Thank you for purchasing the Right Angle Transfer Module (hereinafter referred to as “this product”).

Read this manual before use

Make sure to read this manual carefully before using, and start using only after you have understood all the product’s functions, safety information and precautions.

After reading the manual, make sure to keep it safe in a specified place for future use, whenever necessary.
Features of this product

- This product is a module to divert at a right angle without changing its level, and there is no impact on the trays.
- All-electric control. No pneumatics, which do not require compressor.

Operation description

(when diverting at a right angle)

Load

Switch to the diverting direction

Discharge

Switch to the straight direction
1. Introduction

Disclaimer

This product is designed as a general industrial device. Do not use for other applications. We do not take any responsibility for any damage that may result from the disregarding of these warnings. Also, in the event that an accident results from the use of this product, we do not compensate for any damage, including abnormalities of equipment, connection devices, and/or software, any damage resulting from malfunctions, and/or any other secondary damage.

Notes on industrial property rights

There are some examples of parts that need to be prepared by customers, as explained within this manual. However, this does not provide any guarantee against the existence of any rights, such as our industrial property rights, or those of other companies, in advance.

Notes on technical support

We respond to technical inquiries based on the contents described within this manual, and on this product within the range of general items for this product unit with standard specifications, and for the options prepared by us. There are some descriptions in this manual, about parts, equipment, and wiring arranged by customers, as well as the controls and operation under such circumstances. However, these are not included in the guaranteed operating range and/or support. When in use, please check and perform the aforementioned based on your responsibility according to operation.

About the risk category of this system

This product is intended to comply with the risk category 2 or lower as defined in EN954-1. It does not comply with purposes beyond risk category 3 or higher.

*1: European machinery safety standards
*2: This indicates that even though events that would result in serious injury occur infrequently under assumed risk environment, there is a high probability to avoid danger if you observe the safety contents described in this manual.

About installation environment

This product is not equipped with special dust proof/waterproof countermeasures, and is intended to be used in environments of “Pollution Degree 2”, as defined in IEC60664-1. For this reason, if users install this product in an environment that requires dust proof/waterproof treatments, they need to add necessary countermeasures, and check the performance based on their responsibility.

About description of the product

- In this manual, F-RAT-NX75 is described as F-RAT, and F-RAT-NX75 and F-RAT are described separately, when needed.
- Depending on the signal type (NPN/PNP) specified by customers, different models of control driver cards are supplied as being the standard for this product.

<table>
<thead>
<tr>
<th>Signal input/output type</th>
<th>NPN</th>
<th>PNP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Included driver card model</td>
<td>CBK-109FN (1)</td>
<td>CBK-109FP (1)</td>
</tr>
<tr>
<td></td>
<td>CB-016BN6 (1)</td>
<td>CB-016BP6 (1)</td>
</tr>
<tr>
<td></td>
<td>HBM-201BN (1)</td>
<td>HBM-201BP (1)</td>
</tr>
</tbody>
</table>

In this manual, CBK-109FN and CBK-109FP are described as CBK-109, CB-016BN6 and CB-016BP6 as CB-016, and HBM-201BN and HBK-201BP as HBM-201. Also, CBK-109FN and CBK-109FP, CB-016BN6 and CB-016BP6, as well as HBM-201BN and HBM-201BP are described separately, when needed.
2. Procedures from installation to operation

Procedures from installation to operation

Read this manual

Start using only after you have understood all the product’s functions, safety information, and precautions.

Advance preparation

Prepare the 24V DC power supply, such as DC power supply units.
Prepare control devices, such as PLCS.

Product check

Open the package, and check the model, specifications, voltage, etc.
Check accessories.

Installation

Install the F-RAT main unit.

Wiring

Mount driver cards.
Connect the F-RAT and driver cards.
Connect power and signal cables to driver cards.
Perform settings of driver cards.
Connect to power supply units/PLCs.

Control

Perform control (programming).

Start-up inspection

Perform inspection before operation.

Maintenance/Inspection

Some errors have been found.

Yes

Perform maintenance and inspection based on corresponding parts.

No

Troubleshooting

Have the problems been solved?

Yes

Take appropriate measures based on the corresponding symptoms.

No

Run operation.
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3. Safety precautions

For parts names in sentences, refer to 6. Structures (P.21).

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<tr>
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</tbody>
</table>
3. Safety precautions

Danger level

To prevent hazards to users and/or others, and/or damage to property in advance, the important precautions to be followed securely is described below.

- The degree of hazard and/or damage that may result if a user disregards the description and operates the product improperly is categorized as the following symbols and explained below.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="WARNING" /></td>
<td>This indicates a high possibility that severe injury or even death may result.</td>
</tr>
<tr>
<td><img src="image" alt="CAUTION" /></td>
<td>This indicates a high possibility that injury, or only property damage may result.</td>
</tr>
</tbody>
</table>

Symbol explanation

- The type of precautions is categorized as the following symbols and explained below.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Reminder" /></td>
<td>This symbol indicates a reminder which users should pay attention to.</td>
</tr>
<tr>
<td><img src="image" alt="Prohibited" /></td>
<td>This symbol indicates operations that are prohibited.</td>
</tr>
<tr>
<td><img src="image" alt="Forced" /></td>
<td>This symbol indicates forced operations that users should always perform.</td>
</tr>
</tbody>
</table>
3. Safety precautions

3-1. General precautions

**WARNING**

Do not use the product near places subject to explosive, flammable gas, and/or corrosive atmosphere, and/or combustible materials.
Failure to follow this could result in explosion, fire, electric shock and/or injury.

When using the product in places where serious accidents and/or damage may possibly occur, install backup and/or fail-safe functions systematically.
Failure to follow this could result in the inability to control this product due to driver card malfunction, which could lead to serious accidents.

**CAUTION**

Do not apply heavy loads to this product, such as stepping on it.
Failure to follow this could result in people falling and/or malfunction.

Do not come into contact with the moving parts, such as the carrier wheels, rollers, or lifting sections, and/or allow clothes to get close to them.
Failure to follow this could result in them getting caught and/or stuck.

Do not forcibly bend and/or pull cables. Also, do not put heavy materials on cables, or do not get them stuck between cables.
Failure to follow this could result in fire and/or electric shock due to cable damage.

Never remodel the product and/or driver cards.
Failure to follow this could result in serious accidents.

Make sure to attach ground wires to this product and the DC power supply unit.
Failure to follow this could result in electric shock if any malfunction or leakage occurs.

Do not touch the product when it has just stopped operation.
Failure to follow this could result in burns.

Do not put water and/or oil on the product, and do not transfer wet and/or oily trays.
Failure to follow this could result in electric shock, and/or malfunction.

Do not apply strong impact and/or excessive force to the product, such as hitting it with objects, or dropping it. Also, do not use the equipment if strong impact has been applied, and/or if the appearance has become deformed.
Failure to follow this could result in malfunction due to applied impact.
3-1. General precautions

![CAUTION]

Stop operation when abnormal sound is heard during operation. Failure to follow this could result in unexpected accidents.

Do not use in a way exceeding the range of the product specifications. Failure to follow this could result in malfunction, fire, and/or injury.

Turn off the power supply to the product before moving and/or installing the product, and performing maintenance and inspection (excluding those during operation). Working while the power is on could result in accidents due to unexpected operation.

Observe the safety regulations required for installation locations, and/or products in use.

Securely wire each cable to connection parts. Improper wiring could result in electric shock and/or malfunction.

Do not turn on/off relays and/or contactors near power cables, signal cables, and/or driver cards. Failure to follow this could result in malfunction due to noise generation.

LED or Pull-up/Pull-down circuits implemented in the output circuit of control devices could result in unexpected operation. Carefully check the output circuit.

Turn on the power in order of external control devices, and then the product. Turn off the power in order of the product, and then external control devices. Turning on/off the power in the wrong order could result in malfunction.

Do not unplug power and/or signal cables during operation. Also, do not run/stop this product by the power supply. (Use the signal.) Failure to follow this could result in malfunction.

Do not forcibly rotate the MDR at times other than maintenance and inspection. Failure to follow this could result in damage to driver cards, and/or their lifetime to be significantly shortened.

Do not turn off the power during transfer (during MDR rotation). Failure to follow this could result in malfunction.
3. Safety precautions

3-1. General precautions

![CAUTION]

Do not turn on the power when trays are unstable. Failure to follow this could result in injury, accidents, and/or damage due to load collapse.

Make sure to perform the start-up inspection, and check that devices are free from any abnormalities, and that safety equipment functions correctly before using the product.

When disposing of the product, make consigning contracts with licensed industrial waste disposers, and consign the disposal to them.

3-2. Precautions on installation

![WARNING]

In principle, have two or more persons work when carrying and/or installing the product as it is a heavy load.

When hoisting this product, never enter the area under the suspended load.

When hoisting, use appropriate hoisting equipment, and pay special attention to prevent the balance of the suspended load from being lost and/or falling. Also, have only qualified workers conduct the operation. Improper hoisting could result in serious accidents.

Do not hoist this product with goods loaded.

Failure to follow this could result in objects falling.

![CAUTION]

When handling, wear protective equipment, such as gloves. Since this product consists in large part of metal, careless handling could result in hands getting injured.

Make sure to use the recommended tightening torque to tighten bolts for installing the F-RAT main unit and/or fastening screws of driver cards.

Failure to follow this could result in bolts and/or screws loosening, and/or malfunction.

Check the corresponding installing direction to the loading/discharging sides before installing.

Failure to follow this could result in objects/body parts getting caught and/or stuck.
3. Safety precautions

3-2. Precautions on installation

**CAUTION**

Take appropriate measures to prevent trays from popping out of the equipment.

*Example:* Mount guide rails on the conveyor frames. Failure to follow this could result in workers getting injured by trays popping out of the equipment.

If necessary warning/caution labels become hidden after installing fences, affix again on places where they can be seen.

3-3. Precautions on wiring

**CAUTION**

Perform wiring when the power is shut off. Failure to follow this could result in electric shock and/or accidents due to unexpected operation.

When attaching or removing connectors, turn off the power first, securely hold connectors, and perform operation. Also, do not apply excessive force to the driver card connection parts, such as obliquely attaching or removing connectors. Failure to follow this could result in electric shock, malfunction, and/or accidents due to unexpected operation.

Securely attach connectors to the driver card connection parts. Improper wiring could result in electric shock and/or malfunction.

Perform wiring to connectors so that cables make secure contact with connectors. Barb lines from the cable core could result in heat generation and/or fire due to changes of contact resistance, and/or short circuit with the adjacent contact.

3-4. Precautions related to control

**CAUTION**

Do not change switch settings for HBM-201. Failure to follow this could result in malfunction, and/or accidents due to unexpected operation.

Do not change the VR1 and VR2 values on CBK-109 and CB-016. (Minimum (leftmost): Factory setting)

Do not turn the driver card switches with excessive force. Failure to follow this could result in malfunction.
3. Safety precautions

3-5. Precautions related to operation

**CAUTION**

Do not forcibly move trays when they are placed on the carrier wheels.
Failure to follow this could result in damage and/or malfunction.

Make sure to perform the start-up inspection before starting operation.

At the start-up inspection, wear protective equipment, such as gloves.
Failure to follow this could result in hands getting injured by metal parts.

At the start-up inspection, shut off the power, and perform inspection.
(excluding inspection to be performed when operating this product.)
Failure to follow this could result in injury due to unexpected operation, such as getting caught and/or stuck.

When operating this product at the start-up inspection, take appropriate measures to prevent fingers from getting stuck and/or caught in carrier wheels and/or rollers.
Also, get ready to shut off the power in the event that something should happen.
Failure to follow this could result in accidents/injury by getting caught and/or stuck.

If any abnormalities are found at the start-up inspection, make sure to take countermeasures before the trial run.
Failure to follow this could result in damage and/or malfunction.

3-6. Precautions on maintenance and inspection

**CAUTION**

If any abnormalities are found, do not use this product until the causes have been eliminated completely.
Using this product with unattended abnormalities could result in not only damage to the devices, but also unexpected accidents.

Have specialists (or people who have sufficiently acquired skills) perform maintenance and inspection under instructions by management supervisors.

At the time of repair and replacement work, turn off the power to all connecting devices.
To prevent wraparound for the power circuits and/or signals, shut off the power, wait a sufficient amount of time, and discharge electricity inside the DC power supply equipment.

At the time of maintenance and inspection, post warning labels so as to prevent unauthorized persons from turning on the power.
Failure to follow this could result in malfunction and/or unexpected accidents.
3. Safety precautions

3-6. Precautions on maintenance and inspection

**CAUTION**

- **When repairing/replacing**, wear protective equipment, such as gloves.
  - Failure to follow this could result in hands getting injured by metal parts.

- **Do not disassemble sections and/or parts other than those specified.**
  - Failure to follow this could result in malfunction and/or unexpected accidents.

- **Depending on sections and/or parts to be repaired and/or replaced, they need to be rotated and/or lifted by hand.**
  - Pay attention not to get caught and/or stuck. Failure to follow this could result in injury.

- **Before the trial operation after repair/replacement,**
  - Check that the roller drive belts have been mounted properly.
  - Check that there is no friction between the moving parts, or between the moving and fixed parts.
  - Check that screws/covers previously removed have been securely mounted again.
  - Check that all parts are installed.
  - Failure to follow this could result in malfunction and/or unexpected accidents.

- **Make sure to prepare repair/replacement parts designated by ITOH DENKI.**
  - Using parts other than those designated by ITOH DENKI could result in malfunction.
4. Advance preparation
Advance preparation

Before introducing this product, prepare the following devices separately.

As for the sensor input, and input/output signals of driver cards, adopt the number of inputs/outputs based on operation.

Items to be prepared by customers

**Emergency stop equipment**

Before introducing this product, prepare the following devices separately.

This product does not include the emergency stop equipment. Customers must make sure to install it.

Install the emergency stop equipment on the side of the DC power supply unit to which the power is supplied.

Checking the breaker

Regarding facilities where this product is incorporated, check that a breaker with appropriate capacity for the 24V DC power supply unit has been installed. If abnormal operation should occur, protection through the breaker could be effective.

Note that when using an earth leakage breaker, select one that is “inverter corresponding”. Some inverter non-corresponding earth leakage breakers could result in malfunction, since they may recognize high-frequency components of the switching power supply as leakage.

Operation check

When the 24V DC power supply unit has been incorporated, check that the breaker and emergency stop switch can work properly. Perform operation following the trial operation after checking them.

1. Input to the DC power supply (single phase 100V/200V) is securely turned ON/OFF when turning ON/OFF the breaker.
2. Input to this product (24V DC) is securely turned ON/OFF when turning ON/OFF the emergency stop switch.
4. Advance preparation

24V DC power supply

- Switching power supply (24V DC/10A, 240W or more)
- Rectified power (With a rectifying capacitor, ripple rate 10% or below)
- 24V DC Battery

Operation

- A switching power supply is recommended as the DC power supply (24V DC±10%) for drivers.
- Use a stabilized power supply that has an adequate capacity of 24V DC and 10A or higher and does not fluctuate due to load variation.
- The power supply shall have a capacity larger than the rated value of this product.
- A transformer type power supply cannot be used.
- Secure a voltage of 24V DC±10% at the power supply terminal of a driver card.
- If the capacity of the power supply is less than the rated power of this product, it may cause the supply voltage leading malfunction or damage. Be sure to use the power supply with a capacity larger than the rated power of this product.
- In addition, the power supply should not activate protection with peak current 30A for 1ms or below.
- For the power supply unit, use an isolation type switching power supply compliant with the safety standard (IEC60950-1 or UL60950-1). Do not use a non-isolation type power supply for safety reasons, since it may not conform to the radiation noise regulations.

Control devices

- Devices to control this product, such as PLCs

Sensors

- Zone sensors to check the tray, and area sensors to check loading and discharging, etc.

Term

- Zone sensor: A sensor to detect the existence of trays within the zone
- Area sensor: A sensor to detect load and discharge of trays
4. Advance preparation

Wiring materials

Necessary for wiring of power and signal cables, branch connectors, driver cards, controllers, such as sensors or PLCs, and power supply.

Available wire diameter for driver card connectors:

<table>
<thead>
<tr>
<th>Connector</th>
<th>CBK-109</th>
<th>CB-016 / HBM-201</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power connector</td>
<td>0.8〜1.5mm² (AWG: 18〜14)</td>
<td>0.5〜1.5mm² (AWG: 20〜14)</td>
</tr>
<tr>
<td>Control connector</td>
<td>0.08〜0.5mm² (AWG: 28〜20)</td>
<td></td>
</tr>
</tbody>
</table>

To select the current capacity of wiring materials, secure a high safety margin based on the current value in the equipment to be used.

Longer wiring between the power supply unit and driver cards/controllers could cause the voltage to decrease, resulting in malfunction and/or damage.

MDR extension cable (option)

Necessary when the installing location of the F-RAT main unit is far from that of the driver cards.

- CBK-109: 12P extension cable
  - Model | 12P extension cable length
  - ACE-CBM-G0600 | L= 600mm
  - ACE-CBM-G0850 | L= 850mm
  - ACE-CBM-G1200 | L=1200mm

- CB-016 / HBM-201: 10P extension cable
  - Model | 10P extension cable length
  - ACE-CBM-A0600 | L= 600mm
  - ACE-CBM-A0850 | L= 850mm
  - ACE-CBM-A1200 | L=1200mm

- Use extension cables of 1200 mm or less.
- Do not extend cables by connecting multiple extension cables.

Stay (option)

Necessary when the installing location of the F-RAT main unit is far from that of the driver cards.

- Model | 10P extension cable length
  - ACE-CBM-A0600 | L= 600mm
  - ACE-CBM-A0850 | L= 850mm
  - ACE-CBM-A1200 | L=1200mm

- Use extension cables of 1200 mm or less.
- Do not extend cables by connecting multiple extension cables.

<table>
<thead>
<tr>
<th>Size</th>
<th>L</th>
<th>X (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6040 / 7540 / 9040</td>
<td>370</td>
<td>400</td>
</tr>
<tr>
<td>6050 / 7550 / 9050</td>
<td>470</td>
<td>500</td>
</tr>
<tr>
<td>6060 / 7560 / 9060</td>
<td>570</td>
<td>600</td>
</tr>
<tr>
<td>6070 / 7570 / 9070</td>
<td>670</td>
<td>700</td>
</tr>
<tr>
<td>6080 / 7580 / 9080</td>
<td>770</td>
<td>800</td>
</tr>
</tbody>
</table>

* For X dimensions (between frames) other than those mentioned above, contact us.
5. Product check
5. Product check

Checking the model

Unpack the product, and check that the product model is as ordered.

Checking appearance

① Check that the main unit is free from any abnormalities, such as traces of scratches, dents, dirt, and/or corrosion (rust).
② Check that there is no omission and/or looseness of screws, etc.
* If any abnormalities are found, contact the supplier immediately.
5. Product check

Checking accessories

Driver cards

Check that all the following items are included.

Depending on the F-RAT input and output signal type, driver cards with the NPN (N) or PNP (P) signal input are included. (Not included when no driver card type is specified.)

For F-RAT—NX75—CN

Driver card CBK-109FN
〈For carrier wheel transfer〉

1

Driver card HBM-201BN
〈For drive switching〉

1

Cross-recessed head SW screw M4 x 15/Hex. nut M4
〈For securing each driver card〉

8 sets

Power connector
〈common to each driver card〉

EAHB05

3

Control connector
〈for CBK-109 / CB-016〉

PACB16

2

Control connector
〈for HBM-201〉

1

For F-RAT—NX75—CP

Driver card CBK-109FP
〈For carrier wheel transfer〉

1

Driver card HBM-201BP
〈For drive switching〉

1

Cross-recessed head SW screw M4 x 15/Hex. nut M4
〈For securing each driver card〉

8 sets

Power connector
〈common to each driver card〉

EAHB05

3

Control connector
〈for CBK-109 / CB-016〉

PACB16

2

Control connector
〈for HBM-201〉

1

For installing the F-RAT main unit

Hex. bolt with spring lock and plain washers M8 x 20

4 sets
6. Structures
6. Structures

Product designation

F-RAT-NX75-F60-7540-CN

Motor specifications
- F → FE 10P connector type

Nominal speed
- 17 → Nominal speed 17m/min type
- 60 → Nominal speed 60m/min type
*For details, refer to 8-3. Changing the transfer speed (P.47).

Size (L direction)
- 60 (L595mm)
- 75 (L745mm)
- 90 (L895mm)

Size (W direction)
- 40 (W395mm)
- 50 (W495mm)
- 60 (W595mm)
- 70 (W695mm)
- 80 (W795mm)

Input and output signal type
- N → NPN (Included with driver cards only for input and output)
- P → PNP (Included with driver cards only for input and output)
* Becomes blank when no driver card has been specified.

Included driver cards
- C → Standard driver cards (CBK-109/CB-016/HBM-201)
- E → Driver cards to support network communications (IB-E04/HBM-201)
* Becomes blank when no driver card has been specified.

Nominal speed
The speed on the MDR roller surface (m/min), and the nominal speed with a nice round value for convenience. Values differ slightly from the actual speed.
## 7. Installation/Wiring

<table>
<thead>
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<th>Section</th>
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<tbody>
<tr>
<td>7-1. Before installation</td>
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<tr>
<td>7-2. Installation</td>
<td>33</td>
</tr>
<tr>
<td>7-3. Wiring</td>
<td>35</td>
</tr>
</tbody>
</table>
7. Installation/Wiring

7-1. Before installation

- Prepare stands, and perform frame processing in advance by reference to the mounting holes in dimensions.
- Determine the mounting location for zone sensors to check the existence of trays, and area sensors to check loading and discharging. Then, prepare for them to be mounted.

Mounting preparation for
the F-RAT main unit

Size 6040
L595mm × W395mm

Size 6050
L595mm × W495mm

* Guide for cable marginal projecting length (mm)
  M1: Carrier wheel transfer MDR 1000
  M2: Roller transfer MDR 1100
  M3: Drive switching MDR 1300
7. Installation/Wiring

Size 6060
L595mm×W595mm

Size 6070
L595mm×W695mm

* Cable
* Guide for cable marginal projecting length (mm)

- M1: Carrier wheel transfer MDR 1000
- M2: Roller transfer MDR 800
- M3: Drive switching MDR 1300
7. Installation/Wiring

Size 6080
L595mm×W795mm

Size 7540
L745mm×W395mm

*Guide for cable marginal projecting length (mm)

| M1  | Carrier wheel transfer MDR | 1000 |
| M2  | Roller transfer MDR        | 700  |
| M3  | Drive switching MDR        | 1300 |

* Cable

#542 (Pipe size)

4 × Mounting nut (M8)
7. Installation/Wiring

Size 7550
L745mm × W495mm

Size 7560
L745mm × W595mm

* Guide for cable marginal projecting length (mm)
M1: Carrier wheel transfer MDR 850
M2: Roller transfer MDR 900
M3: Drive switching MDR 1200
7. Installation/Wiring

Size 7570
L745mm×W695mm

Size 7580
L745mm×W795mm
7. Installation/Wiring

Size 9040
L895mm×W395mm

- Guides for cable marginal projecting length [mm]:
  - M1: Carrier wheel transfer MDR 700
  - M2: Roller transfer MDR 1100
  - M3: Drive switching MDR 1100

Size 9050
L895mm×W495mm

- Guides for cable marginal projecting length [mm]:
  - M1: Carrier wheel transfer MDR 700
  - M2: Roller transfer MDR 1100
  - M3: Drive switching MDR 1100
Size 9060
L895mm×W595mm

Size 9070
L895mm×W695mm
7. Installation/Wiring

Size 9080
L895mm×W795mm

Size 9080
L895mm×W795mm

* Cable

4 × Mounting nut(M8)

842(Pipe size)

Guide for cable marginal projecting length (mm)

| M1 | Carrier wheel transfer MDR | 700 |
| M2 | Roller transfer MDR         | 700 |
| M3 | Drive switching MDR         | 1100 |
7. Installation/Wiring

Mounting preparation for driver cards

Hole processing on frames and control panel

1. Perform mounting processing on the frames and control panel by reference to the mounting holes for driver cards.
2. For cable opening and projection from the F-RAT main unit, refer to Mounting preparation for the F-RAT main unit (P.24).

- Mount driver cards on a flat surface where heat can be released easily.
- Prevent chips generated during processing from entering driver cards.

Preparation of MDR extension cables

If the mounting location of the F-RAT main unit is far from that of driver cards, prepare the MDR extension cables separately.

- For CBK-109 (12P extension cable) : ACE-CBM-G
- For CB-016 / HBM-201 (10P extension cable) : ACE-CBM-A

- Use extension cables of 1200 mm or less.
- Do not extend cables by connecting multiple extension cables.

Mounting preparation for sensors

Determine the mounting location for zone sensors, and area sensors for loading and discharging, and prepare for them to be mounted.

Example) Mounting positions for each sensor

Area sensor (Discharge)

Area sensor (Discharge)

Zone sensor

Area sensor (Load)

Transfer direction
7-2. Installation

Installing the F-RAT main unit

1. Carry this product to the installing location.
   - When lifting, hold the bottom of this product. Do not hold the moving parts, such as rollers, belt transfer parts, or lifting sections.

2. Check the installing direction for the loading/discharging sides.
   - Check the direction of V-ribbed pulley.

3. Use the included bolts to secure the unit on stands or stays with the mounting nuts for the F-RAT main unit.
   - When installing, be careful not to get fingers caught.
   - Install this product in places with a mounting surface tilt (inclination) of 0.5% or less.
   - Install in locations where the weight of this product and trays can be sufficiently supported. (For the main unit weight, refer to P.72)
   - The vibration level in the installation environment for this product should be 0.5 G or less.
   - Secure the working space for maintenance around this product.
   - Observe safety regulations required for installation locations or equipment in use.
   - Recommended tightening torque: 12 to 15 N-m

4. Adjust the conveyor frame legs on which the F-RAT main unit has been mounted, and align levels of the F-RAT main unit and the adjacent conveyor.
7. Installation/Wiring

About stays (option)

Dedicated stay (optional) is prepared for F-RAT installation.

⚠ If users do not use the stays, be sure to use the mounting holes on the F-RAT main unit to secure the F-RAT. In addition, comply with the mounting dimensions for stays, as well as mount them by taking into consideration the weight of this product and trays.

To mount stays on the frame, use their mounting holes, and mount them using a tightening torque of 12 to 15 N·m.

*For details, refer to the description related to stays on P.74.
7. Installation/Wiring

Mounting driver cards

Use the included screws and nuts to mount driver cards on the conveyor frames or control panel.

![Recommended tightening torque: 1.5 to 1.9N·m](image)

Mounting sensors, control devices, and power supply units

Mount customer-prepared zone sensor and area sensor for loading and discharging, as well as power supply units, and PLCs.

Connection between the F-RAT main unit and driver cards

- Refer to the labels for cables coming from the F-RAT main unit, and securely connect the MDR connectors and driver cards.
- When using extension cables, securely connect them to the MDR connectors, as well as to the driver card connectors.
7. Installation/Wiring

**Wiring for CBK-109**

- **Power connector (CN1)**
  1. Connect the 24V DC and 0V DC cables to CN1 (2 pin).
  - Do not connect multiple power cables to one pole. Failure to follow this could result in electric shock, short circuit, and/or damage due to the capacity of connectors being exceeded. (Connector capacity: 10 A)
  - Do not connect the 24V DC and 0V DC cables incorrectly.
  - Do not connect cables when connectors are plugged in.

- **Control connector (CN2)**
  2. Connect each cable to CN2 (5 pin).
   - Use the same voltage to be input to CN2#1 (MDR RUN/STOP) and CN2#2 (MDR rotation direction) as the power supply voltage. (Connector capacity: 4A)
   - Refer to the above, and perform wiring according to operation.

- **Connecting to driver cards**
  3. Connect the power connector (CN1), control connector (CN2), and M1 MDR connector to driver cards.

For more details on CBK-109, please download the driver card user manual from our web page.

### 7. Installation/Wiring

**[CB-016]**

M2: For roller transfer

---

#### Wiring for CB-016

![Wiring Diagram](image)

### Connector descriptions

<table>
<thead>
<tr>
<th>CN1 (Power)</th>
<th>CN2 (Control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 DC24V</td>
<td>#5 Output</td>
</tr>
<tr>
<td>#2 0V</td>
<td>#4 Output</td>
</tr>
<tr>
<td></td>
<td>#3 Analog input</td>
</tr>
<tr>
<td></td>
<td>#2 Input</td>
</tr>
<tr>
<td></td>
<td>#1 Input</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Functions</th>
<th>Detailed descriptions</th>
</tr>
</thead>
</table>
| #5 Output Motor pulse output | • Outputs 2-pulse signal per rotation of the internal motor.  
|                     | • NPN open collector output.  
|                     | • Attach protection resistance so that the output is 25 mA or less.  
|                     | • Protection resistance of 100 Ω is included inside driver cards.  |
| #4 Output Error signal output | • Detects MDR errors, and outputs.  
|                     | • Settings for normal output and error output can be specified using ON/OFF on DIP-SW1.  
|                     | • Open collector output.  
|                     | • Attach protection resistance so that the output is 25 mA or less.  
|                     | • Protection resistance of 100 Ω is included inside driver cards.  |
| #3 Analog input MDR external speed setting | The transfer speed can be set by the voltage input of 0 - 10V.  |
| #2 Input MDR rotation direction switching | The transfer direction can be switched.  |
| #1 Input MDR RUN/STOP | Required for RUN/STOP signals.  |

---

**Power connector (CN1)**

1. Connect the 24V DC and 0V DC cables to CN1 (2 pin).

- Do not connect multiple power cables to one pole. Failure to follow this could result in electric shock, short circuit, and/or damage due to the capacity of connectors being exceeded. (Connector capacity: 10 A)
- Do not connect the 24V DC and 0V DC cables incorrectly.
- Do not connect cables when connectors are plugged in.

**Control connector (CN2)**

2. Connect each cable to CN2 (5 pin).

*Refer to the above, and perform wiring according to operation.

- Use the same voltage to be input to CN2#1 (MDR RUN/STOP) and CN2#2 (MDR rotation direction) as the power supply voltage. (Connector capacity: 4A)

**Connecting to driver cards**

3. Connect the power connector (CN1), control connector (CN2), and M2 MDR connector to driver cards.

For more details on CB-016, please download the driver card user manual from our web page.

7. Installation/Wiring

Wiring for HBM-201

**Power connector (CN1)**

1. Connect the 24V DC and 0V DC cables to CN1 (2 pin).

   - Do not connect multiple power cables to one pole. Failure to follow this could result in electric shock, short circuit, and/or damage due to the capacity of connectors being exceeded. (Connector capacity: 10 A)
   - Do not connect the 24V DC and 0V DC cables incorrectly.
   - Do not connect cables when connectors are plugged in.

**Control connector (CN2)**

2. Connect the above four cables.

   - Use the same voltage to be input to CN2#1 as the power supply voltage. (Connector capacity: 4A)

**Connecting to driver cards**

3. Connect the power connector (CN1), control connector (CN2), and M3 MDR connector to driver cards.

---

*Teaching*

Operation to perform the initial setting of the transfer surface position. Teaching must be performed after the power is turned on.
7. Installation/Wiring

## Setting driver cards

### Settings for M1: CBK-109 / M2: CB-016

Turn the driver card volume to the following (factory setting).

![Driver card volume adjustment](diagram)

- The carrier wheel speed for this product of the nominal speed of 17 m/min type is 61.5 m/min (factory setting). To set it to the approximate roller speed, change the speed. Refer to 8-3. Changing the speed (P.47).

### Settings for M3: HBM-201

Turn the driver card DIP switch and rotary switch to the following (factory setting).

![Driver card switch settings](diagram)

## Connecting to power supply units

The power is supplied to driver cards from the power connector (CN1). Connect customer-prepared power cables of zone and area sensors for loading and discharging.

## Connecting signal cables of driver cards/sensors to PLCs

Connect signal cables of driver cards to controllers, such as PLCs. Connect customer-prepared signal cables of zone and area sensors for loading and discharging.

- **Connection example**
  - This product
  - Driver cards
    - F-RAT main unit
    - M1: CBK-109
    - M2: CB-016
    - M3: HBM-201
  - CN2 #1, 2: Standby surface signal
  - CN2 #3, 4, 5: Switch signal
  - CN2 #6, 7: Load conveyor run signal
  - CN2 #8, 9: Discharge conveyor run signal

- **PLC**
  - Area sensor for loading
  - Area sensor for discharging (Carrier wheel transfer direction)
  - Area sensor for discharging (Roller transfer direction)

The following is an example. For input and output of each signal, perform wiring according to your operation.

---

*Note: Diagrams and specific wiring examples are not shown in this text. Please refer to the manual for detailed illustrations and instructions.*
8. Control/Operation

8-1. Basic operation  
8-2. Switching the transfer direction  
8-3. Changing the speed  
8-4. Switching the transfer surface  
8-5. About the initial position setting (teaching) of the transfer surface  
8-6. Program example  
8-7. What to do before operation
8. Control/Operation

Device configuration image

This product

F-RAT main unit

Driver cards

Carrier wheel transfer MDR
Roller transfer MDR
Drive switching MDR

M1 : CBK-109
M2 : CB-016
M3 : HBM-201

CN2 #1 RUN signal
CN2 #1 RUN signal
CN2 #4, #5 Switch signal

Area sensor for loading
F-RAT zone sensor
Area sensor for discharging
(Carrier wheel transfer direction)
Area sensor for discharging
(Roller transfer direction)

Load conveyor run signal
Discharge conveyor run signal

Input
PLC
Output

Label description | MDR code          | Driver card |
------------------|-------------------|-------------|
M1 *              | Carrier wheel transfer MDR | CBK-109    |
M2 *              | Roller transfer MDR     | CB-016     |
M3 *              | Drive switching MDR     | HBM-201    |

* Refer to the labels for cables coming from the F-RAT main unit.

Zone sensor
A sensor to detect the existence of trays within the zone

Area sensor
A sensor to detect load and discharge of trays

Term

Refer to the labels for cables coming from the F-RAT main unit.
# 8. Control/Operation

## 8-1. Basic operation

**Operation image**

**Turn on the power**

**Set the initial position of the transfer surface**  
(Teaching)

### Load

**Switch the transfer surface to the diverting direction**  
(Roller transfer → Carrier wheel transfer)

**Discharge**

**Prepare reception**  
(Transfer surface switch)  
(Carrier wheel transfer → Roller transfer)

---

### About control

- F-RAT uses MDR for each of carrier wheel transfer, roller transfer, and transfer surface switch (3 axes in total). Make sure to control to allow each axis to run independently.

---

### Control/Operation

1. **HBM-201 Signal output from CN2#1, CN2#2**
   - Start teaching
   - HBM-201 Signal output from CN2#1
     - No signal output from CN2#2
     - Preparing reception (teaching) complete
     - The roller surface is set in the initial position.
   - Run the roller transfer MDR
   - Area sensor for loading ON → OFF
   - Stop running the roller transfer MDR (loading complete)
   - HBM-201 Signal input to CN2#5
     - Start to switch to the carrier wheel surface
     - HBM-201 No signal output from CN2#1
     - Signal output from CN2#2
     - HBM-201 Stop signal input to CN2#5
     - Switching to the carrier wheel surface complete
   - Run the carrier wheel transfer MDR
     - Area sensor for discharge ON → OFF
     - Stop running the carrier wheel transfer MDR (loading complete)
   - HBM-201 Signal input to CN2#4
     - Start to switch to the roller surface
     - HBM-201 Signal output from CN2#1
     - No signal output from CN2#2
     - HBM-201 Stop signal input to CN2#4
     - Switching to the roller surface (preparing reception) complete
8. Control/Operation

8-1. Basic operation

The following operation is for when the rotation direction setting SW1#3 for CB-016 and CBK-109 is OFF (factory setting). Loading and discharging directions will be changed depending on the SW1#3 setting and signal input to CN2.

[Refer to 8-2. Switching the transfer direction on P.46.]

Transfer flow chart (when using the roller for loading, and carrier wheel for discharging)

<table>
<thead>
<tr>
<th>Turn on the power</th>
<th>Set the initial position of the transfer surface</th>
<th>Load</th>
<th>Transfer surface switch</th>
<th>Discharge</th>
<th>Transfer surface switch (Prepare reception)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn 24V DC on</td>
<td>HBM-201</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Signal output from CN2#1, CN2#2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Start the transfer surface switch operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HBM-201</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Signal input to CN2#4, CN2#5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HBM-201</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Signal output from CN2#1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HBM-201</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Signal output from CN2#1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stop the transfer surface switch operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transfer surface switch operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transfer surface setting complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

After the power is turned on, the LED display are indicated as below.

- **CBK-109**
  - PWR (Green) ON
  - ERR (Red) OFF
  - STATUS (Orange) OFF

- **CB-016**
  - Signal output from CN2#1
  - Signal output from CN2#2

- **HBM-201**
  - Power 24V
  - SIGNAL: 0V
  - F-RAT M3
    - Run in the roller surface direction
    - Stop
    - Run in the carrier wheel surface direction

When preparing reception is complete, the roller surface is set on standby.

**Teaching**

Operation to perform the initial setting of the transfer surface position.

Teaching must be performed when the power is turned on.
8. Control/Operation

Load

- Run the roller transfer MDR
- Stop running the roller transfer MDR (loading complete)

Transfer surface switch

- Start to switch to the carrier wheel surface
- Switching to the carrier wheel surface complete (Transfer surface setting complete)

HBM-201

- Signal input to CN2#5
- Signal input to CN2#1
- Stop signal output from CN2#1
- Stop signal output from CN2#2
- Signal output from CN2#2
- Stop signal input to CN2#5
8. Control/Operation

Discharge

- Turn on the power
- Set the initial position of the transfer surface
- Load
- Transfer surface switch
- Discharge
- Transfer surface switch (Prepare reception)

Run the carrier wheel transfer MDR

M1 : CBK-109
Signal input to CN2#1

Area sensor for discharge
ON → OFF

YES

M1 : CBK-109
Stop signal input to CN2#1

Stop the carrier wheel transfer MDR (Discharge complete)

HBM-201
Signal input to CN2#4

HBM-201
Stop signal output from CN2#2

HBM-201
Signal output from CN2#1

HBM-201
Stop signal input to CN2#4

Transfer surface switch
(Prepare reception)

Start to switch to the roller surface

Switching to the roller surface complete
(preparing reception complete)
8. Control/Operation

Switching the transfer direction

8-2. Switching the transfer direction

The transfer direction can be set by DIP-SW on the driver card, and signal input.

- When changing the direction, check the F-RAT main unit installation direction.
- The transfer direction cannot be changed by SW1#3 during transfer (while MDR is running). Change the direction when MDR stops.

Transfer/Stop in the CW direction * by inputting signal

* When DIP-SW1#3 is OFF

<table>
<thead>
<tr>
<th>Power</th>
<th>24V</th>
<th>0V</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN2#1</td>
<td>RUN</td>
<td>STOP</td>
</tr>
<tr>
<td>CN2#2</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Transfer</td>
<td>Run</td>
<td>Stop</td>
</tr>
</tbody>
</table>

20ms or more
8. Control/Operation

8-3. Changing the transfer speed

(M1:CBK-109 / M2:CB-016)

There are two types of settings to change speed: the internal speed setting to change the speed by switches on the driver card, and the external speed setting to change the speed by inputting the analog voltage to CN2#3.

### Internal speed setting

1. Set SW1#2 to OFF.
2. Set SW1#5 and SW5.

### External speed setting

1. Turn SW1#2 ON.
2. Input the voltage to CN2#3.

The speed can be changed even during transfer (when RUN signal is being input).
8. Control/Operation

8-3. Changing the speed

[M1 : Carrier wheel speed]

<table>
<thead>
<tr>
<th>Speed chart (m/min)</th>
<th>SW1#5 : ON</th>
<th>SW1#5 : OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9 8 7 6 5 4 3 2 1 0</td>
<td>9 8 7 6 5 4 3 2 1 0</td>
</tr>
<tr>
<td>Setting</td>
<td>61.5 56.4 53.9 51.3 48.7 46.2 41.1 38.4 35.9 33.4</td>
<td>30.8 28.2 25.6 23.1 20.5 18.0 15.5 12.8 10.3 7.7</td>
</tr>
<tr>
<td>Rated</td>
<td>59.8 56.4 53.9 51.3 48.7 46.2 41.1 38.4 35.9 33.4</td>
<td>30.8 28.2 25.6 23.1 20.5 18.0 15.5 12.8 10.3 7.7</td>
</tr>
<tr>
<td>External voltage</td>
<td>9.6 9.1 8.6 8.1 7.6 7.1 6.6 6.1 5.6 5.1</td>
<td>4.6 4.1 3.6 3.1 2.6 2.1 1.6 1.1 0.6 0.1</td>
</tr>
<tr>
<td>Input (V)</td>
<td>9.9 9.4 8.9 8.4 7.9 7.4 6.9 6.4 5.9 5.4</td>
<td>4.9 4.4 3.9 3.4 2.9 2.4 1.9 1.4 0.9 0.4</td>
</tr>
</tbody>
</table>

Factory setting

[M2 : Roller speed]

<table>
<thead>
<tr>
<th>Speed chart (m/min)</th>
<th>SW1#5 : ON</th>
<th>SW1#5 : OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9 8 7 6 5 4 3 2 1 0</td>
<td>9 8 7 6 5 4 3 2 1 0</td>
</tr>
<tr>
<td>Setting</td>
<td>17.4 15.9 15.2 14.5 13.7 13.0 11.6 10.9 10.1 9.4</td>
<td>8.7 8.0 7.2 6.5 5.9 5.1 4.3 3.6 3.2 2.9 2.2</td>
</tr>
<tr>
<td>Rated</td>
<td>15.0 15.0 14.5 13.7 13.0 11.6 10.9 10.1 9.4</td>
<td>8.7 8.0 7.2 6.5 5.9 5.1 4.3 3.6 3.2 2.9 2.2</td>
</tr>
<tr>
<td>External voltage</td>
<td>61.7 56.6 54.0 51.4 48.9 46.3 41.2 38.6 36.0 33.4</td>
<td>30.9 28.3 25.7 23.1 20.6 18.0 15.4 12.9 10.3 7.7</td>
</tr>
<tr>
<td>Input (V)</td>
<td>53.5 53.5 51.4 48.9 46.3 41.2 38.6 36.0 33.4</td>
<td>30.9 28.3 25.7 23.1 20.6 18.0 15.4 12.9 10.3 7.7</td>
</tr>
<tr>
<td></td>
<td>9.6 9.1 8.6 8.1 7.6 7.1 6.6 6.1 5.6 5.1</td>
<td>4.6 4.1 3.6 3.1 2.6 2.1 1.6 1.1 0.6 0.1</td>
</tr>
<tr>
<td></td>
<td>9.9 9.4 8.9 8.4 7.9 7.4 6.9 6.4 5.9 5.4</td>
<td>4.9 4.4 3.9 3.4 2.9 2.4 1.9 1.4 0.9 0.4</td>
</tr>
</tbody>
</table>

Factory setting

- Values in “Setting” indicate the speed when trays are not placed on carrier wheels and rollers.
- 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.
8. Control/Operation

8-4. Switching the transfer surface

[Switching the transfer surface]

The transfer surface can be switched by inputting the signal to CN2#4 and CN2#5.

- After the initial position setting (teaching) of the transfer surface, the roller surface is put on standby. To put the carrier wheel surface on standby (use it for reception), the transfer surface needs to be changed using the signal input.
  Refer to 8-5. About the initial position setting (teaching) of the transfer surface (P.50)

---

Switching the transfer surface

- If the signal input stops when the transfer surface is being switched, operation will be interrupted, and the signal output from both CN2#1 and #2 will stop. When inputting the signal again, operation restarts.
8-5. About the initial position setting (teaching) of the transfer surface

The initial position setting (teaching) of the transfer surface is necessary to set the transfer surface after the power is turned on.

- If teaching has not been set, the transfer surface cannot be switched.
- During teaching operation, do not load trays on the F-RAT.
- When teaching fails, both CN2#1(OUT1)(roller surface status output) and CN2#2(OUT2)(carrier wheel status output) are turned ON, which is the same status as when the power is turned on. In such cases, perform teaching operation again.

### Teaching Operation

<table>
<thead>
<tr>
<th>PLC</th>
<th>HBM-201 (M3)</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>CN2#1 (Roller surface switch input)</td>
<td>ON</td>
</tr>
<tr>
<td>Output</td>
<td>CN2#4 (Roller surface standby output)</td>
<td>OFF</td>
</tr>
<tr>
<td>Input</td>
<td>CN2#2 (Carrier wheel switch input)</td>
<td>ON</td>
</tr>
<tr>
<td>Output</td>
<td>CN2#5 (Carrier wheel standby output)</td>
<td>OFF</td>
</tr>
</tbody>
</table>

- **Run in the roller surface direction**
- Run in the carrier wheel surface direction

### Transfer surface status

<table>
<thead>
<tr>
<th>PWR STATUS ERR</th>
<th>Power OFF</th>
<th>Power ON</th>
<th>Teaching operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWR (Green)</td>
<td></td>
<td>1Hz blinking</td>
<td>6Hz blinking</td>
</tr>
<tr>
<td>STATUS (Orange)</td>
<td></td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>ERR (Red)</td>
<td></td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**Teaching**

Operation to perform the initial setting of the transfer surface position. After the power is turned on, perform teaching by inputting signal from the driver card.
The following time chart is an example. When in use, control the number of sensors, and/or determine how to place/control sensors depending on your operation.

When loading through roller transfer, discharging through carrier wheel transfer, and standing ready on the roller surface after discharge ends

It is assumed that switches on CBK-109 and CB-016 are used based on the initial settings.

**Program example**

- Do not load trays from the roller transfer MDR direction while the carrier wheel status (signal from CN2#2 on HBM-201) is output. Failure to follow this could result in damage to trays, and malfunction.

---

**Basic operation (example)**

Operation by loading through roller transfer and discharging through carrier wheel transfer

---

**Zone sensor**

A sensor to detect the existence of trays within the zone

**Area sensor**

A sensor to detect load and discharge of trays

---

**Time chart example**

<table>
<thead>
<tr>
<th>PLC</th>
<th>Tray position</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Input</td>
<td>Zone sensor for the load conveyor</td>
</tr>
<tr>
<td>Input</td>
<td>Area sensor for loading</td>
</tr>
<tr>
<td>Input</td>
<td>F-RAT zone sensor</td>
</tr>
<tr>
<td>Input</td>
<td>Area sensor for discharging (Carrier wheel discharge direction)</td>
</tr>
<tr>
<td>Output</td>
<td>Roller transfer MDR (M2)</td>
</tr>
<tr>
<td>Output</td>
<td>Carrier wheel transfer MDR (M1)</td>
</tr>
<tr>
<td>Output</td>
<td>Drive switching MDR (M3)</td>
</tr>
<tr>
<td>Input</td>
<td>OUT1 (Roller surface standby output)</td>
</tr>
<tr>
<td>Input</td>
<td>OUT2 (Carrier wheel surface standby output)</td>
</tr>
</tbody>
</table>

---

**Term**

- **Zone sensor**
  - A sensor to detect the existence of trays within the zone
- **Area sensor**
  - A sensor to detect load and discharge of trays
8. Control/Operation

8-7. What to do before operation

Start-up inspection

To prevent accidents and/or damage to devices during operation, refer to the below before operation, and check the safety.

- **Items to check before turning on the power**

Turn off the power of all connected devices, and perform the following inspection, taking necessary measures.

- Turn off the power, wait a sufficient amount of time, and discharge electricity inside the DC power supply equipment.
- Post warning labels so as to prevent unauthorized persons from turning on the power.

<table>
<thead>
<tr>
<th>Parts to be inspected</th>
<th>Inspection items</th>
<th>Description of measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secured positions of the F-RAT main unit</td>
<td>Screw looseness</td>
<td>Re-tighten screws</td>
</tr>
<tr>
<td>Driver card</td>
<td>Damage, deformation</td>
<td>Contact the supplier</td>
</tr>
<tr>
<td></td>
<td>Screw looseness on secured positions</td>
<td>Re-tighten screws</td>
</tr>
<tr>
<td></td>
<td>Mounting failure for driver cards and connectors</td>
<td>Correctly mount connectors</td>
</tr>
<tr>
<td></td>
<td>Damage to cables/Wiring failure</td>
<td>Perform wiring correctly</td>
</tr>
<tr>
<td>Idler for roller transfer</td>
<td>External abnormalities, such as scratches or breakage</td>
<td></td>
</tr>
<tr>
<td>Roller transfer MDR</td>
<td>External abnormalities, such as scratches, dents, or breakage</td>
<td>Refer to P.58</td>
</tr>
<tr>
<td>Roller drive belt for roller transfer</td>
<td>Cracks, looseness, wear on the surface</td>
<td>9-2. Before replacement work</td>
</tr>
<tr>
<td>Carrier wheel</td>
<td>Cracks, wear on the surface</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>Parts deformation, damage</td>
<td>Contact the supplier</td>
</tr>
<tr>
<td></td>
<td>Cable damage</td>
<td></td>
</tr>
</tbody>
</table>

- **Items to check after turning on the power**

Manually input the signal to driver cards according to inspection contents.

- Perform inspection after completing measures to prevent fingers from getting stuck and/or caught in rollers during transfer switching, and/or transfer operation.
- Take safety measures, such as getting ready to shut off the power in the event that something should happen.

<table>
<thead>
<tr>
<th>Parts to be inspected</th>
<th>Inspection items</th>
<th>Description of measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver card</td>
<td>Abnormal temperature rise</td>
<td>Contact the supplier</td>
</tr>
<tr>
<td></td>
<td>Error check with LED display</td>
<td>Check error contents, and eliminate the causes.</td>
</tr>
<tr>
<td></td>
<td>&lt;Normal LED display after the power is turned on.&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Judged as errors if the LED display is other than that below.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CBK-109</td>
<td>PWR (Green) ON</td>
</tr>
<tr>
<td></td>
<td>CB-016</td>
<td>ERR (Red) OFF</td>
</tr>
<tr>
<td></td>
<td>HBM-201</td>
<td></td>
</tr>
<tr>
<td>Idler for roller transfer</td>
<td>Abnormal sound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rotation failure</td>
<td></td>
</tr>
<tr>
<td>Roller transfer MDR</td>
<td>Abnormal sound</td>
<td>* For driver card LED display and error countermeasures, refer to 9-1. Driver card LED display and error countermeasures (P.55).</td>
</tr>
<tr>
<td></td>
<td>Decrease from the specified speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Abnormal temperature rise</td>
<td></td>
</tr>
<tr>
<td>Carrier wheel</td>
<td>Abnormal sound</td>
<td></td>
</tr>
<tr>
<td>transfer MDR</td>
<td>Decrease from the specified speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Abnormal temperature rise</td>
<td>Contact the supplier</td>
</tr>
<tr>
<td></td>
<td>(Check ERR LED on driver cards)</td>
<td></td>
</tr>
<tr>
<td>Drive switching MDR</td>
<td>Abnormal sound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Abnormal temperature rise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Check ERR LED on driver cards)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>Leakage from equipment</td>
<td>Check grounding on equipment, perform grounding</td>
</tr>
</tbody>
</table>
## 4. Control/Operation

### Trial run

#### Items to check before the trial run

Check below before the trial run.
- When the roller transfer MDR and/or idlers have been replaced, check that the drive belts have been mounted in the correct groove positions.
- Check all parts are installed.

#### Performing the trial run

When the start-up inspection has finished, perform the trial run with careful attention to the following points, and check that operation is correctly performed.

- Prevent other devices around the product from operating. Other devices incorporated in the system, such as conveyor lines, could create dangerous situations, since trays may start to flow from upstream when the trial run is driven. Check carefully that other elements in the system will not operate when the product starts running.
- Make sure to check that wiring, driver card settings, and PLC settings have been carried out correctly before the trial run.
- During operation, the transfer speed may not reach the specified value depending on ambient temperature. When the carrier wheel cassette has been replaced, perform running operation thoroughly to eliminate any bends from belts.
9. Maintenance/Inspection

9-1. Driver card LED display and error countermeasures  ..... 55
9-2. Before replacement work  ..... 58
9-3. Replacement of MDR for roller transfer/idlers/roller drive belts  ..... 60
9-4. Replacement of the carrier wheel cassette  ..... 65
9. Maintenance/Inspection

9-1. Driver card LED display and error countermeasures

Checking the driver card status

For carrier wheel transfer LED display explanation

If errors occur with this product, identify the cause of errors, and perform recovery work.

Identify the cause of errors by checking LEDs and error signal output on driver cards, and restore the product.

Errors can be checked by PWR (Green), ERR (Red), and signals from CN2#4.

- When error signals have been released by CN2#1 (RUN / STOP), the F-RAT instantly starts up when RUN is input.
- When the power supply voltage becomes insufficient, operation may be disabled, or an unexpected operation may occur.
- To restart the F-RAT, switch the ON → OFF → ON / OFF → ON → OFF / RUN → STOP → RUN signals at intervals of 100 ms or more.

Error details

<table>
<thead>
<tr>
<th>PWR (Green)</th>
<th>ERR (Red)</th>
<th>CN2#4 (Error signal)</th>
<th>Causes</th>
<th>How to release error signals</th>
<th>Recovery operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>Open</td>
<td>ON</td>
<td>(Normal operation)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Open</td>
<td>Open</td>
<td>Off</td>
<td>No power supply</td>
<td>Supply 24V DC</td>
<td>Refer to P.35</td>
</tr>
<tr>
<td>Open</td>
<td>Output</td>
<td>On/Off</td>
<td>Damage to driver cards</td>
<td>Turn off the power, and replace the driver card</td>
<td>Refer to P.33, 35</td>
</tr>
<tr>
<td>Open</td>
<td>Output</td>
<td>On/Off</td>
<td>Thermal error</td>
<td>When one minute has elapsed after decreasing to the recovery temperature, the error signal is released, and the unit starts up instantly</td>
<td>Refer to P.33, 35</td>
</tr>
<tr>
<td>Open</td>
<td>Output</td>
<td>On/Off</td>
<td>Thermal error</td>
<td>After decreasing to the recovery temperature, release the error signal, and start up the unit by RUN → STOP → RUN on CN2#1</td>
<td>Refer to P.33, 35</td>
</tr>
<tr>
<td>Open</td>
<td>Output</td>
<td>On/Off</td>
<td>Connector</td>
<td>Turn off the power, and connect the connector</td>
<td>Refer to P.35</td>
</tr>
<tr>
<td>Open</td>
<td>Output</td>
<td>On/Off</td>
<td>MDR disconnection</td>
<td>Turn off the power, and replace the MDR</td>
<td>Refer to P.58</td>
</tr>
<tr>
<td>Open</td>
<td>Open</td>
<td>On/Off</td>
<td>Lock error</td>
<td>When 4sec or more have elapsed after an error occurs, release the error signal, and start up the unit by RUN → STOP → RUN on CN2#1</td>
<td>Refer to P.35</td>
</tr>
<tr>
<td>Open</td>
<td>Open</td>
<td>On/Off</td>
<td>Low voltage error</td>
<td>Secure the power supply voltage of 18V or more</td>
<td>Refer to P.58</td>
</tr>
<tr>
<td>Open</td>
<td>Open</td>
<td>On/Off</td>
<td>Back EMF error</td>
<td>Voltage applied to MDR has been 30V or less for 1sec</td>
<td>Refer to P.58</td>
</tr>
<tr>
<td>Blinking</td>
<td>Open</td>
<td>On/Off</td>
<td>A current of 7A or more flows in the MDR</td>
<td>No error signal</td>
<td>—</td>
</tr>
</tbody>
</table>

Errors will be also released when the power is OFF (for two seconds or more).
Errors can be checked by PWR (Green), ERR (Red), and signals from CN2#4.

- When error signals have been released by CN2#1 (RUN / STOP), the F-RAT instantly starts up when RUN is input.
- When the power supply voltage becomes insufficient, operation may be disabled, or an unexpected operation may occur.
- To restart the F-RAT, switch the ON → OFF → ON / OFF → ON / OFF / RUN → STOP → RUN signals at intervals of 100 ms or more.

### Error details

**M** : Manual recovery setting (SW1#1 ON)/ **A** : Automatic recovery setting (SW1#1 OFF <factory setting>)

<table>
<thead>
<tr>
<th>PWR (Green)</th>
<th>CN2#4 (Error signal)</th>
<th>Causes</th>
<th>How to release error signals</th>
<th>Recovery operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Open</td>
<td>(Normal operation)</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Open</td>
<td>Open</td>
<td>No power supply</td>
<td>Supply 24V DC</td>
<td>Refer to P.35 7.3. Wiring</td>
</tr>
<tr>
<td>Open</td>
<td>Output</td>
<td>Damage to driver cards</td>
<td>Turn off the power, and replace the driver card</td>
<td>Refer to P.33, 35 7.2. Installation 7.3. Wiring</td>
</tr>
<tr>
<td>Open</td>
<td>Output</td>
<td>Thermal error</td>
<td>When one minute has elapsed after decreasing to the recovery temperature, the error signal is released, and the unit starts up instantly</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After decreasing to the recovery temperature, release the error signal, and start up the unit by RUN→STOP→RUN on CN2#1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After decreasing to the recovery temperature, switch ON→OFF→ON or OFF→ON→OFF on CN2#2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After decreasing to the recovery temperature, release the error signal, and start up the unit RUN→STOP→RUN on CN2#1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After decreasing to the recovery temperature, switch ON→OFF→ON or OFF→ON→OFF on CN2#2</td>
<td></td>
</tr>
<tr>
<td>Open</td>
<td>Output</td>
<td>Connector disconnected</td>
<td>Turn off the power, and connect the connector</td>
<td>Refer to P.35 7.3. Wiring</td>
</tr>
<tr>
<td>Open</td>
<td>Output</td>
<td>MDR disconnection</td>
<td>Turn off the power, and replace the MDR</td>
<td>Refer to P.58 9.2. Before replacement work</td>
</tr>
<tr>
<td>Open</td>
<td>Output</td>
<td>Lock error</td>
<td>Release the error signal, and start up the unit by RUN→STOP→RUN on CN2#1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Switch ON→OFF→ON or OFF→ON→OFF on CN2#2</td>
<td></td>
</tr>
<tr>
<td>Open</td>
<td>Output</td>
<td>Low voltage error</td>
<td>Secure the power supply voltage of 18V or more</td>
<td>The unit starts up instantly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After securing the power supply voltage of 18V or more, release the error signal, and start up the unit by RUN→STOP→RUN on CN2#1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After securing the power supply voltage of 18V or more, switch ON→OFF→ON or OFF→ON→OFF on CN2#2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Start up the unit by RUN→STOP→RUN on CN2#1</td>
<td></td>
</tr>
</tbody>
</table>

Errors will be also released when the power is OFF (for two seconds or more).
Even if inputting the signal to CN2#4 and #5, but the signal output from CN2#1 and #2 does not change, the following errors have been assumed to occur. Errors can be distinguished by the LED display.

### LED display explanation

- **PWR (green)**
  - : ON
  - : Blinking (1Hz)
  - : Blinking (6Hz)
  - : OFF

### Error details

<table>
<thead>
<tr>
<th>PWR</th>
<th>ERR</th>
<th>Description</th>
<th>Causes</th>
<th>Recovery conditions</th>
<th>Recovery operation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Stop (signals not input)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3Hz blinking x3 OFF for 480ms</td>
<td></td>
<td>When operating on a tilted surface</td>
<td>(Normal operation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3Hz blinking x2 OFF for 480ms</td>
<td></td>
<td>When operating on a horizontal surface</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>During teaching operation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No teaching setting</td>
<td>Teaching setting incomplete</td>
<td>Teaching setting complete</td>
<td>Refer to P.50 8-5. About the initial position setting (teaching) of the transfer surface</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thermal error</td>
<td>Driver card temperature is 85°C or more, or MDR temperature is 110°C or more</td>
<td>Driver card temperature is 75°C or less, and MDR temperature is 95°C or less</td>
<td>Take one of among the following measures: Turn CN2#4 (INPUT1) OFF and ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MDR disconnected</td>
<td>MDR connectors removed</td>
<td>Connect the MDR connectors</td>
<td>Turn CN2#5 (INPUT2) OFF and ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lock error</td>
<td>MDR has been locked when switching the transfer surface</td>
<td>Eliminate the cause of lock</td>
<td>Turn CN2#4 (INPUT1) and CN2#5 (INPUT2) OFF and ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low voltage error</td>
<td>The voltage has been 17 V or less for 1sec, or the power connector is connected improperly</td>
<td>Supply a voltage of 17 V or more, or properly connect the power connector again</td>
<td>Refer to P.33, 35 7-2. Installation 7-3. Wiring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fuse blown</td>
<td>Driver card fuse blown</td>
<td>Replace the driver card</td>
<td></td>
</tr>
</tbody>
</table>

### STATUS (Orange) details

<table>
<thead>
<tr>
<th>STATUS (Orange)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No teaching setting/During teaching operation/When the transfer surface is being switched</td>
</tr>
<tr>
<td></td>
<td>Horizontal surface standby/Tilted surface standby</td>
</tr>
</tbody>
</table>
9. Maintenance/Inspection

9-2. Before replacement work

If any abnormalities, such as damaged parts, are found, immediately take actions, including replacement with new parts.

- Check the model of this product, and prepare parts to be replaced with in advance.
- Contact us for repair/replacement of parts other than those mentioned below.

### Replacement parts list

**Carrier wheel cassette**

<table>
<thead>
<tr>
<th>Part number</th>
<th>NX75-CC□□□</th>
</tr>
</thead>
<tbody>
<tr>
<td>□□□□ : 60 / 75 / 90</td>
<td>Indicates size (L direction) for the model of this product.</td>
</tr>
<tr>
<td>□□□□ : A / B / C / D / E</td>
<td>Indicates type of the cassette.</td>
</tr>
</tbody>
</table>

**Example**

- For F-RAT-NX75-F60-7550-CN

---

### Diagrams

- **Size □□ 40 type**
- **Size □□ 50 type**
- **Size □□ 60 type**
- **Size □□ 70 type**
- **Size □□ 80 type**

---

Example) Carrier wheel cassette Type B for F-RAT-NX75-F60-7550-CN : NX75-CC-75□□
9. Maintenance/Inspection

**Part number : **2PJ-265

The part number of which only belts, size □□60 type, are used to link Φ38 idlers, is 2PJ-246.

*1 Indicates size (W direction) for the model of this product
Example) F-RAT-NX75-F60-7550-CN

**Roller transfer MDR**

| Size 60 □□       | PM486FE-(17/60)*2 -542-D-024-JA-Z150-JA-VN |
| Size 75 □□       | PM486FE-(17/60)*2 -692-D-024-JA-Z150-JA-VN |
| Size 90 □□       | PM486FE-(17/60)*2 -842-D-024-JA-Z150-JA-VN |

*1 Indicates size (L direction) for the model of this product
Example) F-RAT-NX75-F60-7550-CN

**Idler**

| Size 60 □□       | Φ38   | ARI-38-542-JC-VN      |
|                  | Φ48.6 | ARI-48-542-JB-VN      |
| Size 75 □□       | Φ38   | ARI-38-692-JC-VN      |
|                  | Φ48.6 | ARI-48-692-JB-VN      |
| Size 90 □□       | Φ38   | ARI-38-842-JC-VN      |
|                  | Φ48.6 | ARI-48-842-JB-VN      |

*1 Indicates size (L direction) for the model of this product
Example) F-RAT-NX75-F60-7550-CN

**Driver card**

Driver cards are common with each size of the F-RAT.

<table>
<thead>
<tr>
<th>Driver cards</th>
<th>Standard driver cards</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1 : For carrier wheel transfer</td>
<td>CBK-109F</td>
</tr>
<tr>
<td>M2 : For roller transfer</td>
<td>CB-016B</td>
</tr>
<tr>
<td>M3 : For drive switching</td>
<td>HBM-201B</td>
</tr>
</tbody>
</table>

* Specify □ = N (NPN signal input/output) / P (PNP signal input/output).
9. Maintenance/Inspection

9-3. Replacement of roller transfer MDR/idlers /roller drive belts

Before replacement

If any abnormalities are found in one of the roller transfer MDR, idlers, and/or roller drive belts, replace them according to the following methods.

1. Before replacement, prepare necessary tools.

   Tools to be used
   - 8 mm/19 mm wrench
   - Slotted screwdriver

2. Turn off the power of all connecting devices.

   - Shut off the power switch, leave for three minutes or more, and discharge electricity inside the DC power supply equipment.
   - Wear protective equipment, such as gloves.

Replacement procedures

Removing roller transfer MDR/idlers/roller drive belts

Remove the hold cover

1. Remove the screws at the four positions, and remove the hold cover from the F-RAT main unit.

Remove idlers

Remove idlers in order, from the edge of the module, to the position where the roller transfer MDR, idler, or roller drive belt to be replaced can be removed.

1. Push deeper the spring loaded shaft of the idler using the tip of a slotted screwdriver, etc.
9. Maintenance/Inspection

Replacement procedures

2. Slide the spring loaded shaft from the fixed hole (1), and remove the idler from the frame (2).

3. Remove the roller drive belt, and remove the idler.

- The roller drive belt can be removed easily by pulling it while turning the idler.

Remove other idlers in the same procedures.

Remove the roller transfer MDR

1. Remove the cable tie securing the power cable (1), and remove the mounting bracket from the power cable (2).

- When removing the mounting bracket, be careful not to damage the cable.
9. Maintenance/Inspection

Replacement procedures

2 Lift up the tip of the roller transfer MDR (1), and remove the roller drive belt. (2) Remove the roller transfer MDR (3), and pull the power cable off the fixed hole on the frame (4).

Mounting roller transfer MDR/idlers/roller drive belts

Mount the roller transfer MDR

1 Pass the roller transfer MDR power cable through the fixed hole on the frame (1), and put the attaching shaft into the hole (2).
9. Maintenance/Inspection

Replacement procedures

2 Mount the roller drive belt on the V-ribbed pulley of the roller transfer MDR (1), align the tip of the attaching shaft with the notch shape, and fit it into the frame (2).

![Diagram showing roller drive belt, attaching shaft, and frame with notch shape]

- For the mounting groove position for drive belts, refer to the figure below.

![Diagram of groove over which the belt is put]

3 Fix the mounting bracket (1), and bind the power cable with the cable tie (2).

![Diagram showing mounting bracket and cable tie]

- When fixing the mounting bracket, be careful not to damage to the cable.
- Attach the mounting bracket in the direction shown below.

![Diagram seen from the side]

- The tightening torque of 30N·m is recommended.

Mount the idler

1 Mount the roller drive belt on the V-ribbed pulley on the idler.

![Diagram showing roller drive belt and idler]

- The mounting position of the roller drive belt is the same as that for the roller transfer MDR.
9. Maintenance/Inspection

Replacement procedures

2 Align the tip of the attaching shaft on the side of the belt on the V-ribbed pulley, where the roller drive belt has been mounted, with the notch shape on the frame, and fit it into the frame.

- Press the D-shaped cut surface of the axis onto the plate, and fit it into the frame.
- Check that the attaching shaft has come out of the external side of the frame, as shown in the figure below.

3 Push the spring loaded shaft of the idler by the tip of a slotted screwdriver, etc. (1), and pass it through the fixed hole (2).

- Check that the spring loaded shaft has sufficiently come out of the external side of the frame, as shown in the figure below.

Mount the hold cover

1 Mount the hold cover in the reverse of the procedures on page 60, “Remove the hold cover”.

- Make sure to mount the hold cover so that the roller drive belt can be seen.
9. Maintenance/Inspection

9-4. Replacement of the carrier wheel cassette

Before replacement

If any abnormalities are found in the carrier wheels, replace the whole carrier wheel cassette.

1. Before replacement, prepare necessary tools.

![Tools to be used]

- 8 mm/19 mm wrench
- 5 mm hex. wrench
- Slotted screwdriver

2. Turn off the power of all connecting devices.

- Shut off the power switch, leave for three minutes or more, and discharge electricity inside the DC power supply equipment.
- Wear protective equipment, such as gloves.

Replacement procedure

Removing roller transfer MDR/idlers/roller drive belts

Remove the idlers in order, from the edge of the module to the position where the carrier wheel cassette to be replaced can be removed.

9-3. Replacement of roller transfer MDR/idlers/roller drive belts

- Removing roller transfer MDR/idlers/roller drive belts

Remove the carrier wheel cassette

1. Remove hex. bolts at four positions circled on the carrier wheel cassette to be replaced, and lift up the cassette.

- When removing hex. bolts, be careful not to drop them and/or the hex. wrench on the lower part of the F-RAT.
9. Maintenance/Inspection

Replacement procedures

Mounting the carrier wheel cassette on the F-RAT main unit

1. Check the model of the removed carrier wheel cassette and replacement carrier wheel cassette.

   Indication example)
   \[ \text{NX-75CC75A} \]
   This part of the carrier wheel cassette is indicated on the product.

2. Mount the replacement carrier wheel cassette with hex. bolts at four positions circled in the figure, and secure it.

   The tightening torque of 11 N·m is recommended. Excessive tightening may result in damage to hex. bolts.

Mounting roller transfer MDR/idlers/roller drive belts

Mount the roller transfer MDR, idlers, and/or roller drive belt that have been removed.

Refer to P.62

Replacement of roller transfer MDR/idlers/roller drive belts

Mounting roller transfer MDR/idlers/roller drive belts
10. Troubleshooting
## 10. Troubleshooting

If you believe the product may be malfunctioning, check the contents described in this section before contacting the supplier and/or asking for repair.

### Symptoms

#### F-RAT does not operate

<table>
<thead>
<tr>
<th>Items to be checked</th>
<th>Countermeasures</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is PWR LED (Green) for each driver card ON? Or, has 24 VDC been supplied</td>
<td>Supply 24V DC.</td>
<td>7. Installation/ Wiring (⇒P.23)</td>
</tr>
<tr>
<td>in the power connector part of driver cards?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is ERR LED (Red) for each driver card blinking, or is it ON and is there an</td>
<td>Remove the cause of error, and</td>
<td>9. Maintenance/ inspection (⇒P.54)</td>
</tr>
<tr>
<td>error output?</td>
<td>release the error.</td>
<td></td>
</tr>
<tr>
<td>Has each connector been connected correctly? Has wiring been performed properly?</td>
<td>Check wiring, and perform</td>
<td>7. Installation/ Wiring (⇒P.23)</td>
</tr>
<tr>
<td></td>
<td>wiring properly if it has not</td>
<td></td>
</tr>
<tr>
<td></td>
<td>already been done so.</td>
<td></td>
</tr>
<tr>
<td>Has each driver card type * (NPN input/output / PNP input/output) matched the</td>
<td>Match each driver card type (NPN</td>
<td>7. Installation/ Wiring (⇒P.23)</td>
</tr>
<tr>
<td>input and output signals (NPN input/output / PNP input/output) on PLCs?</td>
<td>input/output / PNP input/output) with</td>
<td></td>
</tr>
<tr>
<td>*Check the model of driver cards.</td>
<td>the input and output signals on PLCs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(NPN input/output / PNP input/output).</td>
<td></td>
</tr>
<tr>
<td>Has the same voltage to be input as the power supply voltage been used?</td>
<td>Use the same voltage to be input as</td>
<td>7. Installation/ Wiring (⇒P.23)</td>
</tr>
<tr>
<td></td>
<td>the power supply voltage.</td>
<td></td>
</tr>
</tbody>
</table>

#### The transfer surface cannot be switched, or transfer surface switching operation is incorrect

<table>
<thead>
<tr>
<th>Items to be checked</th>
<th>Countermeasures</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has the initial setting (teaching setting) been performed?</td>
<td>Perform the initial setting (teaching</td>
<td>Initial setting</td>
</tr>
<tr>
<td></td>
<td>setting).</td>
<td>(Teaching setting) (⇒P.50)</td>
</tr>
<tr>
<td>Is ERR LED (Red) on the driver card for M3: drive switching blinking, or is it ON</td>
<td>Remove the cause of error, and</td>
<td>9. Maintenance/ inspection (⇒P.54)</td>
</tr>
<tr>
<td>and is there an error output?</td>
<td>release the error.</td>
<td></td>
</tr>
<tr>
<td>Has the RUN signal input to the driver card for M3: drive switching corresponded to</td>
<td>Check the signal input and input</td>
<td>8. Control/ Operation (⇒P.40)</td>
</tr>
<tr>
<td>the transfer surface? Also, is the input timing correct?</td>
<td>timing when the transfer surface is</td>
<td></td>
</tr>
<tr>
<td></td>
<td>switched.</td>
<td></td>
</tr>
<tr>
<td>Has the setting of the driver card for M3: drive switching not been changed?</td>
<td>Check the setting of the driver card</td>
<td>8. Control/ Operation (⇒P.40)</td>
</tr>
<tr>
<td></td>
<td>for M3: drive switching switch.</td>
<td></td>
</tr>
</tbody>
</table>
## 10. Troubleshooting

### Symptoms

When loading, trays get stuck, or cannot be transferred

<table>
<thead>
<tr>
<th>Items to be checked</th>
<th>Countermeasures</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the load conveyor level the same as the level of the F-RAT?</td>
<td>Align levels of the load conveyor and the F-RAT.</td>
<td>7. Installation/Wiring</td>
</tr>
<tr>
<td>When loading by carrier wheels, have they been set on the top of the surface?</td>
<td>Set either carrier wheels or rollers on the top of the surface according to the loading direction.</td>
<td>8. Control/Operation</td>
</tr>
<tr>
<td>When loading by rollers, have they been set on the top of the surface?</td>
<td>Run either carrier wheel MDR (M1) or roller MDR (M2) according to the loading direction until transfer ends.</td>
<td>8. Control/Operation</td>
</tr>
<tr>
<td>When loading by carrier wheels, have you run the carrier wheel MDR (M1)?</td>
<td>Replace the carrier wheel cassette including the slow rotating wheels.</td>
<td>9. Maintenance/inspection</td>
</tr>
<tr>
<td>When loading by rollers, have you run the roller MDR (M2)? Also, have you run the MDR until loading ends?</td>
<td>Do not run the drive switching MDR (M3) until transfer ends.</td>
<td>8. Control/Operation</td>
</tr>
<tr>
<td>Has the transfer drive switching MDR (M3) not run at the time of loading?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When discharging, trays get stuck, or cannot be transferred

<table>
<thead>
<tr>
<th>Items to be checked</th>
<th>Countermeasures</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the discharge conveyor level same as the level of the F-RAT?</td>
<td>Align levels of the discharge conveyor and the F-RAT.</td>
<td>7. Installation/Wiring</td>
</tr>
<tr>
<td>When discharging by carrier wheels, have they been set on the top of the surface?</td>
<td>Set either carrier wheels or rollers on the top of the surface according to the discharging direction.</td>
<td>8. Control/Operation</td>
</tr>
<tr>
<td>When discharging by rollers, have they been set on the top of the surface?</td>
<td>Run either carrier wheel MDR (M1) or roller MDR (M2) according to the discharging direction until discharging ends.</td>
<td>8. Control/Operation</td>
</tr>
<tr>
<td>When discharging by carrier wheels, have you run the carrier wheel MDR (M1)?</td>
<td>Replace the carrier wheel cassette including the slow rotating wheels.</td>
<td>9. Maintenance/inspection</td>
</tr>
<tr>
<td>When discharging by rollers, have you run the roller MDR (M2)? Also, have you run the MDR until discharging ends?</td>
<td>Do not run the drive switching MDR (M3) until discharging ends.</td>
<td>8. Control/Operation</td>
</tr>
<tr>
<td>Has the transfer drive switching MDR (M3) not run at the time of discharging?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 10. Troubleshooting

#### Symptoms
- The speed cannot be changed
- The speed setting is incorrect

<table>
<thead>
<tr>
<th>Items to be checked</th>
<th>Countermeasures</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>To change the carrier wheel speed, have you operated the switch on the driver card for M1: carrier wheels [CBK-109]? &lt;br&gt; To change the roller speed, have you operated the switch on the driver card for M2: rollers [CB-016]?</td>
<td>To change the carrier wheel speed, operate the switch on the driver card for M1: carrier wheels [CBK-109]. &lt;br&gt; To change the roller speed, operate the switch on the driver card for M2: rollers [CB-016].</td>
<td>Changing the transfer speed (⇒P.47)</td>
</tr>
<tr>
<td>Have you changed the external speed by the voltage input to CN2#3 on CBK-109/CB-016? &lt;br&gt; Have you changed the internal speed with the switch on CBK-109/CB-016?</td>
<td>Check the external and internal speed settings, and change the speed according to the settings.</td>
<td>Changing the transfer speed (⇒P.47)</td>
</tr>
<tr>
<td>When changing the speed by the external voltage, is the power supply 0 V of the external voltage common to 0 V on the driver card?</td>
<td>Use the common power supply 0V.</td>
<td>7. Installation/Wiring (⇒P.23)</td>
</tr>
</tbody>
</table>

The transfer direction (rotating direction of carrier wheels/rollers) is incorrect

<table>
<thead>
<tr>
<th>Items to be checked</th>
<th>Countermeasures</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the transfer/diverting direction based on the rotating direction settings for the driver card for M1: carrier wheels/M2: rollers?</td>
<td>Set the correct transfer/diverting direction, and the correct the rotating direction for the driver card for M1: carrier wheels/ M2: rollers.</td>
<td>8. Control/ Operation (⇒P.40)</td>
</tr>
</tbody>
</table>
Appendix 1.
Product specifications

F-RAT main unit specifications

### Size 60

<table>
<thead>
<tr>
<th>F-RAT main unit</th>
<th>6040</th>
<th>6050</th>
<th>6060</th>
<th>6070</th>
<th>6080</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total length (L) Carrier wheel transfer direction</td>
<td>595mm</td>
<td>595mm</td>
<td>595mm</td>
<td>595mm</td>
<td>595mm</td>
</tr>
<tr>
<td>Total width (W) Roller transfer direction</td>
<td>395mm</td>
<td>495mm</td>
<td>595mm</td>
<td>695mm</td>
<td>795mm</td>
</tr>
<tr>
<td>Weight</td>
<td>32kg</td>
<td>38kg</td>
<td>44kg</td>
<td>52kg</td>
<td>60kg</td>
</tr>
<tr>
<td>Maximum load weight</td>
<td>50kg</td>
<td>50kg</td>
<td>50kg</td>
<td>50kg</td>
<td>50kg</td>
</tr>
</tbody>
</table>

### Size 75

<table>
<thead>
<tr>
<th>F-RAT main unit</th>
<th>7540</th>
<th>7550</th>
<th>7560</th>
<th>7570</th>
<th>7580</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total length (L) Carrier wheel transfer direction</td>
<td>745mm</td>
<td>745mm</td>
<td>745mm</td>
<td>745mm</td>
<td>745mm</td>
</tr>
<tr>
<td>Total width (W) Roller transfer direction</td>
<td>395mm</td>
<td>495mm</td>
<td>595mm</td>
<td>695mm</td>
<td>795mm</td>
</tr>
<tr>
<td>Weight</td>
<td>42kg</td>
<td>48kg</td>
<td>54kg</td>
<td>63kg</td>
<td>71kg</td>
</tr>
<tr>
<td>Maximum load weight</td>
<td>50kg</td>
<td>50kg</td>
<td>50kg</td>
<td>50kg</td>
<td>50kg</td>
</tr>
</tbody>
</table>

### Size 90

<table>
<thead>
<tr>
<th>F-RAT main unit</th>
<th>9040</th>
<th>9050</th>
<th>9060</th>
<th>9070</th>
<th>9080</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total length (L) Carrier wheel transfer direction</td>
<td>895mm</td>
<td>895mm</td>
<td>895mm</td>
<td>895mm</td>
<td>895mm</td>
</tr>
<tr>
<td>Total width (W) Roller transfer direction</td>
<td>395mm</td>
<td>495mm</td>
<td>595mm</td>
<td>695mm</td>
<td>795mm</td>
</tr>
<tr>
<td>Weight</td>
<td>52kg</td>
<td>58kg</td>
<td>64kg</td>
<td>74kg</td>
<td>82kg</td>
</tr>
<tr>
<td>Maximum load weight</td>
<td>50kg</td>
<td>50kg</td>
<td>50kg</td>
<td>50kg</td>
<td>50kg</td>
</tr>
</tbody>
</table>

* Values of the maximum load weight are reference only since they may change depending on tray conditions. Depending on the bottom shape of trays, they may not be transferred normally, even if they are within the above size range.

### Common

<table>
<thead>
<tr>
<th>Speed</th>
<th>Carrier wheel</th>
<th>61.6 m/min (PM570KT-55 type)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Roller</td>
<td>17.4 m/min (PM486FE-17 type)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>61.7 m/min (PM486FE-60 type)</td>
</tr>
</tbody>
</table>

* The above shows the transfer speed when trays are not placed on carrier wheels and rollers with SW1#5 ON / SW5: 9 specified on CBK-109 and CB-016.

#### Installation environment

- Ambient temperature: 0 to 40°C (no freezing)
- Ambient humidity: 90%RH or less (no condensation)
- Altitude: 1,000 m or less
- Atmosphere: No corrosive gas
- Vibration: 0.5G or less
- Installation location: Indoor
- Mounting surface tilt (inclination): 0.5% or less
- Pollution degree: 2 (according to the definition of IEC60640-1, UL840)

#### Product label

```
FRAT NX75 - F60 - 7540 - CN
RATED INPUT: DC24V, FE 2 A, KT 3 A
PAYLOAD: max 4 kg

ITOH DENKI CO., LTD
MADE IN JAPAN

1 Product model
2 Rated current values for roller transfer MDR and drive switching MDR
3 Rated current values for carrier wheel transfer MDR
4 Maximum load weight

Serial No. (YY/MM/DD/Lot No.)
5 Year (last two digits)
6 Month
7 Day
8 Lot No. (three digits)
```
Appendix

Appendix 1.
Product specifications

Driver card specifications

<table>
<thead>
<tr>
<th></th>
<th>For carrier wheel transfer</th>
<th>For roller transfer</th>
<th>For drive switching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>CB-109F</td>
<td>CB-016B</td>
<td>HBM-201B</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>24V DC±10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated voltage</td>
<td>24V DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Static current</td>
<td>0.06A</td>
<td>0.03A</td>
<td>0.06A</td>
</tr>
<tr>
<td>Starting current</td>
<td>6.6A to 7.4A</td>
<td>4.0A</td>
<td>3.7A to 4.4A</td>
</tr>
<tr>
<td>Peak current</td>
<td>30A (1ms or less)</td>
<td>20A (1ms or less)</td>
<td>20A (1ms or less)</td>
</tr>
<tr>
<td>Wire diameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power connector (CN1)</td>
<td>0.80 to 1.5mm² (AWG: 18 to 14)</td>
<td>0.50 to 1.5mm² (AWG: 20 to 14)</td>
<td>0.50 to 1.5mm² (AWG: 20 to 14)</td>
</tr>
<tr>
<td>Control connector (CN2)</td>
<td>0.08 to 0.5mm² (AWG: 28 to 20)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection</td>
<td>Incorrect wiring protection</td>
<td>Incorrect wiring protection</td>
<td>Incorrect wiring protection</td>
</tr>
<tr>
<td>Current limitation</td>
<td>7.0A</td>
<td>4.0A</td>
<td>4.0A</td>
</tr>
<tr>
<td>Operating environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>0 to 40°C (no freezing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>90%RH or less (no condensation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atmosphere</td>
<td>No corrosive gas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>0.5G or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation location</td>
<td>Indoor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time from RUN signal input to motor starting</td>
<td>15 msec or less</td>
<td>15 msec or less</td>
<td></td>
</tr>
</tbody>
</table>

Transfer throughput

- F-RAT-NX75, nominal speed of 60 m/min, size 6050 type
- Using area sensors
- Ambient temperature: 20°C
- Conditions of trays: Cardboard of L 405 mm × W 35030 kg
- Depends on the diverting conditions from the status where trays remain in each load C/V zone

* Values on the graph are only references based on our measurement and are not guaranteed.
* Slug release data is based on the total control by using idLinx for controlling the conveyors before and after F-RAT.
* The stopping distance of trays and throughput depends on the size, material, bottom status of trays, ambient temperature, and/or the speed.
Replacement parts/Options

## Appendix 2. Replacement parts/Options

<table>
<thead>
<tr>
<th>Part name</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier wheel cassette</td>
<td>NX75-CC60 ○ Indicates a type of the cassette. For details, refer to P.58.</td>
</tr>
<tr>
<td>Size 60 ○</td>
<td></td>
</tr>
<tr>
<td>Size 75 ○</td>
<td></td>
</tr>
<tr>
<td>Size 90 ○</td>
<td></td>
</tr>
<tr>
<td>Roller drive belt (V-ribbed pulley)</td>
<td>2PJ-265 (2PJ-246) Only for belts, size 60 ○ type, which are used to link idlers.</td>
</tr>
<tr>
<td>Size 60 ○</td>
<td>PM486FE-(17/60) ○ 3 -542-D-024-JA-Z150-JA-VN</td>
</tr>
<tr>
<td>Size 75 ○</td>
<td>PM486FE-(17/60) ○ 3 -692-D-024-JA-Z150-JA-VN</td>
</tr>
<tr>
<td>Size 90 ○</td>
<td>PM486FE-(17/60) ○ 3 -842-D-024-JA-Z150-JA-VN</td>
</tr>
<tr>
<td>Idler</td>
<td>ARI-38-542-JC-VN φ 38</td>
</tr>
<tr>
<td>Size 60 ○</td>
<td>ARI-48-542-JB-VN φ 48.6</td>
</tr>
<tr>
<td>Size 75 ○</td>
<td>ARI-38-692-JC-VN φ 38</td>
</tr>
<tr>
<td>Size 90 ○</td>
<td>ARI-48-692-JB-VN φ 48.6</td>
</tr>
<tr>
<td>Driver card</td>
<td>CBK-109F ○ (for carrier wheel transfer MDR)</td>
</tr>
<tr>
<td>Specify the N=NPN/P=PNP type based on the input and output type.</td>
<td></td>
</tr>
<tr>
<td>Options Extension cable</td>
<td>CB-016B ○ (for roller transfer MDR)</td>
</tr>
<tr>
<td>CBK-109F ○ (for carrier wheel transfer MDR)</td>
<td></td>
</tr>
<tr>
<td>HBM-201B ○ (for drive switching MDR)</td>
<td></td>
</tr>
</tbody>
</table>

### CBK-109 : 12P extension cable length

<table>
<thead>
<tr>
<th>Model</th>
<th>12P extension cable length</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE-CBM-G0600</td>
<td>L= 600mm</td>
</tr>
<tr>
<td>ACE-CBM-G0850</td>
<td>L= 850mm</td>
</tr>
<tr>
<td>ACE-CBM-G1200</td>
<td>L=1200mm</td>
</tr>
</tbody>
</table>

### CB-016 / HBM-201 : 10P extension cable length

<table>
<thead>
<tr>
<th>Model</th>
<th>10P extension cable length</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE-CBM-A0600</td>
<td>L= 600mm</td>
</tr>
<tr>
<td>ACE-CBM-A0850</td>
<td>L= 850mm</td>
</tr>
<tr>
<td>ACE-CBM-A1200</td>
<td>L=1200mm</td>
</tr>
</tbody>
</table>

### Stay

(with hex. bolt/plain washer/spring washer)

<table>
<thead>
<tr>
<th>Size</th>
<th>L</th>
<th>X (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6040 / 7540 / 9040</td>
<td>370</td>
<td>400</td>
</tr>
<tr>
<td>6050 / 7550 / 9050</td>
<td>470</td>
<td>500</td>
</tr>
<tr>
<td>6060 / 7560 / 9060</td>
<td>570</td>
<td>600</td>
</tr>
<tr>
<td>6070 / 7570 / 9070</td>
<td>670</td>
<td>700</td>
</tr>
<tr>
<td>6080 / 7580 / 9080</td>
<td>770</td>
<td>800</td>
</tr>
</tbody>
</table>

### Safety precautions

- Do not store carrier wheel cassettes in places subject to high temperature, high humidity, and/or direct sunlight. Failure to follow this could result in its lifetime to be significantly shortened.

### Troubleshooting

- For X dimensions (between frames) other than those mentioned above, contact us.
Appendix 3. Residual risk list/MAP

Residual risk list

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation stage</th>
<th>Work</th>
<th>Qualifications/education required for work</th>
<th>Locations on machine</th>
<th>Seriousness of harm</th>
<th>Remaining risk factors</th>
<th>Examples of assumed measures</th>
<th>Measures that have been taken independently</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Installation</td>
<td>Unpack/Carry</td>
<td></td>
<td>Metal parts on the product</td>
<td>CAUTION</td>
<td>Hands may get injured by metal parts of the product</td>
<td>Wear protective equipment, such as gloves, when working.</td>
<td>Described in the instruction manual</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Installation</td>
<td>Carry</td>
<td></td>
<td>No particular location</td>
<td>CAUTION</td>
<td>Carrying the heavy load alone may result in damage to the main machine unit, and/or injury to the body</td>
<td>Have more than one person hold and support the bottom when carrying.</td>
<td>Described in the instruction manual</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Installation</td>
<td>Carry/Install</td>
<td></td>
<td>No particular location</td>
<td>CAUTION</td>
<td>Dropping the product or letting it fall when carrying and/or installing may result in damage to the main machine unit, and/or injury to the body</td>
<td>Check safety of installation location in advance, and wear protective equipment, such as protective glasses, footwear, and/or gloves, when working</td>
<td>Described in the instruction manual</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Installation</td>
<td>Install</td>
<td>Having carefully read the user manual, and having full knowledge of all the contents</td>
<td>Bottom of the product</td>
<td>CAUTION</td>
<td>Fingers may get stuck and workers may be injured when securing the main unit on the stay</td>
<td>When putting the main unit on the stay, hold the very bottom of the main unit, and prevent fingers from getting stuck</td>
<td>Described in the instruction manual</td>
<td>33</td>
</tr>
<tr>
<td>5</td>
<td>Operation</td>
<td>Trial run</td>
<td></td>
<td>No particular location</td>
<td>CAUTION</td>
<td>At the trial run by the single unit, trays may flow to this product</td>
<td>Stop the surrounding conveyor operation before starting operation</td>
<td>Described in the instruction manual</td>
<td>43</td>
</tr>
<tr>
<td>6</td>
<td>Operation</td>
<td>All during operation</td>
<td></td>
<td>Gaps between the moving parts, or moving and fixed parts</td>
<td>WARNING</td>
<td>Workers’ fingers and/or hands may get stuck in gaps between the moving parts, or moving and fixed parts of the main unit</td>
<td>Do not touch this product during operation</td>
<td>• Posting of warning and caution labels</td>
<td>Described in the instruction manual</td>
</tr>
<tr>
<td>7</td>
<td>Operation</td>
<td>All during operation</td>
<td></td>
<td>Top panel of the product</td>
<td>CAUTION</td>
<td>Workers may step on the main unit and lose their footing, or may fall when the main unit moves</td>
<td>Keep workers informed thoroughly about the prohibition of stepping on the machine</td>
<td>Described in the instruction manual</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>Operation</td>
<td>All during operation</td>
<td></td>
<td>No particular location</td>
<td>CAUTION</td>
<td>If problems occur, trays may collide with each other, and pop out of the equipment</td>
<td>For example, mount guide rails on the conveyor frames, and prevent trays from popping</td>
<td>Described in the instruction manual</td>
<td>11</td>
</tr>
<tr>
<td>9</td>
<td>During maintenance/inspection</td>
<td>All during maintenance/inspection</td>
<td></td>
<td>Power supply part to the product (driver card)</td>
<td>WARNING</td>
<td>Persons turning on the power without notice may result in unexpected operation of the product, and/or injury of workers</td>
<td>Post warning labels so as to prevent unauthorized persons from turning on the power</td>
<td>Described in the instruction manual</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>During maintenance/inspection</td>
<td>All during maintenance/inspection</td>
<td></td>
<td>No particular location</td>
<td>WARNING</td>
<td>Workers’ fingers and/or hands may get stuck in the product, and injured</td>
<td>• Wear protective equipment, such as protective glasses, footwear, and/or gloves • Do not put hands close to rotating parts • Take off gloves when workers need to get your hands close to rotating parts during operation.</td>
<td>Described in the instruction manual</td>
<td>13</td>
</tr>
</tbody>
</table>

Residual risk MAP

No.1 CAUTION No.4 CAUTION No.6 WARNING No.7 CAUTION No.9 WARNING

Residual risk for which location on the machine has not been identified
No.2 CAUTION No.8 CAUTION No.3 CAUTION No.10 WARNING No.5 CAUTION
Technology for tomorrow

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