

F-RAT-U225 Operating Instructions

Flat-Right Angle Transfer

Thank you for purchasing F-RAT-U225

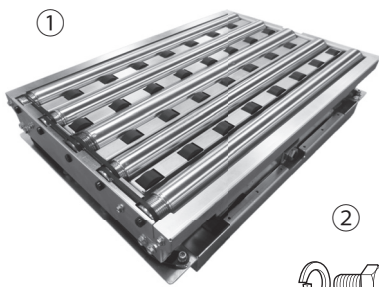
- Before using, please read the operating instructions carefully to obtain the product knowledge, safety information and to understand all of the caution items.
- After reading the instructions, store the booklet in a designated location for readily accessing at any time. When you open the crate, check the model, specifications, voltage, etc. are correct.



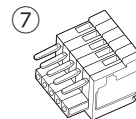
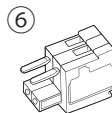
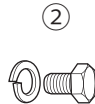
Please refer to HBR-605 user manual when HBR-605 is used for operation.

When opening the crate ...

The crate contains the following items. Check that every item is included.
Also, check if the model, specification, etc. are as you ordered.



The photo shows
Size 6040



	Item	Size 6040 / 6050 9040 / 9050	Size 6060 / 6070 / 6080 6060 / 9070 / 9080
①	F-RAT-U225 Main unit, including Carrier Wheel transfer side sensor (SN·S) Roller transfer side sensor (SN·R)	1 unit	
②	Hex bolt M8×15 / Spring washer For installing F-RAT-U225 main unit	4 sets	
③	Driver card CB-016□ ^(Note) 6	2 unit	1 unit
④	Driver card CB-016□ ^(Note) 6-CP2	—	2 unit
⑤	Driver card (for Lifting) CBR-306F□ ^(Note)	1 unit	
⑥	Power connector 734-102 (WAGO)	3 unit	4 unit
⑦	Control connector 733-105 (WAGO)	3 unit	4 unit
⑧	Cross-slotted screw/washer M4×15 / Hex nut M4 for mounting driver card	6 sets	8 sets

(Note) Depending on the input/output type of F-RAT-U225, NPN (N) or PNP (P) signal input driver card is included.

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1. General Cautions 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.

- Do not step on the product or apply a load. It may lead to a failure or unexpected accident.
- Do not touch the mechanism by hand during operation. The hand may be caught by the mechanism and injured.
- Do not absolutely modify the F-RAT or the driver card. Serious injury may be caused.
- Do not forcibly bend or pull the wire. Do not put a heavy item on the wire or pinch the wire. The cord may break and cause fire or electrical shock.
- To avoid a failure or electrical shock, ground the DC power supply or driver card to the conveyor frame.
- Do not touch the equipment immediately after stopping. It may cause kin burn.
- Do not splash water on the equipment. Electrical shock or failure may be caused.
- Do not apply a strong impact or excessive force such as hitting the equipment or dropping an object. Do not use the equipment after it is impacted or deformed. It may cause a failure.
- When abnormal sound is heard during motion, stop the operation. Continued operation may cause an accident or failure.
- Do not use the equipment by exceeding the specification. It may cause a failure, fire or injury.
- Do not carry out operation of transfer, connection, maintenance inspection (except maintenance inspection to be performed during operation). Switch off the power before operation.
- Comply with the safety rules required for the location and equipment to be used.
- Some type of driver card failure may make the input/output ON condition or OFF condition. Apply an external monitoring circuit for the input/output signal that may lead to an injury or property damage.
- Connect or disconnect a connector when the power is shut off. Do not perform wiring with the connector inserted in the driver card.
- Securely attach the connector of each connecting cable to the connection point.
- Incorrect wiring may cause a failure. Carefully check the wiring.
- Do apply excessive force for operating the DIP switch.
- Do not perform on/off operation of a relay or connector near the power line, signal line, or driver card. That may cause malfunction by noise.
- When LED circuit or Pull-up/Pull-down circuit is connected to the output circuit, unexpected operation may occur.
- Apply power ON in the order of external controller→driver card. Perform power OFF in the order of driver card→External controller. Incorrect order may cause malfunction.
- Cutting the power disables electrical braking control, and the roller becomes easy to be rotated.
- Do not pull out a cable during operation. It may cause a failure.
- Do not forcibly rotate MDR except during maintenance inspection. That may cause driver card breakage or make the operation life extremely short.
- Do not shut off the power during MDR rotation. It may cause a failure.
- Do not apply power while riding on the conveyor or while a tray is unstable condition. MDR rotation immediately after power ON may cause injury, accident or breakage.
- When error occurs frequently, remove the cause.
- When disposing the equipment, make a consignment contract with an authorized industrial waste processing company for disposal.

1 - 3. About Risk Category of this System



Warning

About Risk Category of this System

- This equipment intends to comply with risk category 2 or below in EN 954-1. It does not comply with risk category 3 or higher.

2. Product designation

F-RAT-U225- ① ② - ③ - ④

① Speed

17 ... 17m/min Low speed type (Carrier Wheel / Roller transfer : 17m/min)
60 ... 60m/min standard type (Carrier Wheel / Roller transfer : 60m/min)

② Signal type selection

N ... NPN input/output

(NPN input/output driver card / Roller transfer side sensor •
Carrier Wheel transfer side sensor included)

P ... PNP input/output

(PNP input/output driver card / Roller transfer side sensor •
Carrier Wheel transfer side sensor included)

③ Size

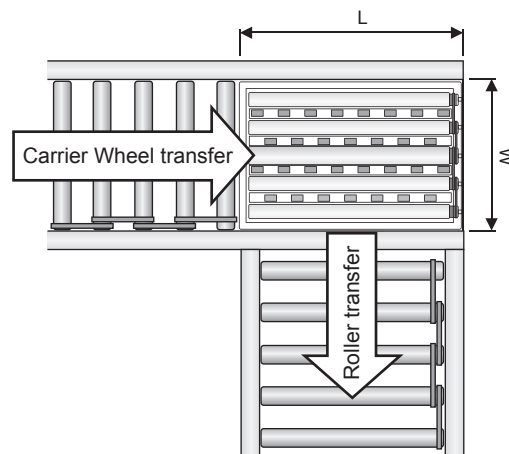
6040...L595mm×W395mm	9040...L895mm×W395mm
6050...L595mm×W495mm	9050...L895mm×W495mm
6060...L595mm×W595mm	9060...L895mm×W595mm
6070...L595mm×W695mm	9070...L895mm×W695mm
6080...L595mm×W795mm	9080...L895mm×W795mm

④ Type

V1

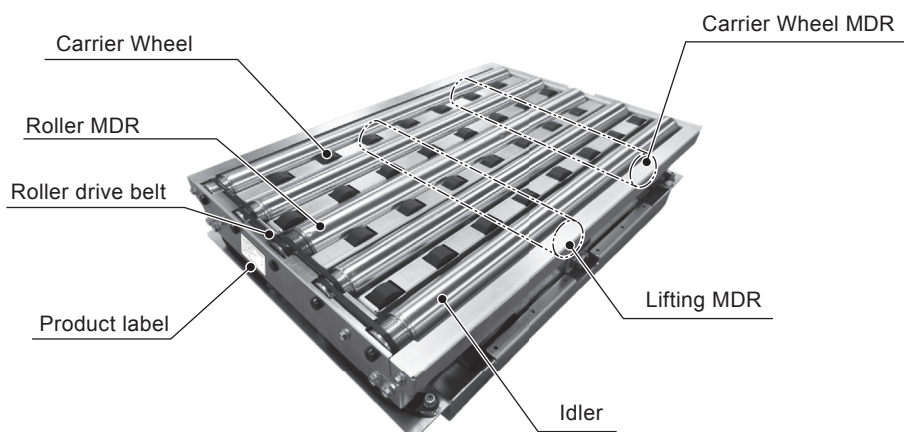
Model Example : F-RAT-U225-60N-6050-V1

Transport speed 60m/min, NPN input/output type, Size 6050 (L595mm×W495mm) , Type V1



3. Structure

■ Main Unit



Label detail

FLAT RIGHT ANGLE TRANSFER
F-RAT-U225-①②-③④
RATED INPUT:DC24V, ③④A
PAYLOAD:max ⑤kg
SERIAL No. ⑦⑧⑨⑩⑥
ITO DENKI CO.,LTD
MADE IN JAPAN

Product model

①Transport speed,②Input/output type,
③Size, ④Type

Transport capacity

⑤Rated current of transport MDR,
⑥Available load weight

Serial No. (YY.MM.DD Lot No)

⑦ Year (last 2 digits) ⑧ Month ⑨ Day
⑩Lot No (3 digits)

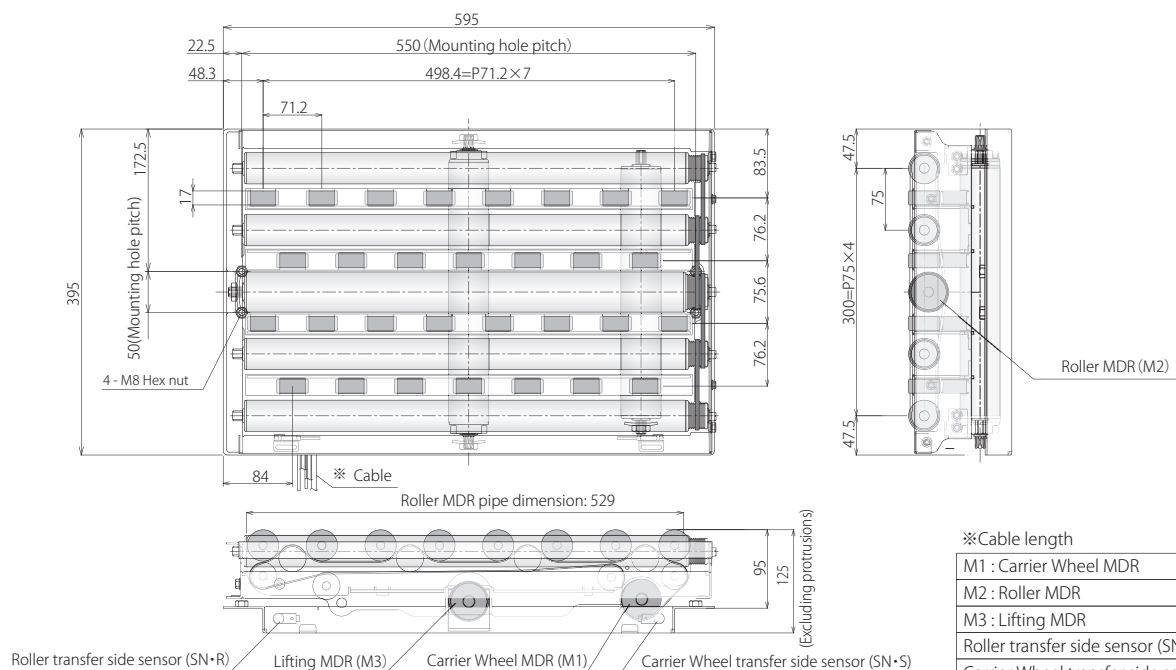
4. Power Supply

- 24VDC Battery
 - Switching power supply (24VDC • 5A 120W)^{※1}
 - Rectified power (With a rectifying capacitor, ripple rate 10% or below)
 - Supplied power must be a stabilized power supply of 24VDC, 5A or higher (Size 6060, 6070, 6080, 9060, 9070, 9080 operates with 10A or higher) without fluctuation by load.
 - In addition, the power supply should not activate protection with peak current 20A, 1ms or below.
- ※1 Size 6060, 6070, 6080, 9060, 9070, 9080 operates with DC24V • 10A 240W

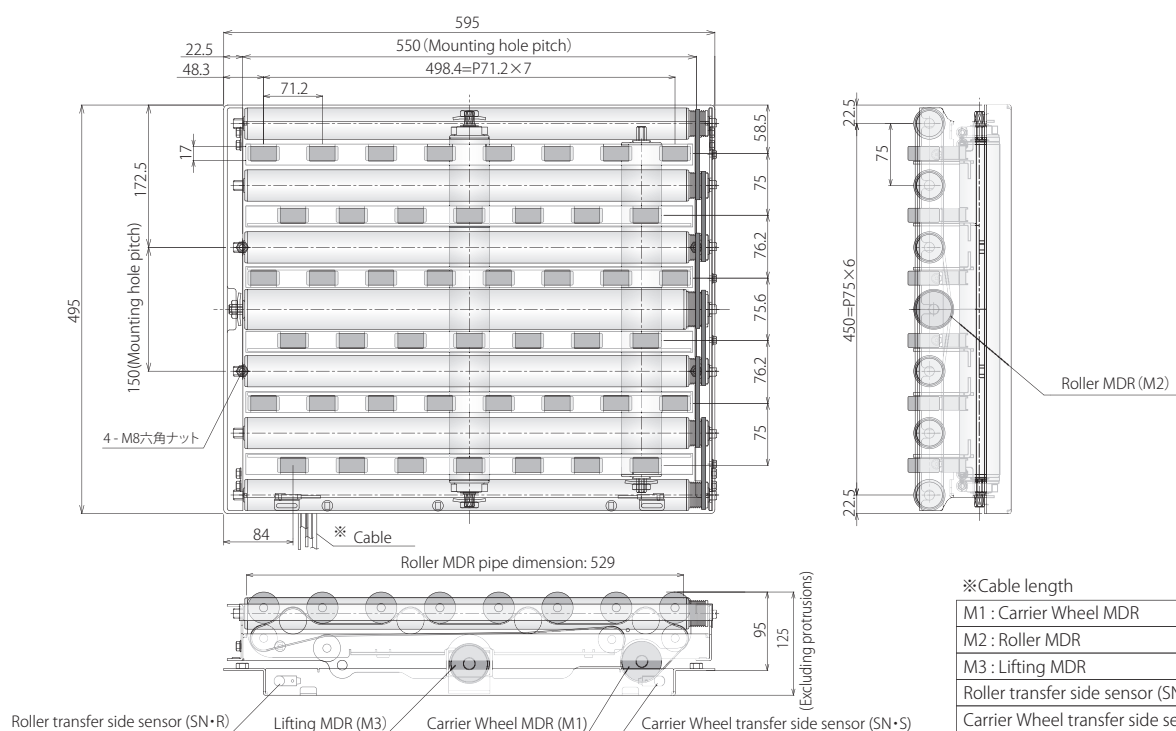
5. Dimensions

■ Main Unit

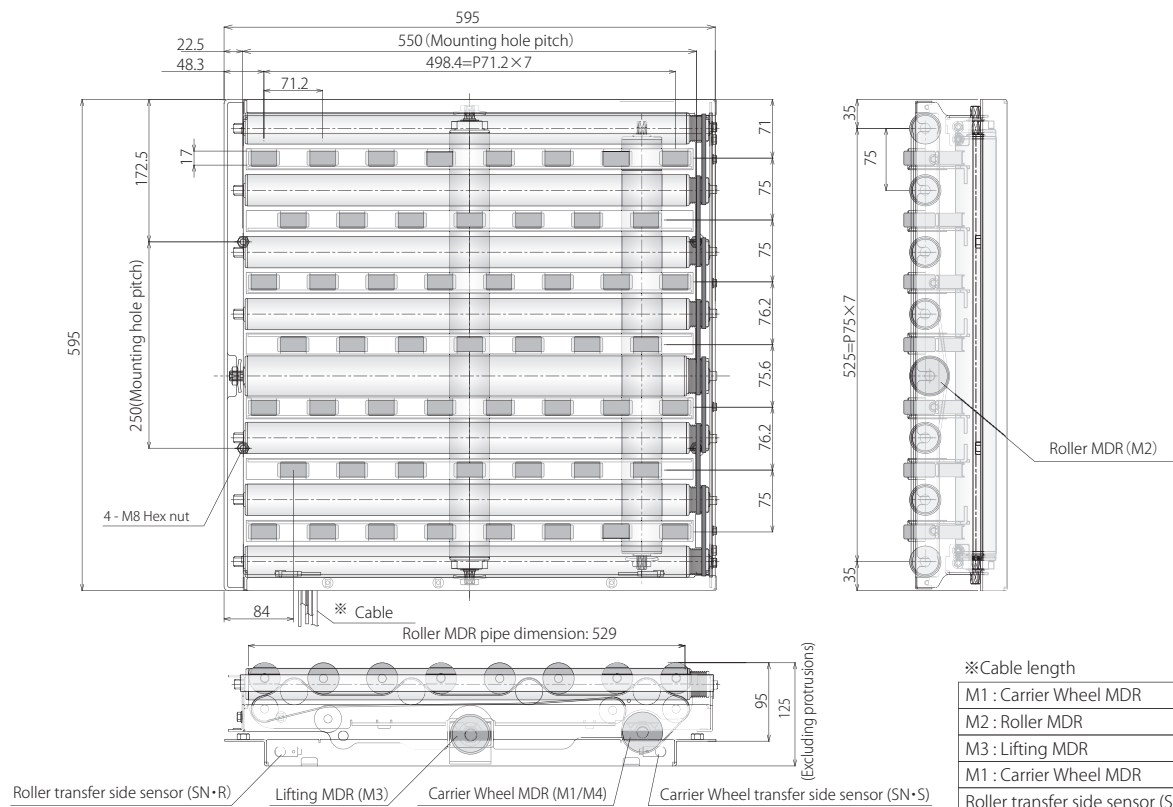
● Size 6040 … L595mm×W395mm



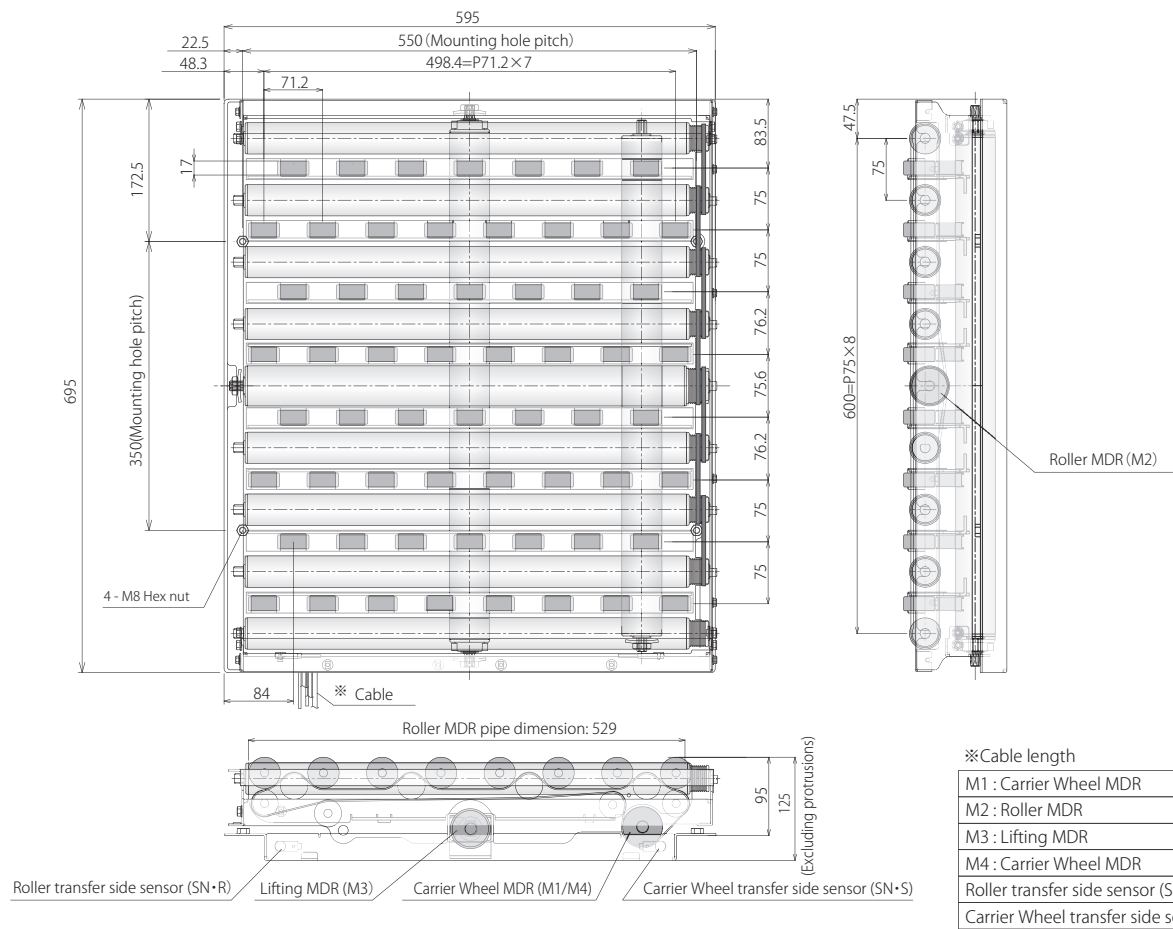
● Size 6050 … L595mm×W495mm



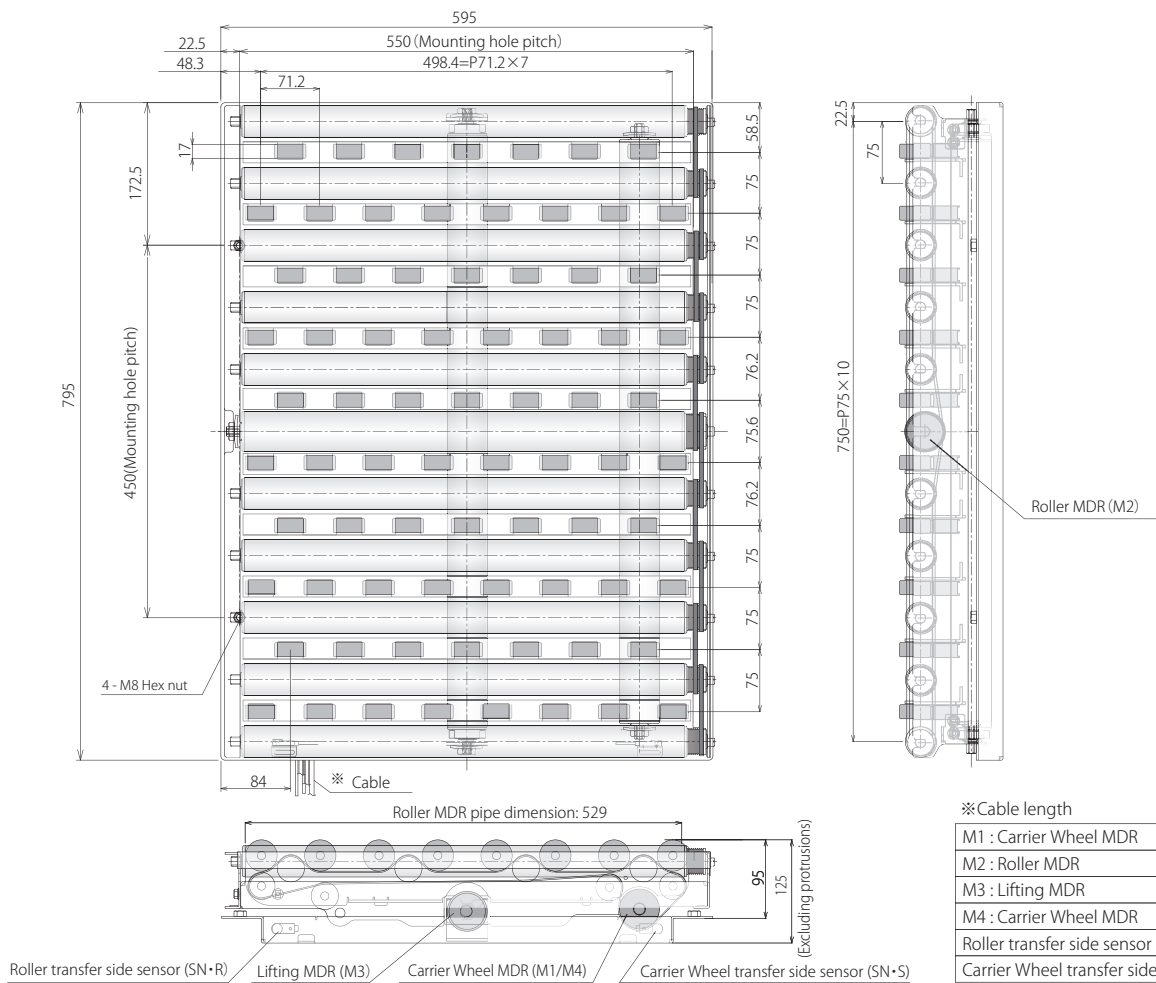
● Size 6060 … L595mm×W595mm



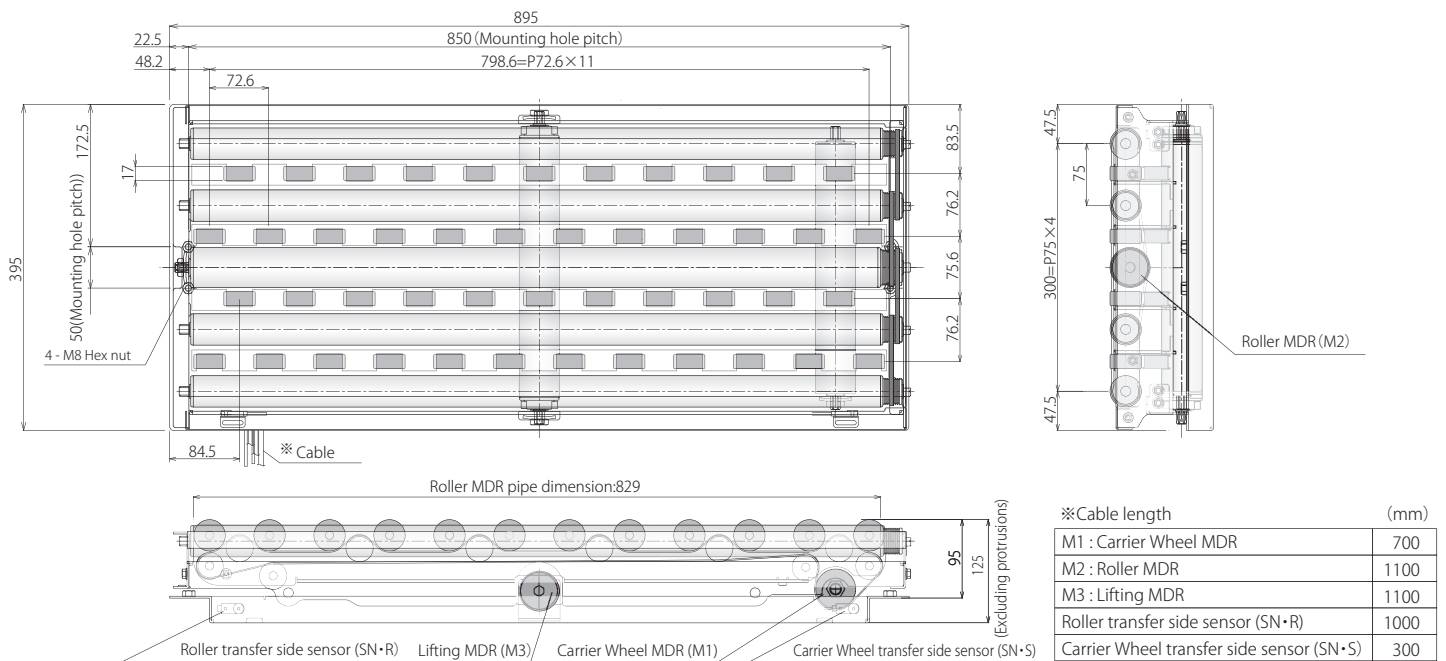
● Size 6070 … L595mm×W695mm



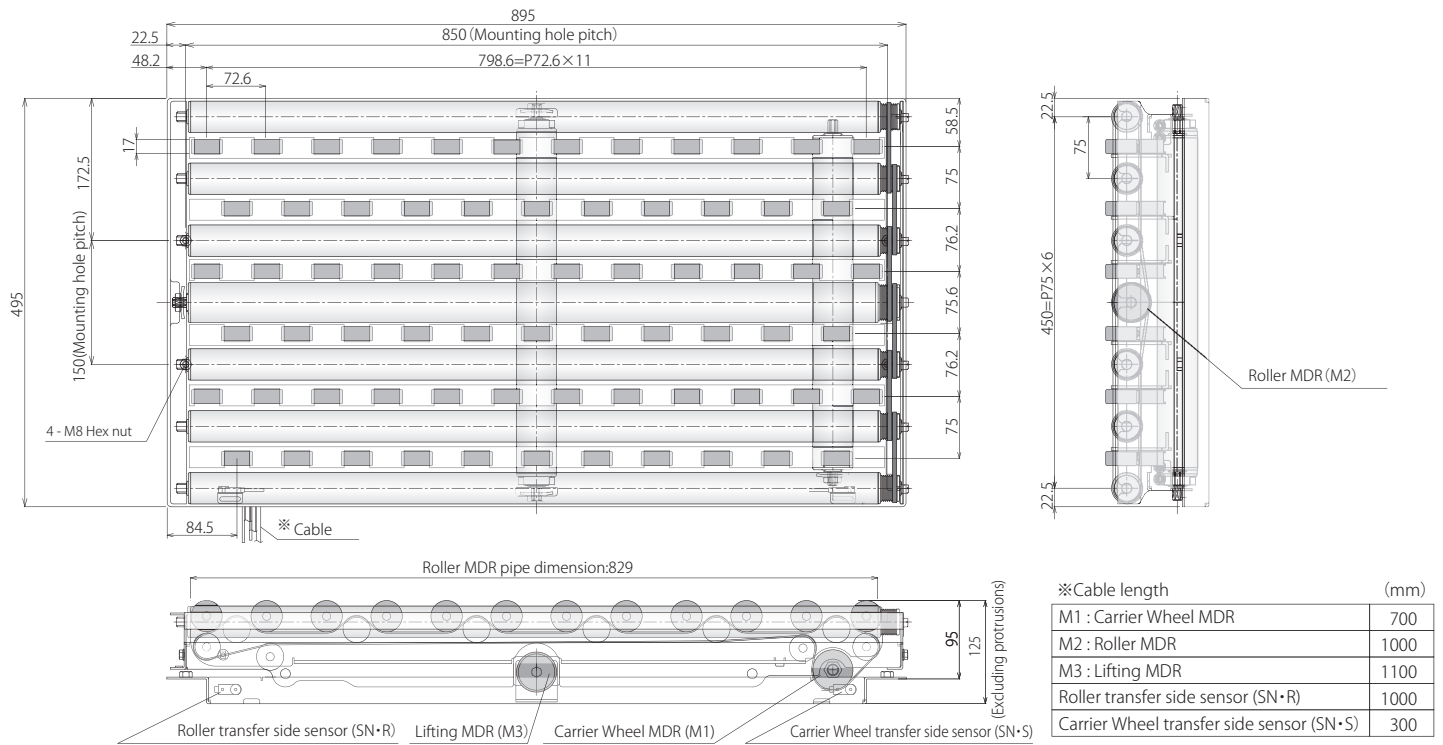
● Size 6080 ... L595mm×W795mm



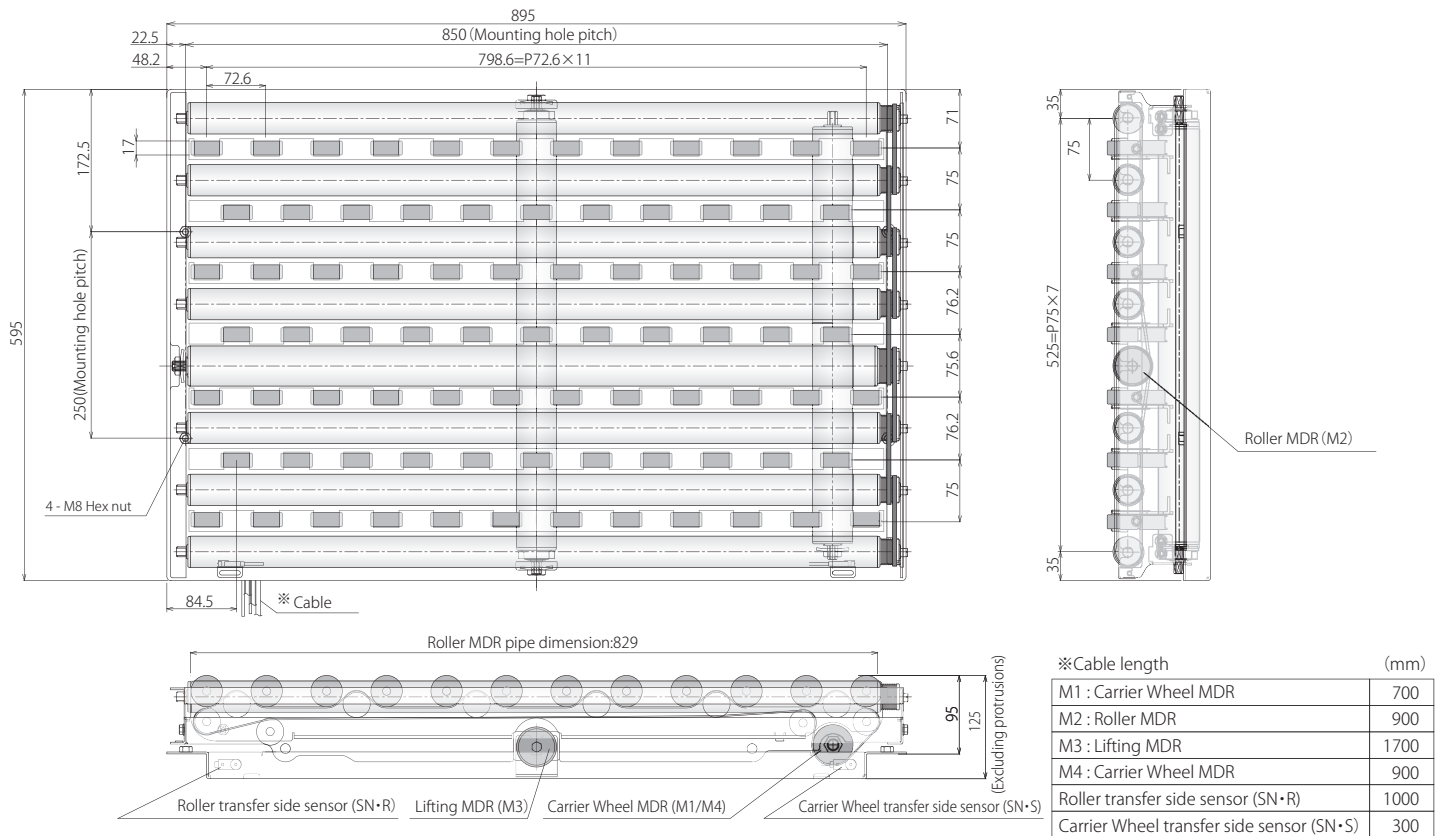
● Size 9040 ... L895mm×W395mm



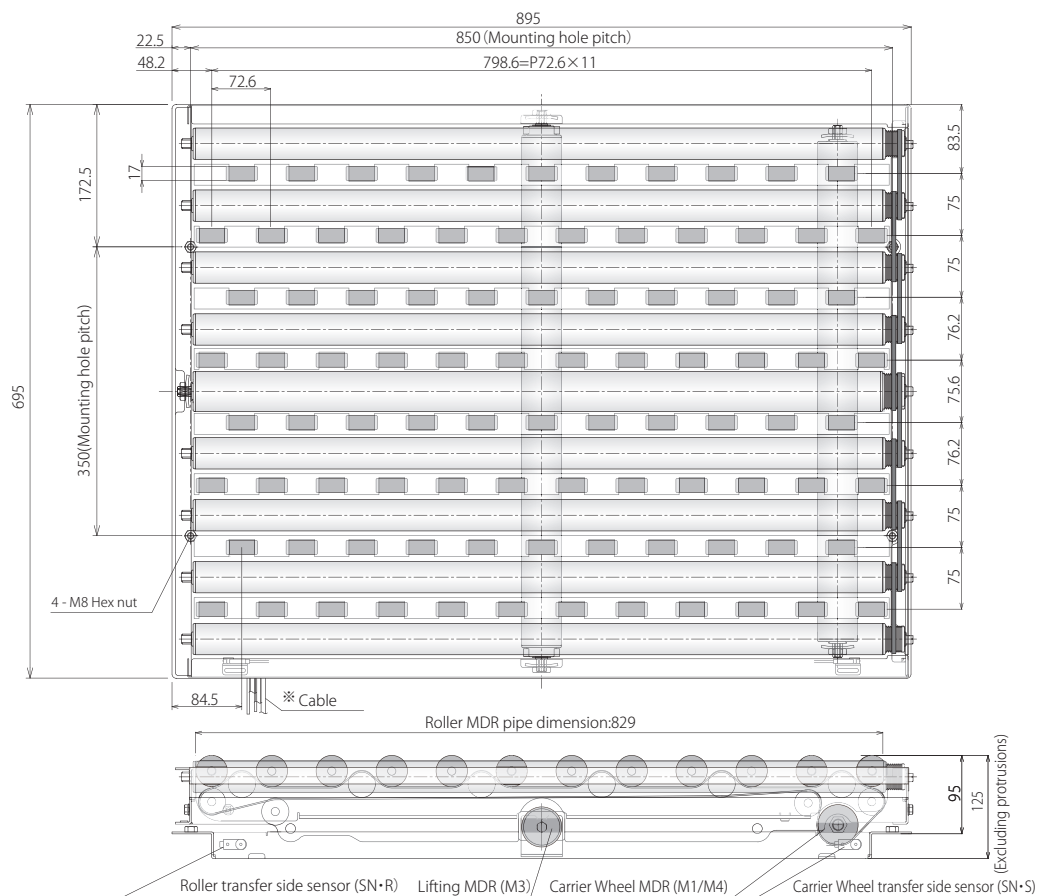
● Size 9050 … L895mm×W495mm



● Size 9060 … L895mm×W595mm

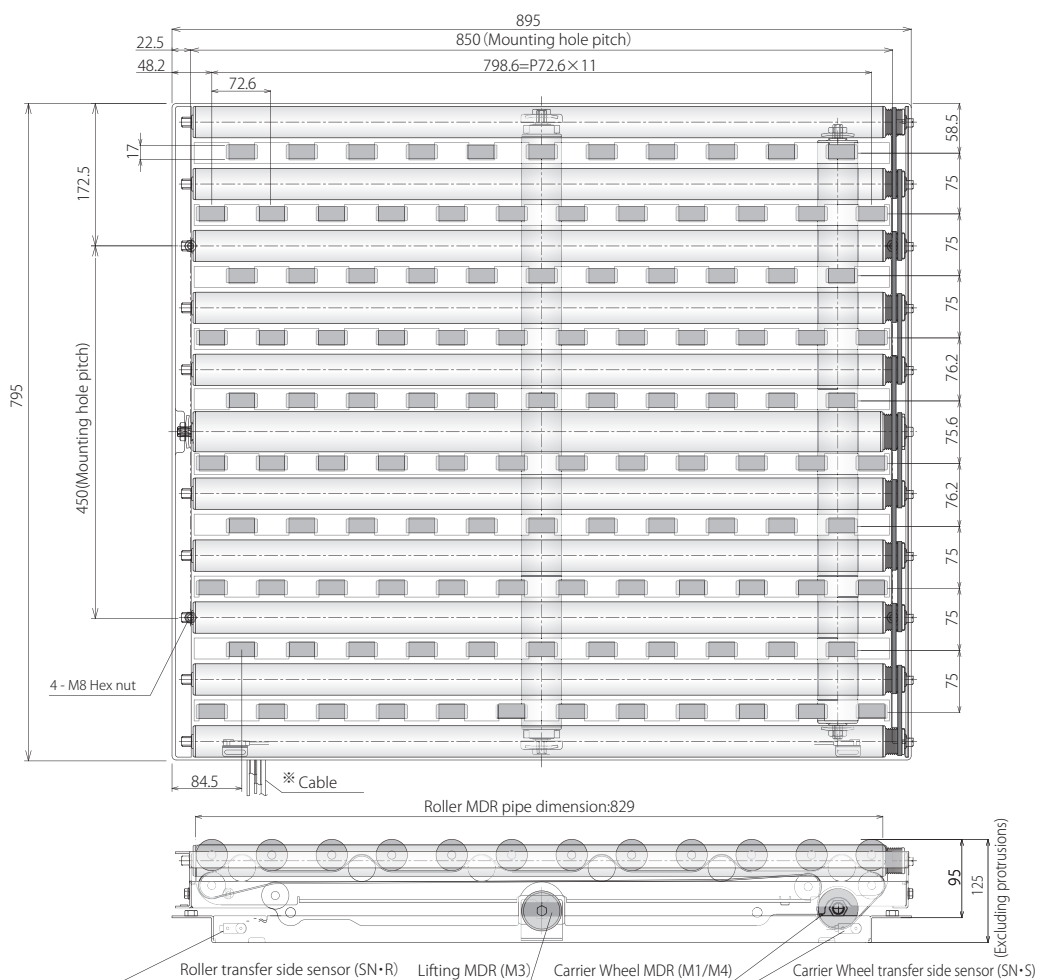


● Size 9070 ... L895mm×W695mm



※Cable length	(mm)
M1 : Carrier Wheel MDR	700
M2 : Roller MDR	800
M3 : Lifting MDR	1100
M4 : Carrier Wheel MDR	800
Roller transfer side sensor (SN•R)	1000
Carrier Wheel transfer side sensor (SN•S)	300

● Size 9080 ... L895mm×W795mm



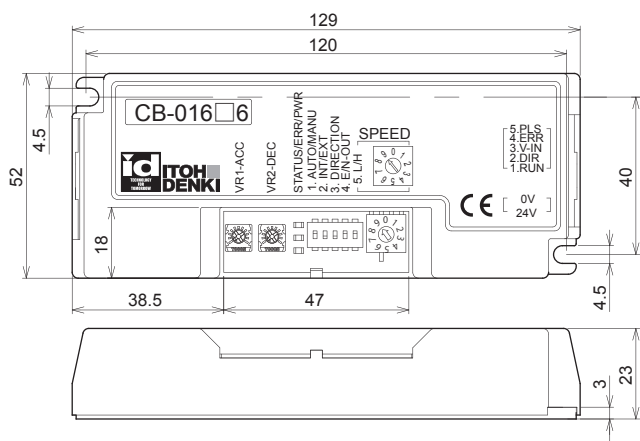
※Cable length	(mm)
M1 : Carrier pulley MDR	700
M2 : Roller MDR	700
M3 : Lifter MDR	1100
M4 : Carrier pulley MDR	700
Roller transfer side senso (r (SN•R)	1000
Carrier pulley transfer side sensor (SN•S)	300

Accessory

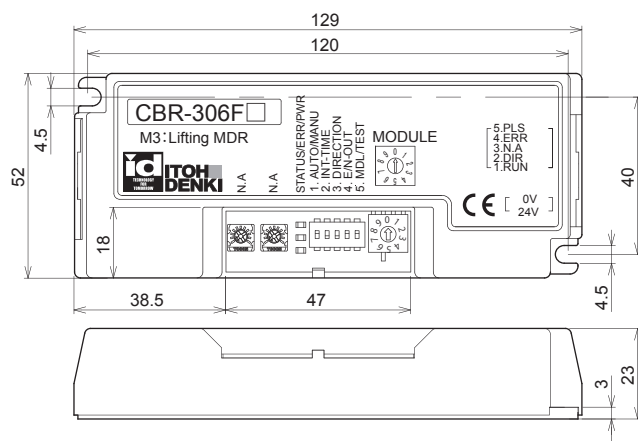


Please refer to HBR-605 user manual when HBR-605 is used for operation.

● CB-016□6 ※□=N (NPN input/output) or P (PNP input/output)

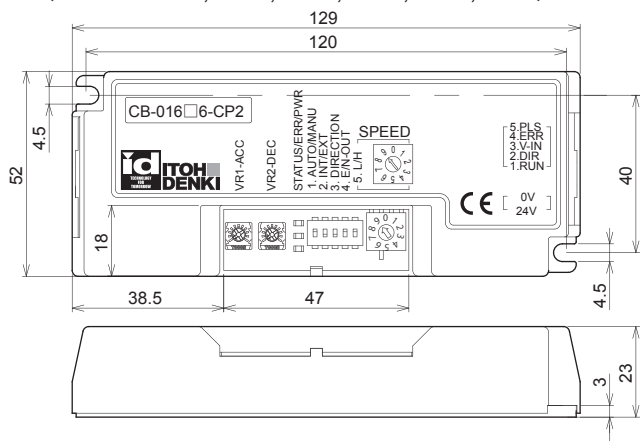


● CBR-306F□ ※□=N (NPN input/output) or P (PNP input/output)



● CB-016□6-CP2 ※□=N (NPN input/output) or P (PNP input/output)

(For Size 6060, 6070, 6080, 9060, 9070, 9080)



6. Installation / Operation

6 - 1. Cautions during Transportation



Caution

- Avoiding injuries

Majority of this product is made from metal and careless handling may cause injury of hands. Be sure to wear protective means such as gloves to avoid injury.

- Handle the heavy item by two persons as a rule

Some product type weighs over 50kg. To protect the operators, transport the unit by two or more persons as a rule of handling a heavy item.

- Prohibiting Impacts

- This product contains precision components such as bearing and microchip. Use caution for avoiding impacts by dropping or collision during transportation as impacts may cause damage of such components.

6 - 2. Cautions during Uncrating



Caution

- Avoiding injuries

Majority of this product is made from metal and careless handling may cause injury of hands. Be sure to wear protective means such as gloves to avoid injury.

- Appearance Check

- Check the following when opening the crate.
 - ① Abnormality on the unit such as dent, concave mark, smear, corrosion (rust), etc.
 - ② Loose or missing screw.

Please report to the supplier when you find abnormality.

6 - 3. Caution during Installation...Electrical

● Checking the Circuit breaker

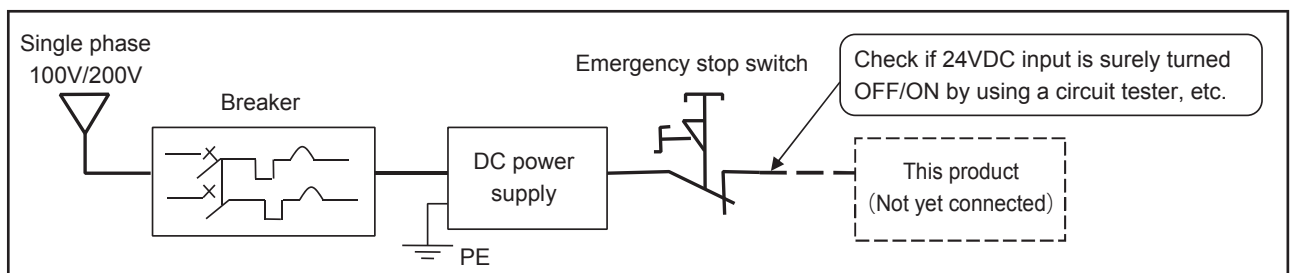
- For the facility equipment using this product, check that a power breaker with appropriate capacity has been installed. In case the product generates abnormal motions, protection by the breaker is sometimes effective.
If the earth leakage breaker is planned for use as a breaker, select a type compatible with inverter. Certain type of incompatible ground fault interrupter causes malfunction by sensing high frequency component of switching power supply as leak current.

● Checking the DC Power Supply

- DC power supply must be an insulation type switching power supply certified by the safety standard (IEC60950-1 or UL60950-1)for ensuring safety. Do not use non-insulation type series power supply for safety as well as conforming to radiation noise restriction.
- Current capacity of the DC power supply should have sufficient capacity to accommodate this product.
Current capacity of the wiring material should also provide sufficient margin to the specified current value.

● Checking the Wiring

- When the DC power supply is integrated, check if the equipment breaker and emergency stop switch correctly operate.
Test operation and any further procedure should be performed after finishing this checking.
① ON/OFF operation of the breaker reliably turns ON/OFF of the input (single phase 100V, 200V) to the DC power supply unit.
② ON/OFF operation of the emergency stop switch reliably turns OFF/ON of the input (24VDC) to this product.



- Carefully check if these wiring would not contact any moving parts of this product.

6 - 4. Caution during Installation...Main Unit

● Installation environment

- This product is not equipped with a special dust or water proof measures, and is intended for use in "pollution level 2" defined by IEC60664-1. For this reason, when the product is installed in the environment requiring dust or water proof measures, the user needs to provide additional protection and check the performance.
- Vibration level of the environment in which this product is used must be 0.5G or below.
- Install this product with the tilt of 5/1000 or below.
- Secure a work space around this product for maintenance purpose.
- Comply with the safety rules required for the place of installation or equipment to be used.

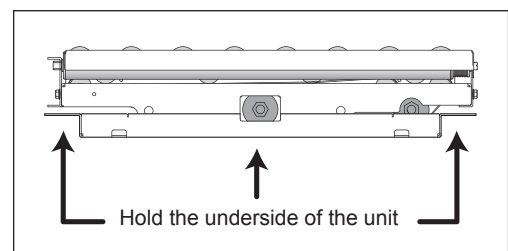
● Main unit installation



Caution

- During installation, use caution for installing direction (orientation). Be sure to use the specified mounting holes. (Refer to 5. Dimension P.5, P.6).
Incorrect direction (orientation) or using non-specified securing holes may cause unexpected accident.

- Perform mounting operations always by 2 persons or more.
Hold the bottom surface of F-RAT main unit.
(F-RAT mass Size 6040 approx 32kg) ※Varies by size.
- Use caution for motor cable or sensor cable not to be pinched by other object.
- Do not attach the driver card on the F-RAT unit.
It may cause loose screws or other failure by vibration.
- Securely attach the unit on the frame by considering the product weight, tray weight, and vibration.



● Safety assurance



Warning

- Operator should not come close to any moving part that may hook or roll-in objects. Provide a means for not permitting the operator to touch the moving part with a safety fence.

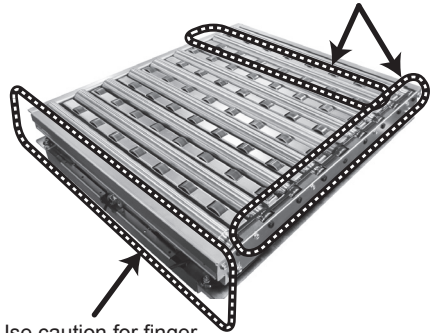


Caution

- To prevent any object from popping out of the area by collision, and to avoid injury by such object, install a safety fence around the equipment.

- If the warning label becomes hidden by installing the product, reattach the warning label in a visible place.
- When performing maintenance operation, make sure the main power is completely shut off.

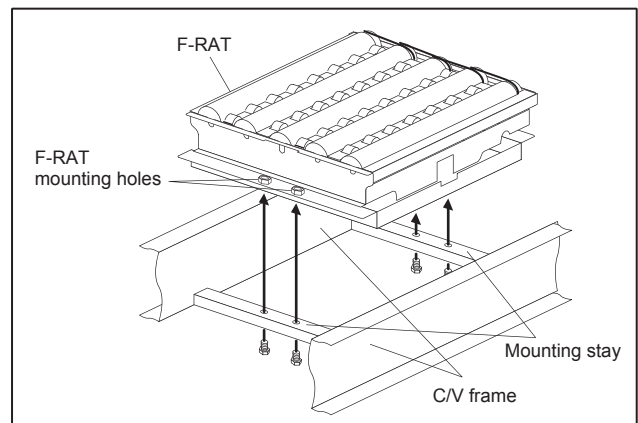
Use caution for roll-in by each belt and roller



Use caution for finger being caught on both sides

6 - 5. Installation

- Attach the F-RAT by using the mounting holes. (Refer to 5. Dimension)
- When using mounting stays, refer to the attachment example shown below.

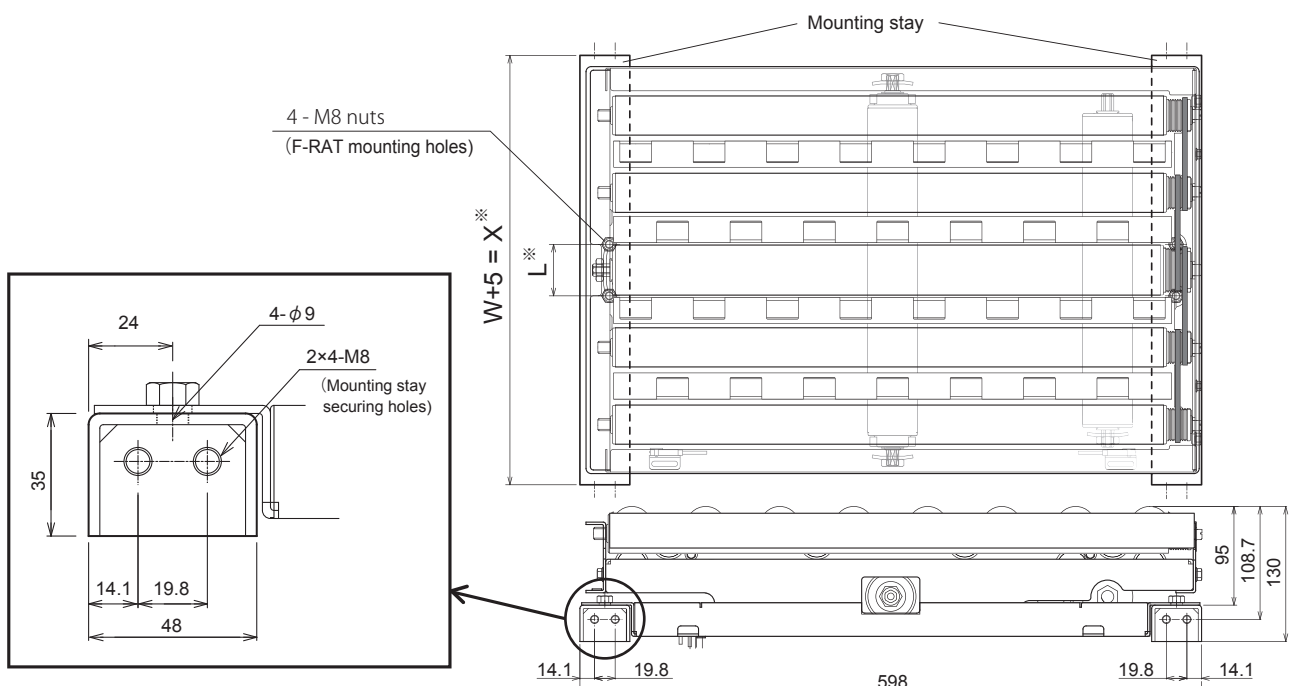


- Reference example for the mounting: In case of using a mounting stay (option).



Caution

- Install the mounting stay by using F-RAT mounting holes (Refer to 5. Dimensions)
For mounting on the frame, use the mounting holes of the mounting stay shown below. Mounting without using the mounting holes may lead to unexpected accident or failure.



※Refer to 8. Specifications (P.25)

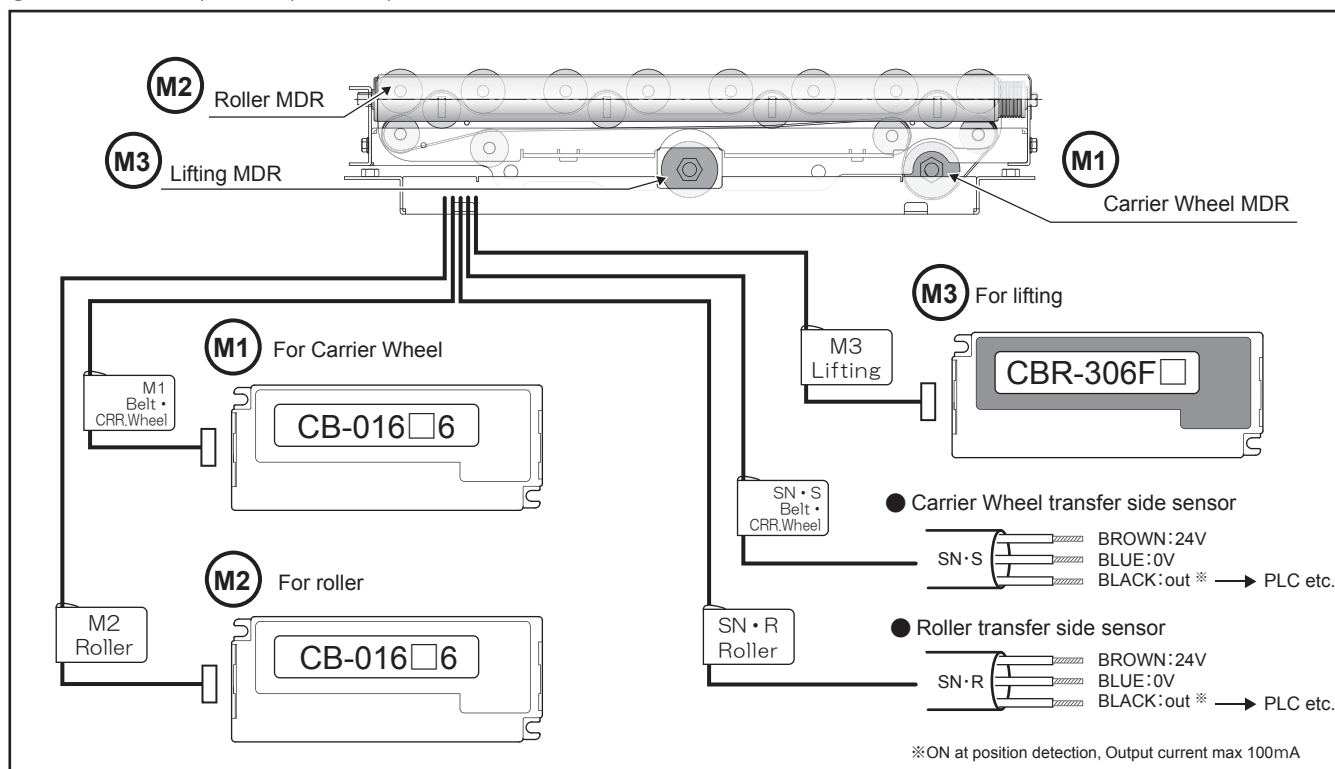
■ Connection

Install MDR connector on each driver card.

※Connector attachment and detachment must be made after shutting off the power and by holding the connector.

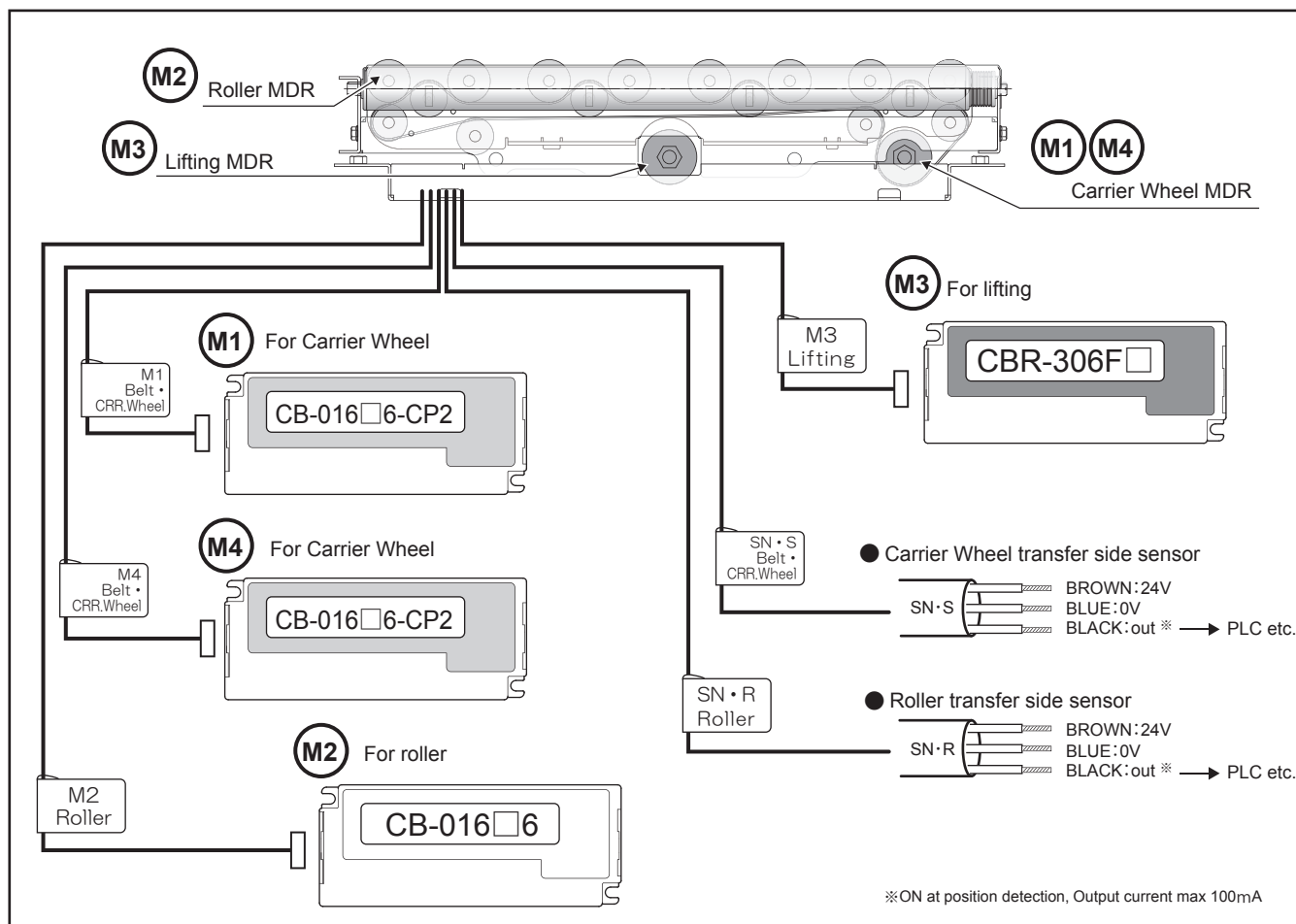
※Securely attach each connector to the contact part.

● For sizes 6040 / 6050 / 9040 / 9050



※F-RAT zone sensor is not included. To be prepared by the user.

● For sizes 6060 / 6070 / 6080 / 9060 / 9070 / 9080



※F-RAT zone sensor is not included. To be prepared by the user.

■ Wiring

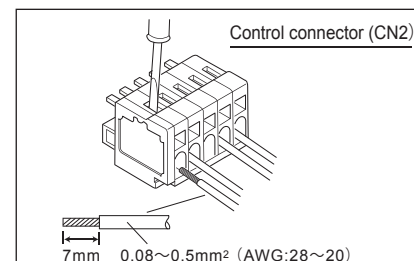
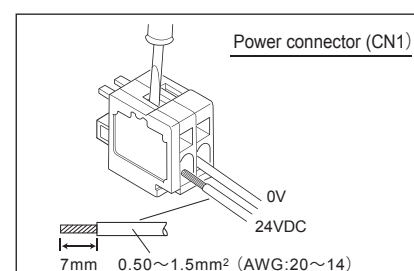


Please refer to HBR-605 user manual when HBR-605 is used for operation.

Size	MDR	M1／M4：For Carrier Wheel	M2：For roller	M3：For lifting																																						
6040 6050 9040 9050		CB-016□6 ※□=N（NPN input/output） or P（PNP input/output）	CB-016□6 ※□=N（NPN input/output） or P（PNP input/output）	CBR-306F□ ※□=N（NPN input/output） or P（PNP input/output）																																						
6060 6070 6080 9060 9070 9080		CB-016□6-CP2 ※□=N（NPN input/output） or P（PNP input/output）	CB-016□6 ※□=N（NPN input/output） or P（PNP input/output）	CBR-306F□ ※□=N（NPN input/output） or P（PNP input/output）																																						
Connector		<table><tr><td rowspan="2">CN1 (Power)</td><td>2</td><td>0V</td></tr><tr><td>1</td><td>24VDC</td></tr></table> <table><tr><td rowspan="6">CN2 (Control)</td><td>5</td><td>Motor pulse output</td><td rowspan="2">Use 25mA ※ or below</td></tr><tr><td>4</td><td>Error signal output</td></tr><tr><td>3</td><td>MDR ext speed setting</td><td rowspan="3">Max 2mA</td></tr><tr><td>2</td><td>MDR rotation dir change</td></tr><tr><td>1</td><td>MDR run/stop</td></tr></table> ※Attach a protection resistor	CN1 (Power)	2	0V	1	24VDC	CN2 (Control)	5	Motor pulse output	Use 25mA ※ or below	4	Error signal output	3	MDR ext speed setting	Max 2mA	2	MDR rotation dir change	1	MDR run/stop	<table><tr><td rowspan="6">CN2 (Control)</td><td></td><td>Motion</td><td>in/out current</td></tr><tr><td>5</td><td>Motor pulse output</td><td rowspan="2">Use 25mA ※ or below</td></tr><tr><td>4</td><td>Error signal output</td></tr><tr><td>3</td><td>—</td><td rowspan="3">3mA</td></tr><tr><td>2</td><td>MDR rotation dir change</td></tr><tr><td>1</td><td>MDR run/stop</td></tr></table> ※Attach a protection resistor <table><tr><td rowspan="2">CN1 (Power)</td><td>2</td><td>0V</td></tr><tr><td>1</td><td>24VDC</td></tr></table>	CN2 (Control)		Motion	in/out current	5	Motor pulse output	Use 25mA ※ or below	4	Error signal output	3	—	3mA	2	MDR rotation dir change	1	MDR run/stop	CN1 (Power)	2	0V	1	24VDC
CN1 (Power)	2	0V																																								
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CN1 (Power)	2	0V																																								
	1	24VDC																																								

■ Connector Wiring (Common to CB-016/CBR-306)

- Connect 24V DC / 0V wires to the power connector < CN1(2 contacts)>.
 - ※Do not connect any branching wire. It may cause electrical shock, short-circuit or failure due to over capacity of the connector. (Connector capacity : 4A)
 - ※Do not wire in reverse polarity.
 - ※Wiring should be made before inserting the connector into the driver card.
- Connect wires to control connector < CN2(5 contacts)>.
 - ※Input voltage supplied to CN2#1(MDR run/stop), CN2#2(MDR rotation direction change) must be common to the power supply voltage. (Connector capacity :4A)
- Plug the power connector < CN1(2 contacts)>, control connector < CN2 (5 contacts)>, MDR connector <CN3> to the driver card.
 - ※Connector attachment/detachment must be made after shutting off the power and by holding the connector.
 - ※Securely insert the connector to the contact part.



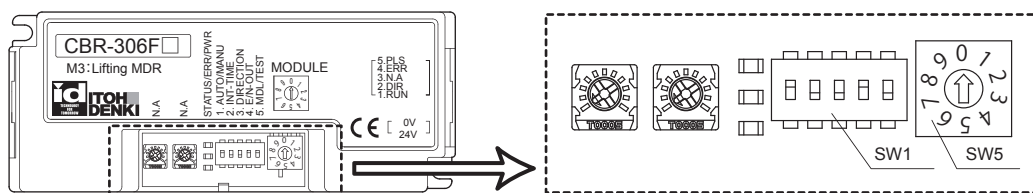
For the detailed specification of CB-016□6, please download the driver card operating instruction manual from our company HP.

Home > Download / Support > User Manual > CB-016□6

* For detail of CBR-306, refer to Appendix 1. CBR-306F Detail (P.28)

■ Driver Card Setting

① M3 : Set the driver card for lifting.

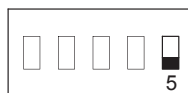


Caution

- Make sure to turn OFF SW1#5.
ON state does not allow external signal input and may lead to a failure.
- SW5 must be set to "3" when using F-RAT-U225.
Using with other than "3" may lead to a failure.

M3 : For lifting

CBR-306F



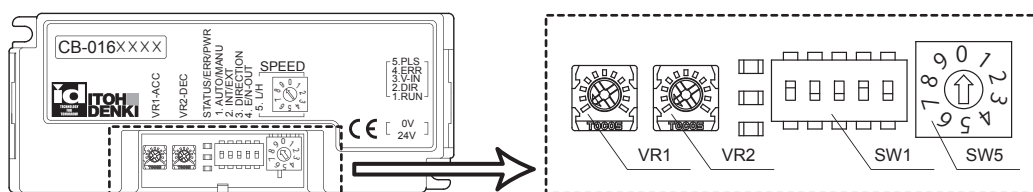
SW1 OFF



SW5

※For detail, refer to Appendix 1. CBR-306F Detail (P.28) .

② Set M1 : Driver card for Carrier Wheel, M4 : Driver card for Carrier Wheel (In the case of size 6060, 6070, 6080, 9060, 9070, 9080) and M2 : Driver card for roller.

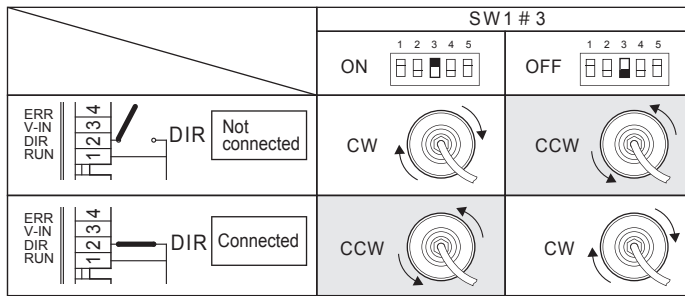


	M1 : For Carrier Wheel	M4 : For Carrier Wheel (For size 6060, 6070, 6080, 9060, 9070, 9080)	M2 : For roller
Size 6040 6050 9040 9050	CB-016□6 ※1 ※2 ※2 VR1 VR2 SW1 SW5	—	CB-016□6 ※1 ※2 ※2 VR1 VR2 SW1 SW5
Size 6060 6070 6080 9060 9070 9080	CB-016□6-CP2 ※1 ※2 ※2 VR1 VR2 SW1 SW5	CB-016□6-CP2 ※1 ※2 ※2 VR1 VR2 SW1 SW5 Set reverse rotation to M1. Set the same as M1 ! Caution • SW1#3 is for setting rotation direction. Always set to reverse rotation to M1. Otherwise, failure would occur. • SW1#5 and SW5 are for setting speed. Always set to the same as M1. Always perform a setin change when the Carrier Wheel (M1 and M4) are in stopped condition. Otherwise, failure may occur.	CB-016□6 ※1 ※2 ※2 VR1 VR2 SW1 SW5

※1 : Rotation direction setting. When changing the setting, refer P.16 [1] Rotation direction setting]

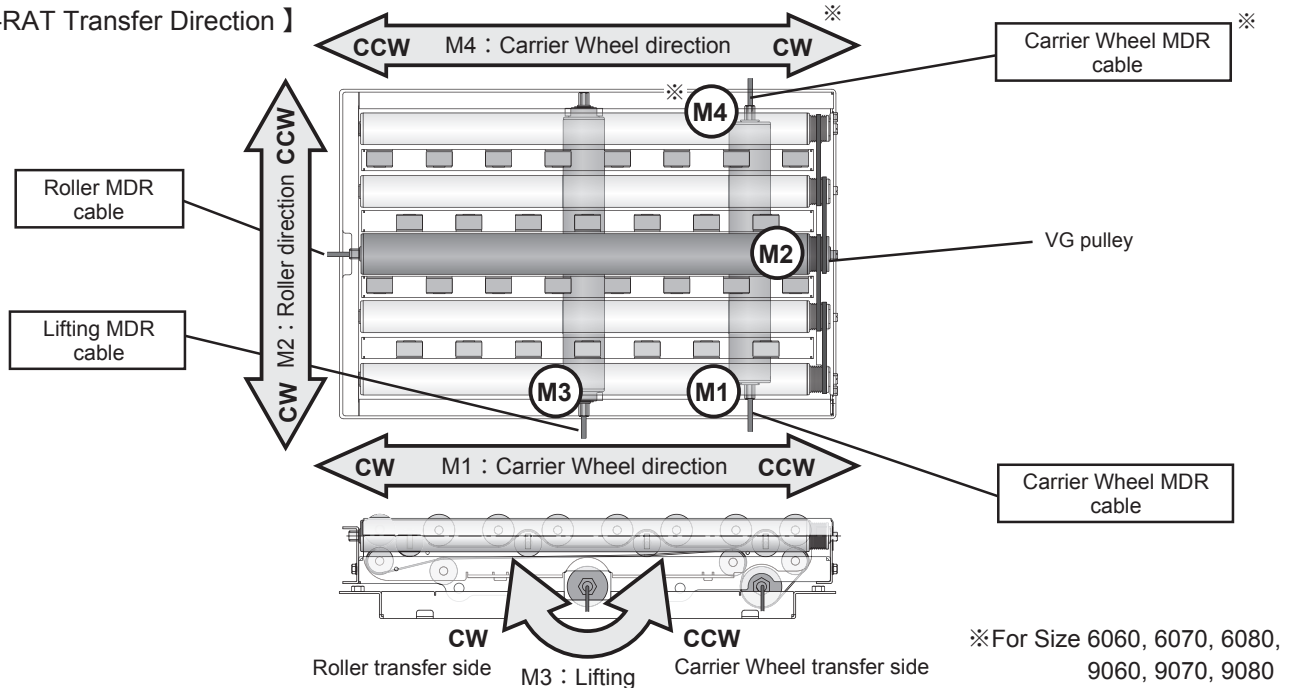
※2 : Speed setting. When changing the setting, refer P.16 [2] Speed setting]

1 Rotation Direction Setting



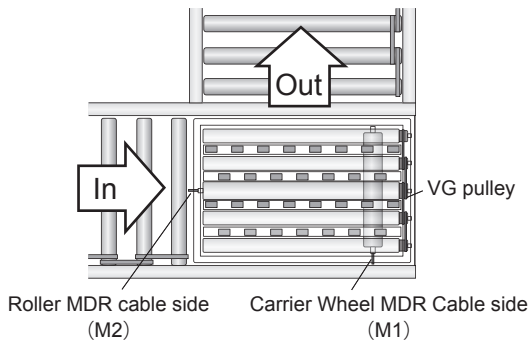
- MDR rotation (F-RAT transfer) direction can be changed by using the switch on the driver card or external switch.
(Or can be used in parallel)
- MDR rotation direction is defined as CW or clockwise direction when viewed from the cable side, and CCW or counter-clockwise direction.

【 F-RAT Transfer Direction 】



Transfer Setting Example①

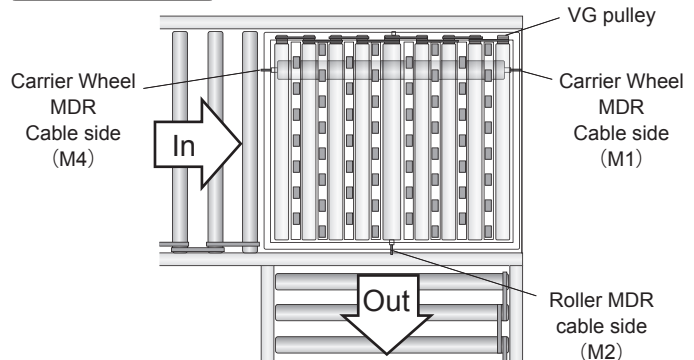
For size 6040, 6050
9040, 9050



		Carry In		Carry Out	
		Carrier Wheel MDR M1		Roller MDR M2	
R. direc.		CCW		CCW	
SW1#3		OFF		OFF	
CN2	#2	OFF		OFF	
	#1	ON		ON	

Transfer Setting Example②

For size 6060, 6070, 6080, 9060, 9070, 9080



		Carry In		Carry Out	
		Roller MDR M2		Carrier Wheel MDR M1	
R. direc.		CW		CW	
SW1#3		ON		OFF	
CN2	#2	OFF		OFF	
	#1	ON		ON	

2 Speed Setting (m/min)

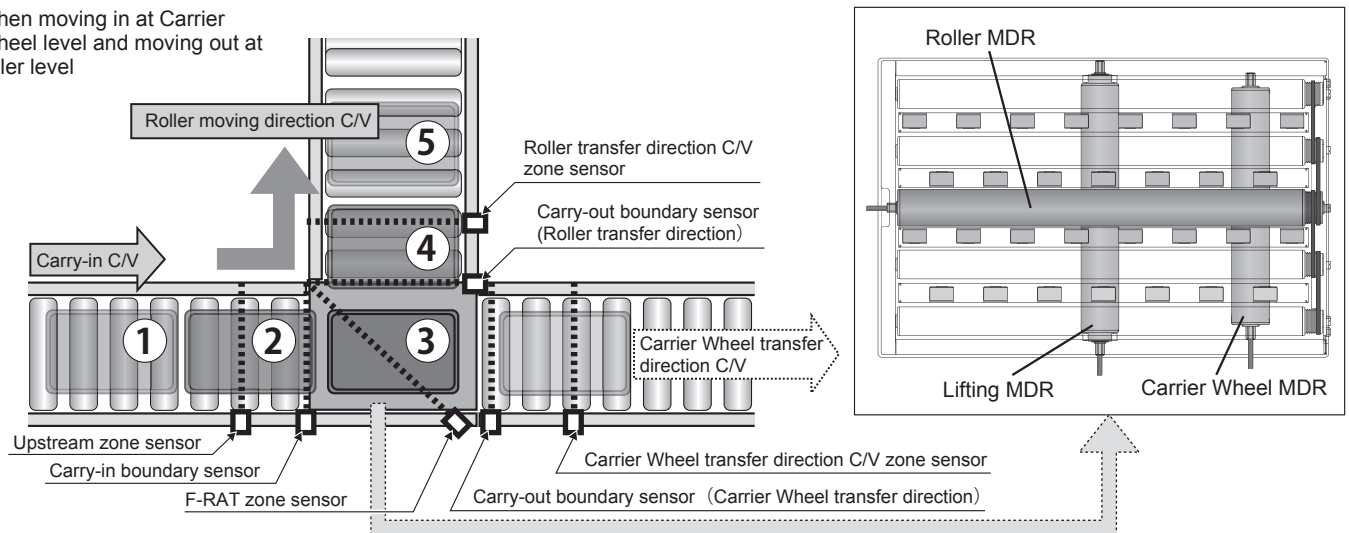
Speed accuracy : ±3%

		SW1#5 : ON										SW1#5 : OFF									
SW5		9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0
17m/min Low speed type	Set	16.9	15.5	14.8	14.1	13.4	12.7	11.2	10.5	9.8	9.1	8.4	7.7	7.0	6.3	5.6	4.9	4.2	3.5	2.8	2.1
	Rated	14.6	14.6	14.6	14.1	13.4	12.7	11.2	10.5	9.8	9.1	8.4	7.7	7.0	6.3	5.6	4.9	4.2	3.5	2.8	2.1
60m/min Standard type	Set	60.0	55.0	52.5	50.0	47.5	45.0	40.0	37.5	35.0	32.5	30.0	27.5	25.0	22.5	20.0	17.5	15.0	12.5	10.0	7.5
	Rated	52.0	52.0	52.0	50.0	47.5	45.0	40.0	37.5	35.0	32.5	30.0	27.5	25.0	22.5	20.0	17.5	15.0	12.5	10.0	7.5

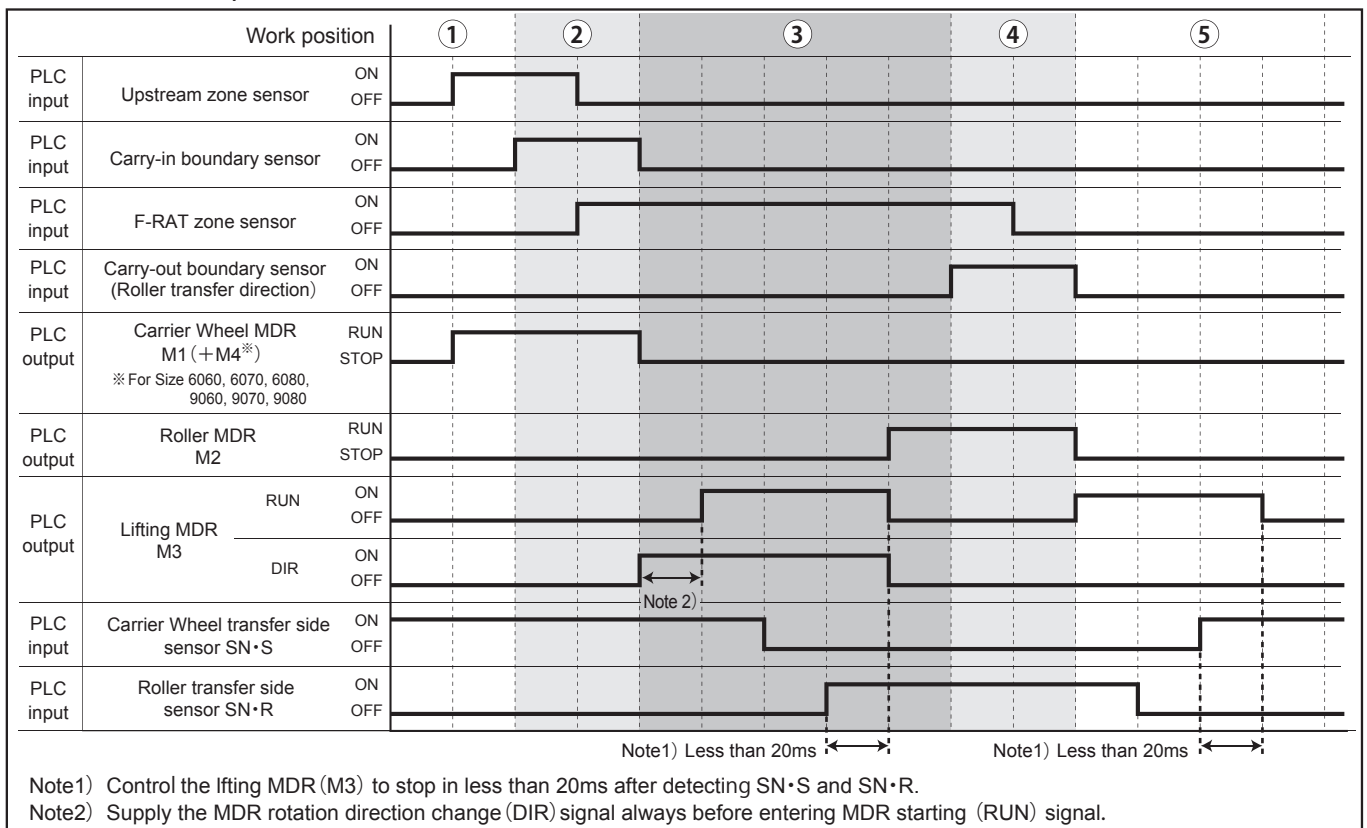
- During operation, the rising time to the setting speed may vary depending on ambient temperature. Perform running operation thoroughly.
- Values described above may differ from the actual transfer speed depending on the weight, material, bottom surface, and/or shape of trays, as well as ambient temperature.

Control

When moving in at Carrier Wheel level and moving out at roller level

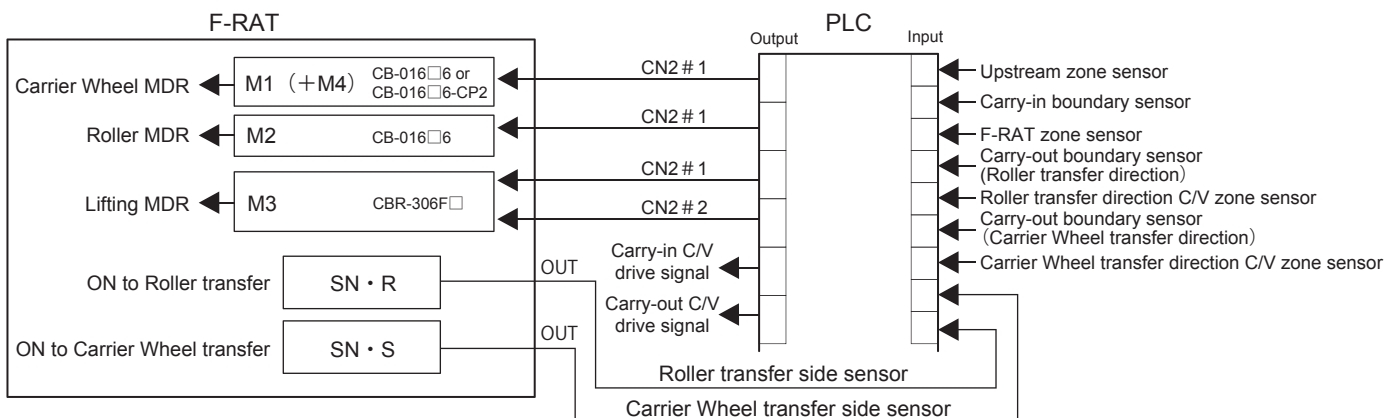


Time Chart Example



- Driver card switch is assumed to be set in the initial setting.
- Use control equipment with its response time less than 20ms. Otherwise, abnormal operation may occur.

Connector wiring example by using a PLC



6 - 6. Precautions for Trial Run

● Checking the environment for permitting trial run



Caution

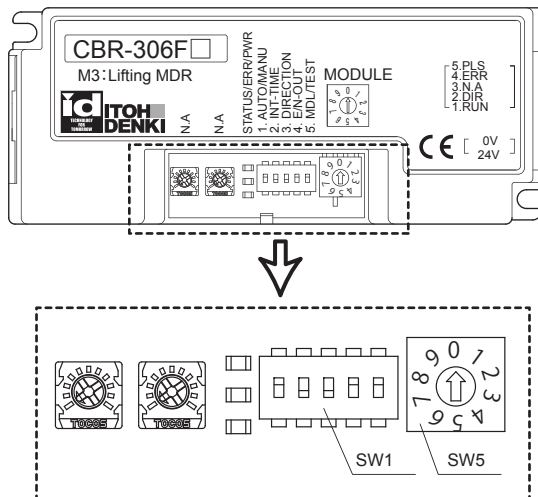
- Make sure other devices in the system do not run.
In the case of a conveyor line integrated in a system, starting signal would cause a tray to flow down the conveyor and cause danger. Before trial run, make sure that other elements of the system does not operate.
- When a load is on the Carrier Wheel, do not forcibly move the load.
Carrier Wheel may break or cause a failure.
- Before a trial run, make sure the wiring and driver card setting have been correctly made.
Insufficient check may lead to a damage and failure.

1. Before starting a trial run, check the following.

① Is the wiring correct? Did you check that no loose connector or wire breakage exist? (⇒ P13 ~ 15)

■ Checking the Carrier Wheel transfer side sensor (SN • S) and roller transfer side sensor (SN • R)

- Confirm that Carrier Wheel transfer side sensor (SN • S) ON makes the Carrier Wheel lifted up, or roller transfer side sensor (SN • R) ON makes the roller lifted up.
- When both the Carrier Wheel transfer side sensor (SN • S) and roller transfer side sensor (SN • R) are OFF, then perform the following operation and, confirm that roller transfer side sensor (SN • R) ON makes the roller lifted up.



1	SW5		M3 : Set SW5 of lifting driver card CBR-306 to "3"
2	SW1		Change SW1#5 to OFF→ON.
3	SW1		When SN • R is turned ON, turn OFF SW1#5.

【Condition of the transfer surface】

Carrier Wheel transfer side sensor (SN • S)	Roller transfer side sensor (SN • R)	Transfer surface
ON	OFF	Carrier Wheel is lifted up
OFF	ON	Roller is lifted up
OFF	OFF	Both Carrier Wheel and roller are lifted up

② Is the driver card setting correct? (⇒ P15)

- M3 : In the lifting driver card (CBR-306), is SW1#5 OFF and SW5 "3"?

2. Trial run should be performed without trays and make sure no abnormal operation occurs.

At such time, check the following points.

- ① No error LED blinks on the driver card.
- ② No abnormal sound or high temperature is detected.

7. Repair / Replacement

In order to avoid accident or damage during operations, confirm safety.

● Safety check before repairing or replacing a part.



Warning

- In order to avoid interference by power circuit and signals, turn off the power of all connected devices.
 - (a) After turning off the power switch, leave for more than 3 minutes for discharging the DC power supply.
 - (b) Indicate warning to prevent other people from turning the power.

● Part repair and replacement



Warning

- Perform repair or replacement operations by wearing protective means such as gloves. Working without protective means results in hand injury such as cut by metal part.

- When a damaged component is discovered, promptly replace with a new component.
- Do not perform disassembly other than in a designated place. Unexpected accident may occur.
- Repair/replacement operation sometimes requires turning or lifting a component. Use caution for being caught or pinched by other parts and injured.

● Component repair and confirmation after replacement

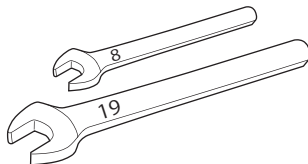
- When component repair and replacement is completed, check the following before starting trial run.
 - (a) Roller link belt are attached in the right groove.
 - (b) The removed cover is securely closed.
 - (c) All removed components and parts are attached.

Tools to be used

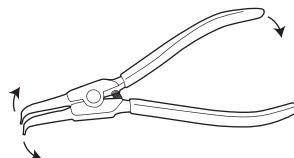
3mm



3mm Hex wrench



8mm • 19mm Spanners



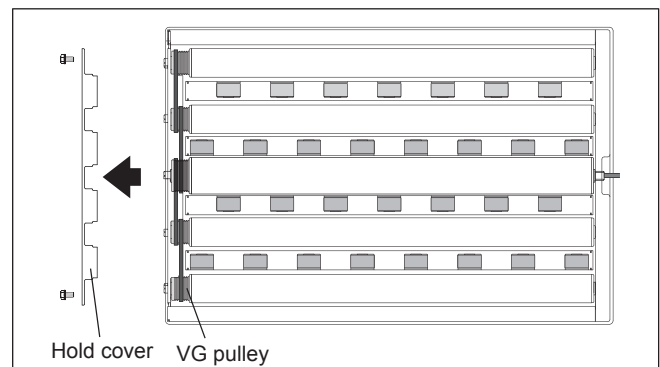
Snap ring plier (for shaft)



Flat-tip screw-driver

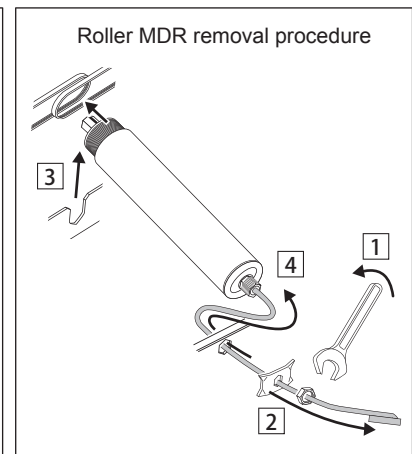
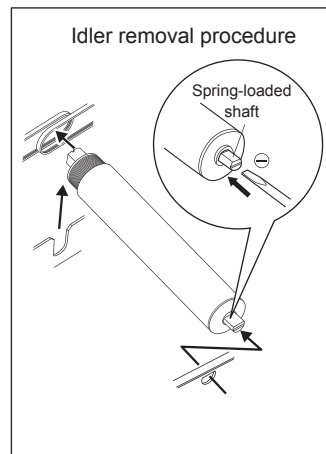
7 - 1. Carrier Wheel Belt Tension Adjustment

① Remove the hold cover.

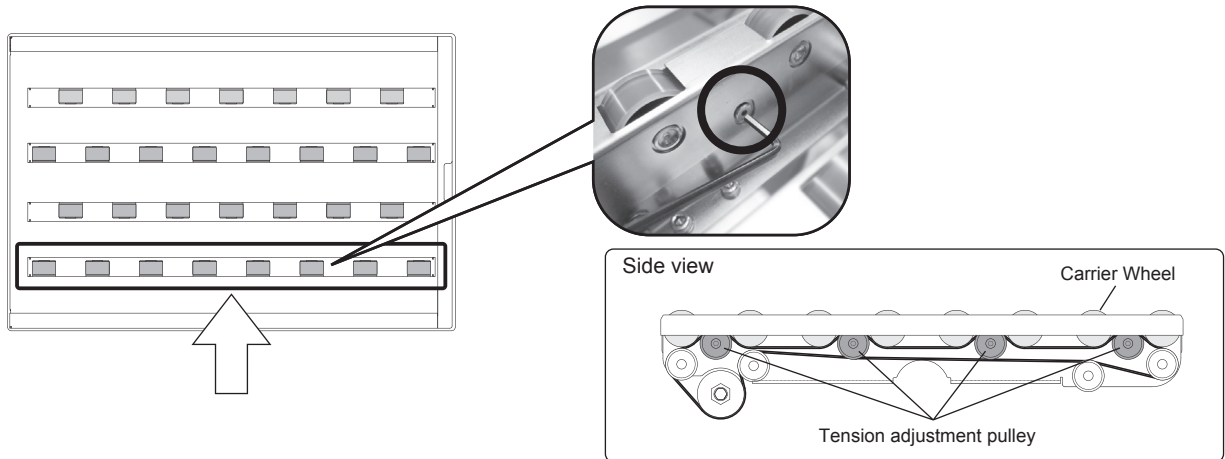


② Starting from the end of the module, remove a Idler or roller MDR until the target Carrier Wheel for adjustment is easily adjustable.

- A roller without a power cable is Idler.
- To remove a roller MDR, loosen the cable retainer at the power cable side, and remove the cable tie which secures the cable.

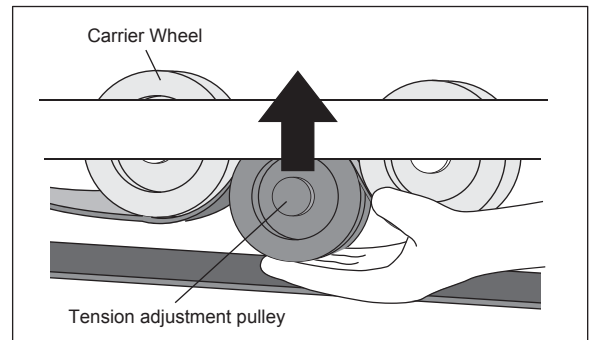


③ Loosen the adjustment bolt of the tension adjustment pulley.



④ While lifting the tension adjustment pulley, fasten the adjustment bolt. (Fastening torque 11N·m)

- Adjust the belt tension to the degree that Carrier Wheel cannot easily be rotated by hand.
- Do not hold the belt under the pulley when lifting the tension adjustment pulley.



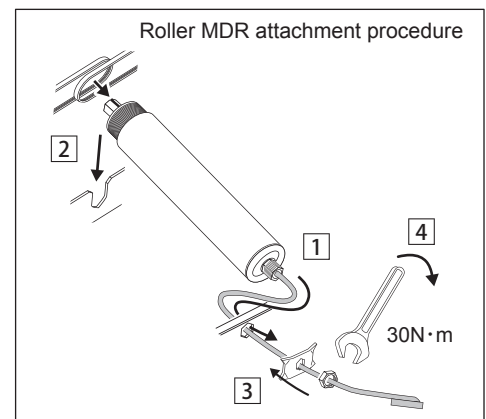
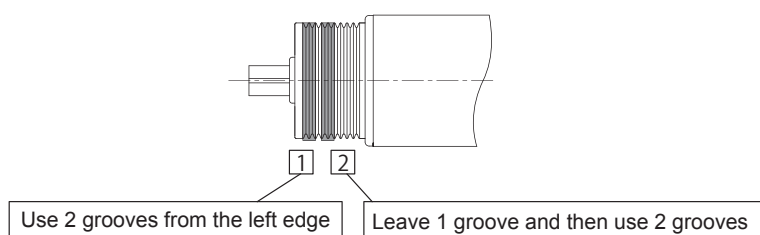
⑤ Reinstall the Idler / roller MDR.

Install the roller MDR and then install Idlers from the roller MDR toward the edge of the module.
After installation, secure the roller MDR cable by using an ordinary cable tie.

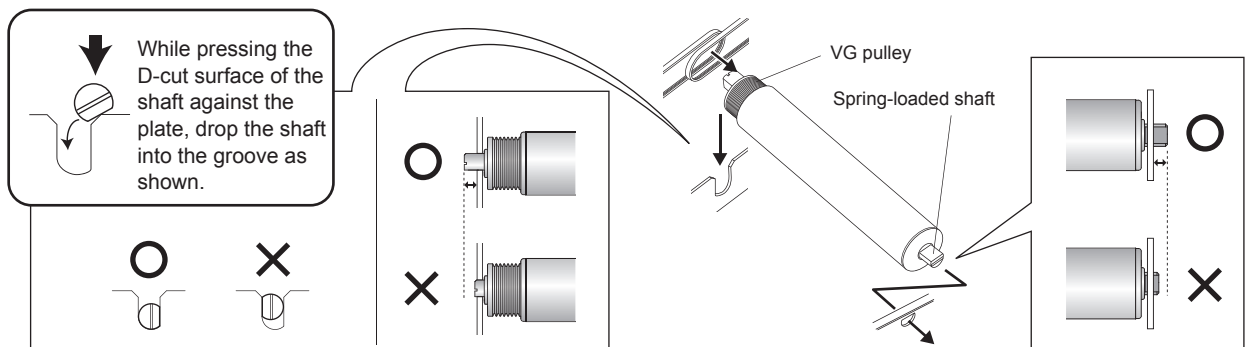
⑤ -1. Install a link belt on all rollers.

Refer to the figure below for attachment groove position of link belt.

- Linking of a roller MDR and Idler PJ256 (2PJ256)
- Linking between Idlers PJ246 (2PJ246)



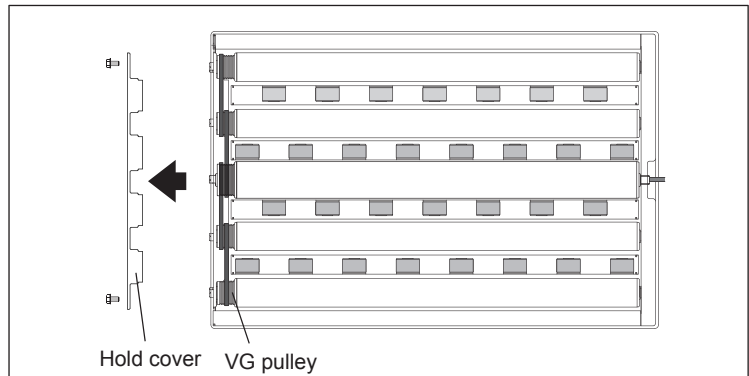
⑤ -2. Assemble Idlers one by one in the order of "shaft opposite from the VG roller" → "VG pulley side shaft".



⑥ Attach the hold cover.

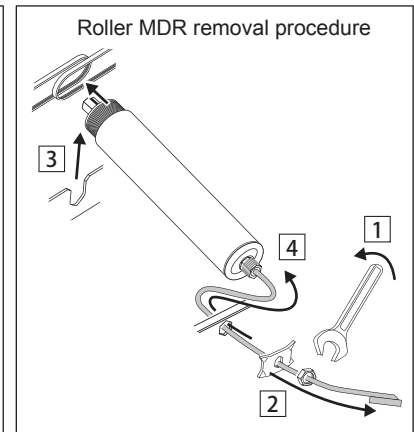
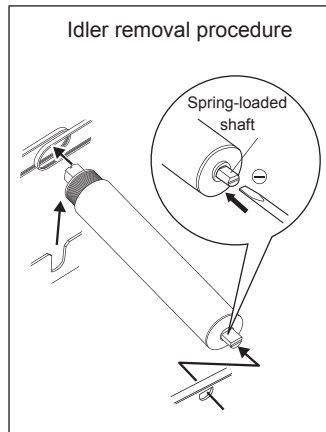
7 - 2. Carrier Wheel Replacement

- ① Remove the hold cover.



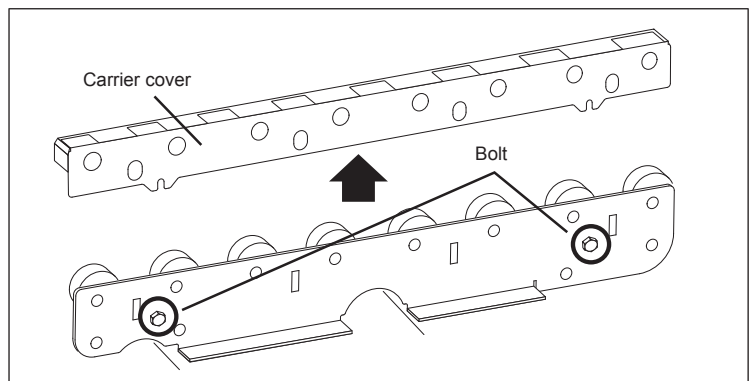
- ② Starting from the edge of a module, remove a Idler or roller MDR until the carrier cover of the Carrier Wheel to be replaced becomes removable.

- Roller without a power cable is Idler.
- Before removing a roller MDR, loosen the cable retainer at the power cable side and remove the cable tie which secures the cable.



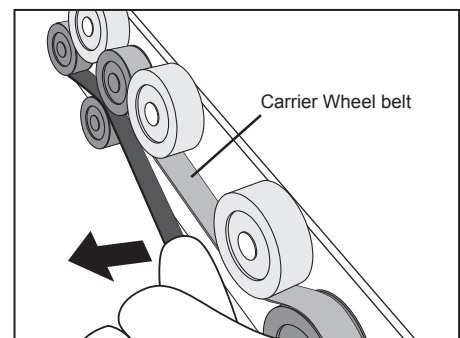
- ③ Remove the carrier cover

- Loosen the carrier cover securing bolts just before coming off, and pull up the carrier cover.



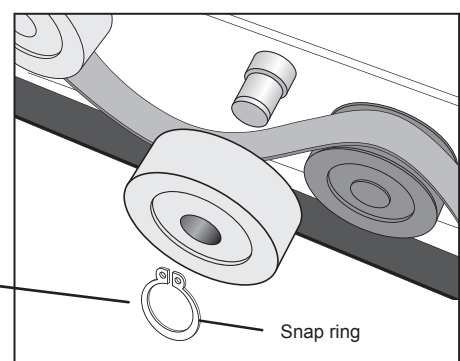
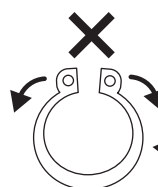
- ④ Remove the Carrier Wheel belt.

- As shown by the figure, rotate the Carrier Wheel MDR by hand while shifting the belt sideways for easy removal.
- When the Carrier Wheel MDR cannot be rotated by hand, loosen the tension adjustment pulley.
(Refer to Carrier Wheel belt tension adjustment ③)



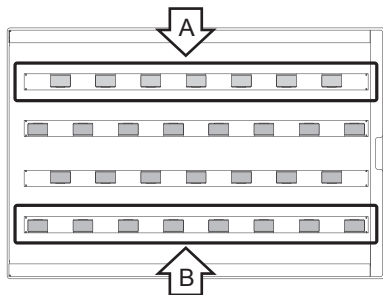
- ⑤ Remove the snap ring and replace the Carrier Wheel.

- When installing the Carrier Wheel, use caution not to open the snap ring excessively.

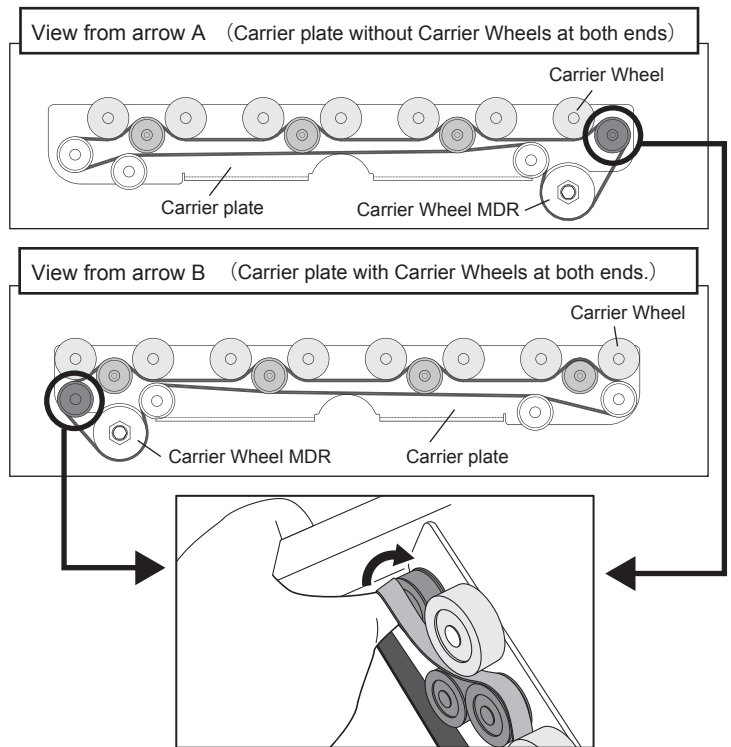


⑥ Install the Carrier Wheel belt.

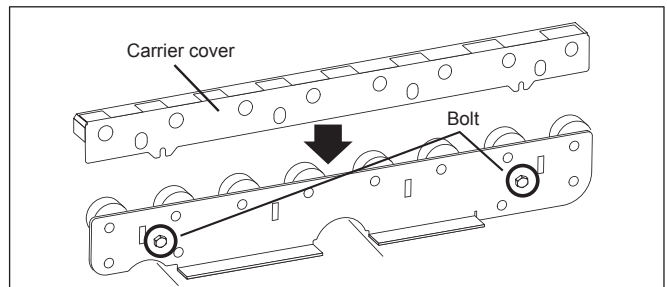
- Refer to the figure to the right for installing the belt.



- For installing the belt, pull the belt near the pulley shown to the right, and hook it on the pulley while rotating the carrier roller by hand.
- When the tension adjustment pulley was loosened for removing the belt, readjust the belt tension after installing the belt and secure the belt tension pulley.
- Adjust the belt tension to the degree that Carrier Wheel cannot easily be rotated by hand.



⑦ Install the carrier cover.



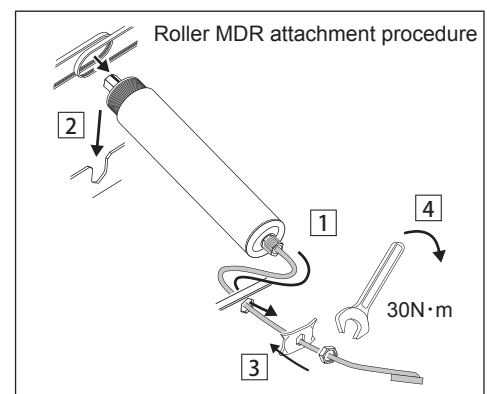
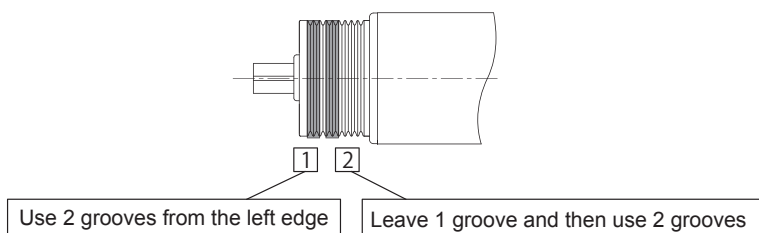
⑧ Install Idler and roller MDR.

Install the roller MDR and then install Idlers from the roller MDR toward the edge of the module.
After installation, secure the roller MDR cable by using an ordinary cable tie.

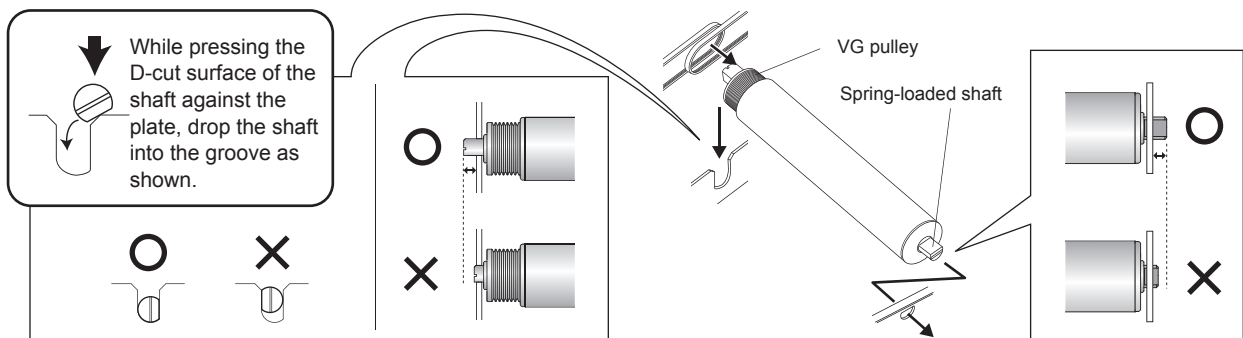
⑧ -1. Attach link belt on all rollers.

Refer to the figure below for attachment groove position of link belt.

- Linking of a roller MDR and Idler PJ256 (2PJ256)
- Linking between Idlers PJ246 (2PJ246)



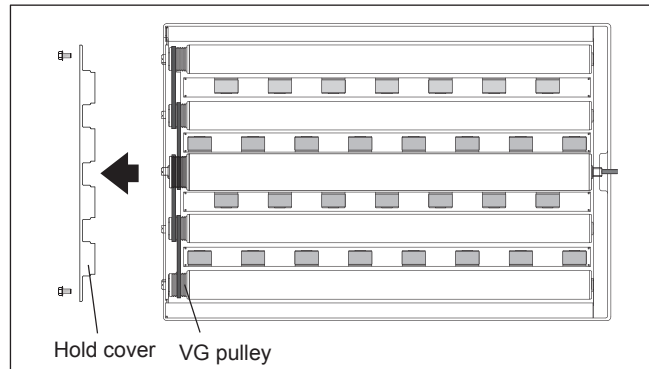
⑧ -2. Assemble Idlers one by one in the order of "shaft opposite from the VG roller" → "VG pulley side shaft".



⑨ Attach the hold cover.

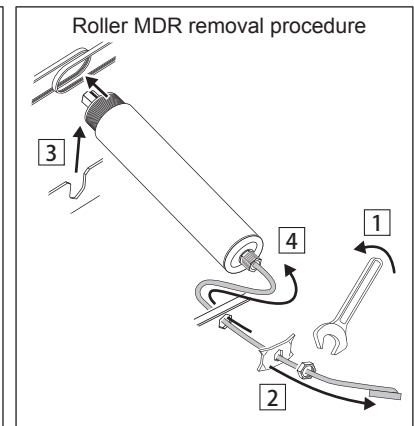
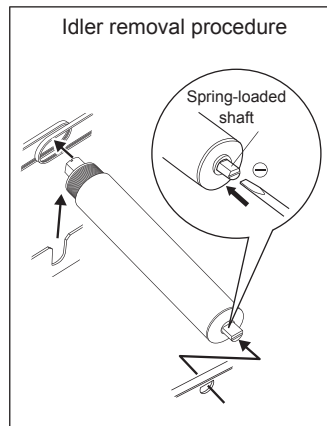
7 - 3. Replacing Idler, Roller Link Belt, Roller MDR

- ① Remove the hold cover.



- ② Starting from the edge of a module, remove a Idler or roller MDR until the carrier cover of the Carrier Wheel to be replaced becomes removable.

- Roller without a power cable is Idler.
- To remove a roller MDR, loosen the cable retainer at the power cable side, and remove the cable tie which secures the cable.



- ③ Replace Idler, roller link belt, roller MDR and install them.

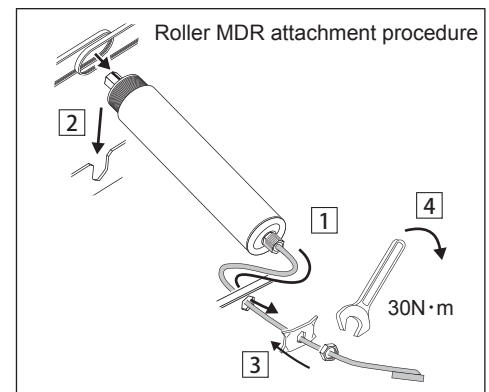
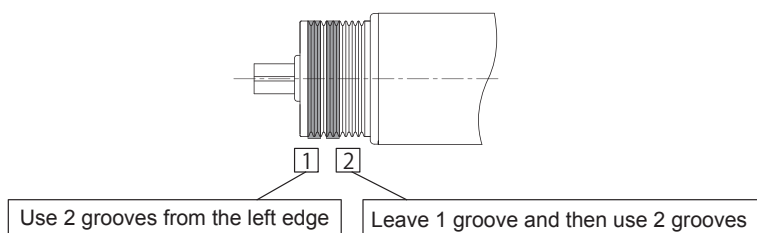
Install the roller MDR and then install Idlers from the roller MDR toward the edge of the module.

After installation, secure the roller MDR cable by using an ordinary cable tie.

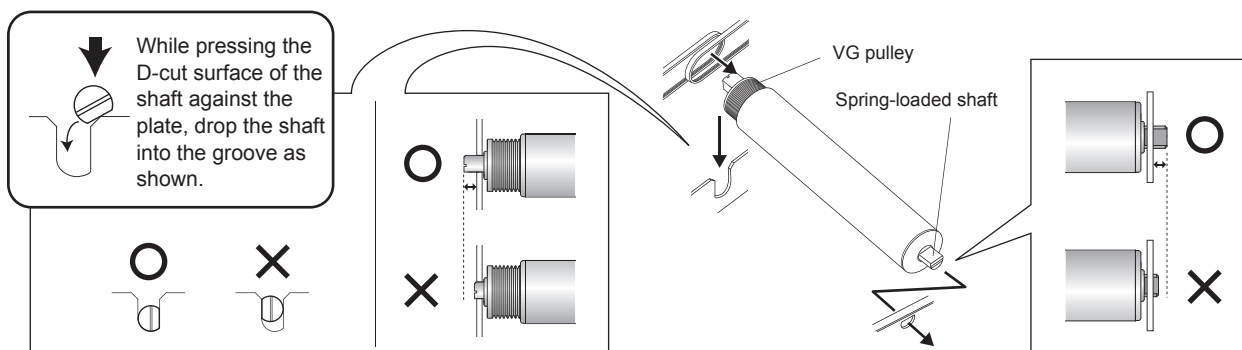
- ③ -1. Attach link belt on all rollers.

Refer to the figure below for attachment groove position of link belt.

- Linking of a roller MDR and Idler PJ256 (2PJ256)
- Linking between Idlers PJ246 (2PJ246)



- ③ -2. Assemble Idlers one by one in the order of "shaft opposite from the VG roller" → "VG pulley side shaft".



- ④ Install the hold cover

8. Specifications

Product Specifications

■ F-RAT-U225 unit specifications

Roller diameter		Roller MDR : ϕ 48.6mm Idler : ϕ 38mm
Size	(W) Roller transfer direction	395mm, 495mm, 595mm, 695mm, 795mm
	(L) Carrier Wheel transfer dir.	595mm, 895mm
Mechanism height		125mm ※Excluding protrusion
Transfer speed		17m/min, 60m/min
Carrier Wheel	Diameter	ϕ 38mm
	Width	17mm
	Material	Urethane
Lifting stroke		7mm (Level difference between the top surface of Carrier Wheel and carrier cover is 4.9mm)
Drive power		24VDC
Operating temperature		0 ~ 40°C (No freezing)
Operating humidity		90%RH or below (No condensation)
Atmosphere		No corrosive gas
Vibration		0.5G or below
Installed location		Indoor
Tilt of the mounting surface		5/1000 or below
Carrier Wheel transfer side sensor SN·S / Roller transfer side sensor SN·R	Current consumption	15mA or below
	Output	Maximum inrush current: 100mA
		Applied voltage: 30V or less (between output and 0V)
		Residual voltage: 2V or less (100mA inrush current)
	Output motion	ON when detecting the position
Cable		Outer dia. ϕ 3mm 0.15mm ² 3 wires

■ Product Weight

Size	Weight	Size	Weight
Size 6040	32kg	Size 9040	52kg
Size 6050	38kg	Size 9050	58kg
Size 6060	45kg	Size 9060	65kg
Size 6070	52kg	Size 9070	74kg
Size 6080	60kg	Size 9080	82kg

Transfer Load

■ Load Size and Weight

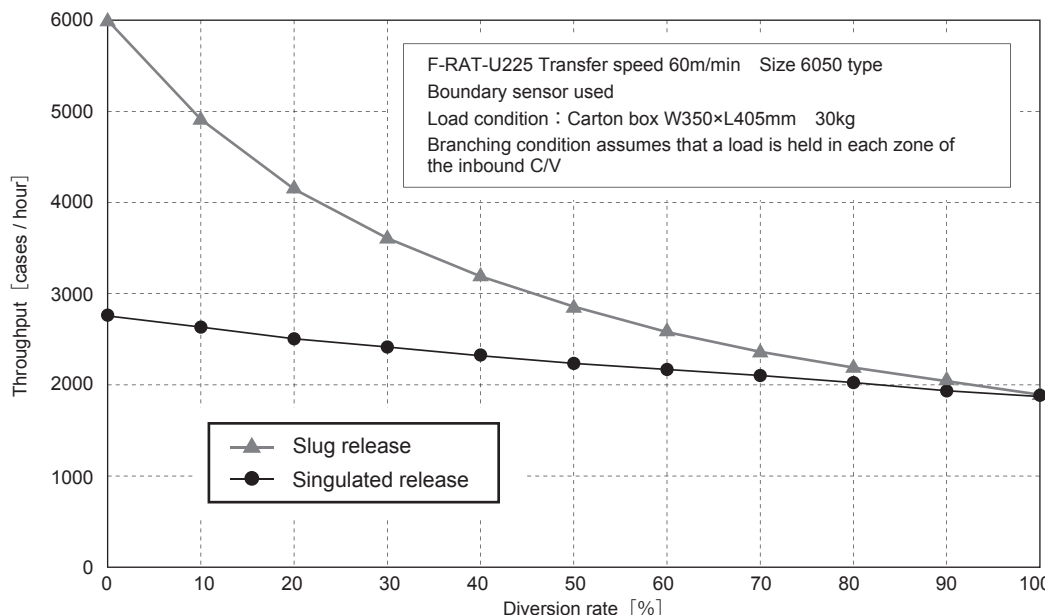
Size	Min. size ~ Max. size	Max. Load Weight	Size	Min. size ~ Max. size	Max. Load Weight
Size 6040	L225×W225mm ~ L500×W325mm	50kg	Size 9040	L225×W225mm ~ L800×W325mm	50kg
Size 6050	L225×W225mm ~ L500×W400mm		Size 9050	L225×W225mm ~ L800×W400mm	
Size 6060	L225×W225mm ~ L500×W500mm		Size 9060	L225×W225mm ~ L800×W500mm	
Size 6070	L225×W225mm ~ L500×W600mm		Size 9070	L225×W225mm ~ L800×W600mm	
Size 6080	L225×W225mm ~ L500×W700mm		Size 9080	L225×W225mm ~ L800×W700mm	

※ Size and mass are approximate, as they vary by the load condition.

※ Certain type of load may not be transferred correctly depending on the bottom shape.

Transfer Throughput

※ The curves shown are based on the company's measurement for reference only, not warranted values.
 ※ Slug release data is based on the total control by using id LinX for controlling the conveyors before and after F-RAT.
 ※ Stopping distance of a load and throughput varies by load size, material, bottom condition, operating temperature and transfer speed.



■ CB-016□6 / CBR-306F□ ※□=N (NPN in/out or P (PNP in/out)

Power voltage		DC24V±10%
Rated voltage		DC24V
Static current		0.03A
Starting current		4.0A
Wire dia.	Pwr connector (CN1)	0.50~1.5mm ² (AWG:20~14) Note)
	Cntrl connector (CN2)	0.08~0.5mm ² (AWG:28~20) Note)
Motor rotation from drive input		15msec or below
Protection function		Mis-wiring protection / Integral 6.3A fuse
Temperature protection		95°C for circuit board, 105°C for motor
Current limit		4A
Ambient temperature		0~40°C (No freezing)
Ambient humidity		90%RH or below (No condensation)
Atmosphere		No corrosive gas
Vibration		0.5G or below
Installed location		Indoor

Note) Conforming wire to the included connector

PCB side	Power connector	734-162 (WAGO)	(MAX: 10A)
	Control connector	733-365 (WAGO)	(MAX: 4A)
Wiring side	Power conn. (CN1)	734-102 (WAGO)	(MAX: 10A)
	Control conn. (CN2)	733-105 (WAGO)	(MAX: 4A)

Replacement Parts

	Part Name	Part Number
1	Carrier Wheel	F-RAT-UCP1
2	Roller link belt	2PJ246 (Idler ⇄ Idler) 2PJ256 (MDR ⇄ Idler)
3	Roller MDR	SIZE 60□□ PM486FE-(60 or 17)-529-D-024-JW-C150-VG-OS Short attaching shaft SIZE 90□□ PM486FE-(60 or 17)-829-D-024-JW-C150-VG-OS Short attaching shaft
4	Idler	SIZE 60□□ ARI-38-532-HX-OS V-ribbed pulley Short attaching shaft SIZE 90□□ ARI-38-832-HX-OS V-ribbed pulley Short attaching shaft
5	Driver card	CB-016□6 (For Carrier Wheel MDR • For Roller MDR) CB-016□6-CP2 (For Carrier Wheel MDR) CBR-306F□ (Lifting)

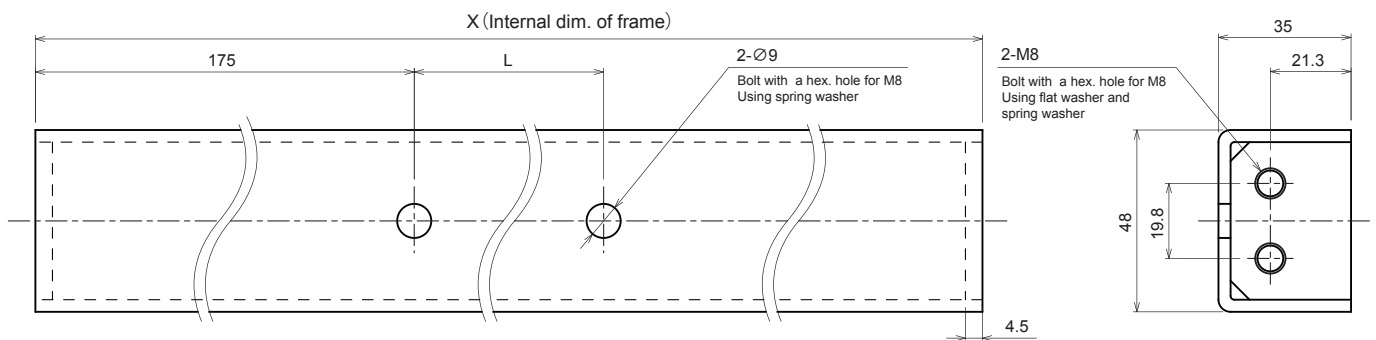
□ : Specify N = NPN or P = PNP according to the input/output type

Optional Item List (Extension cable, etc.)

● Mounting stay

(mm)

Size	L	X
Size 6040 / Size 9040	50	400
Size 6050 / Size 9050	150	500
Size 6060 / Size 9060	250	600
Size 6070 / Size 9070	350	700
Size 6080 / Size 9080	450	800

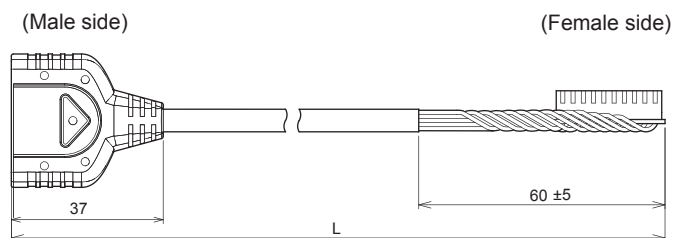


※ Please inquire us for other X dimensions (frame inside dimension).

※ M8 bolt / flat washer / spring washer included.

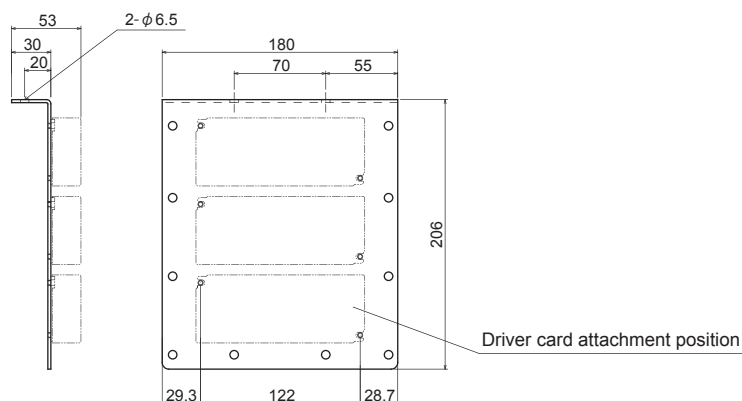
● Extension cable

Model	Cable specification
ACE-CBM-B0600	9P ext. cable length 600mm
ACE-CBM-B0850	9P ext. cable length 850mm
ACE-CBM-B1200	9P ext. cable length 1200mm



● Driver card attaching plate (F-RAT-S1-DB)

※ Up to 3 cards can be mounted.



9. When Questioning a Failure

When questioning a failure, check the items shown below before contacting us or requesting a repair.

Symptom	Check the Following	Perform the Following	Refer to
F-RAT-U225 does not operate	Is PWR LED (green) of each driver card turned on?	Supply 24VDC.	Connector wiring 
	Is ERR LED (red) of each driver card blinking or lit, indicating error output?	Eliminate error cause and cancel the error setting.	• Error detail/cancel method  • CB-016□6 User manual
	Is each connector correctly connected? Is the wiring correct?	Check the wiring and rewire correctly.	Connection  Wiring 
	Does each driver card type※ (NPN/ PNP input/output) and input/output signal (NPN input/output / PNP input/output) of PLC, etc. match?	Match each driver card type (NPN input/output / PNP input/output) and input/output signal (NPN input/output / PNP input/output) of PLC, etc.	Wiring 
	Is the input voltage common to the supplied power voltage?	Make the input voltage common to the supplied power voltage.	CB-016□6 User manual
Lifting unit does not operate, or the motion is abnormal.	M3 : Is the lifting driver card set with SW1#5 to OFF and SW5 to "3"?	M3 : Set the lifting driver card with SW1#5 to OFF and SW5 to "3".	Driver card setting 
	Is the control set with Carrier Wheel transfer side sensor (SN・S) to be ON when the Carrier Wheel is up ?	Set the control to turn ON the Carrier Wheel transfer side sensor (SN・S) when Carrier Wheel is up.	Control 
	Is the control set with roller transfer side sensor (SN・R) to be ON when the roller is up?	Set the control to turn ON the roller transfer side sensor (SN・R) when the roller is up.	Control 
	M3 : Isn't the RUN signal to the lifting driver card kept entered?	M3 : Set the RUN signal to the lifting driver card to OFF when the lifted position is detected.	Control 
	M3 : Is the lifting driver card ERR LED (red) blinking or lit with error output?	Eliminate the error cause and cancel the error.	Error detail/cancel method 
Incoming load is disturbed or is not transferred.	Is the Carrier Wheel lifted when it is expected to move the load, and the roller is lifted when it is expected to move the load?	Make the Carrier Wheel or roller that matches the move-in direction to be lifted up.	Control 
	Is Carrier Wheel MDR (M1) driven when it is expected to move-in the load, and roller MDR (M2) is driven when it is expected to move-in the load? Is the MDR kept driven until the move-in is completed?	Keep the motion of Carrier Wheel MDR (M1) or roller MDR (M2) that matches the move-in operation until the end.	
	Isn't the lifting MDR (M3) starting during move-in operation?	Make sure the lifting MDR (M3) not to start until the end of move-in operation.	
	Size 6060 /6070 / 6080 / 9060 / 9070 / 9080 only When moving in by Carrier Wheel, is the rotation direction (SW1#3) of M1 and M4 driver card different? Is the speed setting of M1 and M4 driver card made the same?	Size 6060 /6070 / 6080 / 9060 / 9070 / 9080 only Set the rotation direction of M1 and M4 different. Set the speed the same.	Driver card setting 

症 状	確 認 事 項	処 理	参照先
Incoming load is disturbed or is not transferred.	Is the roller up when moving out by roller, and is Carrier Wheel up when moving out by Carrier Wheel?	Make the roller or Carrier Wheel lifted up for matching the moving out direction.	Control 
	Is roller MDR (M2) driven for moving out by roller, or is Carrier Wheel MDR (M1) driven for moving out by Carrier Wheel? Is MDR kept driven until completing the moving out operation?	Keep moving the roller MDR (M2) or Carrier Wheel MDR (M1) until completing the moving out operation.	
	Isn't lifting MDR moving during moving out operation?	Make sure not to start lifting MDR (M3) until completing the moving out operation.	
	Size 6060 /6070 / 6080 / 9060 / 9070 / 9080 only When moving out by Carrier Wheel, is the rotation direction (SW1#3) different between M1 and M4 driver cards? Is the speed setting of M1 and M4 driver cards same?	Size 6060 /6070 / 6080 / 9060 / 9070 / 9080 only Set the rotation direction of M1 and M4 different. Set the same speed.	Driver card setting 
- Speed cannot be changed - Speed setting is abnormal	Is the switch operated on M1: Carrier Wheel driver card for speed change of Carrier Wheel, and M2: roller driver card for roller speed change?	Operate the switch of M1 : for Carrier Wheel speed change, and M2 : for roller speed change.	Driver card setting 
	Isn't the switch of M3 : for lifting operated?	If the switch of M3 : for lifting is operated, return the setting as before.	
	Size 6060 /6070 / 6080 / 9060 / 9070 / 9080 only Are the switches of both M1 and M4 driver cards operated for Carrier Wheel speed change?	Size 6060 /6070 / 6080 / 9060 / 9070 / 9080 only Operate both switches of M1 and M4 and use the same setting.	Driver card setting 
	When external voltage is used for Carrier Wheel speed change, is 0V of external power common to the driver card?	Make 0V common to the driver card and external.	CB-016□6 User manual
Transfer direction (Carrier Wheel/roller) does not match.	Is the rotation direction setting of M1: for Carrier Wheel and M2: for roller matches the transfer and branching direction?	Match the transfer/branching direction and rotation direction of Carrier Wheel (M1) and roller (M2)	Driver card setting 
Only some Carrier Wheels rotate.	Is correct tension applied to the Carrier Wheel so that it does not rotate by hand while lightly pressing.	Adjust the tension of Carrier Wheel.	Carrier Wheel belt tension adjustment 

Appendix 1 . CBR-306F□ Detail

CBR-306F is a driver card for up/down motion.
MDR is driven by RUN signal input, but is automatically stopped after counting predetermined motor pulses.



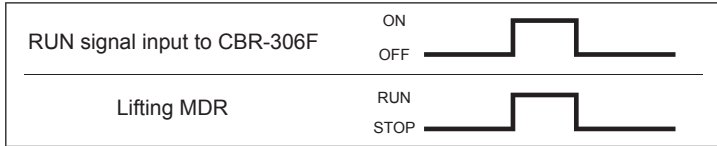
Caution

Keep SW1-5 to be OFF.

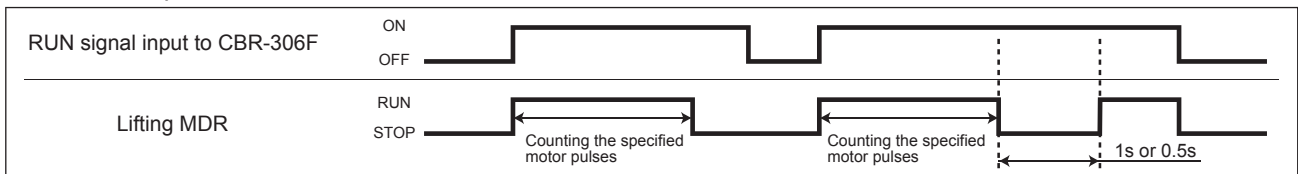
It cannot operate by external input signal, or may cause a failure if SW1-5 is set to ON.

Time Chart

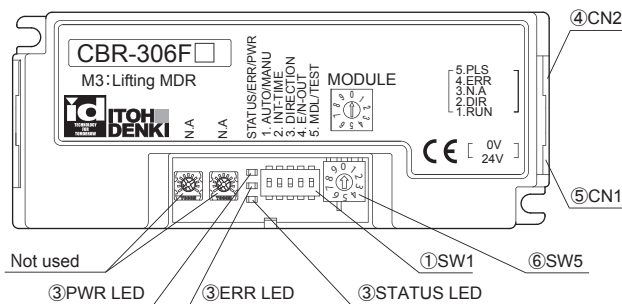
● Normal up/down motion



● Abnormal up/down motion

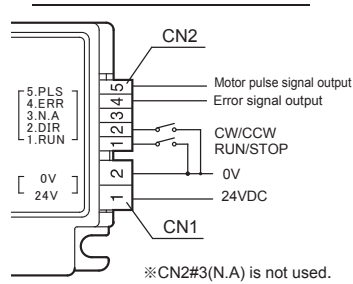


List of Functions

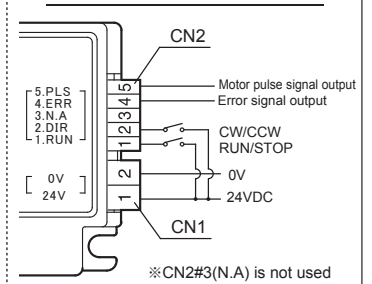


[Wiring]

NPN signal input [FN] type



PNP signal input [FP] type



① SW1 (DIP switch)	Description		ON	OFF	Default	Remarks
	1	Auto/manual recovery selection with thermal, low voltage, induced voltage error	Manual rec.	Auto rec.	ON	Ref. Error detail, cancellation
	2	Stop holding time	0.5sec	1sec	OFF	Ref. Time chart ● Refer to abnormal lifting operation
	3	Rotation direction selection	(Ref. rotation dir. change)		OFF	(Normally set to OFF)
	4	Alarm (error) signal output selection	Normal time output	Error time output	OFF	Ref. Error signal output
	5	Forcible RUN	RUN	Module selection	OFF	⚠ Caution Keep SW1-5 to be OFF. It cannot operate by external input signal, or may cause a failure if SW1-5 is set to ON.

③		Color	Indication	Remarks
	PWR LED	Green	Indicates powered condition	Ref. Error detail, canceling method
	ERR LED	Red	Indicates error type	
	STATUS LED	orange	Indicates number of error occurrence form thermister reaction, motor stall or under voltage	Refer to CB-016 User Manual

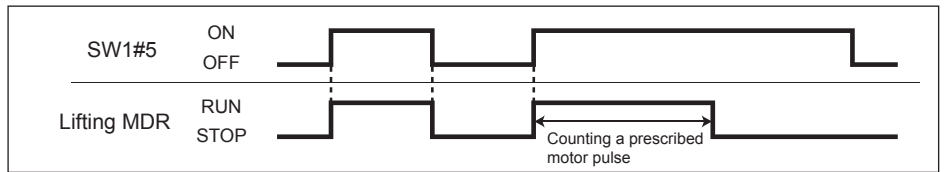
④ CN2 (Control)	No.	Description	Remarks
	5	Motor pulse output	Motor pulse signal output (2pulses/1 rev. of internal motor)
	4	Error signal output	Ref. Error signal output
	3	—	(Not used)
	2	MDR rotation direction change	Ref. Rotation direction change
	1	MDR start/stop	ON : RUN / OFF : STOP (Approx 3mA current flows)

⑤ CN1 (Power)	No.	Signal
	2	0V
	1	24VDC

⑥ SW5 (Module selection)	0	Not operating	 Caution	Make sure to select a correct number for installed product.
	1	F-RAT-S series／Pop-up Diverter		
	2	F-RAT-T225		
	3	F-RAT-U225		
	* Product may be in unexpected behavior in case of incorrect setting.			

■ Forcible RUN

- Lifting MDR starts by turning DIP-SW SW1-5 to ON, without external signal to CN2-1 / CN2-2.

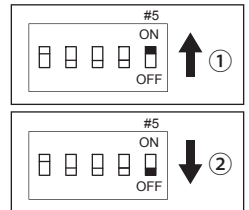


Caution

SW1-5 must be set to OFF when the roller transfer side sensor (SN·R) is ON, in case of F-RAT-U225. That may cause F-RAT-U225 breakage or make the operation life extremely short.

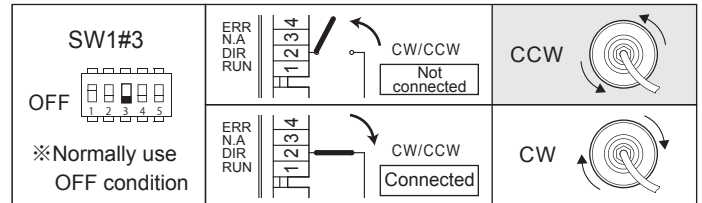
- Lifting MDR starts by turning DIP-SW SW1-5 to ON after injecting main power.
- Lifting MDR stops by turning OFF.

SW1#5 (DIP-SW)



■ Rotation Direction Change

- MDR rotation can be changed by external switch.
- ※MDR rotation in the right turn direction is defined as CW when viewed from the cable side, and left turn as CCW.
- ※0V must be common to the power supply.
- ※CN2#2 carries approx. 3mA current.



■ Error Signal Output

- SW1#4 can change setting of normal-time signal output or error-time signal output.
- CN2#4 delivers error signal output.

- ※Power ON/OFF operation generates error signal. Make the control to ignore error signal from the driver card for 0.5sec at power ON, and 2sec at power OFF.
- ※Use a protection resistor to suppress current to 25mA or below. Use of higher current damages the transistor in the driver card.
- ※Protection resistor 100Ω is furnished in the driver card.

SW1#4	
OFF	ON
Error-time signal output	Normal-time signal output
Normal time open (Transistor in the driver card is ON during error)	Error time open (Transistor in the driver card is OFF during error.)

■ Error Detail, Cancellation Method

- Error can be checked by PWR LED(green), ERR LED(red), and CN2#4 signal.

※Error signal cancellation by CN2#1 ON → OFF → ON immediately starts MDR.
 ※At low power voltage (8.5V or below), the motion same as power shut down or unexpected motion may occur.

LED Indication

Steady ON	Blinking (1Hz)	Blinking (6Hz)	OFF

PWR LED (green) ERR LED (red)	CN2#4 (Error signal)		MDR	Error Cause	Error Signal Cancellation		MDR Restart
	SW1#4OFF	SW1#4ON					
	Open	Output	—	(Normal operation)	—		
	Open	Open	Stop	No power	Supply 24V DC		—
	Output	Open	Stop	Driver card failed	Shut off the power and replace the driver card		—
	Output	Open	Stop	Thermal protection has been activated by temperature rise of driver card or MDR (Thermal error)	Auto rec setting	1 min after reaching recovery temp, error signal cancellation and immediate start	
						After reaching recovery temp, CN2 # 1 ON→OFF→ON to cancel error and start	
					Manual recovery setting	After reaching recovery temp, CN2 # 2 ON→ OFF→ON or OFF→ON→OFF	Start by CN2 # 1 ON→OFF→ON Start within 1 min.
						After reaching recovery temp, CN2 # 1 ON→OFF→ON to cancel error and start	After reaching recovery temp, CN2 # 2 ON→ OFF→ON or OFF→ON→OFF
				MDR connector has been separated	Shut off the power and connect the connector		—
	Output	Open	Stop	4sec elapsed with locked MDR (Lock error)	CN2 # 1 ON→OFF→ON to cancel error and start		
					CN2 # 2 ON→OFF→ON or OFF→ON→OFF	Start by CN2 # 1 ON→OFF→ON	
	Output	Open	Stop	Power voltage is 15V or below (Low voltage error)	Auto rec setting	Secure power voltage 18V or higher	Immediate start
					Manual recovery setting	Secure power voltage 18V or higher, CN2 # 1 ON→OFF→ON to cancel error and start	Start by CN2 # 1 ON→OFF→ON
						CN2 # 2 ON→OFF→ON or OFF→ON→OFF	

Error can be canceled by power OFF (2sec or longer)

Appendix2. Maintenance

- When starting and ending daily operation, perform maintenance inspection by referring to the following.
- To avoid accident or damage during operation, perform safety check and procedure.

● Safety check procedure before starting maintenance inspection operation



Warning

- To avoid interference by power circuit or signal, shut off power to all connected devices.
 - (a) After turning off the power switch, leave for 3min or longer to discharge the DC power supply.
 - (b) To prevent unrelated personnel from supplying power, post a warning indication.
 - (c) When inspecting during operation for noise or abnormal rotation, use caution for finger being caught by rollers and other moving part. In preparation for immediate stopping of the equipment apply sufficient safety measures.
- Always use protective means such as gloves.
Operations without using protective means may lead to cutting by a metal part and other injury.

● Confirmation after maintenance inspection

- After completing maintenance inspection operation, check the following before a trial operation.
 - (a) Whether the roller link belts are attached in the correct groove position.
 - (b) Once-removed covers are securely installed.
 - (c) No components have been forgotten for assembly.

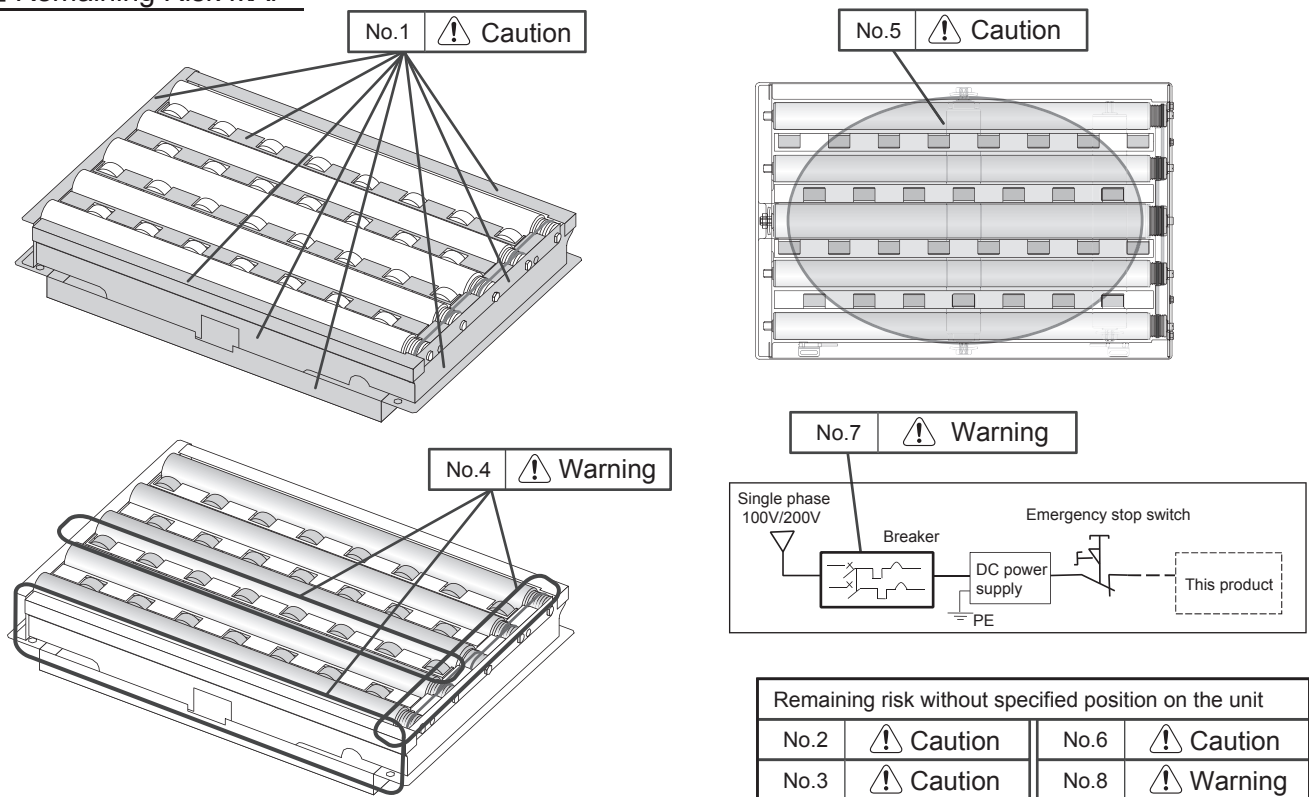
Inspection Locations	Inspection Items	Action Contents
• Mounting points of F-RAT • Mounting stay (Optional)	• Loose screws	• Tighten the screw
• Driver card	• Loose screws at mounting points • Incorrect attachment of driver card • Wire damage, defective wiring • Abnormal temp rise, damage	• Tighten the screw • Attach connector correctly • Correct the wiring • Stop and report to the distributor
• Idler	• Abnormal sound • Rotation failure • Appearance defect by damage	• Repair, replacement P.23 P.25
• Roller MDR	• Abnormal sound • Speed degradation from setting • Appearance abnormality, dent • Abnormal temperature rise	
• Carrier Wheel	• Surface crack, lost material • Surface wear • Appearance abnormality, dent • Abnormal sound, poor rotation	• Repair, replacement P.21 P.25
• Roller link belt	• Crack on belt surface • Wear on belt surface • Damage on belt side(degradation)	• Repair, replacement P.23 P.25
• Other	• Current leak from the equipment • Component deformation, damage	• Equipment grounding • Stop and report to distributor

Appendix 3. Remaining Risks List / MAP

List of Remaining Risks

No.	Stage	Operation	Qualification for operation	Position on unit	Danger level	Remaining risk factor	Presumed measures	Implemented measures	Manual pages
1	Preparation	Uncrate/transfer	Fully reading the manual and understanding the content	Product metal part	Caution	Injury by product metal part	Wear protection: gloves, etc.	Explained in the manual	P10
2	Preparation	Transfer		No specific position	Caution	Heavy item transfer by a single operator may cause injury or damage on product	2 or more operators hold product by both hands while supporting the bottom.	Explained in the manual	P10
3	Operation	Trial opr.		No specific position	Caution	During stand-alone trial operation, unexpected load transfer causes injury	Cut off the control to avoid motion of other parts before starting the unit.	Explained in the manual	P18
4	Operation	All operations		Between moving parts and between moving part and stationary part	Warning	Operator's fingers/hand are caught between the unit and moving part, or between moving parts	- Enclose the area with interlocked fence to prevent operator coming close. - Add a cover to the gap in the unit to eliminate gap.	- Attach a warning/caution label - Explained in the manual	P12
5	Operation	All operations		The upper surface of product	Caution	Operator rides on the unit and slips and falls down	- Enclose the area with safety fence to prevent operator coming close. - Train the operator not to ride on the equipment	Explained in the manual	P3
6	Operation	All operations		No specific position	Caution	Operator is injured by a load popped out of the C/V	Enclose the area with safety fence to keep people off and stop object to pop out.	Explained in the manual	P12
7	Maintenance	All inspections		Power supply to driver card	Warning	Power-on action by someone makes the product move unexpectedly and causes injury	Post a warning sign to prevent unrelated personnel from supplying power.	Explained in the manual	P19, P30
8	Maintenance	All inspections		No specific position	Warning	Operator's finger or hand is caught by the product	Work carefully by wearing protective items such as gloves.	Explained in the manual	P19, P30

Remaining Risk MAP



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