

Washdown Delta Robot R6Y3 Series

Delta Robot

INSTALLATION MANUAL

OMRON

Safety Instructions

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Warranty 1

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1. Safety Information

Industrial robots are highly programmable, mechanical devices that provide a large degree of freedom when performing various manipulative tasks. To operate the robot in safer and correct manner, strictly observe the safety instructions and precautions stated in this "Safety Instructions" guide. Failure to take necessary safety measures or incorrect handling may result in trouble or damage to the robot, and also may cause personal injury (to installation personnel, robot operator or service personnel) including fatal accidents.

The safety instructions and precautions described in the "Safety Instructions" cover only the robot (mechanical sections). For details about operation of the controller and safety precautions associated with the controller operation, refer to the Controller Manual.

Before using this product, read this manual and related manuals and take safety precautions to ensure correct handling. The precautions listed in this manual relate to this product. To ensure the safety of the user's final system that includes robots, the user must take appropriate safety considerations.

To use robots safely and correctly, be sure to strictly observe the safety rules and instructions.

- For specific safety information and standards, refer to the applicable local regulations and comply with the instructions.
- Warning labels attached to the robots are written in English, Japanese, Chinese and Korean. This manual is available in English or Japanese (or some parts in Chinese). Unless the robot operators or service personnel understand these languages, do not permit them to handle the robot.
- Cautions regarding the official language of EU countries. For equipment that will be installed in EU countries, the language used for the manuals, warning labels, operation screen characters, and CE declarations is English only. Warning labels only have pictograms or else include warning messages in English. In the latter case, messages in Japanese or other languages might be added.

It is not possible to list all safety items in detail within the limited space of this manual. So please note that it is essential that the user have a full knowledge of safety and also make correct judgments on safety procedures.

2. Signal words used in this manual

This manual uses the following safety alert symbols and signal words to provide safety instructions that must be observed and to describe handling precautions, prohibited actions, and compulsory actions. Make sure you understand the meaning of each symbol and signal word and then read this manual.



DANGER

THIS INDICATES AN IMMEDIATELY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.



WARNING

THIS INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY.



CAUTION

This indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury, or damage to the equipment.



NOTE

Explains the key point in the operation in a simple and clear manner.

3. Warning labels

Warning labels are attached to the robot body. To ensure correct use, read the warning labels and comply with the instructions.

3.1 Warning labels



WARNING

IF WARNING LABELS ARE REMOVED OR DIFFICULT TO SEE, THEN THE NECESSARY PRECAUTIONS MAY NOT BE TAKEN, RESULTING IN AN ACCIDENT.

- DO NOT REMOVE, ALTER OR STAIN THE WARNING LABELS ON THE ROBOT BODY.
- DO NOT ALLOW WARNING LABELS TO BE HIDDEN BY DEVICES INSTALLED ON THE ROBOT BY THE USER.
- PROVIDE PROPER LIGHTING SO THAT THE SYMBOLS AND INSTRUCTIONS ON THE WARNING LABELS CAN BE CLEARLY SEEN FROM OUTSIDE THE SAFETY ENCLOSURE.

3.1.1 Contents of warning label messages

Word messages on the danger, warning and caution labels are concise and brief instructions. For more specific instructions, read and follow the "Instructions on this label" described on the right of each label shown below.

1. Warning label 1



DANGER

SERIOUS INJURY MAY RESULT FROM CONTACT WITH A MOVING ROBOT.

- KEEP OUTSIDE OF THE ROBOT SAFETY ENCLOSURE DURING OPERATION.
- PRESS THE EMERGENCY STOP BUTTON BEFORE ENTERING THE SAFETY ENCLOSURE.

Instructions on this label	
	<ul style="list-style-type: none"> • Always install a safety enclosure to keep all persons away from the robot movement range and prevent injury from contacting the moving part of the robot. • Install an interlock that triggers emergency stop when the door or gate of the safety enclosure is opened. • The safety enclosure should be designed so that no one can enter inside except from the door or gate equipped with an interlock device. • Warning label 1 that comes supplied with a robot should be affixed to an easy-to-see location on the door or gate of the safety enclosure.
Potential hazard to human body	Serious injury may result from contact with a moving robot.
To avoid hazard	<ul style="list-style-type: none"> • Keep outside of the robot safety enclosure during operation. • Press the emergency stop button before entering the safety enclosure.

2. Warning label 2



WARNING

MOVING PARTS CAN PINCH OR CRUSH HANDS.

KEEP HANDS AWAY FROM THE MOVABLE PARTS OF THE ROBOT.

Instructions on this label	
	<p>Use caution to prevent hands and fingers from being pinched or crushed by the movable parts of the robot when transporting or moving the robot or during teaching.</p>
Potential hazard to human body	Moving parts can pinch or crush hands.
To avoid hazard	Keep hands away from the movable parts of the robot.

3. Warning label 3



WARNING

IMPROPER INSTALLATION OR OPERATION MAY CAUSE SERIOUS INJURY.
BEFORE INSTALLING OR OPERATING THE ROBOT, READ THE MANUAL AND INSTRUCTIONS ON THE WARNING LABELS AND UNDERSTAND THE CONTENTS.

Instructions on this label	
	<ul style="list-style-type: none"> • Be sure to read the warning label and this manual carefully to make you completely understand the contents before attempting installation and operation of the robot. • Before starting the robot operation, even after you have read through this manual, read again the corresponding procedures and "Safety instructions" in this manual. • Never install, adjust, inspect or service the robot in any manner that does not comply with the instructions in this manual.
Potential hazard to human body	Improper installation or operation may cause serious injury.
To avoid hazard	Before installing or operating the robot, read the manual and instructions on the warning labels and understand the contents.

3.1.2 Supplied warning label



CAUTION

Attach the warning label that has been included in the robot at shipment to a legible location close to the robot, such as entrance of the safety enclosure.

3.2 Warning symbols

Warning symbols shown below are attached to the robot body to alert the operator to potential hazards. To use the OMRON robot safely and correctly always follow the instructions and cautions indicated by the symbols.

1. Electrical shock hazard symbol



WARNING

TOUCHING THE TERMINAL BLOCK OR CONNECTOR MAY CAUSE ELECTRICAL SHOCK, SO USE CAUTION.

	Instructions by this symbol
	<p>This indicates a high voltage is present. Touching the terminal block or connector may cause electrical shock.</p>

2. High temperature hazard symbol



WARNING

MOTORS, HEATSINKS, AND REGENERATIVE UNITS BECOME HOT, SO DO NOT TOUCH THEM.

	Instructions by this symbol
	<p>This indicates the area around this symbol may become very hot. Motors, heatsinks, and regenerative units become hot during and shortly after operation. To avoid burns be careful not to touch those sections.</p>

4. Major precautions for each stage of use

This section describes major precautions that must be observed when using robots. Be sure to carefully read and comply with all of these precautions even if there is no alert symbol shown.

4.1 Precautions for using robots

General precautions for using robots are described below.

1. Applications where robots cannot be used

OMRON robots are designed as general-purpose industrial equipment and cannot be used for the applications listed below.



DANGER

ROBOTS ARE DESIGNED AS GENERAL-PURPOSE INDUSTRIAL EQUIPMENT AND CANNOT BE USED FOR THE FOLLOWING APPLICATIONS.

- IN MEDICAL EQUIPMENT SYSTEMS WHICH ARE CRITICAL TO HUMAN LIFE
- IN SYSTEMS THAT SIGNIFICANTLY AFFECT SOCIETY AND THE GENERAL PUBLIC
- IN EQUIPMENT INTENDED TO CARRY OR TRANSPORT PEOPLE
- IN ENVIRONMENTS WHICH ARE SUBJECT TO VIBRATION SUCH AS ONBOARD SHIPS AND VEHICLES.

2. Qualification of operators/workers

Operators or persons who handle the robot such as for teaching, programming, movement check, inspection, adjustment, and repair must receive appropriate training and also have the skills needed to perform the job correctly and safely. They must read the manual carefully to understand its contents before attempting the robot operation or maintenance.

Tasks related to industrial robots (teaching, programming, movement check, inspection, adjustment, repair, etc.) must be performed by qualified persons who meet requirements established by local regulations and standards for industrial robots.



WARNING

- THE ROBOT MUST BE OPERATED ONLY BY PERSONS WHO HAVE RECEIVED SAFETY AND OPERATION TRAINING. OPERATION BY AN UNTRAINED PERSON IS EXTREMELY HAZARDOUS.
- ADJUSTMENT AND MAINTENANCE BY REMOVING A COVER REQUIRE SPECIALIZED TECHNICAL KNOWLEDGE AND SKILLS, AND MAY ALSO INVOLVE HAZARDS IF ATTEMPTED BY AN UNSKILLED PERSON. THESE TASKS MUST BE PERFORMED ONLY BY PERSONS WHO HAVE ENOUGH ABILITY AND QUALIFICATIONS IN ACCORDANCE WITH LOCAL LAWS AND REGULATIONS. FOR DETAILED INFORMATION, PLEASE CONTACT YOUR DISTRIBUTOR WHERE YOU PURCHASED THE PRODUCT.

4.2 Design

1. Restricting the movement range



WARNING

SOFT LIMIT FUNCTION IS NOT A SAFETY-RELATED FUNCTION INTENDED TO PROTECT THE HUMAN BODY. ENSURE SAFETY BY INSTALLING A SAFETY ENCLOSURE AND SO ON.

2. Provide safety measures for end effector (gripper, etc.)



WARNING

- END EFFECTORS MUST BE DESIGNED AND MANUFACTURED SO THAT THEY CAUSE NO HAZARDS (SUCH AS A LOOSE WORKPIECE OR LOAD) EVEN IF POWER (ELECTRICITY, AIR PRESSURE, ETC.) IS SHUT OFF OR POWER FLUCTUATIONS OCCUR.
- IF THE OBJECT GRIPPED BY THE END EFFECTOR MIGHT POSSIBLY FLY OFF OR DROP, THEN PROVIDE APPROPRIATE SAFETY PROTECTION TAKING INTO ACCOUNT THE OBJECT SIZE, WEIGHT, TEMPERATURE, AND CHEMICAL PROPERTIES.

3. Provide adequate lighting

Provide enough lighting to ensure safety during work.

4. Install an operation status light



WARNING

INSTALL A SIGNAL LIGHT (SIGNAL TOWER) AT AN EASY-TO-SEE POSITION SO THAT THE OPERATOR WILL BE AWARE OF THE ROBOT STOP STATUS (TEMPORARILY STOPPED, EMERGENCY STOP, ERROR STOP, ETC.).

4.3 Moving and installation

■ Installation environment

1. Do not use in strong magnetic fields



WARNING

DO NOT USE THE ROBOT NEAR EQUIPMENT OR IN LOCATIONS THAT GENERATE STRONG MAGNETIC FIELDS. THE ROBOT MAY BREAK DOWN OR MALFUNCTION IF USED IN SUCH LOCATIONS.

2. Do not use in locations subject to possible electromagnetic interference, etc.



WARNING

DO NOT USE THE ROBOT IN LOCATIONS SUBJECT TO ELECTROMAGNETIC INTERFERENCE, ELECTROSTATIC DISCHARGE OR RADIO FREQUENCY INTERFERENCE. THE ROBOT MAY MALFUNCTION IF USED IN SUCH LOCATIONS CREATING HAZARDOUS SITUATIONS.

3. Do not use in locations exposed to flammable gases



WARNING

- OMRON ROBOTS ARE NOT DESIGNED TO BE EXPLOSION-PROOF.
- DO NOT USE THE ROBOTS IN LOCATIONS EXPOSED TO EXPLOSIVE OR INFLAMMABLE GASES, DUST PARTICLES OR LIQUID. FAILURE TO FOLLOW THIS INSTRUCTION MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH, OR LEAD TO FIRE.

■ Moving

1. Use caution to prevent pinching or crushing of hands or fingers



WARNING

KEEP YOUR HAND AWAY FROM THE ROBOT INSTALLATION SURFACE DURING MOVING. OTHERWISE, YOUR HAND IS ENTANGLED, CAUSING SERIOUS PERSONAL INJURY.

As instructed in Warning label 2, use caution to prevent hands or fingers from being pinched or crushed by movable parts when transporting or moving the robot. For details on warning labels, see "3. Warning labels" in "Safety instructions."

2. Take safety measures when moving the robot

To ensure safety when moving the DELTA robot, use the eyebolts that come with the robot. Refer to the Robot Manual for details.

■ Installation

1. Protect electrical wiring and hydraulic/pneumatic hoses

Install a cover or similar item to protect the electrical wiring and hydraulic/pneumatic hoses from possible damage.

2. Cautions on arm

In the installation work, do not hold the arm by your hand in case of an emergency.

■ Adjustment

1. Adjustment that requires removing a cover



WARNING

ADJUSTMENT BY REMOVING A COVER REQUIRE SPECIALIZED TECHNICAL KNOWLEDGE AND SKILLS, AND MAY ALSO INVOLVE HAZARDS IF ATEMPTED BY AN UNSKILLED PERSON. THESE TASKS MUST BE PERFORMED ONLY BY PERSONS WHO HAVE ENOUGH ABILITY AND QUALIFICATIONS IN ACORDANCE WITH LOCAL LAWS AND REGULATIONS. FOR DETAILED INFORMATION, PLEASE CONTACT YOUR DISTRIBUTOR WHERE YOU PURCHASED THE PRODUCT.

■ Wiring

1. Robot cable

After checking the specified combinations of the robot and controller, connect the robot and controller.

2. Wiring safety points



WARNING

ALWAYS SHUT OFF ALL PHASES OF THE POWER SUPPLY EXTERNALLY BEFORE STARTING INSTALLATION OR WIRING WORK. FAILURE TO DO THIS MAY CAUSE ELECTRICAL SHOCK OR PRODUCT DAMAGE.



CAUTION

- Do not apply excessive impacts or loads to the connectors when making cable connections. This might bend the connector pins or damage the internal PC board.
- When disconnecting the cable from the robot, do not hold the cable and pull it out by hand. Loosen the screws on the connector (if fastened with the screws), and then disconnect the cable. Trying to detach by pulling on the cable itself may damage the connector or cables, and poor cable contact will cause the controller or robot to malfunction.

3. Precautions for cable routing and installation



CAUTION

- Be sure to store the cables connected to the robot in the duct or clamp them securely in place. If the cables are not stored in a conduit or properly clamped, excessive play or movement or mistakenly pulling on the cable may damage the connector or cables, and poor cable contact will cause the controller or robot to malfunction.
- Do not modify the cables and do not place any heavy objects on them. Handle them carefully to avoid damage. Damaged cables may cause malfunction or electrical shock.
- If the cables connected to the controller may possibly become damaged, protect them with an appropriate cover, etc.
- Check that the control lines and communication cables are routed at a gap sufficiently away from main power supply circuits and power lines, etc. Bundling them together with power lines or close to power lines may cause faulty operation due to noise.

4. Protective measures against electrical shock



WARNING

BE SURE TO GROUND THE CONTROLLER USING THE GROUND TERMINAL ON THE POWER TERMINAL BLOCK. POOR GROUNDING MAY CAUSE ELECTRICAL SHOCK.

4.4 Safety measures

4.4.1 Safety measures

1. Referring to warning labels and manual



WARNING

- BEFORE STARTING INSTALLATION OR OPERATION OF THE ROBOT, BE SURE TO READ THE WARNING LABELS AND THIS MANUAL, AND COMPLY WITH THE INSTRUCTIONS.
- NEVER ATTEMPT ANY REPAIR, PARTS REPLACEMENT AND MODIFICATION UNLESS DESCRIBED IN THIS MANUAL. THESE TASKS REQUIRE SPECIALIZED TECHNICAL KNOWLEDGE AND SKILLS AND MAY ALSO INVOLVE HAZARDS. PLEASE CONTACT YOUR DISTRIBUTOR FOR ADVICE.



NOTE

For details on warning labels, see "3. Warning labels" in "Safety instructions."

2. Draw up "work instructions" and make the operators/workers understand them



WARNING

DECIDE ON "WORK INSTRUCTIONS" IN CASES WHERE PERSONNEL MUST WORK WITHIN THE ROBOT SAFETY ENCLOSURE TO PERFORM STARTUP OR MAINTENANCE WORK. MAKE SURE THE WORKERS COMPLETELY UNDERSTAND THESE "WORK INSTRUCTIONS".

Decide on "work instructions" for the following items in cases where personnel must work within the robot safety enclosure to perform teaching, maintenance or inspection tasks. Make sure the workers completely understand these "work instructions".

1. Robot operating procedures needed for tasks such as startup procedures and handling switches
2. Robot speeds used during tasks such as teaching
3. Methods for workers to signal each other when two or more workers perform tasks
4. Steps that the worker should take when a problem or emergency occurs
5. Steps to take after the robot has come to a stop when the emergency stop device was triggered, including checks for cancelling the problem or error state and safety checks in order to restart the robot.
6. In cases other than above, the following actions should be taken as needed to prevent hazardous situations due to sudden or unexpected robot operation or faulty robot operation as listed below.
 - Place a display sign on the operator panel
 - Ensure the safety of workers performing tasks within the robot safety enclosure
 - Clearly specify position and posture during work
 - Specify a position and posture where worker can constantly check robot movements and immediately move to avoid trouble if an error/problem occurs
 - Take noise prevention measures
 - Use methods for signaling operators of related equipment
 - Use methods to decide that an error has occurred and identify the type of error

Implement the "work instructions" according to the type of robot, installation location, and type of work task.

When drawing up the "work instructions", make an effort to include opinions from the workers involved, equipment manufacturer technicians, and workplace safety consultants, etc.

3. Take safety measures



DANGER

- NEVER ENTER THE ROBOT MOVEMENT RANGE WHILE THE ROBOT IS OPERATING OR THE MAIN POWER IS TURNED ON. FAILURE TO FOLLOW THIS WARNING MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH. INSTALL A SAFETY ENCLOSURE OR A GATE INTERLOCK WITH AN AREA SENSOR TO KEEP ALL PERSONS AWAY FROM THE ROBOT MOVEMENT RANGE.
- WHEN IT IS NECESSARY TO OPERATE THE ROBOT WHILE YOU ARE WITHIN THE ROBOT MOVEMENT RANGE SUCH AS FOR TEACHING OR MAINTENANCE/INSPECTION TASKS, BE SURE TO INSTALL AN ENABLE DEVICE IN THE EXTERNAL SAFETY CIRCUIT SO THAT YOU CAN IMMEDIATELY STOP THE ROBOT OPERATION IN CASE OF AN ABNORMAL OR HAZARDOUS CONDITION. ADDITIONALLY, SET THE ROBOT MOVING SPEED SO THAT IT COMPLIES WITH THE ROBOT SAFETY STANDARDS.

**WARNING**

- DURING STARTUP OR MAINTENANCE TASKS, DISPLAY A SIGN STATING "WORK IN PROGRESS " ON THE OPERATION PANEL OR LOCK THE COVER OF THE OPERATION PANEL IN ORDER TO PREVENT ANYONE OTHER THAN THE PERSON FOR THAT TASK FROM MISTAKENLY OPERATING THE START OR SELECTOR SWITCH.
- ALWAYS CONNECT THE ROBOT AND ROBOT CONTROLLER IN THE CORRECT COMBINATION. USING THEM IN AN INCORRECT COMBINATION MAY CAUSE FIRE OR BREAKDOWN.

4. Install brake release circuit

The DELTA robot is equipped with a brake release switch for the manual teaching or maintenance inspection. To use this brake release switch, it is also necessary to install a brake release circuit on the user side. For details, see "4.2 Wiring the brake release wire connector" in Chapter 2.

**WARNING**

WHEN PERFORMING THE TEACHING OR MAINTENANCE INSPECTION MANUALLY, INSTALL THE BRAKE RELEASE CIRCUIT TO ENSURE THE SAFETY.

5. Install system

When configuring an automated system using a robot, hazardous situations are more likely to occur from the automated system than the robot itself. So the system manufacturer should install the necessary safety measures required for the individual system. The system manufacturer should provide a proper manual for safe, correct operation and servicing of the system.

**WARNING**

TO CHECK THE ROBOT CONTROLLER OPERATING STATUS, REFER TO THE RELATED MANUALS. DESIGN AND INSTALL THE SYSTEM INCLUDING THE ROBOT CONTROLLER SO THAT IT WILL ALWAYS WORK SAFELY.

6. Do not modify

**WARNING**

NEVER ATTEMPT TO MODIFY THE ROBOT. DO NOT OPEN ANY COVER. DOING SO MAY CAUSE ELECTRICAL SHOCK, BREAKDOWN, MALFUNCTION, INJURY, OR FIRE.

4.4.2 Installing a safety enclosure

Be sure to install a safety enclosure to keep anyone from entering within the movement range of the robot. The safety enclosure will prevent the operator and other persons from coming in contact with moving parts of the robot and suffering injury.

**DANGER**

- SERIOUS INJURY MAY RESULT FROM CONTACT WITH A MOVING ROBOT.
- KEEP OUTSIDE OF THE ROBOT SAFETY ENCLOSURE DURING OPERATION.
 - PRESS THE EMERGENCY STOP BUTTON BEFORE ENTERING THE SAFETY ENCLOSURE.

**WARNING**

- INSTALL AN INTERLOCK THAT TRIGGERS EMERGENCY STOP WHEN THE DOOR OR GATE OF THE SAFETY ENCLOSURE IS OPENED.
- THE SAFETY ENCLOSURE SHOULD BE DESIGNED SO THAT NO ONE CAN ENTER INSIDE EXCEPT FROM THE DOOR OR GATE EQUIPPED WITH AN INTERLOCK DEVICE.
- WARNING LABEL 1 (SEE "3. WARNING LABELS" IN "SAFETY INSTRUCTIONS") THAT COMES SUPPLIED WITH A ROBOT SHOULD BE AFFIXED TO AN EASY-TO-SEE LOCATION ON THE DOOR OR GATE OF THE SAFETY ENCLOSURE.

4.5 Operation

When operating a robot, ignoring safety measures and checks may lead to serious accidents. Always take the following safety measures and checks to ensure safe operation.



DANGER

CHECK THE FOLLOWING POINTS BEFORE STARTING ROBOT OPERATION.

- NO ONE IS WITHIN THE ROBOT SAFETY ENCLOSURE.
- THE ROBOT AND PERIPHERAL EQUIPMENT ARE IN GOOD CONDITION.

4.5.1 Trial operation

After installing, adjusting, inspecting, maintaining, or repairing the robot, check the trial operation items stated in the controller manual and perform the trial operation while strictly observing the instructions.

4.5.2 Automatic operation

To perform the automatic operation, follow the instructions stated in the controller manual.

4.5.3 Precautions during operation

1. When the robot is damaged or an abnormal condition occurs



WARNING

- IF UNUSUAL ODORS, NOISE OR SMOKE OCCUR DURING OPERATION, IMMEDIATELY TURN OFF POWER TO PREVENT POSSIBLE ELECTRICAL SHOCK, FIRE OR BREAKDOWN. STOP USING THE ROBOT AND CONTACT YOUR DISTRIBUTOR.
- IF ANY OF THE FOLLOWING DAMAGE OR ABNORMAL CONDITIONS OCCURS THE ROBOT, THEN CONTINUING TO OPERATE THE ROBOT IS DANGEROUS. IMMEDIATELY STOP USING THE ROBOT AND CONTACT YOUR DISTRIBUTOR.

Damage or abnormal condition	Type of danger
Damage to machine harness or robot cable	Electrical shock, robot malfunction
Damage to robot exterior	Damaged parts fly off during robot operation
Abnormal robot operation (position deviation, vibration, etc.)	Robot malfunction
α -axis, β -axis or γ -axis brake malfunction	Shaft or movable base falling or related part fly off

2. High temperature hazard



WARNING

- DO NOT TOUCH THE ROBOT DURING OPERATION. THE ROBOT BODY IS VERY HOT DURING OPERATION, SO BURNS MAY OCCUR IF YOU TOUCH THESE SECTIONS.
- THE MOTOR AND SPEED REDUCTION GEAR CASING ARE VERY HOT SHORTLY AFTER OPERATION, SO BURNS MAY OCCUR IF THESE ARE TOUCHED. BEFORE TOUCHING THOSE PARTS FOR INSPECTIONS OR SERVICING, TURN OFF THE CONTROLLER, WAIT FOR A WHILE AND CHECK THAT THEIR TEMPERATURE HAS COOLED.

3. Use caution when releasing the α -axis, β -axis or γ -axis brake

To release the brake, it is necessary to install a brake release circuit on the user side.



WARNING

- THE α -AXIS, β -AXIS OR γ -AXIS WILL SLIDE DOWNWARD WHEN THE BRAKE IS RELEASED, CAUSING A HAZARDOUS SITUATION. TAKE ADEQUATE SAFETY MEASURES BY TAKING THE WEIGHT AND SHAPE INTO ACCOUNT.
- BEFORE RELEASING THE BRAKE AFTER PRESSING THE EMERGENCY STOP BUTTON, PLACE A SUPPORT UNDER THE α -AXIS, β -AXIS OR γ -AXIS SO THAT IT WILL NOT SLIDE DOWN.
- WHEN PERFORMING TASKS (DIRECT TEACHING, ETC.) WITH THE BRAKE RELEASED, RELEASE THE BRAKE OF ONLY NECESSARY AXIS AND BE CAREFUL NOT TO LET YOUR BODY GET CAUGHT BETWEEN THE MOVABLE BASE AND THE INSTALLATION BASE.

4. If the α -axis, β -axis, γ -axis or θ -axis rotation angle is small



WARNING

IF THE α -AXIS, β -AXIS, γ -AXIS OR θ -AXIS ROTATION ANGLE IS SET SMALLER THAN 5 DEGREES, THEN IT WILL ALWAYS MOVE WITHIN THE SAME POSITION, IT BECOMES DIFFICULT TO FORM AN OIL FILM ON THE SPEED REDUCTION GEAR. THIS MAY SHORTEN THE SERVICE LIFE OF THE SPEED REDUCTION GEAR. IN THIS TYPE OF OPERATION, ADD A RANGE OF MOTION SO THAT EACH AXIS MOVES THROUGH 120 DEGREES OR MORE ABOUT 5 TIMES A DAY.

4.6 Inspection and maintenance

Always perform daily and periodic inspections and make a pre-operation check to ensure there are no problems with the robot and related equipment. If a problem or abnormality is found, then promptly repair it or take other measures as necessary.

Keep a record of periodic inspections or repairs and store this record for at least 3 years.

4.6.1 Before inspection and maintenance work

1. Do not attempt any work or operation unless described in this manual.

Never attempt any work or operation unless described in this manual.



WARNING

NEVER ATTEMPT INSPECTION, MAINTENANCE, REPAIR, AND PART REPLACEMENT UNLESS DESCRIBED IN THIS MANUAL. THESE TASKS REQUIRE SPECIALIZED TECHNICAL KNOWLEDGE AND SKILLS AND MAY ALSO INVOLVE HAZARDS. PLEASE BE SURE TO CONTACT YOUR DISTRIBUTOR FOR ADVICE.

2. Precautions during repair and parts replacement



WARNING

IF IT IS ABSOLUTELY REQUIRED TO REPAIR OR REPLACE ANY PART OF THE ROBOT, PLEASE BE SURE TO CONTACT YOUR DISTRIBUTOR AND FOLLOW THE INSTRUCTIONS THEY PROVIDE. INSPECTION AND MAINTENANCE OF THE ROBOT BY AN UNSKILLED OR UNTRAINED PERSON IS EXTREMELY HAZARDOUS.

Adjustment, maintenance and parts replacement require specialized technical knowledge and skills, and also may involve hazards. These tasks must be performed only by persons who have enough ability and qualifications required by local laws and regulations.



WARNING

ADJUSTMENT AND MAINTENANCE BY REMOVING A COVER REQUIRE SPECIALIZED TECHNICAL KNOWLEDGE AND SKILLS, AND MAY ALSO INVOLVE HAZARDS IF ATTEMPTED BY AN UNSKILLED PERSON. FOR DETAILED INFORMATION, PLEASE CONTACT YOUR DISTRIBUTOR WHERE YOU PURCHASED THE PRODUCT.

3. Shut off all phases of power supply



WARNING

ALWAYS SHUT OFF ALL PHASES OF THE POWER SUPPLY EXTERNALLY BEFORE CLEANING THE ROBOT AND CONTROLLER OR SECURELY TIGHTENING THE TERMINAL SCREWS ETC. FAILURE TO DO THIS MAY CAUSE ELECTRICAL SHOCK OR PRODUCT DAMAGE OR MALFUNCTION.

4. Allow a waiting time after power is shut off (Allow time for temperature and voltage to drop)



WARNING

THE MOTOR AND SPEED REDUCTION GEAR CASING ARE VERY HOT SHORTLY AFTER OPERATION, SO BURNS MAY OCCUR IF THEY ARE TOUCHED. BEFORE TOUCHING THOSE PARTS FOR INSPECTIONS OR SERVICING, TURN OFF THE CONTROLLER, WAIT FOR A WHILE AND CHECK THAT THE TEMPERATURE HAS COOLED.

4.6.2 Precautions during service work

1. Precautions when removing a motor



WARNING

THE α -AXIS, β -AXIS OR γ -AXIS WILL SLIDE DOWNWARD WHEN THE MOTOR IS REMOVED, CAUSING A HAZARDOUS SITUATION .

- TURN OFF THE CONTROLLER AND PLACE A SUPPORT UNDER THE α -AXIS, β -AXIS OR γ -AXIS BEFORE REMOVING THE MOTOR.
 - BE CAREFUL NOT TO LET YOUR BODY GET CAUGHT BETWEEN THE MOVABLE BASE AND THE INSTALLATION BASE.
-

4.7 Disposal

When disposing of robots and related items, handle them carefully as industrial wastes. Use the correct disposal method in compliance with your local regulations, or entrust disposal to a licensed industrial waste disposal company.

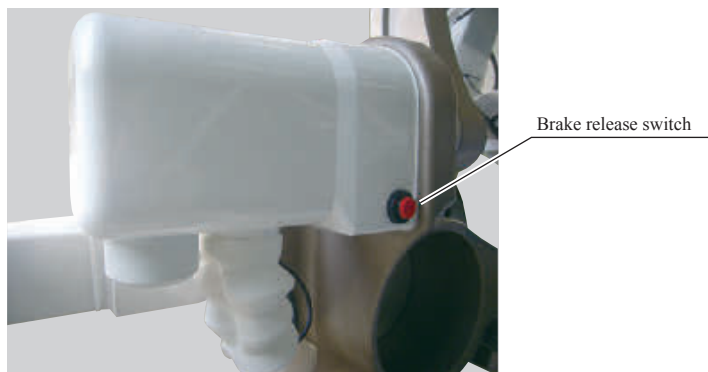
1. Disposal of packing boxes and materials

When disposing of packing boxes and materials, use the correct disposal method in compliance with your local regulations. We do not collect and dispose of the used packing boxes and materials.

5. Emergency action when a person is caught by robot

If a person is caught in between the robot and mechanical section, such as installation base, use the brake release switch on the robot main unit to release the axis.

Brake release switch



As the robot is put in the emergency stop state, the robot drive power is shut down. However, the axis cannot be moved since the brake is activated. So, release the brake, and then push the axis by hand to move it.



WARNING

THE α -AXIS, β -AXIS OR γ -AXIS WILL SLIDE DOWNWARD WHEN THE BRAKE IS RELEASED, CAUSING A HAZARDOUS SITUATION.

- BEFORE RELEASING THE BRAKE, BE SURE TO PLACE A SUPPORT UNDER THE α -AXIS, β -AXIS OR γ -AXIS SO THAT IT WILL NOT SLIDE DOWN.
- WHEN RELEASING THE BRAKE, BE CAREFUL NOT TO LET YOUR BODY GET CAUGHT BETWEEN THE MOVABLE BASE AND THE INSTALLATION BASE.



CAUTION

Release the brake axis-by-axis.



NOTE

For details about the brake release wire connector, see “4.2 Wiring the brake release wire connector” in Chapter 2.

6. Using the robot safely

6.1 Robot protective functions

1. Soft limits

Soft limits can be set on each axis to limit the working envelope in manual operation after return-to-origin and during automatic operation. The working envelope is the area limited by soft limits.



WARNING

SOFT LIMIT FUNCTION IS NOT A SAFETY-RELATED FUNCTION INTENDED TO PROTECT THE HUMAN BODY. ENSURE SAFETY BY INSTALLING A SAFETY ENCLOSURE AND SO ON.

2. α -axis, β -axis or γ -axis brakes

An electromagnetic brake is installed on the α -axis, β -axis and γ -axis to prevent them from sliding downward when the servo is OFF.



WARNING

THE α -AXIS, β -AXIS OR γ -AXIS WILL SLIDE DOWNWARD WHEN THE BRAKE IS RELEASED, CAUSING A HAZARDOUS SITUATION. TAKE ADEQUATE SAFETY MEASURES BY TAKING THE WEIGHT AND SHAPE INTO ACCOUNT.

- BEFORE RELEASING THE BRAKE AFTER PRESSING THE EMERGENCY STOP BUTTON, PLACE A SUPPORT UNDER THE α -AXIS, β -AXIS OR γ -AXIS SO THAT IT WILL NOT SLIDE DOWN.
- WHEN PERFORMING TASKS (DIRECT TEACHING, ETC.) WITH THE BRAKE RELEASED, BE CAREFUL NOT TO LET YOUR BODY GET CAUGHT BETWEEN THE MOVABLE BASE AND THE INSTALLATION BASE.

6.2 Residual risk

To ensure safe and correct use of OMRON robots, System integrators and/or end users implement the machinery safety design that conforms to ISO12100 or JIS9700-1/2.

Residual risks for OMRON robots are described in the DANGER or WARNING instructions provided in each chapter and section. So, read them carefully.

6.3 Special training for industrial robot operation

Operators or persons who handle the robot for tasks such as for teaching, programming, movement checks, inspections, adjustments, and repairs must receive appropriate training and also have the skills needed to perform the job correctly and safely. They must also read the manual carefully to understand its contents before attempting the robot operation or maintenance.

Tasks related to industrial robots (teaching, programming, movement check, inspection, adjustment, repair, etc.) must be performed by qualified persons who meet requirements established by local regulations and safety standards for industrial robots.

Comparison of terms used in this manual with ISO

This manual	ISO 10218-1	Note
Maximum movement range	maximum space	Area limited by mechanical stoppers.
Movement range	restricted space	Area limited by movable mechanical stoppers.
Working envelope	operational space	Area limited by software limits.
Within safety enclosure	safeguarded space	

Warranty

For information on the warranty period and terms, please contact our distributor where you purchased the product.

■ This warranty does not cover any failure caused by:

1. Installation, wiring, connection to other control devices, operating methods, inspection or maintenance that does not comply with industry standards or instructions specified in the OMRON manual;
2. Usage that exceeded the specifications or standard performance shown in the OMRON manual;
3. Product usage other than intended by OMRON;
4. Storage, operating conditions and utilities that are outside the range specified in the manual;
5. Damage due to improper shipping or shipping methods;
6. Accident or collision damage;
7. Installation of other than genuine OMRON parts and/or accessories;
8. Modification to original parts or modifications not conforming to standard specifications designated by OMRON, including customizing performed by OMRON in compliance with distributor or customer requests;
9. Pollution, salt damage, condensation;
10. Fires or natural disasters such as earthquakes, tsunamis, lightning strikes, wind and flood damage, etc;
11. Breakdown due to causes other than the above that are not the fault or responsibility of OMRON;
12. Electrical shock when the user installs the actuator, etc. on the movable base or end effector in the 3-axis specifications.

■ The following cases are not covered under the warranty:

1. Products whose serial number or production date (month & year) cannot be verified.
2. Changes in software or internal data such as programs or points that were created or changed by the customer.
3. Products whose trouble cannot be reproduced or identified by OMRON.
4. Products utilized, for example, in radiological equipment, biological test equipment applications or for other purposes whose warranty repairs are judged as hazardous by OMRON.

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year after the date of manufacturing as shown on the product serial number plate.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NONINFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUERIMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE OR INAPPROPRIATE MODIFICATION OR REPAIR.



Introduction

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Before using the robot (Be sure to read the following notes.)

Thank you for your purchase of this OMRON Delta robot.

1. Before using the robot, first perform the following checks and procedures.

If the following procedures are performed, it will not be possible to set the robot origin position to the same position as the default factory setting. Consequently, it will be necessary to adjust the origin position and the robot may operate abnormally (vibration, noise) or malfunction. Sufficient caution is therefore advised.

- Arm removal (arm position change)

The Delta robot origin position is adjusted at the factory beforehand using the jig (calibration tool) provided.

Perform the following procedure if the arm position is changed for such reasons as bending the arm when installing the robot in order to pass through the factory.

- Adjust the arm position to the origin position with the calibration tool.

(Refer to "2. Adjusting the origin" in Chapter 3 of this manual.)

2. Repetitive positioning accuracy

"Repetitive positioning accuracy" is not guaranteed under the following conditions.

[1] Factors related to absolute accuracy

- If accuracy between the coordinate positions (command positions) inside the robot controller and the real space positions (moving positions) is required.

[2] Motion pattern factors

- If a motion approaching the teaching point from a different direction is included during repetitive operation.
- If the power is turned off or the robot is stopped before completing the motion or the moving speed is changed even when approaching the teaching point from the same direction.

[3] Temperature factors

- If the ambient temperature environment changes significantly.
- If the temperature of the robot body changes.

[4] Load variation factors

- If load conditions vary during operation (the load varies depending on whether or not the workpiece is present, etc.)

3. If the α -axis, β -axis, γ -axis or θ -axis rotation angle is small

If the α -axis, β -axis, γ -axis or θ -axis rotation angle is smaller than 5° so that it moves to almost the same position, it will be difficult for an oil film to form on the reduction gear, possibly leading to shortened gear lifetime. With this type of operation, add a movement so that the joint moves through 120° or more about 5 times a day.

4. α , β and γ -axis arm rotation range and tool movement area

The robot TCP (tool center point) movement area is larger than the actual movement area. Always set the robot movement area at the controller.

Furthermore, when the robot is making its maximum movement (including arm maximum rotation range), a sufficient space must be secured to avoid interference with user units.

If the above points are not observed, the robot may malfunction and collide with user units, resulting in possible damage to the robot.

Furthermore, the shafts, moveable base, or end effector may drop out, or be damaged and go flying.

(Refer to "7. Working envelope and maximum movement range" in Chapter 2 for details.)

5. Shaft and moveable base collision prevention

The robot may be damaged if the shaft and moveable base collide. Take care to ensure that they do not collide.

Introduction

The OMRON R6Y3 industrial robot is a high-speed, multi-joint (parallel link) industrial robot.

The R6Y3 parallel link mechanism features an α -axis, β -axis and γ -axis motor arranged at 120° intervals on a base, and realizes robot movement in the X, Y and Z directions by rotating each axis up and down at the point (TCP: tool center point) where each arm intersects in parallel. By adding a θ -axis to the tip, the tool can also be rotated ± 180 degrees in addition to the above mentioned movements. The R6Y3 industrial robot is ideal for specialized, high-speed work such as part transport or box packing.

This user's manual describes safety measures, handling, adjustment, inspection and maintenance of the R6Y3 robot to ensure correct, safe and effective use. Be sure to read this manual carefully before installing the robot. Even after reading this manual, keep it in a safe and convenient place for future reference. This user's manual should be used with the robot and considered an integral part of it. When the robot is moved, transferred or sold, send this manual to the new user along with the robot. Be sure to explain to the new user the need to read through this manual.

For details regarding robot operation, refer to the controller user's manual.

Chapter 1 **Functions**

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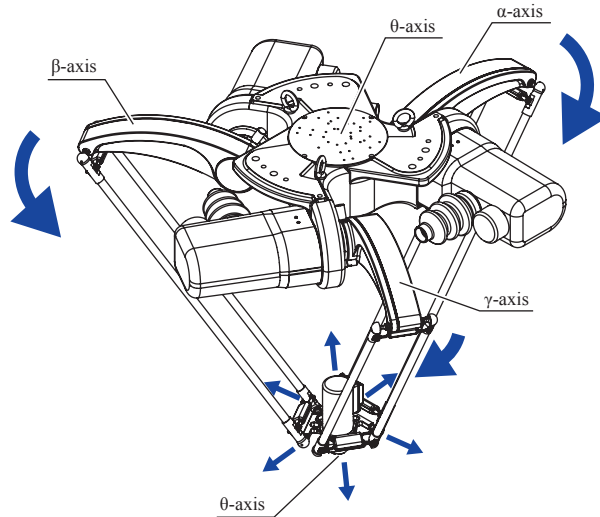
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1. Robot manipulator

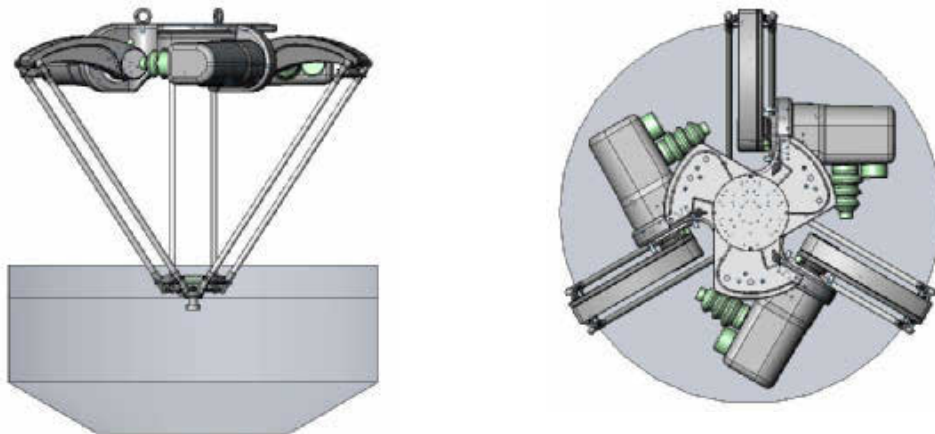
1.1 Manipulator movement

The R6Y3 robot consists of an α -axis, β -axis and γ -axis (arm, shaft), and a θ -axis (moveable base). With these 4 axes, the R6Y3 robot can move as shown in the Fig. below. By attaching different types of end effector (gripper) to the end, a wide range of tasks can be performed with high precision at high speeds.

Manipulator movement



Robot movement range

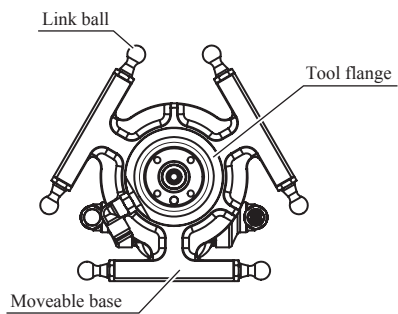
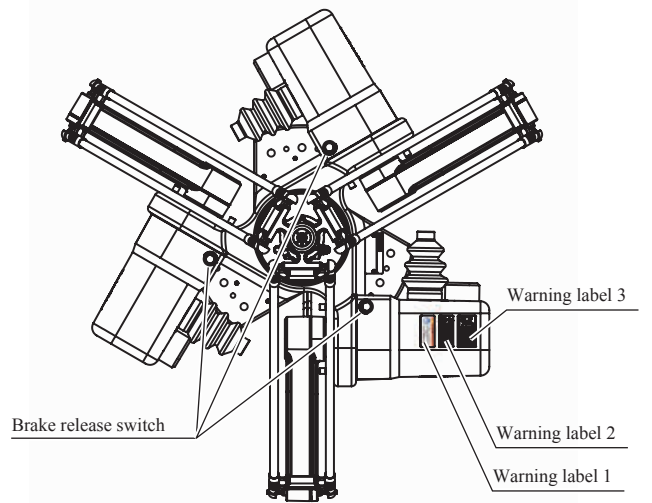
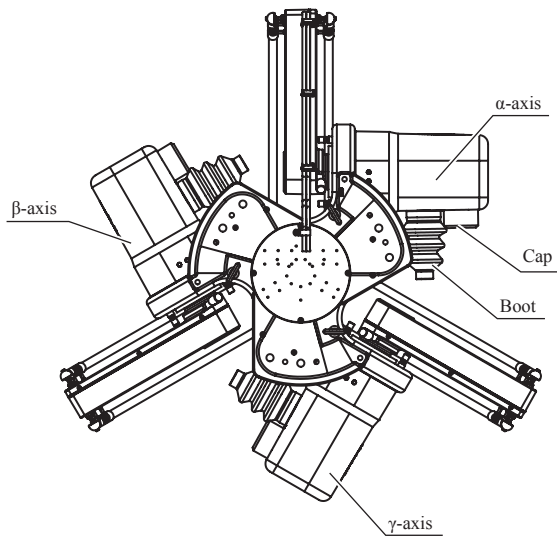
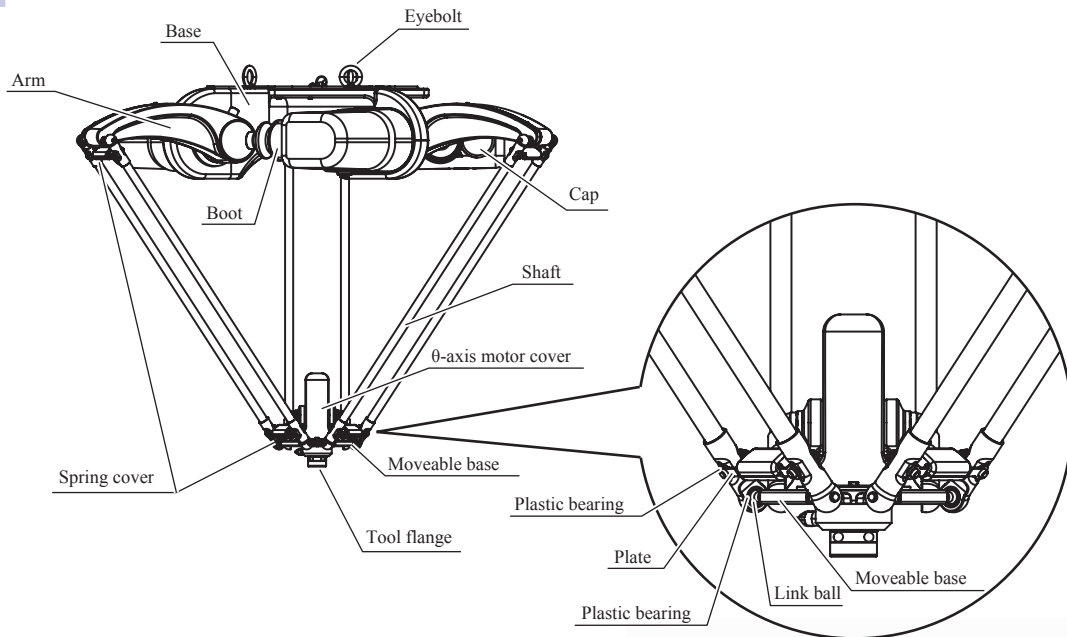


1.2 Part names

1

Functions

R6Y3



Chapter 2 Installation

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1. Robot installation conditions

1.1 Installation environments

Be sure to install the robot in the following environments.

Setting environments	Specifications
Allowable ambient temperature	0 to 45°C
Allowable ambient humidity	35 to 85% RH (non condensation)
Altitude	0 to 1000 meters above sea level
Ambient environments	Avoid installing near cutting water, oil, dust, metallic chips, or organic solvents.
	Avoid installation near corrosive gas and corrosive materials.
	Avoid installation in atmosphere containing inflammable gas, dust or liquid.
	Avoid installation near objects causing electromagnetic interference, electrostatic discharge or radio frequency interference.
Vibration	Do not subject to impacts or vibrations.
Air supply pressure, etc.	Below 0.6MPa (6.1kgf/cm ²); clean dry air not containing deteriorated compressor oil; filtration 40µm or less
Working space	Allow sufficient space margin to perform jobs (teaching, inspection, repair, etc.)



WARNING

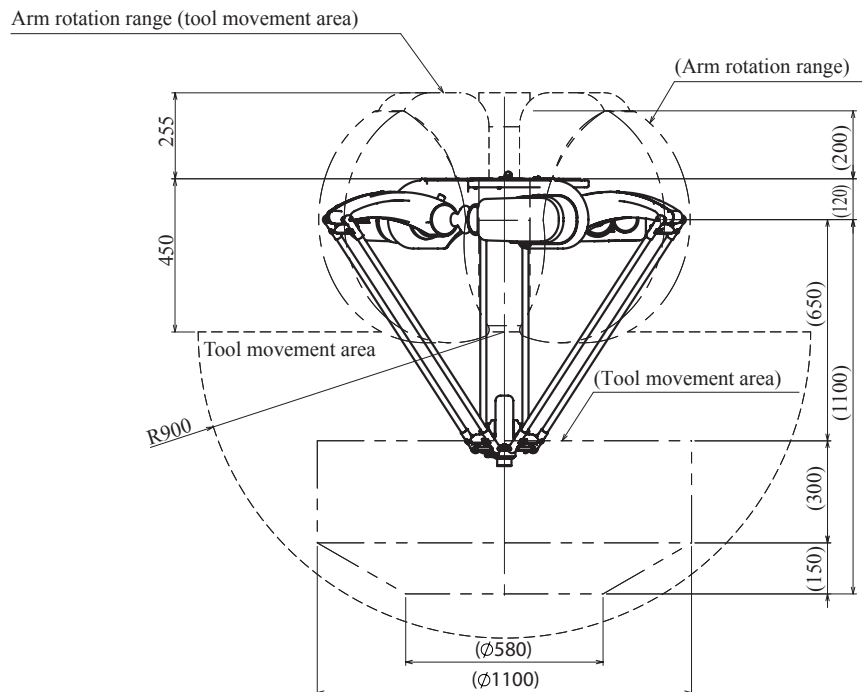
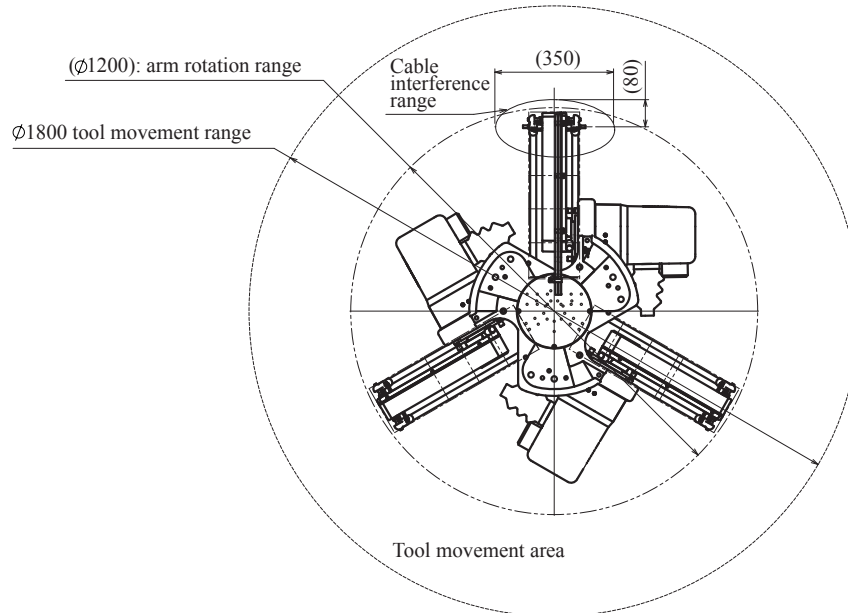
- AVOID INSTALLING THE ROBOT IN LOCATIONS WHERE THE AMBIENT CONDITIONS MAY EXCEED THE ALLOWABLE TEMPERATURE OR HUMIDITY, OR IN ENVIRONMENTS WHERE CORROSIVE GASES, METALLIC POWDER, OR DUST ARE GENERATED. MALFUNCTION, FAILURE OR SHORT CIRCUITS MAY OTHERWISE RESULT.
- THIS ROBOT WAS NOT DESIGNED FOR OPERATION IN ENVIRONMENTS WHERE INFLAMMABLE OR EXPLOSIVE SUBSTANCES ARE PRESENT.
- DO NOT USE THE ROBOT IN ENVIRONMENTS CONTAINING INFLAMMABLE GAS, DUST OR LIQUIDS. EXPLOSIONS OR FIRE COULD OTHERWISE RESULT.
- AVOID USING THE ROBOT IN LOCATIONS SUBJECT TO ELECTROMAGNETIC INTERFERENCE, ELECTROSTATIC DISCHARGE OR RADIO FREQUENCY INTERFERENCE. MALFUNCTION MAY OTHERWISE OCCUR.
- DO NOT USE THE ROBOT IN LOCATIONS SUBJECT TO EXCESSIVE VIBRATION. ROBOT INSTALLATION BOLTS MAY OTHERWISE BECOME LOOSE, CAUSING THE ROBOT TO FALL OVER.

1.2 Installation base

- Prepare a sufficiently rigid installation base. Using an insufficiently rigid base will result in vibrations and poor positioning.
- The arm movement area for each axis is above the robot base, and therefore the robot must not be installed on the ceiling, etc. The robot may malfunction if arms crash.

Installation base attachment surface instruction Parallelism: 0.5

Movement range



2. Installation

2.1 Unpacking



WARNING

THE ROBOT AND ITS ACCESSORIES ARE EXTREMELY HEAVY. TAKE SUFFICIENT CARE NOT TO DROP THEM DURING MOVING OR UNPACKING AS THIS MAY DAMAGE THE EQUIPMENT OR CAUSE BODILY INJURY.

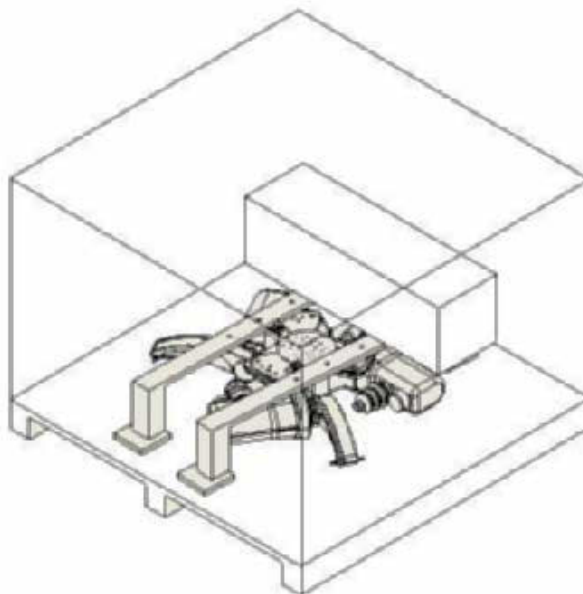


CAUTION

When moving the robot or controller by equipment such as a forklift that require a license, only properly qualified personnel may operate it. The equipment and tools used for moving the robot should be serviced daily.

The R6Y3 robot comes packed with arms, shafts, a moveable base, and accessories. Using a carrying cart (dolly) or forklift, move the package near the installation base. Take sufficient care not to apply shocks to the equipment when unpacking it.

Packed state



2.2 Checking the product

After unpacking, check the product configuration and conditions.



CAUTION

If there is any damage due to transportation or insufficient parts, please notify your distributor immediately.

Name	Q'ty	Remarks
Shafts	3	3 (α , β , γ -axes)
Spring covers	6	
Moveable base	1	
Calibration tool (α , β , γ -axes)	1	α , β , γ -axes home position adjustment jig, with bolts and washers
Calibration tool (θ -axis)	1	θ -axis home position adjustment jig
Brake release wire connector	1	
Plastic bearing replacement jig	1	Plastic bearing that slides toward link ball
Duct	1	
User's Manual	1	
Warning label (1)	1	

2.3 Moving the robot



WARNING

- SERIOUS INJURY MAY OCCUR IF THE ROBOT FALLS AND PINS SOMEONE UNDER IT.
 - DO NOT ALLOW ANY PART OF YOUR BODY TO ENTER THE AREA BENEATH THE ROBOT DURING WORK.
 - ALWAYS WEAR A HELMET, SAFETY SHOES AND GLOVES DURING WORK.
- CHECK THAT THERE ARE NO CRACKS OR CORROSION ON THE EYEBOLTS OR EYEBOLT INSTALLATION AREA. IF FOUND, DO NOT USE EYEBOLTS TO MOVE THE ROBOT.
- SCREW THE EYEBOLTS FIRMLY UNTIL THE BEARING SURFACE OF THE EYEBOLT MAKES TIGHT CONTACT WITH THE BEARING SURFACE ON THE BASE. EYEBOLTS ARE ALREADY FITTED WHEN THE ROBOT IS SHIPPED.
- USE A HOIST AND ROPE WITH CARRYING CAPACITY STRONG ENOUGH TO SUPPORT THE ROBOT WEIGHT.
- MAKE SURE THE ROPE STAYS SECURELY ON THE HOIST HOOK.
- AVOID DANGEROUS BEHAVIOR LIKELY TO UPSET THE BALANCE WHEN TRANSPORTING THE ROBOT.
- REMOVE THE SHAFTS, MOVEABLE BASE, AND LOAD FROM THE END OF THE ROBOT ARM. FAILURE TO REMOVE THESE LOADS MAY RESULT IN ROBOT MALFUNCTION.
- DO NOT APPLY FORCE TO THE ROBOT BODY.

WHEN UNPACKING THE ROBOT, PLEASE PAY ATTENTION TO THE FOLLOWING ADDITIONAL POINT.

- THE ARMS ARE ADJUSTED TO THEIR RESPECTIVE ORIGIN POSITIONS PRIOR TO SHIPPING AND THEREFORE SHOULD NOT BE TOUCHED.



CAUTION

- When moving the robot by equipment such as cranes that require a license, only properly qualified personnel may operate it.
- The equipment and tools used for moving the robot should be serviced daily.

Refer to "1.1 Basic specifications" in Chapter 5 for details on the robot weight.

2.3.1 Installing on base prepared by user



NOTE

The robot is fixed at the origin position when shipped from the factory.

1

Pass three ropes through the eyebolts and hang them on the hoist.

Use looped ropes with the same length to allow a good lifting balance.

2

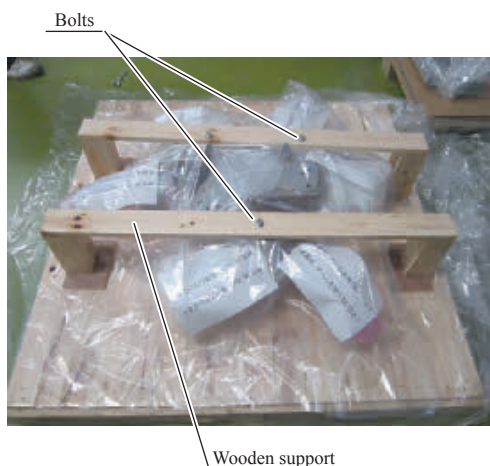
Remove the wooden screws securing the pallet and wooden supports.

3

Hold the robot, remove the bolts used to secure the wooden supports and robot body, and then remove the wooden supports.

Slightly lift the hoist so that the tension is lightly applied to each rope to hold the robot, and then remove the mounting bolts used to secure the wooden supports.

Wooden support, bolt removal



4

Move the robot.

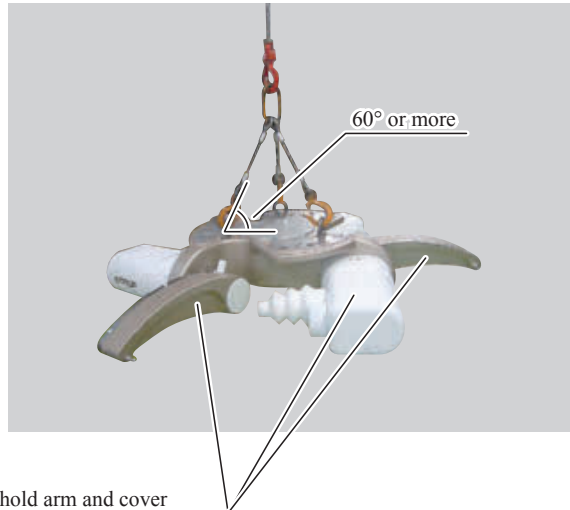
Move the robot carefully to the installation base, using care to keep the robot balanced, and avoid subjecting it to vibrations and shocks.

The rope angle at this time should be kept at 60° or more.

**CAUTION**

When moving the robot, do not hold the robot arm or robot cover. It may cause deviation of the origin position that has been adjusted and damage to the robot arm or robot cover.

Robot transportation



5

Temporarily secure the robot to the base by tightening the bolts.

Move the robot to the base prepared by the user and temporarily secure three points near each axis on the robot base with the bolts. Then temporarily tighten the remaining three bolts.

6

Fully tighten all six bolts.**NOTE**

Refer to "2.4 Installing the robot" in this chapter for details on bolt attachment direction and tightening torque.

7

Remove the ropes.**CAUTION**

- If removing the eyebolts, always attach bolts to protect the tapped eyebolt holes.
- Always store the eyebolts since they may be used to move the robot again.

2.3.2 Moving the robot to another installation base or removing the robot

1

Move the α -axis, β -axis and γ -axis to their respective origin positions.

2

Remove the screw cover, shafts, moveable base, and load from the end of the arm.

Refer to "9. Detaching or attaching the shafts, moveable base, and screw covers" in this chapter.

3 **Remove the duct and connector cover (cap, boot).**

4 **Disconnect the robot cable.**



CAUTION

After disconnecting the brake release wire connector, store the cover cable inside the cover.

5 **Remove the motor cover.**

Refer to "8. Detaching or attaching the covers" in this chapter before removing the cover.

6 **Pass three ropes through the eyebolts and hang them on the hoist.**

Use looped ropes with the same length to allow a good lifting balance.



CAUTION

Attach the eyebolts if they have been removed. Always use the eyebolts and a hoist when moving the robot. Failing to do so could cause bodily injury.

7 **Hold the robot and remove the mounting bolts.**

Slightly lift the hoist so that the tension is lightly applied to each rope to hold the robot, and then remove the base mounting bolts (if moving the robot to another base).

8 **Move the robot.**

Using caution to keep the balance of the robot and avoid subjecting it to any strong vibrations and shocks, carefully move the robot to the installation base.

The rope angle at this time should be kept at 60° or more.

9 **Temporarily secure the robot to the base by tightening the bolts.**

First, temporarily secure three points near each axis on the robot base with the bolts. Then temporarily tighten the remaining three bolts.

10 **Fully tighten all six bolts.**



NOTE

Refer to "2.4 Installing the robot" in this chapter for details on bolt attachment direction and tightening torque.

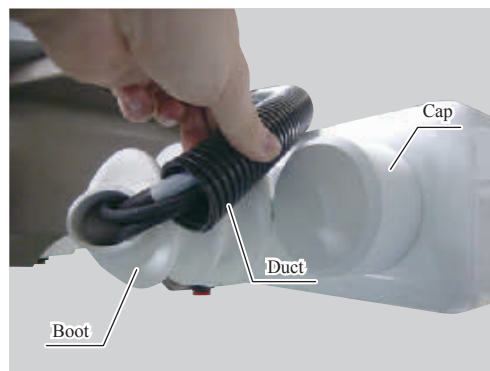
11 **Remove the ropes.**



CAUTION

- If removing the eyebolts, always attach bolts to protect the tapped eyebolt holes.
- Always store the eyebolts since they may be used to move the robot again.

Step 3 Duct, connector cover removal



Cap removal



Boot removal

2.4 Installing the robot

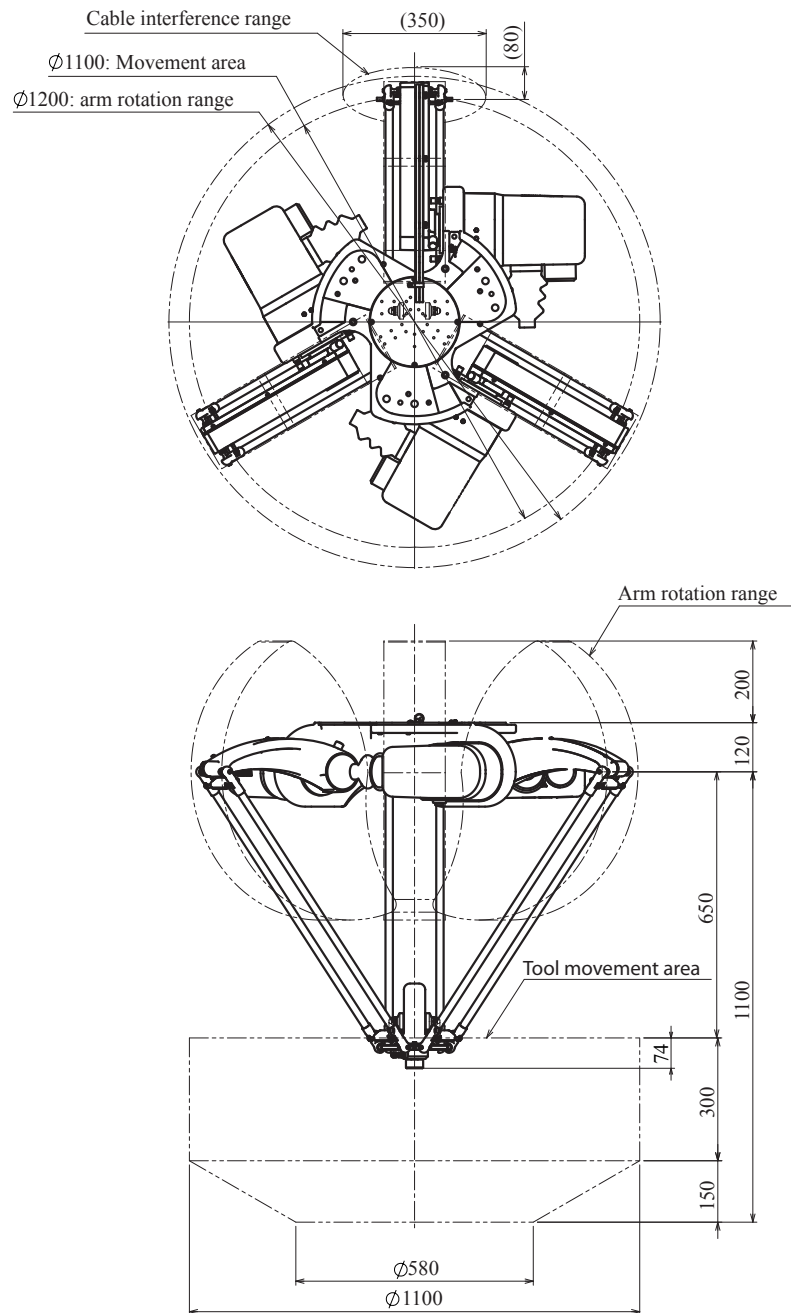


CAUTION

Installation space

- A space of 200mm above the base is included in the movement range of the α , β and γ axes
- Ensure that the installation base prepared by the user does not interfere with the arm movement range.
- Ensure a flatness of 0.5 on the surface of the installation base prepared by the user.

Outline drawing



Either of the following methods may be used to secure the robot to the installation base.

- Bore through holes in the installation base prepared by the user, and use the M12 tapping holes on the robot base to secure the robot to the installation base.
- Bore M14 tapping holes in the installation base prepared by the user, and use the $\phi 16$ through holes on the robot base to secure the robot to the installation base.

Install the robot securely with the six hex socket head bolts as shown in the Fig. below.



WARNING

WHEN INSTALLING THE ROBOT, BE SURE TO USE THE SPECIFIED SIZE AND QUANTITY OF BOLTS THAT MATCH THE DEPTH OF TAPPED HOLES IN THE INSTALLATION BASE, AND SECURELY TIGHTEN THE BOLTS WITH THE CORRECT TORQUE. IF THE BOLTS ARE NOT TIGHTENED CORRECTLY, THE ROBOT MIGHT DROP OR FALL OVER.

	If using M12 tapping holes on robot base	If using ø16 through holes on robot base
Bolts Used	M12	M14
Tightening torque	128Nm (1310 kgfcm)	205Nm (2090 kgfcm)

Depth of tapped holes in installation base:

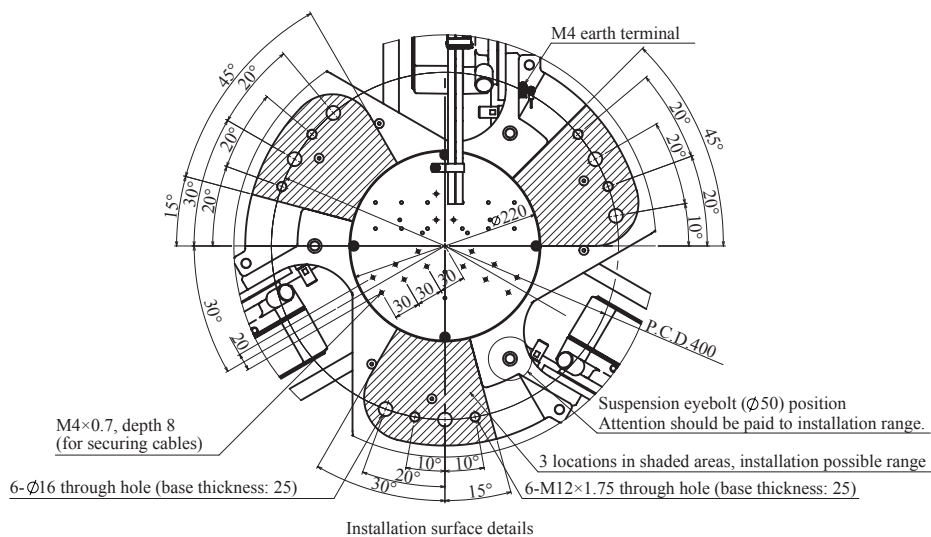
Iron installation base : Bolt diameter × 1.5 or more

Aluminum installation base : Bolt diameter × 3.0 or more

Recommended bolt : JIS B 1176 hex socket head bolt, or equivalent

Strength class JIS B 1051 12.9, or equivalent

Attachment area details



3. Protective bonding



WARNING

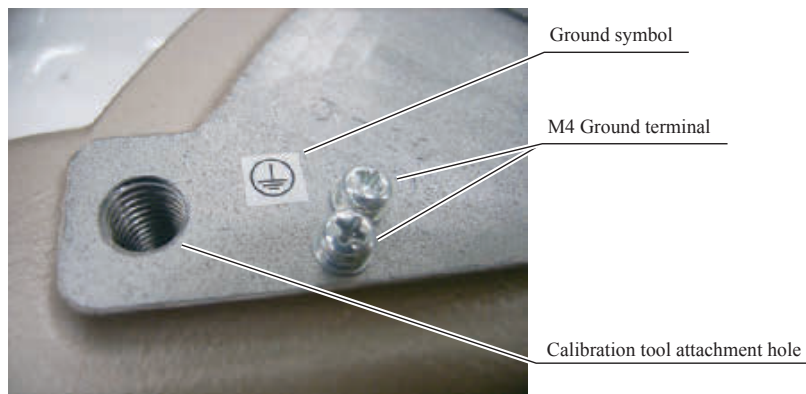
- ALWAYS GROUND THE ROBOT TO PREVENT ELECTRIC SHOCK.
- TURN OFF THE CONTROLLER BEFORE GROUNDING THE ROBOT.

Provide a terminal marked "PE" for the protective conductor of the entire system and connect it to an external protective conductor. In addition, securely connect the ground terminal on the robot pedestal to the same protective conductor. (See the Fig. below.)



(Symbol 417-IEC-5019)

Example of grounding



There are two M4 earth terminals located near the attachment hole (M12) for the calibration tool used to adjust the robot base origin position. Use one terminal for the external protective conductor, and the other terminal for the θ -axis cable grounding.

Use a ground cable with conductor wire cross section of at least 2.0mm^2 and length within 1m.



CAUTION

The user is responsible for providing a proper grounding when the end effector includes an electrical device which could possibly malfunction, causing contact with the power supply.



NOTE

For details on protective bonding for the robot body to comply with CE Marking, follow the instructions described in the controller user's manual.

4. Connection

4.1 Robot cable connection

The robot cable is not connected to the R6Y3 robot.

Refer to the controller user's manual for details on the operation check after connection.



WARNING

- THE SHAPE OF THE MOTOR CONNECTORS AND ENCODER CONNECTORS IS THE SAME FOR THE α -AXIS, β -AXIS AND γ -AXIS EXERCISE CAUTION WHEN CONNECTING. THE ROBOT MAY MALFUNCTION IF INCORRECTLY CONNECTED.
- THE ROBOT MAY MALFUNCTION IF PIN CONTACT DEFECTS OCCUR BECAUSE THE CONNECTORS ARE NOT CONNECTED PROPERLY. ENSURE THAT ALL CONNECTORS ARE SECURELY CONNECTED BEFORE TURNING ON THE CONTROLLER POWER.

4.2 Wiring the brake release wire connector

The brake release wire connector is provided as an accessory with R6Y3 robot.

Refer to the Fig. below when connecting the robot and brake release wire connector.

Furthermore, users are required to prepare the wire leading from the brake release wire connector.

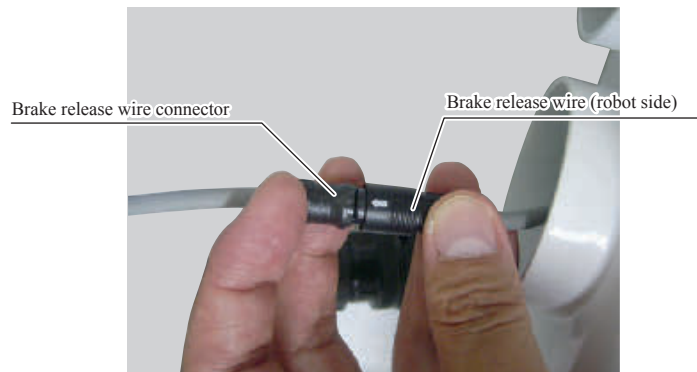
Refer to the controller user's manual for details on the operation check after connection.



WARNING

- THE ROBOT MAY MALFUNCTION IF THE BRAKE RELEASE WIRE CONNECTOR PINS ARE BENT OR BROKEN, OR IF THE CABLE IS DAMAGED. ENSURE THAT THERE IS NO SUCH DAMAGE PRIOR TO CONNECTION.
- THE SHAPE OF THE BRAKE RELEASE WIRE CONNECTOR IS THE SAME FOR THE α -AXIS, β -AXIS AND γ -AXIS EXERCISE CAUTION WHEN CONNECTING. THE ROBOT MAY MALFUNCTION IF INCORRECTLY CONNECTED.
- THE ROBOT MAY MALFUNCTION IF PIN CONTACT DEFECTS OCCUR BECAUSE THE CONNECTORS ARE NOT CONNECTED PROPERLY. ENSURE THAT ALL CONNECTORS ARE SECURELY CONNECTED.

Brake release wire connector connection (robot side)



Wiring

	Contact
1	COM
2	NO
3	NC

Brake release wire connector parts



4.3 θ -axis connection wiring specifications (R6Y31110L03067NJ5, R6Y31110H03067NJ5)

θ -axis connection wiring specifications for the R6Y31110L03067NJ5 and R6Y31110H03067NJ5 are shown below.



CAUTION

Take care not to wire cables incorrectly. The robot will malfunction if used when incorrectly wired.

- Encoder wire wiring, left side is driver side
JN1HS10PL2 (JAE)

No.	Signal	Color	P	Connection	P	Remarks
	E5V	Blue	4		4	P
	E0V	White	1		1	
	BAT+	Yellow	6		6	
	BAT-	Brown	5		5	
	S+	Green	3		3	
	S-	Black	7		7	
	FG	Shield	9		9	

- Motor wire wiring, left side is driver side
NMS3101B-20-4-P, NMS3057-12A (JAE)

No.	Signal	Color	P	Connection	P	Remarks
	U	Red	A		1	
	V	White	B		2	
	W	Black	C		3	
	FG	Green	D		4	
			Round terminal			

5. User tubing



WARNING

- THE ROBOT MAY MALFUNCTION DURING PIPING WORK, AND THEREFORE THE AIR SUPPLY MUST ALWAYS BE TURNED OFF BEFOREHAND.
- DO NOT RUN PIPES ALONG THE SHAFT OR ARM AT THE USER SIDE. DOING SO MAY CAUSE PROBLEMS WITH OPERATIONS SUCH AS PICKUP.

The R6Y3 robot is equipped with an air tube attachment port for use by the user on the moveable base side of the robot. The following air tubes may be used.

User tubing: $\varnothing 6 \times 1$

Air tube specifications are shown below. Always observe these specifications.

User tubing

Maximum pressure	0.6Mpa (6.1 Kgf/cm ²)
Outer diameter × inner diameter	$\varnothing 6\text{mm} \times \varnothing 4\text{mm}$
Fluid	Dry clean air not containing deteriorated compressor oil; filtration 40 μm or less

The TCP side has a tapered screw hole for user tubing. For the locations, refer to "1.3 Robot inner wiring diagram" in Chapter 5.

6. Attaching the end effector

6.1 θ -axis tolerable moment of inertia and acceleration

6.1.1 θ -axis moment of inertia of load and acceleration coefficient

The moment of inertia of a load (end effector and workpiece) that can be attached to the end effector attachment area is limited by the strength of the robot drive unit and residual vibration during positioning. It is therefore necessary to reduce the acceleration in accordance with the moment of inertia.

Model	R6Y30110S03067NJ5	R6Y31110L03067NJ5	R6Y31110H03067NJ5
θ -axis tolerable moment of inertia		0.01kgm ²	0.035kgm ²

Methods for calculating the moment of inertia of the load are shown in "6.2 Equation for moment of inertia calculation" and "6.3 Example of moment of inertia calculation". However, it is not easy to precisely figure out these values. If a calculated value smaller than the actual moment of inertia is set, residual vibrations may occur. In such a case, lower the acceleration even further.



CAUTION

- The robot must be operated with correct tolerable moment of inertia and acceleration according to the manipulator tip mass and moment of inertia. Failing to observe this requirement could shorten the life of the drive units and cause robot damage due to vibration during positioning.
- Depending on the position of the α , β and γ -axes (X, Y, Z-axes), vibrations may occur during X, Y, or Z-axis movement, or during θ -axis rotation. If vibrations occur, lower the α , β and γ -axes (X, Y, Z-axes) and θ -axis acceleration.

6.2 Equation for moment of inertia calculation

Usually the θ axis load is not a simple form, and the calculation of the moment of inertia is not easy. As a method, the load is replaced with several factors that resemble a simple form for which the moment of inertia can be calculated. The total of the moment of inertia for these factors is then obtained.

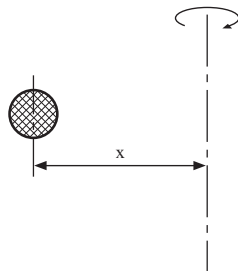
The objects and equations often used for the calculation of the moment of inertia are shown below. Incidentally, there is the following relation: $J \text{ (kgfcmsec}^2\text{)} = I \text{ (kgm}^2\text{)} \times 10.2$.

1) Moment of inertia for material particle

The equation for the moment of inertia for a material particle that has a rotation center such as shown in the Fig. below is as follows:

This is used as an approximate equation when x is larger than the object size.

Moment of inertia for material particle



$$I = mx^2 \text{ (kgm}^2\text{)}$$

$$J = \frac{Wx^2}{g} \text{ (kgfcmsec}^2\text{)}$$

... (1)

g : Gravitational acceleration (cm/sec²)

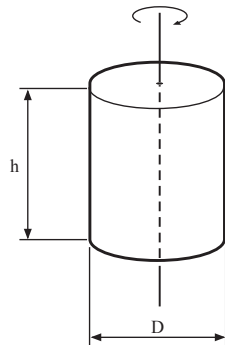
m : Mass of material particle (kg)

W : Weight of material particle (kgf)

2) Moment of inertia for cylinder (part 1)

The equation for the moment of inertia for a cylinder that has a rotation center such as shown in the Fig. below is given as follows.

Moment of inertia for cylinder (part 1)



$$I = \frac{rD^4h}{32} = \frac{mD^2}{8} \text{ (kgm}^2\text{)}$$

$$J = \frac{rD^4h}{32g} = \frac{WD^2}{8g} \text{ (kgfcmsec}^2\text{)}$$

... (2)

r : Density (kg/m³, kg/cm³)

g : Gravitational acceleration (cm/sec²)

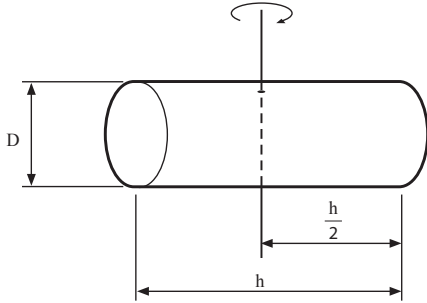
m : Mass of cylinder (kg)

W : Weight of cylinder (kgf)

3) Moment of inertia for cylinder (part 2)

The equation for the moment of inertia for a cylinder that has a rotation center such as shown in the Fig. below is given as follows.

Moment of inertia for cylinder (part 2)



$$I = \frac{r\rho D^2 h}{16} \left(\frac{D^2}{4} + \frac{h^2}{3} \right) = \frac{m}{4} \left(\frac{D^2}{4} + \frac{h^2}{3} \right) \quad (\text{kgm}^2)$$

$$J = \frac{r\rho D^2 h}{16g} \left(\frac{D^2}{4} + \frac{h^2}{3} \right) = \frac{W}{4g} \left(\frac{D^2}{4} + \frac{h^2}{3} \right) \quad (\text{kgfcmsec}^2)$$

... (3)

r : Density (kg/m³, kg/cm³)

g : Gravitational acceleration (cm/sec²)

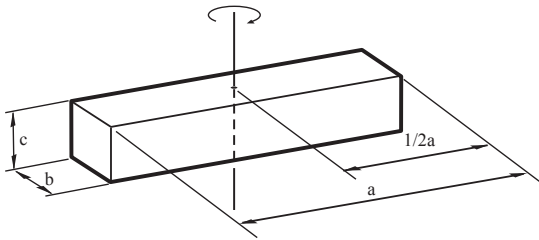
m : Mass of cylinder (kg)

W : Weight of cylinder (kgf)

4) Moment of inertia for prism

The equation for the moment of inertia for a prism that has a rotation center as shown in the Fig. below is given as follows.

Moment of inertia for prism



$$I = \frac{rabc(a^2+b^2)}{12} = \frac{m(a^2+b^2)}{12} \quad (\text{kgm}^2)$$

$$J = \frac{rabc(a^2+b^2)}{12g} = \frac{W(a^2+b^2)}{12g} \quad (\text{kgfcmsec}^2)$$

... (4)

r : Density (kg/m³, kg/cm³)

g : Gravitational acceleration (cm/sec²)

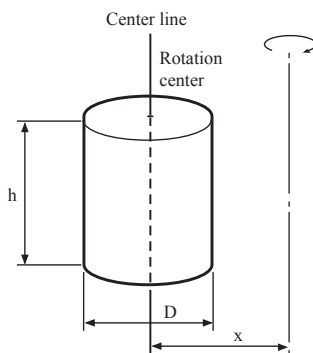
m : Mass of prism (kg)

W : Weight of prism (kgf)

5) When the object's center line is offset from the rotation center.

The equation for the moment of inertia, when the center of the cylinder is offset by the distance "x" from the rotation center as shown in the Fig. below is given as follows.

When the object's center line is offset from the rotation center.



$$I = \frac{r\rho D^4 h}{32} + \frac{r\rho D^2 h x^2}{4} = \frac{mD^2}{8} + mx^2 \quad (\text{kgm}^2)$$

$$J = \frac{r\rho D^4 h}{32g} + \frac{r\rho D^2 h x^2}{4g}$$

$$= \frac{WD^2}{8g} + \frac{Wx^2}{g} \quad (\text{kgfcmsec}^2)$$

... (5)

r : Density (kg/m³, kg/cm³)

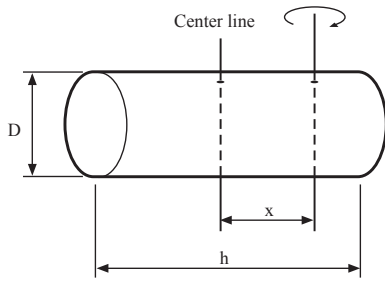
g : Gravitational acceleration (cm/sec²)

m : Mass of cylinder (kg)

W : Weight of cylinder (kgf)

In the same manner, the moment of inertia of a cylinder as shown in the Fig. below is given by

Moment of inertia of a cylinder

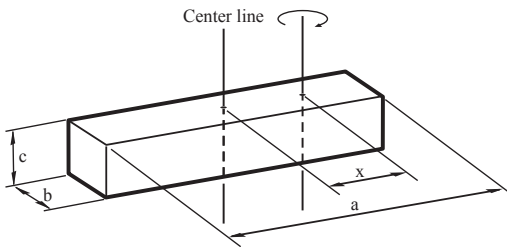


$$\begin{aligned}
 I &= \frac{rD^2h}{16} \left(\frac{D^2}{4} + \frac{h^2}{3} \right) + \frac{rD^2h x^2}{4} \\
 &= \frac{m}{4} \left(\frac{D^2}{4} + \frac{h^2}{3} \right) + mx^2 \quad (\text{kgm}^2) \\
 J &= \frac{rD^2h}{16g} \left(\frac{D^2}{4} + \frac{h^2}{3} \right) + \frac{rD^2h x^2}{4g} \\
 &= \frac{W}{4g} \left(\frac{D^2}{4} + \frac{h^2}{3} \right) + \frac{Wx^2}{g} \quad (\text{kgfcmsec}^2)
 \end{aligned}$$

... (6)

In the same manner, the moment of inertia of a prism as shown in the Fig. below is given by

Moment of inertia of a prism



$$\begin{aligned}
 I &= \frac{rabc(a^2 + b^2)}{12} + rabcx^2 = \frac{m(a^2 + b^2)}{12} + mx^2 \quad (\text{kgm}^2) \\
 J &= \frac{rabc(a^2 + b^2)}{12g} + \frac{rabcx^2}{g} \\
 &= \frac{W(a^2 + b^2)}{12g} + \frac{Wx^2}{g} \quad (\text{kgfcmsec}^2)
 \end{aligned}$$

... (7)

m : Mass of prism (kg)

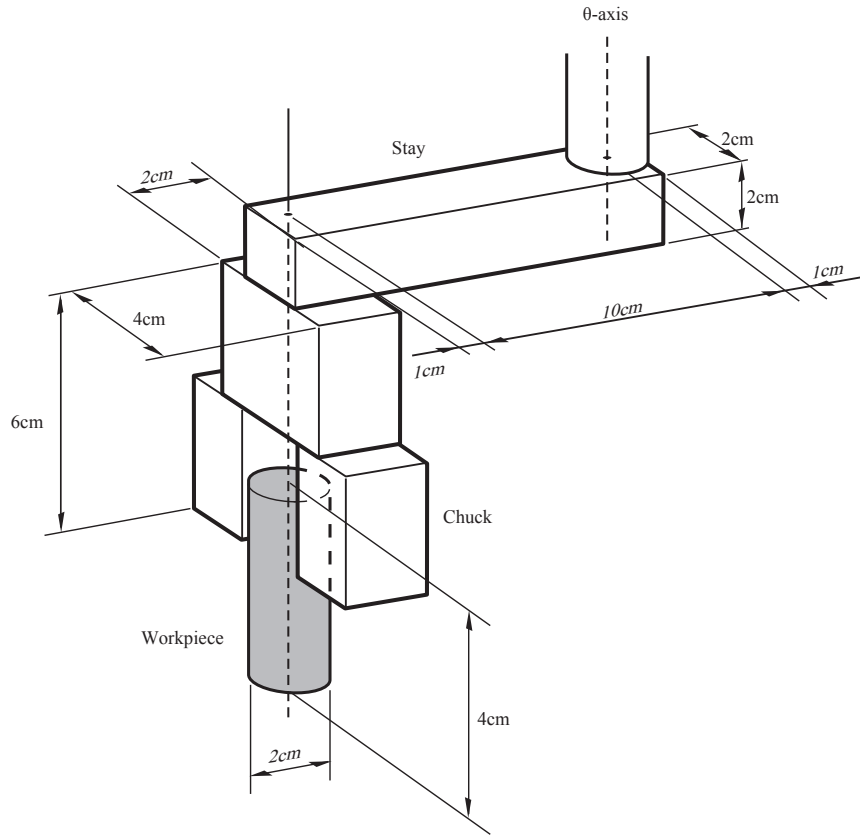
W : Weight of prism (kgf)

6.3 Example of moment of inertia calculation

Let's discuss an example in which the chuck and workpiece are at a position offset by 10cm from the θ -axis by the stay, as shown in the Fig. below. The moment of inertia is calculated with the following three factors, assuming that the load material is steel and its density ρ is $0.0078\text{kg}/\text{cm}^3$.

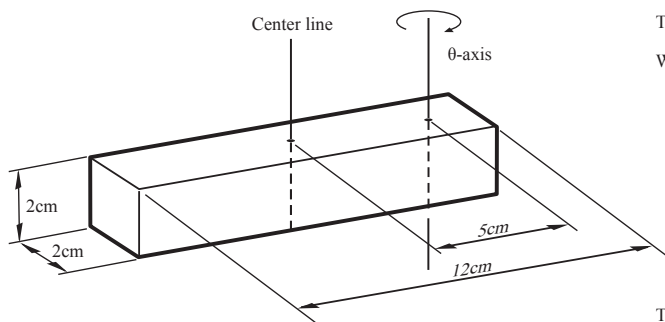
Example of moment of inertia calculation

(The chuck and workpiece are at a position offset by 10cm from the θ -axis by the stay.)



1. Moment of inertia of the stay

Moment of inertia of the stay



The weight of the stay (W_s) is given as follows:

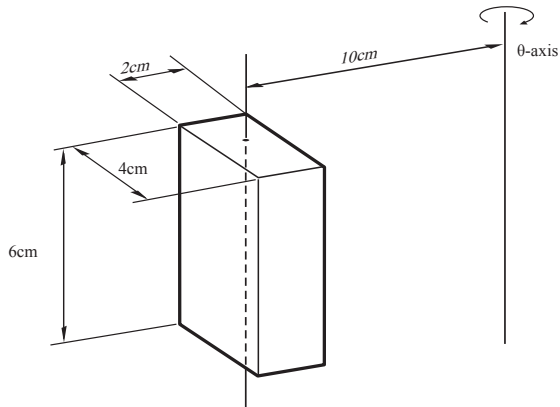
$$W_s = rabc = 0.0078 \times 12 \times 2 \times 2 = 0.37 \text{ (kgf)}$$

The moment of inertia of the stay (J_s) is then calculated from Eq. (7).

$$J_s = \frac{0.37 \times (12^2 + 2^2)}{12 \times 980} + \frac{0.37 \times 5^2}{980} = 0.014 \text{ (kgfcmsec}^2\text{)}$$

2. Moment of inertia of the chuck

Moment of inertia of the chuck



When the chuck form resembles that shown in figure, the weight of the chuck (W_c) is

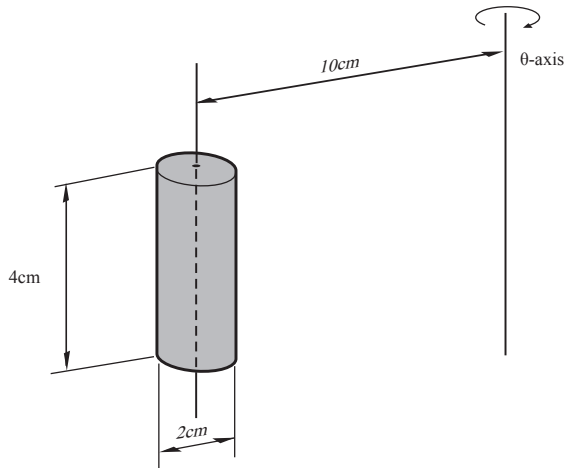
$$W_c = 0.0078 \times 2 \times 4 \times 6 = 0.37 \text{ (kgf)}$$

The moment of inertia of the chuck (J_c) is then calculated from Eq. (7).

$$J_c = \frac{0.37 \times (2^2 + 4^2)}{12 \times 980} + \frac{0.37 \times 10^2}{980} = 0.038 \text{ (kgfcmsec}^2\text{)}$$

3. Moment of inertia of workpiece

Moment of inertia of workpiece



When the workpiece form resembles that shown in figure, the weight of the workpiece (W_w) is

$$W_w = \frac{\rho D^2 h}{4} = \frac{0.0078 \rho \times 2^2 \times 4}{4} = 0.098 \text{ (kgf)}$$

The moment of inertia of the workpiece (J_w) is then calculated from Eq. (5).

$$J_w = \frac{0.097 \times 2^2}{8 \times 980} + \frac{0.097 \times 10^2}{980} = 0.010 \text{ (kgfcmsec}^2\text{)}$$

4. Total weight

The total weight (W) is calculated as follows: $W = W_s + W_c + W_w = 0.84 \text{ (kgf)}$

5. Total moment of inertia

The total moment of inertia (J) is then obtained as follows: $J = J_s + J_c + J_w = 0.062 \text{ (kgfcmsec}^2\text{)}$

6.4 Attaching the end effector

It is necessary to prepare the user's end effector attaching part to the robot that has adequate strength and rigidity, as well as gripping force to prevent positioning errors.



WARNING

- BEFORE ATTACHING THE END EFFECTOR, BE SURE TO TURN OFF THE CONTROLLER.
- WHEN THE END EFFECTOR IS ATTACHED USING THE SLOT CLAMPING, ALWAYS OBSERVE THE CONDITIONS LISTED IN THE TABLE, "MAXIMUM LOAD APPLIED TO END EFFECTOR ATTACHMENT". IF THESE ARE IGNORED, THE END EFFECTOR MAY COME LOOSE AND FLY OFF DURING ROBOT OPERATION, RESULTING IN AN ACCIDENT OR INJURY.



NOTE

Refer to the controller user's manual for details on the end effector operation check.

The recommended end effector attachment method is shown below.

End effector attachment

If attached to tool flange M5 hole



Model	Bolt	Qty	Torque	
			Nm	kgfcm
R6Y3	M5	4	4.5	46

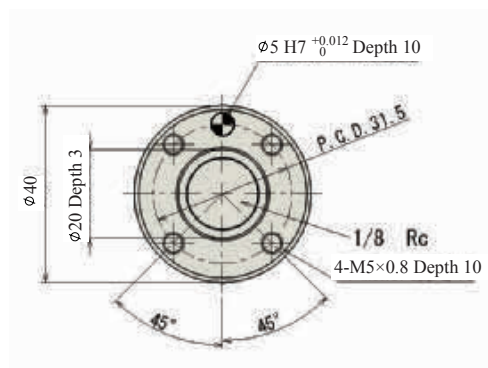


WARNING

ONLY USE THE TAP IN THE CENTER AT THE BOTTOM OF THE END EFFECTOR ATTACHMENT AREA FOR ATTACHING TUBING JOINTS.

End effector attachment area in detail

(ISO9409)



7. Working envelope and maximum movement range

The robot's working envelope and maximum movement range are shown below.

■ For α , β and γ -axes

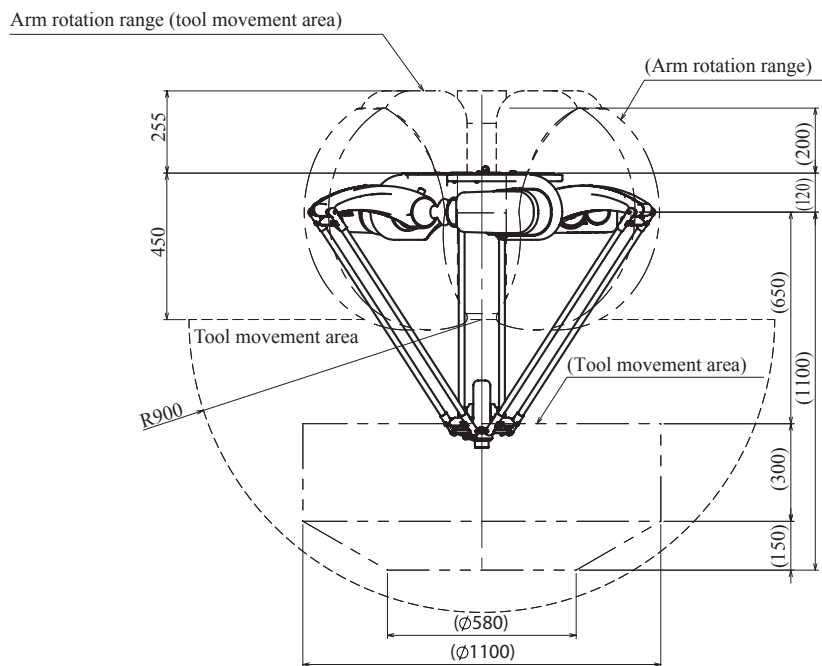
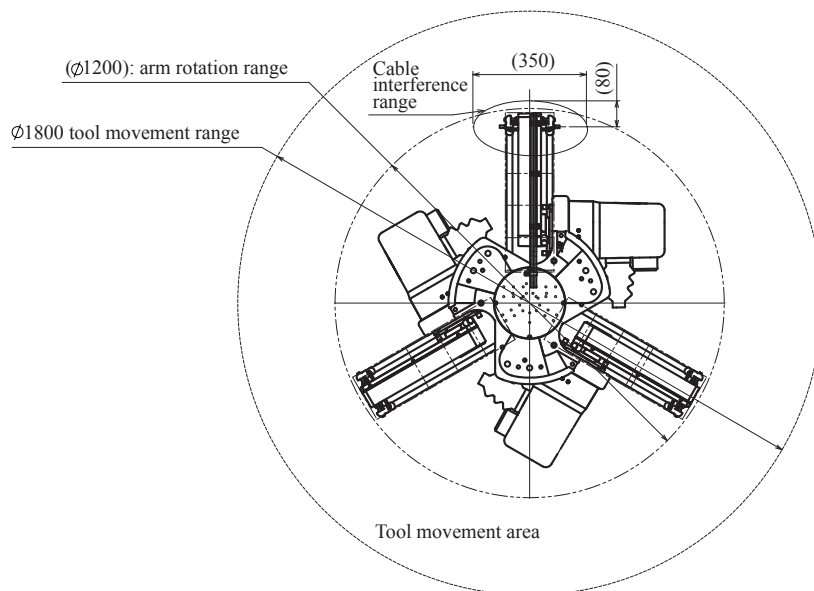


WARNING

IN ORDER TO PREVENT INTERFERENCE WITH OTHER USER EQUIPMENT, BE SURE TO PROVIDE ADEQUATE SPACE TO ACCOMMODATE THE ROBOT'S MAXIMUM MOVEMENT RANGE (INCLUDING THE ARM'S MAXIMUM MOVEMENT RANGE).

Note that the robot's TCP (tool center point) movement range is larger than the actual working envelope. Be sure to specify the robot working envelope at the controller side.

Movement range



8. Detaching or attaching the covers

8.1 Detaching or attaching the α , β and γ -axes covers



WARNING

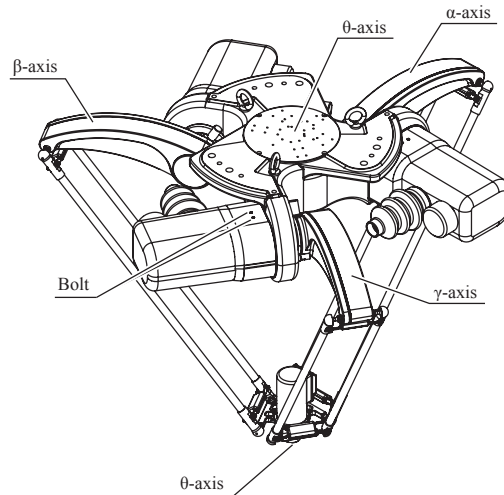
- IF THE COVERS ARE REMOVED FOR MAINTENANCE WORK, BE SURE TO RETURN THEM TO THEIR ORIGINAL POSITIONS USING THE SCREWS AND BOLTS USED TO SECURE THEM.
- IF ANY OF THE SCREWS OR BOLTS BECOME LOST, USE THE SPECIFIED SCREWS/BOLTS AND QUANTITIES TO SECURE THE COVERS WHILE REFERRING TO THE FIG. BELOW.
- IF THE COVERS ARE NOT SECURED FIRMLY, NOISE MAY OCCUR, THE COVERS MAY DROP AND FLY OUT, HANDS MAY BECOME ENTANGLED IN THE DRIVE UNIT DURING TEACHING, OR COME INTO CONTACT WITH THE HOT DRIVE UNIT, CAUSING BURNS. OBSERVE THESE CAUTIONS STRICTLY TO PREVENT SUCH TROUBLE.



CAUTION

The α , β and γ -axes motor cover construction does not comply with IP67, and therefore the inside of the cover should be cleaned periodically. The motor and speed reduction gear inside the cover do comply with IP67.

R6Y3



8.1.1 α , β , γ -axis cover removal procedure



WARNING

WHEN HANDLING MOTORS, TAKE CARE TO AVOID ELECTRIC SHOCK OR BURNS OWING TO THE HEAT GENERATED BY THE MOTORS.

1 *Remove the duct, boot, and cap.*



NOTE

The boot and cap are merely inserted when the robot is shipped.

2 *Disconnect the robot cable connector.*

Step 1 *Duct, boot, and cap removal*



Boot removal



Cap removal

3 **Remove the M5 hex bolt from the top of the motor cover.**

4 **Remove the cover a little.**

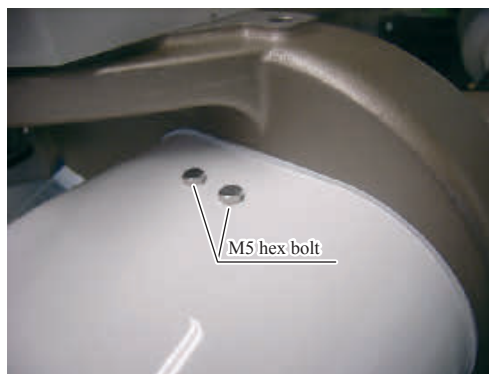
Grasp the rear of the cover and pull it out while shaking it up and down to remove the cover a little. About 10mm of the rubber will come out (within 5mm when attached).



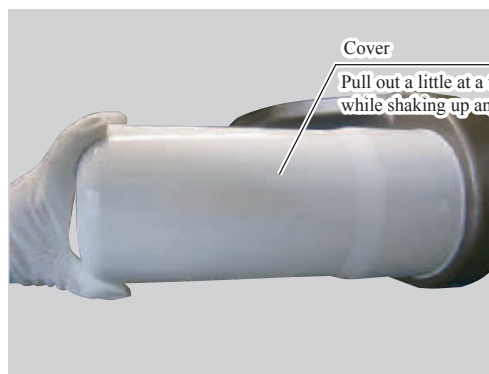
NOTE

The inside of the cover will catch and so will not come off completely.

▶ **Step 3 Bolt removal**



▶ **Step 4 Temporarily removed cover**



Cover bottom temporarily removed



Cover top temporarily removed

5

Pull the cover out further.

Make a gap between the cover and base by pulling the cover out further.



NOTE

The cover will catch at this point and so will not come off completely.

▶ **Step 5**

Temporarily removed cover



Cover bottom temporarily removed



Cover top temporarily removed

6

Pull out the cover.

Grasp the sides of the cover and push both sides so that the bottom deforms a little to pull out the cover. The clips on the inside near the switch will come free, making it easier to pull out the cover without it catching.

The motor connector will catch on the hole on the side of the cover, and so the cover should be shifted to avoid the connector. The switch on the inside will catch on the motor connector, and so the cover should be pulled out while trying to avoid the connector.

▶ **Step 6**

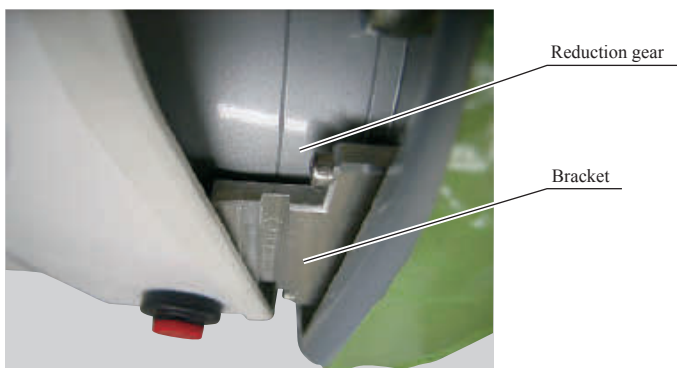
Pull out the cover.



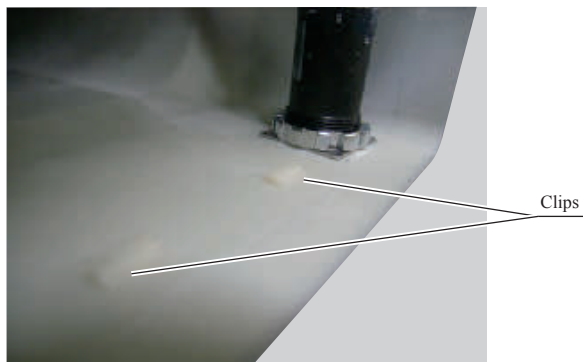
Clip structure

The cover clips will catch on the step on the bracket below the reduction gear. There are two steps, and the clips catch on the second step.

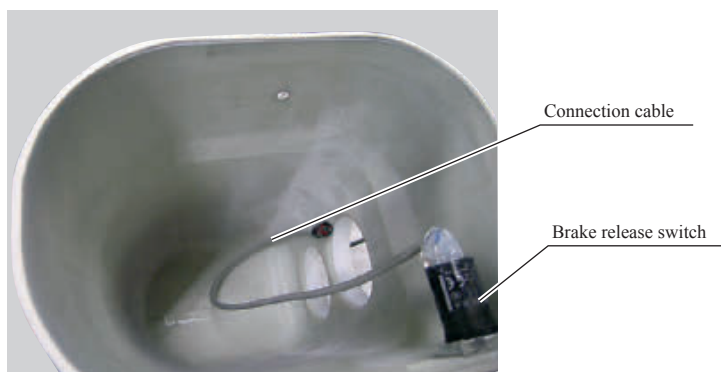
Clip construction



Clip construction on inside



Inside of removed cover



8.1.2 α , β and γ -axis cover attachment procedure

Attach the cover using the opposite of the procedure used for removal.



WARNING

THE SAME TYPE OF MOTOR WIRE AND ENCODER WIRE IS USED FOR THE α -AXIS, β -AXIS AND γ -AXIS. CONNECT THE CABLES SO THAT THEY MATCH THE RESPECTIVE AXES AT THE CONTROLLER (DRIVER). THE ROBOT WILL NOT OPERATE CORRECTLY, RESULTING IN POSSIBLE DANGER IF THE CABLES ARE CONNECTED INCORRECTLY.

1

Insert the motor wire from smaller hole on the boot with small hole.

The motor wire connector is larger and should therefore be inserted first.
The motor wire connector should still be inserted first even if using L-shaped connectors.

2

Insert the encoder wire and brake release wire (prepared by user) from smaller hole on the boot.



CAUTION

The encoder wire must pass through the inside of the cover and therefore a sufficient length of wire should be inserted.

3

Pull the cover internal cables from the hole with the boot.

On the outside of the cover is the cap, and the motor connector part should be the boot.

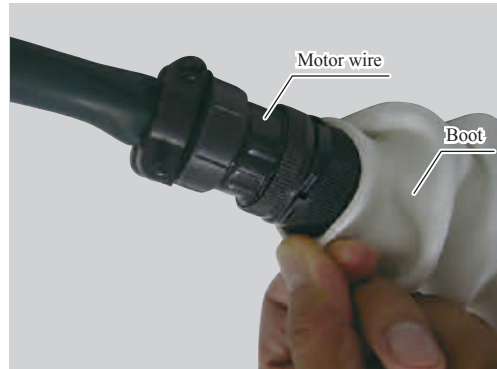
4

Connect the cover internal switch connector and brake release connector.

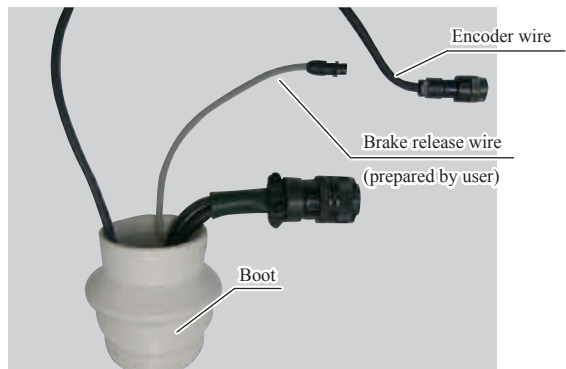
Store the joint inside the cover.

The cable leading from the brake release connector should be prepared by the user.

▶ Step 1 **Insert the motor wire.**



▶ Step 2 **Insert the encoder wire and brake release wire (prepared by user).**



▶ Step 4 **Switch connector and brake release connector connection**



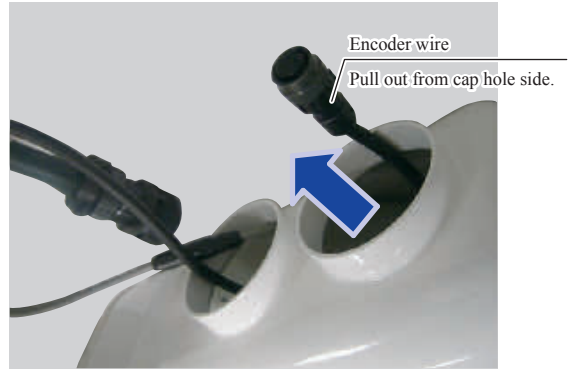
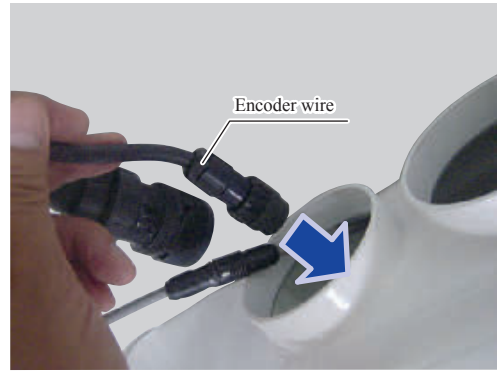
5

Route the encoder wire.

Insert the encoder wire only through the hole for the motor connector, and pull it out from the adjacent cap hole.

▶ **Step 5**

Encoder wire routing



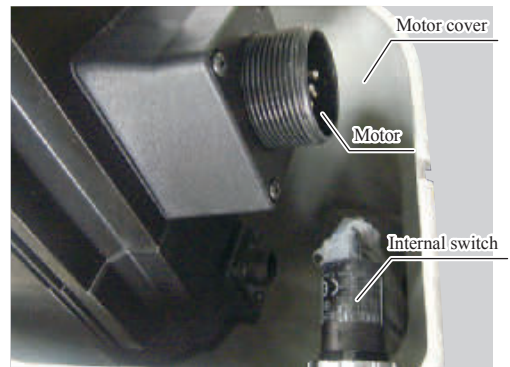
6

Temporarily insert the motor cover.

Insert the motor cover so that the internal switch does not interfere with the motor connector. Pull the brake release wire and encoder wire out from the gap next to the motor connector.

▶ Step 6

Temporary motor cover insertion



Cables removed when temporarily inserting cover

7 ***Insert the cover so that the rubber on the bottom fits in.***

There will be a gap when the cover catches on the first clip.

8 ***Insert the cover so that the rubber on the top fits in.***



CAUTION

Insert the rubber a little at a time, and avoid trying to force it in. If forced in, the rubber will end up deformed, making it difficult to attach the motor cover.

9 ***Push in the motor cover from the rear.***

The rubber at the bottom of the switch should protrude approximately 5mm, and the rubber at the top of the switch should protrude approximately 1mm.

▶ **Step 7** Gap



Gap at top of cover

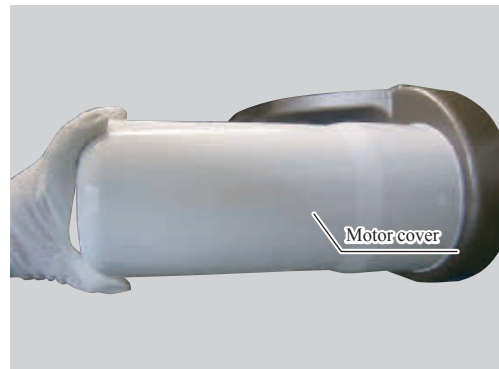


Gap at bottom of cover

▶ **Step 8** Insert the rubber.



▶ **Step 9** Push in the motor cover.



10 *Adjust the motor cover position and then secure with the M5 hex bolt(s).*

Adjust the motor cover position and then screw in two M5 hex bolts to secure.

Ensure that the motor cover has been securely attached.

It will not be possible to insert the bolts if the motor cover position and tapping positions for the M5 hex bolts are not aligned.

▶ Step 10 Motor cover attachment



11 *Attach the robot cable connector.*



WARNING

CONNECT THE α -AXIS, β -AXIS AND γ -AXIS ROBOT CABLES SO THAT THEY MATCH THE RESPECTIVE AXES AT THE CONTROLLER (DRIVER). THE ROBOT WILL NOT OPERATE CORRECTLY, RESULTING IN POSSIBLE DANGER IF THE CABLES ARE CONNECTED INCORRECTLY.

▶ Step 12 Boot, cap attachment

12 *Attach the boot and cap to the motor cover.*

13 *Attach the duct to the robot cable.*

Insert the robot cable into the notch on the duct.

The cable can be inserted easily by inserting a thick rod such as a flat screwdriver.



▶ Step 13 Duct attachment

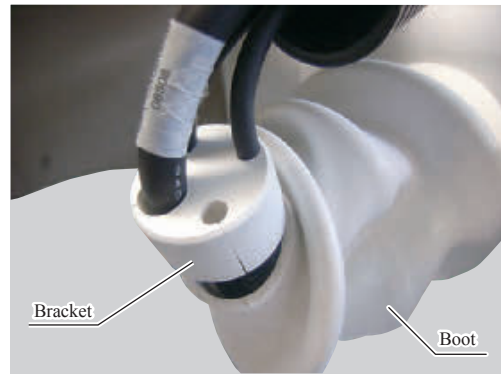


14 *Attach the bracket to the robot cable.*

15 *Insert the bracket in the boot.*

16 *Insert the boot in the duct.*

▶ Step 14 **Bracket attachment**



▶ Step 15 **Bracket insertion**



▶ Step 16 **Boot insertion**



9. Detaching or attaching the shafts, moveable base, and spring covers

9.1 Attaching the shafts, moveable base, and spring covers



CAUTION

It is necessary to enter the safety enclosure in order to detach or attach the shafts, moveable base, or spring covers, and therefore the controller power must be turned off beforehand.

9.1.1 R6Y30110S03067NJ5 (3-axes specification)

The replacement procedure for the shafts, moveable base, and spring covers is the same as that for the α , β and γ -axes.

1

Post a sign indicating that the robot is being adjusted.

Post a sign indicating that the robot is being adjusted to prevent others from turning on the controller power.

2

Enter the safety enclosure.

3

Attach the shafts.

Attach the shafts while ensuring to hook the shaft plastic bearings onto the arm and moveable base link balls. The link balls can be stretched by hand at the end of the shaft as shown in the Fig.

The depression on the shafts for spring cover attachment should face upward.

The moveable base attachment direction is as shown in the Fig. Refer to "2.2 Adjusting the θ -axis origin position" in Chapter 3 for details.

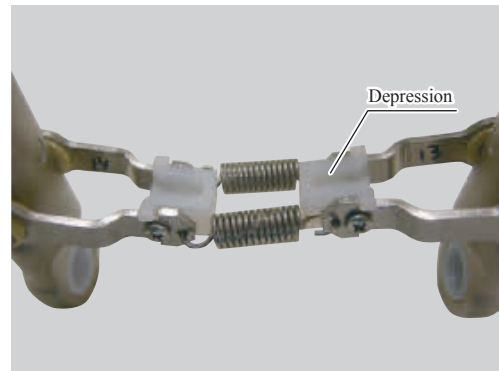


CAUTION

By attaching the shafts with hands placed anywhere other than the shaft end, the joint between the shaft and shaft end may deform, possibly leading to malfunction. Ensure to place hands on the end of the shaft as shown in the Fig. on the right.

Take care not to pull the springs on the shafts too much. If stretched too far, the springs may not return to their original shape, possibly leading to malfunction.

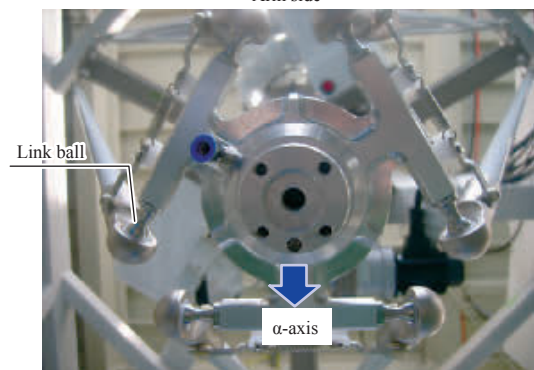
Step 3 Shaft attachment



Moveable base side



Arm side



4

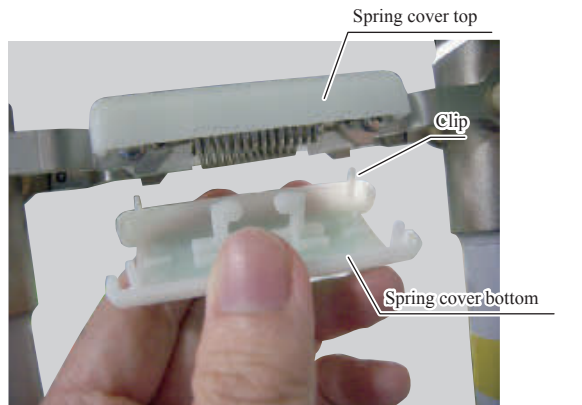
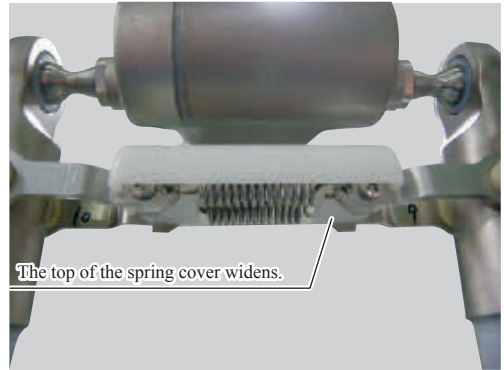
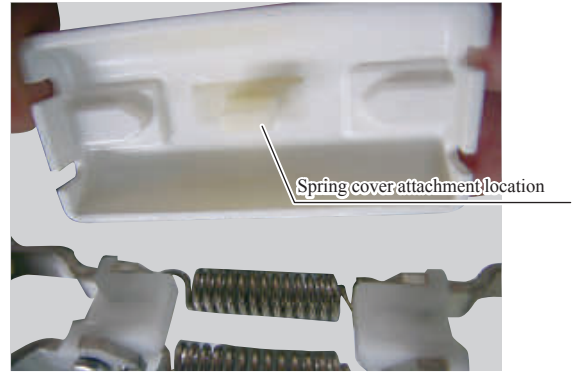
Attach the spring covers.

There are a total of six spring covers: one at the arm, and one at the moveable base for each of the three axes.

The top and bottom positions of the spring covers are fixed.

If the shaft direction is correct at Step 3, the cover attached at the top will be wide as shown in the Fig. The spring covers come as a top and bottom set when shipped. Attach the covers so that they snap together at the guide clips.

▶ **Step 4 Spring cover attachment**



9.1.2 R6Y31110L03067NJ5, R6Y31110H03067NJ5 (4-axes specification)

With the R6Y31110L03067NJ5 and R6Y31110H03067NJ5 (4-axes specification) robots, the cable protrudes from the α -axis shaft.

Shaft, moveable base, and spring cover attachment is the same as that for the 3-axes specification robot.

- 1 **Post a sign indicating that the robot is being adjusted.**

Post a sign indicating that the robot is being adjusted to prevent others from turning on the controller power.

- 2 **Enter the safety enclosure.**

- 3 **Attach the shafts.**

Attach the shafts while ensuring to hook the shaft plastic bearings onto the arm and moveable base link balls. The link balls can be stretched by hand at the end of the shaft as shown in the Fig.

The depression on the shafts for spring cover attachment should face upward.

The moveable base attachment direction is as shown in the Fig. Refer to "2.2 Adjusting the θ -axis origin position" in Chapter 3 for details.

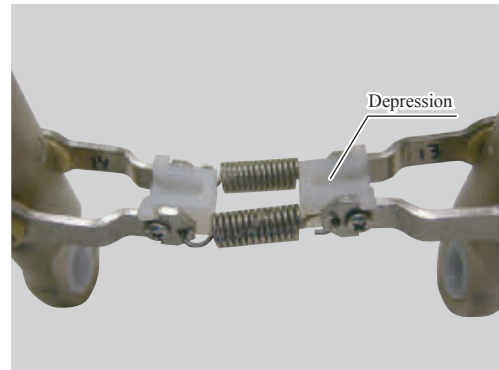


CAUTION

By attaching the shafts with hands placed anywhere other than the shaft end, the joint between the shaft and shaft end may deform, possibly leading to malfunction. Ensure to place hands on the end of the shaft as shown in the Fig. on the right.

Take care not to pull the springs on the shafts too much. If stretched too far, the springs may not return to their original shape, possibly leading to malfunction.

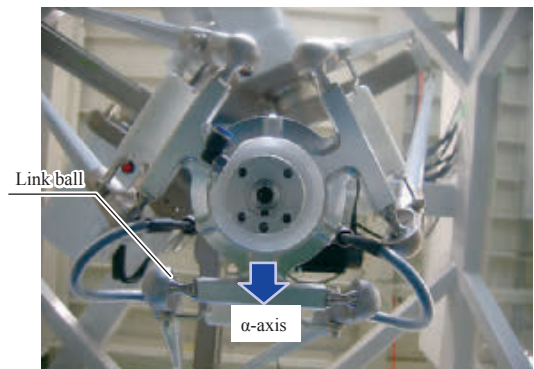
Step 3 Shaft attachment



Moveable base side



Arm side



4 *Attach the spring covers.*

There are a total of six spring covers: one at the arm, and one at the moveable base for each of the three axes.

The top and bottom positions of the spring covers are fixed.

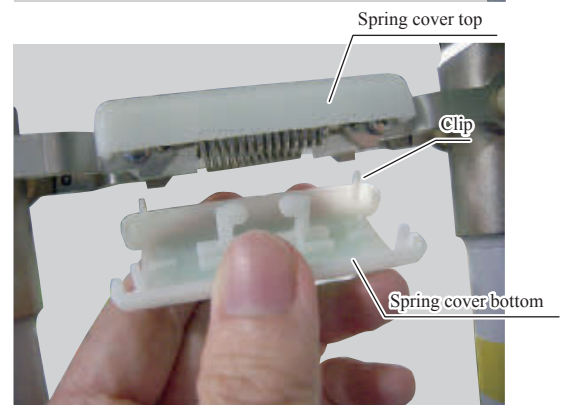
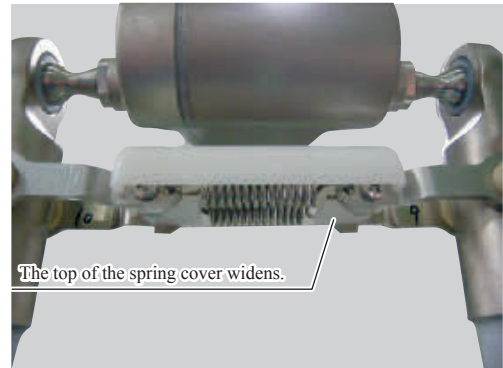
If the shaft direction is correct at Step 3, the cover attached at the top will be wide as shown in the Fig. below.

The spring covers come as a top and bottom set when shipped. Attach the covers so that they snap together at the guide clips.

5 *Route the arm side cable and insert it into the plastic block on the arm.*

Route the cables along the α -axis arm to the robot base while trying not to bend them too much.

▶ Step 4 Spring cover attachment



▶ Step 5 Cable routing at arm side



6 *Secure the attached cable with the plastic block.*

There are a total of three securing locations. Use two tie bands for each location, and secure the cables with the plastic block as shown.



CAUTION

Be careful not to pull the cables too much. If pulled too much, the cables may be damaged, resulting in possible robot malfunction.

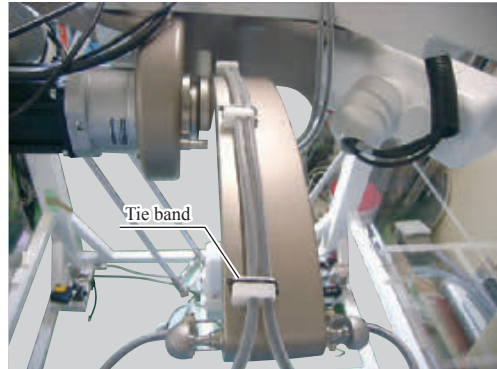
7 *Attach the cable at the moveable base side to the motor cover.*

Ensure that the moveable base and α -axis shaft attachment directions are correct.

Align the arrow on the cable connector with the connector mark on the motor cover and attach.

Attach both the motor cable and encoder cable to their respective connectors.

▶ Step 6 *Securing the cables*



▶ Step 7 *Cable attachment at moveable base side*



9.2 Detaching the shafts, moveable base, and spring cover

The detachment procedure is the opposite of that for attachment.



CAUTION

It is necessary to enter the safety enclosure in order to detach or attach the shafts, moveable base, or spring covers, and therefore the controller power must be turned off beforehand.

1

Post a sign indicating that the robot is being adjusted.

Post a sign indicating that the robot is being adjusted to prevent others from turning on the controller power.

2

Enter the safety enclosure.

3

Remove the spring covers.

There are a total of six spring covers: one at the arm, and one at the moveable base for each of the three axes.

There is a top spring cover and bottom spring cover, with the top cover being wider.

The spring covers are held together with clips on the inside.

Pull the bottom cover down at the arm side and pull the top cover up at the moveable base side to remove the spring cover.



CAUTION

Use both hands when removing the spring covers. Use one hand for removal and the other to stop the bottom cover falling.

If the spring cover falls and is damaged, the robot may operate abnormally.

4

Remove the shafts.

Remove the shafts from the arm and moveable base link balls.

When doing so, the link balls can be stretched by hand at the end of the shaft as shown in the Fig. on the right.

When removing the shafts from the moveable base, disconnect the θ -axis robot cable from the motor beforehand.



CAUTION

Remove the spring covers before removing the shafts. The spring covers may be damaged if work is carried out without removing them.

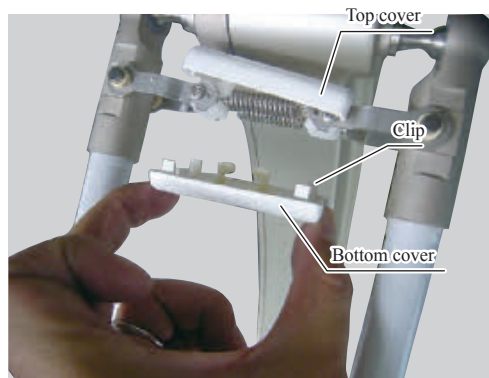
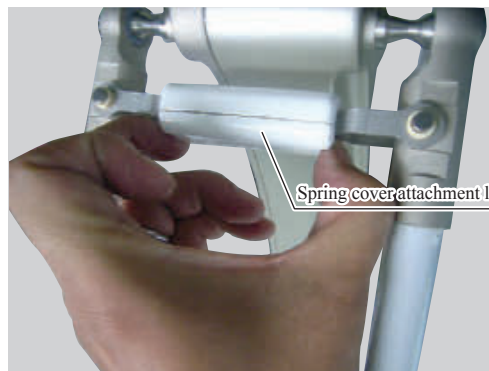
Take care not to pull the springs on the shafts too much.

If stretched too far, the springs may not return to their original shape, possibly leading to abnormal robot movement.

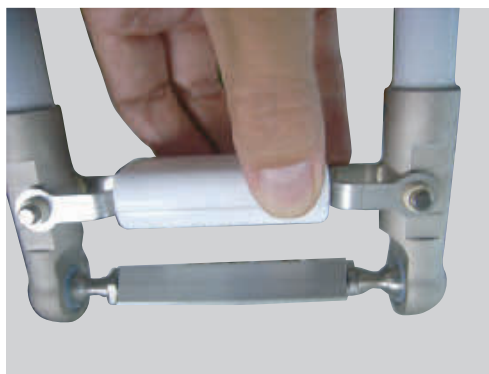
If the shafts are removed from the moveable base without first disconnecting the θ -axis cable from the motor, the cable may be stretched and damaged, leading to possible malfunction. Furthermore, take care not to drop the moveable base.

Step 3

Spring cover removal



Arm side



Base side

Step 4

Shaft removal



Chapter 3 Robot settings

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2. Adjusting the origin	3-2
2.1 Adjusting the α , β and γ -axis origin position	3-3
2.2 Adjusting the θ -axis origin position (4-axes specification only)	3-6
3. Setting the soft limits	3-8
3.1 Setting the α , β and γ -axis soft limits	3-8
3.2 Setting the θ -axis soft limits	3-8

1. Overview

R6Y3 robot origin position setting is performed at the OMRON factory.
Specify the controller settings while referring to the controller user's manual.

The following describes the safety precautions to be observed when making various settings.



CAUTION

- Read and understand the contents of this chapter completely before attempting to set the robot.
 - Place a conspicuous sign indicating the robot is being adjusted, to prevent others from touching the controller switch or operation panel.
 - If a safety enclosure has not yet been provided right after installation of the robot, rope off or chain off the movement range around the manipulator in place of a safety enclosure, and observe the following points.
 1. Use stable posts which will not fall over easily.
 2. The rope or chain should be easily visible by everyone around the robot.
 3. Place a conspicuous sign prohibiting the operator or other personnel from entering the movement range of the manipulator.
 - Refer to the controller user's manual if performing an operation check after setting.
-

2. Adjusting the origin

The R6Y3 uses a calibration tool to mechanically adjust the origin position of the α , β , γ and θ -axes. Be sure to adjust the origin position in the following cases.

1. If the origin position is lost after disconnecting the robot cable connecting the controller with robot
2. If the origin position is lost after disconnecting the θ -axis cables from the θ -axis motor cover connectors and controller side robot cable connector.
3. If the motor is replaced (same reason as above)
4. If any of the axis arms are removed



CAUTION

- If any of the above situations occur after purchasing the robot, it is necessary to adjust the origin position(s) using the calibration tool. (The robot origin positions are adjusted at the factory.)
- Always use the calibration tool to perform origin position adjustment. If adjusted without using the calibration tool, the position will shift, resulting in abnormal robot operation, leading to robot damage and possible bodily injury.

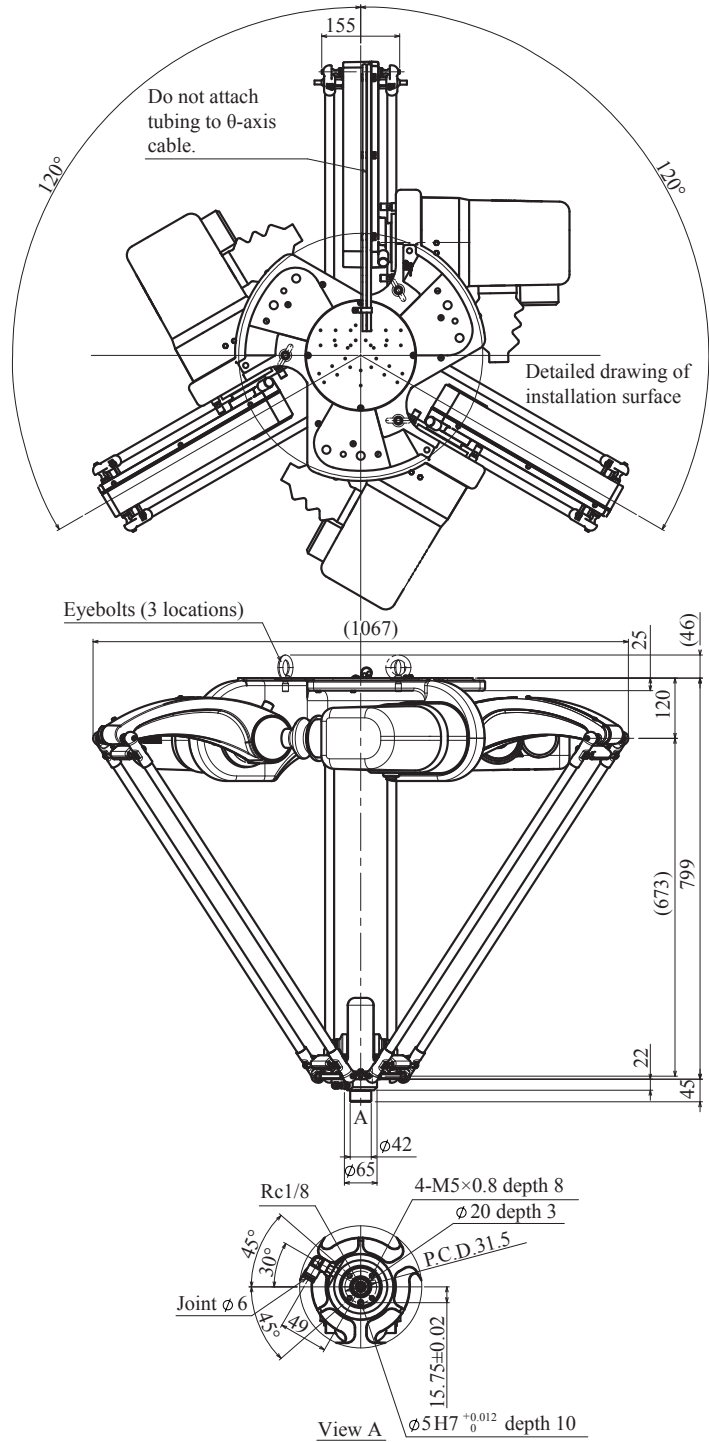
This manual describes the origin position adjustment method using the calibration tool.

2.1 Adjusting the α , β and γ -axis origin position

The α , β and γ -axis origin positions are shown in the Fig. below.

Adjust each axis to its respective origin positions using the calibration jig.

α , β , γ -axis origin positions



Calibration tool (α , β and γ -axis)



1 ***Post a sign indicating that the robot is being adjusted.***

Post a sign indicating that the robot is being adjusted to prevent others from turning on the controller power.

2 ***Enter the safety enclosure.***

3 ***Secure the calibration tool to the base.***

Secure the end of the calibration tool to the jig attachment holes on the base with the M12 hex socket head bolts provided.

The arm is moved at Step 5, and if it hits the calibration tool at that time, temporarily secure the tool, move the arm to a position above the tool at Step 5, apply the brake, secure the tool, and then perform Steps 4 and 5.

4 ***Release the motor brake for α -axis.***

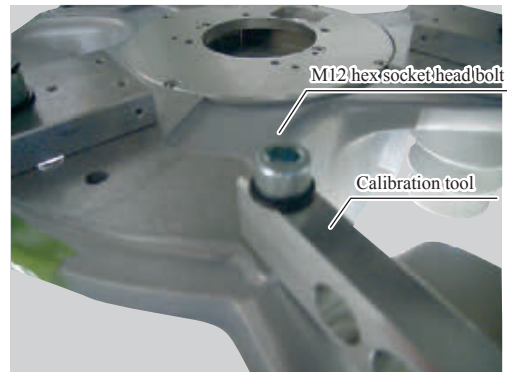


CAUTION

When performing origin position adjustment, release the brake one axis at a time. Never release the brake for all three axes at the same time.

Doing so will result in a drop in origin position accuracy, leading to malfunctions.

▶ Step 3 **Securing the calibration tool**



5 ***Move the arm slowly until the link ball on the end of the arm contacts the top of the calibration tool.***

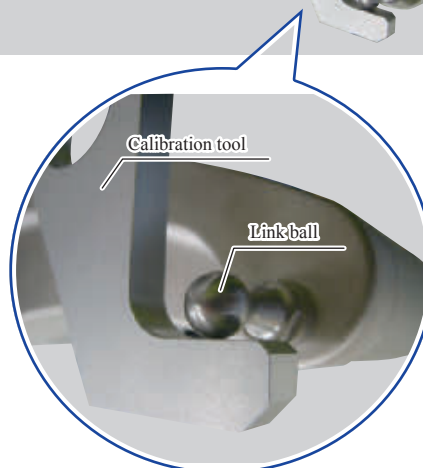
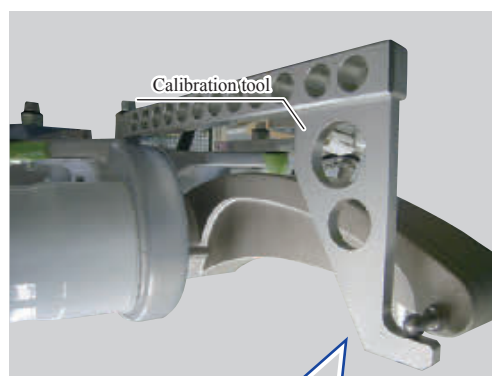
6 ***Apply the motor brake for α -axis.***

7 ***Remove the calibration tool from the base.***

By loosening the M12 hex socket head bolt on the end of the calibration tool, the tool comes away from the arm link ball. Confirm this and then remove the calibration tool.

8 ***Perform the procedure in Steps 3 to 7 for the γ and β -axes also.***

▶ Step 5 **Position link ball against tool.**



2.2 Adjusting the θ -axis origin position (4-axes specification only)

The θ -axis origin position reference is the position in which the tool flange dowel hole is facing the α -axis. The axis is adjusted to the reference position when shipped from the factory, however, the position may shift slightly. When installing the robot for the first time, it is necessary to use the calibration tool to adjust the origin position.

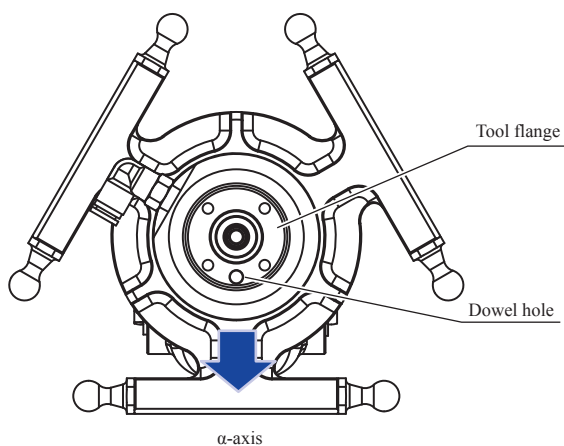


CAUTION

The tool flange is fixed on 3-axes robots and therefore it is only necessary to attach the moveable base in the correct direction. Refer to "9.1 Attaching the shafts, moveable base, and spring covers" in Chapter 2 for details on attaching the moveable base. With the 4-axes robot, it is necessary to adjust the θ -axis origin position in addition to attaching the moveable base in the correct direction. The θ -axis origin position should generally never be changed. If changed, the axis may no longer move in the right direction.

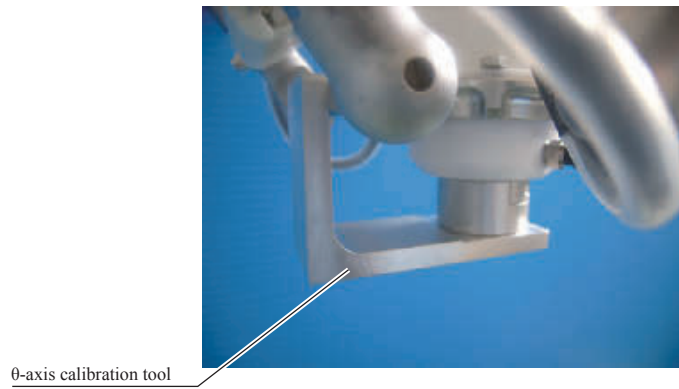
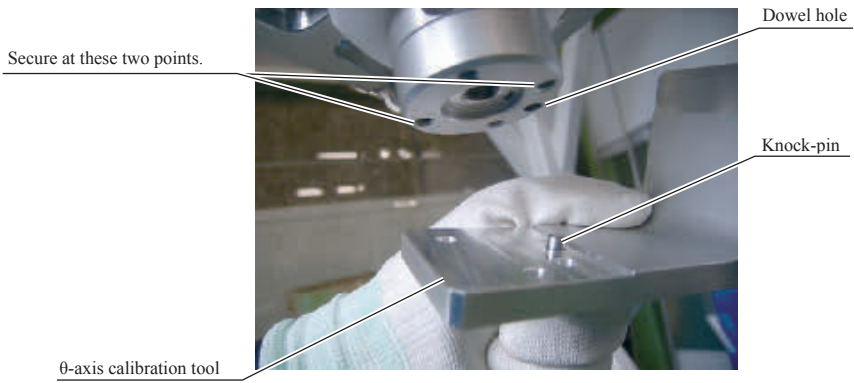
- 1 ***Post a sign indicating that the robot is being adjusted.***
Post a sign indicating that the robot is being adjusted to prevent others from turning on the controller power.
- 2 ***Enter the safety enclosure.***
- 3 ***Secure the calibration tool.***
The θ -axis origin position is the position in which the tool flange dowel hole is facing the α -axis.

θ -axis origin position



- 4 ***Align the θ -axis calibration tool pin with the tool flange dowel hole.***

Securing the calibration tool



3. Setting the soft limits

With the R6Y3 robot, by setting the plus and minus soft limits [°] for each axis with the origin position (0°) as the reference, the movement range is limited by setting the movement angle from the 0° position. Refer to the controller user's manual when setting the soft limits.



CAUTION

When performing actual checks of the soft limit settings, operate the robot manually from outside the safety enclosure.



NOTE

Refer to "1.2 External view and dimensions" in Chapter 5 for the robot movement range.

3.1 Setting the α , β and γ -axis soft limits

Set the soft limits within the movement range or within the range where the robot does not interfere with peripheral equipment (but within movement range). Furthermore, reduce the soft limits to narrow the movement range when the actual movement range of the robot is small or it interferes with the peripheral equipment.

The reference values for the soft limits are as follows.

	Plus direction soft limit [°]	Minus direction soft limit [°]
α -axis	110	-60
β -axis	110	-60
γ -axis	110	-60

3.2 Setting the θ -axis soft limits

The θ -axis has no mechanical stoppers. Set the θ -axis plus and minus soft limits [°] to narrow the movement range when the actual θ -axis movement range of the robot is small or the robot interferes with the peripheral equipment.

Chapter 4 Periodic inspection

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2. List of inspection items	4-2

1. Overview

Daily and periodic inspection of the OMRON robot is essential in order to ensure safe and efficient operation. Periodic inspection for the R6Y3 robot consists of daily inspection, monthly inspection and 6-month inspection. Be sure to perform the daily inspection before starting the robot and after completion of each day's work. For details on inspection items, see "2. List of inspection items" in the next section. For details on how to perform periodic inspection, refer to the separate R6Y3 Maintenance Manual.

Before starting the maintenance work, thoroughly read the following cautions and Safety Instructions to strictly observe the instructions.

■ Cautions on daily inspection



CAUTION

- Adjustment, maintenance and parts replacement require specialized technical knowledge and skills, and also may involve hazards. These tasks must be performed only by persons who have enough and qualifications required by local laws and regulations.
- Do not perform robot inspection, adjustments, repair or part replacement not described in this manual. This work requires specialized technical knowledge and skill, and may also involve work hazards.
- When inspection is required inside the safety enclosure, always turn off the controller and also the external switch board.
- If the inspection or maintenance procedure calls for operation of the robot, stay outside the safety enclosure.
- Place a sign indicating the robot is being inspected, to keep others from operating the controller switch or operation panel.
- Use only the lubricants specified by your distributor.
- Refer to the controller user's manual if performing an operation check after inspection.

■ Monthly and 6-month inspection precaution

Pay attention to the following if applying grease to the θ -axis assembly.



WARNING

PRECAUTIONS WHEN HANDLING GREASE:

- INFLAMMATION MAY OCCUR IF THIS GETS IN THE EYES. USE FOOD GREASE (CASSIDA GREASE, EPS2) WHEN USING THE ROBOT AT FOOD PLANTS.
BEFORE HANDLING THE GREASE, WEAR YOUR SAFETY GOGGLES TO ENSURE THE GREASE WILL NOT COME IN CONTACT WITH THE EYES.
- INFLAMMATION MAY OCCUR IF THE GREASE COMES INTO CONTACT WITH SKIN. BE SURE TO WEAR PROTECTIVE GLOVES TO PREVENT CONTACT WITH SKIN.
- DO NOT TAKE ORALLY OR EAT. (EATING WILL CAUSE DIARRHEA AND VOMITING.)
- HANDS AND FINGERS MIGHT BE CUT WHEN OPENING THE CONTAINER, SO USE PROTECTIVE GLOVES.
- KEEP OUT OF THE REACH OF CHILDREN.
- DO NOT HEAT THE GREASE OR PLACE NEAR AN OPEN FLAME SINCE THIS COULD LEAD TO SPARKS AND FIRES.

EMERGENCY TREATMENT:

- IF THIS GREASE GETS IN THE EYES, WASH LIBERALLY WITH PURE WATER FOR ABOUT 15 MINUTES AND CONSULT A PHYSICIAN FOR TREATMENT.
- IF THIS GREASE COMES IN CONTACT WITH THE SKIN, WASH AWAY COMPLETELY WITH SOAP AND WATER.
- IF TAKEN INTERNALLY, DO NOT INDUCE VOMITING BUT PROMPTLY CONSULT A PHYSICIAN FOR TREATMENT.

DISPOSING OF GREASE AND THE CONTAINER:

- PROPER DISPOSAL IS COMPULSORY UNDER FEDERAL, STATE AND LOCAL REGULATIONS. TAKE APPROPRIATE MEASURES IN COMPLIANCE WITH LEGAL REGULATIONS.
- DO NOT PRESSURIZE THE EMPTY CONTAINER. PRESSURIZING MAY CAUSE THE CONTAINER TO RUPTURE.
- DO NOT ATTEMPT TO WELD, HEAT UP, DRILL HOLES OR CUT THIS CONTAINER. THIS MIGHT CAUSE THE CONTAINER TO EXPLODE AND THE REMAINING MATERIALS INSIDE IT TO IGNITE.

2. List of inspection items



WARNING

REFER TO THE INSPECTION ITEMS IN THE SEPARATE R6Y3 MAINTENANCE MANUAL WHEN CARRYING OUT INSPECTION.

●: Conduct. ○: Conduct if trouble is found as a result of inspection. △: Contact your distributor.

Location	Contents	Daily	6-month	Cleaning	Adjustment	Replacement
■ Inspection with the controller turned off						
Robot cable	• Check for scratch, dent or excessive bend.	●			○	
User cable and wiring	• Check for scratch dent, or excessive bend.	●			○	○
Regulator Joint Air tube Solenoid valve Air cylinder	• Check air pressure.	●			○	
	• Check for air leak.	●			○	
	• Check drain.	●			○	
	• Check air filter for clogging or damage.	●		○		○
Exterior of robot	• Check for damage.	●				△
Plastic bearing (link ball sliding surface)	• Check for deformation, dents. • Check that wear is 0.5mm or less.	●		○		△
Plastic bearing (spring mechanism plate sliding surface)	• Check for deformation, breakage. (Check for cracks.)	●		○		△
Shaft	• Check for deformation.	●				△
Spring cover	• Check for damage. (Check for guide clip breakage.)	●		○		△
Inside spring cover (spring, plate, etc.)	• Check for deformation. • Check the spring to see if it is overstretched. • Check for M3 screw looseness.	●		○	○	△
θ-axis assembly tool	• Check for any grease leaking from the coupling. • Check whether pickup is possible. (Drop in pickup force)	●		○	○	△
Arm	• Check for deformation, damage.		●	○		△
Link ball	• Check for damage.		●	○		△
Major bolts and screws of robot main body (those exposed to the outside)	• Check for looseness. (*1)		●		○	

*1: If any bolt or screw is loose, retighten it. (For details about tightening torque, see the table below.)

Bolt tightening torque

Bolt size	Tightening torque (kgfcm)	Tightening torque (Nm)
M3 set screw	20	2
M3	20	2
M4	46	4.5
M4 4-axes specification α-axis arm cable clamp	20	2
M6	156	15.3
M8	380	37
M10	540	53
M12	1310	128

Chapter 5 Specifications

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1.3 Robot inner wiring diagram	5-4
1.4 Kinematics parameters	5-5

1. Manipulator

1.1 Basic specification

Robot model		R6Y30110S03067NJ5	R6Y31110L03067NJ5	R6Y31110H03067NJ5
Working volume	X, Y axis	Stroke	Ø1100mm	
	Z axis	Stroke	300mm (max. Ø1100mm)/450mm (center Ø580mm)	
	θ axis	Rotation range	±180° (default setting, it can be changed)	
Servo motor	Arm 1, 2, 3		1000W	
	Rotational axis 4		50W	100W
Repeatability ^{*1}	X, Y, Z axis		±0.2mm	
	θ axis		±0.1°	
Maximum payload			3kg	
Maximum through-put ^{*2}			150 CPM ^{*4}	
θ axis tolerable moment of inertia ^{*3}			0.01kgm ² (50W)	0.035kgm ² (100W)
User tubing (outer diameter)			Ø6x1 (moveable tool)	
Travel limit			Soft limit	
Protection class			IP67	
Weight			75kg	

*1: This is the value at a constant ambient temperature.

*2: With 0.1kg payload. When reciprocating 305mm in horizontal and 25mm in vertical directions.

*3: There are limits to acceleration coefficient settings.

*4: CPM: Cycle per minutes. Check the note 2 for the cycle definition.

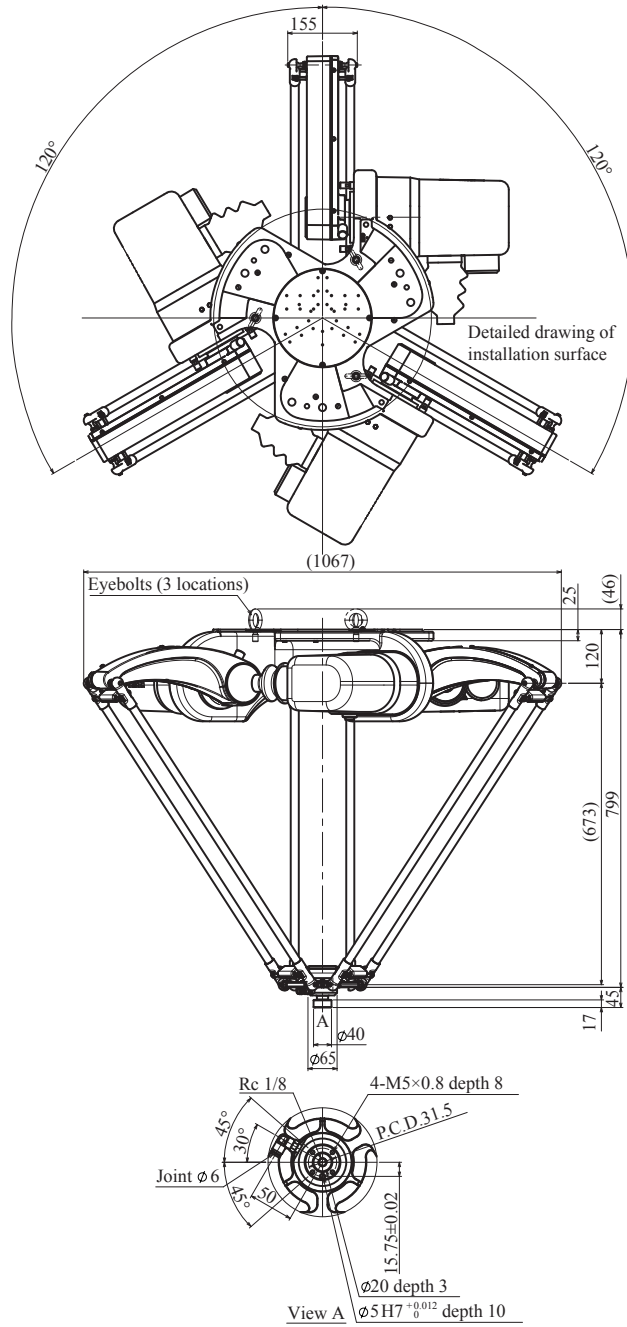
Noise level

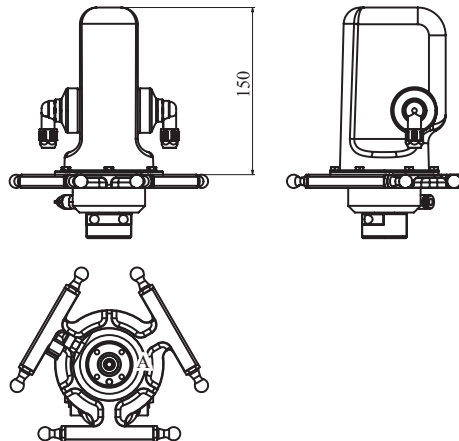
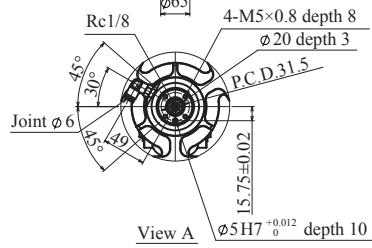
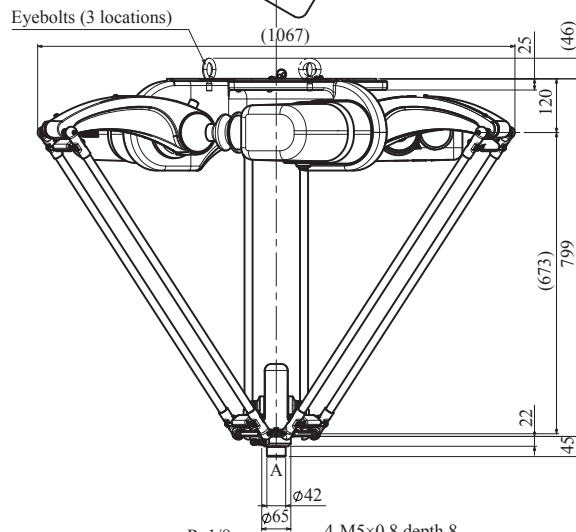
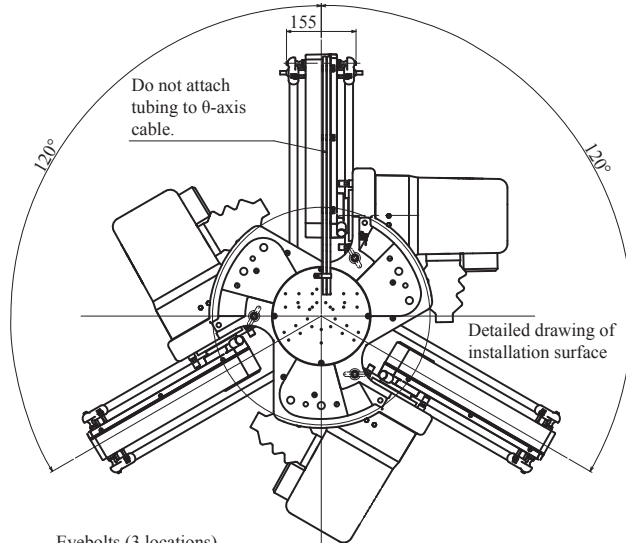
Equivalent sound level of robot, Laeq (A) (when there is 10dB or larger difference from the back ground sound pressure level)	Position where the noise level is measured
73.7dB	Robot surface, 1.0m from moveable range, height 1.6m

Note: The noise level can be higher when the robot is set nearby the objects that cause sound reflection.

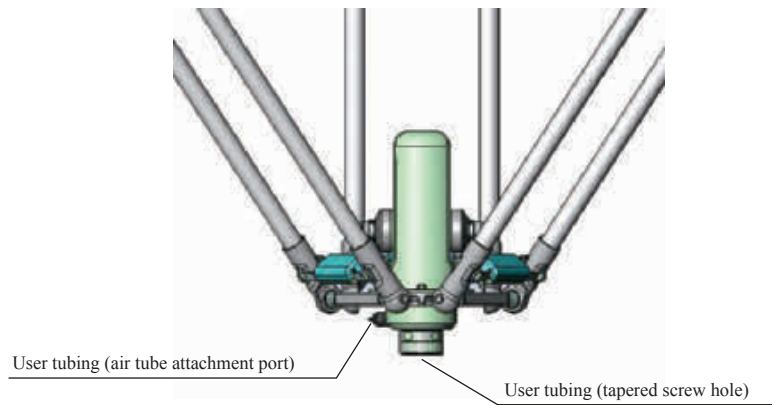
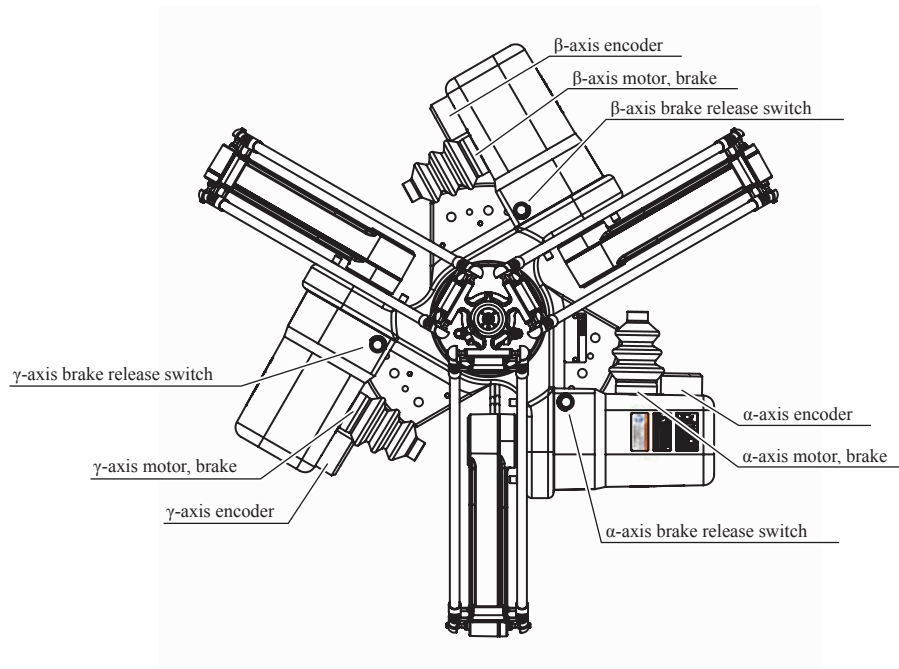
1.2 External view and dimensions

R6Y30110S03067NJ5



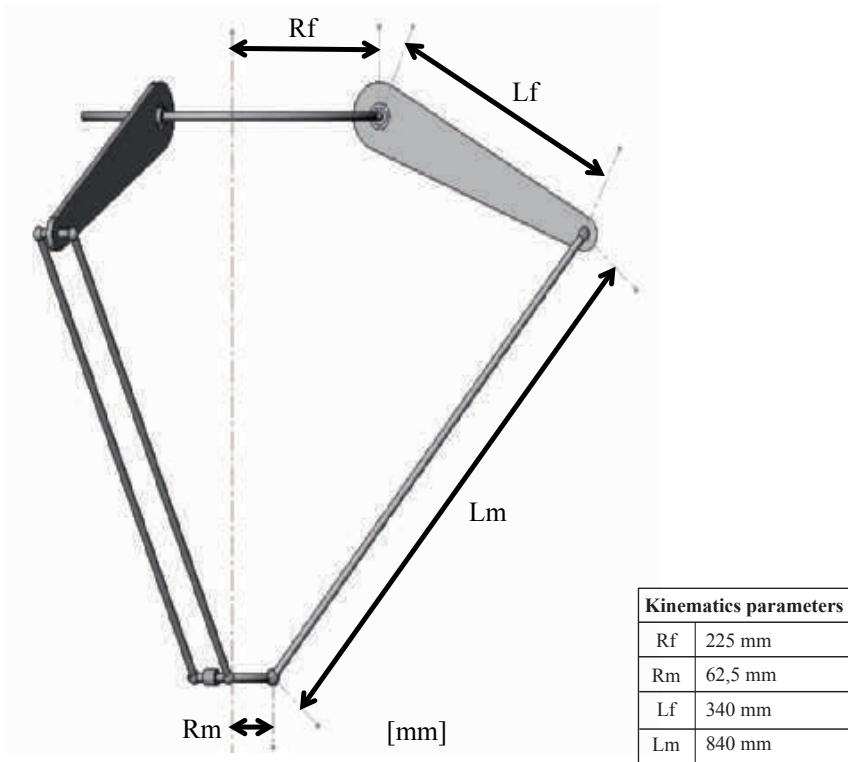


1.3 Robot inner wiring diagram



1.4 Kinematics parameters

Kinematics parameters



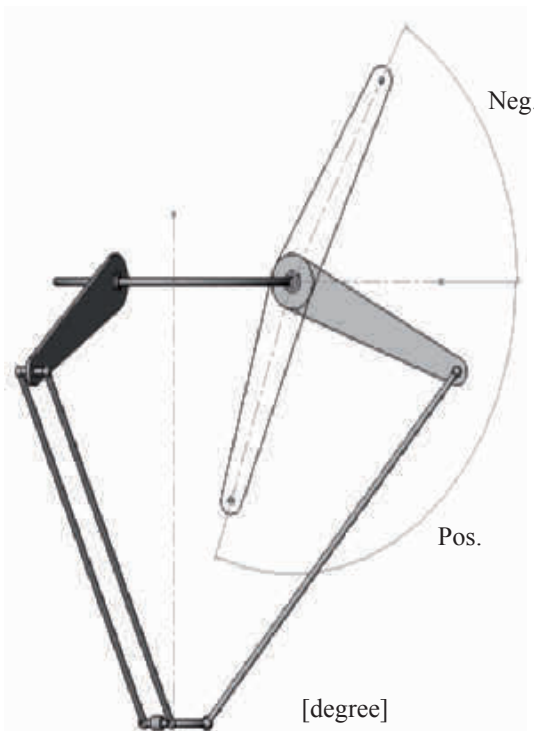
R_f : Distance (radius) from the center of the fixed frame to the motor axis [mm]

R_m : Distance (radius) from the center of the moving frame to the connection point of link 2 [mm]

L_f : Length of the link 1 [mm]

L_m : Length of the link 2 [mm]

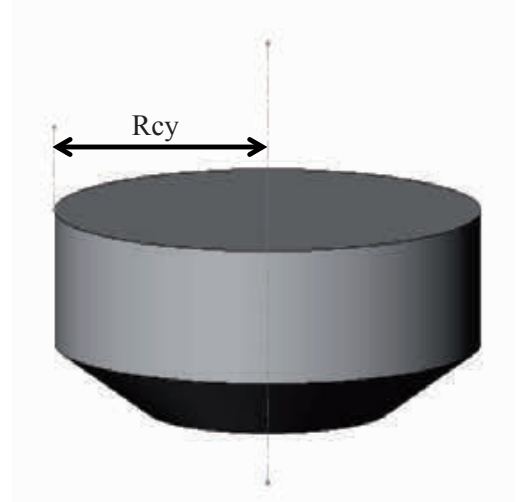
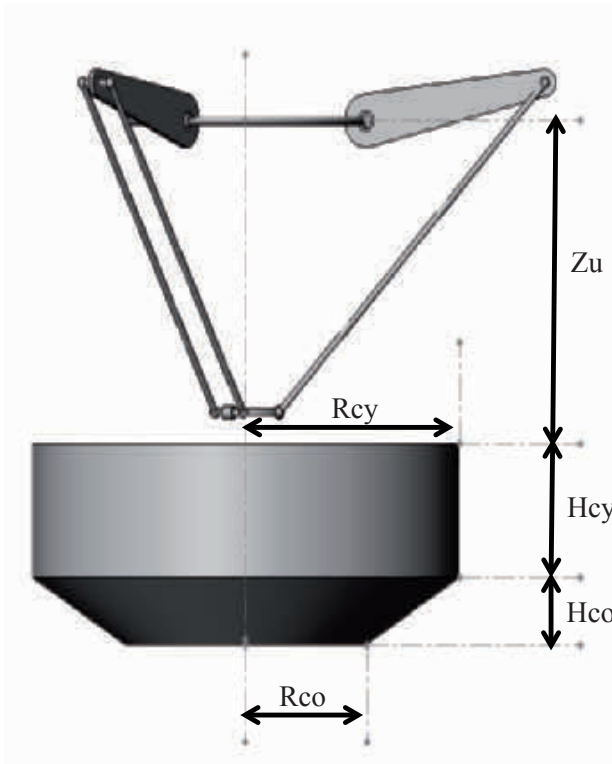
Software limit



Software limit	
Positive software limit	110°
Negative software limit	-60°

Gearbox ratio	
Main motor	1/33 (ratio)
θ motor: Low inertia	1/9 (ratio)
θ motor: High inertia	1/21 (ratio)

Workspace parameters



Workspace parameters	
Z_u	650 mm
R_{cy}	550 mm
H_{cy}	300 mm
R_{co}	290 mm
H_{co}	150 mm

Z_u : Cylinder front position (origin position from the Z-axis) [mm]

R_{cy} : Cylinder radius [mm]

H_{cy} : Cylinder height [mm]

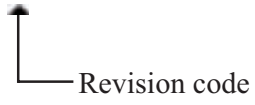
R_{co} : Cone radius [mm]

H_{co} : Cone height [mm]

Revision history

A manual revision code appears as a suffix to the catalog number on the front cover manual.

Cat. No. I194E-EN-01



The following table outlines the changes made to the manual during each revision.

Revision code	Date	Description
01	June 2013	Original production

OMRON

Authorized Distributor: