

EPSON

6-Axis Robots

N6 series

MANIPULATOR MANUAL

Rev.3

EM198R4074F

6-Axis Robots

N6 series Manipulator Manual

Rev. 3

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FOREWORD

Thank you for purchasing our robot products.

This manual contains the information necessary for the correct use of the manipulator.

Please carefully read this manual and other related manuals before installing the robot system.

Keep this manual handy for easy access at all times.

WARRANTY

The robot and its optional parts are shipped to our customers only after being subjected to the strictest quality controls, tests, and inspections to certify its compliance with our high performance standards.

Product malfunctions resulting from normal handling or operation will be repaired free of charge during the normal warranty period. (Please ask your Regional Sales Office for warranty period information.)

However, customers will be charged for repairs in the following cases (even if they occur during the warranty period):

1. Damage or malfunction caused by improper use which is not described in the manual, or careless use.
2. Malfunctions caused by customers' unauthorized disassembly.
3. Damage due to improper adjustments or unauthorized repair attempts.
4. Damage caused by natural disasters such as earthquake, flood, etc.

Warnings, Cautions, Usage:

1. If the robot or associated equipment is used outside of the usage conditions and product specifications described in the manuals, this warranty is void.
2. If you do not follow the WARNINGS and CAUTIONS in this manual, we cannot be responsible for any malfunction or accident, even if the result is injury or death.
3. We cannot foresee all possible dangers and consequences. Therefore, this manual cannot warn the user of all possible hazards.

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Please notify us if you should find any errors in this manual or if you have any comments regarding its contents.

MANUFACTURER

SEIKO EPSON CORPORATION

CONTACT INFORMATION

Contact information is described in “SUPPLIERS” in the first pages of the following manual:

Robot System Safety and Installation Read this manual first

Regarding battery disposal



The crossed out wheeled bin label that can be found on your product indicates that this product and incorporated batteries should not be disposed of via the normal household waste stream. To prevent possible harm to the environment or human health please separate this product and its batteries from other waste streams to ensure that it can be recycled in an environmentally sound manner. For more details on available collection facilities please contact your local government office or the retailer where you purchased this product. Use of the chemical symbols Pb, Cd or Hg indicates if these metals are used in the battery.

This information only applies to customers in the European Union, according to DIRECTIVE 2006/66/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL OF 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC and legislation transposing and implementing it into the various national legal systems.

For other countries, please contact your local government to investigate the possibility of recycling your product.

The battery removal/replacement procedure is described in the following manuals:

Controller manual / Manipulator manual (Maintenance section)

Before Reading This Manual

This section describes what you should know before reading this manual.

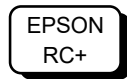
Structure of Control System

N6 Manipulators can be used with the following combinations of controllers and software.

Controller : RC700-A

Software : EPSON RC+ 7.0 Ver.7.3.4 or later

Setting by Software



This manual contains setup procedures using the software.

Those sections are indicated by the symbol on the left.

Turning ON/OFF Controller

When you see the instruction “Turn ON/OFF the Controller” in this manual, be sure to turn ON/OFF all the hardware components.

Photos and Illustrations Used in This Manual

The appearance of some parts may differ from those on an actual product depending on when it was shipped or the specifications. The procedures themselves, however, are accurate.

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Setup & Operation

This volume contains information for setup and operation of the Manipulators.

Please read this volume thoroughly before setting up and operating the Manipulators.

1. Safety




Installation and transportation of the Manipulators and robotic equipment shall be performed by qualified personnel and should conform to all national and local codes.

Please read this manual and other related manuals before installing the robot system or before connecting cables.

Keep this manual handy for easy access at all times.

1.1 Conventions

Important safety considerations are indicated throughout the manual by the following symbols. Be sure to read the descriptions shown with each symbol.


 WARNING	This symbol indicates that a danger of possible serious injury or death exists if the associated instructions are not followed properly.
 WARNING	This symbol indicates that a danger of possible harm to people caused by electric shock exists if the associated instructions are not followed properly.
 CAUTION	This symbol indicates that a danger of possible harm to people or physical damage to equipment and facilities exists if the associated instructions are not followed properly.

1.2 Design and Installation Safety

Only trained personnel should design and install the robot system. Trained personnel are defined as those who have taken robot system training and maintenance training classes held by the manufacturer, dealers, or local representative companies, or those who understand the manuals thoroughly and have the same knowledge and skill level as those who have completed the training courses.

To ensure safety, a safeguard must be installed for the robot system. For details on the safeguard, refer to the *Installation and Design Precautions* in the *Safety* chapter of the EPSON RC+ User's Guide.



The following items are safety precautions for design personnel:

 WARNING	<ul style="list-style-type: none"> ■ Personnel who design and/or construct the robot system with this product must read the <i>Safety</i> chapter in the EPSON RC+ User's Guide. Designing and/or constructing the robot system without understanding the safety requirements is extremely hazardous, and may result in serious bodily injury and/or severe equipment damage to the robot system. ■ The Manipulator and the Controller must be used within the environmental conditions described in their respective manuals. This product has been designed and manufactured strictly for use in a normal indoor environment. Using the product in an environment that exceeds the specified environmental conditions may not only shorten the life of the product but may also cause serious safety problems. ■ The robot system must be used within the installation requirements described in the manuals. Using the robot system outside of the installation requirements may not only shorten the life of the product but also cause serious safety problems.
--	---

Further precautions for installation are described in the chapter *Setup & Operation 3. Environment and Installation*. Please read this chapter carefully to understand safe installation procedures before installing the robots and robotic equipment.

1.3 Operation Safety

The following items are safety precautions for qualified Operator personnel:

 WARNING	<ul style="list-style-type: none"> ■ Please carefully read the <i>Safety-related Requirements</i> in the <i>Safety</i> chapter of the <i>Safety and Installation</i> manual. Operating the robot system without understanding the safety requirements is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system. ■ Do not enter the operating area of the Manipulator while the power to the robot system is turned ON. Entering the operating area with the power ON is extremely hazardous and may cause serious safety problems as the Manipulator may move even if it seems to be stopped. ■ Before operating the robot system, make sure that no one is inside the safeguarded area. The robot system can be operated in the mode for teaching even when someone is inside the safeguarded area. The motion of the Manipulator is always in restricted status (low speeds and low power) to secure the safety of an operator. However, operating the robot system while someone is inside the safeguarded area is extremely hazardous and may result in serious safety problems in case that the Manipulator moves unexpectedly. ■ Immediately press the Emergency Stop switch whenever the Manipulator moves abnormally during operation. Continuing the operation while the Manipulator moves abnormally is extremely hazardous and may result in serious bodily injury and/or severe equipment change to the robot system.
 WARNING	<ul style="list-style-type: none"> ■ Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source. To shut off power to the robot system, disconnect the power plug from the power source. Performing any work while connecting the AC power cable to a factory power source is extremely hazardous and may result in electric shock and/or malfunction of the robot system. ■ Before performing any replacement procedure, turn OFF the Controller and related equipment, and then disconnect the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system. ■ Do not connect or disconnect the motor connectors while the power to the robot system is turned ON. Connecting or disconnecting the motor connectors with the power ON is extremely hazardous and may result in serious bodily injury as the Manipulator may move abnormally, and also may result in electric shock and/or malfunction of the robot system.



CAUTION

- Whenever possible, only one person should operate the robot system. If it is necessary to operate the robot system with more than one person, ensure that all people involved communicate with each other as to what they are doing and take all necessary safety precautions.
- If the joints are operated repeatedly with the operating angle less than 5 degrees, they may get damaged early because the bearings are likely to cause oil film shortage in such situation. To prevent early breakdown, move the joints larger than 30 degrees for about five to ten times a day.
- Oscillation (resonance) may occur continuously depending on the combination of robot motion speed, Arm orientation, and end effector load. Oscillation arises from natural oscillation frequency of the Arm and can be controlled by following measures.
 - Changing Manipulator speed
 - Changing the teach points
 - Changing the end effector load

1.4 Emergency Stop

If the Manipulator moves abnormally during operation, immediately press the Emergency Stop switch. Pressing the Emergency Stop switch immediately changes the Manipulator to deceleration motion and stops it at the maximum deceleration speed.

However, avoid pressing the Emergency Stop switch unnecessarily while the Manipulator is running normally. Otherwise, the Manipulator may hit the peripheral equipment since the operating trajectory until the robot system stops is different from that in normal operation.

Do not press the Emergency Stop switch unnecessarily while the Manipulator is operating. Pressing the switch during operation makes the brakes work. This will shorten the life of the brakes due to the worn friction plates.

Normal brake life cycle: About 2 years (when the brakes are used 100 times/day)

Also, the Emergency Stop during operation applies impact on the reduction gear unit, and it may result in the short life of the reduction gear unit.

To place the robot system in emergency mode during normal operation, press the Emergency Stop switch while the Manipulator is not moving.

Refer to the Controller manual for instructions on how to wire the Emergency Stop switch circuit.

Do not turn OFF the Controller while the Manipulator is operating.

If you attempt to stop the Manipulator in emergency situations, make sure to stop the Manipulator using the Emergency Stop switch of the Controller.

If the Manipulator is stopped by turning OFF the Controller while it is operating, the following problems may occur.

Reduction of the life and damage of the reduction gear unit

Position gap at the joints

In addition, if the Controller was forced to be turned OFF by blackouts and the like while the Manipulator is operating, make sure to check the following points after power restoration.

Whether or not the reduction gear is damaged

Whether or not the joints are in their proper positions

If there is a position gap, perform calibration by referring to the *Maintenance & Calibration* in this manual.

Before using the Emergency Stop switch, be aware of the followings.

- The Emergency Stop (E-STOP) switch should be used to stop the Manipulator only in case of emergencies.
- To stop the Manipulator operating the program except in emergency, use Pause (halt) or STOP (program stop) commands.
Pause and STOP commands do not turn OFF the motors. Therefore, the brake does not function.
- For the Safeguard system, do not use the circuit for E-STOP.

For details of the Safeguard system, refer to the following manuals.

*EPSON RC+ User's Guide 2. Safety - Installation and Design Precautions
- Safeguard System*

Safety and Installation 2.6 Connection to EMERGENCY Connector

To check brake problems, refer to the following manuals.

Manipulator Manual Maintenance 2.1.2 Inspection Point

*- Inspection While the Power is ON
(Manipulator is operating)*

Safety and Installation

5.1.1 Manipulator

*- Inspection While the Power is ON
(Manipulator is operating)*

Free running distance in emergency

The Manipulator in operation cannot stop immediately after the Emergency Stop switch is pressed. However, time, angle, and distance of the free running vary by following factors:

Hand weight	WEIGHT Setting	ACCEL Setting
Workpiece weight	SPEED Setting	Posture etc.

Approximate time and distance of the free running are as follow:

Conditions of Measurement

	N6 series
ACCEL Setting	100
SPEED Setting	100
Load [kg]	6
WEIGHT Setting	6

Robot Controller		RC700-A	
Manipulator		N6-A1000**	N6-A850**R
Free running time [sec.]	Arm #1	0.75	0.9
	Arm #2	0.65	0.6
	Arm #3	0.65	0.55
	Arm #4	0.45	0.45
	Arm #5	0.4	0.4
	Arm #6	0.5	0.5
Free running angle [°]	Arm #1	70	70
	Arm #2	65	45
	Arm #3	70	90
	Arm #4	70	70
	Arm #5	70	70
	Arm #6	110	110

1.5 How to Move Arms with the Electromagnetic Brake

There are two methods to release the Electromagnetic brake.

Follow either method to release the Electromagnetic brake and move the arm manually.

The Joint #1 is not equipped with the Electromagnetic brake.

Moving the arm using the brake release unit:

Follow the method when you just unpack the delivered boxes or when the Controller does not start up yet.

The brake release unit is available as an option.

For details, refer to *Setup & Operation 6. Options*.

Moving the arm using the software:

Follow the method when you can use the software.



CAUTION

- Normally, release the brake of joints one by one. Take extra care if you need to release the brakes of two or more joints simultaneously. Releasing the brakes of two or more joints simultaneously may cause hands and fingers to be caught and/or equipment damage to or malfunction of the Manipulator as the arms of the Manipulator may move in unexpected directions.
- Be careful of the arm falling when releasing the brake. While the brake is being released, the Manipulator's arm falls by its own weight. The arm falling may cause hands and fingers to be caught and/or may cause equipment damage to or malfunction of the Manipulator.
- Before releasing the brake, be sure to keep the Emergency Stop switch handy so that you can immediately press the Emergency Stop switch. Otherwise, you cannot immediately stop the arm falling due to an erroneous operation. The arm falling may cause equipment damage to and/or malfunction of the Manipulator.

EPSON
RC+

After releasing the Emergency Stop switch, execute the following command in [Command Window].

```
>Reset
```

```
>Brake Off, [the number (from 2 to 6) corresponding to the arm whose brake will be turned OFF]
```

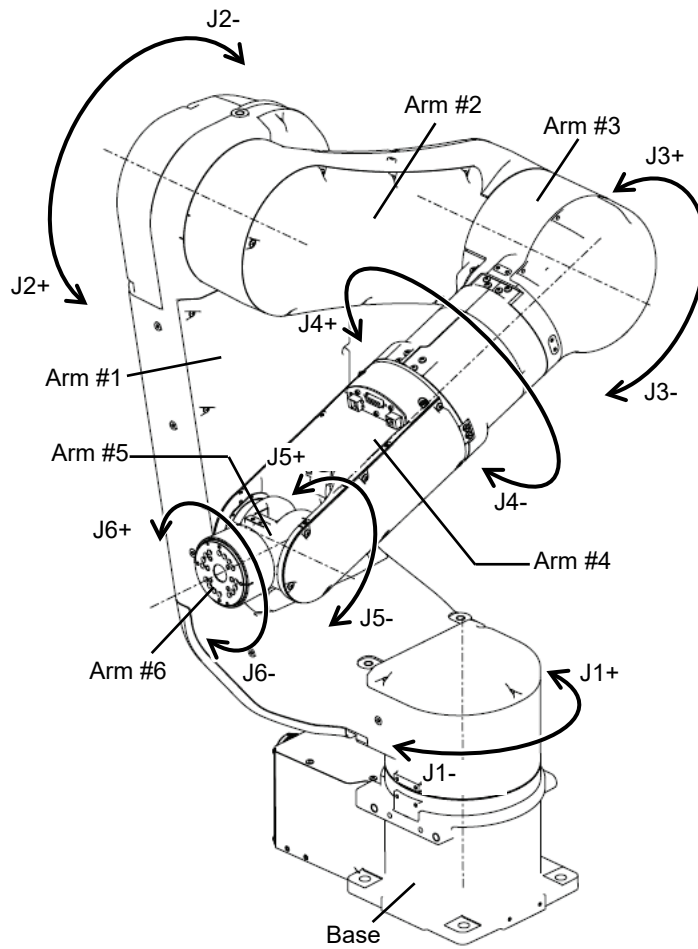
Execute the following command to turn ON the brake again.

```
>Brake On, [The number (from 2 to 6) corresponding to the arm whose brake will be turned ON]
```

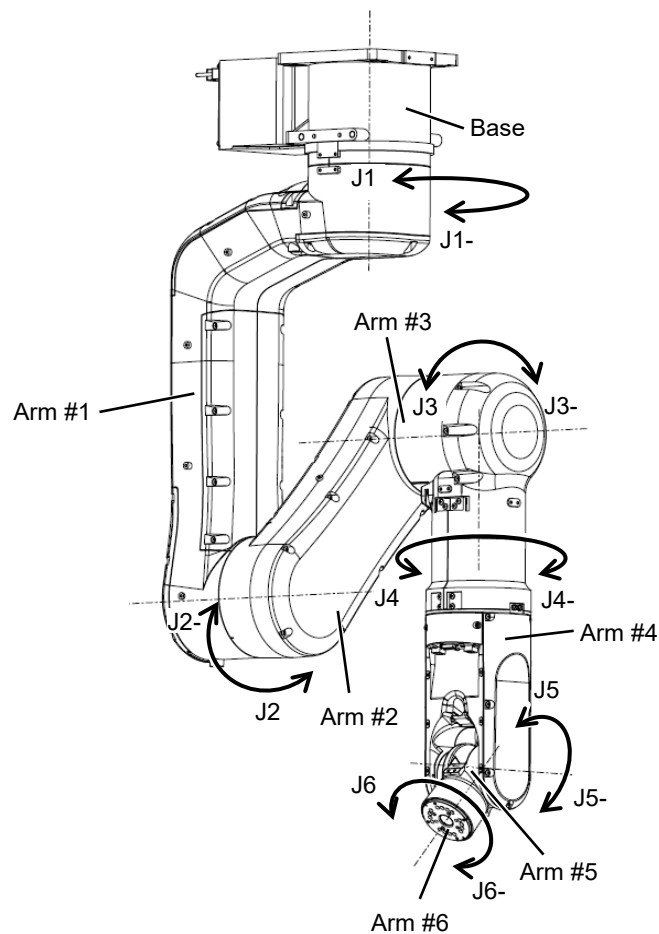
While the Electromagnetic brakes are ON (such as in emergency mode), you cannot move any arms except for Arm #1 by pushing manually.

Arm Motion

N6-A1000**



N6-A850**R



1.6 Precaution for Operation in Low Power Status

In the low power status, the Manipulator operates at low speed and low torque.

Carefully operate the Manipulator since it may get your hands or fingers caught during operation. The Manipulator may also collide with peripheral equipment and cause equipment damage to or malfunction of the Manipulator.




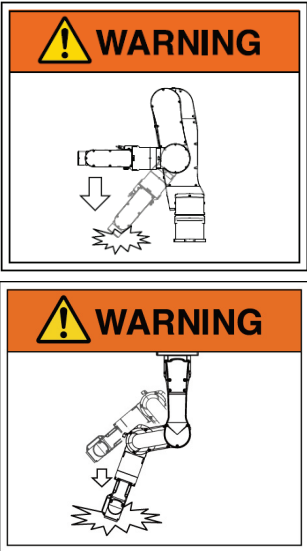

- Carefully operate the Manipulator in the low power status. A comparatively high joint torque may be generated. It may cause your hands and fingers caught and/or cause equipment damage to or malfunction of the Manipulator as it may collide with peripheral equipment.





1.7 Warning Labels


The Manipulator has the following warning labels.

The warning labels are attached around the locations where specific dangers exist. Be sure to comply with descriptions and warnings on the labels to operate and maintain the Manipulator safely.

Do not tear, damage, or remove the warning labels. Use meticulous care when handling those parts or units to which the following warning labels are attached as well as the nearby areas.

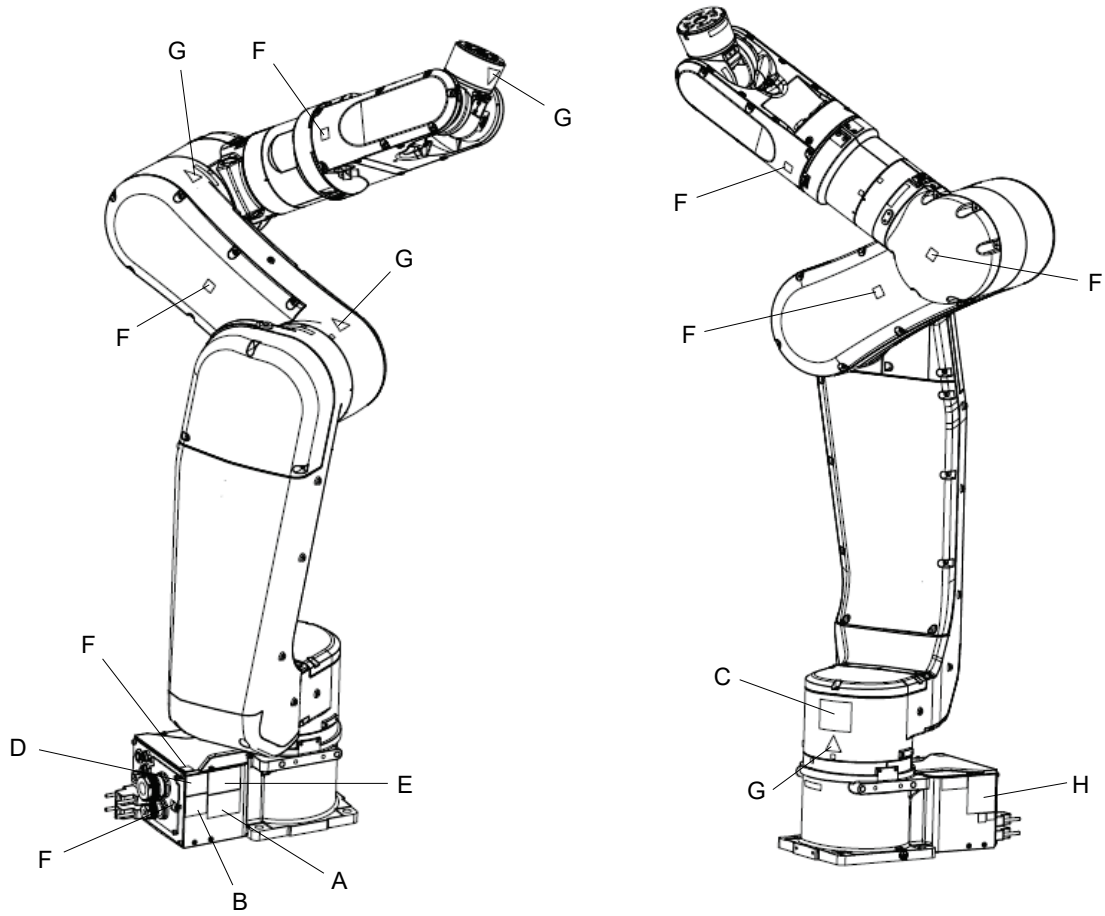
Location	Warning Label	NOTE
A		<p>To avoid the Manipulator from falling, support the Manipulator before removing the base mounting screws.</p> <p>Follow the instructions in this manual for transportation and installation.</p>
B		<p>When releasing the brakes, be careful of the arm falling due to its own weight.</p>
C		<p>You may get your hand or fingers caught when bringing your hand close to moving parts.</p>

Location	Warning Label	NOTE
D		Do not enter the work space when the Manipulator is operating. It is extremely hazardous since the Arm may collide and cause serious safety problems.
E		Only authorized personnel should perform sling work and operate a crane and a forklift. If unauthorized personnel perform these operations, it is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system.
F		Do not touch the current-carrying parts inside the Manipulator while the power is ON. It may cause electrical shock.
G		HOT You can get burned due to high temperature.

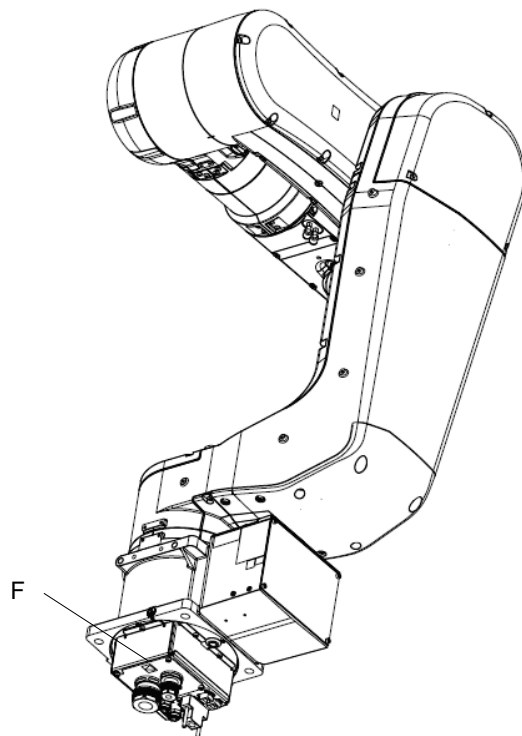
Location	Label	NOTE
H	 <pre> MODEL :N6-A1000S SERIAL NO. :N601000000 MANUFACTURED:01/2018 WEIGHT:69Kg MAX PAYLOAD:6Kg MOTOR POWER AXIS1:600W AXIS2:600W AXIS3:400W AXIS4:100W AXIS5:100W AXIS6:100W MANUFACTURER: SEIKO EPSON CORPORATION 3-5,OWA 3-CHOME,SUWA-SHI NAGANO-KEN,392-8502 JAPAN https://global.epson.com/company/ ENTITY PLACING ON EU MARKET: EPSON DEUTSCHLAND GmbH OTTO-HAHN-STR.4,D-40670 MEERBUSCH GERMANY https://neon.epson-europe.com/de/en/robots/ N601000000 MADE IN JAPAN </pre>	Manipulator model, serial number, year and month of manufacture, weight, and maximum payload are printed.

Location of Labels

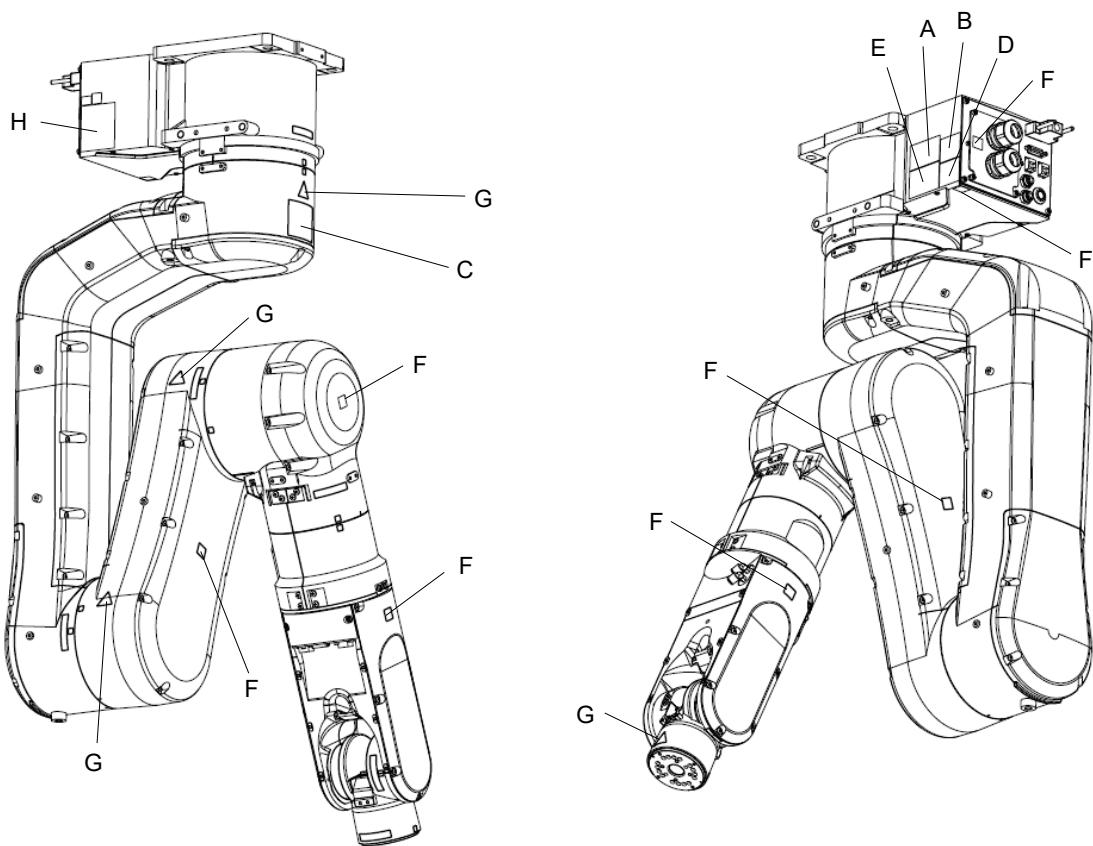
N6-A1000**



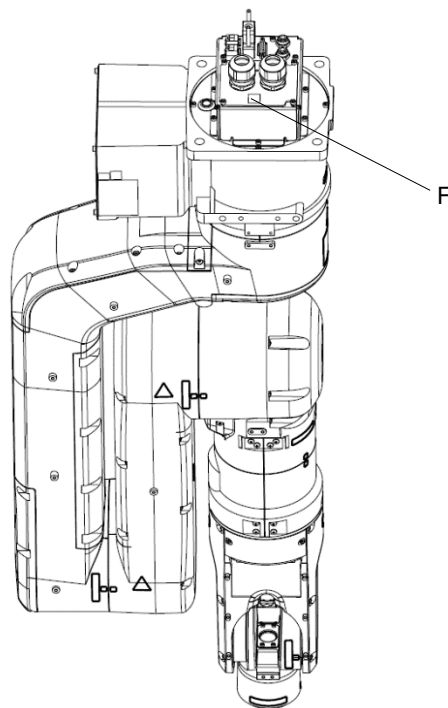
N6-A1000*B



N6-A850**R

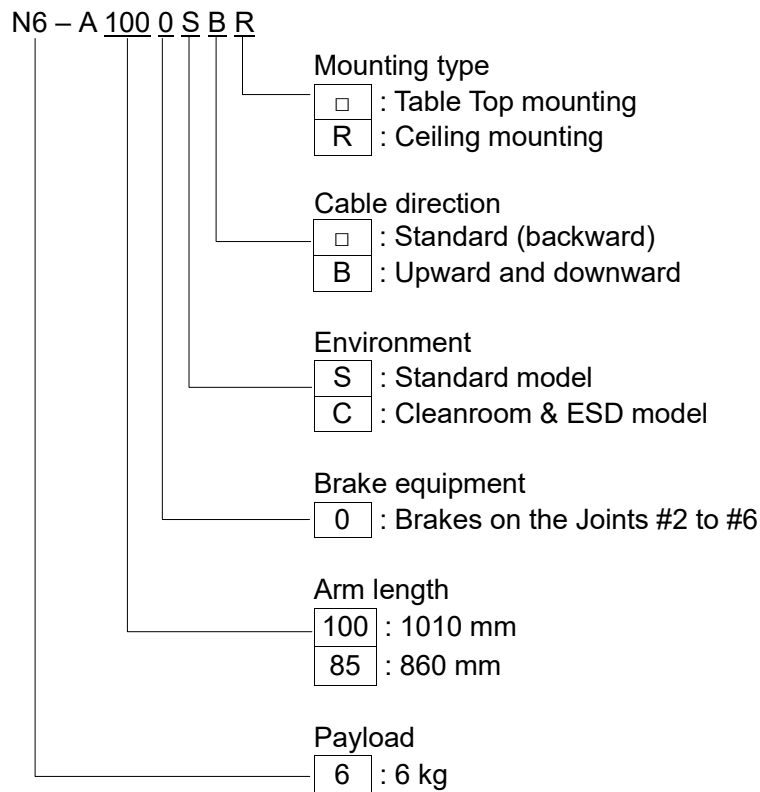


N6-A850*BR



2. Specifications

2.1 Model Number



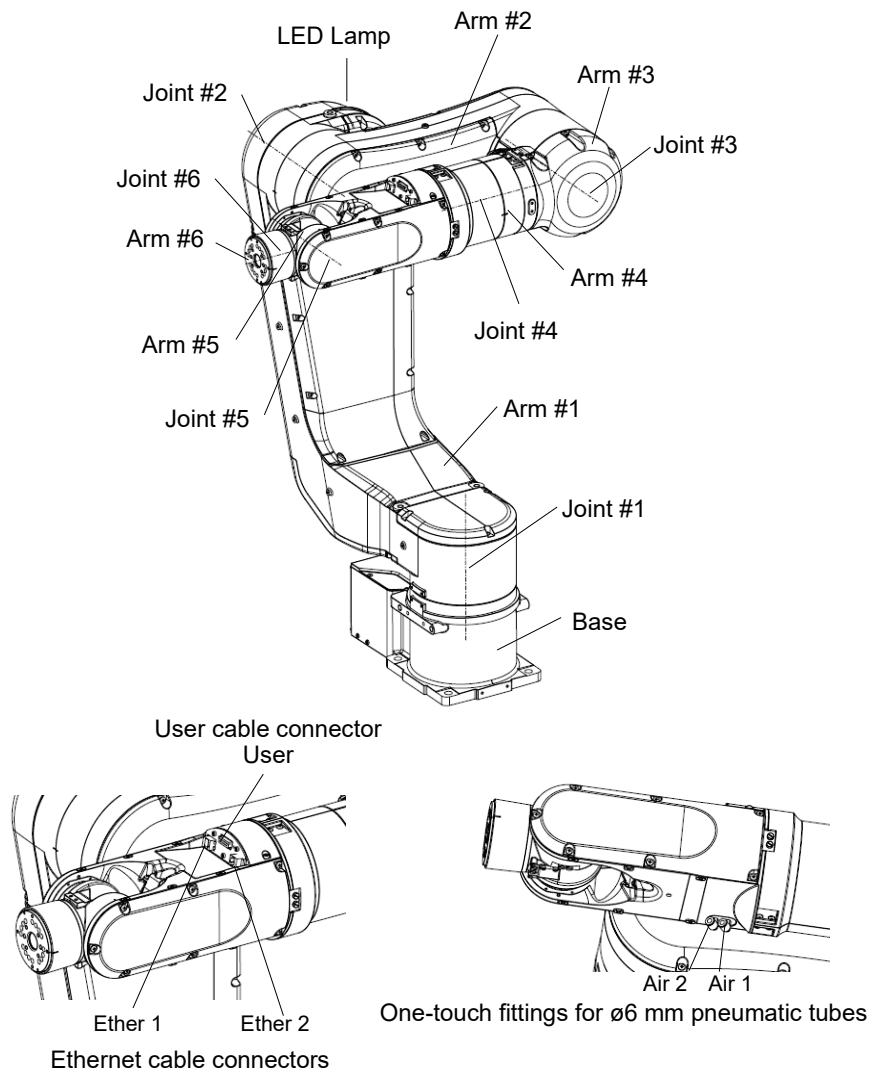
Manipulator is set to “Table top mounting” at shipment. To use the Manipulator as “Ceiling mounting”, you need to change the model settings.

N6-A850**R is for “Ceiling mounting” only. “Table Top mounting” is not available.

For details on how to change the model settings, refer to 5.5 *Changing the Robot*, and *EPSON RC+ User’s Guide Robot Configuration*.

2.2 Part Names

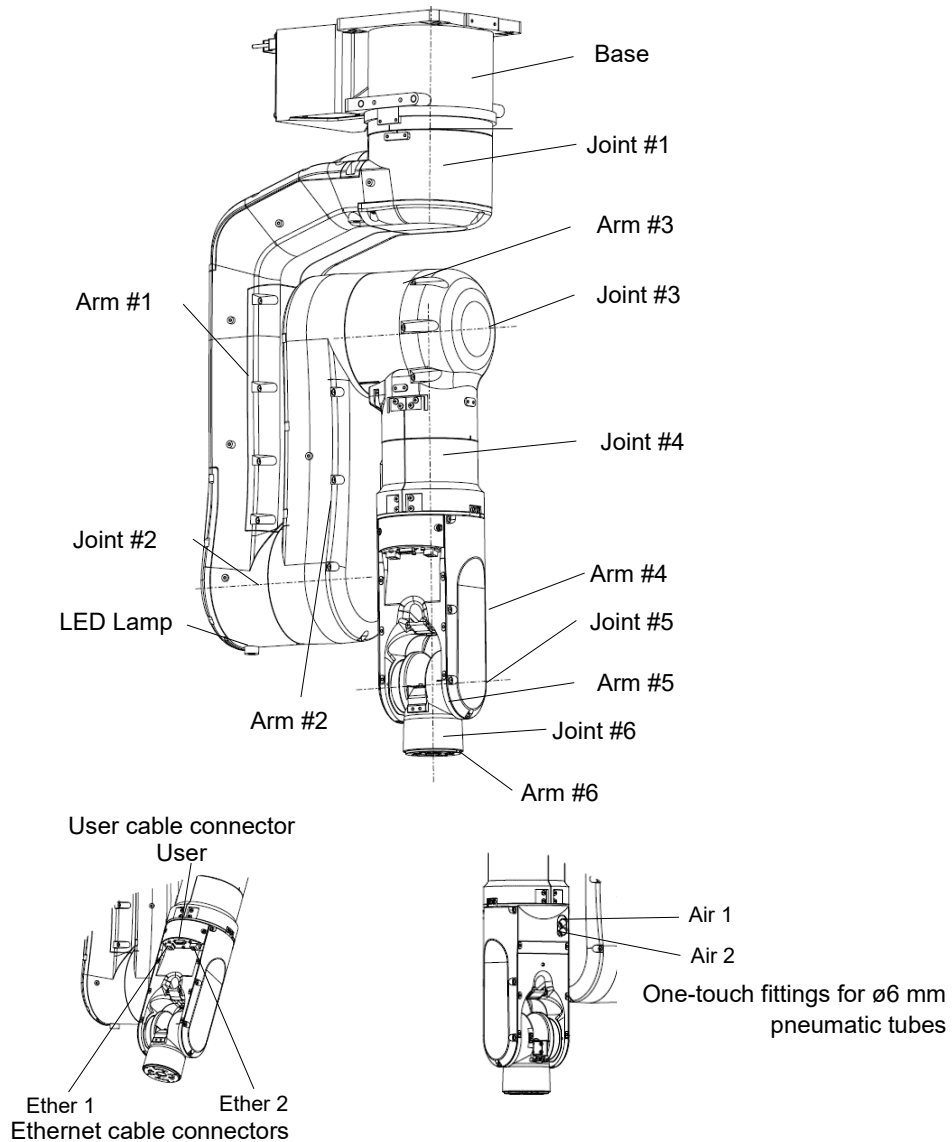
N6-A1000**




NOTE


When the LED lamp is lighting or the Controller power is on, the current is being applied to the Manipulator. (The LED lamp may not be seen depending on the Manipulator's posture. Be very careful.) Performing any work with the power ON is extremely hazardous and it may result in electric shock and/or improper function of the robot system. Make sure to turn OFF the Controller power before the maintenance work.

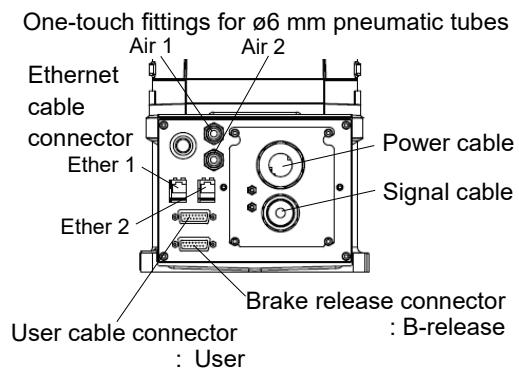
N6-A850**R



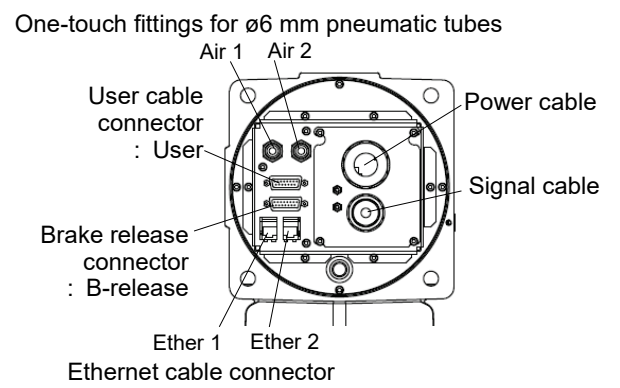
NOTE  When the LED lamp is lighting or the Controller power is on, current is being applied to the Manipulator. (The LED lamp may not be seen depending on the Manipulator's posture. Be very careful.) Performing any work with the power ON is extremely hazardous and it may result in electric shock and/or improper function of the robot system. Make sure to turn OFF the Controller power before maintenance work.

N6-A1000** / N6-A850**R

Cable direction: Standard (backward)



Cable direction: Upward and Downward

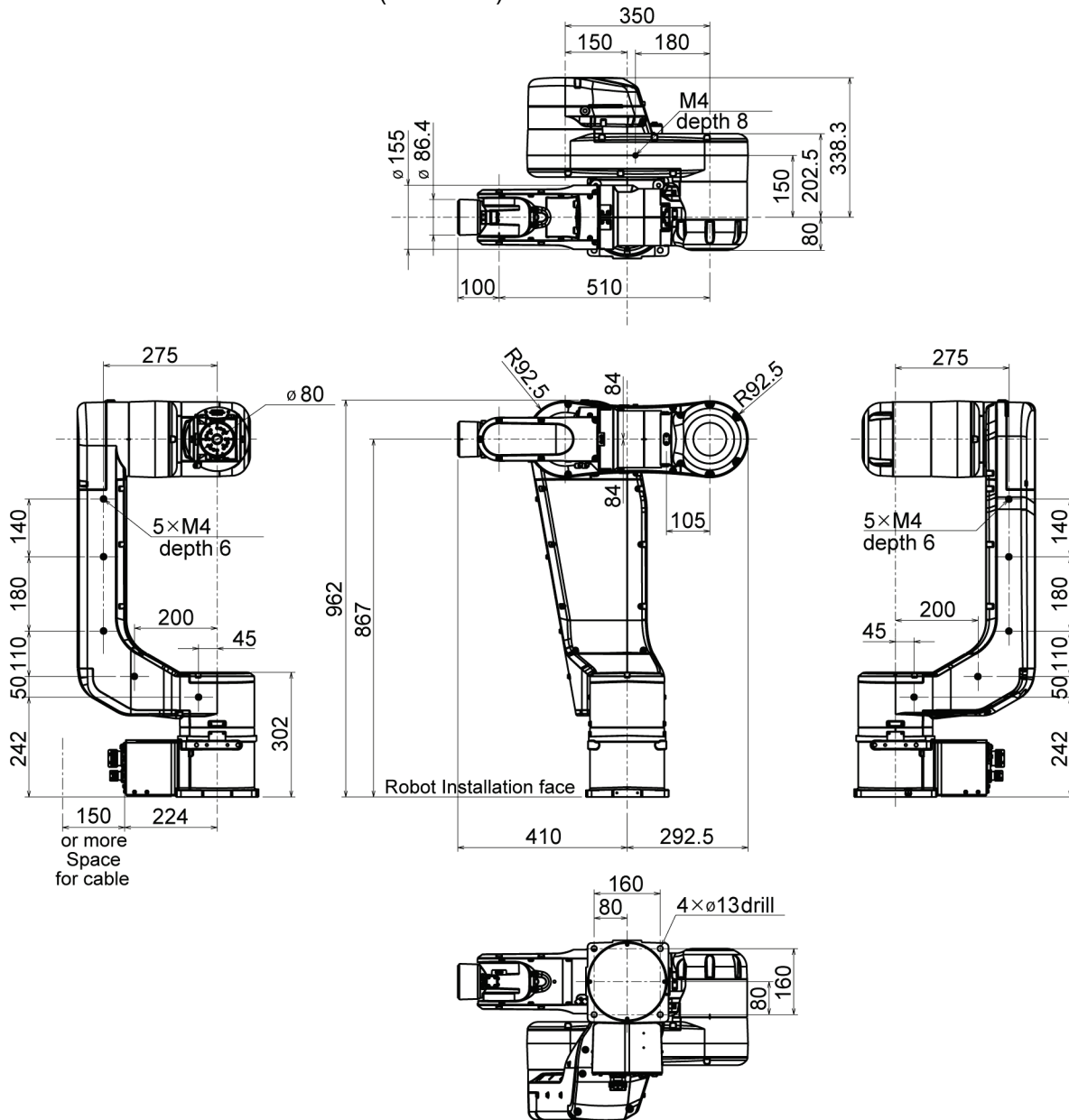


2.3 Outer Dimensions

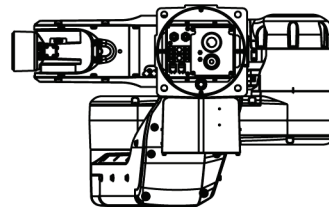
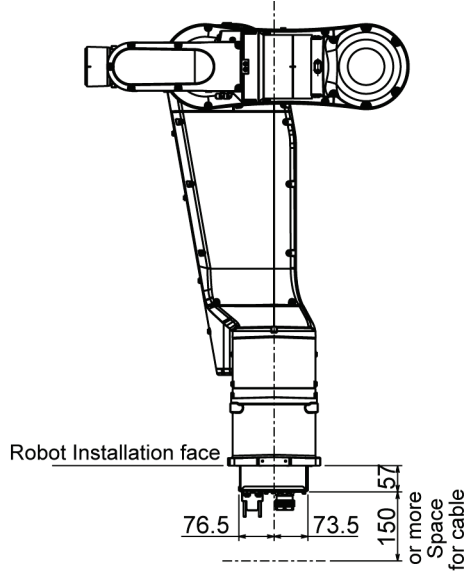
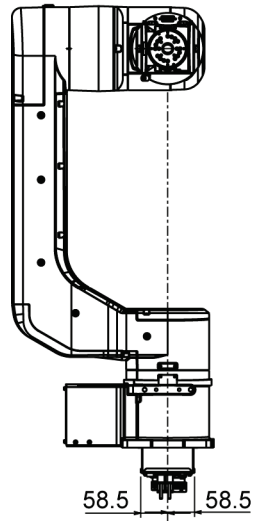
[Unit: mm]

2.3.1 Basic Orientation

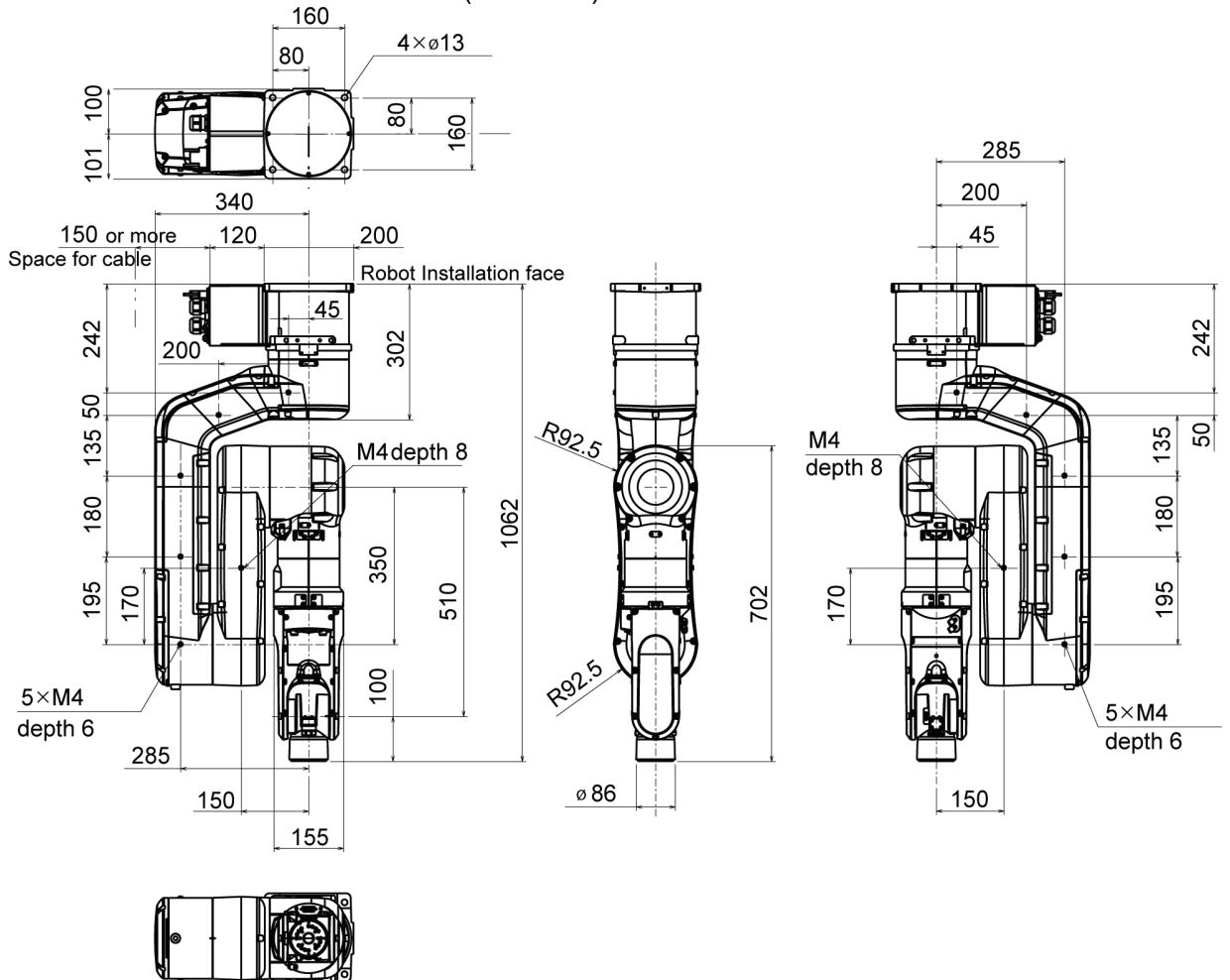
N6-A1000*: Cable direction: Standard (backward)



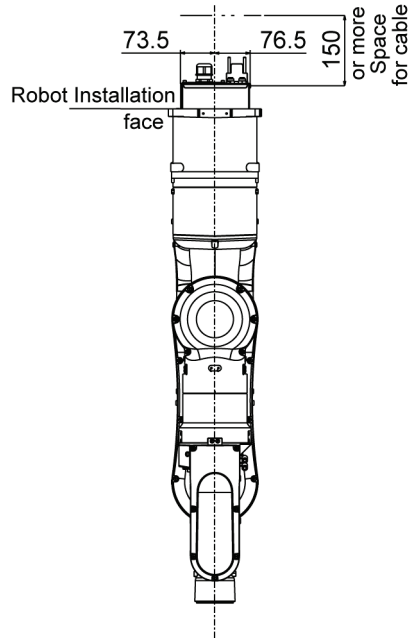
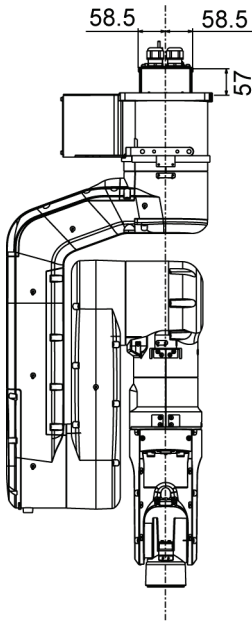
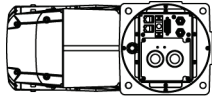
N6-A1000*B: Cable direction: Upward and Downward



N6-A850*R: Cable direction: Standard (backward)

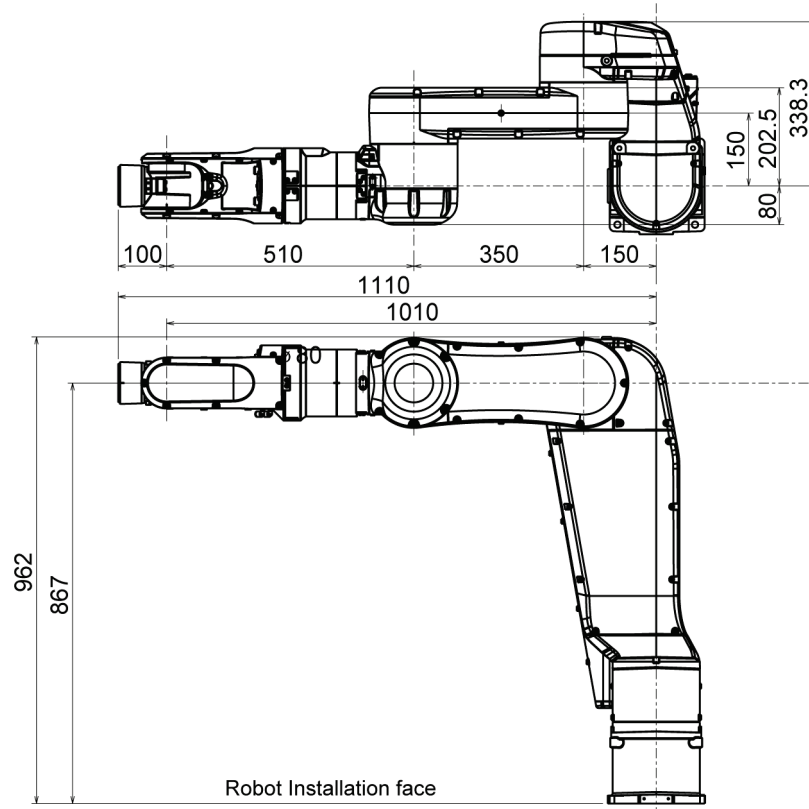


N6-A850*BR: Cable direction: Upward

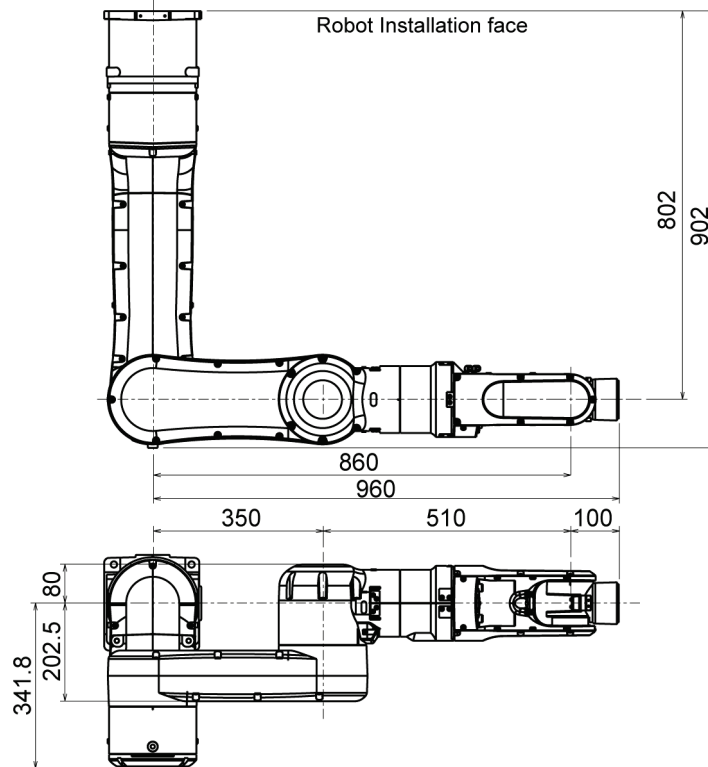


2.3.2 Orientation with the Maximum Arm Length

N6-A1000**



N6-A850**R



2.4 Standard Motion Range

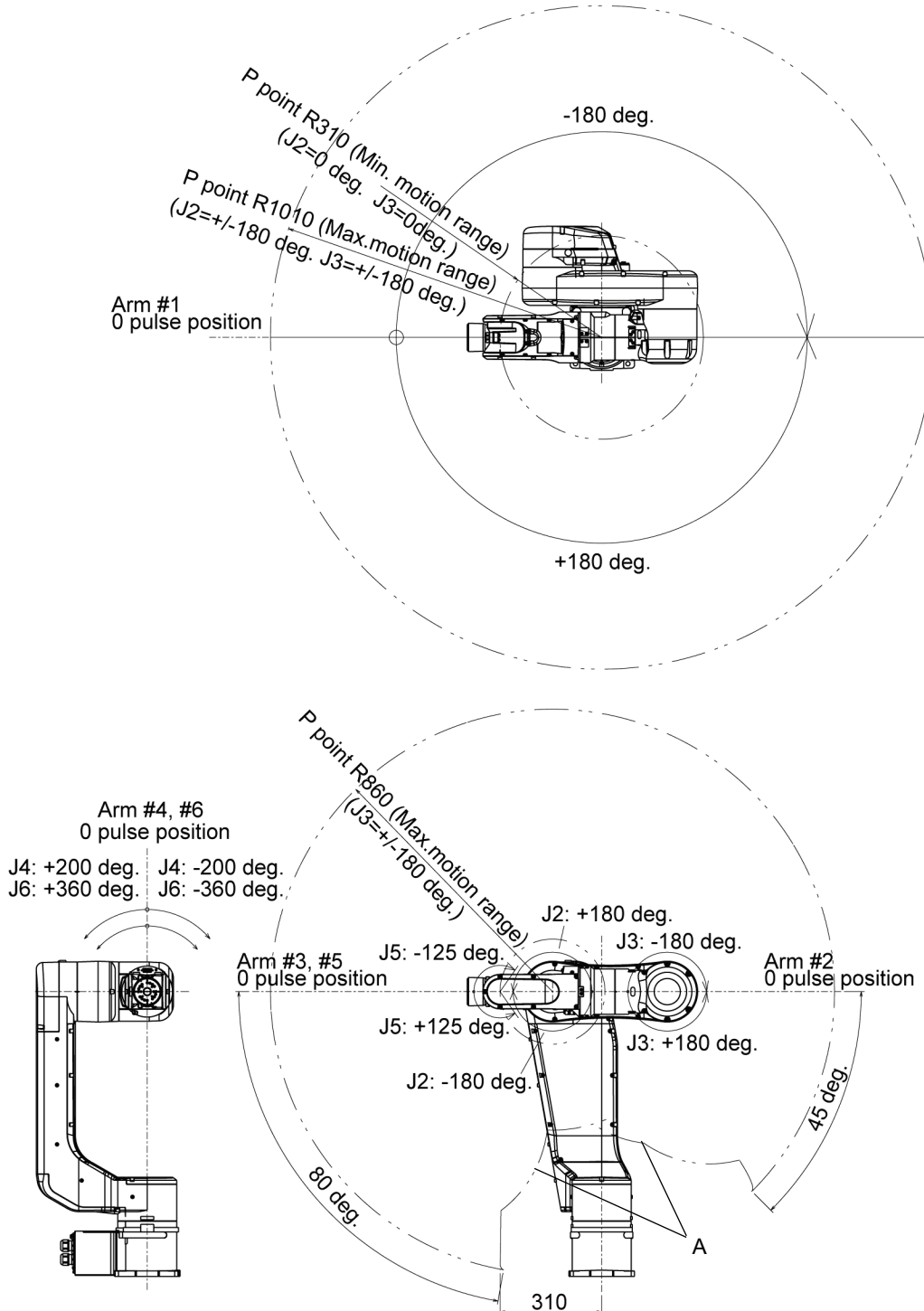


CAUTION

- Pay attention to the arm pose of the basic arms (Arms #1, #2, and #3) when operating the Manipulator. Arm #5 moves keeping a constant angle regardless of the arm pose. Depending on the arm pose of the basic arms, the wrist may collide with the Manipulator. The collision may cause equipment damage to and/or malfunction of the Manipulator.

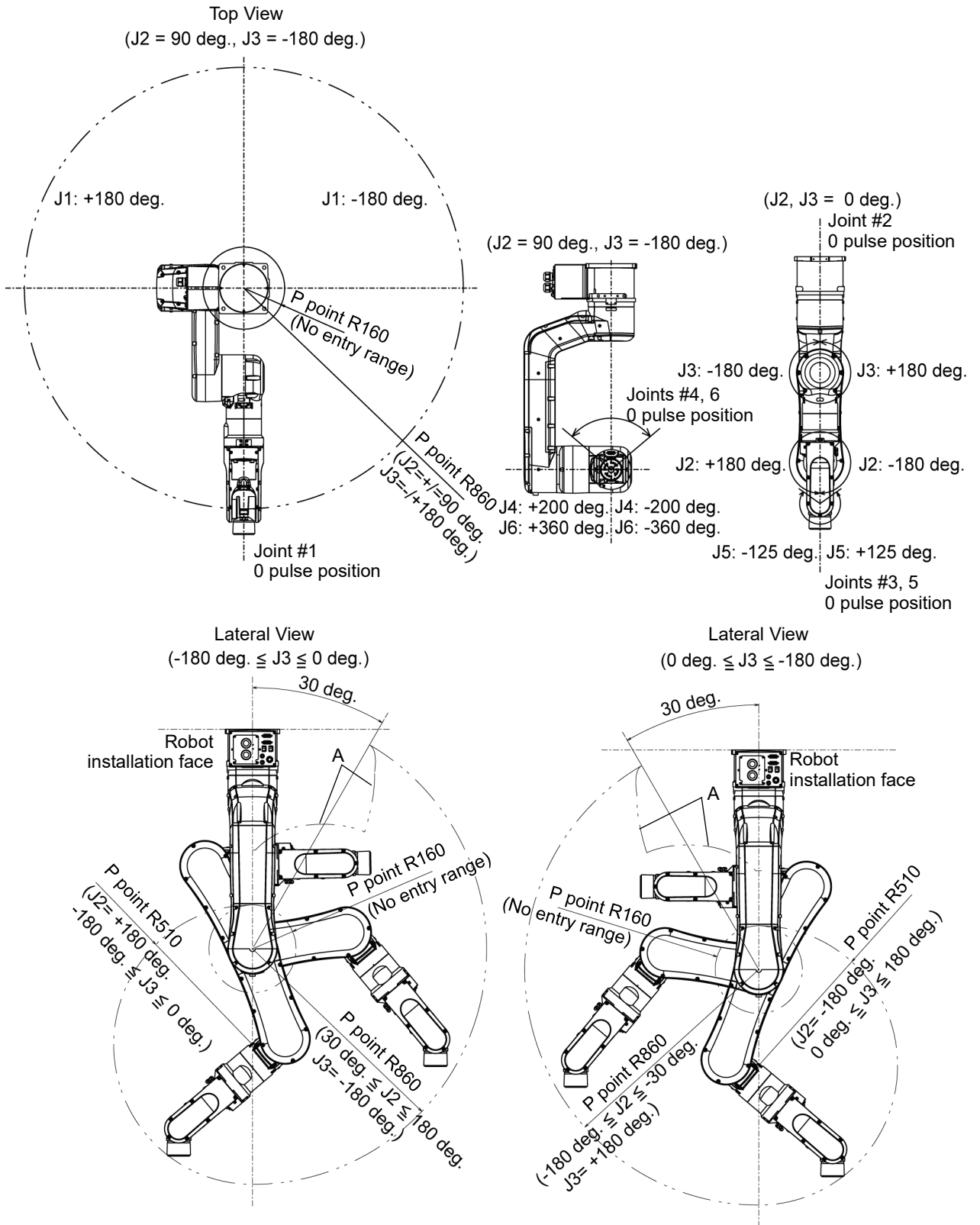
N6-A1000**

[Unit: mm]
(deg.= °)



* P point : Intersection of the rotation centers for Joint #4, #5, and #6
A: No entry range (Refer to *Setup & Operation 5.2 Coordinate System*)

N6-A850**R



* P point : Intersection of the rotation centers for Joint #4, #5, and #6
A: No entry range (Refer to Setup & Operation 5.2 Coordinate System)

2.5 Specifications

2.5.1 Specifications table

Item		Specification	
Model Number		N6-A1000**	N6-A850**R
Model Name		N6	
Mounting type		Ceiling mounting, Table Top mounting *1	Ceiling mounting
Weight (excluding cables)		69 kg (152 lbs.)	64 kg (141 lbs.)
Driving method	All joints	AC servo motor	
Max. operating speed *2	Joint #1	326°/s	
	Joint #2	326°/s	
	Joint #3	444°/s	
	Joint #4	444°/s	
	Joint #5	450°/s	
	Joint #6	537°/s	
Repeatability	-	± 0.04 mm	± 0.03 mm
Max. motion range	Joint #1	± 180°	
	Joint #2	± 180°	
	Joint #3	± 180°	
	Joint #4	± 200°	
	Joint #5	± 125°	
	Joint #6	± 360°	
Max. pulse range	Joint #1	± 6619136 pulse	
	Joint #2	± 6619136 pulse	
	Joint #3	± 5308416 pulse	
	Joint #4	± 5898240 pulse	
	Joint #5	± 3640889 pulse	
	Joint #6	± 8773632 pulse	
Resolution	Joint #1	0.0000272°/pulse	
	Joint #2	0.0000272°/pulse	
	Joint #3	0.0000339°/pulse	
	Joint #4	0.0000339°/pulse	
	Joint #5	0.0000343°/pulse	
	Joint #6	0.0000410°/pulse	
Motor rated capacity	Joint #1	600 W	
	Joint #2	600 W	
	Joint #3	400 W	
	Joint #4	100 W	
	Joint #5	100W	
	Joint #6	100W	
Payload *3	Rated	3 kg	
	Max.	6 kg	
Allowable moment	Joint #4	15.2 N·m (1.55kgf·m)	
	Joint #5	15.2 N·m (1.55kgf·m)	
	Joint #6	9.4 N·m (0.96 kgf·m)	
Allowable moment of inertia (GD2/4) *4	Joint #4	0.42 kg·m ²	
	Joint #5	0.42 kg·m ²	
	Joint #6	0.14 kg·m ²	

Item		Specification
Model Number		N6-A1000** N6-A850**R
Model Name		N6
Installed wire for customer use		15 wires (D-sub) 8 pin (RJ45) Cat 5e or equivalent (2 cables) (also used for Force Sensor)
Installed pneumatic tube for customer use *5		ø6 mm pneumatic tubes (2 tubes), Allowable pressure: 0.59 MPa (6 kgf/cm ²) (86 psi)
Environmental requirements *6	Ambient Temperature	5 to 40 °C
	Ambient relative humidity	10 to 80% (no condensation)
	Vibration	4.9 m·s ⁻² (0.5 G) or less
Noise level *7		LAeq = 80 dB (A) or under
Environment		Standard Cleanroom & ESD *8
Applicable Controller		RC700-A, RC700DU-A
Default values (Max. setting values)	SPEED	3 (100)
	ACCEL *9	5, 5 (120, 120)
	SPEEDS	50 (2000)
	ACCELS	200 (25000)
	FINE	10000, 10000, 10000, 10000, 10000, 10000 (65535, 65535, 65535, 65535, 65535, 65535)
	WEIGHT	3 (6)
	INERTIA	0.03 (0.14)
Safety standard		CE Marking EMC Directive, Machinery Directive, RoHS Directive KC Marking / KCs Marking ANSI/RIA R15.06-2012 NFPA 79 (2007 Edition)

*1: Manipulator is set to “Table Top mounting” at shipment.

To use the Manipulator as “Ceiling mounting”, you need to change the model settings.

Mounting types other than “Table Top mounting” and “Ceiling mounting” are out of the specification.

If you prefer other mounting types, please contact the supplier of your region.

For details on how to change the model settings, refer to 5.5 *Changing the Robot*, and *EPSON RC+ User's Guide Robot Configuration*.

*2: In case of PTP control

*3: Do not apply the load exceeding the maximum payload.

*4: If the center of gravity is at the center of each arm. If the center of gravity is not at the center of each arm, set the eccentric quantity using INERTIA setting.

*5: For details of the installed pneumatic tube for customer use, refer to the *Setup & Operation 3.7 User Wires and Pneumatic Tubes*.

*6: For details of the environmental requirements, refer to the *Setup & Operation 3.1 Environmental Conditions*.

*7: Conditions of Manipulator at measurement are as follows:

Operating conditions: Under rated load, 6 arms simultaneous motion, maximum speed, maximum acceleration, and duty 50%.

Measurement point: 1000 mm apart from the rear of Manipulator

*8: The exhaust system in the Cleanroom model Manipulator draws air from the base interior and arm cover interior. A crack or other opening in the base unit can cause loss of negative air pressure in the outer part of the arm, which can cause increased dust emission.

Cleanliness level : Class ISO 5 (ISO14644-1)

Exhaust System : Fitting for \varnothing 10 mm pneumatic tube
(Refer to *Setup & Operation: 3.6 User Wires and Pneumatic Tubes.*)
60 L/min vacuum

Exhaust tube : Polyurethane tube
Outer diameter: \varnothing 10mm (Inner diameter: \varnothing 6-7 mm)

ESD specification uses resin materials with antistatic treatment. This model controls adhesion of dust due to electrostatic charge.

*9: In general use, Accel setting 100 is the optimum setting that maintains the balance of acceleration and vibration when positioning. Although values larger than 100 can be set to Accel, it is recommended to minimize the use of large values to necessary motions since operating the Manipulator continuously with the large Accel setting may shorten the product life remarkably.

2.5.2 Option

N6 series have the following options. For details, refer to *Setup & Operation 6. Options*.

Brake release unit

The option for moving the arms manually by turning OFF the Electromagnetic brakes.

For EU : Power supply voltage 200 V, short connector included

For US/JP : Power supply voltage 100 V, short connector included

Short connector for the brake release unit

When using the brake release unit with the N6 series Manipulator, it is necessary to connect the short connector to the M/C power cable, or connect the M/C power cable with the Controller. (The brake release unit can be used while the Controller is de-energized state.)

If you are using C3, C4, C8 or N2 series Manipulator and already have the brake release unit, you can use it by connecting the M/C cable with the Controller, or purchasing the short connector separately and connecting it to the M/C power cable.

Camera plate unit

The option for mounting the camera to the Manipulator.

Tool adapter (ISO flange)

The option for mounting the end effector whose dimensions are designed for the ISO flange to the N6 series Manipulators.

User wires

The option for using the internal wiring for the end effector drive.

Standard user connector kit: Standard D-sub 15-pin × 2

2.6 How to Set the Model

The Manipulator model for your system has been set before shipment from the factory.



- When you need to change the setting of the Manipulator model, be sure to set the Manipulator model properly. Improper setting of the Manipulator model may result in abnormal or no operation of the Manipulator and/or cause safety problems.



If the custom specifications number (MT***) is described on MODEL of the signature label (S/N label), the Manipulator has custom specifications. The custom specifications may require a different configuration procedure; check the custom specifications number (MT***) and contact the supplier of your region when necessary.

The Manipulator model can be set from software.

Refer to the chapter Robot Configuration in the *EPSON RC+ User's Guide*.

3. Environment and Installation

Installation and transportation of robots and robotic equipment shall be performed by qualified personnel and should conform to all national and local codes.

3.1 Environmental Conditions

A suitable environment is essential for the robot system to function properly and safely. Be sure to install the robot system in an environment that meets the following conditions:

Item	Conditions
Ambient temperature* ¹	5 to 40 °C
Ambient relative humidity	10% to 80% (no condensation)
First transient burst noise	2 kV or less (Power supply wire)
	1 kV or less (Signal wire)
Electrostatic noise	4 kV or less
Environment	<ul style="list-style-type: none"> - Install indoors. - Keep away from direct sunlight. - Keep away from dust, oily smoke, salinity, metal powder or other contaminants. - Keep away from flammable or corrosive solvents and gases. - Keep away from water. - Keep away from shock or vibration. - Keep away from sources of electric noise.

*1 The ambient temperature conditions are for the Manipulators only. For the Controller which the Manipulator is connected to, refer to the Controller manual.



When using the Manipulators in inadequate environments that do not meet the above conditions, please contact the supplier of your region.

Special Environmental Conditions

The surface of the Manipulator has general oil resistance. However, if your requirements specify that the Manipulator must withstand certain kinds of oil, please contact the supplier of your region.

Rapid change in temperature and humidity can cause condensation inside the Manipulator. If your requirements specify that the Manipulator handles food, please contact the supplier of your region to check whether the Manipulator will damage the food or not.

The Manipulator cannot be used in corrosive environments where acid or alkaline is used. In a salty environment where the rust is likely to gather, the Manipulator is susceptible to rust.


 WARNING	<ul style="list-style-type: none"> ■ Use an earth leakage breaker on the AC power cable of the Controller to avoid the electric shock and circuit breakdown. Prepare the earth leakage breaker that pertains the Controller you are using. For details, refer to the Controller manual.
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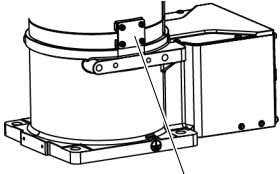
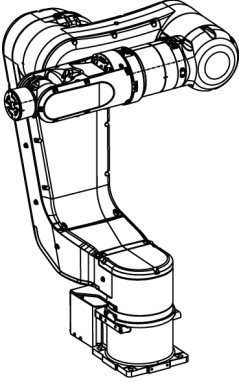
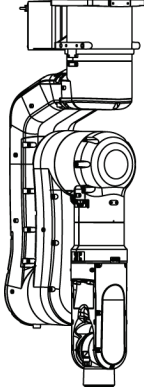
 CAUTION	<ul style="list-style-type: none"> ■ When cleaning the Manipulator, do not rub it strongly with alcohol or benzene. It may lose luster on the coated face.
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3.2 Unpacking, Transportation, and Relocation

Using a cart or similar equipment, transport the Manipulator in the same conditions as it was delivered. Observe the following when unpacking the Manipulator.

The installation shall be made by qualified installation personnel and should conform to all national and local codes.

 WARNING	<ul style="list-style-type: none"> Only authorized personnel should perform sling work and operate a crane or a forklift. When these operations are performed by unauthorized personnel, it is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system. Stabilize the Manipulator with your hands when hoisting it. Unstable hoisting is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system as the fall of the Manipulator.
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 CAUTION	<ul style="list-style-type: none"> When removing the anchor bolts, support the Manipulator to prevent falling. Removing the anchor bolts without supporting the Manipulator may get hands, fingers, or feet caught as the Manipulator may fall. <p>The base and the Arm #1 are fixed by the fixing jig for transportation.</p> <p>Make sure to remove the fixing jig before the robot operates.</p>	 Fixing jig for transportation
	<ul style="list-style-type: none"> To carry the Manipulator, be sure to have at least 2 people to hold the bottom of the base or the Arm by hand. When holding the base installation face by hand, be careful not to cause your hands and fingers caught. 	
	 N6-A1000** Weight: 69 kg: 152 lbs.	 N6-A850**R Weight: 64 kg: 141 lbs.
	<ul style="list-style-type: none"> Avoid excessive vibration or shock during Manipulator transporting. Excessive vibration or shock may cause equipment damage to and/or malfunction of the Manipulator. 	

Be sure to transport and store the robot system in environments that meet the following conditions:

Item	Conditions
Ambient temperature	0 to 45 °C
Ambient relative humidity	10 % to 80 % (no condensation)

During unpacking and relocation, avoid applying external force to the arms and motors of the Manipulator.

When transporting the Manipulator for a long distance, secure it to the delivery equipment so that the Manipulator cannot fall. If necessary, pack the Manipulator in the same way as it was delivered.

When condensation occurs on the Manipulator during transport or storage, turn ON the power only after the condensation dries.

When using the Manipulator for the robot system again after long-term storage, perform a test run to verify that the Manipulator works properly. Then, operate the Manipulator thoroughly.

Relocating

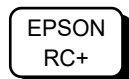
Follow the procedures described below when relocating the Manipulator.



The Joint #1 is not equipped with the brake. When installing the Manipulator, be careful not to rotate the Joint #1.

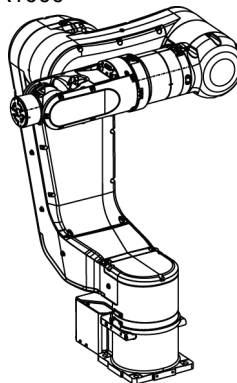
The cable may break when exceeding Max. motion range. Be careful to operate.

- (1) Turn ON the Controller.
- (2) Change the Manipulator orientation so that it is easy to support when removing it.
Recommended posture: Basic orientation.

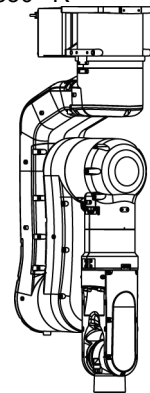


Command
> Pulse 0, 0, 0, 0, 0, 0, 0

N6-A1000**



N6-A850**R



- (3) Turn OFF the power for all devices and disconnect the power cable connector and signal cable connector from the Controller.

- (4) Unscrew the anchor bolts. Then, remove the Manipulator from the base table.



NOTE Manipulator does not stand by itself. Be careful or it will fall over.
When the Manipulator is mounted on the ceiling, make sure it is secured correctly or it may fall.

- (5) Secure the Manipulator to the delivery equipment or have at least 2 people to carry the Manipulator.
- (6) After installing the Manipulator, turn ON the Controller.

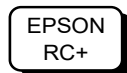
If you use the eyebolt to hang the robot for transportation, follow the steps below.

- (1) Turn ON the Controller.
- (2) Change the Manipulator orientation so that it is easy to support when removing it.

Recommended posture:

N6-A1000** : Joint #2 -65°, Joint #3 -25°

N6-A850**R : Basic orientation

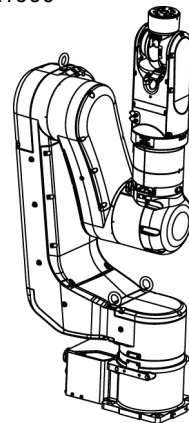


Command

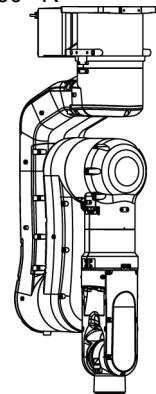
N6-A1000** : > Go AglToPls (0, -65, -25, 0, 0, 0)

N6-A850**R : > Go AglToPls (0, 0, 0, 0, 0, 0)

N6-A1000**



N6-A850**R



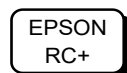
- (3) Turn OFF the power for all devices and disconnect the power cable connector and signal cable connector from the Controller.

- (4) Unscrew the anchor bolts. Then, remove the Manipulator from the base table.



NOTE Manipulator does not stand by itself. Be careful or it will fall over.
When the Manipulator is mounted on the ceiling, make sure it is secured correctly or it may fall.

- (5) Secure the Manipulator to the delivery equipment or have at least 2 people to carry the Manipulator.
- (6) After installing the Manipulator, turn ON the Controller.
- (7) Return the Manipulator to the basic orientation.



Command

> Pulse 0, 0, 0, 0, 0, 0

Using Eyebolt

Before carrying the Manipulator, make sure to check that the eyebolts are securely fastened.

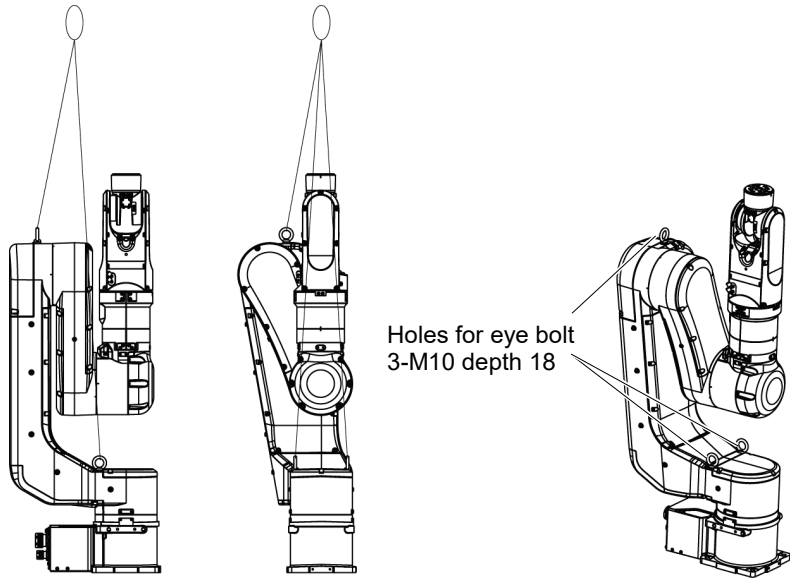
After transporting the Manipulator, remove the eyebolts and keep them for future use.

The eyebolts (accessory, 3 pcs) and wire must be strong enough to withstand the weight (See the figures below).

If you use the eyebolts to lift up the Manipulator, make sure to put hands on it to keep the balance. The Manipulator may fall if the balance is lost and this is extremely hazardous.

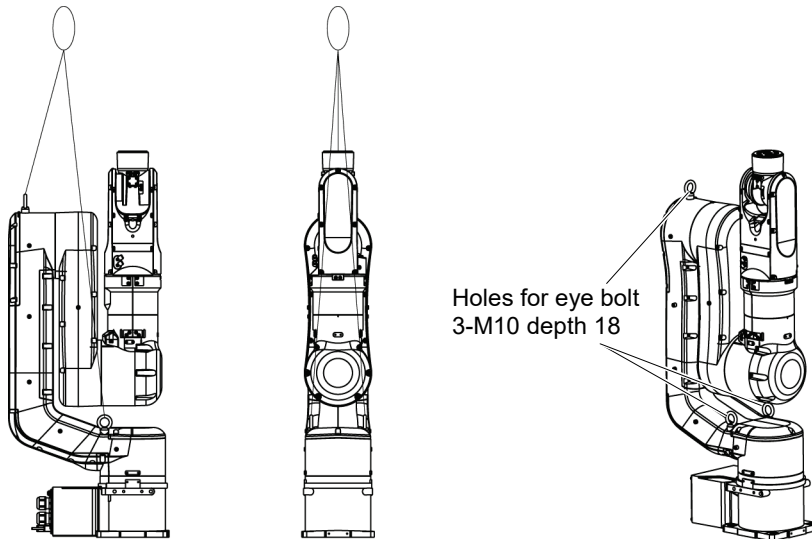
To prevent damage on the covers and arms, it is recommended to protect the contacting parts of the wire and arm with a cloth. Be very careful not to damage the covers since they are made of plastic.

N6-A1000**



Manipulator weight: 69 kg: 152 lbs.

N6-A850**R



Manipulator weight:64 kg: 141 lbs.



- Remove the eyebolts from the Manipulator after transportation/relocation is completed. If the Manipulator is operated with the eyebolts left on it, the arm may collide with the eyebolts and it may cause equipment damage to and/or malfunction of the Manipulator.

3.3 Mounting Dimensions

3.3.1 Mounting Area

Be sure to have the following space available in addition to the space for mounting the Manipulator, Controller, and peripheral equipment.

- Space for teaching points
- Space for maintenance and inspections (for installing jigs)
- Space for cables

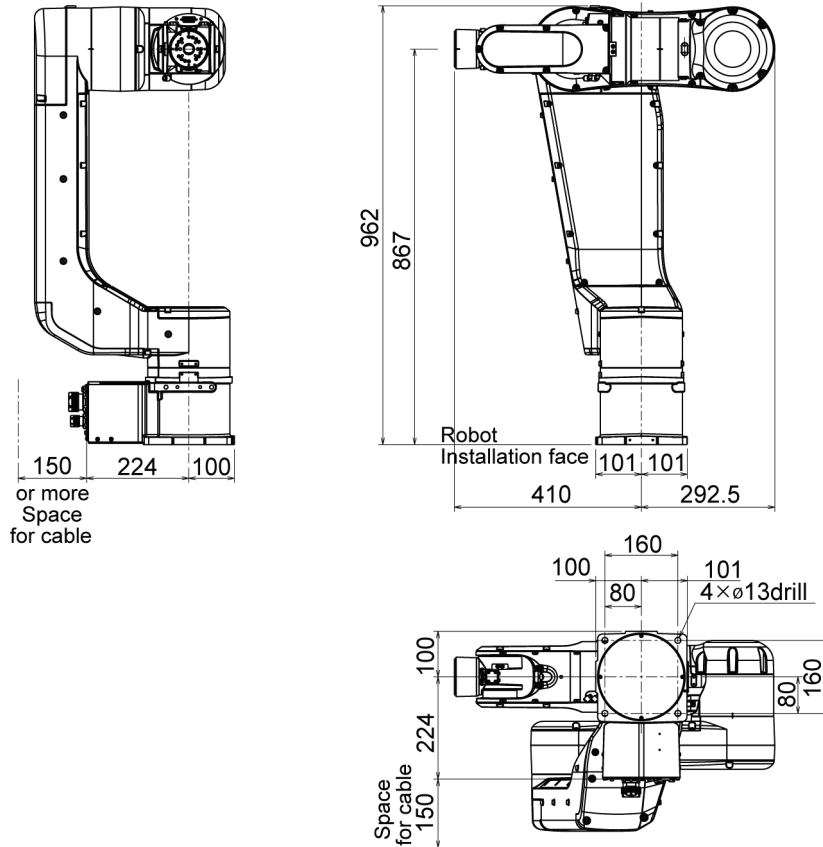


To prevent the power cable from bending, make sure to leave space for 150mm. When installing the cable, be sure to maintain sufficient distance from obstacles. In addition, leave enough space for other cables to prevent them from bending.

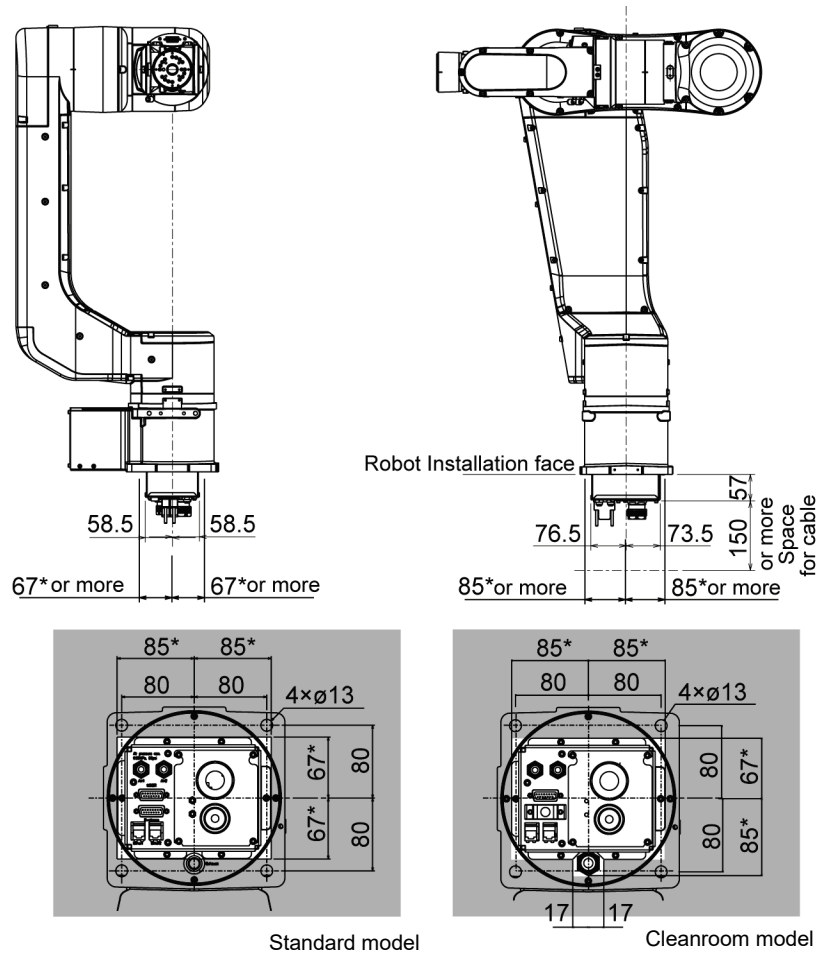
[Unit: mm]

3.3.2 Mounting dimensions

N6-A1000**: Cable direction: Standard (backward)



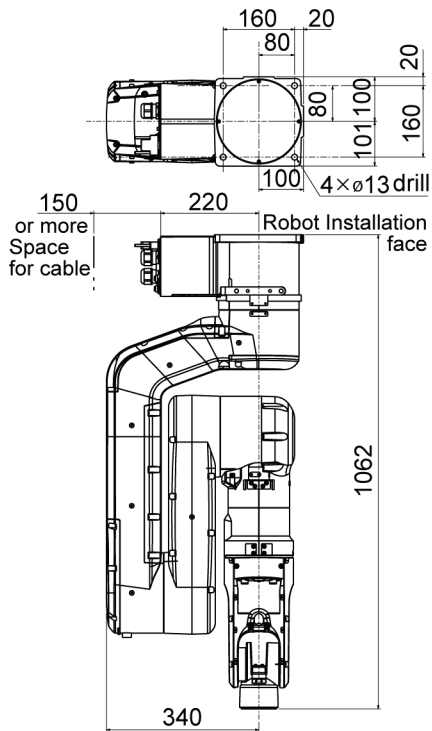
N6-A1000**: Cable direction: Upward and Downward



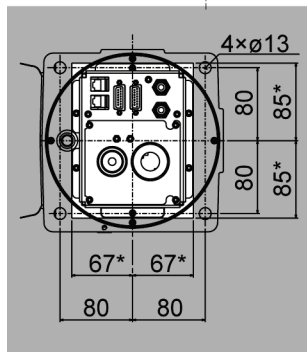
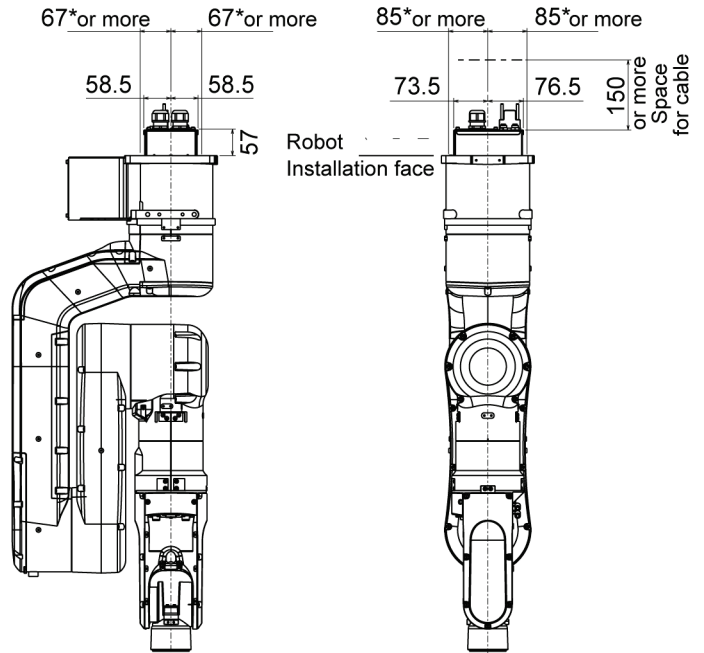
*: Example of space for Manipulator base for "Cable direction: Upward and Downward": Design the base table as shown above considering not interfering with the positioning holes and the installation holes.

N6-A850**R:

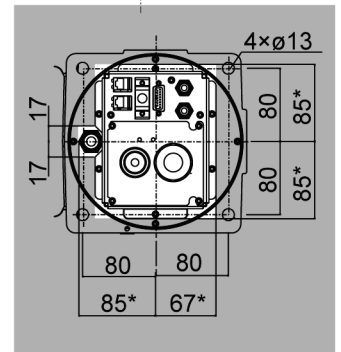
Cable direction: Standard (backward)



Cable direction: Upward



Standard model



Cleanroom model

*: Example of space for Manipulator base for “Cable direction: Upward”:
Design the base table as shown above considering not interfering with the positioning holes and the installation holes.

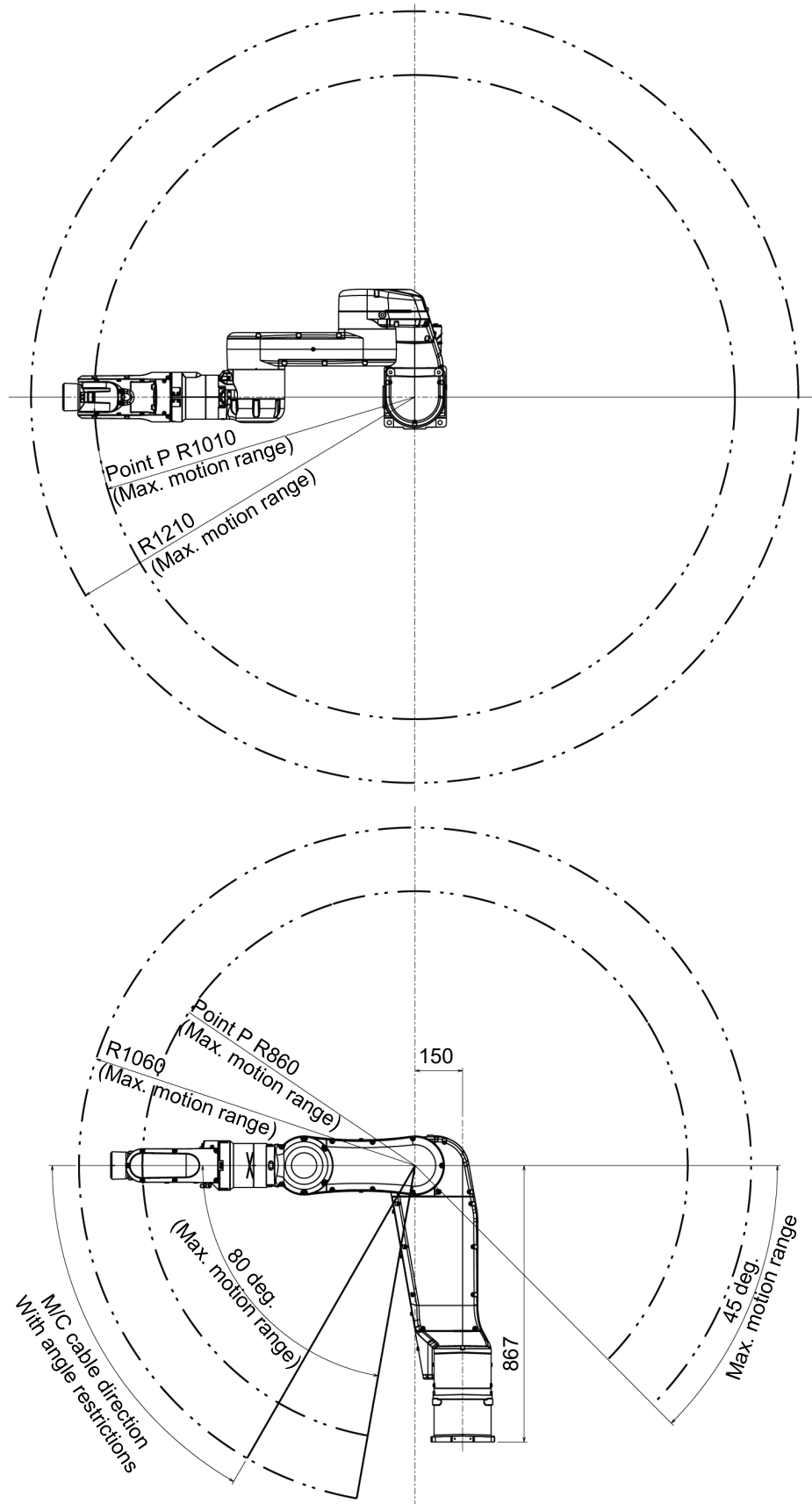
3.3.3 Motion range

The following figures are the cases when the length of the end effector is 100 mm.

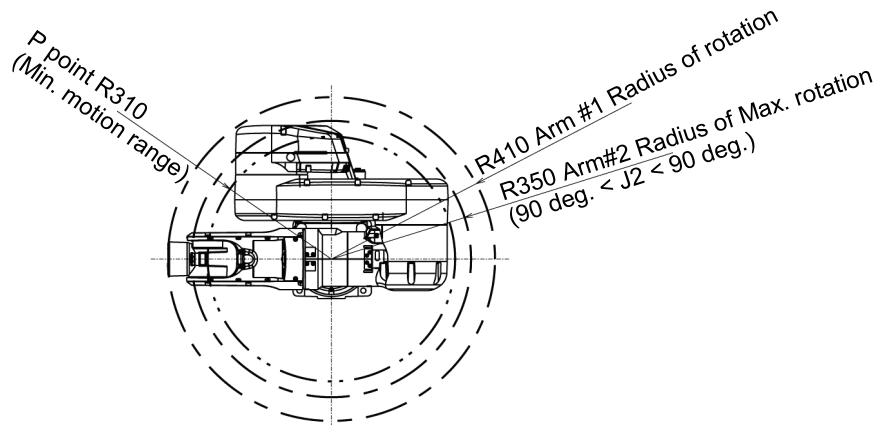
Match the ranges with the actual end effector length. If the camera or the electromagnetic valve attached on the Arm is large, define the max motion ranges by considering the area where these tools may reach.

When operating in narrow space with the basic orientation, make sure to consider the radius of the arm rotation as shown the figure below. The Manipulator must be installed to avoid interference with peripherals during operation.

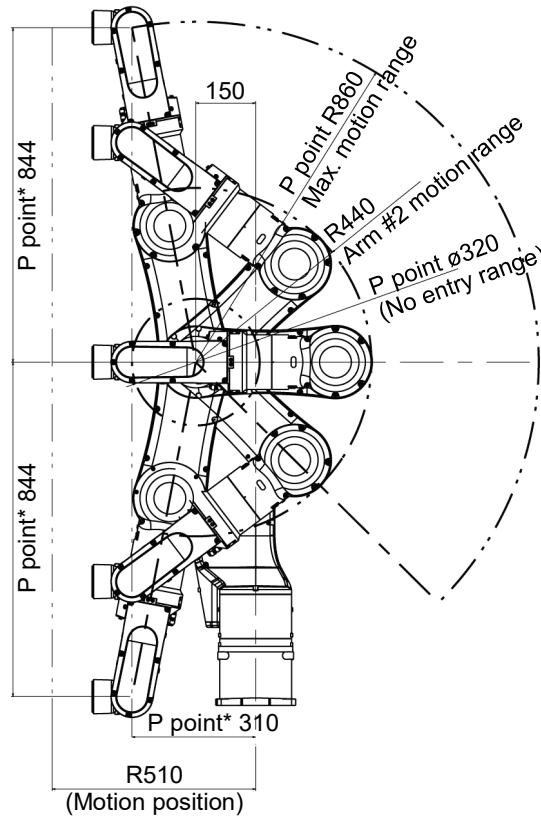
N6-A1000**: Maximum motion range



N6-A1000**: Radius of arm rotation (Basic orientation)

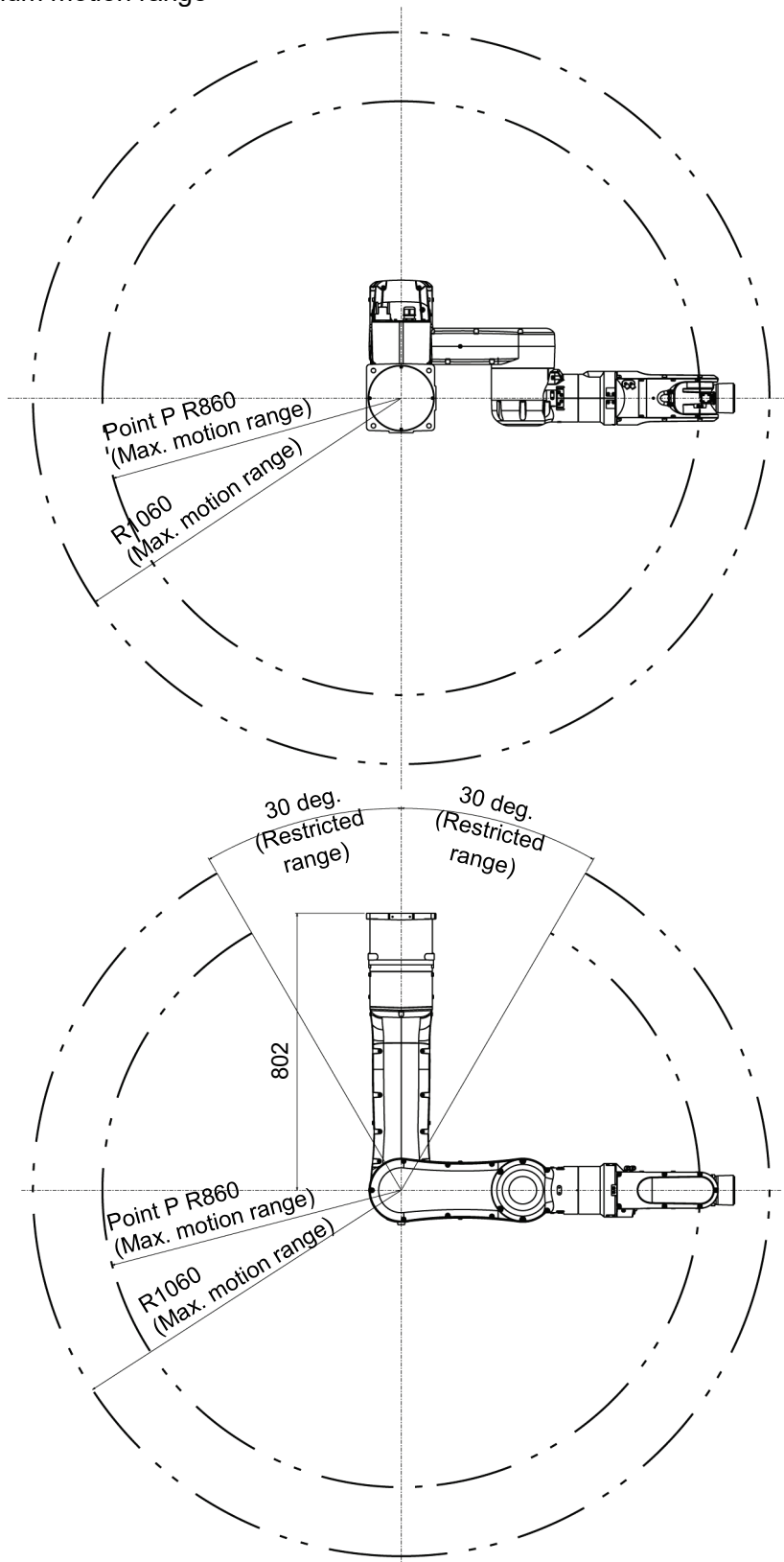


Motion range (CP motion)



* When the P point is 310mm apart from the center, upward and downward distance in CP motion will be the maximum.

N6-A850**R: Maximum motion range



3.4 Installation

The installation shall be made by qualified installation personnel and should conform to all national and local codes.



- To ensure safety, a safeguard must be installed for the robot system. For details on the safeguard, refer to the *Installation and Design Precautions* in the *Safety* chapter of the EPSON RC+ User's Guide.
- Anchor the Manipulator before turning ON the power to or operating the Manipulator. Turning ON the power to or operating the Manipulator that is not anchored is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system as the Manipulator may fall down.
- Before installing and operating the Manipulator, make sure that all parts of the Manipulator are in place and have no external defects. Missing or defective parts may cause improper operation of the Manipulator. Improper operation of the Manipulator is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system.



- The Manipulator must be installed to avoid interference with buildings, structures, utilities, other machines and equipment that may create a trapping hazard or pinch points.
- Oscillation (resonance) may occur during operation depending on rigidity of the installation table. If the oscillation occurs, improve rigidity of the table or change the speed or acceleration and deceleration settings.

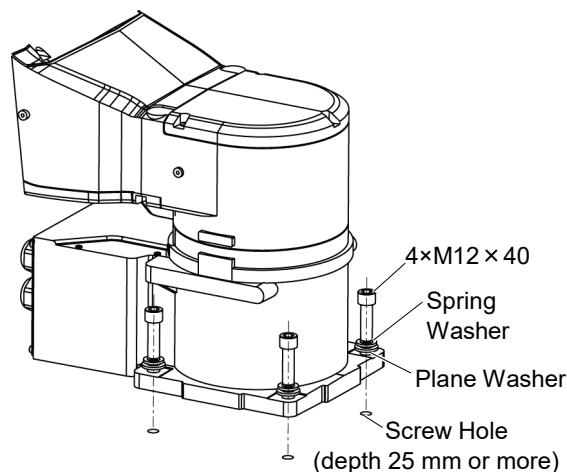
Mounting bolt

For the dimensions, refer to *Setup & Operation 3.3 Mounting Dimensions*.

There are four threaded holes for the Manipulator base.

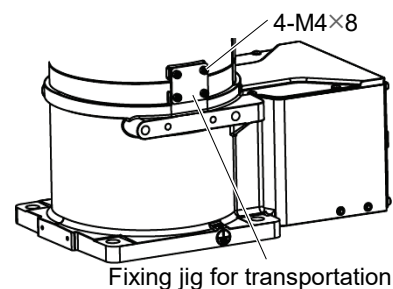
Use M12 mounting bolts conforming to the strength of ISO898-1 property class 10.9 or 12.9.

Tightening torque:
100 N·m (1020 kgf·cm)



After installing the robot, make sure to remove the fixing jig that fix the base and the Arm #1.

Hexagon socket head screws: 4-M4x8



Ceiling mounting

To mount the Manipulator on the ceiling, install the eyebolts on the tap hole for transportation and lift up the Manipulator by the wire.

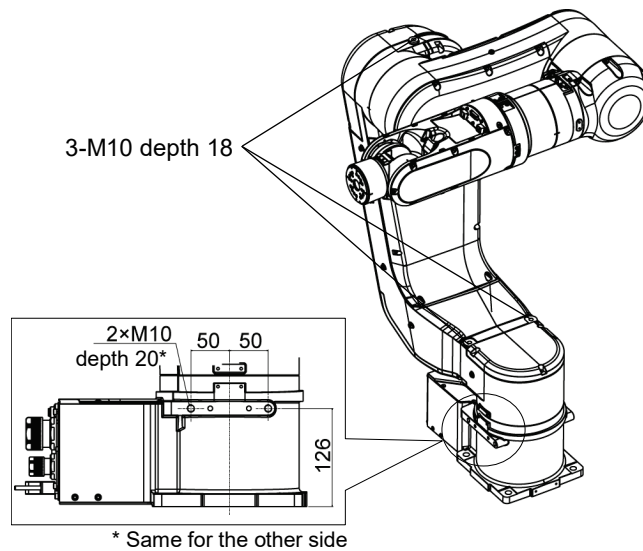
Check that the eyebolts are securely fastened before carrying the Manipulator.
After transporting the Manipulator, remove the eyebolts and keep them for future use.

The eyebolts (3 eyebolts) and wire must be strong enough to withstand the Manipulator weight (See the figures below).

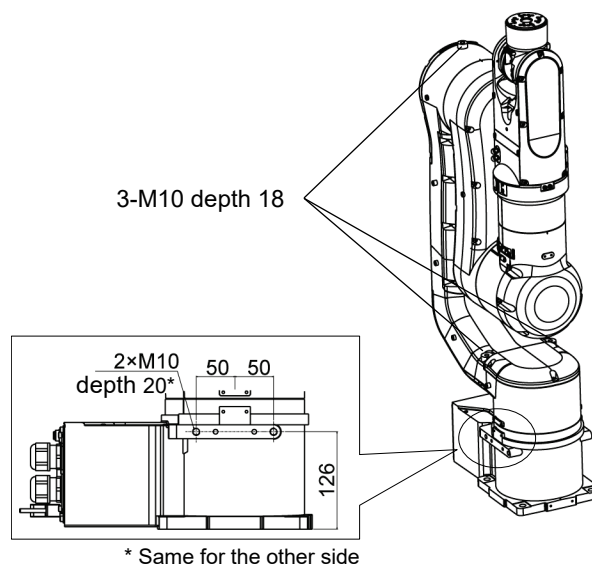
Only authorized personnel should perform sling work and operate a crane and a forklift.
When these operations are performed by unauthorized personnel, it is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system.

Tap hole position for transportation

N6-A1000**



N6-A850**R



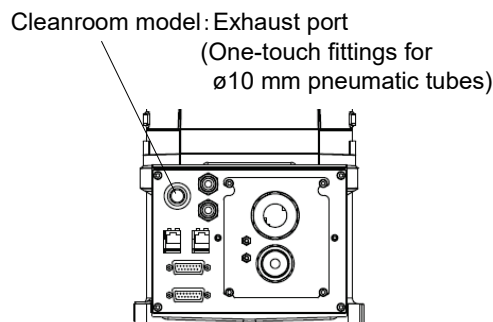
Cleanroom model

When using the Manipulator in the cleanroom, follow the steps below before the installation.

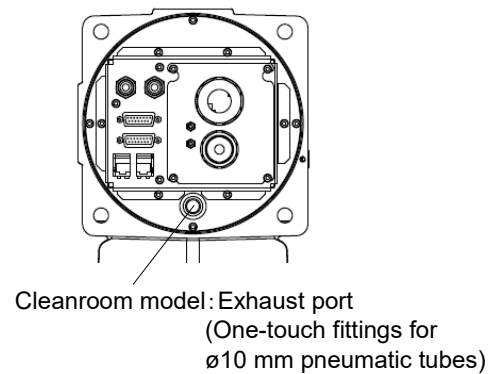
- (1) Unpack the Manipulator outside of the cleanroom.
- (2) Secure the Manipulator to delivery equipment such as a pallet with bolts so that the Manipulator does not fall over.
- (3) Wipe off the dust on the Manipulator with a little alcohol or distilled water on a lint-free cloth.
- (4) Transport the Manipulator to the cleanroom.
- (5) Secure the Manipulator to the base table.

When operating the Manipulator after installing it, exhaust from the exhaust port is 60L/min.

Cable direction: Standard (backward)



Cable direction: Upward and Downward



3.5 Base Table

A base table for anchoring the Manipulator is not supplied. Please make or obtain the base table for your Manipulator. The shape and size of the base table differ depending on the intended use of the robot system. The following is the basic requirements of Manipulator table for your reference.

The base table must not only be able to bear the weight of the Manipulator but also be able to withstand the dynamic movement of the Manipulator when it operates at maximum acceleration. Ensure that there is enough strength on the base table by attaching reinforcing materials such as crossbeams.

The torque and reaction force produced by the movement of the Manipulator are as follows:

Model number	N6-A1000**	N6-A850**R
Model name	N6	
Max. Horizontal rotating torque (N·m)	800	800
Max. Horizontal reaction force (N)	1900	1600
Max. Vertical rotating torque (N·m)	1100	1100
Max. Vertical reaction force (N)	3200	5100

The plate for the Manipulator mounting face should be 30 mm thick or more and made of steel to reduce vibration.

The surface roughness of the steel plate should be 25 μm or less.

The base table must be secured on the floor to prevent it from moving.

The Manipulator must be installed horizontally.

When using a leveler to adjust the height of the base table, use a screw with M16 diameter or more.

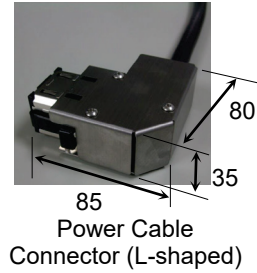
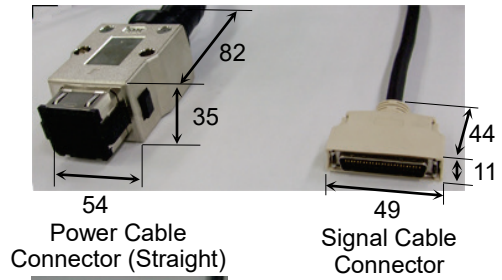
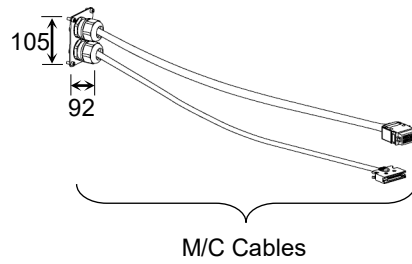
Example of space for Manipulator base for “Cable direction: Downward” is described in the following section.

Setup & Operation 3.3.2 Mounting dimensions

Connector


[unit : mm]

If you are passing cables through the holes on the base table, see the figures below.





NOTE


For environmental conditions regarding space when placing the Controller on the base table, refer to the Controller manual.


 WARNING	<ul style="list-style-type: none"> ■ To ensure safety, a safeguard must be installed for the robot system. For details on the safeguard, refer to the <i>EPSON RC+ User's Guide</i>.
---	---

3.6 Connecting the Cables

 WARNING	<ul style="list-style-type: none"> ■ Before performing any replacement procedure, turn OFF the Controller and related equipment, and then disconnect the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system. ■ Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source. To shut off power to the robot system, disconnect the power plug from the power source. Performing any work while connecting the AC power cable to a factory power source is extremely hazardous and may result in electric shock and/or malfunction of the robot system. ■ Be sure to connect the cables properly. Do not allow unnecessary strain on the cables. (Do not put heavy objects on the cables. Do not bend or pull the cables forcibly.) The unnecessary strain on the cables may result in damage to the cables, disconnection, and/or contact failure. Damaged cables, disconnection, or contact failure is extremely hazardous and may result in electric shock and/or improper function of the robot system. ■ Before wiring, turn OFF the Controller and related equipment, and then pull up a warning sign (e.g. DO NOT TURN ON THE POWER.). Wiring with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system. ■ When connecting or replacing the brake release unit and the external short connector, turn OFF the power to the Controller and the brake release unit. Inserting and removing the connector while the power is ON may result in electrical shock.
--	--

 CAUTION	<ul style="list-style-type: none"> ■ When connecting the Manipulator and the Controller, make sure that the serial numbers on each equipment match. Improper connection between the Manipulator and Controller may not only cause improper function of the robot system but also safety problems. The connection method varies with the Controller used. For details on the connection, refer to the Controller manual. ■ Only authorized or certified personnel should be allowed to perform wiring. Wiring by unauthorized or uncertified personnel may result in bodily injury and/or malfunction of the robot system. ■ If the manipulator is operated without connecting the brake release unit and the external short connector, the brakes cannot be released and it may cause damage on them. After using the brake release unit, be sure to connect the external short connector to the Manipulator, or check connection of the connector for the brake release unit.
--	---

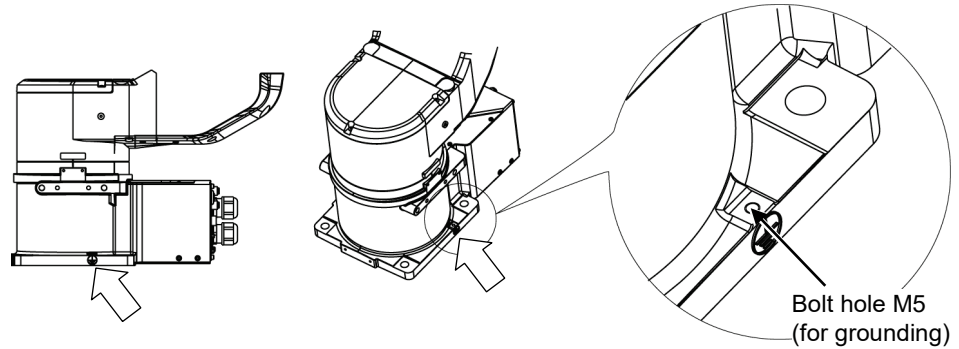
Grounding

 WARNING	<ul style="list-style-type: none"> ■ Ground resistance must be 100 Ω or less. Improper ground resistance may result in fire and/or electric shock. ■ Do not use the ground line for the Manipulator in common with other ground lines or grounding electrodes for other electric power, motor power, welding devices, etc. Using the ground line for the Manipulator in common with other ground lines or grounding electrodes may result in electric shock and/or malfunction of the robot system. ■ When using metal ducts, metallic conduits, or distributing racks for cable, ground in accordance with national and local electric equipment technical standards. Grounding that does not meet the standards may result in electric shock and/or malfunction of the robot system.
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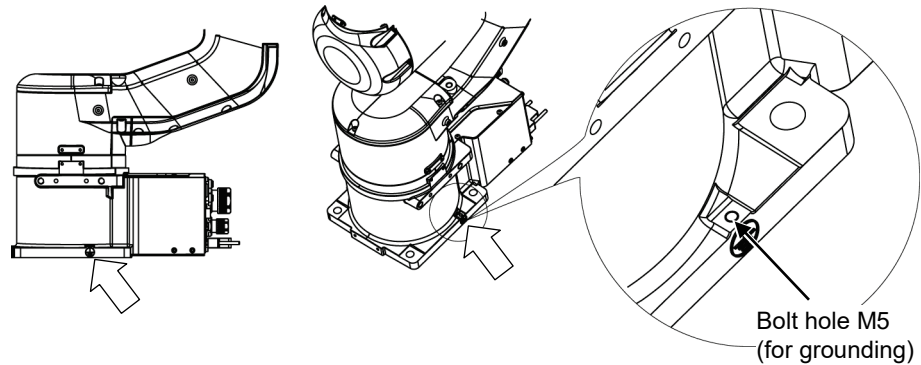
Follow local regulations for grounding. It is recommended that the core size of the grounding wire be 5.5 mm² or more.

Directly connect the ground line to the Manipulator as shown in the figure below.

N6-A1000**



N6-A850**R



3.7 User Wires and Pneumatic Tubes

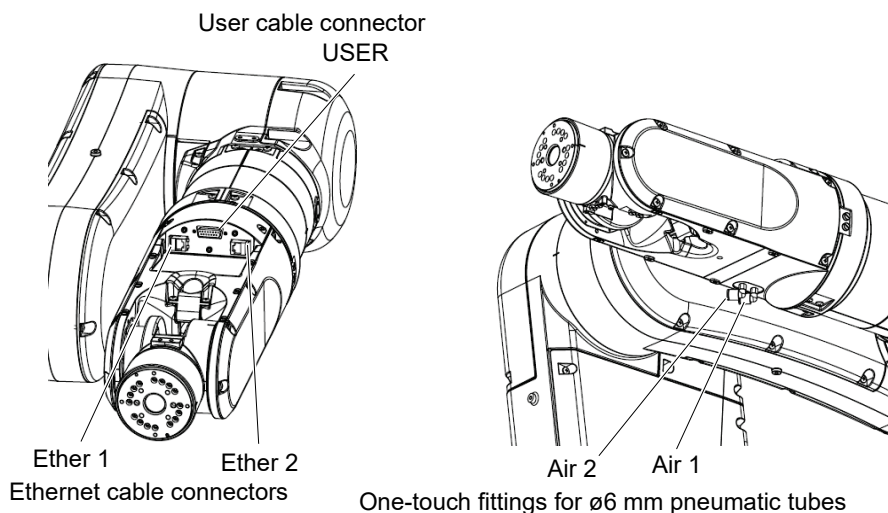


CAUTION

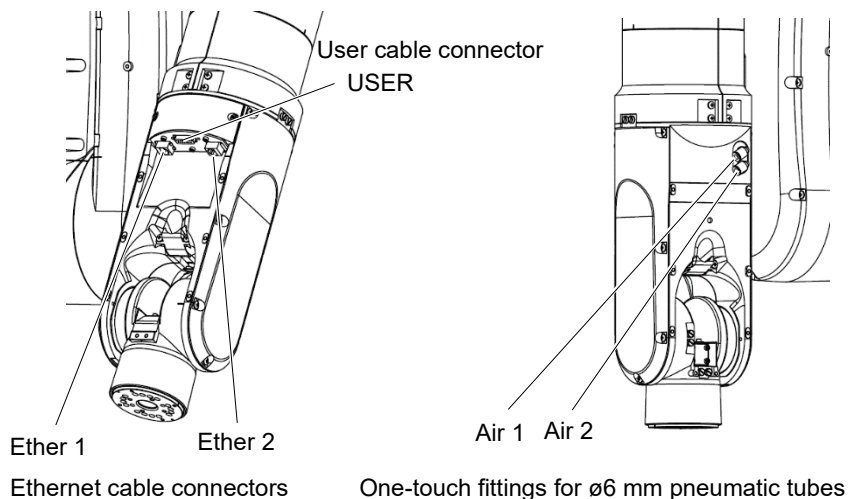
- Only authorized or certified personnel should be allowed to perform wiring. Wiring by unauthorized or uncertified personnel may result in bodily injury and/or malfunction of the robot system.

User electrical wires and pneumatic tubes are contained in the cable unit.

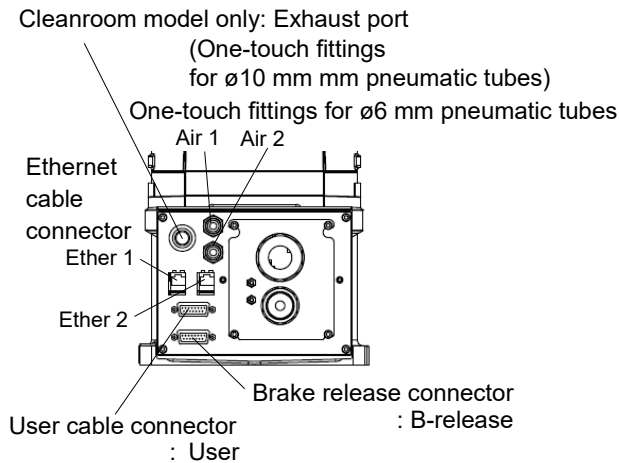
N6-A1000**



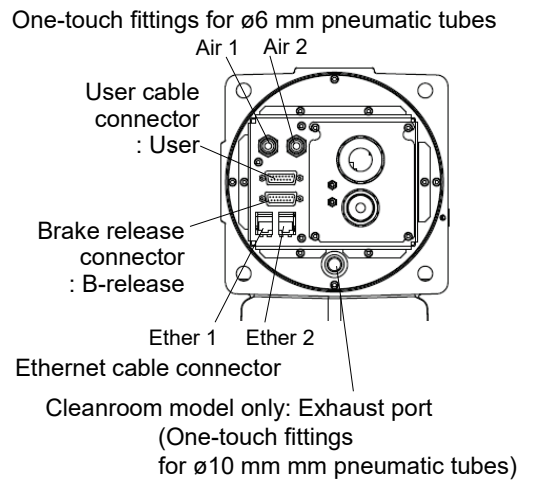
N6-A850**R



Cable direction: Standard (backward)



Cable direction: Upward and Downward



NOTE



The user cable connector and the brake release connector have the same shape. Be careful not to connect the wrong connector.

NOTE



The Ethernet cable connectors Ether 1 and Ether 2 have the same shape. Be careful not to connect the wrong connector.

Electrical wires

Specifications of the user wires D-sub 15-pin

Rated Voltage	Allowable Current	Wires	Nominal Sectional Area	Note
AC/DC30 V	1 A	15	0.106 mm ²	Shielded

Pins with the same number, indicated on the connectors on both ends of the cables, are connected.

Attached connector for the user wires

		Maker	Standard
15 pin	Connector	JAE	DA-15PF-N (Solder type)
	Clamp Hood	HRS	HDA-CTH(4-40)(10) (Connector setscrew: #4-40 UNC)

Two parts are attached for each.

8 pin (RJ45) Cat.5e or equivalent


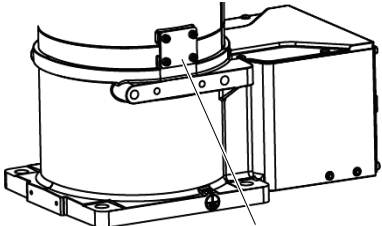
The commercially available Ethernet cables can be used.

For details, refer to *Setup & Operation 6. Option*.

Pneumatic tubes

Max. Usable Pneumatic Pressure	Pneumatic Tubes	Outer Diameter × Inner Diameter
0.59 MPa (6 kgf/cm ² : 86 psi)	2	ø6 mm × ø4 mm

3.8 Checking the Basic Orientation

 CAUTION	<ul style="list-style-type: none"> Before operating the robot, make sure to remove the fixing jig for transportation. Operating the robot with the fixing jig may result in damage to the robot. 	 Fixing jig for transportation
---	---	---

At the time of shipment, the Manipulator's basic orientation shown below is configured as the origin position.

After installing the Manipulator and setup the operating environment, move the Manipulator to the origin position by RC+ and check that it moves to the basic position correctly.

How to return to the origin position

- (1) Turn ON the Controller.
- (2) Turn ON the Manipulator motors.

```

EPSON RC+ Command
                > Motor On
    
```

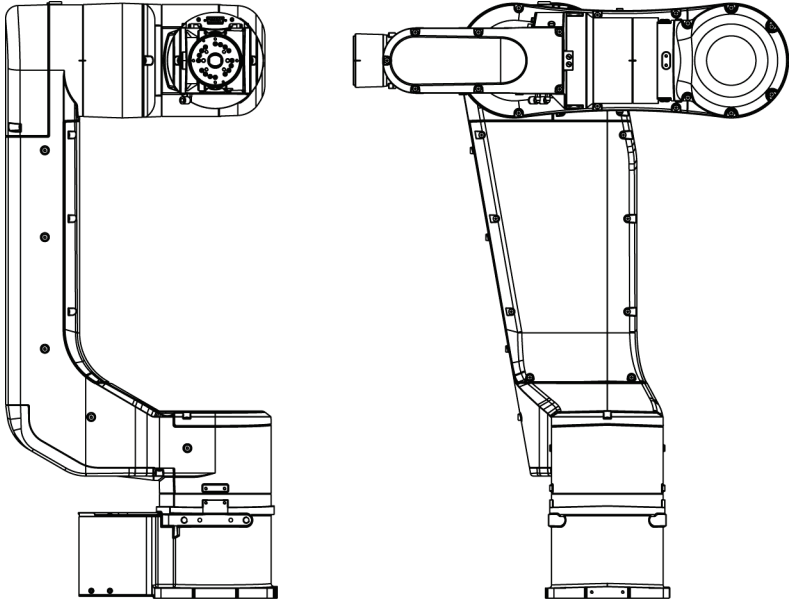
- (3) Move the joints to the origin position.

```

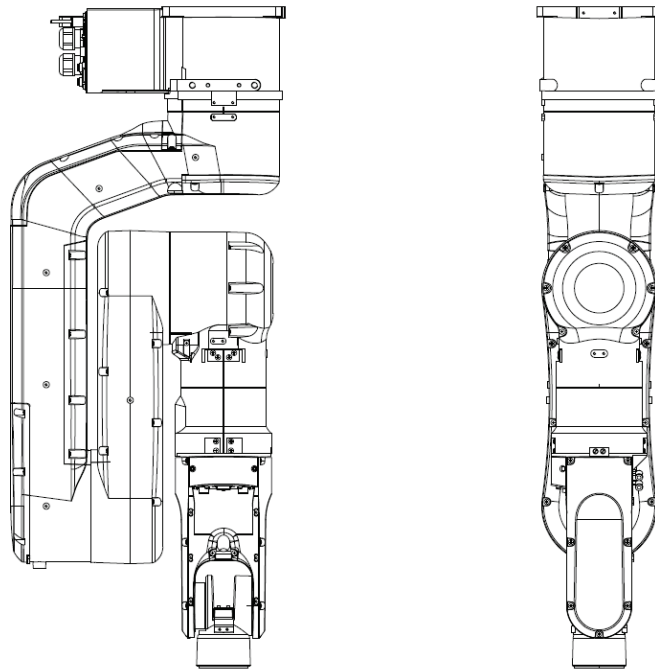
EPSON RC+ Command
                > Pulse 0, 0, 0, 0, 0, 0
    
```

Basic Orientation

N6-A1000**



N6-A850**R



Calibration


After parts (motors, reduction gear units, belts, etc.) have been replaced due to malfunction or any other reason, a gap occurs between the origin positions. The process to compensate the position gap is called “Calibration”.

If the gap still exists and the Manipulator cannot be in the basic orientation after calibration, please contact the supplier of your region.

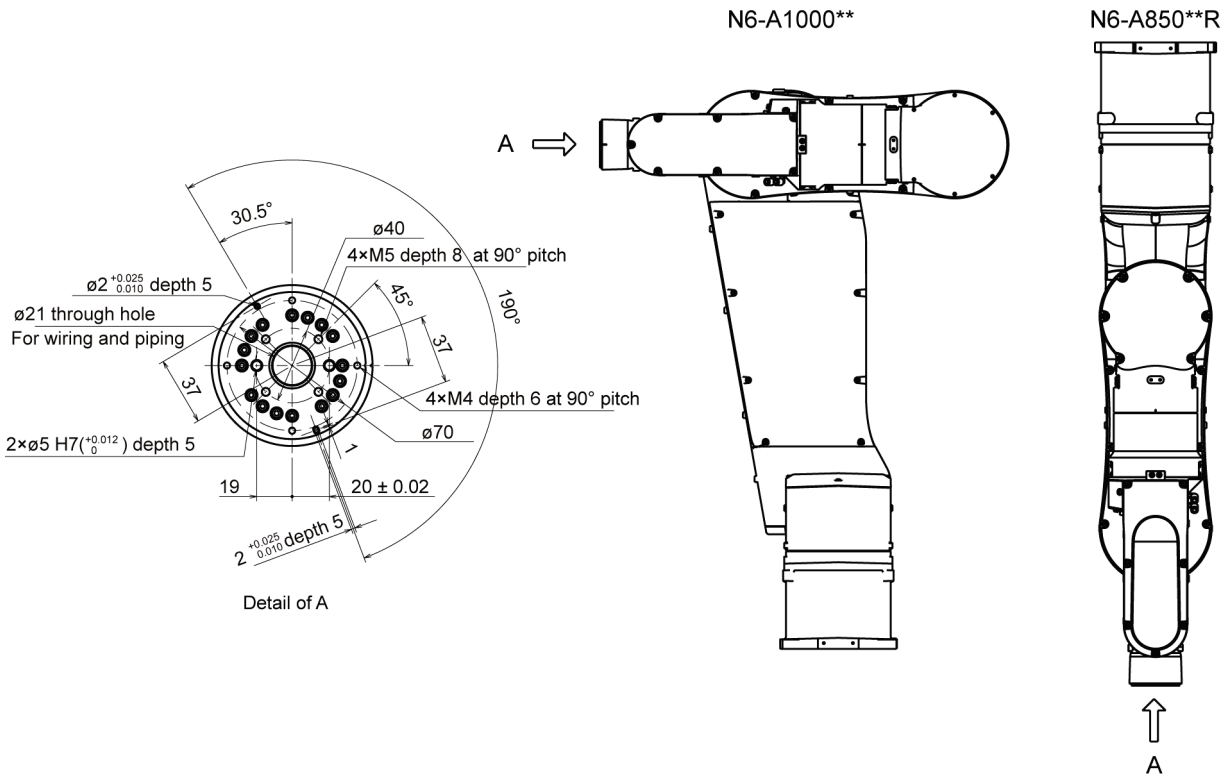
4. End Effectors

4.1 Attaching an End Effector

Create an end effector for your Manipulator. Flange dimensions of the wrist attached to the end of Arm #6 is as below.

 CAUTION	<p>■ If you use an end effector equipped with a gripper or chuck, connect wires and/or pneumatic tubes properly so that the gripper does not release the work piece when the power to the robot system is turned OFF. Improper connection of the wires and/or pneumatic tubes may damage the robot system and/or work piece as the work piece is released when the Emergency Stop switch is pressed. I/O outputs are configured at the factory so that they are automatically shut off (0) by power disconnection, the Emergency Stop switch, or the safety features of the robot system.</p>
---	---

Details of Wrist Flange



Arm #6

Attach an end effector to the end of the Arm #6 using the M5 bolts.
 Screw depth of Arm #6 screw: 8 mm

Layouts

When you operate the Manipulator with an end effector, the end effector may interfere with the Manipulator body depending on the outer diameter of the end effector, the size of the work piece, or the position of the arms. When designing your system layout, pay close attention to the interference area of the end effector.

Hole for wires and tubes

When passing wires and tubes through the hole, you need to note the following.

When operating the Joint #5 or the #6, the wires and the tubes may short or be disconnected due to bent, torsion, and friction.

Make sure to inspect and perform maintenance on the wires and the tubes by yourself.

Compatibility with ISO flange:

For installing the end effector whose mounting dimensions are designed for the ISO flange, the optional tool adapter (ISO flange) is available.

For details, refer to *Setup & Operation: 6. Options.*

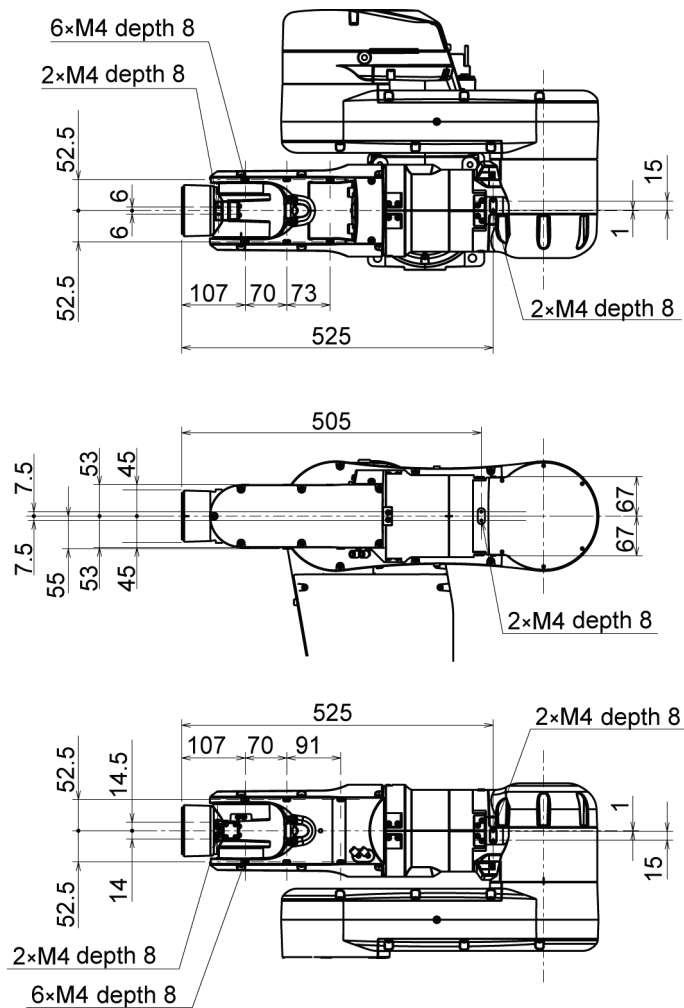
4.2 Attaching Camera and Air Valves

The decks are equipped to the Arms #3, #4 and #5 for easy installation of the air valves.

To mount the camera, the camera plate unit is necessary. The optional Camera Plate Unit is available. For details, refer to *Setup & Operation: 6. Options.*

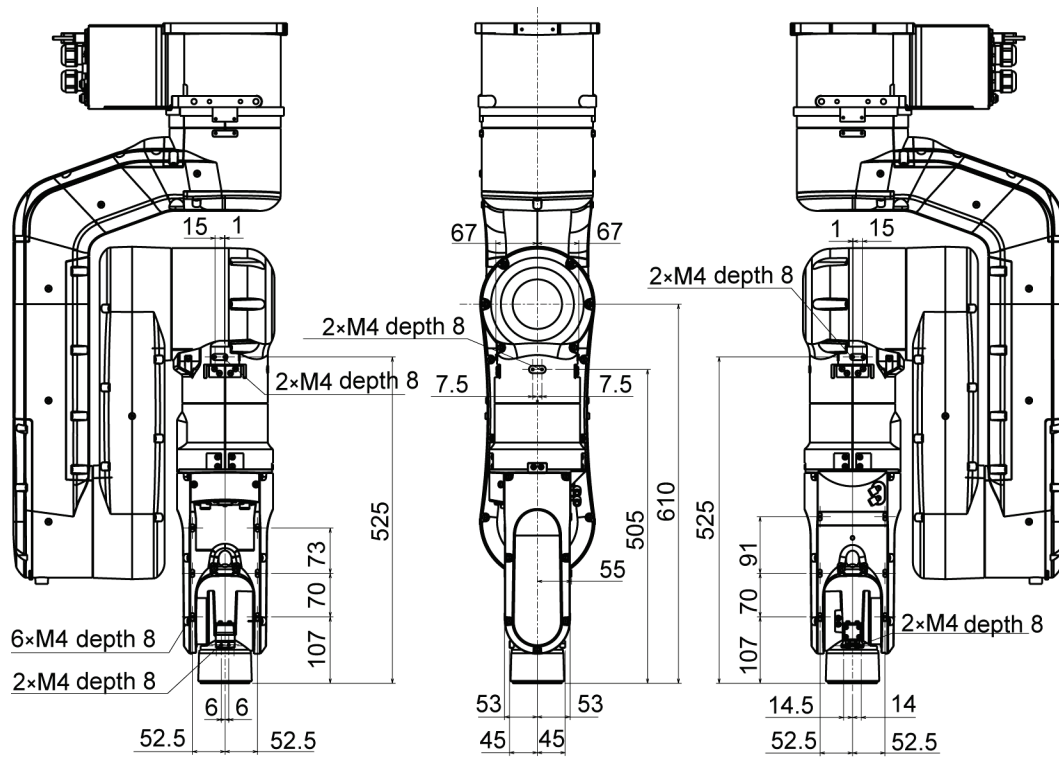
N6-A1000**

[Unit: mm]



N6-A850**R

[Unit: mm]



4.3 WEIGHT and INERTIA Settings

The WEIGHT and INERTIA (inertia moment and eccentricity) commands are for setting the load parameters of the Manipulator. These settings optimize the Manipulator motion.

WEIGHT Setting

The WEIGHT command is for setting the load weight. The more the load weight increases, the more the speed and acceleration/deceleration are reduced.

INERTIA Setting

The INERTIA setting is for setting the inertia moment and the eccentricity of the load. The more the inertia moment increases, the more the acceleration and deceleration of the Arm #6 are reduced. The more the eccentricity increases, the more the acceleration and deceleration for the Manipulator movement are reduced.

To ensure optimum Manipulator performance, make sure that the load (weight of the end effector and work piece) and inertia moment of the load are within the maximum rating for the Manipulator, and that Arm #6 does not become eccentric.

If the load or the inertia moment exceeds the ratings or if the load becomes eccentric, follow the steps in the *Setup & Operation 4.3.1 WEIGHT Setting* and *4.3.2 INERTIA Setting*, to set parameters.

Setting parameters makes the operation of the Manipulator optimal, reduces vibration to shorten the operating time, and improves the capacity for larger loads. In addition, it reduces persistent vibration produced when the inertia moment of the end effector and work piece is bigger.

The allowable load for N6 series Manipulators is 6 kg at the maximum.

Due to the limitations of the moment and inertia moment shown in the table below, the load (end effector weight + work piece weight) should also meet these conditions.

Allowable Load

Joint	Allowable Moment	GD ² /4 Allowable Moment of Inertia
#4	15.2 N·m (1.55 kgf·m)	0.42 kg·m ²
#5	15.2 N·m (1.55 kgf·m)	0.42 kg·m ²
#6	9.4 N·m (0.96 kgf·m)	0.14 kg·m ²

Moment

The moment indicates amount of torque applied on the Joints in order to support the gravity on the load (end effector + work piece).

The moment increases as weight of the load and amount of eccentricity increase. As this also increases the load applied on the joint, make sure to keep the moment within the allowable value.

Inertia moment

The inertia moment indicates how difficult the load (end effector + work piece) to rotate when the Manipulator joint starts to rotate (amount of inertia). The inertia moment increases as weight of the load and amount of eccentricity increase. As this also increase the load applied on the joint, make sure to keep the inertia moment within the allowable value.

The moment M (N·m) and inertia moment I (kgm²) when the volume of the load (end effector + work piece) is small can be obtained by the following formula.

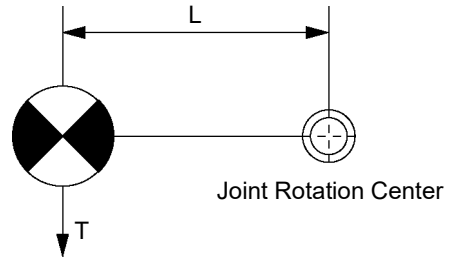
$$M \text{ (N·m)} = m \text{ (kg)} \times L \text{ (m)} \times g \text{ (m/s}^2\text{)}$$

$$I \text{ (kgm}^2\text{)} = m \text{ (kg)} \times L^2 \text{ (m}^2\text{)}$$

m : Weight of load (kg)

L : Eccentric quantity of load (m)

g : Gravitational acceleration (m/s²)



Design the end effector so that the moment M and the inertia moment I do not exceed the allowable load.

The eccentric quantity of load L should satisfy the following:

Less than 260 mm from the Arm #5 rotation center (160 mm or less from the flange)

Less than 160 mm from the Arm #6 rotation center

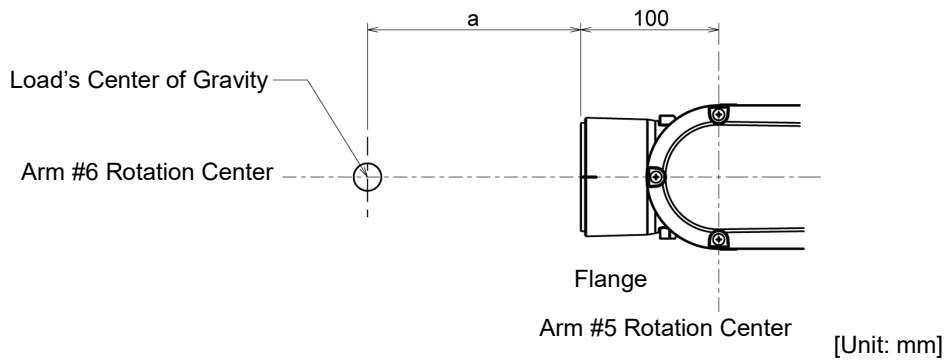
Example: When the load is 3 kg and the center of gravity is 120 mm from the flange:

$$m=3.0\text{kg}, L=120+100=220\text{mm}=0.220\text{m}$$

The moment M and the inertia moment are below the allowable load as follows:

$$\text{Moment } M \quad : \quad 3.0 \text{ kg} \times 0.220\text{m} \times 9.8 \text{ m/s}^2 = 6.468 \text{ N·m} < 15.2 \text{ N·m}$$

$$\text{Inertia moment } I \quad : \quad 3.0 \text{ kg} \times (0.220 \text{ m})^2 = 0.1452 \text{ kgm}^2 < 0.42 \text{ kgm}^2$$



4.3.1 WEIGHT setting



- Set the total weight of the end effector and the work piece smaller than the maximum payload.
The N6 series Manipulators can operate without limitations on the condition unless and until the load exceeds this maximum payload. Always set the Weight parameters of the WEIGHT command according to the load. Setting a value that is smaller than the actual load may cause errors, excessive shock, insufficient function of the Manipulator, and/or shorten the life cycle of parts/mechanisms.

The acceptable weight capacity (end effector and work piece) for N6 series Manipulators is as follows:

Rated	Maximum
3 kg	6 kg

Change the setting of the Weight parameter according to the load.

After changing the Weight parameter setting, the maximum acceleration/deceleration and speed of the robot system corresponding to the load is set automatically.

Setting method of Weight parameters

EPSON
RC+

Select [Tools]-[Robot Manager]-[Weight] panel and set the value in [Weight:].
You may also execute the Weight command from [Command Window].

Load on the Manipulator

When you attach the equipment to the decks on the upper arm, convert its weight into equivalent weight assuming that the equipment is attached to the end of the Arm #6. Then, this equivalent weight added to the load will be a Weight parameter.

Calculate the Weight parameter by using the formula below and enter the value.

Weight Parameter Formula

$$\text{Weight parameter} = M_w + W_a + W_b$$

M_w : Load on the fore end of Arm #6 (kg)

W_a : Equivalent weight of the Arm #3 deck (kg)

W_b : Equivalent weight of the Arm #5 deck (kg)

$$W_a = M_a (L_a)^2 / (L)^2$$

$$W_b = M_b (L_b)^2 / (L)^2$$

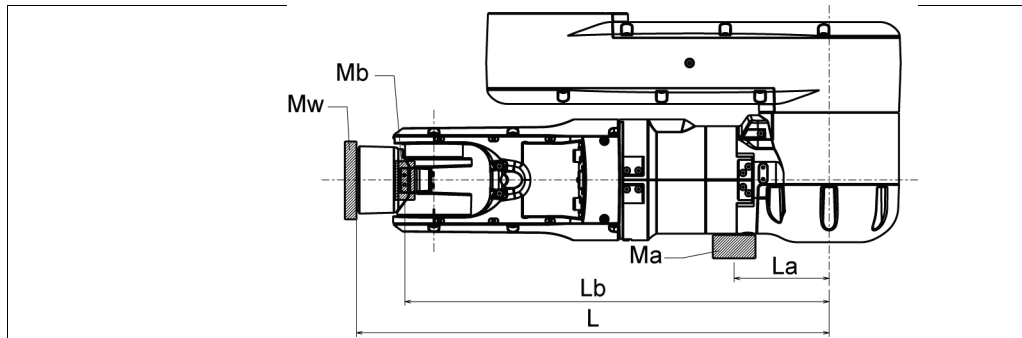
M_a : Weight of the air valve on the Arm #3 deck

M_b : Weight of the camera on the Arm #5 deck

L : Length of the upper arm (mm)

L_a : Distance between the Joint #3 and the center of gravity of the air valve on the Arm #3 deck (mm)

L_b : Distance between the Joint #3 and the center of gravity of the camera on the Arm #5 deck (mm)



<Example> The fore end of the Arm #6 is 610 mm (L) away from the Joint #3 of N6-A1000**

Load on the fore-end of Arm #6 is 3.0 kg (M_w).

Load on the Arm #3 deck is 1.0 kg (M_a).

The deck is 120 mm (L_a) away from Joint #3.

Load on the Arm #5 deck is 0.5 kg (M_b).

The deck is 550 mm (L_b) away from the Joint #3.

$$W_a = 1.0 \times 120^2 / 610^2 = 0.039$$

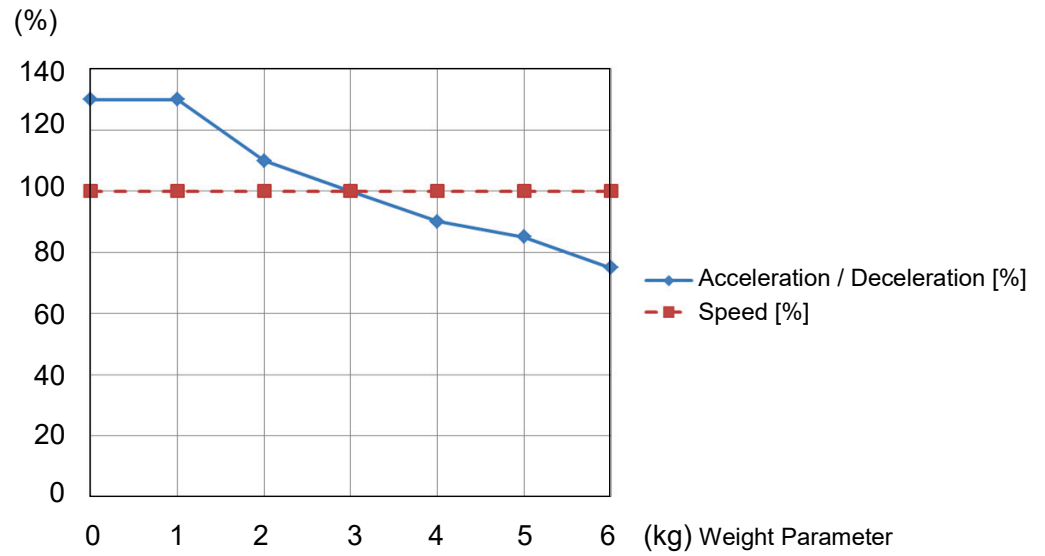
$$W_b = 0.5 \times 550^2 / 610^2 = 0.41$$

$$M_w + W_a + W_b = 3.0 + 0.039 + 0.41 = 3.449 \rightarrow 3.5 \text{ (round up)}$$

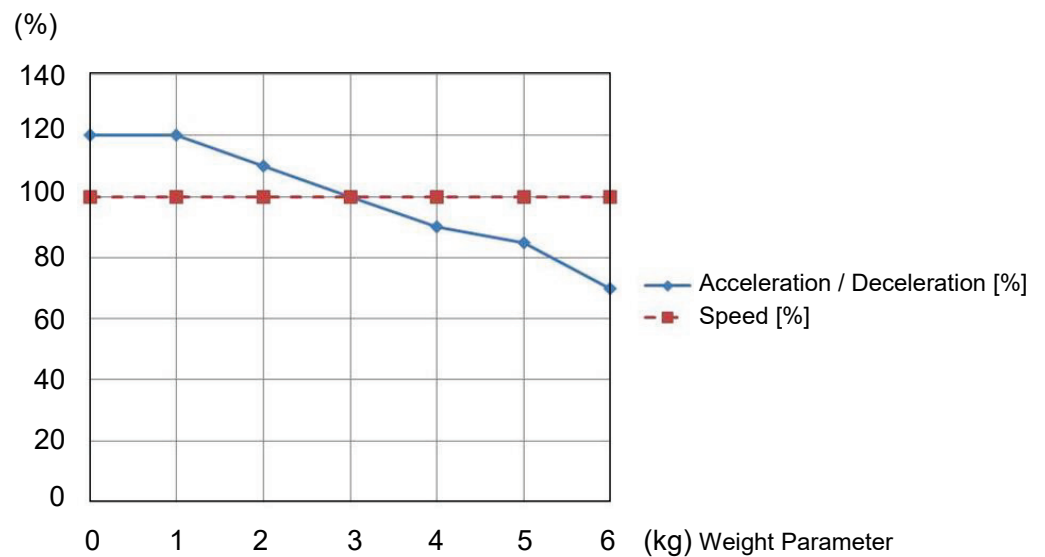
Enter “3.5” for the Weight parameter.

Automatic speed setting by Weight parameter

N6-A1000**



N6-A850**R




The percentages in the graphs are based on the speed at rated weight (3 kg) as 100%.

4.3.2 INERTIA setting

Inertia Moment and the INERTIA Setting

The inertia moment is defined as “the ratio of the torque applied to a rigid body and its resistance to motion”. When the Manipulator operates with objects such as an end effector attached to the Arm #6, the moment of inertia of load must be considered.

 CAUTION	<ul style="list-style-type: none"> ■ The inertia moment of the load (weight of the end effector and work piece) must be 0.14 kg·m² or less. The N6 series Manipulators are not designed to work with inertia moment exceeding 0.14 kg·m². Always set the inertia moment (INERTIA) parameter according to the inertia moment. Setting a value that is smaller than the actual inertia moment may cause errors, excessive shock, insufficient function of the Manipulator, and/or shorten the life of parts/mechanisms.
---	--

The acceptable inertia moment of load for N6 series Manipulators is 0.03 kg·m² nominal rating and 0.14 kg·m² maximum. Change the setting of the inertia moment according to the inertia moment of the load using the INERTIA setting. After the setting has been changed, the maximum acceleration/deceleration speed of Arm #6 responding to “inertia moment” is set automatically.

Inertia moment of load on Arm #6

The inertia moment of the load (weight of the end effector and work piece) on the Arm #6 can be set by the “inertia moment (INERTIA)” parameter of the INERTIA setting.

**EPSON
RC+**

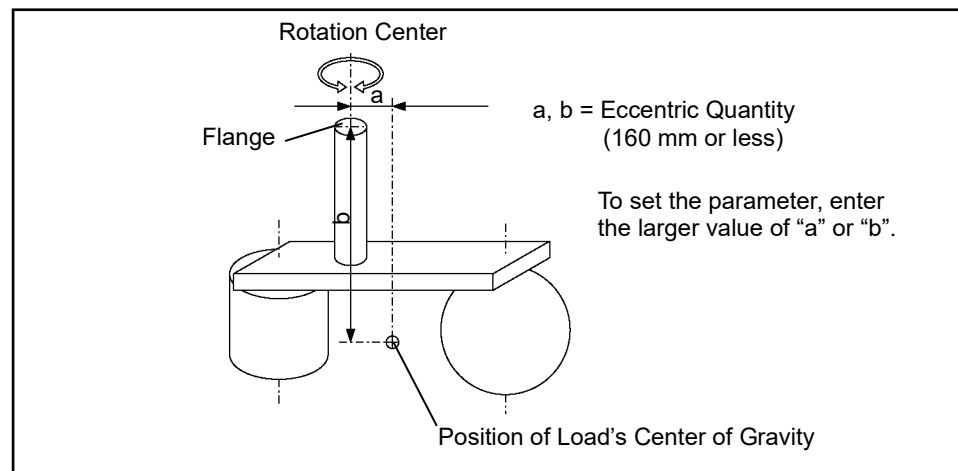
Select [Tools]–[Robot Manager]–[Inertia] panel and enter the value in [Load inertia:]. You may also execute the INERTIA setting from [Command Window].

Eccentric Quantity and the INERTIA Setting



- The eccentric quantity of the load (weight of the end effector and work piece) must be 160 mm or less. The N6 series Manipulators are not designed to work with eccentric quantity exceeding 160 mm. Always set the eccentric quantity parameter according to the eccentric quantity. Setting a value that is smaller than the actual eccentric quantity may cause errors, excessive shock, insufficient function of the Manipulator, and/or shorten the life cycle of parts/mechanisms.

The acceptable eccentric quantity of the load for N6 series Manipulators is 50 mm at nominal rating and 160 mm at maximum. When the eccentric quantity of the load exceeds the rating, change the setting of eccentric quantity parameter using the INERTIA setting. After changing the setting, the maximum acceleration/deceleration speed of Manipulator corresponding to “eccentric quantity” is set automatically.



Eccentric Quantity

Eccentric quantity of load on Arm #6

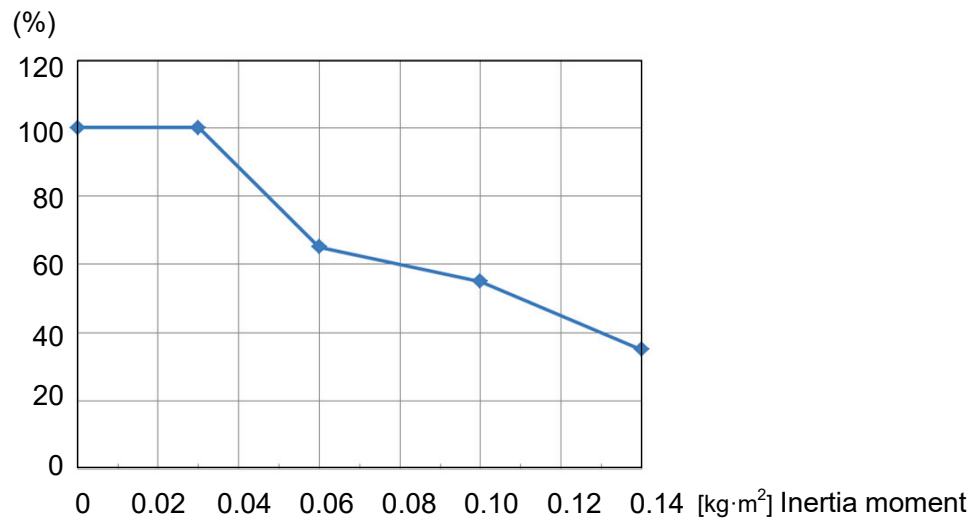
The eccentric quantity of the load (weight of the end effector and work piece) on the Arm #6 can be set by the “eccentric quantity” parameter of the INERTIA setting. Enter the larger value of either “a” or “b” in the figure above to [Eccentricity].



Select [Tools]-[Robot Manager]-[Inertia] panel and enter the value into [Eccentricity:]. You may also execute the INERTIA setting from [Command Window].

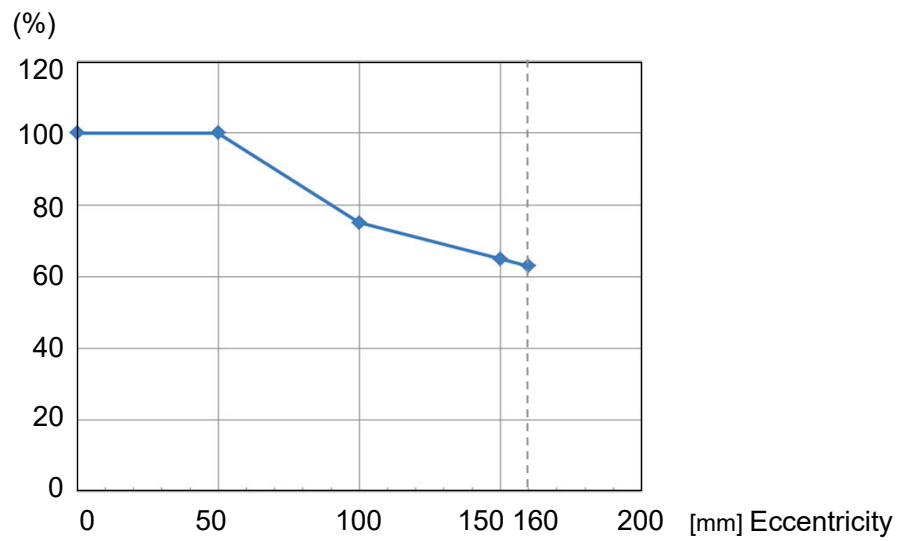
Automatic acceleration/deceleration setting by INERTIA (eccentric quantity)

Automatic setting by inertia moment setting



* The percentage in the graph is based on the acceleration / deceleration at rated eccentricity (0.03 kg·m²) as 100%.

Automatic setting by eccentricity setting

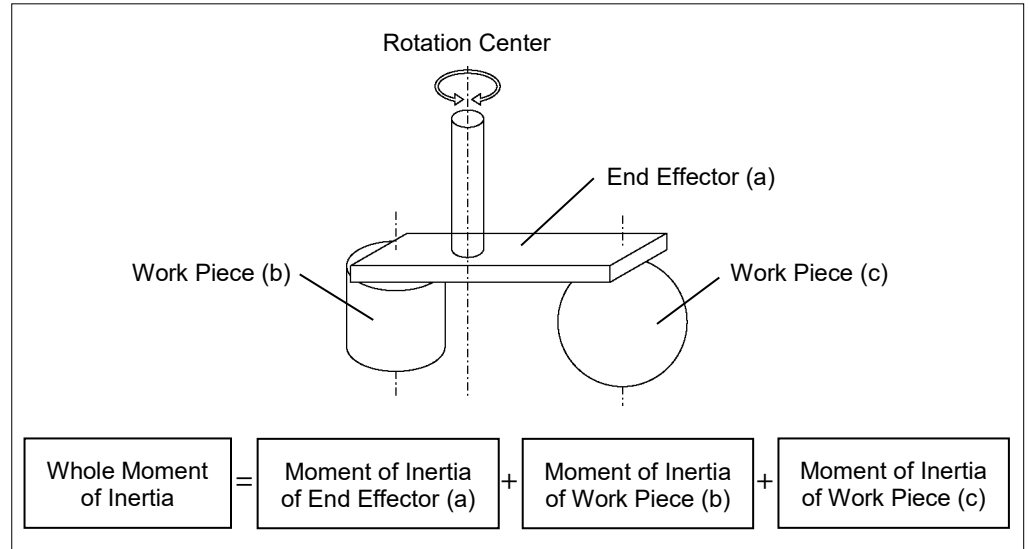


* The percentage in the graph is based on the acceleration / deceleration at rated eccentricity (50 mm) as 100%.

Calculating the Inertia Moment

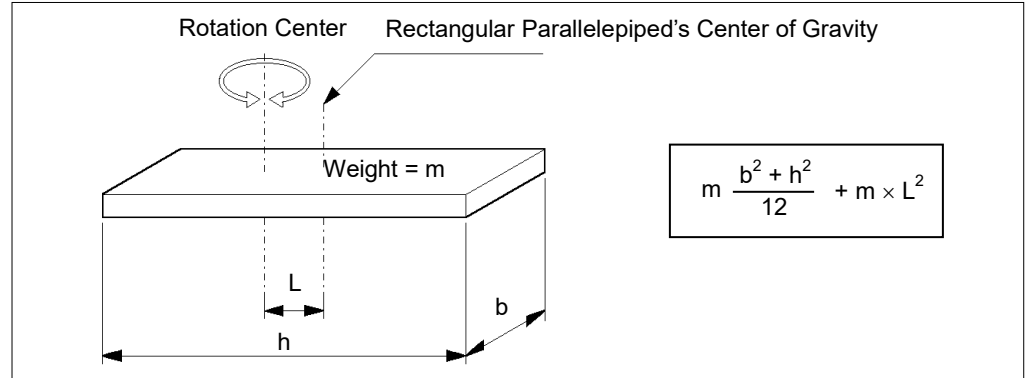
Refer to the following example formulas to calculate the inertia moment of the load (end effector with work piece).

The inertia moment of the entire load is calculated by the sum of (a), (b), and (c).

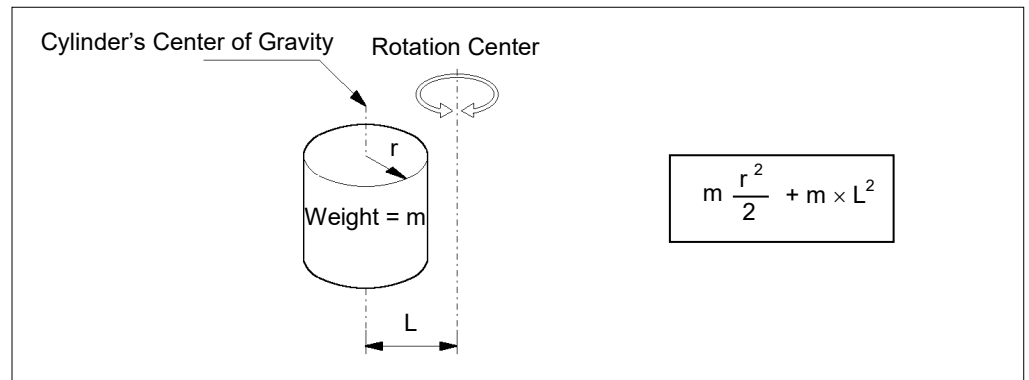


The methods for calculating the inertia moment for (a), (b), and (c) are shown in this and the next page. Figure out the whole inertia moment using the basic formulas below.

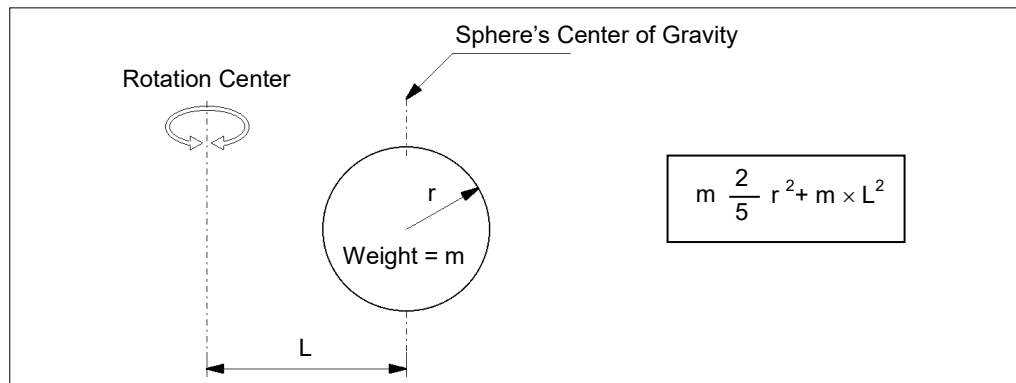
(a) Inertia moment of a rectangular parallelepiped



(b) Inertia moment of a cylinder



(c) Inertia moment of a sphere



4.4 Precautions for Auto Acceleration/Deceleration

The speed and acceleration/deceleration of the Manipulator motion are automatically optimized according to the values of WEIGHT and INERTIA and the Manipulator's postures.

WEIGHT Setting

The speed and acceleration/deceleration of the Manipulator are controlled according to the load weight set by the WEIGHT command.

The more the load weight increases, the more the speed and acceleration/deceleration are reduced to prevent residual vibration.

INERTIA Setting

The acceleration/deceleration of Arm #6 are controlled according to the inertia moment set by the INERTIA setting. The acceleration/deceleration of the whole Manipulator are controlled according to the eccentricity set by the INERTIA setting. The more the inertia moment and eccentricity of the load increase, the more the acceleration/ deceleration are reduced.

Auto Acceleration/Deceleration According to Manipulator's Posture

The acceleration/deceleration are controlled according to the Manipulator's posture. When the Manipulator extends its arms or when the movement of the Manipulator produces vibration frequently, the acceleration/deceleration are reduced.

Set appropriate values for WEIGHT and INERTIA so that the Manipulator operation is optimized.

5. Motion Range



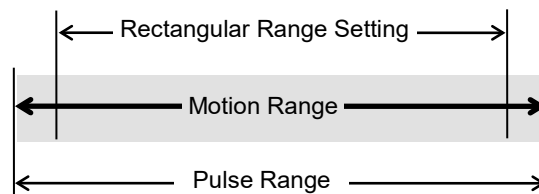
WARNING

- When limiting the motion range for safety, be sure to set by the pulse range. Failure to do so may cause serious safety problems.

The motion range is preset at the factory as describes in the *Setup & Operation 2.4 Standard Motion Range*. This is the maximum motion range of the Manipulator.

Motion range is set by the following two methods:

1. Setting by pulse range (for all arms)
2. Setting the Cartesian (rectangular) range in the X, Y coordinate system of the Manipulator



When the motion range is limited due to layout efficiency or safety, follow the descriptions in 5.1 through 5.3 to set the range.

5.1 Motion Range Setting by Pulse Range (for Each Joint)

Pulses are the basic unit of Manipulator motion. The motion range of the Manipulator is controlled by the pulse range (the lower limit and the upper limit) of each axis.

Pulse values are read from the encoder output of the servo motor.

The pulse range should be set within the maximum motion range.



NOTE

Once the Manipulator receives an operating command, it checks whether the target position specified by the command is within the pulse range before operating. If the target position is out of the set pulse range, an error occurs and the Manipulator does not move.

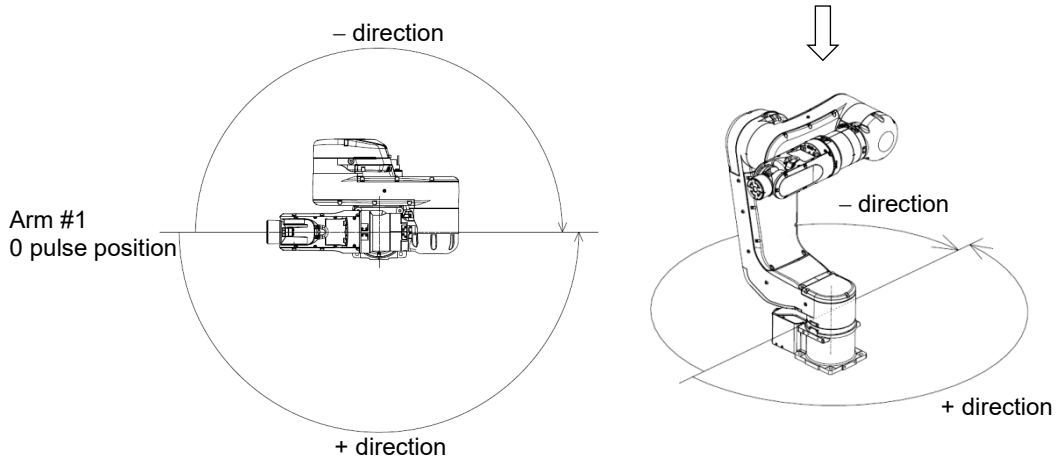
EPSON
RC+

The pulse range can be set in [Tools]-[Robot manager]-[Range] panel.
You may also execute the Range command from the [Command Window].

5.1.1 Max. Pulse Range: N6-A1000**

Joint #1 (N6-A1000**)

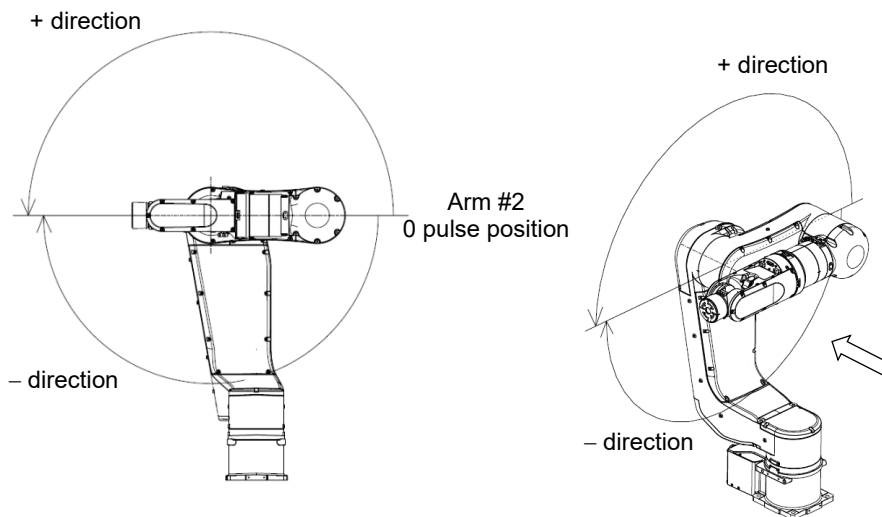
When viewing from the arrow on the right figure, pulse values in counterclockwise direction are positive (+) and values in clockwise direction are negative (-).



Angle (°) : ±180
 Pulse (pulse) : ±6619136

Joint #2 (N6-A1000**)

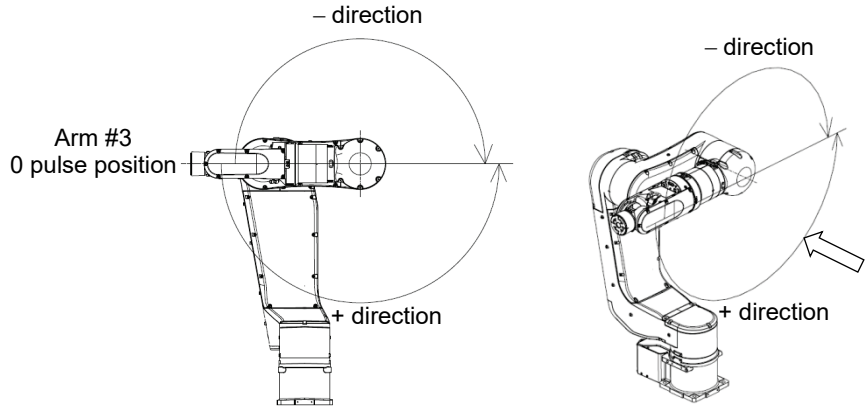
When viewing from the arrow on the right figure, pulse values in counterclockwise direction are positive (+) and values in clockwise direction are negative (-).



Angle (°) : ±180
 Pulse (pulse) : ±6619136

Joint #3 (N6-A1000)**

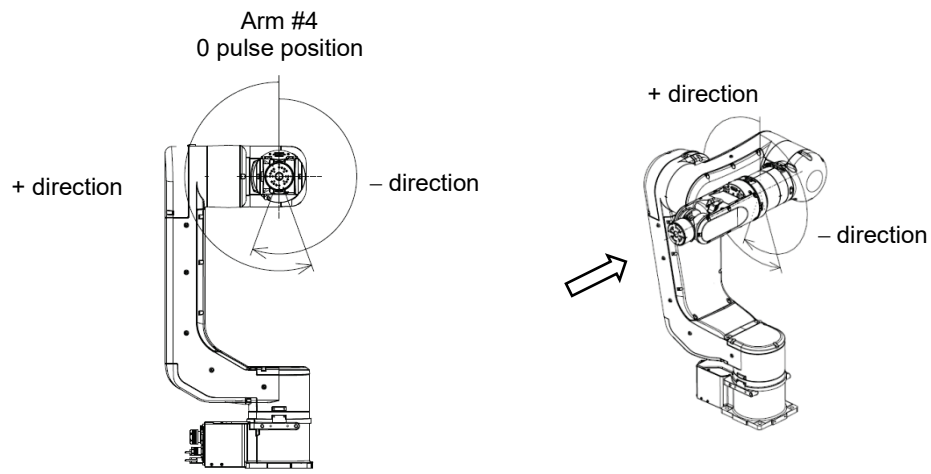
When viewing from the arrow on the right figure, pulse values in counterclockwise direction are positive (+) and values in clockwise direction are negative (-).



Angle (°) : ±180
Pulse (pulse) : ±5308416

Joint #4 (N6-A1000)**

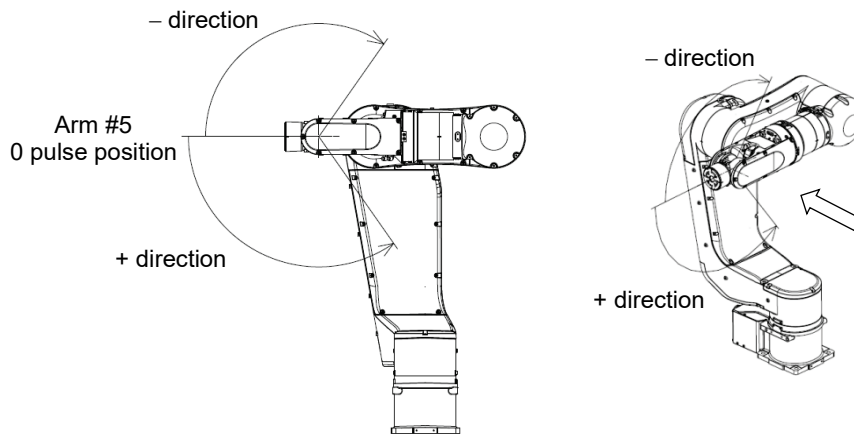
When viewing from the arrow on the right figure, pulse values in counterclockwise direction are positive (+) and values in clockwise direction are negative (-).



Angle (°) : ±200
Pulse (pulse) : ±5898240

Joint #5 (N6-A1000)**

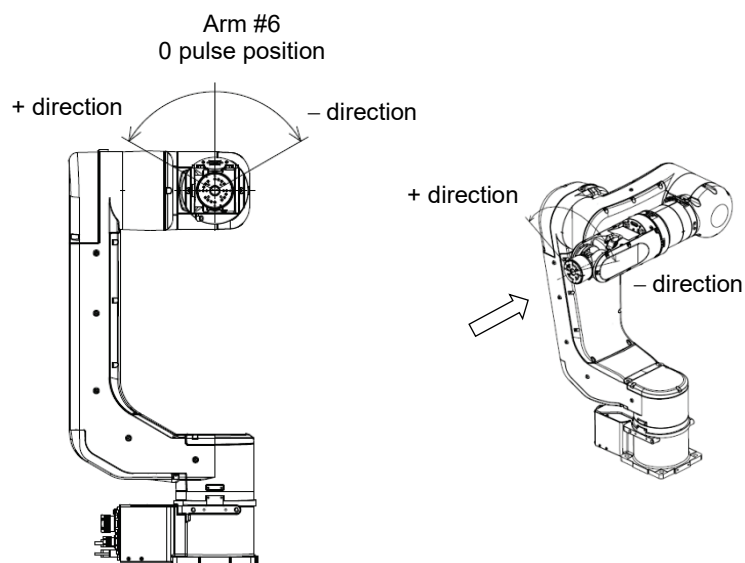
When viewing from the arrow on the right figure, pulse values in counterclockwise direction are positive (+) and values in clockwise direction are negative (-).



Angle (°) : ± 125
 Pulse (pulse) : ± 3640889

Joint #6 (N6-A1000)**

When viewing from the arrow on the right figure, pulse values in counterclockwise direction are positive (+) and values in clockwise direction are negative (-).

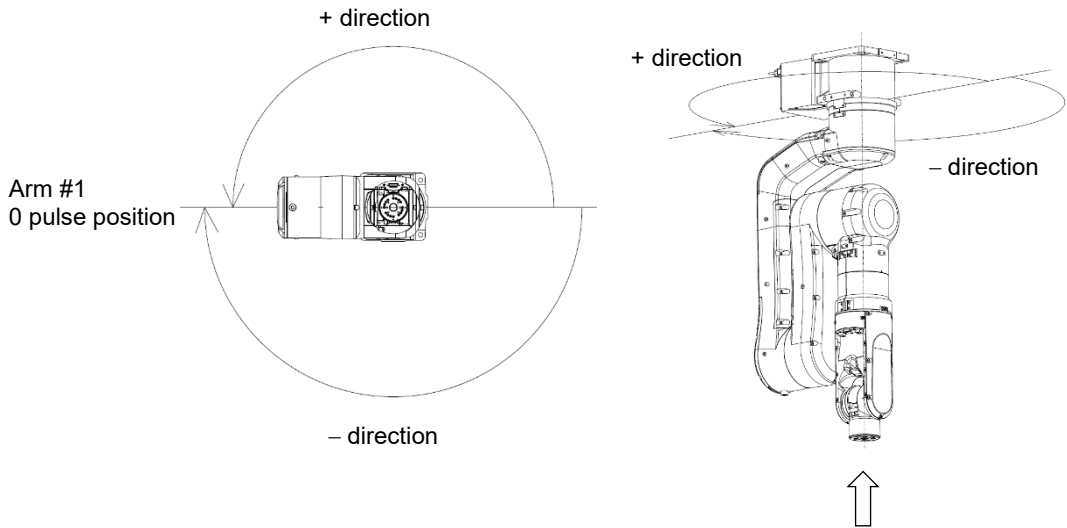


Angle (°) : ± 360
 Pulse (pulse) : ± 8773632

5.1.2 Max. Pulse Range: N6-A850R**

Joint #1 (N6-A850R)**

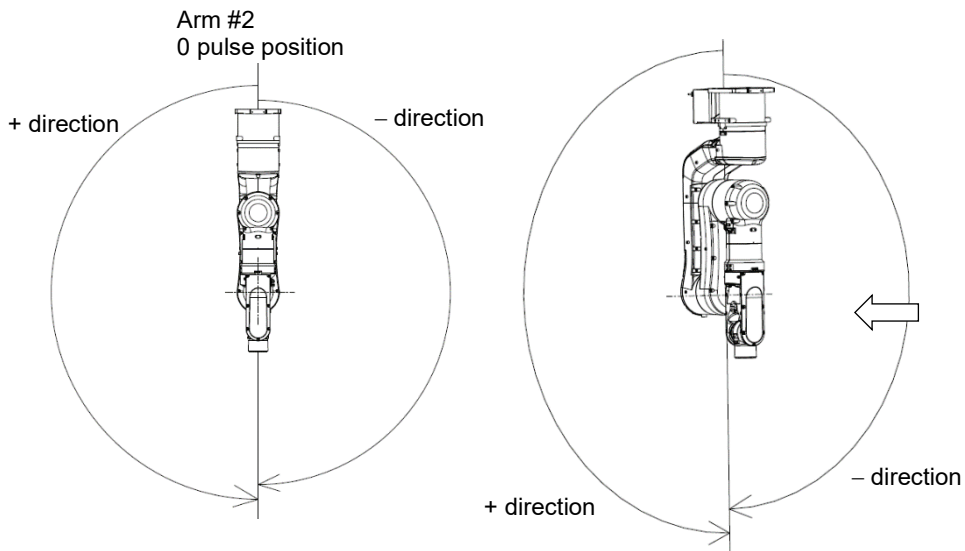
When viewing from the arrow on the right figure, pulse values in counterclockwise direction are positive (+) and values in clockwise direction are negative (-).



Angle (°) : ±180
 Pulse (pulse) : ±6619136

Joint #2 (N6-A850R)**

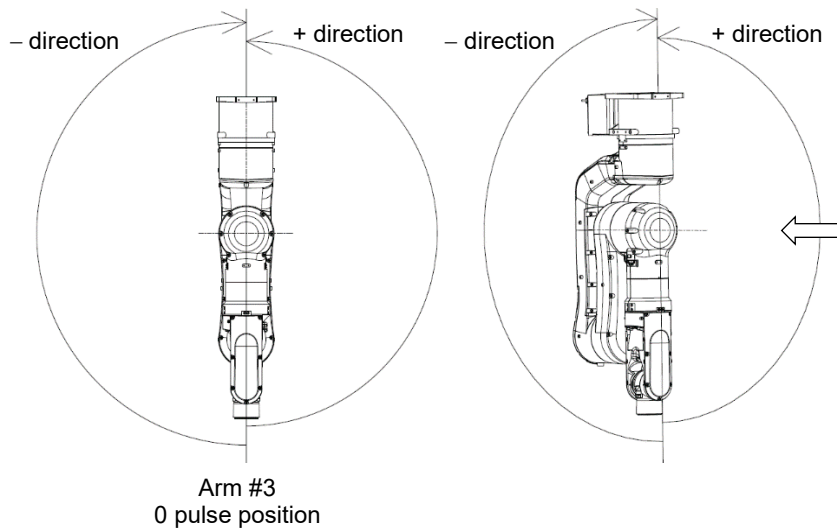
When viewing from the arrow on the right figure, pulse values in counterclockwise direction are positive (+) and values in clockwise direction are negative (-).



Angle (°) : ±180
 Pulse (pulse) : ±6619136

Joint #3 (N6-A850R)**

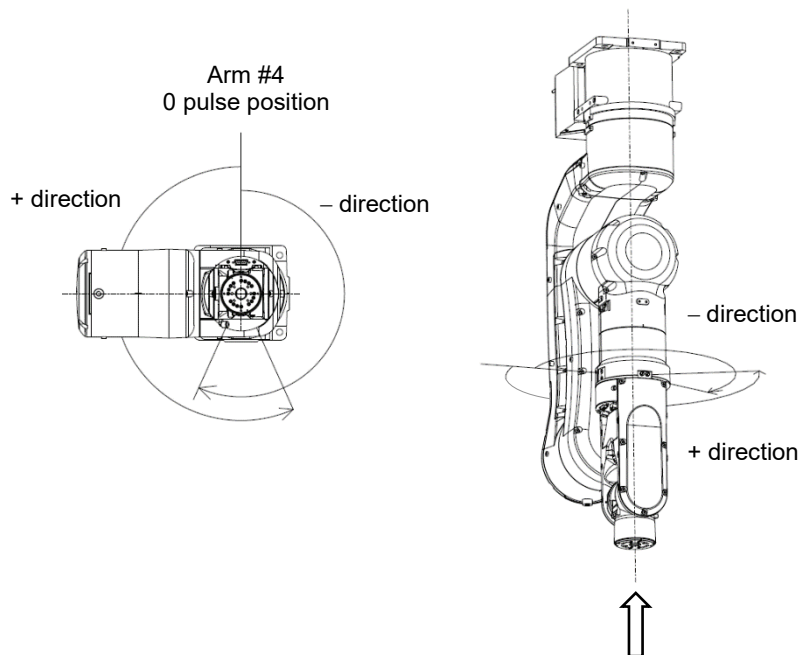
When viewing from the arrow on the right figure, pulse values in counterclockwise direction are positive (+) and values in clockwise direction are negative (-).



Angle (°) : ± 180
Pulse (pulse) : ± 5308416

Joint #4 (N6-A850R)**

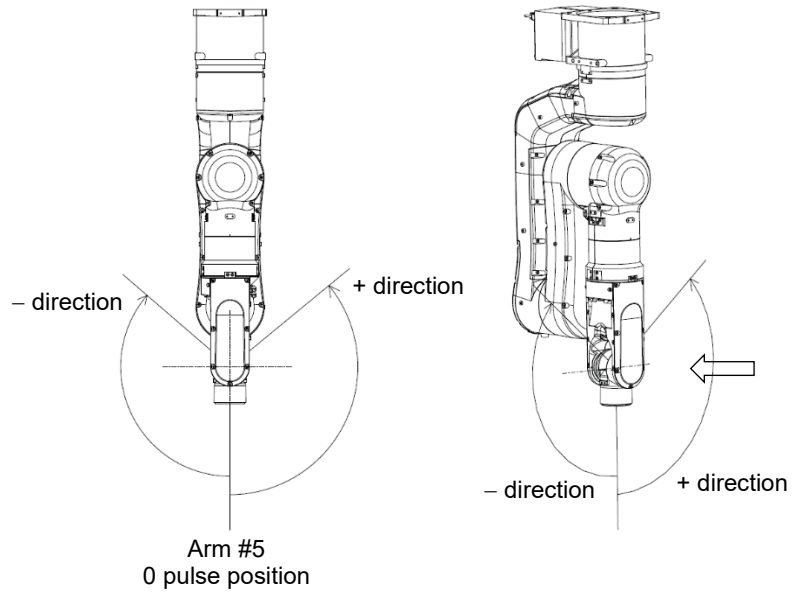
When viewing from the arrow on the right figure, pulse values in counterclockwise direction are positive (+) and values in clockwise direction are negative (-).



Angle (°) : ± 200
Pulse (pulse) : ± 5898240

Joint #5 (N6-A850R)**

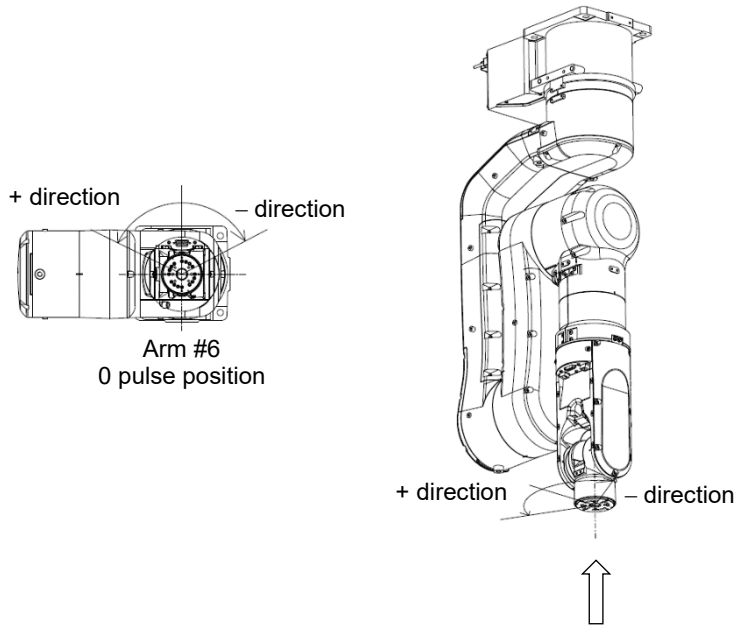
When viewing from the arrow on the right figure, pulse values in counterclockwise direction are positive (+) and values in clockwise direction are negative (-).



Angle (°) : ±125
Pulse (pulse) : ±3640889

Joint #6 (N6-A850R)**

When viewing from the arrow on the right figure, pulse values in counterclockwise direction are positive (+) and values in clockwise direction are negative (-).



Angle (°) : ±360
Pulse (pulse) : ±8773632

5.2 Restriction of Manipulator Operation

To prevent the arms of the Manipulator from interfering each other, the Manipulator operation is restricted as follows:

Combination restriction of joint angles

The motion ranges of the Joints #2 and #3 are defined according to the combinations of their angles. If the combination of the joint angles falls the painted areas in the below figure, the Manipulator motion will be restricted.

Error: 4066

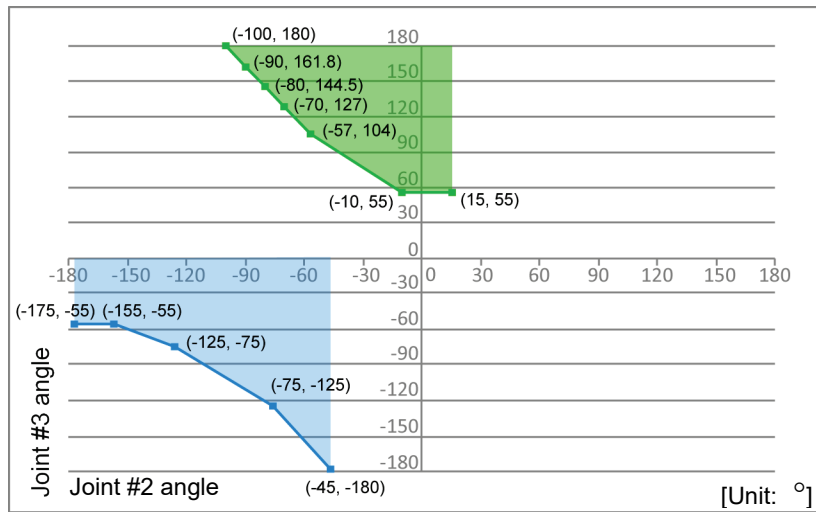
If the arm motion of the Manipulator is operated with a motion which will interfere with itself between the current position and the target position, “Error: 4066” occurs.

The error occurs in PTP motion and CP motion. “Error: 4066” occurs in the following situations:

When the target position is inside the combination restriction area of joint angle (Fig. 1: Green, Blue).

[Remedy] Change the target position and avoid “Error: 4066”.

N6-A1000**



N6-A850R**

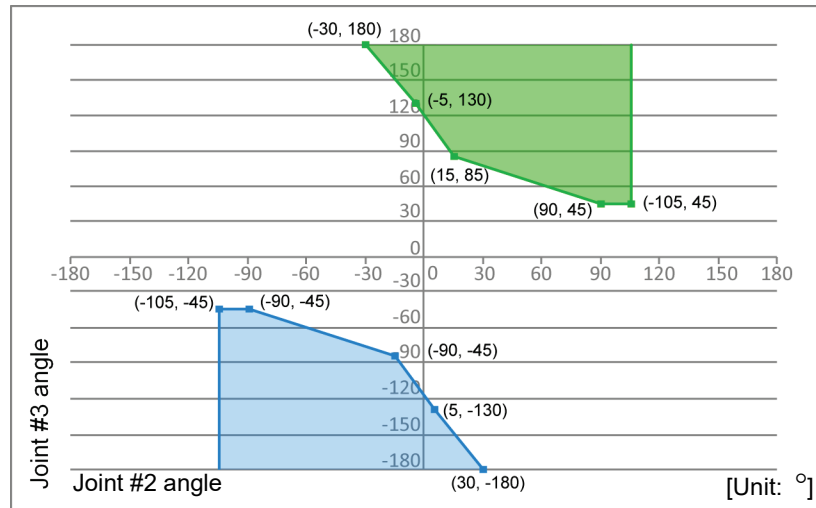


Fig. 1: Combination restriction of joint angle

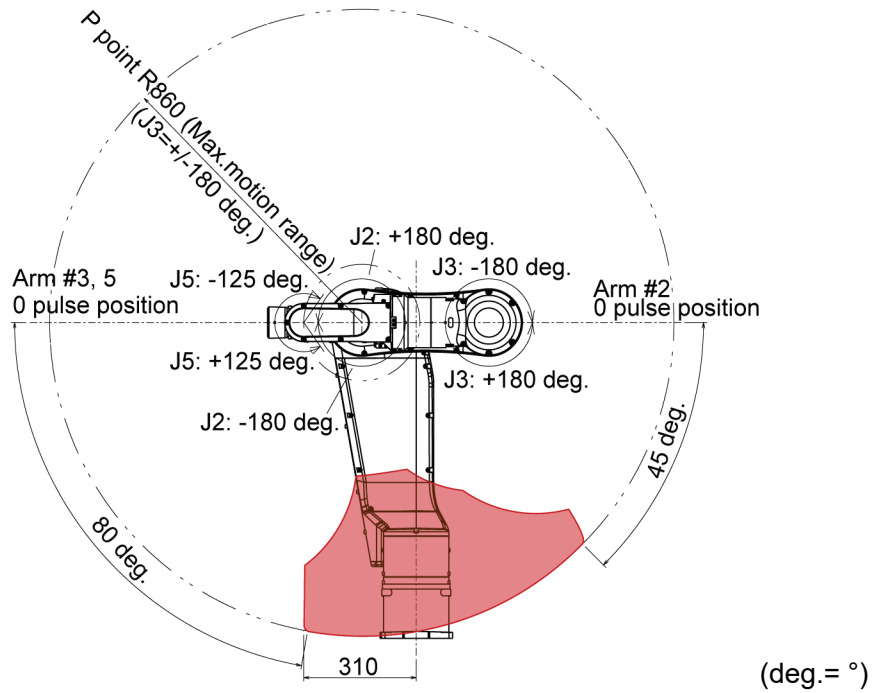


Fig 2: Area that “Error: 4066, 4248” occurs

Green and blue areas in Fig. 1 are red area in Fig. 2.

When the arm/elbow orientation of the target position is in a restricted orientation:

[Remedy] Change the arm/elbow orientation and avoid “Error: 4066”.

When the arm/elbow orientation of the current position is in a restricted orientation:

Normally, the arm/elbow orientation of the current position will not be able to move to a restricted orientation since “Error: 4066” will occur before operating the motion. However, if using jog or releasing the brake to move the Manipulator by hand, the arm/elbow orientation of the current position will be able to move to a restricted orientation. If “Error: 4066” occurs when the motion command “Go Pulse(0,0,0,0,0,0)” is executed, refer to the following remedy to avoid “Error: 4066”.

[Remedy] Move the Manipulator by Jog motion.

Release a brake and move the Manipulator by hand.

Error: 4248

When Manipulator enters into the red area (Fig. 2), “Error: 4248” occurs. The error occurs in PTP motion and occurs order to avoid a collision to Manipulator itself (Fig. 3).

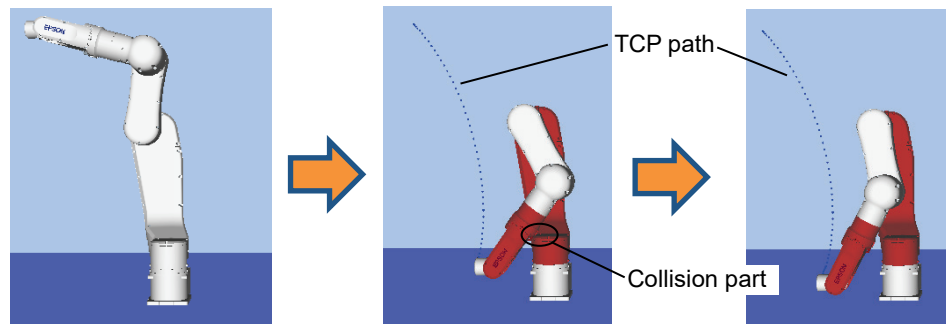


Fig. 3: Motion that collides with the Manipulator itself

Also, “Error: 4248” will occur when the specified target position is inside the orange area (Fig.4).

As shown in [Remedy], if “Error: 4248” occurs, set relay points outside of the orange area.

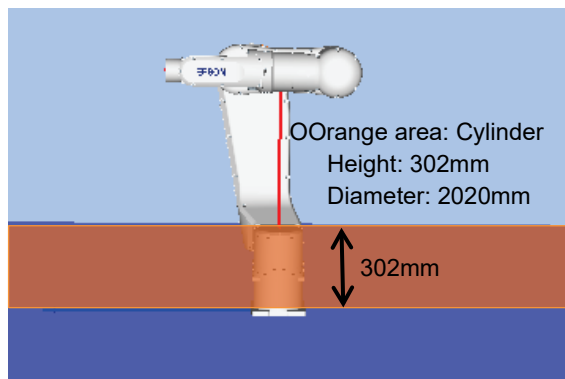


Fig. 4: Range of target position that “Error: 4248” will occur

The range of Fig. 4 is when Tool 0 and Local 0.

[Remedy] Set relay points to avoid a collision.

```
P1 = XY(-420,0, 1200, 0, -90, 0) /R /A /NF
P2 = XY(0,420, 280, 0, -90, -90) /R /B /F
P3 = XY(0,420, 305, 0, -90, -90) /R /B /F
```

```
Go P1
Go P3 CP ' Relay point
Go P2
```

```
Go P3 CP ' Relay point
Go P1
```

“Error: 4248” will occur again even the Manipulator is moved outside of the orange area (Fig. 4) in PTP motion after “Error: 4248” occurred. In that case, the Manipulator is in the red area (Fig. 2). Move the Manipulator from the area by moving the Joint #2 or #3 by Jog motion in Joint mode.



If the Manipulator moves at high speed, it will collide with itself after detecting “Error: 4248”.

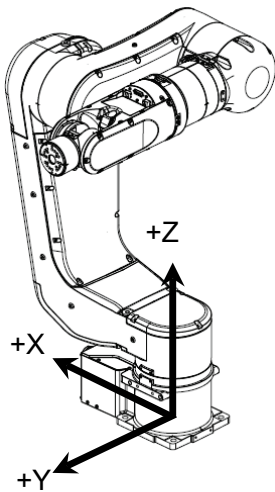
Make sure to check the motion by simulator or motion in low power mode.

5.3 Coordinate System

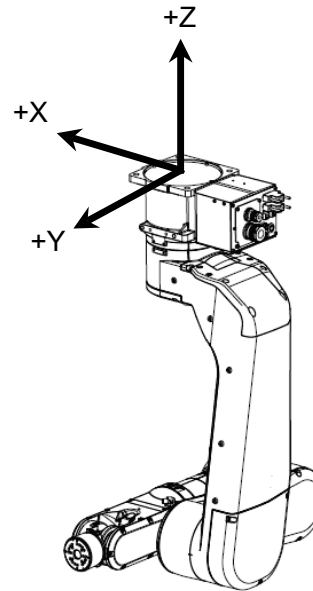
The origin point is where the Manipulator's installation face intersects with the rotation axis of Joint #1.

For details on the coordinate system, refer to the *EPSON RC+ Users Guide manual*.

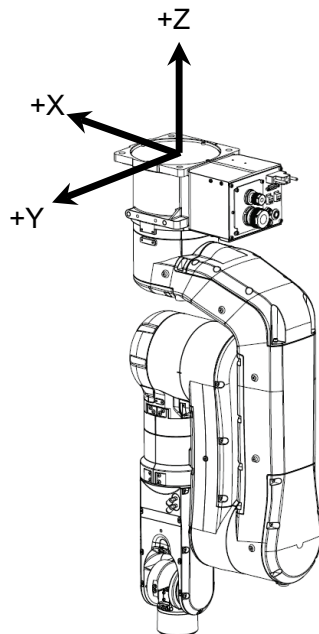
N6-A1000**



N6-A1000**R



N6-A850**R

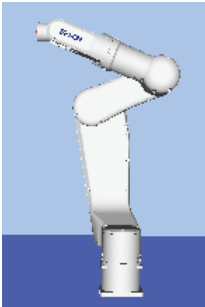


5.4 How to Use Orientation Flag

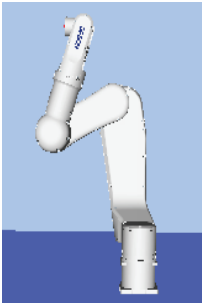
N6-A1000**

As shown in the following examples, N6-A1000** can move to the same position with the different orientation flag (Above, Below).

Ex 1

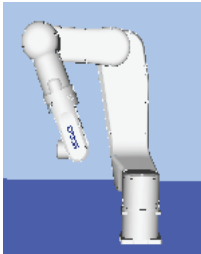


Above



Below

Ex 2



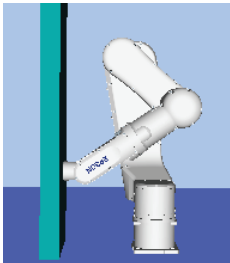
Above



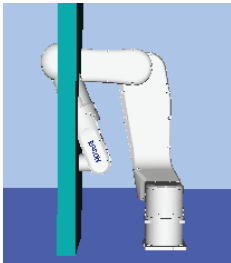
Below

When the improper orientation flag is selected, the robot may collide with the equipment. Be sure to select the proper orientation flag for your equipment.

Ex 3



Orientation which the robot does not collide with the equipment



Orientation which the robot collides with the equipment

When you cannot select the orientation flag for N6-A1000**, use the command: "AutoOrientationFlag". Orientation flag is automatically changed to the orientation which the robot does not collide with the equipment.

Command: “AutoOrientationFlag”

Command: “AutoOrientationFlag” changes the orientation flag of N6-A1000** to the orientation which the robot does not collide with the equipment.

Change the following orientation flag:

Model	Parameter OFF/ON	Orientation flag			Remark
		Hand	Elbow	Wrist	
N6-A1000**	OFF	-	-	-	Move with the orientation flag which is selected by user. (Default)
	ON	-	✓	✓ *1	Set “ON” when you cannot select the orientation flag.

✓: When setting the AutoOrientationFlag to “ON”, the orientation flag is changed

*1: Wrist orientation flag is changed only when you change the elbow orientation flag. When you change the wrist orientation flag, it will be the orientation flag which minimizes the movement of Joint #4.

How to use the command

Syntax

- (1) AutoOrientationFlag On | Off
- (2) AutoOrientationFlag

Example

```
Motor On
Power High
AutoOrientationFlag On

Go P1
Go P2
```

Use AutoOrientationFlag with LJM Function

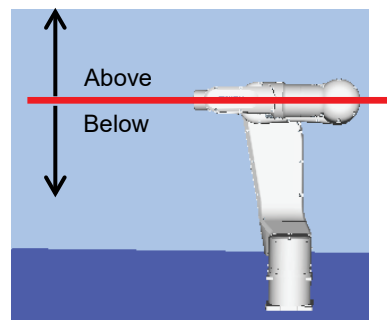
When you use the command with LJM Function, Wrist Flag, J4Flag, and J6Flag will be the orientation selected by LJM Function.

For example, when you set orientationFlag of LJM Function to “3”, “Wrist Flag”, “J4Flag”, and “J6Flag” are selected so that Joint #5 will be the shortest movement. When you do not use LJM Function, “Wrist Flag”, “J4Flag”, and “J6Flag” are selected so that Joint #4 will be the shortest movement.



When setting the AutoOrientationFlag to “ON”: Flag is changed as follows due to the position of point P and the red line.

Point P is above the red line: Above
Point P is below the red line: Below



5.5 Changing the Robot

This section describes how to change the Manipulator model on EPSON RC+. (N6-A1000** is set to “Table top mounting” by default. If you want to change the mounting type to “Ceiling mounting”, follow the steps below to change the model. N6-A850**R is set to “Ceiling mounting” and “Table top mounting” is not available.)



CAUTION

- Changing the Manipulator should be done with great caution. It initializes the robot calibration parameters (Hofs, CalPIs), additional axis information, and PG parameter data.

Before changing the robot, make sure to save the calibration data by following the procedure below.

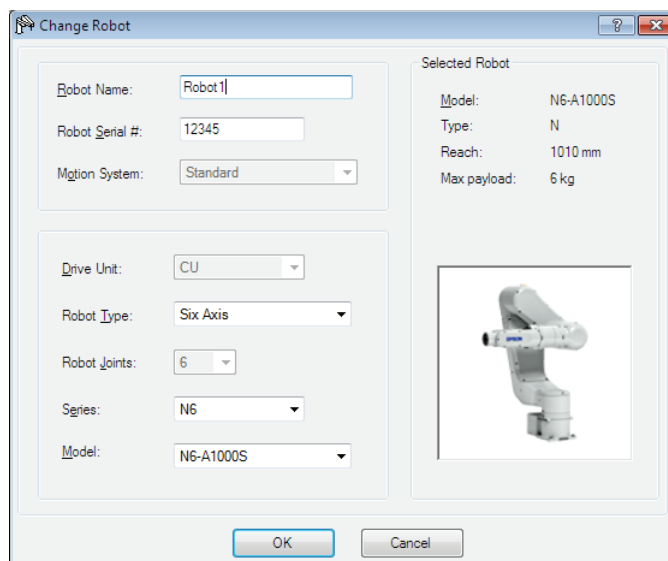
1. Select the EPSON RC+ 7.0 menu-[Setup]-[System Configuration].
2. Select [Robot]-[Robot**]-[Calibration] from the tree list. Then, click <Save>.

(1) Select the EPSON RC+ 7.0 menu-[Setup]-[System Configuration].

(2) Select [Robot]-[Robot**] from the tree list.



(3) Click the <Change...> button. The following dialog box will be displayed.



- (4) Input the robot name and serial number printed on the Label of the Manipulator.
- (5) Select the robot type in the [Robot type] box.
- (6) Select the series name of the Manipulator in the [Series] box.
- (7) Select the robot model in the [Model] box. Available robots will be displayed according to the format of the currently installed motor driver. When [Dry run] is used, all the Manipulators of the series selected in Step 6 will be displayed.
- (8) Click the <OK> button. The Controller will be restarted.

5.6 Setting the Cartesian (Rectangular) Range in the XY Coordinate System of the Manipulator

The Cartesian (rectangular) range in the XY coordinate system of the Manipulator is specified by the limited Manipulator operation area and the XYLim setting.

The limited Manipulator operation area is defined so that the end effector does not interfere with the rear side of the Manipulator. The XYLim setting that you can determine the upper and lower limits of the X and Y coordinates.

The limited Manipulator operation area and the XYLim setting apply only to the software. Therefore, these settings do not change the physical range. The maximum physical range is based on the position of the pulse range.

These settings are disabled during a joint jogging operation. Therefore, be careful not to allow the end effector to collide with the Manipulator or peripheral equipment.

EPSON
RC+

Set the XYLim setting in [Tools]-[Robot manager]-[XYZ Limits] panel.
You may also execute the XYLim command from the [Command Window].

6. Options

N6 series Manipulator has the following options.

- 6.1 Brake Release Unit
- 6.2 Camera Plate Unit
- 6.3 Tool Adapter (ISO flange)
- 6.4 User Wiring
- 6.5 M/C cable

6.1 Brake Release Unit

With the Electromagnetic brakes are ON (such as in Emergency Stop status), all arms except for the Arm #1 cannot be moved by hand.

You can move the Arms by hand using the brake release unit while the controller power is OFF or right after unpacking.

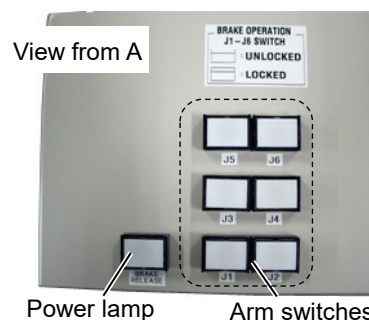
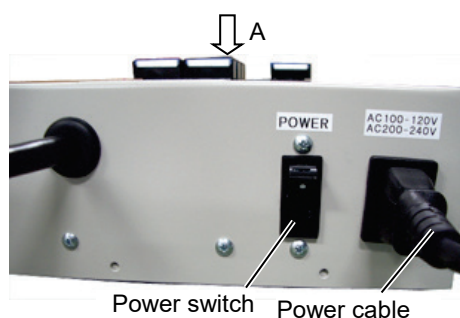


- When connecting or replacing the brake release unit and the external short connector, turn OFF the power to the Controller and the brake release unit. Connecting and disconnecting the connector while the power is ON may result in electrical shock.



- Normally, release the brake of joints one by one. Take extra care if you need to release the brakes of two or more joints simultaneously. Releasing the brakes of two or more joints simultaneously may cause hands and fingers to be caught and/or equipment damage to or malfunction of the Manipulator as the arms of the Manipulator may move in unexpected directions.
- Be careful of the arm falling when releasing the brake. While the brake is being released, the Manipulator's arm falls by its own weight. The arm falling may cause hands and fingers to be caught and/or may cause equipment damage to or malfunction of the Manipulator.

Width	180 mm
Depth	150 mm
Height	87 mm
Weight (Cables are not included.)	1.7 kg
Cable to the Manipulator	2 m
Power cable length	2 m
Power cable (US)	100 V specification
Power cable (EU)	200 V specification
M/C Short connector	For M/C power cable short-circuit



Precautions for use



CAUTION

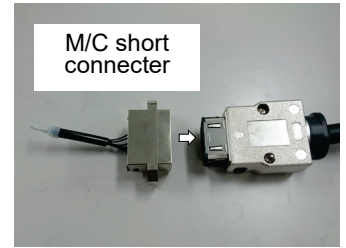
- If the Manipulator is operated without connecting the brake release unit and the external short connector, the brakes cannot be released and it may cause damage on them. After using the brake release unit, be sure to connect the external short connector to the Manipulator, or check connection of the connector for the brake release unit.
- Keep the external short connector.
Otherwise you cannot release the brakes.
- If you turn ON the brake release unit while the brake release switch is being pressed, an unintended arm may move downward.
Before turning ON the brake release unit, make sure that the brake release switch is not pressed.
- If you turn ON the brake release unit without the connector, it may lead to the short for the male pin used in the connector.
Before turning ON the brake release unit, make sure that the connector is connected.

Mount the brake release unit

- (1) Turn OFF the controller.
- (2) When the M/C power cable is not connected to the Controller:

Connect either the M/C short connector or the Controller.
(Keep the Controller power OFF)

The M/C short connector can be purchased singly.

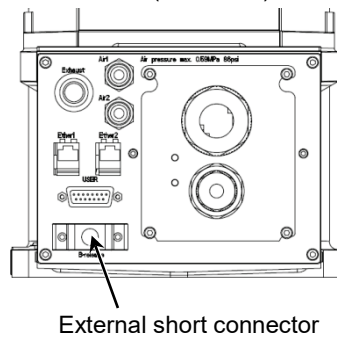


When the M/C power cable is already connected to the Controller:

Go to the step (3).

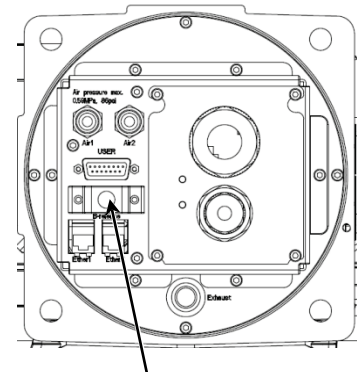


- (3) Disconnect the external short connector.
M/C cable direction: Standard (backward)



External short connector

Upward and downward



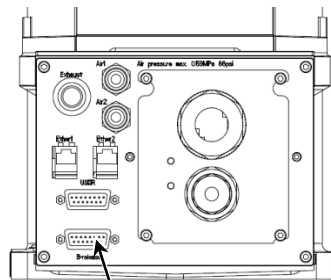
External short connector

- (4) Connect the brake release unit to the connector of the connection cable.



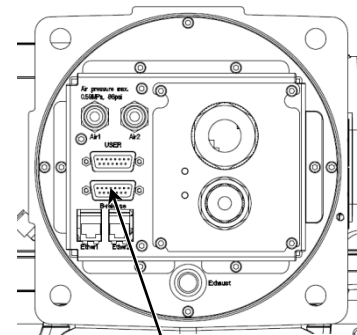
NOTE The connection cable connector and the adjacent user cable connector have the same shape. Be careful not to connect the wrong connector.

M/C cable direction: Standard (backward)



Connector of connection cable

Upward and downward



Connector of connection cable

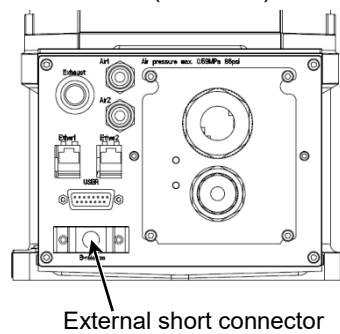
Remove the brake release unit

- (1) Turn OFF the brake release unit.
- (2) Disconnect the power cable of the brake release unit.
- (3) Disconnect the brake release unit from the connector of the connection cable.
- (4) If the M/C short connector is connected to the M/C power cable in the Installation step (2), disconnect the M/C short connector.
- (5) Connect the external short connector to the connector of the connection cable



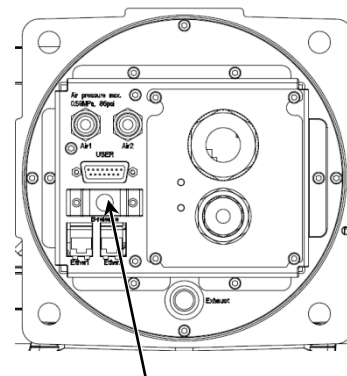
The connection cable connector and the adjacent user cable connector have the same shape. Be careful not to connect the wrong connector.

M/C cable direction: Standard (backward)




External short connector

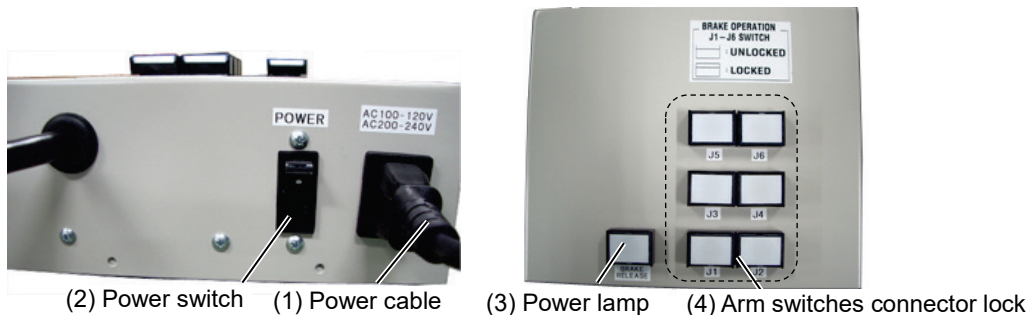
Upward and downward




External short connector

How to use the brake release unit

 CAUTION	<ul style="list-style-type: none"> ■ Be careful of the arm falling when releasing the brake. While the brake is being released, the Manipulator's arm falls by its own weight. The arm falling may cause hands and fingers to be caught and/or may cause equipment damage to or malfunction of the Manipulator. ■ If the arm you released its brake moves awkwardly or faster than usual, stop the operation promptly and contact the supplier of your region. The brake release unit may be broken. If you keep operating the Manipulator, it may lead to the breakdown of the Manipulator or you may get your hand or fingers caught.
---	---



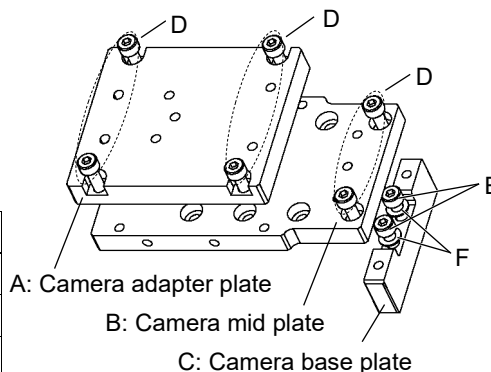
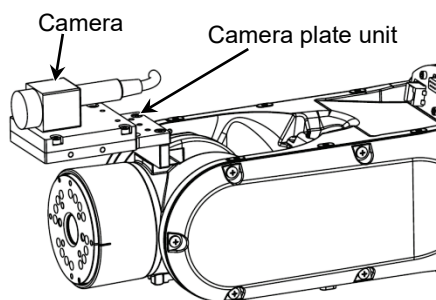
- (1) Connect the power cable to the brake release unit.
- (2) Connect the power cable to the power supply plug.
- (3) Turn ON the brake release unit.
When the brake release unit is enabled, the power lamp lights up.
- (4) Press the switch of the arm (J2 to J6) you want to move and then move the arm.
Press the switch again. The brake will be released.
The brake will be enabled by pressing the switch once again.

NOTE  Move the arm the brake is released by two persons or more (one presses the switch and one moves the arm). The arm can be very heavy and needs the significant force to move.

6.2 Camera Plate Unit

By using the camera plate unit, you can mount the camera to the N6 series Manipulator.

Appearance of arm end with camera

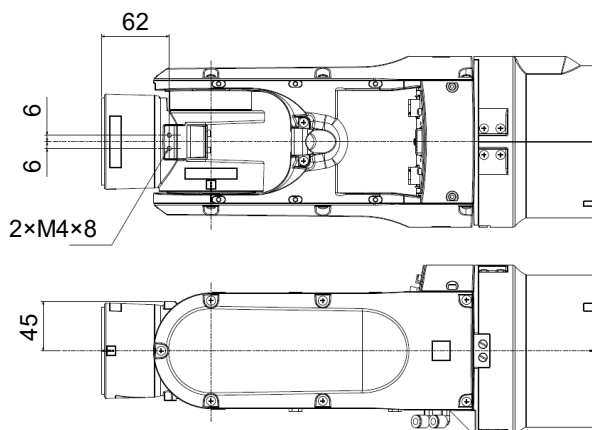
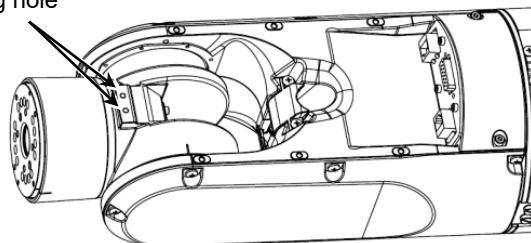


	Parts included	unit
A	Camera adapter plate	1
B	Camera mid plate	1
C	Camera base plate	1
D	Hexagon socket head screws M4×12	6
E	Hexagon socket head screws M4×20	2
F	Plain washer for M4 (small washer)	2

Installation

Mounting holes for the camera base plate on the N6 series Manipulator

Camera base plate mounting hole

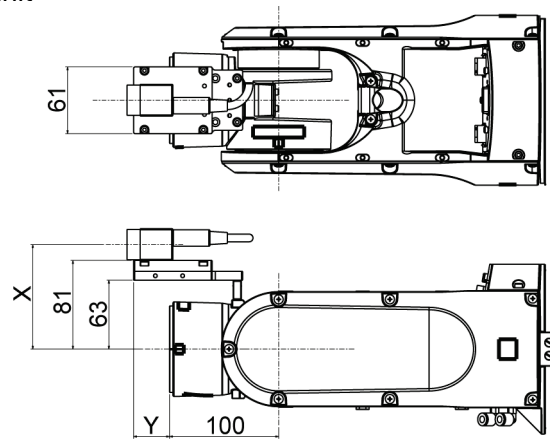


For the installation steps, refer to the following manual:

*EPSON RC+ Option Vision Guide 7.0 Hardware & Setup
Hardware 6.4.1 6-Axis Robot*

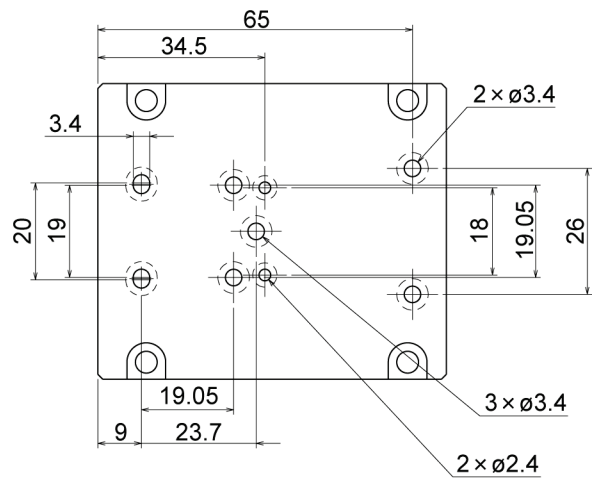
Dimension of the camera plate unit

Dimensions X and Y vary depending on the position of the camera mid plate and camera size. Refer to the table below for the values.



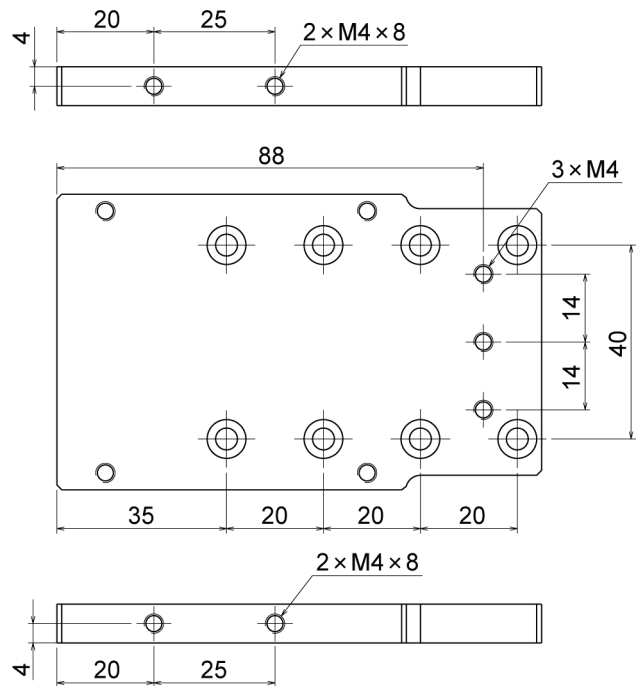
Camera adapter plate

Mounting holes to be used are different depending on the camera.



Camera mid plate

The camera mid plate uses the mounting holes A to D. By using the different mounting holes, it can be mounted to the camera base plate in the different four positions.



Camera and N6 series Manipulator Joint #5 motion range (reference values)

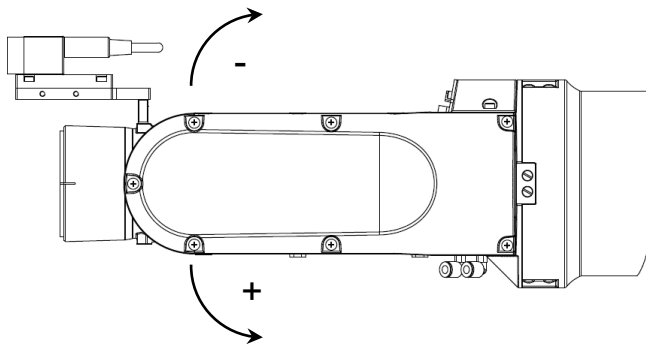
	A	B	C	D	X
USB camera, GigE camera	-75° to +125°	-65° to +125°	-55° to +125°	-45° to +125°	95.5 mm

	A	B	C	D
Y	33 mm	13 mm	-7 mm	-27 mm

The Joint #5 motion range varies depending on the mounting position of camera mid plate and the camera you are using.

The table below shows the motion range (reference values) based on the available cameras for this option and the mounting positions of the camera mid plate. The values in the table may vary depending on how to secure the cables.

Direction of the Joint #5 motion

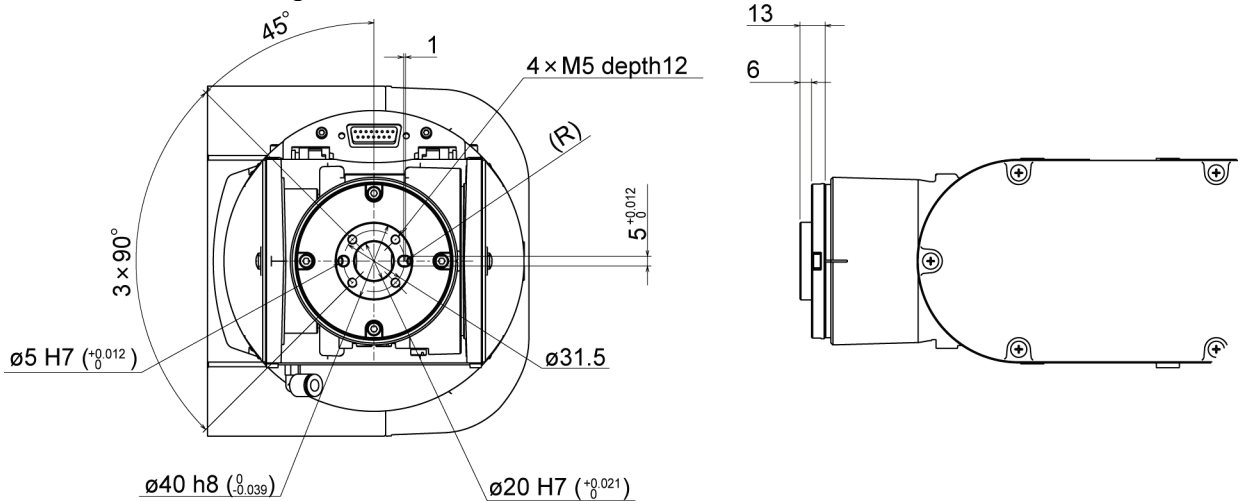


6.3 Tool Adapter (ISO Flange)

By using the tool adapter, you can mount the end effector whose dimensions are designed for the ISO flange to the N6 series Manipulators.

Parts included	Unit
ISO flange	1
Pin $\phi 2 \times 8$	2
Hexagon socket head cap bolts M4 \times 8	4

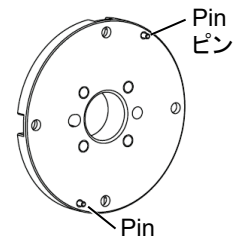
Dimensions of ISO flange



To mount the ISO flange

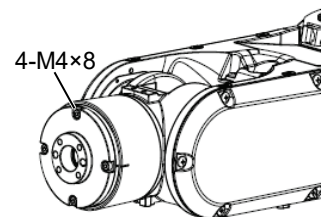
- (1) Insert the two pins into ISO flange.

Pin projection : 4 mm from the flange



- (2) Align the pin and the pin hole on the arm, and then mount the flange.

Hexagon socket head cap bolts: 4-M4 \times 8



6.4 User Wiring

Use the following options when using the internal wiring for the end effector drive.

Standard user connector kit (D-sub)

Item	Qty.	Manufacturer	Standard
Connector	2	JAE	DA-15PF-N (Solder type)
Clamp hood	2	HRS	HDA-CTH(4-40)(10) (Connector setscrew: #4-40 UNC)

6.5 M/C Cable

M/C cable is a cable that connects the Manipulator and the controller.

Item	Qty.
M/C cable	1
Hexagon socket head cap bolts: M4×8	4

One type of M/C cable is included to the Manipulator at the time of shipment.

You can purchase it additionally.

When purchasing, you can select the M/C cable from the following combinations

Cable type

Cable length

Connector shape (controller connection side)

Cable type	Length	Connector shape	Code	
Default	3m	Straight	R12NZ900YF	
		L-shaped	R12NZ900YM	
	5m	Straight	R12NZ900YH	
		L-shaped	R12NZ900YN	
	10m	Straight	R12NZ900YJ	
		L-shaped	R12NZ900YP	
	15m	Straight	R12NZ900YK	
		L-shaped	R12NZ900YQ	
	20m	Straight	R12NZ900YL	
		L-shaped	R12NZ900YR	
	Flexible	3m	Straight	R12NZ900YT
			L-shaped	R12NZ900YY
5m		Straight	R12NZ900YU	
		L-shaped	R12NZ900YZ	
10m		Straight	R12NZ900YV	
		L-shaped	R12NZ900Z1	
15m		Straight	R12NZ900YW	
		L-shaped	R12NZ900Z2	
20m		Straight	R12NZ900YX	
		L-shaped	R12NZ900Z3	

For the replacement of M/C cable, refer to *Maintenance 4.6 Replacing the M/C Cable*

Maintenance

This volume contains maintenance procedures with safety precautions for the N6 series Manipulators.

1. Safety Maintenance

Please read this chapter, this manual, and other relevant manuals carefully to understand safe maintenance procedures before performing any maintenance.

Only authorized personnel who have taken safety training should be allowed to perform the robot maintenance.

Safety training is the program for industrial robot operators to follow the laws and regulations of each nation.

The personnel who have taken safety training acquire knowledge of industrial robots (operations, teaching, etc.), inspections, and related rules/regulations.

The personnel who have completed the robot system-training and maintenance-training held by the manufacturer, dealer, or locally-incorporated company are allowed to perform maintenance.




WARNING

- Do not remove any parts unless otherwise instructed by this manual. Follow the maintenance procedure strictly as described. Improper removal of parts or improper maintenance may cause not only malfunction of the robot system but serious safety problems.
- If you have not received training, keep away from the Manipulator while the power is ON. Do not enter the operating area while the power is ON. Entering the operating area with the power ON is extremely hazardous and may cause serious safety problems as the Manipulator may move even it seems to be stopped.
- When you check the operation of the Manipulator after replacing parts, be sure to check it while you are outside of the safeguarded area. Checking the operation of the Manipulator while you are inside of the safeguarded area may cause serious safety problems as the Manipulator may move unexpectedly.
- Before operating the robot system, make sure that both the Emergency Stop switches and safeguard switch function properly. Operating the robot system when the switches do not function properly is extremely hazardous and may result in serious bodily injury and/or serious damage to the robot system as the switches cannot fulfill their intended functions in an emergency.



WARNING

- To shut off power to the robot system, disconnect the power plug from the power source. Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source.
- Before performing any replacement procedure, turn OFF the Controller and related equipment, and then disconnect the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system.
- When connecting or replacing the brake release unit and the external short connector, turn OFF the power to the Controller and the brake release unit. Inserting and removing the connector while the power is ON may result in electrical shock.



CAUTION

- Be sure to connect the cables properly. Do not allow unnecessary strain on the cables. (Do not put heavy objects on the cables. Do not bend or pull the cables forcibly.) It may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system.
- If the Manipulator is operated without connecting the brake release unit and the external short connector, the brakes cannot be released and it may cause damage on them. After using the brake release unit, be sure to connect the external short connector to the Manipulator, or check connection of the connector for the brake release unit.
- The Manipulator arms may become hot after the Manipulator operation due to heat generation of the motors. Be careful when performing maintenance.

2. General Maintenance

This chapter describes maintenance inspection procedures. Performing maintenance inspection properly is essential to prevent trouble and ensure safety.
 Be sure to perform the maintenance inspections in accordance with the schedule.

2.1 Maintenance Inspection

2.1.1 Schedule for Maintenance Inspection

Inspection points are divided into five stages: daily, monthly, quarterly, biannual, and annual. The inspection points are added every stage.
 If the Manipulator is operated for 250 hours or longer per month, the inspection points must be added every 250 hours, 750 hours, 1500 hours, and 3000 hours operation.

	Inspection Point					
	Daily inspection	Monthly inspection	Quarterly inspection	Biannual inspection	Annual inspection	Overhaul*
1 month (250 h)	Inspect every day	√				
2 months (500 h)		√				
3 months (750 h)		√	√			
4 months (1000 h)		√				
5 months (1250 h)		√				
6 months (1500 h)		√	√	√		
7 months (1750 h)		√				
8 months (2000 h)		√				
9 months (2250 h)		√	√			
10 months (2500 h)		√				
11 months (2750 h)		√				
12 months (3000 h)		√	√	√	√	
13 months (3250 h)		√				
⋮	⋮	⋮	⋮	⋮	⋮	⋮
20000 h						√

h = hour

*Overhaul (parts replacement)

2.1.2 Inspection Point

Inspection While the Power is OFF (Manipulator is not operating)

Inspection Point	Inspection Place	Daily	Monthly	Quarterly	Biannual	Annual
Check looseness or backlash of bolts/screws. Tighten them if necessary. (For the tightening torque, refer to <i>Maintenance: 2.4 Tightening Hexagon Socket Head Cap Bolts.</i>)	End effector mounting bolts	√	√	√	√	√
	Manipulator mounting bolts	√	√	√	√	√
	Each arm locking bolts	√	√	√	√	√
	Bolts/screws around shaft					√
	Bolts/screws securing motors, reduction gear units, etc.					√
Check looseness of connectors. If the connectors are loosen, push it securely or tighten.	External connectors on Manipulator (on the connector plates etc.)	√	√	√	√	√
	Manipulator cable unit		√	√	√	√
Visually check for external defects. Clean up if necessary.	External appearance of Manipulator	√	√	√	√	√
	External cables		√	√	√	√
Check the leak of grease for cables.	Joint #1 to Joint #4	√	√			
Check for bends or improper location. Repair or place it properly if necessary.	Safeguard etc.	√	√	√	√	√
Check tension of timing belts. Tighten it if necessary.	Inside of Arms #4				√	√
Grease conditions	Refer to <i>Maintenance: 2.3 Greasing.</i>					
Battery	Refer to <i>Maintenance: 6. Battery.</i>					
Check either the external short connector or the brake release unit connector is connected.	The external short connector on the back side of the Manipulator, or the brake release unit connector.	√	√	√	√	√

Inspection While the Power is ON (Manipulator is operating)

Inspection Point	Inspection Place	Daily	Monthly	Quarterly	Biannual	Annual
Check motion range	Each joint					√
Check whether unusual sound or vibration occurs.	Whole	√	√	√	√	√
Measure the accuracy repeatedly by a dial gauge.	Whole					√
When brake release unit is installed: Connect the brake release unit and check the sound of the Electromagnetic brake with the brake released. If there is no sound, replace the actuator unit. When brake release unit is not installed: Execute Brake off command (brake off, joint #) from the command window of the EPSON RC+ while the motors are OFF, and then check the sound of the Electromagnetic brake. If there is no sound, replace the actuator unit. Note: The Joint #1 is not equipped with the brake. The Joints #2 to #6 have the brakes.	Brake	√	√	√	√	√

2.2 Overhaul (Parts Replacement)



- Overhaul timing is based on an assumption that all joints are operated for equal distance. If a particular joint has a high duty or high load, it is recommended to overhaul all joints (as many as possible) before exceeding 20,000 operation hours with the joint as a basis.

The parts for the Manipulator joints may cause accuracy decline or malfunction due to deterioration of the Manipulator resulting from long term use. In order to use the Manipulator for a long term, it is recommended to overhaul the parts (parts replacement).

The time between overhauls is 20,000 operation hours of the Manipulator as a rough indication.

However, it may vary depending on usage condition and degree of the load (such as when operated with the maximum motion speed and maximum acceleration / deceleration in continuous operation) applied on the Manipulator.



For the EPSON RC+ 7.0 Ver. 7.2.x or later (firmware Ver.7.2.x.x or later), the recommended replacement time for the parts subject to maintenance (motors, reduction gear units, and timing belts) can be checked in the [Maintenance] dialog box of the EPSON RC+ 7.0.

For details, refer to the following manual.

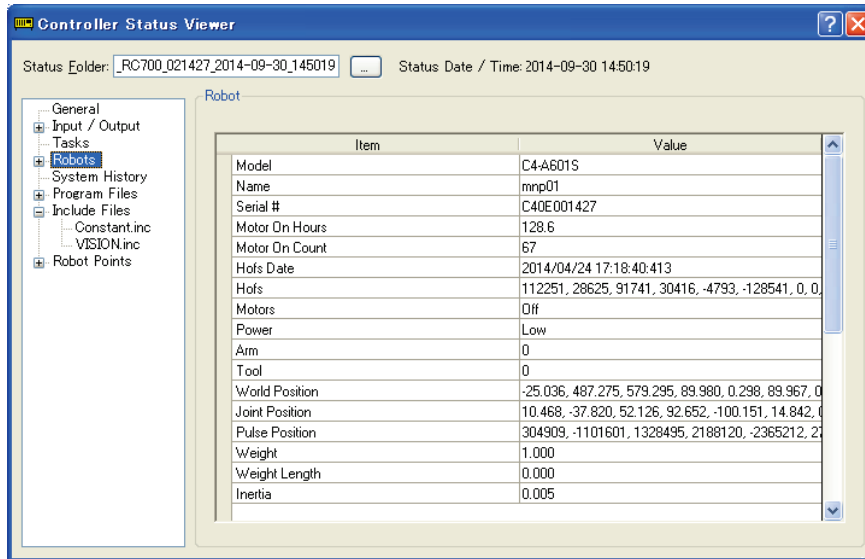
Robot Controller RC700 / RC700-A Maintenance 6. Alarm

Note:

The recommended replacement time for the maintenance parts is when it reaches the L10 life (time until 10% failure probability). In the [Maintenance] dialog box, the L10 life is displayed as 100%.

The Manipulator operation hours can be checked in [Controller Status Viewer] dialog box-[Motor On Hours].

- (1) Select EPSON RC+ menu-[Tools]-[Controller] to open the [Controller Tools] dialog box.
- (2) Click the <View Controller Status> button to open the [Browse For Folder] dialog box.
- (3) Select the folder where the information is stored.
- (4) Click <OK> to view the [Controller Status Viewer] dialog box.
- (5) Select [Robot] from the tree menu on the left side.



For the parts subject to overhaul, refer to *Maintenance 9. Maintenance Parts List*.


For details of replacement of each part, refer to the *Maintenance* section.


Please contact the supplier of your region for further information.

2.3 Greasing

The actuator units and reduction gear units need greasing regularly. Only use the grease specified in the following table.

For the greasing procedure, please contact the supplier of your region.

 WARNING	<ul style="list-style-type: none"> Before greasing, turn OFF the Controller and related equipment, and then disconnect the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system.
--	--

 CAUTION	<ul style="list-style-type: none"> Keep enough grease in the Manipulator. Operating the Manipulator with insufficient grease will cause the noise or damage sliding parts and/or result in insufficient function of the Manipulator. Once the parts are damaged, a lot of time and money will be required for the repairs. If grease gets into your eyes, mouth, or on your skin, follow the instructions below. <ul style="list-style-type: none"> If grease gets into your eyes: Flush them thoroughly with clean water, and then see a doctor immediately. If grease gets into your mouth: If swallowed, do not induce vomiting. See a doctor immediately. If grease just gets into your mouth, wash out your mouth with water thoroughly. If grease gets on your skin: Wash the area thoroughly with soap and water.
--	--


	Greasing part	Greasing Interval	Grease
Joint #1, #2, 3, #4, and #5	Reduction gear unit	Overhaul timing	SK-1A
Joint #6			SK-2
Joint #6	Bevel gear	Once a year (every 8000 hours)	SK-2


Joint #1, 2, 3, 4, 5, 6 reduction gear units

As a rough indication, perform greasing in 10,000 hours or 2 years, whichever comes first.


However, it may vary depending on usage condition and degree of the load (such as when operated with the maximum motion speed and maximum acceleration / deceleration in continuous operation) applied on the Manipulator.

	Name	Quantity	Note
Maintenance parts	Grease up kit	1	1674592 (A set of grease gun, nipple, and extension jig)
	Grease plug	1	1656158
	O-ring for grease inlet	1	1657289
Tools	Hexagonal wrench (width across flats: 2.5 mm)	1	For M3 hexagon socket head cap bolts
	Cross-point screwdriver (#2)	1	For cross-recessed head screws
	Flat head screwdriver	1	For grease plug

NOTE
 Before greasing, move the Manipulator so that the grease inlet is not directed down.
 Do not remove the grease plug while the grease inlet is directed down. Otherwise the oil content separated from the grease may leak out.

NOTE
 Do not use any tool to install and remove the grease nipple and grease line extension jig.
 Always handle them directly by your hand.
 If the grease nipple or grease line extension jig is installed or removed with a tool such as wrench, they will get damage.

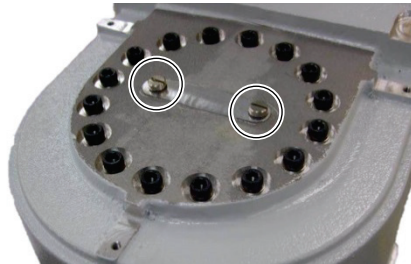
2.3.1 Joint #1 Reduction Gear Unit

NOTE  If the Manipulator is mounted on the ceiling, the grease inlet is directed down. Note that the oil content separated from the grease will leak out if removing the grease plug of the Joint #1 grease inlet while it is directed down.

Greasing

- (1) Remove the Joint #1 inside cover.
For details, refer to *Maintenance: 3. Covers.*
- (2) Remove the two grease plug from the Joint #1 grease inlet located inside the Arm #1.
- (3) Attach the grease nipple to one side of the Joint #1 grease inlet.

N6-A1000**



N6-A850**R



- (4) Inject grease from the grease nipple using a grease gun

Grease: SK-1A

Grease amount: 8g

N6-A1000**

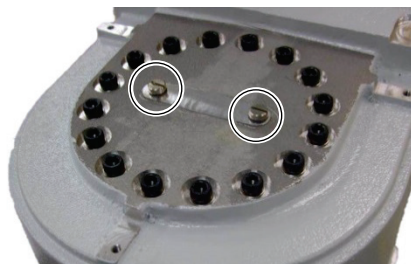


N6-A850**R



- (5) Remove the grease nipple from the Joint #1 grease inlet.
- (6) Attach the grease plug to the Joint #1 grease inlet.
If the grease plug is damaged or deteriorated, replace it with a new one.

N6-A1000**



N6-A850**R



- (7) Install the Joint #1 inside cover.

For details, refer to *Maintenance: 3. Covers.*

2.3.2 Joint #2 Reduction Gear Unit

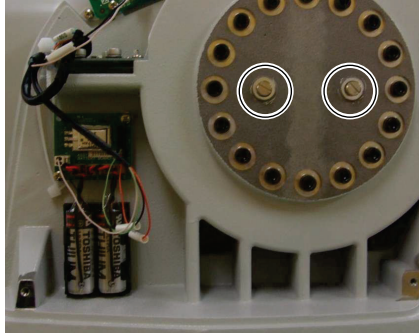
Greasing

- (1) Remove the Joint #2 outside cover.

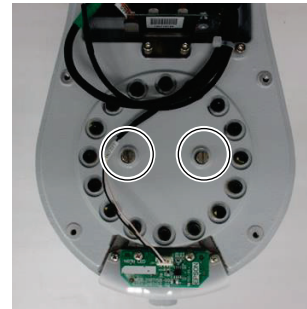
For details, refer to *Maintenance: 3. Covers*.

- (2) Remove the two grease plug from the Joint #2 grease inlet located inside the Arm #2.

N6-A1000**



N6-A850**R

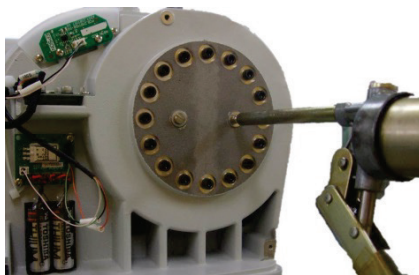


- (3) Attach the grease nipple to one side of the Joint #2 grease inlet.
- (4) Inject grease from the grease nipple using a grease gun.

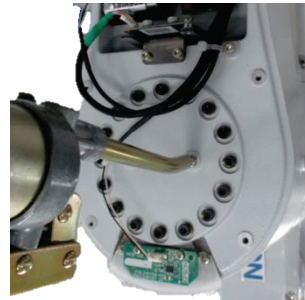
Grease: SK-1A

Grease amount: 7g

N6-A1000**



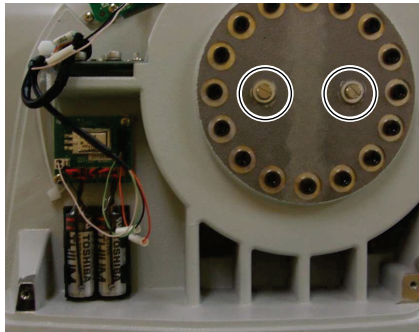
N6-A850**R



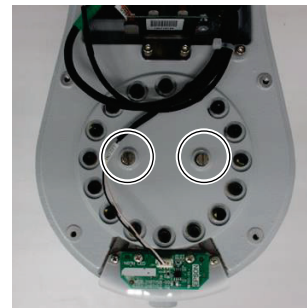
- (5) Remove the grease nipple from the Joint #2 grease inlet.
- (6) Attach the grease plug to the Joint #2 grease inlet.

If the grease plug is damaged or deteriorated, replace it with a new one.

N6-A1000**



N6-A850**R



- (7) Install the Joint #2 outside cover.

For details, refer to *Maintenance: 3. Covers*.

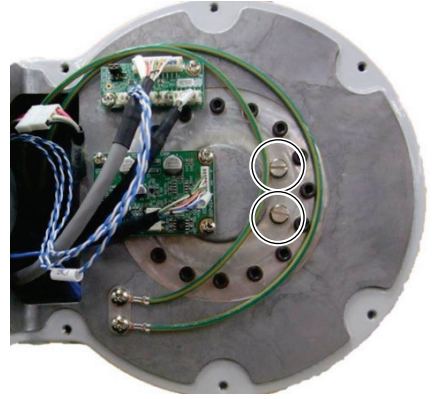
2.3.3 Joint #3 Reduction Gear Unit

Greasing

- (1) Remove the Arm #3 cover.

For details, refer to *Maintenance: 3. Covers*.

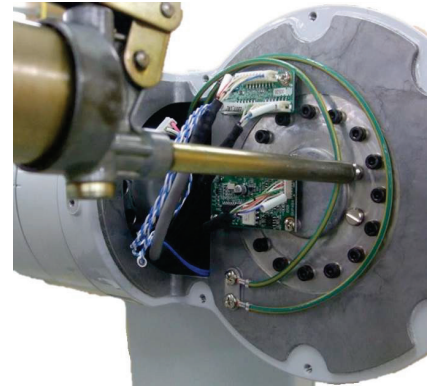
- (2) Remove the two grease plug from the Joint #3 grease inlet located inside the Arm #3.
- (3) Attach the grease nipple to one side of the Joint #3 grease inlet.



- (4) Inject grease from the grease nipple using a grease gun.

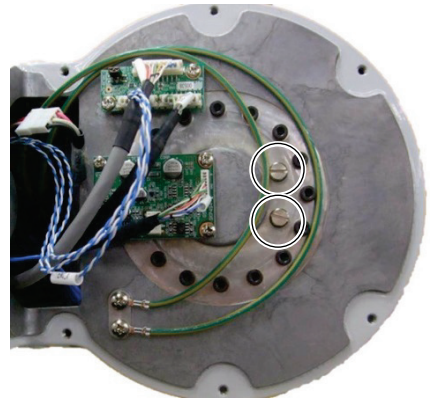
Grease: SK-1A

Grease amount: 4g



- (5) Remove the grease nipple from the Joint #3 grease inlet.
- (6) Attach the grease plug to the Joint #3 grease inlet.

If the grease plug is damaged or deteriorated, replace it with a new one.



- (7) Install the Arm #3 cover.

For details, refer to *Maintenance: 3. Covers*.

2.3.4 Joint #4 Reduction Gear Unit

Greasing

- (1) Remove the two grease plug from the Joint #4 grease inlet of the Arm #4.
- (2) Attach the grease nipple to one side of the Joint #4 grease inlet.



- (3) Inject grease from the grease nipple using a grease gun.

Grease: SK-1A

Grease amount: 2g



- (4) Remove the grease nipple from the Joint #4 grease inlet.
- (5) Attach the grease plug to the Joint #4 grease inlet.

If the grease plug is damaged or deteriorated, replace it with a new one.



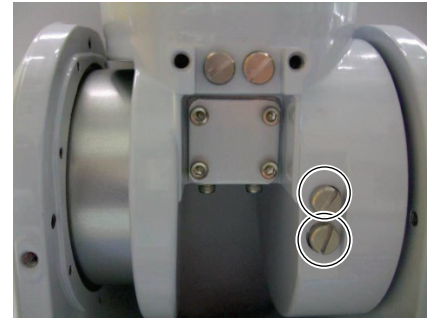
2.3.5 Joint #5 Reduction Gear Unit

Greasing

- (1) Remove the grease plug from the two Joint #5 grease inlet of the Arm #5.
- (2) Attach the grease nipple to one side of the Joint #5 grease inlet.



Be careful not to confuse it with the Joint #6 grease inlet.



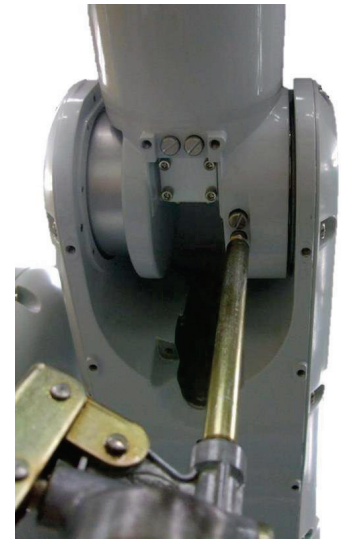
- (3) Inject grease from the grease nipple using a grease gun.

Grease: SK-1A

Grease amount: 1g

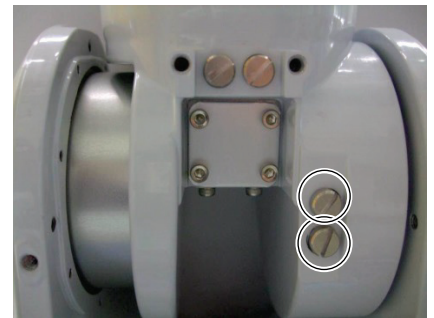


Be careful not to mix with the grease used in the Joint #6 (SK-2).



- (4) Remove the grease nipple from the Joint #5 grease inlet.
- (5) Attach the grease plug to the Joint #5 grease inlet.

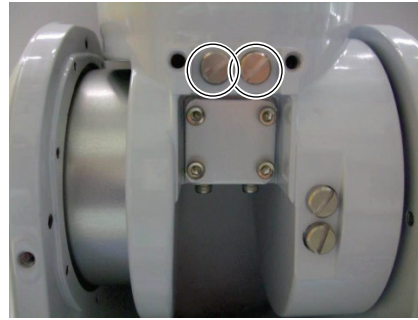
If the grease plug is damaged or deteriorated, replace it with a new one.




2.3.6 Joint #6 Reduction Gear Unit

Greasing

- (1) Remove the grease plug from the two Joint #6 grease inlet of the Arm #5.
- (2) Attach the grease nipple to one side of the Joint #6 grease inlet.




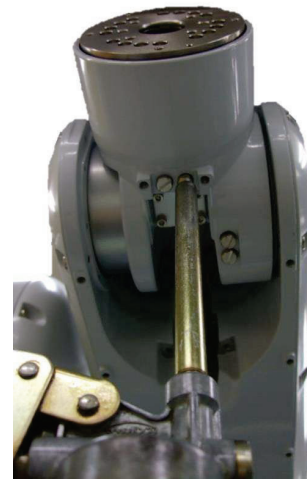
NOTE  Be careful not to confuse it with the Joint #5 grease inlet.

- (3) Inject grease from the grease nipple using a grease gun.

Grease: SK-2

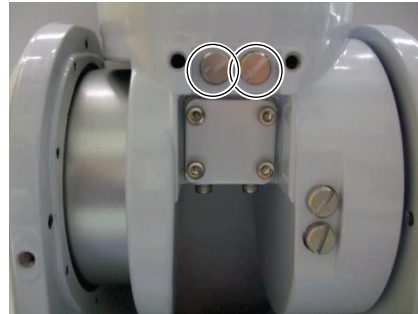
Grease amount: 0.7g

NOTE  Be careful not to mix with the grease used in the Joint #5 (SK-1A).



- (4) Remove the grease nipple from the Joint #6 grease inlet.
- (5) Attach the grease plug to the Joint #6 grease inlet.

If the grease plug is damaged or deteriorated, replace it with a new one.

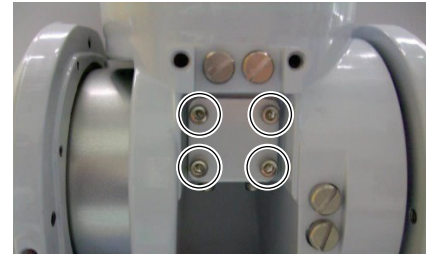


2.3.7 Joint #6 Bevel Gear

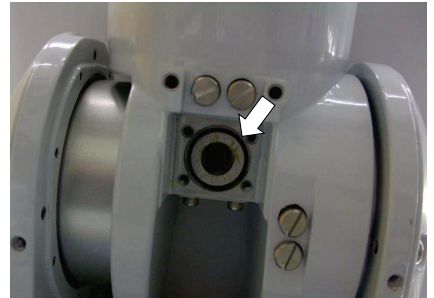
Greasing

- (1) Remove the Arm #5 grease inlet cover.

Hexagon socket head cap bolts: 4-M3×6



- (2) Remove the O-ring located in the base groove.



- (3) Apply grease to the mating surface of the bevel gear inside the Arm #5.

Grease: SK-2

Grease amount: 3g



- (4) Apply a thin coat of grease to the O-ring.
Fit the O-ring into the base groove.

Grease: SK-2



NOTE



Do not allow the O-ring to come out of the groove.

NOTE

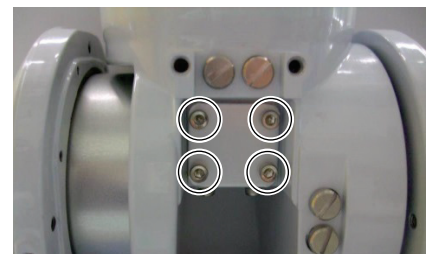


If the O-ring is swollen, damaged, or deteriorated, replace it with a new one.

- (5) Install the Arm #5 grease inlet cover.

Hexagon socket head cap bolts: 4-M3×6

Tightening torque: 2.0 ± 0.1 N·m



2.4 Tightening Hexagon Socket Head Bolts

Hexagon socket head cap bolts (hereinafter, “bolts”) are used in places where mechanical strength is required. These bolts are fastened with the tightening torque shown in the following tables.

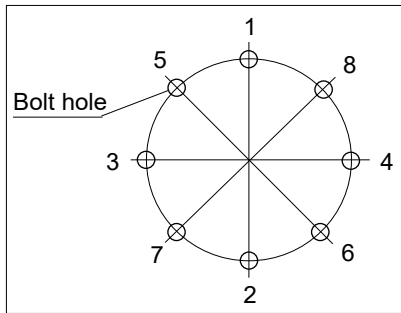
When it is required to refasten the bolts in some procedures in this manual (except special cases as noted), use a torque wrench so that the bolts are fastened with appropriate tightening torque as shown below.

Bolt	Tightening Torque
M2.5	1.4 ± 0.1 N·m (14 ± 1 kgf·cm)
M3	2.0 ± 0.1 N·m (21 ± 1 kgf·cm)
M4	4.0 ± 0.2 N·m (41 ± 2 kgf·cm)
M5	8.0 ± 0.4 N·m (82 ± 4 kgf·cm)
M6	13.0 ± 0.6 N·m (133 ± 6 kgf·cm)
M8	32.0 ± 1.6 N·m (326 ± 16 kgf·cm)
M10	58.0 ± 2.9 N·m (590 ± 30 kgf·cm)
M12	100.0 ± 5.0 N·m (1,020 ± 51 kgf·cm)

See below for the set screw.

Set Screw	Tightening Torque
M3	0.9 ± 0.1 N·m (9 ± 1 kgf·cm)
M4	2.4 ± 0.1 N·m (26 ± 1 kgf·cm)
M5	3.9 ± 0.2 N·m (40 ± 2 kgf·cm)
M6	8.0 ± 0.4 N·m (82 ± 4 kgf·cm)

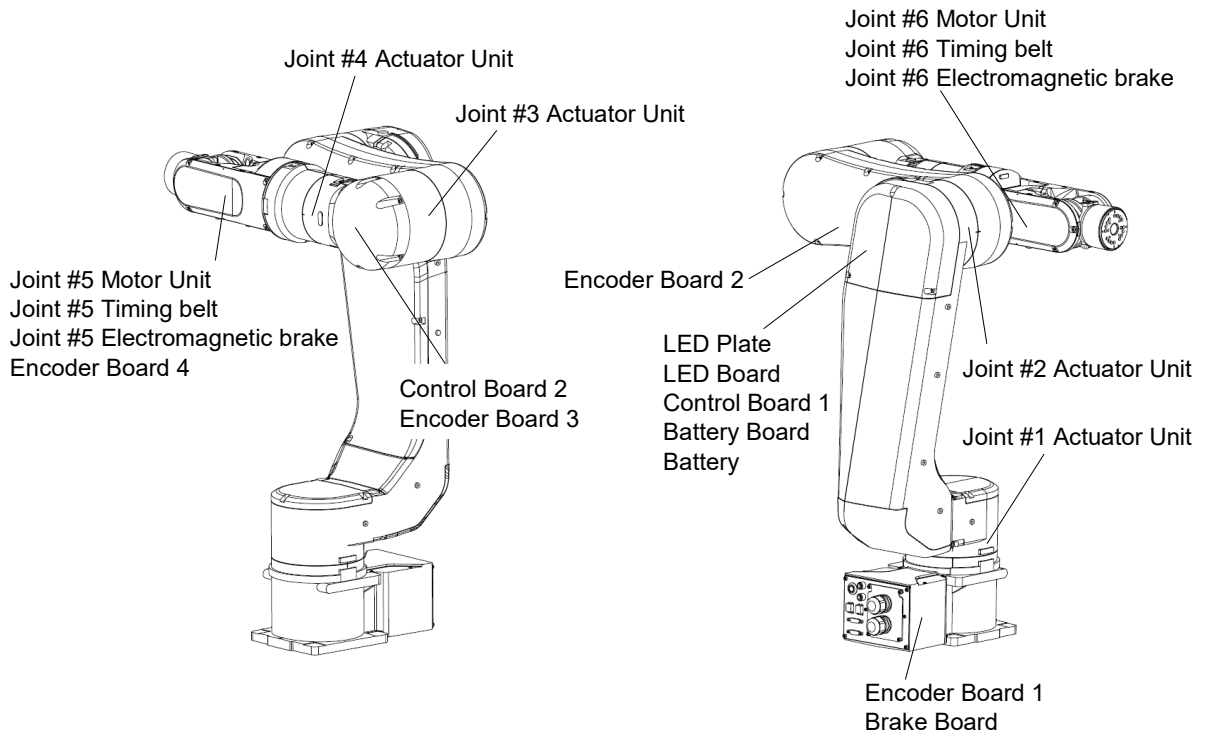
It is recommended to fasten the bolts aligned on a circumference in a crisscross pattern as shown in the figure below.



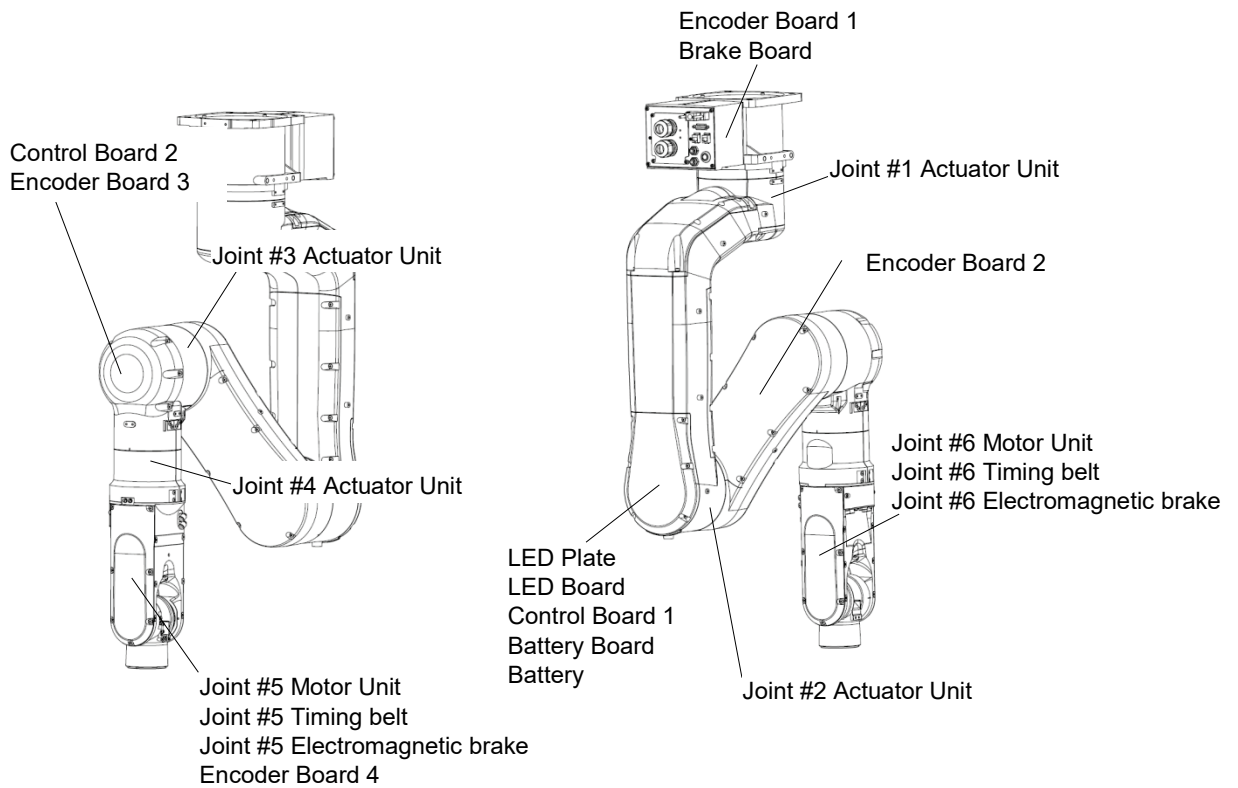
Do not fasten all bolts securely at one time. Divide the number of times to fasten the bolts into two or three and fasten the bolts securely with a hexagonal wrench. Then, use a torque wrench to fasten the bolts with tightening torques shown in the table above.

2.5 Layout of Maintenance Parts

N6-A1000**



N6-A850**R



3. Covers

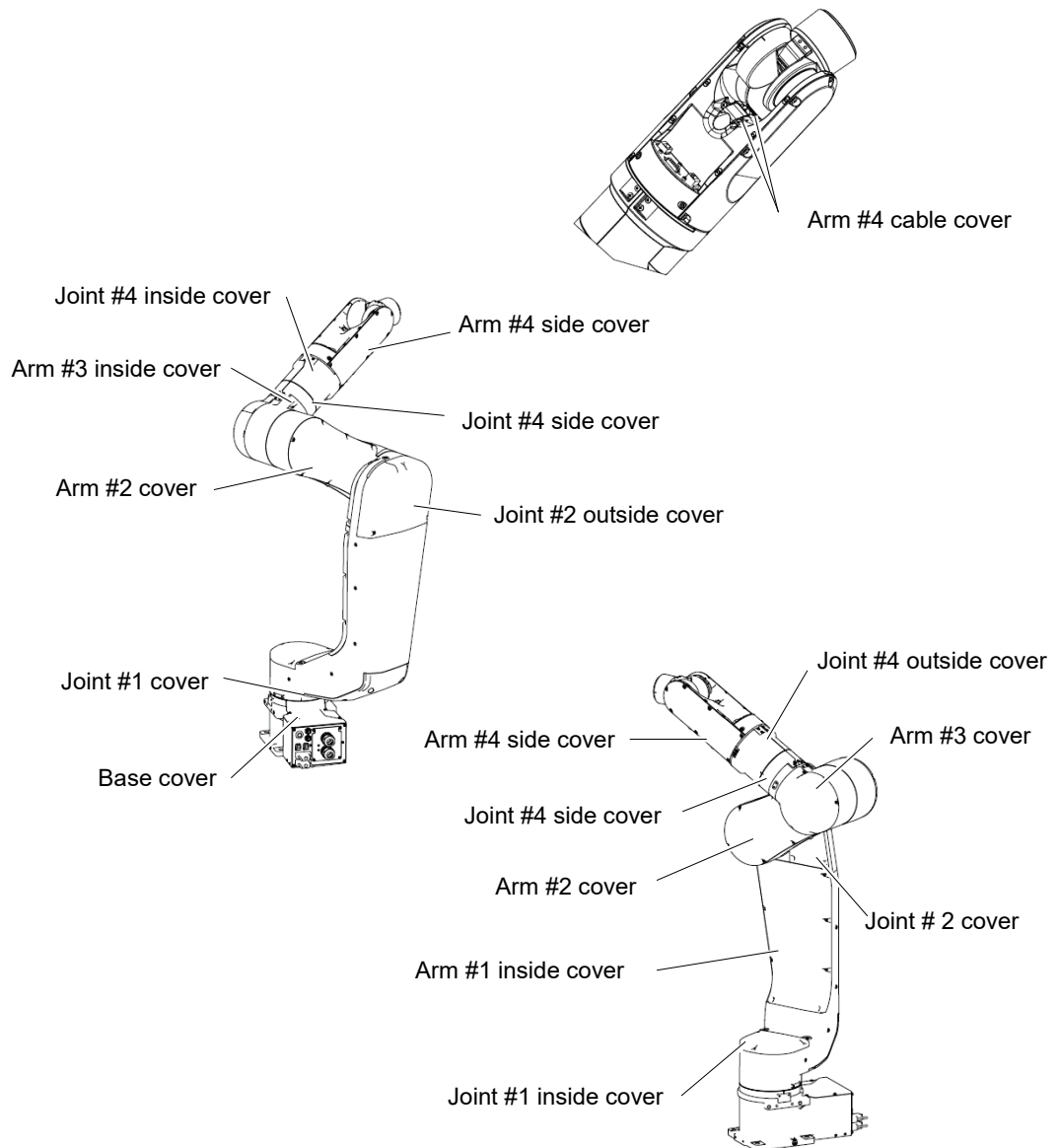
This chapter describes removal and installation steps of the covers necessary for maintenance.



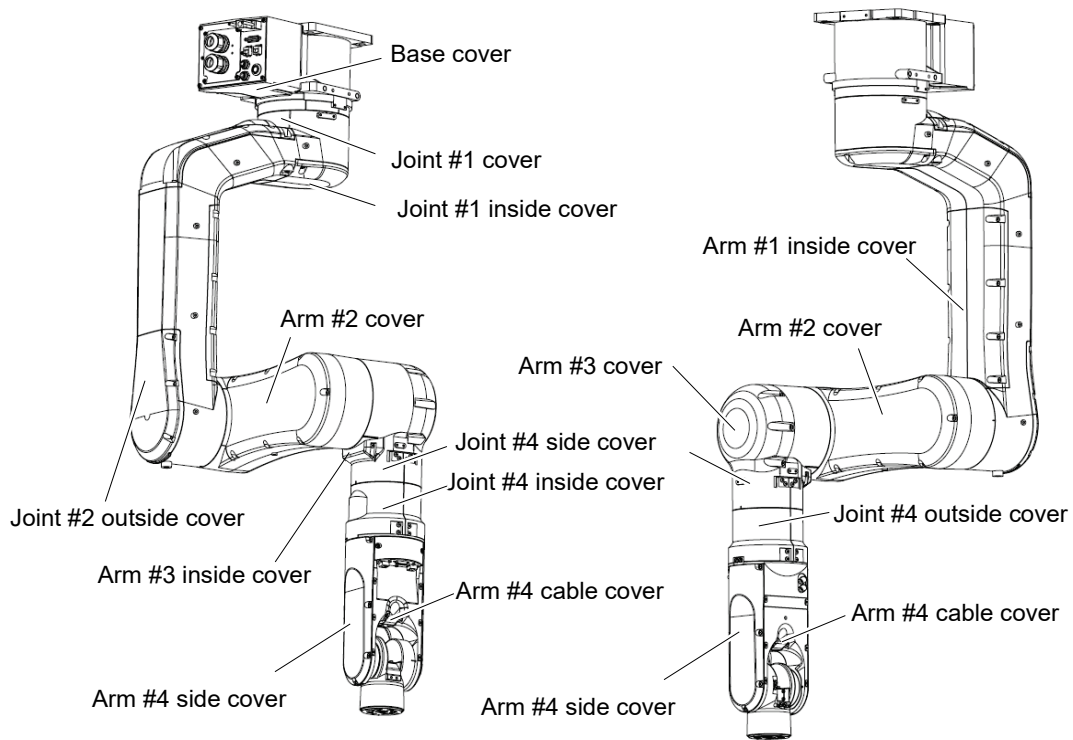
WARNING

- Do not connect or disconnect the motor connectors while the power to the robot system is turned ON. Connecting or disconnecting the motor connectors with the power ON is extremely hazardous and may result in serious bodily injury as the Manipulator may move abnormally, and also may result in electric shock and/or malfunction of the robot system.
- To shut off power to the robot system, disconnect the power plug from the power source. Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source.
- Before performing any replacement procedure, turn OFF the Controller and related equipment, and then disconnect the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system.
- Be careful not to get any foreign substances in the Manipulator, connectors, and pins during maintenance. Turning ON the power to the robot system when any foreign substances exist in them is extremely hazardous and may result in electric shock and/or malfunction of the robot system.

N6-A1000**



N6-A850**R



Standard-Model (N6-A1000S*, N6-A850S*R)

	Name		Qty.	Code, Note	
Maintenance part	Cover (Standard model)	Base	Base cover	1	1749181
		Arm #1 (N6-A1000)	Joint # 1 cover	1	1739213
			Joint # 1 inside cover	1	1739211
			Arm # 1 inside cover	1	1739215
			Joint # 2 outside cover	1	1739214
			Joint # 2 cover	1	1739212
		Arm #1 (N6-A850)	Joint # 1 cover	1	1755217
			Joint # 1 inside cover	1	1755218
			Arm # 1 inside cover	1	1755220
			Joint # 2 outside cover	1	1755219
		Arm #2	Arm # 2 cover	2	1749176
		Arm #3	Arm # 3 inside cover	1	1739218
			Arm # 3 cover	1	1749177
			Joint # 4 side cover	2	1749178
		Arm #4	Joint # 4 inside cover	1	1739223
			Joint # 4 outside cover	1	1749180
			Arm # 4 side cover	2	1749179
			Arm # 4 cable cover	2	1739221
		Tool	Cross-point screwdriver (#2)		1

Cleanroom-Model (N6-A1000C*, N6-A850C*R)

	Name		Qty.	Code, Note	
Maintenance part	Cover (Cleanroom model)	Base	Base cover	1	1761617
		Arm #1 (N6-A1000)	Joint # 1 cover	1	1755506
			Joint # 1 inside cover	1	1755504
			Arm # 1 inside cover	1	1755508
			Joint # 2 outside cover	1	1755507
			Joint # 2 cover	1	1755505
		Arm #1 (N6-A850)	Joint # 1 cover	1	1757779
			Joint # 1 inside cover	1	1757780
			Arm # 1 inside cover	1	1757782
			Joint # 2 outside cover	1	1757781
		Arm #2	Arm # 2 cover	2	1761612
		Arm #3	Arm # 3 inside cover	1	1755511
			Arm # 3 cover	1	1761613
			Joint # 4 side cover	2	1761614
		Arm #4	Joint # 4 inside cover	1	1755514
			Joint # 4 outside cover	1	1761616
			Arm # 4 side cover	2	1761615
			Arm # 4 cable cover	2	1739221
		Tool	Cross-point screwdriver (#2)		1

3.1 Base Cover



CAUTION

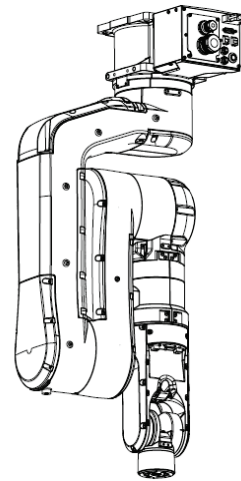
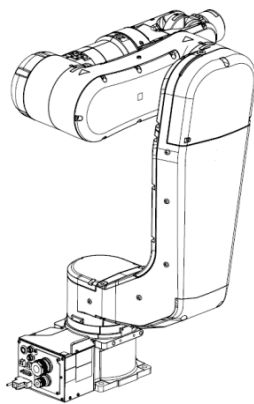
- When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.

Removal

- (1) Move the Arm #1 to a position where you can remove the the base cover.

N6-A1000**

N6-A850**R

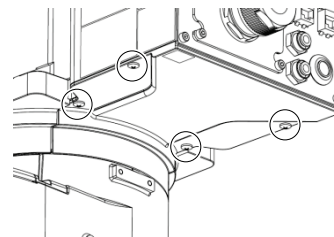
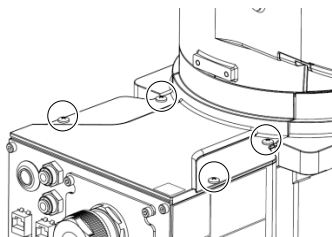


- (2) Remove the screws, and then remove the base cover.

Cross recessed binding head machine screw: 4-M4×8

N6-A1000**

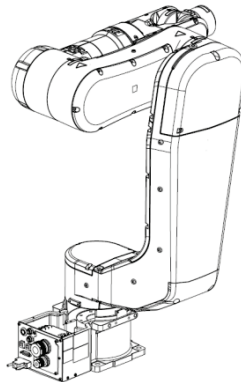
N6-A850**R



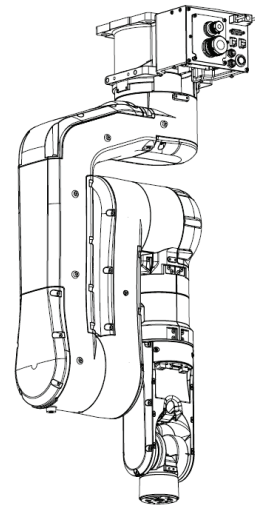
Installation

- (1) Move the Arm #1 to a position where you can install the base cover.

N6-A1000**



N6-A850**R

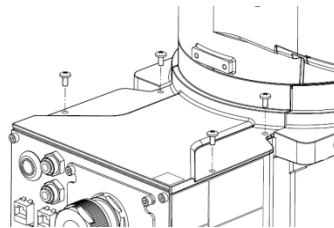


- (2) Install the base cover.

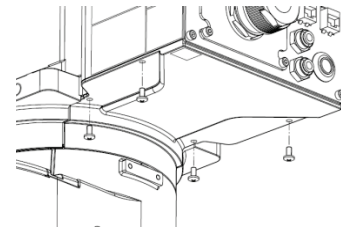
Cross recessed binding head machine screw: 4-M4×8

Tightening torque: 0.45 ± 0.05 N·m

N6-A1000**



N6-A850**R



NOTE



Be careful not to get the cables caught in the cover.

NOTE



The cover may get broken if it is fastened too tight.

Be careful not to exceed the above tightening torque.

3.2 Joint #1 Cover

3.2.1 N6-A1000** (Joint #1 Cover)



CAUTION

- When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.

Removal

- (1) Remove the base cover.

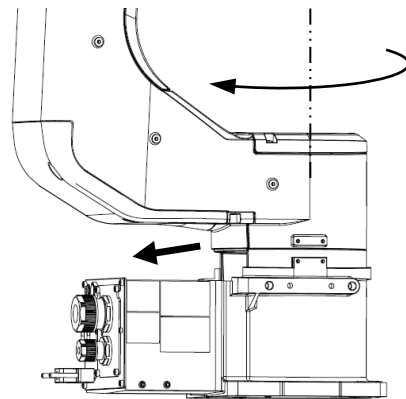
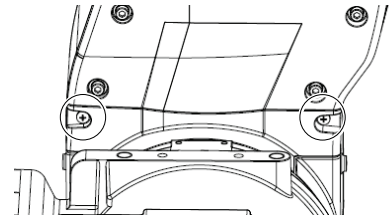
For more details, refer to *Maintenance 3.1 Base Cover*.

- (2) Remove the screws of the Joint #1 cover.

Cross recessed binding head machine screw:
2-M4×8

- (3) Move the Arm #1 to the origin position while holding the Joint #1 cover by hand so as not to fall.

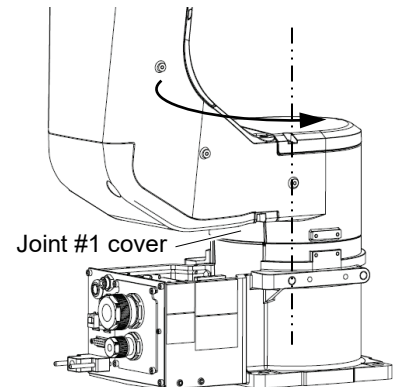
- (4) Remove the Joint #1 cover.



NOTE Do not remove forcibly when the cover is got caught on the Manipulator. The cover may get broken.

Installation

- (1) Make sure that the base cover is removed and the Arm #1 is at the origin position.
For procedures to remove the base cover, refer to *Maintenance 3.1 Base Cover*.
- (2) Set the Joint #1 cover to the installation position and move the Arm #1 to a position where you can install the cover easily.



NOTE



When moving the arm, be careful not to get the cover caught on the Manipulator. If you move the cover while the cover is got caught on the Manipulator, the cover may get broken.

- (3) Fix the Joint #1 cover with the screws.

Cross recessed binding head machine screw:

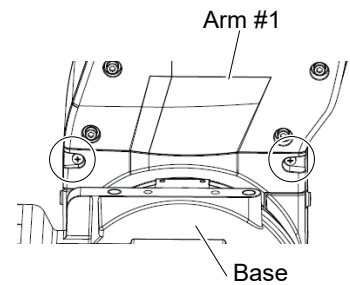
2-M4×8

Tightening torque: 0.45 ± 0.05 N·m

NOTE




The cover may get broken if it is fastened too tight. Be careful not to exceed the above tightening torque.



- (4) Install the base cover.

For more details, refer to *Maintenance 3.1 Base Cover*.

3.2.2 N6-A850**R (Joint #1 Cover)

 CAUTION	<p>■ When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system.</p> <p>When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.</p>
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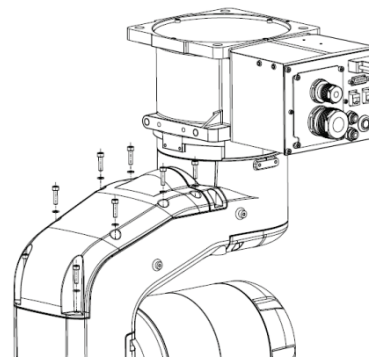
Removal

- (1) Remove the base cover.

For more details, refer to *Maintenance 3.1 Base Cover*.

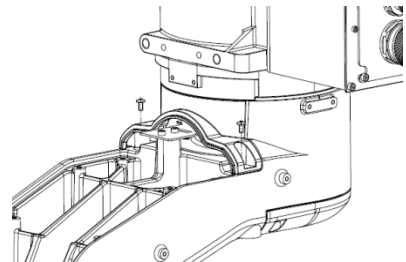
- (2) Remove the Arm #1 outside cover.

Hexagon socket head cap bolts:
8-M5×20 (with plain washer)



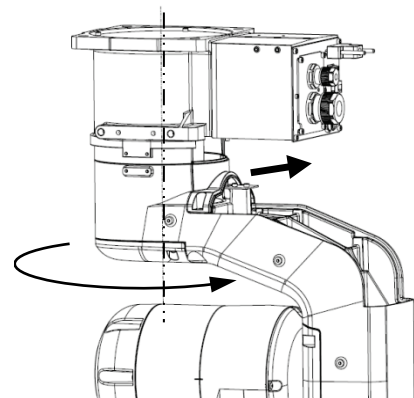
- (2) Remove the screws of the Joint #1 cover.

Cross recessed binding head machine screw:
2-M4×8



- (3) Hold the Joint #1 cover by hand so as not to fall, and move the Arm #1 to the origin position.

- (4) Remove the Joint #1 cover.



NOTE

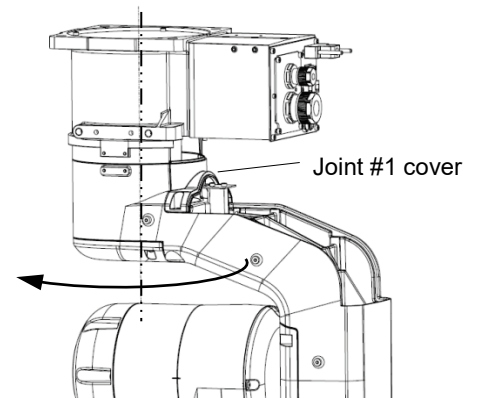


Do not remove forcibly when the cover is got caught on the Manipulator. The cover may get broken.

Installation

- (1) Make sure that the base cover is removed and the Arm #1 is at the origin position.
For procedures to remove the base cover, refer to *Maintenance 3.1 Base Cover*.

- (2) Set the Joint #1 cover to the installation position and move the Arm #1 to a position where you can install the cover easily.



NOTE



When moving the arm, be careful not to get the cover caught on the Manipulator. If you move the cover while the cover is got caught on the Manipulator, the cover may get broken.

- (3) Fix the Joint #1 cover with the screws.

Cross recessed binding head machine screw:

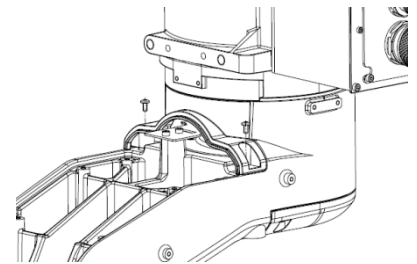
2-M4×8

Tightening torque: 0.45 ± 0.05 N·m

NOTE



The cover may get broken if it is fastened too tight. Be careful not to exceed the above tightening torque.

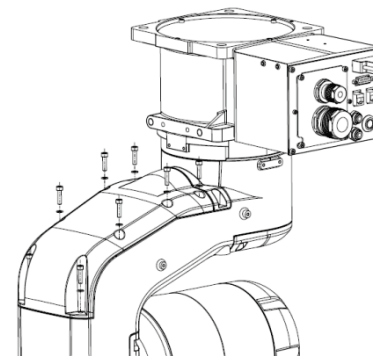


- (4) Install the Arm #1 outside cover.

Hexagon socket head cap bolts:

8-M5×20 (with plain washer)

Tightening torque: 8.0 ± 0.4 N·m



- (5) Install the base cover.

For more details, refer to *Maintenance 3.1 Base Cover*.

3.3 Joint #1 Inside Cover

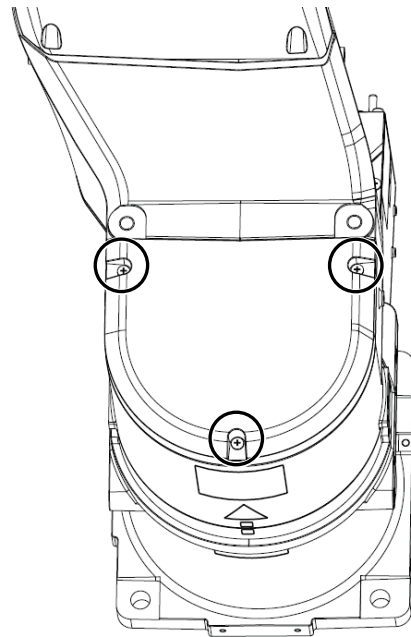
3.3.1 N6-A1000** (Joint #1 Inside Cover)

Removal Remove the screws, and then remove the Joint #1 inside cover.

Cross recessed binding head machine screw:
3-M4×8

Installation Set the Joint #1 inside cover to the Manipulator and fix it with the screws.

Cross recessed binding head machine screw:
3-M4×8
Tightening torque: 0.45 ± 0.05 N·m

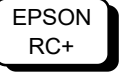


NOTE The cover may get broken if it is fastened too tight.
Be careful not to exceed the above tightening torque.

3.3.2 N6-A850**R (Joint #1 Inside Cover)

Removal


- (1) Turn ON the Controller.
- (2) Release the brake on the Joint #2.

 Command
 > brake off, 2



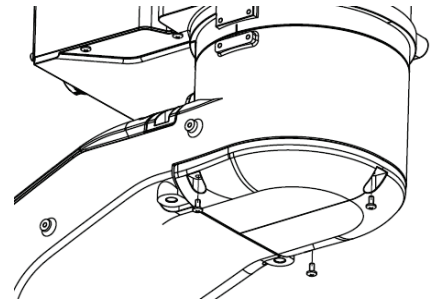
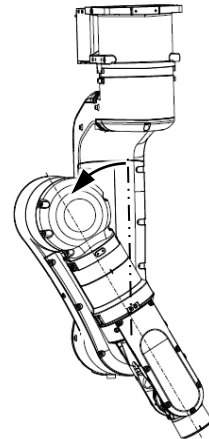
NOTE When releasing the brake, be careful of the arm falling due to its own weight.

- (3) Move the Arm #2 about 30 degrees.
- (4) Operate the brake of the Joint #2.

 Command
 > brake on, 2

- (5) Turn OFF the Controller.
- (6) Remove the screws, and then remove the Joint #1 inside cover.

Cross recessed binding head machine screw:
3-M4×8

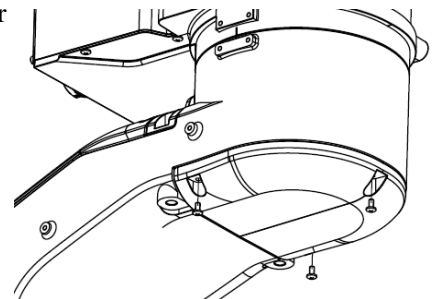


Installation

- (1) Set the Joint #1 inside cover to the Manipulator and fix it with the screws.

Cross recessed binding head machine screw:
3-M4×8


Tightening torque: 0.45 ± 0.05 N·m



NOTE The cover may get broken if it is fastened too tight. Be careful not to exceed the above tightening torque.

3.4 Arm #1 Inside Cover

3.4.1 N6-A1000** (Arm #1 Inside Cover)


 CAUTION	<ul style="list-style-type: none"> ■ When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.
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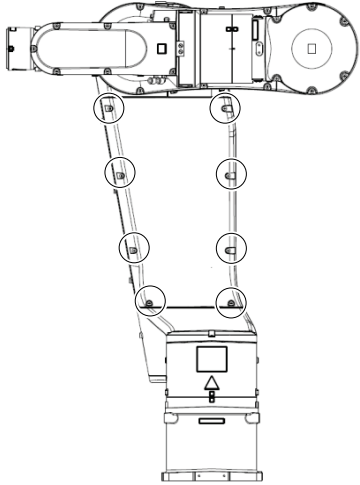
Removal Remove the screws, and then remove the Arm #1 inside cover.

Cross recessed binding head machine screw: 8-M4×8


Installation Install the Arm #1 inside cover to the Manipulator and fix it with the screws.

Cross recessed binding head machine screw: 8-M4×8
 Tightening torque: 0.45 ± 0.05 N·m

NOTE  The cover may get broken if it is fastened too tight. Be careful not to exceed the above tightening torque.

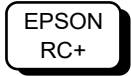


3.4.2 N6-A850**R (Arm #1 Inside Cover)


 CAUTION	<ul style="list-style-type: none"> ■ When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.
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Removal

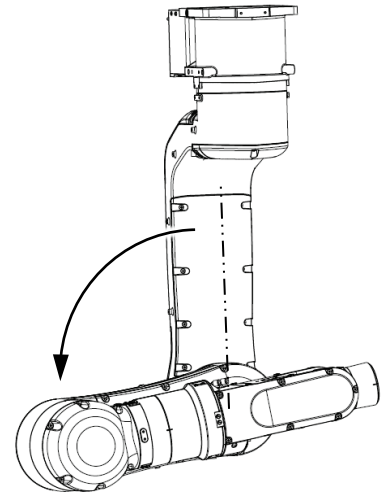
- (1) Turn ON the Controller.
- (2) Release the brake on the Joint #2.

 Command
 > brake off, 2


NOTE

 When releasing the brake, be careful of the arm falling due to its own weight.

- (3) Move the Arm #2 about 100 degrees.



- (4) Operate the brake of the Joint #2.

 Command
 > brake on, 2

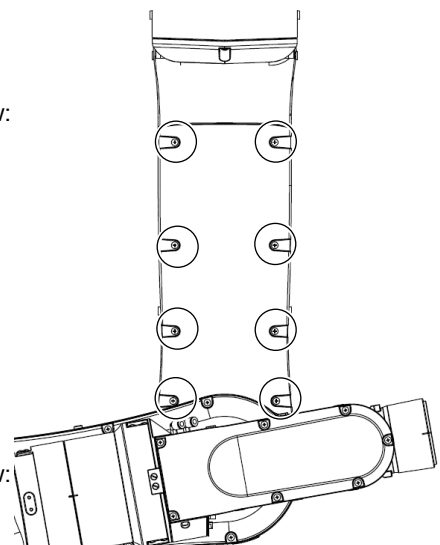
- (5) Turn OFF the Controller.
- (6) Remove the screws, and then remove the Joint #1 inside cover.

Cross recessed binding head machine screw:
 3-M4×8


Installation

- (1) Install the Arm #1 inside cover.

Cross recessed binding head machine screw:
 8-M4×8
 Tightening torque: 0.45 ± 0.05 N·m



3.5 Joint #2 Outside Cover

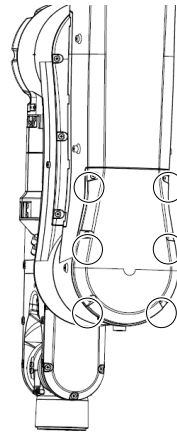
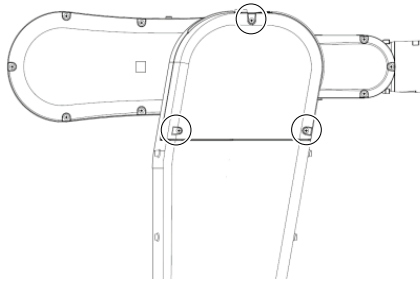
 CAUTION	<ul style="list-style-type: none"> When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.
---	--

Removal

Remove the screws, and then remove the Joint #2 outside cover.

N6-A1000**

N6-A850**R



Cross recessed binding head machine screw:
3-M4×8

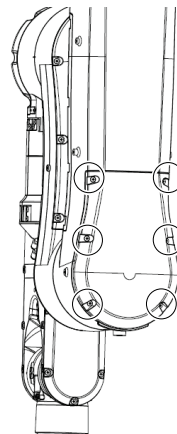
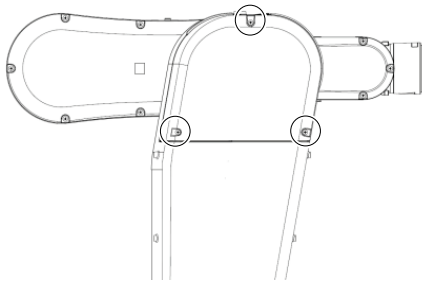
Cross recessed binding head machine screw:
6-M4×8

Installation

Install the Joint #2 outside cover to the Manipulator and fix it with the screws.

N6-A1000**

N6-A850**R



Cross recessed binding head machine screw:
3-M4×8

Cross recessed binding head machine screw:
6-M4×8

Tightening torque: 0.45 ± 0.05 N·m


Tightening torque: 0.45 ± 0.05 N·m



The cover may get broken if it is fastened too tight.
Be careful not to exceed the above tightening torque.


3.6 Joint #2 Cover

3.6.1 N6-A1000** (Joint #2 Cover)

 CAUTION	<ul style="list-style-type: none"> ■ When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.
---	---

Removal

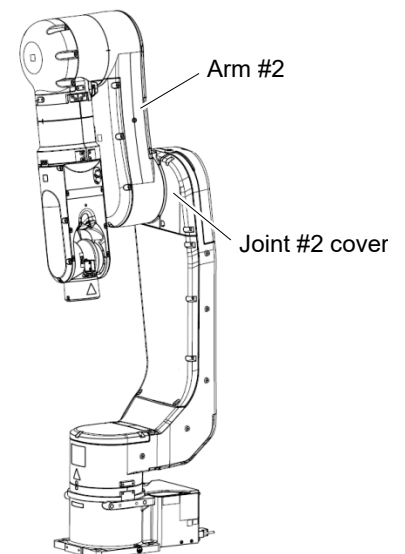
- (1) Turn ON the Controller.
- (2) Release the Joint #2 brake.

 Command
 > brake off, 2

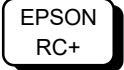


When releasing the brake, be careful of the arm falling due to its own weight.

- (3) Move the Arm #2 about 100 degrees to a position where you can remove the screws of the Joint #2 cover.



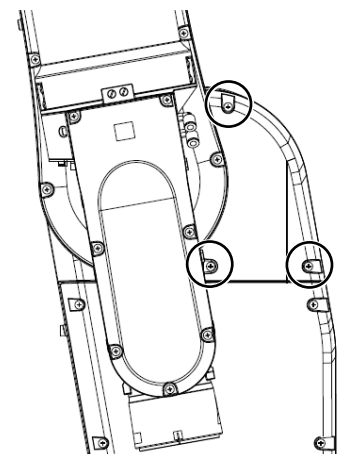
- (4) Operate the brake of the Joint #2.

 Command
 > brake on, 2

- (5) Turn OFF the Controller.

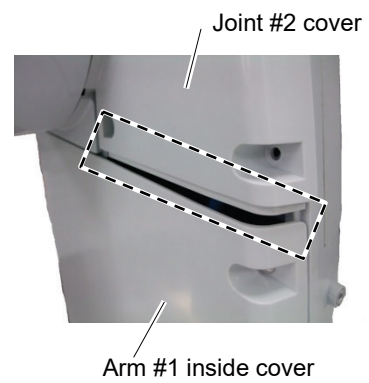
- (6) Remove the screws, and then remove the Joint #2 cover.

Cross recessed binding head machine screw:
 3-M4×8

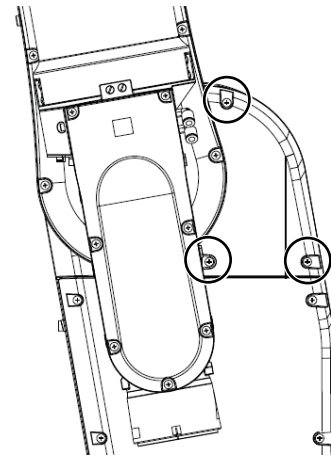



Installation

- (1) Set the Joint #2 cover to the Manipulator.
Install the Joint #2 cover into the Arm #1 inside cover.




- (2) Fix the Joint #2 cover with the screws.
Cross recessed binding head machine screw:
3-M4×8
Tightening torque: $0.45 \pm 0.05 \text{ N}\cdot\text{m}$



NOTE  The cover may get broken if it is fastened too tight.
Be careful not to exceed the above tightening torque.

3.7 Arm #2 Cover (Arm #1 side)

3.7.1 N6-A1000** (Arm #2 Cover, Arm #1 Side)

 CAUTION	<ul style="list-style-type: none"> ■ When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.
---	--

Removal

- (1) Remove the Joint #2 cover.

For more details, refer to *Maintenance 3.6.1 N6-A1000** (Joint #2 Cover)*

- (2) Remove the screws shown in the right figure of the screws that fix the Arm #2 cover (Arm #1 side).

Cross recessed binding head machine screw: 4-M4×8

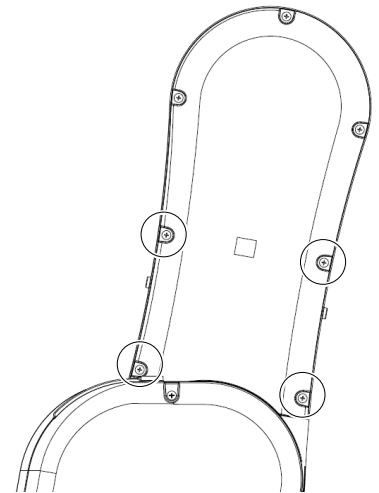
- (3) Turn ON the Controller.
- (4) Release the Joint #2 brake.



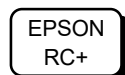
Command
> brake off, 2



When releasing the brake, be careful of the arm falling due to its own weight.

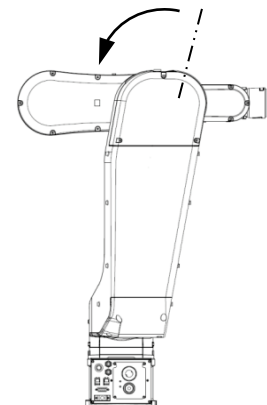


- (5) Move the Arm #2 to the origin position.
- (6) Activate the Joint #2 brake.



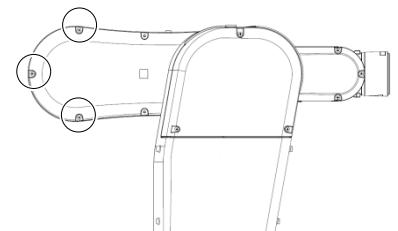
Command
> brake on, 2

- (7) Turn OFF the Controller.



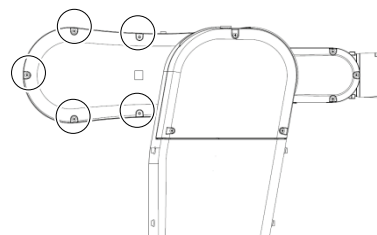
- (8) Remove the rest of the screws that fix the Arm #2 cover (Arm #1 side), and remove the Arm #2 cover.

Cross recessed binding head machine screw: 3-M4×8



Installation

- (1) When the Arm #2 is at the origin position, set the Arm #2 cover to the Manipulator and temporarily fix with the screws.



Cross recessed binding head machine screw:

5-M4×8

Tightening torque: $0.45 \pm 0.05 \text{ N}\cdot\text{m}$

NOTE

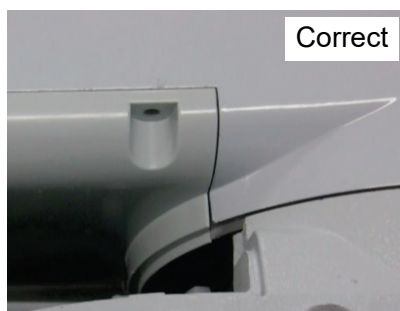


The cover may get broken if it is fastened too tight. Be careful not to exceed the above tightening torque.

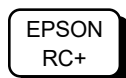
NOTE



Make sure that there is no space between the Arm #2 cover and Arm #2, and then fix it.



- (2) Turn ON the Controller.
- (3) Release the Joint #2 brake.



Command
> brake off, 2

NOTE



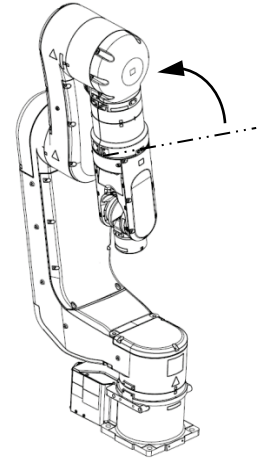
When releasing the brake, be careful of the arm falling due to its own weight.

- (4) Move the Arm #2 about 100 degrees.
- (5) Activate the Joint #2 brake.

EPSON
RC+

Command
> brake on, 2

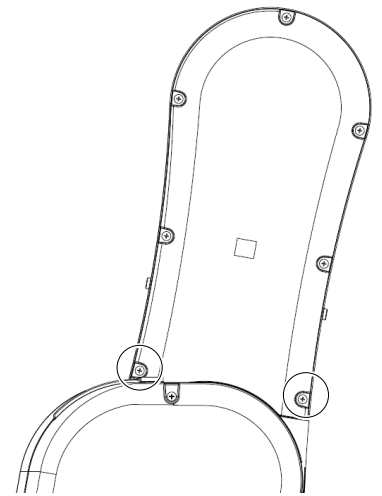
- (6) Turn OFF the Controller.



- (7) Fix the Arm #2 cover (Arm #1 side) with the screws.


Cross recessed binding head machine screw
: 2-M4×8

Tightening torque: 0.45 ± 0.05 N·m



- (8) Install the Joint #2 cover,
For more details, refer to *Maintenance 3.6.1 N6-A1000** (Joint #2 Cover)*

3.7.2 N6- A850**R (Arm #2 Cover, Arm #1 Side)

 CAUTION	<ul style="list-style-type: none"> When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.
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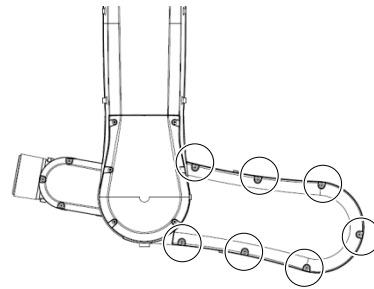
Removal

- Remove the Arm #1 inside cover.

For more details, refer to *Maintenance 3.4.2 N6-A850**R (Arm #1 Inside Cover)*.

- Remove the screws shown in the right figure of the screws that fix the Arm #2 cover (Arm #1 side).

Cross recessed binding head machine screw:
7-M4×8



- Turn ON the Controller.
- Release the Joint #2 brake.

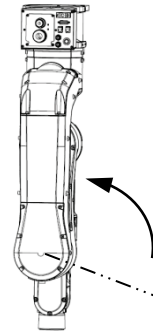
EPSON RC+ Command
> brake off, 2

NOTE

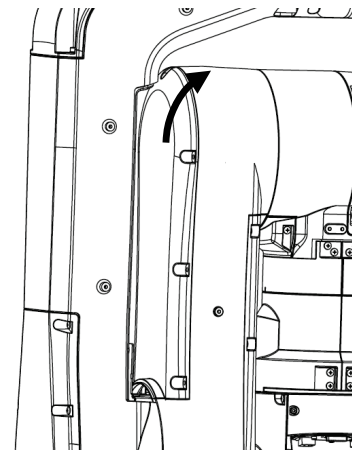

When releasing the brake, be careful of the arm falling due to its own weight.

- Move the Arm #2 to the origin position while holding the Arm #2 cover (Arm #1 side).
- Activate the Joint #2 brake.

EPSON RC+ Command
> brake on, 2

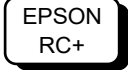


- Turn OFF the Controller.
- Remove the Arm #2 cover.



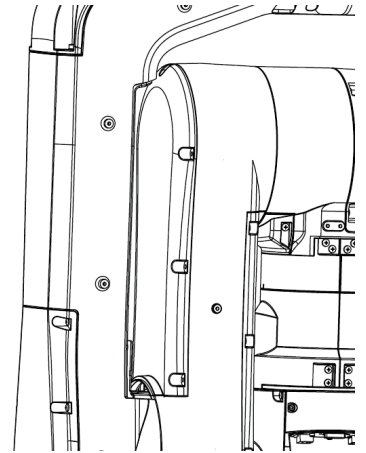
Installation

- (1) When the Arm #2 is at the origin position, set the Arm #2 cover to the Manipulator.
- (2) Turn ON the Controller.
- (3) Release the Joint #2 brake.

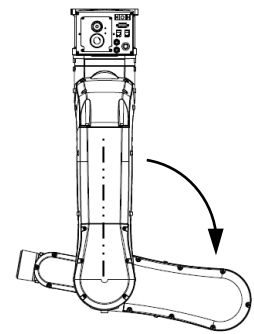
 Command
 > brake off, 2



When releasing the brake, be careful of the arm falling due to its own weight.



- (4) Move the Arm #2 about 100 degrees while holding the Arm #2 cover (Arm #1 side).



- (5) Activate the Joint #2 brake.

 Command
 > brake on, 2

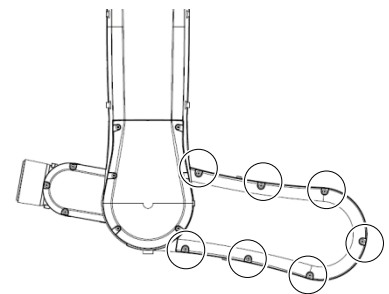
- (6) Turn OFF the Controller.
- (7) Fix the Arm #2 cover (Arm #1 side) with the screws.

Cross recessed binding head machine screw:
7-M4×8


Tightening torque: $0.45 \pm 0.05 \text{ N}\cdot\text{m}$

- (8) Install the Arm #1 inside cover.

For more details, refer to *Maintenance 3.4.2 N6-A850**R (Arm #1 Inside Cover)*.



3.8 Arm #2 Cover (Arm #3 side)

 CAUTION	<ul style="list-style-type: none"> When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.
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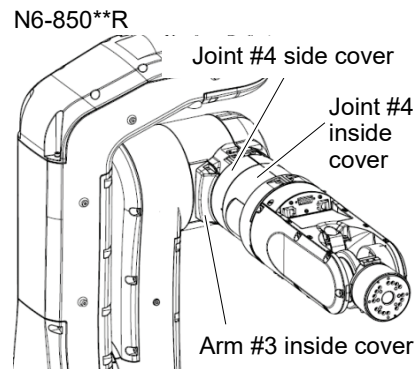
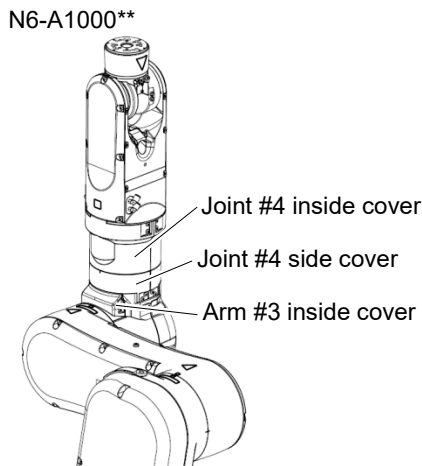
Removal (1) Remove the following covers in order.

- Joint #4 inside cover
- Joint #4 side cover (Arm #2 side)
- Arm #3 inside cover

Details are described in the following sections:

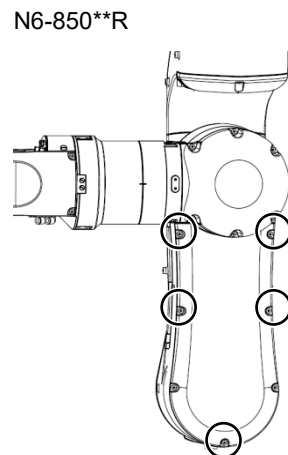
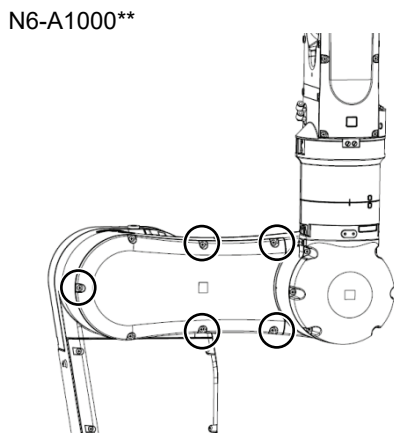
Maintenance

- 3.9 Arm #3 Inside Cover
- 3.12 Joint #4 Inside Cover
- 3.11 Joint #4 Side Cover



(2) Remove the screws shown below of the screws that fix the Arm #2 cover (Arm #3 side).

Cross recessed binding head machine screw: 5-M4×8



- (3) Turn ON the Controller.
- (4) Release the Joint #3 brake.

EPSON RC+ Command
> brake off, 3

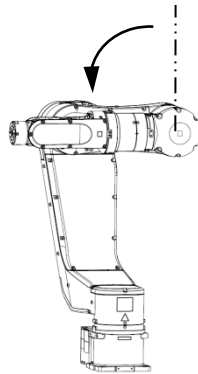
NOTE



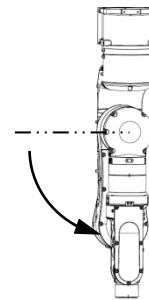
When releasing the brake, be careful of the arm falling due to its own weight.

- (5) Move the Arm #3 to the origin position.

N6-A1000**



N6-850**R



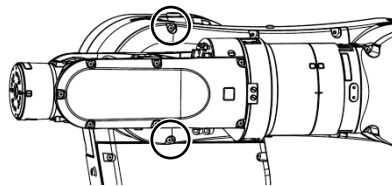
- (6) Activate the Joint #3 brake.

EPSON RC+ Command
> brake on, 3

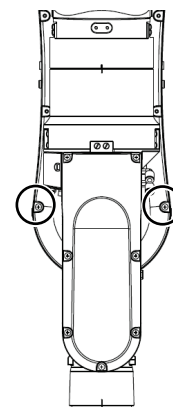
- (7) Turn OFF the Controller.
- (8) Remove the rest of screws that fix the Arm #2 cover, and remove the Arm #2 cover.

Cross recessed binding head machine screw: 2-M4×8

N6-A1000**



N6-850**R



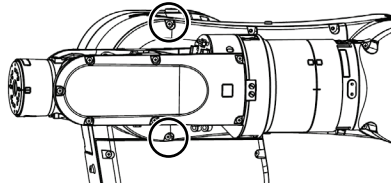
Installation

- (1) When the Arm #3 is at the origin position, set the Arm #2 cover to the Manipulator and temporarily fix with the screws.

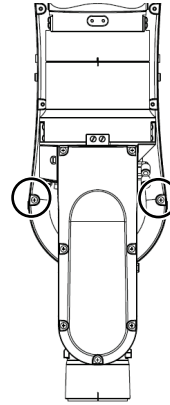
Cross recessed binding head machine screw: 2-M4×8

Tightening torque: 0.45 ± 0.05 N·m

N6-A1000**



N6-850**R



NOTE

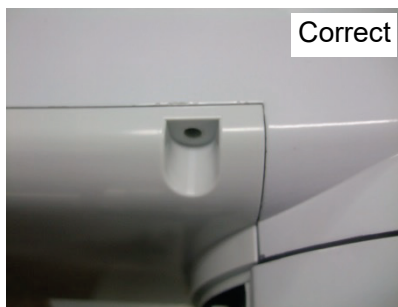
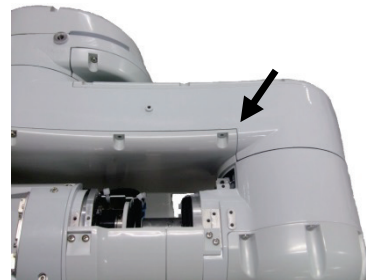


The cover may get broken if it is fastened too tight. Be careful not to exceed the above tightening torque.

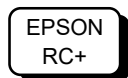
NOTE



Make sure that there is no space between the Arm #2 cover and Arm #2, and then fix it.



- (2) Turn ON the Controller.
- (3) Release the Joint #3 brake.



Command
> brake off, 3

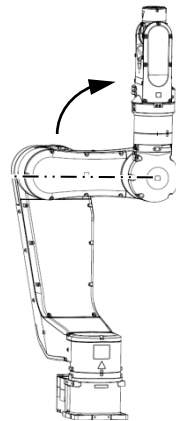
NOTE



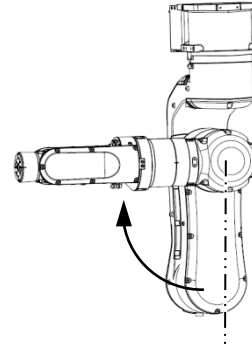
When releasing the brake, be careful of the arm falling due to its own weight.

- (4) Move the Arm #3 about 90 degrees as shown below.

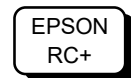
N6-A1000**



N6-850**R



- (5) Activate the Joint #3 brake.

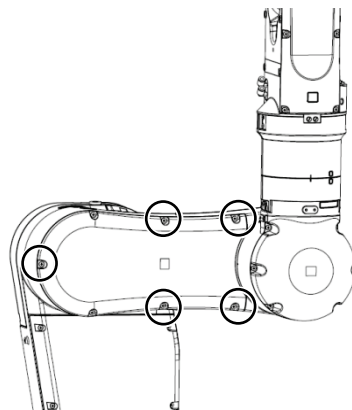


Command
> brake on, 3

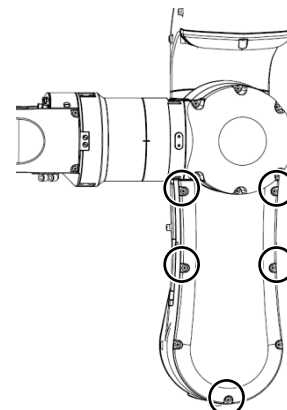
- (6) Turn OFF the Controller.
(7) Fix the Arm #2 cover with the screws.

Cross recessed binding head machine screw: 5-M4×8
Tightening torque: 0.45 ± 0.05 N·m

N6-A1000**



N6-850**R



The cover may get broken if it is fastened too tight.
Be careful not to exceed the above tightening torque.

(8) Install the following covers.

Arm #3 inside cover

Joint #4 side cover (Arm #2 side)

Joint #4 inside cover

Details are described in the following sections:

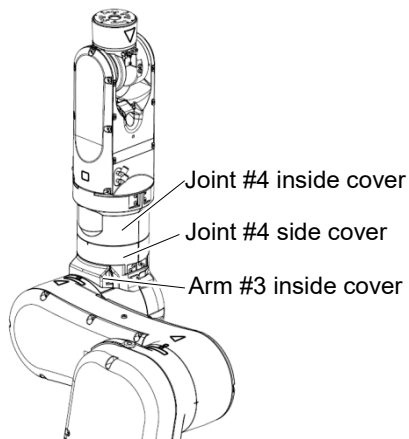
Maintenance

3.9 Arm #3 Inside Cover

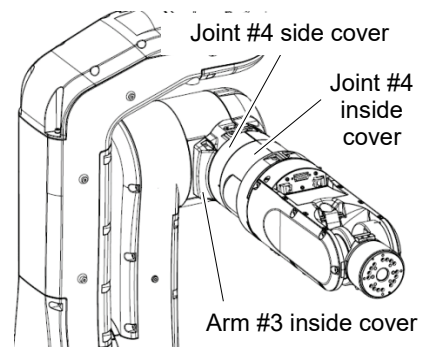
3.12 Joint #4 Inside Cover

3.11 Joint #4 Side Cover

N6-A1000**



N6-850**R



3.9 Arm #3 Inside Cover



- When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.

Removal

- Remove the following covers in order.

Joint #4 inside cover

Joint #4 side cover (Arm #2 side)

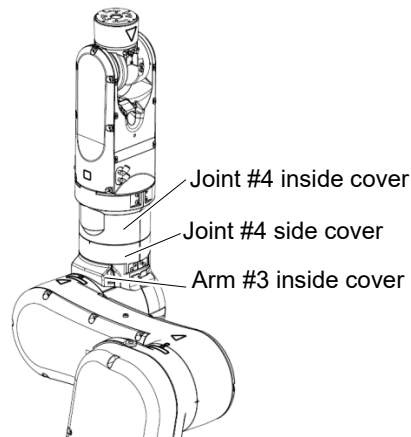
Details are described in the following sections:

Maintenance

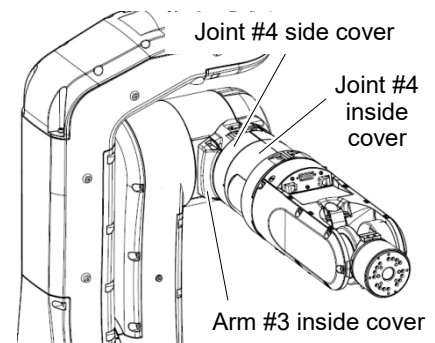
3.11 Joint #4 Side Cover

3.12 Joint #4 Inside Cover

N6-A1000**



N6-850**R



- Remove the screws that fix the Arm #3 inside cover, and then remove the cover.

Cross recessed binding head machine screw:

2-M4×8



Installation

- (1) Set the Arm #3 inside cover to the Manipulator and fix it with the screws.

Cross recessed binding head machine screw:

2-M4×8

Tightening torque: 0.45 ± 0.05 N·m

NOTE



The cover may get broken if it is fastened too tight.
Be careful not to exceed the above tightening torque.



- (2) Install the following covers.

Joint #4 side cover (Arm #2)

Joint #4 inside cover

Details are described in the following sections:

Maintenance

3.11 Joint #4 Side Cover

3.12 Joint #4 Inside Cover

3.10 Arm #3 Cover



CAUTION

- When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.

Removal

Remove the screws, and then remove the Arm #3 cover.

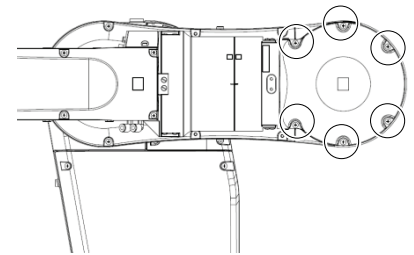
Cross recessed binding head machine screw:
6-M4×8

Installation

Set the Arm #3 cover to the Manipulator and fix it with the screws.

Cross recessed binding head machine screw:
6-M4×8

Tightening torque: 0.45 ± 0.05 N·m



NOTE




Be careful not to get the cables caught in the arm.

NOTE



The cover may get broken if it is fastened too tight. Be careful not to exceed the above tightening torque.

3.11 Joint #4 Side Cover

 CAUTION	<ul style="list-style-type: none"> When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.
--	--

Removal

- Remove the following covers.

Joint #4 inside cover, Joint #4 outside cover

Details are described in the following sections:

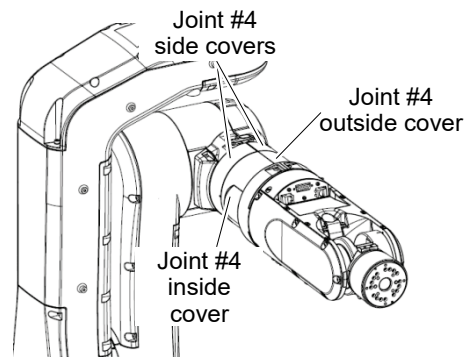
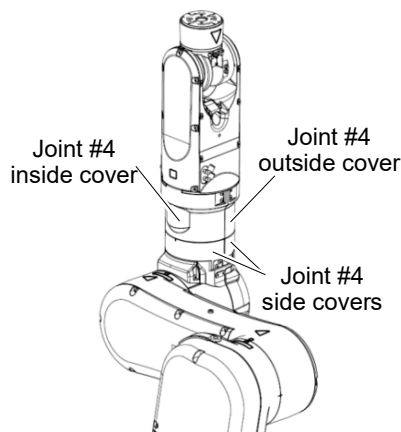
Maintenance

3.12 Joint #4 Inside Cover

3.13 Joint #4 Outside Cover

N6-A1000**

N6-850**R



- Remove the screws, and then remove the Joint #4 side covers (2 covers).

Cross recessed binding head machine screw: 8-M4×8

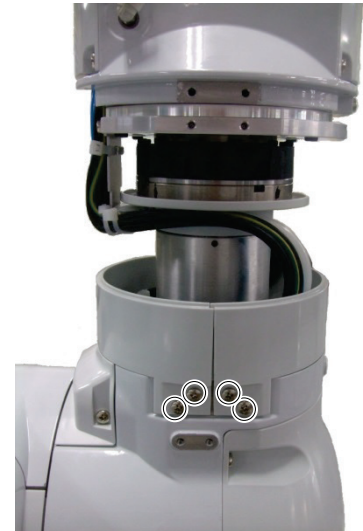


Installation

- (1) Match the two Joint #4 side covers and set to the Manipulator, then fix them with the screws.

Cross recessed binding head machine screw: 8-M4×8

Tightening torque: 0.45 ± 0.05 N·m



The cover may get broken if it is fastened too tight.
Be careful not to exceed the above tightening torque.



Do not tighten the screws when the covers are not matched properly.
The covers may get broken.



Be sure to install the cover while pressing it to the Manipulator.
If the cover is installed away from the Manipulator, it may rub the other covers during the operation.

- (2) Install the following covers:

Joint #4 inside cover, Joint #4 outside cover

Details are described in the following sections:

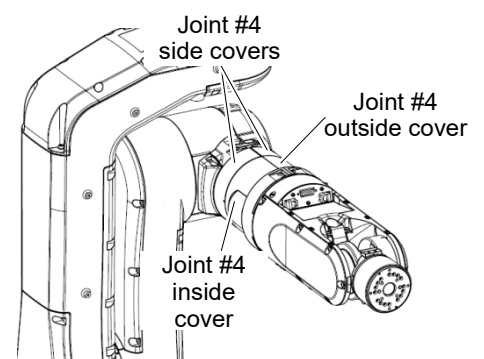
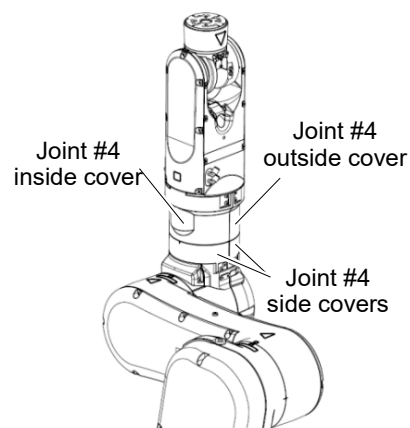
Maintenance

3.12 Joint #4 Inside Cover


3.13 Joint #4 Outside Cover

N6-A1000**

N6-850**R



3.12 Joint #4 Inside Cover

 CAUTION	<ul style="list-style-type: none"> When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.
---	--

Removal

- Turn ON the Controller.
- Release the Joint #3 brake.

```

EPSON Command
RC+ > brake off, 3
    
```

NOTE

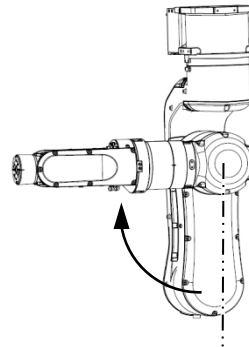
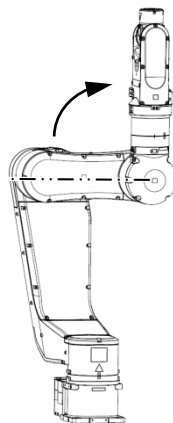


When releasing the brake, be careful of the arm falling due to its own weight.

- Move the Arm #3 about 90 degrees as shown below.

N6-A1000**

N6-850**R



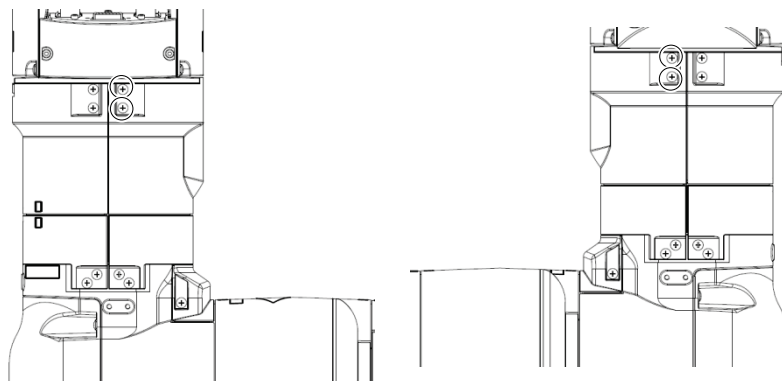
- Activate the Joint #3 brake.

```

EPSON Command
RC+ > brake on, 3
    
```

- Turn OFF the Controller.
- Remove the screws, and then remove the Arm #3 cover.

Cross recessed binding head machine screw: 4-M4×8

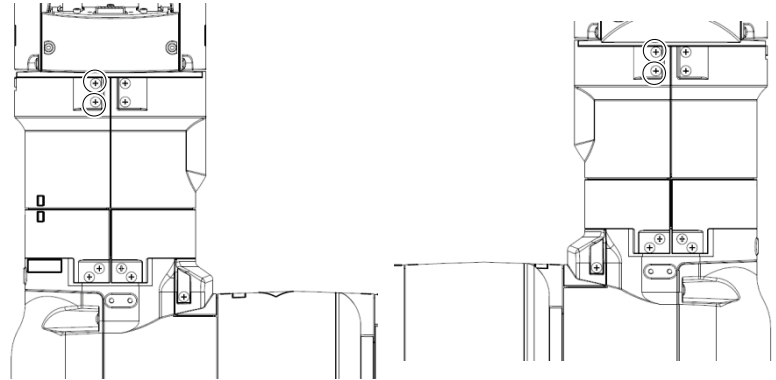


Installation


Match the Joint #4 inside cover and the Joint #4 outside cover, and set them to the Manipulator. Then, fix them with the screws.

Cross recessed binding head machine screw: 4-M4×8


Tightening torque: $0.45 \pm 0.05 \text{ N}\cdot\text{m}$




NOTE

 The cover may get broken if it is fastened too tight.
Be careful not to exceed the above tightening torque.


NOTE

 Do not tighten the screws when the covers are not matched properly.
The covers may get broken.

NOTE

 Be careful not to get the cables caught in the cover.

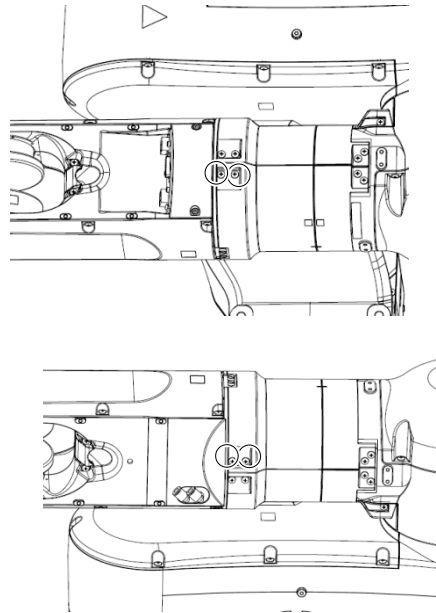
3.13 Joint #4 Outside Cover

 CAUTION	<ul style="list-style-type: none"> When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.
--	--

Removal

Remove the screws, and then remove the Joint #4 outside cover.

Cross recessed binding head machine screw:
4-M4×8




Installation


Match the Joint #4 inside cover and the Joint #4 outside cover, and set them to the Manipulator. Then, fix them with the screws.

Cross recessed binding head machine screw: 4-M4×8
Tightening torque: 0.45 ± 0.05 N·m


NOTE

 The cover may get broken if it is fastened too tight. Be careful not to exceed the above tightening torque.

NOTE

 Do not tighten the screws when the covers are not matched properly. The covers may get broken.

NOTE

 Be careful not to get the cables caught in the cover.


3.14 Arm #4 Side Cover



- When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.

Removal

- (1) Turn ON the Controller.
- (2) Release the Joint #3 brake.

 Command
 > brake off, 3

NOTE

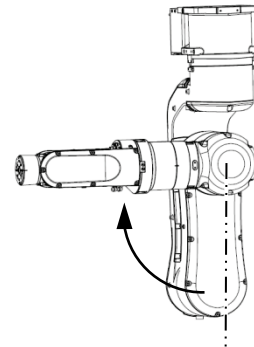
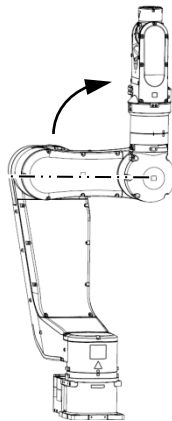


When releasing the brakes, be careful of the arm falling due to its own weight.

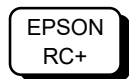
- (3) Move the Arm #3 about 90 degrees as shown below.

N6-A1000**

N6-850**R



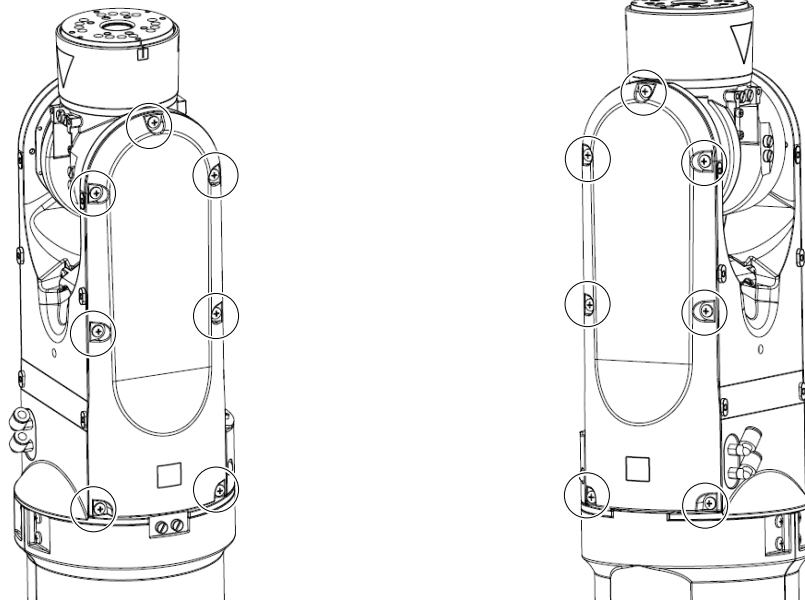
- (4) Activate the Joint #3 brake.

 Command
 > brake on, 3

- (5) Turn OFF the Controller.

- (6) Remove the screws, and then remove the Arm #4 side covers (2 covers).

Cross recessed binding head machine screw: 14-M4×8

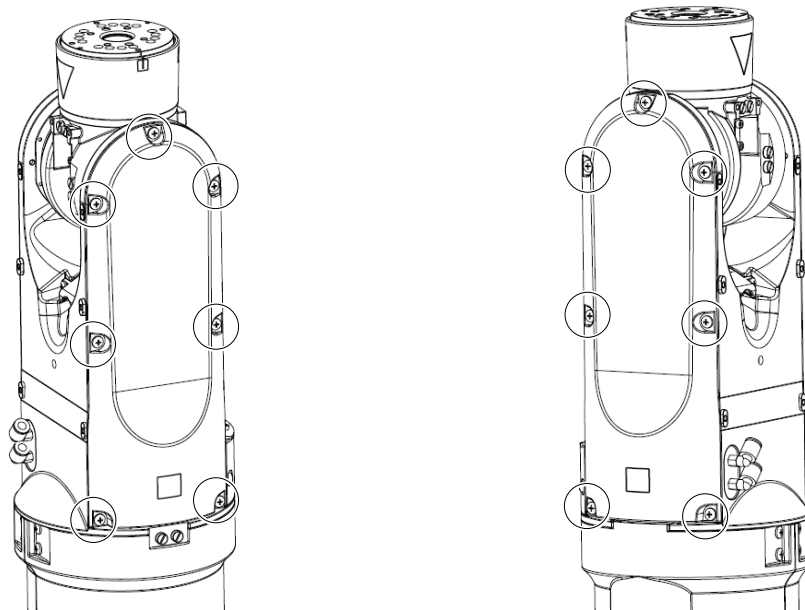


Installation


Set the Arm #4 side covers (2 covers) to the Manipulator and fix with the screws.

Cross recessed binding head machine screw: 14-M4×8


Tightening torque: 0.45 ± 0.05 N·m



NOTE

 Be careful not to get the cables caught in the cover.

NOTE

 The cover may get broken if it is fastened too tight.
Be careful not to exceed the above tightening torque.

3.15 Arm #4 Cable Cover



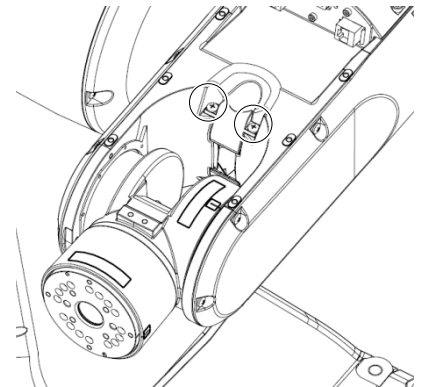
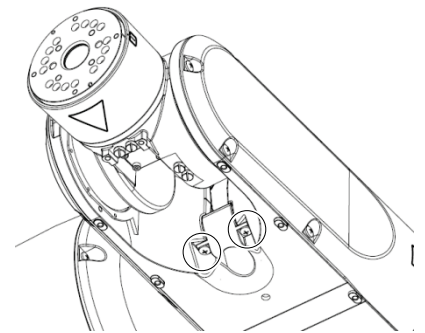
CAUTION

- When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, check the cable locations at removing the cover. Be sure to place the cables back to their original locations.

Removal

Remove the screws, and then remove the Arm #4 cable covers (2 covers).

Cross recessed binding head machine screw:
4-M4×8



Installation

Set the Arm #4 cable covers (2 covers) and fix them with the screws.

Cross recessed binding head machine screw: 4-M4×8
Tightening torque: 0.45 ± 0.05 N·m

NOTE



The cover may get broken if it is fastened too tight. Be careful not to exceed the above tightening torque.


NOTE




When passing cables, be careful not to get the cables caught in the covers.

4. Cable

4.1 Replacing the Cable Unit (N6-A1000*): Cable Direction: Standard (backward)

 <p>WARNING</p>	<ul style="list-style-type: none">■ Before performing any replacement procedure, turn OFF the Controller and related equipment, and then disconnect the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system.■ Do not connect or disconnect the motor connectors while the power to the robot system is turned ON. Connecting or disconnecting the motor connectors with the power ON is extremely hazardous and may result in serious bodily injury as the Manipulator may move abnormally, and also may result in electric shock and/or malfunction of the robot system.■ Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source. To shut off power to the robot system, disconnect the power plug from the power source. Performing any work while connecting the AC power cable to a factory power source is extremely hazardous and may result in electric shock and/or malfunction of the robot system.■ Be careful not to get any foreign substances in the Manipulator, connectors, and pins during maintenance. Turning ON the power to the robot system when any foreign substances exist in them is extremely hazardous and may result in electric shock and/or malfunction of the robot system.■ Be sure to connect the cables properly. Do not allow unnecessary strain on the cables. (Do not put heavy objects on the cables. Do not bend or pull the cables forcibly.) Unnecessary strain on the cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system.■ When installing the cover, be careful not to allow the cables to interfere with the cover mounting and do not bend these cables forcibly to push them into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. Damaged cables, disconnection, or contact failure is extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, observe the cable locations after removing the cover. Be sure to place the cables back to their original locations.
---	--

 <p>CAUTION</p>	<ul style="list-style-type: none">■ When disconnecting the connectors during the replacement of the cable unit, be sure to reconnect the connectors to their proper positions. Improper connection of the connectors may result in improper function of the robot system. For details on the connections, refer to the <i>Maintenance 4.7 Connector Pin Assignments</i>.
--	--

	Name		Qty	Code, Note
Maintenance Parts	Cable unit		1	2187251 (Standard)
				2194258 (Cleanroom)
	Cable tie	AB150	-	1675754, 1 bag (100 ties: white)
		AB200	-	1684328, 1 bag (100 ties: white)
Tools	Hexagonal wrench	width across flats: 2.5 mm	1	For M3 hexagon socket head cap bolts
		width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
		width across flats: 4 mm	1	For M5 hexagon socket head cap bolts
		width across flats: 5 mm	1	For M6 hexagon socket head cap bolts
	Box wrench	width across flats: 5 mm	1	For D-Sub connector
	Long nose pliers		1	For removing air tubes
	Nippers		1	For cutting a cable tie
	Cross-point screwdriver (#2)		1	For cross recessed head screws
	Torque wrench		1	For tightening torque control
	Cable tie gun		1	Refer: HellermannTyton MK8
	Cable tie gun tester		1	Refer: HellermannTyton DGT500-MK8

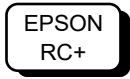


The subsequent steps are described with the standard model's cable unit.
For cleanroom model, a yellow air tube is included in the cable unit.

- | | |
|-----------------|--|
| Removal | (1) Remove the following covers: |
| Cable Unit | Arm #4 side cover (2 covers) |
| Cable direction | Joint #4 inside cover Joint #4 outside cover Joint #4 side covers (2 covers) |
| Standard | Arm #3 cover Arm #3 inside cover Arm #2 cover (2 covers) |
| (backward) | Joint #2 cover Joint #2 outside cover |
| | Arm #1 inside cover Joint #1 cover Base cover |

For details, refer to *Maintenance 3. Covers*.

- (2) Turn ON the Controller.
- (3) Release the brakes of each joint and move the Manipulator to the orientation as shown below.



Command

>Brake off, [the number (from 2 to 6) corresponding to the arm whose brake will be turned OFF]

- Joint #1 +90°
- Joint #2 +90°
- Joint #3 -90°
- Joint #4 0°
- Joint #5 0°
- Joint #6 0°



When releasing the brake, the arm may rotate by its own weight.



Normally, release the brake of joints one by one. Take extra care if you need to release the brakes of two or more joints simultaneously. Releasing the brakes of two or more joints simultaneously may cause hands and fingers to be caught and/or equipment damage to or malfunction of the Manipulator as the arms of the Manipulator may move in unexpected directions.

- (4) Brake each joint.



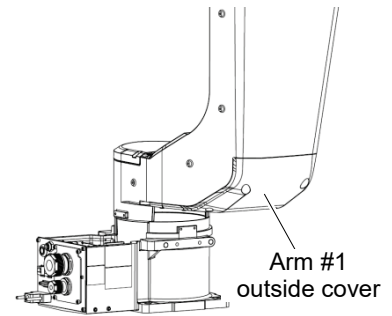
Command

>Brake On, [The number (from 2 to 6) corresponding to the arm whose brake will be turned ON]

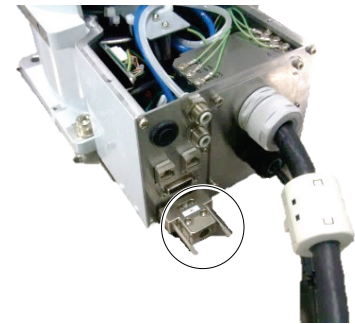
- (5) Turn OFF the Controller.

- (6) Remove the Arm #1 outside cover.

Hexagon socket head cap bolts:
8-M5×20 (with plain washer)



- (7) Disconnect the external short connector.



- (8) Disconnect the M/C cable.

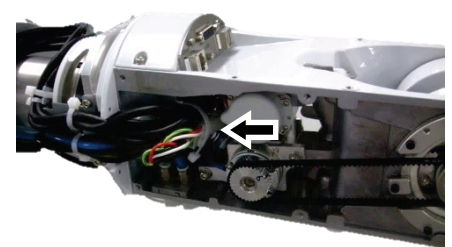
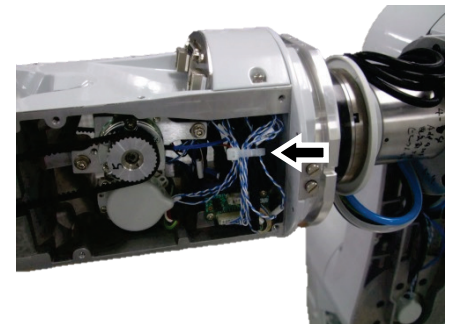
For details, refer to *Maintenance 4.6. M/C Cable*.

- (9) Cut off the cable tie of the cables.

NOTE



Be careful not to cut the cables.



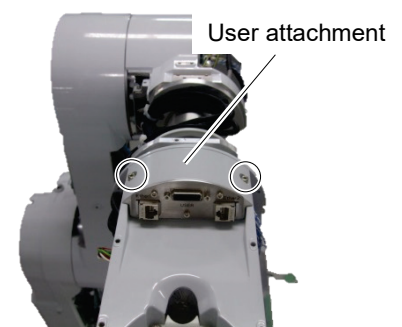
- (10) Remove the user attachment of the Arm #4.

Hexagon socket head cap bolts: 2-M4×8

NOTE

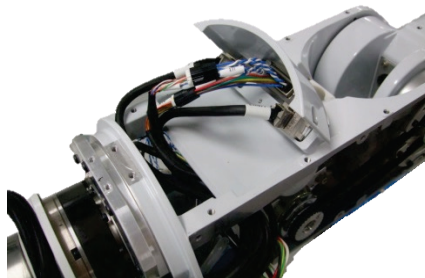


Cables are connected to the user attachment. When you disconnect the cables, make sure not to pull the user attachment forcibly.



- (11) Disconnect the connectors from the user attachment.

Connectors: Ether1, Ether2, X71, X72

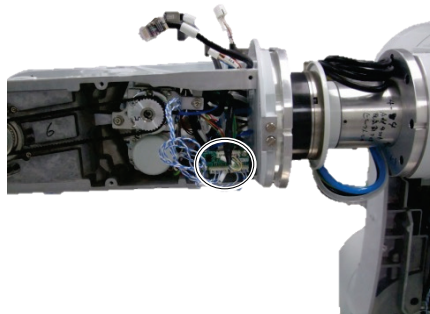


- (12) Disconnect the connector connected to the encoder board 4.

Connector: EB05_CN1



NOTE Be careful that the jumper pins on the board do not come off.

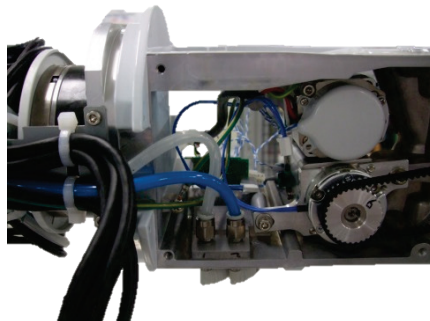


- (13) Remove the connectors.

Connectors: PW5, PW6, BR5, BR6

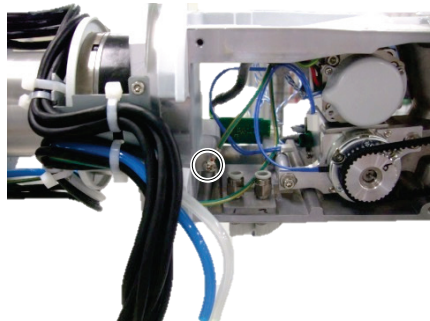


- (14) Remove the two air tubes.

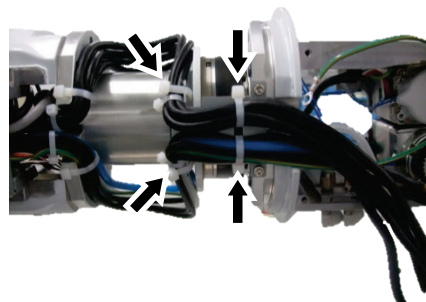


- (15) Remove the ground wire terminals.

Cross recessed binding head machine screw: M4×8



- (16) Cut off the cable tie that fixes the cable unit to the plate.

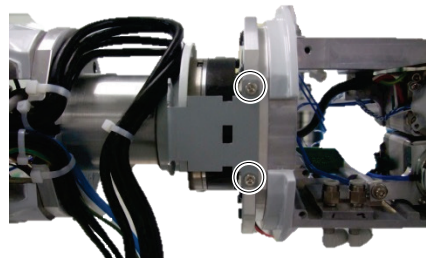


- (17) Remove the cable fixing plate.

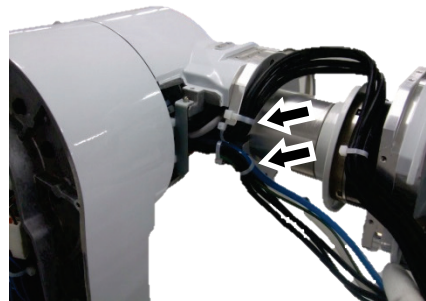
Hexagon socket head cap bolts: 2-M4×8



Be careful not to lose the removed cable fixing plate.



- (18) Cut off the cable tie of the flange on the Joint #4 actuator unit.

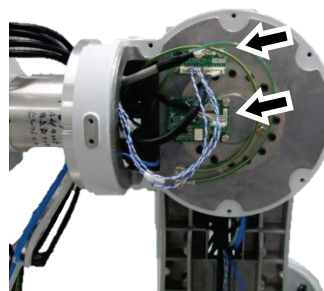


- (19) Disconnect the connectors connected to the encoder board 3 and the control board 2.

Connectors: EB04_CN1, EB04_CN3, EB0x_CN2, GS02

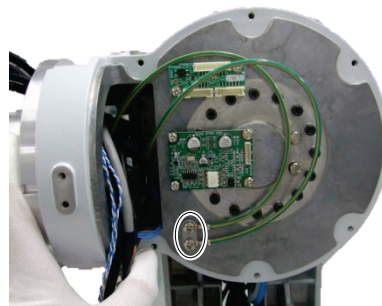


Be careful that the jumper pins on the board do not come off.



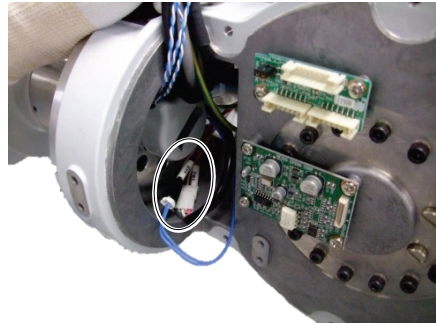
- (20) Remove the two ground wire terminals.

Cross recessed binding head machine screws: 2-M4×8



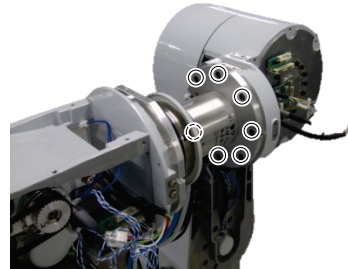
- (21) Disconnect the connectors connected to the Joint #4 actuator unit.

Connectors: PW4, BR4



- (22) Remove the Joint #4 actuator unit from the Arm #3.

Hexagon socket head cap bolts:
7-M4×15 (with plain washer)



NOTE

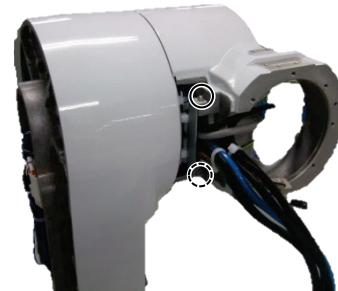

Be sure to have at least 2 people to perform the operation since the parts being heavy.

When removing it, make sure not to lose the positioning pin.

Also, be careful not to catch the cables on the Joint #4 actuator unit.

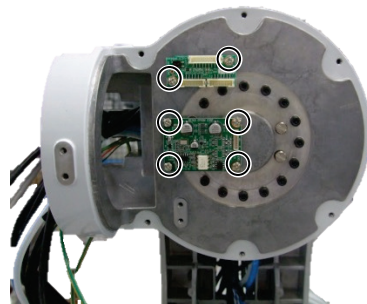
- (23) Remove the J3 cable fixing plate fixed on the Arm #3.

Hexagon socket head cap bolts: 2-M3×6



- (24) Remove the encoder board 3 and the control board 2.

Cross recessed binding head machine screws: 6-M3×6

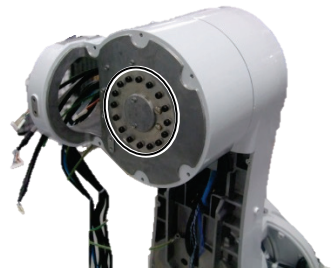


NOTE


Be careful not to lose the removed board

- (25) Remove the Arm #3.

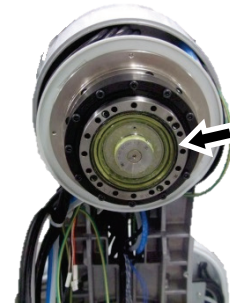
Hexagon socket head cap bolts:
16-M4×30 (with plain washer)





After removing the Arm #3, confirm that the O-ring is installed to the reduction gear unit.

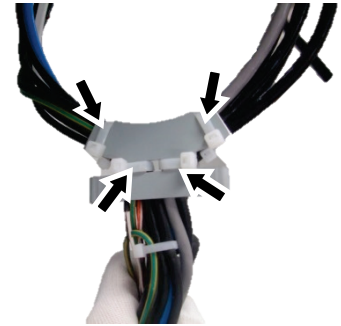
If the O-ring is installed on the Arm #3, re-install it on the reduction gear unit.



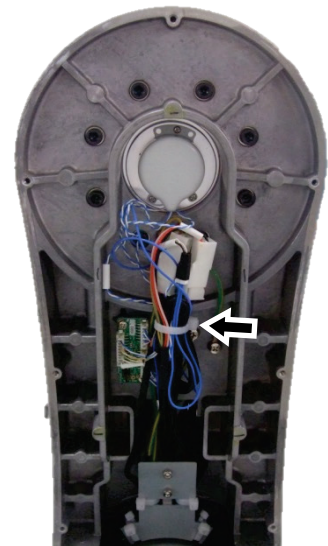
- (26) Cut off the cable tie of the removed J3 cable fixing plate.



Be careful not to lose the removed cable fixing plate.



- (27) Cut off the cable tie of the cables.

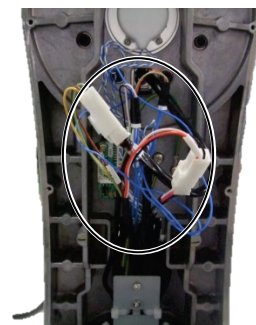


- (28) Disconnect the connectors connected to the Joint #2 actuator unit.

Connectors: PW2, BR2


- (29) Disconnect the connectors connected to the Joint #3 actuator unit.

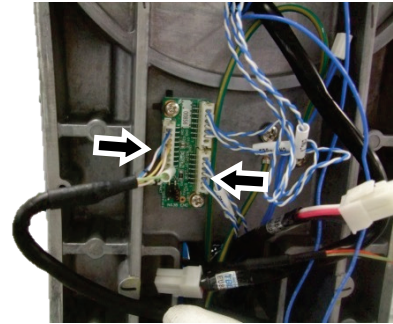
Connectors: PW3, BR3



- (30) Disconnect the connectors connected to the encoder board 2.


Connectors:
EB02_CN1
EB0x_CN2 (Joint #2 side)

NOTE
 Be careful that the jumper pins on the board do not come off.



- (31) Pull the cables from the Joint #2 actuator unit to the Arm #3 side.

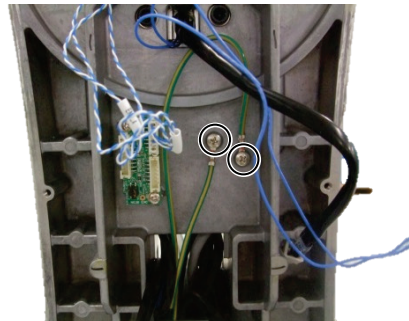
Cables (connectors):
PW2, BR2, EB0x_CN2

NOTE
 Do not pull the cables forcibly while the connectors get caught. Doing so may result in disconnection of the cables or breakage of the connectors.



- (32) Remove the two ground wire terminals.

Cross recessed binding head machine screw: 2-M4×8




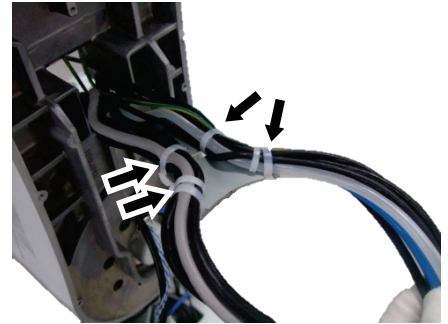
- (33) Remove the J3 cable fixing plate fixed on the Arm #2.

Hexagon socket head cap bolts: 2-M4×8



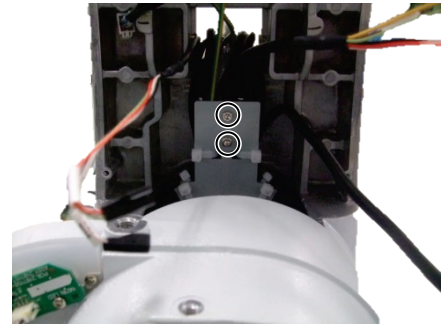
- (34) Cut off the cable tie of the removed J3 cable fixing plate.

NOTE  Be careful not to lose the removed cable fixing plate.




- (35) Remove the J2 cable fixing plate fixed on the Arm #2.

Hexagon socket head cap bolts: 2-M4×8




- (36) Pull out the cable unit passing through the Arm #2.


NOTE  Be careful not to catch the cables coming from the Joint #2 actuator unit to the cable unit.



- (37) Remove the Arm #2.


Hexagon socket head cap bolts:
8-M6×35 (with plain washer)

NOTE  Be sure to have at least 2 people to perform the operation since the parts being heavy.

NOTE  Be careful not to catch the cables on the Joint #2 actuator unit or Arm #2.

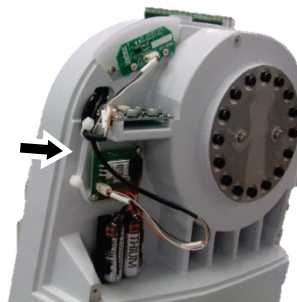


- (38) Cut off the cable tie of the removed J2 cable fixing plate.

NOTE  Be careful not to lose the removed cable fixing plate.



- (39) Cut off the cable tie of the cables.

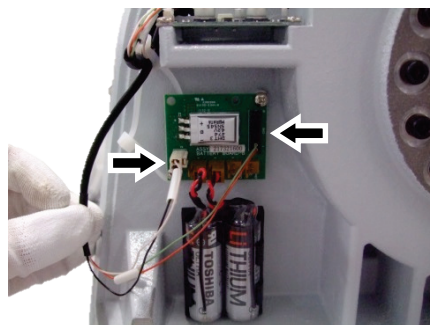


- (40) Disconnect the connectors connected to the battery board.

Connectors: BAT_CN3, BAT_CN6

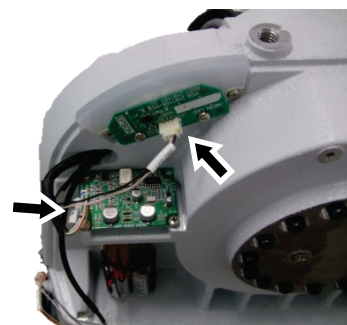


You do not need to disconnect the connectors of the batteries.



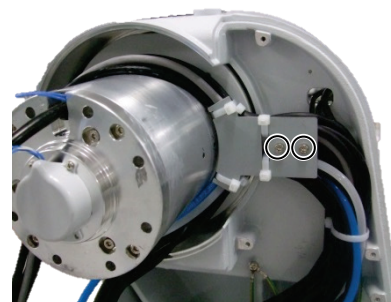
- (41) Disconnect the connectors connected to the control board 1 and the LED board.

Connectors: GS01, LED_CN1



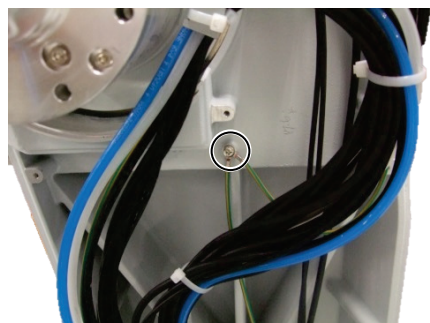
- (42) Remove the J2 cable fixing plate fixed on the Arm #1.

Hexagon socket head cap bolts: 2-M4×8



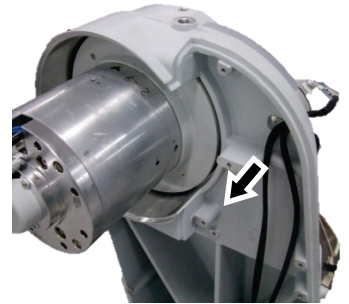
- (43) Remove the ground wire terminals.

Cross recessed binding head machine screw: M4×8



- (44) Pull the following cables (connectors) to the inside of the Arm #1.

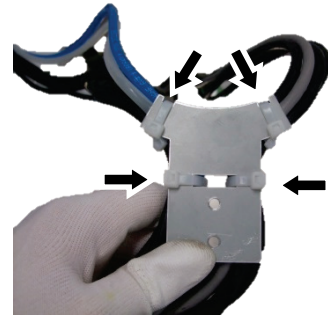
Cables (connectors):
 BAT_CN3, BAT_CN6, GS01,
 LED_CN



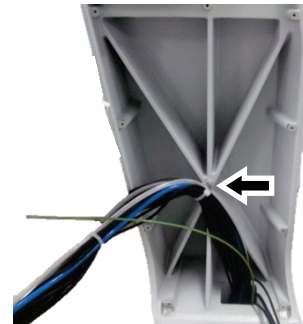
- (45) Cut off the cable tie of the removed J2 cable fixing plate.

NOTE


Be careful not to lose the removed cable fixing plate.

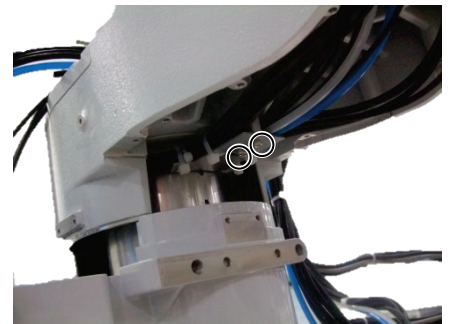


- (46) Cut off the cable tie that fixes the cable unit.



- (47) Remove the J1 cable fixing plate fixed on the Arm #1.

Hexagon socket head cap bolts: 2-M4×8



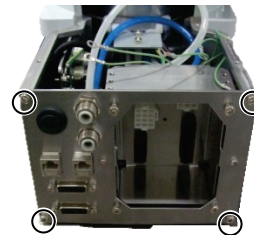
- (48) Remove the six ground wire terminals.

Cross recessed binding head machine screw: M4×8



- (49) Remove the base side plate.

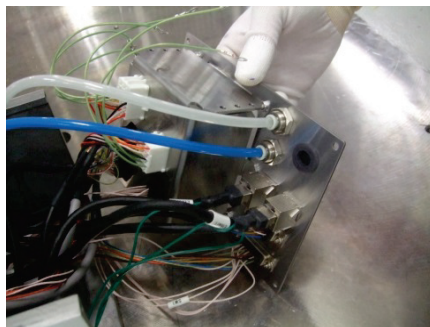
Hexagon socket head cap bolts: 4-M4×8



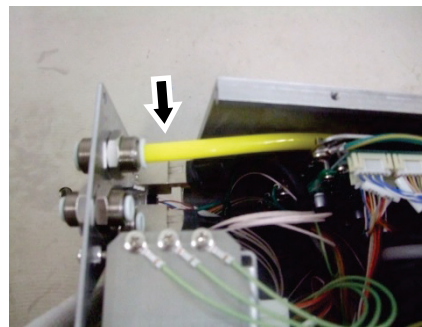
- (50) Disconnect the connectors and two air tubes (for cleanroom model: three air tubes) from the removed base side plate.

Connectors: X11, X12, X010, BR010, Ether1, Ether2, D-sub, SW1

Standard model

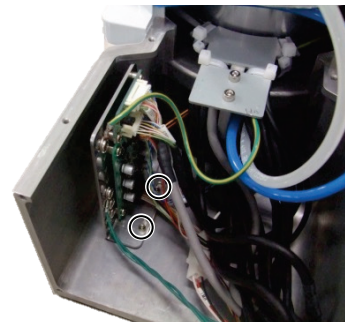


Cleanroom model



- (51) Remove the board fixing plate.

Hexagon socket head cap bolts: 2-M3×6



- (52) Disconnect the connectors connected to the encoder board 1 and the brake board.

Connectors:

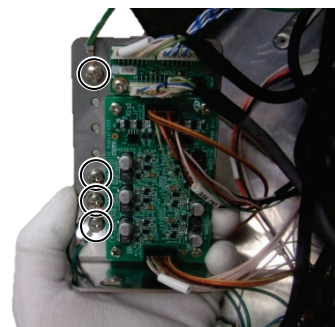
EB01_CN1, EB01_CN3, EB0x_CN2

BRK_CN1, BRK_CN2

NOTE



Be careful that the jumper pins on the board do not come off.

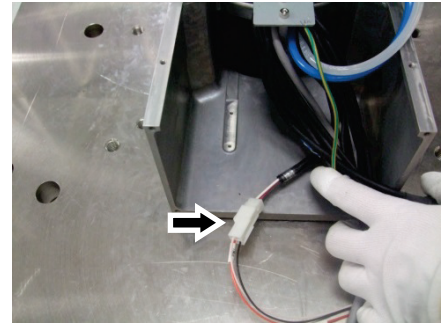


- (53) Remove the four ground wire terminals fixed on the board fixing plate.

Cross recessed binding head machine screws: 4-M4×8

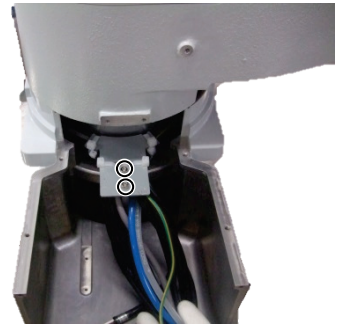
- (54) Disconnect the connector connected to the Joint #1 actuator unit.

Connector: PW1



- (55) Remove the J1 cable fixing plate fixed on the base.

Hexagon socket head cap bolts: 2-M4×8



- (56) Rotate the Arm #1 to the origin position.



- (57) Pull out the cable unit from the Arm #1.



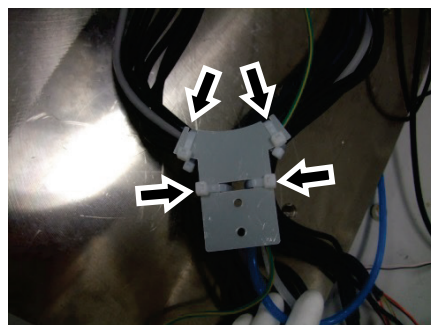
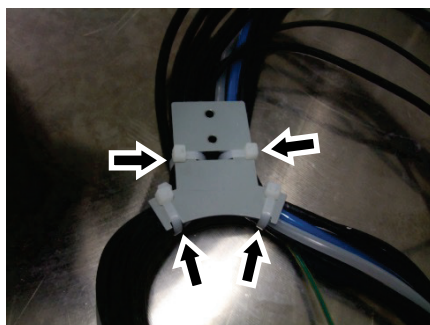
(58) Remove the cable unit from the Joint #1.




(59) Cut off the cable tie of the removed J1 cable fixing plate.

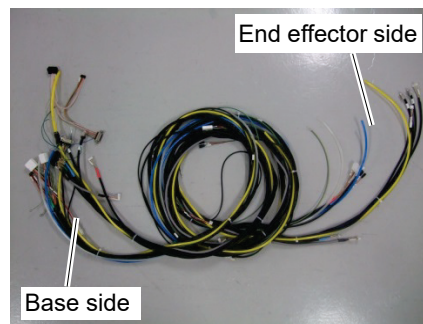
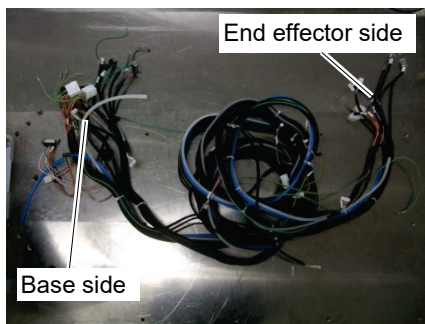
NOTE


Be careful not to lose the removed cable fixing plate.




NOTE
 The subsequent steps are described with the standard model's cable unit.
 For cleanroom model, a yellow air tube is included in the cable unit.

- Installation** (1) Check the cable unit.
Cable Unit The cable unit consists of the cable A and the cable B.
 A: Include the gray colored cable.
 B: Include the ground wire (green).
Cable direction:
Standard The cable A and the cable B are bundled by eight cable ties.
(backward) Standard model Cleanroom model

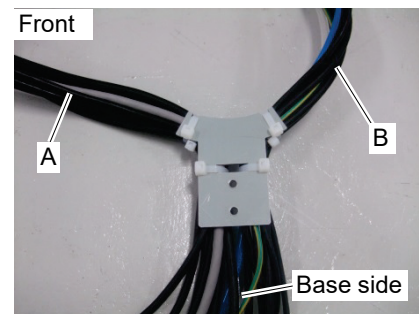


Hereinafter referred to as below in order from the base side.
 A1, A2, ..., A8 (cable A)
 B1, B2, ..., B8 (cable B)

NOTE
 Do not cut off or move the position of the cable tie. The cable unit will not be able to install properly.

- (2) Fix the cable unit to the cable fixing plate.

Be careful for the following:
 Cable ties (AB200) × 4 (1 to 4)
 Tightening strength: 85 ± 5 N

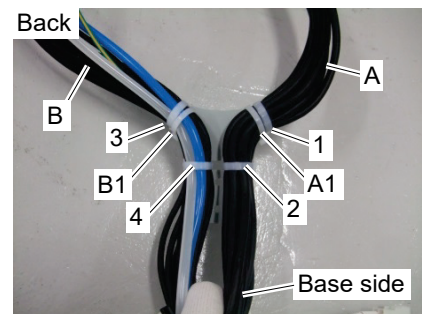



Cable A

Set the A1 of the cable tie to the cable fixing plate and fix it by using the cable ties 1 and 2. Make sure that the gray colored cable is on the plate side.

Cable B

Set the B1 of the cable tie to the cable fixing plate and fix it by using the cable ties 3 and 4. Make sure that the two air tubes (blue and white) are on the opposite side of the plate.



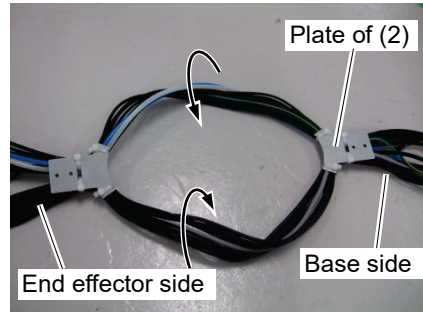
NOTE
 Refer to the figure for positions of the cable tie heads.
 Rotate the heads of the cable ties A1 and B1 to set positions.

Be careful for the orders and the positions of the cable ties.
 Distance between the cable tie 1 and A1, and 3 and B1 should be as close as possible.
 Improper order or position of the cable tie may shorten the life cycle of the cables.

- (3) Fix the cable unit to the cable fixing plate with twisting 180 degrees.

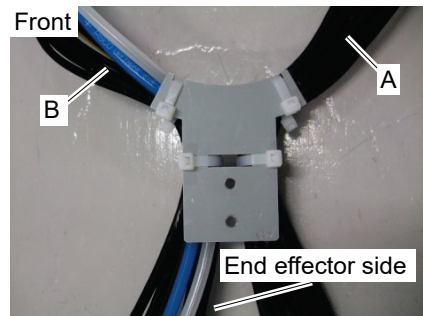
Be careful for the following:

Cable ties (AB200) × 4 (1 to 4)
 Tightening strength: 85 ± 5 N



Cable A

Set the A2 of the cable tie to the cable fixing plate and fix it by using the cable ties 1 and 2. Make sure to twist 180 degrees and fix the cable A so that the gray colored cable is on the opposite side of the plate.



Cable B

Set the B2 of the cable tie to the cable fixing plate and fix it by using the cable ties 3 and 4. Make sure to twist 180 degrees and fix the cable B so that the two air tubes (blue and white) are on the plate side.

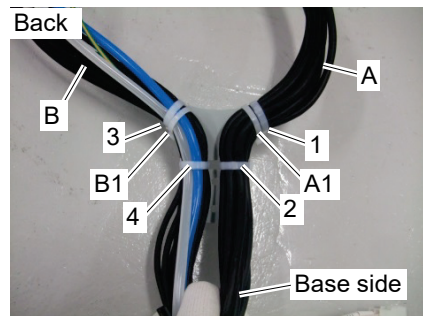
NOTE Refer to the figure for positions of the cable tie heads.

Rotate the heads of the cable ties A2 and B2 to set positions.

Be careful for the orders and the positions of the cable ties.

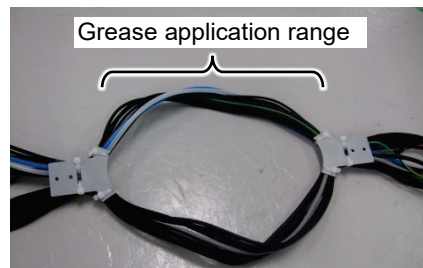
Distance between the cable tie 1 and A2, and 3 and B2 should be as close as possible.

Improper order or position of the cable tie may shorten the life cycle of the cables.



- (4) Apply the grease to the cables between the two cable fixing plates.

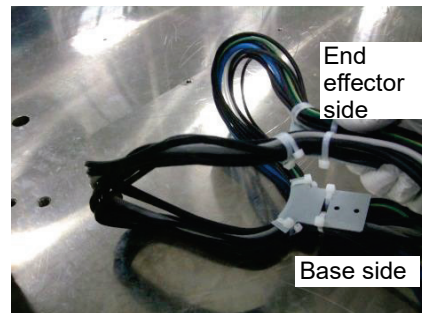
Grease:
 Krytox: Cable A and B
 Standard model: 1g for each
 Cleanroom model: 1.5g for each



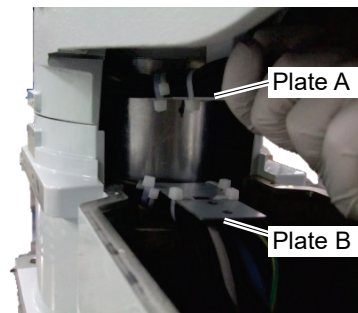
NOTE Apply the grease to each cable evenly.

- (5) To face the two cable fixing plates, bend the cable unit and pass it through the Joint #1.

End effector side : Plate A
 Base side : Plate B



NOTE When operating the Manipulator, make sure not to apply excessive force to the cables.



- (6) Move the Arm #1 approx. 90 degrees.



NOTE Be careful not to get the cables caught in the Arm #1.

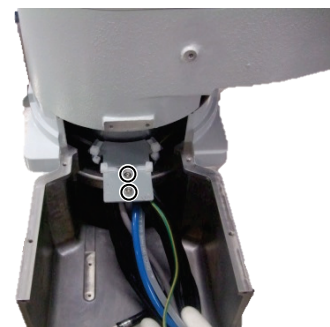


- (7) Install the cable fixing plate B to the base.

Hexagon socket head cap bolts: 2-M4×8
 Tightening torque: 4.0 ± 0.2 N·m



NOTE Be careful not to tighten the screws with the cables get caught on the plate.



- (8) Install the cable fixing plate A to Arm #1.

Hexagon socket head cap bolts: 2-M4×8
 Tightening torque: 4.0 ± 0.2 N·m



NOTE Be careful not to tighten the screws with the cables get caught on the plate.



- (9) Pass the cable unit to the Arm #1.

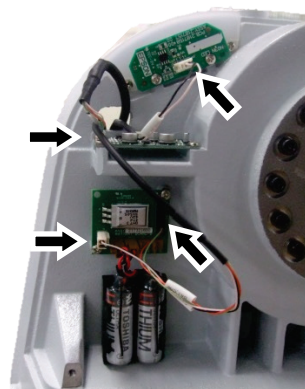


Do not pass the cables forcibly while the connectors get caught. Doing so may result in disconnection of the cables or breakage of the connectors.



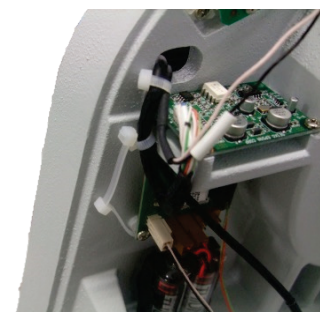
- (10) Pass the cables (connectors) through the hole on the end of the Arm #1

Cables (connectors):
BAT_CN3, BAT_CN6
GS01,
LED_CN1



- (11) Fix the cables on the Arm #1.

Cable ties (AB150) × 4

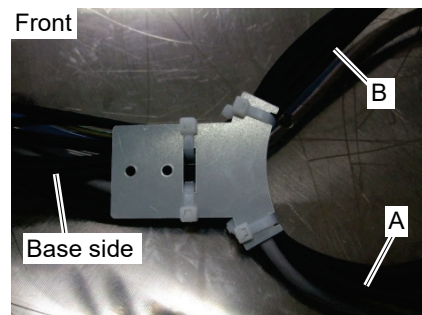


(12) Fix the cable unit to the cable fixing plate.

Be careful for the following:

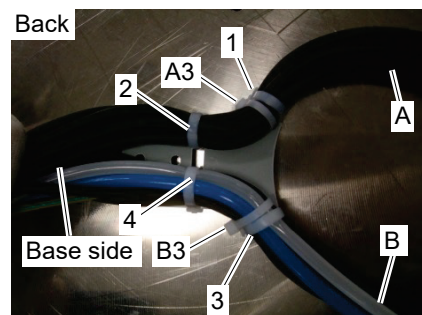
Cable ties (AB200) × 4 (1 to 4)

Tightening strength: 85 ± 5 N



Cable A

Set the A3 of the cable tie to the cable fixing plate and fix it by using the cable ties 1 and 2. Make sure that the gray colored cable is on the plate side.



Cable B

Set the B3 of the cable tie to the cable fixing plate and fix it by using the cable ties 3 and 4. Make sure that the two air tubes (blue and white) are on the opposite side of the plate.



NOTE Refer to the figure for positions of the cable tie heads.

Rotate the heads of the cable ties A3 and B3 to set positions.



NOTE Be careful for the orders and the positions of the cable ties.

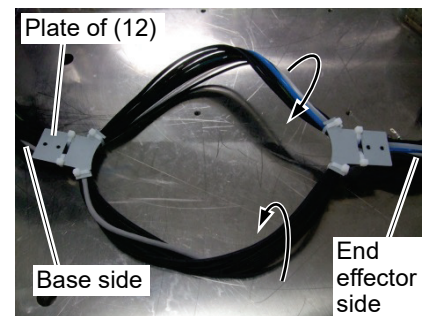
Distance between the cable tie 1 and A3, and 3 and B3 should be as close as possible. Improper order or position of the cable tie may shorten the life cycle of the cables.

(13) Fix the cable unit to the cable fixing plate with twisting 180 degrees.

Be careful for the following:

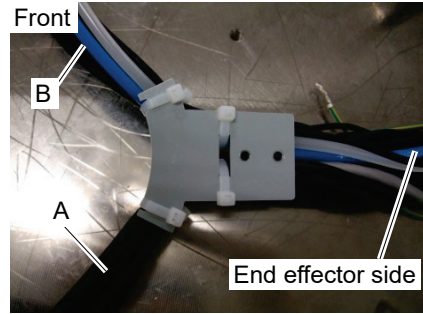
Cable ties (AB200) × 4 (1 to 4)

Tightening strength: 85 ± 5 N



Cable A

Set the A4 of the cable tie to the cable fixing plate and fix it with by using the cable ties 1 and 2. Make sure to twist 180 degrees and fix the cable A so that the gray colored cable is on the opposite side of the plate.



Cable B

Set the B4 of the cable tie to the cable fixing plate and fix it by using the cable ties 3 and 4. Make sure to twist 180 degrees and fix the cable B so that the two air tubes (blue and white) are on the plate side.

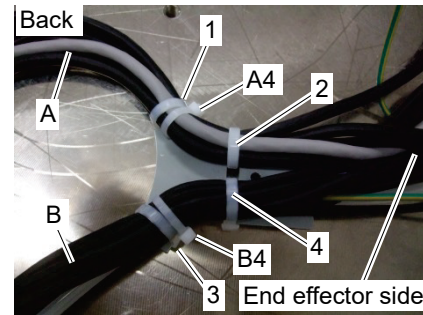


Refer to the figure for positions of the cable tie heads.

Rotate the heads of the cable ties A4 and B4 to set positions.

Be careful for the orders and the positions of the cable ties.

Distance between the cable tie 1 and A4, and 3 and B4 should be as close as possible.

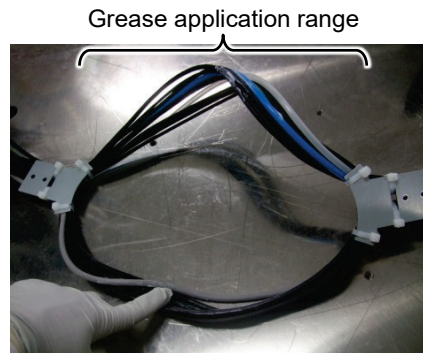


Improper order or position of the cable tie may shorten the life cycle of the cables.

- (14) Apply the grease to the cables between the two cable fixing plates.

Grease:

- Krytox: Cable A and B
- Standard model : 1g for each
- Cleanroom model : 1.5g for each



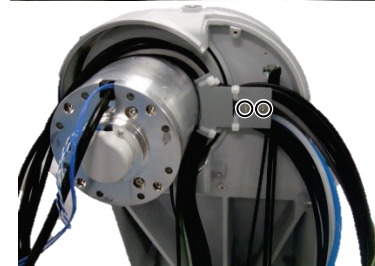
Apply the grease to each cable evenly.

- (15) Install the cable fixing plates to Arm #1.

- Hexagon socket head cap bolts: 2-M4×8
- Tightening torque: 4.0 ± 0.2 N·m



Be careful not to tighten the screws with the cables get caught on the plate.

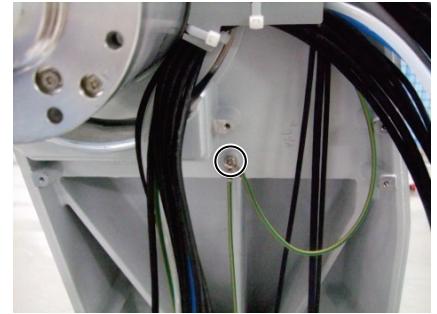


- (16) Install the two ground wire terminals.

Cross recessed binding head machine screw:

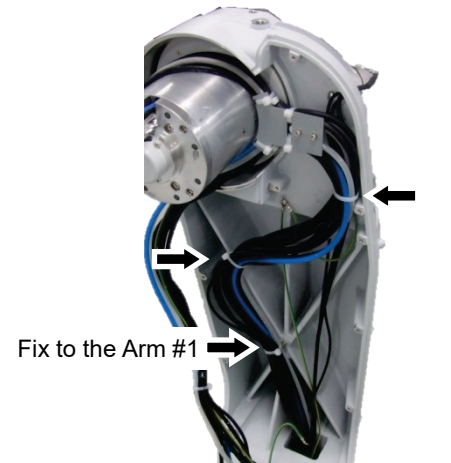
M4×8

Tightening torque: 0.9 ± 0.1 N·m

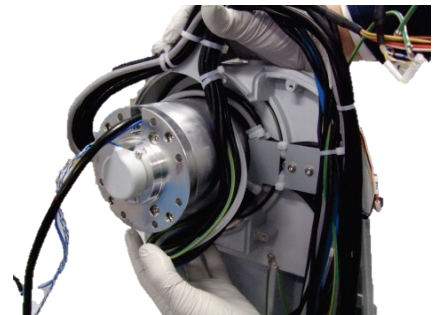


- (17) Bundle (three positions) the cable unit.

Cable ties (AB200)



- (18) To face the two cable fixing plates, bend the cable unit and pass it through the Joint #2.

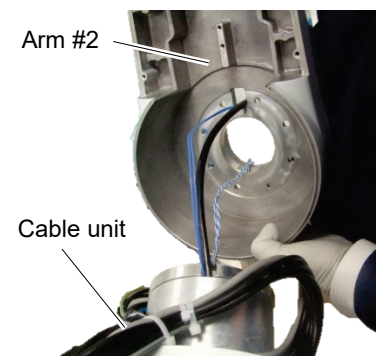


- (19) Install the Arm #2 while aligning the cable unit to the direction of the cables coming from the Joint #2 actuator.

Hexagon socket head cap bolts:

8-M6×35 (with plain washer)

Tightening torque: 18 ± 0.9 N·m



NOTE
☞ Refer to the picture for installing direction.
☞ When installing it, pass the cables from the Joint #2 actuator unit through the hole of the Arm #2.

Be careful not to get the cables caught.

Be sure to have at least 2 people to perform the operation since the parts being heavy.

Do not apply excessive shock to the parts.



(20) Pass the cable unit except the following cables (connectors) to Arm #2.

Cables (connectors):
PW2, PW3, BR2, BR3,
EB02_CN1, ground wire

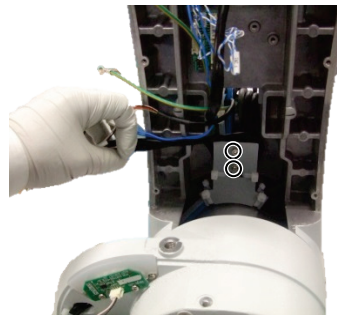


NOTE
☞ Do not pass the cables forcibly while the connectors get caught.
Doing so may result in disconnection of the cables or breakage of the connectors.

(21) Install the cable fixing plates to Arm #2.

Hexagon socket head cap bolts: 2-M4×8
Tightening torque: 4.0 ± 0.2 N·m

NOTE
☞ Be careful not to tighten the screws with the cables get caught on the plate.



For cleanroom model, face one yellow air tube to Joint #2 side.

NOTE



Be careful not to bend or collapse the air tubes.



- (22) Pass the cables from the Joint #2 actuator unit through the hole of the Arm 2, and pull them to the Arm #1 side.

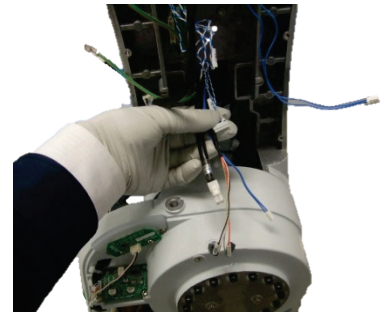
Cables (connectors):

PW2, BR2, EB0x_CN2

NOTE



Do not pull the cables forcibly while the connectors get caught. Doing so may result in disconnection of the cables or breakage of the connectors.



- (23) Connect the connectors to the encoder board 2.

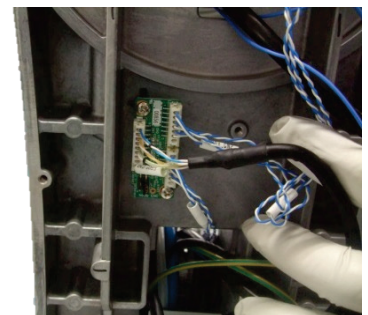
Connectors:

EB02_CN1, EB0x_CN2 (J2 side)

NOTE



Be careful that the jumper pins on the board do not come off.

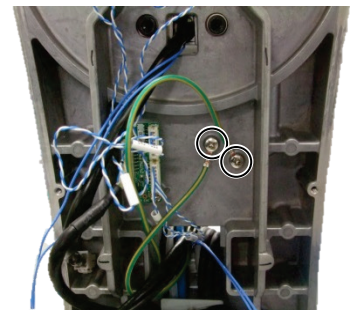


- (24) Install the two ground wire terminals.

Cross recessed binding head machine screws:

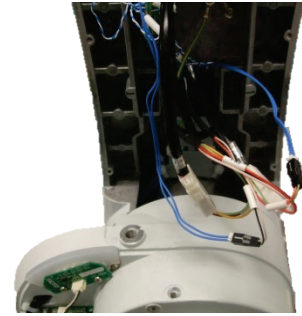
2-M4×8

Tightening torque: 0.9 ± 0.1 N·m



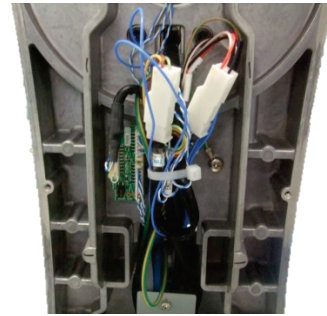
(25) Connect the connectors.

Connectors: PW2, BR2, PW3, BR3



(26) Bundle the cables.

Cable ties (AB200) × 1

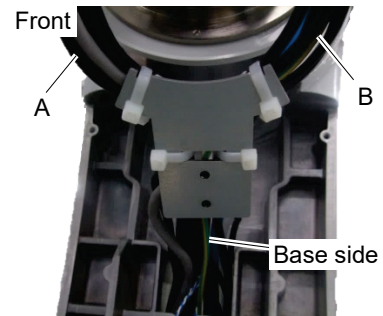


(27) Fix the cable unit to the cable fixing plate.

Be careful for the following:

Cable ties (AB200) × 4 (1 to 4)

Tightening strength: 85 ± 5 N

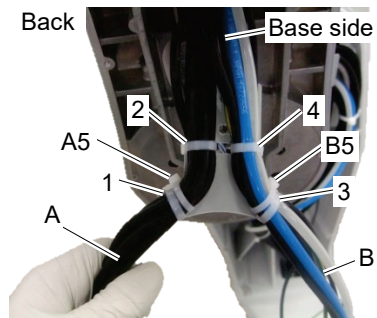


Cable A

Set the A5 of the cable tie to the cable fixing plate and fix it by using the cable ties 1 and 2. Make sure that the gray colored cable is on the plate side.

Cable B

Set the B5 of the cable tie to the cable fixing plate and fix it by using the cable ties 3 and 4. Make sure that the two air tubes (blue and white) are on the opposite side of the plate.



NOTE

Refer to the figure for positions of the cable tie heads.

Rotate the heads of the cable ties A5 and B5 to set positions.

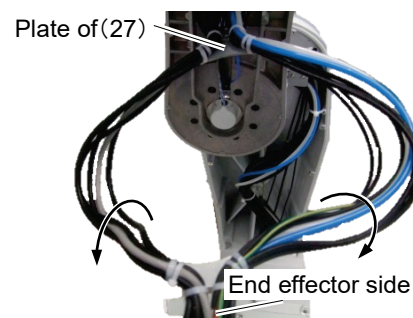
Be careful for the orders and the positions of the cable ties.

Distance between the cable tie 1 and A5, and 3 and B5 should be as close as possible.

Improper order or position of the cable tie may shorten the life cycle of the cables.

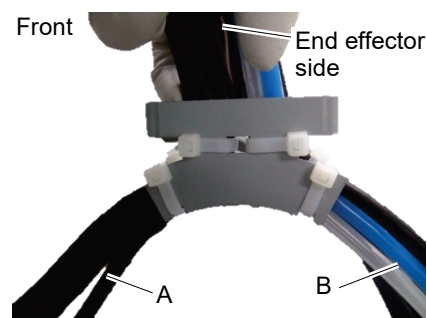
(28) Fix the cable unit to the cable fixing plate with twisting 180 degrees. Be careful for the following:

Cable ties (AB200) × 4 (1 to 4)
Tightening strength: 85 ± 5 N



Cable A

Set the A6 of the cable tie to the cable fixing plate and fix it with by using the cable ties 1 and 2. Make sure to twist 180 degrees and fix the cable A so that the gray colored cable is on the opposite side of the plate.



Cable B

Set the B6 of the cable tie to the cable fixing plate and fix it by using the cable ties 3 and 4. Make sure to twist 180 degrees and fix the cable B so that the two air tubes (blue and white) are on the plate side.



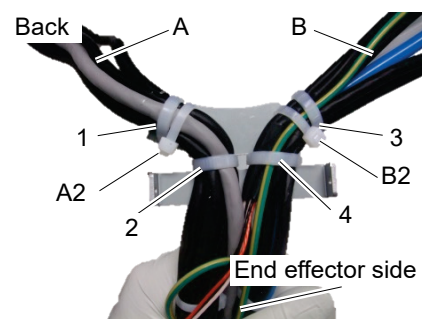
Refer to the figure for positions of the cable tie heads.

Rotate the heads of the cable ties A6 and B6 to set positions.

Be careful for the orders and the positions of the cable ties.

Distance between the cable tie 1 and A6, and 3 and B6 should be as close as possible.

Improper order or position of the cable tie may shorten the life cycle of the cables.



(29) Apply the grease to the cables between the two cable fixing plates.

Grease:
Krytox: Cable A and B
Standard model : 1g for each
Cleanroom model: 1.5g for each



Apply the grease to each cable evenly.

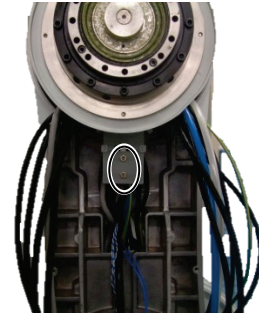


- (30) Install the cable fixing plates to Arm #2.

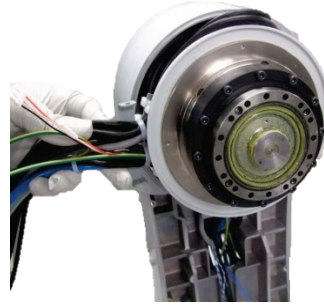
Hexagon socket head cap bolts: 2-M4×8
Tightening torque: 4.0 ± 0.2 N·m



Be careful not to tighten the screws with the cables get caught on the plate.

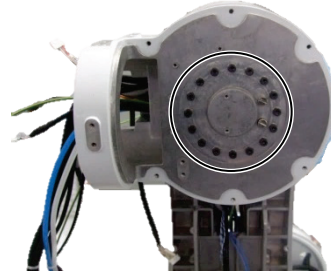


- (31) To face the two cable fixing plates, bend the cable unit and pass it through the Joint #3.



- (32) Install the Arm #3 with approx. - 90 degrees while inserting the cable unit to the Arm #3.

Hexagon socket head cap bolts:
16-M4×30 (with plain washer)
Tightening torque: 5.5 ± 0.25 N·m



Be sure to have at least 2 people to perform the operation since the parts being heavy.

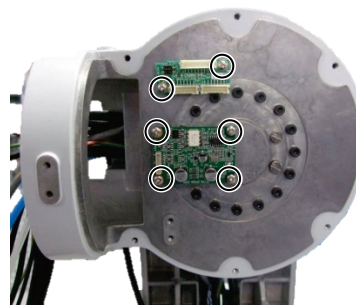
Be careful not to catch the cables.

Make sure that the O-ring will not be out of the groove.

Do not apply excessive shock to the parts.

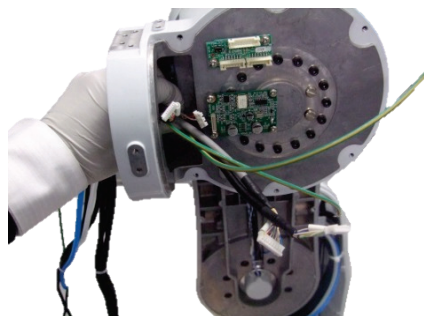
- (33) Install the encoder board 3 and the control board 2.

Cross recessed binding head machine screws:
6-M3×6
Tightening torque: 0.45 ± 0.05 N·m



- (34) Pull the cables (connectors) to the outside of the Arm #3.

Cables (connectors):
PW4, BR4, EB04_CN1, GS02,
EB04_CN3, two ground wires

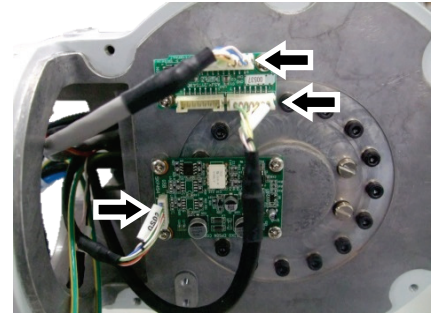


- (35) Connect the connectors to the encoder board 3 and the control board 2.

Connectors:

EB04_CN1, EB04_CN3

GS02

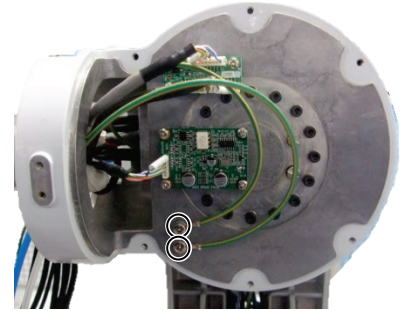


- (36) Install the two ground wire terminals.

Cross recessed binding head machine screws:

2-M4×8

Tightening torque: 0.9 ± 0.1 N·m



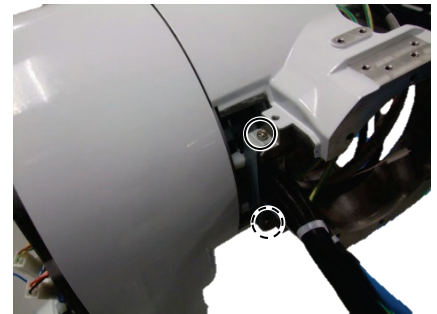
- (37) Install the cable fixing plates to Arm #3.

Hexagon socket head cap bolts: 2-M3×6

Tightening torque: 2.0 ± 0.1 N·m



NOTE Be careful not to tighten the screws with the cables get caught on the plate.



- (38) Install the Joint #4 actuator unit to the Arm #3.

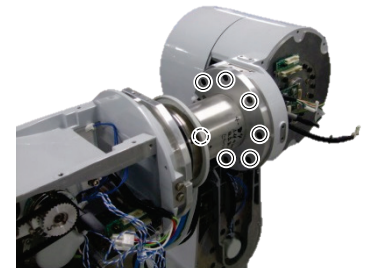
Hexagon socket head cap bolts:

7-M4×15 (with plain washer)

Tightening torque: 5.5 ± 0.25 N·m



NOTE Be sure to have at least 2 people to perform the operation since the parts being heavy.



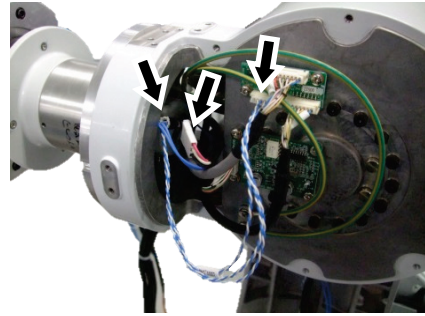
Make sure to take out the cables from the Joint #4 actuator unit to outside of the Arm #3.

Confirm that the positioning pins are installed on the Arm #3. Then, install the Joint #4 actuator unit to match with the pins.

Be careful not to get the cables caught.

(39) Connect the connectors.

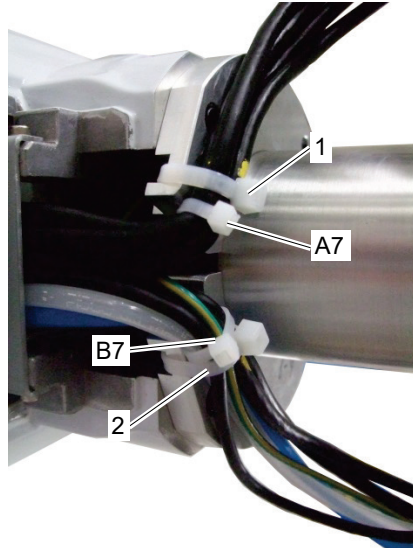
Connectors: PW4, BR4, EB0x_CN2



(40) Fix the cable unit to the flange of the Joint #4 actuator unit with the cable ties.

Cable ties (AB200) × 2 (1 and 2)

Tightening strength: 85 ± 5 N



NOTE Refer to the figure for positions of the cable tie heads.

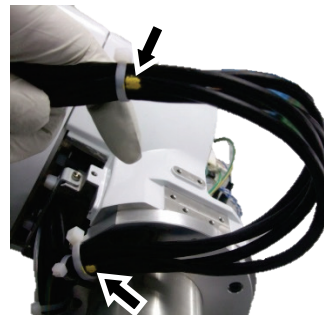
Rotate the heads of the cable ties A7 and B7 to set positions.

Distance between the cable tie 1 and A7, and 3 and B7 should be as close as possible. (Do not pull the cables forcibly to get close the cable ties.)

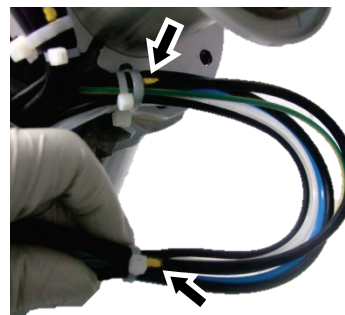
Be careful not to bend the air tubes.

Improper order or position of the cable tie may shorten the life cycle of the cables.

(41) Place marks on the cable of cable A (near the cable ties A7 and A8) on the opposite side of the flange.



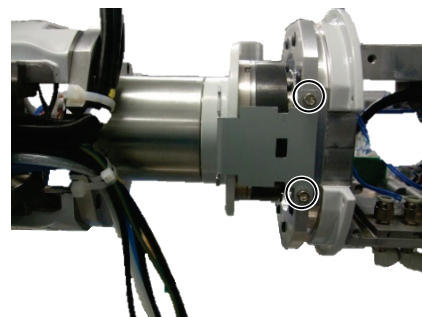
(42) As with the above, place marks on the cable or the air tube of cable B (near the cable ties B7 and B8) on the opposite side of the flange.



- (43) Install the cable fixing plates to the flange of the Arm #4.

Hexagon socket head cap bolts: 2-M4×8

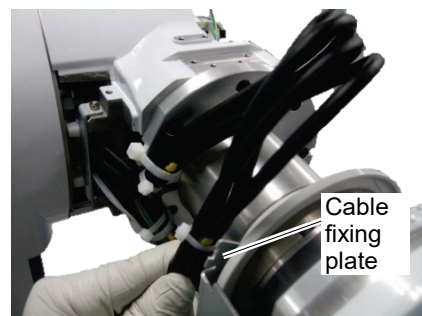
Tightening torque: 4.0 ± 0.2 N·m



- (44) Fix the cable unit on the cable fixing plate.
Follow the steps below:

Cable A

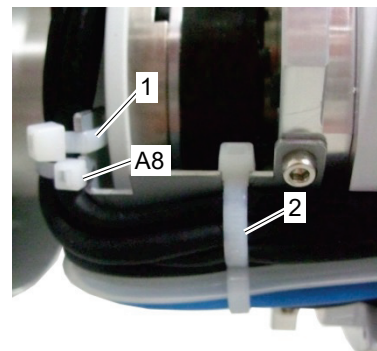
Bend the cable so that the mark near the cable tie A8 will be on the cable fixing plate side.



As shown on the right, set the position of the cable tie A8 to the cable fixing plate and fix it by using cable ties 1 and 2.

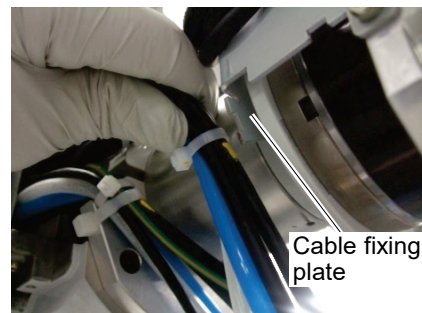
Cable ties (AB200) × 2 (1 and 2)

Tightening strength: 85 ± 5 N



Cable B

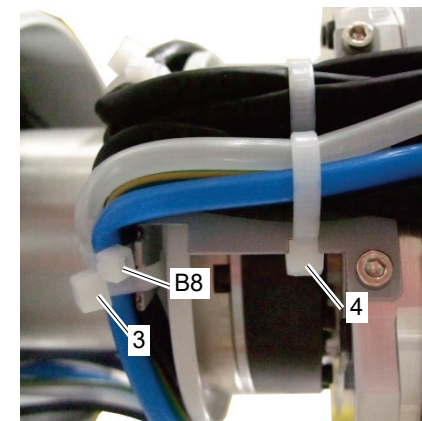
Bend the cable so that the mark near the cable tie B8 will be on the cable fixing plate side.




As shown on the right, set the position of the cable tie B8 to the cable fixing plate and fix it by using cable ties 3 and 4.

Cable ties (AB200) × 2 (3 and 4)

Tightening strength: 85 ± 5 N




NOTE Be careful not to bend the air tubes.

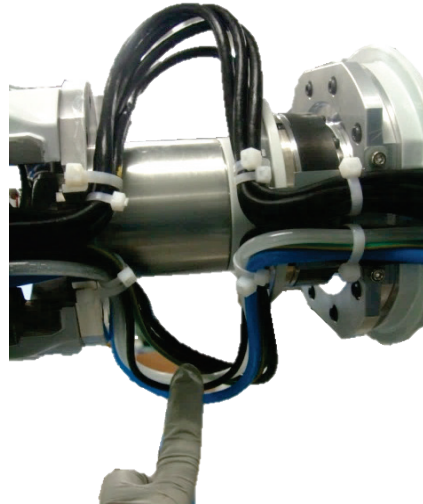
NOTE
 Refer to the figure for positions of the cable tie heads.
Rotate the heads of the cable ties A8 and B8 to set positions.

Be careful for the orders and the positions of the cable ties.
Distance between the cable tie 1 and A8, and 3 and B8 should be as close as possible.
Improper order or position of the cable tie may shorten the life cycle of the cables.

(45) Apply the grease to the cables between the cable tie A7 and A8, and B7 and B8.

Grease:
Krytox: Cable A and B
Standard model : 0.5g for each
Cleanroom model : 0.8g for each

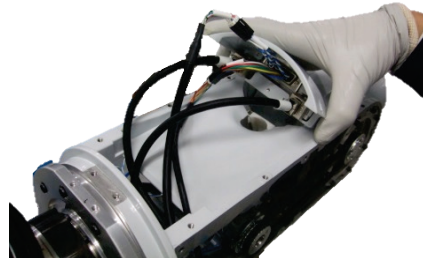
NOTE
 Apply the grease to each cable evenly.



(46) Pass the cables (connectors) through the Arm #4 and connect them to the user attachment.

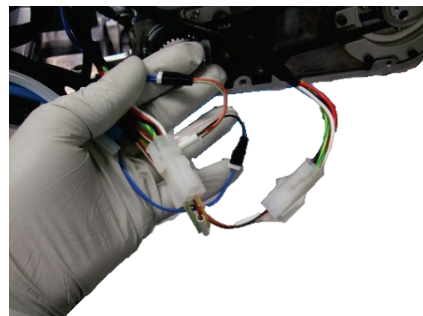
Cables (connectors):
Ether1, Ether2, X71, X72

Connect the Ether1 and Ether2 depending on the user attachment display.




(47) Connect the connectors.

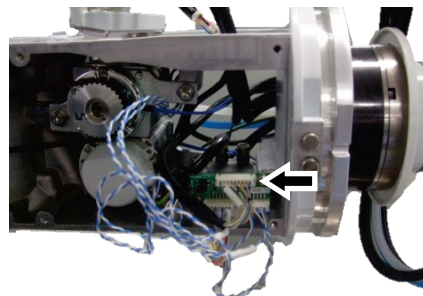
Connectors: PW5, PW6, BR5, BR6



(48) Connect the connector to the encoder board 4.

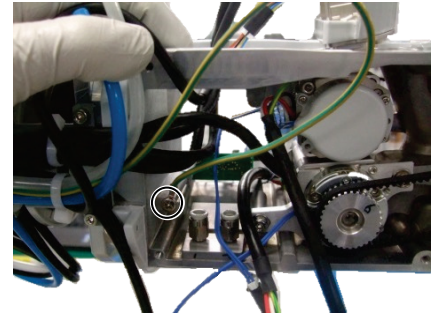
Connector: EB05_CN1

NOTE
 Be careful that the jumper pins on the board do not come off.



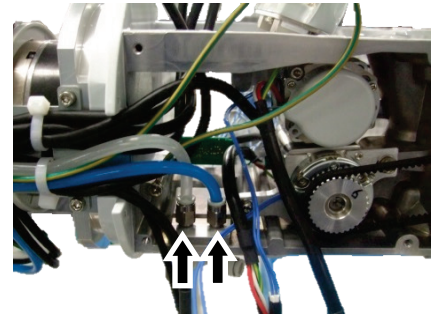
(49) Install the ground wire terminals.

Cross recessed binding head machine screw:
M4×8
Tightening torque: 0.9 ± 0.1 N·m



(50) Cut the two air tubes with proper length and connect them to fittings.

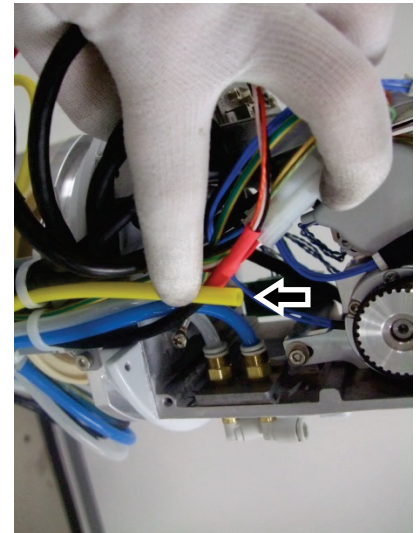
Air1: White
Air2: Blue



For cleanroom model, cut the yellow air tube with the length as shown in the picture.

NOTE


Make sure that the air tube does not interfere with the pulley or belt.

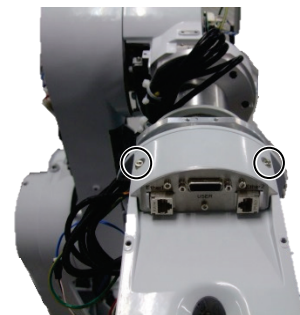


(51) Install the user attachment on the Arm #4.

Hexagon socket head cap bolts: 2-M4×8
Tightening torque: 4.0 ± 0.2 N·m

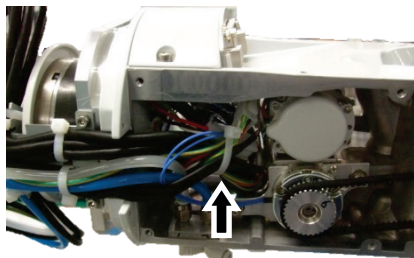
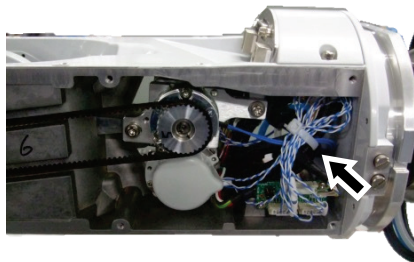
NOTE


Be careful not to get the cables caught.



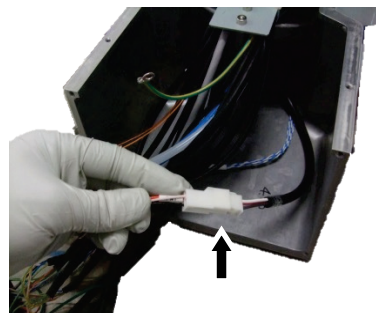
- (52) Bundle the cables with the cable tie to prevent the cables from interfering with the pulley or belt.

Cable ties (AB200) × 2



- (53) Connect the connector.

Connector: PW1

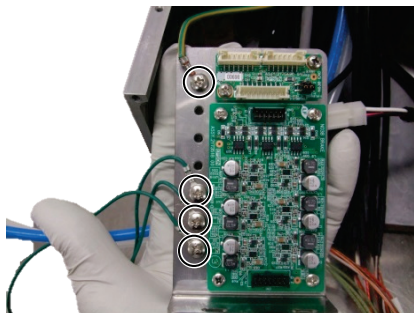


- (54) Install the four ground wire terminals except the connector X11, X12 to the board fixing plate.

Cross recessed binding head machine screws:

4-M4×8

Tightening torque: 0.9 ± 0.1 N·m

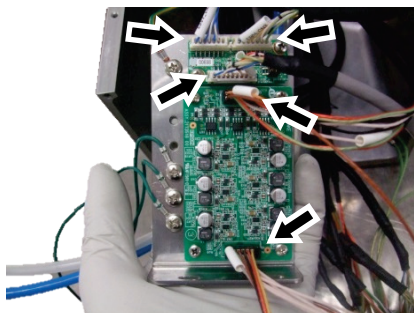


- (55) Connect the connectors to the encoder board 1 and the brake board.

Connectors:

EB01_CN1, EB01_CN3, EB0x_CN2

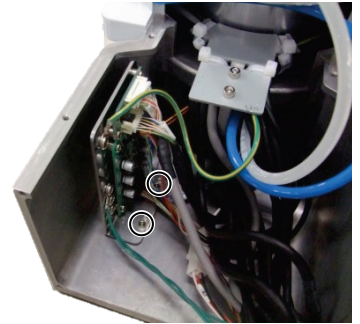
BRK_CN1, BRK_CN2



- (56) Install the board fixing plate in the back of the base.

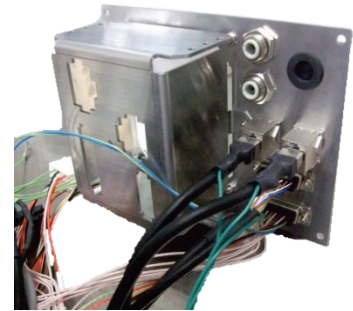
Hexagon socket head cap bolts: 2-M3×6

Tightening torque: 2.0 ± 0.1 N·m



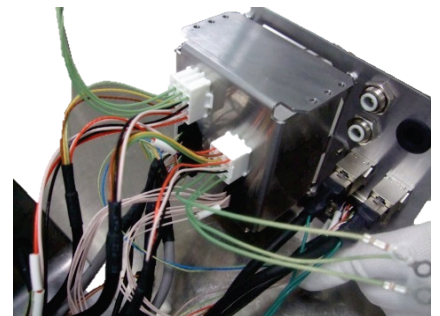
- (57) Connect the connectors to the base side plate.

Connectors: Ether1, Ether2, D-sub, SW1

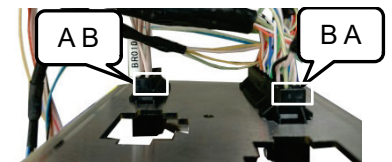


- (58) Connect the connectors to the box-shaped plate.

Connectors: X11, X12, X010, BR010

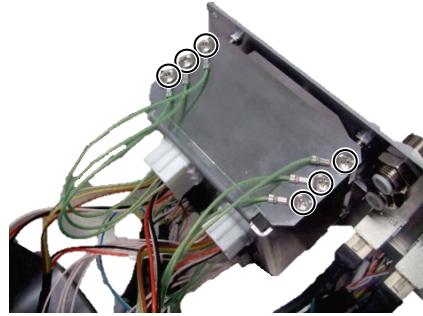


Refer to the right picture for installation direction of black colored connectors (X010, BR010).



- (59) Install the six ground wire terminals from the connector X11, X12 to the box-shaped plate.

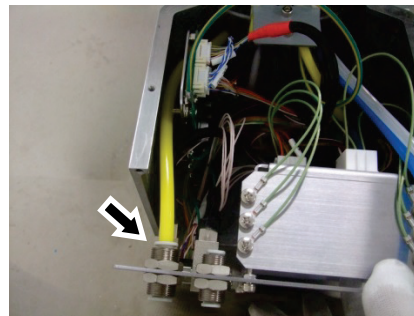
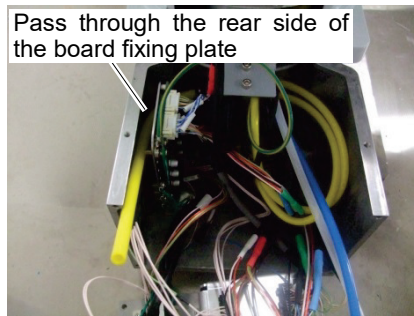
Cross recessed binding head machine screws:
6-M4×8
Tightening torque: 0.9 ± 0.1 N·m



For cleanroom model, install the yellow air tube as shown in the following pictures. Pass the air tube through the rear side of the board fixing plate, then connect to the fittings.

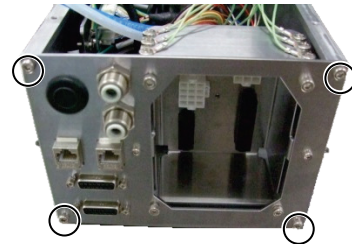
NOTE

Be careful not to bend or collapse the air tubes.

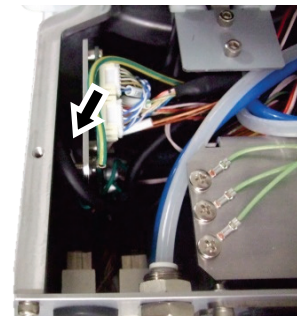


- (60) Install the base side plate.

Hexagon socket head cap bolts: 4-M4×8
Tightening torque: 4.0 ± 0.2 N·m

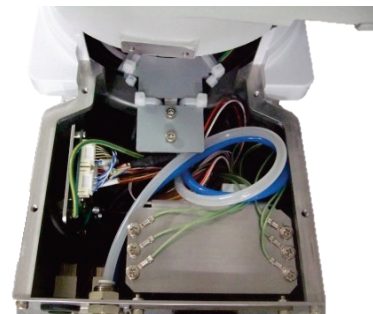


As shown on the right, make sure that the cable of Ether1 passes through the rear side of the board fixing plate.



- (61) Install the two air tubes as shown on the right, and connect them to fittings.

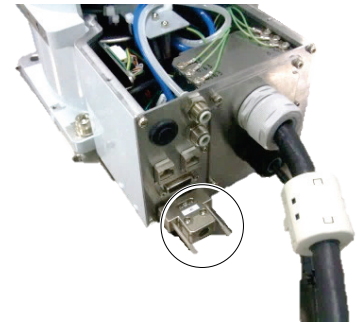
Air1: White
Air2: Blue



- (62) Connect the M/C cable.

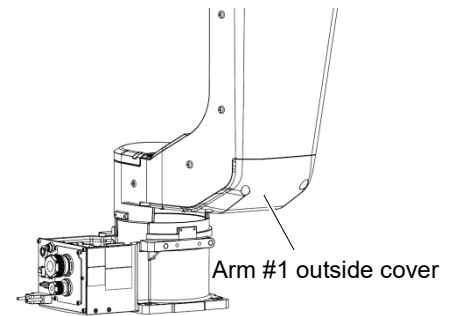
For details, refer to *Maintenance 4.6. M/C Cable*.

(63) Connect the external short connector.



(64) Install the Arm #1 outside cover.

Hexagon socket head cap bolts:
8-M5×20 (with plain washer)
Tightening torque: 8.0 ± 0.4 N·m



(65) Install the following covers:


Arm #4 side cover (2 covers)		
Joint #4 inside cover	Joint #4 outside cover	Joint #4 side covers (2 covers)
Arm #3 cover	Arm #3 inside cover	
Arm #2 cover (2 covers)	Joint #2 cover	Joint #2 outside cover
Arm #1 inside cover	Joint #1 cover	
	Base cover	


For details, refer to *Maintenance 3. Covers*.

(66) Perform calibration.

For details, refer to *Maintenance 8. Calibration*.

**4.2 Replacing the Cable Unit (N6-A1000*B):
Cable Direction: Upward and Downward**

 WARNING	<ul style="list-style-type: none"> ■ Before performing any replacement procedure, turn OFF the Controller and related equipment, and then disconnect the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system. ■ Do not connect or disconnect the motor connectors while the power to the robot system is turned ON. Connecting or disconnecting the motor connectors with the power ON is extremely hazardous and may result in serious bodily injury as the Manipulator may move abnormally, and also may result in electric shock and/or malfunction of the robot system. ■ Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source. To shut off power to the robot system, disconnect the power plug from the power source. Performing any work while connecting the AC power cable to a factory power source is extremely hazardous and may result in electric shock and/or malfunction of the robot system. ■ Be careful not to get any foreign substances in the Manipulator, connectors, and pins during maintenance. Turning ON the power to the robot system when any foreign substances exist in them is extremely hazardous and may result in electric shock and/or malfunction of the robot system. ■ Be sure to connect the cables properly. Do not allow unnecessary strain on the cables. (Do not put heavy objects on the cables. Do not bend or pull the cables forcibly.) Unnecessary strain on the cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. ■ When installing the cover, be careful not to allow the cables to interfere with the cover mounting and do not bend these cables forcibly to push them into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. Damaged cables, disconnection, or contact failure is extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, observe the cable locations after removing the cover. Be sure to place the cables back to their original locations.
--	---

 CAUTION	<ul style="list-style-type: none"> ■ When disconnecting the connectors during the replacement of the cable unit, be sure to reconnect the connectors to their proper positions. Improper connection of the connectors may result in improper function of the robot system. For details on the connections, refer to the <i>Maintenance 4.7 Connector Pin Assignments</i>.
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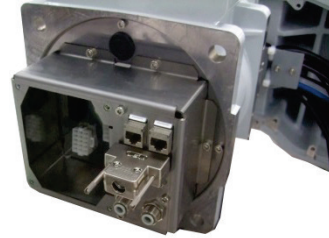
	Name		Qty	Code, Note
Maintenance Parts	Cable unit		1	2187251 (Standard)
				2194258 (Cleanroom)
	Cable tie	AB150	-	1675754, 1 bag (100 ties: white)
		AB200	-	1684328, 1 bag (100 ties: white)
Tools	Hexagonal wrench	width across flats: 2.5 mm	1	For M3 hexagon socket head cap bolts
		width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
		width across flats: 4 mm	1	For M5 hexagon socket head cap bolts
		width across flats: 5 mm	1	For M6 hexagon socket head cap bolts
	Box wrench	width across flats: 5 mm	1	For D-Sub connector
	Long nose pliers		1	For removing air tubes
	Nippers		1	For cutting a cable tie
	Cross-point screwdriver (#2)		1	For cross recessed head screws
	Torque wrench		1	For tightening torque control
	Cable tie gun		1	Refer: HellermannTyton MK8
	Cable tie gun tester		1	Refer: HellermannTyton DGT500-MK8



The subsequent steps are described with the standard model's cable unit.
For cleanroom model, a yellow air tube is included in the cable unit.

Removal Cable Unit (1) Perform the Removal steps (1) through (6), (8) in *Maintenance 4.1 Cable Unit (N6-A1000*)*: Cable direction Standard (backward).

(Cable direction: Upward and Downward) (2) Disconnect the external short connector.



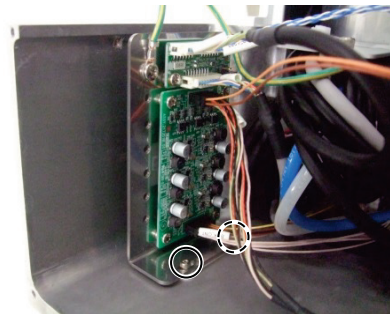
(3) Perform the Removal steps (9) through (47) in *Maintenance 4.1 Cable Unit (N6-A1000*)*: Cable direction Standard (backward).

(4) Remove the base side plate.
Hexagon socket head cap bolts: 4-M4x8



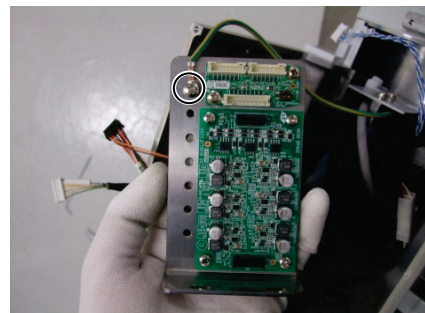
(5) Remove the board fixing plate.
Hexagon socket head cap bolts: 2-M3x6

(6) Disconnect the connectors connected to the encoder board 1 and the brake board.
Connectors:
EB01_CN1, EB01_CN3, EB0x_CN2
BRK_CN1, BRK_CN2




Be careful that the jumper pins on the encoder board do not come off.

(7) Remove the ground wire terminals fixed on the board fixing plate.
Cross recessed binding head machine screw:
M4x8




(8) Perform the Removal steps (54) through (59) in *Maintenance 4.1 Cable Unit (N6-A1000*)*: Cable direction Standard (backward).

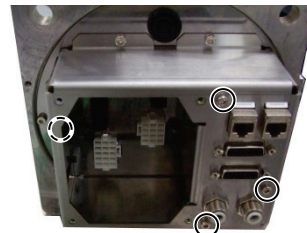
(9) Lay down the Manipulator.

NOTE  Be sure to have at least 2 people to lay down the Manipulator.

(10) Remove the plate part 1 from the base bottom.

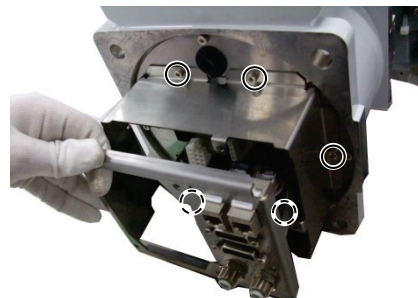
Hexagon socket head cap bolts: 4-M4×8

NOTE  Do not pull the part after removing it. Doing so may result in disconnection of the cables since the cables are connected.



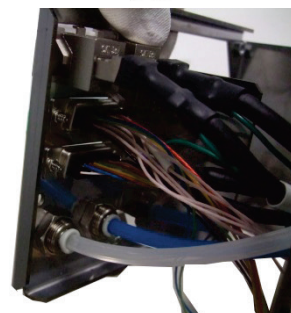
(11) Remove the plate part 2 from the base bottom.

Hexagon socket head cap bolts: 5-M4×8



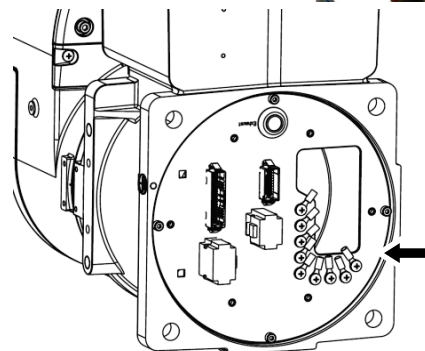
(12) Remove the two air tubes and connectors from the plate part 1.

Connectors: Ether1, Ether2, D-sub, SW1



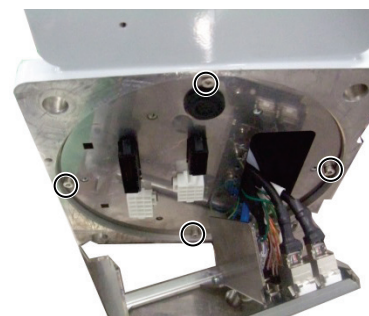
(13) Remove the nine ground wire terminals fixed on the plate part 3.

Cross recessed binding head machine screws:
9-M4×8



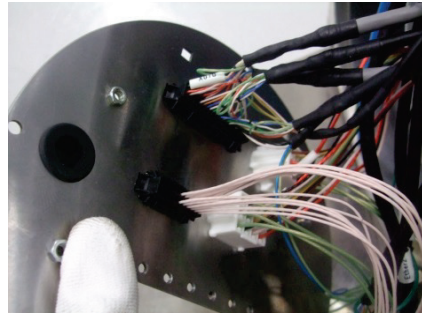
(14) Remove the plate part 3.

Hexagon socket head cap bolts: 4-M4×8




- (15) Disconnect the connectors from the plate part 3.

Connectors: X11, X12, X010, BR010




For cleanroom model, disconnect the yellow air tube as well.



NOTE  The subsequent steps are described with the standard model's cable unit.
For cleanroom model, a yellow air tube is included in the cable unit.


Installation Cable Unit (1) Perform the Installation steps (1) through (8) in *Maintenance 4.1 Cable Unit: Cable direction Standard (backward)*.

(Cable direction: Upward and Downward) (2) Lay down the Manipulator.
NOTE  Manipulator is heavy. Be sure to have at least 2 people to perform the operation.

(3) Pull out the cable unit except the following cables.

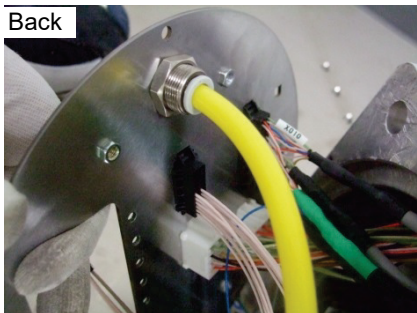
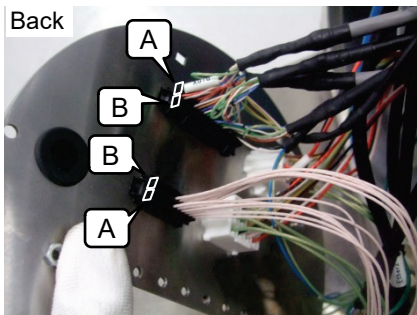
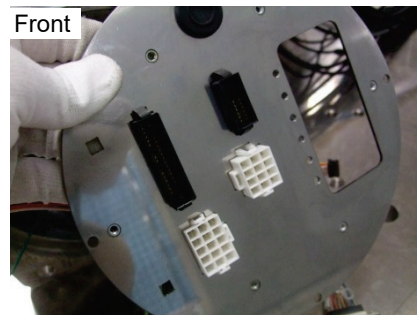
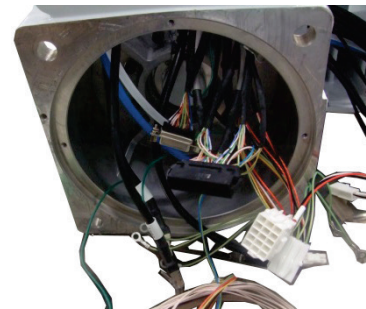
Cables (connectors):
BRK_CN2, EB01_CN3, ground wire

(4) Connect the connectors to the plate part 3
Connectors: X11, X12, X010, BR010

NOTE  There are the front side and the back side on the plate part 3. Be careful for the directions.

Refer to the right picture for installation direction of black colored connectors (X010, BR010).

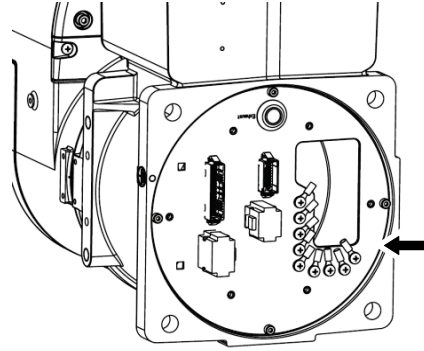
For cleanroom model, connect the yellow air tube to the fittings.




- (5) Install the nine ground wire terminals from the following connectors to the front side of the plate part 3.

Connectors:
X11, X12, D-sub, Ether1, Ether2

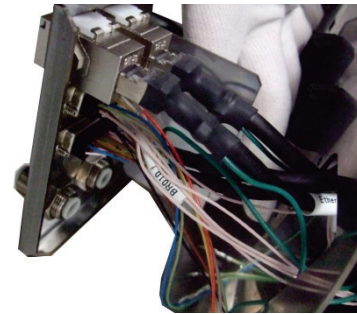
Cross recessed binding head machine screw:
9-M4×8
Tightening torque: 0.9 ± 0.1 N·m



NOTE
 Refer to the right figure for the installation position.

- (6) Pass the connectors through the hole of the plate part 3, and install on the the plate part 1.

Connectors: Ether1, Ether2, D-sub, SW1




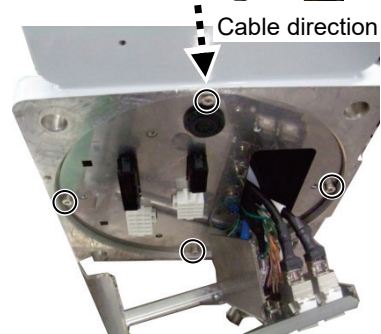
- (7) Connect the two air tubes to fittings.

Air1: White
Air2: Blue




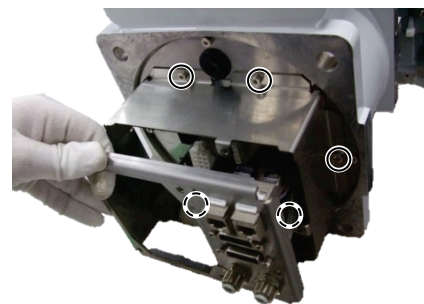
- (8) Install the plate part 3 to the base.
Hexagon socket head cap bolts: 4-M4×8
Tightening torque: 4.0 ± 0.2 N·m

NOTE
 Refer to the right figure for the installation position.



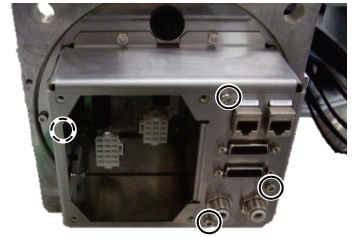
- (9) Install the plate part 2.
Hexagon socket head cap bolts: 5-M4×8
Tightening torque: 4.0 ± 0.2 N·m

NOTE
 Be careful not to get the cables caught.

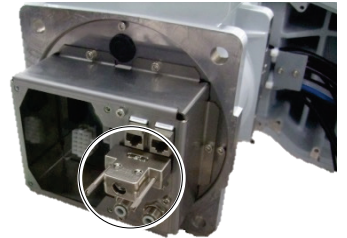


- (10) Install the plate part 1.

Hexagon socket head cap bolts: 4-M4×8
Tightening torque: 4.0 ± 0.2 N·m



- (11) Connect the external short connector.



- (12) Connect the M/C cable.

For details, refer to *Maintenance 4.6. M/C Cable*.

- (13) Mount the Manipulator on the base table.

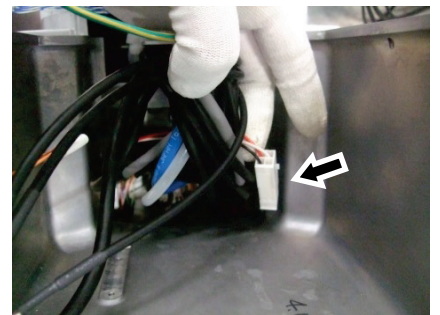
NOTE



Be sure to have at least 2 people to mount the Manipulator.

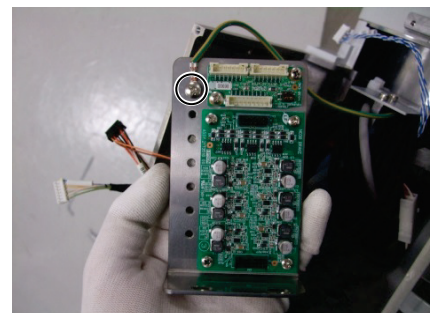
- (14) Connect the connectors.

Connector: PW1



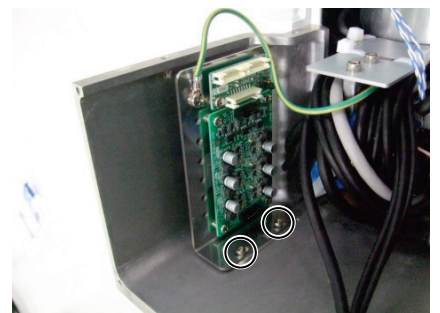
- (15) Install the ground wire terminal on the board fixing plate.

Cross recessed binding head machine screw:
M4×8
Tightening torque: 0.9 ± 0.1 N·m



- (16) Install the board fixing plate in the back of the base.

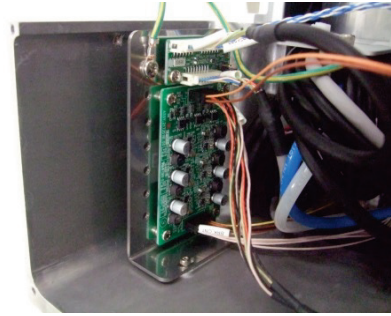
Hexagon socket head cap bolts: 2-M3×6
Tightening torque: 2.0 ± 0.1 N·m



- (17) Connect the connectors to the encoder board 1 and the brake board.

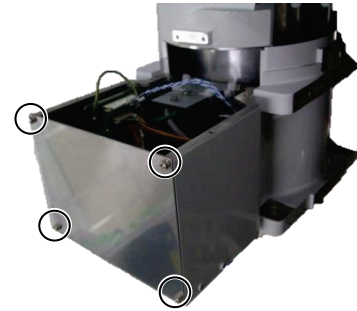
Connectors:

EB01_CN1, EB01_CN3, EB0x_CN2
BRK_CN1, BRK_CN2



- (18) Install the base side plate.

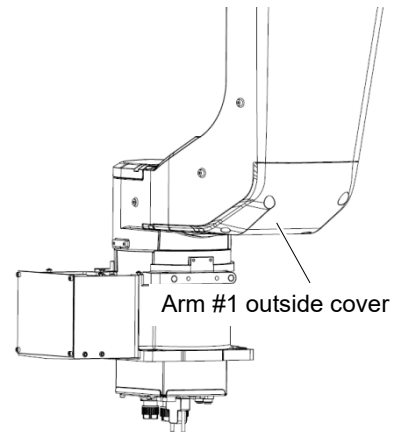
Hexagon socket head cap bolts: 4-M4×8
Tightening torque: 4.0 ± 0.2 N·m



- (19) Perform the Installation steps (9) through (52) in *Maintenance 4.1 Cable Unit (N6-A1000*)*: Cable direction Standard (backward).

- (20) Install the Arm #1 outside cover.

Hexagon socket head cap bolts:
8-M5×20 (with plain washer)
Tightening torque: 8.0 ± 0.4 N·m



- (21) Install the following covers:



Arm #4 side cover (2 covers)
 Joint #4 inside cover Joint #4 outside cover Joint #4 side covers (2 covers)
 Arm #3 cover Arm #3 inside cover
 Arm #2 cover (2 covers) Joint #2 cover Joint #2 outside cover
 Arm #1 inside cover Joint #1 cover
 Base cover

For details, refer to *Maintenance 3. Covers*.

- (22) Perform calibration.

For details, refer to *Maintenance 8. Calibration*.

4.3 Replacing the Cable Unit (N6-A850*R): Cable Direction: Standard (backward)

 WARNING	<ul style="list-style-type: none"> ■ Before performing any replacement procedure, turn OFF the Controller and related equipment, and then disconnect the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system. ■ Do not connect or disconnect the motor connectors while the power to the robot system is turned ON. Connecting or disconnecting the motor connectors with the power ON is extremely hazardous and may result in serious bodily injury as the Manipulator may move abnormally, and also may result in electric shock and/or malfunction of the robot system. ■ Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source. To shut off power to the robot system, disconnect the power plug from the power source. Performing any work while connecting the AC power cable to a factory power source is extremely hazardous and may result in electric shock and/or malfunction of the robot system. ■ Be careful not to get any foreign substances in the Manipulator, connectors, and pins during maintenance. Turning ON the power to the robot system when any foreign substances exist in them is extremely hazardous and may result in electric shock and/or malfunction of the robot system. ■ Be sure to connect the cables properly. Do not allow unnecessary strain on the cables. (Do not put heavy objects on the cables. Do not bend or pull the cables forcibly.) Unnecessary strain on the cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system. ■ When installing the cover, be careful not to allow the cables to interfere with the cover mounting and do not bend these cables forcibly to push them into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. Damaged cables, disconnection, or contact failure is extremely hazardous and may result in electric shock and/or improper function of the robot system. When routing the cables, observe the cable locations after removing the cover. Be sure to place the cables back to their original locations.
 CAUTION	<ul style="list-style-type: none"> ■ When disconnecting the connectors during the replacement of the cable unit, be sure to reconnect the connectors to their proper positions. Improper connection of the connectors may result in improper function of the robot system. For details on the connections, refer to the <i>Maintenance 4.7 Connector Pin Assignments</i>.

Maintenance 4. Cable

	Name		Qty	Code, Note
Maintenance Parts	Cable unit		1	2187251 (Standard)
				2194258 (Cleanroom)
	Cable tie	AB200	-	1684328, 1 bag (100 ties: white)
Tools	Hexagonal wrench	width across flats: 2.5 mm	1	For M3 hexagon socket head cap bolts
		width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
		width across flats: 4 mm	1	For M5 hexagon socket head cap bolts
		width across flats: 5 mm	1	For M6 hexagon socket head cap bolts
	Box wrench	width across flats: 5 mm	1	For D-Sub connector
	Long nose pliers		1	For removing air tubes
	Nippers		1	For cutting a cable tie
	Cross-point screwdriver (#2)		1	For cross recessed head screws
	Torque wrench		1	For tightening torque control
	Cable tie gun		1	Refer: HellermannTyton MK8
	Cable tie gun tester		1	Refer: HellermannTyton DGT500-MK8

NOTE



The subsequent steps are described with the standard model's cable unit.
For cleanroom model, a yellow air tube is included in the cable unit.

Removal

- (1) Mount the ceiling mounted robot to the table top.

Cable Unit

NOTE



Be sure to have at least 2 people to perform the operation since the Manipulator is heavy.

Cable direction
(N6-A850*R)
Standard
(backward)

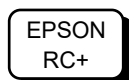
- (2) Remove the following covers:

Arm #4 side cover (2 covers)			
Joint #4 inside cover	Joint #4 outside cover	Joint #4 side covers (2 covers)	
Arm #3 cover	Arm #3 inside cover	Arm #2 cover (2 covers)	
Joint #2 outside cover	Arm #1 inside cover		
Arm #1 outside cover	Joint #1 cover	Base cover	

For details, refer to *Maintenance 3. Covers*.

* Remove the Arm #1 outside cover simultaneously with the Joint #1 cover.

- (3) Turn ON the Controller.
- (4) Release the brakes of each joint and move the Manipulator to the orientation as shown below.



Command

>Brake off, [the number (from 2 to 6) corresponding to the arm whose brake will be turned OFF]

Joint #1	+90°
Joint #2	+90°
Joint #3	-90°
Joint #4	0°
Joint #5	0°
Joint #6	0°



NOTE



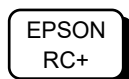
When releasing the brake, the arm may rotate by its own weight.

NOTE



Normally, release the brake of joints one by one. Take extra care if you need to release the brakes of two or more joints simultaneously. Releasing the brakes of two or more joints simultaneously may cause hands and fingers to be caught and/or equipment damage to or malfunction of the Manipulator as the arms of the Manipulator may move in unexpected directions.

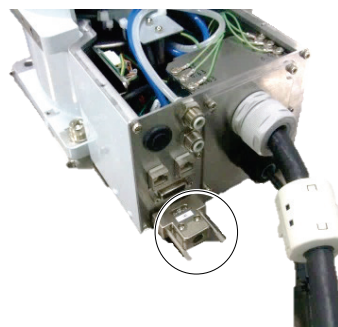
- (5) Brake each joint.



Command


>Brake On, [The number (from 2 to 6) corresponding to the arm whose brake will be turned ON]

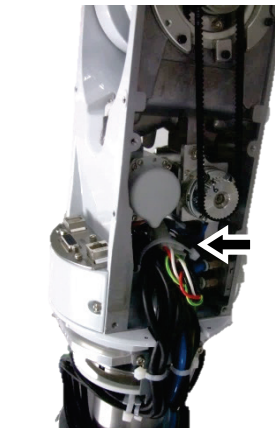
- (6) Turn OFF the Controller.
- (7) Disconnect the external short connector.




- (8) Disconnect the M/C cable.
For details, refer to *Maintenance 4.6. M/C Cable*.

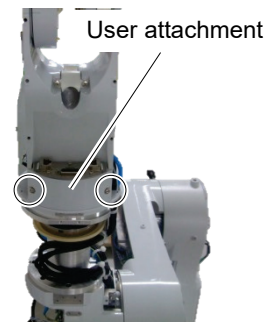
- (9) Cut off the cable tie of the cables.

NOTE  Be careful not to cut the cables.



- (10) Remove the user attachment of the Arm #4.
Hexagon socket head cap bolts: 2-M4×8

NOTE  Cables are connected to the user attachment. When you disconnect the cables, make sure not to pull the user attachment forcibly.



- (11) Disconnect the connectors from the user attachment.

Connectors: Ether1, Ether2, X71, X72



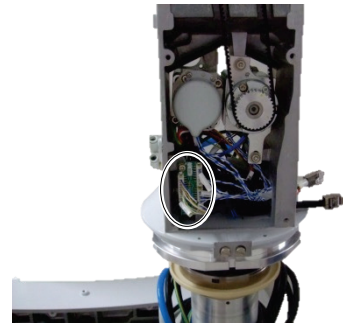
- (12) Disconnect the connector connected to the encoder board 4.

Connector: EB05_CN1

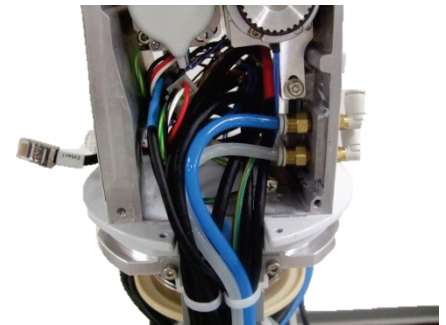
NOTE



Be careful that the jumper pins on the board do not come off.

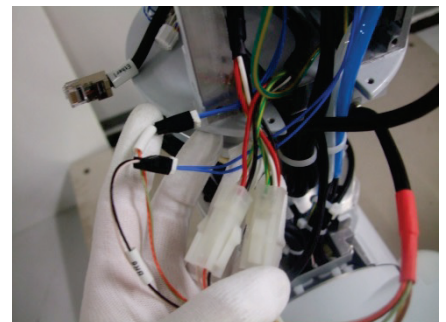


- (13) Remove the two air tubes.



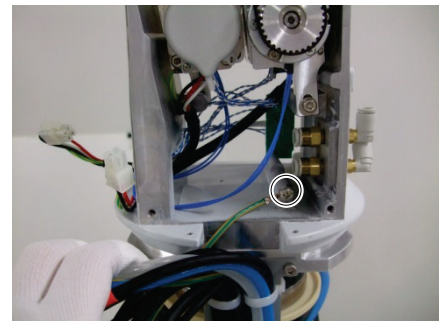
- (14) Remove the connectors.

Connectors: PW5, PW6, BR5, BR6

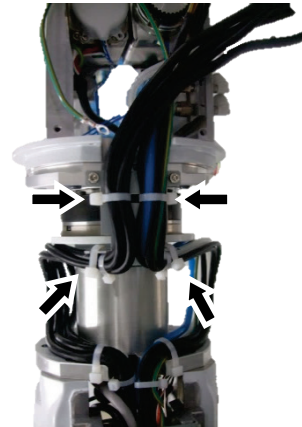


- (15) Remove the ground wire terminals.

Cross recessed binding head machine screw:
M4×8



- (16) Cut off the cable tie that fixes the cable unit to the plate.

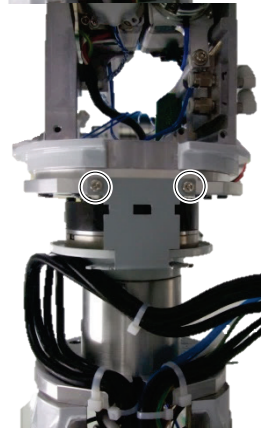


- (17) Remove the cable fixing plate.

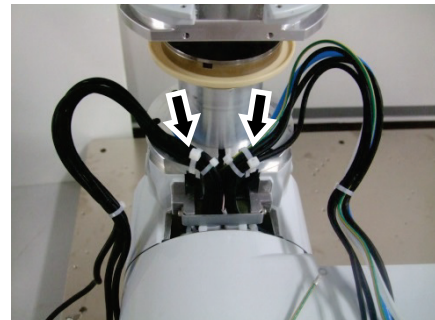
Hexagon socket head cap bolts: 2-M4×8



NOTE Be careful not to lose the removed cable fixing plate.



- (18) Cut off the cable tie of the flange on the Joint #4 actuator unit.

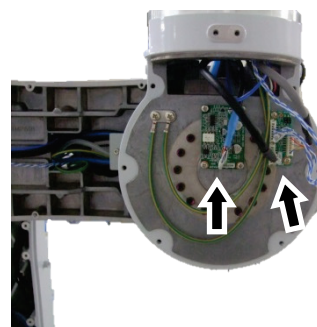


- (19) Disconnect the connectors connected to the encoder board 3 and the control board 2.

Connectors: EB04_CN1, EB04_CN3, EB0x_CN2, GS02

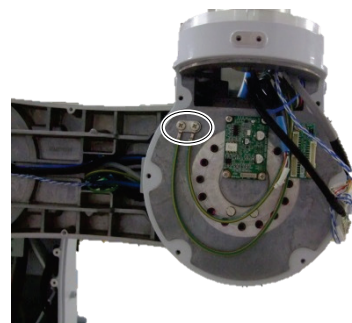


NOTE Be careful that the jumper pins on the board do not come off.



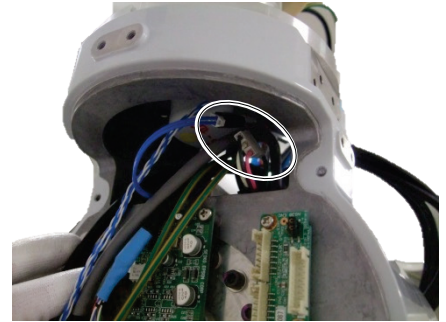
- (20) Remove the two ground wire terminals.

Cross recessed binding head machine screws: 2-M4×8



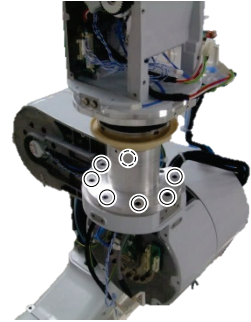
- (21) Disconnect the connectors connected to the Joint #4 actuator unit.

Connectors: PW4, BR4



- (22) Remove the Joint #4 actuator unit from the Arm #3.

Hexagon socket head cap bolts:
7-M4×15 (with plain washer)



NOTE



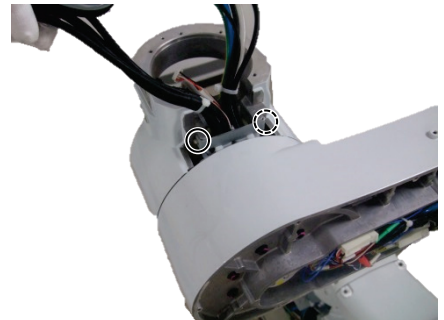
Be sure to have at least 2 people to perform the operation since the parts being heavy.

When removing it, make sure not to lose the positioning pin.

Also, be careful not to catch the cables on the Joint #4 actuator unit.

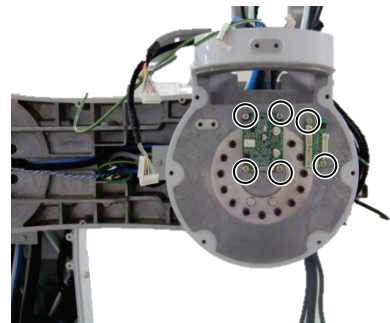
- (23) Remove the J3 cable fixing plate fixed on the Arm #3.

Hexagon socket head cap bolts: 2-M3×6



- (24) Remove the encoder board 3 and the control board 2.

Cross recessed binding head machine screws: 6-M3×6



NOTE



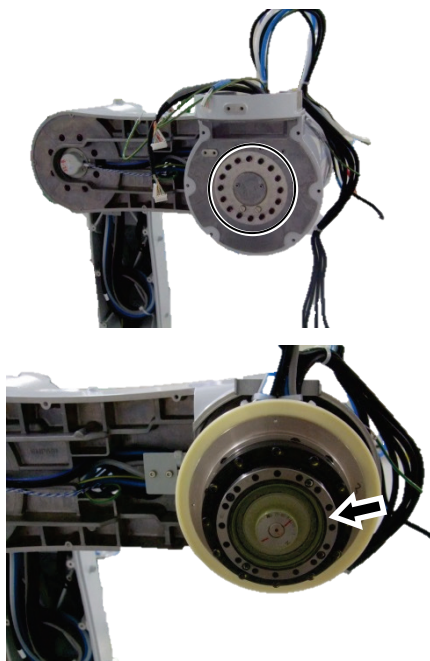
Be careful not to lose the removed board

(25) Remove the Arm #3.

Hexagon socket head cap bolts:
16-M4×30 (with plain washer)



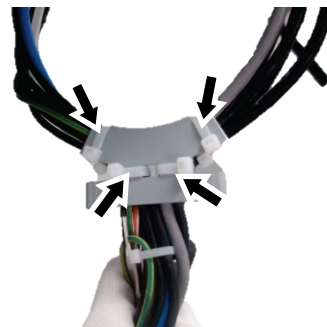
After removing the Arm #3, confirm that the O-ring is installed to the reduction gear unit. If the O-ring is installed on the Arm #3, re-install it on the reduction gear unit.



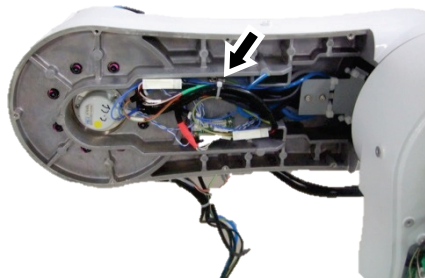
(26) Cut off the cable tie of the removed J3 cable fixing plate.



Be careful not to lose the removed cable fixing plate.



(27) Cut off the cable tie of the cables.

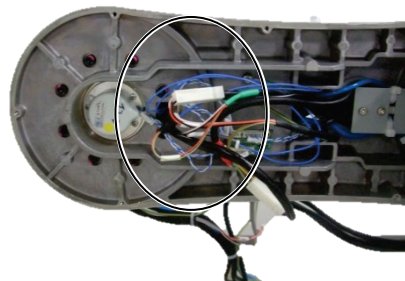


(28) Disconnect the connectors connected to the Joint #2 actuator unit.

Connectors: PW2, BR2

(29) Disconnect the connectors connected to the Joint #3 actuator unit.

Connectors: PW3, BR3

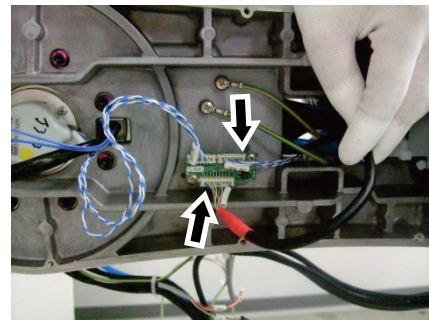


- (30) Disconnect the connectors connected to the encoder board 2.

Connectors:
 EB02_CN1
 EB0x_CN2 (Joint #2 side)



Be careful that the jumper pins on the board do not come off.



- (31) Pull the cables from the Joint #2 actuator unit to the Arm #3 side.

Cables (connectors):
 PW2, BR2, EB0x_CN2

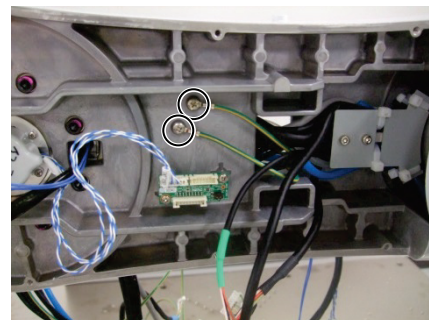


Do not pull the cables forcibly while the connectors get caught. Doing so may result in disconnection of the cables or breakage of the connectors.



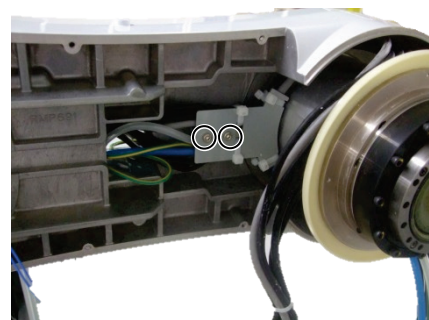
- (32) Remove the two ground wire terminals.

Cross recessed binding head machine screw:
 2-M4×8



- (33) Remove the J3 cable fixing plate fixed on the Arm #2.

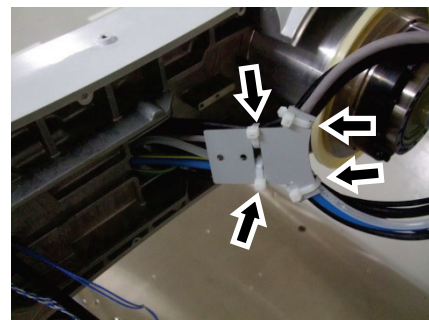
Hexagon socket head cap bolts: 2-M4×8



- (34) Cut off the cable tie of the removed J3 cable fixing plate.

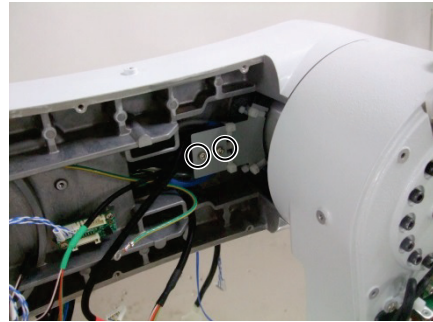


Be careful not to lose the removed cable fixing plate.



- (35) Remove the J2 cable fixing plate fixed on the Arm #2.

Hexagon socket head cap bolts: 2-M4×8



- (36) Pull out the cable unit passing through the Arm #2.

NOTE



Be careful not to catch the cables coming from the Joint #2 actuator unit to the cable unit.



- (37) Remove the Arm #2.

Hexagon socket head cap bolts:
8-M6×35 (with plain washer)

NOTE



Be sure to have at least 2 people to perform the operation since the parts being heavy.

NOTE



Be careful not to catch the cables on the Joint #2 actuator unit or Arm #2.

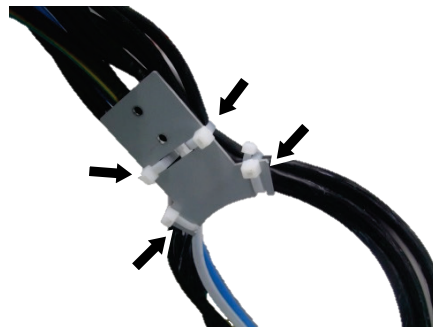


- (38) Cut off the cable tie of the removed J2 cable fixing plate.

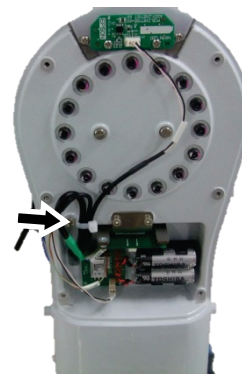
NOTE



Be careful not to lose the removed cable fixing plate.



- (39) Cut off the cable tie of the cables.



- (40) Disconnect the connectors connected to the LED board.

Connector: LED_CN1



- (41) Remove the plate which the control board 1 is fixed.

Hexagon socket head cap bolts: 2-M4x8



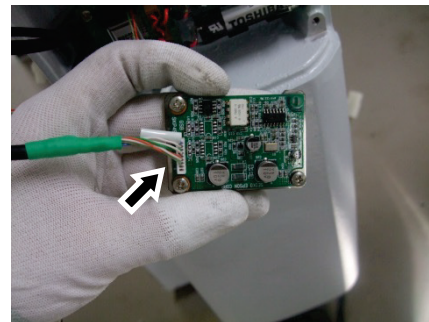
- (42) Disconnect the connectors connected to the control board 1.

Connector: GS01

NOTE



Be careful not to lose the removed plate and board.



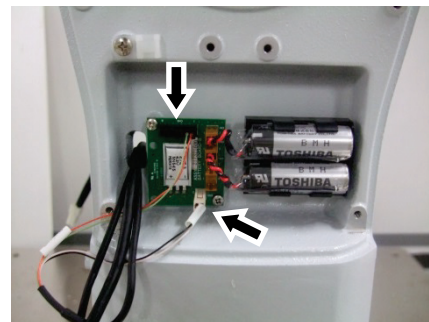
- (43) Disconnect the connectors connected to the battery board.

Connectors: BAT_CN3, BAT_CN6

NOTE

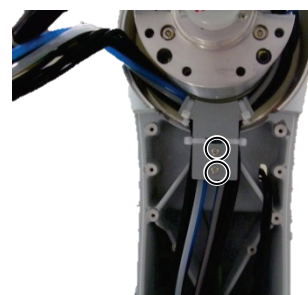


You do not need to disconnect the connectors of the batteries.



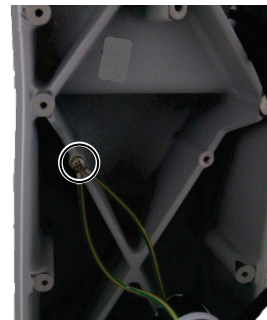
- (44) Remove the J2 cable fixing plate fixed on the Arm #1.

Hexagon socket head cap bolts: 2-M4x8



(45) Remove the ground wire terminals.

Cross recessed binding head machine screw:
M4×8



(46) Pull the following cables (connectors) to the inside of the Arm #1.

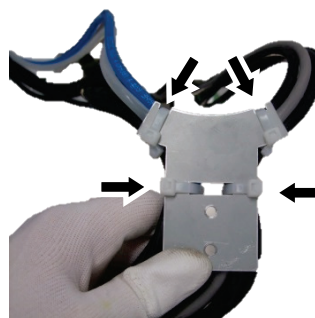
Cables (connectors):
BAT_CN3, BAT_CN6, GS01,
LED_CN1



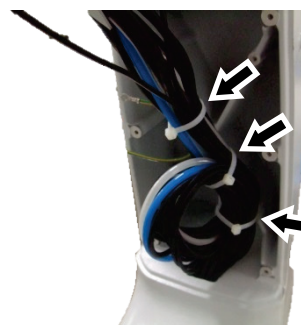
(47) Cut off the cable tie of the removed J2 cable fixing plate.

NOTE


Be careful not to lose the removed cable fixing plate.



(48) Cut off the cable tie that fixes the cable unit.



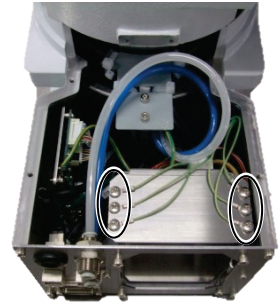
(49) Remove the J1 cable fixing plate fixed on the Arm #1.

Hexagon socket head cap bolts: 2-M4×8



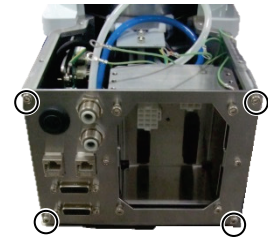
- (50) Remove the six ground wire terminals.

Cross recessed binding head machine screw:
6-M4×8



- (51) Remove the base side plate.

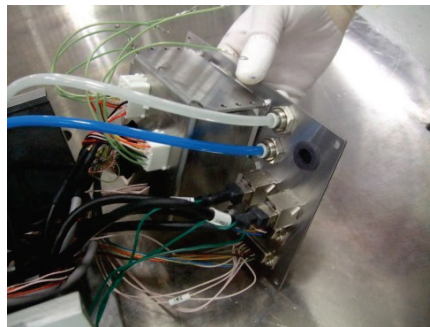
Hexagon socket head cap bolts: 4-M4×8



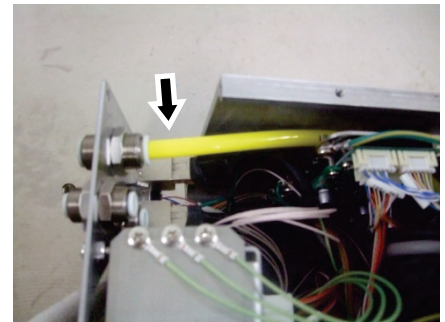
- (52) Disconnect the connectors and two air tubes (for cleanroom model: three air tubes) from the removed base side plate.

Connectors: X11, X12, X010, BR010, Ether1, Ether2, D-sub, SW1

Standard model

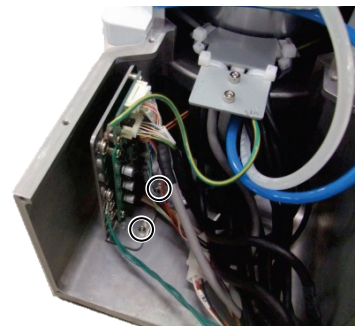


Cleanroom model



- (53) Remove the board fixing plate.

Hexagon socket head cap bolts: 2-M3×6



- (54) Disconnect the connectors connected to the encoder board 1 and the brake board.

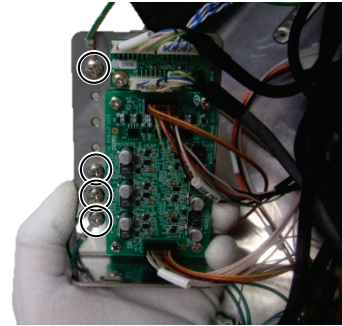
Connectors:

EB01_CN1, EB01_CN3, EB0x_CN2
BRK_CN1, BRK_CN2

NOTE



Be careful that the jumper pins on the board do not come off.

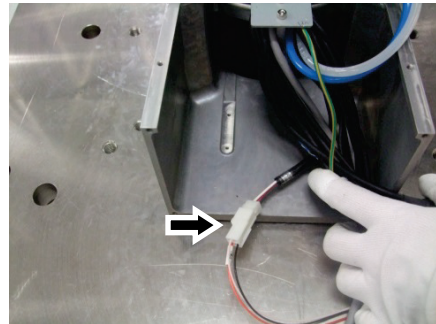


- (55) Remove the four ground wire terminals fixed on the board fixing plate.

Cross recessed binding head machine screws: 4-M4×8

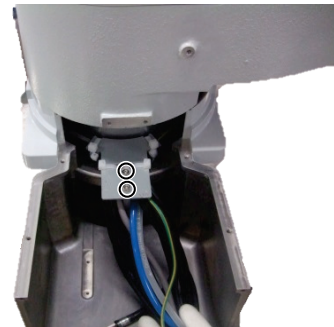
- (56) Disconnect the connector connected to the Joint #1 actuator unit.

Connector: PW1

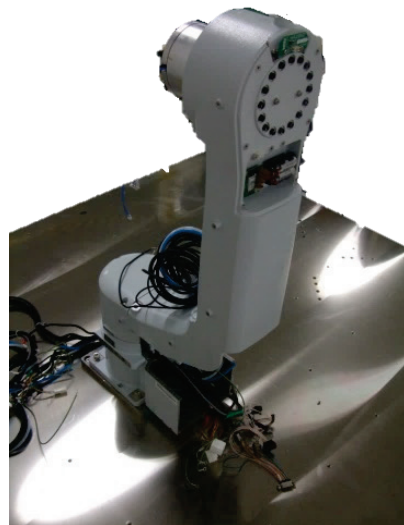


- (57) Remove the J1 cable fixing plate fixed on the base.

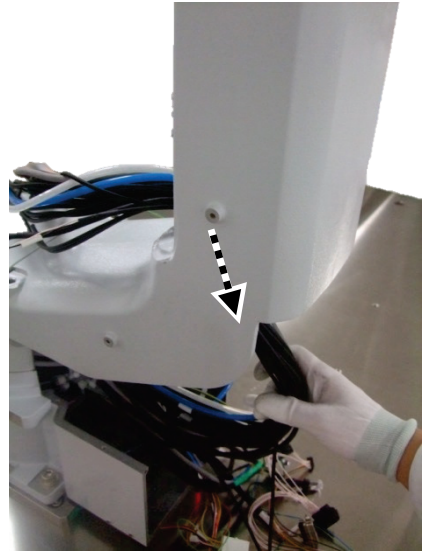
Hexagon socket head cap bolts: 2-M4×8



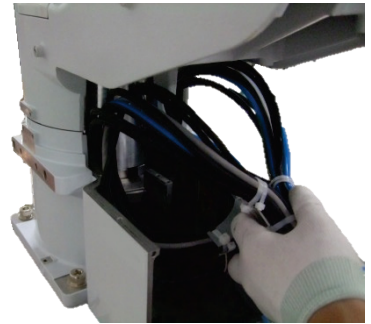
- (58) Rotate the Arm #1 to the origin position.



(59) Pull out the cable unit from the Arm #1.



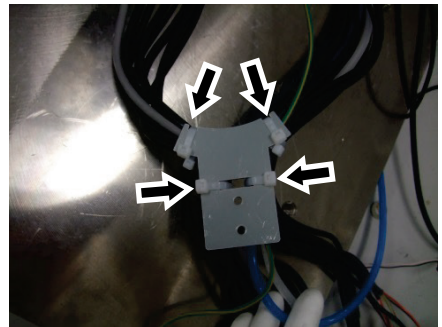
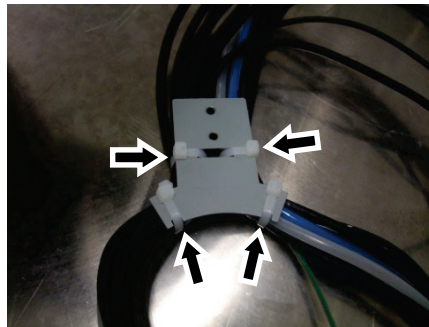
(60) Remove the cable unit from the Joint #1.




(61) Cut off the cable tie of the removed J1 cable fixing plate.



NOTE Be careful not to lose the removed cable fixing plate.



NOTE
 The subsequent steps are described with the standard model's cable unit.
 For cleanroom model, a yellow air tube is included in the cable unit.

Installation (1) Check the cable unit.

Cable Unit (N6-A850*R)
 The cable unit consists of the cable A and the cable B.

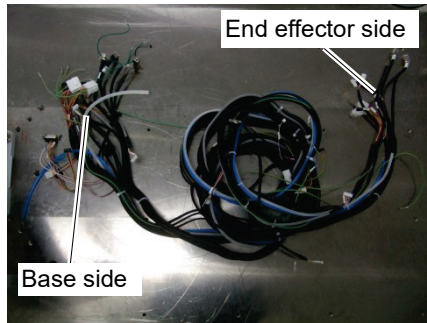
Cable direction:

Standard
(backward)

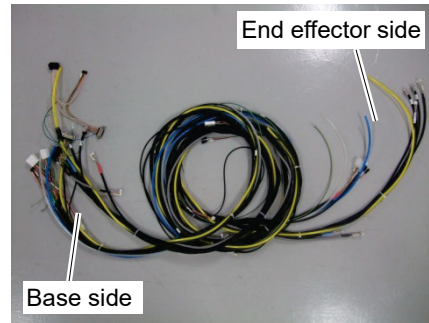
- A: Include the gray colored cable.
- B: Include the ground wire (green).

The cable A and the cable B are bundled by eight cable ties.

Standard model




Cleanroom model



Hereinafter referred to as below in order from the base side.

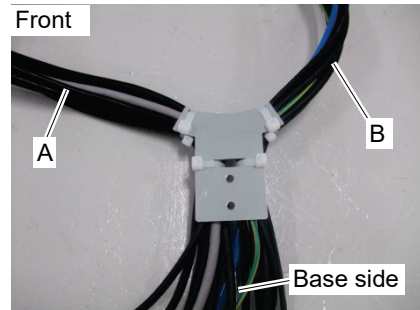
- A1, A2, ..., A8 (cable A)
- B1, B2, ..., B8 (cable B)

NOTE
 Do not cut off or move the position of the cable tie. The cable unit will not be able to install properly.

(2) Fix the cable unit to the cable fixing plate.

Be careful for the following:

- Cable ties (AB200) × 4 (1 to 4)
- Tightening strength: 85 ± 5 N

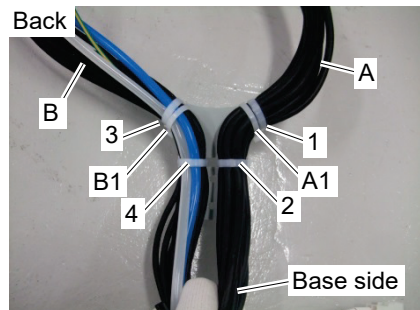


Cable A

Set the A1 of the cable tie to the cable fixing plate and fix it by using the cable ties 1 and 2. Make sure that the gray colored cable is on the plate side.

Cable B

Set the B1 of the cable tie to the cable fixing plate and fix it by using the cable ties 3 and 4. Make sure that the two air tubes (blue and white) are on the opposite side of the plate.



NOTE

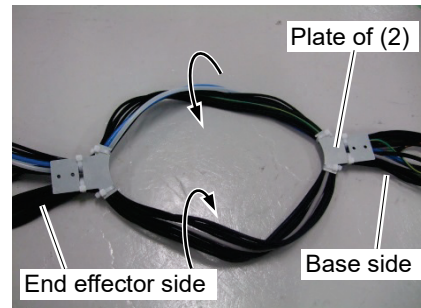


Refer to the figure for positions of the cable tie heads.
 Rotate the heads of the cable ties A1 and B1 to set positions.
 Be careful for the orders and the positions of the cable ties.
 Distance between the cable tie 1 and A1, and 3 and B1 should be as close as possible.
 Improper order or position of the cable tie may shorten the life cycle of the cables.

- (3) Fix the cable unit to the cable fixing plate with twisting 180 degrees.

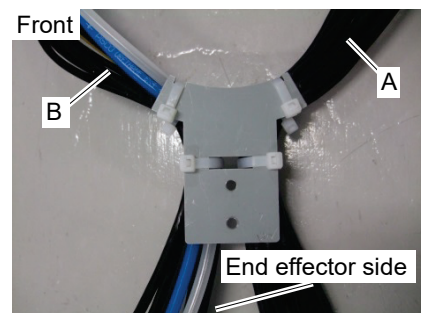
Be careful for the following:

Cable ties (AB200) × 4 (1 to 4)
 Tightening strength: 85 ± 5 N



Cable A

Set the A2 of the cable tie to the cable fixing plate and fix it with by using the cable ties 1 and 2. Make sure to twist 180 degrees and fix the cable A so that the gray colored cable is on the opposite side of the plate.



Cable B

Set the B2 of the cable tie to the cable fixing plate and fix it by using the cable ties 3 and 4. Make sure to twist 180 degrees and fix the cable B so that the two air tubes (blue and white) are on the plate side.

NOTE



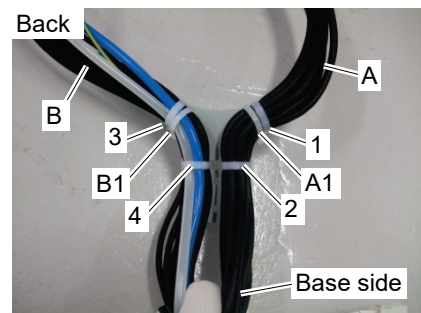
Refer to the figure for positions of the cable tie heads.

Rotate the heads of the cable ties A2 and B2 to set positions.

Be careful for the orders and the positions of the cable ties.

Distance between the cable tie 1 and A2, and 3 and B2 should be as close as possible.

Improper order or position of the cable tie may shorten the life cycle of the cables.



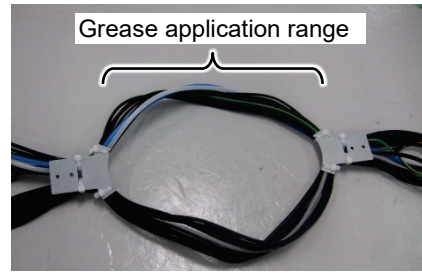
- (4) Apply the grease to the cables between the two cable fixing plates.

Grease:

Krytox: Cable A and B

Standard model: 1g for each

Cleanroom model: 1.5g for each

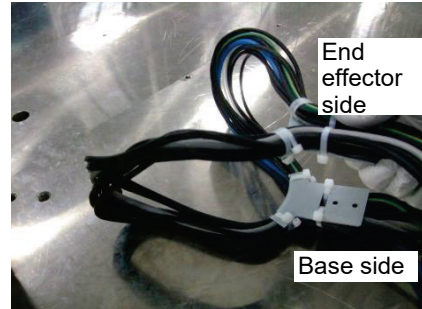


Apply the grease to each cable evenly.

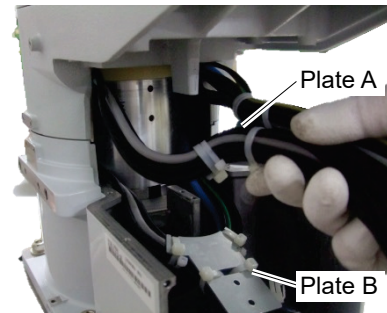
- (5) To face the two cable fixing plates, bend the cable unit and pass it through the Joint #1.

End effector side : Plate A

Base side : Plate B



When operating the Manipulator, make sure not to apply excessive force to the cables.



- (6) Move the Arm #1 approx. 90 degrees.



Be careful not to get the cables caught in the Arm #1.



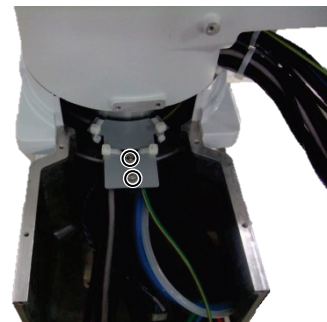
- (7) Install the cable fixing plate B to the base.

Hexagon socket head cap bolts: 2-M4×8

Tightening torque: 4.0 ± 0.2 N·m



Be careful not to tighten the screws with the cables get caught on the plate.



- (8) Install the cable fixing plate A to Arm #1.

Hexagon socket head cap bolts: 2-M4×8
Tightening torque: 4.0 ± 0.2 N·m



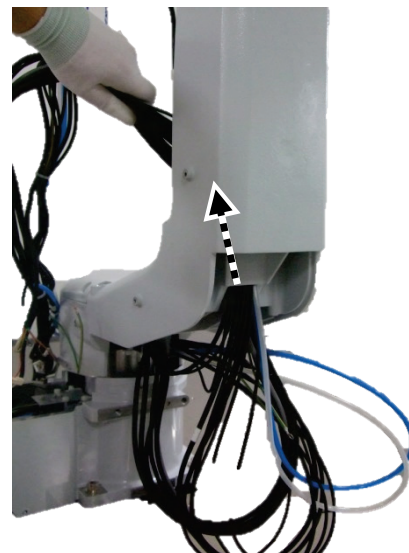
Be careful not to tighten the screws with the cables get caught on the plate.



- (9) Pass the cable unit to the Arm #1.

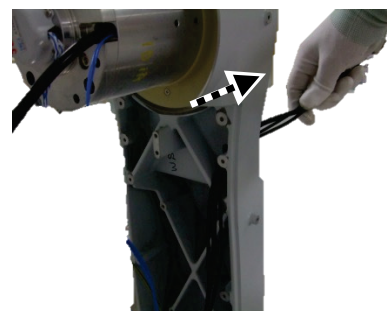


Do not pass the cables forcibly while the connectors get caught. Doing so may result in disconnection of the cables or breakage of the connectors.



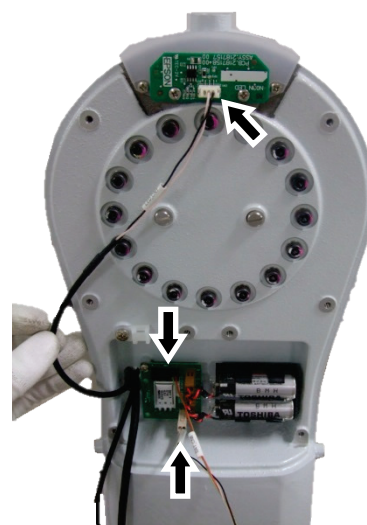
- (10) Pass the cables (connectors) through the hole on the end of the Arm #1

Cables (connectors):
BAT_CN3, BAT_CN6
GS01,
LED_CN1



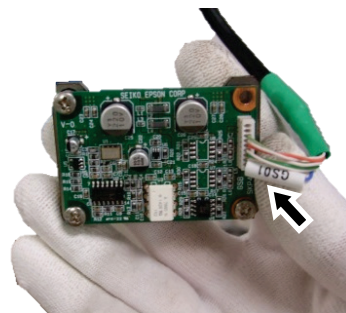
- (11) Connect the connectors to the board.

Cables (connectors):
BAT_CN3, BAT_CN6
LED_CN1



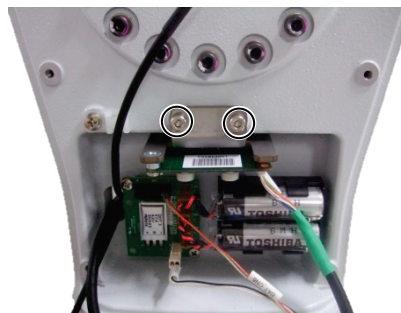
- (12) Connect the connectors to the control board
1.

Cable (connector): GS01



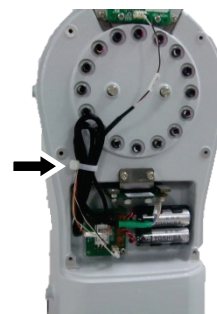
- (13) Install the control board 1 to the Arm #1.

Hexagon socket head cap bolts: 2-M4×8
Tightening torque: 4.0 ± 0.2 N·m



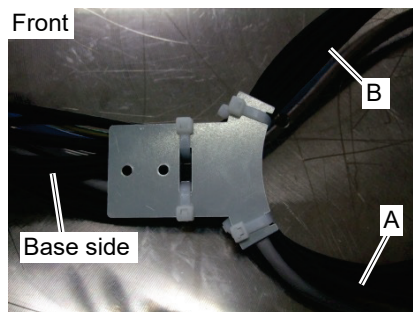
- (14) Fix the cables on the Arm #1.

Cable ties (AB200): 1



- (15) Fix the cable unit to the cable fixing plate.
Be careful for the following:

Cable ties (AB200) × 4 (1 to 4)
Tightening strength: 85 ± 5 N

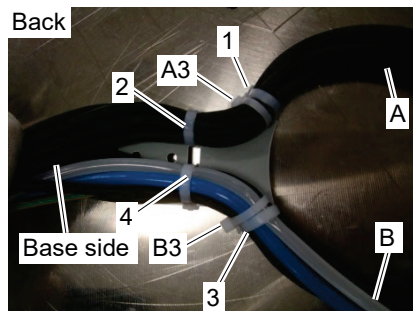



Cable A


Set the A3 of the cable tie to the cable fixing plate and fix it by using the cable ties 1 and 2. Make sure that the gray colored cable is on the plate side.

Cable B

Set the B3 of the cable tie to the cable fixing plate and fix it by using the cable ties 3 and 4. Make sure that the two air tubes (blue and white) are on the opposite side of the plate.



NOTE
 Refer to the figure for positions of the cable tie heads.
 Rotate the heads of the cable ties A3 and B3 to set positions.

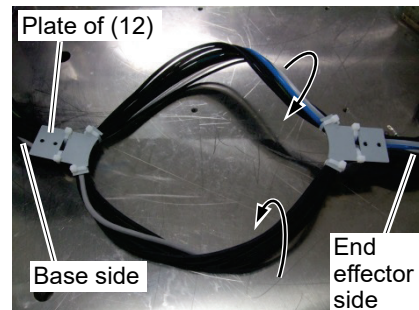
NOTE
 Be careful for the orders and the positions of the cable ties.
 Distance between the cable tie 1 and A3, and 3 and B3 should be as close as possible.
 Improper order or position of the cable tie may shorten the life cycle of the cables.

(16) Fix the cable unit to the cable fixing plate with twisting 180 degrees.

Be careful for the following:

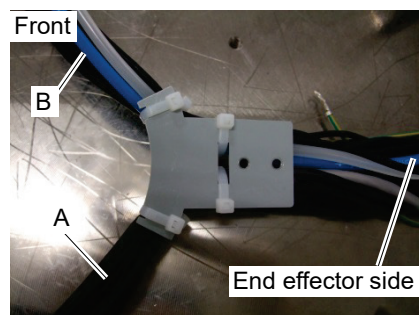
Cable ties (AB200) × 4 (1 to 4)

Tightening strength: 85 ± 5 N




Cable A

Set the A4 of the cable tie to the cable fixing plate and fix it with by using the cable ties 1 and 2. Make sure to twist 180 degrees and fix the cable A so that the gray colored cable is on the opposite side of the plate.



Cable B

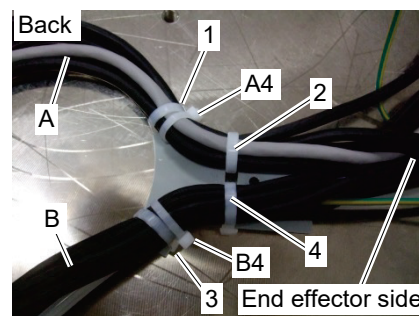
Set the B4 of the cable tie to the cable fixing plate and fix it by using the cable ties 3 and 4. Make sure to twist 180 degrees and fix the cable B so that the two air tubes (blue and white) are on the plate side.

NOTE
 Refer to the figure for positions of the cable tie heads.
 Rotate the heads of the cable ties A4 and B4 to set positions.

Be careful for the orders and the positions of the cable ties.

Distance between the cable tie 1 and A4, and 3 and B4 should be as close as possible.

Improper order or position of the cable tie may shorten the life cycle of the cables.



- (17) Apply the grease to the cables between the two cable fixing plates.

Grease:

Krytox: Cable A and B

Standard model : 1g for each

Cleanroom model : 1.5g for each

NOTE



Apply the grease to each cable evenly.



- (18) Install the cable fixing plates to Arm #1.

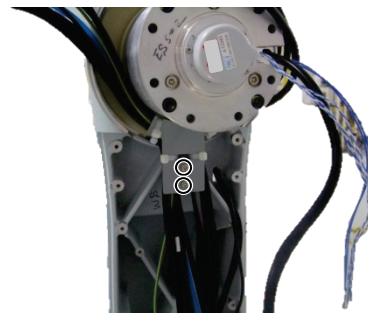
Hexagon socket head cap bolts: 2-M4×8

Tightening torque: 4.0 ± 0.2 N·m

NOTE



Be careful not to tighten the screws with the cables get caught on the plate.



- (19) Install the two ground wire terminals.

Cross recessed binding head machine screw:

M4×8

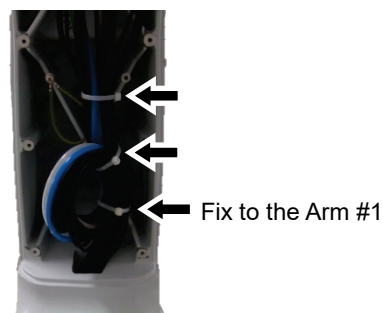
Tightening torque: 0.9 ± 0.1 N·m



- (20) Install the cable unit as shown on the right, and then bundle three positions with the cable ties.

Fix one position to the Arm #1.

Cable ties (AB200)



- (21) To face the two cable fixing plates, bend the cable unit and pass it through the Joint #2.



- (22) Install the Arm #2 while aligning the cable unit to the direction of the cables coming from the Joint #2 actuator.

Hexagon socket head cap bolts:
 8-M6×35 (with plain washer)
 Tightening torque: 18 ± 0.9 N·m



NOTE

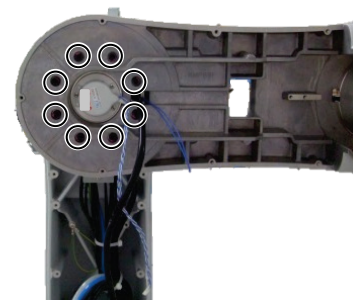


Refer to the picture for installing direction.
 When installing it, pass the cables from the Joint #2 actuator unit through the hole of the Arm #2.

Be careful not to get the cables caught.

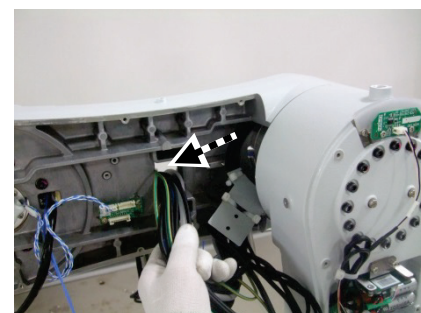
Be sure to have at least 2 people to perform the operation since the parts being heavy.

Do not apply excessive shock to the parts.



- (23) Pass the cable unit except the following cables (connectors) to Arm #2.

Cables (connectors):
 PW2, PW3, BR2, BR3,
 EB02_CN1, ground wire



NOTE



Do not pass the cables forcibly while the connectors get caught.
 Doing so may result in disconnection of the cables or breakage of the connectors.

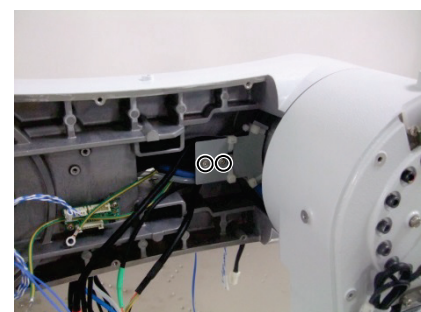
- (24) Install the cable fixing plates to Arm #2.

Hexagon socket head cap bolts: 2-M4×8
 Tightening torque: 4.0 ± 0.2 N·m

NOTE



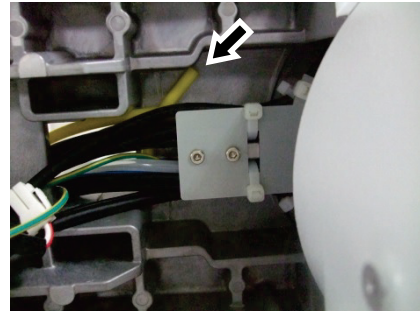
Be careful not to tighten the screws with the cables get caught on the plate.



For cleanroom model, face one yellow air tube to Joint #2 side.



Be careful not to bend or collapse the air tubes.



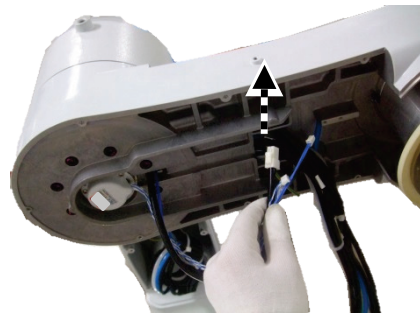
- (25) Pass the cables from the Joint #2 actuator unit through the hole of the Arm 2, and pull them to the Arm #1 side.

Cables (connectors):

PW2, BR2, EB0x_CN2



Do not pull the cables forcibly while the connectors get caught. Doing so may result in disconnection of the cables or breakage of the connectors.



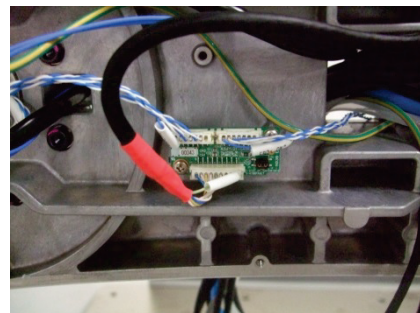
- (26) Connect the connectors to the encoder board 2.

Connectors:

EB02_CN1, EB0x_CN2 (J2 side)



Be careful that the jumper pins on the board do not come off.

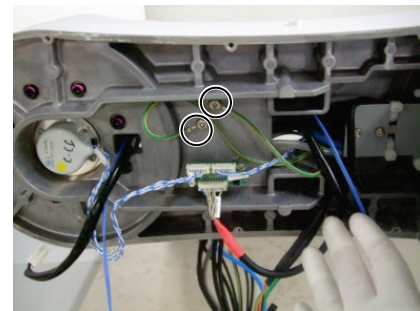


- (27) Install the two ground wire terminals.

Cross recessed binding head machine screws:

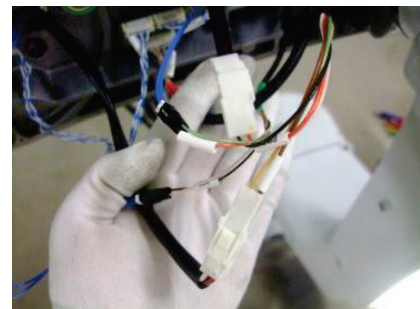
2-M4×8

Tightening torque: 0.9 ± 0.1 N·m



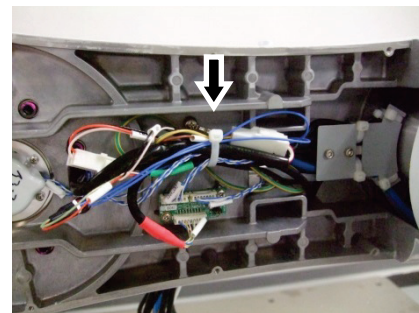
- (28) Connect the connectors.

Connectors: PW2, BR2, PW3, BR3



(29) Bundle the cables.

Cable ties (AB200) × 1

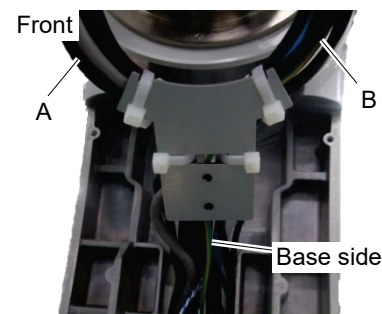


(30) Fix the cable unit to the cable fixing plate.

Be careful for the following:

Cable ties (AB200) × 4 (1 to 4)

Tightening strength: 85 ± 5 N

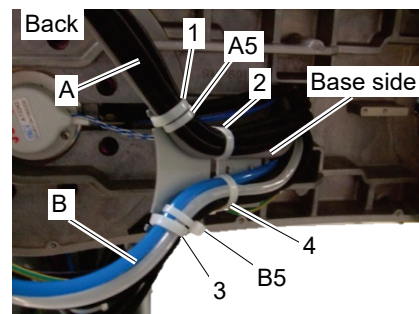


Cable A

Set the A5 of the cable tie to the cable fixing plate and fix it by using the cable ties 1 and 2. Make sure that the gray colored cable is on the plate side.

Cable B

Set the B5 of the cable tie to the cable fixing plate and fix it by using the cable ties 3 and 4. Make sure that the two air tubes (blue and white) are on the opposite side of the plate.



Refer to the figure for positions of the cable tie heads.

Rotate the heads of the cable ties A5 and B5 to set positions.

Be careful for the orders and the positions of the cable ties.

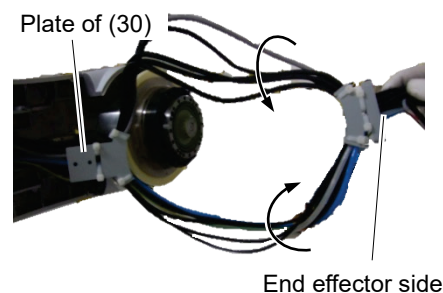
Distance between the cable tie 1 and A5, and 3 and B5 should be as close as possible.

Improper order or position of the cable tie may shorten the life cycle of the cables.

(31) Fix the cable unit to the cable fixing plate with twisting 180 degrees. Be careful for the following:

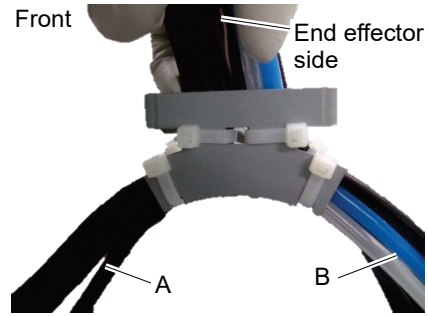
Cable ties (AB200) × 4 (1 to 4)

Tightening strength: 85 ± 5 N



Cable A

Set the A6 of the cable tie to the cable fixing plate and fix it with by using the cable ties 1 and 2. Make sure to twist 180 degrees and fix the cable A so that the gray colored cable is on the opposite side of the plate.



Cable B

Set the B6 of the cable tie to the cable fixing plate and fix it by using the cable ties 3 and 4. Make sure to twist 180 degrees and fix the cable B so that the two air tubes (blue and white) are on the plate side.

NOTE



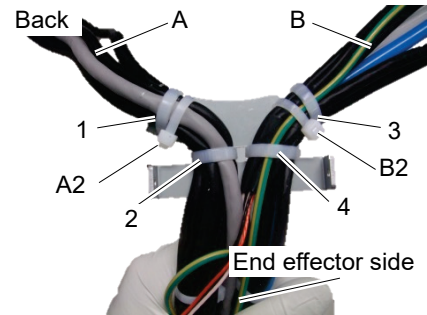
Refer to the figure for positions of the cable tie heads.

Rotate the heads of the cable ties A6 and B6 to set positions.

Be careful for the orders and the positions of the cable ties.

Distance between the cable tie 1 and A6, and 3 and B6 should be as close as possible.

Improper order or position of the cable tie may shorten the life cycle of the cables.



- (32) Apply the grease to the cables between the two cable fixing plates.

Grease:

Krytox: Cable A and B

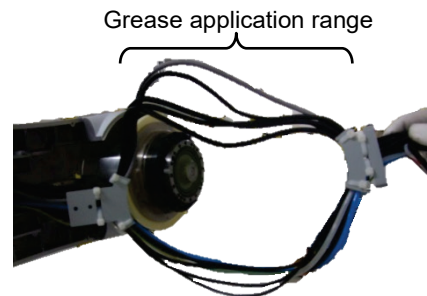
Standard model : 1g for each

Cleanroom model: 1.5g for each

NOTE



Apply the grease to each cable evenly.



- (33) Install the cable fixing plates to Arm #2.

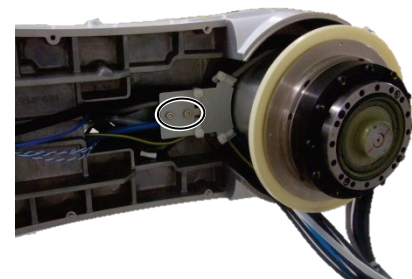
Hexagon socket head cap bolts: 2-M4×8

Tightening torque: 4.0 ± 0.2 N·m

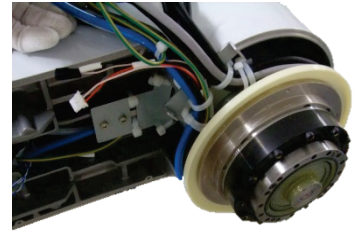
NOTE



Be careful not to tighten the screws with the cables get caught on the plate.

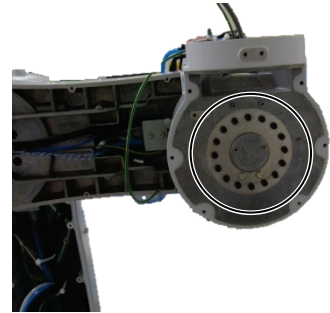


- (34) To face the two cable fixing plates, bend the cable unit and pass it through the Joint #3.



- (35) Install the Arm #3 with approx. - 90 degrees while inserting the cable unit to the Arm #3.

Hexagon socket head cap bolts:
16-M4×30 (with plain washer)
Tightening torque: 5.5 ± 0.25 N·m



NOTE Be sure to have at least 2 people to perform the operation since the parts being heavy.

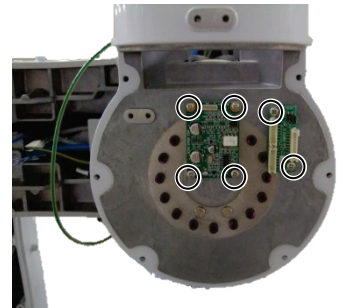
Be careful not to catch the cables.

Make sure that the O-ring will not be out of the groove.

Do not apply excessive shock to the parts.

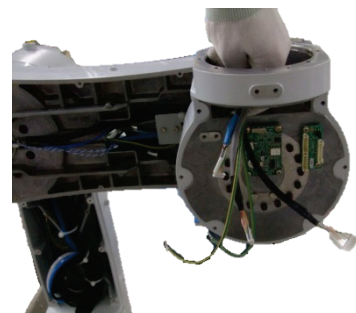
- (36) Install the encoder board 3 and the control board 2.

Cross recessed binding head machine screws:
6-M3×6
Tightening torque: 0.45 ± 0.05 N·m



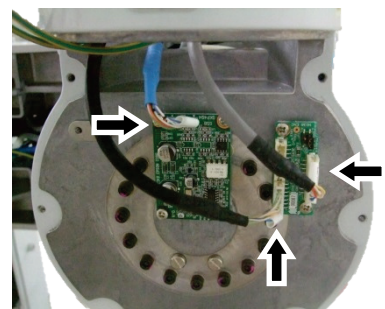
- (37) Pull the cables (connectors) to the outside of the Arm #3.

Cables (connectors):
PW4, BR4, EB04_CN1, GS02,
EB04_CN3, two ground wires



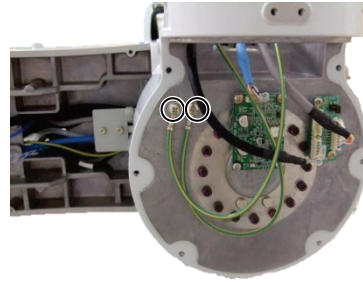
- (38) Connect the connectors to the encoder board 3 and the control board 2.

Connectors:
EB04_CN1, EB04_CN3
GS02



- (39) Install the two ground wire terminals.

Cross recessed binding head machine screws:
2-M4×8
Tightening torque: 0.9 ± 0.1 N·m

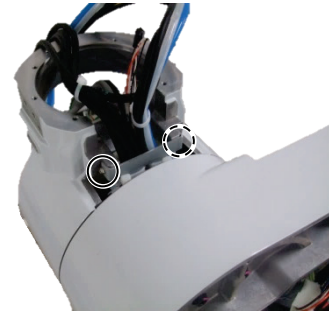


- (40) Install the cable fixing plates to Arm #3.

Hexagon socket head cap bolts: 2-M3×6
Tightening torque: 2.0 ± 0.1 N·m



Be careful not to tighten the screws with the cables get caught on the plate.

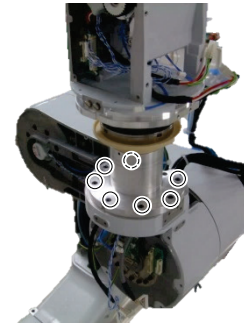


- (41) Install the Joint #4 actuator unit to the Arm #3.

Hexagon socket head cap bolts:
7-M4×15 (with plain washer)
Tightening torque: 5.5 ± 0.25 N·m



Be sure to have at least 2 people to perform the operation since the parts being heavy.



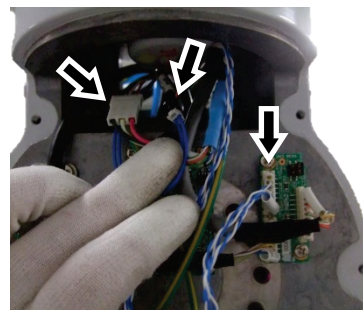
Make sure to take out the cables from the Joint #4 actuator unit to outside of the Arm #3.

Confirm that the positioning pins are installed on the Arm #3. Then, install the Joint #4 actuator unit to match with the pins.

Be careful not to get the cables caught.

- (42) Connect the connectors.

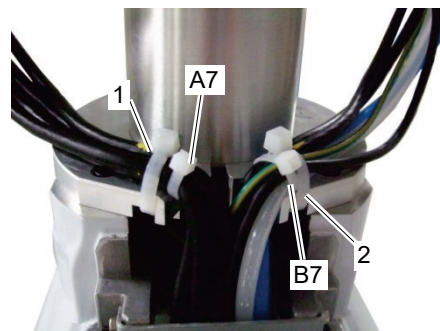
Connectors: PW4, BR4, EB0x_CN2



- (43) Fix the cable unit to the flange of the Joint #4 actuator unit with the cable ties.

Cable ties (AB200) × 2 (1 and 2)

Tightening strength: 85 ± 5 N



NOTE Refer to the figure for positions of the cable tie heads.

Rotate the heads of the cable ties A7 and B7 to set positions.

Distance between the cable tie 1 and A7, and 3 and B7 should be as close as possible. (Do not pull the cables forcibly to get close the cable ties.)

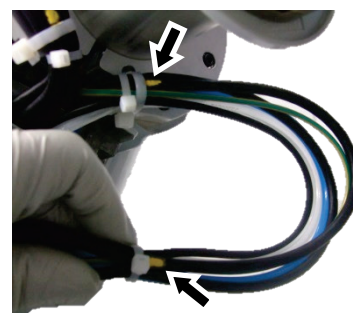
Be careful not to bend the air tubes.

Improper order or position of the cable tie may shorten the life cycle of the cables.

- (44) Place marks on the cable of cable A (near the cable ties A7 and A8) on the opposite side of the flange.



- (45) As with the above, place marks on the cable or the air tube of cable B (near the cable ties B7 and B8) on the opposite side of the flange.



- (46) Install the cable fixing plates to the flange of the Arm #4.

Hexagon socket head cap bolts: 2-M4×8

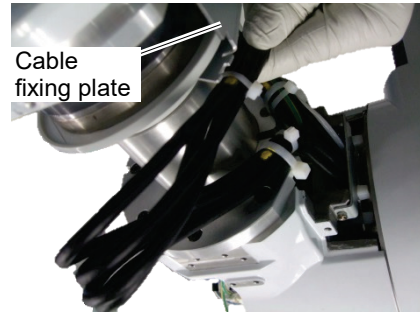
Tightening torque: 4.0 ± 0.2 N·m



- (47) Fix the cable unit on the cable fixing plate.
Follow the steps below:

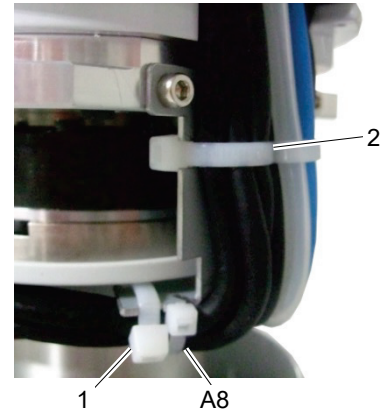
Cable A

Bend the cable so that the mark near the cable tie A8 will be on the cable fixing plate side.



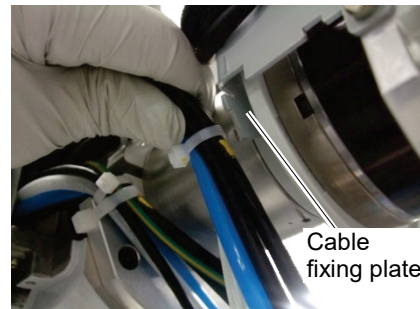
As shown on the right, set the position of the cable tie A8 to the cable fixing plate and fix it by using cable ties 1 and 2.

Cable ties (AB200) × 2 (1 and 2)
Tightening strength: 85 ± 5 N



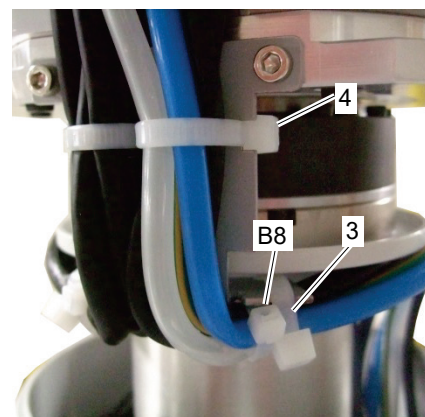
Cable B

Bend the cable so that the mark near the cable tie B8 will be on the cable fixing plate side.



As shown on the right, set the position of the cable tie B8 to the cable fixing plate and fix it by using cable ties 3 and 4.

Cable ties (AB200) × 2 (3 and 4)
Tightening strength: 85 ± 5 N



NOTE


Be careful not to bend the air tubes.

NOTE


Refer to the figure for positions of the cable tie heads.

Rotate the heads of the cable ties A8 and B8 to set positions.

Be careful for the orders and the positions of the cable ties.

Distance between the cable tie 1 and A8, and 3 and B8 should be as close as possible.

Improper order or position of the cable tie may shorten the life cycle of the cables.

- (48) Apply the grease to the cables between the cable tie A7 and A8, and B7 and B8.

Grease:

Krytox: Cable A and B

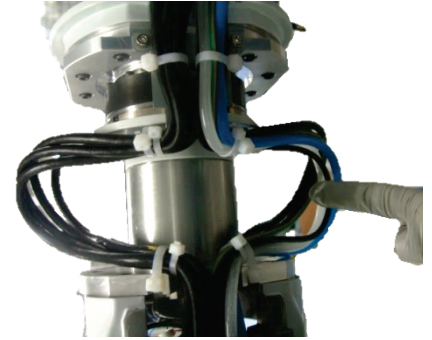
Standard model : 0.5g for each

Cleanroom model : 0.8g for each

NOTE



Apply the grease to each cable evenly.



- (49) Pass the cables (connectors) through the Arm #4 and connect them to the user attachment.

Cables (connectors):

Ether1, Ether2, X71, X72

Connect the Ether1 and Ether2 depending on the user attachment display.



- (50) Connect the connectors.

Connectors: PW5, PW6, BR5, BR6

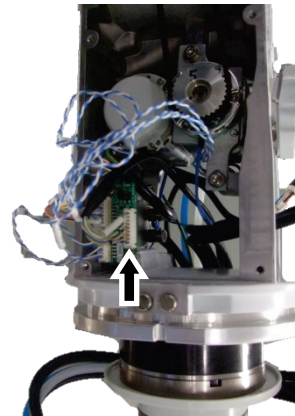


(51) Connect the connector to the encoder board 4.

Connector: EB05_CN1



Be careful that the jumper pins on the board do not come off.

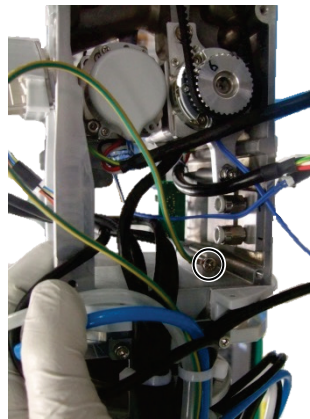


(52) Install the ground wire terminals.

Cross recessed binding head machine screw:

M4×8

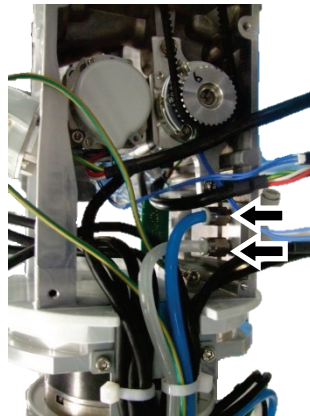
Tightening torque: 0.9 ± 0.1 N·m



(53) Cut the two air tubes with proper length and connect them to fittings.

Air1: White

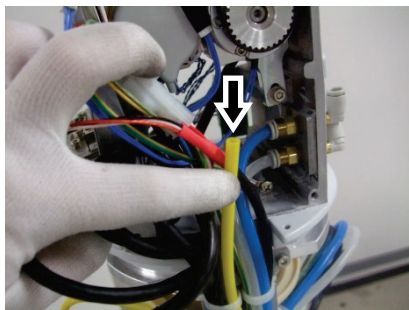
Air2: Blue



For cleanroom model, cut the yellow air tube with the length as shown in the picture.



Make sure that the air tube does not interfere with the pulley or belt.



(54) Install the user attachment on the Arm #4.

Hexagon socket head cap bolts: 2-M4×8

Tightening torque: 4.0 ± 0.2 N·m

NOTE

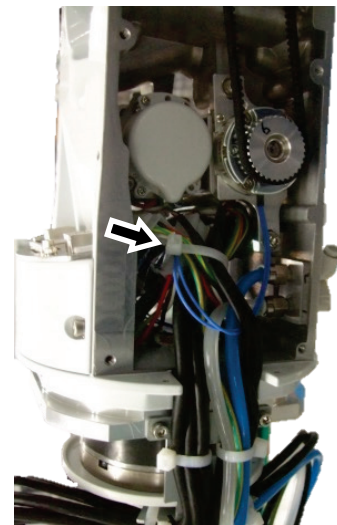
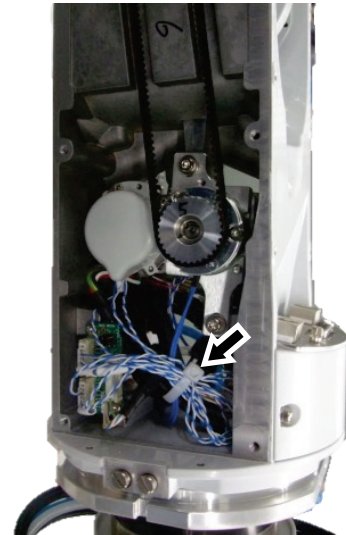


Be careful not to get the cables caught.



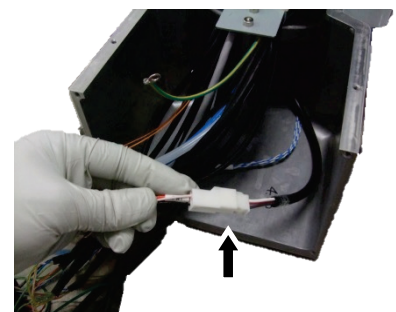
(55) Bundle the cables with the cable tie to prevent the cables from interfering with the pulley or belt.

Cable ties (AB200) × 2



(56) Connect the connector.

Connector: PW1

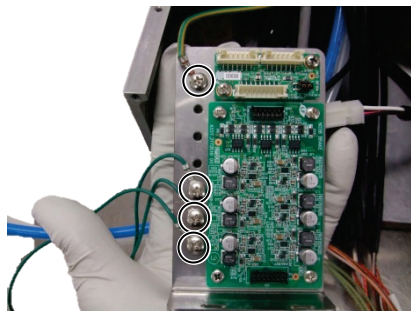


- (57) Install the four ground wire terminals except the connector X11, X12 to the board fixing plate.

Cross recessed binding head machine screws:

4-M4×8

Tightening torque: 0.9 ± 0.1 N·m

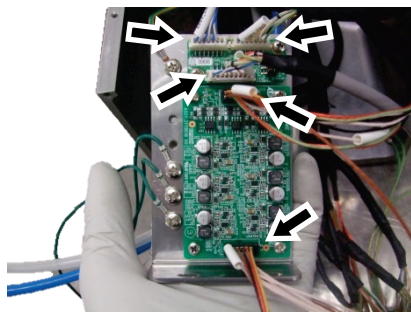


- (58) Connect the connectors to the encoder board 1 and the brake board.

Connectors:

EB01_CN1, EB01_CN3, EB0x_CN2

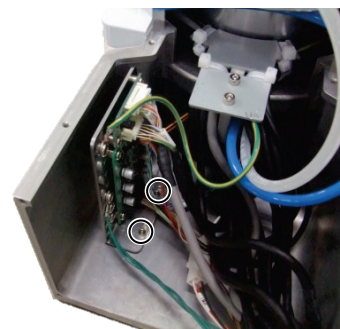
BRK_CN1, BRK_CN2



- (59) Install the board fixing plate in the back of the base.

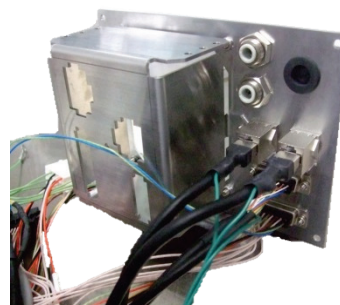
Hexagon socket head cap bolts: 2-M3×6

Tightening torque: 2.0 ± 0.1 N·m



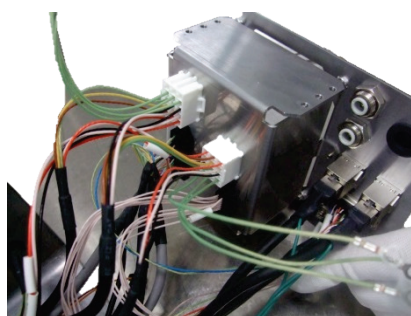
- (60) Connect the connectors to the base side plate.

Connectors: Ether1, Ether2, D-sub, SW1

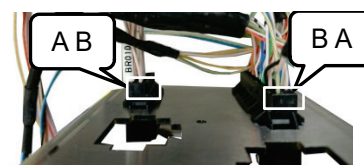


- (61) Connect the connectors to the box-shaped plate.

Connectors: X11, X12, X010, BR010

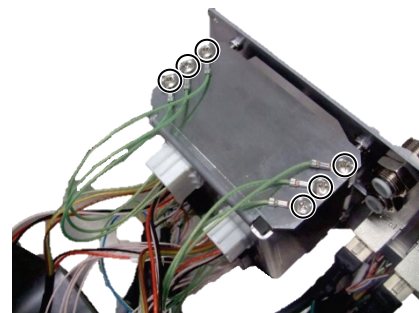


Refer to the right picture for installation direction of black colored connectors (X010, BR010).



- (62) Install the six ground wire terminals from the connector X11, X12 to the box-shaped plate.

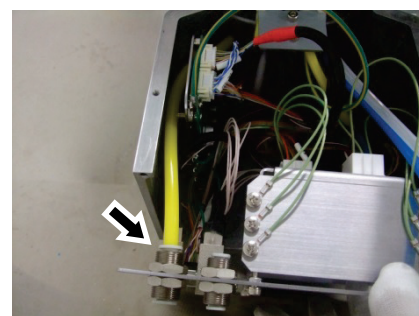
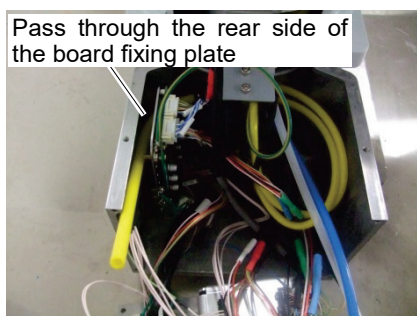
Cross recessed binding head machine screws:
 6-M4×8
 Tightening torque: 0.9 ± 0.1 N·m



For cleanroom model, install the yellow air tube as shown in the following pictures. Pass the air tube through the rear side of the board fixing plate, and then connect to the fittings.

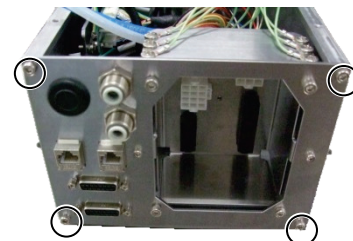
NOTE


Be careful not to bend or collapse the air tubes

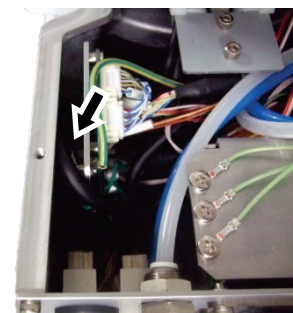


- (63) Install the base side plate.

Hexagon socket head cap bolts: 4-M4×8
 Tightening torque: 4.0 ± 0.2 N·m

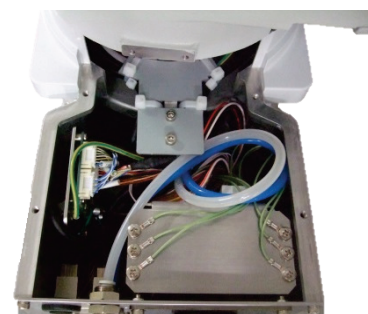


As shown on the right, make sure that the cable of Ether1 passes through the rear side of the board fixing plate.



- (64) Install the two air tubes as shown on the right, and connect them to fittings.

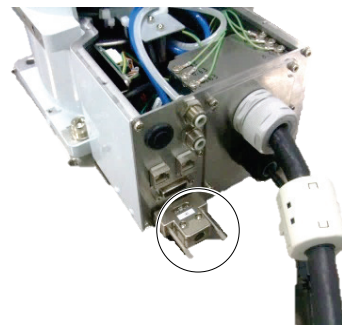
Air1: White
 Air2: Blue



- (65) Connect the M/C cable.

For details, refer to *Maintenance 4.6. M/C Cable*.

(66) Connect the external short connector.



(67) Install the following covers:

Arm #4 side cover (2 covers)

Joint #4 inside cover Joint #4 outside cover Joint #4 side covers (2 covers)

Arm #3 cover Arm #3 inside cover Arm #2 cover (2 covers)

Joint #2 outside cover Arm #1 inside cover

Arm #2 outside cover * Joint #1 cover Base cover

For details, refer to *Maintenance 3. Covers*.

* Install the Arm #1 outside cover simultaneously with the Joint #1 cover.

(68) Perform calibration.

For details, refer to *Maintenance 8. Calibration*.

4.4 Replacing the Cable Unit (N6-A850*BR):Cable Direction: Upward




- Before performing any replacement procedure, turn OFF the Controller and related equipment, and then disconnect the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system.
- Do not connect or disconnect the motor connectors while the power to the robot system is turned ON. Connecting or disconnecting the motor connectors with the power ON is extremely hazardous and may result in serious bodily injury as the Manipulator may move abnormally, and also may result in electric shock and/or malfunction of the robot system.
- Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source. To shut off power to the robot system, disconnect the power plug from the power source. Performing any work while connecting the AC power cable to a factory power source is extremely hazardous and may result in electric shock and/or malfunction of the robot system.
- Be careful not to get any foreign substances in the Manipulator, connectors, and pins during maintenance. Turning ON the power to the robot system when any foreign substances exist in them is extremely hazardous and may result in electric shock and/or malfunction of the robot system.
- Be sure to connect the cables properly. Do not allow unnecessary strain on the cables. (Do not put heavy objects on the cables. Do not bend or pull the cables forcibly.) Unnecessary strain on the cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system.
- When installing the cover, be careful not to allow the cables to interfere with the cover mounting and do not bend these cables forcibly to push them into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. Damaged cables, disconnection, or contact failure is extremely hazardous and may result in electric shock and/or improper function of the robot system.
When routing the cables, observe the cable locations after removing the cover. Be sure to place the cables back to their original locations.



- When disconnecting the connectors during the replacement of the cable unit, be sure to reconnect the connectors to their proper positions. Improper connection of the connectors may result in improper function of the robot system.
For details on the connections, refer to the *Maintenance 4.7 Connector Pin Assignments*.

Maintenance 4. Cable

	Name		Qty	Code, Note
Maintenance Parts	Cable unit		1	2187251 (Standard)
				2194258 (Cleanroom)
	Cable tie	AB200	-	1684328, 1 bag (100 ties: white)
Tools	Hexagonal wrench	width across flats: 2.5 mm	1	For M3 hexagon socket head cap bolts
		width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
		width across flats: 4 mm	1	For M5 hexagon socket head cap bolts
		width across flats: 5 mm	1	For M6 hexagon socket head cap bolts
	Box wrench	width across flats: 5 mm	1	For D-Sub connector
	Long nose pliers		1	For removing air tubes
	Nippers		1	For cutting a cable tie
	Cross-point screwdriver (#2)		1	For cross recessed head screws
	Torque wrench		1	For tightening torque control
	Cable tie gun		1	Refer: HellermannTyton MK8
	Cable tie gun tester		1	Refer: HellermannTyton DGT500-MK8

NOTE
 The subsequent steps are described with the standard model's cable unit.
 For cleanroom model, a yellow air tube is included in the cable unit.

Removal (1) Perform the Removal steps (2) through (6), (8) in *Maintenance 4.3 Cable Unit (N6-A850*R): Cable direction Standard (backward)*.

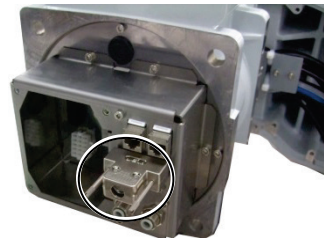
Cable Unit

(N6-A850*BR)

Cable direction:

Upward

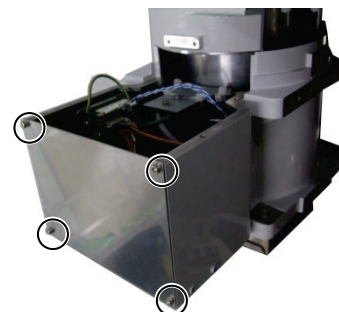
(2) Disconnect the external short connector.



(3) Perform the Removal steps (9) through (49) in *Maintenance 4.3 Cable Unit (N6-A850*R): Cable direction Standard (backward)*.

(4) Remove the base side plate.

Hexagon socket head cap bolts: 4-M4×8



(5) Remove the board fixing plate.

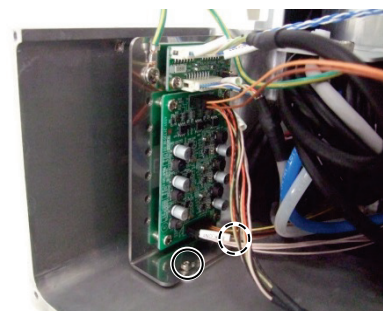
Hexagon socket head cap bolts: 2-M3×6

(6) Disconnect the connectors connected to the encoder board 1 and the brake board.

Connectors:

EB01_CN1, EB01_CN3, EB0x_CN2

BRK_CN1, BRK_CN2



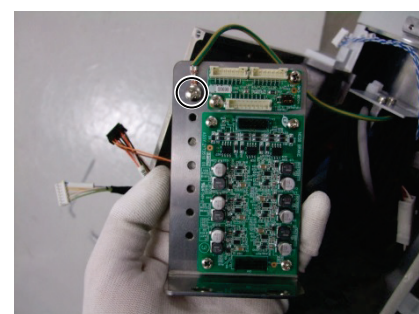
NOTE



Be careful that the jumper pins on the encoder board do not come off.

(7) Remove the ground wire terminals fixed on the board fixing plate.

Cross recessed binding head machine screw:
 M4×8



(8) Perform the Removal steps (56) through (61) in *Maintenance 4.3 Cable Unit (N6-A850*R): Cable direction Standard (backward)*.

(9) Lay down the Manipulator.

NOTE



Be sure to have at least 2 people to lay down the Manipulator.

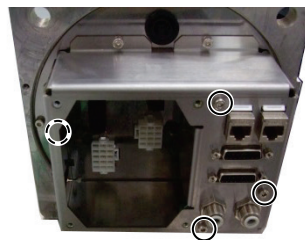
(10) Remove the plate part 1 from the base bottom.

Hexagon socket head cap bolts: 4-M4×8

NOTE

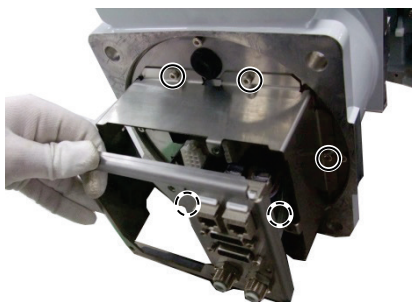


Do not pull the part after removing it.
Doing so may result in disconnection of the cables since the cables are connected.



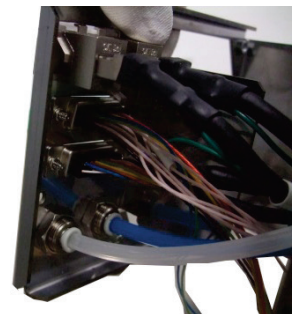
(11) Remove the plate part 2 from the base bottom.

Hexagon socket head cap bolts: 5-M4×8



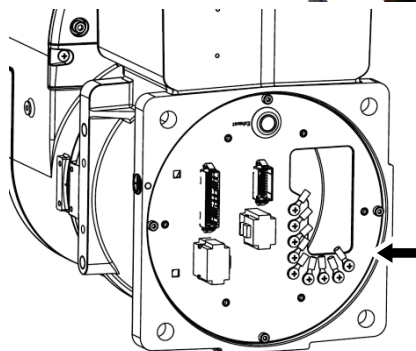
(12) Remove the two air tubes and connectors from the plate part 1.

Connectors: Ether1, Ether2, D-sub, SW1



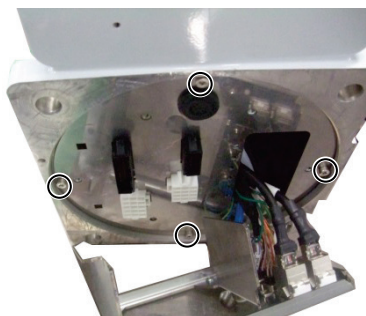
(13) Remove the nine ground wire terminals fixed on the plate part 3.

Cross recessed binding head machine screws:
9-M4×8



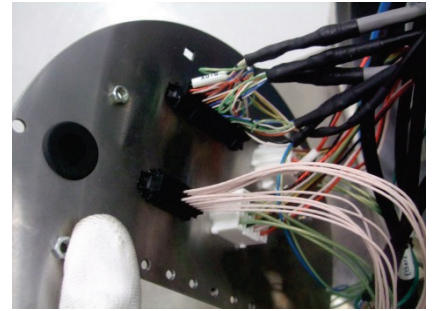
(14) Remove the plate part 3.

Hexagon socket head cap bolts: 4-M4×8

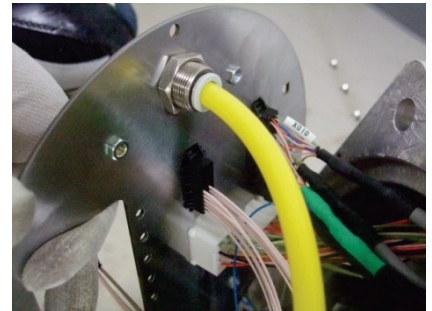



- (15) Disconnect the connectors from the plate part 3.

Connectors: X11, X12, X010, BR010




For cleanroom model, disconnect the yellow air tube as well.



NOTE  The subsequent steps are described with the standard model's cable unit.
For cleanroom model, a yellow air tube is included in the cable unit.


Installation Cable Unit (N6-A850*BR) (1) Perform the Installation steps (1) through (8) in *Maintenance 4.3 Cable Unit (N6-A850*R): Cable direction Standard (backward)*.

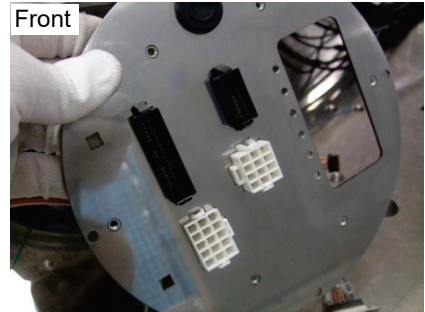
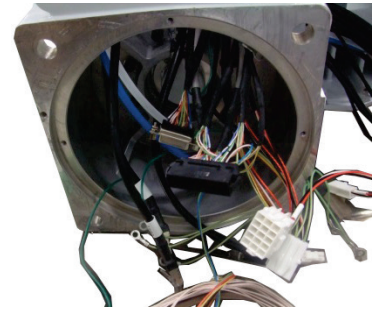
Cable direction: Upward (2) Lay down the Manipulator.
NOTE  Manipulator is heavy. Be sure to have at least 2 people to perform the operation.

(3) Pull out the cable unit except the following cables.

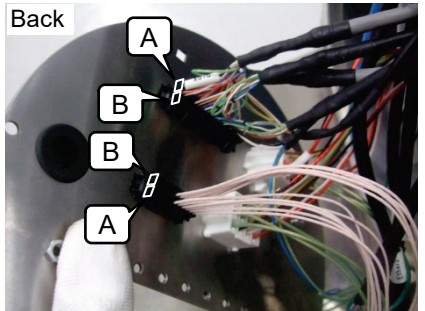
Cables (connectors):
BRK_CN2, EB01_CN3, ground wire

(4) Connect the connectors to the plate part 3
Connectors: X11, X12, X010, BR010

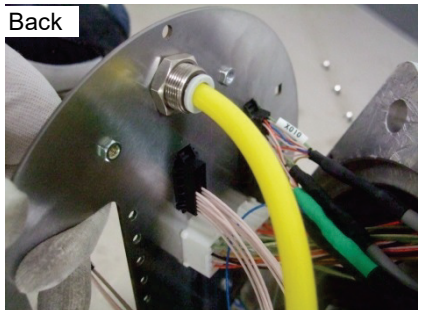
NOTE  There are the front side and the back side on the plate part 3. Be careful for the directions.



Refer to the right picture for installation direction of black colored connectors (X010, BR010).



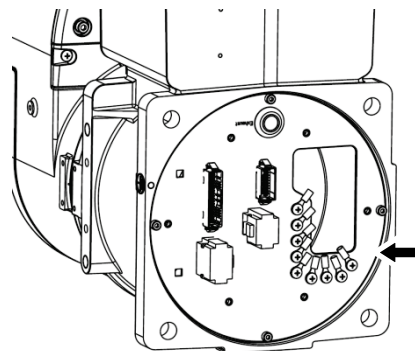
For cleanroom model, connect the yellow air tube to the fittings.




- (5) Install the nine ground wire terminals from the following connectors to the front side of the plate part 3.

Connectors:
X11, X12, D-sub, Ether1, Ether2

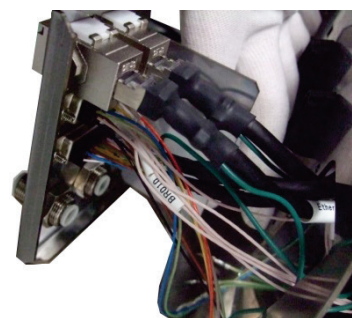
Cross recessed binding head machine screw:
9-M4×8
Tightening torque: 0.9 ± 0.1 N·m



NOTE
 Refer to the right figure for the installation position.

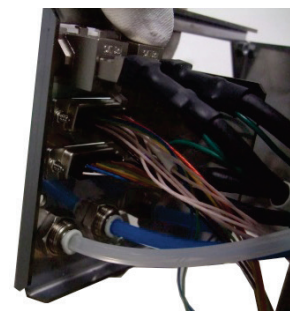
- (6) Pass the connectors through the hole of the plate part 3, and install on the the plate part 1.

Connectors: Ether1, Ether2, D-sub, SW1




- (7) Connect the two air tubes to fittings.

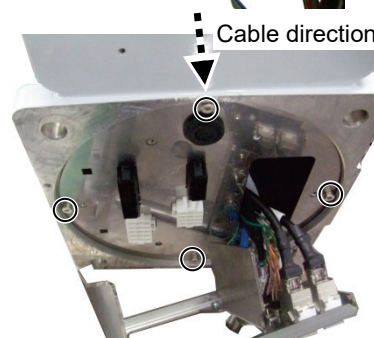
Air1: White
Air2: Blue



- (8) Install the plate part 3 to the base.


Hexagon socket head cap bolts: 4-M4×8
Tightening torque: 4.0 ± 0.2 N·m

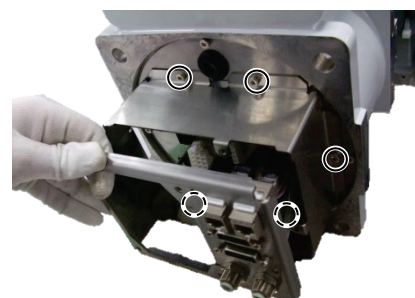
NOTE
 Refer to the right figure for the installation position.



- (9) Install the plate part 2.

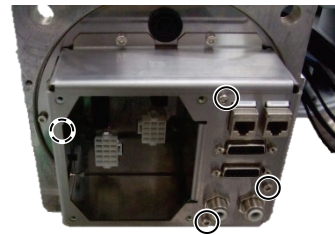
Hexagon socket head cap bolts: 5-M4×8
Tightening torque: 4.0 ± 0.2 N·m

NOTE
 Be careful not to get the cables caught.

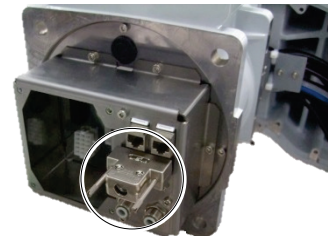


- (10) Install the plate part 1.

Hexagon socket head cap bolts: 4-M4×8
Tightening torque: 4.0 ± 0.2 N·m



- (11) Connect the external short connector.



- (12) Connect the M/C cable.

For details, refer to *Maintenance 4.6. M/C Cable*.

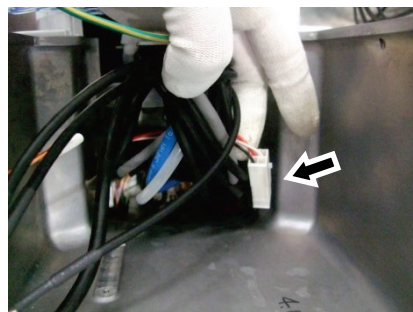
- (13) Mount the Manipulator on the base table.



Be sure to have at least 2 people to mount the Manipulator.

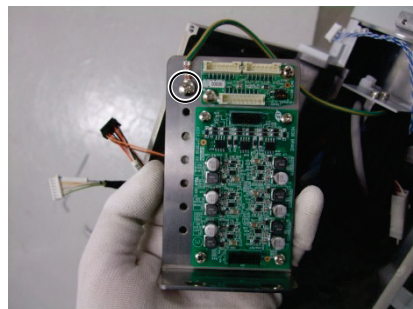
- (14) Connect the connectors.

Connector: PW1



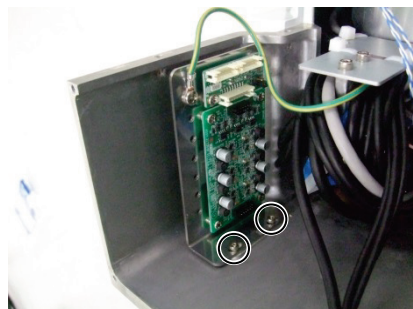
- (15) Install the ground wire terminal on the board fixing plate.

Cross recessed binding head machine screw:
M4×8
Tightening torque: 0.9 ± 0.1 N·m



- (16) Install the board fixing plate in the back of the base.

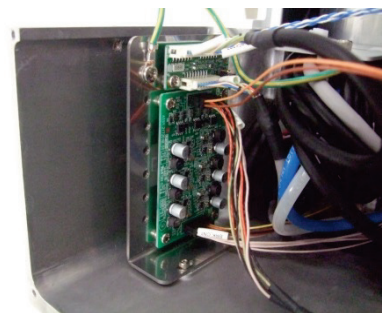
Hexagon socket head cap bolts: 2-M3×6
Tightening torque: 2.0 ± 0.1 N·m



- (17) Connect the connectors to the encoder board 1 and the brake board.

Connectors:

EB01_CN1, EB01_CN3, EB0x_CN2
BRK_CN1, BRK_CN2



- (18) Install the base side plate.

Hexagon socket head cap bolts: 4-M4×8
Tightening torque: 4.0 ± 0.2 N·m



- (19) Perform the Installation steps (9) through (55) in *Maintenance 4.3 Cable Unit (N6-A850*R): Cable direction Standard (backward)*.

- (20) Install the following covers:

Arm #4 side cover (2 covers)

Joint #4 inside cover Joint #4 outside cover Joint #4 side covers (2 covers)

Arm #3 cover Arm #3 inside cover Arm #2 cover (2 covers)

Joint #2 outside cover Arm #1 inside cover

Arm #1 outside cover Joint #1 cover Base cover

For details, refer to *Maintenance 3. Covers*.

* Install the Arm #1 outside cover simultaneously with the Joint #1 cover.

- (21) Perform calibration.

For details, refer to *Maintenance 8. Calibration*.

4.5 Relay Cable



WARNING

- Before performing any replacement procedure, turn OFF the Controller and related equipment, and then disconnect the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system.
- Do not connect or disconnect the motor connectors while the power to the robot system is turned ON. Connecting or disconnecting the motor connectors with the power ON is extremely hazardous and may result in serious bodily injury as the Manipulator may move abnormally, and also may result in electric shock and/or malfunction of the robot system.
- Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source. To shut off power to the robot system, disconnect the power plug from the power source. Performing any work while connecting the AC power cable to a factory power source is extremely hazardous and may result in electric shock and/or malfunction of the robot system.
- Be careful not to get any foreign substances in the Manipulator, connectors, and pins during maintenance. Turning ON the power to the robot system when any foreign substances exist in them is extremely hazardous and may result in electric shock and/or malfunction of the robot system.
- Be sure to connect the cables properly. Do not allow unnecessary strain on the cables. (Do not put heavy objects on the cables. Do not bend or pull the cables forcibly.) Unnecessary strain on the cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system.
- When installing the cover, be careful not to allow the cables to interfere with the cover mounting and do not bend these cables forcibly to push them into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. Damaged cables, disconnection, or contact failure is extremely hazardous and may result in electric shock and/or improper function of the robot system.
When routing the cables, observe the cable locations after removing the cover. Be sure to place the cables back to their original locations.



CAUTION

- When disconnecting the connectors during the replacement of the cable unit, be sure to reconnect the connectors to their proper positions. Improper connection of the connectors may result in improper function of the robot system.
For details on the connections, refer to the *Maintenance 4.7 Connector Pin Assignments*.

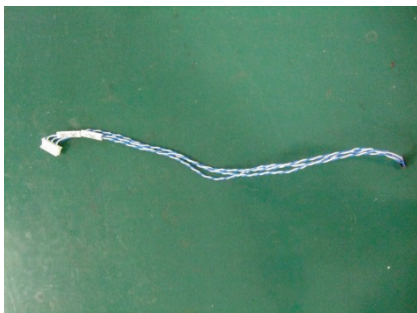
The relay cables are reusable.

Replace them when the cables or the connector clips are damaged during replacement of the cable unit.

	Name		Qty	Code, Note
Maintenance Parts	Relay cable 1		1	2187252
	Relay cable 2		1	2176220
	Cable tie	AB200	-	1684328, 1 bag (100 ties: white)
Tools	Hexagonal wrench	width across flats: 2.5 mm	1	For M3 hexagon socket head cap bolts
		width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
		width across flats: 4 mm	1	For M5 hexagon socket head cap bolts
		width across flats: 5 mm	1	For M6 hexagon socket head cap bolts
	Box wrench	width across flats: 5 mm	1	For D-Sub connector
	Long nose pliers		1	For removing air tubes
	Nippers		1	For cutting a cable tie
	Cross-point screwdriver (#1)		1	For cross recessed head screws
	Cross-point screwdriver (#2)		1	For cross recessed head screws
	Torque wrench		1	For tightening torque control
	Cable tie gun		1	Refer: HellermannTyton MK8
	Cable tie gun tester		1	Refer: HellermannTyton DGT500-MK8

4.5.1 Relay Cable 1

Relay Cable 1



Removal

Joint #1 Actuator Unit Relay Cable 1

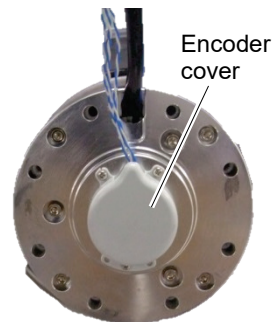
The relay cable 1 is connected to the actuator unit and the motor unit on each joint. Refer to the following steps depending on the positions to replace.

- (1) Remove the Joint #1 actuator unit.

For details, refer to *Maintenance 5.1 Replacing the Joint #1 Actuator Unit*

- (2) Remove the encoder cover.

Cross recessed head screws: 3-M2.5x6



- (3) Disconnect the connector.

Connector: ENC_x



Removal

Joint #2
Actuator Unit
Relay Cable 1

- (1) Remove the Arm #2 cover (2 covers).

For details, refer to the following sections:

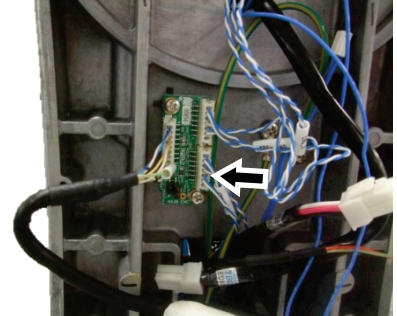
*Maintenance 3.7.1 N6-A1000** (Arm #2 Cover, Arm #1 Side)*

*Maintenance 3.7.2 N6- A850**R (Arm #2 Cover, Arm #1 Side)*

Maintenance 3.8 Arm #2 Cover (Arm #3 side)

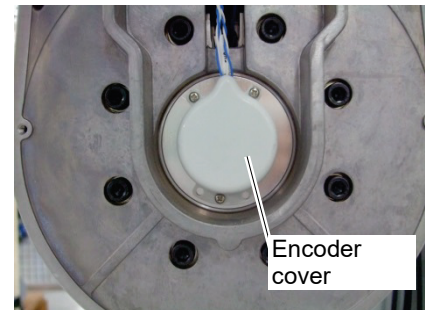
- (2) Remove the connector from the encoder board 2.

Connector: EB0x_CN2 (Joint #2 side)



- (3) Remove the encoder cover.

Cross recessed head screws: 3-M2.5x6



- (4) Disconnect the connector.

Connector: ENC_x



Removal

Joint #3
Actuator Unit
Relay Cable 1

- (1) Remove the Arm #2 cover.

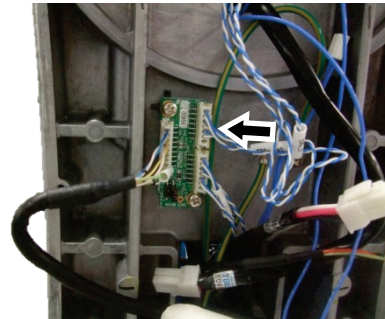
For details, refer to the following sections:

*Maintenance 3.7.1 N6-A1000** (Arm #2 Cover, Arm #1 Side)*

*Maintenance 3.7.2 N6- A850**R (Arm #2 Cover, Arm #1 Side)*

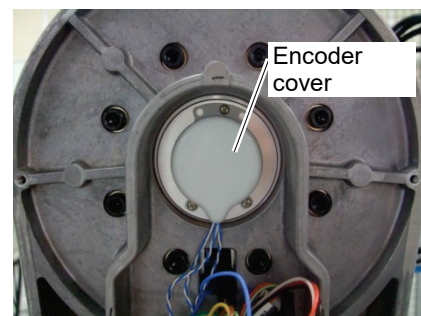
- (2) Remove the connector from the encoder board 2.

Connector: EB0x_CN2 (Joint #3 side)



- (3) Remove the encoder cover.

Cross recessed head screws: 3-M2.5x6



- (4) Disconnect the connector.

Connector: ENC_x



Removal

Joint #4
Actuator Unit
Relay Cable 1

- (1) Remove the covers.

Arm #4 side covers (2 covers)	Joint #4 inside cover
Joint #4 outside cover	Joint #4 side covers (2 covers)
Arm #3 cover	

For details, refer to *Maintenance: 3. Covers*.

- (2) Remove the Joint #4 actuator unit from the Arm #3.

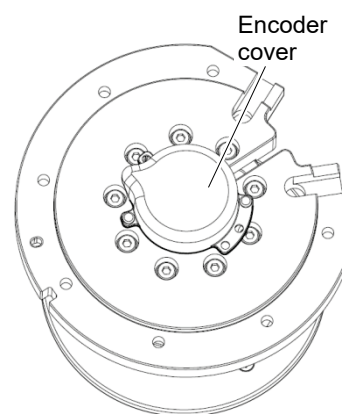
For details, refer to the following section:

Removal steps (9) through (22) in *Maintenance 4.1 Cable Unit (N6-A1000*)*:
Cable direction Standard (backward).

Removal steps (9) through (22) in *Maintenance 4.3 Cable Unit (N6-A850*R)*:
Cable direction Standard (backward).

- (3) Remove the encoder cover.

Cross recessed head screws: 2-M2.5x6



- (4) Disconnect the connector.

Connector: ENC_x



Removal

- (1) Remove the Arm #4 side cover (2 covers).

Joint #5

For details, refer to *Maintenance 3.14 Arm #4 Side Cover*.

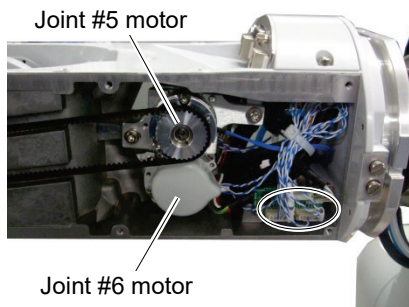
Motor Unit

- (2) Cut off the cable tie that bundles the cables, then disconnect the connector from the encoder board #4.

Relay Cable 1

Connector:

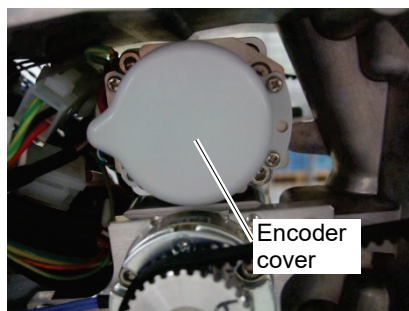
EB0x_CN2 (Joint #5 motor connection)



NOTE You do not need to disconnect the connector connected to the Joint #6 motor.

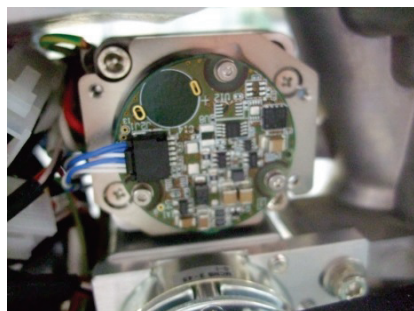
- (3) Remove the encoder cover.

Cross recessed head screws: 3-M2.5x6



- (4) Disconnect the connector.

Connector: ENC_x



Removal

- (1) Remove the Arm #4 side cover (2 covers).

Joint #6

For details, refer to *Maintenance 3.14 Arm #4 Side Cover*.


Motor Unit

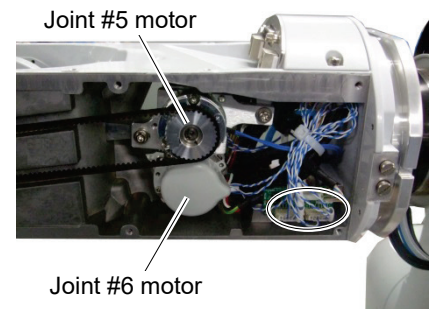
- (2) Cut off the cable tie that bundles the cables, then disconnect the following connector from the encoder board #4.

Relay Cable 1

Connector:

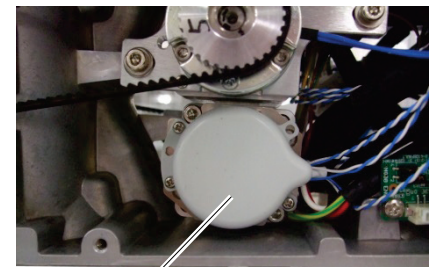
EB0x_CN2 (Joint #6 motor connection)

NOTE  You do not need to disconnect the connector connected to the Joint #5 motor.



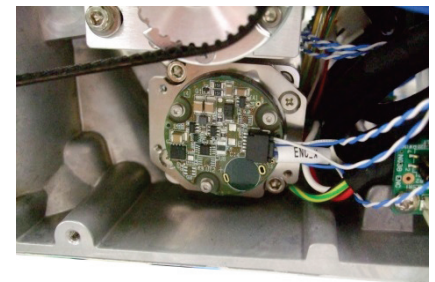
- (3) Remove the encoder cover.

Cross recessed head screws: 3-M2.5x6



- (4) Disconnect the connector.

Connector: ENC_x



Installation

Joint #1

Actuator Unit

Relay Cable 1

The relay cable 1 is connected to the actuator unit and the motor unit on each joint.

Refer to the following steps depending on the positions to replace.

- (1) Connect the connector of the relay cable 1 to the encoder.

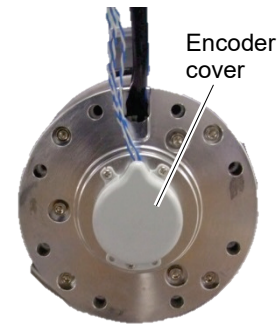
Connector: ENC_x



- (2) Install the encoder cover.

Cross recessed head screws: 3-M2.5x6

Tightening torque: 0.2 ± 0.1 N·m



- (3) Install the Joint #1 actuator unit.

For details, refer to *Maintenance 5.1 Replacing the Joint #1 Actuator Unit*

- (4) Perform calibration for the Joint #1.

For details, refer to *Maintenance 8. Calibration*.

Installation
 Joint #2
 Actuator Unit
 Relay Cable 1

- (1) Connect the connector of the relay cable 1 to the encoder.

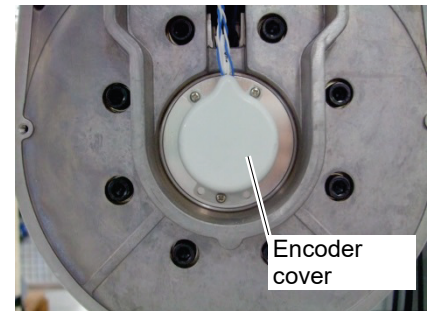
Connector: ENC_x



- (2) Install the encoder cover.

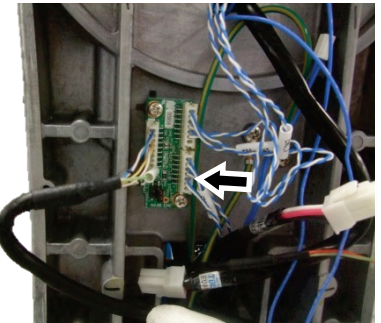
Cross recessed head screws: 3-M2.5x6

Tightening torque: 0.2 ± 0.1 N·m



- (3) Connect the connector to the encoder board 2.

Connector: EB0x_CN2



- (4) Install the Arm #2 cover (2 covers).

For details, refer to the following sections:

*Maintenance 3.7.1 N6-A1000** (Arm #2 Cover, Arm #1 Side)*

*Maintenance 3.7.2 N6-A850**R (Arm #2 Cover, Arm #1 Side)*

Maintenance 3.8 Arm #2 Cover (Arm #3 side)

- (5) Connect the M/C cable.

For details, refer to *Maintenance 4.6. M/C Cable*.

- (6) Perform calibration for the Joint #2.

For details, refer to *Maintenance 8. Calibration*.

Installation
Joint #3
Actuator Unit
Relay Cable 1

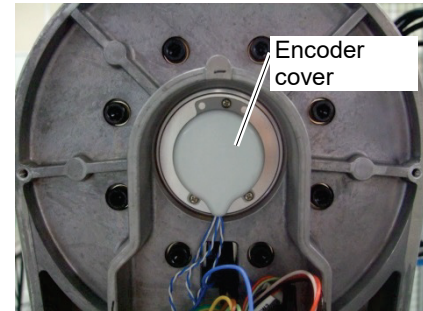
- (1) Connect the connector of the relay cable 1 to the encoder.

Connector: ENC_x



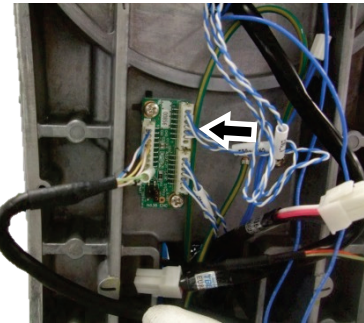
- (2) Install the encoder cover.

Cross recessed head screws: 3-M2.5×6
Tightening torque: 0.2 ± 0.1 N·m



- (3) Connect the connector to the encoder board 2.

Connector: EB0x_CN2



- (4) Install the Arm #2 cover (2 covers).

For details, refer to the following sections:

*Maintenance 3.7.1 N6-A1000** (Arm #2 Cover, Arm #1 Side)*

*Maintenance 3.7.2 N6- A850**R (Arm #2 Cover, Arm #1 Side)*

- (5) Connect the M/C cable.

For details, refer to *Maintenance 4.6. M/C Cable.*

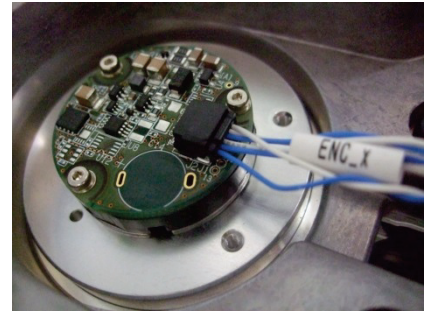
- (6) Perform calibration for the Joint #3.

For details, refer to *Maintenance 8. Calibration.*

Installation
 Joint #4
 Actuator Unit
 Relay Cable 1

- (1) Connect the connector of the relay cable 1 to the encoder.

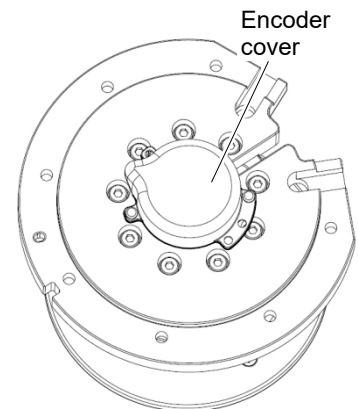
Connector: ENC_x



- (2) Install the encoder cover.

Cross recessed head screws: 2-M2.5x6

Tightening torque: 0.2 ± 0.1 N·m



- (3) Install the Joint #4 actuator unit to the Arm #3.

For details, refer to the following sections:

Installation steps (38) through (52) in *Maintenance 4.1 Cable Unit (N6-A1000*)*:
Cable direction Standard (backward).

Installation steps (41) through (55) in *Maintenance 4.3 Cable Unit (N6-A850*R)*:
Cable direction Standard (backward).

- (4) Connect the M/C cable.

For details, refer to *Maintenance 4.6. M/C Cable*.

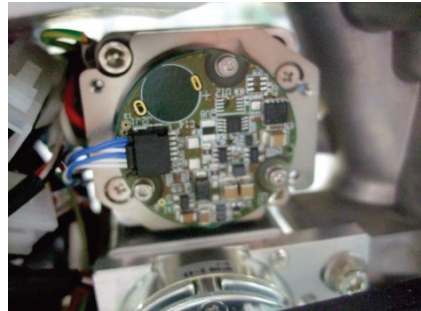
- (5) Perform calibration for the Joint #4.

For details, refer to *Maintenance 8. Calibration*.

Installation
Joint #5
Motor Unit
Relay Cable 1

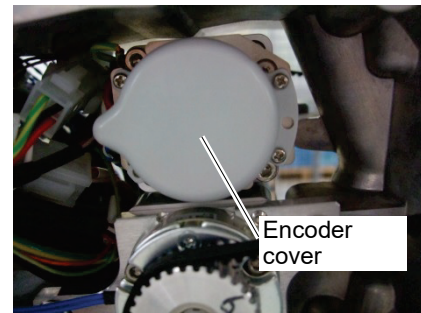
- (1) Connect the connector of the relay cable 1 to the encoder.

Connector: ENC_x



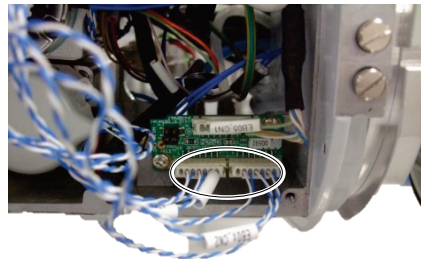
- (2) Install the encoder cover.

Cross recessed head screws: 3-M2.5×6
Tightening torque: 0.2 ± 0.1 N·m



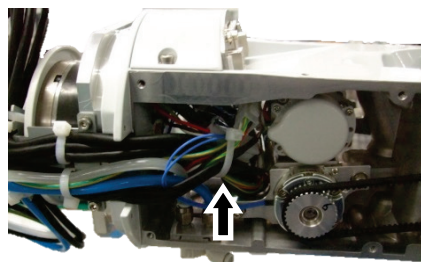
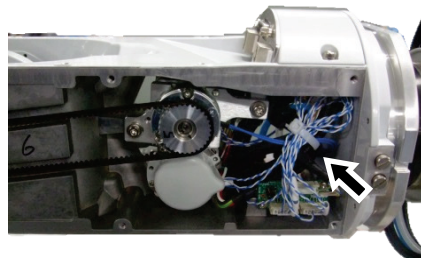
- (3) Connect the connectors to the encoder board 4.

Connector: EB0x_CN2



- (4) Bundle the cables with the cable tie to prevent the cables from interfering with the pulley or belt.

Cable ties (AB200) × 2



- (5) Install the Arm #4 side cover.

For details, refer to *Maintenance 3.14 Arm #4 Side Cover*.

- (6) Connect the M/C cable.

For details, refer to *Maintenance 4.6. M/C Cable*.

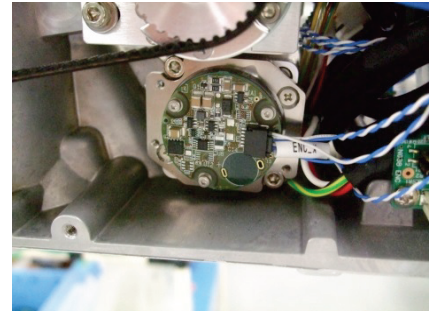
- (7) Perform calibration for the Joint #5 and 6

For details, refer to *Maintenance 8. Calibration*.

Installation
 Joint #6
 Motor Unit
 Relay Cable 1

- (1) Connect the connector of the relay cable 1 to the encoder.

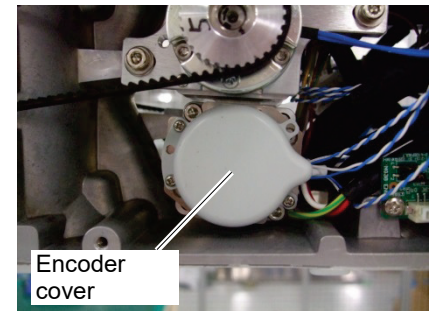
Connector: ENC_x



- (2) Install the encoder cover.

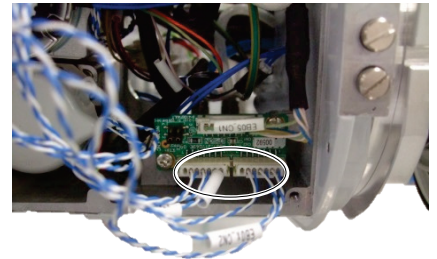
Cross recessed head screws: 3-M2.5×6

Tightening torque: 0.2 ± 0.1 N·m



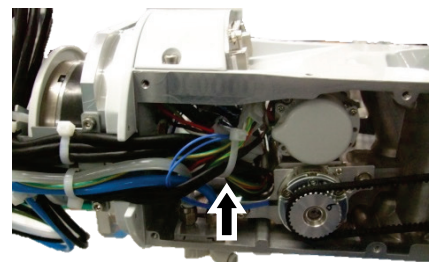
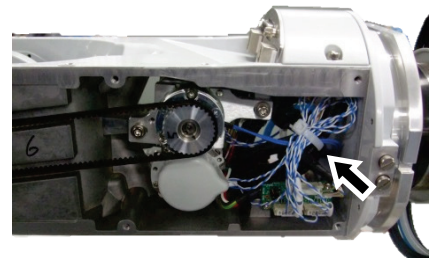
- (3) Connect the connector to the encoder board 4.

Connector: EB0x_CN2



- (4) Bundle the cables with the cable tie to prevent the cables from interfering with the pulley or belt.

Cable ties (AB200) × 2



- (5) Install the Arm #4 side cover (2 covers).

For details, refer to *Maintenance 3.14 Arm #4 Side Cover*.

- (7) Connect the M/C cable.

For details, refer to *Maintenance 4.6 M/C Cable*.

- (6) Perform calibration for the Joint #6.

For details, refer to *Maintenance 8. Calibration*.

4.5.2 Relay Cable 2

Relay Cable 2



Removal

- (1) Remove the Arm #4 side cover (2 covers).

Relay Cable 2

For details, refer to *Maintenance 3.14 Arm #4 Side Cover*.

- (2) Remove the user attachment.

For details, refer to the following sections:

Removal steps (9) through (11) in *Maintenance 4.1 Cable Unit (N6-A1000*)*:
Cable direction Standard (backward).

Removal steps (9) through (11) in *Maintenance 4.3 Cable Unit (N6-A850*R)*:
Cable direction Standard (backward).

- (4) Disconnect the connector plate.

Hexagon socket head cap bolts: 3-M3×5



- (5) Disconnect the relay cable 2.



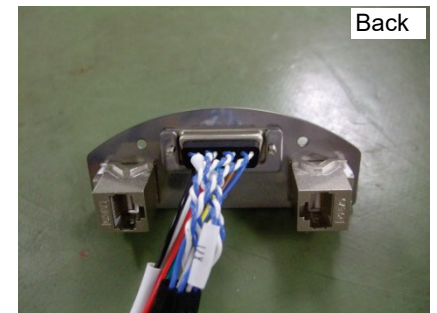
Be careful not to lose the fixing plate.



- Installation
Relay Cable 2
- (1) Connect the relay cable 2 to the connector plate.



Attached nut and washer will not be used.
Please dispose them by yourself.



- (2) Install the connector plate on the user attachment.

Hexagon socket head cap bolts: 3-M3×5
Tightening torque: 2.0 ± 0.1 N·m



- (3) Install the user attachment on the Arm #4.

For details, refer to the following section:

Installation steps (46), (51), and (52) in *Maintenance 4.1 Cable Unit (N6-A1000*)*:
Cable direction Standard (backward).

Installation steps (49), (54), and (55) in *Maintenance 4.3 Cable Unit (N6-A850*R)*:
Cable direction Standard (backward).

- (4) Install the Arm #4 side cover (2 covers).

For details, refer to *Maintenance 3.14 Arm #4 Side Cover*.

4.6 M/C Cable

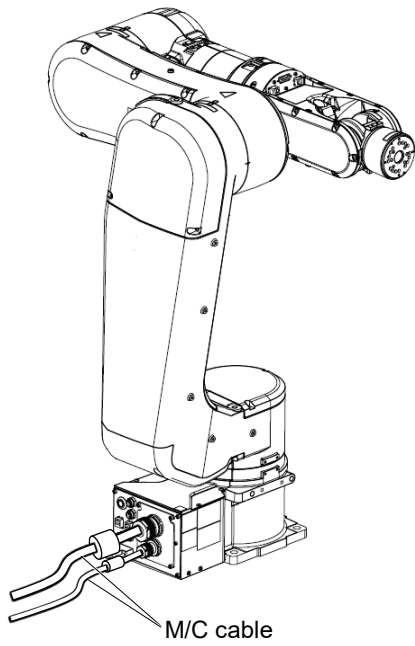


- Before performing any replacement procedure, turn OFF the Controller and related equipment, and then disconnect the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system.
- Do not connect or disconnect the motor connectors while the power to the robot system is turned ON. Connecting or disconnecting the motor connectors with the power ON is extremely hazardous and may result in serious bodily injury as the Manipulator may move abnormally, and also may result in electric shock and/or malfunction of the robot system.
- Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source. To shut off power to the robot system, disconnect the power plug from the power source. Performing any work while connecting the AC power cable to a factory power source is extremely hazardous and may result in electric shock and/or malfunction of the robot system.
- Be careful not to get any foreign substances in the Manipulator, connectors, and pins during maintenance. Turning ON the power to the robot system when any foreign substances exist in them is extremely hazardous and may result in electric shock and/or malfunction of the robot system.
- Be sure to connect the cables properly. Do not allow unnecessary strain on the cables. (Do not put heavy objects on the cables. Do not bend or pull the cables forcibly.) Unnecessary strain on the cables may result in damage to the cables, disconnection, and/or contact failure. These are extremely hazardous and may result in electric shock and/or improper function of the robot system.
- When installing the cover, be careful not to allow the cables to interfere with the cover mounting and do not bend these cables forcibly to push them into the cover. Unnecessary strain on cables may result in damage to the cables, disconnection, and/or contact failure. Damaged cables, disconnection, or contact failure is extremely hazardous and may result in electric shock and/or improper function of the robot system.
When routing the cables, observe the cable locations after removing the cover. Be sure to place the cables back to their original locations.

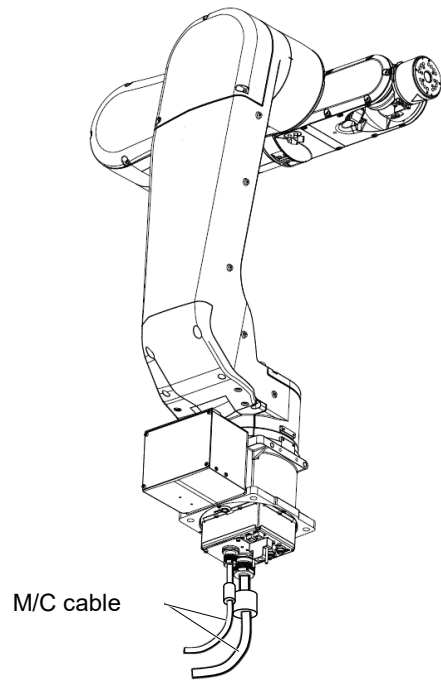


- When disconnecting the connectors during the replacement of the cable unit, be sure to reconnect the connectors to their proper positions. Improper connection of the connectors may result in improper function of the robot system.
For details on the connections, refer to the *Maintenance 4.7 Connector Pin Assignments*.

N6-A1000**

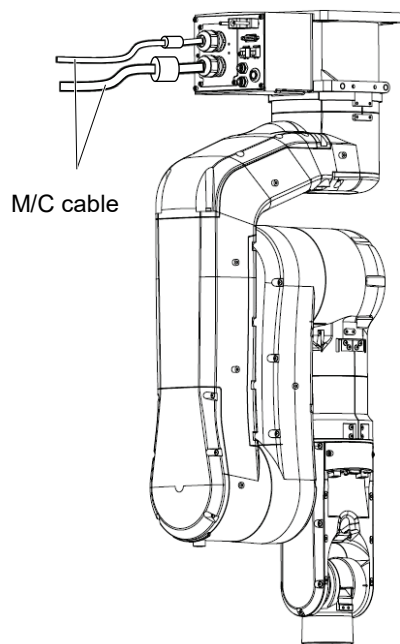


Cable direction: Standard (backward)

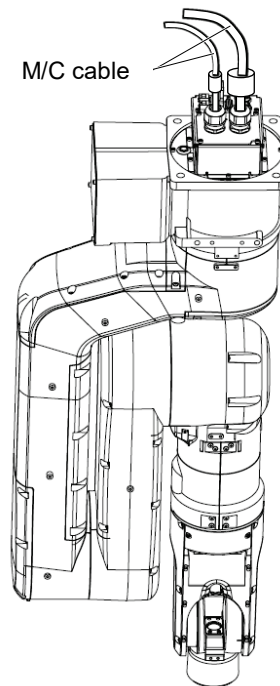


Cable direction: Downward

N6-A850**R



Cable direction: Standard (backward)



Cable direction: Upward

	Name		Qty	Code, Note		
Optional Part Maintenance Part	M/C cable	Default	3 m	Straight	1	R12NZ900YF
				L-shaped	1	R12NZ900YM
			5 m	Straight	1	R12NZ900YH
				L-shaped	1	R12NZ900YN
			10m	Straight	1	R12NZ900YJ
				L-shaped	1	R12NZ900YP
		15m	Straight	1	R12NZ900YK	
			L-shaped	1	R12NZ900YQ	
		20m	Straight	1	R12NZ900YL	
			L-shaped	1	R12NZ900YR	
		Flexible	3m	Straight	1	R12NZ900YT
				L-shaped	1	R12NZ900YY
			5m	Straight	1	R12NZ900YU
				L-shaped	1	R12NZ900YZ
			10m	Straight	1	R12NZ900YV
				L-shaped	1	R12NZ900Z1
			15m	Straight	1	R12NZ900YW
				L-shaped	1	R12NZ900Z2
20 m	Straight	1	R12NZ900YX			
	L-shaped	1	R12NZ900Z3			
Tool	Hexagonal wrench (width across flats: 3 mm)		1	For M4 hexagon socket head cap bolts		

Removal

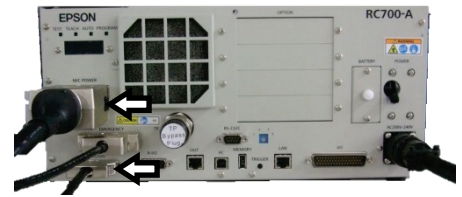
(1) Turn OFF the Controller.

M/C cable

(2) Disconnect the following connectors from the Controller.

Power cable connector

Signal cable connector




(3) Loosen the bolts fixing the plate.
You do not need to remove them completely.

Hexagon socket head cap bolts: 4-M4x8

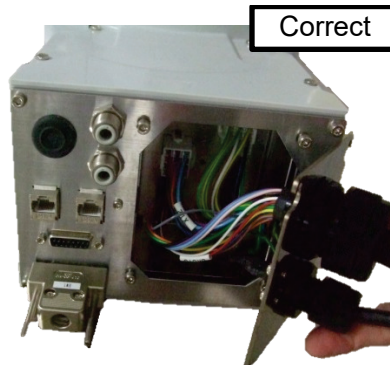


(4) Slide the plate upward to remove it.

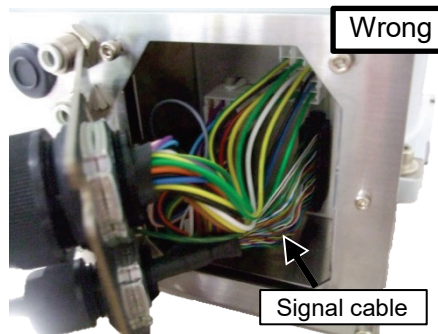
NOTE  Do not pull the M/C cable after removing the plate. M/C cables are connected by the connectors. Doing so may result in disconnection of the cables.



- (5) As shown on the right, pull out the cables from the Manipulator.



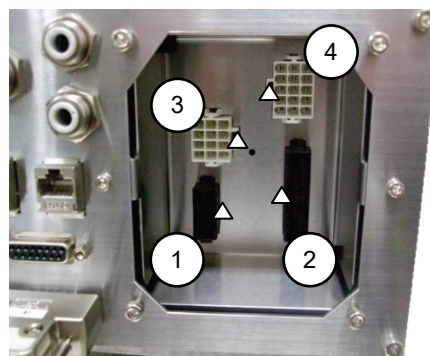
If you pull out the cables as shown on the right, force is applied to the signal cable and may result in the disconnection.



- (6) Disconnect the connectors in the order as shown on the right.



NOTE
Clips of each connector are Δ positions in the figure.
Push the clip to disconnect the connector.



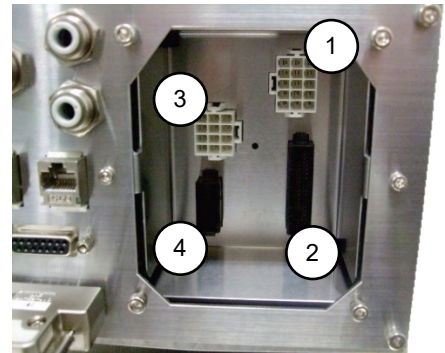
NOTE
Connector (white) for the power cable is difficult to disconnect for safety purpose.
Do not pull the cables. Doing so may result in disconnection.
Do not remove the M/C cable from the plate.

Installation
M/C cable

(1) Set the M/C cable as shown on the right.




(2) Connect the connectors in the order as shown on the right.




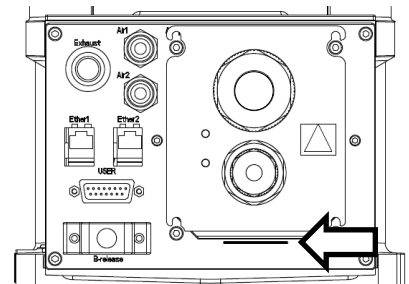
(3) Slide the plate downward to install it.

Hexagon socket head cap bolts: 4-M4×8
Tightening torque: 4.0 ± 0.2 N·m



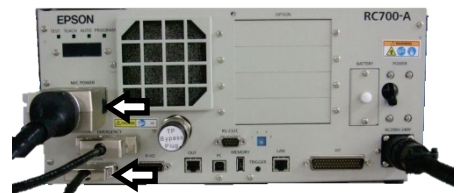
NOTE  Slide the plate until the line on the base side plate will not be seen.

NOTE  Be careful not to tighten the screws with the cables get caught on the plate.



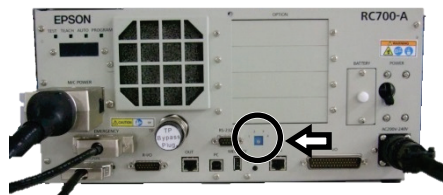
(4) Connect the connectors to the encoder board 2.

Power cable connector
Signal cable connector



- (5) Change the encoder voltage adjustment switch depending on the length of the M/C cable.

Switch	M/C cable length
1	3m
2	5m
3	10m
4	15m, 20m



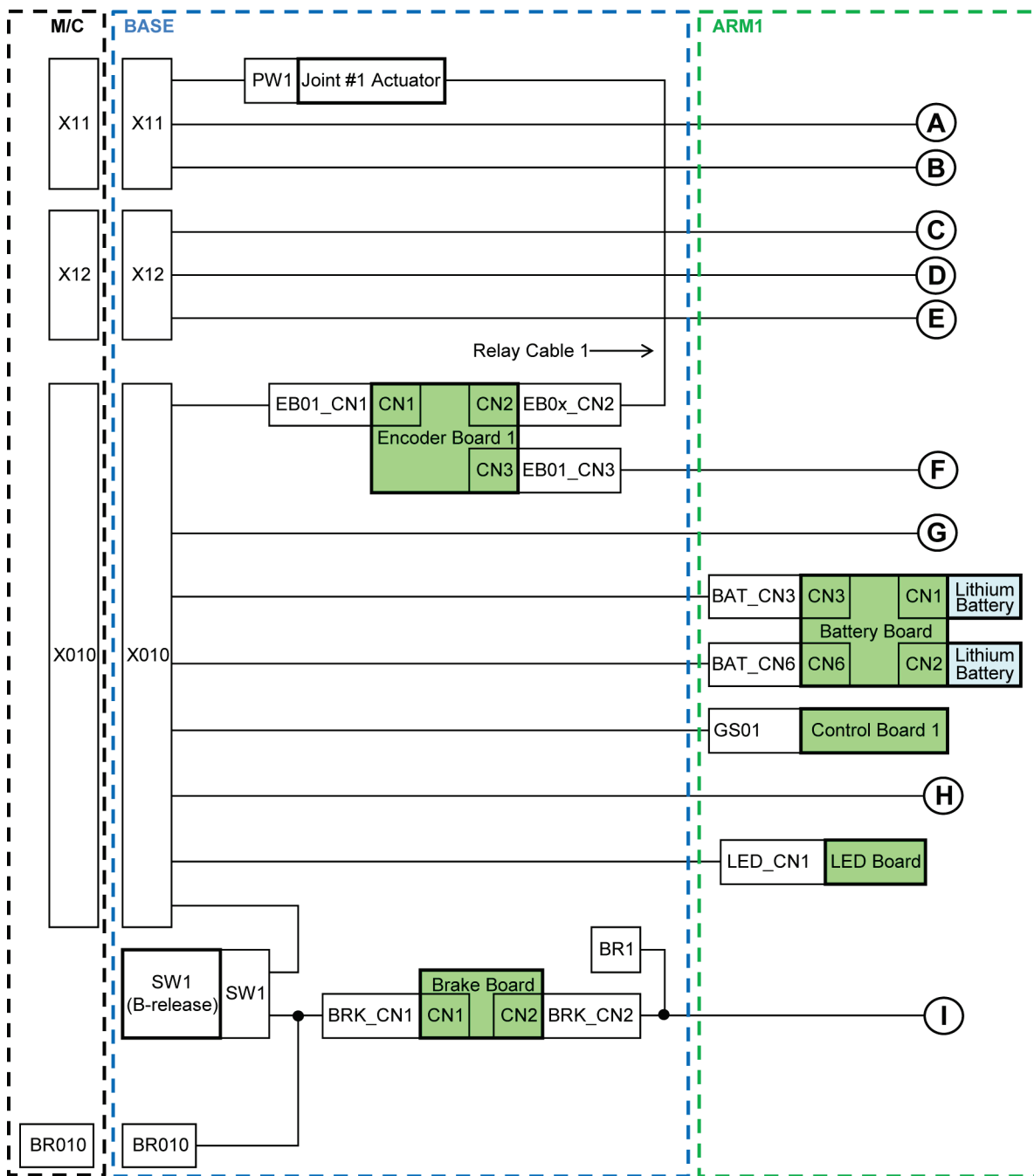
- (6) Turn ON the Controller.
- (7) Check operation to see if the Manipulator's position and posture are out of position.
Move the Manipulator to two or three points (poses) of the registered points.
- (8) If the Manipulator is out of position, calibrate all the joints.
For details, refer to *Maintenance 8. Calibration*.

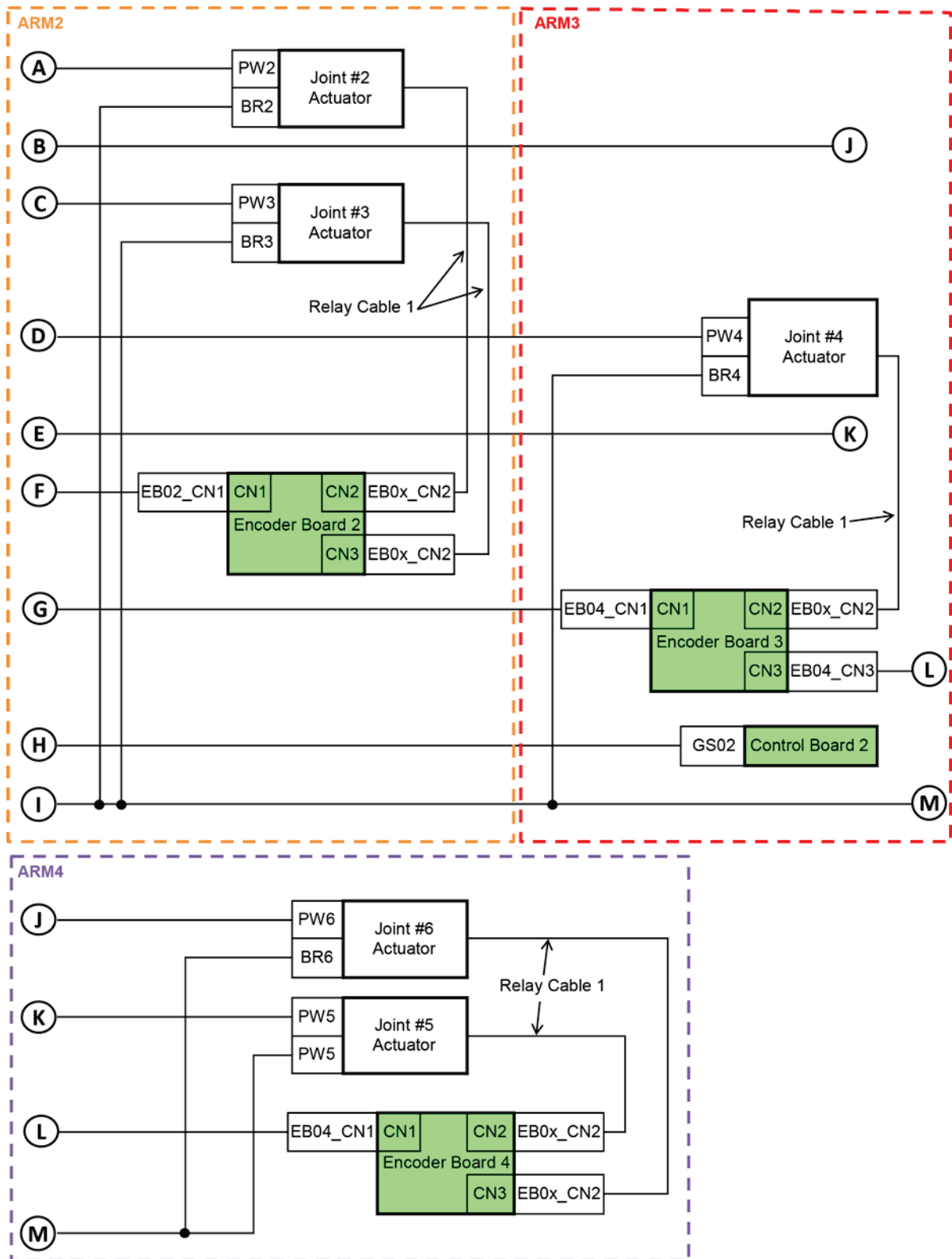
4.7 Connector Pin Assignment

The following table shows the codes and cable colors indicated in the pin assignments.

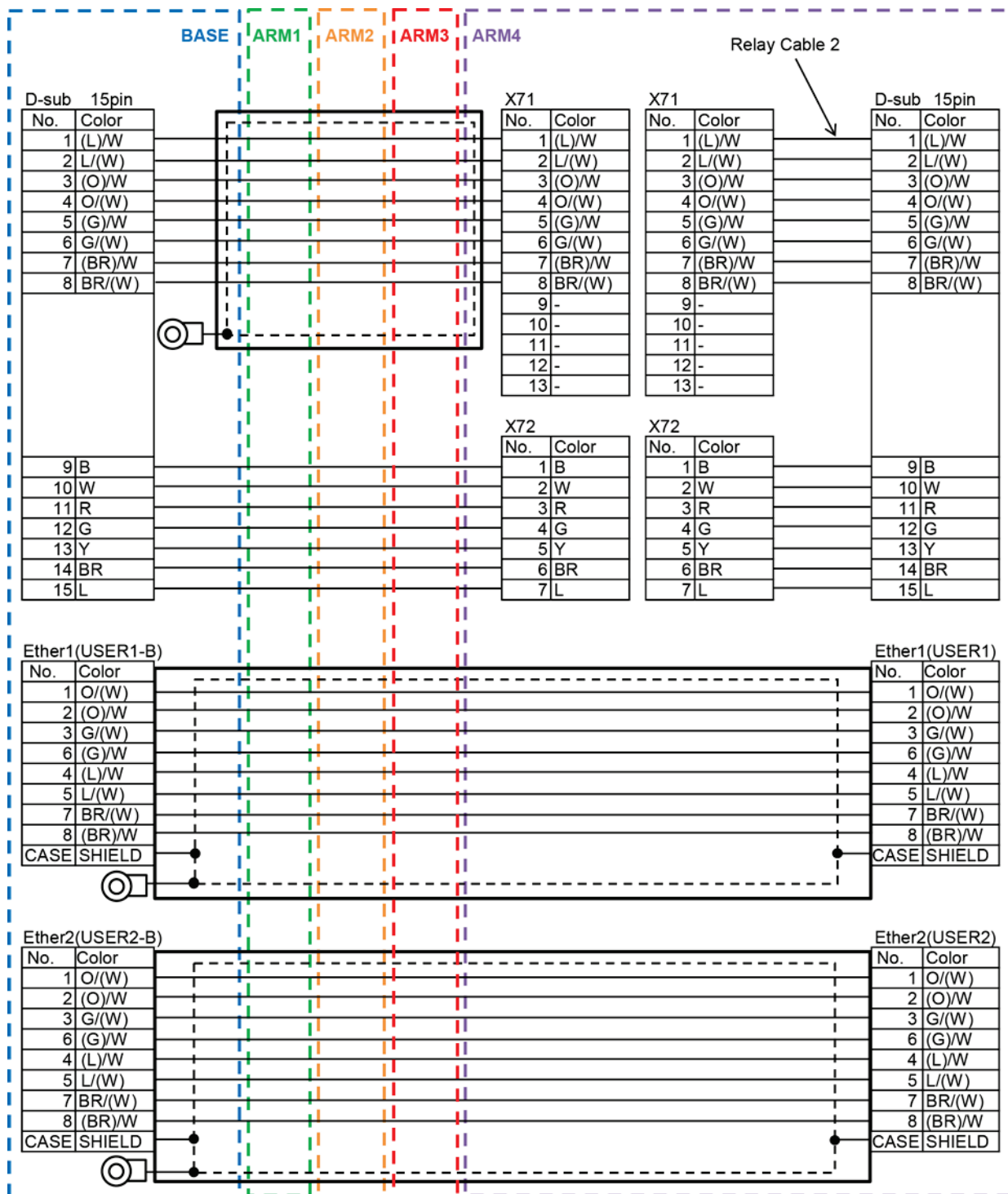
Code	Cable color
B	Black
W	White
R	Red
G	Green
Y	Yellow
BR	Brown
L	Blue
V	Violet
A	Azure
O	Orange
GL	Gray
P	Pink

4.7.1 Signal, Power cable





4.7.2 User Cable



5. Actuator Units



WARNING

- Do not connect or disconnect the motor connectors while the power to the robot system is turned ON. Connecting or disconnecting the motor connectors with the power ON is extremely hazardous and may result in serious bodily injury as the Manipulator may move abnormally, and also may result in electric shock and/or malfunction of the robot system.
- To shut off power to the robot system, disconnect the power plug from the power source. Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source.
- Before performing any replacement procedure, turn OFF the Controller and related equipment, and then disconnect the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system.



CAUTION

- Be careful not to apply excessive shock to the actuator units and motor shaft during replacement procedures. The shock may shorten the life of the actuator units and motor and/or damage them.
- Never disassemble the parts (units). Disassembled the parts will cause a positional gap and cannot be used again.

After parts (units) have been replaced, the Manipulator cannot perform positioning properly because a gap exists between the origin stored in the parts and its corresponding origin stored in the Controller.

After replacing the parts, it is necessary to match these origins.

The process of aligning the two origins is called “Calibration”.

Refer to *Maintenance 8. Calibration* and follow the steps to perform calibration.

NOTE



The Joint #5 and #6 are not equipped with an actuator unit. Replace the following parts for each.

Motor unit, timing belt, electromagnetic brake, Joint #5 and # 6 units



CAUTION

- This procedure has possibility of hands and fingers being caught and/or damage or malfunction to the Manipulator. Be very careful when performing maintenance.
- When removing the Arm #1, there must be two or more people to work on it so that at least one of them can support the arm while the others are removing the bolts. Removing the bolts without supporting the arm may result in the arm falling, bodily injury, and/or malfunction of the robot system.
- Handling heavy parts during maintenance operations. Be sure to have at least 2 people when operating heavy parts.

NOTE



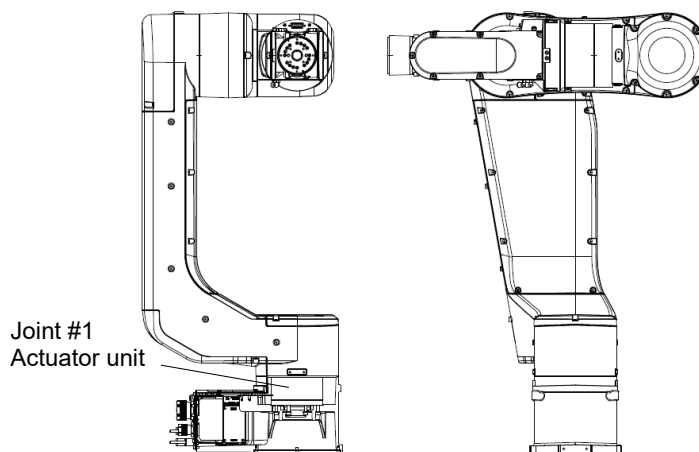
After replacing the Joint #1 actuator unit, teaching points will need to be re-taught.

5.1 Replacing the Joint #1 Actuator Unit

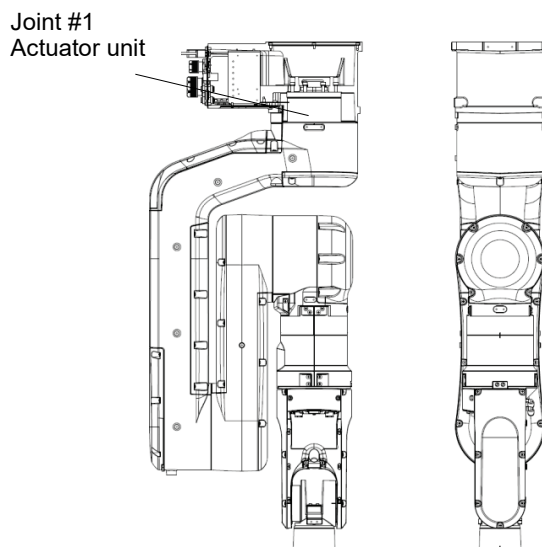
	Name		Qty	Note
Maintenance Parts	Joint #1 actuator unit		1	1749168
Tools	Hexagonal wrench	width across flats: 2.5 mm	1	For M3 hexagon socket head cap bolts
		width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
		width across flats: 4 mm	1	For M5 hexagon socket head cap bolts
		width across flats: 5 mm	1	For M6 hexagon socket head cap bolts
	Box wrench	width across flats: 5 mm	1	For D-Sub connector
	Long nose plier		1	For removing air tubes
	Cross-point screwdriver (#2)		1	For cross recessed head screws
	Torque wrench		1	For tightening torque control
Nippers		1	For cutting a cable tie	

The Joint #1 is not equipped with the brake. When performing maintenance, be careful not to exceed the motion range of the Joint #1.

N6-A1000**



N6-A850**R



5.1.1 Joint #1 (N6-A1000*): Cable direction: Standard (backward)

Removal

- (1) Remove the covers.

Joint #1

Base cover, Joint #1 cover, and Joint #1 inside cover

Actuator Unit

For details, refer to *Maintenance 3. Covers*.

N6-A1000*

- (2) Remove the Arm #1 outside cover.

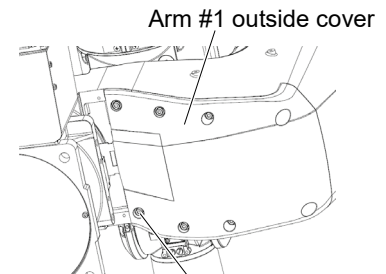
Cable direction:

Hexagon socket head cap bolts:

Standard

8-M5×20 (with plain washer)

(backward)



8-M5×20 (with plain washer)

- (3) Remove the cable unit inside the Joint #1.

For details, refer to the Removal steps (7), (47) through (56), and (58) in *Maintenance 4.1 Cable Unit (N6-A1000*): Cable direction Standard (backward)*.

- (4) Disconnect the M/C cable.

For details, refer to *Maintenance 4.6. M/C Cable*

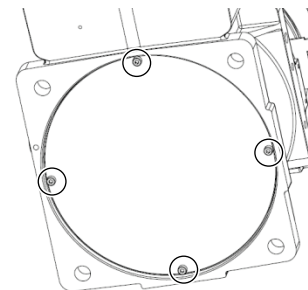
- (5) Lay down the Manipulator.



Be sure to have at least 2 people to lay down the Manipulator.

- (6) Remove the base bottom plate.

Hexagon socket head cap bolts: 4-M4×8



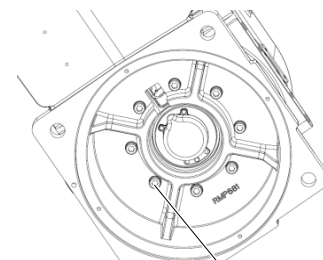
- (7) Remove the base.

Hexagon socket head cap bolts:

8-M6×40 (with plain washer)




When you remove it, be careful not to catch the cables on the Joint #1 actuator unit.



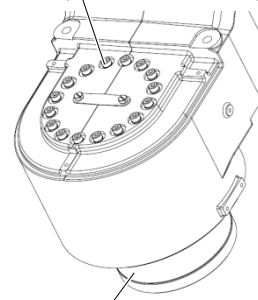
8-M6×40 (with plain washer)

- (8) Remove the Joint #1 actuator unit and the O-ring.

Hexagon socket head cap bolts:
16-M5×35 (with plain washer)

NOTE  Be sure to have at least 2 people to perform the operation since the parts being heavy.
Do not apply excessive shock to the parts.

16-M5×35 (with plain washer)



Joint #1 actuator unit

Installation (1) Install the attached O-ring to the Joint #1 actuator unit.

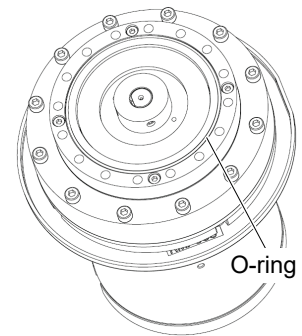
NOTE



Apply a thin coat of grease to the O-ring.

Grease: SK-1A

Joint #1
Actuator Unit
N6-A1000*



Cable direction: (2) Apply the grease to the Joint #1 actuator unit.

Standard
(backward)

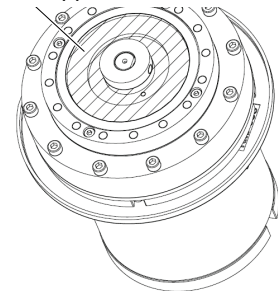
Grease: SK-1A 15g

NOTE



Be careful not to leak the grease from the shaded area shown in the right.

Grease application area



(3) Install the Joint #1 actuator unit to the Arm #1.

Hexagon socket head cap bolts:

16-M5×35 (with plain washer)

Tightening torque: $10 \pm 0.5 \text{ N}\cdot\text{m}$

16-M5×35 (with plain washer)

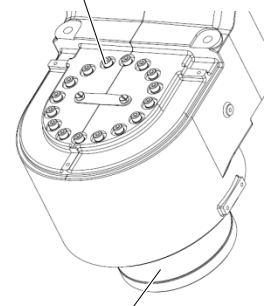
NOTE



Be sure to have at least 2 people to perform the operation since the parts being heavy.

Do not apply excessive shock to the parts.

Be sure to install the O-ring properly.



Joint #1 actuator unit

(4) Install the base.

Hexagon socket head cap bolts:

8-M6×40 (with plain washer)

Tightening torque: $18 \pm 0.9 \text{ N}\cdot\text{m}$

NOTE

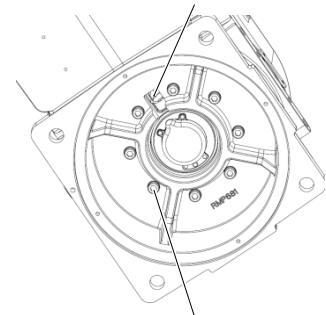


When installing it, make sure to align the directions of the hole of the base and the cable exit of Joint #1 actuator unit.

Pass the cables of the Joint #1 actuator unit through the hole of the base.

Be careful not to catch the cables.

Hole for cables



8-M6×40 (with plain washer)

- (5) Install the base bottom plate.

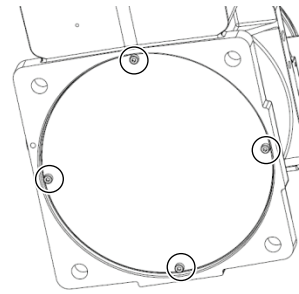
Hexagon socket head cap bolts: 4-M4×8

Tightening torque: 4.0 ± 0.2 N·m

NOTE



Be careful not to catch the cables.



- (6) Install the cable unit inside the Joint #1.

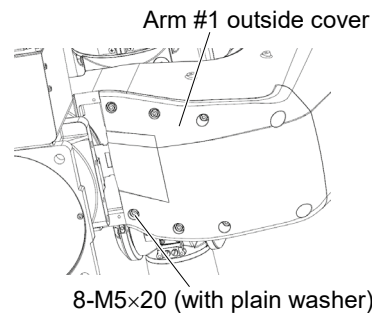
For details, refer to the Installation steps (4) through (8), (53) through (61), and (63) in *Maintenance 4.1 Cable Unit (N6-A1000*): Cable direction Standard (backward)*.

- (7) Install the Arm #1 outside cover.

Hexagon socket head cap bolts:

8-M5×20 (with plain washer)

Tightening torque: 8.0 ± 0.4 N·m



- (8) Install the following covers:

Base cover, Joint #1 cover, and Joint #1 inside cover

For details, refer to *Maintenance 3. Covers*.

- (9) Disconnect the M/C cable.

For details, refer to *Maintenance 4.6. M/C Cable*.

- (10) Perform calibration for the Joint #1.

For details, refer to *Maintenance 8. Calibration*.

5.1.2 Joint #1 (N6-A1000*B): Cable direction:

Upward and Downward

Removal

- (1) Remove the covers.

Joint #1

Base cover, Joint #1 cover, and Joint #1 inside cover

Actuator Unit

For details, refer to *Maintenance 3. Covers*.

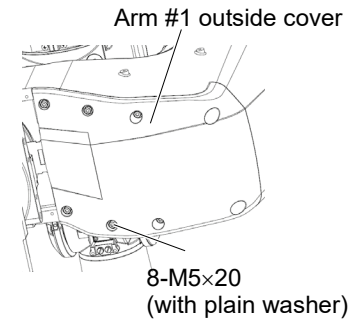
N6-A1000*B

- (2) Remove the Arm #1 outside cover.

Cable direction:

Hexagon socket head cap bolts:
8-M5×20 (with plain washer)

Upward and
Downward



- (3) Remove the J1 cable fixing plate fixed on the Arm #1.

For details, refer to the Removal step (47) in *Maintenance 4.1 Cable Unit (N6-A1000*): Cable direction Standard (backward)*.

- (4) Remove the cable unit inside the base.

For details, refer to the Removal steps (2), (4) through (7), and (9) through (15) in *Maintenance 4.2 Cable Unit (N6-A1000*B): Cable direction Upward and Downward*.

- (5) Remove the cable unit inside the Joint #1.

For details, refer to the Removal steps (54) through (56), and (58) in *Maintenance 4.1 Cable Unit (N6-A1000*): Cable direction Standard (backward)*.

- (6) Disconnect the M/C cable.

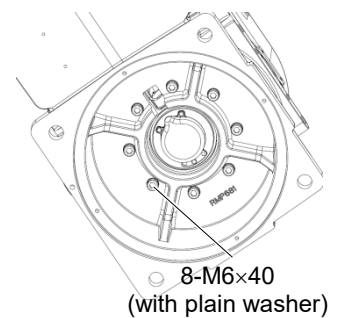
For details, refer to *Maintenance 4.6. M/C Cable*.

- (7) Remove the base.

Hexagon socket head cap bolts:
8-M6×40 (with plain washer)



When you remove it, be careful not to catch the cables on the Joint #1 actuator unit.



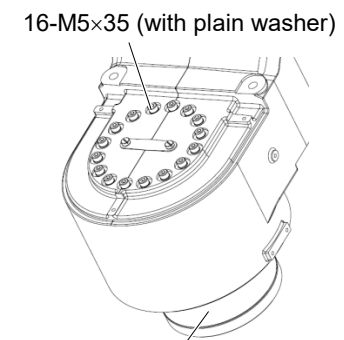
- (8) Remove the Joint #1 actuator unit and the O-ring.

Hexagon socket head cap bolts:
16-M5×35 (with plain washer)



Be sure to have at least 2 people to perform the operation since the parts being heavy.

Do not apply excessive shock to the parts.



Joint #1 actuator unit

Installation

Joint #1
Actuator Unit

N6-A1000**

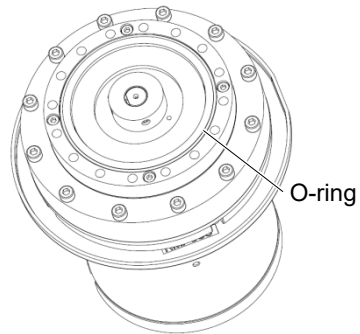
Cable direction:
Downward

- (1) Install the attached O-ring on the Joint #1 actuator unit.

NOTE


Apply a thin coat of grease to the O-ring.

Grease: SK-1A



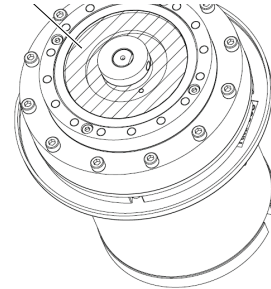
- (2) Apply the grease to the Joint #1 actuator unit.

Grease: SK-1A 15g

NOTE


Be careful not to leak the grease from the shaded area shown in the right.

Grease application area



- (3) Install the Joint #1 actuator unit to the Arm #1.

Hexagon socket head cap bolts:

16-M5×35 (with plain washer)

Tightening torque: 10 ± 0.5 N·m

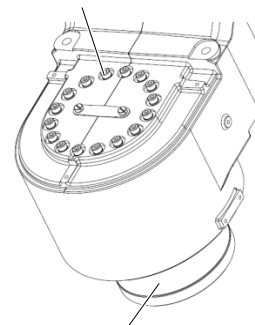
NOTE


Be sure to have at least 2 people to perform the operation since the parts being heavy.

Do not apply excessive shock to the parts.

Be sure to install the O-ring properly.

16-M5×35 (with plain washer)



Joint #1 actuator unit

- (4) Install the base.

Hexagon socket head cap bolts:

8-M6×40 (with plain washer)

Tightening torque: 18 ± 0.9 N·m

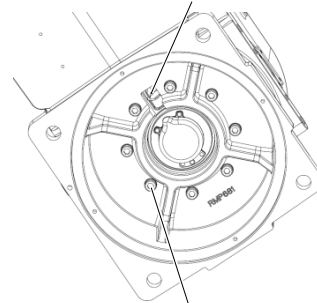
NOTE


Refer to the picture for installing direction.

When installing it, pass the cables of the Joint #1 actuator unit through the hole of the base.

Be careful not to get the cables caught in the base.

Hole for cables



8-M6×40 (with plain washer)

- (5) Install the cable unit.

For details, refer to the Installation steps (4) through (8) in *Maintenance 4.1 Cable Unit (N6-A1000*) Cable direction Standard (backward)*.

- (6) Install the cable unit inside the base.

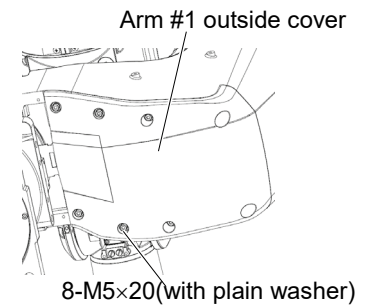
For details, refer to the Installation steps (2) through (11), (13) through (18) in *Maintenance 4.2 Cable Unit (N6-A1000*B): Cable direction Upward and Downward.*

- (7) Install the Arm #1 outside cover.

Hexagon socket head cap bolts:

8-M5×20 (with plain washer)

Tightening torque: 8 ± 0.4 N·m



- (8) Install the following covers:

Base cover, Joint #1 cover, and Joint #1 inside cover

For details, refer to *Maintenance 3. Covers.*

- (9) Disconnect the M/C cable.

For details, refer to *Maintenance 4.6. M/C Cable.*

- (10) Perform calibration for the Joint #1.

For details, refer to *Maintenance 8. Calibration.*

5.1.3 Joint #1 (N6-A850*R): Cable direction: Standard (backward)

Removal

- (1) Remove the covers.

Joint #1

Base cover, Joint #1 cover, and Joint #1 inside cover

Actuator Unit

For details, refer to *Maintenance 3. Covers*.

N6-A850*R

- (2) Remove the cable unit inside the Joint #1.

Cable direction:

For details, refer to the Removal steps (7), (49) through (58), and (60) in *Maintenance 4.3 Cable Unit (N6-A850*R): Cable direction Standard (backward)*.

Standard

(backward)

- (3) Disconnect the M/C cable.

For details, refer to *Maintenance 4.6. M/C Cable*

- (4) Lay down the Manipulator.

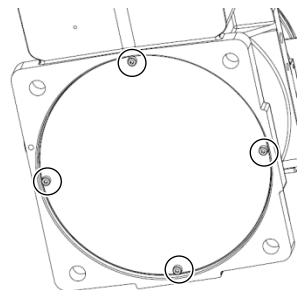
NOTE



Be sure to have at least 2 people to lay down the Manipulator.

- (5) Remove the base bottom plate.

Hexagon socket head cap bolts: 4-M4×8



- (6) Remove the base.

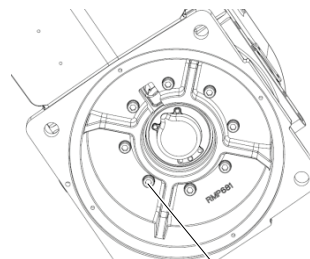
Hexagon socket head cap bolts:

8-M6×40 (with plain washer)

NOTE



When you remove it, be careful not to catch the cables on the Joint #1 actuator unit.



8-M6×40 (with plain washer)

- (7) Remove the Joint #1 actuator unit and the O-ring.

Hexagon socket head cap bolts:

16-M5×35 (with plain washer)

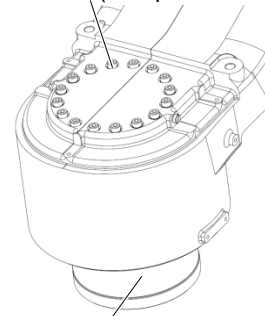
NOTE



Be sure to have at least 2 people to perform the operation since the parts being heavy.

Do not apply excessive shock to the parts.

16-M5×35 (with plain washer)



Joint #1 actuator unit

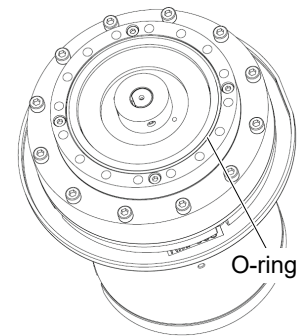
Installation (1) Install the attached O-ring to the Joint #1 actuator unit.

NOTE



Apply a thin coat of grease to the O-ring.

Grease: SK-1A



Joint #1
Actuator Unit
N6-A850*R

(Cable
direction:
Standard
(backward)

(2) Apply the grease to the Joint #1 actuator unit.

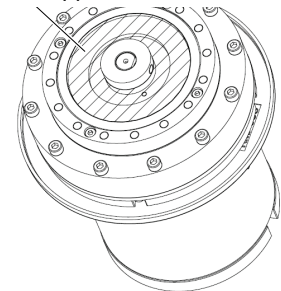
Grease: SK-1A 15g

NOTE



Be careful not to leak the grease from the shaded area shown in the right.

Grease application area



(3) Install the Joint #1 actuator unit to the Arm #1.

Hexagon socket head cap bolts:

16-M5×35 (with plain washer)

Tightening torque: $10 \pm 0.5 \text{ N}\cdot\text{m}$

NOTE

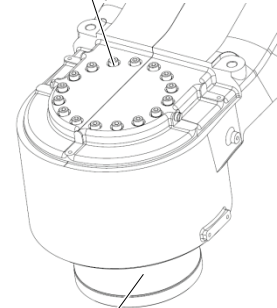


Be sure to have at least 2 people to perform the operation since the parts being heavy.

Do not apply excessive shock to the parts.

Be sure to install the O-ring properly.

16-M5×35 (with plain washer)



Joint #1 actuator unit

(4) Install the base.

Hexagon socket head cap bolts:

8-M6×40 (with plain washer)

Tightening torque: $18 \pm 0.9 \text{ N}\cdot\text{m}$

NOTE

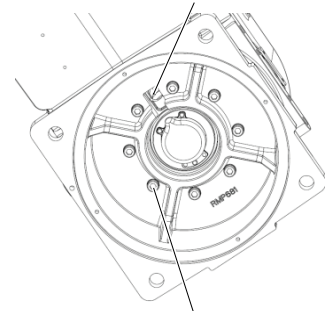


When installing it, make sure to align the directions of the hole of the base and the cable exit of Joint #1 actuator unit.

Pass the cables of the Joint #1 actuator unit through the hole of the base.

Be careful not to catch the cables.

Hole for cables



8-M6×40 (with plain washer)

- (5) Install the base bottom plate.

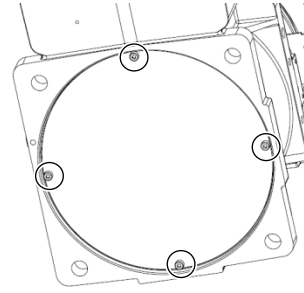
Hexagon socket head cap bolts: 4-M4×8

Tightening torque: 4.0 ± 0.2 N·m

NOTE



Be careful not to catch the cables.



- (6) Install the cable unit inside the Joint #1.

For details, refer to the Removal steps (4) through (8), (56) through (64), and (66) in *Maintenance 4.3 Cable Unit (N6-A850*R): Cable direction Standard (backward)*.

- (7) Install the following covers:

Base cover, Joint #1 cover, and Joint #1 inside cover

For details, refer to *Maintenance 3. Covers*.

- (8) Disconnect the M/C cable.

For details, refer to *Maintenance 4.6. M/C Cable*.

- (9) Perform calibration for the Joint #1.

For details, refer to *Maintenance 8. Calibration*.

5.1.4 Joint #1 (N6-A850*BR): Cable direction: Upward

Removal

- (1) Remove the covers.

Joint #1

Base cover, Joint #1 cover, and Joint #1 inside cover

Actuator Unit

For details, refer to *Maintenance 3. Covers*.

N6-A850*BR

- (2) Remove the J1 cable fixing plate fixed on the Arm #1.

Cable direction:
Upward

For details, refer to the Removal step (49) in *Maintenance 4.3 Cable Unit (N6-A850*R): Cable direction Standard (backward)*.

- (3) Remove the cable unit inside the base.

For details, refer to the Removal steps (2), (4) through (7), and (9) through (15) in *Maintenance 4.4 Cable Unit (N6-A850*BR): Cable direction Upward*.

- (4) Remove the cable unit inside the Joint #1.

For details, refer to the Removal steps (56) through (58), and (60) in *Maintenance 4.3 Cable Unit (N6-A850*R): Cable direction Standard (backward)*.

- (5) Disconnect the M/C cable.

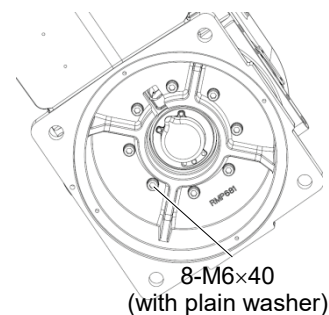
For details, refer to *Maintenance 4.6. M/C Cable*.

- (6) Remove the base.

Hexagon socket head cap bolts:
8-M6×40 (with plain washer)



When you remove it, be careful not to catch the cables on the Joint #1 actuator unit.



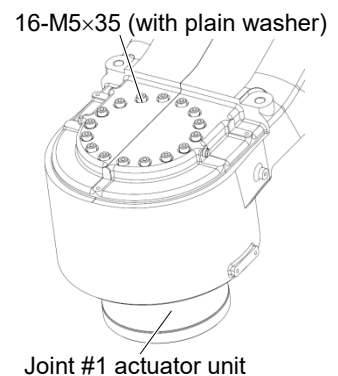
- (7) Remove the Joint #1 actuator unit and the O-ring.

Hexagon socket head cap bolts:
16-M5×35 (with plain washer)




Be sure to have at least 2 people to perform the operation since the parts being heavy.

Do not apply excessive shock to the parts.

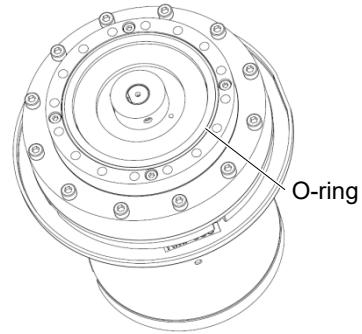


Installation (1) Install the attached O-ring on the Joint #1 actuator unit.

NOTE  Apply a thin coat of grease to the O-ring.
Grease: SK-1A


Joint #1
Actuator Unit
N6-A850*BR

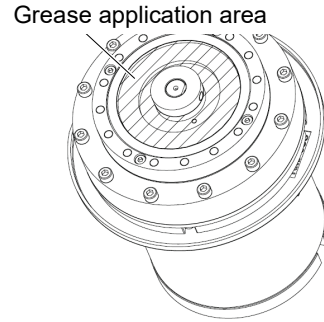
Cable direction:
Upward



(2) Apply the grease to the Joint #1 actuator unit.

Grease: SK-1A 15g


NOTE  Be careful not to leak the grease from the shaded area shown in the right.



(3) Install the Joint #1 actuator unit to the Arm #1.

Hexagon socket head cap bolts:
16-M5×35 (with plain washer)

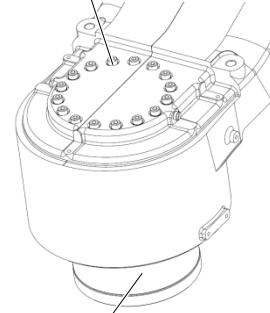
Tightening torque: 10 ± 0.5 N·m

NOTE  Be sure to have at least 2 people to perform the operation since the parts being heavy.

Do not apply excessive shock to the parts.

Be sure to install the O-ring properly.

16-M5×35 (with plain washer)




Joint #1 actuator unit

(4) Install the base.

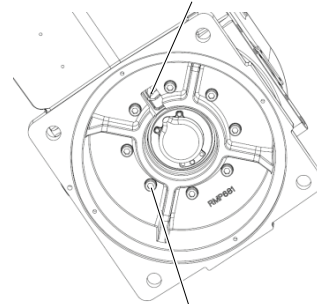
Hexagon socket head cap bolts:
8-M6×40 (with plain washer)

Tightening torque: 18 ± 0.9 N·m

NOTE  Refer to the picture for installing direction.
When installing it, pass the cables of the Joint #1 actuator unit through the hole of the base.

Be careful not to get the cables caught in the base.

Hole for cables



8-M6×40 (with plain washer)

(5) Install the cable unit.


For details, refer to the Removal steps (4) through (8) in *Maintenance 4.3 Cable Unit (N6-A850*R) Cable direction Standard (backward)*.

(6) Install the cable unit inside the base.

For details, refer to the Removal steps (2) through (11), (13) through (18) in *Maintenance 4.4 Cable Unit (N6-A850*BR): Cable direction Upward*.

- (7) Install the following covers:
 - Base cover, Joint #1 cover, and Joint #1 inside cover
 - For details, refer to *Maintenance 3. Covers*.
- (8) Disconnect the M/C cable.
 - For details, refer to *Maintenance 4.6. M/C Cable*.
- (9) Perform calibration for the Joint #1.
 - For details, refer to *Maintenance 8. Calibration*.

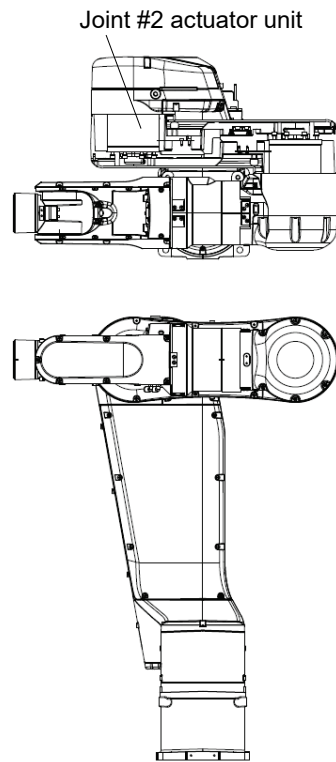
5.2 Replacing the Joint #2 Actuator Unit

 CAUTION	<ul style="list-style-type: none"> ■ This procedure has possibility of hands and fingers being caught and/or damage or malfunction to the Manipulator. Be very careful when performing maintenance. ■ Handling heavy parts during maintenance operations. Be sure to have at least 2 people when operating heavy parts.
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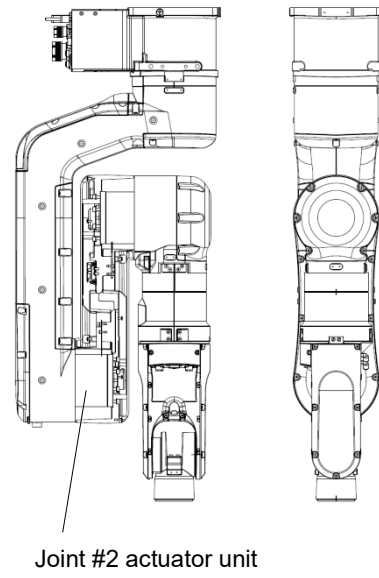
	Name	Qty	Code, Note	
Maintenance Parts	Joint #2 actuator unit	1	1749169	
	Cable tie AB200	-	1684328, 1 bag (100 ties: white)	
Tools	Hexagonal wrench	width across flats: 2.5 mm	1	For M3 hexagon socket head cap bolts
		width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
		width across flats: 4 mm	1	For M5 hexagon socket head cap bolts
		width across flats: 5 mm	1	For M6 hexagon socket head cap bolts
	Box wrench	width across flats: 5 mm	1	For D-Sub connector
	Long nose pliers	1	For removing air tubes	
	Nippers	1	For cutting a cable tie	
	Cross-point screwdriver (#2)	1	For cross recessed head screws	
	Torque wrench	1	For tightening torque control	
	Cable tie gun	1	Refer: HellermannTyton MK8	
	Cable tie gun tester	1	Refer: HellermannTyton DGT500-MK8	

The brake is mounted on each joint to prevent the arm from lowering due to its own weight while the Controller power is OFF or the motor is OFF status. The brake does not work during replacement. Be careful when performing maintenance work.

N6-A1000**



N6-A850**R



5.2.1 Joint #2 (N6-A1000**)

Removal

- (1) Remove the covers.

Joint #2
Actuator Unit
N6-A1000**

Arm #4 side cover (2 covers), Joint #4 inside cover, Joint #4 outside cover
Joint #4 side cover (2 covers), Arm #3 cover, Arm 3 inside cover,
Arm #2 cover (2 covers), Joint #2 cover, Joint #2 outside cover

For details, refer to *Maintenance 3. Covers*.

- (2) Remove the cable unit from Joint #1 to Joint #2.

For details, refer to the Removal steps (2) through (5), (9) through (37), and (42) in *Maintenance 4.1 Cable Unit (N6-A1000*) : Cable direction Standard (backward)*.

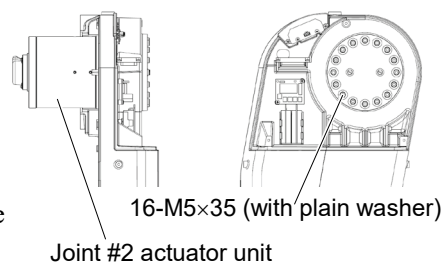
- (3) Remove the Joint #2 actuator unit and the O-ring.

Hexagon socket head cap bolts:
16-M5×35 (with plain washer)




Be sure to have at least 2 people to perform the operation since the parts being heavy.

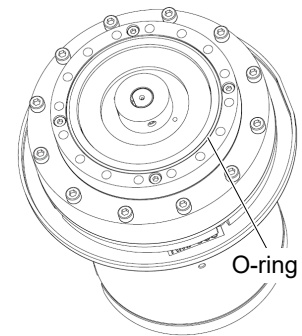
Do not apply excessive shock to the parts.



- Installation (1) Install the attached O-ring on the Joint #2 actuator unit.
- Joint #2
- Actuator Unit
- N6-A1000**

NOTE  Apply a thin coat of grease to the O-ring.

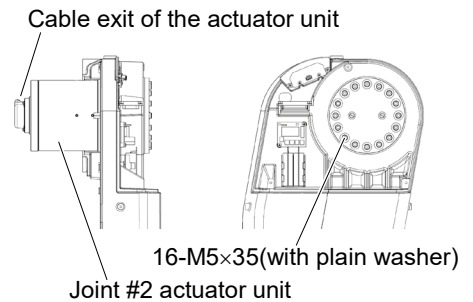
Grease: SK-1A




- (2) Install the Joint #2 actuator unit to the Arm #1.

Hexagon socket head cap bolts:
16-M5×35 (with plain washer)

Tightening torque: 10 ± 0.5 N·m



NOTE  Refer to the figure and install it so that the cable exit of the actuator unit will be the opposite side of the base.

Be sure to have at least 2 people to perform the operation since the parts being heavy.

Do not apply excessive shock to the parts.

Be sure to install the O-ring properly.

- (3) Install the robot arm and the cable unit.

For details, refer to the Removal steps (14) through (52) in *Maintenance 4.1 Cable Unit (N6-A1000*): Cable direction Standard (backward)*.

- (4) Install the following covers:

Arm #4 side cover (2 covers), Joint #4 inside cover, Joint #4 outside cover
Joint #4 side cover (2 covers), Arm #3 cover, Arm #3 inside cover
Arm #2 cover (2 covers), Joint #2 cover, Joint #2 outside cover

For details, refer to *Maintenance 3. Covers*.

- (5) Perform calibration.

For details, refer to *Maintenance 8. Calibration*.

5.2.2 Joint #2 (N6-A850**R)

Removal

- (1) Remove the covers.

Joint #2
Actuator Unit
N6-A850**R

Arm #4 side cover (2 covers), Joint #4 inside cover, Joint #4 outside cover
Joint #4 side cover (2 covers), Arm #3 cover, Arm 3 inside cover,
Arm #2 cover (2 covers), Joint #2 outside cover, Arm #1 inside cover


For details, refer to *Maintenance 3. Covers*.

- (2) Remove the cable unit from Joint #1 to Joint #2.

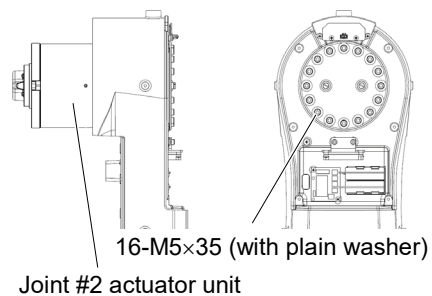
For details, refer to the Removal steps (3) through (6), (9) through (37), and (44) in *Maintenance 4.3 Cable Unit (N6-A850*R) : Cable direction Standard (backward)*.

- (3) Remove the Joint #2 actuator unit and the O-ring.

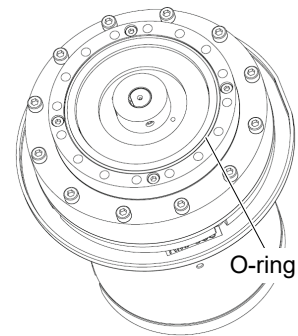
Hexagon socket head cap bolts:
16-M5×35 (with plain washer)

NOTE  Be sure to have at least 2 people to perform the operation since the parts being heavy.

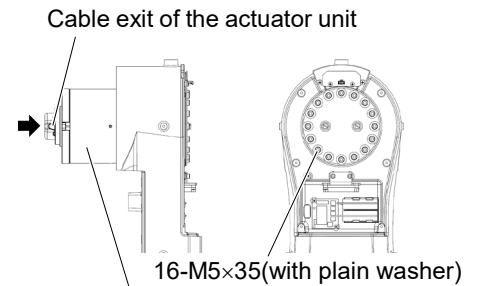
Do not apply excessive shock to the parts.




- Installation
 Joint #2
 Actuator Unit
 N6-A850**R
- (1) Install the attached O-ring on the Joint #2 actuator unit.
 Apply a thin coat of grease to the O-ring.
 Grease: SK-1A



- (2) Install the Joint #2 actuator unit to the Arm #1.
 Hexagon socket head cap bolts:
 16-M5×35 (with plain washer)
 Tightening torque: 10 ± 0.5 N·m




NOTE  Refer to the figure and install it so that the cable exit of the actuator unit will be the right side when viewed from the arrow.

Be sure to have at least 2 people to perform the operation since the parts being heavy.
 Do not apply excessive shock to the parts.
 Be sure to install the O-ring properly.

- (3) Install the robot arm and the cable unit.
 For details, refer to the Removal steps (17) through (55) in *Maintenance 4.3 Cable Unit (N6-A850*R): Cable direction Standard (backward)*.
- (4) Install the following covers:
 Arm #4 side cover (2 covers), Joint #4 inside cover, Joint #4 outside cover
 Joint #4 side cover (2 covers), Arm #3 cover, Arm #3 inside cover
 Arm #2 cover (2 covers), Joint #2 outside cover, Arm #1 inside cover
 For details, refer to *Maintenance 3. Covers*.
- (5) Perform calibration.
 For details, refer to *Maintenance 8. Calibration*.

5.3 Replacing the Joint #3 Actuator Unit

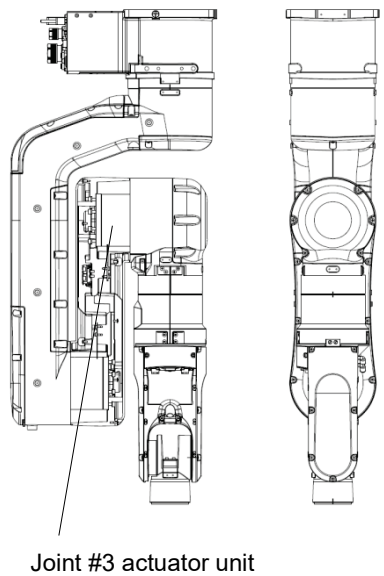
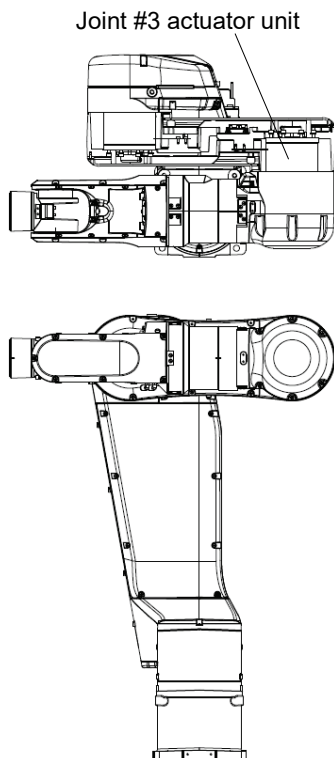
 CAUTION	<ul style="list-style-type: none"> ■ This procedure has possibility of hands and fingers being caught and/or damage or malfunction to the Manipulator. Be very careful when performing maintenance. ■ Handling heavy parts during maintenance operations. Be sure to have at least 2 people when operating heavy parts.
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	Name		Qty	Code, Note
Maintenance Parts	Joint #3 actuator unit		1	1749170
	Cable tie	AB200	-	1684328, 1 bag (100 ties: white)
Tools	Hexagonal wrench	width across flats: 2.5 mm	1	For M3 hexagon socket head cap bolts
		width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
		width across flats: 5 mm	1	For M6 hexagon socket head cap bolts
	Long nose pliers		1	For removing air tubes
	Nippers		1	For cutting a cable tie
	Cross-point screwdriver (#2)		1	For cross recessed head screws
	Torque wrench		1	For tightening torque control
	Cable tie gun		1	Refer: HellermannTyton MK8
Cable tie gun tester		1	Refer: HellermannTyton DGT500-MK8	

The brake is mounted on each joint to prevent the arm from lowering due to its own weight while the Controller power is OFF or the motor is OFF status. The brake does not work during replacement. Be careful when performing maintenance work.

N6-A1000**

N6-A850**R



5.3.1 Joint #3 (N6-A1000**)

Removal

Joint #3
Actuator Unit
N6-A1000**

- (1) Remove the covers.
 Arm #4 side cover (2 covers), Joint #4 inside cover, Joint #4 outside cover
 Joint #4 side cover (2 covers), Arm #3 cover, Arm #3 inside cover
 Arm #2 cover (2 covers)

For details, refer to *Maintenance 3. Covers*.

- (2) Remove the cable unit from Joint #1 to Joint #3.

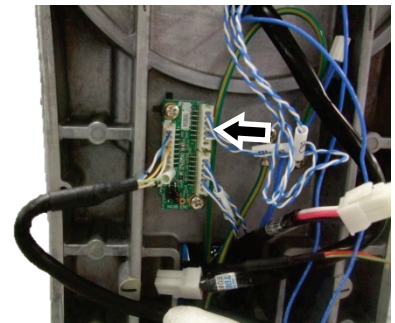
For details, refer to the Removal steps (2) through (5), (9) through (25), (27), (29), and (33) in *Maintenance 4.1 Cable Unit (N6-A1000*): Cable direction Standard (backward)*.

- (3) Disconnect the connector connected to the encoder board 2.

Connector:
EB0x_CN2 (Joint #3 side)



Be careful that the jumper pins on the board do not come off.



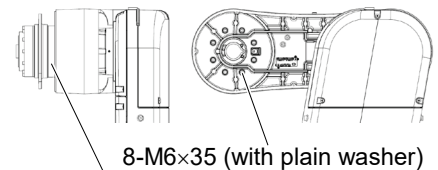
- (4) Remove the Joint #3 actuator unit and the O-ring.

Hexagon socket head cap bolts:
8-M6×35 (with plain washer)



Be sure to have at least 2 people to perform the operation since the parts being heavy.


When you remove it, be careful not to catch the cables on the Joint #3 actuator unit.

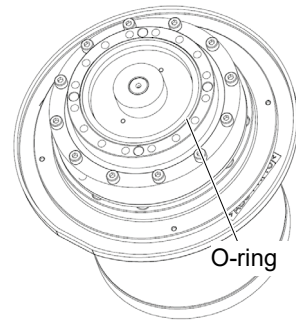


Joint #3 actuator unit

Installation
 Joint #3
 Actuator Unit
 N6-A1000**


- (1) Install the attached O-ring on the Joint #3 actuator unit.

NOTE
 Apply a thin coat of grease to the O-ring.
 Grease: SK-1A



- (2) Install the Joint #3 actuator unit to the Arm #2.

Hexagon socket head cap bolts:
 8-M6×35 (with plain washer)
 Tightening torque: $18 \pm 0.9 \text{ N}\cdot\text{m}$

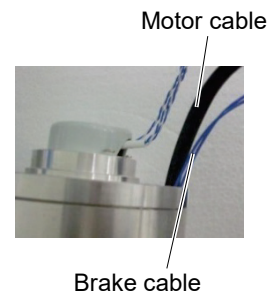
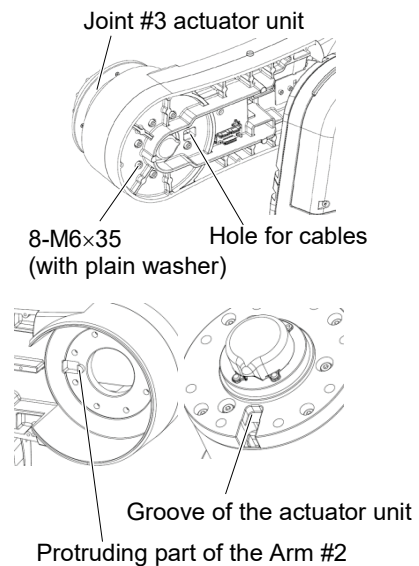
NOTE
 When installing it, make sure to align the protruding part on the Arm #2 and the groove on the Joint #3 actuator unit.

Pass the brake cable and the motor cable of the Joint #3 actuator unit through the hole of the Arm #2.

Be careful not to get the cables caught in the Arm and the actuator unit.

Be sure to have at least 2 people to perform the operation since the parts being heavy.

Do not apply excessive shock to the parts.




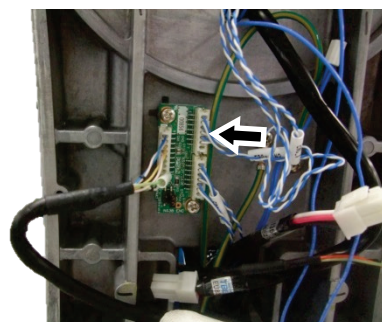
- (3) Install the robot arm and the cable unit.

For details, refer to the Removal steps (25), (26), (29) through (52) in *Maintenance 4.1 Cable Unit (N6-A1000*): Cable direction Standard (backward)*.

- (4) Connect the connector to the encoder board 2.

Connector:
 EB0x_CN2 (Joint #3 side)

NOTE
 Be careful that the jumper pins on the board do not come off.



- (5) Install the following covers:

Arm #4 side cover (2 covers), Joint #4 inside cover, Joint #4 outside cover
Joint #4 side covers (2 covers), Arm #3 cover, Arm #3 inside cover
Arm #2 cover (2 cover)

For details, refer to *Maintenance 3. Covers*.

- (6) Perform calibration.

For details, refer to *Maintenance 8. Calibration*.

5.3.2 Joint #3 (N6-A850**R)

Removal

- (1) Remove the covers.

Joint #3

Arm #4 side cover (2 covers), Joint #4 inside cover, Joint #4 outside cover

Actuator Unit

Joint #4 side cover (2 covers), Arm #3 cover, Arm #3 inside cover

N6-A850**R

Arm #2 cover (2 covers), Arm #1 inside cover

For details, refer to *Maintenance 3. Covers*.

- (2) Remove the cable unit from Joint #1 to Joint #3.

For details, refer to the Removal steps (3) through (6), (9) through (25), (27), (29), (33) in *Maintenance 4.3 Cable Unit (N6-A850*R): Cable direction Standard (backward)*.

- (3) Disconnect the connector connected to the encoder board 2.

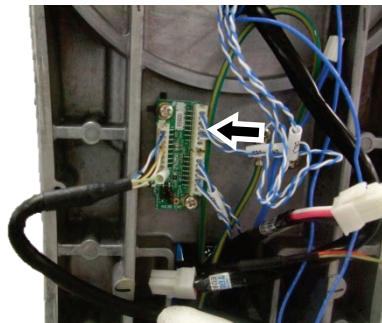
Connector:

EB0x_CN2 (Joint #3 side)

NOTE



Be careful that the jumper pins on the board do not come off.



- (4) Remove the Joint #3 actuator unit and the O-ring.

Hexagon socket head cap bolts:

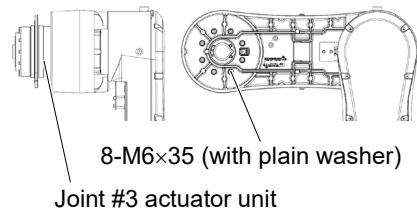
8-M6×35 (with plain washer)

NOTE




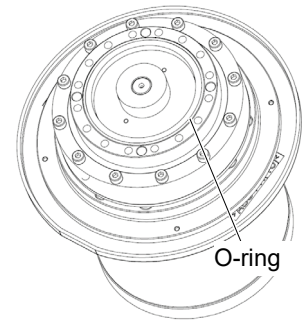
Be sure to have at least 2 people to perform the operation since the parts being heavy.

When you remove it, be careful not to catch the cables on the Joint #3 actuator unit.



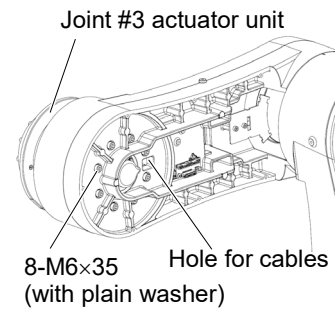
Joint #3 actuator unit


- Installation (1) Install the attached O-ring on the Joint #3 actuator unit.
- Joint #3 NOTE
Actuator Unit  Apply a thin coat of grease to the O-ring.
- N6-A850**R Grease: SK-1A



- (2) Install the Joint #3 actuator unit to the Arm #2.

Hexagon socket head cap bolts:
8-M6×35 (with plain washer)
Tightening torque: 18 ± 0.9 N·m



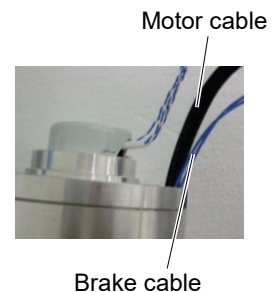
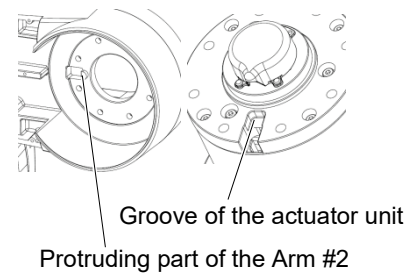
- NOTE  When installing it, make sure to align the protruding part on the Arm #2 and the groove on the Joint #3 actuator unit.

Pass the brake cable and the motor cable of the Joint #3 actuator unit through the hole of the Arm #2.

Be careful not to get the cables caught in the Arm and the actuator unit.

Be sure to have at least 2 people to perform the operation since the parts being heavy.

Do not apply excessive shock to the parts.




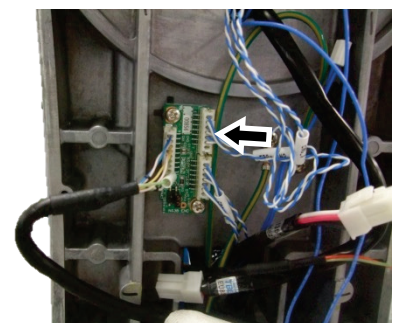
- (3) Install the robot arm and the cable unit.

For details, refer to the Removal steps (28), (29), (32) through (55) in *Maintenance 4.3 Cable Unit (N6-A850*R): Cable direction Standard (backward)*.

- (4) Connect the connector to the encoder board 2.

Connector:
EB0x_CN2 (Joint #3 side)

- NOTE  Be careful that the jumper pins on the board do not come off.



- (5) Install the following covers:


Arm #4 side cover (2 covers), Joint #4 inside cover, Joint #4 outside cover
Joint #4 side covers (2 covers), Arm #3 cover, Arm #3 inside cover
Arm #2 cover (2 cover), Arm #1 inside cover

For details, refer to *Maintenance 3. Covers*.

- (6) Perform calibration.

For details, refer to *Maintenance 8. Calibration*.

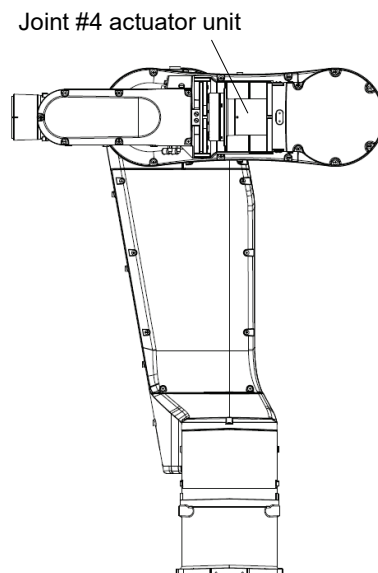
5.4 Replacing the Joint #4 Actuator Unit

 CAUTION	<ul style="list-style-type: none"> ■ This procedure has possibility of hands and fingers being caught and/or damage or malfunction to the Manipulator. Be very careful when performing maintenance.
	<ul style="list-style-type: none"> ■ Handling heavy parts during maintenance operations. Be sure to have at least 2 people when operating heavy parts.

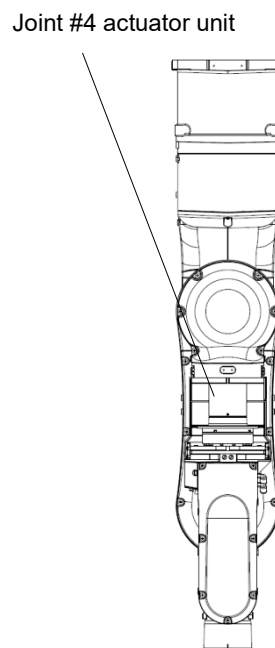
	Name		Qty	Code, Note
Maintenance Parts	Joint #4 actuator unit		1	1749171
	O-ring		1	1554675
	Cable tie	AB200	-	1684328, 1 bag (100 ties: white)
Tools	Hexagonal wrench	width across flats: 2.5 mm	1	For M3 hexagon socket head cap bolts
		width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
	Long nose pliers		1	For removing air tubes
	Nippers		1	For cutting a cable tie
	Cross-point screwdriver (#2)		1	For cross recessed head screws
	Torque wrench		1	For tightening torque control
	Cable tie gun		1	Refer: HellermannTyton MK8
	Cable tie gun tester		1	Refer: HellermannTyton DGT500-MK8

The brake is mounted on each joint to prevent the arm from lowering due to its own weight while the Controller power is OFF or the motor is OFF status. The brake does not work during replacement. Be careful when performing maintenance work.

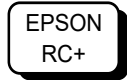
N6-A1000**



N6-A850**R



- Removal (1) Turn ON the Controller.
- Joint #4 (2) Release the brake on the Joint #3.
- Actuator Unit



Command
> Brake Off, 3

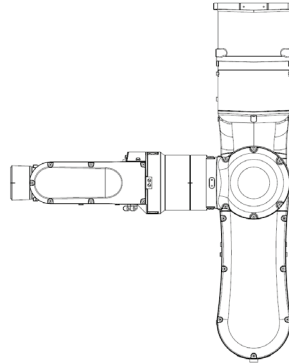
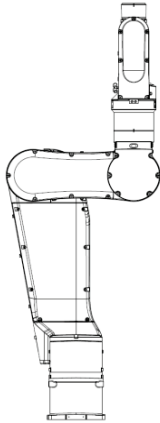
NOTE

When releasing the brake, be careful of the arm falling due to its own weight.

- (3) Move the angle of the Arm #3 about 90 degrees from the origin position.

N6-A1000**

N6-A850**R



- (4) Turn OFF the Controller.
- (5) Remove the covers.

Arm #4 side cover (2 covers), Joint #4 inside cover, Joint #4 outside cover
Joint 4 side cover (2 covers), Arm #3 cover

For details, refer to *Maintenance 3. Covers*.

- (6) Remove the cable unit from Joint #1 to Joint #4.

For more details, refer to the following sections:

N6-A1000**

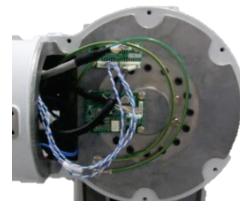
N6-A850**R

Removal steps (9) through (16), (18)
Maintenance
4.1 Cable Unit (N6-A1000*): Cable
direction Standard (backward).

Removal steps (9) through (16), (18)
Maintenance
4.3 Cable Unit (N6-A850*R): Cable
direction Standard (backward).


- (7) Disconnect the connectors.

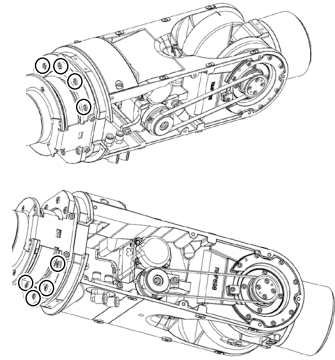
Connectors: PW4, BR4, EB0x_CN2




(8) Remove the Arm #4.

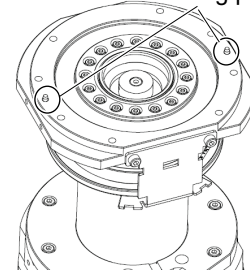
Hexagon socket head cap bolts:
8-M4×20 (with plain washer)

NOTE  Be sure to have at least 2 people to perform the operation since the parts being heavy.




NOTE  When removing it, make sure not to lose the two positioning pins.

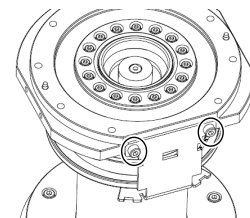
Positioning pins



(9) Remove the cable fixing plate.


Hexagon socket head cap bolts 2-M4×8

NOTE  Do not disconnect the cable from the plate.



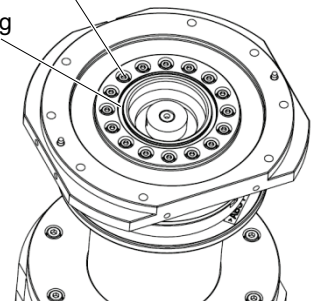
(10) Remove the Joint #4 flange.

Hexagon socket head cap bolts:
16-M3×20 (with plain washer)

NOTE  Remove the O-ring as well.


16-M3×20 (with plain washer)

O-ring



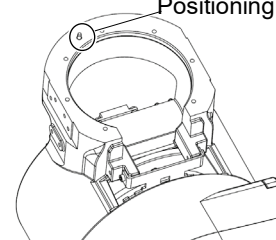
(11) Remove the Joint #4 actuator unit.

Hexagon socket head cap bolts:
7-M4×15 (with plain washer)

NOTE  When removing it, make sure not to lose the positioning pin.
Also, be careful not to catch the cables on the Joint #4 actuator unit.

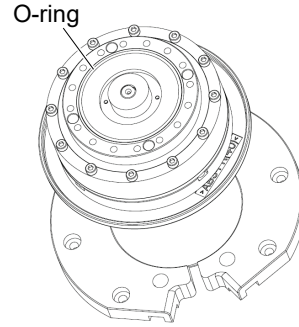
7-M4×15 (with plain washer)

Positioning pin



Installation

- (1) Install the attached O-ring to Joint #4 actuator unit.



Joint #4 Actuator Unit

NOTE Apply a thin coat of grease to the O-ring.
Grease: SK-1A

- (2) Confirm that the positioning pin is installed on the Arm #3. Install the Joint #4 actuator unit.

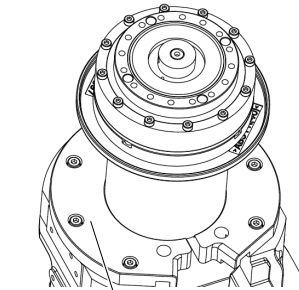
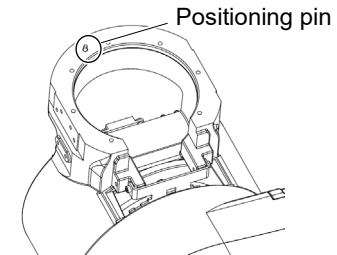
Hexagon socket head cap bolts:
7-M4×15 (with plain washer)

Tightening torque: 5.5 ± 0.25 N·m

NOTE When installing it, make sure to align the pin with the Joint #4 of the actuator unit.

Be careful not to get the cables caught in the actuator unit.

Pass the cables of the Joint #4 actuator unit to be out from the Arm #3 board side.



7-M4×15 (with plain washer)

- (3) Connect the connectors.

Connector: PW4, BR4, EB0x_CN2

- (4) Install the Joint #4 flange.

Hexagon socket head cap bolts:
16-M3×20 (with plain washer)

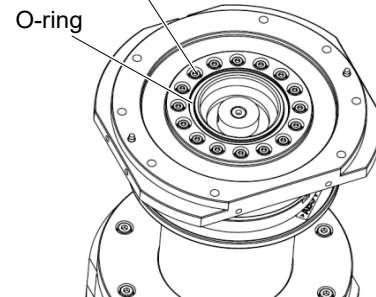
Tightening torque: 2.4 ± 0.1 N·m

NOTE Be sure to install the O-ring properly.

NOTE After installing the Joint #4 flange, install the O-ring on the Joint #4 flange.

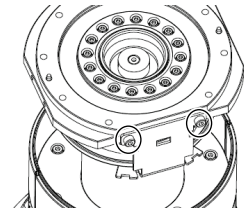
O-ring Inner diameter ø 47.5 mm
Wire diameter ø 2.0 mm

16-M3×20 (with plain washer)

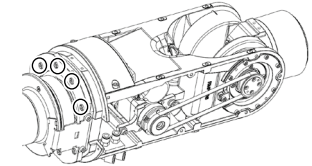


Apply a thin coat of grease to the O-ring.
Grease: SK-1A

- (5) Install the cable fixing plates.
Hexagon socket head cap bolts:
2-M4×8 (with plain washer)
Tightening torque: 4.0 ± 0.2 N·m



- (6) Install the Arm #4.
Hexagon socket head cap bolts:
8-M4×20 (with plain washer)
Tightening torque: 5.5 ± 0.25 N·m

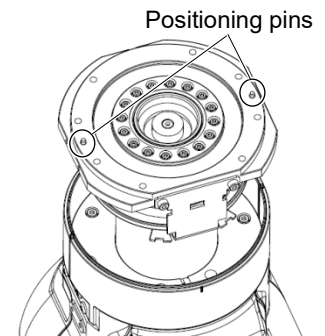
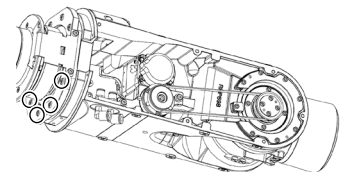


NOTE Be sure to have at least 2 people to perform the operation since the parts being heavy.

Confirm that the two pins are installed on the Joint #4 flange. Then install the Arm #4 to align the pins with the Joint #5 and #6 units.

Be sure to install the O-ring properly.

Be careful not to get the cables caught in the Arm.



- (7) Install the cable unit.

For more details, refer to the following sections:

N6-A1000**

Installation steps (40) through (42), (44) through (52)

Maintenance 4.1 Cable Unit (N6-A1000): Cable direction Standard (backward).*

N6-A850**R

Installation steps (43) through (45), (47) through (55)

*Maintenance 4.1 Cable Unit (N6-A850*R): Cable direction Standard (backward).*

- (8) Install the following covers:


Arm #4 side cover (2 covers), Joint #4 inside cover, Joint 4 outside cover
Joint #4 side cover (2 covers), Arm #3 cover

For details, refer to *Maintenance 3. Covers*.

- (9) Perform calibration.

For details, refer to *Maintenance 8. Calibration*.

5.5 Joint #5



CAUTION

■ This procedure has possibility of hands and fingers being caught and/or damage or malfunction to the Manipulator. Be very careful when performing maintenance.

NOTE
 The Joint #5 is not equipped with an actuator unit. Replace the following parts for each Motor unit, timing belt, electromagnetic brake

5.5.1 Replacing the Joint #5 Motor Unit

	Name	Qty	Code, Note	
Maintenance Parts	Joint #5 motor unit *	1	1749172	
	Belt tensile jig **	1	1749184	
	Cable tie AB200	-	1684328 1 bag (100 ties: white)	
Tools	Hexagonal wrench	width across flats: 2 mm	1	For M4 hexagon socket set screw
		width across flats: 2.5 mm	1	For M3 hexagon socket head cap bolts
		width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
	Cross-point screwdriver (#2)		1	For cross recessed head screws
	Torque wrench		1	For tightening torque control
	Feeler gauge (0.5 mm)		2	For positioning of drive boss
	Belt tension meter		1	Refer: Unitta U-505

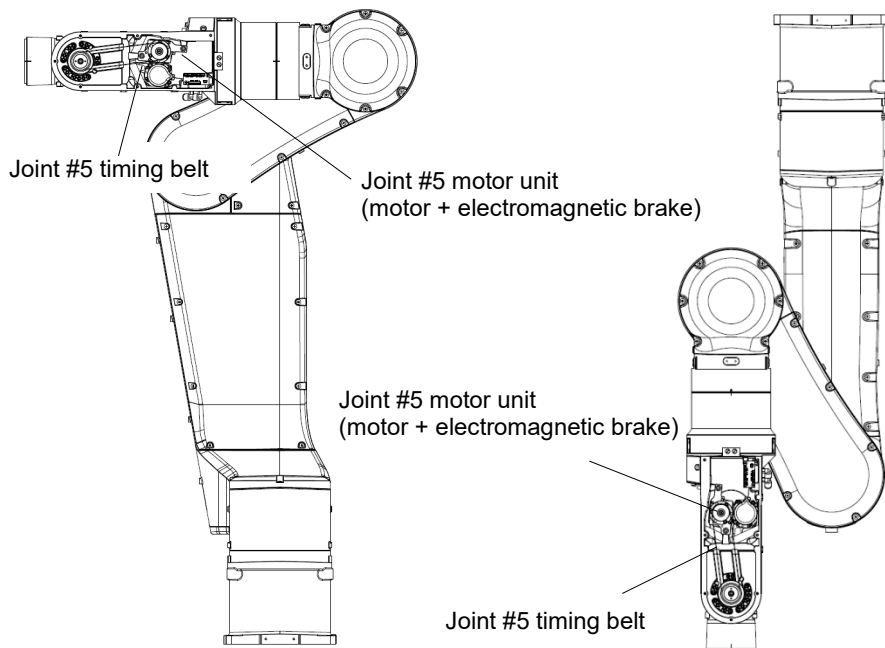
* Joint #5 motor unit (1749172) is a dedicated motor unit. Do not use it for the Joint #6 motor unit.

** The belt tensile jig is an assembly jig. Use this jig when adjusting belt tension.

The brake is mounted on each joint to prevent the arm from lowering due to its own weight while the Controller power is OFF or the motor is OFF status. The brake does not work during replacement. Be careful when performing maintenance work.

N6-A1000**

N6-A850**R



Removal

(1) Turn ON the Controller.

Joint #5

(2) Release the brake on the Joint #2 and Joint #3.

Motor Unit



Command

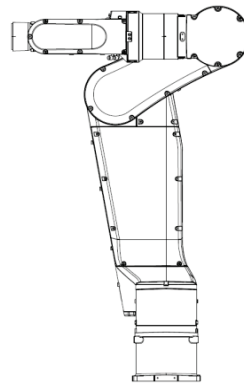
> brake off, 2
> brake off, 3

NOTE

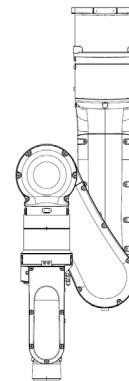
When releasing the brake, be careful of the arm falling due to its own weight.

(3) Move the angles of the Arm #2 and the Arm #3 about 30 degrees from the origin positions.

N6-A1000**



N6-A850**R



(4) Turn OFF the Controller.

(5) Remove the Arm #4 side cover (2 covers).

For details, refer to *Maintenance 3. Covers*.

(6) Cut off the cable tie of the cables.

NOTE

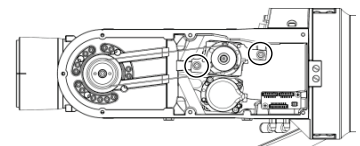
Be careful not to cut the cables.

(7) Disconnect the connectors.

Connectors: PW5, BR5, EB0x_CN2 (Joint #5 motor side)

(8) Remove the bolts fixing the Arm #4 and the Joint #5 motor unit. Then, remove the timing belts on the Joint #5 motor unit and the Joint #5.

Hexagon socket head cap bolts 2-M4×15
(with plain washer for slotted hole
thickness: 1.5mm)

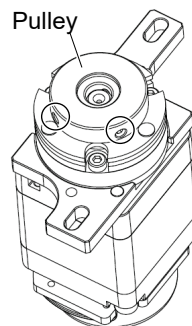



NOTE

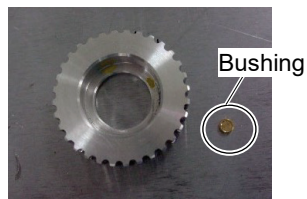
If heavy part such as end effector is installed on the end of the Manipulator, the Arm #5 will move. Be very careful.

(9) Remove the Joint #5 motor pulley.

Hexagon socket set screws:
2-M4×4 (brass bushing × 1)

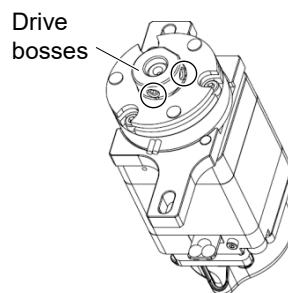


NOTE  One of the screws fixing the pulley contains the brass bushing. Be careful not to lose it.



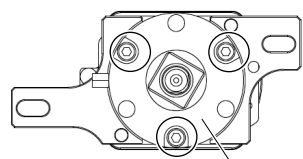
(10) Remove the drive bosses from the motor shaft of the Joint #5 motor unit.

Hexagon socket set screws: 2-M4×4



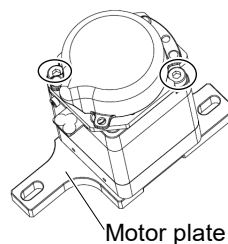
(11) Remove the Joint #5 electromagnetic brake.

Hexagon socket head cap bolts: 3-M3×13



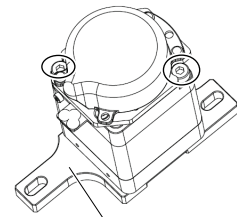
(12) Remove the motor plate from the Joint #5 motor.

Hexagon socket head cap bolts: 2-M4×55



Installation (1) Install the motor plate on the Joint #5 motor.

Joint #5 Hexagon socket head cap bolts: 2-M4×55
 Motor Unit Tightening torque: 4.0 ± 0.2 N·m

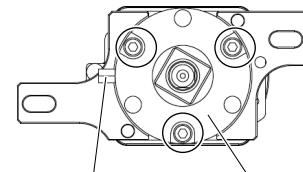


Motor plate

NOTE Be careful of the installation direction of the motor plate. Refer to the figure and install it in the proper position.

(2) Install the Joint #5 electromagnetic brake on the Joint #5 motor unit. Install the spacer between the hexagon socket head cap bolts and the Joint #5 electromagnetic brake.

Hexagon socket head cap bolts: 3-M3×13
 Tightening torque: 2.0 ± 0.1 N·m



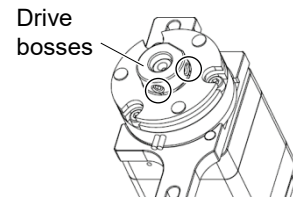
Electromagnetic brake

Cables of Electromagnetic brake

NOTE Direction to exit the cables of the electromagnetic brake is set. Install the electromagnetic brake so that the cables of the electromagnetic brake are positioned in the same direction as the motor cables.

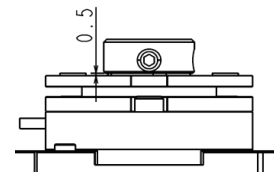
(3) Install the drive bosses on the motor shaft on the Joint #5 motor.

Hexagon socket set screws: 2-M4×4
 Tightening torque: 2.4 ± 0.1 N·m



Drive bosses

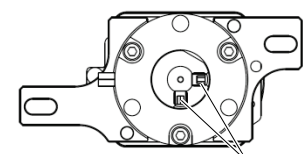
NOTE When fixing the drive bosses, make sure that the clearance between the drive bosses and the brake will be 0.5mm. Use a feeler gauge (0.5 mm) of the drive boss to make clearance (0.5 mm).



Cutout Place in 90 degrees



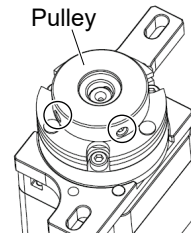
NOTE Fix the set screws to be aligned with the D-cut surface on the motor shaft. If the screw positions are not correct, the side of part will get damage and you cannot pull out the part.



Hexagon socket set screws

- (4) Install the pulley on the drive boss.

Hexagon socket set screws:
 2-M4×4 (brass bushing × 1)
 Tightening torque: 2.4 ± 0.1 N·m



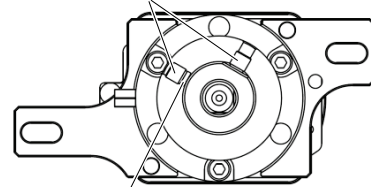
NOTE



Push the pulley to the drive boss and fix it.

Fix the set screw to align with the D-cut surface. Fix the other one after installing the bushing. If the screw positions are not correct or you forget to install the bushing, the side of part will get damage and you cannot pull out the part.

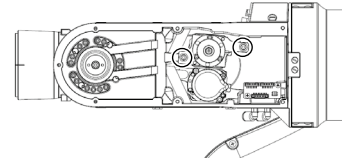
Hexagon socket set screws



Bushing

- (5) Install the Joint #5 motor unit on the Arm #4.

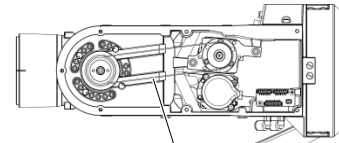
Hexagon socket head cap bolts: 2-M4×15
 (with plain washer for slotted hole
 thickness: 1.5mm)



Do not tighten the screws completely. Loosen them so that the motor unit will not fall.

- (6) Install the timing belt and temporarily fix the Joint #5 motor unit.

Hexagon socket head cap bolts: 2-M4×15
 (with plain washer for slotted hole
 thickness: 1.5mm)



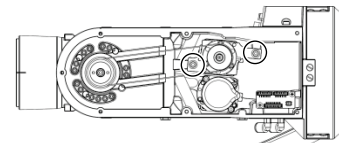
Timing belt

NOTE



When temporary fixing the Joint #5 motor unit, make sure that the motor unit can be moved by hand and does not tilt when being pulled. If the unit is fixed too loose or too tight, the belt will not have proper tension.

- (7) Apply the proper tension to the Joint #5 timing belt and fix the Joint #5 motor unit.



Tension of Joint #5 timing belt: 23 ± 5 N
 Belt tension meter setting value
 Weight: 2.5g/mm Width×m Span, Width:6 mm, Span:142 mm

Hexagon socket head cap bolts:
 2-M4×15 (with plain washer for slotted hole thickness: 1.5mm)
 Tightening torque: 4.0 ± 0.2 N·m

NOTE

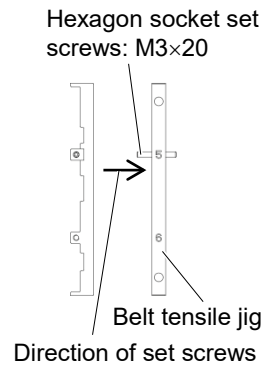


Regarding belt tension:

- Jumping (position gap) may occur if the value is below the lower limit.
- Vibration (abnormal noise) or reduction of life of the parts may occur if the value exceeds the upper limit.

When using belt tensile jig (maintenance part):

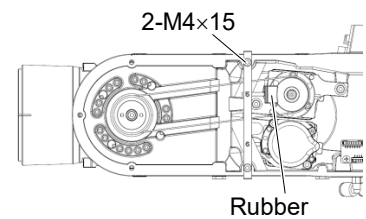
1. Install the hexagon socket set screws (M3×20) to the holes on inscribed side of “5” on the belt tensile jig.
2. Fix the belt tensile jig on the Arm #4 with the hexagon socket head cap bolts (2-M4×15).
3. Push the rubber to the pulley. Push the rubber with the hexagon socket set screws (M3×20) to apply tension.



NOTE



Be careful not to push the set screws forcibly.



- (8) Connect the connectors.

Connector: PW5, BR5, EB0x_CN2 (Joint #5 motor side)

- (9) Bundle the cables with the cable tie to prevent the cables from interfering with the pulley or belt.

- (10) Install the Arm #4 side cover (2 covers).

For details, refer to *Maintenance 3. Covers*.

- (11) Perform calibration.

For details, refer to *Maintenance 8. Calibration*.

5.5.2 Replacing the Joint #5 Timing Belt

	Name	Qty	Code, Note
Maintenance Parts	Timing belt	1	1739205 (Common to Joint #5 and #6)
	Belt tensile jig*	1	1749184
Tools	Hexagonal wrench width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
	Cross-point screwdriver (#2)	1	For cross recessed head screws
	Torque wrench	1	For tightening torque control
	Belt tension meter	1	Refer: Unitta U-505


* The belt tensile jig is an assembly jig. Use this jig when adjusting belt tension.

The brake is mounted on each joint to prevent the arm from lowering due to its own weight while the Controller power is OFF or the motor is OFF status. The brake does not work during replacement. Be careful when performing maintenance work.

Removal (1) Turn ON the Controller.

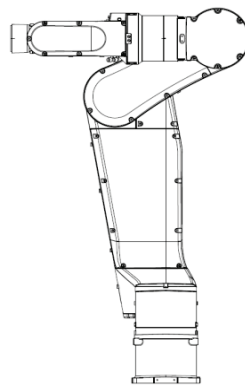
Joint #5 timing belt: (2) Release the brake on the Joint #2 and Joint #3.

EPSON RC+	Command
	> brake off, 2
	> brake off, 3

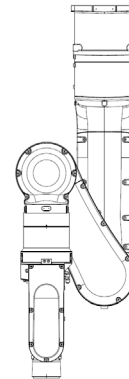
NOTE  When releasing the brake, be careful of the arm falling due to its own weight.

(3) Move the angles of the Arm #2 and the Arm #3 about 30 degrees from the origin positions.

N6-A1000**

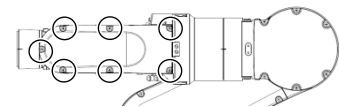


N6-A850**R



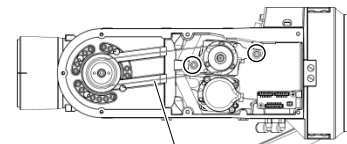
(4) Turn OFF the Controller.
 (5) Remove the Arm #4 side cover.

Cross recessed binding head machine screw:
 7-M4×8




(6) Loosen the screws fixing the Arm #4 and the Joint #5 motor unit. Then, remove the timing belt of the Joint #5.

Hexagon socket head cap bolts: 2-M4×15
 (with plain washer for slotted hole
 thickness: 1.5mm)



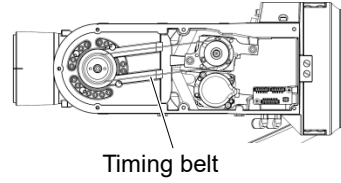
Timing belt


NOTE  If a heavy part such as end effector is installed on the end of the Manipulator, the Arm #5 will move. Be very careful.

Installation
Joint #5
timing belt:

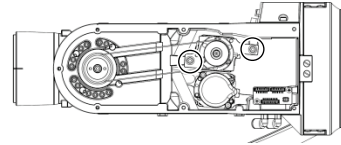
- (1) Install the timing belt and temporarily fix the Joint #5 motor unit.

Hexagon socket head cap bolts: 2-M4×15
(with plain washer for slotted hole thickness: 1.5mm)




NOTE  When temporary fixing the Joint #5 motor unit, make sure that the motor unit can be moved by hand and does not tilt when being pulled. If the unit is fixed too loose or too tight, the belt will not have proper tension.

- (2) Apply the proper tension to the Joint #5 timing belt and fix the Joint #5 motor unit.



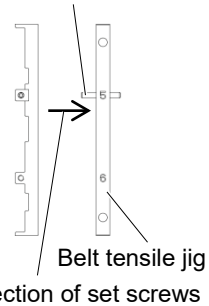
Tension of Joint #5 timing belt: 23 ± 5 N
Belt tension meter setting value
Weight: 2.5g/mm Width×m Span, Width:6 mm, Span:142 mm
Hexagon socket head cap bolts:
2-M4×15 (with plain washer for slotted hole thickness: 1.5mm)
Tightening torque: 4.0 ± 0.2 N·m


NOTE  Regarding belt tension:
- Jumping (position gap) may occur if the value is below the lower limit.
- Vibration (abnormal noise) or reduction of life of the parts may occur if the value exceeds the upper limit.

When using belt tensile jig (maintenance part):

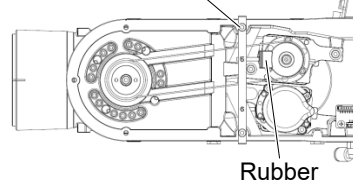
1. Install the hexagon socket set screws (M3×20) to the holes on inscribed side of “5” on the belt tensile jig.
2. Fix the belt tensile jig on the Arm #4 with the hexagon socket head cap bolts (2-M4×15).
3. Push the rubber to the pulley. Push the rubber with the hexagon socket set screws (M3×20) to apply tension.

Hexagon socket set screws: M3×20



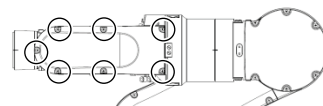
NOTE  Be careful not to push the set screws forcibly.


2-M4×15



- (3) Install the Arm #4 side cover.

Cross recessed binding head machine screw:
7-M4×8



NOTE  Tightening torque: 0.45 ± 0.05 N·m
Be careful not to catch the cables. The cables will be disconnected.

- (4) Perform calibration for the Joint #5.

For details, refer to *Maintenance 8. Calibration*.

5.5.3 Replacing the Joint #5 Electromagnetic Brake

	Name		Qty	Code, Note
Maintenance Parts	Electromagnetic Brake		1	1670649 (Common to Joint #5 and #6)
	Belt tensile jig*		1	1749184
	Cable tie	AB200	-	1684328 1 bag (100 ties: white)
Tools	Hexagonal wrench	width across flats: 2 mm	1	For M4 hexagon socket set screw
		width across flats: 2.5 mm	1	For M3 hexagon socket head cap bolts
		width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
	Cross-point screwdriver (#2)		1	For cross recessed head screws
	Torque wrench		1	For tightening torque control
	Feeler gauge (0.5 mm)		2	For positioning of drive boss
	Belt tension meter		1	Refer: Unitta U-505

* The belt tensile jig is an assembly jig. Use this jig when adjusting belt tension.

The brake is mounted on each joint to prevent the arm from lowering due to its own weight while the Controller power is OFF or the motor is OFF status. The brake does not work during replacement. Be careful when performing maintenance work.


Removal (1) Remove the Joint #5 electromagnetic brake.


For details, refer to Removal steps (1) through (10) in *Maintenance 5.5.1 Replacing the Joint #5 Motor Unit*.

Installation (1) Install the Joint #5 electromagnetic brake.

For details, refer to Installation steps (2) through (10) in *Maintenance 5.5.1 Replacing the Joint #5 Motor Unit*.

5.6 Joint #6

 CAUTION	<ul style="list-style-type: none"> ■ This procedure has possibility of hands and fingers being caught and/or damage or malfunction to the Manipulator. Be very careful when performing maintenance.
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NOTE
 The Joint #6 is not equipped with an actuator unit. Replace the following parts for each Motor unit, timing belt, electromagnetic brake

5.6.1 Replacing the Joint #6 Motor Unit

	Name	Qty	Code, Note	
Maintenance Parts	Joint #6 motor unit *	1	1749173	
	Belt tensile jig **	1	1749184	
	Cable tie AB200	-	1684328 1 bag (100 ties: white)	
Tools	Hexagonal wrench	width across flats: 2 mm	1	For M4 hexagon socket set screw
		width across flats: 2.5 mm	1	For M3 hexagon socket head cap bolts
		width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
	Cross-point screwdriver (#2)		1	For cross recessed head screws
	Torque wrench		1	For tightening torque control
	Feeler gauge (0.5 mm)		2	For positioning of drive boss
	Belt tension meter		1	Refer: Unitta U-505

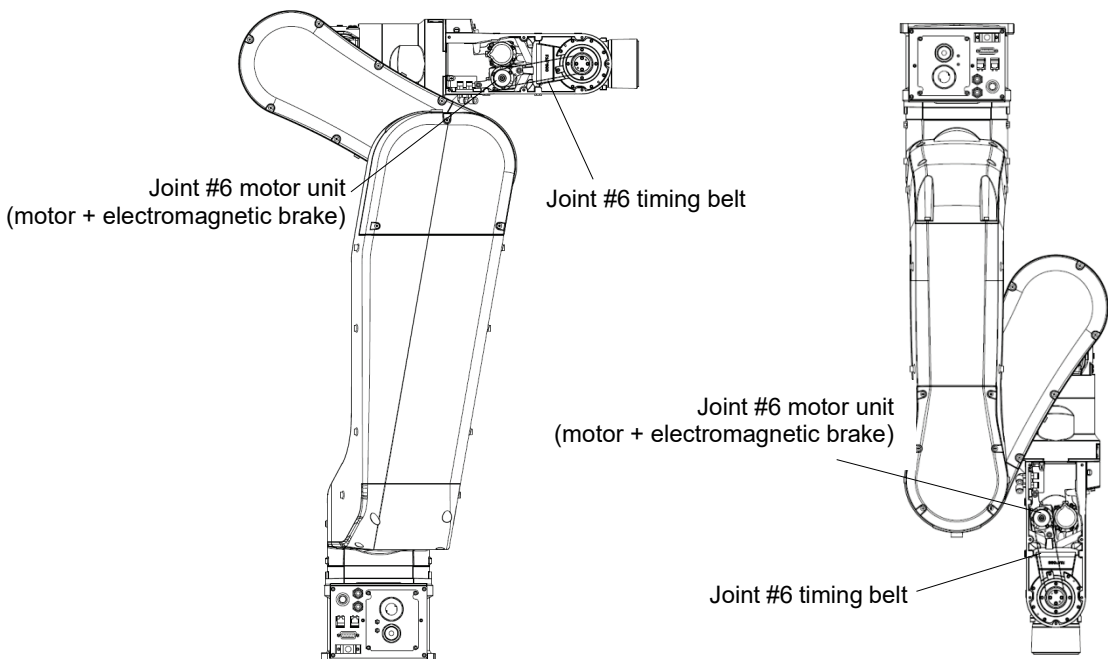
* Joint #6 motor unit (1749173) is a dedicated motor unit. Do not use it for the Joint #5 motor unit.

** The belt tensile jig is an assembly jig. Use this jig when adjusting belt tension.

The brake is mounted on each joint to prevent the arm from lowering due to its own weight while the Controller power is OFF or the motor is OFF status. The brake does not work during replacement. Be careful when performing maintenance work.

N6-A1000**

N6-A850**R



- Removal (1) Turn ON the Controller.
- Joint #6 (2) Release the brake on the Joint #2 and Joint #3.
- Motor Unit



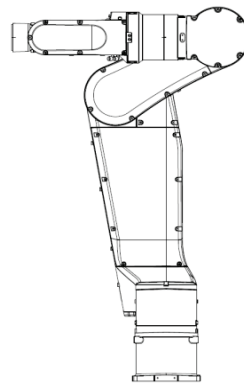
Command
 > brake off, 2
 > brake off, 3



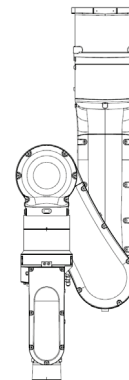
NOTE When releasing the brake, be careful of the arm falling due to its own weight.

- (3) Move the angles of the Arm #2 and the Arm #3 about 30 degrees from the origin positions.

N6-A1000**



N6-A850**R



- (4) Turn OFF the Controller.
- (5) Remove the Arm #4 side cover (2 covers).
 For details, refer to *Maintenance 3. Covers*.
- (6) Cut off the cable tie of the cables.

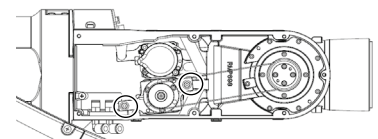


NOTE Be careful not to cut the cables.

- (7) Disconnect the connectors.

Connectors: PW6, BR6, EB0x_CN2 (Joint #6 motor side)

- (8) Remove the bolts fixing the Arm #4 and the Joint #6 motor unit. Then, remove the timing belt of the Joint #6 motor unit and the Joint #6.



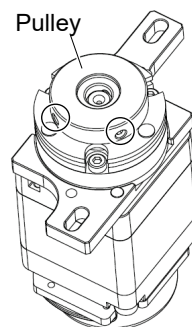
Hexagon socket head cap bolts: 2-M4×15
 (with plain washer for slotted hole
 thickness: 1.5mm)



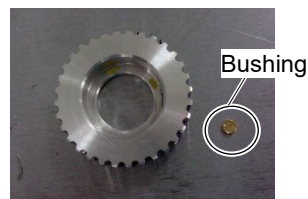
NOTE If a heavy part such as end effector is installed on the end of the Manipulator, the Arm #6 flange will move. Be very careful.

(9) Remove the Joint #6 motor pulley.

Hexagon socket set screws:
2-M4×4 (brass bushing × 1)

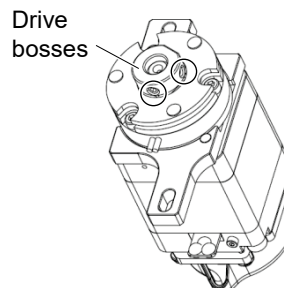


NOTE One of the screws fixing the pulley contains the brass bushing. Be careful not to lose it.



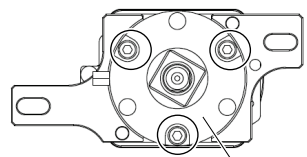
(10) Remove the drive bosses from the motor shaft on the Joint #6 motor unit.

Hexagon socket set screws: 2-M4×4



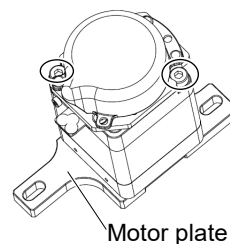
(11) Remove the Joint #6 electromagnetic brake.

Hexagon socket head cap bolts: 3-M3×13



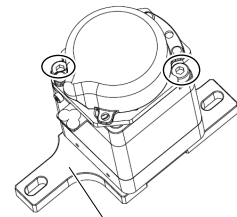
(12) Remove the motor plate from the Joint #6 motor.

Hexagon socket head cap bolts: 2-M4×55



Installation (1) Install the motor plate on the Joint #6 motor.

Joint #6 Hexagon socket head cap bolts: 2-M4×55
 Motor Unit Tightening torque: 4.0 ± 0.2 N·m

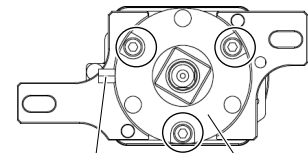


Motor plate

NOTE Be careful of the installation direction of the motor plate. Refer to the figure and install it in the proper position.

(2) Install the Joint #6 electromagnetic brake on the Joint #6 motor unit. Install the spacer between the hexagon socket head cap bolts and the Joint #6 electromagnetic brake.

Hexagon socket head cap bolts: 3-M313
 Tightening torque: 2.0 ± 0.1 N·m



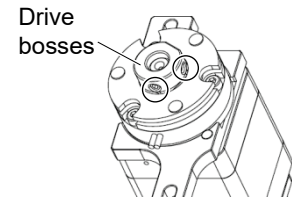
Electromagnetic brake

Wiring of Electromagnetic brake

NOTE Direction to exit the cables of the electromagnetic brake is set. Install the electromagnetic brake so that the cables of the electromagnetic brake are positioned in the same direction as the motor cables.

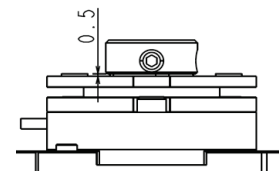
(3) Install the drive bosses on the motor shaft of the Joint #6 motor.

Hexagon socket set screws: 2-M4×4
 Tightening torque: 2.0 ± 0.1 N·m



Drive bosses

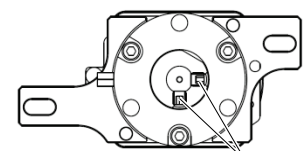
When fixing the drive bosses, make sure that the clearance between the drive bosses and the brake will be 0.5mm.
 Use a feeler gauge (0.5 mm) of the drive boss to make clearance (0.5 mm).



Cutout Place in 90 degrees



NOTE Fix the set screws to be aligned with the D-cut surface on the motor shaft. If the screw positions are not correct, the side of part will get damage and you cannot pull out the part.



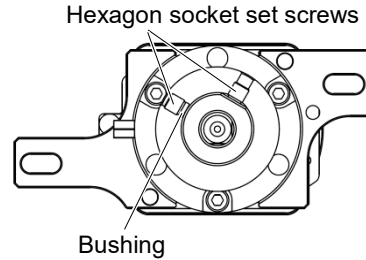
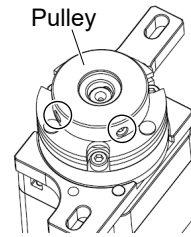
Hexagon socket set screws

- (4) Install the Joint #6 motor pulley on the drive boss.

Hexagon socket set screws:
 2-M4×4 (brass bushing × 1)
 Tightening torque: $2.0 \pm 0.1 \text{ N}\cdot\text{m}$



Push the pulley to the drive boss and fix it.
 Fix the set screw to align with the D-cut surface.
 Fix the other one after installing the bushing.
 If the screw positions are not correct or you forget to install the bushing, the side of part will get damage and you cannot pull out the part.



- (5) Install the Joint #6 motor unit on the Arm #4.

Hexagon socket head cap bolts: 2-M4×15
 (with plain washer for slotted hole
 thickness: 1.5mm)

Do not tighten the screws completely. Loosen them so that the motor unit will not fall.

- (6) Install the timing belt and temporarily fix the Joint #6 motor unit.

Hexagon socket head cap bolts: 2-M4×15
 (with plain washer for slotted hole
 thickness: 1.5mm)



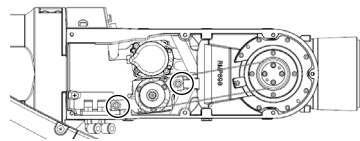
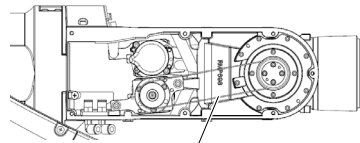
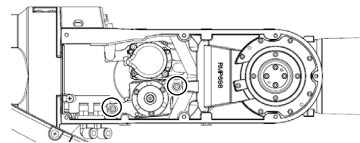
When temporary fixing the Joint #6 motor unit, make sure that the motor unit can be moved by hand and does not tilt when being pulled. If the unit is fixed too loose or too tight, the belt will not have proper tension.

- (7) Apply the proper tension to the Joint #6 timing belt and fix the Joint #6 motor unit.

Tension of Joint #6 timing belt: $23 \pm 5 \text{ N}$
 Belt tension meter setting value
 Weight: 2.5g/mm Width×m Span, Width:6 mm, Span:142 mm
 Hexagon socket head cap bolts:
 2-M4×15 (with plain washer for slotted hole thickness: 1.5mm)
 Tightening torque: $4.0 \pm 0.2 \text{ N}\cdot\text{m}$

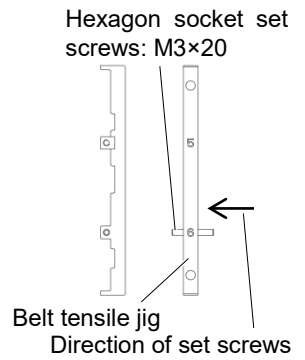


Regarding belt tension:
 - Jumping (position gap) may occur if the value is below the lower limit.
 - Vibration (abnormal noise) or reduction of life of the parts may occur if the value exceeds the upper limit.

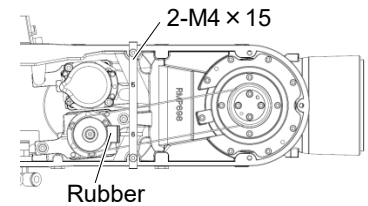


When using belt tensile jig (maintenance part):

1. Install the hexagon socket set screws (M3×20) to the holes on inscribed side of “6” on the belt tensile jig.
2. Fix the belt tensile jig on the Arm #4 with the hexagon socket head cap bolts (2-M4×15).
3. Push the rubber to the pulley. Push the rubber with the hexagon socket set screws (M3×20) to apply tension.



Be careful not to push the set screws forcibly.



- (8) Connect the connectors.

Connector: PW6, BR6, EB0x_CN2 (Joint #6 motor side)

- (9) Bundle the cables with the cable tie to prevent the cables from interfering with the pulley or belt.

- (10) Install the Arm #4 side cover (2 covers).

For details, refer to *Maintenance 3. Covers*.

- (11) Perform calibration.

For details, refer to *Maintenance 8. Calibration*.

5.6.2 Replacing the Joint #6 Timing Belt

	Name	Qty	Code, Note
Maintenance Parts	Timing belt	1	1739205 (Common to Joint #5 and #6)
	Belt tensile jig*	1	1749184
Tools	Hexagonal wrench width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
	Cross-point screwdriver (#2)	1	For cross recessed head screws
	Torque wrench	1	For tightening torque control
	Belt tension meter	1	Refer: Unitta U-505

* The belt tensile jig is an assembly jig. Use this jig when adjusting belt tension.

The brake is mounted on each joint to prevent the arm from lowering due to its own weight while the Controller power is OFF or the motor is OFF status. The brake does not work during replacement. Be careful when performing maintenance work.

Removal

- (1) Turn ON the Controller.

Joint #6
timing belt

- (2) Release the brake on the Joint #2 and Joint #3.

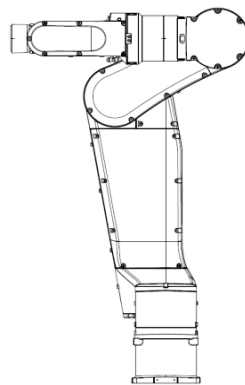
EPSON RC+	Command
	> brake off, 2
	> brake off, 3

NOTE

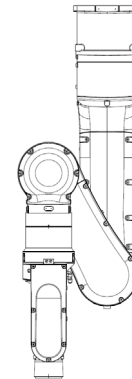
When releasing the brake, be careful of the arm falling due to its own weight.

- (3) Move the angles of the Arm #2 and the Arm #3 about 30 degrees from the origin positions.

N6-A1000**

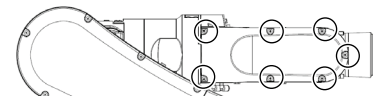


N6-A850**R



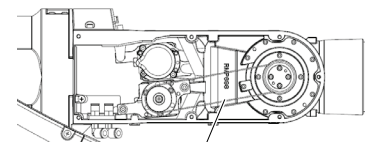
- (4) Turn OFF the Controller.
- (5) Remove the Arm #4 side cover.

Cross recessed binding head machine screws:
7-M4×8



- (6) Loosen the screws fixing the Arm #4 and the Joint #6 motor unit. Then, remove the timing belt of the Joint #6.

Hexagon socket head cap bolts: 2-M4×15
(with plain washer for slotted hole
thickness: 1.5mm)



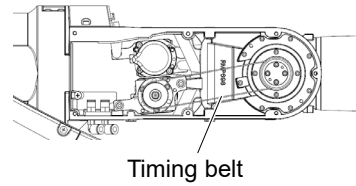
Timing belt


NOTE

If a heavy part such as end effector is installed on the end of the Manipulator, the Arm #6 flange will move. Be very careful.

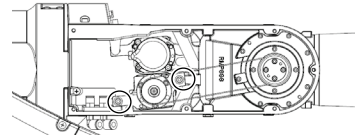
Installation
 Joint #6 timing belt:

- (1) Install the timing belt and temporarily fix the Joint #6 motor unit.
 Hexagon socket head cap bolts: 2-M4×15
 (with plain washer for slotted hole thickness: 1.5mm)




NOTE  When temporary fixing the Joint #6 motor unit, make sure that the motor unit can be moved by hand and does not tilt when being pulled. If the unit is fixed too loose or too tight, the belt will not have proper tension.

- (2) Apply the proper tension to the Joint #6 timing belt and fix the Joint #6 motor unit.

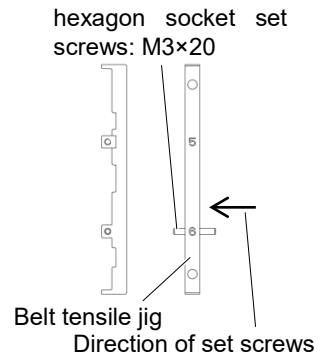



Tension of Joint #6 timing belt: 23 ± 5 N
 Belt tension meter setting value
 Weight: 2.5g/mm Width×m Span, Width:6 mm, Span:142 mm
 Hexagon socket head cap bolts:
 2-M4×15 (with plain washer for slotted hole thickness: 1.5mm)
 Tightening torque: 4.0 ± 0.2 N·m

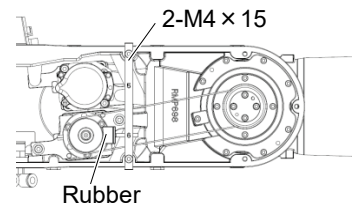
NOTE  Regarding belt tension:
 - Jumping (position gap) may occur if the value is below the lower limit.
 - Vibration (abnormal noise) or reduction of life of the parts may occur if the value exceeds the upper limit.

When using belt tensile jig (maintenance part):

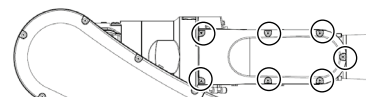
1. Install the hexagon socket set screws (M3×20) to the holes on inscribed side of “6” on the belt tensile jig.
2. Fix the belt tensile jig on the Arm #4 with the hexagon socket head cap bolts (2-M4×15).
3. Push the rubber to the pulley. Push the rubber with the hexagon socket set screws (M3×20) to apply tension.




NOTE  Be careful not to push the set screws forcibly.



- (3) Install the Arm #4 side cover.
 Cross recessed binding head machine screws:
 7-M4×8
 Tightening torque: 0.45 ± 0.05 N·m



NOTE  Be careful not to get the cables caught in the cover. The cables will be disconnected.

- (4) Perform calibration for the Joint #6.

For details, refer to *Maintenance 8. Calibration*.

5.6.3 Replacing the Joint #6 Electromagnetic Brake

	Name		Qty	Code, Note
Maintenance Parts	Electromagnetic Brake		1	1670649 (Common to Joint #5 and #6)
	Belt tensile jig*		1	1749184
	Cable tie	AB200	-	1684328 1 bag (100 ties: white)
Tools	Hexagonal wrench	width across flats: 2 mm	1	For M4 hexagon socket set screw
		width across flats: 2.5 mm	1	For M3 hexagon socket head cap bolts
		width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
	Cross-point screwdriver (#2)		1	For cross recessed head screws
	Torque wrench		1	For tightening torque control
	Feeler gauge (0.5 mm)		2	For positioning of drive boss
	Belt tension meter		1	Refer: Unitta U-505

* The belt tensile jig is an assembly jig. Use this jig when adjusting belt tension.

The brake is mounted on each joint to prevent the arm from lowering due to its own weight while the Controller power is OFF or the motor is OFF status. The brake does not work during replacement. Be careful when performing maintenance work.


Removal (1) Remove the Joint #6 electromagnetic brake.

For details, refer to Removal steps (1) through (10) in *Maintenance 5.6.1 Replacing the Joint #6 Motor Unit*

Installation (1) Install the Joint #6 electromagnetic brake.

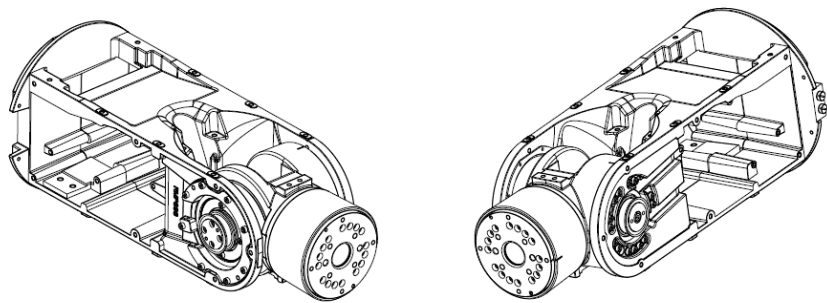
For details, refer to Installation steps (2) through (10) in *Maintenance 5.6.1 Replacing the Joint #6 Motor Unit*

5.7 Joint #5 and #6 Units

 CAUTION	■ This procedure has possibility of hands and fingers being caught and/or damage or malfunction to the Manipulator. Be very careful when performing maintenance.
--	--

	Name		Qty	Code, Note
Maintenance Parts	Joint #5 and #6 unit		1	1749174
	O-ring		1	1554675
	Cable tie	AB200	-	1684328, 1 bag (100 ties: white)
Tools	Hexagonal wrench	width across flats: 3 mm	1	For M4 hexagon socket head cap bolts
	Long nose pliers		1	For removing air tubes
	Nippers		1	For cutting a cable tie
	Cross-point screwdriver (#2)		1	For cross recessed head screws
	Torque wrench		1	For tightening torque control
	Spanner (width across flats: 8 mm)		1	For air tube fittings

The brake is mounted on each joint to prevent the arm from lowering due to its own weight while the Controller power is OFF or the motor is OFF status. The brake does not work during replacement. Be careful when performing maintenance work.



- Removal (1) Turn ON the Controller.
- Joint #5 and #6 (2) Release the brake on the Joint #3.
- Unit

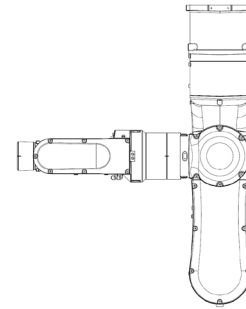
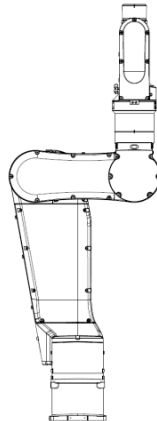
NOTE




Command
 > brake off, 3

When releasing the brake, be careful of the arm falling due to its own weight.

- (3) Move the angle of the Arm #3 about 90 degrees from the origin position.
- N6-A1000** N6-A850**R



- (4) Turn OFF the Controller.
- (5) Remove the covers.
 Arm #4 side cover (2 covers), Joint #4 inside cover, Joint #4 outside cover
 For details, refer to *Maintenance 3. Covers*.

- (6) Remove the cable unit from Joint #1 to Arm #4.
 For details, refer to the Removal steps (9) through (15) in *Maintenance 4.1 Cable Unit (N6-A1000*)*: Cable direction Standard (backward).

- (7) Remove the Joint #5 motor unit and the timing belt.
 For details, refer to the Removal steps (7) and (8) in *Maintenance 5.5.1 Replacing the Joint #5 Motor Unit*.

NOTE

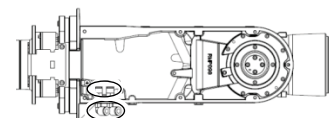

Place a mark on the Joint #5 motor unit to distinguish it later.
 (To distinguish the Joint #5 motor unit from the Joint #6 motor unit.)

- (8) Remove the Joint #6 motor unit and the timing belt.
 For details, refer to the Removal steps (7) and (8) in *Maintenance 5.6.1 Replacing the Joint #6 Motor Unit*

NOTE

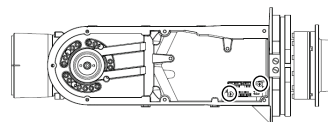

Place a mark on the Joint #6 motor unit to distinguish it later. (To distinguish the Joint #6 motor unit from the Joint #5 motor unit.)

- (9) Remove the four air tube fittings.




(10) Remove the encoder board #4.

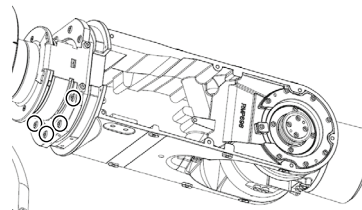
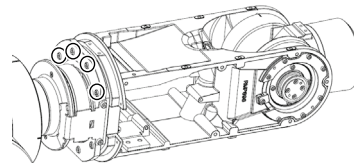
Cross recessed binding head machine screws:
2-M3×6




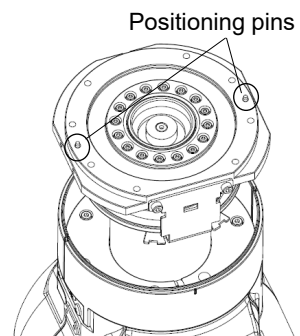
(11) Remove the Arm #4.

Cross recessed head bolts:
8-M4×20 (with plain washer)

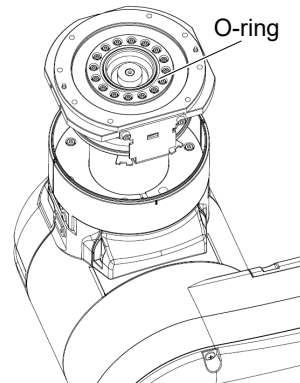
NOTE  Be sure to have at least 2 people to perform the operation since the parts being heavy.



NOTE  When removing it, make sure not to lose the two positioning pins.



(12) Remove the O-ring from the Joint #4 flange.

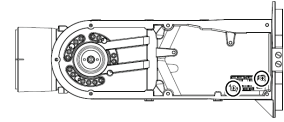


Installation
Joint #5 and #6
Unit

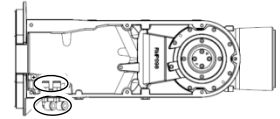
- (1) Install the encoder board #4 to the Joint #5 and #6 units.

Cross recessed binding head machine screws:
2-M3×6

Tightening torque: 0.45 ± 0.05 N·m



- (2) Install the air tube fittings to the Joint #5 and #6 units.

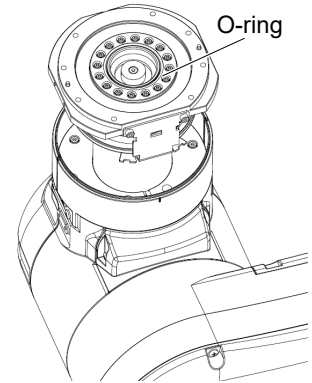


- (3) Install the O-ring to the Joint #4 flange.

O-ring Inner diameter \varnothing 47.5 mm
Wire diameter \varnothing 2.0 mm



Apply a thin coat of grease to the O-ring.
Grease: SK-1A



- (4) Install the Joint #5 and #6 units on the Joint #4 actuator unit.

Hexagon socket head cap bolts:
8-M4×20 (with plain washer)

Tightening torque: 5.5 ± 0.25 N·m

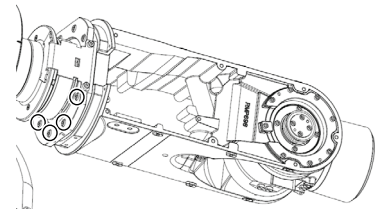
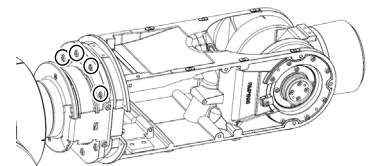
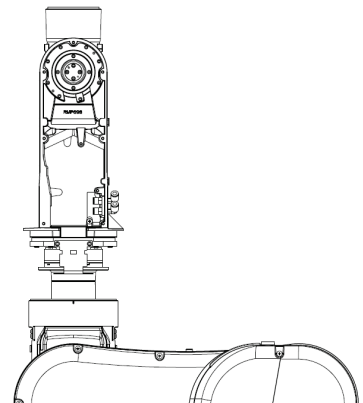


Be sure to have at least 2 people to perform the operation since the parts being heavy.

Confirm that the two pins are installed on the Joint #4 flange. When installing it, make sure to align the pins with the Joint #5 and #6 units.

Be sure to install the O-ring properly.

Be careful not to get the cables caught in the units and the actuator unit.



- (5) Install the Joint #5 motor unit and the timing belt.

For details, refer to the Removal steps (5) through (8) in *Maintenance 5.5.1 Replacing the Joint #5 Motor Unit*

NOTE



When installing the Joint #5 motor unit and the Joint #6 motor unit, make sure to use the proper part. If the wrong part is installed, the Manipulator will move abnormally.

- (6) Install the Joint #6 motor unit and the timing belt.

For details, refer to the Removal steps (5) through (8) in *Maintenance 5.6.1 Replacing the Joint #6 Motor Unit*

NOTE



When installing the Joint #5 motor unit and the Joint #6 motor unit, make sure to use the proper part. If the wrong part is installed, the Manipulator will move abnormally.

- (7) Install the cable unit.

For details, refer to the Removal steps (46) through (52) in *Maintenance 4.1 Cable Unit (N6-A1000*): Cable direction Standard (backward)*.

- (8) Install the following covers:

Arm #4 side cover (2 covers), Joint #4 inside cover, Joint #4 outside cover

For details, refer to *Maintenance 3. Covers*.

- (9) Perform calibration.

For details, refer to *Maintenance 8. Calibration*.

6. Battery



WARNING

- Do not connect or disconnect the motor connectors while the power to the robot system is turned ON. Connecting or disconnecting the motor connectors with the power ON is extremely hazardous and may result in serious bodily injury as the Manipulator may move abnormally, and also may result in electric shock and/or malfunction of the robot system.
- To shut off power to the robot system, disconnect the power plug from the power source. Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source.
- Before performing any replacement procedure, turn OFF the Controller and related equipment, and then disconnect the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system.



WARNING

- Take meticulous care when handling the lithium metal battery. Improper handling of the battery as mentioned below is extremely hazardous and may result in heat generation, leakage, explosion, or inflammation. It also may cause serious safety problems.

<Improper Handling>	
Attempting to charge	Deforming by pressure
Disassembling	Short-circuit (Polarity; Positive/Negative)
Connecting batteries improperly	Heating (85 °C or more)
Exposing to fire	Soldering the terminal of the lithium battery directly
Forcing discharge	
- When disposing the battery, consult with the professional disposal services or comply with the local regulation. Make sure that the battery terminal is insulated, even for a used battery. If the terminal contacts with the other metals, it may short and result in heat generation, leakage, explosion, or inflammation.

In case of the low battery (lithium metal battery) power, the error to warn the voltage reduction occurs at the Controller startup (the software startup). All position data will be lost and you will need to calibrate all joints.

The life span of the lithium metal battery varies depending on the energizing hours and installation environment of the Controller. It is about 3 years as a rough guide (when the Controller is connected to power for 8 hours a day). When the Controller is not connected to power, the battery consumption will significantly increase compared to when the Controller is energized. If warnings of voltage reduction occur, replace the lithium metal battery even if it has not reached the above product life.

NOTE



For the EPSON RC+ 7.0 Ver. 7.2.x or later (firmware Ver.7.2.x.x or later), the recommended replacement time for the battery can be checked in the [Maintenance] dialog box of the EPSON RC+ 7.0.

For details, refer to the following manual.

Robot Controller RC700 / RC700-A *Maintenance 6. Alarm*

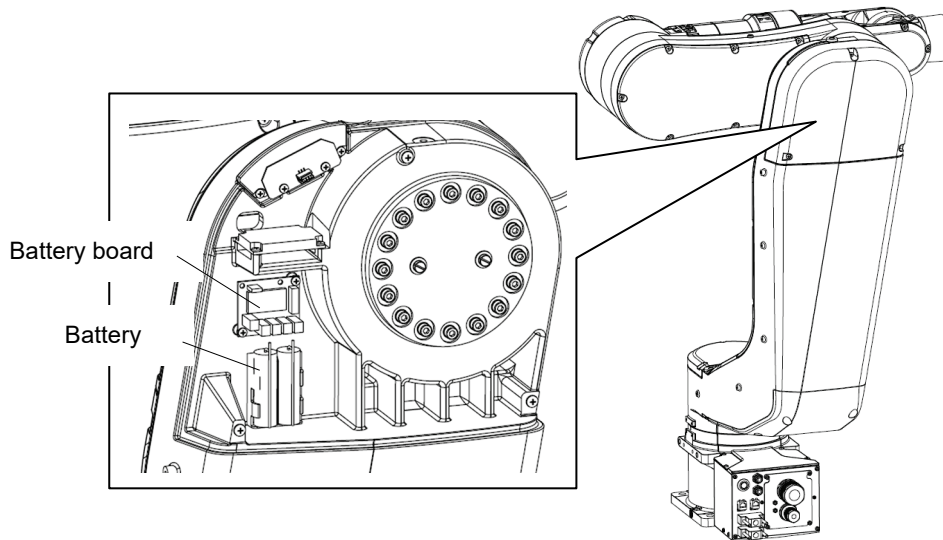
The battery may run out if it passes the recommended replacement time.

If no warnings of voltage reduction occur, calibration for all joints is not necessary. You need to perform calibration if the position moves from the originals after replaced the battery.

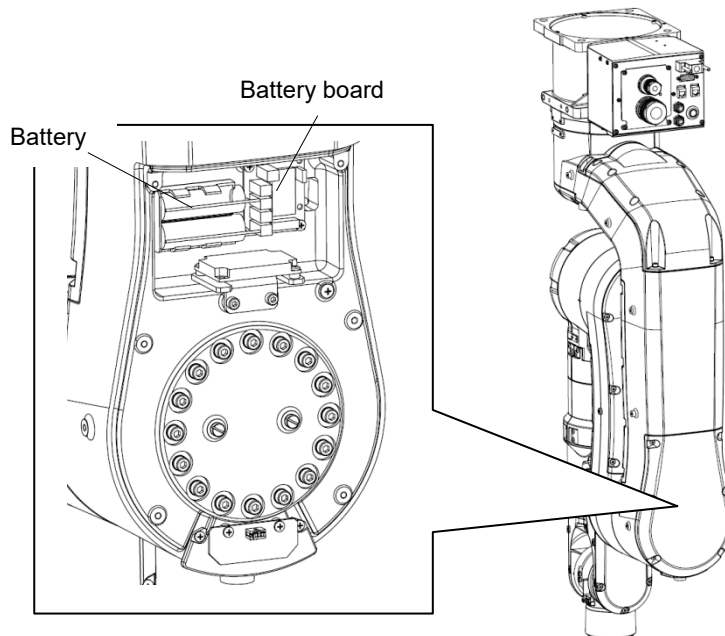
Always use the lithium metal battery and battery board designated by us.

Be careful of the battery polarity to connect it correctly.

N6-A1000**



N6-A850**R

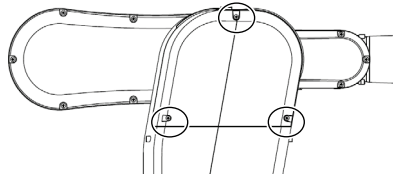


	Name	Qty	Note
Maintenance	Battery	1	2172925 (2 lithium metal batteries for replacement)
Parts	Battery board	1	2173216
Tools	Cross-point screwdriver (#2)	1	For cross recessed head screws

6.1 Replacing the Battery Unit (Lithium Metal Battery)

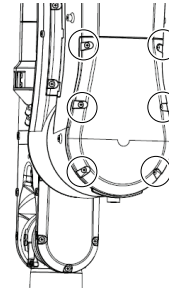
- (1) Turn OFF the Controller.
- (2) Remove the Joint #2 outside cover.

N6-A1000**



Cross recessed binding head
machine screws: 3-M4×8

N6-A850**R



Cross recessed binding head
machine screws: 6-M4×8

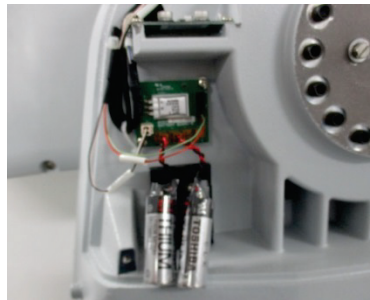
- (3) Remove the old batteries from the battery box.

NOTE Do not disconnect the connectors.



If you remove all batteries before connecting the new ones, the calibration data will be deleted and you will need to perform calibration.

N6-A1000**

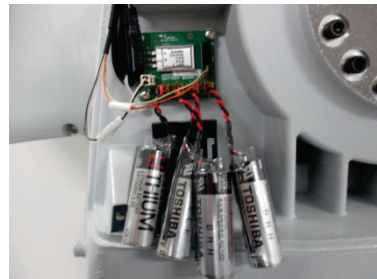


N6-A850**R

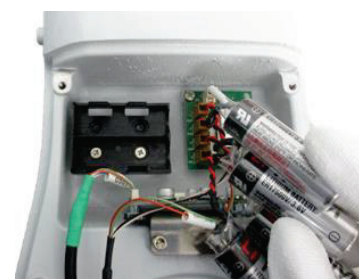


- (4) Connect the two new batteries to the connectors of the battery board which is nothing is connected.

N6-A1000**

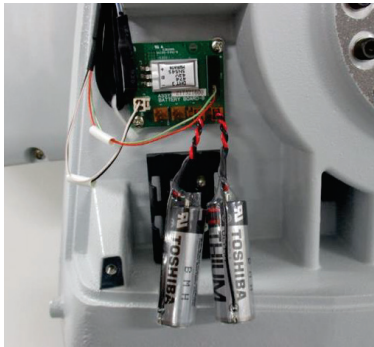


N6-A850**R

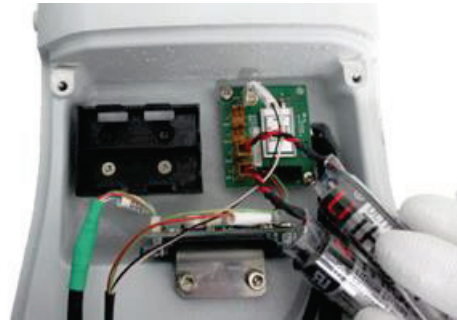


- (5) Remove the old batteries.
Hold the board by hand and pull the battery cable upward to remove the connector.

N6-A1000**

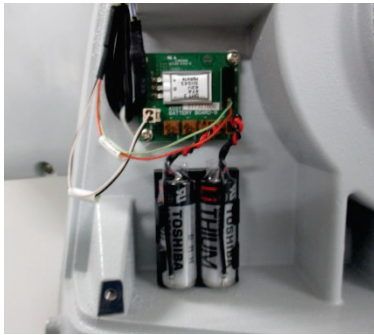


N6-A850**R

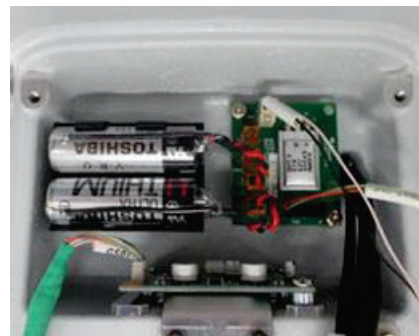


- (6) Install new batteries to the battery box.

N6-A1000**



N6-A850**R

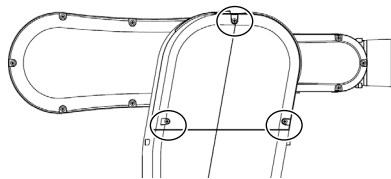


- (7) Install the Joint #2 outside cover.



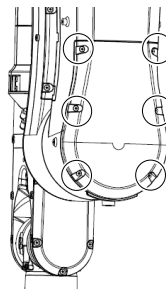
NOTE Be careful not to get the cables caught in the arm.

N6-A1000**



Cross recessed binding head
machine screws: 3-M4×8
Tightening torque: 0.45 ± 0.05 N·m

N6-A850**R



Cross recessed binding head
machine screws: 6-M4×8
Tightening torque: 0.45 ± 0.05 N·m

- (8) Turn ON the Controller.
- (9) Check operation to see if the Manipulator's position and posture are out of position.
Move the Manipulator to two or three points (poses) of the registered points.
- (10) If the Manipulator is out of position, calibrate all the joints and axes.



NOTE Make sure to operate the robot in LowPower mode.

For details, refer to *Maintenance 8. Calibration*.

6.2 Replacing the Battery Board

After parts (actuator units, timing belts, etc.) or the battery board have been replaced, the Manipulator cannot perform positioning properly because a gap exists between the origin stored in each actuator unit and its corresponding origin stored in the Controller.

After replacing the parts, it is necessary to match these origins.

The process of aligning the two origins is called “Calibration”.

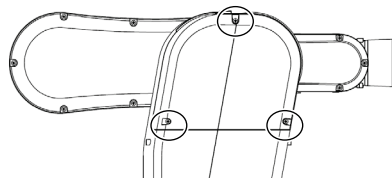
Refer to *Maintenance 8. Calibration* and follow the steps to perform calibration.

Removal

Battery Board

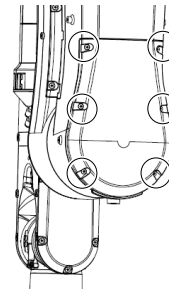
- (1) Turn OFF the Controller.
- (2) Remove the Joint #2 outside cover.

N6-A1000**



Cross recessed binding head machine screws: 3-M4×8

N6-A850**R



Cross recessed binding head machine screws: 6-M4×8

- (3) Remove the battery connectors.



Hold the board by hand and pull the battery cable upward to remove the connector.

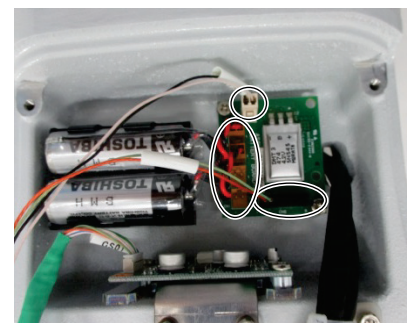
- (4) Remove the connectors from the battery board.

Connector: BAT_CN3,
BAT_CN6

N6-A1000**



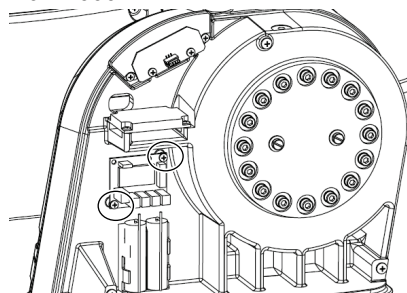
N6-A850**R



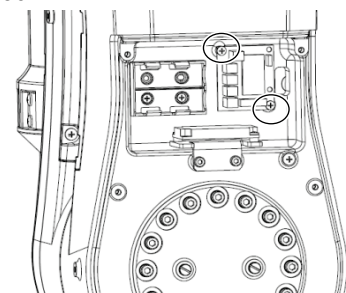
- (5) Remove the battery board.

Cross recessed binding head machine screws: 2-M3×6

N6-A1000**



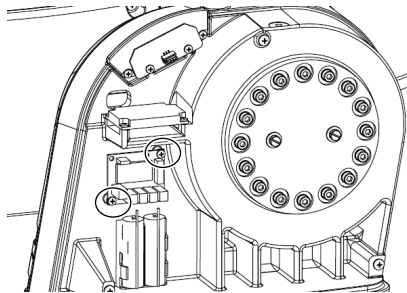
N6-A850**R



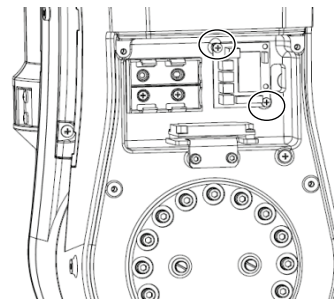
Installation (1) Install the battery board to the Arm #1.

Battery Board Cross recessed binding head machine screws: 2-M3×6
Tightening torque: 0.45 ± 0.05 N·m

N6-A1000**



N6-A850**R



(2) Connect the connectors to the battery board.

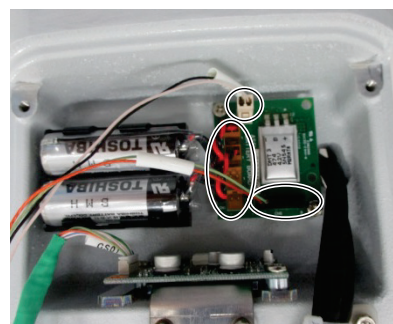
Connector: BAT_CN3
BAT_CN6

(3) Connect the battery connector to the battery board.

N6-A1000**



N6-A850**R

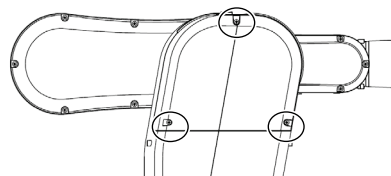


(4) Install the Joint #2 outside cover.

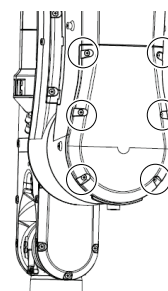
NOTE


Be careful not to get the cables caught in the arm.

N6-A1000**



N6-A850**R



Cross recessed binding head machine screws: 3-M4×8
Tightening torque: 0.45 ± 0.05 N·m

Cross recessed binding head machine screws: 6-M4×8
Tightening torque: 0.45 ± 0.05 N·m

(5) Perform calibration.

For details, refer to *Maintenance 8. Calibration*.

7. Boards

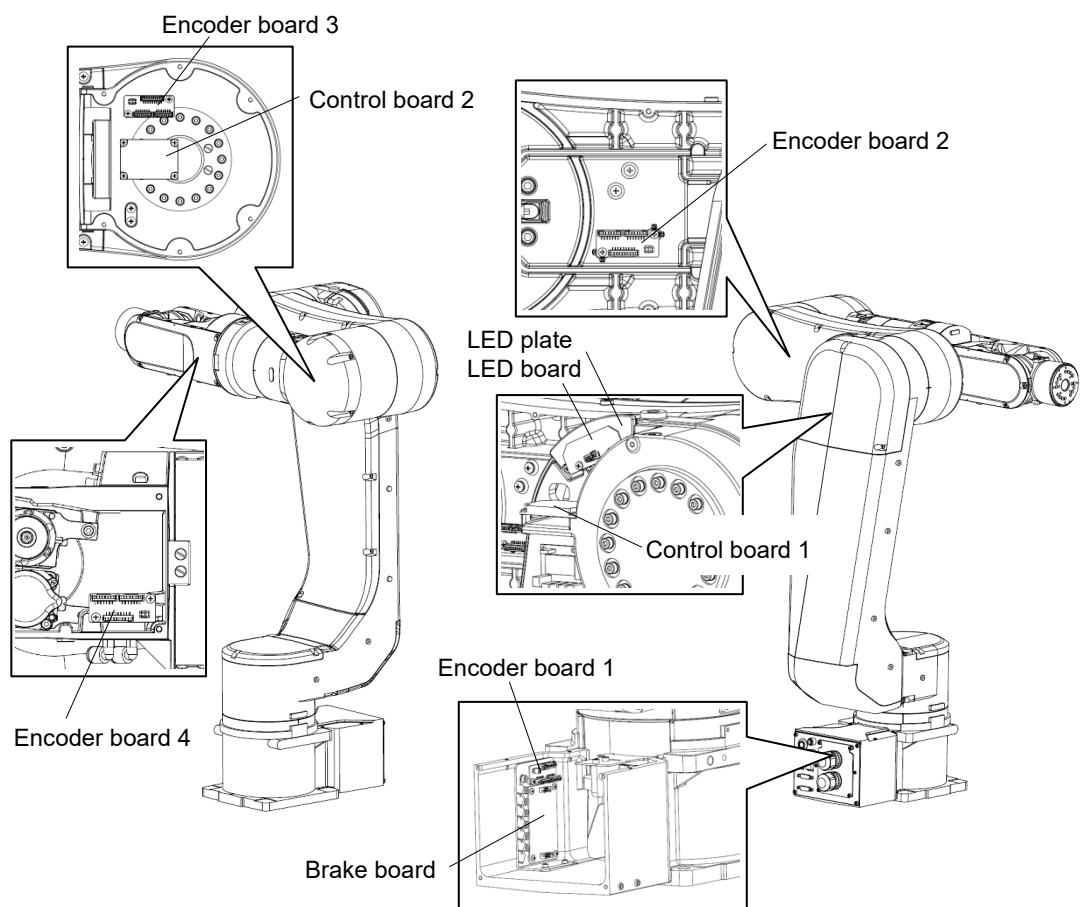


WARNING

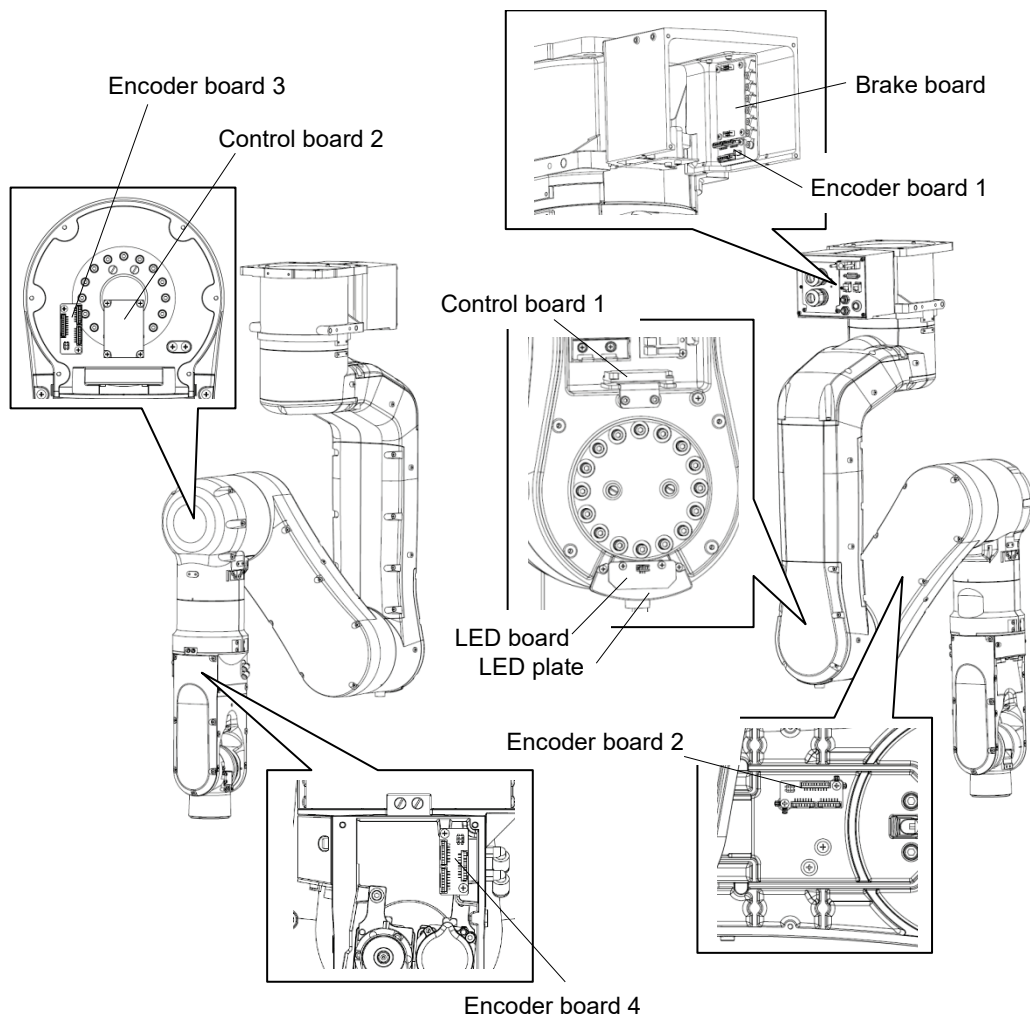
- Do not connect or disconnect the motor connectors while the power to the robot system is turned ON. Connecting or disconnecting the motor connectors with the power ON is extremely hazardous and may result in serious bodily injury as the Manipulator may move abnormally, and also may result in electric shock and/or malfunction of the robot system.
- To shut off power to the robot system, disconnect the power plug from the power source. Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source.
- Before performing any replacement procedure, turn OFF the Controller and related equipment, and then disconnect the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system.

Always use the boards designated by us.

N6-A1000**



N6-A850**R



	Name	Qty	Note
Maintenance Part	Control board (1, 2)	1	2138032
	Encoder board (1, 2, 3, 4)	1	2179137
	Brake board	1	2178379
	LED board	1	2190495
Tools	Hexagonal wrench (width across flats: 2.5 mm)	1	For M3 hexagon socket head cap bolts
	Hexagonal wrench (width across flats: 3 mm)	1	For M4 hexagon socket head cap bolts
	Cross-point screwdriver (#2)	1	For cross recessed head screws

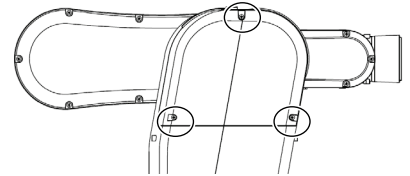
7.1 Replacing the Control Board 1

7.1.1 N6-A1000** (Control Board 1)

Removal (1) Turn OFF the Controller.

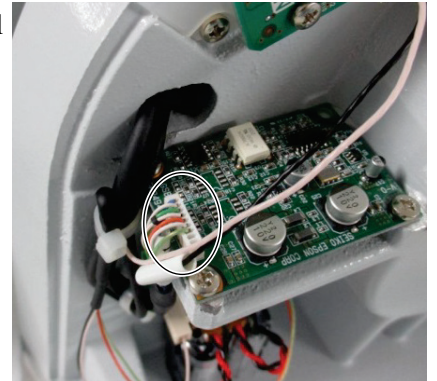
Control Board 1 (2) Remove the Joint #2 outside cover.

Cross recessed binding head machine screws:
3-M4×8



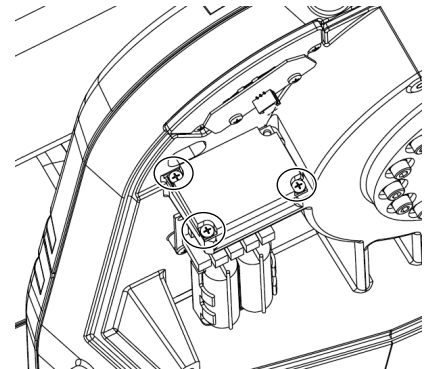
(3) Disconnect the connector connected to the control board 1.

Connector: GS01



(4) Remove the control board 1.

Cross recessed binding head machine screws:
3-M3×6

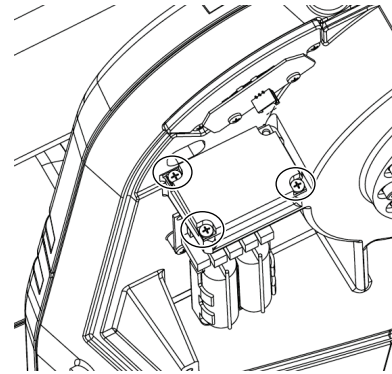


Installation (1) Install the control board 1 to the Arm #1.

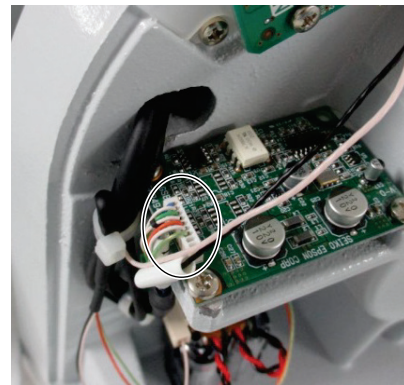
Control Board 1 Cross recessed binding head machine screws:
3-M3×6
Tightening torque: $0.45 \pm 0.05 \text{ N}\cdot\text{m}$



NOTE As shown in the step (2), when installing the board, make sure that the connector of the board is on the cable hole side.



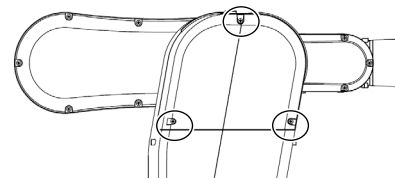
(2) Connect the connector to the control board 1.
Connector: GS01



(3) Install the Joint #2 outside cover.
Cross recessed binding head machine screws:
3-M4×8
Tightening torque: $0.45 \pm 0.05 \text{ N}\cdot\text{m}$



NOTE Be careful not to get the cables caught in the arm.



- (4) Turn ON the Controller.
- (5) Check operation to see if the Manipulator's position and posture are out of position.
Move the Manipulator to two or three points (poses) of the registered points.
- (6) If the Manipulator is out of position, calibrate all the joints and axes.

For details, refer to *Maintenance 8. Calibration*.

7.1.2 N6-A850**R (Control Board 1)

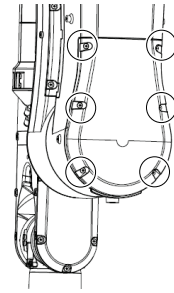
Removal

- (1) Turn OFF the Controller.

Control Board 1

- (2) Remove the Joint #2 outside cover.

Cross recessed binding head machine screws:
6-M4×8

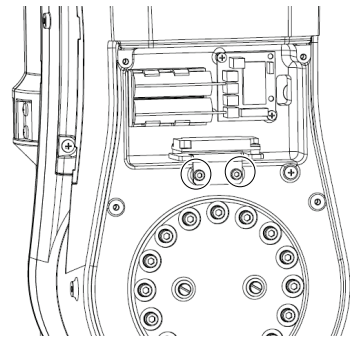


- (3) Remove the control board fixing plate.

Cross recessed binding head machine screws:
2-M4×8

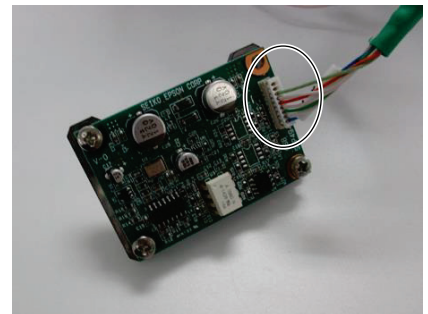


NOTE Cable is connected. Be careful not to pull the plate forcibly.



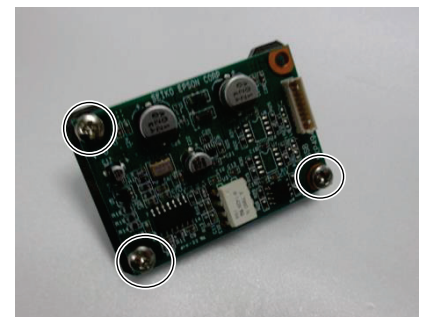
- (4) Disconnect the connector connected to the control board 1.

Connector: GS01



- (5) Remove the control board 1.

Cross recessed binding head machine screws:
3-M3×6

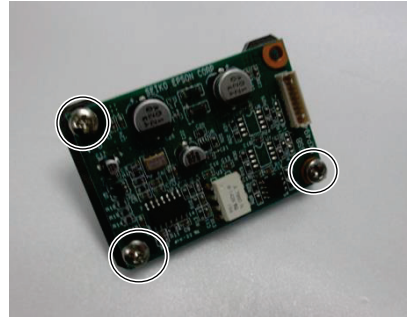


Installation (1) Install the control board 1 to the control board fixing plate.
Control Board 1

Cross recessed binding head machine screws:
3-M3×6
Tightening torque: 0.45 ± 0.05 N·m

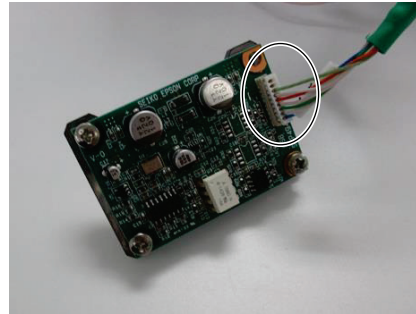


NOTE Make sure to install it in the direction as shown in the picture.



(2) Connect the connector to the control board 1.

Connector: GS01

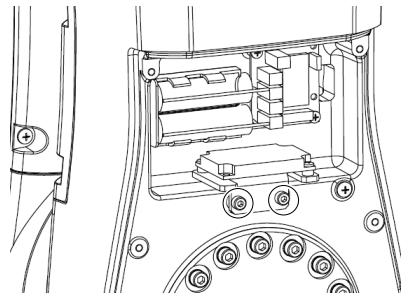


Install the control board fixing plate to the Arm #1.

Cross recessed binding head machine screws:
2-M4×8
Tightening torque: 4.0 ± 0.2 N·m

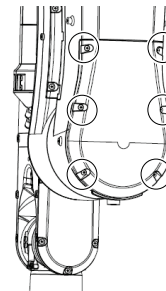


NOTE Make sure to install it in the direction as shown in the picture.



(3) Install the Joint #2 outside cover.

Cross recessed binding head machine screws:
6-M4×8
Tightening torque: 0.45 ± 0.05 N·m



NOTE Be careful not to get the cables caught in the arm.

- (4) Turn ON the Controller.
- (5) Check operation to see if the Manipulator's position and posture are out of position.
Move the Manipulator to two or three points (poses) of the registered points.
- (6) If the Manipulator is out of position, calibrate all the joints and axes.
For details, refer to *Maintenance 8. Calibration*.

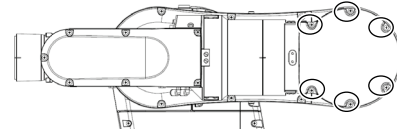
7.2 Replacing the Control Board 2

Removal

Control Board 2

- (1) Remove the Arm #3 cover.

Cross recessed binding head machine screws:
6-M4×8



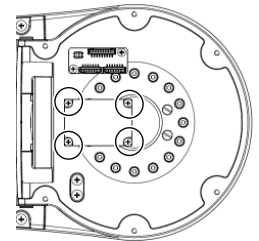
- (2) Disconnect the connector connected to the control board 2.

Connector: GS02




- (3) Remove the control board 2.

Cross recessed binding head machine screws: 4-M3×6



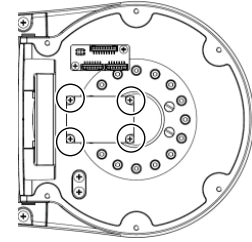
NOTE

 Be careful not to drop the screws inside the Manipulator while removing them.

Installation (1) Install the control board #2 to the Arm #3.

Control Board 2 Cross recessed binding head machine screws: 4-M3×6

Tightening torque: 0.45 ± 0.05 N·m



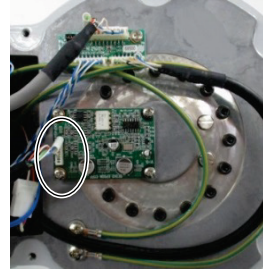
NOTE



Be careful not to drop the screws inside the Manipulator while removing them.

(2) Connect the connector to the control board 2.

Connector: GS02

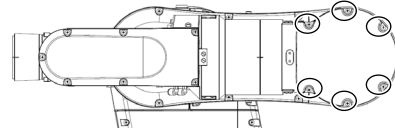


(3) Install the Arm #3 cover.

Cross recessed binding head machine screws:

6-M4×8

Tightening torque: 0.45 ± 0.05 N·m



NOTE



Be careful not to get the cables caught in the cover.

(4) Turn ON the Controller.

(5) Check operation to see if the Manipulator's position and posture are out of position.

Move the Manipulator to two or three points (poses) of the registered points.

(6) If the Manipulator is out of position, calibrate all the joints and axes.

For details, refer to *Maintenance 8. Calibration*.

7.3 Replacing the Encoder Board 1

Removal (1) Turn OFF the Controller.

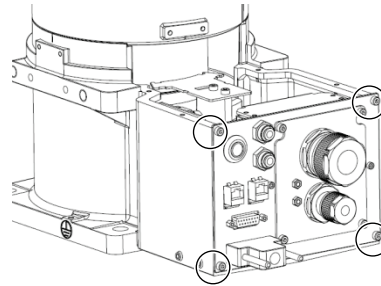
Encoder Board 1 (2) Remove the base cover.

For details, refer to *Maintenance 3. Covers*.

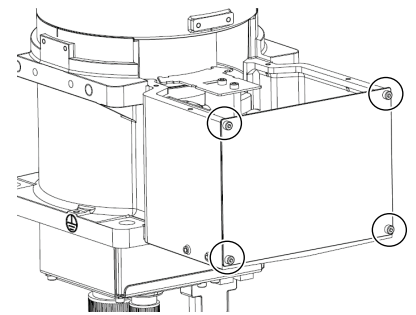
(3) Remove the base side plate.

Hexagon socket head cap bolts: 4-M4×8

M/C cable direction: Standard (backward)

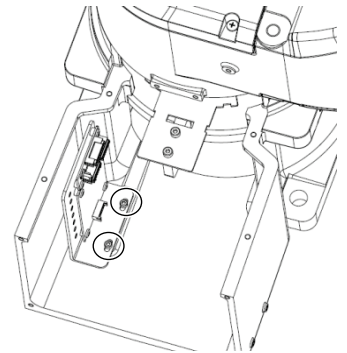


Upward and downward



(4) Remove the board fixing plate in the base.

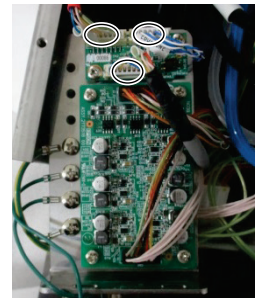
Hexagon socket head cap bolts: 2-M3×6



(5) Disconnect the connectors connected to the encoder board 1

Connectors:

EB01_CN1, EB01_CN3, EB0x_CN2



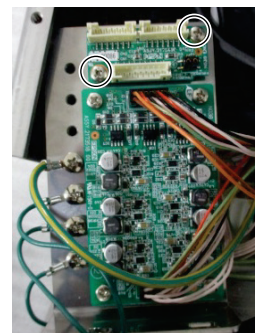
NOTE




Be careful that the jumper pins on the board do not come off.

(6) Remove the encoder board 1.

Cross recessed binding head machine screws: 2-M3×6



 CAUTION	<p>■ Improper jumper pin settings may result in occurrence of the errors such as below.</p> <p>Example: 5042: Position error overflow in high power state.</p> <p>Check the power cable connection, the robot, the driver and the motor.</p> <p>When replacing the boards, be careful not to configure them incorrectly.</p>
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Installation Encoder Board 1 (1) Check that the jumper pin of the encoder board 1 is at “3-4 short”.

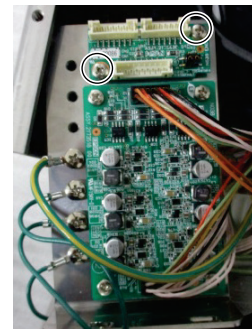


(2) Install the encoder board 1 to the board fixing plate.
 Cross recessed binding head machine screws: 2-M3×6
 Tightening torque: 0.45 ± 0.05 N·m

NOTE



Make sure to install it in the direction as shown in the picture.



(3) Connect the connectors to the encoder board 1.

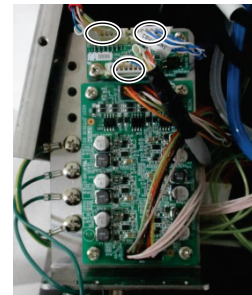
Connectors:

EB01_CN1, EB01_CN3, EB0x_CN2

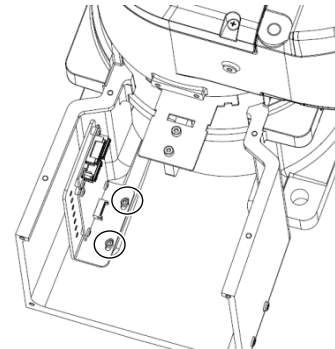
NOTE



Be careful that the jumper pins on the board do not come off.



(4) Install the board fixing plate to the base.
 Hexagon socket head cap bolts: 2-M3×6
 Tightening torque: 2.0 ± 0.1 N·m

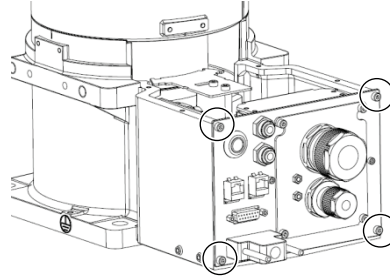


- (5) Install the base side plate.

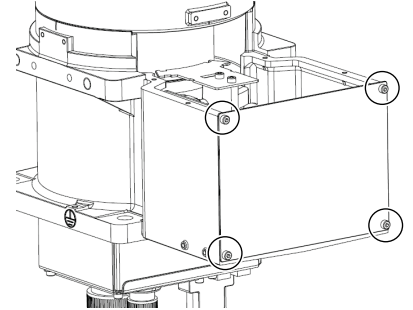
Hexagon socket head cap bolts: 4-M4×8

Tightening torque: 4.0 ± 0.2 N·m


M/C cable direction: Standard (backward)



Upward and downward



NOTE

 Be careful not to get the cables caught in the base.

- (6) Install the base cover.

For details, refer to *Maintenance 3. Covers*.

- (7) Turn ON the Controller.

- (8) Calibrate all the Joints.

For details, refer to *Maintenance 8. Calibration*.

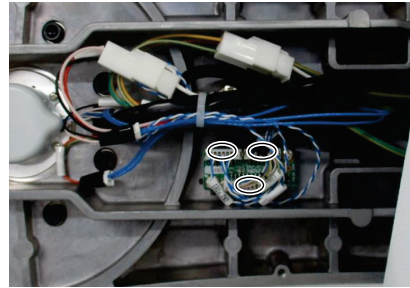
7.4 Replacing the Encoder Board 2

Removal (1) Remove the Arm #2 cover (Arm #1 side).


Encoder Board 2 For details, refer to *Maintenance 3. Covers*.

Disconnect the connectors connected to the encoder board 2.

Connectors: EB02_CN1
EB0x_CN2 (Joint #2 side)
EB0x_CN2 (Joint #3 side)

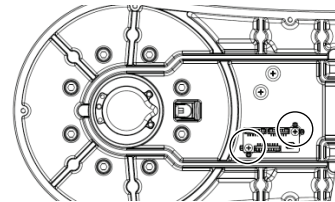


NOTE


 Be careful that the jumper pins on the board do not come off.


(2) Remove the encoder board 2.

Cross recessed binding head machine screws:
2-M3×6



NOTE

 Be careful not to drop the screws inside the Manipulator while removing them.

 CAUTION	<ul style="list-style-type: none"> ■ Improper jumper pin settings may result in occurrence of the errors such as below. Example: 5042: Position error overflow in high power state. Check the power cable connection, the robot, the driver and the motor. When replacing the boards, be careful not to configure them incorrectly.
---	--

Installation
Encoder Board 2

- (1) Change the position of the jumper pin on the encoder board 2 to “1-2 short”.

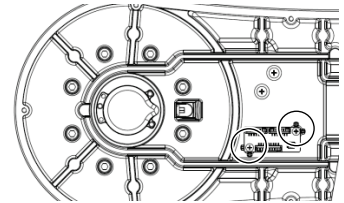


- (2) Install the encoder board 2 to the Arm #2.


Cross recessed binding head machine screws:

2-M3×6


Tightening torque: 0.45 ± 0.05 N·m



NOTE

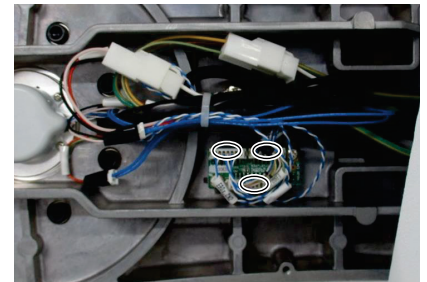
 Be careful not to drop the screws inside the Manipulator while removing them.

NOTE


 Make sure to install as the same direction as the figure.

- (3) Connect the connectors to the encoder board 2.

Connectors: EB02_CN1
 EB0x_CN2 (Joint #2 side)
 EB0x_CN2 (Joint #3 side)



NOTE

 Be careful that the jumper pins on the board do not come off.

- (4) Install the Arm #2 cover (Arm #1 side).

For details, refer to *Maintenance 3. Covers*.

- (5) Turn ON the Controller.

- (6) Calibrate the Joints #2 and #3.

For details, refer to *Maintenance 8. Calibration*.

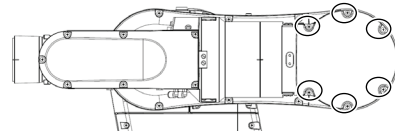
7.5 Replacing the Encoder Board 3

Removal

Encoder Board 3

- (1) Remove the Arm #3 cover.

Cross recessed binding head machine screws:
6-M4×8



- (2) Disconnect the connectors connected to the encoder board 3.

Connectors: EB04_CN1, EB04_CN3, EB0x_CN2



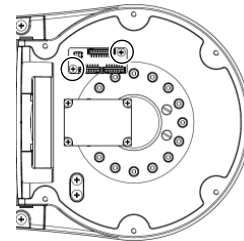
NOTE



Be careful that the jumper pins on the board do not come off.

- (3) Remove the encoder board 3.


Cross recessed binding head machine screws: 2-M3×6



NOTE



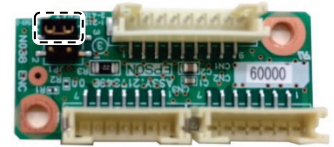
Be careful not to drop the screws inside the Manipulator while removing them.

 CAUTION	<ul style="list-style-type: none"> ■ Improper jumper pin settings may result in occurrence of the errors such as below. Example: 5042: Position error overflow in high power state. Check the power cable connection, the robot, the driver and the motor. When replacing the boards, be careful not to configure them incorrectly.
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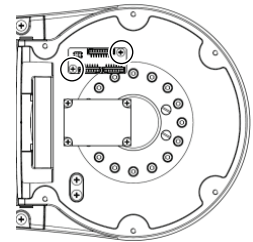
Installation

Encoder Board 3


- (1) Check that the jumper pin of the encoder board 3 is at “3-4 short”.



- (2) Install the encoder board 3 to the Arm #2.
 Cross recessed binding head machine screws: 2-M3×6
 Tightening torque: 0.45 ± 0.05 N·m




NOTE

 Be careful not to drop the screws inside the Manipulator while removing them.

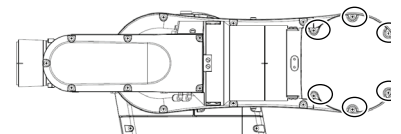
- (3) Connect the connectors to the encoder board 3.
 Connectors: EB04_CN1, EB04_CN3, EB0x_CN2



NOTE


 Be careful that the jumper pins on the board do not come off.

- (4) Install the Arm #3 cover.
 Cross recessed binding head machine screws:
 6-M4×8
 Tightening torque: 0.45 ± 0.05 N·m



For details, refer to *Maintenance 3. Covers*.

NOTE

 Be careful not to get the cables caught in the cover.

- (5) Turn ON the Controller.
- (6) Calibrate the Joints #4, #5, and #6.
 For details, refer to *Maintenance 8. Calibration*.

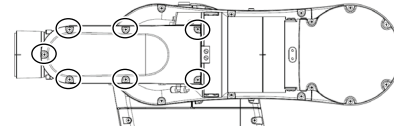
7.6 Replacing the Encoder Board 4

Removal

Encoder Board 4

- (1) Remove the Arm #4 side cover.

Cross recessed binding head machine screws:
7-M4×8



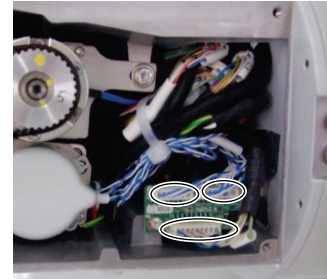
- (2) Disconnect the connectors connected to the encoder board 4.

Connectors:

EB05_CN1

EB0x_CN2(Joint #5 motor side)

EB0x_CN2(Joint #6 motor side)



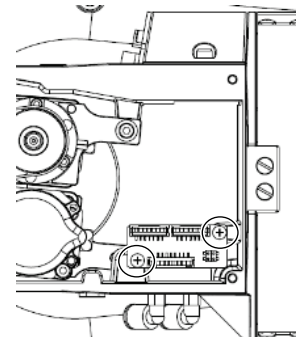
NOTE



Be careful that the jumper pins on the board do not come off.

- (3) Remove the encoder board 4.


Cross recessed binding head machine screws: 2-M3×6



NOTE



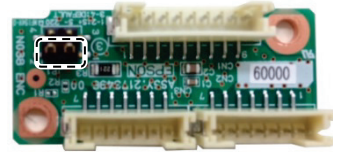
Be careful not to drop the screws inside the Manipulator while removing them.

 CAUTION	<p>■ Improper jumper pin settings may result in occurrence of the errors such as below.</p> <p>Example: 5042: Position error overflow in high power state.</p> <p>Check the power cable connection, the robot, the driver and the motor.</p> <p>When replacing the boards, be careful not to configure them incorrectly.</p>
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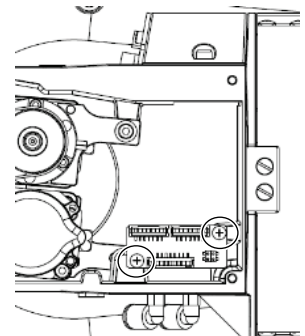
Installation

Encoder Board 4

- (1) Check that the jumper pin of the encoder board 4 is at “1-2 short”.



- (2) Install the encoder board 4 to the Arm #4.
Cross recessed binding head machine screws: 2-M3×6
Tightening torque: $0.45 \pm 0.05 \text{ N}\cdot\text{m}$



NOTE



Be careful not to drop the screws inside the Manipulator while installing them.

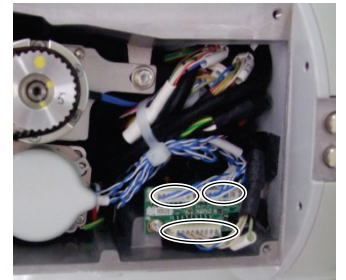
- (3) Connect the connectors to the encoder board 4.

Connectors:

EB05_CN1

EB0x_CN2 (Joint #5 motor side)

EB0x_CN2 (Joint #6 motor side)



NOTE



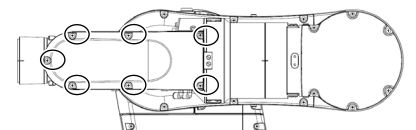
Be careful that the jumper pins on the board do not come off.

- (4) Install the Arm #4 side cover.

Cross recessed binding head machine screws:

7-M4×8

Tightening torque: $0.45 \pm 0.05 \text{ N}\cdot\text{m}$



NOTE



Be careful not to get the cables caught in the cover.

- (5) Turn OFF the Controller.
- (6) Calibrate the Joints #5 and #6.

For details, refer to *Maintenance 8. Caribration*.

7.7 Replacing the Brake Board

Removal (1) Turn OFF the Controller.

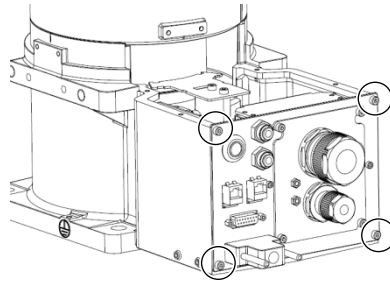
Brake Board (2) Remove the base cover.

For details, refer to *Maintenance 3. Covers*.

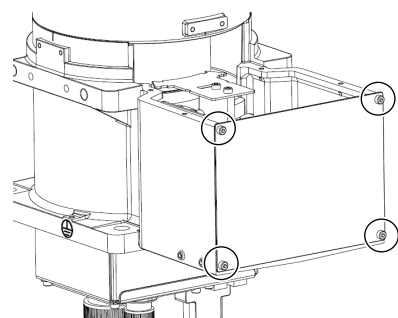
(3) Remove the base side plate.

Hexagon socket head cap bolts: 4-M4×8

M/C cable direction: Standard (backward)

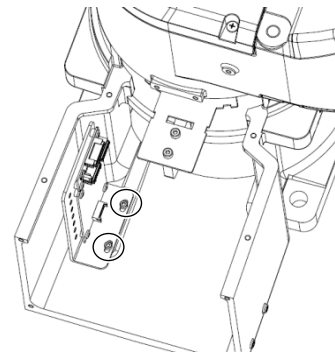


Upward and downward



(4) Remove the board fixing plate in the base.

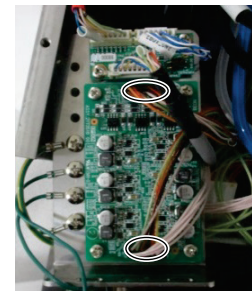
Hexagon socket head cap bolts: 2-M3×6



(5) Disconnect the connectors connected to the brake board.

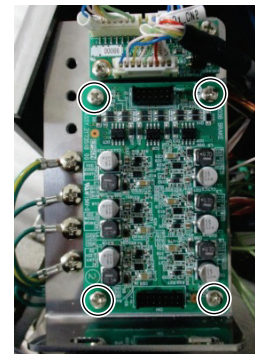
Connectors:

BRK_CN1, BRK_CN2



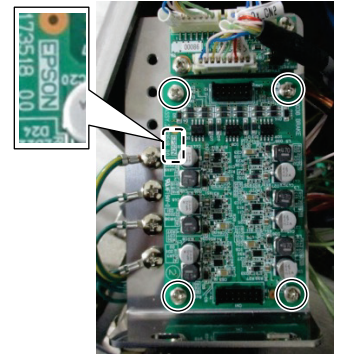
(6) Remove the brake board.

Cross recessed binding head machine screws: 4-M3×6

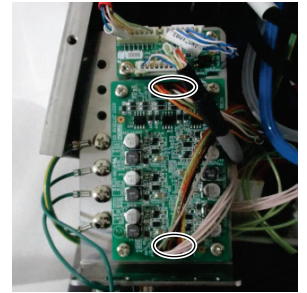


Installation
Brake Board

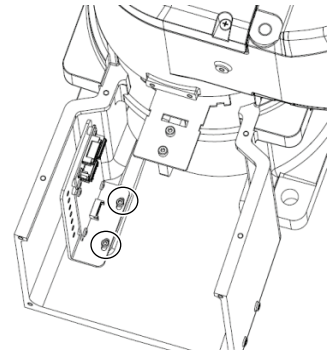
- (1) Install the brake board to the board fixing plate.
Cross recessed binding head machine screws: 4-M3×6
Tightening torque: 0.45 ± 0.05 N·m
Make sure to install as the same direction as the picture.



- (2) Connect the connectors to the brake board.
Connectors: BRK_CN1, BRK_CN2

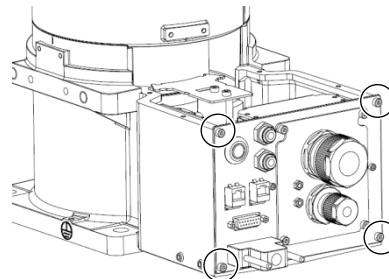


- (3) Install the board fixing plate on the base.
Cross recessed binding head machine screws: 2-M3×6
Tightening torque: 2.0 ± 0.1 N·m

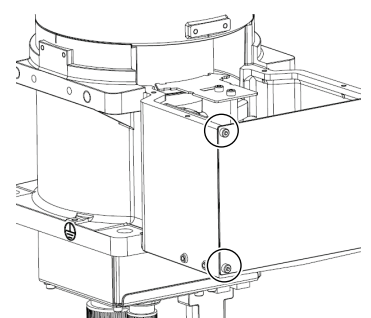


- (4) Install the base side plate.
Hexagon socket head cap bolts: 4-M4×8
Tightening torque: 4.0 ± 0.2 N·m

M/C cable direction: Standard (backward)



Upward and downward



NOTE



Be careful not to get the cables caught in the base.

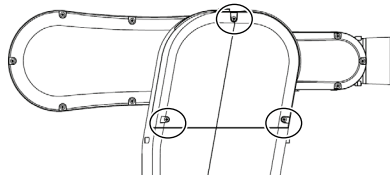
- (5) Install the base cover.
For details, refer to *Maintenance 3. Covers*.
- (6) Turn ON the Controller.

7.8 Replacing the LED Board

Removal (1) Turn OFF the Controller.

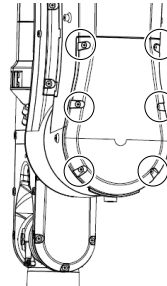
LED Board (2) Remove the Joint #2 outside cover.

N6-A1000**



Cross recessed binding head
machine screws: 3-M4×8

N6-A850**R



Cross recessed binding head
machine screws: 6-M4×8

(3) Disconnect the connector connected to the LED board.

Connector: LED_CN1

N6-A1000**



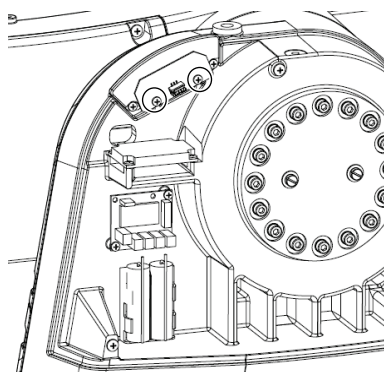
N6-A850**R



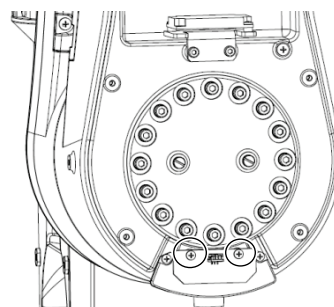
(4) Remove the LED board.

Cross recessed binding head machine screws: 2-M3×6

N6-A1000**



N6-A850**R

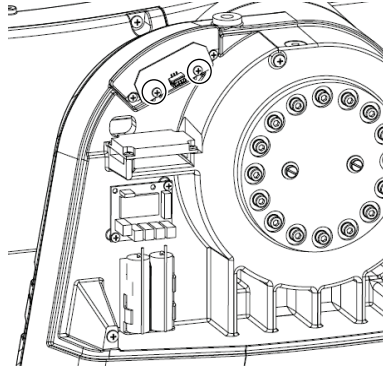


Installation
LED Board

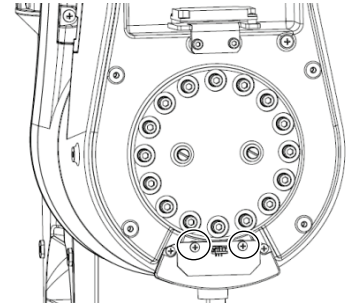
(1) Install the LED board.

Cross recessed binding head machine screws: 2-M3×6
Tightening torque: 0.45 ± 0.05 N·m

N6-A1000**



N6-A850**R



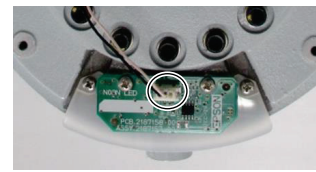
(2) Connect the connector to the LED board.

Connector: LED_CN1

N6-A1000**



N6-A850**R

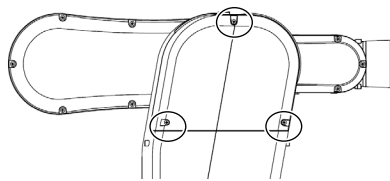


(3) Install the Joint #2 outside cover.

NOTE

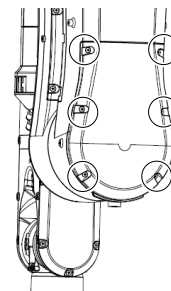

Be careful not to get the cables caught in the cover.

N6-A1000**



Cross recessed binding head machine screws: 3-M4×8
Tightening torque: 0.45 ± 0.05 N·m

N6-A850**R

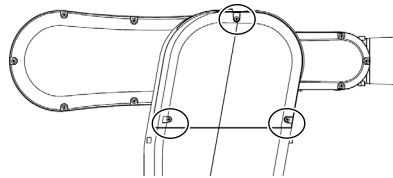


Cross recessed binding head machine screws: 6-M4×8
Tightening torque: 0.45 ± 0.05 N·m

7.9 Replacing the LED Plate

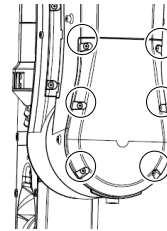
- Removal
- LED Plate
- (1) Turn OFF the Controller.
 - (2) Remove the Joint #2 outside cover.

N6-A1000**



Cross recessed binding head machine screws: 3-M4×8

N6-A850**R



Cross recessed binding head machine screws: 6-M4×8

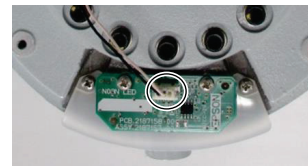
- (3) Disconnect the connector connected to the LED board.

Connector: LED_CN1

N6-A1000**



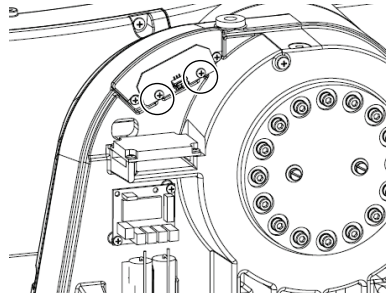
N6-A850**R



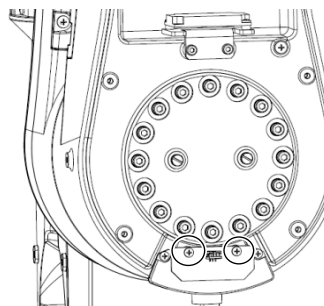
- (4) Remove the LED board.

Cross recessed binding head machine screws: 2-M3×6

N6-A1000**



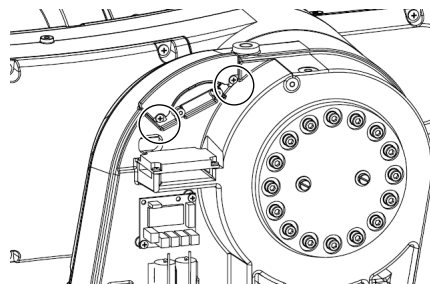
N6-A850**R



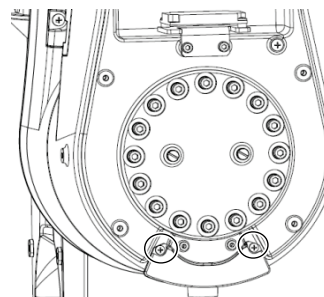
- (5) Remove the LED plate.

Cross recessed binding head machine screws: 2-M3×6

N6-A1000**



N6-A850**R

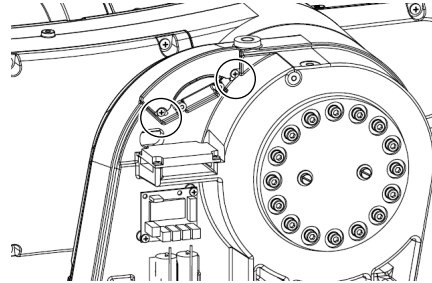


Installation
LED Plate

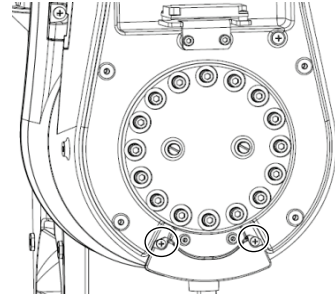
(1) Install the LED plate to the Arm #1.

Cross recessed binding head machine screws: 2-M3×6
Tightening torque: 0.45 ± 0.05 N·m

N6-A1000**



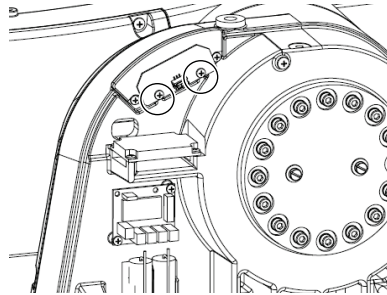
N6-A850**R



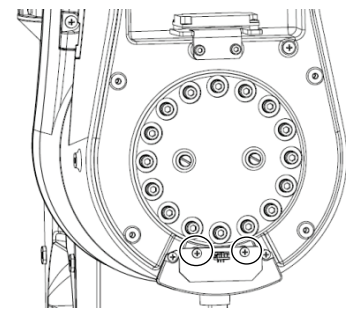
(2) Install the LED board.

Cross recessed binding head machine screws: 2-M3×6
Tightening torque: 0.45 ± 0.05 N·m

N6-A1000**



N6-A850**R



(3) Connect the connector to the LED board.

Connector: LED_CN1

N6-A1000**



N6-A850**R

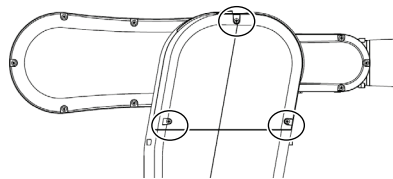


(4) Install the Joint #2 outside cover.

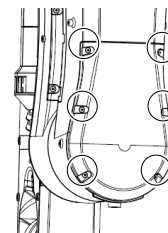
NOTE

Be careful not to get the cables caught in the cover.

N6-A1000**



N6-A850**R



Cross recessed binding head machine screws: 3-M4×8
Tightening torque: 0.45 ± 0.05 N·m

Cross recessed binding head machine screws: 6-M4×8
Tightening torque: 0.45 ± 0.05 N·m

8. Calibration

8.1. Overview


After parts (actuator units, timing belts, etc.) or the battery board have been replaced, the Manipulator cannot perform positioning properly because a gap exists between the origin stored in each actuator unit and its corresponding origin stored in the Controller.

After replacing the parts, it is necessary to match these origins.

The process of aligning the two origins is called “Calibration”.

Note that calibration is not the same as teaching*


* “Teaching” means to teach the Controller coordinate points (including poses) anywhere in the operating area of the Manipulator.

 WARNING	<ul style="list-style-type: none"> ■ To ensure safety, a safeguard must be installed for the robot system. For details on the safeguard, refer to the <i>Installation and Design Precautions</i> in the <i>Safety</i> chapter of the <i>EPSON RC+ User's Guide</i>. ■ Before operating the robot system, make sure that no one is inside the safeguarded area. The robot system can be operated in the mode for teaching even when someone is inside the safeguarded area. The motion of the Manipulator is always in restricted (low speeds and low power) status to secure the safety of an operator. However, operating the robot system while someone is inside the safeguarded area is extremely hazardous and may result in serious safety problems in case that the Manipulator moves unexpectedly.
--	--


There are two methods to move the Manipulator during calibration.

- Releasing the Electromagnetic brake and moving the arms manually.
For details, refer to the *Setup & Operation 1.5 How to Move Arms with the Electromagnetic brake*.
- Moving the Manipulator using Jog & Teach.
For details of Jog & Teach, refer to the following manual.
EPSON RC+ User's Guide 5.11.1 [Robot Manager] Command (Tools Menu)-[Jog and Teach]

Moving the Manipulator while releasing the Electromagnetic brake involves risk as described below.

 CAUTION	<ul style="list-style-type: none"> ■ Normally, release the brake of joints one by one. Take extra care if you need to release the brakes of two or more joints simultaneously. Releasing the brakes of two or more joints simultaneously may cause hands and fingers to be caught and/or equipment damage to or malfunction of the Manipulator as the arms of the Manipulator may move in unexpected directions. ■ Be careful of the arm falling when releasing the brake. While the brake is being released, the Manipulator's arm falls by its own weight. The arm falling may cause hands and fingers to be caught and/or may cause equipment damage to or malfunction of the Manipulator.
--	---

Also, pay attention to the following points at the encoder initialization.

 CAUTION	<p>■ The Joints #1 to Joint #4 have no mechanical stops. If the encoder initialization is performed with improper posture, the Manipulator moves outside the operation range. If the Manipulator was moved outside the operation range, the internal wiring may be damaged by being twisted or pinched and it may result in Manipulator malfunction.</p>
---	--



When the Joint #1 to #4 rotates 360 degrees, the Manipulator will be the same posture. For example, posture at +180 degree and -180 degree is the same.

When you are not sure the current joint angle, check the internal wiring and tubing (cables).

You can check the cable conditions by removing the each cover.

Joint #1 : Base cover

Joint #2 : Joint #2 cover (N6-A1000**), Arm #1 inside cover (N6-A850**R)

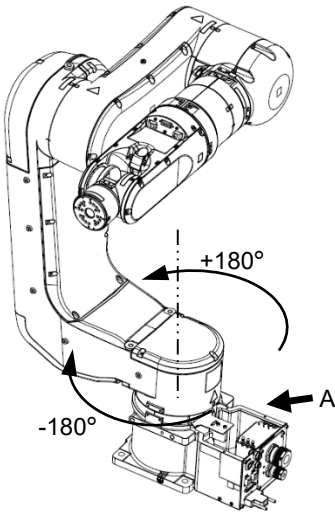
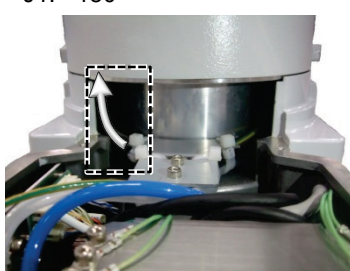
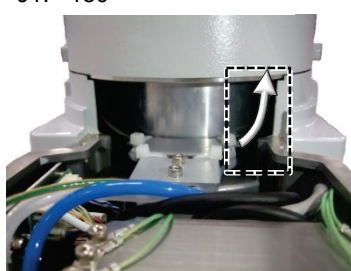
Joint #3 : Arm #3 inside cover

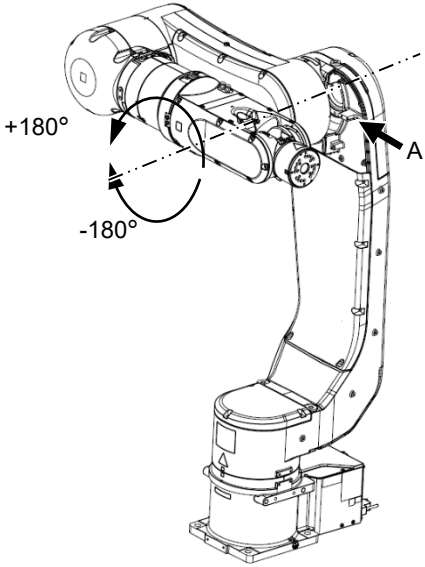
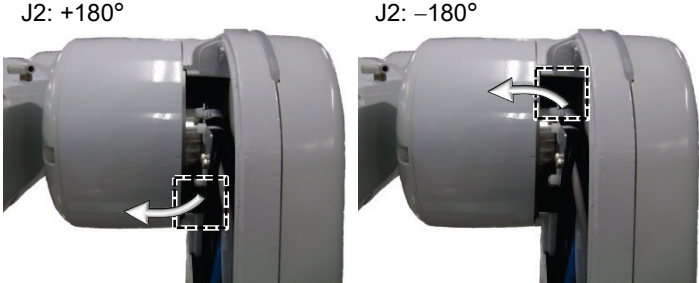
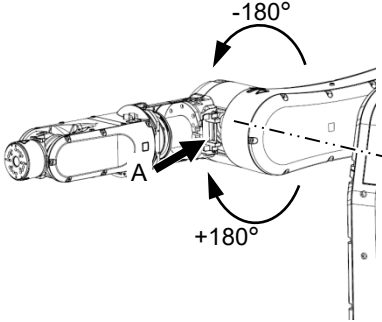
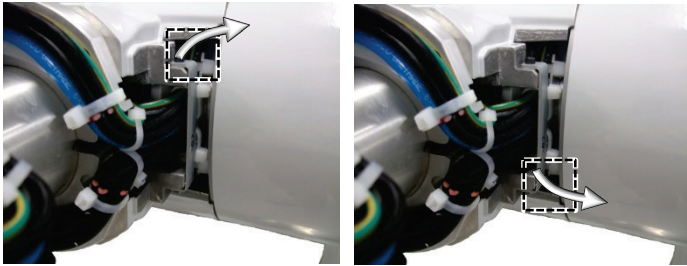
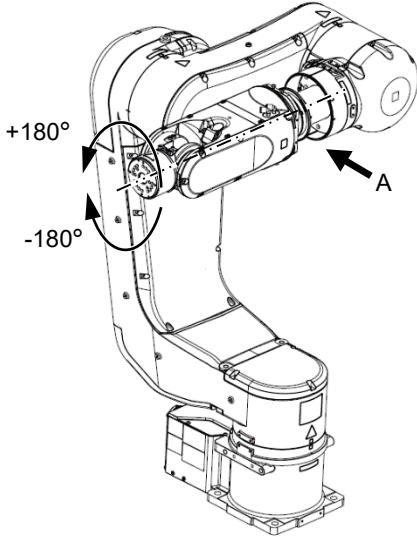
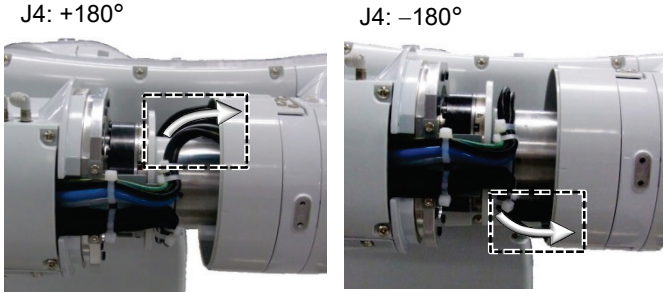
Joint #4 : Joint #4 inside cover, Joint #4 outside cover

For procedures of the cover removal, refer to *Maintenance 3. Covers*.

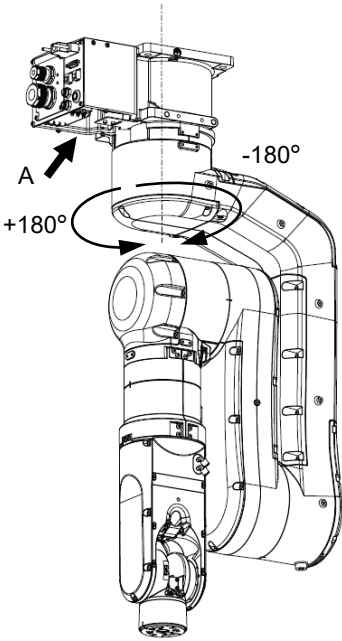
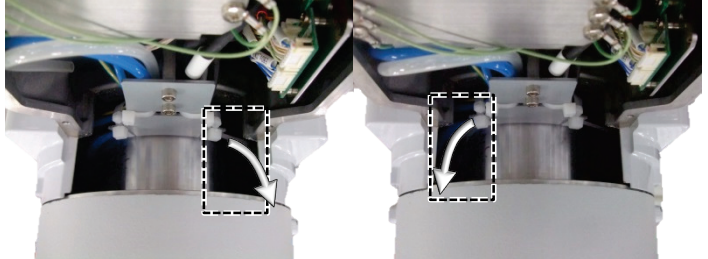
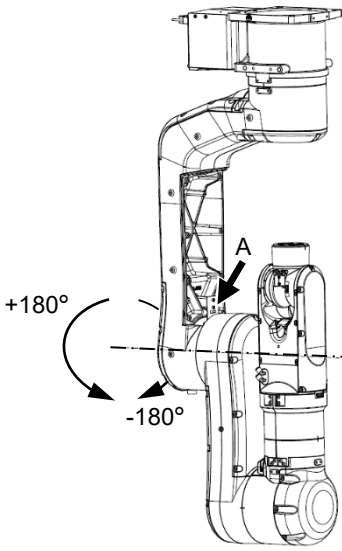
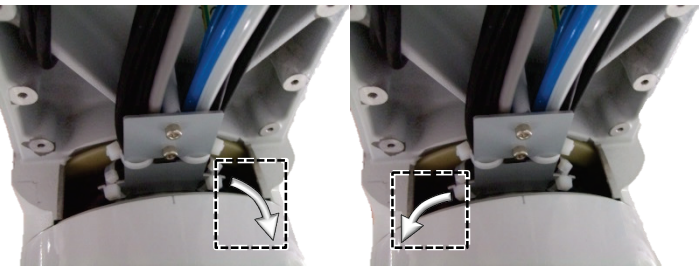
The following are examples of the cable conditions at ± 180 degree posture.
 (White arrow is an image of the cable.)

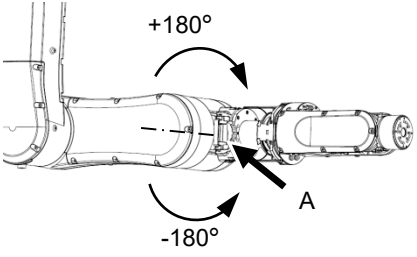
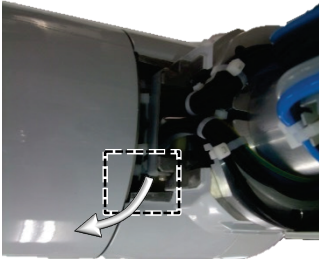
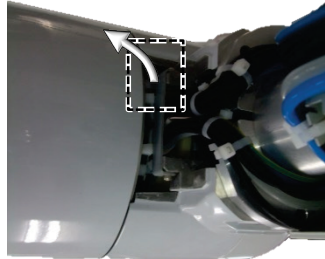
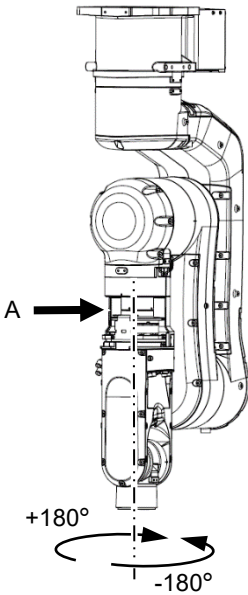
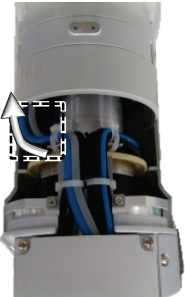
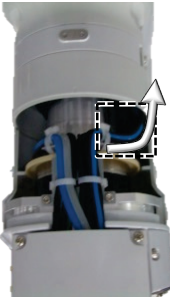
N6-A1000**

N6-A1000**	Detail of A
<p>Joint #1</p> 	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>J1: +180°</p>  </div> <div style="text-align: center;"> <p>J1: -180°</p>  </div> </div> <p style="text-align: center;">Cable direction: Arm #1 side</p>

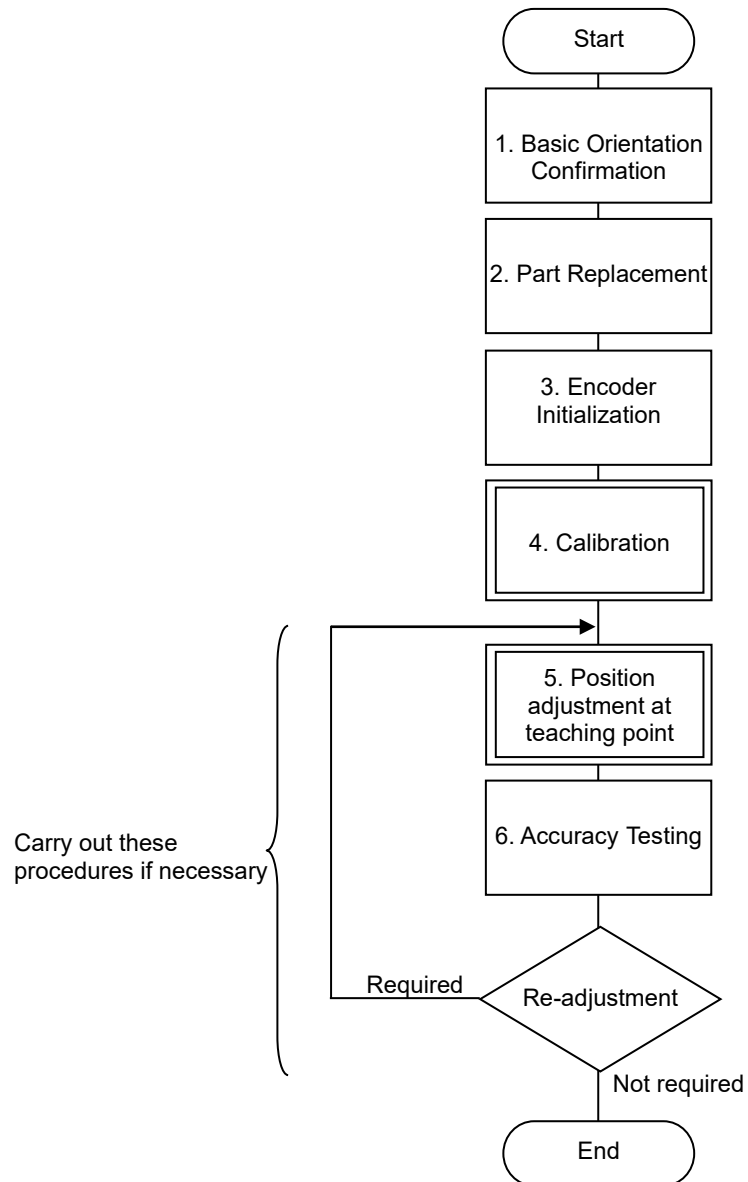
N6-A1000**	Detail of A
<p>Joint #2</p> 	 <p>Cable direction: Arm #2 side</p>
<p>Joint #3</p> 	 <p>Cable direction: Arm #2 side</p>
<p>Joint #4</p> 	 <p>Cable direction: Arm #3 side</p>

N6-A850**R

N6-A850**R	Detail of A
<p>Joint #1</p>  <p>The diagram shows an exploded view of Joint #1. A vertical dashed line indicates the axis of rotation, labeled 'A'. Two curved arrows indicate the rotation directions: +180° (clockwise) and -180° (counter-clockwise).</p>	<div style="display: flex; justify-content: space-around;"> <div data-bbox="742 470 853 504">J1: +180°</div> <div data-bbox="1101 470 1212 504">J1: -180°</div> </div>  <p>Cable direction: Arm #1 side</p> <p>The photographs show the internal cable routing for Joint #1. The left image is labeled 'J1: +180°' and the right image is labeled 'J1: -180°'. Both images show a dashed white box with a white arrow pointing to the cable's exit point from the joint, indicating the direction towards the Arm #1 side.</p>
<p>Joint #2</p>  <p>The diagram shows an exploded view of Joint #2. A vertical dashed line indicates the axis of rotation, labeled 'A'. Two curved arrows indicate the rotation directions: +180° (clockwise) and -180° (counter-clockwise).</p>	<div style="display: flex; justify-content: space-around;"> <div data-bbox="742 1164 853 1198">J2: +180°</div> <div data-bbox="1101 1164 1212 1198">J2: -180°</div> </div>  <p>Cable direction: Arm #2 side</p> <p>The photographs show the internal cable routing for Joint #2. The left image is labeled 'J2: +180°' and the right image is labeled 'J2: -180°'. Both images show a dashed white box with a white arrow pointing to the cable's exit point from the joint, indicating the direction towards the Arm #2 side.</p>

N6-A850**R	Detail of A
<p>Joint #3</p> 	<div style="display: flex; justify-content: space-around;"> <div data-bbox="660 255 979 568"> <p>J3: +180°</p>  </div> <div data-bbox="984 255 1310 568"> <p>J3: -180°</p>  </div> </div> <p style="text-align: center;">Cable direction: Arm #2 side</p>
<p>Joint #4</p> 	<div style="display: flex; justify-content: space-around;"> <div data-bbox="624 808 884 1144"> <p>J4: +180°</p>  </div> <div data-bbox="970 808 1230 1144"> <p>J4: -180°</p>  </div> </div> <p style="text-align: center;">Cable direction: Arm #3 side</p>

Calibration Flowchart



8.2. Calibration Procedure

Command Input

Command execution is required in some calibration procedures.

Select EPSON RC+ menu-[Tools]-[Command Window].

This step is omitted in the calibration procedures.

Jog Motion

Setting of the jog motion is required in some calibration procedures.

Select EPSON RC+ menu-[Tools]-[Robot Manager] and select the [Jog & Teach] page.

The panel, window, and page above are indicated as [Jog & Teach] in the calibration procedures.

Follow the steps 1 to 5 to calibrate the Manipulator.

1. Basic Orientation Confirmation

Calibration is performed with the basic orientation of the Manipulator.

For details about the basic orientation, refer to *Setup & Operation 3.8 Checking the Basic Orientation*.

When the Manipulator cannot have the basic orientation, define the reference orientation in advance, and record the point data. Also, put the “match marks” to indicate the orientation.

The coordinate points including the Arm orientation are referred to as “points”, and the data of the points are called “point data” in EPSON RC+.

2. Part Replacement

Replace the parts as instructed in this manual.

Be careful not to injure yourself or damage parts during part replacement.

3. Encoder Initialization:

Connect the cables and turn ON the Controller while all joints are in the motion range.

The following error message will be displayed on EPSON RC+ window

“Encoder alarm has occurred. Check robot battery. EPSON RC+ must be restarted.”

Initialize the encoder at the current Manipulator position and reset the error.

Execute the following command in the [Command Window] to initialize the encoder.



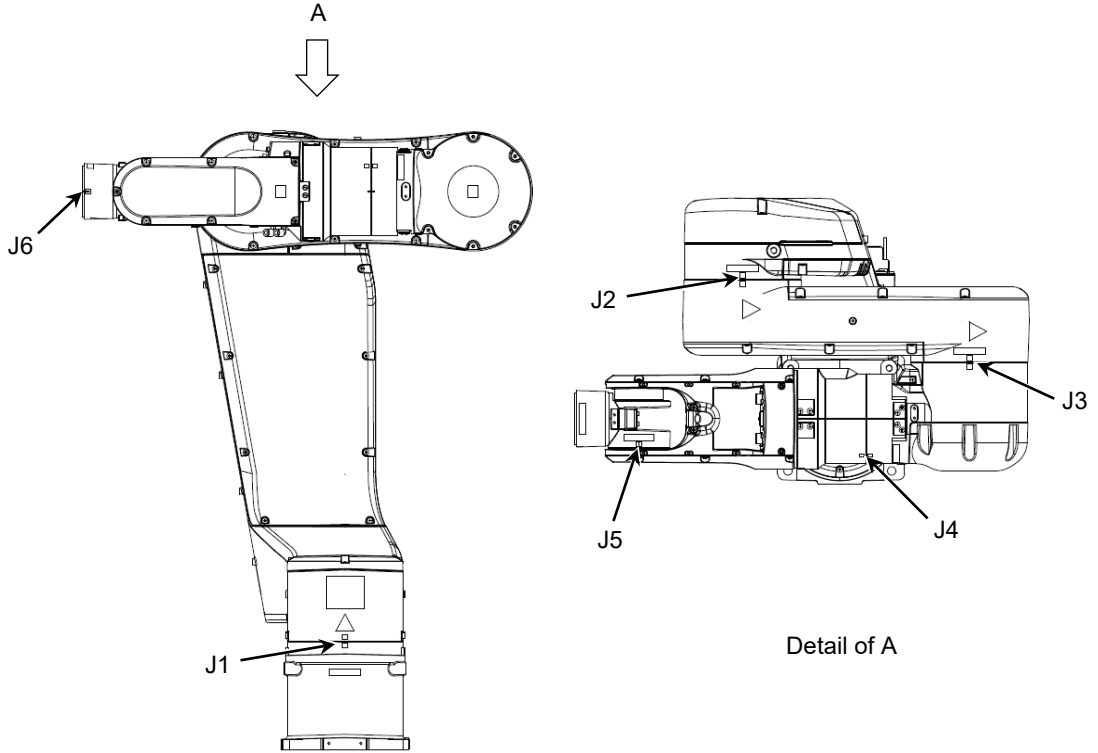
>Encreset [The joint number (1 to 6) of the encoder to be reset]

Select EPSON RC+ menu-[Tools]-[Controller], then click <Reset Controller>.

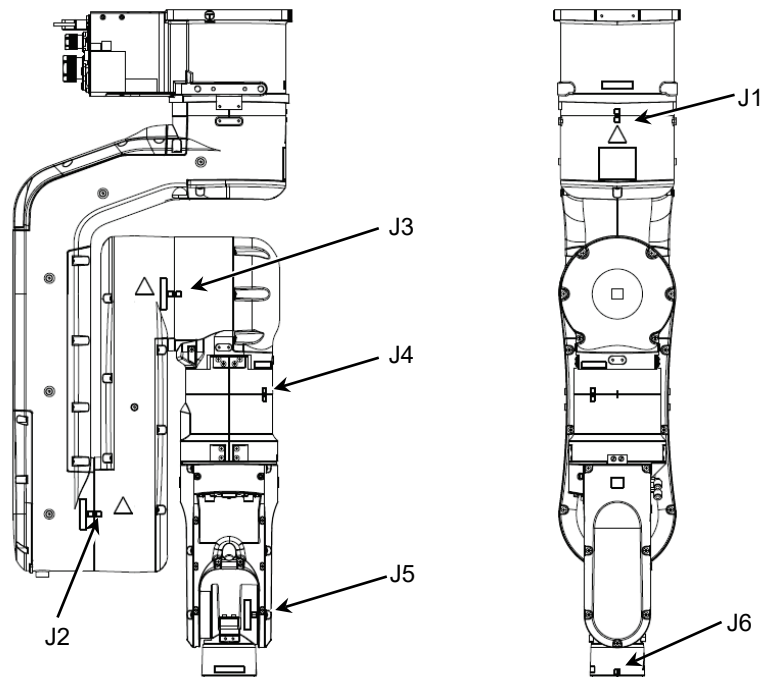
4. Calibration

Calibration marks of each joint

N6-A1000**



N6-A850**R



4-1. Align the calibration marks of the target joint

EPSON
RC+

Set the jog mode to “Joint” in the [Jog & Teach] panel from EPSON RC+ menu - [Tools] - [Robot Manager], and then move the Manipulator in Jog motion so that the calibration marks on the target joint match as much as possible.

Refer to “Calibration marks of each joint” for location of the calibration marks.

When the Manipulator cannot have the basic orientation, move the Manipulator so that the “match marks” depending on the predetermined reference orientation are aligned.

4-2 Initialize the Encoder.

EPSON
RC+

Execute the command in the [Command Window] from EPSON RC+ menu - [Tools] according to the joint to adjust as follows.

```
Joint #1 >Encreset 1
Joint #2 >Encreset 2
Joint #3 >Encreset 3
Joint #4 >Encreset 4
Joint #5 >Encreset 5, 6
Joint #6 >Encreset 6
```

Restart the Controller.

Select EPSON RC+ menu-[Tools]-[Controller], then click <Reset Controller>.

4-3 Execute the origin point setting

EPSON
RC+

Execute the following command in the [Command Window] to specify the pulse values to be set as the origin point.

```
>calpls J1 pulse, J2 pulse, J3 pulse, J4 pulse, J5 pulse, J6 pulse
```

* Manipulator will not move.

Specify the pulse values “0” when the Manipulator is aligned to the calibration marks, or the values recorded at the predetermined reference orientation (where the match marks are aligned) to the command parameters (pulse values).

If the point data for the reference orientation is “P1”, the command parameters can be specified as follows

```
>calpls ppls (P1,1), ppls (P1,2), ppls (P1,3), ppls (P1,4),
ppls (P1,5), ppls (P1,6)
```

Then, execute the following command in the [Command Window] to set the specified pulse values to the encoder according to the joint to set the origin point.

```
Joint #1 >Calib 1
Joint #2 >Calib 2
Joint #3 >Calib 3
Joint #4 >Calib 4
Joint #5 >Calib 5, 6
Joint #6 >Calib 6
```

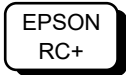
NOTE



When the origin of the Joint #5 is calibrated, the Joint #6 will be out of position. (Due to the structure of the Manipulator, any offset in the position of the Joint #5 affects the Joint #6.)

Calibrate the origin of the Joint #6 together when calibrating the Joint #5.

5. Position adjustment by teaching point (perform if necessary)



After calibration, move the Manipulator to the selected point data by jogging in [Jog & Teach].

When the selected point data is “P1”,

Execute “Motor On” in [Control Panel] and execute “Go P1” in [Jog & Teach].



Adjust the calibrated joints accurately by jog command so that the end effector is aligned to the selected point data position.

*When the Joint #5 is calibrated, adjust the Joint #5 and #6.

Select the “Joint” jog mode from [Jog & Teach] to change and adjust the angle of the target joint in the jog motion.

Set the pulse values again at the adjusted point.

Execute the following command in the [Command Window] to specify the pulse values to set.

```
>calpls J1 pulse, J2 pulse, J3 pulse, J4 pulse, J5 pulse, J6 pulse
```

* Manipulator will not move.

Specify the pulse values of the selected point data to the command parameters.

If the point data for the reference orientation is “P1”, the command parameters can be specified as follows

```
>calpls ppls(P1,1), ppls(P1,2), ppls(P1,3), ppls(P1,4),
ppls(P1,5), ppls(P1,6)
```

* Manipulator will not move.

Then, execute the following command in the [Command Window] to set the specified pulse values to the encoder according to the joint to set the origin point.

```
Joint #1 >Calib 1
Joint #2 >Calib 2
Joint #3 >Calib 3
Joint #4 >Calib 4
Joint #5 >Calib 5, 6
Joint #6 >Calib 6
```

6. Accuracy Testing

Move the Manipulator to a different pose (point) to verify whether it moves back to the original position. If accuracy is inadequate, it is necessary to re-calibrate the origin using a different pose (point). You must set the pose (point) again if the Manipulator does not move back to the original position after re-calibration.

9. Maintenance Parts List

Name		Code	Note	Reference in Maintenance	Overhaul *
Actuator unit	Joint #1	1749168	600 W, unit	5.1	✓
	Joint #2	1749169	600 W, unit	5.2	✓
	Joint #3	1749170	400 W, unit	5.3	✓
	Joint #4	1749171	100 W, unit	5.4	✓
AC servo motor	Joint #5	1749172	100 W, single item	5.7	✓
	Joint #6	1749173	100 W, single item	5.6	✓
Joint unit		1749174	Unit	5.7	✓
Electromagnetic brake	Joint #5, 6	1670649	(Solenoid brake)	5.5, 5.6	✓
Timing belt		1739205		5.5, 5.6	✓
Belt tensile jig		1749184	Assembly jig	5.5, 5.6	
Battery set		2172925	(2 lithium metal batteries for replacement)	6.1	
Battery board		2173216		6.2	

* Overhaul

As a rough indication, perform overhaul (parts replacement) before reaching 20,000 operation hours of the Manipulator.

The operation hours can be checked in [Controller Status Viewer] dialog box - [Motor On Hours].

For details, refer to *Maintenance 2.2 Overhaul (Parts Replacement)*.

Name		Code	Note	Reference in Maintenance
Grease **	Joint #1, 2, 3,4 ,5: SK-1A	-	For purchasing the grease, please contact the supplier of your region.	2.1.2, 2.3
	Joint #6, bevel gear: SK-2	-		
	Cable: GPL-224	-		4, 5

** Due to the chemicals regulations of individual countries (the UN GHS), we are requesting our customers to purchase grease required for maintenance from the manufacturers listed in the table below as of April 2015.

Regarding purchase of the grease and other materials, please contact the following manufacturers.

If there is anything unclear, please contact the supplier of your region.

Product name	Manufacturer	URL
Harmonic Grease SK-1A Harmonic Grease SK-2	Harmonic Drive Systems Inc.	http://www.harmonicdrive.net/
Krytox®GPL-224	DuPont	http://www2.dupont.com/Our_Company/en_US/worldwide/us_country.html

Maintenance 9. Maintenance Parts List

Name		Code	Note	Reference in Maintenance
Control Board 1, 2		2138032		7.1, 7.2
LED plate		1739260		7.9
LED board		2190495		7.8
Encoder board 1, 2, 3, 4		2179137		7.3, 7.4, 7.5, 7.6
Brake board		2178379		7.7
O-ring	Joint #4	1554675	Wire diameter \varnothing 2.0mm, Inner diameter \varnothing 47.5mm	5.4
	Oil filler	1657289	Wire diameter \varnothing 1.0mm, Inner diameter \varnothing 17.0mm	2.3
M/C cable	3 m	Straight	R12NZ900YF	4.6
		L-shaped	R12NZ900YM	
	5 m	Straight	R12NZ900YH	
		L-shaped	R12NZ900YN	
	10 m	Straight	R12NZ900YJ	
		L-shaped	R12NZ900YP	
	15 m	Straight	R12NZ900YK	
		L-shaped	R12NZ900YQ	
	20 m	Straight	R12NZ900YL	
		L-shaped	R12NZ900YR	
M/C cable (flexible)	3 m	Straight	R12NZ900YT	
		L-shaped	R12NZ900YY	
	5 m	Straight	R12NZ900YU	
		L-shaped	R12NZ900YZ	
	10 m	Straight	R12NZ900YV	
		L-shaped	R12NZ900Z1	
	15 m	Straight	R12NZ900YW	
		L-shaped	R12NZ900Z2	
	20 m	Straight	R12NZ900YX	
		L-shaped	R12NZ900Z3	
Cable unit		2187251	Standard model	4.1
		2194258	Cleanroom & ESD model	4.1
Relay cable 1		2187252		4.5
Relay cable 2		2176220		4.5
Cable tie	AB150	1675754	100 ties/1 bag: white	
	AB200	1684328		

Name		Code	Note	Reference in Maintenance
Cover (Standard model)	Base	Base cover	1749181	Plastic cover 3
	Arm #1 (N6-A1000)	Joint #1 inside cover	1739211	
		Joint #2 cover	1739212	
		Joint #1 cover	1739213	
		Joint #2 outside cover	1739214	
		Arm #1 inside cover	1739215	
	Arm #1 (N6-A850)	Joint #1 cover	1755217	
		Joint #1 inside cover	1755218	
		Joint #2 outside cover	1755219	
	Arm #1 inside cover	1755220		
	Arm #2	Arm #2 cover	1749176	
	Arm #3	Arm #3 cover	1749177	
		Arm #3 inside cover	1739218	
		Joint #4 side cover	1749178	
	Arm #4	Arm #4 cable cover	1739221	
		Arm #4 side cover	1749179	
		Joint #4 inside cover	1739223	
Joint #4 outside cover		1749180		
Cover (Cleanroom model)	Base	Base cover	1761617	Plastic cover (Plating) 3
	Arm #1 (N6-A1000)	Joint #1 cover	1755506	
		Joint #1 inside cover	1755504	
		Arm #1 inside cover	1755508	
		Joint #2 outside cover	1755507	
		Joint #2 cover	1755505	
	Arm #1 (N6-A850)	Joint #1 cover	1757779	
		Joint #1 inside cover	1757780	
		Arm #1 inside cover	1757782	
	Joint #2 outside cover	1757781		
	Arm #2	Arm #2 cover	1761612	
	Arm #3	Arm #3 inside cover	1755511	
		Arm #3 cover	1761613	
		Joint #4 side cover	1761614	
	Arm #4	Joint #4 inside cover	1755514	
		Joint #4 outside cover	1761616	
		Arm #4 side cover	1761615	
Arm #4 cable cover		1739221		
Pad	Arm #4	1686754		
Calibration mark		1692799		8

10. Option Parts List

Name		Code	Note	Reference in <i>Setup & Operation</i>
Brake release unit (with cable and M/C short connector)		R12NZ900N4	For Europe (200V)	6.1
		R12NZ900N5	For U.S. & Japan (100V)	
MC short connector		R12NZ900N7	For brake release unit	
Camera plate unit		R12NZ9003F	Common to C3, C4, C8, and N2	6.2
Tool adapter (ISO flange)		R12NZ900Z4		6.3
User connector kit	D-sub	R12NZ900LX		6.4