



Mitsubishi Electric Industrial Robot

RH-10CRH/20CRH INSTRUCTION MANUAL

ROBOT ARM SETUP & MAINTENANCE

RH-10CRH series
RH-20CRH series



Safety Precautions

Always read the following precautions and the separate "Safety Manual" before starting use of the robot to learn the required measures to be taken.



CAUTION

All teaching work must be carried out by an operator who has received special training. (This also applies to maintenance work with the power source turned ON.)

Enforcement of safety training



CAUTION

For teaching work, prepare a work plan related to the methods and procedures of operating the robot, and to the measures to be taken when an error occurs or when restarting. Carry out work following this plan. (This also applies to maintenance work with the power source turned ON.)

Preparation of work plan



WARNING

Prepare a device that allows operation to be stopped immediately during teaching work. (This also applies to maintenance work with the power source turned ON.)

Setting of emergency stop switch



CAUTION

During teaching work, place a sign indicating that teaching work is in progress on the start switch, etc. (This also applies to maintenance work with the power source turned ON.)

Indication of teaching work in progress



DANGER

Provide a fence or enclosure during operation to prevent contact of the operator and robot.

Installation of safety fence



CAUTION

Establish a set signaling method to the related operators for starting work, and follow this method.

Signaling of operation start



CAUTION

As a principle turn the power OFF during maintenance work. Place a sign indicating that maintenance work is in progress on the start switch, etc.

Indication of maintenance work in progress



CAUTION

Before starting work, inspect the robot, emergency stop switch and other related devices, etc., and confirm that there are no errors.

Inspection before starting work

The points of the precautions given in the separate "Safety Manual" are given below.
Refer to the actual "Safety Manual" for details.

 DANGER

When automatic operation of the robot is performed using multiple control devices (GOT, programmable controller, push-button switch), the interlocking of operation rights of the devices, etc. must be designed by the customer.

 CAUTION

Use the robot within the environment given in the specifications. Failure to do so could lead to a drop or reliability or faults. (Temperature, humidity, atmosphere, noise environment, etc.)

 CAUTION

Transport the robot with the designated transportation posture. Transporting the robot in a non-designated posture could lead to personal injuries or faults from dropping.

 CAUTION

Always use the robot installed on a secure table. Use in an instable posture could lead to positional deviation and vibration.

 CAUTION

Wire the cable as far away from noise sources as possible. If placed near a noise source, positional deviation or malfunction could occur.

 CAUTION

Do not apply excessive force on the connector or excessively bend the cable. Failure to observe this could lead to contact defects or wire breakage.

 CAUTION

Make sure that the workpiece weight, including the hand, does not exceed the rated load or tolerable torque.
Exceeding these values could lead to errors or faults.

 WARNING

Securely install the hand and tool, and securely grasp the workpiece. Failure to observe this could lead to personal injuries or damage if the object comes off or flies off during operation.

 WARNING

Securely ground the robot and controller. Failure to observe this could lead to malfunctioning by noise or to electric shock accidents.

 CAUTION

Indicate the operation state during robot operation. Failure to indicate the state could lead to operators approaching the robot or to incorrect operation.

 WARNING

When carrying out teaching work in the robot's movement range, always secure the priority right for the robot control. Failure to observe this could lead to personal injuries or damage if the robot is started with external commands.

 CAUTION

Keep the jog speed as low as possible, and always watch the robot. Failure to do so could lead to interference with the workpiece or peripheral devices.

 CAUTION

After editing the program, always confirm the operation with step operation before starting automatic operation. Failure to do so could lead to interference with peripheral devices because of programming mistakes, etc.

-  **CAUTION** Make sure that if the safety fence entrance door is opened during automatic operation, the door is locked or that the robot will automatically stop. Failure to do so could lead to personal injuries.
-  **CAUTION** Never carry out modifications based on personal judgments, or use non-designated maintenance parts.
Failure to observe this could lead to faults or failures.
-  **WARNING** When the robot arm has to be moved by hand from an external area, do not place hands or fingers in the openings. Failure to observe this could lead to hands or fingers catching depending on the posture.
-  **CAUTION** Do not stop the robot or apply emergency stop by turning the robot controller's main power OFF. If the robot controller main power is turned OFF during automatic operation, the robot accuracy could be adversely affected. Moreover, it may interfere with the peripheral device by drop or move by inertia of the arm.
-  **CAUTION** Do not turn off the main power to the robot controller while rewriting the internal information of the robot controller such as the program or parameters.
If the main power to the robot controller is turned off while in automatic operation or rewriting the program or parameters, the internal information of the robot controller may be damaged.
-  **DANGER** Do not connect the Handy GOT when using the GOT direct connection function of this product. Failure to observe this may result in property damage or bodily injury because the Handy GOT can automatically operate the robot regardless of whether the operation rights are enabled or not.
-  **DANGER** Do not remove the SSCNET III cable while power is supplied to the multiple CPU system or the servo amplifier. Do not look directly at light emitted from the tip of SSCNET III connectors or SSCNET III cables of the Motion CPU or the servo amplifier. Eye discomfort may be felt if exposed to the light. (Reference: SSCNET III employs a Class 1 or equivalent light source as specified in JIS C 6802 and IEC60825-1 (domestic standards in Japan).)
-  **DANGER** Do not remove the SSCNET III cable while power is supplied to the controller. Do not look directly at light emitted from the tip of SSCNET III connectors or SSCNET III cables. Eye discomfort may be felt if exposed to the light. (Reference: SSCNET III employs a Class 1 or equivalent light source as specified in JIS C 6802 and IEC60825-1 (domestic standards in Japan).)
-  **DANGER** Attach the cap to the SSCNET III connector after disconnecting the SSCNET III cable. If the cap is not attached, dirt or dust may adhere to the connector pins, resulting in deterioration connector properties, and leading to malfunction.
-  **CAUTION** Make sure there are no mistakes in the wiring. Connecting differently to the way specified in the manual can result in errors, such as the emergency stop not being released. In order to prevent errors occurring, please be sure to check that all functions (such as the teaching box emergency stop, customer emergency stop, and door switch) are working properly after the wiring setup is completed.

CAUTION

Use the network equipments (personal computer, USB hub, LAN hub, etc) confirmed by manufacturer. The thing unsuitable for the FA environment (related with conformity, temperature or noise) exists in the equipments connected to USB. When using network equipment, measures against the noise, such as measures against EMI and the addition of the ferrite core, may be necessary. Please fully confirm the operation by customer. Guarantee and maintenance of the equipment on the market (usual office automation equipment) cannot be performed.

CAUTION

To maintain the security (confidentiality, integrity, and availability) of the robot and the system against unauthorized access, DoS^{*1} attacks, computer viruses, and other cyberattacks from unreliable networks and devices via network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

Mitsubishi Electric shall have no responsibility or liability for any problems involving robot trouble and system trouble by unauthorized access, DoS attacks, computer viruses, and other cyberattacks.

^{*1} DoS: A denial-of-service (DoS) attack disrupts services by overloading systems or exploiting vulnerabilities, resulting in a denial-of-service (DoS) state.

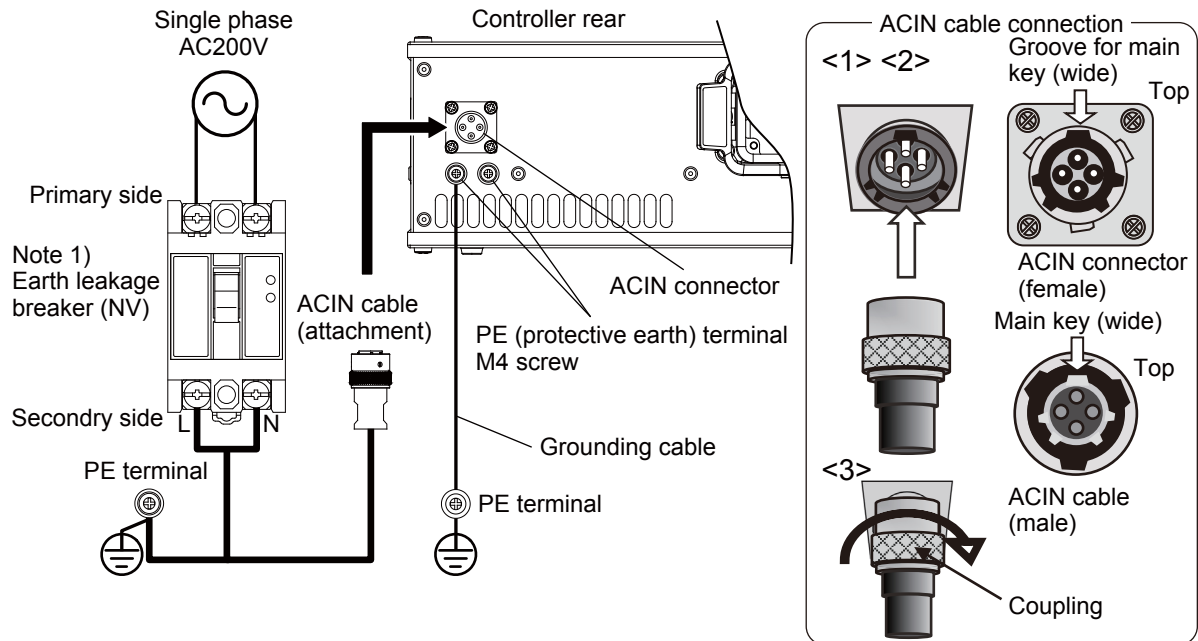
*CR800 controller

Notes of the basic component are shown.



CAUTION

Please install the earth leakage breaker in the primary side power supply of the controller because of leakage protection.



Note 1) Always use the terminal cover for the earth leakage breaker.

1) Prepare the following items.

Part name	Specifications	Remarks
Earth leakage breaker	The following is recommended product. Single phase: NV30FAU-2P-10A-AC100-240V-30mA (Terminal cover: TCS-05FA2)	Prepared by customer.
Cable for primary power supply	AWG14 (2mm ²) or above	Prepared by customer. Tightening torque for terminal fixing screw is 2 ~ 3Nm.
Grounding cable	AWG14 (2mm ²) or above	Prepared by customer. Tightening torque for terminal fixing screw is 2 ~ 3Nm.
ACIN cable	Terminal: M5, cable length: 3m	Supplied with the product.

- 2) Confirm that the primary power matches the specifications.
- 3) Confirm that the primary power is OFF and that the earth leakage breaker power switch is OFF.
- 4) Connect the ACIN cable to the breaker.
Connect the power terminals of the ACIN cable to the secondary side terminals of the earth leakage breaker. Also, ground the FG terminal of the cable.
- 5) Connect the ACIN cable to the ACIN connector on the rear of the controller.
 - <1> Face the main key on the ACIN cable plug upwards. (Refer to the "ACIN cable connection" illustration.)
 - <2> Align the main key of the ACIN cable plug with the grooves on the ACIN connector. Push the plug into the connector as far as it will go.
The plug may be damaged if it is not correctly aligned with the connector.
 - <3> Tighten the coupling on the ACIN cable, turning it to the right until it locks.
- 6) Connect one end of the grounding cable to the PE (protective earth) terminal on the controller and ground the other end (2-point grounding) in order to comply with the requirements of EN 61800-5-1 for the touch current of 3.5 mA AC or more.
- 7) Connect the primary power cable to the primary side terminal of the earth leakage breaker.

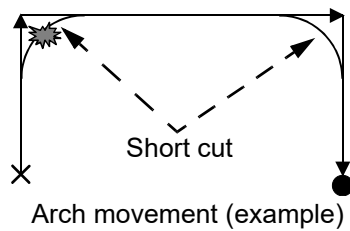
CAUTION

Be careful of interference with peripheral equipment.
Especially don't give a shock to the shaft (J3 axis). When you install the hand, be careful not to knock at the shaft end by the hammer etc. The shaft may be damaged.

Take care also of the following items.

- (1) The robot's locus of movement may change with specified speed.

Especially as for the corner section, short cut distance may change. Therefore, when beginning automatic operation, moves at low speed at first, and you should gather speed slowly with being careful of interference with peripheral equipment.



- (2) It can be confirmed whether the specified position exist in the defined area by using the instruction command "Zone". It can utilize as one of the methods for collision evasion. Refer to the "detailed description of the instructions manual/function, and operation" of the separate volume for the details of the instruction command.

Revision history

Date of Point	Instruction Manual No.	Revision Details
2024-08-09	BFP-A3856-A	<ul style="list-style-type: none">• First print
2024-10-21	BFP-A3856-B	<ul style="list-style-type: none">• Added "Instructions for replacing the machine cable (replaceable type)".
2025-01-31	BFP-A3856-C	<ul style="list-style-type: none">• Revised "5.4 About Overhaul" and "Appendix 2: How to take out the battery at the disposal of the robot".
2025-07-01	BFP-A3856-D	<ul style="list-style-type: none">• Corrected transportation steps and information on the transporting jig in "2.2.2 Transportation procedures".• Changed some sections.

*Introduction

Thank you for purchasing the Mitsubishi industrial robot.

This instruction manual explains the method of unpacking, installation and maintenance and inspection of the robot arm.

Always read through this manual before starting use to ensure correct usage of the robot.

The information contained in this document has been written to be accurate as much as possible.

Please interpret that items not described in this document "cannot be performed."

This document explains for the following robot type.

Robot type

- RH-10CRH
- RH-20CRH

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- The details of this manual are subject to change without notice.
- The information contained in this document has been written to be accurate as much as possible. Please interpret that items not described in this document "cannot be performed" or "error may occur". Please contact your nearest dealer if you find any doubtful, wrong or skipped point.
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1 Before starting use

This chapter explains the details and usage methods of the instruction manuals, the basic terminology and the safety precautions. Moreover, handling and operation of a teaching pendant (T/B) are described based on R32TB in instruction manuals. If using other T/B, such as R86TB, refer to a supplied instruction manual of the T/B.

1.1 Using the instruction manual

1.1.1 The details of each instruction manual

The contents and purposes of the documents enclosed with this product are shown below. Use these documents according to the application.

For special specifications, a separate instruction manual describing the special section may be enclosed.

Manual name	Description
Safety Manual	Explains the common precautions and safety measures to be taken for robot handling, system design and manufacture to ensure safety of the operators involved with the robot.
Standard Specifications	Explains the product's standard specifications, factory-set special specifications, option configuration and maintenance parts, etc. Precautions for safety and technology, when incorporating the robot, are also explained.
Robot Arm Setup & Maintenance	Explains the procedures required to operate the robot arm (unpacking, transportation, installation, confirmation of operation), and the maintenance and inspection procedures.
Controller setup, basic operation, and maintenance	Explains the procedures required to operate the controller (unpacking, transportation, installation, confirmation of operation), basic operation from creating the program to automatic operation, and the maintenance and inspection procedures.
Detailed explanations of functions and operations	Explains details on the functions and operations such as each function and operation, commands used in the program, connection with the external input/output device, and parameters, etc.
Troubleshooting	Explains the causes and remedies to be taken when an error occurs. Explanations are given for each error No.
Additional axis function	Explains the specifications, functions and operations of the additional axis control.
Tracking Function	Explains the control function and specifications of conveyor tracking.
GOT Direct Connection Extended Function	Explains the detailed description of data configuration of shared memory, monitoring, and operating procedures about the GOT (standalone type robot).
Ethernet Function	Explains the measures to perform communication with personal computers on Ethernet with the TCP/IP protocol.

1.1.2 Symbols used in instruction manual

The symbols and expressions shown in [Table 1-1](#) are used throughout this instruction manual. Learn the meaning of these symbols before reading this instruction manual.

Table 1-1:Symbols in instruction manual

Terminology	Item/Symbol	Meaning
Item	Standalone type	
	Controller	Indicates the controller which controls the robot arm.
Symbol	 DANGER	Precaution indicating cases where there is a risk of operator fatality or serious injury if handling is mistaken. Always observe these precautions to safely use the robot.
	 WARNING	Precaution indicating cases where the operator could be subject to fatalities or serious injuries if handling is mistaken. Always observe these precautions to safely use the robot.
	 CAUTION	Precaution indicating cases where operator could be subject to injury or physical damage could occur if handling is mistaken. Always observe these precautions to safely use the robot.
	[JOG]	If a word is enclosed in brackets or a box in the text, this refers to a key on the teaching pendant.
	[RESET] + [EXE] (A) (B)	This indicates to press the (B) key while holding down the (A) key. In this example, the [RESET] key is pressed while holding down the [EXE] key.
	T/B	This indicates the teaching pendant. Descriptions in this manual are based on R32TB.

1.2 Safety Precautions

Always read the following precautions and the separate "Safety Manual" before starting use of the robot to learn the required measures to be taken.

CAUTION

All teaching work must be carried out by an operator who has received special training. (This also applies to maintenance work with the power source turned ON.)
Enforcement of safety training

CAUTION

For teaching work, prepare a work plan related to the methods and procedures of operating the robot, and to the measures to be taken when an error occurs or when restarting. Carry out work following this plan. (This also applies to maintenance work with the power source turned ON.)
Preparation of work plan

WARNING

Prepare a device that allows operation to be stopped immediately during teaching work. (This also applies to maintenance work with the power source turned ON.)
Setting of emergency stop switch

CAUTION

During teaching work, place a sign indicating that teaching work is in progress on the start switch, etc. (This also applies to maintenance work with the power source turned ON.)
Indication of teaching work in progress

DANGER

Provide a fence or enclosure during operation to prevent contact of the operator and robot.
Installation of safety fence

CAUTION

Establish a set signaling method to the related operators for starting work, and follow this method.
Signaling of operation start

CAUTION

As a principle turn the power OFF during maintenance work. Place a sign indicating that maintenance work is in progress on the start switch, etc.
Indication of maintenance work in progress

CAUTION

Before starting work, inspect the robot, emergency stop switch and other related devices, etc., and confirm that there are no errors.
Inspection before starting work

1.2.1 Precautions given in the separate Safety Manual

The points of the precautions given in the separate "Safety Manual" are given below.
Refer to the actual "Safety Manual" for details.

DANGER

When automatic operation of the robot is performed using multiple control devices (GOT, programmable controller, push-button switch), the interlocking of operation rights of the devices, etc. must be designed by the customer.

CAUTION

Use the robot within the environment given in the specifications. Failure to do so could lead to a drop or reliability or faults. (Temperature, humidity, atmosphere, noise environment, etc.)

CAUTION

Transport the robot with the designated transportation posture. Transporting the robot in a non-designated posture could lead to personal injuries or faults from dropping.

CAUTION

Always use the robot installed on a secure table. Use in an instable posture could lead to positional deviation and vibration.

CAUTION

Wire the cable as far away from noise sources as possible. If placed near a noise source, positional deviation or malfunction could occur.

CAUTION

Do not apply excessive force on the connector or excessively bend the cable. Failure to observe this could lead to contact defects or wire breakage.

CAUTION

Make sure that the workpiece weight, including the hand, does not exceed the rated load or tolerable torque.
Exceeding these values could lead to errors or faults.

WARNING

Securely install the hand and tool, and securely grasp the workpiece. Failure to observe this could lead to personal injuries or damage if the object comes off or flies off during operation.

WARNING

Securely ground the robot and controller. Failure to observe this could lead to malfunctioning by noise or to electric shock accidents.

CAUTION

Indicate the operation state during robot operation. Failure to indicate the state could lead to operators approaching the robot or to incorrect operation.

WARNING

When carrying out teaching work in the robot's movement range, always secure the priority right for the robot control. Failure to observe this could lead to personal injuries or damage if the robot is started with external commands.

CAUTION

Keep the jog speed as low as possible, and always watch the robot. Failure to do so could lead to interference with the workpiece or peripheral devices.

CAUTION

After editing the program, always confirm the operation with step operation before starting automatic operation. Failure to do so could lead to interference with peripheral devices because of programming mistakes, etc.

CAUTION

Make sure that if the safety fence entrance door is opened during automatic operation, the door is locked or that the robot will automatically stop. Failure to do so could lead to personal injuries.

CAUTION

Never carry out modifications based on personal judgments, or use non-designated maintenance parts.
Failure to observe this could lead to faults or failures.

WARNING

When the robot arm has to be moved by hand from an external area, do not place hands or fingers in the openings. Failure to observe this could lead to hands or fingers catching depending on the posture.

⚠ CAUTION

Do not stop the robot or apply emergency stop by turning the robot controller's main power OFF.
If the robot controller main power is turned OFF during automatic operation, the robot accuracy could be adversely affected.

⚠ CAUTION

Do not turn off the main power to the robot controller while rewriting the internal information of the robot controller such as the program or parameters. If the main power to the robot controller is turned off while in automatic operation or rewriting the program or parameters, the internal information of the robot controller may be damaged.

⚠ DANGER

Do not connect the Handy GOT when using the GOT direct connection function of this product. Failure to observe this may result in property damage or bodily injury because the Handy GOT can automatically operate the robot regardless of whether the operation rights are enabled or not.

⚠ DANGER

Do not remove the SSCNET III cable while power is supplied to the multiple CPU system or the servo amplifier. Do not look directly at light emitted from the tip of SSCNET III connectors or SSCNET III cables of the Motion CPU or the servo amplifier. Eye discomfort may be felt if exposed to the light. (Reference: SSCNET III employs a Class 1 or equivalent light source as specified in JIS C 6802 and IEC60825-1 (domestic standards in Japan).)

⚠ DANGER

Do not remove the SSCNET III cable while power is supplied to the controller. Do not look directly at light emitted from the tip of SSCNET III connectors or SSCNET III cables. Eye discomfort may be felt if exposed to the light. (Reference: SSCNET III employs a Class 1 or equivalent light source as specified in JIS C 6802 and IEC60825-1 (domestic standards in Japan).)

⚠ DANGER

Attach the cap to the SSCNET III connector after disconnecting the SSCNET III cable. If the cap is not attached, dirt or dust may adhere to the connector pins, resulting in deterioration connector properties, and leading to malfunction.

⚠ CAUTION

Make sure there are no mistakes in the wiring. Connecting differently to the way specified in the manual can result in failures, such as the emergency stop not being released. In order to prevent from occurring, please be sure to check that all functions (such as the teaching box emergency stop, customer emergency stop, and door switch) are working properly after the wiring setup is completed

⚠ CAUTION

Use the network equipments (personal computer, USB hub, LAN hub, etc) confirmed by manufacturer. The thing unsuitable for the FA environment (related with conformity, temperature or noise) exists in the equipments connected to USB. When using network equipment, measures against the noise, such as measures against EMI and the addition of the ferrite core, may be necessary. Please fully confirm the operation by customer. Guarantee and maintenance of the equipment on the market (usual office automation equipment) cannot be performed.

⚠ CAUTION

To maintain the security (confidentiality, integrity, and availability) of the robot and the system against unauthorized access, DoS^{*1} attacks, computer viruses, and other cyberattacks from unreliable networks and devices via network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

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^{*1} DoS: A denial-of-service (DoS) attack disrupts services by overloading systems or exploiting vulnerabilities, resulting in a denial-of-service (DoS) state.

2 Unpacking to Installation

2.1 Confirming the product

The standard configuration of the robot arm, part of the purchased product, is shown in [Table 2-1](#).

Confirm the parts.

Users who have purchased optional products should refer to the separate "Standard Specifications Manual".

Table 2-1:Standard configuration

No.	Part name	Type	Qty.	Remarks
RH-10CRH				
1	Robot arm		1 unit	
2	Installation bolts	M8×30	4 pcs.	For robot arm installation
3	Spring washer for installation bolts	For M8	4 pcs.	
4	Plain washer for installation bolts	For M8	4 pcs.	
5	D-sub connector set		2 sets	Connector for fixing the tool wiring
RH-20CRH				
1	Robot arm		1 unit	
2	Installation bolts	M12×45	4 pcs.	For robot arm installation
3	Spring washer for installation bolts	For M12	4 pcs.	
4	Plain washer for installation bolts	For M12	4 pcs.	
5	D-sub connector set	15-pin D-sub connector	2 sets	Connector for fixing the tool wiring
6	D-sub connector set	9-pin D-sub connector	2 sets	Connector for fixing the tool wiring

Note) Items No. 2 to 6 are contained in the plastic bag of attachment in the robot arm.

2.2 Installation

2.2.1 Unpacking

(1) RH-10CRH

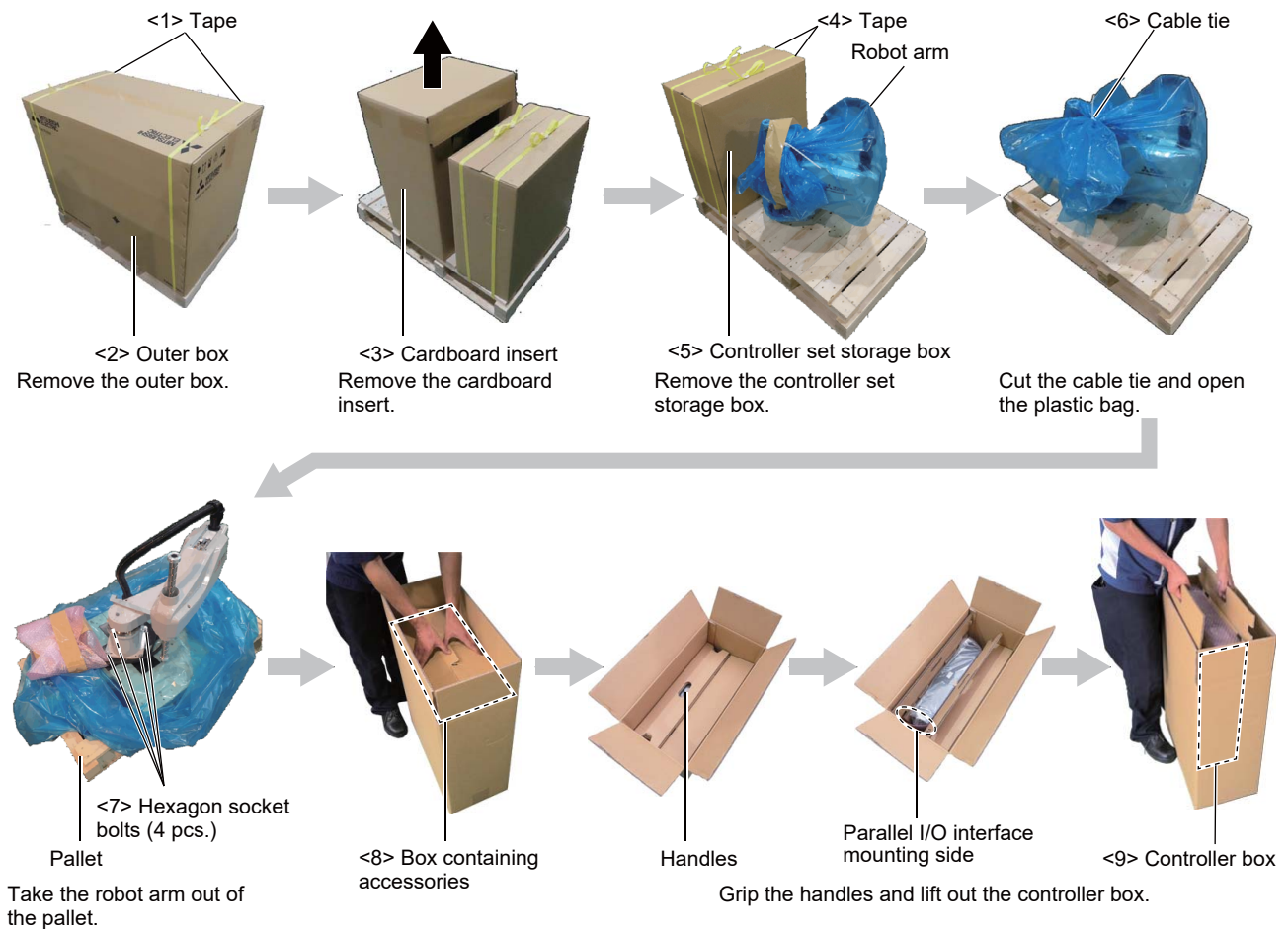


Fig.2-1:Unpacking of the robot arm (RH-10CRH)

The unpacking procedure is shown below.

- 1) Cut the tapes <1> with scissors or other cutting tool and lift and remove the outer box <2>.
- 2) Lift and remove the cardboard insert <3>.
- 3) Cut the tapes <4> with scissors or other cutting tool and take out the controller set storage box <5>.
- 4) Cut the cable tie <6> with nippers or other cutting tool and open the plastic bag.
- 5) Remove the four hexagon socket bolts <7> connecting the robot base to the pallet, then lift and detach the robot.

Note that the robot will not stand on its own with the hexagon socket bolts <7> removed.

- 6) Take the accessory storage box <8> out of the controller set storage box <5>.
- 7) Grip the handles of the controller box <9> and take out the controller.

Unpacking is completed.

⚠ CAUTION

Take the robot out of the box slowly. Be careful not to get injured with the edge of the robot.

⚠ CAUTION

Note that the robot will not stand on its own if the hexagon socket bolts are removed. Fix the robot securely in place for installation.

⚠ CAUTION

Always unpack the robot at a flat place. Otherwise, the robot may fall down.



CAUTION

Take the controller box straight up slowly. Be careful not to let the controller slip out of the box.



CAUTION

The parallel I/O interface is installed on the controller.
Do not hold the parallel I/O interface section when taking out the controller.
Otherwise, the interface may be fractured.

(2) RH-20CRH

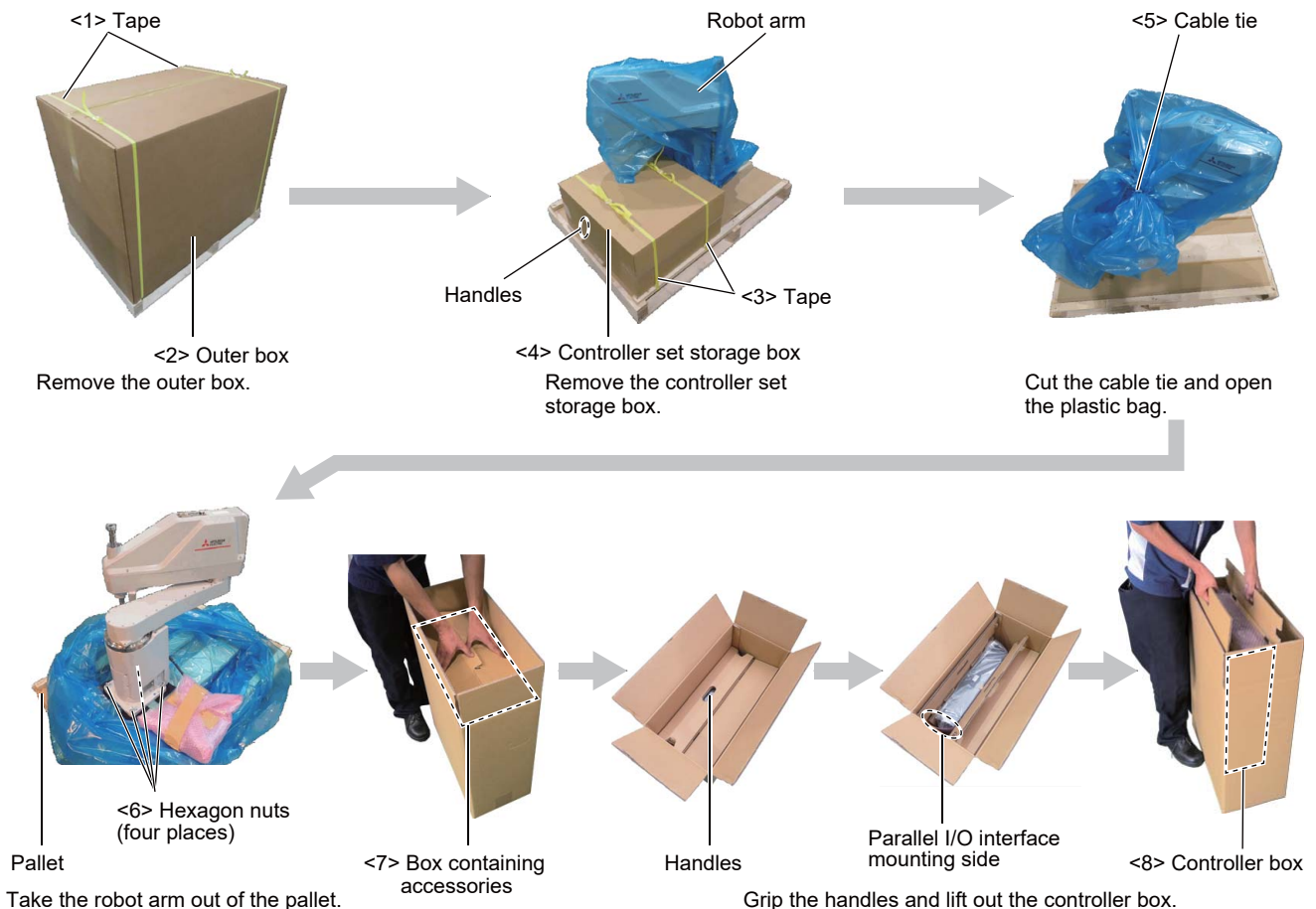


Fig.2-2:Unpacking of the robot arm (RH-20CRH)

The unpacking procedure is shown below.

- 1) Cut the tapes <1> with scissors or other cutting tool and lift and remove the outer box <2>.
- 2) Cut the banding straps <3> with scissors or other cutting tool and remove the controller set storage box <4>.
Use the handles to stand the controller set storage box upright.
- 3) Cut the cable tie <5> with nippers or other cutting tool and open the plastic bag.
- 4) Remove the four hexagon nuts <6> connecting the robot base to the pallet so that the robot can be lifted up.
Note that the robot will not stand on its own with the hexagon nuts <6> removed.
For information on transporting the robot, refer to [Page 10, "2.2.2 Transportation procedures"](#).
- 5) Take the accessory storage box <7> out of the controller set storage box <4>.
- 6) Grip the handles of the controller box <8> and take out the controller.

Unpacking is completed.

 **CAUTION** Take the robot out of the box slowly. Be careful not to get injured with the edge of the robot.

 **CAUTION** Note that the robot will not stand on its own if the hexagon nuts are removed. Follow the transportation procedure and remove the hexagon nuts once you are prepared to handle the robot.

 **CAUTION** The robot will not stand on its own in its packaging posture. Fix the robot securely in the installation position after transportation.

 **CAUTION** Always unpack the robot at a flat place. Otherwise, the robot may fall down.

 **CAUTION** Take the controller box straight up slowly. Be careful not to let the controller slip out of the box.

 **CAUTION** The parallel I/O interface is installed on the controller.
Do not hold the parallel I/O interface section when taking out the controller.
Otherwise, the interface may be fractured.

2.2.2 Transportation procedures

(1) Transportation procedure when unpacking

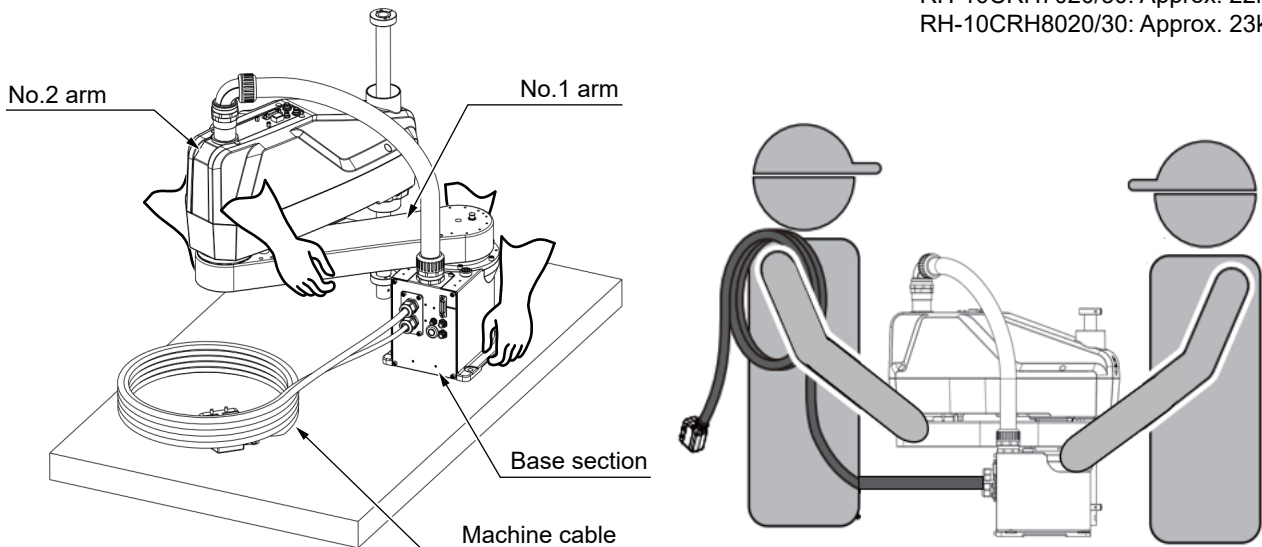
*RH-10CRH

Mass

RH-10CRH6020/30: Approx. 22kg

RH-10CRH7020/30: Approx. 22kg

RH-10CRH8020/30: Approx. 23kg



Grease is applied to the tip of the shaft (J3 axis) to prevent rust.

Fig.2-3:Transportation posture and method (RH-10CRH)

- 1) The robot must be transported by two workers. Use a cart or other device for transporting the robot near the installation place. The following instructions for carrying the robot are applicable only when the robot is transferred onto the stand or another cart, or moved for positioning.
- 2) The robot will fall down when the robot is not installed with installation bolts. Support the robot arm with one hand while removing the installation bolts.
- 3) When carrying the robot, one person should hold arm No.1 and the machine cable. The other person should hold the base.
Do not hold the cover of the robot for carrying it. Otherwise, the robot may fall down, the cover may be broken or fall, or other accidents may occur.
Do not apply force to the cover or avoid strong impact on the robot while carrying the robot.
- 4) Transfer the robot slowly. Be careful not to get injured with the edge of the robot arm.
- 5) Transport the robot with fixing it to the packing box at delivery again for secondary transportation such as changing the installation place. If the robot is lifted while it is in the operation posture, its components may be damaged or its gravity position may be inappropriate, resulting in danger at transportation.

CAUTION To prevent accidents, do not carry the robot by the cover or pull the machine cable.

CAUTION Do not apply force to the shaft (J3 axis). Otherwise, the shaft may be damaged, resulting in an overload error.

CAUTION When transferring the robot again, adjust the posture of each axis of the robot as specified in [Table 2-2](#).

CAUTION Do not place the robot facing sideways. Otherwise, grease leaks or malfunction may occur.

Table 2-2:Transportation posture (RH-10CRH)

Axis	RH-10CRH
J1	133°
J2	-154.2°
J3	45 mm (not fixed)
J4	Not fixed

***RH-20CRH**

Use the transporting jig and a crane when transporting the RH-20CRH.

The transporting jig is not included with the product. If a transporting jig is required, fabricate/procure one or contact your local dealer.

Refer to [Fig. 2-6](#) for the material and shape of the transporting jig.

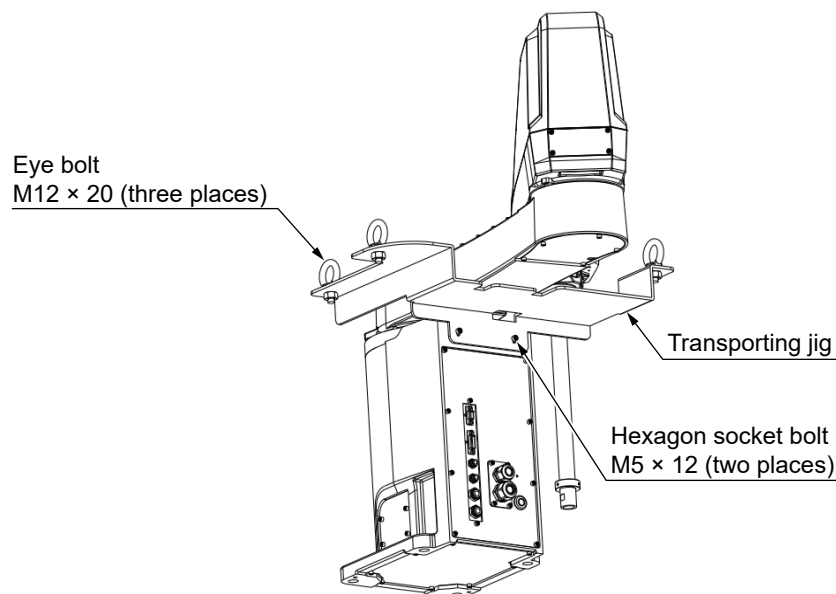


Fig.2-4:Installing the transporting jig (RH-20CRH)

1) Attach the transporting jig as indicated in [Fig. 2-4](#).

2) When attaching the transporting jig, one person should support the jig while the other tightens the screws.

When removing the transporting jig, one person should support the jig while the other removes the screws.

CAUTION

Use a material that is equal to or stronger than the specified material for the transporting jig.

Using a material that is not strong enough may cause accidents such as the robot falling.

CAUTION

Place the transporting jig against arm No.1 and fix it in place using the hexagon socket bolts (two places).

CAUTION

After installing the robot, remove the transporting jig before operating the robot.

CAUTION

When transporting the robot using a method other than the one above, lock each axis in place to prevent them from moving.

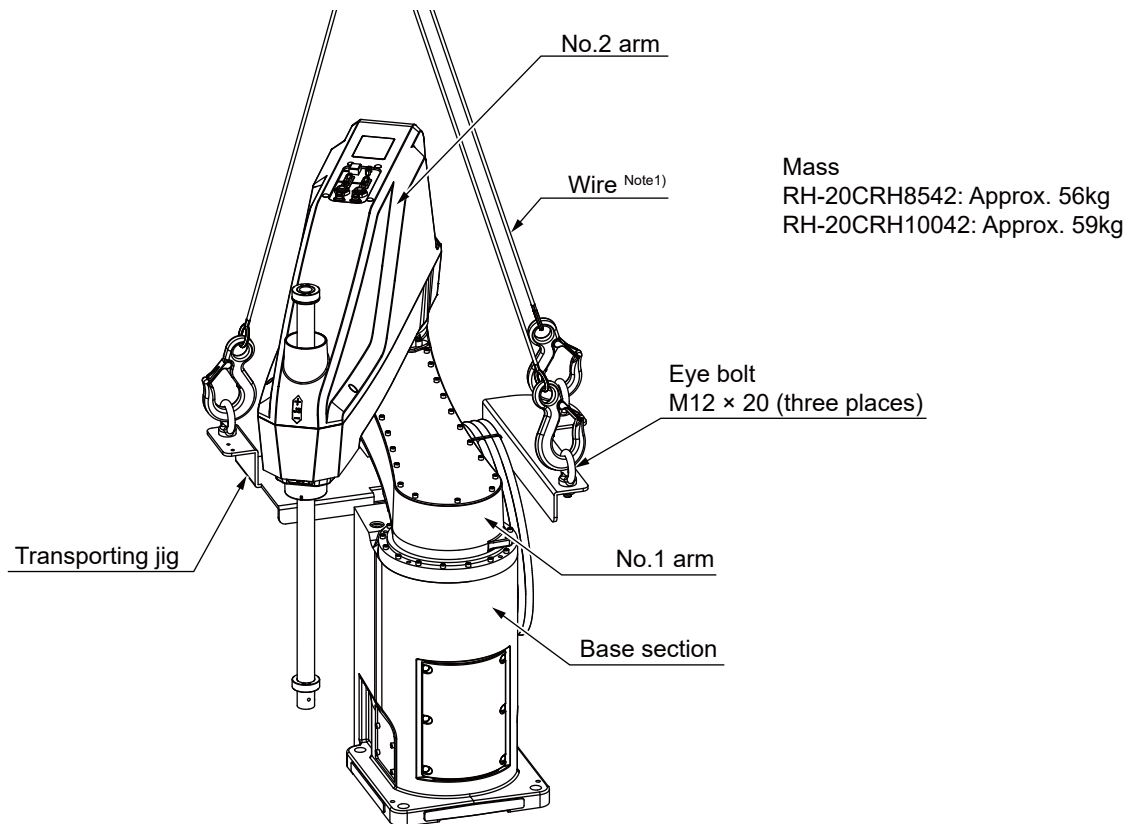
Refer to the robot's center of gravity ([Fig. 2-7](#)) when transporting the robot in the posture shown in [Table 2-3](#).

Applying excessive loads to the axes when locking them in place may damage components or lead to malfunction.



CAUTION

The robot will not stand on its own in its packaging posture. Use a crane to hoist the robot up by the transporting jig then remove the robot from the pallet.



Grease is applied to the tip of the shaft (J3 axis) to prevent rust.

Note 1) Use wires that are 1000 mm or longer.

Fig.2-5:Transportation posture and method (RH-20CRH)

- 3) Hook the wires to the eye bolts (three places) attached to the transporting jig. Ensure that the hooks are fixed securely on the eye bolts.
- 4) Lift the robot with a crane to transport it to the designated location.
When lifting the robot with a crane, prevent the wires or other things from interfering with the robot arm or covers. Always cover areas that may be subject to interference with a cloth or similar material. Do not subject the robot to strong impacts during transportation.
- 5) After installation, remove the wires, hooks, and the transporting jig.
- 6) When relocating the robot for reasons such as changing the installation site, attach the transporting jig with the robot in the transportation posture indicated in [Table 2-3](#). Then follow the same procedure as shown above. Directly hoisting the arm or hoisting the robot in a position other than the one that it came in without the transporting jig may cause damage to peripherals. Furthermore, the robot may become unstable due to an unfavorable center of gravity and cause an accident while the robot is being moved.



CAUTION

Three wires must be attached when transporting the robot.



CAUTION

When relocating the robot, adjust the axes of the robot to the transportation posture specified in [Table 2-3](#).



CAUTION

Do not hold the cover or pull the machine cable during transportation or installation.

⚠ CAUTION When transporting the robot, the contact surfaces between the transporting jig and robot may become scratched from rubbing together.
When using a transporting jig, attach a protective material such as tape to the contact surfaces between the transporting jig and robot.

⚠ CAUTION Do not apply force to the shaft (J3 axis). Otherwise, the shaft may be damaged, resulting in an overload error.

⚠ CAUTION Do not place the robot facing sideways. Otherwise, grease leaks or malfunction may occur.

⚠ CAUTION If it is not possible to follow the same transportation method mentioned above, use the screw holes for the transporting jig to lock the axes in place.
Otherwise, an excessive external force may be applied to the joints, causing a malfunction.
Do not apply an excessive load to the robot arm while locking the joints in place. If applied, the robot arm may be damaged.

Table 2-3:Transportation posture (RH-20CRH)

Axis	RH-20CRH85**	RH-20CRH100**
J1	173.3°	
J2	148.1°	156.4°
J3	100 mm (not fixed)	
J4	Not fixed	

Material: SPHC (JIS standard)

Surface treatment: galvanized

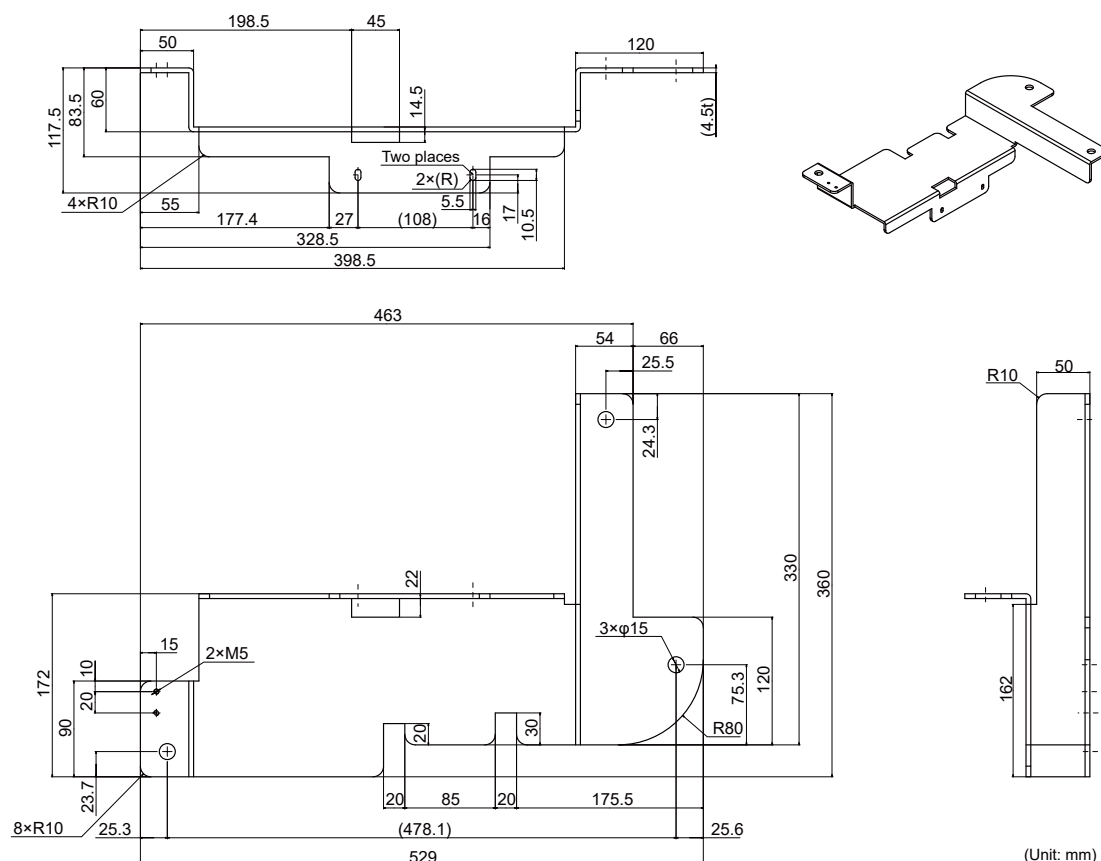
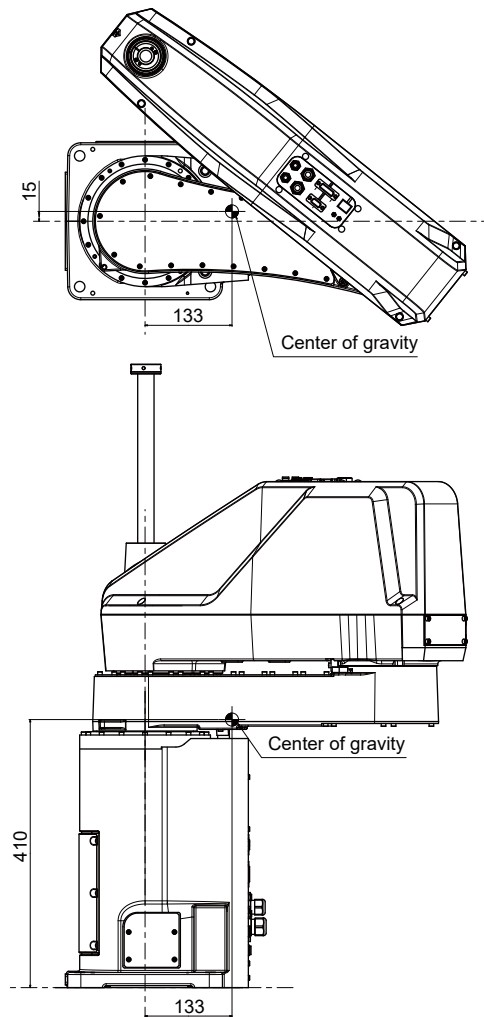
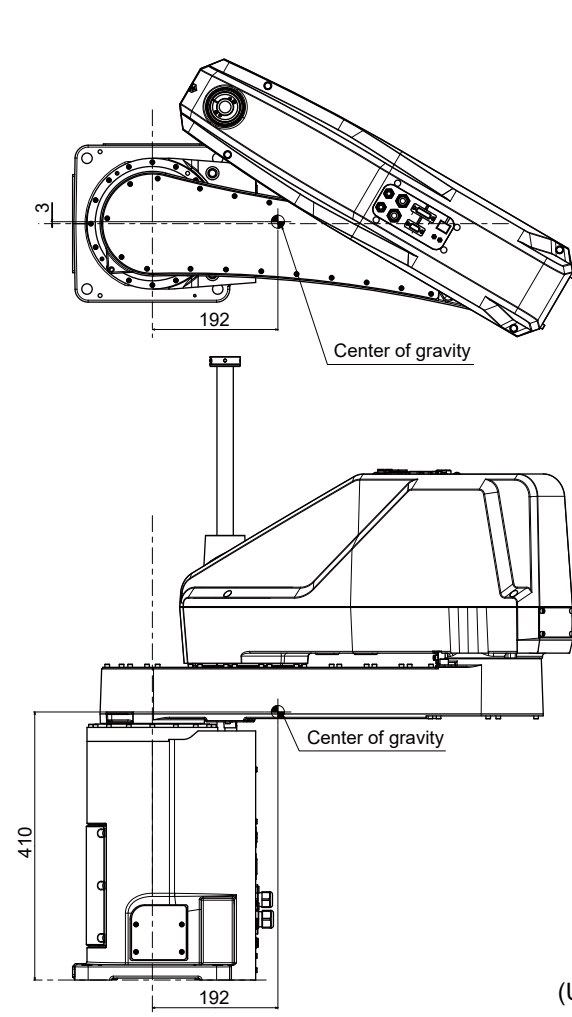


Fig.2-6:Transporting jig reference diagram (RH-20CRH)

RH-20CRH8542



RH-20CRH10042



(Unit: mm)

Fig.2-7:Center of gravity in packaging posture (RH-20CRH)

(2) Transportation procedure at secondary transportation

If it is difficult to follow the transportation procedure at secondary transportation described in [Page 10, "\(1\) Transportation procedure when unpacking"](#), take countermeasures not to allow the joints of the robot arm freely move by fixing the robot arm in such a way as to take advantage of the screw holes for fixing plates or the like. Do not apply an excessive load to the robot arm while fixing it.

If the robot arm is transported with its joints unfixed, applying an excessive power on the joints by external forces may cause a malfunction.

The reference figure of the fixing plate is shown below.

*RH-10CRH

Before installing the fixing plate, position the robot by adjusting each axis according to [Table 2-2](#).

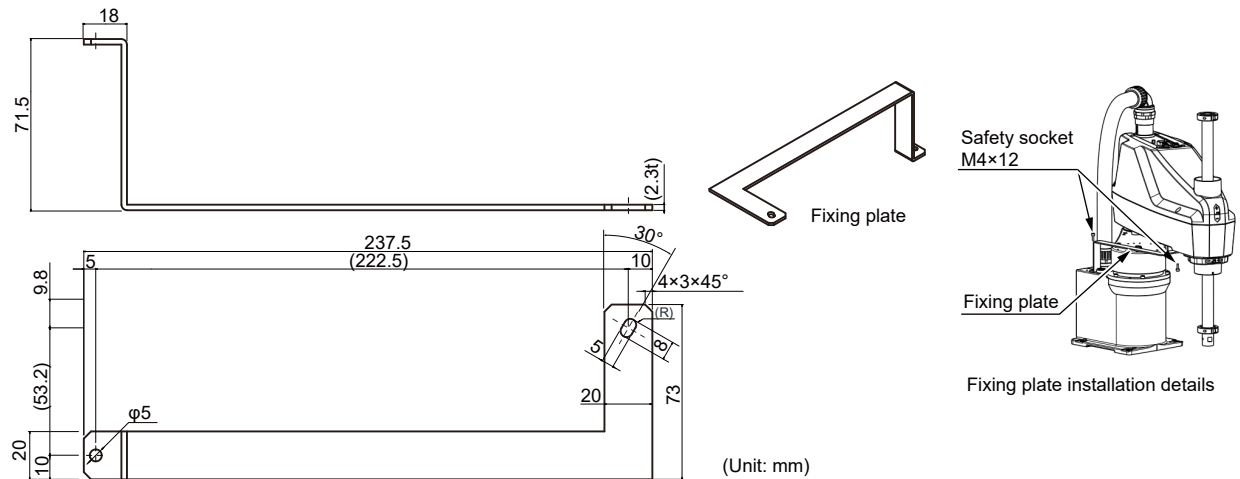


Fig.2-8: Fixing plate reference figure (RH-10CRH60xx)

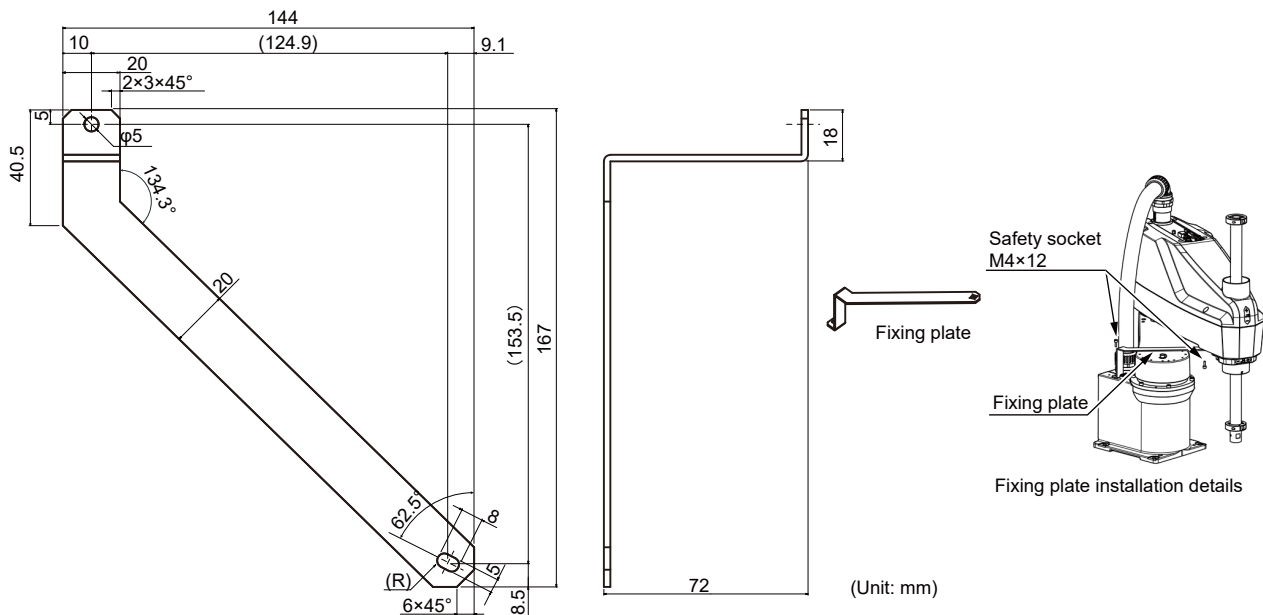


Fig.2-9: Fixing plate reference figure (RH-10CRH70xx)

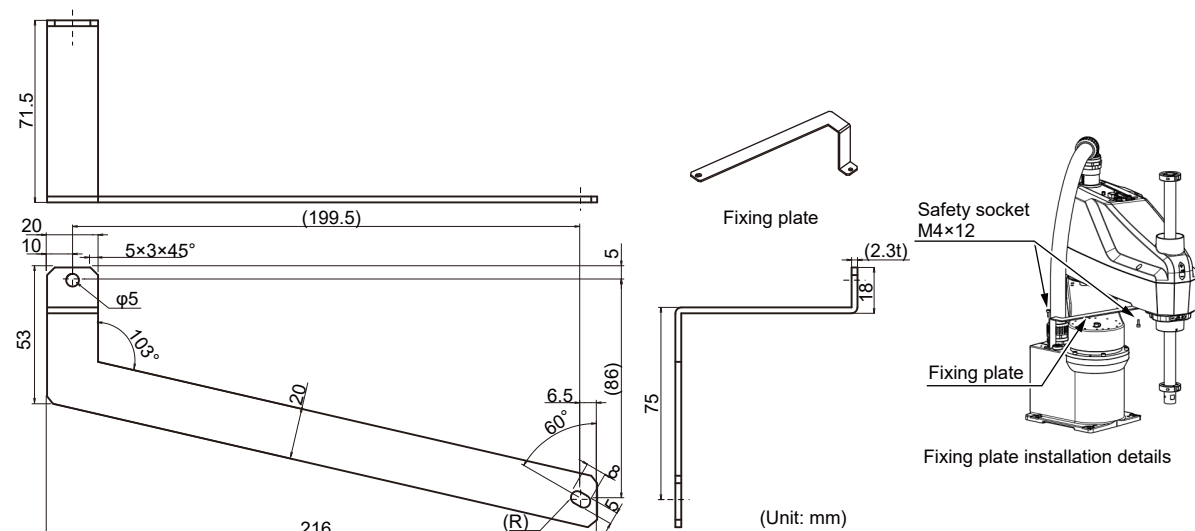


Fig.2-10:Fixing plate reference figure (RH-10CRH80xx)

*RH-20CRH

Before installing the fixing plate, position the robot by adjusting each axis according to [Table 2-3](#).

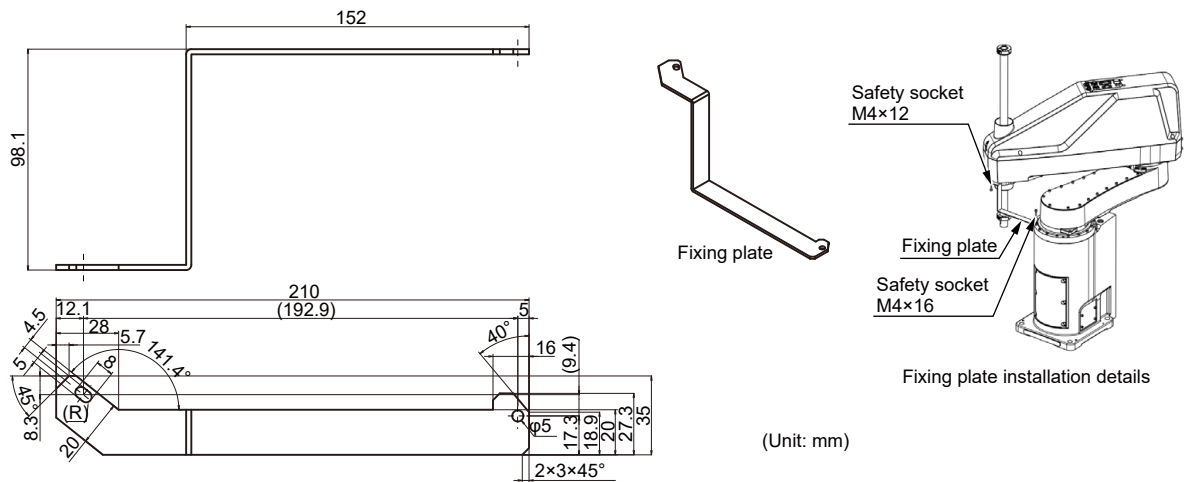


Fig.2-11: Fixing plate reference figure (RH-20CRH8542)

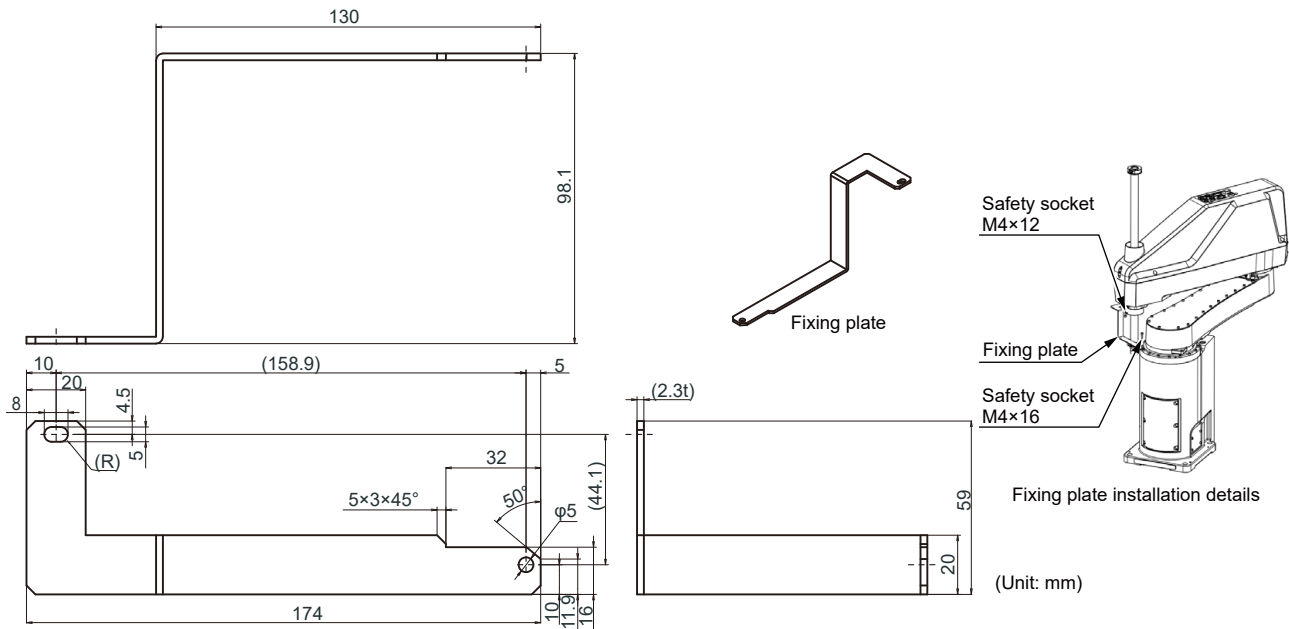
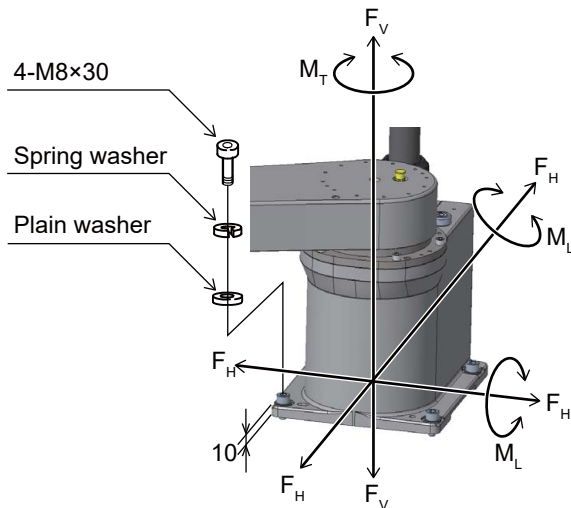


Fig.2-12: Fixing plate reference figure (RH-20CRH10042)

2.2.3 Installation procedures

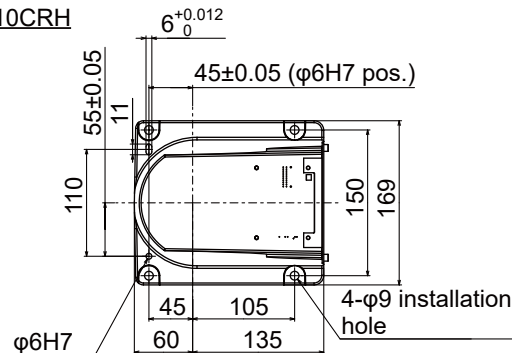
The installation procedure of the robot arm is shown below.

RH-10CRH

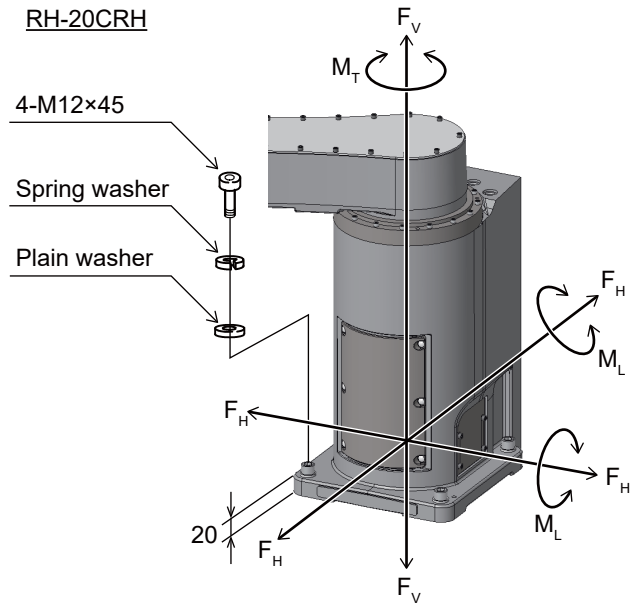


<Top view of the base section>

RH-10CRH



RH-20CRH



RH-20CRH

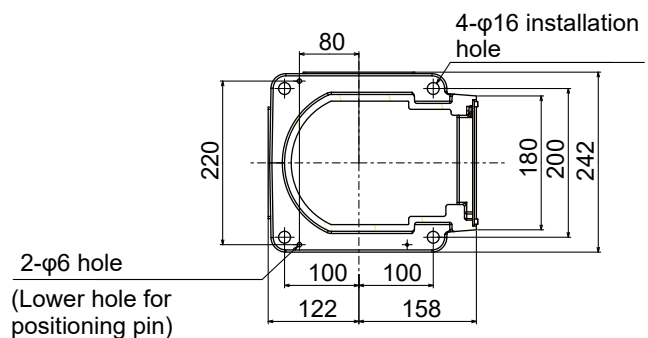


Fig.2-13: Installation dimensions

- 1) The robot installation surface has been machine finished. There are four installation holes on the base of the robot. Secure the robot in place using the included installation bolts.

Model	Installation hole size	Installation bolts (included)	Recommended tightening torque
RH-10CRH series	4-φ9	M8 hexagon socket bolt	26.5 N•m
RH-20CRH series	4-φ16	M12 hexagon socket bolt	92.1 N•m

- 2) Install the robot on a level surface.
- 3) It is recommended that the surface roughness of the table onto which the robot is to be installed by 6.3 Ra or more. If the installation surface is rough, the contact with the table will be poor, and positional deviation could occur when the robot moves.
- 4) When installing, use a common table to prevent the position of the devices and jigs subject to robot work from deviating.
- 5) The installation surface must have sufficient strength to withstand the arm reaction during operation, and resistance against deformation and vibration caused by the static (dynamic) load of the robot arm and peripheral devices, etc.
- 6) If you operate the robot at a high speed, reaction forces are applied to the installation stand by the robot's operation. Make sure that the installation stand on which the robot is placed has sufficient strength and rigidity. Table 2-4 shows the maximum reaction force (design values) that may be applied to an installation stand. Please use these values as reference when designing the installation stand.

Table 2-4: Magnitude of each reaction force

Item	Unit	Value
RH-10CRH6020/30		
Tilt moment : M_L	N•m	770
Torsional moment : M_T	N•m	310
Horizontal direction translation force : F_H	N	1280
Vertical direction translation force : F_V	N	1120
RH-10CRH7020/30		
Tilt moment : M_L	N•m	910
Torsional moment : M_T	N•m	390
Horizontal direction translation force : F_H	N	1240
Vertical direction translation force : F_V	N	1120
RH-10CRH8020/30		
Tilt moment : M_L	N•m	1050
Torsional moment : M_T	N•m	480
Horizontal direction translation force : F_H	N	1250
Vertical direction translation force : F_V	N	1130
RH-20CRH8542		
Tilt moment : M_L	N•m	1960
Torsional moment : M_T	N•m	1050
Horizontal direction translation force : F_H	N	1960
Vertical direction translation force : F_V	N	2210
RH-20CRH10042		
Tilt moment : M_L	N•m	2370
Torsional moment : M_T	N•m	1340
Horizontal direction translation force : F_H	N	1840
Vertical direction translation force : F_V	N	2260

⚠ CAUTION

Do not install the robot arm in areas where direct sunlight is present or heat is generated from lighting.

The skin temperature of the robot arm may rise, and the error may occur.

2.2.4 Grounding procedures

(1) Grounding methods

- 1) There are three grounding methods as shown in Fig. 2-14, but the dedicated grounding (Fig. 2-14 (a)) should be used for the robot arm and controller when possible. (Refer to the separate "Controller Setup, Basic Operation and Maintenance" for details on the controller grounding.)
- 2) Use Class D grounding (grounding resistance 100Ω or less).
Dedicated grounding separated from the other devices should be used.
- 3) Use a AWG#11(4.2mm²) or more stranded wire for the grounding wire. The grounding point should be as close to the robot arm and controller as possible, and the length of the grounding wire should be short.

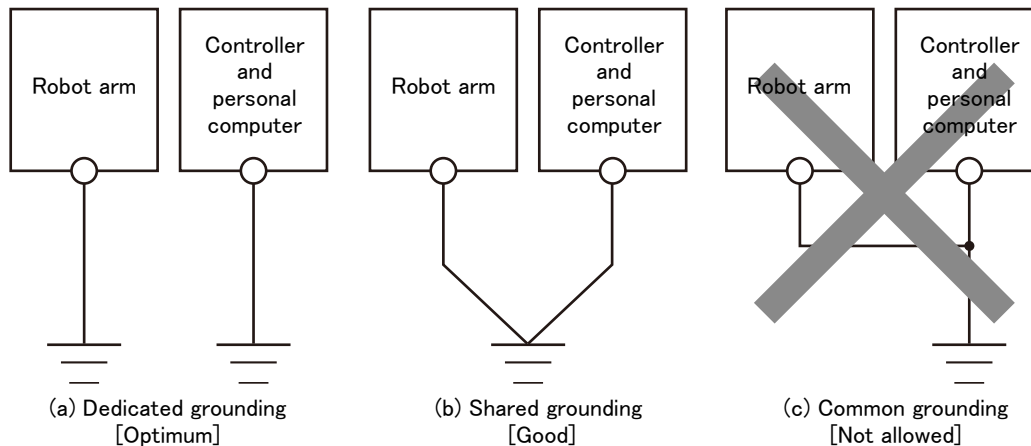
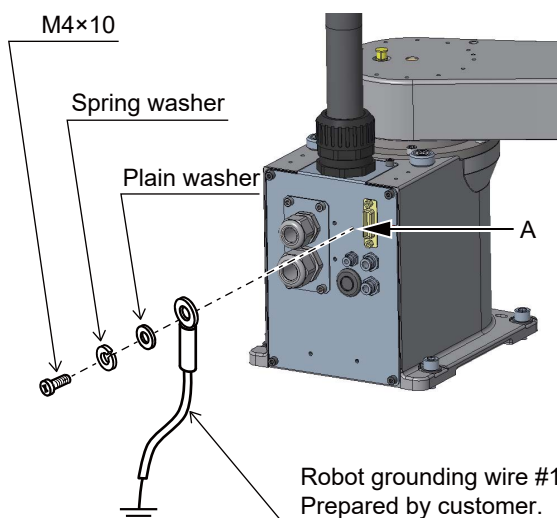


Fig.2-14:Grounding methods

(2) Grounding procedures

- 1) Prepare a grounding cable (AWG#11 (4.2 mm²) or more) and the installation screw and washer for the robot.
- 2) If there is rust or paint on the grounding screw section (A), remove it with a file, etc.
- 3) Connect the grounding cable to the grounding screw section.

RH-10CRH



RH-20CRH

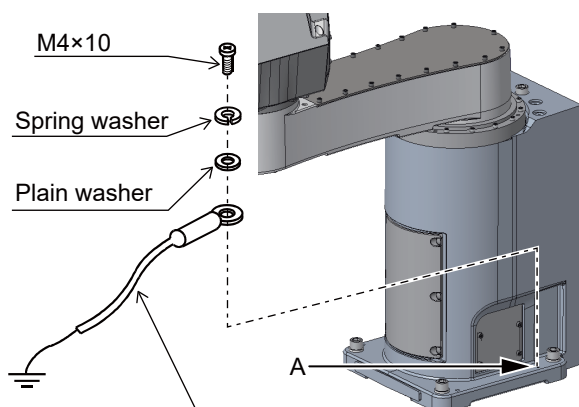


Fig.2-15:Connecting the grounding cable

2.2.5 Connecting with the controller

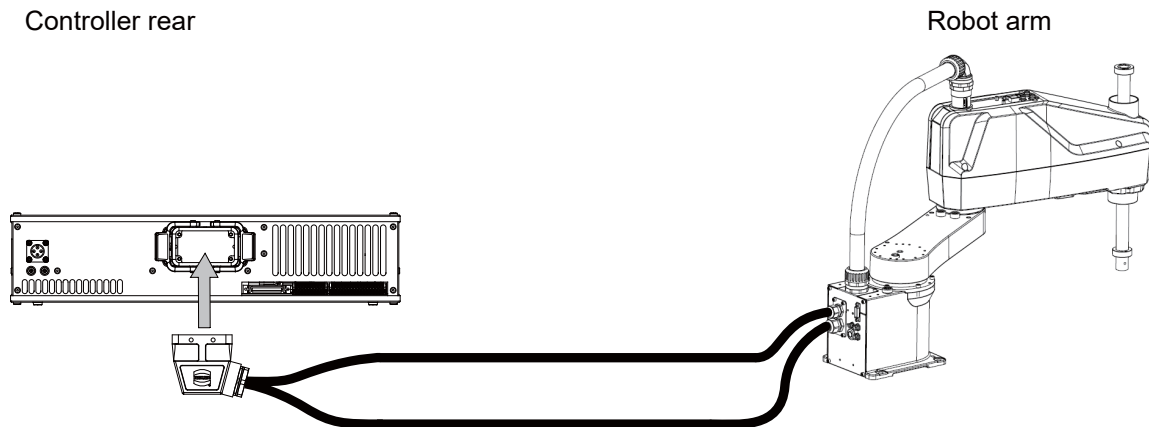
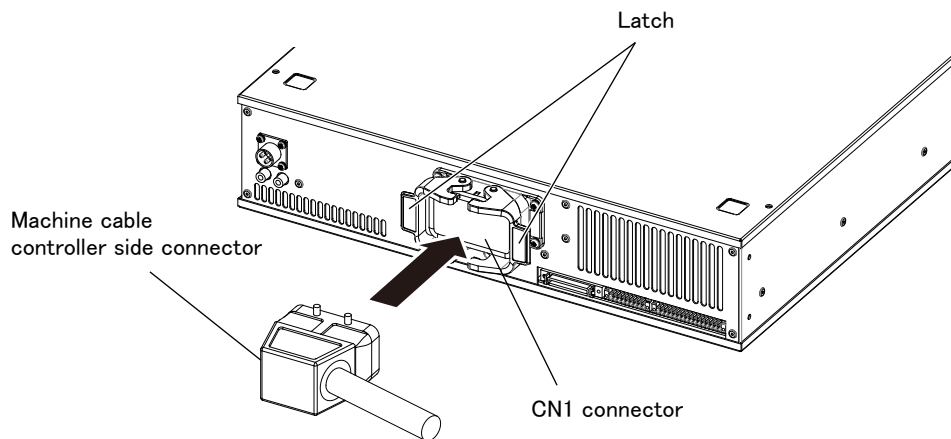


Fig.2-16:Connecting the machine cables

Carry out the following procedure after installing the controller referring to the separate "Controller Setup, Basic Operation and Maintenance" manual.



- 1) Make sure that the power of the controller is turned OFF.
- 2) Connect the controller side connector of the machine cable to CN1 connector on the rear side of the controller.
- 3) To fix the inserted connector, close the latches of the CN1 connector.
- 4) The connection method is the same for the optional machine cables (replaceable type). However, refer to the separate "Standard Specifications Manual" for information on how to fix a flexible cable.

Connecting the machine cable is completed.



CAUTION

When connecting and disconnecting the connector, be careful not to get your hand pinched.



CAUTION

When installing or removing the connector, to the connector of the other party in parallel, install or remove.
If load strong against one side is applied, the connector pin may be damaged and it may not be connected securely.



CAUTION

To disconnect the cable, open the latches, hold the connector part, and pull out the cable. Pulling the cable part may cause the cable to come off or break.



CAUTION

Take special care to the leading of the connection cable. If the cable is pulled with force or bent excessively, wires could break or the connector could be damaged.



CAUTION

Connect the machine cable at the place without the effect of the dust or oil mist. Please keep the dust and oil mist from being applied to of the robot arm connector section, in the condition that the machine cable is removed. Since it becomes the cause of failure.



CAUTION

When connected, the model is automatically selected; therefore, when the current model is replaced with a different model, H1601 (model mismatch error) will occur.

Change the parameter ATMESEL to "1" and turn the power ON again. After the change of the parameter as above, the other parameters and programs will be lost. Back up the data beforehand.

2.3 Confirming the operation

After the robot is connected to the controller, the origin data is automatically written.

Then, manually move the robot using the T/B to confirm that the operation is correct.

Moving the robot manually is called "jog operation". This operation includes the JOINT jog that moves each axis, the XYZ jog that moves along the base coordinate system, the TOOL jog that moves along the tool coordinate system, the Work jog that moves along the work coordinate system, and the CYLINDER jog that moves along the circular arc.

This operation is carried out while pressing the 3-position enable switch on the back of the T/B.

Note) The figure of the robot which indicated to the explanation page in each jog mode is an example.



CAUTION

The robot will move during this operation. Make sure that there are no operators near the robot, and that there are no obstacles, such as tools, in the robot operation range.



CAUTION

To immediately stop the robot, release the 3-position enable switch on the back of the T/B. The servo power will turn OFF, and the robot will stop.

The robot will also stop if the emergency stop switch on the front of the T/B is pressed.



CAUTION

To check whether the origin of the robot deviates, move the robot arm to the position where the ABS marks align each other, and check the displayed joint coordinates of the position.

For the details of the ABS mark position and the joint coordinates, refer to [Page 76, "5.6 Resetting the origin"](#).

2.3.1 Installing the teaching pendant (T/B)

Installing the T/B, with turning off the controller power.



CAUTION

Please do not pull the cable of T/B strongly or do not bend it too much. It becomes the breaking of a wire of the cable and the cause of breakage of the connector. Please installing so that stress does not start the cable with the connector itself.

Explain the installation method of T/B below.

- 1) Check that the controller's power supply is OFF.
- 2) Refer to Fig. 2-17 and connect T/B connector to the robot controller.
Use as the upper surface the lock lever, and push in until there is sound.
- 3) Pressing down the lock lever to lock the connector as shown below.

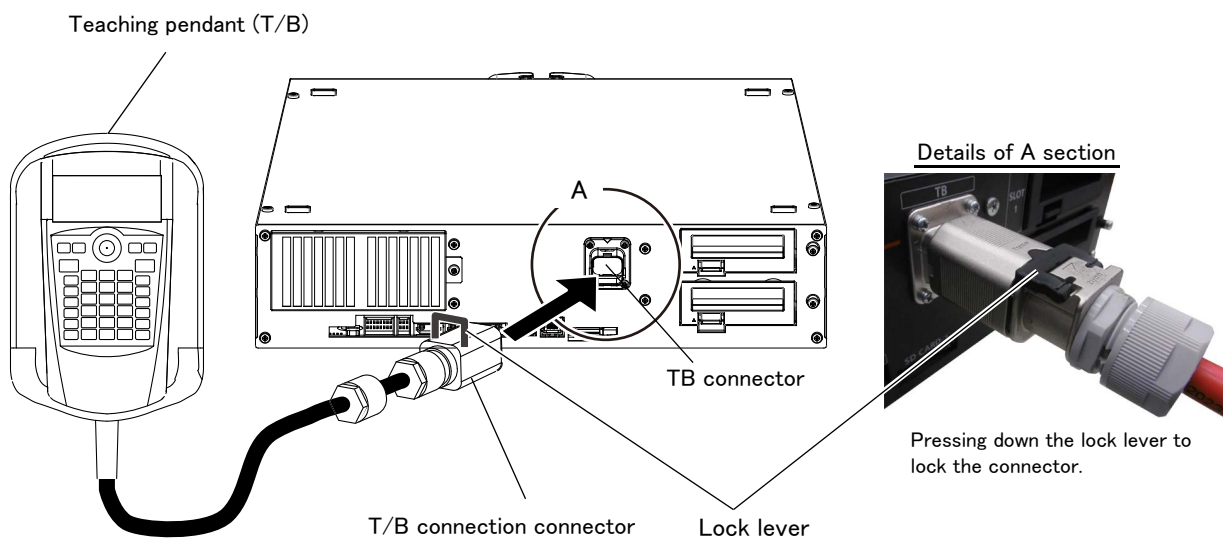


Fig.2-17:Installing the T/B

The installation of T/B is finished.

2.3.2 Turning ON the control power



CAUTION

Confirm that there are no operators near the robot before turning the power ON.

- 1) Turn the controller power switch ON.
Turns ON the switch of the earth leakage breaker of installation outside.

* Controller software version C2d or later

If the hand conditions (weight, size, and center of gravity) have not been set, error C0330 (Undefined hand condition) will occur upon power on.

Clear the error from the teaching pendant or RT ToolBox3 until the hand conditions are set.

Set the hand conditions using the parameter HNDDAT* (* = 0 to 8).

For further information, refer to "Movement parameter" in the "Instruction Manual/Detailed explanations of functions and operations".

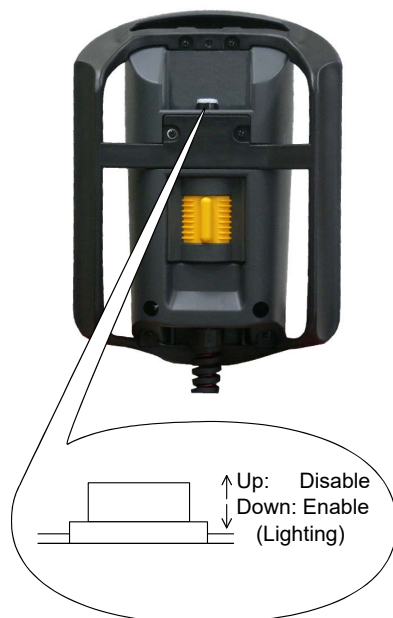
2.3.3 Preparing the T/B

Next, prepare to use the T/B

1) Set the mode of the controller to "MANUAL".

2) Set the [T/B ENABLE] switch of the T/B to "ENABLE". The menu selection screen will appear.

The following operations are carried out with the T/B.

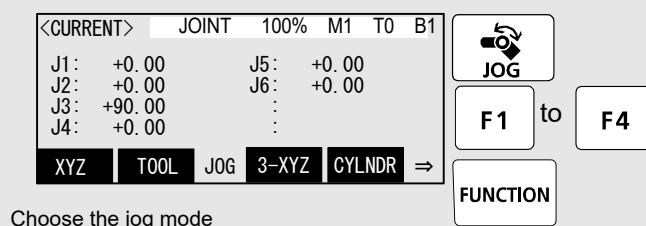


◆◆◆ Operating from the T/B ◆◆◆

Be sure to set the controller mode to "MANUAL" before setting the [T/B ENABLE] switch of the T/B to "ENABLE".

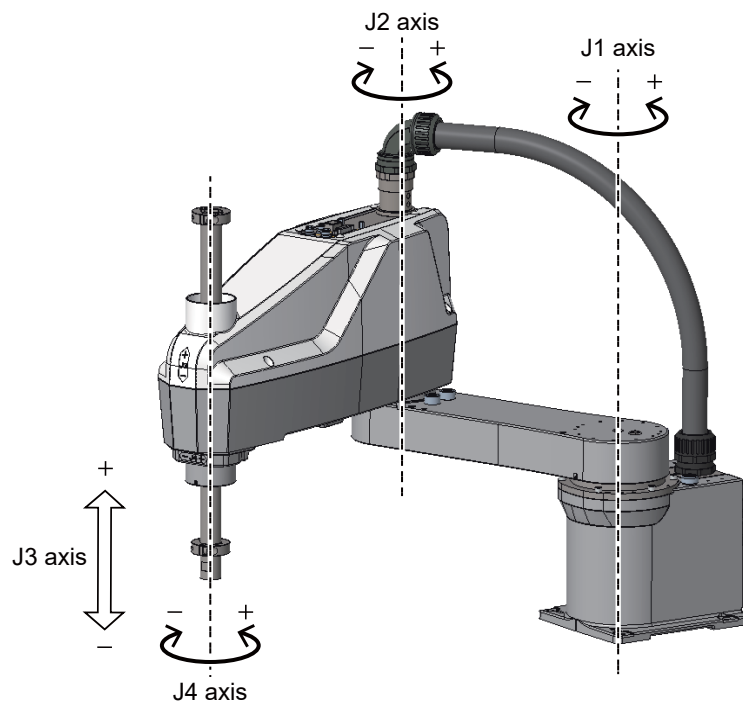
When the T/B is valid, only operations from the T/B are possible. Operations from the external signals will not be accepted. The stop-related operations such as an emergency stop can be performed regardless of the valid/invalid setting.

◆◆◆ How to choose the jog mode ◆◆◆



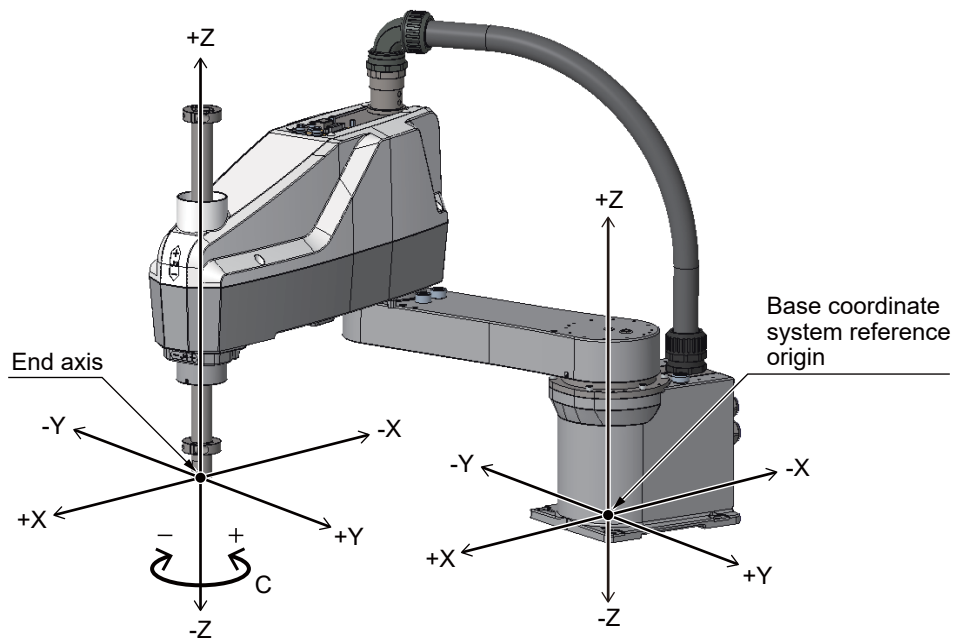
Choose the jog mode

Press the [JOG] key, the jog screen will be displayed, and display the jog mode which can be chosen at the bottom of the screen. Because these correspond to the function key of [F1] - [F4], press the function key corresponding to the jog mode to wish. And, if the [FUNCTION] key is pressed, selection in jog modes other than the present display is possible. The override (100%), the mechanism number (M1), and the tool number (T0), and the base coordinate number (B1) are displayed on the upside of the screen following the present jog mode (JOINT).



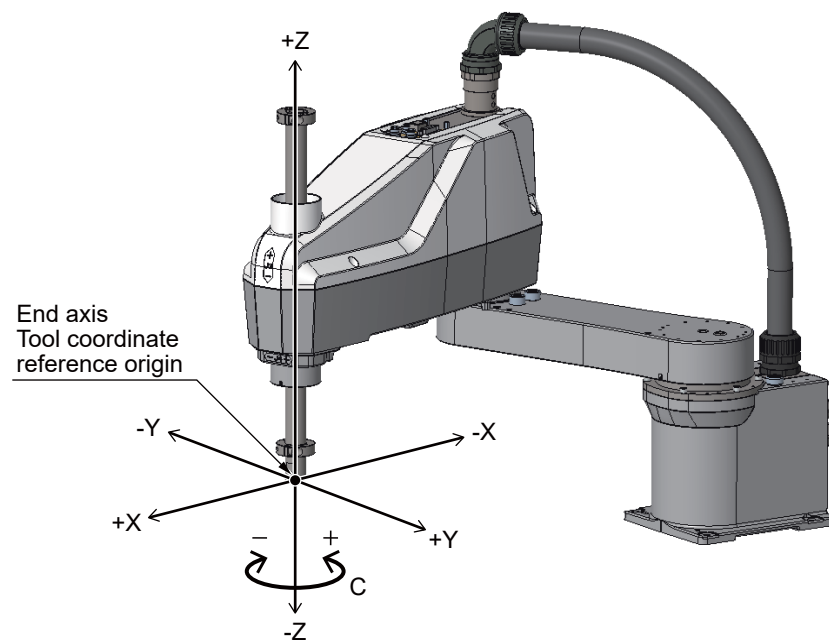
* Each axis moves independently.

Fig.2-18:JOINT jog operation



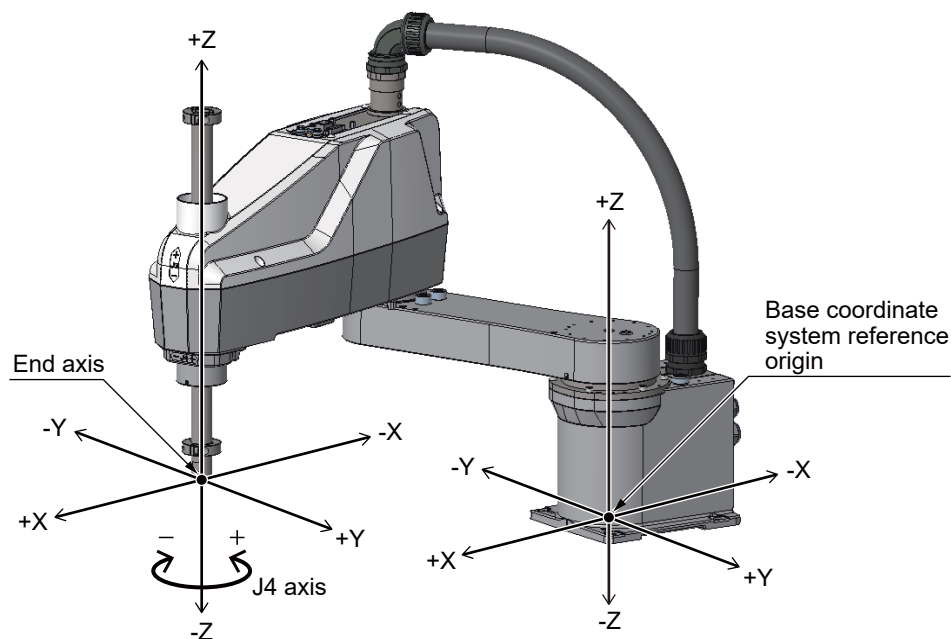
* While maintaining the end axis posture, the axis moves straight along the base coordinate system.
Also, while maintaining the end axis position, the end axis posture changes.

Fig.2-19:XYZ jog operation



* While maintaining the end axis posture, the axis moves straight along the tool coordinate system.
Also, while maintaining the end axis position, the end axis posture changes

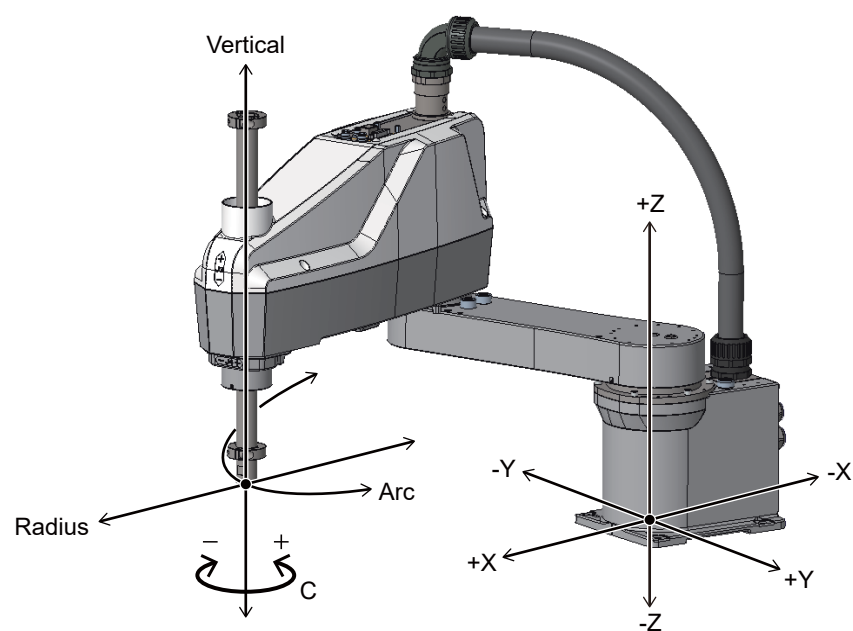
Fig.2-20:TOOL jog operation



* The axis moves straight along the base coordinate system. At this time, the end axis posture is not maintained.

Also, the end axis posture changes.

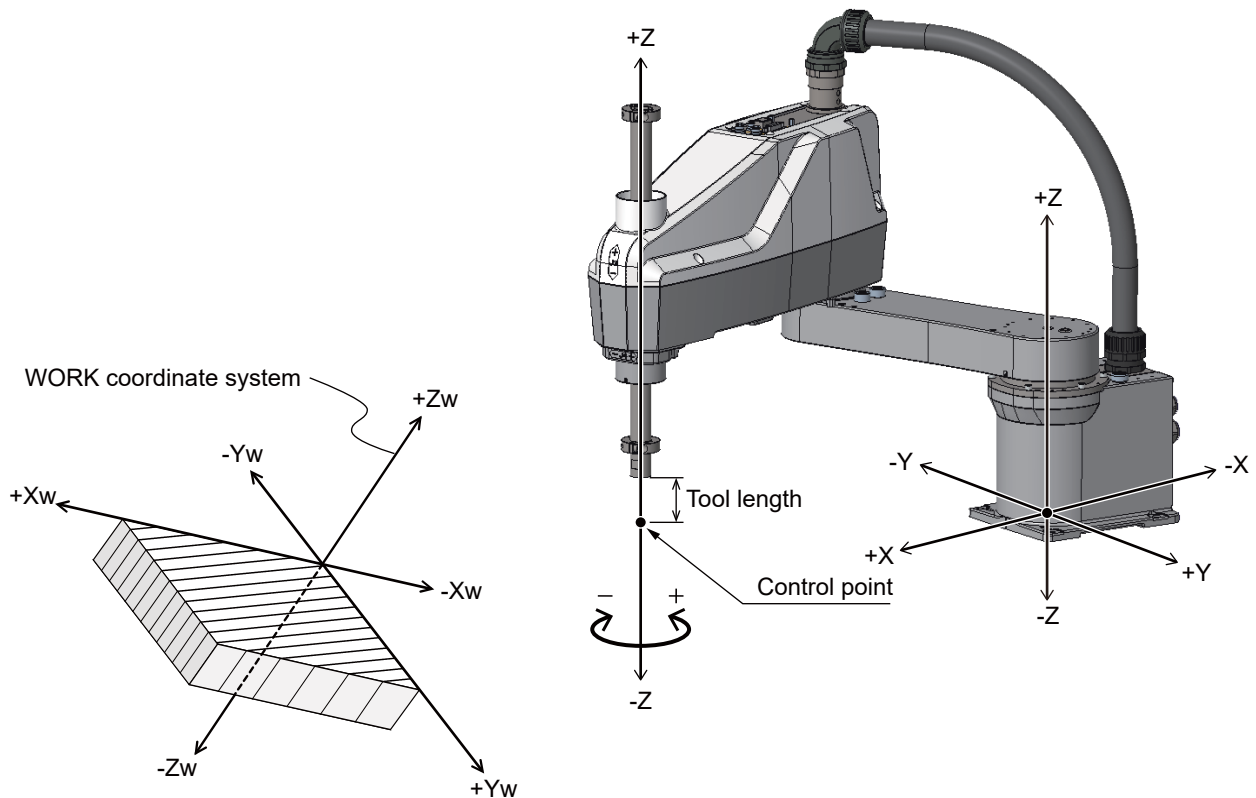
Fig.2-21:3-axis XYZ jog operation



* The current position is set as the arc centering on the Z axis, and the axis moves along that arc, expands and contracts in the radius direction, and moves vertically. At this time, the end axis posture is maintained. Also, while maintaining the axis posture position, the end axis posture changes.

Fig.2-22:CYLINDER jog operation

The jog movement based on work coordinates system



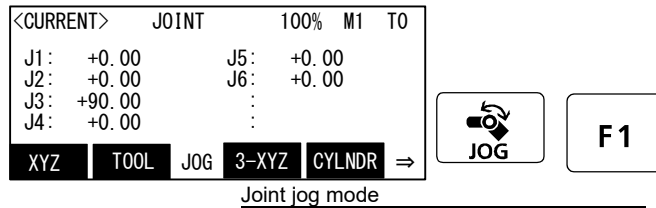
* While maintaining the end axis posture, the axis moves straight along the work coordinate system. Also, while maintaining the end axis position, the end axis posture changes.

* Jog operation around the work coordinates system is available (EX-T jog). In this jog operation, when the jog operation is performed for the posture elements, the posture rotates on the Xw axis, Yw axis, or Zw axis of the work coordinates system while the control point is changed.

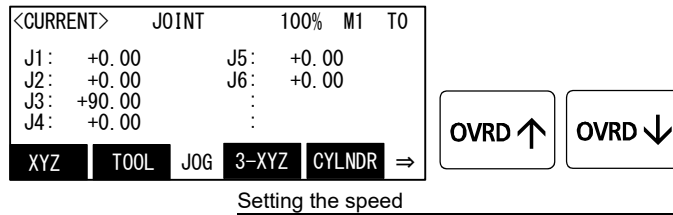
Fig.2-23:WORK jog operation

(1) JOINT jog operation

Select joint jog mode



Set jog speed



[JOG] Press the key and display the jog screen. ("JOG" is displayed on the screen bottom)

Check that the "joint" in jog mode is displayed on the screen.

If other jog modes are displayed, please press the function key corresponding to the "joint." (If the jog mode which he wishes under the screen is not displayed, it is displayed that the [FUNCTION] key is pressed)

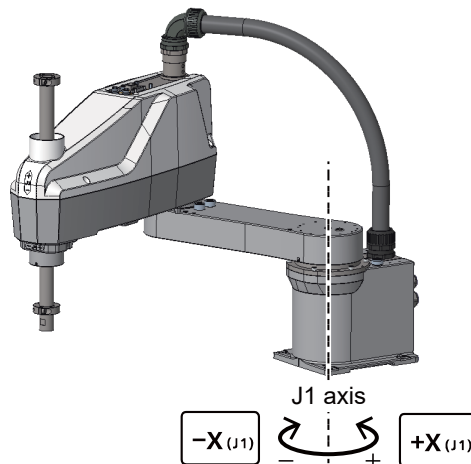
If it finishes jog operation, press the [JOG] key again, or function key which correspond to "close."

Whenever it presses the key of [OVRD↑], the override goes up. Conversely, if the [OVRD↓] key is pressed, it will go down.

The current setting speed is displayed on the screen upper right.

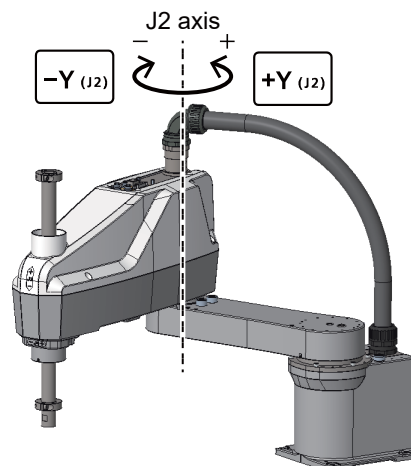
Set the override to 10% here for confirmation work.

J1 axis jog operation



- When the [+X (J1)] keys are pressed, the J1 axis will rotate in the plus direction.
When the [-X (J1)] keys are pressed, rotate in the minus direction.

J2 axis jog operation

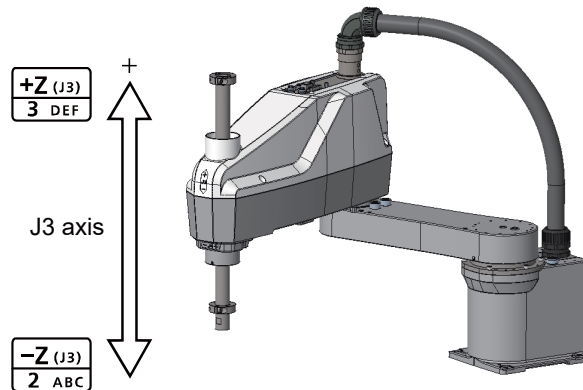


- When the [+Y (J2)] keys are pressed, the J2 axis will rotate in the plus direction.
When the [-Y (J2)] keys are pressed, rotate in the minus direction.

◇◆◇ When the robot is in the transportation posture ◇◆◇

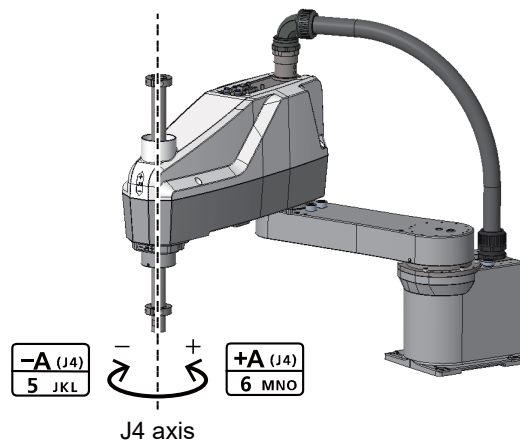
The axes may be outside the movement area. Move these axes toward the inner side of the movement area.

J3 axis jog operation



- When the [+Z (J3)] keys are pressed, the J3 axis will rotate in the plus direction.
When the [-Z (J3)] keys are pressed, rotate in the minus direction.

J4 axis jog operation



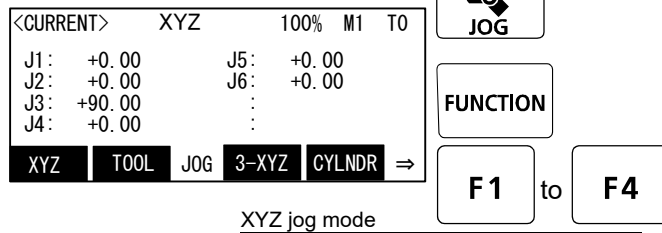
- When the [+A (J4)] keys are pressed, the J4 axis will rotate in the plus direction.
When the [-A (J4)] keys are pressed, rotate in the minus direction.

◇◆◇ If the buzzer of T/B sounds and the robot does not move ◇◆◇

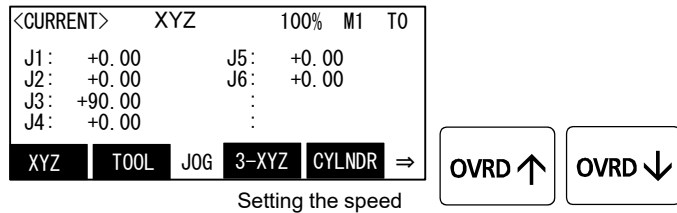
If it is going to move the robot across the operation range, the buzzer of T/B sounds and the robot does not move. In this case, please move to the counter direction.

(2) XYZ jog operation

Select XYZ jog mode



Set jog speed



[JOG] Press the key and display the jog screen. ("JOG" is displayed on the screen bottom)

Check that the "XYZ" in jog mode is displayed on the screen.

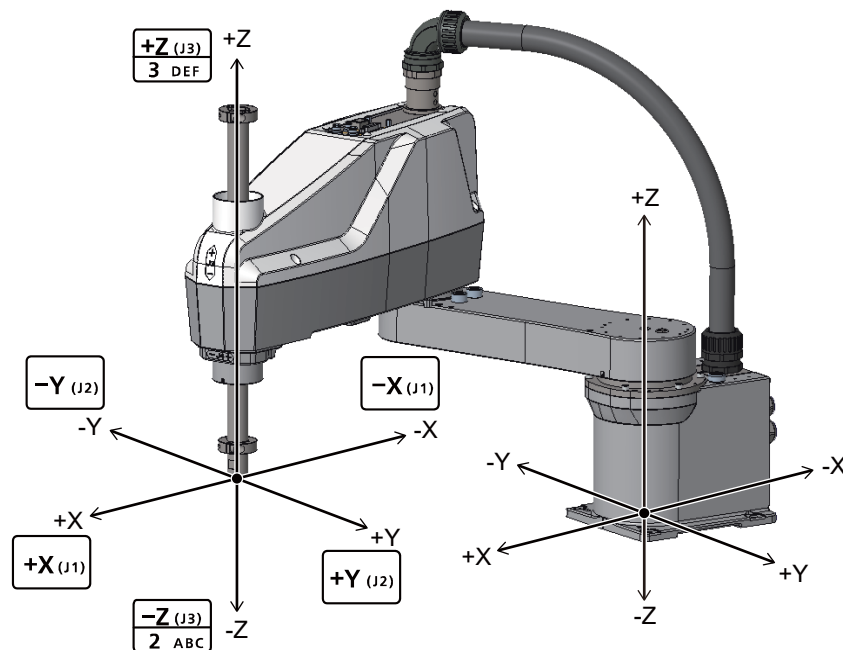
If other jog modes are displayed, please press the function key corresponding to the "XYZ." (If the jog mode which he wishes under the screen is not displayed, it is displayed that the [FUNCTION] key is pressed)

If it finishes jog operation, press the [JOG] key again, or function key which correspond to "close."

Whenever it presses the key of [OVRD↑], the override goes up. Conversely, if the [OVRD↓] key is pressed, it will go down.

The current setting speed is displayed on the screen upper right. Set the override to 10% here for confirmation work.

Moving along the base coordinate system



- When the [+X (J1)] keys are pressed, the robot will move along the X axis plus direction. When the [-X (J1)] keys are pressed, move along the minus direction.
- When the [+Y (J2)] keys are pressed, the robot will move along the Y axis plus direction. When the [-Y (J2)] keys are pressed, move along the minus direction.
- When the [+Z (J3)] keys are pressed, the robot will move along the Z axis plus direction. When the [-Z (J3)] keys are pressed, move along the minus direction.

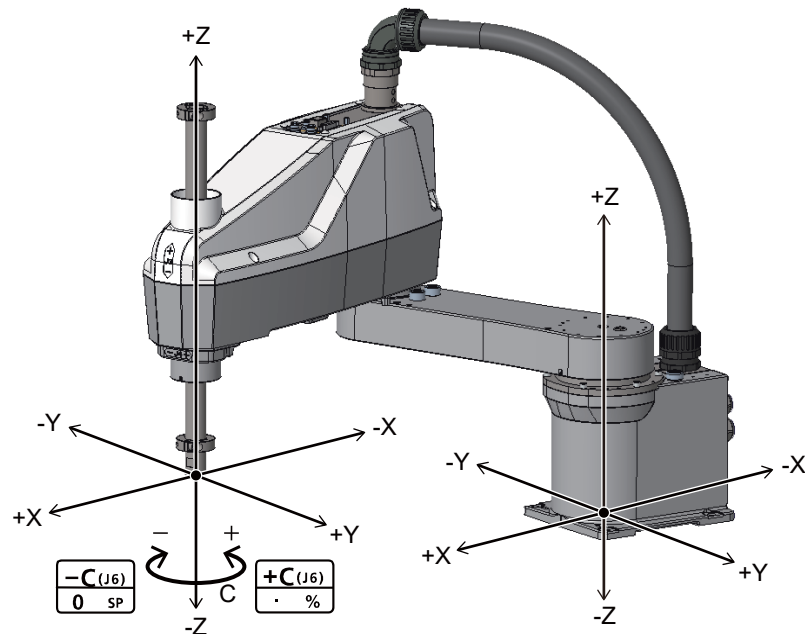
◆◆◆ When the robot is in the transportation posture ◆◆◆

There are directions from which linear movement is not possible from the transportation posture. In this case, the robot will not move. Refer to [Page 30, "\(1\) JOINT jog operation"](#), and move the robot to a position where linear movement is possible, and then carry out XYZ jog.

◆◆◆ If the buzzer of T/B sounds and the robot does not move ◆◆◆

If it is going to move the robot across the operation range, the buzzer of T/B sounds and the robot does not move. In this case, please move to the counter direction.

Changing the end axis posture



* The Position of the end axis will not change.

- When the $[+C (J6)]$ keys are pressed, the Z axis will rotate in the plus direction.
When the $[-C (J6)]$ keys are pressed, rotate in the minus direction.

◆◆◆ When alarm No. 5150 occurs ◆◆◆

If alarm No. 5150 (ORIGIN NOT SET) occurs, the origin has not been set correctly. Reconfirm the value input for the origin data.

◆◆◆ Tool length ◆◆◆

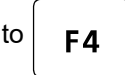
The default tool length is 0mm, and the control point is the center of the end axis.

After installing the hand, set the correct tool length in the parameters. Refer to the separate manual "Detailed Explanation of Functions and Operations" for details.

(3) TOOL jog operation

Select TOOL jog mode

<CURRENT>	JOINT	100%	M1	T0
J1: +0.00	J5: +0.00			
J2: +0.00	J6: +0.00			
J3: +90.00	:			
J4: +0.00	:			
XYZ TOOL JOG 3-XYZ CYLNDR ⇒				
TOOL jog mode				



[JOG] Press the key and display the jog screen. ("JOG" is displayed on the screen bottom)

Check that the "TOOL" in jog mode is displayed on the screen.

If other jog modes are displayed, please press the function key corresponding to the "TOOL." (If the jog mode which he wishes under the screen is not displayed, it is displayed that the [FUNCTION] key is pressed)

If it finishes jog operation, press the [JOG] key again, or function key which correspond to "close."

Whenever it presses the key of [OVRD↑], the override goes up. Conversely, if the [OVRD↓] key is pressed, it will go down.

The current setting speed is displayed on the screen upper right.

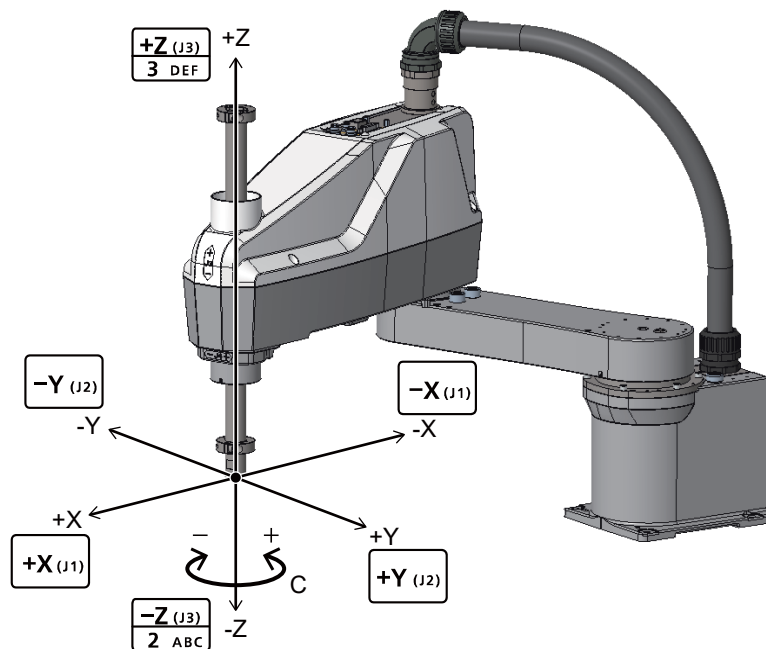
Set the override to 10% here for confirmation work.

Set jog speed

<CURRENT>	JOINT	100%	M1	T0
J1: +0.00	J5: +0.00			
J2: +0.00	J6: +0.00			
J3: +90.00	:			
J4: +0.00	:			
XYZ TOOL JOG 3-XYZ CYLNDR ⇒				
Setting the speed				



Moving along the tool coordinate system



- When the [+X (J1)] keys are pressed, the robot will move along the X axis plus direction of the tool coordinate system.
When the [-X (J1)] keys are pressed, move along the minus direction.
- When the [+Y (J2)] keys are pressed, the robot will move along the Y axis plus direction of the tool coordinate system.
When the [-Y (J2)] keys are pressed, move along the minus direction.
- When the [+Z (J3)] keys are pressed, the robot will move along the Z axis plus direction of the tool coordinate system.
When the [-Z (J3)] keys are pressed, move along the minus direction.

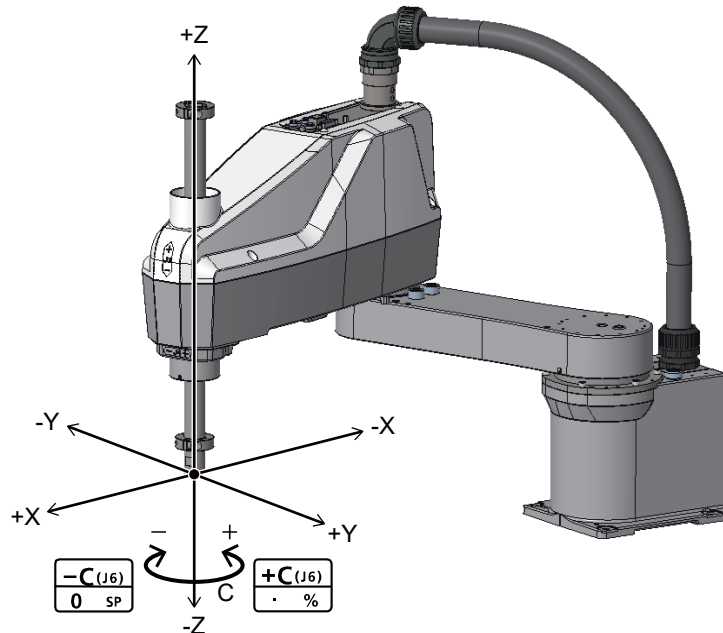
◆◆◆ When the robot is in the transportation posture ◆◆◆

There are directions from which linear movement is not possible from the transportation posture. In this case, the robot will not move. Refer to [Page 30, "\(1\) JOINT jog operation"](#), and move the robot to a position where linear movement is possible, and then carry out XYZ jog.

◆◆◆ If the buzzer of T/B sounds and the robot does not move ◆◆◆

If it is going to move the robot across the operation range, the buzzer of T/B sounds and the robot does not move. In this case, please move to the counter direction.

Changing the end axis posture



*The Position of the end axis will not change.

- When the $[+C(J6)]$ keys are pressed, the Z axis will rotate in the plus direction of the tool coordinate system.
When the $[-C(J6)]$ keys are pressed, rotate in the minus direction.

◆◆◆ When alarm No. 5150 occurs ◆◆◆

If alarm No. 5150 (ORIGIN NOT SET) occurs, the origin has not been set correctly. Reconfirm the value input for the origin data.

◆◆◆ Tool length ◆◆◆

The default tool length is 0mm, and the control point is the center of the end axis.

After installing the hand, set the correct tool length in the parameters. Refer to the separate manual "Detailed Explanation of Functions and Operations" for details.

(4) 3-axis XYZ jog operation

Select 3-axis XYZ jog mode

<CURRENT> 3-XYZ 100% P5			
X:	+977.45	A:	-180.00
Y:	+0.00	B:	+89.85
Z:	+928.24	C:	+180.00
L1:		L2:	
FL1:	7	FL2:	0
JOINT XYZ JOG TOOL CYLNR =>			



FUNCTION

F1

to

F4

3-axis XYZ jog mode

Set jog speed

<CURRENT> 3-XYZ 70% P5			
X:	+977.45	A:	-180.00
Y:	+0.00	B:	+89.85
Z:	+928.24	C:	+180.00
L1:		L2:	
FL1:	7	FL2:	0
JOINT XYZ JOG TOOL CYLNR =>			

OVRD ↑

OVRD ↓

Setting the speed

[JOG] Press the key and display the jog screen. ("JOG" is displayed on the screen bottom)

Check that the "3-XYZ" in jog mode is displayed on the screen.

If other jog modes are displayed, please press the function key corresponding to the "3-XYZ." (If the jog mode which he wishes under the screen is not displayed, it is displayed that the [FUNCTION] key is pressed)

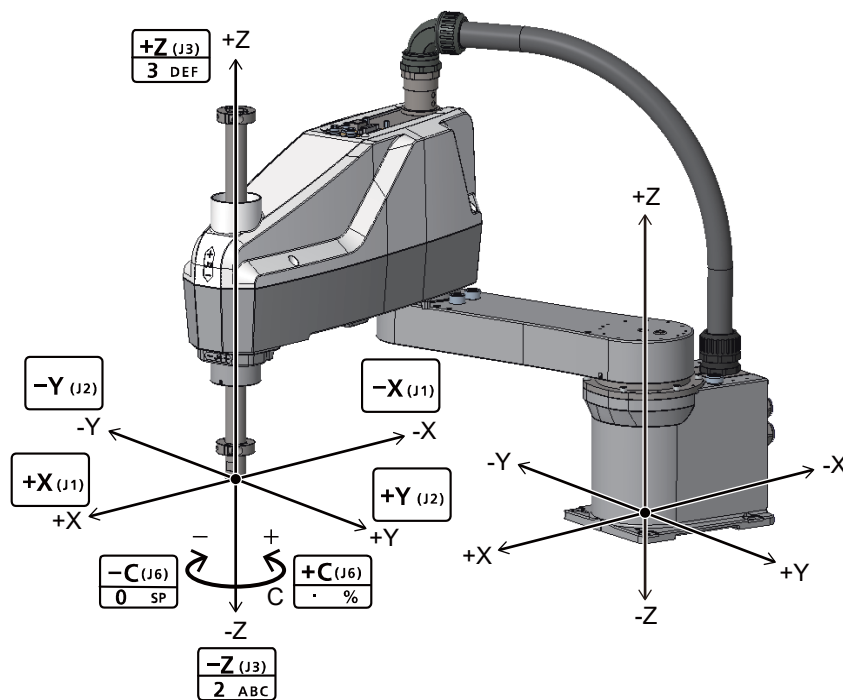
If it finishes jog operation, press the [JOG] key again, or function key which correspond to "close."

Whenever it presses the key of [OVRD↑], the override goes up. Conversely, if the [OVRD↓] key is pressed, it will go down.

The current setting speed is displayed on the screen upper right.

Set the override to 10% here for confirmation work.

Moving along the base coordinate system

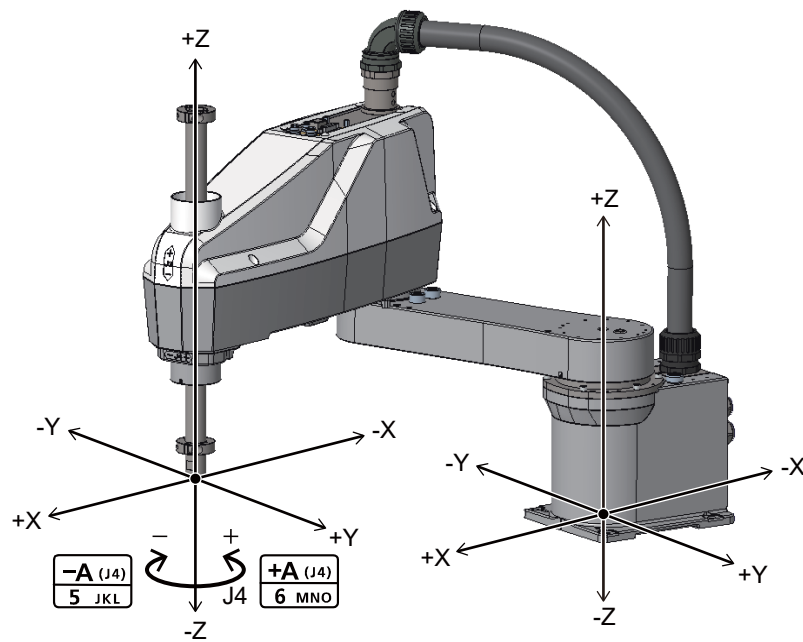


*The direction of the end axis will change.

- When the [+X (J1)] keys are pressed, the robot will move along the X axis plus direction.
When the [-X (J1)] keys are pressed, move along the minus direction.
- When the [+Y (J2)] keys are pressed, the robot will move along the Y axis plus direction.
When the [-Y (J2)] keys are pressed, move along the minus direction.
- When the [+Z (J3)] keys are pressed, the robot will move along the Z axis plus direction.
When the [-Z (J3)] keys are pressed, move along the minus direction.

◆◆◆ The flange surface end axis posture cannot be maintained with 3-axis XYZ jog. ◆◆◆
With 3-axis XYZ jog, the flange surface end axis posture (orientation) is not maintained when moving linearly in the X, Y or Z axis direction.
Use XYZ jog to maintain the posture.

Changing the end axis posture



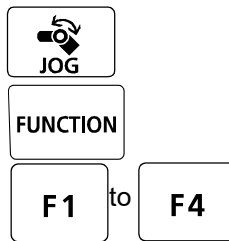
*The Position of the end axis will not change.

- When the[+C (J6)] keys are pressed, the J4-axis will rotate in the plus direction.
When the[-C (J6)] keys are pressed, rotate in the minus direction.

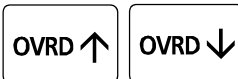
(5) CYLINDER jog operation

Select cylindrical jog mode

<CURRENT> CYLINDER 100% P5			
X:	+977.45	A:	-180.00
Y:	+0.00	B:	+89.85
Z:	+928.24	C:	+180.00
L1:		L2:	
FL1:	7	FL2:	0
JOINT XYZ JOG TOOL 3-XYZ ⇒			
CYLINDER jog mode			

Set jog speed

<CURRENT> CYLINDER 70% P5			
X:	+977.45	A:	-180.00
Y:	+0.00	B:	+89.85
Z:	+928.24	C:	+180.00
L1:		L2:	
FL1:	7	FL2:	0
JOINT XYZ JOG TOOL 3-XYZ ⇒			
Setting the speed			



[JOG] Press the key and display the jog screen. ("JOG" is displayed on the screen bottom)

Check that the "CYLINDER" in jog mode is displayed on the screen.

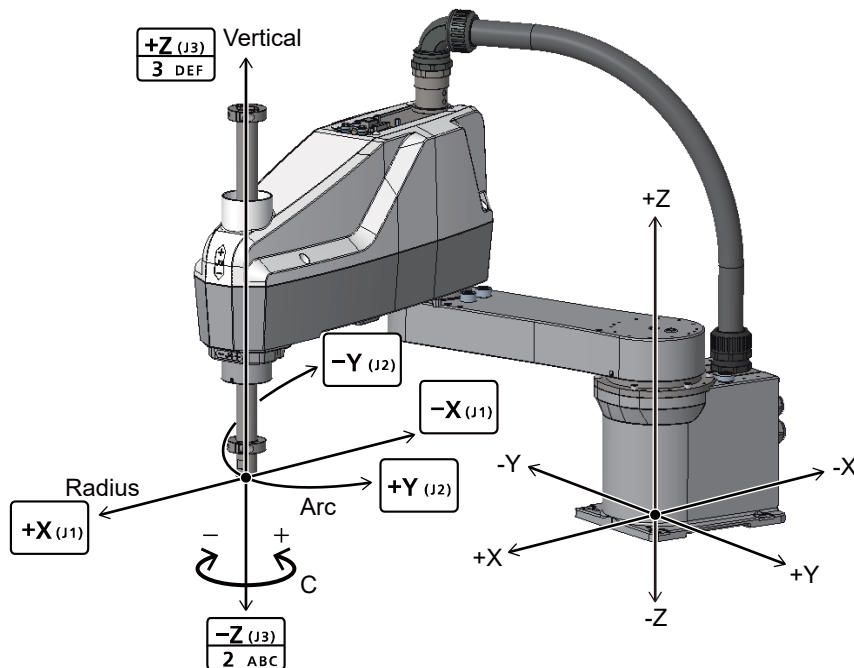
If other jog modes are displayed, please press the function key corresponding to the "CYLINDER." (If the jog mode which he wishes under the screen is not displayed, it is displayed that the [FUNCTION] key is pressed)

If it finishes jog operation, press the [JOG] key again, or function key which correspond to "close."

Whenever it presses the key of [OVRD↑], the override goes up. Conversely, if the [OVRD↓] key is pressed, it will go down.

The current setting speed is displayed on the screen upper right.

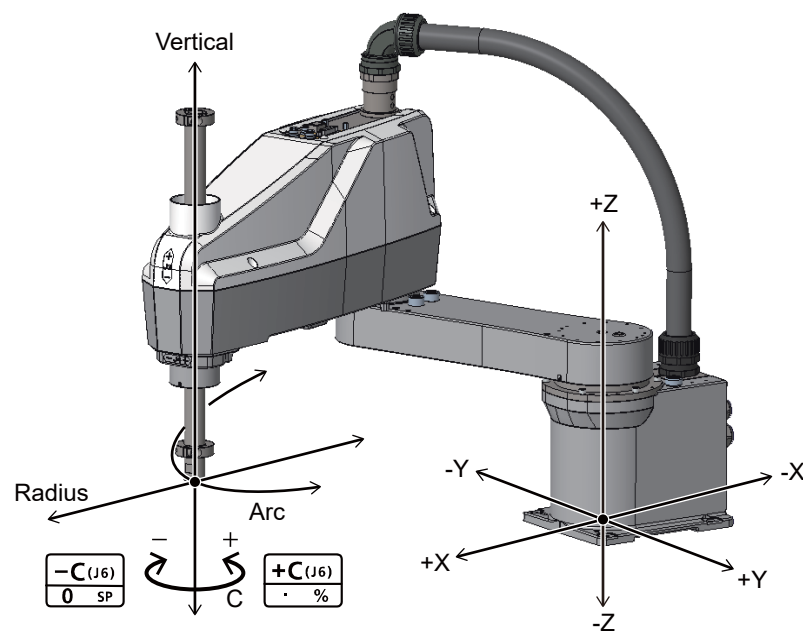
Set the override to 10% here for confirmation work.

Moving along an arc centering on the Z axis

* The direction of the frange will not change.

Assuming that the current position is on an arc centering on the Z axis, the robot moves along that arc.

- When the [+X (J1)] keys are pressed, the robot will expand in the radial direction.
When the [-X (J1)] keys are pressed, contract in the radial direction.
- When the [+Y (J2)] keys are pressed, the robot will move along the arc in the plus direction.
When the [-Y (J2)] keys are pressed, move in the minus direction.
- When the [+Z (J3)] keys are pressed, the robot will move along the Z axis plus direction.
When the [-Z (J3)] keys are pressed, move along the minus direction.



*The position of the end axis will not change.

- When the [+C (J6)] keys are pressed, the Z axis will rotate in the plus direction.
When the [-C (J6)] keys are pressed, rotates in the minus direction.

(6) Work jog operation

Setting of the work coordinates system is necessary.

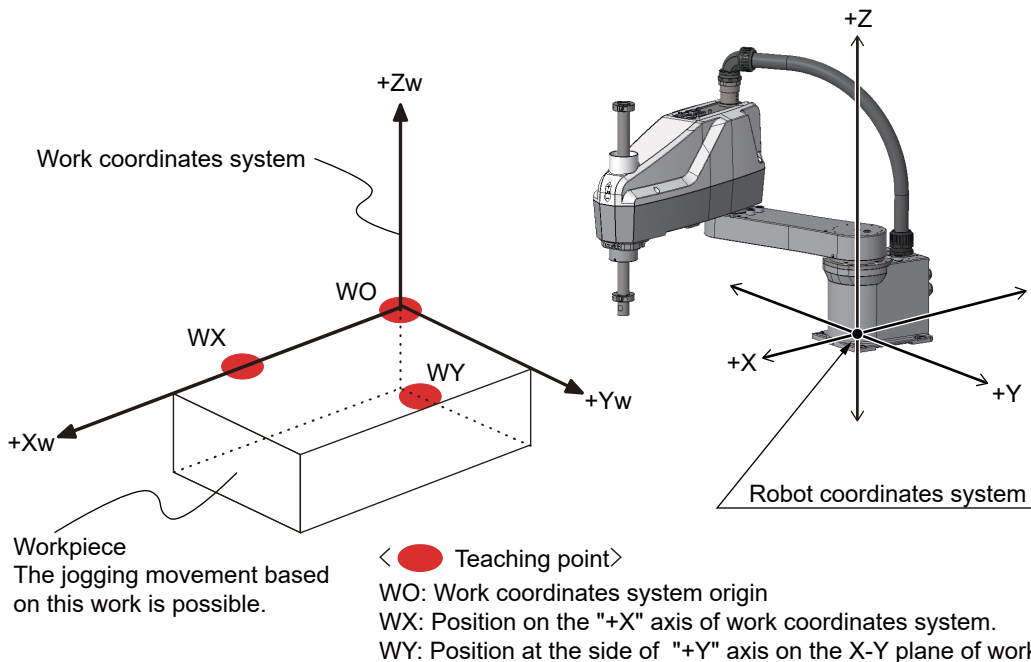
By this jog operation, robot can be move along with the direction of work (or working table etc.), so teaching operations get easier.

When jog operation, select by which work coordinates the robot moves.

The setting method of the work coordinates system using T/B (R33TB) is shown in the following.

(Parameter: Setting the coordinate value to WK n CORD ("n" is meaning the number (1-8) of work coordinates) can also set up the work coordinates system. Refer to the separate manual "Detailed Explanation of Functions and Operations" for details of parameter.)

The work coordinates system teaches and sets up the three points (WO, WX, WY).

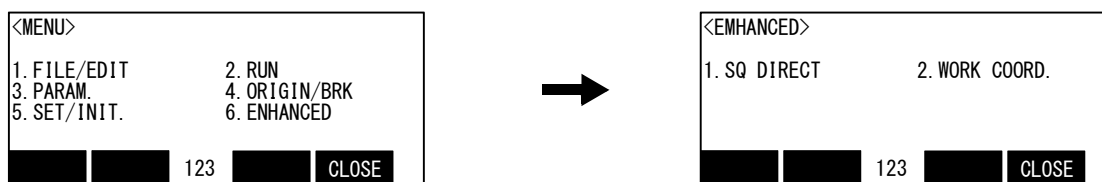


[Supplement] : The coordinate values which use all three teaching points for setting of the work coordinates system are each only X, Y, and the Z-axis. Although the coordinate value of A, B, and C axis is not used, positioning will get easy if the XYZ jog or TOOL jog movement is effected with the same value. (The direction of the hand is the same)

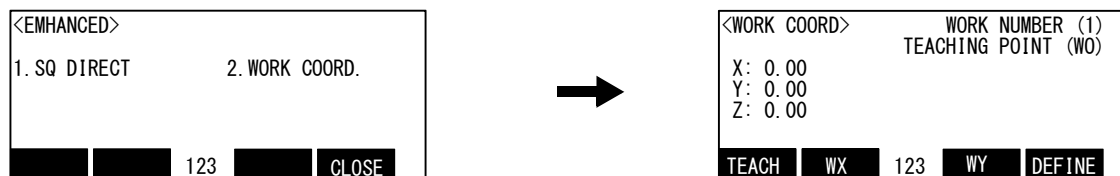
Fig.2-24:Setting of the work coordinates system (teaching point)

The setting (definition) method of the work coordinates system is shown as following.

- 1) Select "6.ENHANCED" screen on the <MENU> screen.



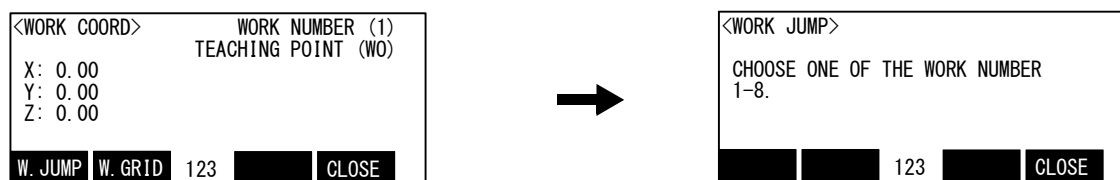
- 2) Press the [2] keys in the menu screen and select "2. WORK COORD."



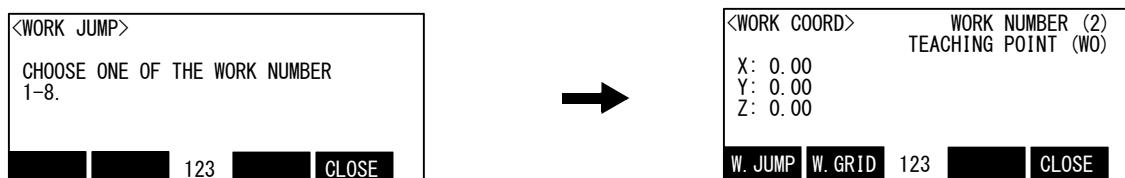
The screen shows the coordinate value of the origin (WO) of the work coordinates number 1.

- 3) Selection of the work coordinates number

Press the [FUNCTION] keys, and display "W: JUMP" function. Press the function key corresponding to "W: JUMP"



Press numeral key [1] - [8] and specify the work coordinates number. The coordinate value of the specified work coordinates system is displayed.

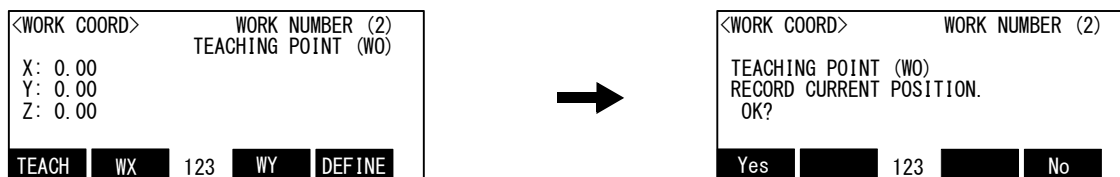


Operation will be canceled if the [CLOSE] key is pressed.

The screen is the example which specified the work coordinates number 2. ("2" at the upper right of the screen)

- 4) The teaching of the work coordinates system

Teach the three points shown in Fig. 2-24. Confirm the name currently displayed on the "TEACHING POINT" at the upper right of the screen. If it differs, press the function key corresponding to each point(WO, WX, WY) to teach. Move the robot's arm by jog operation (other jogging movement), and press the function key corresponding to "TEACH."([F1]) The confirmation screen is displayed.



Specify the teaching point [WO],[WX],[WY]
teaching the position [TEACH]

Presses the function key corresponding to "Yes", the robot's current position is registered, and the registered coordinates value is displayed. Operation will be canceled if the [CLOSE] key is pressed.

<WORK COORD>		WORK NUMBER (2)	
TEACHING POINT (WO)			
RECORD CURRENT POSITION.			
OK?			
Yes	123	No	

→

<WORK COORD>		WORK NUMBER (2)	
TEACHING POINT (WO)			
X:	214.12		
Y:	-61.23		
Z:	553.30		
W. JUMP	W. GRID	123	CLOSE

Teach the three points, WO, WX, and WY, by the same operation.

The position data taught here is each registered into the following parameters. ("n" means the work coordinates numbers 1-8)

WO= parameter: WKnWO

WX= parameter: WKnWX

WY= parameter: WKnWY

5) Setting of work coordinates (definition)

If the function key corresponding to "DEFINE" ([F1]) is pressed, the work coordinates system will be calculated using the three points, and the result will be displayed.

<WORK COORD>		WORK NUMBER (2)	
TEACHING POINT (WO)			
X:	214.12		
Y:	-61.23		
Z:	553.30		
TEACH	WX	123	WY DEFINE

→

<WORK COORD>		WORK NUMBER (2)	
WORK COORDINATES DATA			
(3.53, -220.00, 5.14, 0.00, 0.00, 0.00)			
		123	CLOSE

The alarm occurs if the work coordinates system is incalculable. (There are the three points on the straight line, or the two points have overlapped) In this case, reset alarm and re-teach the three points.

This work coordinate data is registered into parameter: WKnCORD. ("n" means the work coordinates numbers 1-8)

If the function key corresponding to "CLOSE" is pressed, it will return to the previous screen.

<WORK COORD>		WORK NUMBER (2)	
WORK COORDINATES DATA			
(3.53, -220.00, 5.14, 0.00, 0.00, 0.00)			
		123	CLOSE

→

<WORK COORD>		WORK NUMBER (2)	
TEACHING POINT (WO)			
X:	214.12		
Y:	-61.23		
Z:	553.30		
TEACH	WX	123	WY DEFINE

6) Finishing of setting the work coordinates

Press the [FUNCTION] keys, and display "CLOSE" function. Press the function key corresponding to "CLOSE". Returns to the <MENU> screen.

<WORK COORD>		WORK NUMBER (2)	
TEACHING POINT (WO)			
X:	214.12		
Y:	-61.23		
Z:	553.30		
W. JUMP	W. GRID	123	CLOSE

→

<EMHANCED>			
1. SQ DIRECT		2. WORK COORD.	
		123	CLOSE

Although setting of work coordinates is finishing above, confirmation of work coordinates can be done by pressing the function key corresponding to "W GRID."([F2])

<WORK COORD>		WORK NUMBER (2)	
X: 214.12		TEACHING POINT (W0)	
Y: -61.23			
Z: 553.30			
W. JUMP	W. GRID	123	CLOSE



<WORK COORD>		WORK NUMBER (2)	
WORK COORDINATES DATA			
(3.53, -220.00, 5.14, 0.00, 0.00, 0.00)			
		123	CLOSE

Return to the previous screen by pressing the [CLOSE] ([F4]) key.

Then, the operation method of the work jog is shown.
Change to the work jog after nearing the work.

Select WORK jog mode

<CURRENT>		WORK		100% M1 TO W1	
J1:	+0.00	J5:	+0.00		
J2:	+0.00	J6:	+0.00		
J3:	+90.00	:	:		
J4:	+0.00	:	:		
XYZ	TOOL	JOG	3-XYZ	CYLNR	⇒



FUNCTION

F1

to

F4

WORK jog mode

Note) The displayed values are based on the XYZ coordinate system.

[JOG] Press the key and display the jog screen. ("JOG" is displayed on the screen bottom)

Check that the "WORK" in jog mode is displayed on the screen.

If other jog modes are displayed, please press the function key corresponding to the "WORK." (If the jog mode which he wishes under the screen is not displayed, it is displayed that the [FUNCTION] key is pressed)

If it finishes jog operation, press the [JOG] key again, or function key which correspond to "close."

Confirmation and selection of the work coordinates system

<CURRENT>		WORK		100% M1 TO W1	
J1:	+0.00	J5:	+0.00		
J2:	+0.00	J6:	+0.00		
J3:	+90.00	:	:		
J4:	+0.00	:	:		
XYZ	TOOL	JOG	3-XYZ	CYLNR	⇒

Target work coordinates system



Select the work coordinates system

Confirm the target work coordinates system.

The current target number is displayed on the screen upper right. (W1 - W8)

The number of work coordinates can be changed by the arrow key [Upper arrow], [Lower arrow]

Push the key [Upper arrow], the number will increase. (W1, W2, W8) Conversely, push the key [Lower arrow], the number will decrease



CAUTION

Always confirm that the number of the target work coordinates system is displayed correctly (Display of W1-W8 at the upper right of the screen)

If mistaken, the robot will move in the direction which is not meant and will cause the damage and the personal injuries.

Set jog speed

<CURRENT>		JOINT		100% M1 TO	
J1:	+0.00	J5:	+0.00		
J2:	+0.00	J6:	+0.00		
J3:	+90.00	:	:		
J4:	+0.00	:	:		
XYZ	TOOL	JOG	3-XYZ	CYLNR	⇒

OVRD ↑

OVRD ↓

Setting the speed

Whenever it presses the key of [OVRD(Upper arrow)], the override goes up. Conversely, if the [OVRD(Lower arrow)] key is pressed, it will go down.

The current setting speed is displayed on the screen upper right.

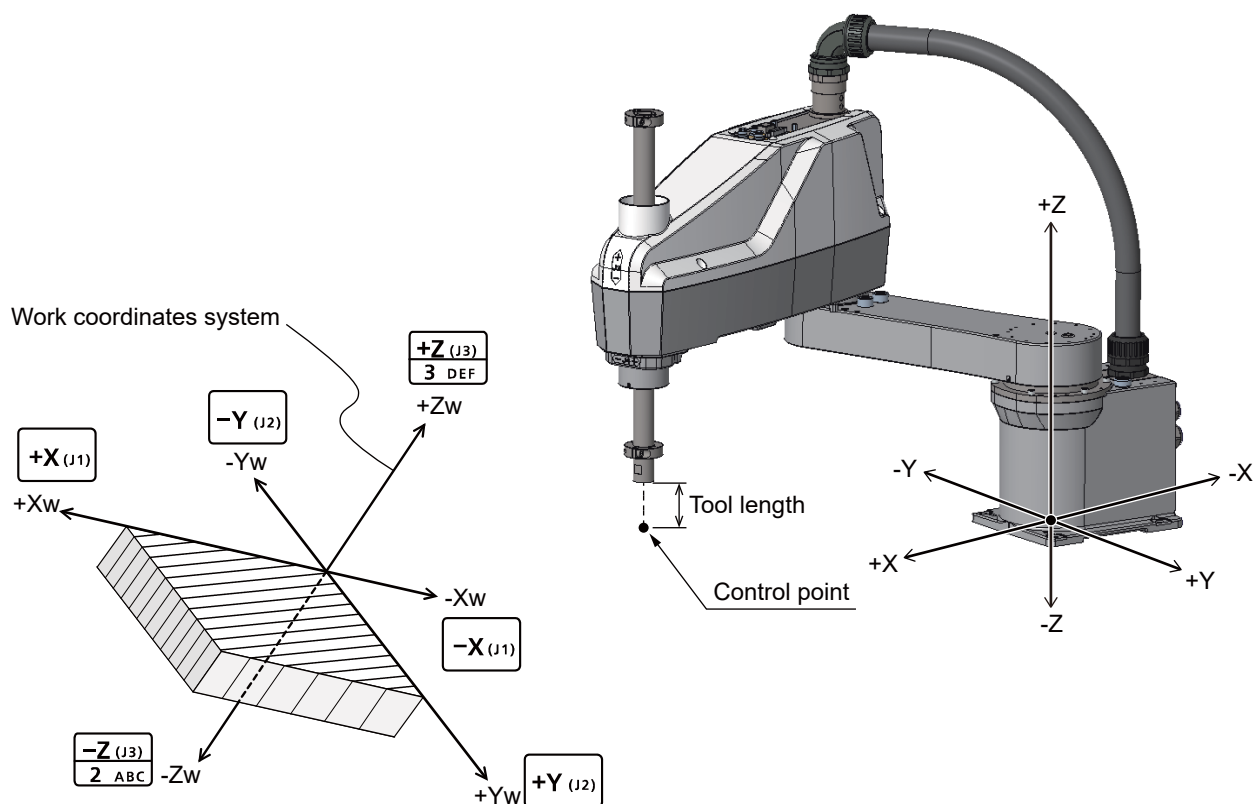
Set the override to 10% here for confirmation work

The WORK jog operation and the Ex-T jog operation can be switched by setting the parameters WK1-JOGMD to WK8JOGMD of each work coordinates system.

The respective operations are as follows.

WORK jog operation mode	Conventional WORK jog	Ex-T jog
Parameters WK n JOGMD (n is 1 to 8) setting	0 (initial value)	1
XYZ key operation	Moves along each axis of the work coordinates system	Same as the conventional WORK jog
C key operation	With the control point position maintained, the direction changes along the work coordinates system.	While the control point position is changed, the direction changes on the Z axis of the work coordinates system (Z _w).
AB key operation	The robot does not move.	The robot does not move.

The jog movement based on work coordinates system



* The direction of the end axis will not change.

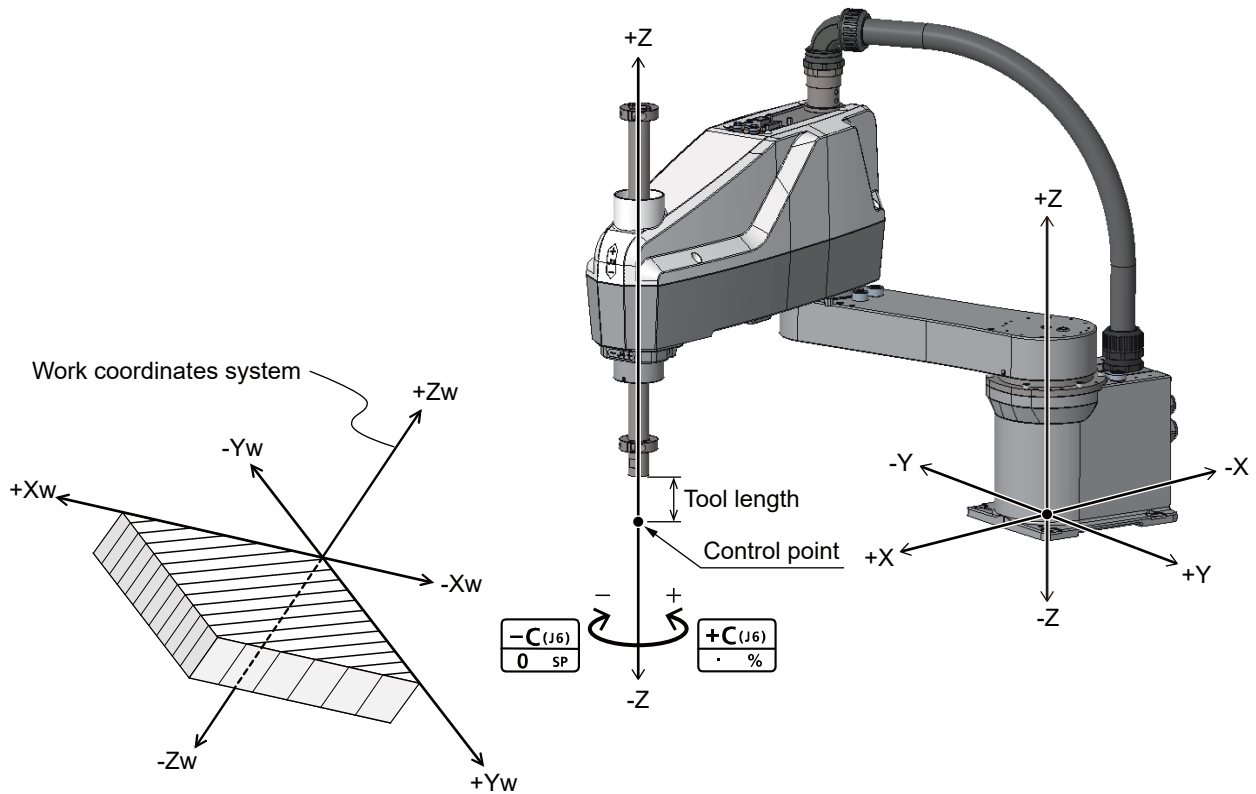
Move the control point with a straight line in accordance with the work coordinates system

- When the [+X (J1)] keys are pressed, the robot will move along the X axis (X_w) plus direction on the work coordinates system.
When the [-X (J1)] keys are pressed, Move along the minus direction.
- When the [+Y (J2)] keys are pressed, the robot will move along the Y axis (Y_w) plus direction on the work coordinates system.
When the [-Y (J2)] keys are pressed, Move along the minus direction.
- When the [+Z (J3)] keys are pressed, the robot will move along the Z axis (Z_w) plus direction on the work coordinates system.
When the [-Z (J3)] keys are pressed, Move along the minus direction.

When the X, Y, or Z keys are used, the operation is the same in the WORK jog and the Ex-T jog modes.

Changing the end axis posture

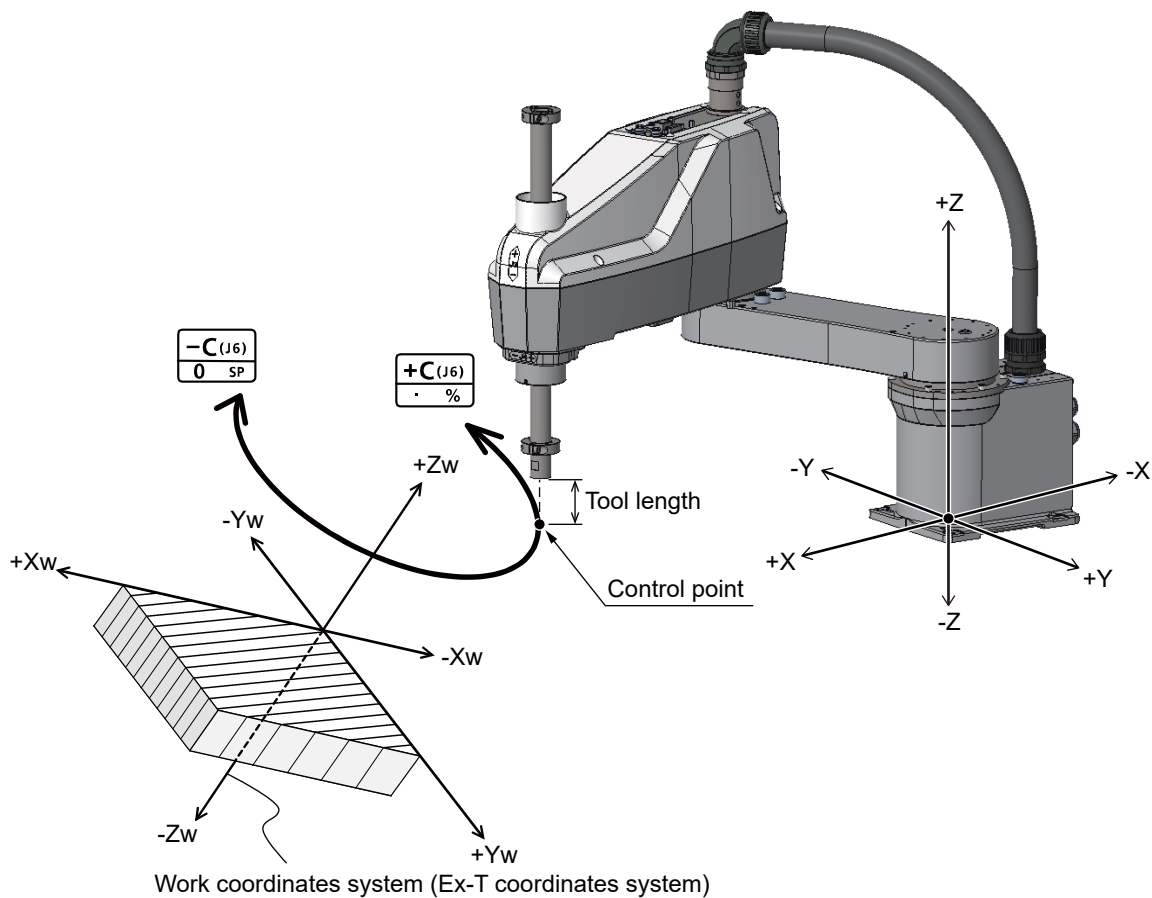
<1> Work jog mode



* The position of the control point does not change.
The end axis is rotated.

- When the [+C (J6)] keys are pressed, the Z axis will rotate in the plus direction of the XYZ coordinate system.
When the [-C (J6)] keys are pressed, rotate in the minus direction.

<2> Ex-T jog mode



- When the [+C (J6)] keys are pressed, the control point will rotate in the plus direction around the Z axis (Zw) of work coordinates system (Ex-T coordinates system).
When the [-C (J6)] keys are pressed, the control point will rotate in the minus direction.

◆◆◆ When the robot is in the transportation posture ◆◆◆

There are directions from which linear movement is not possible from the transportation posture. In this case, the robot will not move. Refer to [Page 30, "\(1\) JOINT jog operation"](#), and move the robot to a position where linear movement is possible, and then carry out XYZ jog.

◆◆◆ If the buzzer of T/B sounds and the robot does not move ◆◆◆

If it is going to move the robot across the operation range, the buzzer of T/B sounds and the robot does not move. In this case, please move to the counter direction.

◆◆◆ Tool length ◆◆◆

The default tool length is 0mm, and the control point is the center of the end axis.
After installing the hand, set the correct tool length in the parameters. Refer to the separate manual "Detailed Explanation of Functions and Operations" for details.

2.3.4 Setting the hand parameters

Set the parameters to set the hand I/O type and the hand condition according to the robot hand to be used. Refer to the separate volume, "Instruction Manual/Detailed Explanations of Functions and Operations" for how to set parameters.

Table 2-5: Hand parameter

Parameter	Parameter name	Details explanation	Factory setting
Hand I/O type	HIOTYPE	Set either the sink type or the source type for the solenoid valve and the logic of the hand input signal. -1: Not set 0: Source type 1: Sink type	-1
Hand condition	HNDDAT* * is 0 to 8	Set the initial condition of the hand. (Specify with the tool coordinate system.) (Weight, size X, size Y, size Z, center of gravity X, center of gravity Y, center of gravity Z) Unit: kg, mm  CAUTION Set the hand and workpiece conditions correctly. If a value lower than the actual load is set, the life of robot mechanical parts may be shortened.	The setting varies depending on the model.
Hand condition setting check	HNDCHK	Enable or disable whether to notify that the HNDDAT parameter is not set. 0: Disabled 1: Enabled When this parameter is set to "1" (enabled), error C0330 will occur upon power on of the controller if all the values of the hand condition parameter HNDDAT* (* = 0 to 8) are not set (not changed from the initial values). When this parameter is set to "0" (disabled), the above settings are not checked, and error C0330 does not occur even if the hand conditions are not set. This parameter is available with controller software version C2d or later.	1

3 Installation of optional equipment

3.1 Operation range change

The operation range of the J1 axis can be limited. Change the mechanical stopper settings and the operation range inside the region between the mechanical stoppers.

When there is possibility of interference with peripheral devices or it is necessary to limit the operation range, set the range as follows.

(1) Angle setting for changing the operation range

The operation range can be set with the angles shown in [Table 3-1](#).

Table 3-1: Angle setting for changing the operation range

Model	Axis	Direction ^{Note1)}	Standard	Angle setting for changing the operation range ^{Note2)} ^{Note3)}		
						Customer-prepared items
RH-10CRH6020/30	J1 axis	Positive	+132°	+110°		—
		Mechanical stopper angle	+133°	+111.9°	Hexagon socket bolt M8 (length: 16)	
		Mechanical stopper position	P10	P11		
		Negative	-132°	-110°		—
		Mechanical stopper angle	-133°	-111.9°	Hexagon socket bolt M8 (length: 16)	
		Mechanical stopper position	P10	P12		
	J2 axis	Positive	+150°	+125°		—
		Mechanical stopper angle	+154.2°	+127.7°	Move the bolt at P13.	
		Mechanical stopper position	P13	P14		
		Negative	-150°	-125°		—
		Mechanical stopper angle	-154.2°	-127.7°	Move the bolt at P15.	
		Mechanical stopper position	P15	P16		
RH-10CRH7020/30	J1 axis	Positive	+132°	+110°		—
		Mechanical stopper angle	+133°	+111.9°	Hexagon socket bolt M8 (length: 16)	
		Mechanical stopper position	P10	P11		
		Negative	-132°	-110°		—
		Mechanical stopper angle	-133°	-111.9°	Hexagon socket bolt M8 (length: 16)	
		Mechanical stopper position	P10	P12		
	J2 axis	Positive	+150°	+125°		—
		Mechanical stopper angle	+154.2°	+127.7°	Move the bolt at P13.	
		Mechanical stopper position	P13	P14		
		Negative	-150°	-125°		—
		Mechanical stopper angle	-154.2°	-127.7°	Move the bolt at P15.	
		Mechanical stopper position	P15	P16		
RH-10CRH8020/30	J1 axis	Positive	+132°	+110°		—
		Mechanical stopper angle	+133°	+111.9°	Hexagon socket bolt M8 (length: 16)	
		Mechanical stopper position	P10	P11		
		Negative	-132°	-110°		—
		Mechanical stopper angle	-133°	-111.9°	Hexagon socket bolt M8 (length: 16)	
		Mechanical stopper position	P10	P12		
	J2 axis	Positive	+150°	+125°		—
		Mechanical stopper angle	+154.2°	+127.7°	Move the bolt at P13.	
		Mechanical stopper position	P13	P14		
		Negative	-150°	-125°		—
		Mechanical stopper angle	-154.2°	-127.7°	Move the bolt at P15.	
		Mechanical stopper position	P15	P16		
RH-20CRH8542	J1 axis	Positive	+170°	+153°	+130°	—
		Mechanical stopper angle	+173.3°	+156.4°	+133.3°	Hexagon socket bolt M12 (length: 20)
		Mechanical stopper position	P10	P11	P12	
		Negative	-170°	-153°	-130°	—
		Mechanical stopper angle	-173.3°	-156.4°	-133.3°	Hexagon socket bolt M12 (length: 20)
		Mechanical stopper position	P10	N11	N12	

Model	Axis	Direction ^{Note1)}	Standard	Angle setting for changing the operation range ^{Note2) Note3)}			Customer-prepared items
RH-20CRH10042	J1 axis	Positive	+170°	+153°	+130°		—
		Mechanical stopper angle	+173.3°	+156.4°	+133.3°		Hexagon socket bolt M12 (length: 20)
		Mechanical stopper position	P10	P11	P12		
		Negative	-170°	-153°	-130°		—
		Mechanical stopper angle	-173.3°	-156.4°	-133.3°		Hexagon socket bolt M12 (length: 20)
		Mechanical stopper position	P10	N11	N12		

Note1) Refer to [Fig. 3-1](#) for the mechanical stopper position.

Note2) The angles in [Table 3-1](#) for the axes show the movable range set by software.

The mechanical stopper angles in the table show the angles limited by the mechanical stoppers. Care should be needed in designing the layout.

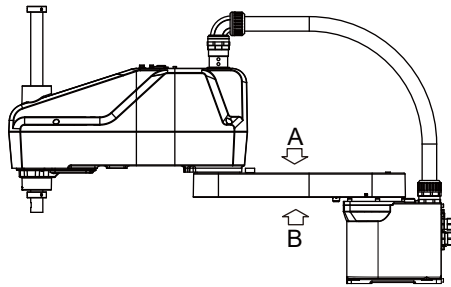
Note3) The positive and negative angles can be set separately.

(2) Operation range change method

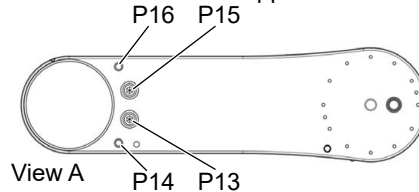
*Installing the mechanical stoppers

- 1) Turn off the controller's power supply.
- 2) Refer to [Table 3-1](#) and [Fig. 3-1](#), and install the stoppers in the screw holes at the angles to be set. [Fig. 3-1](#) shows the mechanical stopper positions. When the screw holes are hidden under the arm, slowly move the No.1 arm by hand.

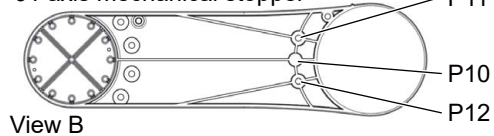
RH-10CRH



J2 axis mechanical stopper



J1 axis mechanical stopper



RH-20CRH

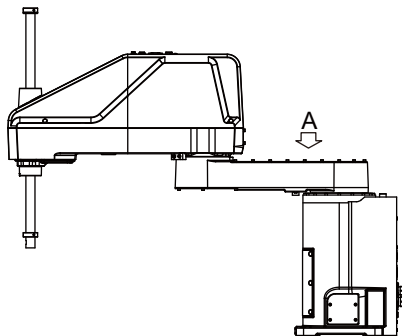
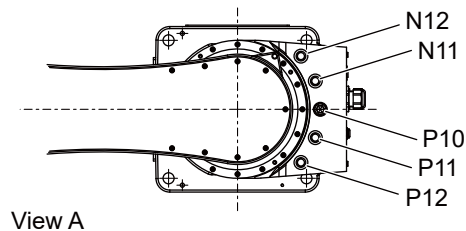


Fig.3-1:Mechanical stopper position

*Changing the operation range parameter

Set the operation range (angle setting in [Table 3-1](#)) in the joint operation range parameter MEJAR.

- 1) Turn on the controller's power supply.
- 2) Set the operation range after the change in the parameter MEJAR.
MEJAR: (J1 negative direction operation range, J1 positive direction operation range, [], [], ...)

*Checking the operation range

Turn off and on the controller's power supply after changing the setting of this parameter. Then, move the axis by joint jog operation to the limit of the operation range to check that the robot stops at the angle after the change.

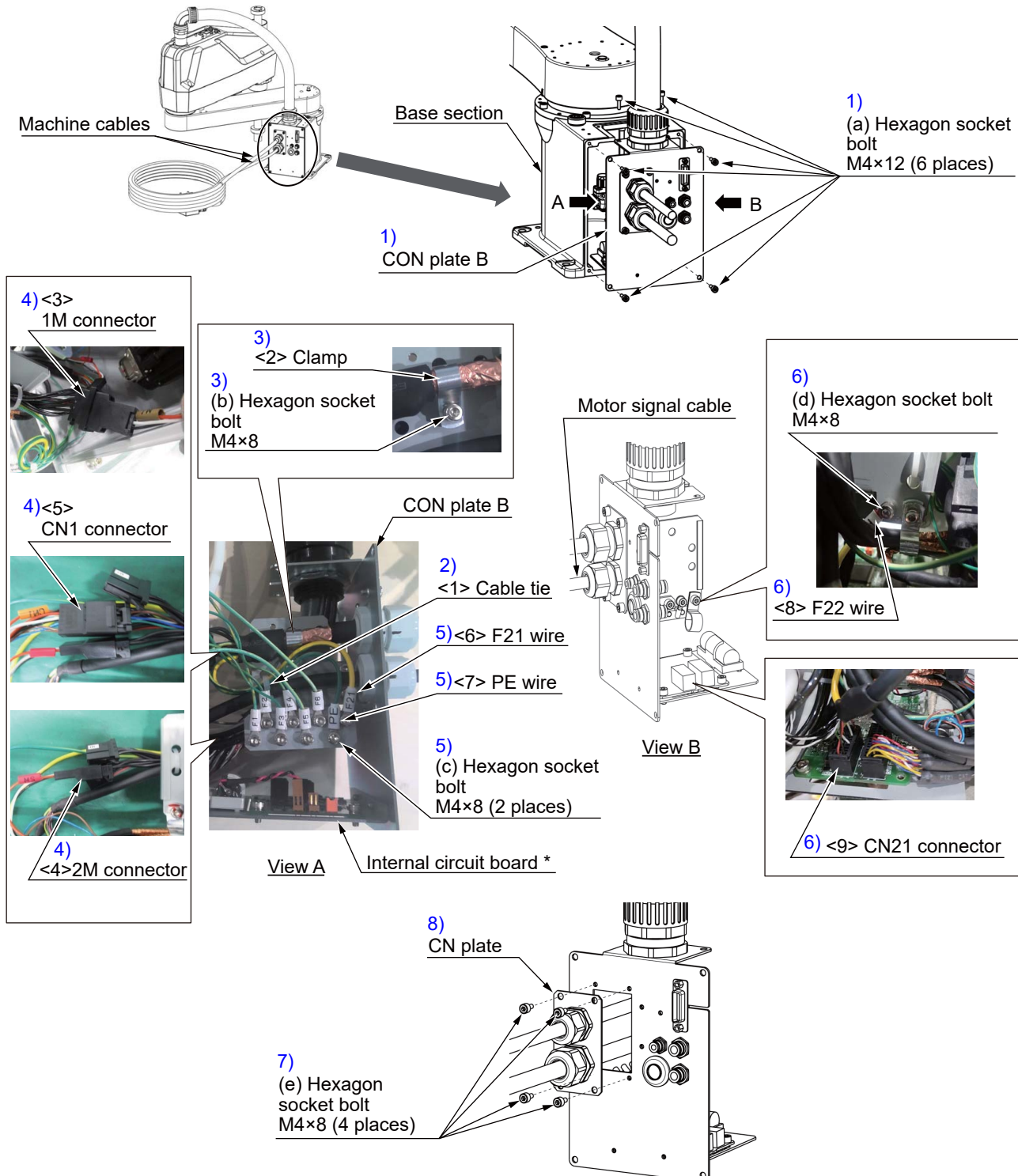
The operation range change is completed.

3.2 Replacement procedure for machine cables (replaceable type)

The replacement method for optional machine cables (replaceable type) is explained.

The robot arm comes with standard accessory machine cables installed before shipment.

(1) RH-10CRH



* Ensure the exposed circuit board does not come into contact with any surrounding metal parts.

Fig.3-2:Replacing machine cables (replaceable type) on the RH-10CRH

- 1) Remove the installation screws (a) from CON plate B on the back of the base, and pull CON plate B forward.



CAUTION

When pulling out CON plate B, ensure the exposed circuit board does not come into contact with any surrounding metal parts.

- 2) Cut the cable tie <1> with nippers, and remove the cables from the plate. The cables use the two holes on the plate and are fixed with cable ties.
- 3) Remove the screw (b) from the clamp <2>.
- 4) Remove the 1M connector <3>, 2M connector <4>, and CN1 connector <5>.
- 5) Disconnect the F21 <6> and PE <7> wires of the power cable. Remove the screws (c) from each of the terminals.
- 6) Disconnect the F22 wire and the CN21 connector of the motor signal cable. Remove the screw (d) from the terminal of the F22 wire <8> then disconnect the CN21 connector <9>.
- 7) Remove the screws (e) from the CN plate.
- 8) Check that all the parts from <1> to <9> have been disconnected or removed, pull out the connectors from the holes on CON plate B, and disconnect the machine cables from the CN plate.

To connect an optional machine cable (replaceable type), conduct the steps for removing the cable in reverse.

When installing the CON plate B and the CN plate, use a bolting torque of 1.39 to 1.89 N·m for the installation screws.

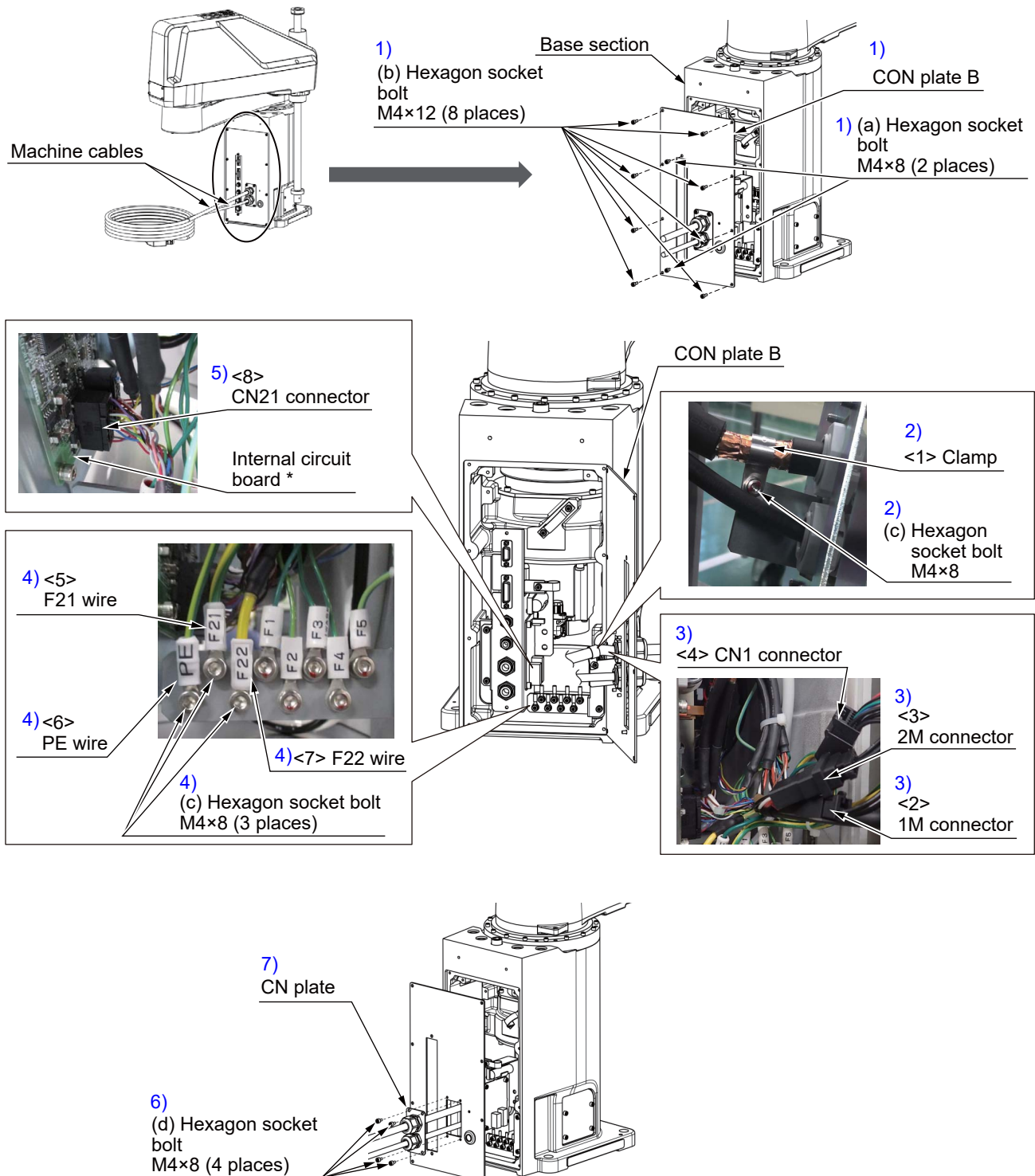


CAUTION

When installing CON plate B and the CN plate, ensure that the cables are not pinched by the plates.

This completes replacement of the machine cables (replaceable type).

(2) RH-20CRH



* Ensure the exposed circuit board does not come into contact with any surrounding metal parts.

Fig.3-3:Replacing machine cables (replaceable type) on the RH-20CRH

- 1) Remove screws (a) and (b) from CON plate B then pull the plate off the rear of the base.



CAUTION

When pulling out CON plate B, ensure the exposed circuit board does not come into contact with any surrounding metal parts.

- 2) Remove the screw (c) from the clamp <1>.
- 3) Remove the 1M connector <2>, 2M connector <3>, and CN1 connector <4>.

- 4) Disconnect the F21 <5> and PE <6> wires of the power cable and the F22 wire <7> of the motor signal cable. Remove the screws (c) from each of the terminals.
- 5) Remove the CN21 connector <8>.
- 6) Remove the screws (d) from the CN plate.
- 7) Check that all the parts from <1> to <8> have been disconnected or removed, pull out the connectors from the hole on CON plate B, and disconnect the machine cable from the CN plate.

To connect an optional machine cable (replaceable type), conduct the steps for removing the cable in reverse.

When installing the CON plate B and the CN plate, use a bolting torque of 1.39 to 1.89 N·m for the installation screws.



CAUTION

When installing CON plate B and the CN plate, ensure that the cables are not pinched by the plates.

This completes replacement of the machine cables (replaceable type).

4 Basic operations

The basic operations from creating the program to automatic operation are explained in section "4. Basic operations" in the "Controller setup, basic operation, and maintenance" manual. Refer that manual as necessary.

5 Maintenance and Inspection

The maintenance and inspection procedures to be carried out to use the robot for a long time without trouble are described in this chapter. The types and replacement methods of consumable parts are also explained.

5.1 Type of inspection and maintenance works

Maintenance and inspection are divided into the inspections carried out daily, and the periodic inspections carry out at set intervals. Always carry these out to prevent unforeseen trouble, to maintain the product for a long time, and to secure safety.

[Table 5-1](#) lists the type of inspection and maintenance works.

Table 5-1: Type of inspection and maintenance works

No.	Type of inspection and maintenance works		Description	Operating time ^{Note1)}
1	Daily inspection		Inspection works to be performed every day before starting operation for the safe use of the robot.	-
2	Periodic inspection	Monthly inspection	Inspection and maintenance works to be performed every month.	Every 300hr
3		3-month inspection	Inspection and maintenance works to be performed every 3 months.	Every 900hr
4		2-year inspection	Inspection and maintenance works to be performed every 2 years.	Every 7,200hr
5		Lubrication	Lubrication of each axis (including the shaft) of the robot. Refer to Page 70, "5.3.4 Lubrication" for the lubrication schedule.	-

Note1) The operating hours assume the robot operation of 15 hours per day for 20 days per month.

When the robot operates for 8 hours per day, the operating hours per month become about a half of the one under the above condition. Then, the monthly inspection is required every two months. To check the periodic inspection schedule and calculate the operating hours, refer to [Page 59, "\(2\) Schedule"](#).

5.2 Inspection items

The inspection items for the robot arm are shown below.

Also refer to section "5. Maintenance and inspection" in the "Controller setup, basic operation, and maintenance" manual, and inspect the controller.

5.2.1 Daily inspection items

Table 5-2 shows the procedure and inspection items. If you notice any abnormal condition, take appropriate measures.

Table 5-2:Daily inspection items (details)

Procedure	Inspection item (details)	Remedies
Before turning power ON (Check the following items before turning the power ON.)		
1	Are any of the robot installation bolts loose? (Visual)	Securely tighten the bolts.
2	Are any of the cover tightening screws loose? (Visual)	Securely tighten the screws.
3	Are any of the hand installation bolts loose? (Visual)	Securely tighten the bolts
4	Is the power supply cable securely connected? (Visual)	Securely connect.
5	Is the machine cable between the robot and controller securely connected? (Visual)	Securely connect.
6	Are there any cracks, foreign contamination or obstacles on the robot and controller cover?	Replace with a new part, or take remedial measures.
7	Is there any abnormality in the pneumatic system? Are there any air leaks, drain clogging or hose damage? Is the air source normal? (Visual)	Drain the drainage, and remedy the air leaks (replace the part).
8	Is grease leaking out of the robot? (Visual)	Wipe off any grease that has leaked out of the robot. If grease continuously leaks out of the robot, contact your dealer. Refer to "Troubles and measures" in the separate Troubleshooting manual for possible causes of the leak.
After turning the power ON (Turn the power ON while monitoring the robot.)		
1	Is there any abnormal motion or abnormal noise when the power is turned ON?	Follow the troubleshooting section.
During operation (try running with an original program)		
1	Check whether the movement points are deviated? Check the following points if there is any deviation. 1. Are any installation bolts loose? 2. Are any hand installation section bolts loose. 3. Are the positions of the jigs other than the robot deviated? 4. If the positional deviation cannot be corrected, refer to "Troubleshooting", check and remedy.	Follow the troubleshooting section.
2	Is there any abnormal motion or abnormal noise? (Visual)	Follow the troubleshooting section.

5.2.2 Periodic inspection

The inspection items and timings for the robot arm are shown below.

(1) Inspection item

Carry out periodic inspection given in [Table 5-3](#).

Table 5-3:Periodic inspection items (details)

Inspection item (details)	Remedies
Monthly inspection	
Are any of the bolts or screws on the robot arm loose?	Securely tighten the bolts.
Are any of the connector fixing screws or terminal block terminal screws loose?	Securely tighten the screws.
3-month inspection	
Is the oil leaking from the felt attached to the ball screw/spline section? If the leaked oil is adhered to the cover, the cover may be deteriorated and cracked.	Wipe off the old grease.
2-year inspection ^{Note1)}	
Is the friction at the timing belt teeth severe?	If the teeth are missing or severe friction is found, replace the timing belt.
Is the timing belt tension value more than the guideline value? Does any position mismatch occur?	When the tension value becomes less than the guideline value, the timing belt must be replaced.
Lubrication	
Check the lubrication schedule for each axis, and perform lubrication. The lubrication schedule differs according to the model.	Lubricate it referring to Page 70, "5.3.4 Lubrication" .
Is enough grease applied on the shaft? (Greasing is required approximately every 2000 km.)	

Note1) When the robot is operated 24 hours a day or with a heavy load, it is recommended to be inspected every 6 months (1,800hr).

(2) Schedule

The following shows the schedule for the periodic inspection works. Perform the periodic inspection works as appropriate according to the following table.

Operating time Note1)	Inspection schedule		Type of periodic inspection works Note2)			
	15 hours per day	8 hours per day	Monthly inspection	3-month inspection	2-year inspection	Lubrication
300hr	1 month	2 months	○			As appropriate Note3)
600hr	2 months	4 months	○			
900hr	3 months	6 months	○	○		
1,200hr	4 months	8 months	○			
1,500hr	5 months	10 months	○			
1,800hr	6 months	12 months	○	○		
:	:	:	:	:	:	
3,600hr	12 months	24 months	○	○		
:	:	:	:	:	:	
7,200hr	24 months	48 months	○	○	○	
:	:	:	:	:	:	
10,800hr	36 months	72 months	○	○		

Note1) The following shows examples of calculation of the operating hours.

Operating hours when the robot operates 15 hours per day for 20 days per month for three months:

15 hr/day × 20 days/month × 3 months = 900hr

Operating hours when the robot operates 8 hours per day for 20 days per month for three months:

8 hr/day × 20 days/month × 3 months = 480hr ... Approx. 500 hr

Note2) The item marked with the circle (○) is to be performed. According to the guideline of the operating hours, perform the inspection to check the items described in [Table 5-3](#).

Note3) Check the lubrication interval described in [Page 70, "5.3.4 Lubrication"](#).

5.3 Maintenance and inspection procedures

The procedures for carrying out the periodic maintenance and inspection are described in this section. Thoroughly read the contents, and follow the instructions. This work can be commissioned to the Mitsubishi Service Department for a fee. (Never disassemble, etc., the parts not described in this manual.)

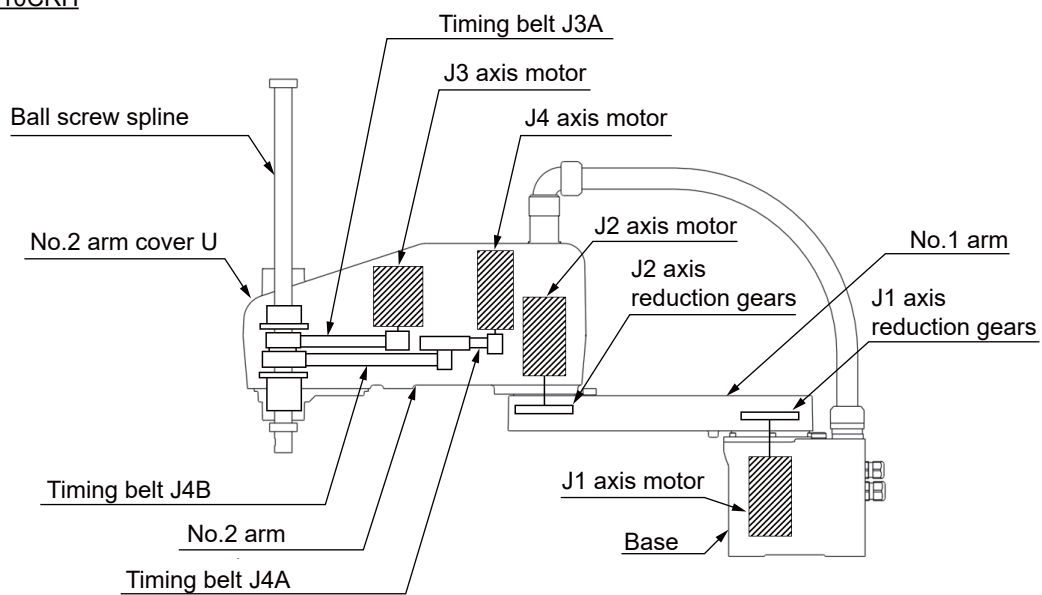
The maintenance parts, etc., required for the customer to carry out maintenance and inspection are described in [Page 75, "5.5 Maintenance parts"](#) of this manual. Always contact your dealer when parts are needed.

CAUTION The origin of the machine system could deviate when this work is carried out. "Review of the position data" and "re-teaching" will be required.

5.3.1 Robot arm structure

An outline structure drawing of the robot arm is shown below.

RH-10CRH



RH-20CRH

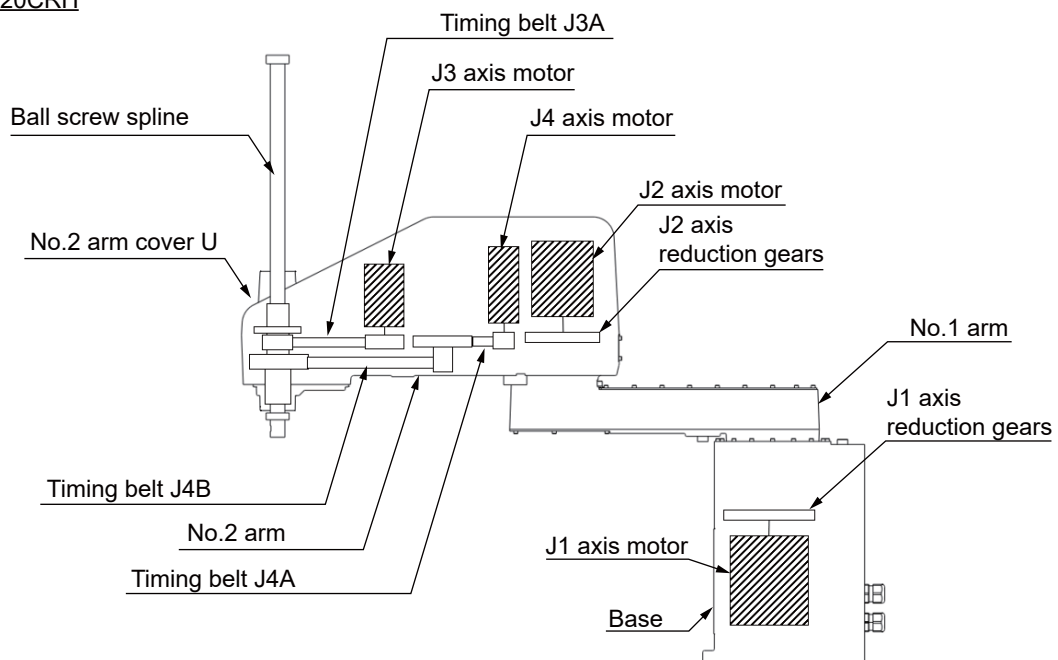


Fig.5-1:Outline structure drawing of robot arm (RH-10CRH, RH-20CRH)

5.3.2 Installing/removing the cover

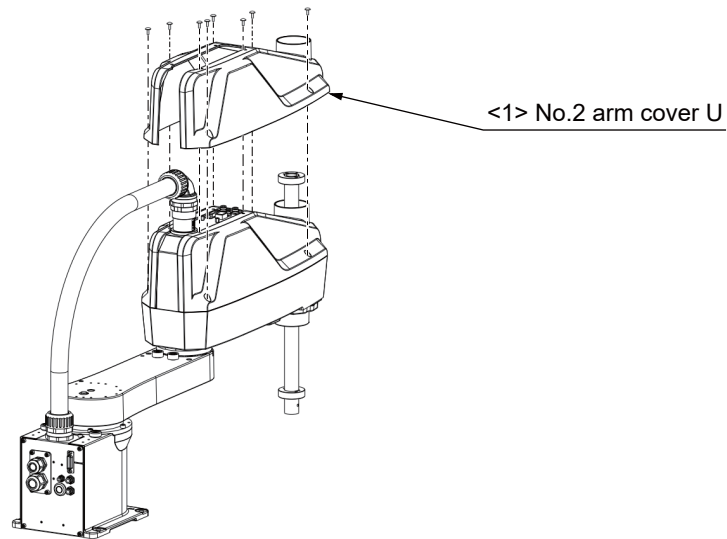
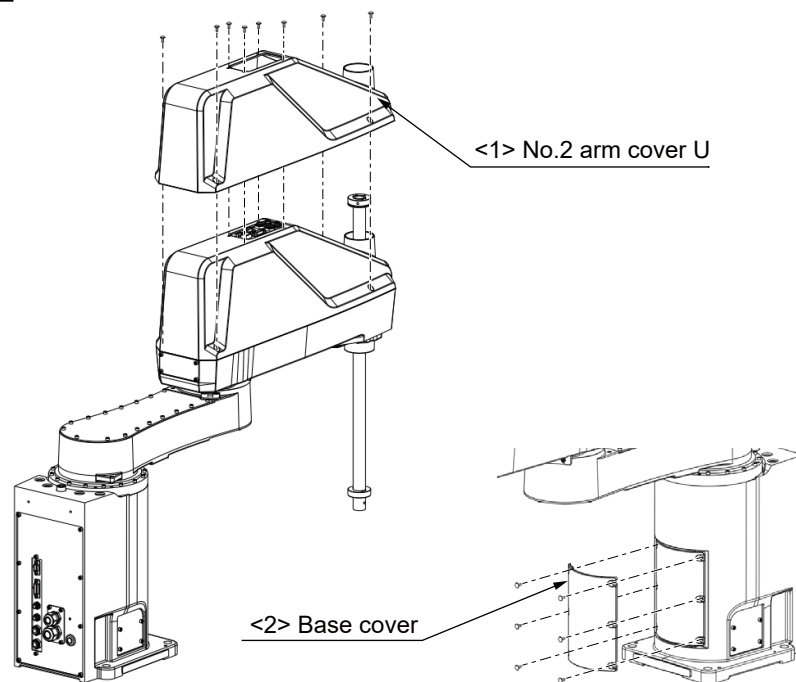
RH-10CRHRH-20CRH

Fig.5-2:Installing/removing the cover (RH-10CRH, RH-20CRH)

Table 5-4:List of covers and installation screws (for RH-10CRH and RH-20CRH)

No.	Cover name	Installation screw	Qty.	Remarks
RH-10CRH				
<1>	No.2 arm cover U	Truss screw M4×10	8	Tightening torque: 1.39 to 1.89 N•m
RH-20CRH				
<1>	No.2 arm cover U	Truss screw M4×10	8	Tightening torque: 1.39 to 1.89 N•m
<2>	Base cover	Truss screw M4×10	6	Tightening torque: 1.39 to 1.89 N•m

- (1) Refer to [Fig. 5-2](#) and [Fig. 5-3](#) to remove the covers.
- (2) The names of the covers are given in [Table 5-4](#).
- (3) When installing the cover after maintenance and inspection, use the procedure of removal in reverse.
Bolt the installation screw with the torque shown in [Table 5-4](#).

5.3.3 Inspection replacement of timing belt

This robot uses a timing belt for the drive conveyance system. Compared to gears and chains, the timing belt does not require lubrication and has a low noise. However, if the belt usage method and tension adjustment are inadequate, the life could drop and noise could be generated. Sufficient aging to remove the initial elongation of the belt have been carried out before shipment from the factory.

However, depending on the robot working conditions, elongation will occur gradually over a long time. The tension must be confirmed during the periodic inspection.

Please prepare the sound wave type belt tension gauge in inspection of the timing belt. Refer to the [Page 68, "\(4\) Timing belt tension"](#) for the tension of the timing belt.

The recommendation gauge is shown below.

Manufacture: Gates Unitta Asia Company

Type: U-550



Fig.5-3:Tension adjustment method of timing belt

CAUTION

When the timing belt has to be removed for repair or some other reason, measure the tension before removing the belt.

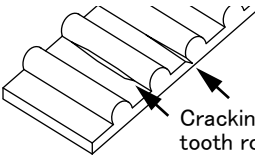
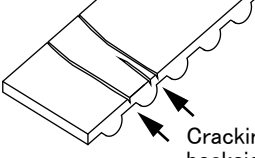
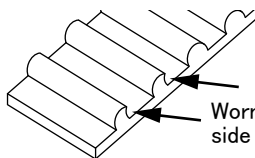
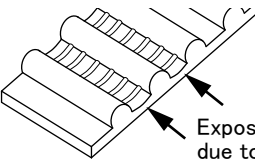
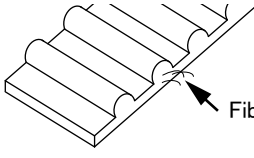
When the belt is reinstalled, the tension must be the same as the one measured before removal. Otherwise, the life of the belt and the relevant parts may be shortened.

(1) Timing belt replacement period

The timing belt life is greatly affected by the robot working conditions, so a set time cannot be given. However, if the following symptoms occur, replace the belt.

- 1) The belt tension value becomes less than the guideline value.
- 2) A position mismatch or gear teeth skipping occurs.
- 3) The belt is damaged as shown in [Table 5-5](#).

Table 5-5: Typical damage conditions of the timing belt

Damage condition	Appearance	Cause
Gear tooth crack	 Cracking at the tooth root	Overload
Backside crack	 Cracking on the backside of the belt	Deterioration of rubber due heat to or ozone
Worn teeth	 Worn out on one side	Overload Excessive or insufficient tension
Tooth bottom abrasion and exposure of cores	 Exposure of cores due to abrasion	Excessive tension
The following is not a belt damage.		
Fibers coming out of the side face of the belt	 Fibers	Manufacturing related factor. This is not a belt damage.

**CAUTION**

Due to the manufacturing of the timing belt, initial wear will occur. Wear chips may accumulate in the cover after approx. 300 hr of operating the robot, but this is not a fault.

**CAUTION**

When the belt is replaced, the machine system origin may deviate. After the replacement, ensure to reset the origin.

(2) Timing belt tension measurement

Rotate the drive axis timing pulley in one direction while visually checking its position. Measure the belt tension at 90-degree intervals, four times in total. The average of the four measurements is used as the timing belt tension value.

The timing belt must be pulled tight before the tension is measured. For this purpose, rotate the drive axis timing pulley 90 degrees before measurement. Measure the tension of the belt from the side of the belt that will begin to wind around the drive axis timing pulley.

When the temperature of the robot arm is high, the timing belt tension is increased. To ensure reliability of the measurement, take measurements at least 30 minutes after the robot stops its movement.

Low ambient temperature may make accurate measurements using a tension gauge impossible. In this case, perform the automatic operation or jog operation at measuring target axis for a few minutes, then measure the tension of the belt.

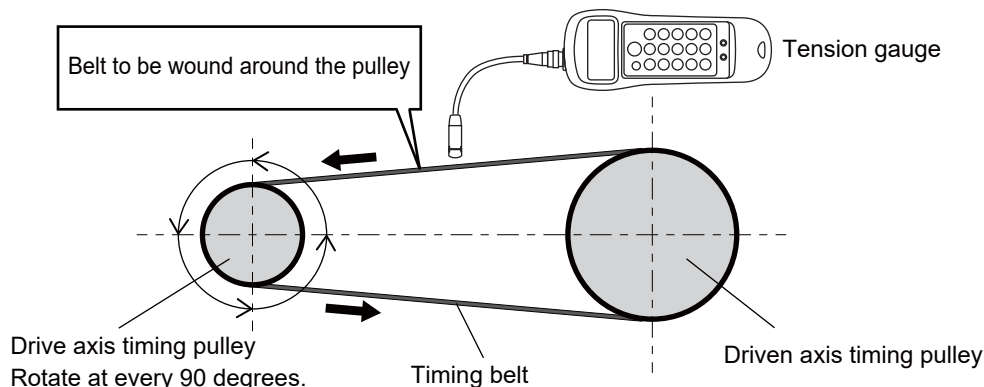


Fig.5-4:Timing belt tension measurement

Table 5-6:List of drive axes and driven axes

Axis	Pulley name	Pulley type
J3 axis	Timing pulley J3A	Drive axis
	Timing pulley J3B	Driven axis
J4 axis	Timing pulley J4A	Drive axis
	Timing pulley J4B	Driven axis
	Timing pulley J4C	Drive axis
	Timing pulley J4D	Driven axis

The procedure is shown below.

- 1) Turn on the controller's power supply.
- 2) Rotate the drive axis timing pulley in one direction using jog operation while visually checking its position. Measure the belt tension at 90-degree intervals, four times in total (one full turn of the drive axis timing pulley).
For information on the amount each axis moves when the drive axis timing pulley is rotated 90 degrees, refer to [Page 69, "\(5\) Amount of movement of each axis during the timing belt tension measurement"](#).
- 3) Take an average of the four measurements to determine the timing belt tension value.
During inspection of the timing belt, check that the belt tension exceeds the replacement guideline value in [Page 68, "\(4\) Timing belt tension"](#). When the belt tension value becomes less than the guideline value, the belt must be replaced immediately.

(3) Inspection of timing belt

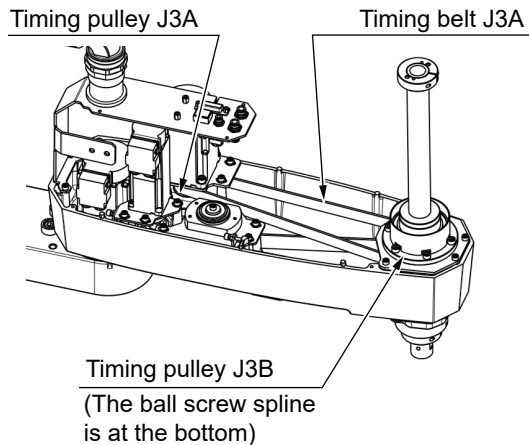
The parts related to the inspection of the timing belt are shown in Fig. 5-5. The picture is the image which removed the No.2 arm cover.

Replacement of the timing belt will be performed by Mitsubishi Electric.

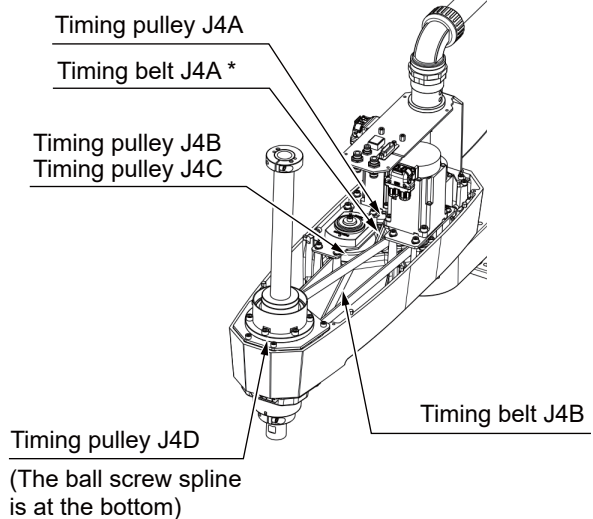
Check the serial numbers of the robot arm and the controller, and contact Mitsubishi Electric.

RH-10CRH

<J3 axis>

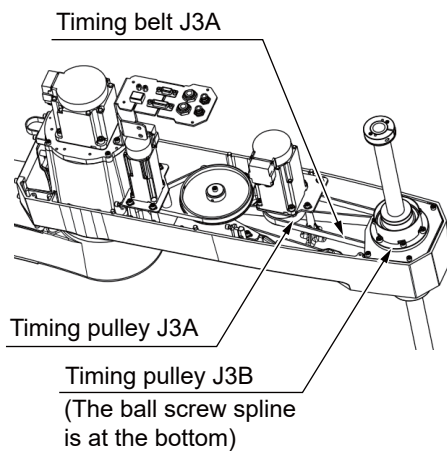


<J4 axis>

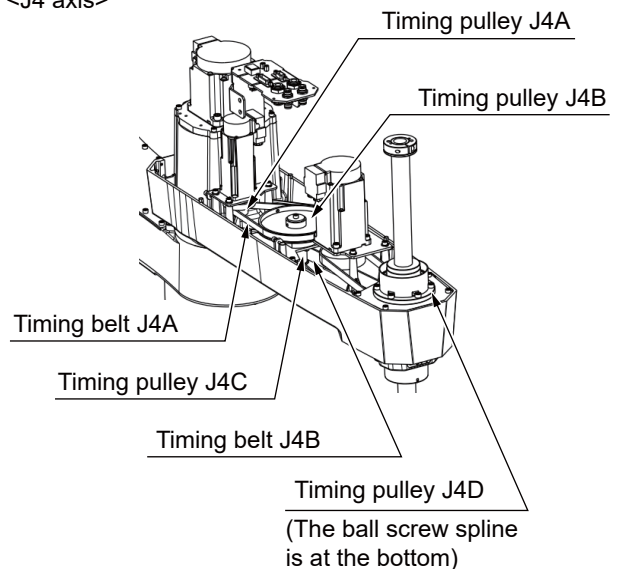


RH-20CRH

<J3 axis>



<J4 axis>



* When measuring the tension of the J4A timing belt on the RH-10CRH, insert the sonic belt tension gauge from the direction shown by the arrow in the figure below.

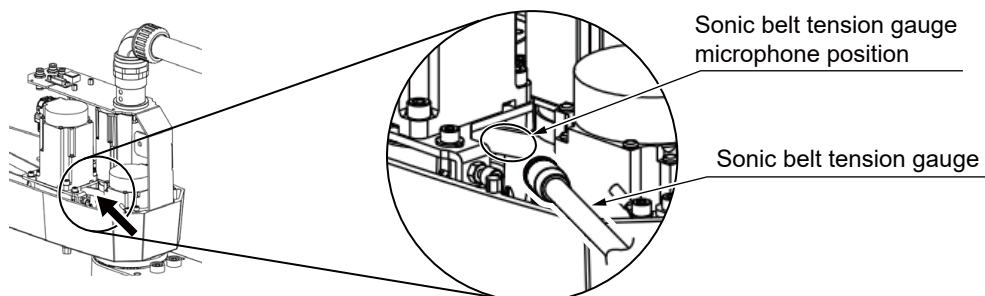


Fig.5-5:Inspecting the timing belt

The procedure for inspecting the timing belt is shown below.

- 1) Refer to [Page 61, "5.3.2 Installing/removing the cover"](#), and remove the No.2 arm cover U.
- 2) Visually confirm that the symptoms indicated in [Page 64, "\(1\) Timing belt replacement period"](#) have not occurred with the timing belt.
- 3) Refer to [Page 65, "\(2\) Timing belt tension measurement"](#), and confirm the belt tension.
- 4) Install the No.2 arm cover U securely as before and finish inspection.

(4) Timing belt tension

The following table shows the preset values of the sonic belt tension gauge, the tension value for new belt installation, and the tension value as the replacement guideline.

Table 5-7: Belt tension

Axis	Belt type	Preset value			Tension for new belt installation (N)	Replacement guideline tension (N)
		M(g/m)	W(mm/R)	S(mm)		
RH-10CRH series						
Timing belt J3A	150MTS3M729-G	2.2	15	243	71.1 to 86.9	39.5
Timing belt J4A	297-EV3GT-10	2.5	10	99	44.1 to 53.9	24.5
Timing belt J4B	200MTS3M624-G	2.2	20	208	96.6 to 118.0	53.7
RH-20CRH series						
Timing belt J3A	120MTS3M579-G	2.2	12	193	55.8 to 68.2	31.0
Timing belt J4A	417-EV3GT-9	2.5	9	139	39.6 to 48.4	22.0
Timing belt J4B	200MTS3M789-G	2.2	20	263	96.6 to 118.0	53.7

(5) Amount of movement of each axis during the timing belt tension measurement

The amount each axis moves when the drive axis timing pulley is rotated 90 degrees is shown in [Table 5-8](#).

Table 5-8: Amount of movement of each axis during the tension measurement

Model	Amount of movement		
	Timing belt J3A	Timing belt J4A	Timing belt J4B
RH-10CRH series	6.0 mm	13.7°	15.6°
RH-20CRH series	12.5 mm	12.0°	51.0°

5.3.4 Lubrication

(1) Lubrication position and specifications

The grease nipple position is shown in Fig. 5-6. The lubrication specifications for each place are shown in Table 5-9. Refer to the Page 61, "5.3.2 Installing/removing the cover" for the method of removing and installing the cover.

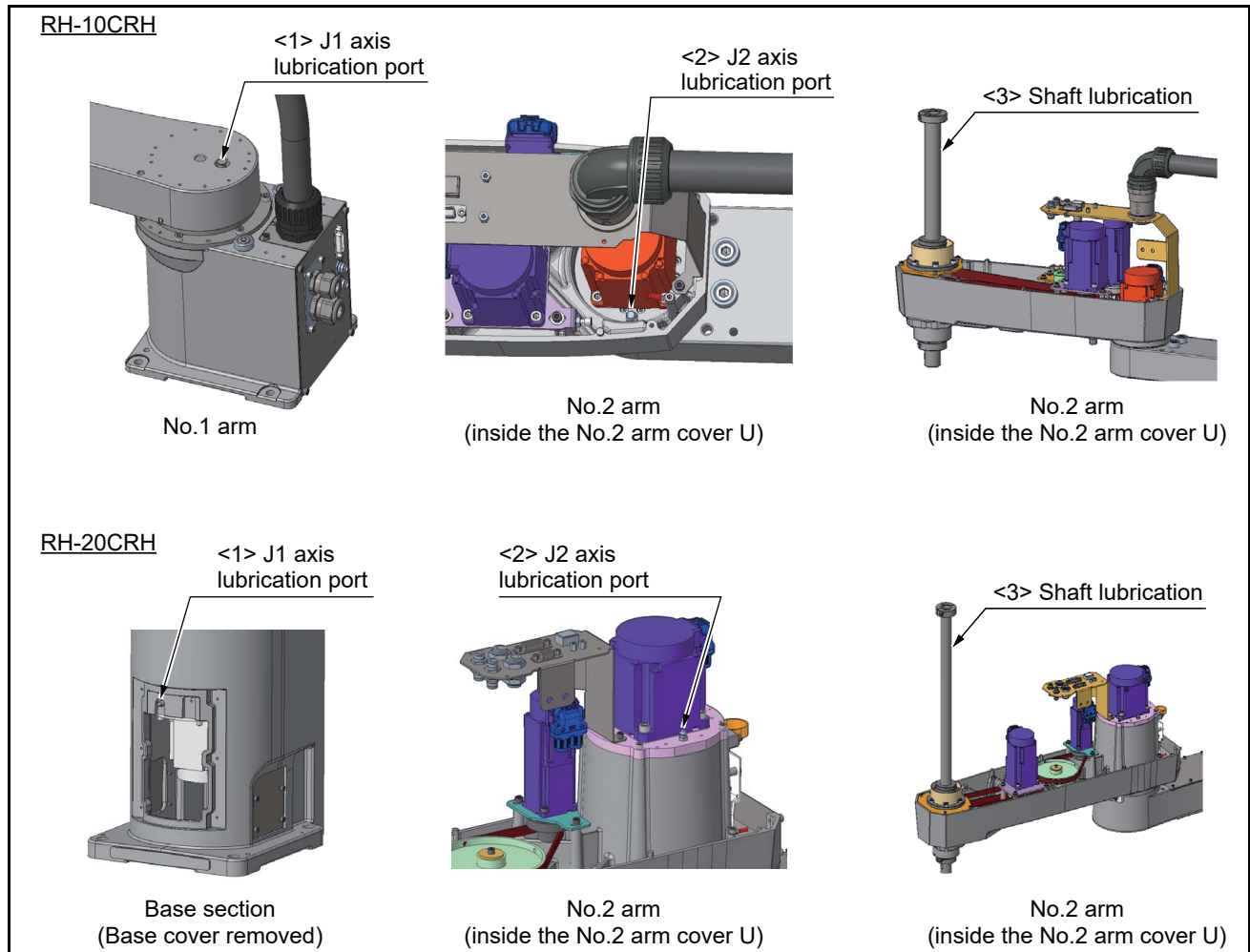


Fig.5-6:Lubrication positions

Table 5-9:Lubrication specifications

No.	Parts to be lubricated	Oiling method	Lubrication oil (maker)	Lubrication interval	Lubrication amount guide	Cover to remove
RH-10CRH						
<1>	J1 axis reduction gears	Grease nipple WA-610	Sumiplex SFB No.1 (NIDEC DRIVE TECHNOLOGY CORPORATION)	24,000 Hr	8 g	-
<2>	J2 axis reduction gears	Grease nipple WA-610		24,000 Hr	5 g	No.2 arm cover U
<3>	Shaft (Ball screw spline)	Wipe the old grease, and paint	Marutenpu PS No.2 (KYODO YUSHI CO.,LTD.)	Every 2000km movement	1 g	
RH-20CRH						
<1>	J1 axis reduction gears	Grease nipple WA-610	SK-1A (Harmonic Drive Systems Inc.)	6,000 Hr	12 g	Base cover
<2>	J2 axis reduction gears	Grease nipple WA-610		6,000 Hr	8 g	No.2 arm cover U
<3>	Shaft (Ball screw spline)	Wipe the old grease, and paint	Marutenpu PS No.2 (KYODO YUSHI CO.,LTD.)	Every 2000km movement	1 g	

[Caution]

- The brand name of the grease shown in the [Table 5-9](#) is the grease put in at shipping.
- The lubrication time is a cumulative value of the operation at the maximum speed. If the operation has been suspended, or if the designated speed is slow, the lubrication time can be lengthened in proportion.
- Depending on the robot operation state, the lubrication time will fluctuate, so determine the time according to the state so that the grease does not run out.
For the shaft, the lubrication interval should be shorter than one in [Table 5-9](#) when the operation is repeated with a short stroke.
- By the maintenance forecast function of RT ToolBox3 (option) computes the guide of the lubrication hours put together with the customer's operation status.
- The numbers in the [Table 5-9](#) correspond to the supply positions in [Fig. 5-6](#).

(2) Lubrication method to the J1, J2 axis

- 1) Then, turn off the controller's power supply.
- 2) Refer to [Page 61](#), "5.3.2 Installing/removing the cover", and remove the covers necessary.
- 3) Insert the grease shown in [Table 5-9](#) using a grease gun from the lubrication grease nipple. Apply the specified amount of grease. Too much lubrication causes grease leakage.

** CAUTION**

Use manual grease gun, and inject grease with pressure 0.03Mpa or less. Do not use the grease gun, which derived by the factory air presser to avoid injecting by too high pressure.

A grease gun that fits the grease nipple is required.

Recommended grease gun: KH-120 (capacity: 140 ml) or KH-32 (capacity: 200 ml)
(manufacturer: Yamada Corporation)

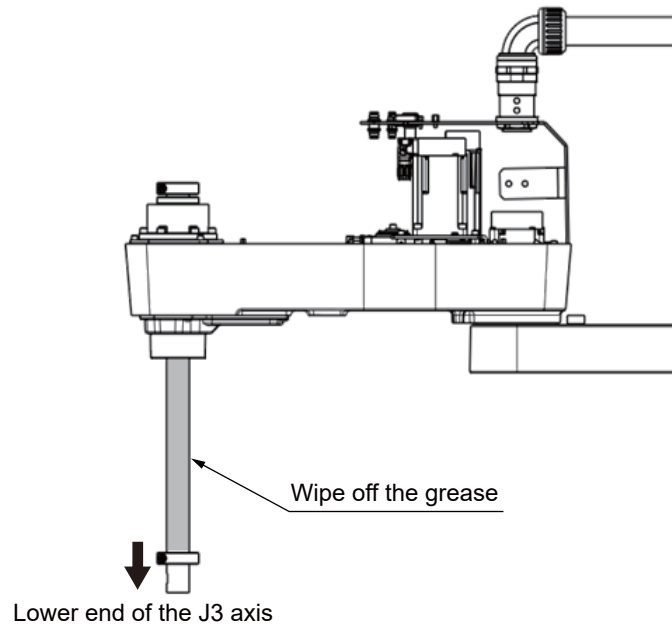
The above-mentioned grease gun comes with a short nozzle (HSP-1) as standard. If this short nozzle does not reach the desired areas, depending on the robot model and installation location, it may be useful to use a long nozzle (HSP-2).

- 4) Install the covers with the removal procedure in reverse.
- 5) If the maintenance forecast function is enable, please reset the accumulated data about grease. Carries out the resetting operation by RT ToolBox3 (option) or parameter (MFGRST). Refer to separate "RT ToolBox3 / RT ToolBox3 mini User's Manual" for the operation method of RT ToolBox, and refer to separate "Instruction Manual/Detailed Explanation of Functions and Operations" for details of parameter (MFGRST).

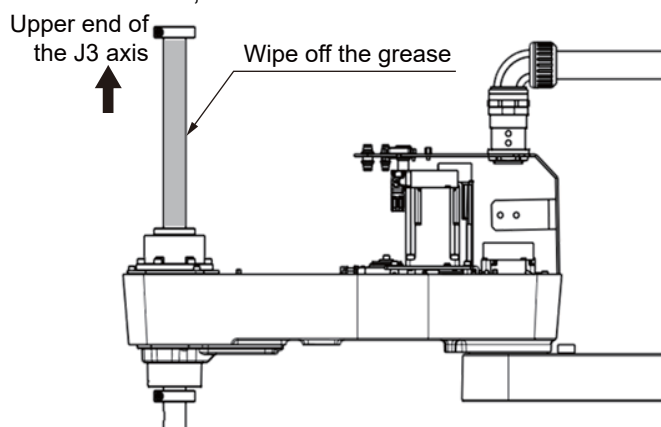
The lubricating to J1 and J2 axes is completed.

(3) Lubrication method to the shaft

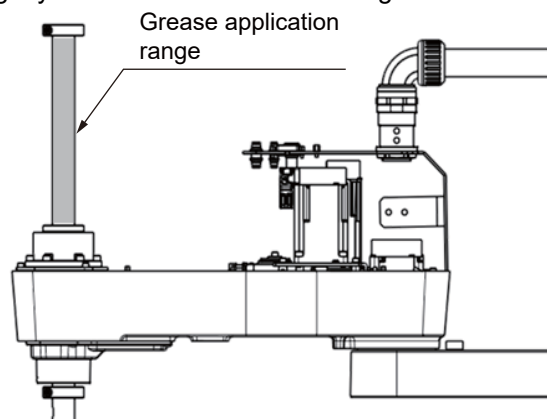
- 1) Move the J3 axis to the lower end limit by jog operation. Then, turn off the controller's power supply.
- 2) Refer to [Page 61, "5.3.2 Installing/removing the cover"](#), and remove the No.2 arm cover U.
- 3) Wipe off the old grease on the shaft. Also, wipe off the grease scattered inside the No.2 arm cover U.



- 4) Turn on the controller's power supply, and move the J3 axis to the upper end limit by jog operation. Then, turn off the controller's power supply again.
- 5) Wipe off the old grease on the shaft, which was hidden beneath the ball screw spline nut.

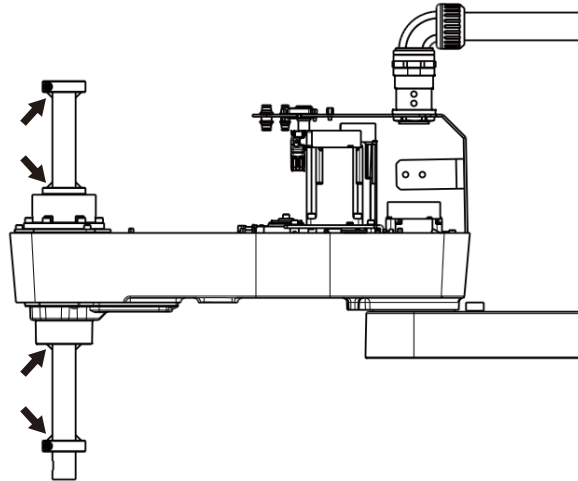


- 6) Apply the specified amount of grease to the shaft. Fill the shaft grooves with the grease. Also, apply the grease lightly to the areas other than the grooves on the shaft surface to prevent rusting.



- 7) Turn on the controller's power supply. Move the J3 axis up and down for several times using the jog operation to distribute the grease inside the ball spline nut and the ball screw nut.
- 8) Move the J3 axis to a position around the center of the stroke using the jog operation. Then, turn off the controller's power supply.
- 9) Wipe off the grease adhering around the shaft ends or the nuts of the ball screw spline (indicated with the arrows below).

When the ball spline and the ball screw are moved with extra grease on them, a large amount of grease is scattered inside the arm. The grease may reach the timing belt inside the No.2 arm, causing the timing belt to deteriorate early.



- 10) Reinstall the No.2 arm cover U.

Lubrication to the shaft is completed.

CAUTION

When applying grease to the shaft, prevent the grease from adhering to the No.2 arm cover U. If the grease is adhered to the cover, wipe it off. If the grease is adhered around the screw installation section for a long time, the cover may be deteriorated and cracked.

5.4 About Overhaul

Robots which have been in operation for an extended period of time can suffer from wear and other forms of deterioration. In regard to such robots, we define overhaul as an operation to replace parts running out of specified service life or other parts which have been damaged, so that the robots may be put back in shape for continued use. As a rule of thumb, it is recommended that overhaul be carried out before the total amount of servo-on time reaches the specified time (24,000 hours for the robot arm and 36,000 hours for the controller). (See Fig. 5-7.) However, the degree of the equipment's wear and deterioration presumably varies depending on their operating conditions. Especially for operation with high load and frequency, the maintenance cycle may be shorter. For details on the part selection for replacement and the timing of overhaul, contact your dealer.

It is also recommended that the internal robot battery is changed when overhauling the robot.

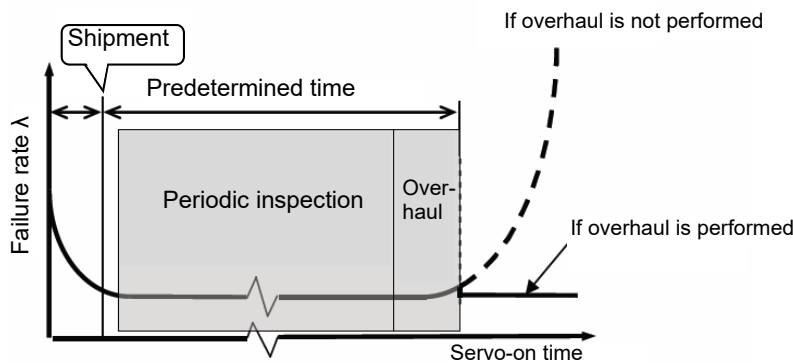


Fig.5-7:Periodic inspection/overhaul periods

5.5 Maintenance parts

The consumable parts that must be replaced periodically are shown in [Table 5-10](#), and spare parts that may be required during repairs are shown in [Table 5-11](#). Purchase these parts from the dealer when required.

[Note] Some Mitsubishi-designated parts differ from the maker's standard parts. Thus, confirm the part name, robot arm and controller serial No. and purchase the parts from the dealer.

Table 5-10: Consumable part list

No.	Part name	Usage place	Q'ty	Refer to section	Supplier
1	Grease	Reduction gears of each axis	A small amount	"5.3.4Lubrication"	Mitsubishi Electric
2		Shaft	A small amount		
RH-10CRH					
3	Timing belt	J3 axis	1	"5.3.3Inspection replacement of timing belt"	Mitsubishi Electric
4		J4 axis motor side	1		
5		J4 axis shaft side	1		
RH-20CRH					
6	Timing belt	J3 axis	1	"5.3.3Inspection replacement of timing belt"	Mitsubishi Electric
7		J4 axis motor side	1		
8		J4 axis shaft side	1		

Table 5-11: Spare parts list

No.	Names	Usage place	Q'ty	Supplier
RH-10CRH				
1	AC servo motor	J1 axis	1	Mitsubishi Electric
2		J2 axis	1	
3		J3 axis	1	
4		J4 axis	1	
5	Reduction gears	J1 axis	1	
6		J2 axis	1	
7	Ball screw spline	J3 axis	1	
RH-20CRH				
1	AC servo motor	J1 axis	1	Mitsubishi Electric
2		J2 axis	1	
3		J3 axis	1	
4		J4 axis	1	
5	Reduction gears	J1 axis	1	
6		J2 axis	1	
7	Ball screw spline	J3 axis	1	

5.6 Resetting the origin

The origin is set so that the robot can be used with a high accuracy. The origin is set so that the robot can be used with a high accuracy. Setting is required if the motor is replaced or an encoder error occurs.

The origin setting methods and when each origin setting method is required are shown in [Table 5-12](#).

Table 5-12: Origin setting method

No	Method	Explanation	Cases when setting the origin is required	Remarks
1	Jig method	The origin posture is set with the calibration jig installed.	<ul style="list-style-type: none"> When a structural part of the robot (motor, reduction gear, timing belt, etc.) is replaced When deviation occurred by a collision. 	The setting method is explained in Page 77, "5.6.1 Jig method" .
2	ABS origin method	Use this method when encoder backup data is lost.	<ul style="list-style-type: none"> When encoder data is lost (when error H112n occurs) 	Before using this method, the origin must be set with the other method with same encoder. The setting method is explained in Page 85, "5.6.2 ABS origin method" .
3	User origin method	A randomly designated position is set as the origin posture.	<ul style="list-style-type: none"> When an arbitrary position is set as the origin 	Before using this method, the origin must be set with the other method. The setting method is explained in Page 88, "5.6.3 User origin method" .

[Remarks]

- The origin data is inherent to the serial number of each robot arm.
- The ABS origin method is used to restore the previous data by aligning the triangular marks to each other for each axis to set the lost origin data.
(Although the setting position is confirmed visually, deviations within a half rotation of the motor can be compensated.)

[Caution]

- The ABS origin method cannot be used when the robot arm mechanically deviates (for example caused by replacement of the reduction gear, motor, or timing belt).
- After the origin setting is completed, move the robot arm to the position where the ABS marks align each other, and check that the displayed joint coordinates of the position are correct.
For the details of the ABS mark position and the joint coordinates, refer to [Page 85, "5.6.2 ABS origin method"](#).

5.6.1 Jig method

This method is using the origin setting tool. If the origin setting tool is required, please ask nearby dealer. The reference figure of the origin setting tool is shown in Fig. 5-8.

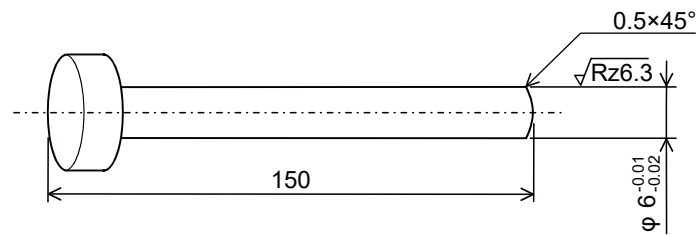


Fig.5-8:Reference dimension of origin setting tool

The procedure of setting the origin with the origin setting tool is shown below.

The origin setting can be performed for the target axis only instead of for all axes. Go to steps for the target axis to set the origin.



CAUTION

In the following procedure, the J3 axis brake is released to move its shaft with both hands.

When the brake is released, the J3 axis falls by its own weight.

To ensure safety, take appropriate measures such as supporting the axis to avoid the free fall.

This operation is carried out with the teaching pendant. Set the mode of the controller to "MANUAL", and set the [T/B ENABLE] switch on the teaching pendant to "ENABLE" to enable the teaching pendant.

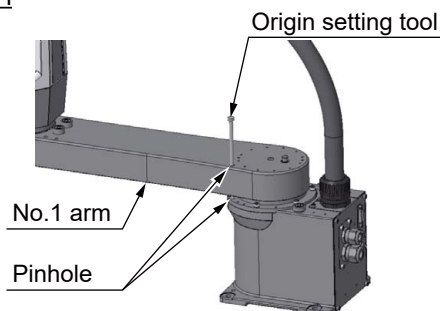
Do the following operations, pressing down the 3-position enable switch of T/B lightly.

(1) J1 axis origin setting

<MENU>	
1. FILE/EDIT	2. RUN
3. PARAM.	4. ORIGIN/BRK
5. SET/INIT.	6. ENHANCED
123	CLOSE
Select ORIGIN/BRK	
4	GHI

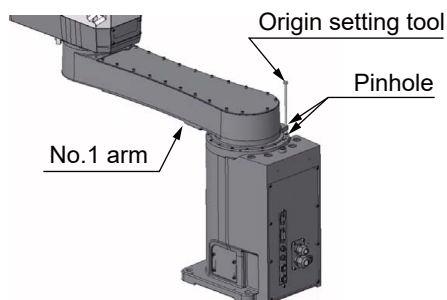
- 1) Press the [4] key on the menu screen, and display the Origin/Break selection screen.

RH-10CRH



- 2) Move the J1 axis slowly toward the front using both hands. Align the pinhole of the No.1 arm and the pinhole at the base section, feed through the origin jig into the pinholes and fasten.

RH-20CRH



< ORIGIN / BRAKE >	
1. ORIGIN	2. BRAKE
123	CLOSE
1 ' ()	

- 3) Press the [1] key, and display the Origin setting selection screen.

<ORIGIN>	
1. DATA	2. MECH
3. TOOL	4. ABS
5. USER	
123	CLOSE
Select TOOL	
+Z (J3)	3 DEF

- 4) Press the [3] key, and display the Tool selection screen.

<ORIGIN> TOOL		COMPLETED
J1: (1)	J2: ()	J3: ()
J4: ()	J5: ()	J6: ()
J7: ()	J8: ()	
123	CLOSE	
EXE		

- 5) Input "1" into the J1 axis. Set "0" to other axes.

- 6) Press the [EXE] key, and display Confirmation screen.

<ORIGIN> TOOL			
CHANGE TO ORIGIN. OK?			
Yes	123	No	F1

7) Press the [F1] key, and the origin position is set up.

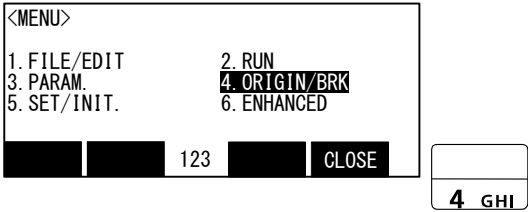
<ORIGIN> TOOL		COMPLETED
J1: (1)	J2: ()	J3: ()
J4: ()	J5: ()	J6: ()
J7: ()	J8: ()	
123	CLOSE	

8) Setting of the origin is completed.

◆◆◆ Select the axis of origin setting ◆◆◆

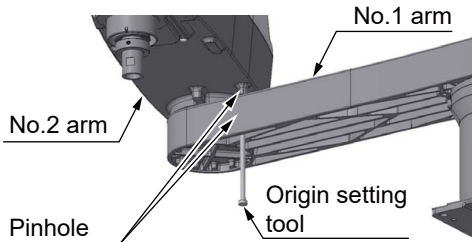
Do cursor movement into the parenthesis of each axis by the arrow key. The origin is set only for the axis for which a "1" is displayed on the screen. If the origin is not to be set, press the [0] key and display a "0".

(2) J2 axis origin setting



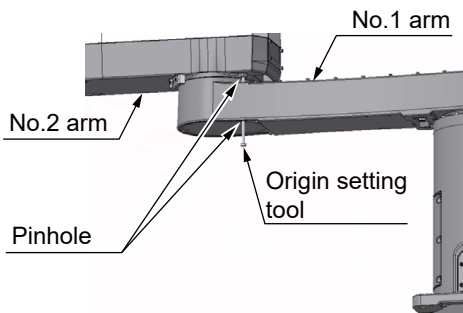
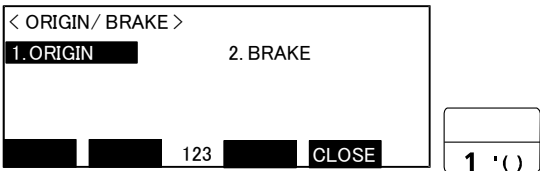
1) Press the [4] key on the menu screen, and display the Origin/Break selection screen.

RH-10CRH

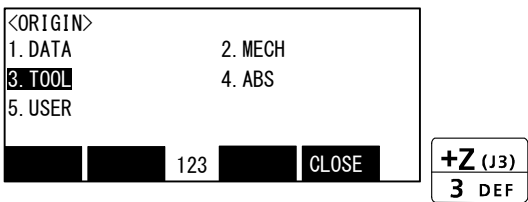


2) Move the J2 axis slowly using both hands. Align the pinholes of the No. 1 and No. 2 arms, feed through the origin jig into the pinholes and fasten. The posture angle is +110 degrees for RH-10CRH, and 0 degrees for RH-20CRH.

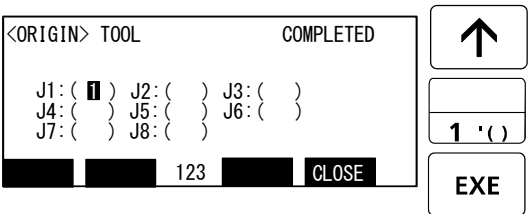
RH-20CRH



3) Press the [1] key, and display the Origin setting selection screen.



4) Press the [3] key, and display the Tool selection screen.



5) Input "1" into the J2 axis. Set "0" to other axes.

6) Press the [EXE] key, and display Confirmation screen.

<ORIGIN> TOOL			
CHANGE TO ORIGIN. OK?			
Yes	123	No	

F1

7) Press the [F1] key, and the origin position is set up.

<ORIGIN> TOOL		COMPLETED	
J1:()	J2:(1)	J3:()	
J4:()	J5:()	J6:()	
J7:()	J8:()		
	123	CLOSE	

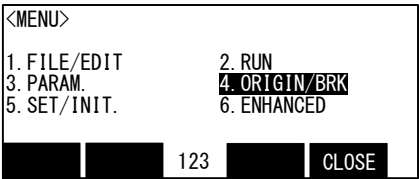
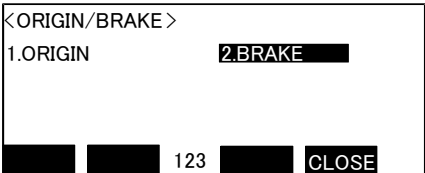
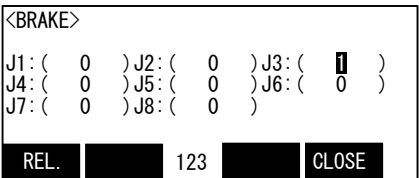
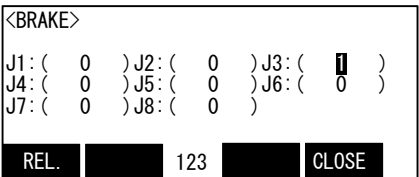
8) Setting of the origin is completed.

◆◆◆ Select the axis of origin setting ◆◆◆

Do cursor movement into the parenthesis of each axis by the arrow key. The origin is set only for the axis for which a "1" is displayed on the screen. If the origin is not to be set, press the [0] key and display a "0".

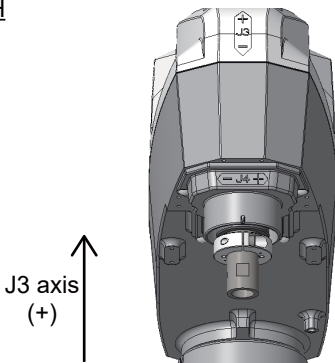
(3) J3 and J4 axis origin setting

Always perform origin setting of the J3 axis and the J4 axis simultaneously.

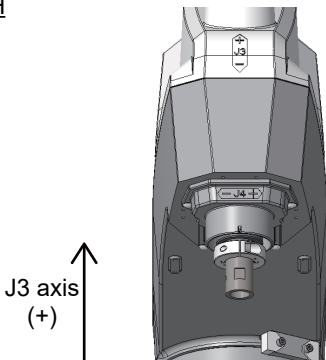


- 1) Press the [4] key on the menu screen, and display the Origin/Break selection screen.
- 2) Press the [2] key, and display the Break release selection screen.
- 3) Release the brake of the J3 axis for RH-10CRH.
Input "1" into the J3 axis. Set "0" to other axes.
Release the brake of the J3 axis and J4 axis for RH-20CRH.
- 4) Confirm the axis for which the brakes are to be released.

RH-10CRH



RH-20CRH



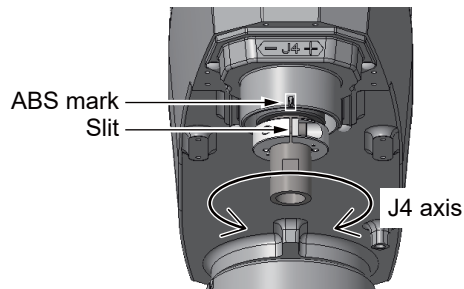
- 5) Pressing the [F1] key is kept with the 3-position enable switch of T/B pressed down. The brake is released while pressing the key.
Note) To prevent sudden fall of the J3 axis, release and lock the brake of the following axis repeatedly at intervals of about 200 ms. (Intermittent releasing of the brake)
- 6) With both hands, slowly move the J3 axis in + (plus) direction, and contact the axis against the mechanical stopper.



To ensure safety, take appropriate measures such as supporting the axis to avoid the free fall.

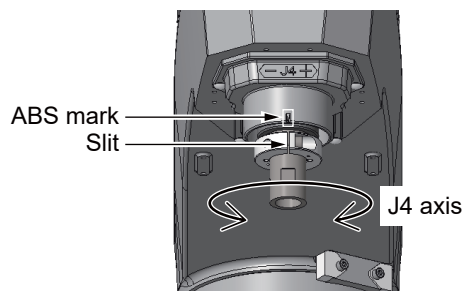
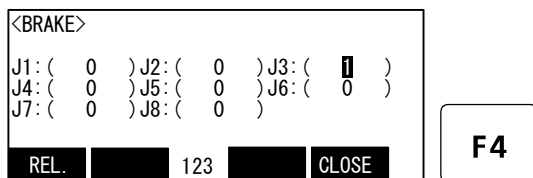


immediately.

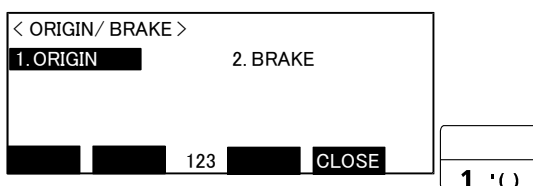
RH-10CRH

*Move the J4 axis with maintaining the

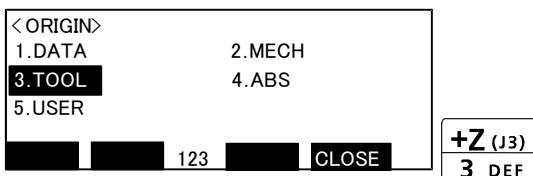
condition that the releasing brake of the J3 axis and the J3 axis contact to the mechanical stopper.

RH-20CRH

8) Detach the [F1] key and work the brake.
Press the [F4] key and return to the origin /
brake screen.



9) Press the [1] key, and display the Origin setting selection screen.



10) Press the [3] key, and display the Tool selection selection screen.

<ORIGIN> TOOL

J1() J2() J3(1)
 J4(1) J5() J6()
 J7() J8()

123 CLOSE



11) Input "1" into the J3 and J4 axis. Set "0" to other axes.

12) Press the [EXE] key, and display Confirmation screen.

<ORIGIN> MECH

CHANGE TO ORIGIN. OK?

Yes 123 No



13) Press the [F1] key, and the origin position is set up.

14) Setting of the origin is completed.

◆◆◆ Release the brake ◆◆◆

Do cursor movement into the parenthesis of each axis by the arrow key. The brakes can be released only for the axis for which a "1" is displayed on the screen. If the brakes are not to be released, press the [0] key and display a "0". If the [F1] key on the teaching pendant or the 3-position enable switch is detached while the brakes are released, the brakes will be work immediately.

◆◆◆ Select the axis of origin setting ◆◆◆

Do cursor movement into the parenthesis of each axis by the arrow key. The origin is set only for the axis for which a "1" is displayed on the screen. If the origin is not to be set, press the [0] key and display a "0".

5.6.2 ABS origin method

When the origin setting of the robot is performed for the first time, this product records the angular position of the origin within one rotation of the encoder as the offset value. If the origin setting is performed according to the ABS origin method, this value is used to suppress variations in the origin setting operations and to reproduce the initial origin position accurately.

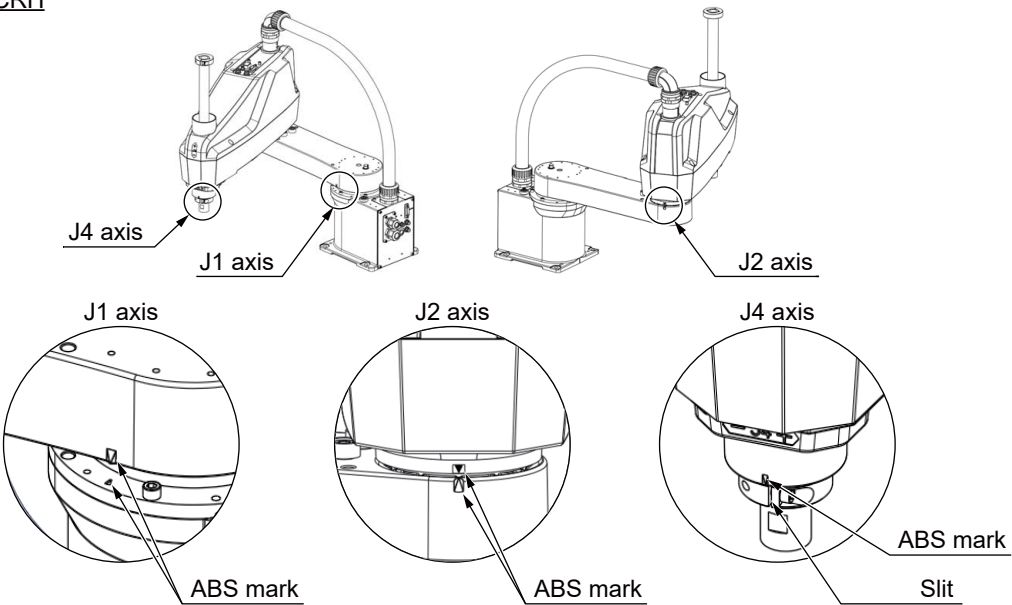
This operation is carried out with the teaching pendant. Set the mode of the controller to "MANUAL", and set the [T/B ENABLE] switch on the teaching pendant to "ENABLE" to enable the teaching pendant.

First, set to the ABS mark arrow of the axis for which the origin is to be set with jog operation. This can be set for all axes simultaneously or each axis independently.

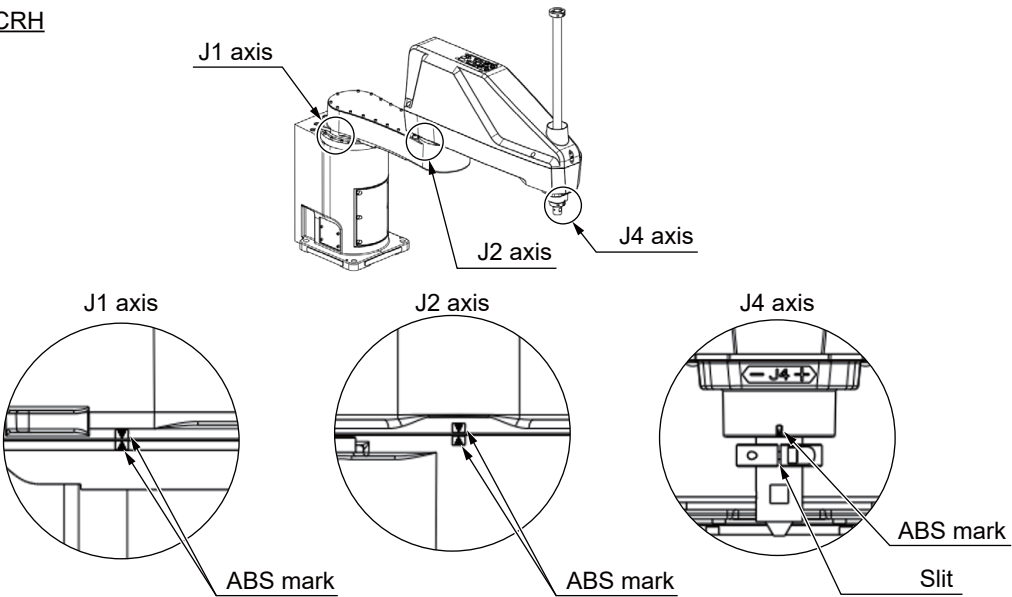
To align the ABS marks, view the robot from the front. The deviation between the end points of the two triangular marks must be 1 mm or less.

The positions where the ABS mark is attached are shown in below. Refer to [Page 23, "2.3 Confirming the operation"](#) for details on the jog operation.

RH-10CRH



RH-20CRH



Note) There is no alignment mark of the J3 axis. The posture to be set is the same with the mechanical stopper method. Refer to [Page 82, "\(3\) J3 and J4 axis origin setting"](#).

The angles of each axis which sets up the ABS origin are shown below.

Model	J1 axis	J2 axis	J3 axis	J4 axis
RH-10CRH	0°	100°	151mm	0°
RH-20CRH	0°	0°	397.5mm	0°

Fig.5-9:ABS mark attachment positions

The procedures for setting the origin with the ABS method are explained below.

(1) Origin setting procedure

Do the following operations, pressing down the 3-position enable switch of T/B lightly.

```

<MENU>
1. FILE/EDIT      2. RUN
3. PARAM.         4. ORIGIN/BRK
5. SET/INIT.      6. ENHANCED
REL. 123 CLOSE
  
```

```

4 GHI
  
```

1) Press the [4] key on the menu screen, and display the Origin/Break selection screen.

```

< ORIGIN / BRAKE >
1. ORIGIN      2. BRAKE
REL. 123 CLOSE
  
```

```

1 '()
  
```

2) Press the [1] key, and display the Origin setting selection screen.

```

<ORIGIN>
1. DATA      2. MECH
3. TOOL       4. ABS
5. USER
REL. 123 CLOSE
  
```

```

4 GHI
  
```

3) Press the [4] key, and display the ABS selection screen.

```

<ABS>
J1: ( 1 ) J2: ( 0 ) J3: ( 0 )
J4: ( 0 ) J5: ( 0 ) J6: ( 0 )
J7: ( 0 ) J8: ( 0 )
REL. 123 CLOSE
  
```

```

↑ ↓
1 '() → EXE
  
```

4) Input "1" into the axis to origin setting. Press the [EXE] key, and display Confirmation screen.

```

<ORIGIN> ABS
CHANGE TO ORIGIN. OK?
Yes 123 No
  
```

```

F1
  
```

5) Press the [F1] key, and the origin position is set up.

```

<ABS>
J1: ( 1 ) J2: ( 0 ) J3: ( 0 )
J4: ( 0 ) J5: ( 0 ) J6: ( 0 )
J7: ( 0 ) J8: ( 0 )
REL. 123 CLOSE
  
```

The origin settings are completed by the ABS method.



CAUTION

After setting the origin, when the joint coordinates of the ABS mark position deviate from the coordinates of the ABS origin by 1.5° or more, align the end points of the ABS marks and set the origin using the ABS origin method again.

5.6.3 User origin method



Before using this method, the origin must be set with the other method.
The setting method is explained in [Page 76, "Table 5-12: Origin setting method"](#).

The procedure for setting the origin with the user origin method is explained below.
This operation is carried out with the teaching pendant. Set the mode of the controller to "MAMNUAL", and set the [T/B ENABLE] switch on the teaching pendant to "ENABLE" to enable the teaching pendant.
The operation method is shown below.

Software version "C2j" or later has the "user origin data setting specification parameter (UORGSPEC)". Changing the setting value to "1" (high accuracy) will perform compensation considering sagging due to the gravity applied to the robot. This improves the accuracy of setting the origin with this method. However, if the setting value is changed to "1" (high accuracy), reset the user origin position and origin. With software version earlier than "C2j", after setting the user origin position and changing the parameter (UORGSPEC) to "1" (high accuracy), setting the origin will deteriorate the accuracy. Therefore, perform the above steps without fail.
This function is available for the RV-FR series. As the RH-FRH series are not subject to sagging, the settings are not effective.

When setting the origin for the first time using this method, carry out the operations in order from step 1). For the second and following time, move the robot arm to the user origin position with jog operation, and accurately position all axis. Then start the procedure from step 4).

- 1) Determine the user origin position

Operations required before configuring the settings

The same hand and workpiece conditions must be applied for the user origin position and user origin settings. Be sure to perform the following operations.

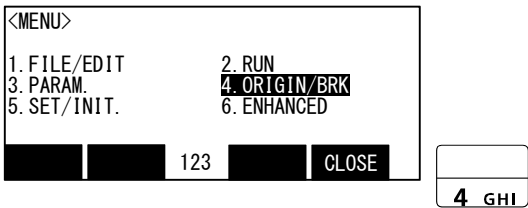
- Disable the "robot mechanism thermal compensation function".
- Set the hand and workpiece conditions (HNDDAT0, WRKDAT0) beforehand.

Move the robot to the position to be set as the origin with jog operation. Refer to [Page 23, "2.3 Confirming the operation"](#) for details on the jog operation.



Choose the user origin position as the position where it doesn't move by the gravity.
This position is left as a guideline to position all axes with jog operation when setting the origin again with this method.

- 2) Enter the JOINT jog mode, and display the joint coordinates on the teaching pendant screen. Record the value of the axis for which the origin is to be set.
- 3) Input the value recorded in the "user designated origin parameter (USERORG)".
The parameter details and input methods are described in the separate "Instruction Manual/Detailed Explanation of Functions and Operations". Refer to that manual and input the user designated origin position.



Before performing step 4), refer to [Page 88, "Operations required before configuring the settings"](#).

- 4) Next, set the origin.
Display the menu screen.
- 5) Press the [4] key on the menu screen, and display the Origin/Break selection screen.

< ORIGIN/ BRAKE >	
1. ORIGIN	2. BRAKE
123	CLOSE

1 '()

6) Press the [1] key, and display the Origin setting selection screen.

<ORIGIN>	
1. DATA	2. MECH
3. TOOL	4. ABS
5. USER	
123	CLOSE

-A (J4)
5 JKL

7) Press the [5] key, and display the User selection screen.

<USER>			
J1: (	1	) J2: (	0
J4: (	0	) J5: (	0
J7: (	0	) J8: (	0
REL.	123	CLOSE	

↑	↓
1 '()	EXE

8) Input "1" into the axis to origin setting. Press the [EXE] key, and display Confirmation screen.

<ORIGIN> USER	
CHANGE TO ORIGIN. OK?	
Yes	No

F1

9) Press the [F1] key, and the origin position is set up.

The origin settings are completed by the User origin method.

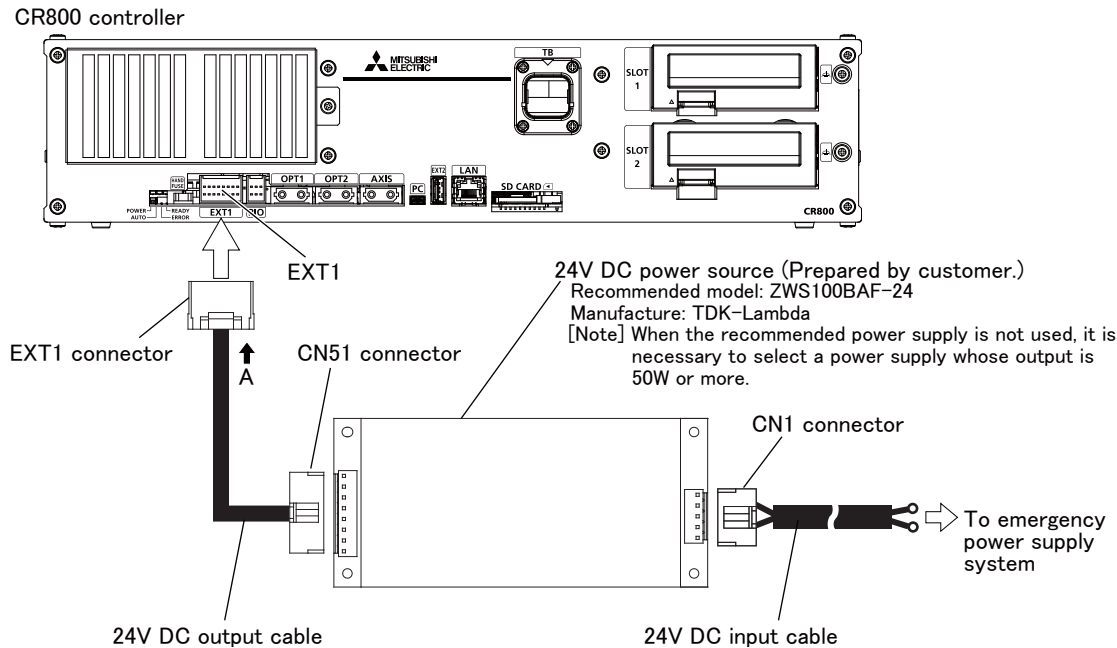
5.7 How to release the brake in an emergency

The following describes how to release the brake using the emergency power supply in an emergency. Using an emergency power supply system separated from the primary power supply of the robot prevents the robot from moving accidentally during the brake release operation, which contributes to enhancing customer safety.

An emergency here means an emergency stop of robot operation, which requires the brake release operation to set the robot in an evacuation posture temporarily.

[Note] Do not connect an emergency power supply to multiple robots and release their brakes at the same time.

- 1) Connect the teaching pendant to the robot controller.
- 2) Connect the 24V DC power supply to EXT1 of the controller as shown in the figure below.
To prevent accidental power supply from the primary power supply of the robot, prepare an emergency power supply system separated from the primary power supply of the robot to supply AC power to the 24V DC power supply.



The following shows the connector specifications.

EXT1 connector
Connector: J21DF-16V-KX
Contact: SJ2F-01GF-P1.0
Manufacture: JST

CN51 connector (recommended)
Connector: VHR-8N
Contact: SVH-41T-P1.1
Manufacture: JST

CN1 connector (recommended)
Connector: VHR-5N
Contact: SVH-41T-P1.1
Manufacture: JST

Pin assignment

Pin number	Signal name
8A	24V
8B	
3B	
7A	
7B	GND
3A	

Pin assignment

Pin number	Signal name
1	GND
2	
3	
4	
5	24V
6	
7	
8	

Pin assignment

Pin number	Signal name
1	L
3	N
5	FG

- 3) When the 24V DC power supply is turned on, the controller starts and then errors (H0712, H0090, H0212) will occur.
- 4) Release the brake using the teaching pendant.
For the brake release operation using the teaching pendant, refer to "Explanation of operation methods" in the separate volume, "Instruction Manual/Detailed Explanations of Functions and Operations".

6 Appendix

Appendix 1: Configuration flag

The configuration flag indicates the robot posture.

For the robot, the robot hand end is saved with the position data configured of X, Y, Z, A, B and C. However, even with the same position data, there are several postures that the robot can change to. The posture is expressed by this configuration flag, and the posture is saved with FL1 in the position constant (X, Y, Z, A, B, C) (FL1, FL2).

The types of configuration flags are shown below.

(1) RIGHT/LEFT

Indicates the location of the end axis relative to the line that passes through both the rotational center of the J1 axis and the rotational center of the J2 axis.

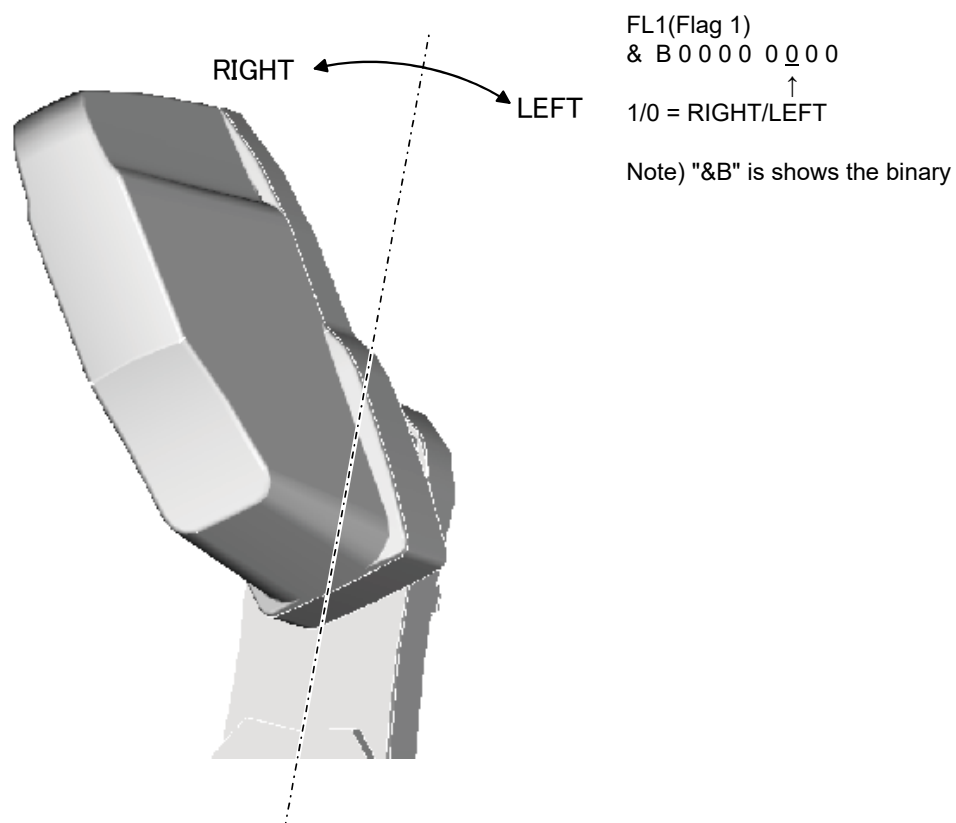


Fig.6-1: Configuration flag(RIGHT/LEFT)

Appendix 2:How to take out the battery at the disposal of the robot

**WARNING**

Always perform this procedure with the controller control power turned off. Failure to observe this may result in electric shock or malfunction. Check "MODEL name" on the rating plate. If "-SZ01" is at the end of MODEL name, the ER6V is installed. If not, the CR2450HR WK is installed.

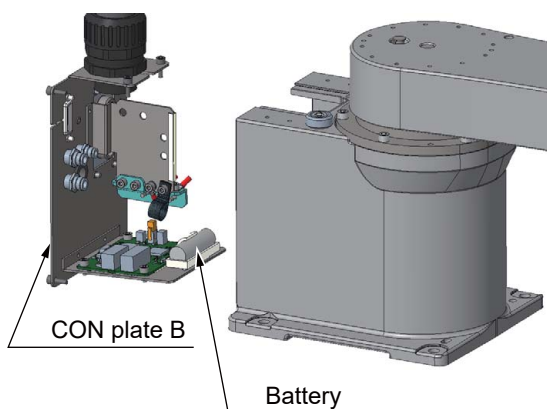
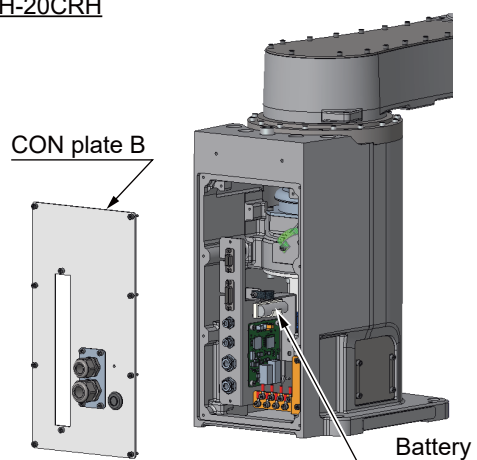
The robot has a battery.

When disposing of the robot, take out the battery for correct disposal.

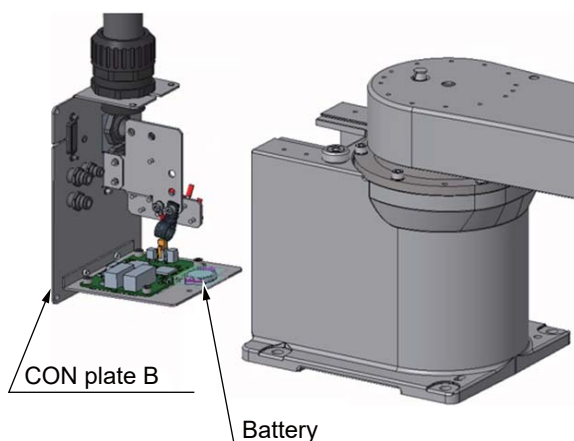
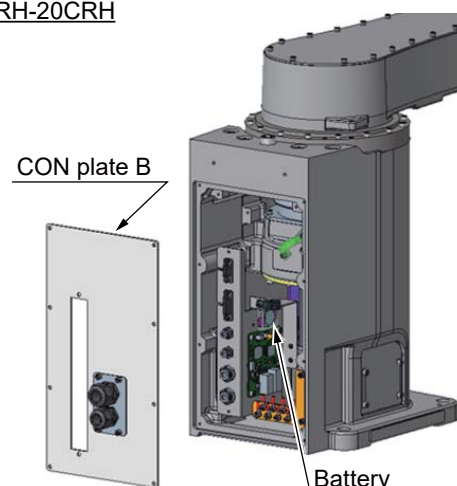
Remove CON plate B (shown in the figure below) from the robot and take out the battery.

The battery does not need to be replaced during normal use. If a battery replacement is required due to errors or other factors, contact the dealer.

The figure below shows the robot base with CON plate B removed.

RH-10CRHRH-20CRH

If "-SZ01" is at the end of MODEL name:

RH-10CRHRH-20CRH

If "-SZ01" is not at the end of MODEL name:

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