Cat. No.I141E-EN-01

SCARA Robots
XG Series

R6Y - XG series

USER´S MANUAL

OMRON

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

1. Please be sure to perform the following tasks before using the robot.

Failing to perform the tasks below will require re-teaching of the robot since the origin position cannot be set to the same previous position. Robot malfunctions (vibration, noise) may also occur.

The origin position of the XG series robots is adjusted to the robot arm extended position at the factory prior to shipment, so the reference or standard coordinates are temporarily set. The customer should set the origin position before any other job. There are 2 types of origin position settings as shown below.

[1] Setting the robot arm extended position (the origin position adjusted at the factory prior to shipment) as the origin position (When setting the origin position with the robot arm extended, you must check that there will not be any interference from any peripheral equipment during the next absolute reset.)

[2] Setting a position OTHER than the robot arm extended position (the origin position adjusted at the factory prior to shipment) as the origin position

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[1] To set the robot arm extended position (the origin position adjusted at the factory prior to shipment) as the origin position

Absolute Reset

The XG series robots only require the absolute reset to be performed once when the robot is introduced. Once the absolute reset is performed, you do not need to reperform it when the power is turned on next time. Set the origin position while referring to absolute reset methods in “3. Adjusting the origin” in Chapter 4 of this manual and in “Absolute Reset” of the “OMRON Robot Controller User’s Manual”. Setting of standard coordinates is not required in the above case. To set the standard coordinates with high accuracy, refer to “5. Setting the Standard Coordinates” in Chapter 4 of this manual and “Setting the Standard Coordinates” in the “OMRON Robot Controller User’s Manual”. If the standard coordinate settings are incorrect, robot malfunctions (vibration, excessive noise) may occur.

CAUTION

⚠ NEVER ENTER THE ROBOT MOVEMENT RANGE ONCE THE ROBOT SERVO IS TURNED ON AS THIS IS EXTREMELY HAZARDOUS.

[2] To set a position OTHER than the robot arm extended position (the origin position adjusted at the factory prior to shipment) as the origin position

1. Absolute reset

The XG series robots only require the absolute reset to be performed once when the robot is introduced. Once the absolute reset is performed, you do not need to reperform it when the power is turned on next time. Set the origin position while referring to absolute reset methods in "3. Adjusting the origin" in Chapter 4 of this manual and in "Absolute Reset" of the "OMRON Robot Controller User's Manual". Set the origin position with the absolute reset.

⚠ CAUTION

NEVER ENTER THE ROBOT MOVEMENT RANGE ONCE THE ROBOT SERVO IS TURNED ON AS THIS IS EXTREMELY HAZARDOUS.

2. Affixing the origin position sticker

Set in emergency stop when absolute reset is complete, and immediately affix the origin point sticker according to instructions in "6. Affixing Stickers for Origin Positions, Movement Directions and Axis Names" in Chapter 4 of this manual.

3. Setting the reference coordinates

Set the reference coordinates while referring to instructions in "5. Setting the Reference Coordinates" in Chapter 4 of this manual and also to "Setting the Reference Coordinates" in the "OMRON Robot Controller User's Manual". Robot malfunctions (vibration, noise) may occur if the reference coordinates are not set correctly.

Even though there is no problem with the robot, the following error messages are issued when the robot and controller are connected and power first turned on. (Actual error messages may differ according to how the robot and controller are connected.)

Error messages issued when robot & controller are connected (YRC v.1)

17.81 : D?.ABS.battery wire breakage
17.83 : D?.Backup position data error 1
17.85 : D?.Backup position data error 2
17.92 : D?.Resolver disconnected during power off
17.93 : D?.Position backup counter overflow

etc.

2. If the X, Y or R axis rotation angle is small.

If the X, Y or R axis rotation angle is smaller than 5° so that it always moves in the same position, an oil film is difficult to be formed on the joint support bearing, possibly leading to damage to the bearing. In this type of operation, add a movement so that the joint moves through 90° or more, about 5 times a day.

3. Do not remove the Z-axis upper-end mechanical stopper

Removing or moving the upper-end mechanical stopper attached to the Z-axis spline can damage the Z-axis ball screw. Never remove or move it.

Copyright

Introduction

The OMRON XG series robots are SCARA type industrial robots.
The XG series robots have a two-joint manipulator consisting of an X-axis arm and a Y-axis arm, and are further equipped with a vertical axis (Z-axis) and a rotating axis (R-axis) at the tip of the manipulator. The XG series robots can be used for a wide range of assembly applications such as installation and insertion of various parts, application of sealant, and packing operations.

This instruction manual describes the safety measures, handling, adjustment and maintenance of XG series robots for correct, safe and effective use. Be sure to read this manual carefully before installing the robot. Even after you have read this manual, keep it in a safe and convenient place for future reference. This instruction 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.

This manual describes the R6YXG500, R6YXG600, R6YXGH600, R6YXG700, R6YXG800, R6YXG900, and R6YXG1000. For details on specific operation and programming of the robot, refer to the separate “OMRON Robot Controller User’s Manual”.

Disclaimers

CHANGE IN SPECIFICATIONS
Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS
Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA
Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS
The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

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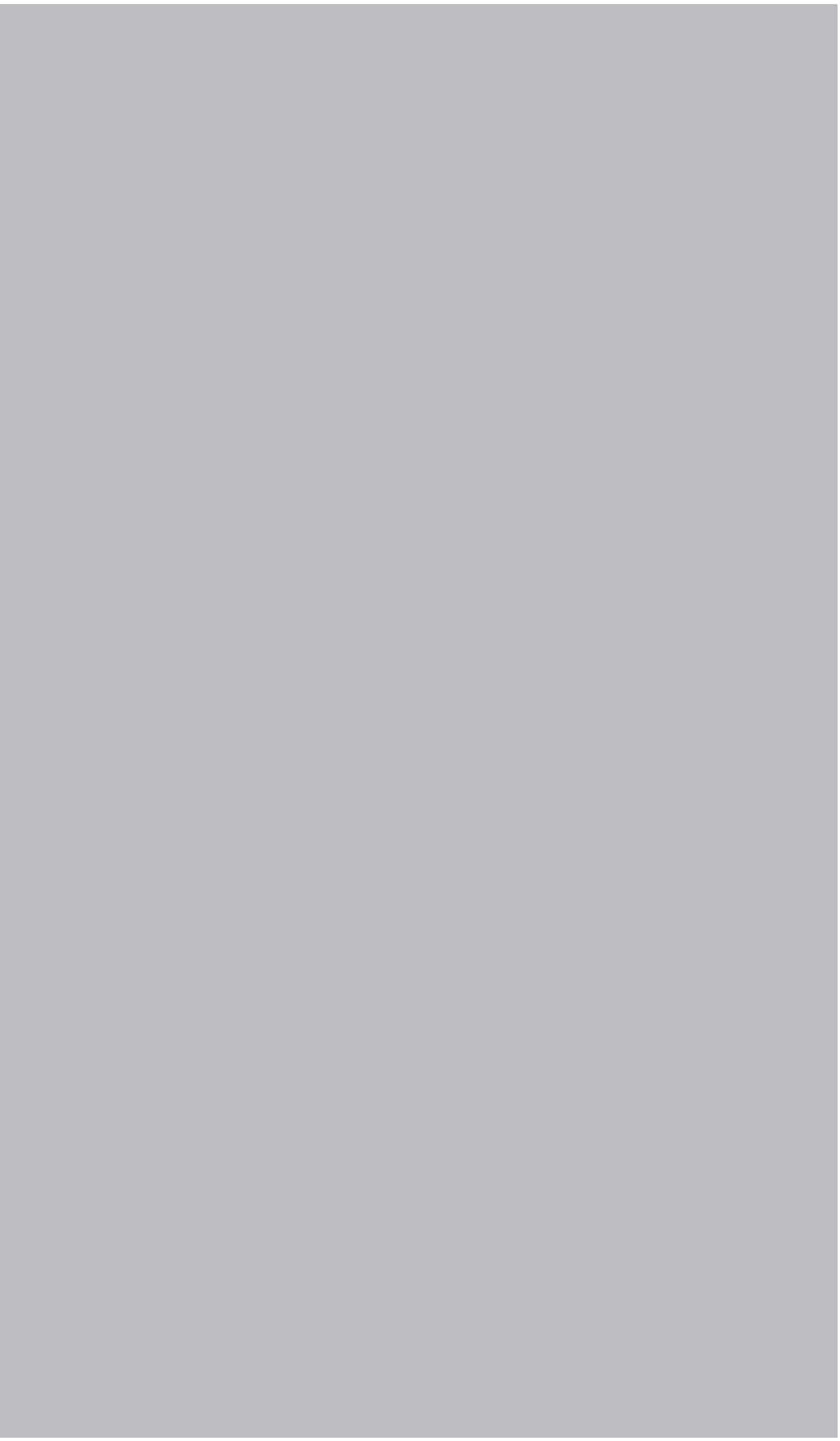


1. Safety Information

Industrial robots are highly programmable, mechanical devices that provide a large degree of freedom when performing various manipulative tasks. To ensure correct and safe use of OMRON industrial robots, carefully read this manual and make yourself well acquainted with the contents. FOLLOW THE WARNINGS, CAUTIONS AND INSTRUCTIONS INCLUDED IN THIS MANUAL. Failure to take necessary safety measures or mishandling due to not following the instructions in this manual may result in trouble or damage to the robot and injury to personnel (robot operator or service personnel) including fatal accidents.

Warning information in this manual is shown classified into the following items.

⚠ DANGER

FAILURE TO FOLLOW DANGER INSTRUCTIONS WILL RESULT IN SEVERE INJURY OR DEATH TO THE ROBOT OPERATOR, A BYSTANDER OR A PERSON INSPECTING OR REPAIRING THE ROBOT. ADDITIONALLY, THERE MAY BE SEVERE PROPERTY DAMAGE.

⚠ WARNING

FAILURE TO FOLLOW WARNING INSTRUCTIONS COULD RESULT IN SEVERE INJURY OR DEATH TO THE ROBOT OPERATOR, A BYSTANDER OR A PERSON INSPECTING OR REPAIRING THE ROBOT. ADDITIONALLY, THERE MAY BE SEVERE PROPERTY DAMAGE.

⚠ CAUTION

FAILURE TO FOLLOW CAUTION INSTRUCTIONS MAY RESULT IN INJURY TO THE ROBOT OPERATOR, A BYSTANDER OR A PERSON INSPECTING OR REPAIRING THE ROBOT, OR DAMAGE TO THE ROBOT AND/OR ROBOT CONTROLLER.

NOTE

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

Refer to the user's manual by any of the following methods to operate or adjust the robot safely and correctly.

1. Operate or adjust the robot while referring to the printed version of the user's manual (available for an additional fee).
2. Operate or adjust the robot while viewing the CD-ROM version of the user's manual on your computer screen.
3. Operate or adjust the robot while referring to a printout of the necessary pages from the CD-ROM version of the user's manual.

It is not possible to list all safety items in detail within the limited space of this manual. So it is essential that the user have a full knowledge of basic safety rules and also that the operator makes correct judgments on safety procedures during operation.
For specific safety information and standards, refer to the applicable local regulations and comply with the instructions. This manual and warning labels supplied with or attached to the robot are written in English. Unless the robot operators or service personnel understand English, 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 user's manuals, CE declarations, and operation screen characters is English only.
Warning labels only have pictograms or else include warning messages in English.

2. Essential Caution Items

Particularly important cautions for handling or operating the robot are described below. In addition, safety information about installation, operation, inspection and maintenance is provided in each chapter. Be sure to comply with these instructions to ensure safe use of the robot.

(1) Observe the following cautions during automatic operation.

Warning labels 1 (Fig. 1-1) are affixed to the robot. See Fig. 2-2 for the locations of warning labels.

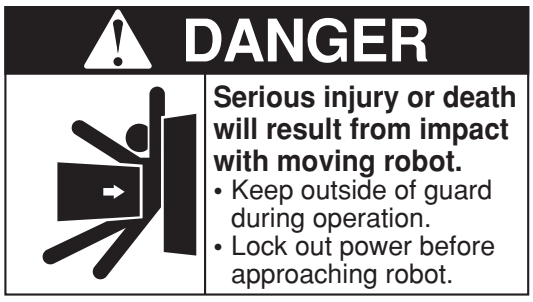
- Install a safeguard enclosure (protective enclosure) to keep any person from entering within the movement range of the robot and suffering injury due to being struck by moving parts.
- Install a safety interlock that triggers emergency stop when the door or panel is opened.
- Install safeguards so that no one can enter inside except from doors or panels equipped with safety interlocks.
- The warning labels shown in Fig. 1-1 are supplied with the robot and should be affixed to a conspicuous spot on doors or panels equipped with safety interlocks.

⚠ DANGER

SERIOUS INJURY OR DEATH WILL RESULT FROM IMPACT WITH MOVING ROBOT.

- KEEP OUTSIDE OF GUARD DURING OPERATION.
- LOCK OUT POWER BEFORE APPROACHING ROBOT.

Fig. 1-1 Warning label 1



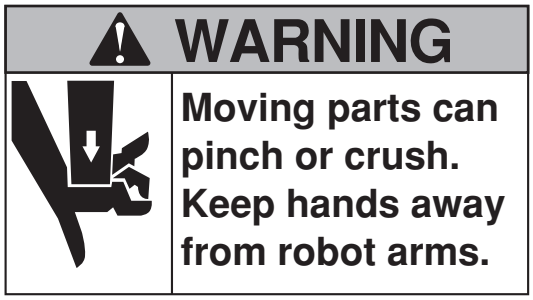
(2) Use caution to prevent hands or fingers from being pinched or crushed.

Warning labels 2 (Fig. 1-2) are affixed to the robot. See Fig. 2-2 for the locations of warning labels. Be careful not to let hands or fingers be pinched or crushed by the moving parts of the robot during transportation or teaching.

⚠ WARNING

MOVING PARTS CAN PINCH OR CRUSH HANDS. KEEP HANDS AWAY FROM ROBOT ARMS.

Fig. 1-2 Warning label 2



(3) Follow the instructions on warning labels and in this manual.

Warning label 3 (Fig. 1-3) is affixed to the robot. See Fig. 2-2 for the locations of warning labels.

- Be sure to read the warning label and this manual carefully and make you thoroughly 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 cautions in this manual as well as descriptions in this chapter (Chapter 1, “Using the Robot Safely”).
- Never install, adjust, inspect or service the robot in any manner that does not comply with the instructions in this manual.

⚠ WARNING

IMPROPER INSTALLATION OR OPERATION CAN RESULT IN SERIOUS INJURY OR DEATH READ USER’S (OWNER’S) MANUAL AND ALL WARNING LABELS BEFORE INSTALLATION OR OPERATION.

Fig. 1-3 Warning label 3

(4) Do not remove the Z-axis upper-end mechanical stopper

Removing or moving the upper-end mechanical stopper attached to the Z-axis spline can damage the Z-axis ball screw. Never remove or move it.

⚠CAUTION

DO NOT REMOVE THIS PART. DAMAGE TO THE BALL SCREW WILL RESULT.

Fig. 1-4 Warning label 4

(5) Do not use the robot in environments containing inflammable gas, etc.

⚠WARNING

- 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.

(6) Do not use the robot in locations possibly subject to electromagnetic interference, etc.

⚠WARNING

AVOID USING THE ROBOT IN LOCATIONS SUBJECT TO ELECTROMAGNETIC INTERFERENCE, ELECTROSTATIC DISCHARGE OR RADIO FREQUENCY INTERFERENCE. MALFUNCTION MAY OTHERWISE OCCUR.

(7) Use caution when releasing the Z-axis (vertical axis) brake.

⚠WARNING

THE Z-AXIS WILL SLIDE DOWN WHEN THE Z-AXIS BRAKE IS RELEASED, CAUSING A HAZARDOUS SITUATION.

- PRESS THE EMERGENCY STOP BUTTON AND PROP UP THE Z-AXIS WITH A SUPPORT STAND BEFORE RELEASING THE BRAKE.
- USE CAUTION NOT TO LET YOUR BODY GET CAUGHT BETWEEN THE Z-AXIS AND INSTALLATION BASE WHEN RELEASING THE BRAKE TO PERFORM DIRECT TEACH.

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

⚠WARNING

- END EFFECTORS MUST BE DESIGNED AND MANUFACTURED SO THAT THEY CAUSE NO HAZARDS (FOR EXAMPLE, LOOSENING OF WORKPIECE) EVEN IF POWER (ELECTRICITY, AIR PRESSURE, ETC.) IS SHUT OFF OR POWER FLUCTUATIONS OCCUR.
- IF THERE IS A POSSIBLE DANGER THAT THE OBJECT GRIPPED BY THE END EFFECTOR MAY FLY OFF OR DROP, THEN PROVIDE APPROPRIATE SAFETY PROTECTION TAKING INTO ACCOUNT THE OBJECT SIZE, WEIGHT, TEMPERATURE AND CHEMICAL PROPERTIES.

(9) Be cautious of possible Z-axis movement when the controller is turned off or emergency stop is triggered. (2-axis robots with air-driven Z-axis)

⚠ WARNING

THE Z-AXIS MOVES UP WHEN THE POWER TO THE CONTROLLER OR PLC IS TURNED OFF, THE PROGRAM IS RESET, EMERGENCY STOP IS TRIGGERED, OR AIR IS SUPPLIED TO THE SOLENOID VALVE FOR THE Z-AXIS AIR CYLINDER.

- DO NOT LET HANDS OR FINGERS GET CAUGHT AND SQUEEZED BY MOVING PARTS OF THE Z-AXIS.
- KEEP THE USUAL ROBOT POSITION IN MIND SO THAT THE Z-AXIS WILL NOT INTERFERE WITH OBSTACLES DURING RAISING OF THE Z-AXIS, EXCEPT IN CASE OF EMERGENCY STOP.

(10) Use the following caution items when the Z-axis is interfering with peripheral equipment. (2-axis robots with air driven Z-axis)

⚠ WARNING

WHEN THE Z-AXIS COMES TO A STOP DUE TO OBSTRUCTIONS FROM PERIPHERAL EQUIPMENT, THE Z-AXIS MAY MOVE SUDDENLY WHEN THE OBSTRUCTION IS REMOVED, CAUSING INJURY SUCH AS PINCHED OR CRUSHED HANDS.

- TURN OFF THE CONTROLLER AND REDUCE THE AIR PRESSURE BEFORE ATTEMPTING TO REMOVE THE OBSTRUCTION.
- BEFORE REDUCING THE AIR PRESSURE, PLACE A SUPPORT STAND UNDER THE Z-AXIS BECAUSE IT WILL DROP UNDER ITS OWN WEIGHT.

(11) Use caution on Z-axis movement when air supply is stopped. (2- axis robots with air-driven Z-axis)

⚠ WARNING

THE Z-AXIS MAY SUDDENLY DROP WHEN THE AIR PRESSURE TO THE Z-AXIS AIR CYLINDER SOLENOID VALVE IS REDUCED, CREATING A HAZARDOUS SITUATION. TURN OFF THE CONTROLLER AND PLACE A PROP OR SUPPORT UNDER THE Z-AXIS BEFORE CUTTING OFF THE AIR SUPPLY.

(12) Use the following caution items when disassembling or replacing the pneumatic equipment.

⚠ WARNING

AIR OR PARTS MAY FLY OUTWARDS IF PNEUMATIC EQUIPMENT IS DISASSEMBLED OR PARTS REPLACED WHILE AIR IS STILL SUPPLIED.

- DO SERVICE WORK AFTER FIRST TURNING OFF THE CONTROLLER AND REDUCING THE AIR PRESSURE.
- BEFORE REDUCING THE AIR PRESSURE, PLACE A SUPPORT STAND UNDER THE Z-AXIS (2-AXIS ROBOTS WITH AIR DRIVEN Z-AXIS) SINCE IT WILL DROP UNDER ITS OWN WEIGHT.

(13) Use the following caution items when removing the Z-axis motor.

⚠ WARNING

THE Z-AXIS WILL DROP WHEN THE Z-AXIS MOTOR IS REMOVED, POSSIBLY RESULTING ININJURY.

- TURN OFF THE CONTROLLER AND SET A SUPPORT STAND UNDER THE Z-AXIS BEFORE REMOVING THE MOTOR.
- USE CAUTION NOT TO ALLOW HANDS OR BODY TO BE SQUEEZED OR CRUSHED BY MOVING PARTS ON THE Z-AXIS OR BETWEEN THE Z-AXIS AND THE INSTALLATION BASE.

(14) Use the following caution during inspection of controller.

⚠ WARNING

- WHEN YOU NEED TO TOUCH THE TERMINALS OR CONNECTORS ON THE OUTSIDE OF THE CONTROLLER DURING INSPECTION, ALWAYS FIRST TURN OFF THE CONTROLLER POWER SWITCH AND ALSO THE POWER SOURCE IN ORDER TO PREVENT POSSIBLE ELECTRICAL SHOCK.
- NEVER TOUCH ANY INTERNAL PARTS OF THE CONTROLLER.

For precautions on handling the controller, refer to the “OMRON Robot Controller User’s Manual”.

(15) Consult us for corrective action when the robot is damaged or malfunction occurs.

⚠ WARNING

IF ANY PART OF THE ROBOT IS DAMAGED OR ANY MALFUNCTION OCCURS, CONTINUOUS OPERATION MAY BE VERY DANGEROUS. PLEASE CONSULT OMRON DEALER FOR CORRECTIVE ACTION.

If the following damages or troubles exist	These dangers can happen
Damage to machine harness or robot cable	Electrical shock, malfunction of robot
Damage to exterior of robot	Flying outwards of damaged parts during robot operation
Abnormal operation of robot (positioning error, excessive vibration, etc.)	Malfunction of robot
Z-axis brake trouble	Dropping of load

(16) Use caution not to touch the controller cooling fan.

⚠ WARNING

- BODILY INJURY MAY OCCUR FROM COMING INTO CONTACT WITH THE COOLING FAN WHILE IT IS ROTATING.
- WHEN REMOVING THE FAN COVER FOR INSPECTION, FIRST TURN OFF THE CONTROLLER AND MAKE SURE THE FAN HAS STOPPED.

(17) Use caution not to touch the high temperature motor or speed reduction gear casing.

⚠ WARNING

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

(18) Do not remove, alter or stain the warning labels.

⚠ WARNING

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

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

(19) Protective bonding

⚠ WARNING

BE SURE TO GROUND THE ROBOT AND CONTROLLER TO PREVENT ELECTRICAL.

(20) Be sure to make correct parameter settings.

⚠ CAUTION

THE ROBOT MUST BE OPERATED WITH CORRECT TOLERABLE MOMENT OF INERTIA AND ACCELERATION COEFFICIENTS ACCORDING TO THE MANIPULATOR TIP MASS AND MOMENT OF INERTIA. IF THIS IS NOT OBSERVED, PREMATURE END TO THE LIFE OF THE DRIVE UNITS, DAMAGE TO THE ROBOT PARTS OR RESIDUAL VIBRATION DURING POSITIONING MAY RESULT.

(21) Do not use the robot for tasks requiring motor thrust.

⚠ CAUTION

AVOID USING THE XG SERIES ROBOTS FOR TASKS WHICH MAKE USE OF MOTOR THRUST (PRESS-FITTING, BURR REMOVAL, ETC.). THESE TASKS MAY CAUSE MALFUNCTIONS OF THE ROBOT.

(22) If the X, Y or R axis rotation angle is small

⚠ CAUTION

IF THE X, Y OR R AXIS ROTATION ANGLE IS SMALLER THAN 5° SO THAT IT ALWAYS MOVES IN THE SAME POSITION, AN OIL FILM IS DIFFICULT TO BE FORMED ON THE JOINT SUPPORT BEARING, POSSIBLY LEADING TO DAMAGE TO THE BEARING. IN THIS TYPE OF OPERATION, ADD A MOVEMENT SO THAT THE JOINT MOVES THROUGH 90° OR MORE, ABOUT 5 TIMES A DAY.

(23) Adjustment and inspection

⚠ WARNING

DO NOT ATTEMPT ANY INSTALLATION, ADJUSTMENT, INSPECTION OR MAINTENANCE UNLESS IT IS DESCRIBED IN THIS MANUAL.

(24) Repair and modification

⚠ WARNING

DO NOT ATTEMPT ANY REPAIR, PARTS REPLACEMENT AND MODIFICATION UNLESS DESCRIBED IN THIS MANUAL. THESE WORKS REQUIRE TECHNICAL KNOWLEDGE AND SKILL, AND MAY ALSO INVOLVE WORK HAZARDS.

(25) Precautions when disposing of the robot

When disposing of the robot, handle it as industrial waste.

(26) Location for installing the controller and the programming box

The robot controller and programming box should be installed at a location that is outside the robot movement range yet where it is easy to operate and view the robot performing tasks.

(27) Protect electrical wiring and hydraulic/pneumatic hoses as needed.

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

(28) Install an operation status light.

Install an operation status light (signal light tower, etc.) at an easy-to-see position so the operator will know whether the robot is merely stopped or is in emergency-error stop.

(29) Clean work tools, etc.

Work tools such as welding guns and paint nozzles which are mounted in the robot arm will preferably be cleaned automatically.

(30) Provide adequate lighting.

Make sure to provide enough lighting to ensure safety during work.

(31) Draw up "work instructions" and makes sure the operator learns them well.

Decide on "work instructions" for the following items in cases where personnel must work within the robot movement range to perform teaching, maintenance or inspection. Make sure the workers know these "work instructions" well.

(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

(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.

1. Show a display on the operator panel
2. Ensure the safety of workers performing tasks within the robot movement range
3. Clearly specify position and posture during work
   Position and posture where worker can constantly check robot movements and immediately move to avoid trouble if an error/problem occurs
4. Install noise prevention measures
5. Use methods for signaling operators of related equipment
6. 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 manufacture's technicians, and workplace safety consultants, etc.

(32) Display a sign on operation panel during work

Display an easy to understand sign or message on the programming box and operation panel during the job task, to prevent anyone other than the operators for that job task from mistakenly operating a start or selector switch. If needed, take other measures such as locking the cover on the operation panel.

(33) Make daily and periodic inspections.

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

(2) When you make periodic inspections or repairs, make a record and store it for at least 3 years

3. Industrial Robot Operating and Maintenance Personnel

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 user's manual carefully to understand its contents before attempting the robot operation.

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.

4. Robot Safety Functions

(1) Overload detection.

This function detects an overload applied to the motor and shuts off the servo power. If an overload error occurs, take the following measures.

1. Insert a timer in the program.
2. Reduce the acceleration coefficient.

(2) Overheat detection

This function detects an abnormal temperature rise in the driver inside the controller and shuts off the servo power. If an overheat error occurs, take the following measures.

1. Insert a timer in the program.
2. Reduce the acceleration coefficient.

(3) 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.

Note: The working envelope is the area limited by soft limits.

⚠ WARNING

SOFT LIMITS MUST BE SET WITHIN THE MOVEMENT RANGE (MECHANICAL STOPPER). IF THE SOFT LIMIT IS SET OUTSIDE THE MOVEMENT RANGE, THE ROBOT AXIS MAY COLLIDE WITH THE MECHANICAL STOPPER AT HIGH SPEED, CAUSING THE OBJECT GRIPPED BY THE END EFFECTOR TO FLY OR DROP AND THE ROBOT TO MALFUNCTION.

(4) Mechanical stoppers

If the servo power is suddenly shut off during high-speed operation by emergency stop or safety functions, these mechanical stoppers prevent the axis from exceeding the movement range. The movement range is the area limited by mechanical stoppers.

- The movement ranges of the X-axis arm can be limited as needed by use of mechanical stoppers.
- On the Y-axis arm, mechanical stoppers are fixed at both ends of the maximum movement range.
- The Z-axis has a mechanical stopper at the upper end and lower end.
- No mechanical stopper is provided on the R-axis.

⚠ WARNING

AXIS MOVEMENT WILL NOT STOP IMMEDIATELY AFTER THE SERVO POWER SUPPLY IS SHUT OFF BY EMERGENCY STOP OR OTHER SAFETY FUNCTIONS.

(5) Z-axis (vertical axis) brake

An electromagnetic brake is installed on the Z-axis to prevent the Z-axis from sliding down when servo power is turned off. This brake is working when the controller is off or the Z-axis servo power is off even when the controller is on. The Z-axis brake can be released by means of the programming unit or by a command in the program when the controller is on.

⚠ WARNING

THE Z-AXIS WILL SLIDE DOWN WHEN THE Z-AXIS BRAKE IS RELEASED, CREATING A HAZARDOUS SITUATION.

- PRESS THE EMERGENCY STOP BUTTON AND PROP THE Z-AXIS WITH A SUPPORT STAND BEFORE RELEASING THE BRAKE.
- USE CAUTION NOT TO LET YOUR BODY GET CAUGHT BETWEEN THE Z-AXIS AND INSTALLATION BASE WHEN RELEASING THE BRAKE TO PERFORM DIRECT TEACH.

5. Safety Measures for the System

Since the robot is commonly used in conjunction with an automated system, dangerous situations are more likely to occur from the automated system than from the robot itself. Accordingly, appropriate safety measures must be taken on the part of the system manufacturer according to the individual system. The system manufacturer should provide a proper instruction manual for safe, correct operation and servicing of the system.

6. Trial Operation

After making installations, adjustments, inspections, maintenance or repairs to the robot, make a trial run using the following procedures.

(1) If a safeguard enclosure has not yet been provided right after installation of the robot, rope off or chain off around the movement area of the manipulator in place of the safeguard enclosure, and observe the following points.

1. Use sturdy, 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 sign to keep the operator or other personnel from entering the movement range of the manipulator.

(2) Check the following points before turning on the controller.

1. Is the robot securely and correctly installed?
2. Are the electrical connections to the robot correct?
3. Are items such as air pressure correctly supplied?
4. Is the robot correctly connected to peripheral equipment?
5. Have safety measures (safeguard enclosure, etc.) been taken?
6. Does the installation environment meet the specified standards?

(3) After the controller is turned on, check the following points from outside the safeguard enclosure.

1. Does the robot start and stop as intended? Can the operation mode be selected correctly?
2. Does each axis move as intended within the soft limits?
3. Does the end effector move as intended?
4. Are the signal transmissions to the end effector and peripheral equipment correct?
5. Does emergency stop work?
6. Are the teaching and playback functions normal?
7. Are the safeguard enclosure and interlock working as intended?
8. Does the robot move correctly during automatic operation?

7. Work Within the Safeguard Enclosure

(1) When work is required inside the safeguard enclosure, always turn off the controller and place a sign indicating that the robot is being adjusted or serviced in order to keep any other person from touching the controller switch or operation panel, except for the following cases.

1) Origin position setting (See Section 3 in Chapter 4.)
2) Soft limit settings (See Section 4 in Chapter 4.)
3) Standard coordinate settings (See Section 5 in Chapter 4.)
4) Teaching

For items 1) to 3), follow the precautions and procedure for each section. To perform item 4), refer to the description in (2) below.

(2) Teaching

When performing teaching within the safeguard enclosure, comply with the instructions listed below.

1) Check or perform the following points from outside the safeguard enclosure.
   1. Make sure that no hazards are present within the safeguard enclosure by a visual check.
   2. Check that the programming unit PB operates correctly.
   3. Check that no failures are found in the robot.
   4. Check that emergency stop works correctly.
   5. Select teaching mode and prohibit automatic operation.
2) Never enter the movement range of the manipulator while within the safeguard enclosure.

8. Automatic Operation

Automatic operation described here includes all operations in AUTO mode.

(1) Check the following before starting automatic operation.

1. No one is within the safeguard enclosure.
2. The programming unit and tools are in their specified locations.
3. The alarm or error lamps on the robot and peripheral equipment do not flash.
4. The safeguard enclosure is securely installed with safety interlocks actuated.

(2) Observe the following during automatic operation or in cases where an error occurs.

1) After automatic operation has started, check the operation status and warning lamp to ensure that the robot is in automatic operation.
2) Never enter the safeguard enclosure during automatic operation.
3) If an error occurs in the robot or peripheral equipment, observe the following procedure before entering the safeguard enclosure.
   1. Press the emergency stop button to set the robot to emergency stop.
   2. Place a sign on the start switch, indicating that the robot is being inspected in order to keep any other person from touching the start switch and restarting the robot.

9. Warranty

The OMRON robot and/or related product you have purchased are warranted against the defects or malfunctions as described below.

Warranty description

If a failure or breakdown occurs due to defects in materials or workmanship in the genuine parts constituting this OMRON robot and/or related product within the warranty period, then OMRON shall supply free of charge the necessary replacement/repair parts.

Warranty Period

The warranty period ends 24 months after the date of manufacturing as shown on the products.

Exceptions to the Warranty

This warranty will not apply in the following cases:

(1) Fatigue arising due to the passage of time, natural wear and tear occurring during operation (natural fading of painted or plated surfaces, deterioration of parts subject to wear, etc.)

(2) Minor natural phenomena that do not affect the capabilities of the robot and/or related product (noise from computers, motors, etc.).

(3) Programs, point data and other internal data that were changed or created by the user.

Failures resulting from the following causes are not covered by warranty.

1) Damage due to earthquakes, storms, floods, thunderbolt, fire or any other natural or man-made disasters.
2) Troubles caused by procedures prohibited in this manual.
3) Modifications to the robot and/or related product not approved by OMRON or OMRON sales representatives.
4) Use of any other than genuine parts and specified grease and lubricants.
5) Incorrect or inadequate maintenance and inspection.
6) Repairs by other than authorized dealers.

WARRANTY
OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.
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 REQUIREMENTS 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 COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER 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.**

Chapter 2 Functions

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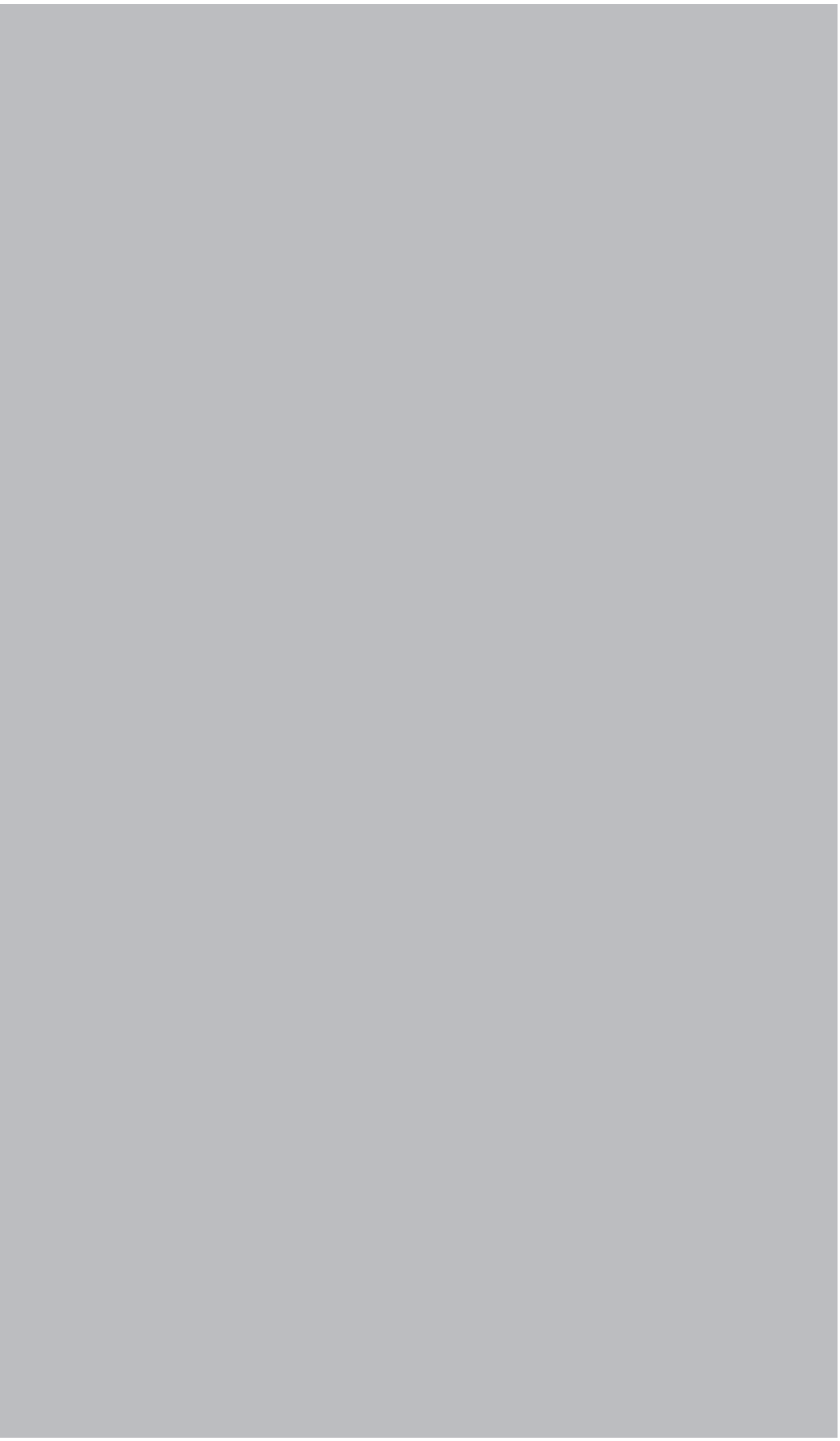


1. Robot Manipulator

The XG series robots are available in 4-axis models having an X/Y-axis arm (equivalent to human arm) and a Z/R-axis (equivalent to human wrist). With these 4 axes, the XG series robots can move as shown in Fig. 2-1. By attaching different types of end effector (gripper) to the end of the arm, a wide range of tasks can be performed with high precision at high speeds. The (+) and (-) signs show the direction of axis movement when the jog keys on the programming unit are pressed (standard setting at the factory). Fig. 2-2 on the subsequent pages show part names and functions of each robot model.

Fig. 2-1 Manipulator movement

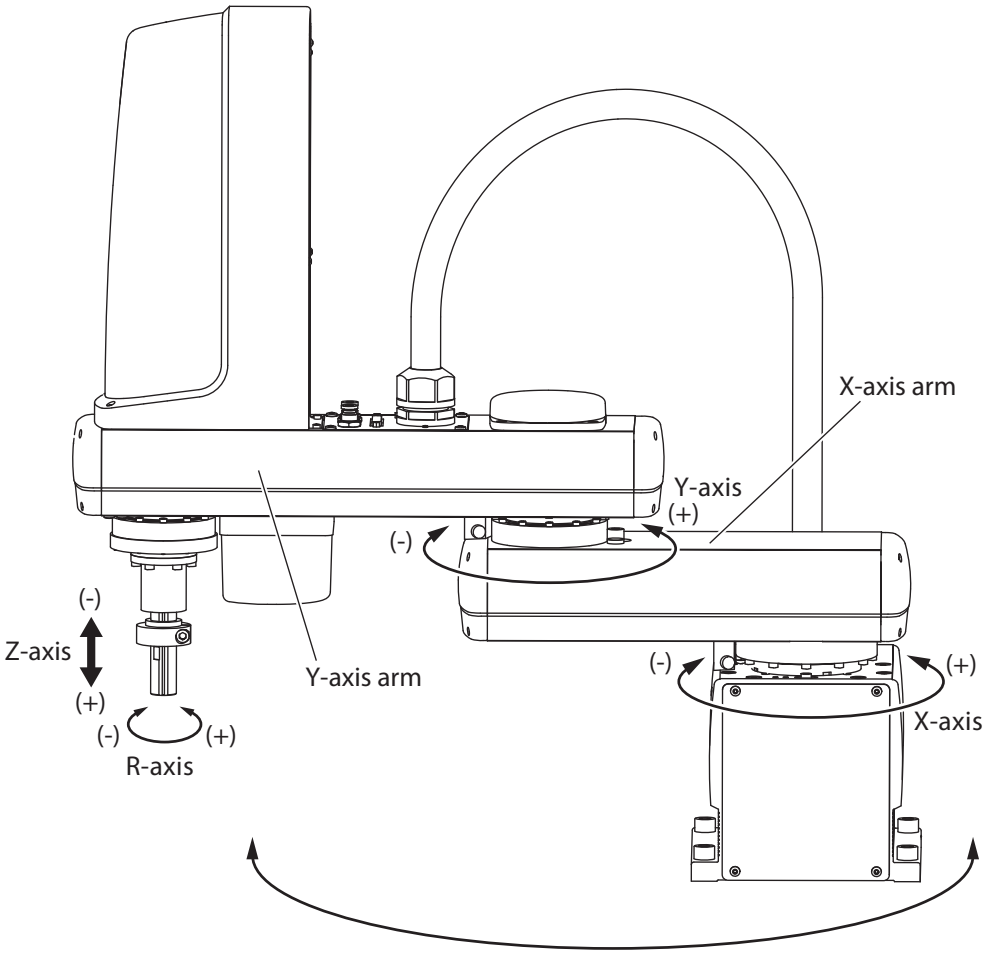
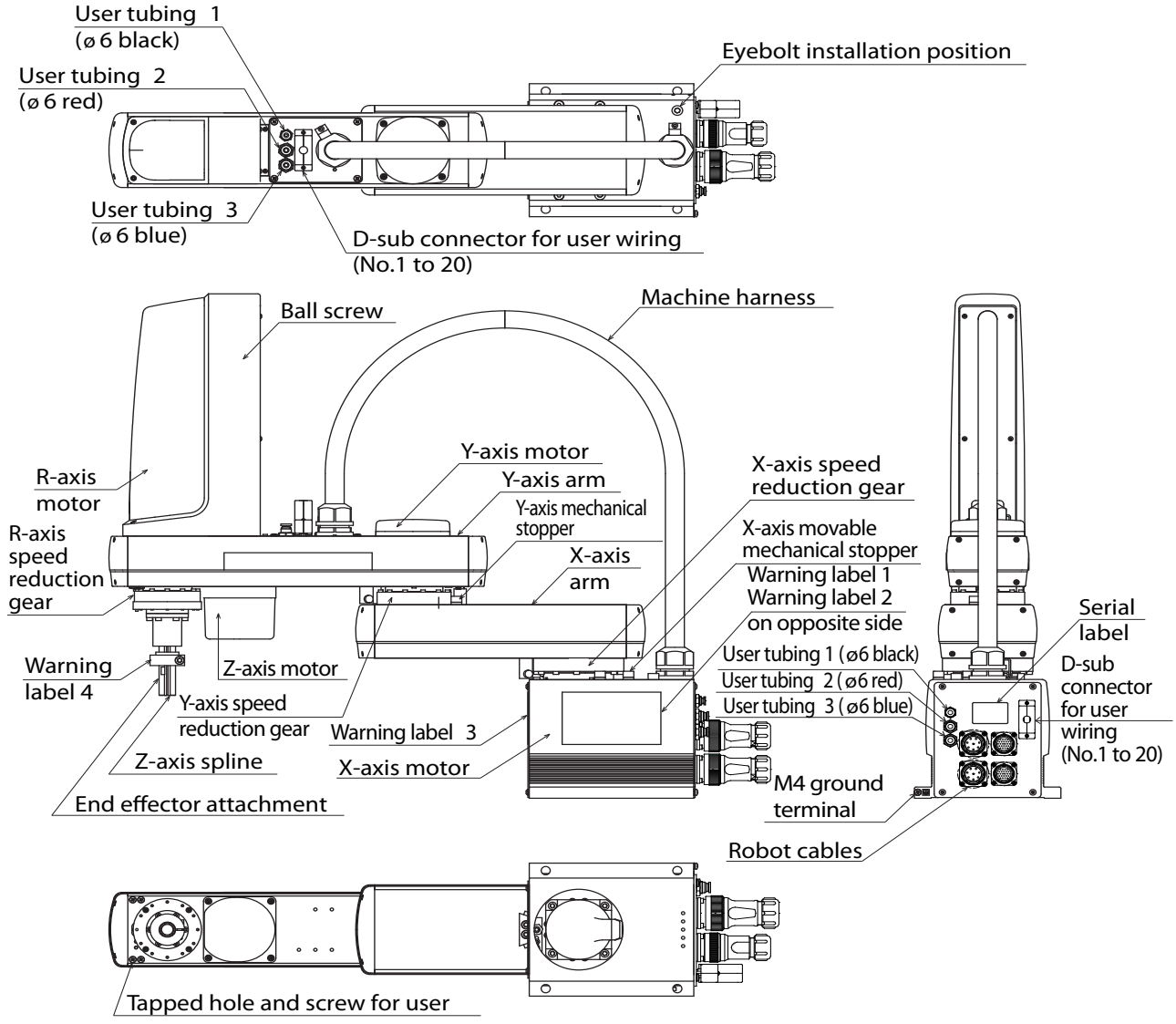


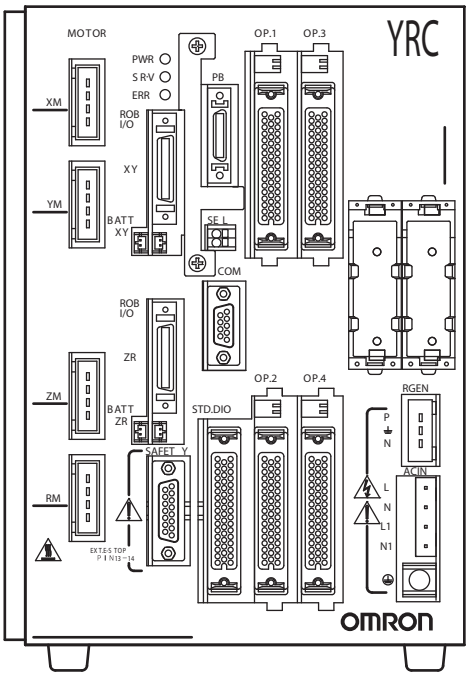
Fig. 2-2 R6YXG500, R6YXG600, R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000



2. Robot Controller

The XG series robot comes supplied with a robot controller YRC v.1. For more details, refer to the separate “OMRON Robot Controller User’s Manual”.

Fig. 2-3 Robot controller



YRC v.1

3. Robot Initialization Number List

The XG series robots are initialized for optimum setting (default setting) according to the robot model prior to shipping. The robot controllers do not have to be reinitialized during normal operation. However, if for some reason the controller must be reinitialized, proceed while referring to the list below.

⚠ CAUTION

- ABSOLUTE RESET MUST BE PERFORMED AFTER REINITIALIZING THE CONTROLLER. BEFORE REINITIALIZING THE CONTROLLER, READ THE DESCRIPTIONS IN "3. ADJUSTING THE ORIGIN" IN CHAPTER 4 AND MAKE SURE YOU THOROUGHLY UNDERSTAND THE PROCEDURE.
- WHEN THE CONTROLLER IS INITIALIZED, THE "ARM LENGTH" AND "OFFSET PULSE" SETTINGS IN THE AXIS PARAMETERS WILL BE ERASED, MAKING THE STANDARD COORDINATE SETTINGS INVALID. (FOR DETAILS ON STANDARD COORDINATES, SEE "5. SETTING THE STANDARD COORDINATES" IN CHAPTER 4.) IF YOU DO NOT WANT TO CHANGE THE ORIGIN POSITION BY INITIALIZING, MAKE A NOTE OF THE "ARM LENGTH" AND "OFFSET PULSE" SETTINGS BEFORE INITIALIZING, AND RE-ENTER THEIR SETTINGS AFTER INITIALIZATION IS COMPLETE.

Robot initialization number	Model name
2117	R6YXG500 200
2118	R6YXG500 300
2119	R6YXG600 200
2120	R6YXG600 300
2121	R6YXGH600 200
2122	R6YXGH600 400
2123	R6YXG700 200
2124	R6YXG700 400
2125	R6YXG800 200
2126	R6YXG800 400
2127	R6YXG900 200
2128	R6YXG900 400
2129	R6YXG1000 200
2130	R6YXG1000 400

Chapter 3 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 40°C
Allowable ambient humidity	35 to 85% RH (non condensation)
Altitude	0 to 1000 meters above sea level
Ambient environments	Avoid installing near water, cutting water, oil, dust, metallic chips and organic solvent.
	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 0.58MPa (6.0kgf/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.)

For detailed information on how to install the robot controller, refer to the separate “OMRON Robot Controller User’s Manual”.

⚠ WARNING

- AVOID INSTALLING THE ROBOT IN LOCATIONS WHERE THE AMBIENT CONDITIONS MAY EXCEED THE ALLOWABLE TEMPERATURE OR HUMIDITY, OR IN ENVIRONMENTS WHERE WATER, 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 MANIPULATOR TO FALL OVER.

1-2 Installation base

⚠ WARNING

- INSTALL THE ROBOT ON A HORIZONTAL SURFACE, WITH THE BASE MOUNT SECTION FACING DOWN. IF INSTALLED BY OTHER METHODS WITH THE BASE MOUNT SECTION NOT FACING DOWN, GREASE MIGHT LEAK FROM THE REDUCTION GEAR UNIT.
- DO NOT PLACE THE ROBOT ON A MOVING INSTALLATION BASE. EXCESSIVE LOADS WILL BE APPLIED TO THE ROBOT ARM BY MOVEMENT OF THE INSTALLATION BASE, RESULTING IN DAMAGE TO THE ROBOT.

⚠ WARNING

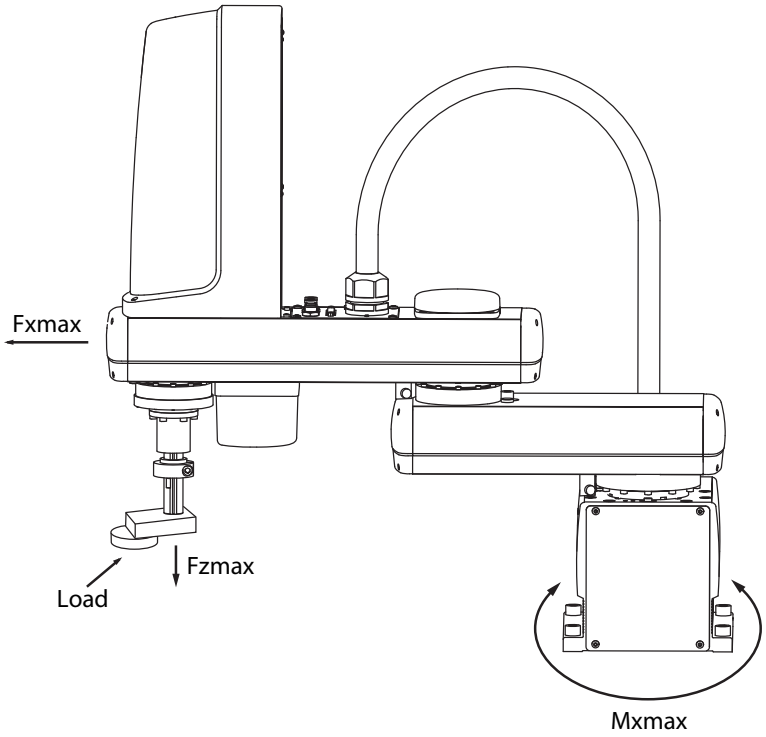
- THE MANIPULATOR POSITIONING MIGHT DECREASE IF THE INSTALLATION SURFACE PRECISION IS INSUFFICIENT.
- IF THE INSTALLATION BASE IS NOT SUFFICIENTLY RIGID AND STABLE OR A THIN METALLIC PLATE IS ATTACHED TO THE INSTALLATION BASE, VIBRATION (RESONANCE) DURING OPERATION, CAUSING DETRIMENTAL EFFECTS ON THE MANIPULATOR WORK.

1) Prepare a sufficiently rigid and stable installation base, taking account of the robot weight including the end effector (gripper), workpiece and reaction force while the robot is operating. The maximum reaction force (see Fig. 3-1) applied to the X-axis and Z-axis of each robot during operation is shown in the table below. These values are an instantaneous force applied to the robot during operation and do not indicate the maximum load capacity.

The maximum reaction force

Robot Model	Fxmax		Mxmax		Fzmax	
	N	kgf	Nm	kgfm	N	kgf
R6YXG500	1416	144	178	18	134	14
R6YXG600	1476	150	178	18	134	14
R6YXGH600	2125	217	395	40	205	21
R6YXG700	2479	253	395	40	239	24
R6YXG800	2561	261	395	40	239	24
R6YXG900	2494	254	395	40	165	17
R6YXG1000	2427	248	395	40	165	17

Fig. 3-1 Maximum reaction force applied during operation



2) The parallelism of the installation base surface must be machined within a precision of ±0.05mm/500mm. The robot base mount must be installed facing down and in a level position (except ceiling-mount models which should be installed with the base mount facing up).
3) Tap holes into the surface of the installation base. For machining dimensions and positions, refer to “1-2 External view and dimensions” in Chapter 7.
4) Securely fix the installation base on the floor with anchor bolts.

2. Installation

2-1 Unpacking

⚠ WARNING

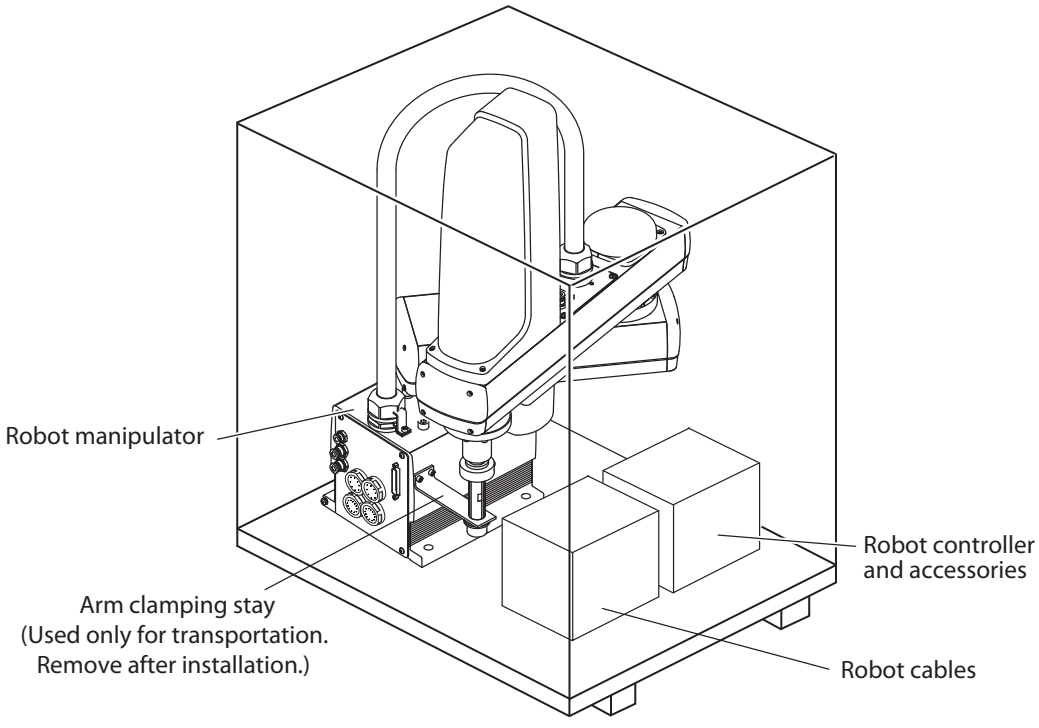
THE ROBOT AND CONTROLLER ARE HEAVY. TAKE SUFFICIENT CARE NOT TO DROP THEM DURING MOVING OR UNPACKING AS THIS MAY DAMAGE THE EQUIPMENT OR CAUSE BODILY INJURY.

⚠ CAUTION

WHEN MOVING THE ROBOT OR CONTROLLER BY EQUIPMENT SUCH AS A FOLKLIFT 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 XG series robot comes packed with a robot controller and accessories, according to the order specifications. Using a carrying cart (dolly) or forklift, move the package to near the installation base. Take sufficient care not to apply shocks to the equipment when unpacking it.

Fig. 3-2 Packed state



R6YXG500, R6YXG600, R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

2-2 Checking the product

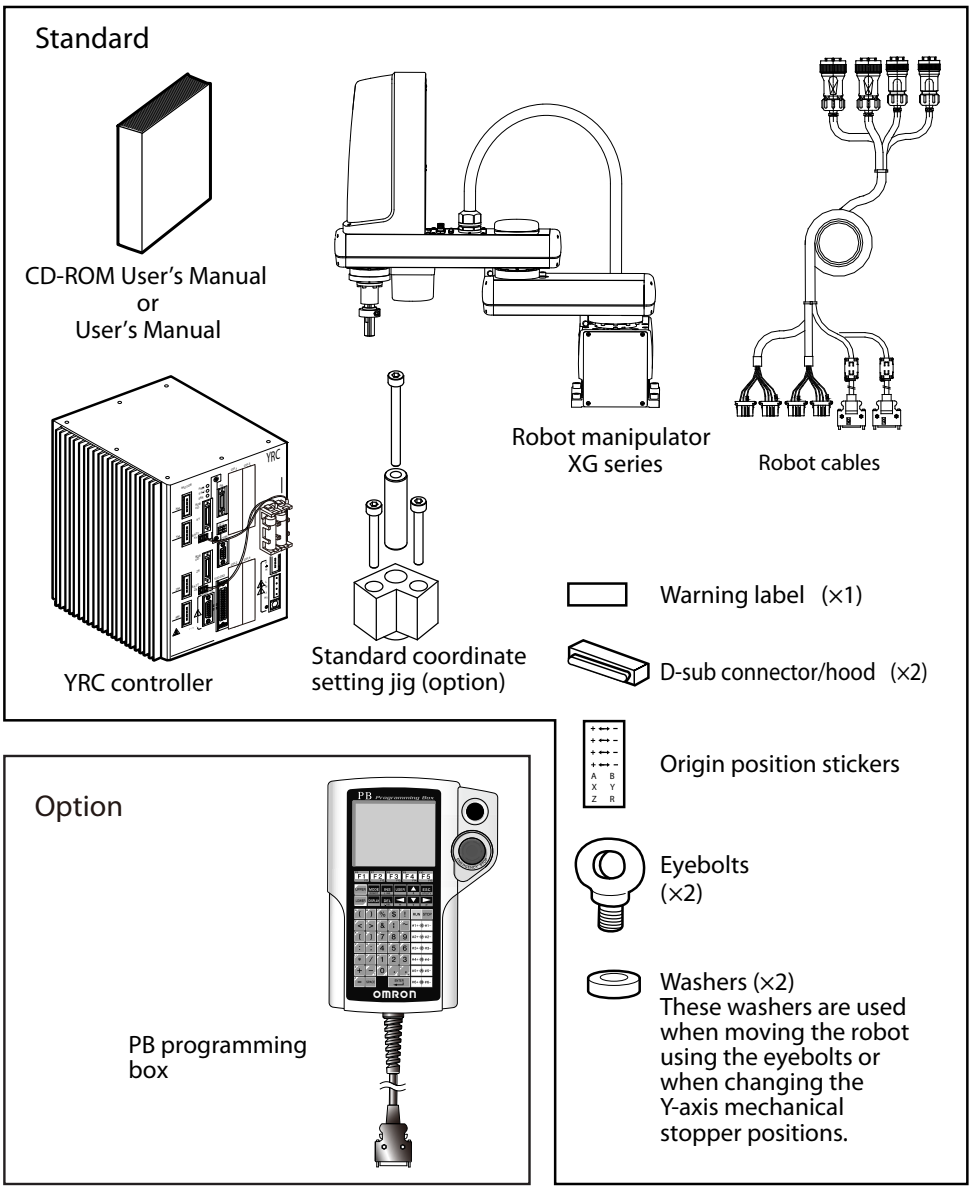
After unpacking, check the product configuration and conditions.
The following configurations are typical examples, so please check that the product is as specified in your order.

⚠ CAUTION

IF THERE IS ANY DAMAGE DUE TO TRANSPORTATION OR INSUFFICIENT PARTS, PLEASE NOTIFY YOUR OMRON SALES OFFICE OR DEALER IMMEDIATELY.

Controller : YRC v.1
Robot : R6YXG500, R6YXG600, R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

Fig. 3-3 Product configurations



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.

To check the mass of each robot, refer to “1-1 Basic specifications” in Chapter 7.

2-3-1 Moving the R6YXG500, R6YXG600, R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

⚠ WARNING

SERIOUS INJURY MAY OCCUR IF THE ROBOT FALLS AND PINS SOMEONE UNDER IT.

- CHECK THAT THERE ARE NO CRACKS AND CORROSION ON THE EYEBOLT INSTALLATION. IF FOUND, DO NOT USE EYEBOLTS TO MOVE THE ROBOT.
- SCREW THE EYEBOLTS SECURELY INTO THE TAPPED HOLES UNTIL THE BEARING SURFACE OF EYEBOLT MAKES TIGHT CONTACT WITH THE BEARING SURFACE ON THE ARM.
- 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.
- REMOVE ALL LOADS ATTACHED TO THE ROBOT MANIPULATOR END. IF ANY LOAD IS STILL ATTACHED, THE ROBOT MAY LOSE BALANCE WHILE BEING CARRIED, AND TOPPLE OVER CAUSING ACCIDENTS.

⚠ 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.

To move a robot (for example, the R6YXG500) correctly and safely, follow the procedure below. (See Fig. 3-4.) Use the same procedure to move other robots.

1) Lower the Z-axis to a point approximately 24mm (35mm for R6YXGH600 or longer arm robots) lower than the origin position. Then turn off the controller and unplug the robot cable from the controller. (The Z-axis is fixed to the base with an arm clamp stay at the factory prior to shipment.)
2) Remove the bolts on the X-axis arm.

3) Fold the X and Y-axis arms as shown in the drawing, and clamp the Y-axis arm to the robot base by using the stay, bolts and washers (2 washers for R6YXG500 and R6YXG600; 1 washer for R6YXGH600 or longer arm robots) that come with the robot.
If the arms cannot be folded in the carrying position due to the X-axis mechanical stoppers, then remove them. (When the robot is shipped, the mechanical stoppers are installed to provide the maximum movement range.)

4) Screw and tighten the two eyebolts through washers into the upper surface of the X-axis arm. (The washers are also used when changing the Y-axis mechanical stopper positions. So if they are used, remove the washers and place them underneath the eyebolts.)

5) Wind the robot cable around the upper part of the robot base so that it does not hang up on the base mount, then fasten the cable end with adhesive tape.

6) Prepare two looped ropes with the same length to allow a good lifting balance, then pass each rope through each eyebolt and catch it on the hoist hook.

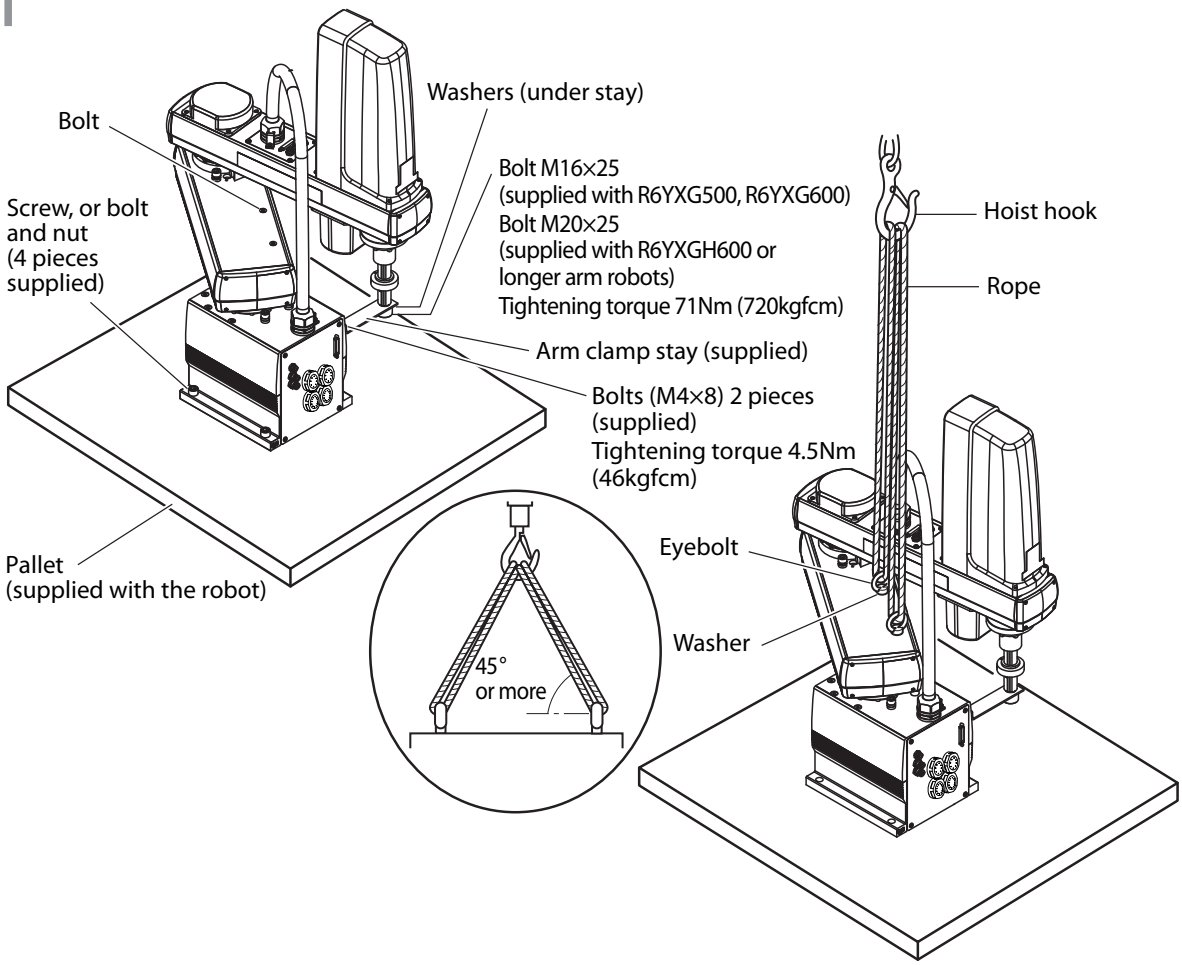
7 Slightly lift the hoist so that each rope has light tension to hold the robot. In this state, remove the bolts securing the robot base to the pallet supplied or installation base (if robot is to be moved to another installation base).

8) Using caution to keep the balance of the robot and avoid subjecting it to any strong vibrations and shocks, operate the hoist carefully to move to the installation base. The angle between each rope and the arm surface should be kept at 45 degrees or more.

9) Slightly lower the robot on the installation base and temporarily secure it by tightening the bolts.
(For tightening torque to secure the robot firmly, see the next section, “2-4 Installing the robot”.)

10) Remove the rope, eyebolts and arm clamp stay. Screw the bolts into the upper surface of the X-axis. (Always attach these bolts to protect the eyebolt hole threads.) Be sure to keep the eyebolts, arm clamp stay, bolts and pallet, since they may be used to move the robot again.

Fig. 3-4


Bolt
Washers (under stay)
Bolt M16×25
(supplied with R6YXG500, R6YXG600)
Bolt M20×25
(supplied with R6YXGH600 or
longer arm robots)
Tightening torque 71Nm (720kgfcm)
Screw, or bolt
and nut
(4 pieces
supplied)
Arm clamp stay (supplied)
Bolts (M4×8) 2 pieces
(supplied)
Tightening torque 4.5Nm
(46kgfcm)
Pallet
(supplied with the robot)
45°
or more
Hoist hook
Rope
Eyebolt
Washer

2-4 Installing the robot

Install the robot securely with the four hex socket head bolts as shown in Fig. 3-5.

⚠ 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 TO THE CORRECT TORQUE. IF THE BOLTS ARE NOT TIGHTENED CORRECTLY, THE ROBOT MIGHT FALL OVER DURING OPERATION CAUSING A SERIOUS ACCIDENT.

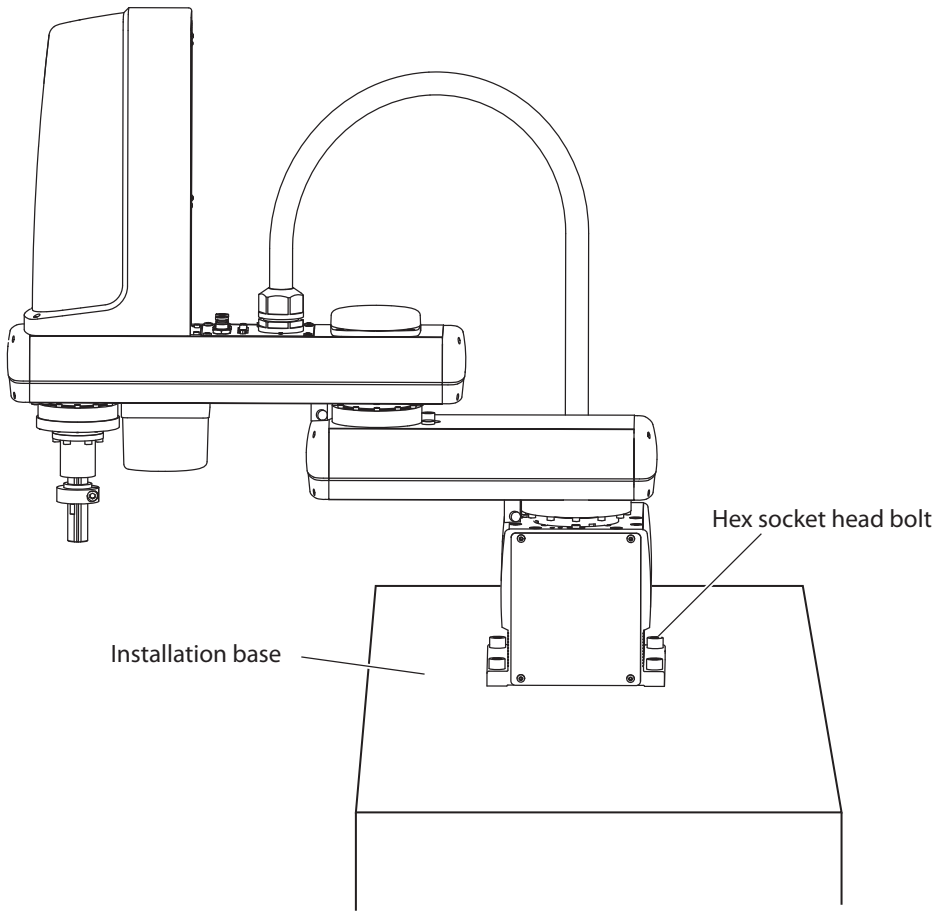
Tightening torque

Robot Model	Bolts Used	Tightening torque
R6YXG500, R6YXG600	M10	71Nm (720kgfcm)
R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000	M12	128Nm (1310kgfcm)

Depth of tapped holes in installation base:

Iron installation base	Bolt diameter × 1.5 or more
Aluminum installation base	Bolt diameter × 3 or more
Recommended bolt	JIS B 1176 hex socket head bolt, or equivalent Strength class JIS B 1051 12.9, or equivalent.

Fig. 3-5 Installing the robot



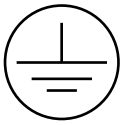
3. Protective Bonding

⚠ WARNING

- BE SURE TO GROUND THE ROBOT AND CONTROLLER TO PREVENT ELECTRICAL SHOCK.
- TURN OFF THE CONTROLLER BEFORE GROUNDING THE ROBOT.

The robot must be grounded as follows:

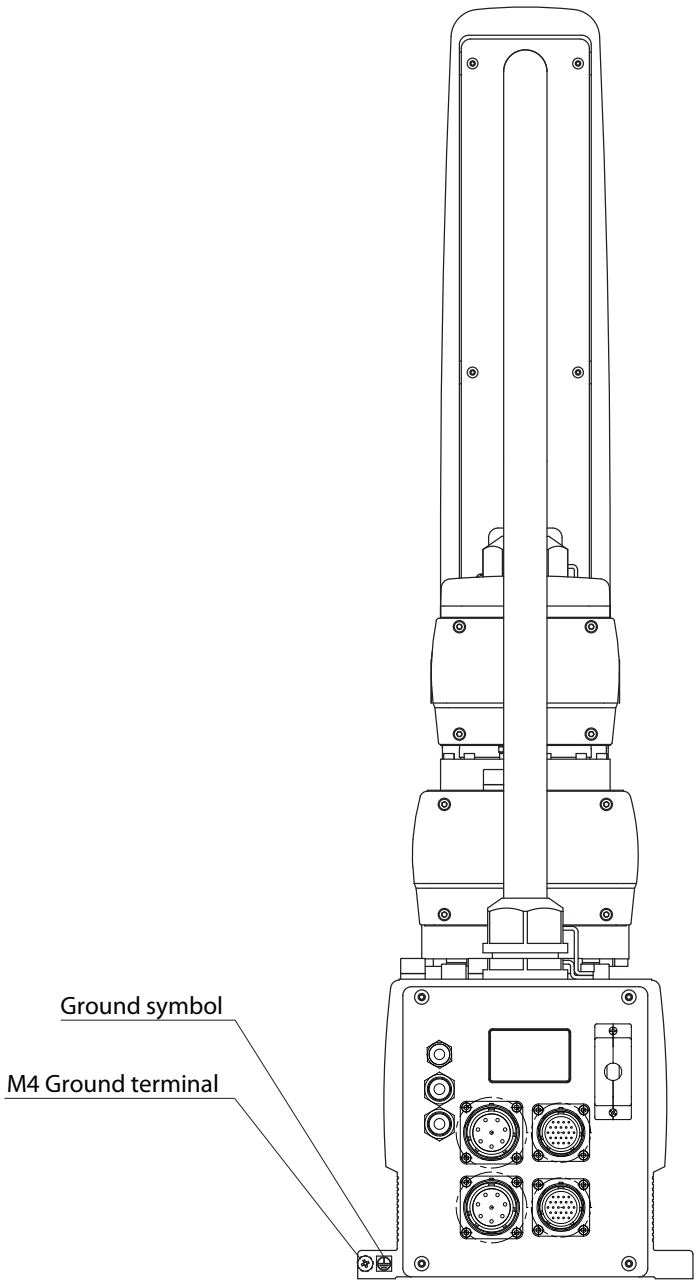
1) Provide a terminal marked “PE” for the protective conductor of the entire system and connect it to an external protective conductor. In addition, securely connect the ground terminal on the robot pedestal to the same protective conductor. (See Fig. 3-6 for example of the R6YXG500.)



(Symbol 417-IEC-5019)

2) When the end effector uses an electrical device which, if it malfunctions, might make contact with the power supply, the user must provide proper grounding on his own responsibility. The XG series robots do not have a ground terminal for this purpose.
3) For details on protective bonding on the robot body to comply with CE Marking, follow the instructions on protective bonding explained in the “OMRON Robot Controller User’s Manual” or “CE Marking manual”.
4) Use a ground cable with a conductor wire cross section of at least 2.0mm^2 and a length within 1 meter.

Fig. 3-6 Ground terminal



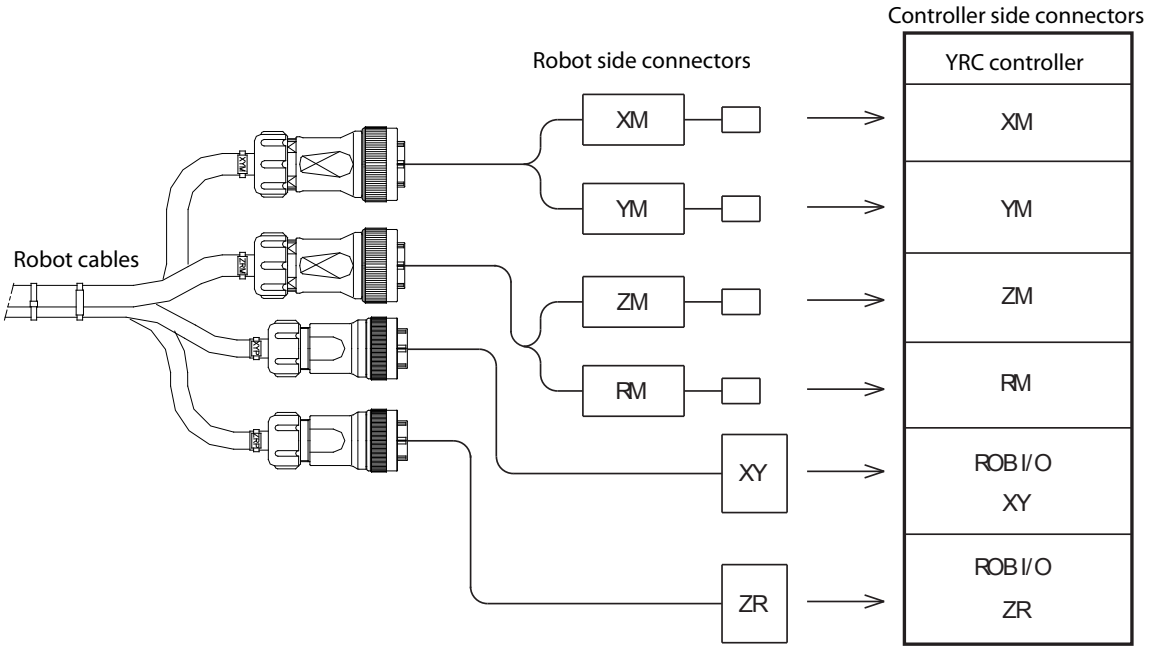
4. Robot Cable Connection

For details on connections to the robot controller, refer to Fig. 3-7 and the “OMRON Robot Controller User’s Manual”. After making connections, check the operation while referring to “6 Trial operation” in Chapter 1.

⚠ WARNING

- BEFORE CONNECTING THE CABLES, CHECK THAT THERE ARE NO BENDS OR BREAKS IN THE CONNECTOR PINS OF THE ROBOT CABLE AND THAT THE CABLES ARE NOT DAMAGED. BENT OR BROKEN PINS OR CABLE DAMAGE MAY CAUSE MALFUNCTION OF THE ROBOT.
- ENSURE THAT THE CONTROLLER IS OFF BEFORE CONNECTING THE ROBOT CABLE TO THE CONTROLLER.
- IN THE YRC CONTROLLER, THE MOTOR CONNECTORS XM AND ZM, AND YM AND RM EACH HAVE IDENTICAL SHAPES. IN ADDITION, THE PI CONNECTORS XY AND ZR HAVE IDENTICAL SHAPES. DO NOT CONFUSE THESE CONNECTORS WHEN MAKING CONNECTIONS. WRONG CONNECTIONS MAY RESULT IN MALFUNCTION AND HAZARDOUS SITUATIONS.
- IF THE CONNECTOR INSTALLATION IS INADEQUATE OR IF THERE ARE CONTACT FAILURES IN THE PINS, THE ROBOT MAY MALFUNCTION CAUSING A HAZARDOUS SITUATION. RECONFIRM THAT EACH CONNECTOR IS SECURELY INSTALLED BEFORE TURNING ON THE CONTROLLER.
- TO ATTACH THE PI CONNECTOR SECURELY, TIGHTEN THE SCREWS SUPPLIED WITH THE ROBOT.
- TAKE CAUTION NOT TO APPLY AN EXCESSIVE LOAD TO THE CONNECTORS DUE TO STRESS OR TENSION ON THE CABLES.
- LAY OUT THE CABLES SO THAT THEY DO NOT OBSTRUCT THE MOVEMENT OF THE MANIPULATOR. DETERMINE THE ROBOT WORK AREA IN WHICH THE ROBOT CABLES WILL NOT INTERFERE WITH THE LOAD OR WORKPIECE PICKED UP BY THE MANIPULATOR. IF THE ROBOT CABLES INTERFERE WITH THE MOVABLE PARTS OF THE ROBOT, THE CABLES MAY BE DAMAGED CAUSING MALFUNCTION AND HAZARDOUS SITUATIONS. REFER TO “1-2 EXTERNAL VIEW AND DIMENSIONS” IN CHAPTER 7.
- LAY OUT THE ROBOT CABLES SO AS TO KEEP THE OPERATOR OR ANY OTHER PERSON FROM TRIPPING ON THEM. BODILY INJURY MAY RESULT IF SOMEONE TRIPS ON THE CABLES.

Fig. 3-7 Robot cable connections



5. User Wiring and User Tubing

⚠ WARNING

ALWAYS TURN OFF THE CONTROLLER AND SHUT OFF AIR SUPPLY BEFORE ATTEMPTING WIRING AND PIPING WORK. IF AIR OR POWER IS SUPPLIED DURING THIS WORK, THE MANIPULATOR MAY MOVE ERRONEOUSLY CAUSING A HAZARDOUS SITUATION.

1) The XG series robots are equipped with user wires and air tubes in the machine harness. The table below shows the number of wires and air tubes available for each robot model.

Robot Model	User wiring	User tubing
R6YXG500, R6YXG600, R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000	20 wires	ø6, 3 tubes

(Robot models for custom specifications may have different wiring or tubing.)
The specifications of the user wires and air tubes are shown below. Always observe the specifications.

User Wiring

Rated voltage	30V
Allowable current	1.5A
Nominal cross-section area of conductor	0.2mm^2
Shield	Yes

User Tubing

Maximum pressure	0.58MPa (6Kgf/cm^2)
Outer diameter × inner diameter	ø6mm×ø4mm
Fluid	Dry clean air not containing deteriorated compressor oil; filtration 40µm or less

2) A D-sub connector for user wiring and a bulkhead union for user tubing are provided one each on the arm side and pedestal side. For the locations, refer to “1-2 External view and dimensions” in Chapter 7.

3) Signal wiring connections in the machine harness

1. R6YXG500, R6YXG600

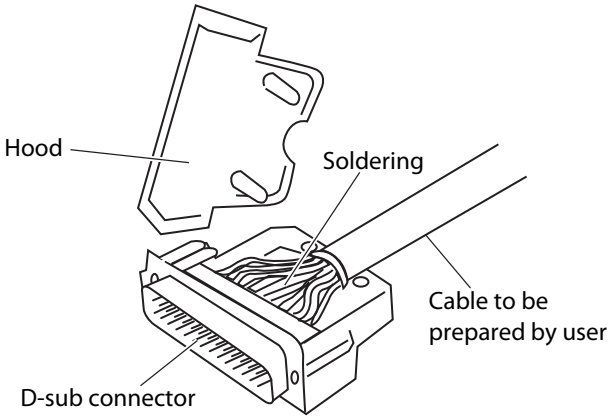
Connector pins 1 to 20 can be used. Pin 25 is connected to a shield wire and cannot be used as a signal wire.

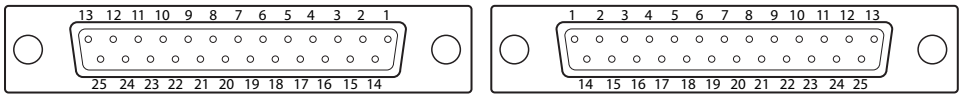
Signal	Connector	NO	Connection	NO	Connector	Color
User signal line	I O (Arm side)	1		1	I O (Base side)	Brown
		2		2		Red
		3		3		Orange
		4		4		Blue
		5		5		Violet
		6		6		Grey
		7		7		White
		8		8		Black
		9		9		Brown
		10		10		Red
		11		11		Orange
		12		12		Blue
		13		13		Brown
		14		14		Red
		15		15		Orange
		16		16		Blue
		17		17		Violet
		18		18		Grey
		19		19		White
		20		20		Black
		21		21		
		22		22		
		23		23		
		24		24		
Shield		25		25		Green
Flame Ground				1	FG	Green

(Robots models with non-standard specifications may have different wiring colors.)

4) As shown in Fig. 3-8, solder the user cable wires to the D-sub connector (supplied with the robot). Reattach the hood to the D-sub connector after soldering, then plug it into the user wiring connector.
The connector pinouts as viewed from the solder side are shown below.

Fig. 3-8





D-sub connector on arm side
(As viewed from solder side)

D-sub connector on base side
(As viewed from solder side)

R6YXG500, R6YXG600, R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

⚠ WARNING

- THE USER CABLE WIRES SHOULD HAVE A SHIELD WIRE. CONNECT IT TO THE SAME NO. PIN IN THE D-SUB CONNECTOR ON THE ROBOT SIDE, WHICH ALSO CONNECTS TO THE SHIELD WIRE. IF THIS TASK IS OMITTED, NOISE MAY CAUSE MALFUNCTION OF THE ROBOT.
- SECURELY ATTACH THE D-SUB CONNECTOR (SUPPLIED WITH THE ROBOT) INTO THE D-SUB CONNECTOR ON THE ROBOT SIDE, BY TIGHTENING THE SCREWS ON THE CONNECTOR HOOD. IF THIS CONNECTOR COMES LOOSE OR COMES OFF, MALFUNCTION MAY RESULT.
- AVOID FASTENING THE USER CABLE OR TUBE WITH THE MACHINE HARNESS, AS THIS MAY LEAD TO HARNESS BREAKAGE AND MALFUNCTION.
- MAKE SURE THAT THE USER CABLE ATTACHED TO THE D-SUB CONNECTOR FOR USER WIRING AND THE TUBE ATTACHED TO THE BULKHEAD UNION FOR USER TUBING WILL NOT INTERFERE WITH THE ROBOT MOVEMENT, ENTANGLE AROUND THE ROBOT OR FLAP AROUND DURING OPERATION. WIRING AND TUBING MIGHT THEN BE DAMAGED CAUSING MALFUNCTION OF THE ROBOT.
- LAY OUT THE USER CABLE ATTACHED TO THE D-SUB CONNECTOR FOR USER WIRING AND THE TUBE ATTACHED TO THE BULKHEAD UNION FOR USER TUBING SO THAT THEY DO NOT OBSTRUCT THE MOVEMENT OF THE OPERATOR OR ANY OTHER PERSONS. BODILY INJURY MAY RESULT IF ANYONE TRIPS ON THE CABLE OR AIR TUBE.

CAUTION

- THE D-SUB CONNECTOR SUPPLIED WITH THE ROBOT SHOULD BE CONNECTED TO THE ARM SIDE BY PIN CONTACT, AND TO THE PEDESTAL SIDE BY SOCKET CONTACT. USE CAUTION AT THESE POINTS WHEN SOLDERING.
- BE SURE TO USE THE D-SUB CONNECTOR AND HOOD WHICH ARE SUPPLIED WITH THE ROBOT. USING OTHER TYPES MAY RESULT IN CONTACT FAILURE.

D-sub connectors (supplied with robot)

Robot Model	D-sub connector on arm side	D-sub connector on base side	Hood
R6YXG500, R6YXG600, R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000	DB-25P-NR	DB-25S-NR	DB-C2-J9R

5) To check the operation and signal transmission between the end effector and the controller or peripheral equipment after making connections, refer to “6. Trial operation” in Chapter 1.

6. Attaching the End Effector

6-1 R-axis tolerable moment of inertia and acceleration coefficient

1) The moment of inertia of a load (end effector and workpiece) that can be attached to the R-axis is limited by the strength of the robot drive unit and residual vibration during positioning. It is therefore necessary to reduce the acceleration coefficient in accordance with the moment of inertia.
2) The R-axis tolerable moment of inertia and the acceleration coefficient versus R-axis moment of inertia for each robot model are shown in Fig. 3-9 to Fig. 3-13 on the subsequent pages. The symbols A_X, A_Y, and A_R in each figure respectively indicate the acceleration coefficients of the X-axis, Y-axis and R-axis. The symbol I_R (J_R) is the moment of inertia of the load around the Raxis and m is the tip mass.

   Example: R6YXG500
   Assume that the mass of the load installed to the R-axis is 1.5kg and the moment of inertia around the R-axis is 0.1kgm^2 (1.0kgfcmsec^2). When the tip mass parameter is set to 2kg, the robot can be operated by reducing the X, Y and R-axis acceleration coefficients to 62%, as can be seen from Fig. 3-9. Be sure to select an optimum tip mass and acceleration coefficient parameters that meet the mass of the load and moment of inertia before using the robot. To make settings for the tip mass and acceleration coefficient, refer to the separate “OMRON Robot Controller User’s Manual”.

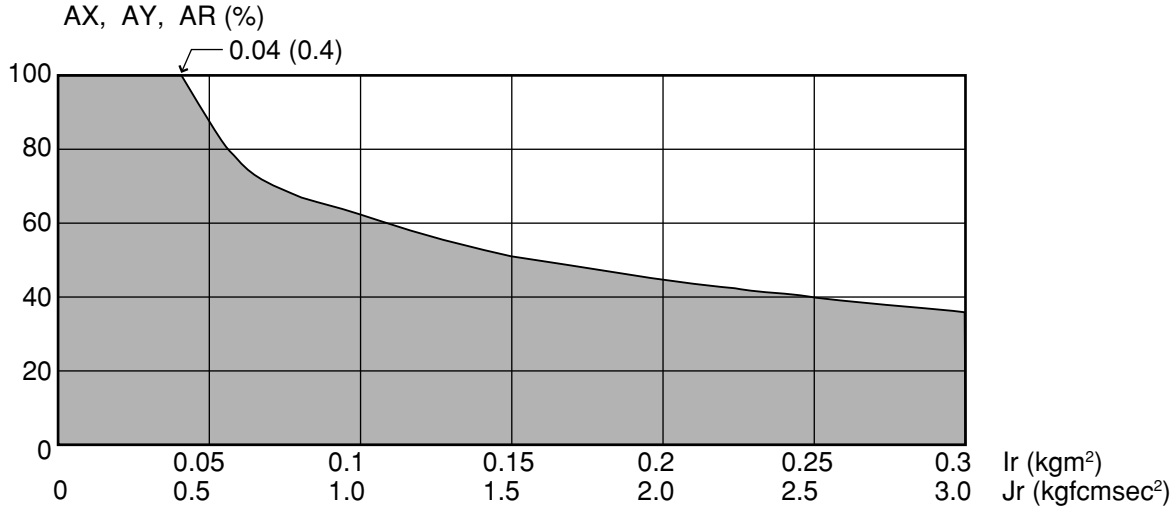
3) Methods for calculating the moment of inertia of the load are shown in Section 6-2, however, it is not easy to precisely figure out these values. If a calculated value smaller than the actual moment of inertia is set, residual vibrations may occur. If this happens, reduce the acceleration coefficient parameter even further.

⚠ CAUTION

- THE ROBOT MUST BE OPERATED WITH CORRECT TOLERABLE MOMENT OF INERTIA AND ACCELERATION COEFFICIENTS ACCORDING TO THE MANIPULATOR TIP MASS AND MOMENT OF INERTIA. IF THIS IS NOT OBSERVED, PREMATURE END TO THE LIFE OF THE DRIVE UNITS, DAMAGETO THE ROBOT PARTS OR RESIDUAL VIBRATION DURING POSITIONING MAY RESULT.
- DEPENDING ON THE Z-AXIS POSITION, VIBRATION MAY OCCUR WHEN THE X, Y OR RAXIS MOVES. IF THIS HAPPENS, REDUCE THE X, Y OR R-AXIS ACCELERATION TO AN APPROPRIATE LEVEL.
- IF THE MOMENT OF INERTIA IS TOO LARGE, VIBRATION MAY OCCUR ON THE Z-AXIS DEPENDING ON ITS OPERATION POSITION. IF THIS HAPPENS, REDUCE THE Z-AXIS ACCELERATION TO AN APPROPRIATE LEVEL.

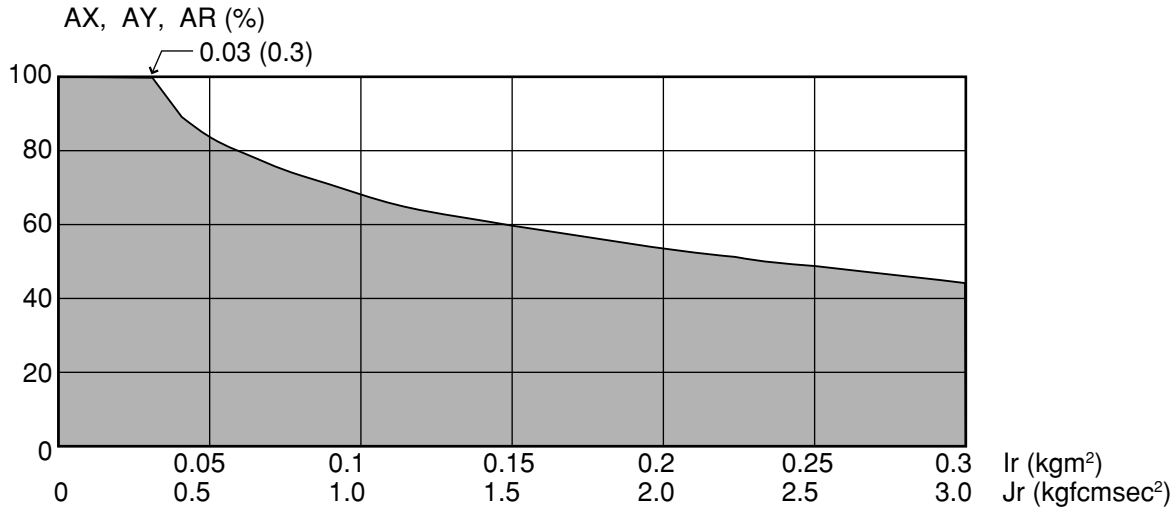
6-1-1 Acceleration coefficient vs. moment of inertia (R6YXG500)

Fig. 3-9 m=1 to 10kg



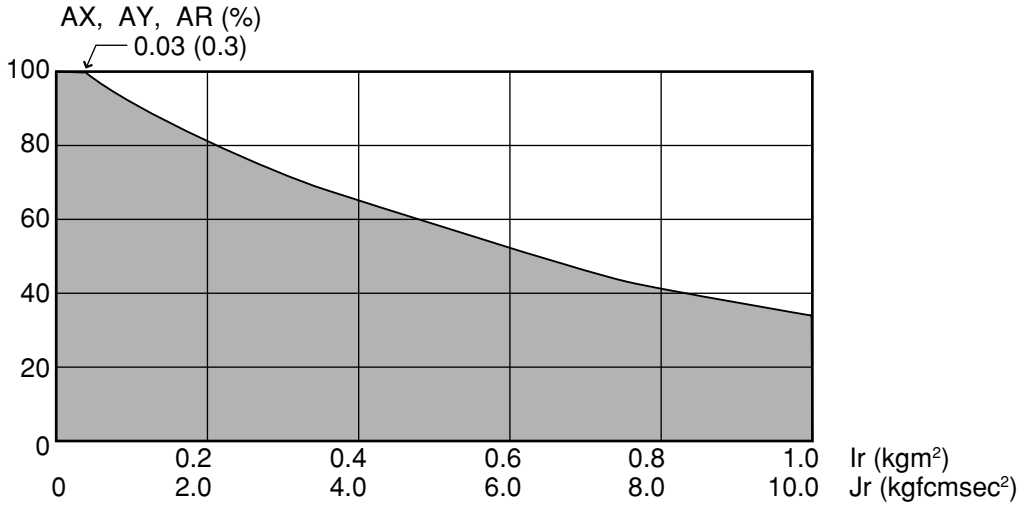
6-1-2 Acceleration coefficient vs. moment of inertia (R6YXG600)

Fig. 3-10 m=1 to 10kg



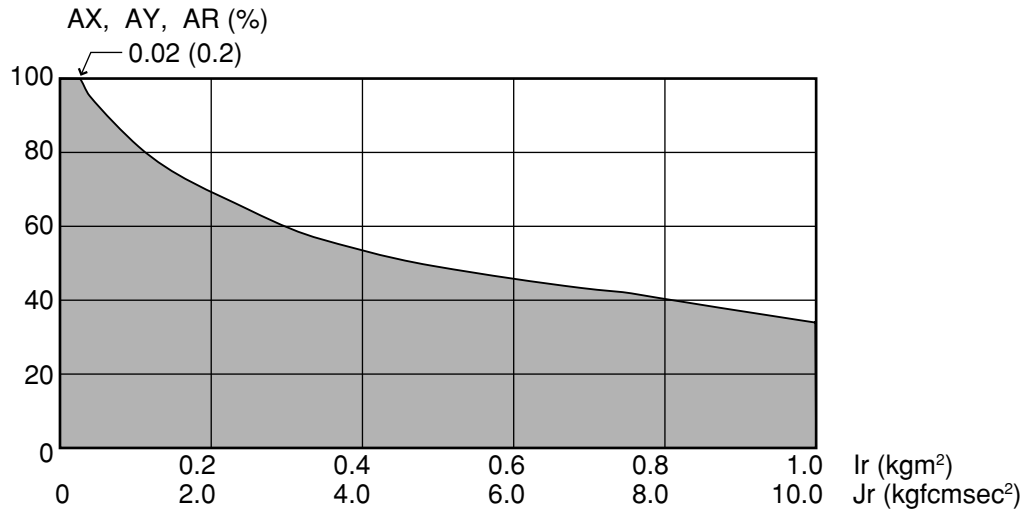
6-1-3 Acceleration coefficient vs. moment of inertia (R6YXGH600)

Fig. 3-11 m=1 to 20kg



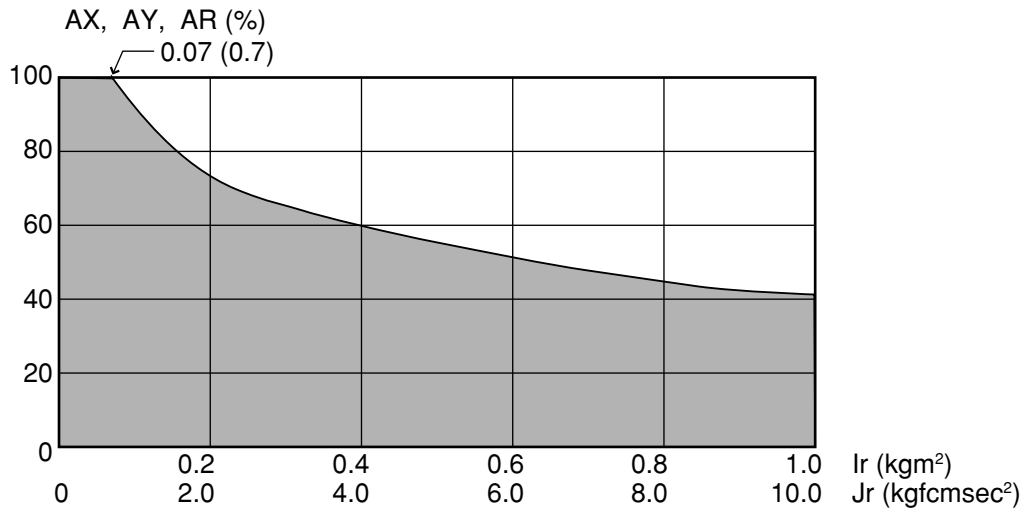
6-1-4 Acceleration coefficient vs. moment of inertia (R6YXG700, R6YXG800)

Fig. 3-12 m=1 to 20kg



6-1-5 Acceleration coefficient vs. moment of inertia (R6YXG900, R6YXG1000)

Fig. 3-13 m=1 to 20kg



6-2 Equation for moment of inertia calculation

Usually the R 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 (kgfcmsec^2) = I (kgm^2) × 10.2.

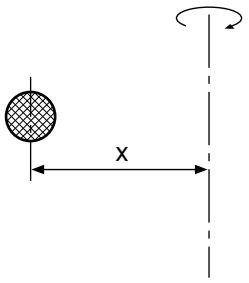
1) Moment of inertia for material particle
The equation for the moment of inertia for a material particle that has a rotation center such as shown in Fig. 3-14 is as follows:
This is used as an approximate equation when x is larger than the object size.

Fig. 3-14

$$I = mx^2 \ (kgm^2)$$

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

... (Eq. 3.1)



g : Gravitational acceleration (cm/sec^2)
m : Mass of material particle (kg)
W : Weight of material particle (kgf)

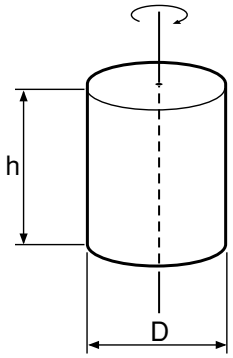
2) Moment of inertia for cylinder (part 1)
The equation for the moment of inertia for a cylinder that has a rotation center such as shown in Fig. 3-15 is given below.

Fig. 3-15

$$I = \frac{\rho\pi D^4 h}{32} = \frac{mD^2}{8} \ (kgm^2)$$

$$J = \frac{\rho\pi D^4 h}{32g} = \frac{WD^2}{8g} \ (kgfcmsec^2)$$

... (Eq. 3.2)



ρ : Density (kg/m^3, kg/cm^3)
g : Gravitational acceleration (cm/sec^2)
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 Fig. 3-16 is given below.

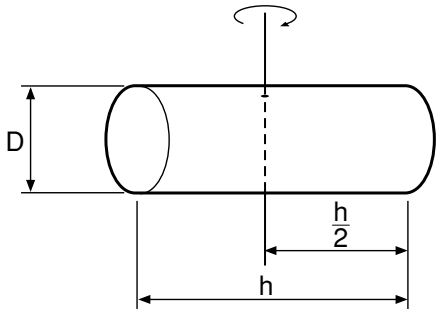
Fig. 3-16

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

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

... (Eq. 3.3)

ρ : 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

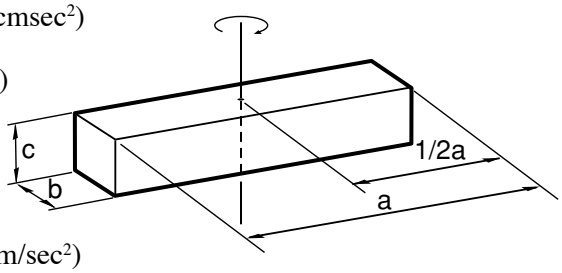
The equation for the moment of inertia for a prism that has a rotation center as shown in Fig. 3-17 is given as follows.

Fig. 3-17

$$I = \frac{\rho\ abc(a^2+b^2)}{12} = \frac{m(a^2+b^2)}{12}\ (kgm^2)$$

$$J = \frac{\rho\ abc(a^2+b^2)}{12g} = \frac{W(a^2+b^2)}{12g}\ (kgfcmsec^2)$$

... (Eq. 3.4)



ρ : 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 Fig. 3-18, is given as follows.

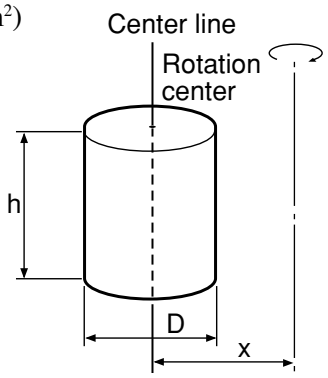
Fig. 3-18

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

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

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

... (Eq. 3.5)



ρ : Density (kg/m^3, kg/cm^3)
g : Gravitational acceleration (cm/sec^2)
m : Mass of cylinder (kg)
W : Weight of cylinder (kgf)

In the same manner, the moment of inertia of a cylinder as shown in Fig. 3-19 is given by

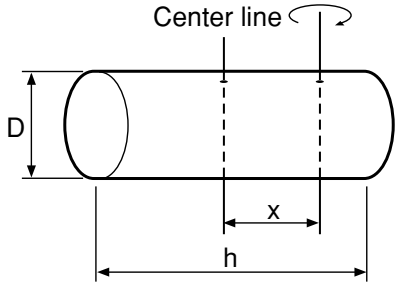
Fig. 3-19

$$I = \frac{\rho\pi\, D^2 h}{16}\left(\frac{D^2}{4} + \frac{h^2}{3}\right) + \frac{\rho\pi\, D^2 h\, x^2}{4} = \frac{m}{4}\left(\frac{D^2}{4} + \frac{h^2}{3}\right) + mx^2 \quad (kgm^2)$$

$$J = \frac{\rho\pi\, D^2 h}{16g}\left(\frac{D^2}{4} + \frac{h^2}{3}\right) + \frac{\rho\pi\, D^2 h\, x^2}{4g}$$

$$= \frac{W}{4g}\left(\frac{D^2}{4} + \frac{h^2}{3}\right) + \frac{Wx^2}{g} \quad (kgfcmsec^2)$$

... (Eq. 3.6)



In the same manner, the moment of inertia of a prism as shown in Fig. 3-20 is given by

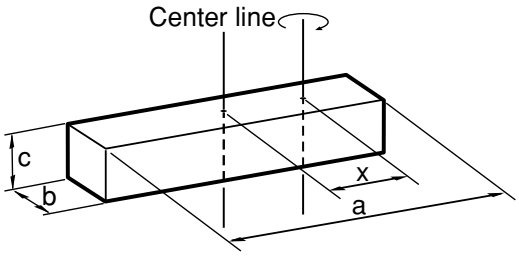
Fig. 3-20

$$I=\frac{\rho abc(a^2+b^2)}{12}+\rho abcx^2=\frac{m(a^2+b^2)}{12}+mx^2 \quad (kgm^2)$$

$$J=\frac{\rho abc(a^2+b^2)}{12g}+\frac{\rho abcx^2}{g}$$

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

... (Eq. 3.7)

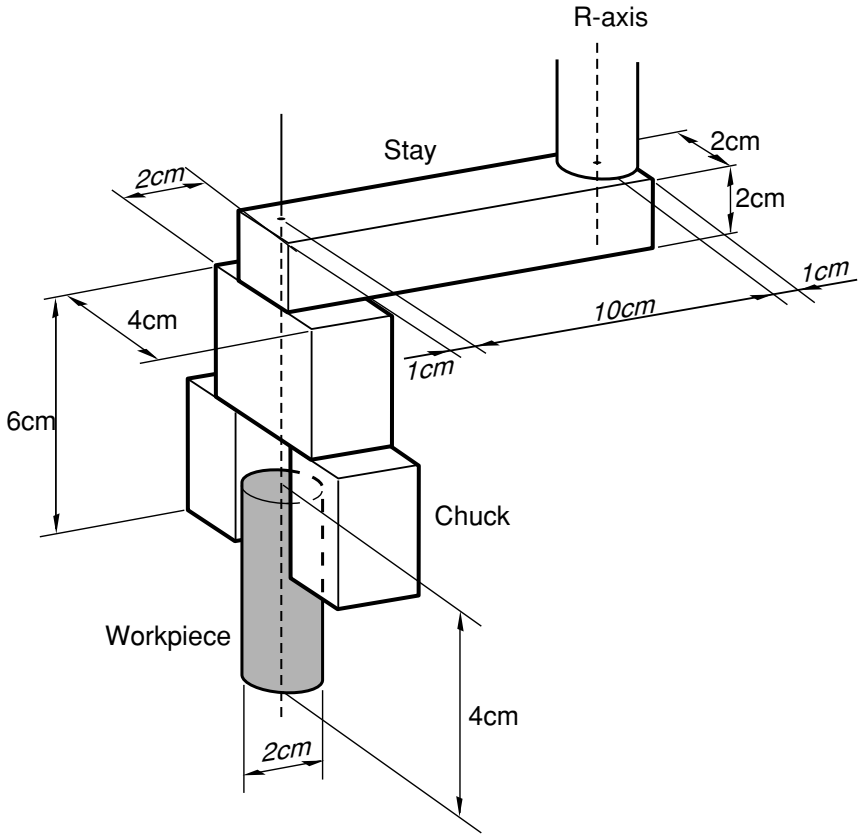


m : Mass of prism (kg)
W : Weight of prism (kgf)

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 R-axis by a stay, as shown in Fig. 3-21. The moment of inertia is calculated with the following three factors, assuming that the load material is steel and its density ρ is 0.0078kg/cm^3.

Fig. 3-21



1) Moment of inertia of the stay

Fig. 3-22

From Fig. 3-22, the weight of the stay (Ws) is given as follows:

$Ws = \rho abc = 0.0078 \times 12 \times 2 \times 2$
$= 0.37$ (kgf)

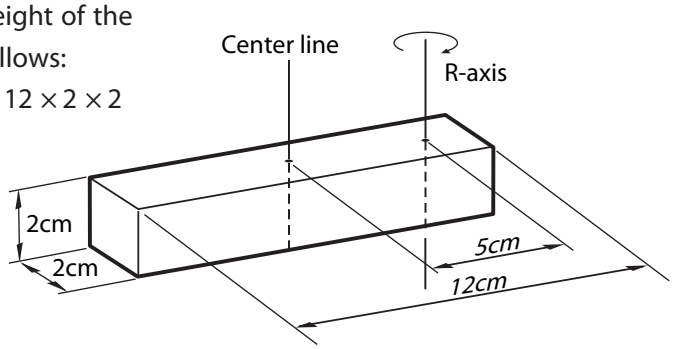


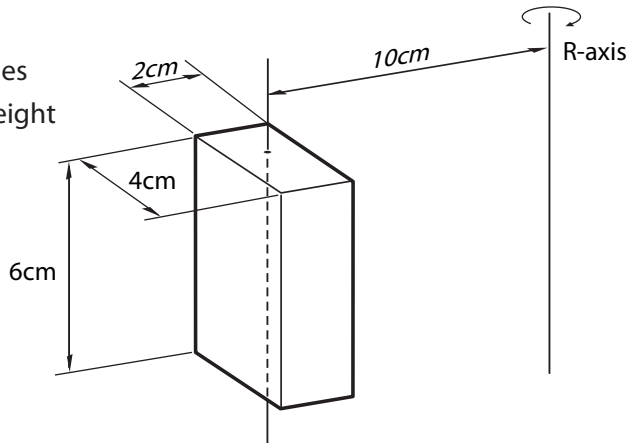
Fig. 3-22

The moment of inertia of the stay (Js) is then calculated from Eq. 3-7.

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

2) Moment of inertia of the chuck

Fig. 3-23



When the chuck form resembles that shown in Fig. 3-23, the weight of the chuck (Wc) is

$Wc = 0.0078 \times 2 \times 4 \times 6$

$= 0.37$ (kgf)

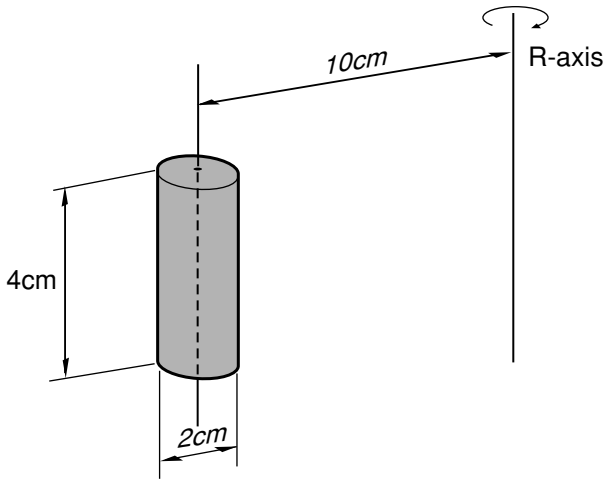
The moment of inertia of the chuck (Jc) is then calculated from Eq. 3-7.

$$Jc = \frac{0.37 \times (2^2+4^2)}{12 \times 980} + \frac{0.37 \times 10^2}{980}$$

$= 0.038$ (kgfcmsec^2)

3) Moment of inertia of workpiece

Fig. 3-24



When the workpiece form resembles that shown in Fig. 3-24, the weight of the workpiece (Ww) is

$$Ww = \frac{\rho\pi D^2 h}{4} = \frac{0.0078\pi \times 2^2 \times 4}{4}$$

$= 0.098$ (kgf)

The moment of inertia of the workpiece (Jw) is then calculated from Eq. 3-5.

$$Jw = \frac{0.097 \times 2^2}{8 \times 980} + \frac{0.097 \times 10^2}{980}$$

$= 0.010$ (kgfcmsec^2)

4) Total weight

The total weight (W) is calculated as follows: $W = Ws + Wc + Ww = 0.84$ (kgf)

5) Total moment of inertia

The total moment of inertia (J) is then obtained as follows: $J = Js + Jc + Jw = 0.062$ (kgfcmsec^2)

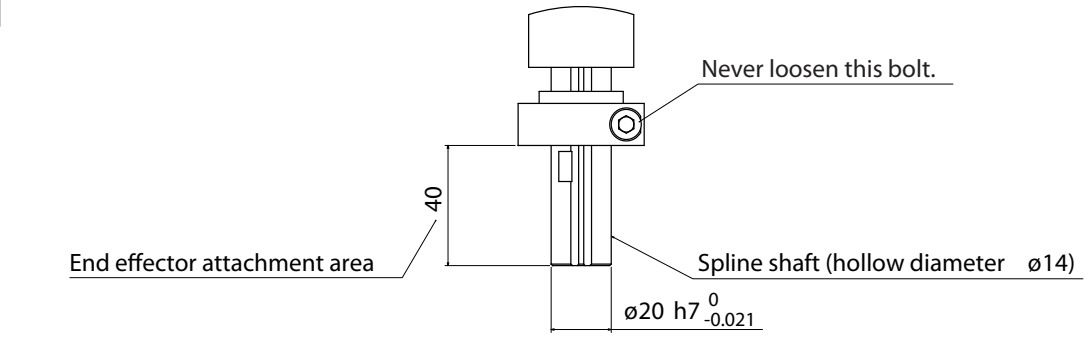
6-4 Attaching the end effector

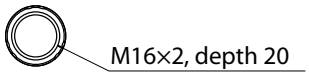
⚠ WARNING

- BEFORE ATTACHING THE END EFFECTOR, BE SURE TO TURN OFF THE CONTROLLER.
- WHEN THE END EFFECTOR IS ATTACHED BY SLOT CLAMPING, ALWAYS OBSERVE THE CONDITIONS LISTED IN TABLE 3-2. IF THESE ARE IGNORED, THE END EFFECTOR MAY COME LOOSE AND FLY OFF DURING ROBOT OPERATION, RESULTING IN AN ACCIDENT OR INJURY.
- IN CASES WHERE OTHER ATTACHMENT METHODS ARE USED, BE SURE THAT THE END EFFECTOR WILL NOT COME OFF WHEN THE LOADS LISTED IN TABLE 3-1 ARE APPLIED.

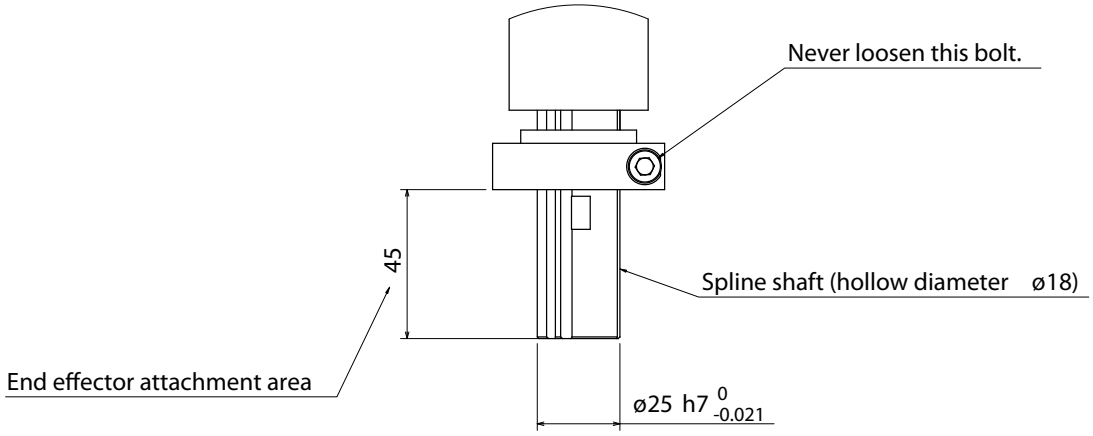
The user's end effector that attaches to the robot must have adequate strength and rigidity, as well as gripping force to prevent positioning errors. Table 3-1 shows the maximum load that can be applied to the end effector attachment of each robot model. Recommended methods for attaching end effectors are shown in Table 3-2 and Fig. 3-27. Refer to Fig. 3-25 for details on the end effector attachment of each robot model. Refer to Fig. 3-3 for the depth of tapped hole and recommended type of tap bolt. When checking end effector operation, refer to "6 Trial Operation" in Chapter 1.

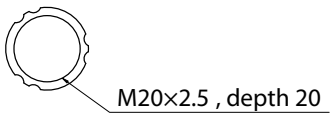
Fig. 3-25





R6YXG500, R6YXG600





R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

⚠ WARNING

- THE TAPPED HOLE (SEE FIGS. 3-25) PROVIDED ON THE LOWER PART OF THE END EFFECTOR ATTACHMENT SHOULD BE USED ONLY FOR PREVENTING THE END EFFECTOR FROM COMING LOOSE.
- DO NOT FASTEN THE END EFFECTOR JUST BY USING THIS TAPPED HOLE. IF THE END EFFECTOR IS FASTENED ONLY WITH THIS TAPPED HOLE, IT MAY COME LOOSE FROM THE ATTACHMENT DURING ROBOT OPERATION AND FLY OFF RESULTING IN ACCIDENTS OR INJURIES.

Table 3-1

Robot Model	F_{XYmax}		F_{Zmax}		F_{Rmax}		M_{Rmax}		M_{max}	
	N	kgf	N	kgf	N	kgf	Nm	kgfm	Nm	kgfm
R6YXG500	173	18	134	14	506	52	24	2.6	15	1.5
R6YXG600	173	18	134	14	506	52	24	2.6	15	1.5
R6YXGH600	489	49	214	22	696	71	56	5.7	26	2.7
R6YXG700	489	49	214	22	696	71	56	5.7	26	2.7
R6YXG800	489	49	191	19	696	71	56	5.7	24	2.4
R6YXG900	443	46	191	19	696	71	56	5.7	24	2.4
R6YXG1000	443	46	191	19	696	71	56	5.7	24	2.4

⚠ WARNING

- THE END EFFECTOR ATTACHMENT MUST HAVE ADEQUATE STRENGTH TO WITHSTAND THE LOADS LISTED IN TABLE 3-1. IF TOO WEAK, THE ATTACHMENT MAY BREAK DURING ROBOT OPERATION AND FRAGMENTS FLY OFF CAUSING ACCIDENTS OR INJURIES.
- THE END EFFECTOR ATTACHMENT MUST HAVE SUFFICIENT RIGIDITY VERSUS THE LOADS LISTED IN TABLE 3-1. IF THIS RIGIDITY IS INADEQUATE, THE END EFFECTOR MAY VIBRATE DURING ROBOT OPERATION CAUSING BAD EFFECTS ON THE MANIPULATOR OPERATION.

Fig. 3-26 Maximum load applied to end effector attachment

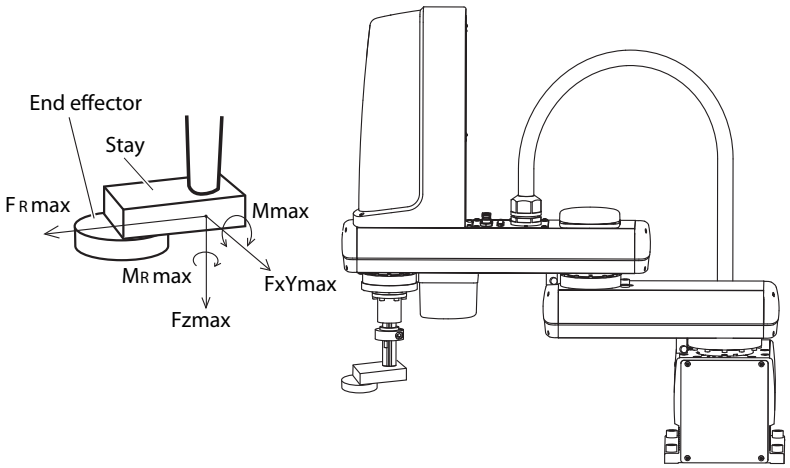


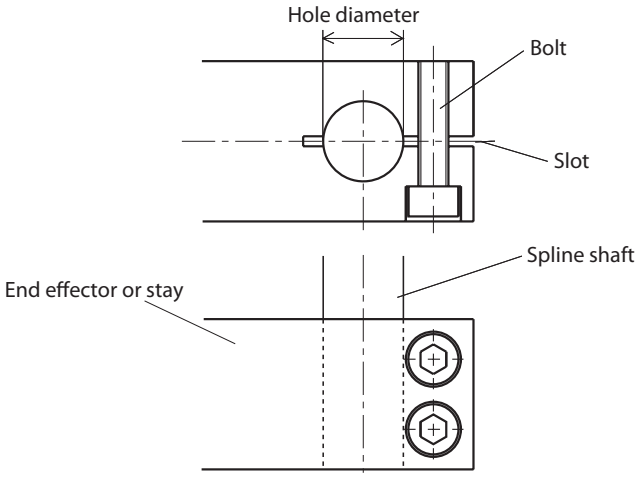
Table 3-2

Robot Model	Bolts Used	Number of bolts	Tightening torque		Hole diameter (mm)
			Nm	kgfcm	
R6YXG500, R6YXG600	M6 or lager	2 or more	15.3	156	$20\ ^{+0.021}_{0}$
R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000	M8 or lager	2 or more	37.0	380	$25\ ^{+0.021}_{0}$

Table 3-3

Depth of tapped hole	Iron material base	Bolt diameter × 1.5 or more
	Aluminum material 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)	

Fig. 3-27



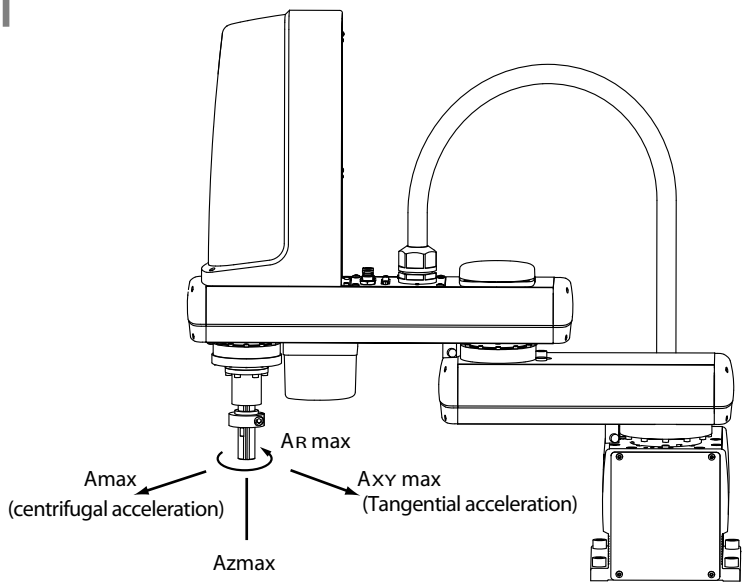
6-5 Gripping force of end effector

The gripping force of the end effector must have a sufficient extra margin of strength versus the workpiece weight and reaction force applied to the workpiece during robot operation. The reaction force applied to the workpiece during operation can be calculated from the acceleration applied to the end effector attachment. The maximum acceleration on the end effector attachment of each robot model is listed in the table below. When the workpiece position is offset to the end effector attachment, the accelerations Amax and AXYmax become larger by an amount equal to the offset versus the arm length. When the R-axis rotates during operation, this acceleration ARmax must be taken into account.

Table 3-4 Maximum acceleration during robot operation

Robot Model	Amax(m/sec^2)	AXYmax(m/sec^2)	Azmax(m/sec^2)	ARmax(rad/sec^2)
R6YXG500	98	48	57	280
R6YXG600	104	41	57	280
R6YXGH600	78	60	38	176
R6YXG700	96	60	38	176
R6YXG800	101	51	38	176
R6YXG900	95	51	38	176
R6YXG1000	95	51	38	176

Fig. 3-28 Maximum acceleration on end effector attachment



⚠ WARNING

THE GRIPPING FORCE OF THE END EFFECTOR MUST HAVE A SUFFICIENT EXTRA MARGIN OF STRENGTH TO PREVENT THE WORKPIECE FROM COMING LOOSE AND FLYING OFF DURING ROBOT OPERATION. IF THE GRIPPING FORCE IS TOO WEAK, THE WORKPIECE MAY COME LOOSE AND FLY OFF CAUSING ACCIDENTS OR INJURIES.

7. Limiting the Movement Range with X- and Y-Axis Mechanical Stoppers

In the XG Series, the movement range can be limited by changing the X- and Y-axis mechanical stopper positions (see Fig. 3-29). When the robot is shipped from factory, the movement range is set to the maximum. If the maximum movement range is too large compared to the actual work range, or the manipulator might interfere with peripheral units, then the movement range can be limited as outlined below. The mechanical stopper positions may slightly differ depending on machining precision of the parts.

⚠ WARNING

ALWAYS TURN OFF THE CONTROLLER BEFORE CHANGING THE MOVEMENT RANGE WITH MECHANICAL STOPPERS.

⚠ CAUTION

WHEN THE MECHANICAL STOPPER POSITIONS ARE CHANGED, THE SOFT LIMITS MUST BE SET TO A POINT INSIDE THE MECHANICAL STOPPER POSITIONS. (REFER TO "4 SETTING THE SOFT LIMITS" IN CHAPTER 4.)

The Y-axis stopper position can be changed by installing the stopper parts shown in Table 3-5, which are supplied with the robot.
The X-axis stopper position can be changed by changing the position of the existing stoppers.

Table 3-5

R6YXG500, R6YXG600

	No.	Part No.	Qty	Remarks
Additional mechanical stopper parts in either one direction of Y-axis plus or minus direction (*1)	**(1)**	KBF-M1123-001	1	Washer (supplied)
	(2)	91312-08016	1	Bolt (supplied)

*1: Since the X-axis has two stoppers as standard, no additional stopper will be needed for changing the X-axis stopper position. To change the Y-axis stopper position in the plus or minus direction or even in both directions, use one each of the above stopper parts. (When changing the movement range in both directions, move the existing stopper position.)
*2: Washers are also used when moving the robot using the eyebolts. After having moved the robot, use the washers to change the stopper position.
If the washers are again needed to move the robot using the eyebolts, remove the washers from the stopper and then place them underneath the eyebolts.

R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

	No.	Part No.	Qty	Remarks
Additional mechanical stopper parts in either one direction of Y-axis plus or minus direction (*1)	**(1)**	KBP-M1123-001	2	Washer (supplied)
	(2)	90112-10J025	1	Bolt (supplied)

*1: Since the X-axis has two stoppers as standard, no additional stopper will be needed for changing the X-axis stopper position. To change the Y-axis stopper position in the plus or minus direction or even in both directions, use one each of the above stopper parts. (When changing the movement range in both directions, move the existing stopper position.)
*2: Washers are also used when moving the robot using the eyebolts. After having moved the robot, use the washers to change the stopper position.
If the washers are again needed to move the robot using the eyebolts, remove the washers from the stoppers and place them underneath the eyebolts.

After changing the mechanical stopper position, set the soft limits to the following values.

Table 3-6

R6YXG500, R6YXG600, R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

X-axis stopper position	Soft limit (pulses)	Working envelope
±12°	±32768	±9°
±43°	±145635	±40°
±87°	±305834	±84°
±132° (maximum movement range position)	±473315	±130°

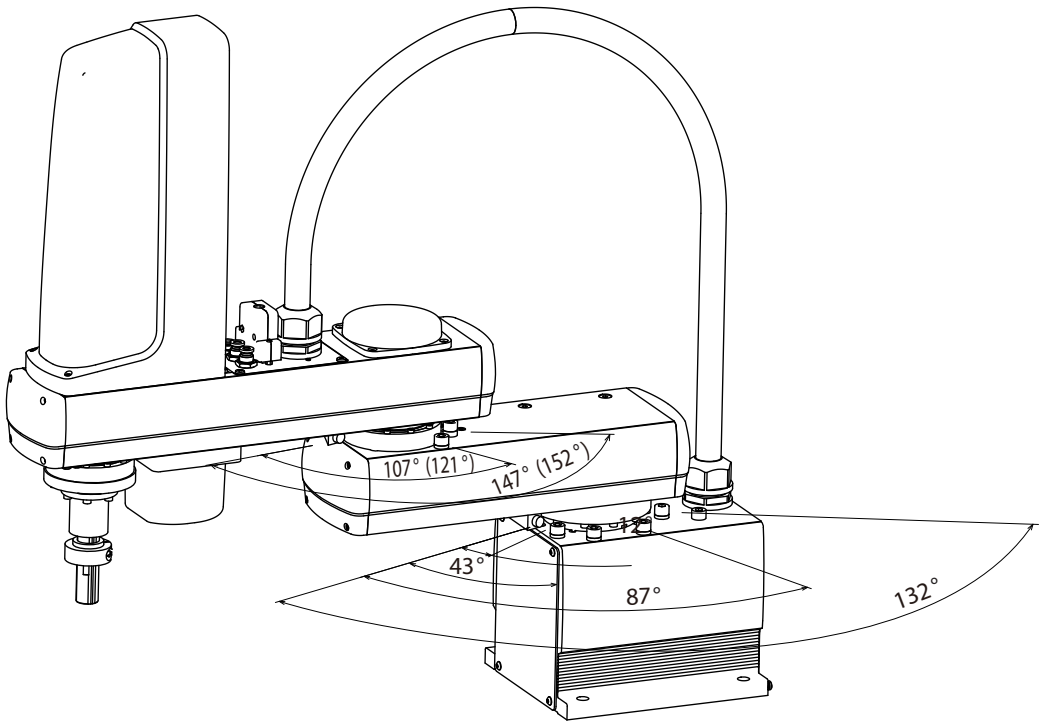
R6YXG500, R6YXG600

Y-axis stopper position	Soft limit (pulses)	Working envelope
±147° (maximum movement range position)	±527928	±145°
+107°	+378652	+104°
-102°	-360448	-99°

R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

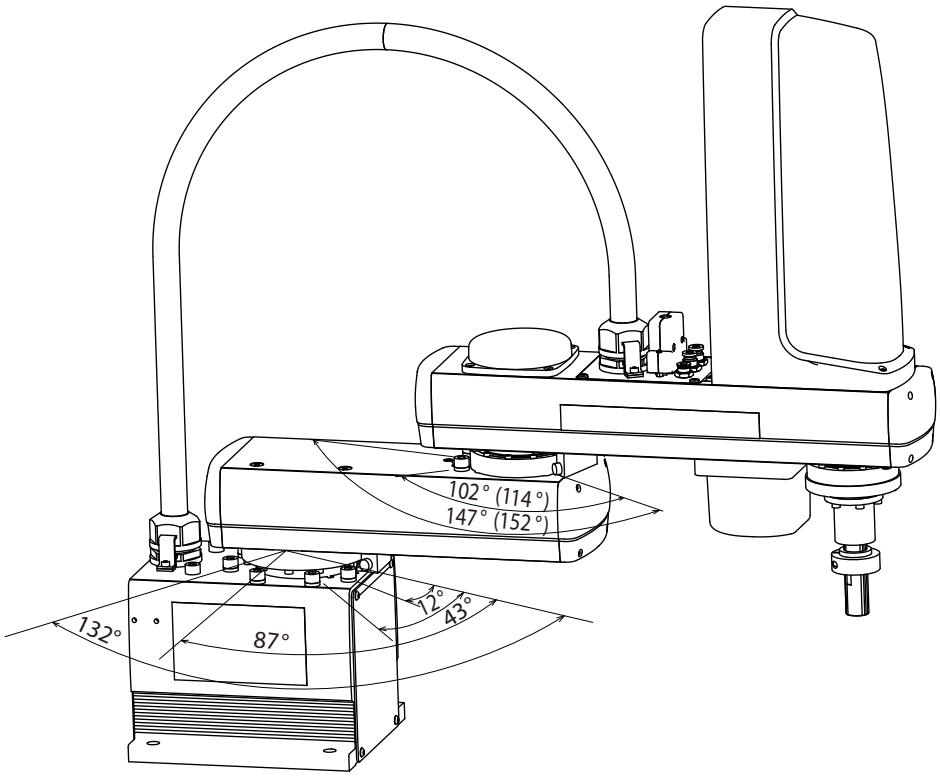
Y-axis stopper position	Soft limit (pulses)	Working envelope
±152° (maximum movement range position)	±546133	±150°
+121°	+429264	+118°
-114°	-415061	-111°

Fig. 3-29 (stopper position in plus direction)



* Values in parentheses apply to the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000.

Fig. 3-29 (stopper position in minus direction)



* Values in parentheses apply to the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000.

7-1 Changing the X-axis mechanical stopper position

The following describes the procedure for shifting the X-axis mechanical stopper position from the maximum movement range position (132°) to the 87° position.

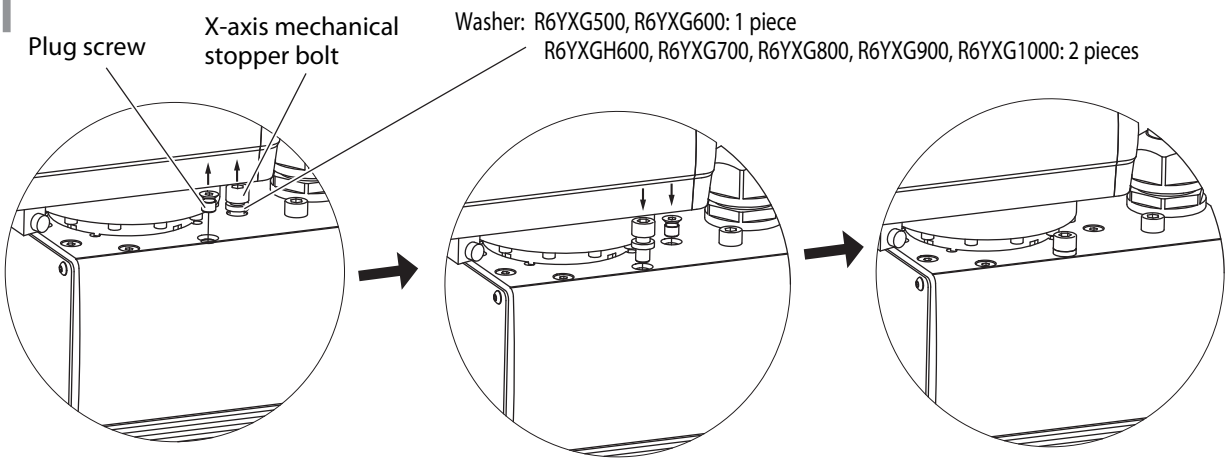
1) Prepare a hex wrench set.
2) Turn off the controller.
3) Place a sign indicating the robot is being adjusted, to keep others from touching the controller switch.
4) Enter the safeguard enclosure.
5) Remove the plug screw and the X-axis mechanical stopper bolt and washer that are installed as shown in Fig. 3-30. Then reinstall the X-axis mechanical stopper bolt and washer at the position that determines the desired movement range, by tightening the bolt to the torque specified in Table 3-7.
   Screw the plug screw into the position where the X-axis mechanical stopper was installed.
6) Check that the movement range is limited by the mechanical stoppers as desired.
7) Go out of the safeguard enclosure.
8) Check that no one is inside the safeguard enclosure and then turn on the controller.

Table 3-7

Robot model	Bolt size	Tightening torque (kgfcm)	Tightening torque (Nm)
R6YXG500, R6YXG600	M8	380	37.2
R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000	M10	459	45.0

9) Set the soft limits as shown in Table 3-6.
10) Stay outside the safeguard enclosure and check that the soft limits work to stop the X-axis arm at a point before the stopper position.
    Depending on the accuracy and position of the stopper parts, the X-axis arm may not stop until it reaches the stopper. In this case, set the soft limits smaller than the values shown in Table 3-6.

Fig. 3-30 Changing X-axis mechanical stopper positions



7-2 Changing the Y-axis mechanical stopper position

The Y-axis mechanical stopper position can be changed in the same way as for the X-axis stoppers.
To change the stopper position in the plus or minus direction, use the washer and bolt (supplied with the robot) as shown in Fig. 3-31 to Fig. 3-35. Do not remove the standard stopper. If removed, there will be no stopper in the direction opposite the stopper whose position is changed.

Fig. 3-31

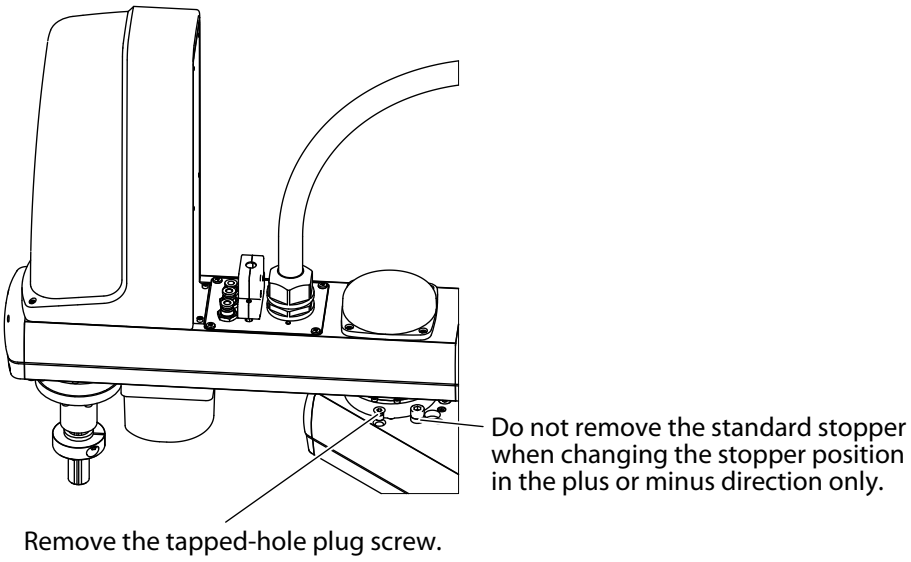


Fig. 3-32

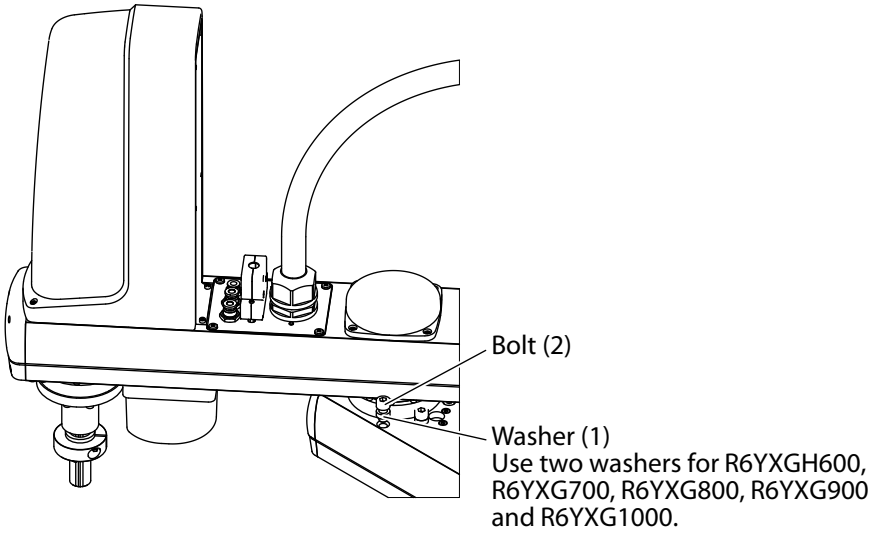
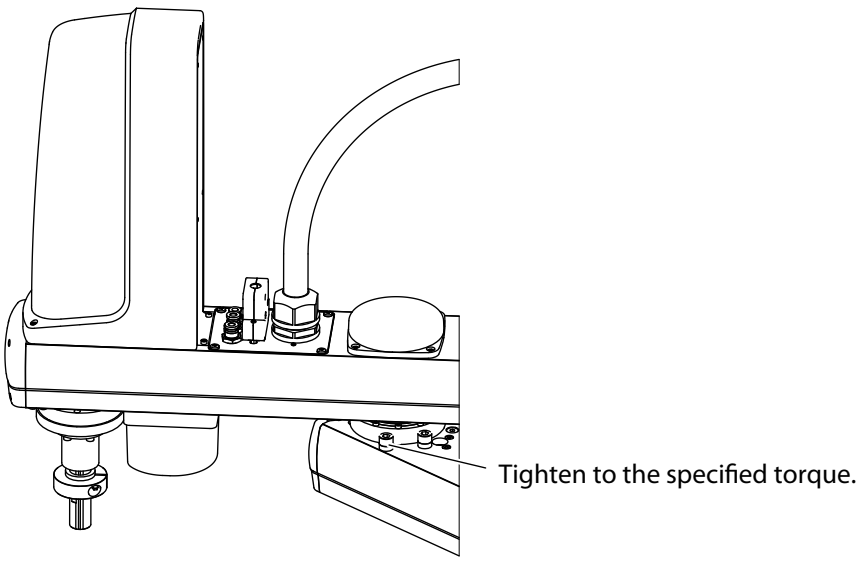


Fig. 3-33



Remove the standard stopper when changing the movement range in both plus and minus directions.

Fig. 3-34

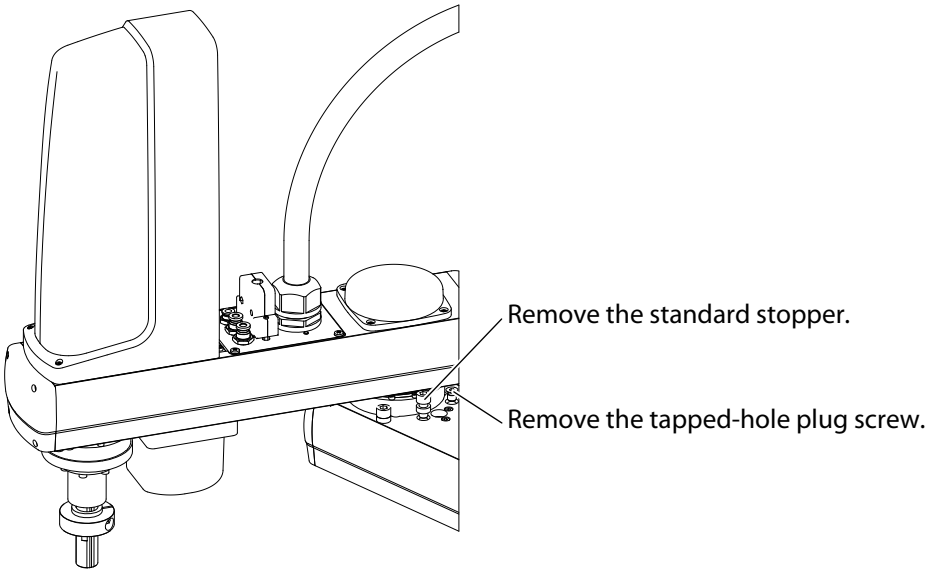
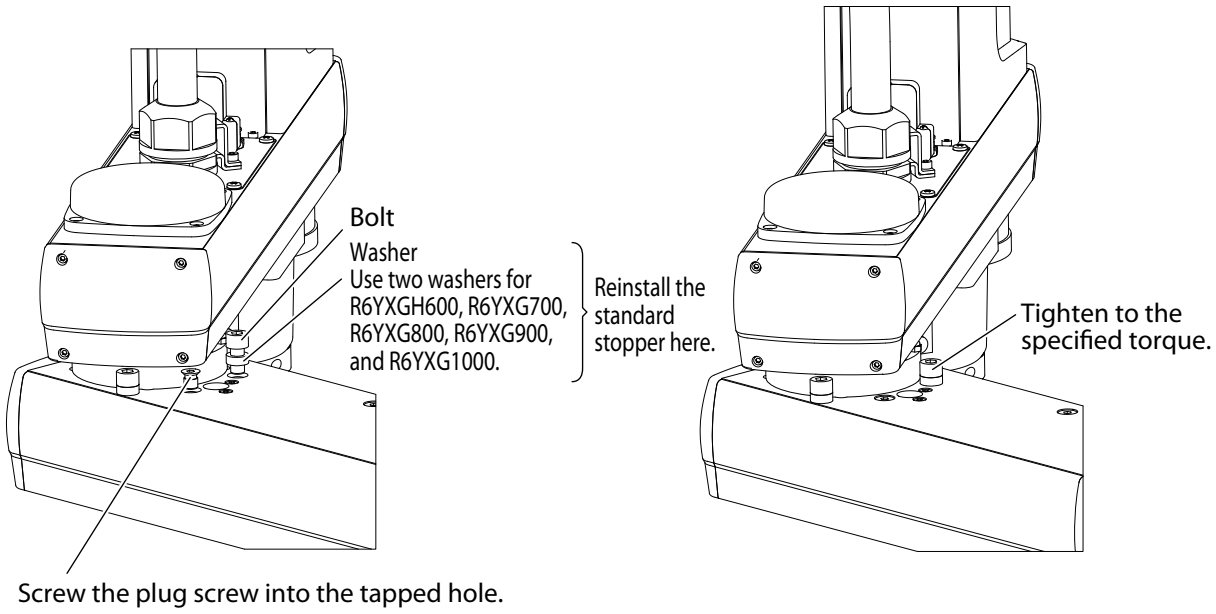


Fig. 3-35


Bolt
Washer
Use two washers for R6YXGH600, R6YXG700, R6YXG800, R6YXG900, and R6YXG1000.
Reinstall the standard stopper here.
Tighten to the specified torque.
Screw the plug screw into the tapped hole.

7-3 Robot overrun during impacts with X-axis or Y-axis mechanical stopper

A urethane damper is installed to absorb the shock when an impact occurs with the mechanical stopper, so a certain amount of overrun occurs when the robot strikes the mechanical stopper. Use caution and take overrun into account since the end effector may interfere with the robot body and peripheral equipment or the robot body may interfere with the peripheral equipment. Maximum overrun amounts are listed below (for normal operation, maximum payload, maximum speed).

Robot model	X-axis	Y-axis
R6YXG500, R6YXG600	9°	16°
R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000	9°	16°

Note: Here, ° (deg.) is the overrun angle at the X-axis and Y-axis joints.

1. If the X-axis or Y-axis mechanical stopper is deformed or damaged due to an impact on the stopper, please contact our sales office or dealer. Continued use of the deformed or damaged stopper is very dangerous, and so it must be replaced.
2. When the robot strikes the X-axis or Y-axis mechanical stopper or another object, or when the R-axis collides with an object, the speed reduction gears are locked while being meshed if the collision impact is large. If this happens, please contact our sales office or dealer.

8. Limiting the Movement Range with Z-Axis Mechanical Stoppers

The Z-axis movement range can be narrowed as shown in Table 3-9 by ordering and installing additional optional parts listed in Table 3-8.
The mechanical stopper positions may slightly differ depending on machining precision of the parts and the installation position.

⚠ WARNING

ALWAYS TURN OFF THE CONTROLLER BEFORE CHANGING THE MOVEMENT RANGE WITH MECHANICAL STOPPERS.

⚠ WARNING

AFTER THE PLUS DIRECTION STOPPER IS INSTALLED TO THE R6YXGH600, R6YXG700, R6YXG800, R6YXG900 OR R6YXG1000, THE Z-AXIS ACCELERATION MAY NEED TO BE REDUCED. REFER TO "8-2 INSTALLING THE PLUS DIRECTION STOPPER" FOR DETAILS.

⚠ CAUTION

AFTER THE MECHANICAL STOPPER POSITIONS ARE CHANGED, THE SOFT LIMITS MUST BE SET TO A POINT INSIDE THE MECHANICAL STOPPER POSITIONS.

Table 3-8

	No.	Part No.	Qty	Remarks
Additional mechanical stopper parts in Z-axis plus direction	**(1)**	KBF-M1781-000	1	Stopper block
	(2)	KBF-M1788-100	1	Damper
	(3)	91312-05016	2	Bolt

R6YXG500, R6YXG600

	No.	Part No.	Qty	Remarks
Additional mechanical stopper parts in Z-axis minus direction	**(4)**	KBF-M183A-000	1	Stopper block (supplied with bolt)

R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

	No.	Part No.	Qty	Remarks
Additional mechanical stopper parts in Z-axis minus direction	**(4)**	KBP-M183A-000	1	Stopper block (supplied with bolt)

Table 3-9

R6YXG500, R6YXG600 Z=200mm stroke type

	Standard stopper	Additional stopper
Stopper position in Z-axis plus direction (*1)	210mm	210-L_1mm
Maximum movement position in Z-axis plus direction (*1)	200mm	200-L_1mm
Stopper position in Z-axis minus direction (*1)	-8mm	L_2-8mm
Maximum movement position (origin position) in Z-axis minus direction (*1)	0mm	L_2mm (*2)

R6YXG500, R6YXG600 Z=300mm stroke type

	Standard stopper	Additional stopper
Stopper position in Z-axis plus direction (*1)	310mm	310-L_1mm
Maximum movement position in Z-axis plus direction (*1)	300mm	300-L_1mm
Stopper position in Z-axis minus direction (*1)	-8mm	L_2-8mm
Maximum movement position (origin position) in Z-axis minus direction (*1)	0mm	L_2mm (*2)

R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000 Z=200mm stroke type

	Standard stopper	Additional stopper
Stopper position in Z-axis plus direction (*1)	212mm	212-L_1mm
Maximum movement position in Z-axis plus direction (*1)	200mm	200-L_1mm
Stopper position in Z-axis minus direction (*1)	-6mm	L_2-6mm
Maximum movement position (origin position) in Z-axis minus direction (*1)	0mm	L_2mm (*2)

R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000 Z=400mm stroke type

	Standard stopper	Additional stopper
Stopper position in Z-axis plus direction (*1)	412mm	412-L_1mm
Maximum movement position in Z-axis plus direction (*1)	400mm	400-L_1mm
Stopper position in Z-axis minus direction (*1)	-6mm	L_2-6mm
Maximum movement position (origin position) in Z-axis minus direction (*1)	0mm	L_2mm (*2)

*1: The Z-axis movement range and working envelope indicate the positions when the downward direction relative to the initial Z-axis origin position is set as the plus direction.
The actual origin position is lowered by L_2 and the movement range and stroke are reduced by L_1+L_2.

*2: Depending on the relation to the Z-axis machine reference adjustment, L_2 will be a position at 5 mm intervals, such as approximately 15mm, 20mm, etc.

● **Soft limits after installing additional stoppers**

Z=200mm stroke type

	Soft limit (pulses)	Working envelope
Z-axis working envelope in plus direction	16384 (200- (L_1+L_2)) /20	200- (L_1+L_2) mm
Z-axis working envelope in minus direction	-819	-1mm

Z=300mm stroke type

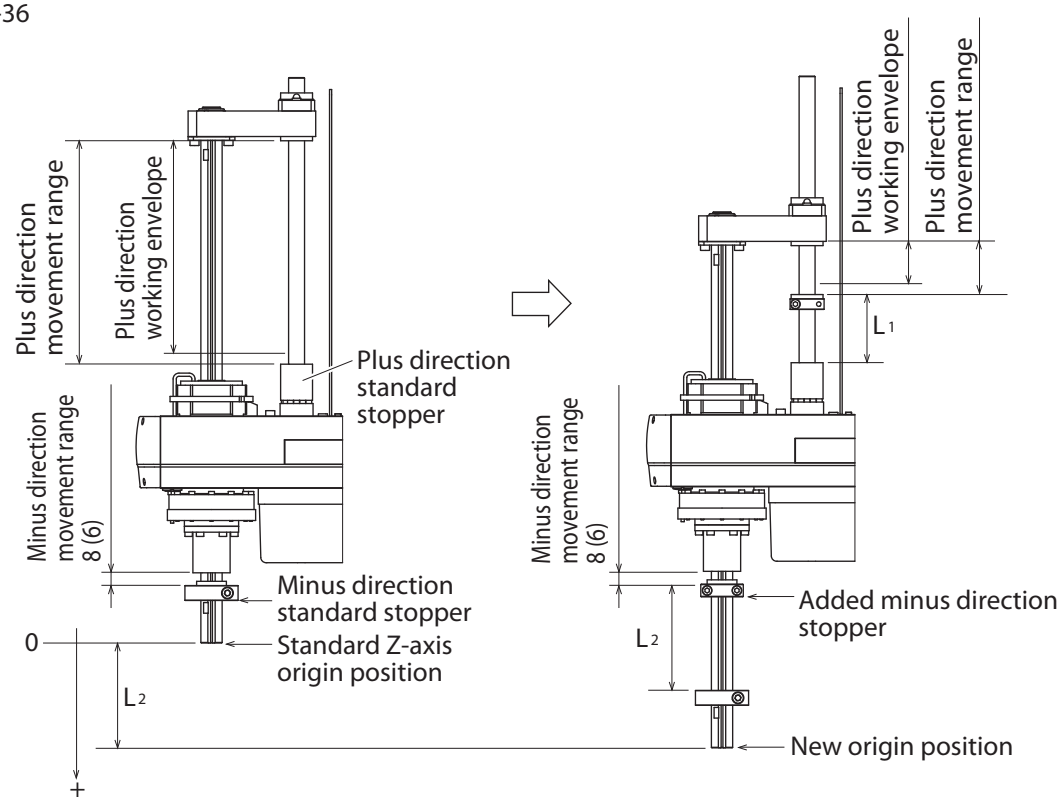
	Soft limit (pulses)	Working envelope
Z-axis working envelope in plus direction	16384 (300- (L_1+L_2)) /20	300- (L_1+L_2) mm
Z-axis working envelope in minus direction	-819	-1mm

Z=400mm stroke type

	Soft limit (pulses)	Working envelope
Z-axis working envelope in plus direction	16384 (400- (L_1+L_2)) /20	400- (L_1+L_2) mm
Z-axis working envelope in minus direction	-819	-1mm

L_1 minimum value = 14, L_2 minimum value = 12

Fig. 3-36



* Values in parentheses apply to the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000.

8-1 Installing the minus direction stopper

Install the additional mechanical stopper in the Z-axis minus direction by following the instructions shown in Fig. 3-37.

1) Prepare a hex wrench set.
2) Turn off the controller.
3) Place a sign indicating the robot is being adjusted, to keep others from touching the controller switch.
4) Enter the safeguard enclosure.
5) Remove the Y-axis arm cover by referring to Fig. 3-37, and move up the urethane damper.
6) Be sure to degrease the inner diameter cylindrical surface of the additional stopper and the spline where the stopper is to be installed. Then install the additional stopper (4) to the spline shaft by tightening the supplied bolts to the specified torque.
   Alternately tighten the bolts a little at a time. Depending on the relation to the Z-axis machine reference adjustment, L_2 in the Z-axis minus direction stopper in Table 3-9 will be a position at 5 mm intervals, such as approximately 15mm, 20mm, etc.
7) Go out of the safeguard enclosure.
8) Check that no one is inside the safeguard enclosure and then turn on the controller.
9) Place a sign indicating the robot is being adjusted, to keep others from touching the controller and operation panel switches.
10) Perform the Z-axis absolute reset.
    To perform the Z-axis absolute reset, see "3-3 Absolute reset procedures" in Chapter 4.
    Make a note of the Z-axis machine reference value.

⚠ CAUTION

USE THE FOLLOWING PROCEDURE TO DISPLAY THE ADJUSTMENT MACHINE REFERENCE VALUE. WHEN ADJUSTING THE MACHINE REFERENCE VALUE, ALWAYS CHECK THE ADJUSTMENT MACHINE REFERENCE VALUE WITH THIS PROCEDURE.

(1) Press the MODE key.
(2) Press the F3 key to enter MANUAL mode.
(3) Press the F13 key (LOWER+F3) to select "ABS Reset".
(4) After the Z-axis absolute reset is completed, press the F10 (UPPER+F5) key to display the **adjustment machine reference value** (%).

When the machine reference is within the allowable range (between 26 and 74%), proceed to step 16).

If the machine reference is outside the allowable range, adjust it as described in step 11) onward.

11) Turn off the controller and then enter the safeguard enclosure.

12) Put a mark at the added stopper position and loosen the bolt for the added stopper.
To adjust the machine reference value, move the added stopper as follows:
Machine reference value < 26% : Move the added stopper in the plus direction.
Machine reference value > 74% : Move the added stopper in the minus direction.
As an approximate guide, a 5mm movement equals 100%.

13) Repeat the same procedure from step 6) until the machine reference is within the allowable range.

14) When the machine reference is set within the allowable range, go out of the safeguard enclosure.

15) Check that no one is inside the safeguard enclosure and then turn on the controller.

16) Set the soft limits as shown in Table 3-9.
The soft limit in the minus direction is already set by default to the value shown in Table 3-9.

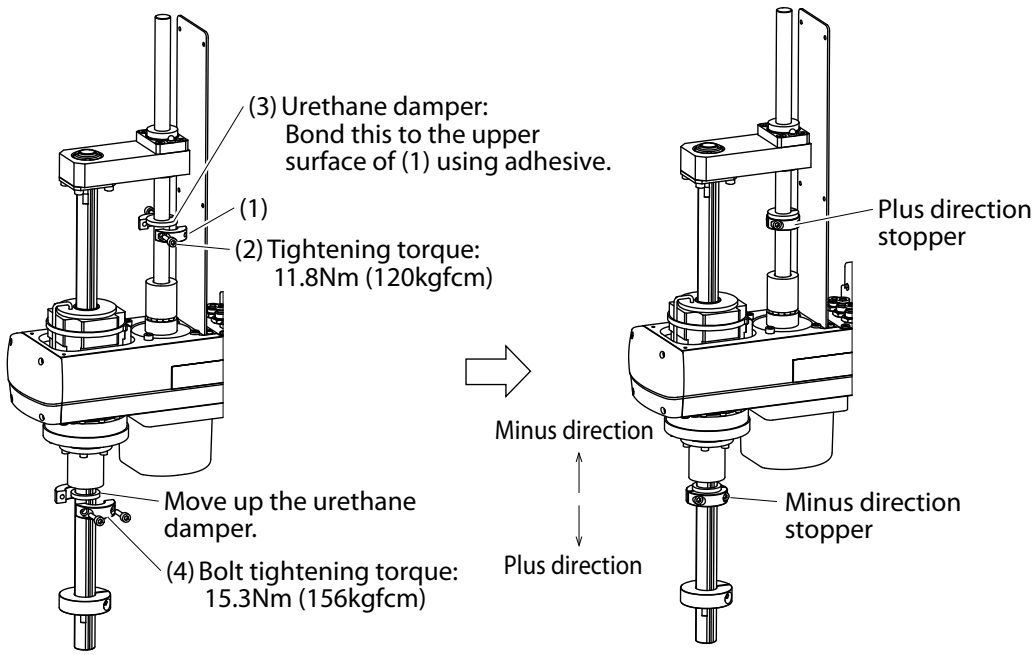
17) Stay outside the safeguard enclosure and check that the soft limits work to stop the Z-axis unit at a point before the stopper position. Depending on the accuracy and position of the stopper parts, the Z-axis unit may not stop until it reaches the stopper. In this case, set the soft limits larger than the values shown in Table 3-9.

18) Check that the movement range is limited by the stoppers as desired.

19) Turn off the controller and enter the safeguard enclosure.

20) Reattach the Y-axis arm cover.

Fig. 3-37



8-2 Installing the plus direction stopper

Install the additional mechanical stopper in the Z-axis plus direction by following the instructions shown in Fig. 3-37 of the preceding section 8-1.

1) Prepare a hex wrench set.
2) Turn off the controller.
3) Place a sign indicating the robot is being adjusted, to keep others from touching the controller switch.
4) Enter the safeguard enclosure.
5) Remove the Y-axis arm cover by referring to Fig. 3-37.
6) Be sure to degrease the inner diameter cylindrical surface of the additional stopper and the ball screw where the stopper is to be installed. Then install the additional stopper (1) to the ball screw by tightening the bolts (2) to the specified torque.
   Alternately tighten the bolts a little at a time. There is no restriction on the stopper position in the plus direction.
7) Open the urethane damper (3), fit it onto the ball screw, and bond it to the upper surface of (1) using adhesive. Use ThreeBond 1739 instant adhesive as the adhesive. Fully degrease the bonding surfaces before applying the adhesive.
8) Go out of the safeguard enclosure.
9) Check that no one is inside the safeguard enclosure and then turn on the controller.
10) Place a sign indicating the robot is being adjusted, to keep others from touching the controller and operation panel switches.
11) Set the soft limit in the plus direction as shown in Table 3-9.
12) Stay outside the safeguard enclosure and check that the soft limits work to stop the Z-axis unit at a point before the stopper position. Depending on the accuracy and position of the stopper parts, the Z-axis unit may not stop until it reaches the stopper. In this case, set the soft limits smaller than the values shown in Table 3-9.
13) Check that the movement range is limited by the stoppers as desired.
14) Turn off the controller and enter the safeguard enclosure.
15) Reattach the Y-axis arm cover.

⚠ WARNING

IN THE CASE OF THE R6YXGH600, R6YXG700, R6YXG800, R6YXG900 AND R6YXG1000, THE PLUS DIRECTION STOPPER WILL BECOME A LOAD, AND SO IF THE TIP LOAD IS 0KG OR 1KG, THE Z-AXIS ACCELERATION MUST BE REDUCED AS SHOWN BELOW. IF NOT REDUCED, THE SERVICE LIFE OF THE Z-AXIS DRIVE UNIT WILL DECREASE.

Tip load	0kg	1kg
Z-axis acceleration	90%	80%

8-3 Overrun amounts during impacts with Z-axis mechanical stopper

A urethane damper is installed to absorb the shock when an impact occurs with the mechanical stopper, so a certain amount of overrun occurs when the robot strikes the mechanical stopper. Use caution and take overrun into account since the end effector may interfere with the robot body and peripheral equipment or the robot body may interfere with the peripheral equipment. Maximum overrun amounts are listed below (for normal operation, maximum payload, maximum speed).

Robot model	Z-axis	
	Upper end	Lower end
R6YXG500, R6YXG600	5mm	11mm
R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000	7mm	14mm

Note: Here, ° (deg.) is the overrun angle at the X-axis and Y-axis joints.

1. If the Z-axis mechanical stopper is deformed or damaged by impacts, please contact our sales office or dealer. Using the deformed or damaged mechanical stopper is dangerous, so it must be replaced.
2. After the robot strikes the Z-axis mechanical stopper, the stopper position may shift, and so check the stopper position. If shifted, move the stopper to the correct position and refasten it securely by following the assembly procedure.

9. Working Envelope and Mechanical Stopper Positions for Maximum Working Envelope

Working envelope of each robot and mechanical stopper positions for the maximum working envelope are shown in “1-2 External view and dimensions” in Chapter 7.
Here, those are described using the R6YXG500 as an example. Other robot models are the same.

1) X and Y axes
   1. Do not attempt operation outside the working envelope. On the XG series, the origin can be set at a discrete position. The working envelope described in this manual is an area with the robot frontal reference when no load is applied.
   2. Interference positions where a load may touch the robot within the working envelope and their radii are shown in the figure. Here, “a”, “b”, “c” and “d” are the respective interference positions with the base front panel, base side panel, base rear panel, and base corners. Be careful not to allow the robot load to interfere with any part of the robot. The Z-axis spline may touch the base or the Y-axis arm may touch the wire harness before the robot strikes the X-axis or Y-axis mechanical stoppers, so use caution.
   3. Interference positions where a load might touch the robot within the maximum movement range and their radii are shown in the figure. Here, “a”, “b”, “c” and “d” are the respective interference positions with the base front panel, base side panel, base rear panel and the base corners. The Zaxis spline may touch the base or the Y-axis arm may touch the wire harness before the robot strikes the X-axis or Y-axis mechanical stoppers, so use caution.

2) Z-axis
   Do not attempt work outside the working envelope. In particular, do not attempt work in the area between the working envelope and mechanical stopper position. Mechanical stoppers are installed at both the upper and lower ends of the movement range.

⚠ WARNING

THE ROBOT CABLE, USER WIRING OR TUBING MAY BE DAMAGED IF THE ROBOT LOAD INTERFERES WITH THEM RESULTING IN HAZARDOUS ROBOT MALFUNCTIONS. DO NOT OPERATE AT POINTS WHERE THE LOAD MAY INTERFERE WITH THE ROBOT CABLE, USER WIRING OR TUBING.

3) R-axis
   The R-axis has no mechanical stoppers.

⚠ CAUTION

SINCE THE R-AXIS HAS NO MECHANICAL STOPPERS, MAKE CERTAIN THAT THE END EFFECTOR WIRING AND TUBING DO NOT BECOME ENTANGLED DURING OPERATION.

4) Robot overrun during impacts with mechanical stopper
A urethane damper is installed to absorb the shock when an impact occurs with the mechanical stopper, so a certain amount of overrun occurs when the robot strikes the mechanical stopper. Use caution and take overrun into account since the end effector may interfere with the robot body and peripheral equipment or the robot body may interfere with the peripheral equipment. Maximum overrun amounts are listed below (for normal operation, maximum payload, maximum speed).

Robot model	X-axis	Y-axis	Z-axis	
			Upper end	Lower end
R6YXG500, R6YXG600	9°	12°	5mm	5mm
R6YXGH600, R6YXG700 to R6YXG800	9°	12°	5mm	5mm

Note: Here, ° (deg.) is the overrun angle at the X-axis and Y-axis joints.

(1) If the X-axis, Y-axis or Z-axis mechanical stopper is deformed or damaged by impacts, please contact our sales office or dealer. Using the deformed or damaged mechanical stopper is dangerous, so it must be replaced.

(2) When the robot strikes the X-axis or Y-axis mechanical stopper or another object, or when the R-axis collides with an object, speed reduction gears are locked while being meshed if the collision impact is large. If this happens, please contact our sales office or dealer.

(3) After the robot strikes the Z-axis mechanical stopper, the stopper position may shift, and so check the stopper position. If shifted, move the stopper to the correct position and refasten it securely by following the assembly procedure.

10. Stopping Time and Stopping Distance at Emergency Stop

When the emergency stop button is pressed during robot operation or the power supply to the controller is turned off, the stopping time and stopping distance or angle of the main 3 axes change depending on the operation speed as shown below. The following figures show typical time and distance or angle needed for each axis to come to a stop after a stop signal is initiated when the robot arms are fully extended while 3 types of tip mass (33%, 66% and 100% of maximum payload) are loaded.

10-1 R6YXG500, R6YXG600

Fig. 3-38 XY-axis stopping time for R6YXG500

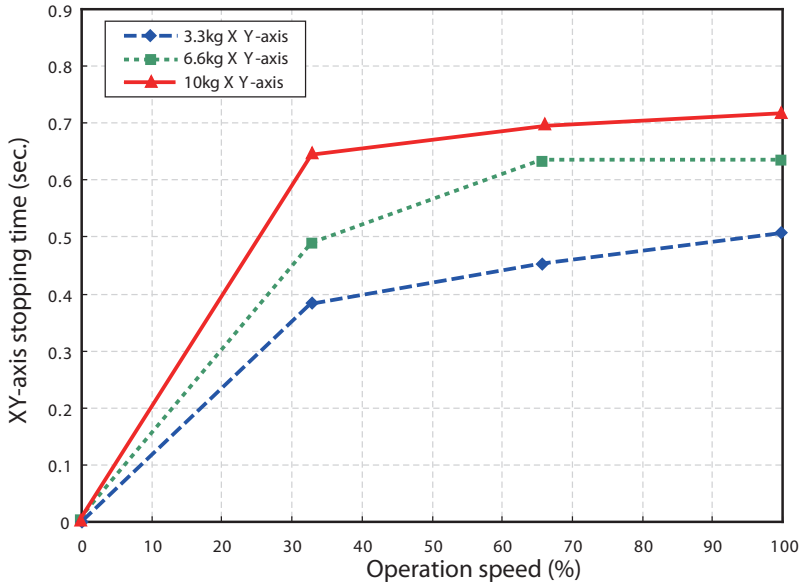


Fig. 3-39 XY-arm stopping rotation angle for R6YXG500

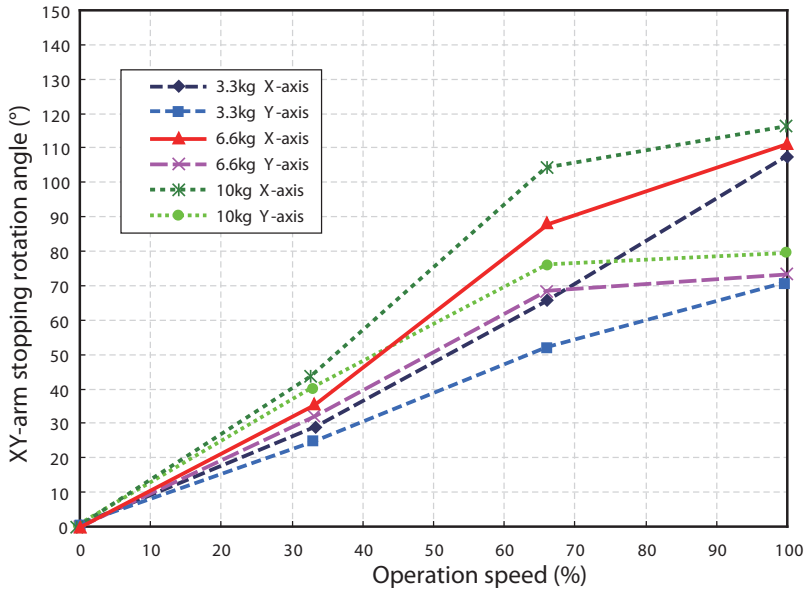


Fig. 3-40 XY-axis stopping time for R6YXG600

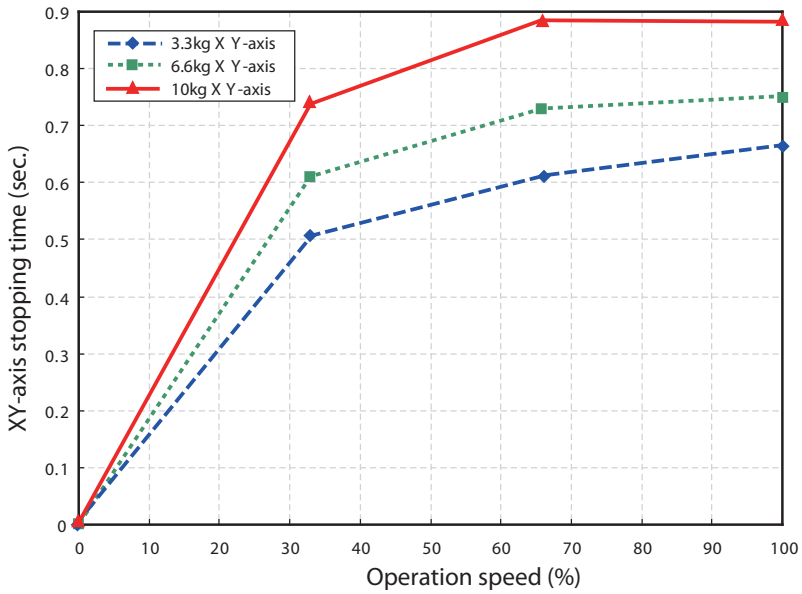


Fig. 3-41 XY-arm stopping rotation angle for R6YXG600

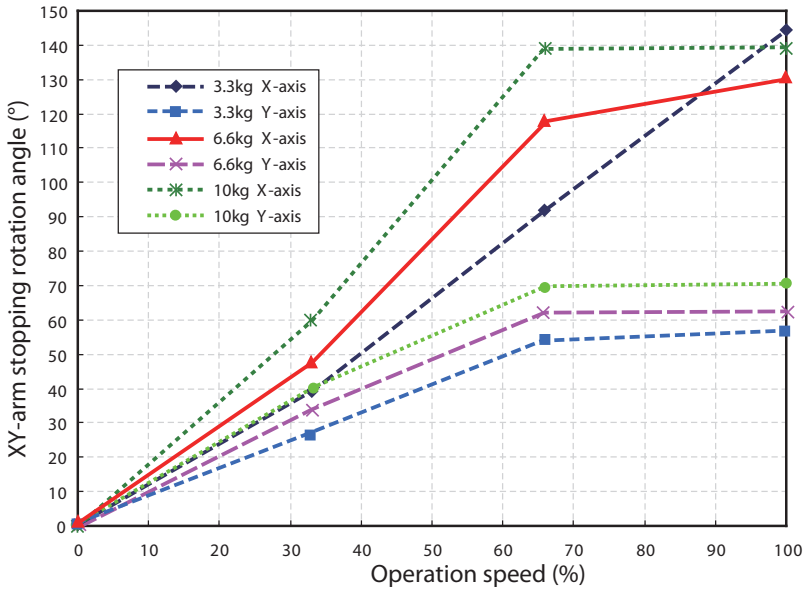


Fig. 3-42 Z-axis stopping time for R6YXG500 200

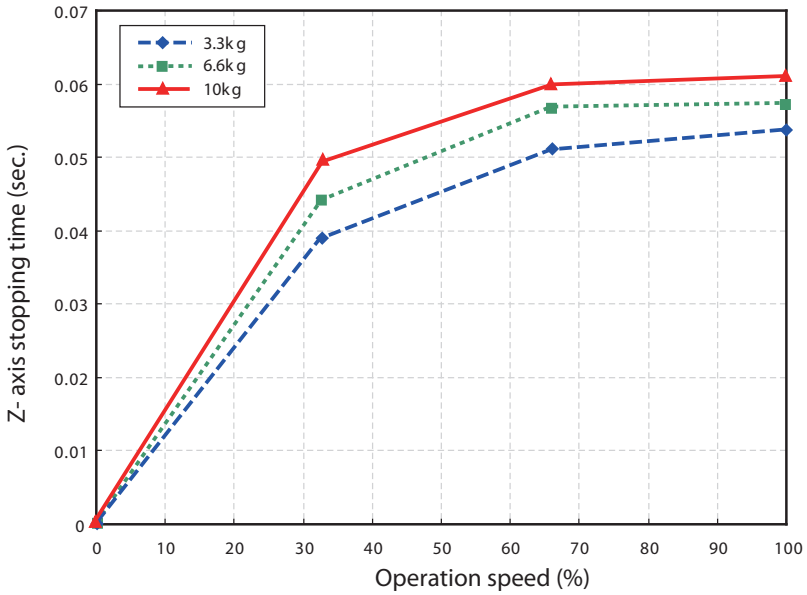


Fig. 3-43 Z-axis stopping distance for R6YXG500 200

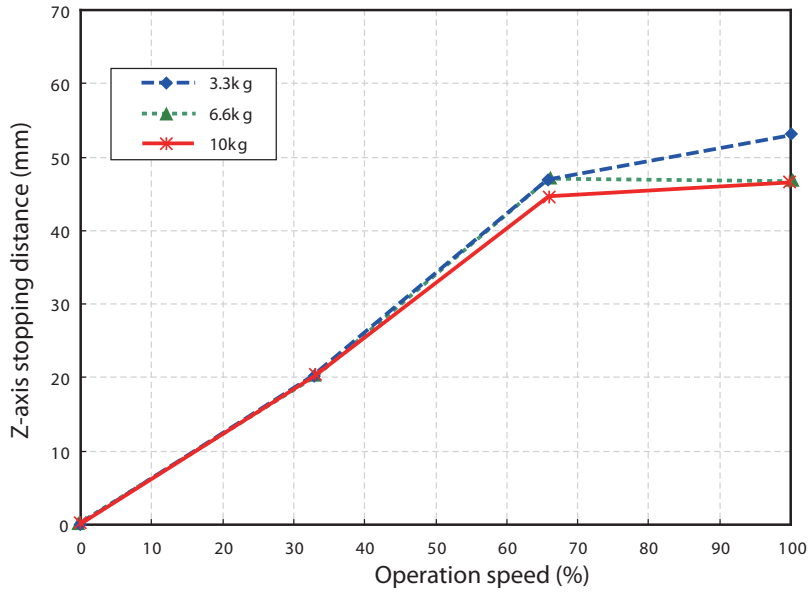


Fig. 3-44 Z-axis stopping time for R6YXG600 200

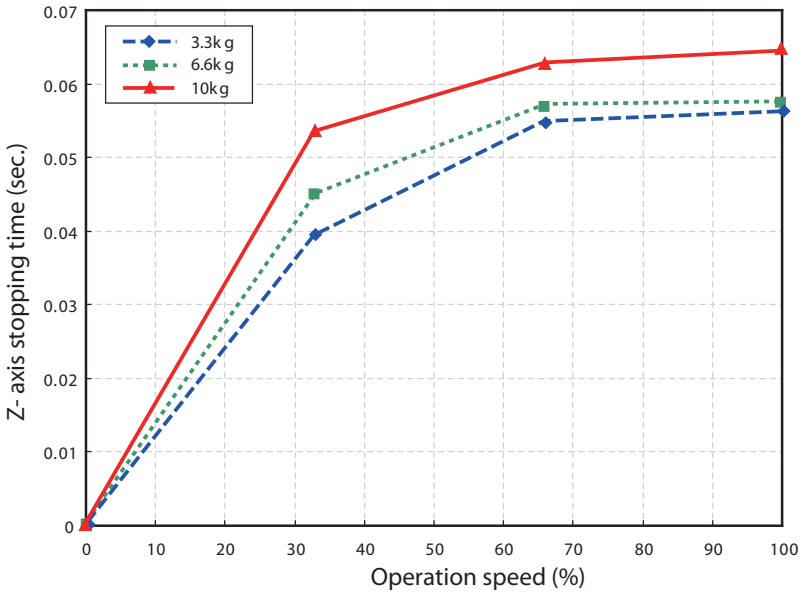


Fig. 3-45 Z-axis stopping distance for R6YXG600 200

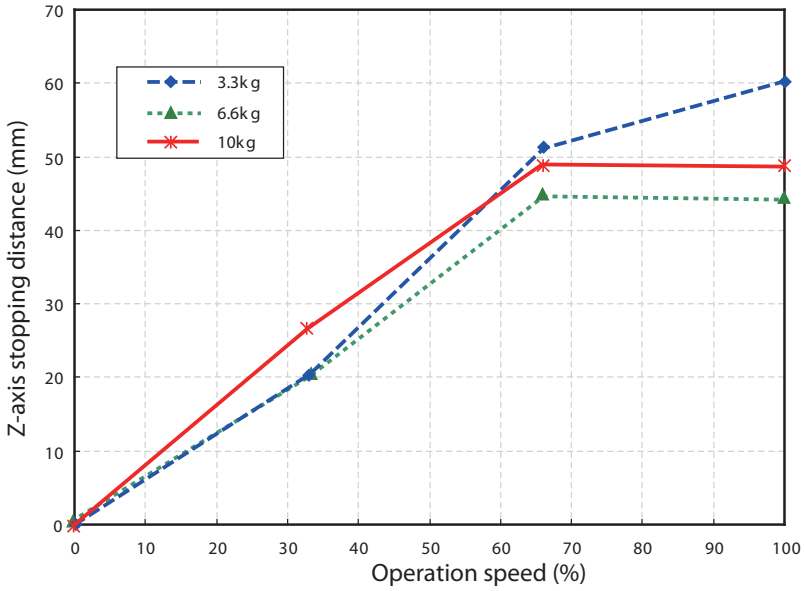


Fig. 3-46 Stopping time for R6YXG500 300 and R6YXG600 300

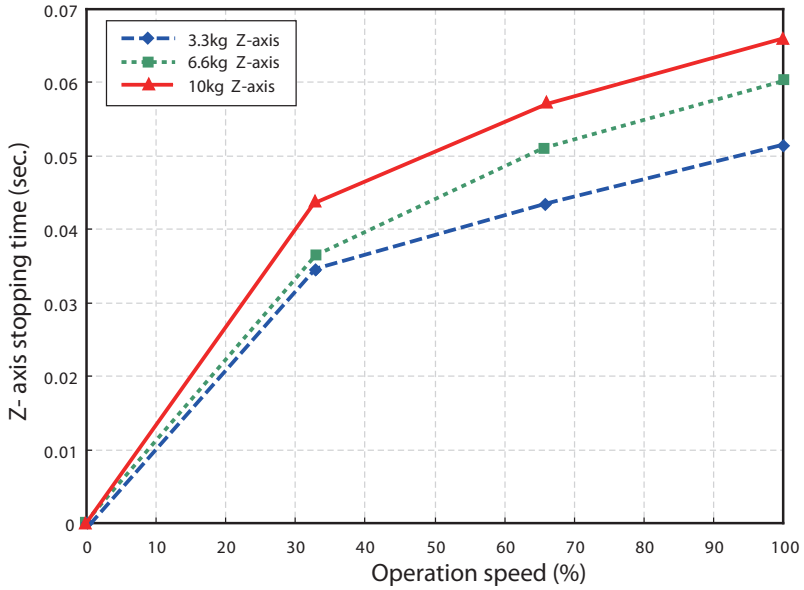
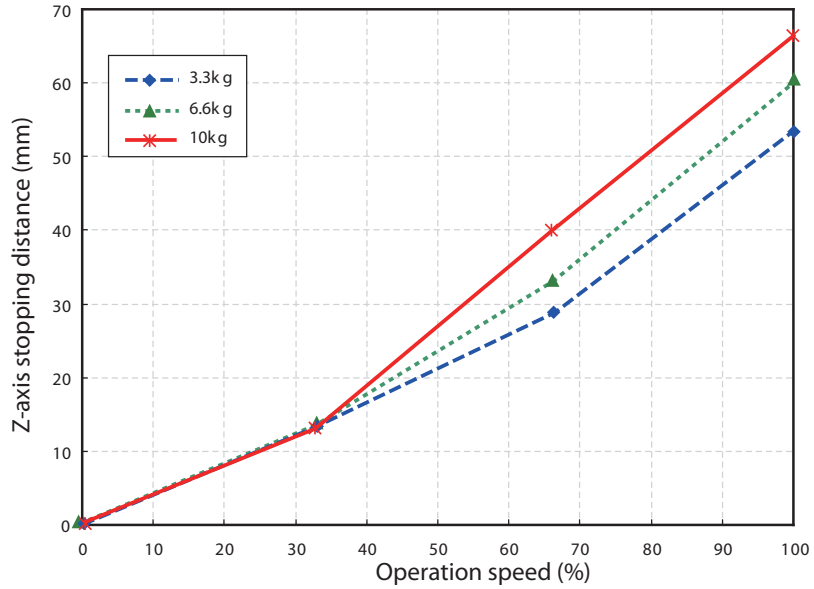


Fig. 3-47 Stopping distance for R6YXG500 300 and R6YXG600 300



10-2 R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000

Fig. 3-48 XY-axis stopping time for R6YXGH600

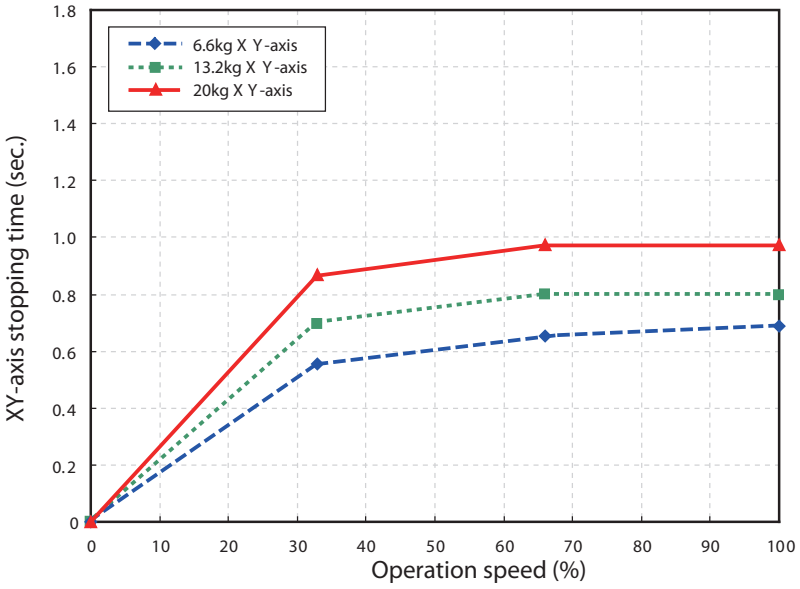


Fig. 3-49 XY-arm stopping rotation angle for R6YXGH600

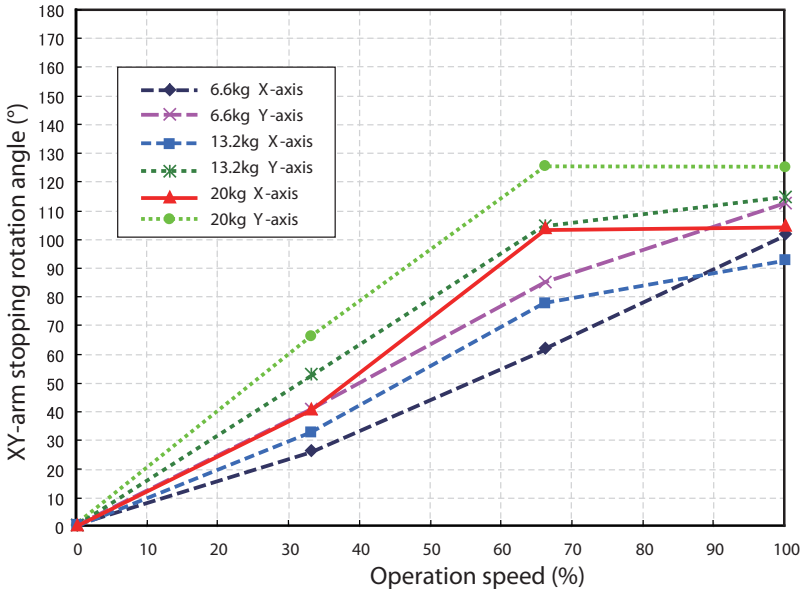


Fig. 3-50 XY-axis stopping time for R6YXG700

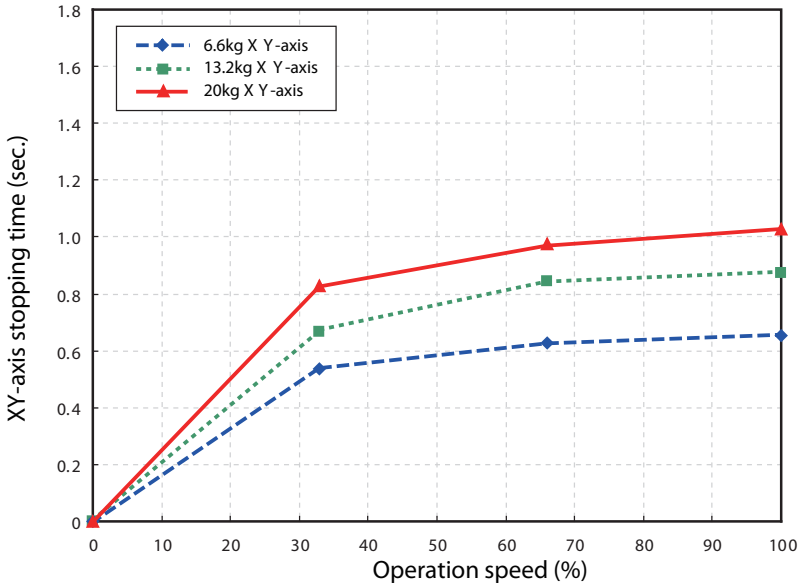


Fig. 3-51 XY-arm stopping rotation angle for R6YXG700

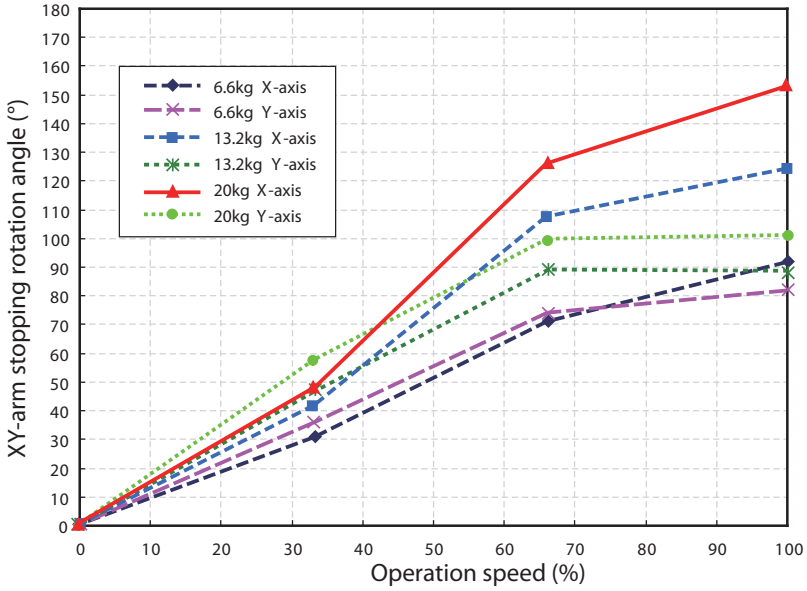


Fig. 3-52 XY-axis stopping time for R6YXG800

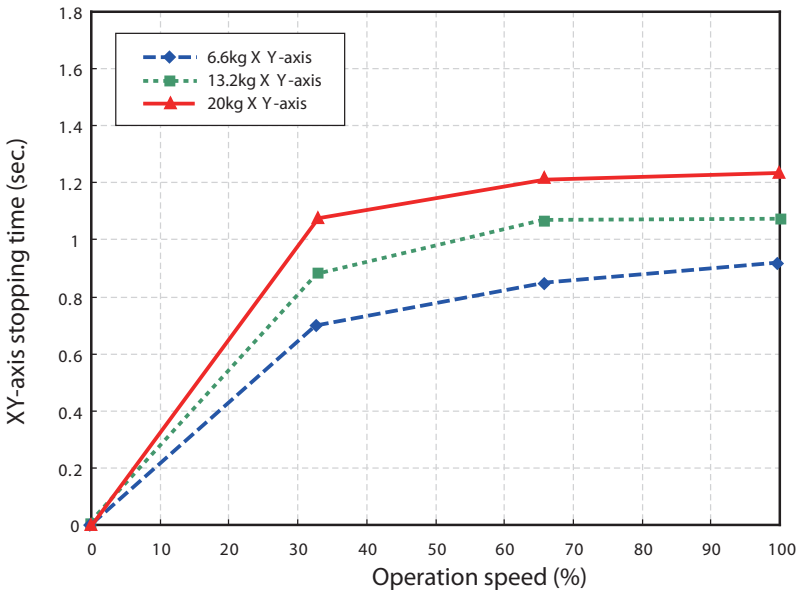


Fig. 3-53 XY-arm stopping rotation angle for R6YXG800

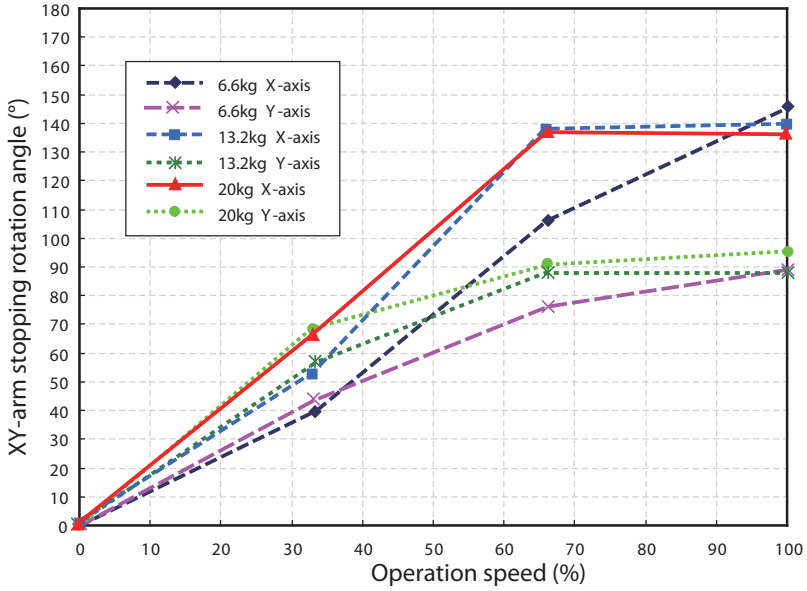


Fig. 3-54 XY-axis stopping time for R6YXG900

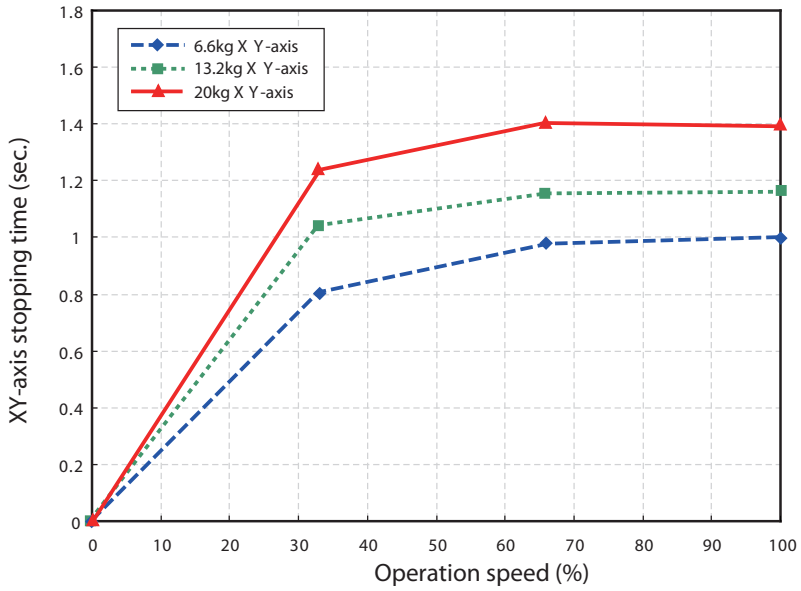


Fig. 3-55 XY-arm stopping rotation angle for R6YXG900

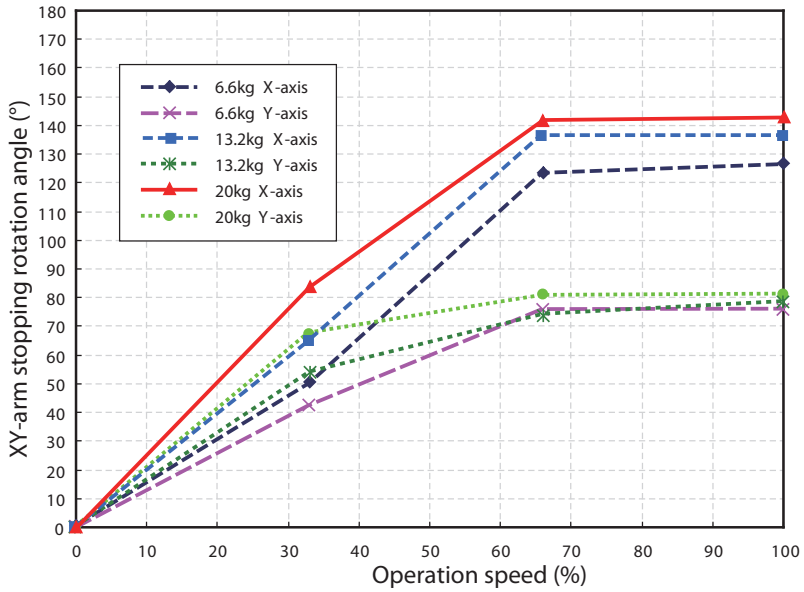


Fig. 3-56 XY-axis stopping time for R6YXG1000

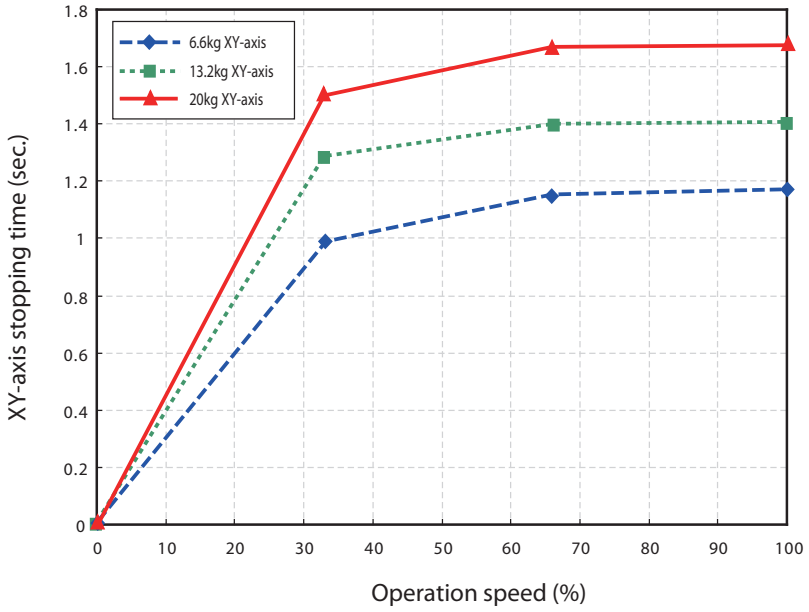


Fig. 3-57 XY-arm stopping rotation angle for R6YXG1000

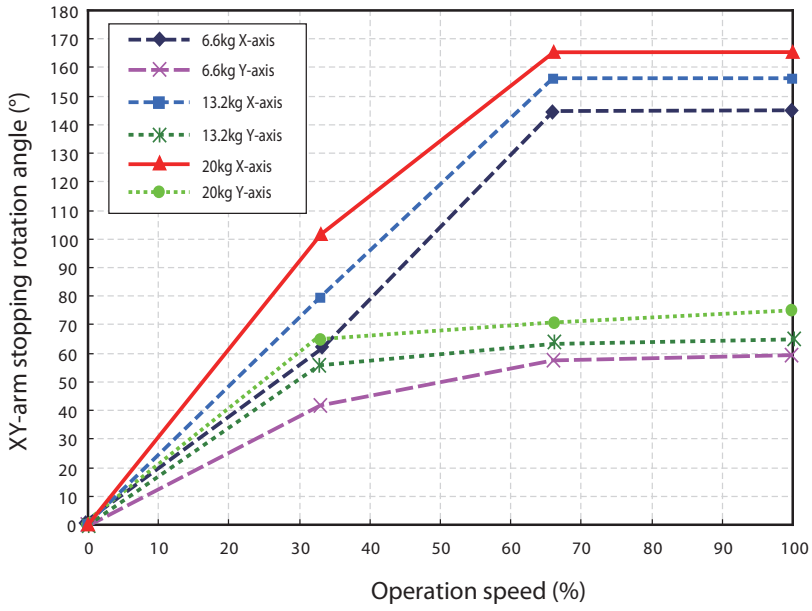


Fig. 3-58 Z-axis stopping time for R6YXGH600 400

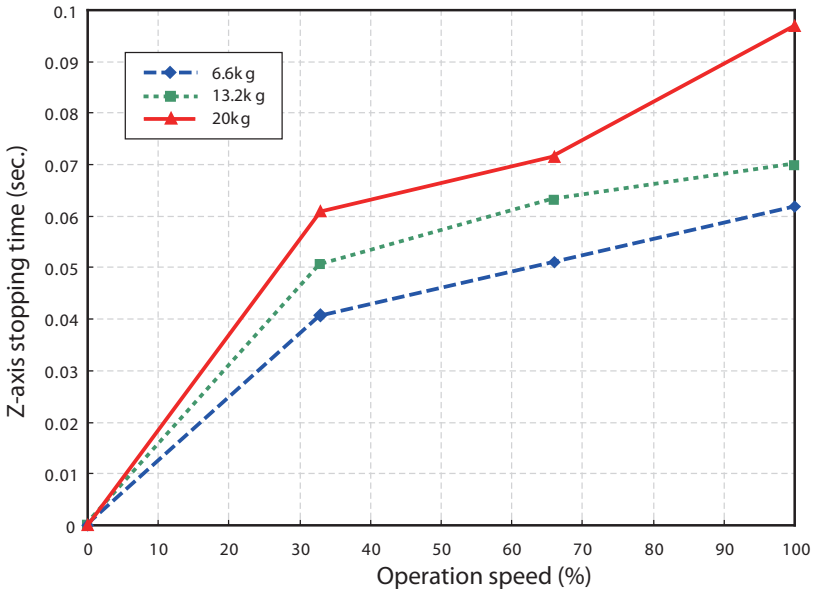


Fig. 3-59 Z-axis stopping distance for R6YXGH600 400

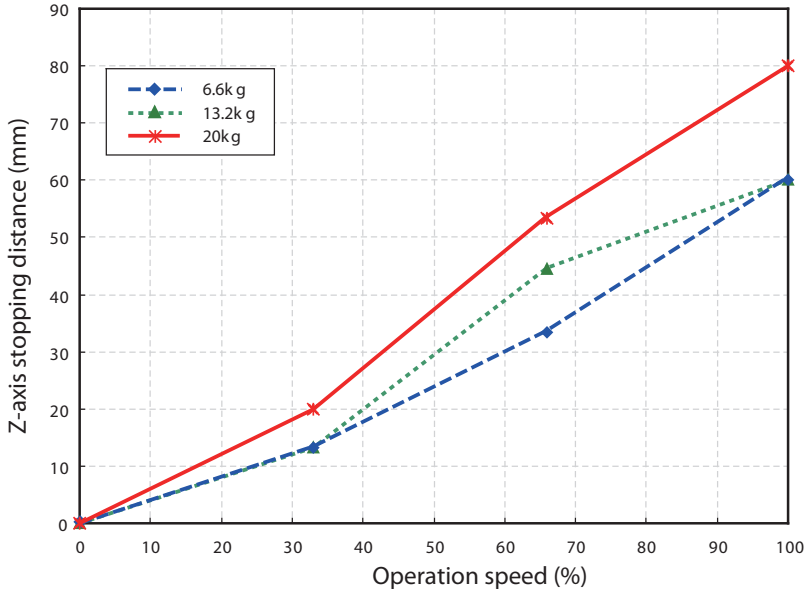


Fig. 3-60 Z-axis stopping time for R6YXG700 200

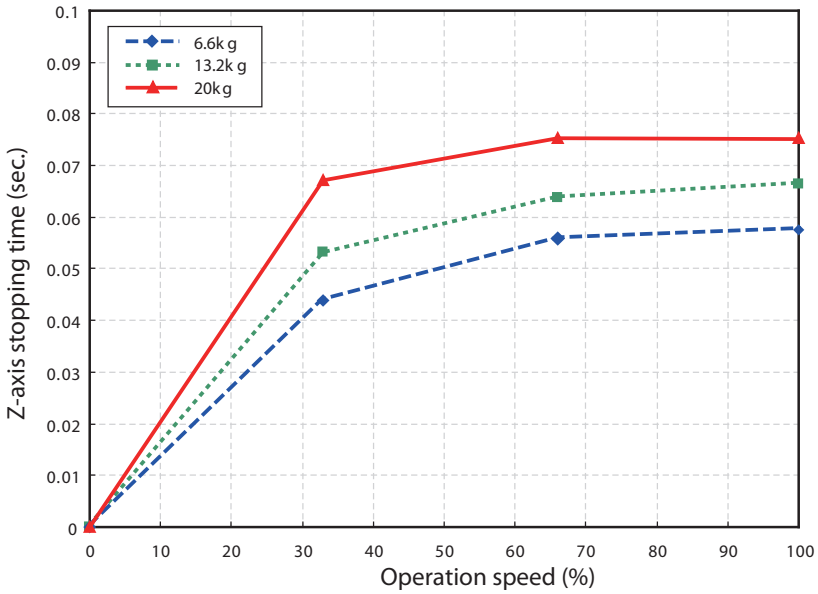


Fig. 3-61 Z-axis stopping distance for R6YXG700 200

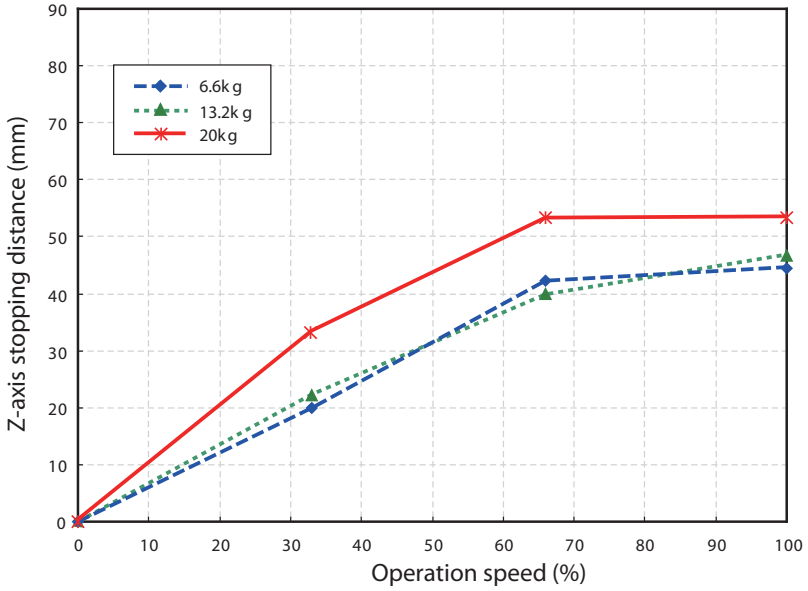


Fig. 3-62 Z-axis stopping time for R6YXG700 400

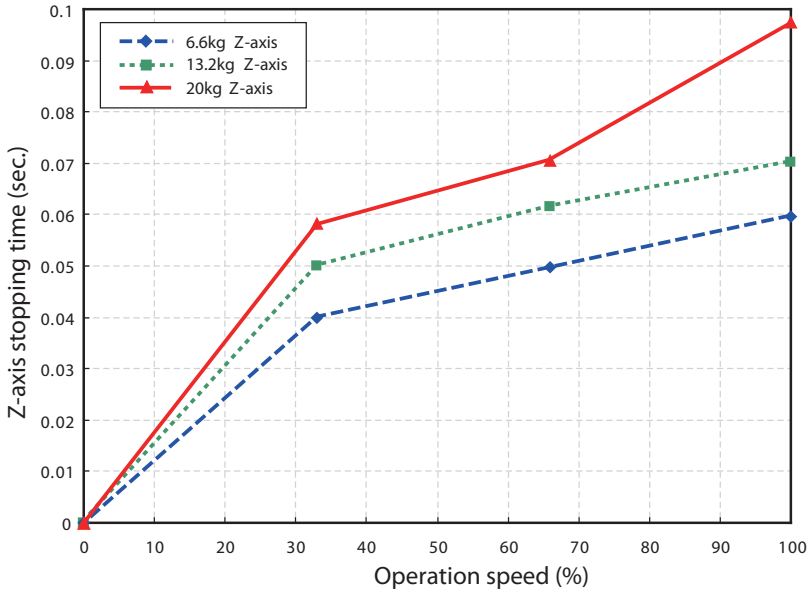


Fig. 3-63 Z-axis stopping distance for R6YXG700 400

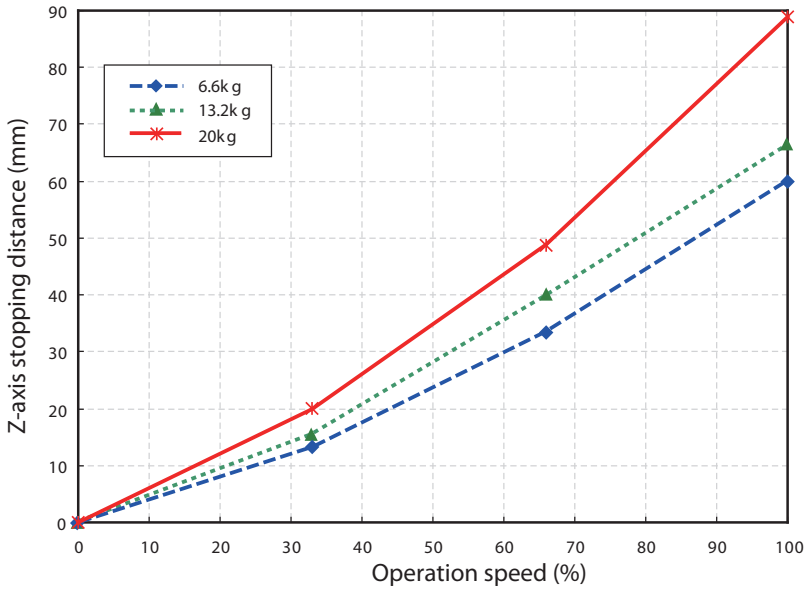


Fig. 3-64 Z-axis stopping time for R6YXGH600 200, R6YXG800, R6YXG900 and R6YXG1000

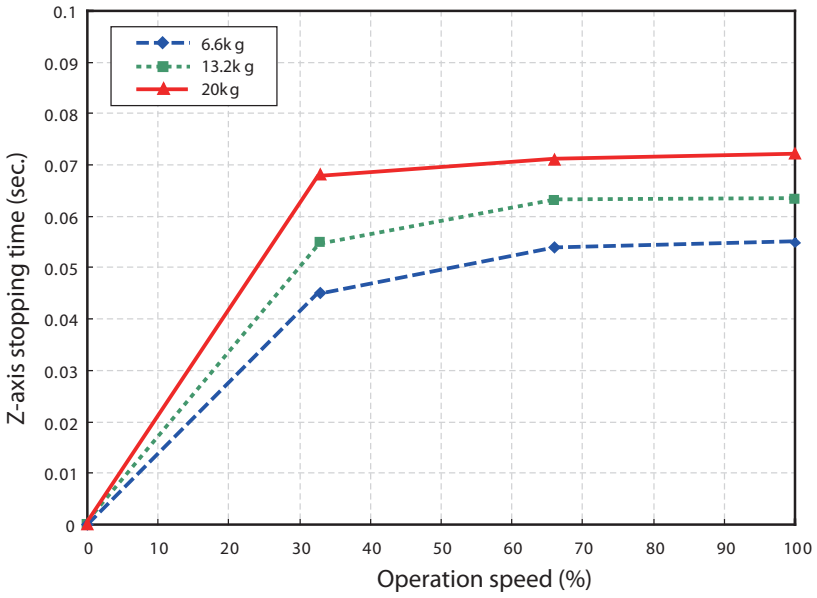
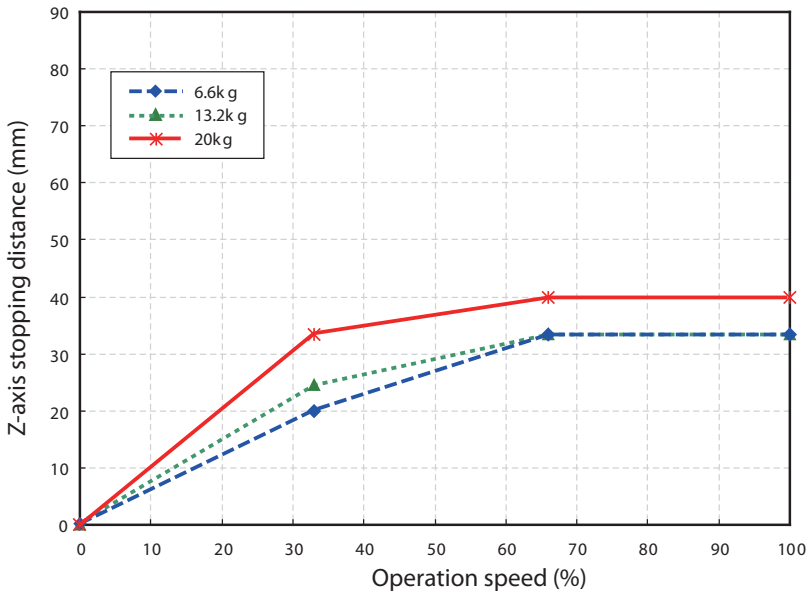


Fig. 3-65 Z-axis stopping distance for R6YXGH600 200, R6YXG800, R6YXG900 and R6YXG1000



Chapter 4 Adjustment

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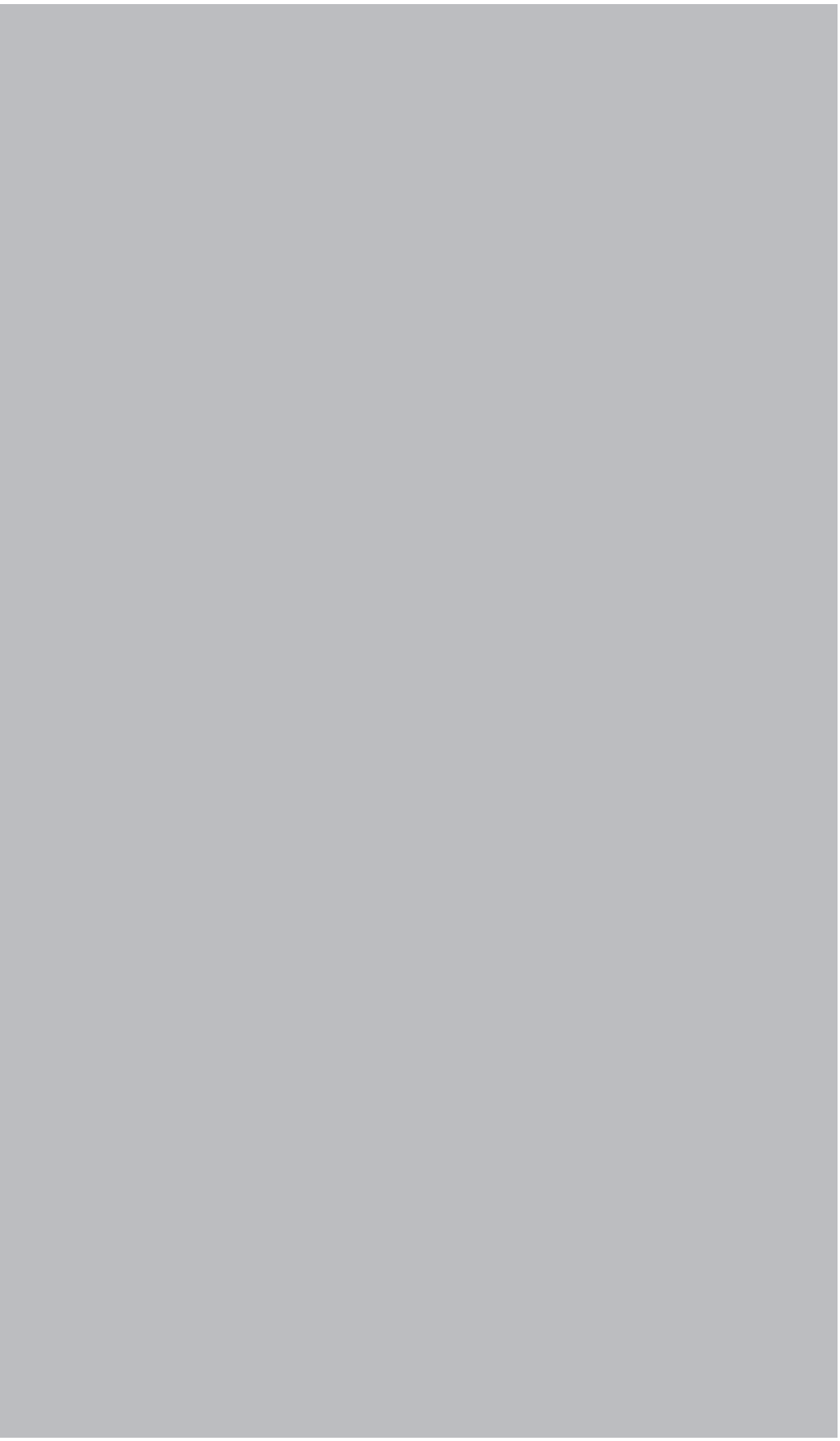


1. Overview

OMRON robots have been completely adjusted at the factory or by the sales representative before shipment, including the origin position adjustment. If the operating conditions are changed and the robot must be adjusted, then follow the procedures described in this chapter.

2. Safety Precautions

(1) Read and understand the contents of this chapter completely before attempting to adjust the robot.

(2) Place a conspicuous sign indicating the robot is being adjusted, to prevent others from touching the controller switch, programming unit or operation panel.

(3) If a safeguard enclosure has not yet been provided right after installation of the robot, rope off or chain off the movement area around the manipulator in place of a safeguard 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 area of the manipulator.

(4) To check operation after adjustment, refer to “6. Trial Operation” in Chapter 1.

3. Adjusting the Origin

All models of the XG series robots use an absolute type position detector. The origin position (zero pulse point) can be determined by absolute reset. Once absolute reset is performed, you do not have to repeat absolute reset when turning the power on next time. However, absolute reset is required if any of the following cases occur. The robot is shipped from the factory in condition “c” (below), so please perform absolute reset after installing the robot.

a. Absolute-related error occurred on the axis.
b. Power drop was detected in the absolute battery for the driver installed inside the robot controller.
c. Cable connecting the robot unit to the controller was disconnected.
(This is the status when shipped from the factory.)
d. Robot generation was changed.
e. Parameters were initialized.
f. Axis parameters “Origin shift”, “Origin method”, “Origin direction” or “Motor direction” were changed.
g. Motor was replaced. (Motor wiring connector was removed.)
h. Data in the ALL data file (extension: ALL) or parameter file (extension: PRM) was written into the controller by way of the RS-232C.

The following sections explain how to perform absolute reset.

⚠ CAUTION

- IF ANY OF THE ABOVE CASES OCCUR AFTER INSTALLING THE ROBOT, ABSOLUTE RESET MUST BE PERFORMED AGAIN. TO PERFORM ABSOLUTE RESET, MOVE THE ROBOT ARMS BACK TO THEIR ORIGIN POSITIONS WHERE THE ROBOT DOES NOT INTERFERE WITH PERIPHERAL EQUIPMENT AFTER THE SETUP IS COMPLETE.
- AFTER PERFORMING ABSOLUTE RESET, MOVE THE ROBOT TO A KNOWN POINT TO CHECK WHETHER THE ORIGIN POSITION IS CORRECTLY SET. WHEN DOING THIS CHECK, MOVE THE ROBOT AT THE SLOWEST POSSIBLE SPEED.
- THE STANDARD COORDINATE AND POINT DATA MUST BE RESET WHEN THE ORIGIN POSITION IS CHANGED.
- MAKE POINT DATA SETTING AFTER CHANGING THE ORIGIN POSITION. AFTER CHANGING THE ORIGIN POSITION, DO NOT USE THE PREVIOUS POINT DATA.

There are three absolute reset methods for the XG series: the sensor method, mark method, and stroke end method. The X-axis, Y-axis, and R-axis use the sensor method as the initial setting, while the Z-axis uses the stroke end method.

3-1 Absolute reset method

3-1-1 Sensor method (X-axis, Y-axis, and R-axis)

In the sensor method, the target axis is automatically operated for the absolute reset, and the absolute reset is performed at the position where the proximity sensor provided on the target axis detects the detection area (dog). The absolute reset in the sensor method can be executed with the programming box (PB), RS-232C communication, and dedicated input.

⚠ WARNING

SERIOUS INJURY MIGHT OCCUR FROM PHYSICAL CONTACT WITH THE ROBOT DURING OPERATION. NEVER ENTER WITHIN THE ROBOT MOVEMENT RANGE DURING ABSOLUTE RESET.

⚠ CAUTION

THE ORIGIN CANNOT BE DETECTED IN ANY AXIS WHICH IS NOT POSITIONED ON THE PLUS SIDE FROM THE ORIGIN (SEE FIG. 4-2) BEFORE STARTING THE RETURN-TO-ORIGIN OPERATION. (FACTORY SETTING AT SHIPMENT.) IN THIS CASE, PRESS THE STOP KEY TO INTERRUPT THE RETURN-TO-ORIGIN OPERATION, MOVE THE TARGET AXIS TO THE PLUS SIDE OF THE ORIGIN, AND REPERFORM THE ORIGIN RETURN OPERATION. IF THE RETURN-TO-ORIGIN OPERATION IS NOT INTERRUPTED, THE ROBOT WILL CONTINUE THE OPERATION AND MAY COLLIDE WITH THE MECHANICAL STOPPER OR A PERIPHERAL DEVICE. SINCE A MECHANICAL STOPPER IS NOT PROVIDED IN THE R-AXIS, THE WIRING AND PIPING INSTALLED ON THE END EFFECTER MAY BE WOUND UP BY THE OPERATION.

3-1-2 Stroke end method (Z-axis)

In the stroke end method, absolute reset is performed at a position slightly backed off from the stroke end, after the Z-axis contacts the mechanical stopper and stroke end is detected.

⚠ WARNING

SERIOUS INJURY MIGHT OCCUR FROM PHYSICAL CONTACT WITH THE ROBOT DURING OPERATION. NEVER ENTER WITHIN THE ROBOT MOVEMENT RANGE DURING ABSOLUTE RESET.

3-2 Machine reference

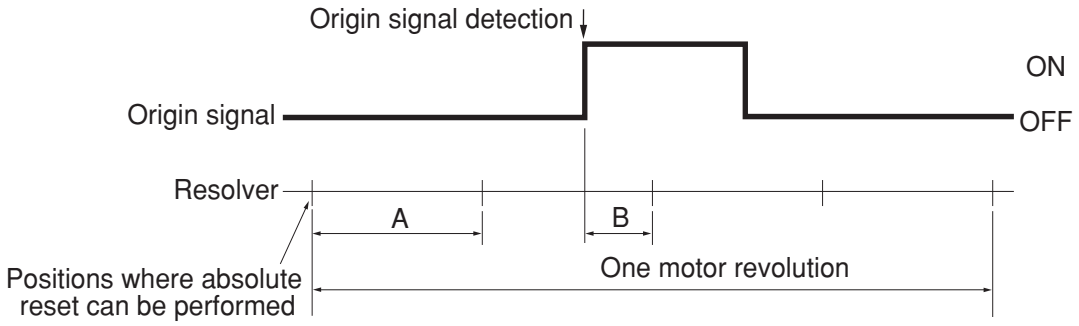
The XG series position detectors are resolvers that have four positions where absolute reset can be performed per motor revolution. If the sensor method is used for the absolute reset, the origin position will be set at the positions where absolute reset can be performed soon after the origin sensor reacts to the dog (the origin signal is detected). The machine reference means the position relationship of the position where the robot detects the origin signal to the position where the absolute reset can be performed soon after detection (see Fig. 4-1). The machine reference is expressed with the ratio of interval A to interval B shown in Fig. 4-1. Interval A is the minimum distance between the positions where absolute reset can be performed and interval B is the distance between the position where the origin signal is detected and the position where absolute reset can be performed soon after the origin signal detection. The machine reference value (unit: %) is displayed on the optional PB screen.

Machine reference value = B/A × 100(%)

⚠ CAUTION

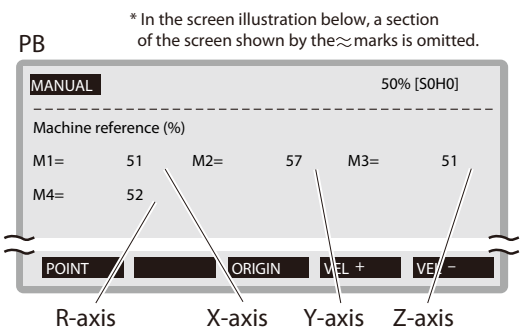
THE MACHINE REFERENCE MUST BE ADJUSTED WITHIN A SPECIFIED RANGE TO KEEP THE REPEATABILITY PRECISION OF THE ABSOLUTE RESET POSITION (THE MACHINE REFERENCE IS FACTORY-ADJUSTED PRIOR TO SHIPPING). IF THE ORIGIN POSITION IS CHANGED, THE MACHINE REFERENCE MUST BE READJUSTED. FOR INFORMATION ON HOW TO ADJUST THE MACHINE REFERENCE, REFER TO "3-4 CHANGING THE ORIGIN POSITION AND ADJUSTING THE MACHINE REFERENCE" IN CHAPTER 4. WHEN THE TEMPERATURE OF THE ROBOT JOINT SECTIONS IS HIGH IMMEDIATELY AFTER THE ROBOT HAS BEEN OPERATED, THE MACHINE REFERENCE VALUE MIGHT BE OUTSIDE THE SPECIFIED RANGE (40 TO 60%). WHEN CHECKING OR ADJUSTING THE MACHINE REFERENCE VALUE, ALWAYS MAKE SURE THAT THE TEMPERATURE OF THE ROBOT JOINT SECTIONS HAS RETURNED TO ROOM TEMPERATURE.

Machine reference



Machine reference display on PB screen

Fig. 4-1



3-3 Absolute reset procedures

3-3-1 Sensor method (X-axis, Y-axis, and R-axis)

⚠ WARNING

SERIOUS INJURY MIGHT OCCUR FROM PHYSICAL CONTACT WITH THE ROBOT DURING OPERATION. NEVER ENTER WITHIN THE ROBOT MOVEMENT RANGE DURING ABSOLUTE RESET.

The operation procedure using the PB is described next. (Press the ESC key on the PB if you want to return to the preceding step.) See the "OMRON Robot Controller User's Manual" for information on operating the robot controller.

1) Check that no one is inside the safeguard enclosure and then turn on the controller.
2) Place a sign indicating the robot is being adjusted, to keep others from touching the controller switch or operation panel.
3) Set the controller to MANUAL mode, if not in MANUAL mode.
4) Press the F13 (LOWER+F3) key to select "RST. ABS".
5) Select the axis for absolute reset. (X-axis: M1, Y-axis: M2, R-axis: M4)
   To perform absolute reset on all axes, select "ALL" with the F11 (LOWER+F1) key.

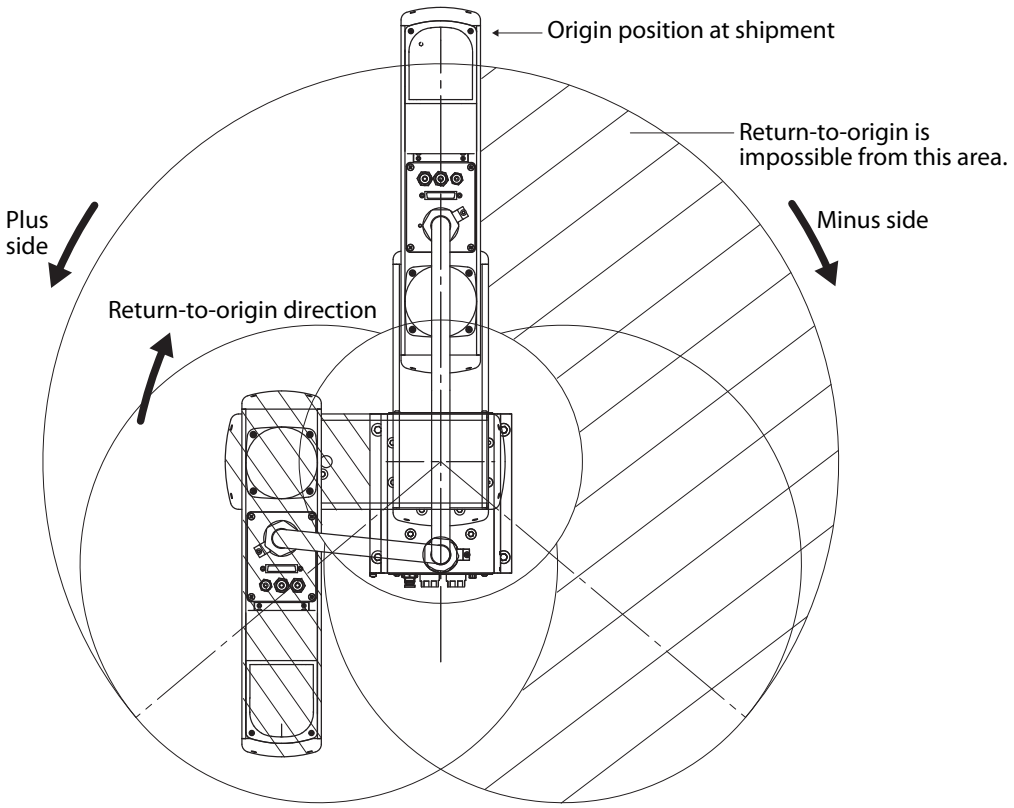
⚠ CAUTION

THE Z-AXIS OF THE STROKE END METHOD FIRST RISES DURING THE ABSOLUTE RESET OF ALL AXES (DEFAULT SETTING). BE CAREFUL THAT YOUR FINGERS DO NOT GET PINCHED OR CRUSHED BY ANY SUDDEN MOVEMENT.

6) Check that the absolute reset axis must be positioned at the plus side of the origin. (See Fig. 4-2.) If it is not at the plus side, then press the jog key to move the target axis to the plus side.
7) Since the message "Reset ABS encoder OK?" is displayed, check that there are not any obstacles in the robot movement range, and press the F4 key (YES).

8) After the absolute reset is completed, check that the machine reference value displayed on the PB is between 40 and 60 (recommended range). If the machine reference value is outside the recommended range, then the next absolute reset may not be properly performed. In this case, refer to "3-4 Changing the origin position and adjusting the machine reference", and make the necessary adjustments.

Fig. 4-2



3-3-2 Stroke end method (Z-axis)

WARNING

SERIOUS INJURY MIGHT OCCUR FROM PHYSICAL CONTACT WITH THE ROBOT DURING OPERATION. NEVER ENTER WITHIN THE ROBOT MOVEMENT RANGE DURING ABSOLUTE RESET.

The operation procedure using the PB is described next. (Press the ESC key on the PB if you want to return to the preceding step.) See the "OMRON Robot Controller User's Manual" for information on operating the robot controller.

1) Check that no one is inside the safeguard enclosure and then turn on the controller.
2) Place a sign indicating the robot is being adjusted, to keep others from touching the controller switch or operation panel.
3) Set the controller to MANUAL mode, if not in MANUAL mode.
4) Press the F13 (LOWER+F3) key to select "RST. ABS".
5) Select M3 (Z-axis).
6) Since the message "Reset ABS encoder OK?" is displayed, check that there are not any obstacles in the robot movement range, and press the F4 key (YES).
7) After absolute reset is complete, check that the adjustment machine reference value displayed on the PB is within the absolute reset tolerance range (25 to 75).

CAUTION

USE THE FOLLOWING PROCEDURE TO DISPLAY THE ADJUSTMENT MACHINE REFERENCE VALUE. WHEN ADJUSTING THE MACHINE REFERENCE VALUE, ALWAYS CHECK THE ADJUSTMENT MACHINE REFERENCE VALUE WITH THIS PROCEDURE.

(1) Press the MODE key.
(2) Press the F3 key to enter MANUAL mode.
(3) Press the F13 key (LOWER+F3) to select "ABS Reset".
(4) After the Z-axis absolute reset is complete, press the F10 (UPPER+F5) key to display the adjustment machine reference value (%).

If the machine reference value is outside the absolute reset tolerance range, then the next absolute reset may not be properly performed. In this case, make the necessary adjustments by referring to "3-4 Changing the origin position and adjusting the machine reference" in Chapter 4.

3-4 Changing the origin position and adjusting the machine reference

⚠ CAUTION

- IF THE ORIGIN POSITION HAS BEEN CHANGED, THEN THE ABSOLUTE RESET MUST BE PERFORMED, THE MACHINE REFERENCE MUST BE ADJUSTED, AND THE STANDARD COORDINATE AND POINT DATA MUST BE RESET.
- IF ANY MACHINE REFERENCE IS ADJUSTED, THE ORIGIN POSITION MAY CHANGE. BEFORE THE ADJUSTMENT, MARK OFF THE REFERENCE MARK AT THE CURRENT ORIGIN POSITION ON THE MAIN BODY OF THE ROBOT. AFTER THE MACHINE REFERENCE IS ADJUSTED, BE SURE TO CHECK THAT THE ORIGIN POSITION HAS NOT DEVIATED. IF THE ORIGIN POSITION CHANGES AFTER THE MACHINE REFERENCE HAS BEEN ADJUSTED, THEN THE STANDARD COORDINATE AND POINT DATA MUST BE RESET.

3-4-1 Sensor method

3-4-1-1 R6YXG500, R6YXG600, R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

1-1. Adjusting the X-axis machine reference

CAUTION

THE ORIGIN POSITION MAY CHANGE DUE TO MACHINE REFERENCE ADJUSTMENT. IF IT OCCURS, YOU MUST SET POINT DATA AGAIN.

The adjustment method for the X-axis machine reference is as follows.

1) Prepare a hex wrench set.
2) Check that no one is inside the safeguard enclosure and then turn on the controller.
3) Perform the absolute reset from outside the safeguard enclosure.
   Refer to "3-3 Absolute reset procedures" for information about the absolute reset method.
4) If any machine reference value displayed on the PB is not in the range between 40 and 60 (recommended range) after the absolute reset has been completed, then proceed with the following adjustment procedure.
5) Place a sign indicating that the robot is being adjusted in order to keep others from operating the controller or operation panel.
6) Turn off the controller and enter the safeguard enclosure.
7) Mark off the reference mark at the current origin position on the X-axis joint area of the robot.
   At this time, be careful to prevent the origin position from deviating since the X-axis arm is touched.
8) Remove the cover.
9) Scribe a mark on the position of the X-axis origin sensor stay.
10) Using the hex wrench, loosen the two bolts securing the X-axis origin sensor stay. (See Fig. 4-3.)

CAUTION

THE BOLTS ONLY NEED TO BE LOOSENED, AND DO NOT NEED TO BE COMPLETELY REMOVED.

11) Move the X-axis origin sensor stay in the following manner and then secure it with the bolts.

NOTE

- When the machine reference is less than 40%, move the stay in direction (1): See Fig. 4-3 (b).
- When the machine reference is more than 40%, move the stay in direction (2): See Fig. 4-3 (b).

As an approximate guide, a 1mm movement equals to 100%.

12) Go out of the safeguard enclosure, and check that no one is inside the safeguard enclosure. Then turn on the controller.

13) Perform the absolute reset from outside the safeguard enclosure.

14) After the absolute reset is completed, read the machine reference value displayed on the PB.

15) If the machine reference value is in the range between 40 and 60 (recommended range), then the machine reference has been completely adjusted.
If it is outside the recommended range, then repeat the procedure that starts in 5) to readjust it.

16) Reattach the cover after the adjustment is complete.

Fig. 4-3 (a)

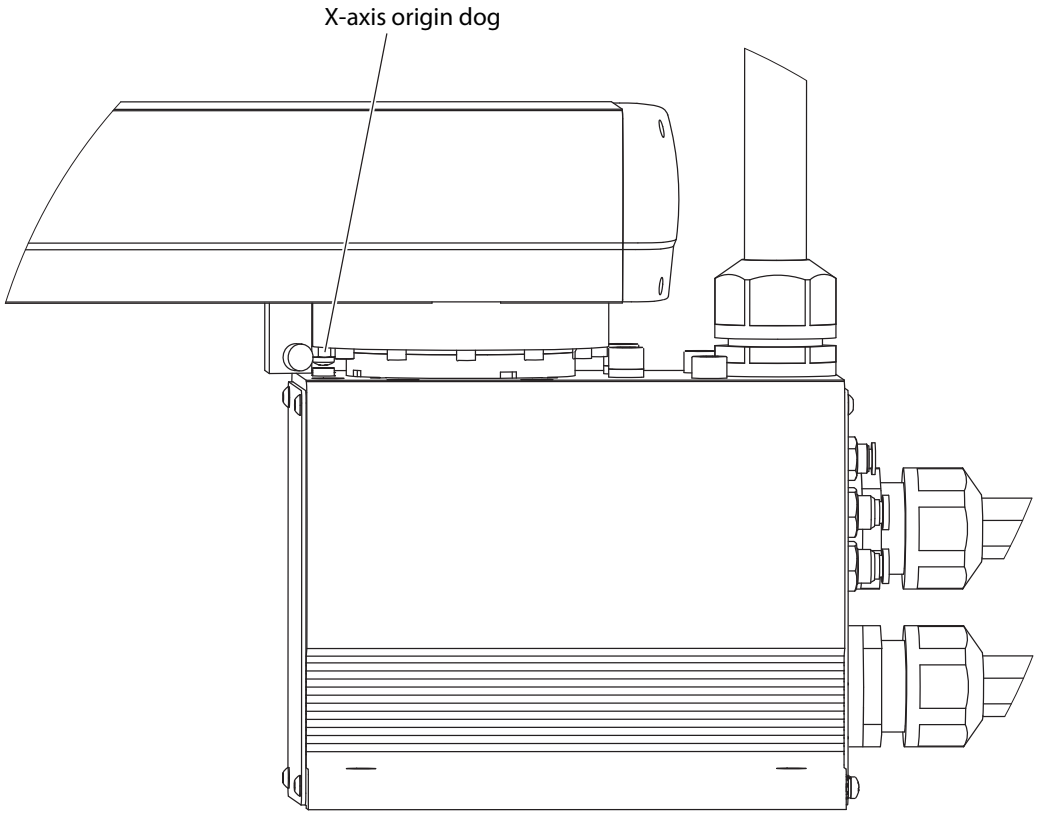
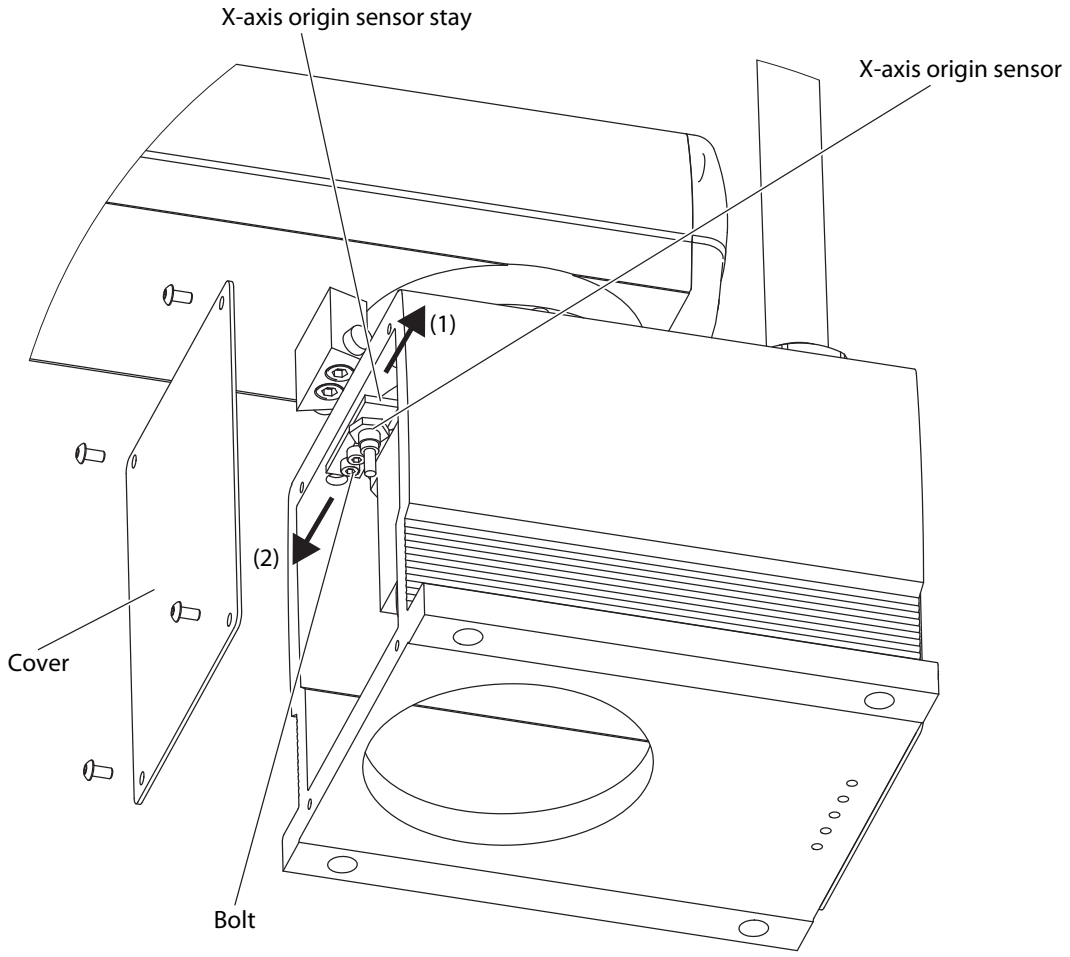


Fig. 4-3 (b)



1-2. Changing the X-axis origin position

The X-axis origin position can be changed to any position in the range from the front position of the X-axis arm base to a maximum of 120° clockwise and counterclockwise at 30° intervals, by changing the positions of the dog and the mounting bolt for the X-axis speed reduction unit as shown in Fig. 4-4.

⚠ CAUTION

- IF THE ORIGIN POSITION HAS BEEN CHANGED, THEN THE ABSOLUTE RESET MUST BE PERFORMED, THE MACHINE REFERENCE MUST BE ADJUSTED, AND THE STANDARD COORDINATE AND POINT DATA MUST BE RESET.
- THE DOG AND BOLT MIGHT COME OFF AND CAUSE THE JOINT TO LOCK UP UNLESS YOU APPLY "SCREW LOCK" TO THEM AND TIGHTEN TO THE SPECIFIED TORQUE.

The following describes the method for changing the X-axis origin position, for example, to a position 90° counterclockwise.

1) Prepare the necessary tools.
   - Hex wrench set
   - Phillips screwdriver
   - Phillips screwdriver bit
   - Torque wrench
   - Screw Lock (thread sealant)
   - Hex bit
2) Check that no one is inside the safeguard enclosure and then turn on the controller.
3) Perform the absolute reset from outside the safeguard enclosure.
   Refer to "3-3 Absolute reset procedures" for information about the absolute reset method.
4) Place a sign indicating that the robot is being adjusted in order to keep others from operating the controller or operation panel.
5) Turn off the controller and enter the safeguard enclosure.
6) Remove the cover. (See Fig. 4-5 (a).)
7) Using the hex wrench, loosen the two bolts securing the X-axis origin sensor stay.
8) Remove the X-axis origin sensor stay.
9) Remove the dog and hex nut through the elongated hole.
   We recommend using the Phillips screwdriver bit and wrench to remove the dog since it is secured with "Screw Lock".
10) Rotate the X-axis arm 90° counterclockwise. (See Fig. 4-5 (b).)
11) Remove the bolt located opposite the elongated hole.
12) Apply "Screw Lock" to the dog and nut, insert them into the tapped hole where the bolt was attached, and tighten to the specified torque. (See Fig. 4-5 (c).)
13) Return the X-axis arm to the current origin position. (See Fig. 4-5 (d).)
14) Apply "Screw Lock" to the bolt, insert it into the tapped hole where the dog was attached, and tighten to the specified torque.

15) Temporarily fasten the X-axis origin sensor stay using the bolts. At this point, check that the sensor does not interfere with other parts while turning the X-axis arm by hand.

16) Go out of the safeguard enclosure, and check that no one is inside the safeguard enclosure. Then turn on the controller.

17) Perform the absolute reset from outside the safeguard enclosure.

18) After the absolute reset is completed, read the machine reference value displayed on the PB.

19) If the machine reference value is in the range between 40 and 60 (recommended range), then the origin position has been correctly changed. Fully tighten the bolts to secure the X-axis origin sensor stay. If it is outside the recommended value, then adjust the machine reference by referring to "1-1 Adjusting the X-axis machine reference".

20) Reattach the cover after the adjustment is complete.

Fig. 4-4

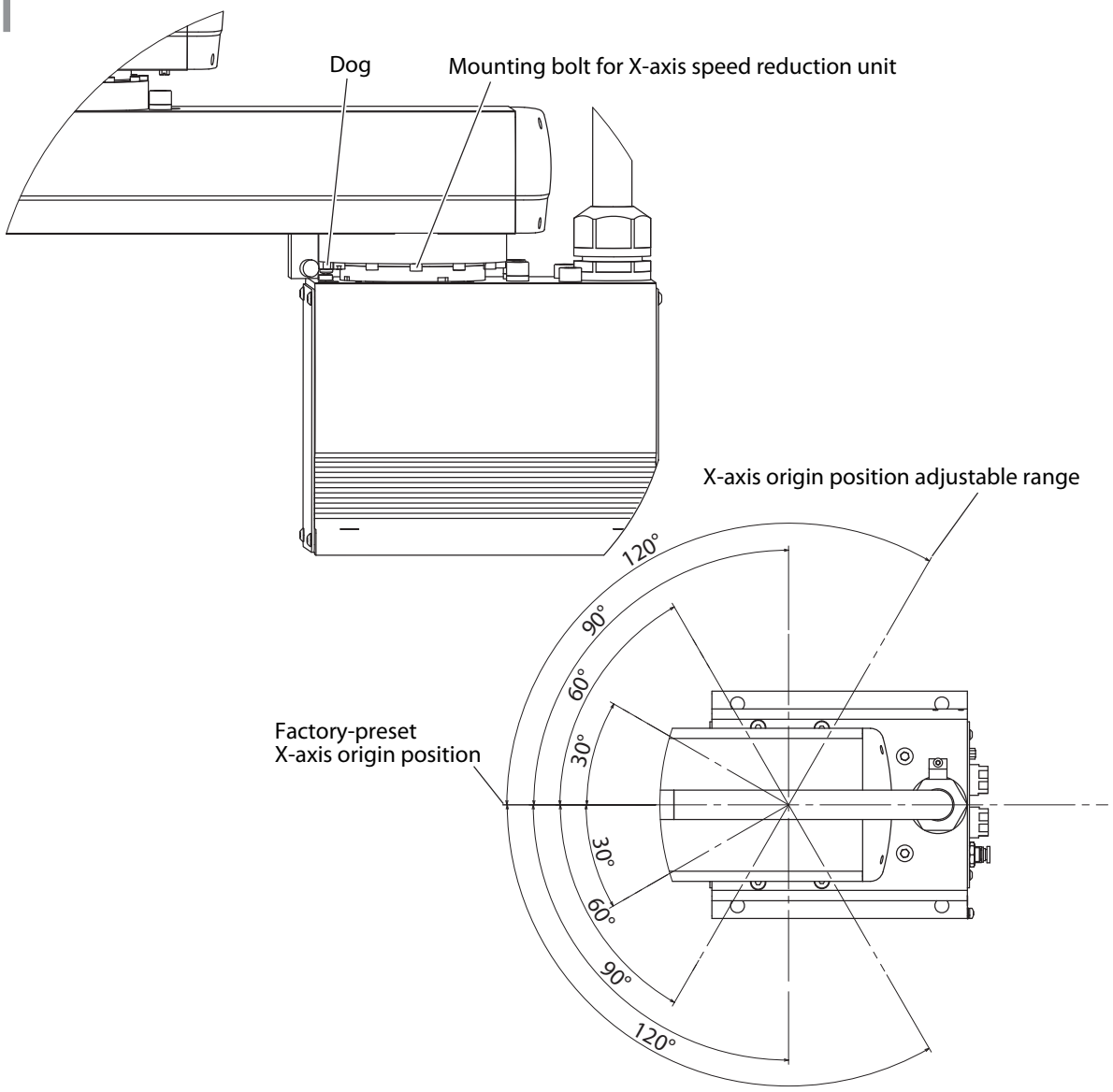


Fig. 4-5 (a)

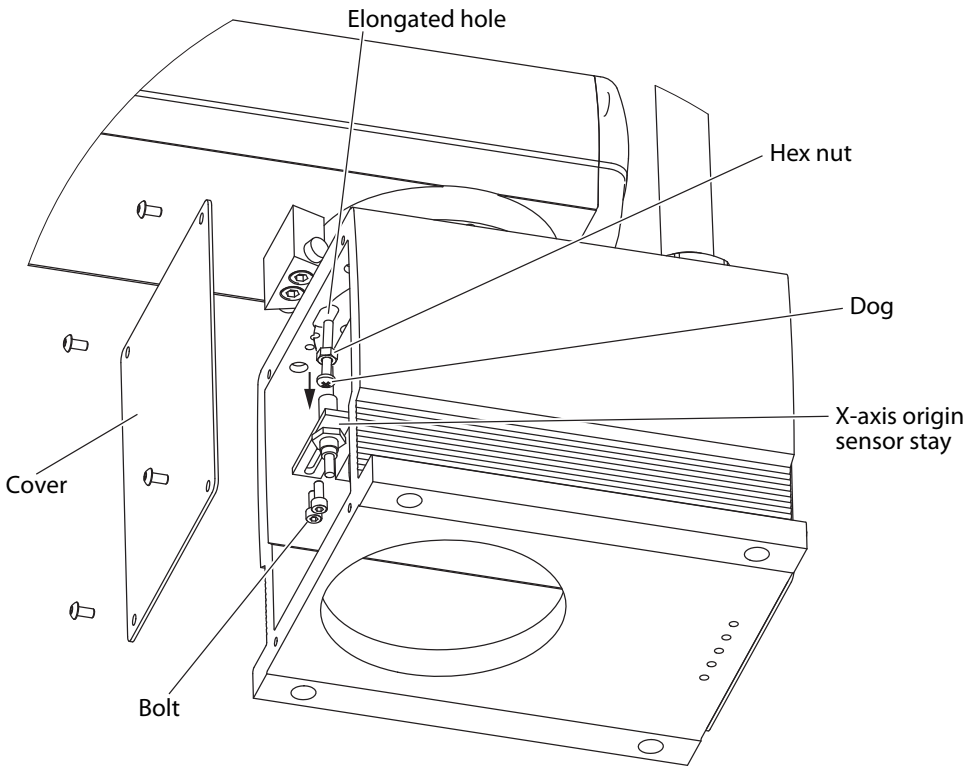


Fig. 4-5 (b)

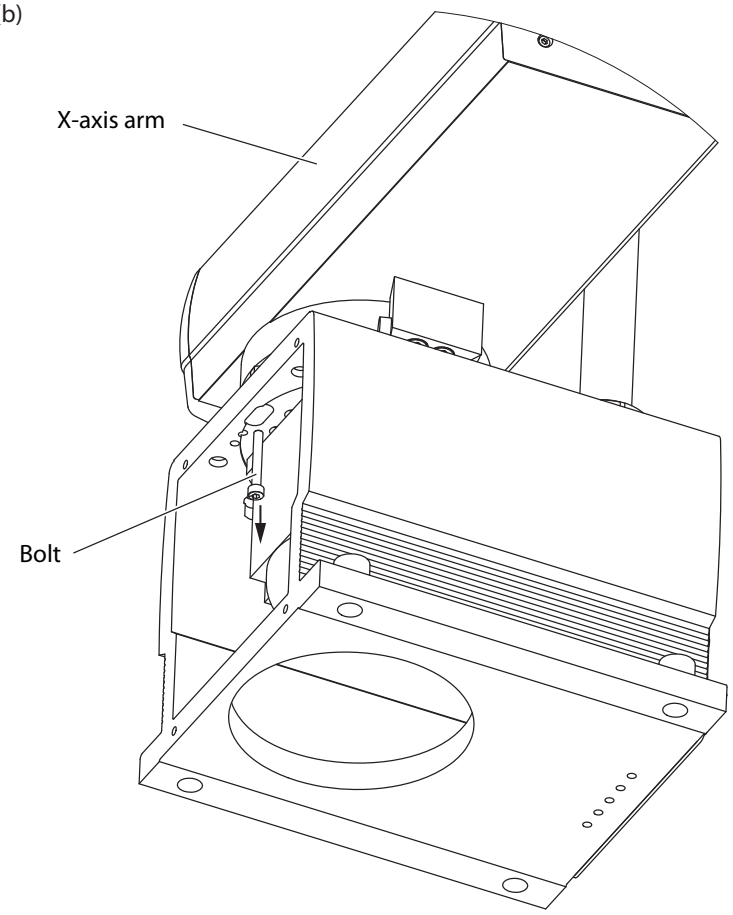
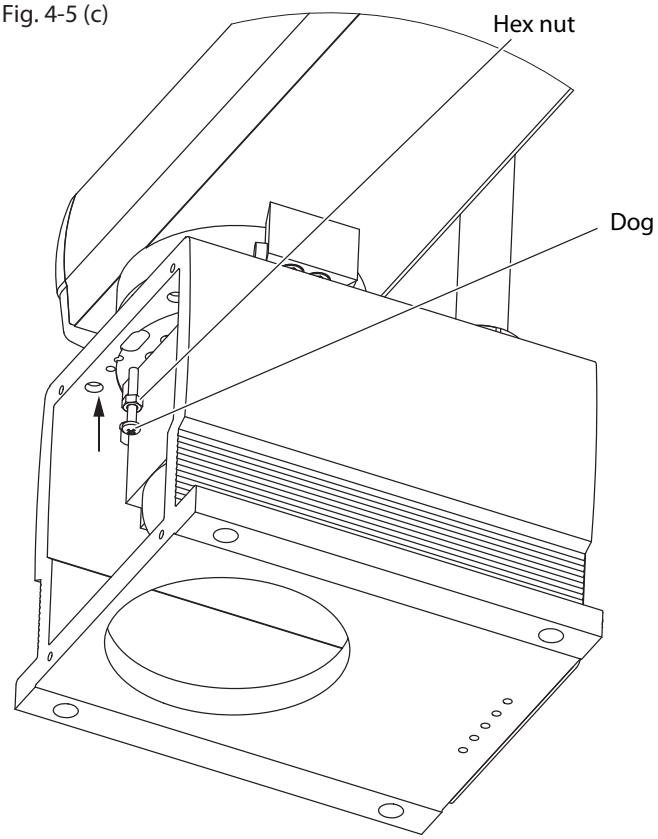


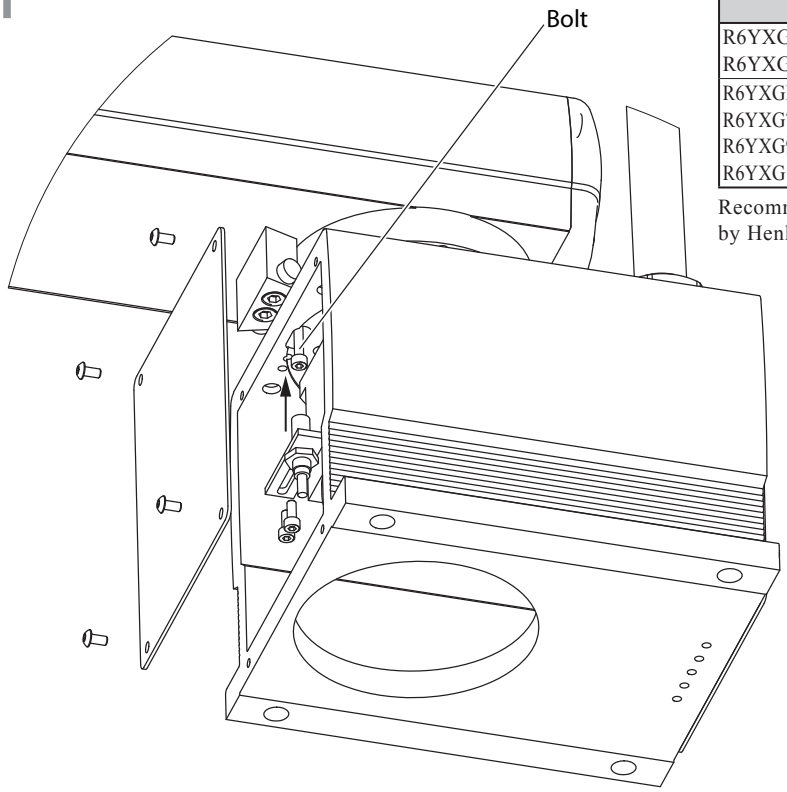
Fig. 4-5 (c)



Robot Model	Dog	Tightening torque (kgfcm)	Tightening torque (cNm)
R6YXG500, R6YXG600	M4×30	16	160
R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000	M5×40	32	320

Recommended "Screw Lock": LOCTITE 262 (made by Henkel Corporation)

Fig. 4-5 (d)



Robot Model	Bolt	Tightening torque (kgfcm)	Tightening torque (Nm)
R6YXG500, R6YXG600	M4×30	46	4.5
R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000	M5×40	92	9.0

Recommended "Screw Lock": LOCTITE 262 (made by Henkel Corporation)

2-1. Adjusting the Y-axis machine reference

⚠ CAUTION

THE ORIGIN POSITION MAY CHANGE DUE TO MACHINE REFERENCE ADJUSTMENT. IF IT OCCURS, YOU MUST SET POINT DATA AGAIN.

The adjustment method for the Y-axis machine reference is as follows.

1) Prepare a hex wrench set.
2) Check that no one is inside the safeguard enclosure and then turn on the controller.
3) Perform the absolute reset from outside the safeguard enclosure.
   Refer to "3-3 Absolute reset procedures" for information about the absolute reset method.
4) If any machine reference value displayed on the PB is not in the range between 40 and 60 (recommended range) after the absolute reset has been completed, then proceed with the following adjustment procedure.
5) Place a sign indicating that the robot is being adjusted in order to keep others from operating the controller or operation panel.
6) Turn off the controller and enter the safeguard enclosure.
7) Mark off the reference mark at the current origin position on the Y-axis joint area of the robot.
   At this time, be careful to prevent the origin position from deviating since the Y-axis arm is touched.
8) Remove the cover.
9) Scribe a mark on the position of the Y-axis origin sensor stay.
10) Using the hex wrench, loosen the two bolts securing the Y-axis origin sensor stay. (See Fig. 4-6.)

⚠ CAUTION

THE BOLTS ONLY NEED TO BE LOOSENED, AND DO NOT NEED TO BE COMPLETELY REMOVED.

11) Move the Y-axis origin sensor stay in the following manner and then secure it with the bolts.

NOTE

- When the machine reference is less than 40%, move the stay in direction (1): See Fig. 4-6.
- When the machine reference is more than 40%, move the stay in direction (2): See Fig. 4-6.

As an approximate guide, a 0.8mm movement equals to 100%.

12) Go out of the safeguard enclosure, and check that no one is inside the safeguard enclosure. Then turn on the controller.

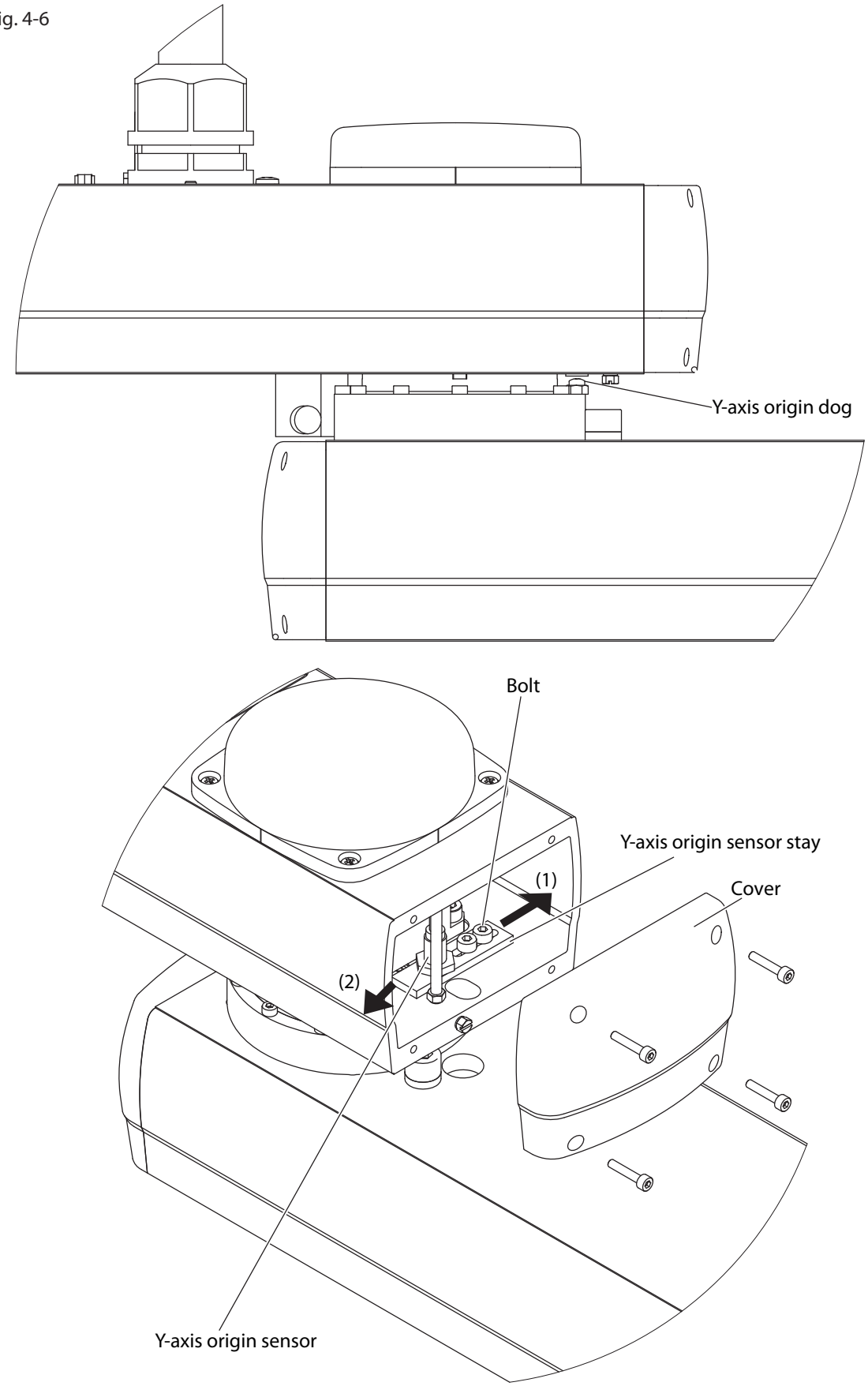
13) Perform the absolute reset from outside the safeguard enclosure.

14) After the absolute reset is completed, read the machine reference value displayed on the PB.

15) If the machine reference value is in the range between 40 and 60 (recommended range), then the machine reference has been completely adjusted.
If it is outside the recommended range, then repeat the procedure that starts in 5) to readjust it.

16) Reattach the cover after the adjustment is complete.

Fig. 4-6


Y-axis origin dog
Bolt
Y-axis origin sensor stay
(1)
Cover
(2)
Y-axis origin sensor

2-2. Changing the Y-axis origin position

The Y-axis origin position can be changed to any position in the range from the front position of the Y-axis arm and X-axis arm to a maximum of 120° clockwise and counterclockwise at 30° intervals, by changing the positions of the dog and the mounting bolt for the Y-axis speed reduction unit as shown in Fig. 4-7.

⚠ CAUTION

- IF THE ORIGIN POSITION HAS BEEN CHANGED, THEN THE ABSOLUTE RESET MUST BE PERFORMED, THE MACHINE REFERENCE MUST BE ADJUSTED, AND THE STANDARD COORDINATE AND POINT DATA MUST BE RESET.
- THE DOG AND BOLT MIGHT COME OFF AND CAUSE THE JOINT TO LOCK UP UNLESS YOU APPLY "SCREW LOCK" TO THEM AND TIGHTEN TO THE SPECIFIED TORQUE.

The following describes the method for changing the Y-axis origin position, for example, to a position 90° counterclockwise.

1) Prepare the necessary tools.
   - Hex wrench set
   - Phillips screwdriver
   - Phillips screwdriver bit
   - Torque wrench
   - Screw Lock (thread sealant)
   - Hex bit
2) Check that no one is inside the safeguard enclosure and then turn on the controller.
3) Perform the absolute reset from outside the safeguard enclosure.
   Refer to "3-3 Absolute reset procedures" for information about the absolute reset method.
4) Place a sign indicating that the robot is being adjusted in order to keep others from operating the controller or operation panel.
5) Turn off the controller and enter the safeguard enclosure.
6) Remove the cover. (See Fig. 4-8 (a).)
7) Using the hex wrench, loosen the two bolts securing the Y-axis origin sensor stay.
8) Remove the Y-axis origin sensor stay.
9) Remove the dog and hex nut through the elongated hole. (See Fig. 4-8 (b).)
   We recommend using the Phillips screwdriver bit and wrench to remove the dog since it is secured with "Screw Lock".
10) Rotate the Y-axis arm 90° counterclockwise. (See Fig. 4-8 (c).)
11) Remove the bolt located opposite the elongated hole.
12) Apply "Screw Lock" to the dog and nut, insert them into the tapped hole where the bolt was attached, and tighten to the specified torque. (See Fig. 4-8 (d).)
13) Return the Y-axis arm to the current origin position. (See Fig. 4-8 (e).)
14) Apply "Screw Lock" to the bolt, insert it into the tapped hole where the dog was attached, and tighten to the specified torque.

15) Temporarily fasten the Y-axis origin sensor stay using the bolts. At this point, check that the sensor does not interfere with any parts while turning the Y-axis arm by hand.

16) Go out of the safeguard enclosure, and check that no one is inside the safeguard enclosure. Then turn on the controller.

17) Perform the absolute reset from outside the safeguard enclosure.

18) After the absolute reset is completed, read the machine reference value displayed on the PB.

19) If the machine reference value is in the range between 40 and 60 (recommended range), then the origin position has been correctly changed. Fully tighten the bolts to secure the Y-axis origin sensor stay. If it is outside the recommended value, then adjust the machine reference by referring to "2-1 Adjusting the Y-axis machine reference".

20) Reattach the cover after the adjustment is complete.

Fig. 4-7

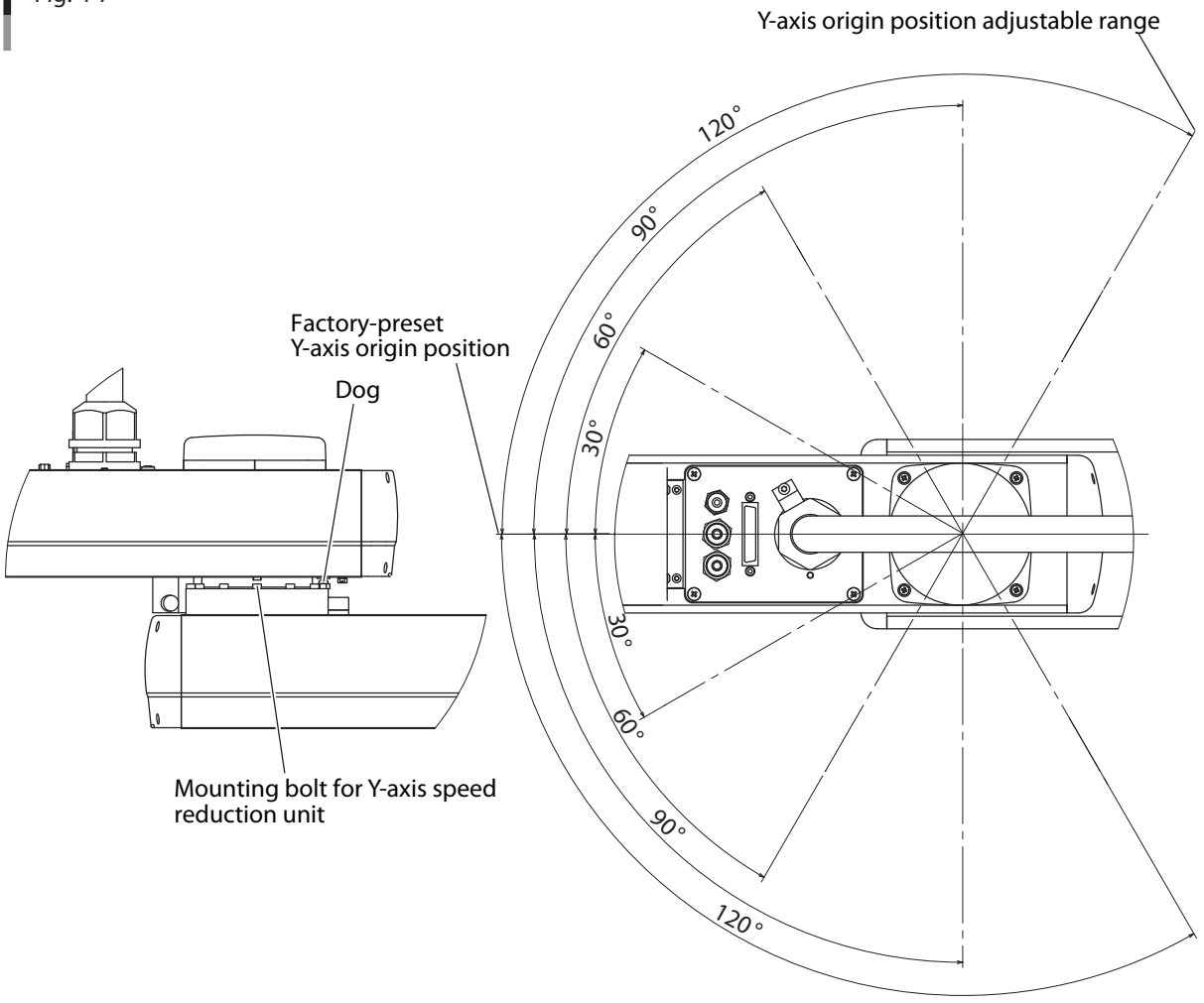


Fig. 4-8 (a)

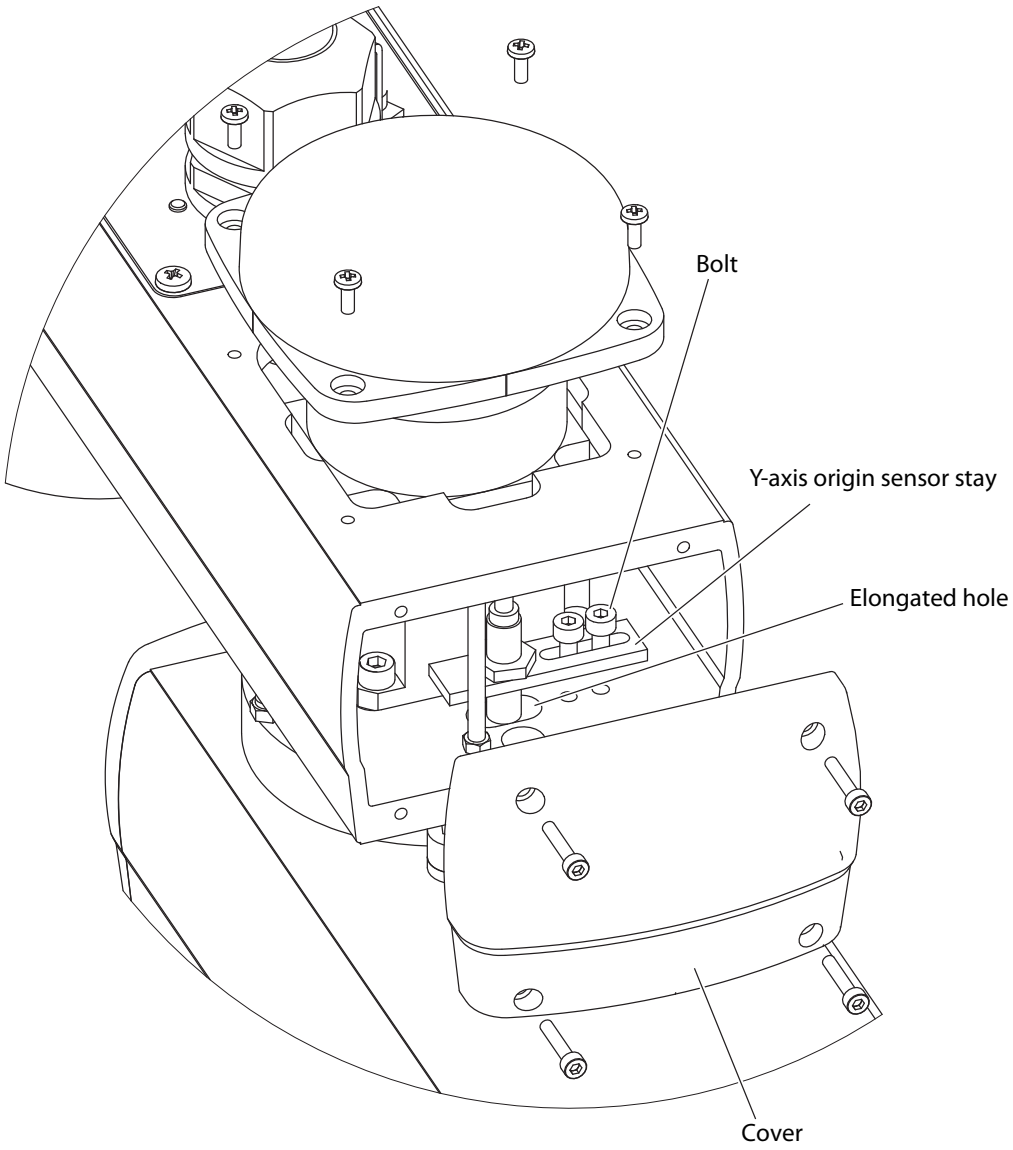


Fig. 4-8 (b)

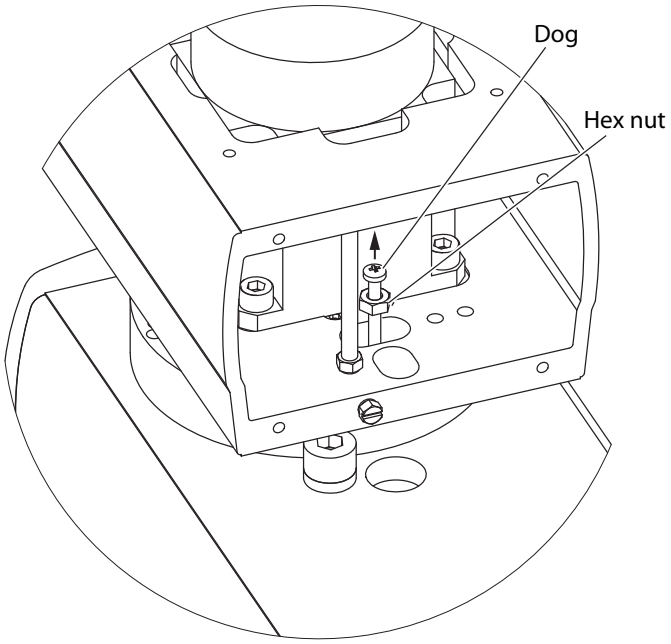


Fig. 4-8 (c)

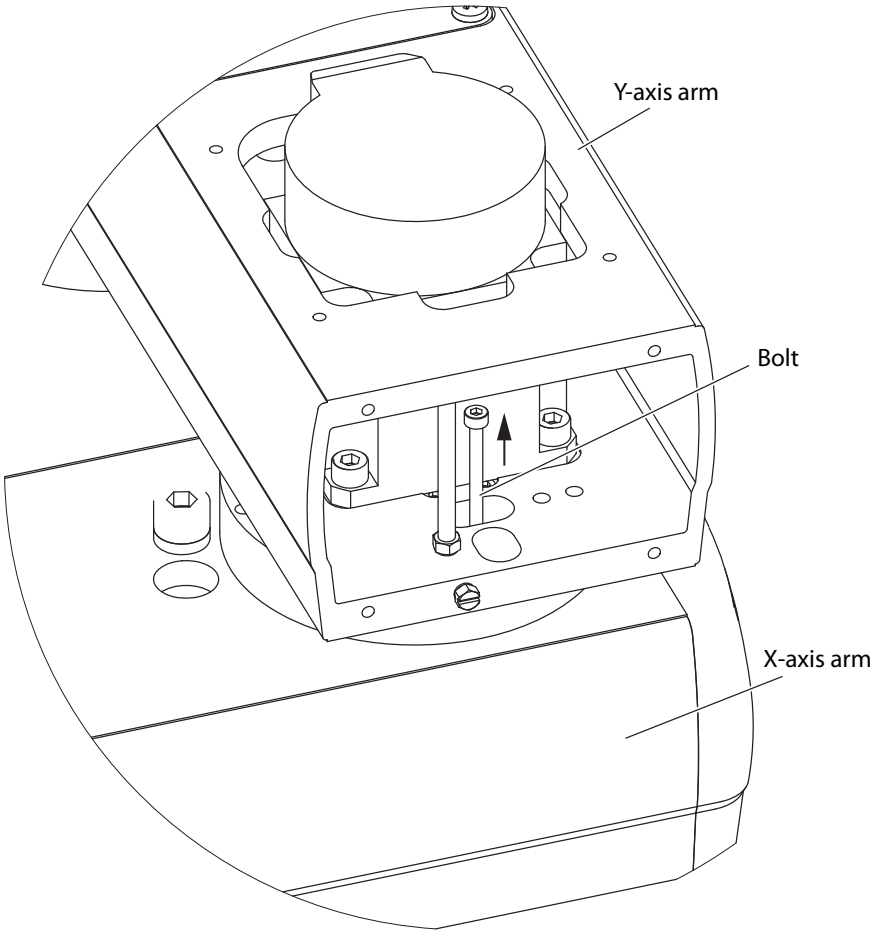
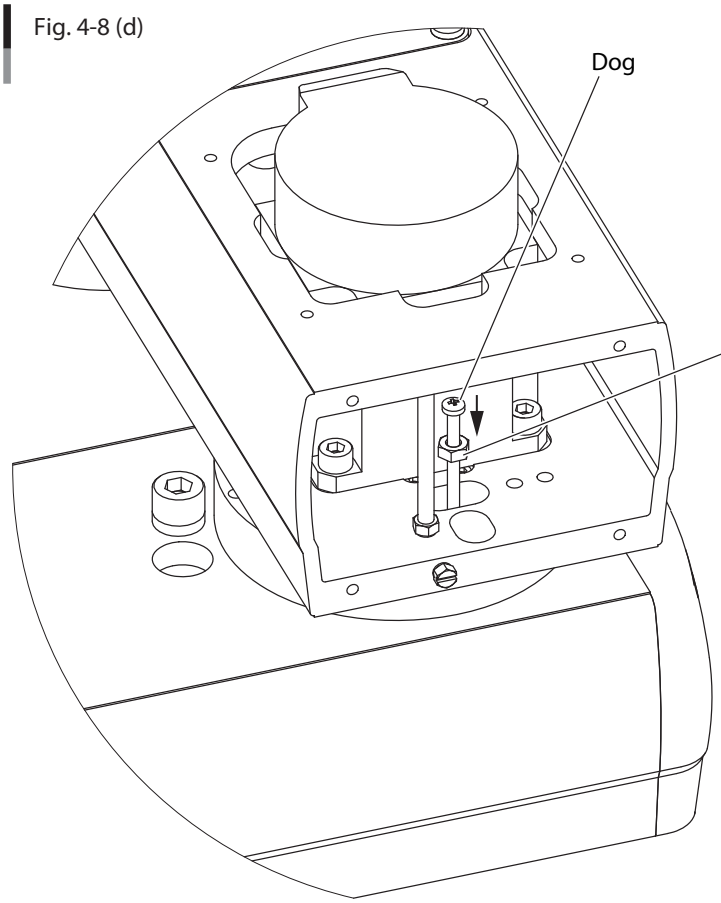


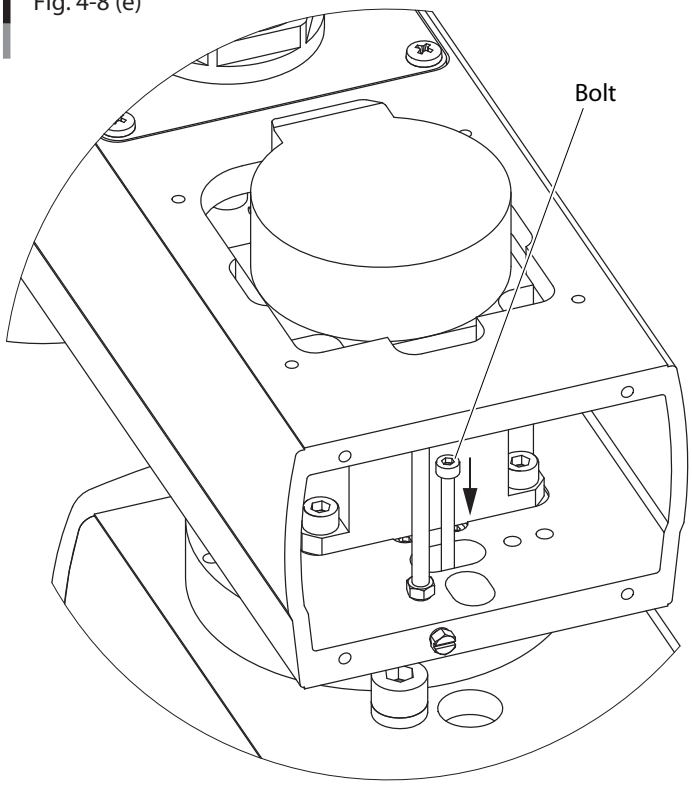
Fig. 4-8 (d)



Robot Model	Dog	Tightening torque (kgfcm)	Tightening torque (cNm)
R6YXG500, R6YXG600	M3×30	9	90
R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000	M4×40	16	160

Recommended “Screw Lock”: LOCTITE 262 (made by Henkel Corporation)

Fig. 4-8 (e)



Robot Model	Bolt	Tightening torque (kgfcm)	Tightening torque (Nm)
R6YXG500, R6YXG600	M3×30	20	2.0
R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000	M4×40	46	4.5

Recommended “Screw Lock”: LOCTITE 262 (made by Henkel Corporation)

3-1. Adjusting the R-axis machine reference

The adjustment method for the R-axis machine reference is as follows.

1) Prepare a hex wrench set.
2) Check that no one is inside the safeguard enclosure and then turn on the controller.
3) Perform the absolute reset from outside the safeguard enclosure.
   Refer to "3-3 Absolute reset procedures" for information about the absolute reset method.
4) If any machine reference value displayed on the PB is not in the range between 40 and 60 (recommended range) after the absolute reset has been completed, then proceed with the following adjustment procedure.
5) Place a sign indicating that the robot is being adjusted in order to keep others from operating the controller or operation panel.
6) Turn off the controller and enter the safeguard enclosure.
7) Mark off the reference mark at the current origin position on the R-axis area of the robot.
   At this time, be careful not to touch the tool at the tip of the robot arm so that the origin position does not shift.
8) Remove the cover.
9) Scribe a mark on the position of the R-axis origin sensor stay.
10) Using the hex wrench, loosen the two bolts securing the R-axis origin sensor stay.
    (See Fig. 4-9.)

CAUTION

THE BOLTS ONLY NEED TO BE LOOSENED, AND DO NOT NEED TO BE COMPLETELY REMOVED.

11) Move the R-axis origin sensor stay in the following manner and then secure it with the bolts.

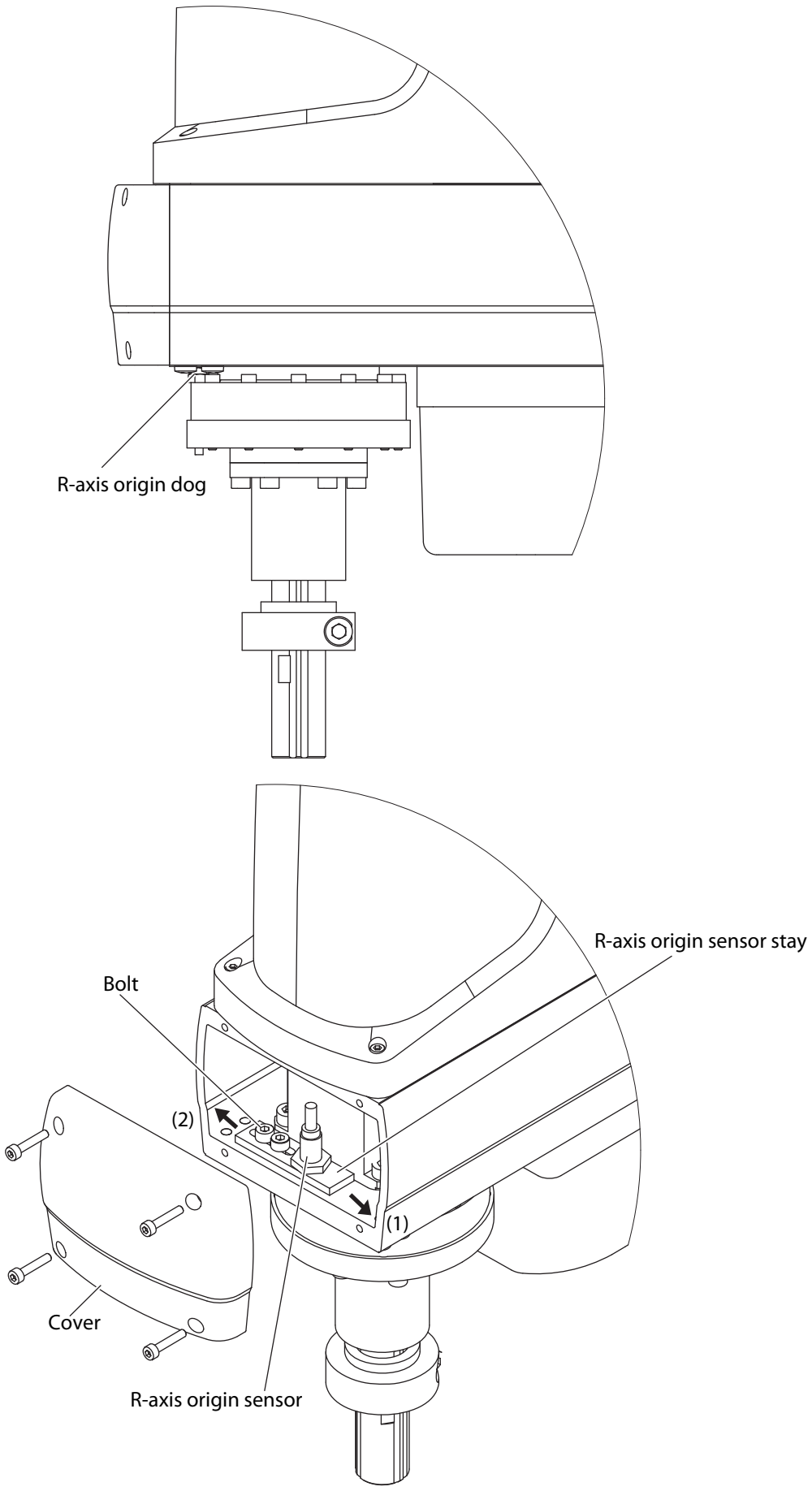
NOTE

- When the machine reference is less than 40%, move the stay in direction (1): See Fig. 4-9.
- When the machine reference is more than 40%, move the stay in direction (2): See Fig. 4-9.

As an approximate guide, a 1.9mm movement equals to 100%.

12) Go out of the safeguard enclosure, and check that no one is inside the safeguard enclosure. Then turn on the controller.
13) Perform the absolute reset from outside the safeguard enclosure.
14) After the absolute reset is completed, read the machine reference value displayed on the PB.
15) If the machine reference value is in the range between 40 and 60 (recommended range), then the machine reference has been completely adjusted.
    If it is outside the recommended range, then repeat the procedure that starts in 5) to readjust it.
16) Reattach the cover after the adjustment is complete.

Fig. 4-9


R-axis origin dog
R-axis origin sensor stay
Bolt
(2)
(1)
Cover
R-axis origin sensor

3-4-2 Stroke end method

The stroke end method is employed on the XG series robots for the absolute reset of the Z-axis. The origin position of the Z-axis is fixed at the upper end of the Z-axis stroke, and it cannot be changed. The machine reference is factory adjusted at shipment, and readjustment is not necessary for normal use. The readjustment in the following procedure is required, however, if the machine reference exceeds the tolerance range (25 to 75) of the absolute reset for any reason.

⚠ CAUTION

THE ORIGIN POSITION MAY CHANGE DUE TO MACHINE REFERENCE ADJUSTMENT. IF IT OCCURS, YOU MUST SET POINT DATA AGAIN.

3-4-2-1 R6YXG500, R6YXG600, R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

1) Check that no one is inside the safeguard enclosure, and then turn on the controller.
2) Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.
3) Perform the Z-axis absolute reset.
   To perform the Z-axis absolute reset, see “3-3 Absolute reset procedures” in Chapter 4.
   Make a note of the Z-axis machine reference value.

⚠ CAUTION

USE THE FOLLOWING PROCEDURE TO DISPLAY THE ADJUSTMENT MACHINE REFERENCE VALUE.
WHEN ADJUSTING THE MACHINE REFERENCE VALUE, ALWAYS CHECK THE ADJUSTMENT MACHINE REFERENCE VALUE WITH THIS PROCEDURE.

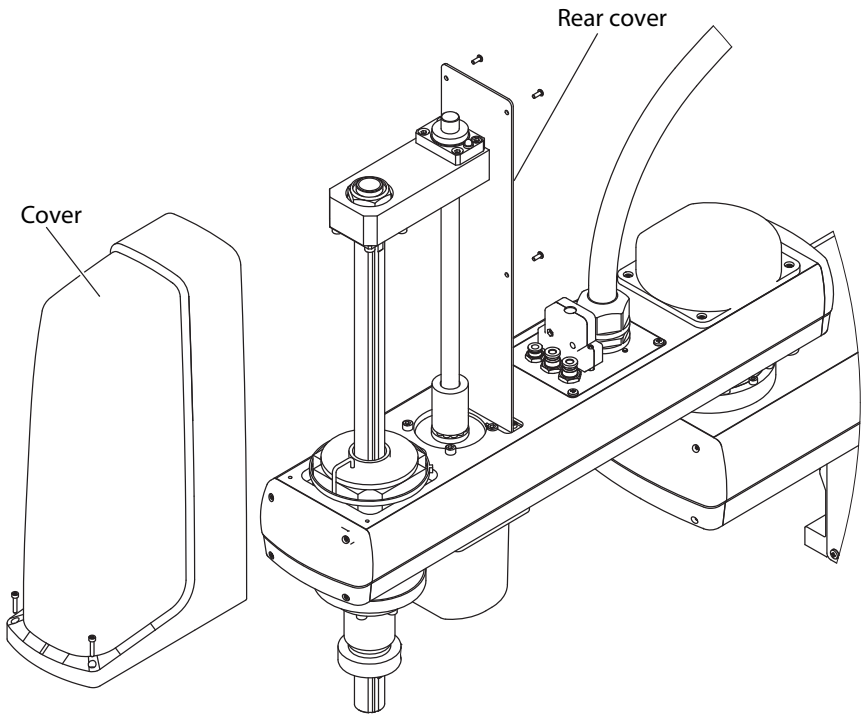
   (1) Press the MODE key.
   (2) Press the F3 key to enter MANUAL mode.
   (3) Press the F13 key (LOWER+F3) to select “ABS Reset”.
   (4) After the Z-axis absolute reset is complete, press the F10 (UPPER+F5) key to display the **adjustment machine reference value (%)**.
4) Turn off the controller.
   The Z-axis motor brake is now working at the origin position.
5) Enter the safeguard enclosure.
6) Remove the cover. (See Fig. 4-10.)

⚠ WARNING

IF THE BALL SCREW COMES OFF THE Z-AXIS MOTOR, THE Z-AXIS DROPS CAUSING A HAZARDOUS SITUATION. ALWAYS PROP UP THE Z-AXIS WITH A SUPPORT STAND OR THE LIKE.

7) Prop the spline or end effector with a support stand to prevent the Z-axis from dropping.
8) Lift up the Z-axis lower end damper. If this is difficult, insert a screwdriver between the damper and the holder, and pry up the damper. (See Fig. 4-11 (a).)
9) Put a mark to indicate the current flange position with respect to the motor shaft. Fit the spanner (wrench) to the flat surfaces of the flange and loosen the bolts. This allows the ball screw to rotate freely independent of the Z-axis motor.
10) Rotate the flange with respect to the motor shaft. (See Fig. 4-11 (b).)
Rotating the flange 30 degrees changes the machine reference value by 33%.
The machine reference value decreases by rotating the flange clockwise as viewed from top, while it increases by rotating the flange counterclockwise.
Determine the flange position based on the Z-axis machine reference value you made a note of, so that the machine reference value is within 25 to 75%.
11) Tighten the bolts a little at a time in a diagonal pattern. The tightening torque should be 2.0Nm (20kgfcm). The bolts can be inserted into 10 holes among 12 through-holes.
12) Go outside the safeguard enclosure.
13) Check that no one is inside the safeguard enclosure, and then turn on the controller.
14) Perform the Z-axis absolute reset.
To perform the Z-axis absolute reset, see "3-3 Absolute reset procedures" in Chapter 4.
After absolute reset is complete, check that the **adjustment machine reference value** is within the tolerance range (25 and 75). If the **adjustment machine reference value** is outside the tolerance range (25 to 75), then repeat the procedure from 4) to readjust it.
15) When the machine reference value is within the tolerance range, lower the Z-axis lower end damper until it makes tight contact with the holder and then reattach the cover.

Fig. 4-10



Recommended bolts or JIS B 1176 hex socket head bolts (strength class: JIS B 1051 12.9).

Fig. 4-11 (a)

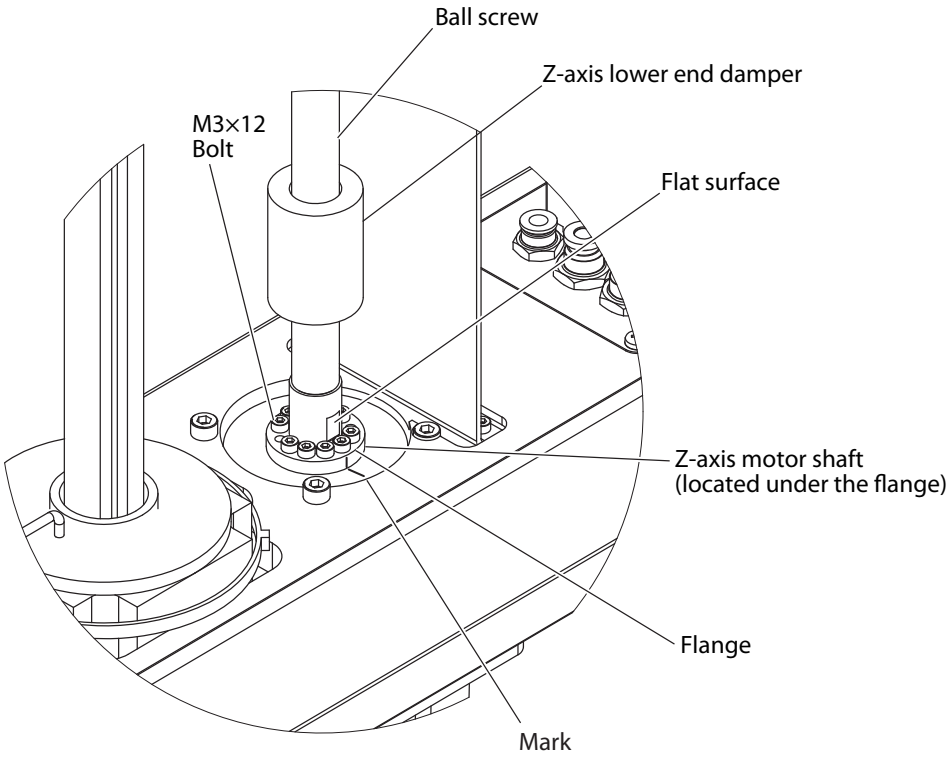
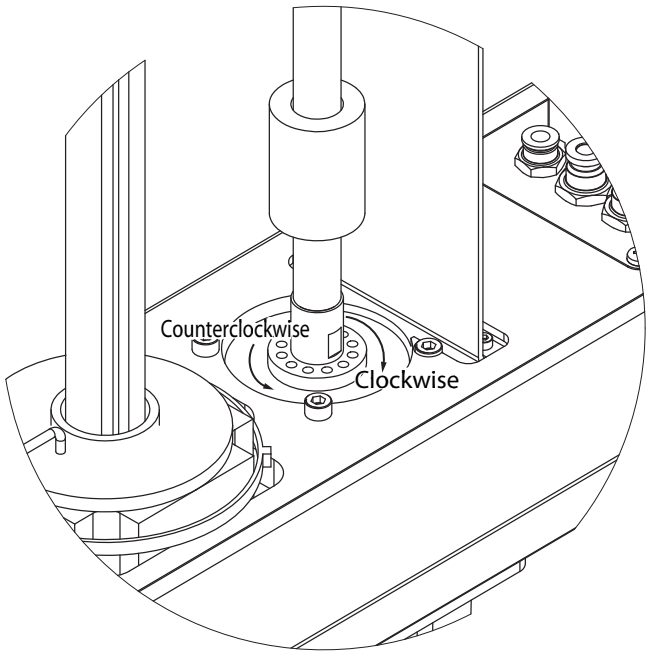


Fig. 4-11 (b)



4. Setting the Soft Limits

In the XG Series, the working envelope during manual and automatic operation can be limited by setting the plus soft limit [pulse] and minus soft limit [pulse] on each axis. The origin point (0 [pulse]) is used as the reference to set the soft limits. The working envelope can be limited by specifying the number of pulses from the 0 pulse position. Refer to the "OMRON Robot Controller User's Manual" for further details.
Also refer to "1-2 External view and dimensions" in Chapter 7 for the working envelope area.
When performing actual checks of the soft limit settings, operate the robot manually from outside the safeguard enclosure.

(1) Setting the X-axis and Y-axis soft limits

The soft limits must be set within the movement range limited by the mechanical stoppers as explained in Section 7 in Chapter 3 or within the range where the manipulator does not interfere with the peripheral equipment (but within maximum working envelope). Set the soft limits with the following procedure. Also use this procedure when the origin position has been changed. Likewise, in models where the mechanical stopper position cannot be changed, reduce the soft limits to narrow the working envelope when the actual working range of the robot is small or the manipulator interferes with the peripheral equipment.

1) Check that no one is inside the safeguard enclosure, and then turn on the controller.
2) Press the emergency stop button on the PB to set emergency stop.
   Refer to the "OMRON Robot Controller User's Manual" for further details on emergency stop and canceling emergency stop.
3) Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.
4) Enter the safeguard enclosure while holding the PB.
5) Move the X-axis and Y-axis arms by hand to the mechanical stopper positions or to the point where interference with the peripheral equipment occurs, and note the X-axis and Y-axis plus (+) and minus (-) direction pulses displayed on the PB.
6) Check that no one is inside the safeguard enclosure, then cancel emergency stop from outside the safeguard enclosure.
7) Set the soft limits to within the figure for the X-axis and Y-axis encoder pulses that you noted above in step 5).
   This software limit setting must be made from outside the safeguard enclosure.
   Refer to the "OMRON Robot Controller User's Manual" for further details on soft limit settings.

⚠ CAUTION

THE ORIGIN POSITION FACTORY-ADJUSTED AT SHIPMENT IS NOT COMPLETELY ALIGNED WITH THE FRONT FACE POSITION OF THE ROBOT. WHEN INTRODUCING THE ROBOT, BE SURE TO SET THE SOFT LIMITS WITH THE NUMBER OF PULSES FROM THE ORIGIN POSITION (0 PULSE POSITION).

(2) Setting the Z-axis soft limits

Make this setting from outside the safeguard enclosure. The Z-axis has mechanical stoppers fixed at the upper and lower ends of the Z-axis movement range. When the actual working range of the robot is smaller than the maximum working envelope or the manipulator interferes with the peripheral equipment, reduce the Z-axis plus (+) soft limit [pulses] to narrow the working envelope.

(3) Setting the R-axis soft limit

To make this setting, set emergency stop just as for the X-axis and Y-axis, or be sure to do this from outside the safeguard enclosure. The R-axis has no mechanical stoppers. When the actual working range of the R-axis is small or it interferes with the peripheral equipment, reduce the R axis plus (+) soft limit [pulse] and minus (-) soft limit [pulses] to narrow the working envelope.

⚠ CAUTION

OVERLOADS MAY OCCUR IF THE SOFT LIMIT IS ALMOST NEAR THE ENCODER PULSE AT THE MECHANICAL STOPPER AND THE OPERATING POINT IS USED AT THE EDGE OF THE MOVEMENT RANGE. SET THE SOFT LIMIT TO THE INNER SIDE OF THE MECHANICAL STOPPER WITH AN AMPLE SAFETY MARGIN.

(4) Relation between the X, Y and R-axis movement angle, the Z-axis movement distance and the number of pulses

The tables below are for calculating resolver pulses with respect to the X, Y and R-axis movement angles and to the Z-axis movement distance for each robot. Use these figures as a guide to set the soft limits.

X, Y and R-axis speed reduction ratio and Z-axis ball screw lead for each robot

Robot Model	X-axis	Y-axis	Z-axis	R-axis
R6YXG500, R6YXG600	80	80	20mm	30
R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000	80	80	20mm	30

Operation angle/distance vs. number of resolver pulses X, Y and R-axis speed reduction ratio

Speed ratio	Number of resolver pulses per turn (360 degrees)
30	491520
50	819200
80	1310720
100	1638400
105	1720320
121	1982464

Z-axis

Lead	Number of resolver pulses per lead movement
10mm	16384
12mm	16384
20mm	16384
30mm	16384

5. Setting the Standard Coordinates

⚠ CAUTION

IF THE STANDARD COORDINATE SETTINGS ARE INCORRECT, THE ACCELERATION CANNOT BE OPTIMIZED TO MATCH THE ARM POSITION. THIS RESULTS IN TOO SHORT A SERVICE LIFE, DAMAGE TO THE DRIVE UNIT, OR RESIDUAL VIBRATION DURING POSITIONING. IN ADDITION, THE CARTESIAN COORDINATE ACCURACY WILL BE IMPAIRED.

Setting the standard coordinates enables the following operations and functions.

1. Optimizes acceleration according to arm position during automatic operation.
2. Allows moving robot arm tip at right angles.
3. Allows using shift coordinates.
4. Enables commands such as linear interpolation and arm switching.

The procedure for setting standard coordinates and cautions are shown below.

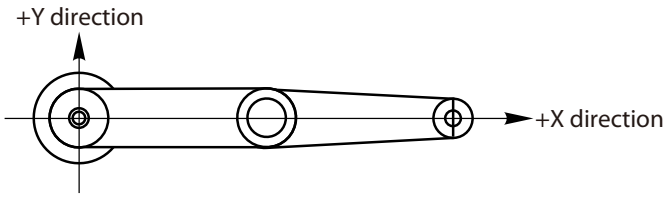
1) Check that no one is inside the safeguard enclosure, and then turn on the controller.
2) Check that the soft limits are correctly set.
   If not correctly set, adjust the soft limits while referring to the description of “4 Setting the Soft Limits” in Chapter 4.
3) Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.
4) Enter the safeguard enclosure while holding the PB. Stay outside the robot movement range at this time.
5) Make the standard coordinate settings while referring to methods for “Setting the Standard Coordinates” as explained in the “OMRON Robot Controller User’s Manual”. Never enter within the robot movement range. The next section, “5-1 Standard coordinate setting using a standard coordinate setup jig (option)”, describes how to set the standard coordinates more accurately using an optional setup jig.
6) When the standard coordinate settings are complete, check the following points from outside the safeguard enclosure.

   1. Check that the robot arm tip can move at right angles in MANUAL operation (cartesian coordinates).
   2. Check that the values nearly equal to the X-axis and Y-axis arm lengths are entered in “Arm length” of the axis parameters.

   If the above points are not satisfied, the standard coordinate settings are incorrect, so make the standard coordinate settings again.

5-1 Standard coordinate setting using a standard coordinate setup jig (option)

Fig. 4-12



Standard coordinates can be set accurately using the following optional parts.

	Part No.	Name	Qty
(1)	KBP-M1562-001	Sleeve	1
(2)	KBP-M1577-001	Pin	1
(3)	91312-04025	Bolt (R6YXG500, R6YXG600)	2
	91312-04030	Bolt (R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000)	2
(4)	91312-04045	Bolt	1

1) Check that no one is inside the safeguard enclosure, and then turn on the controller.
2) Press the emergency stop button on the PB to set emergency stop.
   Refer to the “OMRON Robot Controller User’s Manual” for further details on emergency stop and canceling emergency stop.
3) Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.
4) Enter the safeguard enclosure while holding the PB.
5) Position the robot arms as shown in Fig. 4-13 and remove the bolts.
6) Position the robot arms so that you can easily insert the sleeve into the hole, and insert the sleeve into the hole. Then tighten the bolt just enough to hold the sleeve. (See Fig. 4-14.)
7) Turn the X and Y-axis arms so that they are nearly straight. (See Fig. 4-15.)
   Remove the cover and plate.
8) Position the Y-axis arm so that you can easily insert the pin into the sleeve through the elongated hole in the Y-axis arm. (See Fig. 4-16.)
   Secure the pin with the bolt. Tighten the bolt just enough to hold the pin.
9) Enter “MANUAL>POINT” mode. Lightly apply a clockwise torque to the Y-axis to unload it while holding the X-axis arm, and make a note of the Y-axis position pulse value displayed on [POS].
10) Lightly apply a counterclockwise torque to the Y-axis to unload it while holding the X-axis arm, and make a note of the Y-axis position pulse value displayed on [POS].
11) Move the X-axis arm in the direction that you want to set as the + direction of the X-axis as shown in Fig. 4-12. At this point, make a note of the X-axis position pulse value displayed on [POS].

12) Enter the following values in M1 and M2 for "11. Arm length [mm]" of axis parameters.

	M1 (X-axis arm length)	M2 (Y-axis arm length)
R6YXG500	200.00	300.00
R6YXG600	300.00	300.00
R6YXGH600	200.00	400.00
R6YXG700	300.00	400.00
R6YXG800	400.00	400.00
R6YXG900	500.00	400.00
R6YXG1000	600.00	400.00

13) Enter the following values in "12. Offset pulse" of axis parameters.

M1= X-axis position pulse value you made a note of in step 11)

$$M2 = \frac{\text{Y-axis position pulse value you made a note of in step 9)} + \text{Y-axis position pulse value you made a note of in step 10)}}{2}$$

Round off the decimal part of the M2 value.

14) After entering the parameters, remove the pin, bolt, and sleeve.
Reattach the cover, plate and bolt

Fig. 4-13

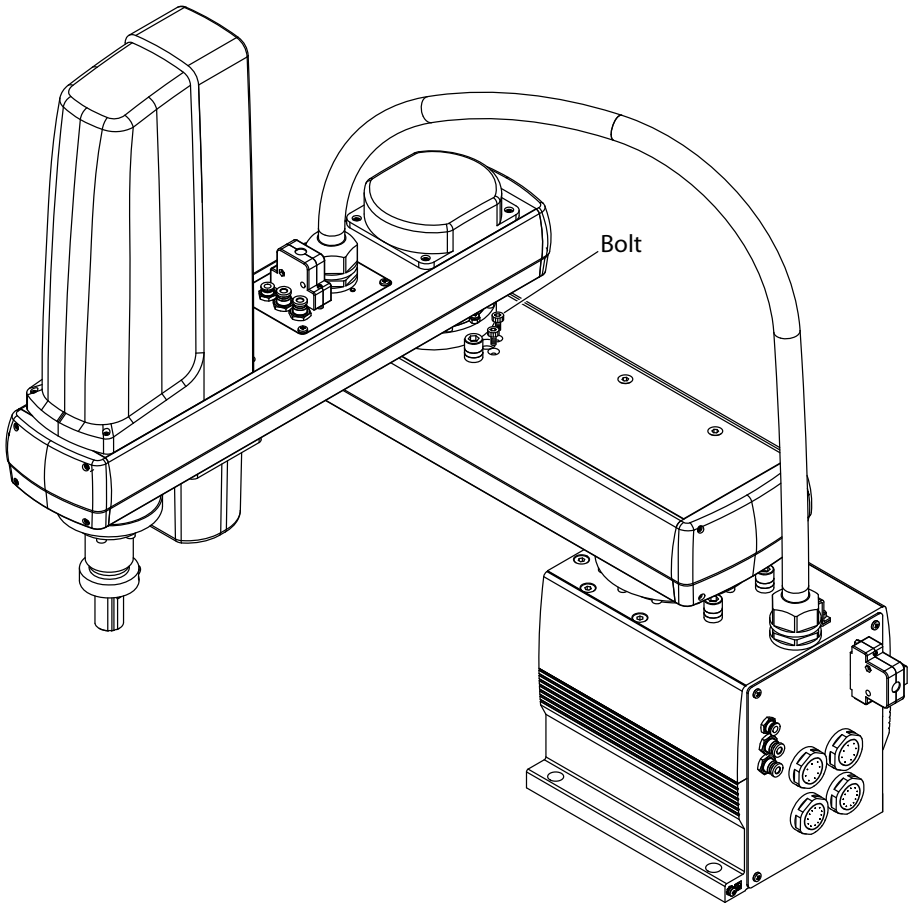


Fig. 4-14

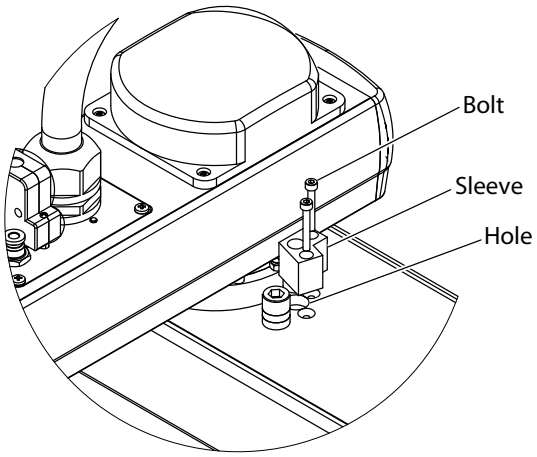


Fig. 4-15

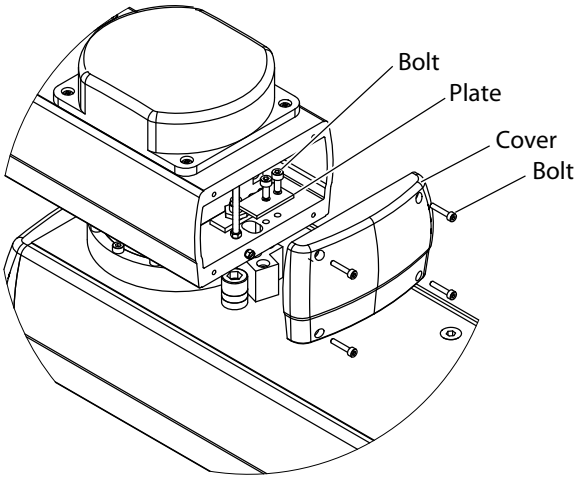
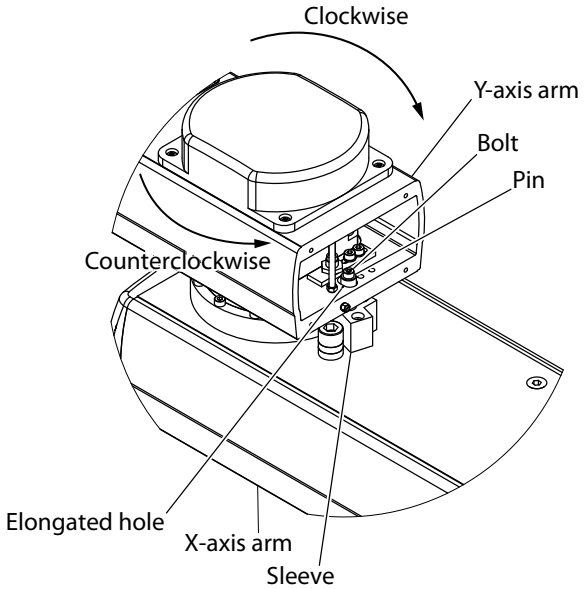


Fig. 4-16



6. Affixing the Stickers for Movement Directions and Axis Names

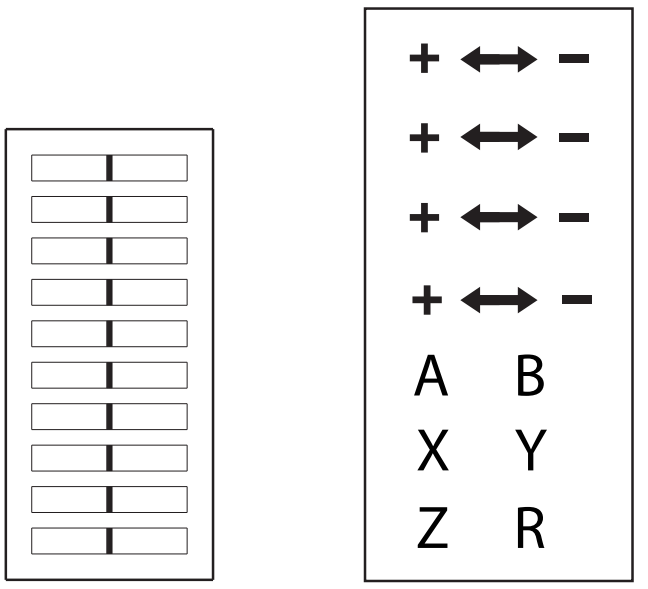
The robot comes packed with stickers showing origin positions, movement directions and axis names as shown in Fig. 4-17. Using the following procedure, attach these stickers in conspicuous points on the robot after changing the origin position and installing peripheral equipment.

1) Check that no one is inside the safeguard enclosure, and then turn on the controller.
2) Move the robot to the 0 pulse position.
   To move the axes to their "0" pulse positions, see "Chapter 4 Point trace function" in the "OMRON Robot Controller User's Manual".
3) Turn off the controller.
4) Place a sign indicating the robot is being adjusted, to keep others from operating the controller switch.
5) Enter the safeguard enclosure.
6) Being careful not to move the origin positions, attach stickers at conspicuous points on matching sides of components such as the robot arm of each axis, base (robot pedestal) and end effector. Affix stickers nearby showing the axis name and direction of movement. Use a cloth moistened with alcohol to remove grease from the surface where you will affix the stickers. After the surface is dry, affix the stickers securely. (See Fig. 4-18)

⚠ WARNING

AFFIX THE ORIGIN POSITION STICKERS PRECISELY ON THE ORIGIN POSITIONS. ALIGN THE DIRECTION OF MOVEMENT STICKERS WITH THE JOG DIRECTION AND AFFIX THEM CORRECTLY. AFFIX EACH AXIS NAME STICKER ON THE CORRECT AXIS. AFFIXING THE STICKER AT A WRONG LOCATION MAY CAUSE FAULTY OPERATION AND HAZARDOUS SITUATIONS.

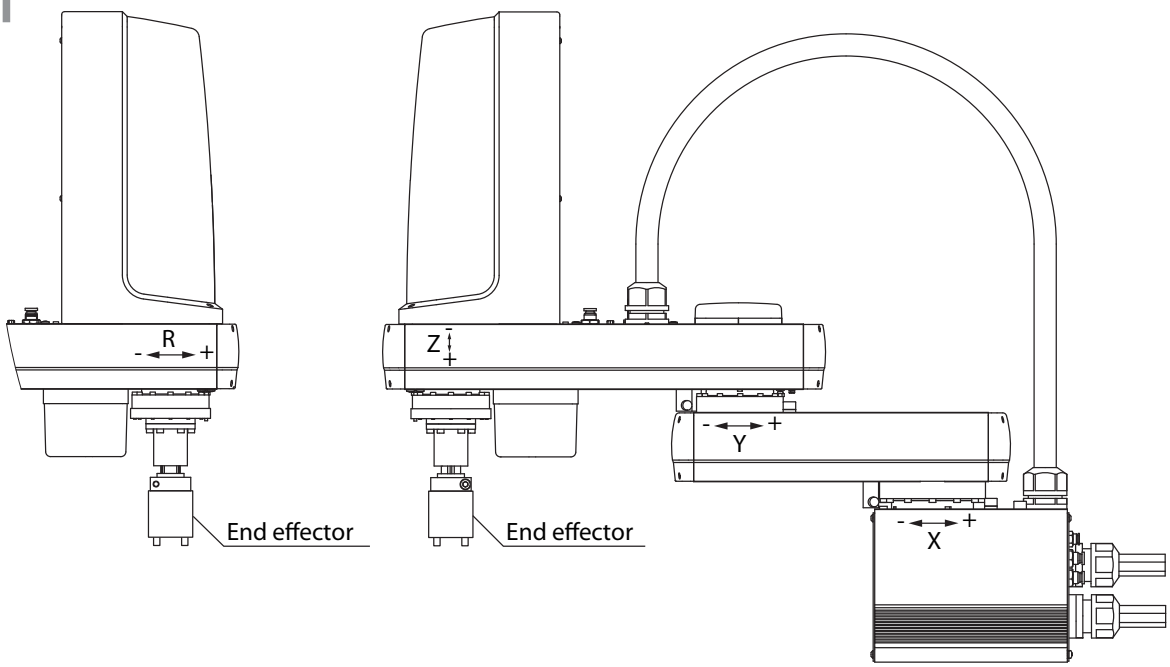
Fig. 4-17



(a) Origin position stickers

(b) Direction of movement and axis name stickers

Fig. 4-18



Chapter 5 Periodic Inspection

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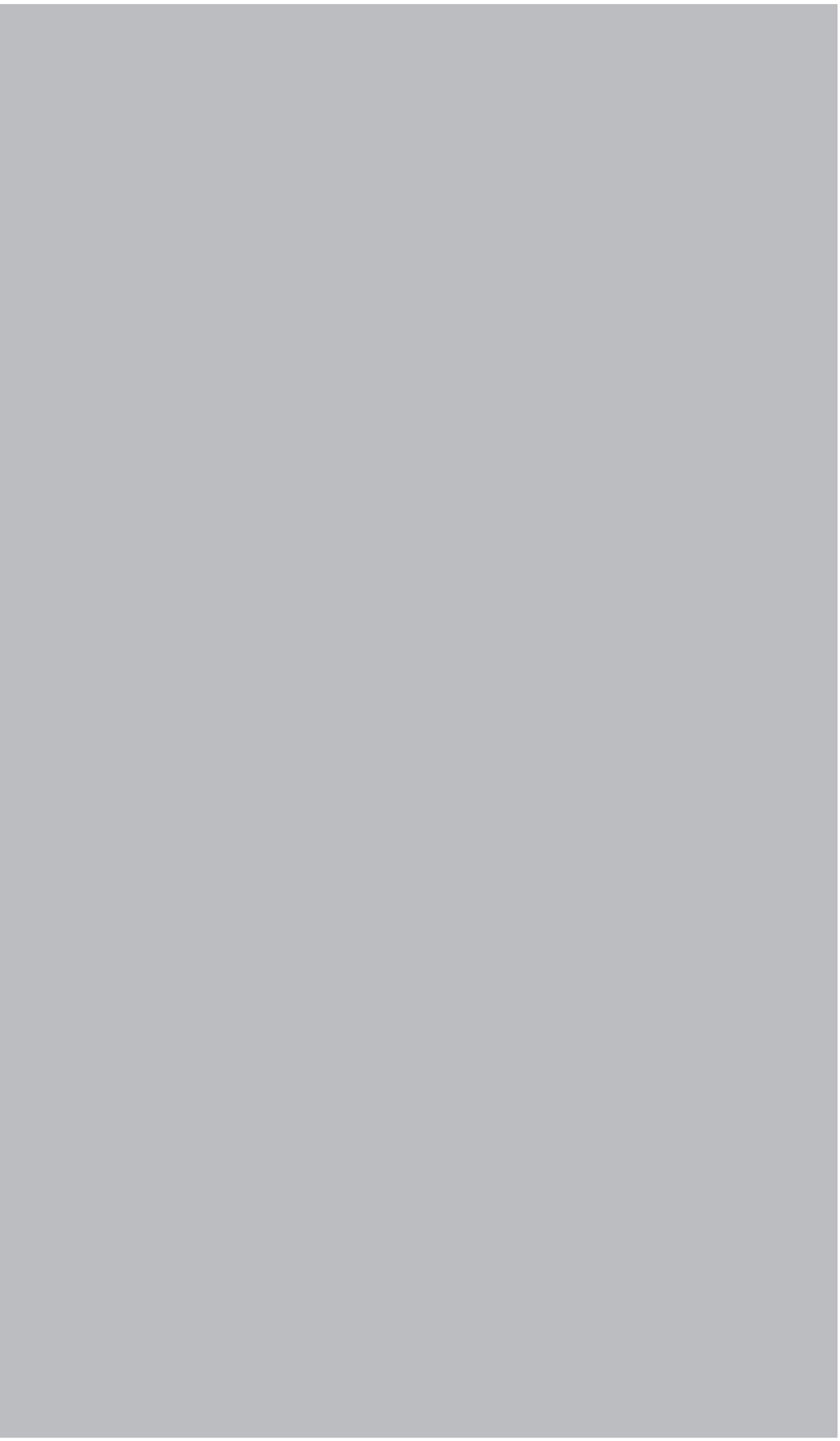


1. Overview

Daily and periodic inspection of the OMRON robot is essential in order to ensure safe and efficient operation. This chapter describes the periodic inspection items and procedures for the OMRON XG series robots.

Periodic inspection includes:

- Daily inspection
- 6-month inspection
- Replacement of speed reduction gear (harmonic drive)

Make sure that you thoroughly understand details of the inspection and follow the procedures and precautions explained in this chapter.

2. Precautions

(1) Periodic inspection must be performed by or in the presence of personnel who have received the Robot Training given by OMRON.

(2) Do not attempt any inspection, adjustment, repair and parts replacement not described in this manual. This work requires specialized technical knowledge and skill, and may also involve work hazards.

(3) When inspection is required inside the safeguard enclosure, always turn off the controller and also the external switch board.

(4) If the inspection or maintenance procedure calls for operation of the robot, stay outside the safeguard enclosure.

(5) Place a sign indicating the robot is being inspected, to keep others from operating the controller switch, programming unit or operation panel.

(6) Use only the lubricants specified by OMRON.

(7) To check the operation after inspection, refer to “6 Trial operation” in Chapter 1.

⚠ WARNING

- WHEN YOU NEED TO TOUCH THE TERMINALS OR CONNECTORS ON THE OUTSIDE OF THE CONTROLLER DURING INSPECTION, ALWAYS FIRST TURN OFF THE CONTROLLER POWER SWITCH AND ALSO THE POWER SOURCE IN ORDER TO PREVENT POSSIBLE ELECTRICAL SHOCK
- NEVER TOUCH ANY INTERNAL PARTS OF THE CONTROLLER.

For precautions on handling the controller, refer to the “OMRON Robot Controller User’s Manual”.

3. Daily Inspection

The following is an inspection list that must be performed every day before and after operating the robot.

(1) Inspection to be performed with the controller turned off

1) Turn off the controller.
2) Place a sign indicating the robot is being inspected, to keep others from operating the controller switch.
3) Enter the safeguard enclosure and check the following points.

Checkpoint	Procedure
Machine harness Robot cable User cable and wiring	Check for scratches, dents and excessive bend and kinks. (If the machine harness or robot cable is damaged, contact OMRON dealer.)
Regulator, joints, air tube, solenoid valve, air cylinder	Check air pressure. Check for air leaks. Check drain. Check air filter for clogging or damage.
Robot exterior	Check for damage. (If a damage is found, contact OMRON dealer.)

(2) Inspection to be performed with the controller turned on

1) Check that no one is inside the safeguard enclosure, and then turn on the controller.
2) Place a sign indicating the robot is being inspected, to keep others from operating the controller, programming unit or operation panel.
3) Check the following points from outside the safeguard enclosure.

Checkpoint	Procedure
Safeguard enclosure	Check if the safeguard enclosure is in place. Check if emergency stop is triggered when the door is opened. Check if warning labels are affixed at the entrance and clearly visible.
Emergency stop device	Press the emergency stop button to check if it works.
Robot movement	Check for abnormal movement and excessive vibration and noise. (If any abnormal symptom is found, contact OMRON dealer.)
Z-axis brake operation *1	Check if the brake works to stop the Z-axis from dropping more than 3mm from the stationary point. (If any abnormal operation is found, contact OMRON dealer.)

*1 Visually check the Z-axis movement when you press the emergency stop button from outside the safeguard enclosure and also when you turn off the controller.

(3) Adjustment and parts replacement

1) After inspection, if you notice any adjustment or parts replacement is needed, first turn off the controller and then enter the safeguard enclosure to perform the necessary work. After adjustment or replacement is finished, again review the checkpoints outlined in (1) and (2) above.
2) If repair or parts replacement is required for the robot or controller, please contact your OMRON dealer. This work requires specialized technical knowledge and skill, so do not attempt it by yourself.

4. Six-Month Inspection

Take the following precautions when performing 6-month inspection.

⚠ WARNING

THE Z-AXIS WILL SLIDE DOWN WHEN THE Z-AXIS BRAKE IS RELEASED, CAUSING A HAZARDOUS SITUATION. DO NOT RELEASE THE BRAKE WHEN LUBRICATING THE Z-AXIS PARTS.

When lubricating the ball screw and spline shaft, observe the following precautions.

⚠ WARNING

PRECAUTIONS WHEN HANDLING GREASE:

- INFLAMMATION MAY OCCUR IF THIS GETS IN THE EYES. 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.

⚠ CAUTION

UNLESS GREASE SPECIFIED BY OMRON IS USED, THE SERVICE LIFE OF THE BALL SCREW AND BALL SPLINE WILL SHORTEN.

(1) Inspection to be performed with the controller turned off

1) Turn off the controller.
2) Place a sign showing that the robot is being inspected, to keep others from operating the controller switch.
3) Enter the safeguard enclosure and check the following points.

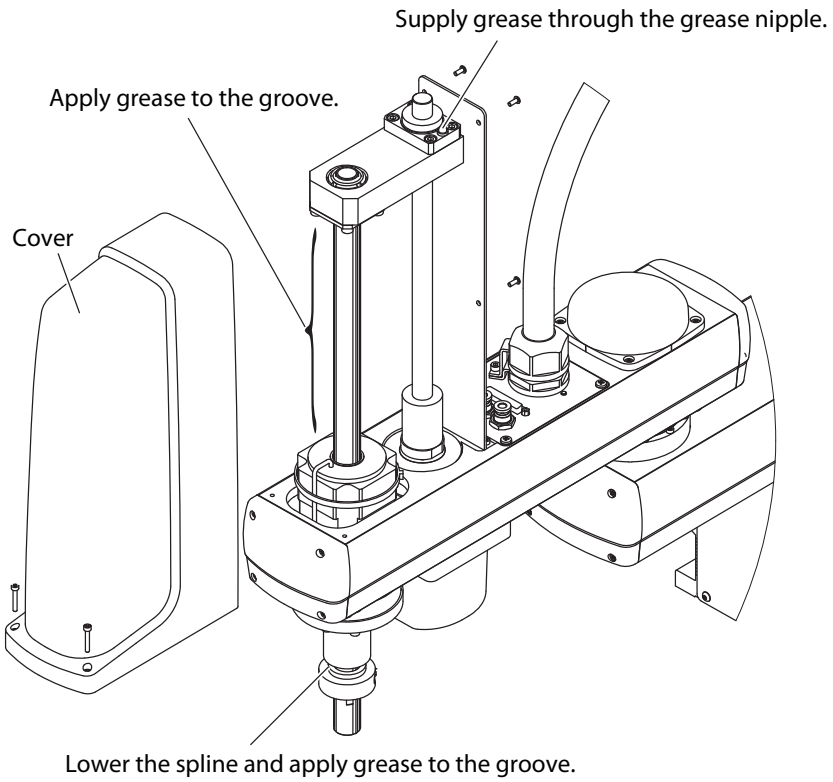
Checkpoint	Procedure
Manipulator bolts and screws (Only for major bolts and screws exposed externally)	Check for looseness and tighten if necessary.*1
Detection areas of the origin sensors of the X-axis, Y-axis, and R-axis	Clean if it is dirty.
Controller	Check for looseness at each terminal and connector on the panel. (See 4 in Chapter 3.)
Grease lubrication of Z-axis ball screw and spline	Lubricate the Z-axis spline shaft and ball screw nut after removing the old grease. The specified grease is Alvania S2 (SHOWA SHELL SEKIYU KK). (See Fig. 5-1.)
Z-axis ball spline, ball screw	Check for backlash. (If any abnormality is found, contact OMRON dealer.)

***1 Bolt tightening torque**

Bolt size	Tightening torque (kgfcm)	Tightening torque (Nm)
M3 button head bolt	14	1.4
M4 set screw	20	2.0
M3	20	2.0
M4	46	4.5
M5	92	9.0
M6	156	15.3
M8	380	37
M10	459	45.0
M12	1310	128
M14	2090	205

Use only OMRON genuine bolts. When tightening the mounting bolts for the harmonic drive, observe the tightening torque specified in each replacement procedure (section 5-2-1).

Fig. 5-1


Supply grease through the grease nipple.
Apply grease to the groove.
Cover
Lower the spline and apply grease to the groove.

(2) Inspection to be performed with the controller turned on

⚠ WARNING

- THE ROBOT CONTROLLER MUST BE INSTALLED OUTSIDE THE SAFEGUARD ENCLOSURE, TO PREVENT A HAZARDOUS SITUATION IN WHICH YOU OR ANYONE ENTER THE SAFEGUARD ENCLOSURE TO INSPECT THE CONTROLLER WHILE IT IS TURNED ON.
- BODILY INJURY MAY OCCUR FROM COMING INTO CONTACT WITH THE FAN WHILE IT IS ROTATING.
- WHEN REMOVING THE FAN COVER FOR INSPECTION, FIRST TURN OFF THE CONTROLLER AND MAKE SURE THE FAN HAS STOPPED.

1) Check that no one is inside the safeguard enclosure, and then turn on the controller.
2) Place a sign indicating the robot is being inspected, to keep others from operating the controller, programming unit or operation panel.
3) Check the following points from outside the safeguard enclosure.

Checkpoint	Procedure
• Cooling fan at rear of controller	• Check if the fan rotates normally. • Check if objects blocking the fan are located and remove if any are found. • Check for abnormal noise from the rotating fan. If abnormal noise is heard, visually check and remove the cause. If no cause is found, contact OMRON dealer. • Check for dust on the fan cover. Remove and clean if necessary.

(3) Adjustment and parts replacement

1) After inspection, if you notice any adjustment or parts replacement is needed, first turn off the controller and then enter the safeguard enclosure to perform the necessary work. After adjustment or replacement is finished, again review the checkpoints outlined in (1) and (2) above.
2) If repair or parts replacement is required for the robot or controller, please contact your OMRON dealer. This work requires specialized technical knowledge and skill, so do not attempt it by yourself.

5. Replacing the Harmonic Drive

The XG series robots listed in Table 5-1 use a harmonic drive as the speed reduction gear for the X, Y and R axes. Harmonic drives need to be replaced after a specified operation time. Use the guideline explained below to determine the replacement period and replace the harmonic drive periodically. Since the XG series robots listed in Table 5-1 use long-life harmonic grease, it is not necessary to replace the harmonic grease.

5-1 Replacement period

The harmonic drive replacement period is determined by the total number of turns of the wave generator used in the harmonic drive. It is recommended to replace the harmonic drive when the total number of turns has reached 8.4×10^8 (at ambient operating temperatures of 0°C to +40°C). This means that the replacement period will differ depending on the following operating conditions. If the robot operation duty ratio is high or the robot is operated in environments at higher temperatures, the harmonic drive should be replaced earlier.

Replacement period $= 8.4\times10^8/(n\times60\times h\times D\times N\times\theta)$ years

where
- n : Number of axis movements per minute
- θ : Average turn per axis movement
- N : Speed reduction ratio
- h : Operation time per day
- D : Operation days per year

For example, when the robot is used under the following conditions, the replacement period for the X-axis harmonic drive of the R6YXG500 can be calculated as follows.

- n : 10
- θ : 0.25
- N : 80
- h : 24 hours per day
- D : 240 days per year

Replacement period $= 8.4\times10^8/(n\times60\times h\times D\times N\times\theta)$
$= 8.4\times10^8/(10\times60\times24\times240\times80\times0.25)$
$= 12.2$ years

Table 5-1 Harmonic drive speed reduction ratio

Robot model	X-axis	Y-axis	R-axis
R6YXG500, R6YXG600	80	80	30
R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000	80	80	50

5-2 Basic replacement procedure for harmonic drive and precautions

Basic procedures and precautions for replacing the harmonic drive are described below. Before beginning the replacement work, always be sure to read these replacement procedures and caution.

⚠ WARNING

- THE MOTOR AND SPEED REDUCTION GEAR CASING ARE EXTREMELY HOT AFTER AUTOMATIC OPERATION, SO BURNS MAY OCCUR IF THESE ARE TOUCHED. BEFORE TOUCHING THESE PARTS, TURN OFF THE CONTROLLER, WAIT FOR A WHILE AND CHECK THAT THE TEMPERATURE HAS COOLED.
- WHEN REMOVING THE WAVE GENERATOR FROM THE MOTOR SHAFT OR REINSTALLING IT BACK ONTO THE MOTOR SHAFT, USE CAUTION TO AVOID AS MUCH AS POSSIBLE, APPLYING A THRUST LOAD TO THE MOTOR SHAFT. IF A LOAD IS APPLIED, THE RESOLVER MAY BE DAMAGED RESULTING IN A HAZARDOUS SITUATION OF THE ROBOT TROUBLE.

⚠ WARNING

PRECAUTIONS WHEN HANDLING HARMONIC GREASE, CLEANING OIL:

- INFLAMMATION MAY OCCUR IF THEY GET IN THE EYES.
  BEFORE HANDLING THEM, WEAR YOUR SAFETY GOGGLES TO ENSURE THEY WILL NOT COME IN CONTACT WITH THE EYES
- INFLAMMATION MAY OCCUR IF THEY COME 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 THEM OR PLACE NEAR AN OPEN FLAME SINCE THIS COULD LEAD TO SPARKS AND FIRES.

EMERGENY TREATMENT:

- IF THEY GET IN THE EYES, WASH LIBERALLY WITH PURE WATER FOR ABOUT 15 MINUTES AND CONSULT A PHYSICIAN FOR TREATMENT.
- IF THEY COME 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 HARMONIC GREASE, CLEANING OIL 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.

⚠ CAUTION

THE HARMONIC DRIVE SERVICE LIFE MAY SHORTEN IF THE GREASE RECOMMENDED BY OMRON IS NOT USED.

Recommended grease

Use the following harmonic drive grease.
4B No.2 (made by Harmonic Drive Systems Inc.)

⚠ CAUTION

HARMONIC DRIVE

- DO NOT APPLY STRONG SHOCKS OR IMPACTS TO THESE PARTS SUCH AS WITH A HAMMER.ALSO, DO NOT SCRATCH, SCAR OR DENT THESE PARTS BY DROPPING, ETC. SUCH ACTIONS WILL DAMAGE THE HARMONIC DRIVE.
- THE SPECIFIED PERFORMANCE CANNOT BE MAINTAINED IF ANY PART OF THE HARMONIC DRIVE IS USED IN A DAMAGED STATE. THIS DAMAGE OR WEAR MAY ALSO LEAD TO TROUBLE WITH THE HARMONIC DRIVE.
- SINCE A POSITIONAL SHIFT OCCURS AFTER REPLACING THE HARMONIC DRIVE, IT IS NECESSARY TO MAKE ABSOLUTE RESET, STANDARD COORDINATE SETTING AND POINT DATA SETTING AGAIN.

5-2-1 Replacement procedure for harmonic drive

Procedures and precautions for replacing the harmonic drive are described below using the drawings of the R6YXG500 as an example. For the bolt tightening torque in this work, refer to Table 5-2. However, when tightening the mounting bolts for the harmonic drive, observe the tightening torque specified in each replacement procedure. Use only OMRON genuine bolts.

Table 5-2 Bolt tightening torque

Bolt size	Tightening torque (kgfcm)	Tightening torque (Nm)
M3 button head bolt	14	1.4
M4 set screw	20	2.0
M3	20	2.0
M4	46	4.5
M5	92	9.0
M6	156	15.3
M8	380	37
M10	720	71

Recommended "Screw Lock": LOCTITE 262 (made by Henkel Corporation)

5-2-1-1 X-axis

1) Prepare the parts and tools required for replacement work.

■ Replacement parts

• R6YXG500, R6YXG600

	Part Name	OMRON Part No.	Part No. / Specs	Qty	Remarks
(1)	Harmonic drive	KBF-M2110-000	SHG-25-80	1	
(2)	O-ring	KN4-M2143-000	S90 (JIS)	1	Becomes worn and must be replaced
(3)	O-ring	90990-17J030	Cross section diameter: 1.78mm Inner diameter: 66.4mm	1	Becomes worn and must be replaced
(4)	O-ring	KN5-M257L-000	Cross section diameter: 1.30mm Inner diameter: 66.5mm	1	Supplied with harmonic drive
(5)	Motor mounting bolt	KBP-M259A-000	M6, length: 16, black	4	Must be replaced when robot reference number is prior to KC346
		91312-06016	M6, length: 16, white	4	Spare parts for robots with a reference number of KC346 or later
(6)	Harmonic drive mounting bolt	91312-04020	M4, length: 20, white	16	Must be replaced
(7)	Harmonic drive mounting bolt	91312-04030	M4, length: 30, white	11	Must be replaced
(8)	Panhead bolt for dog	98502-04030	M4, length: 30, white	1	Spare parts
(9)	Nut for dog	95302-05600	M4, white	1	Spare parts
(10)	Washer	92903-04600	M4, white	16	Must be replaced

• R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

	Part Name	OMRON Part No.	Part No. / Specs	Qty	Remarks
(1)	Harmonic drive	KBP-M2110-000	SHG-32-80	1	
(2)	O-ring	KN5-M2159-000	S115 (JIS)	1	Becomes worn and must be replaced
(3)	O-ring	90990-17J035	Cross section diameter: 1.50mm Inner diameter: 82.0mm	1	Becomes worn and must be replaced
(4)	O-ring	KN5-M2199-000	Cross section diameter: 1.50mm Inner diameter: 87.5mm	1	Supplied with harmonic drive
(5)	Motor mounting bolt	91312-5016	M5, length: 16, white	4	Spare parts
(6)	Harmonic drive mounting bolt	91312-05040	M5, length: 40, white	16	Must be replaced
(7)	Harmonic drive mounting bolt	91312-05040	M5, length: 40, white	11	Must be replaced
(8)	Panhead bolt for dog	98502-05040	M5, length: 40, white	1	Spare parts
(9)	Nut for dog	95302-06600	M6, white	1	Spare parts

■ Torque wrench, etc. (Use accurately calibrated torque screwdrivers and torque wrenches.)

• R6YXG500, R6YXG600

	Name	Part No.	Manufacturer	Remarks
A	Torque wrench	N230QLK	KANON (Nakamura Mfg. Co., Ltd.)	For M6 hex socket head bolt Tightening torque: 15.2Nm (156kgfcm)
	Drive bit	Y5	KTC (Kyoto Tool Co., Ltd.)	Attachment: 9.53mm sq Overall length: 83mm Hexagonal width across flat at tip: 5mm
B	Torque wrench	N120QLK	KANON (Nakamura Mfg. Co., Ltd.)	For M4 hex socket head bolt Tightening torque: 4.0Nm (41kgfcm)
	Drive bit	2H3	TONE (Maeda Metal Industries, Ltd.)	Attachment: 6.35mm sq Hexagonal width across flat at tip: 3mm
C	Torque screwdriver	N20LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M4 set screw Tightening torque: 1.7Nm (17kgfcm)
	Drive bit	3C2010	NAC (Nagahori Industry Co., Ltd.)	Attachment hexagonal width across flat: 6.35mm Overall length: 100mm Hexagonal width across flat at tip: 2mm
D	Torque screwdriver	N20LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M4 Phillips-head screw Tightening torque: 1.6Nm (16kgfcm)
	Drive bit	+2×50	Vessel Co., Inc.	Attachment hexagonal width across flat: 6.35mm Overall length: 50mm Bit number: #2

• **R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000**

	Name	Part No.	Manufacturer	Remarks
A	Torque wrench	N230QLK	KANON (Nakamura Mfg. Co., Ltd.)	For M5 hex socket head bolt Tightening torque: 9Nm (92kgfcm)
	Drive bit	BT3-04L	KTC (Kyoto Tool Co., Ltd.)	Attachment: 9.53mm sq Overall length: 128mm Hexagonal width across flat at tip: 4mm
B	Torque wrench	N230QSPK	KANON (Nakamura Mfg. Co., Ltd.)	For M5 hex socket head bolt Tightening torque: 8.4Nm (86kgfcm)
	Drive bit	3010M-100	Ko-ken (Koken Tool Co., Ltd.)	Attachment: 9.53mm sq Overall length: 100mm Hexagonal width across flat at tip: 4mm
C	Torque screwdriver	N20LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M4 set screw Tightening torque: 1.7N·m (17kgfcm)
	Drive bit	3C2010	NAC (Nagahori Industry Co., Ltd.)	Attachment hexagonal width across flat: 6.35mm Overall length: 100mm Hexagonal width across flat at tip: 2mm
D	Torque screwdriver	N50LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M5 Phillips-head screw Tightening torque: 3.2Nm (32kgfcm)
	Drive bit	B35+2×50	Vessel Co., Inc.	Attachment hexagonal width across flat: 6.35mm Overall length: 50mm Bit number: #2

■ **Other tools**

Name	Part No.	Manufacturer	Remarks
Harmonic grease	4B No.2	Harmonic Drive Systems	Do not use grease if it was purchased 4 or more years ago. The grease has probably deteriorated.
Cleaning wipe			
Phillips screwdriver			
Hex wrench set			
“Screw Lock” LOCTITE	Loctite 262	Henkel	High strength type (red)

2) Turn off the controller.
3) Place a sign indicating that the robot is being inspected, to keep others from operating the controller switch.
4) Enter the safeguard enclosure.
   In the following steps, we recommend removing the Y-axis arm from the X-axis arm in advance by referring to the instructions in “5-2-1-2 Y-axis”, because moving the X-axis arm without removing the Y-axis arm is very heavy.
5) Remove the base front and rear covers (see Fig. 5-2).
6) Unplug the connectors on the X-axis motor power wire XM and resolver wire XP in the base. Also disconnect the X-axis motor ring-tongue terminal.

⚠ CAUTION

CAREFULLY REMOVE THE MOTOR NOT TO PINCH FINGERS BETWEEN THE MOTOR AND THE BASE. AN O-RING IS PLACED BETWEEN THE MOTOR MATING END FACE AND THE BASE. REPLACE THIS O-RING WITH A NEW ONE (SEE FIG. 5-4 AND FIG. 5-6).
ON THE R6YXGH600, R6YXG700, R6YXG800, R6YXG900 AND R6YXG1000, AN O-RING IS PLACED BETWEEN THE MOTOR FLANGE END FACE AND THE BASE.

7) Using the tool A, remove the bolts securing the motor.
The bolts must be replaced with new ones later on.
When removing the bolts, hold the motor not to let it drop (see Fig. 5-3).

8) Pull the motor out of the base while turning the X-axis arm.

9) Remove the wave generator from the motor shaft.
The wave generator is secured with a set screw (1 piece) and key (see Fig. 5-6). A spacer and bolts need to be removed for R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000.

⚠ CAUTION

A SPACER IS INSERTED BETWEEN THE WAVE GENERATOR AND THE MOTOR, SO BE CAREFUL NOT TO LOSE IT. NO SPACER IS USED THERE FOR THE R6YXGH600, R6YXG700, R6YXG800, R6YXG900 AND R6YXG1000.

⚠ WARNING

- WHEN YOU REMOVE THE X-AXIS ARM INSTALLATION BOLTS IN THE NEXT STEP, THE X-AXIS ARM MAY COME OFF CAUSING A HAZARDOUS SITUATION. BE ESPECIALLY CAREFUL TO KEEP THE ARM FROM FALLING WHEN A HEAVY TOOL IS ATTACHED TO THE ARM TIP (SEE FIG. 5-4).
- REMOVING THE X-AXIS ARM IS DANGEROUS FOR JUST ONE PERSON. ALWAYS USE TWO OR MORE PEOPLE, OR REMOVE THE Y-AXIS ARM IN ADVANCE. REFER TO “5-2-1-2 Y-AXIS” FOR REMOVING THE Y-AXIS ARM.

10) Remove the X-axis arm installation bolts by using the tool B (see Fig. 5-4).

11) Remove the X-axis arm and place it where it will not obstruct the work.

12) Remove the bolts securing the X-axis harmonic drive and also remove the panhead bolt along with the nut (see Fig. 5-5).

13) Remove the X-axis harmonic drive from the X-axis arm.

⚠ CAUTION

AN O-RING IS FITTED TO THE X-AXIS ARM. REPLACE THIS O-RING WITH A NEW ONE.

14) Apply harmonic grease to the new wave generator and flexspline. See Fig. 5-7 for applying grease properly. Degrease the mating surfaces on top and bottom of the harmonic drive.

15) Wipe away old grease and wear particles on the motor, base, and X-axis arm.
If foreign objects or debris get caught during reassembly, the harmonic drive may cause abnormal noise or may be damaged.
Degrease the X-axis arm mating surface where the harmonic drive is to be installed.
Fit the new O-ring (2) coated with harmonic grease into the O-ring groove of the X-axis arm (see Fig. 5-8.). Grease applied to the O-ring is to prevent the O-ring from coming off, so a small amount is enough.
Secure the new harmonic drive to the X-axis arm with the new bolts as described below (see Fig. 5-8).
Apply harmonic grease 4B No.2 to the tip of each bolt so that the roots of at least the first 4 threads are filled with grease (see Fig. 5-9). Grease applied to the bolt tip is to stabilize the bolt axial force.
Return the panhead bolt and nut to the original position. Do not apply grease to the panhead bolt. Doing so may cause the panhead bolt to loosen.

Then tighten the bolts and panhead bolt in the following order (see Fig. 5-10).

1. Using the wrench, manually tighten all bolts in the order indicated by circled numbers in Fig. 5-10.
2. Using the torque wrench, tighten all bolts to about 50% of the specified torque in the order indicated by circled numbers in Fig. 5-10.
3. Tighten each bolt up to the specified torque, loosen it one or two turns (do not remove), and retighten it to the specified torque. Do this sequentially for each bolt, in the order indicated by circled numbers in Fig. 5-10. This is to stabilize the bolt axial force.
4. Finally check that each bolt is tightened to the specified torque.

⚠ CAUTION

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A PROBLEM WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

16) Fit the new O-ring (4) coated with harmonic grease into the O-ring groove of the harmonic drive.
Grease applied to the O-ring is to prevent the O-ring from coming off, so a small amount is enough.
Degrease the mating surface on top of the base where the harmonic drive is to be installed.
Secure the harmonic drive to the base with the new bolts as described below. The harmonic drive's phase with respect to the base should be as shown in Fig. 5-11. At this point, keep the X-axis and Y-axis arms level with two people so as not to apply a moment load to the harmonic drive. One person supports the X-axis and Y-axis arms and the other person secures the X-axis arm.

⚠ CAUTION

TIGHTENING THE BOLTS WHILE A MOMENT LOAD IS APPLIED TO THE HARMONIC DRIVE MAY DAMAGE THE HARMONIC DRIVE. PERFORM THE WORK SO AS NOT TO APPLY A MOMENT LOAD TO THE HARMONIC DRIVE.

Apply harmonic grease 4B No.2 to the tip of each bolt so that the roots of at least the first 4 threads are filled with grease (see Fig. 5-9). Grease applied to the bolt tip is to stabilize the bolt axial force.

Then tighten the bolts in the following order (see Fig. 5-10 and Fig. 5-11).

1. Using the wrench, manually tighten all bolts in the order indicated by circled numbers in Fig. 5-11.
2. Using the torque wrench, tighten all bolts to about 50% of the specified torque in the order indicated by circled numbers in Fig. 5-11.
3. Tighten each bolt up to the specified torque, loosen it one or two turns (do not remove), and retighten it to the specified torque. Do this sequentially for each bolt, in the order indicated by circled numbers in Fig. 5-11. This is to stabilize the bolt axial force.
4. Finally check that each bolt is tightened to the specified torque.

⚠ CAUTION

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A PROBLEM WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

17) Fit the spacer and wave generator onto the motor shaft, fully insert them against the motor, and secure the wave generator to the motor shaft with the set screw (1 piece). At this point, apply a small amount of Screw Lock to the set screw (see Fig. 5-13). On the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000, the wave generator should be fixed with M5 bolts and spacers prior to this step.

⚠ CAUTION

IF IT IS DIFFICULT TO FIT THE WAVE GENERATOR ONTO THE MOTOR SHAFT BY PUSHING BY HAND, DO NOT FORCEFULLY PUSH IN. GRIND THE KEY OR MOTOR SHAFT WITH SANDPAPER OR SIMILAR TOOL TO MAKE IT EASIER TO FIT THE WAVE GENERATOR ONTO THE MOTOR SHAFT.
APPLY THE SPECIFIED AMOUNT OF HARMONIC GREASE TO EACH PART OF THE HARMONIC DRIVE. AN INSUFFICIENT AMOUNT OF GREASE MAY SHORTEN THE SERVICE LIFE OF THE DRIVE PARTS, AND AN EXCESSIVE AMOUNT MAY CAUSE GREASE TO LEAK.

18) Place the new O-ring (3) in the cylindrical section of the base and push the O-ring to the top end face (see Fig. 5-12). In the case of the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000, just fit the O-ring into the single groove.

⚠ CAUTION

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A PROBLEM WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

19) Push the X-axis motor into the base while moving the X-axis arm by hand. Using the tool A, uniformly tighten the four bolts while moving the X-axis arm by hand slowly left and right through 45°. If any jamming or catching is felt while moving the axis at this time, then reassemble from the beginning (see Fig. 5-14).

20) Reattach the connectors on the X-axis motor power wire XM and resolver wire XP (see Fig. 5-15). Also reattach the X-axis motor ring-tongue terminal.

21) Reattach the base front and rear covers.

22) Go out of the safeguard enclosure.

23) Check that no one is inside the safeguard and then turn on the controller.

⚠ CAUTION

AFTER THE HARMONIC DRIVE IS REPLACED, AN ABSOLUTE RESET MUST BE PERFORMED, AND THE STANDARD COORDINATE AND POINT DATA MUST BE SET AGAIN. REFER TO CHAPTER 4 “ADJUSTMENT” TO MAKE ADJUSTMENTS.

Fig. 5-2

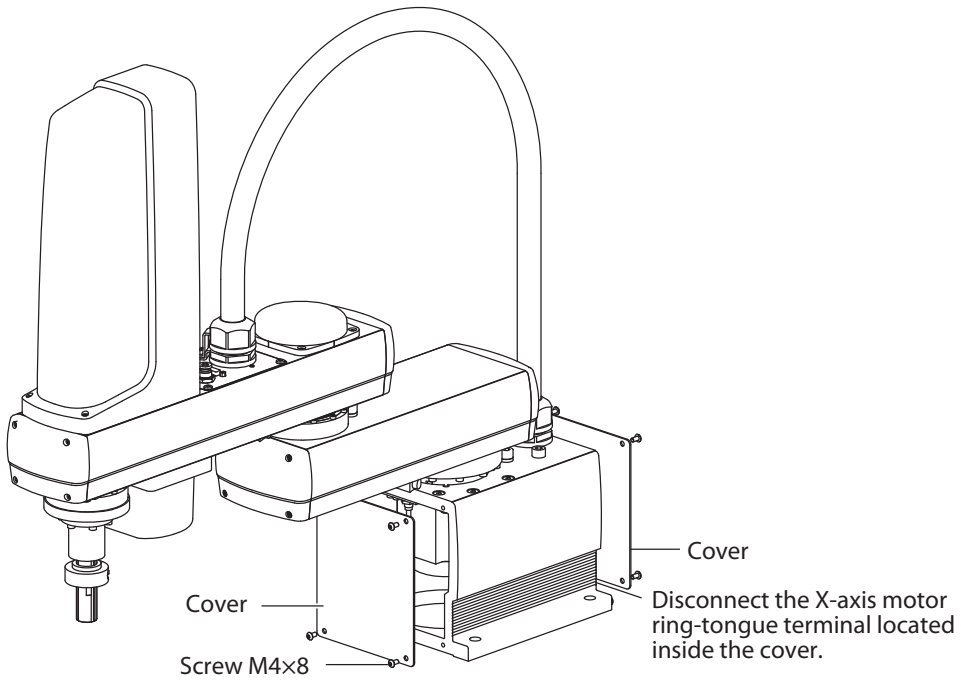
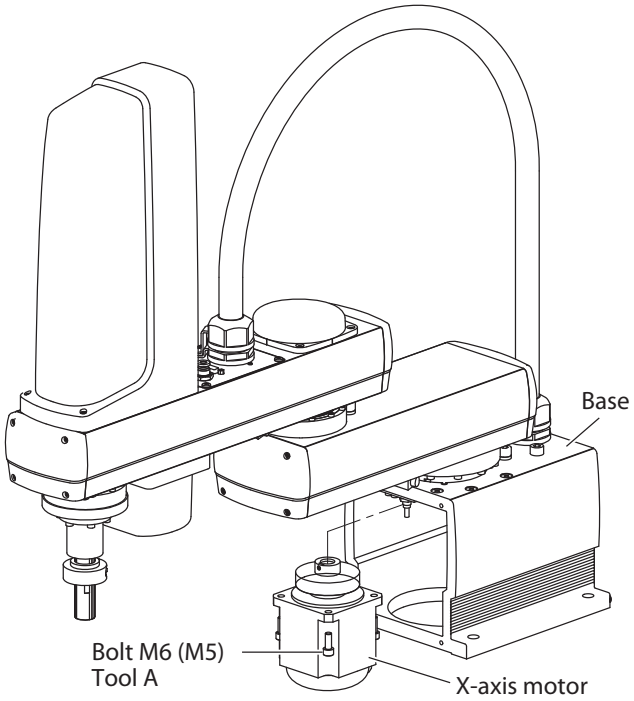
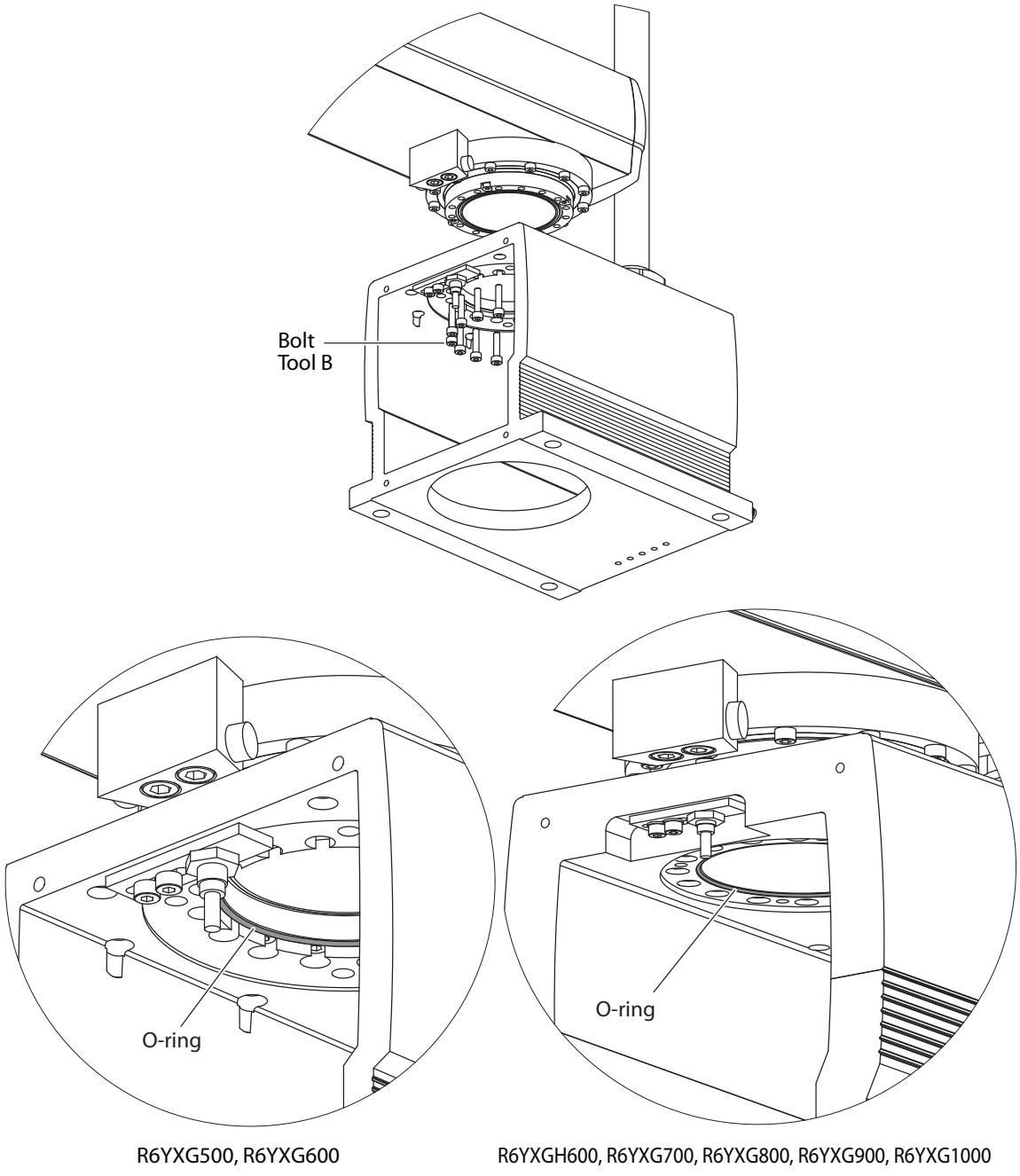


Fig. 5-3



* Values in parentheses apply to the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000.

Fig. 5-4



R6YXG500, R6YXG600

R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

Fig. 5-5

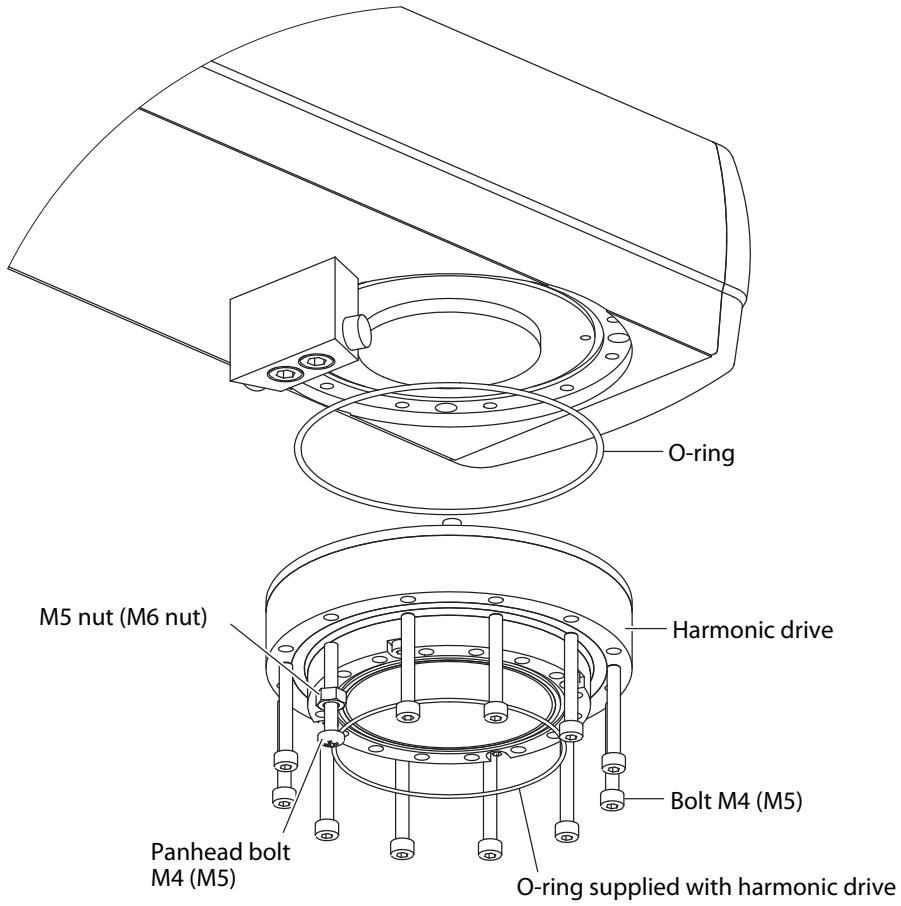

O-ring
M5 nut (M6 nut)
Harmonic drive
Bolt M4 (M5)
Panhead bolt
M4 (M5)
O-ring supplied with harmonic drive

Fig. 5-6

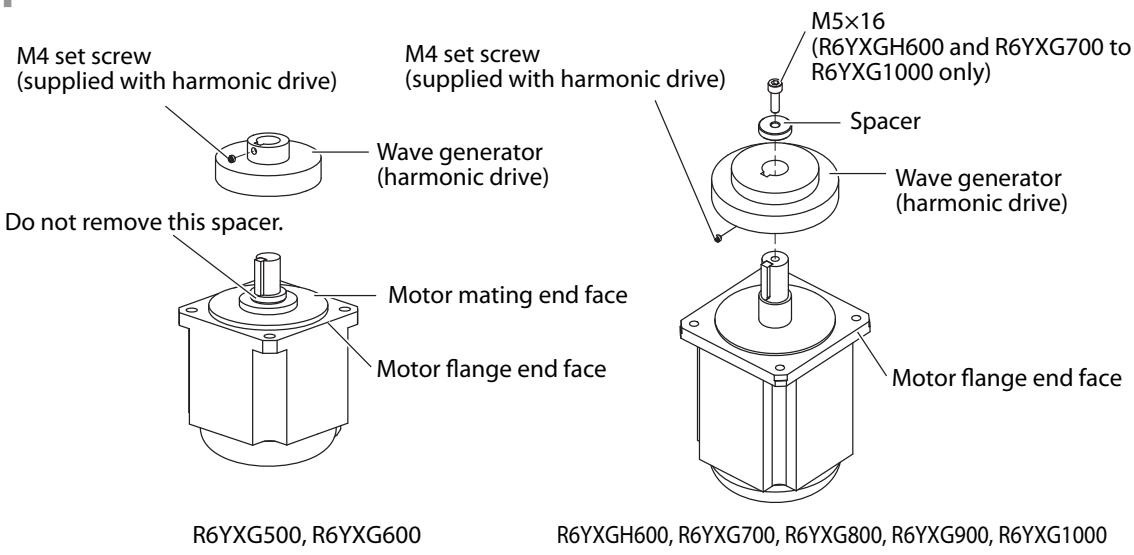
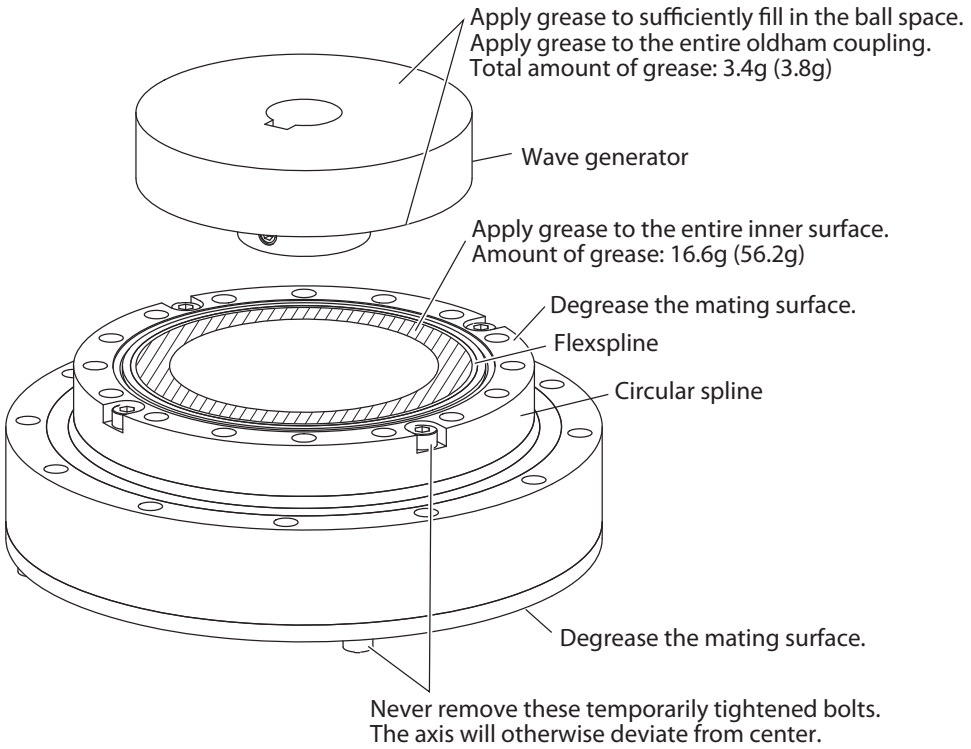

M4 set screw
(supplied with harmonic drive)
Wave generator
(harmonic drive)
Do not remove this spacer.
Motor mating end face
Motor flange end face
R6YXG500, R6YXG600
M4 set screw
(supplied with harmonic drive)
M5×16
(R6YXGH600 and R6YXG700 to
R6YXG1000 only)
Spacer
Wave generator
(harmonic drive)
Motor flange end face
R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

Fig. 5-7



* Values in parentheses apply to the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000.

Fig. 5-8

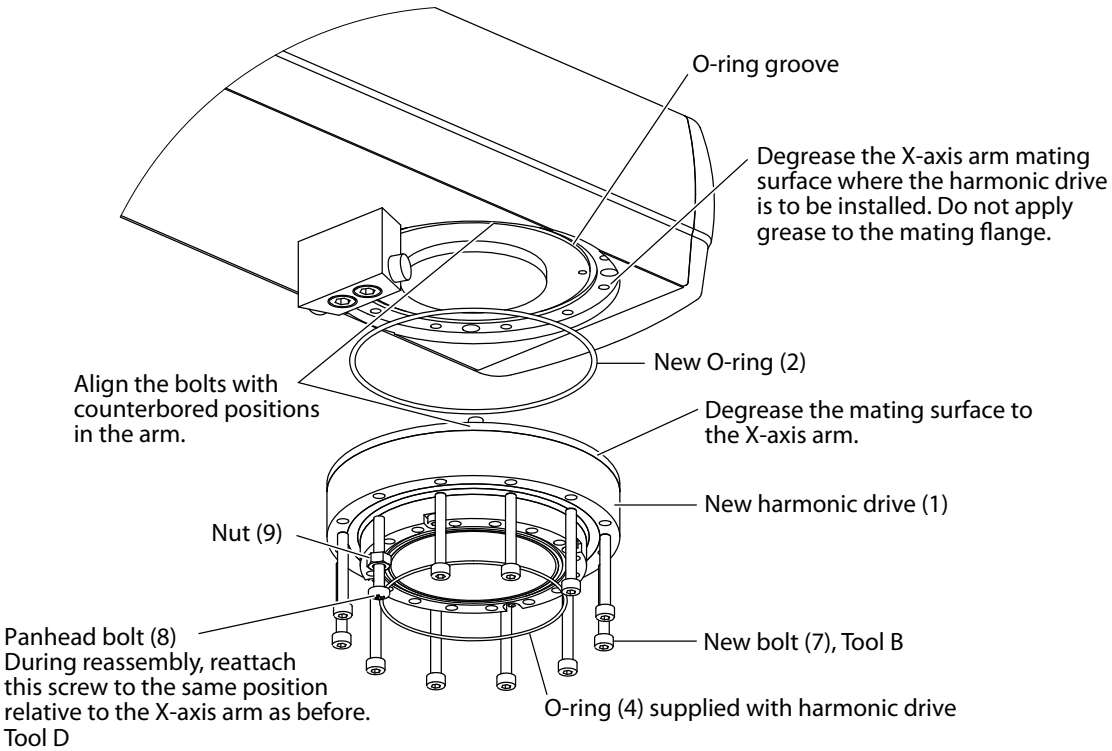


Fig. 5-9

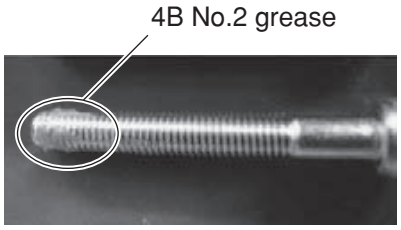


Fig. 5-10

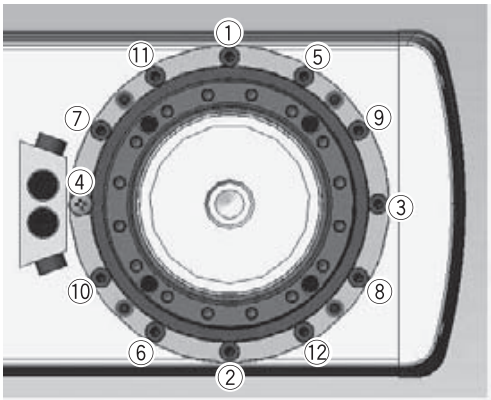
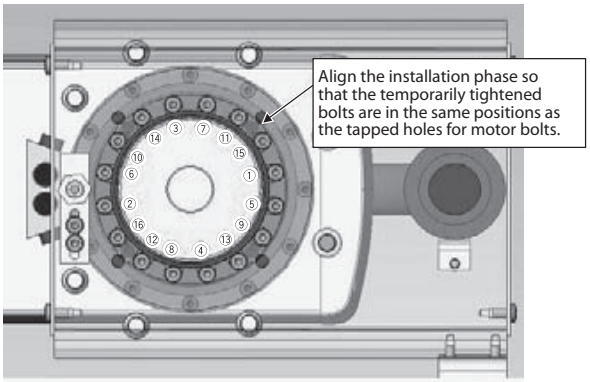
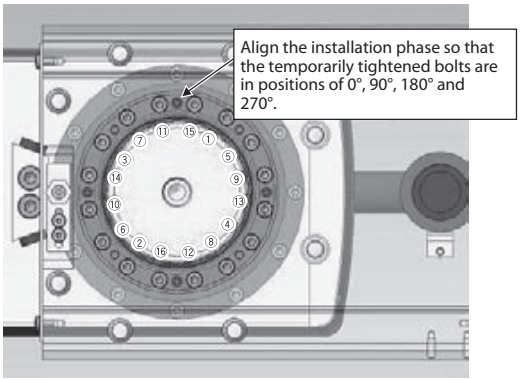


Fig. 5-11



R6YXG500, R6YXG600



R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

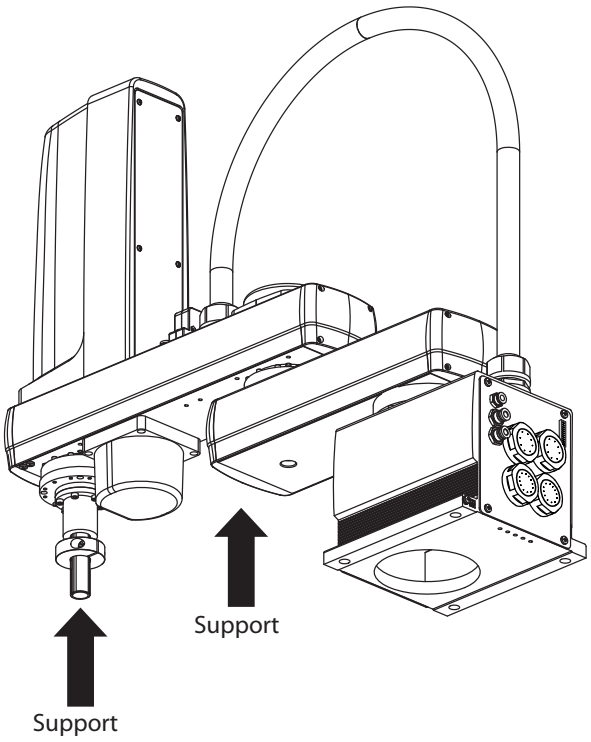
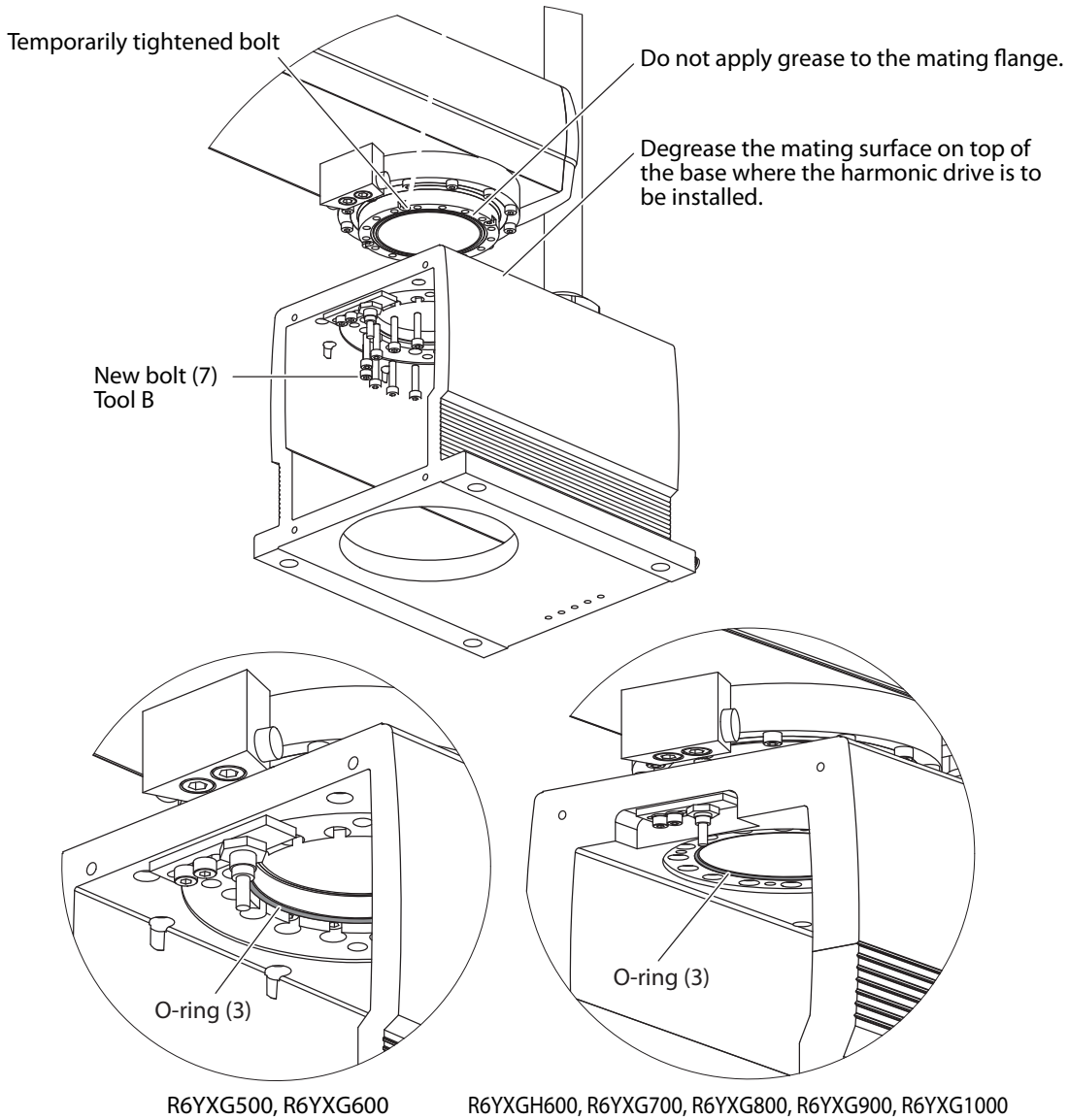
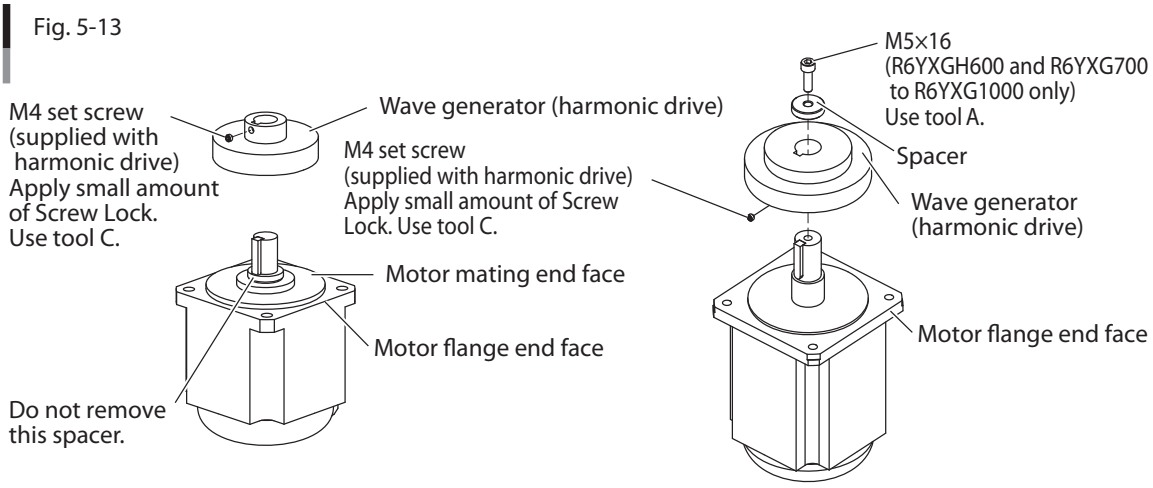


Fig. 5-12



R6YXG500, R6YXG600 R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

Fig. 5-13



R6YXG500, R7YXG600 R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

Fig. 5-14

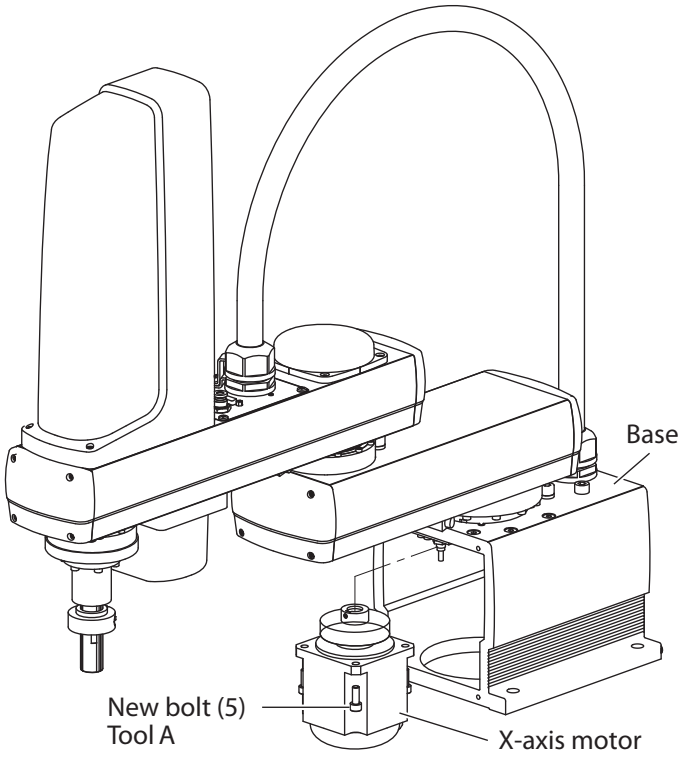
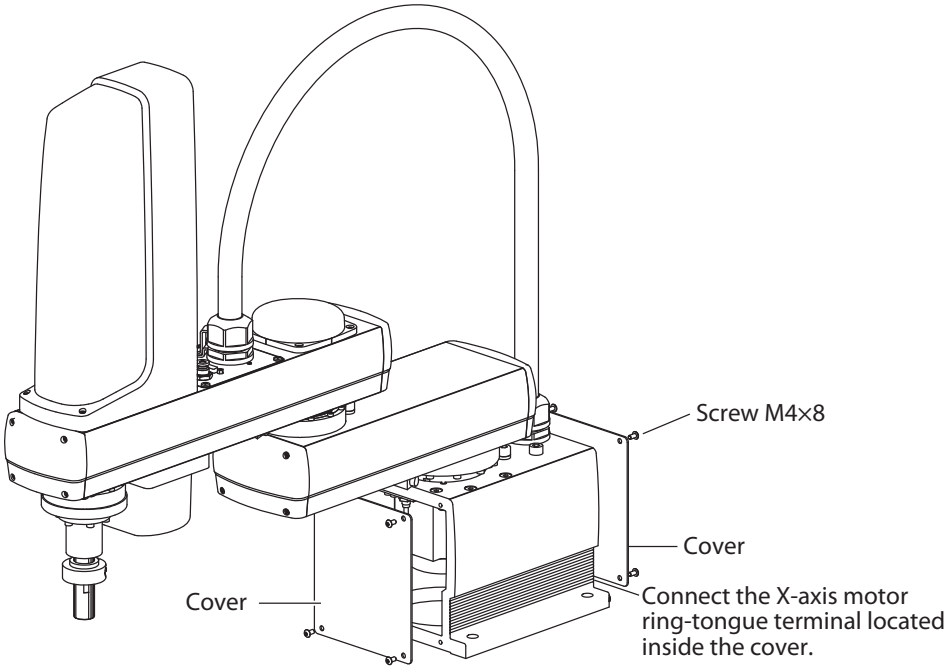


Fig. 5-15



5-2-1-2 Y-axis

1) Prepare the parts and tools required for replacement work.

■ Replacement parts

• R6YXG500, R6YXG600

	Part Name	OMRON Part No.	Part No. / Specs	Qty	Remarks
(1)	Harmonic drive	KBF-M2510-000	SHG-20-80	1	
(2)	O-ring	KN4-M257K-000	Cross section diameter: 1.78mm Inner diameter: 72.75mm	1	Becomes worn and must be replaced
(3)	O-ring	KN3-M2143-000	Cross section diameter: 1.50mm Inner diameter: 49.00mm	1	Becomes worn and must be replaced
(4)	O-ring	90990-17J002	Cross section diameter: 0.99mm Inner diameter: 53.28mm	1	Supplied with harmonic drive
(5)	Motor mounting bolt	KBF-M259A-000	M5, length: 12, black	4	Must be replaced when robot reference number is prior to KC394
		91312-05012	M5, length: 12, white	4	Spare parts for robots with a reference number of KC394 or later
(6)	Harmonic drive mounting bolt	91312-03016	M3, length: 16, white	16	Must be replaced
(7)	Harmonic drive mounting bolt	91312-03030	M3, length: 30, white	11	Must be replaced
(8)	Panhead bolt for dog	98502-03030	M3, length: 30, white	1	Spare parts
(9)	Nut for dog	95302-04600	M4, white	1	Spare parts

• R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

	Part Name	OMRON Part No.	Part No. / Specs	Qty	Remarks
(1)	Harmonic drive	KBP-M2510-000	SHG-25-80	1	
(2)	O-ring	KN4-M2143-000	S90 (JIS)	1	Becomes worn and must be replaced
(3)	O-ring	90990-17J030	Cross section diameter: 1.78mm Inner diameter: 66.4mm	1	Becomes worn and must be replaced
(4)	O-ring	KN5-M257L-000	Cross section diameter: 1.30mm Inner diameter: 66.5mm	1	Supplied with harmonic drive
(5)	Motor mounting bolt	KBP-M259A-000	M6, length: 16, black	4	Must be replaced when robot reference number is prior to KC346
		91312-06016	M6, length: 16, white	4	Spare parts for robots with a reference number of KC346 or later
(6)	Harmonic drive mounting bolt	91312-04020	M4, length: 20, white	16	Must be replaced
(7)	Harmonic drive mounting bolt	91312-04030	M4, length: 30, white	11	Must be replaced
(8)	Panhead bolt for dog	98502-04030	M4, length: 30, white	1	Spare parts
(9)	Nut for dog	95302-05600	M4, white	1	Spare parts
(10)	Washer	92903-04600	M4, white	16	Must be replaced

■ **Torque wrench, etc. (Use accurately calibrated torque screwdrivers and torque wrenches.)**

• **R6YXG500, R6YXG600**

	Name	Part No.	Manufacturer	Remarks
A	Torque wrench	N120CPCK	KANON (Nakamura Mfg. Co., Ltd.)	For M5 hex socket head bolt Tightening torque: 7.4Nm (76kgfcm)
	Replaceable head	230HCK4	KANON (Nakamura Mfg. Co., Ltd.)	Wrench (without ball end) for M5 hex socket head bolt; insert 110mm
B	Torque screwdriver	N30LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M3 hex socket head bolt Tightening torque: 2.0Nm (20kgfcm)
	Driver bit	B35, opposite side 2.5×75	Vessel Co., Inc.	Attachment hexagonal width across flat: 6.35mm Overall length: 75mm Hexagonal width across flat at tip: 2.5mm
C	Torque screwdriver	N12LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M3 set screw Tightening torque: 0.7Nm (7kgfcm)
	Driver bit	3C1507	NAC (Nagahori Industry Co., Ltd.)	Attachment hexagonal width across flat: 6.35mm Overall length: 70mm Hexagonal width across flat at tip: 1.5mm
D	Torque screwdriver	N12LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M3 Phillips-head screw Tightening torque: 0.9Nm (9kgfcm)
	Driver bit	B35+2×50	Vessel Co., Inc.	Attachment hexagonal width across flat: 6.35mm Overall length: 50mm Bit number: #2

• **R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000**

	Name	Part No.	Manufacturer	Remarks
A	Torque wrench	N230SPCK	KANON (Nakamura Mfg. Co., Ltd.)	For M6 hex socket head bolt Tightening torque: 15.2Nm (156kgfcm)
	Replaceable head	230HCK5	KANON (Nakamura Mfg. Co., Ltd.)	Wrench (without ball end) for M6 hex socket head bolt; insert 100mm
B	Torque screwdriver	N50LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M4 hex socket head bolt Tightening torque: 4.0Nm (41kgfcm)
	Driver bit	3C3007	NAC (Nagahori Industry Co., Ltd.)	Attachment hexagonal width across flat: 6.35mm Overall length: 70mm Hexagonal width across flat at tip: 3mm
C	Torque screwdriver	N20LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M4 set screw Tightening torque: 1.7Nm (17kgfcm)
	Driver bit	3C2010	NAC (Nagahori Industry Co., Ltd.)	Attachment hexagonal width across flat: 6.35mm Overall length: 100mm Hexagonal width across flat at tip: 2mm
D	Torque screwdriver	N20LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M4 Phillips-head screw Tightening torque: 1.6Nm (16kgfcm)
	Driver bit	+2×50	Vessel Co., Inc.	Attachment hexagonal width across flat: 6.35mm Overall length: 50mm Bit number: #2

■ **Other tools**

Name	Part No.	Manufacturer	Remarks
Harmonic grease	4B No.2	Harmonic Drive Systems	Do not use grease if it was purchased 4 or more years ago. The grease has probably deteriorated.
Cleaning wipe			
Phillips screwdriver			
Hex wrench set			
"Screw Lock" LOCTITE	Loctite 262	Henkel	High strength type (red)

2) Turn off the controller.
3) Place a sign indicating that the robot is being inspected, to keep others from operating the controller switch.
4) Enter the safeguard enclosure.
5) Remove the cover (see Fig. 5-16).
6) Unplug the connectors on the Y-axis motor power wire YM and resolver wire YP in the Y-axis arm. Also disconnect the Y-axis motor ring-tongue terminal.
7) Remove the bolts securing the Y-axis motor and slowly pull out the Y-axis motor while turning the Y-axis joint.
   The bolts must be replaced with new ones later on.
   Also remove the O-ring to replace it with a new one later on (see Fig. 5-17).
8) Remove the wave generator from the motor shaft.
   The wave generator is secured with a set screw (1 piece) and key (see Fig. 5-18).

⚠ WARNING

WHEN YOU REMOVE THE Y-AXIS ARM INSTALLATION BOLTS IN THE NEXT STEP, THE Y-AXIS ARM MAY COME OFF CAUSING A HAZARDOUS SITUATION. BE ESPECIALLY CAREFUL TO KEEP THE ARM FROM FALLING WHEN A HEAVY TOOL IS ATTACHED TO THE ARM TIP (SEE FIG. 5-19).

9) Before removing the Y-axis arm, reattach the cover so that the harness wires are not pulled.
   Remove the bolts securing the Y-axis arm bolts.
10) Remove the Y-axis arm and place it where it will not obstruct the work.
   The O-ring in the harmonic drive must be replaced with a new one later on.
   The O-ring might adhere to the under surface of the Y-axis arm, so be sure to remove it.
11) Remove the bolts securing the Y-axis harmonic drive and also remove the panhead bolt along with the nut (see Fig. 5-20).
12) Remove the Y-axis harmonic drive from the X-axis arm.
   Also remove the O-ring to replace it with a new one later on.

13) Wipe away old grease and wear particles on the motor, X-axis arm, and Y-axis arm.
If foreign objects or debris get caught during reassembly, the harmonic drive may cause abnormal noise or may be damaged.
Apply harmonic grease 4B No.2 to the wave generator and the inner wall of the harmonic drive.
Degrease the mating surface on the underside of the harmonic drive (Fig. 5-21).

⚠ CAUTION

APPLY THE SPECIFIED AMOUNT OF HARMONIC GREASE TO EACH PART OF THE HARMONIC DRIVE. AN INSUFFICIENT AMOUNT OF GREASE MAY SHORTEN THE SERVICE LIFE OF THE DRIVE PARTS, AND AN EXCESSIVE AMOUNT MAY CAUSE GREASE TO LEAK.

14) Degrease the X-axis arm mating surface where the harmonic drive is to be installed.
Fit the new O-ring into the O-ring groove in the X-axis arm (Fig. 5-22).

⚠ CAUTION

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A PROBLEM WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

15) Place the new harmonic drive on the X-axis arm and secure it with the new bolts as described below.
Apply harmonic grease 4B No.2 to the tip of each bolt so that the roots of at least the first 4 threads are filled with grease (see Fig. 5-23). Grease applied to the bolt tip is to stabilize the bolt axial force.
Return the panhead bolt and nut to the original position. Do not apply grease to the panhead bolt. Doing so may cause the panhead bolt to loosen.

Then tighten the bolts and panhead bolt in the following order (see Fig. 5-24).

1. Using the wrench, manually tighten all bolts in the order indicated by circled numbers in Fig. 5-24.
2. Using the torque screwdriver, tighten all bolts to about 50% of the specified torque in the order indicated by circled numbers in Fig. 5-24.
3. Tighten each bolt up to the specified torque in the order indicated by circled numbers in Fig. 5-24.
4. Finally check that each bolt is tightened to the specified torque.

16) Degrease the mating surface on top of the harmonic drive.
Fit the new O-ring (supplied with new harmonic drive) into the O-ring groove of the harmonic drive.
If it is difficult to fit the O-ring into the groove, slightly stretch the O-ring.
You may apply a small amount of harmonic drive grease to the O-ring in order to prevent the O-ring from coming off the groove (see Fig. 5-25).

⚠ CAUTION

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A PROBLEM WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

17) Degrease the Y-axis arm side where the harmonic drive is to be installed.
Place the Y-axis arm onto the harmonic drive, aligning the counterboring in the harmonic drive with the tapped hole in the Y-axis arm so that the harmonic drive's phase is matched with the Y-axis arm (see Fig. 5-26). At this point, keep the Y-axis arm level with two people so as not to apply a moment load to the Y-axis harmonic drive. One person supports the end of the Y-axis arm and the other person secures the Y-axis arm in place.

⚠ CAUTION

TIGHTENING THE BOLTS WHILE A MOMENT LOAD IS APPLIED TO THE HARMONIC DRIVE MAY DAMAGE THE HARMONIC DRIVE. PERFORM THE WORK SO AS NOT TO APPLY A MOMENT LOAD TO THE HARMONIC DRIVE.

Apply harmonic grease 4B No.2 to the tip of each bolt so that the roots of at least the first 4 threads are filled with grease (see Fig. 5-23).
Then tighten the bolts in the following order (see Fig. 5-27).

1. Using the wrench, manually tighten all bolts in the order indicated by circled numbers in Fig. 5-27.
2. Using the torque wrench, tighten all bolts to about 50% of the specified torque in the order indicated by circled numbers in Fig. 5-27.
3. Tighten each bolt up to the specified torque in the order indicated by circled numbers in Fig. 27.
4. Finally check that each bolt is tightened to the specified torque.

18) On the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000, fit the washer and the wave generator onto the motor shaft while paying attention to the orientation, and fully insert the wave generator until it contacts the stepped surface of the motor shaft. Then tighten the set screw (1 piece) to secure the wave generator to the motor shaft (see Fig. 5-28). At this point, apply a small amount of Screw Lock to the set screw.
Also apply harmonic grease to a thickness of 3mm on the underside of the mating section of the motor.

⚠ CAUTION

IF IT IS DIFFICULT TO FIT THE WAVE GENERATOR ONTO THE MOTOR SHAFT BY PUSHING BY HAND, DO NOT FORCEFULLY PUSH IN. GRIND THE KEY OR MOTOR SHAFT WITH SANDPAPER OR SIMILAR TOOL TO MAKE IT EASIER TO FIT THE WAVE GENERATOR ONTO THE MOTOR SHAFT.
APPLY THE SPECIFIED AMOUNT OF HARMONIC GREASE TO EACH PART OF THE HARMONIC DRIVE. AN INSUFFICIENT AMOUNT OF GREASE MAY SHORTEN THE SERVICE LIFE OF THE DRIVE PARTS, AND AN EXCESSIVE AMOUNT MAY CAUSE GREASE TO LEAK.

19) With the cover opened, pass the cable wires to the Y-axis arm side (Fig. 5-29).
Fit the new O-ring to the mating section of the motor (or the mating section in the Y-axis arm for the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000). Then gently install the motor into the Y-axis arm while turning the Y-axis joint, and tighten the bolts to temporarily secure the motor to the Y-axis arm.

⚠ CAUTION

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A PROBLEM WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

20) Uniformly tighten the four bolts temporarily fastened in the previous step while turning the Y-axis joint. If any jamming or catching is felt at this time, then reassemble from the beginning.

21) Reattach the connectors on the Y-axis motor power wire YM and resolver wire YP. Also reattach the Y-axis motor ring-tongue terminal.

22) Reattach the cover (see Fig. 5-30).

23) Go out of the safeguard enclosure.

24) Check that no one is inside the safeguard enclosure, and then turn on the controller.

⚠ CAUTION

AFTER THE HARMONIC DRIVE IS REPLACED, AN ABSOLUTE RESET MUST BE PERFORMED, AND THE POINT DATA MUST BE SET AGAIN.

Fig. 5-16

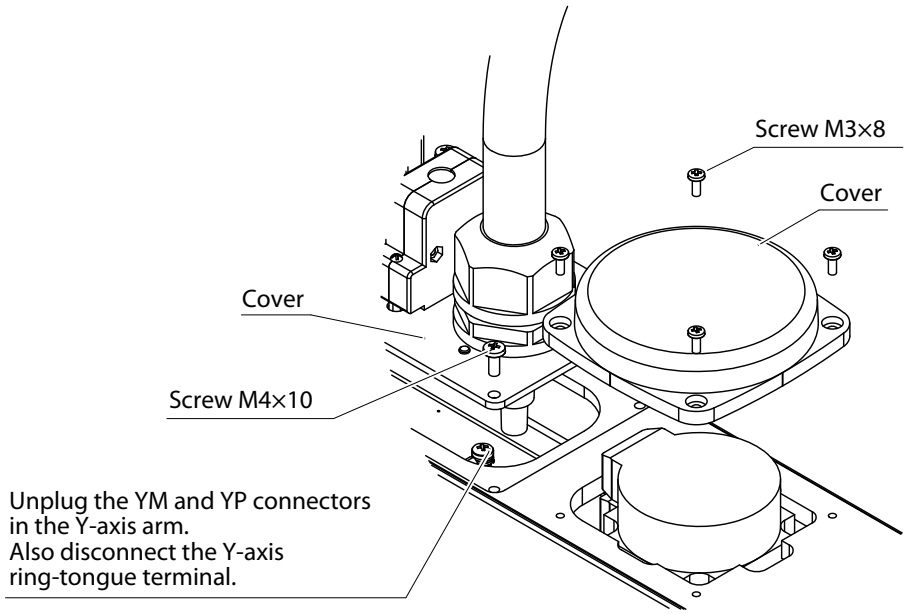
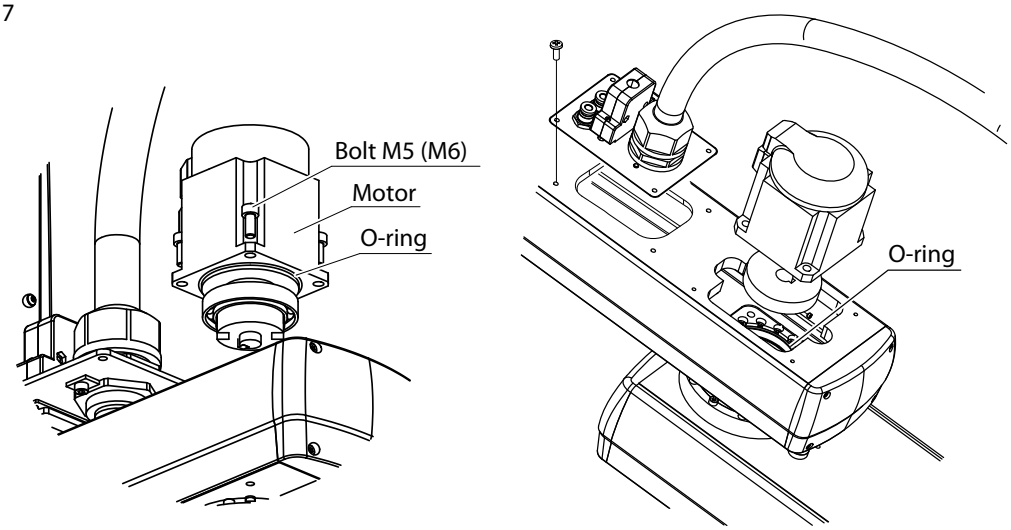
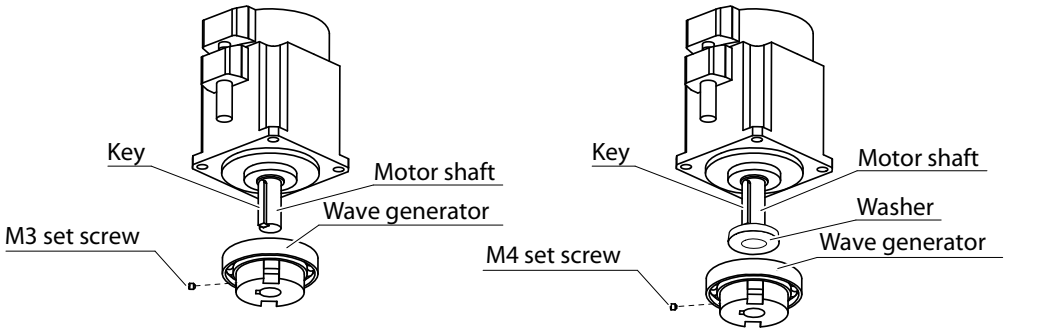


Fig. 5-17



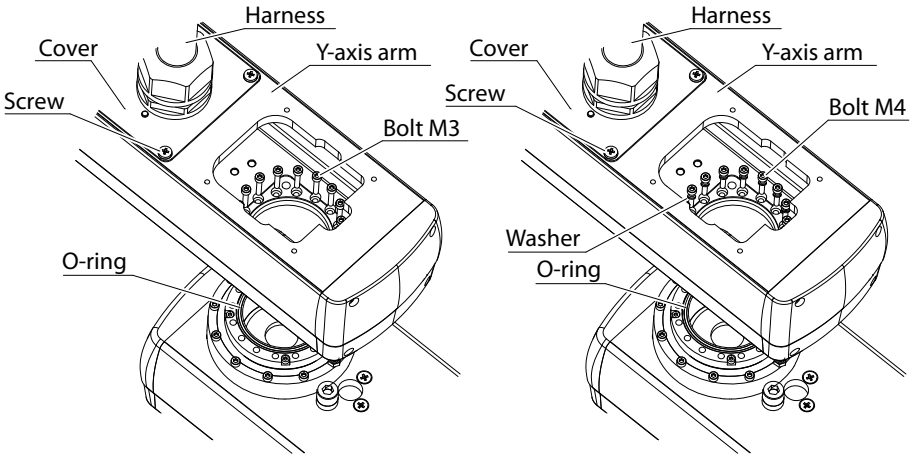
* Values in parentheses apply to the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000.

Fig. 5-18



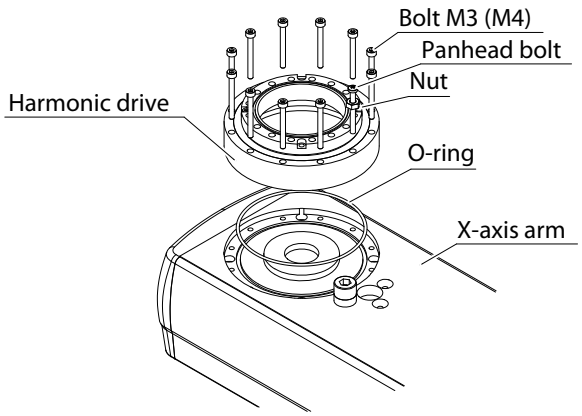
R6YXG500, R6YXG600 R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

Fig. 5-19



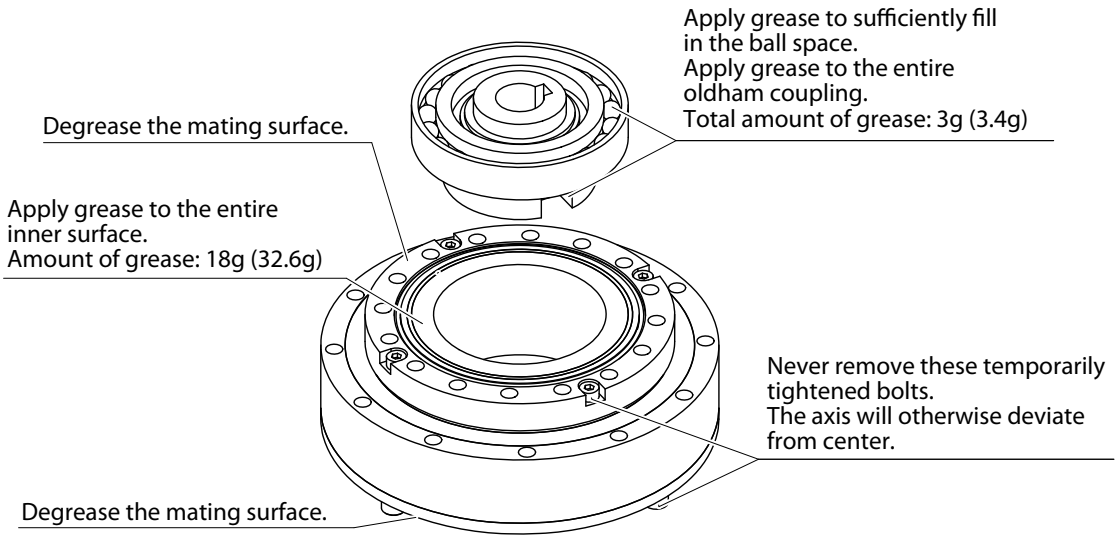
R6YXG500, R6YXG600 R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

Fig. 5-20



* Values in parentheses apply to the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000.

Fig. 5-21



* Values in parentheses apply to the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000.

Fig. 5-22

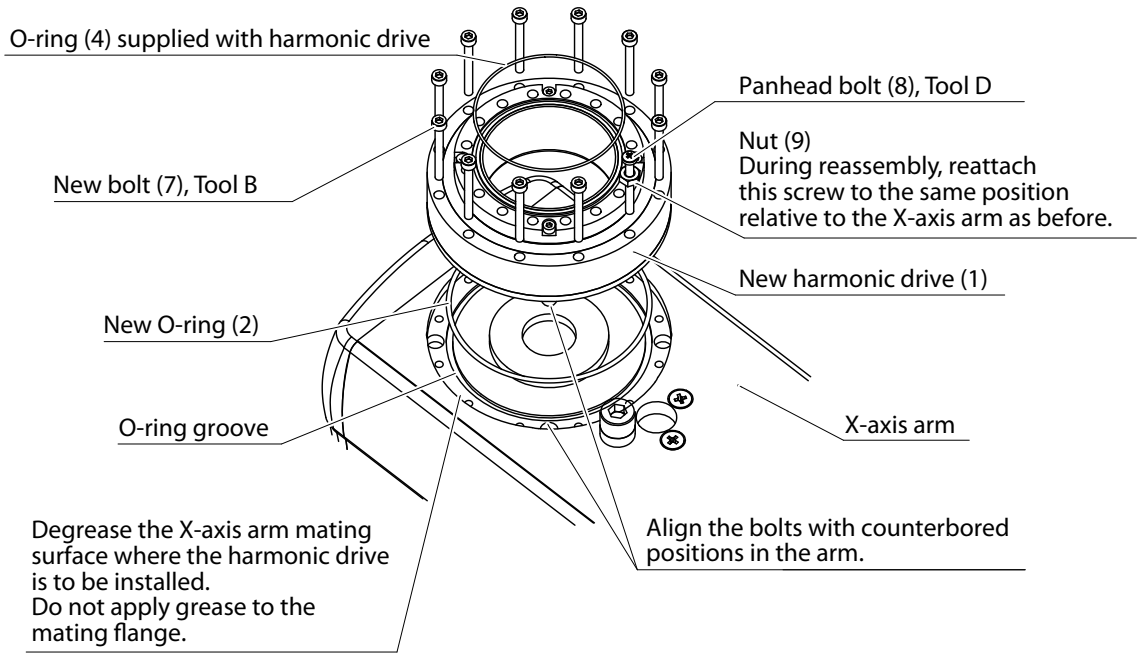


Fig. 5-23

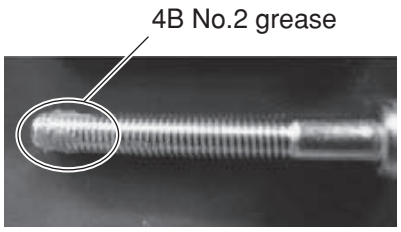


Fig. 5-24

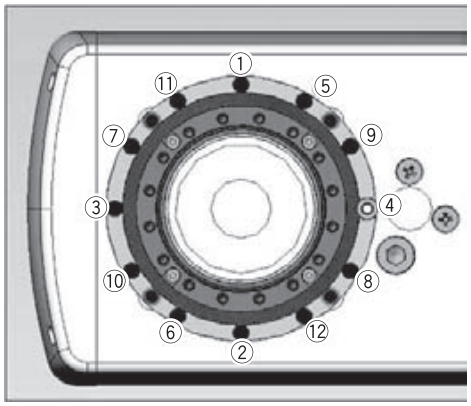
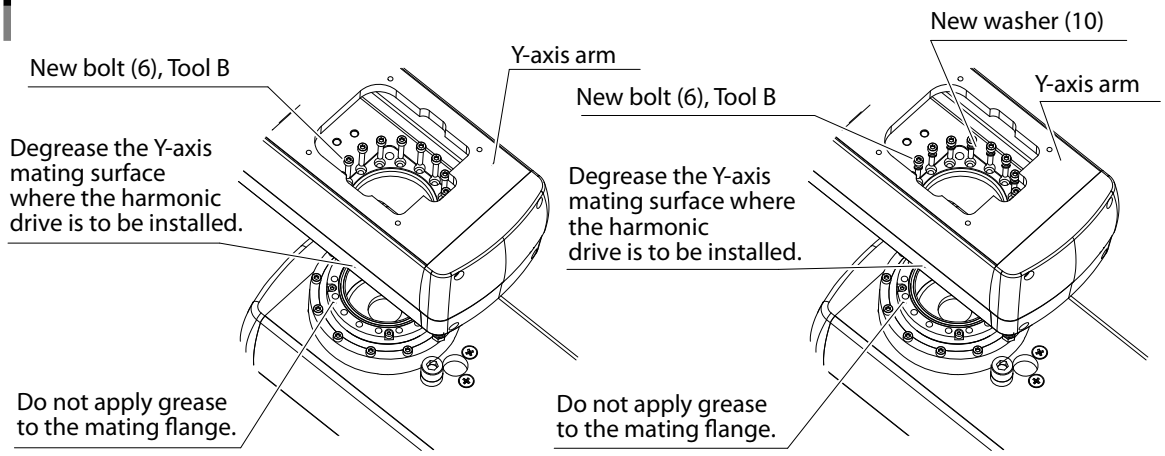


Fig. 5-25



R6YXG500, R6YXG600

R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

Fig. 5-26

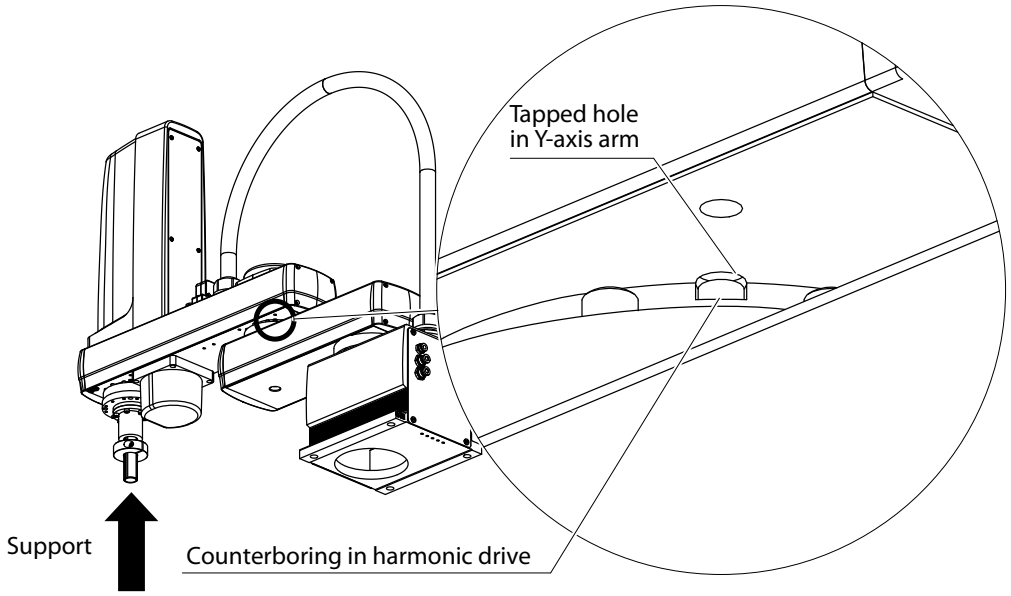


Fig. 5-27

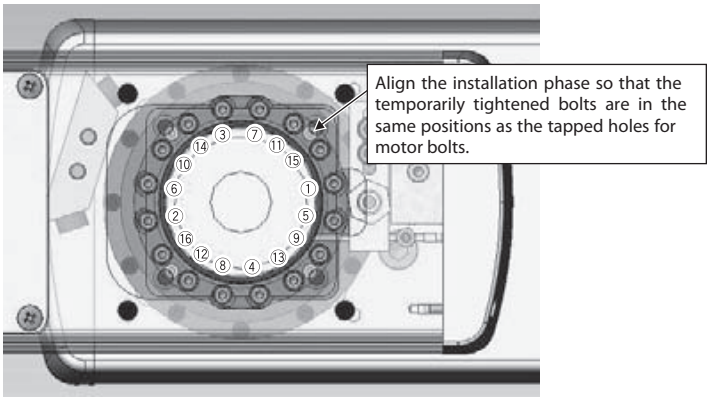


Fig. 5-28

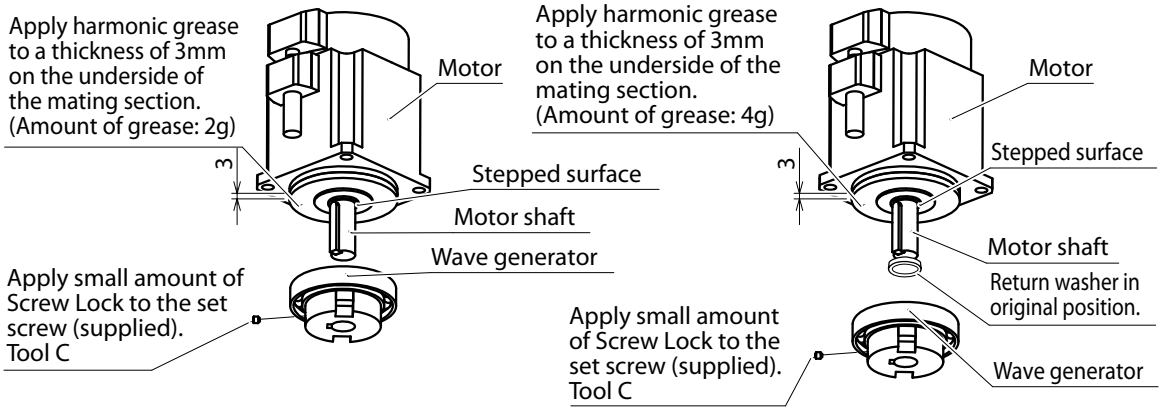
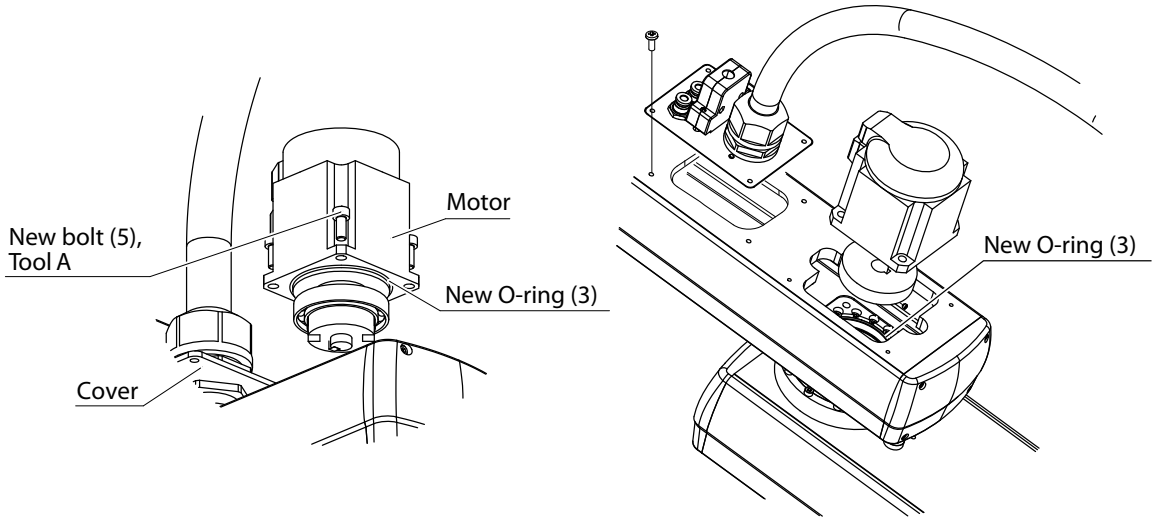
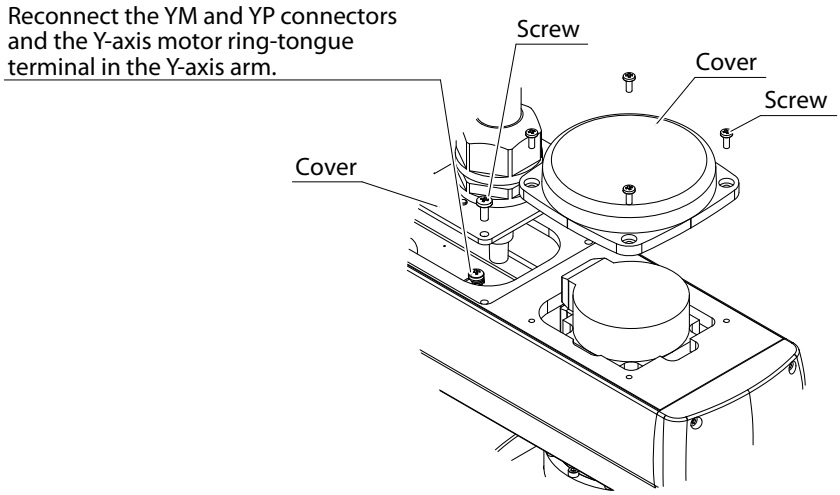


Fig. 5-29



R6YXG500, R6YXG600 R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

Fig. 5-30



5-2-1-3 R-axis

1) Prepare the parts and tools required for replacement work.

■ Replacement parts

• R6YXG500, R6YXG600

	Part Name	OMRON Part No.	Part No. / Specs	Qty	Remarks
(1)	Harmonic drive	KBF-M1821-100	SHG-17-30	1	
(2)	O-ring	KN4-M1896-000	Cross section diameter: 1.78mm Inner diameter: 63.22mm	1	Becomes worn and must be replaced
(3)	O-ring	90990-17J016	Cross section diameter: 0.80mm Inner diameter: 45.40mm	1	Supplied with harmonic drive
(4)	O-ring	90990-17J031	Cross section diameter: 1.00mm Inner diameter: 35.30mm	1	Becomes worn and must be replaced
(5)	O-ring	90990-17J032	Cross section diameter: 1.00mm Inner diameter: 46.00mm	1	Becomes worn and must be replaced
(6)	O-ring	90990-17J034	Cross section diameter: 0.60mm Inner diameter: 22.20mm	1	Becomes worn and must be replaced
(7)	Motor mounting bolt	KBF-M259A-000	M5, length: 12, black	4	Must be replaced when robot reference number is prior to KC368
		91312-05014	M5, length: 14, white	4	Spare parts for robots with a reference number of KC368 or later
(8)	Harmonic drive mounting bolt	91312-03014	M3, length: 14, white	16	Must be replaced
(9)	Harmonic drive mounting bolt	91312-03025	M3, length: 25, white	11	Must be replaced
(10)	Panhead bolt for dog	98502-03030	M3, length: 30, white	1	Spare parts
(11)	Nut for dog	95302-04600	M4, white	1	Spare parts

• R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

	Part Name	OMRON Part No.	Part No. / Specs	Qty	Remarks
(1)	Harmonic drive	KBP-M1821-100	SHG-20-50	1	
(2)	O-ring	KN3-M2159-000	S71 (JIS)	1	Becomes worn and must be replaced
(3)	O-ring	KN3-M2144-000	Cross section diameter: 0.99mm Inner diameter: 53.28mm	1	Supplied with harmonic drive
(4)	O-ring	90990-17J036	Cross section diameter: 1.00mm Inner diameter: 43.00mm	1	Becomes worn and must be replaced
(5)	O-ring	90990-17J038	Cross section diameter: 1.30mm Inner diameter: 53.00mm	1	Becomes worn and must be replaced
(6)	O-ring	90990-17J037	Cross section diameter: 0.50mm Inner diameter: 28.00mm	1	Becomes worn and must be replaced
(7)	End face seal	KBP-M1886-000	V-28A (N+C)	1	
(8)	Motor mounting bolt	KBP-M259A-000	M6, length: 16, black	4	Must be replaced when robot reference number is prior to KC172
		91312-06016	M6, length: 16, white	4	Spare parts for robots with a reference number of KC172 or later
(9)	Harmonic drive mounting bolt	91312-03016	M3, length: 16, white	16	Must be replaced
(10)	Harmonic drive mounting bolt	91312-03025	M3, length: 25, white	11	Must be replaced
(11)	Bolt for dog	91312-03030	M3, length: 30, white	1	Spare parts

■ Torque wrench, etc. (Use accurately calibrated torque screwdrivers and torque wrenches.)

• R6YXG500, R6YXG600

	Name	Part No.	Manufacturer	Remarks
A	Torque wrench	N120CPCK	KANON (Nakamura Mfg. Co., Ltd.)	For M5 hex socket head bolt Tightening torque: 7.4Nm (76kgfcm)
	Replaceable head	230HCK4	KANON (Nakamura Mfg. Co., Ltd.)	Wrench (without ball end) for M5 hex socket head bolt; insert 110mm
B	Torque screwdriver	N30LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M3 hex socket head bolt Tightening torque: 2.0Nm (20kgfcm)
	Driver bit	B35, opposite side 2.5×75	Vessel Co., Inc.	Attachment hexagonal width across flat: 6.35mm Overall length: 75mm Hexagonal width across flat at tip: 2.5mm
C	Torque screwdriver	N20LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M4 set screw Tightening torque: 0.7Nm (7.1kgfcm)
	Driver bit	3C2010	NAC (Nagahori Industry Co., Ltd.)	Attachment hexagonal width across flat: 6.35mm Overall length: 100mm Hexagonal width across flat at tip: 2mm
D	Torque screwdriver	N12LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M3 Phillips-head screw Tightening torque: 0.9Nm (9kgfcm)
	Driver bit	B35+2×50	Vessel Co., Inc.	Attachment hexagonal width across flat: 6.35mm Overall length: 50mm Bit number: #2

• **R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000**

	Name	Part No.	Manufacturer	Remarks
A	Torque wrench	N230SPCK	KANON (Nakamura Mfg. Co., Ltd.)	For M6 hex socket head bolt Tightening torque: 15.2Nm (156kgfcm)
	Replaceable head	230HCK5	KANON (Nakamura Mfg. Co., Ltd.)	Wrench (without ball end) for M6 hex socket head bolt; insert 100mm
B	Torque screwdriver	N30LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M3 hex socket head bolt Tightening torque: 2.0Nm (20kgfcm)
	Driver bit	B35, opposite side 2.5×75	Vessel Co., Inc.	Attachment hexagonal width across flat: 6.35mm Overall length: 75mm Hexagonal width across flat at tip: 2.5mm
C	Torque screwdriver	N12LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M4 set screw Tightening torque: 0.8Nm (8.1kgfcm)
	Driver bit	3C2010	NAC (Nagahori Industry Co., Ltd.)	Attachment hexagonal width across flat: 6.35mm Overall length: 100mm Hexagonal width across flat at tip: 2mm

■ **Other tools**

Name	Part No.	Manufacturer	Remarks
Harmonic grease	4B No.2	Harmonic Drive Systems	Do not use grease if it was purchased 4 or more years ago. The grease has probably deteriorated.
Cleaning wipe			
Phillips screwdriver			
Hex wrench set			
Hook spanner/wrench			
“Screw Lock” LOCTITE	Loctite 262	Henkel	High strength type (red)

2) Turn off the controller.
3) Place a sign indicating that the robot is being inspected, to keep others from operating the controller switch.
4) Enter the safeguard enclosure.
5) Remove the cover (see Fig. 5-31).
   Unplug the connectors on the R-axis motor power wire RM and resolver wire RP in the Y-axis arm. Also disconnect the R-axis motor ring-tongue terminal.

⚠ WARNING

THE Z-AXIS WILL SLIDE DOWN WHEN THE BEARING MOUNTING BOLTS ARE REMOVED IN THE NEXT STEP, CAUSING A HAZARDOUS SITUATION. PROP THE Z-AXIS WITH A SUPPORT STAND BEFORE LOOSENING THESE BOLTS (SEE FIG. 5-32).

6) Remove the bolts securing the bearing to the upper end of the spline and remove the spline and bearing from the holder (see Fig. 5-32).
7) Fit the spanner or wrench to the flat surfaces at the bottom of the bearing to grip it, and loosen and remove the U-nut on top of the spline with the hook spanner. Then remove the bearing and bearing mount plate (see Fig. 5-33).
   At this point, be careful to keep the spline shaft from coming off the spline nut.

8) Remove the bolts securing the spline nut and remove the spline nut (see Fig. 5-34).

⚠ CAUTION

AN O-RING IS FITTED TO THE SHAFT. REPLACE THIS O-RING WITH A NEW ONE. DO NOT REMOVE THE V-RING AND SLEEVE (SEE FIG. 5-34).

9) Remove the bolts securing the R-axis motor and pull out the R-axis motor while turning the R-axis (see Fig. 5-35).

⚠ CAUTION

AN O-RING IS PLACED BETWEEN THE R-AXIS MOTOR FLANGE AND THE Y-AXIS ARM. REPLACE THIS O-RING WITH A NEW ONE (SEE FIG. 5-35).

10) Loosen the two set screws for the wave generator.
Pull the wave generator out of the R-axis motor shaft (see Fig. 5-39).

⚠ CAUTION

AN O-RING IS PLACED BETWEEN THE R-AXIS MOTOR SHAFT AND THE WAVE GENERATOR. REPLACE THIS O-RING WITH A NEW ONE (SEE FIG. 5-39).

11) Remove the bolts securing the harmonic drive and remove the harmonic drive (see Fig. 5-36).

⚠ CAUTION

AN O-RING IS FITTED TO THE HARMONIC DRIVE. REPLACE THIS O-RING WITH A NEW ONE (SEE FIG. 5-36).

12) Remove the shaft mounting bolts from the harmonic drive and also remove the panhead bolt along with the nut. Then remove the shaft (see Fig. 5-37).
On the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000, remove the dog and bolt (see Fig. 5-38).

⚠ CAUTION

AN O-RING IS PLACED BETWEEN THE HARMONIC DRIVE AND THE SHAFT. REPLACE THIS O-RING WITH A NEW ONE (SEE FIG. 5-37 AND FIG. 5-38).

13) Apply harmonic grease to the new wave generator. See Fig. 5-40 for applying grease properly.

14) Fit the O-ring (6) to the inner side of the new wave generator. Insert the wave generator into the inner end of the R-axis motor shaft and secure it with the two set screws (see Fig. 5-41) while pressing the wave generator with a load of about 1kg.
The wave generator deflection must satisfy the values shown in Fig. 5-41. Also make sure that the O-ring is properly fitted.

15) Apply harmonic grease to the flexspline. See Fig. 5-40 for applying grease properly.
Degrease the mating surfaces on top and bottom of the harmonic drive.

16) Degrease the mating surface of the shaft where the harmonic drive is to be installed. Fit the new O-ring (2) coated with harmonic grease into the groove in the shaft. Then secure the harmonic drive to the shaft with the new bolts as described below. Return the panhead bolt and nut (bolt and dog for the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000) to the original position. It is not necessary to apply grease to the R-axis bolts.

Then tighten the bolts and panhead bolt in the following order (see Fig. 5-44).

1. Using the wrench, manually tighten all bolts in the order indicated by circled numbers in Fig. 5-44.
2. Using the torque wrench, tighten all bolts to about 50% of the specified torque in the order indicated by circled numbers in Fig. 5-44.
3. Tighten each bolt up to the specified torque in the order indicated by circled numbers in Fig. 5-44.
4. Finally check that each bolt is tightened to the specified torque.

⚠ CAUTION

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A PROBLEM WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

17) Fit the O-ring (3) coated with a small amount of harmonic grease into the O-ring groove of the new harmonic drive (see Fig. 5-45). Degrease the Y-axis arm mating surface where the harmonic drive is to be installed. If it is difficult to fit the O-ring into the groove, slightly stretch the O-ring. Secure the harmonic drive to the Y-axis arm by tightening the new bolts from above the Y-axis arm.

Then tighten the bolts in the following order (see Fig. 5-46).

1. Using the wrench, manually tighten all bolts in the order indicated by circled numbers in Fig. 5-46.
2. Using the torque wrench, tighten all bolts to about 50% of the specified torque in the order indicated by circled numbers in Fig. 5-46.
3. Tighten each bolt up to the specified torque in the order indicated by circled numbers in Fig. 5-46.
4. Finally check that each bolt is tightened to the specified torque.

⚠ CAUTION

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A PROBLEM WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

18) Fit the new O-ring (5) coated with harmonic grease into the O-ring groove in the Y-axis arm.
Insert the R-axis motor into the Y-axis arm while turning the R-axis. Then tighten the bolts while turning the R-axis (see Fig. 5-47).

⚠ CAUTION

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A PROBLEM WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

19) Fit the new O-ring (4) coated with harmonic grease into the groove in the bottom of the shaft.
Check that the sleeve and V-ring are fitted in place, and then secure the spline nut to the shaft with the bolt (Fig. 5-48).

⚠ CAUTION

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A PROBLEM WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

20) Insert the bearing mount plate and bearing onto the spline from the top, and tighten the U-nut to secure the bearing. (Utilize the flat surfaces when tightening the U-nut like you did to loosen it.) On the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000, do not forget to insert a spacer (see Fig. 5-49).

21) Insert the spline and bearing through the holder and secure them with the bolts (see Fig. 5-50).

22) Reconnect the R-axis motor power wire RM and resolver wire RP.
Also reconnect the R-axis motor ring-tongue terminal (see Fig. 5-51).

23) Reattach the cover.

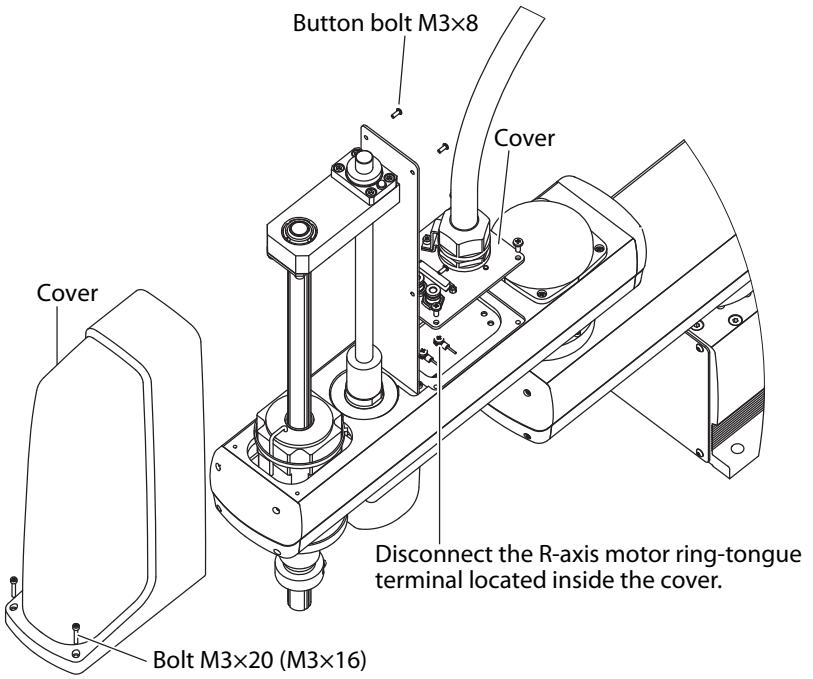
24) Go out of the safeguard enclosure.

25) Check that no one is inside the safeguard enclosure, and then turn on the controller.

⚠ CAUTION

AFTER THE HARMONIC DRIVE IS REPLACED, AN ABSOLUTE RESET MUST BE PERFORMED, AND THE POINT DATA MUST BE SET AGAIN. REFER TO CHAPTER 4 “ADJUSTMENT” TO MAKE ADJUSTMENTS.

Fig. 5-31



* Values in parentheses apply to the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000.

Fig. 5-32

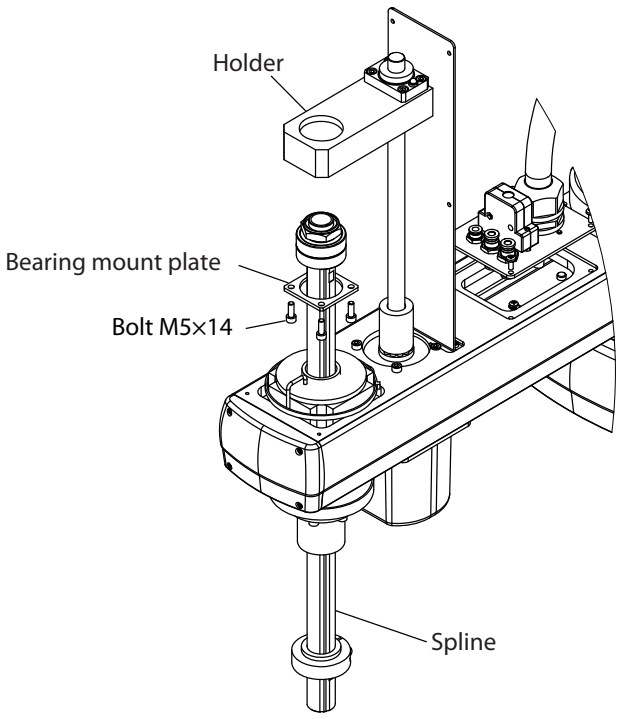
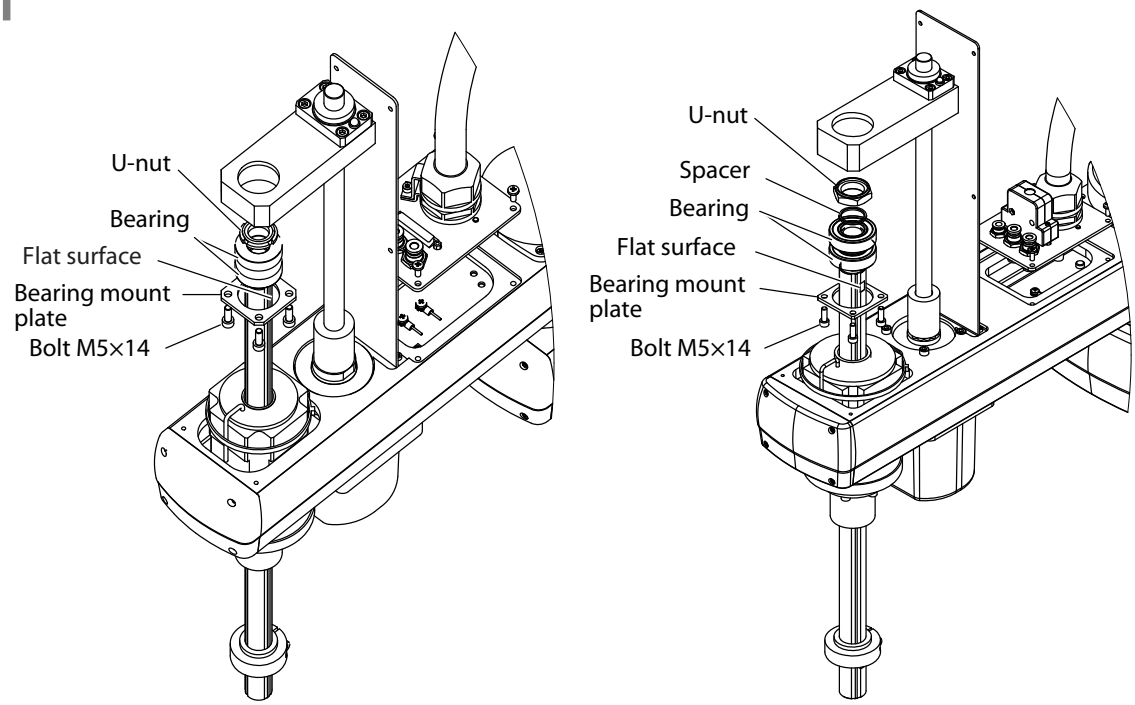


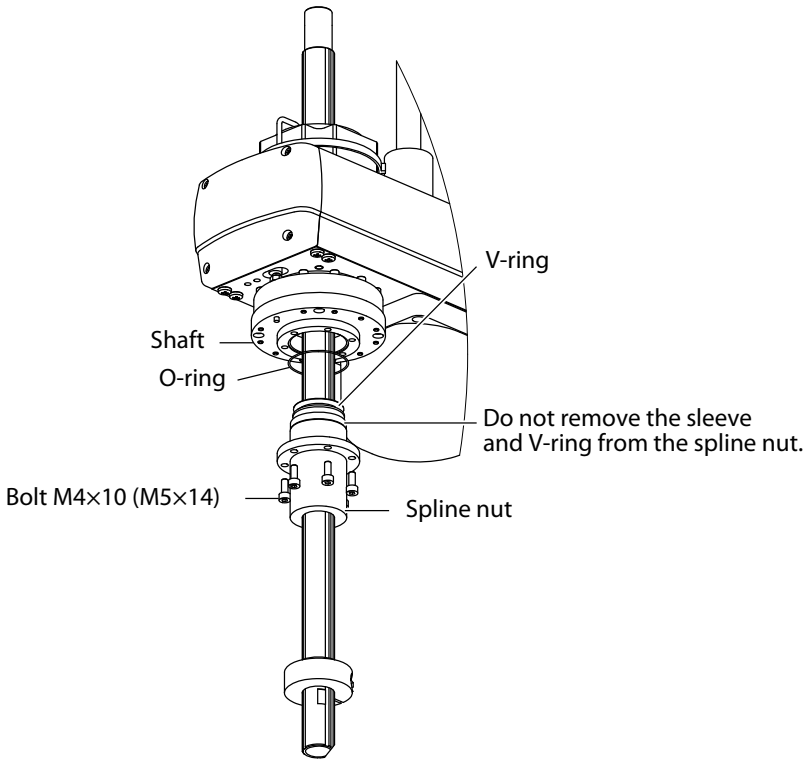
Fig. 5-33



R6YXG500, R6YXG600

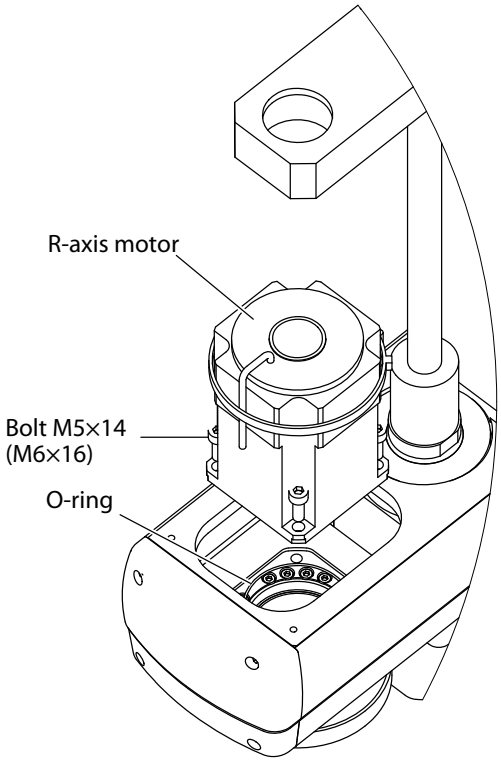
R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

Fig. 5-34



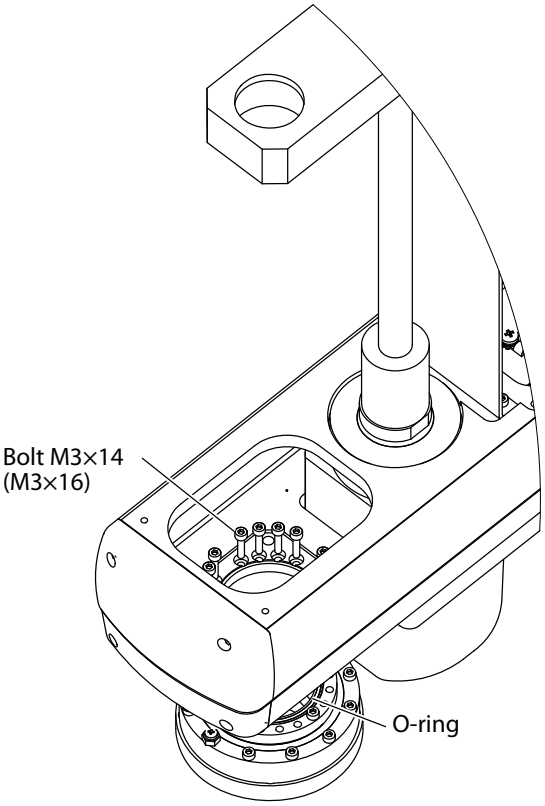
* Values in parentheses apply to the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000.

Fig. 5-35



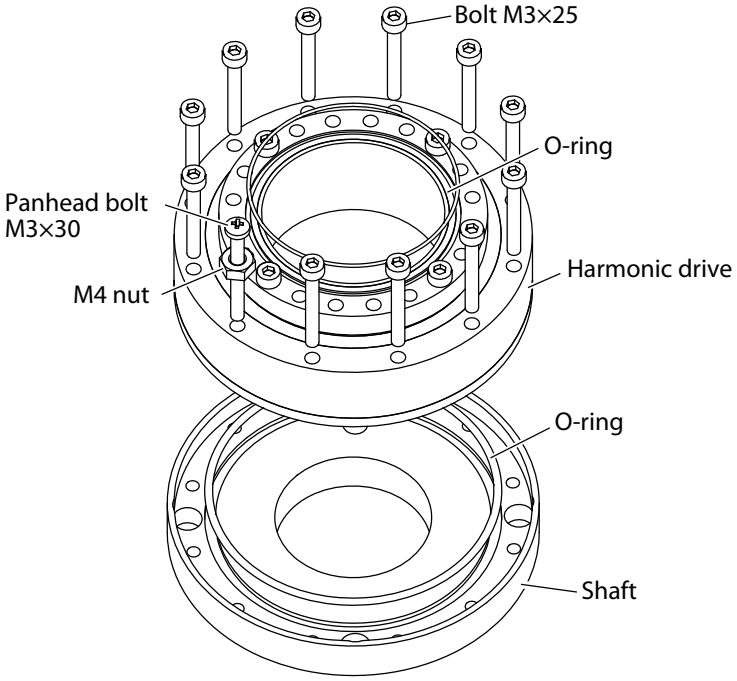
* Values in parentheses apply to the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000.

Fig. 5-36



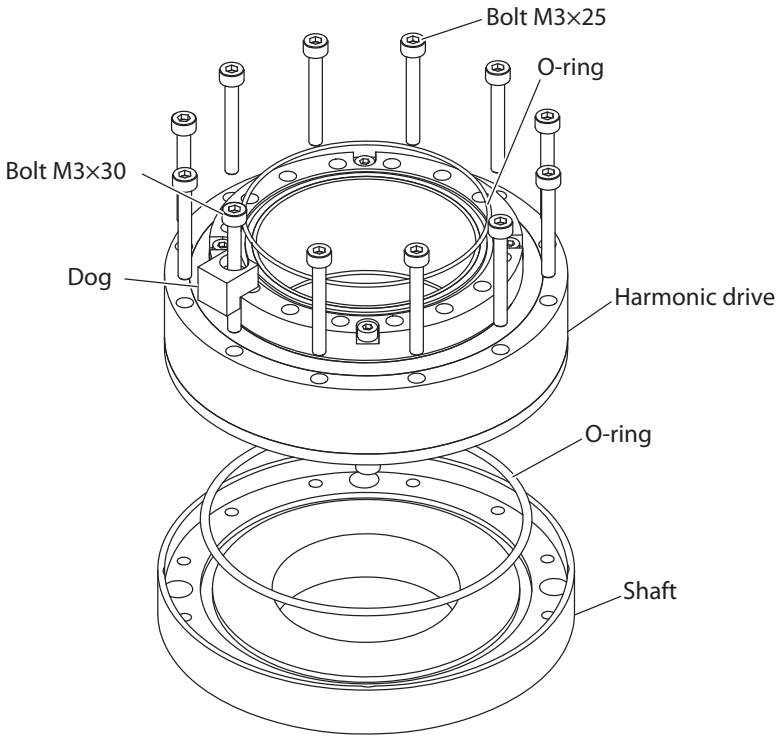
* Values in parentheses apply to the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000.

Fig. 5-37



R6YXG500, R6YXG600

Fig. 5-38



R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

Fig. 5-39

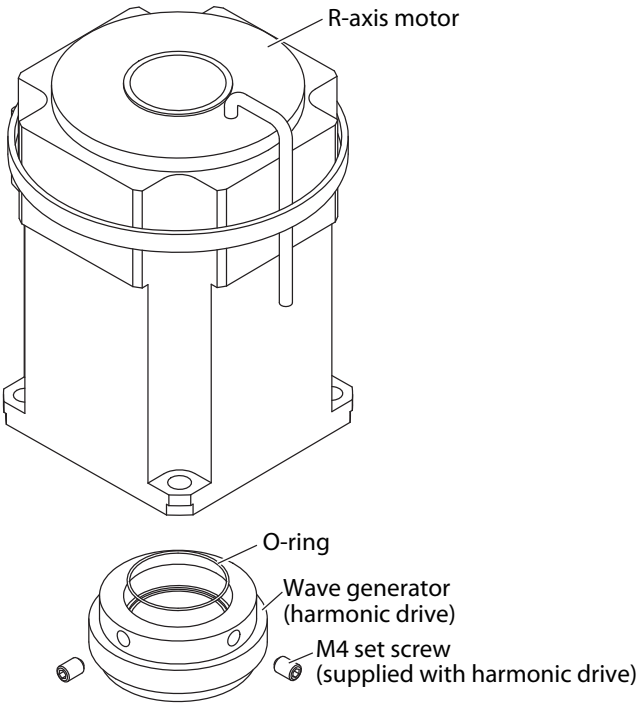
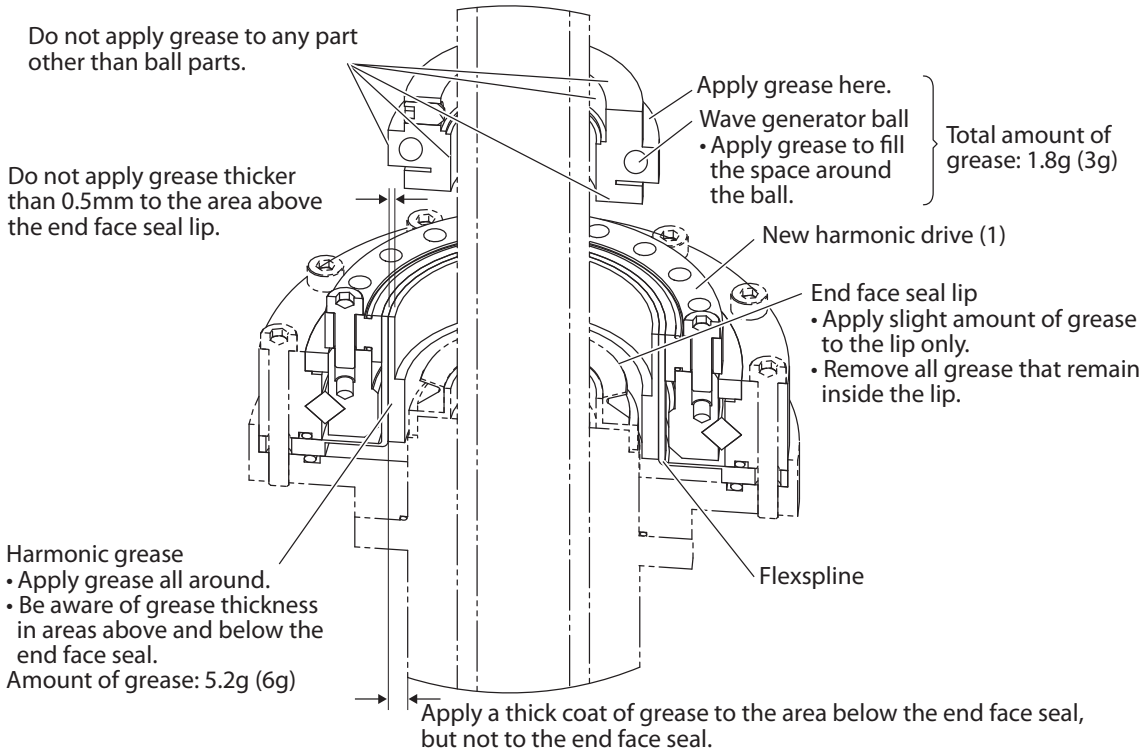


Fig. 5-40



* Values in parentheses apply to the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000.

Fig. 5-41

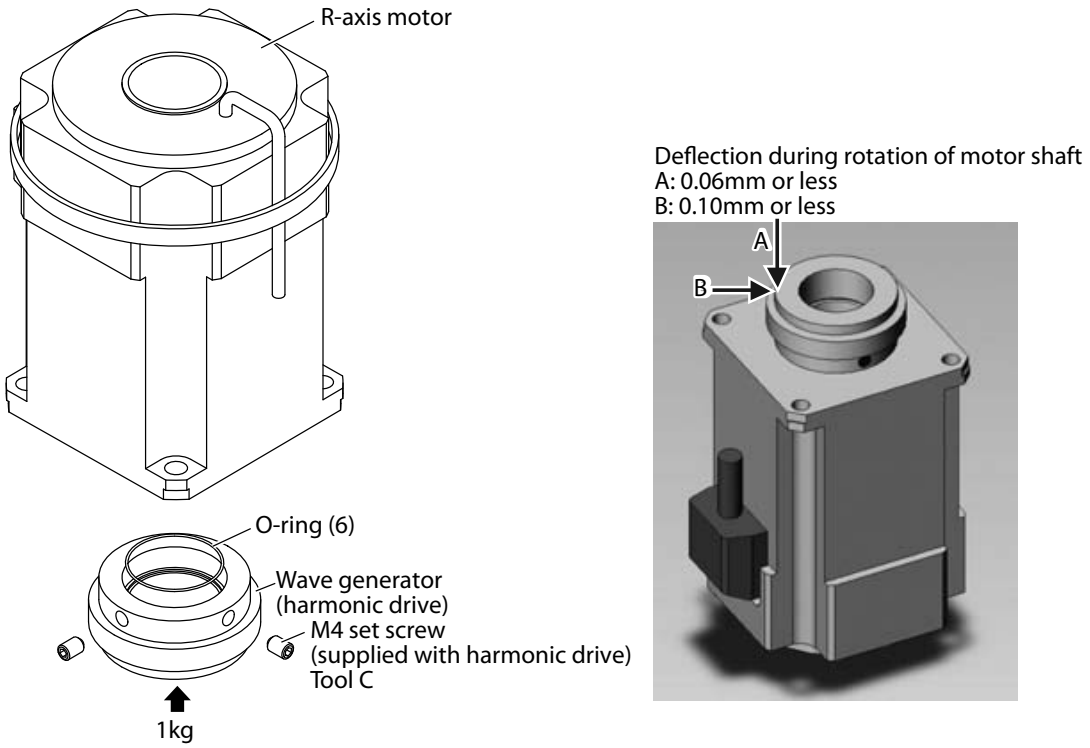


Fig. 5-42

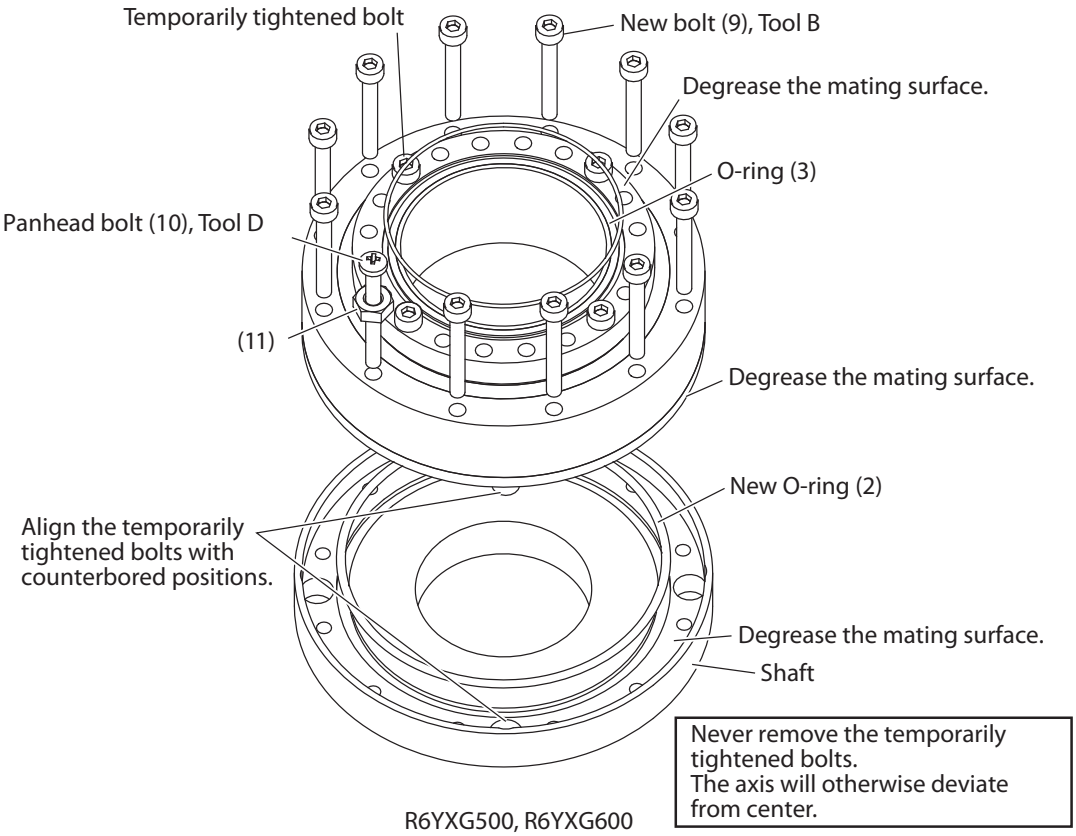
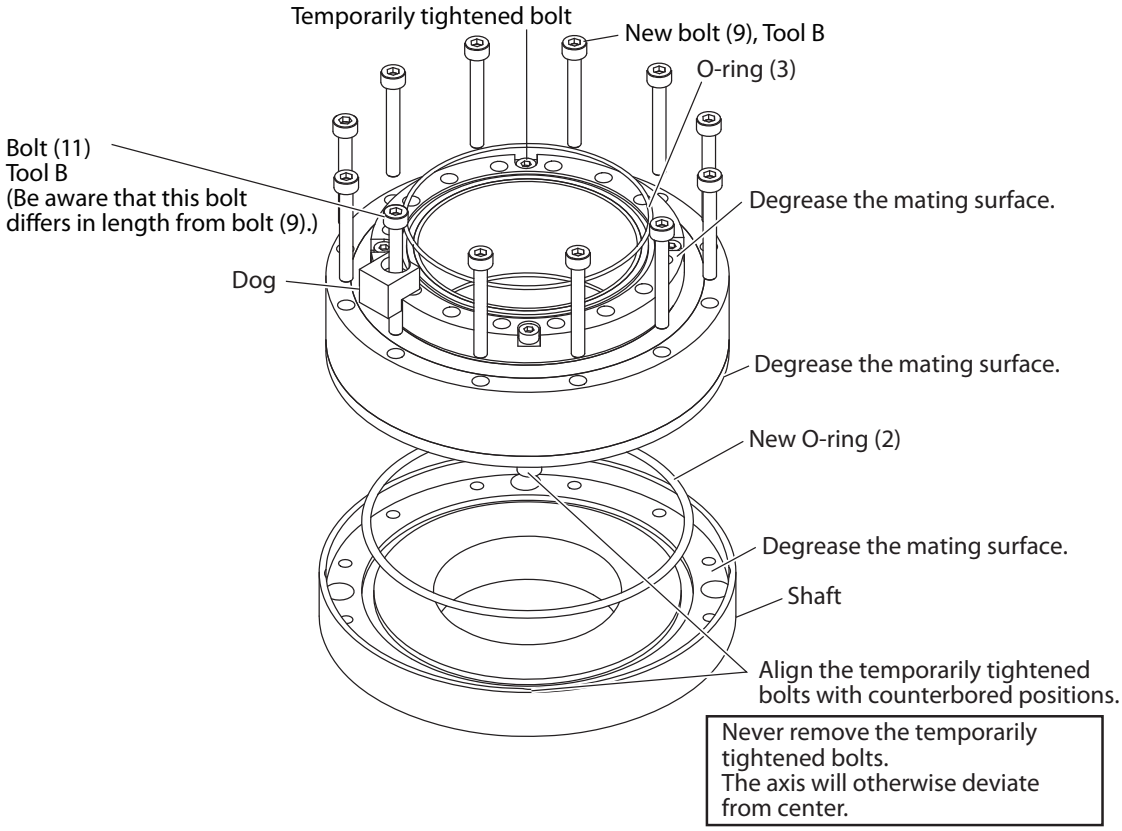
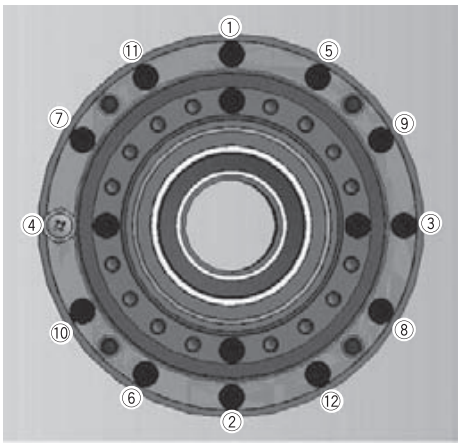


Fig. 5-43

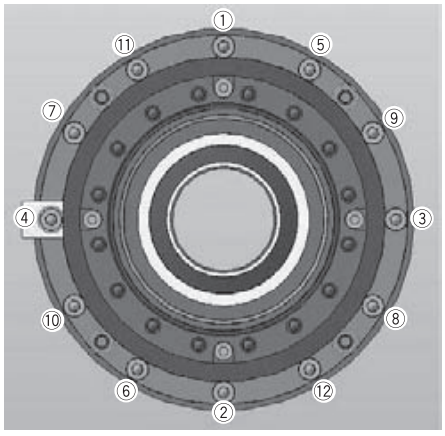


R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

Fig. 5-44

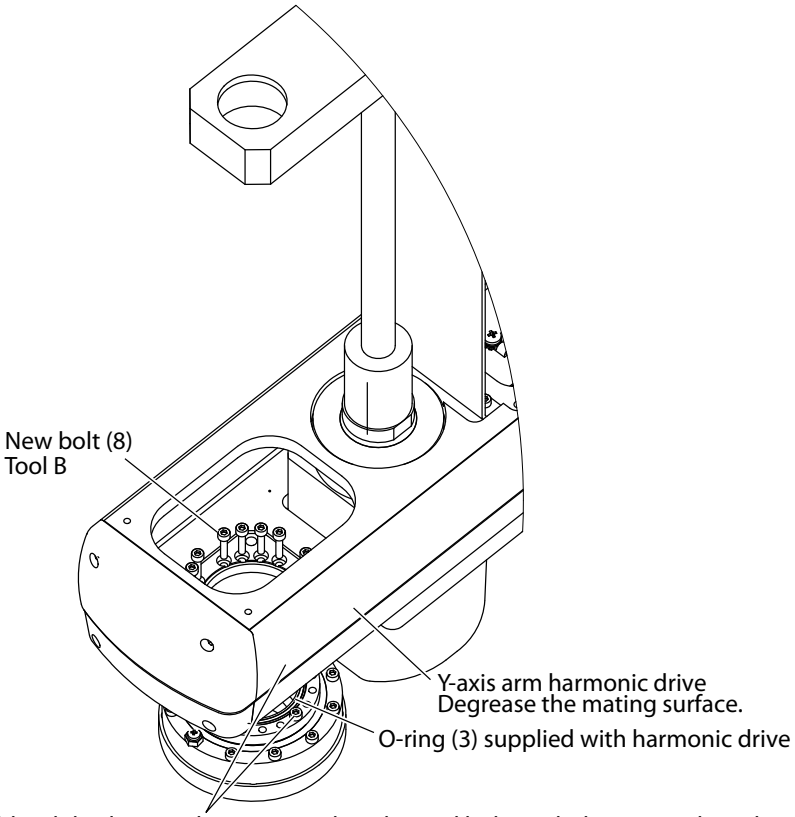


R6YXG500, R6YXG600



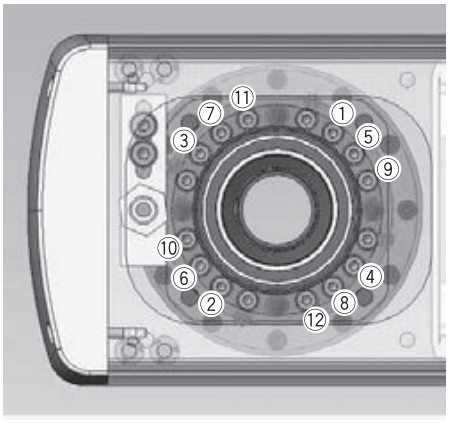
R6YXGH600, R6YXG700, R6YXG800,
R6YXG900, R6YXG1000

Fig. 5-45

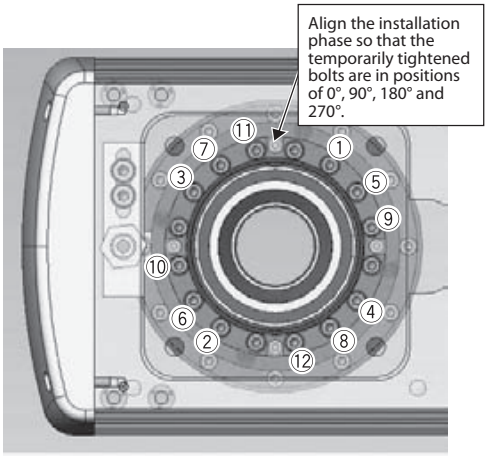


Reassemble while aligning the temporarily tightened bolts with the counterbored positions in the Y-axis arm. (R6YXG500, R6YXG600)
On the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000, align the phase as shown in Fig. 5-46.

Fig. 5-46



R6YXG500, R6YXG600



R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

Fig. 5-47

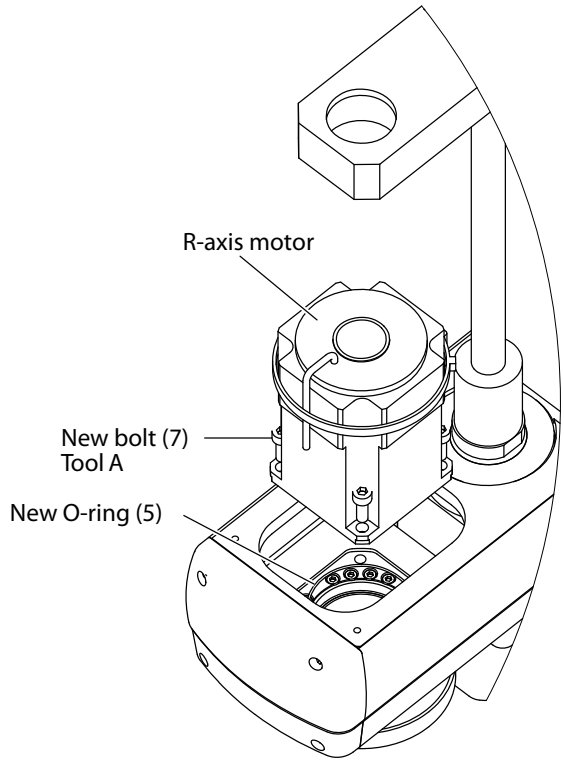


Fig. 5-48

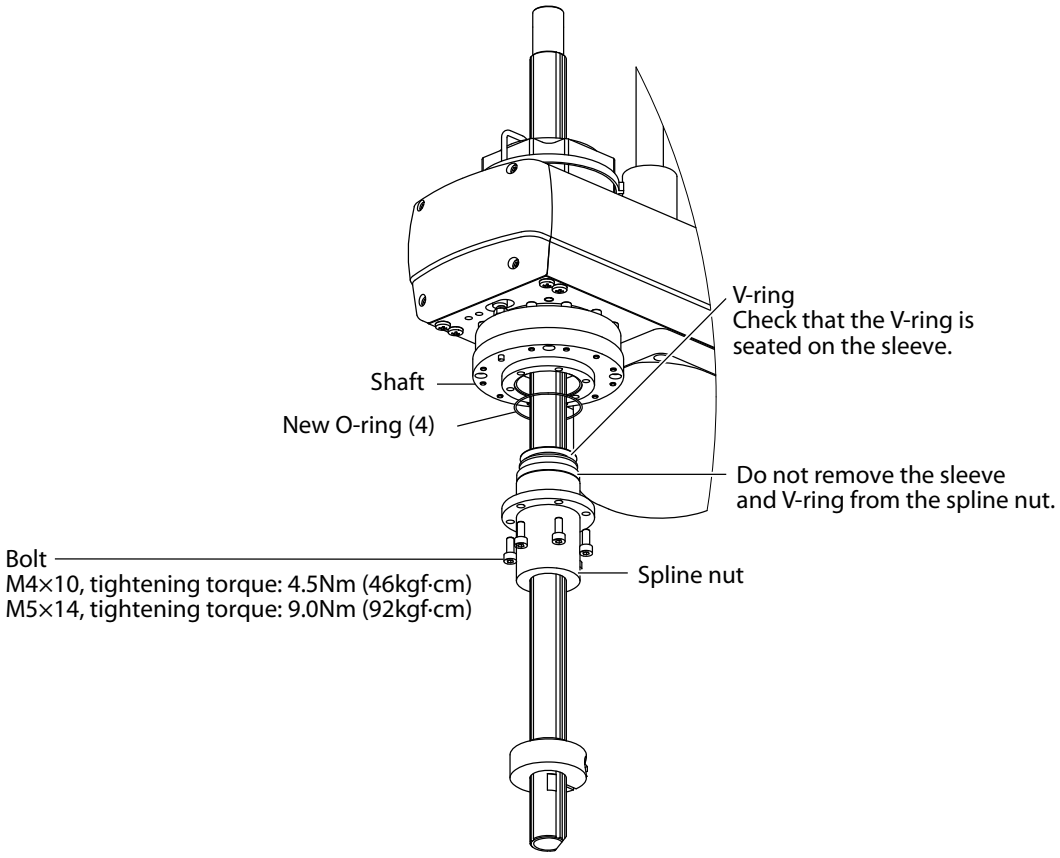
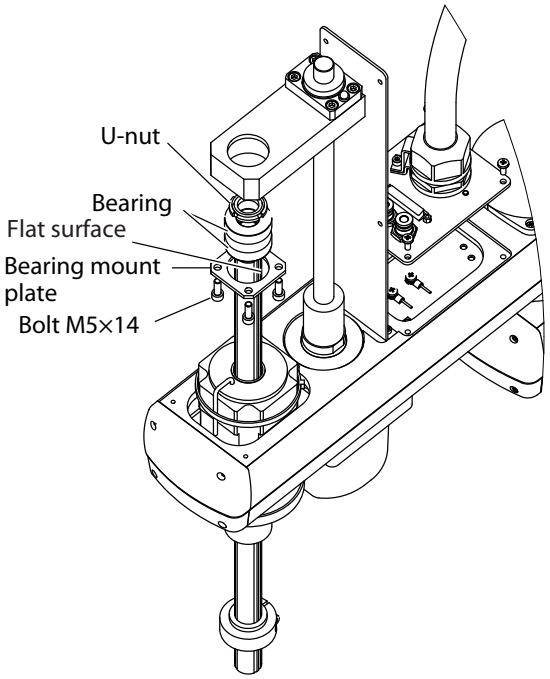
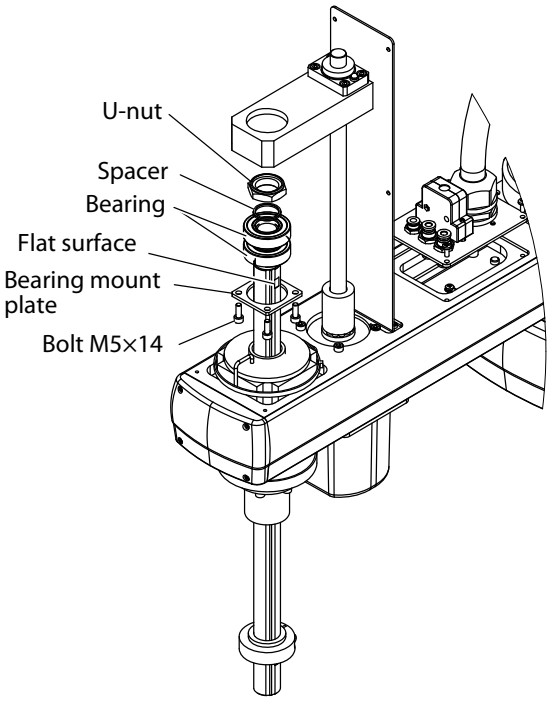


Fig. 5-49



R6YXG500, R6YXG600



R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

Fig. 5-50

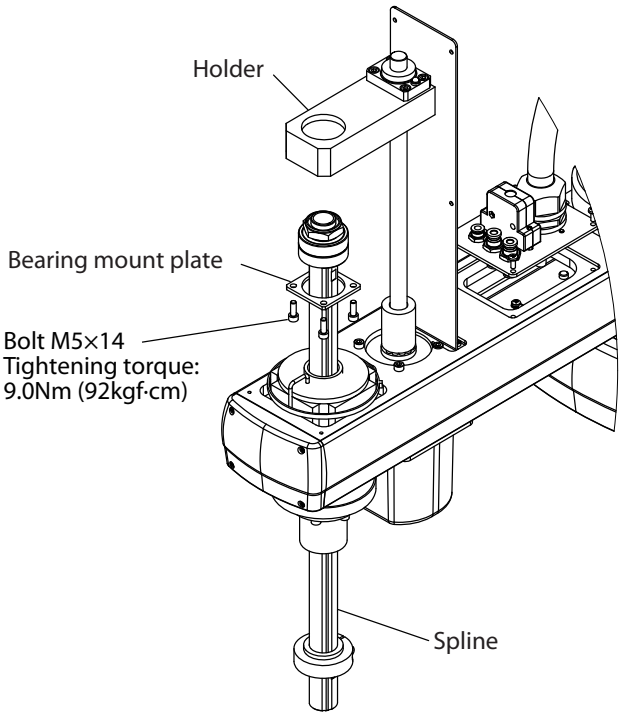
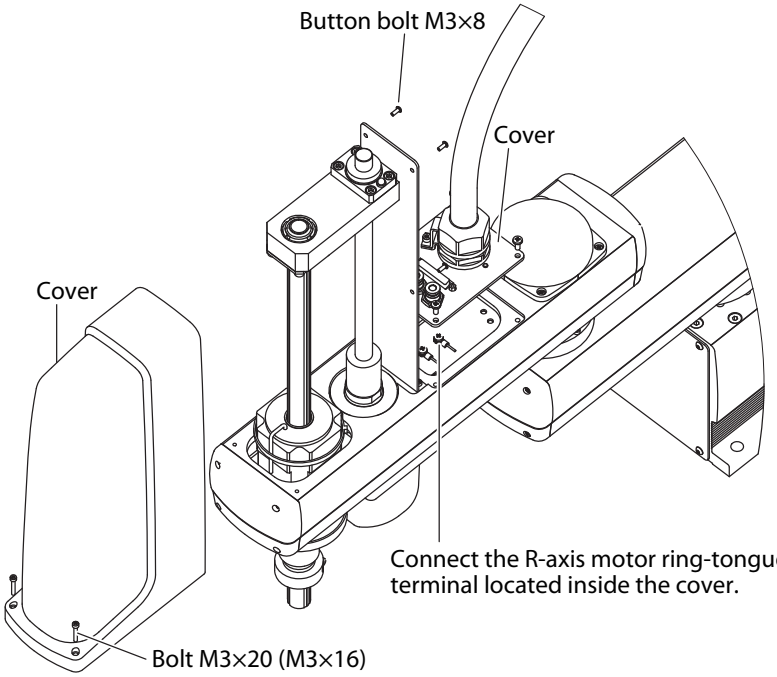


Fig. 5-51

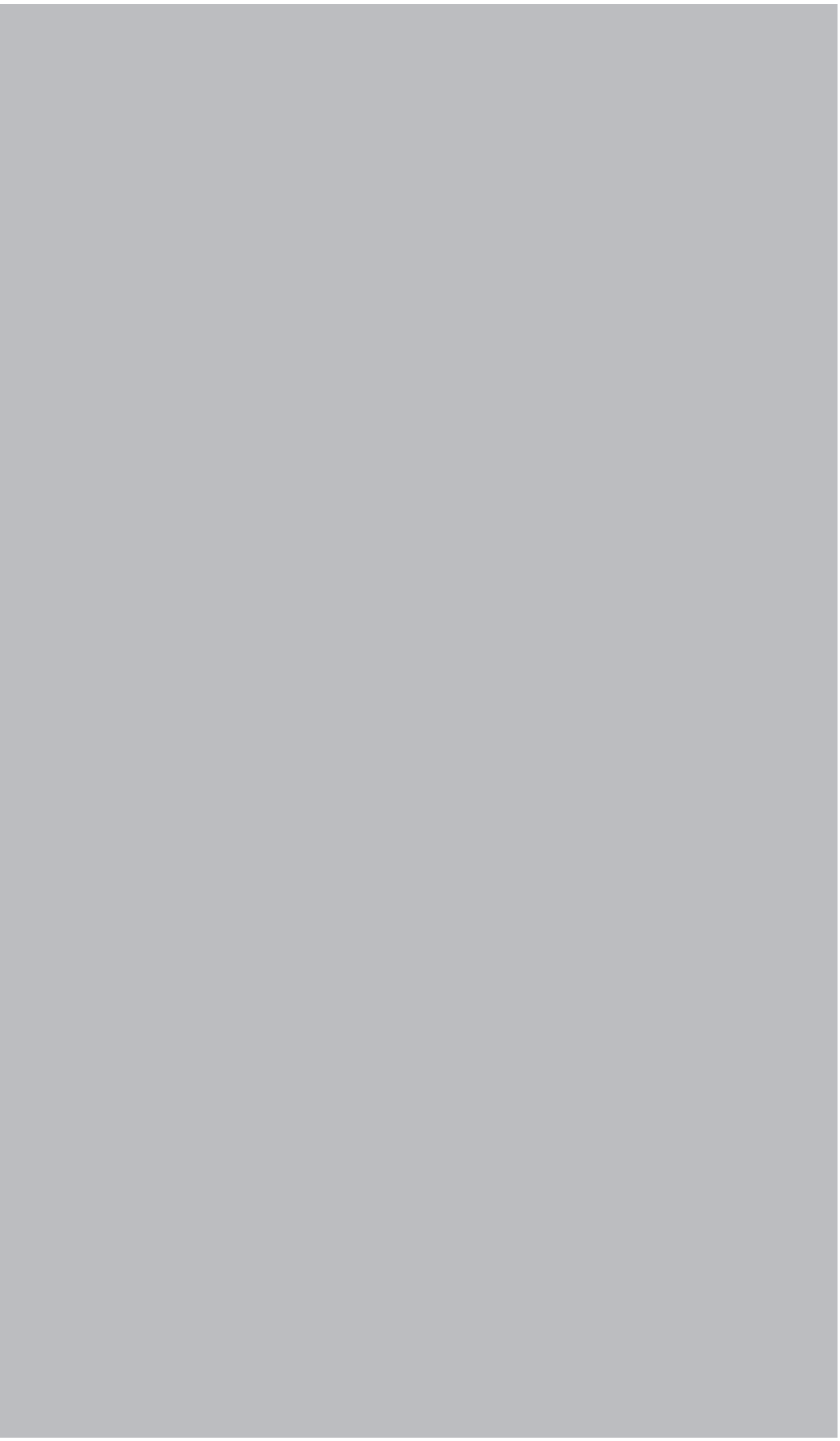


* Values in parentheses apply to the R6YXGH600, R6YXG700, R6YXG800, R6YXG900 and R6YXG1000.

Chapter 6 Increasing the robot operating speed

Contents

1. Increasing the Robot Operating Speed 6-1



1. Increasing the Robot Operating Speed

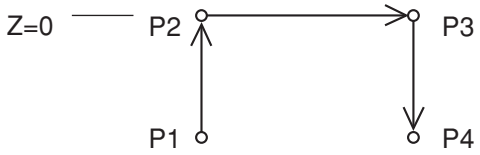
The robot operating speed can be increased by the following methods. Use these methods as needed when programming.

(1) Increasing speed by arch motion

[Also refer to:] Robot controller user's manual
("Axis parameters" – "Arch position" in Chapter 4)
Programming manual
(ARCH statement in "10. Command statements".)

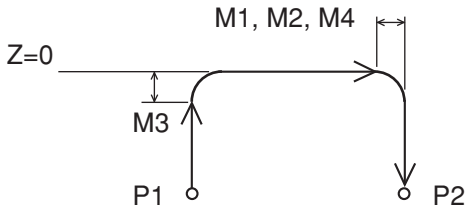
1) Gate motion

From point P1 to P4 via P2 and P3:
MOVE P, P2
MOVE P, P3
MOVE P, P4



2) Arch motion: Using default arch position: (2000 pulses)

From point P1 to P2:
MOVE P, P2, Z=0



"Axis parameters" – "Arch position"
M1 (X-axis arch position) = 2000 pulses
M2 (Y-axis arch position) = 2000 pulses
M3 (Z-axis arch position) = 2000 pulses
M4 (R-axis arch position) = 2000 pulses

When the Z-axis moves upward from P1 and enters the M3 arch position range (2000 pulses prior to Z=0), the X, Y and R axes begin to move. When these 3 axes enter the M1, M2 and M4 arch position range (2000 pulses prior to P2), the Zaxis moves downward to P2. Compared with the gate motion 1), this arch motion shortens the cycle time approximately 20% by moving the robot arm along an arc.

3) Arch motion: Making the arch position value larger

In the arch motion 2), making the arch position value larger can further shorten the cycle time. Since the robot arm moves along a larger arc, use caution to avoid obstacles if they are located near the arm movement path. The arch position parameter can be set for each axis.

4) Arch motion: changing the arch positions in the program

From point P1 to P2 and then to P3:

ARCH (1) = 10000 ... X-axis arch position (pulses)

ARCH (2) = 20000 ... Y-axis arch position (pulses)

ARCH (3) = 20000 ... Z-axis arch position (pulses)

ARCH (4) = 20000 ... R-axis arch position (pulses)

MOVE P, P2, Z=0

ARCH (1) = 2000

ARCH (2) = 2000

ARCH (3) = 2000

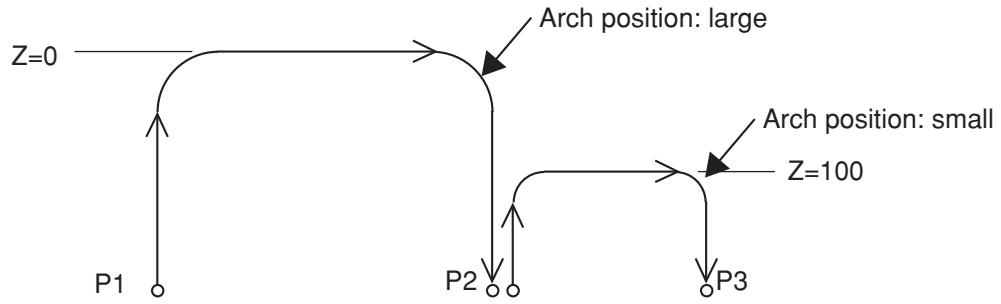
ARCH (4) = 2000

MOVE P, P3, Z=100

Arch position can be set for each axis.

If the same arch position value (pulses) is used for all axes, you can write as "ARCH 2000".

Since the arch positions can be changed in the program, optimizing the arch positions can further shorten the cycle time.



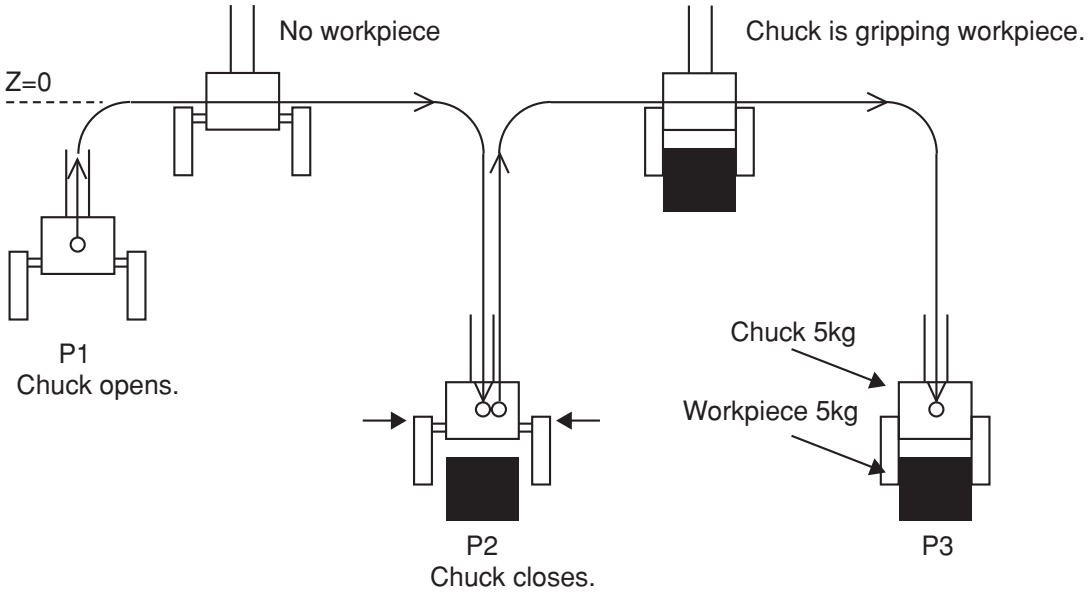
(2) Increasing the speed with the WEIGHT statement

[Also refer to:] Robot controller user's manual
("Robot parameters" – "Axis tip weight" in Chapter 4)
Programming manual
(WEIGHT statement in "10. Command statements".)

[Example]

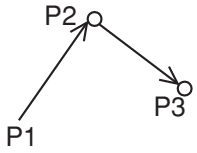
From P1 when chuck is open:
WEIGHT 5.....Changes the axis tip weight parameter to 5kg (no workpiece).
MOVE P, P2, Z=0
DO3 (0) = 1 .....Chuck closes.
WEIGHT 10.....Changes the axis tip weight parameter to 10kg (with workpiece).
MOVE P, P3, Z=0

In the above program, the acceleration can be set to a higher level by reducing the axis tip weight parameter to 5kg while the chuck does not grip any workpiece, and then set to a lower level by changing the axis tip weight parameter to 10kg. Compared to programs using an axis tip weight parameter left set at 10kg, this method shortens the cycle time since the acceleration is increased.



(3) Increasing the speed by the tolerance parameter

[Also refer to:] Robot controller user's manual
("Axis parameters" – "Tolerance" in Chapter 4)
Programming manual
(TOLE statement in "10. Command statements".)



[Example]

From P1 to P3 via P2

```
TOLE (1) = 2048 ... X-axis tolerance (pulses) : Increases the tolerance.
TOLE (2) = 2048 ... Y-axis tolerance (pulses)
TOLE (3) = 2048 ... Z-axis tolerance (pulses)
TOLE (4) = 2048 ... R-axis tolerance (pulses)
MOVE P, P2
TOLE (1) = 80 ..... Returns the tolerance to the default value.
TOLE (2) = 80
TOLE (3) = 80
TOLE (4) = 80
MOVE, P, P3
```

Tolerance can be set for each axis. If the same tolerance is used for all axes, you can write as "TOLE 2048".

If the same tolerance is used for all axes, you can write as "TOLE 80".

When P2 is an escape point and does not need to be accurately positioned, setting the tolerance parameter to a larger value allows the robot arm to pass through P2 quickly. The larger the tolerance value for the positioning time, the shorter the cycle time will be. The maximum value of the tolerance parameter is 2048 (pulses) and the default is 80 (pulses).

(4) Increasing the speed by the OUT effective position parameter

[Also refer to:] Robot controller user's manual
("Axis parameters" – "Out effective Position" in Chapter 4)
Programming manual
(OUTPOS statement in "10. Command statements".)

[Example]

From P1 when chuck is open:

OUTPOS (1) = 10000... X-axis OUT effective position (pulses) : Increases the OUT effective position.

OUTPOS (2) = 10000... Y-axis OUT effective position (pulses)

OUTPOS (3) = 10000... Z-axis OUT effective position (pulses)

OUTPOS (4) = 10000... R-axis OUT effective position (pulses)

The OUT effective position can be set for each axis.
If the same OUT effective position is used for all axes, you can write as "OUTPOS 10000".

MOVE P, P2, Z=0

DO3 (0) = 1 ..... Chuck closes.

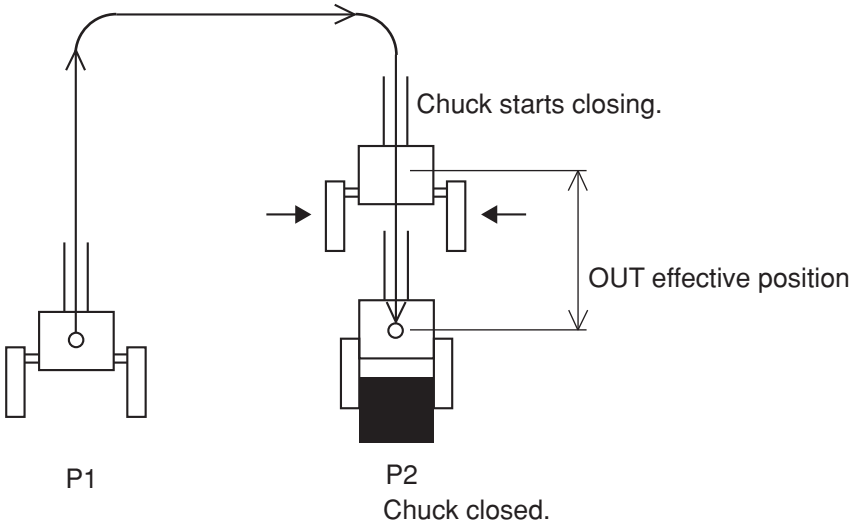
OUTPOS (1) = 2000..... Returns the OUT effective position to the default value.

OUTPOS (2) = 2000

OUTPOS (3) = 2000

OUTPOS (4) = 2000

If the same OUT effective position is used for all axes, you can write as "OUTPOS 2000".



When all of the X, Y, Z and R axes enter the OUT effective position (10000 pulses prior to P2), the chuck starts closing. By setting the OUT effective position larger, the chuck starts closing while the robot arm is still moving at an earlier point, so that the chuck can grip the workpiece more quickly. The default value of the OUT effective position is 2000 (pulses).

[Reference]

Relation between X, Y, R-axis rotating angle, Z-axis movement distance and pulse values

The arch position, tolerance and OUT effective position parameters are set in pulses. For the relation between X, Y, R-axis rotating angle, Z-axis movement distance and pulse values, refer to the tables listed under item (4) in "4. Setting the soft limits" (Chapter 4 in this manual).

Chapter 7 Specifications

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1-2 External view and dimensions 7-2
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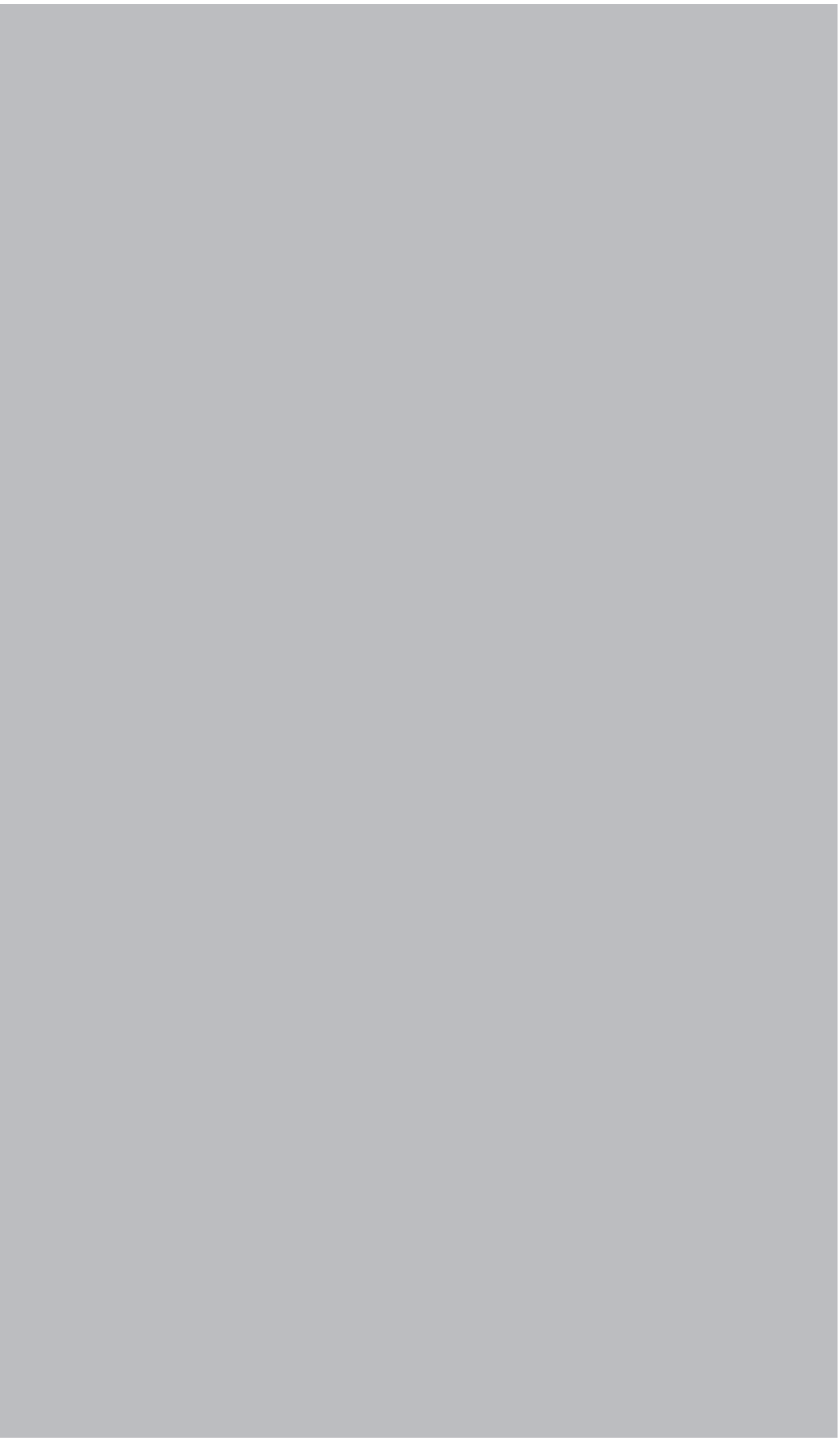


1. Manipulator

1-1 Basic specification

Robot model			R6YXG500	R6YXG600
Axis specifications	X-axis	Arm length	200mm	300mm
		Rotation angle	±130°	±130°
	Y-axis	Arm length	300mm	300mm
		Rotation angle	±145°	±145°
	Z-axis	Stroke	200, 300mm	200, 300mm
	R-axis	Rotation angle	±360°	±360°
Motor		X-axis	400W	400W
		Y-axis	200W	200W
		Z-axis	200W	200W
		R-axis	200W	200W
Maximum speed		XY resultant	7.6m/s	8.4m/s
		Z-axis	2.3m/s (200mm stroke Z-axis) 1.7m/s (300mm stroke Z-axis)	
		R-axis	1700°/s	1700°/s

Robot model		R6YXG500	R6YXG600
Repeatability *1	XY-axes	±0.01mm	±0.01mm
	Z-axis	±0.01mm	±0.01mm
	R-axis	±0.004°	±0.004°
Payload		10kg	
R-axis tolerable moment of inertia *2		0.30kgm^2 (3.0kgfcms^2)	
User wiring		20 cables	
User tubing		φ6×3	
Travel limit		1.Soft limit 2.Mechanical stopper (XYZ-axes)	
Robot cable		3.5m (option: 5m, 10m)	
Weight		30kg	31kg

*1 At constant ambient temperature (XY)
*2 There are limits to acceleration coefficient settings.

Robot model			R6YXGH600	R6YXG700	R6YXG800	R6YXG900	R6YXG1000
Axis specifications	X-axis	Arm length	200mm	300mm	400mm	500mm	600mm
		Rotation angle	±130°	±130°	±130°	±130°	±130°
	Y-axis	Arm length	400mm	400mm	400mm	400mm	400mm
		Rotation angle	±150°	±150°	±150°	±150°	±150°
	Z-axis	Stroke	200, 400mm	200, 400mm	200, 400mm	200, 400mm	200, 400mm
	R-axis	Rotation angle	±360°	±360°	±360°	±360°	±360°
Motor		X-axis	750W	750W	750W	750W	750W
		Y-axis	400W	400W	400W	400W	400W
		Z-axis	400W	400W	400W	400W	400W
		R-axis	200W	200W	200W	200W	200W
Maximum speed		XY resultant	7.7m/s	8.4m/s	9.2m/s	9.9m/s	10.6m/s
		Z-axis	2.3m/s (200mm stroke Z-axis) 1.7m/s (400mm stroke Z-axis)				
		R-axis	920°/s	920°/s	920°/s	920°/s	920°/s
Repeatability *1		XY-axes	±0.02mm	±0.02mm	±0.02mm	±0.02mm	±0.02mm
		Z-axis	±0.01mm	±0.01mm	±0.01mm	±0.01mm	±0.01mm
		R-axis	±0.004°	±0.004°	±0.004°	±0.004°	±0.004°
Payload			20kg				
R-axis tolerable moment of inertia *2			1.0kgm^2 (10.0kgfcms^2)				
User wiring			20 cables				
User tubing			φ6×3				
Travel limit			1.Soft limit 2.Mechanical stopper (XYZ-axes)				
Robot cable			3.5m (option: 5m, 10m)				
Weight			48kg, 50kg	50kg, 52kg	52kg, 54kg	54kg, 56kg	56kg, 58kg

*1 At constant ambient temperature (XY)
*2 There are limits to acceleration coefficient settings.

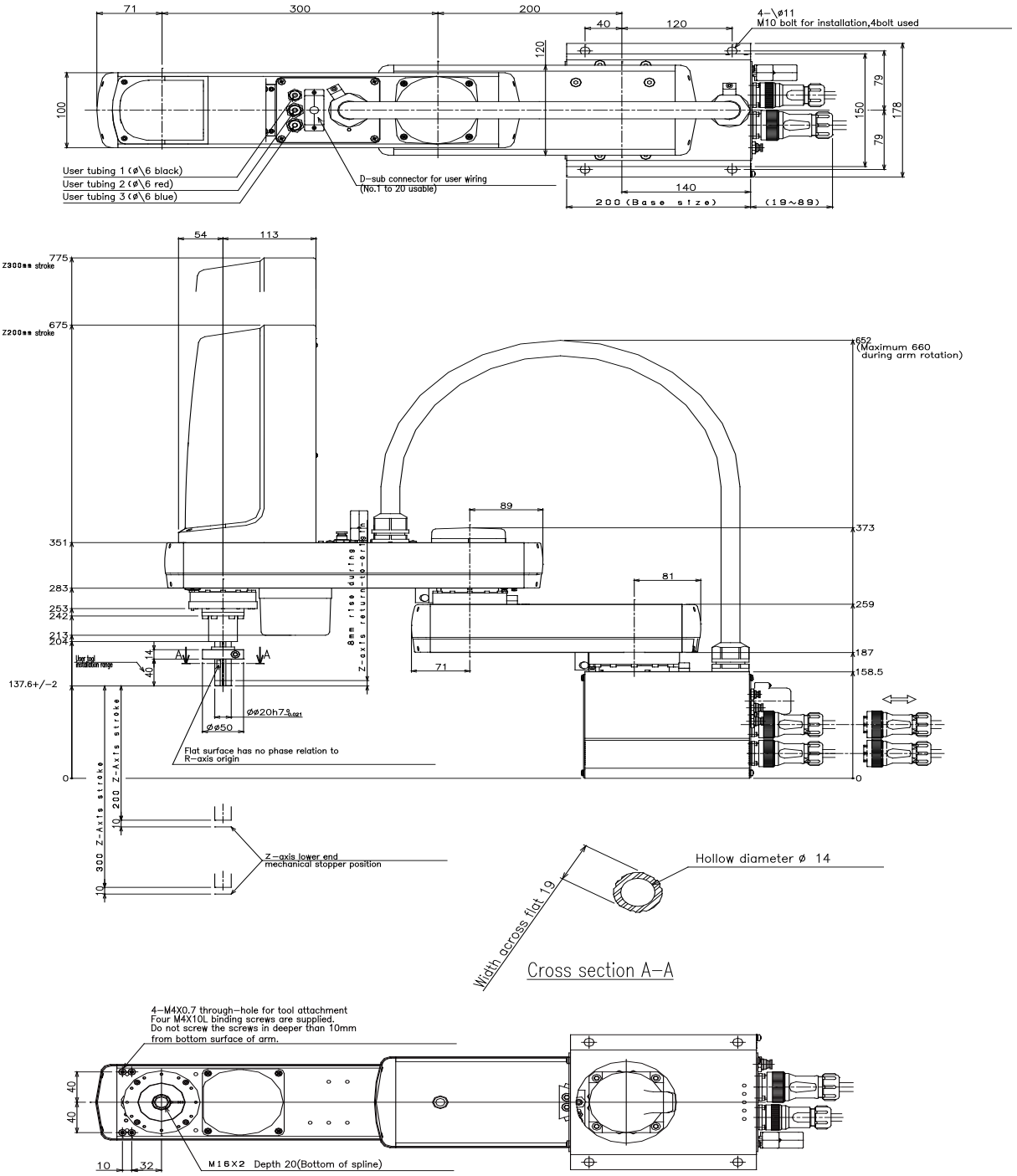
Noise level

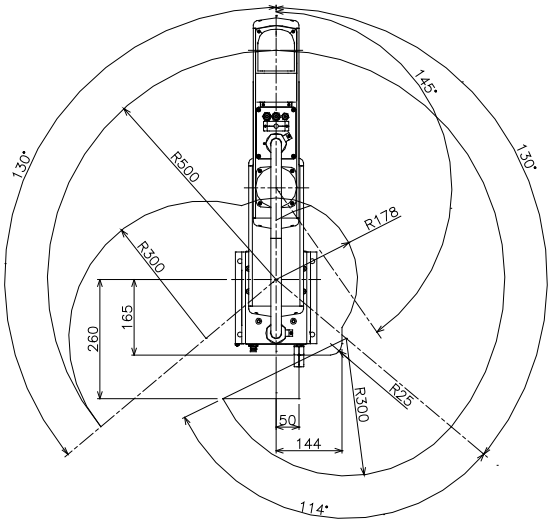
Maximum sound pressure level of the robot (when there is 10dB or larger difference from the back ground sound pressure level)	Position where the maximum sound pressure is measured
78.4dB	1 meter apart from the back of the robot, 1.6m height from the floor surface.

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

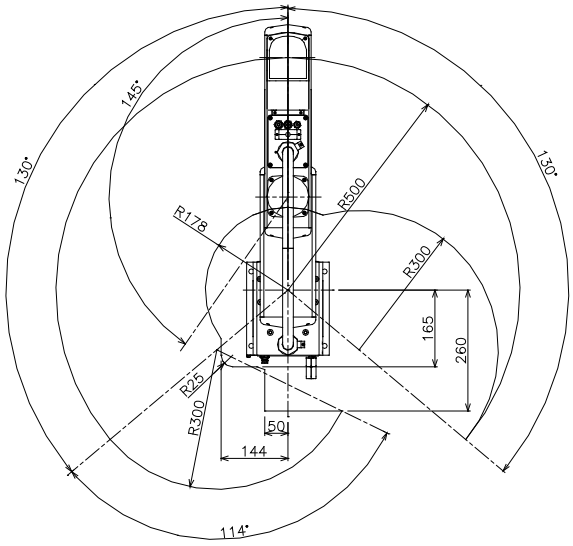
1-2 External view and dimensions

Fig. 7-1 R6YXG500





Working envelope of left-handed system



Working envelope of right-handed system

X-axis mechanical stopper position:132°
Y-axis mechanical stopper position:147°

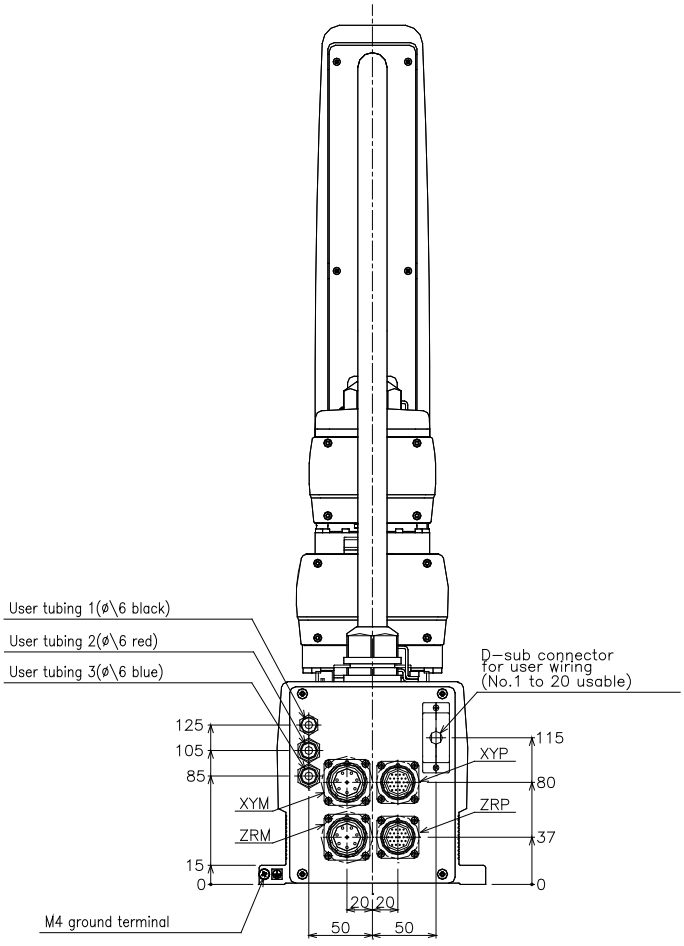
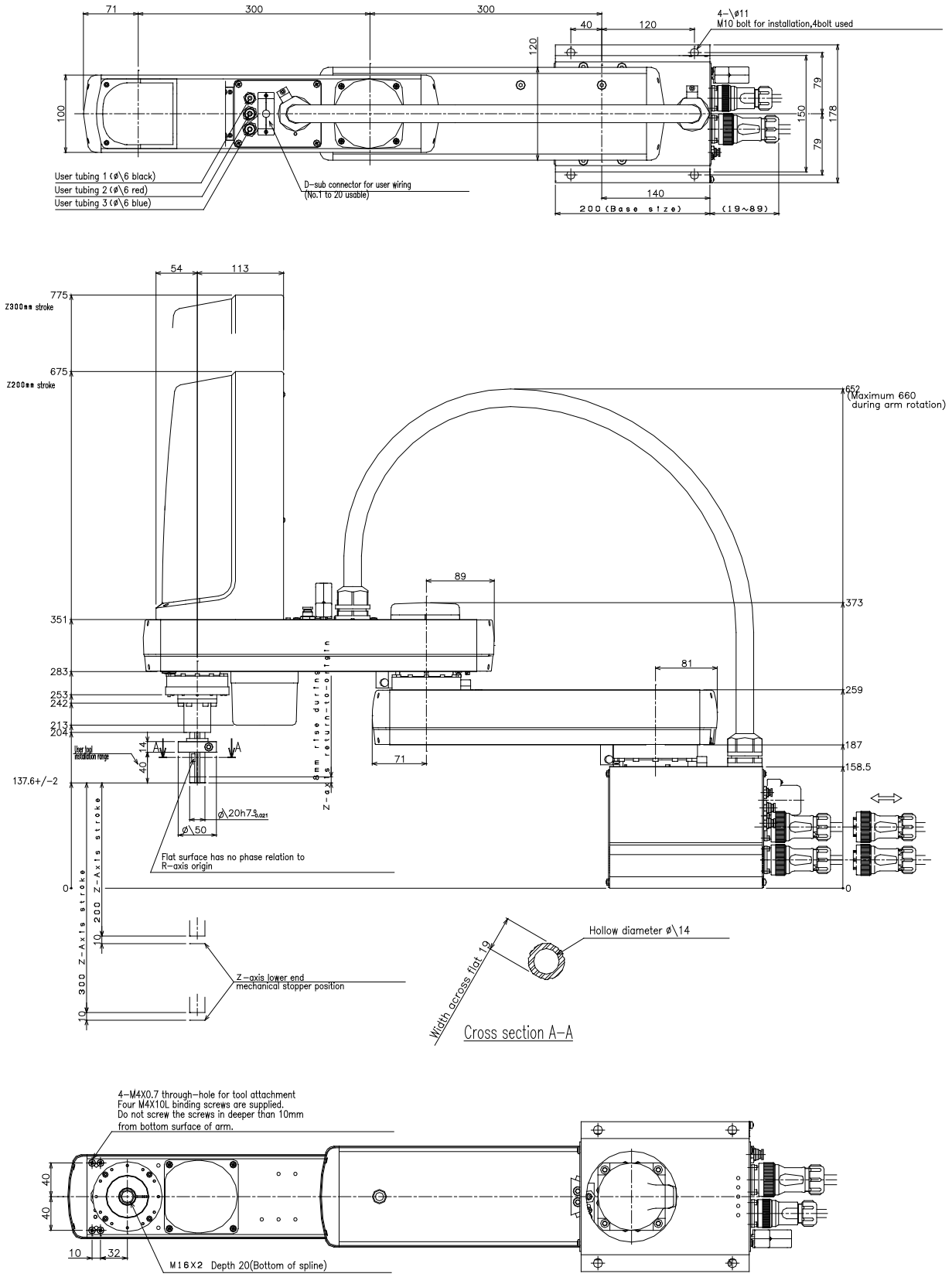
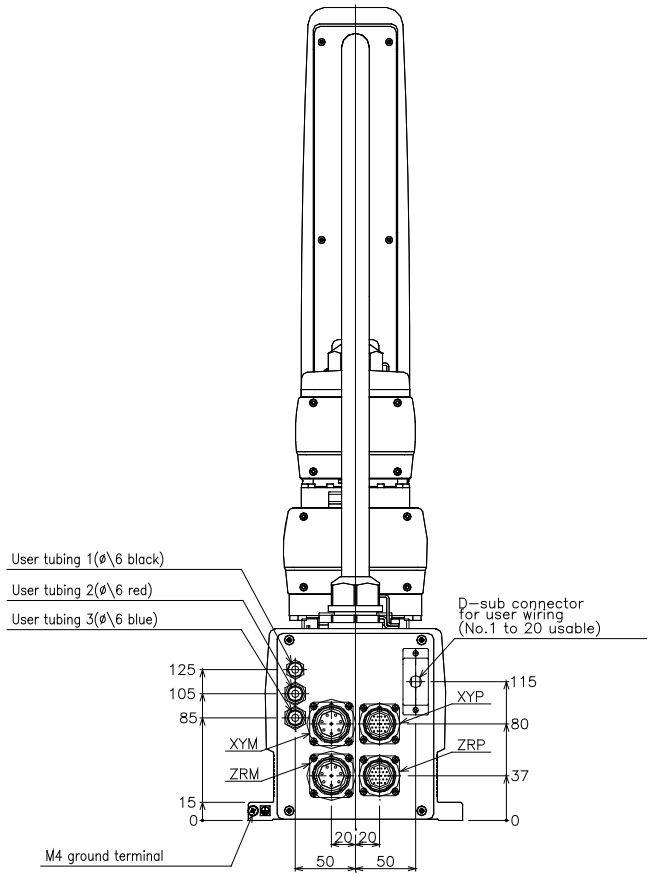
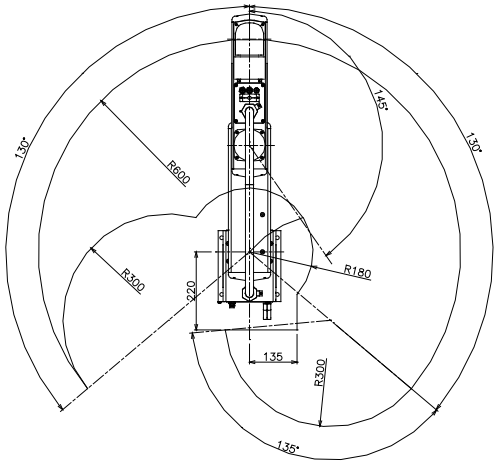


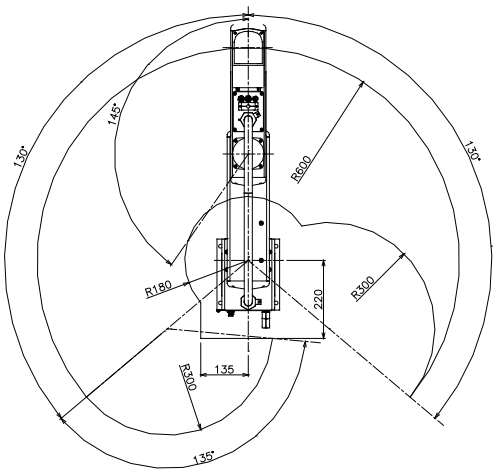
Fig. 7-2 R6YXG600







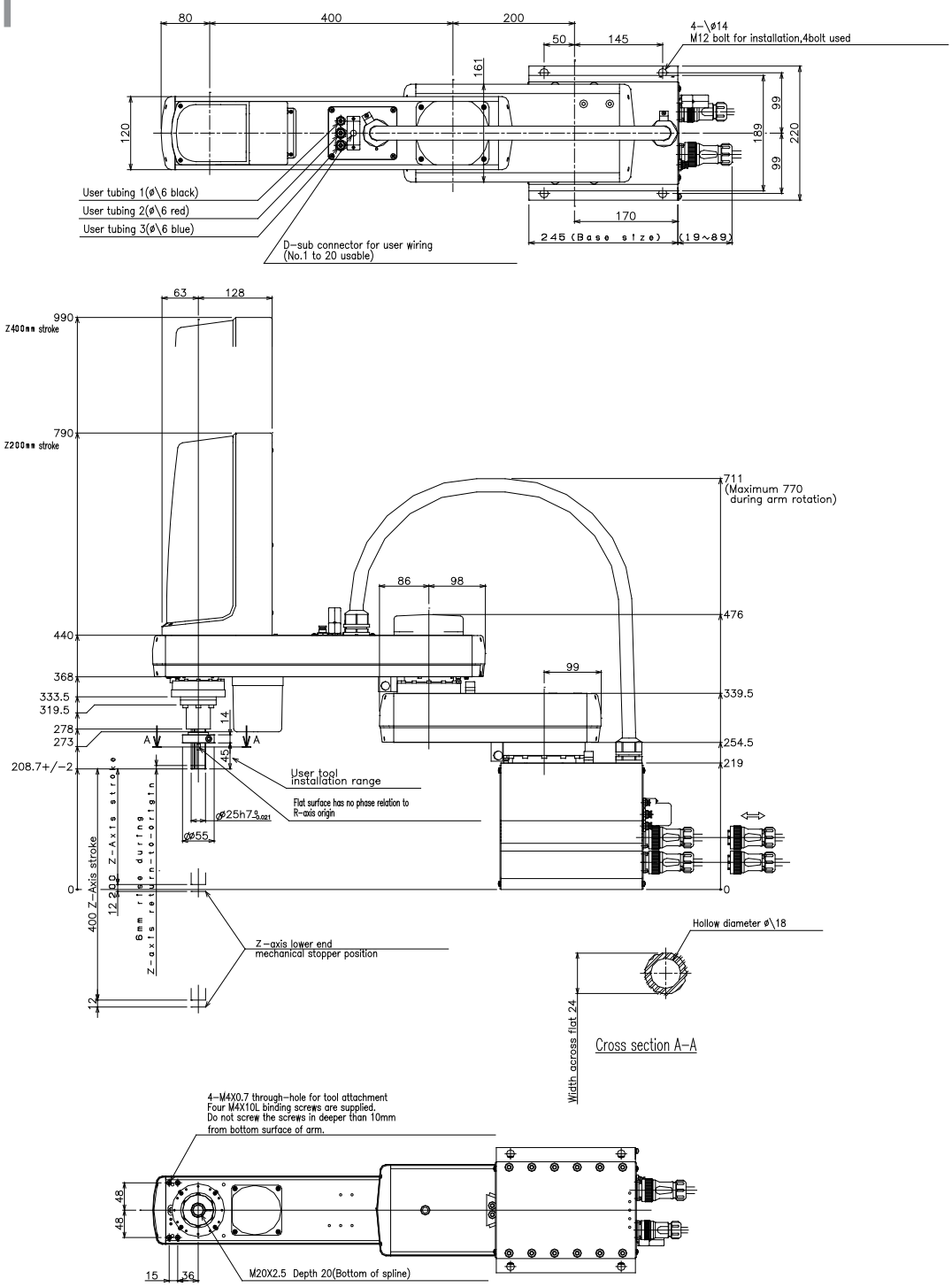
Working envelope of left-handed system

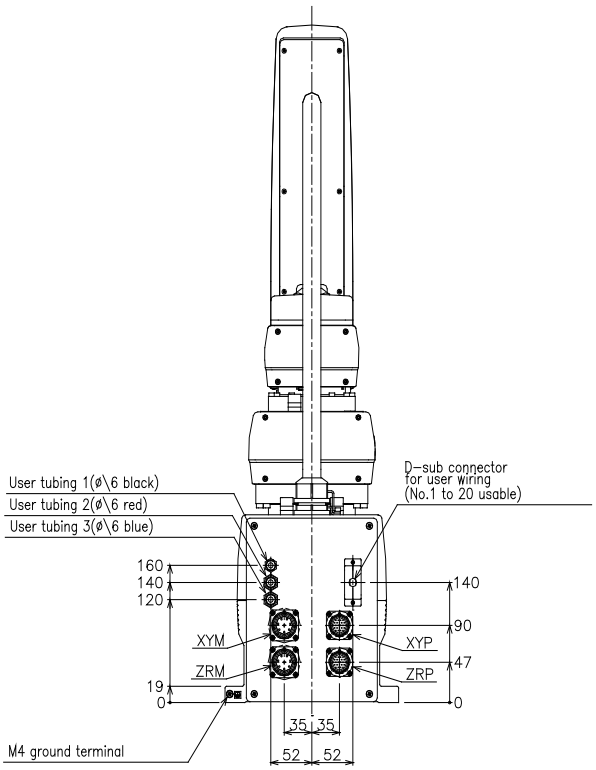


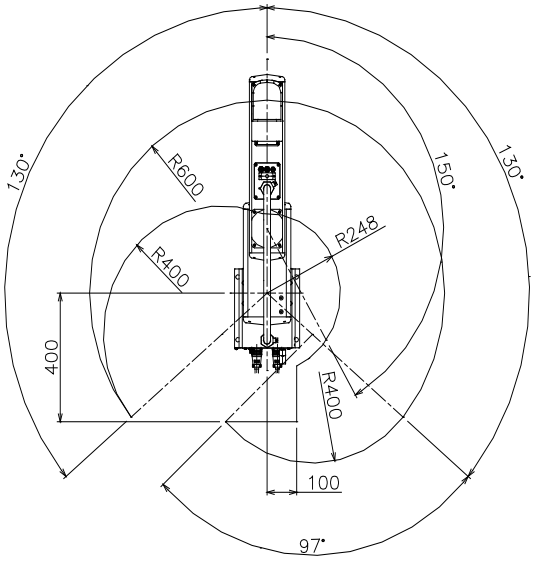
Working envelope of right-handed system

X-axis mechanical stopper position:132°
Y-axis mechanical stopper position:147°

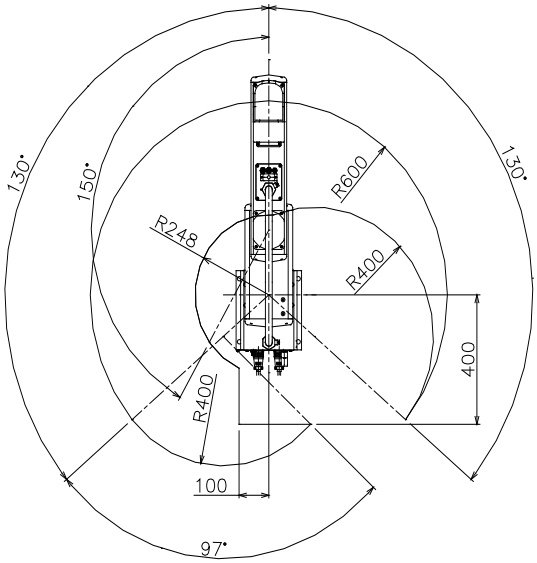
Fig. 7-3 R6YXGH600







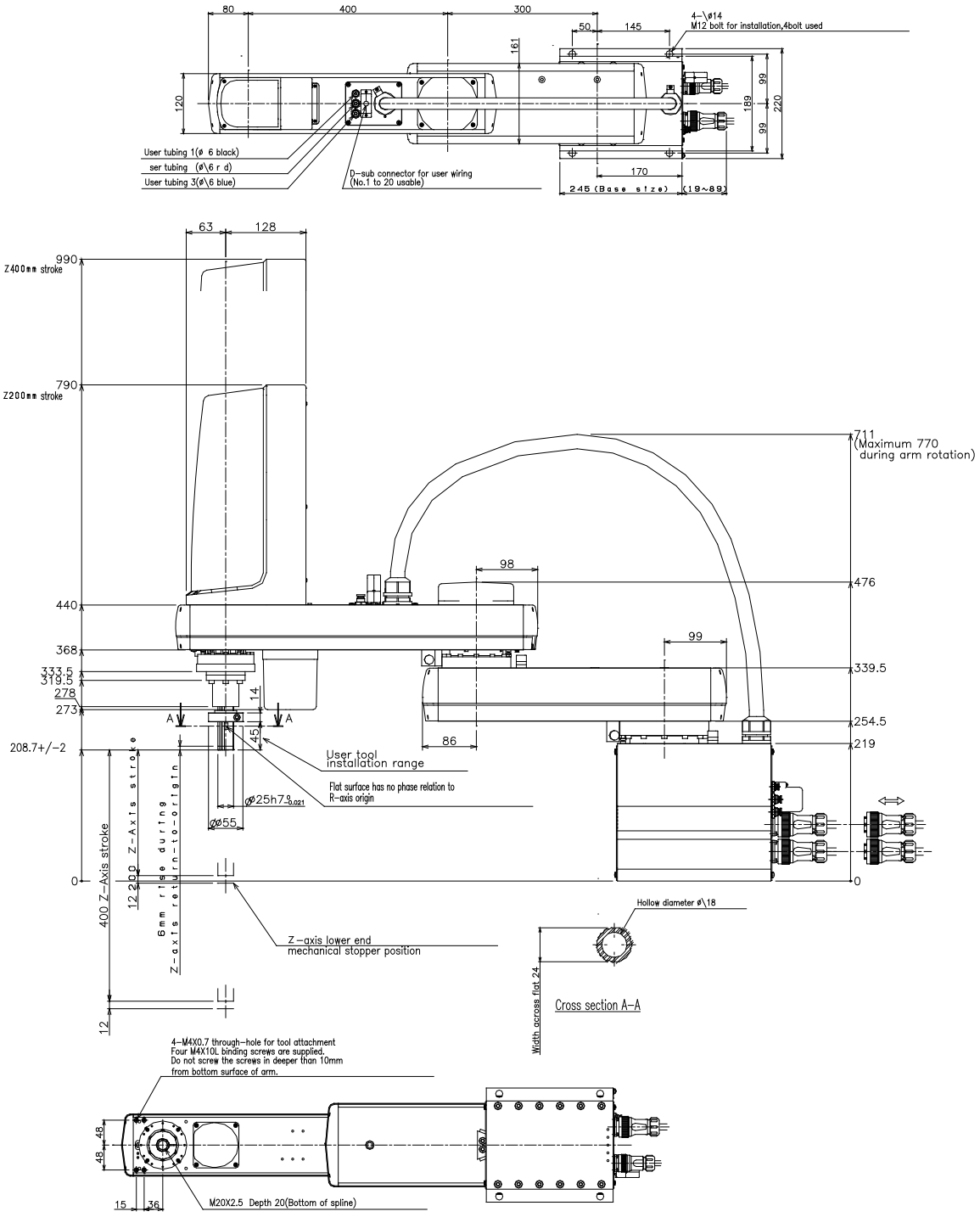
Working envelope of left-handed system

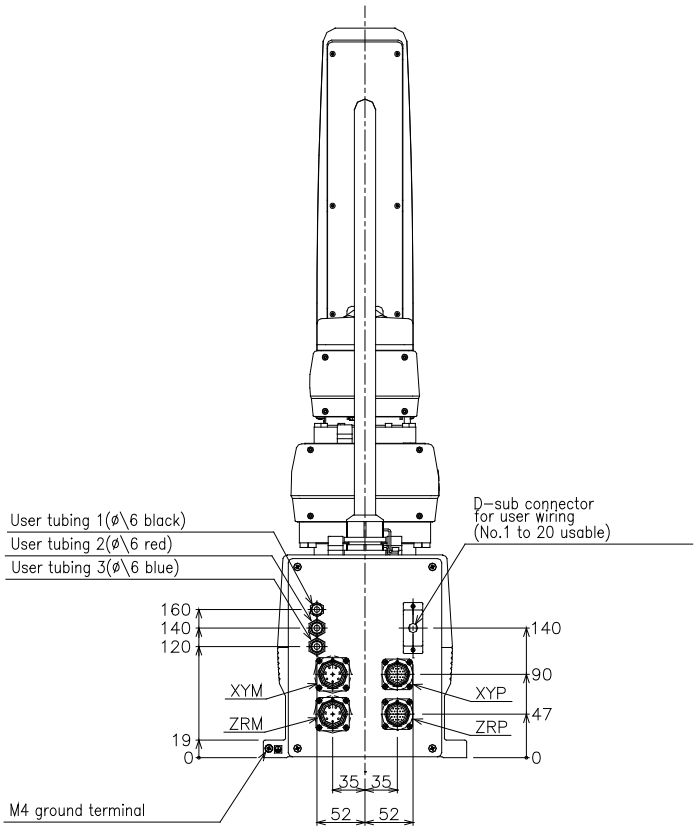


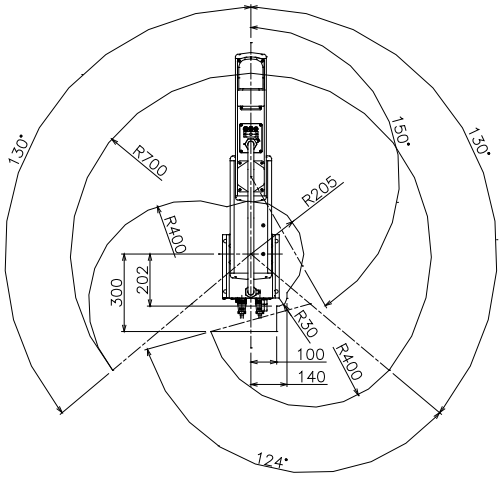
Working envelope of right-handed system

X-axis mechanical stopper position:132°
Y-axis mechanical stopper position:152°

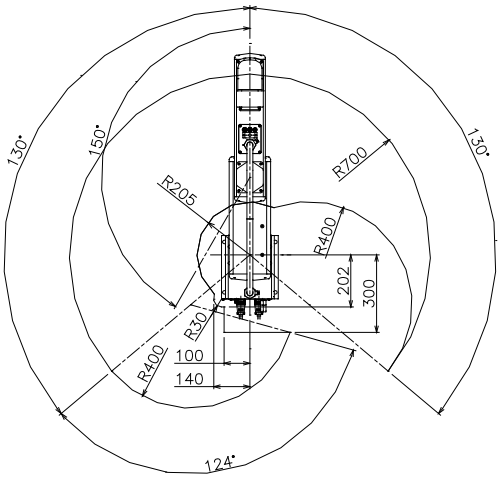
Fig. 7-4 R6YXG700







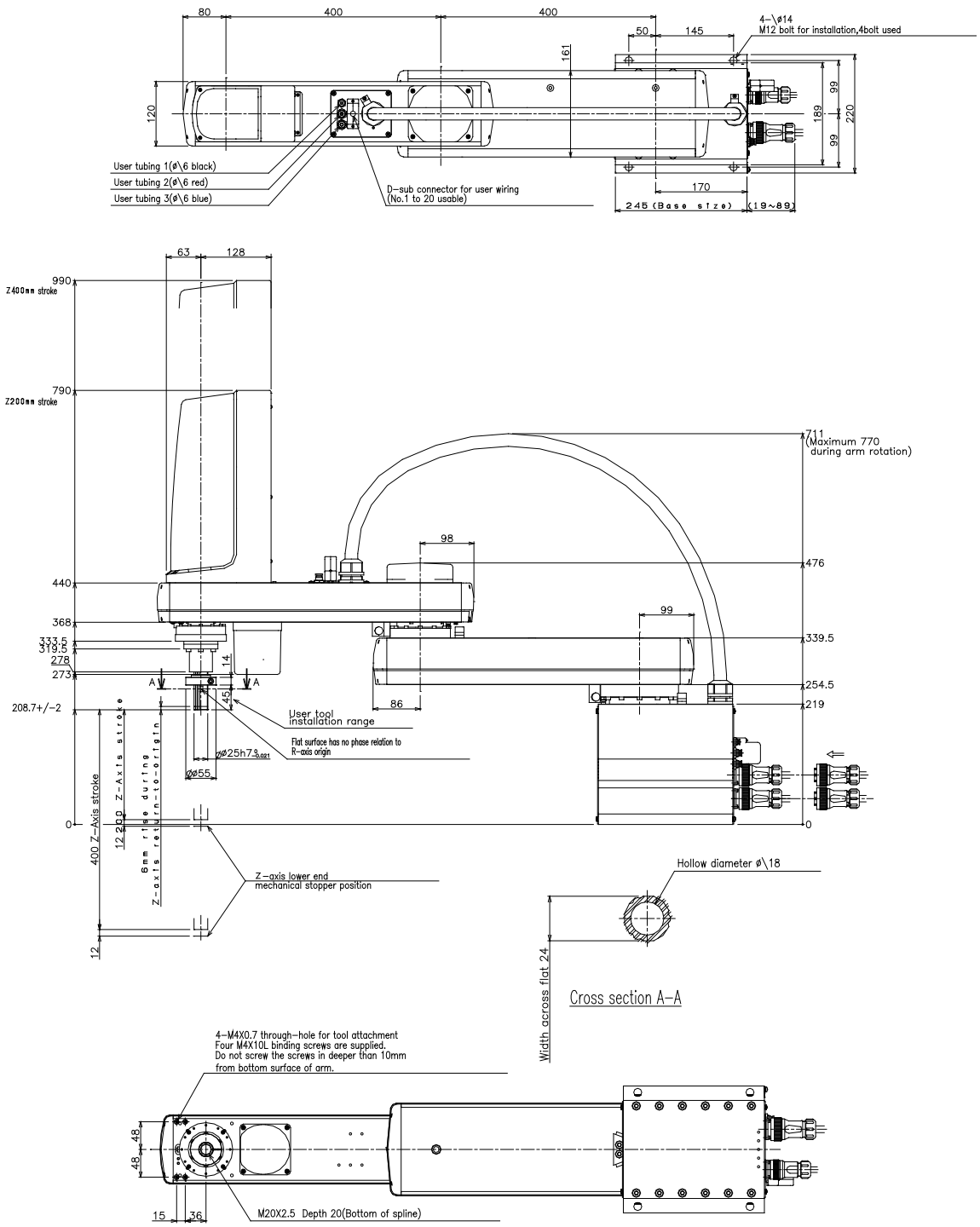
Working envelope of left-handed system

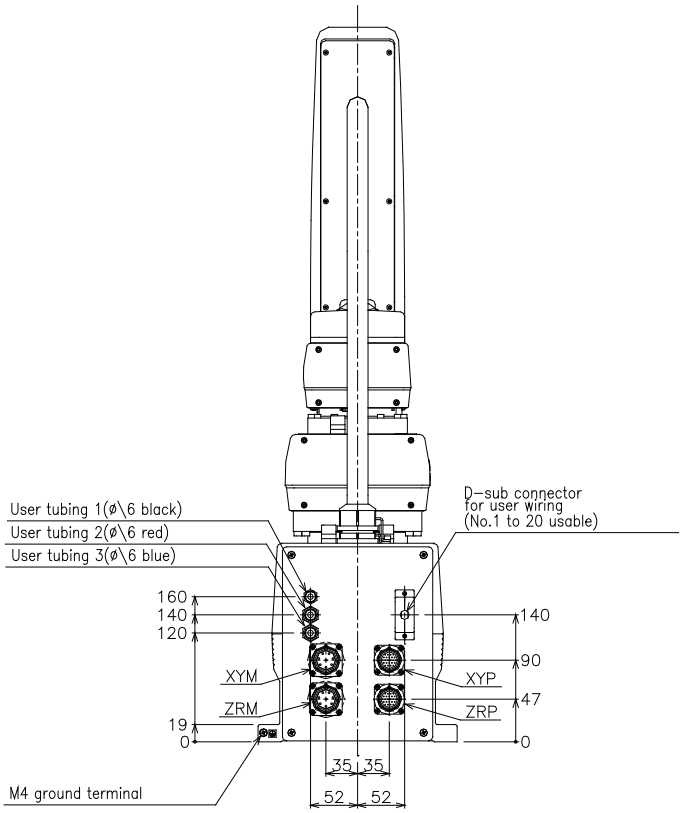


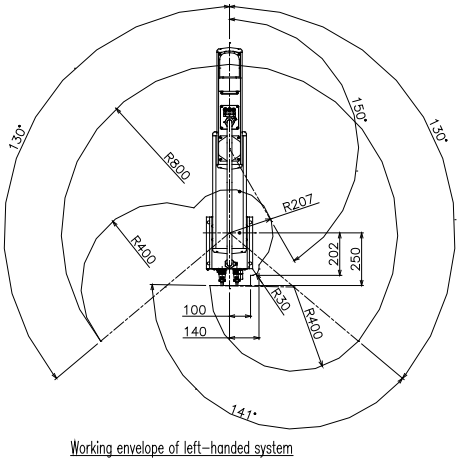
Working envelope of right-handed system

X-axis mechanical stopper position:132°
Y-axis mechanical stopper position:152°

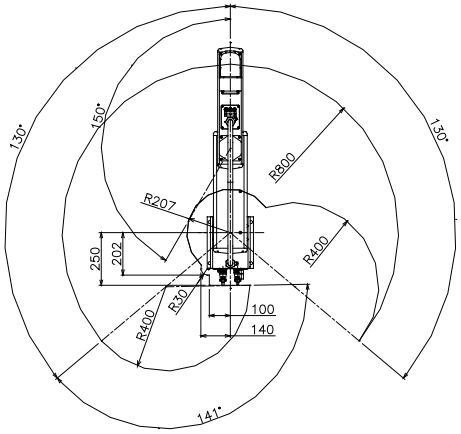
Fig. 7-5 R6YXG800







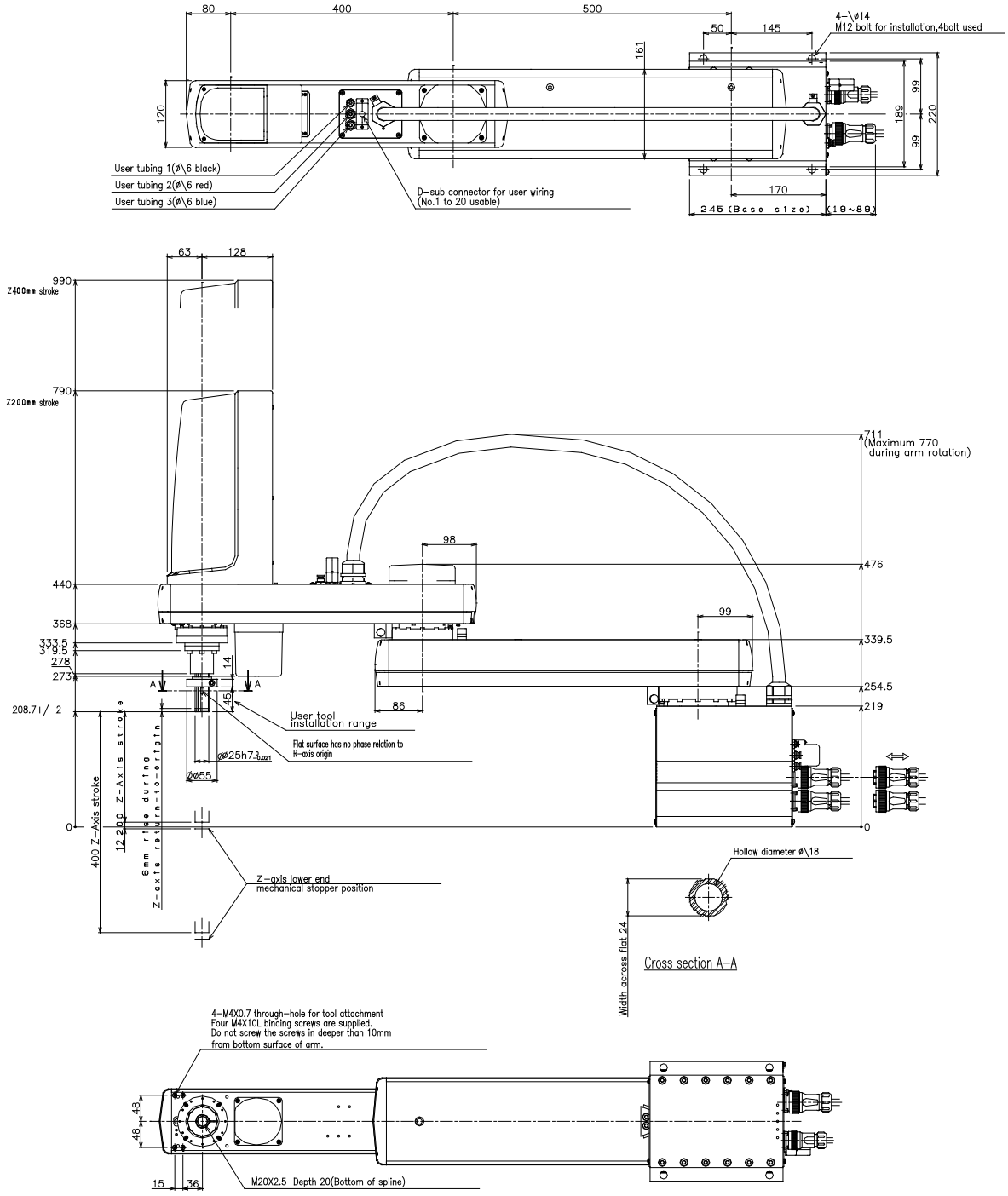
Working envelope of left-handed system

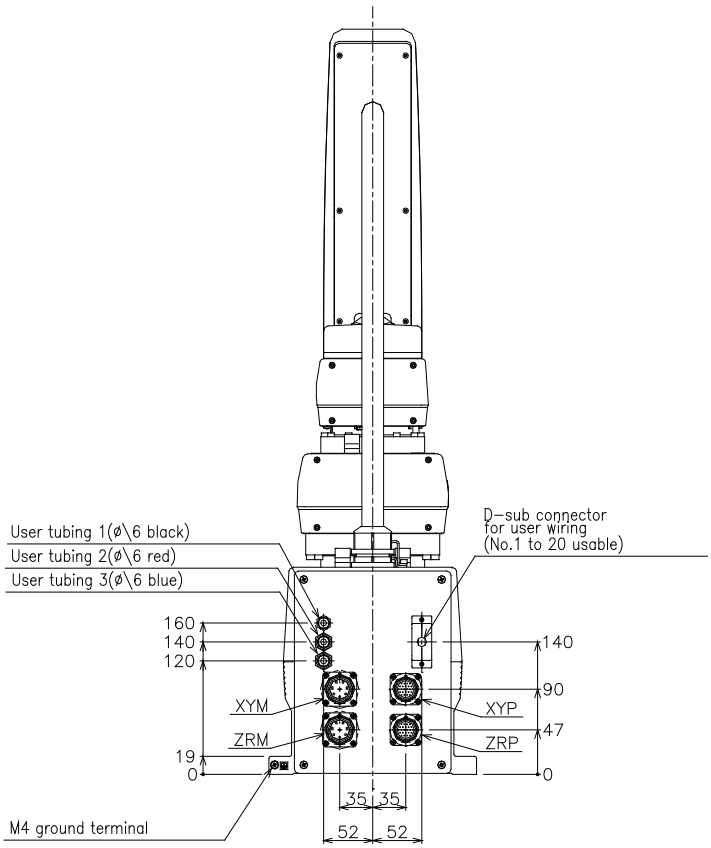


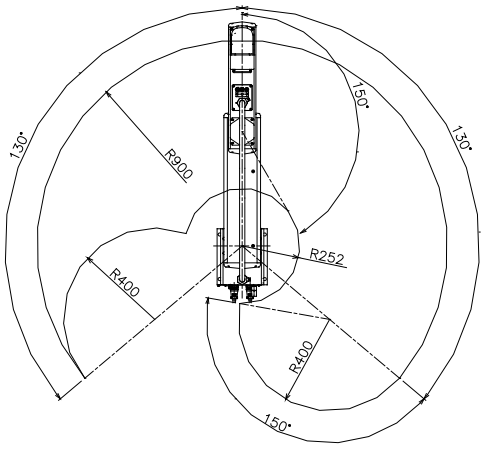
Working envelope of right-handed system

X-axis mechanical stopper position:132°
Y-axis mechanical stopper position:152°

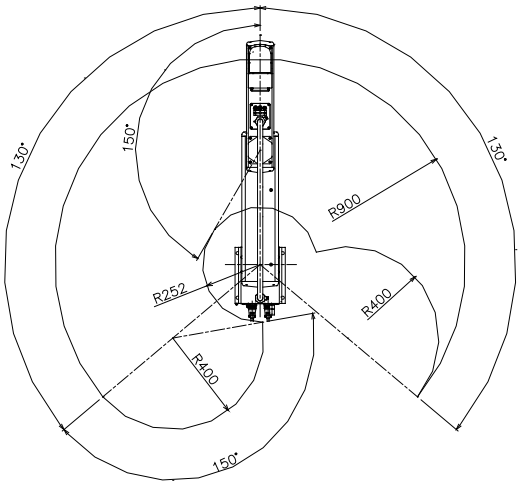
Fig. 7-6 R6YXG900







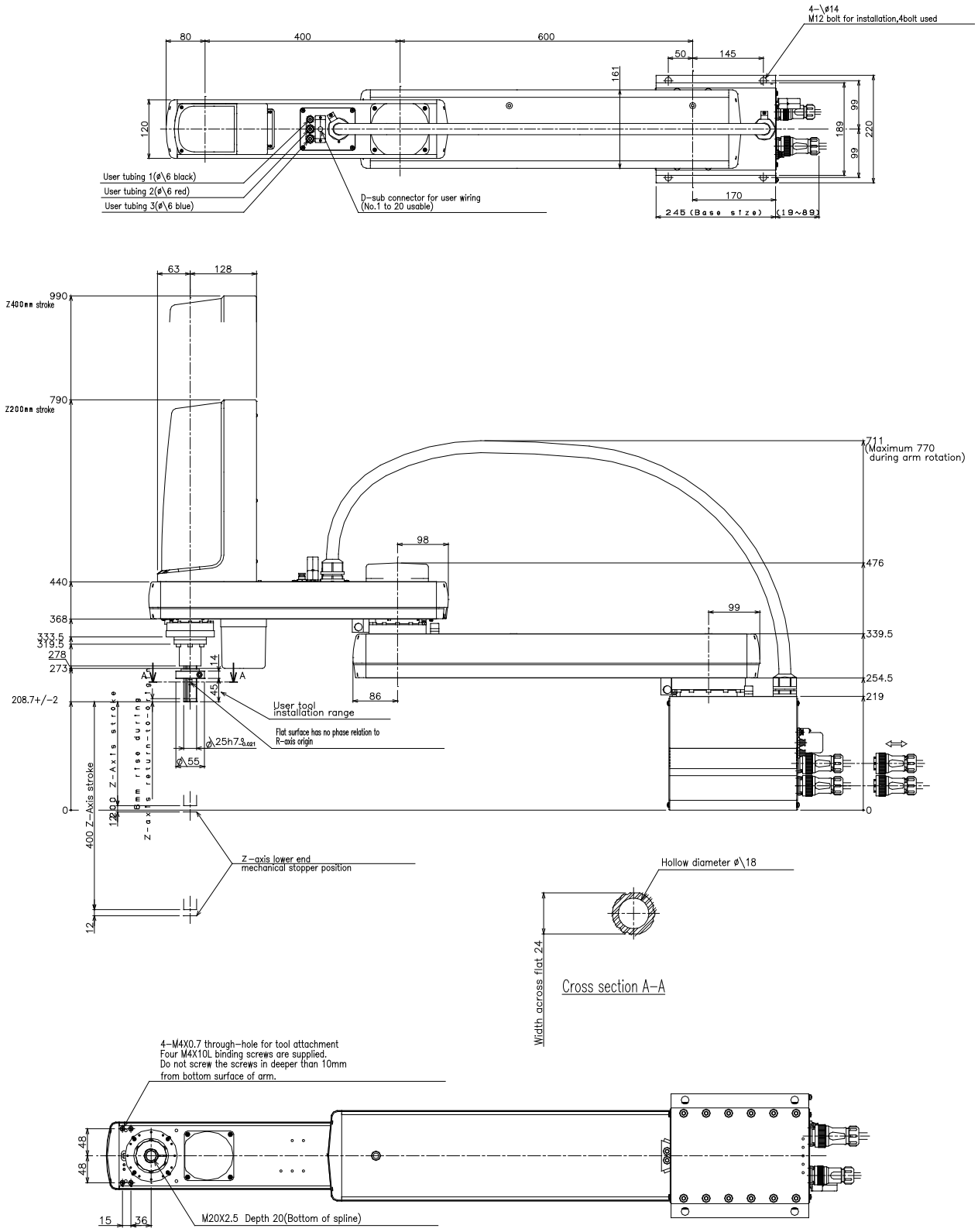
Working envelope of left-handed system

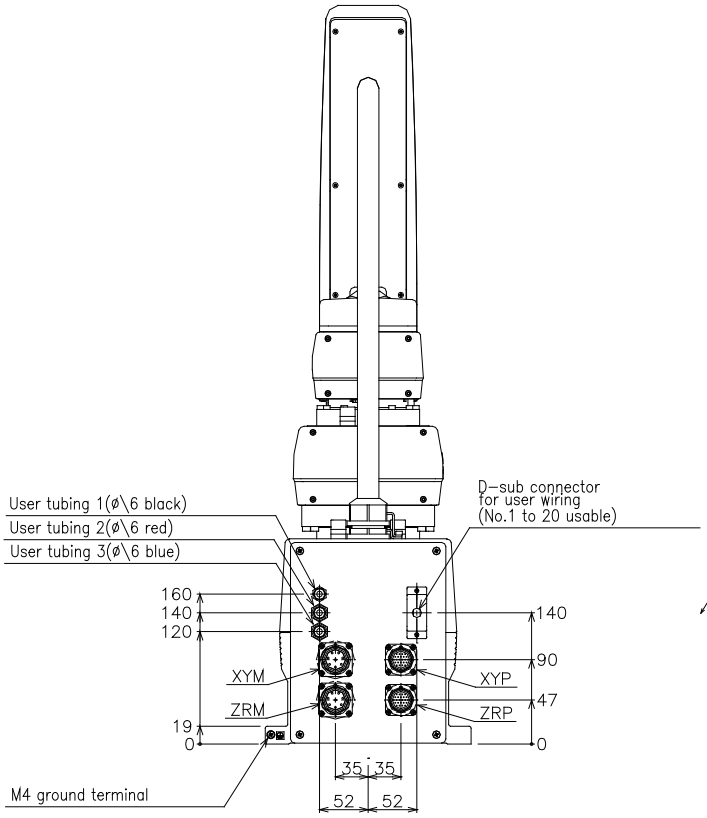


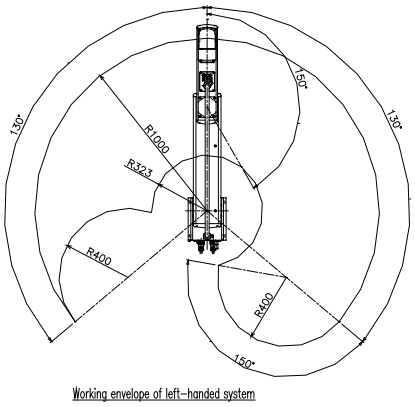
Working envelope of right-handed system

X-axis mechanical stopper position:132°
Y-axis mechanical stopper position:152°

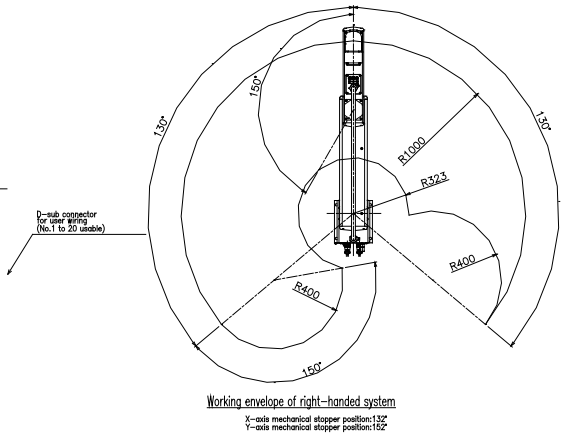
Fig. 7-7 R6YXG1000







Working envelope of left-handed system

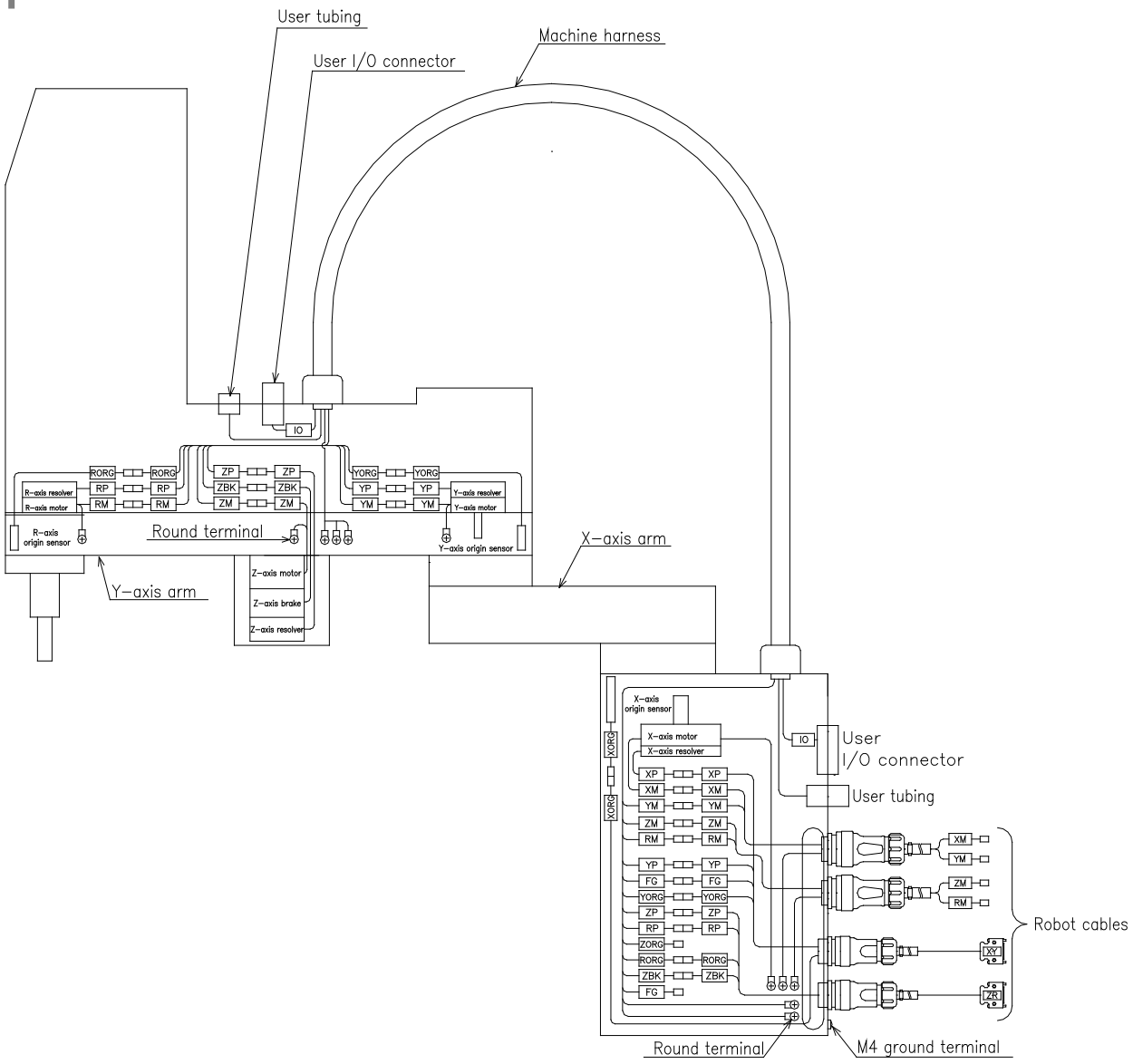


Working envelope of right-handed system

X-axis mechanical stopper position:132°
Y-axis mechanical stopper position:152°

1-3 Robot inner wiring diagram

Fig. 7-8 R6YXG500



R6YXG500,R6YXG600, R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000

1-4 Wiring table

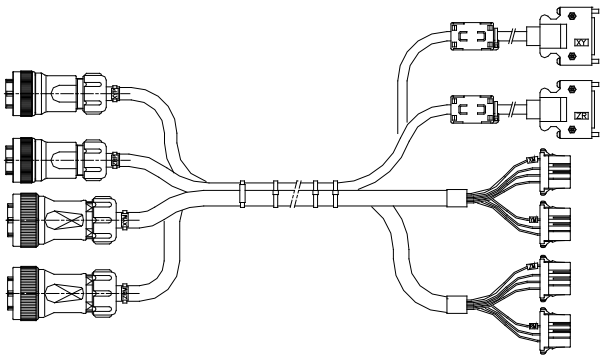
Robot cable wiring table

No.	SIGNAL	COLOR	P	CONNECTION	P	REMARKS
XP	Resolver S2	Blue	XYP 1		XY 1	0.15sq Twisted pair
	S4	Orange	2		2	
	S1	Green	3		3	0.15sq Twisted pair
	S3	Brown	4		4	
	R1	Dark gray	5		5	0.15sq Twisted pair
	R2	Red	6		6	
	DG	Gray	7		7	0.3sq
			8		14	
			9		16	
YP	Resolver S2	Black	10		19	0.15sq Twisted pair
	S4	Yellow	11		20	
	S1	Pink	12		21	0.15sq Twisted pair
	S3	Purple	13		22	
	R1	White	14		23	0.15sq Twisted pair
	R2	Blue−Red−1	15		24	
	DG	Gray	16		25	0.3sq
	Frame ground	Orange−White−1	17		18	0.15sq Twisted pair
		Green−White−1			36	
	HLIM	Gray			10	0.3sq
	GND24				11	
	HLIM	Gray			28	0.3sq
	GND24				29	
XORG	Origin Sensor GND	Yellow−Black−1	18		13	0.15sq Twisted pair
	ORG	Pink−Black−1	19		12	
	24V	Purple−White−1	20		9	0.15sq Twisted pair
YORG	Origin Sensor 24V	White−Blue−1	21		27	
	ORG	Blue−Red−2	22		30	0.15sq Twisted pair
	GND	Orange−White−2	23		31	
			24			

No.	SIGNAL	COLOR	P	CONNECTION	P	REMARKS
ZP	Resolver S2	Blue	ZRP 1		ZR 1	0.15sq Twisted pair
	S4	Orange	2		2	
	S1	Green	3		3	0.15sq Twisted pair
	S3	Brown	4		4	
	R1	Dark gray	5		5	0.15sq Twisted pair
	R2	Red	6		6	
	DG	Gray	7		7	0.3sq
ZBK	Brake MB+	Black	8		14	0.15sq Twisted pair
	MB−	Yellow	9		16	
		Pink			15	0.15sq Twisted pair
		Purple			17	
RP	Resolver S2	White	10		19	0.15sq Twisted pair
	S4	Blue−Red−1	11		20	
	S1	Orange−White−1	12		21	0.15sq Twisted pair
	S3	Green−White−1	13		22	
	R1	Brown−White−1	14		23	0.15sq Twisted pair
	R2	Dark gray−White−1	15		24	
	DG	Gray	16		25	0.3sq
	Frame ground	Red−White−1	17		18	0.15sq Twisted pair
		Black−White−1			36	
	HLIM	Gray			10	0.3sq
	GND24				11	
	HLIM	Gray			28	0.3sq
	GND24				29	
			18		13	
			19		12	
			20		9	0.15sq Twisted pair
RORG	Origin Sensor 24V	White−Blue−1	21		27	
	ORG	Blue−Red−2	22		30	0.15sq Twisted pair
	GND	Orange−White−2	23		31	
			24			

No.	SIGNAL	COLOR	P	CONNECTION	P	REMARKS
XM	U	Black	XYM 1		XM 2	0.75sq
	V	Red	3		3	0.75sq
	W	White	6		4	0.75sq
	FG	Gray	8		1	0.75sq
YM	U	Yellow	2		YM 2	0.75sq
	V	Brown	4		3	0.75sq
	W	Blue	7		4	0.75sq
			5			

No.	SIGNAL	COLOR	P	CONNECTION	P	REMARKS
ZM	U	Black	ZRM 1		ZM 2	0.75sq
	V	Red	3		3	0.75sq
	W	White	6		4	0.75sq
	FG	Gray	8		1	0.75sq
RM	U	Yellow	2		RM 2	0.75sq
	V	Brown	4		3	0.75sq
	W	Blue	7		4	0.75sq
			5			



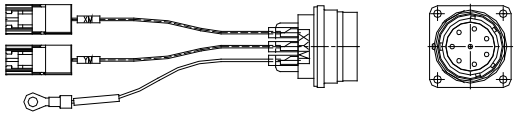
Machine harness wiring table (R6YXG500, R6YXG600, R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000)

Y-axis arm side					Base side			
Signal	Connector	No	Connection	No	Connector	Color	Wire	
Y-axis Resolver S2	YP	1		1	YP	Brown	0.2mm² Twisted pair	
S4		2		2		White		
S1		3		3		Red	0.2mm² Twisted pair	
S3		4		4		White		
R1		5		5		Orange	0.2mm² Twisted pair	
R2		6		6		White		
DG		7		7		Green	Shield	
Z-axis Resolver S2	ZP	1		1	ZP	Brown	0.2mm² Twisted pair	
S4		2		2		Black		
S1		3		3		Red	0.2mm² Twisted pair	
S3		4		4		Black		
R1		5		5		Orange	0.2mm² Twisted pair	
R2		6		6		Black		
DG		7		7		Green	Shield	
R-axis Resolver S2	RP	1		1	RP	Brown	0.2mm² Twisted pair	
S4		2		2		Gray		
S1		3		3		Red	0.2mm² Twisted pair	
S3		4		4		Gray		
R1		5		5		Orange	0.2mm² Twisted pair	
R2		6		6		Gray		
DG		7		7		Green	Shield	
Y-axis motor U	YM	1		1	YM	Brown	0.75mm²	
V		2		2		Red		
W		3		3		Orange		
Z-axis motor U	ZM	1		1	ZM	Blue	0.75mm²	
V		2		2		Purple		
W		3		3		Gray		
R-axis motor U	RM	1		1	RM	Black	0.75mm²	
V		2		2		White		
W		3		3		Brown		
Z-axis brake 1	ZBK	1		1	ZBK	White	0.3mm²	
Z-axis brake 2		2		2		Black		
User signal line	IO	1		1	IO	Brown	0.2mm²	
		2		2		Red		
		3		3		Orange		
		4		4		Blue		
		5		5		Purple		
		6		6		Gray		
		7		7		White		
		8		8		Black		
		9		9		Brown		
		10		10		Red		
		11		11		Orange		
		12		12		Blue		
		13		13		Brown	0.2mm²	
		14		14		Red		
		15		15		Orange		
		16		16		Blue		
		17		17		Purple		
		18		18		Gray		
		19		19		White		
		20		20		Black		
		21		21		Brown		
		22		22		Red		
		23		23		Orange		
		24		24		Blue		
Frame ground		25		25		Green	Shield	
Frame ground				1	FG	Green	Shield	
Origin Sensor 24V	YORG	1		1	YORG	Brown	0.2mm²	
ORG		2		2		Red		
GND		3		3		Orange		
Origin Sensor 24V	RORG	1		1	RORG	Brown	0.2mm²	
ORG		2		2		Blue		
GND		3		3		Orange		
	Round terminal				Round terminal	Yellow/Green	0.75sq	
	Round terminal				Round terminal	Black	0.75sq	

Motor wiring table

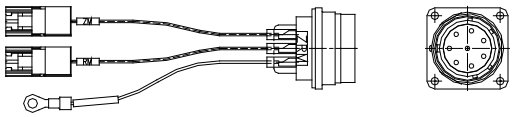
Motor X, Y

No.	SIGNAL	COLOR	P	CONNECTION	P	REMARKS
	U	Red	XM 1		XYM 1	
	V	White	2		3	
	W	Black	3		6	
	FG	Gray	Round terminal		8	0.75sq
	U	Red	YM 1		2	
	V	White	2		4	
	W	Black	3		7	
					5	



Motor Z, R

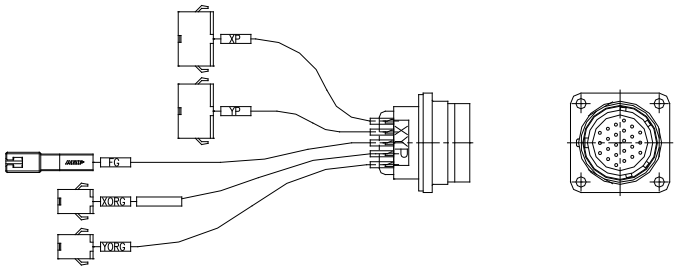
No.	SIGNAL	COLOR	P	CONNECTION	P	REMARKS
	U	Red	ZM 1		ZRM 1	
	V	White	2		3	
	W	Black	3		6	
	FG	Gray	Round terminal		8	0.75sq
	U	Red	RM 1		2	
	V	White	2		4	
	W	Black	3		7	
					5	



Resolver wiring table

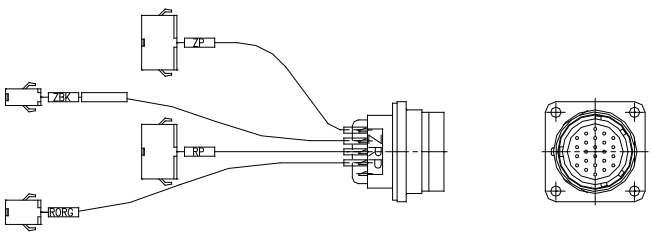
Resolver X, Y

No.	SIGNAL	COLOR	P	CONNECTION	P	REMARKS
	Resolver S2	Blue	XP 1		XYP 1	
	S4	Orange	2		2	
	S1	Black	3		3	
	S3	Brown	4		4	
	R1	Gray	5		5	
	R2	Red	6		6	
	DG	Gray	7		7	
					8	
					9	
	Resolver S2	Blue	YP 1		10	
	S4	Orange	2		11	
	S1	Black	3		12	0.3sq
	S3	Brown	4		13	
	R1	Gray	5		14	
	R2	Red	6		15	
	DG	Gray	7		16	
	Frame ground	Gray	1		17	
	Origin Sensor GND	Blue	XORG 3		18	
	ORG	Yellow	2		19	
	24V	White	1		20	
	Origin Sensor 24V	White	YORG 1		21	
	ORG	Yellow	2		22	
	GND	Blue	3		23	
					24	



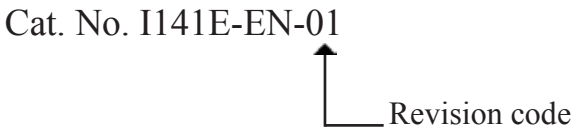
Resolver Z, R

No.	SIGNAL	COLOR	P	CONNECTION	P	REMARKS
	Resolver S2	Blue	ZP 1		ZRP 1	
	S4	Orange	2		2	
	S1	Black	3		3	
	S3	Brown	4		4	
	R1	Gray	5		5	
	R2	Red	6		6	
	DG	Gray	7		7	
	Brake MB+	Black	ZBK 1		8	
	MB−	Yellow	2		9	
	Resolver S2	Blue	RP 1		10	
	S4	Orange	2		11	
	S1	Black	3		12	0.3sq
	S3	Brown	4		13	
	R1	Gray	5		14	
	R2	Red	6		15	
	DG	Gray	7		16	
					17	
					18	
					19	
					20	
	Origin Sensor 24V	White	RORG 1		21	
	ORG	Yellow	2		22	
	GND	Blue	3		23	
					24	



Revision History

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



The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous revision.

Revision code	Date	Revised content
01	February 2010	Original production