

F-RAT-S300 User Manual

Flat-Right Angle Transfer



Thank you for purchasing Flat Right Angle Transfer unit.

- Before using the product, carefully read this manual and retain it for future reference.
- Make sure whether the product you received complies to your purchased order, with its designation, specification and operating voltage.
- Photo and drawing on this manual is Size B for explanations.

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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-S300- ① ② - ③ - ④

① Speed

17 ... 17 m/min (Belt / Roller transfer : 17 m/min)

60 ... 60 m/min (Belt / Roller transfer : 60 m/min)

90 ... 90 m/min (Belt / Roller transfer : 90 m/min)

② Signal type selection

N ... NPN signal type (NPN proximity sensor / driver card included)

P ... PNP signal type (PNP proximity sensor / driver card included)

③ Size

A...W379mm×L758mm

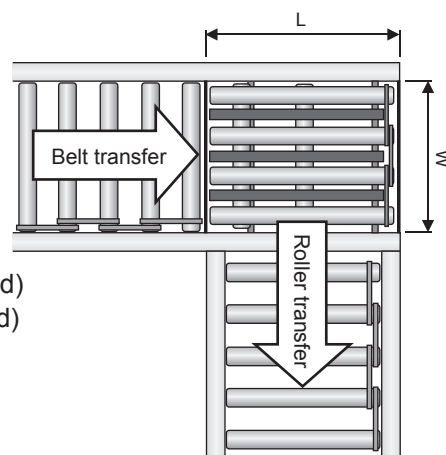
B...W497mm×L758mm

C...W597mm×L758mm

D...W697mm×L758mm

④ Type

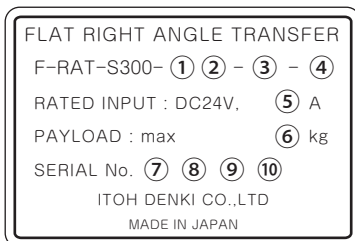
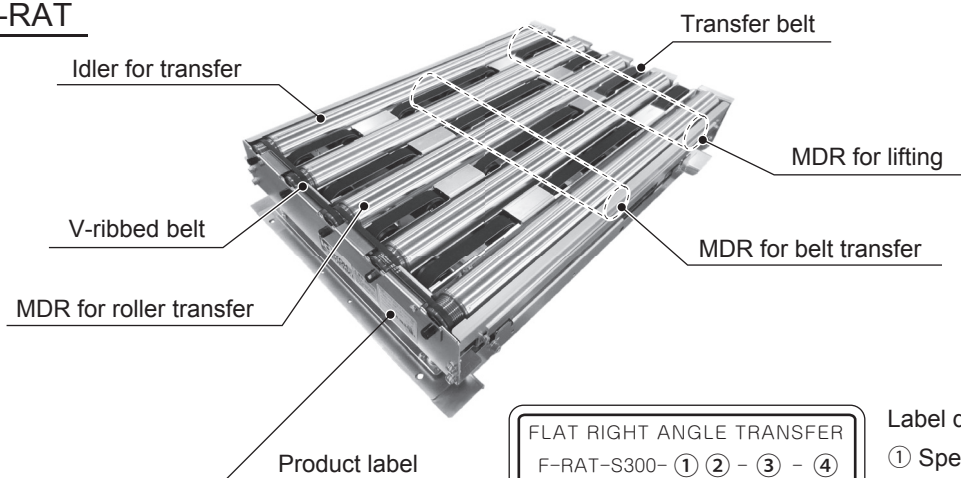
S1



Example : **F - RAT - S300 - 17N - B - S1** Speed 17 m/min, NPN signal type, W 497 x L 758 mm, S1type

3. Structure

■ F-RAT



Label detail

- ① Speed type
- ② Signal type
- ③ Size
- ④ Type
- ⑤ MDR rated current
- ⑥ Max load weight
- ⑦ ⑧ ⑨ Serial NO; YY/MM/DD
- ⑩ Lot No

■ Accessories

- F-RAT mounting hardware
 - 4 sets of M8-20 bolt / M8 nut
- Standard driver card :
 - MDR for roller transfer / belt transfer ; CB-016N × 2 or CB-016P × 2
 - MDR for lifting ; CBR-305FN-B or CBR-305FP-B
 - * The other driver cards are also available as option.
- Proximity NPN sensor or Proximity PNP sensor

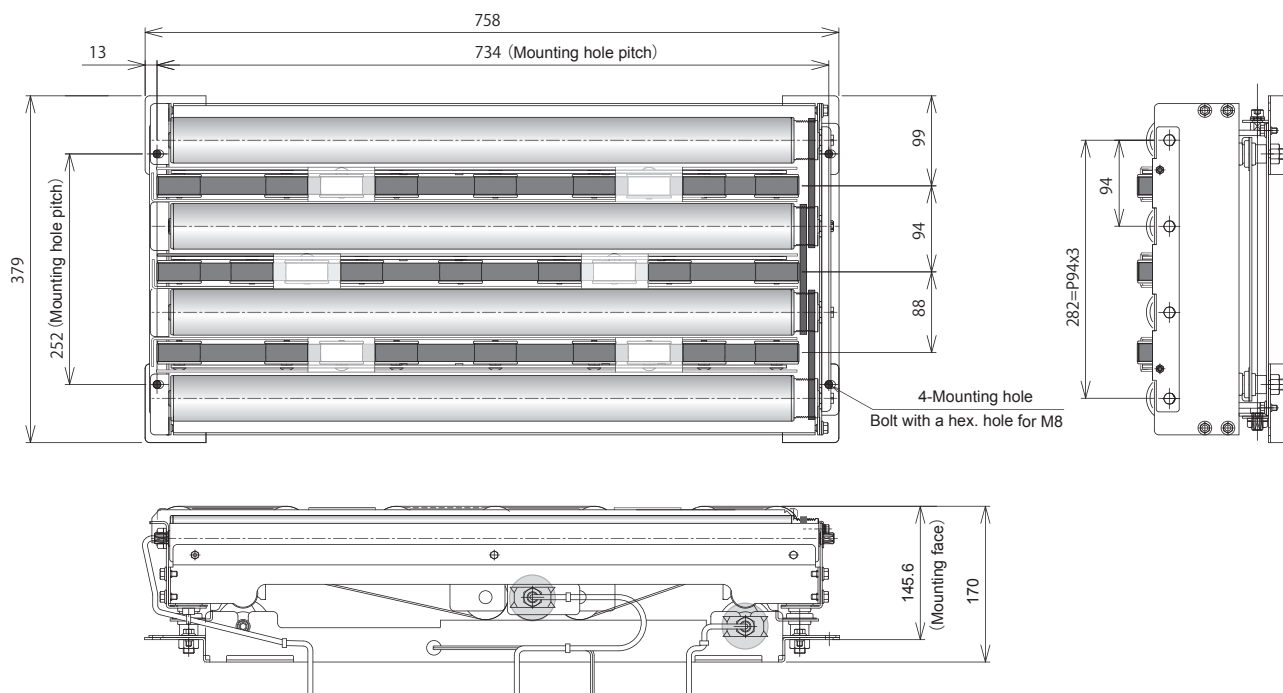
4. Power supply

- 24VDC Battery
- Switching power supply (24VDC · 5A 120W)
- Rectified power (With a rectifying capacitor, ripple rate 10% or below)
 - ※ Supplied power must be a stabilized power supply of 24VDC, 5A or higher without fluctuation by load.
 - In addition, the power supply should not activate protection with peak current 20A, 1ms or below.

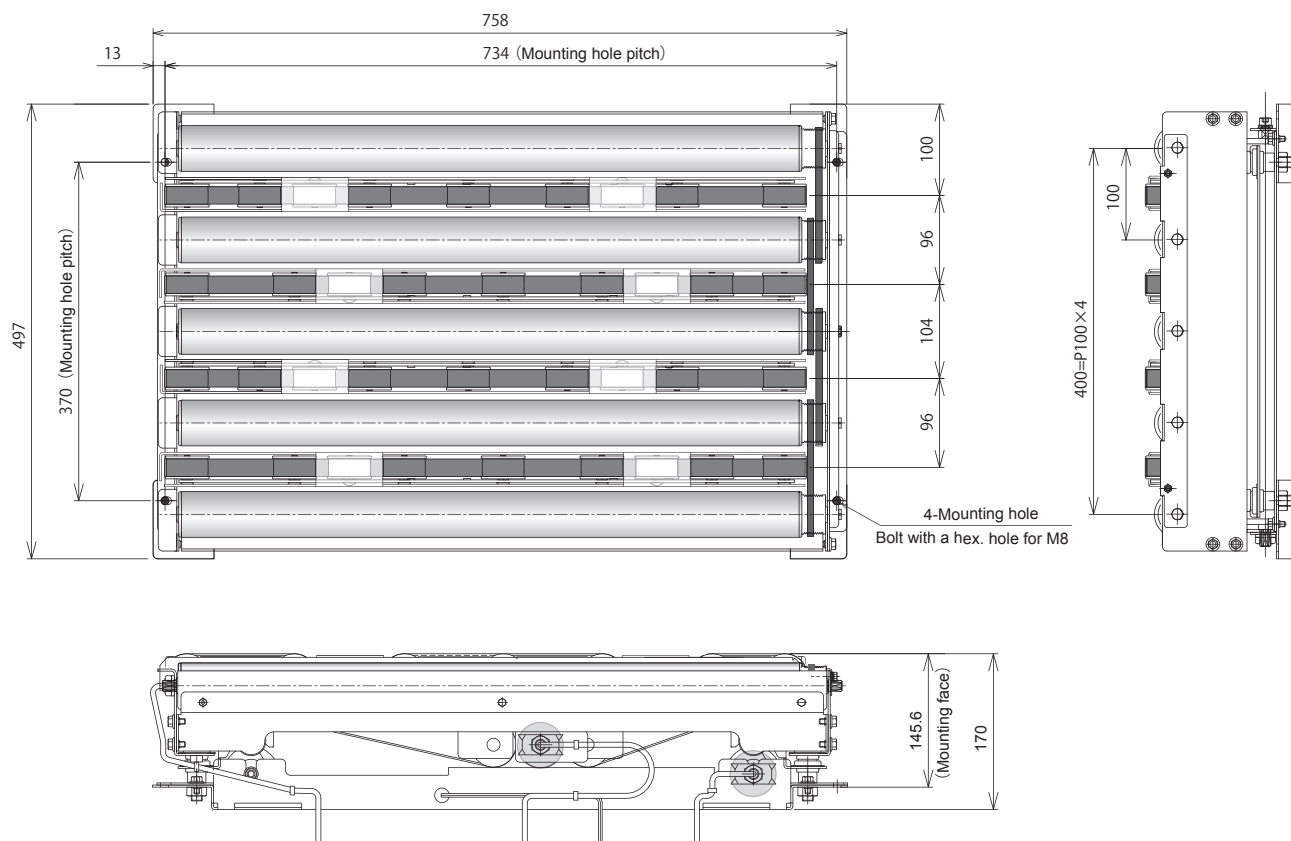
5. Dimensions

■ F-RAT

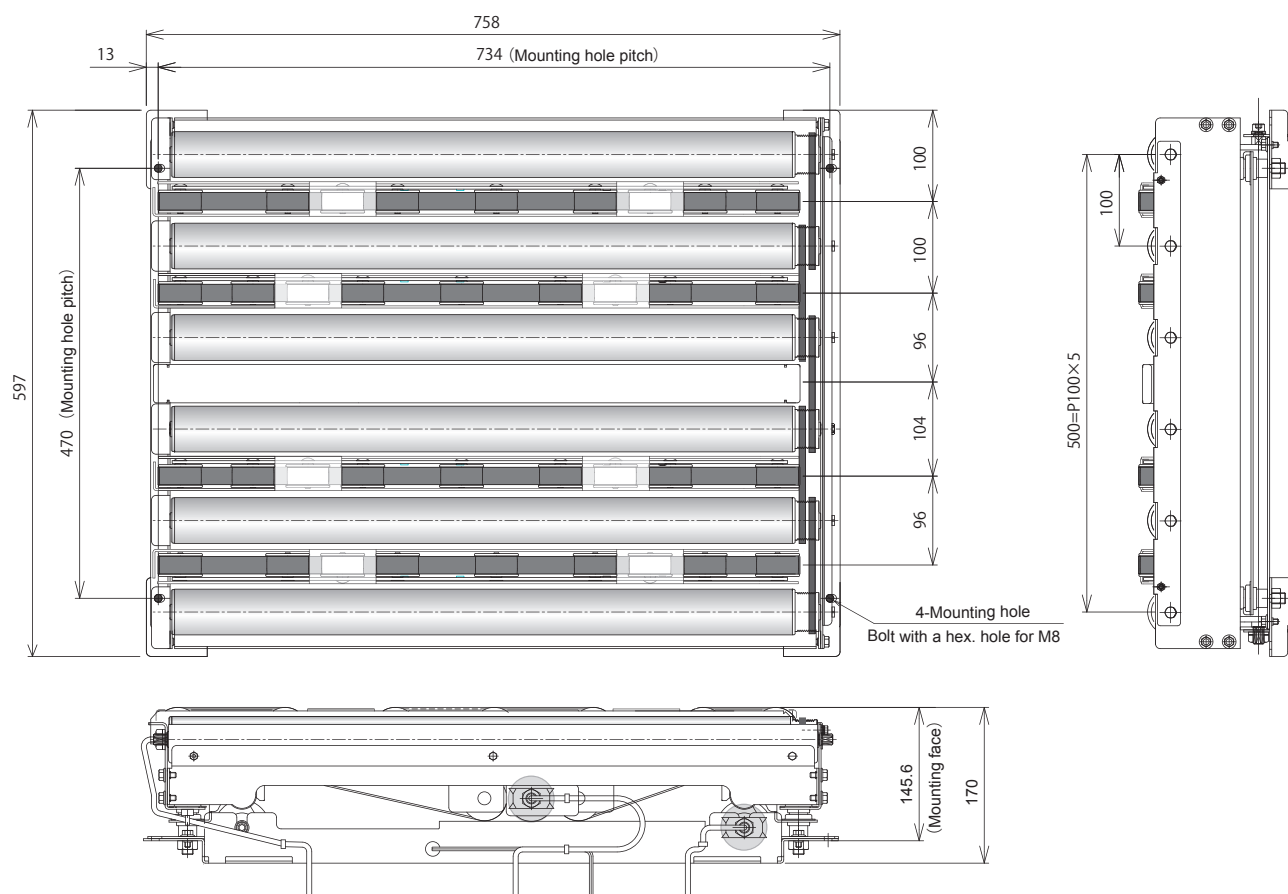
● SIZE A ... W379mm×L758mm



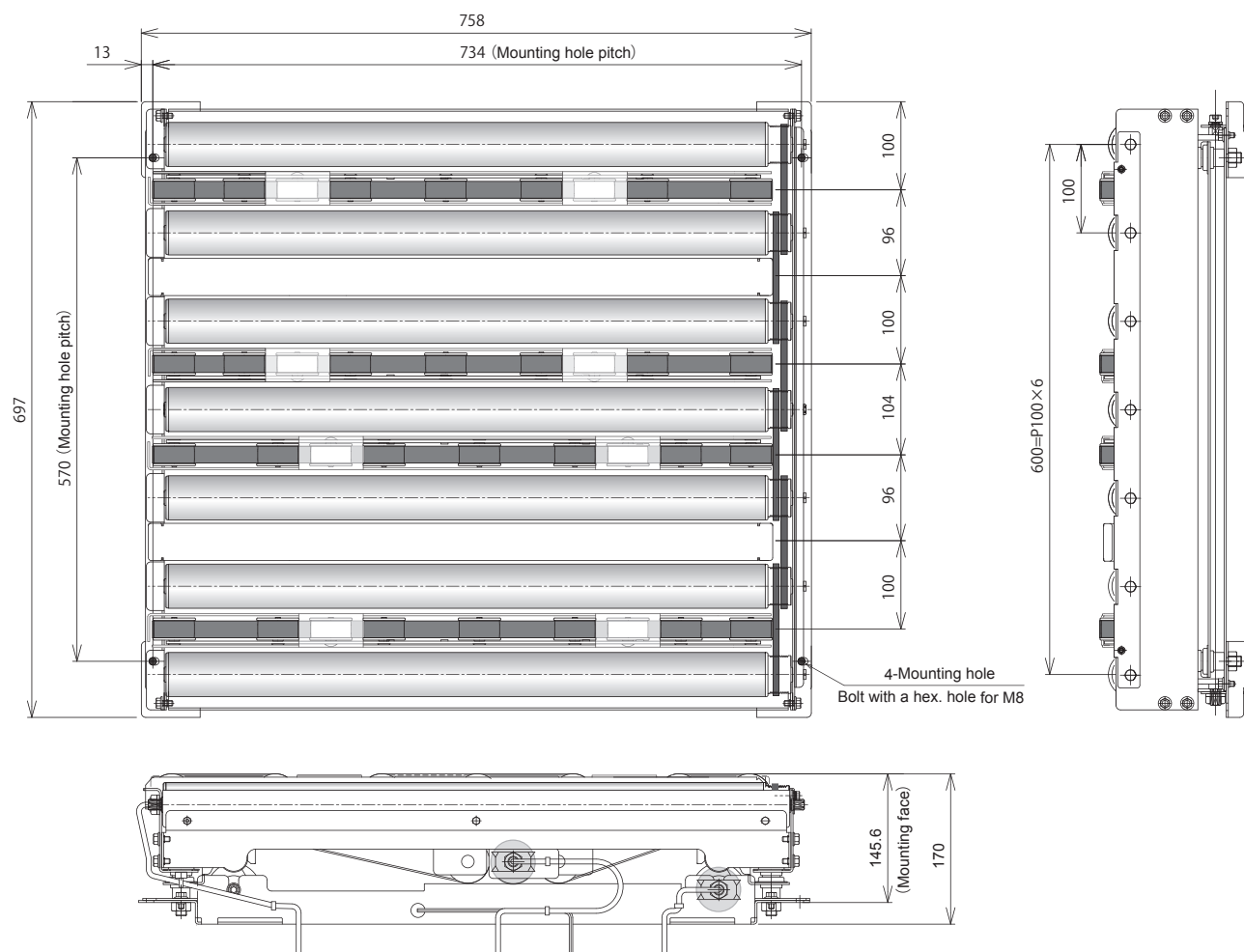
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● SIZE C ... W597mm×L758mm



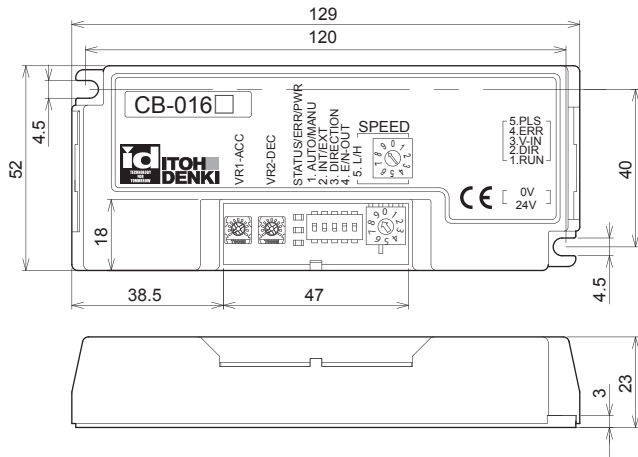
● SIZE D ... W697mm×L758mm



■ Accessory

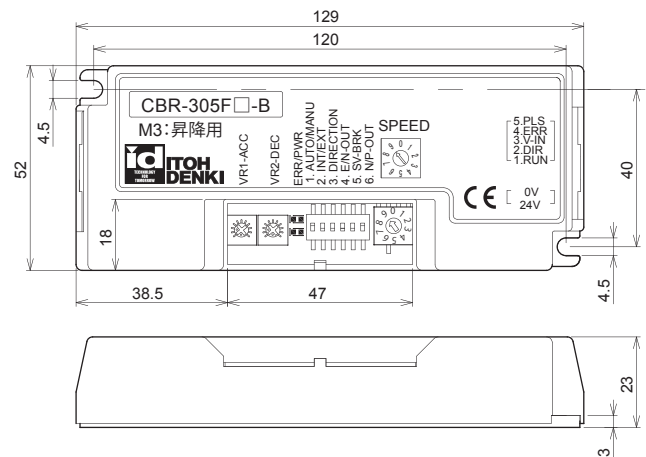
● CB-016□

* □=N (NPN input / output) or P (PNP input / output)



● CBR-305F□-B

* □=N (NPN input / output) or P (PNP input / output)



6. Installation and Operation

6 - 1. Caution when Transporting



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. Caution for Unpacking



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

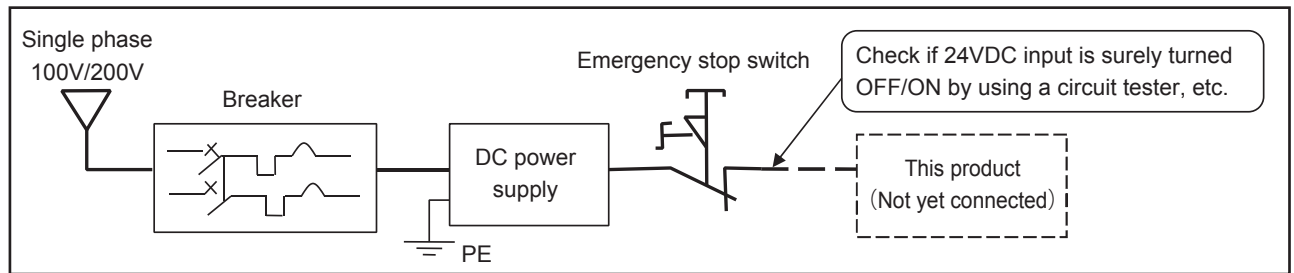
- For the facility equipment using this product, check that a power breaker with appropriate capacity has been installed. In case the product generates abnormal motions, protection by the breaker is sometimes effective. If the earth leakage breaker is planned for use as a breaker, select a type compatible 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.
 - ON/OFF operation of the breaker reliably turns ON/OFF of the input (single phase 100V, 200V) to the DC power supply unit.
 - 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.

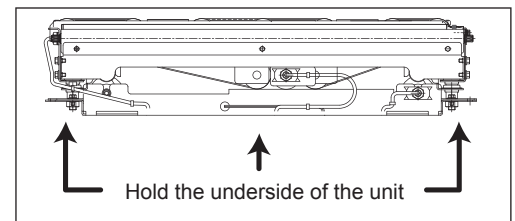
● Main unit installation



Caution

- During installation, use caution for installing direction (orientation). Be sure to use the specified mounting holes. (Refer to 5. Dimension P.3, P.4).
Incorrect direction (orientation) or using non-specified securing holes may cause unexpected accident.

- Perform installation operation always by two persons.
- 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.

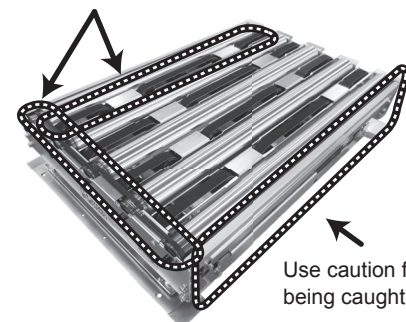


Caution

- 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



■ Installation

● F-RAT-S installation

Mounting

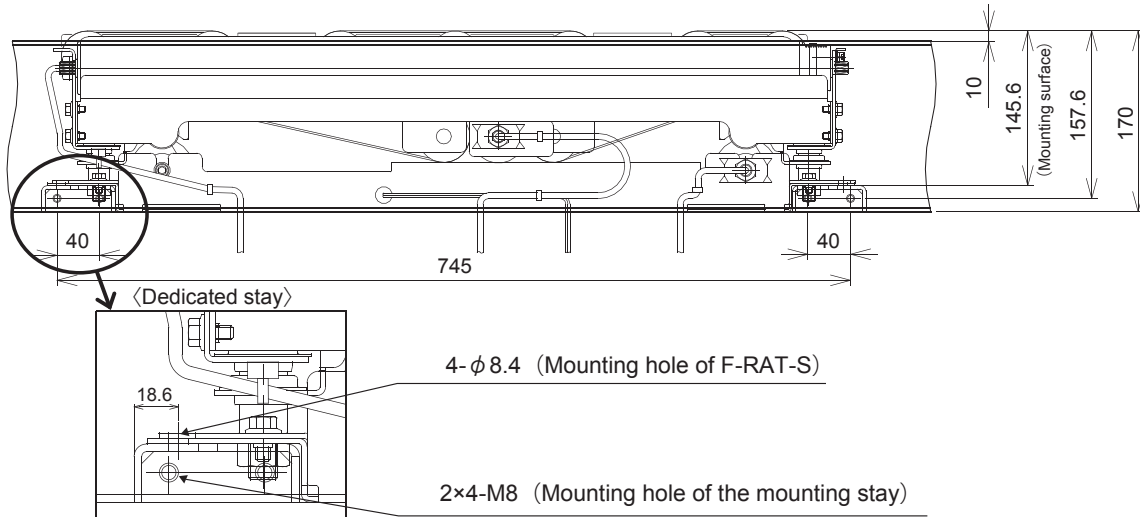
- Use assistance and recheck the installation precaution before starting the installation.
- Firmly mount the product in consideration of product weight, load weight and vibration.

● Reference example for the mounting: In case of using a mounting stay (option), (Frame height is 160mm).



Caution

- Use mounting holes for F-RAT-S installation, otherwise it may cause a failure or accident.

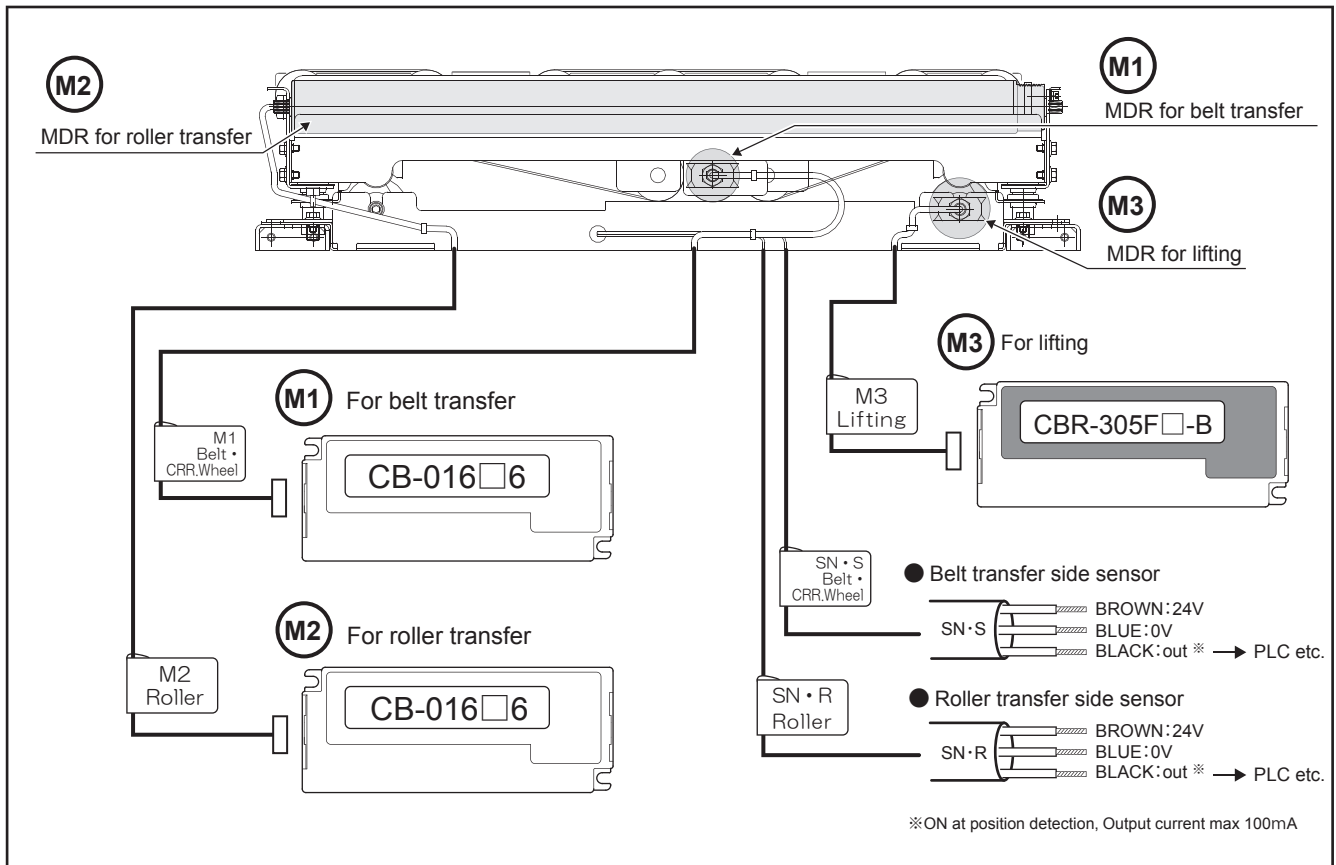


* Mounting stay is not included as standard accessory.

■ Connection

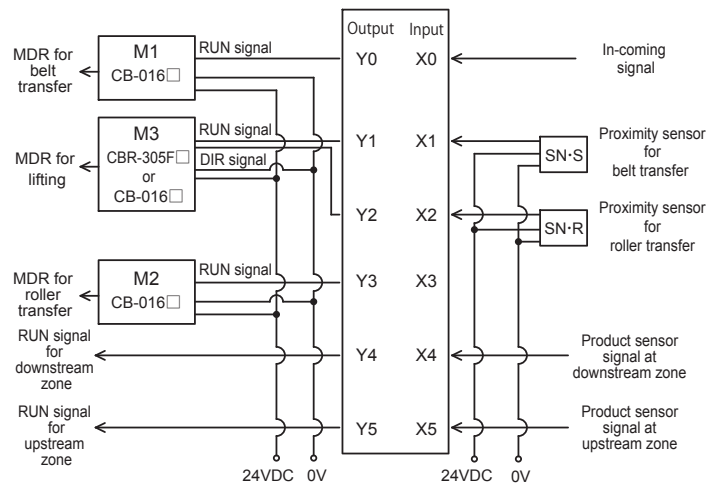
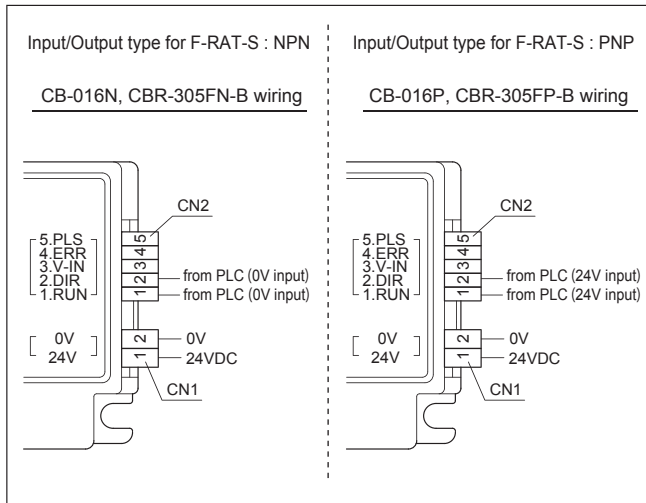
Install MDR connector on each driver card.

- ※ 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.



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

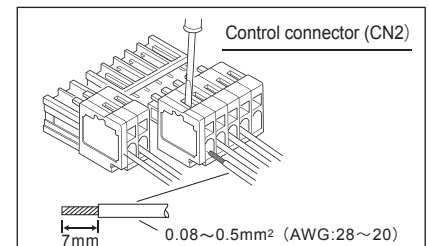
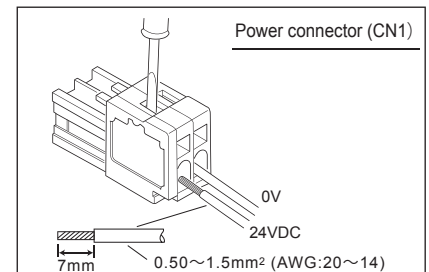
■ Wiring diagram



Note) Do not drive relay with sensor output because it may cause a malfunction of the proximity sensor.
Make sure all of wiring is correct. Otherwise, it may cause damage / a malfunction.

■ Connector Wiring (Common to CB-016/CBR-305)

- Connect 24VDC / 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 : 10A)
※ 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.



Refer to the user manual of the driver card for the detailed instruction.

<http://itohdenki.co.jp> > english > Download Support > User Manual > CB-016

■ M3 : CBR-305F□-B Switch setting*

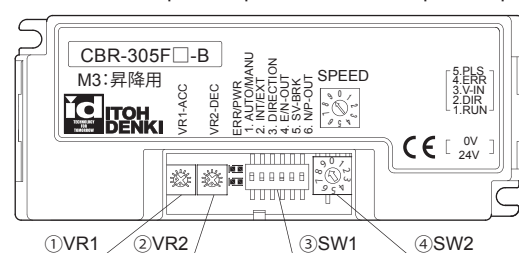
- VR1 : Minimum (Turns to CCW)
- VR2 : Minimum (Turns to CCW)
- SW1 : #1-ON, #2-OFF, #3-OFF, #4-OFF
#5-OFF, #6-NPN [OFF] / PNP [ON]
- SW2 : 9



* Do not change switch and potentiometer from factory setting.

● CBR-305F□-B

* □=N (NPN input / output) or P (PNP input / output)

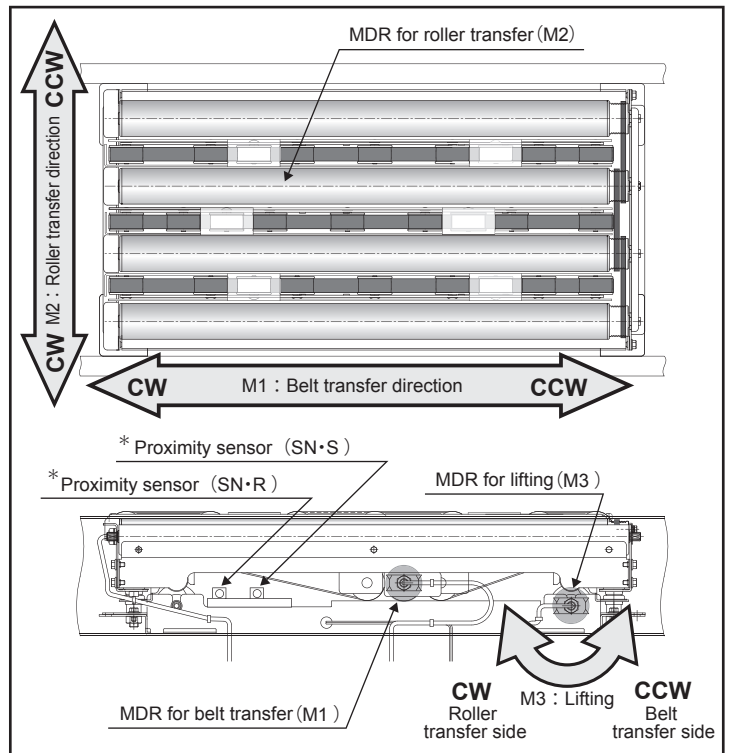
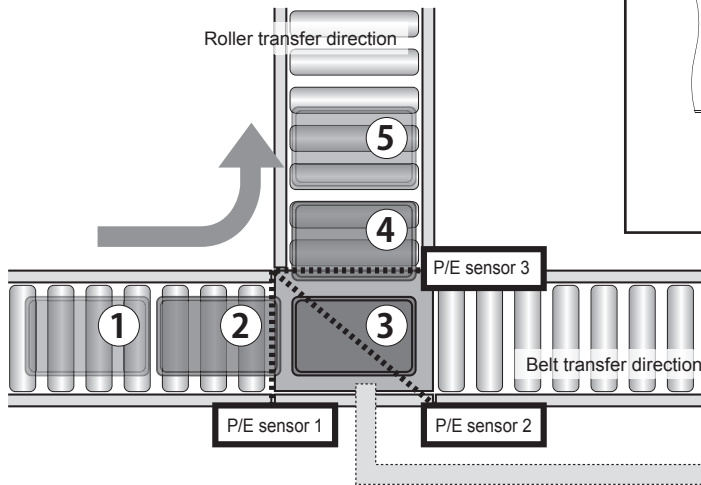


■ F-RAT-S control

Rotation Direction Setting

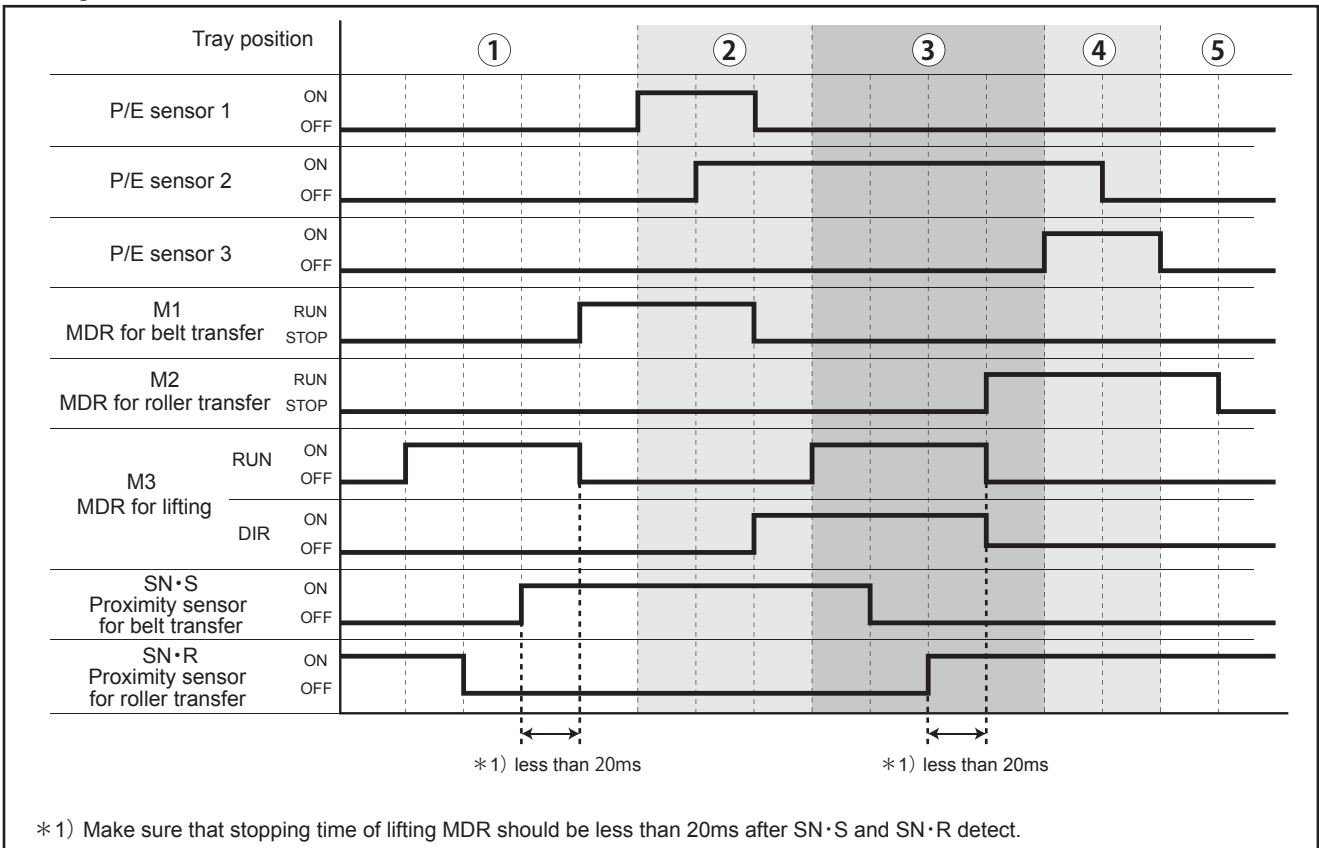
		SW 1 # 3									
		ON					OFF				
ERR V-IN DIR RUN	1 2 3 4	Not connected					1 2 3 4 5				
	DIR	CW					CCW				
ERR V-IN DIR RUN	1 2 3 4	Connected					1 2 3 4 5				
	DIR	CCW					CW				

- 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.



* Make sure wiring of the proximity sensor is correct.
Otherwise, it may cause damage.

Timing chart



Response time of a control device should be within 20ms. If not, it may cause a malfunction.

6 - 5. 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.
- 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.

- 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.



Caution

Do not apply external force to tote during operation.
It may cause a problem of transfer belt deviation.

7. Maintenance

Precautions for Maintenance and Inspection

● Safety check before maintenance and inspection



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.

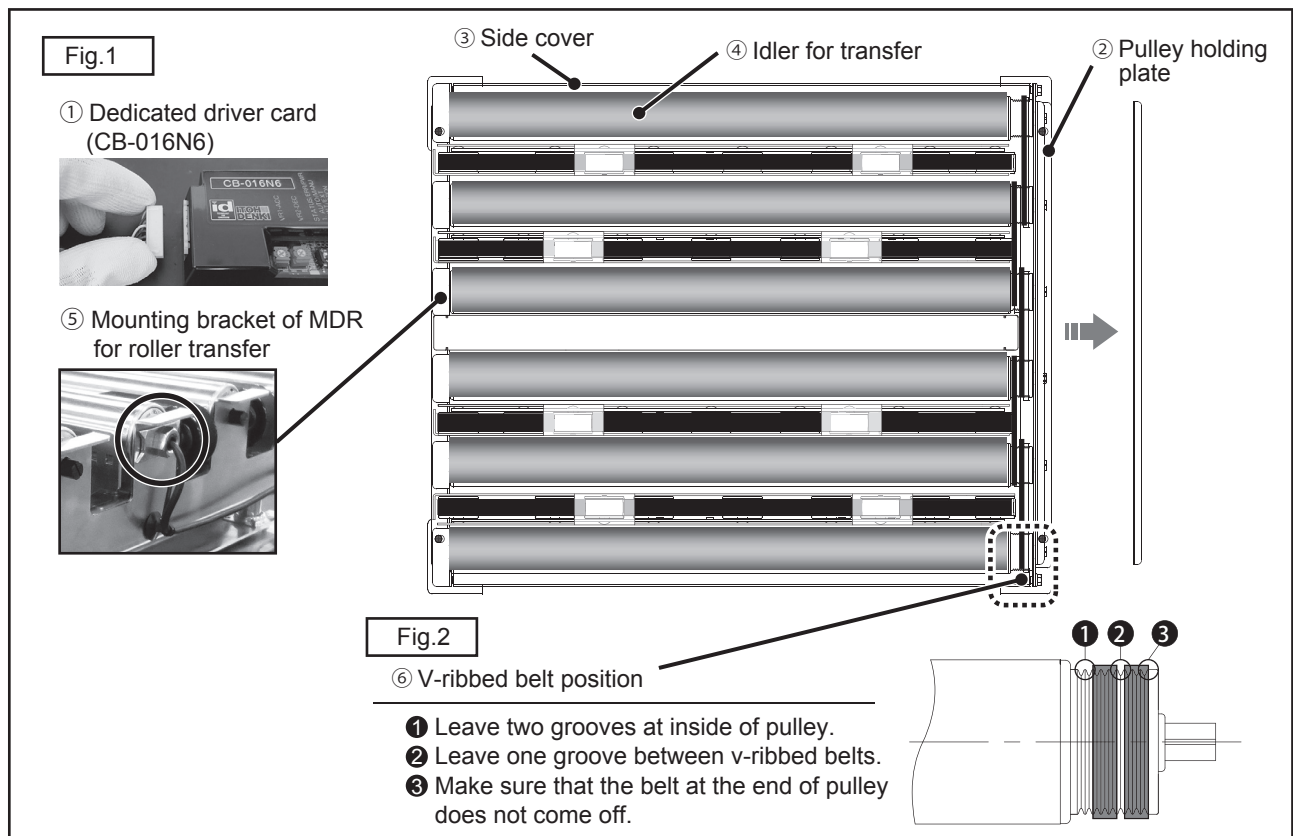
● Check after maintenance and inspection

- After maintenance / inspection, make sure the following checking before running.
 - ① Cover is properly closed.
 - ② All parts are attached.

■ Transfer MDR replacement

《Replacement procedure》

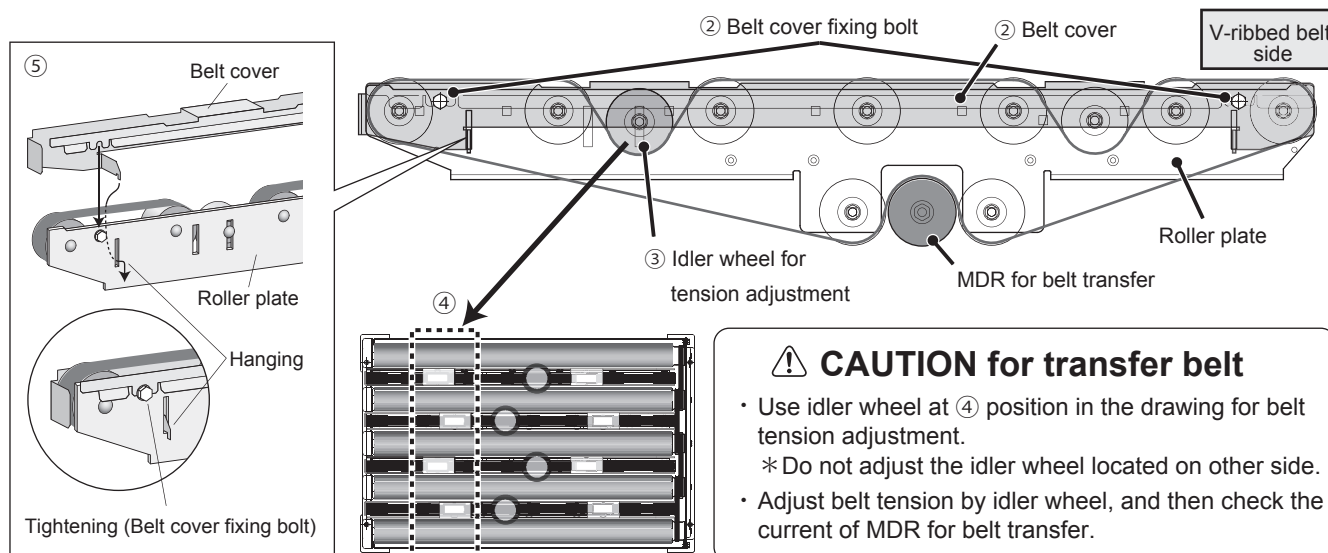
- ① Turn off F-RAT-S and then remove the motor cable of MDR for roller transfer from the driver card (CB-016N6).
- ② Loosen the screws for the pulley holding plate to remove it.
- ③ Remove the screws for the side cover, and then remove the side cover.
- ④ Remove idlers and belts.
- ⑤ Remove a mounting bracket and MDR paying attention to not damage on motor cable or connector.
- ⑥ Make sure v-ribbed belts are placed in correct position as showing on fig.2. Motor cable must be fixed with a cable tie not to contact with moving-parts.
- ⑦ Install new MDR in the step ⑤ ~ ① mentioned above.



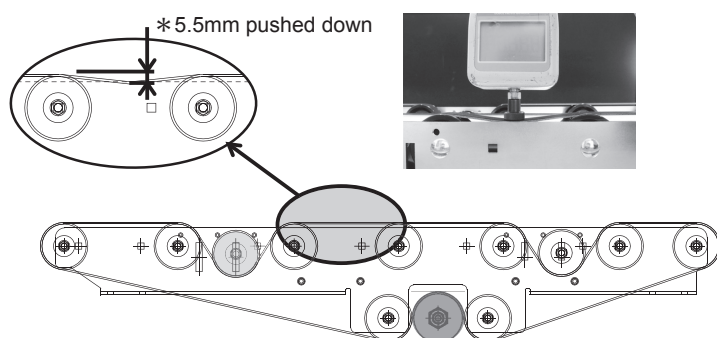
■ Transfer belt replacement

《Replacement procedure》

- ① Remove idlers for roller transfer adjoining the replaced transfer belt. (Refer to Transfer MDR replacement, P11.)
- ② Loosen the screws for the belt cover, and then remove the belt cover.
- ③ Loosen the screws for idler wheel that is for belt tension adjustment. (Do not remove the screws).
Remove transfer belt.
- * Remember installed position of the transfer belt.
- ④ Install the new transfer belt, and then tighten a screw of tension adjusting idler wheel applying tension to adjust belt tension. (Only one idler wheel per a transfer belt is used for belt tension adjustment.)
- ⑤ Attach the belt cover to roller plate, and then tighten a bolt to fix the belt cover.



《Belt tension adjustment with push-pull gauge》



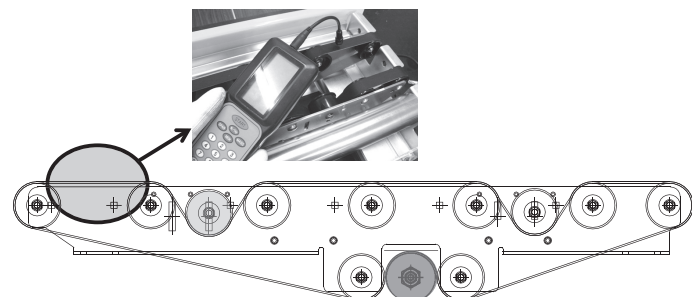
- * Push the transfer belt until the belt surface becomes the same level as the roller plate and then check belt tension. See below table.

■ Belt tension reference

Transfer speed type	Tension
17m/min, 60m/min type	12N
90m/min type	10N

* Use a push-pull gauge after reading the manual provided by the manufacturer.

《Belt tension adjustment with belt tension meter》



- * Check belt tension at the right position. (See page13)

■ Belt tension reference

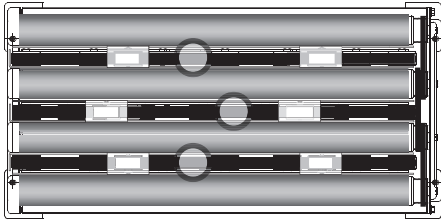
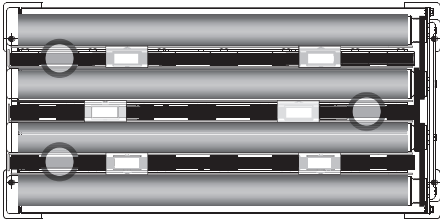
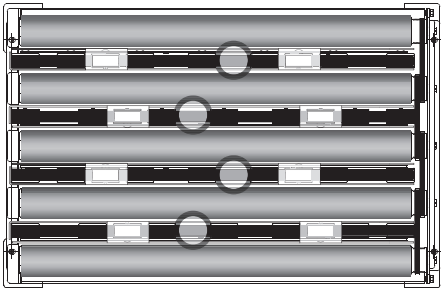
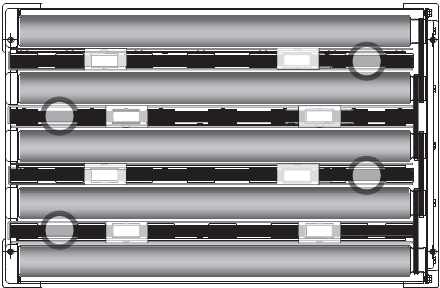
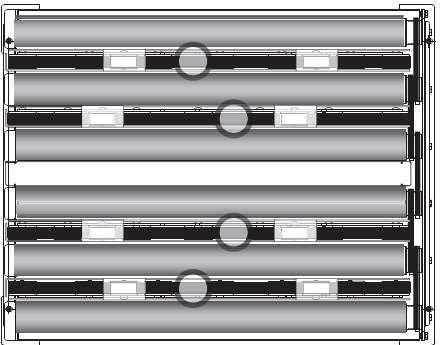
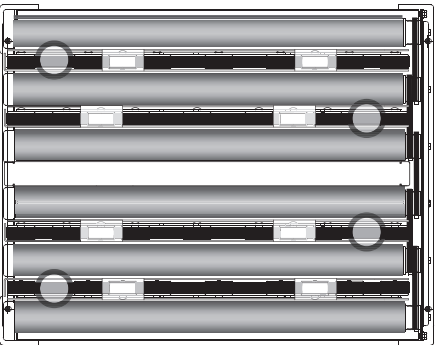
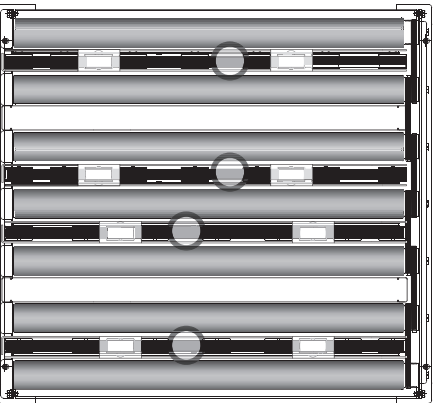
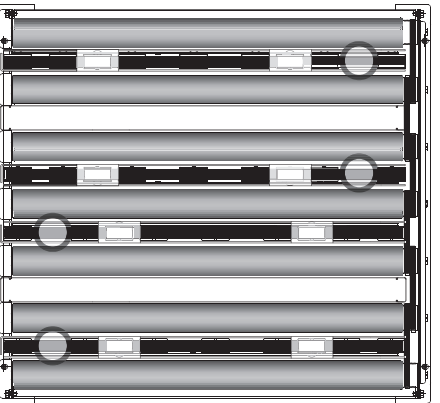
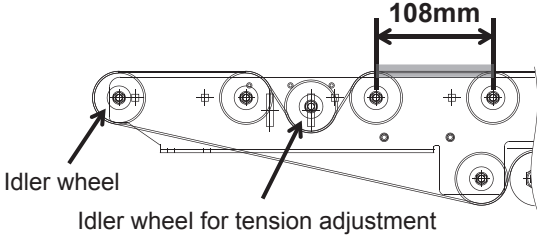
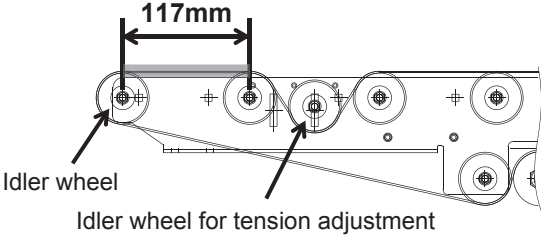
Transfer speed type	Tension
17m/min, 60m/min type	45N
90m/min type	45N

* Use a belt tension meter after reading the manual provided by the manufacturer.

- After tension adjustment in the steps mentioned above (See P13), current value should be as shown in the right table.
- After transfer belt and MDR for belt transfer replacement, make sure there is no interference and do running test. After running test, check tension according to the belt tension reference mentioned above.
- Too strong tension of transfer belt may cause a malfunction because overload is applied to MDR for belt transfer. On the other hand too loose tension may cause decrease transfer belt's speed.
- The check position of belt tension depends on the plate attaching position. (See P13)

Speed Code	Current of MDR for belt transfer
17	1.5A or less
60	2.3A or less
90	3.2A or less

Checking Position of tension for transfer belt

	《With push-pull gauge》	《With belt tension meter》
Size A	V-ribbed belt side 	V-ribbed belt side 
Size B	V-ribbed belt side 	V-ribbed belt side 
Size C	V-ribbed belt side 	V-ribbed belt side 
Size D	V-ribbed belt side 	V-ribbed belt side 
	 108mm Idler wheel Idler wheel for tension adjustment	 117mm Idler wheel Idler wheel for tension adjustment

* Make a measurement in 108mm-pitch between idlers wheel.

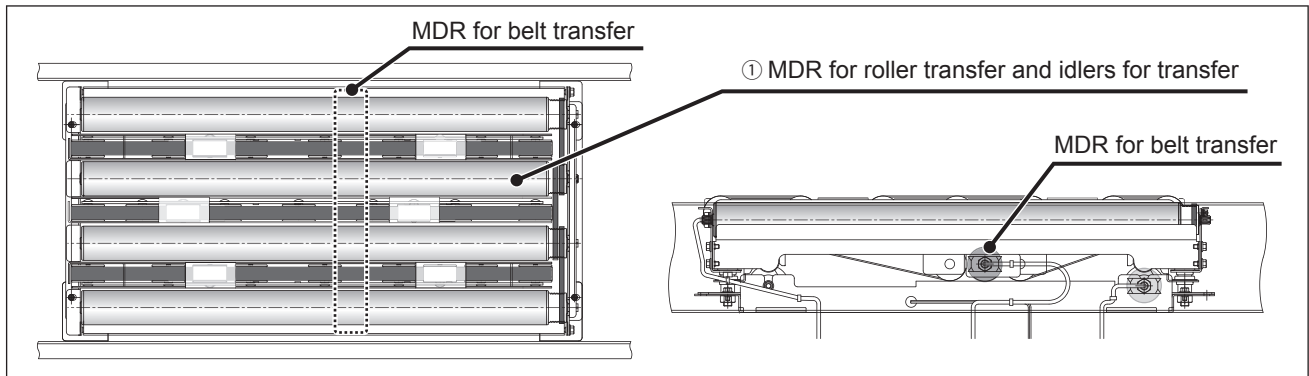
* Make a measurement in 117mm-pitch between idlers wheel.

■ Belt transfer MDR replacement

《Replacement procedure》

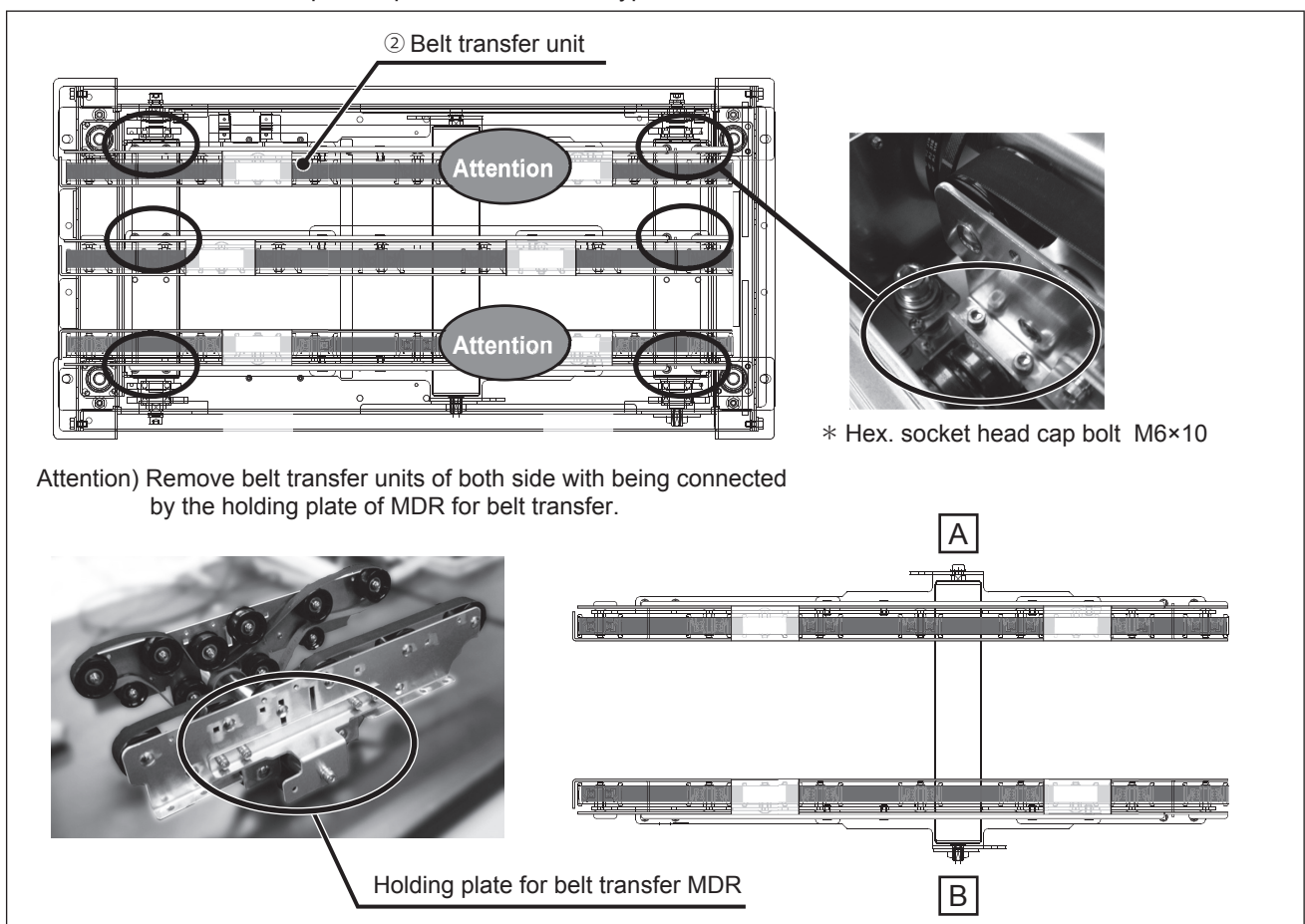
* Before replacing please turn off F-RAT-S and remove the motor cable of each MDR from the driver card.

① Remove the MDR and all idlers. (Refer to Transfer MDR replacement , P11.)

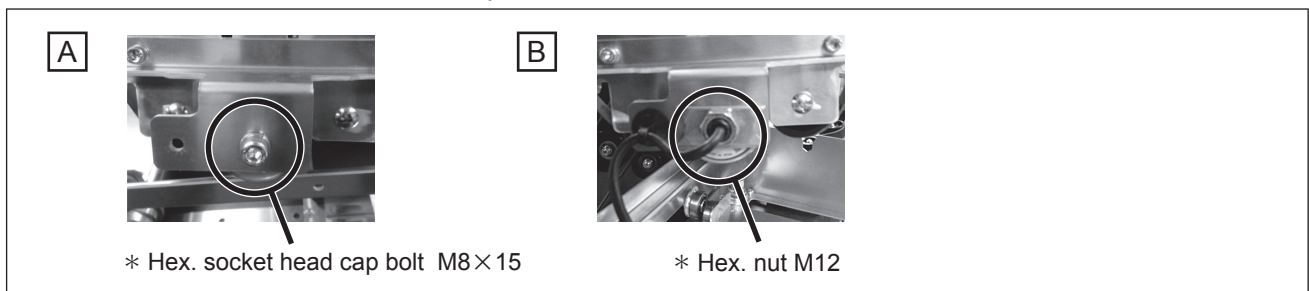


② Remove all belt transfer units from the belt transfer unit in the center.

* Belt transfer unit multiplier depends on F-RAT-S type's size.



③ Remove nut A, B and bolt and then replace MDR for belt transfer.



④ Follow steps ③ to ① mentioned above to install.

* Make sure the belt transfer unit position is right. (See the dimensional drawing, P3- 4)

* Adjust the belt tension. (See the transfer belt replacement, P12)

8. Product specification

Product specification

■ F-RAT-S

Roller Diameter		φ50mm
Size	Width (W) Roller transfer direction	379mm, 497mm, 597mm, 697mm
	Length (L) Belt transfer direction	758mm
Height		170mm
Speed		17, 60, 90m/min
Stroke		10mm
Power voltage		24VDC
Ambient temperature		0 ~ 40°C (No freezing)
Humidity Below		90%RH or less (No condensation)
Atmosphere		No corrosive gas
Vibration		0.5G or less
Installation		Indoor
Proximity sensor for belt transfer (SN·S) / roller transfer (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.φ3mm 0.15mm ² 3wires

* Standard motor cable length : 1500mm / Standard sensor wire length : 1000mm

■ CB-016□ / CBR-305F□-B * □ = N (NPN) or P (PNP)

Power voltage		24VDC±10%
Rated voltage		24VDC
Static current		0.03A
Starting current		4.0A
Wire size	Power connector CN1	0.50 ~ 1.5mm ² (AWG:20 ~ 14)
	Control connector CN2	0.08 ~ 0.5mm ² (AWG:28 ~ 20)
Time difference from RUN signal to motor starting		15msec or less
Protections		Integral 6.3A* fuse Diode against miss-wiring * 7A for CBR-305
Thermister protection		95°C for circuit board 105°C for motor
Current limitation		4.0A
Ambient temperature		0 ~ 40°C (No freezing)
Humidity		90%RH or less (No condensation)
Atmosphere		No corrosive gas
Vibration		0.5G or less
Installation		Indoor

■ Product weight

F-RAT-S size	Weight
Size A	37kg
Size B	43kg
Size C	49kg
Size D	55kg

Transferred goods

■ Recommended size of transferred goods

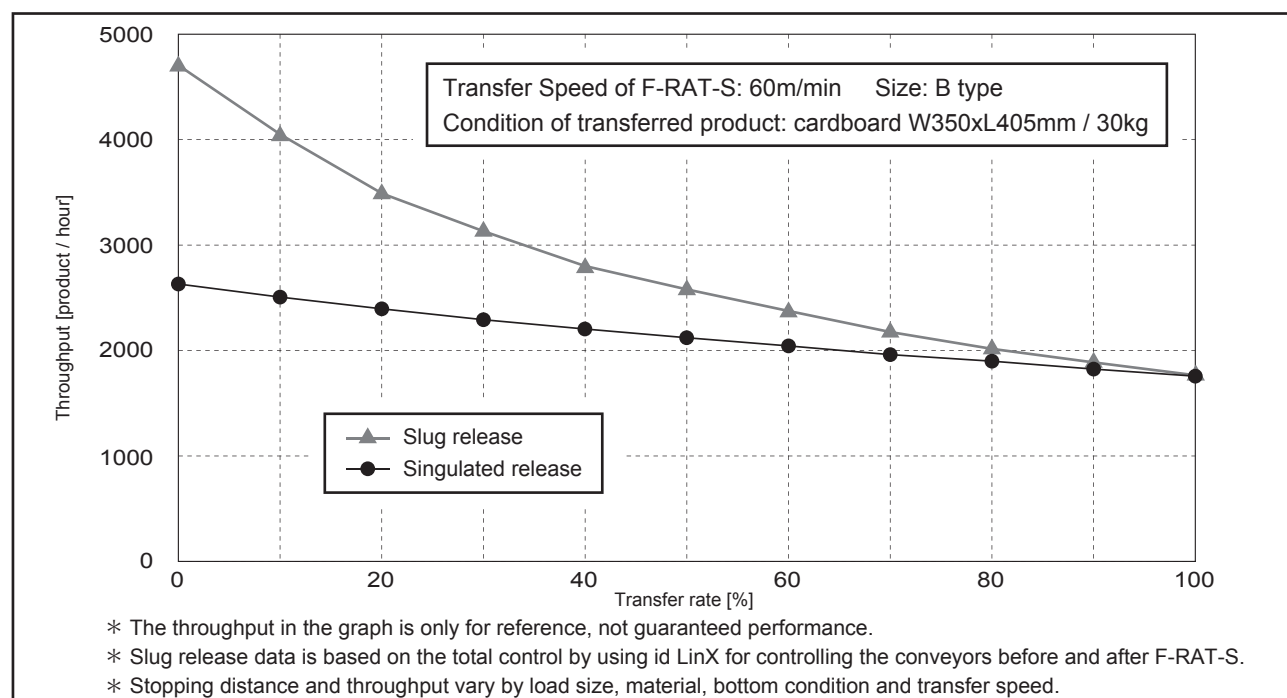
F-RAT-S size	Size
Size A	W300 × L300mm ~ W300 × L650mm
Size B	W300 × L300mm ~ W400 × L650mm
Size C	W300 × L300mm ~ W500 × L650mm
Size D	W300 × L300mm ~ W600 × L650mm

■ Maximum load weight

Speed	Max. load weight	
	Size A	Size B, C, D
17	37.5kg	50kg
60	37.5kg	50kg
90	10kg	10kg

Note: Size and load weight are just guidance. (This may differ by conditions of transferred goods)

Transfer throughput



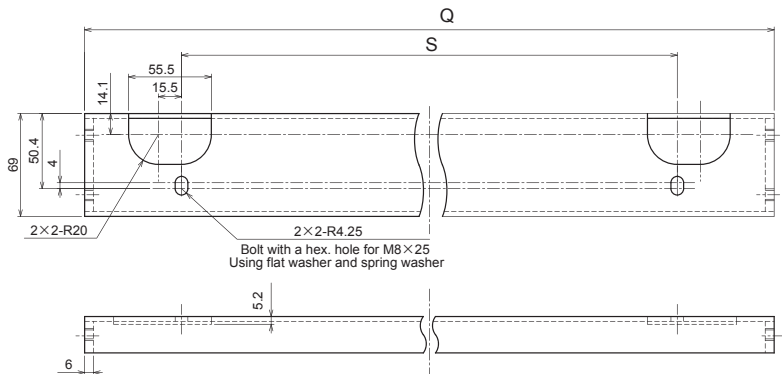
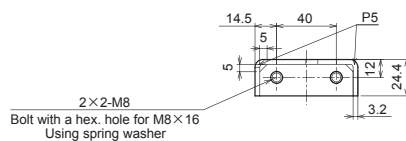
■ Replacement parts for F-RAT-S

- ① Transfer belt
 - Flat belt : TF10 L1630 W19
- ② V-ribbed belt
 - 3PJ336 (For pitch 100mm)
 - 3PJ316 (For pitch 94mm) *For size A
- ③ MDR for belt transfer
 - For size A • PM500FE- *speed code-277-D-024-JG-C150
 - For size B • PM500FE- *speed code-392-D-024-JG-C150
 - For size C • PM500FE- *speed code-492-D-024-JG-C150
 - For size D • PM500FE- *speed code-592-D-024-JG-C150
 - * Select speed from 17 (17m/min), 60 (60m/min) or 90 (90m/min) .
 - * Note that it's "PM500FC-90" for 90m/min type.
- ④ MDR for roller transfer
 - PM500FE- *speed code-674-D-024-JW-C150-VG
 - * Select speed from 17 (17m/min), 60 (60m/min) or 90 (90m/min) .
 - * Note that it's "PM500FC-90" for 90m/min type.
- ⑤ Idler for transfer
 - IDR-50-674-JH-VG for all types
- ⑥ Driver card (Specify input and output type NPN (N) or PNP (P).)
 - CB-016□ (□... N : NPN / P : PNP)
 - CBR-305F□-B (□... N : NPN / P : PNP)
- ⑦ Idler wheel
 - F-RAT-SFL1
 - Cup square neck bolt M6 x 30mm*
 - U nut M6*
 - * For idler wheel installation. Need to be purchased with idler wheel.

■ Option for F-RAT-S

● Mounting stay

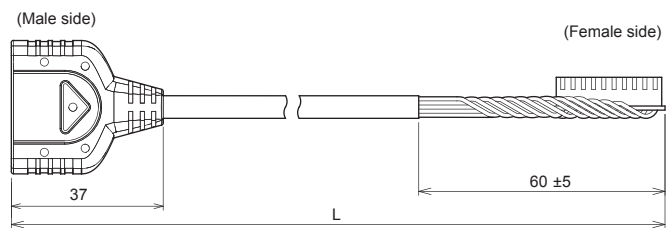
F-RAT-S size	Dimension (mm)	
	Q (Between frame)	S
A	381 ~ 499	252
B	500 ~ 599	370
C	600 ~ 699	470
D	700 ~	570



* M8 bolt / nut / flat washer / spring washer included.

● Extension cable

Model	Specifications
ACE-CBM-B0600	9P Extension cable 600mm long
ACE-CBM-B0850	9P Extension cable 850mm long
ACE-CBM-B1200	9P Extension cable 1200mm long



● Holding plate for F-RAT-S driver card

Appendix 1 . CBR-305F□ Detail

CBR-305 is a dedicated driver for up/down motion. MDR is driven by RUN signal input, but is automatically stopped after counting predetermined motor pulses.

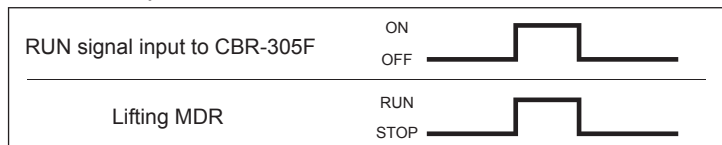


Caution

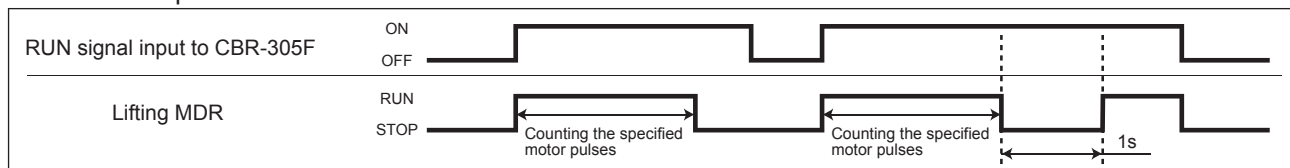
M3 : Lifting driver card has been set by the factory.
Do not change. Change may lead to a failure.

Time Chart

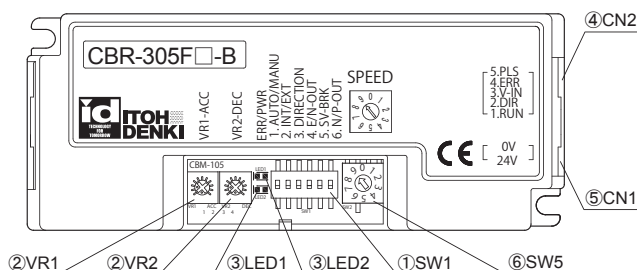
● Normal up/down motion



● Abnormal up/down motion

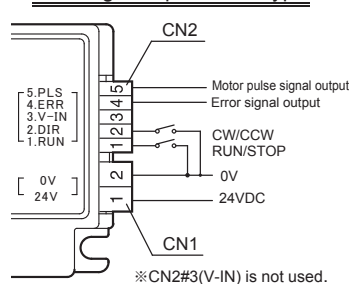


List of Functions

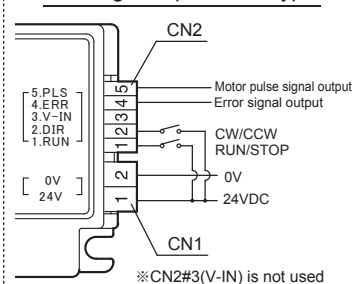


【Wiring】

NPN signal input [FN] type



PNP signal input [FP] type



※CN2#3(V-IN) is not used.

※CN2#3(V-IN) is not used

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	Internal/external speed setting selection	External	Internal	OFF	(Normally set to OFF)
	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	Braking method	Servo lock	Electric	OFF	Caution Always set to min. Using other than min. may cause a failure.
⑥ SW5 (Internal speed setting)	Error signal output setting		PNP output	NPN output	[FN] type : OFF [FP] type : ON	Ref. Error signal output

② VR (Variable resistor)	Description		Minimum  (End of CCW)	Maximum  (End of CW)	Default	Remarks
	1	Startup time from RUN signal input to set speed	0	2.5sec	Min	Caution Always set to min. Using other than min. may cause a failure.
	2	Startup time from STOP signal input to set speed	0	2.5sec	Min	

③ LED	Color	Indication	Remarks
	1 Green	Indicates powered condition	Ref. Error detail, canceling method
	2 Red	Indicates error type	

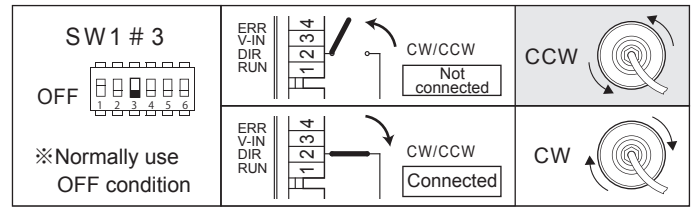
④ CN2 (Control)	No.	Description	Remarks
	5	Motor pulse output	Motor pulse signal output (2pulses/1 rev. of internal motor)
	4	Error signal output	Ref. Error signal output
	3	MDR external speed setting	(Not used)
	2	MDR rotation direction change	Ref. Rotation direction change
⑤ CN1 (Power)	1	MDR start/stop	ON : RUN / OFF : STOP (Approx 7.3mA current flows)

⑤ CN1 (Power)	2	0V
	1	24VDC

⑥ SW5 (Internal speed setting)	Normally set to "9"
-----------------------------------	---------------------

■ 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. 7.3mA 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#6	
OFF	ON
NPN open-collector output	PNP open-collector output

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

■ Error Detail, Cancellation Method

- Error can be checked by LED1(green), 2(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)	Blink twice(6Hz) ↓ OFF(1.5秒)	OFF

LED1 (green)	LED2 (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	
							After reaching recovery temp, CN2 # 2 ON→ OFF→ON or OFF→ON→OFF	Start by CN2 # 1 ON→OFF→ON Start within 1 min.
						Manual recovery setting	After reaching recovery temp, CN2 # 1 ON→OFF→ON to cancel error and start	
		Output	Open	Stop	Power voltage is 15V or below (Low voltage error)		After reaching recovery temp, CN2 # 2 ON→ OFF→ON or OFF→ON→OFF	Start by CN2 # 1 ON→OFF→ON
						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	
							Secure power voltage 18V or higher, CN2 # 2 ON→OFF→ON or OFF→ON→OFF	Start by CN2 # 1 ON→OFF→ON
		Output	Open	Stop	※1 40V or higher voltage occurred for 2sec or 60V or higher for 0.1sec. (Back EMF error)	Auto rec setting	Supplied voltage to MDR gets 30V or below	Immediate start
							Supplied voltage to MDR gets 30V or below and CN2 # 1 ON→OFF→ON to cancel error and start.	
						Manual recovery setting	Supplied voltage to MDR gets 30V or below and CN2 # 2 ON→OFF→ON or OFF→ON→OFF	Start by CN2 # 1 ON→OFF→ON

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

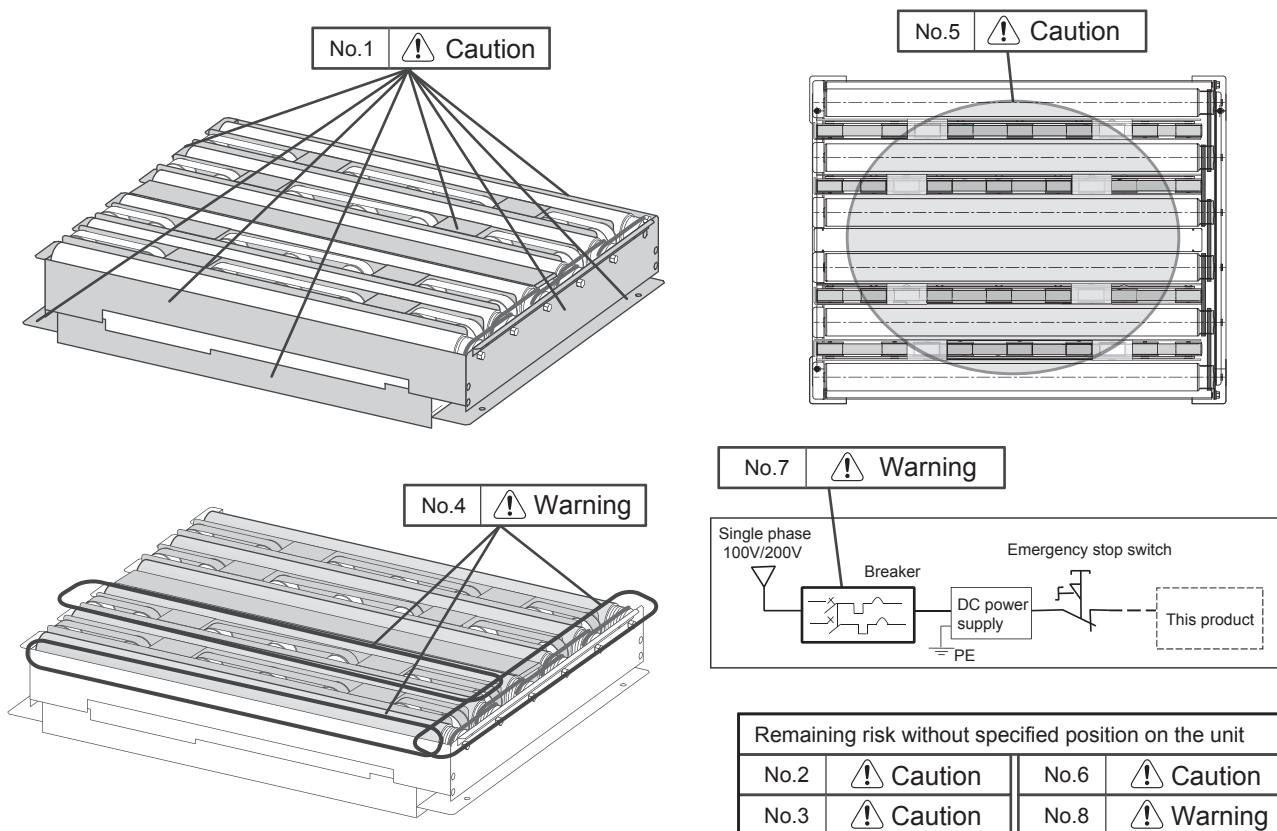
※1 MDR rotation above the set speed may also generates error.

Appendix 2. 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	P5
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	P5
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	P10
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	P6
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	P1
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	P6
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	P11
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	P11

Remaining Risk MAP



<http://www.itohdenki.co.jp>



Headquarters: Itoh Denki Co., Ltd.
Phone: +81 (0)790 47 0955 Fax: +81 (0)790 47 1325
www.itohdenki.co.jp

Europe, Middle East, Africa: Itoh Denki Europe SAS
Phone: +33 (0)4 50 03 09 99 Fax: +33 (0)4 50 03 07 60
www.itoh-denki.com

North & South America: Itoh Denki USA, Inc.
Phone: +1 570 820 8811 Fax: +1 570 820 8838
www.itohdenki.com

Asia/Oceania: Itoh Denki Asia Limited
Phone: +852 2427 2576 Fax: +852 2427 2203

China: Itoh Denki Shanghai Company Limited
Phone: +86 21 6341 0181 Fax: +86 21 6341 0180
www.itohdenki.com.cn

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