MELFA Robots

Industrial Robot

Instruction Manual

RV-2SD/2SDB

Robot Arm Setup & Maintenance

BFP-A8791
30 03 2010
Version A

⚠ 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

⚠ WARNING

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.

⚠ 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 alarms 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.

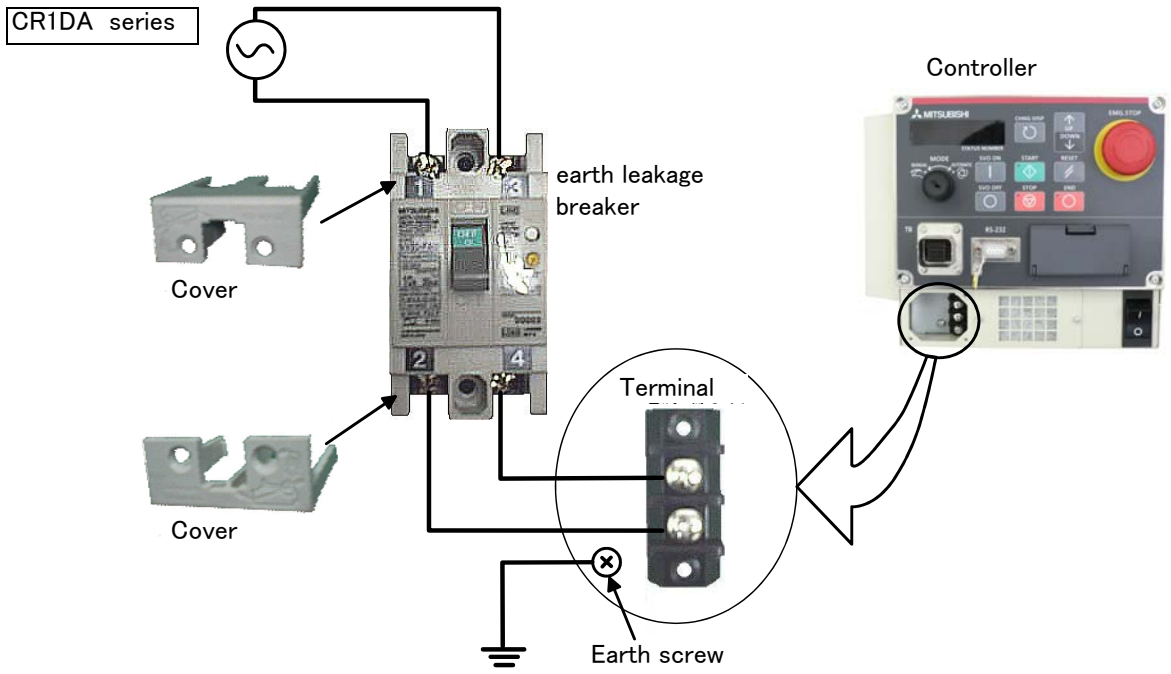
⚠ CAUTION

Use the USB devices confirmed by manufacturer. In other case, it might have care difficulty by the effect of temperature, noise and so on. When using it, measures against the noise, such as measures against EMI and the addition of the ferrite core, may be necessary. Please fully confirm of the operation by the customer

*SD (CR1D) series: CR1DA-7xx

⚠ CAUTION

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



Revision history

Date of Point	Instruction Manual No.	Revision Details
2010-02-04	BFP-A8791	・First print
2010-03-30	BFP-A8791-A	・CE specification of the CR1DA controller was added.

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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.

1.1 Using the instruction manuals

1.1.1 The details of each instruction manuals

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.

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 or special 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 Explanation 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 Manual	Explains the control function and specifications of conveyor tracking. SD series only.

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	The "Robot controller" or the "Controller"	Indicates the controller which controls the robot arm. Indicates the box which arranged control parts, such as robot CPU, servo amplifier, and the safety circuit.
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.
	O/P	This indicates the operating panel on the front of the controller.

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 If the automatic operation of the robot is operated by two or more control equipment, design the right management of operation of each equipment of 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 alarms 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.
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

When the SSCNETIII cable is removed, install the cap in the connector.
If the cap is not installed, there is a possibility of malfunctioning by adhesion of the dust etc.

⚠DANGER

Don't remove the SSCNETIII cable, when the power supply of the robot controller is turned on. Don't face squarely the light emitted from the tip of the SSCNETIII connector or the cable. If light strikes the eyes, there is a possibility of feeling the sense of incongruity for the eyes. (The light source of SSCNETIII is equivalent to the class 1 specified to JISC6802 and IEC60825-1.)

2 Unpacking to Installation

2.1 Confirming the product

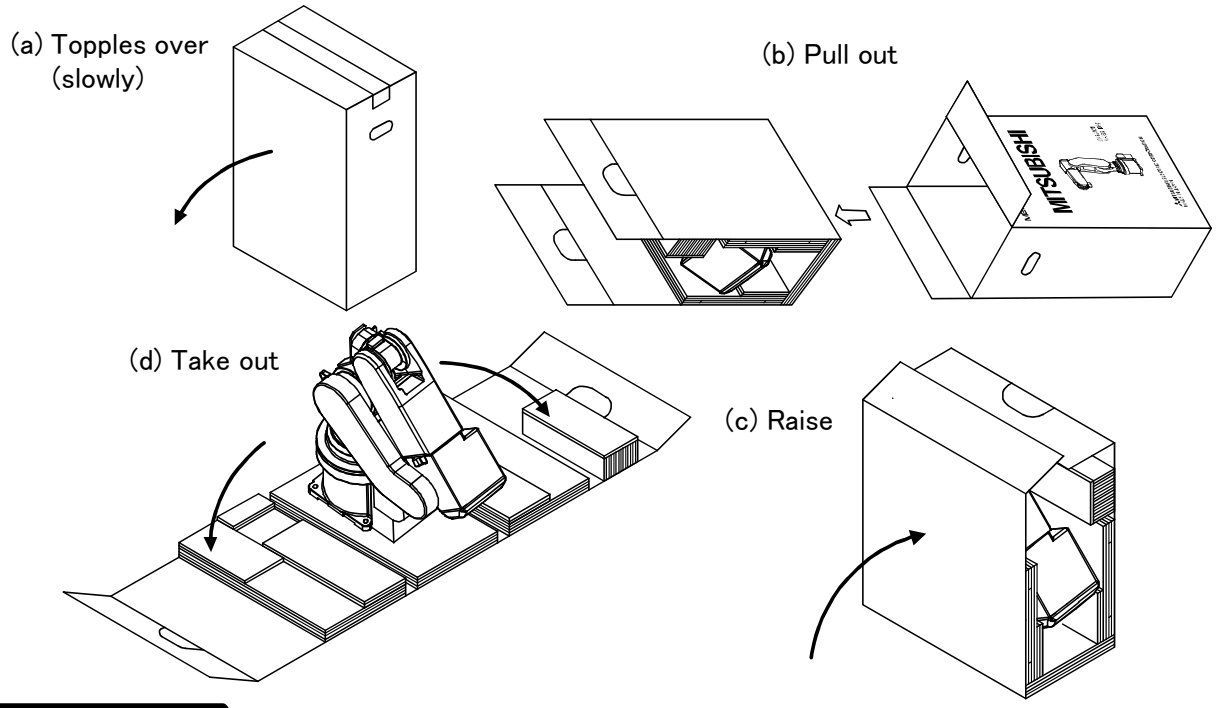
The standard configuration of the robot arm, part of the purchased product, is shown in Table 2-1.
Confirm the parts.
Users who have purchased optional products should refer to the separate "Standard Specifications".

Table 2-1 : Standard configuration

No.	Part name	Type	Qty.	Remarks
1	Robot arm	RV-2SD	1 unit	
2	Guarantee card		1 copy	
3	Installation bolts	M8x35	4 pcs.	
4	Spring washer for installation bolts	For M8	4 pcs.	
5	Plain washer for installation bolts	For M8	4 pcs.	
6	Fixing plates (For fixing the rotation axis)		2 pcs.	This is installed in the robot arm at the time of shipment.
7	Safety socket for fixing plates	M5x12	6 pcs.	
8	Plain washer for fixing plate	For M5		
9	Grease nipple	For J5 and J6 gears	3 pcs.	

2.2 Installation

2.2.1 Unpacking



⚠CAUTION

Always unpack the robot at a flat place. The robot could tilt over if unpacked at an unstable place.

Notes) The packing material is required at re-transportation.
Please keep it with care.

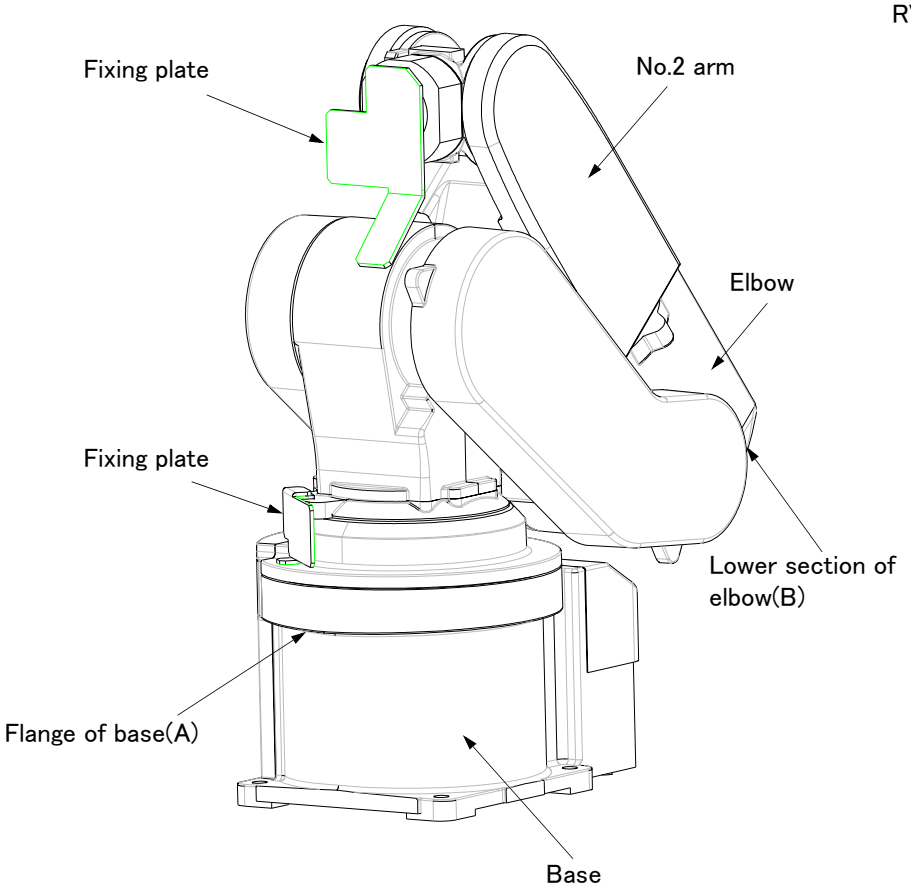
Fig.2-1 : Unpacking the robot arm

The robot is shipped from the factory in cardboard and plywood frame packing. Always refer to Fig. 2-1 and unpack the robot.Handle the robot arm according to "2.2.2 Transportation procedures(Transportation by people)". The unpacking process is shown below.

1) The cardboard box is toppled over horizontally slowly. Take care so that a shock may not be given (Fig. 2-1 (a))
2) Using a knife, etc., slit the tape fixing the upper lid of the cardboard box.
3) Pull out inner box horizontally with the handle. (Fig. 2-1 (b))
4) Raise the inner box and the robot simultaneously. (Fig. 2-1 (c))
5) Remove the robot from the inner box. (Fig. 2-1 (d))

2.2.2 Transportation procedures(Transportation by people)

Mass
RV-2SD : Approx. 21kg



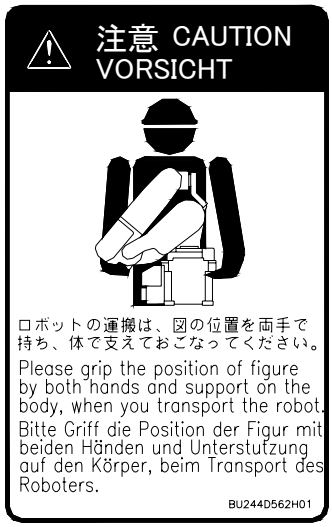


Fig.2-2 : Transportation of robot arm (Transportation by people)

1) The robot be transported by one worker. Place the robot on a dolly, etc. and move it to the vicinity of the installation site.
2) raises the robot as supports the robot's left side by your body with having the flange of base (A) and the lower section of elbow (B).
   Please be sure to avoid holding the robot from the front/back side or by the cover because the robot may tilt over and the cover may be damaged or dropped, which may lead to accidents.
3) When transporting the robot, do not apply force on the cover, or apply a strong impact on the robot
4) Remove the fixing plate after installing the robot.

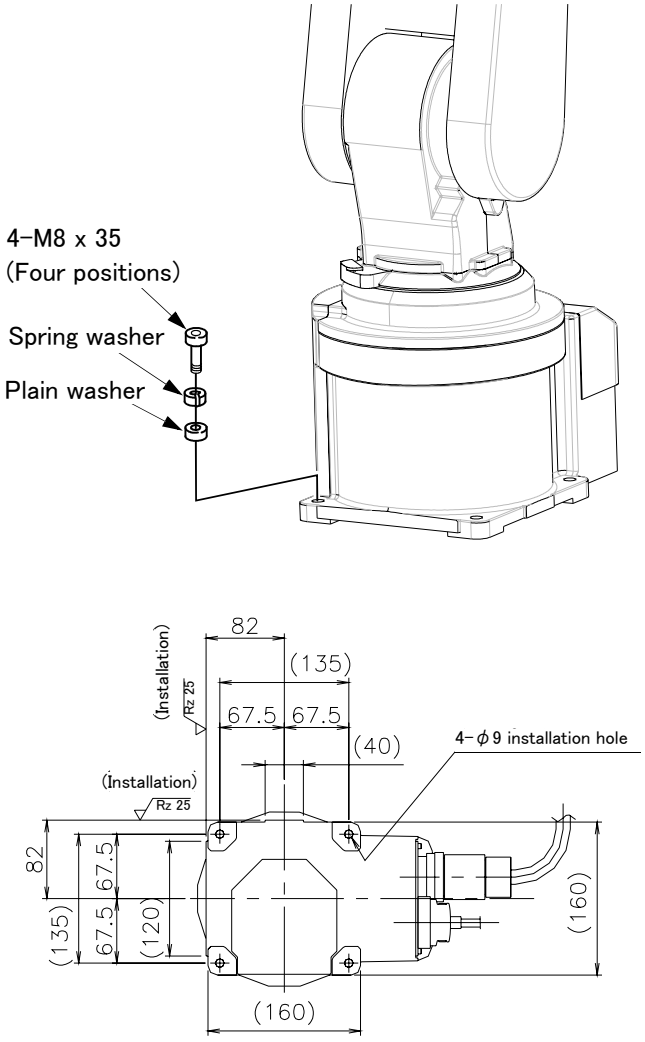
⚠ CAUTION

To prevent accidents, do not hold the robot from the front/back sides, or hold covers that have no grips.

2.2.3 Installation procedures

The installation procedure of the robot arm is shown below.

1) The robot installation surface has been machine finished. Use the installation holes (4−φ9 holes) opened at the four corners of the base, and securely fix the robot with the enclosed installation bolts (M8 x 35 hexagon socket bolts).
2) Installation of the robot arm is a very important step for ensuring the optimum functions of the robot. Observe the following points when designing.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 6.3a 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) Remove the fixing plates after installing the robot.

7) When the robot is installed by hanging from the ceiling or on the wall, the MEGDIR parameter must be changed. For more information about parameters and how to change the parameters, refer to the separate "Instruction Manual/ Detailed Explana−tion of Functions and Opera-tions".
8) The installation surface must have sufficient strength to withstand the arm reaction during moving the robot at high speed.

Note) Although the figure is RV−2SD, the RV−2SDB is the same also.

Fig.2−3 : Installation dimensions

⚠CAUTION Please secure the maintenance space required for connection of the machine cable, and exchange of the backup battery in the rear side, and also space for J1 axis belt in the right side.

2.2.4 Grounding procedures

(1) Grounding methods

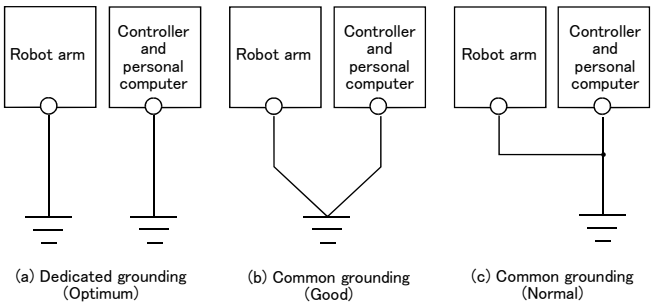


Fig.2-4 : Grounding methods

1) There are three grounding methods as shown in Fig. 2-4, but the dedicated grounding (Fig. 2-4 (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(3.5mm^2) 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.

(2) Grounding procedures

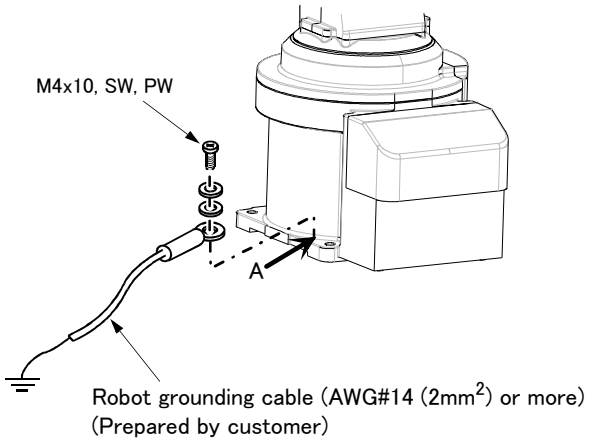


Fig.2-5 : Connecting the grounding cable

1) Prepare the grounding cable (AWG#14(2mm^2) or more) and robot side installation screw and washer.

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.

2.2.5 Connecting with the controller

(1) RV-2SD (standard specification)

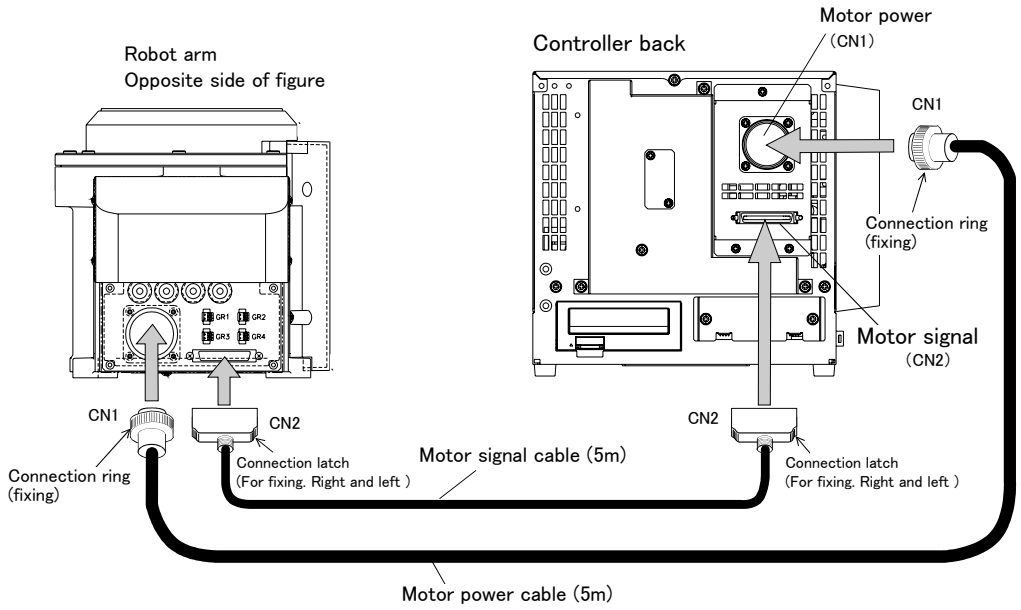


Fig.2-6 : Connecting the machine cables (RV-2SD)

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 switch on the front of the controller is turned OFF.
2) Connect the machine cable to its corresponding connector on the robot arm side and controller.
   Connect the CN2 first at connection. Conversely, remove the CN1 first at removal.
   After CN1 unites the key slot with each other's connector, insert the connector. And rotates the connection ring section to fix it securely.
   Pick the latch of both sides on CN2 connector, and inserts CN2. CN2 is fixed when the latch is released.

⚠ CAUTION Please connect the connector securely.
If it inserts by force, the pin will break. And it becomes the cause of failure.

⚠ CAUTION The machine cable connectors are dedicated for the controller side and robot arm side, so take special care when connecting.
If connected incorrectly, the connector pins could bend or break. Thus, even if connected correctly, the robot will not operate correctly, creating a dangerous situation.

⚠ 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 Please be careful not to catch the hand at installation and removal.

(2) RV-2SDB (CE marking specification)

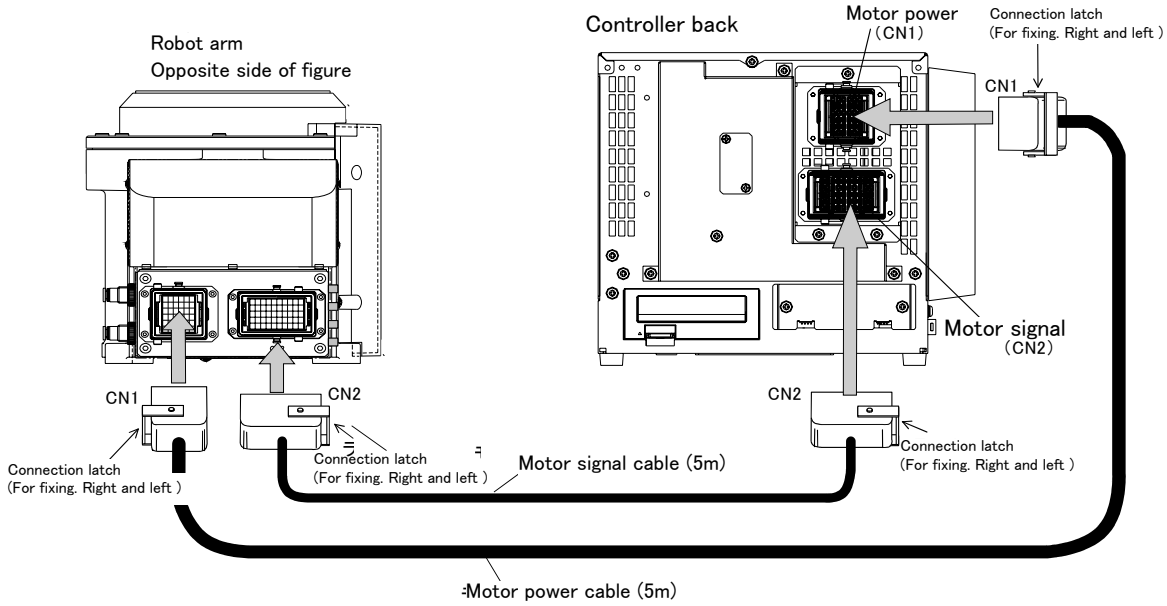
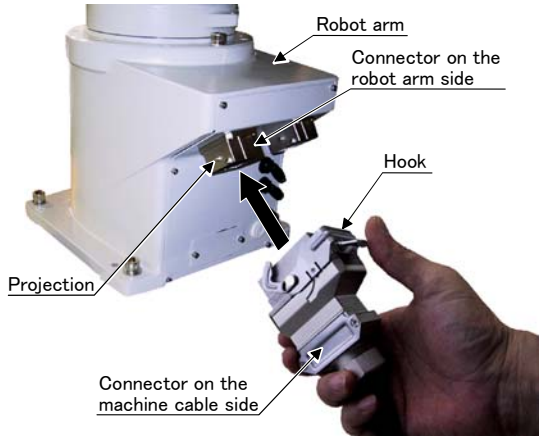
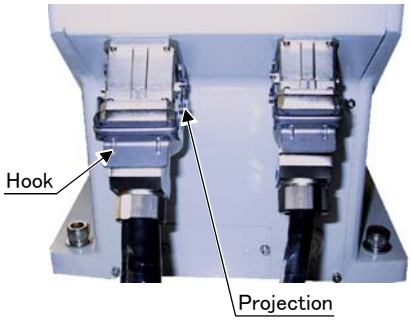


Fig.2-7 : Connecting the machine cables (RV-2SDB-S15)

Carry out the following procedure after installing the controller referring to the separate "Controller Setup, Basic Operation and Maintenance" manual.
Note) Although the following figure differs in the robot's image, please make it reference of connector operation.



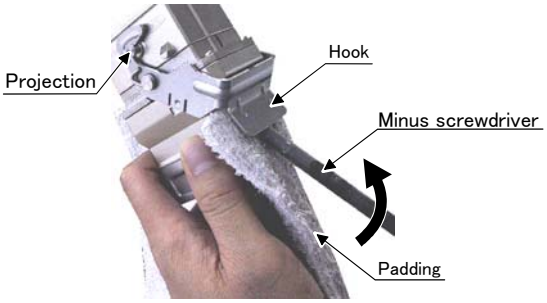
1) Make sure that the power switch on the front of the controller is turned OFF.



2) Connect the machine cable to its corresponding connector on the robot arm side.

3) After connecting the connector, insert the hook attached to the connector on the machine cable side to the rear of the projection of the robot arm connector to fix securely in place.

⚠CAUTION Be careful not to get your hand pinched.



4) To remove the cable, insert a minus screwdriver into the hook while padding with a cloth, and remove the cable by lifting the hook.

⚠ CAUTION Please connect the connector securely.
If it inserts by force, the pin will break. And it becomes the cause of failure.

⚠ CAUTION The machine cable connectors are dedicated for the controller side and robot arm side, so take special care when connecting.
If connected incorrectly, the connector pins could bend or break. Thus, even if connected correctly, the robot will not operate correctly, creating a dangerous situation.

⚠ 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 Please be careful not to catch the hand at installation and removal.

2.3 Setting the origin

The origin is set so that the robot can be used with a high accuracy. After purchasing the robot, always carry out this step before starting work. This step must also be carried out if the combination of robot and controller being used is changed.

There are several methods for setting the origin, but the origin data input method will be explained here. Refer to "5.5 Resetting the origin" on page 55 for the other methods.

The teaching pendant is required for this operation.

[Caution] If the origin data at shipment is erased due to out of battery, it is necessary to set the origin again. Refer to "5.5 Resetting the origin" on page 55 and reset the origin using the jig method or ABS method.

2.3.1 Installing the teaching pendant (T/B)

When installing and removing the T/B, turn off the controller power supply. If T/B is installed or removed in the state of power supply ON, emergency stop alarm will occur.

If you use the robot wherein T/B is removed, please install the attached dummy connector. With the connector, put the dummy connector or draw it out.

⚠ 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 and removing so that stress does not start the cable with the connector itself.

Explain the installation method of T/B below.

1) Check that the POWER (power supply) switch of the robot controller is OFF.
2) Connects T/B connector to the robot controller. Use as the upper surface the lock lever shown in Fig. 2-8, and push in until there is sound.

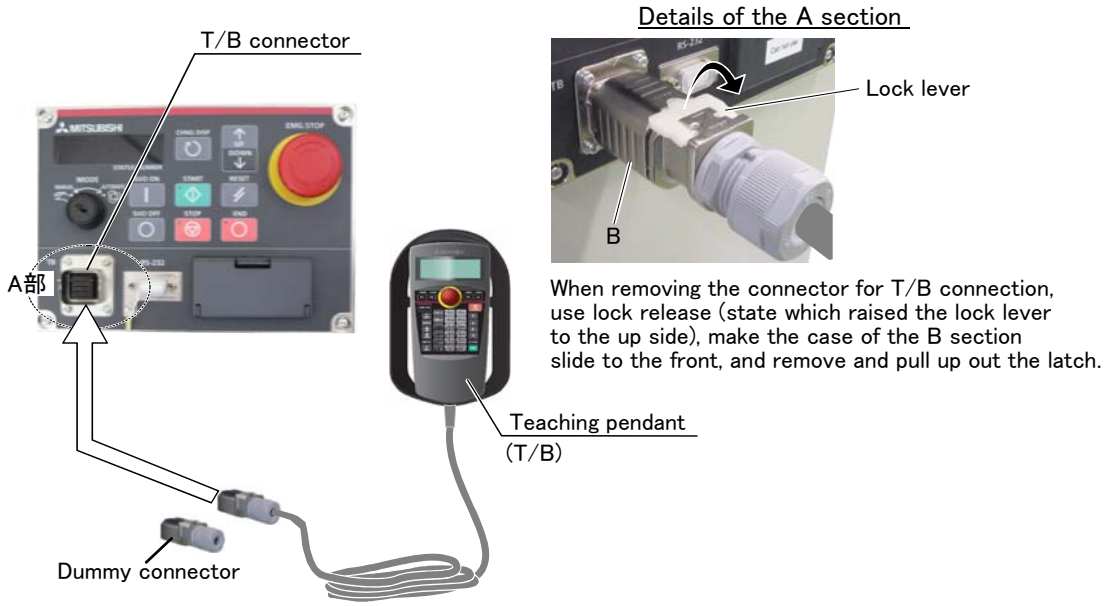


Fig.2-8 : Installing and removing the T/B

The installation of T/B is finished.

◇◆◇ If error C0150 occurs ◇◆◇

At the time of the first power supply injection, error:C0150 (the serial number of the robot arm has not been set up) occur the robot after purchase.

Parameter: Please input the serial number of the robot body into RBSERIAL. Refer to "instructions manual / controller setup, and basic operation & maintenance" for the operation method.

2.3.2 Setting the origin with the origin data input method

(1) Confirming the origin data

● Origin data history table (Origin Data History) Serial No.ES804008

Date	Default	. . .	. . .	. . .
D	V!#S29			
J 1	06DTYY			
J 2	2?HL9X			
J 3	1CP55V			
J 4	T6!M$Y			
J 5	Z2IJ%Z			
J 6	A12%Z0			
Method	E	E・N・SP	E・N・SP	E・N・SP

(O: O(Alphabet), 0: Zero)

Note) Meanings of symbols in method column
E: Jig method
N: Not used
SP: Not used

The origin data to be input is noted in the origin data sheet enclosed with the arm, or on the origin data history table attached to the back side of the .J1 motor cover. (Refer to Fig. 2-9).

Referring to "5.3.2 Installing/removing the cover" on page 42, remove the J1 motor cover and confirm the value.

The value given in the default setting column is the origin settings set with the calibration jig before shipment.

Fig.2-9 : Origin data label (an example)

* The origin data to input is found on also the robot examination report sheet.

⚠ WARNING Always install/remove the cover with the controller control power turned OFF. Failure to do so could lead to physical damage or personal injury should the robot start moving due to incorrect operations.

(2) Turning ON the control power

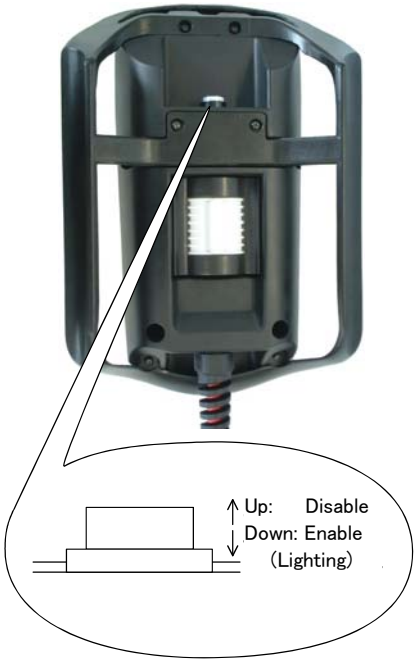
⚠ CAUTION Confirm that there are no operators near the robot before turning the power ON.

1) Turn the controller [POWER] switch ON.
The control power will be turned ON, and "o. 100" will appear on the STATUS NUMBER display on the front of the controller.

(3) Preparing the T/B

Next, prepare to use the T/B

1) Set the [MODE] switch on the front of the controller to "MANUAL".

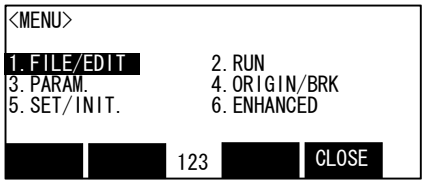


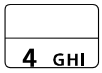
2) Set the T/B [ENABLE] switch to "ENABLE". The menu selection screen will appear.
The following operations are carried out with the T/B.

◇◆◇ Operating from the T/B ◇◆◇

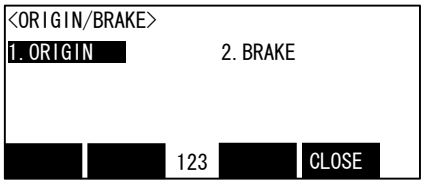
Always set the [MODE] switch (mode selection key switch) on the front of the controller to "MAMNUAL", and then set the T/B [ENABLE] switch to "ENABLE".
When the T/B is valid, only operations from the T/B are possible. Operations from the controller or external signals will not be accepted.

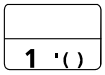
(4) Selecting the origin setting method



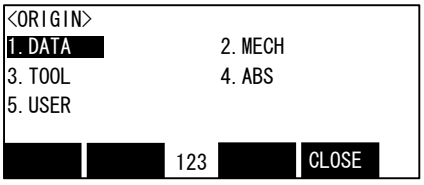


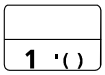
1) Press the [4] key on the menu screen, and display the ORIGIN/BRAKE screen.





2) Press the [1] key on the ORIGIN/BRAKE screen, and display the origin setting method selection screen.





3) Press the [1] key on the origin setting method selection screen, and select the data input method.

4) Display the origin data input screen

◇◆◇ Selecting a menu ◇◆◇

The menu can be selected with one of the following methods.
A: Press the numeral key for the No. of the item to be selected.
B: Using the [↓] and [↑] keys, etc., move the cursor to the item to be selected, and then press the [INP] key.

◇◆◇ The input method of numeral ◇◆◇

The number can be inputted if the key displayed on the lower left of each key is pressed. Press the [CHARACTER] key, and in the condition that "123" is displayed on the screen lower side, press the number key.

(5) Inputting the origin data

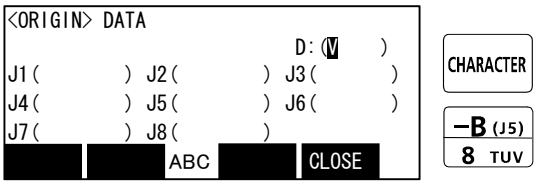
T/B screen　　Origin data label
(D,J1,J2,J3,J4,J5,J6,J7,J8)

Input the value confirmed in section "(1) Confirming the origin data" on page 15.
The correspondence of the origin data label value and axis to be input is shown in Fig. 2-10.

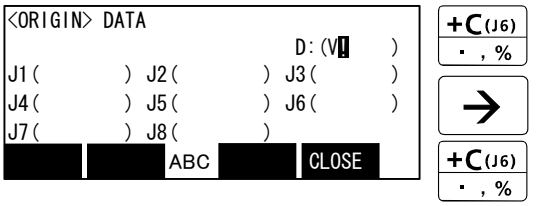
Fig.2-10 : Correspondence of origin data label and axis

The method for inputting the origin data is explained below. The value shown in Fig. 2-9 will be input as an example.

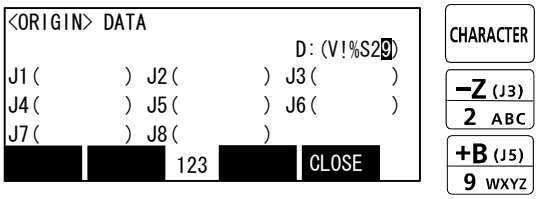
1) Confirm that the cursor is at the "D" position on the T/B display screen.



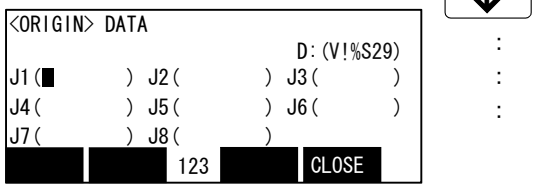
2) Input the D value "V!%S29".
Inputting "V"
Press the [CHARACTER] key and set to the character input mode. (Condition that "ABC" was displayed under the screen)
Press the [TUV] key three times. "V" will be set.



Inputting "!"
Press the [, %] key five times. "!" will be set.
Press the [→] key once and advance the cursor.
Press the [, %] key twice (input "%"), and press the [PQRS] key four times (input "S").

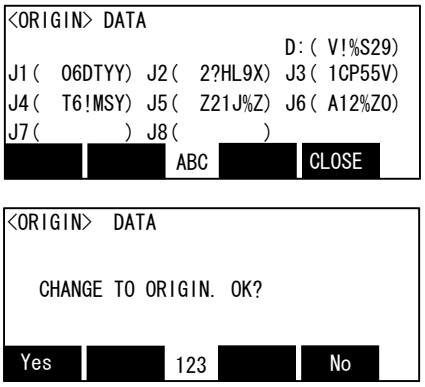


Press the [CHARACTER] key and set to the numeral input mode. (Condition that "123" was displayed under the screen)
Press the [2] key (input "2"), and press the [9] key (input "9").
"V!%S29" will appear at the "D" data on the teaching pendant screen.



3) Press the [↓] key, and move the cursor to the J1 input position.
4) Input the J1 value in the same manner as above.

Input the J2, J3, J4, J5 and J6 values in the same manner.



5) After inputting all of the values, press the [EXE] key. The origin setting confirmation screen will appear.

6) Press [F1] (Yes) to end the origin setting

◇◆◇ Moving the cursor ◇◆◇
Press the [↑], [↓], [←] and [→] keys.

◇◆◇ Inputting characters ◇◆◇
Press the [CHARACTER] key and set to the character input mode. (Condition that "ABC" was displayed under the screen). The displayed character is scrolled each time at pressing the key.

◇◆◇ Correcting an input ◇◆◇
After returning one character by pressing the [C L E A R] key, input the character again.

(6) Installing the J1 motor cover.
Return the J1 motor cover removed in section "(1) Confirming the origin data" on page 15 to its original position. This completes the setting of the origin with the origin data input method.

⚠ WARNING
Always remove and install the cover with the controller power turned OFF. Failure to do so could lead to the robot moving because of incorrect operations, or to physical damage or personal injury.

◇◆◇ If the origin input data is incorrect ◇◆◇
If the origin input data is incorrect, the alarm No. 1760 (origin setting data illegal) will occur when origin data input. In this case, reconfirm the value input for the origin data.

2.4 Confirming the operation

In this section, the robot will be moved manually 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, and the CYLNDER jog that moves along the circular arc.
This operation is carried out while pressing the deadman switch on the back of the T/B.

⚠ CAUTION

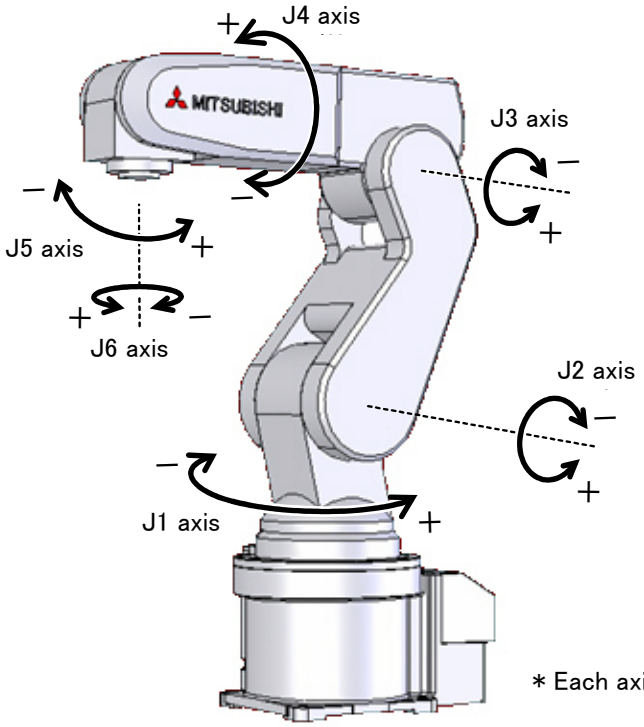
The robot will move during this operation. Make sure that there are no operators near the robot, and that there are no obstacles, such as tools, in the robot operation range.

⚠ CAUTION

To immediately stop the robot, release the deadman 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 [EMG.STOP] switch (emergency stop switch) on the front of the T/B or the [EMG.STOP] switch (emergency stop) on the front of the controller is pressed.

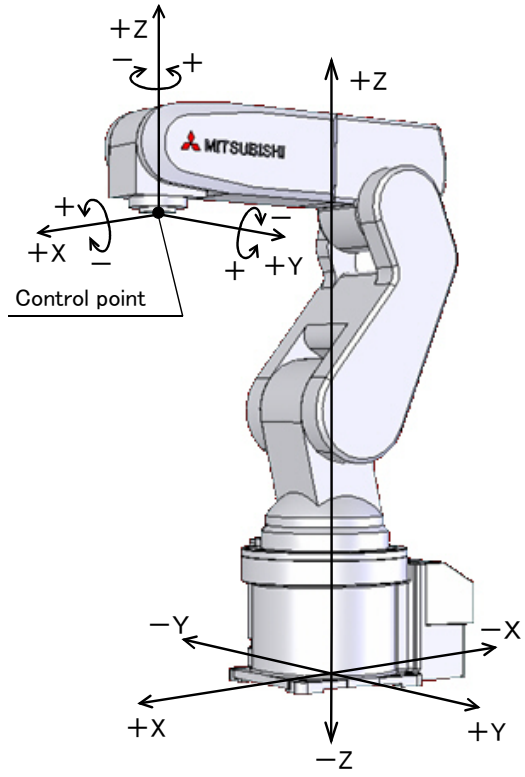
⚠ WARNING

Confirm that the origin has been set. If the origin has not been set, "****" will appear at the current position display on the teaching pendant, the JOINT jog operation will take place in any jog mode selected.
Refer to "2.3 Setting the origin" on page 14 for details on setting the origin.



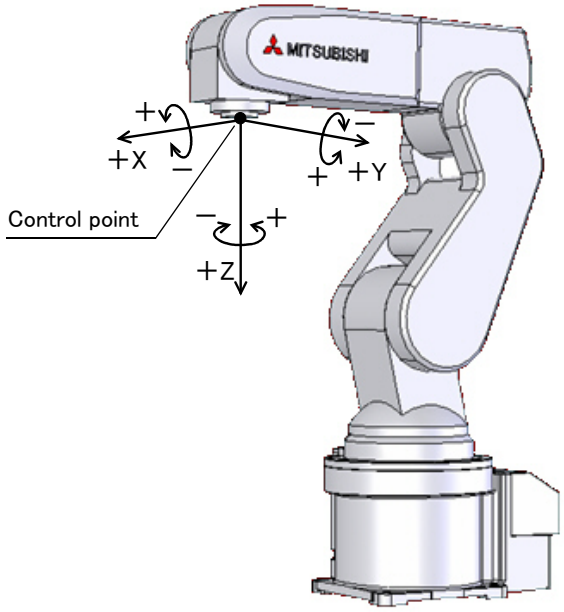
* Each axis moves independently.

Fig.2-11 : JOINT jog operation



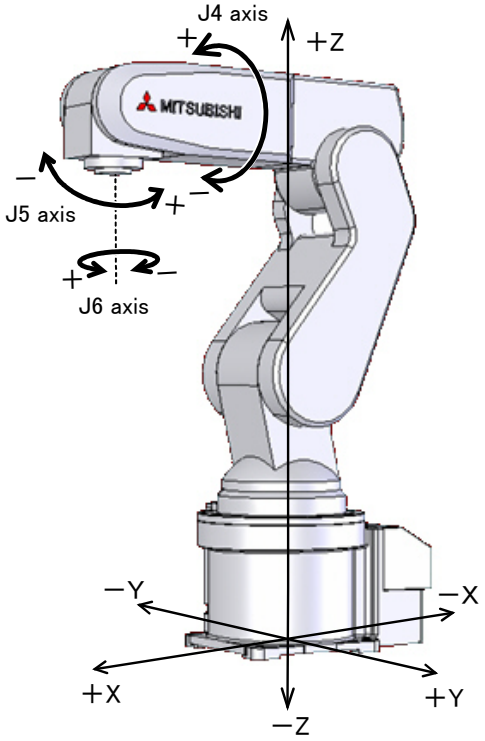
* While maintaining the flange surface posture, the axis moves straight along the base. coordinate system. Also, while maintaining the flange surface position, the flange surface posture changes.

Fig.2-12 : XYZ jog operation



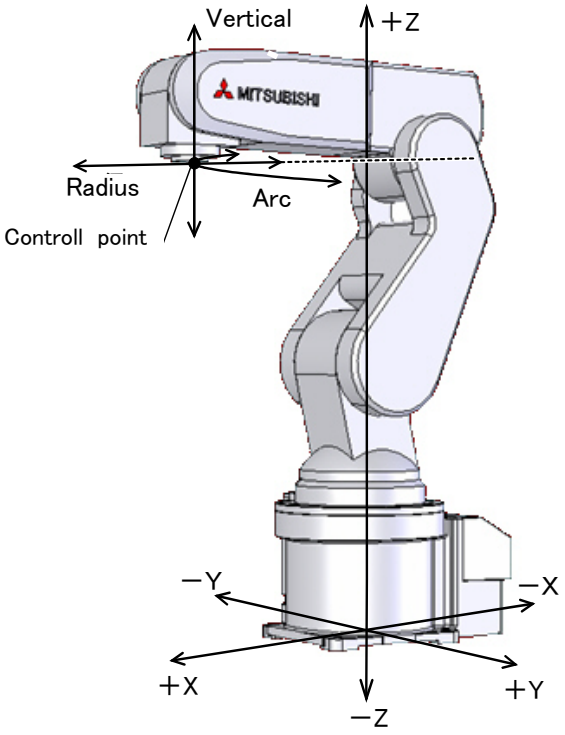
* While maintaining the flange surface posture, the axis moves straight along the tool. coordinate system. Also, while maintaining the flange surface position, the flange surface posture changes.

Fig.2-13 : TOOL jog operation



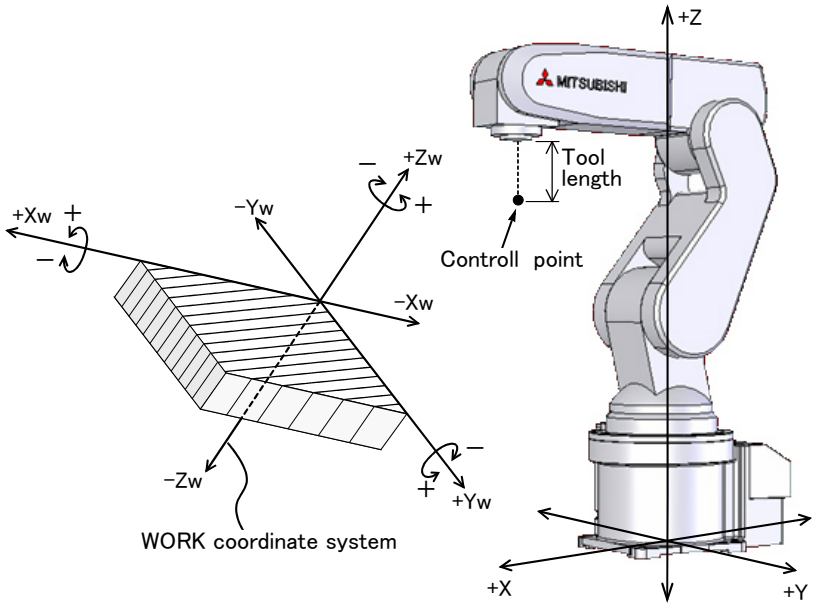
* The axis moves straight along the base coordinate system. At this time, the flange surface posture is not maintained. Also, the flange surface posture changes. The flange surface position does not change at this time. It is effective to change the posture of the wrist, with the position maintained.

Fig.2-14 : 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 flange surface posture is maintained. Also, while maintaining the flange surface position, the flange surface posture changes.

Fig.2-15 : CYLINDER jog operation

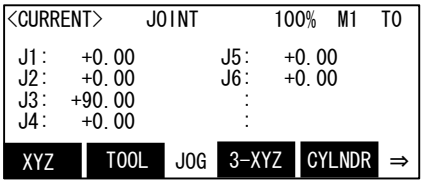


* While maintaining the flange surface posture, the axis moves straight along the work coordinate system. Also, while maintaining the flange surface position, the flange surface posture changes.

Fig.2-16 : WORK jog operation

(1) JOINT jog operation

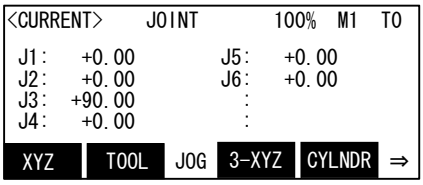
Select joint jog mode



Joint jog mode

[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."

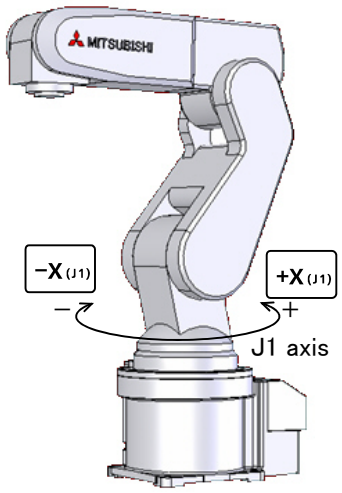
Set jog speed



Setting the speed

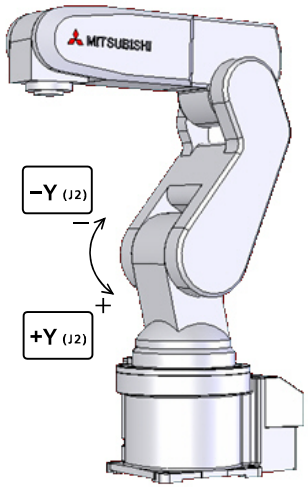
Whenever it presses the key of [OVRD ↑], the override goes up. Conversely, if the [OVRD ↓] key is pressed, it will go down.
The current setting speed is displayed on screen upper right, and "STATUS NUMBER" of the controller.
Set the override to 10% here for confirmation work

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

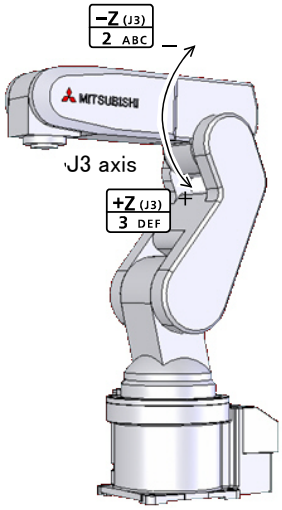


・When the [+Y (J2)] keys are pressed, the J2 axis will rotate in the plus direction.
When the [−Y (J2)] keys are pressed, Rotate in the minus direction.

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

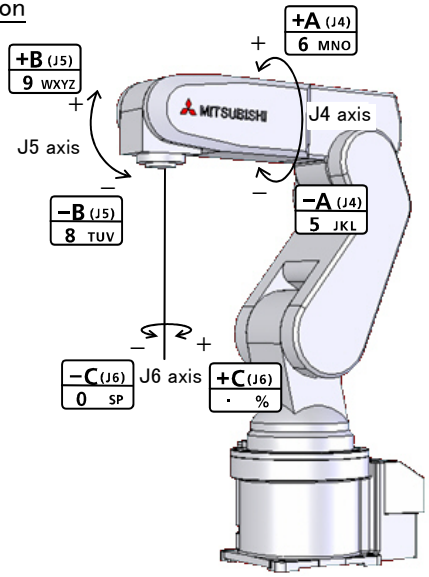
The axes may be outside the movement area. Move these axes toward the inner side of the movement area.

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, J5 and J6 axis jog operation



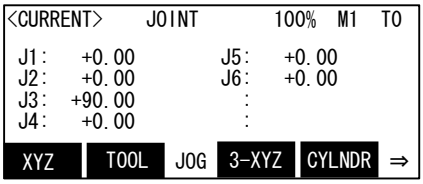
・When the [+A (J4)] keys are pressed, the J4 axis will rotate in the plus direction.
When the [−A (J4)] keys are pressed, Rotate in the minus direction.
・When the [+B (J5)] keys are pressed, the J5 axis will rotate in the plus direction
When the [−B (J5)] keys are pressed, Rotate in the minus direction.
・When the [+C (J6)] keys are pressed, the J6 axis will rotate in the plus direction
When the [−C (J6)] 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

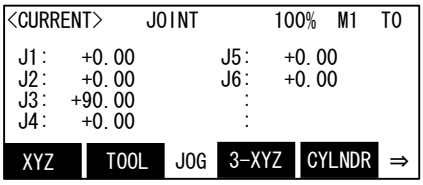
Select XYZ jog mode



XYZ jog mode

[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."

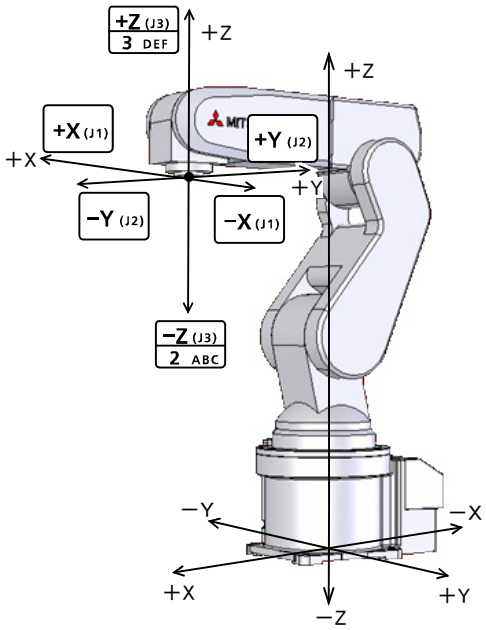
Set jog speed



Setting the speed

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 screen upper right, and "STATUS NUMBER" of the controller.
Set the override to 10% here for confirmation work

Moving along the base coordinate system



* The direction of the flange will not 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.

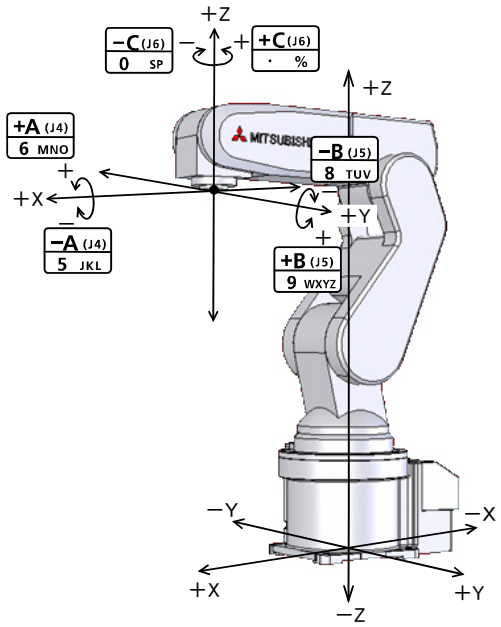
◇◆◇ When the robot is in the transportation posture ◇◆◇

There are directions from which linear movement is not possible from the transportation posture. In this case, the robot will not move. Refer to section "(1) JOINT jog operation" on page 24", 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 flange surface posture



* The control point does not change.

- When the [+A (J4)] keys are pressed, The X axis will rotate in the plus direction.
  When the [−A (J4)] keys are pressed, Rotate in the minus direction.
- When the [+B (J5)] keys are pressed, The Y axis will rotate in the plus direction.
  When the [−B (J5)] keys are pressed, Rotate in the minus direction.
- 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 ◇◆◇

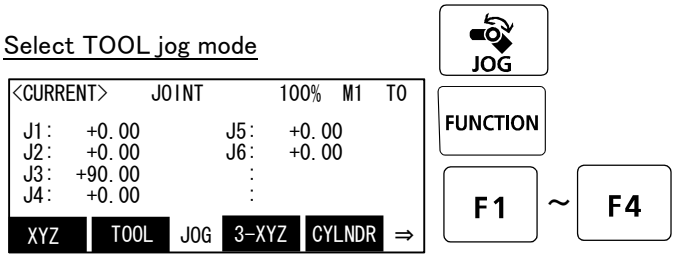
If alarm No. 5150 (ORIGIN NOT SET) occurs, the origin has not been set correctly. Reconfirm the value input for the origin data.

◇◆◇ 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

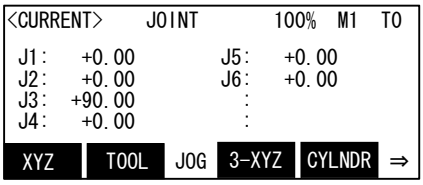
Select TOOL jog mode



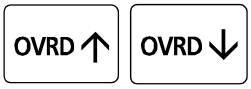
TOOL jog mode

[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 [FUNC-TION] key is pressed)
If it finishes jog operation, press the [JOG] key again, or function key which correspond to "close."

Set jog speed

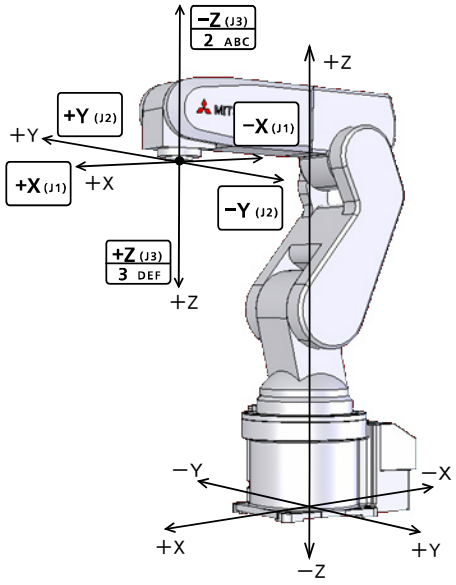


Setting the speed



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 screen upper right, and "STATUS NUMBER" of the controller.
Set the override to 10% here for confirmation work

Moving along the tool coordinate system



* The direction of the flange will not change

- 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.

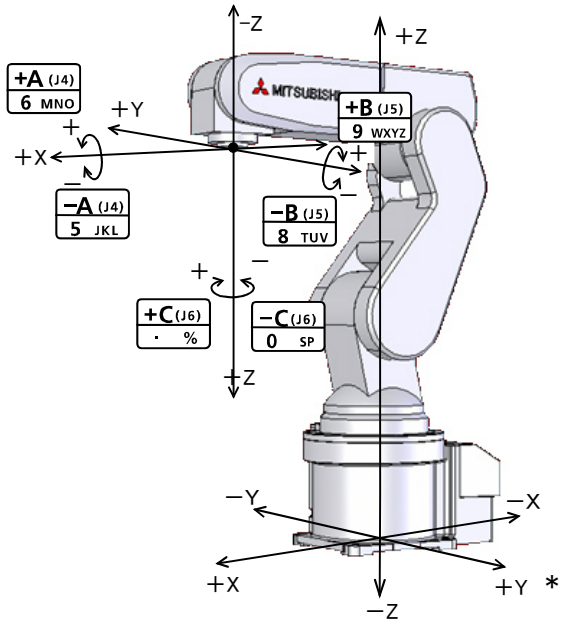
◇◆◇ When the robot is in the transportation posture ◇◆◇

There are directions from which linear movement is not possible from the transportation posture. In this case, the robot will not move. Refer to section "(1) JOINT jog operation" on page 24", 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 flange surface posture



＊The control point does not change.

- When the[+A (J4)] keys are pressed, The X axis will rotate in the plus direction of the tool coordinate system. When the[−A (J4)] keys are pressed, Rotate in the minus direction.
- When the[+B (J5)] keys are pressed, The Y axis will rotate in the plus direction of the tool coordinate system. When the[−B (J5)] keys are pressed, Rotate in the minus direction.
- 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 ◇◆◇

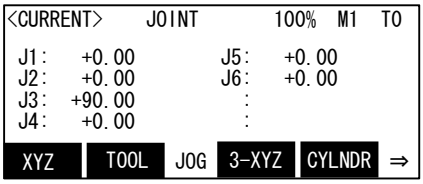
If alarm No. 5150 (ORIGIN NOT SET) occurs, the origin has not been set correctly. Reconfirm the value input for the origin data.

◇◆◇ Tool length ◇◆◇

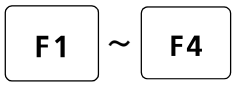
The default tool length is 0mm, and the control point is the center of the end axis.
After installing the hand, set the correct tool length in the parameters. Refer to the separate manual "Detailed Explanation of Functions and Operations" for details.

(4) 3-axis XYZ jog operation

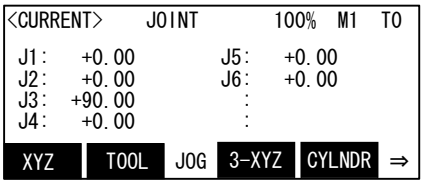
Select XYZ456 jog mode



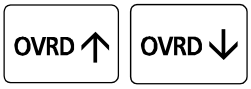
XYZ456 jog mode



Set jog speed

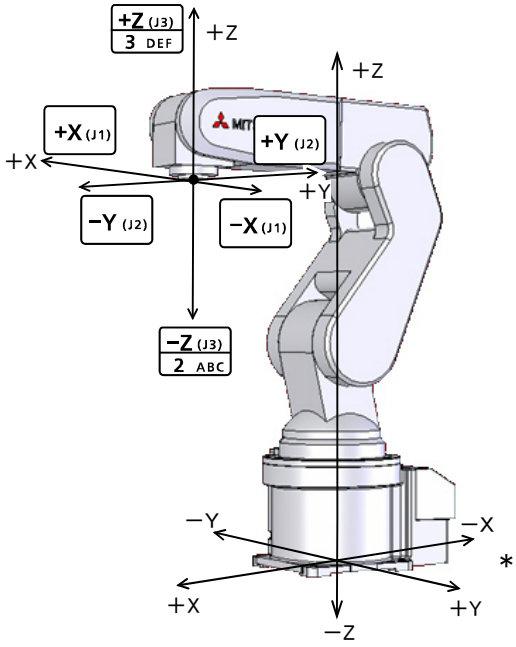


Setting the speed



[JOG] Press the key and display the jog screen. ("JOG" is displayed on the screen bottom)
Check that the "XYZ456" in jog mode is displayed on the screen.
If other jog modes are displayed, please press the function key corresponding to the "XYZ456." (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 screen upper right, and "STATUS NUMBER" of the controller.
Set the override to 10% here for confirmation work

Moving along the base coordinate system

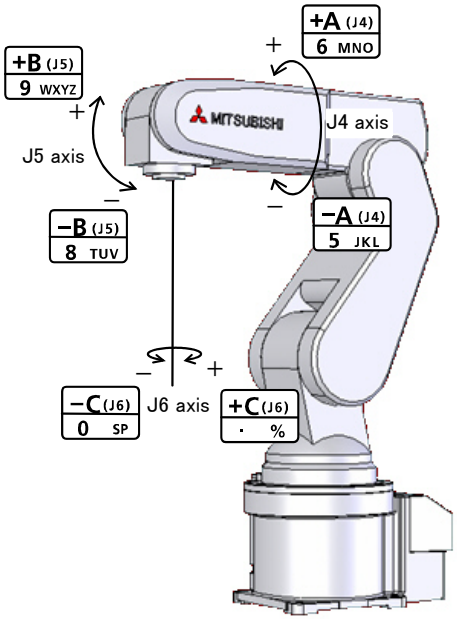


* The direction of the flange will change

- 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 flange surface posture

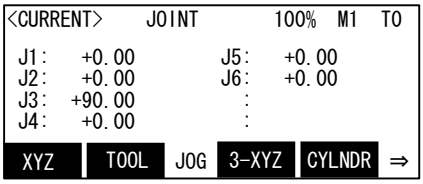


* The wrist posecan be changed maintaining the flange's position.

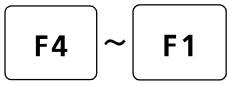
- When the[+A (J4)] keys are pressed, the J4−axis will rotate in the plus direction.
  At this time, to maintain the flange's position, other axes move simultaneously except J5 and J6.
  When the[−A (J4)] keys are pressed, Rotate in the minus direction.
- When the[+B (J5)] keys are pressed, the J5−axis will rotate in the plus direction.
  At this time, to maintain the flange's position, other axes move simultaneously except J4 and J6.
  When the[−B (J5)] keys are pressed, Rotate in the minus direction.
- When the[+C (J6)] keys are pressed, the J6−axis will rotate in the plus direction.
  When the[−C (J6)] keys are pressed, Rotate in the minus direction.

(5) CYLNDER jog operation

Select cylindrical jog mode

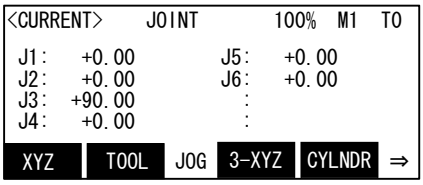


CYLNDER jog mode

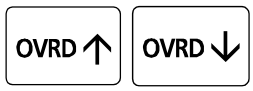


[JOG] Press the key and display the jog screen. ("JOG" is displayed on the screen bottom)
Check that the "CYLNDER" in jog mode is displayed on the screen.
If other jog modes are displayed, please press the function key corresponding to the "CYLNDER." (If the jog mode which he wishes under the screen 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."

Set jog speed

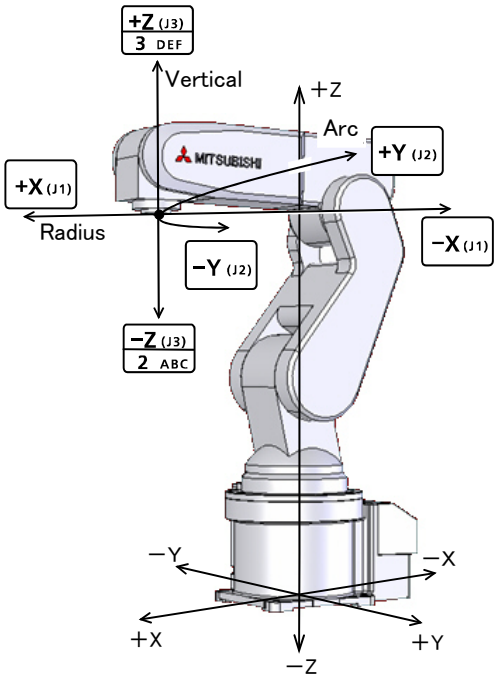


Setting the speed



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 screen upper right, and "STATUS NUMBER" of the controller.
Set the override to 10% here for confirmation work

Moving along an arc centering on the Z axis

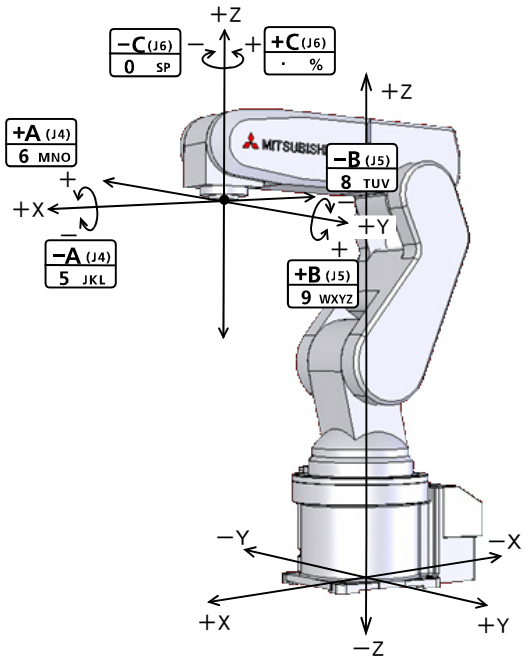


＊ The direction of the frange will not change.

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.

Changing the flange surface posture



∗ The flange position does not change.
This is the same as the A, B and C axis XYZ jog operation.

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

- When the [+B (J5)] keys are pressed, The Y axis will rotate in the plus direction.
  When the [−B (J5)] keys are pressed, Rotate in the minus direction.

- 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.

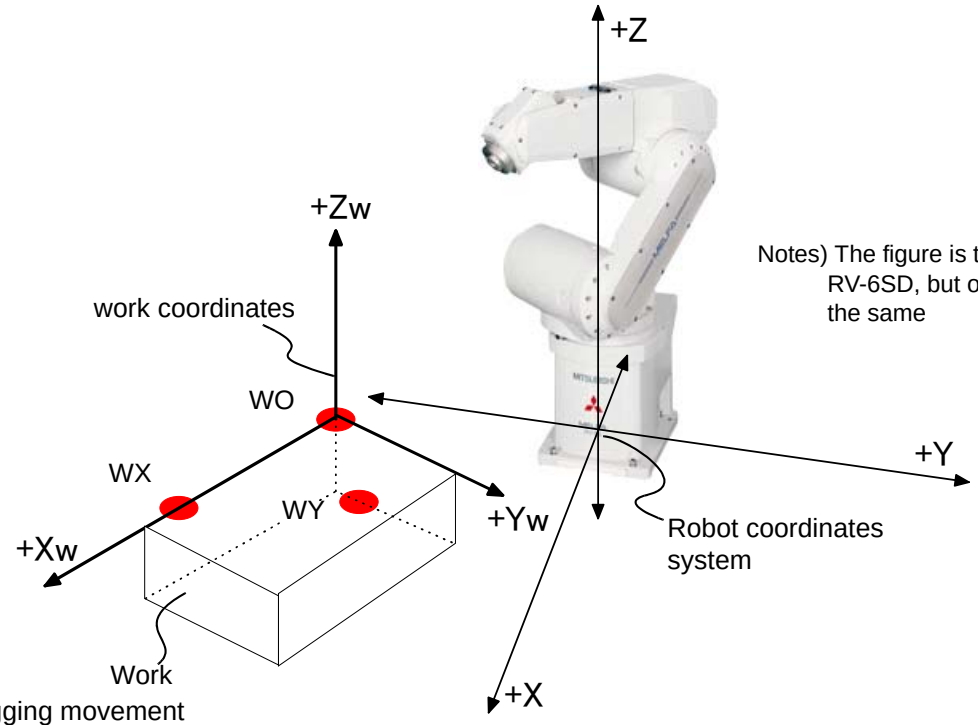
(6) Work jog operation

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 (R32TB) is shown in the following.
(Parameter: Setting the coordinate value to WKnCORD ("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.)

In addition, this jog operation is available at the following software versions. The below-mentioned "6.ENHANCED" menu is not displayed in the other versions.

T/B :Ver.1.3 or later
SQ series: N8 or later
SD series :P8 or later

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



Notes) The figure is the example of RV-6SD, but other types are the same

The jogging movement based on this work is possible.

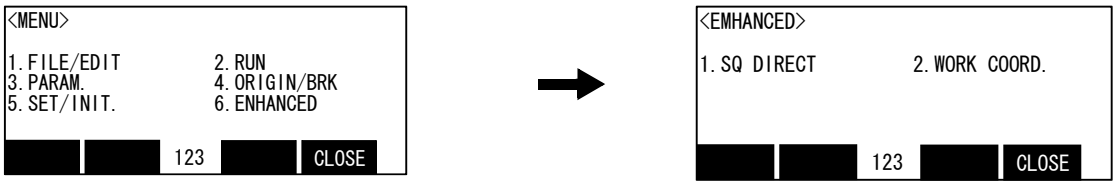
< Teaching point>
WO: Work coordinates system origin
WX: Position on the "+X" axis of work coordinates system.
WY: Position at the side of "+Y" axis on the X-Y plane of work coordinates system

[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)

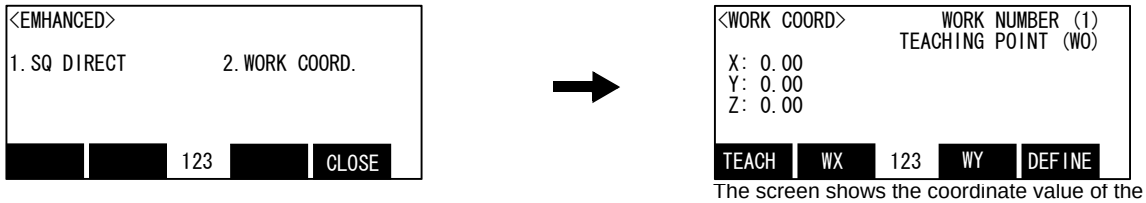
Fig.2-17 : Setting of the work coordinates system (teaching point)

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

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



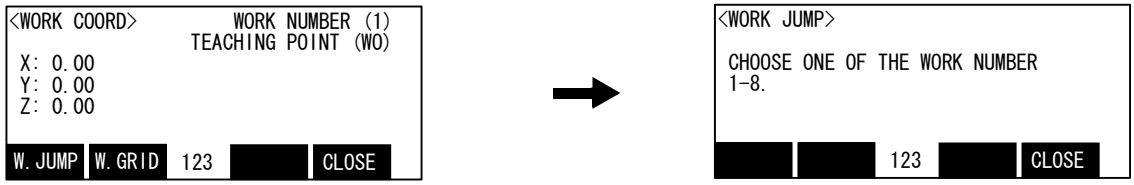
2) Press the [2] keys in the menu screen and select "2. xxxxx."



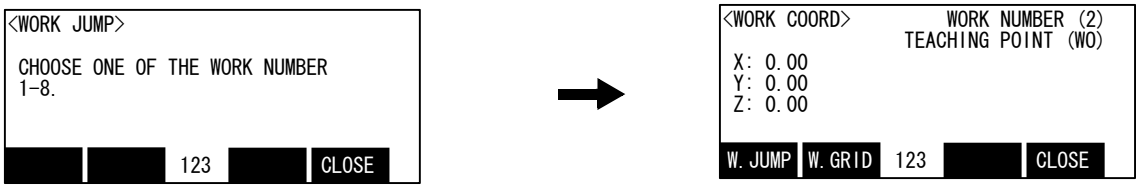
The screen shows the coordinate value of the origin (WO) of the work coordinates number 1.

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.

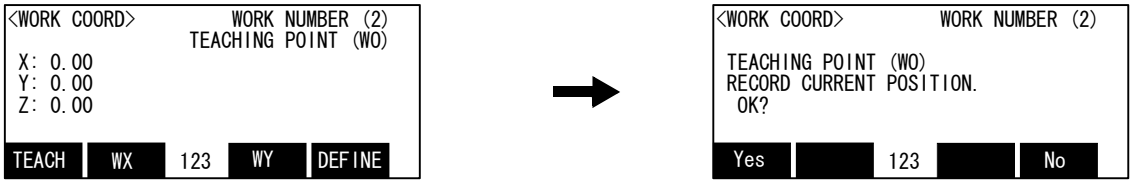


Operation will be canceled if the [CLOSE] key is pressed.

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

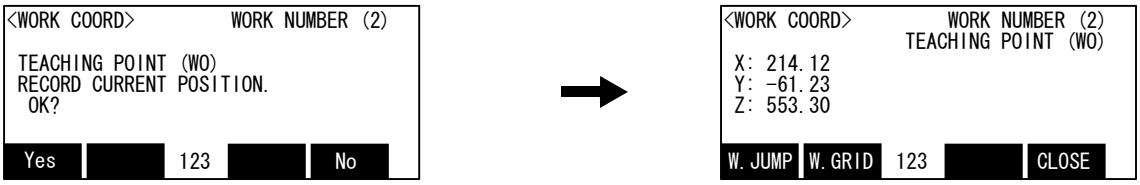
4) The teaching of the work coordinates system

Teach the three points shown in Fig. 2-17. 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]

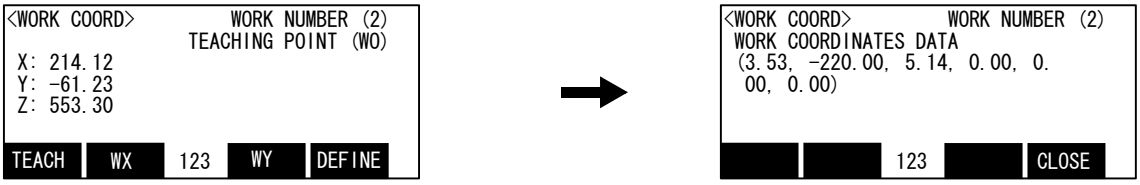
Presses the function key corresponding to"Yes", the robot's current position is registered, and the registered coordinates value is displaye. Operation will be canceled if the [CLOSE] key is pressed.



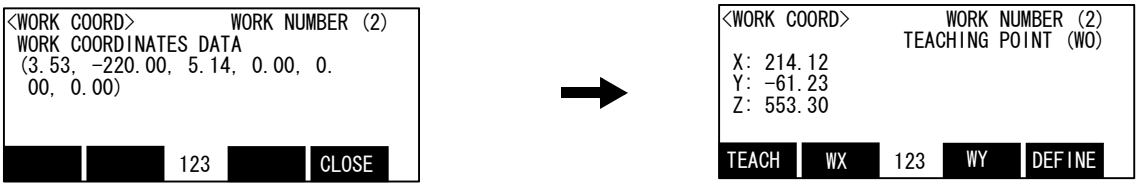
Teach the three points, WO, WX, and WY, by the same operation.
The position data taught here is each registered into the following parameters. ("n" means the work coordinates numbers 1-8)

WO= parameter: WKnWO
WX= parameter: WKnWX
WY= parameter: WKnWY

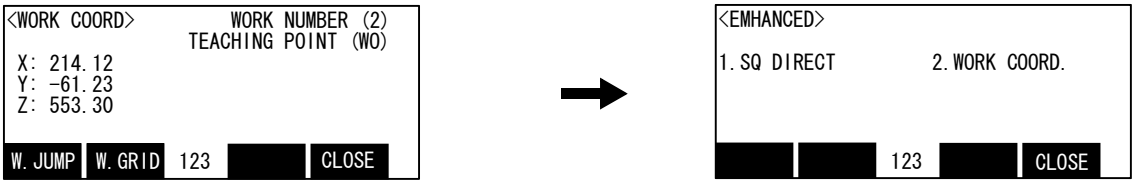
5) Setting of work coordinates (definition)
If the function key corresponding to "DEFINE" ([F1]) is pressed, the work coordinates system will be calculated using the three points, and the result will be displayed.



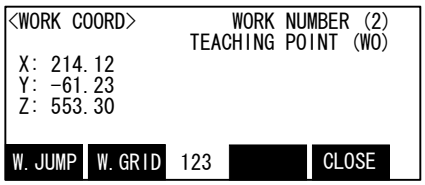
The alarm occurs if the work coordinates system is incalculable. (There are the three points on the straight line, or the two points have overlapped) In this case, reset alarm and re-teach the three points.
This work coordinate data is registered into parameter: WKnCORD. ("n" means the work coordinates numbers 1-8)
If the function key corresponding to "CLOSE" is pressed, it will return to the previous screen.

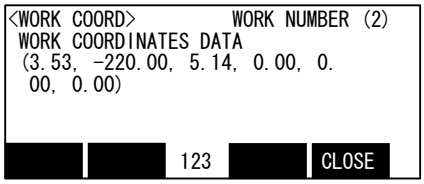


6) Finishing of setting the work coordinates
Press the [FUNCTION] keys, and display "CLOSE" function. Press the function key corresponding to "CLOSE". Returns to the <MENU> screen.



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])

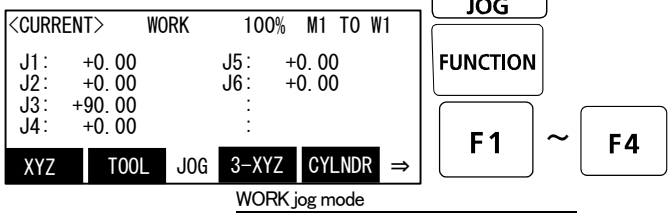




Return to the previous screen by pressing the [CLOSE] ([F4]) key.

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

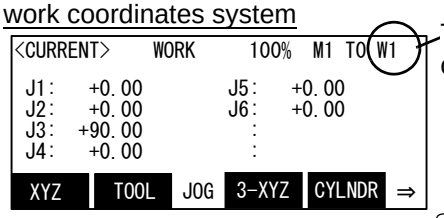
Select WORK jog mode



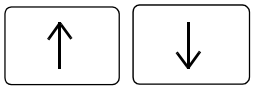
WORK jog mode

[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



Target work coordinates system



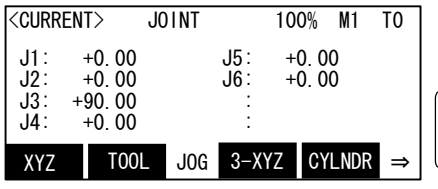
Select the work coordinates system

Confirm the target work coordinates system.
The current target number is displayed on the screen upper right. (W1Å`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

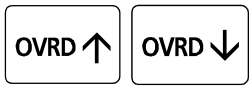
⚠ CAUTION

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

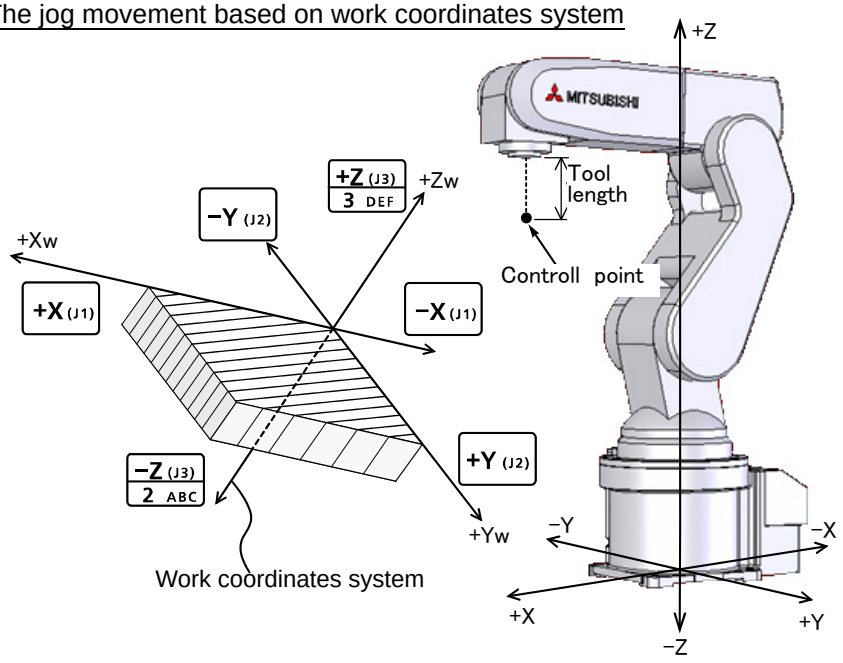


Setting the speed



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 screen upper right, and "STATUS NUMBER" of the controller.
Set the override to 10% here for confirmation work

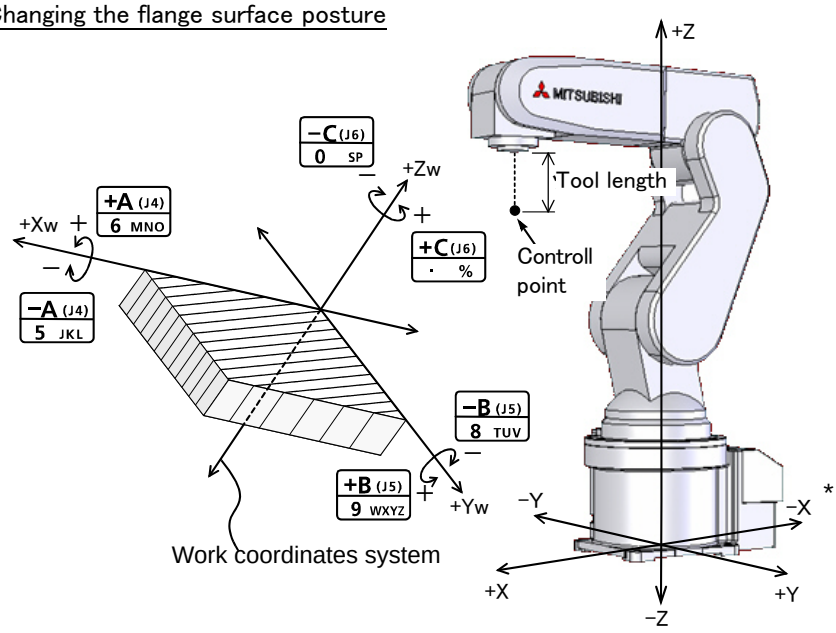
The jog movement based on work coordinates system



* The direction of the flange 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 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 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 plus direction on the work coordinates system.
  When the[−Z (J3)] keys are pressed, Move along the minus direction.

Changing the flange surface posture



* The position of the control point does not change. Change the direction of the flange in accordance with the work coordinates system.

・When the[+A (J4)] keys are pressed, The X axis will rotate in the plus direction of the work coordinate system.
When the[−A (J4)] keys are pressed, Rotate in the minus direction.
・When the[+B (J5)] keys are pressed, The Y axis will rotate in the plus direction of the work coordinate system.
When the[−B (J5)] keys are pressed, Rotate in the minus direction.
・When the[+C (J6)] keys are pressed, The Z axis will rotate in the plus direction of the work coordinate system.
When the[−C (J6)] keys are pressed, 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 section ″(1) JOINT jog operation″ on page 24″, 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.

3 Installing the option devices

Explain the installation methods, such as the solenoid valve set.

3.1 Installing the solenoid valve set

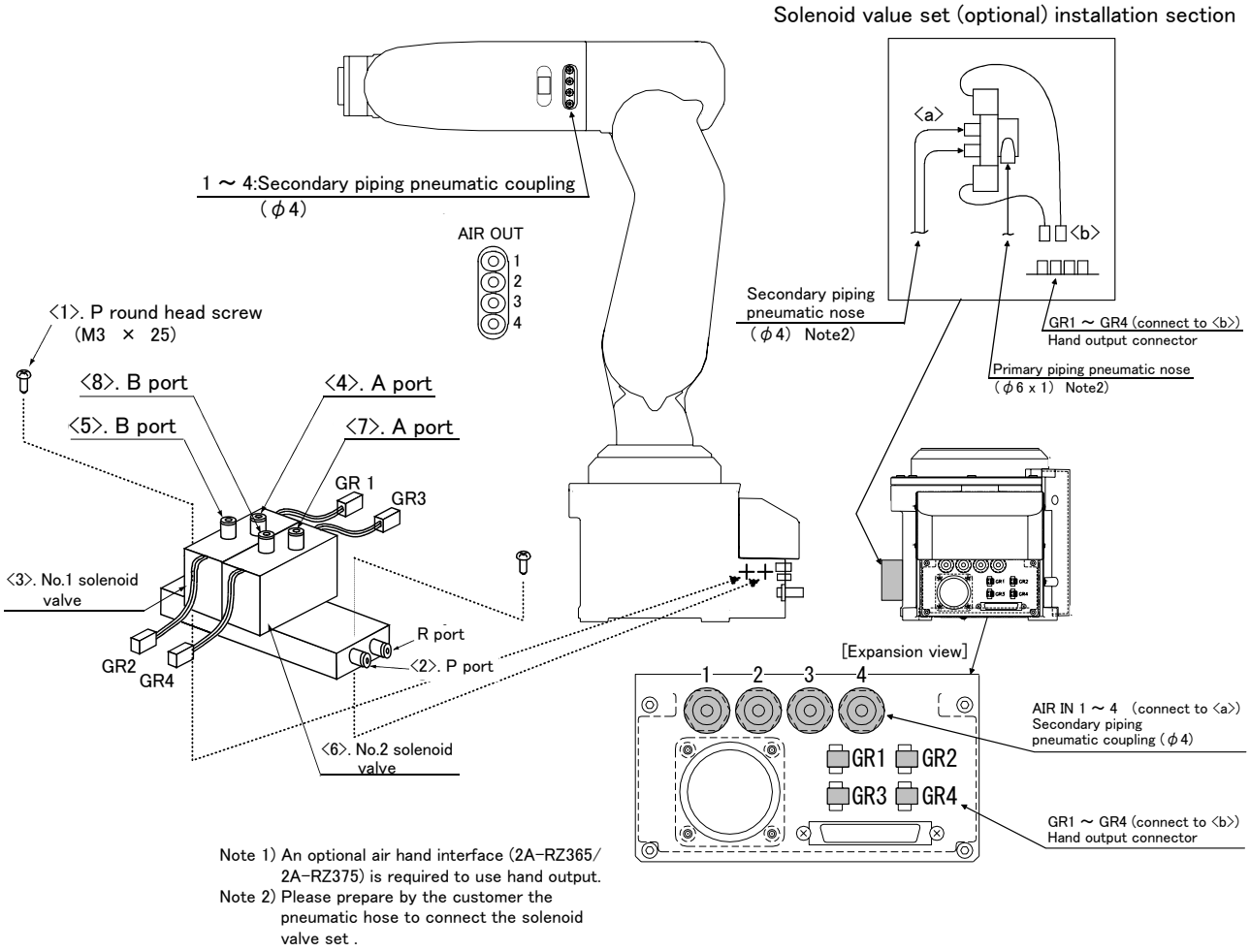


Fig.3-1 : Solenoid valve installation procedures

Fig. 3-1 shows the solenoid valve installation procedures and the solenoid valve connector connection procedures. The installation procedures are as follow. This work must be carried out with the controller power turned OFF.

1) Using the screw holes on the base of the robot arm, install the solenoid valve with the enclosed screw <1> (M3 x 25: 2 screws).
2) Connect the primary air supply air hose (φ6, prepared by customer) to the quick joint (P port) <2> of the solenoid valve.
3) Connect the AIR IN "1" mark secondary piping coupler to the A port <4> of the No. 1 solenoid valve <3> with an air hose (φ4 approx. 250mm, prepared by customer.)
   In the same manner, connect the AIR IN "2" mark secondary piping coupler to the B port 5 of the No. 1 solenoid valve.
   For a double valve (1E-VD02), connect the following:
   Connect the AIR IN "3" mark secondary coupler to the A port <7> of the No. 2 solenoid valve <6>.
   Connect the AIR IN "4" mark secondary coupler to the B port <8> of the No. 2 solenoid valve <6>.
4) Connect the GR1 plug from the No. 1 solenoid valve <3> to the GR1 connector on the back of the robot arm.
   Connect the GR2 plug from the No. 1 solenoid valve <3> to the GR2 connector on the back of the robot arm.
   For a double valve (1E-VD02), connect the following:
   Connect the GR3 plug from the No. 2 solenoid valve <6> to the GR3 connector on the back of the robot arm.
   Connect the GR4 plug from the No. 2 solenoid valve <6> to the GR4 connector on the back of the robot arm.

4 Basic operations

The basic operations from creating the program to automatic operation are explained in section ″4. Basic operations″ in the ″From Controller Setup to Maintenance″ manual. Refer that manual as necessary.

5 Maintenance and Inspection

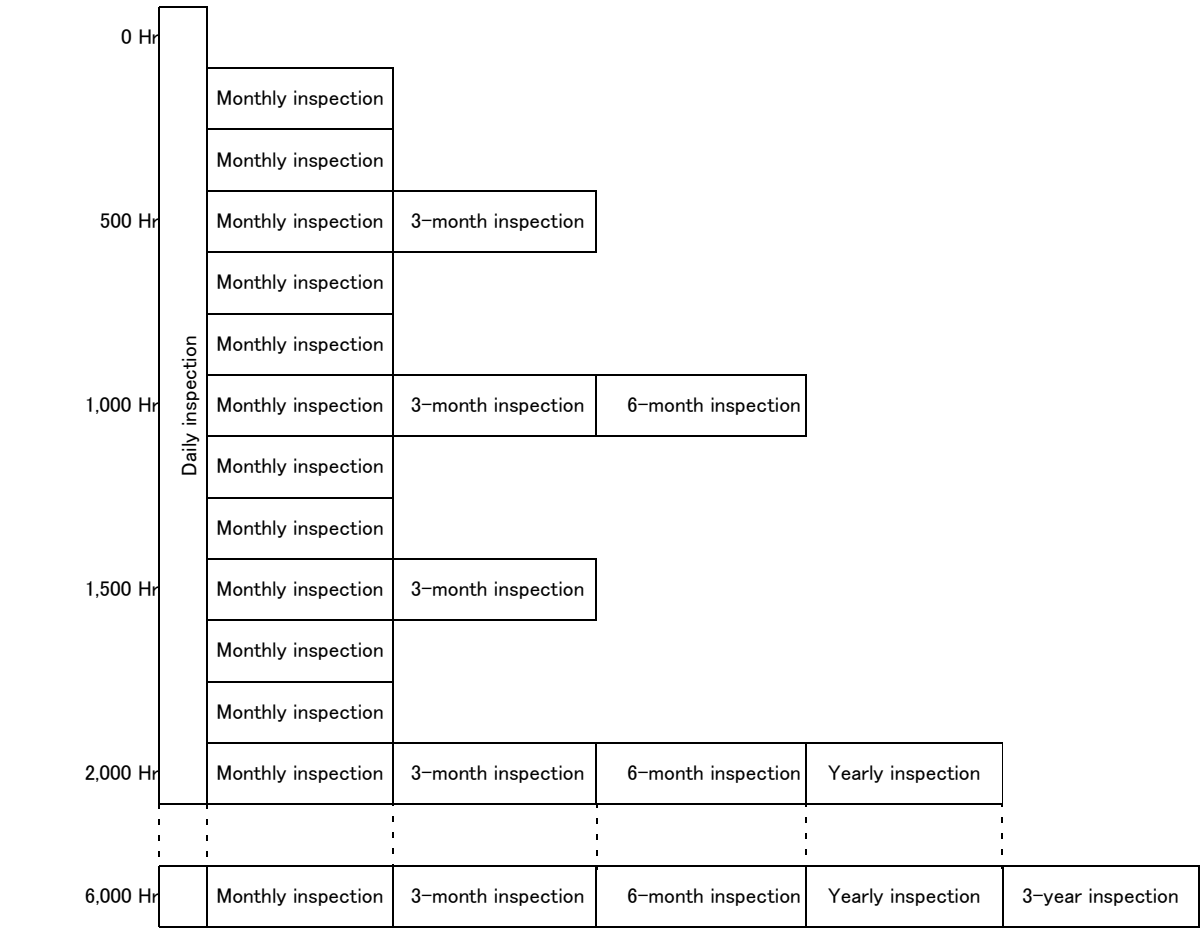
The maintenance and inspection procedures to be carried out to use the robot for a long time without trouble are described in this chapter. The types and replacement methods of consumable parts are also explained.

5.1 Maintenance and inspection interval

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.

(1) Inspection schedule

In addition to the monthly inspection, add the following inspection items every three months (estimated at 500 Hr operation hours).



<Guideline for inspection period>

For one shift

8 Hr/day × 20 days/month × 3 months = approx. 500 Hr

10 Hr/day × 20 days/month × 3 months = approx. 600 Hr

For two shifts

15 Hr/day × 20 days/month × 3 months = approx. 1000 Hr

[Caution] When using two lines, the 3-month inspection, 6-month inspection and yearly inspection must be carried out when half the time has passed.

Fig.5-1 : Inspection 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

Carry out the daily inspections with the procedures given in Table 5-1.

Table 5-1 : 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 any grease leaking from the robot arm? (Visual)	After cleaning, replenish the grease.
8	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).
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

Carry out periodic inspection with the procedures given in Table 5-2.

Table 5-2 : Periodic inspection items (details)

Procedure	Inspection item (details)	Remedies
Monthly inspection items		
1	Are any of the bolts or screws on the robot arm loose?	Securely tighten the bolts.
2	Are any of the connector fixing screws or terminal block terminal screws loose?	Securely tighten the screws.
3	Remove the cover at each section, and check the cables for wear damage and adherence of foreign matter.	Check and eliminate the cause. If the cables are severely damaged, contact the Mitsubishi Service Department.
3-month inspection items		
1	Is the timing belt tension abnormal?	If the timing belt is loose or too tense, adjust it.
6-month inspection items		
1	Is the friction at the timing belt teeth severe?	If the teeth are missing or severe friction is found, replace the timing belt.
Yearly inspection items		
1	Replace the backup battery in the robot arm.	Exchange it referring to "5.3.5Replacing the backup battery" on page 64.
3-year inspection items		
1	Lubricate the grease at the harmonic reduction gears for each axis	Lublicate it referring to "5.3.4Lubrication" on page 62

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 "5.4Maintenance parts" on page 66 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 is shown in Fig. 5-2.. Each part is as shown below.

1) The rotation of the J1 axis motor <1> arranged in the base is conveyed to the reduction gears <3> via the timing belt <2> to rotate the J1 axis. Brakes are not mounted in the J1 axis motor
RV-2SD: Brakes are not mounted in the J1 axis motor.
RV-2SDB: Non-excitation magnetic brakes are mounted in the J1 axis motor.

2) The rotation of the J2 axis motor <4> arranged in the No.1 arm is conveyed to the reduction gears <6> via the timing belt <5> to rotate the J2 axis.
Non-excitation magnetic brakes are mounted in the J2 axis motor.

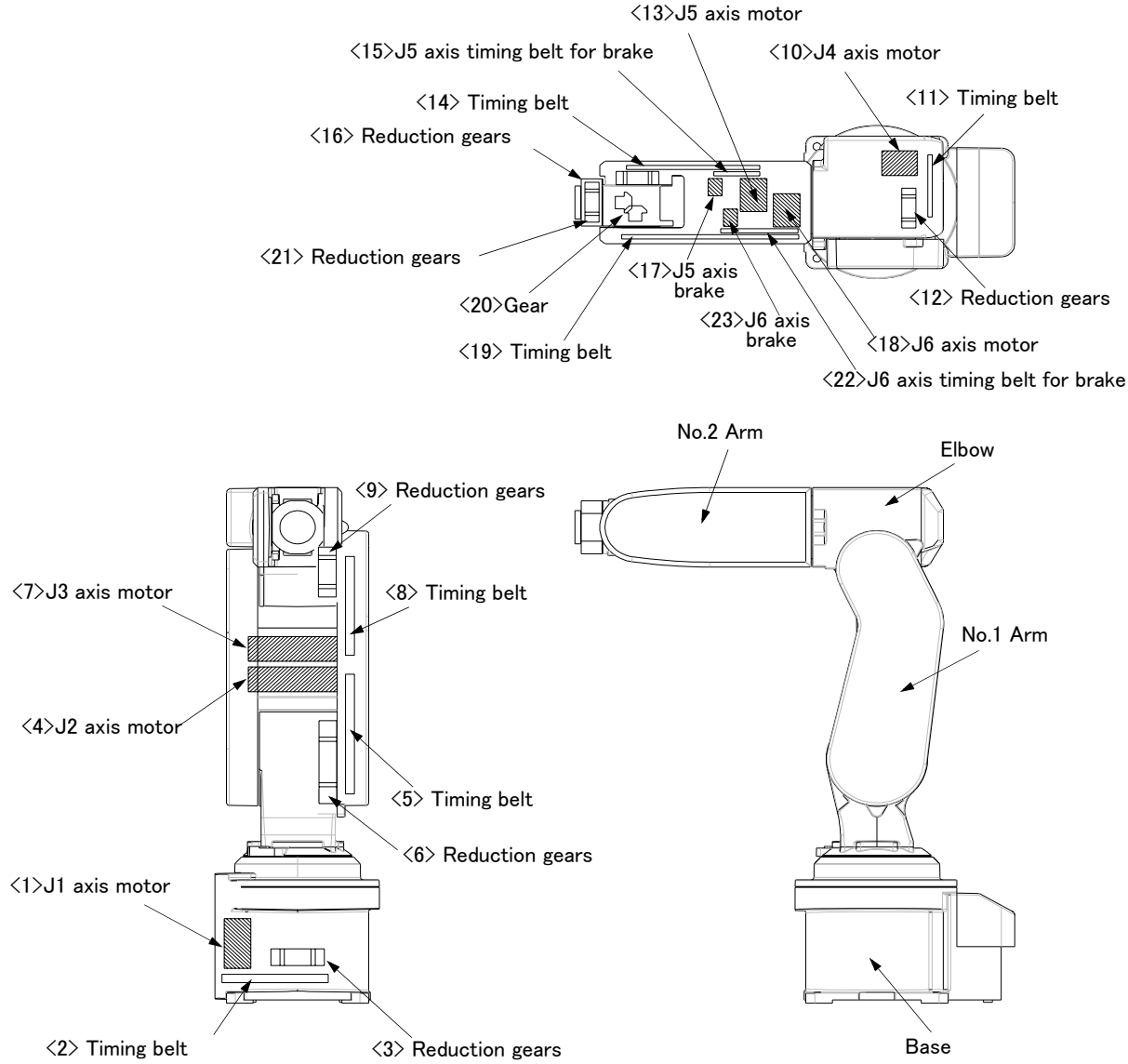
3) The rotation of the J3 axis motor <7> arranged in the No.1 arm is conveyed to the reduction gears <9> via the timing belt <8> to rotate the J3 axis.
Non-excitation magnetic brakes are mounted in the J3 axis motor.

4) The rotation of the J4 axis motor <10> arranged in the elbow is conveyed to the reduction gears <12> via the timing belt <11> to rotate the J4 axis. Brakes are not mounted in the J4 axis motor.
RV-2SD: Brakes are not mounted in the J4 axis motor.
RV-2SDB: Non-excitation magnetic brakes are mounted in the J4 axis motor.

5) The rotation of the J5 axis motor <13> arranged in the No.2 arm is conveyed to the reduction gears <16> via the timing belt <14> to rotate the J5 axis. Non-excitation magnetic brakes <17> are mounted via the timing belt <15> in the J5 axis motor.

6) The rotation of the J6 axis motor <18> arranged in the No.2 arm is conveyed to the reduction gears <21> via the timing belt <19> and gear <20> to rotate the J6 axis. Brakes are not mounted in the J6 axis motor.

7) The J6 axes differ as follows depending on the type
RV-2SD: The rotation of the J6 axis motor <18> arranged in the No.2 arm is conveyed to the reduction gears <21> via the timing belt <19> and gear <20> to rotate the J6 axis. Brakes are not mounted in the J6 axis motor.
RV-2SDB: The rotation of the J6 axis motor <18> arranged in the No.2 arm is conveyed to the reduction gears <21> via the timing belt <19> and gear <20> to rotate the J6 axis. Non-excitation magnetic brakes <23> are mounted via the timing belt <22> in the J6 axis motor.



Note) <22> J6 axis brake timing belt and <23> J6 axis brake are only RV-2SDB (all axes have the brake).

Fig.5-2 : Outline structure drawing of robot arm

5.3.2 Installing/removing the cover

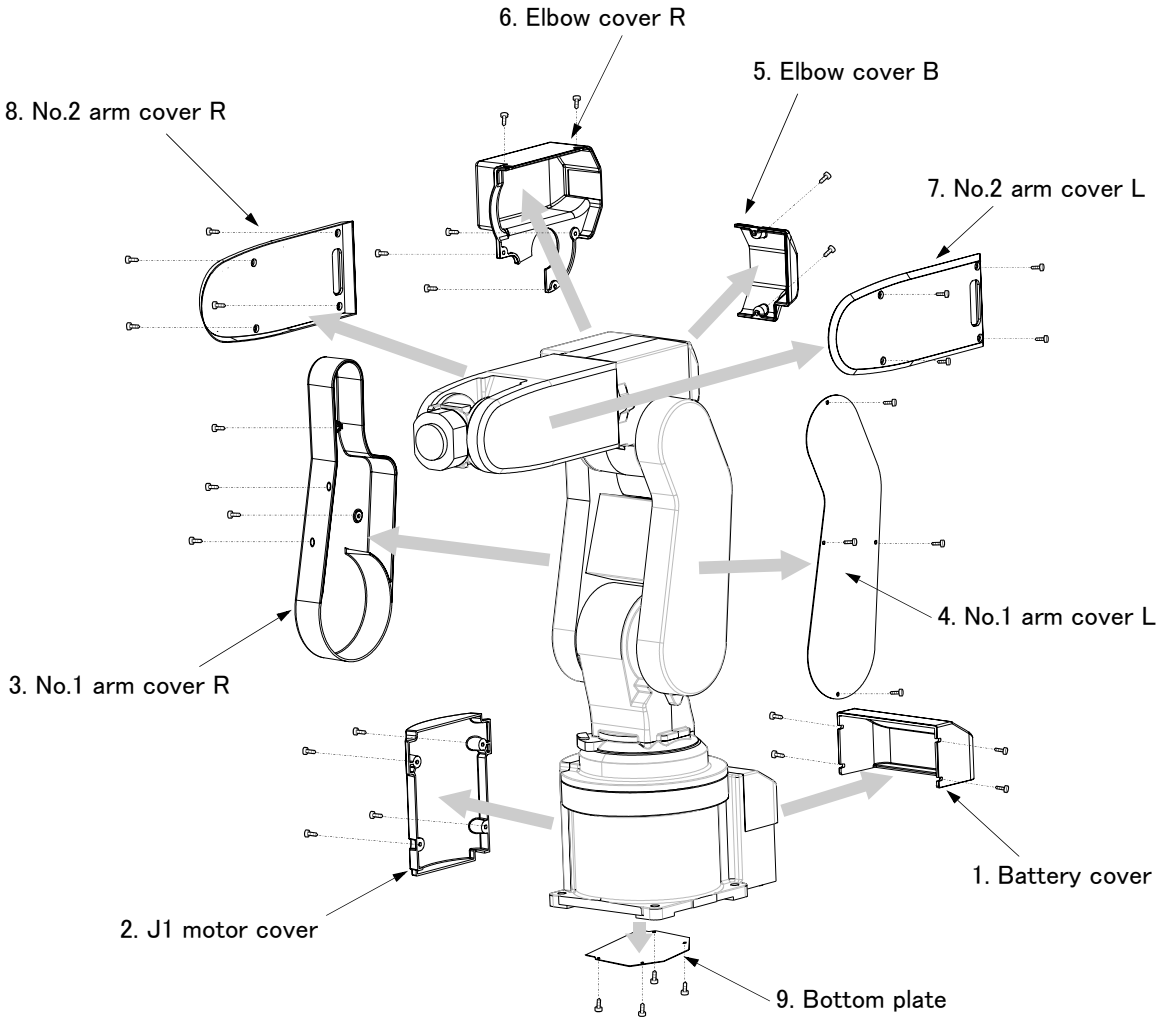


Fig.5-3 : Installing/removing the cover

Table 5-3 : Cover names

No	Cover names	Qty	Installation screw
<1>	Battery cover	1	Bind screw M3 Four
<2>	J1 motor cover	1	Bind screw M3 Four
<3>	No. 1 arm cover R	1	Bind screw M3 Four
<4>	No. 1 arm cover L	1	Low head safety socket M3 (Nickel plating) Four
<5>	Elbow cover B	1	Bind screw M3 Two
<6>	Elbow cover R	1	Bind screw M3 Five
<7>	No. 2 arm cover L	1	Bind screw M3 Four
<8>	No. 2 arm cover R	1	Bind screw M3 Four
<9>	Bottom plate	1	Low head safety socket M3 (Nickel plating) Four

(1) Each cover's names and installation screw are shown in Fig. 5-3. Refer to Fig. 5-3 and remove the cover.
(2) There are some covers that may be difficult to remove due to the robot posture. In this case, change the robot posture with jog operation, and then remove the cover.
(3) When attaching the cover after maintenance and inspection, use the detaching procedure in reverse.

The part Nos. and symbols in Table 5-3 correspond to Fig. 5-3.

5.3.3 Inspection, maintenance and replacement of timing belt

This robot uses a timing belt for the drive conveyance system of the J5 axis. 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, and adjustment of the belt tension 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. The timing belt must be replaced in the following cases.
In addition, it is serviceable if there is the sound wave type belt tension gauge in inspection and adjustment of the timing belt. The recommendation gauge is shown below. Please prepare by customer. Refer to the "(8)Timing belt tension" on page 61 for the tension adjustment value of the timing belt.

Maker:Gates Unitta Asia Company,
Type:U-505

(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) When cracks from at the base or back of the belt teeth.
2) When the belt expands due to adherence of oil, etc.
3) When the belt teeth wear (to approx. half of the tooth width).
4) When the belt teeth jump due to belt teeth wear.
5) When the belt snaps.

⚠ 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. If the wear chips appear soon after wiping them off, replace the belt.

⚠ CAUTION When the belt is replaced, the machine system origin may deviate. In this case, the position data must be reviewed.

(2) Inspection, maintenance and replacement of J1-axis timing belt

The reference figure at inspection, adjustment, and replacement of the timing belt is shown in Fig. 5-4

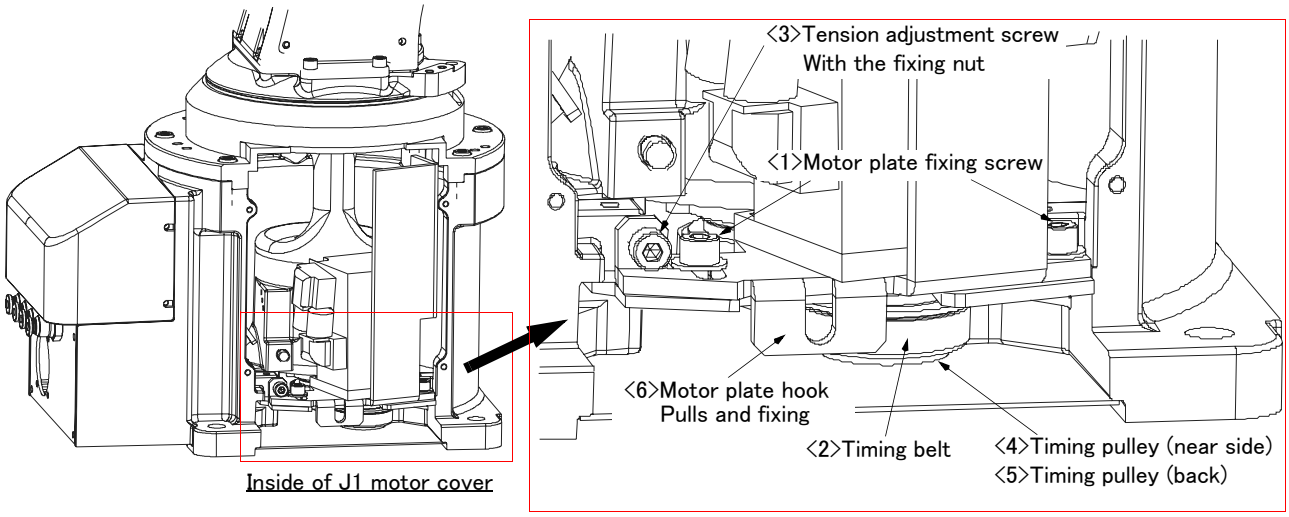


Fig.5-4 : Inspection, maintenance and replacement of J1 axis timing belt

■ Inspecting the J1 axis timing belt

1) Confirm that the robot controller power is OFF.
2) Refer to "5.3.2Installing/removing the cover" on page 47, and remove the J1 motor cover.
3) Visually confirm that the symptoms indicated in "(1)Timing belt replacement period" have not occurred with the timing belt.
4) Adjust the belt with reference to following " ■ Adjusting the J1 axis timing belt".

■ Adjusting the J1 axis timing belt

1) Carry out steps "1)" and "2)" indicated in " ■ Inspecting the J1 axis timing belt" above.
2) Lightly loosen the motor plate fixing screw <1>.(two pc.) (Do not loosen too much.)
3) Loosen the nut fixing tension adjustment screw <3>. And lightly loosen tension adjustment screw <3>.
4) In the condition that hook <6> of the motor plate is pulled by 31-39N, fix the motor plate fixing screws <1> tight. (two pc.) The tension of J1 axis timing belt is adjusted with this method. Certainly fix two motor plate fixing screws <1>. Improper tightening can cause the belt to loosen with vibration.
   If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.
5) After adjustment, fixes the fixing nut and certainly fix tension adjustment screw <3>.

■ Replacing the J1 axis timing belt

Timing belt replacement of the J1 axis removes the bottom plate in the robot-arm bottom, and replace the belt from the robot's bottom. For this reason, it is necessary to remove the robot arm from the installation surface and to place it sideways. Remove the machine cable or piping, etc. corresponding to the usage condition, and put the robot on the floor sideways.

⚠ CAUTION

When removing and placing the robot arm, place J1 motor cover upward. Moreover, also to turn the No.1 arm cover upward, turn the J1 axis to the front by jog operation beforehand. (joint angle is near 0 degree) This is the necessity to not damaging the resin cover.

Topple slowly so that a shock may not be given. If you have the resin cover, there is a possibility that the cover may be broken.

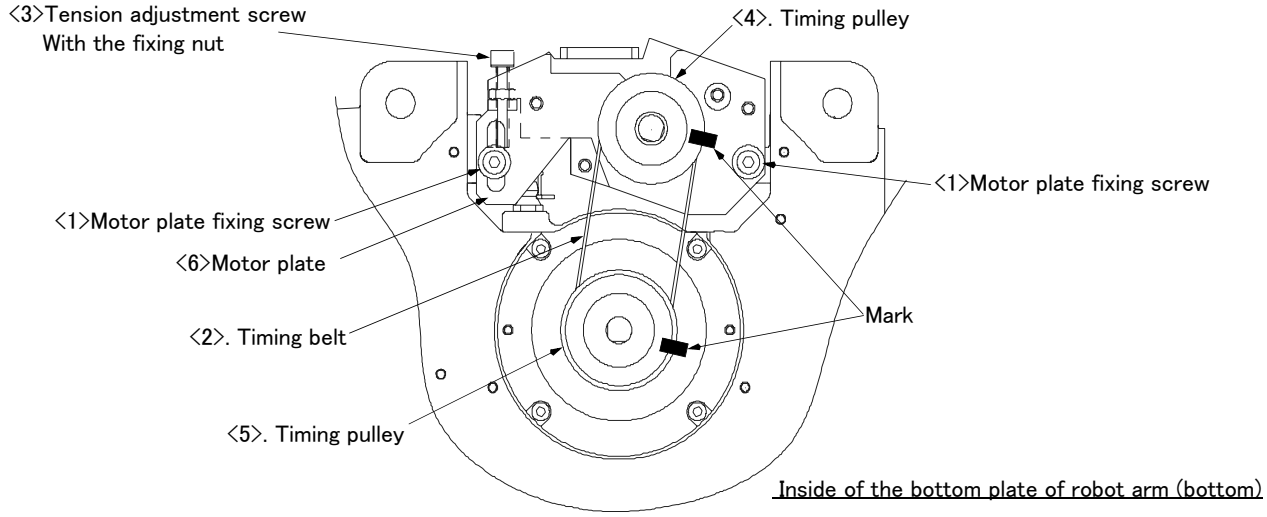


Fig.5-5 : Replacing the J1 axis timing belt

1) Turn the J1 axis to the front by jog operation beforehand. (joint angle is near 0 degree)
2) Turn off the robot controller.
3) Remove the machine cable or piping, etc. corresponding to the usage condition, and place the robot on the floor sideways. Turn J1 motor cover upward, and place sideways slowly so that a shock may not be given to the robot arm.
4) Please remove J1 motor cover and the bottom plate with reference to "5.3.2Installing/removing the cover" on page 47.
5) The image figure inside the bottom plate of the robot arm is shown in Fig. 5-4.
6) Make sure that the pulleys do not move while replacing the belt. If the timing pulley <4> and <5> position relation deviates, the position could deviate.
7) Make marks on the timing belt <2> and timing pulleys <4> and <5> with a felt-tip pen as shown in Fig. 5-4 so that the engagement of the timing belt <2> and timing pulleys <4> and <5> does not deviate.
8) Lightly loosen the motor plate fixing screw <1>. (two pc.) (Do not loosen too much.)
9) Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt.
10) Copy the marks onto the new timing belt. Make sure that both belts are tense when making the marks.
11) Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install.
12) The nut which is fixing tension adjustment screw <3> is loosened, turn tension adjustment screw <3>, and adjust the tension of timing belt <2>.
    When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.
    Confirm that the belt tension is adjusted to slacken approx. 1.0mm when the center of the belt is lightly pressed with a finger (approx. 2.0N).
13) After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. Moreover, also fasten motor plate fixing screws <1> certainly. (two pc.) Improper tightening can cause the belt to loosen with vibration.
14) Reinstall the robot arm just as before.
15) The position could deviate after the belt is replaced. Confirm that the position has not deviated. If deviated, refer to "5.5Resetting the origin" on page 67, and reset the origin position.

(3) Inspection, maintenance and replacement of J2-axis timing belt

The reference figure at inspection, adjustment, and replacement of the timing belt is shown in Fig. 5-6.

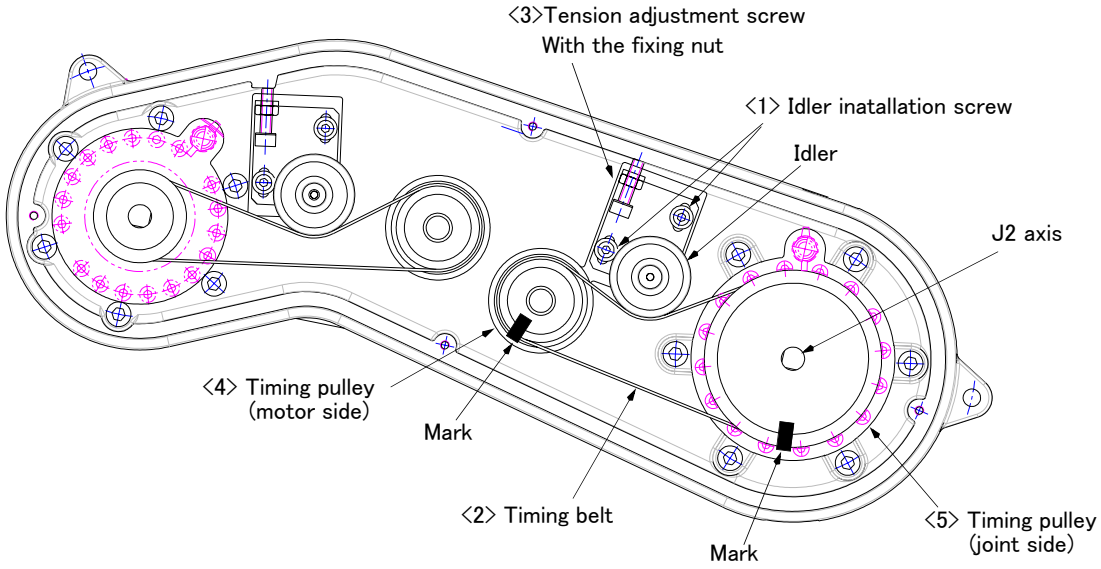


Fig.5-6 : Inspection, maintenance and replacement of J2 axis timing belt

■ Inspecting the J2 axis timing belt

1) Confirm that the robot controller power is OFF.
2) Refer to "5.3.2Installing/removing the cover" on page 47, and remove the No. 1 arm cover.
3) Visually confirm that the symptoms indicated in "(1)Timing belt replacement period" have not occurred with the timing belt <2>.
4) Confirm that the belt tension is adjusted to slacken approx. 1.4mm when the center of the belt is lightly pressed with a finger (approx. 2N) as shown in "Fig.5-13 : Belt tension".

■ Adjusting the J2 axis timing belt

1) Carry out steps "1)" and "2)" indicated in " ■ Inspecting the J2 axis timing belt" above.
2) Lightly loosen the two idler installation bolts <1>. (Do not loosen too much.)
3) The nut which is fixing tension adjustment screw <3> is loosened, turn tension adjustment screw <3>, and adjust the tension of timing belt <2>.
   When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.
   Confirm that the belt tension is adjusted to slacken approx. 1.4mm when the center of the belt is lightly pressed with a finger (approx. 2.0N).
   If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.
4) After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. Moreover, also fasten idler fixing screw <1> certainly. (two pc.) Improper tightening can cause the belt to loosen with vibration.

■ Replacing the J2 axis timing belt

1) Carry out steps 1) and 2) indicated in " ■ Inspecting the J2 axis timing belt" above.
2) Make sure that the pulleys do not move while replacing the belt. If the timing pulley <4> and <5> position relation deviates, the position could deviate.
3) Make marks on the timing belt <2> and timing pulleys <4> and <5> with a felt-tip pen as shown in Fig. 5-6 so that the engagement of the timing belt <2> and timing pulleys <4> and <5> does not deviate.
4) Lightly loosen the two idler installation bolts <1>.(Do not loosen too much.)
5) Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt.
6) Copy the marks onto the new timing belt. Make sure that both belts are tense when making the marks.
7) Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install.
8) Refer to " ■ Adjusting the J2 axis timing belt" and "(8)Timing belt tension" to adjust the tension.
9) The position could deviate after the belt is replaced. Confirm that the position has not deviated. If deviated, refer to "5.5Resetting the origin" on page 67, and reset the origin position.

(4) Inspection, maintenance and replacement of J3-axis timing belt

The reference figure at inspection, adjustment, and replacement of the timing belt is shown in Fig. 5-6.

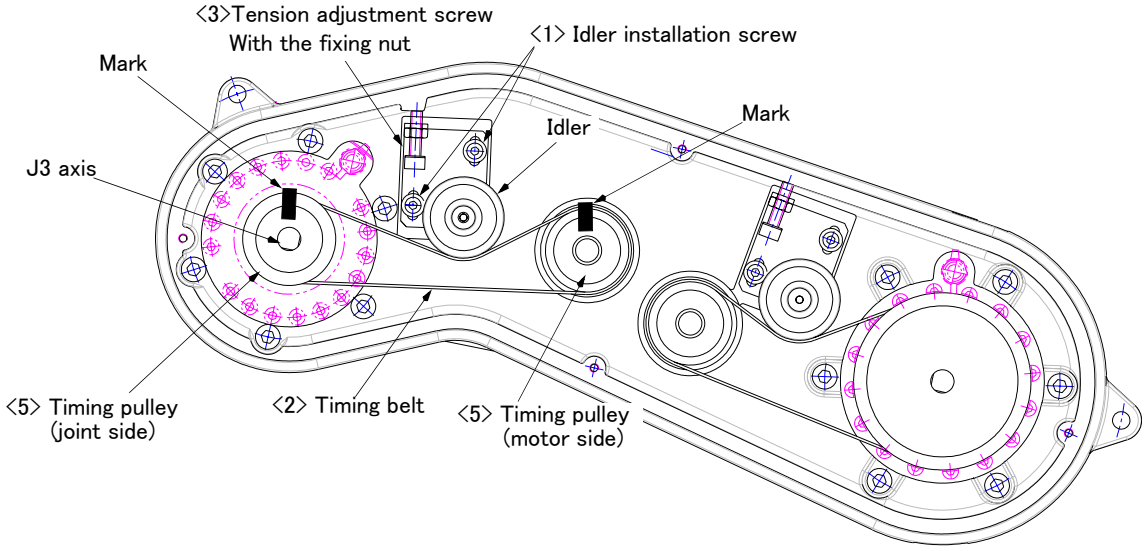


Fig.5-7 : Inspection, maintenance and replacement of J3 axis timing belt

■ Inspecting the J3 axis timing belt

1) Confirm that the robot controller power is OFF.
2) Refer to "5.3.2Installing/removing the cover" on page 47, and remove the No. 1 arm cover.
3) Visually confirm that the symptoms indicated in "(1)Timing belt replacement period" have not occurred with the timing belt <2>.
4) Confirm that the belt tension is adjusted to slacken approx. 1.6mm when the center of the belt is lightly pressed with a finger (approx. 2N) as shown in "Fig.5-13 : Belt tension".

■ Adjusting the J3 axis timing belt

1) Carry out steps 1) and 2) indicated in " ■ Inspecting the J3 axis timing belt" above.
2) Lightly loosen the two idler installation bolts <1>. (Do not loosen too much.)
3) The nut which is fixing tension adjustment screw <3> is loosened, turn tension adjustment screw <3>, and adjust the tension of timing belt <2>.
   When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.
   Confirm that the belt tension is adjusted to slacken approx. 1.6mm when the center of the belt is lightly pressed with a finger (approx. 2.0N).
   If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.
4) After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. Moreover, also fasten idler fixing screw <1> certainly. (two pc.) Improper tightening can cause the belt to loosen with vibration.

■ Replacing the J3 axis timing belt

1) Carry out steps "1)" and "2)" indicated in " ■ Inspecting the J3 axis timing belt" above.
2) Make sure that the pulleys do not move while replacing the belt. If the timing pulley <4> and <5> position relation deviates, the position could deviate.
3) Make marks on the timing belt <2> and timing pulleys <4> and <5> with a felt-tip pen as shown in Fig. 5-6 so that the engagement of the timing belt <2> and timing pulleys <4> and <5> does not deviate.
4) Lightly loosen the two idler installation bolts <1>. (Do not loosen too much.)
5) Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt.
6) Copy the marks onto the new timing belt. Make sure that both belts are tense when making the marks.
7) Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install.
8) Refer to " ■ Inspecting the J3 axis timing belt" and "(8)Timing belt tension" to adjust the tension.
9) The position could deviate after the belt is replaced. Confirm that the position has not deviated. If deviated, refer to "5.5Resetting the origin" on page 67, and reset the origin position.

(5) Inspection, maintenance and replacement of J4-axis timing belt

The reference figure at inspection, adjustment, and replacement of the timing belt is shown in Fig. 5-8.

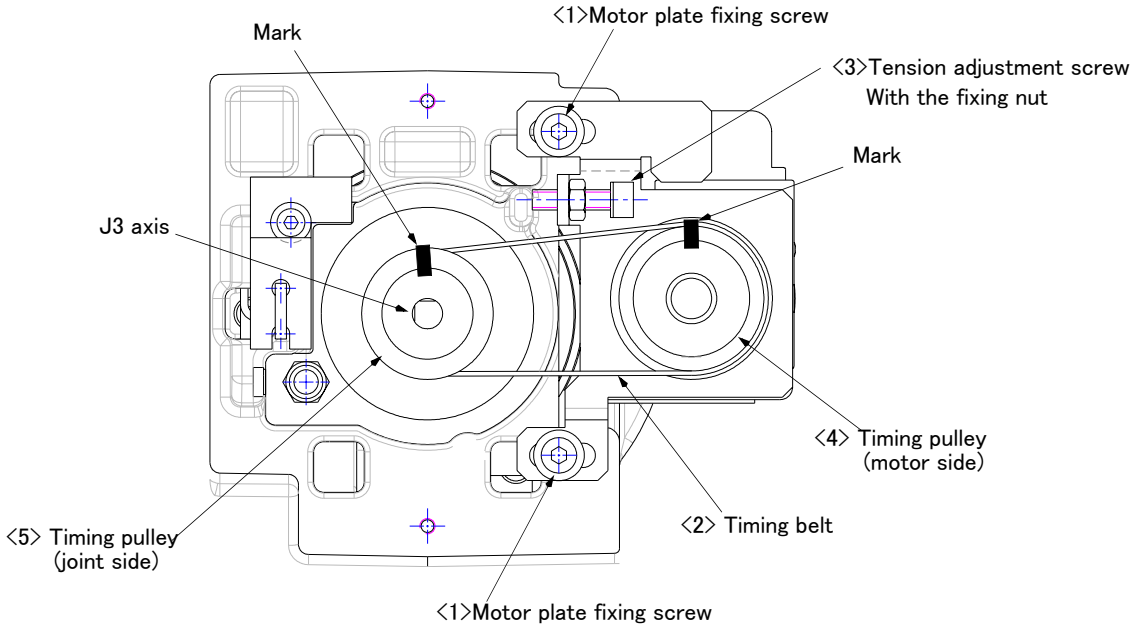


Fig.5-8 : Inspection, maintenance and replacement of J4 axis timing belt

■ Inspecting the J4 axis timing belt

1) Confirm that the robot controller power is OFF.
2) Refer to "5.3.2Installing/removing the cover" on page 47, and remove the elbow cover B and R.
3) Visually confirm that the symptoms indicated in "(1)Timing belt replacement period" have not occurred with the timing belt.
4) Confirm that the belt tension is adjusted to slacken approx. 0.8mm when the center of the belt is lightly pressed with a finger (approx. 1.3N) as shown in "Fig.5-13 : Belt tension".

■ Adjusting the J4 axis timing belt

1) Carry out steps 1) and 2) indicated in " ■ Inspecting the J4 axis timing belt" above.
2) Lightly loosen the two motor plate fixing screws <1>. (Do not loosen too much.)
3) The nut which is fixing tension adjustment screw <3> is loosened, turn tension adjustment screw <3>, and adjust the tension of timing belt <2>.
   When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.
   Confirm that the belt tension is adjusted to slacken approx. 0.8mm when the center of the belt is lightly pressed with a finger (approx. 1.3N).
   If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.
4) After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. Moreover, also fasten motor plate fixing screw <1> certainly. (two pc.) Improper tightening can cause the belt to loosen with vibration.

■ Replacing the J4 axis timing belt

1) Carry out steps 1) and 2) indicated in " ■ Inspecting the J4 axis timing belt" above.
2) Make sure that the pulleys do not move while replacing the belt. If the timing pulley <4> and <5> position relation deviates, the position could deviate.
3) Make marks on the timing belt <2> and timing pulleys <4> and <5> with a felt-tip pen as shown in Fig. 5-8 so that the engagement of the timing belt <2> and timing pulleys <4> and <5> does not deviate.
4) Lightly loosen the two motor plate fixing screws <1>. (Do not loosen too much.)
5) Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt.
6) Copy the marks onto the new timing belt. Make sure that both belts are tense when making the marks.
7) Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install.
8) Refer to " ■ Adjusting the J4 axis timing belt" and "(8)Timing belt tension" to adjust the tension.
9) The position could deviate after the belt is replaced. Confirm that the position has not deviated. If deviated, refer to "5.5Resetting the origin" on page 67, and reset the origin position.

(6) Inspection, maintenance and replacement of J5 axis timing belt and brake timing belt

The J5 axis has the timing belt rotating the J5 axis and the brake timing belt conveying the brake. The inspection, maintenance and replacement method of each belt is shown below.

A)Inspection, maintenance and replacement of J5-axis timing belt

The reference figure at inspection, adjustment, and replacement of the timing belt is shown in Fig. 5-9 .

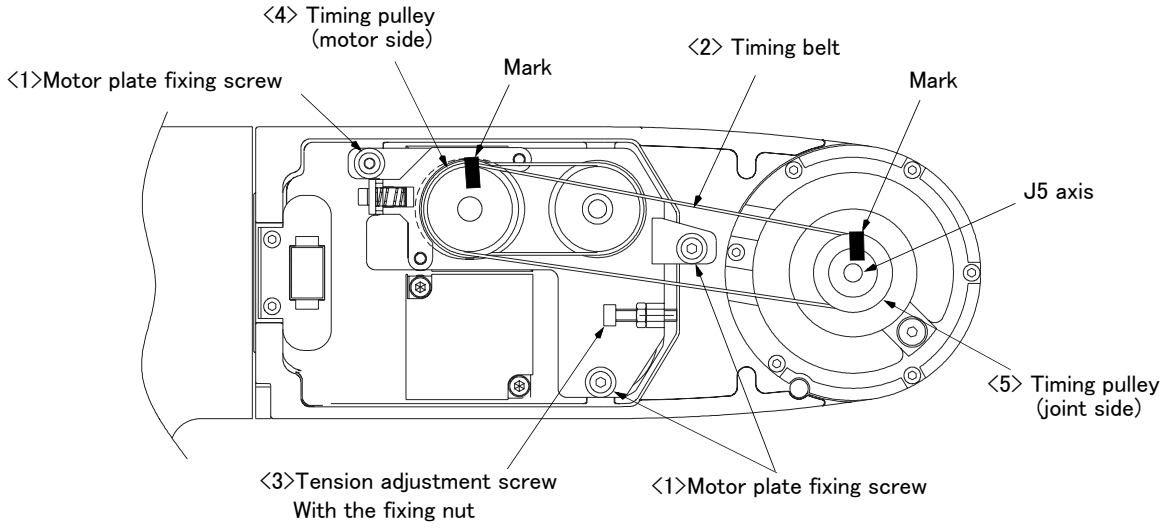


Fig.5-9 : Inspection, maintenance and replacement of J5 axis timing belt

■ Inspecting the J5 axis timing belt

1) Confirm that the robot controller power is OFF.
2) Refer to "5.3.2Installing/removing the cover" on page 47, and remove the No. 2 arm cover R.
3) Visually confirm that the symptoms indicated in "(1)Timing belt replacement period" have not occurred with the timing belt.
4) Confirm that the belt tension is adjusted to slacken approx. 2.0mm when the center of the belt is lightly pressed with a finger (approx. 1.3N) as shown in "Fig.5-13 : Belt tension".

■ Adjusting the J5 axis timing belt

1) Carry out steps 1) and 2) indicated in " ■ Inspecting the J5 axis timing belt" above.
2) Lightly loosen the three motor plate fixing screws <1>. (Do not loosen too much.)
3) The nut which is fixing tension adjustment screw <3> is loosened, turn tension adjustment screw <3>, and adjust the tension of timing belt <2>.
   When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.
   Confirm that the belt tension is adjusted to slacken approx. 2.0mm when the center of the belt is lightly pressed with a finger (approx. 1.3N).
   If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.
4) After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. Moreover, also fasten motor plate fixing screw <1> certainly. (three pc.) Improper tightening can cause the belt to loosen with vibration.

■ Replacing the J5 axis timing belt

1) Carry out steps 1) and 2) indicated in " ■ Inspecting the J5 axis timing belt" above.
2) Make sure that the pulleys do not move while replacing the belt. If the timing pulley <4> and <5> position relation deviates, the position could deviate.
3) Make marks on the timing belt <2> and timing pulleys <4> and <5> with a felt-tip pen as shown in Fig. 5-9 so that the engagement of the timing belt <2> and timing pulleys <4> and <5> does not deviate.
4) Lightly loosen the three motor plate fixing screws <1>. (Do not loosen too much.)
5) Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt.
6) Copy the marks onto the new timing belt. Make sure that both belts are tense when making the marks.
7) Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install.
8) Refer to " ■ Adjusting the J5 axis timing belt" and "(8)Timing belt tension" to adjust the tension.
9) The position could deviate after the belt is replaced. Confirm that the position has not deviated. If deviated, refer to "5.5Resetting the origin" on page 67, and reset the origin position.

B)Inspection, maintenance and replacement of J5 axis brake timing belt

The reference figure at inspection, adjustment, and replacement of the brake timing belt is shown in Fig. 5-10. After adjustment of J5 axis brake timing belt, the adjustment of the timing belt which rotates the J5 axis is also needed. Moreover, it is necessary to remove J5 axis timing belt for the replacement of brake timing belt.

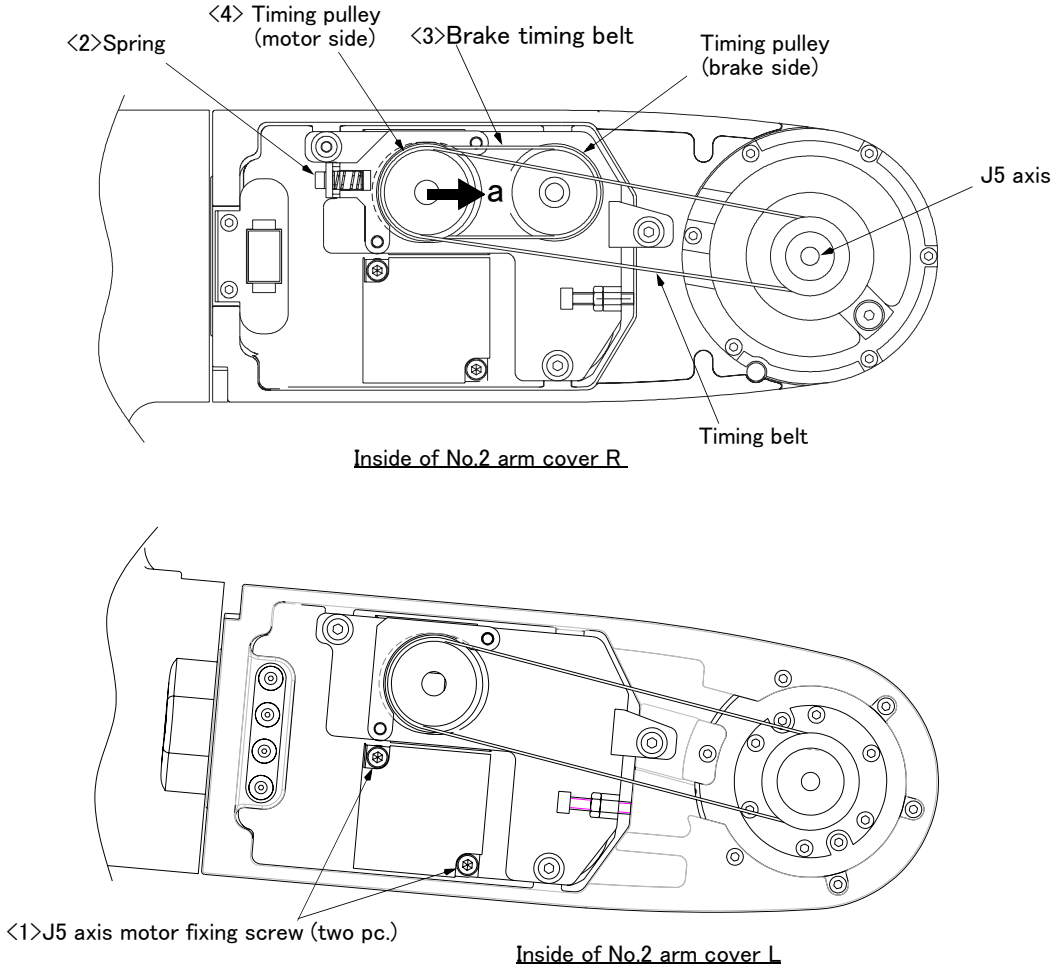


Fig.5-10 : Inspection, maintenance and replacement of J5 axis brake timing belt

■ Inspecting the J5 axis brake timing belt

1) Confirm that the robot controller power is OFF.
2) Refer to "5.3.2Installing/removing the cover" on page 47, and remove the No. 2 arm cover R and L.
3) Visually confirm that the symptoms indicated in "(1)Timing belt replacement period" have not occurred with the timing belt.
4) Adjust the tension of the belt with referring to " ■ Adjusting the J5 axis timing belt".

■ Adjusting the J5 axis brake timing belt

1) Carry out steps 1) and 2) indicated in " ■ Inspecting the J5 axis brake timing belt" above.
2) Loosen J5 axis motor fixing screw (1). (two pc.) (Loosen so that it may not escape from nut.)
   By loosening the screw, the tension of brake timing belt <3> is automatically adjusted by the work of spring <2> installed in the motor plate.
3) After adjustment, securely tighten the two motor installation screws <1>. Improper tightening can cause the belt to loosen with vibration.
4) Adjust J5 axis timing belt. Adjust the tension of J5 axis timing belt with referring to " ■ Adjusting the J5 axis timing belt".

■ Replacing the J5 axis brake timing belt

1) Carry out steps 1) and 2) indicated in ″ ■ Inspecting the J5 axis brake timing belt″ above.
2) Remove J5 axis timing belt with referring to above ″ ■ Replacing the J5 axis timing belt″.
3) Loosen motor fixing screw (1). (two pc.) (Do not loosen too much.)
4) Move motor side timing belt pulley (4) in the direction of the arrow ″a″ of Fig. 5-9 , and remove the brake timing belt..
5) Install the new brake timing belt. The operations of matching the position for brake timing belt is unnecessary.
6) After replacement, securely tighten the two motor installation screws <1>. (Tension is automatically adjusted by the work of the spring.) Improper tightening can cause the belt to loosen with vibration.
7) Install J5 axis timing belt with reference to above ″ ■ Replacing the J5 axis timing belt″, and adjust tension.

(7) Inspection, maintenance and replacement of J6-axis timing belt

In the RV-2SDB the J6 axis has the timing belt rotating the J6 axis and the brake timing belt conveying the brake. Also inspection, maintenance and replace the brake timing belt simultaneously.

A)Inspection, maintenance and replacement of J6-axis timing belt

The reference figure at inspection, adjustment, and replacement of the timing belt is shown in Fig. 5-11.

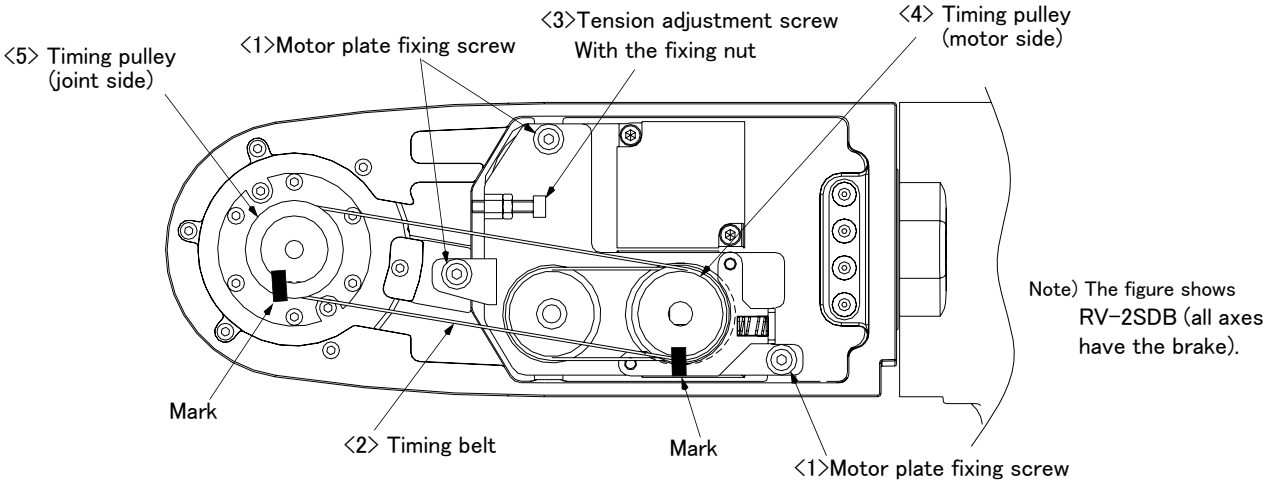


Fig.5-11 : Inspection, maintenance and replacement of J6 axis timing belt

■ Inspecting the J6 axis timing belt

1) Confirm that the robot controller power is OFF.
2) Refer to "5.3.2Installing/removing the cover" on page 47, and remove the No. 2 arm cover L
3) Visually confirm that the symptoms indicated in "(1)Timing belt replacement period" have not occurred with the timing belt.
4) Confirm that the belt tension is adjusted to slacken approx. 2.0mm when the center of the belt is lightly pressed with a finger (approx. 1.3N) as shown in "Fig.5-13 : Belt tension".

■ Adjusting the J6 axis timing belt

1) Carry out steps 1) and 2) indicated in " ■ Inspecting the J6 axis timing belt" above.
2) Lightly loosen the three motor plate fixing screws <1>. (Do not loosen too much.)
3) The nut which is fixing tension adjustment screw <3> is loosened, turn tension adjustment screw <3>, and adjust the tension of timing belt <2>.
   When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.
   Confirm that the belt tension is adjusted to slacken approx. 2.0mm when the center of the belt is lightly pressed with a finger (approx. 1.3N).
   If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.
4) After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>.Moreover, also fasten motor plate fixing screw <1> certainly. (three pc.) Improper tightening can cause the belt to loosen with vibration.

■ Replacing the J6 axis timing belt

1) Carry out steps 1) and 2) indicated in " ■ Inspecting the J6 axis timing belt" above.
2) Make sure that the pulleys do not move while replacing the belt. If the pulley <4> and <5> position relation deviates, the position could deviate.
3) Make marks on the timing belt <2> and timing pulleys <4> and <5> with a felt-tip pen as shown in Fig. 5-9 so that the engagement of the timing belt <2> and timing pulleys <4> and <5> does not deviate.
4) Lightly loosen the three motor plate fixing screws <1>. (Do not loosen too much.)
5) Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt.
6) Copy the marks onto the new timing belt. Make sure that both belts are tense when making the marks.
7) Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install.
8) Refer to " ■ Adjusting the J6 axis timing belt" and "(8)Timing belt tension" to adjust the tension.
9) The position could deviate after the belt is replaced. Confirm that the position has not deviated. If deviated, refer to "5.5Resetting the origin" on page 67, and reset the origin position.

B)Inspection, maintenance and replacement of J6 axis brake timing belt

The reference figure at inspection, adjustment, and replacement of the brake timing belt is shown in Fig. 5-12. After adjustment of J6 axis brake timing belt, the adjustment of the timing belt which rotates the J6 axis is also needed. Moreover, it is necessary to remove J6 axis timing belt for the replacement of brake timing belt.

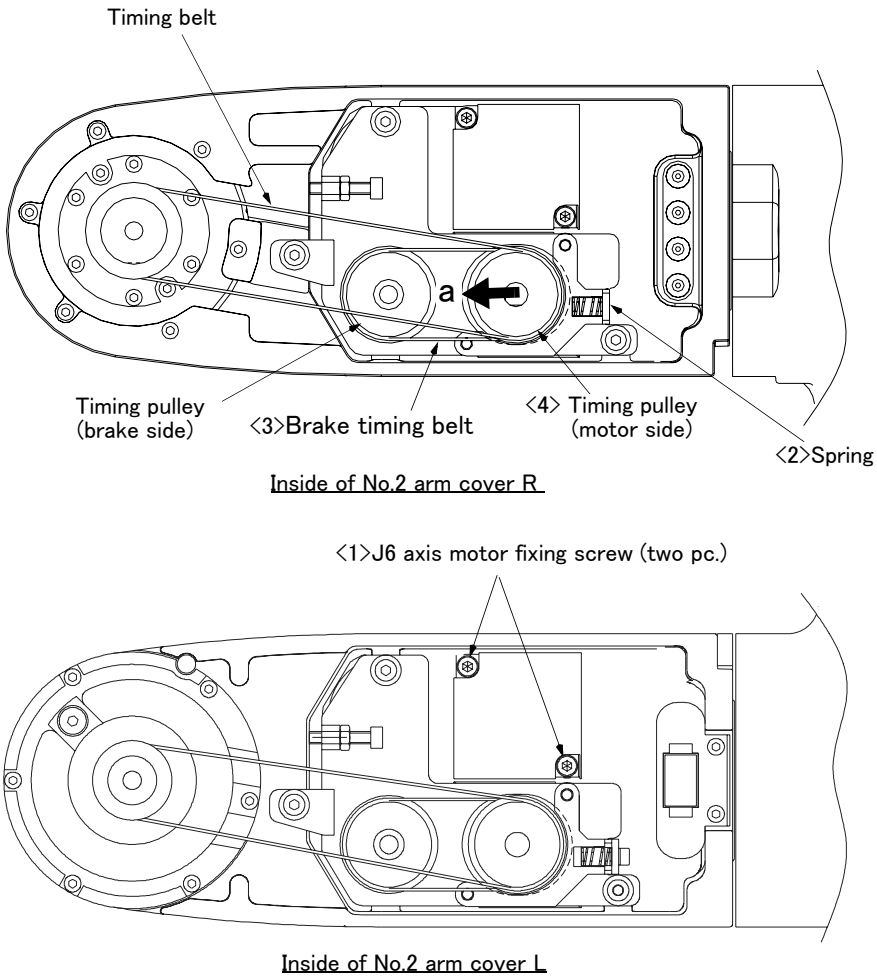


Fig.5-12 : Inspection, maintenance and replacement of J6 axis brake timing belt

■ Inspecting the J6 axis brake timing belt

1) Confirm that the robot controller power is OFF.
2) Refer to "5.3.2Installing/removing the cover" on page 47, and remove the No. 2 arm cover R and L.
3) Visually confirm that the symptoms indicated in "(1)Timing belt replacement period" have not occurred with the timing belt.
4) Adjust the tension of the belt with referring to " ■ Adjusting the J6 axis brake timing belt".

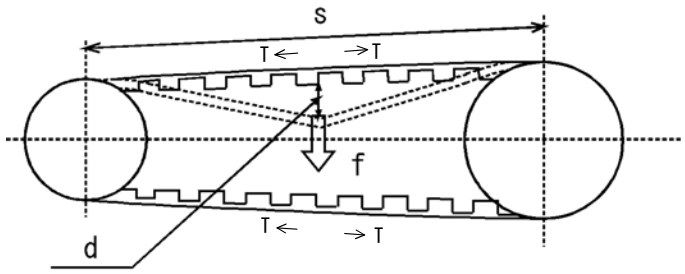
■ Adjusting the J6 axis brake timing belt

1) Carry out steps 1) and 2) indicated in " ■ Inspecting the J6 axis brake timing belt" above.
2) Loosen J6 axis motor fixing screw (1). (two pc.) (Loosen so that it may not escape from nut.)
   By loosening the screw, the tension of brake timing belt <3> is automatically adjusted by the work of spring <2> installed in the motor plate.
3) After adjustment, securely tighten the two motor installation screws <1>. Improper tightening can cause the belt to loosen with vibration.
4) Adjust J6 axis timing belt. Adjust the tension of J6 axis timing belt with referring to " ■ Adjusting the J6 axis timing belt".

■ Replacing the J6 axis brake timing belt

1) Carry out steps 1) and 2) indicated in ″ ■ Inspecting the J6 axis brake timing belt″ above.
2) Remove J6 axis timing belt with referring to above ″ ■ Replacing the J6 axis timing belt″.
3) Loosen motor fixing screw (1). (two pc.) (Do not loosen too much.)
4) Move motor side timing belt pulley (4) in the direction of the arrow ″a″ of Fig. 5-12 , and remove the brake timing belt..
5) Install the new brake timing belt. The operations of matching the position for brake timing belt is unnecessary.
6) After replacement, securely tighten the two motor installation screws <1>. (Tension is automatically adjusted by the work of the spring.) Improper tightening can cause the belt to loosen with vibration.
7) Install J6 axis timing belt with reference to above ″ ■ Replacing the J6 axis timing belt″, and adjust tension.

(8) Timing belt tension



f : Pressing force
s : Span
d : Slack
T : Tension

■ The preset value and adjustment value in the sound wave type belt tension gauge

Axis	Preset value			Tension: Used belt (N)		Tension: New belt (N)		Force of pulling the motor plate note 1)
	wait	width	span	Minimum	Maximum	Minimum	Maximum	
J1	2.5	6	61	26	32	37	43	31(N) ～ 39(N)
J2	2.5	6	88	26	32	37	43	
J3	2.5	6	103	26	32	37	43	
J4	2.5	4	52	18	22	26	30	
J5	2.5	4	131	18	22	26	30	
J6	2.5	4	131	18	22	26	30	

Note 1) The force when pulling the motor plate for belt adjustment of the J1 axis is shown.

The sound wave type belt tension gauge of the standard
Maker:Gates Unitta Asia Company, Type:U-505

■ Belt specification

Axis	Belt type	Span : s (mm)
J1	210-3GT-6	61
J2	324-3GT-6	88
J3	303-3GT-6	103
J4	186-3GT-4	52
J5	345-3GT-4	131
J5(brake)	174-3GT-4	42
J6	336-3GT-4	131
J5(brake)	174-3GT-4	42

■ Inspection

Axis	Tension : T (N)	Slack : d (mm)	Pressing force : f (N)
J1	14.7 ～ 43	1.0	1.0 ～ 2.9
J2	14.7 ～ 43	1.4	1.0 ～ 2.9
J3	14.7 ～ 43	1.6	1.0 ～ 2.9
J4	10 ～ 30	0.8	0.7 ～ 2
J5	10 ～ 30	2.0	0.7 ～ 2
J6	10 ～ 30	2.0	0.7 ～ 2

■ Adjustment

Axis	Tension : T (N)	Slack : d (mm)	Pressing force : f (N)
J1	29	1.0	1.9
J2	29	1.4	1.9
J3	29	1.6	1.9
J4	20	0.8	1.3
J5	20	2.0	1.3
J6	20	2.0	1.3

■ Exchange （New article installation）

Axis	Tension : T (N)	Slack : d (mm)	Pressing force : f (N)
J1	40	1.0	2.7
J2	40	1.4	2.7
J3	40	1.6	2.7
J4	28	0.8	1.9
J5	28	2.0	1.9
J6	28	2.0	1.9

<Note>
The tension of brake timing belt of the J5 and the J6 axis is automatically adjusted by the work of spring installed in the motor plate.

Fig.5-13 : Belt tension

The timing belt can satisfactorily convey the drive and keep a durable force only when it has an adequate tension. The belt tension should not be too tight or too lose. Instead, it should be adjusted to a degree that elasticity is felt when the belt is pressed with the thumb. If the belt tension is too weak, the belt loosening side will vibrate. On the other hand, if the belt tension is too strong, a sharp sound will be heard and the belt tension side will vibrate.
The detailed adjustment (tension) is shown in Fig. 5-13.
Check and adjust with the belt pressing force f and the slack amount d between span s.

5.3.4 Lubrication

(1) Lubrication position and specifications

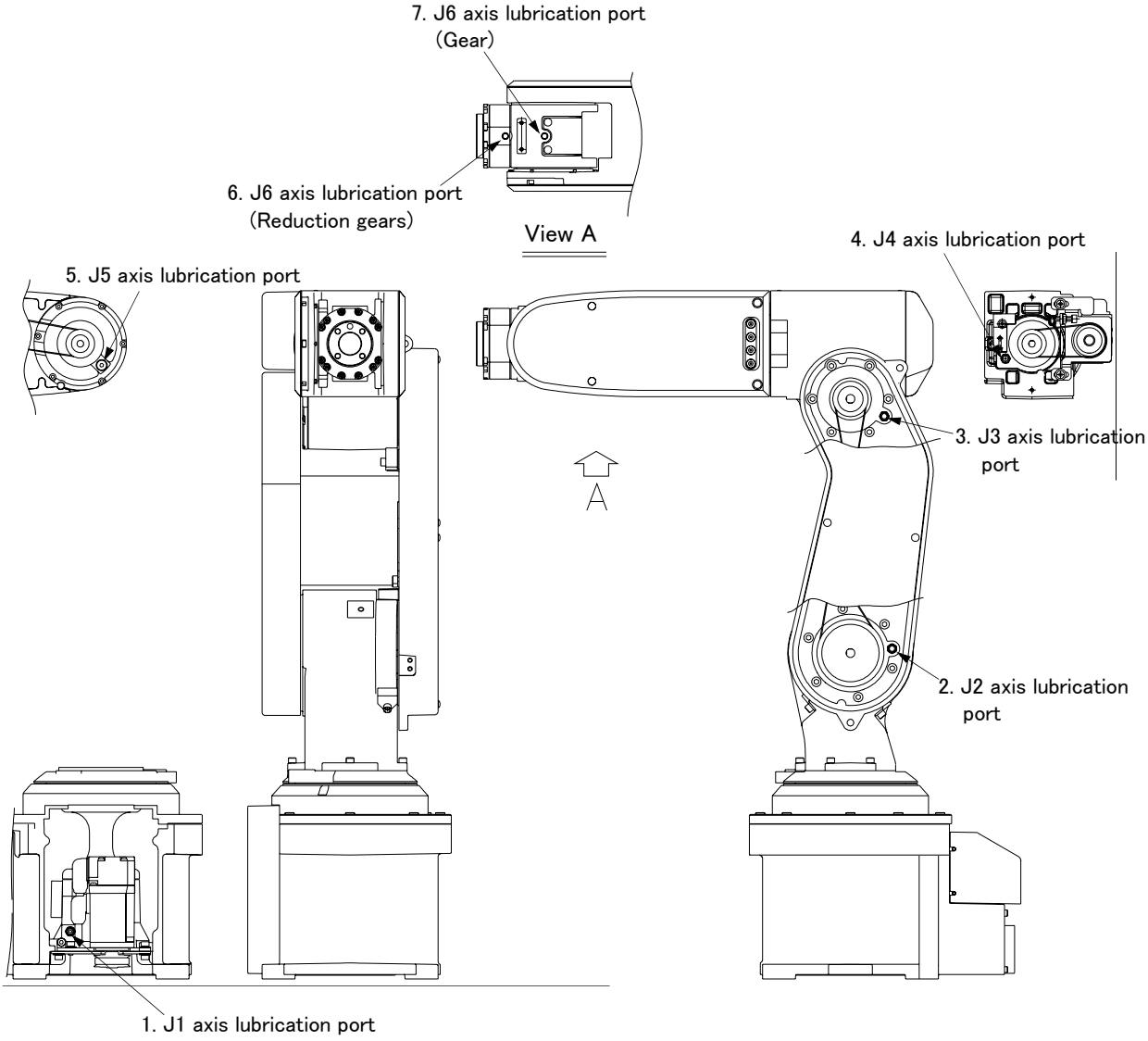


Fig.5-14 : Lubrication positions

Table 5-4 : Lubrication specifications

No.	Parts to be lubricated	Oiling method	Lubrication oil (maker)	Default charge amount	Lubrication interval	Lubrication amount	Cover to remove
1	J1 axis reduction gears	Grease nipple WA-610	Grease Harmonic grease SK-1A (Japan Harmonic Systems)	11.9g	6,000Hr	2.8g	J1 motor cover
2	J2 axis reduction gears			15.6g		2.3g	No1. Arm cover plate
3	J3 axis reduction gears			10.1g		2.3g	
4	J4 axis reduction gears			2.7g		0.5g	Elbow cover B
5	J5 axis reduction gears			2.7g		0.5g	—
6	J6 axis reduction gears			2.7g		0.5g	—
7	J6 axis gear			11.0g		1.3g	—

The lubrication specifications for each place are shown in Fig. 5-4.

[Caution]

・The name of each grease of Table 5-4 is the enclosed at shipping.

- 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.
- With the maintenance forecast function of the personal computer support software (option), the guidance of lubrication time is calculated according to the operating environment of the customer.
- The numbers in theTable 5-4 correspond to the supply positions in Fig. 5-14.
- Avoid excessive lubrication since it may lead to grease leak. Also, the number of lubrications is limited to 3 times.

(2) Lubrication method

1) Set the robot to the posture shown in Fig. 5-3.
2) Refer to "5.3.2Installing/removing the cover" on page 47, and remove the covers.
3) Please protect the timing belt with the cloth etc. so that the grease does not take for the timing belt at the time of oil supply.
4) J5 axis lubrication port <5>, the J6 axis lubrication port <6> (reduction gears), and the J6 axis lubrication port <7> (gear) should remove the bolt, and should install the attached grease nipple. Securely tighten the grease nipple by 4.7 Nm to 6.3 Nm.
5) Insert the grease shown in Table 5-6 using a grease gun from the lubrication grease nipple.
6) J5 axis lubrication port <5>, the J6 axis lubrication port <6> (reduction gears), and the J6 axis lubrication port <7> (gear) should remove the grease nipple, and should install the original bolt. Securely tighten the bolt by 4.7 Nm to 6.3 Nm.
7) Replace the covers with the removal procedure in reverse.

⚠ 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.

5.3.5 Replacing the backup battery

An absolute encoder is used for the position detector, so the position must be saved with the backup battery when the power is turned OFF. The controller also uses a backup battery to save the program, etc. These batteries are installed when the robot is shipped from the factory, but as these are consumable parts, they must be replaced periodically by the customer.

The guideline for replacing the battery is one year, but this will differ according to the robot's usage state.

Error No. 7520 :Battery consumption time is over
Error No. 133n :Encoder battery voltage low. (n indicates the axis number.)
(The encoder battery voltage of the robot arm is low.)
Error No. 7510 :Battery voltage low (R/C)
(The battery voltage of the controller is low.)
Error No. 7500 :No battery voltage
(The battery of the controller is depleted.)

⚠ CAUTION

If error No. 7500 occurs, the program data and other data in the controller is lost and it becomes necessary to load the data again.

If any of the battery-related errors above occur and the robot continues to be used, the data integrity of the memory cannot be guaranteed. If an error occurs, replace the batteries of both the robot arm and controller promptly.

It is also recommended to save programs and position data on the personal computer side via the personal computer support software and so forth in advance.

(1) Replacing the robot arm battery

⚠ CAUTION

Don't disconnect connector, etc. While replacing the battery, the encoder position data is saved by the power supplied from the controller. Thus, if the cable connection is incomplete, the encoder position data will be lost when the controller power is turned OFF. Several batteries are used in the robot arm, but replace all old batteries with new batteries at the same time.

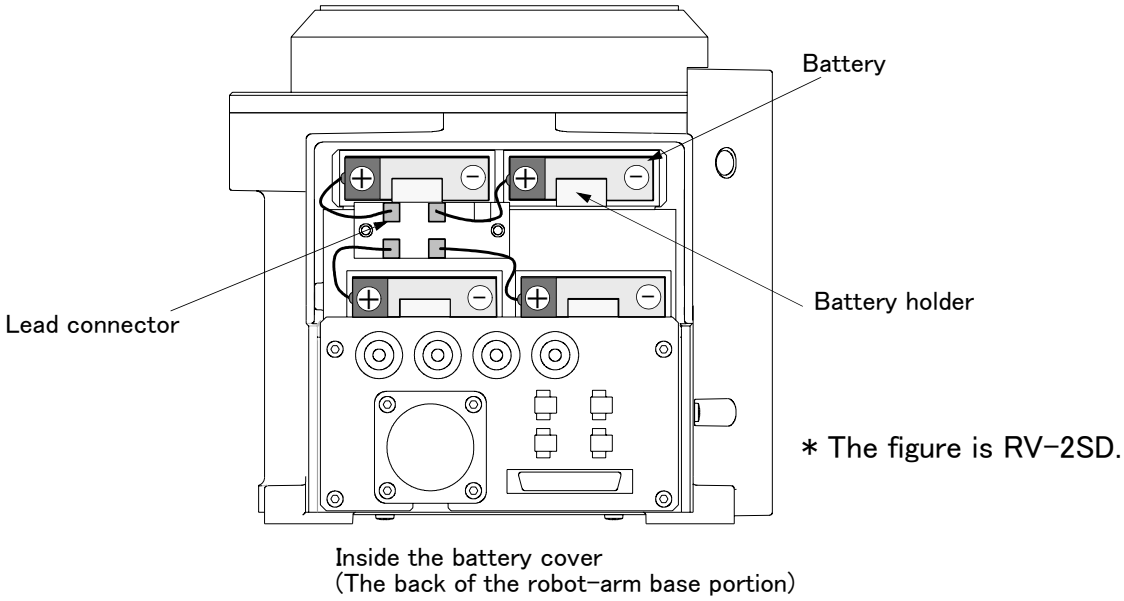


Fig.5-15 : Replacing the battery

1) Confirm that the robot arm and controller are connected with a cable.
2) Turn the controller control power ON.
   The position data is retained by the power supplied from the controller while replacing the battery. Thus, if the cable is not connected correctly, or if the controller power is OFF, the position data will be lost.
3) Press the emergency stop button to set the robot in the emergency stop state. This is a measure for safety, and must always be carried out.
4) Remove battery cover <1>, referring to "Fig. 5-3Installing/removing the cover" on page 47.
5) The battery holder is located in the battery cover <1>. Remove the old battery from the holder, and disconnect the lead connector.
6) Insert the new battery into the holder, and connect the lead connector. The "+" pole is left-hand side. Replace all batteries with new ones at the same time.
7) All the batteries should check that it has been exchanged newly. If the old battery is contained, generating heat and damaging may occur.
8) Install battery cover <1>.
9) Initialize the battery consumption time.
   Always carry out this step after replacing the battery, and initialize the battery usage time. Refer to the separate "Instruction Manual/Detailed Explanation of Functions and Operations" for details on the operation methods.

Refer to "5.5Resetting the origin" on page 67 and reset the origin using the jig method or mechanical stopper method or ABS origin method.

5.4 Maintenance parts

The consumable parts that must be replaced periodically are shown in Table 5-5, and spare parts that may be required during repairs are shown in Table 5-5. Purchase these parts from the dealer when required. 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 5-5 : Consumable part list

No.	Part name	Type Note1)	Usage place	Q'ty	Supplier
1	Timing belt		J1 axis	1	Mitsubishi Electric System & Service;Co.,Ltd.
2			J2 axis	1	
3			J3 axis	1	
4			J4axis	1	
5			J5axis	1	
6			For J5 axis brakes	1	
7			J6 axis	1	
8			For J6 axis brakes Note1)	1	
9	Grease		Reduction gears of each axis	An needed	
10	Lithium battery		Inside the battery cover	4	

Note1)Only for RV-2SDB.

Table 5-6 : Spare parts list

No.	Names	Type Note1)	Usage place	Q'ty	Supplier
1	AC servo motor		J1,J2,J3 axis	3	Mitsubishi Electric
2			J4,J5,J6 axis	3	
3	Reduction gears		J1,J2,J3,J6 axis	4	
4			J4,J5 axis	2	

Note1)Confirm the robot arm serial No., and contact the dealer or service branch of Mitsubishi Electric Co., for the type.

5.5 Resetting the origin

The origin is set so that the robot can be used with a high accuracy. After purchasing the robot, always carry out this step before starting work. The origin must be reset if the combination of robot and controller being used is changed or if the motor is changed causing an encoder area. The types of origin setting methods are shown in Table 5-7.

[Caution] If the old battery is replaced because it has been used up, it is necessary to set the origin again.Reset the origin using the jig method or mechanical stopper method or ABS origin method.

.

Table 5-7 : Origin setting method

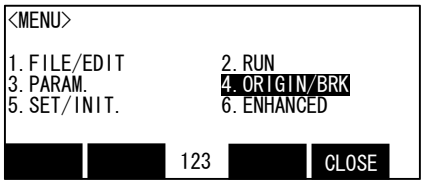
No	Method	Explanation	Remarks
1	Origin data input method	The origin data set as the default is input from the T/B.	The setting method is explained in "2.3Setting the origin" on page 11 .
2	Mechanical stopper method	This origin posture is set by contacting each axis against the mechanical stopper.	The setting method is explained in "5.5.1Mechanical stopper method" on page 68 .
3	Jig method	The origin posture is set with the calibration jig installed.	The setting method is explained in "5.5.2Jig method" on page 79 .
4	ABS origin method	This method is used when the encoder backup data lost in the cause such as battery cutting.	Before using this method, the origin must be set with the other method with same encoder. The setting method is explained in "5.5.3ABS origin method" on page 91.
5	User origin method	A randomly designated position is set as the origin posture.	The setting method is explained in "5.5.4User origin method" on page 93.

5.5.1 Mechanical stopper method

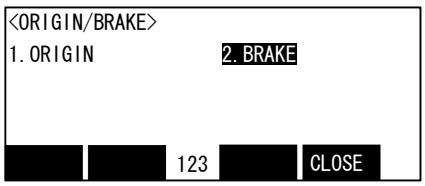
The method for setting the origin with the transportation jig is explained below.
This operation is carried out with the T/B. Set the [MODE] switch on the front of the controller to "MANUAL", and set the T/B [ENABLE] switch to "ENABLE" to validate the T/B.

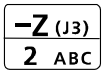
⚠ CAUTION Here, if an axis is equipped with a brake, release the brake and move the arm with both hands.At this point release the brakes and move the arm with both hands. To ensure safety, the brake-release procedure described below should always be done by two persons.

(1) J1 axis origin setting(mechanical stopper)

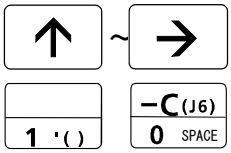


1) Press the [4] key on the menu screen, and display the Origin/BRK selection screen.

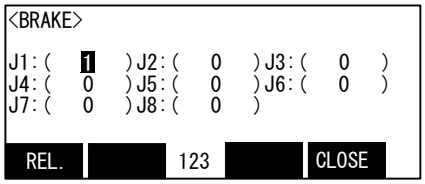




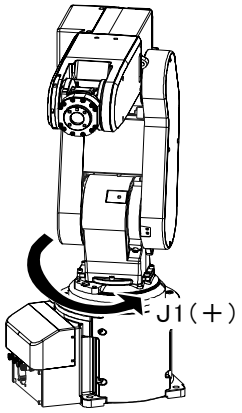
2) The type which does not have the brake in the J1 axis should go to "6)"->"8)". Press the [2] key , and display the Break release selection screen.



3) Release the brake of the J1 axis.
Input "1" into the J1 axis. Set "0" to other axes.



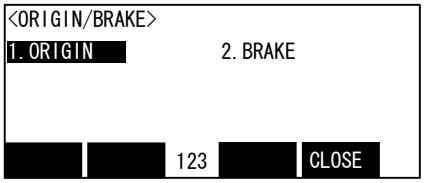
4) Confirm the axis for which the brakes are to be released.
5) Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key.



6) With both hands, slowly move the J1 axis in + (plus) direction , and contact the axis against the mechanical stopper.

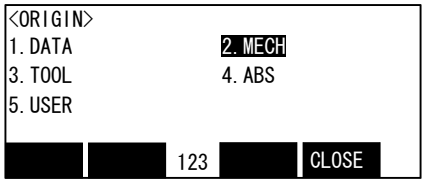
F4

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



1 '()

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



−Z (J3)
2 ABC

9) Press the [2] key , and display the Mechanical stopper selection screen.

↑ ~ →

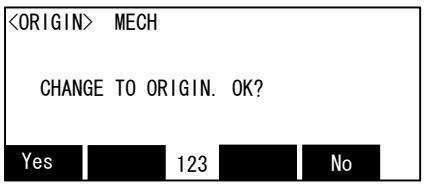
1 '()

−C (J6)
0 SPACE

EXE

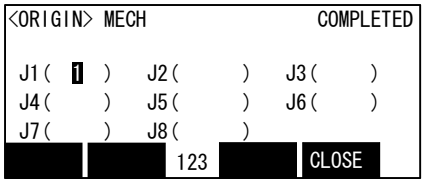
10) Input "1" into the J1 axis. Set "0" to other axes.

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



F1

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



13) Setting of the origin is completed.

14) Refer to "5.5.5Recording the origin data" on page 95 in this manual, and record the origin data on the origin data seal.

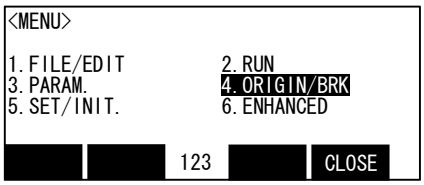
◇◆◇ Release the brake ◇◆◇

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 enabling switch is detached while the brakes are released, the brakes will be work immediately.

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

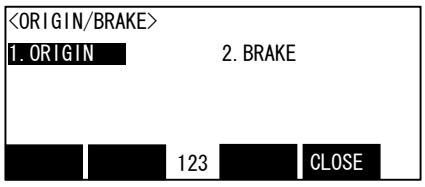
Do cursor movement into the parenthesis of each axis by the arrow key. The origin is set only for the axis for which a "1" is displayed on the screen. If the origin is not to be set, press the [0] key and display a "0".

(2) J2 axis origin setting(mechanical stopper)



4 GHI

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



−Z (J3)
2 ABC

2) Press the [2] key , and display the Break release selection screen.

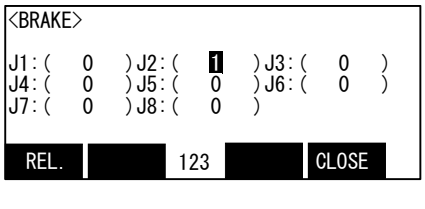
↑ ~ →

1 '()

−C (J6)
0 SPACE

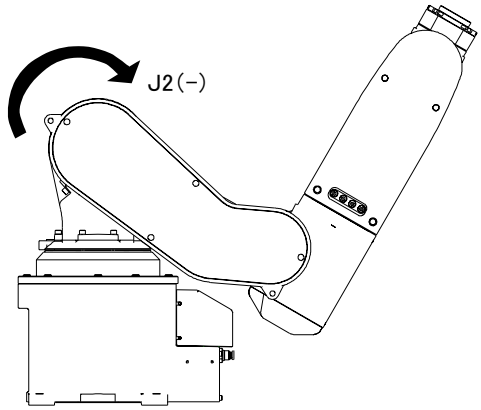
3) Release the brake of the J2 axis.
Input "1" into the J2 axis. Set "0" to other axes.

4) Confirm the axis for which the brakes are to be released.



F1

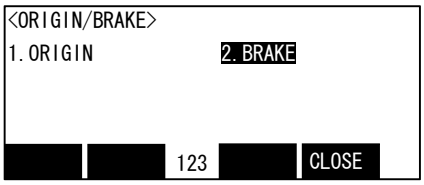
5) Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key.



6) With both hands, slowly move the J2 axis in + (plus) direction , and contact the axis against the mechanical stopper.

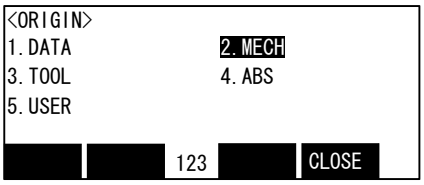
F4

7) Detach the [F1] key and work the brake.
Press the [F4] key and return to the Origin / BRK screen.



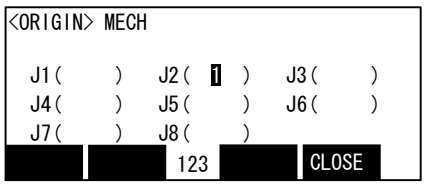
1 '( )

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



−Z (J3)
2 ABC

9) Press the [2] key , and display the Mechanical stopper selection screen.



↑ ~ →

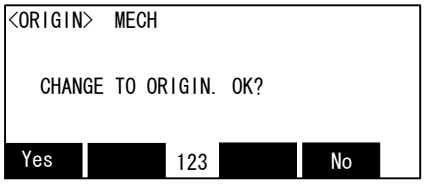
1 '( )

−C (J6)
0 SPACE

EXE

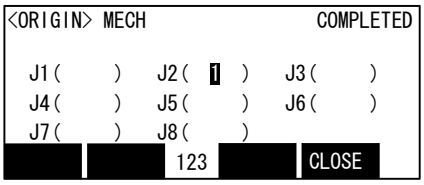
10) Input "1" into the J2 axis. Set "0" to other axes.

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



F1

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



13) Setting of the origin is completed.

14) Refer to "5.5.5Recording the origin data" on page 95 in this manual, and record the origin data on the origin data seal.

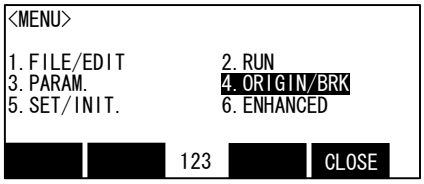
◇◆◇ Release the brake ◇◆◇

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 enabling switch is detached while the brakes are released, the brakes will be work immediately.

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

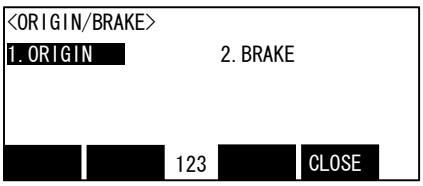
Do cursor movement into the parenthesis of each axis by the arrow key. The origin is set only for the axis for which a "1" is displayed on the screen. If the origin is not to be set, press the [0] key and display a "0".

(3) J3 axis origin setting(mechanical stopper)



4 GHI

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



−Z (J3)
2 ABC

2) Press the [2] key , and display the Break release selection screen.

↑ ~ →

1 '()

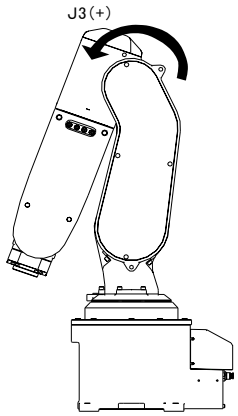
−C (J6)
0 SPACE

3) Release the brake of the J3 axis.
Input "1" into the J3 axis. Set "0" to other axes.

4) Confirm the axis for which the brakes are to be released.

F1

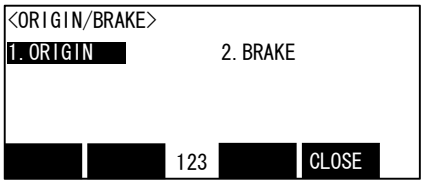
5) Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key.

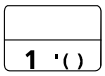


6) With both hands, slowly move the J3 axis in + (plus) direction , and contact the axis against the mechanical stopper.

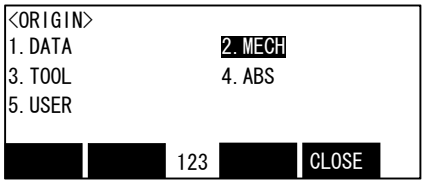
F4

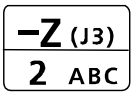
7) Detach the [F1] key and work the brake.
Press the [F4] key and return to the Origin / BRK screen.



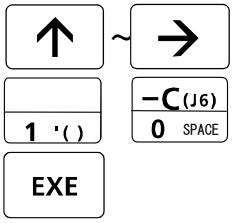


8) Press the [1] key , and display the Origin setting selection screen.



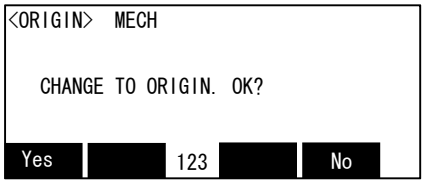


9) Press the [2] key , and display the Mechanical stopper selection screen.



10) Input "1" into the J3 axis. Set "0" to other axes.

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



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

13) Setting of the origin is completed.

14) Refer to "5.5.5Recording the origin data" on page 95 in this manual, and record the origin data on the origin data seal.

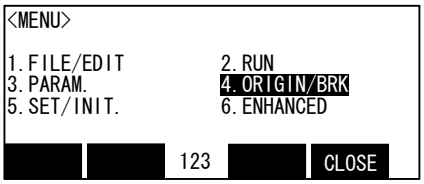
◇◆◇ Release the brake ◇◆◇

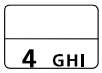
Do cursor movement into the parenthesis of each axis by the arrow key. The brakes can be released only for the axis for which a "1" is displayed on the screen. If the brakes are not to be released, press the [0] key and display a "0". If the [F1] key on the teaching pendant or the enabling switch is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

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

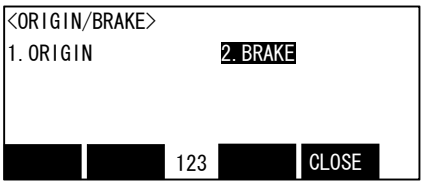
Do cursor movement into the parenthesis of each axis by the arrow key. The origin is set only for the axis for which a "1" is displayed on the screen. If the origin is not to be set, press the [0] key and display a "0".

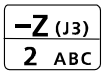
(4) J4 axis origin setting(mechanical stopper)



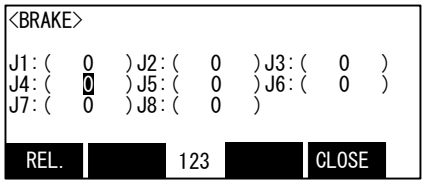


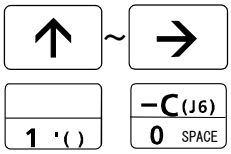
1) Press the [4] key on the menu screen, and display the Origin/BRK selection screen.





2) The type which does not have the brake in the J4 axis should go to 6−>8.
Press the [2] key , and display the Brake release selection screen.

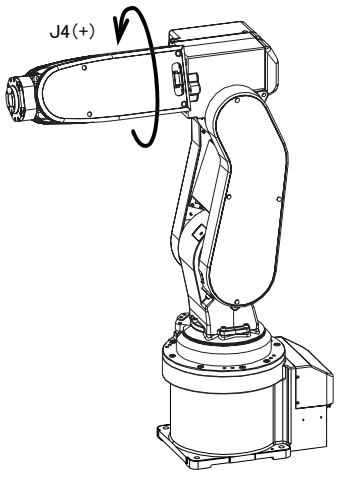




3) Press the [Arrow] key, move the cursor to the J4 axis and press the [1] key. Set [0] to other axes.

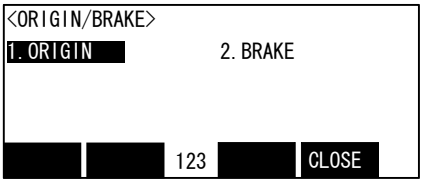
4) Confirm the axis for which the brakes are to be released.

5) Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key

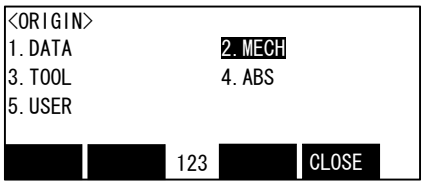


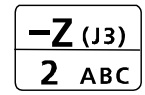
6) With both hands, slowly move the J4 axis in + (plus) direction , and contact the axis against the mechanical stopper.

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

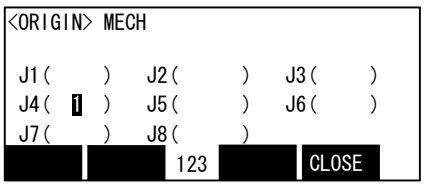


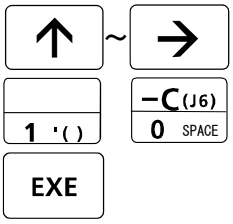
9) Press the [1] key , and display the Origin setting selection screen.





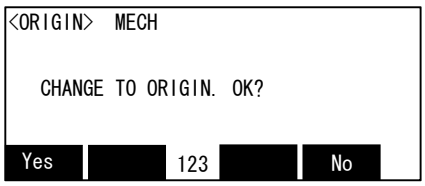
10) Press the [2] key , and display the Mechanical stopper selection screen.



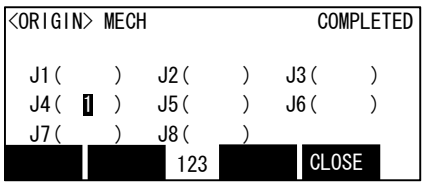


11) Press the [Arrow] key, move the cursor to the J4 axis and press the [1] key. Set [0] to other axes.

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



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



14) Setting of the origin is completed.

15) Refer to "5.5.5Recording the origin data" on page 95 in this manual, and record the origin data on the origin data seal.

◇◆◇ Release the brake ◇◆◇

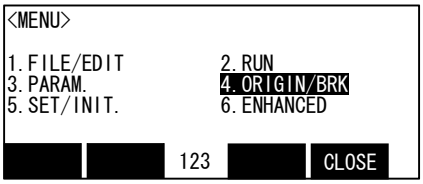
Do cursor movement into the parenthesis of each axis by the arrow key. The brakes can be released only for the axis for which a "1" is displayed on the screen. If the brakes are not to be released, press the [0] key and display a "0". If the [F1] key on the teaching pendant or the enabling switch is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

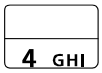
◇◆◇ Select the axis of origin setting ◇◆◇

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".

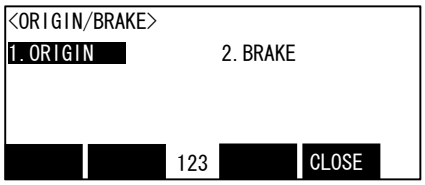
(5) J5/J6 axis origin setting(mechanical stopper)

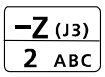
Always perform origin setting of the J5 axis and the J6 axis simultaneously. First, set the J5 axis posture.



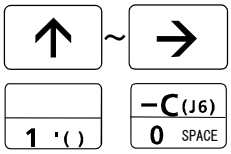


1) Press the [4] key on the menu screen, and display the Origin/BRK selection screen.





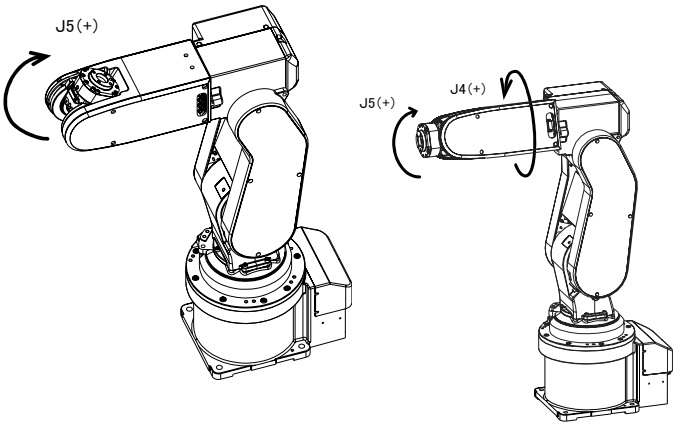
2) Press the [2] key , and display the Brake release selection screen.



3) Brake release of the J5 axis
Press the [Arrow] key, move the cursor to the J5 axis and press the [1] key. Set [0] to other axes.

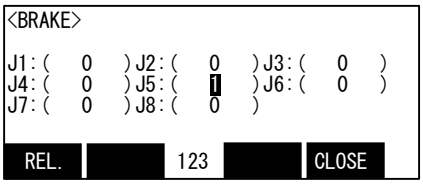
4) Confirm the axis for which the brakes are to be released.

5) Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key.



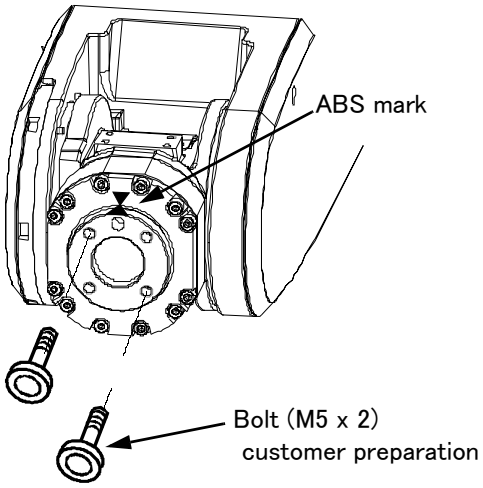
* The direction of the J5 axis shows the case where the J4 axis is in the mechanical stopper position. 。

6) With both hands, slowly move the J5 axis in + (plus) direction , and contact the axis against the mechanical stopper.



7) Detach the [F1] key and work the brake.

Then, set the J6 axis posture.

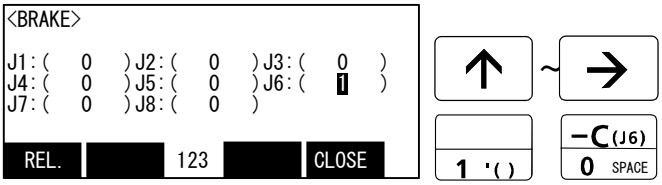


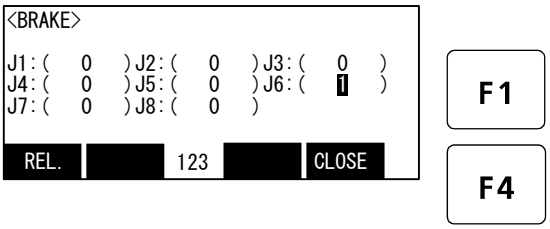
CAUTION The J6-axis dose not have a mechanical stopper.
When setting the origin position , do not rotate the axis more than themotion range(± 200 deg.).

8) Install the bolt (M5: 2 customer preparation) in the diagonal position at the J6 axis.
Hold the bolts with hands, rotate them slowly and align the ABS mark of the J6 axis with the ABS mark of the wrist area.
The type which has the brake in the J6 axis releases the brake. The type which does not have the brake should go to "13)".
Press the [Arrow] key, move the cursor to the J6 axis and press the [1] key. Set [0] to other axes.

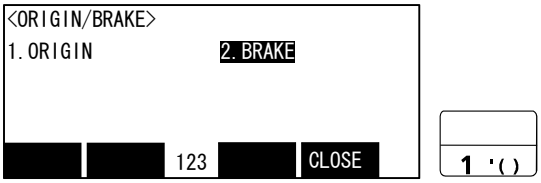
9) Confirm the axis for which the brakes are to be released.
10) Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key.

11) Hold the bolts with hands, rotate them slowly and align the ABS mark of the J6 axis with the ABS mark of the wrist area.

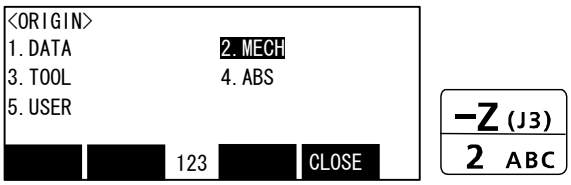




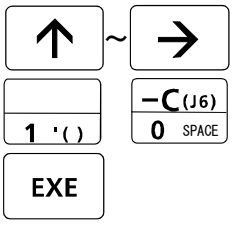
12) If the ABS mark is aligned detach the [F1] key and work the brake.
13) Press the [F4] key and return to the origin / brake screen.



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

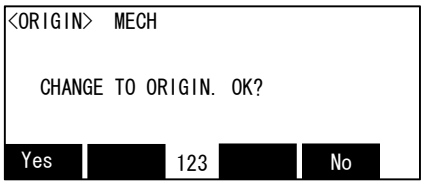


15) Press the [2] key , and display the Mechanical stopper selection screen.



16) Press the [Arrow] key, move the cursor, and set "1" to the J5 axis and J6 axis. Set [0] to other axes.

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



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

19) Setting of the origin is completed.

20) Refer to "5.5.5Recording the origin data" on page 95 in this manual, and record the origin data on the origin data seal.

◇◆◇ 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 enabling 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".

5.5.2 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. 5-16.

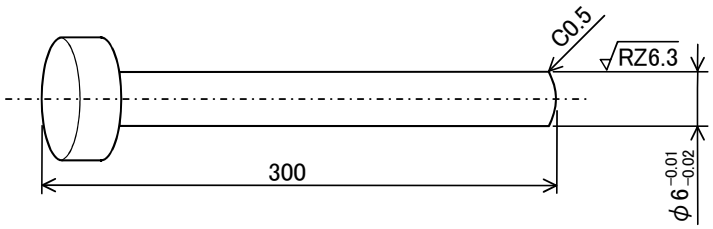


Fig.5-16 : Reference dimension of origin setting tool

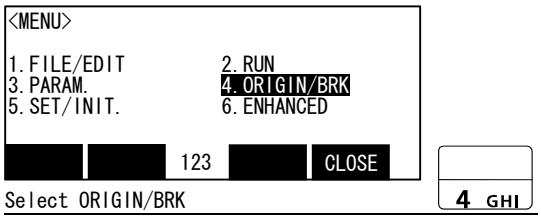
The procedure of setting the origin with the origin setting tool is shown below.

Carry out this method for each axis.
First, set each axis by the origin position. There are the method of releasing the brake and adjusting with the origin position manually and the method of adjusting with the origin position by jog feed. Here, explain operation by brake release.
Then, do origin setting operation and set up the origin.

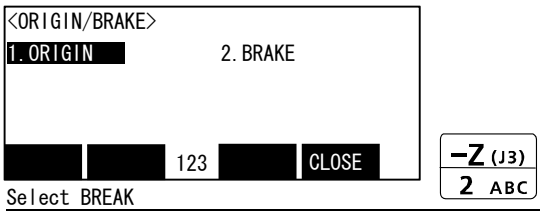
⚠ CAUTION To ensure safety, the brake-release procedure described below should always be done by two persons.

This operation is carried out with the teaching pendant. Set the [MODE] switch on the front of the controller to "MANUAL", and set the [ENABLE] switch on the teaching pendant to "ENABLE" to enable the teaching pendant. Do the following operations, pressing down the enabling switch of T/B lightly.

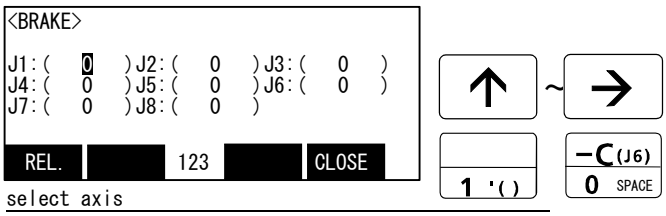
(1) J1 axis origin setting



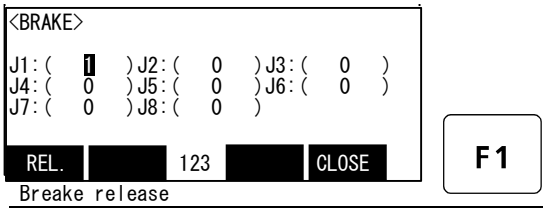
1) Press the [4] key on the menu screen, and display the Origin/Break selection screen.



2) The type which does not have the brake in the J1 axis should go to "6)"->"8)".
Press the [2] key , and display the Break release selection screen.



3) Release the brake of the J1 axis.
Input "1" into the J1 axis. Set "0" to other axes.



4) Confirm the axis for which the brakes are to be released.
5) Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key.

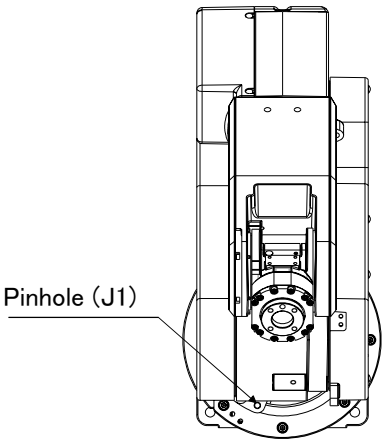
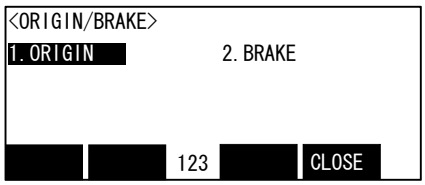


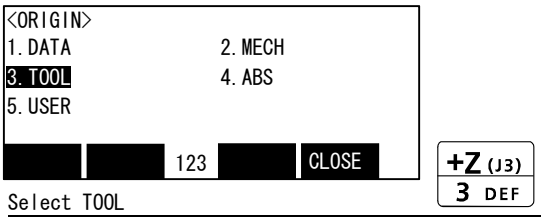
Diagram of the robot viewed from the top

6) 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 (ϕ 6) into the pinholes and fasten.

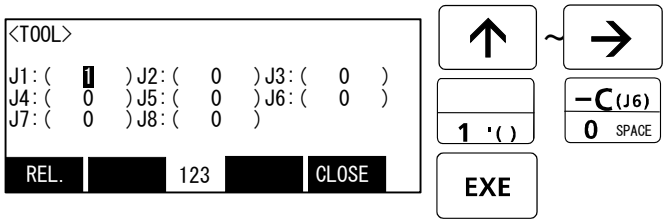
7) Detach the [F1] key and work the brake.
Press the [F4] key and return to the origin / brake screen.



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

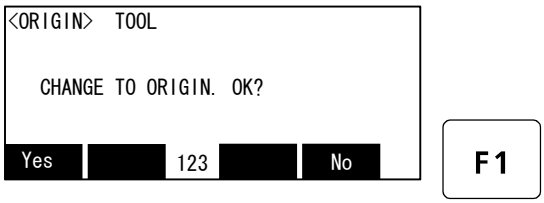


9) Press the [3] key , and display the Tool selection screen.



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

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



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

13) Setting of the origin is completed.

14) Refer to "5.5.5Recording the origin data" on page 95 in this manual, and record the origin data on the origin data seal.

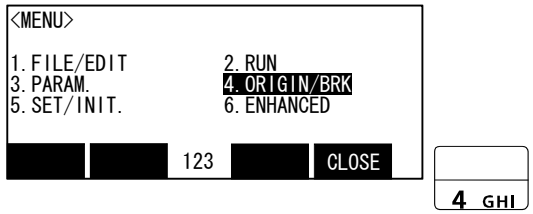
◇◆◇ Release the brake ◇◆◇

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 enabling switch is detached while the brakes are released, the brakes will be work immediately.

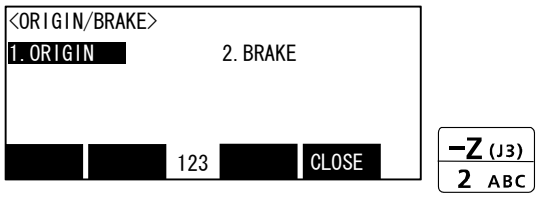
◇◆◇ Select the axis of origin setting ◇◆◇

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".

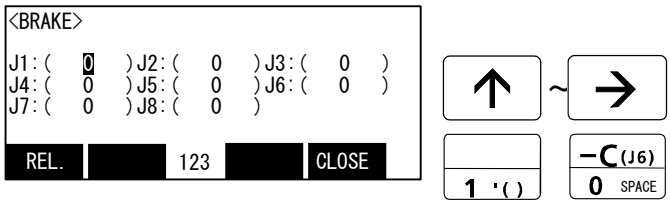
(2) J2 axis origin setting



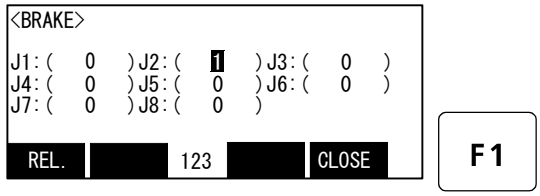
1) Press the [4] key on the menu screen, and display the Origin/Break selection screen.



2) Press the [2] key , and display the Break release selection screen.



3) Release the brake of the J2 axis.
Input "1" into the J2 axis. Set "0" to other axes.

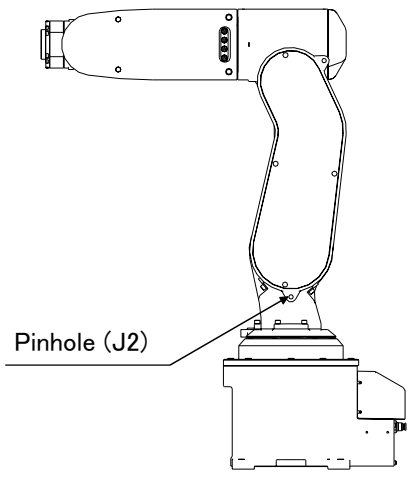


4) Confirm the axis for which the brakes are to be released.

5) One worker must securely support the upper arm with both hands.

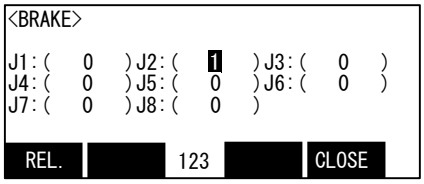
6) Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key.

7) Move the J2 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 (ϕ 6) into the pinholes and fasten.

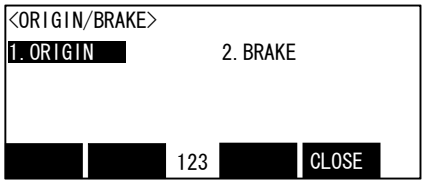


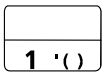
⚠ CAUTION For safety purposes, the step for releasing the brakes must be carried out by two workers. One worker must operate the T/B, and the other must support the arm. When the brakes are released, the robot arm could drop by its own weight depending on the posture.

⚠ CAUTION If [F1] key or enable switch of T/B is released, the brakes will be work immediately.

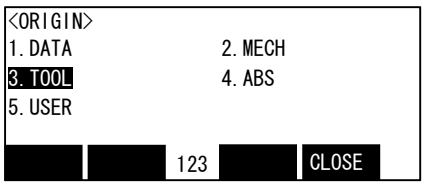


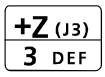
8) Detach the [F1] key and work the brake.
Press the [F4] key and return to the origin / brake screen.



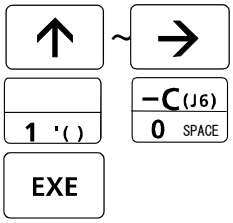


9) Press the [1] key , and display the Origin setting selection screen.



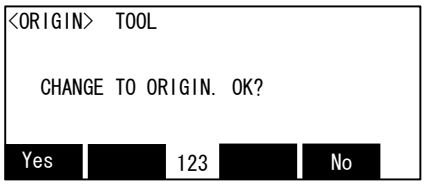


10) Press the [3] key , and display the Tool selection screen.

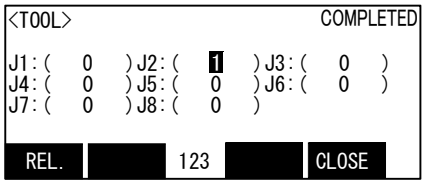


11) Input "1" into the J2 axis. Set "0" to other axes.

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



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



14) Setting of the origin is completed.

15) Refer to "5.5.5Recording the origin data" on page 95 in this manual, and record the origin data on the origin data seal.

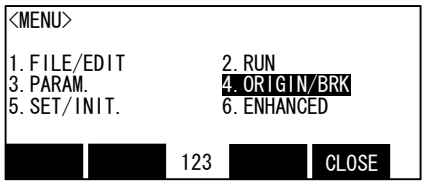
◇◆◇ Release the brake ◇◆◇

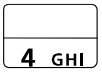
Do cursor movement into the parenthesis of each axis by the arrow key. The brakes can be released only for the axis for which a "1" is displayed on the screen. If the brakes are not to be released, press the [0] key and display a "0". If the [F1] key on the teaching pendant or the enabling switch is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

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

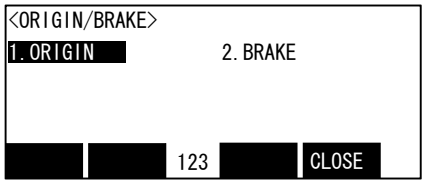
Do cursor movement into the parenthesis of each axis by the arrow key. The origin is set only for the axis for which a "1" is displayed on the screen. If the origin is not to be set, press the [0] key and display a "0".

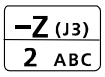
(3) J3 axis origin setting



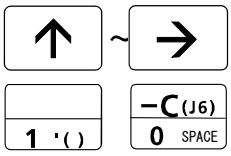


1) Press the [4] key on the menu screen, and display the Origin/Break selection screen.





2) Press the [2] key , and display the Break release selection screen.

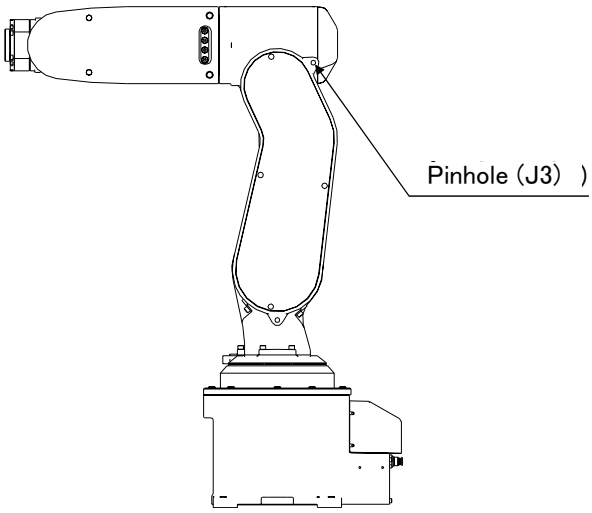


3) Release the brake of the J3 axis.
Input "1" into the J3 axis. Set "0" to other axes.

4) Confirm the axis for which the brakes are to be released.

5) One worker must securely support the upper arm with both hands.

6) Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key.



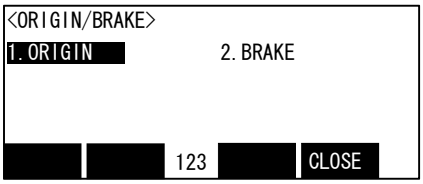
7) Move the J3 axis slowly toward the front using both hands. Align the pinhole of the No.1 arm and the pinhole at the base section, feed through the origin jig (ϕ 6) into the pinholes and fasten.

⚠ CAUTION For safety purposes, the step for releasing the brakes must be carried out by two workers. One worker must operate the T/B, and the other must support the arm. When the brakes are released, the robot arm could drop by its own weight depending on the posture.

⚠ CAUTION If [F1] key or enable switch of T/B is released, the brakes will be work immediately.

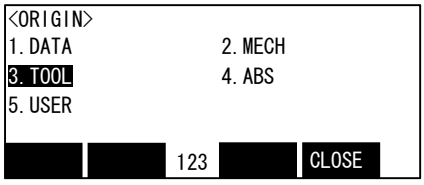
F4

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



1 '( )

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



+Z (J3) 3 DEF

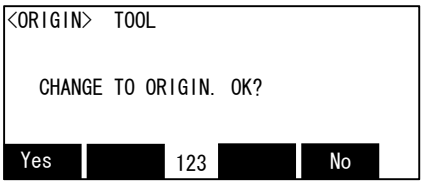
10) Press the [3] key , and display the Tool selection screen.

−C (J6) 0 SPACE

1 '( )

EXE

11) Input "1" into the J3 axis. Set "0" to other axes.
12) Press the [EXE] key , and display Confirmation screen.



F1

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

14) Setting of the origin is completed.

15) Refer to "5.5.5Recording the origin data" on page 95 in this manual, and record the origin data on the origin data seal.

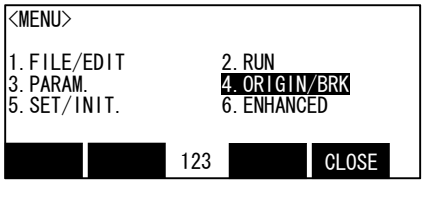
◇◆◇ Release the brake ◇◆◇

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 enabling switch is detached while the brakes are released, the brakes will be work immediately.

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

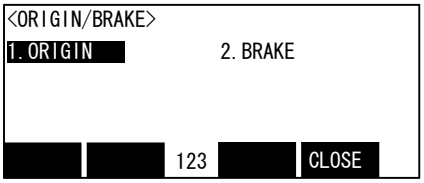
Do cursor movement into the parenthesis of each axis by the arrow key. The origin is set only for the axis for which a "1" is displayed on the screen. If the origin is not to be set, press the [0] key and display a "0".

(4) J4 axis origin setting



4 GHI

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



−Z (J3)
2 ABC

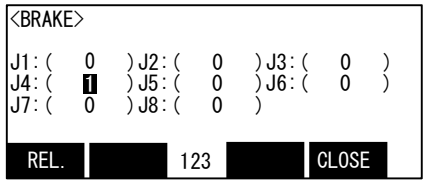
2) The type which does not have the brake in the J4 axis should go to "7)"->"9)".
Press the [2] key , and display the Break release selection screen.

↑ ~ →

1 '( )

−C (J6)
0 SPACE

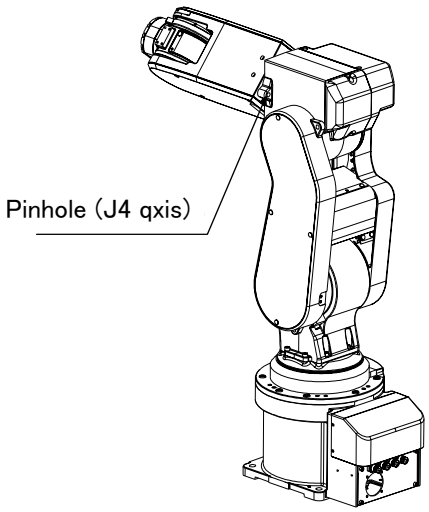
3) Release the brake of the J4 axis.
Input "1" into the J4 axis. Set "0" to other axes.



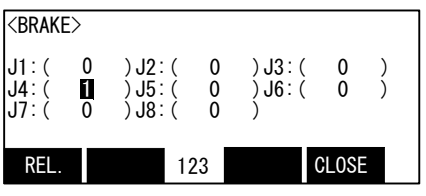
F1

4) Confirm the axis for which the brakes are to be released.
5) One worker must securely support the upper arm with both hands.

6) Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key.

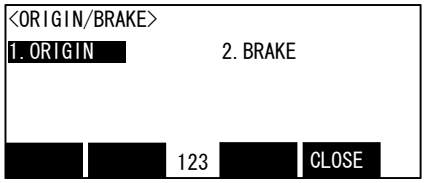


7) Slowly rotate the J4 axis in the direction of minus with both hands. Align the pinholes of the No. 1 arm and shoulder, feed through the origin jig (ϕ6) into the pinholes and fasten.

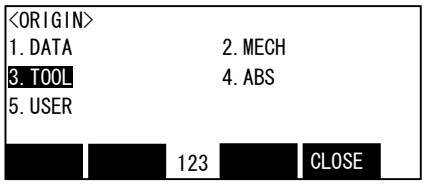


F4

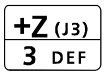
8) Detach the [F1] key and work the brake.
Press the [F4] key and return to the origin / brake screen.

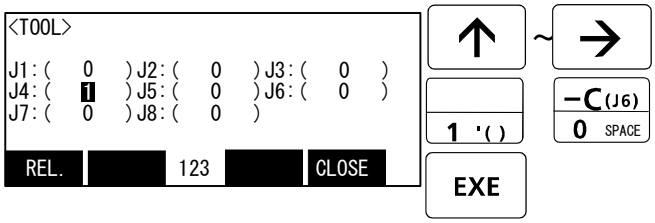


9) Press the [1] key , and display the Origin setting selection screen.

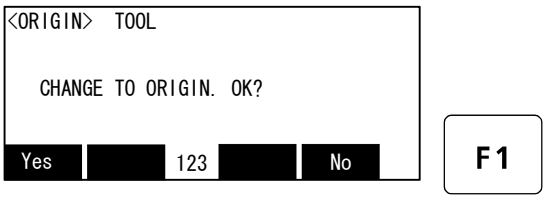


10) Press the [3] key , and display the Tool selection screen.

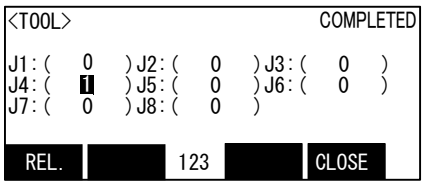




11) Input "1" into the J4 axis. Set "0" to other axes.
12) Press the [EXE] key , and display Confirmation screen.



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



14) Setting of the origin is completed.

15) Refer to "5.5.5Recording the origin data" on page 95 in this manual, and record the origin data on the origin data seal.

◇◆◇ Release the brake ◇◆◇

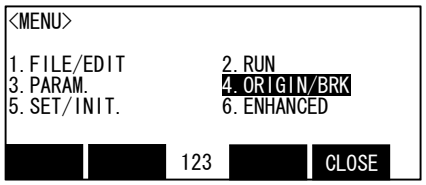
Do cursor movement into the parenthesis of each axis by the arrow key. The brakes can be released only for the axis for which a "1" is displayed on the screen. If the brakes are not to be released, press the [0] key and display a "0". If the [F1] key on the teaching pendant or the enabling switch is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

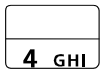
◇◆◇ Select the axis of origin setting ◇◆◇

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".

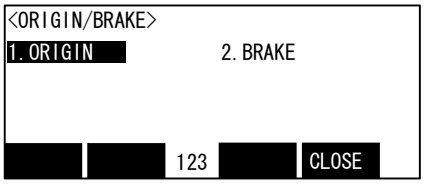
(5) Origin setting of J5 axis and J6 axis (jig)

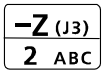
Always perform origin setting of the J5 axis and the J6 axis simultaneously. First, set the J5 axis posture.



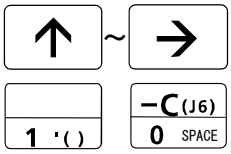


1) Remove the No.2 arm cover B. The pin hole is inside the cover.
2) Press the [4] key on the menu screen, and display the Origin/BRK selection screen.

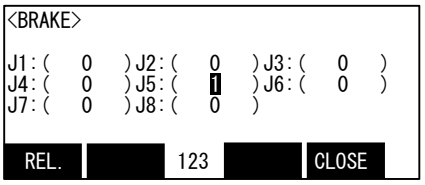




3) Press the [2] key , and display the Brake release selection screen.



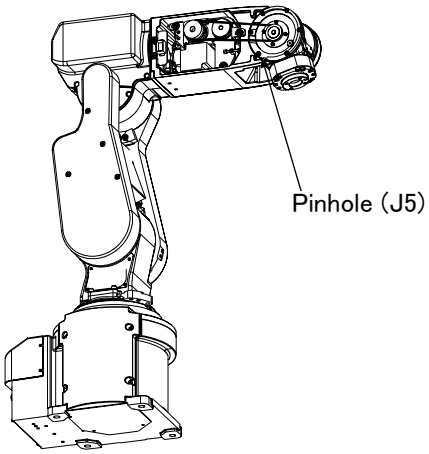
4) Brake release of the J5 axis
Press the [Arrow] key, move the cursor to the J5 axis and press the [1] key. Set [0] to other axes.



5) Confirm the axis for which the brakes are to be released.

6) The one person needs to support the list part securely with both hands.

7) Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key.



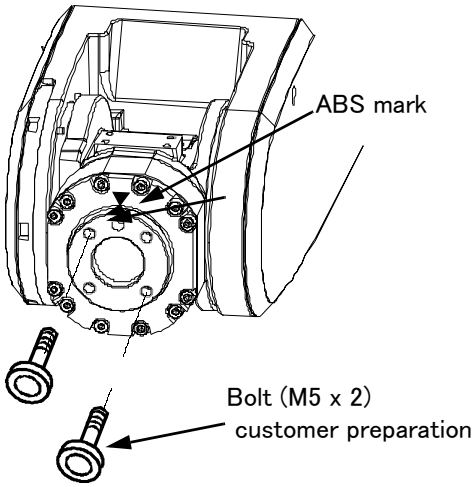
8) Slowly rotate the J5 axis in the direction of plus 90 degree with both hands. Align the pinholes of the No. 2 arm and wrist housing , feed through the origin jig (ϕ 6) into the pinholes and fasten.

⚠ CAUTION To ensure safety, the brake-release procedure described below should always be done by two persons.
Be careful that the robot arm will fall by the self-weight depending on the posture if the brake is released.

⚠ CAUTION If the [F1] key or the enabling switch of T/B is detached, the brake will work immediately.

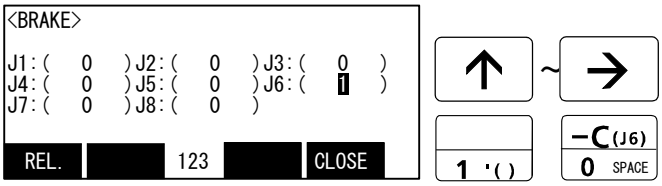
9) Detach the [F1] key and work the brake.

Next, set the J6 axis posture.



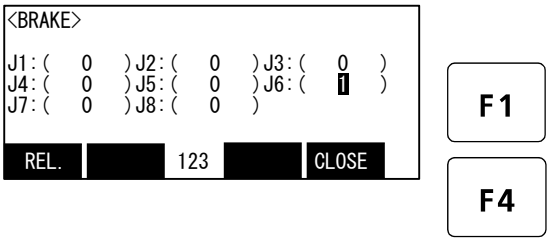
10) Install the bolt (M5: 2 customer preparation) in the diagonal position at the J6 axis.
Hold the bolts with hands, rotate them slowly and align the ABS mark of the J6 axis with the ABS mark of the wrist area.
The type which has the brake in the J6 axis releases the brake. The type which does not have the brake should go to "15)".
[Press the [Arrow] key, move the cursor to the J6 axis and press the [1] key. Set [0] to other axes.

⚠CAUTION The J6-axis dose not have a mechanical stopper.
When setting the origin position , do not rotate the axis more than themotion range(± 200 deg.).



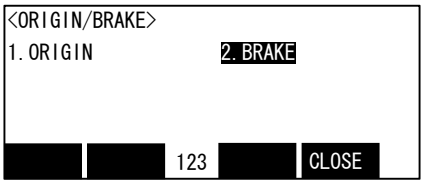
11) Confirm the axis for which the brakes are to be released.

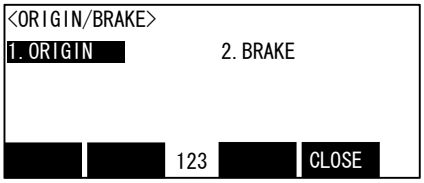
12) Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key.

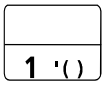


13) Hold the bolts with hands, rotate them slowly and align the ABS mark of the J6 axis with the ABS mark of the wrist area.

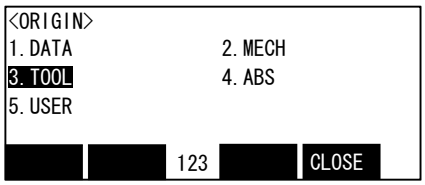
14) If the ABS mark is aligned detach the [F1] key and work the brake.
15) Press the [F4] key and return to the origin / brake screen.

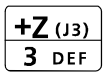




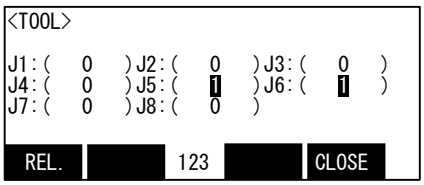


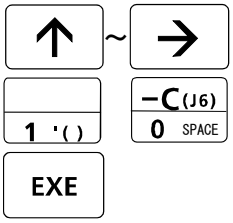
16) Press the [1] key , and display the Origin setting selection screen.





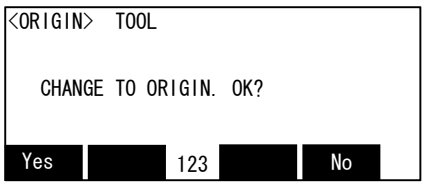
17) Press the [3] key , and display the Tool selection screen.





18) Press the [Arrow] key, move the cursor, and set "1" to the J5 axis and J6 axis. Set [0] to other axes.

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



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

21) Setting of the origin is completed.

22) Refer to "5.5.5Recording the origin data" on page 95 in this manual, and record the origin data on the origin data seal.

◇◆◇ 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 enabling 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".

5.5.3 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] switch on the front of the controller to "MANUAL", and set the [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.
When setting the ABS mark, always view the operations from the mark, and set at the end of the triangular mark. The positions where the ABS mark is attached are shown in below. Refer to "1.5Confirming the operation" on page 40 for details on the jog operation.

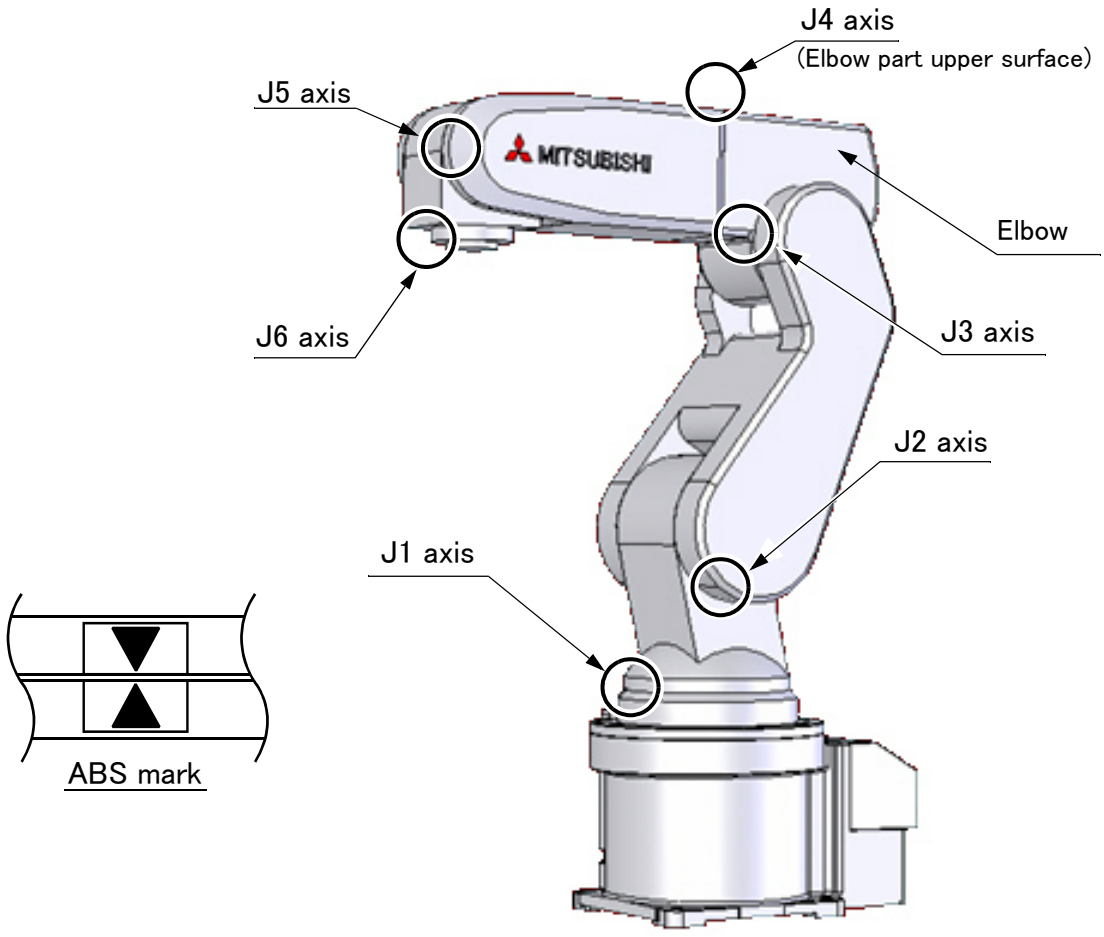
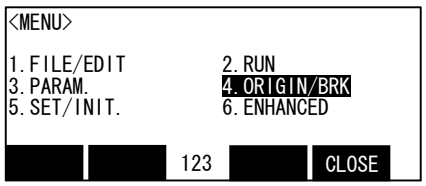


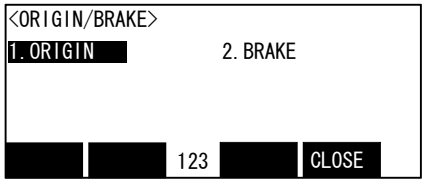
Fig.5-17 : ABS mark attachment positions

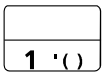
The procedures for setting the origin with the ABS method are explained below.

(1) Select the T/B

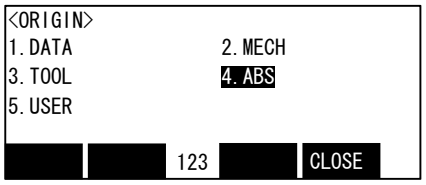


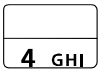
1) Press the [4] key on the menu screen, and display the Origin/Break selection screen.



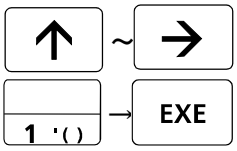


2) Press the [1] key , and display the Origin setting selection screen.

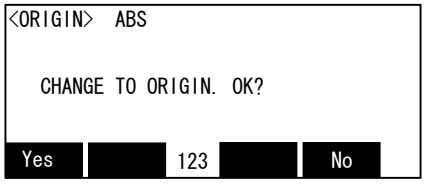




3) Press the [4] key , and display the ABSI selection screen.



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



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

This completes the setting of the origin with the ABS method.

5.5.4 User origin method

CAUTION Before using this method, the origin must be set with the other method.
The setting method is explained in "Table 5-7 : Origin setting method" on page 67.

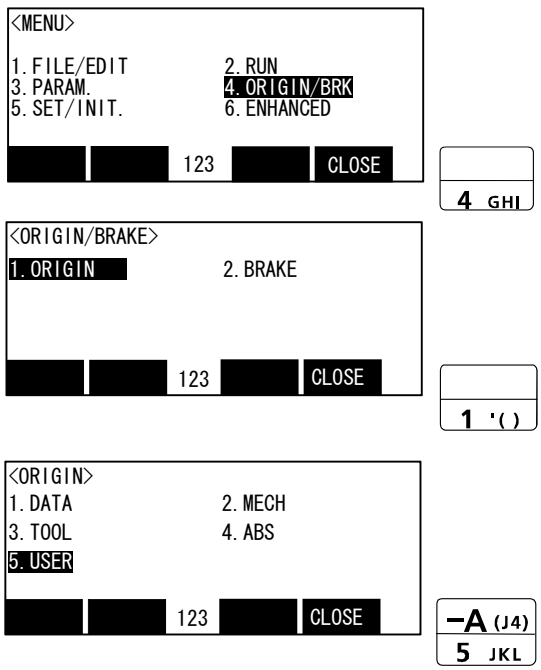
The procedure for setting the origin with the user origin method is explained below.
This operation is carried out with the teaching pendant. Set the [MODE] switch on the front of the controller to "AMNUAL", and set the [ENABLE] switch on the teaching pendant to "ENABLE" to enable the teaching pendant.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

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 axes. Then start the procedure from step 4).

1) Determine the user origin position
Move the robot to the position to be set as the origin with jog operation. Refer to "2.4Confirming the operation" on page 20 for details on the jog operation.

CAUTION 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 (USRORG)".
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.

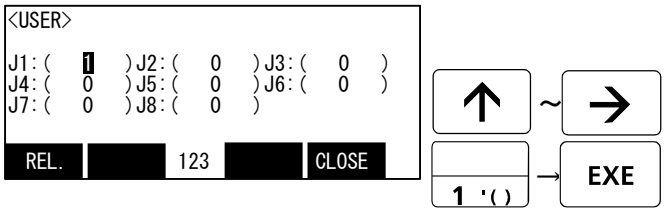


4) Next, set the origin.
Display the menu screen.

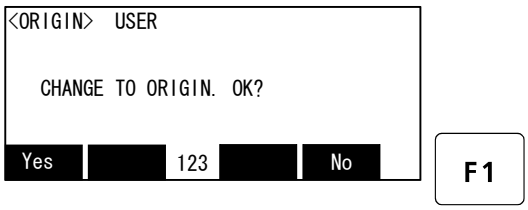
5) Press the [4] key on the menu screen, and display the Origin/Break selection screen.

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

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



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



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

This completes the setting of the origin with the user origin method.

5.5.5 Recording the origin data

When the origin has been set with the jig method, record that origin data on the origin data label. With this, the origin can be set with the origin data input method the next time.

Confirm the origin data on the teaching pendant screen (origin data input screen). The origin data label is enclosed with the arm or attached on the back of the J1 motor cover.
The teaching pendant operation method and J1 motor cover removal method for confirming the origin data is the same as the methods for setting the origin with the origin data input method. Refer to "2.3.2Setting the origin with the origin data input method" on page 12, and write the origin data displayed on the teaching pendant onto the origin label.

(1) Confirming the origin data label
Remove the J1 motor cover.
Refer to "5.3.2Installing/removing the cover" on page 47, and remove the J1 motor cover.

(2) Confirming the origin data
Confirm the value displayed on the teaching pendant's Origin Data Input screen.
Refer to "2.3.2Setting the origin with the origin data input method""(5)Inputting the origin data" , and display the Origin Data Input screen on the teaching pendant display screen.

(3) Recording the origin data
Write the origin data displayed on the teaching pendant to the origin data label attached to the back of the J1 motor cover. Refer to "Fig. 2-8Origin data label (an example)" on page 12, and "Fig. 2-9Correspondence of origin data label and axis" on page 15 for details on the origin data label.

(4) Installing the cover
Install the J1 motor cover removed in step "(1)Confirming the origin data label" above.
Refer to "5.3.2Installing/removing the cover" on page 47, and replace the J1 motor cover.

This completes the recording of the origin data.

6 Appendix

Appendix 1 : Configuration flag

The configuration flag indicates the robot posture.
For the 6-axis type 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

P is center of flange in comparison with the plane through the J1 axis vertical to the ground.
Q is center of J5 axis rotation in comparison with the plane through the J1 axis vertical to the ground.

.

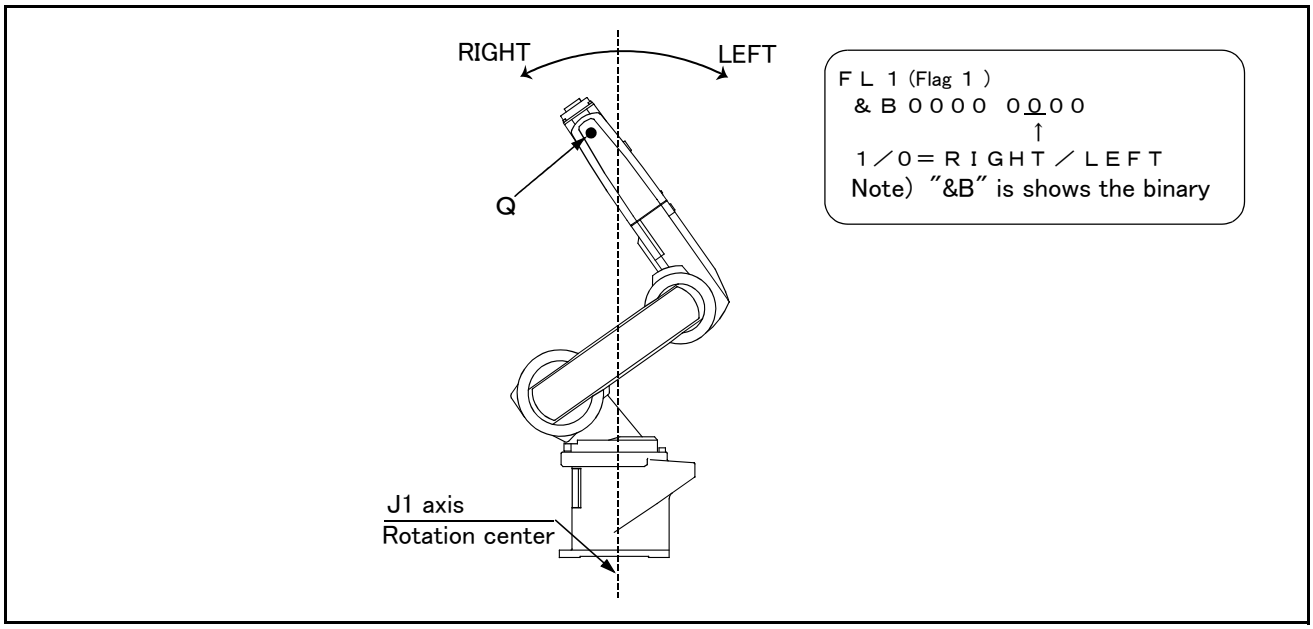


Fig.6-1 : Configuration flag (RIGHT/LEFT)

(2) ABOVE/BELOW

Q is center of J5 axis rotation in comparison with the plane through both the J3 and the J2 axis.

.

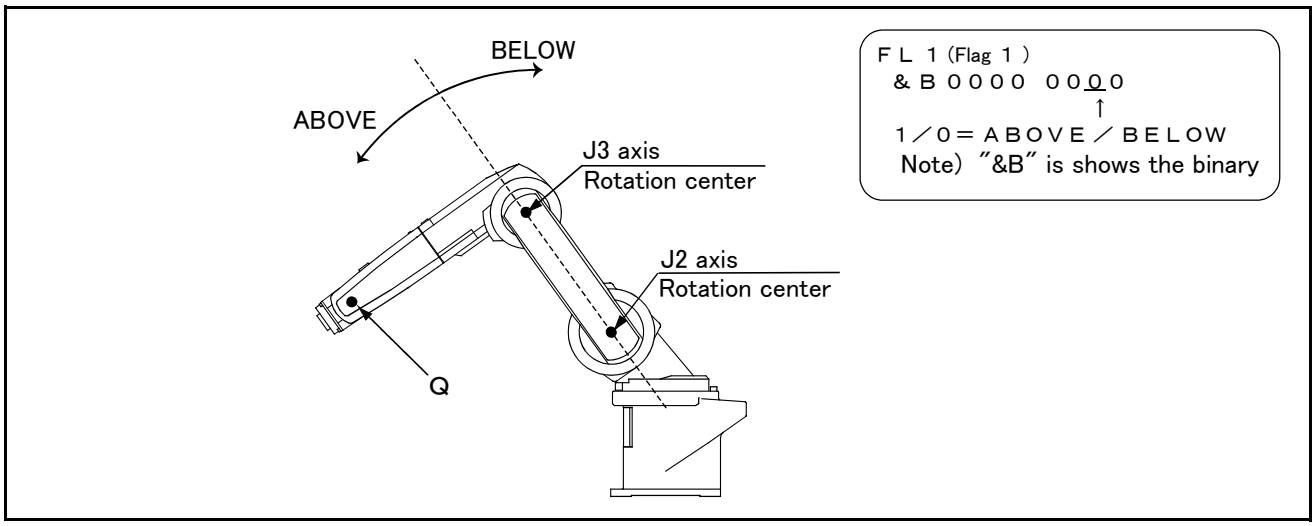


Fig.6-2 : Configuration flag (ABOVE/BELOW)

(3) NONFLIP/FLIP

This means in which side the J6 axis is in comparison with the plane through both the J4 and the J5 axis.

.

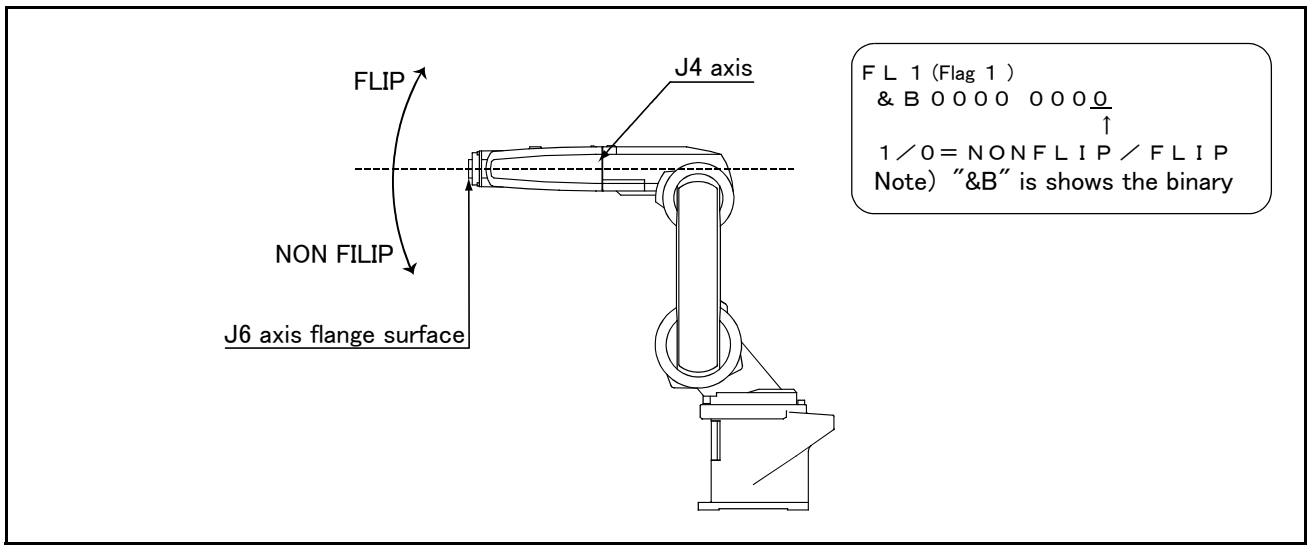


Fig.6-3 : Configuration flag (NONFLIP/FLIP)

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