HBR-605 User Manual

Thank you for purchasing ITOH DENKI product.

- 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 model：F-RAT-S Series／F-RAT-U225 Series

⚠
- Read the user manual of your F-RAT model carefully before use to fully understand the details of the product, the safety information and all the precautions.

  Home > Download / Support > User Manual ·····

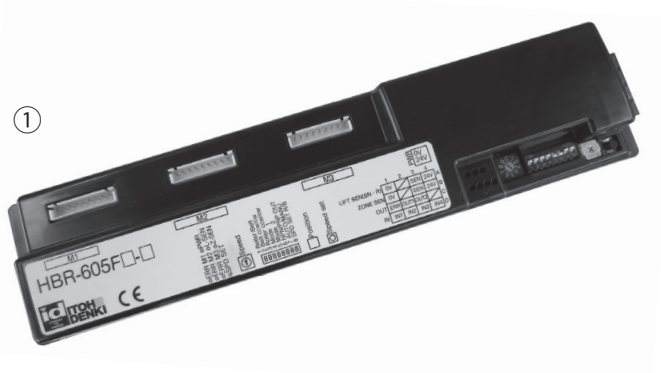
- F-RAT-U225 only supports sizes of 6040, 6050, 9040 and 9050.
  Sizes of 6060, 6070, 6080, 9060, 9070 and 9080 are not supported.
- The F-RAT series supports the speed of 60m/min types only.

When you have opened the package,

The items shown below should be in the package. Make sure that all of the items are included.
Also check whether the types and specifications of the items are correct.

	Accessories	Details	Quantity
①	Driver	HBR-605F□-□	1 piece
②	Power connector	734-102(WAGO)	1 piece
③	Control connector (Zone sensor／Proximity sensor：yellow)	37104-3122-000 FL(3M)	2 piece
④	Control connector (Input・Output：gray)	37104-2206-000 FL(3M)	2 piece
⑤	Set of driver fixing screws	Cross-recessed screw M4 with SW × 15 / hexagon nut M4	2 Set

①



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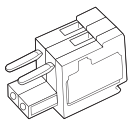

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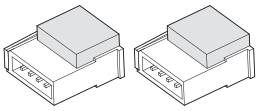

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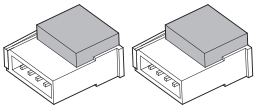
④



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1. Safety Instructions ····· For your safety, please comply with them.

- Be sure to comply with all of the caution items and instructions contained in this safety manual.
- To avoid functional deterioration, unexpected accident or product failure, check the operation according to this manual.

Warning & Caution

Shown below are the caution items for using the product safely and avoiding danger and damage to the user.
Caution items can be classified into danger, warning and caution as described below.

⚠ Danger	The most serious danger with possibility of death or serious injury.
⚠ Warning	Incorrect handling may lead to death or serious injury, indicating potential danger.
⚠ Caution	Possible danger of light or medium injury, or only a material damage.

1 - 1. Basic Warning

⚠ Warning Incorrect handling may lead to death or serious injury, indicating potential danger.
Comply with the following warning and perform the work correctly.

- Do not use the product in an explosive, flammable or corrosive atmosphere, or near flammable material.
  It may cause explosion, fire, electrical shock or injury.

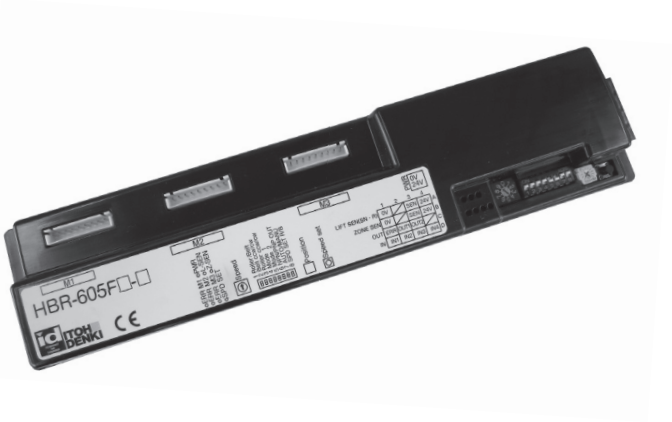
1 - 2. Basic Cautions

⚠ Caution Incorrect work or use may lead to light or medium-level injuries and/or property damages.
Comply with the following warning and perform the work correctly.

- 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.

2. Product Designation

HBR-605F ① - ②



① Type of input/output

N ··· NPN input/output

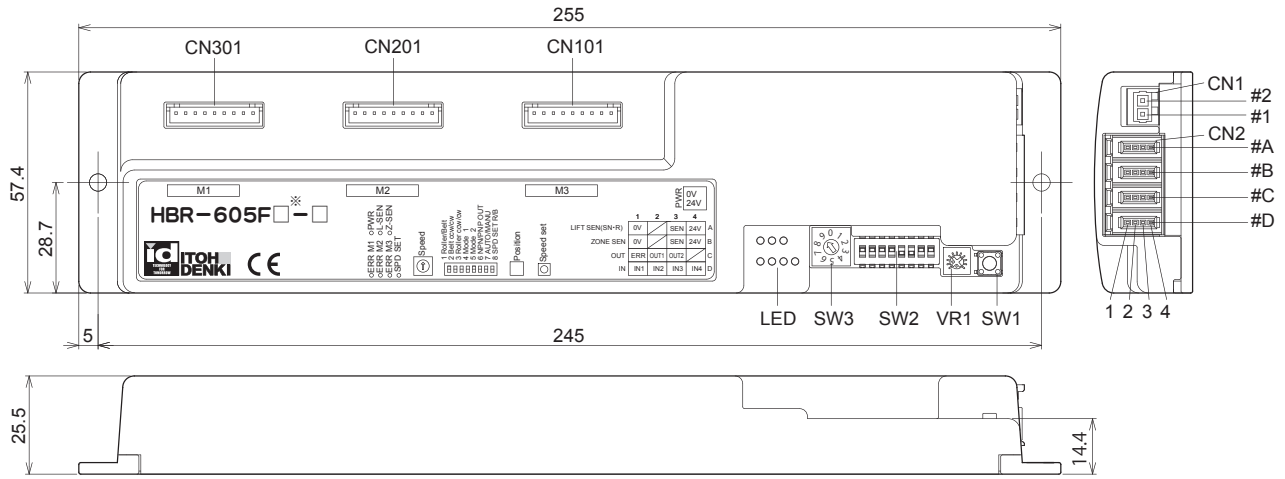
P ··· PNP input/output

② Applicable module

B ··· F-RAT-S Series

D ··· F-RAT-U225 Series

3. Dimensions and Part Details



＊ □ : N - NPN input ／ P - PNP input

● CN1:Power connector

Connector number	Function
#2	0V
#1	+24V DC

● CN2:Control connector

Connector number	Function
A	Proximity sensor (max35mA DC)
B	Zone sensor (max35mA DC)
C	Output (Open collector: max25mA DC)
D	Input (24V DC / 0V max7.3mA DC)

＊ Assignment varies depending on the logic mode for C and D.

Refer P.9 Logic mode

● M1, M2, M3:Motor connector

Connector number	Function
M1	For Belt/Carrier wheel
M2	For Roller
M3	For Lifting

● VR1:Potentionmeter

Number	Function	CCW end	CW end
VR1	Adjust stopping position	Min (note)	Max

(note) factory setting

Refer P.22 Adjust stopping position

● LED indication

Label	Function
PWR	Powered
L-SEN	Proximity sensor SN・R
Z-SEN	F-RAT Zone sensor
SPD SET	Speed setting ・ Error
ERR M1	Error on M1
ERR M2	Error on M2
ERR M3	Error on M3

Refer P.24 LED indication

● SW1:Speed setting

This is a switch for setting the speed.

Refer P.21 Speed setting

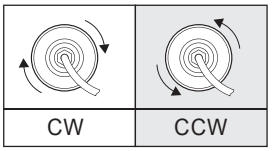
● SW2:Dip Switch (8bit)

Number	Function	ON	OFF	Factory setting
1	Selection of MDR for receiving	Belt/ Carrier wheel	Roller	ON
2	Direction of Belt/Carrier wheel	CW	CCW	ON
3	Direction of Roller	CW	CCW	ON
4	Selection of transfer mode ・Auto L-shape Mode ・Diverter Mode ・Upper-level command Mode	Refer P.9 Logic Mode Setting		ON
5				OFF
6	NPN/PNP out	PNP out	NPN out	OFF (note)
7	Error reset (P.24)	Manual	Automatic	ON
8	Selection of MDR for speed setting (P.21)	Belt/ Carrier wheel	Roller	ON

Note: This setting is for HBR-605FN. For HBR-605FP, this setting is ON.

《 MDR direction 》

・ Viewed from MDR's power cable side.



● SW3:Speed setting Rotary switch (10 step variation)

・This switch allows users to set the speed on a scale of one to nine.

SW3	Conveyance speed (m/min)			
	HBR-605F□-B (F-RAT-S)		HBR-605F□-D (F-RAT-U225)	
	Setting	Rating	Setting	Rating
9 (note)	61.7	53.5	60.0	52.0
8	56.6	53.5	55.0	52.0
7	51.4	51.4	50.0	50.0
6	46.3	46.3	45.0	45.0
5	41.2	41.2	40.0	40.0
4	30.9	30.9	30.0	30.0
3	20.6	20.6	20.0	20.0
2	15.4	15.4	15.0	15.0
1	10.3	10.3	10.0	10.0
0	7.7	7.7	7.5	7.5

(note) factory setting

＊ The speed is used as a reference value for setting the MDR speed.

Refer P.21 Speed setting

4. Power

- 24V DC battery (24V DC / 5 A)
- Switching power (24V DC / 5 A 120W)
- Smoothed and rectified power (≧ 10% ripple)

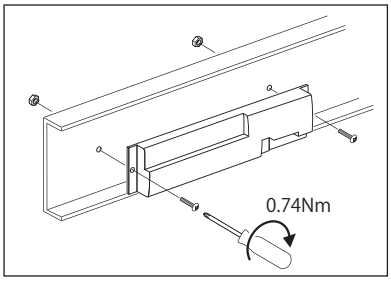
  ＊ Use stable power supply, 5 A or greater. The power supply must be able to handle 20 A peak for 1 msec.
- Sensor connection power is limited to 35 mA. Dark ON sensor only.

5. Installation

5-1. Attaching Driver

① Perform hole processing on the conveyor frame and other components in accordance with the attaching holes.
（For sizes of the attaching holes, refer to 3. Dimensions and Part Details.）
＊ Attach the driver to the surface of flat metal having high heat dissipation.
＊ Be careful not to let shavings generated from hole processing enter the driver.

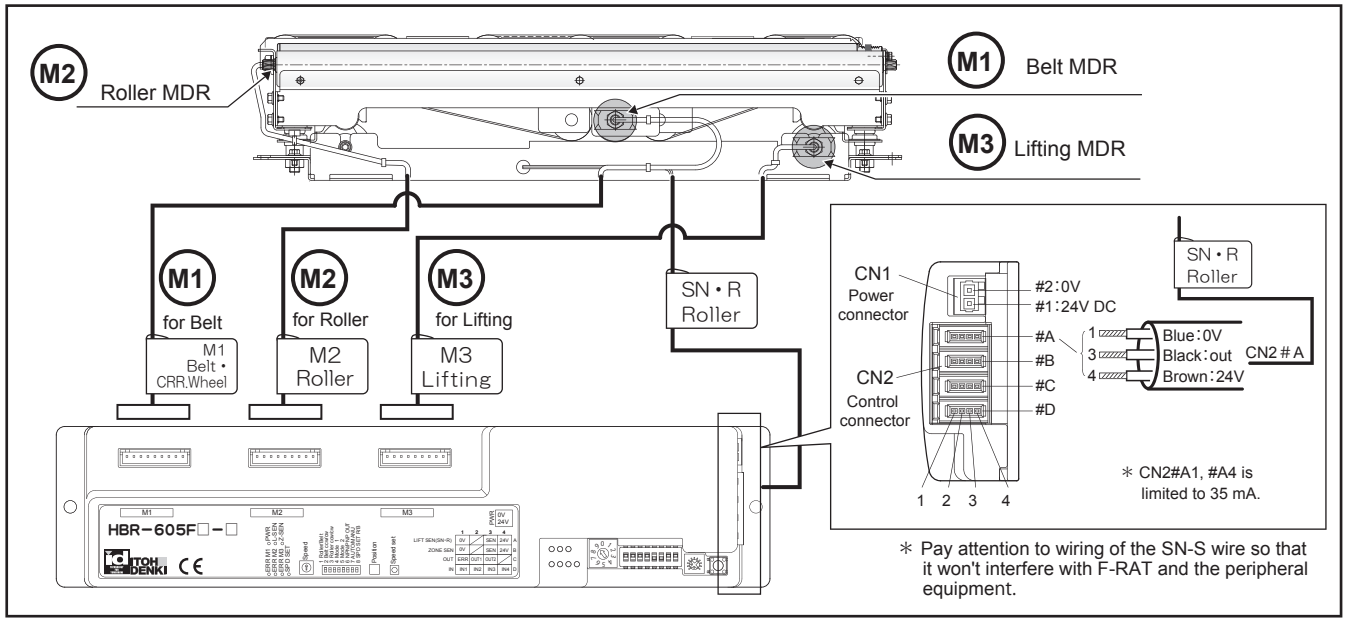
② Fix the diver securely with the provided screws and nuts.
＊ Securely tighten the screws at the torque of 0.74Nm.



5-2. Connecting F-RAT and HBR-605

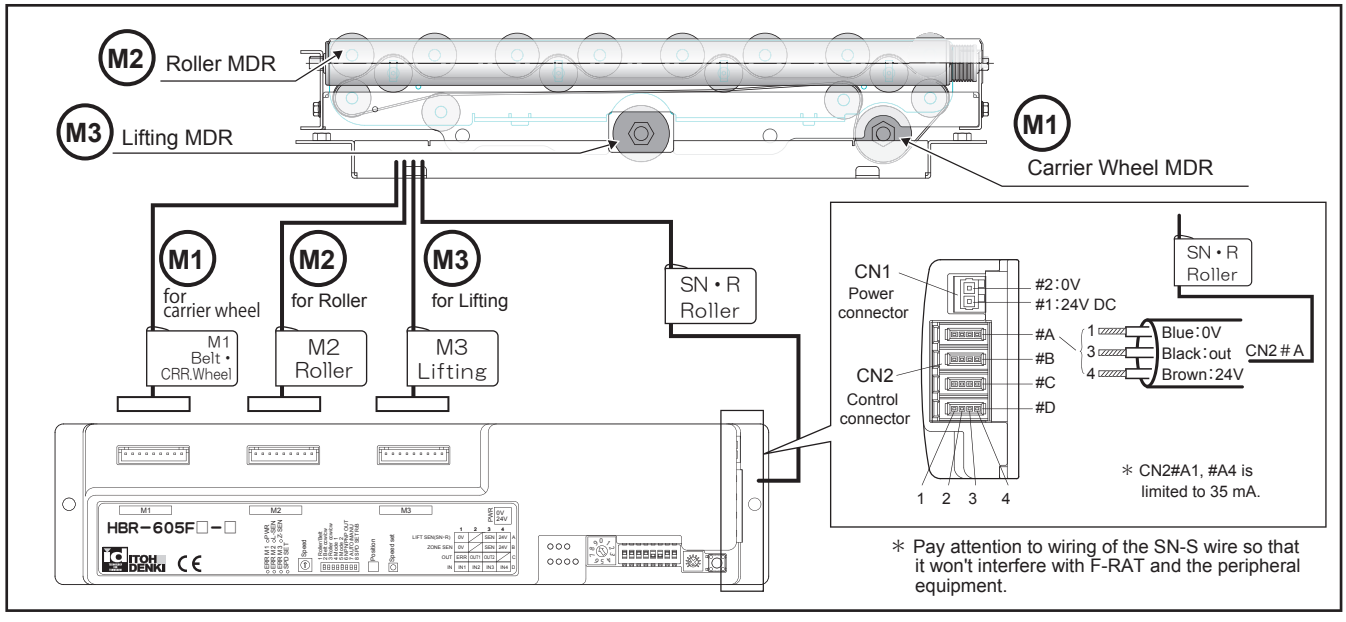
- Install power connector < CN1 >, control connector < CN2 > and motor connector <M1: belt/carrier wheel transport, M2: roller transport, M3: Lifting > of MDR on the driver.
  ＊When connecting or disconnecting a connector, always shut off the power and hold the connector.
  ＊Insert each connector firmly into the contact part.
- Download the user manual from our Internet website before attaching the F-RAT body.
  Home > Download / Support > User Manual ·····

■ F-RAT-S Series



＊The F-RAT Zone sensor does not come with the product. Prepare one on your own.

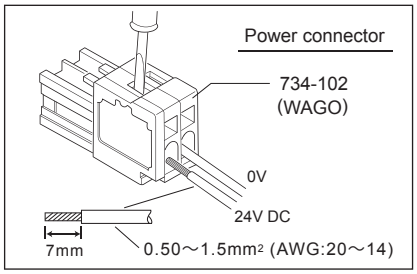
■ F-RAT-U225（Size 6040／6050／9040／9050）



＊The F-RAT Zone sensor does not come with the product. Prepare one on your own.

5 - 3. Wiring

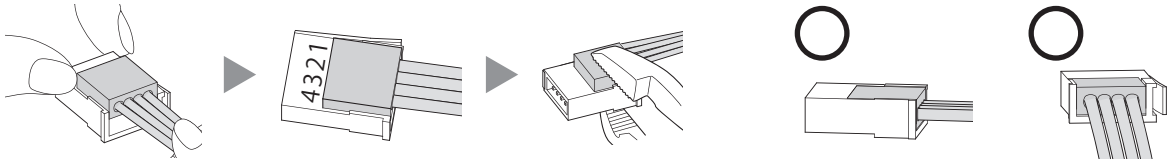
Wiring of Power connector



- Connect 24V DC and 0V to the Power connector < CN1 (2 poles) >.
  - ＊Avoid divert wiring from the power line. Excessive current in the connector may lead to electrical shock, short-circuit or connector damage. (Connector capacity: 10A)
  - ＊Make sure correct wiring position of 24V DC and 0V.
  - ＊Do not perform wiring while the connector is inserted.

Wiring of Control connector

- Check the pin number (shown) of the control connector < CN2 (4 poles) >, insert each cable to the end of connector, and crimp the wire with a tool.
  Confirm that no gap remains with the cover in the side direction and from the back.
  - ＊Wiring of CN2 varies by logic mode. Check the list of CN2 logic mode before wiring each connector.



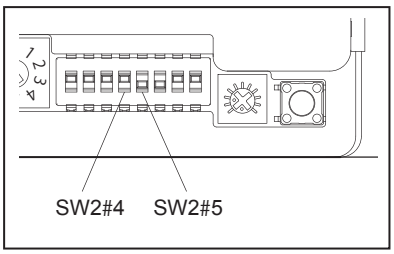
- For F-RAT Zone sensor (yellow): 37104-3122-000 FL (AWG No.: 26 to 24, Nominal cross sectional area: Less than 0.14 to 0.3mm2, Finished outside diameter: ϕ 1.0 to 1.2mm)
- For input/output (gray): 37104-2206-000 FL (AWG No.: 22 to 20, Nominal cross sectional area: Less than 0.3 to 0.5mm2, Finished outside diameter: ϕ 1.6 to 2.0mm)

6. Operating in Each Mode

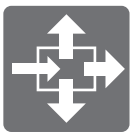
- There are three ways (logic modes) to use HBR-605 according to the operation.

■ About the Logic Mode

- Logic mode can be selected by combining SW2 #4 and #5.
- Because the setting is made once at the time of power on, it should be made before applying the power.
  Operating SW2#4 or SW2#5 after power ON does not change the logic mode setting.
- Setting SW2#4: OFF and SW2#5: ON does not operate HBR-605.



● About the Logic Mode Setting

Logic Mode		operating	DIP-SW Setting		factory setting
			SW2#4	SW2#5	
	Auto L-shape Mode Refer P.10	The mode for automatically performing L-shaped transport by connecting 2 units of HB-510.	ON	ON	
	Diverter Mode Refer P.13	The mode for feeding to F-RAT from one direction and Divert out to 3 directions.	ON	OFF	○
	Upper-level command Mode Refer P.18	The mode for activating forced drive on F-RAT by an input signal from the upper-level controller. Stopping of the lifting drive motor is controlled by the internal logic. Apply an input signal (lifting command) with one-shot signal of 0.1s~0.2s .	OFF	OFF	

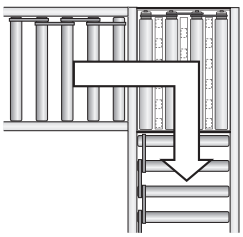
＊ When using an F-RAT in a merging line, use the upper-level command mode.

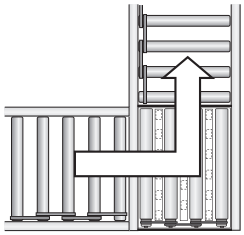
6-1. Auto L-shape Mode

- Use the same signal I/O type of HBR-605 for HB-510.
- HB-510 and HB-510 control connector are provided separately as option.
  If a control connector is not included in HB-510 you have now, purchase a control connector (PAHB08) separately.
- For detailed information on HB-510, download the user manual from our Internet website and refer to it.
  Home > Download / Support > User Manual
- In Auto L-shape mode, a carry-out operation is executed as long as the zone sensor is ON and the downstream Zone sensor input is OFF after a lapse of 15 seconds from power on. To control the drive for belt motions and carrier wheel roller up/down motions, use the upper level command mode.

■ About the Auto L-shape mode

- The Auto L-shape mode connects HBR-605 to upstream/downstream HB-510 and carries out transfer of trays at right angles automatically (single ZPA transfer).

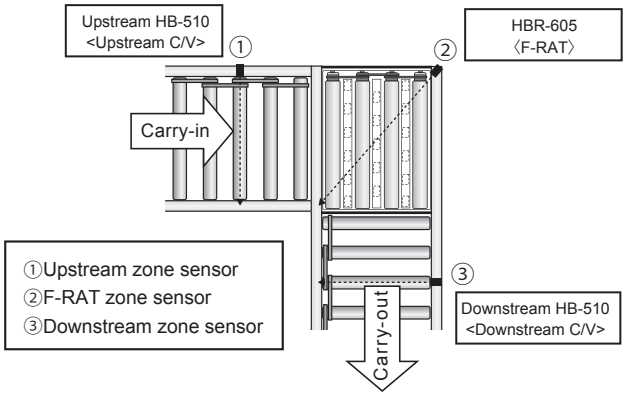




Because a carry-in operation is performed according to the signal from upstream HB-510, it is recommended to use the setting of carry-in by roller so that the carry-in direction will be upstream side after the initial operation. (For the stand-by position, see page 23.)
For belt/carrier wheel carry-in operations, the position and speed of the upstream Zone sensor need to be adjusted.

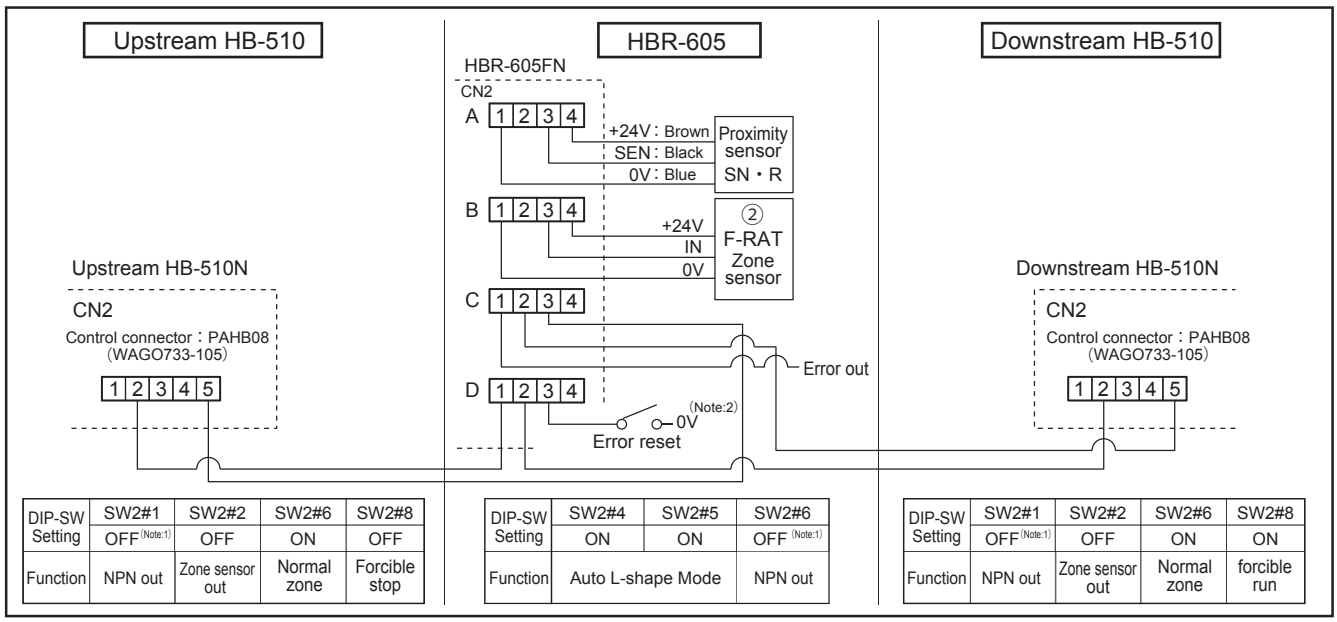
■ Zone sensor attachment position

- During Carry-in Operation
  Adjust the Zone sensor② and downstream zone sensor① are not blocked same by tray.
- During a Carry-out Operation
  Adjust the sensor position so that F-RAT Zone sensor and the upstream zone sensor are not blocked by same tray.
- When carry-in completed
  Adjust the sensor position so that F-RAT Zone sensor will be on.



■ Wiring

- Wiring should be made while the product is not powered.
- Switch for Run/stop or CW/CCW is an option and is not supplied.
- Relay contact or PLC output can be used instead of the above switch.
- Wiring to the supplied connectors should be made before inserting into the driver card.



DIP-SW Setting	SW2#1	SW2#2	SW2#6	SW2#8
	OFF (Note:1)	OFF	ON	OFF
Function	NPN out	Zone sensor out	Normal zone	Forcible stop

DIP-SW Setting	SW2#4	SW2#5	SW2#6
	ON	ON	OFF (Note:1)
Function	Auto L-shape Mode		NPN out

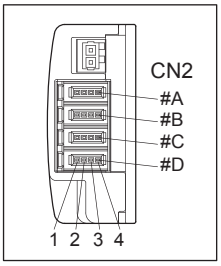
DIP-SW Setting	SW2#1	SW2#2	SW2#6	SW2#8
	OFF (Note:1)	OFF	ON	ON
Function	NPN out	Zone sensor out	Normal zone	forcible run

Note 1: When HB-510P and HBR-605FP are used, it should be ON (PNP output).
Note 2: When HBR-605FP is used, it should be +24V.
＊ Make the setting of "Zone sensor out" to be ON in detection of trays.
＊ As the voltage to be input to the control connectors (CN2), use the same voltage for the power supply.

■ CN2 assignment in Auto L-shape mode

⚠ Assignment of CN2 control connectors varies depending on the logic mode.

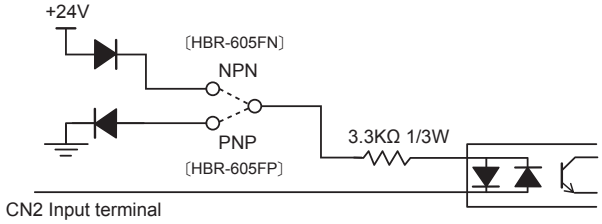
Connector number		Pin number			
		#1	#2	#3	#4
CN2#A	Proximity sensorSN・R	0V	N.A	In	+24V
CN2#B	F-RAT Zone sensor	0V	N.A	In	+24V
CN2#C	Output	Error out	Forcible run	Forcible stop	N.A
CN2#D	Input	Upstream zone sensor	Downstream zone sensor	Error reset	Unused



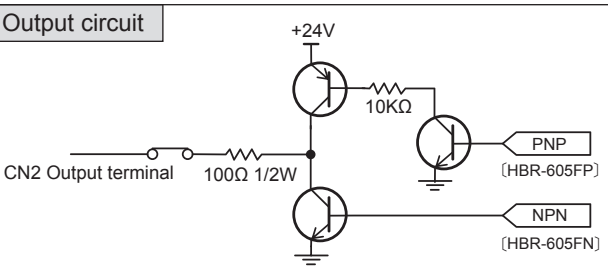
CN2#A1 ～ 4	Proximity sensor SN・R	・Voltages for #1 and #4 are the same as the voltage of the motor power supply. ・The maximum output of the sensor power supply is 35mA.
CN2#B1 ～ 4	F-RAT Zone sensor	・Voltages for #1 and #4 are the same as the voltage of the motor power supply. ・The maximum output of the sensor power supply is 35mA. ・Make the setting of "Zone sensor out" to be ON in detection of trays.
CN2#C1	Error out (note) Refer P.24,25	・This signal is discharged when HBR-605 is normal condition. - Normally output. ・The transistor for open collector output is turned off when an error occurs. If an error occurs frequently, it can cause a failure unless the cause of the error is removed.
CN2#C2	Forcible RUN output	・This signal is discharged when the downstream HB-510 is forced to RUN. ・When the forcible RUN output is discharged, the transistor with an open collector output is turned ON. (Max 25mA)
CN2#C3	Forcible STOP output	・This signal is discharged when the uptream HB-510 is forced to STOP. ・When the forcible STOP output is discharged, the transistor with an open collector output is turned ON. (Max 25mA)
CN2#D1	Upstream Zone sensor input	・When the upstream Zone sensor is ON, carry-in operation is performed with ZPA condition. ・Set the upstream Zone sensor signal output to be ON in detection of trays.
CN2#D2	Downstream Zone sensor input	・When the downstream Zone sensor is ON, carry-out operation is stopped. ・Set the downstream Zone sensor signal output to be ON in detection of trays.
CN2#D3	Error reset	・When the input signal is ON, the MDR drive stops and "Forcible STOP output" (CN2#C3) becomes ON. (The transistor for open collector output is turned on. (Max 25mA)) ・While manual recovery is set (SW2#7: ON), error reset can be made by error reset input OFF→ON→OFF.

Note: "Error out" can be switched between NPN output and PNP output by SW2#6. No signal for "Error out" (normal output) is output immediately after the power is turned on or off. Be aware that no error out signal is output for one second after the power is turned on and for two seconds after the power is turned off.

Input circuit



Output circuit



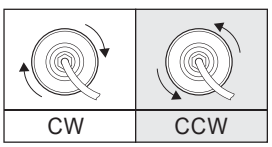
Connecting with external device such as Relay Coil requires apply coil surge absorption type or add protective devices to protect from surge otherwise remote OUTPUT in HBR-605 may be damaged by back EMF when output signal is changed.

■ Transport setting

● Carry-out/in MDR and carry-out/in direction are switched by SW2 of HBR-605.
Check the F-RAT orientation and carry-out/in direction to make each setting.

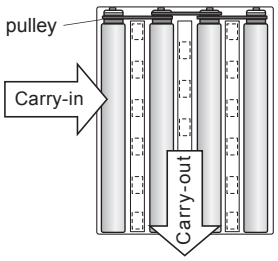
	Carry-in ⇒ Carry-out operation	Direction of Belt/Carrier wheel	Roller MDR direction
	SW2#1	SW2#2	SW2#3
ON	Carry-in by Belt/Carrier wheel / out by Roller	CW	CW
OFF	Carry-in by Roller / out by Belt/Carrier wheel	CCW	CCW

《MDR direction》
・Viewed from MDR's power cable side.



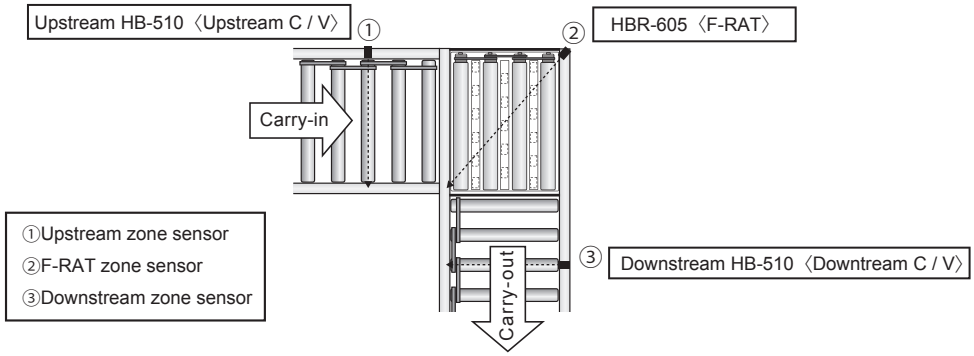
Sample Transport setting

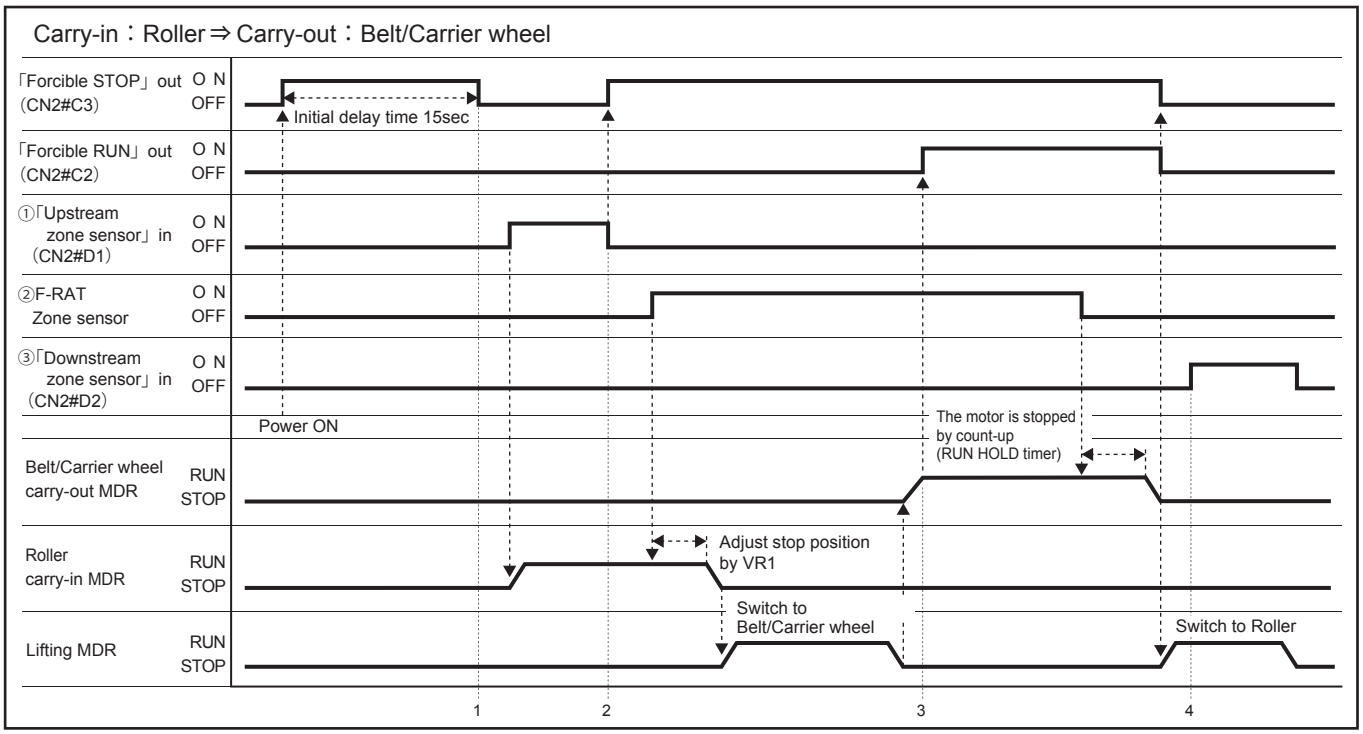
● Carry-in：Roller（CW）⇒ Carry-out：Belt/Carrier wheel（CW）



Carry-in：Roller ⇒ Carry-out：Belt/ Carrier wheel	carry-out (Belt/Carrier wheel MDR CW rotation)	carry-in (Roller CW rotation)
SW2#1	SW2#2	SW2#3
OFF	ON	ON

■ Auto L-shape mode : Timing chart





1	＊ At a Power ON ・During the first 15 sec after power on, no carry-in or carry-out operation takes place due to the initial motions. ・During the first 15 sec, “Forcible STOP” signal to the upstream HB-510 turns ON. ・During the first 15 sec, “Forcible RUN” signal to the downstream HB-510 turns OFF.
2	＊ Adjust the positions of the F-RAT Zone sensor and upstream Zone sensor to avoid being turned ON at the same time during carry-in operation.
3	＊ If the downstream Zone sensor is ON, carry-out MDR keeps stopping. ＊ The “forcible RUN” signal to the downstream zone is ON to operate the downstream zone.
4	＊ If the downstream Zone sensor turns on before the RUN HOLD timer for the belt/carrier wheel carry-out MDR runs out, the belt/carrier wheel carry-out MDR will stop operating. (Refer to 6-6. Timer Function on page 22.) ＊ Adjust the positions of the F-RAT Zone sensor and downstream Zone sensor to avoid being turned ON at the same time during carry-out operation.

6 - 2. Divert Mode

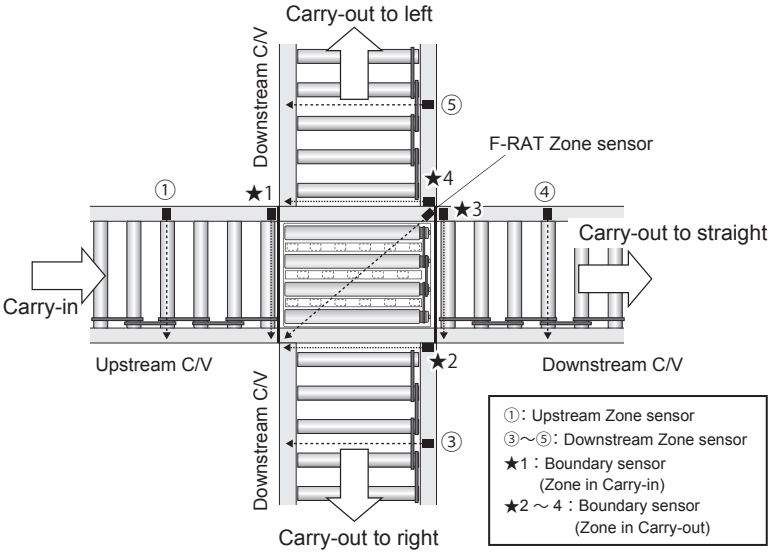
■ About Divert mode

- This mode enable to divert from one direction to multiple direction up to three.
- The F-RAT roller is set at the upper position when the power is turned on. (Initial operation)

■ Zone sensor attaching position

- During Carry-in Operation
  Adjust the Zone sensor and upstream zone sensor① are not blocked same by tray.
- During a Carry-out Operation
  Adjust the sensor position so that F-RAT Zone sensor and the downstream zone sensor (③～⑤) are not blocked by same tray.

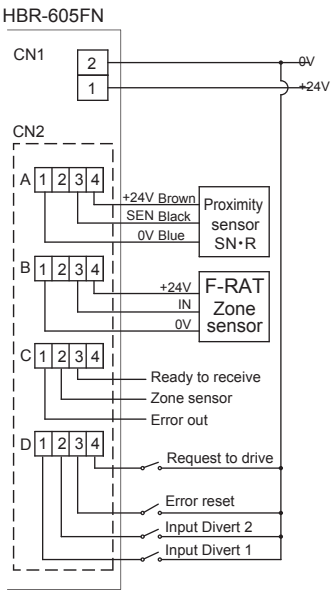
《 Arrangement image 》



■ Wiring

- Wiring should be made while the product is not powered.
- Switch for Run/stop or CW/CCW is an option and is not supplied.
- Relay contact or PLC output can be used instead of the above switch.
- Wiring to the supplied connectors should be made before inserting into the driver card.

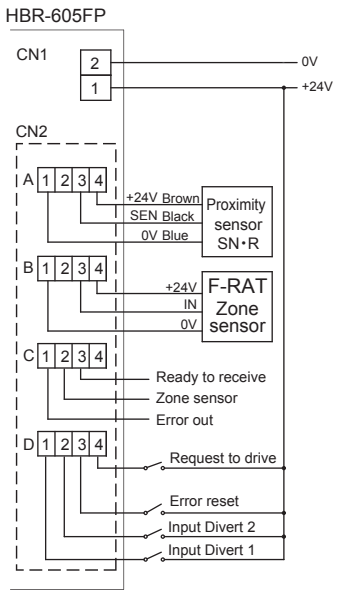
■ For the NPN I/O type



● DIP-SW Setting

SW2#4	SW2#5	SW2#6
ON	OFF	OFF
Select the Divert mode		NPN out

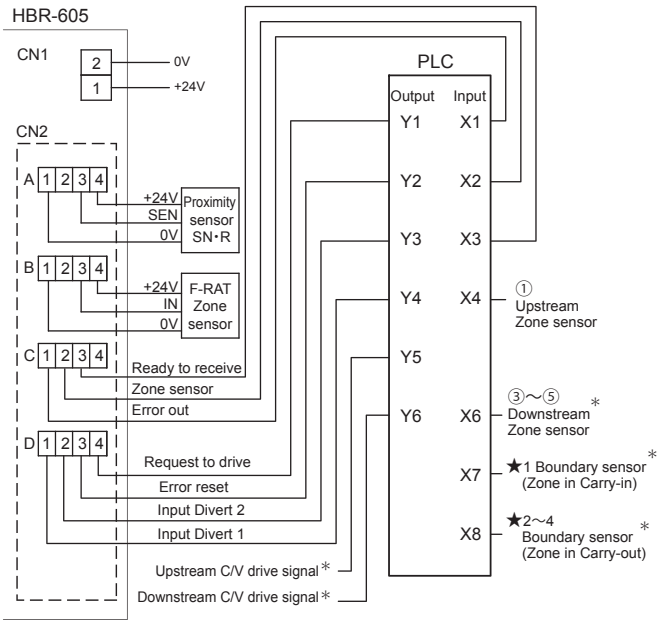
■ For the PNP I/O type



● DIP-SW Setting

SW2#4	SW2#5	SW2#6
ON	OFF	ON
Select the Divert mode		PNP out

Sample wiring using PLC



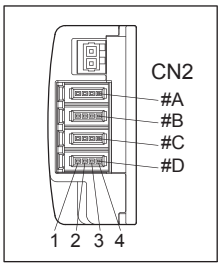
＊The number of signals/sensors to be input to and output from the PLC varies depending on the operation.

・Make the setting of "Zone sensor out" to be ON in detection of trays.
・As the voltage to be input to the control connectors (CN2), use the same voltage for the power supply.

■ CN2 assignment in Divert mode

Assignment of CN2 control connectors varies depending on the logic mode.

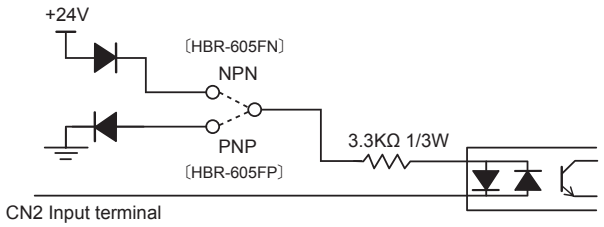
Connector number		Pin number			
		#1	#2	#3	#4
CN2#A	Proximity sensor SN・R	0V	N.A	In	+24V
CN2#B	F-RAT Zone sensor	0V	N.A	In	+24V
CN2#C	Output	Error out	Zone sensor	Ready to receive	N.A
CN2#D	Input	Divert 1 input	Divert 2 input	Error reset	Request to drive



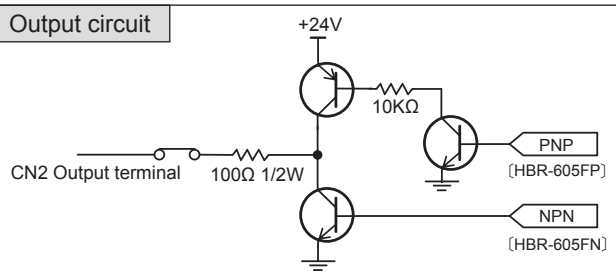
Sensor	CN2#A1 ～ 4	Proximity sensor SN・R	・Voltages for #1 and #4 are the same as the voltage of the motor power supply. ・The maximum output of the sensor power supply is 35mA.
	CN2#B1 ～ 4	F-RAT Zone sensor	・Voltages for #1 and #4 are the same as the voltage of the motor power supply. ・The maximum output of the sensor power supply is 35mA. ・Make the setting of "Zone sensor out" to be ON in detection of trays.
Upper-level PLC input	CN2#C1	Error out (Note1) (Note2) Refer P.24,25	・This signal is discharged when HBR-605 is normal condition. - Normally output. ・During abnormality, the transistor with an open collector output is turned OFF.(Max 25mA) When this error is discharged frequently, it may lead to a failure if the cause is not eliminated.
	CN2#C2	Zone sensor (Note1)	・The F-RAT Zone sensor signal is output directly. ・During Zone sensor, the transistor with an open collector output is turned ON.(Max 25mA)
	CN2#C3	Ready to receive (Note1)	・**When the F-RAT Zone sensor is OFF and the carry-in MDR can drive,** the signal is output. ・During Zone sensor, the transistor with an open collector output is turned ON.(Max 25mA)
Upper-level PLC output	CN2#D1 CN2#D2	Divert 1 input Divert 2 input	・The carry-out direction can be switched among **three directions** by combining input signals. (For details, refer to Transport Setting on page 15.)
	CN2#D3	Error reset	・When the input signal is ON, the MDR drive stops and "Ready to receive" (CN2#C3) is set to OFF. ・Even when the input signal is ON, "Zone sensor" (CN2#C2) is enabled. ・While manual recovery is set (SW2#7: ON), error reset can be possible by error reset input OFF⇒ON⇒OFF.
	CN2#D4	Request to drive	・While Ready to receive output (CN2#C3) is present, and Request to drive input is ON, **carry-in operation can be performed.**

(Note1) "Error out", "Zone sensor" and "Ready to receive" can be switched between NPN output and PNP output by SW2#6.
(Note2) No signal for "Error out" (normal output) is output immediately after the power is turned on or off. Be aware that no "Error out" signal is output for one second after the power is turned on and for two seconds after the power is turned off.

Input circuit



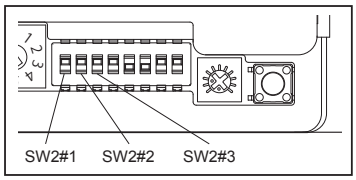
Output circuit



Connecting with external device such as Relay Coil requires apply coil surge absorption type or add protective devices to protect from surge otherwise remote OUTPUT in HBR-605 may be damaged by back EMF when output signal is changed.

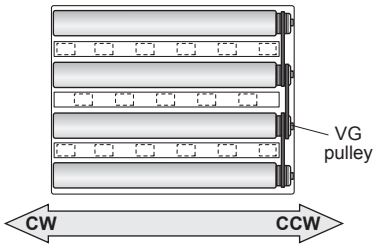
■Transport Setting

- Operation of the carry-in MDR and direction change is enabled by setting SW2#1, #2 and #3.
  Carry-out operation is enabled by combining the Divert input signals CN2#D1 and D2.
  Set up signals and switches by checking the layout of the F-RAT, upstream and downstream connections.



● Carry-in by belt/carrer wheel

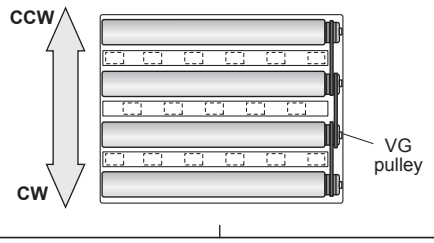
SW2#1 MDR for receiving		SW2#2 belt/carrer wheel MDR direction		SW2#3 roller MDR direction	CN2#D1 Divert 1 input	CN2#D2 Divert 2 input	Carry-out Operation
ON	OFF	ON	OFF				
Carry-in by belt/ carrer wheel	–	CW	CCW	ON	ON	ON	Carry-out to straight
					ON	OFF	Carry-out to right (Note 1)
					OFF	ON	Carry-out to left (Note 1)
					OFF	OFF	Stop
				OFF	ON	ON	Carry-out to straight
					ON	OFF	Carry-out to left (Note 1)
					OFF	ON	Carry-out to right (Note 1)
					OFF	OFF	Stop



Note 1: Carry-out direction based on the carry-in direction.

● Carry-in by roller

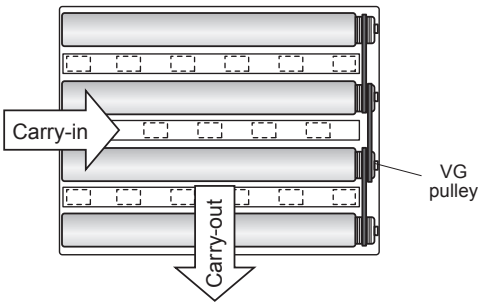
SW2#1 MDR for receiving		SW2#2 belt/carrer wheel MDR direction	SW2#3 roller MDR direction		CN2#D1 Divert 1 input	CN2#D2 Divert 2 input	Carry-out Operation
ON	OFF		ON	OFF			
–	Carry-in by roller	ON	CW	CCW	ON	ON	Carry-out to straight
					ON	OFF	Carry-out to right (Note 1)
					OFF	ON	Carry-out to left (Note 1)
					OFF	OFF	Stop
		OFF			ON	ON	Carry-out to straight
					ON	OFF	Carry-out to left (Note 1)
					OFF	ON	Carry-out to right (Note 1)
					OFF	OFF	Stop



Note 1: Carry-out direction based on the carry-in direction.

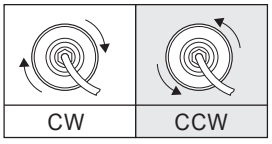
Sample Transport setting

● Carry-in by belt/carrer wheel（CCW）⇒ out by roller（CW））



Carry-in by belt/carrer wheel（CCW） ⇒ out by roller（CW）	Carry-in by belt/carrer wheel CCW rotation	Carry-out by roller CW rotation	Input Divert 1	Input Divert 2
SW2#1	SW2#2	SW2#3	CN2#D1	CN2#D2
ON	OFF	ON	ON	OFF

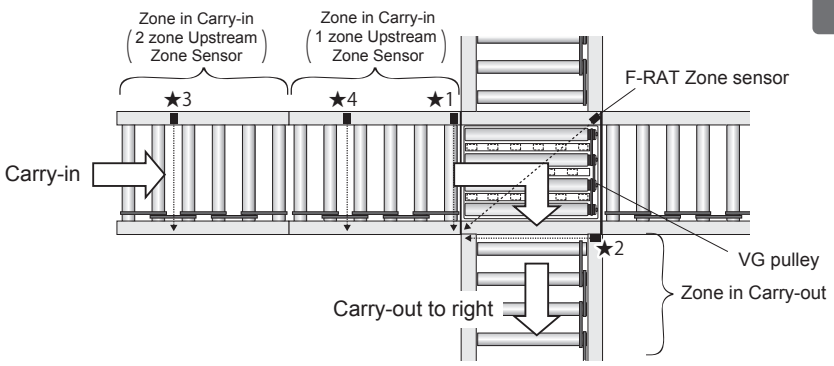
《MDR direction》
・Viewed from MDR's power cable side.



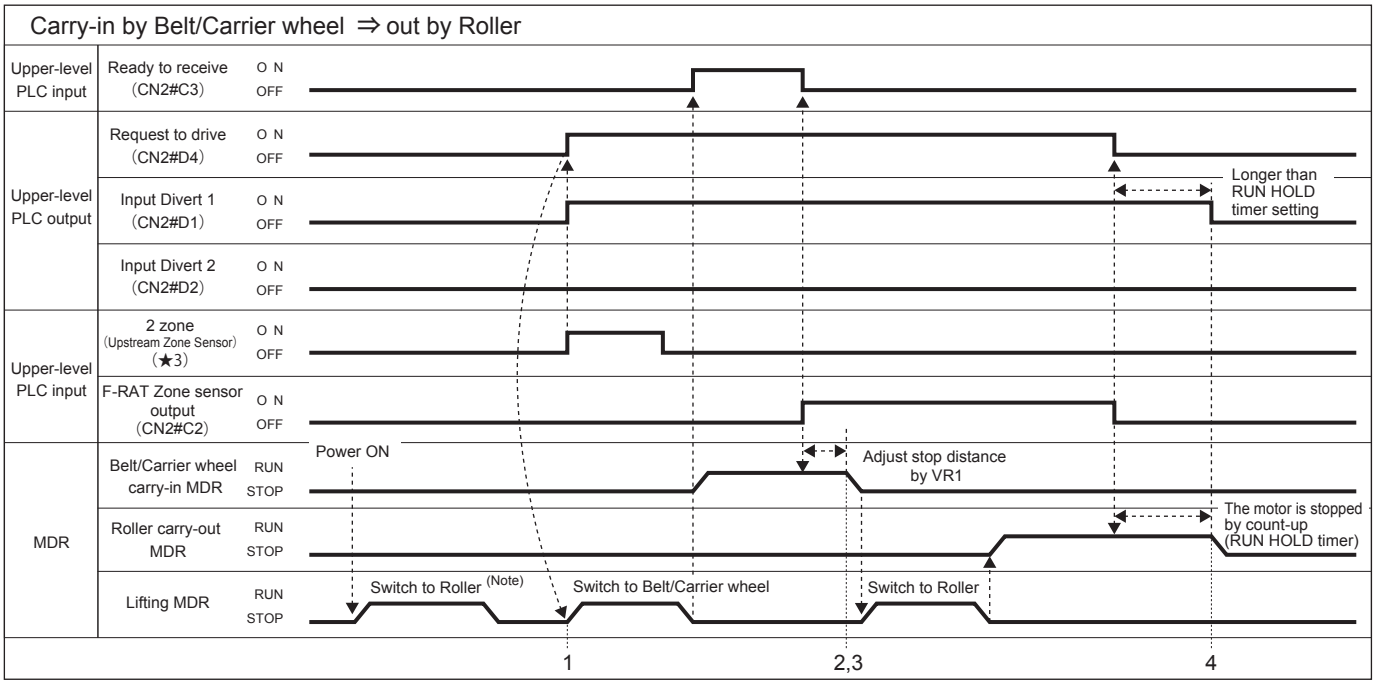
■ Divert mode Timing chart

- Carry-in by Belt/Carrier wheel
  ⇒ Carry-out by Roller to right

★1 :Boundary sensor (Zone in Carry-in)
★2 : Boundary sensor (Zone in Carry-out)
★3 : 2 zone（Upstream Zone Sensor）
★4 : 1 zone（Upstream Zone Sensor）



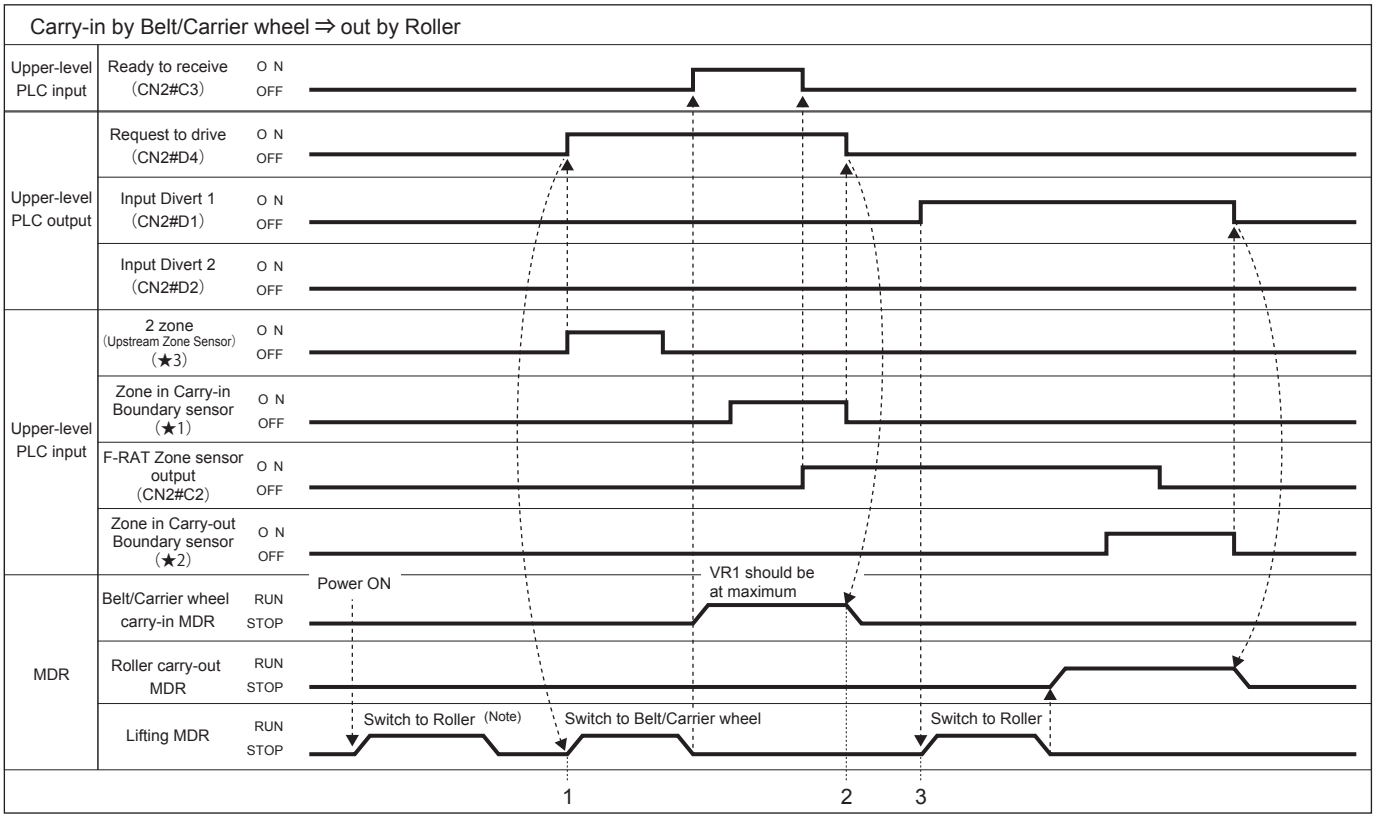
① MDR stops with VR1 or RUN HOLD timer [No boundary sensor is used]



Note : Initial Operation

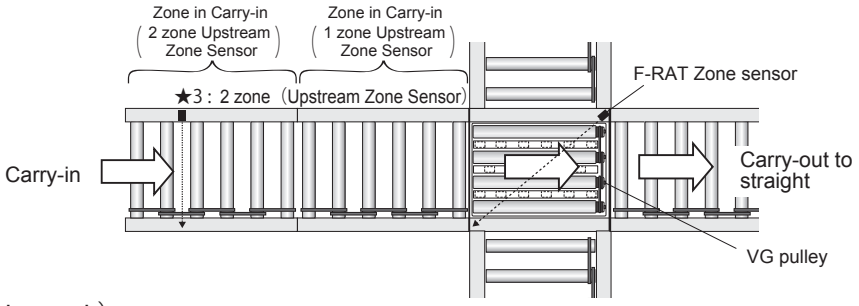
② Boundary sensors are used＊ to adjust Divert 1 input timing by PLC

＊Because carry-in and carry-out of trays can be detected, the number of processing will be more than that without using boundary sensors.



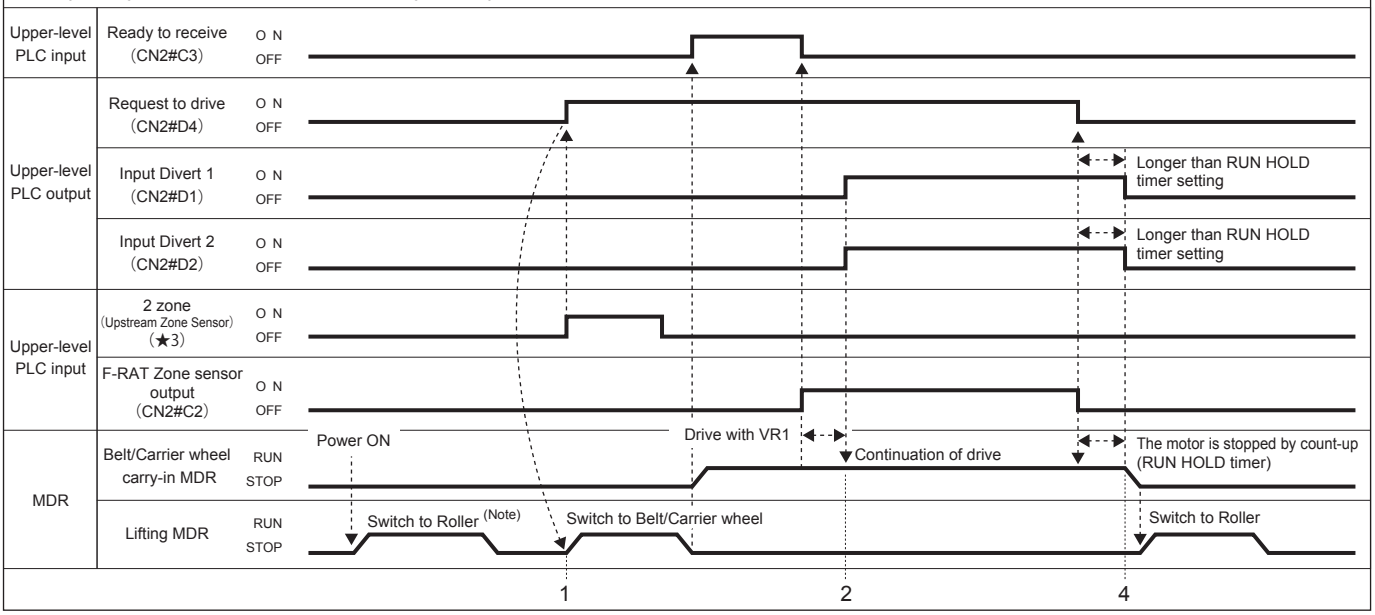
Note : Initial Operation

- Carry-in by Belt/Carrier wheel
  ⇒ Carry-out by Belt/Carrier wheel



③ Divert to straight（No boundary sensor is used.）

Carry-in by Belt/Carrier wheel ⇒ Carry-out by Belt/Carrier wheel



Note : Initial Operation

Supplementary explanation of Divert mode Timing chart①②③

1	＊ If trays stop temporarily in the 1-zone upstream of F-RAT, set "Request to drive" to ON at rising of the 2 zone (Upstream Zone Sensor) signal. ＊ For Carry-in by roller, the signal is output from "Ready to receive" (CN2#C3) when the F-RAT Zone sensor is OFF.
2	― Timing chart①③ ― ＊ When adjusting the stoppage of MDR for carry-in by belt/carrier wheel using VR1, do not set "Request to drive" to OFF until the carry-in operation stops unless boundary sensors are used. ― Timing chart② ― ＊ When using boundary sensors, maximize the volume (VR1) for adjusting the stoppage of MDR for carry-in by belt/carrier wheel. (Refer to 6-5. Adjust stopping position on page 22.)
3	＊ Drive the MDR for carry-out by roller without any trays in the carry-out zone. ＊ Until the F-RAT Zone sensor signal falls after the MDR for carry-out by roller has started driving, any divert command sent from the PLC or other units is invalid. (The carry-out direction is not switched.)
4	― MDR for carry-out by roller in timing chart ① and ② and MDR for carry-in by belt/carrier wheel in timing chart ③ ― ＊ When completing a carry-out operation (stopping the MDR) in response to the RUN HOLD timer setting, do not set "Input Divert 1" and "Input Divert 2" to OFF until the carry-out operation is completed. (Refer to 6-6. Timer Function on page 26.)

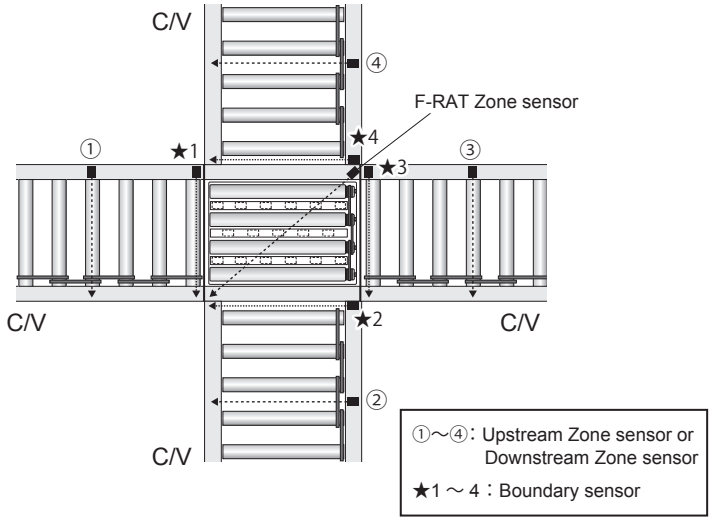
- By inputting the signal to "Input Divert 1" and "Input Divert 2" during a carry-in operation, trays can be transferred without delay time from carry-in to carry-out.
- If the carry-out direction of a tray is different from that of the next tray, switch "Input Divert 1" and "Input Divert 2" between ON and OFF after the F-RAT Zone sensor signal has risen by the first tray.

6 - 3. Upper-level Command Mode

■ About the Upper-level Command Mode

- This mode enables forced operation of the roller MDR, Lifting MDR and belt/carrier wheel MDR independently by input signal from the upper-level controller.
- The lifting motion is controlled by internal logic.
- Enter a one-shot signal of 0.1s~0.2s for the lifting motion.
- The rollers of F-RAT are set at the upper position when the power is turned on.
  (Initial operation)

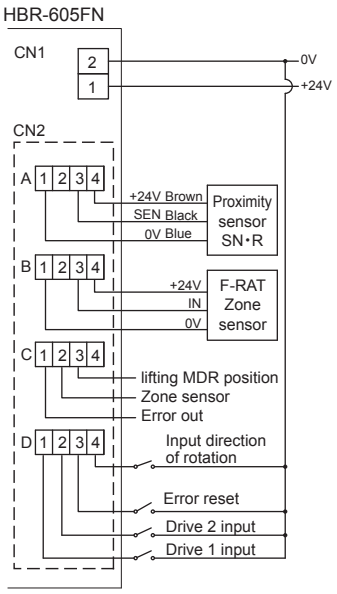
《Arrangement image》



■ Wiring

- Wiring should be made while the product is not powered.
- Switch for Run/stop or CW/CCW is an option and is not supplied.
- Relay contact or PLC output can be used instead of the above switch.
- Wiring to the supplied connectors should be made before inserting into the driver card.

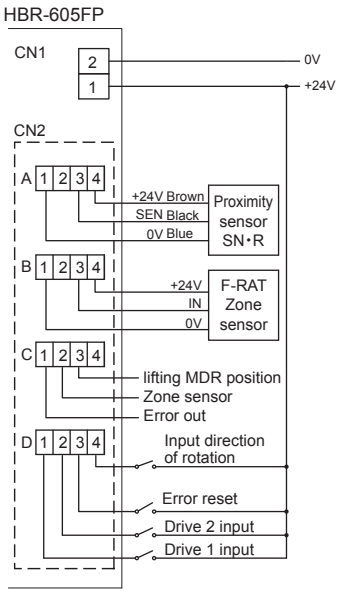
■ For the NPN I/O type



● DIP-SW Setting

SW2#4	SW2#5	SW2#6
OFF	OFF	OFF
Select the Upper-level Command Mode		NPN out

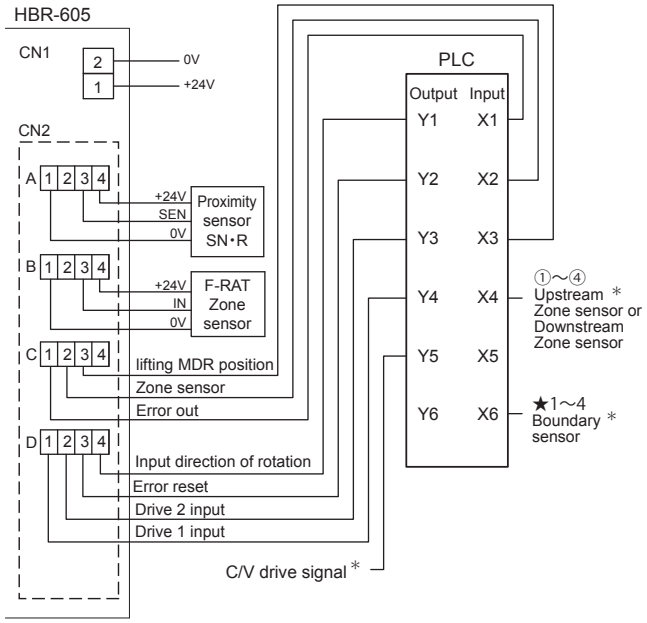
■ For the PNP I/O type



● DIP-SW Setting

SW2#4	SW2#5	SW2#6
OFF	OFF	ON
Select the Upper-level Command Mode		PNP out

Sample wiring using PLC



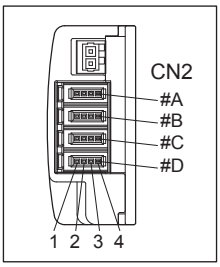
＊The number of signals/sensors to be input to and output from the PLC varies depending on the operation.

・Make the setting of "Zone sensor out" to be ON in detection of trays.
・As the voltage to be input to the control connectors (CN2), use the same voltage for the power supply.

■ CN2 assignment in Upper-level command mode

⚠ Assignment of CN2 control connectors varies depending on the logic mode.

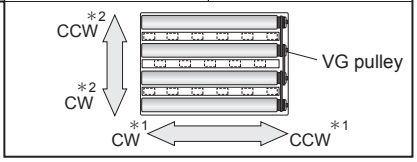
Connector number		Pin number			
		#1	#2	#3	#4
CN2#A	Proximity sensor SN・R	0V	N.A	In	+24V
CN2#B	F-RAT Zone sensor	0V	N.A	In	+24V
CN2#C	Output	Error out	Zone sensor	lifting MDR position	N.A
CN2#D	Input	Drive 1 input	Drive 2 input	Error reset	Input direction of rotation



Sensor	CN2#A1 ～ 4	Proximity sensor SN・R	・Voltages for #1 and #4 are the same as the voltage of the motor power supply. ・The maximum output of the sensor power supply is 35mA.
	CN2#B1 ～ 4	F-RAT Zone sensor	・Voltages for #1 and #4 are the same as the voltage of the motor power supply. ・The maximum output of the sensor power supply is 35mA. ・Make the setting of "Zone sensor out" to be ON in detection of trays.
Upper-level PLC input	CN2#C1	Error out (Note1) (Note2) Refer P.24,25	・This signal is discharged when HBR-605 is normal condition. - Normally output. ・During abnormality, the transistor with an open collector output is turned OFF.(Max 25mA)
	CN2#C2	Zone sensor (Note1)	・The F-RAT Zone sensor signal is output directly. ・During Zone sensor, the transistor with an open collector output is turned ON.(Max 25mA)
	CN2#C3	lifting MDR position (Note1)	・**Based on rising and falling of the signal, the state of the upper position can be detected.** (Max 25mA) ・If the roller of F-RAT is at the upper position, the signal is set to ON. ・If the belt/carrier wheel of F-RAT is at the upper position, the signal is set to OFF. ・Up/down movement is performed automatically so that the roller will come to the upper position at the time of power-on to set the signal to ON.
Upper-level PLC output	CN2#D1 CN2#D2	Drive 1 input Drive 2 input	・"Lifting MDR," "Belt/Carrier wheel MDR" or "Roller MDR" is performed depending on the combination of input signals. ・**Enter a one-shot signal of 0.1s~0.2s for the lifting motion.**

＊1 When SW2 #2 is ON (Inverted if it is OFF) ＊2 When SW2 #3 is ON (Inverted if it is OFF)

Drive motion	CN2#D1 Drive 1 input	CN2#D2 Drive 2 input	CN2#D4 Switch Belt/Carrier wheel ⇔ Roller		CN2#D4 Direction of Belt/Carrier wheel		CN2#D4 Direction of Roller	
			ON	OFF	ON	OFF	ON	OFF
Lifting MDR	ON	ON	Belt/carrier wheel is at the upper position	Roller is at the upper position	—		—	
Belt/Carrier wheel MDR	ON	OFF	—		CW ＊1	CCW ＊1	—	
Roller MDR	OFF	ON	—		—		CW ＊2	CCW ＊2
STOP	OFF	OFF	—		—		—	

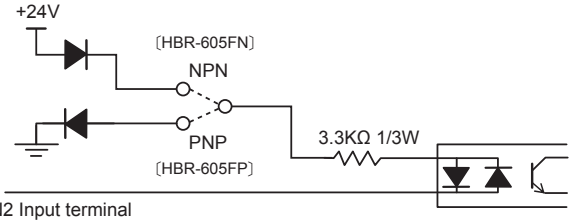


Upper-level PLC output	CN2#D3	Stop to drive/ Error reset	・When the signal is ON, MDR is stopped. ・Even when the input signal is ON, "Zone sensor" (CN2#C2) and "lifting MDR position" (CN2#C3) are enabled. ・While manual recovery is set (SW2#7: ON), error reset can be made by error reset input OFF⇒ON⇒OFF.
	CN2#D4	Input direction of rotation	"Belt/carrier wheel is at the upper position" and "Roller is at the upper position" can be switched. The direction of "Belt/Carrier wheel MDR" and the direction of "Roller MDR" can be switched. ＊ Switching between "Belt/Carrier wheel" and "Roller" cannot be performed just by the CN2＃D4 signal. Switching is performed in conjunction with input of CN2＃D1 and CN2＃D2 signals. ＊ If the signal for rotation direction is switched while the belt/carrier wheel and roller are driving, the rotation direction is switched after the system has stopped operating for 500ms. ＊ Signals that can switch the rotation direction during operation of the belt or roller are external input signals only. The rotation direction cannot be changed by SW2 (DIP-SW).

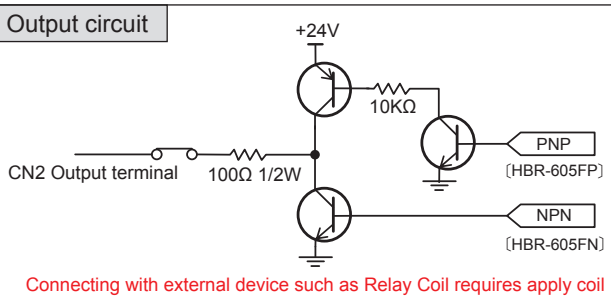
Note 1: "Error out," "Zone sensor" and "lifting MDR position" can be switched between NPN output and PNP output by SW2#6.

Note 2: No signal for "Error out" (normal output) is output immediately after the power is turned on or off. Be aware that no "Error out" signal is output for one second after the power is turned on and for two seconds after the power is turned off.

Input circuit



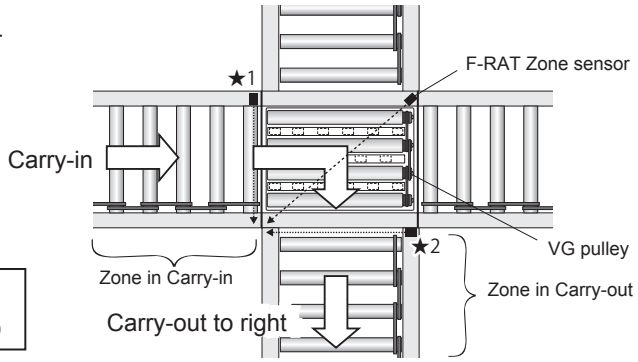
Output circuit



Connecting with external device such as Relay Coil requires apply coil surge absorption type or add protective devices to protect from surge otherwise remote OUTPUT in HBR-605 may be damaged by back EMF when output signal is changed.

■ Upper-level command mode Timing chart

● Carry-in by Belt/Carrier wheel
⇒ Carry-out by Roller to right

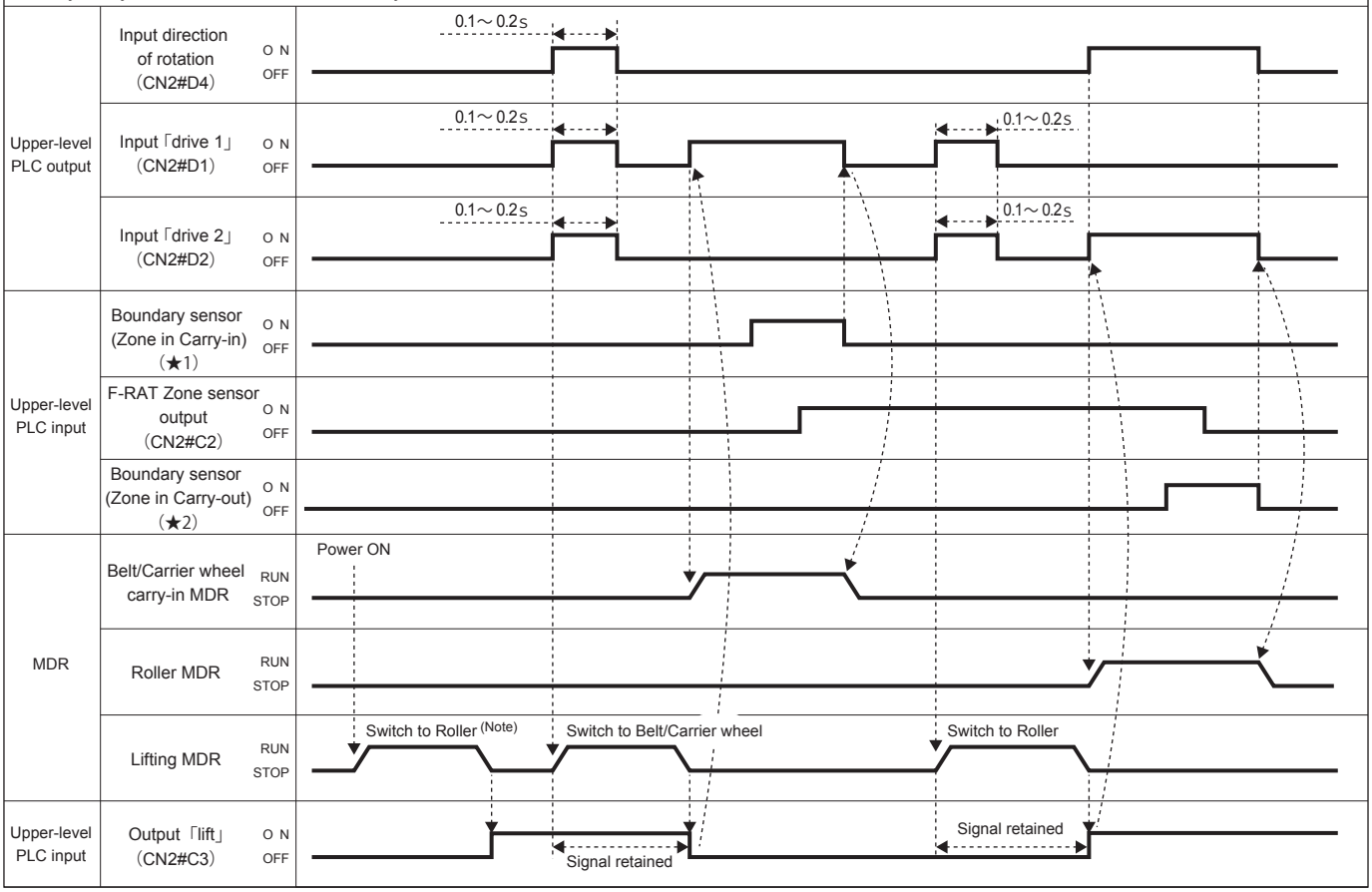


★1：Boundary sensor (Zone in Carry-in)
★2：Boundary sensor (Zone in Carry-out)

● Timing of Input「drive 1」and Input「drive 2」is adjusted by PLC using boundary sensors*

*Because carry-in and carry-out of trays can be detected, the number of processing will be more than that without using boundary sensors.

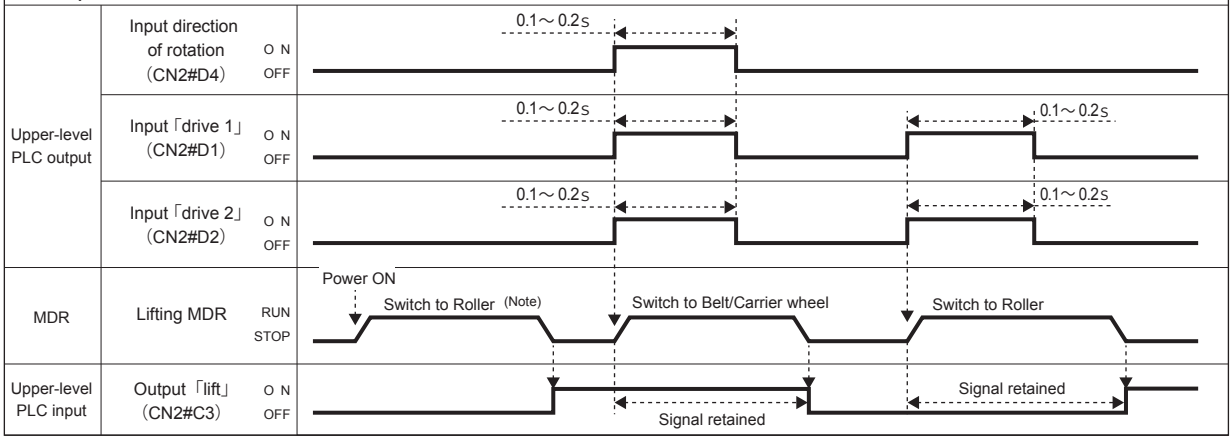
Carry-in by Belt/Carrier wheel ⇒ out by Roller



Note : Initial Operation

Reference: Lift operation timing chart

Lift operation



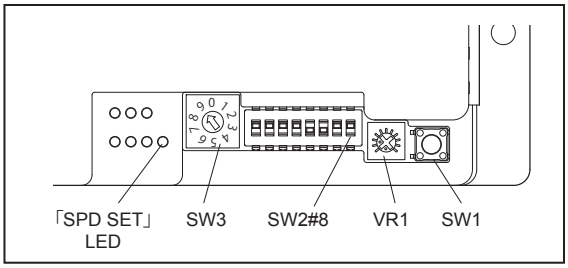
Note : Initial Operation

Speed Setting

6 - 4. Speed Setting

■ About the Speed Setting Function

- Roller MDR and Belt/Carrier wheel MDR operate at the speed written in the driver.
  ＊Lifting MDR operates at a constant speed.
- Speed cannot be changed when motor is running or error is occurred.



● Speed Setting Method

1	Select the MDR setting	SW2#8	ON	Conveyance speed of Belt/Carrier wheel
			OFF	Conveyance speed of Roller
2	Select a speed	SW3		Select a speed from the 10 levels.
3	Decision	SW1		Press SW1 (tact switch) for 1 second or longer.
4	Completes	「SPD SET」 LED (orange)	○○○ ○○○☼	When the writing of the set speed into the data flash completes, “SPD SET” LED (orange) turns ON.

SW3	Conveyance speed (m/min)			
	HBR-605F□-B (For F-RAT-S)		HBR-605F□-D (For F-RAT-U225)	
	Setting	Rating	Setting	Rating
9 (note)	61.7	53.5	60.0	52.0
8	56.6	53.5	55.0	52.0
7	51.4	51.4	50.0	50.0
6	46.3	46.3	45.0	45.0
5	41.2	41.2	40.0	40.0
4	30.9	30.9	30.0	30.0
3	20.6	20.6	20.0	20.0
2	15.4	15.4	15.0	15.0
1	10.3	10.3	10.0	10.0
0	7.7	7.7	7.5	7.5

(note) factory setting
※ Speed on MDR is referent.

● Confirmation Method of Speed Setting

1	Select the MDR setting	SW2#8	ON	Conveyance speed of Belt/Carrier wheel
			OFF	Conveyance speed of Roller
2	Select a speed	SW3		Change selection with SW3 (rotary switch).
3	Confirmation	「SPD SET」 LED (orange)	○○○ ○○○☼ Turn ON	When the speed setting and the marking of SW3 (rotary switch) match, “SPD SET” LED (orange) turns ON.
			○○○ ○○○○ Turn OFF	“SPD SET” LED(orange) does not light up when they do not match.
		＊ Error indication LED takes the priority when a sensor timer error, JAM error, or unmatched transport MDR error occurs. (“SPD SET” LED does not turn ON during error indication)		

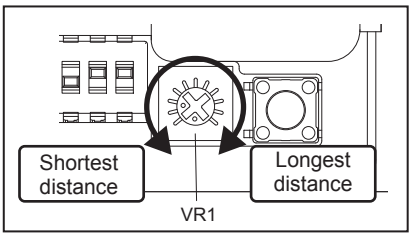
Adjust stopping position

6 - 5. Adjust stopping position

＊When the system is operated with the“upper-level command”, VR1 cannot be used.

- By adjusting the variable resistor (VR1), the motion distance from the Zone sensor ON to the stopping of the carry-in MDR can be adjusted.
- The left side of the knob scale indicates the shortest distance, and the right side of the knob scale indicates the longest distance.
- At the shortest value, the carry-in MDR stops immediately when the Zone sensor is blocked by a product.
  When using HBR-605F□-B, stopping position can be adjusted between 0 to 757mm＊.
  When using HBR-605F□-D, stopping position can be adjusted between 0 to 895mm＊.

※Stopping position is approximate because it varies by the conditions of the product being carried.
※To complete a carry-in operation by setting "Request to drive" (CN2#D4) to OFF when boundary sensors are used in Diverter mode, maximize the scale of VR1.



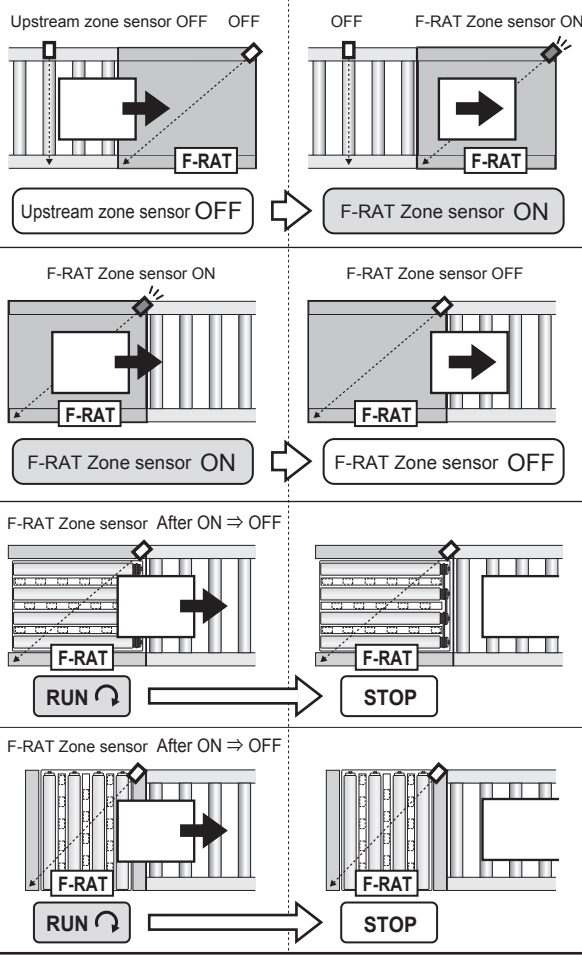
Timer Function

6 - 6. Timer Function

＊Timer function is made invalid when using the upper-level command mode.

- Conditions for the timer function change depending on the logic mode and the set speed.

Timer function and corresponding logic mode	motion	Time-up time and transfer distance (Note 4)
Sensor timer (Note 1) During a carry-in transport operation, when the upstream zone sensor turns OFF, and the Zone sensor does not change to ON within the set time of the timer, the carry-in drive stops and an error signal is issued. Auto L-shape Mode Error reset Method (refer P.25)	Carry in	1.5 ～ 12.0 sec 1,500mm
JAM timer (Note 2) During a carry-out operation, when the Zone sensor does not change to OFF within the set time of the timer, the carry-out MDR stops and error signal is issued. Auto L-shape Mode / Diverter Mode Error reset Method (refer P.25)	Carry out	2.0 ～ 16.0 sec 2,000mm
RUN HOLD timer (Note 3) During a carry-out operation, after the Zone sensor turns OFF, the timer continues the motor drive for the set length of time. Auto L-shape Mode / Diverter Mode	HBR-605F□-B Carry-out by Belt/Carrier wheel (For F-RAT-S)	0.8 ～ 6.1 sec 757mm
	HBR-605F□-D Carry-out by Carrier pulley (For F-RAT-U225)	0.9 ～ 7.2 sec 895mm
	HBR-605F□-B Carry-out by Roller (For F-RAT-S)	0.7 ～ 5.7 sec 709mm
	HBR-605F□-D Carry-out by Roller (For F-RAT-U225)	0.6 ～ 4.8 sec 595mm



Note 1: Depending on the sensor attaching position, zone length, size of the tray and/or transfer speed, the sensor timer may run out during normal transfer; therefore, the trays may not be carried in completely.
Note 2: Depending on the sensor attaching position, zone length, size of the tray and/or transfer speed, the JAM timer may run out during normal transfer; therefore, the trays may not be carried out completely.
Note 3: Product may not be carried out from the F-RAT within the timer set time depending on the condition of the sensor position, zone length, tray size, and transport speed.
Note 4: The transfer distance is an approximate value as it varies by the condition of carried product.

● Table for timer setting and speed setting

(sec)

SW3	Sensor timer	JAM timer	RUN HOLD timer			
			HBR-605F□-B (For F-RAT-S)		HBR-605F□-D (For F-RAT-U225)	
			Carry-out by Belt	Carry-out by Roller	Carry-out by Carrier Pulley	Carry-out by Roller
9 (Note)	1.5	2.0	0.8	0.7	0.9	0.6
8	1.6	2.2	0.8	0.8	1.0	0.6
7	1.8	2.4	0.9	0.9	1.1	0.7
6	2.0	2.7	1.0	1.0	1.2	0.8
5	2.3	3.0	1.1	1.1	1.3	0.9
4	3.0	4.0	1.5	1.4	1.8	1.2
3	4.5	6.0	2.3	2.1	2.7	1.8
2	6.0	8.0	3.0	2.8	3.6	2.4
1	9.0	12.0	4.5	4.3	5.4	3.6
0	12.0	16.0	6.1	5.7	7.2	4.8

Note : factory setting

7. Operation

7 - 1. Initial Operation

● Power ON

・When power is turned on, the Lifting MDR initial drive is activated.

＊When the transport surface changes to rollers, the Lifting MDR stops.

＊Only when the auto L-shaped mode is used, carry-in and carry-out motions do not operate for 15 seconds after turning the power.

● About the stand-by position

・After completing the initial drive, the transport surface stands by with the roller surface.

・If an error is discharged, the system gets into stand-by with the transport surface switched to the roller surface.

＊The transport surface is not switched with a low voltage error, lifting motor locking error or connector disconnection.

7 - 2. Test Run

⚠ CAUTION

- Confirm that no surrounding units/machines will start working.
  With regard to equipment that is built in the system, such as a conveyor line, it can be dangerous because trays are carried from the upstream as the conveyor is started. Before starting a test run, make sure that starting the test run won't activate any other elements in the system.
- Do not attempt to forcibly move trays that are on the belt/carrier wheel.
  Such an attempt can cause damage to or a failure of the system and/or trays.
- Before starting a test run, make sure that the wiring and driver settings are correctly configured.
  Failure to do so can cause damage to or a failure of the system and/or trays.

● First, perform several test runs without any trays to check for abnormal system behaviors.
In so doing, pay attention to the following points:

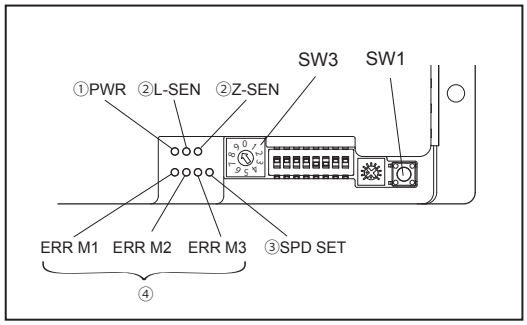
①The error LED of the driver should not illuminate.

②There should be no abnormal noises and parts/sections with abnormally high temperature.

8 . LED Indications

①“PWR” LED (Green)

- This indicator turns ON when 24V DC and 0V are connected to CN1.
- It also makes blinking when error is discharged by disconnecting the motor connector.



②“L-SEN”, “Z-SEN” LED (Green)

- “L-SEN” LED turns ON according to the input condition of the Proximity sensor (CN2#A).
- “Z-SEN” LED turns ON according to the input condition of the Zone sensor (CN2#B).
- These indicators are turned ON with sensor input: ON, and turned OFF with sensor input: OFF.

③S“SPD SET” LED (Orange)

- This indicator turns ON when SW1 (tact switch) is pressed and speed is set.*1
- It turns ON when SW3 (rotary switch) position and the set speed are matched.*1
- It blinks when a sensor timer error occurs.*2 (When using auto L-shaped operation)
- It also blinks when JAM error occurs.*2 (When using auto L-shaped operation and divert mode)
- It also blinks when a Unmatched transport MDR error occurs.*2 (When using upper-level command mode)

＊1 For details on the speed setting and set speed, see page 21.
＊2 For the timer function, see page 22. For details of errors and how to reset them, see page 25.

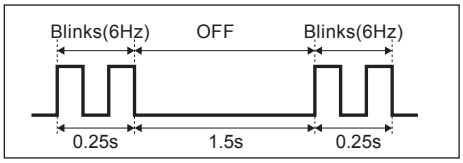
④“ERR M1”, “ERR M2”, “ERR M3” LED (Red)

- Each of these indicators turns ON or blinks when the corresponding error occurs.
- When an error occurs by low voltage error, or fuse blown off, all of “ERR M1”, “ERR M2”, and “ERR M3” turns on or blink.
- When an error occurs with Back EFM error, thermal error, motor connector disconnection, motor lock, or current limit, only the LED corresponding to the motor axis that discharged an error turns ON or blinks.

(For details of errors and how to reset them, see page 29.)

LED / Status	「PWR」 LED (Green)	「SPD SET」 LED (Orange)	「ERR M1、M2、M3」 LED (Red) (Note1)	CN2#C1 (Note2) Error out	Priority
Normal operation	ON	ON / OFF (Note3)	OFF	Discharged	
Power OFF	OFF	OFF	OFF	n.a	
Low voltage	OFF	ON / OFF (Note3)	Blinks (6Hz)	n.a	1
Fuse blown off	OFF	ON / OFF (Note3)	Blinks (6Hz)	n.a	
Back EFM	ON	ON / OFF (Note3)	Blinks (6Hz) ⇔ OFF (Note9)	n.a	
Motor connector disconnected (Note4)	Blinks (1Hz)	ON / OFF (Note3)	Blinks (1Hz)	n.a	2
Thermal error	ON	ON / OFF (Note3)	ON	n.a	3
Motor stall (lock)	ON	ON / OFF (Note3)	Blinks (1Hz)	n.a	4
Sensor timer error (Note5)	ON	Blinks (1Hz)	OFF	n.a	
JAM error (Note6)	ON	Blinks (1Hz)	OFF	n.a	
Unmatched transport MDR error (Note7)	ON	Blinks (1Hz)	OFF	n.a	
Current limitation (Note8)	ON	ON / OFF (Note3)	Blinks (6Hz)	Discharged	

NOTE1 : “ERR M1” corresponds to belt/carrier wheel MDR, “ERR M2” to roller MDR, and “ERR M3” to Lifting MDR.
NOTE2 :Error output is an normality output.
NOTE3 :This indicator turns ON when the indication by SW3 (rotary switch) and the set speed are matched.
NOTE4 :When the motor connector is disconnected, the LED (Green) and LED (Red) blink alternately.
NOTE5 :Sensor timer error becomes valid when auto L-shaped mode is used.
NOTE6 :JAM error becomes valid when auto L-shaped mode or divert mode is used.
NOTE7 :Unmatched transport MDR error becomes valid when the upper-level command mode is used.
NOTE8 :When a current limit continues for 1s or longer, LED (Red) turns ON.
NOTE9 :The pattern of Blinks(6Hz) ⇔ OFF



- “L-SEN” LED (Green) turns ON according to the input condition of Proximity sensor (CN2#A) regardless of the condition shown above.
- “Z-SEN” LED (Green) turns ON according to the input condition of Zone sensor (CN2#B) regardless of the condition shown above.

■Detail of Errors and Method of Reset

- If an error is discharged, the transport surface switched to the roller surface.
  ＊The transport surface is not switched with a low voltage error, lifting motor locking error or connector disconnection.
- Error signal is issued from CN2#C1 (Error out) during abnormality.Error output can be selected between NPN/PNP output by using SW2#6.
- Automatic/manual recovery from an error can be set using SW2#7. (See page 5.)

Type		Generation Condition	Recovery Condition		
Voltage Abnormality	Low voltage error	Power supply voltage of 15V or below continues for 1s or below 15V 5 times in 0.5s	Reset when power supply voltage gets above 18V	Auto	The signal from CN2#C1 (Error out) is set to ON and the LED indication is set to the "Normal operation" status when the recovery condition is met.
				Manual	The signal from CN2#C1 (Error out) is set to ON and the LED indication is set to the "Normal operation" status by satisfying the recovery condition and inputting signals OFF ⇒ ON ⇒ OFF in CN2#D3 (Error reset).
	Fuse blown off	Fuse is blown off（1秒経過後）	No recovery condition (PC board needs to be replaced)		
	Back EMF error	Motor voltage of 40V continued for 2 sec. Motor voltage of 60V continued for 0.1sec.	Rest when motor voltage of 30V or below continued for 1sec.	Auto	The signal from CN2#C1 (Error out) is set to ON and the LED indication is set to the "Normal operation" status when the recovery condition is met.
				Manual	The signal from CN2#C1 (Error out) is set to ON and the LED indication is set to the "Normal operation" status by satisfying the recovery condition and inputting signals OFF ⇒ ON ⇒ OFF in CN2#D3 (Error reset).
Temperature Abnormality	PB thermal error	Board (FET) temperature of 95°C or Upper continued for 1s.	Reset when board (FET) temp is 85°C or below	Auto	The signal from CN2#C1 (Error out) is set to ON after 60 seconds and the LED indication is set to the "Normal operation" status when the recovery condition is met.
				Manual	The signal from CN2#C1 (Error out) is set to ON and the LED indication is set to the "Normal operation" status by satisfying the recovery condition and inputting signals OFF ⇒ ON ⇒ OFF in CN2#D3 (Error reset).
	Motor thermal error	MDR internal temp of 105°C continued for 1s.	Reset when MDR internal temp gets 95°C	Auto	The signal from CN2#C1 (Error out) is set to ON after 60 seconds and the LED indication is set to the "Normal operation" status when the recovery condition is met.
				Manual	The signal from CN2#C1 (Error out) is set to ON and the LED indication is set to the "Normal operation" status by satisfying the recovery condition and inputting signals OFF ⇒ ON ⇒ OFF in CN2#D3 (Error reset).
Other Abnormality Abnormality	Motor connector disconnection	Abnormality is detected when the motor connector is disconnected during power ON or motor starting	Connecting the motor connector	Auto	The signal from CN2#C1 (Error out) is set to ON and the LED indication is set to the "Normal operation" status when the recovery condition is met.
				Manual	The signal from CN2#C1 (Error out) is set to ON and the LED indication is set to the "Normal operation" status by satisfying the recovery condition and inputting signals OFF ⇒ ON ⇒ OFF in CN2#D3 (Error reset).
	Lock error	Abnormality is detected when the motor does not rotate for 1s.		Auto	If the MDR motor in which a lock error has occurred has a change of eight or more pulses, the signal from CN2#C1 (Error out) is set to ON and the LED indication is set to the "Normal operation" status.
				Manual	The signal from CN2#C1 (Error out) is set to ON and the LED indication is set to the "Normal operation" status by inputting signals OFF ⇒ ON ⇒ OFF in CN2#D3 (Error reset).
	Sensor timer error (Auto L-shaped mode)	After the upstream zone sensor turns OFF in a carry-in operation, Zone sensor OFF condition continues for a certain period.		Auto	None
				Manual	・The signal from CN2#C1 (Error out) is set to ON and the LED indication is set to the "Normal operation" status by switching the F-RAT Zone sensor from OFF to ON. ・The signal from CN2#C1 (Error out) is set to ON and the LED indication is set to the "Normal operation" status by inputting signals OFF ⇒ ON ⇒ OFF in CN2#D3 (Error reset)。
	JAM error (Auto L-shaped / divert mode)	Zone sensor ON condition continues for a certain period during carry-out motor drive.		Auto	None
				Manual	・The signal from CN2#C1 (Error out) is set to ON and the LED indication is set to the "Normal operation" status by switching the F-RAT Zone sensor from OFF to ON. ・The signal from CN2#C1 (Error out) is set to ON and the LED indication is set to the "Normal operation" status by inputting signals OFF ⇒ ON⇒ OFF in CN2#D3 (Error reset).
	Unmatched transport MDR error (Upper-level command mode)	・The roller MDR drive signal is input for 0.1 seconds or more with the F-RAT belt/carrier wheel set at the upper position. ・The belt/carrier wheel MDR drive signal is input for 0.1 seconds or more with the F-RAT roller set at the upper position. ・The "switching to belt/carrier wheel" drive signal is input for 0.1 seconds or more with the F-RAT belt/carrier wheel set at the upper position. ・The "switching to roller" drive signal is input for 0.1 seconds or more with the F-RAT roller set at the upper position. (Refer to "CN2 assignment in Upper-level command mode" on page 19.)		Auto	None
				Manual	The signal from CN2#C1 (Error out) is set to ON and the LED indication is set to the "Normal operation" status by inputting signals OFF ⇒ ON ⇒ OFF in CN2#D3 (Error reset).

9. Specifications

■ HBR-605F①-□ ＊①＝N (NPN input / output) or P (PNP input / output)

Power voltage			24V DC±10%
Rated voltage			24V DC
Static current			0.12A
Starting current			4.0A
Wir Dia	Power connector (CN1)		0.50～1.5mm² (AWG:20～14)
	Control connector (CN2)	#A, #B	0.14～0.3mm² (AWG:26～24) (Note)
		#C, #D	0.30～0.5mm² (AWG:22～20) (Note)
Motor rotation from drive input			15ms or below
Protection function			Error wiring protection by 7A fuse
Temp protection			95°C on board, 105°C on motor
Current restriction			4A
Ambient temperature			0~40°C (No freezing)
Ambient humidity			90%RH or below (No condense)
Atmosphere			No corrosive gas permitted
Vibration			0.5G or below
Installation			Indoor

Note : Recommend wiring size

Board side	Power connector		734-162 (WAGO)
	Control connector		37216-62M3-004PL (3M)
Wiring side	Power connector (CN1)		734-102 (WAGO)
	Control connector (CN2)	#A, #B	37104-3122-000 FL (yellow) (3M) ・AWG No.: 26～24 ・Nominal cross sectional area : 0.14～0.3mm² or less ・Finished outside diameter: ϕ1.0～1.2mm
		#C, #D	37104-2206-000 FL (gray) (3M) ・AWG No.: 22～20 ・Nominal cross sectional area : 0.3～0.5mm² or less ・Finished outside diameter: ϕ1.6～2.0mm

< MEMO >

● Use the following formats to record the system settings.

System name, number, etc.	SW3 (Note): Belt/carrier pulley speed SW2(DIP-SW)#8 ON	SW3 (Note): Conveyance speed of Roller SW2(DIP-SW)#8 OFF	SW2 (DIP-SW)									VR1
				#1	#2	#3	#4	#5	#6	#7	#8	
〈Sample form〉 C/V-001	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	ON	✓	✓	✓	✓			✓	✓	
			OFF					✓	✓			
	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	ON									
			OFF									
	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	ON									
			OFF									
	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	ON									
			OFF									
	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	ON									
			OFF									
	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	ON									
			OFF									

Note: For how to check the set speed, refer to 6-4. Speed Setting on page 21.

10. Troubleshooting

When a failure is suspected, check the following before contacting us.

	Symptom	Point to be checked	Processing	Reference
General	F-RAT does not operate.	Is the PWR LED on?	Supply power of 24VDC.	Wiring of connector P.8
		Is SPD SET LED (orange) blinking and is ERR M1, ERR M2 or ERR M3 LED on or blinking after the error has occurred?	Remove the cause of the error and recover from the error.	LED Indications P.24
		Is every connector connected properly? Is the wiring correct?	Check the wiring for each mode.	About the Logic Mode P.9
		Is the proximity sensor assigned to CN2#A? Is the wiring correct?	Wire (assign) the proximity sensor to CN2#A.	Connecting F-RAT and HBR-605 P.7
		Is the setting of SW2#6 (output signal: NPN/PNP) correct?	Configure the setting of SW2#6 correctly.	Dimensions and Part Details P.5
		Is the F-RAT Zone sensor set to be ON as it detects a tray?	Set the F-RAT Zone sensor to be ON as it detects a tray.	
		Is the voltage to be input to the control (CN2) connectors same as that of the power supply?	As the voltage to be input to the control (CN2) connectors, use the same voltage as that of the power supply.	Wiring P.10 P.13 P.18
	The speed cannot be changed.	Has the MDR of which to change the speed been set with SW2#8? After having determined the speed using SW3, did you press SW1 for 1 second or more? If you did, did you confirm that SPD LED (orange) had illuminated after pressing SW1?	Check the method for setting the speed.	Speed Setting Method P.21
	When an error occurred, the belt/carrier wheel stopped at the upper position.	Is the voltage supplied to the driver 24V DC?	Supply a voltage of 24VDC, and then turn on the system again.	LED Indications P.25
		Is PWR LED (green) off and is ERR M1, ERR M2 or ERR M3 LED (red) blinking after the error has occurred? (Has the "Low voltage" error occurred?)		
		Is PWR LED (green) on or blinking and is ERR M3 LED (red) blinking after the error has occurred? (Has a lifting motor locking error or connector disconnection error occurred?)	Remove the cause of the error, and then turn on the system again.	
Auto L-shape mode	The MDR does not operate.	Is the wiring of the MDR with HB-510 correct?	Check the wiring for the Auto L-shape mode.	Wiring P.10
	The upstream C/V and/or downstream C/V do not operate.	Are the DIP-SW settings for HB-510 and HBR-605 correct?	Check the DIP-SW settings for HB-510 and HBR-605.	

	Symptom	Point to be checked	Processing	Reference
Divert Mode	The carry-in MDR does not operate.	Is the signal input to "Request to drive" (CN2#D4) for the carry-in operation?	Input the signal to "Request to drive."	Divert mode Timing chart P.16 P.17
		Is the F-RAT Zone sensor set to be ON as it detects a tray?	Set the F-RAT Zone sensor to be ON as it detects a tray.	
	The carry-out MDR does not operate.	Are the signals input to "Divert 1 input" (CN2#D1) and "Divert 2 input" (CN2#D2) for a carry-out operation?	Input the signals to "Divert 1 input" and "Divert 2 input."	Divert mode Timing chart P.16 P.17
	The carry-out direction does not change.	Is the combination of the signals to be input to "Divert 1 input" (CN2#D1) and "Divert 2 input" (CN2#D2) consistent with the carry-out direction?	Input the signals that are consistent with the carry-out direction.	Transport setting P.15
	The carry-out MDR stops operating before all the trays are completely carried out.	When no boundary sensor is used, are the signals to be input to "Divert 1 input" (CN2#D1) and "Divert 2 input" (CN2#D2) set to be OFF after the RUN HOLD timer runs out?	Set the signals to be input to "Divert 1 input" and "Divert 2 input" to OFF after the RUN HOLD timer runs out.	Divert mode Timing chart P.16 P.17 Timer Function P.22
		When no boundary sensor is used, are the signals to be input to "Divert 1 input" (CN2#D1) and "Divert 2 input" (CN2#D2) set to be OFF after the Boundary sensor (Zone in Carry-out) is switched from ON to OFF?	Set the signals to be input to "Divert 1 input" and "Divert 2 input" to OFF after the Boundary sensor (Zone in Carry-out) is switched from ON to OFF.	Divert mode Timing chart P.16
	When the system is used for Carry-in by Belt/Carrier wheel, trays stop temporarily at the upstream C/V or trays stop and are not carried into F-RAT.	Is the setting configured as follows: The upstream C/V is driven by receiving ON of "Ready to receive" (CN2#C3) after the signal is output to "Request to drive" (CN2#D4)?	Set the one-zone upstream C/V to be driven by receiving ON of "Ready to receive" after the signal is output to "Request to drive."	Divert mode Timing chart P.16 P.17
Upper-level Command Mode	When the signal for switching to the belt/carrier wheel operation is input, an error occurs.	Is the F-RAT roller at the upper position? Is "lifting MDR position" (CN2＃C3) set to ON? Is SPD SET LED (orange) blinking?	When the belt/carrier wheel is at the upper position, do not switch the operation to the belt/carrier wheel operation.	Detail of Errors and Method of Reset "Unmatched transport MDR error" P.25
	When the signal for switching to the roller operation is input, an error occurs.	Is the F-RAT belt at the upper position? Is "lifting MDR position" (CN2＃C3) set to OFF? Is SPD SET LED (orange) blinking?	When the roller is at the upper position, do not switch the operation to the roller operation.	Input drive 1 (CN2＃D1) Input drive 2 (CN2＃D2) P.19
	After the operation is switched to the belt/carrier wheel operation or the roller operation, an error occurs.	Are the signals to be input to "Input drive 1" (CN2＃D1) and "Input drive 2" (CN2＃D2) one shot between 0.1s and 0.2s? Is SPD SET LED (orange) blinking?	Set the signals to be input to "Input drive 1" and "Input drive 2" to be one shot between 0.1s and 0.2s.	Detail of Errors and Method of Reset "Unmatched transport MDR error" P.25 Upper-level Command Mode Timing chart P.20
	When the belt/carrier wheel MDR drive signal is input, an error occurs.	Is the belt/carrier wheel at the upper position? Is "lifting MDR position" (CN2＃C3) set to OFF? Is SPD SET LED (orange) blinking?	Set the belt/carrier wheel at the upper position, and then input the belt/carrier wheel MDR drive signal.	Detail of Errors and Method of Reset "Unmatched transport MDR error" P.25
	When the roller MDR drive signal is input, an error occurs.	Is the roller at the upper position? Is "Ready to receive" (CN2＃C3) set to ON? Is SPD SET LED (orange) blinking?	Set the roller at the upper position, and then input the roller MDR drive signal.	Input drive 1 (CN2＃D1) Input drive 2 (CN2＃D2) P.19
	The transfer direction does not change.	Is the signal to be input to "Input direction of rotation" (CN2#D4) consistent with the transfer direction?	Input the signal that is consistent with the transfer direction.	Input drive 1 (CN2＃D1) Input drive 2 (CN2＃D2) P.19

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