3. When axle of roller idles, the error will be occurred, roller will be damaged, and conveyor will be forced to stop.

2-5 Installation

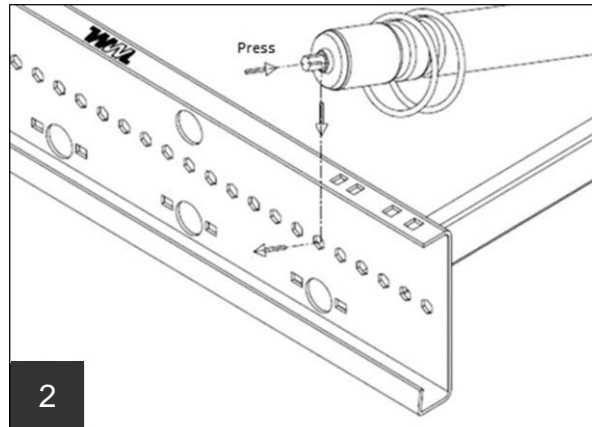
2-5-1 Illustration



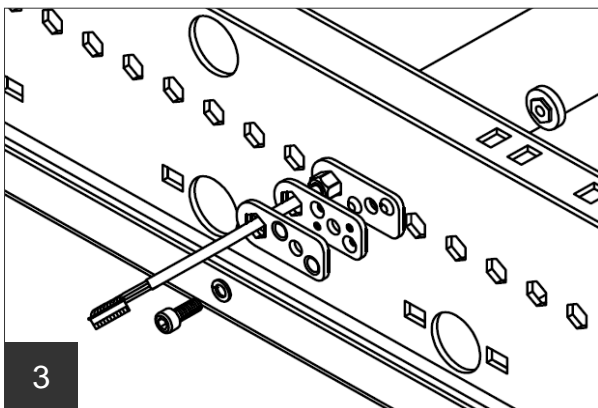
2-5-2 Steps of Installation



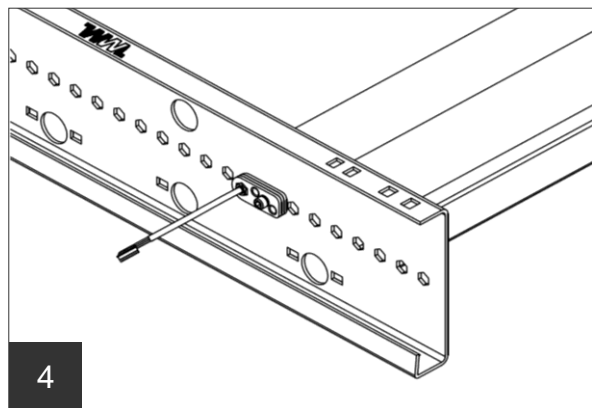
1. Insert the cable and axle of power roller into hexagonal hole on the frame of conveyor.



2. Put belts into the bearing (grooved) side; press the spring axle and insert axle into hexagonal hole on the other side of frame of conveyor.



3. Lock the patent fixture, washer, M6 screw in sequence, and fasten the nut on the corresponding hexagonal hole.

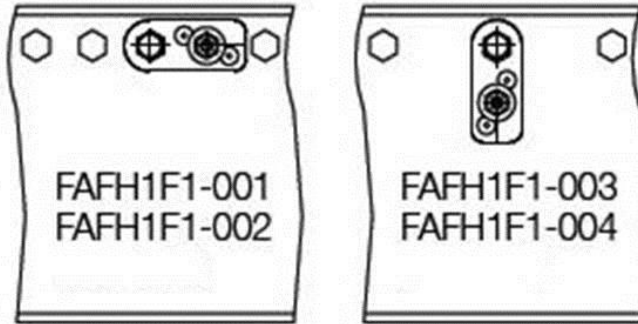


4. Please use proper tool to fasten the fixture by moment 12N.m~13N.m.

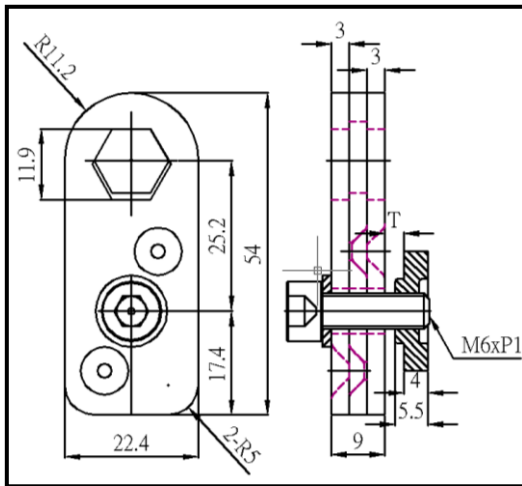
※ Please aware of the direction of fixtures, each piece should be fit with each other tightly.

2-6 Specification of Fixture

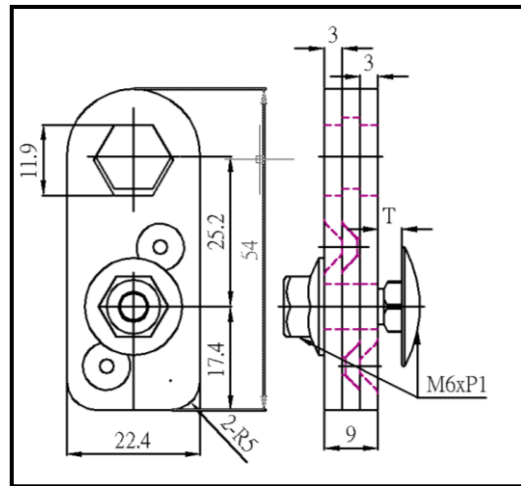
2-6-1 Installation of Fixture



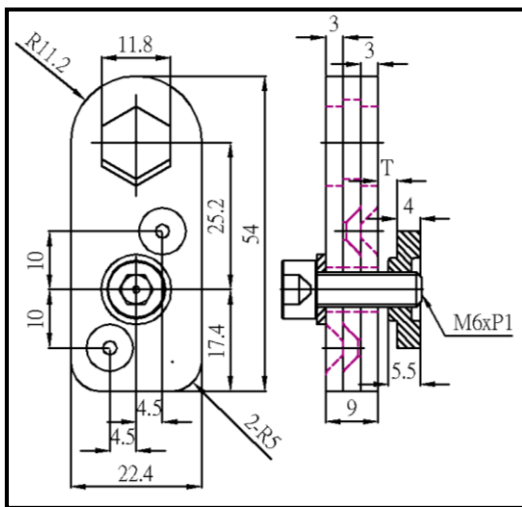
2-6-2 Specification of Fixture



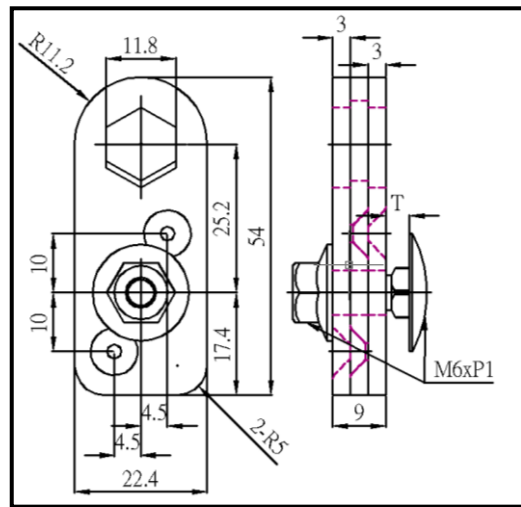
FAFH1F1001



FAFH1F1002



FAFH1F1003



FAFH1F1004

2-7 Notice of Utilization

1. Overload Protection

Once power roller is locked or overloaded for 4 seconds, for protecting the motor, control card will shut down the motor.

2. Overheat Protection

If the motor runs at critical electric current for a long period of time, the motor will become overheated. The overheat protection will shut down the motor. If above abnormal situation occurs frequently, the insulator will gradually become fragile and the durability of motor will be reduced.

3. Limit for Interval Operation

The shortest frequency for ON and OFF:

1.5 seconds for ON; 0.5 second for OFF.

4. Speed Difference in Continuous Movement:

If there is speed difference while conveying on the same line, the motor will be impacted (the impact degree will be based on the weight of products and speed). Therefore, please avoid rapid speed change; generally speaking, the change ratio less than 50% is acceptable.

5. Level of Roller Installation

Please use patent fixtures to complete the assembly of rollers. If roller's installation level is not satisfied or the base of the goods in movement is uneven, rollers will either idly or slantwise move the goods onward; especially for the goods that are possibly heavier than the allowed weight limit of roller, be sure to make the installation level smooth.

CHAPTER III Intelligent Control Card

Intelligent Control Card provides efficiency and smoothness for DC 24V Brushless Motor Power Roller with salient features and functions. Each zone consists of a bundle of free rollers and one power roller controlled by one control card in a conveying system. To form a large conveying system, control card connects in a card-to-card fashion via RJ45 connectors and CAT5 cables. The features are as below.

1. Built-in operation modes: Zero Pressure Accumulation (ZPA) and Master/Slave.
 - ZPA mode includes eight operation functions: Accumulation, SING (Singulation), SLUG (Train), Back-To-Back, Long Box Detection, Jam Timer Detection, and Run-Holding Timer.
 - Master/Slave is for load sharing in declined or inclined zone.
2. Up to 24 DIP switches for flexible application
 - Speed control source (Internal/External)
 - Timing of Jam timer and Run-Holding timer
 - Operation mode (ZPA/Master/Slave).
 - Release mode (SLUG/SING)
 - Card location setting (EOZ/INT)
 - I/O signal polarity (PNP/NPN)
 - Polarity, operation mode (Dark/Light) , and status (Health/Alarm) of eye sensor
 - Motion command (STOP/RUN)
 - Direction of rotation and its signal polarity
 - Acceleration/deceleration time
 - 16 segments speed control
 - Half speed control
 - Synchronization signal polarity
3. Protection
 - Card over-heat, low-voltage, over-current and short circuit protection.
 - Motor over-heat and anti-locked protection.
 - Photo eye sensor short circuit protection.
 - I/O pin short circuit protection.
4. Up to 100mA output capability for driving electromagnetic relay or PLC directly.

3-1 Specification

Card Type	CS1004
Rated Voltage	24V DC \pm 10%
Static Current	70mA
Peak Current	20A , 1mS
Current of Start	4A
LED Display	Display green light when power on, flash LED light for 7 kinds of abnormalities.
Operational Functions	a. With 100mA driving force, 4 sets of NPN/PNP output signals are able to drive external computer, relay, PLC or Remote I/O etc.
	b. Control motor speed either by using internal switch for 16 speed selection, or by using external DC 0~10V voltage.
	c. Speed up or slow down setting (0.2~15 seconds)
Power Protection	Built-in resettable fuse and anti-reversed connection
Thermal Protection	When temperature of control card is up to 75 °C/ 167 °F, the motor will be stopped; As soon as the temperature is down to 70°C/ 158 °F, the motor will be restarted automatically.
	The running will be stopped when the temperature inside the motor is over 100°C/ 212°F; Half-speed when it down to 95 °C/ 203°F; As soon as the temperature was downed to 194°F, the regular running continues.
Type of Brake	Electromagnetic Brake (Note 1)
Mechanical Brake (Built-in, for DB series only) (Note 2)	Duration of Brake: 200mS
	When motor starts within 100mS, the current will be 250mA; When it starts over 100mS, the current will be 125mA °
Environmental Conditions	Humidity: Under 90% RH (non-condensing)
	Temperature: 0°C~40°C (32°F~104°F)
	Vibration: Under 0.5G

Note 1: Electromagnetic brake: use reverse torque produced by the current of back EMF to brake.

Note 2: The mechanical braking feature is built-in at R48DB model, which can eliminate load inertia and enable precise stopping.

※Customized specifications are welcome, please contact us for details.

※Specifications are subject to change without prior notice.

3-2 Installation

- Four mounting holes are used to mount control card onto the base. **Figure 1** shows the location of four mounting holes and dimension of the card.
- Please follow **3-3 Safety Notice** before installation.
- The moment on screw is limited between 1.5 N.m to 1.9 N.m.

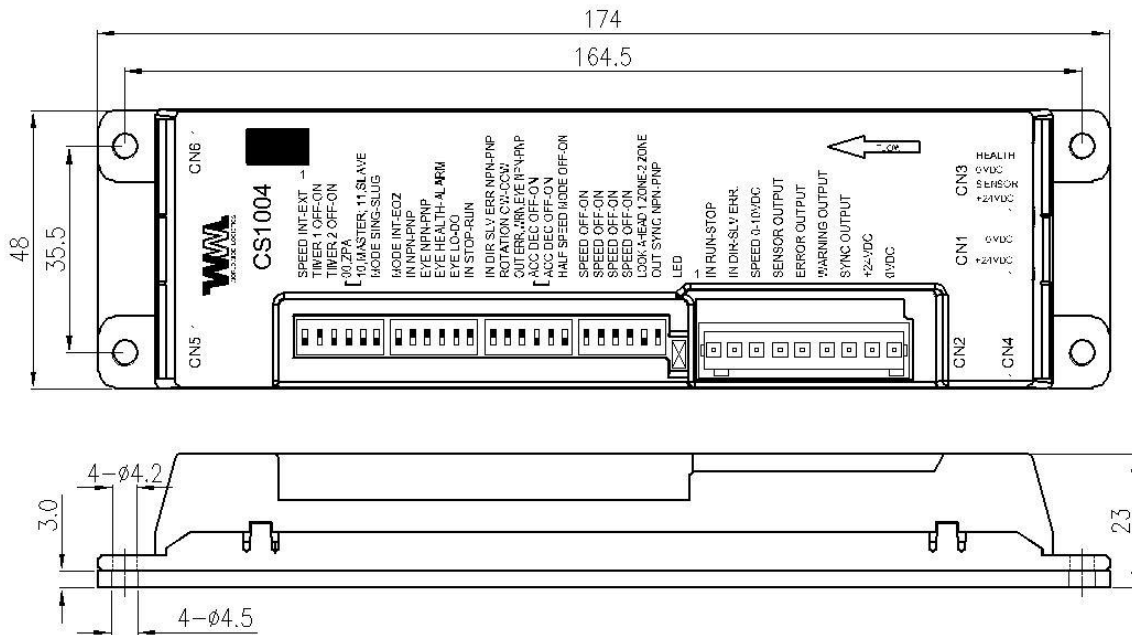


Figure 1: The Location of Four Mounting Holes (unit in “mm”)

3-3 Safety Notice

1. Only trained technician or maintenance person is allowed to perform troubleshooting and maintenance.
2. The power should be shut down before checking, plugging/unplugging connectors, or moving the conveyor.
3. Any improper installation or operation may cause personnel injury or card damage.
4. It is prohibited to disassemble or replace components on control card.
5. Please replace potentially damaged control cards; especially those have been dropped, suffered impact or collision.
6. The heat sink of control card and conveyor should be grounded for ESD and or surge-voltage protection.
7. To avoid electromagnetic interference, control card should keep away from power lines, signal sources, and other electromagnetic devices.
8. The printed circuit board (PCB) of control card is vulnerable to electrostatic discharges (ESD). Please do not touch the PCB unless precautions are followed to prevent ESD.
9. The control card cannot perform electromagnetic brake after power is shut down. Please choose the power roller with built-in brake for inclined or declined conveyor.
10. I/O signals will become indeterminate if control card is malfunctioned; it is suggested to deploy an additional signal-monitoring circuit to detect such failure should the user deem necessary.
11. The minimum responsive time for power or signal is 15 mS.
12. Please obey the local industrial waste law for discarding or recycling control card.

3-4 Definition of Connectors and DIP Switches

3-4-1 Connector

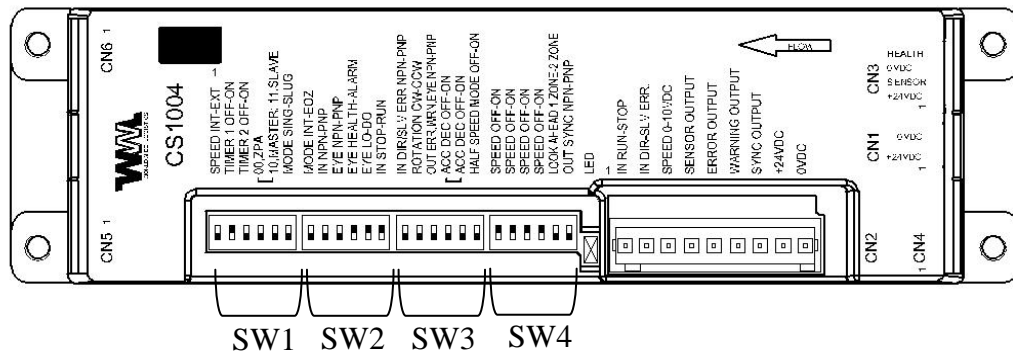


Figure 2: The Location of Connectors and DIP Switches

CN1 (24V DC Power Connector): 2-Pole WAGO 734-162 (Male)
Field Wiring - WAGO 734-102 (Female)

PIN #	DESCRIPTION	INPUT/OUTPUT	WIRE SIZE
CN1-1	+24V DC	INPUT	28-14 AWG
CN1-2	Common	INPUT	28-14 AWG

CN2 (Auxiliary I/O Connector): 9-Pole WAGO 734-239 (Male)
Field Wiring - WAGO 734-209 (Female)

PIN #	DESCRIPTION	INPUT/OUTPUT	POLARITY	WIRE SIZE
CN2-1	RUN/STOP Control	INPUT	NPN/PNP	28-14 AWG
CN2-2	Direction of Rotation or Slave error	INPUT	NPN/PNP	28-14 AWG
CN2-3	Analog Speed Command	INPUT	0~10V DC	28-14 AWG
CN2-4	Sensor Signal	OUTPUT	NPN/PNP	28-14 AWG
CN2-5	Error Signal	OUTPUT	NPN/PNP	28-14 AWG
CN2-6	Warning Signal	OUTPUT	NPN/PNP	28-14 AWG
CN2-7	Synchronization Signal	OUTPUT	NPN/PNP	28-14 AWG
CN2-8	24V DC	Power Supply	+24V DC	28-14 AWG
CN2-9	0V DC	Power Supply	0V	28-14 AWG

CN3 (Photo Eye Connector): 4-Pole WAGO 733-364 (Male)
Field Wiring - WAGO 733-104 (Female)

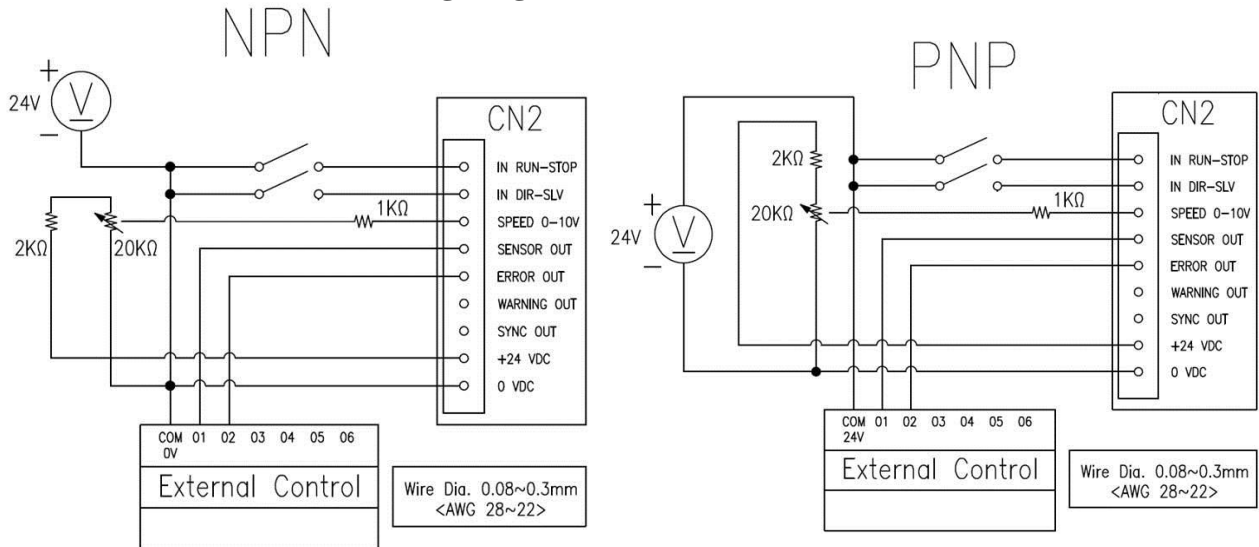
PIN #	DESCRIPTION	INPUT/OUTPUT	POLARITY	WIRE SIZE
CN3-1	24V DC	OUTPUT	24V DC	28-20 AWG
CN3-2	Sensor State	INPUT	NPN/PNP	28-20 AWG
CN3-3	0V DC	OUTPUT	0V	28-20 AWG
CN3-4	Health/Alarm Status	INPUT	NPN/PNP	28-20 AWG

CN4 (Upstream Handshake Connector): Ethernet RJ-45, Wire UTP, CAT 5

CN5 (Downstream Handshake Connector): Ethernet RJ-45, Wire UTP, CAT 5

CN6 (Motor Connector): JST S10B-XH-A

3-4-2 External Control Wiring Diagram



★Warning!!

The common modes (GND) of control card and external control system must be all grounded.

3-4-3 DIP Switches

SW1

SWITCH #	DESCRIPTION	ON STATE	OFF STATE	DEERROR
SW1-1	Speed Control	External (EXT) (Table IV)	Internal (INT)	OFF
SW1-2	Timer Setting	TABLE I		ON
SW1-3				OFF
SW1-4	Operation Mode	TABLE II		OFF
SW1-5				OFF
SW1-6	Release Mode	SLUG	SING	OFF

TABLE I: Timer Setting

SW1-2	SW1-3	Run-Holding Timer (Sec)	Jam Timer (Sec)	MODEL
OFF	OFF	-	-	-
OFF	ON	1	3	DH100
ON	OFF	6	4	DA060/DH018/DB060
ON	ON	8	5	DA018/DB018

TABLE II: Operation Mode

SW1-4	SW1-5	Operation Mode
OFF	OFF	ZPA
OFF	ON	-
ON	OFF	Master
ON	ON	Slave

SW2

SWITCH #	DESCRIPTION	ON	OFF	DEERROR
SW2-1	Card Location	EOZ	INT	OFF
SW2-2	External Input-Signal Polarity	PNP	NPN	OFF
SW2-3	Photo Eye Polarity	PNP	NPN	OFF
SW2-4	Photo Eye Status	Alarm	Health	ON
SW2-5	Photo Eye Operation Mode	Dark (DO)	Light (LO)	ON
SW2-6	Motion Command	RUN	STOP	ON

SW3

SWITCH #	Description	ON	OFF	DEERROR
SW3-1	Direction Signal Type	PNP	NPN	OFF
SW3-2	Direction of Rotation	CCW (Counter Clockwise)	CW (Clockwise)	OFF
SW3-3	Output Signal Type	PNP	NPN	OFF
SW3-4	Acceleration/Deceleration Time	TABLE III		OFF
SW3-5				OFF
SW3-6	Half-Speed Control	ON	OFF	OFF

TABLE III

SW3-4	SW3-5	MODE	Acceleration/Deceleration Timer Values (ms)
ON	ON	Normal	200
ON	OFF	Stable	240
OFF	ON	downslope	400
OFF	OFF	Unbalance Product (Tall box, liquid)	600

SW4

SWITCH #	DESCRIPTION	ON	OFF	DEERROR
SW4-1	16-Segment Speed Selection	TABLE IV		ON
SW4-2				ON
SW4-3				ON
SW4-4				ON
SW4-5	Half Speed Control	Two zones Ahead	One zone Ahead	OFF
SW4-6	Synchronization Output Signal Polarity	PNP	NPN	OFF

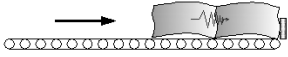
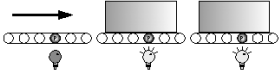
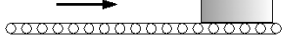
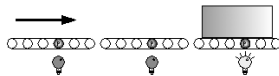
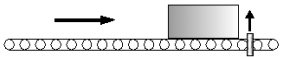
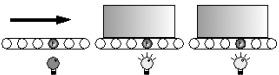
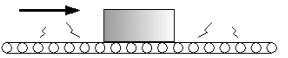
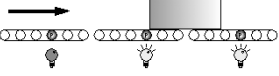
TABLE IV: 16-Segment Speed Selection

SW 4-1	SW 4-2	SW 4-3	SW 4-4	External Speed Control ($V \pm 0.2$)	DA018 DB018		DA060 DH060 DB060		DH100	
					m/min	ft/min	m/min	ft/min	m/min	ft/min
					$\pm 3\%$	$\pm 3\%$	$\pm 3\%$	$\pm 3\%$	$\pm 3\%$	$\pm 3\%$
OFF	OFF	OFF	OFF	-----	0.0	0.0	0.0	0.0	0.0	0.0
OFF	OFF	OFF	ON	2.55-2.95	5.7	18.7	20.0	65.6	45.7	150.0
OFF	OFF	ON	OFF	3.05-3.45	6.4	21.0	22.5	73.8	49.0	160.7
OFF	OFF	ON	ON	3.55-3.95	7.1	23.4	25.0	82.0	52.2	171.4
OFF	ON	OFF	OFF	4.05-4.45	7.8	25.7	27.5	90.2	55.5	182.1
OFF	ON	OFF	ON	4.55-4.95	8.6	28.1	30.0	98.4	58.8	192.9
OFF	ON	ON	OFF	5.05-5.45	9.3	30.4	32.5	106.6	62.1	203.6
OFF	ON	ON	ON	5.55-5.95	10.0	32.8	35.0	114.8	65.4	214.6
ON	OFF	OFF	OFF	6.05-6.45	10.7	35.1	37.5	123.0	68.6	225.0
ON	OFF	OFF	ON	6.55-6.95	11.4	37.4	40.0	131.2	71.8	235.7
ON	OFF	ON	OFF	7.05-7.45	12.8	42.1	45.0	147.6	75.1	246.4
ON	OFF	ON	ON	7.55-7.95	13.6	44.5	47.5	155.8	78.4	257.1
ON	ON	OFF	OFF	8.05-8.45	14.3	46.8	50.0	164.0	81.7	267.9
ON	ON	OFF	ON	8.55-8.95	15.0	49.2	52.5	172.2	84.9	278.6
ON	ON	ON	OFF	9.05-9.45	15.7	51.5	55.0	180.4	88.2	289.3
ON	ON	ON	ON	9.55-9.95	17.1	56.2	60.0	196.9	91.4	300.0

✧ If using CN2 external control, please set DIP switches SW 4-1, 4-2, 4-3, 4-4 into ON.

3-5 Features and Functions

ZPA (Zero Pressure Accumulation) mode, keeping products in distance and anti-accumulated while conveying, only drives power rollers while products passing the zone. This not only save power, but also reduce noise.

	Traditional Solution	ZPA Mode
Accumulation	Crushing happens often while products accumulate. 	Products accumulate without crushing. 
Power wasting	The whole conveyor running at the same time even with no products on. 	Only zones with products are running; power consumption efficiently reduced. 
Mechanism Simplifying	Using stopper to prevent the products moving forward. 	Products can be stopped automatically without crushing and stopper use. 
Noise	The whole conveyor running all the time even with no products on. 	Only zones with products are running; Substantially reduce noise. 

3-5-1 Operation Mode

Control card can perform three operation modes by setting SW1-4 and SW1-5

1. ZPA mode (SW1-4 for OFF, SW1-5 for ON)

When setting in this mode, INT zone act as independent normal ZPA logic without slave card linked together.

2. Master mode (SW1-4 for ON, SW1-5 for OFF)

- When setting in this mode, the zone has two motorized rollers to share the loading and the Master will command the logic of motion. Master and Slave must be under the same speed for balancing current and speed.
- Master card needs to be linked with both downstream and upstream zones by CN4 and CN5. Besides, Master CN2-7 needs to wire to Slave CN2-1 for roller synchronization and Master CN2-2 needs to wire to Slave CN2-5. Once Slave Error happened, it will inform Master to stop simultaneously. Be aware of different polarity of input signal (NPN/PNP).

3. Slave mode (SW1-4 for ON, SW1-5 for OFF)

The motion of Slave card follows Master card's movement. Slave needs to set SW2-6 to ON (RUN State) and choose the right input polarity.

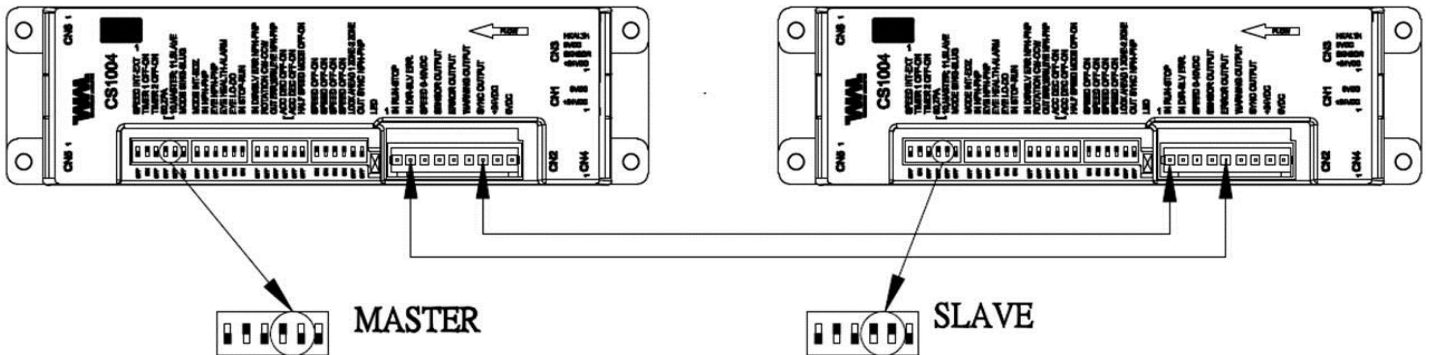


Figure 3 Setting Diagram for Mater & Slave Mode

3-5-2 Functions of Control Card

1. Motor Initialization

Once control card has switched on, initialization executes simultaneously. Even if zones are cleared, for completing the synchronization mode among each zone, motors will run until photo eyes are blocked or initialization timer is over (4 seconds).

2. Motor Speed Control (SW1-1, SW4-1, SW4-2, SW4-3, SW4-4, CN2-3)

DIP switch SW1-1 controls the speed of motorized roller in two methods:

- Set SW1-1 to OFF (INT- internal) to allow the speed of the roller to be controlled by SW4-1, SW4-2, SW4-3 and SW4-4 with 16 segments of speed.
- Set SW1-1 to ON (EXT- external) to allow the speed of the roller to be controlled by the 0-10V DC remote input on CN2-3.

3. Release Modes (SW1-4, SW1-5, SW1-6)

ZPA has two release modes, SING and SLUG. SING and SLUG mode will be applicable when the card is set to ZPA (SW1-4 is OFF and SW1-5 is OFF).

- Set SW1-6 to OFF, the zone will be in SING release mode. The zone won't release product until the downstream photo eye becomes clear.
- Set SW1-6 to ON, the zone will be in SLUG release mode. The zone won't release product until the downstream motor start running.
- Verify that the downstream motor is not in a Error or jam state before the zone release product to the downstream zone.

4. Card Location (SW2-1)

While in a ZPA mode, a zone can either be a normal zone or end zone. INT stands for an intermediate or normal zone. EOZ stands for End of Zone.

- a. Set SW2-1 to OFF, the zone of card location will be in INT. Most of the zones are intermediate (INT) zones.
- b. Set SW2-1 to ON, the zone of card location will be in EOZ. If a zone is the last zone, and the last part of conveyor, where there is nowhere for product in this zone to release to, then it would become EOZ.
- c. The only other time you would want to set a zone to EOZ is to force product to stay in a zone. Through an external control to force the zone to release by setting SW2-6 to RUN, and put a RUN signal on CN2-1, would cause the motor to run and release product out of the zone. If a discharge handshake is used, do not set the zone to EOZ.
- d. Once a zone is set to EOZ, the motor of the zone will not initialize as long as the power restarts.

5. Motion Command (SW2-6, CN2-1)

The motor can be forced to run or to stop.

- a. Set SW2-6 to OFF to force motor to stop (accumulation). The zone will not release product to the next zone until the signal on CN2-1 is removed.
- b. Set SW2-6 to ON to force motor to run. If the signal is presented through CN2-1, the motor will run, and jam holding timer will be overrode.

6. Input Signal Polarity (SW2-2)

The input signals on the auxiliary I/O connector (CN2) are 24VDC control signals and can be either NPN (sinking) or PNP (sourcing).

- a. Set SW2-2 to OFF in NPN signal mode. The input state will be true (active) when 0V is applied to CN2 and false (inactive) when 24V is applied.
- b. Set SW2-2 to ON in PNP signal mode. The input state will be true (active) when 24V is applied to CN2 and false (inactive) when 0V is applied.
- c. Input signals:
 - CN2-1 – External Control (Force to stop/run)
 - CN2-2 – External Control or Control Card breakdown

7. Photo Eye Input configuration (SW2-3, SW2-4, SW2-5)

Photo eye can be flexibly installed by the difference of polarity, utilization, and methods of detection. Regarding to the perfect way of operation, please refer to table V.

- a. Setting SW2-3 to OFF, NPN type of sensor will be applicable; Setting SW2-3 to ON, PNP type of sensor will be applicable.

- b. Setting SW2-4 to OFF, self-detected type of sensor will be applicable combining CN3-4 lead as feedback; Setting SW2-4 to ON, three-phase sensor will be applicable.
- c. Setting SW2-5 to OFF, sensor for (LO) will be applicable (photo eye is cleared); Setting SW2-5 to ON, sensor for (DO) will be applicable (photo eye is blocked).
- d. Setting SW2-4 to OFF, warning output on CN2-6 will occur and send to downstream zone.

TABLE V: Photo Eye State

SW2-3	SW2-5	CN3-2	CN3-2
OFF (NPN)	LO (Light Operation)	0V DC	24V DC
OFF (NPN)	DO (Dark Operation)	Cleared	Blocked
ON (PNP)	LO (Light Operation)	Blocked	Cleared
ON (PNP)	DO (Dark Operation)	Blocked	Cleared

NOTE 1: TABLE V assumes the photo eye is retro-reflective. If the eye is a diffused type photo eye, please switch SW2-5 to opposite position.

NOTE 2: If CN3-4 is not connected, SW2-4 must be set to ALARM to avoid false warning signal on the Control card.

8. Half Speed Control (SW3-4, SW3-5, SW3-6, SW4-5)

When SW3-4, SW3-5, and SW3-6 are set to ON, it will enable half speed to be functioned. This feature is useful for High-speed running or on a declined style conveyor.

- a. Set SW4-5 to OFF (One zone ahead), it will detect if the next downstream zone is blocked (accumulated) and Control card will react to run the motor in half speed.
- b. Set SW4-5 to ON (Two zone ahead) for detecting that if the next or the next two downstream zones are blocked (accumulated) and control card will react to run the motor in half speed.

9. Direction of Rotation (SW3-1, SW3-2, CN2-2)

The control of direction a power roller runs can be controlled locally and externally CN2-2 (Not in Master mode). Yet, external control of direction rotation is not applied for Master Mode, because CN2-2 will turn to be alarm I/O signal in Slave Mode.

- a. By setting SW3-2 to OFF (CW), SW3-1 to OFF (NPN) and CN2-2 is 24V, the motor direction will be CW. If change CN2-2 24V to 0V, it will reverse direction to be CCW.
- b. By setting SW3-2 to ON (CCW), SW3-1 to OFF (NPN) and CN2-2 24V, the motor direction will be CCW. If change CN2-2 24V to 0V, it will reverse direction to be CW. By setting SW3-2 to OFF (CW), SW3-1 to ON (PNP) and CN2-2 24V, motor direction will be CCW. If change CN2-2 24V to 0V, it will reverse direction to be CW.

- c. By setting SW3-2 to ON (CCW), SW3-1 to ON (PNP) and CN2-2 24V, the motor direction will be CW. If change CN2-2 24V to 0V, it will reverse direction to be CCW.

10. Output Signal

The output signals on the auxiliary I/O connector (CN2) are 24V DC 100mA.

These output signals are:

- CN2-4 – Output Sensor: Blocked = active = TRUE
Cleared = inactive = FALSE
- CN2-5 – Output Error: Output is active or TRUE when control card has error.
- CN2-6 – Output Warning: Output is active or TRUE when the control card has a health/alarm condition.
- CN2-7 – Synchronization Signal: Motor running = active
Motor stop = inactive

3-5-3 Standard Conveyor Configurations

Figure 4 gives a pictorial example of Control card conveying system configuration, which includes:

- Normal infeed Zone: First zone in a line
- Normal intermediate Zone: with both zones upstream and downstream
- Normal Discharge Zone: Last zone in a line

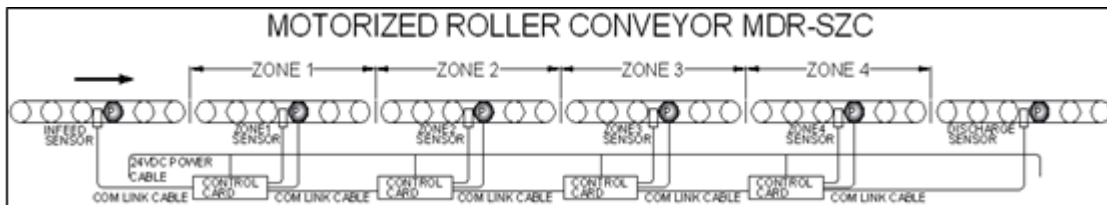


Figure 4: Conveying System Configuration

1. Accumulation:

- a. When the infeed photo eye is blocked as a product passing by the photo eye, the control card starts the power roller once the downstream zone is cleared.
- b. When the ZONE 1 photo eye is blocked by the product, the control card drives the zone to continue to run if the ZONE 2 photo eye is clear.
- c. This sequence cascades downstream until conveyor is full, as indicated by the Discharge sensor being blocked.

2. Release mode:

Release (De-accumulation) mode has two selections: SING or SLUG.

- a. SING: When sensor in discharge zone is cleared and ZONE 4 sensor is blocked, motors in ZONE 4 will convey the products forward to the discharge zone. The upstream zones will move products forward in sequence.

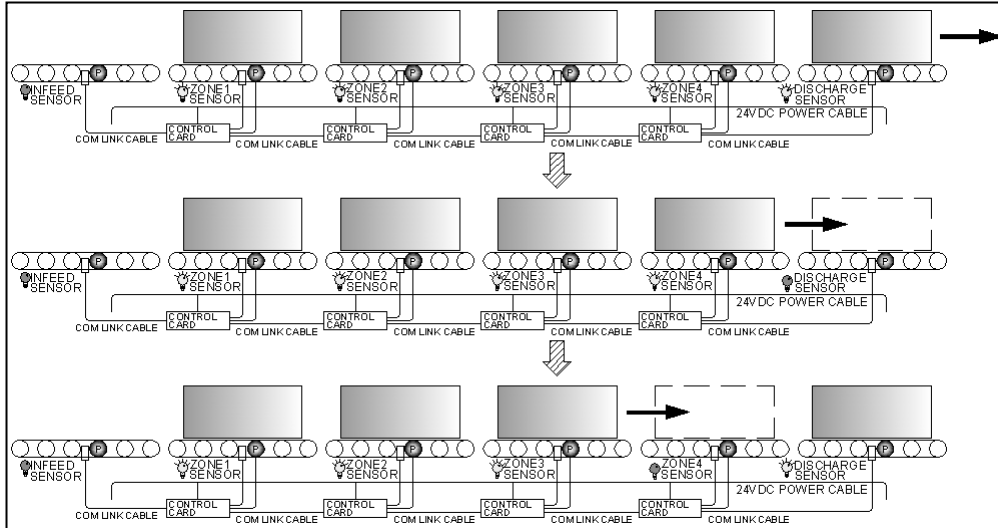


Figure 5: SING Conveying Mode

- b. SLUG: When the Discharge sensor is cleared and all the zone are set to SLUG, all the motors will be started simultaneously and continue to run until the discharge sensor is blocked beyond the jam timer.

※SLUG is not applicable for high-speed motor.

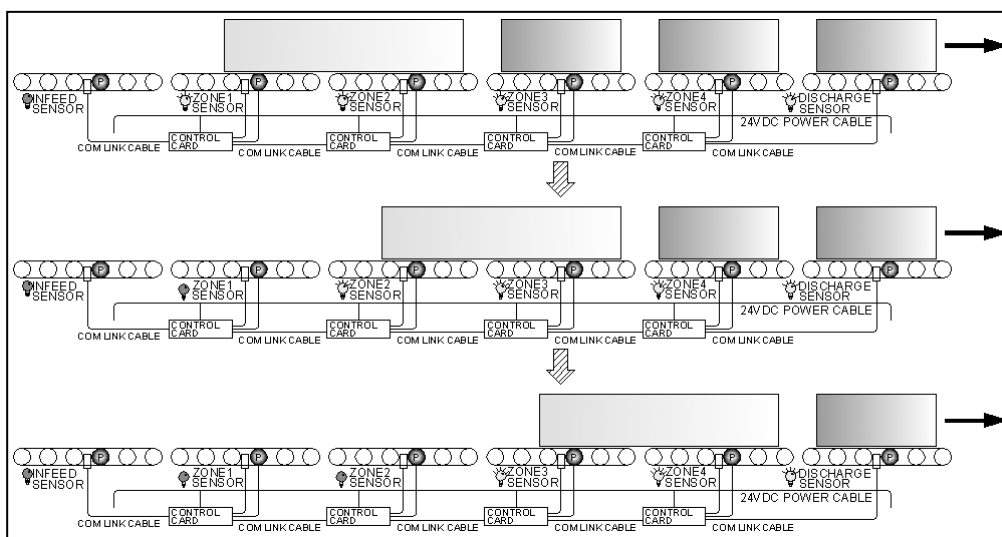


Figure 6: SLUG Conveying Mode

3. Long Box Detection

Normally, the dimension of products couldn't go beyond the length of a zone (Included reserved space for braking). Long box here means the length of products is longer than a zone's and the distance of two zones' sensors, yet less than the length of two zones (Included reserved space for braking). Long box blocks 2 zone photo eyes, and two power rollers run synchronously. (Please refer to figure 7)

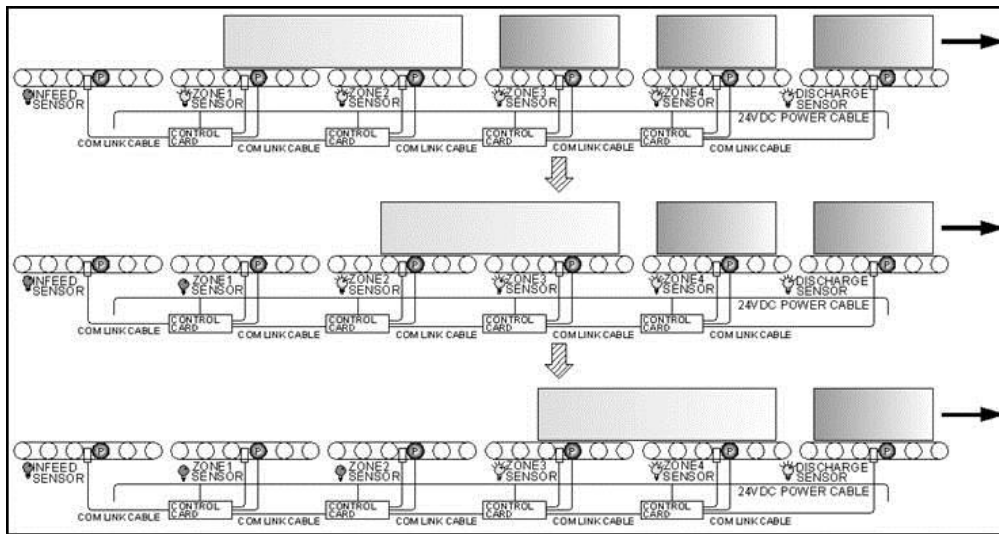


Figure 7: Long Box Detection Mode

4. Back To Back Detection

When infeed products are too close, the control card will part the products in downstream zone and temporarily stop products in upstream zone, until the product left and unblocked the sensor in downstream zone.

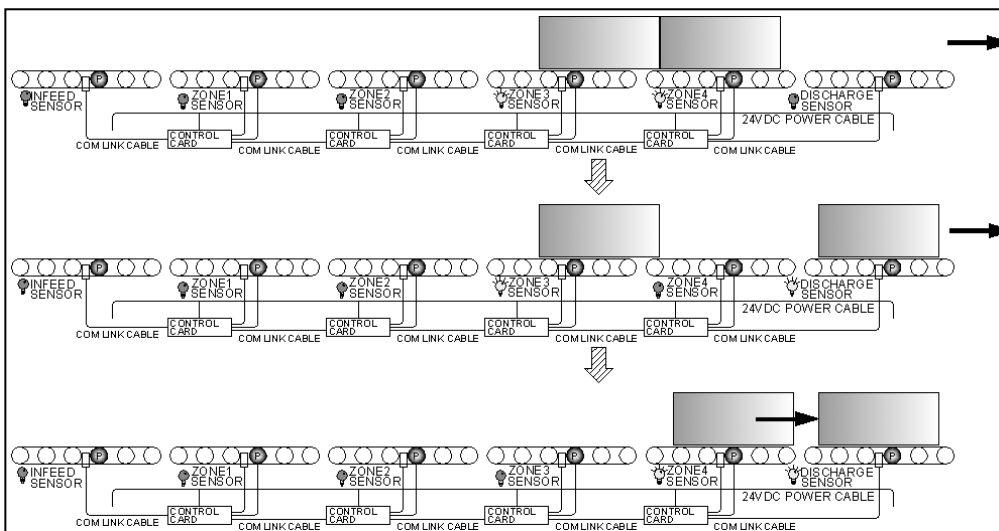


Figure 8: Back To Back Conveying Mode

5. Jam Timer Detection

When photo eye is blocked (please refer to table 1 on P12), control card will shut down the motor, turn the error output, and blink LED twice. As soon as the jam is obviated, the running continues, the error output and LED Error state will be removed.

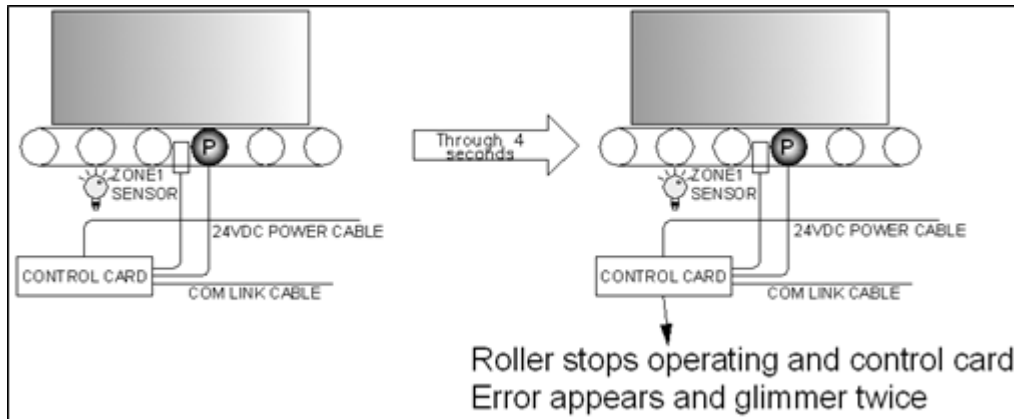


Figure 10: Jam Timer Detection Conveying Mode

3-5-4 Motor and Card Errors Protection

There are several motor protections built in the control card to keep durability and safety of motorized roller.

1. Locked Rotor or Over-Current Protection

If the card detects the motor locked for more than 4 seconds; or the motor current is above 4A and last 4 seconds, the over-current Error will activate, and motor will be stopped. Control card will attempt to restart the motor every ten seconds after the Error is detected, turn on the error output, as well as blink the LED 5 times. Once the locked rotor condition is removed or the motor current is less than 4A, the motorized roller will be commanded to run in full speed, in the meantime remove the error output and the LED Error state.

2. Motor Thermal Protection

When control card detects the internal temperature of power roller is above 100°C/ 212°F, the card will stop the power roller, turn on the error output, and blink the LED 4 times. Then it will wait until the roller has cooled down to 95°C/ 203°F and begin to run power roller in half speed, turn on the error output, and blink the LED. Once the motor has cooled down to 90°C/ 194°F, control card will drive the motorized roller at full speed, remove the error output and the LED Error state.

3. Card Thermal Protection

Four seconds after the card has detected its inner temperature is above 75°C/ 167°F, the card will shut down the motor, turn on the error output, and blink the LED 3 times. Once the temperature is cooling down to 70°C/ 158°F, the card will restart the motor, remove the error output and the LED Error state.

4. Low Voltage Detection

If control card detects power voltage is below 21.5V DC, low voltage detection will activate. The motor will shut off and LED will blink six times. If the low voltage Error condition exists, and the voltage rises above 21.5VDC, the card will automatically clear the Error and proceed normal operation.

5. CN6 Connector Error Detection

When control card detects CN6 misconnection or short circuit, it will output the Error signal and blink LED 4 times.

CHAPTER IV Error Alarm & Trouble Shooting

4-1 Error Alarm

LED Alarm	Description	Solution
Solid	Well-functioned	
Blink once	Warning Present Photo eye has marginal gain	<ol style="list-style-type: none"> 1. Check if the reflective board is unclean? 2. Check if photo eye reflection beam is shifted? 3. Check if the strength of photo eye detection setting is low. (SW-4)
Blink twice	Zone jam error	<ol style="list-style-type: none"> 1. Remove jammed products. 2. Check the input setting of photo eye.
Blink 3 times	Card thermal error	<ol style="list-style-type: none"> 1. Check the environmental condition. 2. Check if the motor is stocked or overloaded? 3. Check if the products are overloaded. 4. The maximum temperature of control card is 75°C/ 167°F. When the temperature is above 75°C/ 167°F, motor will stop until the temperature is below 70°C/ 158°F.
Blink 4 times	<ul style="list-style-type: none"> • Motor thermal error • Irregular CN6 connection 	<ol style="list-style-type: none"> 1. Motor will be shut down as the internal heat of motor is above 100°C/ 212°F; run in half speed as cooling down to 95°C/ 203°F; Running normally until the temperature has down to 90°C/ 194°F. 2. Check if the connector of motor is unfastened.
Blink 5 times	Motor locked rotor error or over-current	<ol style="list-style-type: none"> 1. Remove the products. 2. Check if the motor is locked or overloaded.
Blink 6 times	Low voltage (< 21.5VDC)	<ol style="list-style-type: none"> 1. Check if the voltage is excessively low. (< 21.5V) 2. Check if the power supply is overloaded.
Blink 7 times	Abnormal slave card	Check if the slave control card is abnormal.

4-2 Trouble Shooting

SITUATION	ACTION
Power Roller is not able to start or rotate.	<ol style="list-style-type: none"> 1. Check if the power is applied. 2. Check if the voltage of power is $24V \pm 10\%$ 3. Check if the re-settable fuse is blown. 4. Check if the setting of SW2-6 (Motion Command) is correct. 5. Check if the input signal of CN2-1 (RUN/STOP Control) is correct. 6. Check if the power roller is damaged. 7. Check if the power roller is over-loaded.
Power roller is able to rotate, but cannot control speed.	<ol style="list-style-type: none"> 1. Check if the setting of SW1-1 (Speed Control) is internal or external. 2. Check if the MODEL setting of SW1-2 and SW1-3 (Timer Setting) is correct. 3. Check if the input voltage 0~10V of CN2-3 (Remote Speed Control) is correct.
Power roller is able to rotate but cannot change direction. (Direction control should be switched while power roller is stopped.)	<ol style="list-style-type: none"> 1. Check if the setting of SW3-1 (IN DIR/ SLV ERR NPN-PNP) is correct. 2. Check if the setting of SW3-2 (ROTATION CW-CCW) is correct. 3. Check if the input signal of CN2-2 (IN DIR-SLV ERR) is correct.
Output signal is abnormal	<ol style="list-style-type: none"> 1. Check if the setting of SW3-3 (OUT ERR, WRN, EYE NPN-PNP) is correct. 2. Check if the setting of SW4-6 (OUT SYNC NPN-PNP) is correct. 3. Check if the current output is larger than 100mA.

※Please operate above actions while power roller has stopped.



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