DENSO ROBOT

Integrated compact type

XR-G SERIES

INSTALLATION & MAINTENANCE GUIDE

Preface

Thank you for purchasing this high-speed, high-accuracy assembly robot.

Before operating your robot, read this manual carefully to safely get the maximum benefit from your robot in your assembling operations.

Robot series and/or models covered by this manual

Series	Model
XR-G (Integrated compact robot)	XR-43***G

NOTE 1: Model names listed above apply to the robot systems. The model names of robot units are followed by M. If the robot system model is XR-43***G, for example, the robot unit model is XR-43***GM.

NOTE 2: Asterisks (***) in model names denote the arm length and vertical stroke of axes.

Important

To ensure operator safety, be sure to read the precautions and instructions in "SAFETY PRECAUTIONS."

NOTE:

Robots and controllers that will be exported to South Korea after March 1st 2013 need to have KCs mark for each equipment.

How this book is organized

This book is just one part of the robot documentation set. This book consists of SAFETY PRECAUTIONS and chapters one through three.

Chapter 1 Installing Robot Components
Provides information about physical site planning, installation procedures, and engineering-design notes for hands.

Chapter 2 Customizing Your Robot
Describes how to customize your robot--defining the software motion space and restricted space, CALSETing, and setting control set of motion optimization.

Chapter 3 Maintenance and Inspection
Describes the regular maintenance and inspections necessary for maintaining the performance and functions of your robot.

Contents

Chapter 1
Installing Robot Components

1.1 Preparing a Proper Environment for Installation

Before installing the robot unit and robot controller, confirm that the operating environment is in conformity with each item of the "SAFETY PRECAUTIONS, Installation Precautions". Also, take proper measures to protect the components from vibration.

In an inappropriate environment, the robot will not operate to its full capacity or performance, components may not last long, and unexpected failure may result.

1.1.1 Ambient Temperature and Humidity

Keep the ambient temperature between 0°C and 40°C during operation.

Keep the ambient humidity at 90% or below to prevent dew condensation.

1.1.2 Vibration

Do not install the robot in an environment where it will be exposed to excessive vibration or impact.

1.1.3 Connecting the Robot Unit and Robot Controller

Before delivery, the robot unit and the robot controller are configured as a set. If you purchase two or more robot systems, take care not to mistake each set when connecting robot units and controllers.

> ⚠**Caution: Configured as a set, the robot unit and robot controller are given the same serial number.**

1.1.4 Installation Environment of the Robot Unit

The table below lists the installation requirements for the robot unit. Prepare a highly rigid mount as shown on page 4.

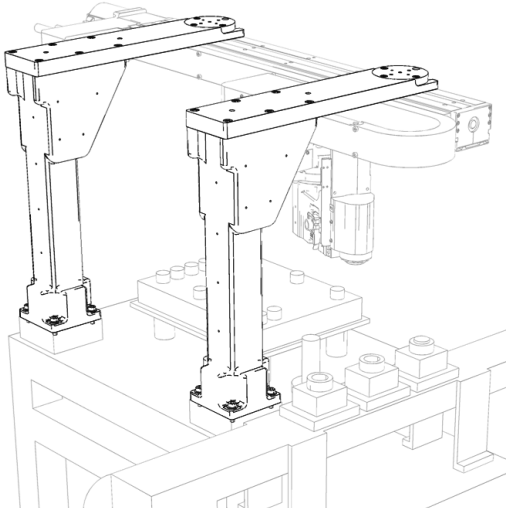
> ⚠**Caution: Do not electric-weld the equipment including the robot. A large current may flow through the motor encoder or robot controller resulting in a failure. If electric welding is required, remove the robot unit and the robot controller from the equipment beforehand.**

Installation Requirements for the Robot Unit

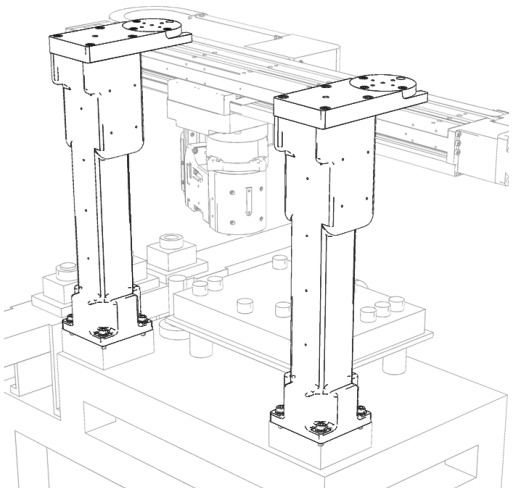
Item	Environments and Conditions
Flatness of the mount	0.1/500 mm (See the figure on page 4.)
Rigidity of the mount	Use steel materials. (See the figure on page 4.)
Installation type	Overhead-mount
Ambient temperature	During operation : 0 to 40°C During storage and transportation : -10 to 60°C
Humidity	During operation : 90% or less (No dew condensation allowed.) During storage and transportation : 75% or less (No dew condensation allowed.)
Vibration	During operation : 4.9 m/s^2 (0.5G) or less During storage and transportation : 29.4 m/s^2 (3G) or less
Safe installation environment	Refer to the SAFETY PRECAUTIONS, 3.1 "Insuring the proper installation environment"
Working space, etc.	• Sufficient service space must be available for inspection and disassembly. • Keep wiring space (190 mm or more), and fasten the wiring to the mounting face or beam so that the weight of the cables will not be directly applied to the connectors.
Grounding conditions	Grounding resistance: 100Ω or less

Frame for hanging

There are two types of stands; full-range type, which allows the robot to use its whole workable space, and half-range type, which can be used in a smaller space.



Full-range type (411759-0010)



Half-range type (411759-0020)

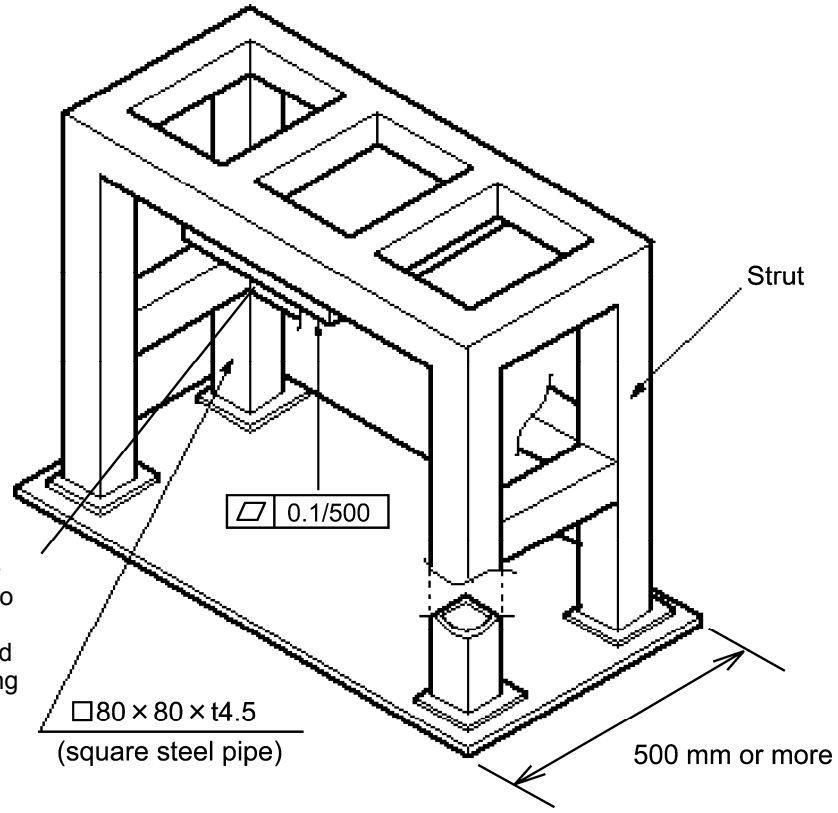
Specifications

	Full-range type	Half-range type
Outer Dimensions	Width: 130 mm Depth: 557.5 mm Height: 590 mm	Width: 130 mm Depth: 257.5 mm Height: 590 mm
Weight	Approx. 40kg per stand	Approx. 30kg per stand

For details, see Chapter 4 Appendices.

Note: The deflection of full-range type is approx. 0.3mm.

Half-range stands limit the workable space, since they are placed inside the space. Take measures (e.g. software limit) to avoid collision between a robot and a stand.



The installation surface must be large enough to support all of the mounting bolts specified in "Positions of mounting bolts" on page 6.

⚠Caution (1) When the robot runs at high speed, the robot mount undergoes large reaction forces. The mount must be rigid enough so that it will not vibrate or be displaced due to reaction forces. It is also advisable to mechanically join the robot mount with heavy equipment.

(2) Some mounts may produce a resonance sound (howling). If this sound is loud, increase the rigidity of the mount or slightly modify the robot speed.

Robot Mount Sample for Overhead-mount Type

1.2 Mounting the Robot Unit

> ⚠**Caution: Before handling or mounting the robot unit, be sure to read "SAFETY PRECAUTIONS, Installation Precautions."**

1.2.1 Transporting the Robot Unit

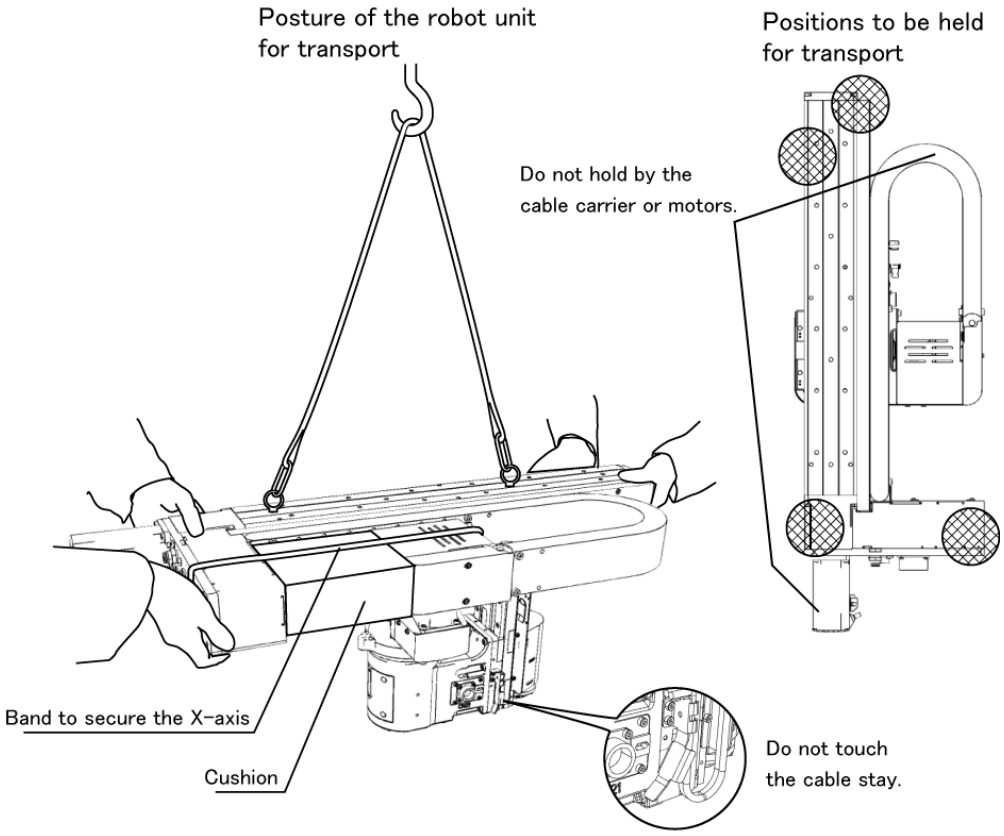
(1) Cautions in transporting the robot

The XR-G series of robots weighs approximately 53 kg (116 lb.) (in the case of the heaviest model, XR-43A32GM). Use a crane with sufficient capacity.

Transporting should be handled by at least three people, while wearing a helmet, safety shoes, safety goggles, and gloves.

Follow the transporting procedure given below.

> ⚠**Caution**
> - **Pass the hoisting wires through the specified eyebolts as illustrated below. Passing them through other sections may drop the robot unit, resulting in a broken robot or bodily injuries.**
> - **Do not hold by the covers or apply force to them.**
> - **Make sure that the transport path is free of obstacles.**
> - **Do not touch the cable stay during transport. If deformed, the cable stay may break the cable(s) when the robot arm is in motion.**



A robot unit with X-axis stroke of 450 mm is packed with a cushion . Do not remove when transporting the robot unit.

(2) Transporting the robot unit

> ⚠**Caution: Make sure that the transport path is free of obstacles.**
> During transportation, always bind the X-axis tightly to prevent it from moving unexpectedly. Since the X-axis has no brake, tilting the robot unit with power off will slide the unbound X-axis so that the robot unit becomes off-balance, resulting in accidents.

Transport the robot unit to the installation position and mount it temporarily on the robot mount using the following procedure.

Step 1

Make sure that the robot mount and bolt holes have been set up for the robot unit. (For the locations of the mounting bolt holes, see the drawing in Section 1.2.2.)

Step 2

< When removing from original packaging >
At the time of shipment, the robot unit is packaged so that it can be hoisted immediately after unpacked. Open the top cover of the package, hook wires on hoisting eyebolts provided on the X-axis rail, and hoist the robot unit with a crane. Do not release the band that secures the X-axis until the completion of transportation.

< When transferring installed robot unit >
Before hoisting the robot unit, secure the joints and remove all of the cables, air pipes, and other items that could hinder transportation. In particular, the X-axis has no brake and could slide if the robot unit tilts.

Mount the hoisting eyebolts on the X-axis rail, hook wires on those eyebolts, and hoist the robot unit with a crane, keeping safety in mind with the posture shown on the previous page during transportation.

Step 3

Free up a sufficient transport path by getting rid of obstacles and dangerous items.

Step 4

Transport the robot unit to the vicinity of the target installation position. The two people at both ends of the robot unit should support the robot unit while the other person unhooks the robot unit from the crane and removes the wires and hoisting eyebolts from the robot unit.

Remove the grease splash protector that has been preset in the X-axis rail at the time of shipment.

Step 5

The two people at both ends of the robot unit should locate the robot unit on the installation position while the other person temporarily secures the robot unit with bolts.

After the X-axis is horizontal, remove the band and cushion that secure the X-axis.

Step 6

Firmly secure the robot unit, referring to Section 1.2.2.

1.2.2 Securing the Robot Unit

(1) Drill 2 x n tap holes in the robot mount where the robot unit is to be secured, according to the dimensions shown below.

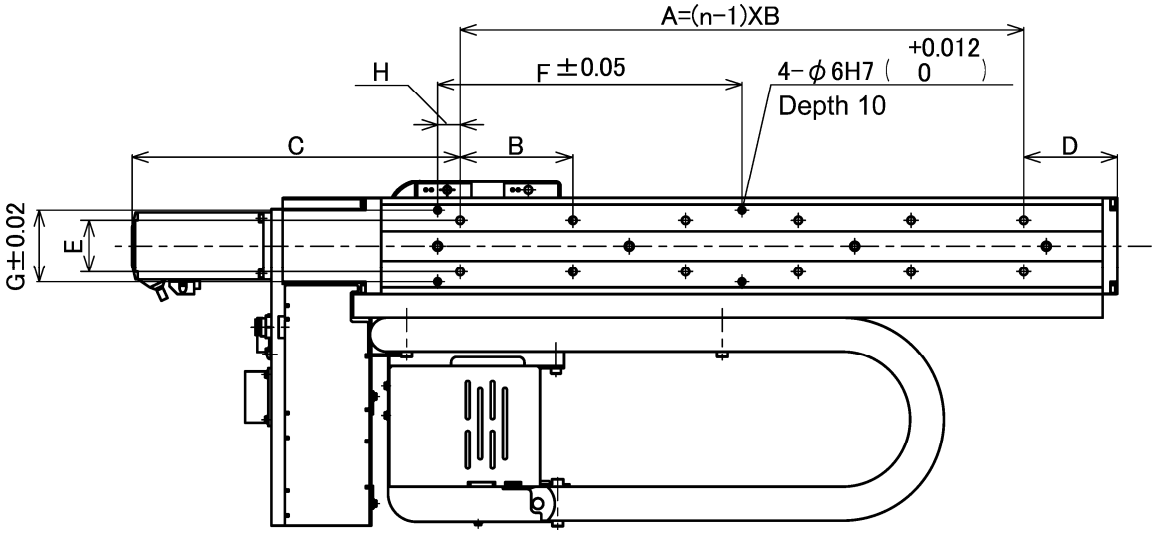
(2) Temporality secure the robot unit to the intended installation position, following the instructions given in Section 1.2.1 "Transporting the Robot Unit."

(3) Firmly secure the robot unit with bolts to the specified tightening torque.

(4) Mount the X-axis cover.

> ⚠**Caution: Be sure to tighten all bolts firmly. If any one of those bolts is loose, vibration of the robot system may occur. When designing the robot mount, take care not to cause trouble due to improper installation. Failures which arise from improper installation shall not be covered by the warranty.**

X-axis stroke	Dimensions in the figure below (mm)									Hex. socket-head bolts for securing	Tightening torque
	A	B	C	D	E	F	G	H	n (Qty)		
450 mm	500	100	291	58	46	270	64	20	6	M6x18	14.7±2 N▪m
760 mm	900	150	285	55	50	450	80	0	7	M8x20	35.3±7 N▪m
1060 mm	1200	150	285	55	50	600	80	0	9	M8x20	35.3±7 N▪m



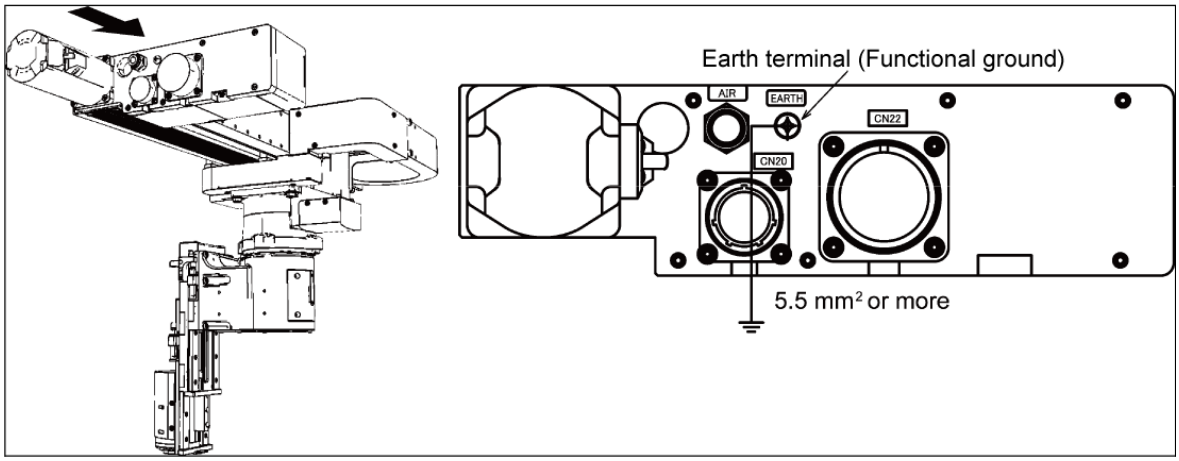
> ⚠**Caution: If you remove and reinstall the robot unit for maintenance or other jobs, you need to correct an out-of-position error in teaching.**

Bolt Positions for Securing

1.2.3 Grounding the Robot Unit

Ground the earth terminal of the robot unit using a wire of 5.5 mm^2 or more.

NOTE: Use a dedicated grounding wire and grounding electrode. Do not share them with any other electric power or power equipment such as a welder.



Grounding the Robot Unit

1.2.4 Changing the Mounting Position of T-axis Unit

The XR-G series of robots allows the T-axis unit to be shifted by 40 or 80 mm in the positive direction of the Z-axis from the original mounting position as shown below.

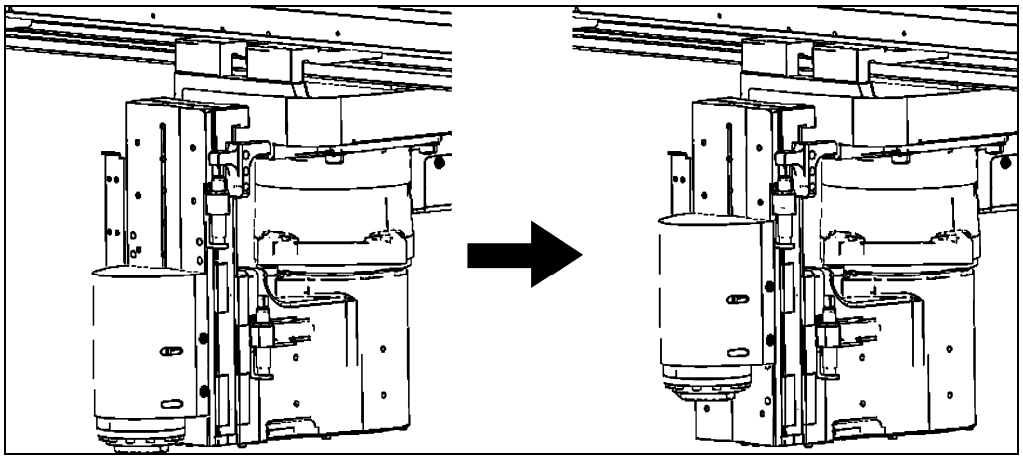
The T-axis unit is mounted on the robot unit with four bolts (M5) and two positioning pins (ϕ5).

After changing of the mounting position, the Z-axis coordinates in software can be used without modification.

> ⚠**Caution: Shifting the T-axis unit may cause the end-of-arm-tooling (EOAT) to interference with the Z-axis' movable components.**

As shown below, the mounting position of the T-axis unit can be changed in the positive direction of the Z-axis.

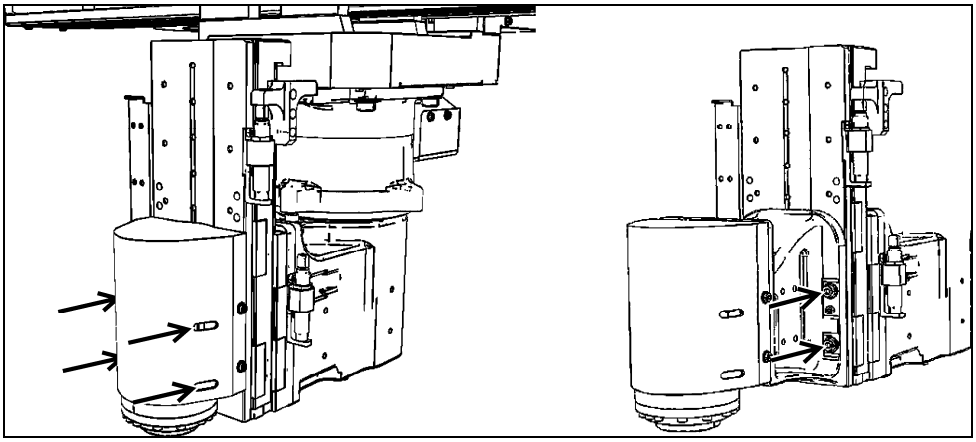
⚠Caution: While changing the mounting position take care not to pull, scratch, or damage the T-axis wiring.



Mounting example of T-axis unit shifted by 40 mm in the positive direction

Removing the four bolts from the T-axis unit

⚠Caution: When loosening those bolts, be sure to support the T-axis unit by hand; otherwise, the T-axis unit will drop.



Bolt positions (4 locations) when R=200 mm
Insert an Allen wrench (4 mm) through the slots provided in the T-axis unit and remove the four bolts (M5). (The T-axis unit is designed so that those bolts will not drop.)

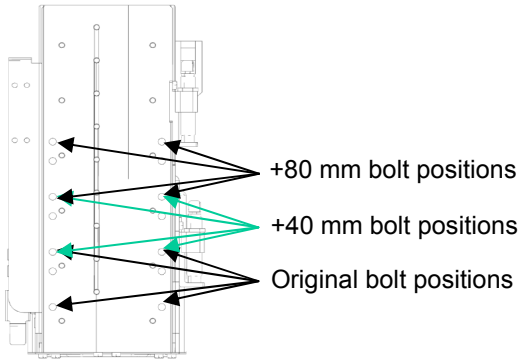
Bolt positions (4 locations) when R=250 or 300 mm

Securing the T-axis unit

The allowable shift amount is 40 or 80 mm in the positive direction of the Z-axis.

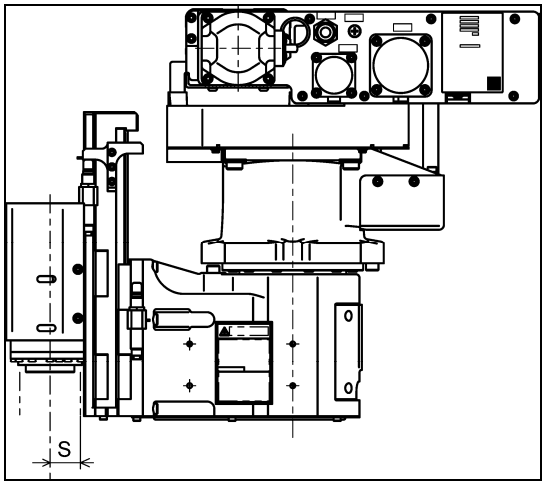
As shown at the right, secure the T-axis unit with four bolts (M5).

Tightening torque: 5.9 ±0.6 N▪m



Engineering-design notes for robot end-of-arm-tooling when the T-axis unit is shifted

Shifting the T-axis unit may cause the robot end-of-arm-tooling to interfere with the robot unit. It depends upon the arm length of the R-axis. Design the robot end-of-arm-tooling so that no interference occurs.



Arm length of R-axis	S (Distance between T-axis and robot unit
200 mm	25 mm
250 mm	75 mm
300 mm	125 mm

1.3 Installing the Robot Controller

For the installing procedures of the robot controller, refer to the RC7M CONTROLLER MANUAL, "Installing the Robot Controller."

1.4 Electrical Wiring and Air Piping of the Robot Unit

Make electrical wiring and air piping of the hand or tool to be attached to the arm end, referring to the GENERAL INFORMATION ABOUT ROBOT for XR-G SERIES, Section 3.4 "Air Piping and Signal Wiring."

Use robot instrumentation cables (manufactured by Daikyo Denshi) or equivalent for electrical wiring.

1.5 Engineering-design Notes for Robot Hands

Refer to the GENERAL INFORMATION ABOUT ROBOT for XR-G SERIES, Chapter 3, Section 3.6 "Engineering-design Notes for Robot Hands."

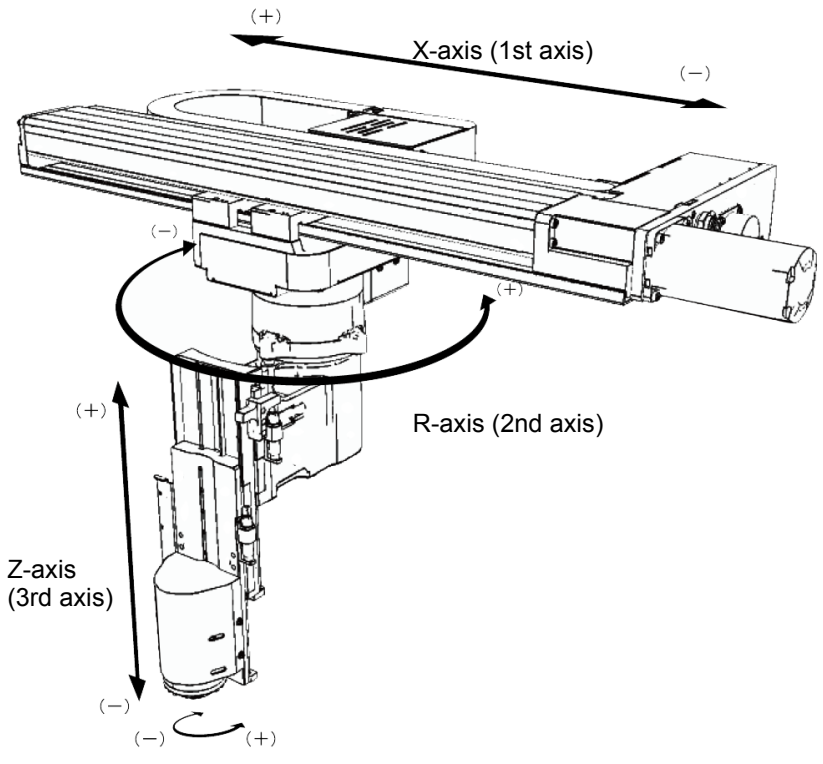
1.6 Moving Each Axis with Motor Power OFF in Emergency Stop

The table below shows how to move each axis with the motor power OFF when the robot is in an emergency stop. The 3rd axis (Z-axis) brake must be released.

> ⚠**Warning: (1) Performing the brake release operation drops the Z-axis. Make sure beforehand that the release operation will not cause bodily injuries or equipment damages.**
> **(2) When moving the 3rd axis (Z-axis), be careful not to let your fingers get caught in the geared part of the rack.**

Moving the axes in an emergency stop

Axis	How to move the axes TP: Teach pendant MP: Mini-pendant
1st axis (X-axis) 2nd axis (R-axis) 4th axis (T-axis)	Move each of these axes by hand.
3rd axis (Z-axis)	Release the emergency stop, and then release the brake with the teach pendant or mini-pendant. - Releasing the emergency stop : If the emergency stop has been triggered by the teach pendant or mini-pendant, turn the Emergency stop button on the pendant clockwise; if it has been triggered by the equipment, cancel the emergency stop. - Releasing the brake with the teach pendant or mini-pendant : Perform the brake release operation or enter the direct teach mode using the teach pendant. Access : [F2 Arm]—[F12 Maint.]—[F3 Brake.] on the teach pendant Access : [F2 Arm]—[F6 Aux.]—[F3 Direct.] on the teach pendant **Note: For details, refer to the SETTING-UP MANUAL, Chapter 5 "Commands Assigned to Function Keys of the Teach Pendant" and Chapter 6 "Using the Mini-Pendant."**



Chapter 2
Customizing Your Robot

2.1 What Is Customization?

You may customize your robot by modifying or setting the following:

- Software motion limits for defining motion space
- Mechanical ends for defining restricted space
- Control set of motion optimization
- Robot installation conditions

You are recommended to define new motion space and restricted space in order to prevent interference with other devices or entanglement of the robot hand wiring and piping.

WARNING:

Always set the software motion limits and mechanical ends so that the motion space will be within the restricted space. Otherwise, the robot will bump the mechanical stops, causing serious accidents.

2.2 Modifying Software Motion Limits to Define New Motion Space

2.2.1 What Is a Software Motion Limit?

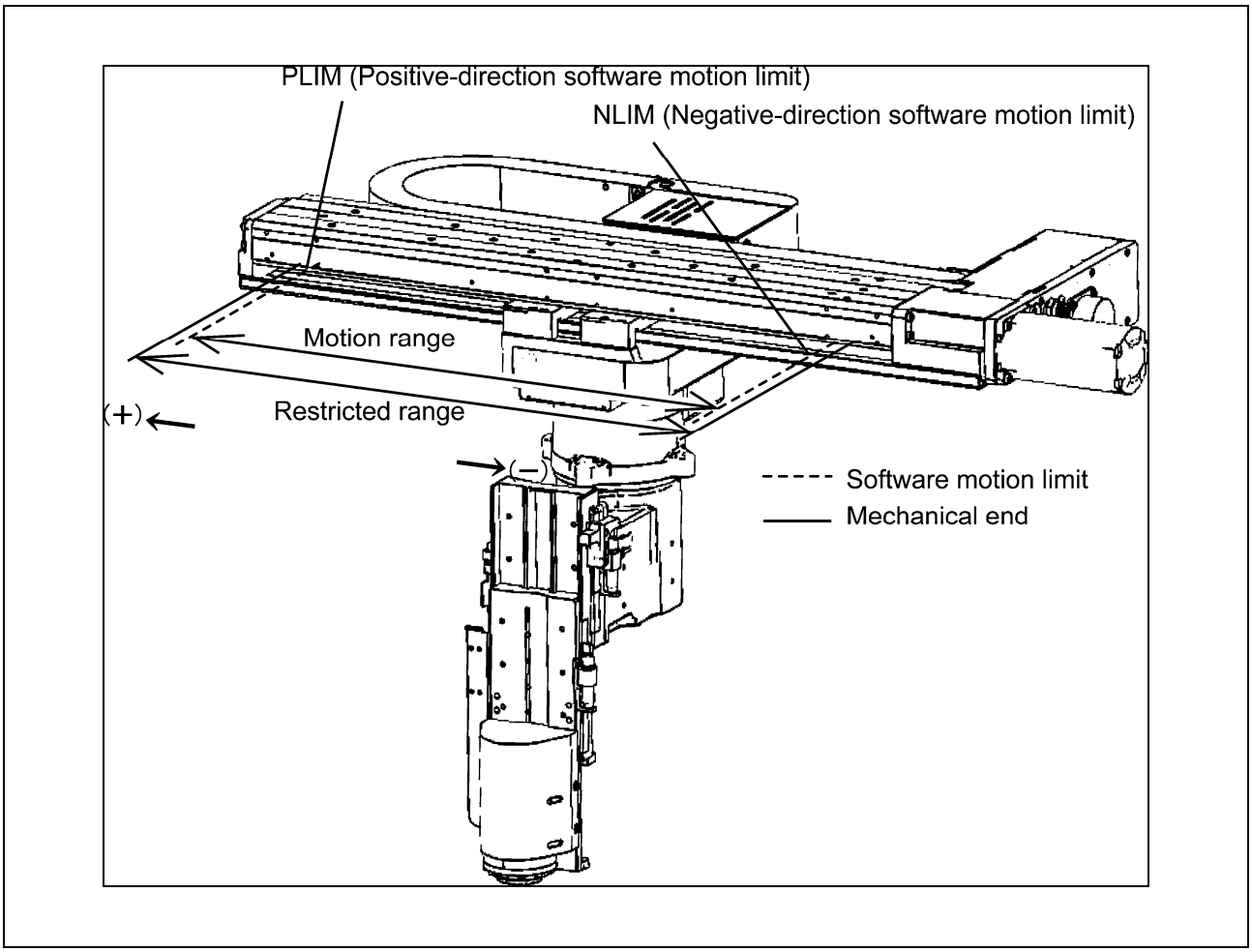
A limit to the operation range of the robot defined by the software is called a software motion limit. Software motion limits become valid after CAL of the robot has been completed and the robot has entered the range set by the limits.

A mechanical motion limit is called a mechanical end and set by a mechanical stop. To prevent the robot from striking against a mechanical stop, each software motion limit is set slightly in front of the mechanical end as shown below. Although there is no mechanical stop for the 4th axis (T-axis), a software motion limit is set.

If the robot reaches a software motion limit during manual or automatic operation, an error message will be displayed (error code starting from 6070; the first digit represents the axis number) and the robot will come to a stop. The power to the motor is also turned OFF in such a case during automatic operation.

All axes are assigned a software motion limit in both the positive and negative direction of the operation range. The software motion limit in the positive direction is called the positive-direction software motion limit and that in the negative direction is called the negative-direction software motion limit.

⚠**Note:** Software motion limits are not functions in accordance with safety standards.



Software Motion Limits and Mechanical Ends

2.2.2 Software Motion Limits (Factory defaults)

The tables below list the software motion limits that are set at the time of delivery.

Software Motion Limits (Factory defaults)

1st axis (X-axis)

1st-axis stroke	450 mm	760 mm	1060 mm
Positive direction	0 mm	0 mm	0 mm
Negative direction	450 mm	760 mm	1060 mm

2nd axis (R-axis)

Positive direction	168°
Negative direction	-168°

3rd axis (Z-axis)

3rd-axis (Z) stroke	135 mm	200 mm
Positive direction	0 mm	0 mm
Negative direction	-135 mm	-200 mm

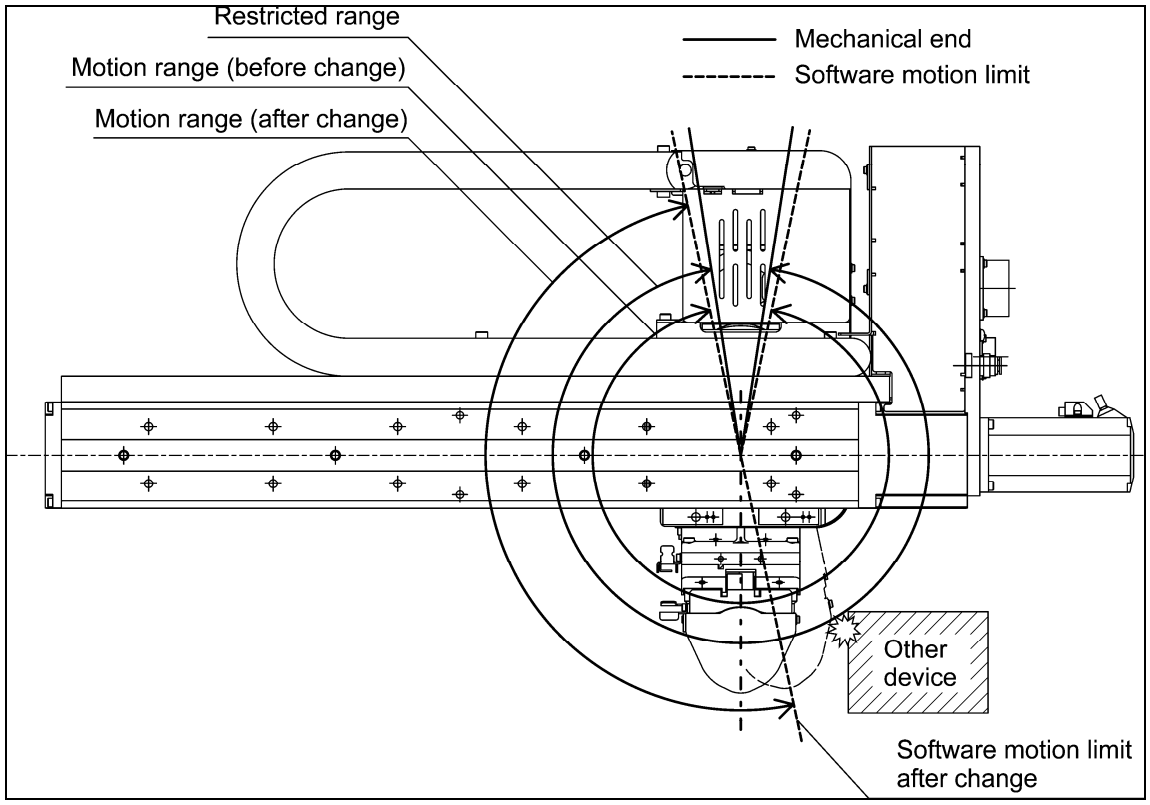
4th axis (T-axis)

Positive direction	360°
Negative direction	-360°

2.2.3 Changing Software Motion Limits

If the robot interferes with other devices or the air piping and wiring of the hand become taut as the robot arm moves, then change the software motion limits to make the motion space smaller as shown below.

> ⚠**Caution: When changing software motion limits, be sure to check the mechanical stop positions. Configure the setting so that the robot arm can move without interfering with the mechanical stoppers. For changing mechanical stops, refer to Section 2.3 "Changing the Mechanical End."**



Changing Software Motion Limits

2.2.4 Precautions When Changing the Software Motion Limits

> ⚠**Caution:** **Before changing the software motion limit for the 2nd axis (R-axis), determine the mechanical stop positions and select the motion space of the R-axis.**
> **Confirm the operating space of the robot unit in the actual working environment. Set the software motion limits using the correct unit of measurement.**
> **If the operating space is too small, the robot may seem to become inoperable.**

2.2.5 Procedure for Changing the Software Motion Limits

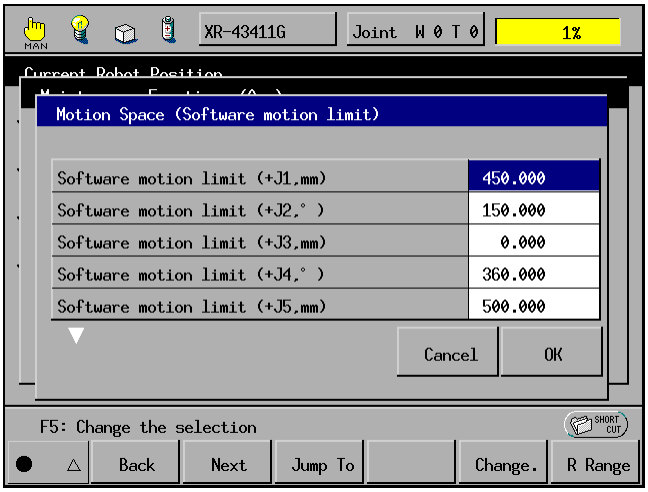
Described below is the procedure for changing the software motion limits.

Step 1 Turn the power switch of the robot controller ON.

Step 2 Set the mode selector switch of the teach pendant to MANUAL.

Step 3 Press [F2 Arm]—[F12 Maint.]—[F1 M Space] from the top screen of the teach pendant.

The Motion Space window appears as shown below.

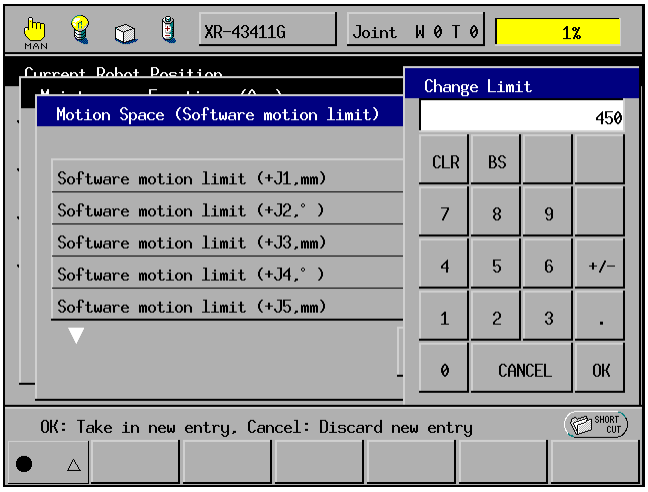


Select the software motion limit to be modified, then press [F5 Change].

Step 4

The numeric keypad appears as shown below.

Enter a desired value using the numerical keypad, then press OK.



The new value will be set on the line of the item selected in the Motion Space window.
If two or more items must be changed, repeat Steps 3 and 4.

Step 5

Press OK in the Motion Space window.

2.3 Changing the Mechanical End

This section describes the procedures of changing the mechanical ends of the 2nd-axis for the XR-G series.

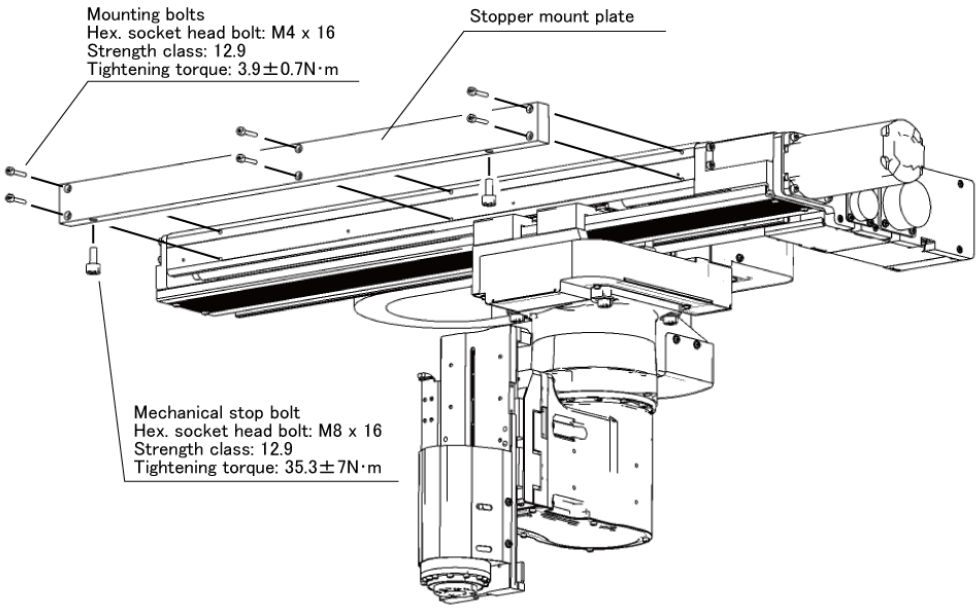
CAUTIONS IN CHANGING THE MECHANICAL ENDS

1. **When changing the mechanical ends, design the mechanical stoppers according to your usage and manufacture them.**
2. **After changing the mechanical end, the software motion limits (PLIMs, NLIMs) should be changed not to interfere the mechanical end at the robot operation.**
3. **When the robot has collided with a mechanical stopper, contact us for inspection and repairs before using the robot because the robot may be damaged.**
   Also because the mechanical stopper designed and made by the customer may be damaged, do not reuse the mechanical stopper, but replace it before using the robot.
4. **The failures caused by the mechanical stoppers shall not be covered by the warranty even if the robot is under warranty.**

2.3.1 Limiting the Motion Range of the 1st axis (X-axis)

To limit the motion range of the 1st axis (X-axis), a stopper mount plate and mechanical stop bolts are used.

Drill holes for the mechanical stop bolts on the stopper mount plate where the motion of the 1st axis (X-axis) is to be limited, and screw the bolts. Make sure that the motion range is properly limited, referring to the drawings on the later pages.



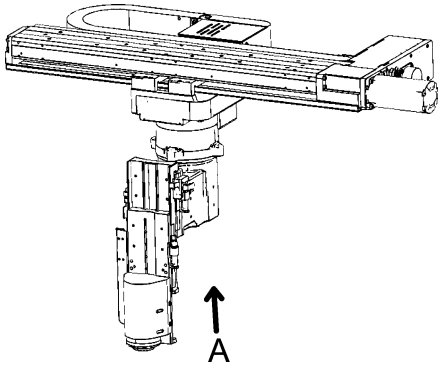
2.3.2 2nd-axis (R-axis) Mechanical End Change

[1] What is the 2nd-axis (R-axis) mechanical end change?

From the factory, the mechanical stop bolt on the XR-G series robot is mounted at the 180° position of the 2nd axis (R-axis) as shown below.

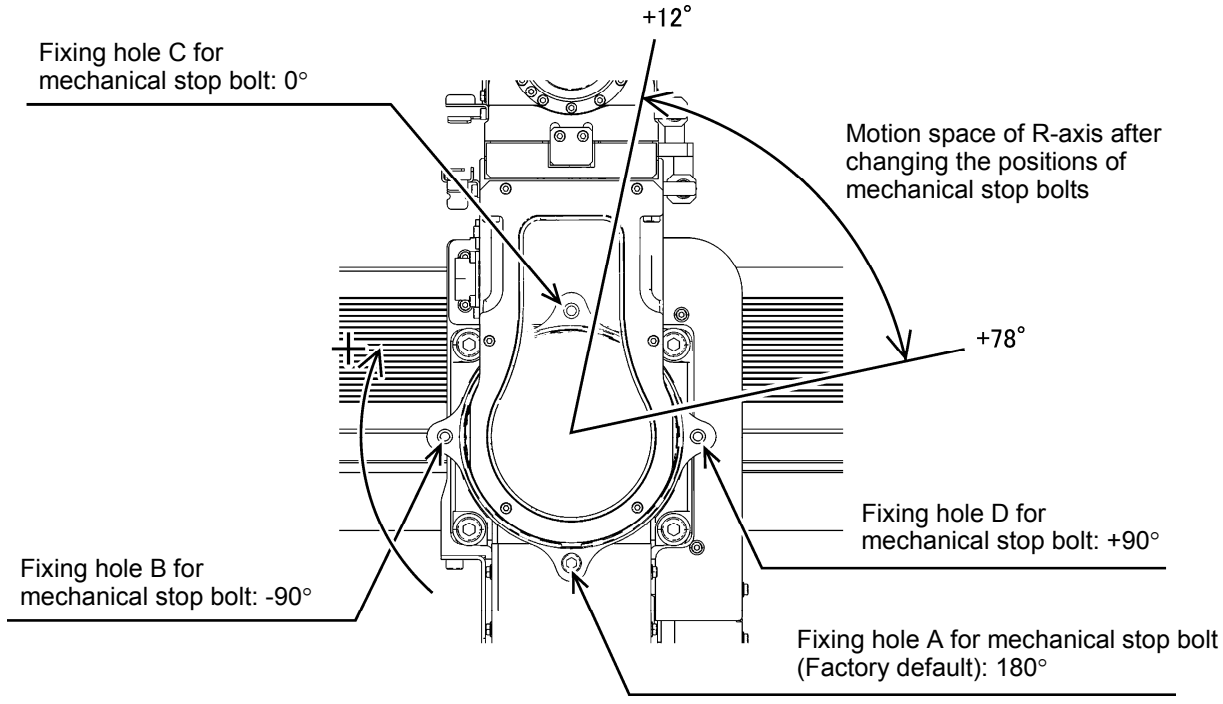
To change the motion space of the 2nd axis (R-axis), first change the mechanical stop position. Changing the mechanical stop position and motion space is called a mechanical end change.

The 2nd axis (R-axis) of the XR-G series has four bolt holes for mechanical stops. Set up the mechanical stop positions and the motion space of the 2nd axis (R-axis) correctly, referring to the procedure shown below.



Motion space (software motion limits) of 2nd-axis (R-axis) for each mechanical stop position				
Mechanical stop position	180°	90°	0°	-90°
Positive direction	168°	78°	348°	258°
Negative direction	-168°	-258°	12°	-78°

↑ Factory default



Viewed from A

⚠Caution: If you change the mechanical end positions of the 2nd axis (R-axis), you also need to configure the motion space of the 2nd axis on the controller.

[2] Changing the 2nd-axis (R-axis) mechanical ends

To change the 2nd-axis mechanical ends, first change the position of the mechanical stop bolt that was mounted from the factory, and then change the motion space of the R-axis with the teach pendant.

Follow the procedure given below.

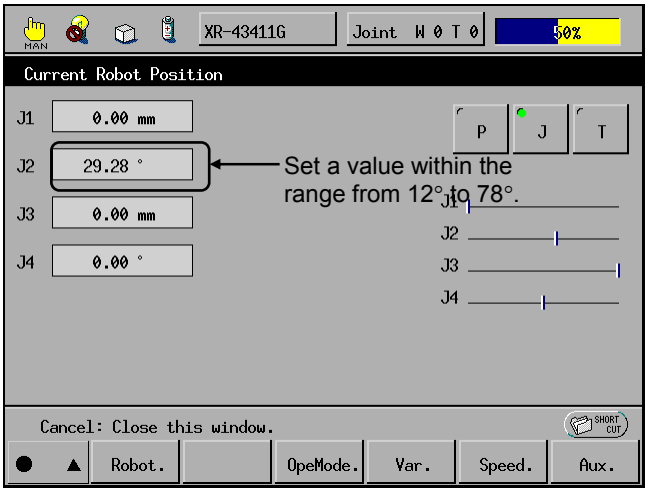
Step 1

Turn the power switch of the robot controller to ON.

Set the mode selector switch of the teach pendant to MANUAL.

Step 2

Move the 2nd axis (R-axis) to the range from 12° to 78° using the teach pendant.

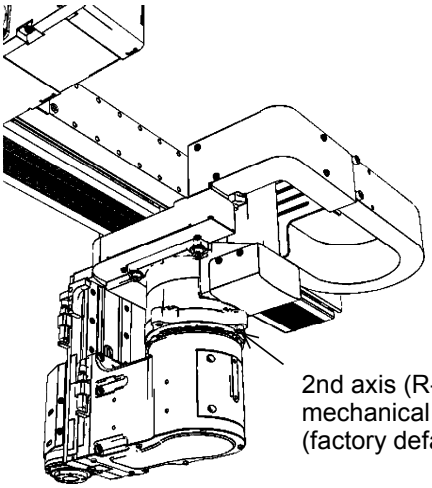


Step 3

Press the MOTOR key to turn the motor power OFF.

> ⚠**Caution: When working within the robot's motion space, do not allow the robot unit to move.**

Step 4 Remove the mechanical stop bolt and reinstall it to the desired position.



2nd axis (R-axis)
mechanical stop position
(factory default)

For available positions of the mechanical stop bolt, refer to "[1] What is the 2nd-axis (R-axis) mechanical end change?".

Tightening torque: 9.8 ±2.0 N▪m

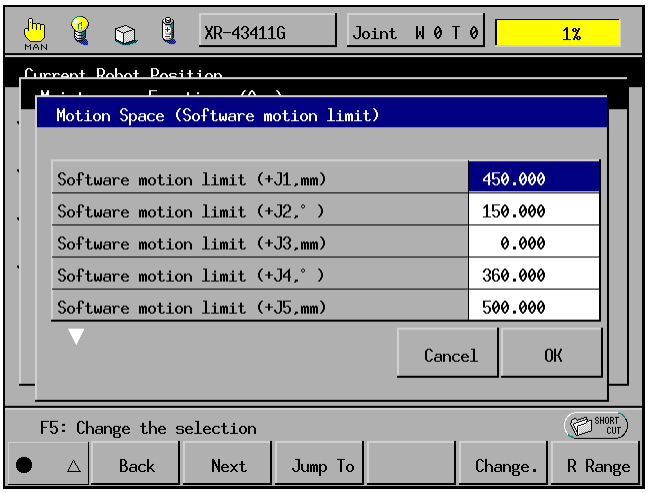
Tip: Specification of mechanical stop bolt
Plated, hex. socket-head bolt M6x12 (one piece), strength class 10.9
<Bolt specifications: M6x12 SCM435 (JIS G4105) HRC34-44>

Step 5 Press the MOTOR key to turn the motor power ON.

⚠Caution: Confirm that there is no person in the robot's motion space.

Step 6

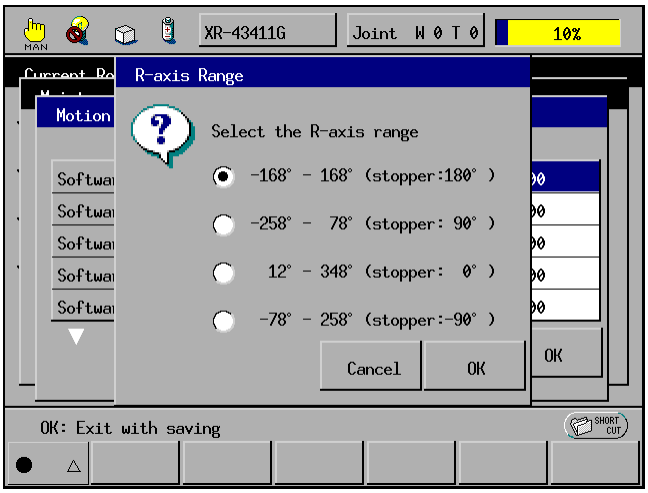
Specify the R-axis motion space in the Motion Space window on the teach pendant.
Access: [F2 Arm]—[F12 Maint.]—[F1 M Space.] from the top screen



Press [F6 R Range].

Step 7

The R-axis Range window appears as shown below.



Select the R-axis motion range for which the mechanical stop is positioned then press OK.

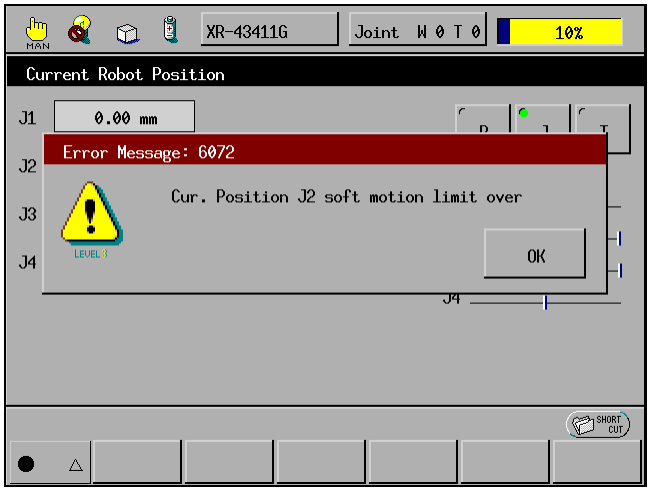
To change the R-axis motion range using WINCAPSIII, refer to [3] given later.

Step 8

Check that the software motion limit has been specified correctly by moving the R-axis.

Gradually move the arm to the mechanical stop. If the robot stops near the mechanical stop showing the error message "Cur. Position J2 soft motion limit over," then the software motion limit has been correctly specified.

If the arm hits the mechanical stop, respecify the software motion limit again.



[3] Changing the R-axis motion range using WINCAPSIII

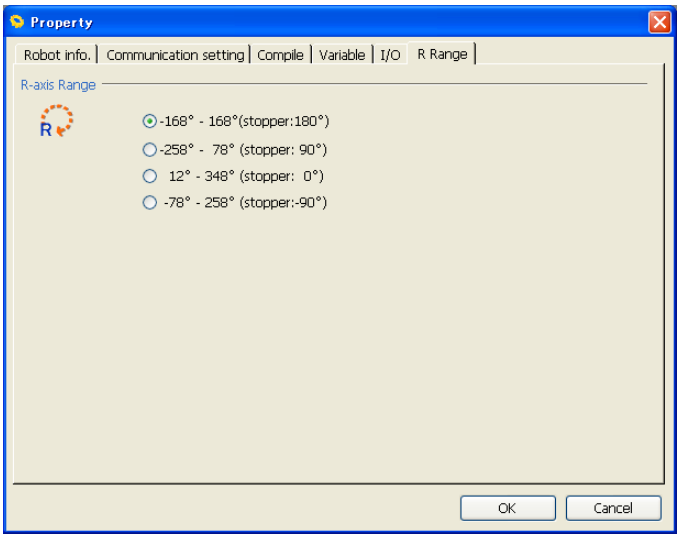
The R-axis motion range data held in the robot controller can be changed using WINCAPSIII.

Step 1

Start WINCAPSIII and log on as a Programmer.
Create a project for the XR-G series in WINCAPSIII.

Step 2

Choose Project | Property | R Range tab.

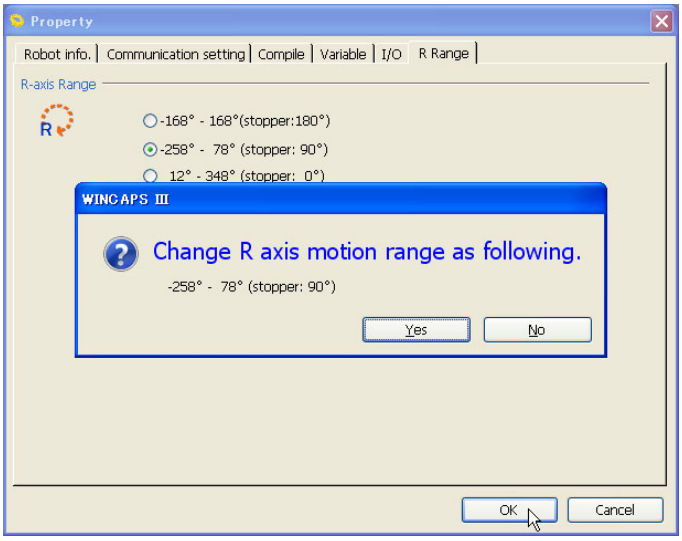


Step 3

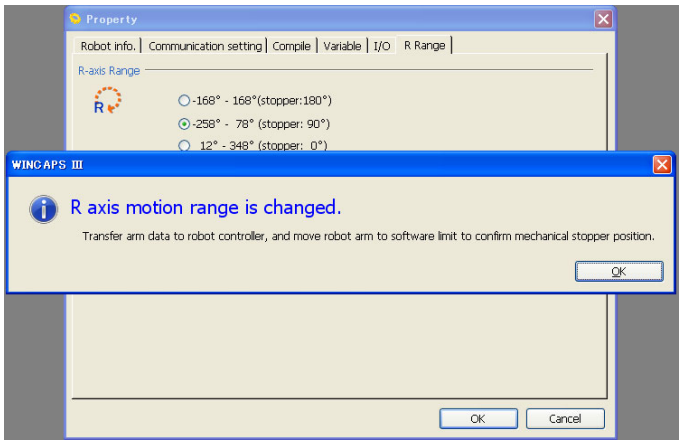
Select the R-axis motion range and press OK. Refer to "[1] What is the 2nd-axis (R-axis) mechanical end change?".

Step 4

The following message appears, prompting you to check the motion range angles and the mechanical stop position. If they are OK, press the Yes button.



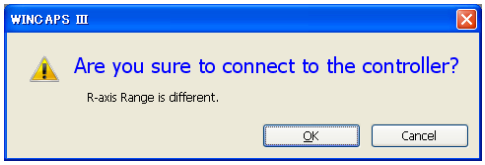
Step 5 Check that the R-axis motion range of the project in WINCAPSIII has been changed.



Step 6 To transfer the arm data of the project from WINCAPSIII to the robot controller, choose Connect | Transfer data.

The following confirmation message appears since the R-axis motion range data held in the robot controller is different from the one specified in WINCAPSIII.

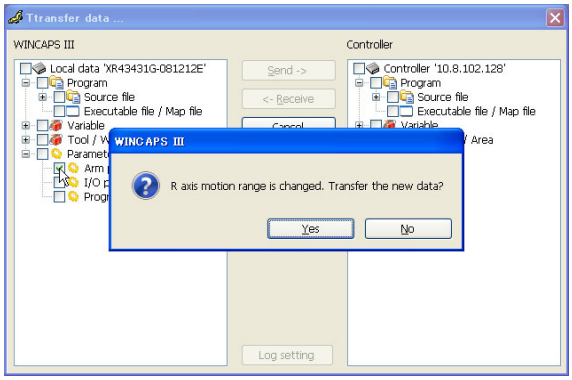
Press OK.



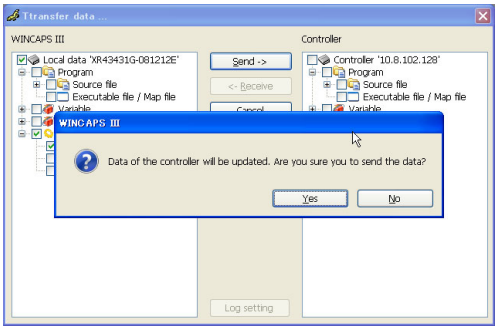
Step 7 In the Transfer data window, select Parameters | Arm parameters.

The confirmation message appears. Press Yes.

Then, press Send.

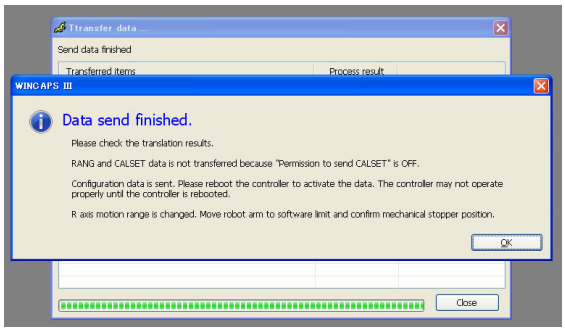


Step 8 The confirmation message appears.
Press Yes.



Step 9

The following message appears, indicating that the R-axis motion range data has been transferred to the robot controller and the one held in the controller has been updated.
Move the robot's R-axis and confirm that the motion range is properly changed.



Step 10

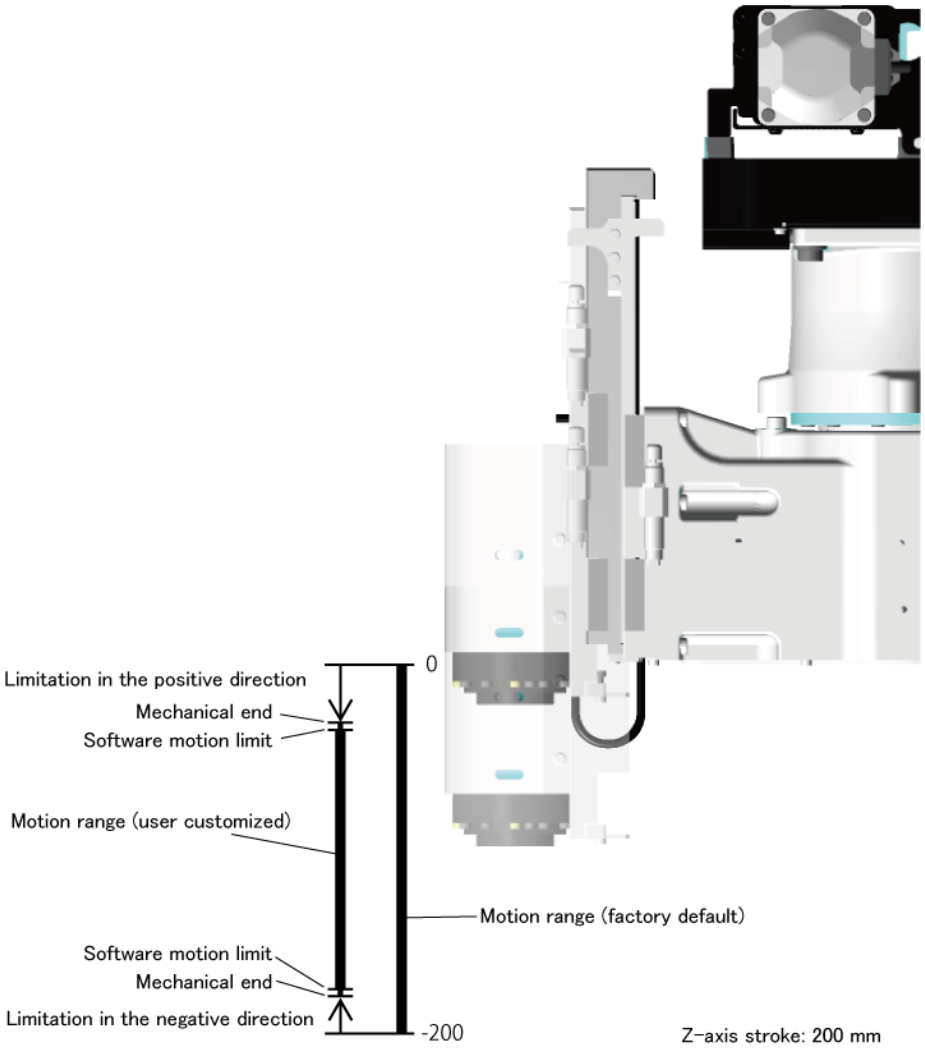
After changing the R-axis motion range, confirm that the mechanical stop bolt position is suitable for that motion range. Refer to "[2] Changing the 2nd-axis (R-axis) Mechanical Ends."

> ⚠**Caution: Running the robot without changing the mechanical stop bolt position may cause the robot arm to collide against the mechanical end, resulting in a breakage. If you change the R-axis motion range, be sure to also change the mechanical stop bolt position.**

2.3.3 Limiting the Motion Range of the 3rd axis (Z-axis)

The motion range of the 3rd axis (Z-axis) can be limited by mounting mechanical stoppers prepared by user.

Mechanical stopper differs depending on the Z-axis stroke of the robot (135 mm or 200 mm) and the direction in which the robot motion is to be limited (positive or negative).

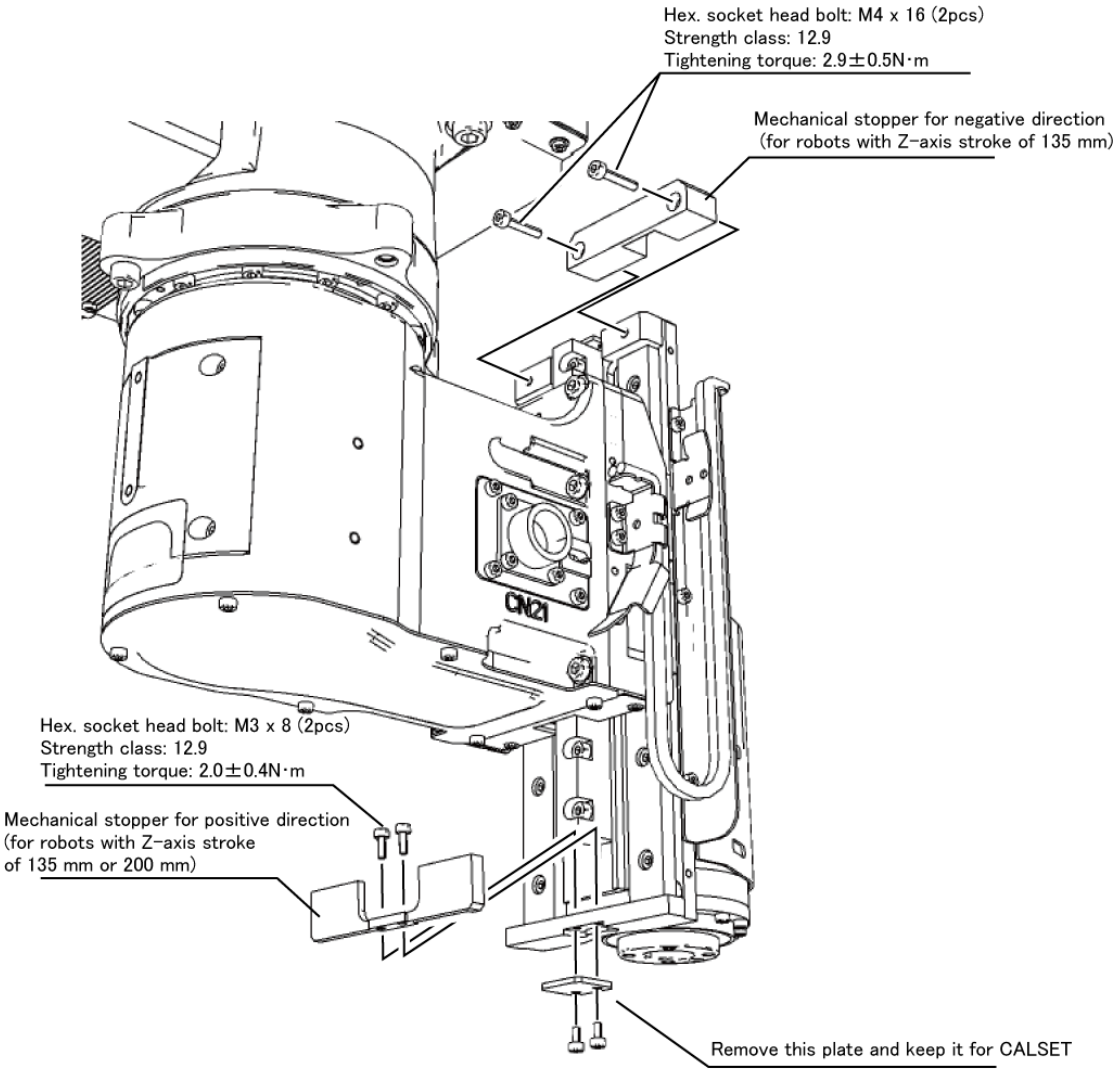


2.3.4 For Robots with the Z-axis Stroke of 135 mm

To limit the motion range of the 3rd axis (Z-axis), mechanical stoppers for positive direction (upwards) and/or the negative direction (downwards) need to be mounted.

Prepare mechanical stoppers that allow the robot motion in your desired range, referring to the drawings on later pages.

Move the Z-axis unit so that the mechanical stopper can be mounted on the specified position. After turning off the motor and controller power, mount the mechanical stopper. Make sure that the Z-axis brake is NOT released while mounting the stopper.

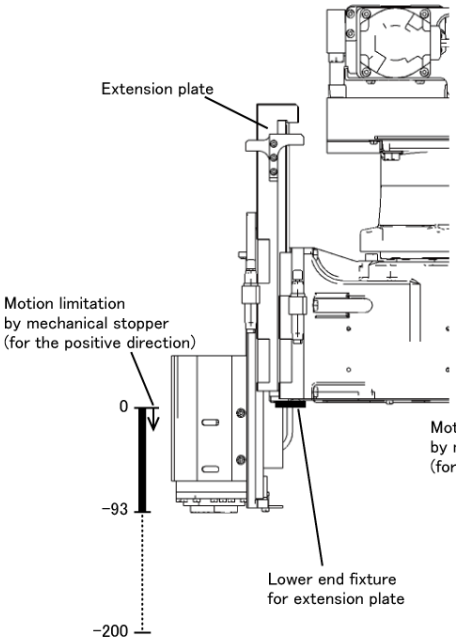


Note: Do NOT move the 3rd axis (Z-axis) by hand.
To mount the mechanical stopper for positive direction, a plate mounted on the extension plate needs to be removed. Keep the plate in a safe place as it is used to CALSET.

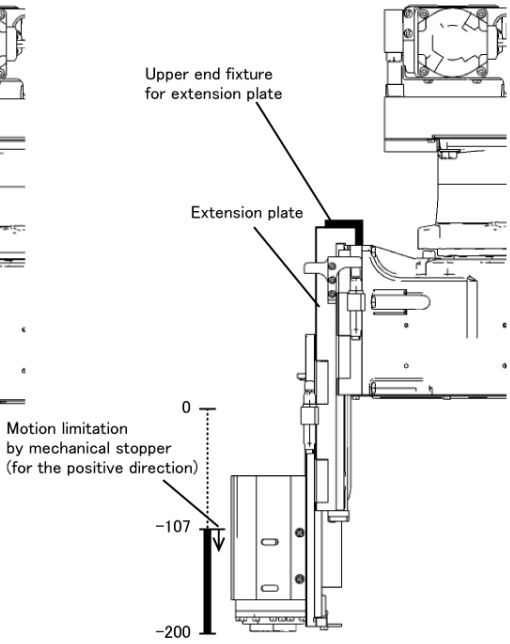
2.3.5 For Robots with the Z-axis Stroke of 200 mm

To limit the motion range of the robot with the Z-axis stroke of 200 mm, fix the extension plate either at the uppermost or lowermost position.

For further limitation in the positive direction, mount the mechanical stopper for positive direction. The mechanical stopper is the same as that for robots with the Z-axis stroke of 135 mm.



Motion range with the extension plate fixed at the uppermost position



Motion range with the extension plate fixed at the lowermost position

Note: When limiting the motion range of the robot with the Z-axis stroke of 200 mm, make sure that the extension plate is fixed.

2.4 CALSET

2.4.1 What Is CALSET?

Calibrating the relationship between position-related information recognized by the robot controller and the actual position of the robot unit is called CALSET.

CALSET must be performed when the motor is replaced or when the encoder backup battery goes dead and the position-related data retained in the encoder is lost as a result.

After CALSET is completed, the calibrated data of the robot unit will be stored in the robot controller. This data is called CALSET data which is different on each robot.

Back up the CALSET data periodically, referring to "Backing Up Projects."

> ⚠**Caution: Before CALSETing the 2nd axis (R-axis), return the mechanical end position and the software limit values to the factory default positions.**

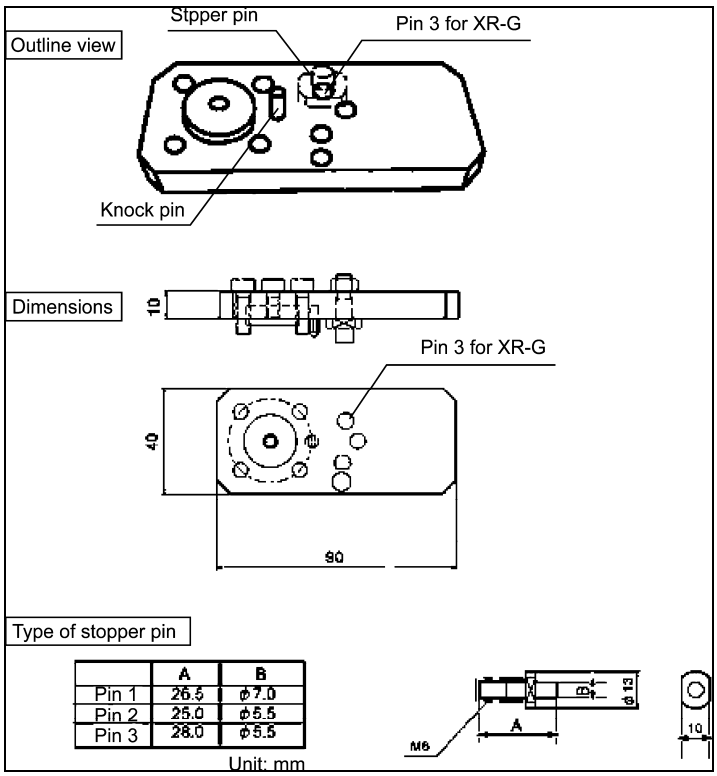
2.4.2 Mounting the CALSET Jig

To CALSET the 4th axis (T-axis) or all axes, you need to mount the CALSET jig on the axis beforehand according to the procedure given in (1) below or (2) given later, respectively.

To CALSET all axes including the above axes, follow those procedures (1) and (2).

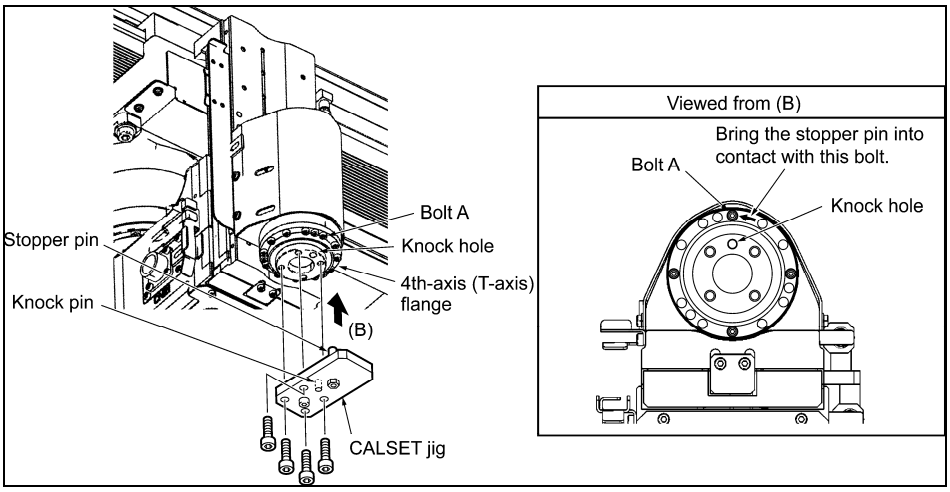
(1) Mounting the CALSET jig on the 4th axis (T-axis)

Step 1 Fit a stopper pin in the CALSET jig.

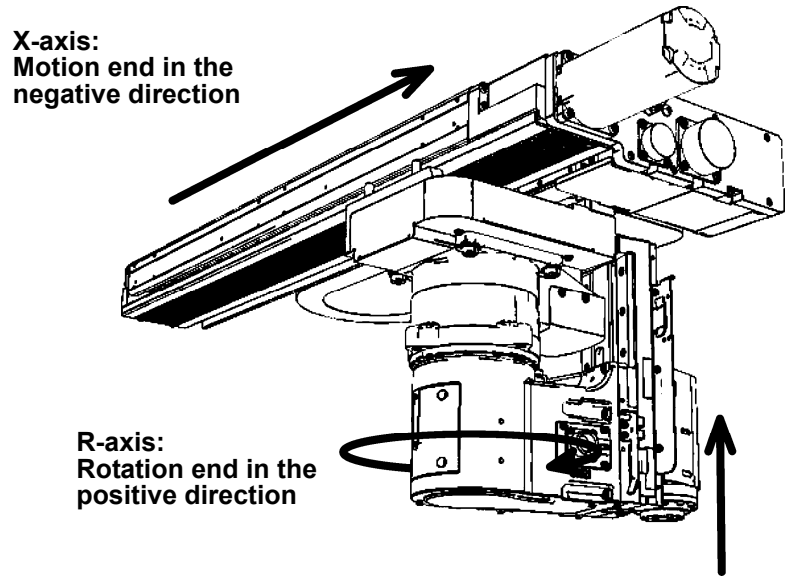


Step 2 Mount the CALSET jig on the 4th-axis (T-axis) flange as shown below.

The CALSET position of the 4th axis (T-axis) refers to the point where the stopper pin (shown below) comes into contact with bolt A by turning the 4th-axis (T-axis) flange.



Robot series		XR-G Series
Location	X-axis (1st axis)	Motion end in the negative direction
	R-axis (2nd axis)	Rotation end in the positive direction
	Z-axis (3rd axis)	Uppermost motion end (in the positive direction)
	T-axis (4th axis)	Rotation end in the positive direction set by the CALSET jig (Refer to the "Mounting the CALSET jig on the 4th axis (T-axis)" on the previous page.)



⚠Caution: If the R-axis mechanical end position has been changed by the customer, revert it to the 180° position (factory default) before CALSETing.

CALSET Positions (by factory default)

2.4.3 CALSET Procedure

[1] CALSETing a Single Axis

CALSETing a specified single axis only is called single-axis CALSET.

Perform single-axis CALSET if the motor of an axis is replaced so that the axis must be CALSET, or if some axes cannot be moved to the CALSET positions (mechanical stop positions) at any given time because of interference between the robot unit and its surrounding facilities.

NOTE: Step 1 is required for CALSETing the 4th axis. When CALSETing any other axes, skip to Step 2.

Step 1
(Required for CALSETing the 4th axis)

Mount the CALSET jig according to Section 2.4.2 [1] "Mounting the CALSET jig on the 4th axis (T-axis)."

Step 2

Turn the power switch of the robot controller to ON.

Step 3

Set the mode selector switch of the teach pendant to MANUAL.

Step 4

Press MOTOR to turn ON the power to the motor.

Step 5

Move the axis to be CALSET in the vicinity of the mechanical stop via the manual operation from the teach pendant.

Step 6

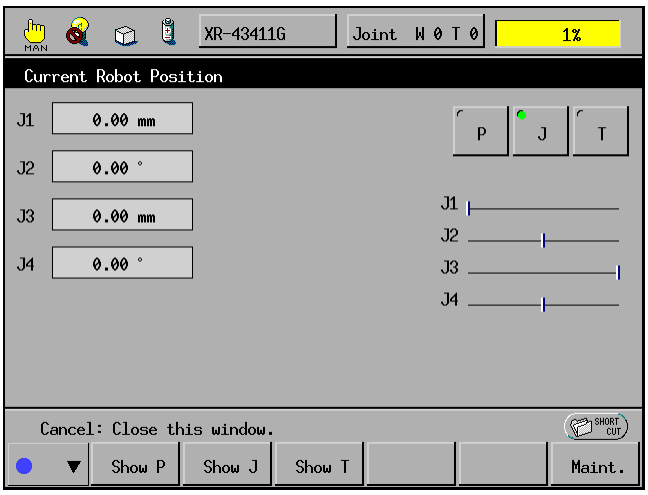
Press the MOTOR key on the teach pendant to turn OFF the power to the motor.

Step 7

Release the brake when CALSETing the 3rd axis (Z-axis). When no CALSETing is required for the 3rd axis (Z-axis), skip to Step 13.

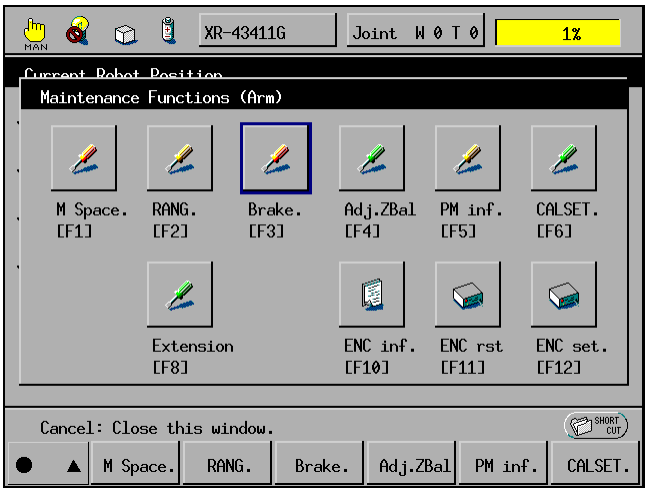
Press [F2 Arm] on the teach pendant.

Step 8 Press the SHIFT key and [F12 Maint.].



F12

Step 9 Press [F3 Brake.].



F3

Step 10

The Brake release setting window appears as shown below.

The XR-G series of robots has a brake only for the 3rd axis (Z-axis). Confirm that it is safe to release the break as the arm will drop.

Step 11

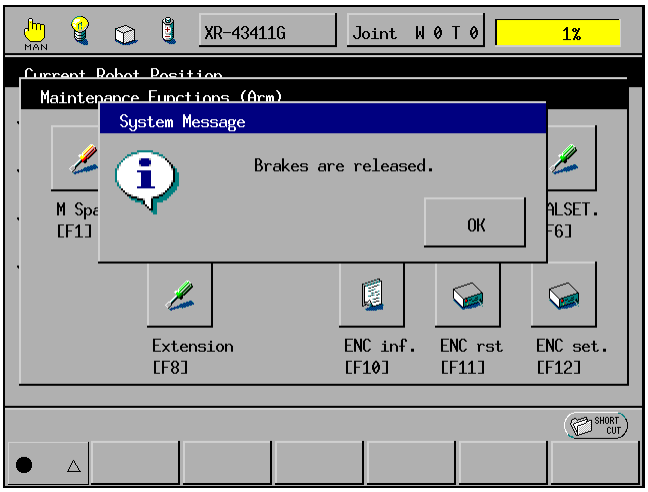
Press OK.

The system message appears asking you whether you want to change the brake settings.

Step 12

Press OK.

The system message appears informing that the brake is released.



Step 13

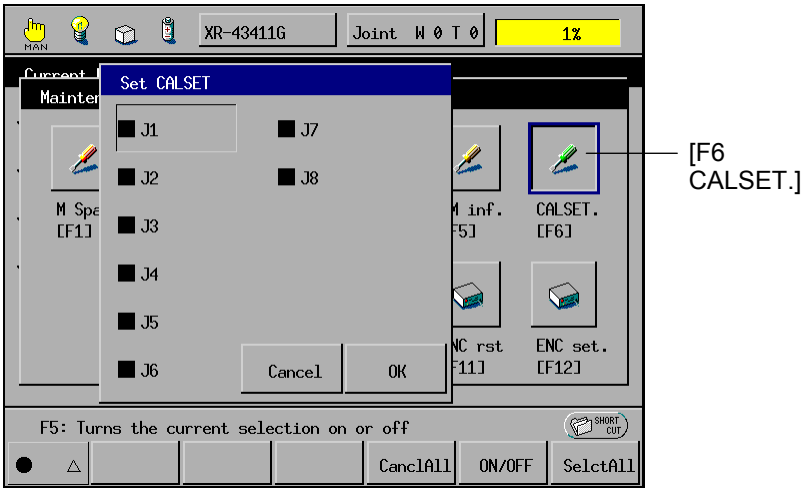
Press the axis to be CALSET against the mechanical stop by hand.

Caution: When bringing the 3rd axis (Z-axis) into contact with the mechanical end, be careful not to let your fingers get caught in the geared part of the rack.

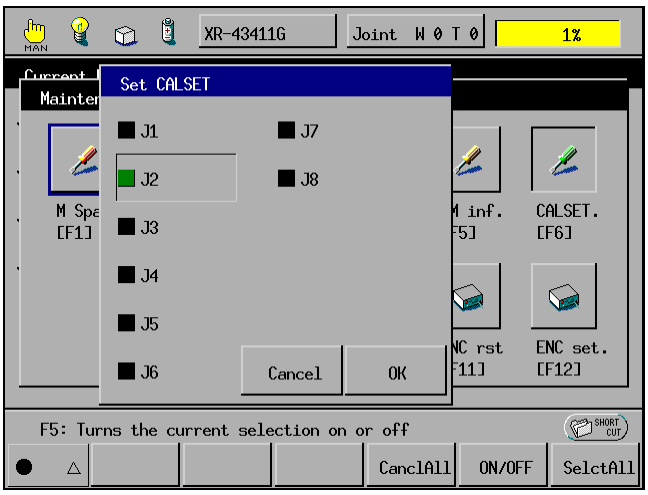
Step 14

Press [F6 CALSET.].

The Set CALSET window appears.



Step 15 Press the axis number to be CALSET to select CALSET (green display). Deselect CALSET (black display) for the other axes that are not required to be CALSET.



Step 16 Press OK.

The system message appears asking whether you want to carry out CALSET and showing a caution that the robot reference position will change.

Step 17 Press OK.

The system message appears informing that CALSET is completed.

Step 18 Press the ROBOT STOP button.

The robot brake becomes activated.

Step 19 Turn the ROBOT STOP button to cancel robot stop.

Step 20 Press the MOTOR to turn ON the power to the motor.

Caution: A "motor lock overload" error may occur just after the power to the motor is turned ON. In this case, try to turn ON the power several times, or release the brake, move the axis a little in the opposite direction of the mechanical end, and turn ON the power again.

Step 21 Move the CALSETed axis in the opposite direction from the mechanical end by the manual operation of the teach pendant.

[2] CALSETing All Axes

The CALSET of all axes is called all-axis CALSET.

The procedure is the same as that for single-axis CALSET except that you should select all axes in Step 15. For details of the procedure, see "[1] CALSETing a Single Axis."

2.5 Setting Control Set of Motion Optimization

The optimum speed or acceleration will vary depending upon the payload and center of gravity of a robot hand or workpiece that is to be set at the end of the robot flange. Set the payload and center of gravity position of the robot hand or workpiece and the control set of motion optimization according to the payload and robot posture.

For further information, see the PROGRAMMER'S MANUAL, Section 4.7 "Setting the Master Control Parameters in User Preferences." For the setting procedure, refer to the SETTING-UP MANUAL, Section 2.8, "Setting the Master Control Parameters of the Payload, Center of Gravity, and Control Set of Motion Optimization."

Chapter 3
Maintenance and Inspection

3.1 Maintenance & Inspection Intervals and Purposes

The table below lists the intervals and purposes of maintenance & inspection required for your robot.

Maintenance & Inspection Intervals and Purposes

No.	Intervals		Purposes
1	Daily	Perform inspection jobs specified in Section 3.2 every day before starting operations.	To use your robot safely.
2	Quarterly	Perform inspection jobs specified in Section 3.3 every three months.	- To prevent the controller from failure due to heat. (Inspection of filters) - To check the rotary sections and slideways of the robot and its controller for wear, preventing seizure, breakage, and other serious failures that could result from wear. (Lubrication)
3	Annual	Replace the dampers as specified in Section 3.4 every year, approximately every 2 million cycles*. * One cycle means a Z-axis reciprocating motion.	To prevent seizure, breakage, and other serious failures that could result from wear of the dampers on the slide.
4	Biennial	Replace backup batteries as specified in Section 3.5 every two years.	To retain the robot-specific data (programs, parameters, etc.) stored in the internal memory of the robot controller and the position data stored in the electronic absolute encoder built in the robot unit.

⚠Caution: Maintenance and inspection must be carried out by a trained worker who possesses the ability to perform these tasks safely. Before performing maintenance and inspection jobs, read the SAFETY PRECAUTIONS, "Precautions While Robot is Running" and "Daily and Periodical Inspections."

3.2 Daily Inspections

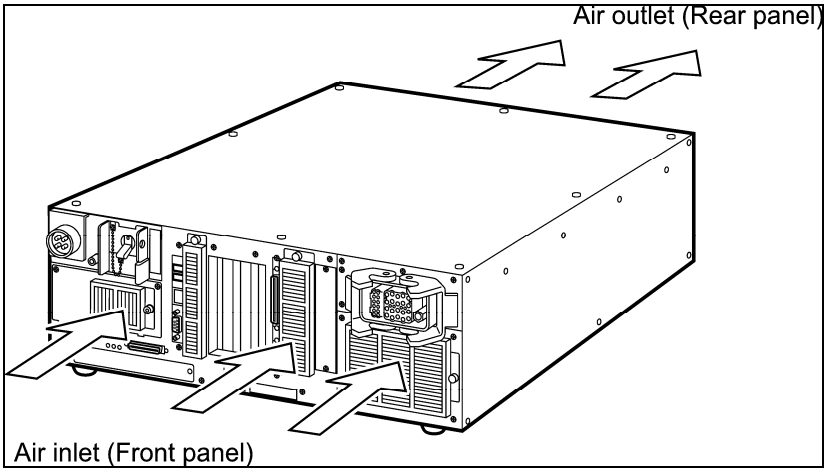
3.2.1 Check Items

Before starting operations, check the items listed below every day.

Daily Inspections Table

No.	Check:	Controller Power	How to check:	Criterion	What to do: (Note 1)
1	Connectors (CN1 to CN10 on the robot controller) and their mating parts	OFF	Visually	No looseness, disengagement or dirt.	Engage the parts properly and clean them.
2	Cables (connected to CN1 to CN10 on the robot controller) and robot's external cables	OFF	Visually	Free of damage or gouges.	Repair or replace.
3	LCD on the teach pendant	ON	Visually	Properly displayed	Repair or replace.
4	Pilot lamps on the robot controller	ON	Visually	Should light.	Repair or replace.
5	Cooling fan in the robot controller	ON	Visually (Note 2)	Should work properly.	Repair or replace.
6	Emergency stop button on the mini-pendant, or teach pendant	ON	Press the emergency stop button.	The robot should come to an emergency stop.	Repair or replace.
7	Safety door	ON	Operate the safety door switch and open the switch-wiring door.	The robot should come to an emergency stop.	Inspect and repair.
8	Robot unit (Except lubrication points)	OFF	Visually	No grease leak	Wipe off grease

(Note 1) Some repair and replacement operations, shown in "What to do:" column, may involve special work. Contact the DENSO Robot Service Section.
(Note 2) The normal air flow of the cooling fan is as shown below.



Normal Air Flow of Cooling Fan

3.3 Quarterly Inspections

3.3.1 Check Items and Lubrication

Check the items and lubricate your robot as listed below every three months.

Quarterly Inspections Table

No.	Check:	Controller power	How to check:	Criterion	What to do:
1	Robot base mounting bolts	OFF	Measure the tightening torque with a torque wrench.	No looseness. Use specified tightening torque. (Refer to Section 1.2.2.)	Tighten the bolts to the specified torque.
2	Rotary sections and slideways of the robot	OFF	Apply the specified lubricants to the specified points. (Refer to Section 3.3.3.)		
3	Cooling fan filters in the robot controller	OFF	Visually	No dust or dirt.	Clean the cooling fan filters. (Refer to Section 3.3.2.)

3.3.2 Cleaning the Cooling Fan Filters in the Robot Controller

For the cleaning procedures of the air intake filters, refer to the RC7M CONTROLLER MANUAL, Section 6.4 "Cleaning the Air Intake Filter."

3.3.3 Lubrication Jobs

Apply the specified lubricants to the rotary sections and slideways of the robot unit as listed below every three months.

Lubrication Points and Lubricants

No.	Lubrication points	Lubricant type	Lubricant amount
1	X-axis rail	Epinoc AP1	2 to 3 cc
2	Z-axis rail and rack	↑	2 to 3 cc

3.3.3.1 Grease feeding method for X-axis rail

Please contact your DENSO representative for more details of grease feeding.

3.3.3.2 Grease feeding method for Z-axis (rail, rack)

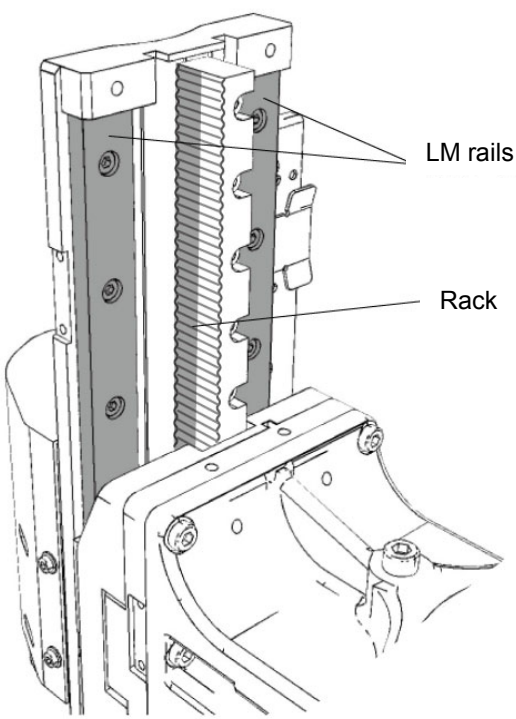
Notes on greasing

When applying grease to the Z-axis rack of the XR-G series, follow the instructions for the lubrication points, amount of grease, and greasing procedure correctly. Otherwise, grease oil may drop.

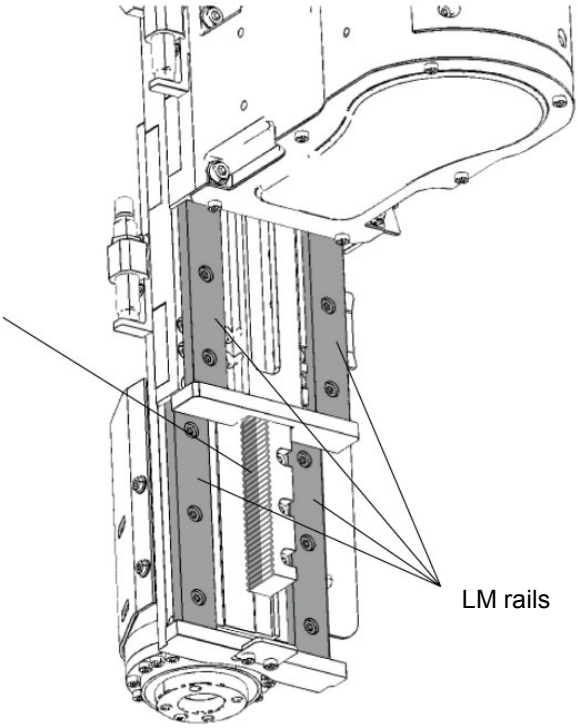
Note: Confirm that the Z-axis brake is activated before starting lubrication.

Greasing procedure

Move the Z-axis shaft to the lowermost position and apply grease to the lubrication points specified below.
For robots with the stroke of 135 mm, move the Z-axis shaft also to the uppermost position and apply grease.
Applying grease to points other than the specified lubrication points may drop grease oil.



Z-axis stroke: 135 mm

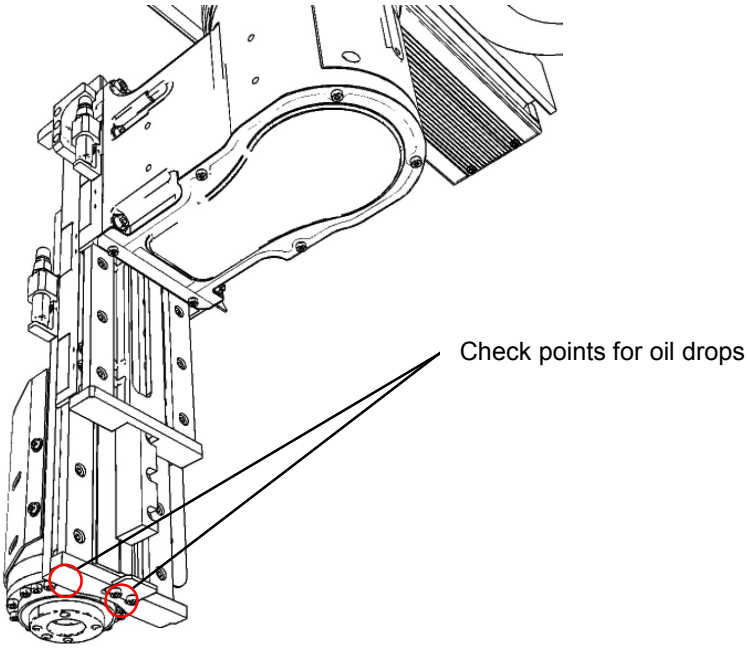


Z-axis stroke: 200 mm

	Amount of grease	Lubrication points
Rack	1.0 to 1.3 g	Half of rack tooth surface (See the above figure.)
LM rails	0.5 to 1.0 g per rail	Uniformly and wholly

Checking for oil drops

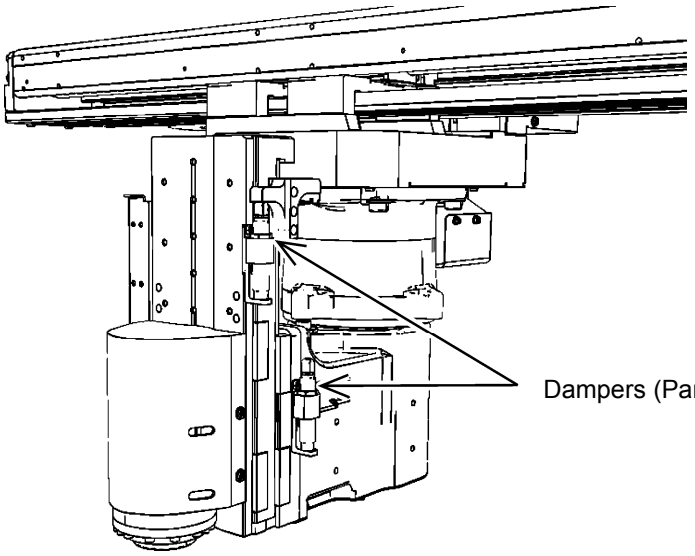
Check that there are no oil drops on the bottom of the shaft shown below. Improper environment, amount of grease, or lubrication procedure may cause oil drops.

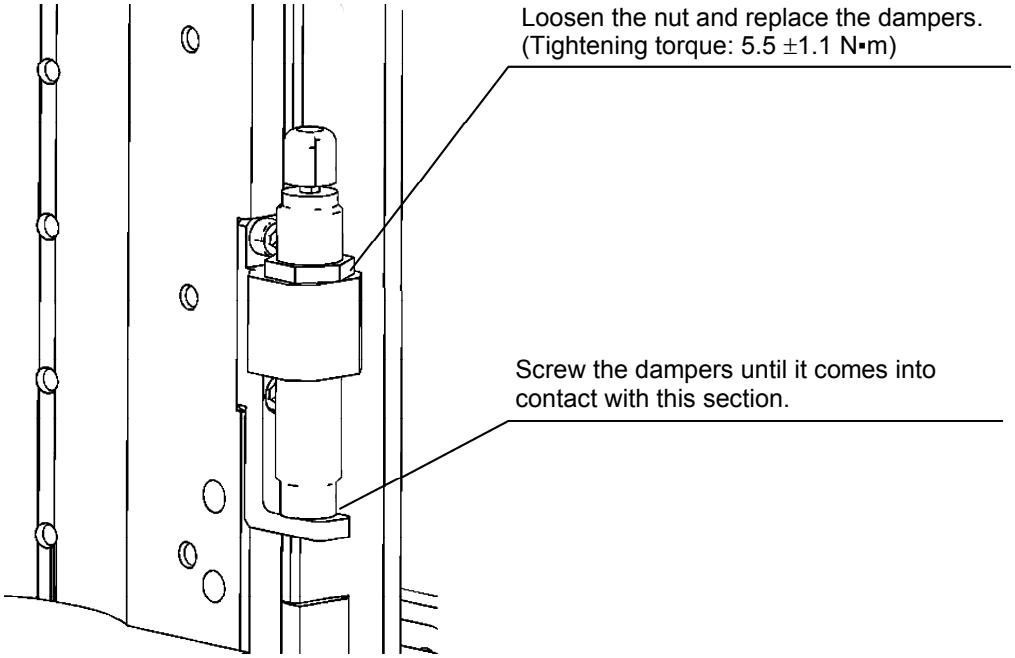


3.4 Annual Inspections

Replace the two dampers on the 3rd axis (Z-axis) during the annual inspection. The replacement interval is 2,000,000 cycles of the 3rd axis reciprocating motion. However, deterioration may accelerate with extremely quick operation, with prolonged operation, or under the special environment. In such cases, conduct tests below, and use the test results as an indication.

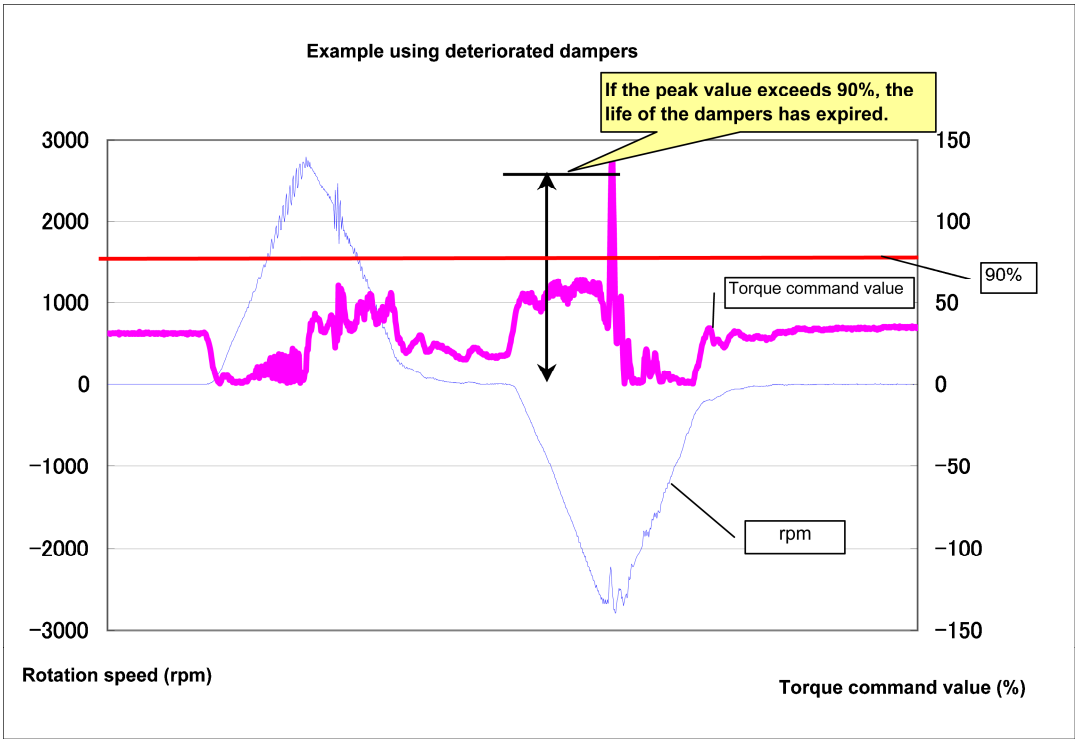
Two absorbers are mounted at the upper and lower positions. Replace both.





3.4.1 Test for deterioration

To check the deterioration of dampers, see the joint servo log (torque command value %) when the robot is in motion. If the dampers have deteriorated, the torque command value (current) increases.
A guide for replacement is 90% of the maximum current. If the peak value exceeds 90%, replace both dampers.



Keeping a Joint Servo Log

Use a joint servo log program and WINCAPSIII to keep a joint servo log. For details, refer to the Programmer's Manual II and WINCAPSIII Guide.

Step 1 Register the following subroutines by selecting them from the program bank to use in a logging program.

- SetMonitorCond
- ClearSrvMonitor
- StartSrvMonitor
- StopSrvMonitor

Step 2 Create a logging program, referring to the sample program given below.

■ **Sample program for logging single-axis servo**

```
'!TITLE "<absorber>"
PROGRAM absorber
TAKEARM
Call SetMonitorCond(3,1,4,1)
'Get servo info (Motor shaft #, absolute motor current,
'and sampling intervals)
SPEED 100
MOVE P, P50
Call ClearSrvMonitor
Call StartSrvMonitor
Delay 200
MOVE P, P51
Delay 200
MOVE P, P50
Delay 400
Call StopSrvMonitor
GIVEARM
END
```

■ **Teaching points**

In the sample program above, set P50 and P51 to use the full stroke of the Z axis within the normal operation range.

Step 3 In WINCAPSIII, choose Connect | Transfer data to display the Transfer data window.

In the controller pane, select Log | Single Joint Servo Log and then press Receive to display single joint servo log data obtained by WINCAPSIII.

3.5 Biennial Inspections

3.5.1 Battery Replacement

Replace the two types of backup batteries listed below during biennial inspections.

> **⚠Caution (1) The battery used in this device may present a risk of fire or chemical burn if mistreated. Do not recharge, disassemble, heat above 100°C (212°F), or incinerate.**
> **(2) Dispose of used battery promptly. Keep away from children. Do not disassemble and do not dispose of in fire.**

Backup Battery Type

	Battery type	Used to:	Located:	Refer to:
1	Encoder backup batteries	Back up the position data of the servomotor encoder.	In the robot unit	Section 3.5.2
2	Memory backup battery	Back up programs, parameters, and CAL data.	In the robot controller	Section 3.5.3

The position data of the encoder built in the servomotor is stored in the internal memory of the encoder.

Programs, parameters, CAL data, etc. are stored in the internal memory of the robot controller.

The backup battery for each memory retains the above data, while the power to the robot controller is turned OFF. However, these batteries have a limited lifetime and must, therefore, be replaced regularly.

NOTE: If two years elapse from replacement of either backup battery, the "Time to change controller backup battery" message will appear on the teach pendant.

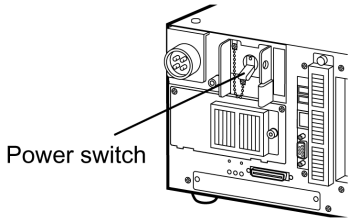
> **⚠Caution: Without replacing the backup batteries, important robot-specific data stored in each memory will be lost.**

3.5.2 Replacing the Encoder Backup Batteries

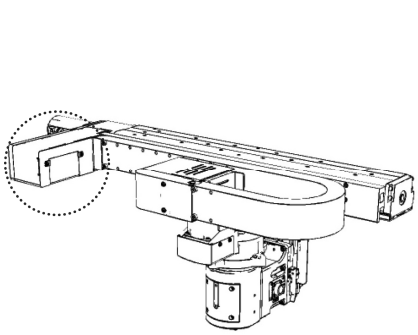
> ⚠**Caution** **(1) The batteries used in this device may present a risk of fire or chemical burn if mistreated. Do not recharge, disassemble, heat above 100°C (212°F), or incinerate them.**
> **(2) Dispose of used batteries promptly. Keep away from children. Do not disassemble and do not dispose of them in fire.**

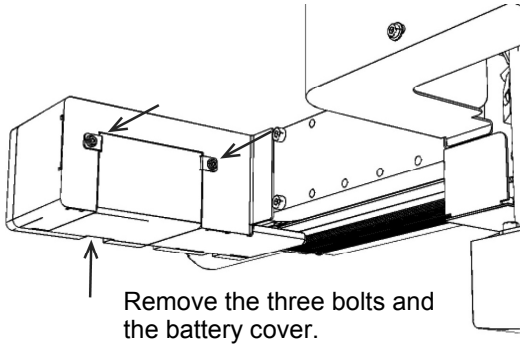
Replace the encoder backup batteries listed on the previous page according to the procedure given below.

Step 1 Make sure that the controller power is turned OFF.

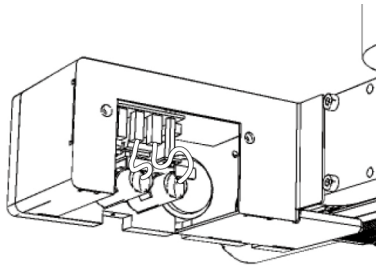


Step 2 The location of the encoder backup batteries is shown below.

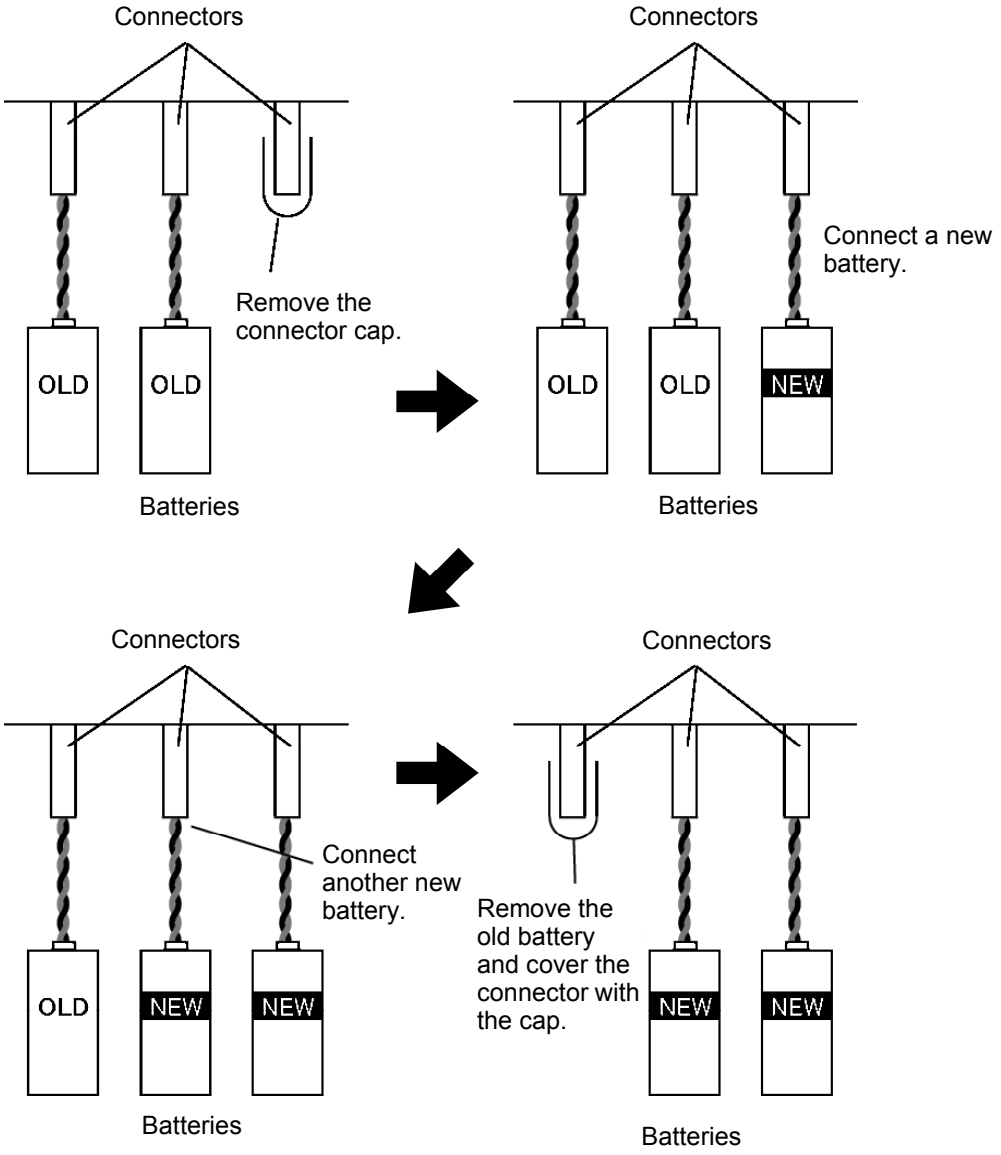




Step 3 There are three connectors, two of which are connected to batteries and the remaining one is covered with a connector cap.



Replace the batteries as follows.



Put the battery cover back into place and tighten the three bolts.
(Tightening torque: 0.8 ±0.2 N▪m)

3.5.3 Replacing the Memory Backup Battery

Refer to the RC7M CONTROLLER MANUAL, Section 6.5 "Replacing the Memory Backup Battery."

3.5.4 Setting the Next Battery Replacement Date

After replacing the memory backup battery, set the next battery replacement date from the teach pendant, according to the following procedure.

NOTE: Check that the system clock of the robot controller shows the correct date beforehand. If it is incorrect, the next replacement date will also become incorrect.

Step 1

On the top screen of the teach pendant, press [F6 Set].

The Settings (Main) window appears.

Step 2

Press [F6 Maint.] in the Settings (Main) window.

The Maintenance menu appears.

Step 3

Press [F4 Battery] in the Maintenance menu.

The Next Battery Replacement Date window appears.

In the top of the window, the current setting is displayed.

TIP: The date entry areas show the default replacement date that is two years later the current data at which you open this window, assuming that the battery service life is two years.

Step 4

Press OK.

If you do not want to change the replacement date, press Cancel.
The message "Are you sure you want to set the next battery replacement date?" appears.

Step 5

Press OK.

The screen returns to the Settings (Main) window.

3.6 Supplies and Tools for Maintenance

The tables below list the supplies and robot components to be replaced regularly, and the recommended tools necessary for maintenance and inspection.

3.6.1 Supplies and Components Required

> **⚠Caution (1) The battery used in this device may present a risk of fire or chemical burn if mistreated. Do not recharge, disassemble, heat above 100°C (212°F), or incinerate.**
> **(2) Dispose of used battery promptly. Keep away from children. Do not disassemble and do not dispose of in fire.**

List of Supplies and Components

No	Name	Part No.	Remarks	
1	Grease	410971-0040	2.5 kg can	Epinoc Ap-l
2	Grease	410971-0050	16 kg can	
3	Encoder backup battery set	410679-0010	A set of two batteries	
4	Air filter set	410053-0100	For standard type of controllers (FS-1705W)	
		410053-0110	For global type of controllers (FS-1705)	
5	Memory backup battery	410076-0261	For RC7M controller	
6	Fuse (1.3A)	410054-0230	For LM13 for controller I/O	
7	Fuse (3.2A)	410054-0270	For LM32 for controller I/O	
8	IC for output (NPN)	410077-0010	IC (M54522P) for controller output	
9	IC for output (PNP)	410077-0020	IC (M54564P) for controller output	
10	CALSET jig	410192-0010	For CALSETing the 4th axis (T-axis)	
11	Damper	410617-0570	For the 3rd axis (Z-axis), 1 piece	

3.7 Replacing Fuses and Output ICs

Refer to the RC7M CONTROLLER MANUAL, Section 6.6 "Replacing Fuses and Output ICs."

3.8 Resetting Encoders

In any of the following cases, you need to reset encoders and perform CALSET.

- Error 641* occurs due to the expired service life of backup batteries or
- Error 677* occurs due to an excessive impact applied to the robot when the controller power is off.

(* is any of 1 to 4 denoting the object axis.)

For the encoder resetting procedure, refer to the SETTING-UP MANUAL, Section 5.3 "[F2 Arm]—[F12 Maint.]—[M11 ENC rst]."

3.9 Checking the Odometer and Trip Meter

You may check the odometer and trip meter which count traversed distance of each axis in the Odometer window of the teach pendant.

The access to the Odometer window is [F6 Set]—[F6 Maint.]—[F5 Odometer].

The Odometer window shows the following items:

[Odometer]	Shows the total distance of each axis traversed after the robot leaves the factory. You cannot reset the odometer.
[Trip meter]	Shows the distance of each axis traversed after you reset the trip meter to zero. You can reset the trip meter by pressing [F5 Reset] in the Odometer window and following the guidance shown on the screen.

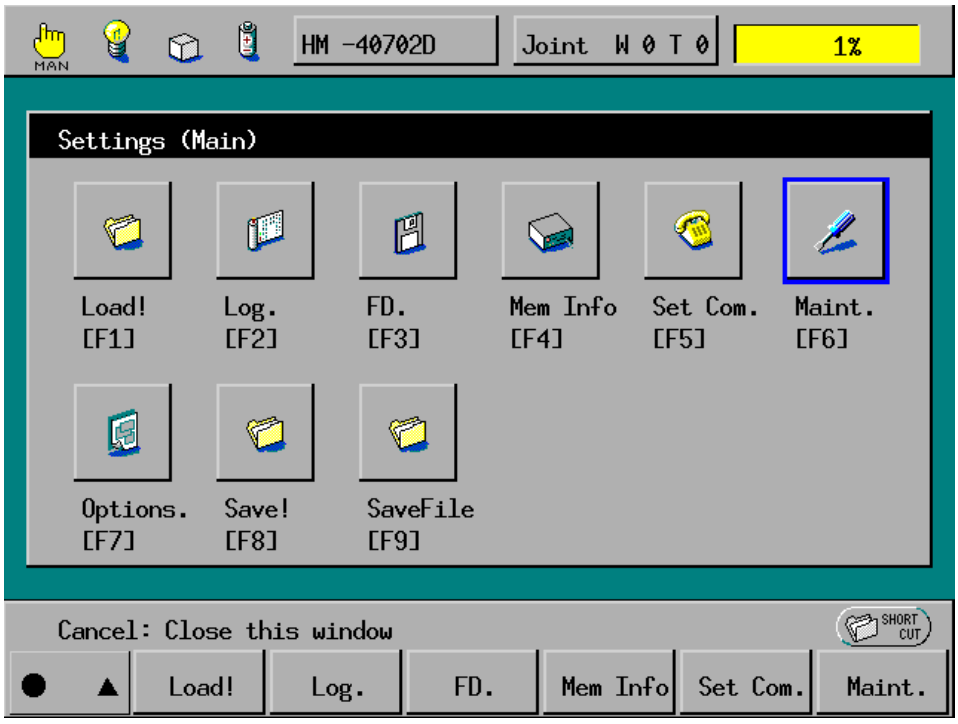
3.9.1 Displaying the Odometer and Trip Meter

Step 1 Turn the robot controller ON.

Step 2 On the teach pendant, set the mode switch to the MANUAL position.

Step 3 On the top screen, press [F6 Set].

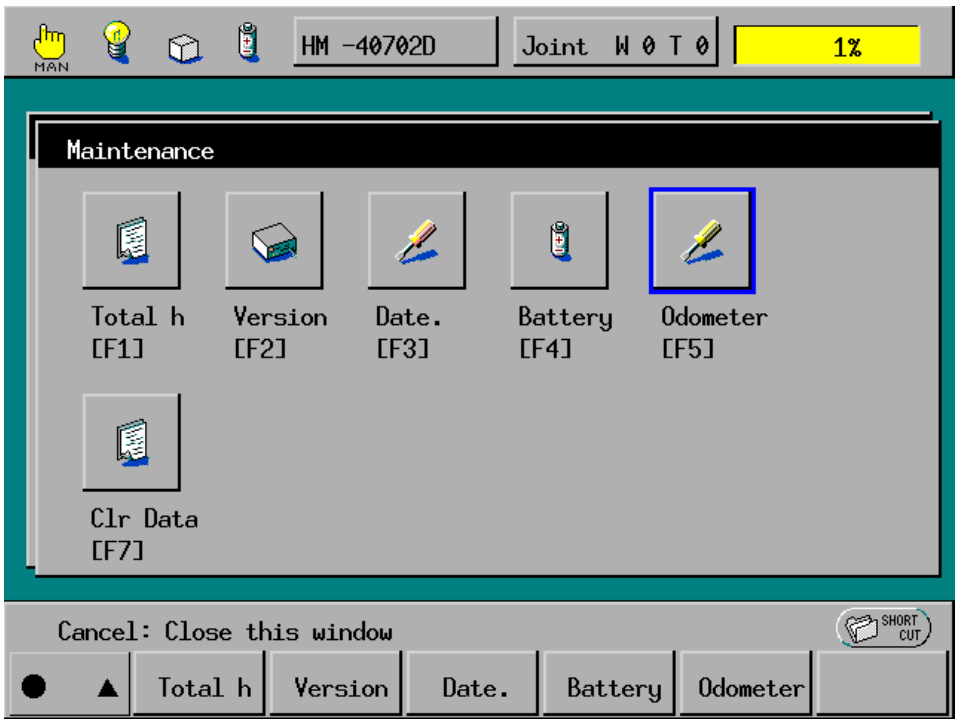
The Settings (Main) window appears as shown below.



F6

Press [F6 Maint.].

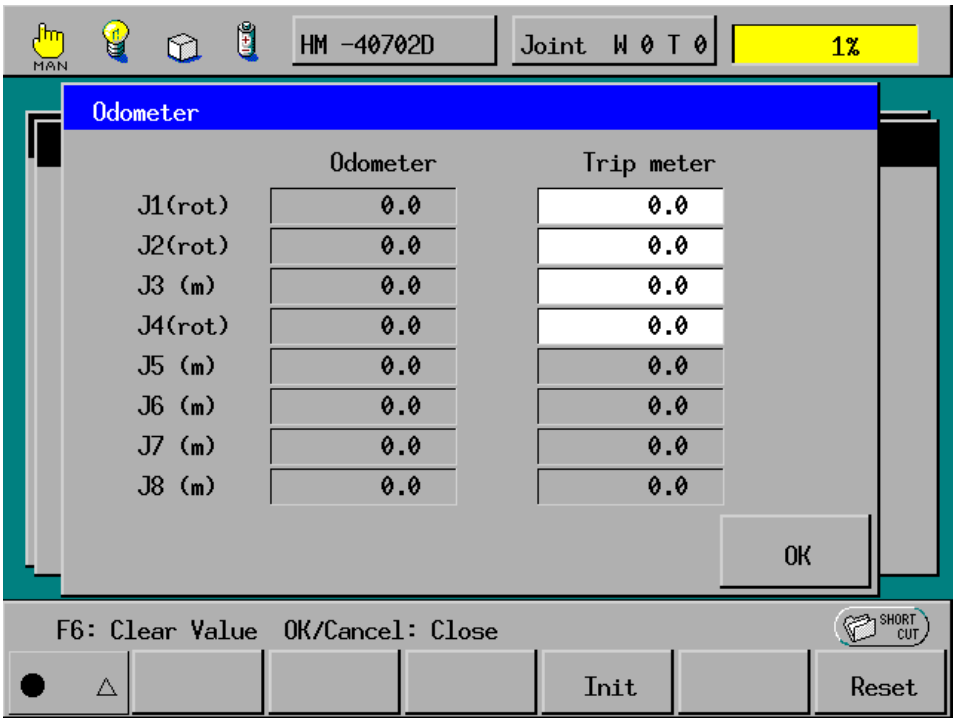
Step 4 The Maintenance menu appears as shown below.



F5

Press [F5 Odometer].

Step 5 The Odometer window appears as shown below.



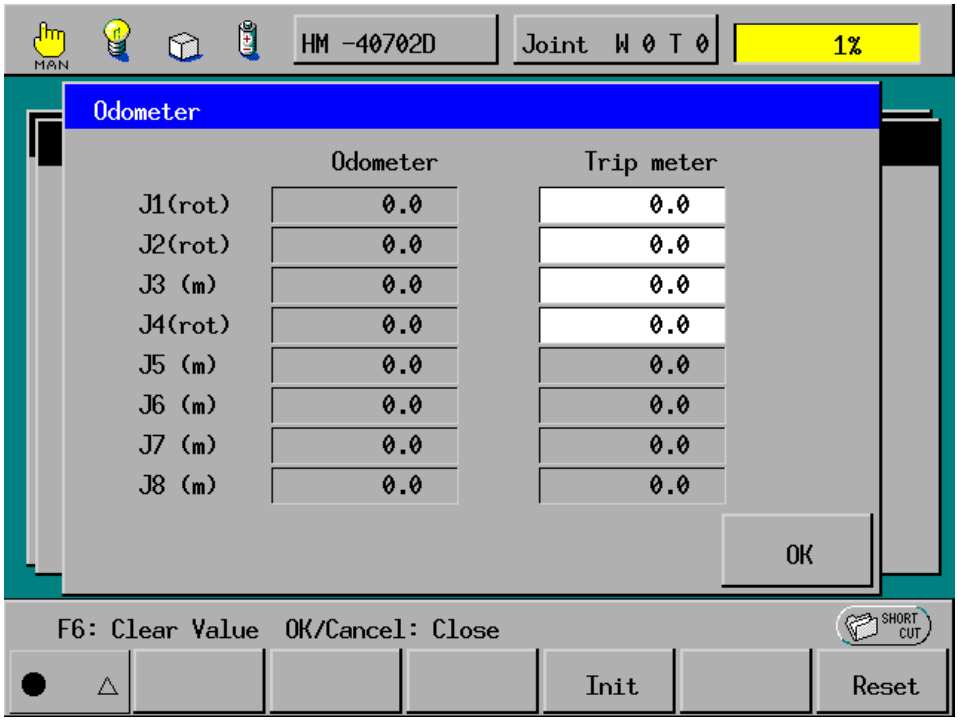
F6

3.9.2 Resetting the Trip Meter to Zero

Step 1

Display the Odometer window as shown below.

Access: [F6 Set]—[F6 Maint.]—[F5 Odometer] from the top screen.

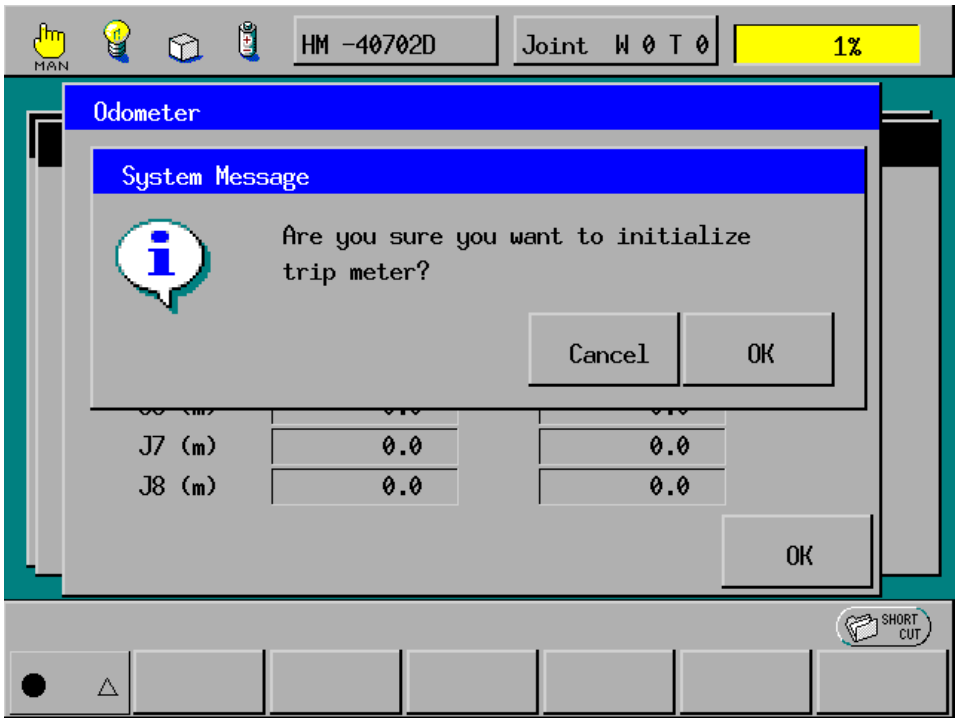


F6

Press [F6 Reset].

Step 2

The following system message appears.



Press the OK button.

The trip meter has been reset to zero.

3.10 Checking the Controller ON-Time and the Robot Running Time and Resetting Their User Counters

You may check the robot controller ON-time and the robot running time in the Total hours window of the teach pendant.

The Total hours window shows the following items:

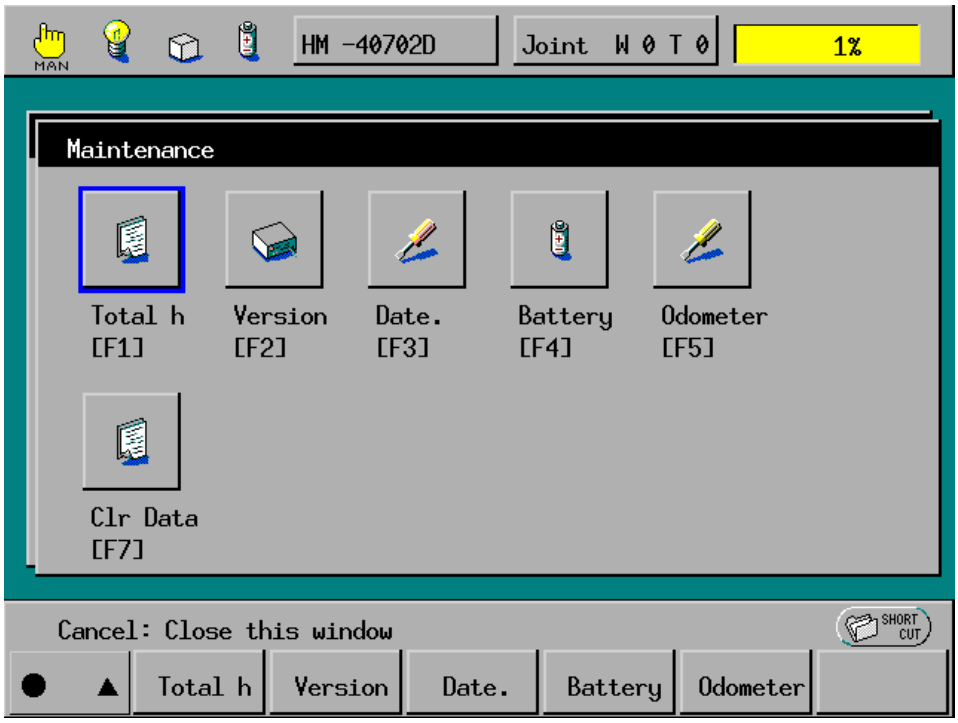
[Total operation]	Shows the grand total of the robot controller ON-time counted after the controller leaves the factory.
[Total running]	Shows the grand total of the robot running time counted after the robot leaves the factory.
[Cumu. operation]	Shows the total of the robot controller ON-time counted after you reset the user counter to zero.
[Cumu. running]	Shows the total of the robot running time counted after you reset the user counter to zero.
[Operation]	Shows the ON-time of the robot controller counted after it is turned ON this time.
[Running]	Shows the running time of the robot counted after the robot controller is turned ON this time.

3.10.1 Displaying the Controller ON-time and the Robot Running Time

Step 1

Display the Maintenance window as shown below.

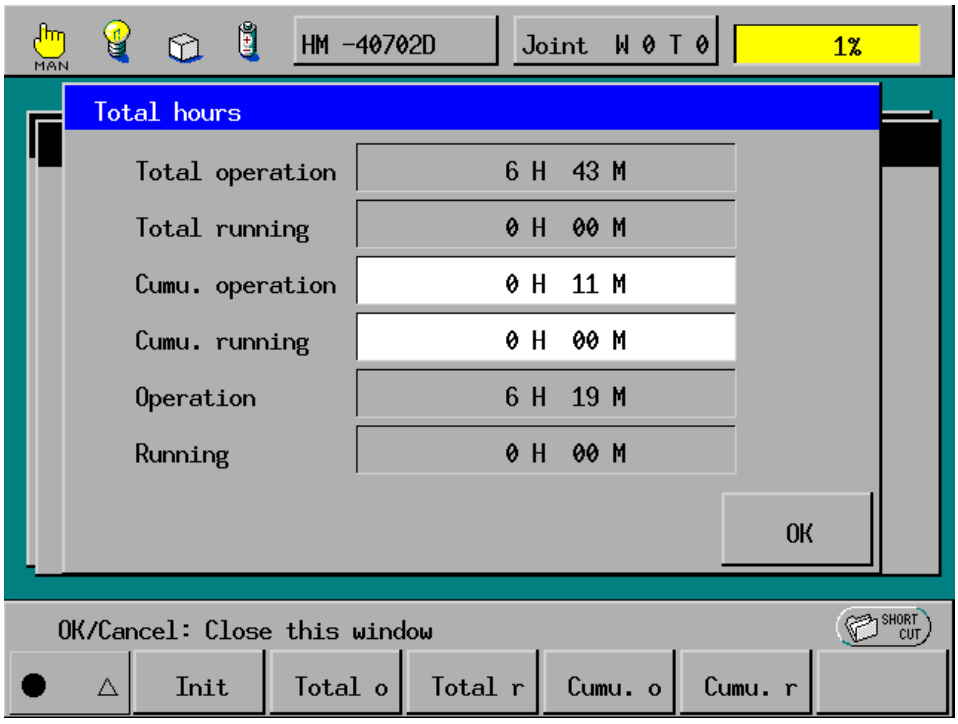
Access: [F6 Set]—[F6 Maint.] from the top screen



F1

Press [F1 Total h].

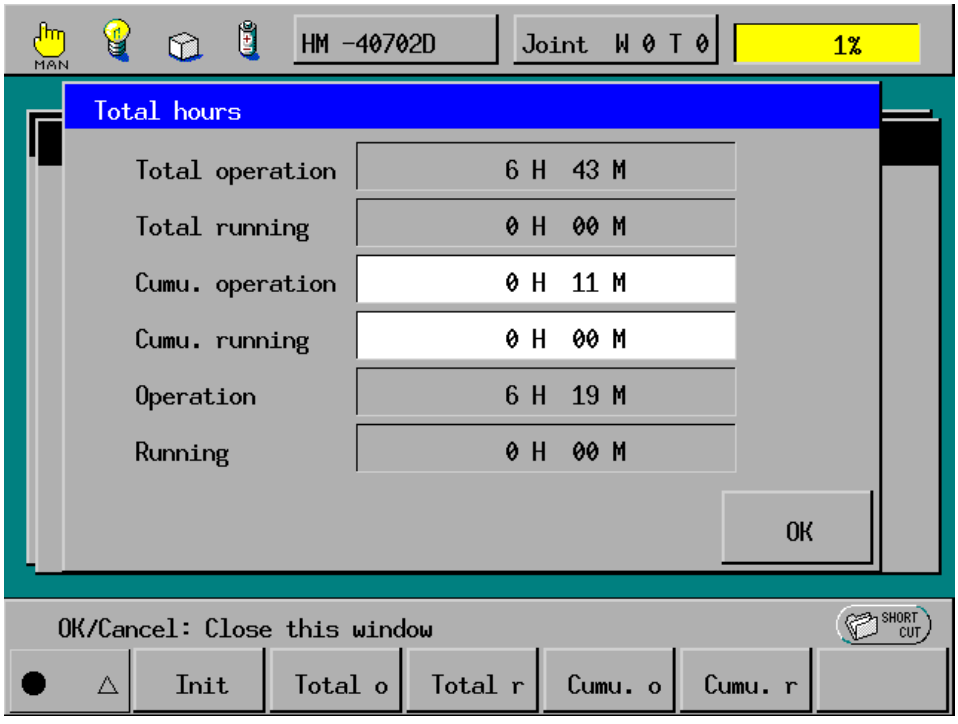
Step 2 The Total hours window appears as shown below.



3.10.2 Resetting the User Counters of the Controller ON-Time and the Robot Running Time

Step 1 Display the Total hours window as shown below.

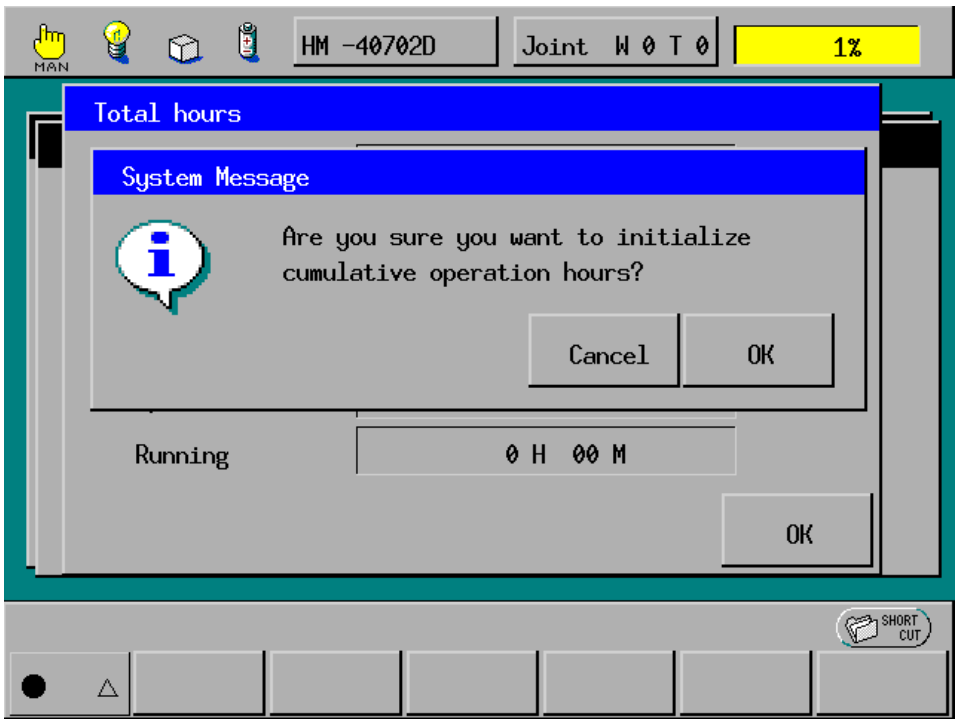
Access: [F6 Set]—[F6 Maint.]— [F1 Total h] from the top screen



F4

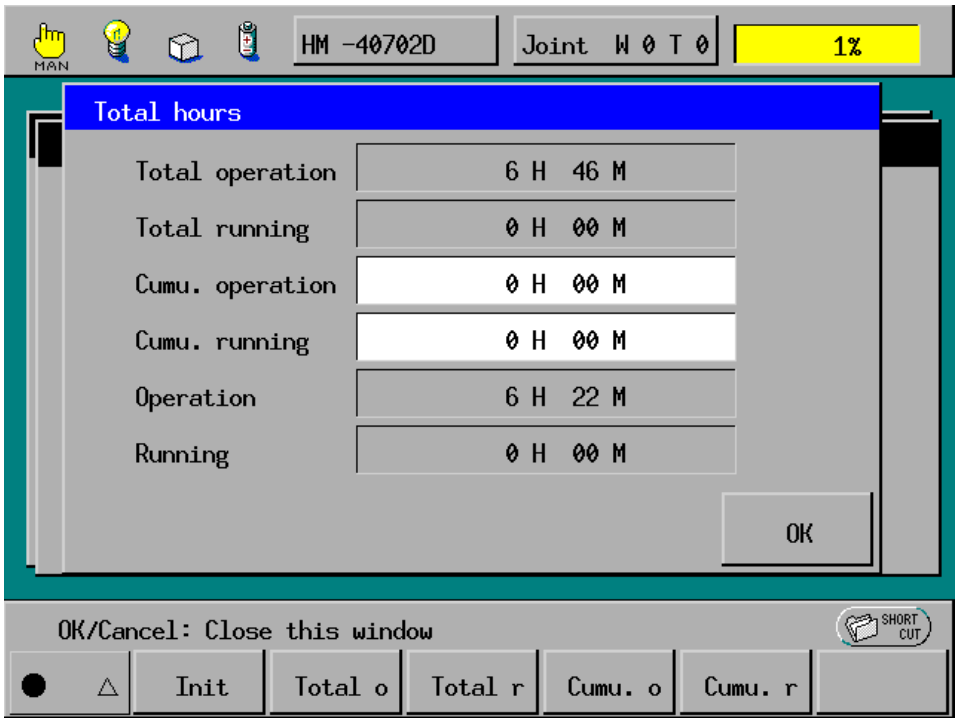
To reset the user counter of the controller ON-time to zero, press [F4 Cumu. o].

Step 2 The following system message appears.



Press the OK button.

Step 3 The user counter of the controller ON-time has been reset to zero.



3.11 Backing up Projects

You should back up project data periodically in WINCAPSIII in order to recover the robot controller smoothly after loss of project data due to unexpected accidents such as expired service life of memory backup batteries.

Be sure to back up project data and preserve it, in particular:

- at the time of purchase
- after performing CALSET
- after changing RANG values
- after replacement of a motor

DENSO preserves arm data configured at the time of shipment for 10 years. If your arm data is lost, contact your DENSO representative.

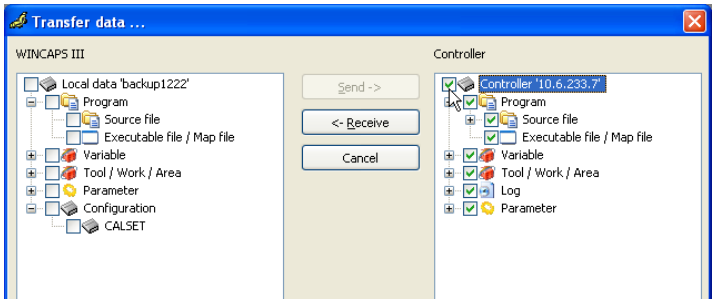
> **Note**: Arm data refers to CALSET and RANG values in project data, which is unique to individual robots and determines the position of each joint.

3.11.1 Back up project data

Use WINCAPSIII to back up project data.

When a project has been created in WINCAPSIII

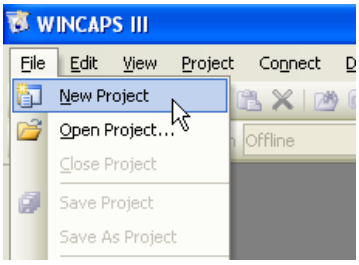
Receive all data from the controller and preserve it.



When creating a new project to preserve backup data

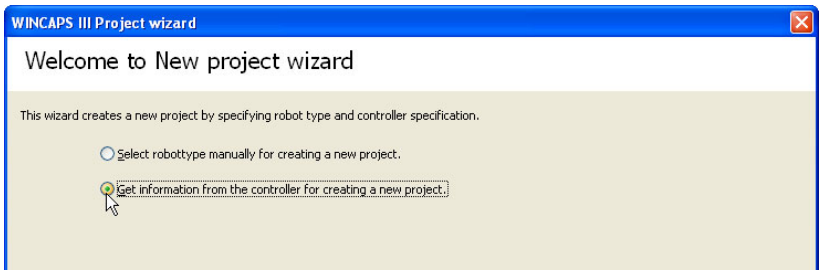
Follow the procedure given below.

Step 1 Create a new project in WINCAPSIII.



Step 2

Choose "Get information from the controller for creating a new project."

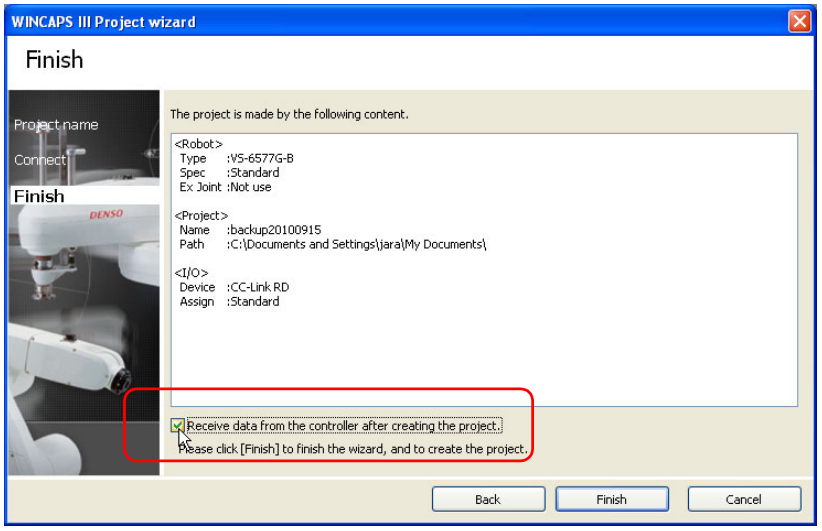


Step 3

Following the project wizard, enter the IP address and the desired backup file name.

Step 4

Select "Receive data from the controller after creating the project."



Step 5

Close the project.

3.11.2 Transfer arm data

When WINCAPSIII exchanges project data with the robot controller, arm data unique to individual robots can be transferred only from the robot controller to WINCAPSIII, but it cannot from WINCAPSIII to the robot controller. This is to protect arm data in the robot controller from being overwritten accidentally.

To transfer arm data from WINCAPSIII to the robot controller, use the following procedure.

Step 1

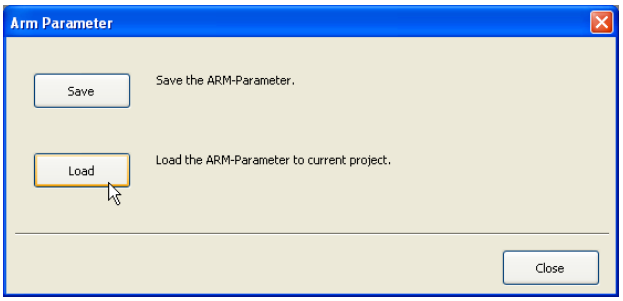
Loading the arm data (***.wam) into the WINCAPSIII project

This step is necessary when only arm data is supplied by DENSO. When project data has been backed up, open the project data in WINCAPSIII and proceed to STEP 2.

Start WINCAPSIII, log on as a Programmer, and create a project suitable for your robot model.

Choose Tool | Arm parameters to display the Arm Parameter window.

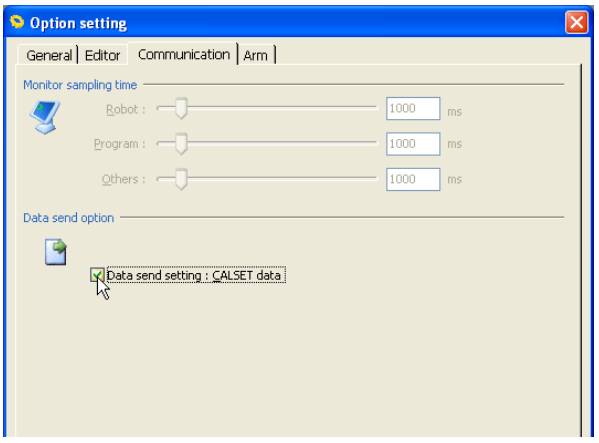
Press Load and select the arm data (***.wam) to load.



Step 2

Configuring communication options for transfer of arm data from WINCAPSIII to the robot controller

Choose Tool | Option | Communication tab. Select "Data send setting: CALSET data" and press OK.



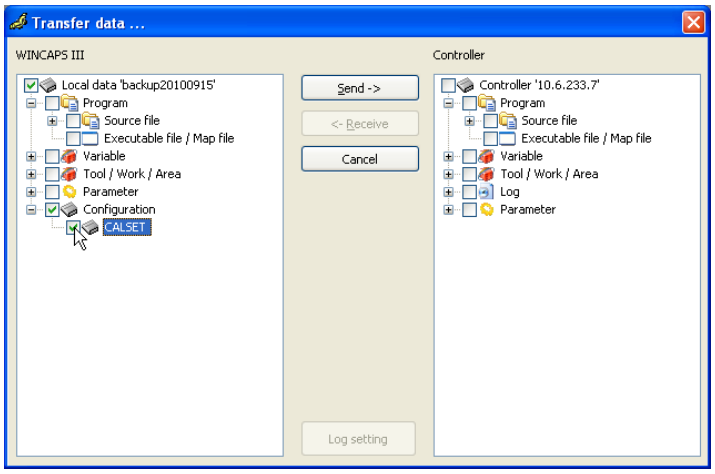
ATTENTION: During ordinary operations, the "Data send setting: CALSET data" should be deselected. If it is selected, creating a new project and transferring arm parameters overwrites the CALSET-related data in the robot controller with the transferred data, causing errors in teaching positions.

Step 3

Transferring arm data to the robot controller

Choose Connect | Transfer data to display the Transfer data window.

Select Parameters | Arm parameters and Configuration | CALSET, then press Send.



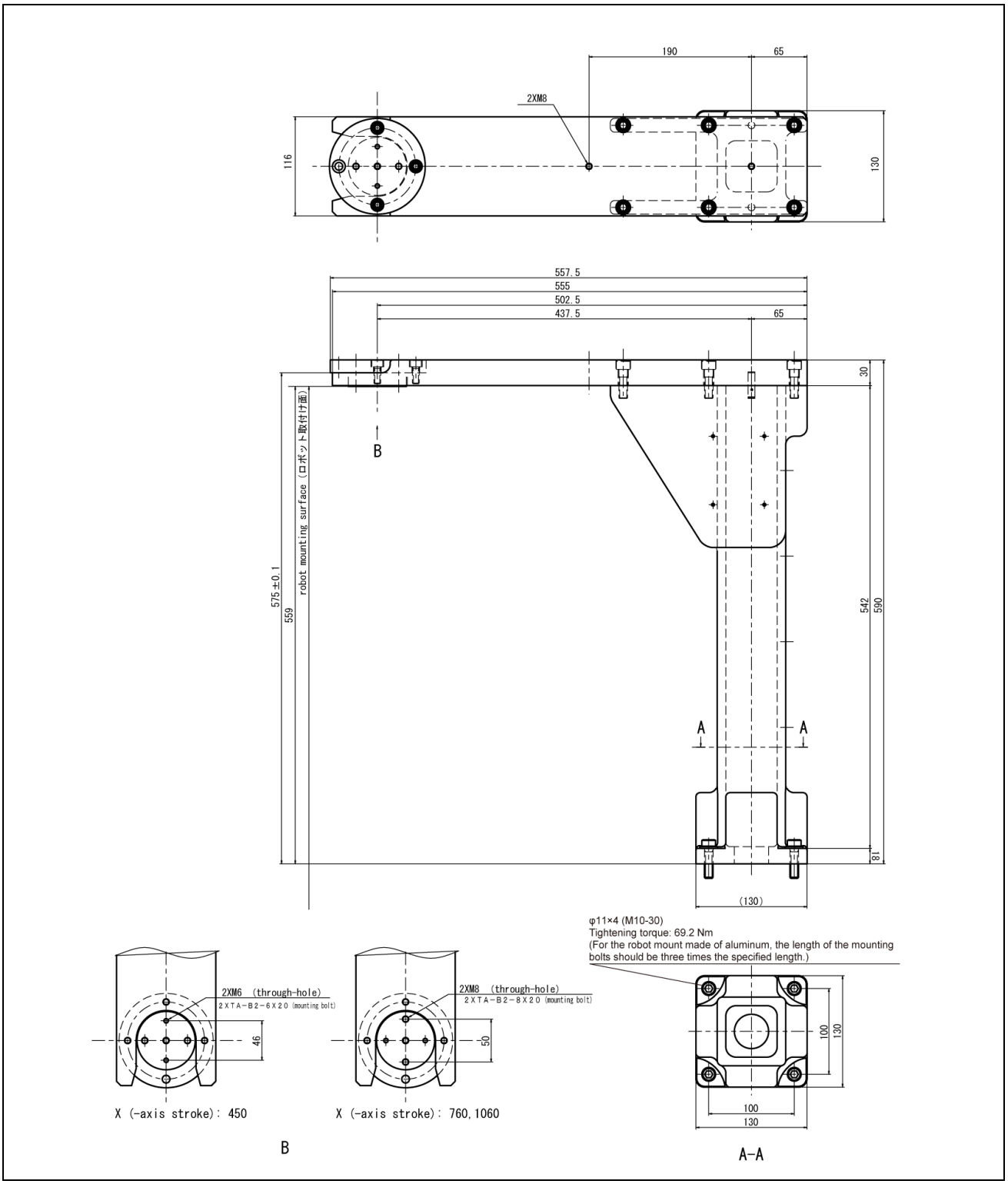
Upon completion of transfer of the CALSET-related arm data, restart the robot controller.

Chapter 4
Appendices

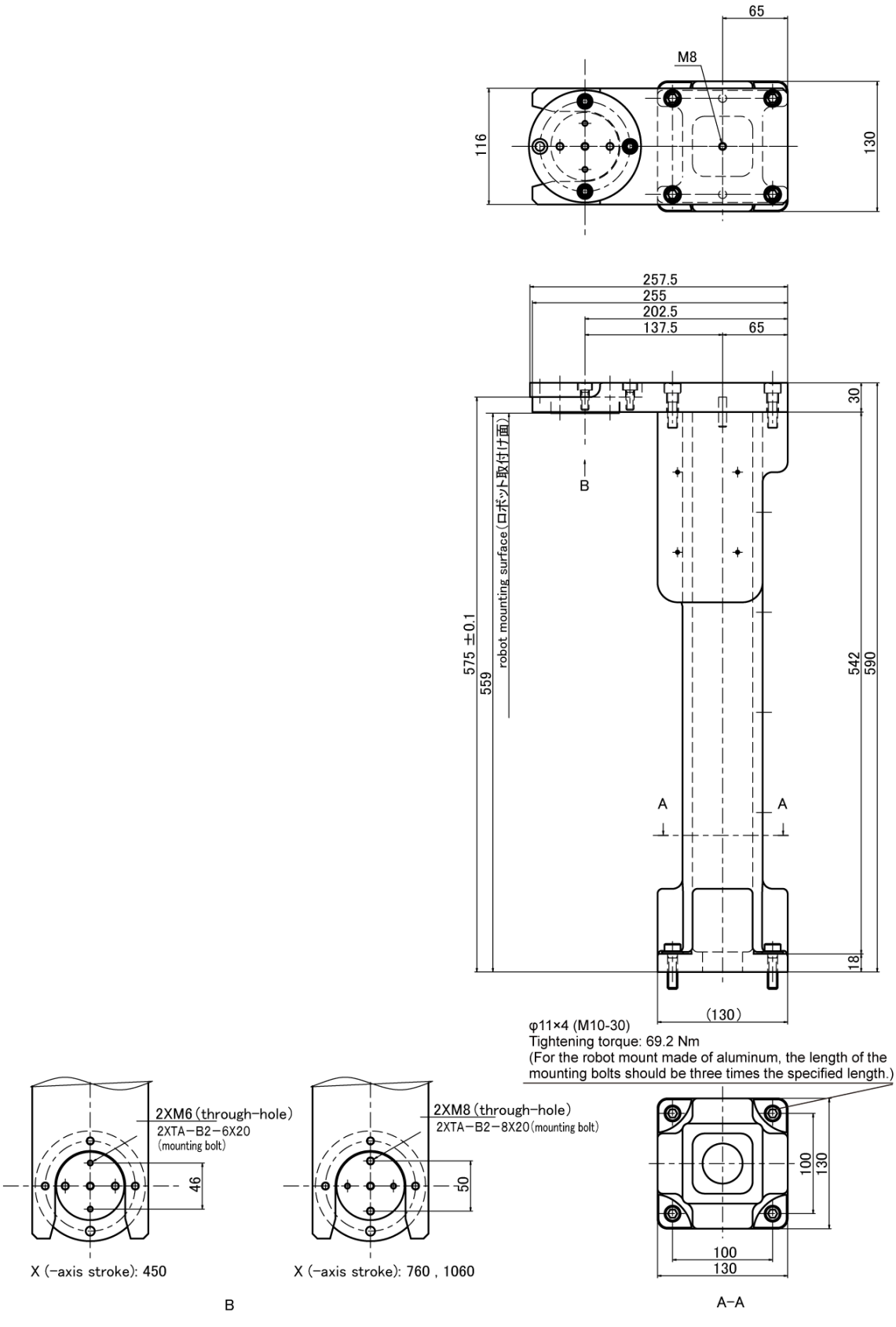
4.1 Stands for XR-G series (optional) drawing

Stands for XR-G series (optional)

FULL RANGE STAND



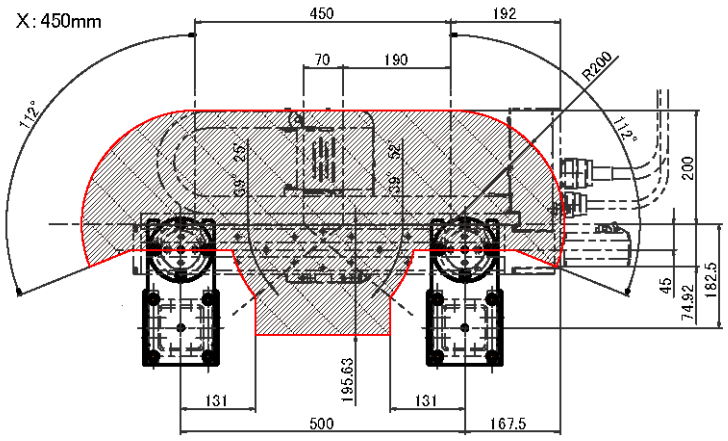
HALF RANGE STAND



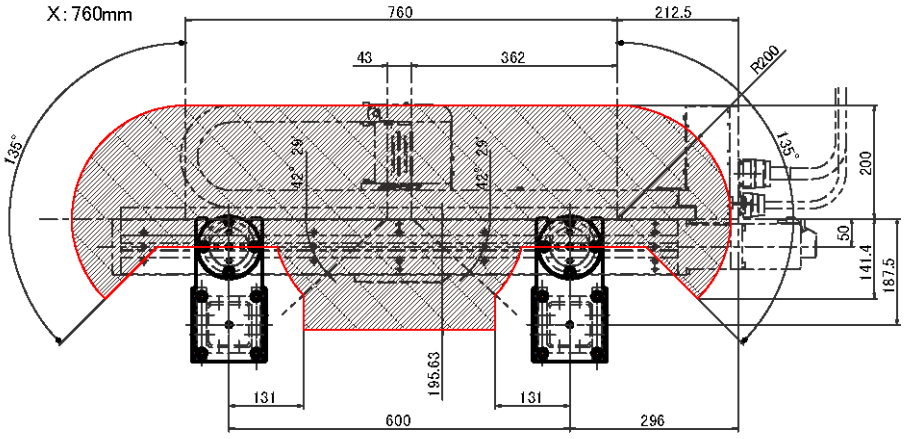
Workable space of the robot eith the half-range type stand

Arm lengh of R-axis: 200mm
R軸アーム長200mmの場合

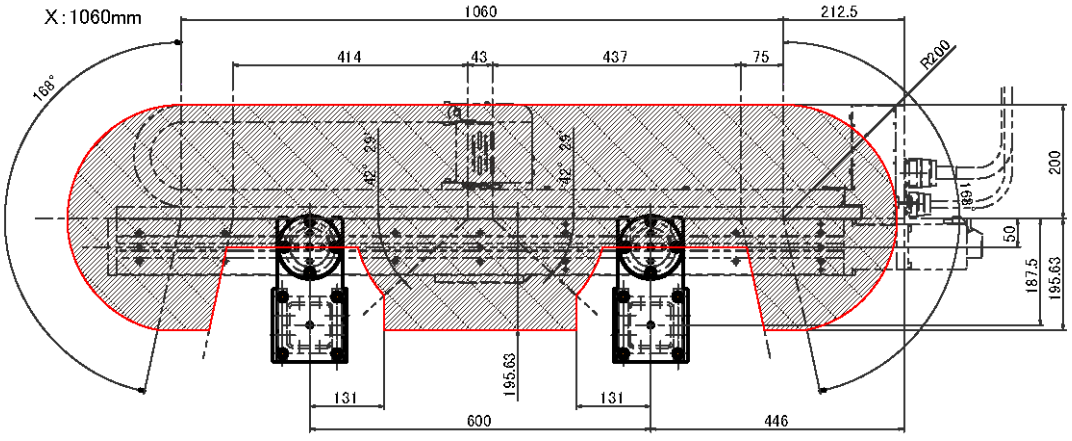
X: 450mm



X: 760mm

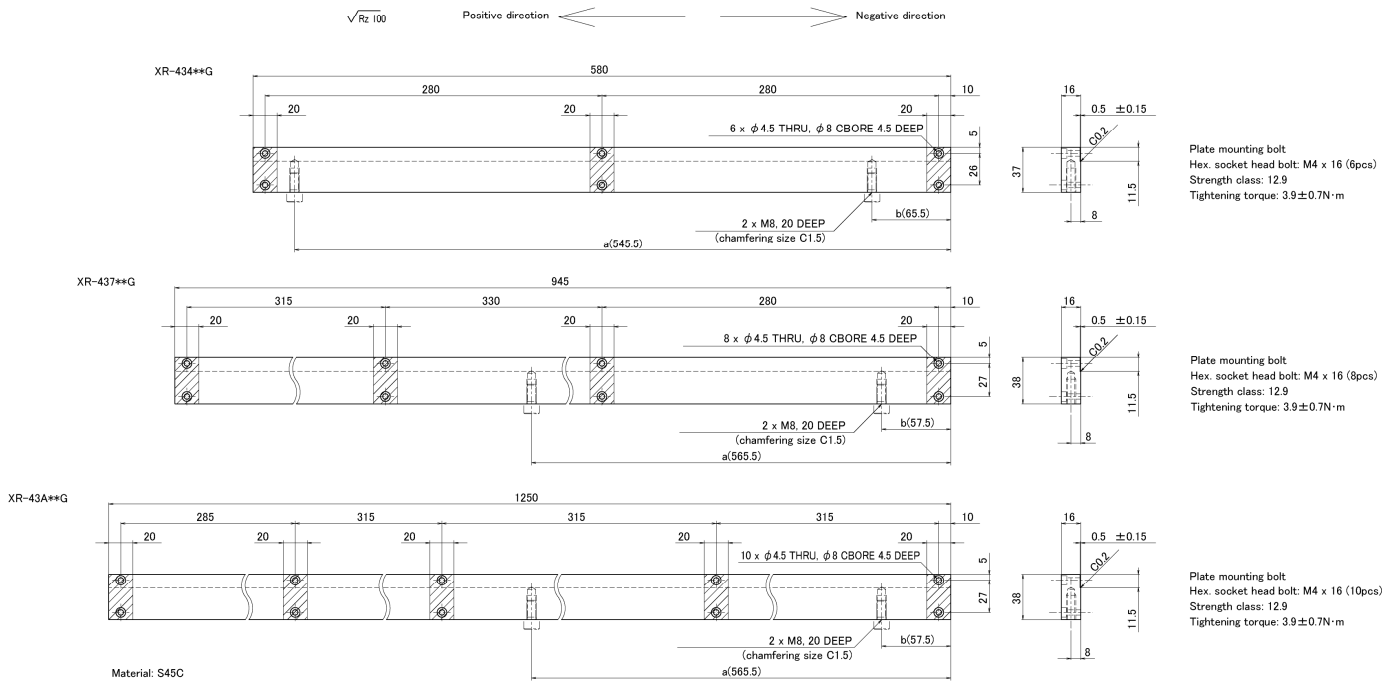


X: 1060mm



4.2 Drawings of Mechanical stoppers

4.2.1 Drawings of the 1st axis (X-axis) Mechanical Stopper

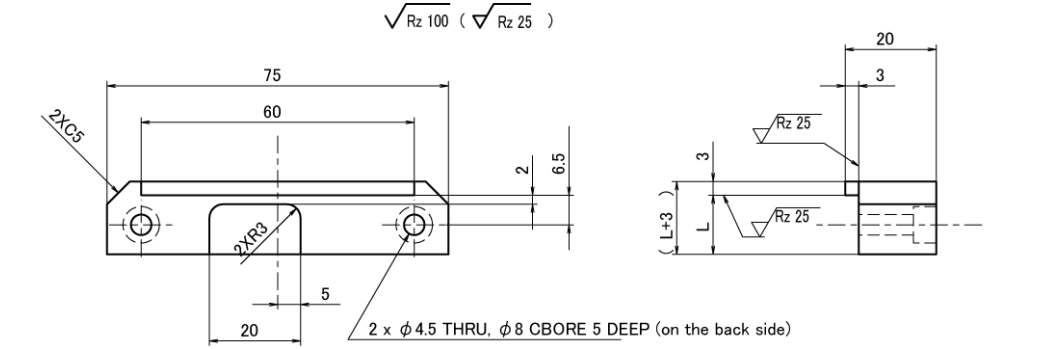


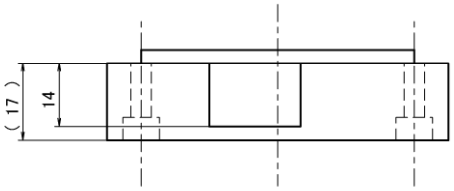
The table below shows the values of "a" and "b" in the drawings when A is the motion limit value in the positive direction and B is the motion limit value in the negative direction.

	XR434**G	XR437**G	XR43A**G
a	A+165.5	A+185.5	A+185.5
b	B+15.5	B+7.5	B+7.5

Note:
1) The values in brackets are for when the motion limit value for positive direction is 380 and the motion limit value for negative direction is 50.
2) Unless otherwise specified, corners should be C0.3 to C0.5.
3) Do NOT drill holes for the mechanical stop bolts in the area marked with diagonal lines.

4.2.2 Drawings of the 3rd axis (Z-axis) Mechanical Stopper for Negative Direction (Z-axis stroke: 135 mm)





Mounting bolt
Hex. socket head bolt: M4 x 20 (2pcs)
Strength class: 12.9
Tightening torque: 2.9±0.5N·m

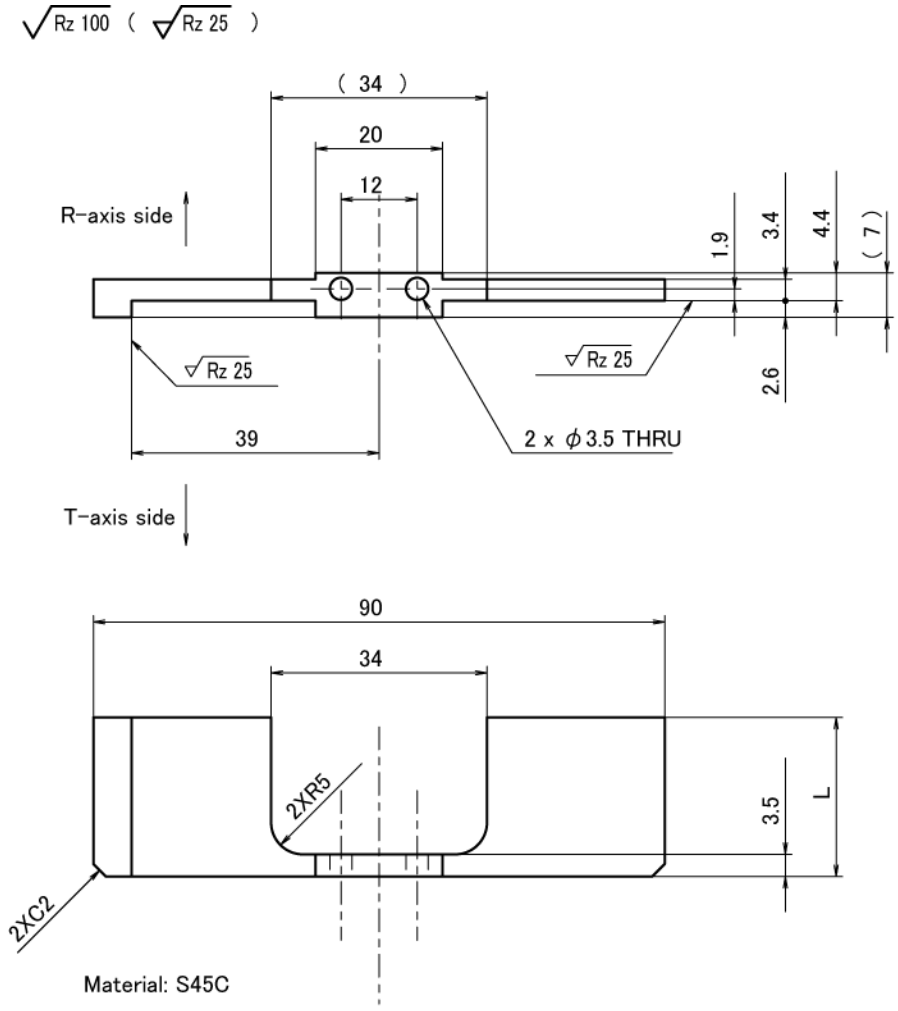
Material: S45C

Note: Unless otherwise specified, corners should be C0.1 to C0.3.

When the limit value of the motion range is Lz,

L = 123 − Lz (0≦Lz≦110)

4.2.3 Drawings of the 3rd axis (Z-axis) Mechanical Stopper for Positive Direction (Z-axis stroke: 135 mm or 200 mm)



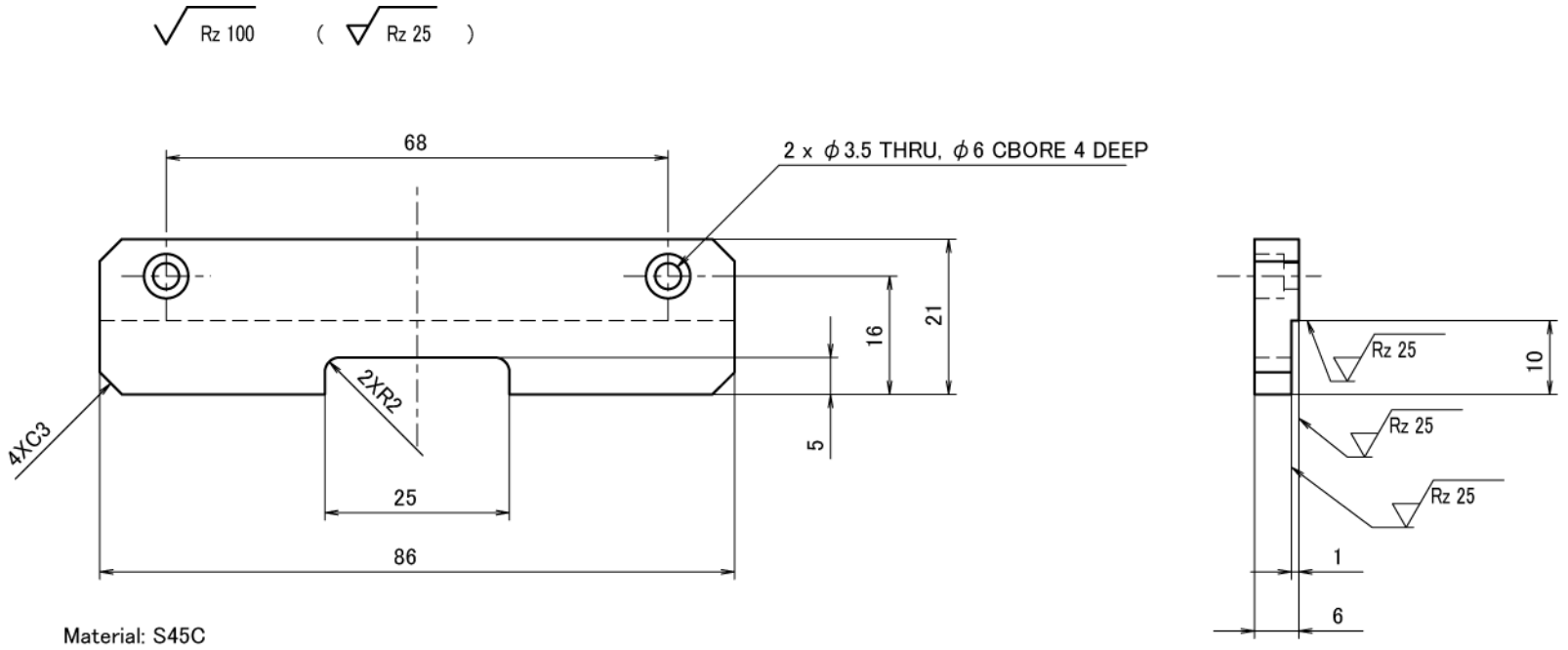
Relational expression between L value in the drawing and the motion limit value (Lz)

Robot model		L value	Motion range
XR43**1G (Z-axis stroke: 135 mm)		L=-Lz+5	-88≦Lz≦0
XR43**2G (Z-axis stroke: 200 mm)			
	With extension plate at the highest position	L=-Lz	-93≦Lz≦-5
	With extension plate at the lowest position	L=-Lz-107	-200≦Lz≦-112

Mounting bolt
Hex. socket head bolt: M3 x 8 (2pcs)
Strength class: 12.9
Tightening torque: 2±0.4N·m

Note
1) Unless otherwise specified, corners should be C0.1 to C0.3.

4.2.4 Drawings of the Lower End Fixture for the Extension Plate (Z-axis stroke: 200 mm)

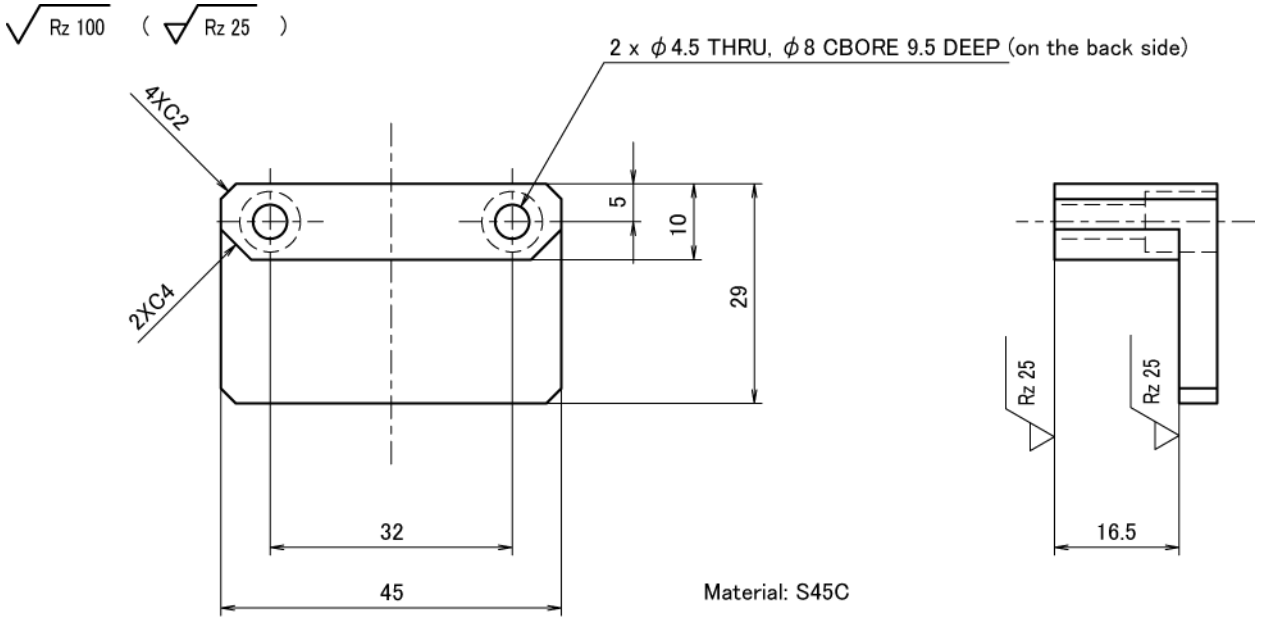


Material: S45C

Mounting bolt
Hex. socket head bolt: M3 x 8 (2pcs)
Strength class: 12.9
Tightening torque: 2±0.4N·m

Note: Unless otherwise specified, corners should be C0.1 to C0.3.

4.2.5 Drawings of the Upper End Fixture for the Extension Plate (Z-axis stroke: 200 mm)



Mounting bolt
Hex. socket head bolt: M4 x 20 (2pcs)
Strength class: 12.9
Tightening torque: 2.9±0.5N·m

Note: Unless otherwise specified,
corners should be C0.1 to C0.3.

Integrated compact robot
XR-G SERIES

INSTALLATION & MAINTENANCE GUIDE

First Edition March 2008
Seventh Edition October 2011
Eighth Edition February 2013

DENSO WAVE INCORPORATED 2Q**C

The purpose of this manual is to provide accurate information in the handling and operating of the robot. Please feel free to send your comments regarding any errors or omissions you may have found, or any suggestions you may have for generally improving the manual.

In no event will DENSO WAVE INCORPORATED be liable for any direct or indirect damages resulting from the application of the information in this manual.