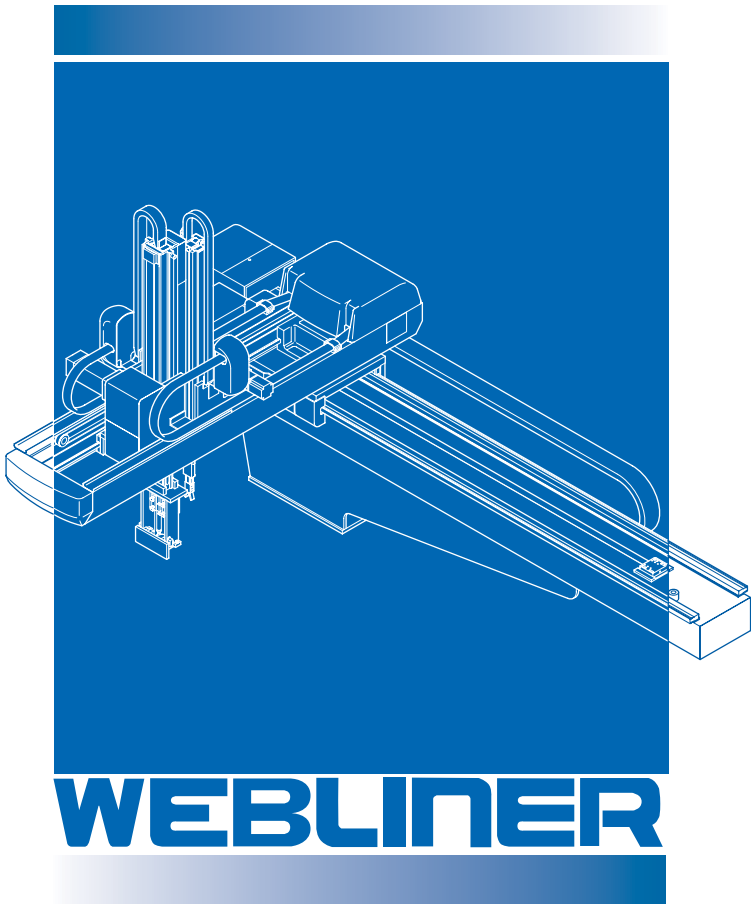
For maintenance staff

TAKE-OUT ROBOT
MAINTENANCE MANUAL



WEBLINER

This manual provides information on the following models.

- RA Ⅱ -α-1300S
- RA Ⅱ -α-1300D

CAUTION

Deliver this manual for the related department.
Read this manual before operation.

Version 1.0

Heartful Technology

Yushin

■**Greetings**

Thank you for purchasing a Yushin take-out robot. We strive every day to develop and manufacture take-out robots that are one step ahead of competition and we are confident that you will be satisfied with your new take-out robot. In order to use your new take-out robot to its fullest potential, please read this manual carefully and use the take-out robot correctly.

We will continue our efforts to improve our technology and services so that we can provide you with even better products in the future. We look forward to your ongoing patronage.

Yushin Precision Equipment Co., Ltd.

Taking the Robot abroad

- When the entire take-out robot or any part thereof is to be taken abroad after delivery to the original purchaser, the purchaser must obtain legal permission to export the robot according to the laws in both the exporting country and the importing country. Yushin Precision Equipment Co., Ltd. will assume no responsibility whatsoever if the purchaser exports the robot without following the required procedures.

Disclaimers

- The content of this manual is subject to change without notice.
- While every effort has been made to ensure the accuracy of the information in this manual, we invite you to inform us if any errors or questionable content is discovered.
- The various data included in this manual is intended to serve as reference data concerning the take-out robot. Yushin Precision Equipment Co., Ltd., is not regally bound in any way whatsoever by these data.
- Yushin Precision Equipment Co., Ltd., assumes no responsibility whatsoever for damage or lost profits resulting from modifications, disassembly, misuse, inadequate installation environment, or any other situation beyond our control.
- Yushin Precision Equipment Co., Ltd., assumes no responsibility whatsoever for damage or lost profits resulting from the use of this equipment.

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- The copyrights associated with the freeware “UNLHA32.DLL” are held by the author thereof, namely Micco.

INTRODUCTION

Thank you for purchasing a Yushin take-out robot. This take-out robot is designed to be part of a fully automated manufacturing system for plastic parts. When used in conjunction with an injection molding machine, this take-out robot can be used as a single automatic means to handle such processes as taking the molded products out of the injection molding machine and casing the products.

In order to use the take-out robot efficiently and to its full potential, read this manual before using the take-out robot. After reading the manual, keep it in a convenient location for easy reference.

Take-out robot manuals

The following manuals are provided.

- **Operation manual**
  This manual, provided for an operation staff, explains how to operate the take-out robot.

- **Data maintenance manual**
  This manual is intended for mold data management personnel and a robot installation/ maintenance staff. It explains how to teach the take-out robot and how to manage the mold data.

- **Parts catalog**
  This catalog, provided for a maintenance staff, contains information regarding replacement parts for the take-out robot. It includes a list of parts numbers.

Safety symbols

This manual employs the following safety symbols for the safety of operation.

Pay special attention to the messages with these symbols when reading this manual.

Each safety symbol has the following meaning.

DANGER

A danger notice with this symbol indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

A warning notice with this symbol indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

A caution notice with this symbol indicates a potentially hazardous situation which, if not avoided, may result in minor/moderate injury or property damage.

This symbol indicates that you should be careful in handling workpieces.


Inflammables


High temperature


Electric shock


Biting of fingers

This symbol indicates that a certain action is prohibited.


Don't do this


Don't disssemble


Don't cause fire


Don't touch

This symbol indicates that a certain action should be done.


Do this


Disconnect plug


Ground terminal

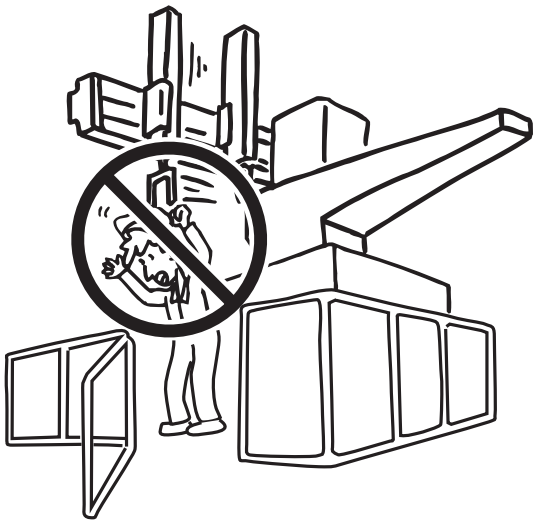
In addition to the above symbols and messages, the following symbol is used to give supplemental information or advice.

- This symbol is used to give supplemental information or advice.

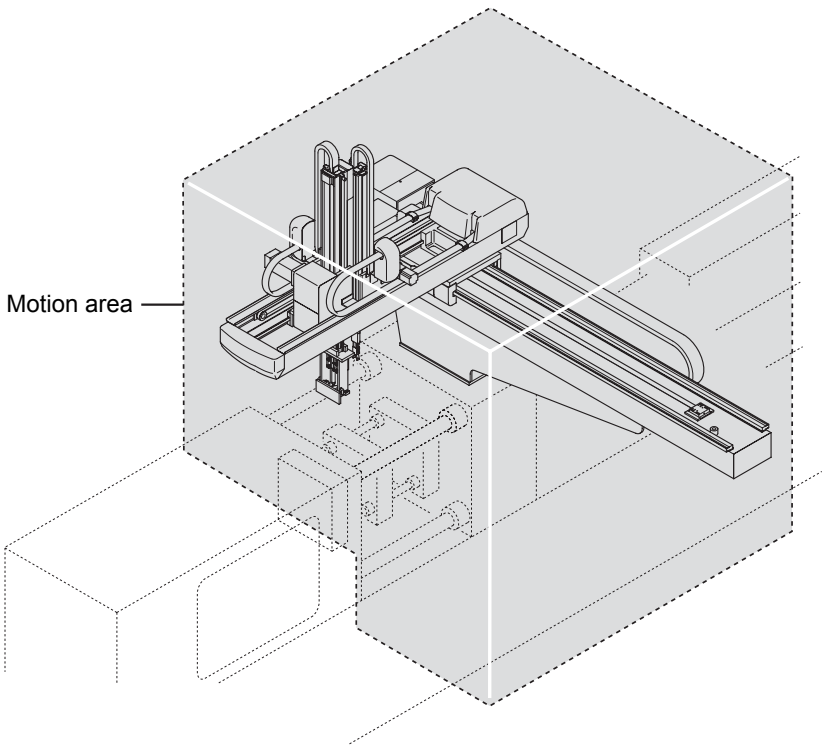
Safety notices related to take-out robot operation

DANGER

- Do not enter the robot motion area when the take-out robot is in operation.



- The robot motion area is indicated by the shaded portion in the figure below. Install a safety fence so that personnel will not enter this area. A serious accident could result if someone enters the robot motion area during Auto operation.



WARNING

- Stay away from the safety fence and the robot motion area when the take-out robot is in operation. Do not climb over the fence or lean objects against it.

- Do not open or remove the safety fence or the safety gate while the take-out robot is in operation. Always operate the take-out robot from outside the safety fence.

- Do not put any vessel containing water, such as a vase or glass, on top of the robot body or the control devices. If water spills over the robot body or the control devices, electric shock could result.

- Do not put any small pieces of metal, such as paper clips or staples, on the robot body or the control devices. If such objects fall into the robot body or the control devices, a short circuit could occur and a fire or electric shock could result.

- Do not put heavy objects on the robot body or the control devices. The take-out robot may become unbalanced and fall over, causing the heavy object to fall and injure a person.

- Do not place objects on the operator station or inadvertently press the deadman switch with your hand. Axis operation will be enabled, presenting the danger of accidental operation.

- Do not use highly flammable sprays near the take-out robot. A fire could result.

WARNING

- If an air leak is discovered in the pneumatic tubing, be sure to stop the take-out robot and then remove the cause of the air leak.
  If an error message is displayed, check the error message section in this manual and make sure that the take-out robot is at a halt. Then inform the maintenance personnel designated by the take-out robot safety supervisor or contact us.

- Check the following before turning ON the take-out robot control power and the main power.
  - No persons are in the robot motion area.
  - The touch panel and other tools are located in their specified positions.
  - No foreign objects are on the moving frame of the take-out robot.

- If any of the following cases occurs, immediately stop operation and turn OFF the control power and the main power. Then inform the maintenance personnel designated by the take-out robot safety supervisor or contact us. Continued operation could result in a fire.
  - Smoke rises from the take-out robot or operator station or the outside surface of the take-out robot is abnormally hot.
  - An abnormal noise is heard.
  - Water or other substance has gotten inside the take-out robot.

- If anything abnormal occurs while the injection molding machine and the take-out robot are in operation, press the emergency stop switch immediately. If an error message is displayed, check the error message section in this manual and then inform the maintenance personnel designated by the take-out robot safety supervisor or contact us.

CAUTION

- Do not attempt to modify the robot body or the control device. Contact us if modification is required.

- Do not use air that contains any of the substances indicated below. Also, make sure these substances are not contained in the surrounding air. Use only clean air.
  - Organic solvents
  - Phosphate-base hydraulic oil
  - Sulfur dioxide gas
  - Chroline gas
  - Deteriorated compressor oil
  - Acids

- Do not move or remove the attention plates or labels.

- Do not overturn the operator station, drop the touch panel controller or CF card, or otherwise subject these items to severe physical shock.

- Do not use any operating fluid other than compressed air.

- Do not cut or otherwise damage the pneumatic tubing. Damaged tubing could result in air leakage

- When lowering the take-out arm in manual mode, make sure the take-out arm does not contact the mold. Be sure to operate the take-out arm from outside the safety fence.

CAUTION

- Use the correct pneumatic pressure.
  Pneumatic pressure: 3.9 to 4.9 $\times 10^5$ Pa (Gauge).

- Provide a handbook consisting of guidelines regarding the following items and make sure that every operator observes them.
  - Signs used when a group of persons works together
  - Signs used between take-out robot operators and operators of linked equipment.

- When the take-out robot is not going to be used for several days or longer, turn OFF the control power and the main power and pull out the plug to ensure safety.
  Otherwise, insulation deterioration may cause electric shock or current leakage.

- Wear appropriate clothing when operating the take-out robot. Remove neckties and other ornamental items or secure them so that they do not hang outside of your clothing.

- Do not operate the take-out robot when not feeling well.

Safety notices related to installation

WARNING

- Provide a safety fence so that personnel cannot easily enter the dangerous area (motion area) of the take-out robot while the robot is in operation.

- Make sure the safety fence satisfies the following requirements:
  - The safety fence shall have sufficient strength to withstand the forces and environmental conditions that exist when the robot is in operation. It shall also be onstructed so that it cannot be easily adjusted, removed, or climbed over.
  - The safety fence shall not have any sharp protrusions or other objects that might injure personnel.
  - The safety fence shall be fixed.
  - The safety fence shall be equipped with a safety device that stops the take-out robot when the safety gate is opened.

- An emergency stop device that stops the take-out robot immediately should be provided in a position where it can be easily operated in an emergency.

- The robot body mounting section should have sufficient strength and there should not be any looseness after the robot body is installed.

- If necessary, install additional emergency stop switches in locations other than the operator station in order to provide easy access to the emergency stop function in an emergency.

- Install the operator station outside the robot motion area in a location where the operator has an unobstructed view of the take-out robot and its operation.

WARNING

- Install the take-out robot so that there is sufficient workspace for such activities as teaching and maintenance checks.

CAUTION

- Make sure that the operation environment is as follows:
  Temperature: 0 °C to +40 °C
  (32 °F to 104 °F)
  Storage temperature: -15 °C to +65 °C
  (5 °F to 149 °F)
  Humidity: 35 % RH to 85 % RH
  (without drew formation)
  There are to be no corrosive gases or floating particles of electrically conductive material around the take-out robot.

- Provide a rotating light or other light-emitting device to indicate that the take-out robot and the injection molding machine are in operation.

- Before operating the take-out robot, make sure the specified power is supplied. Refer to the take-out robot specifications for details regarding the rated voltage and frequency.

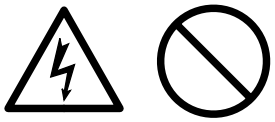
- Flush the pneumatic tubing thoroughly with compressed air before installing it. Chips of material, seal tape, and/or rust generated during the installation process may cause leaks and other malfunctions.

- Use the correct pneumatic pressure.
  Pneumatic pressure: 3.9 to 4.9 $\times 10^5$ Pa (Gauge).

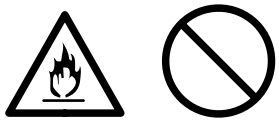
Safety notices related to connecting the power supply and grounding

WARNING

- Do not touch the power plug with wet hands.
  Otherwise, electric shock may result.

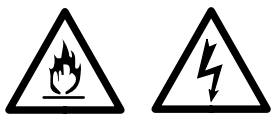


- Do not connect or disconnect the plug from the plug socket with control power turned ON. Otherwise, the plug may be damaged, causing a fire, or the take-out robot may be damaged.

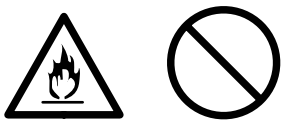


- Always hold the plug when removing the plug from the plug socket. Pulling the power cable may damage the cable, resulting fire or electric shock.

- Do not cut, damage, or modify the power cable. Also, do not pull, bend, or place a heavy object on it. A damaged cable could be the cause of fire or electric shock.



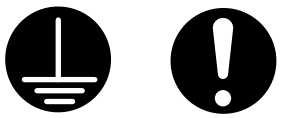
- Do not use an extension cable with an insufficient rating. Otherwise, abnormal heating or burning may result.



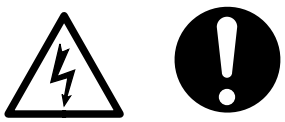
- Do not connect the ground terminal of the plug to the following objects.
  - Gas line (Flashing or explosion may result.)
  - Public telephone line grounding wire or lighting rod (A dangerously large current may flow through the wire when lightning strikes.)
  - Water pipe or faucet (If plastic is used somewhere in the piping, it will not function as a grounding medium.)

WARNING

- Be sure to ground the take-out robot to prevent electric shock from possible current leakage.
  Use a plug socket having a ground terminal that has been installed with Class D grounding or higher.



- Before connecting the cables, be sure to turn OFF the control power. Otherwise, electric shock or mechanical damage may result.



- Remove any dust that is attached to the plug or plug socket. If the dust is not removed, dampness may eventually cause a small current to flow through it, resulting in abnormal heat or fire.

- Provide a cover for any wiring or pneumatic tubing that might otherwise be at risk for damage.

- Have a qualified electrician install the main breaker and the earth leakage breaker of the take-out robot.
  Allow only those personnel who have received basic training in electrical work and been designated by the safety supervisor install the cables for the take-out robot.

CAUTION

- After installing the take-out robot, make sure the specified power is supplied before starting operation.Refer to the specifications for details regarding the rated voltage and frequency.

- Supply the main power for the take-out robot and the injection molding machine from separate power circuits.

- Be sure all connectors are connected correctly.
  Incorrect connections can result in malfunction of the take-out robot. Be especially careful regarding connections with the control devices.

Safety notices related to maintenance

WARNING

- Before cleaning, maintenance, inspection, repair, or adjustment of the take-out robot, be sure to turn OFF the control power and the main power and pull out the power plug. Attempting to perform any of these actions without turning OFF the control power or the main power may result in electric shock or an accident.


- Before performing maintenance operations in the robot motion area, turn OFF the control power and the main power and release the pneumatic pressure. Then put up a notice in the vicinity of the injection molding machine operation panel and the take-out robot operator station warning not to turn ON the control power because of maintenance operations in progress.

- Do not work alone when performing maintenance operations in the robot motion area. Always post an authorized supervisor who is skilled at operating the take-out robot in a position wher he or she can quickly press the emergency stop switch.

- When performing maintenance in the robot motion area, do not allow any personnel other than those conducting the maintenance to enter the robot motion area.

- Before adjusting mechanical parts, stop operating the take-out robot and turn OFF the control power and the main power. Do not make adjustments while the take-out robot is in operation.

- Before adjusting the timing belts, be sure to turn OFF the control power and the main power.

CAUTION

- Be sure to release the pneumatic pressure before replacing the filter bowl.

- Provide a maintenance platform when setting, adjusting, or inspecting the take-out robot at a height or two meters or higher from the floor.

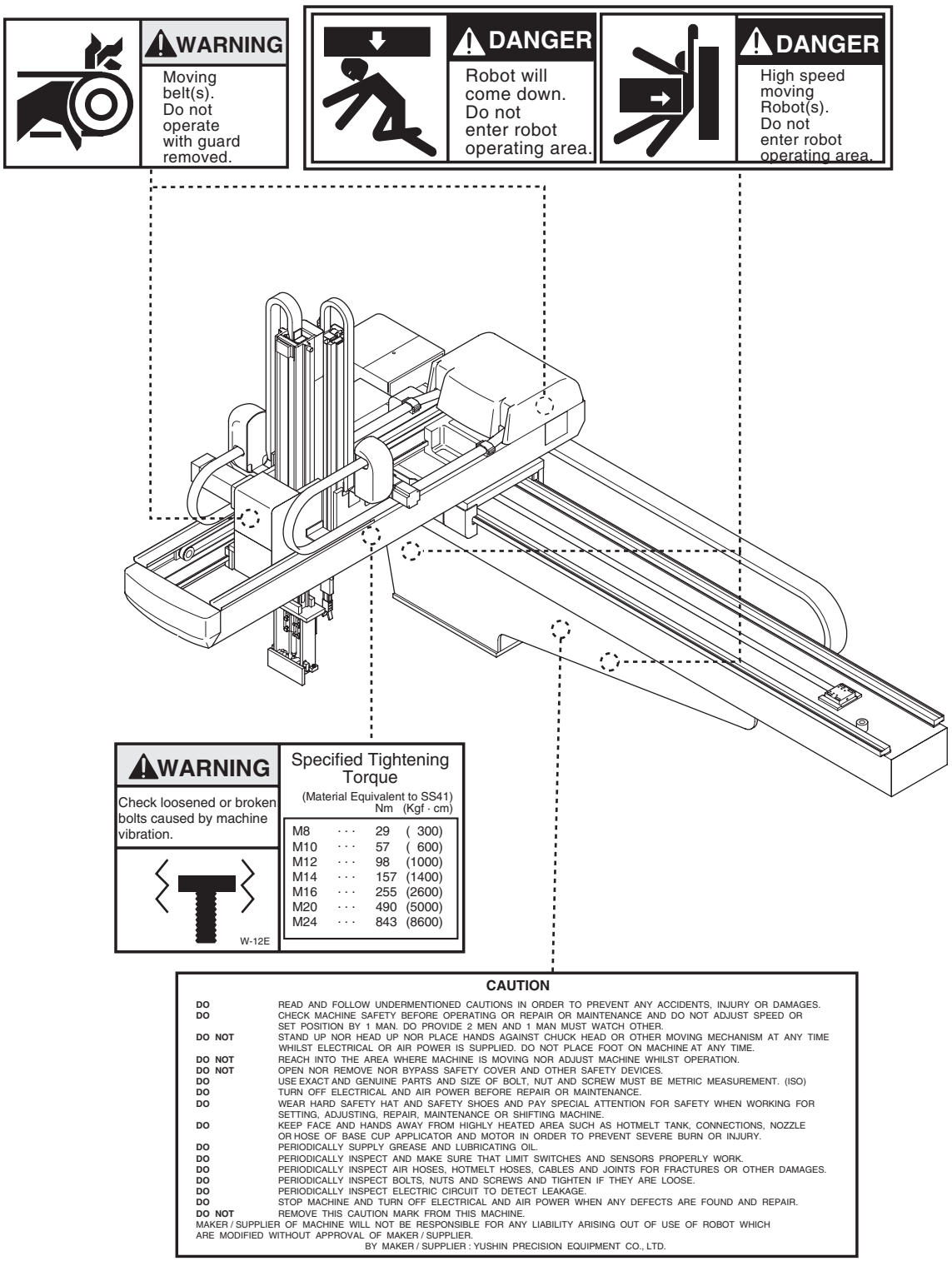
- The maintenance platform should have a level surface, sufficient area to work, and handrails or a fence. Do not make adjustments to the take-out robot while it is in operation.

- Allow maintenance operations to be performed only by those who have knowledge concerning mechanical and electrical maintenance procedures, have been trained in the operation of the take-out robot, and have been granted permission from the safety supervisor.

- Be sure to used the parts specified for replacement.

DANGER, WARNING, and CAUTION labels

The take-out robot is provided with DANGER, WARNING, and CAUTION labels as shown in the figure below. Be sure to observe the information on these labels when operating, inspecting, or performing maintenance on the take-out robot. Do not deface these labels. If any of these labels peels off or becomes dirty or torn, replace it.

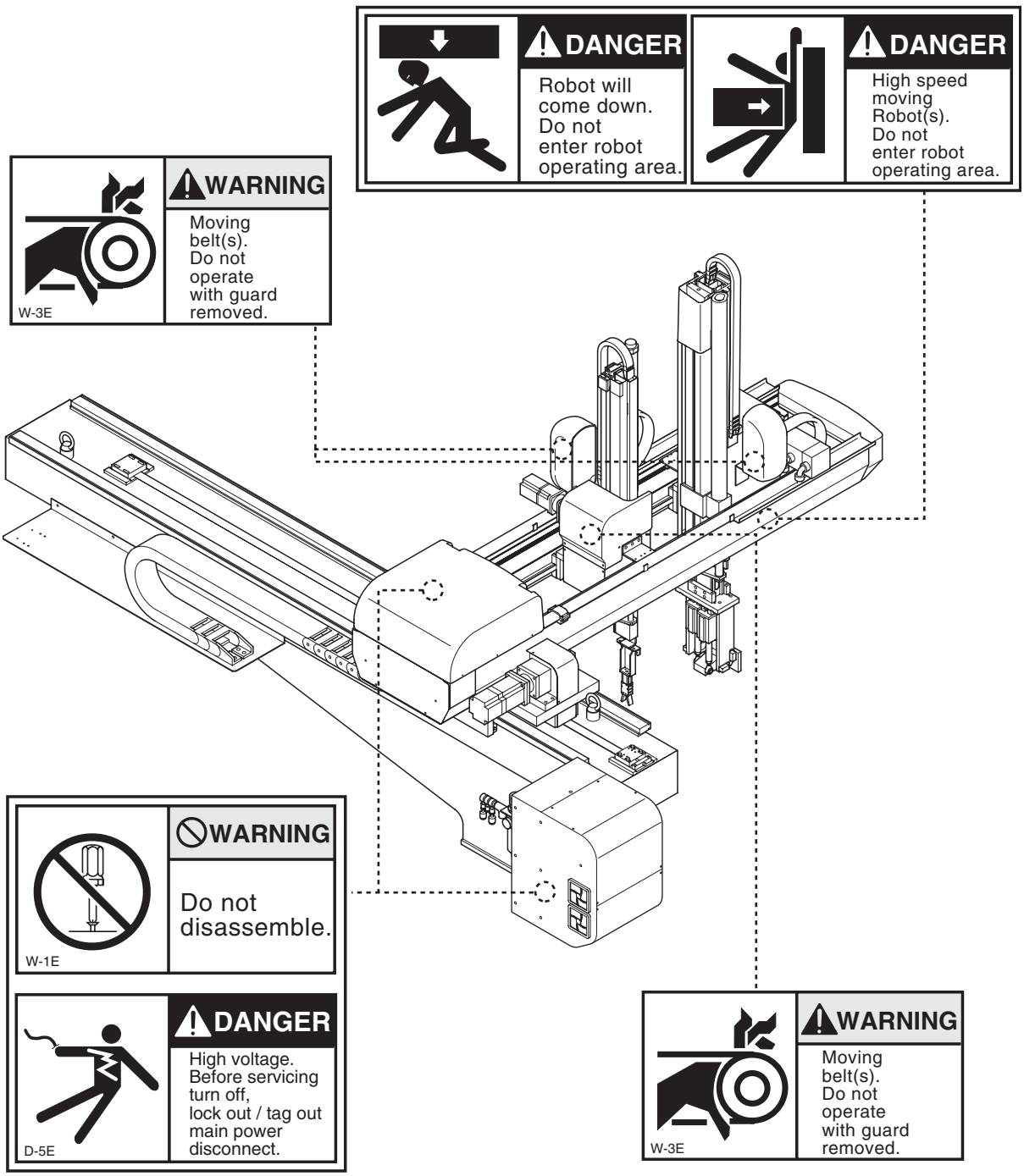


CAUTION

DO	READ AND FOLLOW UNDERMENTIONED CAUTIONS IN ORDER TO PREVENT ANY ACCIDENTS, INJURY OR DAMAGES.
DO	CHECK MACHINE SAFETY BEFORE OPERATING OR REPAIR OR MAINTENANCE AND DO NOT ADJUST SPEED OR SET POSITION BY 1 MAN. DO PROVIDE 2 MEN AND 1 MAN MUST WATCH OTHER.
DO NOT	STAND UP NOR HEAD UP NOR PLACE HANDS AGAINST CHUCK HEAD OR OTHER MOVING MECHANISM AT ANY TIME WHILST ELECTRICAL OR AIR POWER IS SUPPLIED. DO NOT PLACE FOOT ON MACHINE AT ANY TIME.
DO NOT	REACH INTO THE AREA WHERE MACHINE IS MOVING NOR ADJUST MACHINE WHILST OPERATION.
DO NOT	OPEN NOR REMOVE NOR BYPASS SAFETY COVER AND OTHER SAFETY DEVICES.
DO	USE EXACT AND GENUINE PARTS AND SIZE OF BOLT, NUT AND SCREW MUST BE METRIC MEASUREMENT. (ISO)
DO	TURN OFF ELECTRICAL AND AIR POWER BEFORE REPAIR OR MAINTENANCE.
DO	WEAR HARD SAFETY HAT AND SAFETY SHOES AND PAY SPECIAL ATTENTION FOR SAFETY WHEN WORKING FOR SETTING, ADJUSTING, REPAIR, MAINTENANCE OR SHIFTING MACHINE.
DO	KEEP FACE AND HANDS AWAY FROM HIGHLY HEATED AREA SUCH AS HOTMELT TANK, CONNECTIONS, NOZZLE OR HOSE OF BASE CUP APPLICATOR AND MOTOR IN ORDER TO PREVENT SEVERE BURN OR INJURY.
DO	PERIODICALLY SUPPLY GREASE AND LUBRICATING OIL.
DO	PERIODICALLY INSPECT AND MAKE SURE THAT LIMIT SWITCHES AND SENSORS PROPERLY WORK.
DO	PERIODICALLY INSPECT AIR HOSES, HOTMELT HOSES, CABLES AND JOINTS FOR FRACTURES OR OTHER DAMAGES.
DO	PERIODICALLY INSPECT BOLTS, NUTS AND SCREWS AND TIGHTEN IF THEY ARE LOOSE.
DO	PERIODICALLY INSPECT ELECTRIC CIRCUIT TO DETECT LEAKAGE.
DO	STOP MACHINE AND TURN OFF ELECTRICAL AND AIR POWER WHEN ANY DEFECTS ARE FOUND AND REPAIR.
DO NOT	REMOVE THIS CAUTION MARK FROM THIS MACHINE.

MAKER / SUPPLIER OF MACHINE WILL NOT BE RESPONSIBLE FOR ANY LIABILITY ARISING OUT OF USE OF ROBOT WHICH ARE MODIFIED WITHOUT APPROVAL OF MAKER / SUPPLIER.

BY MAKER / SUPPLIER : YUSHIN PRECISION EQUIPMENT CO., LTD.


DANGER
Robot will come down. Do not enter robot operating area.
DANGER
High speed moving Robot(s). Do not enter robot operating area.
WARNING
Moving belt(s). Do not operate with guard removed.
W-3E
WARNING
Do not disassemble.
W-1E
DANGER
High voltage. Before servicing turn off, lock out / tag out main power disconnect.
D-5E
WARNING
Moving belt(s). Do not operate with guard removed.
W-3E

CAUTION IN USE

① **Make a team of two people to adjust the speed or position. One does the adjustment, while the other keeps a close watch for safety.**

② **Keep yourself away from the movable section of the robot. Do not touch or adjust the robot while it is running.**

③ **Before starting maintenance, be sure to turn the power off and shut the air off.**

④ **Maker / supplier of machine will not be responsible for any liability arising out of use of robot which are modified without approval of maker / supplier.**

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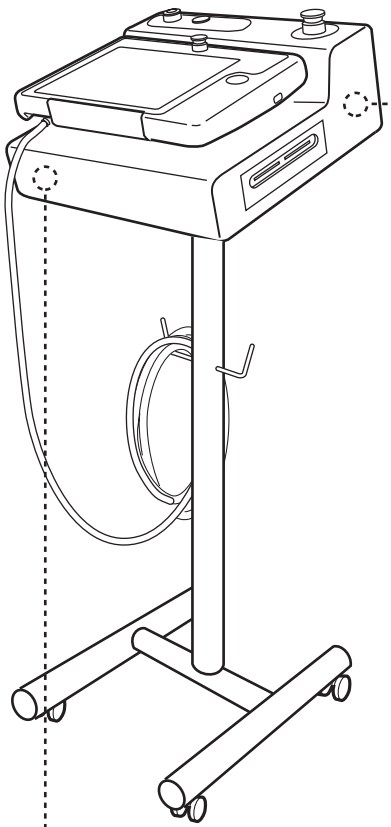
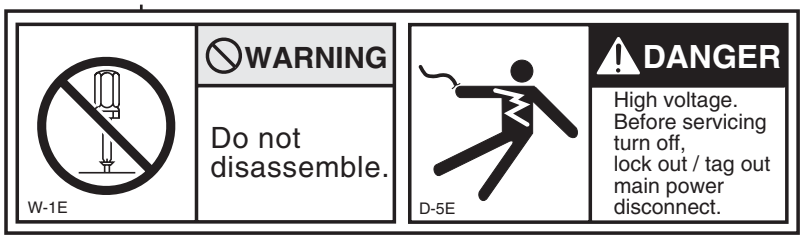




CONTENTS

1 GENERAL DESCRIPTION

1.1 Installation procedure

The general flow from installation to operation of the take-out robot for production is shown below. Refer to the **Operation Manual** and **Data Maintenance Manual** if necessary.

	Reference
Robot body installation	**<2.1 Robot body installation>**
▼	
Control box shipping hardware removal	**<2.2 Control box shipping hardware removal>**
▼	
Interface connector installation	**<2.3 Interface connector installation>**
▼	
Electrical interface	**<2.4 Electrical interface>**
▼	
Pneumatic hook-up	**<2.5 Pneumatic hook-up>**
▼	
Safety fence installation	**<2.6 Safety fence installation>**
▼	
Operation check	**<3 OPERATION CHECK>**
▼	
Post-installation adjustments	**<4 POST INSTALLATION ADJUSTMENT>**
▼	
Teaching	**<3 TEACHING>, Data Maintenance Manual**
▼	
Confirm operation	**<4 CONFIRM OPERATION>, Data Maintenance Manual**
▼	
Revising mold data during Auto operation	**<5 REVISING MOLD DATA DURING AUTO OPERATION>, Data Maintenance Manual**
▼	
Auto operation (production)	**<4 AUTO OPERATION>, Operation Manual**

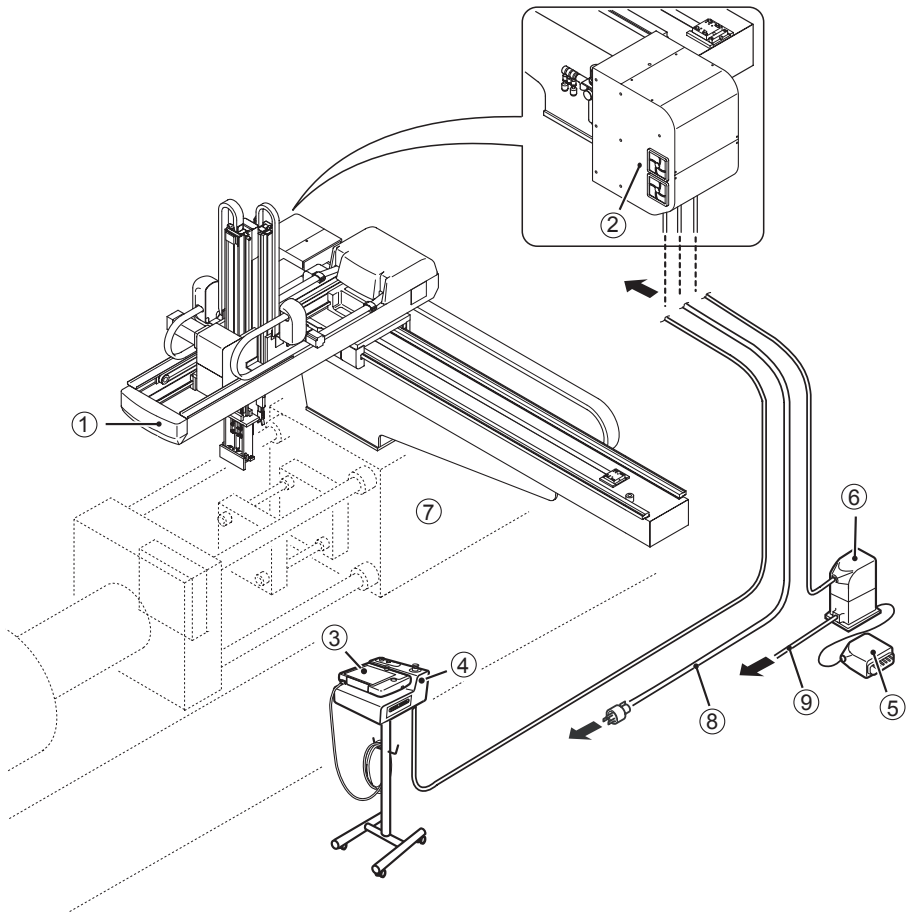
1.2 Component configurations

1.2.1 Configuration

This take-out robot consists of the following.

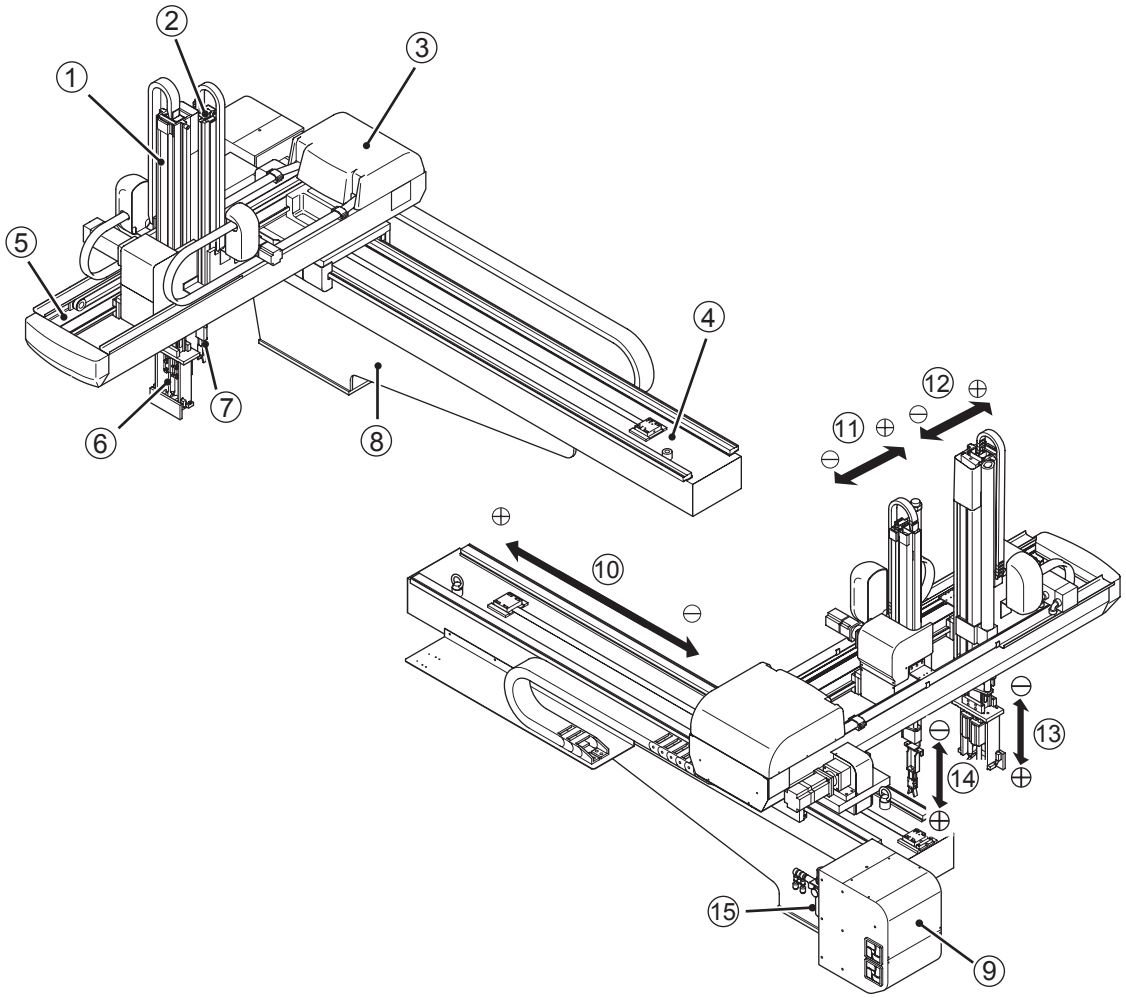
- Robot body
- Control box
- Interface connector and dummy connnector
- Operator station
- Touch panel controller

- In this manual, the above mentioned components are referred to collectively as the take-out robot.



No.	Name	No.	Name
1	Robot body	6	Interface connector
2	Control box	7	Injection molding machine
3	Touch panel controller	8	Power cable
4	Operator station	9	Injection molding machine ineterface cable
5	Dummy connector		

1.2.2 Robot body and control box



No.	Item	Description
1	Main arm unit	Raises and lowers the end-of-arm tool.
2	Sub arm unit	Raises and lowers the runner chuck.
3	Junction box	Houses the solenoid valves and the I/O.
4	Traverse frame	Guide frame for movement in the traverse direction.
5	Kick frame	Guide frame for movement in the kick direction.
6	Flip cylinder	Flips the end-of-arm tool 90 degrees.
7	Runner chuck	Grips the runner.
8	Spacer	
9	Control box	Houses the servo controller.
10	Traverse axis	
11	Sub arm kick axis	
12	Main arm kick axis	

No.	Item	Description
13	Main arm descent axis	
14	Sub arm descent axis	
15	Filter and regulator unit	

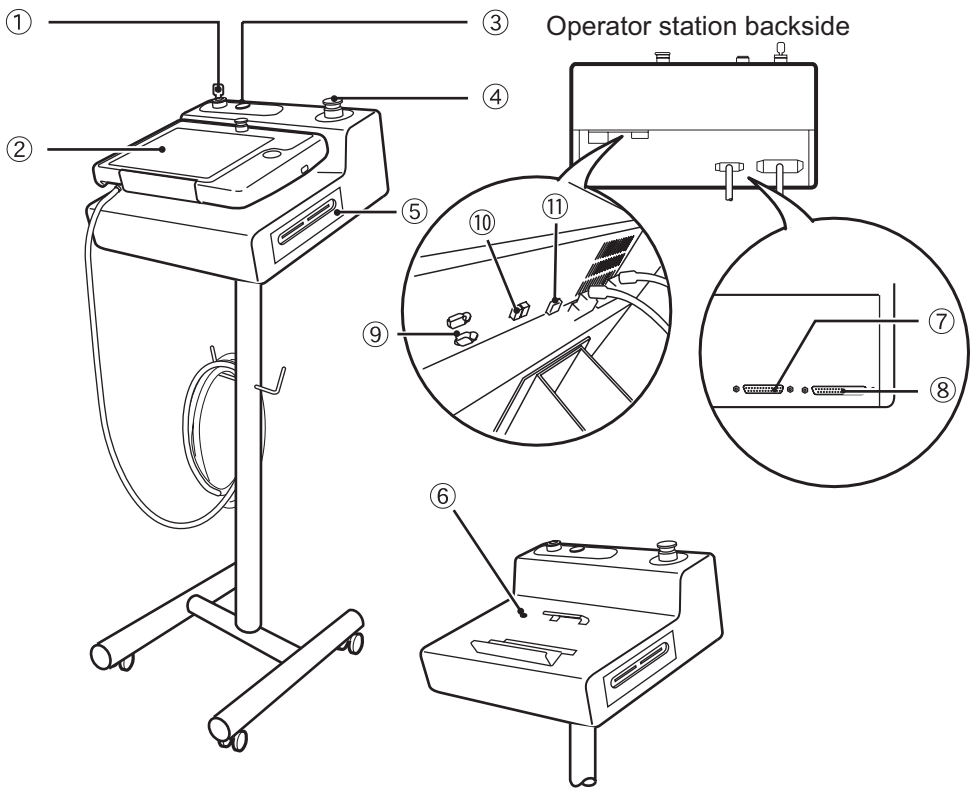
1.2.3 Operator station

CAUTION

- **Precautions regarding the operator station**

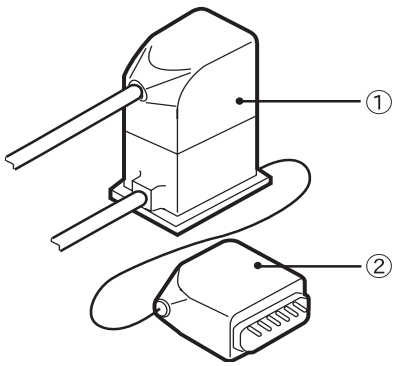
  The operator station houses the control circuit unit and other precision parts. If the control circuit unit is damaged, the touch panel controller and the control box will not work and, consequently, the take-out robot cannot be controlled. Be sure to observe the following precautions.

  - Place the operator station in a stable, level place which is free of vibration.
  - Do not turn the operator station over, slam objects into it, or in any other way apply physical shock to it. Otherwise the control circuit unit may be damaged.
  - Do not move the operator station while its power is ON. Otherwise the CF card may be crushed, resulting in loss of stored programs and data.



No.	Item	Description
1	Control power switch	Use to turn ON and OFF the control power.
2	Touch panel controller	Touch buttons and icons on the touch panel screen with fingers or the touch pen.
3	Control power lamp	This lamp lights when the control power is ON.
4	Emergency stop switch	Press this switch to stop the take-out robot in an emergency.
5	PC card slot	Insert a CF card equipped with the adapter. Insert the CF card into the left slot.
6	Operator station deadman switch	When the touch panel controller is dismounted from the operator station, this switch is released to render the take-out robot axes inoperative for preventing accidents.
7	Touch panel controller connector	This connector connects the touch panel controller and the operator station.
8	Robot connector	This connector connects the take-out robot and the operator station.
9	COM port	
10	USB port	Connects an USB camera and the operator station.
11	LAN port	Connects a take-out robot to the network using LAN cable.

1.2.4 Interface connector and dummy connector



No.	Item	Description
1	Interface connector	The interface connector serves as an interface between the take-out robot and the injection molding machine.
2	Dummy connector	The injection molding machine can be used independently by inserting the dummy connector in place of the take-out robot connector.

1.2.5 Touch panel controller

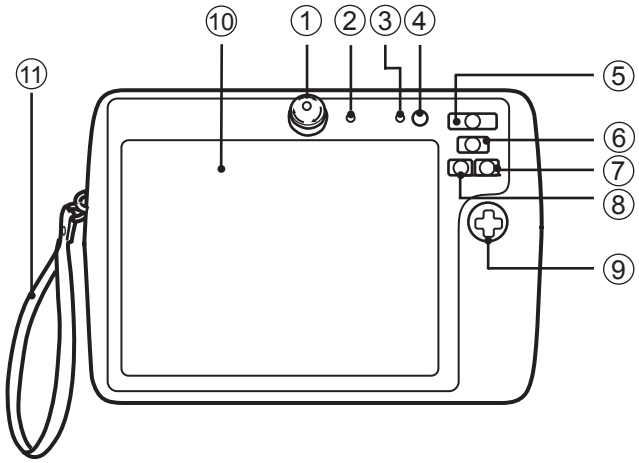
WARNING

- When the touch panel controller is placed on the operator station, the deadman switch on the operator station is pressed so that take-out robot operations are enabled. Do not carelessly touch the touch panel. Otherwise the robot body will move.

CAUTION

- **Precautions regarding touch panel controller**
  The touch panel controller holds precision parts including the liquid crystal display. The liquid crystal display is made of glass. Be sure to observe the following precautions.
  - Do not drop or apply physical shock to the touch panel controller.
  - When holding the touch panel controller, be sure to pass your hands through the hand strap.
  - When not holding the touch panel controller, be sure to place it on the operator station properly, as shown in the figure in section **<1.2.3 Operator station>**.
  - Do not place objects on the touch panel controller or press it with excessive force. Otherwise, the glass of the liquid crystal display may break.
  - Do not press the touch panel surface with sharp objects. Otherwise, the surface may be scratched or the touch panel controller may be damaged.
  - Do not pull on the cable connecting the touch panel controller to the operator station. Otherwise, the cable may break or the connector may be damaged.

- While the backlight is OFF, it does not turn ON even if you touch the screen. Press the backlight switch to turn ON the backlight.



No.	Item	Description
1	Emergency stop switch	Press this switch to stop the take-out robot in an emergency while using the touch panel controller.
2	Power lamp	This lamp lights when the control power is ON.
3	Backlight lamp	This lamp lights when the backlight of the touch panel is OFF.
4	Backlight switch	Use this switch to turn ON and OFF the backlight of the touch panel. Screen operation is disabled when the backlight is OFF. Turn OFF the backlight when cleaning the touch panel surface.
5	Stop button	Press this button to stop Auto operation.
6	Start/Pause button	Press this button to start/pause Auto operation.
7	Step forward button	Press this button to move the robot one step forward while in Auto operation, Auto one-cycle operation or confirm operation.
8	Step backward button	Use this button to move the robot one step backward while in Auto one-cycle operation or confirm operation.
9	Manual operation button	Use this button to move axes in manual operation. Use the enter button at the center to change axes.
10	Touch panel (LCD: Liquid crystal display)	This section displays buttons, icons and operation guides. Touch the displayed buttons and icons with a finger or a touch pen.
11	Hand strap	Use this hand strap when using the touch panel controller off the operator station.

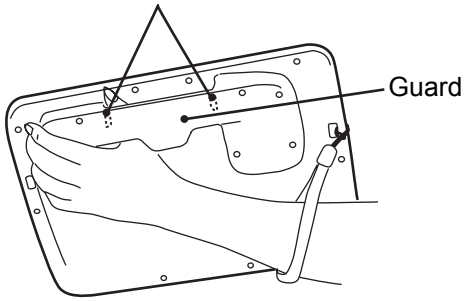
How to hold the touch panel controller

1 **Pass your arm through the hand strap to hold the touch panel controller.**

To hold the controller with the opposite hand from the drawing, attach the hand strap on the opposite side.

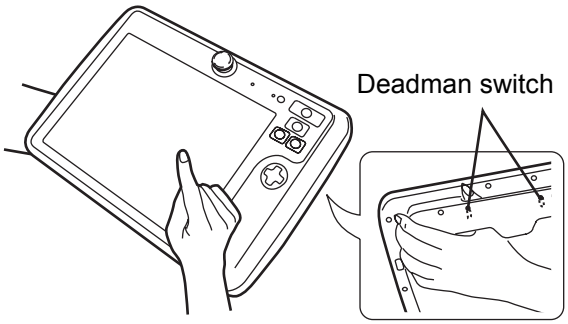
Deadman switches

They are attached inside the protection guard in order to prevent misoperation.



2 **Touch the screen softly.**

Keep pressing the deadman switch when moving axes in manual operation.



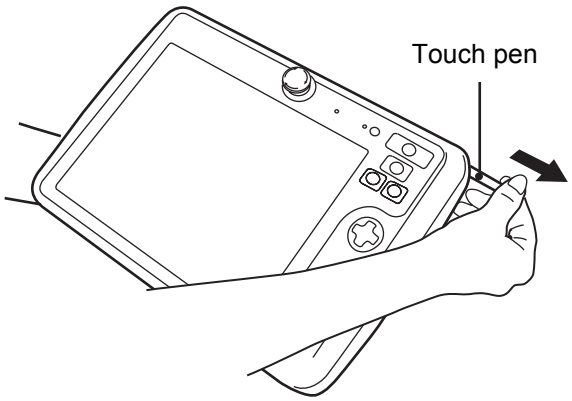
- Operation other than manual axis operation is allowed without the deadman switches being pressed.
- When a deadman switch is pressed slightly, the touch panel controller goes operative (ON), allowing you to move axes. It goes OFF while the deadman switch is not pressed or is pressed further into. At that time, you cannot move axes.

How to use the touch pen

CAUTION

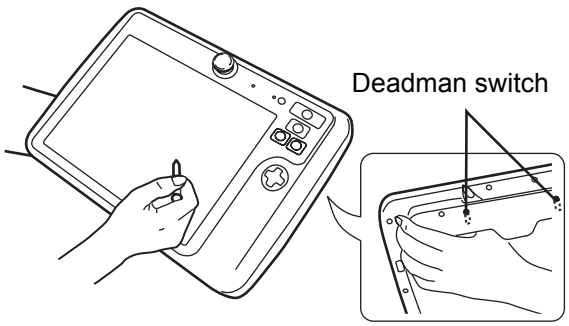
- Do not touch the touch panel surface with sharp objects such as ball point pens or mechanical pencils. Be sure to use the attached touch pen when touching the touch panel surface with other than fingers.

1 **Pull out the touch pen from the touch panel controller.**



2 **Touch or write down on the surface softly.**

Keep pressing the deadman switch when moving axes in manual operation.



1.2.6 CF cards

CF cards are used for storing and copying the mold data.

CAUTION

- **Precautions regarding CF cards**

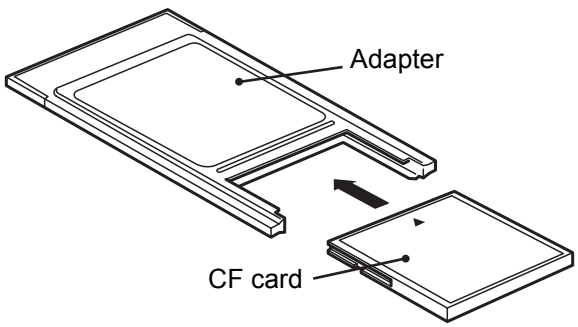
  Observe the following precautions to avoid erasing important data:

  • Do not drop, bend, or apply strong physical shock to CF cards. Otherwise the card may be damaged.

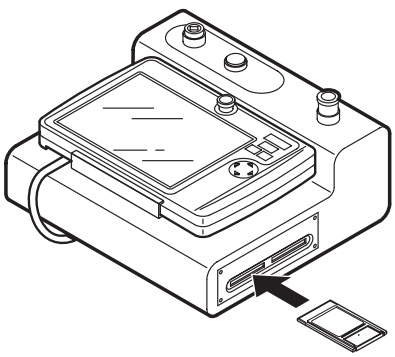
  • Avoid using or storing CF cards in places exposed to high or low temperatures or direct sunlight.

CF card insertion

1 **Insert a CF card into the adapter.**



2 **Insert the adapter into the left slot of the operator station with the arrow side turned upward.**



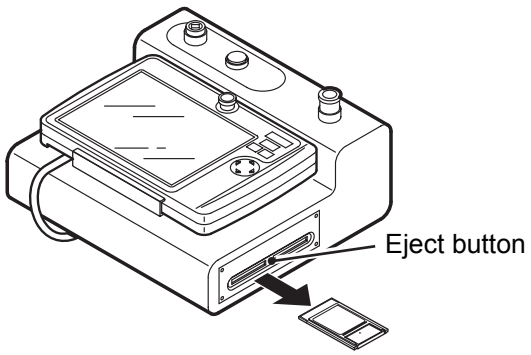
- Normally, a dummy card is inserted into the slot. When using a CF card, remove the dummy card from the slot.
- Insert a CF card with the adapter into the left slot. The right slot is reserved for networking option.
- Be sure to insert a dummy card when you do not use a CF card.

CF card removal

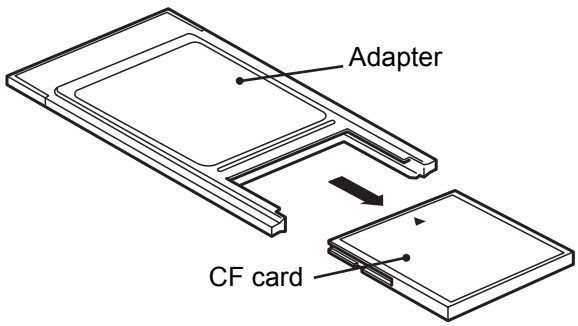
CAUTION

- Never push the eject button while the CF card is being accessed. The CF card may be damaged and the data stored on the CF card may be lost.

1 **After making sure that the controller is not accessing the CF card (for writing or loading data), push the eject button to remove the CF card.**



2 **Remove the CF card from the adapter.**



2 INSTALLATION

2.1 Robot body installation

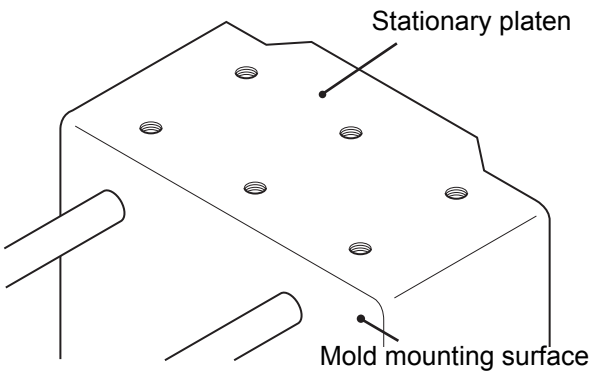
WARNING

- Make sure the injection molding machine power is turned OFF before beginning the installation work.
- Place a placard on the injection molding machine operation panel indicating that work is in progress and the power should not be turned ON.

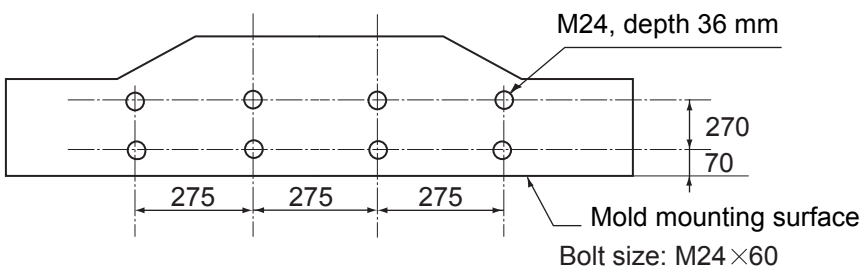
CAUTION

- Some injection molding machines already have the take-out robot mounting holes drilled. Contact the injection molding machine manufacturer or us regarding the details of mounting holes.
- In the case of a quenched stationary platen, the holes should be made using a carbide-tipped drill. Tapping should be performed carefully using roughing, intermediate, and finishing taps.
- Make sure there are no castings or protrusions on the stationary platen at the locations where holes are to be tapped.
- Whether it is necessary to mount a spacer or not should be determined with the size of the product and the height of the factory ceiling in mind.
- Unless otherwise specified, apply a locking agent before installing the bolts.
- Be sure to use a torque wrench to tighten each bolt. (See **<A.7 Tightening torque>**).

1 **If there are no holes in the injection molding machine, make tapped holes in the stationary platen of the injection molding machine according to the figure below.**



Tapped hole dimensions For standard spacer

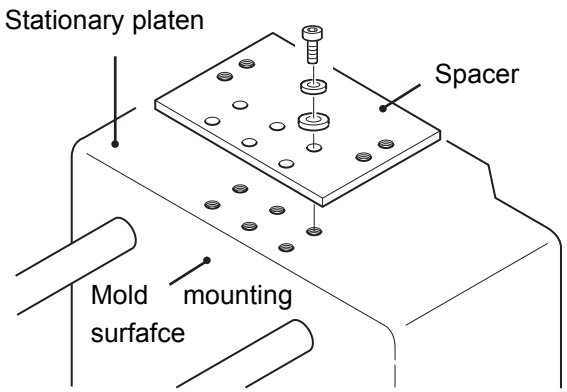


CAUTION

- Mount the spacer so that it does not extend beyond the mold mounting surface.

2 **Attach the spacer to the injection molding machine stationary platen.**

- Install the mounting bolts into the tapped holes, each with a washer and a spring washer.
- If the spacer is not required, proceed to **Step 4**.

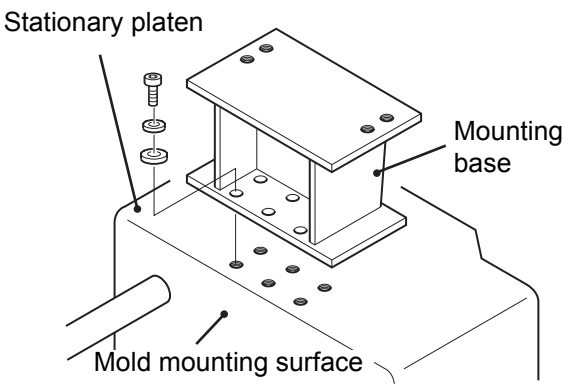


3 **Tighten each bolt to the specified torque using a toque wrench.**

- Make mounting holes in the spacer to match the existing holes in the stationary platen.

4 **Mount the mounting base to the injection molding machine stationary platen.**

- Install the mounting bolts into the tapped holes, each with a washer and a spring washer.



5 **Tighten each bolt to the specified torque using a torque wrench.**

DANGER

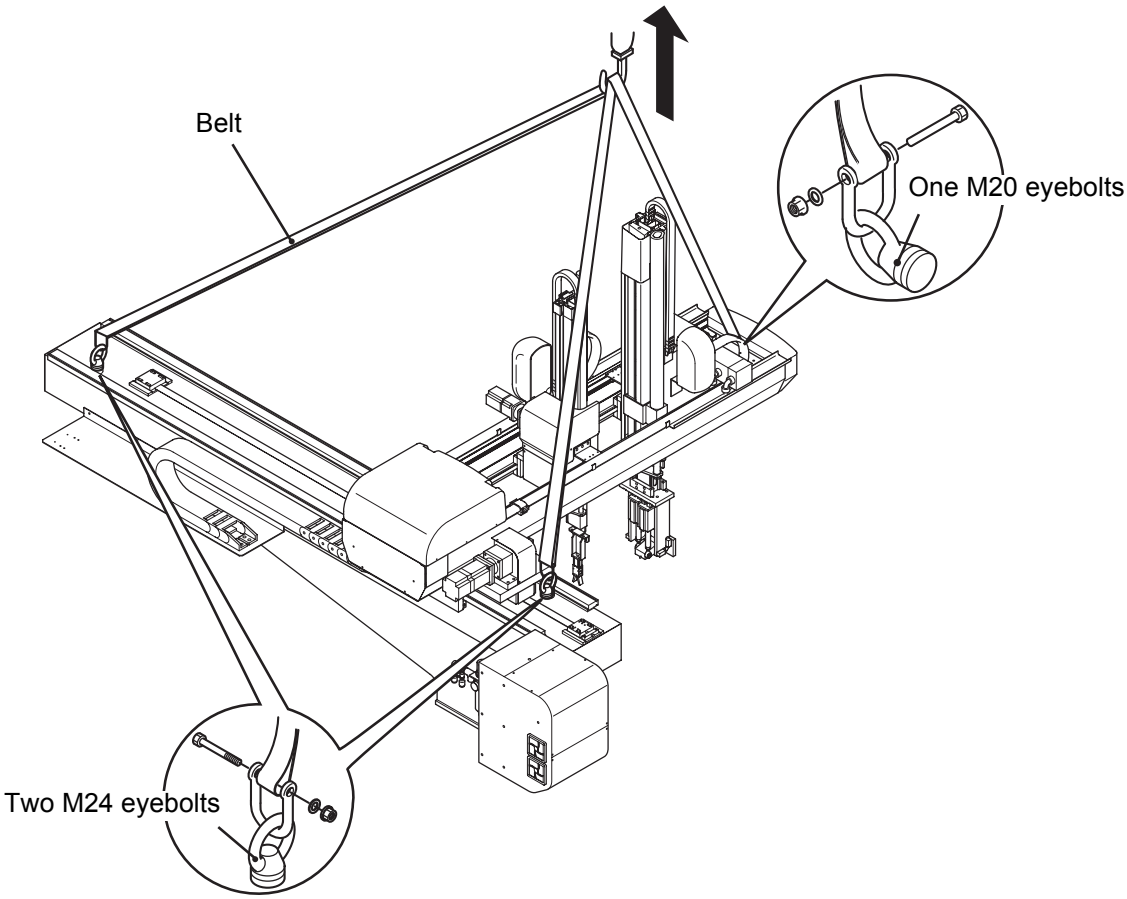
- Be sure to use a crane capable of bearing the weight of the robot body when slinging the robot body.
- Be sure to use the sling points when slinging the robot body. Before slinging the robot body, make sure each of the sling point fittings is secure.
- Take care that no personnel enter the area under the robot body when it is slung.

CAUTION

- Remove wiring, piping, parts, or other obstructions from the installation site before installing the robot body.

6 **Use a rope or the like to secure the traverse unit so that it does not move.**

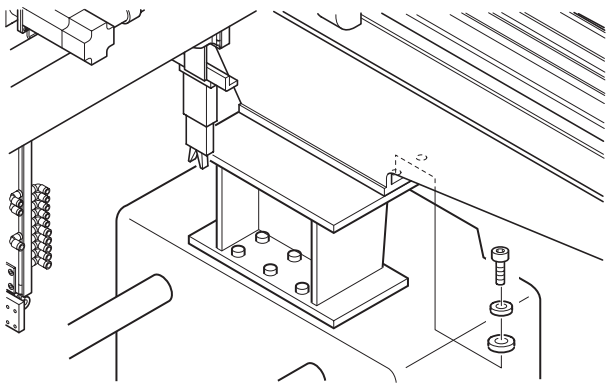
7 **Suspend the robot body as shown in the figure.**



8 **Place the robot body on the mounting base.**

9 **Insert each bolt (M24), along with a washer and a spring washer, into the tapped holes (or nuts).**

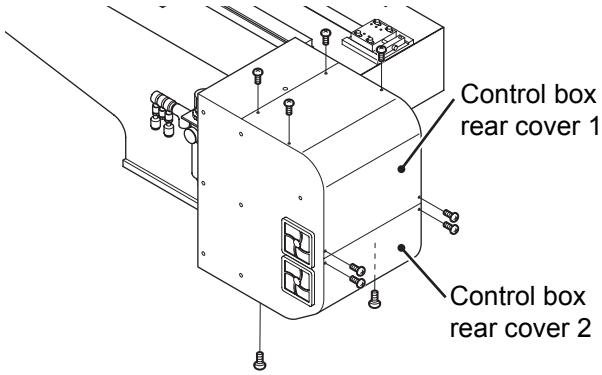
10 **Tighten each bolt to 843 N·m using a torque wrench.**



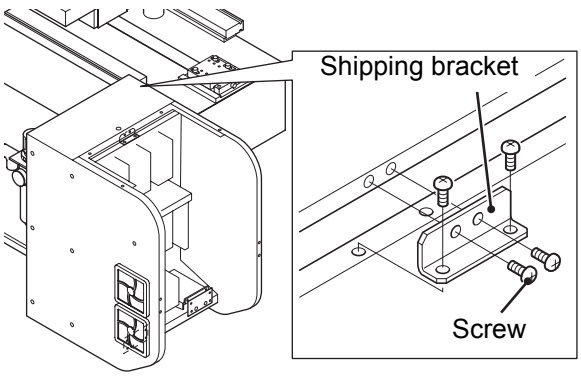
2.2 Control box shipping hardware removal

- Remove control box shipping hardware (three shipping brackets) immediately after installing the control box. The removed shipping hardware is reusable and should be returned to Yushin.

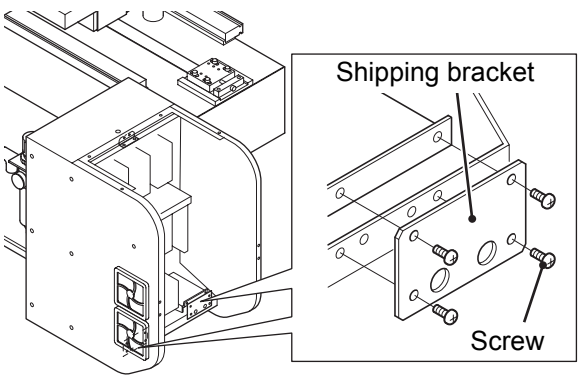
1 **Remove the control box rear cover 1 and the control box rear cover 2.**



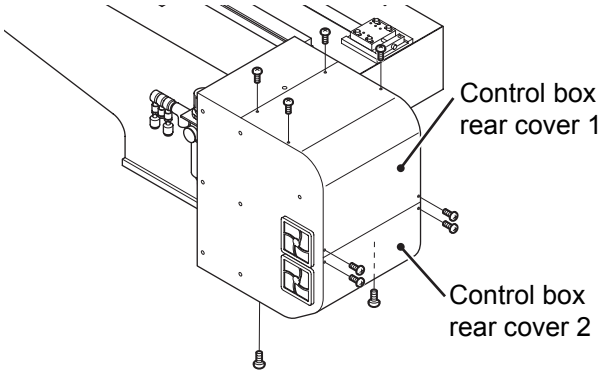
2 **Remove the upper shipping bracket.**



3 **Remove the lower shipping brackets.**



4 **Reinstall the removed covers.**



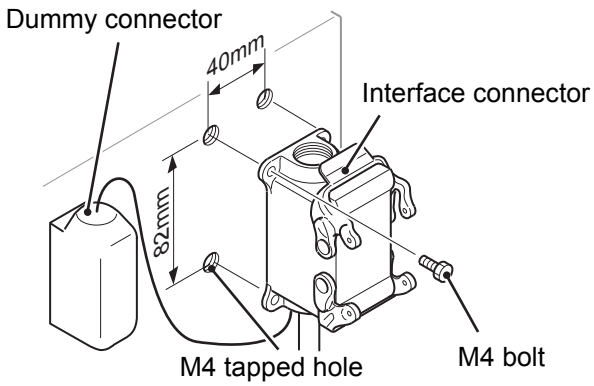
2.3 Interface connector installation

CAUTION

- Be sure to install the interface connector in a location that is not out of reach considering the length of the cables.
- Before making the mounting holes, be sure the holes will not cause a problem.

1 **Make the mounting holes (tapped holes) as shown in the figure.**

2 **Install the interface connector with four M4 bolts.**



2.4 Electrical interface

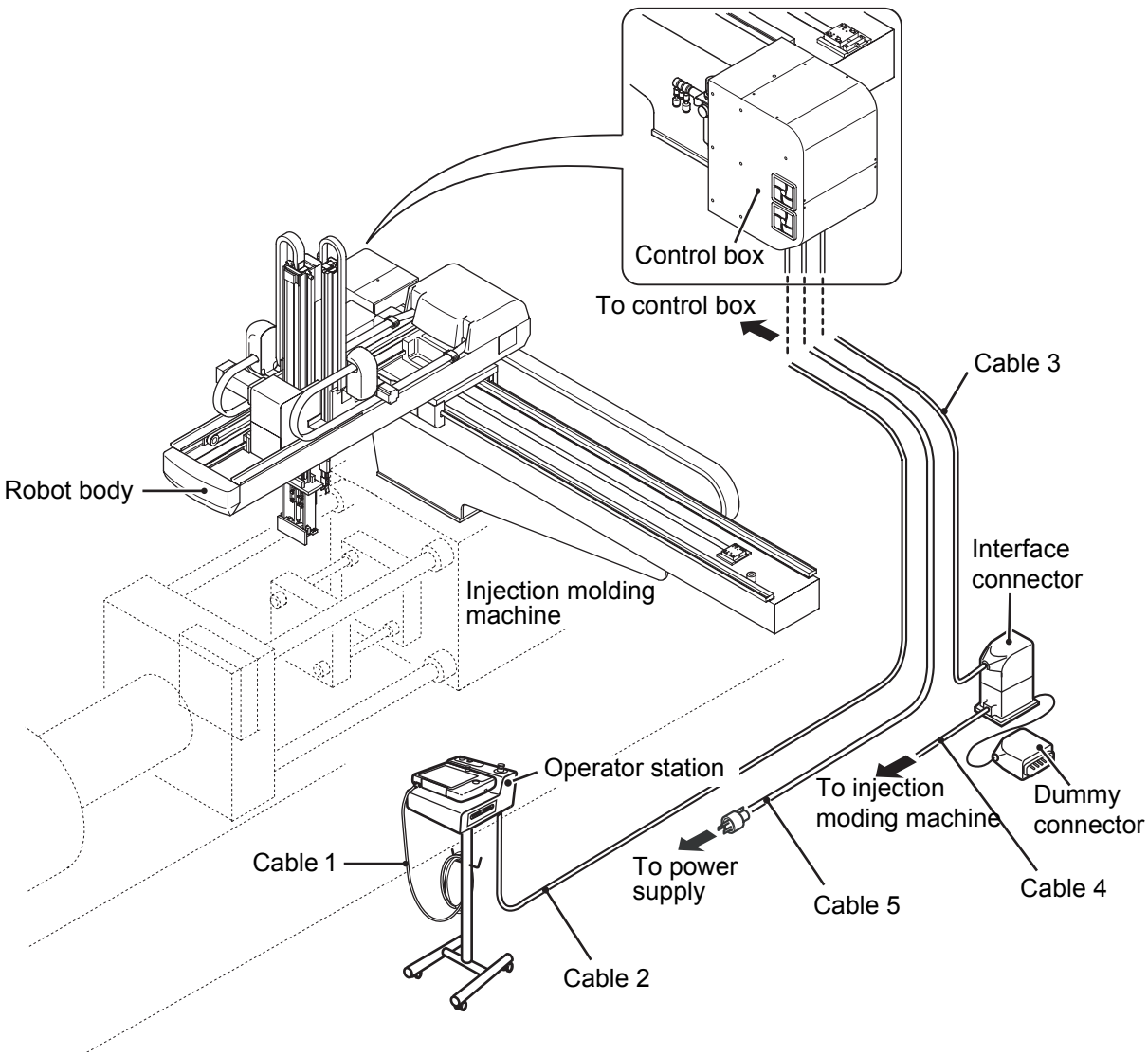
CAUTION

- Make sure the power supply to which the take-out robot will be connected is three-phase and rated for 20 A or higher.

WARNING

- Have a qualified electrician install the main power breaker and leakage breaker of the take-out robot.
- To prevent electrical accidents, allow only those technicians who have received basic electrical training and been approved by the take-out robot safety supervisor to conduct this work.

Connect each cable as shown in the figure below.



Cable	Length (m)	Connection	
Cable 1	5	Operator station	- Touch panel controller
Cable 2	8	Operator station	- Control box
Cable 3	8	Control box	- Interface connector
Cable 4	6	Interface connector	- Injection molding machine
Cable 5	8	Control box	- Power outlet socket

2.5 Pneumatic hook-up

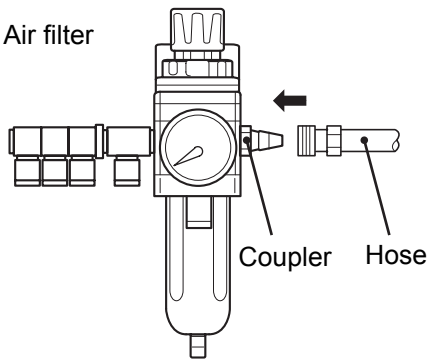
CAUTION

- An air supply hose with an excessively small diameter may cause a pressure drop. Therefore, use a hose with sufficiently large diameter.
- Before hooking up the air supply hose, flush it out thoroughly with compressed air. Intrusion of chips, seal tape, or rust generated during the piping operation may cause malfunctions, such as air leakage.

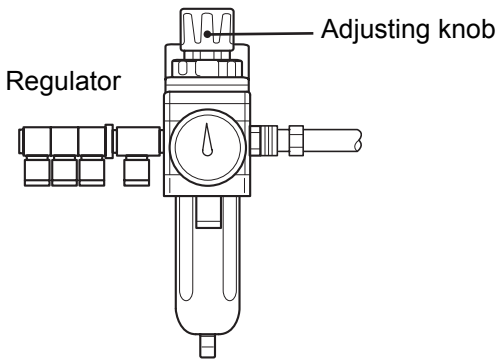
- See **<1.2.2 Robot body and control box>** for an illustration of the position where the filter and regulator unit is mounted.

1 **Connect one end of the air supply hose to the plant air.**

2 **Connect the other end of the hose to the coupler on the pneumatic filter of the take-out robot.**



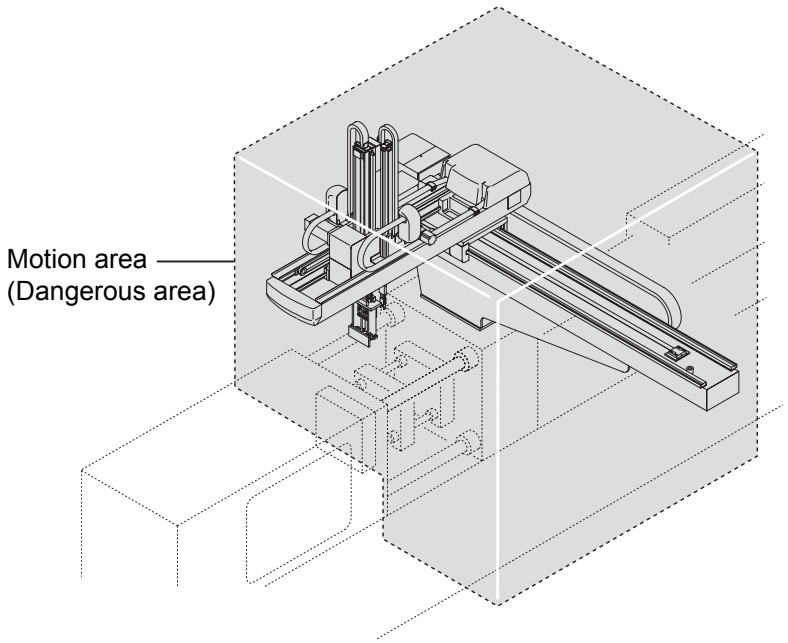
3 **Supply the plant air. Use the adjusting knob to adjust the pneumatic pressure to 3.9×10^5 to 4.9×10^5 Pa (gauge).**



4 **Make sure there is no air leakage in the pneumatic system.**

2.6 Safety fence installation

After the take-out robot and other accessory equipment have been installed, install the safety fence to prevent people from entering the robot motion area (dangerous area) when the take-out robot is in operation.



1 **The above figure illustrates the robot motion area (dangerous area). Install the safety fence while taking this and other dangerous area into consideration.**

2 **Install the safety circuit, which detects the open/close status of the safety fence gate.**

3 **Connect the safety circuit to the emergency stop circuits of the take-out robot and other equipment so that the take-out robot and other equipment undergo an emergency stop immediately when the safety gate is opened during their operation.**

4 **After installing the safety fence, check the safety fence according to the following items.**

- Make sure that the safety fence is sufficiently solid that it will not fall down when someone leans against it.
- Make sure that the safety fence is constructed so as not to permit someone to easily modify, remove, or climb over it.
- Make sure that the safety fence does not hinder the operation of the take-out robot and other equipment.
- Make sure that all operations of the take-out robot and other equipment can be executed from outside the safety fence.
- Make sure that the safety fence has no sharp protrusions that could cause personal injury.
- Make sure that opening the safety gate during operation of the take-out robot and other equipment activates their emergency stop circuits, thus immediately stopping them.

3 OPERATION CHECK

After installing the take-out robot, perform the following operation checks.

	Reference
Control power ON	**<3.1 Control power ON>**
▼	
Manual operation	**<5.1 Manual operation description>, Operation Manual**
▼	
Motion prohibition area setting	**<Prohibition area setting>, Data Maintenance Manual**
▼	
Date and time setting	**<Buzzer/Date setting>, Data Maintenance Manual**
▼	
Control power OFF	**<3.5 Control power OFF>**
▼	
Interlock check	**<3.6 Interlock check>**
▼	
Emergency stop	**<3.7 Emergency stop>**

WARNING

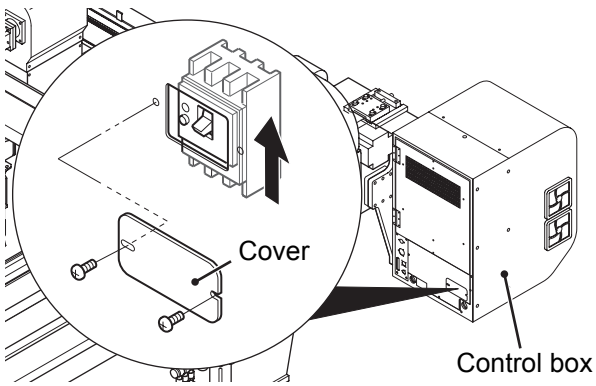
- Before starting the operation check, make sure no persons or obstacles exist in the robot motion area.
- To prevent electrical accidents, allow only those technicians who received basic electrical training and been approved by the take-out robot safety supervisor to conduct this work.

3.1 Control power ON

1 **Turn ON the main power to the take-out robot.**

2 **Remove the cover shown in the figure and turn ON the circuit breaker inside the control box.**

3 **After turning ON the breaker, install the cover.**



WARNING

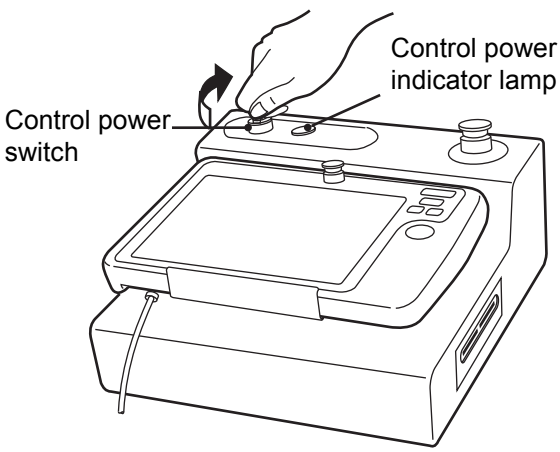
- Before turning ON the control power, make sure no persons or obstacles exist in the robot motion area.

CAUTION

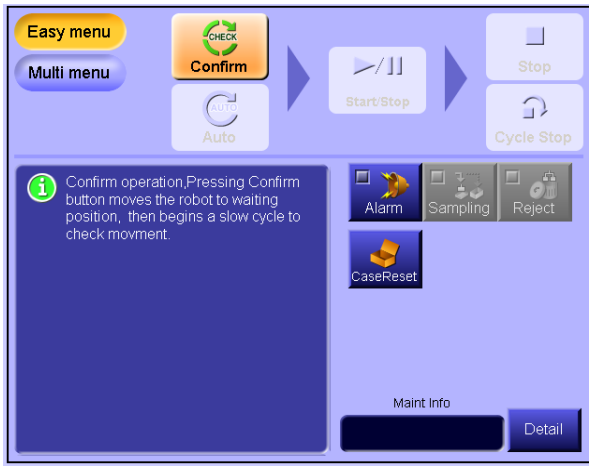
- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

4 **Turn the control power clockwise.**

Make sure the control power indicator lamp lights.



After a few moments, the operation screen appears on the touch panel controller display.

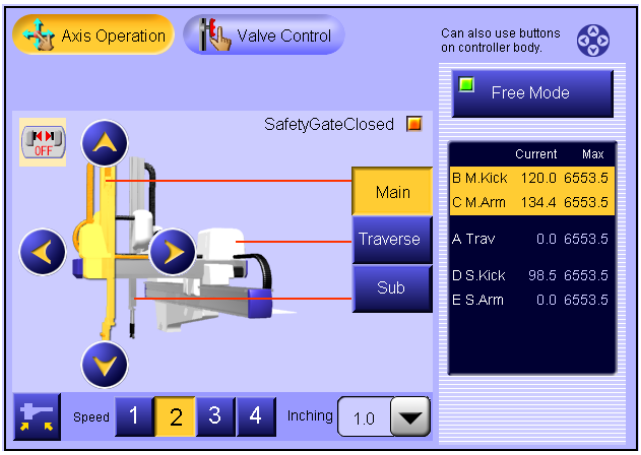


3.2 Manual operation

Check the robot motions in manual mode.

1 **Touch the [Manual] tab on the operation screen.**

The manual operation screen appears.



2 **Move each axis and valve manually and make sure it functions properly.**

- See **<5.1 Manual operation desription>** in the **Operation Manual** regarding how to perform manual operation.

3.3 Motion prohibition area setting

The motion prohibition area is set at the factory before shipping and normally there is no need to change the motion prohibition area settings.

Change the settings only when it is necessary to change the motion prohibition area in view of the installation conditions of the take-out robot.

- See **<Motion prohibition area setting>** in the **Data Maintenance Manual** regarding how to set the motion prohibition area.

3.4 Date and time setting

Set the date and time of the clock inside the control box.

- See **<Buzzer/Date setting>** in the **Data Maintenance Manual** regarding how to set the date and time.

3.5 Control power OFF

1 **In manual mode, move the take-out robot to the waiting position where it is safe.**

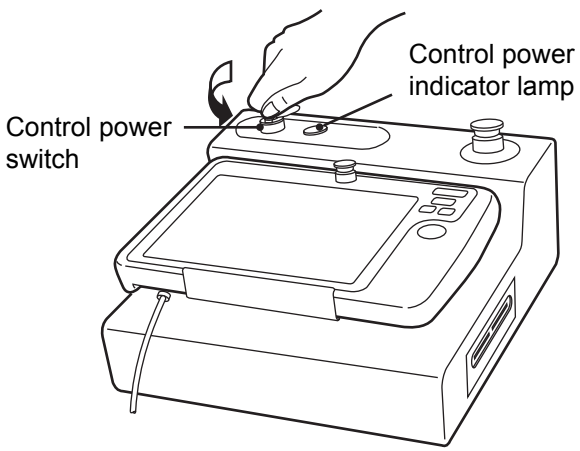
- See **<5.1 Manual operation desription>** in the **Operation Manual** regarding how to perform manual operation.

CAUTION

- Do not turn OFF the control power when the take-out robot is in operation, screen pages are changing or the controller is accessing the CF card. Otherwise, the data on the CF card may be lost.
- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

2 **Turn the control power counter-clockwise.**

Make sure the control power lamp goes out and the display on the touch panel disappears, indicating that the control power is OFF.



3.6 Interlock check

Interlock signals are used to make sure the injection molding machine and the take-out robot interact properly.

3.6.1 Signals

The table below describes the input/output signals used for communication between the take-out robot and the injection molding machine.

Input signals from the injection molding machine

Signal name	Description
Mold open limit	This signal is ON when the injection molding machine has fully opened the mold. When this signal is ON, the take-out arm can enter the mold area.
Safety gate closed	This signal is ON when the injection molding machine safety gate is closed. During Auto operation, the take-out robot motion will not start unless this signal is ON.
Injection (For Japan standard only)	This signal turns ON when the injection molding machine injects. This signal is used as one of the conditions for starting the take-out motion. The take-out robot senses that this signal has been turned ON and stores the fact in its memory. If the safety gate is opened or the injection molding machine is stopped during full-auto operation, this memory is cleared. The take-out motion will not start unless the memory of the injection signal turning ON exists. This use of the injection signal assures that, during Auto operation, the take-out motion starts only when injection molding has been performed.
Injection molding machine full-auto	This signal turns ON when the injection molding machine starts full-auto operation. During Auto operation, the take-out motion will not start unless this signal is ON.
Reject	This signal turns ON when the injection molding machine produces defective product during full-auto operation. When this signal turns ON, the take-out robot performs the flip motion at the reject discharge position and releases the product.

Input signals from external equipments (conveyor, stocker)

Signal name	Description
Descent order	During Auto operation, the take-out arm can descend on the product release side when this signal is ON.

Output signals to the injection molding machine

Signal name	Description
Mold close interlock	This is an authorization signal for the mold close motion. When this signal is ON, the injection molding machine can perform the mold close motion.
Mold close interlock 2 (For USA standard only)	This is an authorization signal for the mold close motion. When this signal is ON, the injection molding machine can perform the mold close motion.
Mold open interlock	This is an authorization signal for the mold open motion. When this signal is ON, the injection molding machine can perform the mold open motion.
Ejector order	This is an authorization signal for the ejector forward motion.
Cycle start (For Japan standard only)	During Auto operation, this signal indicates to the injection molding machine that the take-out motion has been completed. When this signal turns ON, the injection molding machine closes the mold and the next cycle begins. When a take-out failure occurs, this signal does not turn ON and the injection molding machine does not close the mold.

Output signals to external equipments (conveyor, stocker)

Signal name	Description
Conveyor interlock (For USA standard only)	This is the interlock signal sent to a conveyor. The conveyor operation is enabled when this signal turns ON and disabled when the signal turns OFF. During manual mode, the conveyor interlock signal turns OFF while the robot is in the release side with the main arm ascent limit sensor turned OFF, and the signal turns ON in other conditions. In Auto mode (confirm operation, one cycle operation, Auto operation), this signal turns OFF when the take-out robot starts to descend to the product release position remains OFF until the robot arrives at the ascent limit, and turns ON in other conditions.
External signal	During Auto operation, this signal turns ON after the product release motion.
Casing Complete Signal 1	This signal turns ON after one case (or pallet or other container) has been filled with products.
Casing Complete Signal 2	This signal turns ON after one case (or pallet or other container) has been filled with products.

Hold flags

Signal name	Description
Injection flag	During Auto operation, this flag turns ON when the injection signal is received from the injection molding machine and remains ON as long as the safety gate closed signal is ON. The take-out motion will not start unless this signal is ON. If the safety gate opens even for a moment after this flag turns ON, this flag turns OFF and the take-out motion will not start.
Reject flag	During Auto operation, this flag turns ON when the reject signal is received form the injection molding machine and remains ON until the take-out motion is complete. If this flag is ON when the take-out motion starts, the take-out robot releases the product at the reject discharge position.

3.6.2 Interface signal check

Follow the procedures described in this section to make sure the interface signal function properly. After the injection molding machine and the take-out robot have been started up, the status of the signals can be checked using the signal monitor screen on the handheld controller.

Perform the signal checks listed below. Details are described on the following pages.

(1) Interface signal check performed at start-up (1 of 2)

(2) Interface signal check performed at start-up (2 of 2)

(3) Interface signal check performed operating the injection molding machine

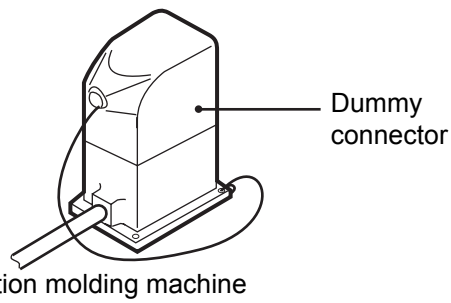
(4) Interface signal check performed using the monitor screens

(5) Interface signal check performed operating the injection molding machine

(6) Interface signal check performed while the take-out robot is in Auto operation

(1) Interface signal check performed at start-up (1 of 2)

1 **Disconnect the injection molding machine interface connector and connect the dummy connector.**



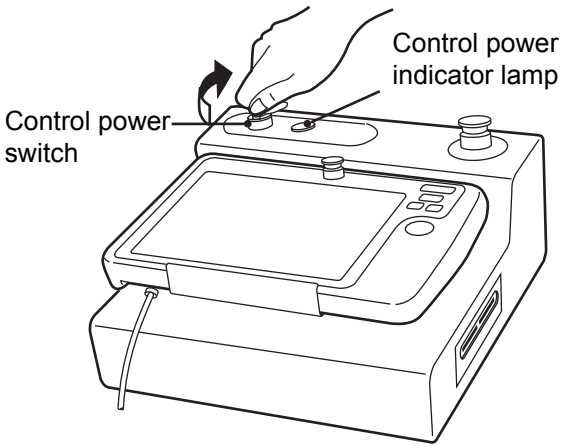
WARNING

- Before turning ON the control power, make sure no persons or obstacles exist in the motion area of the injection molding machine and the take-out robot.

CAUTION

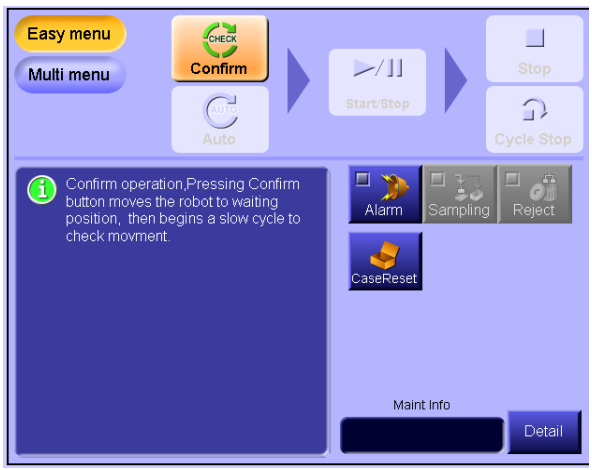
- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

2 Turn ON the control power.



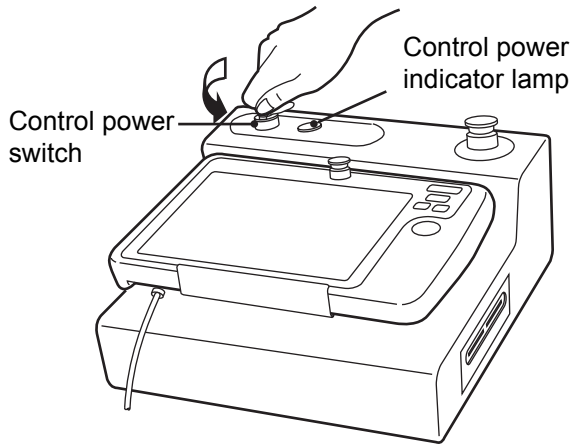
After a few moments, the operation screen appears.

When the dummy connector is connected, the take-out robot is in the emergency stop condition. Although the operation screen is displayed as usual when the control power is turned ON, if you attempt to operate the take-out robot by selecting the [Manual] tab, the emergency stop error message window appears and the take-out robot does not operate.



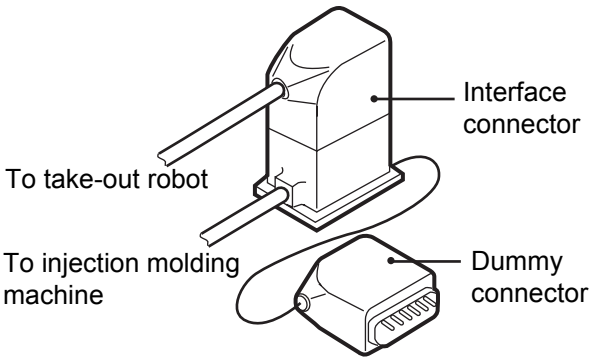
3 Make sure the emergency stop error message window appears.

4 **Turn OFF the control power.**



(2) Interface signal check performed at start-up (2 of 2)

5 **Connect the injection molding machine and the take-out robot with the interface connector.**



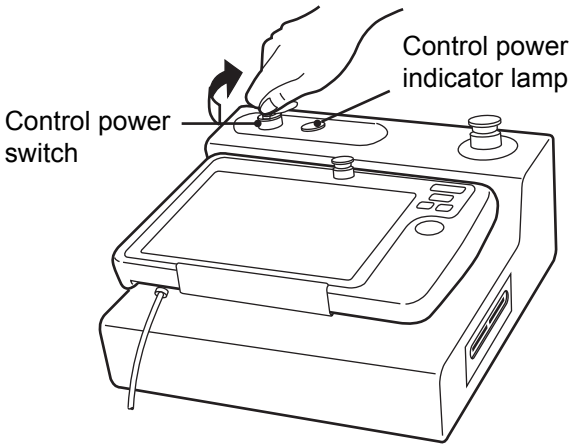
WARNING

- Before turning ON the control power, make sure no persons or obstacles exist in the motion area of the injection molding machine and the take-out robot.

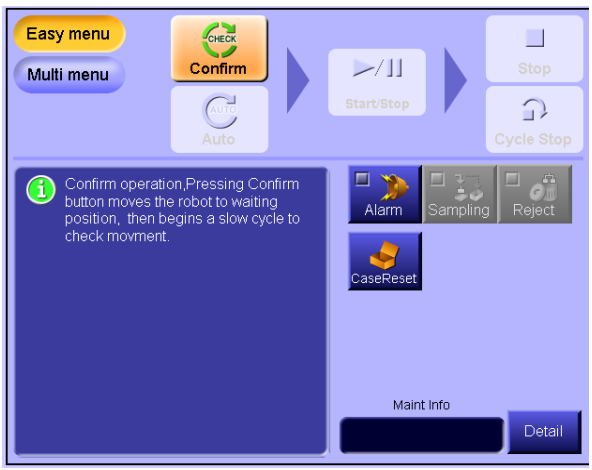
CAUTION

- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

6 **Turn ON the control power.**



After a few moments, the operation screen appears.



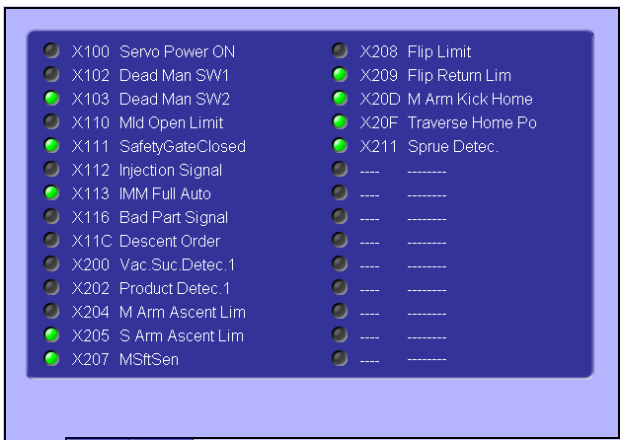
(3) Interface check performed operating the injection molding machine

Signal name	Description
Mold closed interlock	● Make sure that the mold close operation of the injection molding machine is disabled when the mold close interlock signal is OFF.
Mold closed interlock 2	● Make sure that the mold close operation of the injection molding machine is disabled when the mold close interlock signal is OFF.
Mold open interlock	● Make sure that the mold open operation of the injection molding machine is disabled when the mold open interlock signal is OFF.
Ejector order	● Make sure that the eject operation of the injection molding machine is disabled when the ejector order signal is OFF. For injection molding machines that allow the ejector to operate regardless of the status of the ejector order signal when in manual mode, perform this check with the injection molding machine in full-auto mode.

7 **Access the input signal monitor screen.**

- See the **Data Maintenance Manual** regarding how to access the input signal monitor screen.

The input signal monitor screen appears.



(4) Interface signal check performed using the monitor screens

Signal name	Description
Mold open limit	● Make sure this signal turns ON when the mold fully opens. ● Make sure this signal turns OFF when the mold is closed.
Safety gate	● Make sure this signal turns ON when the safety gate of the injection molding machine is closed. ● Make sure this signal turns OFF when the safety gate of the injection molding machine is open.
Injection (For Japan standard only)	● Make sure this signal turns OFF when the injection molding machine is not performing any operations. ● Make sure this signal turns ON when the injection operation is performed.
Injection molding machine full-auto	● Make sure this signal turns OFF when the injection molding machine is in manual mode or semi-auto mode. ● Make sure this signal turns ON when the injection molding machine is in full-auto mode.
Reject	● Make sure this signal is normally OFF after the mold opens during non-defective molding cycles. ● Make sure this signal turns ON after the mold opens when a defective product is molded.

Signal name	Description
Descent order	● Make sure this signal turns ON when external equipment is ready to receive a product. ● Make sure this signal turns OFF when external equipment is not ready to receive a product.

(5) Interface signal check performed while the injection molding machine is in operation

Signal name	Description
Mold close interlock	● Make sure that the mold close operation of the injection molding machine is enabled when the mold close interlock signal is ON.
Mold open interlock	● Make sure that the mold open operation of the injection molding machine is enabled when the mold open interlock signal is ON.
Ejector order	● Make sure that the ejector of the injection molding machine is enabled when the ejector order is ON. ● For injection molding machines that allow the ejector to operate regardless of the status of the ejector order signal when in manual mode, perform this check with the injection molding machine in Auto mode.

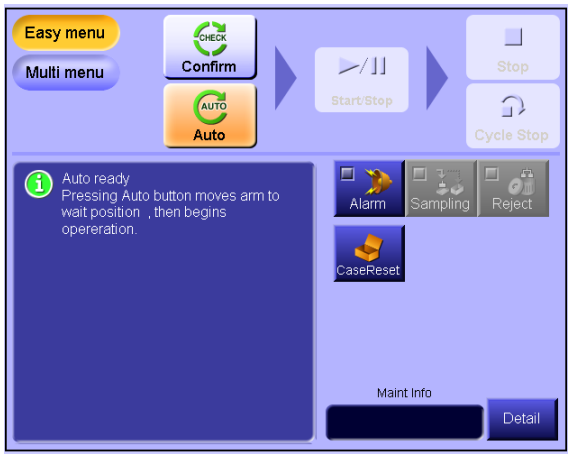
8 Access the operation screen.

● See the **Data Maintenance Manual** regarding how to display the operation screen.

WARNING

- Before starting Auto operation, make sure no persons or obstacles exist in the robot motion area.

9 **Start Auto operation.**



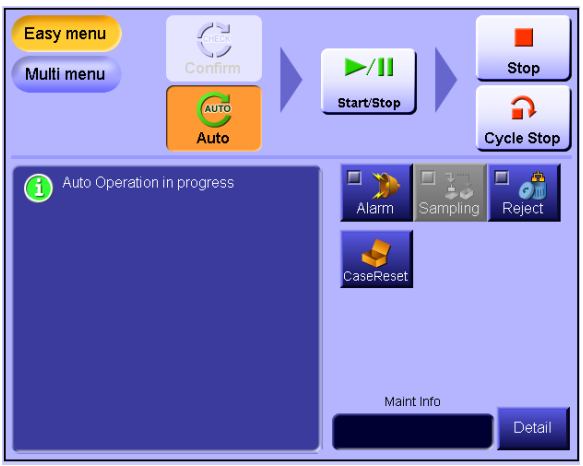
- See **<4.1 Easy operation>** or **<4.2 Multi-function operation>** in the **Operation Manual** regarding how to perform Auto operation.

(6) Interface signal check performed while the take-out robot is in Auto operation

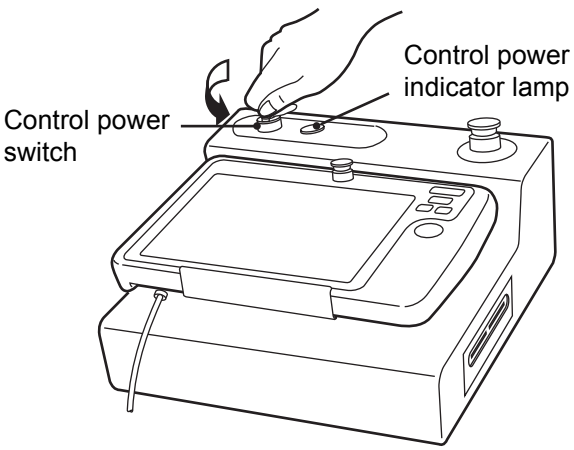
Signal name	Description
Conveyor interlock (For USA standard only)	● Make sure that this signal turns OFF when the take-out robot is at the release side with the main arm ascent limit sensor tuned OFF in manual mode. ● Make sure that this signal turns OFF when the take-out robot starts to descend to the product release position until the robot arrives at the ascent limit, and that the signal turns ON under other conditions.
Mold close interlock 1, 2	● Mold close interlock 1 and Mold close interlock 2 signals are used to operate the injection molding machine serially. Make sure that the injection molding machine performs serial operation while the robot is in Auto operation and that the injection molding machine does not perform serial operation when the take-out failure occurs.
Casing complete signal 1, 2	● When the casing complete signal is connected, make sure the external equipment operation is interlocked with the take-out robot operation during Auto operation. For example, assuming the external equipment is a conveyor, make sure the conveyor performs the pitch motion when the take-out robot arm unit has fully ascended after filling a case or pallet with product.

Signal name	Description
Cycle start (For Japan standard only)	● The cycle start is used to continuously operate the injection molding machine. Make sure that, during Auto operation of the take-out robot, the injection molding machine is allowed to operate continuouly so long as the take-out motion is successfully completed. Then make sure that the injection molding machine is not allowed to operate continuouly when a take-out failure occurs.
Ejector order	● Make sure that when the ejector interlock is set to Interlock from the mode selection screen, the ejector ejects when the take-out robot chuck is at the kick limit. ● Make sure that when the ejector interlock is set to No from the mode selection screen, the ejector operation is timed according to the injection molding machine.
External emergency stop	● Make sure the injection molding machine also stops when the emergency stop switch on the take-out robot is pressed. ● Make sure the take-out robot also stops when the emergency stop switch on the injection molding machine is pressed.

10 Touch the [Stop] button on the Auto operation screen to stop Auto operation.



11 Turn OFF the control power.



3.7 Emergency stop

Make sure the emergency stop switch operates properly.

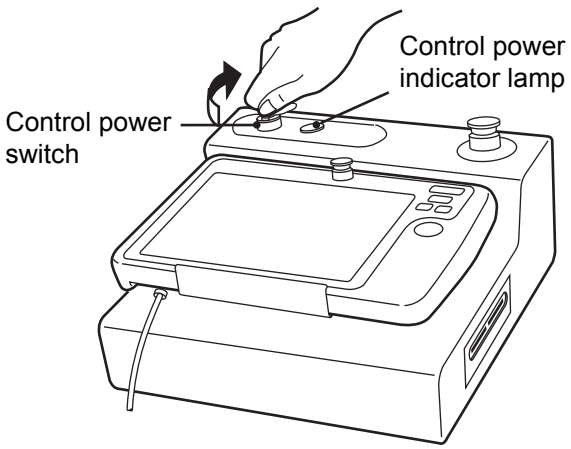
WARNING

- Before turning ON the control power, make sure no persons or obstacles exist in the robot motion area.

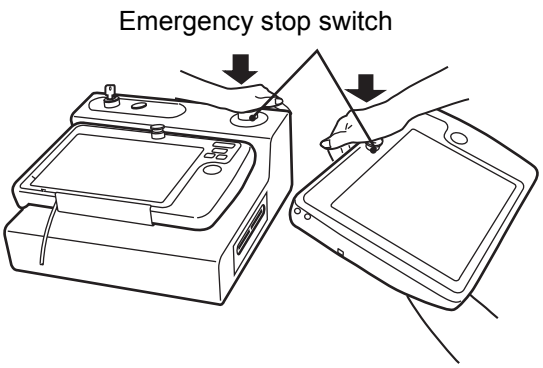
CAUTION

- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

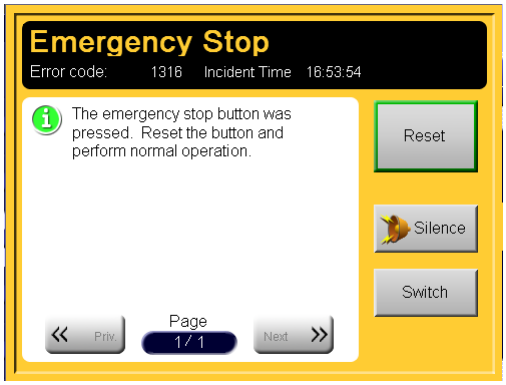
1 **Turn ON the control power.**



2 **After pressing the emergency stop switch, touch the [Manual] tab.**

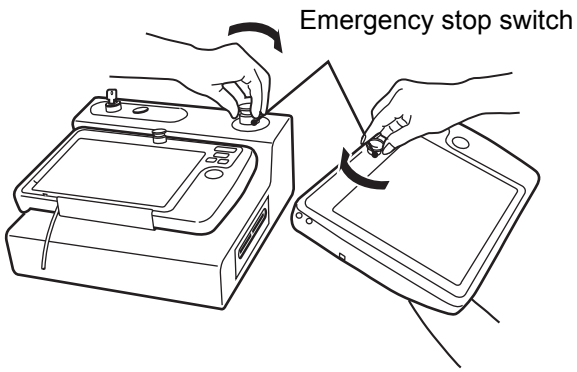


3 **Make sure the alarm sounds and the emergency stop error message window appears on the touch panel controller.**



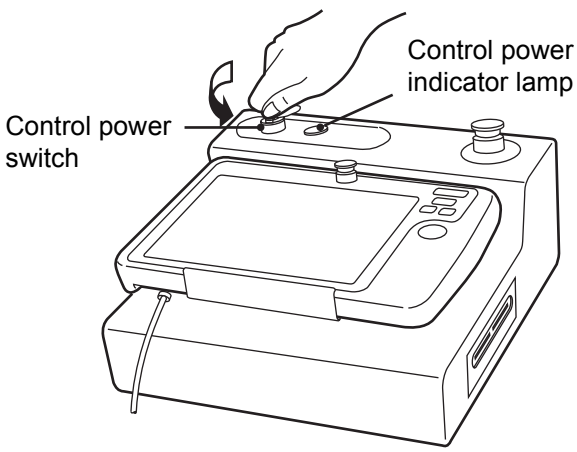
4 **Reset the emergency stop switch.**

Turning the switch clockwise will release it and allow it to return to its original position.



5 **Touch the [Reset] button on the error message window.**

6 **Turn OFF the control power.**



4 POST INSTALLATION ADJUSTMENT

Perform the following adjustments after checking the robot motion.

WARNING

- Each procedure described in this section is on the condition that the injection molding machine power and the take-out robot control power are both OFF, unless otherwise specified. Always make sure the power is OFF before conducting these procedures.
- Place placards on the injection molding machine operation panel and the operator station of the take-out robot indicating that work is in progress and the power should not be turned ON.
- When it is necessary to turn the take-out robot control power ON during these procedures, be sure to have at least two persons conduct the work and one person ready to press the emergency stop switch at any time.

CAUTION

- Never apply an anaerobic locking agent to plastic cover mounting bolts. Gases evolved when such a locking agent is cured may deteriorate plastic, resulting in looseness of the mounting bolts.
- It is recommended to use the following locking agent for plastic cover mounting bolts.
  ThreeBond 1401

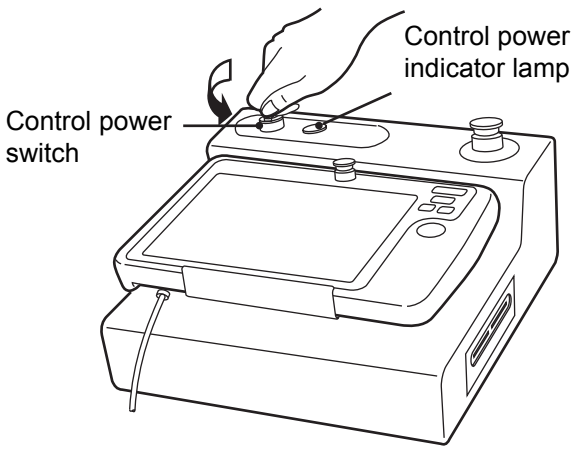
4.1 Visual inspection

Visually inspect the entire take-out robot, making sure there are no scratches or other damage.

4.2 Pneumatic unit

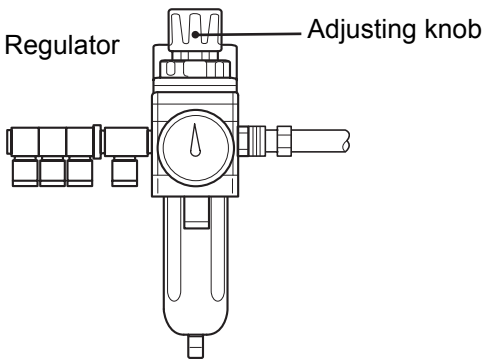
4.2.1 Pneumatic pressure adjustment

1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**



- See **<1.2.2 Robot body and control box>** for an illustration of the position where the filter and regulator unit is mounted.

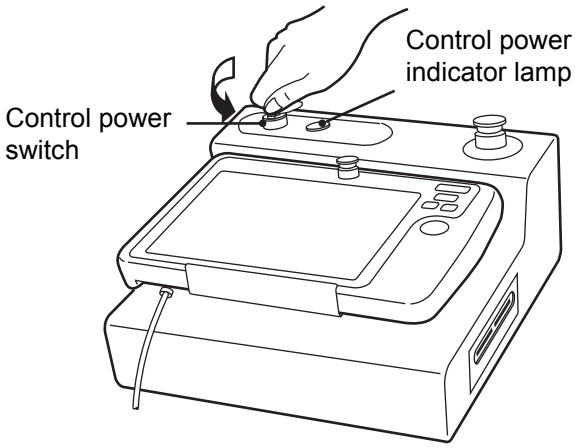
2 **Connect the plant air to the take-out robot. Pull down the adjusting knob as shown in the figure and adjust the pressure to 3.9×10^5 to 4.9×10^5 Pa (gauge).**



3 **Make sure there is no air leakage in the pneumatic system.**

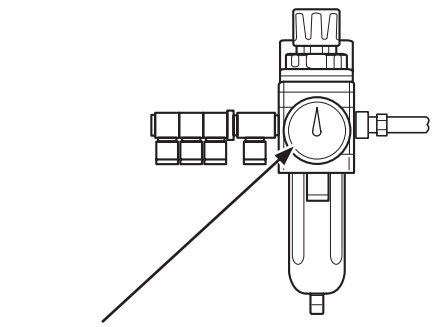
4.2.2 Solenoid valve check

1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**



- See **<1.2.2 Robot body and control box>** for an illustration of the position where the filter and regulator unit is mounted.

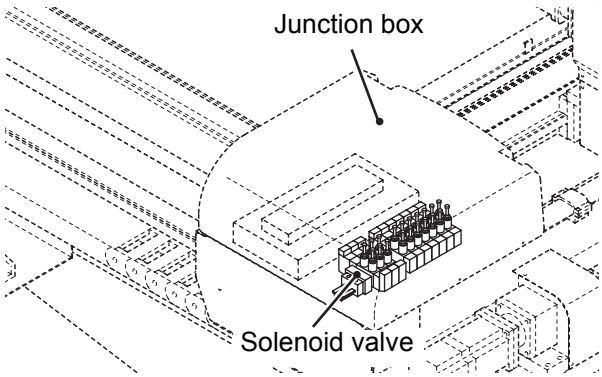
2 **Make sure the appropriate pneumatic pressure (3.9×10^5 to 4.9×10^5 Pa (gauge)) is being supplied.**



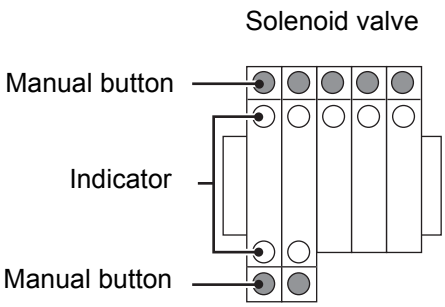
CAUTION

- Before operating the solenoid valves, make sure no persons or obstacles exist in the robot motion area.

3 **Remove the junction box cover.**

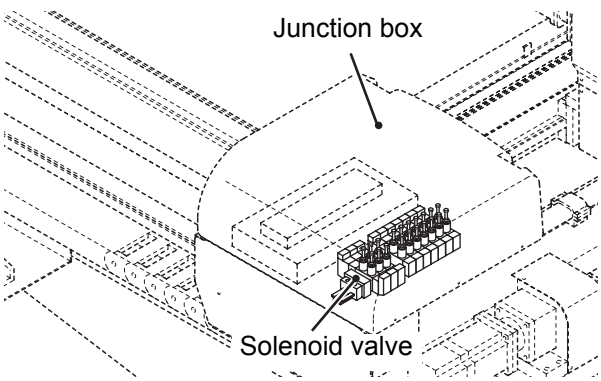


4 **Press the manual button of each solenoid valve in the junction box, making sure the corresponding chuck or cylinder operates properly.**



- The number of solenoid valves differs depending on the options included with the take-out robot.

5 **Install the removed cover.**



4.2.3 Pressure sensor adjustment

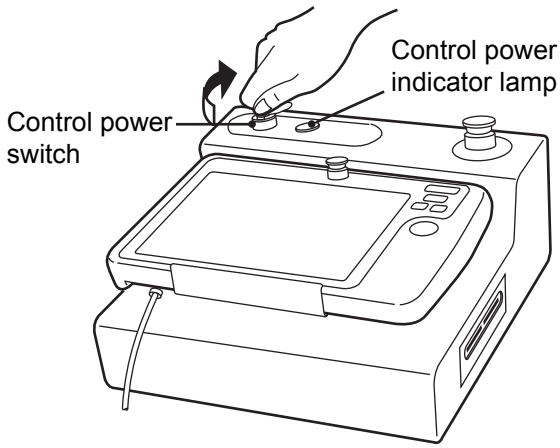
WARNING

- Before turning ON the take-out robot control power, make sure no persons or obstacles exist in the robot motion area.

CAUTION

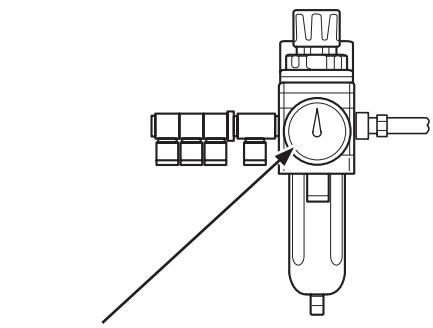
- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

1 **Make sure the injection molding machine power is OFF. Then turn ON the take-out robot control power.**



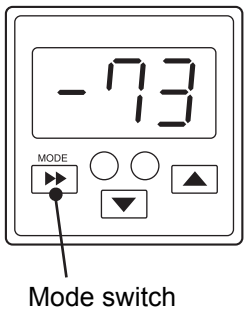
- See **<1.2.2 Robot body and control box>** for an illustration of the position where the filter and regulator unit is mounted.

2 **Make sure the appropriate pneumatic pressure (3.9×10^5 to 4.9×10^5 Pa (gauge)) is being supplied.**



- The pressure sensor can be set from -1 to -101 kPa (gauge).
- The pressure sensor senses a negative pressure in the vacuum suction unit to detect that the suction pad has sucked a product. When the vacuum pressure is larger than the setting value (for example, between -73 and -101 kPa(gauge) for a setting value of -73 kPa (gauge)), the product vacuum suction complete signal is transmitted to the control box.
- Adjust the pressure sensor setting value when either of the following occurs:
  - The take-out failure occurs even though the product has been sucked properly.
  - The take-out failure does not occur even though the product has not been sucked properly.
- See **<1.2.2 Robot body and control box>** for an illustration of the position where the pressure sensor is mounted.
- The value indicated for “H-1” and “h-1” are standard values.
  Change the value as necessary depending on the shape of the end-of-arm tool and the shape of the product.

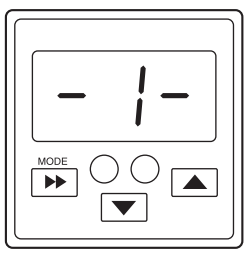
3 **Check the pressure sensor.**



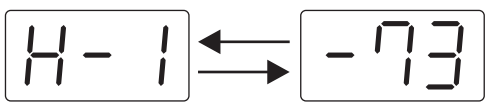
Mode switch

4 **Press the ▶▶ key.**

“-1” appears.



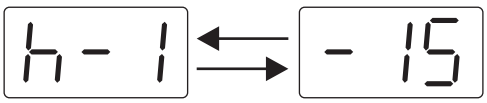
After three seconds, “H-1” and the setting value appear alternately.



5 **Use the ▲ ▼ keys to set the sensor to -73 kPa (gauge) (standard value).**

6 **Press the ▶▶ key once.**

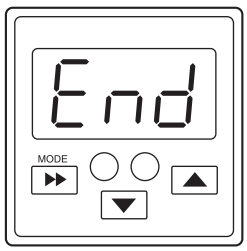
"h-1" and the setting value appear alternately.



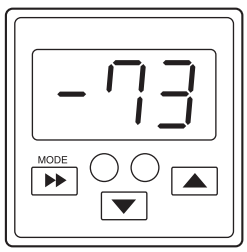
7 **Use the ▲ ▼ keys to set the sensor to -15 kPa (gauge) (standard value).**

8 **Press the ▶▶ key once.**

"End" appears, indicating the setting adjustment is complete.

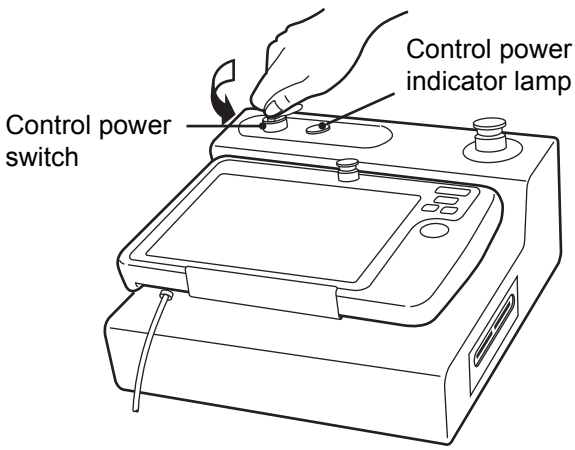


After a few moments, the display returns to the current value.



- Normally 0.0 is displayed when the vacuum suction is not ON. If a different value is displayed, zero the display by pressing and holding the ▶▶ key for at least five seconds. This display will change to 0.0.

9 **After adjustment, turn OFF the control power.**



4.3 Mechanical adjustments

4.3.1 Runner chuck position adjustment

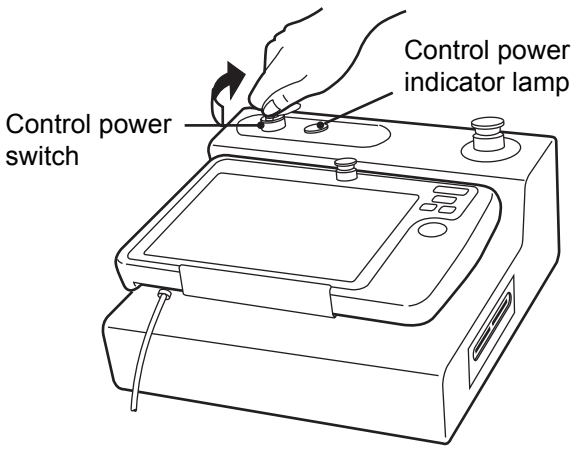
WARNING

- Before turning ON the take-out robot control power, make sure no persons or obstacles exist in the robot motion area.

CAUTION

- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

1 **Turn ON the take-out robot control power.**



2 **In manual mode, move the runner chuck to the runner take-out position.**

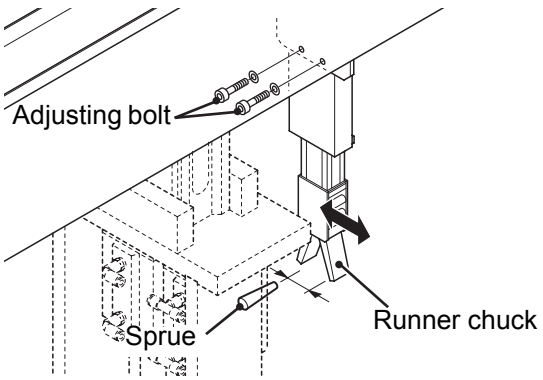
- See **<5.1 Manual operation description>** in the **Operation Manual** regarding how to operate the take-out robot in manual mode.

DANGER

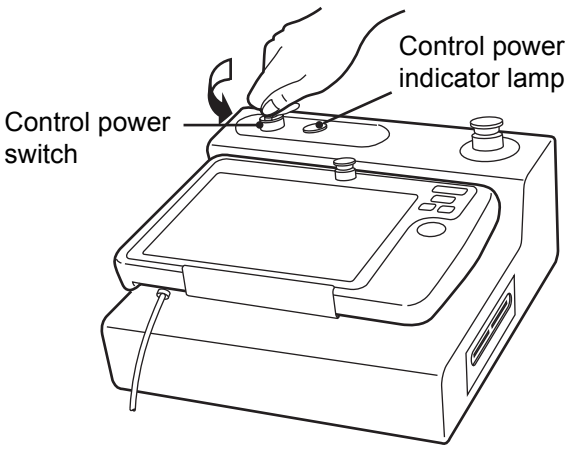
- The following step requires the operator to enter the motion are of the injection molding machine and the take-out robot. Be sure to check that the injection molding machine power is OFF before entering the motion area.
  Be sure to have at least two persons conduct the work and one person ready to press the emergency stop switch at any time.

3 **Loosen the two adjusting bolts securing the runner chuck and align the position of the chuck with the sprue.**

4 **When the correct position is attained, tighten the adjusting bolts.**



5 **After adjustment, turn OFF the control power.**



4.3.2 Runner chuck sensor position adjustment

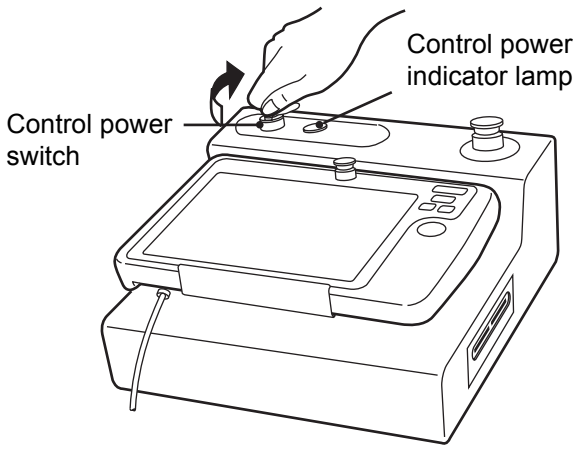
WARNING

- Before turning ON the take-out robot control power, make sure no persons or obstacles exist in the robot motion area.

CAUTION

- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

1 **Turn ON the take-out robot control power.**



2 **In manual mode, move the runner chuck to the end-of-arm tool change position.**

- See **<5.1 Manual operation>** in the **Operation Manual** regarding how to operate the take-out robot in manual mode.

DANGER

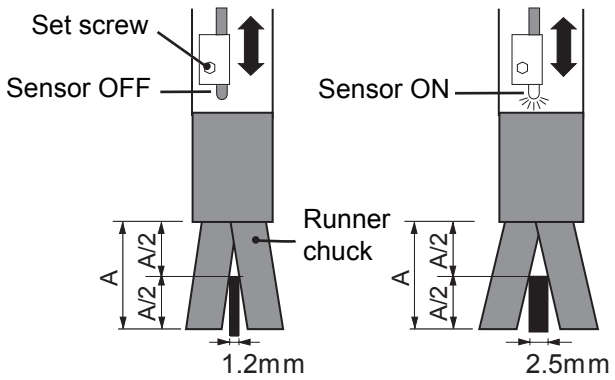
- The following step requires the operator to enter the motion are of the take-out robot. Be sure to have at least two persons conduct the work and one person ready to press the emergency stop switch at any time.

WARNING

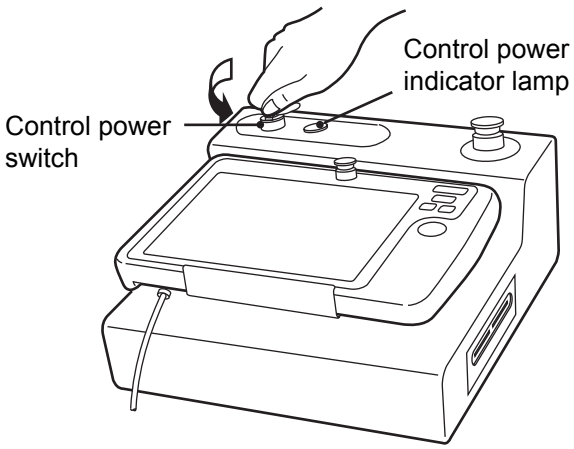
- Be careful not to get your fingers pinched in the runner chuck.

3 **In manual valve operation, hold a plate with the runner chuck as shown in the figure.**

- Adjust the sensor so that the sensor is OFF when a 1.2-millimeter plate is held and ON when a 2.5-millimeter plate is held.
- Also make sure the sensor is OFF when the runner chuck is open.
- When the sensor is ON, the lamp on the tip of the sensor lights.

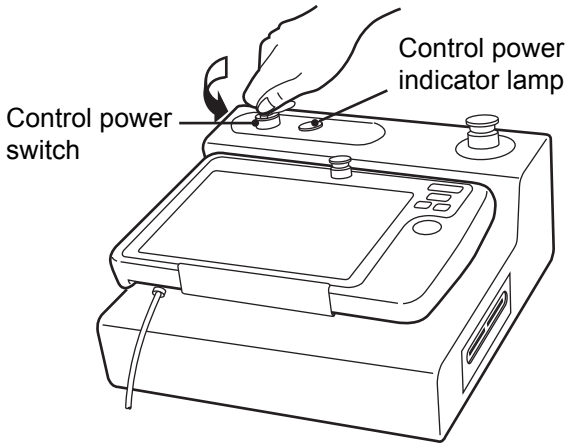


4 **After adjustment, turn OFF the control power.**

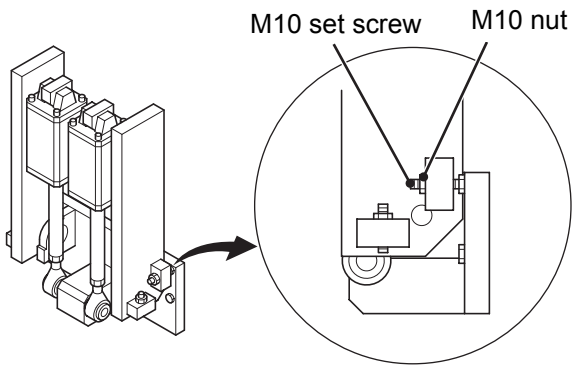


4.3.3 Flip unit angle adjustment

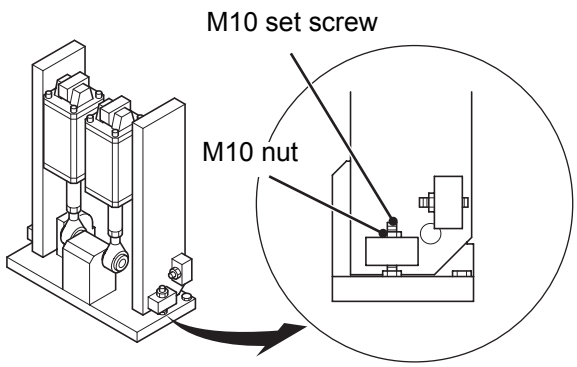
1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**



2 **Loosen M10 nut and set screw to adjust the flip unit to vertical, then retighten M10 nut and set screw.**

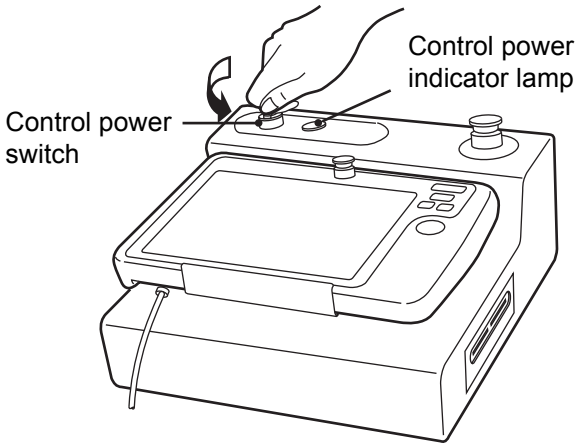


3 **Loosen M10 nut and set screw to adjust the flip unit to horizontal, then retighten M10 nut and set screw.**



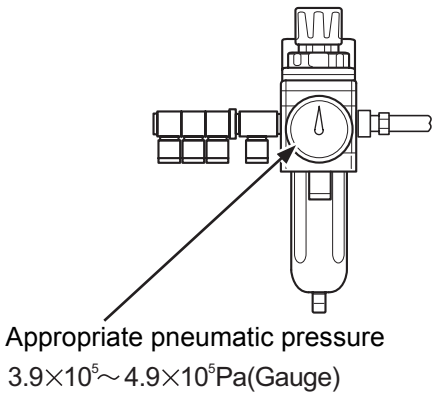
4.3.4 Flip/flip return speed adjustment

1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**



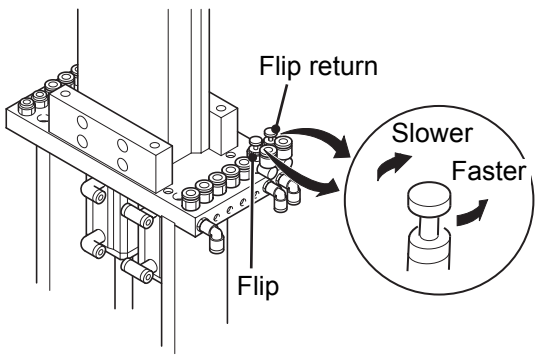
- See **<1.2.2 Robot body and control box>** for an illustration of the position where the filter and regulator unit is mounted.

2 **Make sure the appropriate pneumatic pressure (3.9×10^5 to 4.9×10^5 Pa (gauge)) is being supplied.**



3 **Adjust the speed using the speed controller shown in the figure.**

Turn the speed controller counter-clockwise to increase the speed or clockwise to decrease the speed.



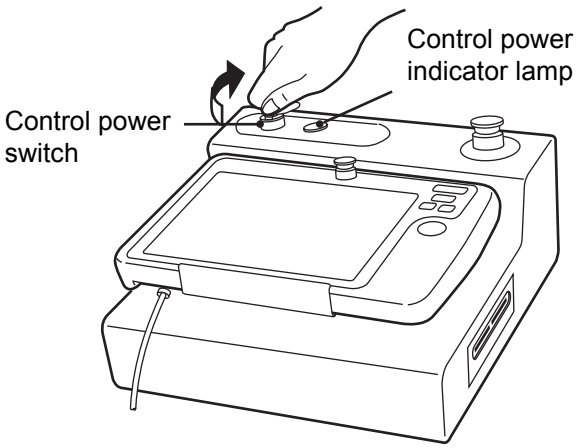
WARNING

- Before turning ON the take-out robot control power, make sure no persons or obstacles exist in the robot motion area.

CAUTION

- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

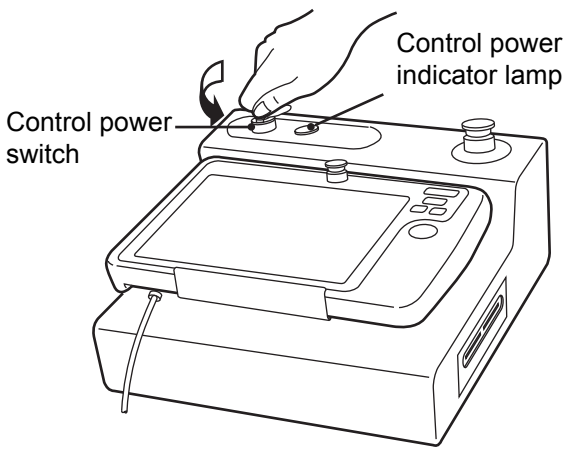
4 **Make sure the injection molding machine power is OFF. Then turn the take-out robot control power ON.**



5 **Operate the take-out robot and make sure the speed is appropriate.**

Repeat **Step 3** as required until the appropriate speed is attained.

6 **After adjustment, turn OFF the control power.**



5 REGULAR MAINTENANCE

WARNING

- Each procedure described in this section is on the condition that the injection molding machine power and the take-out robot control power are both OFF, unless otherwise specified. Always make sure the power is OFF before conducting these procedures.
- Place placards on the injection molding machine operation panel and the operator station of the take-out robot indicating that work is in progress and the power should not be turned ON.
- When it is necessary to turn the take-out robot control power ON during these procedures, be sure to have at least two persons conduct the work and one person ready to press the emergency stop switch at any time.

Parts replacement

CAUTION

- Unless otherwise specified, apply locking agent before fitting the bolts.
- Be sure to use the specified parts. (See **<A.6 Maintenance parts list>**.)
- Never apply an anaerobic locking agent to plastic cover mounting bolts. Gases evolved when such a locking agent is cured may deteriorate plastic, resulting in looseness of the mounting bolts.
- It is recommended to use the following locking agent for plastic cover mounting bolts.
  ThreeBond 1401

5.1 Maintenance check list

The take-out robot has the following regular maintenance items.

- **Start-up**
  Perform this maintenance item every day before operating the take-out robot.

- **Initial one month**
  Perform this maintenance item one month after installing the take-out robot.

- **Initial three months**
  Perform this maintenance item three months after installing the take-out robot.

- **One month**
  Perform this maintenance item monthly. However, at one month after installing the take-out robot, perform the initial one month maintenance item instead.

- **Three months**
  Perform this maintenance item every three months. However, at three month after installing the take-out robot, perform the initial three month maintenance item instead.

- **Six months**
  Perform this maintenance item every six months.

- **Twelve months**
  Perform this maintenance item every twelve months.

- Use the **maintenance list** to make a **Maintenance Check List** for each take-out robot.
- Make efficient use of the **maintenance list** to maintain the take-out robot.

	Maintenance item		Frequency							Date checked				Reference section
			Start-up	Initial one month	Initial three months	1 month	3 months	6 months	12 months					
Traverse unit	**Pulleys, timing belt**													
	1	Check each pulley mounting for looseness.			●				●					5.2.1
	2	Check the timing belt for looseness and damage.		●	●	●	●	●	●					
	Motor													
	1	Check the motor mounting for looseness.			●	●	●	●	●					5.2.1
	2	Check that the pulley mounting is tight.			●				●					
	3	Check the home position.							●					6.1.2
	Guide rails, track roller bearing													
	1	Lubrication.			●		●	●	●					5.2.3
Kick unit	**Motor, pulleys, timing belt**													
	1	Check the motor mounting for looseness.			●				●					5.2.4
	2	Check the drive pulley mounting for looseness.			●				●					
	3	Check the idle pulley mounting for looseness.			●				●					
	4	Check the timing belt for looseness and damage.		●	●	●	●	●	●					
	5	Check the home position.							●					6.2.2
	Guide rails													
	1	Lubrication.			●		●	●	●					5.2.6
Flip unit	**Flip bracket**													
	1	Check the flip bracket for damage.			●				●					5.2.7
	2	Check the flip bracket mounting for damage.		●	●	●	●	●	●					
	Flip cylinder													
	1	Check for air leaks.		●	●	●	●	●	●					5.2.7
	2	Check the cylinder rod for damage and looseness.			●				●					
	3	Check the rod end bearing for looseness.		●					●					
	Flip housing													
	1	Check the flip housing for damage.			●				●					5.2.7
	2	Check the flip housing bearing for damage.		●					●					

	Maintenance item		Frequency							Date checked				Reference section
			Start-up	Initial one month	Initial three months	1 month	3 months	6 months	12 months					
Arm unit	**Frame**													
	1	Check each frame mounting for looseness.		●					●					5.2.8
	2	Check each frame and the arm for damage and deformation.		●	●	●	●	●	●					
	3	Check unit cover for damage and looseness in its mounting.		●					●					
	Pulleys, timing belt													
	1	Check each pulley mounting for looseness.		●	●	●	●	●	●					5.2.8
	2	Check the timing belt for damage and looseness.		●	●	●	●	●	●					
	Guide rail													
	1	Lubrication.			●		●	●	●					5.2.10
Pneumatic system	**Filter and regulator unit**													
	1	Check the function of the regulator unit.							●					
	2	Adjust the pneumatic pressure.	●	●	●	●	●	●	●					4.2.1
	3	Check the condition of the pneumatic filter.	●	●	●	●	●	●	●					5.3.1
	Pneumatic tubing													
	1	Check the connections for air leakage.	●	●	●	●	●	●	●					
	2	Check the condition of the pneumatic tube bindings.	●	●	●	●	●	●	●					
	Vacuum generator													
	1	Check the mounting for looseness and damage.		●					●					5.3.2
	2	Check the function of the vacuum generator.		●	●	●	●	●	●					
	3	Check the condition of the filter.	●	●	●	●	●	●	●					
	Exhaust unit													
	1	Check the mounting for looseness and damage.		●					●					
	Solenoid valve													
	1	Check for air leakage.	●	●	●	●	●	●	●					4.2.2
	2	Check the mountings for looseness.		●					●					
	3	Check the function of each solenoid valve.							●					
Robot body	**Robot body**													
	1	Check the spacer and the mounting base for looseness.		●	●	●	●	●	●					
	2	Check the leg mountings for looseness.		●	●	●	●	●	●					
	3	Check the robot body and covers for looseness and damage.		●	●	●	●	●	●					

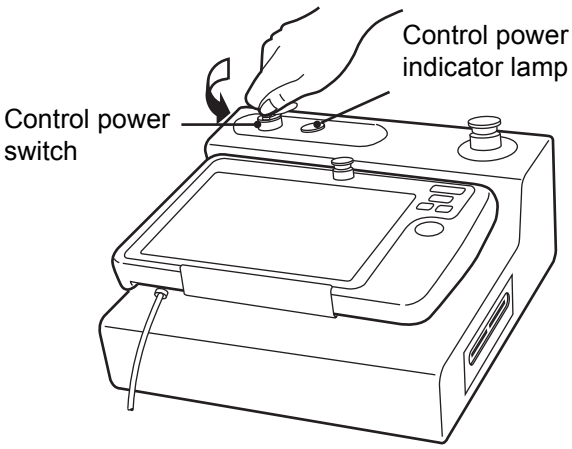
		Maintenance item	Frequency							Date checked				Reference section
			Start-up	Initial one month	Initial three months	1 month	3 months	6 months	12 months					
Robot body		**Parts that showed abnormalities on the previous work day**												
	1	Check for normal operation.	●											
Electrical unit		**Control box**												
	1	Check the operation and cable connections of the power supply unit.		●				●	●					5.4.3
	2	Check the operation and cable connections of the servo amp unit.		●				●	●					
	3	Check the operation of the servo control unit.		●				●	●					
	4	Check the operation and optical connector of the CPU.		●				●	●					
	5	Check the condition of the relay contacts on the interface board.		●	●	●	●	●	●					
	6	Check the condition of the interlocks with the injection molding machine.	●	●	●	●	●	●	●					
	7	Check the function of the cooling fan.		●				●	●					5.4.1
	8	Check the encoder cable and other connectors for looseness.		●				●	●					
		Operator station												
	1	Check the emergency stop function.	●	●	●	●	●	●	●					3.7
	2	Check the operation of each switch and lamp.							●					
		Touch panel controller												
	1	Check the CF card operation.							●					1.2.6
	2	Check the eject button operation.							●					1.2.6
	3	Check the emergency stop function.	●	●	●	●	●	●	●					
	4	Check the function of each screen.							●					5.4.2
	5	Check the monitor for dirt and damage.							●					
		Sensors, switches												
	1	Check the operation and mounting condition of each sensor and switch.	●	●				●	●					5.4.3
	2	Check the condition of wiring and bindings.		●	●	●	●	●	●					
		Wiring												
	1	Check each connector and terminal connection for looseness.		●					●					5.4.3
	2	Check the cables and wiring for damage.		●	●	●	●	●	●					

5.2 Mechanical section

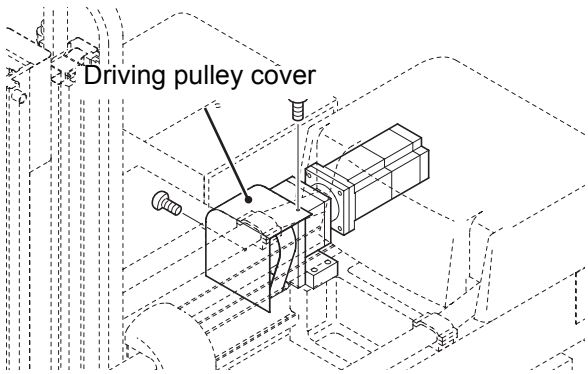
- Procedures described in this section are based on a maintenance frequency of twelve months. Some steps may not be necessary depending on when the maintenance work is conducted. Perform only necessary steps.

5.2.1 Traverse unit

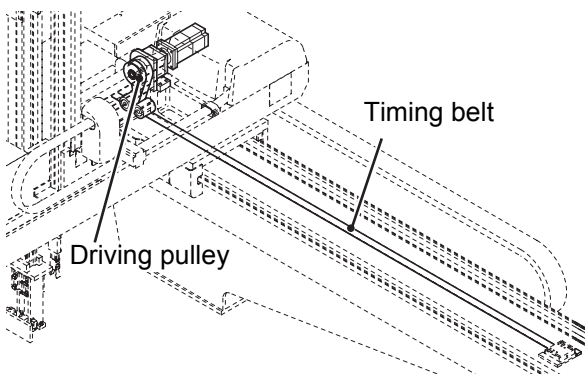
1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**



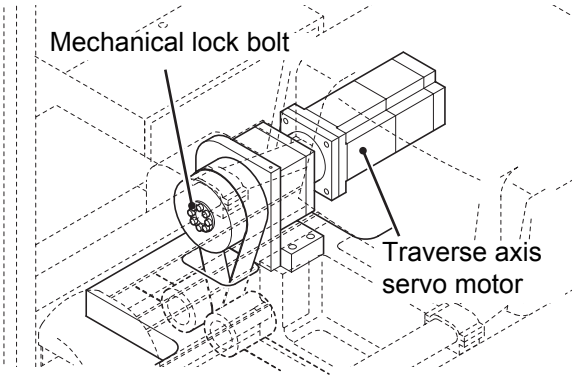
2 **Remove the cover of the driving pulley.**



3 **Make sure the driving pulley is securely mounted.**



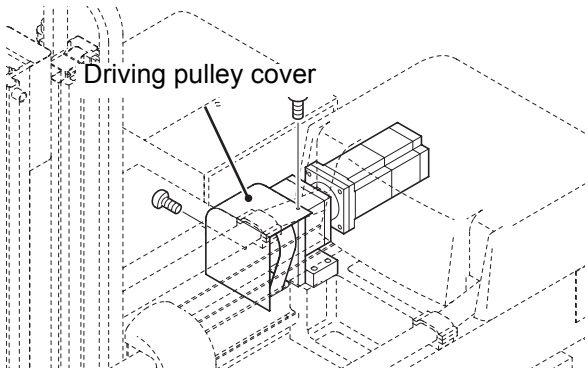
4 **Make sure the motor is securely mounted.**



5 **Make sure the timing belt has the specified tension and is not damaged.**

- See **<5.2.2 Traverse axis timing belt tension adjustment>** regarding how to adjust the timing belt tension.

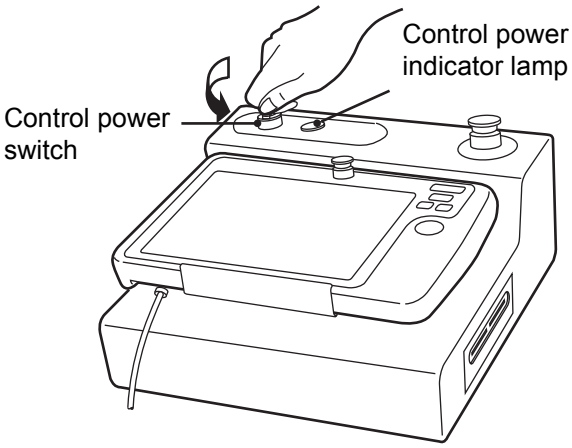
6 **Install the removed cover.**



5.2.2 Traverse axis timing belt tension adjustment

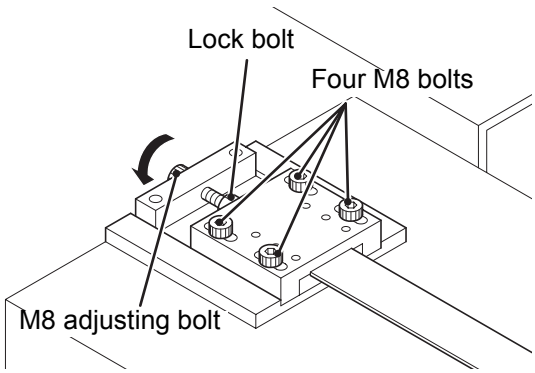
- See **<A.10 Timing belt tension measurement>** regarding how to measure the tension of the timing belt.

1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**



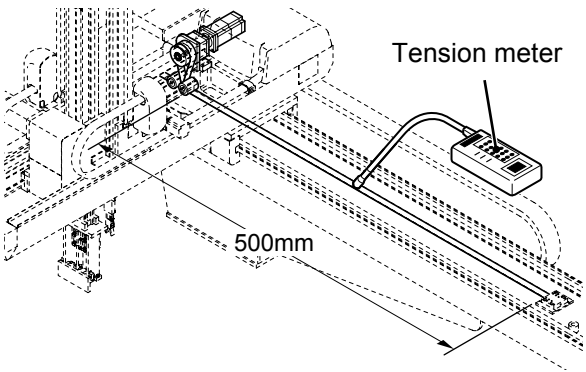
2 **Loosen the four M8 bolts securing the clamp. Loosen the lock nut.**

3 **Adjust the tension of the timing belt using the M8 adjusting bolt.**



4 **Move the traverse axis by hand to the position shown in the figure.**

5 **Enter the measurement conditions into the tension meter.**



Measurement conditions

- Specific weight : 0.60 g/cm^2
- Width : 50 mm
- Span : 500 mm

6 **Pluck the timing belt with your finger and measure the tension.**
The tension should be 70 ± 3 kgf (686 ± 30 N).
If necessary, return to **Step 3** and adjust the tension to the appropriate value.

7 **Reassemble in the opposite order of disassembly.**

DANGER

- Before beginning break-in operation, make sure no persons or obstacles exist in the robot motion area. Break-in operation is performed with the take-out robot operating in Auto mode and the injection molding machine OFF.

8 **Perform break-in operation for five to ten minutes.**

- After installing a new timing belt, perform break-in operation for ten hours or more.

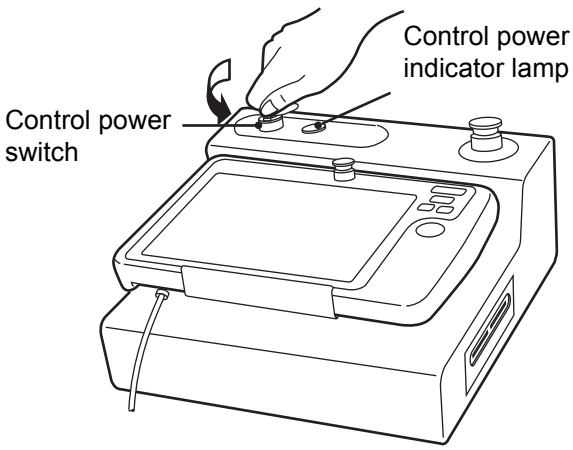
9 **After the timing belt has stretched, repeat the tension measurement and adjustment.**

5.2.3 Traverse axis lubrication

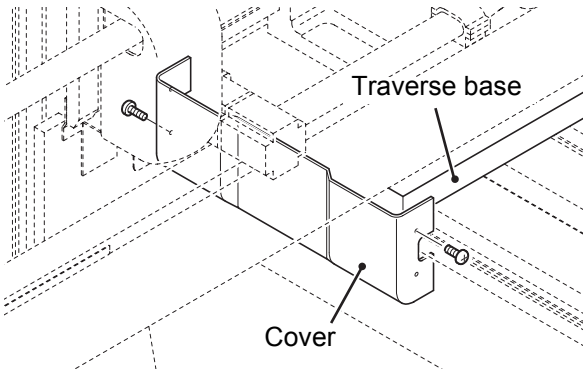
CAUTION

- Use gleitmo 585M (FUCHS LUBRITECH GMBM) we recommend for lubrication. The product is factory greased with this lubricant.
- Never use a fluorine-based grease. It may chemically react, causing damage to the product.

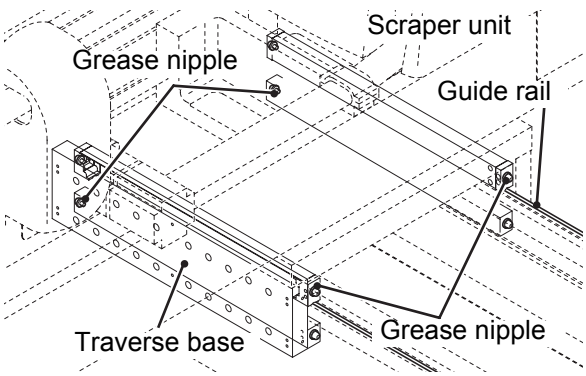
1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**



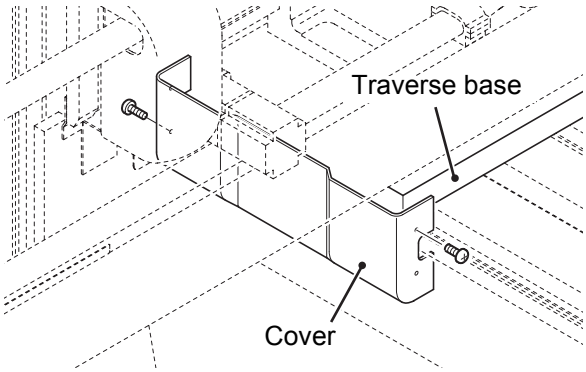
2 **Remove the cover of the traverse base.**



3 **Apply the specified grease to 8 grease nipples using a grease gun.**

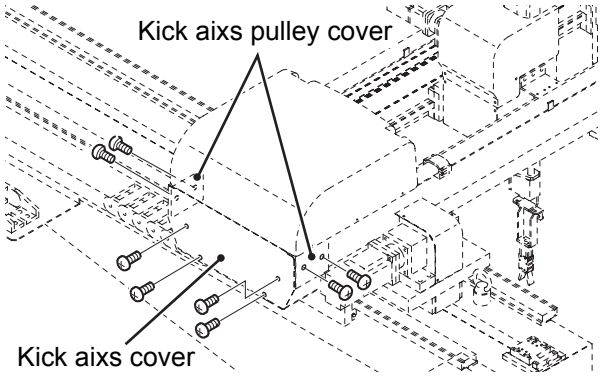


4 **Install the removed cover.**



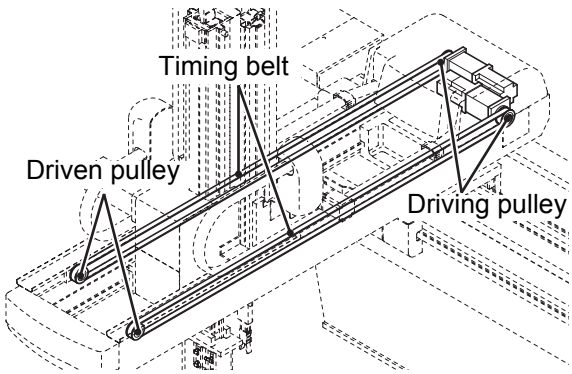
5.2.4 Kick unit

1 **Remove the kick axis cover and the kick axis pulley covers.**



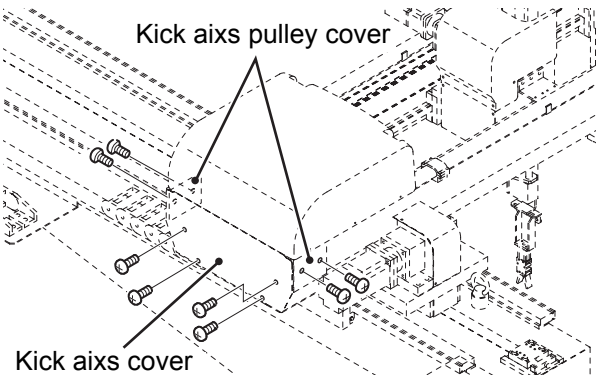
2

- **Make sure the motors are securely mounted.**
- **Make sure the driving pulleys are securely mounted.**
- **Make sure the driven pulleys are securely mounted.**
- **Make sure the timing belts have the specified tension and are not damaged.**



- See **<5.2.5 Kick axis timing belt tension adjustment>** regarding how to adjust the timing belt tension.

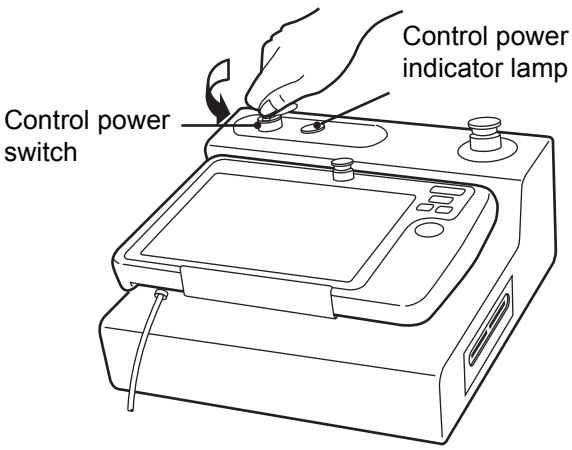
3 **Install the removed covers.**



5.2.5 Kick axis timing belt tension adjustment

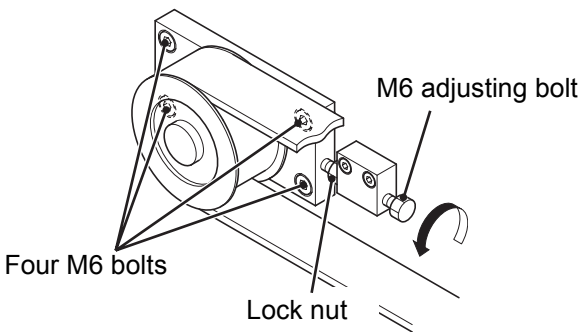
- This subsection describes how to adjust the tension of the main arm kick axis timing belt, but the procedure for the sub arm kick axis is basically the same. Follow the steps described below when adjusting the timing belt of the sub arm kick axis as well.
- See **<A.10 Timing belt tension measurement>** for instructions regarding how to measure the tension of the timing belt.

1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**



2 **Loosen the four M6 bolts securing the driven pulley. Loosen the lock nut.**

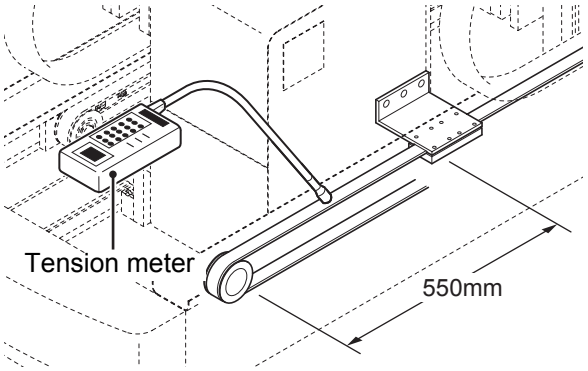
3 **Adjust the tension of the timing belt using the M6 adjusting bolt.**



CAUTION

- The M6 adjusting bolt and block can be used for both main and sub arms. To adjust the sub arm, use the main arm block after removing it from the main arm.

4 **Move the kick axis by hand to the position shown in the figure.**



5 **Enter the measurement conditions into the tension meter.**

Measurement conditions

- Specific weight : 0.6 g/cm^2
- Width : 25 mm
- Span : 550 mm

6 **Pluck the timing belt with your finger and measure the tension.**
The tension should be 40 ± 3 kgf (392 ± 30 N).

If necessary, return to **Step 3** and adjust the tension to the appropriate value.

7 **Reassemble in the opposite order of disassembly.**

DANGER

- Before beginning break-in operation, make sure no persons or obstacles exist in the robot motion area. Break-in operation is performed with the take-out robot operating in Auto mode and the injection molding machine OFF.

8 **Perform break-in operation for five to ten minutes.**

- After installing a new timing belt, perform break-in operation for ten hours or more.

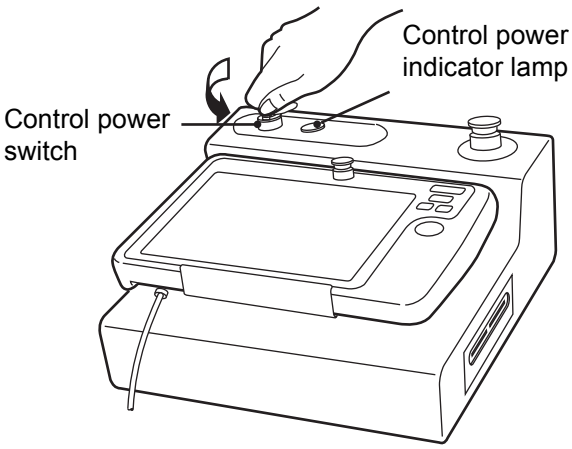
9 **After the timing belt has stretched, repeat the tension measurement and adjustment.**

5.2.6 Kick axis lubrication

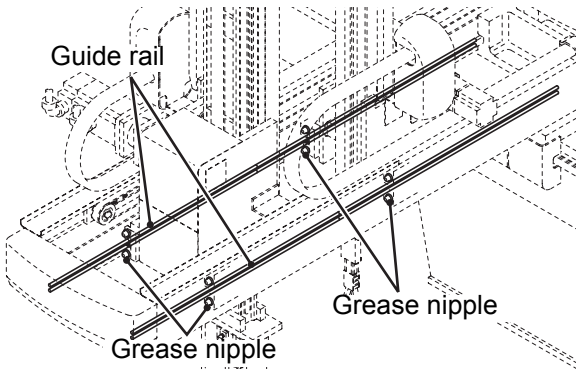
CAUTION

- Use gleitmo 585M (FUCHS LUBRITECH GMBM) we recommend for lubrication. The product is factory greased with this lubricant.
- Never use a fluorine-based grease. It may chemically react, causing damage to the product.

1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**



2 **Apply the specified grease to 8 grease nipples using a grease gun.**



5.2.7 Flip unit

1

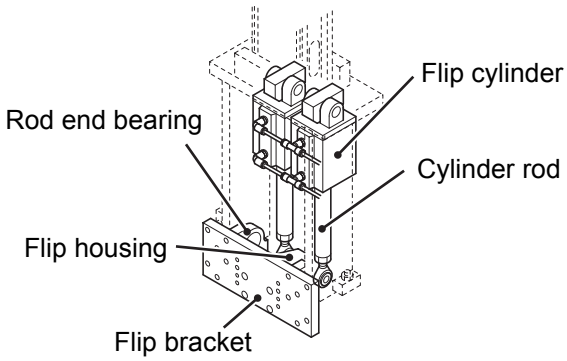
- **Check the flip bracket for damage.**
- **Check the flip bracket mounting for looseness.**

2

- **Check the flip cylinder and pneumatic tubing for air leakage.**
- **Check the cylinder for damage and looseness.**
- **Check the rod end bearing for looseness.**

3

- **Check the flip housing for damage.**
- **Check the flip housing bearing for looseness.**



5.2.8 Arm unit

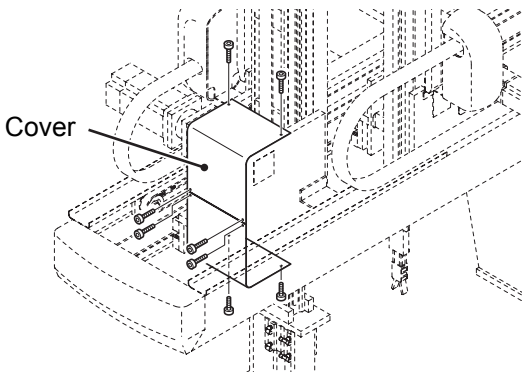
- This subsection describes how to check and adjust the main arm unit, but the procedure for the sub arm unit is basically the same. Follow the steps described below when checking and adjusting the sub arm unit as well.

1

- **Check each frame mounting for looseness.**
- **Check each frame and arm unit for damage and deformation.**
- **Check each cover for damage and make sure each cover is mounted securely.**

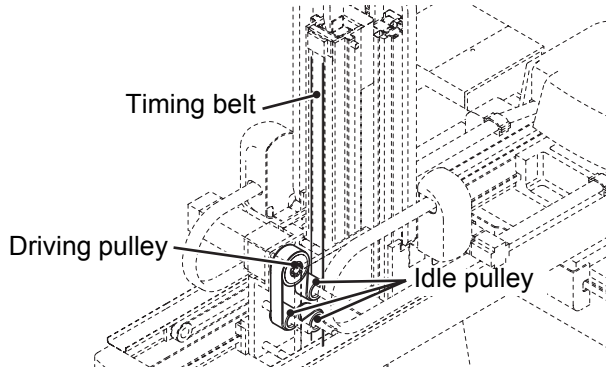
2

Remove the cover required for the check.



3

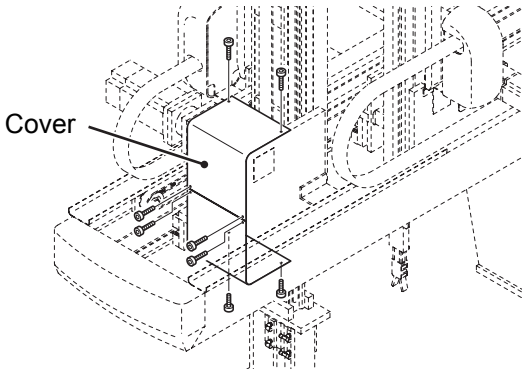
- **Make sure each pulley is mounted securely.**
- **Make sure the timing belt has the specified tension and is not damaged.**



- See **<5.2.9 Descent axis timing belt tension adjustment>** regarding how to adjust tension of the timing belt.

4

Install the removed cover.



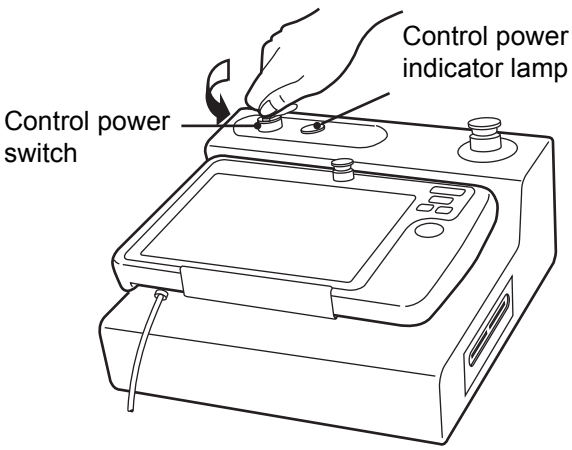
5.2.9 Descent axis timing belt tension adjustment

- This subsection describes how to adjust the tension of the main arm descent axis timing belt, but the procedure for the sub arm descent axis is basically the same. Follow the steps described below when adjusting the timing belt of the sub arm descent axis as well.
- See **<A.10 Timing belt tension measurement>** for instructions regarding how to measure the tension of the timing belt.

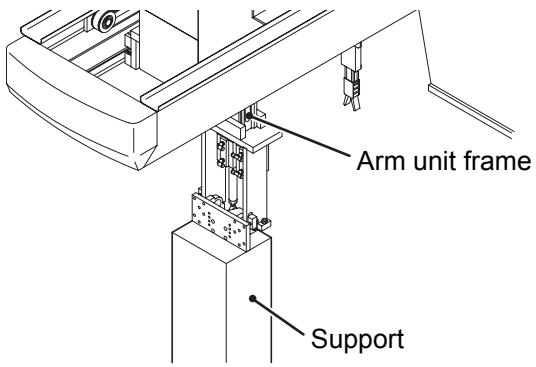
CAUTION

- Perform the following procedure with the end-of-arm tool removed. The take-our arm drops down due to its own weight when the mechanical lock of the driving pulley is loosened.
- Place a support under the arm unit frame. Otherwise the arm unit frame may drop down.

1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**



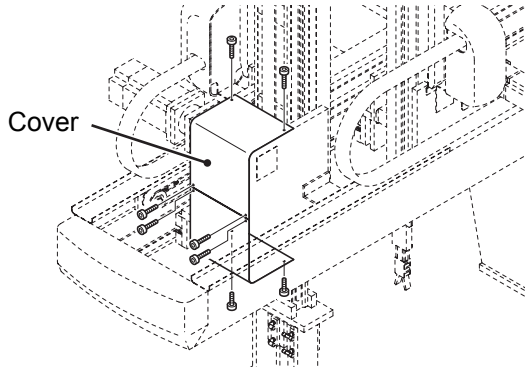
2 **Place a support under the arm unit frame and release the pneumatic pressure of the main arm.**



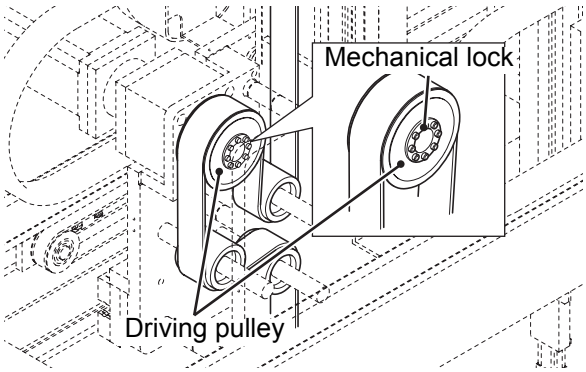
DANGER

- Be sure to release the pneumatic pressure of the main arm.
  If you loosen the mechanical lock without releasing the pneumatic pressure, the arm unit frame may ascend due to the function of the balance cylinder.

3 **Remove the covers shown in the figure.**

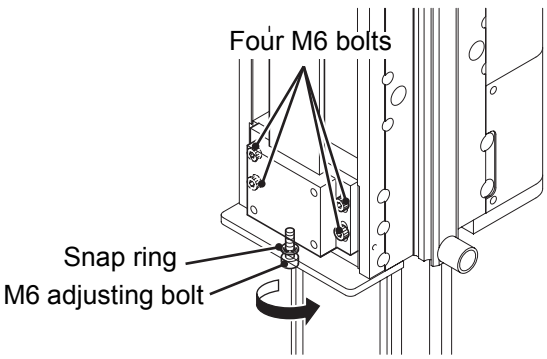


4 **Loosen the mechanical lock securing the driving pulley and place the arm unit frame on the support.**



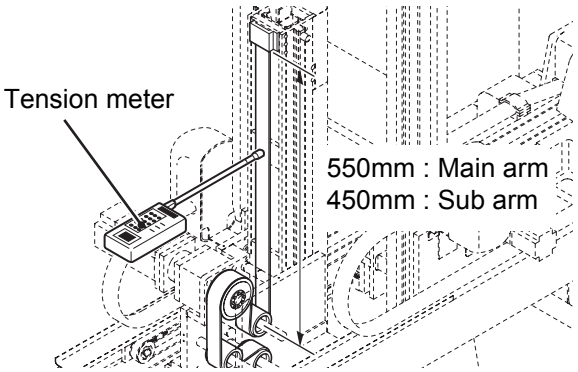
- See **<A.12 Mechanical lock installation/removal>** regarding how to loosen the mechanical lock.

5 **Loosen the four M6 bolts and adjust the tension of the timing belt using the M6 adjusting bolts.**



6 **Enter the measurement conditions into the tension meter.**

Measurement condition	Main arm	Sub arm
Specific weight	0.60 g/cm^2	0.60 g/cm^2
Width	50 mm	25 mm
Span	550 mm	450 mm
Tension	85 ± 3 kgf 833 ± 30 N	35 ± 3 kgf 343 ± 30 N



7 **Pluck the timing belt with your finger and measure the tension.**
The table of Step 6 shows the proper tension for each robot model.
If necessary, return to **Step 5** and adjust the tension to the appropriate value.

8 **Reassemble in the opposite order of disassembly.**

9 **Adjust the home position.**

- See **<6.4 Home position setting>** regarding how to adjust the home position.

DANGER

- Before beginning break-in operation, make sure no persons or obstacles exist in the robot motion area. Break-in operation is performed with the take-out robot operating in Auto mode and the injection molding machine OFF.

10 **Perform break-in operation for five to ten minutes.**

- After installing a new timing belt, perform break-in operation for ten hours or more.

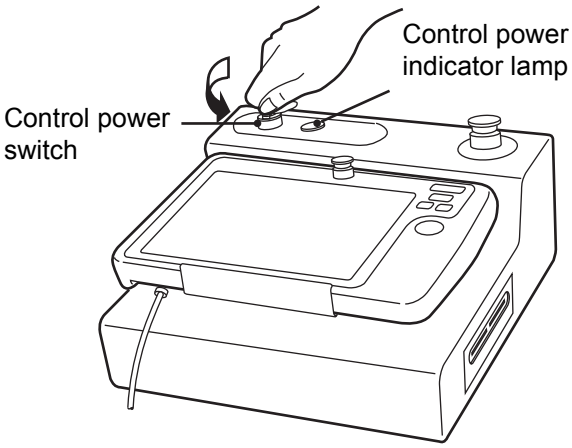
11 **After the timing belt has stretched, repeat the tension measurement and adjustment.**

5.2.10 Sub arm Descent axis lubrication

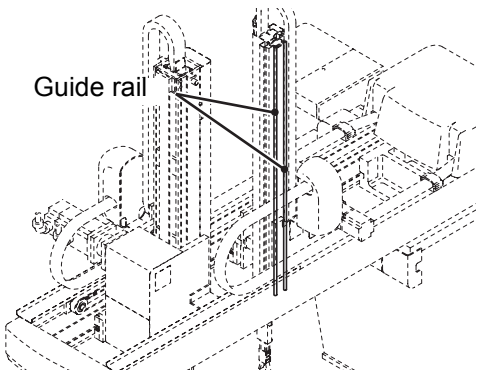
CAUTION

- Use gleitmo 585M (FUCHS LUBRITECH GMBM) we recommend for lubrication. The product is factory greased with this lubricant.
- Never use a fluorine-based grease. It may chemically react, causing damage to the product.

1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**



2 **Wipe grease off the guide rails (first step) and apply new grease using a brush or the like.**



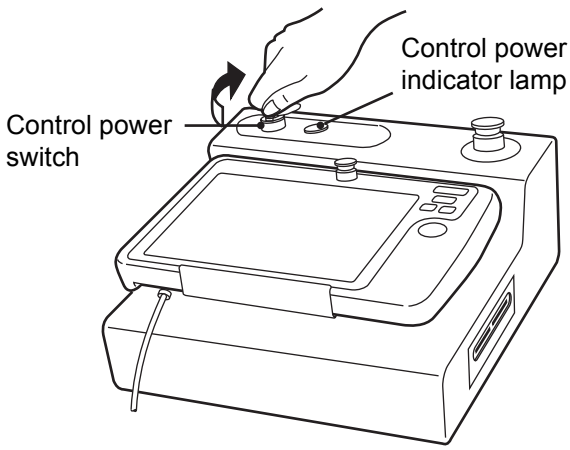
WARNING

- Before turning ON the take-out robot control power, make sure no persons or obstacles exist in the robot motion area.

CAUTION

- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

3 Turn ON the take-out robot control power.



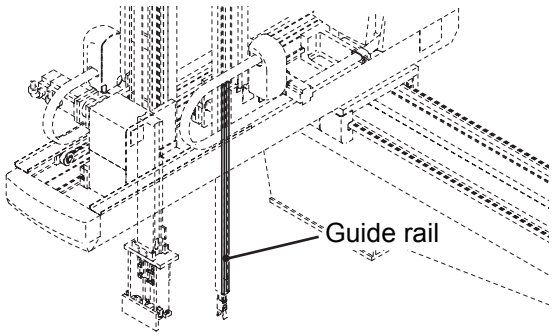
4 Move the arm unit to the maximum stroke in manual mode.

- See **<5.1 Manual operation description>** in the **Operation Manual** regarding how to operate the take-out robot in manual mode.

DANGER

- The following step requires the operator to enter the motion area of the take-out robot. Be sure to have at least two persons conduct the work and one person ready to press the emergency stop switch at any time.

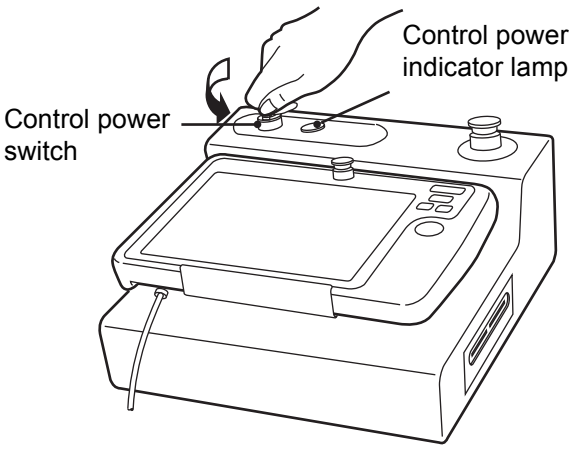
5 **Wipe the grease off the guide rails (second step) and apply new grease using a brush or the like.**



6 **Move the arm unit to the ascent limit in manual mode.**

- See **<5.1 Manual operation description>** in the **Operation Manual** regarding how to operate the take-out robot in manual mode.

7 **Turn OFF the take-out robot control power.**

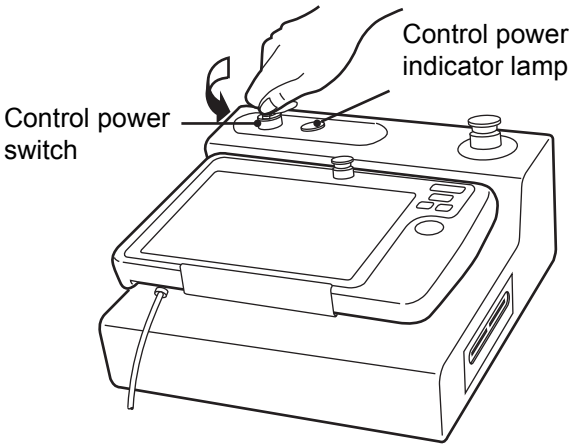


5.2.11 Main arm Descent axis lubrication

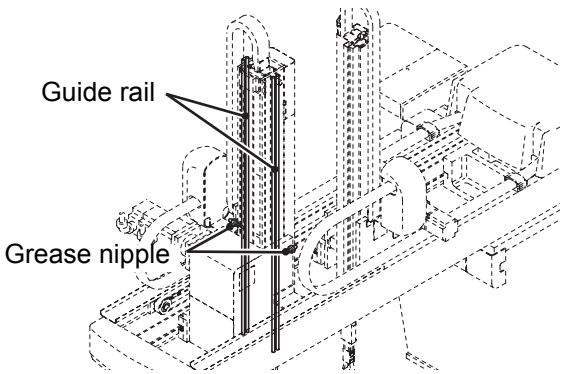
CAUTION

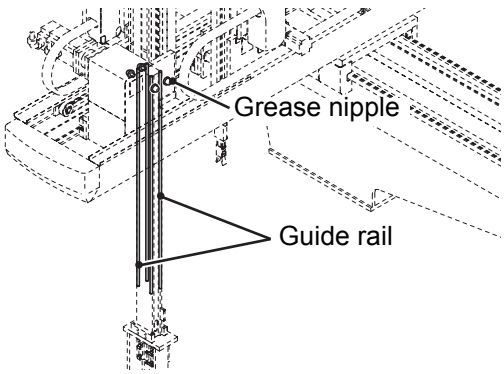
- Use gleitmo 585M (FUCHS LUBRITECH GMBM) we recommend for lubrication. The product is factory greased with this lubricant.
- Never use a fluorine-based grease. It may chemically react, causing damage to the product.

1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**



2 **Apply the specified grease to 6 grease nipples using a grease gun.**





5.3 Pneumatic system

- Procedures described in this section are based on a maintenance frequency of twelve months. Some steps may not be necessary depending on when the maintenance work is conducted. Perform only necessary steps.

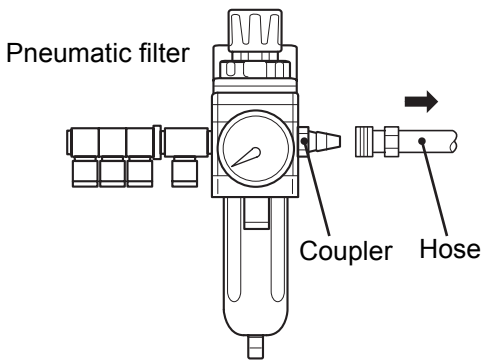
5.3.1 Pneumatic filter

WARNING

- Be sure to release the pneumatic pressure before performing the following procedure.

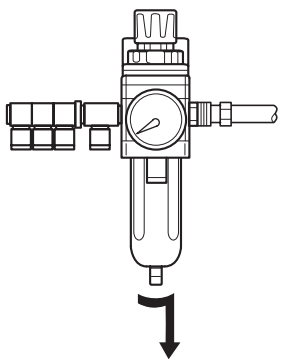
- See **<1.2.2 Robot body and control box>** for an illustration of the position where the filter and regulator unit is mounted.

1 **Remove the hose from the pneumatic filter coupler.**



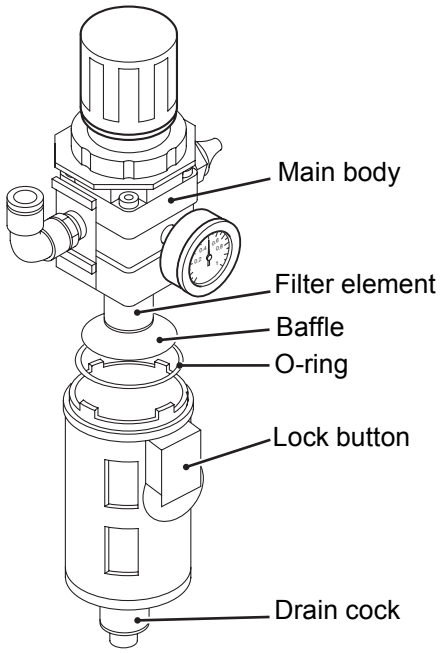
2 **While pressing the red lock button, turn the bowl guard clockwise (in the opposite direction of the arrow) and align the lock button with IN.**

Remove the bowl and bow guard.



3 **Check that the filter element is clean and undamaged.**
If the filter element is dirty, blow it clean with compressed air.
If the filter element is badly damaged, replace it.
(See <A.6 Maintenance parts list>.)
Make sure the filter element is clean.

Filter structure



4 **Reassemble in the opposite order of disassembly.**

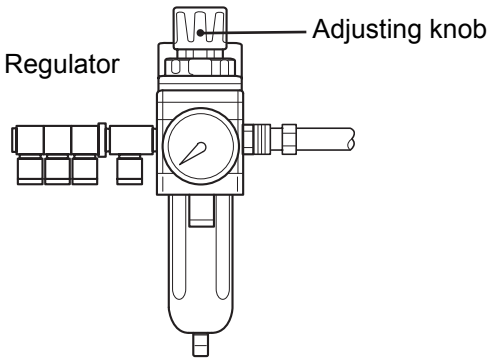
5.3.2 Vacuum generator check and vacuum generator filter replacement

WARNING

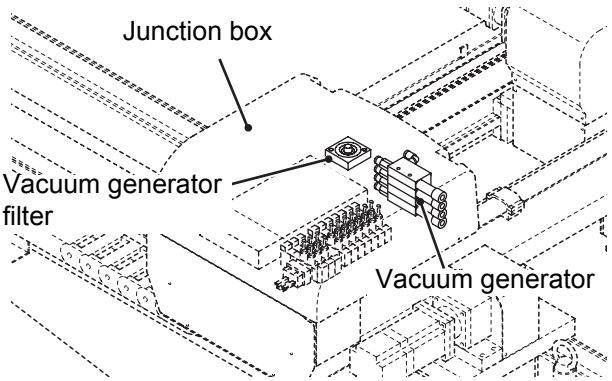
- Be sure to release the pneumatic pressure before performing the following procedure.

- See **<1.2.2 Robot body and control box>** for an illustration of the position where the filter and regulator unit is mounted.

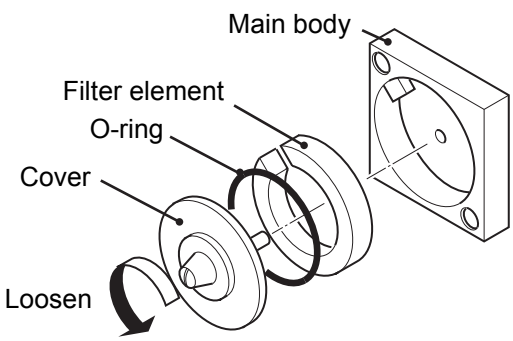
1 **Turn the regulator adjusting knob so that the pneumatic pressure is 0 Pa (gauge)**



2 **Make sure the vacuum generator in the junction box is mounted securely.**
Make sure the vacuum generator filter is clean and undamaged.

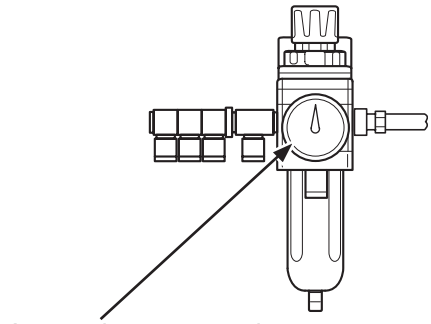


3 **If the filter is dirty, clogged, or damaged, change the filter element. (See <A.6 Maintenance parts list>.)**
To remove the filter element, unscrew and remove the cover.



4 **Reassemble in the opposite order of disassembly.**

5 **Pull up the adjusting knob as shown in the figure and adjust the pneumatic pressure to 3.9×10^5 to 4.9×10^5 Pa (gauge).**



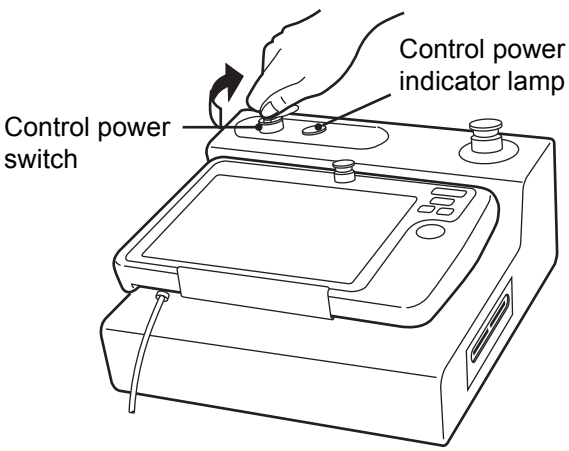
WARNING

- Before turning ON the take-out robot control power, make sure no persons or obstacles exist in the robot motion area.

CAUTION

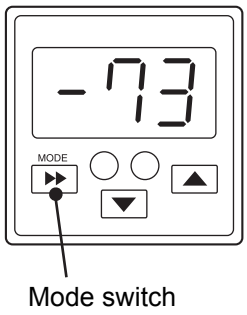
- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

6 **Turn ON the take-out robot control power.**
Do not turn ON the injection molding machine power at this time.



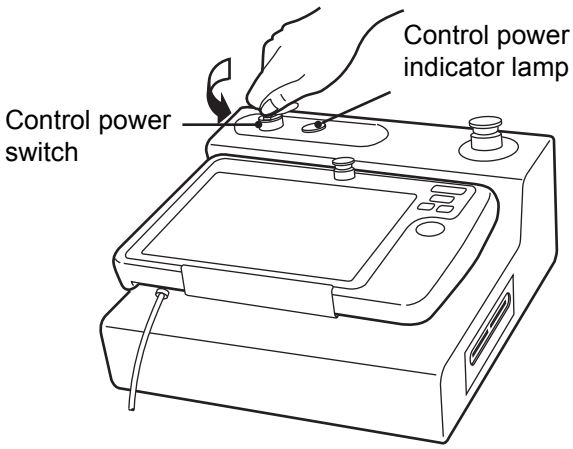
7 **Check the function of the vacuum generator using the pressure sensor.**

The pressure should be -73 kPa (gauge).



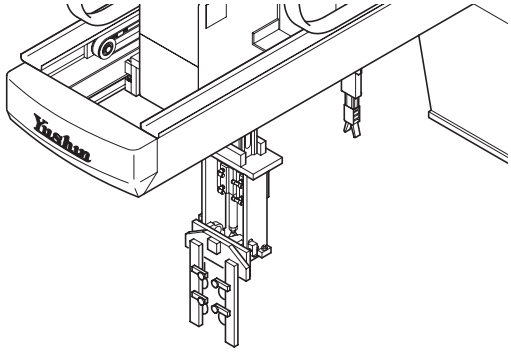
- See **<1.2.2 Robot body and control box>** for an illustration of the position where the pressure sensor is mounted.

8 **Turn OFF the take-out robot control power.**



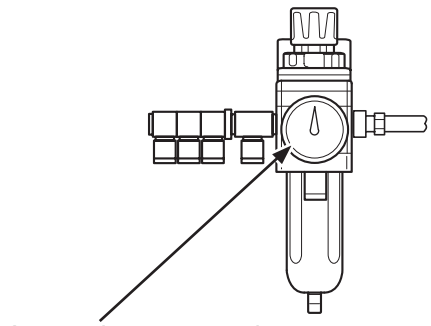
5.3.3 Balance cylinder pneumatic pressure adjustment

1 **Attach the desired end-of-arm tool.**

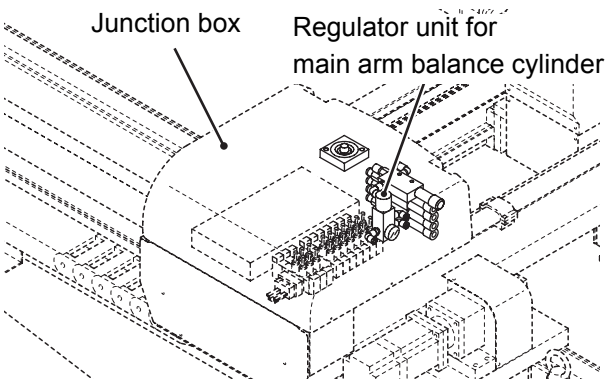


- See **<1.2.2 Robot body and control box>** for an illustration of the position where the filter and regulator unit is mounted.

2 **Make sure the appropriate pneumatic pressure (3.9×10^5 to 4.9×10^5 Pa (gauge)) is being supplied.**



3 **Adjust the balance cylinder regulator to 0.4 MPa (factory setting value).**



5.4 Electrical section

WARNING

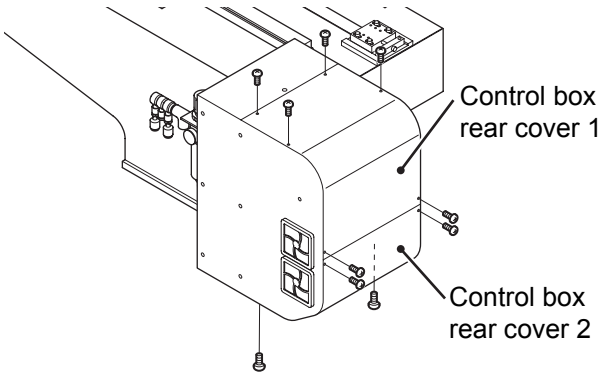
- To prevent electrical accidents, allow only those technicians who have received basic electrical training and been approved by the take-out robot safety supervisor to conduct this work.

- Procedures described in this section are based on a maintenance frequency of twelve months. Some steps may not be necessary depending on when the maintenance work is conducted. Perform only necessary steps.

5.4.1 Control box

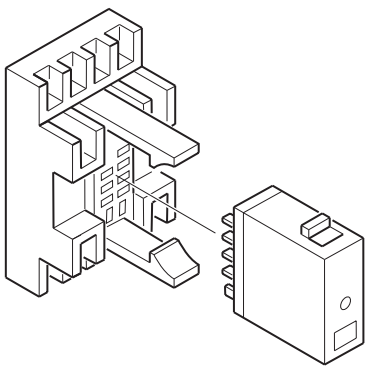
1 **Remove the control box rear cover 1 and the control box rear cover 2.**

2 **Check each mounting and terminal for looseness.**

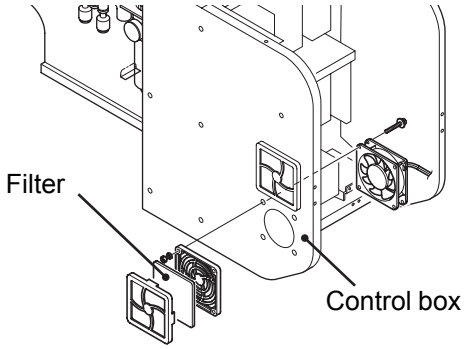


- See **<A.4 Control box layout drawings>** regarding the control box layout.

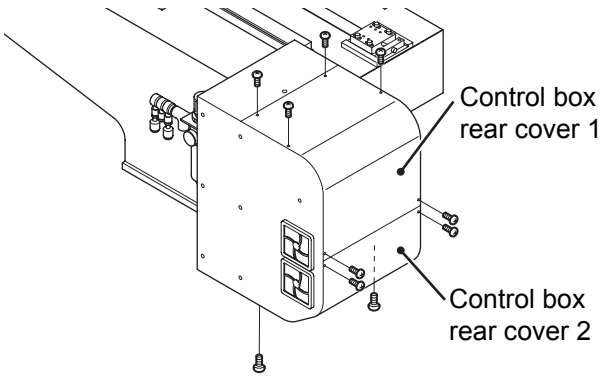
3 **If a relay is damaged or its contacts are bad, replace it. (See <A.6 Maintenance parts list>.)**



4 **Check the condition of the cooling fan filter.**
If the filter is dirty or damaged, replace it. (See <A.6 Maintenance parts list>.)



5 **Reinstall the removed covers.**



5.4.2 Operator station

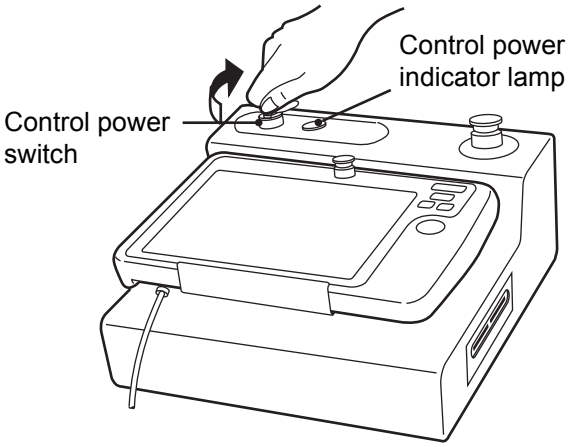
DANGER

- Before beginning confirm operation, make sure no persons or obstacles exist in the robot motion area.
- During confirm operation, operation of the take-out robot can be started when the mold opens even if the injection molding machine safety gate is open. Work from outside the safety fence. When working within the safety fence is unavoidable, be sure to work with at least two persons and one person ready to press the emergency stop switch at any time. Never put your hand inside the mold.

CAUTION

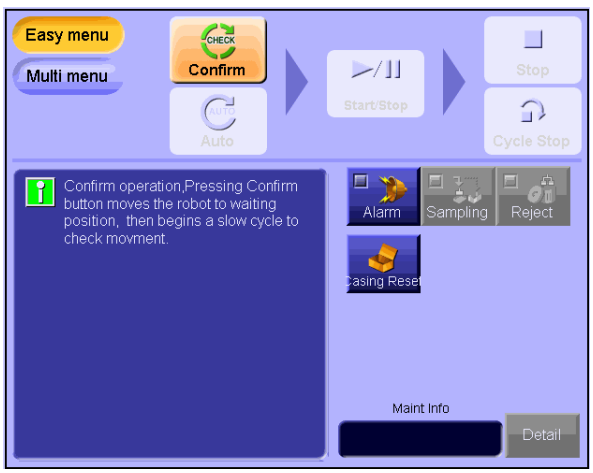
- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

1 **Turn ON the take-out robot control power.**



- See **<3.1 Confirm operation description>** in the **Operation Manual** regarding how to perform confirm operation.

The operation screen appears.

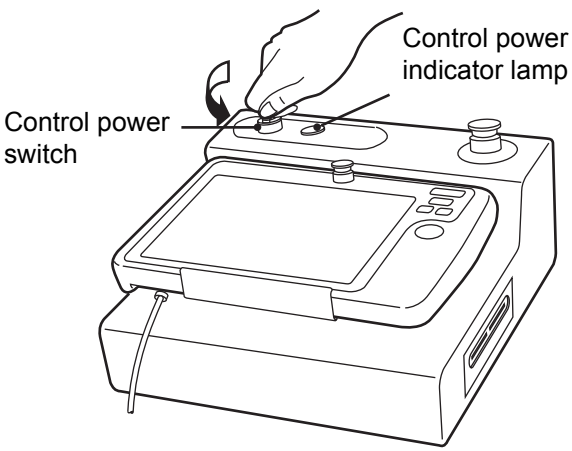


2 **Touch the [Confirm] button to perform confirm operation.**

3 **After the robot has moved to the waiting position, touch the [Start] button to start confirm operation.**

Make sure that the take-out robot operates properly in response to the operation of the touch panel controller.

4 **Turn OFF the control power.**



5.4.3 Sensors and wiring

1

- **Check the operation of each sensor and switch and make sure it is securely mounted.**
- **Check the wiring for damage, wear, and burns.**
- **Check the wiring bindings for cracks and damage.**
- **Check each cable connection for cracks and damage.**

6 OVERHAUL

WARNING

- Each procedure described in this section is on the condition that the injection molding machine power and the take-out robot control power are both OFF, unless otherwise specified. Always make sure the power is OFF before conducting these procedures.
- Place placards on the injection molding machine operation panel and the operator station of the take-out robot indicating that work is in progress and the power should not be turned ON.
- When it is necessary to turn the take-out robot control power ON during these procedures, be sure to have at least two persons conduct the work and one person ready to press the emergency stop switch at any time.

Parts replacement

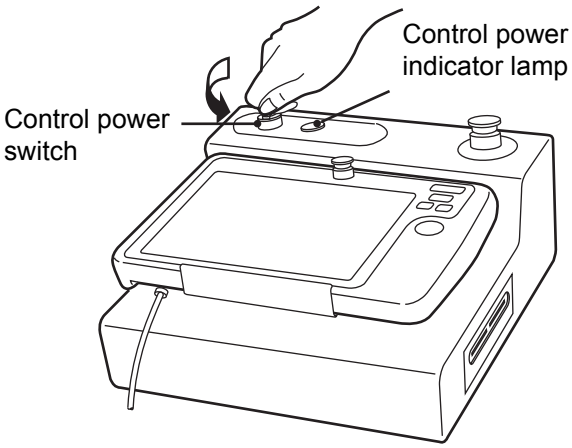
CAUTION

- Unless otherwise specified, apply locking agent before fitting the bolts.
- Be sure to use the specified parts. (See **<A.6 Maintenance parts list>**.)
- Never apply an anaerobic locking agent to plastic cover mounting bolts. Gases evolved when such a locking agent is cured may deteriorate plastic, resulting in looseness of the mounting bolts.
- It is recommended to use the following locking agent for plastic cover mounting bolts.
  ThreeBond 1401

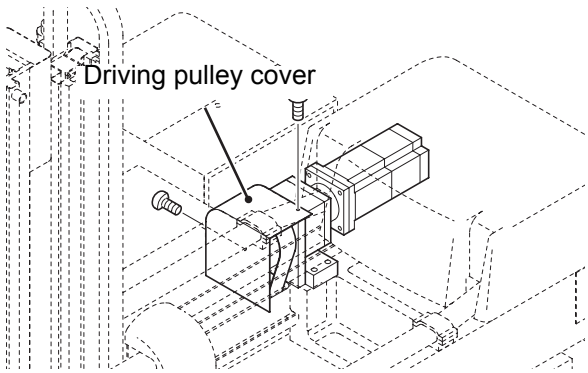
6.1 Traverse unit

6.1.1 Traverse unit timing belt replacement

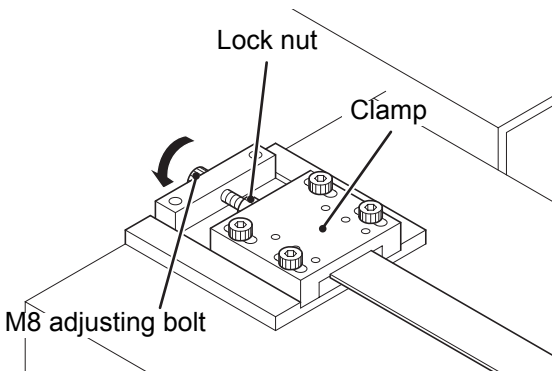
1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**



2 **Remove the cover of the driving pulley.**

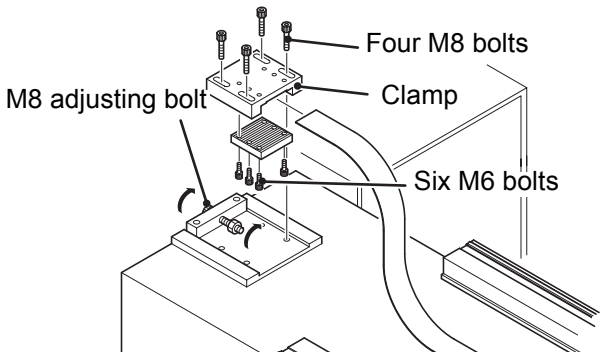


3 **Loosen the lock nut and remove the M8 adjusting bolt from the clamp on the traverse return side.**

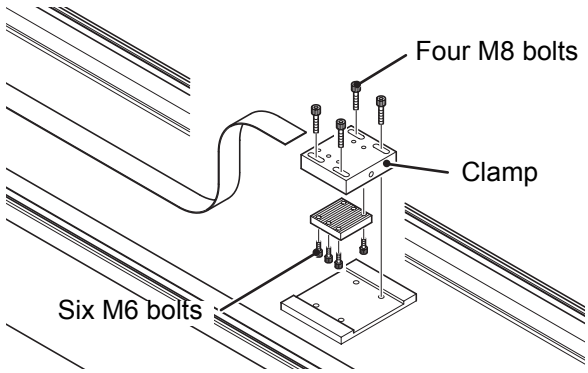


4 **Loosen the four M8 adjusting bolts securing the clamp on the traverse return side. Remove the clamp.**

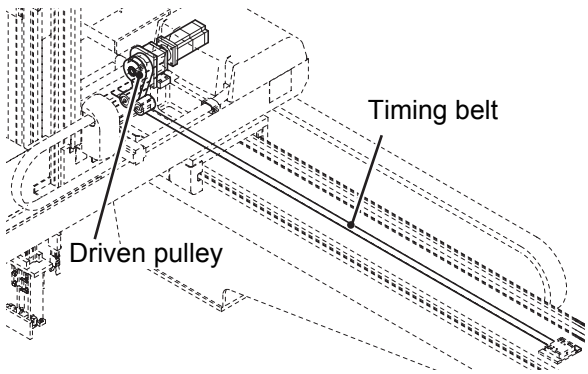
5 **Remove the six M6 bolts and detach the timing belt from the clamp.**



6 **As for the traverse side, detach the timing belt from the clamp in the same manner.**

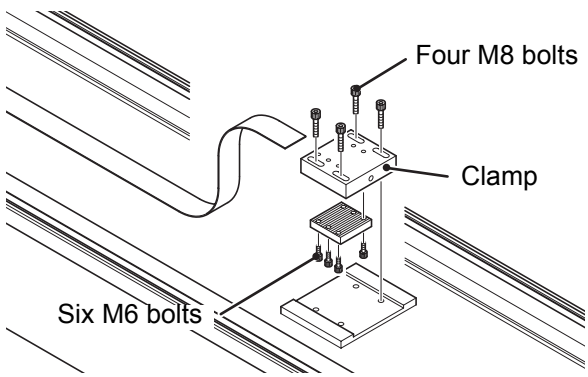


7 **Remove the old timing belt. Then position the new timing belt in the same manner as the old timing belt was positioned.**

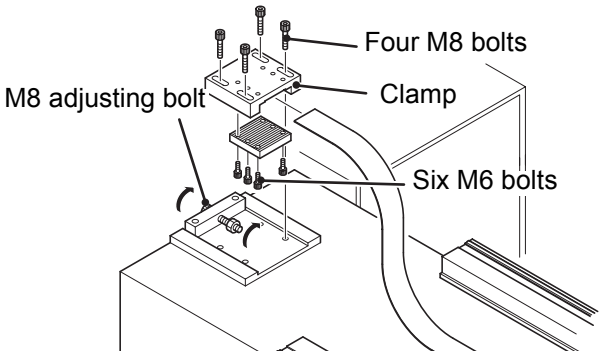


8 **Tighten the six M6 bolts so that all teeth of the timing belt mesh the clamp.**

9 **Tighten the four M8 bolts to secure the clamp to the traverse frame.**



10 **As for the traverse return side, follow the same manner. Then mount the M8 adjusting bolt as it was.**



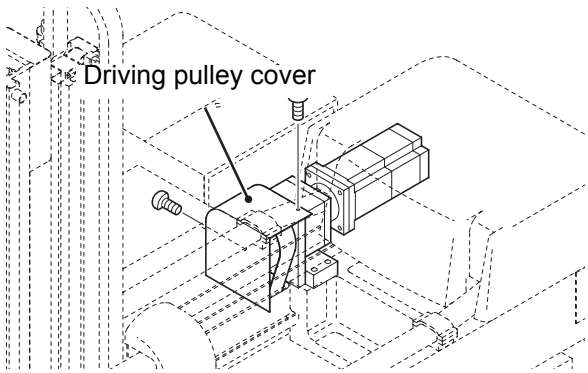
11 **Adjust the tension of the timing belt.**

- See **<5.2.2 Traverse axis timing belt tension adjustment>** regarding how to adjust the timing belt tension.

12 **Adjust the home position.**

- See **<6.4 Home position setting>** regarding how to adjust the home position.

13 **Install the removed cover.**



6.1.2 Traverse axis home position adjustment

CAUTION

- To perform home position adjustment, set the home position seeing **<6.4 Home position setting>**. Afterwards, perform home position adjustment following the steps described below.

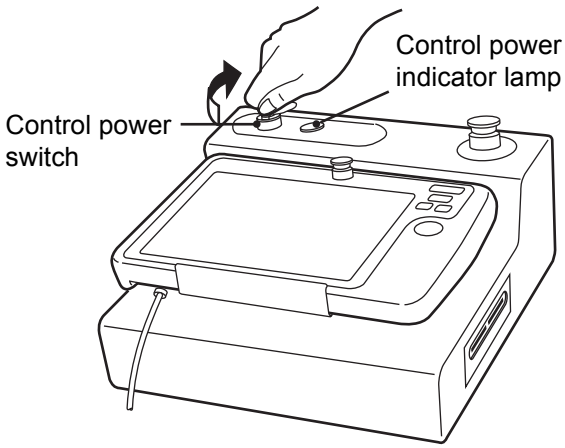
WARNING

- Before turning ON the take-out robot control power, make sure no persons or obstacles exist in the robot motion area.

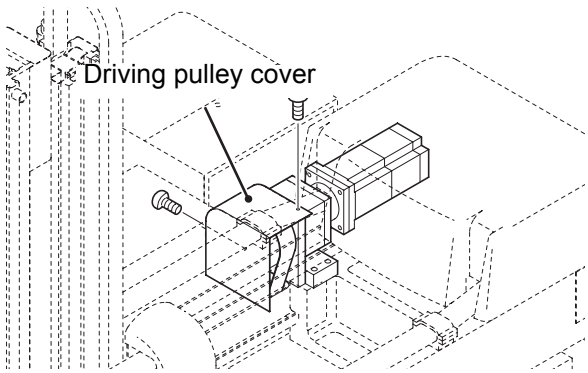
CAUTION

- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

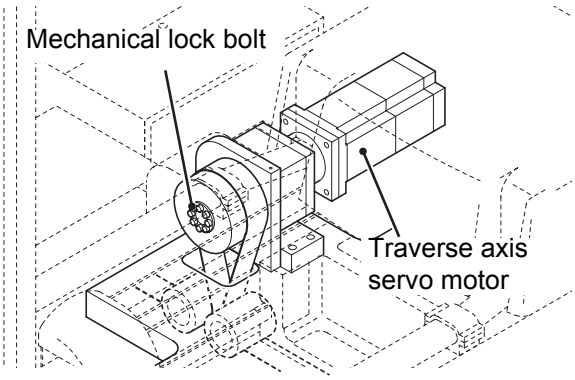
1 **Turn ON the take-out robot control power.**



2 **Remove the cover of the traverse axis driving pulley.**



3 **Loosen the bolts of the mechanical lock that secures the driving pulley to the traverse axis servo motor.**



- See **<A.12 Mechanical lock installation/removal>** regarding how to loosen the mechanical lock.

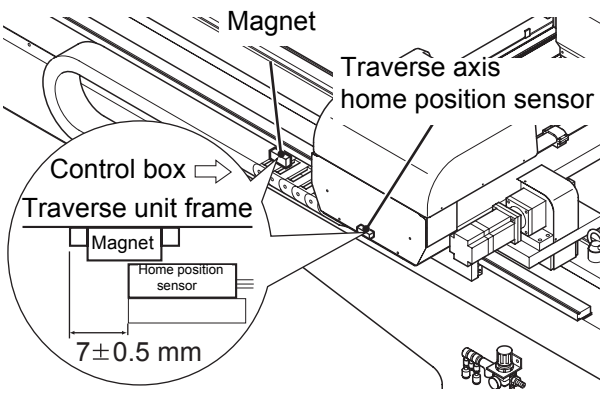
DANGER

- The following steps require the operator to enter the motion area of the take-out robot. Be sure to have at least two persons conduct the work and one person ready to press the emergency stop switch at any time.

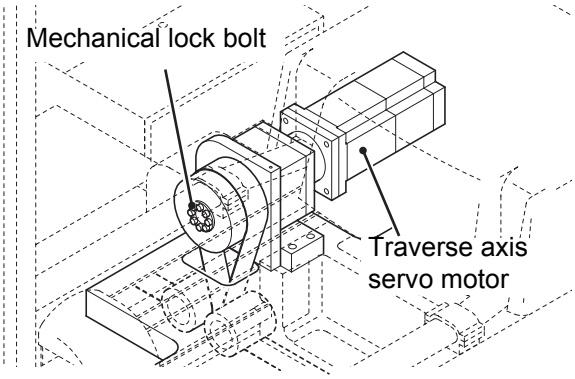
WARNING

- Do not change the position of the magnet. Doing so will disturb the positioning of the axis.

4 **Pushing the kick unit by hand, adjust the position of the home position sensor so that the magnet and the traverse axis home position sensor are aligned as shown in the figure.**

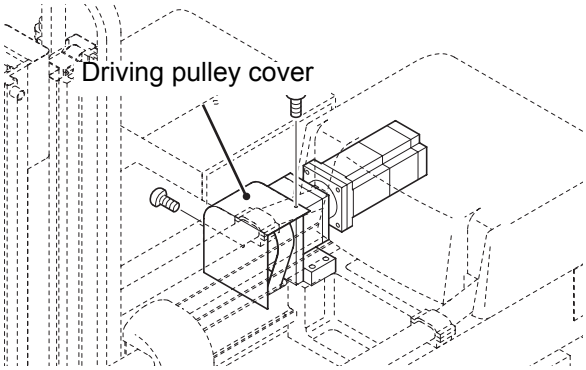


5 **Tighten the bolts of the mechanical lock that secures the driving pulley to the traverse axis servo motor.**



- See **<A.12 Mechanical lock installation/removal>** regarding how to tighten the mechanical lock.

6 **Install the removed cover.**

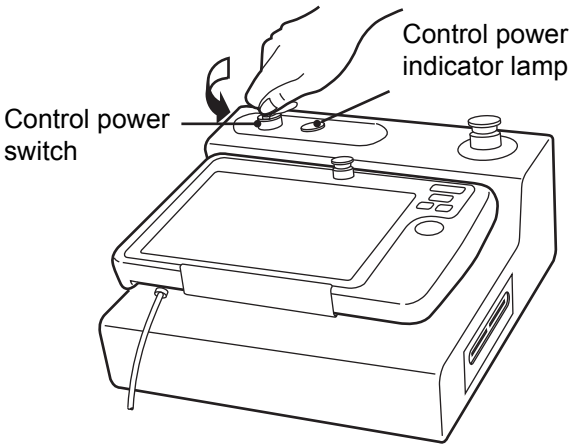


6.1.3 Traverse axis servo motor replacement

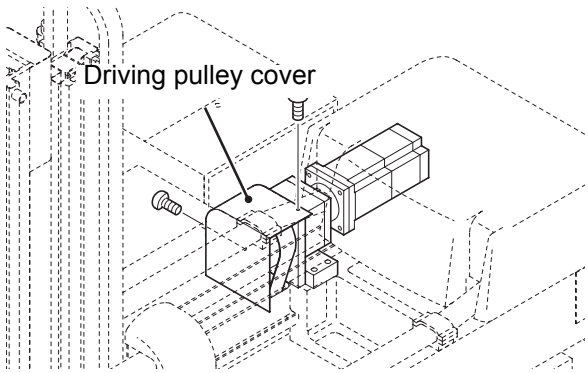
CAUTION

- After replacing the servo motor following the steps described below, home position setting needs to be performed using the touch panel. Be sure to set the home position seeing **<6.4 Home position setting>**.
- The servo motor is heavy. Handle it carefully.
- Place a support under the servo motor before removing the mounting bolts. Otherwise, the motor may drop from its mounting.

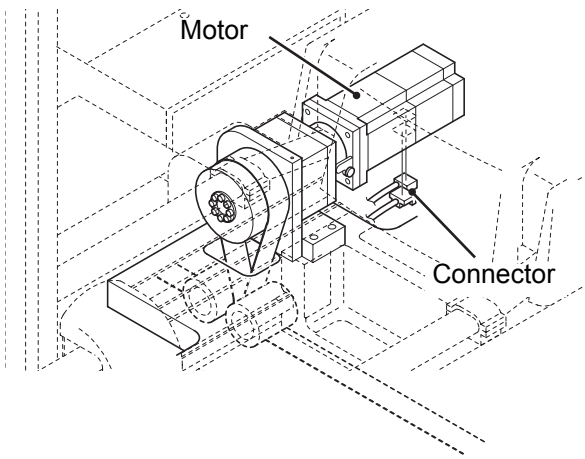
1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**



2 **Remove the driving pulley cover.**



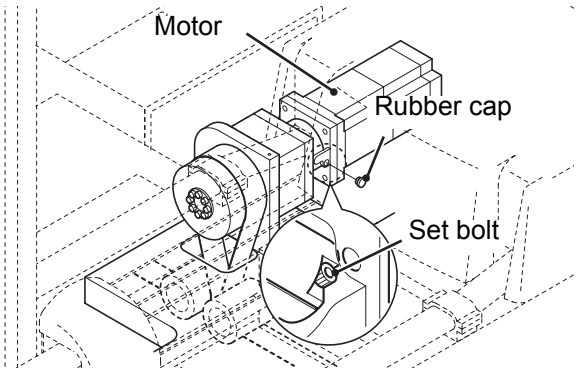
3 **Disconnect motor/encoder cable connector.**



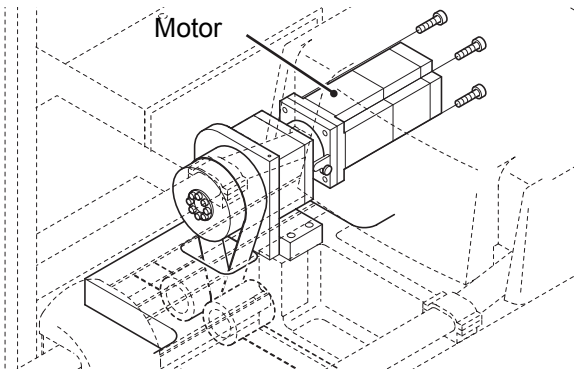
CAUTION

- Be careful not to drop connector mounting screws and packing.

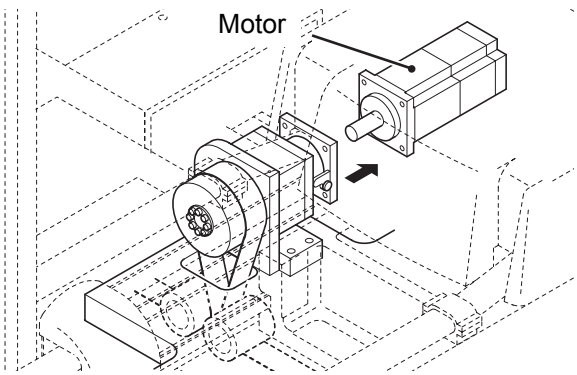
4 **Remove the rubber cap, jog the traverse axis until the socket set bolt securing the motor shaft is accessible, and loosen the bolt.**



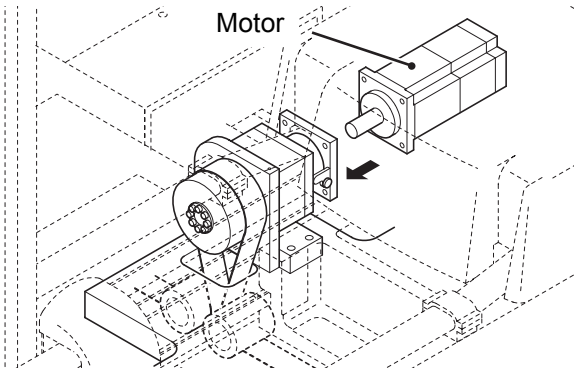
5 **Support the motor from underneath and remove the four M6 bolts.**



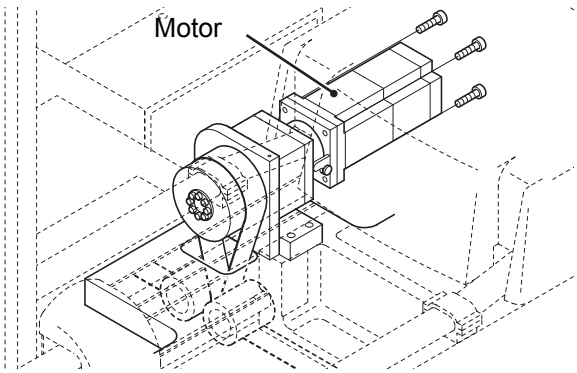
6 **Remove the motor from the reduction gear.**



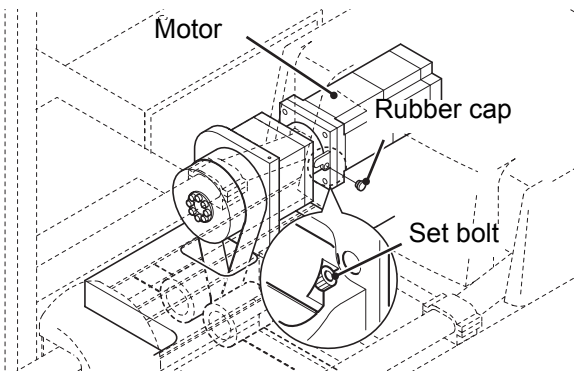
7 **Insert the new motor into the reduction gear.**
Make sure that the socket set bolt is visible from the rubber cap hole in the reduction gear.



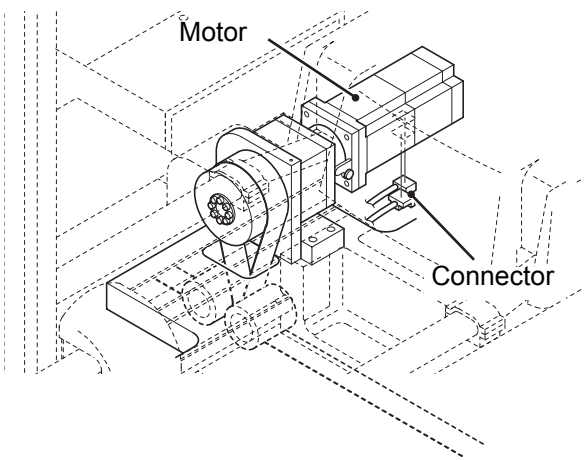
8 **Support the motor from underneath and install the four M6 mounting bolts.**



9 **Tighten the set bolt. After fixing the motor shaft, put the rubber cap.**



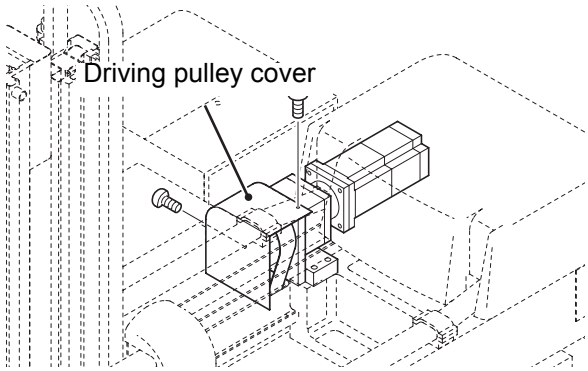
10 **Connect the motor/encoder cable connector.**



11 Adjust the home position.

- See **<6.4 Home position setting>** regarding how to adjust the home position.

12 Install the removed cover.

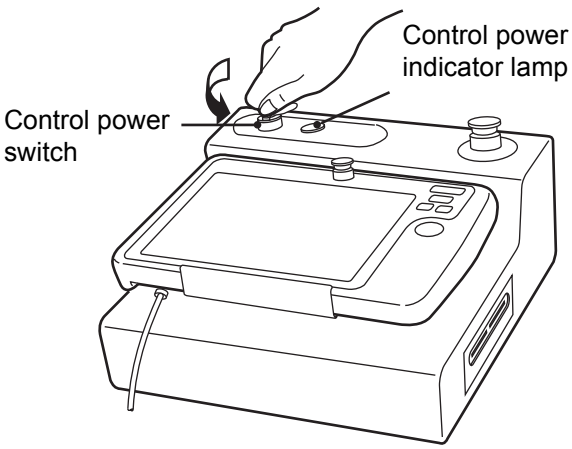


6.2 Kick unit

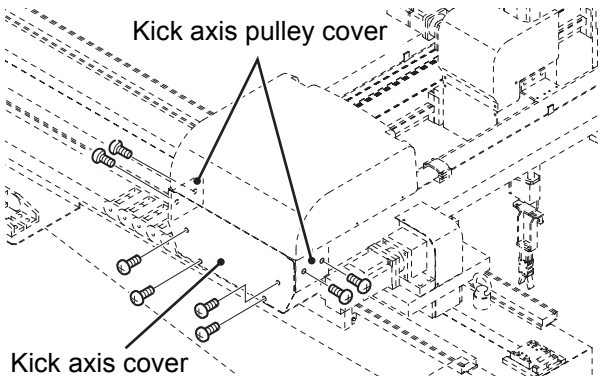
6.2.1 Kick axis timing belt replacement

- This subsection describes how to change the timing belt of the main arm kick axis, but the procedure for the sub arm kick axis is basically the same. Follow the steps described below when changing the timing belt of the sub arm kick axis as well.

1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**

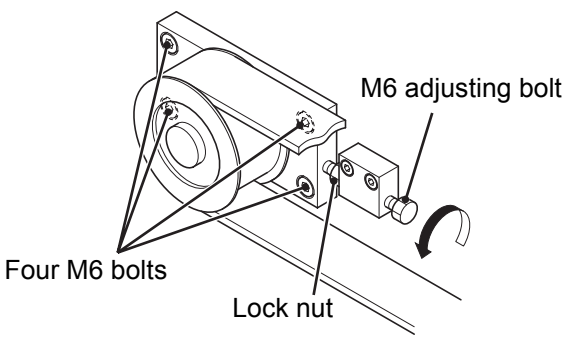


2 **Remove the kick axis cover and the kick axis pulley covers.**



3 **Loosen the four M6 bolts securing the driven pulley.**

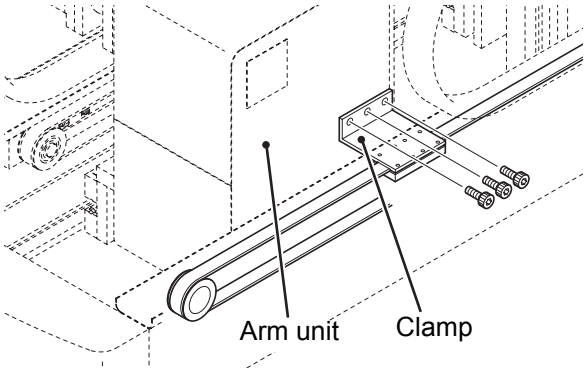
4 **Loosen the lock nut and loosen the M6 adjusting bolt to slacken the timing belt.**



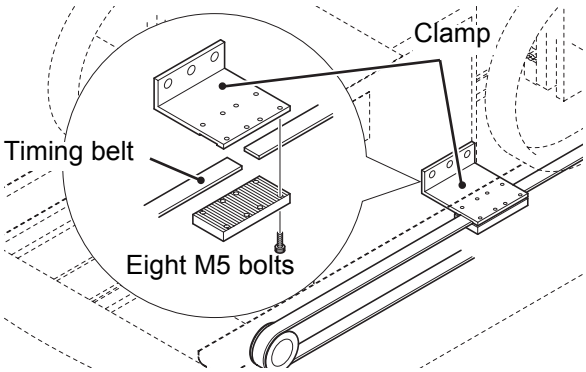
CAUTION

- The M6 adjusting bolt and block can be used for both main and sub arms. To adjust the sub arm, use the main arm block after removing it from the main arm.

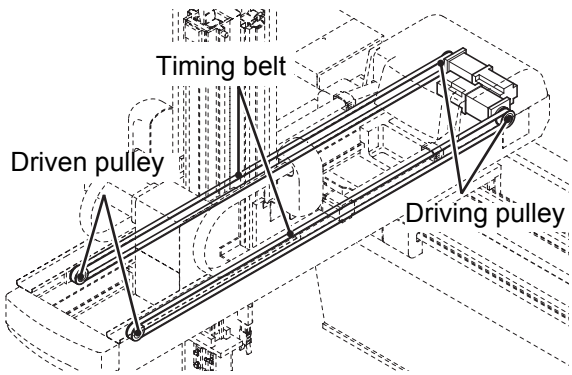
5 **Remove the three M10 bolts and detach the clamp from the arm unit.**



6 **Remove the eight M5 bolts and detach the clamp from the timing belt.**

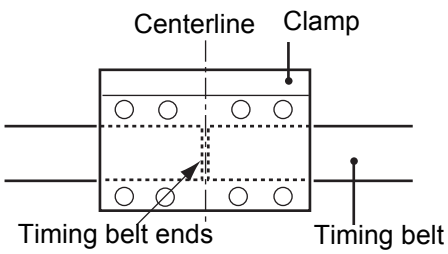


7 **Remove the old timing belt. Then position the new timing belt in the same manner as the old timing belt was positioned.**

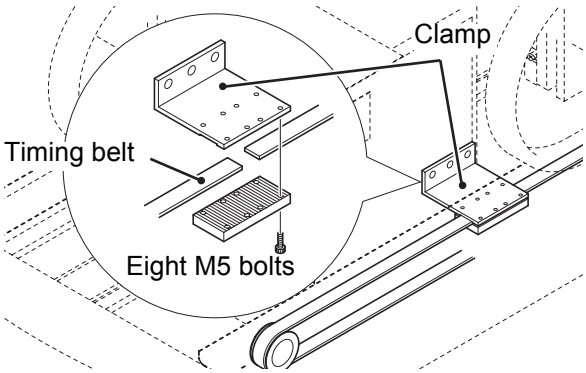


CAUTION

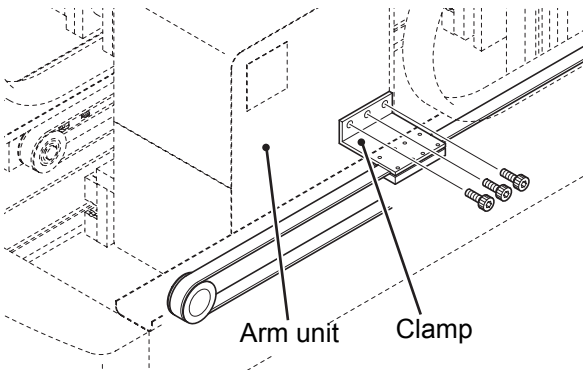
- Aline the ends of the timing belt with the centerline of the clamp.



8 **Hold the timing belt between the two pieces of the clamp. Tighten the eight M5 bolts so that the timing belt is held firmly in the clamp.**



9 **Tighten the three M10 bolts to secure the clamp to the arm unit.**



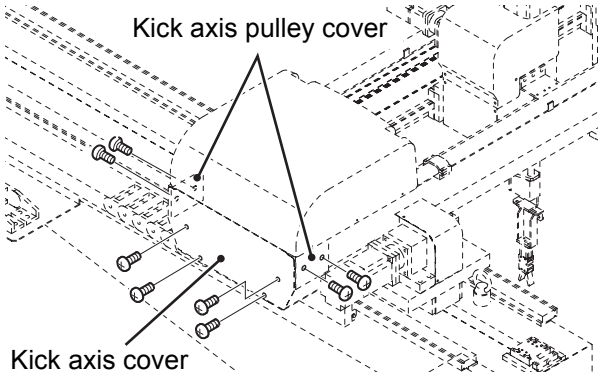
10 **Adjust the tension of the timing belt.**

- See **<5.2.5 Kick axis timing belt tension adjustment>** regarding how to adjust the timing belt tension.

11 **Adjust the home position.**

- See **<6.4 Home position setting>** regarding how to adjust the home position.

12 **Install the removed covers.**



6.2.2 Kick axis home position adjustment

CAUTION

- To perform home position adjustment, set the home position seeing **<6.4 Home position setting>**. Afterwards, perform home position adjustment following the steps described below.

- This subsection describes how to adjust the home position of the main arm kick axis, but the procedure for the sub arm kick axis is basically the same. Follow the steps described below when adjusting the home position of the sub arm kick axis as well.

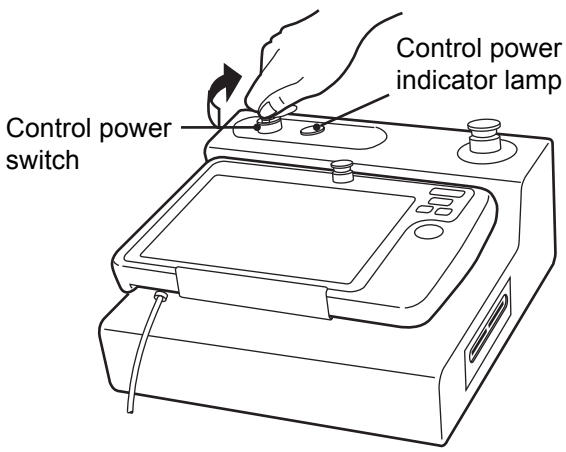
WARNING

- Before turning ON the take-out robot control power, make sure no persons or obstacles exist in the robot motion area.

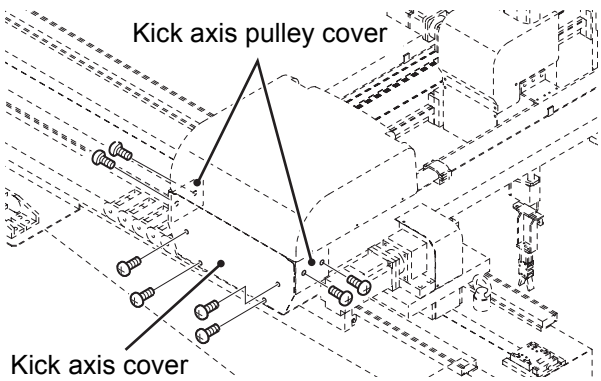
CAUTION

- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

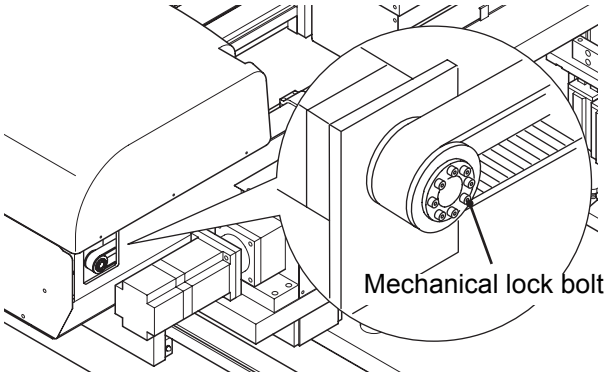
1 **Turn the take-out robot control power ON.**



2 **Remove the kick axis cover and the kick axis pulley covers.**



3 **Loosen the bolts of the mechanical lock that secures the pulley to the kick axis servo motor.**



- See **<A.12 Mechanical lock installation/removal>** regarding how to loosen the mechanical lock.

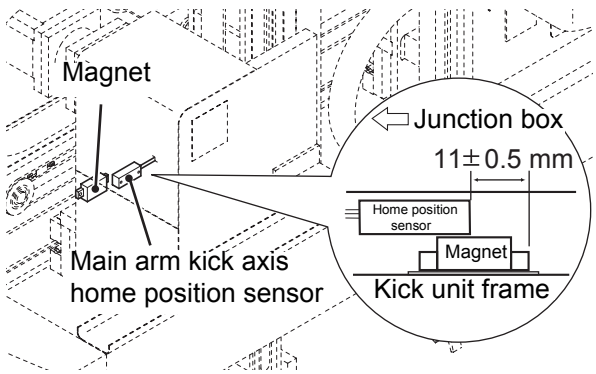
DANGER

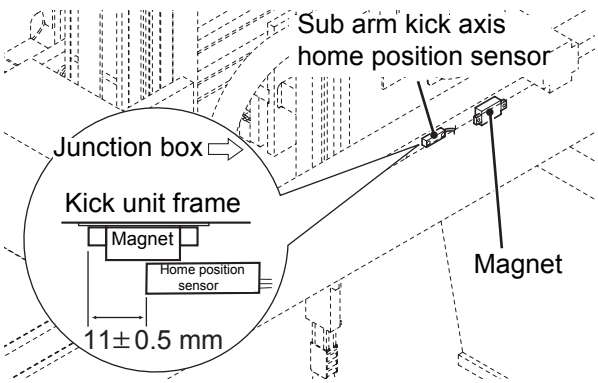
- The following steps require the operator to enter the motion area of the take-out robot. Be sure to have at least two persons conduct the work and one person ready to press the emergency stop switch at any time.

WARNING

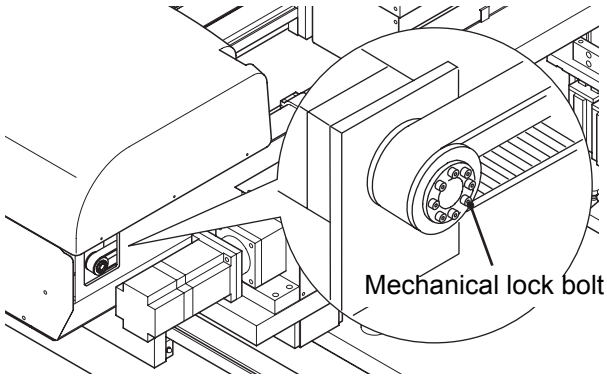
- Do not change the position of the magnet. Doing so will disturb the positioning of the axis.

4 **Move the arm unit and adjust the position of the home position sensor so that the magnet and the home position sensor are aligned as shown in the figure.**



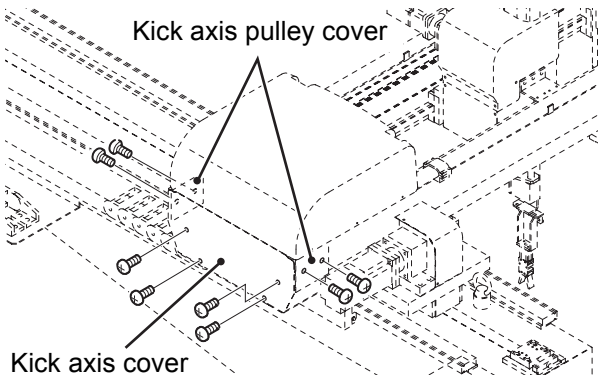


5 **Tighten the bolts of the mechanical lock that secures the pulley to the kick axis servo motor.**



- See **<A.12 Mechanical lock installation/removal>** regarding how to tighten the mechanical lock.

6 **Install the removed covers.**

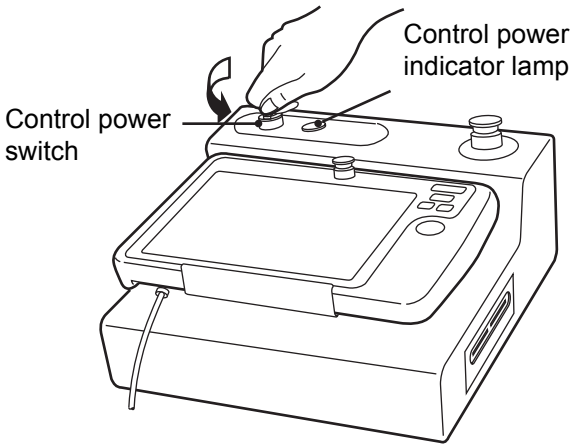


6.2.3 Kick axis servo motor replacement

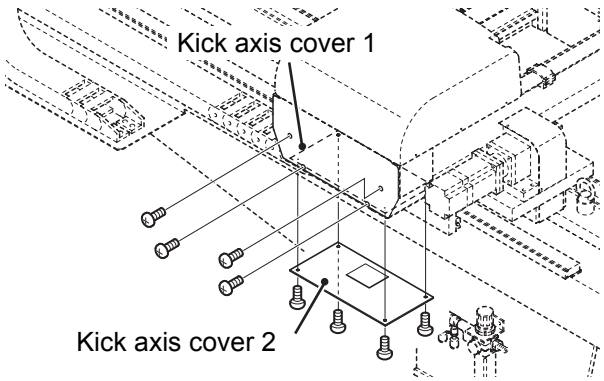
CAUTION

- After replacing the servo motor following the steps described below, home position setting needs to be performed using the touch panel. Be sure to set the home position seeing **<6.4 Home position setting>**.
- The servo motor is heavy. Handle it carefully.
- Place a support under the servo motor before removing the mounting bolts. Otherwise, the motor may drop from its mounting.

1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**

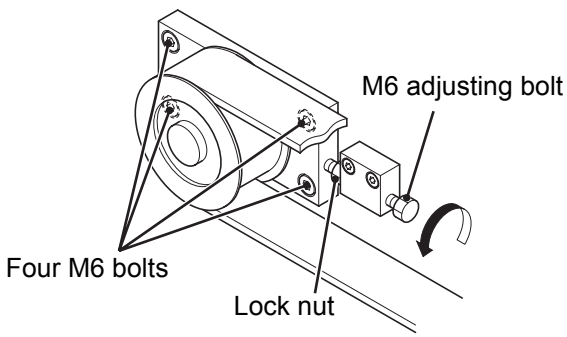


2 **Remove the kick axis cover 1 and the kick axis cover 2.**

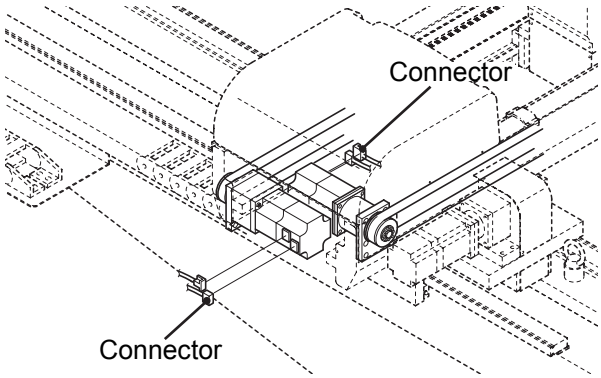


3 **Loosen the four M6 bolts securing the driven pulley.**

4 **Loosen the lock nut and loosen the M6 adjusting bolt to slacken the timing belt.**



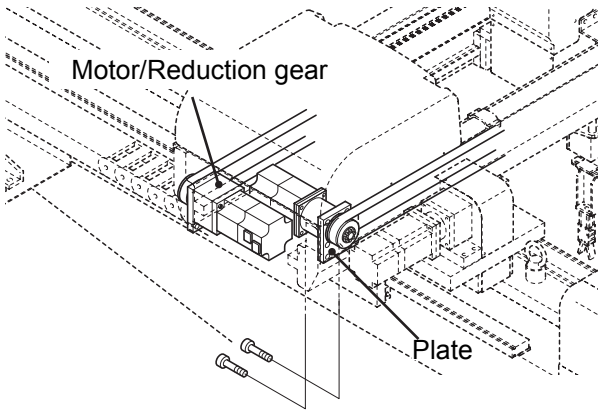
5 **Disconnect motor/encoder cable connector.**



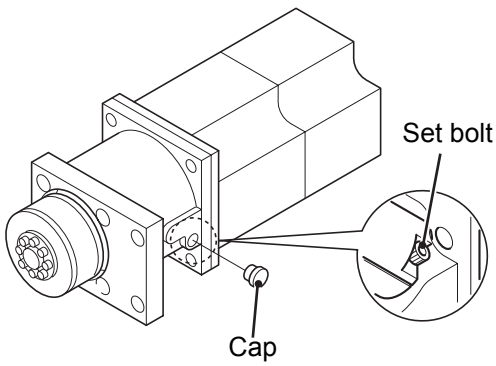
CAUTION

- Be careful not to drop connector mounting screws and packing.

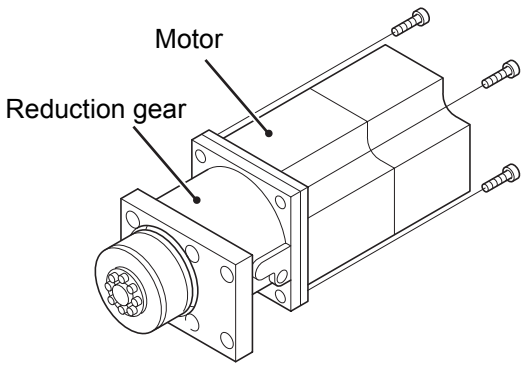
6 **Remove the plate to which the reduction gear and the motor are mounted, and pull out the reduction gear with the motor from the kick unit frame.**



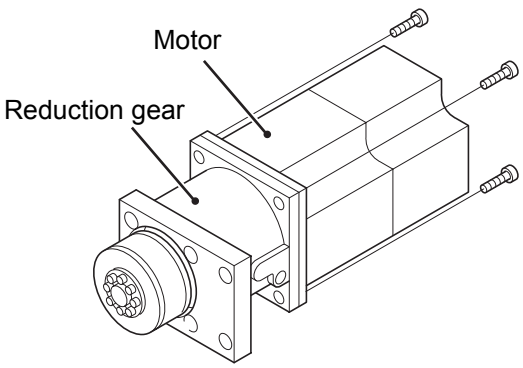
7 **Remove the rubber cap.**
Use the driving pulley to turn the reduction gear so that the socket set bolt is visible from the rubber cap hole. Loosen the socket set bolt securing the motor shaft.



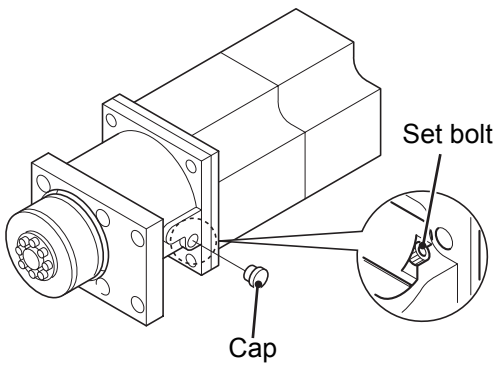
8 **Support the motor from underneath and loosen the four M5 bolts. Remove the motor from the reduction gear.**



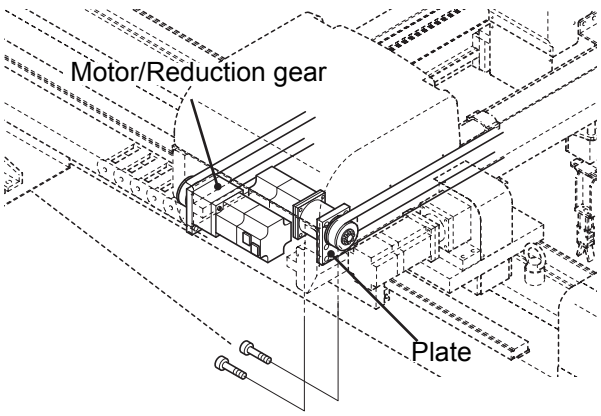
9 **Make sure the socket set screw is visible from the rubber cap hole in the reduction gear, and insert the new motor into the reduction gear. Then install the four M5 motor mounting bolts.**



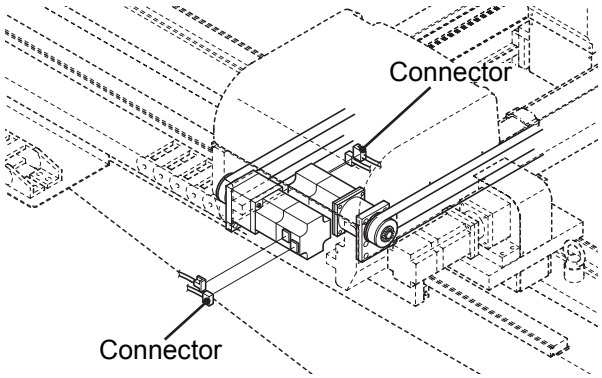
10 **Tighten the set bolt. After fixing the motor shaft, put the rubber cap.**



11 **Secure the reduction gear and the motor to the kick unit frame while they are fixed to the plate.**



12 **Connect the motor/encoder cable connector.**



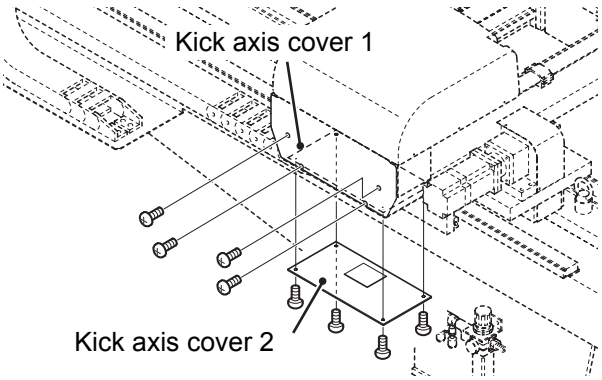
13 **Adjust the tension of the timing belt.**

- See **<5.2.5 Kick axis timing belt tension adjustment>** regarding how to adjust the timing belt tension.

14 **Adjust the home position.**

- See **<6.4 Home position setting>** regarding how to adjust the home position.

15 **Install the removed covers.**



6.3 Arm unit

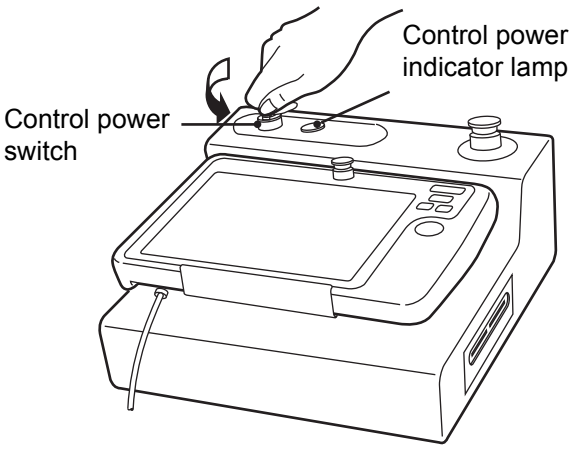
6.3.1 Descent axis timing belt replacement

- This subsection describes how to change the timing belt of the main arm descent axis, but the procedure for the sub arm descent axis is basically the same. Follow the steps described below when changing the timing belt of the sub arm descent axis as well.

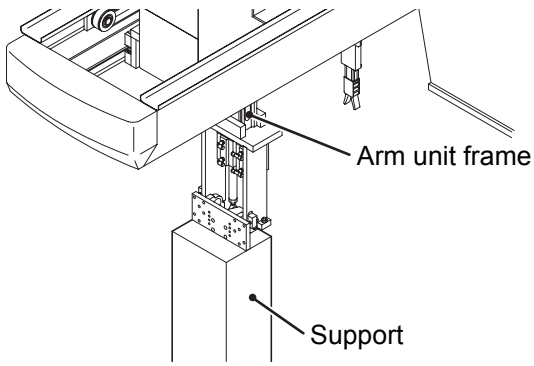
CAUTION

- Perform the following procedure with the end-of-arm tool removed. The take-out arm drops down due to its own weight when the timing belt is removed.
- Place a support under the arm unit frame. Otherwise the arm unit frame drops down.

1 **Make sure the injection molding machine power and the take-out robot control power are both OFF.**



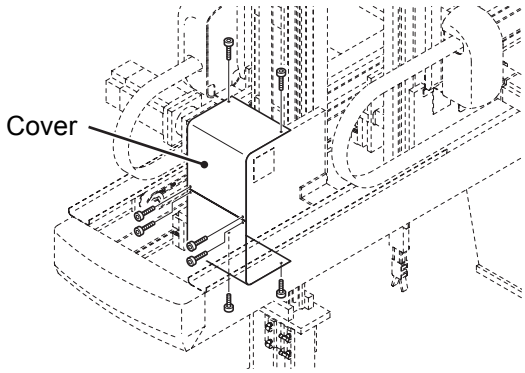
2 **Place a support under the arm unit frame and release the pneumatic pressure of the main arm.**



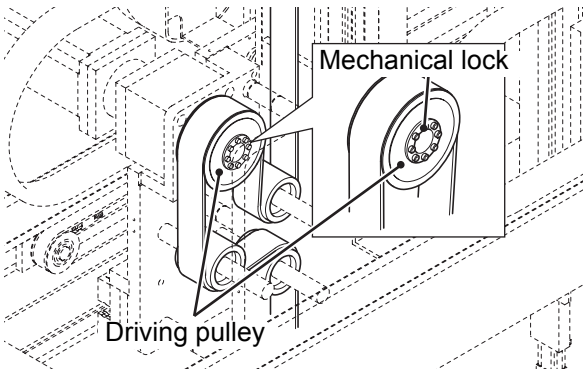
DANGER

- Be sure to release the pneumatic pressure of the main arm.
  If you loosen the mechanical lock without releasing the pneumatic pressure, the arm unit frame may ascend due to the function of the balance cylinder.

3 **Remove the cover shown in the figure.**

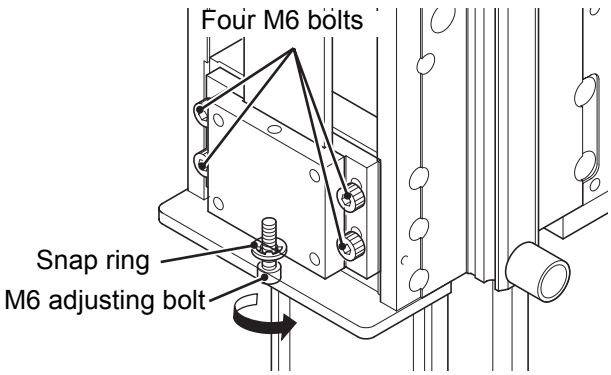


4 **Loosen the mechanical lock securing the driving pulley and place the arm unit frame on the support.**

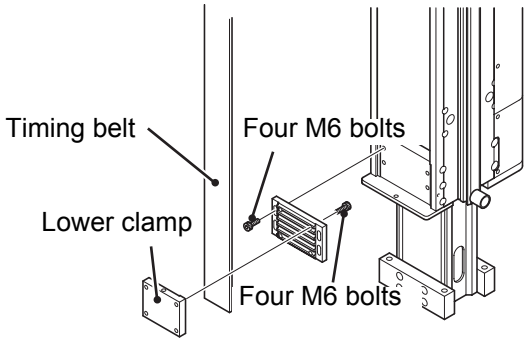


- See **<A.12 Mechanical lock installation/removal>** regarding how to loosen the mechanical lock.

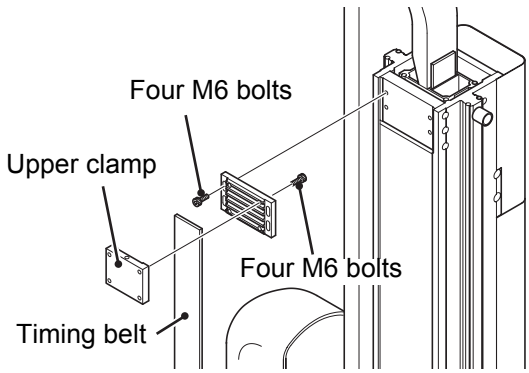
5 **Remove the M6 adjusting bolt from the clamp.**



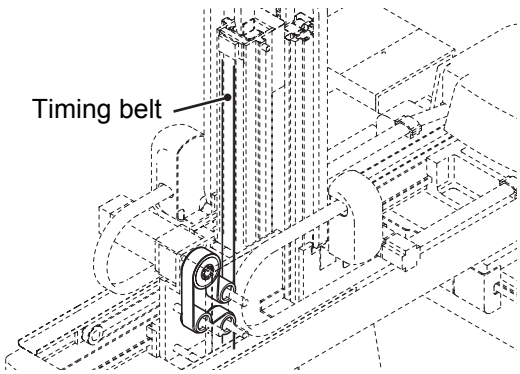
6 **Loosen the four M6 bolts and remove the lower clamp.**



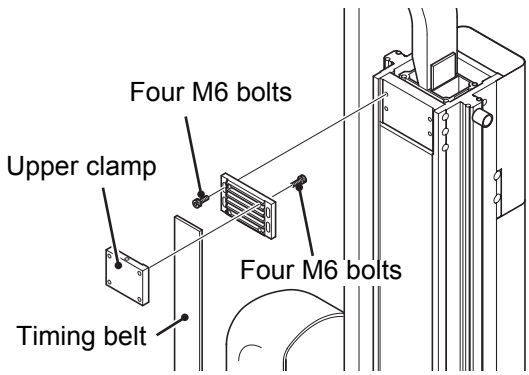
7 **Loosen the four M6 bolts and remove the upper clamp.**



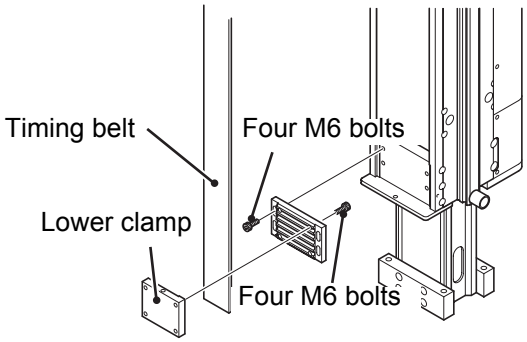
8 **Remove the old timing belt. Then position the new timing belt in the same manner as the old timing belt was positioned.**



9 **Hold the timing belt between the upper clamp and the frame. Tighten the four M6 bolts so that the timing belt is held firmly in the clamp.**



10 **Hold the timing belt between the lower clamp and the frame. Tighten the four M6 bolts so that the timing belt is held firmly in the clamp.**



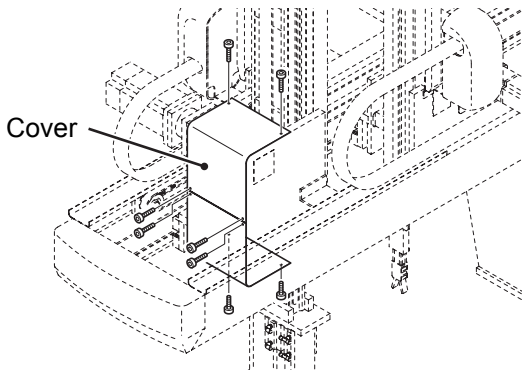
11 **Adjust the tension of the timing belt.**

- See **<5.2.9 Descent axis timing belt tension adjustment>** regarding how to adjust the timing belt tension.

12 **Adjust the home position.**

- See **<6.4 Home position setting>** regarding how to adjust the home position.

13 **Install the removed cover.**



6.3.2 Descent axis home position adjustment

CAUTION

- To perform home position adjustment, set the home position seeing **<6.4 Home position setting>**. Afterwards, perform home position adjustment following the steps described below.

- This subsection describes how to adjust the home position of the main arm descent axis, but the procedure for the sub arm descent axis is basically the same. Follow the steps described below when adjusting the home position of the sub arm descent axis as well.

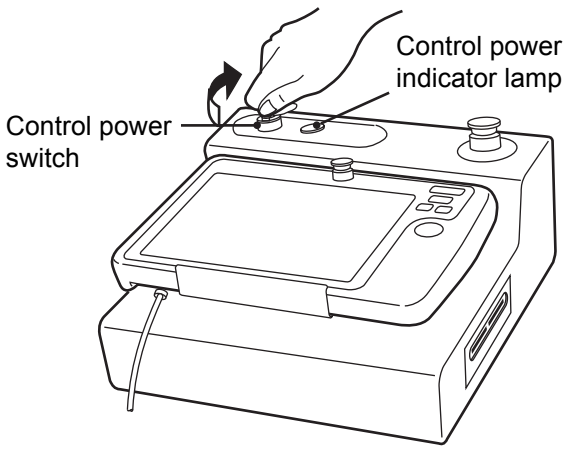
WARNING

- Before turning ON the take-out robot control power, make sure no persons or obstacles exist in the robot motion area.

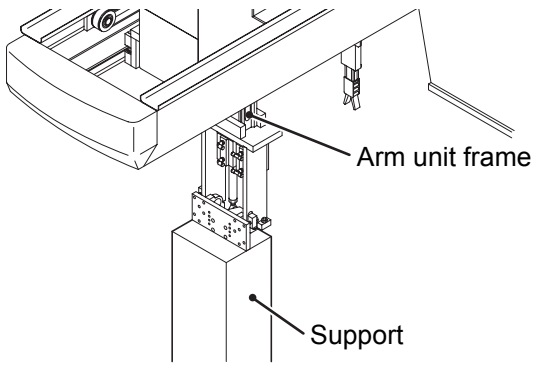
CAUTION

- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

1 **Turn the take-out robot control power ON.**



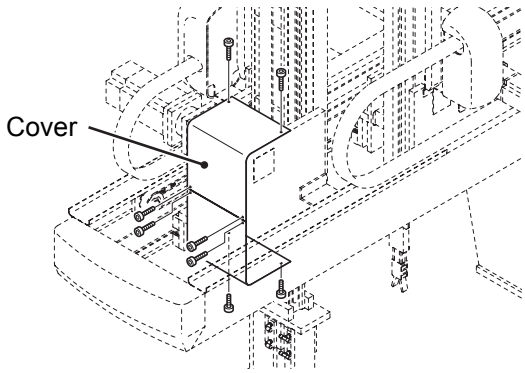
2 **Place a support under the arm unit frame and release the pneumatic pressure of the main arm.**



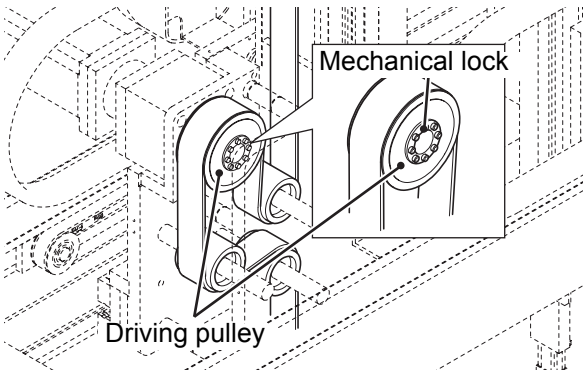
DANGER

- Be sure to release the pneumatic pressure of the main arm.
  If you loosen the mechanical lock without releasing the pneumatic pressure, the arm unit frame may ascend due to the function of the balance cylinder.

3 **Remove the cover shown in the figure.**



4 **Loosen the bolts of the mechanical lock that secures the descent axis driving pulley.**

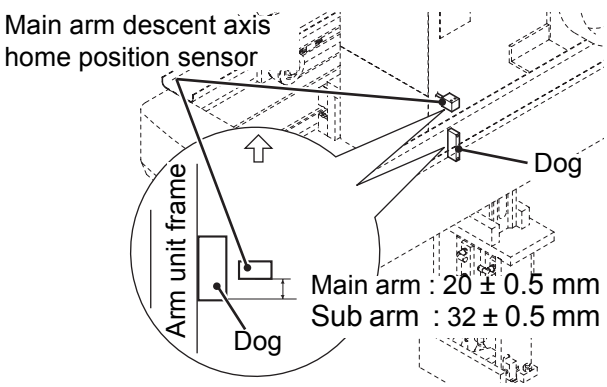


- See **<A.12 Mechanical lock installation/removal>** regarding how to loosen the mechanical lock.

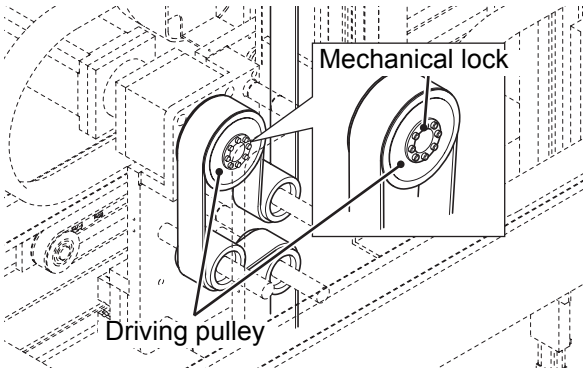
DANGER

- The following steps require the operator to enter the motion area of the take-out robot. Be sure to have at least two persons conduct the work and one person ready to press the emergency stop switch at any time.

5 **Move the arm unit and adjust the position of the main arm descent axis home position sensor so that the dog and the main arm descent axis home position sensor are aligned as shown in the figure.**

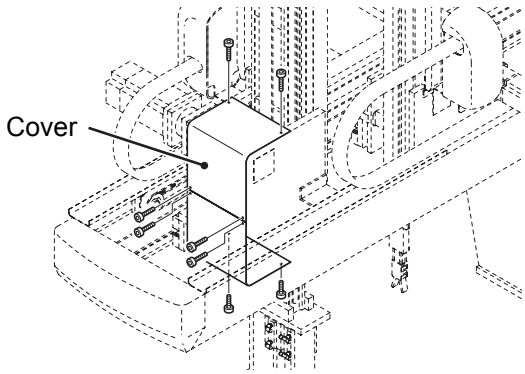


6 **Tighten the bolts of the mechcanical lock that secures the descent axis driving pulley.**



- See **<A.12 Mechanical lock installation/removal>** regarding how to tighten the mechanical lock.

7 **Install the removed cover.**



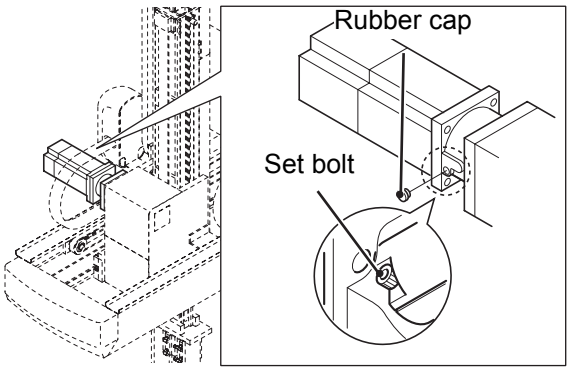
6.3.3 Descent axis servo motor replacement

- This section describes how to replace the main arm descent axis servo motor, but the procedure for the sub arm descent axis servo motor is basically the same. Follow the steps described below when replacing the sub arm descent axis servo motor as well.

CAUTION

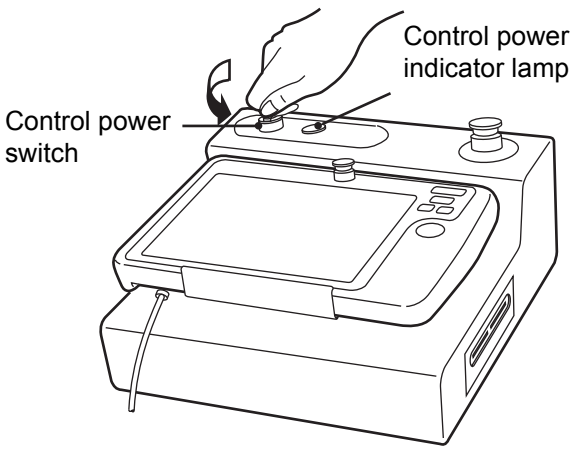
- After replacing the servo motor following the steps described below, home position setting needs to be performed using the touch panel. Be sure to set the home position seeing **<6.4 Home position setting>**.
- The servo motor is heavy. Handle it carefully.
- Place a support under the servo motor before removing the mounting bolts. Otherwise, the motor may drop down.

1 **Remove the rubber cap of the reduction gear and rotate the motor shaft until the set bolt appears in manual operation.**

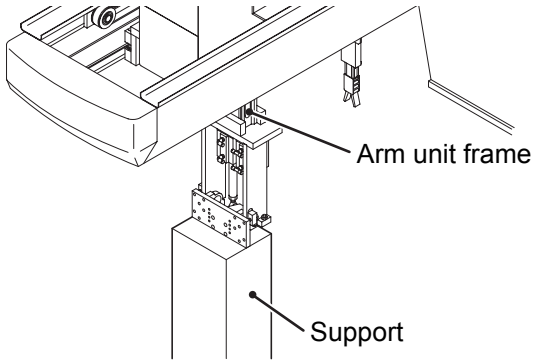


- See **<5.1 Manual operation description>** in the **Operation Manual** regarding how to perform manual operation.

2 **Turn OFF the injection molding machine power and the take-out robot control power.**



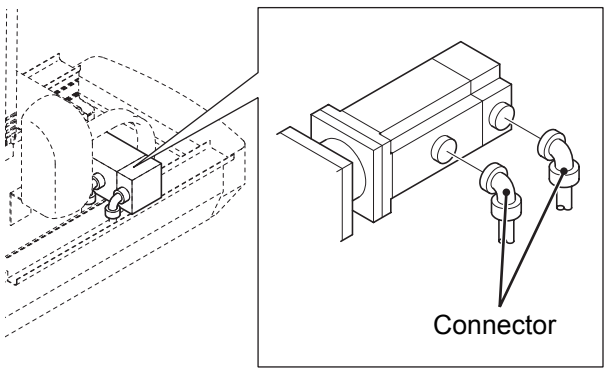
3 **Place a support under the arm unit frame and release the pneumatic pressure of the main arm.**



DANGER

- Be sure to release the pneumatic pressure of the main arm.
  If you loosen the mechanical lock without releasing the pneumatic pressure, the arm unit frame may ascend due to the function of the balance cylinder.

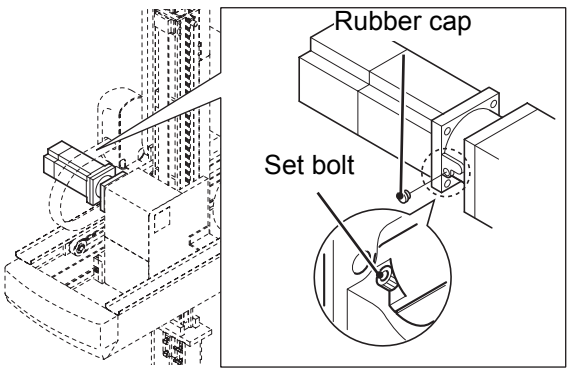
4 **Disconnect motor/brake cable connector and the encoder cable connector.**



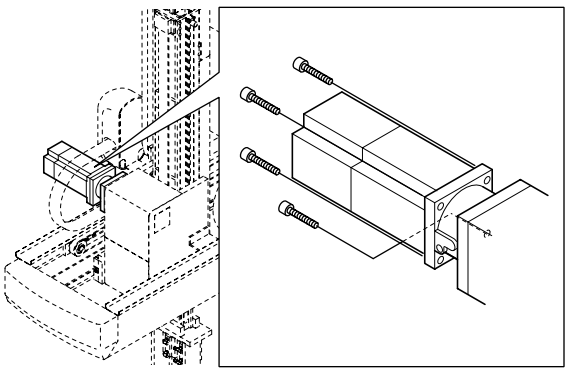
CAUTION

- Be careful not to drop the connector mounting screws and packing.

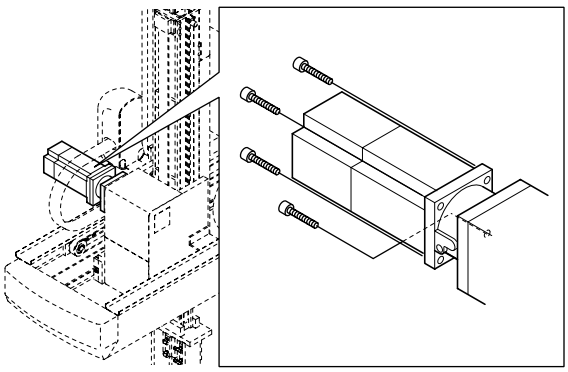
5 **Remove the rubber cap and loosen the set bolt securing the motor shaft.**



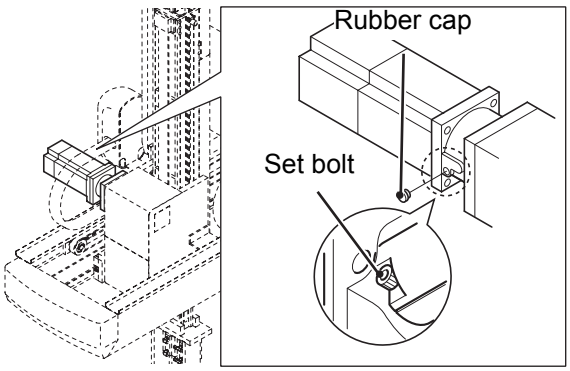
6 **Support the motor from underneath and remove the four M6 bolts. Remove the motor from the reduction gear.**



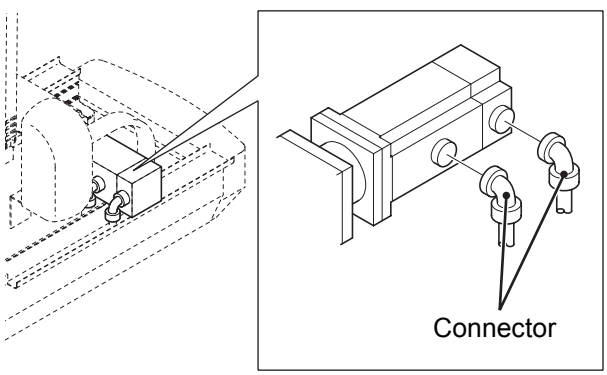
7 **Insert the new motor into the reduction gear.**
Support the motor from underneath and install the four M6 bolts.



8 **Tighten the set bolt. After fixing the motor shaft, put the rubber cap.**



9 **Connect the motor/brake cable connector and the encoder cable connector.**



10 **Adjust the home position.**

- See **<6.4 Home position setting>** regarding how to adjust the home position.

6.4 Home position setting

After replacing the timing belt of motor, positions are drifted. Be sure to perform set home positions.

CAUTION

- If the battery for the absolute encoder is replaced while the control power is OFF, be sure to recalibrate the home position.

- After replacing the timing belts and motors of several axes, perform home position setting once to set home positions for those axes.

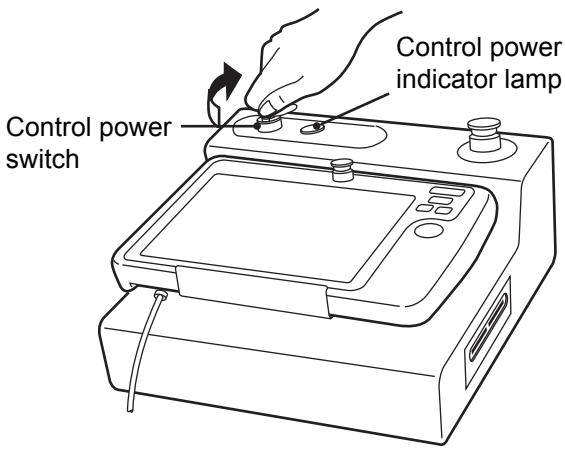
WARNING

- Before turning ON the take-out robot control power, make sure no persons or obstacles exist in the robot motion area.

CAUTION

- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

1 **Turn ON the control power.**

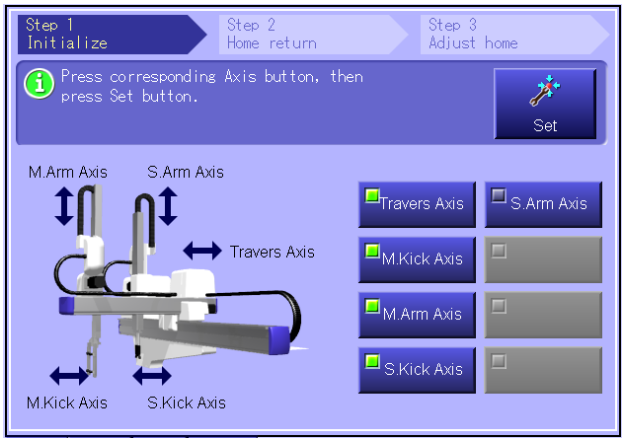


2 **Access the home position setting screen.**

- See the **Data Maintenance Manual** regarding how to access the home position setting screen.

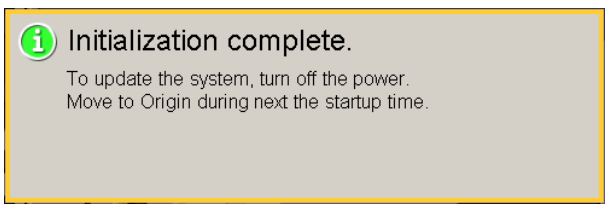
3 Select the axis whose home position you wish to set.

The indicator of the button turns ON indicating that the axis is selected.

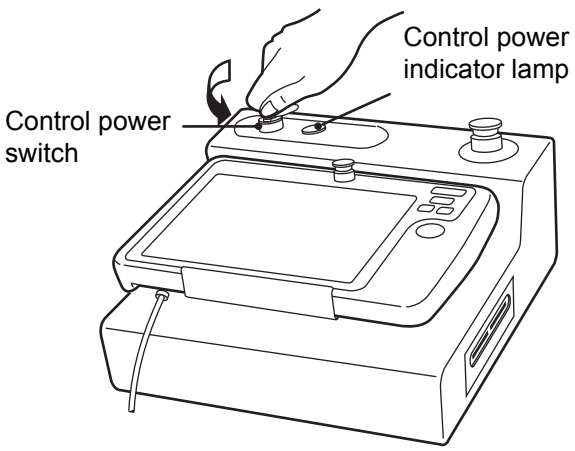


- After replacing motors (removing encoder cables) or replacing absolute batteries with the control power turned OFF, the screen shown in the **Step 3** appears.

After a few moment, the message "Initialization complete." appears.



4 Turn OFF the control power.



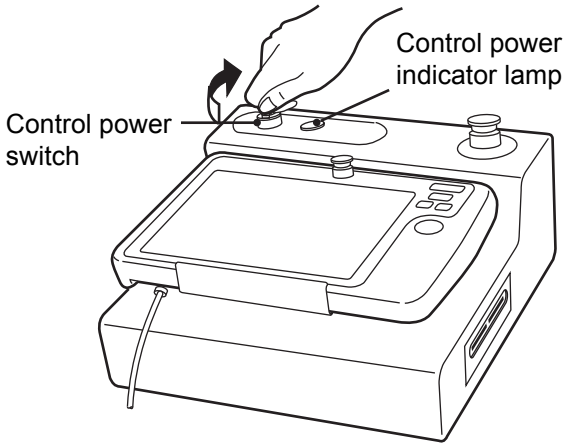
WARNING

- Before turning ON the control power, make sure no persons or obstacles exist in the robot motion area.

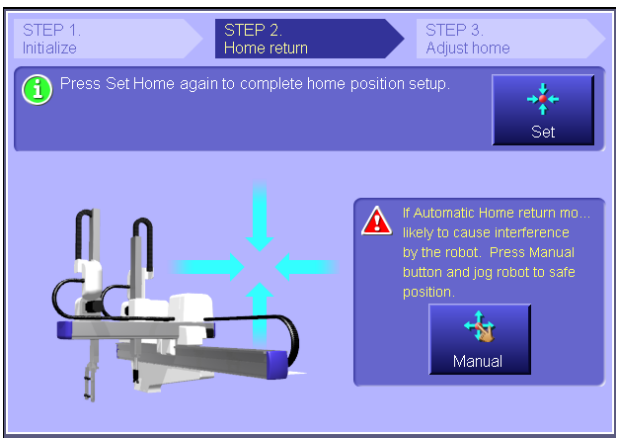
CAUTION

- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

5 Turn ON the control power ON.



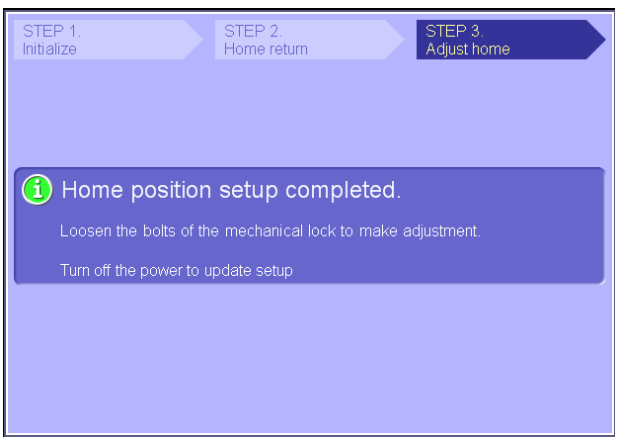
The home position setting confirmation screen appears.



6 Read the message and touch the [Set] button.

If the robot could hit the mold, move it in manual operation after touching the [Manual] button.
Then touch the [Set] button.

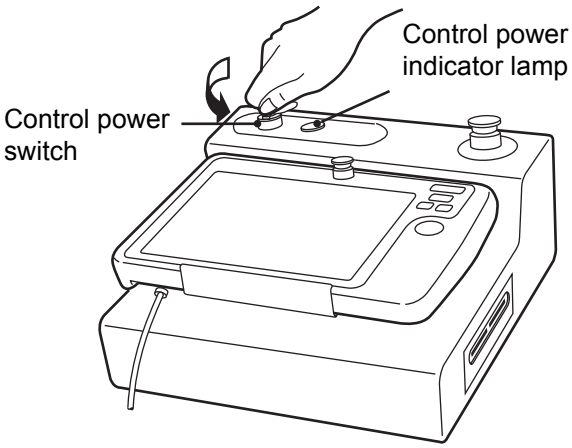
A message appears when home position return is complete.



7 **Tighten the bolts of the mechanical lock that secures the pulley to the motor of the replaced axis. Fine-adjust the home position.**

- See the following sections regarding how to tighten the bolt of mechanical lock that secures the pulley to each motor.
  <6.1.2 Traverse axis home position adjustment>
  <6.2.2 Kick axis home position adjustment>
  <6.3.2 Descent axis home position adjustment>

8 **Turn OFF the control power.**



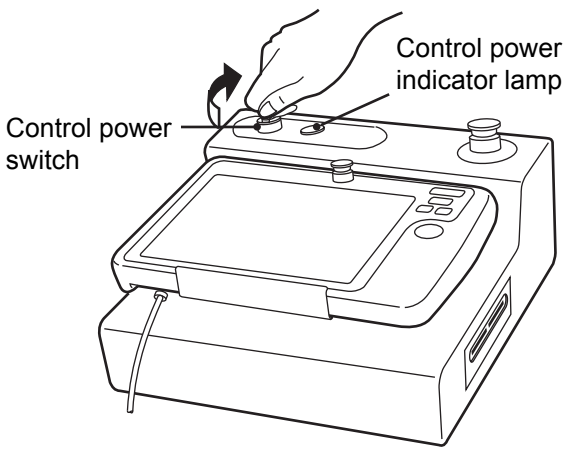
WARNING

- Before turning ON the control power, make sure no persons or obstacles exist in the robot motion area.

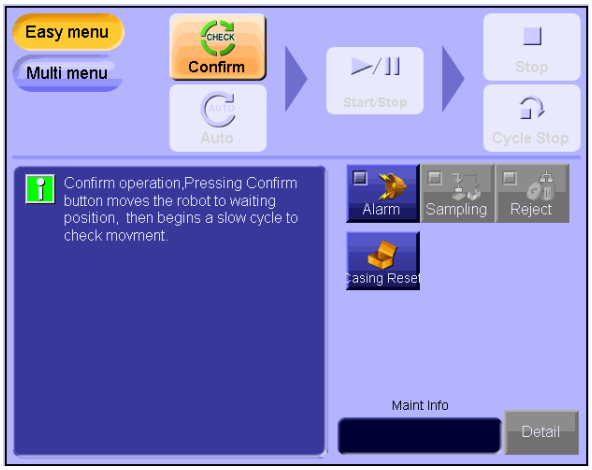
CAUTION

- Do not turn the control power ON and OFF in rapid succession. When the control power must be turned ON and OFF repeatedly, wait at least 60 seconds before turning it ON again after turning it OFF.

9 **Turn ON the control power.**



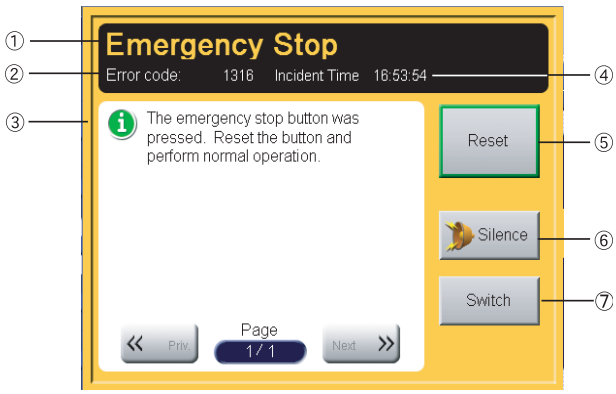
After a few moment, the operation screen appears.



7 TROUBLESHOOTING

7.1 Error messages

An error message window appears on the screen when an error occurs.



Take appropriate action according to the error number and error name displayed on the error message window. Contact us if the condition of the take-out robot does not improve or otherwise seems abnormal after the suggested action has been taken.

No.	Item	Description
1	Error name	This section displays an error name.
2	Error code	This section displays an error code.
3	Corrective action message	This section displays actions to clear errors.
4	Error time	This section displays the time at which the error occurred according to the internal clock of the operator station.
5	[Reset] button	Touch this button to reset and close the error display window.
6	[Silence] button	Touch this button turn OFF the buzzer sound.
7	[Switch] button	When an error occurs during Auto operation, touch this button to check the number of blocks or steps where the error occurred.

CAUTION

- When the alarm buzzer setting is set to “OFF”, the alarm buzzer does not sound. (See **<Buzzer/Date setting>** in the **Data Maintenance Manual**.)

- Help function
  The take-out robot has a help function. See **<13.1 Help function>** in the **Data Maintenance Manual** for details.

7.1.1 Command errors

Command errors occur when there is a mistake in a command or when a command cannot be executed. Error codes 0001 to 0999 are allotted to command errors.

Error No.	Error name	Cause/Operation	Corrective action
0001	Command Number Error	A nonexistent number was specified. The command is not executed.	Turn the take-out robot control power OFF and then turn it ON again.
0002	Command Parameter Error	A mistake exists in the command parameters. The command is not executed.	Turn the take-out robot control power OFF and then turn it ON again.
0003	JOG Operation Error	The Jog command was received during the execution of another command. The command is not executed.	Turn the take-out robot control power OFF and then turn it ON again.
0004	Servo Command Error	A command which cannot be executed unless the servo motor is ON was received. The command is not executed.	Turn the take-out robot control power OFF and then turn it ON again.
0005	Home Return Incomplete Error	A command which cannot be executed unless the home position return motion is complete was received. The command is not executed.	Turn the take-out robot control power OFF and then turn it ON again.
1117	Motion Prohibition Area Err. 1	The motion prohibition area 1 minimum position exceeds the motion prohibition area 1 maximum position.	Check the data of the motion prohibition area again.
1118	Motion Prohibition Area Err. 2	The motion prohibition area 2 minimum position exceeds the motion prohibition area 2 maximum position.	Check the data of the motion prohibition area again.
1119	Motion Prohibition Area Err. 3	The motion prohibition area 3 minimum position exceeds the motion prohibition area 3 maximum position.	Check the data of the motion prohibition area again.
1120	Watch-dog TImer Up Err	Blocks or steps do not change during Auto operation.	Check the status referring to Flexible Monitor.
1121	Command Not Allowed in Warning	Command cannot be sent while a warning occurs in the servo amplifier.	Touch the reset button.
1311	ID Collation Error	ID data might have been lost.	Set the ID data again.
1313	Servo Connection Error	An abnormality exists in the input signal from the servo driver.	Check the connection.
1314	Cannot Reset Pos. Module Err.		
1315	Servo Driver Error	An abnormality exists in the servo driver.	Inspect the servo driver.
1316	Emergency Stop	The emergency stop button was touched.	Reset the button and restart operation.

Error No.	Error name	Cause/Operation	Corrective action
1317	Cannot Execute Position-ing		Turn the take-out robot control power OFF and then turn it ON again.
1318	Vibration Stop Check Error	There is a possibility that the vibration stop data has been lost.	Re-set the vibration stop data.
1319	Body No. Collation Error	Teaching data created for other robots cannot be used as is.	Revise the teaching data.
1320	Data Version Error	Attempted to use teaching data for a different version.	Proceed from new mold registration.
1321	Servo Power OFF Detected	Servo ON signal from the servo driver is cut off.	Check the servo driver and cables.
1338	Manual Operation error		To perform Auto operation, set the Auto/Manual change key to Auto.
1339	Auto Operation error		To perform manual operation, set the Auto/Manual change key to Manual.
1340	Emergency Stop reset error	The emergency stop button has not been reset.	Reset the emergency stop button before pressing the servo ON switch.
1341	Speed Setting Abnormal	The speed setting value is abnormal. Check the value on the speed setting screen.	Re-set or load the data because the teaching data is abnormal.

7.1.2 Application errors

Application errors are errors, such as the take-out failure, whose case lies in the take-out robot.
Error codes 1001 to 1999 are allotted to application errors.

Error No.	Error name	Cause/Operation	Corrective action
1003	EOAT Change Position Error	A mistake exists in the teaching position data. The move to the end-of-arm tool change position is not executed.	Reset the end-of-arm tool change position settings.
1006	Mold Open Limit Signal OFF	The mold open limit signal was not ON when the move to the waiting position was attempted from inside the mold area. The move to the waiting position is not executed.	Move the arm out of the mold area in manual operation.
1007	Flip Return Limit OFF	The flip return limit sensor was not ON when the move to the waiting position was attempted from inside the mold area. The move to the waiting position is not executed.	Move the arm out of the mold area in manual operation. Make sure the input signal monitor indicates the signal status properly. Contact us if the monitor displays incorrect sensor status.
1008	Safety Sensor OFF	The descent axis safety sensor was not ON when the move to the waiting position was attempted from above the descent prohibition area. The move to the waiting position is not executed.	Raise the take-out arm to the ascent limit in manual operation and contact us.
1009	Traverse Axis Motion Area Error	The traverse axis is outside the motion area. All operation is disabled.	Move the traverse axis back inside the motion area in manual operation.
1010	Main Arm Kick Axis Motion Area Error	The main arm kick axis is outside the motion area. All operation is disabled.	Move the main arm kick axis back inside the motion area in manual operation.
1011	Main Arm Axis Motion Area Error	The main arm descent axis is outside the motion area. All operation is disabled.	Move the main arm descent axis back inside the motion area in manual operation.
1012	Sub Arm Kick Axis Motion Area Error	The sub arm kick axis is outside the motion area. All operation is disabled.	Move the sub arm kick axis back inside the motion area in manual operation.
1013	Sub Arm Axis Motion Area Error	The sub arm descent axis is outside the motion area. All operation is disabled.	Move the sub arm descent axis back inside the motion area in manual operation.
1014	F Axis Motion Area Error	The F axis is outside the motion area. All operation is disabled.	Move the F axis back inside the motion area in manual operation.

Error No.	Error name	Cause/Operation	Corrective action
1015	G Axis Motion Area Error	The G axis is outside the motion area. All operation is disabled.	Move the G axis back inside the motion area in manual operation.
1016	H Axis Motion Area Error	The H axis is outside the motion area. All operation is disabled.	Move the H axis back inside the motion area in manual operation.
1101	Teaching Incomplete Error	Auto operation was attempted without performing teaching. Auto operation is disabled.	Perform teaching or read the mold data before performing Auto operation.
1102	Teaching Position Error‘	A mistake exists in the teaching position data. Auto operation is disabled.	Recheck the teaching position data and correct any existing incorrect data.
1104	Casing Data Error	A mistake exists in the casing data. Auto operation is disabled.	Reset the casing settings of the current teaching data.
1105	Emergency Stop Error	The emergency stop switch is not reset. No motions are executed.	After taking sufficient safety precautions, reset the emergency stop switch.
1120	Watch Dog timer Up	Blocks or steps are not changing during Auto operation.	Check the current condition referring to the Flexible Teaching monitor.
1201	Take-out Failure	The designated detection sensor did not turn ON when the take-out motion completes. The operation cycle is stopped.	Close the mold after making sure a product is not remaining inside the mold. Reset the error to resume Auto operation. Take sufficient precautions before resetting the error.
1202	Safety Gate Error	The safety gate of the injection molding machine was opened during take-out motion in Auto operation. No motions are executed.	Close the safety gate, reset the error, and resume Auto operation. Take proper safety prefautions before closing the safety gate.
1203	Mold Open Limit Moment OFF Error	The mold open limit signal turned OFF while the end-of-arm tool was inside the mold during Auto operation. The take-out robot stops immediately.	Reset the error. The Auto operation waiting screen appears.
1204	Arm Unit Error	The safety sensor (ascent limit) of the main or sub arm turned OFF when the traverse motion was performed during Auto operation. The take-out robot stops immediately.	After resetting the error, raise both the main and sub arms in manual operation.
1205	Flip Sensor Error	Both the flip sensor and flip return sensor turned ON. The take-out robot stops immediately.	Make sure the input signal monitor indicates the signal status properly. Contact us if the monitor displays incorrect sensor status.

Error No.	Error name	Cause/Operation	Corrective action
1206	Flip Limit Input Error	The flip limit sensor turned OFF when the traverse motion was performed during Auto operation. The take-out robot stops immediately.	Check the pneumatic pressure. Make sure the input signal monitor indicates the signal status properly. Contact us if the monitor displays incorrect sensor status.
1207	Flip Return Limit Input OFF	The flip return limit sensor turned OFF when the take-out motion was performed during Auto operation. The take-out robot stops immediately.	Check the pneumatic pressure. Make sure the input signal monitor indicates the signal status properly. Contact us if the monitor displays incorrect sensor status.
1208	Main Arm Axis Home Position Sensor Error	The main arm descent axis home position sensor does not turn OFF at the take-out position. The take-out robot stops immediately.	Make sure the input signal monitor indicates the signal status properly. Contact us if the monitor displays incorrect sensor status.
1209	Sub Arm Axis Home Position Sensor Error	The sub arm descent axis home position sensor does not turn OFF at the take-out position. The take-out robot stops immediately.	Make sure the input signal monitor indicates the signal status properly. Contact us if the monitor displays incorrect sensor status.
1210	Sub Arm Ascent Limit Sensor Error	The sub arm ascent t limit sensor does not turn OFF at the take-out position. The take-out robot stops immediately.	Make sure the input signal monitor indicates the signal status properly. Contact us if the monitor displays incorrect sensor status.
1218	Sub Arm Axis Sensor Error	Both the sub arm ascent limit and descent limit sensors turned ON. The take-out robot stops immediately.	Make sure the input signal monitor indicates the signal status properly. Contact us if the monitor displays incorrect sensor status.
1222	Cycle Start Delay Timer Set Error	The setting value of the cycle start delay timer is too large. Auto operation is disabled.	Check the setting value.
1223	Dropped Product Error (Optional)	The product dropped. The take-out robot stops immediately. Touch the Reset button to clear the error.	Check the end-of-arm tool for abnormalities.
1224	Take-out Detection Error	The take-out detection signal is ON at the waiting position. The take-out robot stops immediately. Touch the Reset button to clear the error.	Check the end-of-arm tool for a remaining product.
1225	Traverse Axis Home Position Return Disabled	The traverse axis cannot perform home position return when the descent axis ascent limit sensor is not ON. The take-out robot stops immediately. Touch the Reset button to clear the error.	Change the order of the home position return motion.

Error No.	Error name	Cause/Operation	Corrective action
1226	Flip Motion Disabled	The main arm cannot perform flip motion when the descent axis ascent limit sensor is not ON. The take-out robot stops immediately. Touch the Reset button to clear the error.	Change the order of the home position return motion.
1227	Wrist Rotation Sensor Error (Optional)	Both the wrist rotation limit and the wrist rotation return limit sensors turned ON. The take-out robot stops immediately.	Make sure the input signal monitor indicates the signal status properly. Contact us if the monitor displays incorrect sensor status.
1228	Wrist Rotation Return Limit Input Error	The wrist rotation return limit sensor turned OFF while the end-of-arm tool was inside the mold. The take-out robot stops immediately. Resetting the error results in the operation mode to be manual.	Move the take-out arm out of the mold in manual operation and check the pneumatic pressure. Make sure the input signal monitor indicates the signal status properly. Contact us if the monitor displays incorrect sensor status.
1229	Pneumatic Pressure Drop Detect	The pneumatic pressure dropped. The take-out robot stops immediately.	Check the plant air supply and pneumatic hose connection.
1230	Descent Order Moment OFF Error (Optional)	The descent order turned OFF during product release motion.	Check the downstream equipment.
1232	Descent Order Waiting Time Up	The descent order did not turn ON after the set timer elapsed. The take-out robot cannot descend.	Check the downstream equipment.
1270	Valve Operation Error	Valves not used in the operation mode was controlled.	Check the current operation mode and change the operation mode if you use the valve.
1289	Program Create Error (F030 flag)	The motion that the main descent axis descends to the take-out position [P01, S00, C axis] does not exist or has been changed.	Modify the program.
1290	Program Create Error (F032 flag)	The motion that the main kick axis moves forward to the take-out position [P01, S04, B axis] does not exist or has been changed.	Modify the program.
1291	Program Create Error (F034 flag)	The motion that the sub descent axis descends to the take-out position [P01, S00, E axis] does not exist or has been changed.	Modify the program.
1292	Program Create Error (F035 flag)	The motion that the sub kick axis moves forward to the take-out position [P01, S04, D axis] does not exist or has been changed.	Modify the program.
1293	Program Create Error (F036 flag)	The motion that the sub kick axis moves forward to the take-out position [P01, S04, D axis] does not exist or has been changed.	Modify the program.

Error No.	Error name	Cause/Operation	Corrective action
1294	Program Create Error (F039 flag)	The motion that the main kick axis moves backward to the kick return position [P03, S05, B axis] does not exist or has been changed.	Modify the program.
1295	Program Create Error (F03A flag)	The motion that the sub kick axis moves backward to the kick return position [P03, S05, D axis] does not exist or has been changed.	Modify the program.
1296	Motion Mode Setting Error	The operation not set in the motion mode was performed.	Check the current operation mode and change the operation mode if necessary.
1311	ID Collation Error‘	ID data may have been lost.	The ID data needs to be reset. Contact us.
1312	Parameter Collation Error	Parameters may have been lost.	The parameters need to be reset. Contact us.
1313	Servo Driver Error	An abnormality exits in the servo driver. The take-out robot stops immediately.	Check the connection. Turn the take-out robot control power OFF and then turn it ON again.
1314	Cannot Reset Positioning Module Error	The positioning module error cannot be reset.	Turn the take-out robot control power OFF and then turn it ON again.
1315	Servo Driver Error	An abnormality exists in the servo driver. The take-out robot stops immediately.	The servo driver needs to be inspected. Contact us.
1316	Emergency Stop	The emergency stop switch was pressed. The take-out robot stops immediately.	Remove the cause of the emergency stop and touch the Reset button to reset the emergency stop condition.
1317	Cannot Execute Positioning	The take-out robot stops immediately.	Turn the take-out robot control power OFF and then turn it ON again.
1319	Body No. Collation Error	Attempted to use teaching data created for another take-out robot, or the data is damaged. Auto operation is disabled.	Read the correct mold data or perform teaching from the new mold registration. Or, correct the mold data.
1320	Data Version Error	Attempted to use teaching data of different version. Auto operation is disabled.	Perform teaching from the new mold registration.
1321	Servo Power OFF Detected	The servo ON input signal from the servo driver turned OFF. The take-out robot cannot function.	The servo driver and cables need to be inspected. Contact us.

7.1.3 Servo errors

Servo errors are errors in the parameters which are used when the sequencer positioning-motion command is executed and errors regarding the operation of the servo motors. When a servo error occurs, the servo power to the related axes is cut off and the servo motors stop.

- An additive digit representing the axis where an error occurred is allotted to the beginning of the servo error number. This additive digit is designated by "☐" in the following tables.
  1 Traverse axis
  2 Main arm kick axis
  3 Main arm descent axis
  4 Sub arm kick axis
  5 Sub arm descent axis

Error No.	Error name	Cause/Operation	Corrective action
☐ 0012	Driver Alarm Input Detected		Turn the take-out robot control power OFF and then turn it ON again.
☐ 0013	CW Limit Input Detected		Turn the take-out robot control power OFF and then turn it ON again.
☐ 0014	CWW Limit Input Detected		Turn the take-out robot control power OFF and then turn it ON again.
☐ 0015	Plus Limit Error (Encoder)		Turn the take-out robot control power OFF and then turn it ON again.
☐ 0016	Minus Limit Error (Encoder)		Turn the take-out robot control power OFF and then turn it ON again.
☐ 0017	Over Speed Detected		Turn the take-out robot control power OFF and then turn it ON again.
☐ 0018	Over Acceleration Detected		Turn the take-out robot control power OFF and then turn it ON again.
☐ 0019	Variation Error		Turn the take-out robot control power OFF and then turn it ON again.

Error No.	Error name	Cause/Operation	Corrective action
□ 0031	Plus Limit Err. (Command Pos.)		Turn the take-out robot control power OFF and then turn it ON again.
□ 0032	Minus Limit Err. (Command Pos.)		Turn the take-out robot control power OFF and then turn it ON again.
□ 0041	Home Position Search Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 0051	Encoder Absolute Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 0052	Position Data Overflow		Turn the take-out robot control power OFF and then turn it ON again.
□ 0053	Position Data Read Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 0061	Positioning Completed Time Out		Turn the take-out robot control power OFF and then turn it ON again.
□ 0099	Servo OFF During Motor Drive		Turn the take-out robot control power OFF and then turn it ON again.
□ 0999	Internal Calculation Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 9999	Emergency Stop		Turn the take-out robot control power OFF and then turn it ON again.
□ 2001	Plus Limit Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 2003	Minus Limit Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 2005	Speed Limit Error		Turn the take-out robot control power OFF and then turn it ON again.

Error No.	Error name	Cause/Operation	Corrective action
□ 2007	Over Speed Detected Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 2009	Over Accel Detected Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 2011	Variation Error Detected		Turn the take-out robot control power OFF and then turn it ON again.
□ 2013	Motor Rotation Direction Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 2016	Position Loop Range Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 2017	Speed Feed FWD Coefficient Err		Turn the take-out robot control power OFF and then turn it ON again.
□ 2018	Encoder Type Selection Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 2019	Encoder Multiplication Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 2020	Speed to Voltage Ratio Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 3031	Setting Speed Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 3033	Target Position Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 3035	Target Position Mode Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 3036	Acceleration Time Error		Turn the take-out robot control power OFF and then turn it ON again.

Error No.	Error name	Cause/Operation	Corrective action
□ 3037	Acceleration Mode Select Err.		Turn the take-out robot control power OFF and then turn it ON again.
□ 3038	Acceleration Parameter 1 Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 3039	Acceleration Parameter 2 Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 3040	Deceleration Time Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 3041	Deceleration Mode Select Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 3042	Deceleration Parameter 1 Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 3043	Deceleration Parameter 2 Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 3044	Positioning Time Out Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 3046	Course-Auxil.Mode Select Err.		Turn the take-out robot control power OFF and then turn it ON again.
□ 3047	Course-Auxil.Mode Select Err.		Turn the take-out robot control power OFF and then turn it ON again.
□ 3048	Start-up MOde Selection Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 3049	Position Detected Mode Error		Turn the take-out robot control power OFF and then turn it ON again.
□ 3050	Position Detected Set Value		Turn the take-out robot control power OFF and then turn it ON again.

Error No.	Error name	Cause/Operation	Corrective action
□ 5002	Parameter Checksum Error	An abnormality exists in EEPROM in the servo amplifier.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5003	Main Circuit Detector Error	An abnormality exists in the detection data for the power circuit.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5004	Parameter Setting Error	A user constant exceeding the range has been set.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5005	Combination Error	The capacity of the servo motor does not match the one of the servo amplifier.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5008	Scale Pitch Setting Error	An abnormality exists in the setting of the scale pitch.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5016	Overcurrent or Heat Sink Overheated	Overcurrent ran the power transistor, or the heat sink of the servo amplifier overheated.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5048	Regenerative Error	The regenerative resistor is disconnected, or the regenerative transistor is abnormal.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5050	Regenerative Overload	Regenerative power exceeds the allowable value.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5051	Main Circuit Wiring Error	The power supply to the main circuit does not match the parameter setting.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).

Error No.	Error name	Cause/Operation	Corrective action
□ 5064	Overvoltage	Main circuit DC voltage is excessively high.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5065	Undervoltage	Main circuit DC voltage is excessively low.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5081	Overspeed	Rotational speed of the motor is excessively high.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5082	Vibration Alarm	Abnormal vibration was detected during the motor rotation.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5113	Overload : High Load	The motor was operating for several seconds to several tens of seconds under a torque largely exceeding ratings.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5114	Overload : Low Load	The motor was operating continuously under a torque largely exceeding ratings.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5115	Dynamic Brake Overload	When the dynamic brake was applied, the rotational energy exceeded the capacity of the dynamic brake registor.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5116	Overload of Surge Current Limit Resistor	The main circuit power was frequently turned ON and OFF.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5122	Heat Sink Overheated	The heat sink of the servo amplifier overheated.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).

Error No.	Error name	Cause/Operation	Corrective action
□ 5129	Encoder Backup Error	All the power supplies for the absolute encoder have failed and position data was cleared.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5130	Encoder Checksum Error	An abnormality exists in the checksum result of encoder memory.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5131	Encoder Battery Error	Battery voltage for the absolute encoder has dropped.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5132	Encoder Data Error	Data in the encoder is abnormal.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5133	Encoder Overspeed	The encoder was rotating at high speed when the power was turned ON.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5134	Encoder Overheated	The internal temperature of the encoder is too high.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5135	FC Serial Encoder Checksum Error		Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5136	FC Serial Encoder Data Error		Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5138	FC Serial Encoder Error		Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).

Error No.	Error name	Cause/Operation	Corrective action
□ 5177	Reference Speed Input Read Error	The A/D converter for reference speed input is faulty.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5178	Reference Torque Input Read Error	The A/D converter for reference torque input is faulty.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5179	Current Detection Error	An abnormality exists in the ammeter.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5191	System Alarm	A program error occurred in the servo amplifier.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5193	Servo Overrun Detected	The servo motor ran out of control.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5194	Phase Detection Error		Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5197	Magnetic Pole Detection Failure		Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5200	Encoder Clear/Multiturn Setting Error	Absolute encoder multiturn has not been properly cleared or set.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5201	Encoder Communication Error	An error occurred in communications between encoder and servo amplifier.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).

Error No.	Error name	Cause/Operation	Corrective action
□ 5202	Encoder Parameter Error	Encoder parameters are faulty.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5203	Encoder Echoback Error	Contents of communications with encoder is incorrect.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5204	Multi-turn Limit Disagreement	Diffent multiturn limits have been set in the encoder and servo amplifier.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5206	FPG Multi-turn Error		Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5207	FC Serial Encoder Communication Error		Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5208	Position Error Pulse Overflow	An abnormality exists in the positional deviation pulse.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5209	Motor Overload Excessive Position Error		Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5211	Position Data Over		Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5224	Optional Board Setting Invalid		Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).

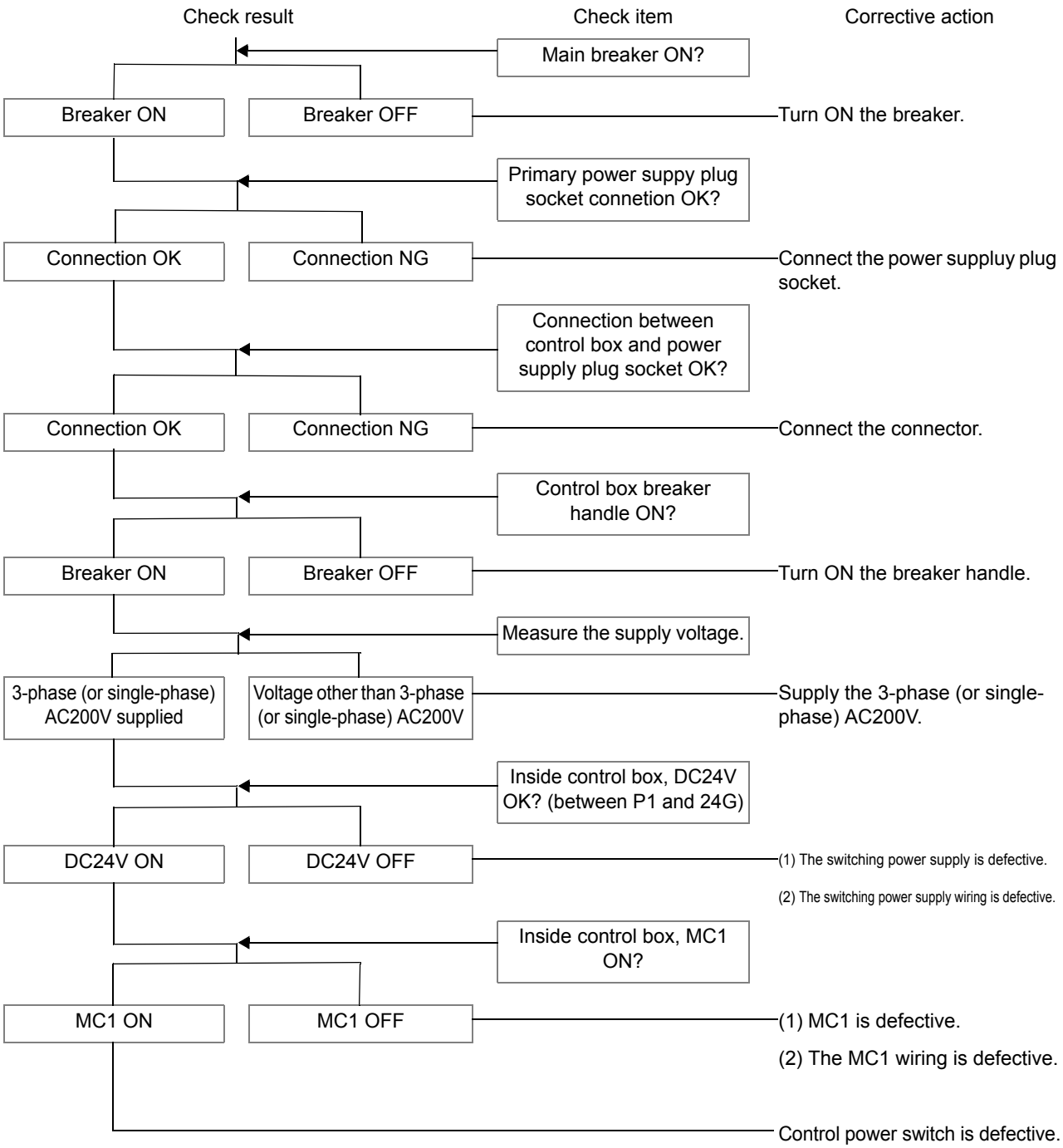
Error No.	Error name	Cause/Operation	Corrective action
□ 5228	MECHATROLINK Transmission Cycle Setting Error	An abnormality exists in the transmission cycle setting of the MECHATROLINK.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5229	MECHATROLINK Watchdog Timer Synchronizing Error	The MECHATROLINK communication is not properly synchronized.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5230	MECHATROLINK Communication Error	An abnormality exists in the MECHATROLINK communication.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5234	Servopack Error		Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5237	Command Incomplete Error		Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5241	Power Line Open Phase	One of three phases is not connected in the main power supply.	Clear the error after checking the error code. See the algorithm manual for details (made by YASKAWA).
□ 5242	Motor Disconnected, or Current Detector Error	The motor cable is disconnected or the current detector of the servo amplifier is abnormal.	

7.2 Troubleshooting flowcharts

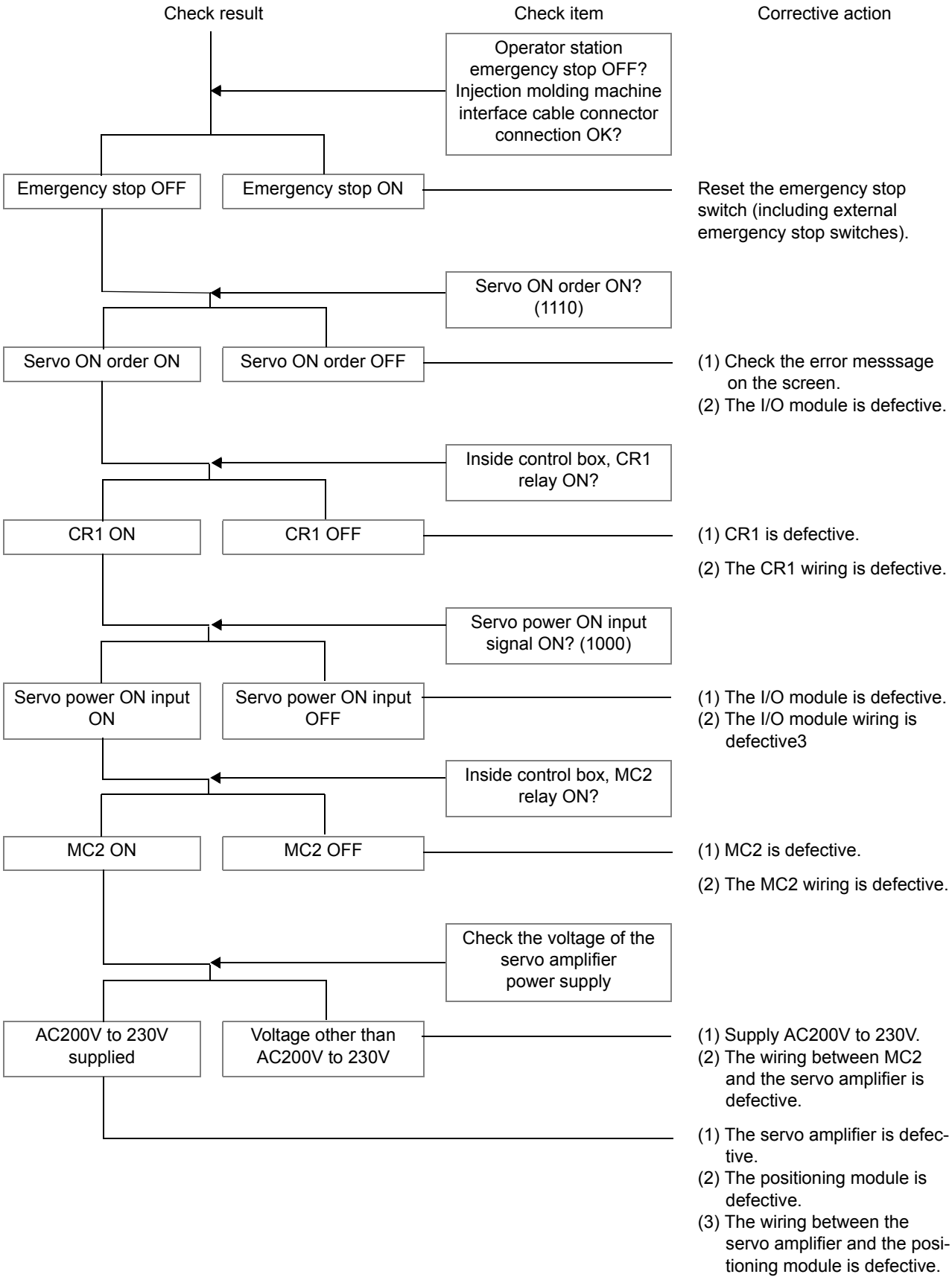
WARNING

- To prevent electrical accidents, allow only those technicians who have received basic electrical training and been approved by the take-out robot safety supervisor to conduct this work.

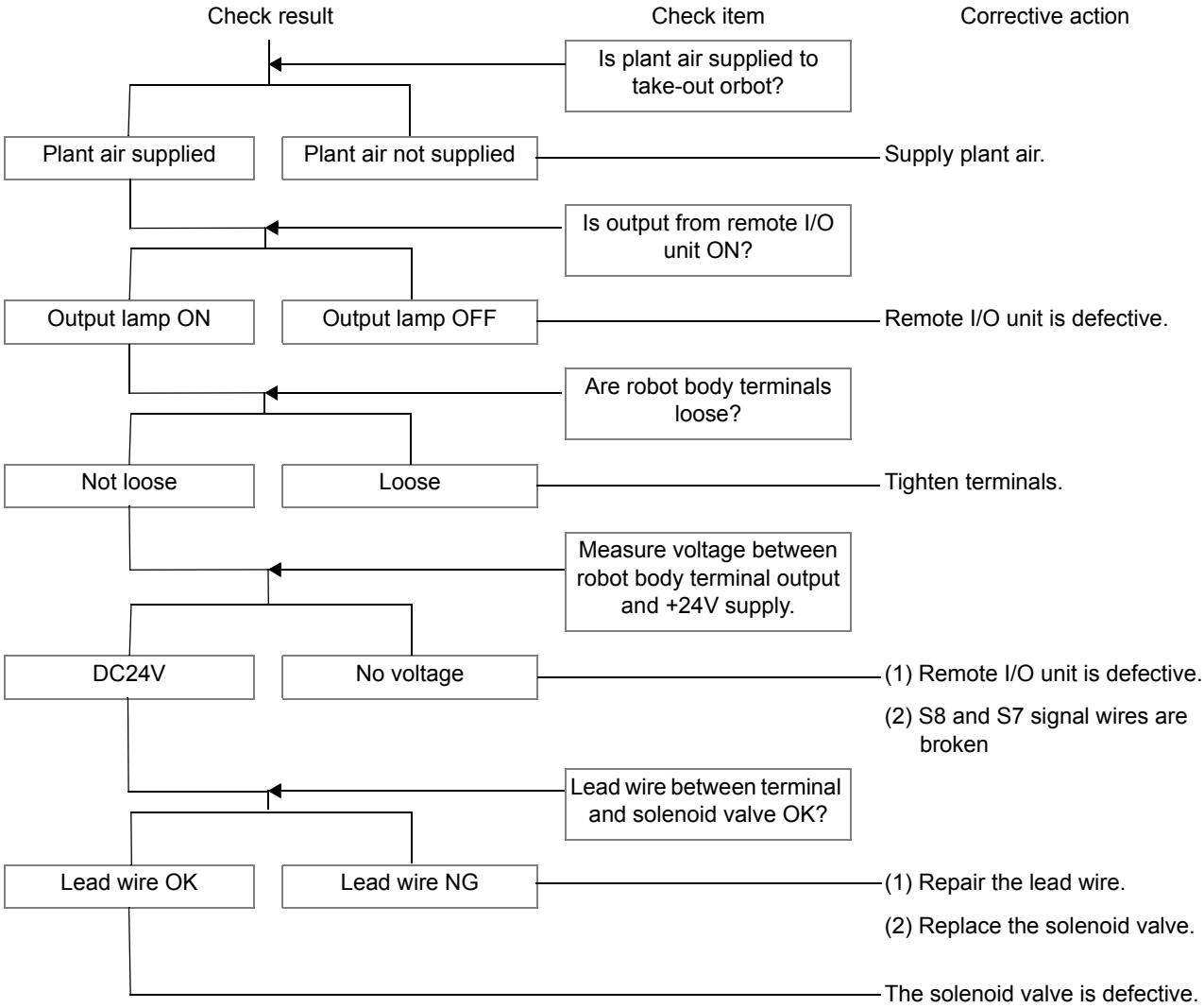
7.2.1 Control power fails to turn ON



7.2.2 Servo power fails to turn ON



7.2.3 The solenoid valve fails to turn ON



7.2.4 Position displacement

- **Check items**

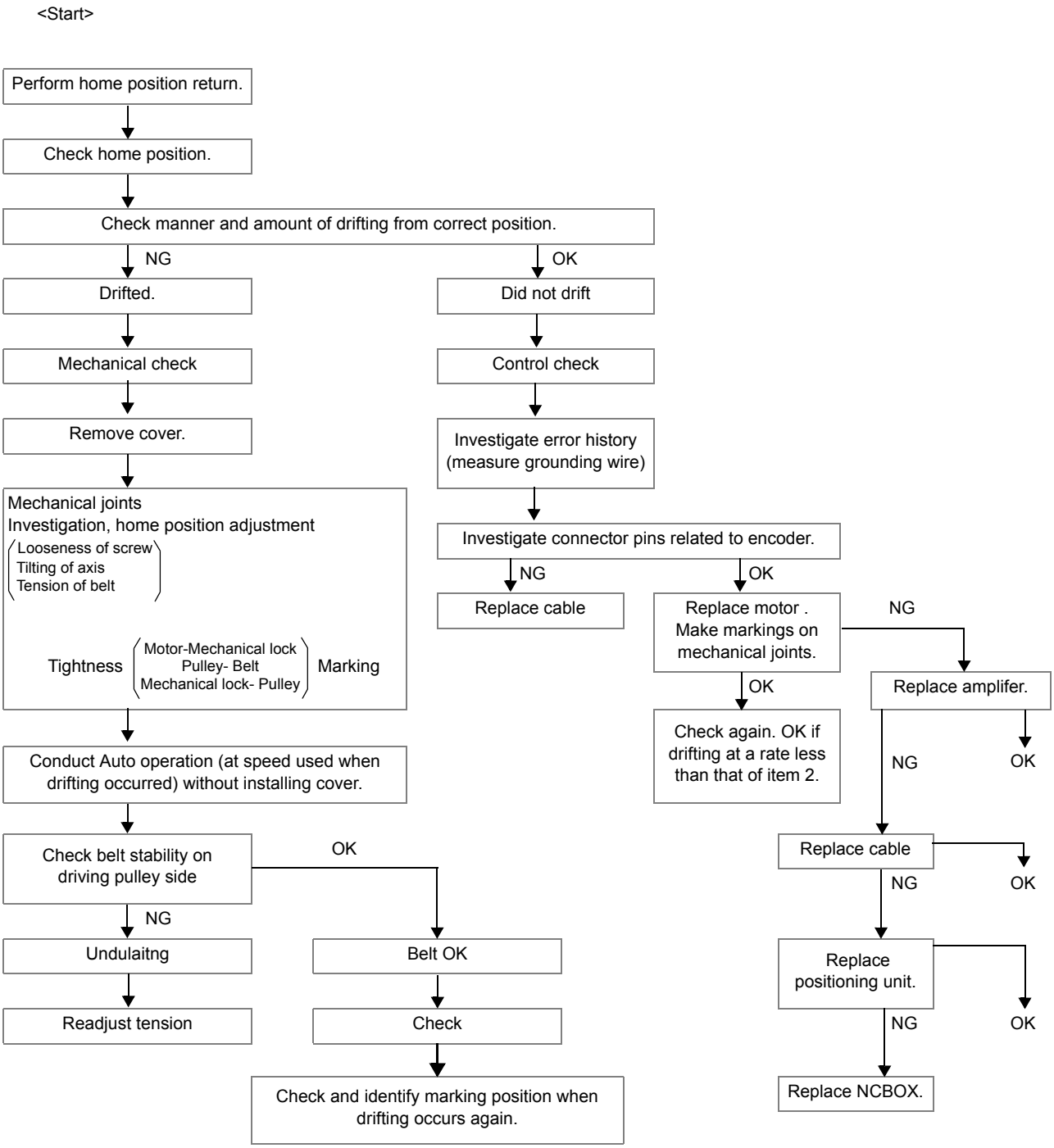
  (1) How far (mm) and in what direction did the position drift?

  (2) What was the rate of the drifting? (mm/cycle)

  (3) What operation(s) were performed before the drifting occurred? What was the motion speed when the drifting occurred?

  (4) What were the conditions under which the drifting occurred? (manual operation, auto operation, power outage, heater ON or OFF, etc.)

  (5) In what manner did the position drift? (gradually or suddenly)



7.2.5 PLC communication error

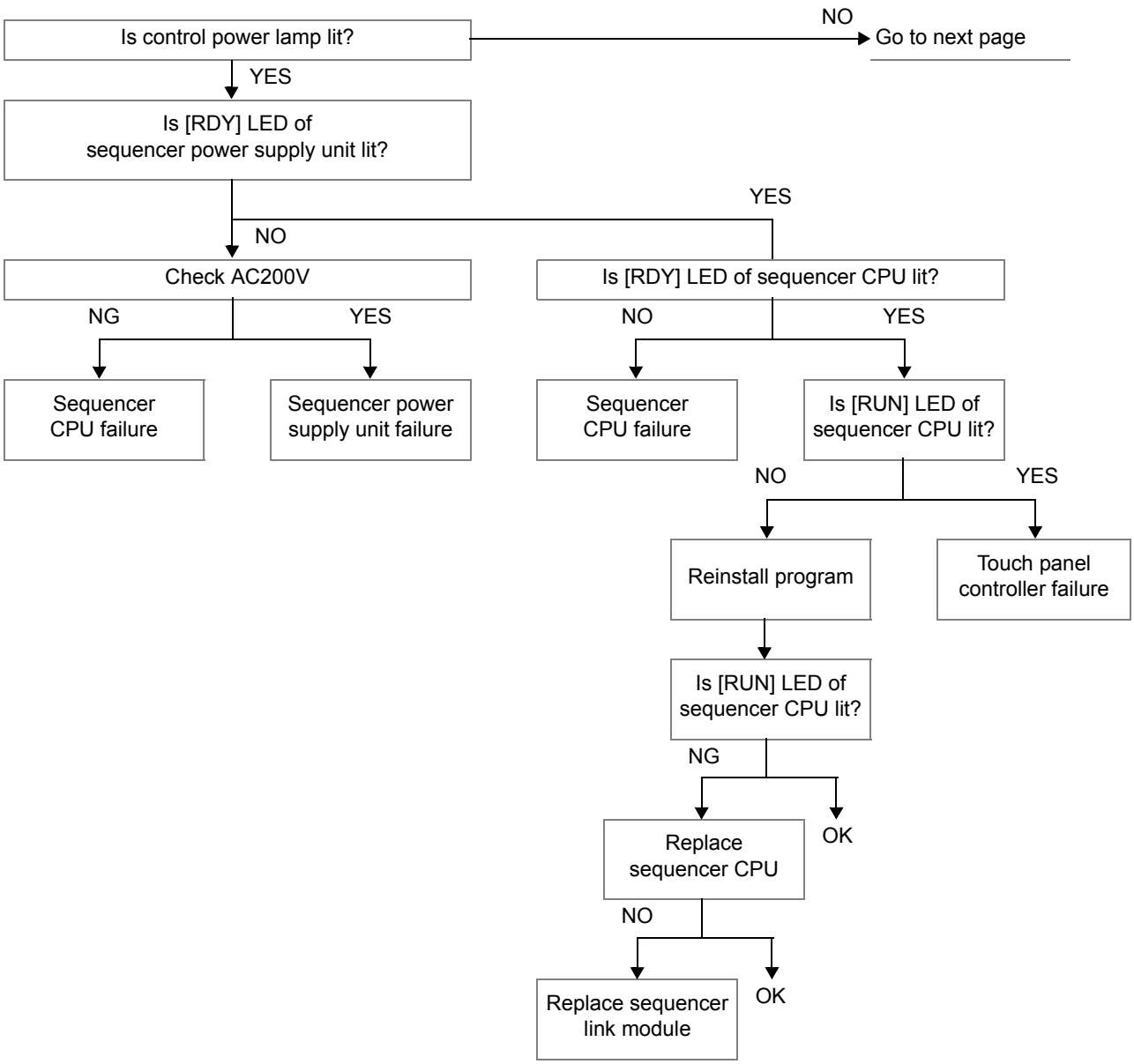
- **Check items**

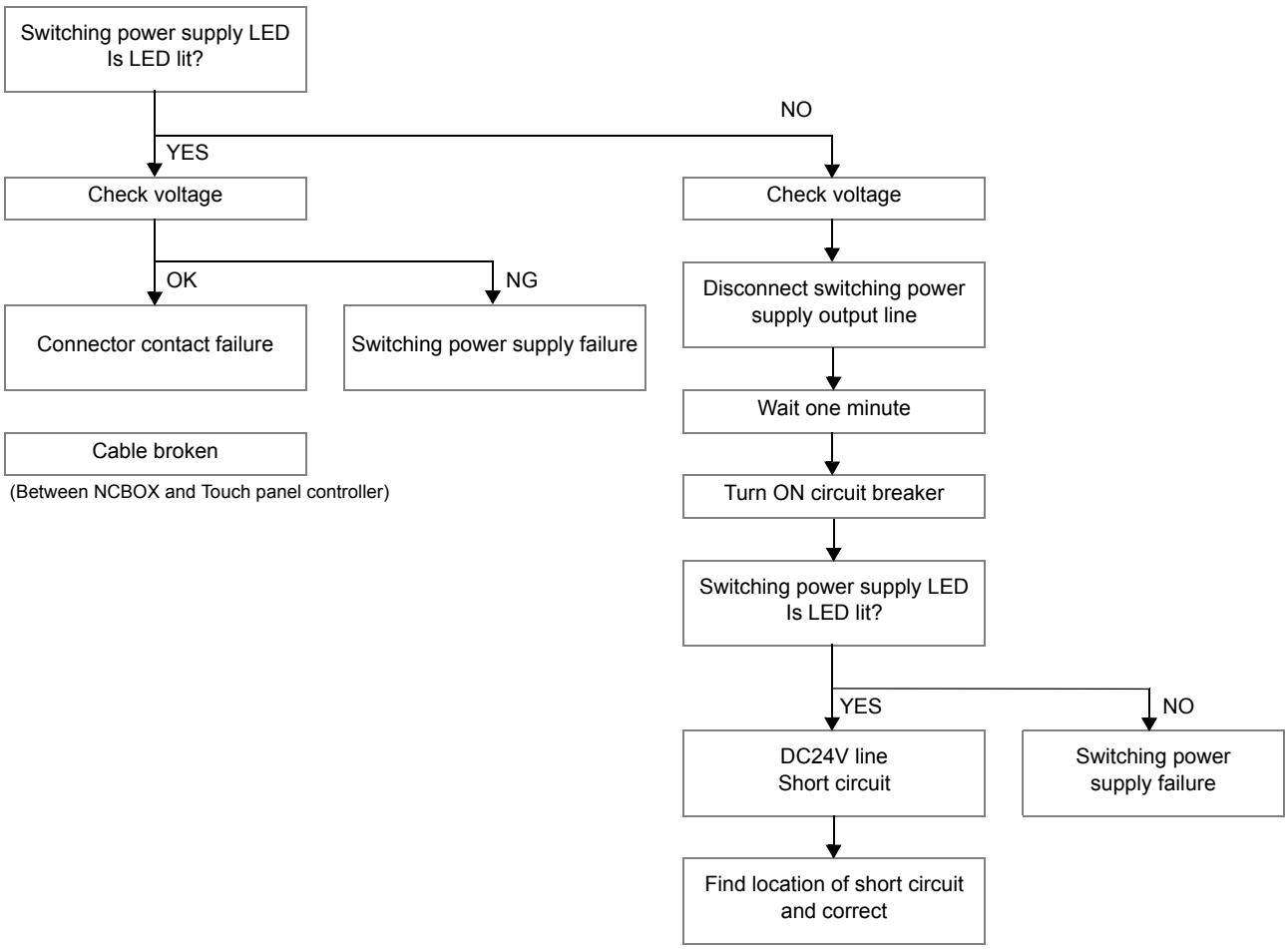
  (1) What were the conditions under which the error occurred? (Auto operation, manual operation, installation, start-up, teaching, etc.)

  (2) What is the frequency of occurrence?

  (3) What operation was being performed immediately before the error occurred?

<Start> OK -Normal NG-PLC communication error




Switching power supply LED
Is LED lit?
YES
NO
Check voltage
OK
NG
Connector contact failure
Switching power supply failure
Cable broken
(Between NCBOX and Touch panel controller)
Check voltage
Disconnect switching power supply output line
Wait one minute
Turn ON circuit breaker
Switching power supply LED
Is LED lit?
YES
NO
DC24V line
Short circuit
Switching power supply failure
Find location of short circuit and correct

7.2.6 Servomotor power failure

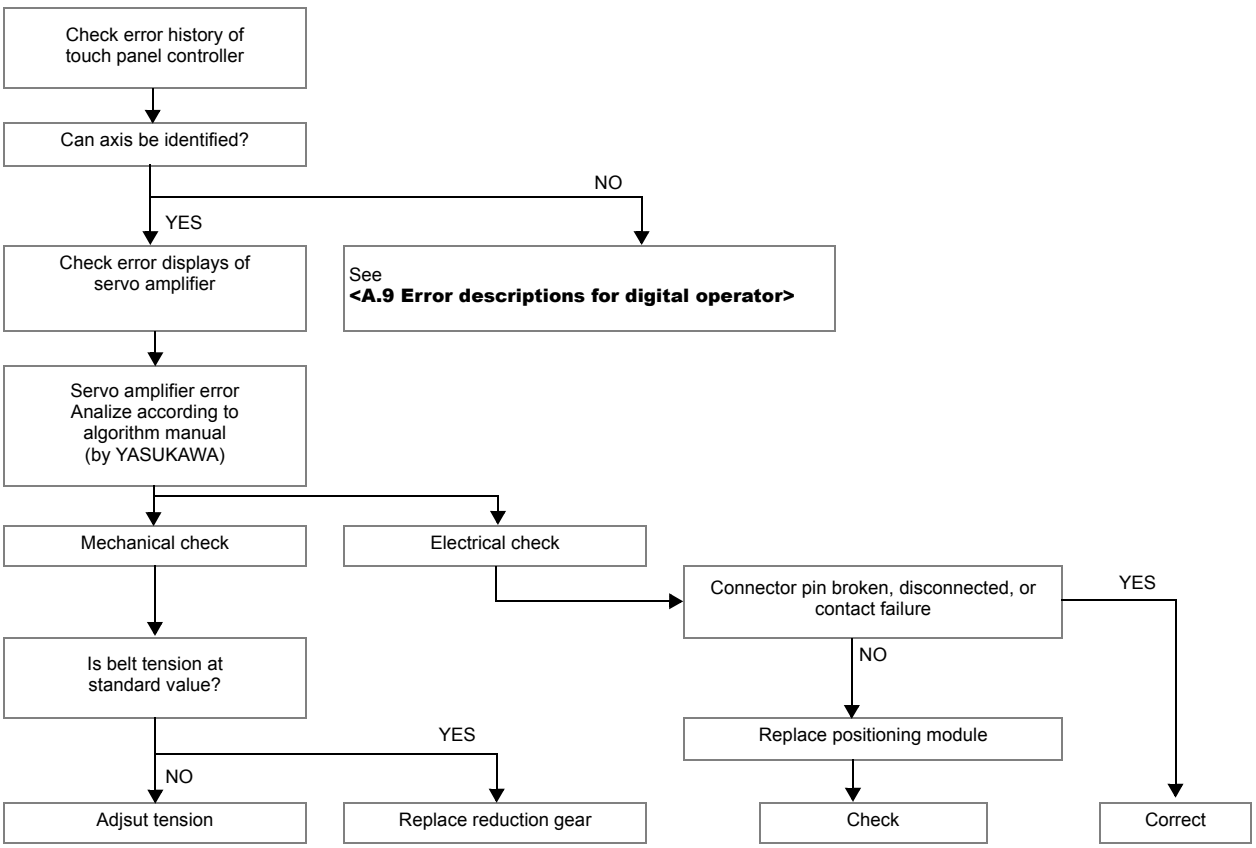
- **Check items**

  (1) What were the conditions under which the error occurred? (Auto operation, manual operation, installation, start-up, teaching, etc.)

  (2) What is the frequency of occurrence?

  (3) What operation was being performed immediately before the error occurred?

<START>



7.2.7 Motor out of control

- **Check items**

  (1) What were the conditions under which the error occurred? (Auto operation, manual operation, installation, start-up, teaching, etc.)

  (2) What is the frequency of occurrence?

  (3) What operation was being performed immediately before the error occurred?

- **Possible cause**

  - Bad positioning unit
  - Bad servo amplifier
  - Bad encoder
  - Incorrect grounding line
  - Bad servomotor
  - Contact failure of encoder cable connector
  - Software bag

7.2.8 Improper stopping during Auto operation

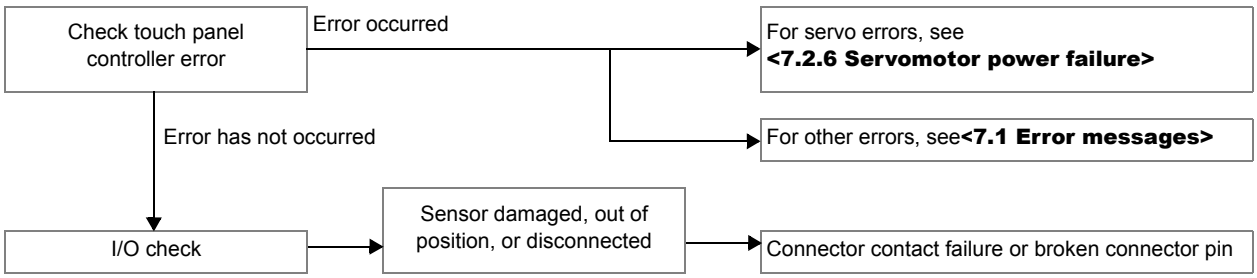
- **Check items**

  (1) What were the conditions under which the error occurred? (Auto operation, manual operation, installation, start-up, teaching, etc.)

  (2) What is the frequency of occurrence?

  (3) What operation was being performed immediately before the error occurred?

<START>



7.2.9 Cannot perform home return

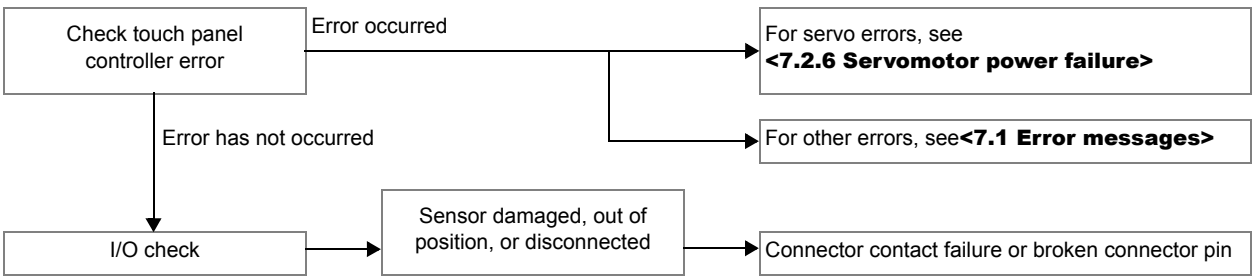
- **Check items**

  (1) What were the conditions under which the error occurred? (Auto operation, manual operation, installation, start-up, teaching, etc.)

  (2) What is the frequency of occurrence?

  (3) What operation was being performed immediately before the error occurred?

<START>



- If the take-out robot will only move in the minus direction or plus direction during the home return motion, the home position sensor may be bad (home position sensor remains ON or OFF constantly).
- If the speed is abnormal, the problem may be in the servo amplifier, motor, or MC unit.

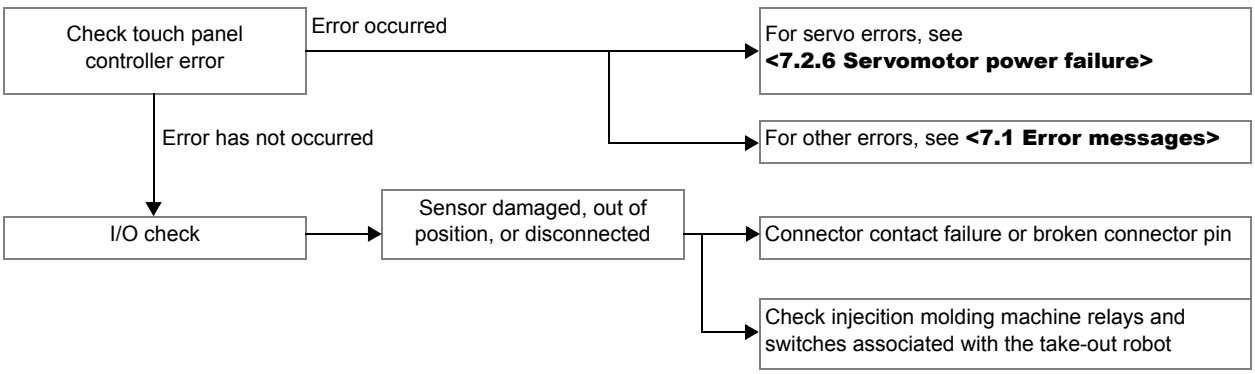
7.2.10 Cannot execute Auto start

- **Check items**

  (1) What is the frequency of occurrence?

  (2) What operation was being performed immediately before the error occurred?

<START>



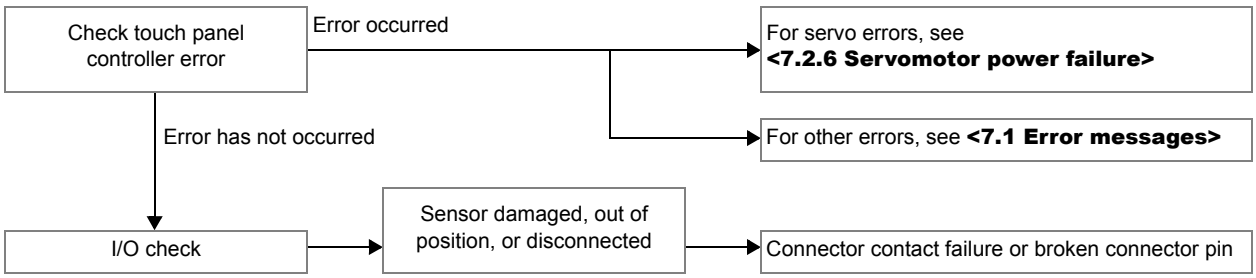
7.2.11 Unstable and abnormal motion

- **Check items**

  (1) What is the frequency of occurrence?

  (2) What operation was being performed immediately before the error occurred?

<START>



- Is the tension at the standard value?
- Loosen mechanical locks to determine if the cause is mechanical or electrical.

Mechanical cause:
- Check if sliding is smooth or conversely, is heavy, catches.
- Check if reduction gear is damaged.

Electrical cause:
- Check if bearing is damaged.
- Check servo amplifier data.
  (Pn100, Pn101 and Pn102 are factory settings for Σ Ⅲ series.)
- Run motor in manual operation using the digital operator.
  If NG, the cause is in the servomotor or servo amplifier (including cable).
  If OK, the cause is in the positioning unit (including cable).

7.2.12 Trouble occurs when installed on old injection molding machine

This section provides troubleshooting information for use with injection molding machines whose control circuitry comprises only relays.

- **Check items**
  (1) What were the conditions under which the error occurred? (Auto operation, manual operation, installation, start-up, teaching, etc.)
  (2) What is the frequency of occurrence?
  (3) What operation was being performed immediately before the error occurred?

- **Possible cause**
  - I/F circuit power supply is 200V
  - Power supply quality is poor
  - Incorrect grounding line
  - Current leakage is occurring

7.2.13 Factory earth leakage breaker turns OFF

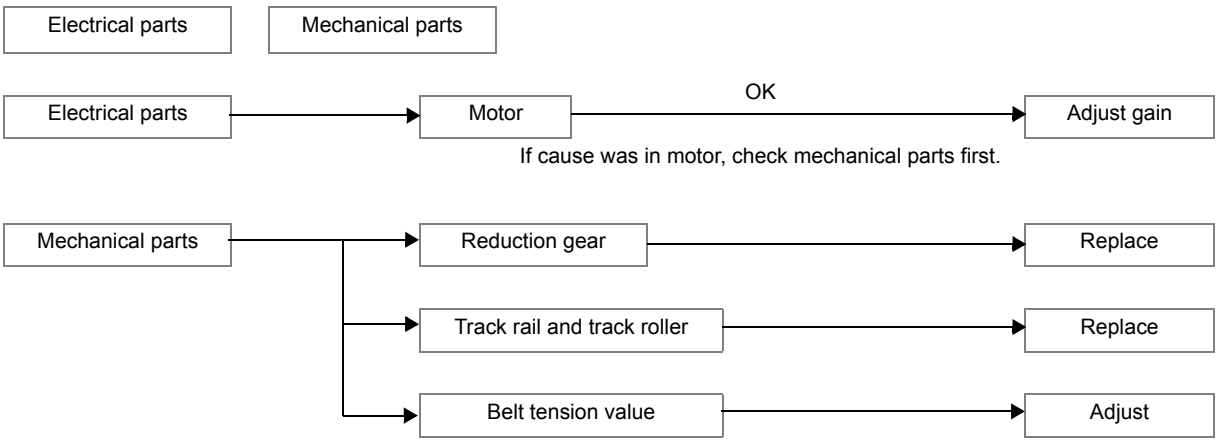
- **Check items**
  (1) What were the conditions under which the error occurred? (Auto operation, manual operation, installation, start-up, teaching, etc.)
  (2) What is the frequency of occurrence?
  (3) What operation was being performed immediately before the error occurred?

- **Possible cause**
  - Leakage breaker is of an old type.
  - Leakage breaker is not designed for use with a motor.
  - If earth leakage breaker rating is insufficient (leakage current or overcurrent), separate breakers.
    When the earth leakage breaker turns OFF, you can check whether it turned OFF due to leakage current or overcurrent by checking the breakers.

7.2.14 Emits abnormal noise but error does not occur

- **Check items**
  (1) What is the frequency of occurrence?
  (2) What operation was being performed immediately before the error occurred?
  (3) Where does the noise emit from?

<START>



- When abnormal noise emits from between timing belt and pulley
  - Is reduction gear mounting plate arched?
  - Is timing belt clamp position incorrect?

7.2.15 Emergency stop error

- Check items
  (1) What is the frequency of occurrence?
  (2) What operation was being performed immediately before the error occurred?

<Start>

- When emergency stop error and servo drive error occur
  - 24V line is bad (check switching power supply, wiring, connector, end-of-arm tool, and flip unit terminals).

- Emergency stop error only
  - Check emergency stop line for broken wire, contact failure, broken amp connector pin, or disconnected pin.
  - Check emergency stop switch to see if it is bad or has a fallen contact block.

7.3 Absolute encoder battery replacement

WARNING

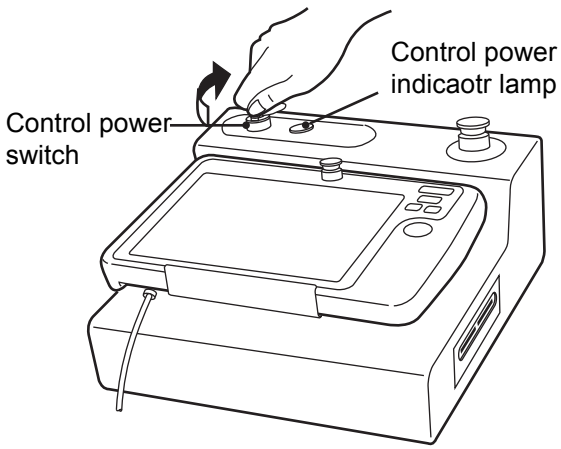
- Replace the battery while the control power is ON. Be sure to have at least two persons conduct the work and one person ready to press the emergency stop switch at any time.

CAUTION

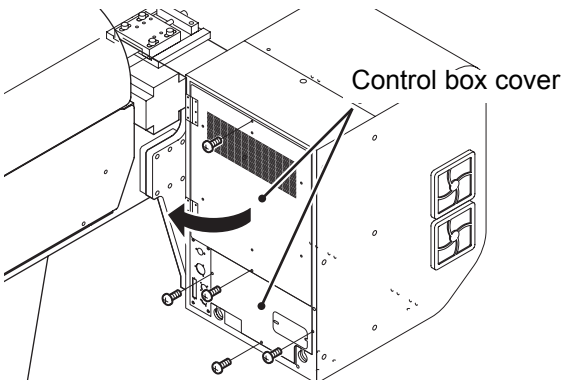
- Be sure to keep the control power ON while replacing the battery. If the battery is replaced while the control power is OFF, an encoder backup alarm is generated and the home position needs to be recalibrated. For the procedure for recalibrate the home position, see **<6.4 Home position setting>**.

- If the battery voltage decreases to 2.7V or less, the servo amplifier generates the A.830 alarm (“Absolute encoder battery alarm”). This alarm is generated in response to the alarm signal from the absolute encoder only when the supply power to the servo amplifier is ON. If the battery voltage LOW is detected during servo amplifier power ON operation, therefore, no alarm is generated.

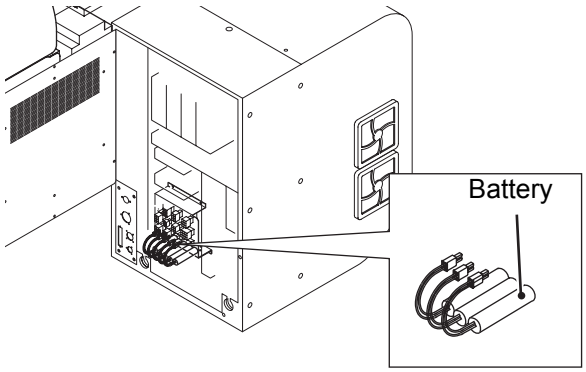
1 **Turn ON the take-out robot control power.**



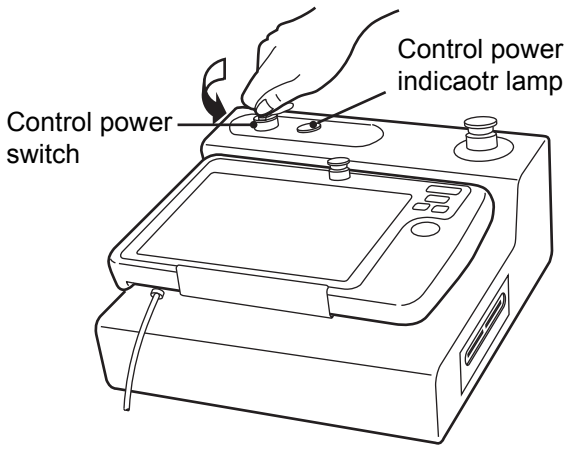
2 **Remove the control box cover.**



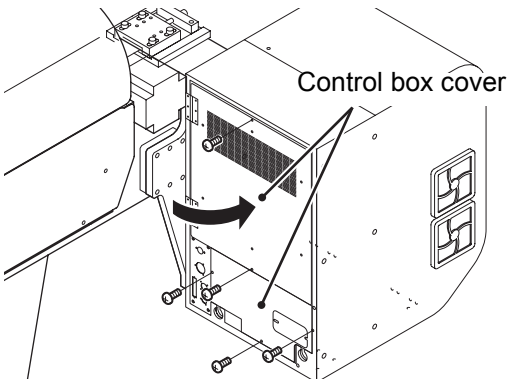
3 **Replace the battery in the control box with the new one.**



4 **Turn OFF the control power.**

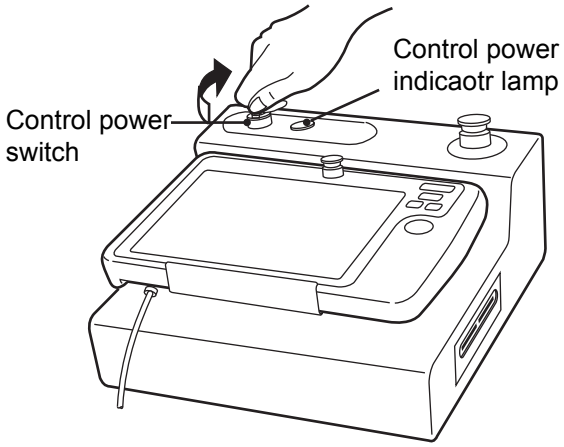


5 **Install the removed cover.**



6 **Turn ON the take-out robot control power.**

The battery is successfully replaced if no alarm is generated after the control power turns ON.



- If the A.810 encoder backup error is generated after the control power turns ON, the home position must be recalibrated. For the procedure for recalibrating the home position, see **<6.4 Home position setting>**.
- If the A.810 encoder backup error is generated at **Step 7** of **<6.4 Home position setting>** and the servo power fails to turn ON, use the digital operator to clear the error. For details, see **<7.4 Using the digital operator>**.

7.4 Using the digital operator

If the A.810 encoder backup error persists at the **Step 7** of **<6.4 Home position setting>**, use the digital operator to clear the alarm.

1 **Connect the digital operator to the servo amplifier where the error is displayed.**

2 **Use MODE/SET button on the digital operator to select the Function screen.**

3 **Use the Up/Down buttons to select "Fn008". (The selected item blinks.)**

4 **Touch the DATA button.**
The display shows "Multiturn Clear PGCL1".

5 **Press and hold down the Up/Down button until PGLC5 appears.**

6 **Touch the DATA button.**
Make sure "BB" at the upper left corner on the digital operator display changes to "Done" for some time.

- Repeat **Step 1** to **6** for each servo amplifier where the error is displayed.

7 **Turn OFF the take-out robot control power.**

8 **Turn ON the take-out robot control power.**

9 **Resume the home position calibration starting with Step 7 of <6.4 Home position setting>.**

APPENDIX

A.1 Specifications

Power voltage	: AC200V (50/60 Hz)
Drive method	: Digital servo motor Type S : 3 axes Type D : 5 axes
Control method	: Microcomputer control
Working pressure	: 4.9 × 10^5 Pa (gauge)
Maximum allowable pressure	: 7.9 × 10^5 Pa (gauge)
Flip angle	: 90 degrees

Specification breakdown based on model

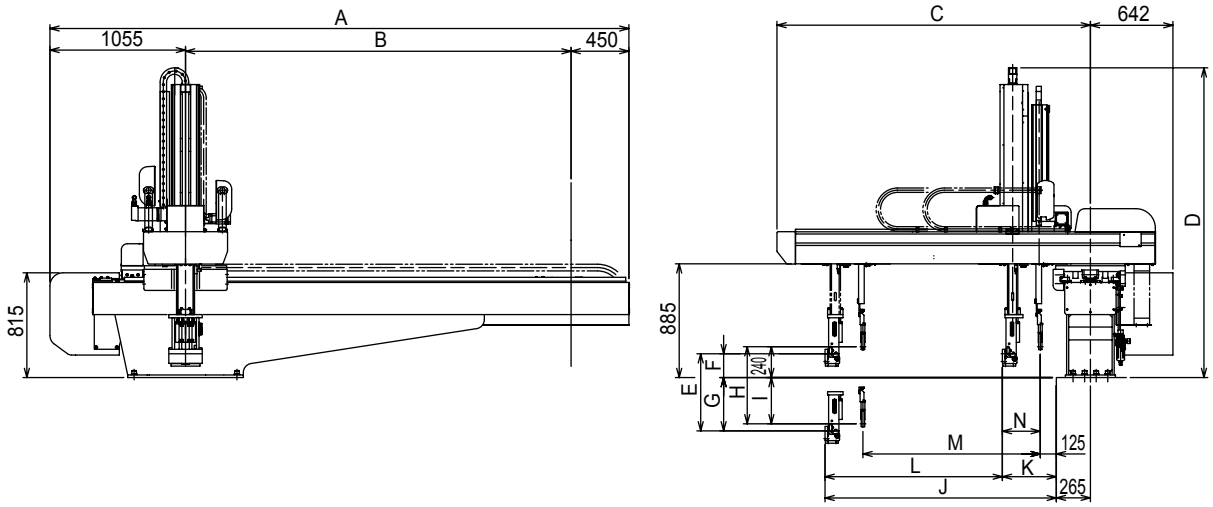
Model	Maximum power consumption	Traverse stroke (mm)	Kick stroke (mm)		Descent stroke (mm)		Air consumption l(Normal)/ Cycle	Maximum weight capacity (kg)	Weight (kg)
			Main arm	Sub arm	Main arm	Sub arm			
RA Ⅱ - α -1300S	S type Three-phase AC200V × 9.1A Max.	3000 (3500)	1570	-	1800	-	50.8	35	1280
RA Ⅱ - α -1300D	D type Three-phase AC200V × 12.1A Max.		1380	1380	1800	1800	56.6		1380

( ) Type L

Primary power source breakdown based on model

Model	Power consumption	Circuit breaker
RA Ⅱ - α -1300S	2.45 KVA	Three-phase leakage breaker Rated current 20A Residual operating current 30mA
RA Ⅱ - α -1300D	3.05 KVA	

A.2 External dimensions

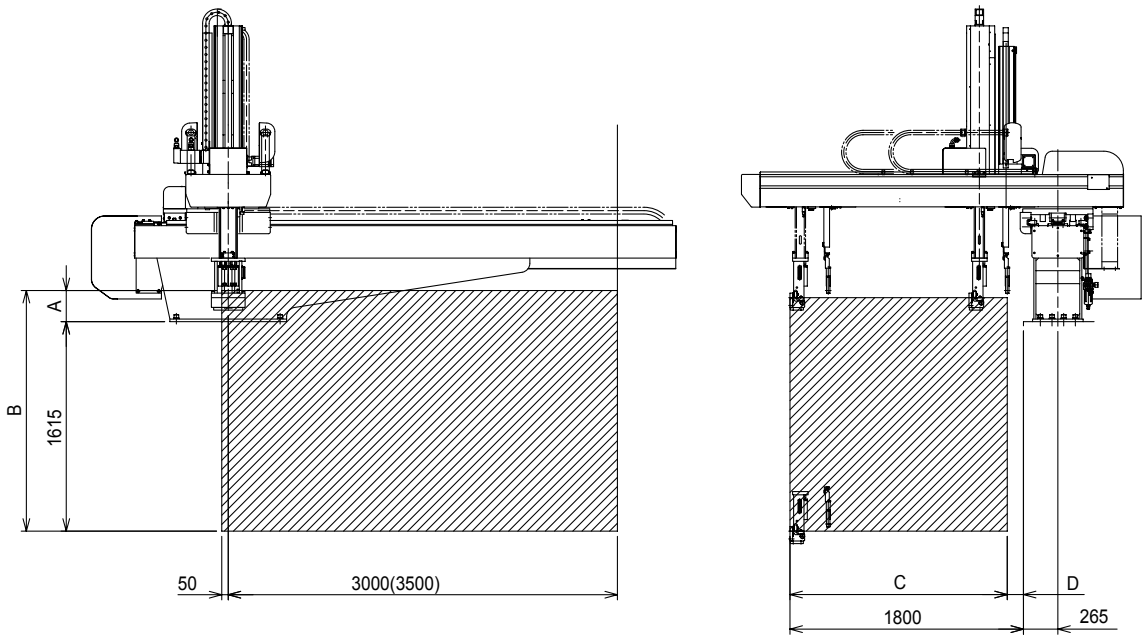


All dimensions in millimeters

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N
RA Ⅱ - α -1300S	4505 (5005)	300 (3500)	2439	2410	1800	185	1615	1800	1560	1800	230	1570	-	295
RA Ⅱ - α -1300D											420	1380	1380	

( ) Type L

A.3 Motion area



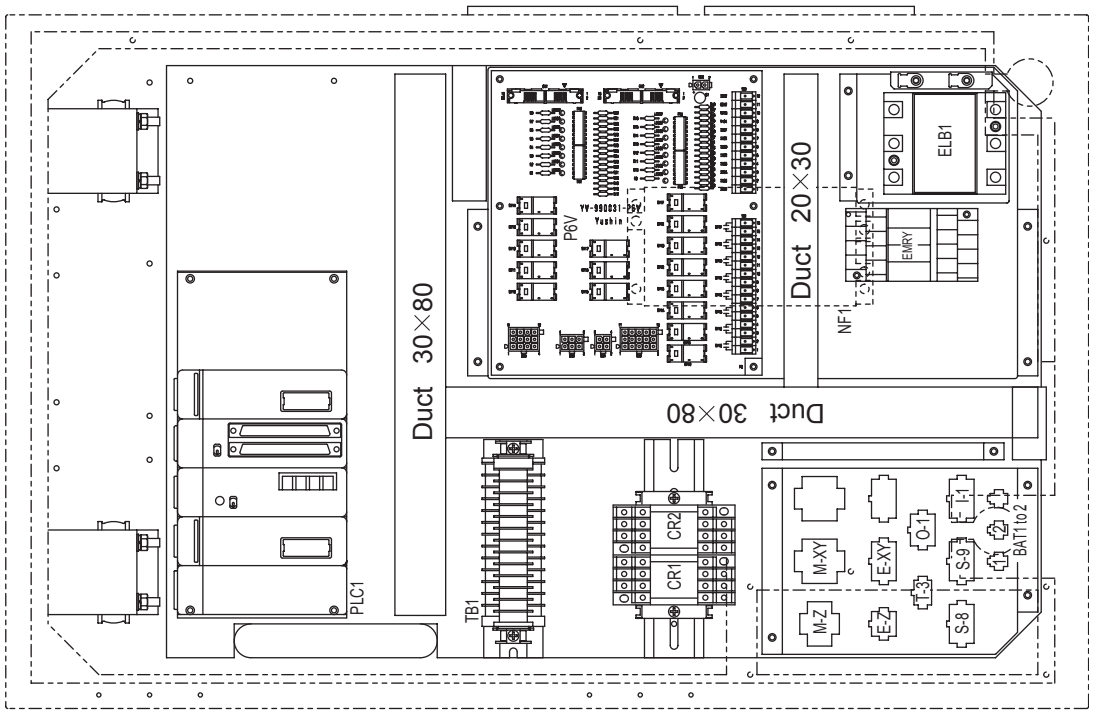
All dimensions in millimeters

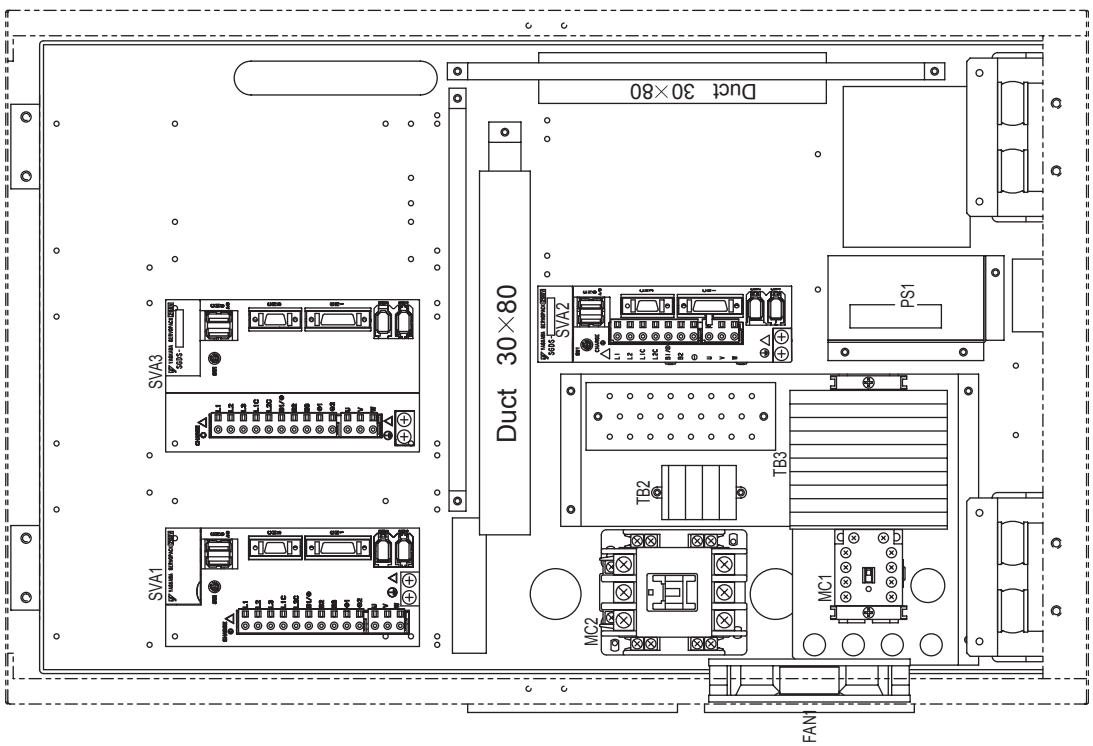
Model	A	B	C	D
RA Ⅱ - α -1300S	185	1800	1570	230
RA Ⅱ - α -1300D	240	1855	1675	125

( ) Type L

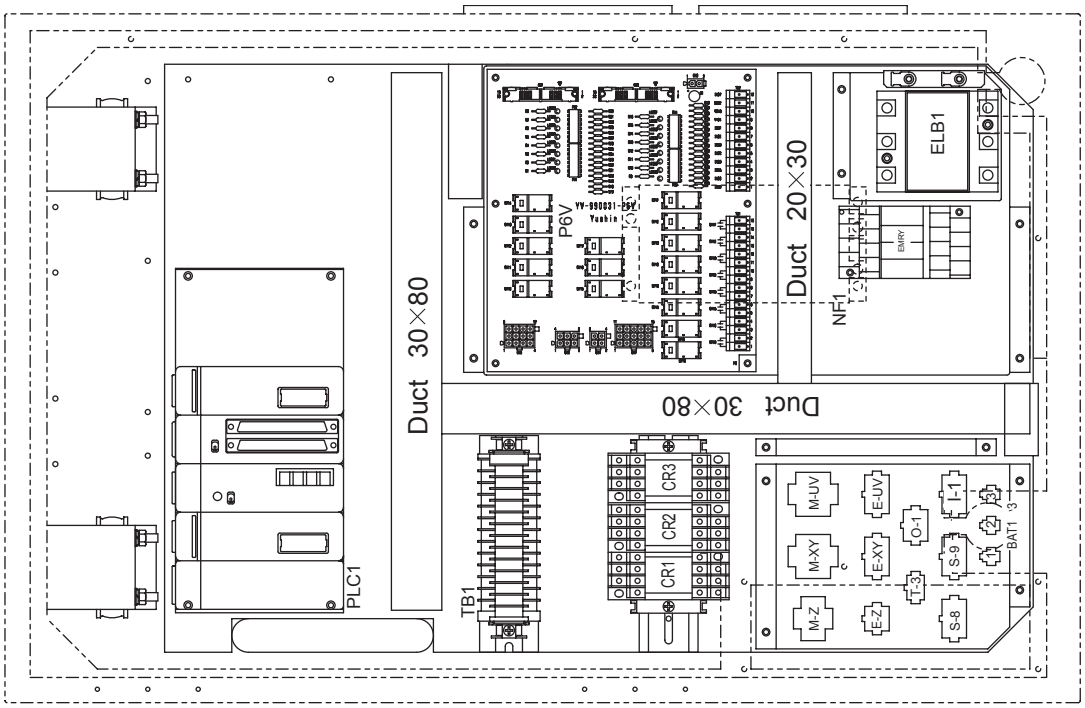
A.4 Control box layout drawings

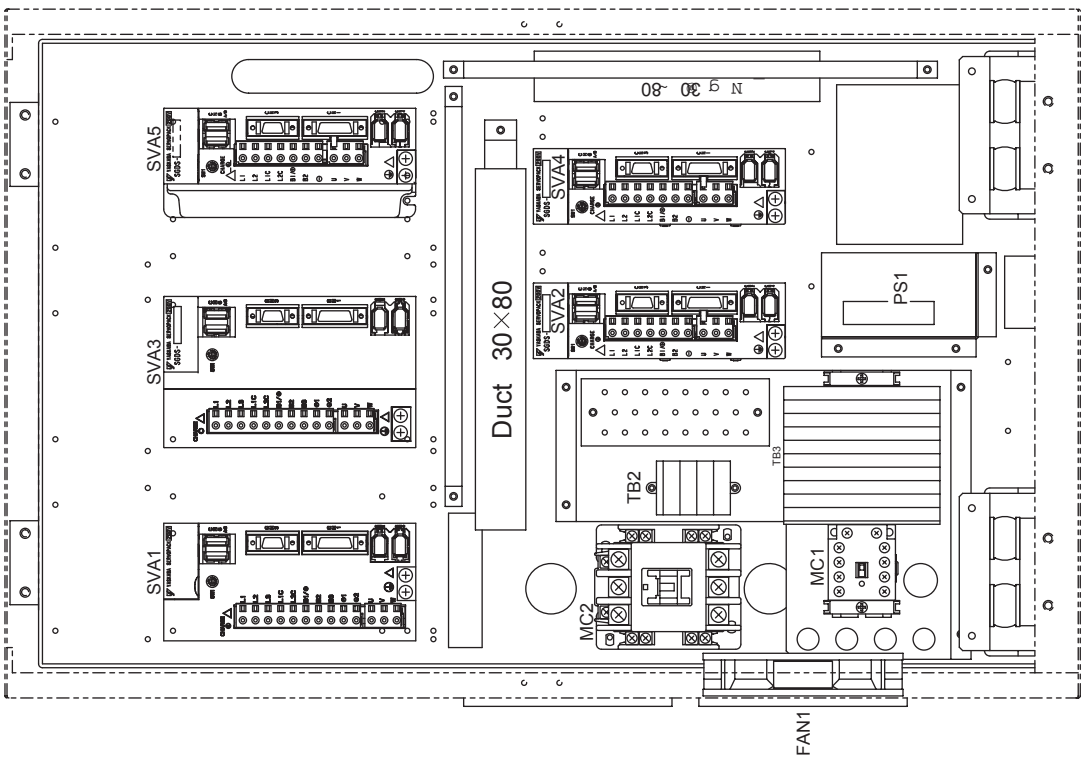
Type S





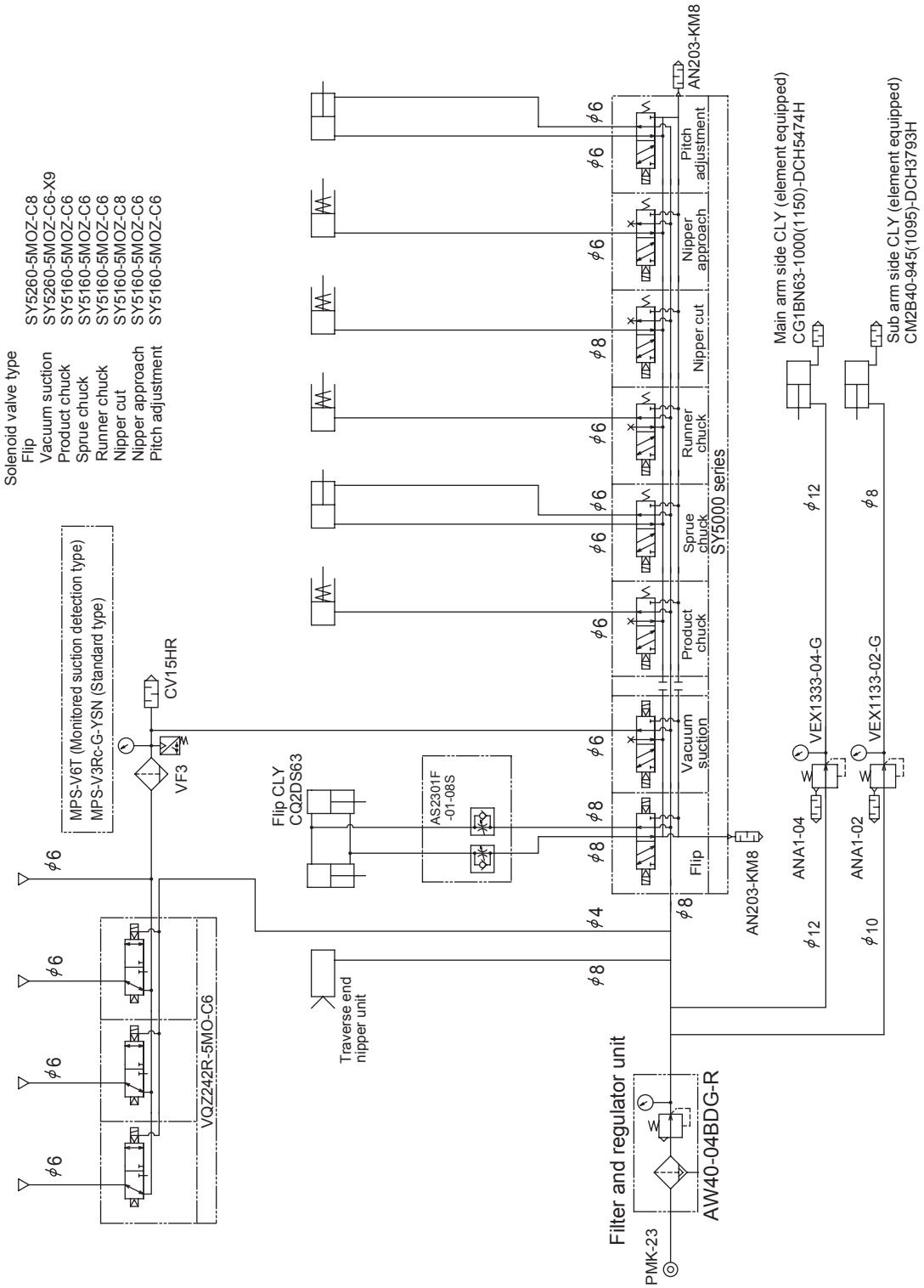
Type D


Duct 30×80
Duct 20×30
Duct 30×80
ELB1
P6V
NF1
EMRY
PLC1
TB1
CR1
CR2
CR3
M-UV
E-UV
I-1
M-XY
E-XY
O-1
S-9
T-3
M-Z
E-Z
S-8
BAT1

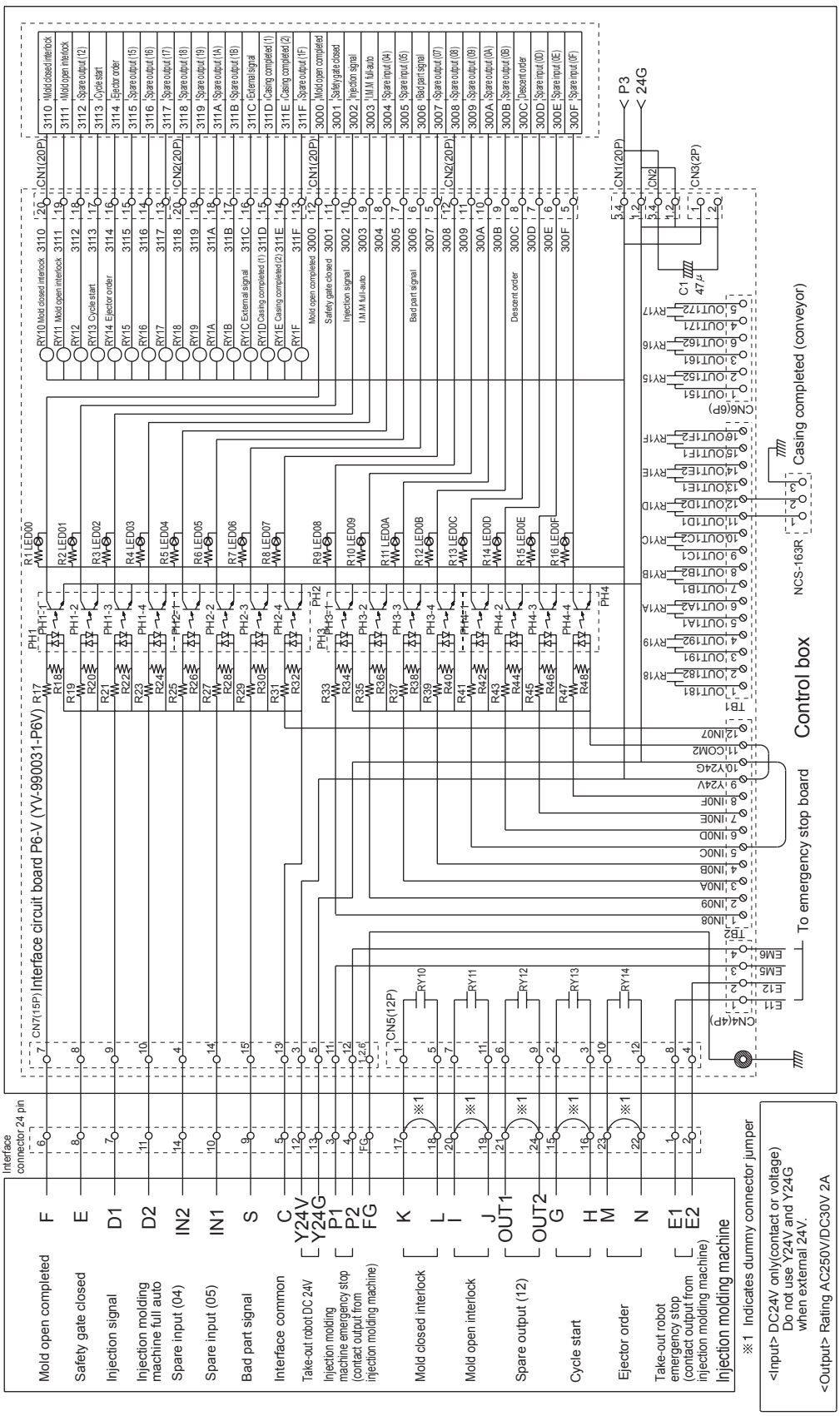

Duct 30×80
SVA5
SVA4
SVA3
SVA2
SVA1
PS1
TB2
TB3
MC1
MC2
FAN1

A.5 Circuit drawings

A.5.1 Pneumatic circuit



A.5.2 Injection molding machine interface



A.6 Maintenance parts list

Unit name	Part name	Model number	Part number	Remarks
Traverse	Timing belt	050-AT10-0396E-LY	2647000	3000 traverse
		050-AT10-0446E-LY	1649170	3500 traverse
	Element (filter)	Element for AW30 (AF30P-060S)	2381520	
	Magnet	MG-C	0106480	
	Radial ball bearing	941001BM0840230	0840230	
Main arm	Timing belt	050-AT10-0207E-LY	2697170	1800 stroke
		050-AT10-0222E-LY	2697250	2100 stroke
		0500-S8M-2600	2697150	1800 stroke
		0500-S8M-2888	2697240	2100 stroke
	Pneumatuc cylinder	CG1BN63-1000-DCH5474H	2697180	1800 stroke
		CG1BN63-1150-DCH5474H	2697260	2100 stroke
	Radial ball bearing	10BG03S12-2NSCS	0607140	For kick, first and second stage arm
Flip	Speed controller	AS2301F-01-08S	0907610	
	Pneumatic cylinder	CQ2D63C-W2313-100	1694320	
Sub arm	Timing belt	025-AT10-0168E-LY (Wax)	2648750	1800 stroke
		025-AT10-0191E-LY (Wax)	2697480	2100 stroke
		0300-S5M-2475	2648760	1800 stroke
		0300-S5M-2775	2697510	2100 stroke
	Radial ball bearing	10BG03S12-2NSCS	0607140	For kick
		10BG03S8-2NS	0522750	For first stage arm unit
		10BG03S15-2NSCS	2389310	For second stage arm unit
	Pneumatic cylinder	CM2B40-945-DCH3793H	2648770	1800 stroke
		CM2B40-1095-DCH3793H	2697550	2100 stroke
Kick	Timing belt	025-AT10-0512E-LY (Wax)	2698700	
	Magnet	MG-C	0106480	
Junction box	Solenoid valve	SY5260-5MOZ-C8	1041490	Flip
		SY5260-5MOZ-C6-X9	1132570	Vacuum suction
		SY5260-5MOZ-C4	1041510	Sprue chuck Nipper approach Pitch adjustment Product chuck Runner chuck
		SY3160-5MOZ-C6	1639170	Nipper cut
	Pressure sensor	MPS-V3RC-G-YSN	1346190	
	Vacuum generator	CV-15HR	0804550	
	Vacuum generator filter	VF-3	0113070	
	Muffler	AN203-KM8	0529780	For flip unit and optional valve
	Pneumatic filter for balance cylinder	ANA1-02	2484200	For sub arm
		ANA1-04	2022330	For main arm
Electrical parts	Contact relay	MY4N-D2 DC24V	0209120	
		G6B-1177P-FD-ND-US DC24V	0160360	
	Control box filter	FLM12Y	1921380	
All axis	Grease	585M 400g	2839530	For lubrication by grease gun or centralized lubrication

A.7 Tightening torque

N·m

	Steel members	Aluminum members
M3	1.5	1.1
M4	3.4	2.4
M5	6.9	4.5
M6	12	8
M8	29	20
M10	57	39
M12	98	71
M14	157	108
M16	255	159
M20	490	321
M24	843	490

A.8 Digital operator parameter setting values

Category	User constant No.(Pn-)	Description	Unit	Setting range	Factory setting				
				Lower/Upper limit	A-axis	B-axis	C-axis	D-axis	E-axis
Function selection constants	Pn000	Function Selection Basic Switch 0	-	---	0000H	0000H	0001H	0000H	0000H
	Pn001	Function Selection Application Switch 1	-	---	0000H	0000H	0000H	0000H	0000H
	Pn002	Function Selection Application Switch 2	-	---	0000H	0000H	0000H	0000H	0000H
	Pn006	Function Selection Application Switch 6	-	---	0002H	0002H	0002H	0002H	0002H
	Pn007	Function Selection Application Switch 7	-	---	0000H	0000H	0000H	0000H	0000H
	Pn008	Function Selection Application Switch 8	-	---	0110H	0100H	0110H	0100H	0110H
Gain constants	Pn100	Speed Loop Gain	0.1Hz	10/20000	400	400	450	350	900
	Pn101	Speed Loop Integral Time Constant	0.01ms	15/51200	1600	3000	900	800	1000
	Pn102	Position Loop Gain	0.1/s	10/20000	300	130	250	130	250
	Pn103	Moment of Inertia Ratio	%	0/20000	1000	1000	1000	1000	1000
	Pn104	2nd Speed Loop Gain	0.1Hz	10/20000	400	400	400	400	400
	Pn105	2nd Speed Loop Integral Time Constant	0.01ms	15/51200	2000	2000	2000	2000	2000
	Pn106	2nd Position Loop Gain	0.1/s	10/20000	400	400	400	400	400
	Pn107	Bias	min-1	0/450	0	0	0	0	0
	Pn108	Bias Addition Width	command unit	0/250	7	7	7	7	7
	Pn109	Feed Forward Gain	%	0/100	0	0	0	0	0
	Pn10A	Feed Forward Filter Time Constant	0.01ms	0/6400	0	0	0	0	0
	Pn10B	Gain Related Application Switch	-	---	0000H	0000H	0000H	0000H	0000H
	Pn10C	Mode Switch (torque reference)	%	0/800	20	40	115	60	200
	Pn10D	Mode Switch (speed reference)	min-1	0/10000	0	0	0	0	0
	Pn10E	Mode Switch (acceleration)	min-1/s	0/30000	0	0	0	0	0
	Pn10F	Mode Switch (error pulse)	command unit	0/10000	0	0	0	0	0
	Pn110	Normal Autotuning Switch	-	---	7012H	7012H	7012H	7012H	7012H
	Pn111	Speed Feedback Compensation Gain	%	1/500	100	100	100	100	100
	Pn119	Reference Filter Gain	0.1/s	10/20000	500	500	500	500	500
	Pn11A	Reference Filter Gain Compensation	0.1%	500/2000	1000	1000	1000	1000	1000
	Pn11E	Reference Filter Bias (Forward)	0.1%	0/10000	1000	1000	1000	1000	1000
	Pn11F	Position Integral Time Constant	0.1ms	0/50000	0	0	0	0	0
	Pn12B	3rd Speed Loop Gain	0.1Hz	10/20000	400	400	400	400	400
	Pn12C	3rd Speed Loop Integral Time Constant	0.01ms	15/51200	2000	2000	2000	2000	2000
	Pn12D	3rd Position Loop Gain	0.1/s	10/20000	400	400	400	400	400
	Pn12E	4th Speed Loop Gain	0.1Hz	10/20000	400	400	400	400	400
	Pn12F	4th Speed Loop Integral Time Constant	0.01ms	15/51200	2000	2000	2000	2000	2000
	Pn130	4th Position Loop Gain	0.1/s	10/20000	400	400	400	400	400
	Pn131	Gain Switching Time 1	ms	0/65535	0	0	0	0	0
	Pn132	Gain Switching Time 2	ms	0/65535	0	0	0	0	0
	Pn135	Gain Switching Waiting Time 1	ms	---	0	0	0	0	0
	Pn136	Gain Switching Waiting Time 2	ms	0/10000	0	0	0	0	0
	Pn139	Automatic Gain Changeover Related Switch 1	-	---	0000H	0000H	0000H	0000H	0000H
	Pn144	Reference Filter Bias (Reverse)	0.1%	0/300	1000	1000	1000	1000	1000
	Pn150	Predictive Control Selection Switch	-	0/300	0210H	0210H	0210H	0210H	0210H
	Pn151	Predictive Control Acceleration Deceleration Gain	%	1/500	100	100	100	100	100
	Pn152	Predictive Control Weighting Ratio	%	1/500	100	100	100	100	100
	Pn1A0	Servo Rigidity	%	30/3200	60	60	60	60	60

Category	User constant No.(Pn-)	Description	Unit	Setting range	Factory setting				
				Lower/Upper limit	A-axis	B-axis	C-axis	D-axis	E-axis
Gain constants	Pn1A1	Servo rigidity #2	%	30/3200	60	60	60	60	60
	Pn1A2	Speed Feedback Fiter Timer Constant	0.01ms	0/2500	72	72	72	72	72
	Pn1A3	Sppe Feedback Filter TImer Constant #2	0.01ms	---	72	72	72	72	72
	Pn1A4	Torque Reference Filter Time Constant	0.01ms	0/500	36	36	36	36	36
	Pn1A7	Utility Control Switch	-	0/500	1121H	1121H	1121H	1121H	1121H
	Pn1A9	Utility Integral Gain	Hz	0/500	37	37	37	37	37
	Pn1AA	Position Proportional Gain	Hz	0/2000	60	60	60	60	60
	Pn1AB	Speed Integral Gain	Hz	---	0	0	0	0	0
	Pn1AC	Speed Proportional Gain	Hz	0/65535	120	120	120	120	120
	Pn200	Position Control Reference Form Selection Switch	-	---	0100H	0100H	0100H	0100H	0100H
	Pn205	Multiturn Limit Setting	Rev	0/65535	65535	65535	65535	65535	65535
Other constants	Pn207	Position Control Function Switch	-	---	0012H	0012H	0012H	0012H	0012H
	Pn209	Position Reference Acceleration/Deceleration Bias	command unit/s	0/65535	0	0	0	0	0
	Pn20A	Number of External Scale Pitch	pitch/Rev	100/1048576	32768	32768	32768	32768	32768
	Pn20E	Electronic Gear Ratio (Numerator)	-	1/1073741824	16	16	16	16	16
	Pn210	Electronic Gear Ratio (Denominator)	-	1/1073741824	1	1	1	1	1
	Pn212	PG Dividing Pulse (pulse unit)	P/Rev	16/1073741824	2048	2048	2048	2048	2048
	Pn214	Backlash Compensation Amount	command unit	-32767/32767	0	0	0	0	0
	Pn215	Backlash Compensation Time Constant	0.01ms	0/65535	0	0	0	0	0
	Pn216	Position Reference Acceleration/Deceleration Time Constant	0.1ms	0/65535	0	250	250	300	50
	Pn217	Average Movement Time of Position Reference	0.1ms	0/10000	150	200	100	350	0
	Pn281	Encoder Output Resolution	P/scale pitch	1/265	20	20	20	20	20
	Pn300	Speed Reference Input Gain	0.01V/rated speed	150/3000	600	600	600	600	600
	Pn301	Internal Set Speed 1	min-1	0/10000	100	100	100	100	100
	Pn302	Internal Set Speed 2	min-1	0/10000	200	200	200	200	200
	Pn303	Internal Set Speed 3	min-1	0/10000	300	300	300	300	300
	Pn304	JOG Speed	min-1	0/10000	500	500	500	500	500
	Pn305	Soft Start Acceleration Time	ms	0/10000	0	0	0	0	0
	Pn306	Soft Start Deceleration Time	ms	0/10000	0	0	0	0	0
	Pn307	Speed Reference Filter Time Constant	0.01ms	0/65535	40	40	40	40	40
	Pn308	Speed Feedback Filter Time Constant	0.01ms	0/65535	0	0	0	0	0
	Pn310	Vibration Detection Switch	-	---	0000H	0000H	0000H	0000H	0000H
	Pn311	Vibration Detection Sensibility	%	50/500	100	100	100	100	100
	Pn312	Vibration Detection Level	min-1	0/5000	50	50	50	50	50
	Pn400	Torque Reference Input Gain	0.01/rated torque	10/100	30	30	30	30	30
	Pn401	Torque Reference Filter Time Constant	0.01ms	0/65535	100	100	150	50	100
	Pn402	Forward Torque Limit	%	0/800	800	800	800	800	800
	Pn403	Reverse Torque Limit	%	0/800	800	800	800	800	800
	Pn404	Forward External Torque Limit	%	0/800	100	100	100	100	100
	Pn405	Reverse External Torque Limit	%	0/800	100	100	100	100	100
	Pn406	Emergency Stop Torque	%	0/800	800	800	800	800	800
	Pn407	Speed Limit during Torque Control	min-1	0/10000	10000	10000	10000	10000	10000
	Pn408	Torque Related Function Switch	-	---	0000H	0000H	0000H	0000H	0000H
	Pn409	1st Step Notch Filter Frequency	Hz	50/2000	2000	2000	2000	2000	2000
	Pn40A	1st Step Notch Filter Q Value	0.01	70/1000	70	70	70	70	70
	Pn40C	2nd Step Notch Filter Frequency	Hz	50/2000	2000	2000	2000	2000	2000
	Pn40D	2nd Step Notch Filter Q Value	0.01	70/1000	70	70	70	70	70

Category	User constant No.(Pn-)	Description	Unit	Setting range	Factory setting				
				Lower/Upper limit	A-axis	B-axis	C-axis	D-axis	E-axis
Other constants	Pn40F	2nd Step 2nd Torque Reference Filter Frequency	Hz	100/2000	2000	2000	2000	2000	2000
	Pn410	2nd Step 2nd Torque Reference Filter Q Value	0.01	70/1000	70	70	70	70	70
	Pn411	3rd Step Torque Reference Filter Time Constant	μs	0/65535	0	0	0	0	0
	Pn412	1st Step 2nd Torque Reference Filter Time Constant	0.01ms	0/65535	100	100	100	100	100
	Pn413	1st Step 3rd Torque Reference Filter Time Constant	0.01ms	0/65535	100	100	100	100	100
	Pn414	1st Step 4th Torque Reference Filter Time Constant	0.01ms	0/65535	100	100	100	100	100
	Pn420	Damping for Vibration Suppression on Stopping	%	10/100	100	100	100	100	100
	Pn421	Vibration Suppression Starting Time	ms	0/65535	1000	1000	1000	1000	1000
	Pn422	Gravity Compensation Torque	0.01%	-20000/20000	0	0	0	0	0
	Pn456	Sweep Torque Reference Amplitude	%	1/800	15	15	15	15	15
	Pn501	Zero Clamp Level	min-1	0/10000	10	10	10	10	10
	Pn502	Zero Speed Level	min-1	1/10000	20	20	20	20	20
	Pn503	Speed Coincidence Signal Output Width	min-1	0/100	10	10	10	10	10
	Pn506	Brake Reference-Servo OFF Delay Time	10ms	0/50	0	0	10	0	10
	Pn507	Brake Reference Output Speed Level	min-1	0/10000	100	100	100	100	100
	Pn508	Waiting Time for Brake Signal When Motor Running	10ms	10/100	50	50	50	50	50
	Pn509	Instantaneous Power Cut Hold Time	ms	20/1000	20	20	20	20	20
	Pn50A	Input Signal Selection 1	-	---	8881H	8881H	8881H	8881H	8881H
	Pn50B	Input Signal Selection 2	-	---	8888H	8888H	8888H	8888H	8888H
	Pn50C	Input Signal Selection 3	-	---	8888H	8888H	8888H	8888H	8888H
	Pn50D	Input Signal Selection 4	-	---	8888H	8888H	8888H	8888H	8888H
	Pn50E	Output Signal Selection 1	-	---	0000H	0000H	0000H	0000H	0000H
	Pn50F	Output Signal Selection 2	-	---	0300H	0300H	0300H	0300H	0300H
	Pn510	Output Signal Selection 3	-	---	0000H	0000H	0000H	0000H	0000H
	Pn512	Output Signal Reversal Setting	-	---	0000H	0000H	0000H	0000H	0000H
	Pn515	Input Signal Selection 5	-	---	8888H	8888H	8888H	8888H	8888H
	Pn51B	Motor Overload Excessive Position Error Level	command unit	0/1073741824	1000	1000	1000	1000	1000
	Pn51E	Excessive Position Error Warning Level	%	10/100	100	100	100	100	100
	Pn520	Excessive Position Error Alarm Level	command unit	1/1073741824	262144	262144	262144	262144	262144
	Pn522	Positioning Completion Width	command unit	0/1073741824	6000	6000	4000	5000	4000
	Pn524	NEAR Signal Width	command unit	1/1073741824	1073741824	1073741824	1073741824	1073741824	1073741824
	Pn526	Excessive Position Error Alarm Level at Servo ON	command unit	1/1073741824	262144	262144	262144	262144	262144
	Pn528	Excessive Position Error Warning Level at Servo ON	%	10/100	100	100	100	100	100
	Pn529	Speed Limit Level at Servo ON	min-1	0/10000	10000	10000	10000	10000	10000
	Pn52A	Multiple Value per Full Close Loop	%	1/100	20	20	20	20	20

Category	User constant No.(Pn-)	Description	Unit	Setting range	Factory setting				
				Lower/Upper limit	A-axis	B-axis	C-axis	D-axis	E-axis
Other constants	Pn52F	Monitor Display at Power ON	-	0000H/0FFFH	0FFFH	0FFFH	0FFFH	0FFFH	0FFFH
	Pn530	Program JOG Operation Related Switch	-	---	0000H	0000H	0000H	0000H	0000H
	Pn531	Program JOG Movement Distance	command unit	1/1073741824	32768	32768	32768	32768	32768
	Pn533	Program JOG Movement Speed	min-1	1/10000	500	500	500	500	500
	Pn534	Program JOG Acceleration/Deceleration Time	ms	2/10000	100	100	100	100	100
	Pn535	Program JOG Waiting Time	ms	0/10000	100	100	100	100	100
	Pn536	Number of Times of Program JOG Movement	times	1/1000	1	1	1	1	1
	Pn540	Gain Limit	0.1Hz	10/2000	2000	2000	2000	2000	2000
	Pn550	Analog Monitor 1 Offset Voltage	0.1V	-10000/10000	0	0	0	0	0
	Pn551	Analog Monitor 2 Offset Voltage	0.1V	-10000/10000	0	0	0	0	0
	Pn600	Regenerative Resistor Capacity	10W	0/65535	3	0	3	0	0

A.9 Error descriptions for digital operator

Alarms

Alarm display	Alarm name	Meaning
A.020	Parameter Checksum Error	The SERVOPACK EEPROM is faulty.
A.02A	Parameter Checksum Error	Option side
A.030	Main Circuit Detector Error	
A.040	Parameter Setting Error	The parameter is outside the allowable setting range.
A.04A	Parameter Setting Error	Option side
A.041	Dividing Pulse Output Setting Error	
A.050	Combination Error	Capacities of the SERVOPACK and the servomotor exceeded the allowable range.
A.080	Scale Pitch Setting Error	
A.100	Overcurrent or Heat Sink Overheated	An overcurrent flowed through the power transistor (IGBT).
A.300	Regeneration Error Detected	Detected when the power to the main circuit is turned ON.
A.320	Regenerative Overload	Detected when the power to the main circuit is turned ON.
A.330	Main Circuit Power Supply Wiring Error	Detected when the power to the main circuit is turned ON.
A.400	Overvoltage	Detected when the SERVOPACK's main circuit DC voltage is 410V or more. Detected when the power to the main circuit is turned ON.
A.410	Undervoltage	Detected when the SERVOPACK's main circuit DC voltage is 170V or less. Detected when the power to the main circuit is turned ON.
A.510	Overspeed	Detected when the feedback speed is the maximum motor speed 1.1 or less.

Alarm display	Alarm name	Meaning
A.511	Dividing Pulse Output Overspeed	
A.520	Vibration Alarm	
A.710	Overload	High load
A.720	Overload	Low load
A.730	Dynamic Brake Overload	For SERVOPACKs 500 W to 1.0 kW
A.740	Overload of Surge Current Limit Resistor	Detected when the number of times that the main circuit's power is turned ON or OFF more than 10 times/2 seconds.
A.7A0	Heat Sink Overheated	Detected when the heat sink temperature exceeds 100 × c.
A.810	Encoder Backup Error	Only when an absolute encoder is connected. Detected on the encoder side.
A.820	Encoder Checksum Error	Detected on the encoder side.
A.830	Absolute Encoder Battery Error	Detected when the battery voltage is lower than the specified value 2 to 4 seconds after the control power supply is turned ON. Only when an absolute encoder is connected.
A.840	Encoder Data Error	Detected on the encoder side.
A.850	Encoder Overspeed	Detected when the encoder power supply was turned ON. Detected on the encoder side.
A.860	Encoder Overheated	Only when an absolute encoder is connected. Detected on the encoder side.
A.870	FC Serial Encoder Checksum Error	
A.880	FC Serial Encoder Data Error	
A.8A0	FC Serial Encoder Scale Error	
A.8A1	FC Serial Encoder Module Error	
A.8A2	FC Serial Encoder Sensor Error	Incremental
A.8A3	FC Serial Encoder Position Error	Absolute
A.b10	Reference Speed Input Read Error	Detected when the Servo is turned ON.
A.b20	Reference Torque Input Read Error	Detected when the Servo is turned ON.
A.b31	Current Detection Error 1	
A.b32 A.b33	Current Detection Error 2 Current Detection Error 3	
A.bF0	System Alarm 0	Internal program processing error
A.bF1	System Alarm 1	Internal program error
A.bF2	System Alarm 2	Current control processing program error
A.bF3	System Alarm 3	Encoder interface processing error
A.bF4	System Alarm 4	CPU watchdog timer error
A.C10	Servo Overrun Detected	Detected when the Servo is turned ON.
A.C20	Phase Detection Error	
A.C50	Magnetic Pole Detection Failure	
A.C80	Absolute Encoder Clear Error and Multi-turn Limit Setting Error	

Alarm display	Alarm name	Meaning
A.C90	Encoder Communications Error	
A.C91	Encoder Communications Position Data Error	
A.C92	Encoder Communications Timer Error	
A.CA0	Encoder Parameter Error	
A.Cb0	Encoder Echoback Error	
A.CC0	Multi-turn Limit Disagreement	
A.CE0	FPG Multi-turn Error	
A.CF1	FC Serial Encoder Communication Error	Communication failure
A.CF2	FC Serial Encoder Communication Error	Timer stop
A.d00	Position Error Pulse Overflow	In servo ON status, the position error pulses exceed the overflow level set in the parameter Pn520.
A.d01	Position Error Pulse Overflow Alarm at Servo ON	
A.d02	Position Error Pulse Overflow Alarm by Speed Limit at Servo ON	
A.d30	Position Data Over	
A.E00	Optional Board Setting Invalid	
A.E01	Optional Timer Up	
A.E02	Optional Watchdog Timer Error	
A.E07	Optional Unit Detection Failure	
A.E40	MECHATROLINK Transmission Cycle Setting Error	
A.E50	MECHATROLINK Watchdog Timer Synchronizing Error	
A.E60	MECHATROLINK Communication Error	
A.E61	MECHATROLINK Transmission Cycle Disagreement	
A.EA0	Servopack Error	
A.EA1	Servopack Initial Access Error	
A.EA2	Servopack Watchdog Timer Error	
A.ED0	Command Imcomplete Error	
A.F10	Power Line Open Phase	In the main power supply ON status, the voltage stays low for 1 second or more at one of the phases R, S, and T. Detected when the power to the main circuit is turned ON.
A.F20	Motor Cable Disconnected or Current Detection Error	
CPF00	Digital Operator Transmission Error 1 *1	
CPF01	Digital operator Transmission Error 2 *2	

(Note) OFF: Output transistor is OFF (high). ON: Output transistor is ON (low).

*1. This alarm display appears only within the range of 30 W to 1000 W.

*2. These alarms are not reset for the alarm reset signal (/ALM-RST). Eliminate the cause of the alarm and then turn OFF the power supply to reset the alarms.

*3. This alarm will occur for the new version (SGDM-□DA) only.

Warnings

Warning display	Warning name	Meaning
A.900	Position Error Pulse Overflow	Position error pulse exceeded the user constant (Pn520 × Pn51E/100).
A.901	Position Error Pulse Overflow at Servo ON	Position error pulse exceeded the user constant (Pn526 × Pn528/100) when the servo was turned ON.
A.910	Overload	Warning for the alarms A.710 and A.720 Continuing the operation could lead those alarms.
A.911	Vibration	Detected abnormal vibration during motor rotation. It is in the same detection level as A.520, and the Vibration Detection Switch (Pn310) determines the vibration to be warning or alarm.
A.920	Regenerative Overload	Warning for the alarm A320 Continuing the operation could lead the alarm.
A.930	Absolute Encoder Battery Warning	Warning of low battery voltage Continuing the operation could lead the alarm.
A.931	Full Closed Battery Warning	
A.941	Change of Parameters Requires the Setting Validation	Changed the user constant which requires the power to be turned ON again.
A.94A	Data Setting Alarm	User constant number mistake
A.94B	Data Setting Alarm	Out of data
A.94C	Data Setting Alarm	Operation error
A.94D	Data Setting Alarm	Data size disagreement
A.95A	Command Alarm	Out of command conditions
A.95B	Command Alarm	Unsupported command
A.95C	Command Alarm	Out of user constant command conditions
A.95D	Command Alarm	Command interference
A.95E	Command Alarm	Sub command not allowed

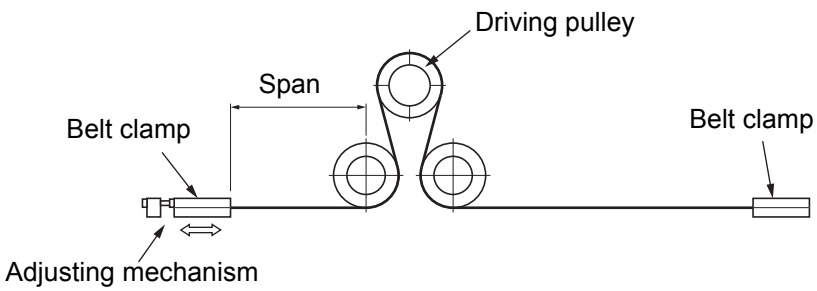
(Note) OFF: Output transistor is OFF (high). ON: Output transistor is ON (low).

A.10 Timing belt tension measurement

- **Timing belt replacement**
  When installing a new timing belt, adjust the tension to the “new belt tension value” to account for initial stretching.
- **Regular maintenance**
  Check the belt tension and adjust to the “standard tension value” in the following circumstances:
  - The tension value is less than the standard tension value.
  - The tension value exceeds the new belt tension value.

  Otherwise, do not adjust the belt tension.
- **Temperature related tension variation**
  The tension value varies depending on the temperature of the belt. be sure to warm the belt up by running it for five to ten minutes before measuring the tension.

A.10.1 Traverse axis and kick axis



1 **Turn OFF the take-out robot control power.**

2 **Under the specified measurement condition for the take-out robot, enter the specific weight, width, and span into the tension meter.**

The span value in the measurement conditions table is merely a recommended value.
A different value based on a measurement can also be used.

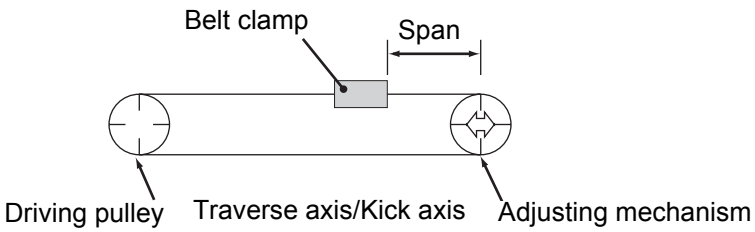
3 **Position the belt clamp so that the distance between the end of the belt clamp and the pulley equals the span value that was entered in Step 2.**

4 **Measure the tension with the tension meter.**

5 **If the tension needs to be adjusted, do so using the adjusting mechanism. After the adjustment, measure the tension again and then heed the following:**

- Measure the tension again after tightening the bolts that secures the adjusting mechanism.
- If the tension is correct after tightening the bolts, run the belt for five to ten minutes and check the tension once again.

A.10.2 Kick axis



1 **Turn OFF the take-out robot control power.**

2 **Under the specified measurement conditions for the take-out robot, enter the specific weight, width, and span into the tension meter.**

The span value in the measurement conditions table is merely a recommended value.
A different value based on a measurement can also be used.

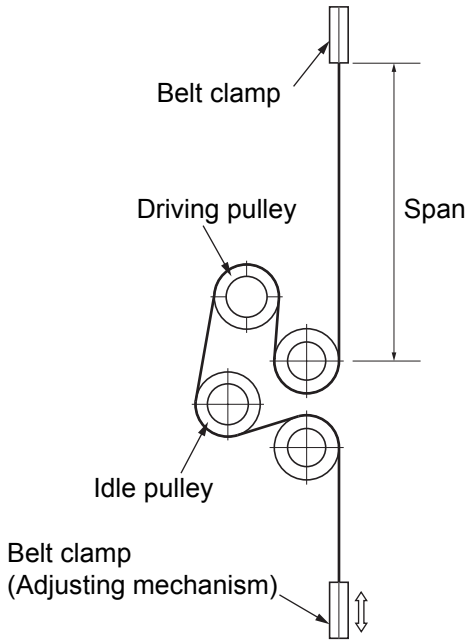
3 **Position the belt clamp so that the distance between the end of the belt clamp and the pulley equals the span value that was entered in Step 2.**

4 **Measure the tension with the tension meter.**

5 **If the tension needs to be adjusted, do so using the adjusting mechanism. After the adjustment, measure the tension again and then heed the following:**

- Measure the tension again after tightening the bolts that secures the adjusting mechanism.
- If the tension is correct after tightening the bolts, run the belt for five to ten minutes and check the tension once again.

A.10.3 Descent axis



1 **Turn OFF the take-out robot control power.**

2 **Remove the end-of-arm tool.**

3 **Release the pneumatic pressure of the main arm.**
Loosen the mechanical lock securing the driving pulley while holding the descent arm frame (so that the descent arm unit does not move the belt).

4 **Under the specified measurement conditions for the take-out robot, enter the specific weight, width, and span into the tension meter.**

The span value in the measurement conditions table is merely a recommended value.
A different value based on a measurement can also be used.

5 **Position the belt clamp so that the distance between the end of the belt clamp and the pulley equals the span value that was entered in Step 4.**

6 **Measure the tension with the tension meter.**

7 **If the tension needs to be adjusted, do so using the adjusting mechanism. After the adjustment, measure the tension again and then heed the following:**

- Measure the tension again after tightening the bolts that secures the adjusting mechanism.
- If the tension is correct after tightening the bolts, run the belt for five to ten minutes and check the tension once again.

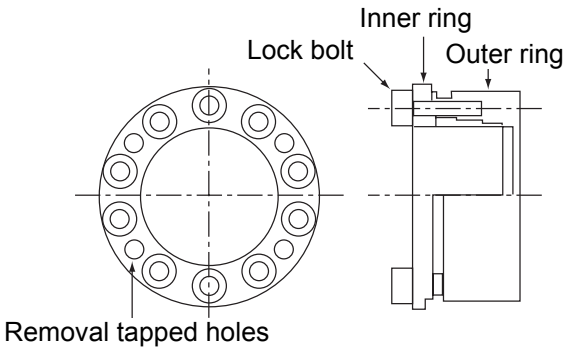
8 **After completing the tension measurement, reinstall the end-of-arm tool.**

A.11 Timing belt tension adjustment standards

Axis name	Specific weight	Width	Span	Standard tension		New belt tension	
	(g/cm^2)	(mm)	(mm)	(kgf)	(N)	(kgf)	(N)
Traverse axis	0.60	50	500	70 ± 3	686 ± 30	86 ± 3	843 ± 30
Kick axis	0.60	25	550	40 ± 3	392 ± 30	50 ± 3	490 ± 30
Main arm descent axis	0.60	50	550	85 ± 3	833 ± 30	105 ± 3	1029 ± 30
Sub arm descent axis	0.60	25	450	35 ± 3	343 ± 30	45 ± 3	441 ± 30

A.12 Mechanical lock installation/removal

A.12.1 MA, MB, MKA and MSA series



Installation

WARNING

- Do not use grease or oils which contain molybdenum or extreme agents. If using them, torque reduction to well below the allowable limit and slipping may result.

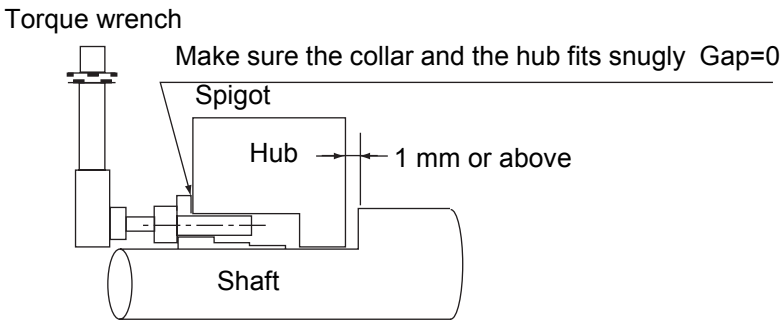
1 **Wipe off any rust, dust or dirt from the surface of the shaft and the inside of the hub. Apply a thin coat of oil or grease.**

2 **Apply a thin coat of oil or grease to the inner and outer diameter surfaces of the mechanical lock, the contact points of all tapers, and the lock bolts on the threaded portion of and the bearing surface of the head. (When the mechanical lock is taken apart in order to apply the oil or grease, put it back together loosely after applying the oil or grease.)**

WARNING

- If the inner ring collar and the end of the hub do not fit together precisely, the mechanical lock and the collar may become warped.
- If there is a shoulder behind the back surface of the hub, leave at least a 1 millimeter gap between the back surface of the hub and the shoulder. If no gap is maintained between the hub and the shoulder, an inappropriately large amount of force will be required to remove the mechanical lock. Such force may result in deformation of the inner ring, rendering it unfit for reuse. (See the figure of **Step 3**.)
- When tapping with a plastic hammer, do not use excessive force. If doing so, the parts may be damaged.

3 **Attach the hub, which has been manufactured to the specified dimensions, to the shaft. Push on the mechanical lock. Then make sure the collar fits snugly with the end surface of the hub. (See figure below.)**
If the outer ring will not fit, loosen the bolts and separate the tapered portions of the inner ring and the outer ring. Then insert the outer ring.
If the spigot will not fit, tap it lightly with a plastic hammer to insert it.

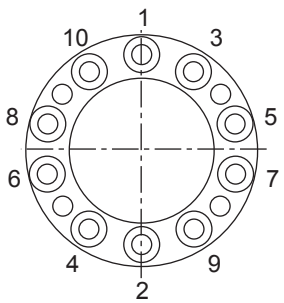


WARNING

- Apply oil or grease to the mounting bolts.
- Be sure to use all of the threaded removal holes and tighten each one a potion at a time. Otherwise, the inner ring may be deformed, rendering it unfit for reuse.

4 **When all parts are in the proper position, tighten the lock bolts.**
Use a torque wrench and tighten alternately between opposing bolts in order from 1 to 10 as shown below. First tighten lightly (about 1/4 of the specified torque) and then increase the torque slightly (to about 1/2 of the specified torque). Lastly, tighten to the specified torque.

5 **Be sure to tighten the bolts in order until each bolt has been tightened to the specified torque.**
Make sure that none of the bolts has been neglected.



Strength classification

Bolt size	Tightening torque
	N·m
M3	1.9
M4	3.9 (2.7)
M5	8.8 (5.6)
M6	15.7 (9.5)
M8	37.3
	39.2 (MB series)
M10	78.5
M12	137.3

( ) indicates stainless specifications, MSA series.

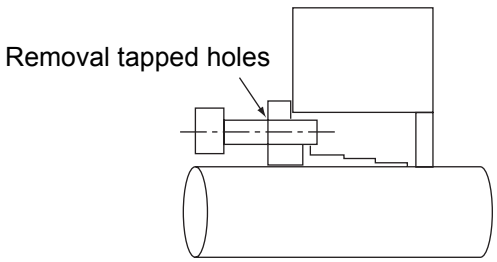
Removal

WARNING

- Take the proper safety precautions before performing remove operations.

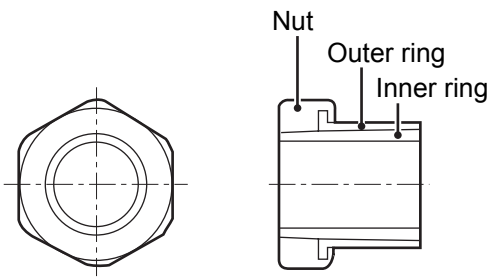
1 **Turn OFF the control power. Make sure there is no torque or thrust applied to the mechanical lock. Also, make sure there is no danger of the any parts falling.**

2 **Loosen the lock bolts in order, a portion at a time. Insert the loosened lock bolts into the removal tapped holes and tighten alternately between opposing bolts under equal torque to remove the mechanical lock.**



A.12.2 MN series

Configuration



Installation

WARNING

- Do not use grease or oils which contain molybdenum or extreme agents. If using them, torque reduction to well below the allowable limit and slipping may result.

1 **Wipe off any rust, dust or dirt from the surface of the shaft and the inside of the hub. Apply a thin coat of oil or grease.**

2 **Apply a thin coat of oil or grease to the inner and outer diameter surfaces of the mechanical lock, the contact points of all tapers, and the lock bolts on the threaded portion of and the bearing surface of the head. (When the mechanical lock is taken apart in order to apply the oil or grease, put it back together loosely after applying the oil or grease.)**

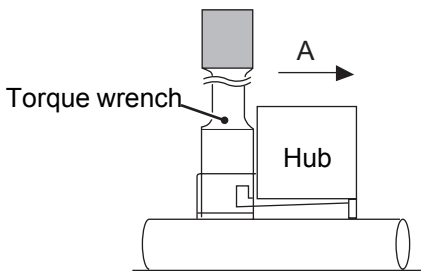
3 **Fit the mechanical lock into the hub machined to the specified dimensions, attach the hub to the shaft, and then lightly tighten the nut by hand to ensure proper positioning.**

CAUTION

- When the nut is tightened, the hub will move to the A direction shown in the figure of **Step 5**.
- If the mechanical lock is hard to fit into the hub, loosen the nut slightly.

4 **When all parts are in the proper position, tighten the nut slightly, and then tighten the nut gradually to the specified torque with torque wrench while taking care not to turn other parts with the nut.**

5 **Retighten the nut to check if the nut has been tightened to the specified torque.**



Nut types and tightening torque

Bolt size	Tightening torque
	N·m
MN 8	24.5
MN 10	29.4
MN 11	34.3
MN 12	44.1
MN 14	58.8
MN 15	68.6
MN 17	98.1
MN 20	137.0
MN 22	147.0
MN 24	167.0
MN 25	186.0
MN 28	226.0
MN 30	255.0
MN 35	294.0

Removal

CAUTION

- Take the proper safety precautions before performing remove operations.

1 **Turn the power source (control power) OFF. Then make sure there is no torque or thrust applied to the mechanical lock. Also, make sure there is no danger of the any parts falling.**

2 **Apply oil to the threaded portion and gradually loosen the nut.**
The shaft and hub will be disengaged.

Take-out robot
Maintenance Manual

15th April, 2004 Version 1.0

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