POWER MOLLER®24!

HBK-608FP／FN　Handling Instructions

Thank you for purchasing ITOH DENKI MDR products. Please, review this document and be familiar with the product, safety, and caution information before operating this product. Keep this information readily accessible for future reference.

Applicable Power Moller models

- PM570KT , PM605KT , PM635KT , PM486/500FH

＊12pin Motor connector only.

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【Standard accessories】

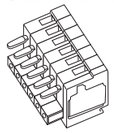
Make sure the following accessories are enclosed upon opening the pakage.

- ●HBK card　× 1
- ●Mounting screws and nuts
  - Screw　M4×15 —— × 2
  - Nut　M4 —— × 2
- ●Power connector　× 1
- ●Sensor connector　× 2

【Option】

●Communication cable

●Control connector



1. Safety Instructions

— General —

- Switch off the power before wiring, performing maintenance, or removing the unit from the conveyor, to avoid the risk of electrical shock or injury.
- Follow the local/national electrical codes and regulations (labor, safety, sanitary, electrical, etc.) where the product is installed.
- Operate this product within its intended design parameters and operating specifications to avoid the risk of electrical shock, injury, or fire.
- Do not disassemble, repair, or modify this product to avoid the risk of electrical shock or injury, damage to the product, and voiding the warranty.
- Use an external control device/circuit when connecting to this product's input or output signals for important connections or control. In the event of a product failure, the inputs or outputs may remain active and need to be bypassed.
- Do not wire a connector while it is attached to the product. Make sure all the wires are properly seated within the connector.
- Be careful not to drop the product or expose it to impact or pressure as damage may result.
- Make sure the surface to which the product is mounted is properly grounded.
- Be careful not to have switching devices (relays, contactors, etc.), which may generate or induce noise, within close proximity of this product, its power line, or its signal lines.
- Make sure power or input signals are active/steady for more than 15ms to ensure proper operation.
- The dynamic brake function is only operational while the product is powered.
- Do not remove any connections to the product while it is in operation. This may
- damage the product or shorten its lifetime.
  Do not shut off power while the motor is in operation. This may damage the
- product or shorten its lifetime.
  Do not stand on conveyor while power is ON to avoid the risk of product failure,
- electrical shock, or injury.
  Do not turn power on while conveyed products are not properly positioned or
- supported to avoid the risk of product failure or injury.
  Do not physically force the MDR to rotate. This may damage the product or
- shorten its lifetime.
  In case of external controller has pull-up or pull-down register at output line, unexpected behavior may be occurred.

ITOH DENKI

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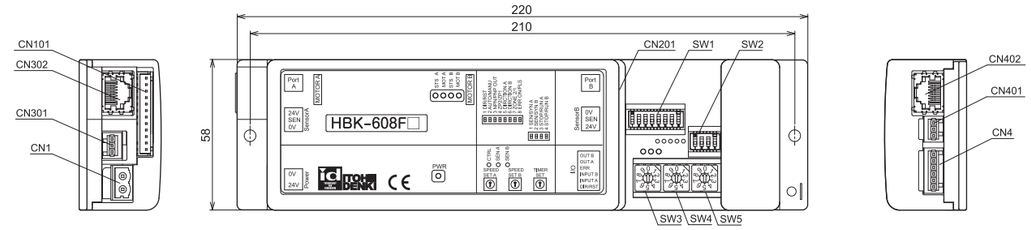
2. Power

- 24 VDC battery (24 V DC / 15A)
- Switching power (24 V DC / 15 A) or smoothed and rectified power
- Smoothed and rectified power (≦ 10% ripple)
  ＊ Use a stable power supply, 15A or greater. The power supply must be able to handle 30A peak for 1ms.
- Sensor connection power is limited to 35mA, maximum. Use a sensor that requires less than 35mA for proper operation.

3. Before Operating of Product

3 - 1　Dimensions

Refer 7. Specification for each connector's model.



■CN1：Power connector

CN1	No.	Function
2 1	1	24VDC
	2	0VDC

・Wire 24VDC and 0VDC to the power connector CN1 (2P).

■CN101、CN201：Motor connector

CN101,CN201
1 12

・12pin Power Moller only available.

■CN4：Control connector

CN4	No.	Function
1 6	1	DIR/ERROR reset
	2	Motor A forcible RUN/STOP
	3	Motor B forcible RUN/STOP
	4	Error output
	5	Motor A synchronization / sensor output
	6	Motor B synchronization / sensor output

・Control connector (wiring side) is optional.

■CN301、CN401：Sensor connector

CN301 , CN401	No.	Function
1 3	1	24VDC
	2	Sensor input
	3	0VDC

＊Sensor input type (NPN/PNP) can be selected to match the sensor signal
Note: Sensor input type will be the same for both CN301 and CN401
＊Sensor connection power is limited to 35mA, maximum. Use a sensor that requires less than 35mA for proper operation.

■CN302、CN402：Communication connector

CN302 , CN402	No.	Function
1 8	1	Sensor status
	2	Sensor status
	3	0VDC
	4	Error reset
	5	Motor status
	6	Motor status
	7	Error status
	8	Error status

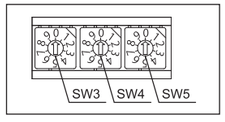
＊ Communication cable (wiring side) is optional.

■SW1、SW2：Dip switch

	SW	No.	Function	ON	OFF	Factory setting
	SW1	1	Selects direction signal or error reset input	Error reset	Direction	OFF
		2	Selects error recovery	Manual	Automatic	ON
		3	Selects PNP or NPN output	PNP	NPN	ON for HBK-608FP OFF for HBK-608FN
		4	Selects ZPA release mode	Slug (Train)	Singulated	OFF
		5	Motor A direction	Based on MDR.		ON
		6	Motor B direction			ON
		7	Selects MDR connections	1 MDR on this driver card	2 MDRs on this driver card	OFF
		8	Selects error output function	Pulse out	Discharged when error	OFF
	SW2	1	Selects Sensor A or Motor A synchronization signal	Synchronization signal output	Sensor signal output	ON
		2	Selects Sensor B or Motor B synchronization signal	Synchronization signal output	Sensor signal output	ON
		3	Selects Motor A input function	Forcible RUN	Forcible STOP	ON
		4	Selects Motor B input function	Forcible RUN	Forcible STOP	ON

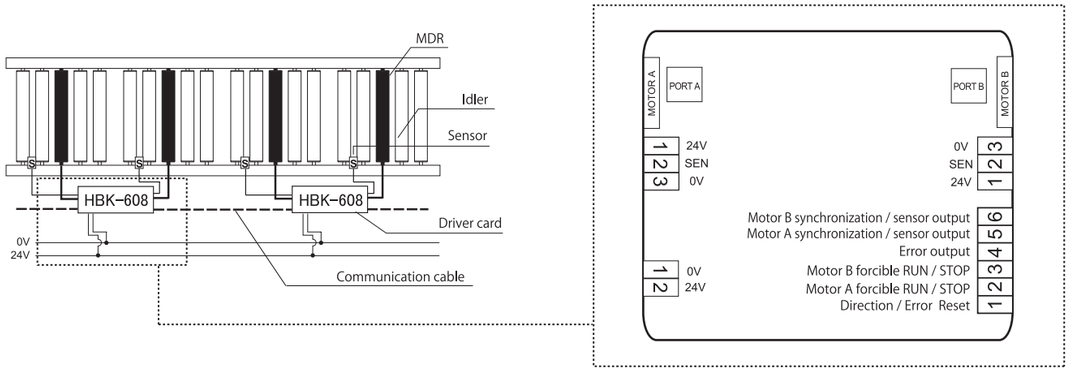
Note: When SW1 #7 is ON, SW2 #3 and #4 have different functions (Refer to 4-2)

■SW3、SW4、SW5：Rotary switch



・SW3 ・・・ 10 step speed variation fo Motor A
・SW4 ・・・ 10 step speed variation fo Motor B
・SW5 ・・・ 10 step timer setting

3 - 2 Wiring



3 - 3 Control connector

#1 Direction /Error reset

- Direction signal; Change direction of Zero Pressure Accumulation(ZPA)
  ON; Left to Right
  OFF; Right to Left
- Error reset; Input for error recovery signal.
  Transmits the signal to the adjacent driver cards (not in CB mode)
  Select function by SW1 #1 (Error reset / Direction)
  When Direction / Error reset signal is input to multiple cards, timing of these input should be injected at the same time.

#2 Motor A Forcible RUN / STOP
#3 Motor B Forcible RUN / STOP

- Forcible RUN: While the signal is ON, it forces the present zone to RUN, unless there is an error condition. After the signal is turned OFF, the MDR will continue to run for the duration of the RUN-HOLD TIMER.
- Forcible STOP: While the signal is ON, it prevents an article from advancing downstream once the present zone becomes occupied.
- "READY TO RECEIVE" Signal:
  While the signal is ON, it allows a product to discharge from the present/last zone. When there is no communication cable connected to a downstream driver card, the last zone is automatically set to prevent product release. This signal is applicable when discharging product onto another conveyor or piece of equipment.

#4 Error out

- Discharge in error condition.
- Selectable PNP or NPN output by SW1 #3. ON; PNP / OFF; NPN
- Selectable error discharged type by SW1 #8 ON; Pulse / OFF; Steady voltage

● Pulse out

Priority	Error type	Period
1	Low voltage error	40msec
2	Motor unplugged error	60msec
3	Motor lock error	80msec
4	Thermal overload on PCB	100msec
5	Thermal overload in MDR	120msec
6	Back EMF error	140msec
7	JAM error	160msec

＊ Refer 6-1 Error status and reset error.

#5 Motor A synchronization / Sensor output
#6 Motor B synchronization / Sensor output

- Synchronization output; Output is active while internal motor RUN signal is ON
- Sensor output; Output is active while sensor (CN301 for motor A or CN401 for motor B)
- Selectable PNP or NPN output by SW1 #3

4. Operational Instructions

4 - 1 General Settings and Wiring

① Make sure the power is turned off before wiring the driver card. Pay careful attention to the connector pin assignment.
② Set the desired operation from the DIP switches SW1 and SW2
③ The most upstream zone will run when the zone's sensor is blocked or a Forcible RUN input signal is active.

- Motor operation (RUN/STOP) must not be controlled by turning the power on and off.
- 0V DC of connected driver cards and connected controls must be common.
- Input connections on CN4 draw a maximum of 7.3mA

Before operating this product

- Make sure the MDR is installed properly following its user manual
- Make sure to use the proper mounting hardware for the MDR
- Make sure that all wiring (power, signal, etc.) matches the intended connection
- Make sure that the driver card is installed properly and within the specified environment
- Make sure that the power supply meets or exceeds the power requirements
  Switching power (24 V DC / 15 A) or smoothed and rectified power
  Smoothed and rectified power (≦ 10% ripple)
  ＊Use stable power supply with 15 A or over. The power supply should not be affected by peak current 30 A for 1 msec.

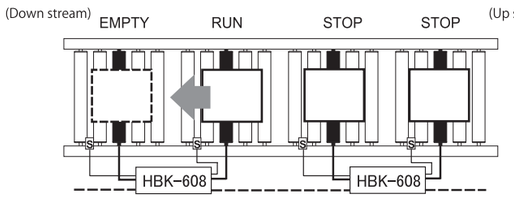
4 - 2 Conveyor zone configuration

- Select by SW1 to SW5

ZPA mode (Singulated Release)

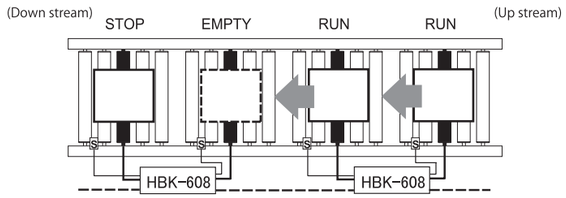
① Singulated Release

- The product will always stop in the last zone of the driver card when there is no communication connection to, or no ready-to-receive signal from, a downstream driver card or piece of equipment.
- The product will always stop in the zone before a zone with an error.
- Transfers product as long as downstream is running.



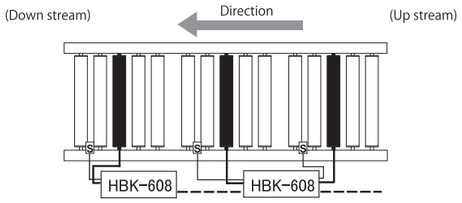
② Slug (Train)

- Transfer product when downstream zone is not stopped with product.
- SW1 #4; ON
- If communication cable is not connected to adjacent driver card of downstream zone side, the driver card automatically detect as zone end and MDR will be stopped when sensor is blocked.
- If error is occurred on adjacent driver card of downstream zone side, MDR will be stopped when sensor is blocked.



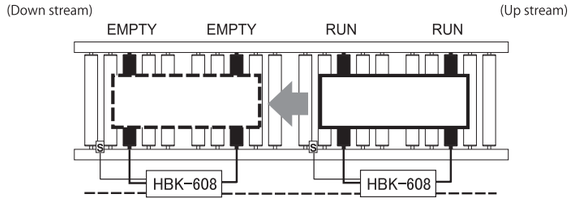
ZPA mode (One MDR on the driver)

- Only one(1) MDR is connected to this driver card.
  The MDR should connect to motor A and sensor should connect to Sensor A.
- SW1 #7; ON (Only detect this setting when powered on)
- ZPA function is followed based on SW1 #4. (Singulated release / Slug)
- A second motor can also be used, plugged into Motor B and synchronized with motor A



Synchronization mode

- Motor B runs same timing as Motor A.
- SW1 #7(number of connected MDR); ON
- SW2 #4; ON
- When error is happened on Motor A, Motor B is also stopped. But if motor B is in error condition, Motor A is not effected by error condition on Motor B.



ZPA mode (Driver as slave card)

- RUN / STOP by CN4. Input signal to CN4 #2 to run motor A, CN4 #3 for motor B.
- SW5; 0
- There is no communication to the other driver cards.

Synchronization / Sensor output , Forcible RUN / STOP setting

- Synchronization / Sensor output (Output from CN4#5 (6))
  - SW2#1 (2) ON : Synchronization
  - SW2#1 (2) OFF : Sensor
- Forcible RUN / STOP (Input to CN4#2 (3))
  - SW2#3 (4) ON : Forcible RUN
  - SW2#3 (4) OFF : Forcible STOP

■ 2 MDRs on driver（SW1#7 OFF）

● ZPA mode

SW2	Function	ON	OFF	Note	Factory setting
1	Motor A synchronization / Sensor output	synchronization output	Sensor output	—	ON
2	Motor B synchronization / Sensor output	synchronization output	Sensor output	—	ON
3	Motor A Forcible RUN / STOP	Forcible RUN	Forcible STOP	—	ON
4	Motor B Forcible RUN / STOP	Forcible RUN	Forcible STOP	—	ON

● Driver as slave card

SW2	Function	ON	OFF	Note	Factory setting
1	Motor A synchronization / Sensor output	synchronization output	Sensor output	—	—
2	Motor B synchronization / Sensor output	synchronization output	Sensor output	—	—
3	Motor A Forcible RUN / STOP	Forcible RUN only		—	—
4	Motor B Forcible RUN / STOP	Forcible RUN only		—	—

■ One MDR on driver（SW1#7 ON）

● ZPA mode

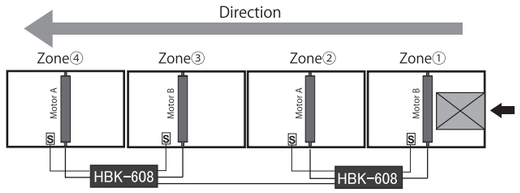
SW2	Function	ON	OFF	Note	Factory setting
1	Motor A synchronization / Sensor output	synchronization output	Sensor output	—	—
2	Motor B synchronization / Sensor output	synchronization output	Sensor output	—	—
3	Motor A Forcible RUN / STOP	Forcible RUN	Forcible STOP	—	—
4	Motor B synchronization mode	synchronization mode	Motor B is not used	Select mode be for powered	—

● Driver as slave card

SW2	Function	ON	OFF	Note	Factory setting
1	Motor A synchronization / Sensor output	synchronization output	Sensor output	—	—
2	Motor B synchronization / Sensor output	synchronization output	Sensor output	—	—
3	Motor A Forcible RUN / STOP	Forcible RUN only		—	—
4	Motor B synchronization mode	synchronization mode	Motor B is not used	Select mode be for powered	—

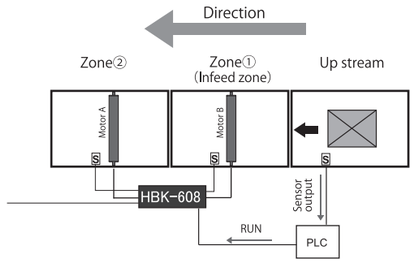
4 - 3 Application Example

＜Standard zone＞



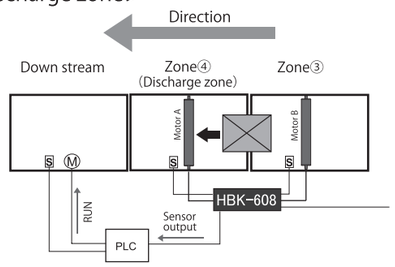
This configuration (factory default) is the standard set-up for the intermediate zones, not infeed or discharge.

＜Infeed zone＞



1. Up stream sensor ON
2. Input forcible RUN
3. Transfer zone① to zone② automatically by logic.
   (Refer "Standard zone")

＜Discharge zone＞

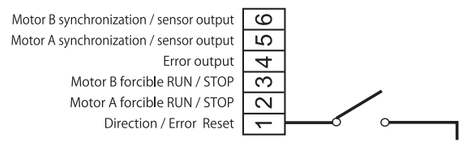


Product will be discharged when signal from controller (PLC) will be applied to input CN4#2.

4 - 4 Direction

- Only one DIR signal is required for a series of connected cards.
  Any card within that series can receive the DIR signal.
  ＊SW1#1 shoud be OFF to change direction.

CN4：Control connector

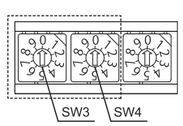


Change motor turn direction by SW1#5 (motor A), SW1#6 (motor B).

SW1＃5 or ＃6	CN4＃1	KT type	FH type
ON	ON	CW	CCW
	OFF	CCW	CW
OFF	ON	CCW	CW
	OFF	CW	CCW

＊ Combination of CN4#1 and SW1#5 or 6, motor direction is different.

4 - 5 Speed setting



- Speed can be varied 10 steps by SW3 (motor A) and SW4 (motor B).

PM570KT (m/min)

SW3/4	Nominal	
	55	15
9	61.6	16.2
8	56.5	14.9
7	51.3	13.5
6	46.2	12.2
5	41.1	10.8
4	35.9	9.5
3	30.8	8.1
2	25.7	6.8
1	20.5	5.4
0	15.4	4.1

PM605KT (m/min)

SW3/4	Nominal	
	55	15
9	65.4	17.2
8	59.9	15.8
7	54.5	14.3
6	49.0	12.9
5	43.6	11.5
4	38.1	10.0
3	32.7	8.6
2	27.2	7.2
1	21.8	5.7
0	16.3	4.3

PM486FH (m/min)

SW3/4	Nominal	
	255	55
9	296.3	65.2
8	271.6	59.7
7	246.9	54.3
6	222.2	48.9
5	197.5	43.4
4	172.8	38.0
3	148.1	32.6
2	123.4	27.1
1	98.8	21.7
0	74.14	16.3

PM500FH (m/min)

SW3/4	Nominal	
	255	55
9	304.8	67.0
8	279.4	61.4
7	254.0	55.9
6	228.6	50.3
5	203.2	44.7
4	177.8	39.1
3	152.4	33.5
2	127.0	27.9
1	101.6	22.3
0	76.2	16.8

4 - 6 Sensor timer / RUN hold timer / JAM timer setting

Sensor timer, RUN hold timer and JAM timer can be set by rotary switch as showing table.

Sensor timer;
The motor in the present zone will be stopped by sensor timer function when
- The motor in the present zone is running
- No tote entry into the present zone for the set time after the sensor turns OFF
- No tote present in the adjacent upstream zone

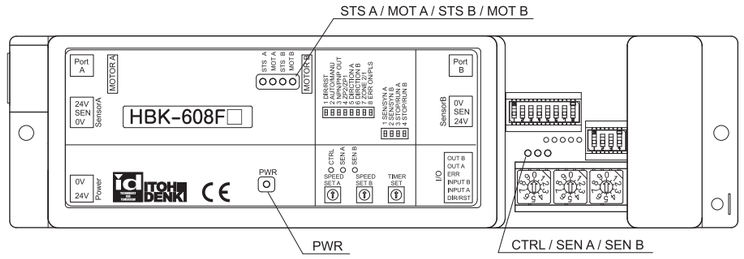
RUN hold timer;
The motor in the present zone will be stopped by the RUN hold timer when
- The motor in the present zone is running
- No tote entry into the present zone for the set time after the sensor turns OFF

JAM timer;
- Error signal is sent and motor is stopped when
  - Present zone has a sensor ON status (presence of product) and the motor is running
  - No change in the sensor status (still ON) for the set time
- Error reset – the blocking tote should be removed to switch off the sensor (i.e. clear jam)

SW5	Sensor timer RUN hold timer initial operation	JAM timer	Factory setting
9	18sec	36sec	
8	16sec	32sec	
7	14sec	28sec	
6	12sec	24sec	
5	10sec	20sec	
4	8sec	16sec	
3	6sec	12sec	
2	4sec	8sec	
1	2sec	4sec	○
0	Slave mode		

5. LED indications

- Indicates status of HBK-608 by LED.
  (Refer 6-1 Error)

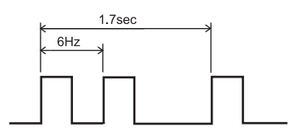


■LED Indication

LED		LED condition			Status
		Green	Red	Orange	
PWR	Motor power LED	ON	—	—	Power ON
		OFF	—	—	Power OFF
MOT A	MOTOR A LED	ON	—	—	Ready to operation
		OFF	—	—	＊1
MOT B	MOTOR B LED	ON	—	—	Ready to operation
		OFF	—	—	＊1
STS A	Motor A	OFF	OFF	—	normal
		ON	OFF	—	MotorA Run
		OFF	Blinks (6Hz)	—	Low voltage Fuse blown
		OFF	Blinks (1Hz)	—	Motor A unplugged
		ON	Blinks (1Hz)	—	Motor stall error
		OFF	ON	—	thermister error
		ON	Blinks＊2	—	back EMF error

LED #		LED condition			Status
		Green	Red	Orange	
STS B	Motor B	OFF	OFF	—	Normal
		ON	OFF	—	Motor B Run
		OFF	Blinks (6Hz)	—	Low voltage Fuse blown
		OFF	Blinks (1Hz)	—	Motor B unplugged
		ON	Blinks (1Hz)	—	Motor stall error
		OFF	ON	—	thermister error
		ON	Blinks＊2	—	back EMF error
CTRL	Control power	ON	ON	—	Power OFF
		OFF	OFF	—	Power ON
SEN A	Motor A sensor	—	—	ON	Sensor ON
		—	—	OFF	Sensor OFF
		—	—	Blinks (1Hz)	JAM error
SEN B	Motor B sensor	—	—	ON	Sensor ON
		—	—	OFF	Sensor OFF
		—	—	Blinks (1Hz)	JAM error

＊2：Blinks 2 times(6Hz) in 1.7second



＊1：Power is not supplied to motor drive circuit board.
The HBM may be needed replace.

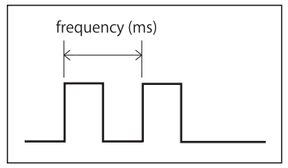
6. Error

6 - 1 Error status and reset error

- Error signal is discharged from C4#4
- Select type of discharged signal by SW1#8 (ON : Pulse out OFF : Steady voltage)

● Pulse out

Priority	Error type	Period
1	Low voltage error	40msec
2	Motor unplugged error	60msec
3	Motor lock error	80msec
4	Thermal overload on PCB	100msec
5	Thermal overload in MDR	120msec
6	Back EMF error	140msec
7	JAM error	160msec



＊ 50% duty cycle

- Reset error by CN4#2 (3) (RUN signal), Power Moller starts running immediately.
- In case power is 8.5V or less, the driver card may not work properly.

■ Error status and reset error

	Error type	Symptom / Causes	Reset driver card / MDR		
Error related power	Low voltage error	Low voltage below 15 V DC for 1 second	Supply 18 V DC or over	Auto reset	Restarts immediately when error condition is removed
				Manual reset	A signal applied to CN4#1 or receive reset signal through communication cable or applied CN4#2 for Motor A CN4#3 for Motor B will reset the error
	Back EMF error	Supply voltage more than 40 V DC for 2 second or over 60 V DC for 0.1 second	Supply 30 V DC or below	Auto reset	n.a
				Manual reset	A signal applied to CN4#1 or receive reset signal through communication cable or applied CN4#2 for Motor A CN4#3 for Motor B will reset the error
	Fuse blown	Replace the driver card			
Error related temperature	Thermal overload on PCB	Thermister on PCB reacted	Thermister recovery from cooling off.	Auto reset	Thermister recovery from cooling off.
				Manual reset	A signal applied to CN4#1 or receive reset signal through communication cable or applied CN4#2 for Motor A CN4#3 for Motor B will reset the error
	Thermal overload in MDR	Thermister in motor reacted	Thermister recovery from cooling off.	Auto reset	Thermister recovery from cooling off.
				Manual reset	A signal applied to CN4#1 or receive reset signal through communication cable or applied CN4#2 for Motor A CN4#3 for Motor B will reset the error
Other error	Motor unplugged error	Motor connector unplugged	Plug the motor connector	Auto reset	Restarts immediately when error condition is removed
				Manual reset	A signal applied to CN4#1 or receive reset signal through communication cable or applied CN4#2 for Motor A CN4#3 for Motor B will reset the error
	Motor lock error	Motor stall for 0.5 second		Auto reset	Driver detect motor is turned. (More than 8 pluses)
				Manual reset	A signal applied to CN4#1 or receive reset signal through communication cable or applied CN4#2 for Motor A CN4#3 for Motor B will reset the error
	JAM error	JAM timer activated		Auto reset	Change present zone sensor status from ON to OFF or change downstream zone sensor from OFF to ON
				Manual reset	A signal applied to CN4#1 or receive reset signal through communication cable or applied CN4#2 for Motor A CN4#3 for Motor B will reset the error

7. Specifications

Power voltage		24VDC±10%
Rated voltage		24VDC
Static current		0.6A
Peak current		7A/motor
Input	Motor A Forcible RUN/STOP	NPN/PNP
	Motor B Forcible RUN/STOP	NPN/PNP
	Direction/Error reset	NPN/PNP
Output	Motor A synchronization / Sensor output	NPN/PNP open collector
	Motor B synchronization / Sensor output	NPN/PNP open collector
	Error out	NPN/PNP open collector
LED indications		Error status (Red)
		Power status (Green)
		Sensor status (Orange)
Protections		Integral 10A fuse per motor
		Integral diode against miss wiring
Thermal protection		React at 95℃ on circuit board or 105℃ on motor
Brake		Electric brake

HB side	Power connector	WAGO 231-532/001-000
	Sensor connector	WAGO 733-363
	Control connector	WAGO 733-366
Wiring side	Power connector	WAGO 231-302/026-000
		AGW28～12
	Sensor connector	WAGO 733-103
		AGW28～20
	Control connector	WAGO 733-106
		AGW28～20
Motor connector		JST S12B－XH－A
Environment	Ambient temperature	0～40℃
	Relative humidity	≦ 90%RH (no condensation)
	Atmosphere	No corrosive gas
	Vibration	≦ 0.5G

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