



Original instructions

YAMAHA SCARA ROBOT

YK-XE Series

Installation Manual

YK400XE-4
YK510XE-10 / YK610XE-10 / YK710XE-10



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Declaration of incorporation of partly completed machinery

Warranty

Warranty

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

■ This warranty does not cover any failure caused by:

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

■ The following cases are not covered under the warranty:

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

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Chapter 1

Introduction

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1. Introduction

The YAMAHA YK-XE series robots are SCARA type industrial robots developed based on years of YAMAHA experience and achievements in the automation field as well as efforts to streamline our in-house manufacturing systems.

The YK-XE 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 YK-XE 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.

1.1 Available manuals

The following manuals are included in the disk that comes supplied with the YAMAHA robot or controller.



Safety instructions

Describes safe and correct operating method for controller and robot.



Installation manual (this manual)

Describes how to install and connect the robot.



Maintenance manual

Describes the maintenance procedures for the robot.

Use any of the following approaches to this manual when installing, operating and adjusting the YAMAHA robot and/or controller so that you can quickly refer to this manual when needed.

1. Keep the printed version of this manual (available for an additional fee) handy for ready reference.
2. View the disk version of this manual on your personal computer screen.
3. Print out the necessary pages of this manual from the disk and keep them handy for ready reference.

TIP

Manuals are available by downloading from our website (Member Site). Registering is required for accessing the member site:

https://www2.yamaha-motor.co.jp/Robot/Member/loginagain/lang_div/en

This user's manual describes the safety measures, handling, adjustment and maintenance of YK-XE 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 user's manual should be used with the robot and considered an integral part of it. When the robot is moved, transferred or sold, send this manual to the new user along with the robot. Be sure to explain to the new user the need to read through this manual.

For details about actual robot operation and programming, refer to the "YAMAHA Robot Controller User's Manual".



WARNING

The adjustment and maintenance work with the cover removed needs the special knowledge and skill.

If unskilled work person performs such work, this may involve risk. Read "2. Qualification of operators/workers" in section 4.1 of the Safety Instructions and allow only qualified engineers to perform this work while referring to the separate Maintenance Manual.

- Place a conspicuous sign indicating the robot is being adjusted, to prevent others from touching the controller switch, programming box (PBX) or operation panel.
- If a safety enclosure has not yet been provided right after installation of the robot, rope off or chain off the movement range around the manipulator in place of a safety enclosure, and observe the following points.
 - 1. Use stable posts which will not fall over easily.
 - 2. The rope or chain should be easily visible by everyone around the robot.
 - 3. Place a conspicuous sign prohibiting the operator or other personnel from entering the movement range of the manipulator.
- To check the operation after setting, refer to "4.6.1 Trial run" in the chapter "Safety precautions" in the separate Safety Manual.

**CAUTION**

Use only the lubricants specified by your distributor.

"Harmonic" and "Harmonic drive" are the registered trademarks of Harmonic Drive Systems Inc.

1.2 Signal symbols

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

**DANGER**

This indicates an immediately hazardous situation which, if not avoided, will result in death or serious injury.

**WARNING**

This indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

**CAUTION**

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

**NOTE**

This indicates a supplementary explanation in the operation.

2. Action when a person is caught by robot

If a person is caught or caught by a robot, a machine such as a frame, release the person by the following methods.

■ Using the Robot Brake Release Switch (YK-XE Series Optional)



WARNING

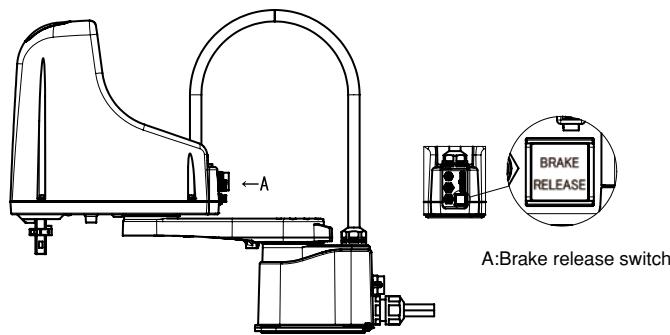
The Z-axis will slide down when the brake is released, causing a hazardous situation.

- Prop up the Z-axis with a support stand before releasing the brake.
- Be careful not to let your body get caught between the Z-axis and the installation base before releasing the brake.

In the emergency stop state, the Z-axis cannot be moved by the brake. Press the brake release switch, and then Z.

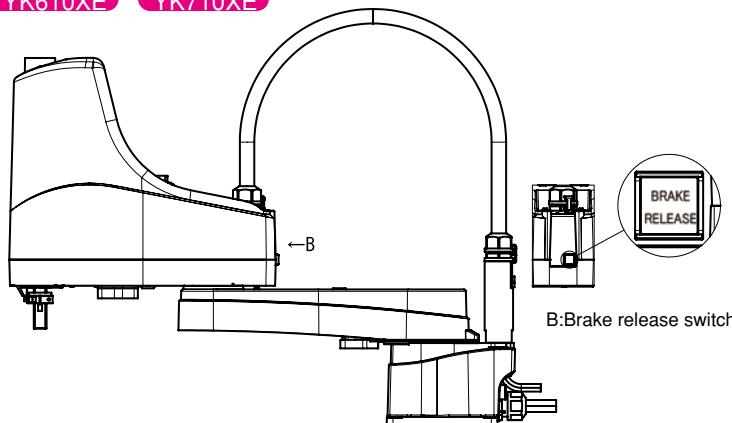
Brake release switch

YK400XE



A:Brake release switch

YK510XE YK610XE YK710XE



B:Brake release switch

■ When releasing the Z-axis brake in the programming box

Refer to "Troubleshooting when a Robot is Pinched" in RCX3 Operation User's Manual.

3. Emergency action when a person is caught by robot

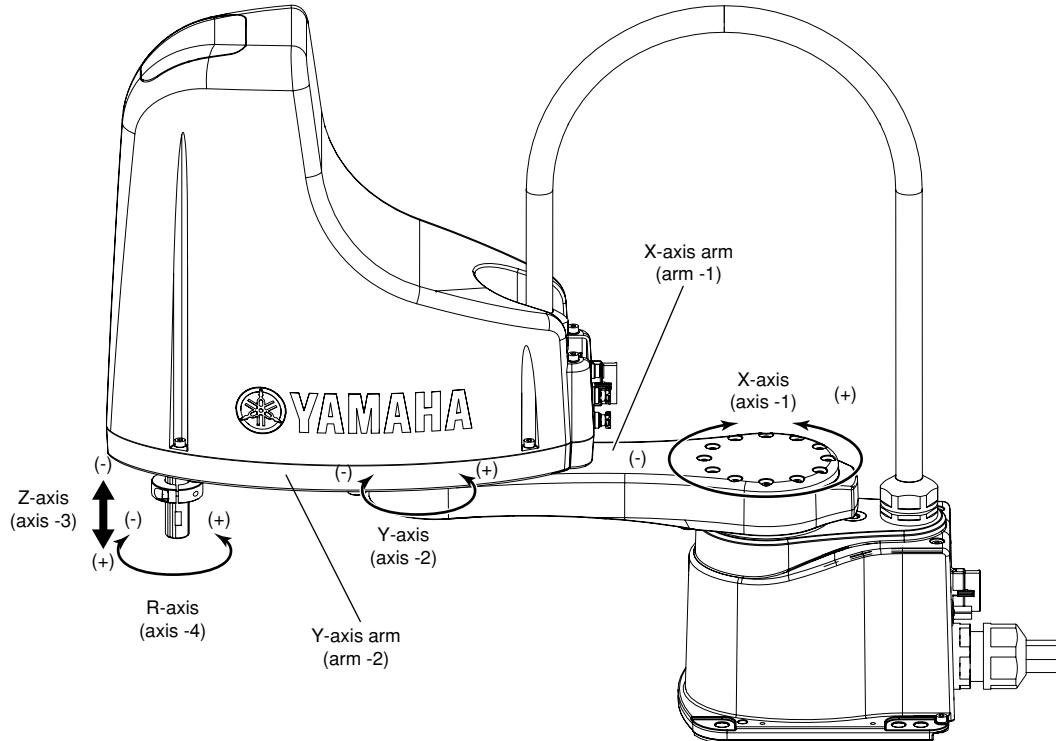
At this time, our thanks for your purchase of this YAMAHA YK-XE series SCARA robot.



NOTE

In the RCX340 controller, axis names are called using numeric values, like axis-1, axis-2, axis-3, and so on. In this manual, axis names are called using alphabetic characters, like X-axis, Y-axis, Z-axis, and so on. So, read this manual while referring to the robot external view and axis name correspondence table shown below.

External view of robot and axis name correspondence table



23002-FV-00

RCX340 controller axis name	Axis name in this manual
Axis 1	X-axis
Axis 2	Y-axis
Axis 3	Z-axis
Axis 4	R-axis

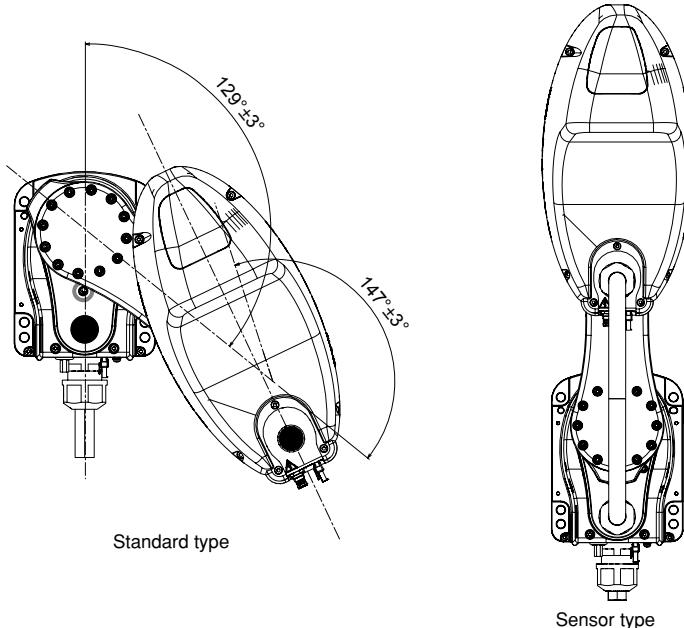
1. Please be sure to perform the following tasks before using the robot.

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 YK-XE series robots is adjusted to the position as shown below, 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 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 return-to-origin.)
- [2]Setting a position OTHER than the origin position adjusted at the factory prior to shipment as the origin position

Default origin position



23313-FV-00

[1]To set the origin position adjusted at the factory prior to shipment as the origin position

Return-to-origin

The YK-XE series robots only require the return-to-origin to be performed once when the robot is introduced. Once the return-to-origin is performed, you do not need to reperform it when the power is turned on next time. Set the origin position while referring to return-to-origin methods in "2. Adjusting the origin" in Chapter 3 of this manual and in "Return-to-origin" of the "YAMAHA 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 "4. Setting the standard coordinates" in Chapter 3 of this manual and "Setting the Standard Coordinates" in the "YAMAHA 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 origin position adjusted at the factory prior to shipment as the origin position

1.Return-to-origin

The YK-XE series robots only require the return-to-origin to be performed once when the robot is introduced. Once the return-to-origin is performed, you do not need to reperform it when the power is turned on next time. Set the origin position while referring to return-to-origin methods in "2. Adjusting the origin" in Chapter 3 of this manual and in "Return-to-origin" of the "YAMAHA Robot Controller User's Manual". Set the origin position with the return-to-origin.



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 return-to-origin is complete, and immediately affix the origin point sticker according to instructions in "5. Affixing stickers for origin positions, movement directions and axis names" in Chapter 3 of this manual.

3. Setting the standard coordinates

Set the standard coordinates while referring to instructions in "4. Setting the standard coordinates" in Chapter 3 of this manual and also to "Setting the Standard coordinates" in the "YAMAHA Robot Controller User's Manual". Robot malfunctions (vibration, noise) may occur if the standard coordinates are not set correctly.

Even though there is no problem with the robot, the 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.)

Example of error messages issued when robot & controller are connected Example

17.410: ABS. battery error

17.411: ABS. encoder error

17.412: ABS. count error

17.413: ABS. overflow error

17.414: ABS. mixing error 1

etc.

2. Repetitive positioning accuracy

Accuracies under the following conditions are not guaranteed in "Repetitive positioning accuracy".

[1] Factors related to absolute accuracy

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

[2] Motion pattern factors

- If a motion approaching to the teaching point from a different direction is included during repetitive operation.
- If the power is turned off or the robot is stopped before completing the motion or the moving speed is changed even when approaching to the teaching point from the same direction.
- If the robot is moved to the teaching point using a hand system different from the hand system (right-handed or left-handed system) used for the teaching.

[3] Temperature factors

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

[4] Load variation factors

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

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

If the X-axis, Y-axis or R-axis rotation angle is smaller than 5° so that it moves in almost 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.

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.

Chapter 2 Functions

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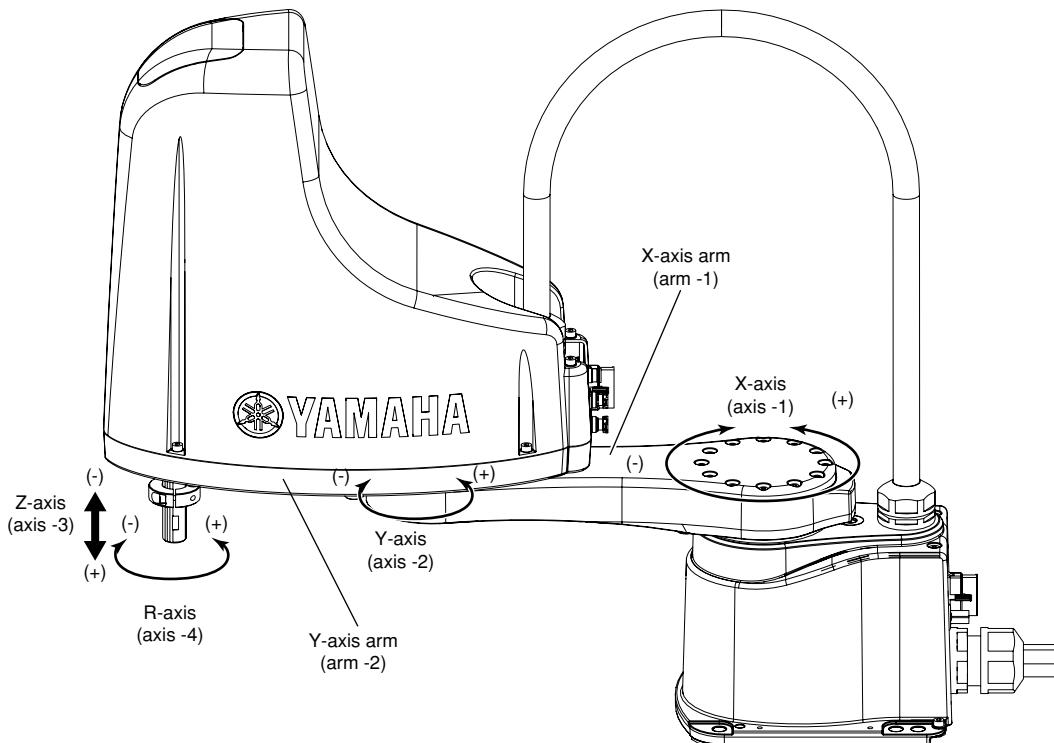
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1. Robot manipulator

1.1 Manipulator movement

The YK-XE 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 YK-XE series robots can move as shown in the Fig. below. 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 box are pressed (standard setting at the factory).

Manipulator movement

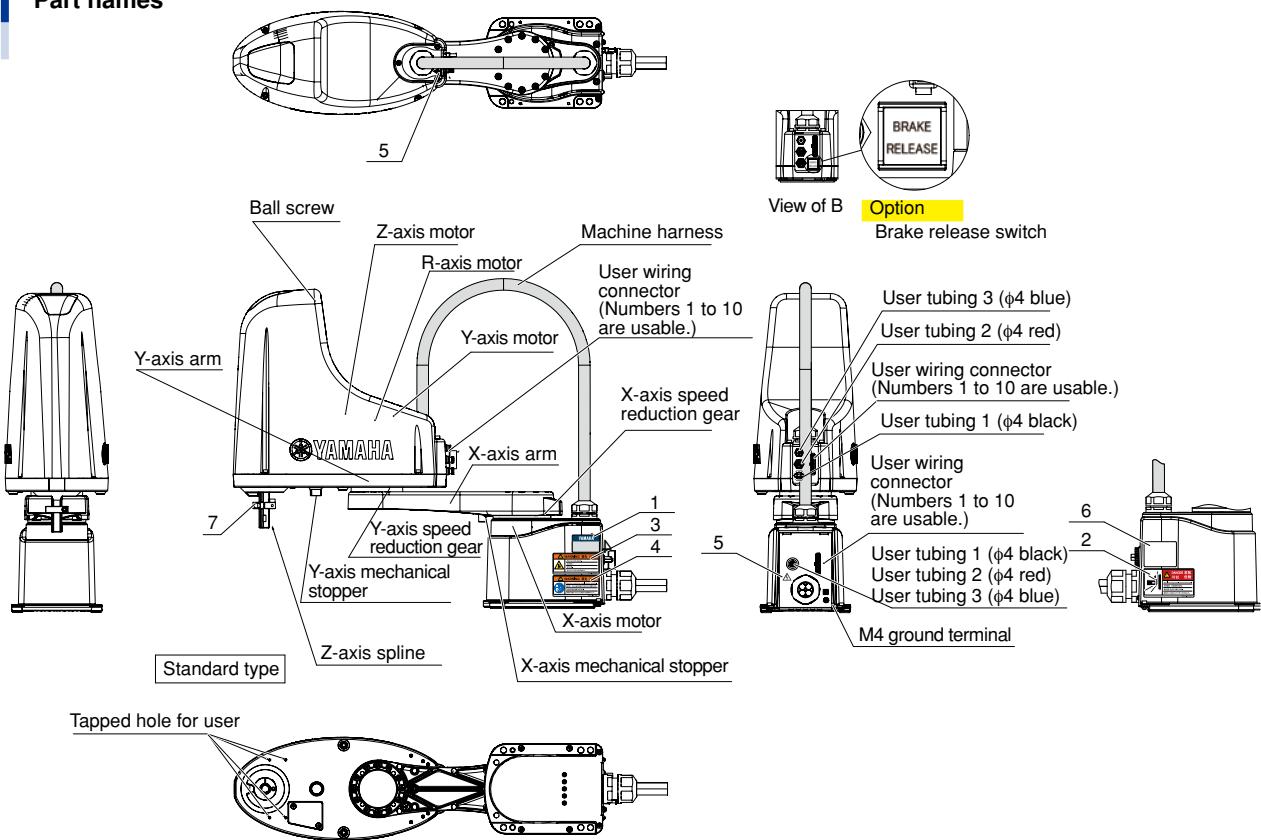


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1.2 Part names

■ YK400XE-4

Part names



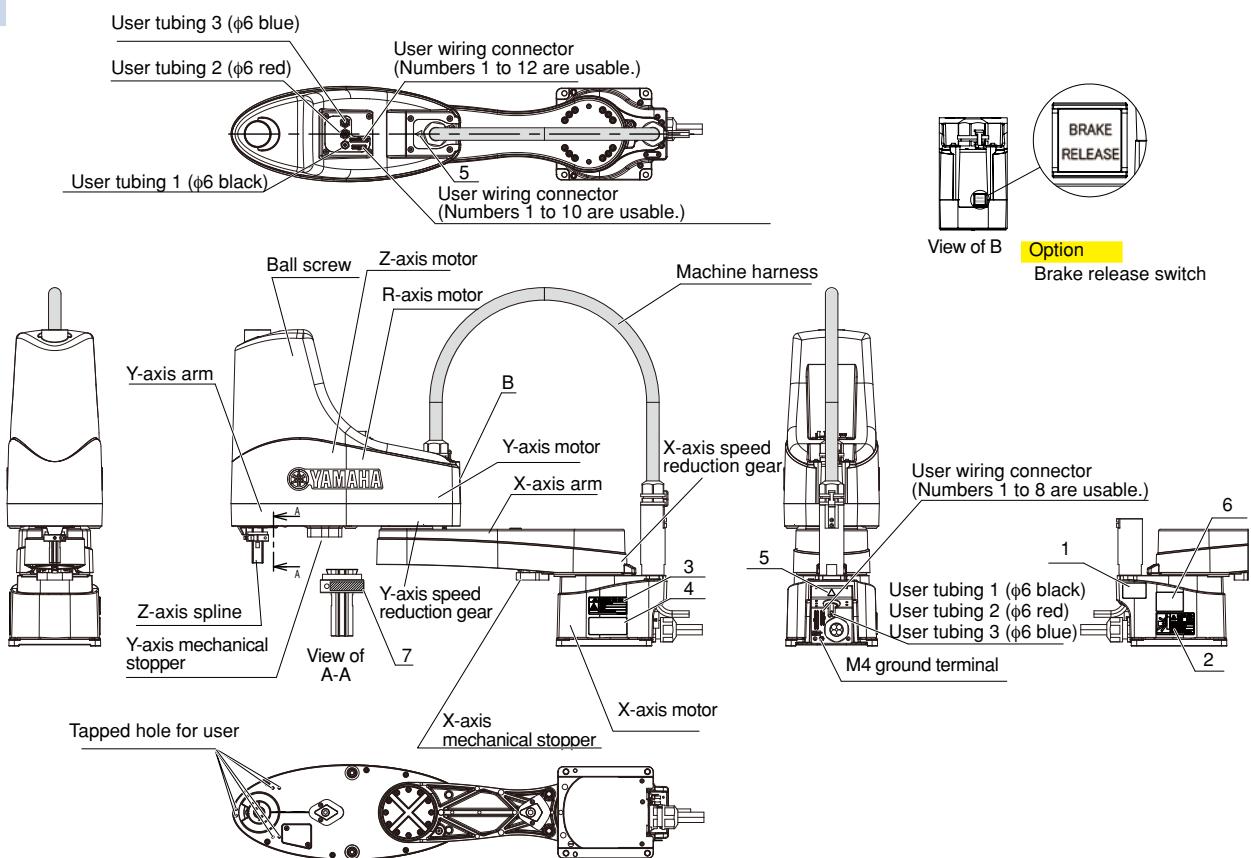
23102-FV-01

* YAMAHA Part Nos.

	PARTS NAME	PARTS NO.	QTY	
1	LABEL,SERIAL NUMBER	90K43-000100	1	
2	LABEL,DANGER	90K41-001470	1	
3	LABEL,WARNING	90K41-001460	1	
4	LABEL,WARNING	90K41-001290	1	
5	LABEL,CAUTION	90K41-001910	2	
6	LABEL,SAFETY STANDARD COMPLIANT	90K43-200850	1	
7	LABEL,ALERT	90K41-001490	1	

■ YK510XE-10 / YK610XE-10 / YK710XE-10

Part names



23104-FV-00

* YAMAHA Part Nos.

PARTS NAME	PARTS NO.	QTY	
1 LABEL,SERIAL NUMBER	90K43-000100	1	
2 LABEL,DANGER	90K41-001470	1	
3 LABEL,WARNING	90K41-001460	1	
4 LABEL,WARNING	90K41-001290	1	
5 LABEL,CAUTION	90K41-001910	2	
6 LABEL,SAFETY STANDARD COMPLIANT	90K43-200850	1	
7 LABEL,ALERT	90K41-001490	1	

2. Brake release switch



WARNING

The Z-axis will slide down when the brake is released, causing a hazardous situation.

- Prop up the Z-axis with a support stand before releasing the brake.
- Be careful not to let your body get caught between the Z-axis and the installation base during the work with releasing the brake such as the direct teach including setting of reference coordinates, the operation check of the brake release switch (the daily inspection, the confirmation after mounting the switch).
- Make sure that the brake release switch does not interfere with peripheral devices during robot operation and the switch is not pressed.

While pressing the brake release switch in the emergency stop state, the Z-axis brake is released and the Z-axis can be moved. When the switch is released, the Z-axis is braked.

Use the brake release switch when a person is caught between the robots (including setting the reference coordinates) and when checking the operation of the brake release switch in the direct teaching.

■ When caught by robot

In the emergency stop state, the brake is activated and the Z-axis cannot be moved, so press the brake release switch and move the Z-axis by hand to escape. The other axes do not have brakes, so move them by hand to escape.

When releasing the Z-axis brake with the programming box refer to RCX340 User's or Operation manual "Emergency action when a person is caught by robot".

■ For direct teaching

RCX340 Operation manual "Servo operation" - "Motor power and servo on/off"

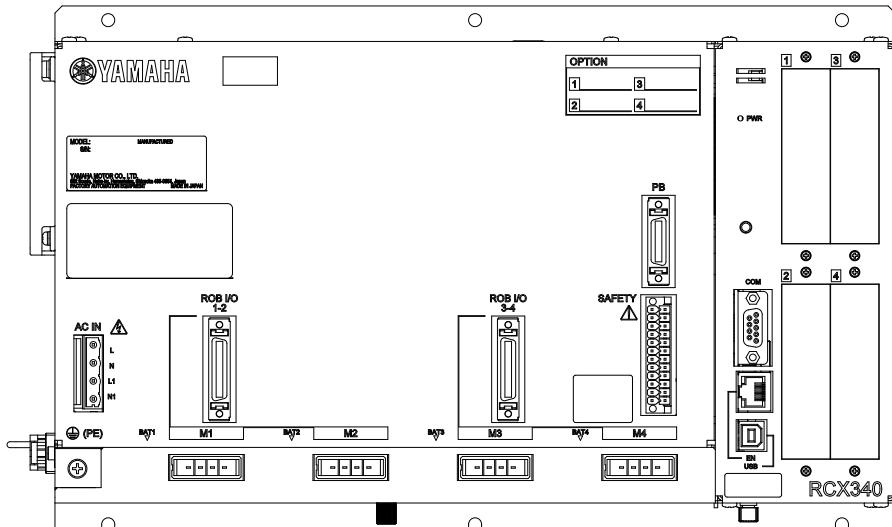
■ For direct teaching

Refer to each Chapter.

3. Robot controller

The YK-XE series robot comes supplied with a robot controller RCX340/RCX340XE. For more details, refer to the separate "YAMAHA Robot Controller User's Manual".

Robot controller



RCX340

4. Robot initialization number list

The YK-XE 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 robot number shown below.

■ YK400XE-4 Robot number:

Robot initialization number	Model name	Remarks
2700	YK400XE_T	Arm 1/2 Return-to-origin: Stroke end method
2701	YK400XE_S	Arm 1/2 Return-to-origin: Sensor method
2703	YK510XE	Arm 1/2 Return-to-origin: Sensor method
2705	YK610XE	Arm 1/2 Return-to-origin: Sensor method
2707	YK710XE	Arm 1/2 Return-to-origin: Sensor method



CAUTION

- Return-to-origin must be performed after reinitializing the controller. Before reinitializing the controller, read the descriptions in "2. 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 "4. 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.

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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 "YAMAHA 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

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.



WARNING

- Be sure to install the robot on a horizontal surface with the base mount section facing down. Install the wall-mount or wall-mount inverse model robot with the base mount section facing sideward. If the orientation of the base mount section is not observed when installing the robot, the grease of the speed reduction unit may leak.
- 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.



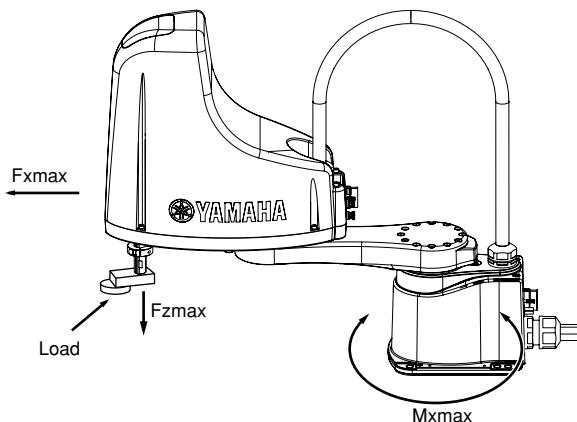
CAUTION

- 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.

Step 1 Prepare a robot installation base.

The maximum reaction force applied to the X-axis and Z-axis of each robot during operation is shown in the Table below. These values are instantaneous force values applied to the robot during operation and do not indicate the load resistant values.

Maximum reaction force during robot operation



Robot Model	Fxmax		Mxmax		Fzmax	
	N	kgf	Nm	kgfm	N	kgf
YK400XE	173	18	73	7.4	70	7.1
YK510XE	239	24	178	18	210	21
YK610XE	300	31	178	18	200	20
YK710XE	192	20	178	18	184	19

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The flatness of the robot installation base surface must be machined within a precision of $\pm 0.05\text{mm}/500\text{mm}$.

Step 2 Tap holes into the installation surface of the base.



NOTE

For details about machining dimensions and positions, see "1.2 External view and dimensions" in Chapter 8.

Step 3 Securely fix the installation base on the floor.

Securely fix the installation base with the anchor bolts so that it does not move.

2. Installation

2.1 Unpacking

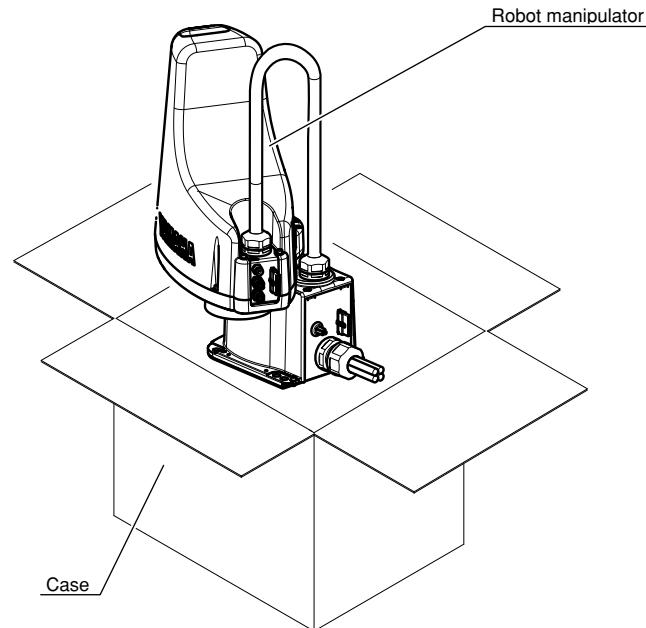
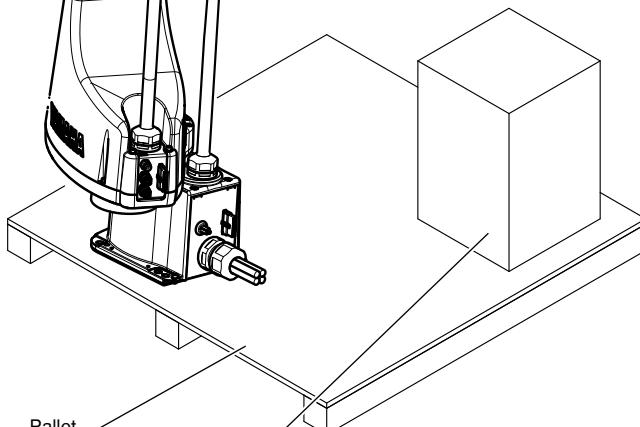

WARNING

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

The YK-XE 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.

Packed state
Transportation using case

Transportation using pallet


Robot controller and accessories

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2.2 Checking the product

After unpacking, check the product configuration and conditions.

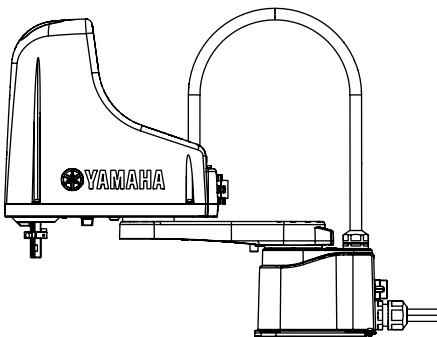
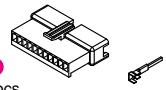
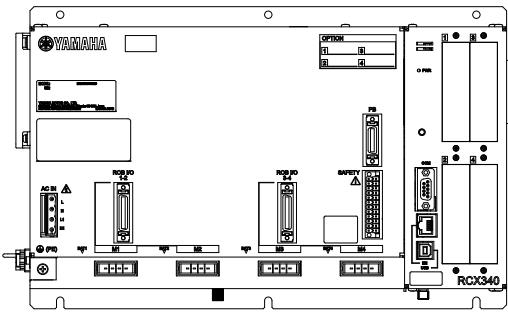


CAUTION

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

- Controller : RCX340
- Robot : YK-XE series

Product configurations

Standard	
Robot manipulator	 Accessories Warning label (x1)  User wiring connector kit  YK400XE Connector, 2 pcs. Pin, 30 pcs. YK510XE / YK610XE / YK710XE Connector, 2 types, 2 pcs. Pin, 50 pcs. Origin position stickers  M8 bolt 1PCS. (YK510XE / YK610XE / YK710XE) YK400XE X-axis Reference Coordinate Setting Jig (Optional) YK400XE Y-axis Reference Coordinate Setting Jig (Optional) YK400XE X-axis additional stopper (Optional) YK400XE Y-axis additional stopper (Optional) YK510XE / YK610XE / YK710XE Reference coordinate setting jig (Common to XY-axis)(Optional) YK510XE / YK610XE / YK710XE Z-axis + direction additional stopper(Optional) YK510XE / YK610XE / YK710XE Z-axis - direction additional stopper(Optional) YK510XE / YK610XE / YK710XE X-axis origin shift jig(Optional) YK510XE / YK610XE / YK710XE Y-axis origin shift jig(Optional)
RCX340 controller	
Option	
PBX programming box, etc.	

2.3 Moving the robot YK400XE



WARNING

Serious injury may occur if the robot falls and pins someone under it.

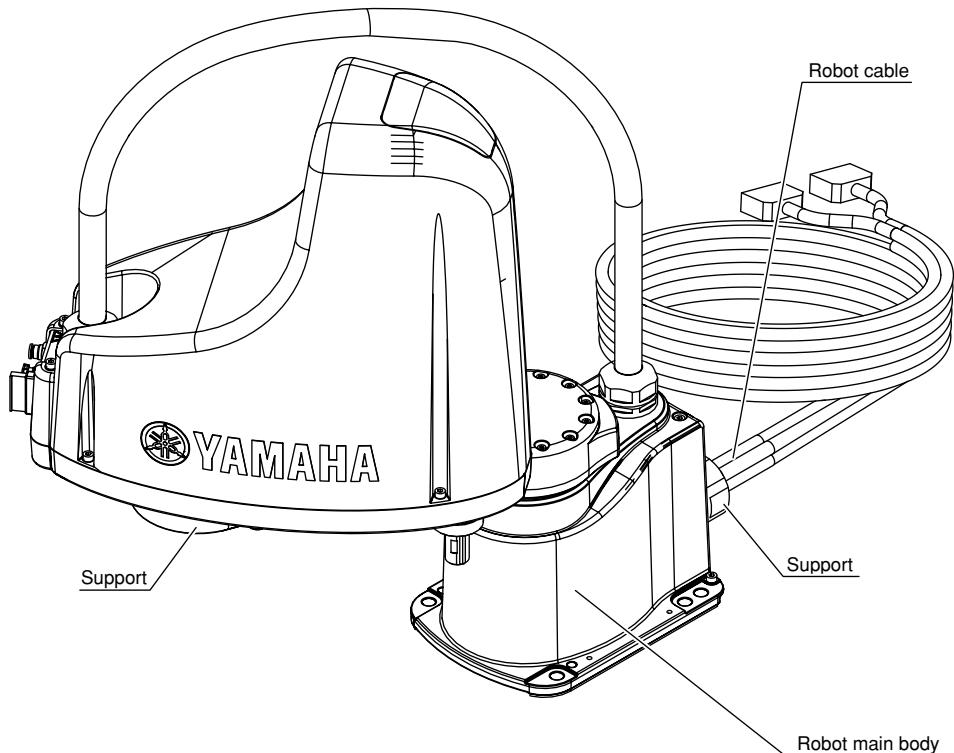
- Do not allow any part of your body to enter the area beneath the robot during work.
- Always wear a helmet, safety shoes and gloves during work.

To check the mass of robot, refer to "1.1 Basic specification" in Chapter 9.

step 1 Fold the arms.

Take out the robot from the case or remove it from the pallet. Fold the arms while referring to the Fig. below.

Moving the robot



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step 2 Place the robot on the base.

One work person holds the support of the robot main body with both hands and other work person holds the robot cable to place the robot on the base.

step 3 Temporarily secure the robot by tightening the bolts.



NOTE

For details about tightening torque to secure the robot firmly, see "2.4 Installing the robot".

2.4 Moving the robot YK510XE YK610XE YK710XE



WARNING

If the transported robot falls and is laid down, serious injury may result.

- Use a hoist and rope that can carry the weight of the robot with sufficient margin.
- Be careful not to let the rope come off the hoist.
- Remove all loads attached to the tip of the robot. This is dangerous because the balance during transportation is lost.



CAUTION

- Only qualified personnel are allowed to operate cranes and other machinery and equipment that require proper qualification.
- Inspect the transportation machinery and tools thoroughly on a daily basis.

This section describes the transport procedures in YK610XE examples. Transport YK510XE, YK710XE in the same way.

Step 1 Moves the Z-axis down from the home position.

Z-axis lowering amount: 26mm (Tool flange type : 20mm)



NOTE

The Z-axis is fixed to the base with an arm fixing stay at the time of shipment.

Step 2 Turn off the controller.

▶ Step 4 Attaching the arm fixing stay

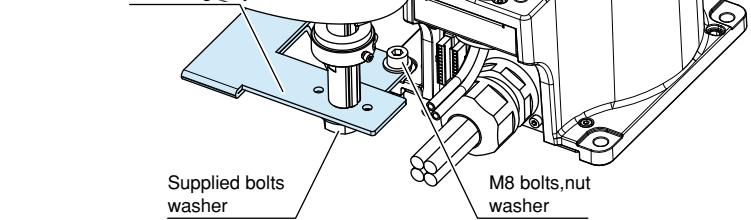
Step 3 Disconnect the robot cable from the controller.

Step 4 Secure the arm.

Fix the arm with the attached arm fixing stay, bolt and washer.

If the additional mechanical stoppers for the X and Y axes cannot keep the arm position as shown in the figure on the right, remove the mechanical stoppers for the X and Y axes.

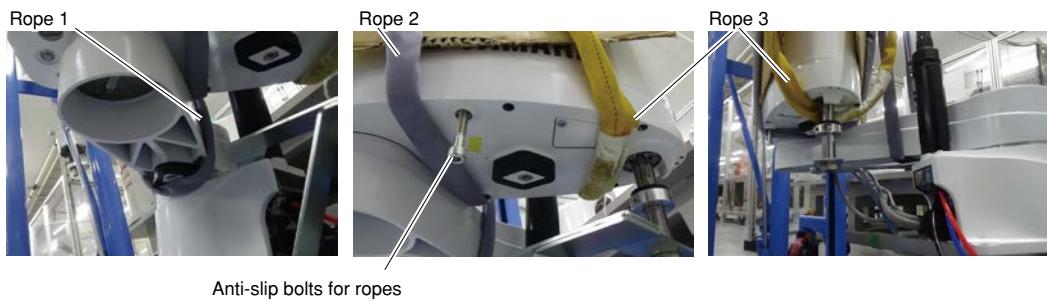
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step 5 Support the robot.

Support the robot with 3 rope and non-slip bolts ($M8 \times 40$).

Insert the protective material to prevent the arm cover from being damaged.

► Step 5 Bolt mounting

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step 6 Transport the robot.**step 7 Secure the robot to the base with bolts.****step 8 Remove the rope and non-slip bolt.**

2.5 Installing the robot

Install the robot securely with the four hex socket head bolts as shown in the Fig. below. The robot can be secured from the upper portion.



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.

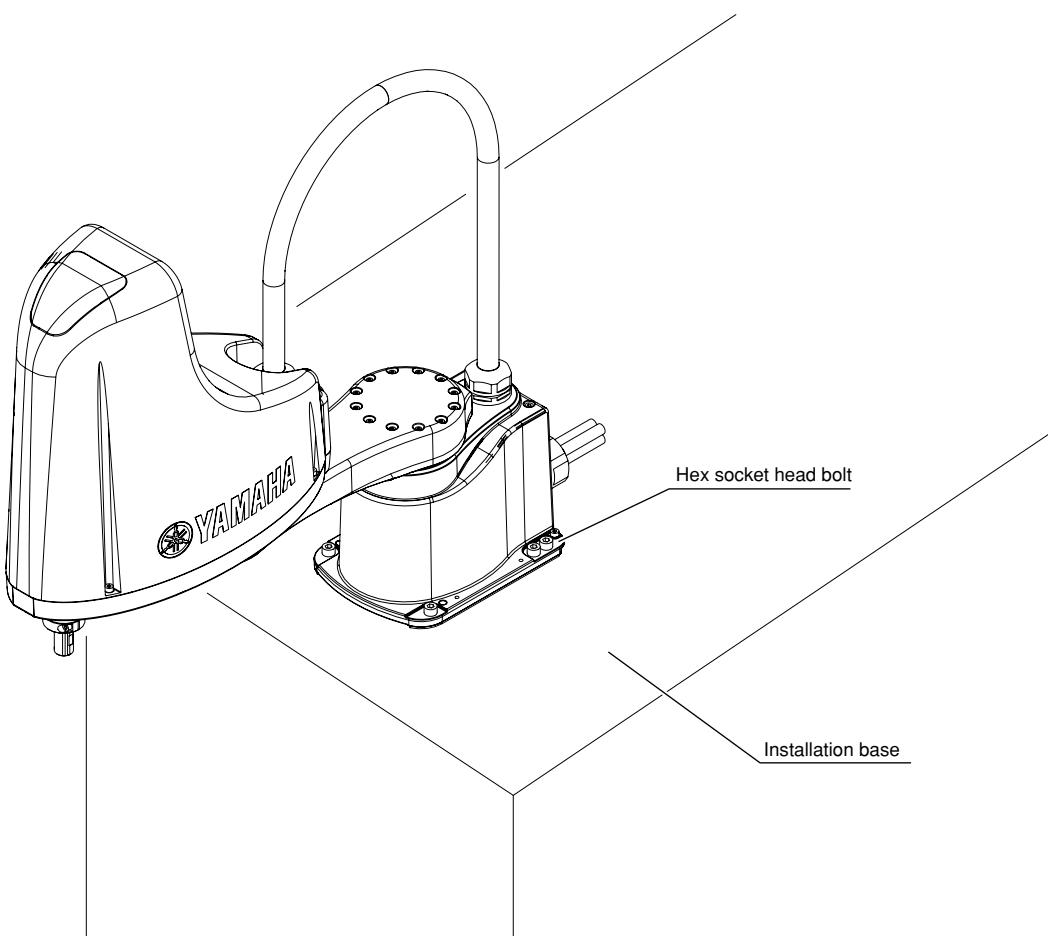
Tightening torque

Bolts Used	Tightening torque
M8	37Nm (380kgfcm)

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

Installing the robot



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NOTE

Knock holes for the positioning pins are provided on the base surface of the robot main body. When driving the positioning pins, the positional deviation due to attachment/detachment or vibration of the robot main body during maintenance work can be suppressed to the minimal level. For details about knock hole shape and dimensions, refer to "1.2 External view and dimensions" in Chapter 9.

3. Protective bonding


WARNING

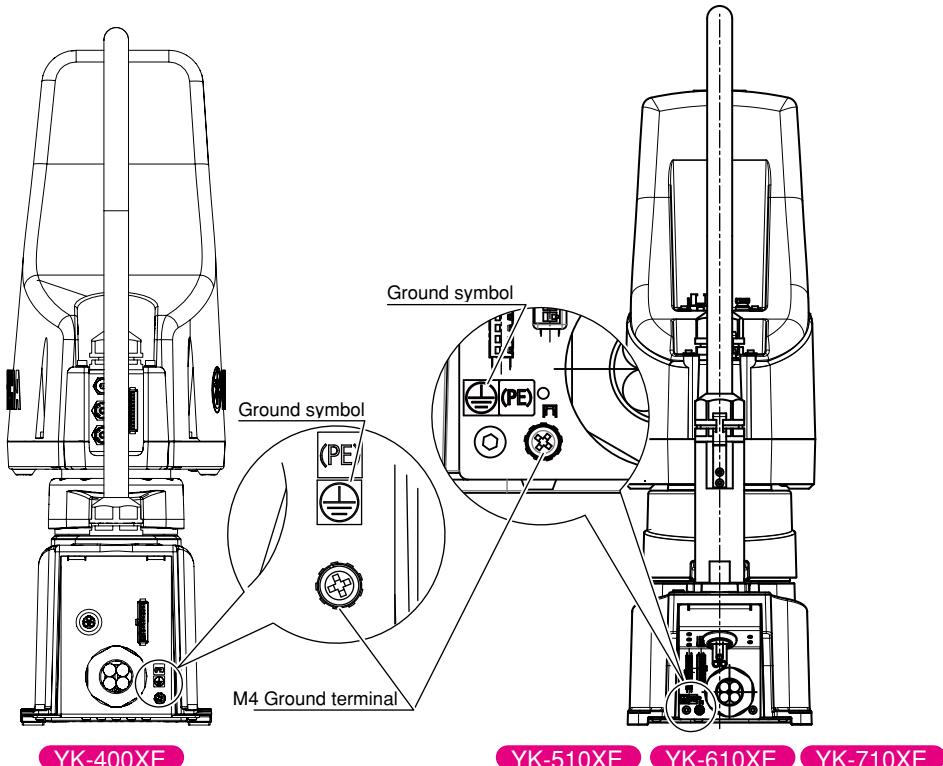
- Be sure to ground the robot and controller to prevent electrical shock.
- Turn off the controller before grounding the robot.

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



(Symbol 417-IEC-5019)

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Example of grounding


23204-FV-01

Use a ground cable with a conductor wire cross section of at least 2.0mm² and a length within 1 meter.


CAUTION

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 YK-XE series robots do not have a ground terminal for this purpose.


NOTE

For details on protective bonding on the robot body to comply with CE Marking, follow the instructions on protective bonding explained in the "YAMAHA Robot Controller User's Manual".

4. Robot cable connection

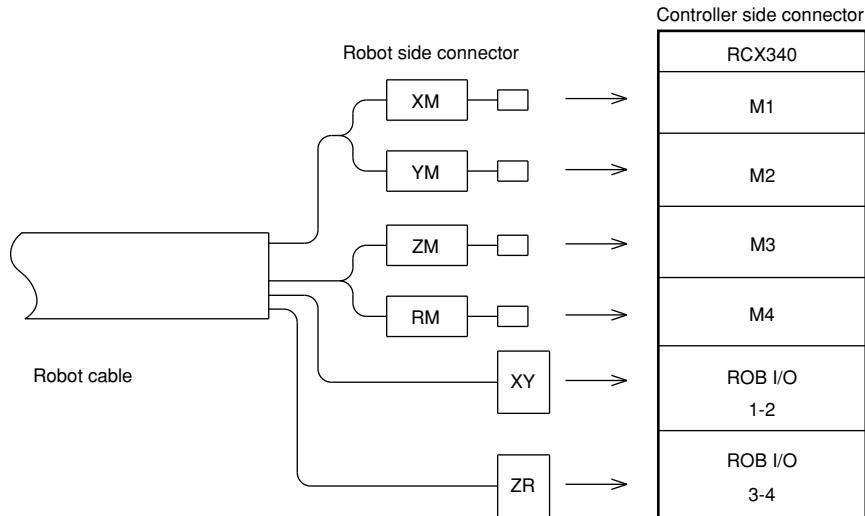
The robot cable is pre-connected to the YK-XE series robot. For details on connections to the robot controller, refer to the Fig. below and the "YAMAHA Robot Controller User's Manual". After making connections, check the operation while referring to the section "4.6.1 Trial Operation" in Chapter "Safety Instructions" of this manual.



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 RCX340 controller, the MOTOR connectors XM (M1) and ZM (M3), and YM (M2) and RM (M4) 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 8.
- 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.

Robot cable connections



23205-FV-00

5. User wiring and user tubing



WARNING

Always turn off the controller and shut off air supply before attempting wiring and tubing work. If air or power is supplied during this work, the manipulator may move erroneously causing a hazardous situation.

The YK-XE 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	YK400XE	YK510XE / YK610XE / YK710XE
User wiring	10 wires	20 wires
User tubing	φ4, 3 tubes (Base - Y-arm)	φ6, 3 tubes (Base - Y-arm)

* 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 (All models)

	YK400XE	YK510XE / YK610XE / YK710XE
Rated voltage		30V
Allowable current		1.0A
Nominal cross-section area of conductor	0.15mm ²	0.2mm ²
Shield		Present

User Tubing

	YK400XE	YK510XE / YK610XE / YK710XE
Maximum pressure		0.58MPa (6kgf/cm ²)
Outer diameter x inner diameter	φ4mm x φ2.5mm	φ6mm x φ4mm
Fluid	Dry clean air not containing deteriorated compressor oil; filtration 40μm or less	

There is a connector for user wiring and a bulkhead union for (user) plumbing on the arm/base of Y-axis. For the locations, refer to "1.3 External view and dimensions" in Chapter 9.

■ Signal wiring connections in the machine harness

YK400XE

Connector pins 1 to 10 can be used. Pin 11 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		Brown
		9	—	9		Red
		10	—	10		Orange
		11	—	11		Green
Flame Ground					FG	Grey
Flame Ground						

YK510XE YK610XE YK710XE

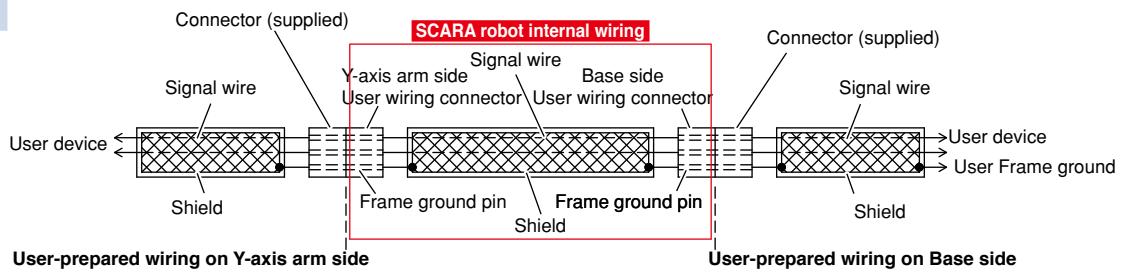
No. 1 to 12 of the I/O 1 connector (12 pin) and No. 1 to 8 of the I/O 2 connector (9 pin) can be used. No. 9 of the I/O 2 connector is connected to a shield wire and cannot be used as a signal wire.

Signal	Connector	No.	Connection	No.	Connector	Color
User signal line	I/O 1	1	/ \	1	I/O 1	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
User signal line	I/O 2	1	—	1	I/O 2	Brown
		2	—	2		Red
		3	—	3		Orange
		4	—	4		Blue
		5	—	5		Violet
		6	—	6		Grey
		7	—	7		White
		8	—	8		Black
		9	—	9		Grey
Flame Ground					FG	Grey
Flame Ground						

As shown in the Fig below, either use a crimping tool (J.S.T. Mfg Co., Ltd. YC12) to crimp the connector for the user-prepared wiring, or solder it.

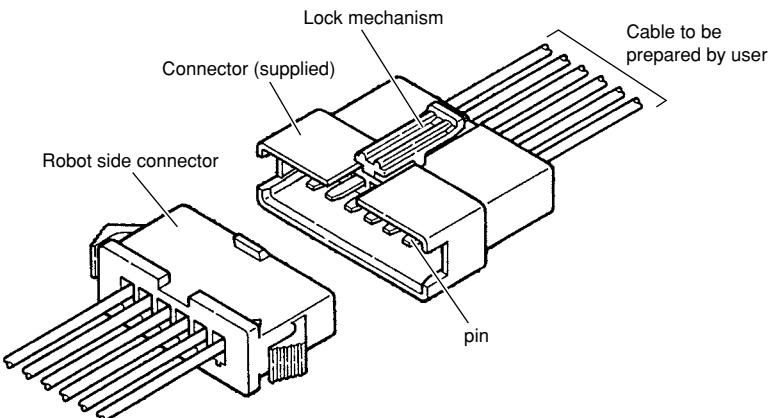
The connector pinouts as viewed from the solder side are shown below.

Wiring example



62240-FR-00

Connecting the connector



23209-FG-00



WARNING

- Be sure to use a shielded cable for user-prepared wiring.
- Cover the shield of the user-prepared wiring onto the supplied connector and onto the connection part with the user device.
- If the robot side user wiring connector has a shield frame ground pin, wire it so that it can be connected to the shield of the user-prepared wiring. (Refer to " Signal wiring connections in the machine harness")
- At the end of the user device of the user-prepared wiring on the base side, wire so that the shield falls to the frame ground.



WARNING

- Securely fix the connector (supplied) to the robot's connector using the lock mechanism attached with the housing (See Fig. above). The operation could malfunction if the connector dislocates.
- Perform the user-prepared wiring and tubing according to "15. Installing the user wiring and tubing newly". If you do not follow the instructions, the machine harness and user signal line may break and malfunction. Also, the positioning accuracy will deteriorate.
- Make sure that user wiring and tubing connected with the user wiring connector and user tubing joint do not interfere with the robot, get wound around the robot or led around when the robot moves. The wiring and tubing could be damaged and result in malfunctioning.
- Arrange the user wiring and tubing installed with the user wiring connector and user tubing joint not to pose hazards for the operators. The operators could trip on these parts and be injured.



CAUTION

Always use the supplied connectors and pins. Contact faults could occur if other types are used.

• YK400XE Connector supplied at shipment

YAMAHA's part number	Part name	Model number	Q'ty
KDS-M4870-00	Connector (Used for both the arm and base.)	SMR-11V-B (J.S.T. Connector)	2
	Pin contact	SYM-001T-P0.6 or BYM-001T-P0.6 (J.S.T. Connector)	30

• YK510XE YK610XE YK710XE Connector supplied at shipment

YAMAHA's part number	Part name	Model number	Q'ty
KFS-M4870-00	Connector (Used for both the arm and base.)	SMR-12V-B(J.S.T. Connector)	2
		SMR-09V-B(J.S.T. Connector)	2
	Pin contact	SYM-001T-P0.6 or BYM-001T-P0.6 (J.S.T. Connector)	50

To check the operation and signal transmission between the end effector and the controller or peripheral equipment after making connections, refer to the section "4.6.1 Trial Operation" in Chapter "Safety Instructions" of Separate manual.

6. Attaching the end effector

6.1 Setting the parameters

6.1.1 Setting the parameters according to the load

The RCX340 holds various data for each model depending on the load, the offset distance of the center of gravity of the load, and the moment of inertia.

By setting the parameter correctly according to the mounting load, the appropriate motion is automatically determined.



CAUTION

If the load, the offset distance or the moment of inertia is set less than the actual load, it may cause shorten the lifetime of the driving part of the robot.

6.1.2 Relevant parameters

The following 4 parameters are indispensable to set the load. Never change parameters other than these 4 parameters.

- ① Tip weight (kg) : The tip weight (workpiece weight + tool weight) is set in "kg" units. (Normally, set "0")
- ② Tip weight (g) : The tip weight (workpiece weight + tool weight) is set in "g" units.
- ③ R axis inertia offset for SCARA [μm]
- ④ R axis inertia for SCARA [$\text{kgm}^2 \times 10^{-4}$]

① ② "Tip weight" are the parameters for setting the attached load.

Setting ① and ② leads to calculate the acceleration, the deceleration and the velocity.

Example: Load is 2.5 kg.

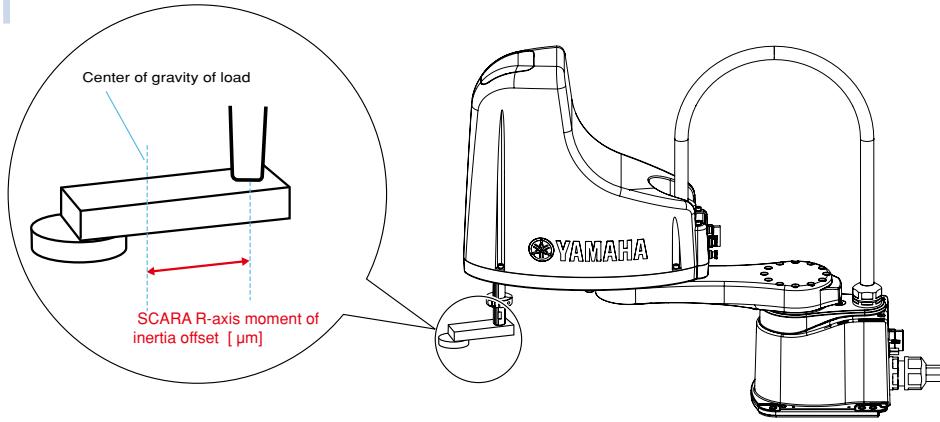
- ① Tip weight (kg) : 0
- ② Tip weight (g) : 2500



CAUTION

- If ① + ② is larger than the maximum mass of the model specification, the calculated acceleration / deceleration and speed will be the maximum mass set value of the model specification. Please use below the mass.
- If the tool flange or the user wiring/tubing through spline is added as an option, add the weight in the table below to the tip mass.
- Please include the tip mass in the tool mass attached to the Y arm and X arm.

SCARA R-axis moment of inertia offset [μm] in ③ is a parameter that sets the distance from the center of the spline shaft to the center of gravity of the entire mounting load.

SCARA R-axis moment of inertia offset

23229-FG-01

Options to be attached to and weight to be added to tip mass ① + ②

	Tool flange	Through tubing	Tool flange& Through tubing	Y arm additional stopper
YK400XE-4	No settings	100g + weight of wiring and tubing to be installed	No settings	No settings
YK510XE-10 YK610XE-10 YK710XE-10	600g	200g + weight of wiring and tubing to be installed	800g + weight of wiring and tubing to be installed	500g per piece

④ "R axis inertia for SCARA" is the parameter that sets the moment of inertia of the whole attached load.

**CAUTION**

The moment of inertia of the attached load is restricted by the strength/ lifetime of the driving part of the robot and by the residual vibration of positioning. Be sure to use under the value of the tolerable moment of inertia for each model. Pay attention to the unit of input value.

Methods for calculating the moment of inertia of the load are shown in "6.2 Equation for moment of inertia calculation" and "6.3 Example of moment of inertia calculation" in this Chapter.

However, it is not easy to precisely figure out these values. If a calculated value smaller than the actual moment of inertia is set, residual vibrations may occur. In this case, Enter a larger value than the calculated one to the SCARA R-axis moment of inertia.

6.1.3 Confirmation after setting the parameters

If the lighter weight, the shorter offset distance of gravity center or the lower moment of inertia than the actual load is set for the controller, residual vibrations or a controller alarm may occur.

In this case, increase all of the tip weight, the R-axis moment of inertia offset, and the R-axis moment of inertia further.

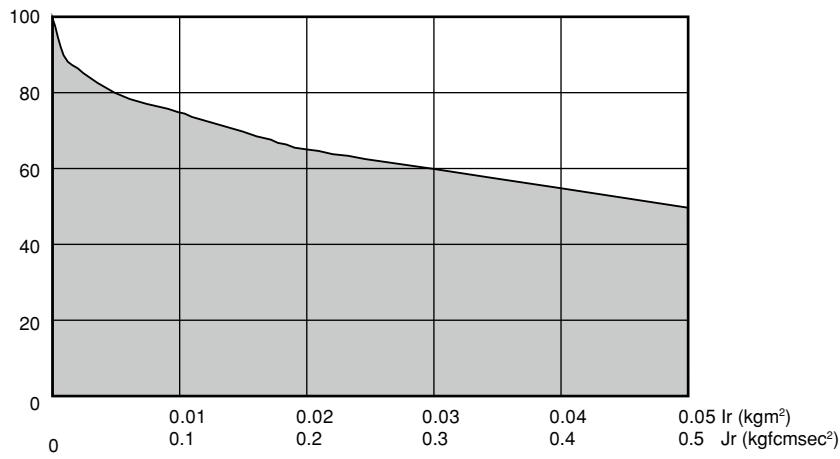
Never attempt to change other parameters than these ones.

6.2 Acceleration coefficient vs. moment of inertia

6.2.1 R-axis tolerable moment of inertia and acceleration coefficient

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.

The acceleration coefficient corresponding to the R-axis tolerable moment of inertia and the moment of inertia has the relationship shown in the graph below. The RCX340 holds different data by model or load weight inside the controller. (Y-axis: Acceleration coefficient, X-axis: Moment of inertia around R-axis)



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Therefore, optimal motion is automatically determined by entering only the load weight weight and the moment of inertia.

6.3 Equation for moment of inertia calculation

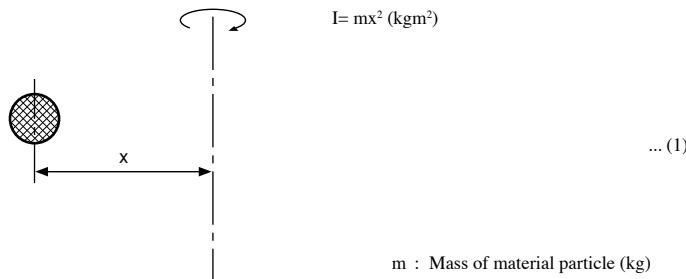
Usually the R axis load is not a simple form, and the calculation of the moment of inertia is not easy. As a method, the load is replaced with several factors that resemble a simple form for which the moment of inertia can be calculated. The total of the moment of inertia for these factors is then obtained.

1) Moment of inertia for material particle

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

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

Moment of inertia for material particle

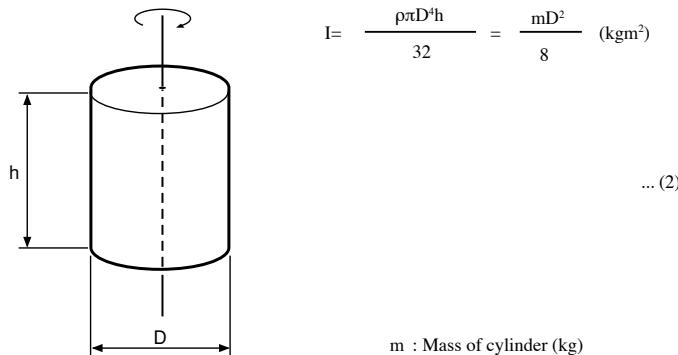


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2) Moment of inertia for cylinder (part 1)

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

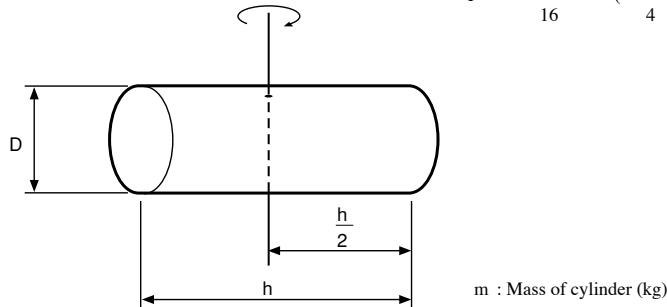
Moment of inertia for cylinder (part 1)



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3) Moment of inertia for cylinder (part 2)

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

Moment of inertia for cylinder (part 2)

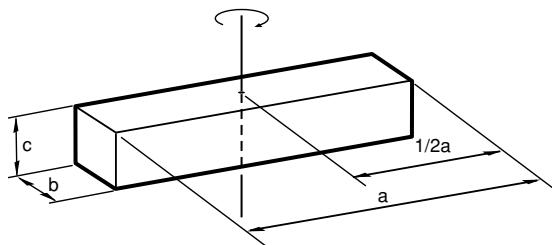
$$I = \frac{\rho\pi D^3 h}{16} \left(\frac{D^2}{4} + \frac{h^2}{3} \right) = \frac{m}{4} \left(\frac{D^2}{4} + \frac{h^2}{3} \right) \text{ (kgm}^2\text{)}$$

... (3)

23205-F0-01

4) Moment of inertia for prism

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

Moment of inertia for prism

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

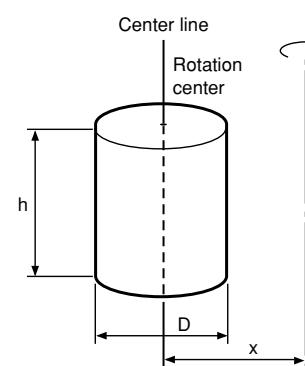
... (4)

m : Mass of prism (kg)

23206-F0-01

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

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

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

$$I = \frac{\rho\pi D^3 h}{32} + \frac{\rho\pi D^2 h x^2}{4} = \frac{mD^2}{8} + mx^2 \text{ (kgm}^2\text{)}$$

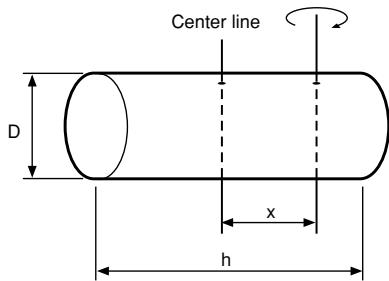
... (5)

m : Mass of cylinder (kg)

23207-F0-01

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

Moment of inertia of a cylinder



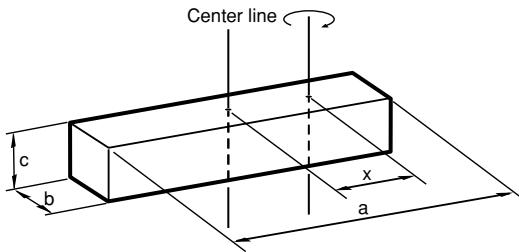
$$\begin{aligned} I &= \frac{\rho\pi D^2 h}{16} \left(\frac{D^2}{4} + \frac{h^2}{3} \right) + \frac{\rho\pi D^2 h x^2}{4} \\ &= \frac{m}{4} \left(\frac{D^2}{4} + \frac{h^2}{3} \right) + mx^2 \text{ (kgm}^2\text{)} \end{aligned}$$

... (6)

23208-F0-01

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

Moment of inertia of a prism



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

... (7)

m : Mass of prism (kg)

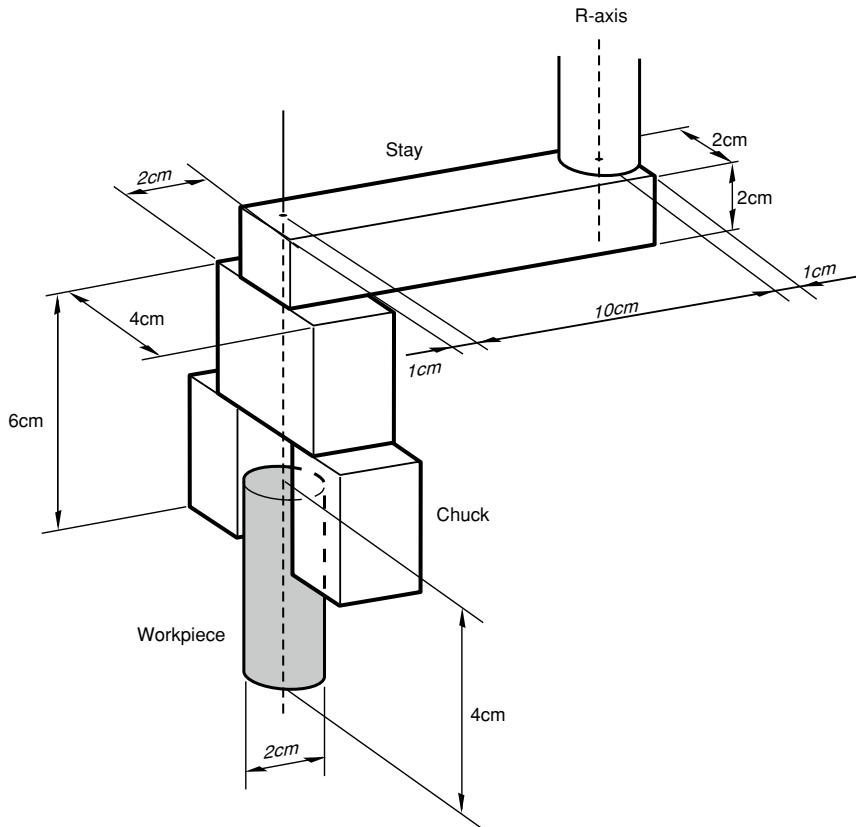
23209-F0-01

6.4 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 the stay, as shown in the Fig. below. The moment of inertia is calculated with the following three factors, assuming that the load material is steel and its density ρ is 0.0078kg/cm³.

Example of moment of inertia calculation

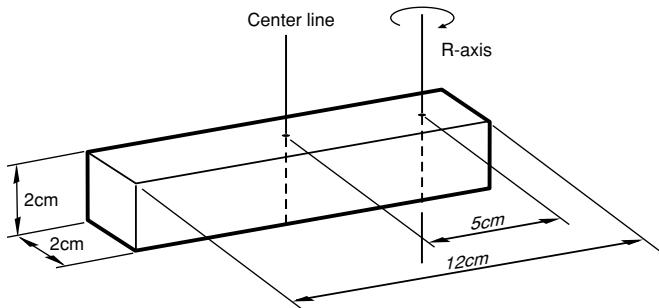
(The chuck and workpiece are at a position offset by 10 cm from the R-axis by the stay.)



23210-F0-00

1. Stay

Stay



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

$$\begin{aligned} W_s &= 0.0078 \times 12 \times 2 \times 2 \\ &= 0.37 \text{ (kgf)} \end{aligned}$$

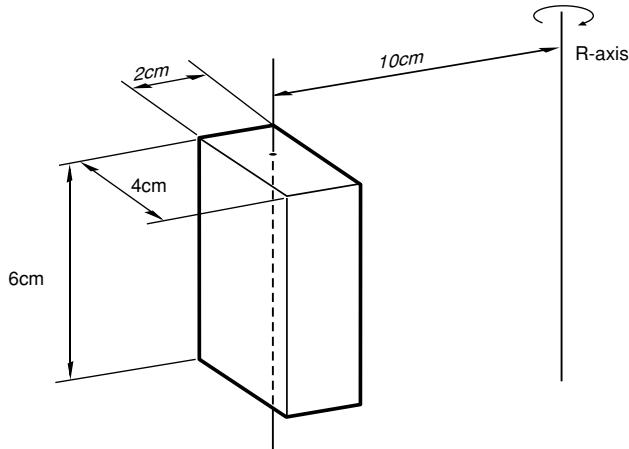
$$\begin{aligned} \text{Moment of inertia} \\ J_s &= 0.37 \times (0.12^2 + 0.02^2) / 12 + 0.37 \times 0.05^2 \\ &= 0.00138 \text{ (kgm}^2\text{)} \end{aligned}$$

$$\begin{aligned} \text{Moment of inertia offset} \\ L_s &= 0.05 \text{ (m)} \end{aligned}$$

23211-F0-01

2. Chuck

Chuck



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

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

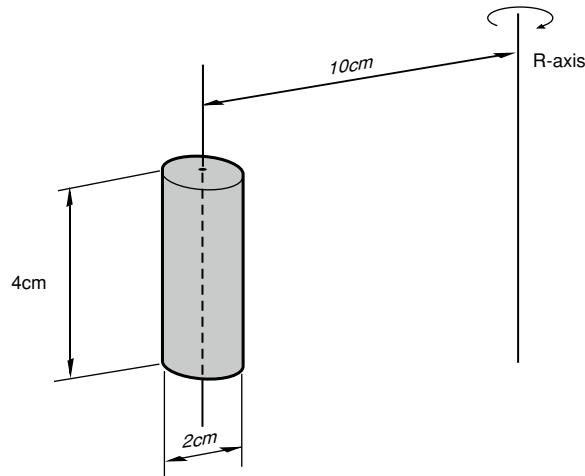
Moment of inertia
 $J_c = 0.37 \times (0.02^2 + 0.04^2) / 12 + 0.37 \times 0.1^2 \\ = 0.00376 (\text{kgm}^2)$

Moment of inertia offset
 $L_c = 0.1 (\text{m})$

23212-F0-01

3. Workpiece

Workpiece



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

$$W_w = 0.0078 \times \pi \times 1^2 \times 4 \\ = 0.098(\text{kg})$$

Moment of inertia
 $J_w = 0.098 \times 0.02^2 / 8 + 0.098 \times 0.1^2 \\ = 0.00099 (\text{kgm}^2)$

Moment of inertia offset
 $L_w = 0.1 (\text{m})$

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4. Total weight

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

5. Total moment of inertia

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

6. Overall moment of inertia offset

When calculating the distance from the R-axis to the center of gravity of the total weight

$$L_x = (W_s \times 0.05 + W_c \times 0.1 + W_w \times 0.1) / W = 0.078 (\text{m})$$

$$L_y = (W_s \times 0 + W_c \times 0 + W_w \times 0) / W = 0 (\text{m})$$

$$L = \sqrt{L_x^2 + L_y^2} = 0.078 (\text{m})$$

6.5 Attaching the end effector

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



WARNING

- Before attaching the end effector, be sure to turn off the controller.
- When the end effector is attached using the slot clamping, always observe the conditions listed in the Table, "Maximum load applied to end effector attachment". If these are ignored, the end effector may come loose and fly off during robot operation, resulting in an accident or injury.
- In cases where other attachment methods are used, be sure that the end effector will not come off even when the loads listed in the Table, "Maximum load applied to end effector attachment" are applied.



NOTE

When checking end effector operation, refer to the section "4.6.1 Trial Operation" in Chapter "Safety Instructions" of Separate manual.

The following shows the maximum load that can be applied to the end effector attachment of each robot model.



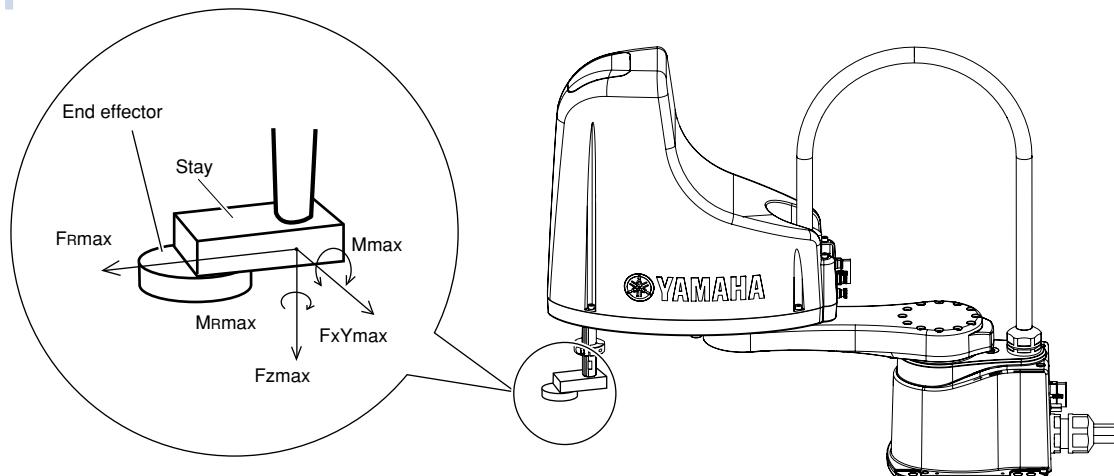
WARNING

- The end effector attachment must have adequate strength to withstand the loads listed in the Table below. If the strength is insufficient, the attachment may break during robot operation and fragments fly off, causing accidents or injuries.
- The end effector attachment must have sufficient rigidity to the loads listed in the Table below. If this rigidity is inadequate, the end effector may vibrate during robot operation, causing adverse effects on the work.

Maximum load applied to end effector attachment

Robot Model	FxYmax		Fzmax		Frmax		Mrmax		Mmax	
	N	kgf	N	kgf	N	kgf	Nm	kgfm	Nm	kgfm
YK400XE	83	8.5	75	8	173	18	11	1.1	8	0.8
YK510XE	130	13	218	22	239	24	17	1.7	36	3.7
YK610XE	125	13	218	22	300	31	17	1.7	35	3.6
YK710XE	114	12	201	21	192	20	17	1.7	32	3.3

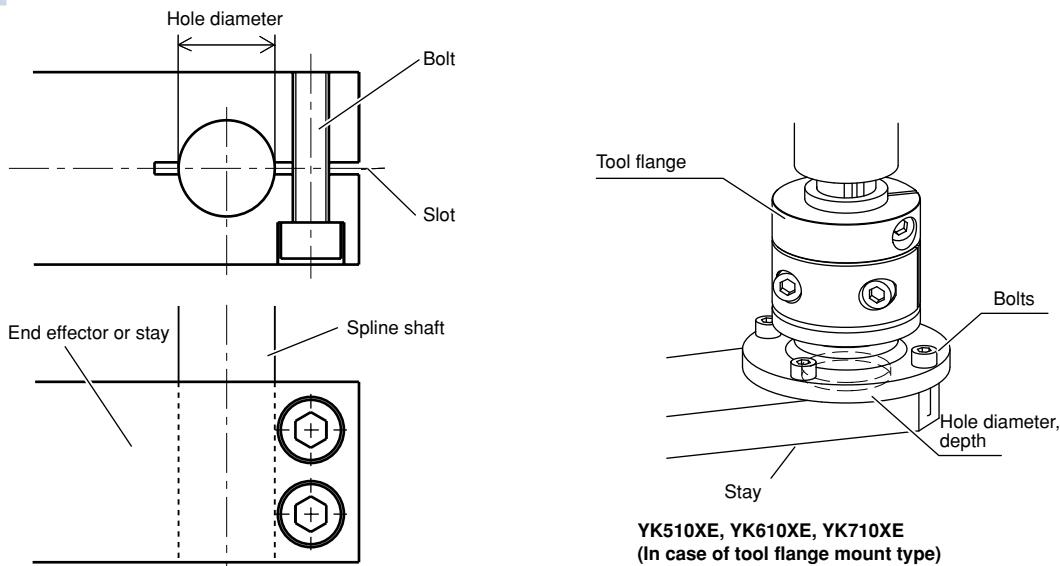
Maximum load applied to end effector attachment



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Next, the following shows the recommended end effector attaching method.

Attaching the end effector



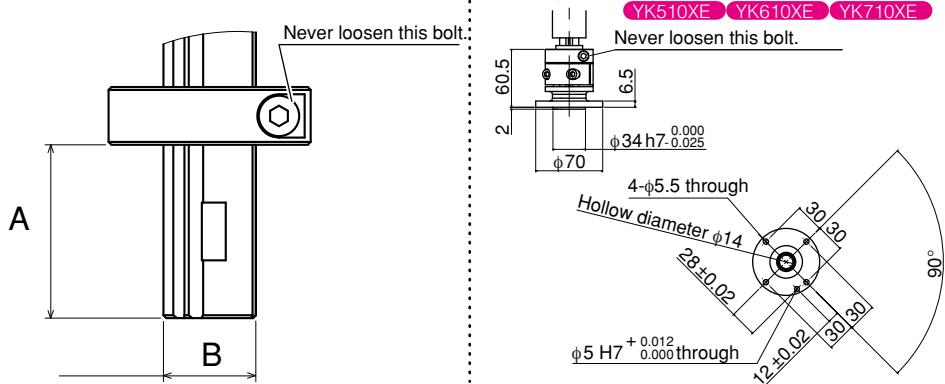
23229-F0-00

Robot Model	Bolts used	Number of bolts	Tightening torque		Hole diameter (mm)	
			Nm	kgfcm		
YK400XE	M5 or more	2 or more	9	92	16	+0.018 0
YK510XE / YK610XE / YK710XE	M6	2	37	380	20	+0.021 0
YK510XE / YK610XE / YK710XE (Tool flange mount type)	M5	4	9	92	34	+0.025 0 Depth 2.5 or more

Tool flange specifications are only available for YK510XE, YK610XE, and YK710XE.

The following shows the details of the end effector attachment of each robot.

Details of end effector attachment



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	A	B
YK400XE	30	φ16 h7 0 -0.018
YK510XE / YK610XE / YK710XE	40	φ20 h7 0 -0.021

For details about the depth of the tapped hole and recommended bolt, see the Table below.

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)	

6.6 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 A_{max} and A_{XYmax} become larger by an amount equal to the offset versus the arm length. For Z-axis, consider the gravitational acceleration. When the R-axis rotates during operation, this acceleration A_{Rmax} must be taken into account.



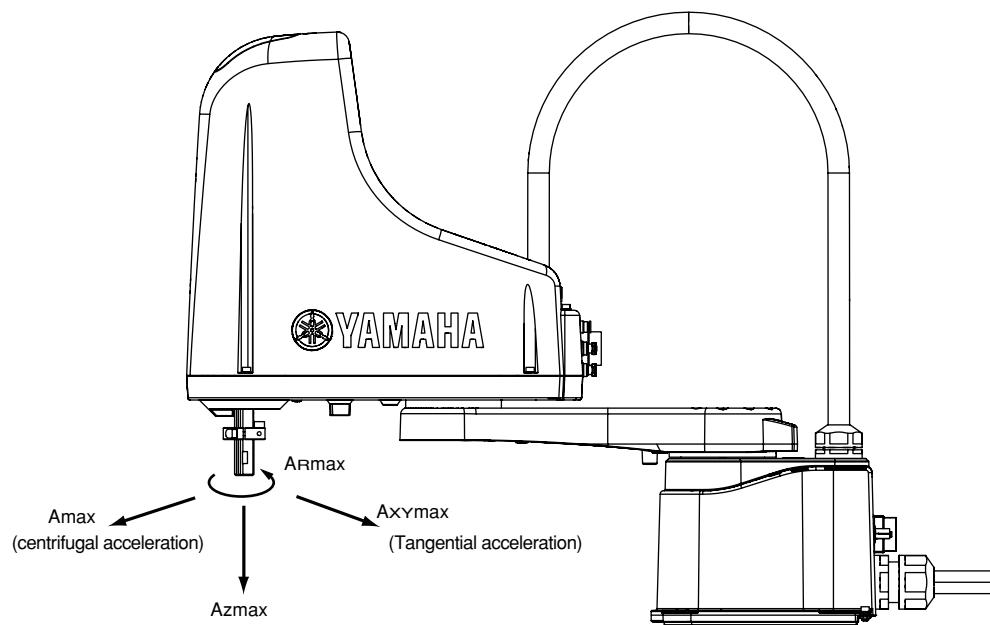
WARNING

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.

Maximum acceleration during robot operation

Robot Model	$A_{max}(m/sec^2)$	$A_{XYmax}(m/sec^2)$	$A_{Zmax}(m/sec^2)$	$A_{Rmax}(rad/sec^2)$
YK400XE	87	33	25	917
YK510XE	109	42	42	833
YK610XE	87	37	40	792
YK710XE	59	32	32	600

Maximum acceleration on end effector attachment



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7. Limiting the movement range with X-axis and Y-axis mechanical stoppers


WARNING

Always turn off the controller before changing the movement range with mechanical stoppers.


CAUTION

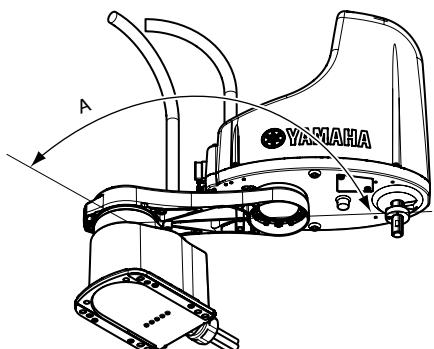
When the mechanical stopper positions are changed, the soft limits must be set to a point inside the mechanical stopper positions. (Refer to "3. Setting the soft limits" in Chapter 3.)

If the working envelope during robot work is smaller than the maximum working envelope range or if the robot interferes with peripheral units, the movement range is limited. (When the robot is shipped from factory, the movement range is set to the maximum level.)

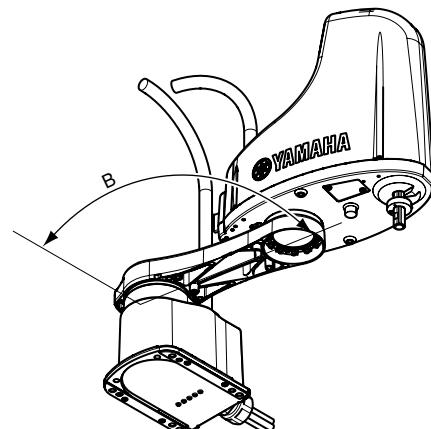
The movement range can be limited by shifting the X-axis and Y-axis mechanical stopper positions. Follow the steps below to limit the movement range.

The following shows the mechanical stopper positions and movement range.

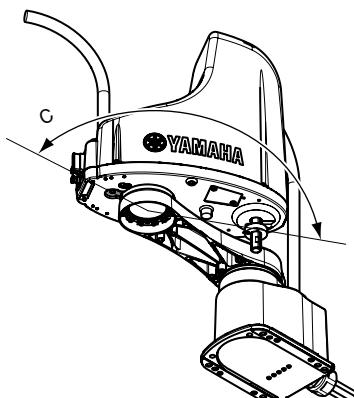
Mechanical stopper position and maximum movement position



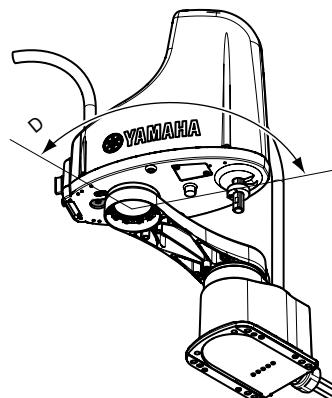
X-axis standard stopper position



X-axis additional stopper



Y-axis standard stopper position



Y-axis additional stopper

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As option parts are ordered, and then they are installed, the movement ranges of the X-axis and Y-axis can be narrowed.


NOTE

Note that the stopper position may slightly deviate due to the part machining accuracy and mounting position.

After changing the mechanical stopper positions, set the soft limits to the values shown below.

■ Soft limits

		Standard stopper (°)	Additional stopper (°)
YK400XE	Stopper position in X-axis plus or minus direction	134	96
	Maximum movement position in X-axis plus or minus direction	132 (A*)	94 (B*)
	Stopper position in Y-axis plus or minus direction	154	100
	Maximum movement position in Y-axis plus or minus direction	150 (C*)	98 (D*)
YK510XE / YK610XE / YK710XE	Stopper position in X-axis plus or minus direction	142	104
	Maximum movement position in X-axis plus or minus direction	134 (A*)	101 (B*)
	Stopper position in Y-axis plus or minus direction	154	110
	Maximum movement position in Y-axis plus or minus direction	152 (C*)	107 (D*)

* ABCD is the location indicated by the illustration on the previous page "Mechanical stopper position and maximum movement position".

■ Soft limits after setting additional stopper

	X-axis	Soft limit (pulses)	Working envelope (°)
	Y-axis	Soft limit (pulses)	Working envelope (°)
YK400XE	Working envelope in X-axis plus direction	268800	94
	Working envelope in X-axis minus direction	-268800	-94
	X-axis	Soft limit (pulses)	Working envelope (°)
	Working envelope in Y-axis plus direction	280177	98
YK510XE / YK610XE / YK710XE	Working envelope in Y-axis minus direction	-280177	-98
	X-axis	Soft limit (pulses)	Working envelope (°)
	Working envelope in X-axis plus direction	367729	101
	Working envelope in X-axis minus direction	-367729	-101
	Y-axis	Soft limit (pulses)	Working envelope (°)
	Working envelope in Y-axis plus direction	304355	107
	Working envelope in Y-axis minus direction	-304355	-107

7.1 Installing the X-axis/Y-axis additional mechanical stoppers YK400XE

Follow the steps below to install the X-axis/Y-axis additional mechanical stoppers.
Use the bolts listed below to install optional mechanical stoppers.

	No.	Part No.	Q'ty	Remarks
Additional mechanical stopper parts in either one direction of X-axis plus or minus direction	1	KDS-M2137-00	2	Bolt
	2	KDS-M2193-00	1	Stopper (Stopper bolt)
Additional mechanical stopper parts in either one direction of Y-axis plus or minus direction	3	91312-08012	2	Stopper bolt

The following describes how to install the mechanical stopper using the stopper in the Y-axis plus direction as an example. (The stopper in the minus direction can also be installed in the same manner.)
Prepare a hex wrench set.

Step 1 Turn off the controller.

Step 2 Place a sign indicating the robot is being adjusted.

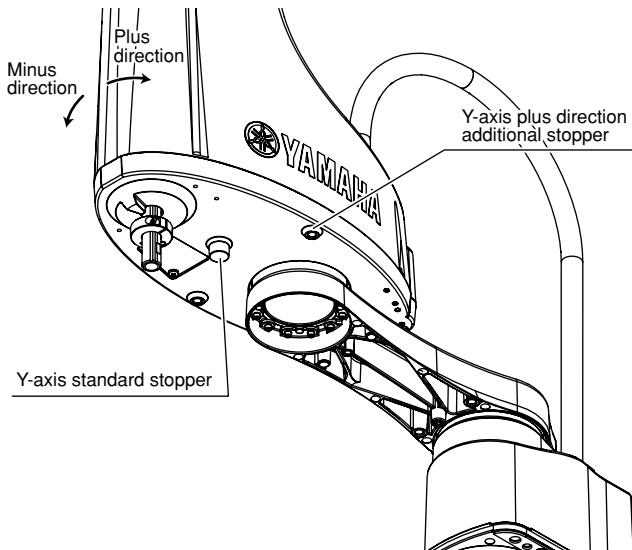
Place a sign indicating the robot is being adjusted, to keep others from touching the controller switch.

Step 3 Enter the safety enclosure.

Step 4 Secure the bolt.

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Step 4 Installing to the standard stopper



Step 5 Check that the movement range is limited.

Step 6 Go out of the safety enclosure.

Step 7 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 8 Set the Y-axis soft limits in the plus direction.

When the stopper is installed in the minus direction, set the soft limits in the minus direction.



CAUTION

Whether or not the X-axis stops at a position before the stopper limited by the soft limit must be checked from the outside of the safety enclosure.

Step 9 Check that the Y-axis stops firmly.

Whether or not the X-axis stops at a position before the stopper limited by the maximum soft limit must be checked from the outside of the safety enclosure.



NOTE

The X-axis may not stop at a position before the stopper due to the stopper part accuracy or position. If this happens, decrease the value while referring to the Table "■ Soft limits" described previously.

7.2 Installing the X-axis/Y-axis additional mechanical stoppers

YK510XE YK610XE YK710XE

Follow the steps below to install the X-axis/Y-axis additional mechanical stoppers.

Regarding the bolts provided as optional parts, use them listed below.

Even if either of +/- direction additional mechanical stopper is installed, add 1 kg to the tip weight.

	No.	Part No.	Q'ty	Remarks
Additional mechanical stopper parts in either one direction of X-axis plus or minus direction	1	KFS-M2193-00 (Plus direction) KFS-M2193-10 (Minus direction)	1	Stopper
	2	90112-10J030		Bolt
	3	KFS-M2196-00	1	Damper
	4	90990-41J134	1	Color
	5	91312-04010	1	Bolt
	6	90990-41J102	1	Color
	7	91312-04025	1	Bolt
Additional mechanical stopper parts in either one direction of Y-axis plus or minus direction	1	KFS-M2587-00 (Plus direction) KFS-M2587-10 (Minus direction)	1	Stopper
	2	90990-28J091		Washer
	3	91312-04025	1	Bolt
	4	91312-08030	1	Bolt
	5	KFS-M2578-00	1	Damper
	6	90990-41J134	1	Color
	7	91312-04010	1	Bolt

The following describes how to install the mechanical stopper using the stopper in the Y-axis plus direction as an example. (The stopper in the minus direction can also be installed in the same manner.)

Prepare a hex wrench set.

Step 1 Turn off the controller.

Step 2 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from touching the controller switch.

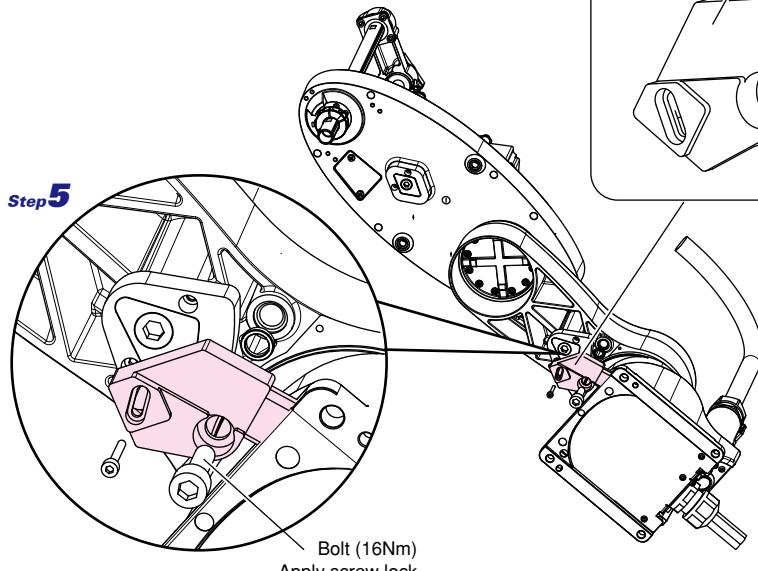
Step 3 Enter the safety enclosure.

Step 4 Assemble the damper to the stopper.

Step 5 Assemble the stopper to the arm.

Installing to the standard stopper

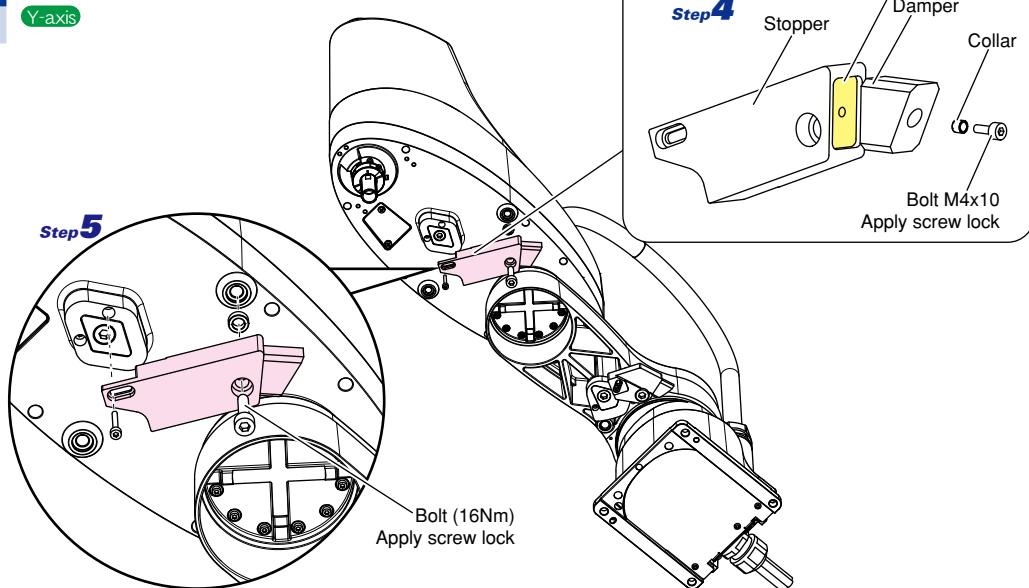
X-axis



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Installing to the standard stopper

Y-axis



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step 6 Make sure that the range of motion is limited.**step 7** Go out of the safety enclosure.**step 8** Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

step 9 Set the Y-axis soft limits in the plus direction.

Check that the X-axis / Y-axis stops firmly.

When the stopper is installed in the minus direction, set the soft limits in the minus direction.



CAUTION

Whether or not the X-axis/ Y-axis stops at a position before the stopper limited by the soft limit must be checked from the outside of the safety enclosure. For the X-axis, check in the same manner.



NOTE

The X-axis/ Y-axis may not stop at a position before the stopper due to the stopper part accuracy or position. If this happens, decrease the value while referring to the Table "■ Soft limits" described previously.

8. Robot overrun during impacts with X-axis or Y-axis mechanical stopper

The robot may overrun from the mechanical stopper position for some reason, such as deformation of the mechanical stopper during impacts with mechanical stopper. Be aware that the end effector may interfere with the robot main body and peripheral unit or the robot main body may interfere with the peripheral unit due to overrun during impacts with mechanical stopper.

Maximum overrun amounts are listed below (for normal operation, maximum payload, maximum speed).

3

Installation

	X-axis (°)	Y-axis (°)
YK400XE	9	1
YK510XE, YK610XE, YK710XE	11	16

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



CAUTION

- If the X-axis or Y-axis mechanical stopper is deformed or damaged due to an impact on the stopper, please contact your distributor. Continued use of the deformed or damaged stopper is very dangerous, and so it must be replaced.
- 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 your distributor.

9. Limiting the movement range with Z-axis mechanical stopper YK510XE YK610XE YK710XE

As option parts are ordered, and then they are installed, the Z-axis movement range can be narrowed by ordering and assembling optional parts.



WARNING

Before starting the work, thoroughly read "16. Detaching or attaching the covers" in this Chapter.



WARNING

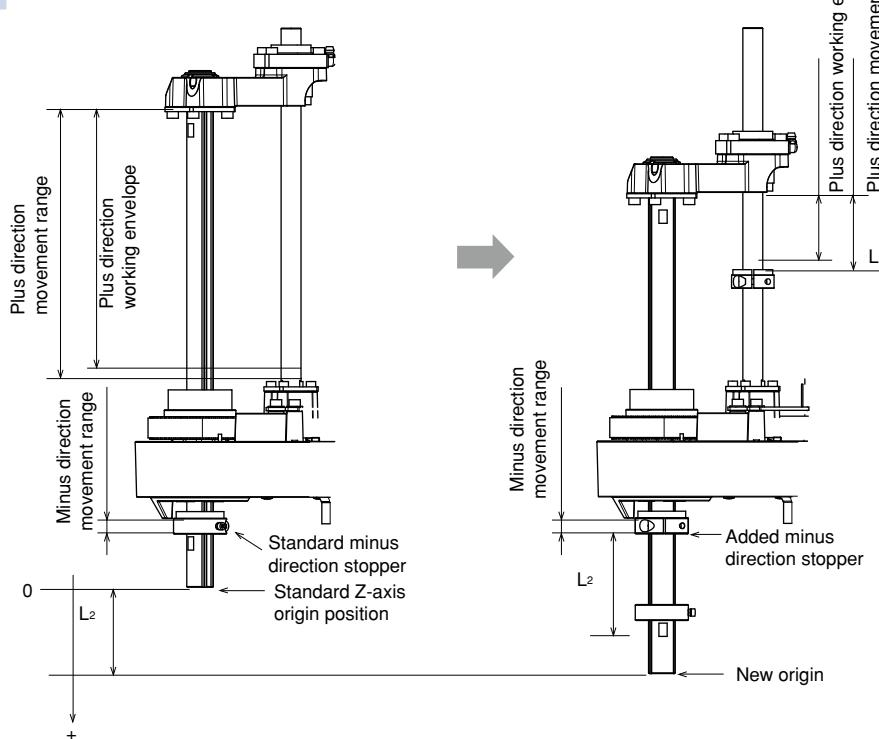
Always turn off the controller before changing the movement range with mechanical stoppers.



CAUTION

After the mechanical stopper positions are changed, the soft limits must be set to a point inside the mechanical stopper positions.

Limiting the movement range using Z-axis mechanical stopper



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Z-axis stopper positions

	Standard stopper	Additional stopper
Stopper position in Z-axis plus direction (*1)	204.7	204.7-L ₁
Maximum movement position in Z-axis plus direction (*1)	200	200-L ₁
Stopper position in Z-axis minus direction	-7.5mm	L ₂ -7.5
Maximum movement position in Z-axis minus direction (origin position) (*1)	0	L ₂ (*2)

* 1 : The above Z-axis movable range ("movement range" and "working envelope" in the fig. above, respectively) and operation range represent the position when the + direction is taken downward with reference to the original Z-axis origin. The actual origin is lowered by L₂, and the moveable and operation stroke is reduced by L₁ + L₂.

* 2 : L₂ takes an incremental position by approximately 4mm; 16mm, 20mm,... depending on the Z-axis reference adjustment.

After installing the mechanical stoppers, set the soft limits to the values shown below.

■ Soft limits after installing additional stoppers

Z=200mm stroke type

	Soft limit (pulses)	Working envelope
Working envelope in Z-axis plus direction	1024 (200- (L ₁ +L ₂))	200- (L ₁ +L ₂)
Working envelope in Z-axis minus direction	-1024	-1

L₁ minimum value = 14 L₂ minimum value = 15



NOTE

The stopper position may slightly deviate due to the part machining accuracy and mounting position.

The following shows the additional parts (option).

■ Additional parts

	No.	Part No.	Q'ty	Remarks
Additional mechanical stopper parts in Z-axis plus direction	1	KBF-M1781-00	1	Stopper
	2	KBF-M1788-10	1	Damper
	3	91312-05016	2	Bolt
Additional mechanical stopper parts in Z-axis minus direction	4	KFS-M1780-00	1	Stopper (upper)
	5	91312-05016	1	Bolt

9.1 Installing the minus direction stopper

Follow the steps below to install the additional mechanical stopper in the Z-axis minus direction. Prepare a hex wrench set.

Step 1 Turn off the controller.

Step 2 Place a sign indicating the robot is being adjusted

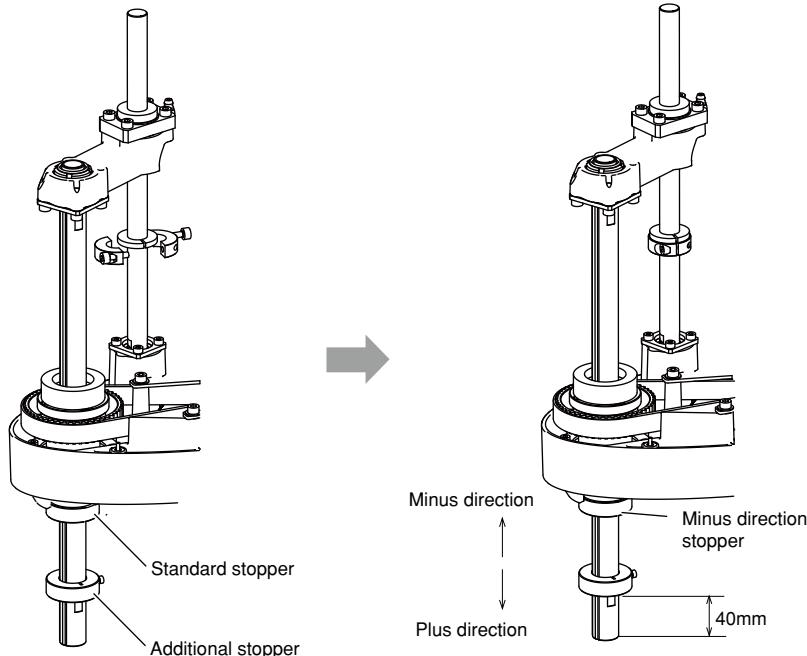
Place a sign indicating the robot is being adjusted, to keep others from touching the controller switch.

Step 3 Enter the safety enclosure.

Step 4 Remove the Y-axis arm cover.

Remove the cover while referring to "16. Detaching or attaching the covers" in this chapter.

Installing the minus direction stopper



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Step 5 Degrease the spline.

Be sure to degrease the inner diameter cylindrical surface of the additional stopper and the spline where the stopper is to be installed.

Step 6 Move the standard stopper to any position.

Step 7 Fix the additional stopper at the position where the original standard stopper was.

Attach the additional stopper to the spline with the supplied bolts.

- Tightening torque: 9Nm (92kgfcm)



NOTE

For the minus direction stopper position, depending on the Z-axis origin reference adjustment, L₂ stated in the "Z-axis stopper positions" table described previously will be a position at 5mm intervals, such as approximately 15mm, 20mm, etc.

Step 8 Go out of the safety enclosure.

Step 9 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 10 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller and operation panel.

Step 11 Perform the Z-axis return-to-origin.

NOTE

For details about how to perform the Z-axis return-to-origin, see "2.3 Return-to-origin procedures" in Chapter 4.

Step 12 Make a note of the Z-axis machine reference value.

When the machine reference is within the allowable range (between 26 and 74%), proceed to step 18.

When the machine reference is beyond the allowable range, proceed to step 13.

Step 13 Turn off the controller.**Step 14 Enter the safety enclosure.****Step 15 Put a mark at the additional stopper position.****Step 16 Loosen the stopper bolt.**

Machine reference value < 26%: Move the additional stopper in the plus direction.

Machine reference value > 74%: Move the additional stopper in the minus direction.

As an approximate guide, a 5mm-movement equals 100%.

Step 17 Check the machine reference value again.

Repeat the same procedure from step 5) until the machine reference is within the allowable range.

When the machine reference is set within the allowable range,

Step 18 Go out of the safety enclosure.**Step 19 Turn on the controller.**

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 20 Set the soft limits.

See the Table "■Soft limits after installing additional stoppers".

The soft limit in the minus direction is already set by default to the value shown in the Table "■Soft limits after installing additional stoppers".

Step 21 Check that Z-axis stops firmly.

Whether or not the Z-axis stops at a position before the stopper by the soft limit must be checked from the outside of the safety enclosure.



NOTE

The Z-axis may not stop at a position before the stopper due to the stopper part accuracy or position. If this happens, increase the value while referring to the Table "■Soft limits after installing additional stoppers" described previously.

Step 22 Check that the movement range is limited.**Step 23 Turn off the controller.****Step 24 Enter the safety enclosure.****Step 25 Reattach the Y-axis arm cover.**

9.2 Installing the plus direction stopper

Follow the steps below to install the additional stopper in the Z-axis plus direction.
Prepare a hex wrench set.

Step 1 Turn off the controller.

Step 2 Place a sign indicating the robot is being adjusted

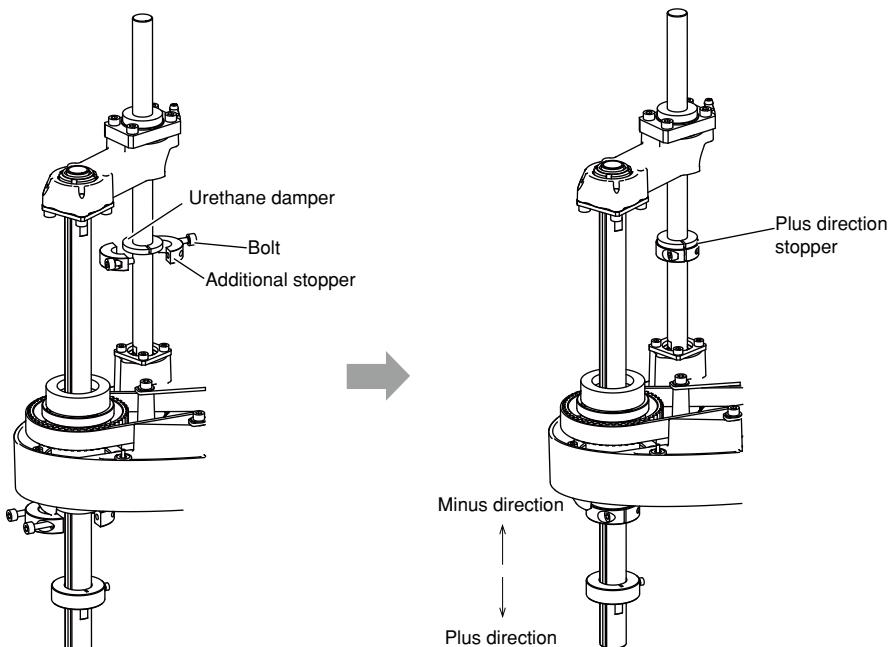
Place a sign indicating the robot is being adjusted, to keep others from touching the controller switch.

Step 3 Enter the safety enclosure.

Step 4 Remove the Y-axis arm cover.

Remove the cover while referring to "16. Detaching or attaching the covers" in this chapter.

Installing the plus direction stopper



23316-FV--00

Step 5 Degrease the ball screw.

Be sure to degrease the inner diameter cylindrical surface of the additional stopper and the ball screw where the stopper is to be installed.

Step 6 Install the additional stopper.

Install the additional stopper (1) to the ball screw with tightening the bolts (2).

- Tightening torque: 11.8 Nm (120 kgfcm)

Alternately tighten the bolts a little at a time.

There is no restriction on the stopper position in the plus direction.

Step 7 Secure the urethane damper.

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.

Step 8 Go out of the safety enclosure.

Step 9 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 10 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller and operation panel.

Step 11 Set the soft limits.

Set the soft limits in the plus direction while referring to the calculation values shown in the Table "Soft limits after installing additional stoppers" described previously.

Step 12 Check that Z-axis stops firmly.

Whether or not the Z-axis stops at a position before the stopper by the soft limit must be checked from the outside of the safety enclosure.



NOTE

The Z-axis may not stop at a position before the stopper due to the stopper part accuracy or position. If this happens, decrease the value while referring to the Table "Soft limits after installing additional stoppers" described previously.

Step 13 Check that the movement range is limited.**Step 14 Turn off the controller.****Step 15 Enter the safety enclosure.****Step 16 Reattach the Y-axis arm cover.**

10. Overrun amounts during impacts with Z-axis additional 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).

	Z-axis	
	Upper end	Lower end
YK400XE	1mm	10mm
YK510XE,YK610XE,YK710XE	5mm	4mm



CAUTION

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.

11. Working envelope

11.1 Working envelope

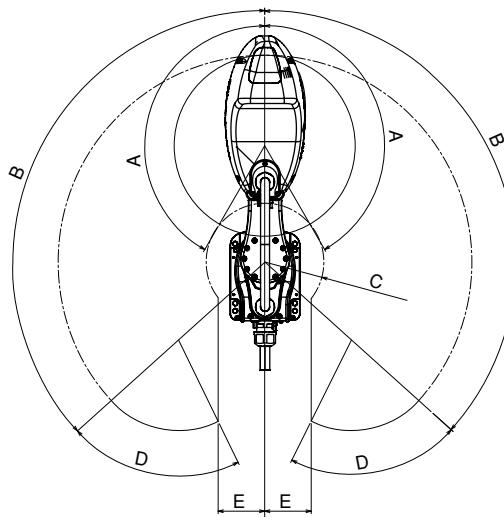
The working envelope of each robot is shown in "1.3 External view and dimensions" of Chapter 8.

■ Working envelope (angle) of X, Y arm

Do not attempt operation outside the working envelope.

The working envelope described in this manual is an area with the robot frontal reference when no load is applied.

Working envelope



A	YK400XE	150°
	YK510XE	152°
	YK610XE	152°
	YK710XE	152°
B	YK400XE	132°
	YK510XE	134°
	YK610XE	134°
	YK710XE	134°
C	YK400XE	R115
	YK510XE	R129
	YK610XE	R159
	YK710XE	R232
D	YK400XE	74°
	YK510XE	60°
	YK610XE	82°
	YK710XE	152°
E	YK400XE	90
	YK510XE	105
	YK610XE	80
	YK710XE	0

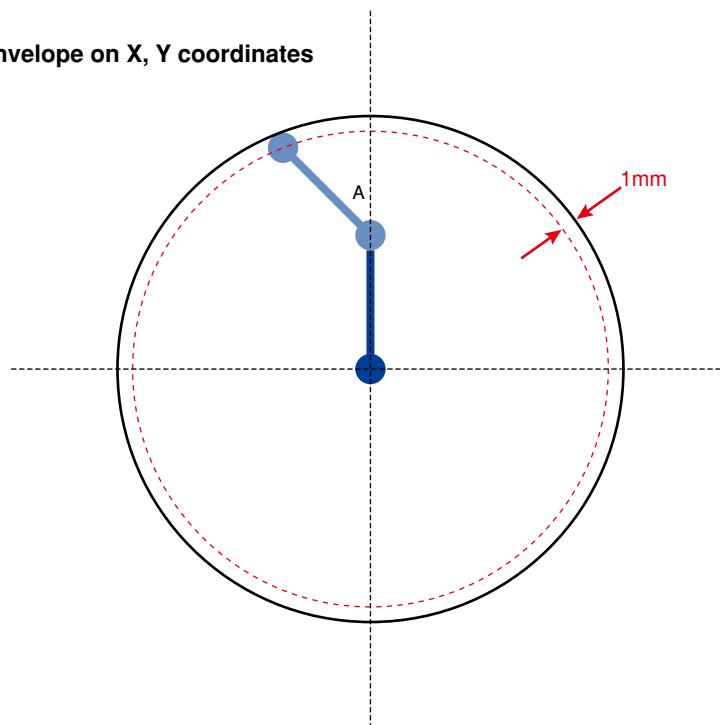
■ Working envelope on X, Y coordinates(Available area for JOG motion in mm coordinate system)

Working envelope on X, Y coordinates(Available area for JOG motion in mm coordinate system)

PTP motion: available to move up to the maximum radius [mm] that is formed by expanding (unfolding) X- and Y- arms.

CP motion or JOG motion in mm/tool coordinates: the radius of working envelope is smaller than the maximum one by 1 mm, and the operation on the outer side of dotted circle is not available.

Working envelope on X, Y coordinates

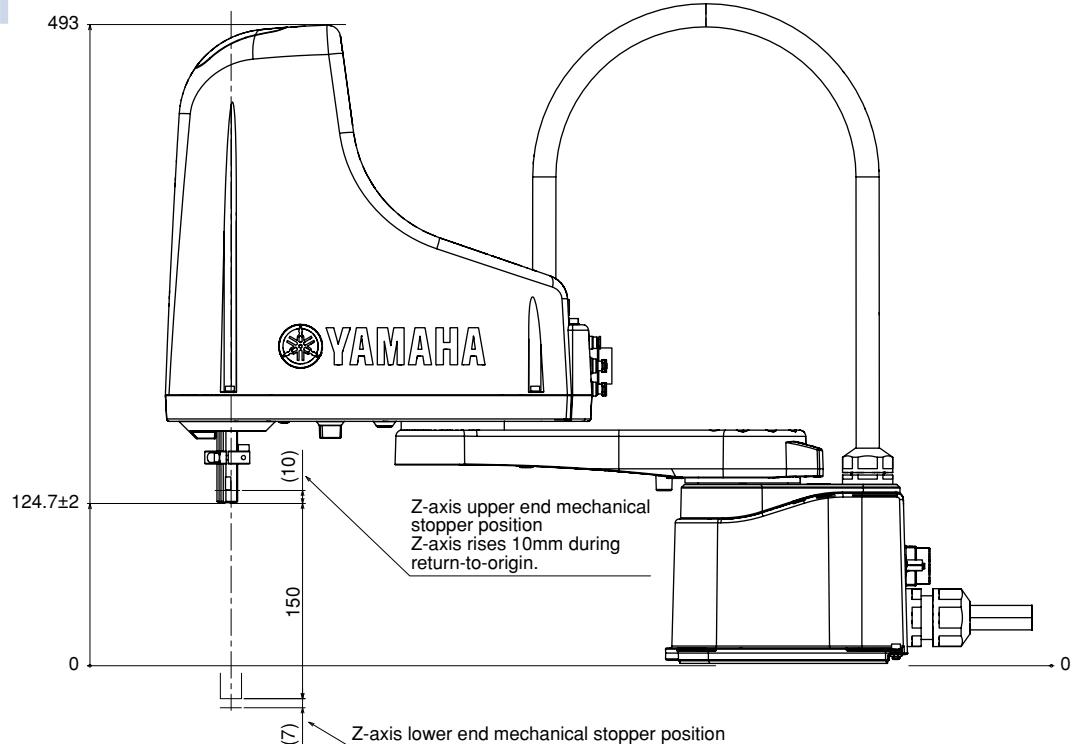
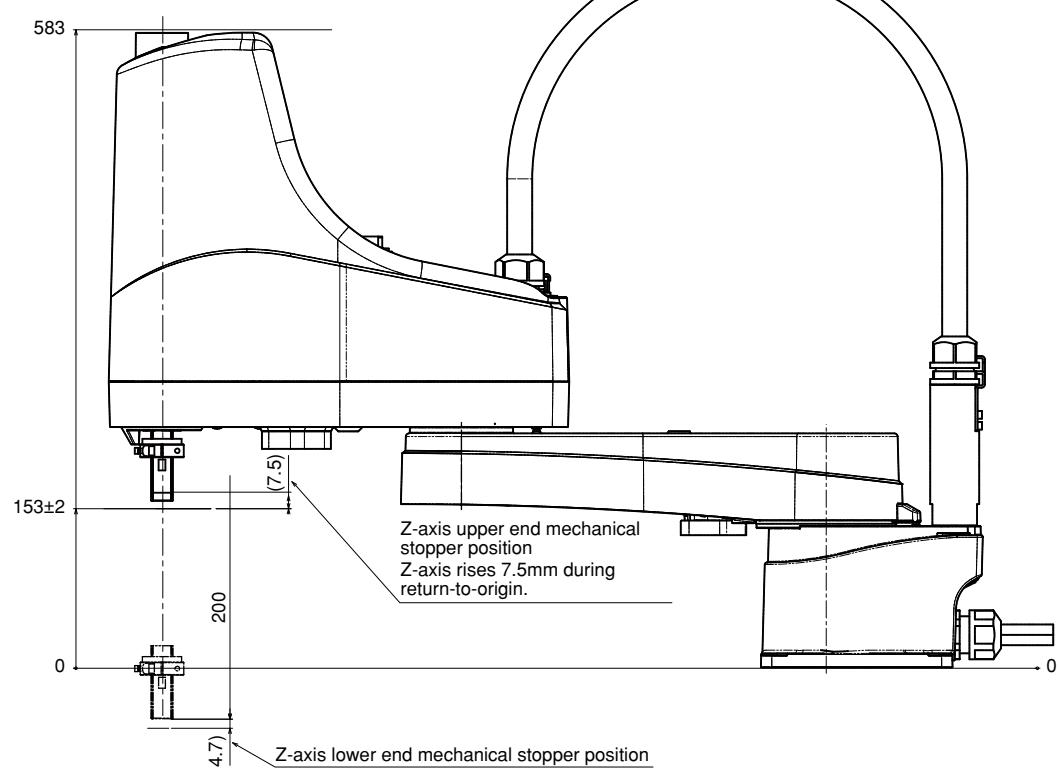


Z-axis

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.

YK400XE**Z-axis mechanical stopper position****YK510XE / YK610XE / YK710XE****Z-axis mechanical stopper position**

■ 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.

■ Robot overrun during impacts with mechanical stopper

The robot may overrun from the mechanical stopper position for some reason, such as deformation of the mechanical stopper during impacts with mechanical stopper. Be aware that the end effector may interfere with the robot main body and peripheral unit or the robot main body may interfere with the peripheral unit due to overrun during impacts with mechanical stopper.

Maximum overrun amounts are listed below (for normal operation, maximum payload, maximum speed).

	X-axis	Y-axis	Z-axis	
			Upper end	Lower end
YK400XE	9°	1°	2mm	3mm
YK510XE / YK610XE / YK710XE	6°	5°	5mm	4mm

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



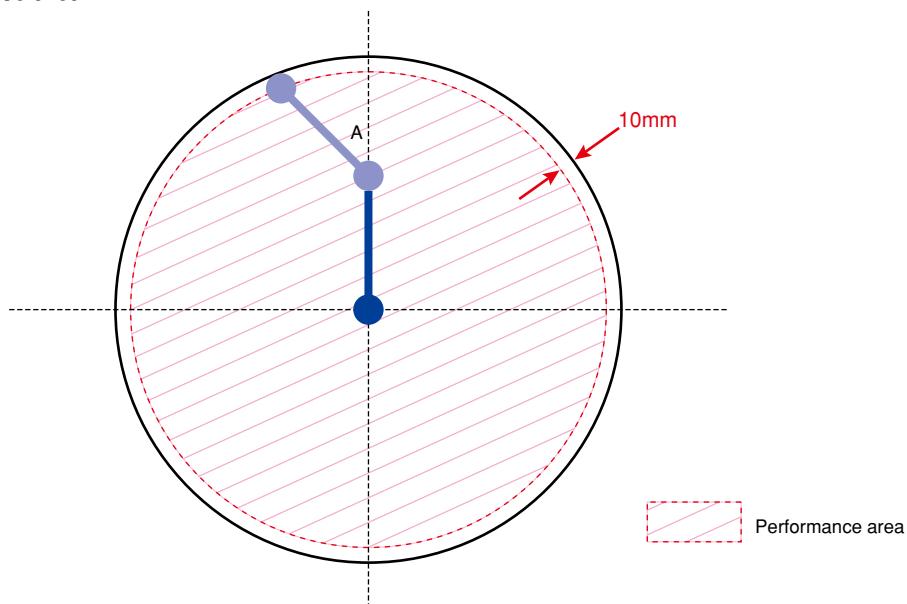
CAUTION

- If an impact occurs with the mechanical stopper and the stopper is deformed or broken, contact your distributor. If the deformed or broken mechanical stopper is used continuously, this is hazardous. So, the defective mechanical stopper needs to be replaced.
- 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.

11.2 Performance area

YK-XE series has areas (performance areas) that are advantageous for CP operation. The performance area is from the maximum radius of straight extension of the XY arm to 10mm in front. In areas outside the performance area, vibration may occur during CP operation. If vibrations occur, lower the SCARA MOVE L acceleration coefficient [%] of the robot parameter or all axes of the acceleration coefficient [%] of the axis parameter at the same ratio. The jog CP operation speed is also limited in areas outside this performance area.

Performance area



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12. Stopping time and stopping distance at emergency stop YK400XE

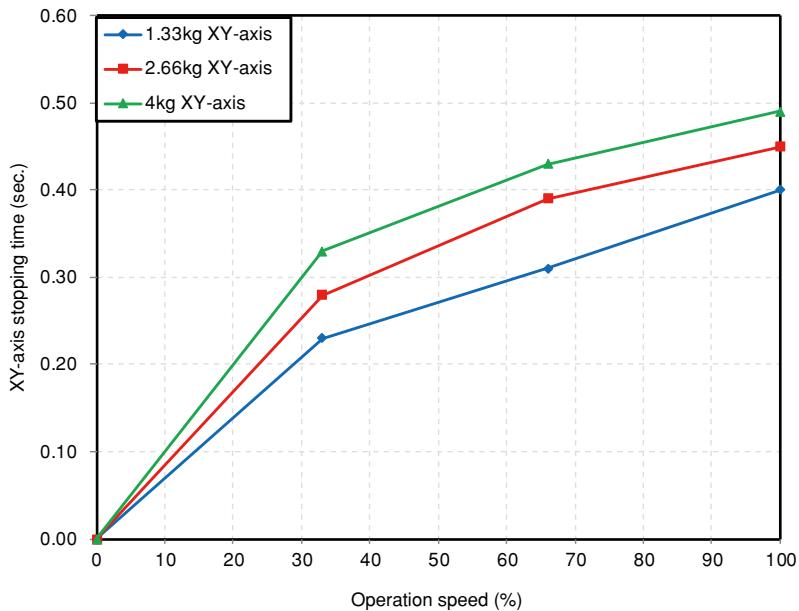
When the emergency stop button is pressed during robot operation or the power supply to the controller is turned off, the stopping time and stopping distance or angle of the main 3 axes change depending on the operation speed as shown below. The following figures show typical time and distance or angle 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.

3

Installation

XY-axis stopping time

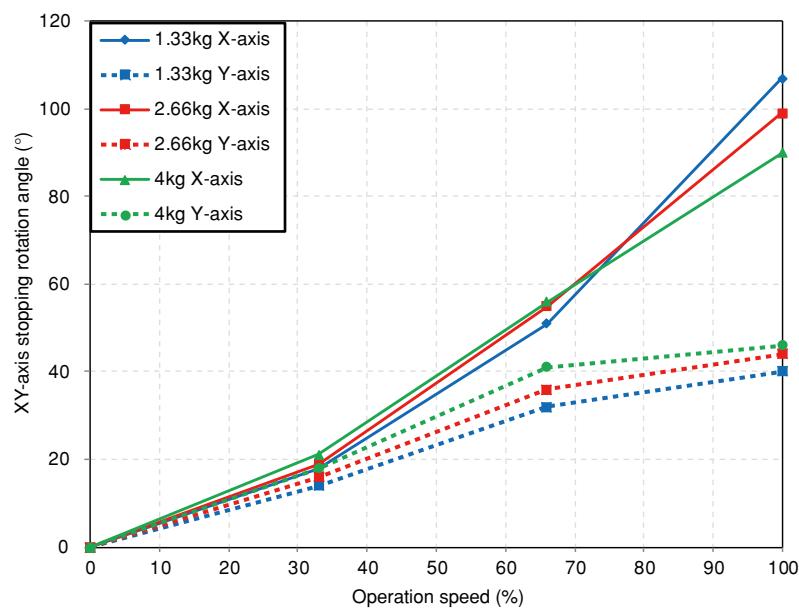
(Emergency stop is activated while the XY-axis operates in the plus direction.)



23220-FV-00

XY-axis stopping angle

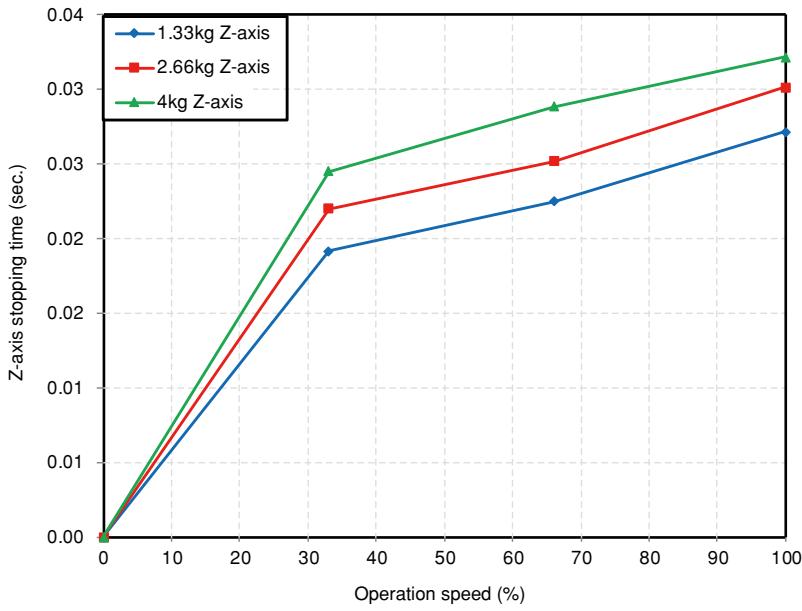
(Emergency stop is activated while the XY-axis operates in the plus direction.)



23221-FV-00

Z-axis stopping time

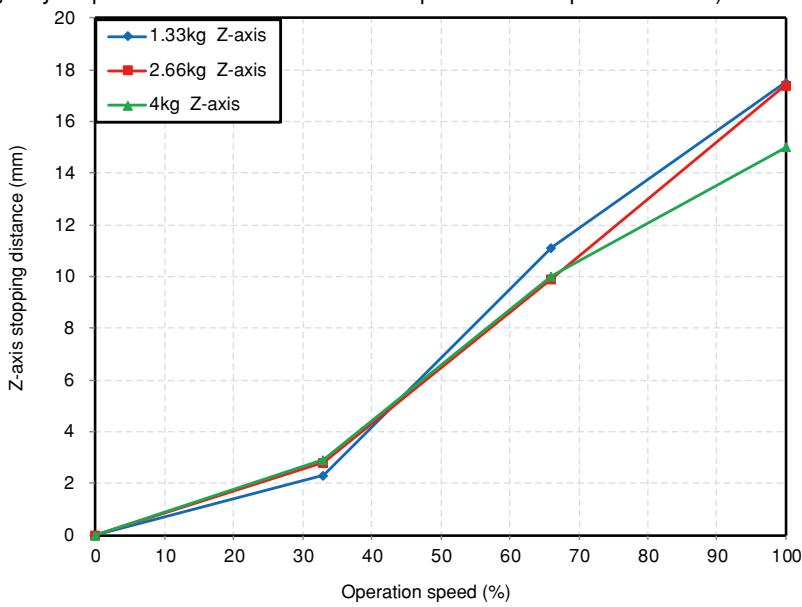
(Emergency stop is activated while the Z-axis operates in the plus direction.)



23222-FV-00

Z-axis stopping distance

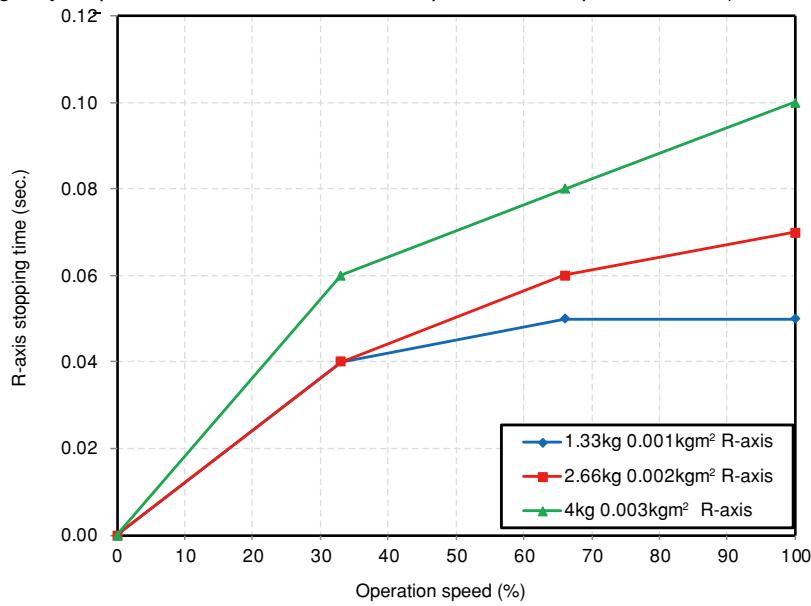
(Emergency stop is activated while the Z-axis operates in the plus direction.)



23223-FV-01

R-axis stopping time

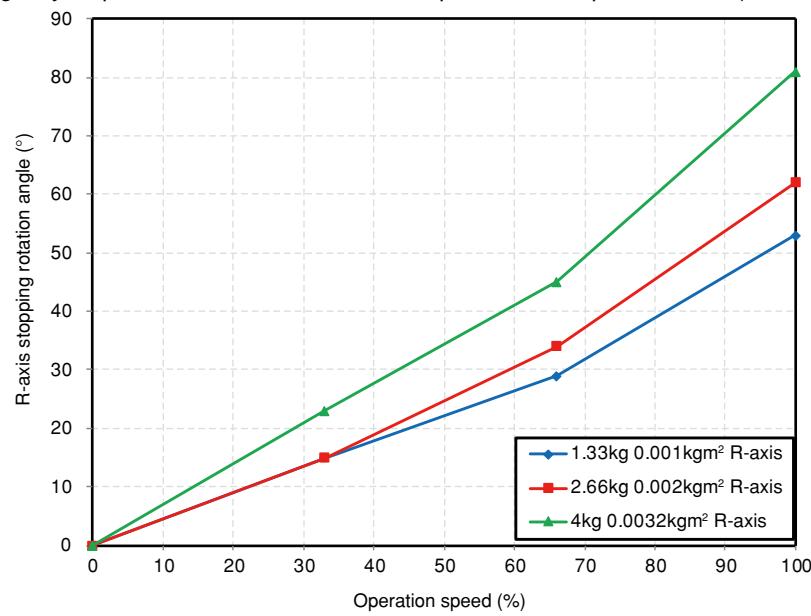
(Emergency stop is activated while the R-axis operates in the plus direction.)



23224-FV-00

R-axis stopping angle

(Emergency stop is activated while the R-axis operates in the plus direction.)



23225-FK-00

13. Stopping time and stopping distance at emergency stop YK510XE

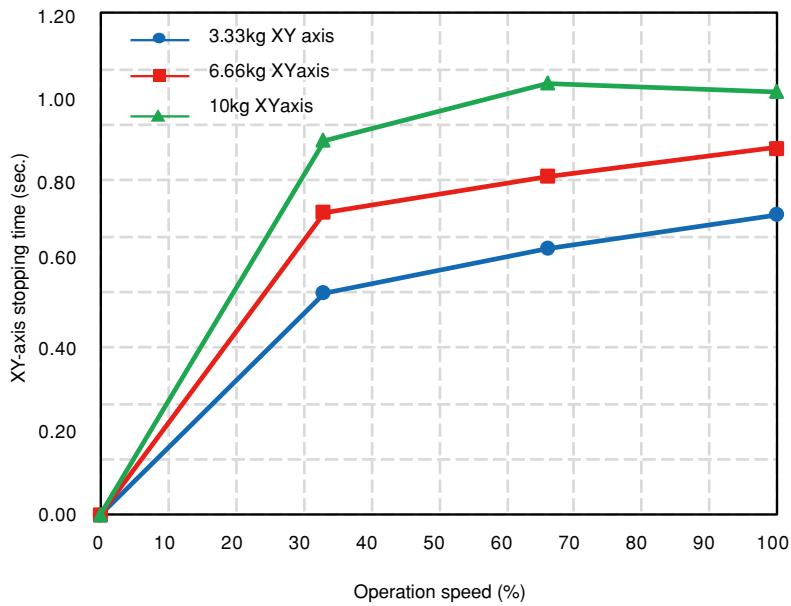
The stopping time and stopping distance or angle of the three major axes when the power (main power) supply to the controller is cut off by the emergency stop input during robot operation are shown below.

The stopping time and stopping distance (angle) are as follows according to the speed and tip load mass (33%, 66% and 100% of the maximum payload) with the robot arm extended.

The stopping time and the stopping distance (angle) are from the time when the power (main power) supply to the controller is cut off to the time when the axes stop.

XY-axis stopping time

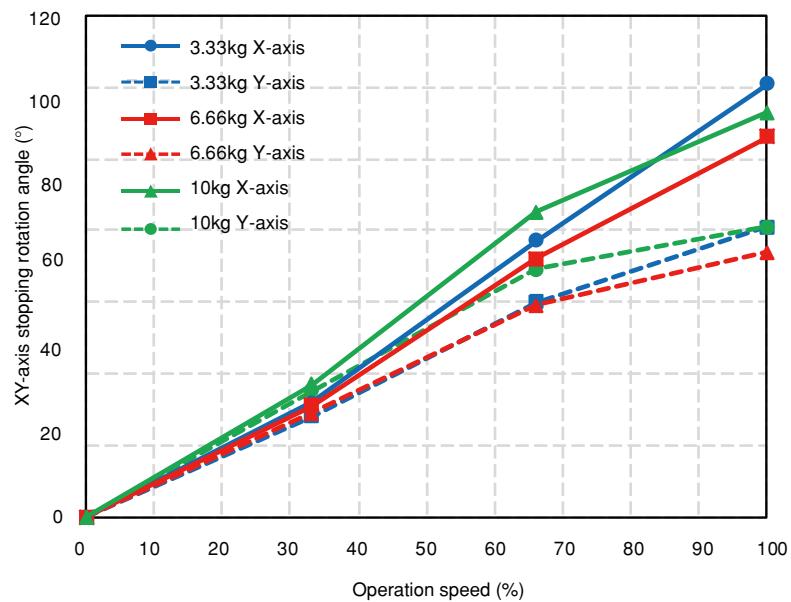
(Shut off power supply during XY axis + direction operation)



23251-FV-00

XY-axis stopping angle

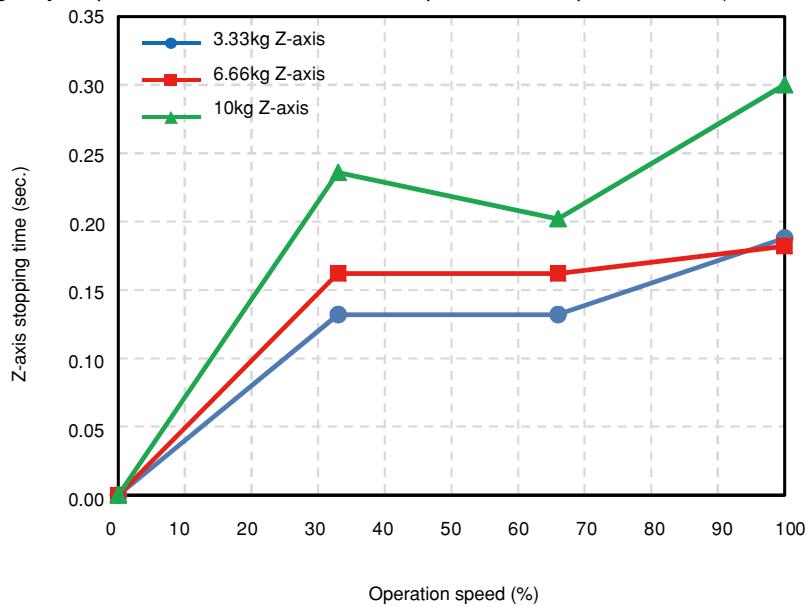
(Shut off power supply during XY axis + direction operation)



23252-FV-00

Z-axis stopping time

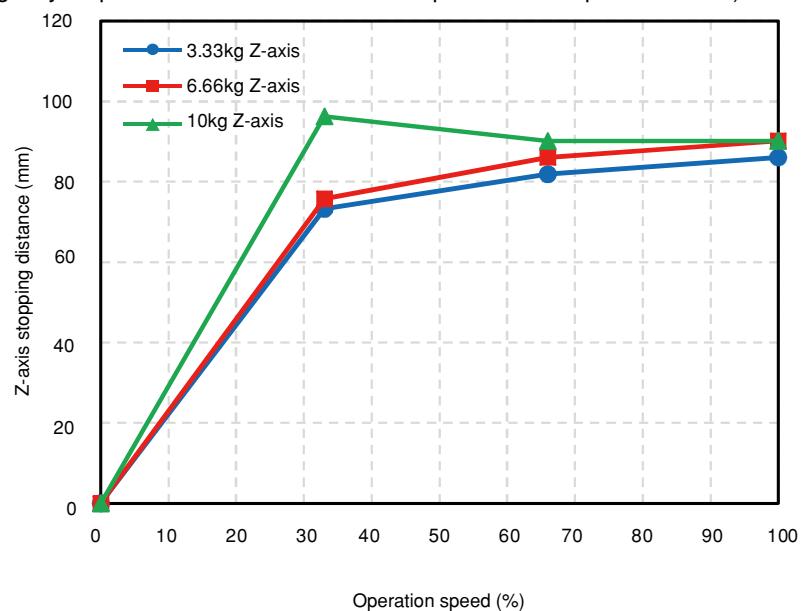
(Emergency stop is activated while the Z-axis operates in the plus direction.)



23263-FV-00

Z-axis stopping distance

(Emergency stop is activated while the Z-axis operates in the plus direction.)



23264-FV-01

14. Stopping time and stopping distance at emergency stop YK610XE

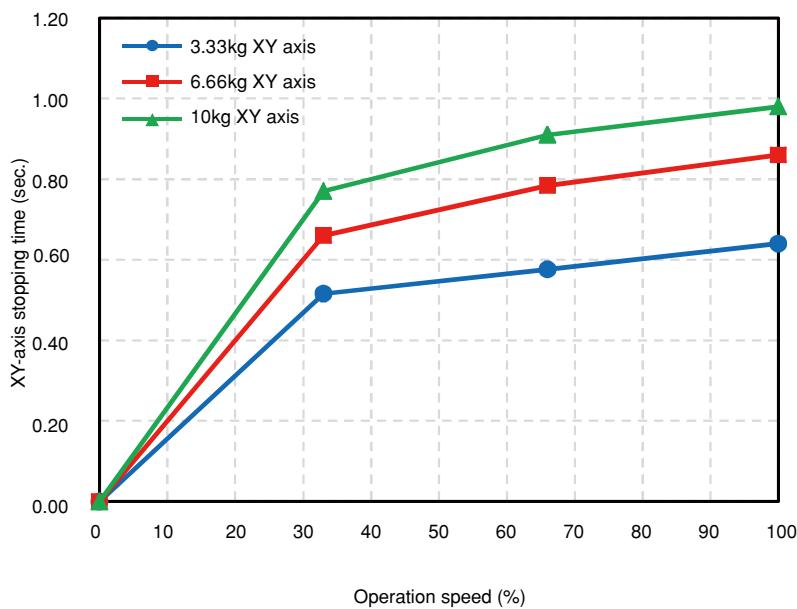
The stopping time and stopping distance or angle of the three major axes when the power (main power) supply to the controller is cut off by the emergency stop input during robot operation are shown below.

The stopping time and stopping distance (angle) are as follows according to the speed and tip load mass (33%, 66% and 100% of the maximum payload) with the robot arm extended.

The stopping time and the stopping distance (angle) are from the time when the power (main power) supply to the controller is cut off to the time when the axes stop.

XY-axis stopping time

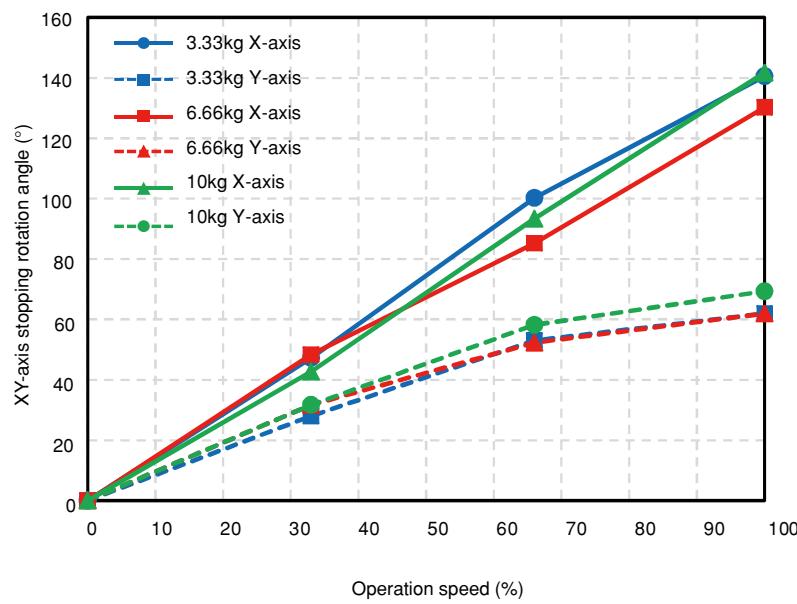
(Shut off power supply during XY axis + direction operation)



23261-FV-00

XY-axis stopping angle

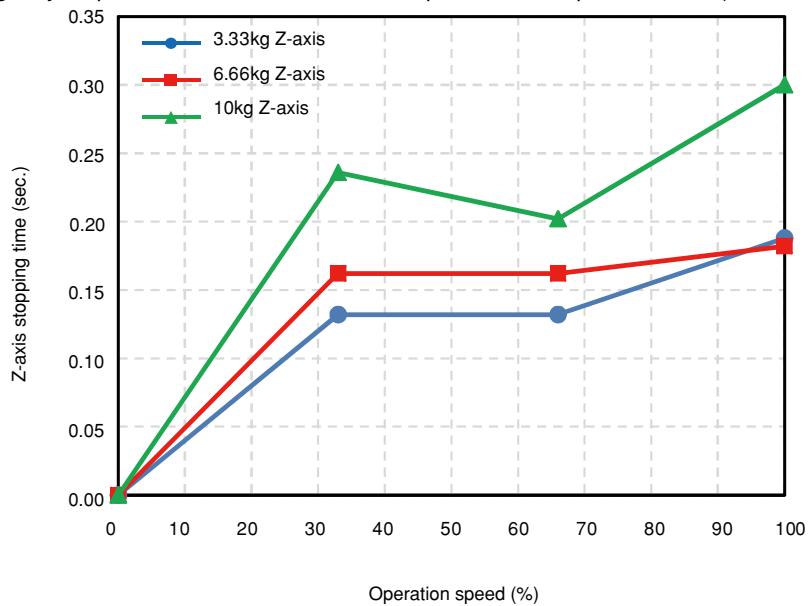
(Shut off power supply during XY axis + direction operation)



23262-FV-00

Z-axis stopping time

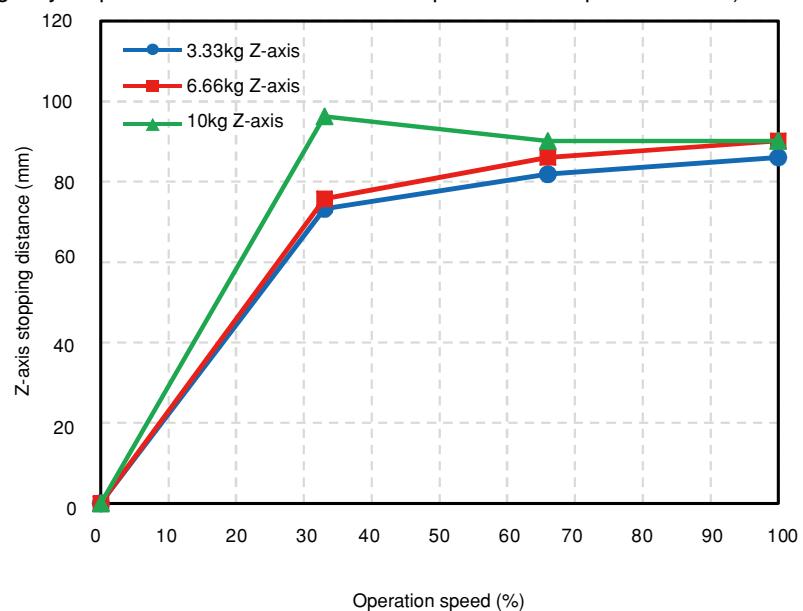
(Emergency stop is activated while the Z-axis operates in the plus direction.)



23263-FV-00

Z-axis stopping distance

(Emergency stop is activated while the Z-axis operates in the plus direction.)



23264-FV-01

15. Stopping time and stopping distance at emergency stop YK710XE

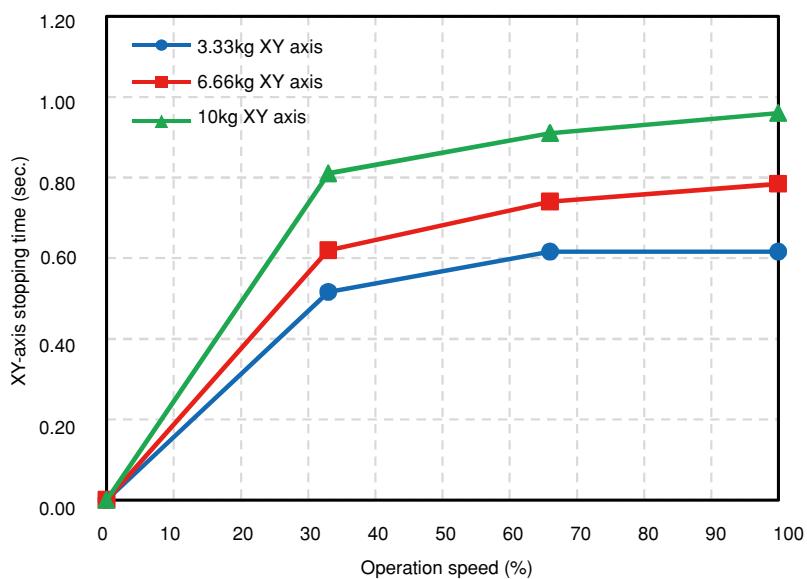
The stopping time and stopping distance or angle of the three major axes when the power (main power) supply to the controller is cut off by the emergency stop input during robot operation are shown below.

The stopping time and stopping distance (angle) are as follows according to the speed and tip load mass (33%, 66% and 100% of the maximum payload) with the robot arm extended.

The stopping time and the stopping distance (angle) are from the time when the power (main power) supply to the controller is cut off to the time when the axes stop.

XY-axis stopping time

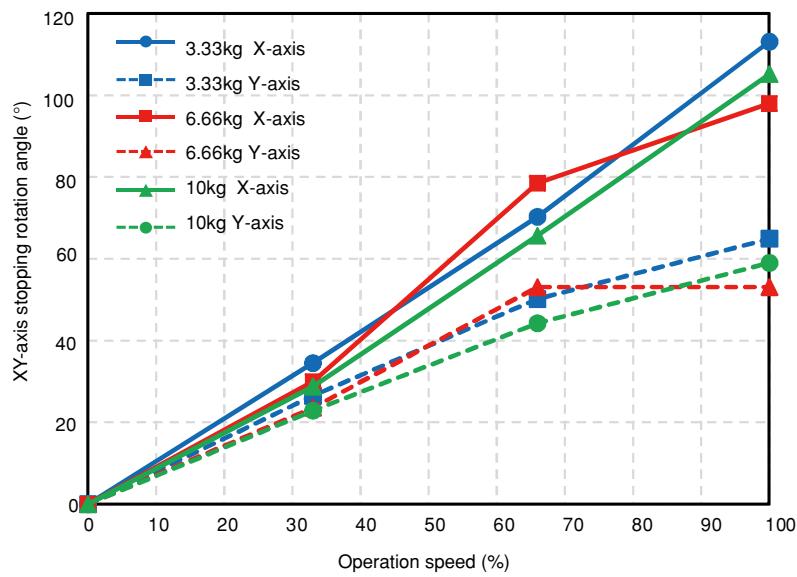
(Shut off power supply during XY axis + direction operation)



23271-FV-00

XY-axis stopping angle

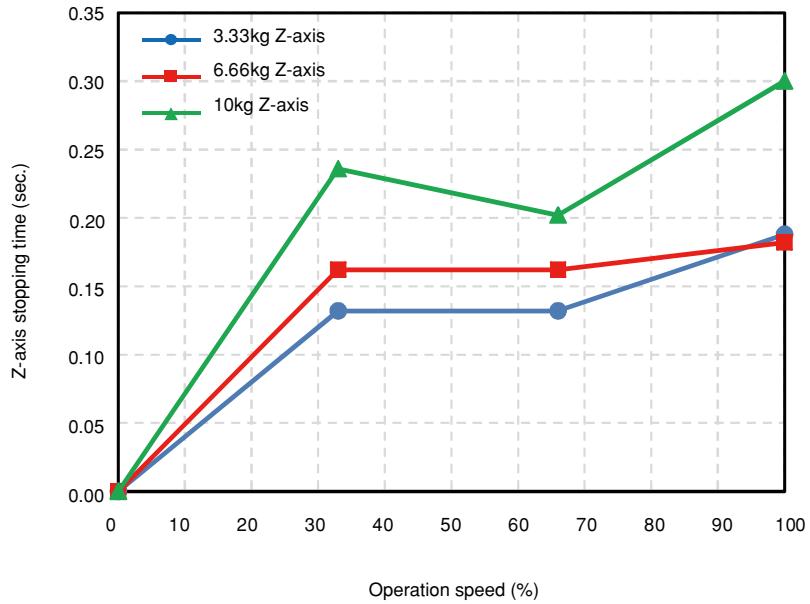
(Shut off power supply during XY axis + direction operation)



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Z-axis stopping time

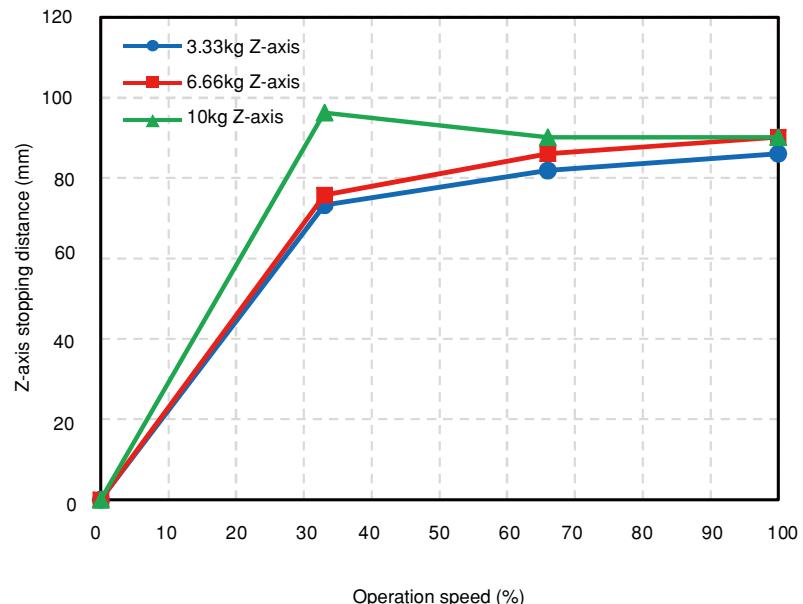
(Emergency stop is activated while the Z-axis operates in the plus direction.)



23263-FV-00

Z-axis stopping distance

(Emergency stop is activated while the Z-axis operates in the plus direction.)



23264-FV-01

16. Installing the user wiring and tubing newly

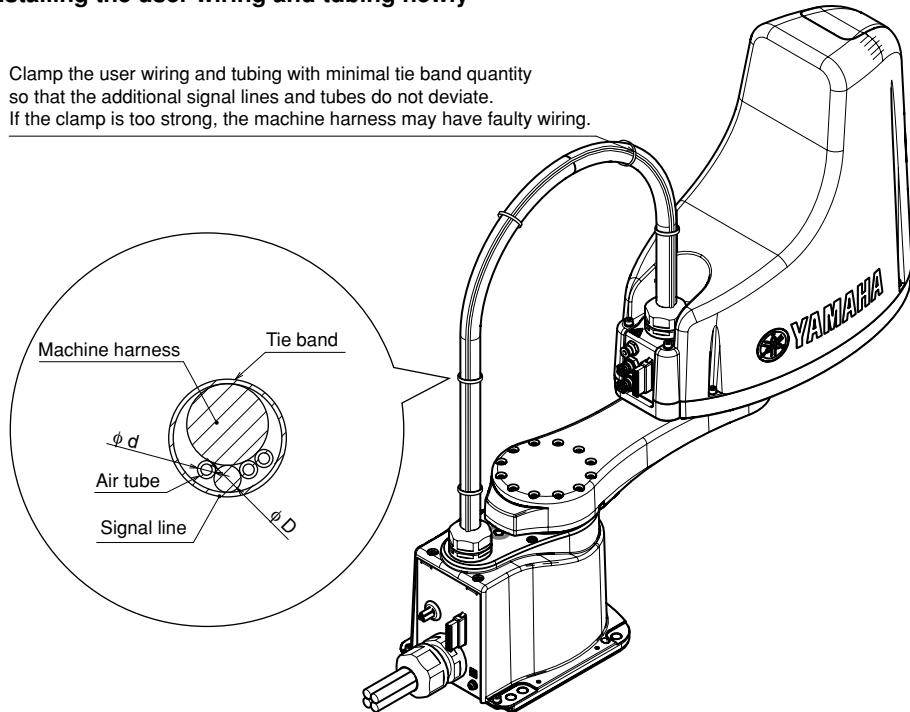
Use the user wiring and tubing in the machine harness as much as possible by considering the durability of the machine harness.

If the user wiring and tubing incorporated into the machine are insufficient, add new user wiring and tubing using tie bands.

The following shows the outside diameters and quantities that can be added by considering the durability of the machine harness.

Installing the user wiring and tubing newly

Clamp the user wiring and tubing with minimal tie band quantity so that the additional signal lines and tubes do not deviate.
If the clamp is too strong, the machine harness may have faulty wiring.



23227-FV-00

Robot model	Signal line outside diameter ϕD (mm) × quantity	Tube outside diameter ϕd (mm) × quantity
YK400XE	$\phi 6 \times 1$ pc.	$\phi 4 \times 3$ pc.
YK510XE / YK610XE / YK710XE	$\phi 10 \times 1$ pc.	$\phi 6 \times 3$ pc.

17. Detaching or attaching the covers

To detach or attach the covers, remove the bolts and screws shown in the Fig. below.



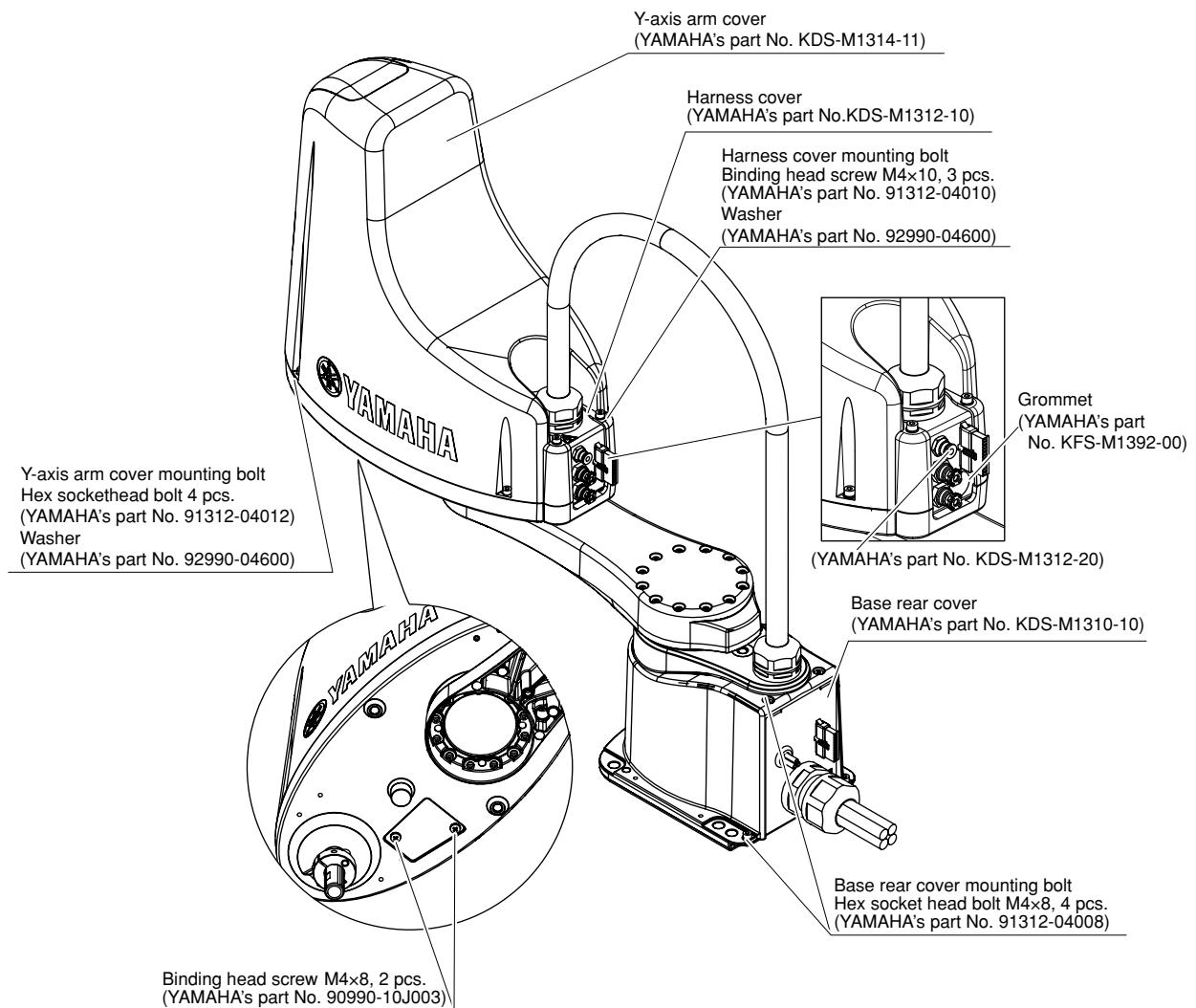
WARNING

- When the covers have been removed for the maintenance work, be sure to return the covers to their original positions using the screws and bolts that have secured them.
- If any screw or bolt is lost, be sure to secure the covers with the specified number of specified screws and bolts while referring to the Fig. below.
- If the covers are not secured firmly, noise may occur, the cover may drop and fly out, your hand may be entangled in the drive unit during teaching, or your hand may be in contact the hot drive unit, causing burn. To prevent such troubles, strictly observe this caution.

3

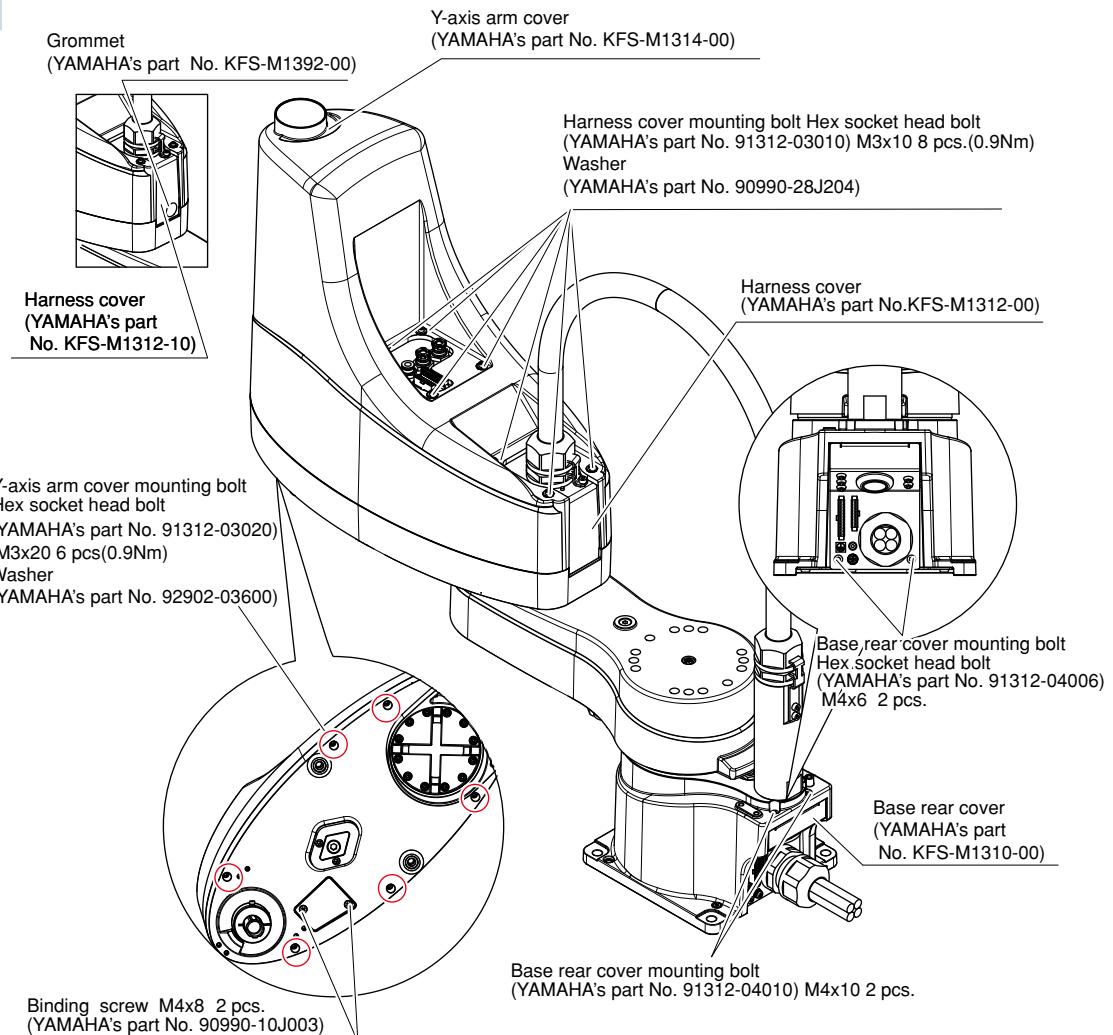
Installation

YK400XE



23217-FV-01

YK510XE / YK610XE / YK710XE



23218-FV-01

18. Extension Shaft Mounting (for user wiring/tubing through spline type)


WARNING

Before starting the work, thoroughly read "16. Detaching or attaching the covers" in this Chapter.

Extension shafts can be retrofitted to route the user wiring / tubing through the spline. The following optional parts are required.

	No.	YAMAHA Part Number	Q'ty	Remarks
YK400XE	1	KCY-M1872-00	1	Extension shaft
	2	91312-03010	4	Bolt
	3	KDS-M1874-00	1	Nut
YK510XE / YK610XE / YK710XE	1	KFS-M1872-00	1	Extension shaft
	2	91312-03010	4	Bolt
	3	KFS-M1874-00	1	Nut


CAUTION

When the extension shaft is installed, set as follows.

Tip mass parameter = Actual tip mass + 1 (kg)

Failure to do so may shorten the life of the drive.

Step 1 Turn off the controller.

Step 2 Place a sign indicating the robot is being adjusted

Place a sign indicating the robot is being adjusted, to keep others from touching the controller switch.

Step 3 Enter the safety enclosure.

Step 4 Remove the Y-axis arm cover.

Remove the cover while referring to "16. Detaching or attaching the covers" in this chapter.

Step 5 Assemble the extension shaft.

Assemble the extension shaft 1 to the upper nut with bolt 2 at the specified torque.

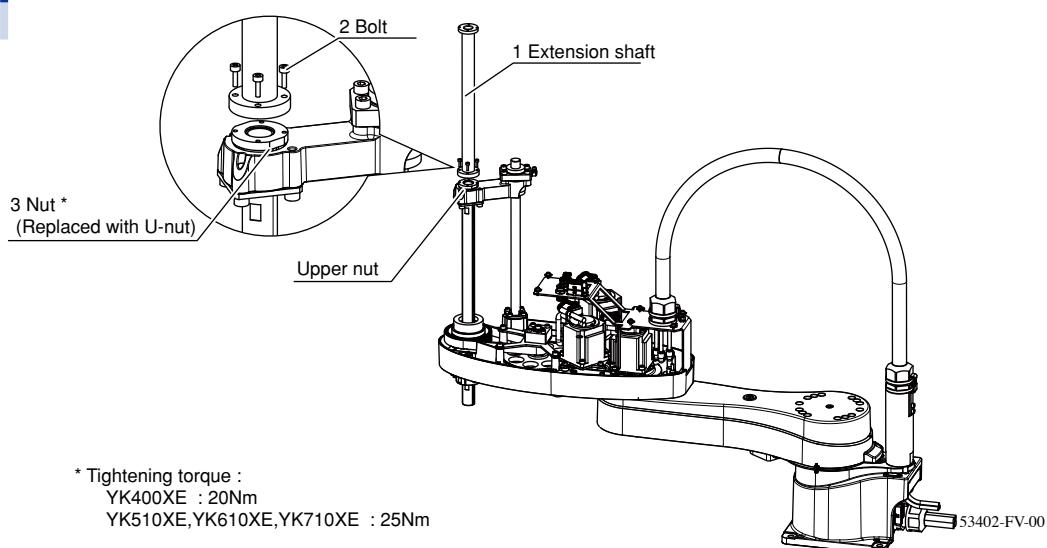
Be sure to use the specified bolts. Use of non-specified nuts may loosen the upper nut.

- Tightening torque : 2 Nm(20 kgfcm)


NOTE

If the extension shaft is to be retrofitted, remove the U-nut that was originally installed and then install the 3 nuts before attaching the extension shaft.

Installing the Extension Shaft

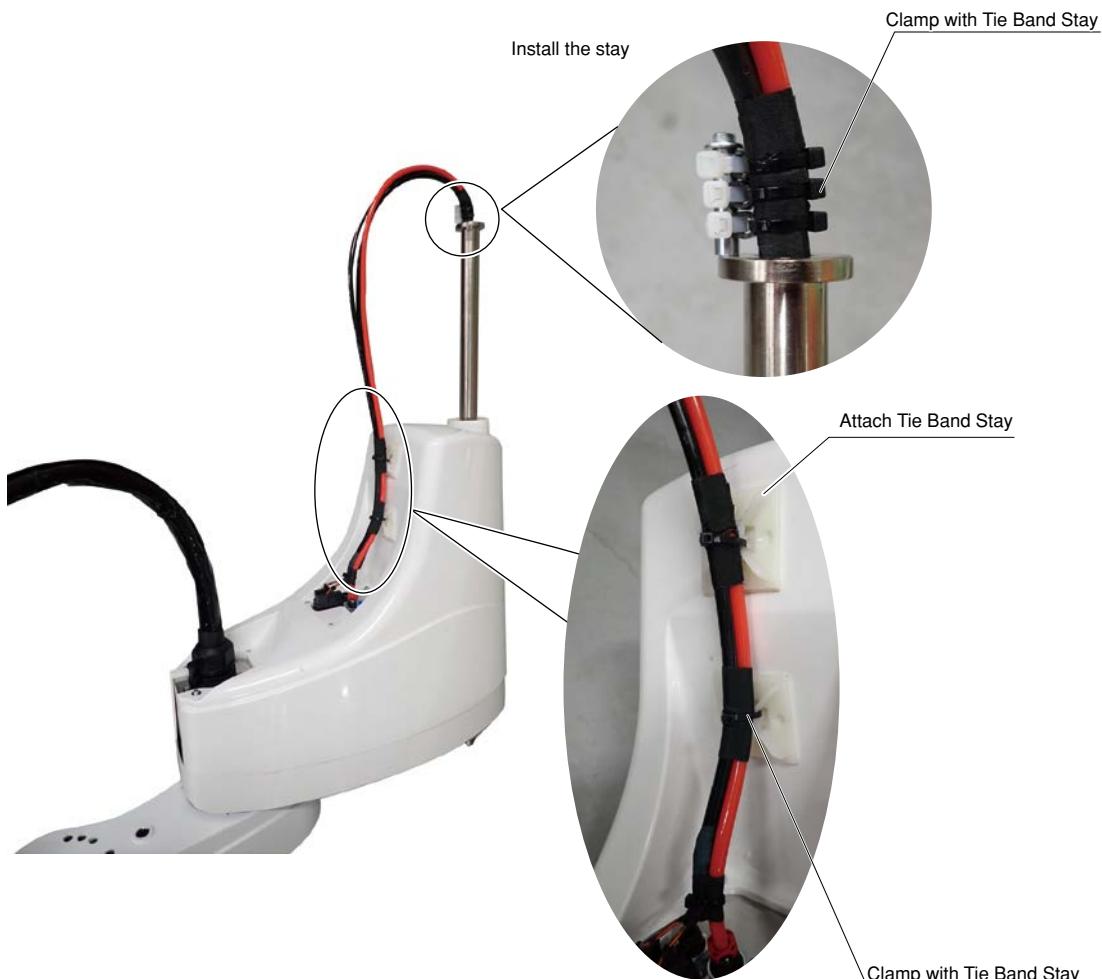


Step 6 Go out of the safety enclosure.

19. How to pass wiring and tubing

19.1 For user wiring/tubing through spline type

Example of how to pass wiring and tubing



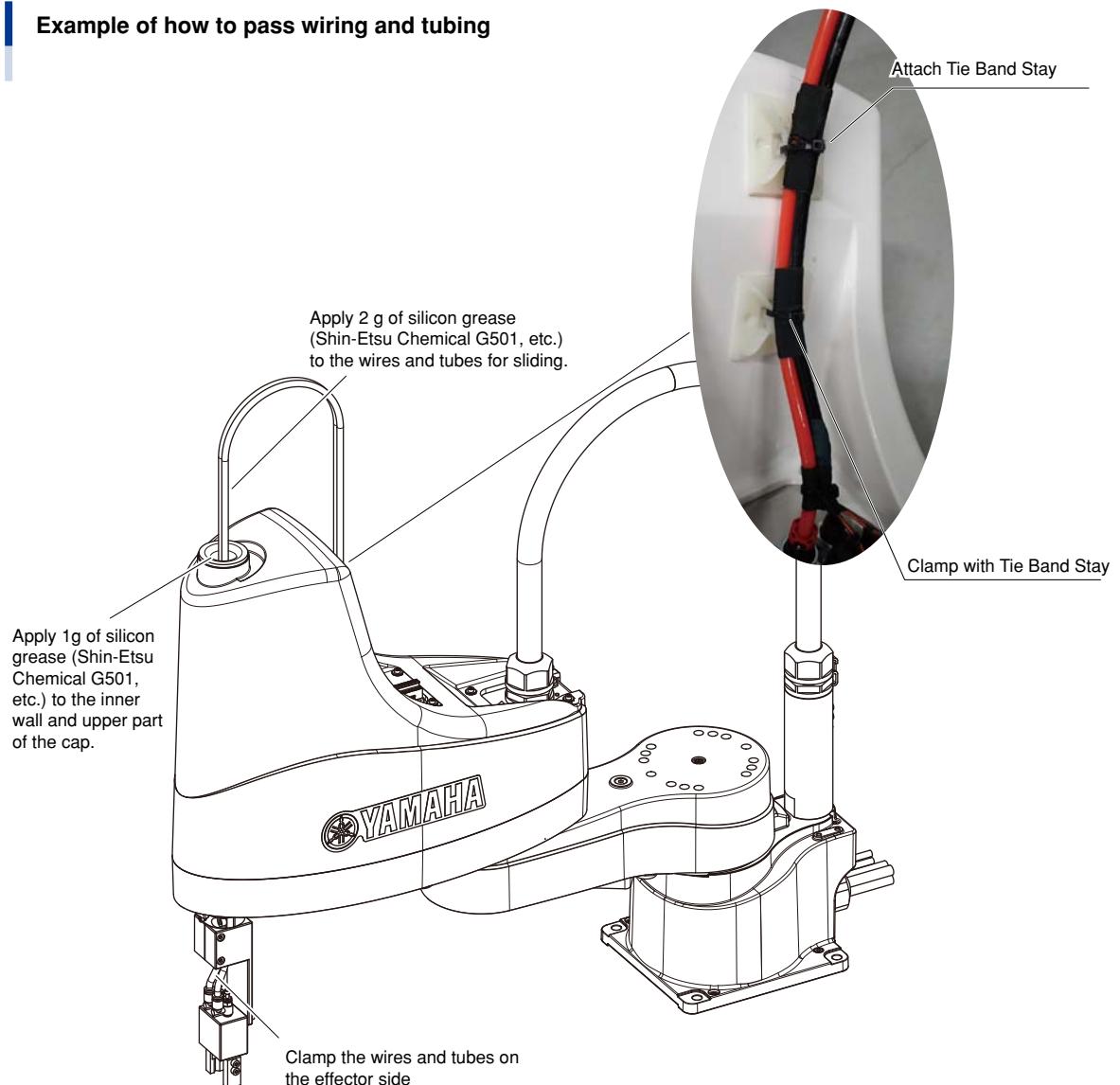
23318-FV-00

19.2 For user wiring/tubing through cap type YK510XE YK610XE YK710XE

3

Installation

Example of how to pass wiring and tubing



21322-FV-00

20. Tool flange mounting YK510XE YK610XE YK710XE

3

Installation

You can add a tool flange later. The following optional parts are required.

1. Replacement parts

No.	Part No.	Q'ty	Remarks
1	KBF-M1790-00	1	Tool flange
2	91312-06025	2	Bolt
3	92A08-05308	1	Set screw

2. Tools(Torque wrench, etc.)



CAUTION

Use a torque driver and torque wrench that have been calibrated precisely.

	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	3KH-05K		Mounting 9.53mm □, overall length 50.4mm, tip hexagon 2 facewidth 5mm
B	Torque screwdriver	N50LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M5 hex socket head bolt Tightening torque: 3.5Nm (36kgfcm)
	Drive bit	B35, opposite side 2.5×75		Attachment hexagonal width across flat: 6.35mm Overall length: 75mm Hexagonal width across flat at tip: 2.5mm

3. Other tools

Name	Part No.	Manufacturer	Remarks
Harmonic grease	4B No.2 (*1)	Harmonic Drive Systems	Do not use grease if it was purchased 4 or more years ago. The grease has probably deteriorated.
Cleaning wipe			
Hex wrench set			
Screw thread locking agent	Loctite 262	Henkel	High strength type (red)

*1 : If there is no harmonic grease, a common grease would be fine.



CAUTION

- When the tool flange is installed, set as follows.
Tip mass parameter = Actual tip mass + 1 (kg)
Failure to do so may shorten the life of the drive.
- To prevent the slip between the spline and the tool flange, tighten the bolts with the specified torque and apply grease to the thread surface of the bolts.

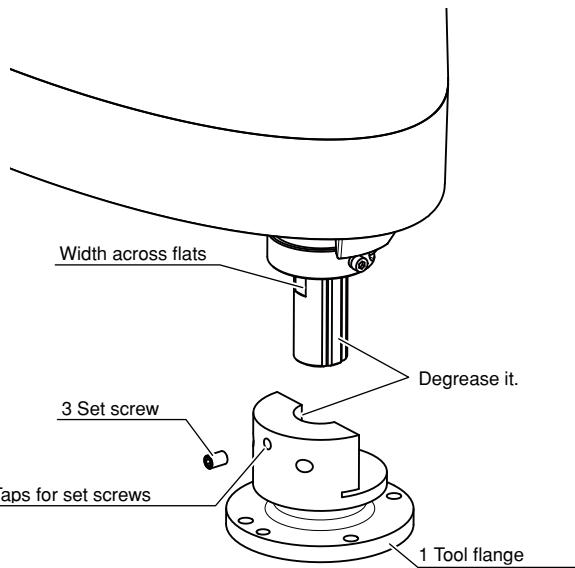
Step 1 Turn off the controller.**Step 2 Place a sign indicating the robot is being adjusted**

Place a sign indicating the robot is being adjusted, to keep others from touching the controller switch.

Step 3 Enter the safety enclosure.**Step 4 Installing the Tool Flange.**

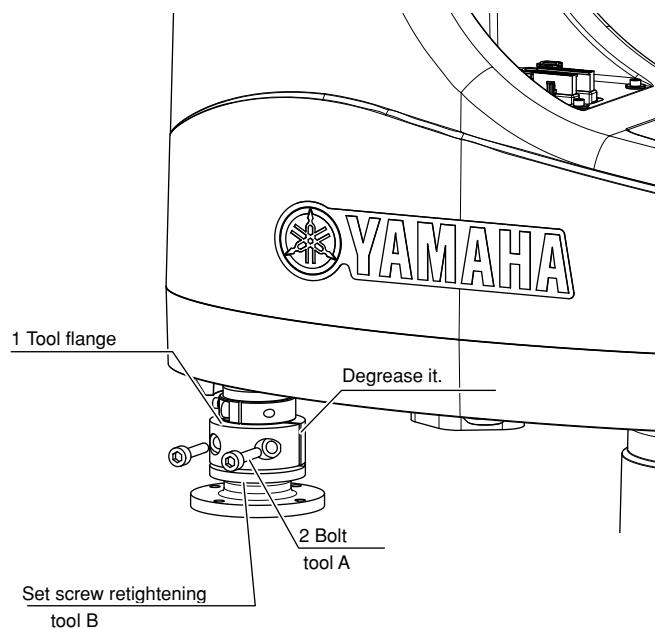
- 1 Align the taps for the set screws on the tool flange with the two side widths of the spline and insert until the tool flange abuts against the spline.
- 2 Temporarily secure the set screw to position the tool flange. Be sure to fix the tool flange at the position where it contacts.
Apply Loctite to the set screw.

23237-FV-00

Step 4 Installing the Tool Flange**Step 5 Tighten bolt 2.**

- Tightening torque
15.2Nm(152kgfcm):
Apply a slight amount of grease to the screw surface of the bolt to stabilize the tightening torque.

21238-FV-00

Step 5-6 Assembling the tool flange**Step 6 Tighten set screw 3.**

- Tightening torque :3.5 Nm(36 kgfcm)

Step 7 Go out of the safety enclosure.

21. Attaching cap (for user wiring/tubing through cap type) YK510XE YK610XE YK710XE

The cap (KFS-M1318-00 COVER, 8) can be retrofitted to route the user wires / tubes.

Step 1 Turn off the controller.

Step 2 Place a sign indicating the robot is being adjusted

Place a sign indicating the robot is being adjusted, to keep others from touching the controller switch.

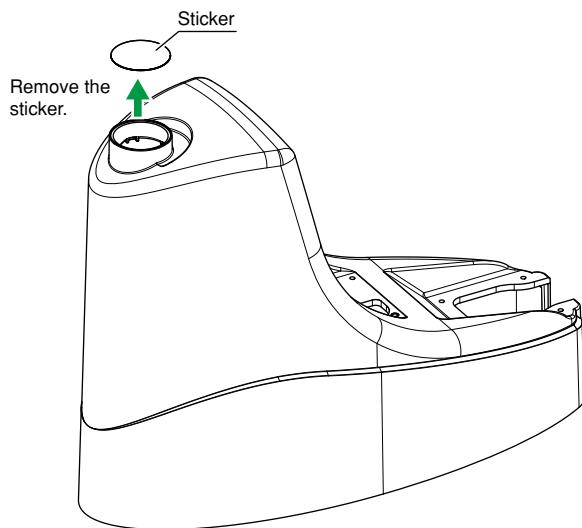
Step 3 Enter the safety enclosure.

Step 4 Remove the Y-axis arm cover.

Remove the cover while referring to "17. Detaching or attaching the covers" in this chapter.

Step 5 Remove the sticker on the top of the cover.

Step 5 Remove the sticker.

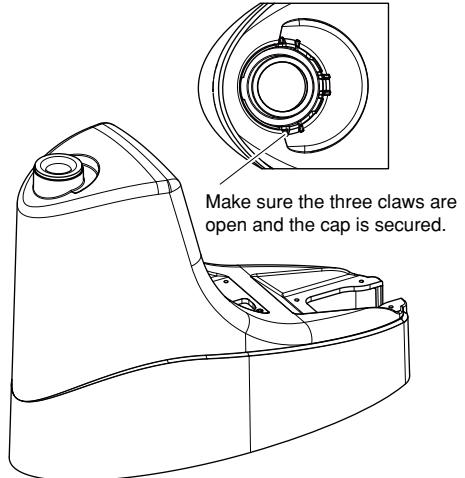
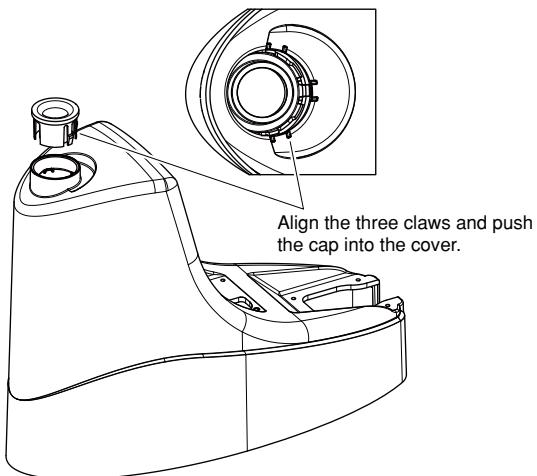


23225-FV-00

Step 6 Insert the cap into the cover.

Part No.	Remarks
KFS-M1318-00	Cap

Inserting the Cap



23226-FV-00

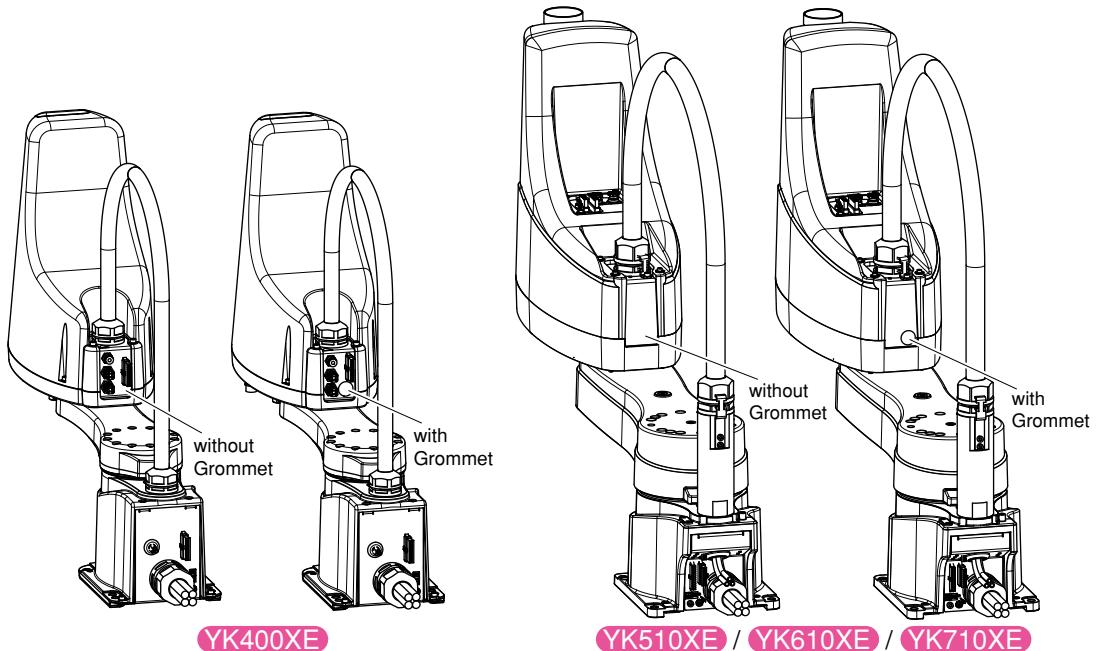
Step 7 Reattach the cover to the Y-axis arm.

Attach the cover while referring to "17. Detaching or attaching the covers" in this chapter.

Step 8 Go out of the safety enclosure.

22. Retrofitting the brake release switch

The brake release switch can be retrofitted. The following optional parts are required.



■ Replacement parts

Harness stay with grommet (YK400XE) / (YK510XE) / (YK610XE) / (YK710XE)

No.	Part No.	Q'ty	Remarks
1	KFS-M4851-00	1	Brake release switch
2	KFS-M4811-00	1	Arm side intermediate cable
3	KFS-M4812-00	1	Base side intermediate cable

Harness stay without grommet (YK400XE)

No.	Part No.	Q'ty	Remarks
1	KFS-M4851-00	1	Brake release switch
2	KFS-M4811-00	1	Arm side intermediate cable
3	KFS-M4812-00	1	Base side intermediate cable
4	KDS-M1312-20	1	Harness stay

Harness stay without grommet (YK400XE) / (YK510XE) / (YK610XE) / (YK710XE)

No.	Part No.	Q'ty	Remarks
1	KFS-M4851-00	1	Brake release switch
2	KFS-M4811-00	1	Arm side intermediate cable
3	KFS-M4812-00	1	Base side intermediate cable
4	KFS-M1312-10	1	Harness stay

22.1 Mounting procedure

Step 1 Turn off the controller.

Step 2 Place a sign indicating the robot is being adjusted

Place a sign indicating the robot is being adjusted, to keep others from touching the controller switch.

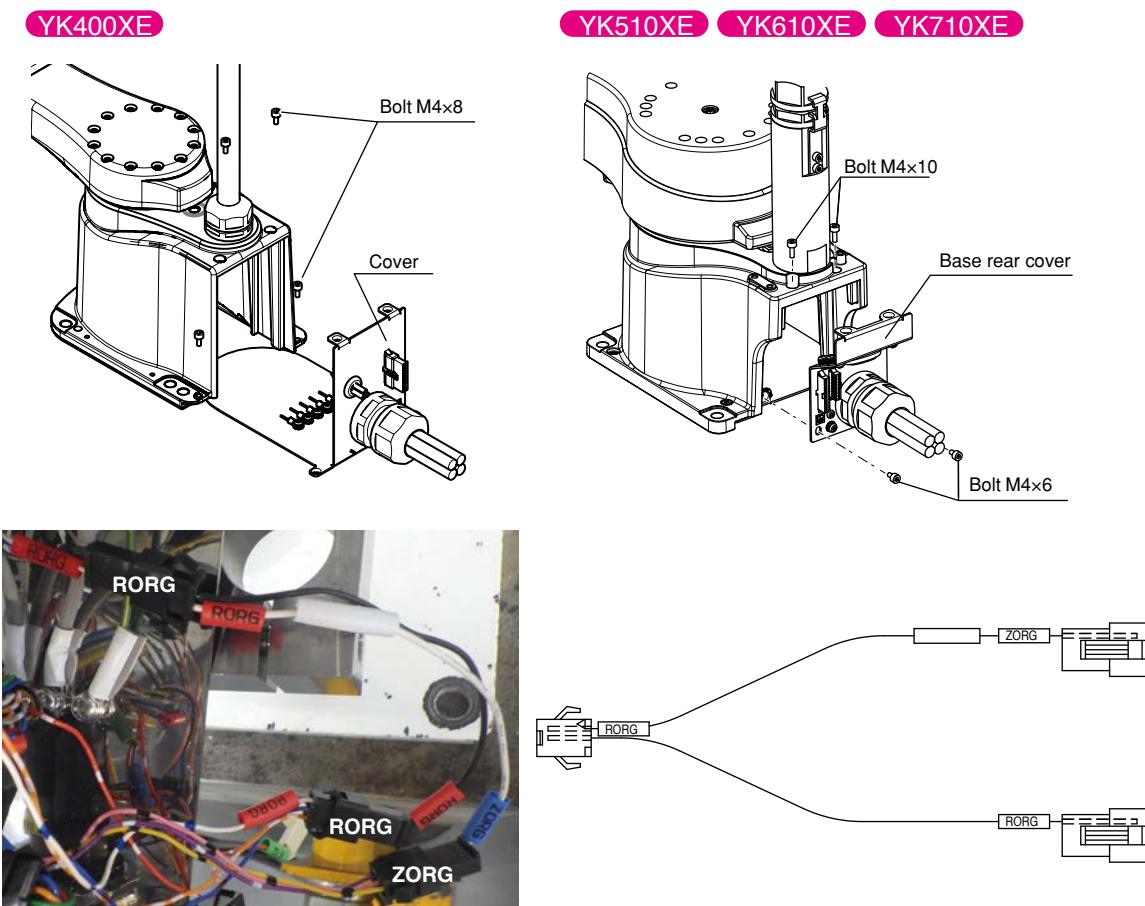
Step 3 Enter the safety enclosure.

Step 4 Remove the Y-axis arm cover and Base rear cover.

Remove the cover while referring to "17. Detaching or attaching the covers" in this chapter.

Step 5 Pull out the wires from the base, remove the RORG connector, and connect the base side intermediate cable (part No. 3) between the RORG and the RORG / ZORG connectors.

Remove the cover while referring to "1.4 Robot inner wiring diagram" in chapter 9.

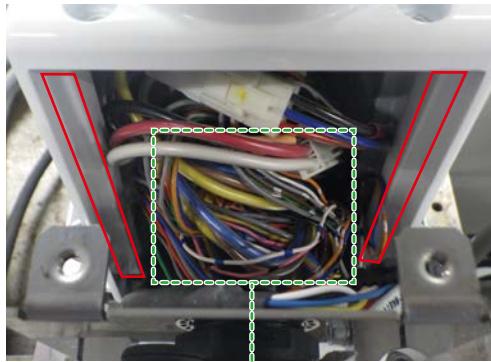


3

Installation

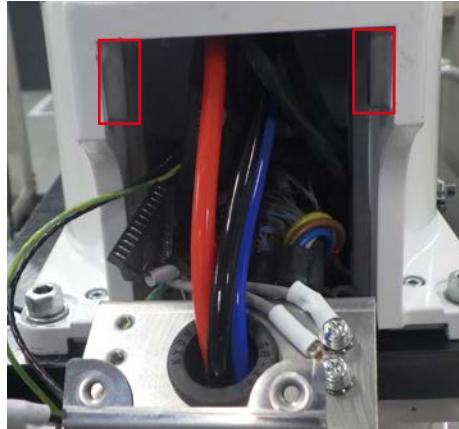
Step 6 Put the wires in the base and reattach the rear cover.

YK400XE



Store the wires in the space in front of the X motor.

YK510XE YK610XE YK710XE



Store the signal wire to the left back side of the X motor and the power wire to the right back side when viewed from the base wiring side.

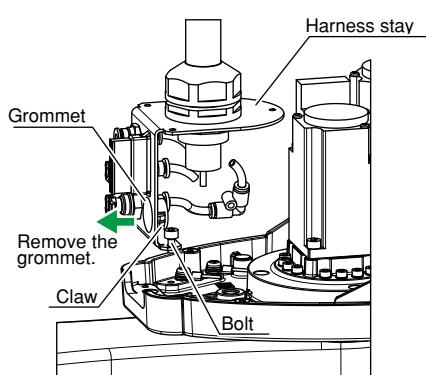


CAUTION

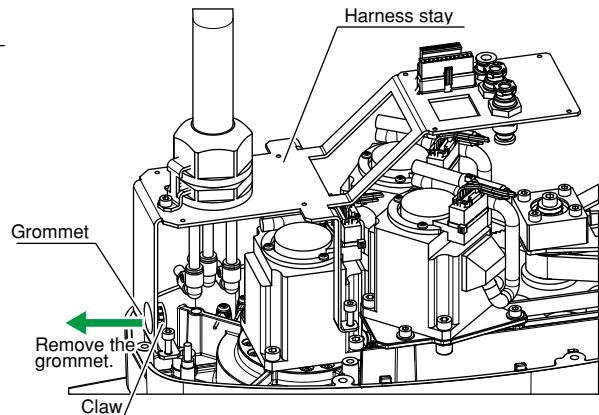
Make sure that the wiring does not get caught in the cover. (Make sure that there are no wires in the red frame in the above figure so that the wires are not pinched.)

Step 7 If the Y-axis arm harness stay (part No. 4) has a grommet, remove the harness stay and remove the grommet to the outside of the cover while pressing the claw inside the grommet cover.

YK400XE



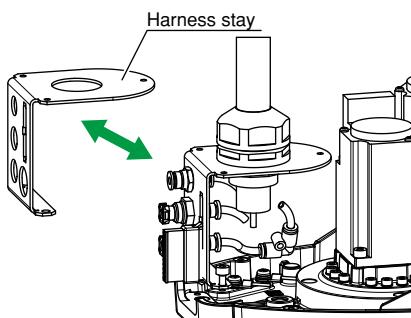
YK510XE YK610XE YK710XE



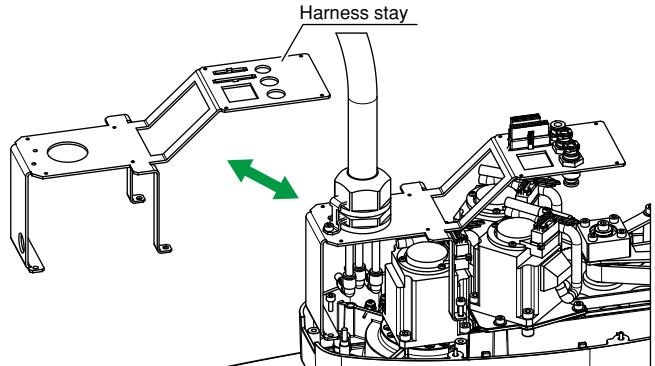
If the Y-axis arm harness stay does not have a grommet, remove the harness stay and replace it with a new one.

Detachment of harness from harness stay, refer to the Maintenance manual "Replacing the machine harness".

YK400XE

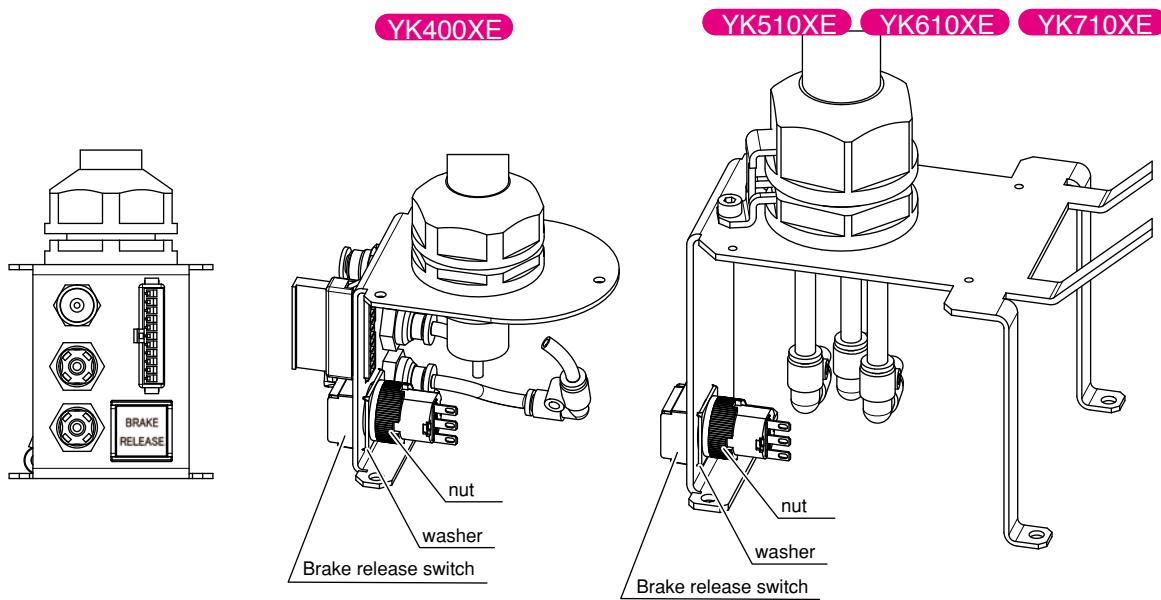


YK510XE YK610XE YK710XE



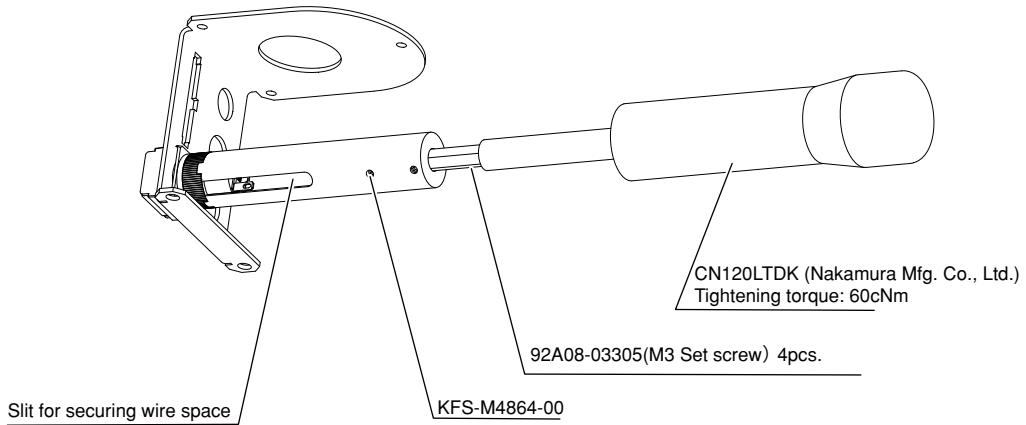
Step 8 Insert the brake body into the hole of the harness stay from the outside, and fix it with washers and nuts from the opposite side.

Tighten the nut with plier so that it will not come loose.



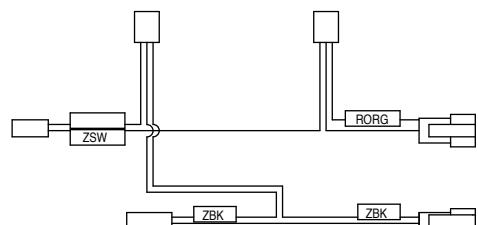
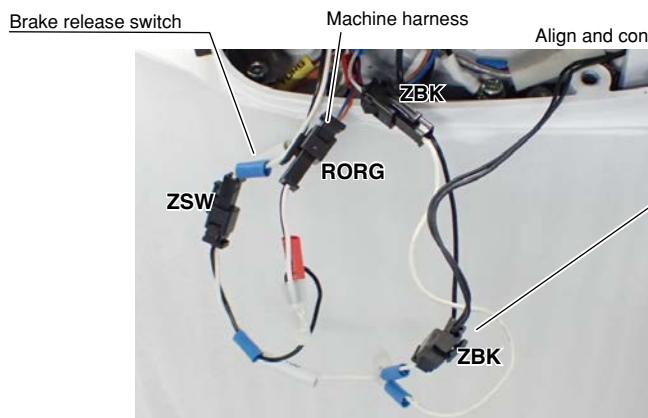
NOTE

If you prepare a tool, you can tighten it as shown in the figure.



Step 9 Secure the harness stay to the Y-axis arm.

Step 10 Remove the ZBK connector, and connect the arm side intermediate cable (part No. 2) to the ZSW connector, to the RORG connector and between the ZBK connectors. Remove the cover while referring to "1.4 Robot inner wiring diagram" in chapter 9.

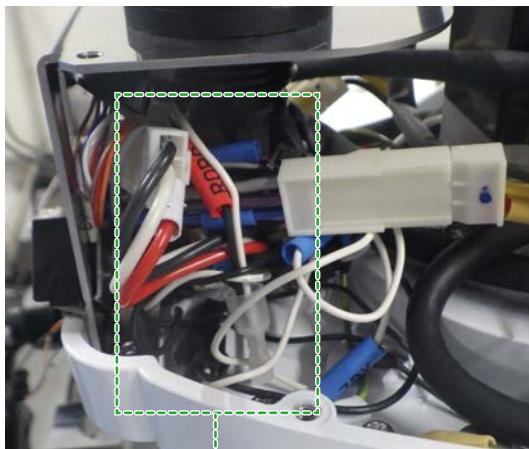


3

Installation

Step 11 Put the wires in the base and reattach the rear cover.

YK400XE

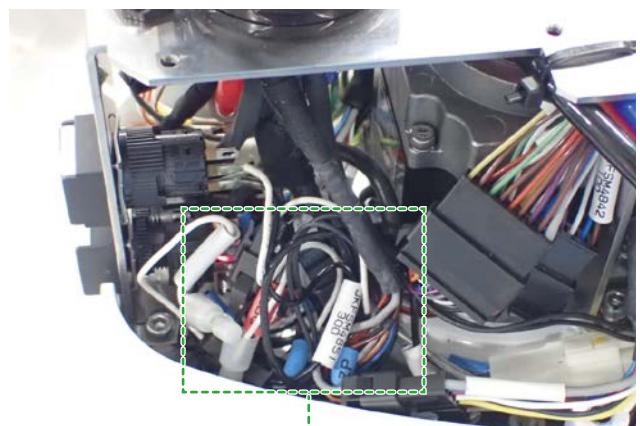


Store the wires under the harness stay

YK510XE

YK610XE

YK710XE



Store the wires in the space next to the switch.

Step 12 Attach the Y-axis arm cover to the Y-axis arm.

Step 13 Check the operation of the Z-axis brake switch.



CAUTION

The Z-axis will slide down when the brake is released, causing a hazardous situation.

- Prop up the Z-axis with a support stand before releasing the brake.
- Be careful not to let your body get caught between the Z-axis and the installation base before releasing the brake.

Turn on the controller.

While pressing the brake release switch, make sure the brake is released and the Z-axis is free.

Check that the brake is applied when the release switch is released and the Z-axis does not move.

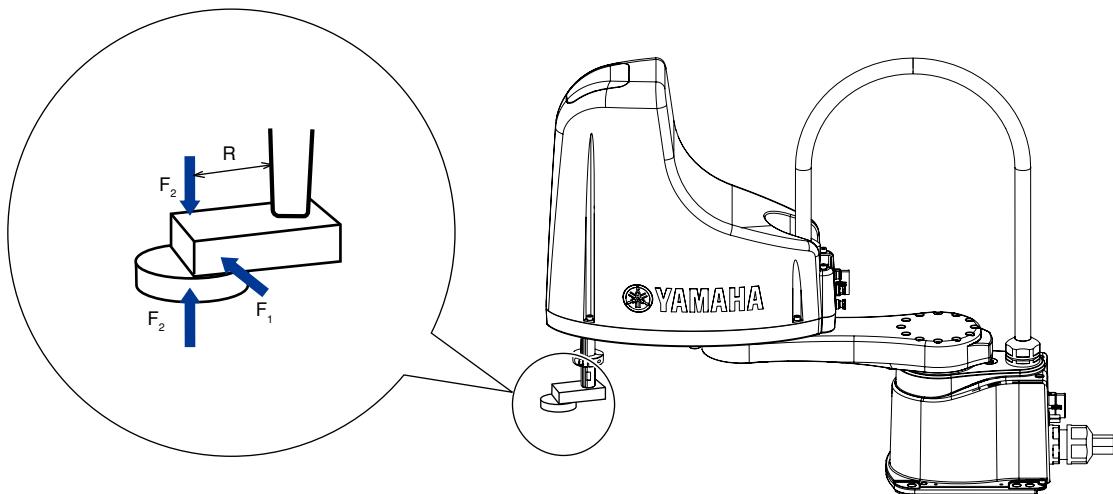
If the switch does not work properly, check the wiring to make sure it works properly.

Step 14 Go out of the safety enclosure.

23. Permissible spline load

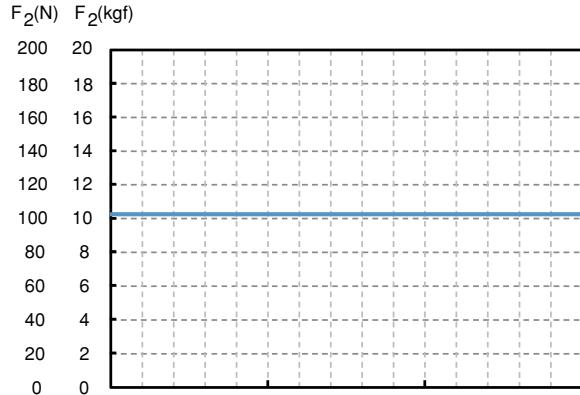
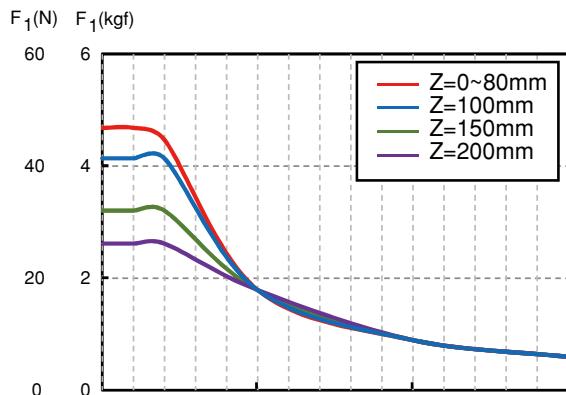
Due to the strength factors of the spline, and the X,Y,Z,R axes, do not apply loads which exceed those shown below during an all-axis servo hold status, or during ultra-slow-speed operations.
 "F₂" includes the load of the tip load's weight.

Permissible spline loads

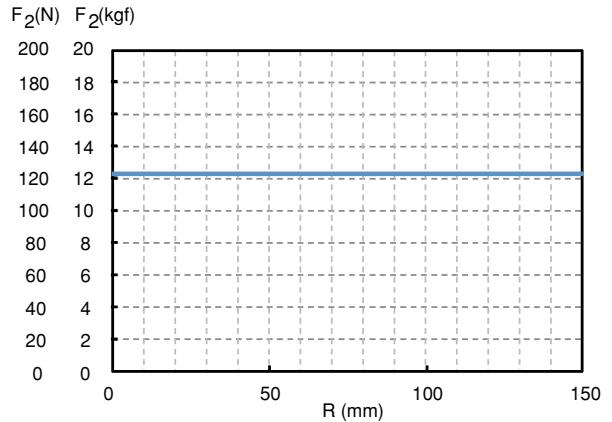
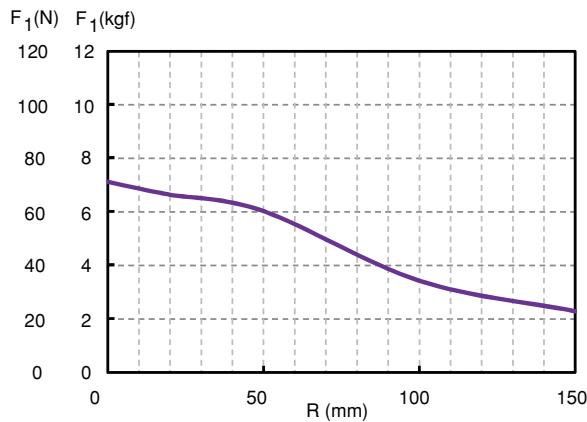


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YK400XE



YK510XE / YK610XE / YK710XE



21240-FV-00 / 21241-FV-00

Chapter 4

Robot settings

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1. Overview

Various settings have been completely made at the factory or by your distributor before shipment, including the origin position setting. If the operating conditions are changed and the robot needs to be set again, then follow the procedures described in this chapter.

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



CAUTION

- Read and understand the contents of this chapter completely before attempting to set the robot.
- Place a conspicuous sign indicating the robot is being adjusted, to prevent others from touching the controller switch, programming box (PBX) or operation panel.
- If a safety enclosure has not yet been provided right after installation of the robot, rope off or chain off the movement range around the manipulator in place of a safety enclosure, and observe the following points.
 1. Use stable posts which will not fall over easily.
 2. The rope or chain should be easily visible by everyone around the robot.
 3. Place a conspicuous sign prohibiting the operator or other personnel from entering the movement range of the manipulator.
- To check the operation after the settings have been made, refer to the section "4.6.1 Trial Operation" in Chapter "Safety Instructions" of this manual.

2. Adjusting the origin

The YK-XE series robots use an absolute type position detector. The origin position (zero pulse point) can be determined by return-to-origin. Once return-to-origin is performed, you do not have to repeat return-to-origin when turning the power on next time. However, return-to-origin is required if any of the following cases occur. The robot is shipped from the factory in condition "3." (below), so please perform return-to-origin after installing the robot. For more details on return-to-origin, refer to "Return-to-origin" in the "YAMAHA Robot Controller User's Manual".

1. Absolute-related error occurred on the axis.
2. Power drop was detected in the absolute battery for the driver installed inside the robot controller.
3. Cable connecting the robot unit to the controller was disconnected. (This is the status when shipped from the factory.)
4. Robot generation was performed.
5. Parameters were initialized.
6. Axis parameters "Origin shift", "Return-to-origin method", "Return-to-origin direction" or "Motor axis polarity" were changed.
7. Motor was replaced. (Motor wiring connector was removed.)
8. Data in the ALL data file (extension: ALL) or parameter file (extension: PRM) was written into the controller by way of the Online command.

The following sections explain how to perform return-to-origin.



CAUTION

- If any of the above cases occur after installing the robot, return-to-origin must be performed again. To perform return-to-origin, 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 return-to-origin, 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.

2.1 Return-to-origin method

The YK400XE has a return-to-origin method that includes the stroke end method and the mark method, and the sensor method is an option.

YK510XE, YK610XE and YK710XE can only use the sensor method to return-to-origin.

2.1.1 Stroke end method YK400XE

In the stroke end method, return-to-origin is performed at a position slightly backed off from the stroke end, after the axis whose return-to-origin is performed contacts the mechanical stopper and stroke end is detected.



WARNING

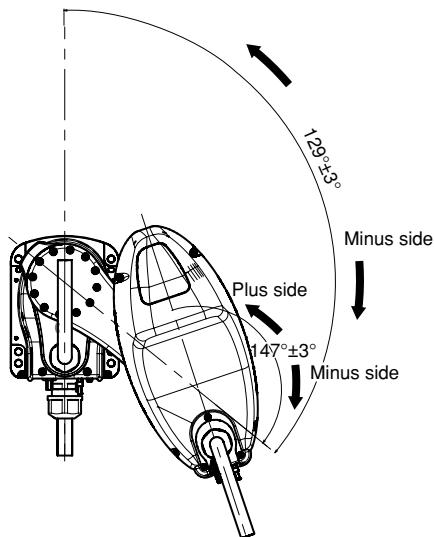
Serious injury might occur from physical contact with the robot during operation. Never enter within the robot movement range during return-to-origin.



CAUTION

- Before starting return-to-origin operation, move the X-axis to a position on the plus side from the origin position (See Fig. Below), and the Y-axis to a position on the minus side, so that the robot is positioned in a right-handed system as shown in Fig. below. When the return-to-origin operation starts, the X-axis will move to the minus side and the Y-axis will move to the plus side. After pushing against the mechanical stopper, the axes will return slightly, and the return-to-origin will be completed.
- When performing the return-to-origin of the Z-axis or R-axis, the return-to-origin operations of the Z-axis and R-axis are **automatically performed continuously**. So, pay special attention to the interference between the tip tool and robot or peripheral unit.

Default origin position



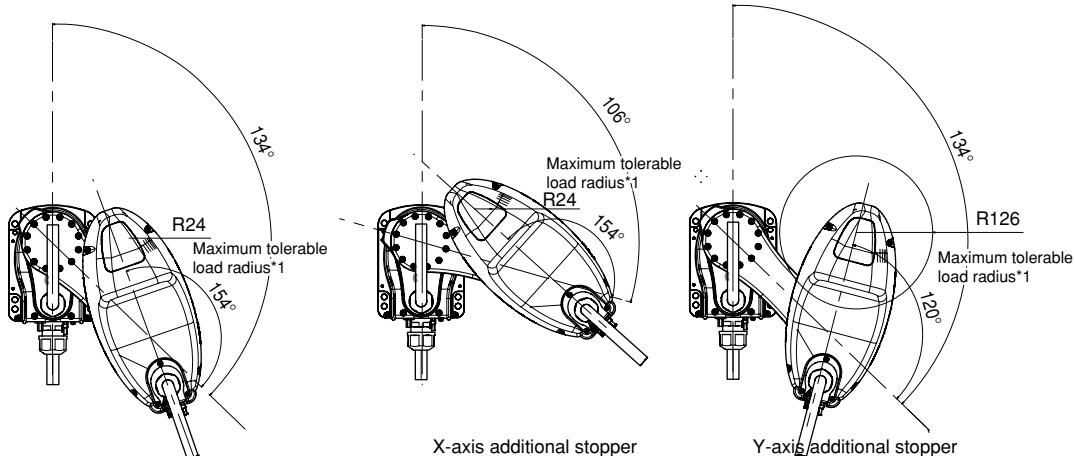
23001-FV-00



CAUTION

The X and Y-axes will move to the positions shown in Fig. below during return-to-origin, so make sure that the tool on the end, the robot and the peripheral devices do not interfere. The maximum tolerable load radius (when load is cylindrical object) is shown in Fig. below. If return-to-origin is performed with a load larger than this radius installed on the R-axis, the base and load could interfere.

X and Y-axis maximum movement position during detecting origin position by mechanical stroke end



*1 Load is a cylindrical object.

When the additional stopper is installed and the return-to-origin in the stroke end method is performed, it is necessary to change the origin shift amount of the axis, on which the additional stopper is installed.

23314-FV-00

2.1.2 Mark method YK400XE

In the mark method, the robot is moved to a position beforehand where the return-to-origin is performed and this position is determined to the return-to-origin position.

There are two kinds of methods to move the robot to a position where the return-to-origin is performed as described below. (See also "■ Absolute reset flowchart" in "2.4.2 Mark method".)

■ Move the robot using the step operation in the servo on state.

When the mark (sticker) that shows the origin position is seen from a position beyond the robot movement range, select this step.

The origin position reset by means of the mark method is called "absolute reset".

■ Move the robot by hand in the servo off state.

When the mark (sticker) that shows the origin position is not seen from a position beyond the robot movement range, select this step.



CAUTION

The absolute reset by means of the mark method can be executed using the programming box (PBX) or online command. However, note that the absolute reset cannot be executed using the dedicated input.



CAUTION

When performing the absolute reset again at the previous absolute reset position, the deviation between the origin position marks needs to be put in a certain range (repeatability allowable value)

(See the illustration showing the positional relationship between origin position stickers stated in "2.4.2 Mark method" of this Chapter.)

If the absolute reset is performed at a position exceeding the repeatability allowable value or at a position different from the previous absolute reset position, the position deviation may occur.

Use the origin position stickers supplied with the product so that the origin position can be reproduced correctly within the allowable value.

In section "2.4.2.2 Absolute reset in servo off state (re-reset)" of this chapter, the "origin position repeatability allowable value" indicates the origin position repeatability allowable value for each axis of the robot.

2.1.3 Sensor method (X-axis, Y-axis)

In the sensor method, the target axis is automatically operated for the return-to-origin, and the return-to-origin is performed at the position where the proximity sensor provided on the target axis detects the detection area (dog). The return-to-origin in the sensor method can be executed with the programming box (PBX), online command, and dedicated input.



WARNING

Serious injury might occur from physical contact with the robot during operation. Never enter within the robot movement range during return-to-origin.



CAUTION

The origin cannot be detected in any axis which is not positioned on the plus side from the origin (see the Fig. stated in step 5 of "2.3.2 Sensor method (X-axis, Y-axis)" in this Chapter) before starting the return-to-origin

operation. 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.

2.2 Machine reference

The position detector of the YK-XE series uses a resolver that has five positions where the return-to-origin can be performed per motor revolution. (YK510XE, YK610XE, YK710 has four X axes)

The machine reference means the position relationship of the position where the robot detects the origin signal to the position where the reset can be performed soon after detection (see the Fig. below). The machine reference is expressed with the ratio of the minimum interval (A) between the positions where the return-to-origin can be performed to the interval (B) between the positions where the return-to-origin can be performed soon after the origin signal detection.

The machine reference value is displayed on the optional PBX screen (unit: %).

$$\text{Machine reference value} = B/A \times 100(\%)$$



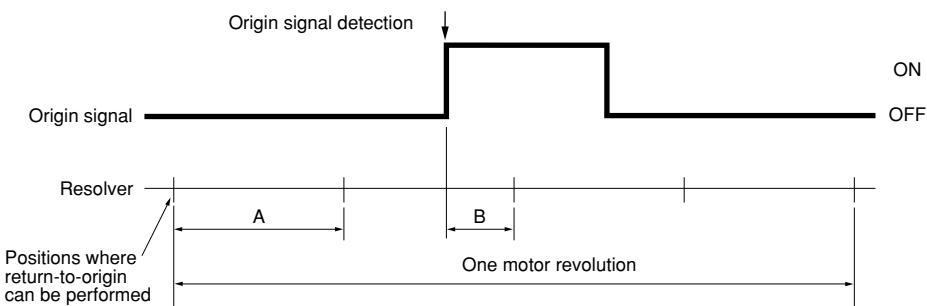
CAUTION

The machine reference must be adjusted within a specified range to keep the repeatability precision of the return-to-origin 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 "2. Adjusting the origin" in this Chapter. 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 (25 to 75%). When checking or adjusting the machine reference value, always make sure that the temperature of the robot joint sections has returned to room temperature.

Recommended machine reference value: 25 to 75%

Machine reference



23301-F0-00

Machine reference display on PBX screen

ORIGIN RTN(TRQ/SENS)					S:-- RBT:1	H:-- SPD:20	SRV
[ALL] Origin Sequence: 312456							
Axis	Status	Method	Sensor	Ref.			
1	OK	Sensor	ON	54			
2	OK	Sensor	ON	52			
3	OK	ZR-Torqu	ON	53			
4	OK	ZR-Torqu	OFF	67			
5							
6							
1	MARK						

24301-F0-00

2.3 Return-to-origin procedures

2.3.1 Stroke end method YK400XE


WARNING

Serious injury may occur from physical contact with the robot during operation. Never enter within the robot movement range during return-to-origin.

The Z-axis and R-axis perform the return-to-origin in the stroke end method at the same time.

The operation procedure using the PBX is described below.


NOTE

- When pressing the **ESC** key on the execution confirmation screen, the execution of the return-to-origin is canceled.
- For details about how to operate the robot controller, see the "YAMAHA Robot Controller User's Manual".

Step 1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 2 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

Step 3 Display the "ORIGIN RTN (TRQ/SENS)" screen on the PBX (operation → return-to-origin).

24304-F0-00

Step 4 Select an axis whose return-to-origin is performed.

Use the cursor keys (**▲** / **▼**) to select an axis number whose return-to-origin is performed.


NOTE

As the return-to-origin operations of the Z-axis and R-axis are performed simultaneously, you can select either axis number 3 or 4.

The execution confirmation screen will pop up.

Step 5 Perform the return-to-origin.

The return-to-origin execution confirmation screen pops up.

Check that there are no obstacles within the movement range, and then press **RUN**. To cancel the return-to-origin, press **ESC**. After the return-to-origin has been completed, press **ENTER** to return to the "ORIGIN RTN (TRQ/SENS)" screen.

24304-F0-00

Step 6 Check the status and machine reference value.

"Status" and "Ref." (machine reference) are displayed on the "ORIGIN RTN (TRQ/SENS)" screen.

Check that the status is "OK" and that the machine reference value is within the return-to-origin tolerable range (25 to 75%).

24305-F0-00

▶ **Step 3-4 Return-to-origin mode screen**

ORIGIN RTN(TRQ/SENS)				
S:-- RBT:1 H:-- SPD:20 SRV				
ALL Origin Sequence: 312456				
Axis	Status	Method	Sensor	Ref.
1	NG	Sensor	OFF	54
2	NG	Sensor	OFF	52
3	NG	ZR-Torqu	ON	56
4	NG	ZR-Torqu	ON	0
5				
6				
1	MARK			

▶ **Step 5 Return-to-origin**

ORIGIN RTN(TRQ/SENS)				
S:-- RBT:1 H:-- SPD:20 SRV				
ALL Origin Sequence: 312456				
Axis	Status	Method	Sensor	Ref.
1	NG	ZR-Torqu	ON	51
2	NG	ZR-Torqu	ON	52
3	NG	ZR-Torqu	ON	53
4	NG	ZR-Torqu	ON	54
5				
6				
1	MARK			

Execute origin return.
 After having pushed the [RUN],
 please push [OK].

OK

▶ **Step 6 Machine reference value**

ORIGIN RTN(TRQ/SENS)				
S:-- RBT:1 H:-- SPD:20 SRV				
ALL Origin Sequence: 312456				
Axis	Status	Method	Sensor	Ref.
1	NG	Sensor	OFF	54
2	NG	Sensor	OFF	52
3	OK	ZR-Torqu	ON	53
4	OK	ZR-Torqu	OFF	67
5				
6				
1	MARK			

■ Machine reference value checking procedure

1. Use the cursor keys (/) on the initial screen to select Operation and press to display the operation menu.
2. Select Origin Return and press to display the "ORIGIN RTN (TRQ/SENS)" screen. The return-to-origin completion status and machine reference are then displayed.

If the machine reference value is beyond the return-to-origin tolerable range, the next return-to-origin may not be performed correctly.

In this case, make the adjustment while referring to "2. Adjusting the origin" in this Chapter.

2.3.2 Sensor method (X-axis, Y-axis)



WARNING

Serious injury might occur from physical contact with the robot during operation. Never enter within the robot movement range during return-to-origin.

The operation procedure using the PBX is described below.



NOTE

- When pressing the key on the execution confirmation screen, the execution of the return-to-origin is canceled.
- For details about how to operate the robot controller, see the "YAMAHA Robot Controller User's Manual".

Step 1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 2 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

Step 3 Display the "ORIGIN RTN (TRQ/SENS)" screen on the PBX (operation → return-to-origin).

24302-F0-00

Step 4 Select an axis whose return-to-origin is performed.

Use the cursor keys (/) to select an axis number whose return-to-origin is performed.

The execution confirmation screen will pop up.



CAUTION

When absolute reset for all axes is performed, the stroke end method Z-axis will rise first (default setting), so take care that your hand does not get pinched.

Step 5 Check the axis position.

Check that the axis whose return-to-origin is performed is located at a position on the plus side from the origin. (See also the figure on the right.)

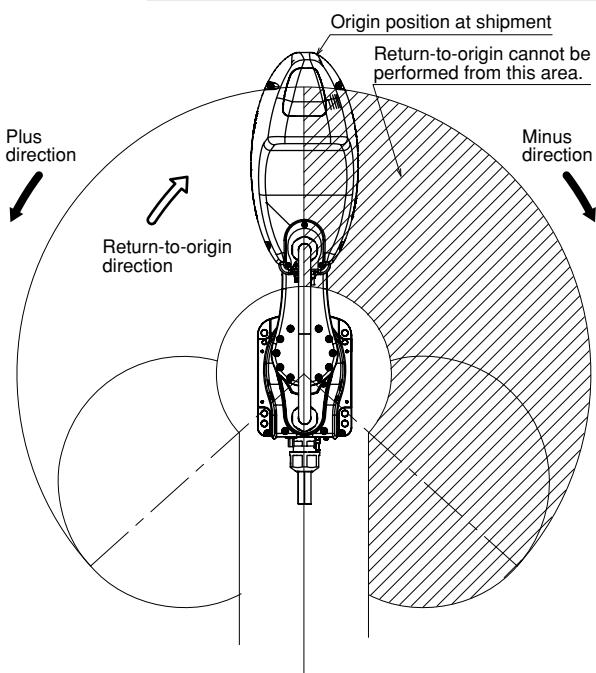
If not located on the plus side, move the target axis to the plus side using the JOG operation beforehand.

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▶ Step 3-4 Return-to-origin mode screen

ORIGIN RTN(TRQ/SENS) S:--- RPD:1 SRV:20				
Axis	Status	Method	Sensor	Ref.
1	NG	Sensor	OFF	54
2	NG	Sensor	OFF	52
3	OK	ZR-Torqu	ON	53
4	OK	ZR-Torqu	OFF	67
5				
6				
1	MARK			

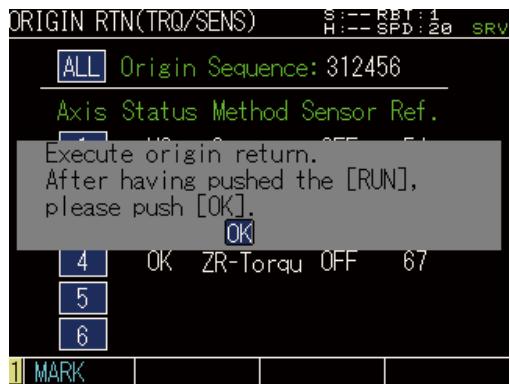
▶ Step 5 Return-to-origin possible range



Step 6 Perform the return-to-origin.

The return-to-origin execution confirmation screen pops up.
Check that there are no obstacles within the movement range, and then press **RUN**. To cancel the return-to-origin, press **ESC**. After the return-to-origin has been completed, press **ENTER** to return to the "ORIGIN RTN (TRQ/SENS)" screen.

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Step 6 Return-to-origin**Step 7 Check the machine reference value.**

"Status" and "Ref." (machine reference) are displayed on the "ORIGIN RTN (TRQ/SENS)" screen.

Check that the status is "OK" and that the machine reference value is within the return-to-origin tolerable range (25 to 75%).

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■ Machine reference value checking procedure

1. Use the cursor keys (**▲** / **▼**) on the initial screen to select Operation and press **ENTER** to display the operation menu.
2. Select Origin Return and press **ENTER** to display the "ORIGIN RTN (TRQ/SENS)" screen. The return-to-origin completion status and machine reference are then displayed.

If the machine reference value is beyond the return-to-origin tolerable range, the next return-to-origin may not be performed correctly.

In this case, make the adjustment while referring to "2. Adjusting the origin" in this Chapter.

■ Posture after completion of Y-axis origin return

When axis origin return is completed, only the Y-axis will move to within the operation range (millimeter coordinate system jog operation ready area) and stop automatically.

Note that the stopped position is not the home position (0 pulse).

2.4 Adjusting the machine reference value

The X- and Y-axis origin positions of the YK-XE series are fixed and cannot be changed. Additionally, the machine reference value was correctly adjusted at shipment. The readjustment is not needed during normal operation. However, if the machine reference value exceeds the return-to-origin tolerance range for some reason, follow the steps below to readjust the machine reference value.


WARNING

Before starting the work, thoroughly read "16. Detaching or attaching the covers" in Chapter 3.


CAUTION

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.

2.4.1 Stroke end method YK400XE

The return-to-origin of the YK-XE series uses the stroke end method.

The machine reference value was adjusted correctly at shipment. So, the readjustment is not needed during normal operation. However, if the machine reference value exceeds the return-to-origin tolerance range (25 to 75%) for some reason, follow the steps below to readjust the machine reference value.


CAUTION

The origin position may change due to machine reference adjustment. If it occurs, you must set point data again.

step 1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

step 2 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

step 3 Perform the return-to-origin.


NOTE

For details about how to perform the return-to-origin, refer to "2.3 Return-to-origin procedures" in this Chapter.

step 4 Record the machine reference value.

step 5 Turn off the controller.

The Z-axis motor brake is now working at the origin position.

step 6 Enter the safety enclosure.

■ Changing the X-axis reference value

Step 7 Loosen the bolts that secure the speed reduction gear.

At this time, it is enough to loosen the bolts. Do not pull out the bolts.

A rattle is produced. Utilize this rattle to turn the arm.

To increase the reference value, turn the X-axis arm clockwise when viewed from the top of the robot. Conversely, to decrease the reference value, turn the X-axis arm counterclockwise when viewed from the top of the robot.

Step 8 Secure the speed reduction gear temporarily.

Tighten the bolts while applying an appropriate torque so that the speed reduction gear and arm do not deviate.

Step 9 Remove the temporarily secured bolts, and then secure the speed reduction gear temporarily with new bolts.

Replace the bolts one-by-one and take great care so that the speed reduction gear and arm do not deviate. Bolt M3 x 35, (YAMAHA's part No. 91312-03035) 12 pcs.

Step 10 Secure the speed reduction gear.

Secure the speed reduction gear while referring to "2.1 Replacing the X-axis harmonic drive" in Chapter 5 of the Maintenance Manual.

■ Changing the Y-axis reference value

Step 7 Loosen the bolts that secure the speed reduction gear.

At this time, it is enough to loosen the bolts. Do not pull out the bolts.

A rattle is produced. Utilize this rattle to turn the arm.

To increase the reference value, turn the Y-axis arm counterclockwise when viewed from the top of the robot. Conversely, to decrease the reference value, turn the Y-axis arm clockwise when viewed from the top of the robot.

Step 8 Secure the speed reduction gear temporarily.

Tighten the bolts while applying an appropriate torque so that the speed reduction gear and arm do not deviate.

Step 9 Remove the temporarily secured bolts, and then secure the speed reduction gear temporarily with new bolts.

Replace the bolts one-by-one and take great care so that the speed reduction gear and arm do not deviate. Bolt M3 x 30, (YAMAHA's part No. 91312-03030) 12 pcs.

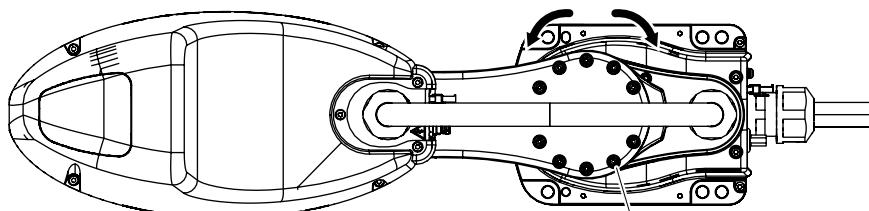
Step 10 Secure the speed reduction gear.

Secure the speed reduction gear while referring to "2.2 Replacing the Y-axis harmonic drive" in Chapter 5 of the Maintenance Manual.

Step 7 Changing the reference value

Turning the speed reduction gear counterclockwise will decrease the reference value.

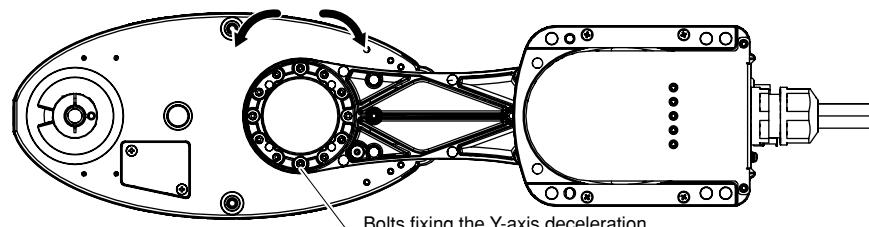
Turning the speed reduction gear clockwise will increase the reference value.



Bolts fixing the X-axis deceleration

Reference value increases.

Reference value decreases.



Bolts fixing the Y-axis deceleration

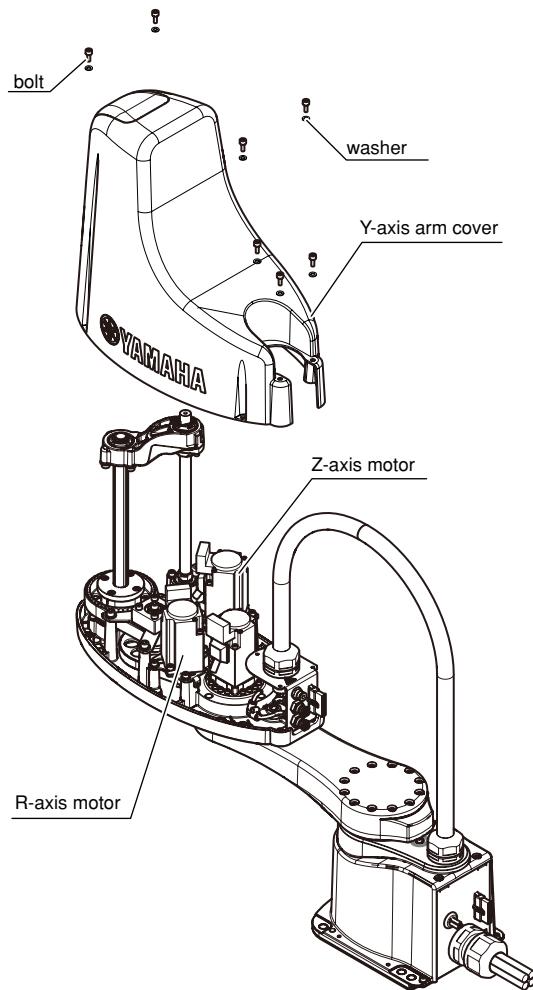
■ **Changing the Z-axis and R-axis reference values**

► **Step 9** **Removing the cover**

step 9 Remove the cover.

Remove the cover while referring to "16. Detaching or attaching the covers" in Chapter 3.

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WARNING

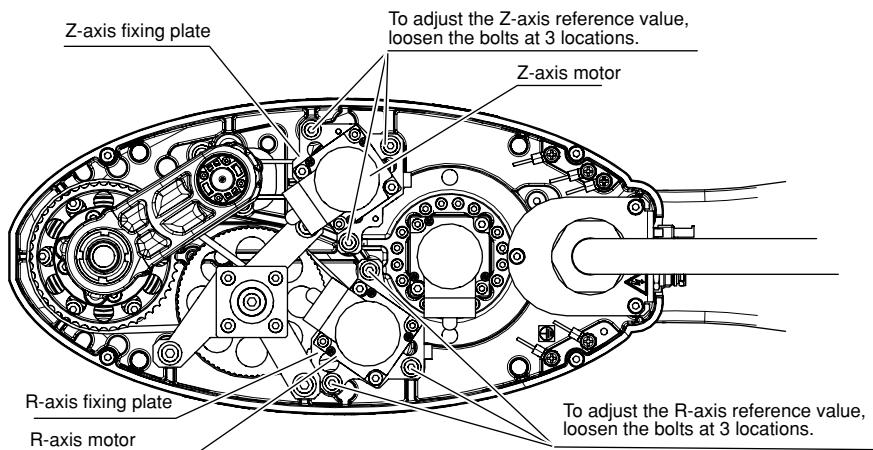
If the pulley comes off from the belt, the Z-axis may drop. Be sure to prop the Z-axis with a support stand. Be careful not to drop the Z-axis and entangle the belt during adjustment.

step 10 Prop the spline or end effector with a support stand to prevent from dropping.

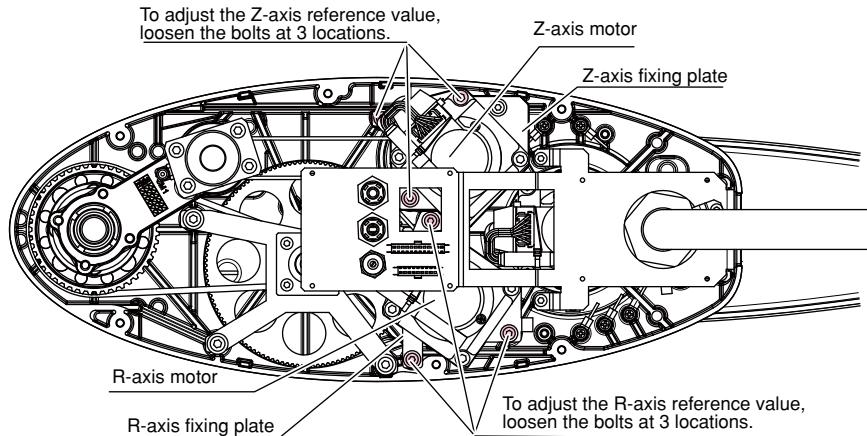
step 11 Loosen the bolts that secure the motor installation plate.

YK400XE

Step 11 Removing the plate



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Step 11 Removing the plate

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Step 12 Shift the engagement between the motor pulley and belt tooth.

Shifting the belt engagement one tooth will change the machine reference value approximately 25%. When shifting the pulley clockwise with the belt teeth left as they are, the reference value will increase. Conversely, when shifting the pulley counterclockwise, the reference value will decrease. Shift the engagement between the pulley and belt so that the Z-axis machine reference value enters a range of 25 to 75% when compared to that confirmed in Step 4.

Step 13 Tighten the plate mounting bolts.

At this time, tighten the bolts while applying an appropriate tension to the belt.

The appropriate tension can be checked as the vibration frequency is measured when the belt is stretched.

	YK400XE	YK510XE / YK610XE / YK710XE
Z-axis belt tension (Appropriate frequency)	259 to 333Hz	150 to 173Hz
R-axis belt tension (Appropriate frequency)	308 to 398Hz	286 to 366Hz

Step 14 Go out of the safety enclosure.**Step 15 Turn on the controller.**

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 16 Perform the return-to-origin of the Z-axis.

NOTE

For details about how to perform the return-to-origin, refer to "2.3 Return-to-origin procedures" in this Chapter.

Step 17 Check the Z-axis machine reference value.

After the return-to-origin has been completed, check that the machine reference value is within the return-to-origin tolerance range (25 to 75%).

If the adjustment machine reference value is outside the tolerance range (25 to 75%), then repeat the procedure from step 9 again to readjust it.

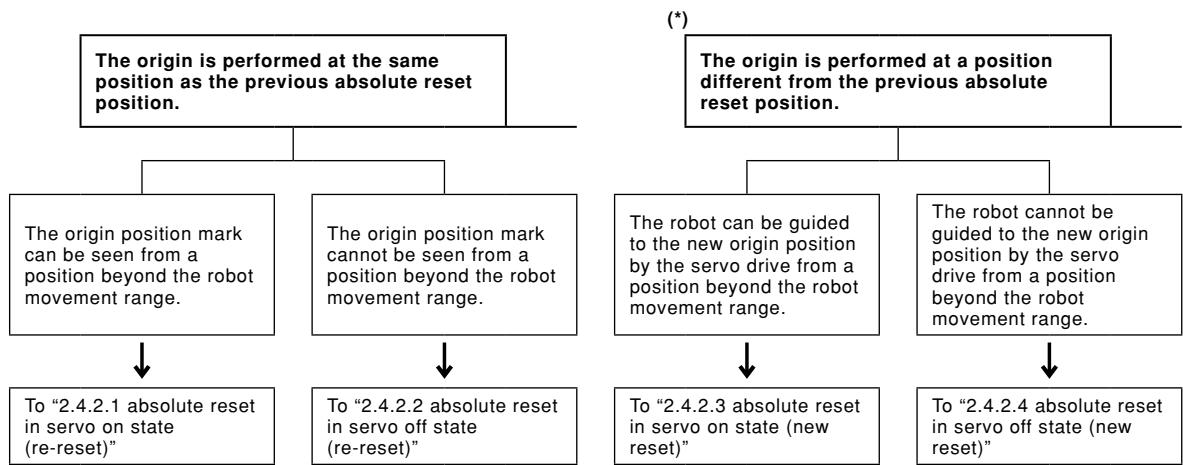
Step 18 Turn off the controller.**Step 19 Enter the safety enclosure.****Step 20 Reattach the cover.**

2.4.2 Mark method YK400XE

The absolute reset in the mark method is classified into four groups according to the conditions as shown in the flowchart below.

Since each operating procedure varies, refer to relevant portion.

■ Absolute reset flowchart



2.4.2.1 Absolute reset in servo on state (re-reset)



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 PBX is described below.



NOTE

- When pressing the **ESC** key on the execution confirmation screen, the execution of the absolute reset is canceled.
- For details about how to operate the robot controller, see the "YAMAHA Robot Controller User's Manual".

Step 1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 2 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

Step 3 Move to a position where the origin position sticker can be seen.

Move to a position where the origin position sticker can be seen while holding the PBX. At this time, never enter the robot movement range.

Step 4 Display the "ORIGIN RTN (TRQ/SENS)" screen on the PBX (operation → return-to-origin).

Step 5 Display the "ORIGIN RTN (MARK)" screen.

Press **F1** (MARK) on the "ORIGIN RTN (TRQ/SENS)" screen.

Step 6 Select an axis whose absolute reset is performed.

Use the cursor keys (\uparrow / \downarrow) to select an axis number whose absolute reset is performed, and then press .

The execution confirmation screen will pop up.

Step 7 Perform the step movement.

Press the jog key to perform the step movement of the robot until the origin position marks are matched with each other.



CAUTION

Multiple absolute resettable positions exist discretely.

When moving the robot by pressing the jog key, all robot stop positions become absolute resettable positions.

Before performing the absolute reset, press the jog key again to move the axis left or right to check that the origin position marks are matched with each other correctly.

(See the figure below.)

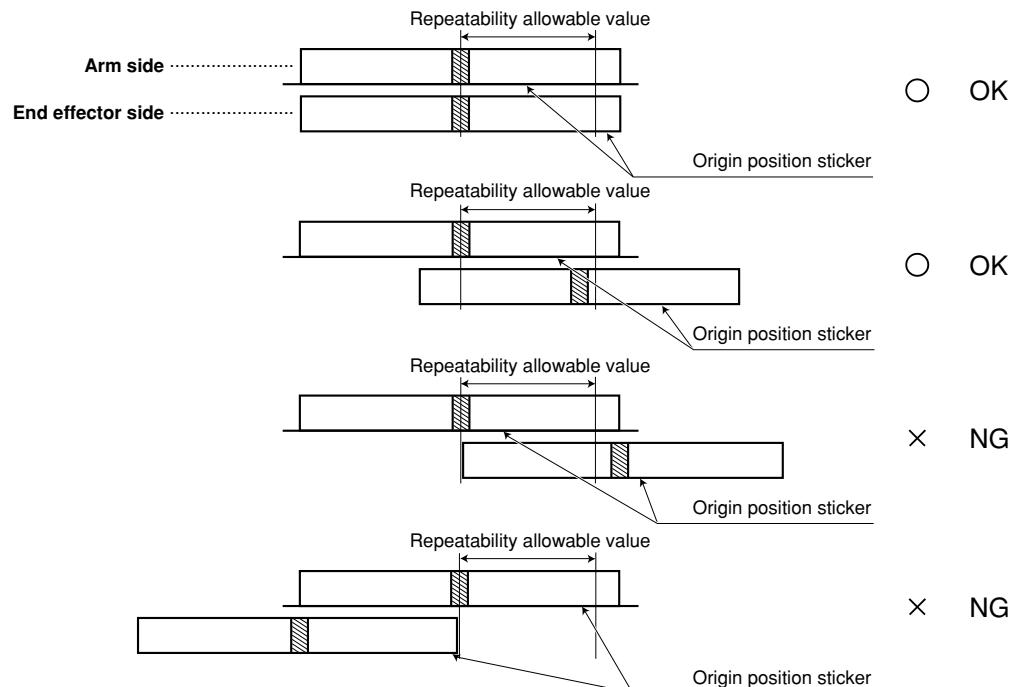
When performing the absolute reset again at the previous absolute reset position, the deviation between the origin position marks needs to be put in a certain range (repeatability allowable value). (See the figure below.) If the absolute reset is performed at a position exceeding the repeatability allowable value or at a position different from the previous absolute reset position, the position deviation may occur. When performing the absolute reset, take appropriate measures so that the deviation between the origin position marks is put in the repeatability allowable value range correctly.

The origin position repeatability allowable value of each axis is shown below.

Origin position repeatability allowable value.

axis	Origin position repeatability allowable value($^{\circ}$)
X	± 0.72
Y	± 0.72
R	± 3.00

Positional relationship between origin position stickers



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Step 8 Perform the absolute reset.

Press  on the "ORIGIN RTN (MARK)" pop-up screen to complete the absolute reset. After the absolute reset has been completed, the axis moves to the "0" pulse position.

2.4.2.2 Absolute reset in servo off state (re-reset)



WARNING

Be sure to press the emergency stop button and move the robot in the state where the servo on cannot be operated from the outside.

The operation procedure using the PBX is described below.



NOTE

- When pressing the **ESC** key on the execution confirmation screen, the execution of the absolute reset is canceled.
- For details about how to operate the robot controller, see the "YAMAHA Robot Controller User's Manual".

Step 1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 2 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

Step 3 Enter the safety enclosure.

Enter the safety enclosure while holding the PBX.

Step 4 Display the "ORIGIN RTN (TRQ/SENS)" screen on the PBX (operation → return-to-origin).

Step 5 Display the "ORIGIN RTN (MARK)" screen.

Press **F1** (MARK) on the "ORIGIN RTN (TRQ/SENS)" screen.

step 6 Move the arm to the position where the origin position marks are matched with each other.

Press the emergency stop button on the PBX to put the robot in the emergency stop state.



WARNING

Be sure to press the emergency stop button and move the robot in the state where the servo on cannot be operated from the outside.

Manually move the robot to a position where the origin position marks are aligned with each other.



CAUTION

To perform the absolute reset again at the same position as the previous absolute reset position, it is necessary to put the deviation between the origin position marks within a certain range (repeatability allowable value). (See the Fig. below.)

If the absolute reset is performed at a position exceeding the repeatability allowable value or a position different from the previous absolute reset position, the positional deviation may occur.

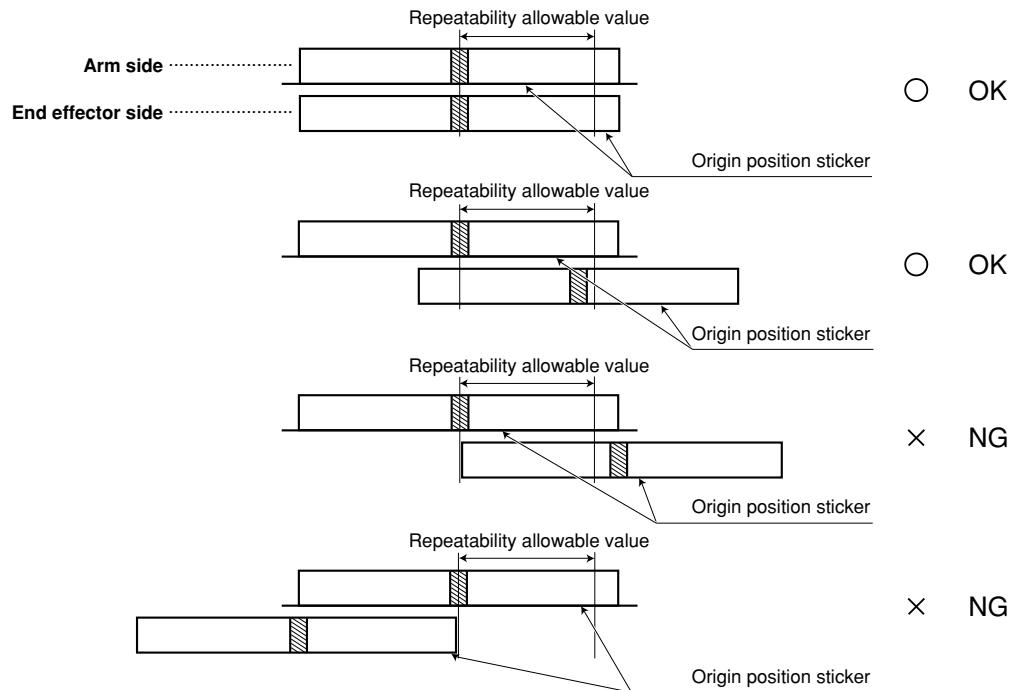
When performing the absolute reset, take appropriate measures so that the deviation between the origin position marks is put in the repeatability allowable value range correctly.

The origin position repeatability allowable value of each axis is shown below.

Origin position repeatability allowable value.

axis	Origin position repeatability allowable value(°)
X	±0.72
Y	±0.72
R	±3.00

Positional relationship between origin position stickers



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step 7 Check the machine reference value.

When the robot is moved to a position where the absolute reset is performed, check that the value of the selected axis is in the range between 26 and 74 on the PBX screen. (Normally, this value is 50.)

Step 8 Select an axis whose absolute reset is performed.

Use the cursor keys (/) to select an axis number whose absolute reset is performed, and then press .

The execution confirmation screen will pop up.

**CAUTION**

- There are multiple discrete positions where the absolute reset can be performed. Move the robot step-by-step while referring to the PBX screen. When the robot comes to a position near the return-to-origin position where the value of the selected axis on the PBX screen enters the range between 26 and 74, press the key.
- If the value of the selected axis is not in the range between 26 and 74, the message, "Position reset malposition", appears in the next operation and the absolute reset cannot be completed.

Step 9 Perform the absolute reset.

Press on the "ORIGIN RTN (MARK)" pop-up screen to complete the absolute reset.

Step 10 Go out of the safety enclosure.**Step 11 Release the emergency stop of the controller.**

After checking that no one is inside the safety enclosure, release the emergency stop of the controller.

2.4.2.3 Absolute reset in servo on state (new reset)


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 PBX is described below.


NOTE

- When pressing the **ESC** key on the execution confirmation screen, the execution of the absolute reset is canceled.
- For details about how to operate the robot controller, see the "YAMAHA Robot Controller User's Manual".

Step 1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 2 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

Step 3 Move to a position where the joint can be seen.

Move the robot to an arm position where the absolute reset is performed newly, and then move to a position where the joint can be seen while holding the PBX. At this time, never enter the robot movement range.

Step 4 Display the "ORIGIN RTN (TRQ/SENS)" screen on the PBX (operation → return-to-origin).

Step 5 Display the "ORIGIN RTN (MARK)" screen.

Press **F1** (MARK) on the "ORIGIN RTN (TRQ/SENS)" screen.

Step 6 Select an axis whose absolute reset is performed.

Use the cursor keys (**▲** / **▼**) to select an axis number whose absolute reset is performed, and then press **ENTER**.

Step 7 Perform the step movement.

Press the jog key to perform the step movement of the robot until the absolute reset position are matched with each other.


CAUTION

There are multiple discrete positions where the absolute reset can be performed.

When moving the robot by pressing the jog key, all robot stop positions become absolute resettable positions.

Step 8 Perform the absolute reset.

Press **ENTER** on the "ORIGIN RTN (MARK)" pop-up screen to complete the absolute reset.

After the absolute reset has been completed, the axis moves to the "0" pulse position.

Step 9 Move to the all-axis 0 pulse position.

When the absolute reset has been completed, move the robot to the all-axis 0 pulse position. For details about how to move to the 0 pulse position, refer to the "YAMAHA Robot Controller User's Manual".


CAUTION

Before affixing the origin position stickers, be sure to move the robot to the all axes "0" pulse position. If the robot is not moved to this position, the next absolute reset may not be performed correctly.

Step 10 Affix the origin position stickers.

After the robot has been moved to the all axes "0" pulse position, press the emergency stop button and affix the origin position stickers to legible positions. After that, these origin position stickers are used to perform the absolute reset again at the same position.

Degrease the origin position sticker affixing surface with alcohol, etc. After the surface has been dried, affix the sticker.



CAUTION

When the next absolute reset is performed at the same position, it is necessary to put the deviation between the origin position stickers in a certain range (repeatability allowable value). (See the Fig. below.)

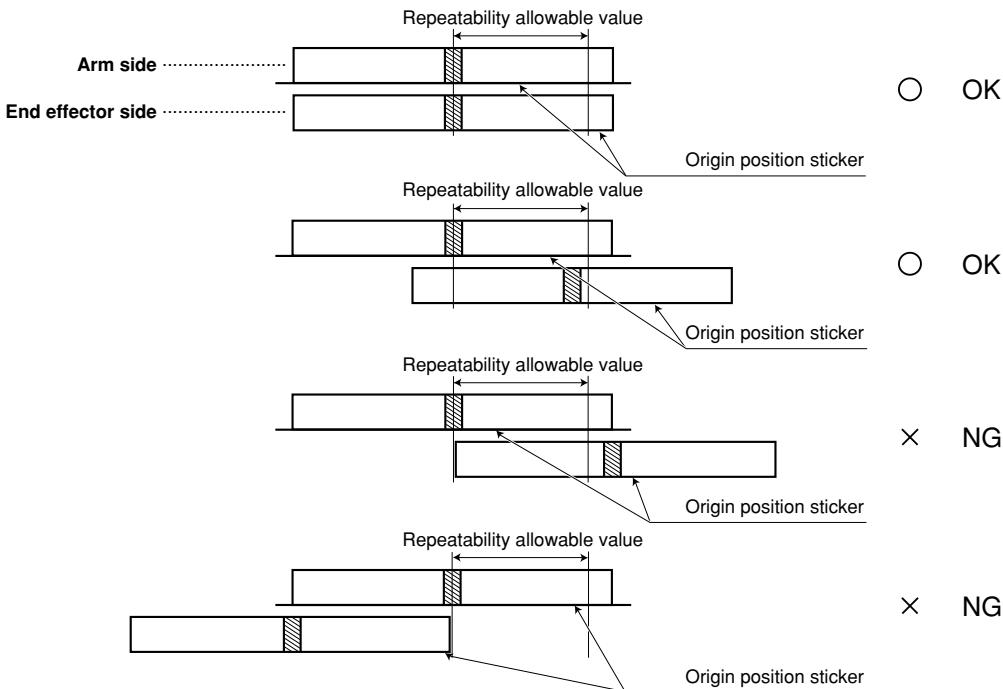
When affixing the origin position stickers, eliminate the deviation between the upper and lower stickers as much as possible so that the reset position can be understood securely during next absolute reset.

The origin position repeatability allowable value of each axis is shown below.

Origin position repeatability allowable value.

axis	Origin position repeatability allowable value(°)
X	±0.72
Y	±0.72
R	±3.00

Positional relationship between origin position stickers



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CAUTION

When affixing the origin position stickers, be careful not to move the joint of the robot. When the servo is turned off, the joint may move due to the harness reaction force depending on the arm position. If this symptom is predicted, determine other position where the joint does not move to the origin position.

Step 11 Go out of the safety enclosure.**Step 12** Release the emergency stop of the controller.

After checking that no one is inside the safety enclosure, release the emergency stop of the controller.

2.4.2.4 Absolute reset in servo off state (new reset)


WARNING

Be sure to press the emergency stop button and move the robot in the state where the servo on cannot be operated from the outside.


NOTE

- When pressing the **ESC** key on the execution confirmation screen, the execution of the absolute reset is canceled.
- For details about how to operate the robot controller, see the "YAMAHA Robot Controller User's Manual".

Step 1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 2 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

Step 3 Enter the safety enclosure.

Enter the safety enclosure while holding the PBX.

Step 4 Display the "ORIGIN RTN (TRQ/SENS)" screen on the PBX (operation → return-to-origin).

Step 5 Display the "ORIGIN RTN (MARK)" screen.

Press **F1** (MARK) on the "ORIGIN RTN (TRQ/SENS)" screen.

Step 6 Move the arm to the position where the origin position marks are matched with each other.

Press the emergency stop button on the PBX to put the robot in the emergency stop state.


WARNING

Be sure to press the emergency stop button and move the robot in the state where the servo on cannot be operated from the outside.

Manually move the robot to a position where the return-to-origin is performed.

Step 7 Check the machine reference value.

When the robot is moved to a position where the absolute reset is performed, check that the value of the selected axis is in the range between 26 and 74 on the PBX screen. (Normally, this value is 50.)

Step 8 Select an axis whose absolute reset is performed.

Use the cursor keys (**↑** / **↓**) to select an axis number whose absolute reset is performed, and then press **ENTER**.

The execution confirmation screen will pop up.


CAUTION

- There are multiple discrete positions where the absolute reset can be performed. Move the robot step-by-step while referring to the PBX screen. When the robot comes to a position near the absolute reset position where the value of the selected axis on the PBX screen enters the range between 26 and 74, press the **ENTER** key.
- If the value of the selected axis is not in the range between 26 and 74, the message, "Position reset malposition", appears in the next operation and the return-to-origin cannot be completed.

Step 9 Perform the absolute reset.

Press **ENTER** on the "ORIGIN RTN (MARK)" pop-up screen to complete the absolute reset.
After the absolute reset has been completed, the axis moves to the "0" pulse position.

Step 10 Move the robot to the all-axis 0 pulse position.

When the absolute reset has been completed, move the robot to the all-axis 0 pulse position. For details about how to move to the 0 pulse position, refer to the "YAMAHA Robot Controller User's Manual".


CAUTION

Before affixing the origin position stickers, be sure to move the robot to the all axes "0" pulse position. If the robot is not moved to this position, the next absolute reset may not be performed correctly.

Step 11 Affix the origin position stickers.

After the robot has been moved to the all-axis 0 pulse position, press the emergency stop switch and affix the origin position stickers supplied with the robot to easy-to-identify positions near the R-axis rotation part so that they can be used when the absolute reset is performed again at the same position. Degrease the origin position sticker affixing surfaces with alcohol. After the surfaces have been dried, affix the origin position stickers.

**CAUTION**

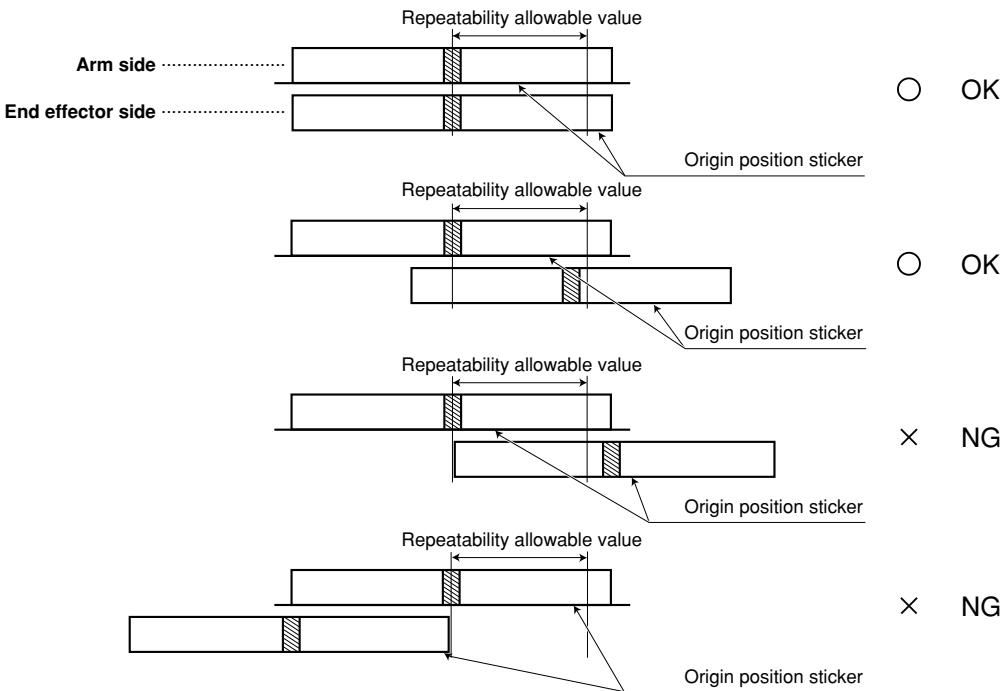
When the next absolute reset is performed at the same position, it is necessary to put the deviation between the origin position stickers in a certain range (repeatability allowable value). (See the Fig. below.)

When affixing the origin position stickers, eliminate the deviation between the upper and lower stickers as much as possible so that the reset position can be understood securely during next absolute reset.

The origin position repeatability allowable value of each axis is shown below.

Origin position repeatability allowable value.

axis	Origin position repeatability allowable value(°)
X	±0.72
Y	±0.72
R	±3.00

Positional relationship between origin position stickers

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**CAUTION**

When affixing the origin position stickers, be careful not to move the joint of the robot. When the servo is turned off, the joint may move due to the harness reaction force depending on the arm position. If this symptom is predicted, determine other position where the joint does not move to the origin position.

Step 12 Go out of the safety enclosure.**Step 13 Release the emergency stop of the controller.**

After checking that no one is inside the safety enclosure, release the emergency stop of the controller.

2.4.3 Sensor method (X-axis, Y-axis)

■ 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.
- When the return-to-origin direction is reversed, the origin position may not be the base front. When using the standard soft limit, the axis may collide with the mechanical stopper. At this time, set the soft limit 2° or more inward from the mechanical stopper while referring to "3. Setting the soft limits".

Follow the steps below to adjust the X-axis machine reference value.
Prepare a wrench for a width across flat of 13 mm.

step 1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

step 2 Perform the return-to-origin.

Perform the return-to-origin from outside the safety enclosure.

For details about how to perform the return-to-origin, refer to "2.3 Return-to-origin procedures" in this Chapter.

step 3 Check the machine reference value.

If the machine reference value displayed on the PBX is not in the range between 25 and 75 (recommended range) after the return-to-origin has been completed, follow the steps below to adjust the machine reference value.

step 4 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

step 5 Turn off the controller.

step 6 Enter the safety enclosure.

step 7 Put a mark at the origin position.

Scribe a 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.

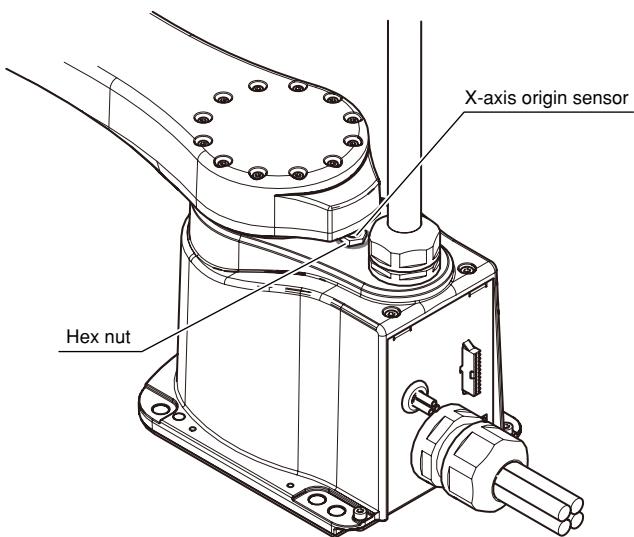
Step 8 Loosen the hex nut.

Using the wrench, loosen the hex nut that secures the X-axis origin sensor.

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**CAUTION**

It is enough to loosen the nut. Do not remove the nut completely.

Step 8-10 Adjusting the X-axis machine reference value**Step 9 Move the X-axis origin sensor.**

Move the X-axis origin sensor as follows.

Determine the distance between the sensor and dog to 0.2 to 0.8 mm so that the sensor does not collide with the dog.

To decrease the X-axis machine reference value, move the sensor away from the dog.

To increase the X-axis machine reference value, put the sensor close the dog.

Step 10 Secure the X-axis origin sensor with the hex nut.

Secure the X-axis origin sensor with the hex nut.

Tightening torque	5Nm (50kgfcm)
Tool	KANON (Nakamura Mfg. Co., Ltd.)
Torque wrench	N190SPK 13

Step 11 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 12 Perform the return-to-origin.

Perform the return-to-origin from outside the safety enclosure.

Step 13 Check the machine reference value.

1. After the return-to-origin has been completed, read the machine reference value displayed on the PBX.
2. If the machine reference value is in the range between 25 and 75 (recommended range), the adjustment of the machine reference value is then completed.
3. If it is outside the recommended range, then repeat the procedure from step 9 again to readjust it.

Step 14 Turn off the controller.**Step 15 Go out of the safety enclosure.**

■ 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.

Follow the steps below to adjust the Y-axis machine reference value.

Prepare a wrench for a width across flat of 13 mm.

Step 1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 2 Perform the return-to-origin.

Perform the return-to-origin from outside the safety enclosure.

For details about how to perform the return-to-origin, refer to "2.3 Return-to-origin procedures" in this Chapter.

Step 3 Check the machine reference value.

If the machine reference value displayed on the PBX is not in the range between 25 and 75 (recommended range) after the return-to-origin has been completed, follow the steps below to adjust the machine reference value.

Step 4 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

Step 5 Turn off the controller.

Step 6 Enter the safety enclosure.

Step 7 Put a mark at the origin position.

Scribe a 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.

Step 8 Loosen the hex nut.

Using the wrench, loosen the hex nut that secures the Y-axis origin sensor.

23308-FV-02

**CAUTION**

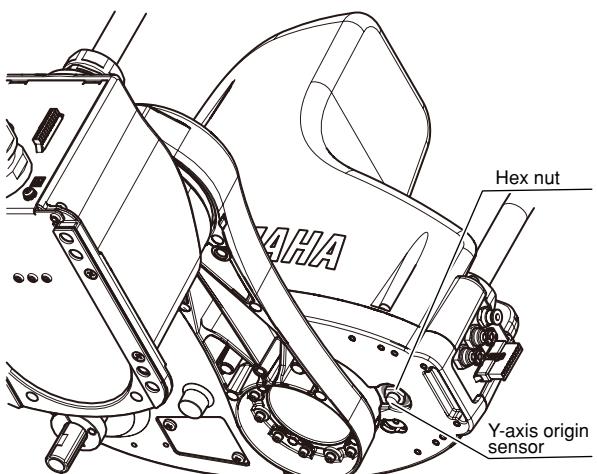
It is enough to loosen the nut. Do not remove the nut completely.

Step 9 Move the Y-axis origin sensor as follows.

Move the Y-axis origin sensor as follows. Determine the distance between the sensor and dog to 0.2 to 0.8mm.

To decrease the Y-axis machine reference value, move the sensor away from the dog.

To increase the Y-axis machine reference value, put the sensor close the dog.

Step 8-10 Adjusting the Y-axis machine reference value**CAUTION**

Pay special attention so that the sensor does not collide with the dog.

Step 10 Secure the Y-axis origin sensor with the hex nut.

Secure the Y-axis origin sensor with the hex nut.

Tightening torque	5Nm (50kgfcm)
Tool	KANON (Nakamura Mfg. Co., Ltd.)
Torque wrench	N190SPK 13

Step 11 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 12 Perform the return-to-origin.

Perform the return-to-origin from outside the safety enclosure.

Step 13 Check the machine reference value.

- After the return-to-origin has been completed, read the machine reference value displayed on the PBX.
- If the machine reference value is in the range between 25 and 75 (recommended range), the adjustment of the machine reference value is then completed.
- If it is outside the recommended range, then repeat the procedure from step 9 again to readjust it.

Step 14 Turn off the controller.**Step 15 Go out of the safety enclosure.**

3. Changing the origin position of X/Y-axis

YK510XE YK610XE YK710XE

The origin position of X-axis and Y-axis can be changed by 90 degrees clockwise and counterclockwise from the front position of the X-axis and Y-axis arm base by attaching a bolt to the origin position change dog as shown in the figure below.



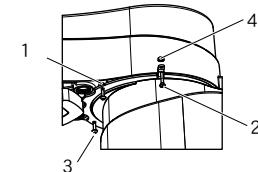
CAUTION

The dog for changing the origin position (Hereafter, origin position change dog) must be purchased separately.

■ X-axis origin shift

No.	Name	Part No.	Q'ty
1	Origin position change dog	KFS-M1534-00	1
2	BOLT	98502-03014	1
3	BOLT	92012-03008	2
4	NUT	95302-03600	1

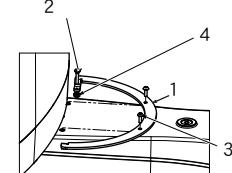
X-axis origin shift



■ Y-axis origin shift

No.	Name	Part No.	Q'ty
1	Origin position change dog	KFS-M1535-00	1
2	BOLT	98502-03014	1
3	BOLT	92012-03008	2
4	NUT	95302-03600	1

Y-axis origin shift

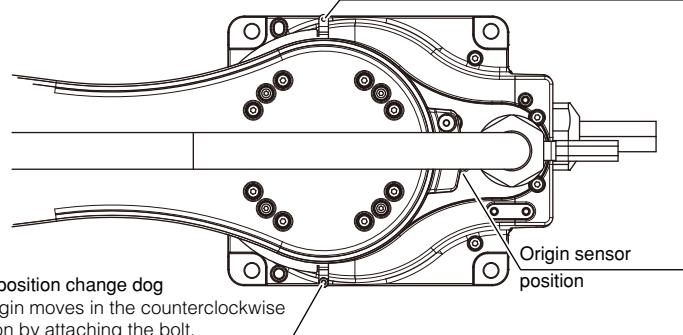


3.1 Setting and installation

Relationship between origin position change dog and bolt

For X-axis

Origin position change dog
The origin moves in the clockwise direction by attaching the bolt.



23411-FV-02

step 1 Place a sign indicating the robot is being adjusted.

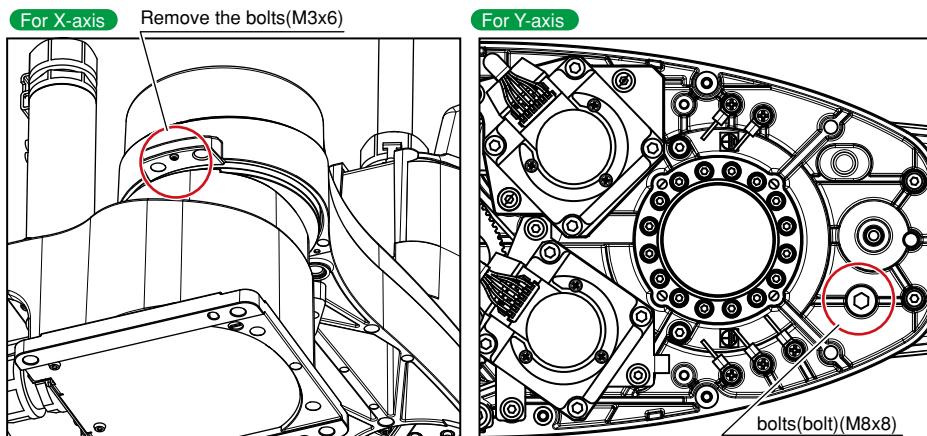
Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

step 2 Turn off the controller.

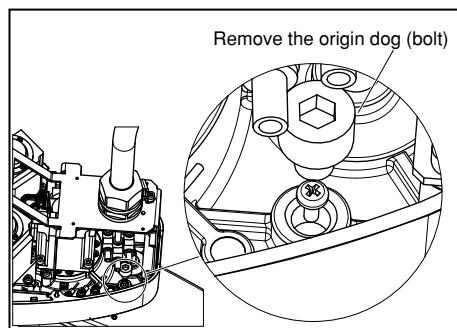
step 3 Enter the safety enclosure.

Step 4 Remove the original origin dog (bolt; see Fig. below).

► **Step 4** Installing the dog



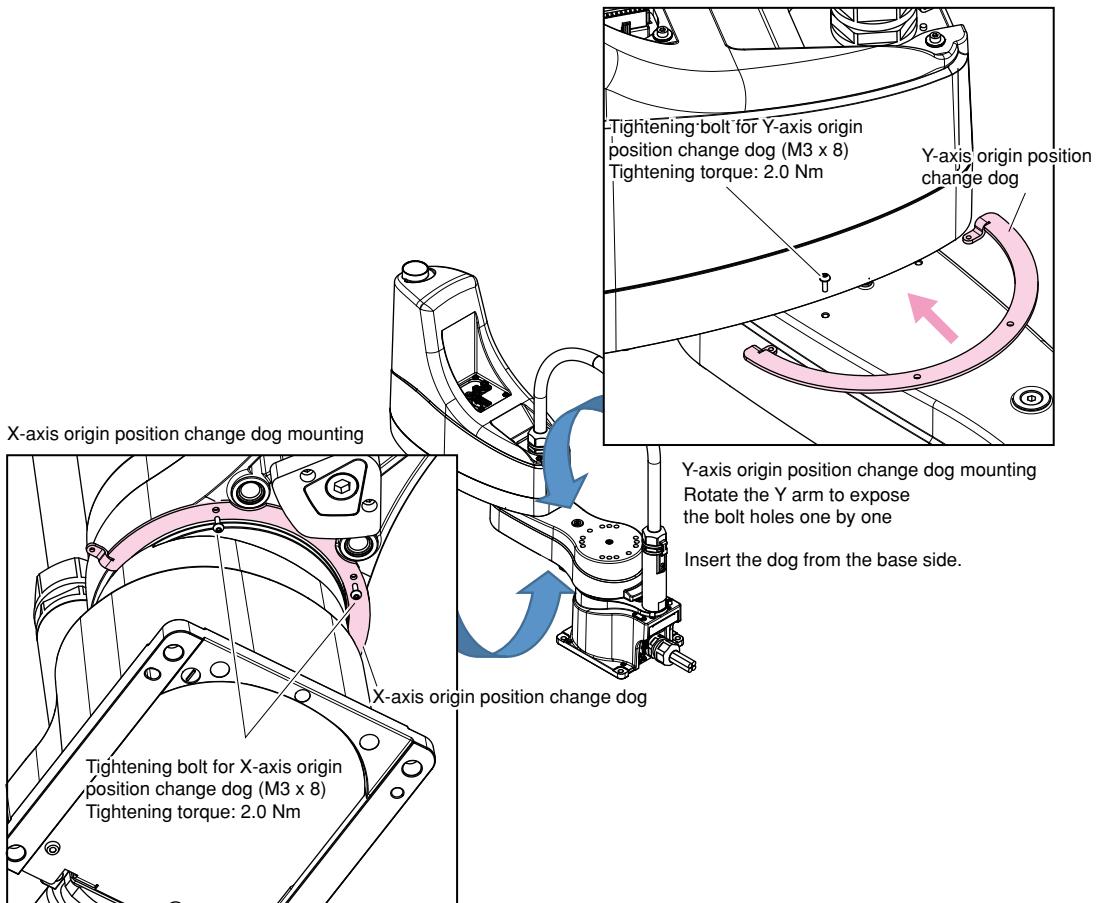
Remove the origin dog (bolt) attached to arm X from the through hole from which the Y arm bolt has been removed.



23457-FV-00

Step 5 Install the origin position change dog.

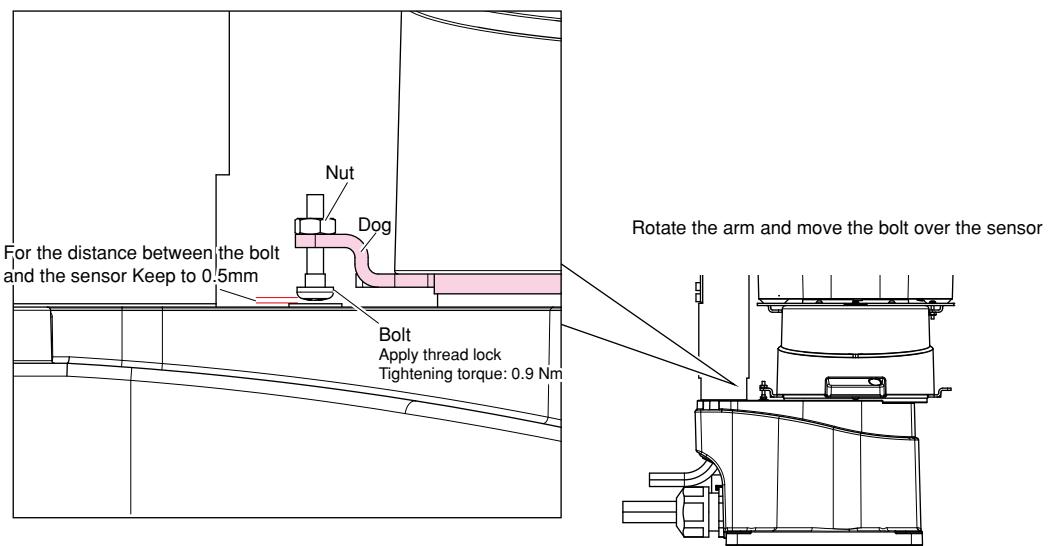
► **Step 5** Installing the origin position change dog.



23412-FV-00

step 6 Attach the bolts to the origin position change dog.

► **Step 6** Bolt Installation



21413-FV-00

step 7 Turn on the controller.

Turn on the controller after confirming that there is nobody in the safety protection fence.

step 8 Return to origin.

Move the arm in the -direction relative to the new origin before returning it to the origin.

Return to the origin from outside the safety enclosure.

step 9 Check the machine reference value.

- 1 Read the machine reference value displayed on PBX after completion of origin return.
- 2 If the machine reference value is between 25 and 75 (recommended value), adjustment of the machine reference value is complete.
- 3 If not, see "2.4 Adjusting the machine reference value" in this chapter.

Step 10 Turn off the controller.

4. Setting the soft limits

On the YK-XE series, the working envelope during jog movement and automatic operation can be limited by specifying a "+" soft limit [pulse] and a "-" soft limit [pulse]. 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.

**CAUTION**

If you want to check the soft limits by operating the robot, perform jog operation from outside the safety enclosure.

**NOTE**

Refer to the "YAMAHA Robot Controller User's Manual" for further details.

Also refer to "1.2 External view and dimensions" in Chapter 8 for the working envelope area.

4.1 Setting the X-axis and Y-axis soft limits

The X-axis and Y-axis have mechanical stoppers for protection of internal wiring outside their movement ranges. The soft limits must be set within the working envelope or the inside of the interference position with peripheral equipment (this must be within the working envelope). If the working envelope during robot work is small or if the robot interferes with the peripheral equipment, narrow the working envelope.

Follow the steps below to set the soft limits.

Step 1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 2 Press the emergency stop button.

Press the emergency stop button on the PBX to put the robot in the emergency stop status.

**NOTE**

For details about emergency stop and how to cancel the emergency stop, see the "YAMAHA Robot Controller User's Manual".

Step 3 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

Step 4 Enter the safety enclosure while holding the PBX.**Step 5 Move the X-axis and Y-axis arms by hand.**

Move the X-axis and Y-axis to the mechanical stopper positions or to the point where interference with the peripheral equipment occurs.

Step 6 Note the pulse values.

Read the X-axis and Y-axis plus (+) and minus (-) direction pulses displayed on the PBX in step 5 and note them.

**CAUTION**

- Before cancelling the emergency stop, check from outside the safety enclosure that no one is inside the safety enclosure.
- Set the soft limits from outside the safety enclosure.

Step 7 Set the soft limits.

Set the soft limits to within the figure for the X-axis and Y-axis encoder pulses that you have noted in step 6.

**NOTE**

For details about how to set the soft limits, see the "YAMAHA Robot Controller User's Manual".

**CAUTION**

- The origin position factory-adjusted at shipment is not completely aligned with the front face position of the robot. When installing the robot, be sure to set the soft limits with the number of pulses from the origin position (0 pulse position).
- 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.

4.2 Setting the Z-axis soft limits


CAUTION

Set the Z-axis soft limits from outside the safety 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.


CAUTION

Overloads may occur if the soft limit is almost near the encoder pulse of 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.

4.3 Setting the R-axis soft limits


CAUTION

Set the R-axis soft limits from outside the safety enclosure or after the emergency stop button has been pressed in the same manner as the X-axis and Y-axis soft limits.

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.

4.4 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

	X-axis	Y-axis	Z-axis	R-axis
YK400XE	50	50	12mm	12
YK510XE / YK610XE / YK710XE	80	50	20mm	15

Operation angle/distance vs. number of resolver pulses

X, Y and R-axis

Axis	Speed ratio	Angle/position	Resolver pulses
R	12	360°	245760
R	15	360°	307200
Z	1	12mm	20480
Z	1	20mm	20480
X/Y	50	360°	1024000
X	80	360°	1310720

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. The tip of the robot arm can be moved orthogonally.
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.

4

Robot settings

Step 1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 2 Check that the soft limits are correctly set.

If not correctly set, adjust the soft limits while referring to "3. Setting the soft limits".

Step 3 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

Step 4 Enter the safety enclosure while holding the PBX.

At this time, stay outside the robot movement range.



CAUTION

Never enter the robot movement range.

Step 5 Set the standard coordinates.

See RCX340 Operation manual "Standard coordinates"

For direct teaching

See RCX340 Operation manual "Servo operation"



WARNING

The Z-axis will slide down when the brake is released, causing a hazardous situation.

- Prop up the Z-axis with a support stand before releasing the brake.
- Be careful not to let your body get caught between the Z-axis and the installation base before releasing the brake.



NOTE

The next section, "4.1 Standard coordinate setting using a standard coordinate setup jig (option)", describes how to set the standard coordinates more accurately using an optional setup jig.

Step 6 Check that the standard coordinates are set correctly.

1. Does jog operation (millimeter coordinate system) move the robot arm tip at right angles?
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 points 1 and 2 shown above 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 YK400XE

Use a standard coordinate setup jig (option) to set the standard coordinates more accurately. The following describes how to set the standard coordinates using the standard coordinate setup jig.

Standard coordinate setup jig (option)

Part No.	Name	Q'ty
99480-06018	Pin	1
KFS-M1577-10	Shaft	1
91312-04065	Bolt	1

Step 1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 2 Put the robot in the emergency stop status.

Press the emergency stop button on the PBX to put the robot in the emergency stop status.



NOTE

For details about emergency stop and how to cancel the emergency stop, see the "YAMAHA Robot Controller User's Manual".

Step 3 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

Step 4 Enter the safety enclosure while holding the PBX.

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Step 5 Insert the shaft.

1. Make the adjustment so that the X-axis arm and Y-axis arm are aligned on an almost straight line.
2. Adjust the arm positions so that the shaft enters the slot in the Y-axis arm and the hole in the X-axis arm without prying, and then insert the shaft.

Step 6 Secure the shaft with the bolts.

Tighten the bolts so that the shaft does not move.

Step 7 Insert the pin.

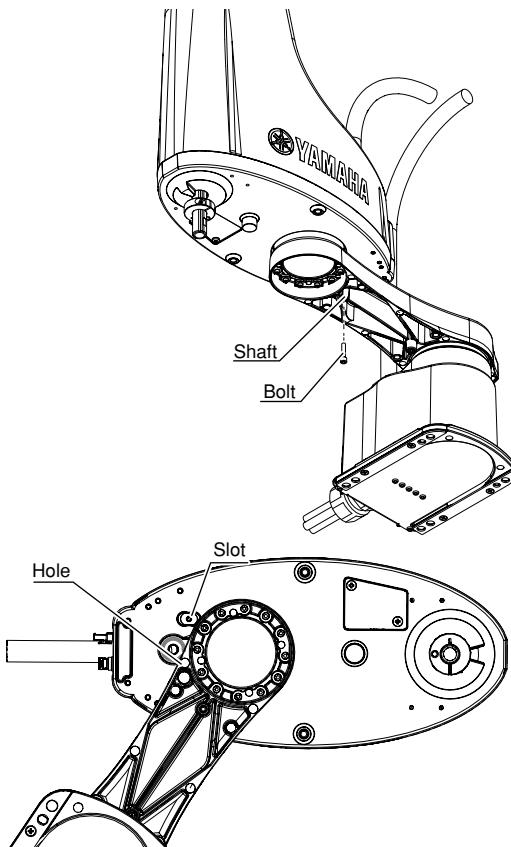
Insert the pin into the hole in the base as shown in the Fig.

23312-FV-00

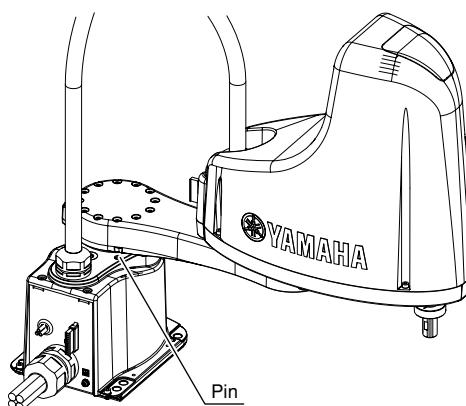
Step 8 Make a note of the Y-axis position pulse value.

1. Access the "Jog" screen.
2. Lightly apply a clockwise torque to the Y-axis while holding the X-axis.
3. Make a note of the Y-axis position pulse value displayed on (CURRENT) when the torque is unloaded.
4. Lightly apply a counterclockwise torque to the Y-axis while holding the X-axis.
5. Make a note of the Y-axis position pulse value displayed on (CURRENT) when the torque is unloaded.

▶ Step 5-6 Installing the Y-axis standard coordinate jig



▶ Step 7 Installing the X-axis standard coordinate jig



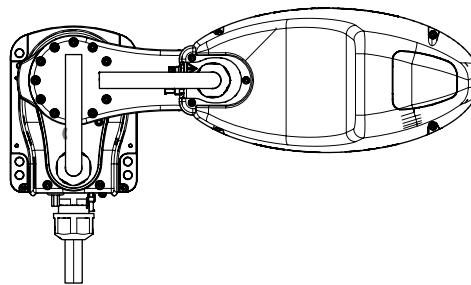
Step 9 Put the X-axis arm in contact with the X-axis standard coordinate setting jig.

Put the X-axis arm in contact with the standard coordinate setup jig as shown in the figure. At this time, make a note of the X-axis position pulse value displayed on (CURRENT).

23310-FV-00

▶ Step 9

Putting the X-axis arm in contact with the X-axis standard coordinate setting jig



Step 10 Enter the axis parameter "ARM LENGTH".

Enter the following values (arm length values) in the axis parameter "ARM LENGTH" A1 and A2.

A1 (X-axis arm length)	A2 (Y-axis arm length)
225	175

Step 11 Enter the axis parameter "OFFSET PULSE".

Enter the values shown on the right in the axis parameter "OFFSET PULSE".

23304-FK-00

▶ Step 11 Entering the "Offset pulse" values

A1= X-axis position pulse value you have made a note of in step 9

A2= $\frac{\text{Y-axis position pulse value you have made a note of in step 8 (clockwise)} + \text{Y-axis position pulse value you have made a note of in step 8 (counterclockwise)}}{2}$

Note) Round off the decimal part of the A2 value.

Step 12 Remove the standard coordinate jig.

5.2 Standard coordinate setting using a standard coordinate setup jig **YK510XE** **YK610XE** **YK710XE**

Use a standard coordinate setup jig (option) to set the standard coordinates more accurately. The following describes how to set the standard coordinates using the standard coordinate setup jig.

Standard coordinate setup jig (option)

Part No.	Name	Q'ty
KFS-M1577-10	Shaft	1
91312-04065	Bolt	1

Step 1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 2 Put the robot in the emergency stop status.

Press the emergency stop button on the PBX to put the robot in the emergency stop status.



NOTE

For details about emergency stop and how to cancel the emergency stop, see the "YAMAHA Robot Controller User's Manual".

Step 3 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

Step 4 Enter the safety enclosure while holding the PBX.

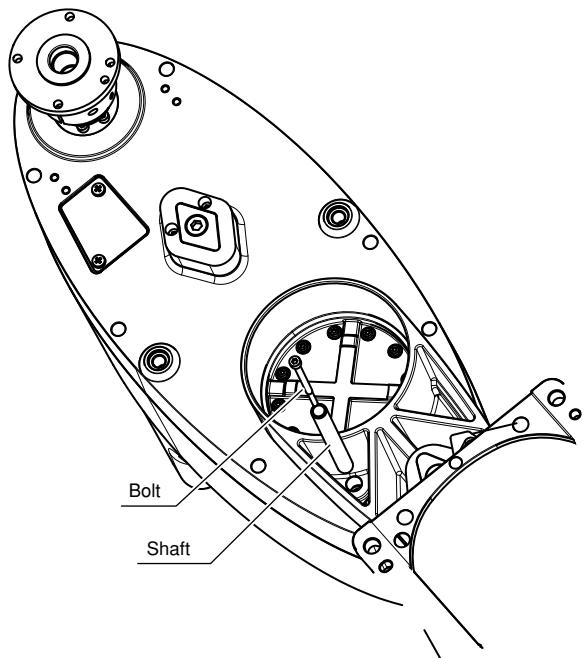
step 5 Insert the shaft.

1. Make the adjustment so that the X-axis arm and Y-axis arm are aligned on an almost straight line.
2. Adjust the arm positions so that the shaft enters the slot in the Y-axis arm and the hole in the X-axis arm without prying, and then insert the shaft.

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step 6 Secure the shaft with the bolts.

Tighten the bolts so that the shaft does not move.

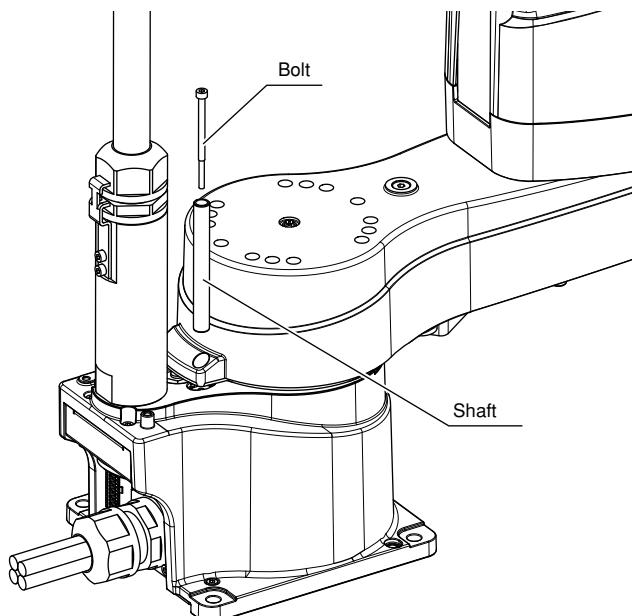
▶ Step 5-6 Attaching the Y-axis reference coordinate jig**step 7 Make a note the pulse value at the X-axis position.**

1. Access the "Jog" screen.
2. Lightly apply clockwise torque to the X-axis.
3. Make a note of the X-axis pulse value displayed in (CURRENT) when the torque is unloaded.
4. Lightly apply counter-clockwise torque to the X-axis.
5. Make a note of the X-axis pulse value displayed in "CURRENT" when the torque is unloaded.

23312-FV-00

step 8 Make a note of the pulse value at the Y-axis position.

1. Access the "Jog" screen.
2. Lightly apply a clockwise torque to the Y-axis while holding the X-axis.
3. Make a note of the Y-axis position pulse value displayed on (CURRENT) when the torque is unloaded.
4. Lightly apply a counterclockwise torque to the Y-axis while holding the X-axis.
5. Make a note of the Y-axis position pulse value displayed on (CURRENT) when the torque is unloaded.

▶ Step 5-6 Attaching the X-axis reference coordinate jig**step 9 Enter the axis parameter "ARM LENGTH".**

Enter the following values (arm length values) in the axis parameter "ARM LENGTH" A1 and A2.

	A1 (X-axis arm length)	A2 (Y-axis arm length)
YK510XE	235	275
YK610XE	335	
YK710XE	435	

Step 10 Enter the axis parameter "OFFSET PULSE".

Enter the values shown on the right in the axis parameter "OFFSET PULSE".

Step 11 Remove the standard coordinate jig.**Step 11** Entering the "Offset pulse" values

$$A1 = \frac{YX\text{-axis position pulse value in step 7 (clockwise)} + X\text{-axis position pulse value in step 7 (counterclockwise)}}{2} - 327680$$

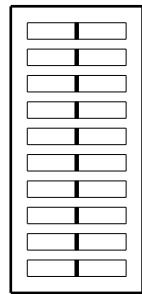
$$A2 = \frac{Y\text{-axis position pulse value in step 8 (clockwise)} + Y\text{-axis position pulse value in step 8 (counterclockwise)}}{2}$$

Note) Round off the decimal part.

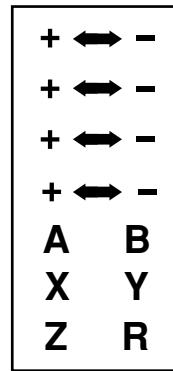
6. Affixing the stickers for origin positions, movement directions, and axis names

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

Origin position stickers, direction of movement and axis name stickers



Origin position stickers



Direction of movement and axis name stickers

23305-F6-00



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.

Step 1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

Step 2 Move the robot to the 0 pulse position.



NOTE

For details about how to move the robot to the 0 pulse position, see "8. Point trace function" in Chapter 3 of the "RCX340 User's Manual".

Step 3 Turn off the controller.

Step 4 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

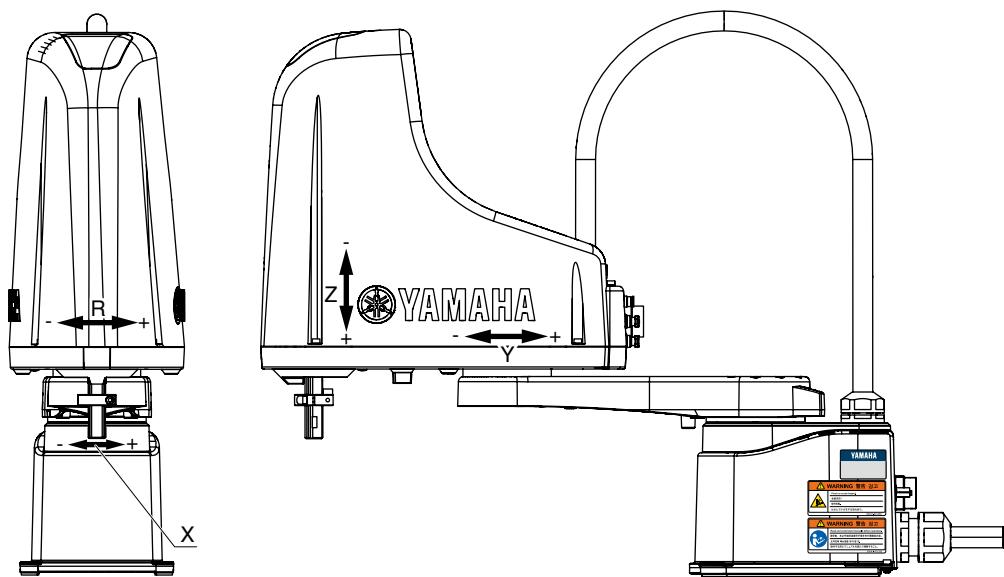
Step 5 Enter the safety enclosure.

Step 6 Affix the stickers.

Being careful not to move the origin positions, affix the stickers at legible points on matching sides of components such as the robot arm of each axis, base, and end effector. Affix stickers nearby showing the axis name and movement direction.

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.

Sticker affixing positions (example)



23305-FV-01

Chapter 5

Periodic inspection

Contents

1. Overview	5-1
2. List of inspection items	5-2

1. Overview

Daily and periodic inspection of the YAMAHA robot is essential in order to ensure safe and efficient operation. The periodic inspection for YK-XE series consists of daily inspection and 6-month inspection. Be sure to perform the daily inspection before starting the robot and after completion of the day's work. For details about inspection items, see "2. List of inspection items" in the next section. For details about how to perform the periodic inspection, see the separate Maintenance Manual for YK-XE series.

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



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.

■ Cautions on daily inspection



CAUTION

- Read "2. Qualification of operators/workers" in section 4.1 of the Safety Guide and allow only qualified engineers to perform the periodic inspection while referring to the separate Maintenance Manual. Or, perform the periodic inspection with engineers having the qualification of operators/workers attended.
- 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.
- When inspection is required inside the safety enclosure, always turn off the controller and also the external switch board.
- If the inspection or maintenance procedure calls for operation of the robot, stay outside the safety enclosure.
- Place a sign indicating the robot is being inspected, to keep others from operating the controller switch, programming box (PBX) or operation panel.
- Use only the lubricants specified by your distributor.
- To check the operation after inspection, refer to the separate volume "Safety Guide".



NOTE

For precautions on handling the controller, refer to the "YAMAHA Robot Controller User's Manual".

■ Cautions on 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 YAMAHA is used, the service life of the ball screw and ball spline will shorten.

2. List of inspection items

**WARNING**

Engineers who have the qualification in conformity with "2. Qualification of operators/workers" in section 4.1 of the Safety Guide must perform the inspection items requiring the cover removal while referring to the separate YK-XE Series Maintenance Manual.

**CAUTION**

The Z-axis will slide down when the brake is released with the brake release switch (optional for YE-XE) or the programming box, causing a hazardous situation.

- Prop up the Z-axis with a support stand before releasing the brake.
- Be careful not to let your body get caught between the Z-axis and the installation base before releasing the brake.

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

Location	Contents	Daily	6-month	Cleaning	Adjustment	Replacement
■ Inspection with the controller turned off						
Machine harness Robot cable	<ul style="list-style-type: none"> • Check for scratch, dent, or excessive bend. • Check for damage. 	● ●			○	
Cables prepared by user	• Check for scratch, dent, or excessive bend.	●			○	○
Regulator Joint Air tube Solenoid valve Air cylinder	<ul style="list-style-type: none"> • Check that the air pressure level is correct. • Check for air leak. • Check that the drain is discharged. • Check the air filter for contamination or damage. 	● ● ● ●			○ ○ ○	○
Exterior of robot	• Check for damage.	●				△
Wires and tubes (Optional user wiring/tubing through spline type)	• Check for damage to the wiring that runs through the robot.	●				○
Wires, tubes and cap (Optional user wiring/tubing through cap type)	<ul style="list-style-type: none"> • Check for wear on cap. • Check for sufficient silicon grease • Check that the through-hole wiring moves smoothly. 	● ● ●			○ ○ ○	
Major bolts and screws of robot main body (those exposed to the outside)	• Check for looseness. (*1)		●		○	
Belt	• Check that the belt tension is appropriate.		●		○	
Detection parts of X-axis and Y-axis origin sensors	• Check for contamination.		●		○	
Controller	<ul style="list-style-type: none"> • Check the terminal on the outside of the controller for looseness. • Check the connection connector for looseness. (*2) 		● ●		○ ○	
Application of grease to Z-axis spline and Z-axis ball screw (*3)	• After removing old grease with a waste cloth, replenish L100 (KDS-M7122-00).		●			
Z-axis ball screw and ball spline	• Check for play.		●		○	△
■ Inspection with the controller turned on						
Safeguard enclosure	<ul style="list-style-type: none"> • Check that the safeguard enclosure is located at its specified position. • Check that the emergency stop turns on when the safeguard enclosure is open. • Check that the warning label is affixed to the entrance. 	● ● ●			○ ○ ○	
Emergency stop button	• Check that the emergency stop turns on when pressed.	●			○	
Robot operation	• Check for unusual operation, vibration, or noise.	●				△

Location	Contents	Daily	6-month	Cleaning	Adjustment	Replacement
Functional check of Z-axis brake (*4)	• Drop amount from the Z-axis rest state is 3 mm or less.	●			△	
Functional check of Brake release switch (optional to YK-XE) and Brake release switch of programming box (*6)	• Check that the Z-axis moves when pressing the switch and does not move when releasing the switch.	●			○	
Air cooling fan of the controller	• Check that the fan rotates.		●	○		
	• Check for object blocking the fan.		●	○		
	• Check for noise during rotation. (*5)		●	○	△	
	• Check the fan cover for contamination.		●	○		△

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

*2: For details, see "4. Robot cable connection" in Chapter 2.

*3: For detail about how to apply the grease, see the separate Maintenance Manual.

*4: When the emergency stop button is pressed outside the safeguard enclosure or when the controller power is turned off, visually inspect the Z-axis brake.

*5: If any object is found through the visual inspection, remove it. If noise is heard even when no object is found, contact your distributor.

*6: To perform the functional check, make an emergency stop beforehand and follow the WARNING for brake release.

Bolt tightening torque

Bolt size	Tightening torque (kgfcm)	Tightening torque (Nm)
M3 set screw	7	0.69
M4 set screw	17	1.7
M3	20	2.0
M4	46	4.5
M5	92	9.0
M6	156	15.3
M8	380	37
M10	459	45.0

Chapter 6

Harmonic drive replacement period

Contents

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2. Replacement period	6-2

1. Overview

The YK-XE series robots uses a harmonic drive as the speed reduction gear for the X and Y axes. Harmonic drives need to be replaced after specified operation hours have elapsed. Use the guideline explained below to determine the replacement period and replace the harmonic drive periodically. Since the YK-XE series robots listed below use long-life harmonic grease, it is not necessary to replace the harmonic grease.



WARNING

Engineers who have the qualification in conformity with "2. Qualification of operators/workers" in section 4.1 of the Safety Guide must perform the harmonic drive replacement while referring to the separate YK-XE Series Maintenance Manual.

2. 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.

$$\text{Replacement period} = 8.4 \times 10^8 / (n \times 60 \times h \times D \times N \times \theta) \text{ years}$$

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 YK-XE series robots can be calculated as follows.

n : 10
 θ : 0.25
N : 50
h : 24 hours per day
D : 240 days per year

$$\begin{aligned}\text{Replacement period} &= 8.4 \times 10^8 / (n \times 60 \times h \times D \times N \times \theta) \\ &= 8.4 \times 10^8 / (10 \times 60 \times 24 \times 240 \times 50 \times 0.25) \\ &= 19.4 \text{ years}\end{aligned}$$

Harmonic drive speed reduction ratio

Robot model	X-axis	Y-axis
YK400XE	50	50
YK510XE / YK610XE / YK710XE	80	50

Chapter 7

Increasing the robot operating speed

Contents

1. Increasing the robot operating speed	7-1
1.1 Increasing speed by arch motion	7-1
1.2 Increasing the speed with the WEIGHT statement	7-3
1.3 Increasing the speed by the tolerance parameter	7-4
1.4 Increasing the speed by the OUT effective position parameter	7-5

1. Increasing the robot operating speed

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

1.1 Increasing speed by arch motion

[Also refer to:]

Programming manual

(MOVE Arch motion setting)

1. Gate motion

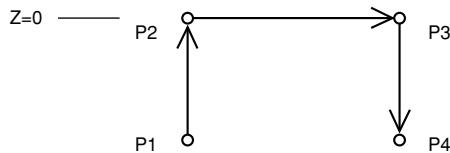
From point P1 to P4 via P2 and P3:

MOVE P, P2

MOVE P, P3

MOVE P, P4

Gate motion



23601-F0

2. Arch motion

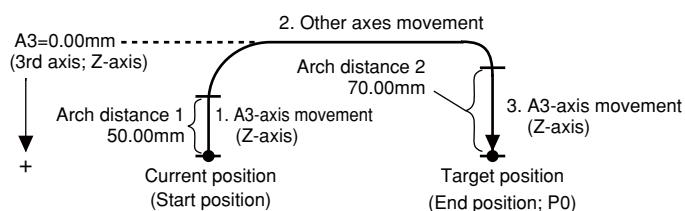
From the state of being at the starting point to P0:

MOVE P,P0,A3=0.00 {50.00, 70.00}

The A3-axis moves from the current position to the "0.00 mm" position.

After that, other axes move to P0. Finally, the A3-axis moves to P0.

Arch motion:



23602-FV

Compared to the gate motion in 1., the cycle time is shortened because the path draws an arc.

It is necessary to pay attention to the interference with the objects inside and outside the path during the operation.

1.2 Increasing the speed with the WEIGHTG statement

[Also refer to:]

Robot controller user's manual

(Robot parameters Tip weight)

Programming manual

(WEIGHTG)

[Example]

From P1 when chuck is open:

WEIGHTG 5000Changes the tip weight parameter to 5kg(5000g) (no workpiece).

MOVE P, P2, A3=0

DO3 (0) = 1Chuck closes.

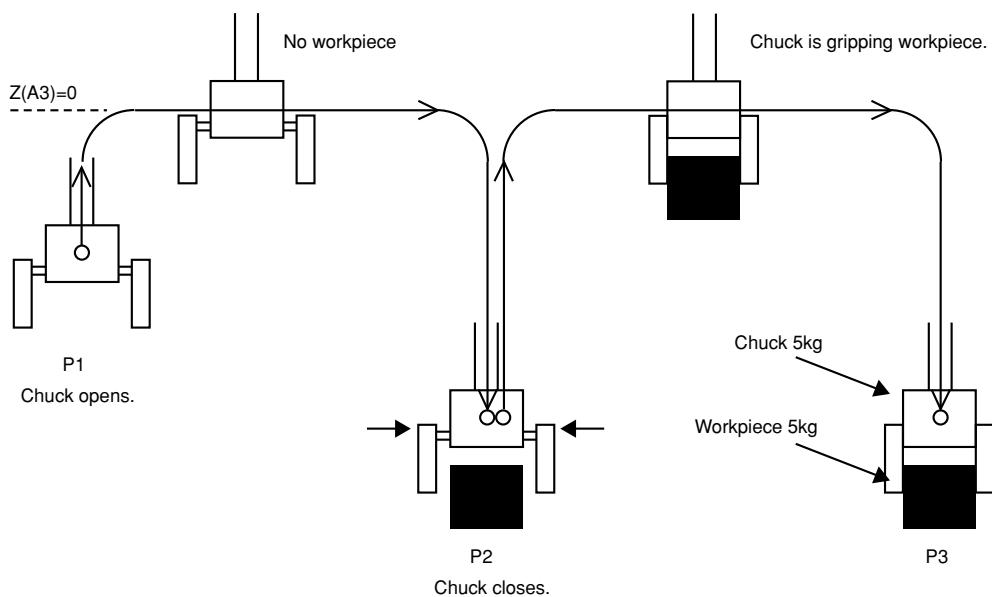
WEIGHTG 10000.....Changes the tip weight parameter to 10kg(10000g) (with workpiece).

MOVE P, P3,A3=0

When the workpiece is not held, increase the acceleration by setting the tip mass to 5kg, and when the workpiece is held, reduce the acceleration by setting the tip weight to 10kg .

The cycle time is shortened because the acceleration when the work piece is not held increases than when the mass at the tip of the axis parameter is set to 10kg .

Increasing the speed with the WEIGHTG statement



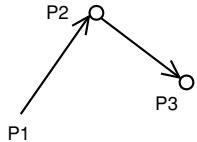
23604-FV

1.3 Increasing the speed by the tolerance parameter

[Also refer to:]

Robot controller user's manual
(Axis parameters Tolerance)
Programming manual
(TOLE)

Increasing the speed by the tolerance parameter



23605-F0

[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 Decreases the tolerance at P3.

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".

If P2 is a transit point whose location does not need to be specified precisely, speed can be increased by increasing the tolerance of positioning at P2.

Specifying a greater tolerance will produce increased sound and vibration when the robot is operating, and will make the movement path irregular, so pay attention to the sound, vibration, and movement path as you increase the tolerance little by little from the default value. In general, you should consider 2048 for each axis to be the maximum value.

1.4 Increasing the speed by the OUT effective position parameter

[Also refer to:]

Robot controller user's manual

(Axis parameters Out valid position)

Programming manual

(OUTPOS)

[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)

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

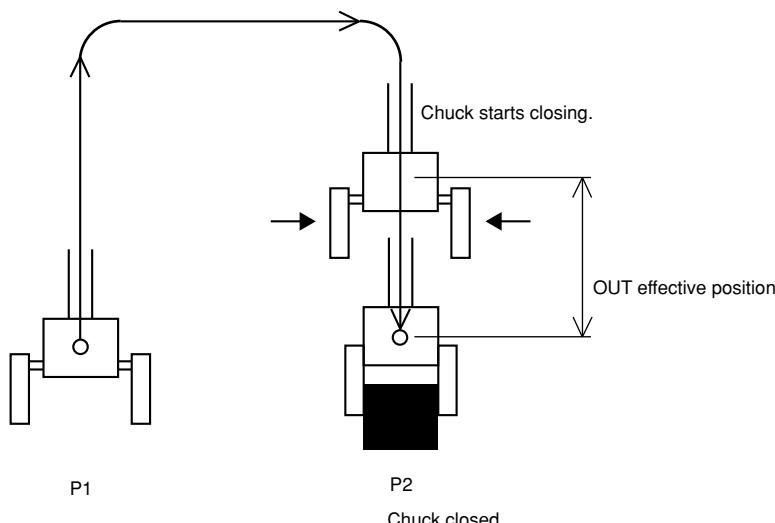
The OUT effective position can be set for each axis.
If the same OUT effective position is used for all axes, you can write as "OUTPOS 10000".

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

Increasing the speed by the OUT effective position parameter

7

Increasing the robot operating speed



23606-F0

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.

[Reference]

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

The tolerance and OUT effective position parameters are set in pulses. For the relation between X, Y, R-axis movement angle, Z-axis movement distance and pulse values, refer to "4.4 Relation between the X, Y, and R-axis movement angle, the Z-axis movement distance and the number of pulses" in Chapter 4.

Chapter 8

Torque limit designated Z-axis pushing action

Contents

1. Torque limit designated Z-axis pushing action

8-1

1. Torque limit designated Z-axis pushing action

You can use the PUSH statement in a program to apply a Z-axis pushing action (in the direction of gravity). The table below shows the torque limit value (%) and speed limit value (%) for the motor rated torque at the tip load weights.

Stay within these limit values while operating the robot. Failure to observe these limits may shorten the life of the Z-axis drive unit and the arm joint section.

The pushing force (N) shown in the table is the pushing force when a downward pushing action is applied at the torque limit value (%).

The actual pushing force will differ due to individual variance and sliding friction of the robot model.

The speed limit value (%) shown in the table is one of the options of the PUSH statement, and is the value to be entered as the movement speed DS of the axis.

If the speed limit value (%) is 100%, the movement speed will be 10% of the maximum speed.

For specific programming, refer to the separate "RCX340 Programming Manual".

1. YK400XE

Tip Load Weight (kg)	Torque Limit Value (%)	Pushing Force (N)	Speed Limit Value (%)
4	10 to 100	50 to 170	20
3.5	10 to 100	45 to 165	20
3	10 to 100	40 to 150	20
2.5	10 to 100	35 to 145	20
2	10 to 100	35 to 145	20
1.5	10 to 100	25 to 140	20
1	10 to 100	20 to 135	20
0.5	15 to 100	20 to 130	20
0	15 to 100	15 to 125	20

* In the case of optional specifications (tool flange mount specifications), the tip load weight must not exceed 4 kg. The load of the optional specification part itself must be added to the tip load weight and to the pushing force. Tool flange weight 0.3 kg, pushing force 2.9N

Speed Limit Value (%): when using the speed setting option "DSPEED (DS)" of PUSH command

2. YK510XE / YK610XE / YK710XE

Tip Load Weight (kg)	Torque Limit Value (%)	Pushing Force (N)	Speed Limit Value (%)
10	10 to 100	125 to 315	20
9.5	10 to 100	120 to 315	20
9	10 to 100	115 to 310	20
8.5	10 to 100	105 to 305	20
8	10 to 100	100 to 305	20
7.5	10 to 100	100 to 300	20
7	10 to 100	95 to 295	20
6.5	10 to 100	85 to 290	20
6	10 to 100	80 to 285	20

* In the case of optional specifications (tool flange mount specifications), the tip load weight must not exceed 10kg. The load of the optional specification part itself must be added to the tip load weight and to the pushing force. Tool flange weight 0.6 kg, pushing force 2.9N

Speed Limit Value (%): when using the speed setting option "DSPEED (DS)" of PUSH command

Tip Load Weight (kg)	Torque Limit Value (%)	Pushing Force (N)	Speed Limit Value (%)
5.5	10 to 100	75 to 280	20
5	10 to 100	70 to 275	20
4.5	10 to 100	65 to 270	20
4	10 to 100	65 to 265	20
3.5	10 to 100	60 to 255	20
3	10 to 100	55 to 250	20
2.5	10 to 100	50 to 245	20
2	10 to 100	45 to 240	20
1.5	10 to 100	40 to 235	20
1	10 to 100	35 to 235	20
0.5	10 to 100	30 to 230	20
0	10 to 100	25 to 220	20

* In the case of optional specifications (tool flange mount specifications), the tip load weight must not exceed 10kg.
The load of the optional specification part itself must be added to the tip load weight and to the pushing force.
Tool flange weight 0.6 kg, pushing force 2.9N

Speed Limit Value (%): when using the speed setting option "DSPEED (DS)" of PUSH command

Chapter 9 Specifications

Contents

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1.2 Regarding the noise level	9-1
1.3 External view and dimensions	9-3
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1. Manipulator

1.1 Basic specification

			YK400XE-4	YK510XE-10	YK610XE-10	YK710XE-10			
Axis specifications	X-axis	Arm length	225mm	235mm	335mm	435mm			
		Rotation angle	±132°	±134°					
	Y-axis	Arm length	175mm	275mm					
		Rotation angle	±150°	±152°					
	Z-axis	Stroke	150mm	200mm					
Motor	R-axis	Rotation angle	±360°						
		X-axis	200W	400W					
	Y-axis		100W	200W					
		Z-axis							
	R-axis								
Maximum speed	XY resultant	6m/s	7.8m/s	8.6m/s	9.5m/s				
	Z-axis	1.1m/s	2m/s						
	R-axis	2600°/s							
Repeatability (*1)	XY-axes	±0.01mm			±0.02mm				
	Z-axis	±0.01mm							
	R-axis	±0.01°							
Payload		4kg (*4)	10kg (Standard type, Optional: User wiring/tubing through cap type, Brake release switch type)						
		3kg (*5)	9kg (Optional: Tool flange mount type, User wiring/tubing through spline type)						
Standard cycle time (*2)		0.41s	0.38s	0.39s	0.42s				
R-axis tolerable moment of inertia (*3)		0.05kgm ²	0.3kgm ²						
User wiring		0.2sq×10	0.2sq×20						
User tubing (outside diameter)		φ4×3	φ6×3						
Travel limit		1. Soft limit 2. Mechanical stopper (X, Y, Z-axis)							
Robot cable		Standard: 3.5m Option: 5m, 10m							
Weight		17kg	25kg	26kg					

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

*2: Values when horizontal 300 mm, vertical 25 mm reciprocating, 2 kg transport, and rough positioning arch operation.

*3: Motion is automatically set by setting the tip weight and R-axis moment of inertia offset amount.

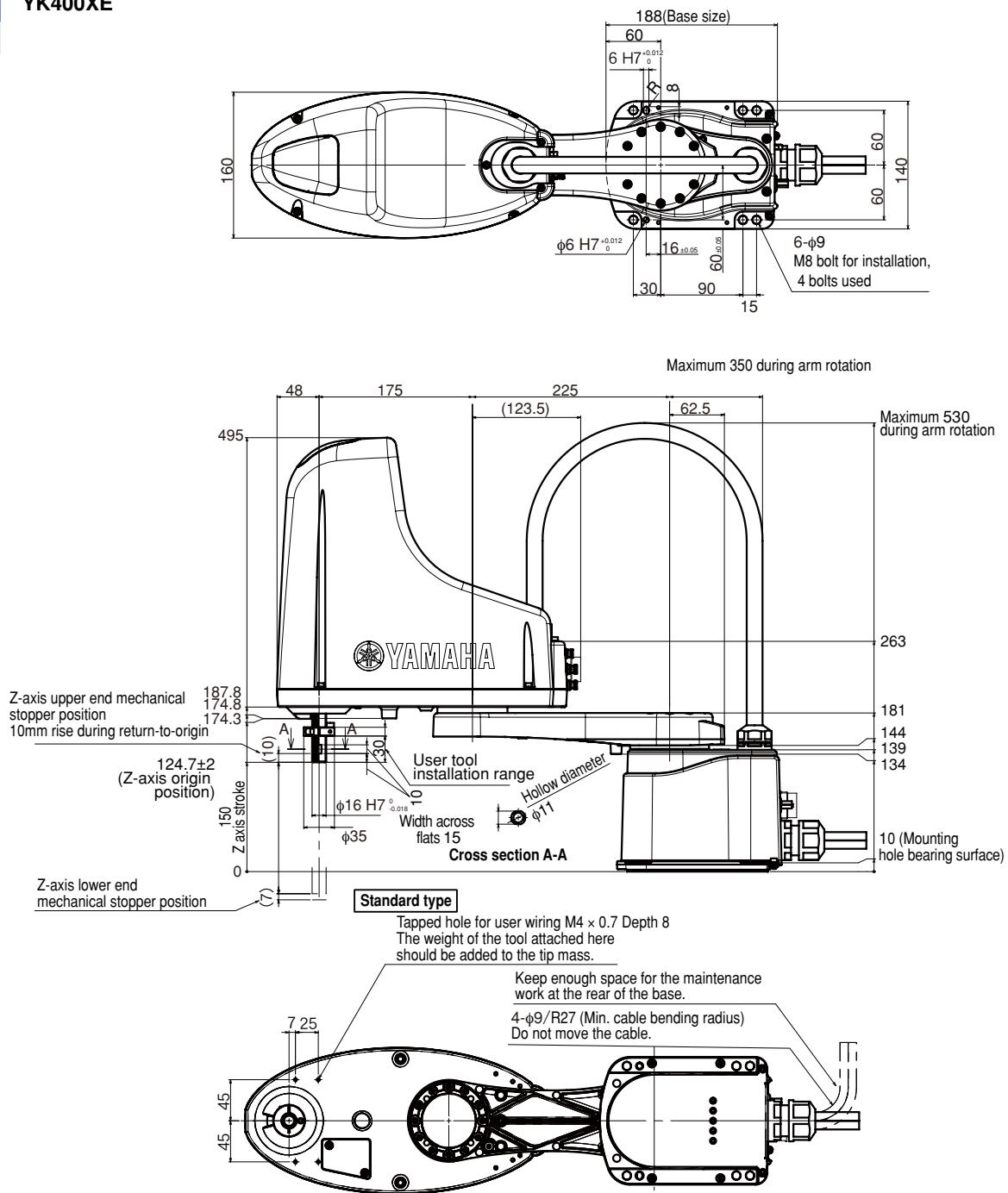
*4: Standard type, Optional Brake release switch type

*5: Optional User wiring/tubing through spline type

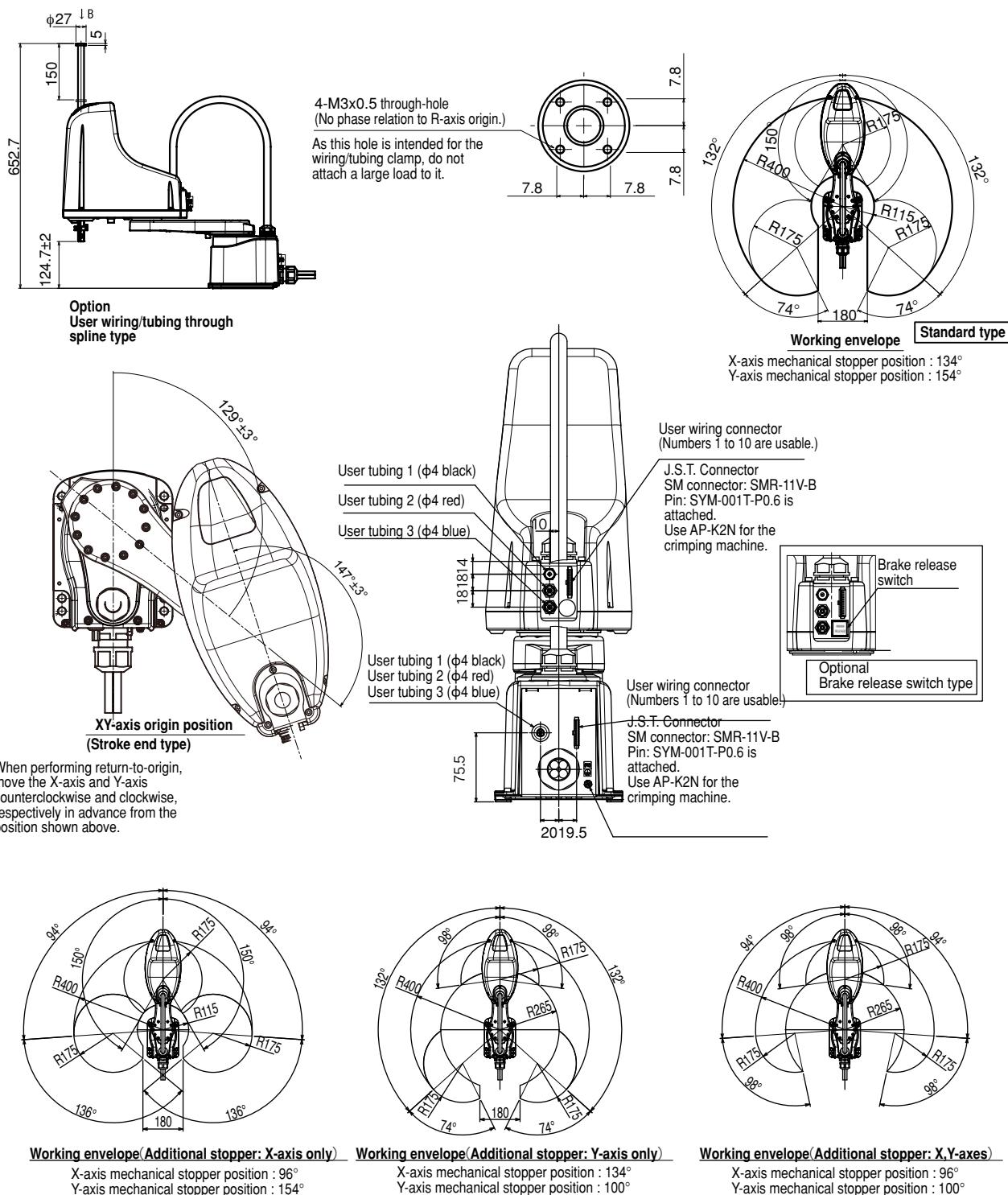
1.2 Regarding the noise level

	Equivalent sound level of robot, Laeq (A) (when there is 10dB or larger difference from the back ground sound pressure level)	Position where the noise level is measured
YK400XE	71.3dB	1.0m away from the robot's back / the working envelope of the robot, 1.5m height from the floor surface.
YK510XE / YK610XE / YK710XE	72.0dB	45 ° from the front of the robot, 1.0 m away from the work envelope, 1.5m height from the floor.

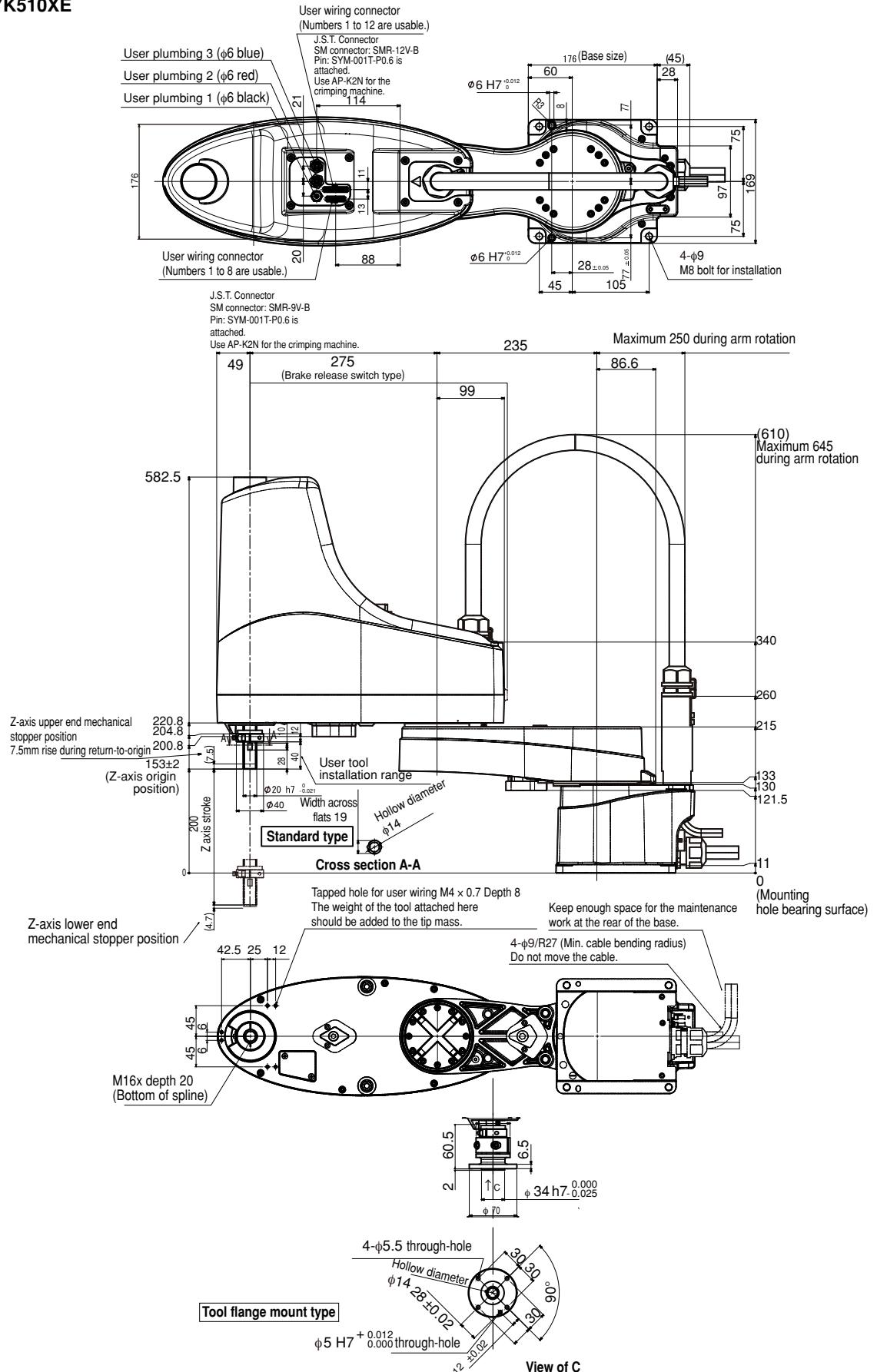
Note: The noise level can be higher when the robot is set nearby the objects that cause sound reflection.

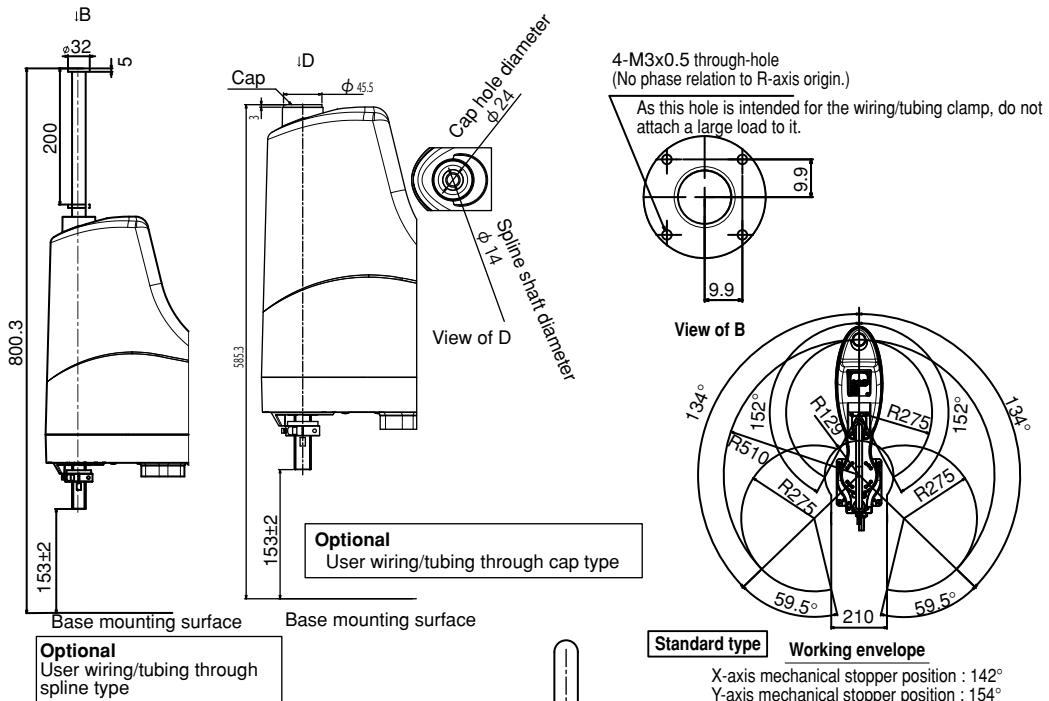


YK400XE



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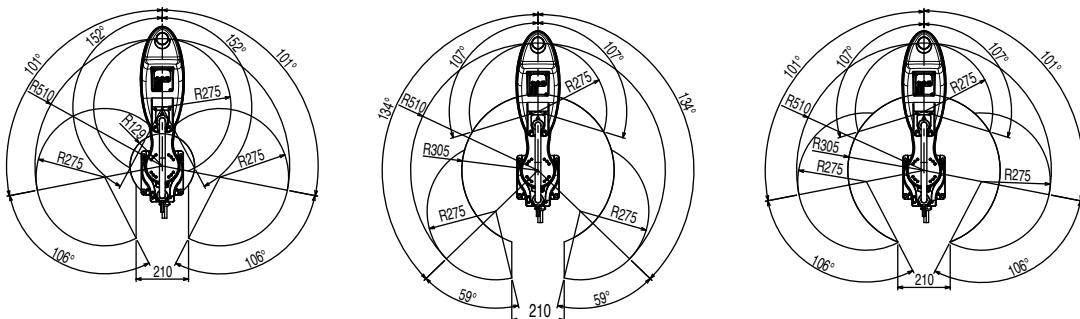
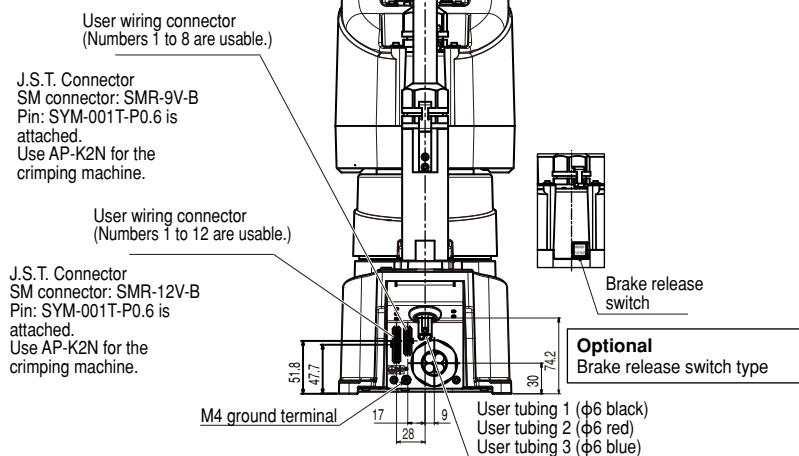


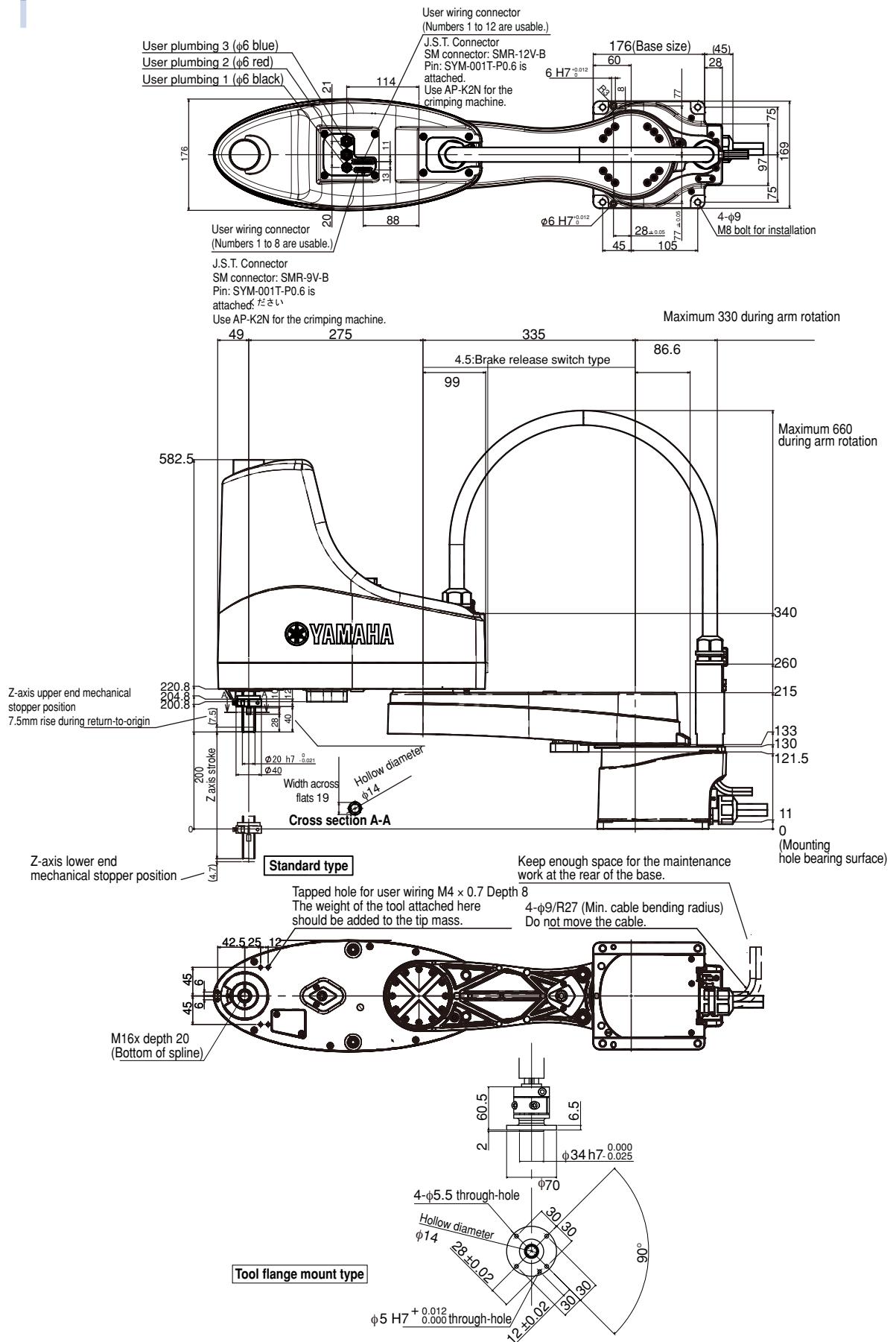
YK510XE

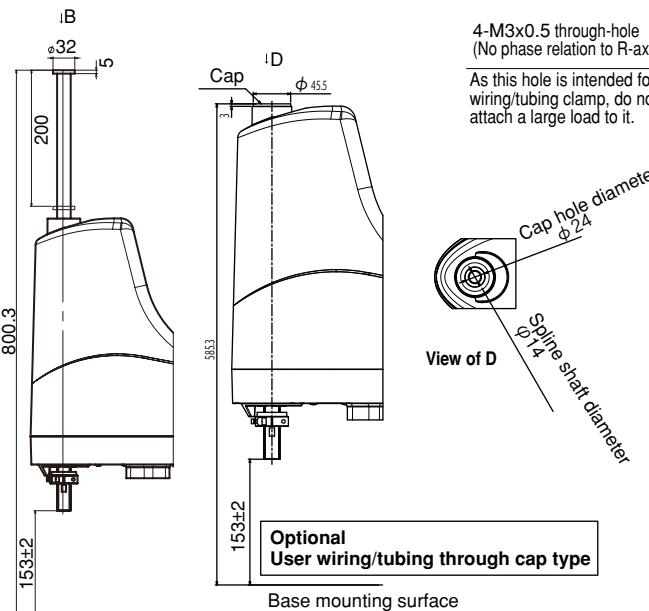
Optional User wiring/tubing through spline type:

Standard type Working envelope:

X-axis mechanical stopper position : 142°
Y-axis mechanical stopper position : 154°





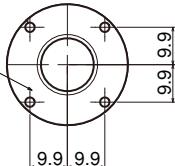
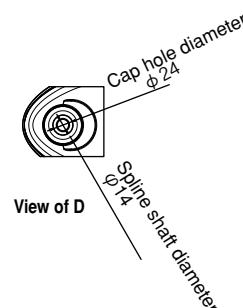
YK610XE

Optional User wiring/tubing through cap type

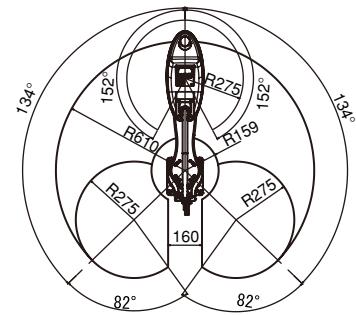
Base mounting surface

Optional User wiring/tubing through spline type

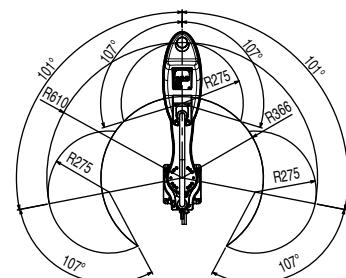
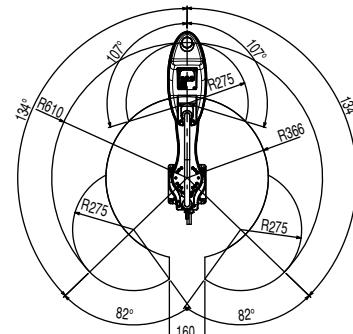
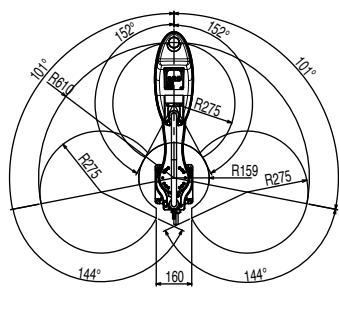
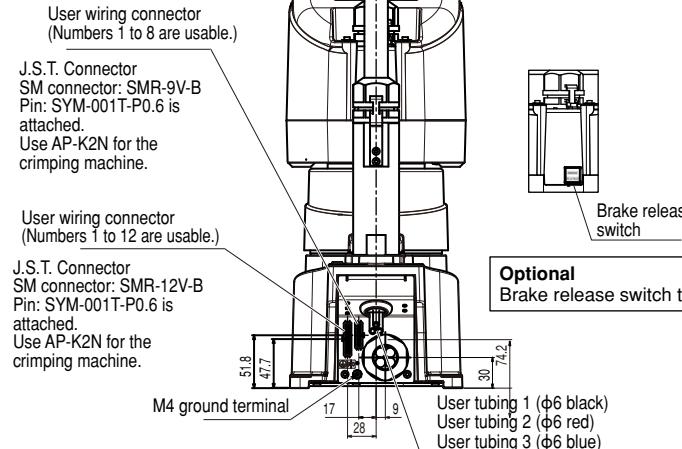
Base mounting surface



View of B



X-axis mechanical stopper position : 142°
Y-axis mechanical stopper position : 154°

**Working envelope(Additional stopper: X-axis only)**

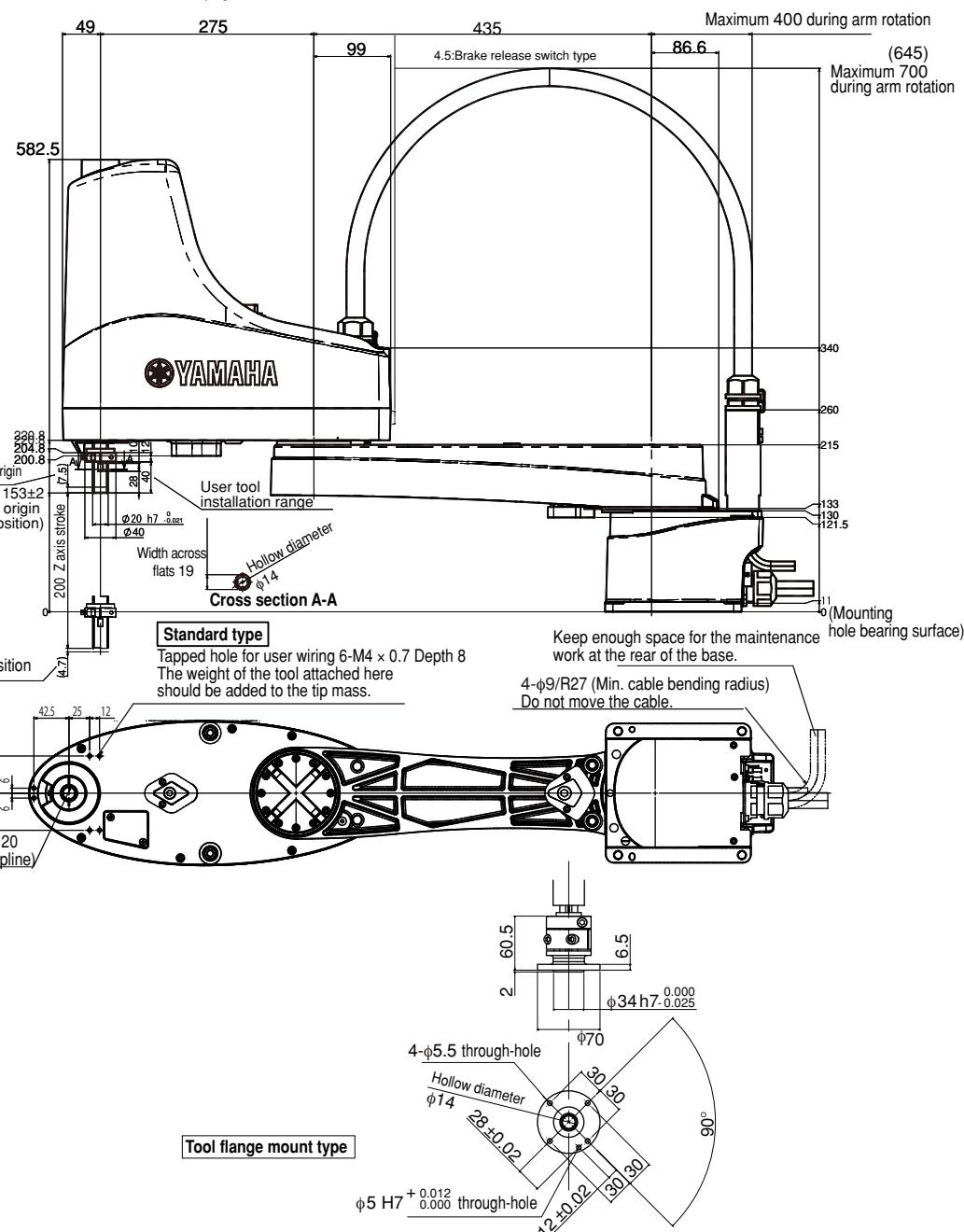
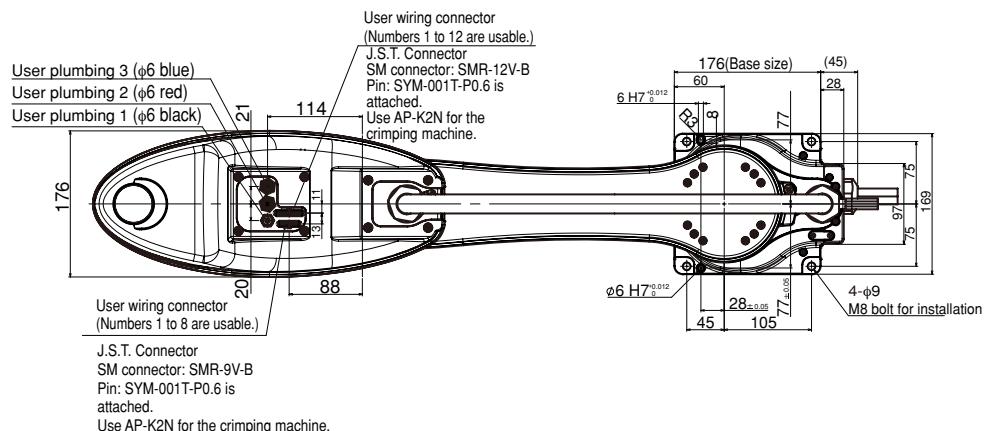
X-axis mechanical stopper position :104°
Y-axis mechanical stopper position :154°

Working envelope(Additional stopper: Y-axis only)

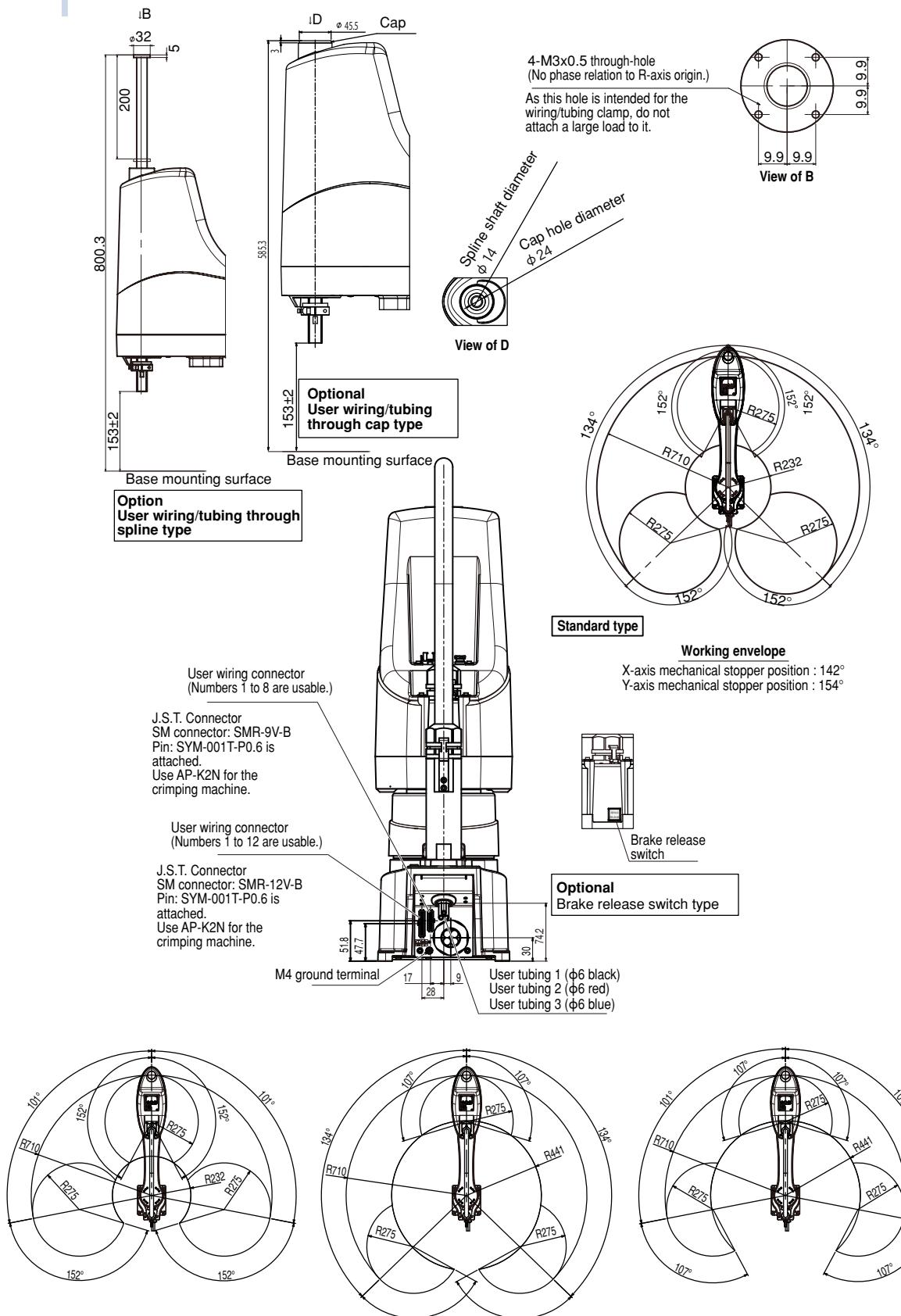
X-axis mechanical stopper position :142°
Y-axis mechanical stopper position :110°

Working envelope(Additional stopper: X,Y-axes)

X-axis mechanical stopper position :104°
Y-axis mechanical stopper position :110°



YK710XE

**Working envelope(Additional stopper: X-axis only)**

X-axis mechanical stopper position : 104°
Y-axis mechanical stopper position : 154°

Working envelope(Additional stopper: Y-axis only)

X-axis mechanical stopper position : 142°
Y-axis mechanical stopper position : 110°

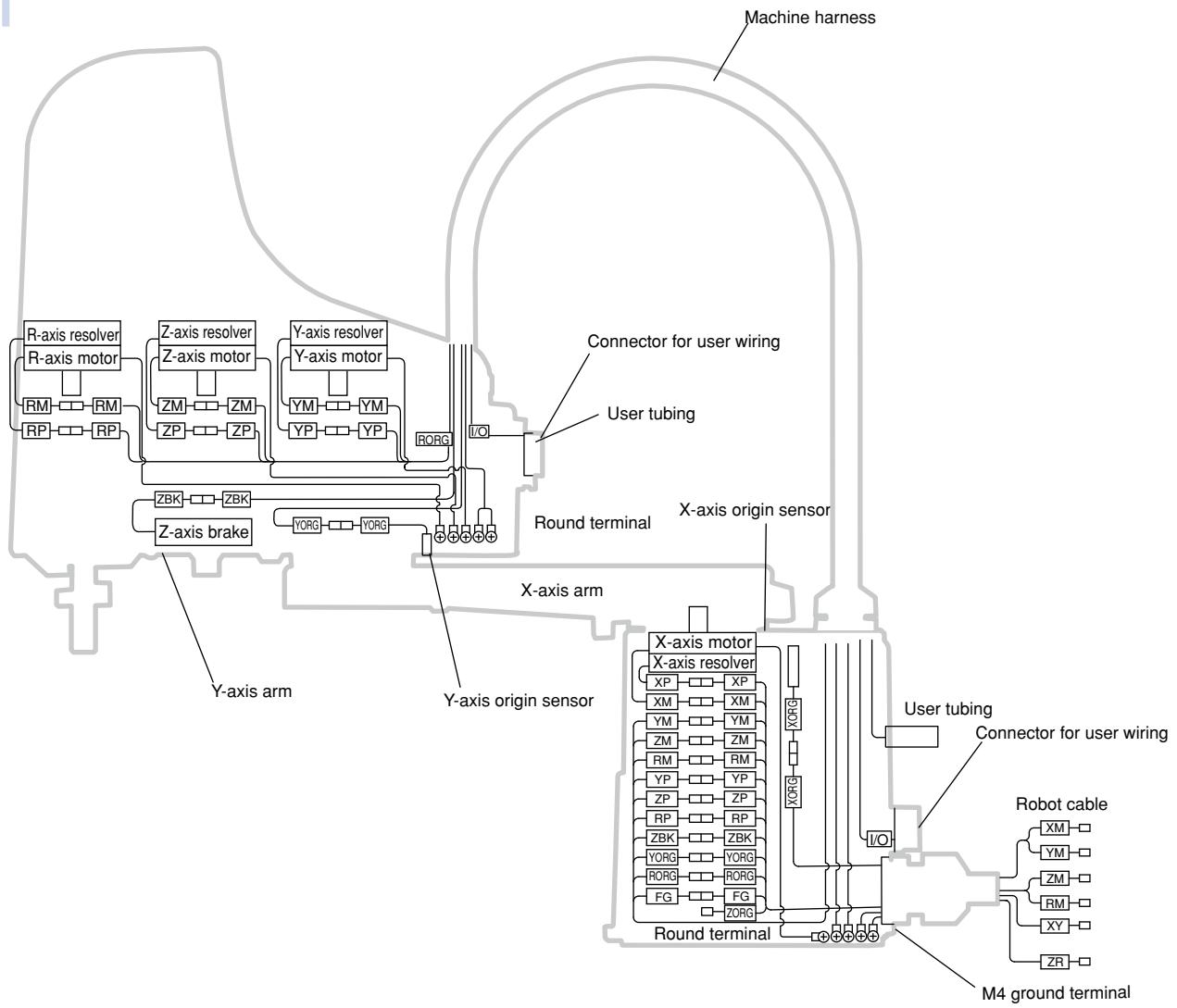
Working envelope(Additional stopper: X, Y-axes)

X-axis mechanical stopper position : 104°
Y-axis mechanical stopper position : 110°

1.4 Robot inner wiring diagram

YK400XE Standard type

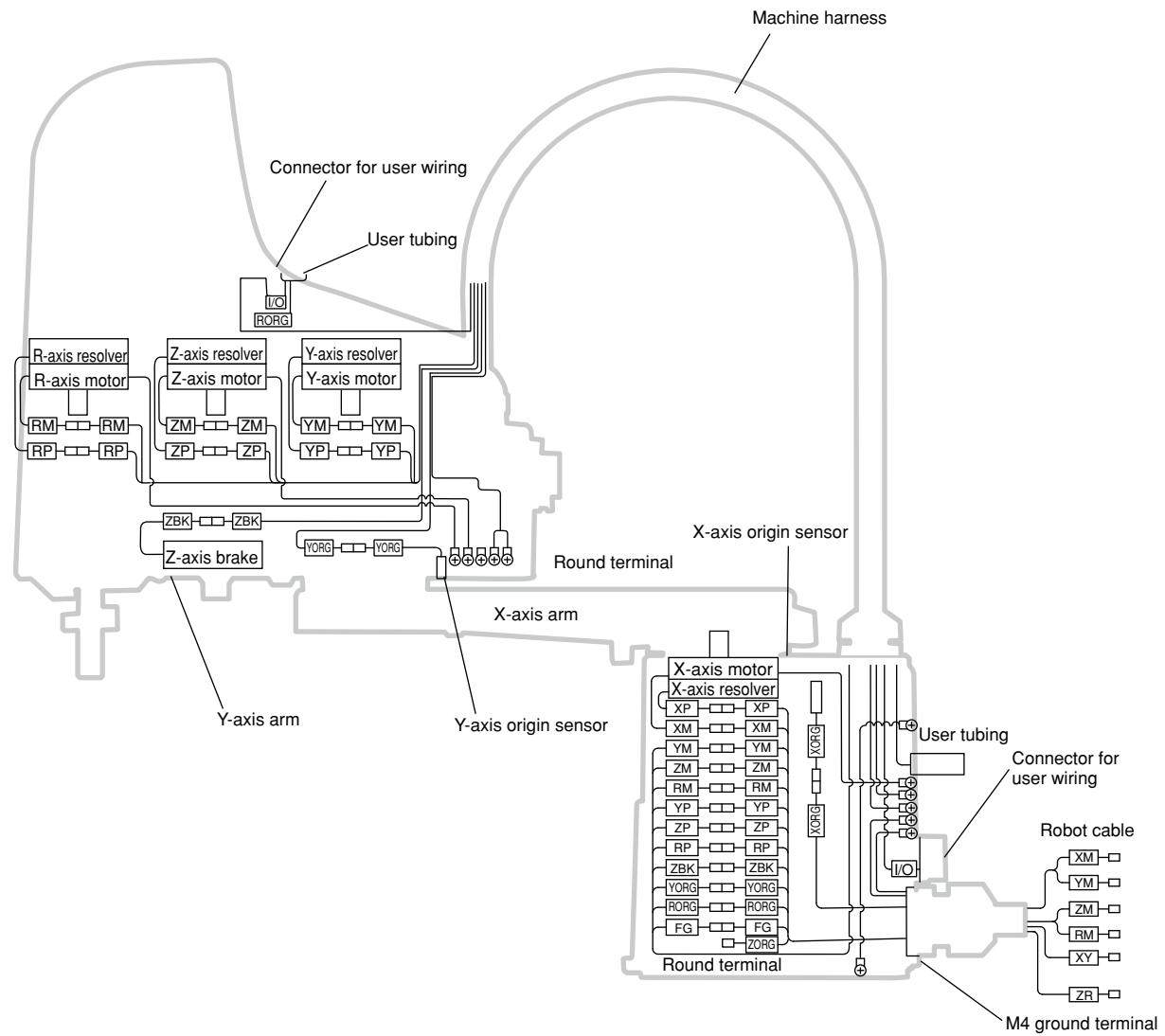
Robot inner wiring diagram



23803-FV-01

YK510XE YK610XE YK710XE Standard type

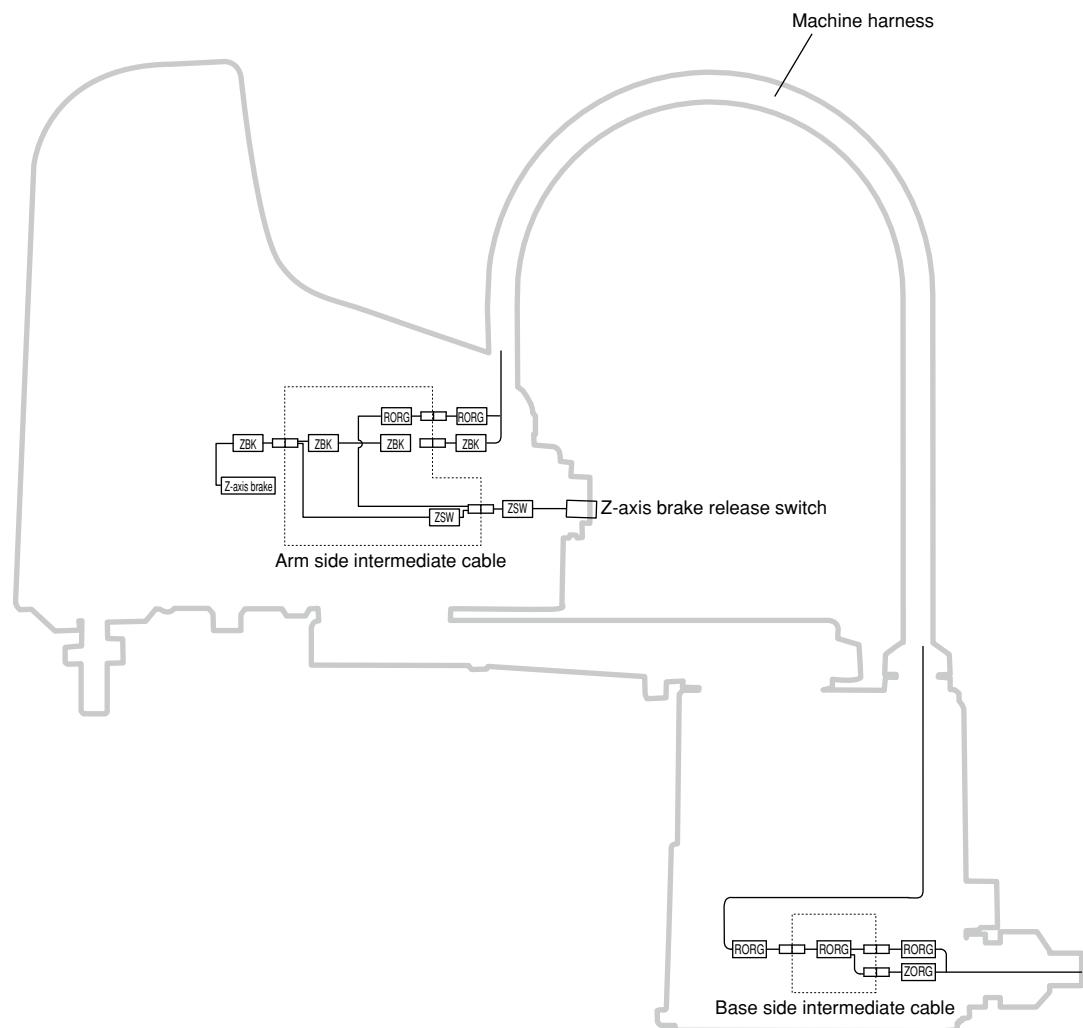
Robot inner wiring diagram



23903-FV-03

YK410XE YK510XE YK610XE YK710XE Option: Z-axis brake release switch type
(Only the parts that differ from the standard type are shown)

Robot inner wiring diagram



23905-FV-00

1.5 Wiring table

Robot cable wiring table

Signal	Connector	No.	Connection	No.	Connector	Color/Number	Wire
Resolver	XP	1		1	XY	Orange-1-Red	0.15sq
S4		2		2		Orange-1-Black	Twisted pair
S1		3		3		Gray-1-Red	0.15sq
S3		4		4		Gray-1-Black	Twisted pair
R1		5		5		Sky blue-2-Red	0.15sq
R2		6		6		Sky blue-2-Black	Twisted pair
DG		7		7		Gray	0.3sq
Resolver	YP	1		19	XY	Orange-2-Red	0.15sq
S4		2		20		Orange-2-Black	Twisted pair
S1		3		21		Bright green-2-Red	0.15sq
S3		4		22		Bright green-2-Black	Twisted pair
R1		5		23		Pink-2-Red	0.15sq
R2		6		24		Pink-2-Black	Twisted pair
DG		7		25		Gray	0.3sq
FG	FG	1		18	XY	Gray-2-Red	0.15sq
				36		Gray-2-Black	0.15sq
HLIM	XORG			10	XY	Gray	0.3sq
GND24				11			
HLIM				28		Gray	0.3sq
GND24				29			
Origin Sensor	GND	3		13	XY	Sky blue-3-Red	0.15sq
ORG		2		12		Sky blue-3-Black	Twisted pair
24V		1		9		Pink-3-Red	0.15sq
Origin Sensor	YORG	1		27	XY	Pink-3-Black	Twisted pair
ORG		2		30		Bright green-1-Red	0.15sq
GND		3		31		Bright green-1-Black	Twisted pair
U	XM	1		2	XM	Black	0.75sq
V		2		3		Red	0.75sq
W		3		4		White	0.75sq
FG	Round terminal			1		Gray	0.75sq
U	YM	1		2	YM	Yellow	0.75sq
V		2		3		Brown	0.75sq
W		3		4		Blue	0.75sq

9 Specifications

Signal	Connector	No.	Connection	No.	Connector	Color/Number	Wire
Resolver	ZP	1		1	ZR	Orange-1-Red	0.15sq
S4		2		2		Orange-1-Black	Twisted pair
S1		3		3		Gray-1-Red	0.15sq
S3		4		4		Gray-1-Black	Twisted pair
R1		5		5		Sky blue-2-Red	0.15sq
R2		6		6		Sky blue-2-Black	Twisted pair
DG		7		7		Gray	0.3sq
Brake	ZBK	1		14	ZM	Pink-1-Red	0.15sq
MB+		2		16		Pink-1-Black	Twisted pair
MB-				15		Sky blue-1-Red	0.15sq
				17		Sky blue-1-Black	Twisted pair
Resolver	RP	1		19		Orange-2-Red	0.15sq
S4		2		20		Orange-2-Black	Twisted pair
S1		3		21		Bright green-2-Red	0.15sq
S3		4		22		Bright green-2-Black	Twisted pair
R1		5		23		Pink-2-Red	0.15sq
R2		6		24		Pink-2-Black	Twisted pair
DG		7		25		Gray	0.3sq
FG	FG	1		18		Gray-2-Red	0.15sq
				36		Gray-2-Black	0.15sq
HLIM				10	RM	Gray	0.3sq
GND24				11			
HLIM				28		Gray	0.3sq
GND24				29			
Origin Sensor	ZORG	3		13	ZM	Sky blue-3-Red	0.15sq
24V		2		12		Sky blue-3-Black	Twisted pair
ORG		1		9		Pink-3-Red	0.15sq
Origin Sensor	RORG	1		27		Pink-3-Black	Twisted pair
24V		2		30		Bright green-1-Red	0.15sq
ORG		3		31		Bright green-1-Black	Twisted pair
U	ZM	1		2	RM	Black	0.75sq
V		2		3		Red	0.75sq
W		3		4		White	0.75sq
FG	Round terminal			1		Gray	0.75sq
U	RM	1		2	RM	Yellow	0.75sq
V		2		3		Brown	0.75sq
W		3		4		Blue	0.75sq

Machine harness wiring table YK400XE

Signal	Connector	No.	Connection	No.	Connector	Color	Wire
Y-axis Resolver	YP	1		1	YP	Brown	0.2mm ²
S4		2		2		White	Twisted pair
S1		3		3		Red	0.2mm ²
S3		4		4		White	Twisted pair
R1		5		5		Orange	0.2mm ²
R2		6		6		White	Twisted pair
DG		7		7		Gray	Shield
Z-axis Resolver	ZP	1		1	ZP	Brown	0.2mm ²
S2		2		2		Black	Twisted pair
S4		3		3		Red	0.2mm ²
S1		4		4		Black	Twisted pair
S3		5		5		Orange	0.2mm ²
R1		6		6		Black	Twisted pair
DG		7		7		Gray	Shield
R-axis Resolver	RP	1		1	RP	Brown	0.2mm ²
S4		2		2		Gray	Twisted pair
S1		3		3		Red	0.2mm ²
S3		4		4		Gray	Twisted pair
R1		5		5		Orange	0.2mm ²
R2		6		6		Gray	Twisted pair
DG		7		7		Gray	Shield
Y-axis motor	YM	U	1	1	YM	Brown	0.75mm
		W	2	2		Red	
		V	3	3		Orange	
Z-axis motor	ZM	U	1	1	ZM	Blue	0.75mm
		W	2	2		Purple	
		V	3	3		Gray	
R-axis motor	RM	U	1	1	RM	Black	0.75mm
		W	2	2		Blue	
		V	3	3		Red	
Z-axis brake	ZBK	1	1	1	ZBK	Purple	0.3mm
Z-axis brake		2	2	2		Gray	0.3mm
User signal line	IO	1		1	IO	Brown	0.2mm ²
		2		2		Red	
		3		3		Orange	
		4		4		Blue	
		5		5		Purple	
		6		6		Gray	
		7		7		White	
		8		8		Brown	0.2mm ²
		9		9		Red	
		10		10		Orange	
Frame ground	YORG	11		11	YORG	Gray	
Frame ground						Shield	
Origin Sensor		24V	1	1		Gray	Shield
	RORG	ORG	2		YORG	White	0.2mm ²
		GND	3			Purple	
Origin Sensor		24V	1	1		Gray	
	RORG	ORG	2	2	RORG	Blue	0.2mm ²
		GND	3	3		Gray	
		Round terminal		Round terminal	Round terminal	Yellow/Green	0.75sq
		Round terminal		Round terminal	Round terminal	White	0.75sq

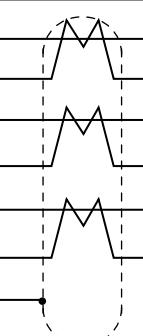
Machine harness wiring table YK510XE / YK610XE / YK710XE

Signal	Connector	No.	Connection	No.	Connector	Color	Wire	
Y-axis Resolve	YP	4		1	YP	Brown	0.2mm ²	
S4		6		2		White	Twisted pair	
S1		3		3		Red	0.2mm ²	
S3		5		4		White	Twisted pair	
R1		1		5		Orange	0.2mm ²	
R2		2		6		White	Twisted pair	
DG				7		Gray	Shield	
Z-axis Resolver	ZP	4		1	ZP	Brown	0.2mm ²	
S4		6		2		Black	Twisted pair	
S1		3		3		Red	0.2mm ²	
S3		5		4		Black	Twisted pair	
R1		1		5		Orange	0.2mm ²	
R2		2		6		Black	Twisted pair	
DG				7		Gray	Shield	
R-axis Resolver	RP	4		1	RP	Brown	0.2mm ²	
S4		6		2		Gray	Twisted pair	
S1		3		3		Red	0.2mm ²	
S3		5		4		Gray	Twisted pair	
R1		1		5		Orange	0.2mm ²	
R2		2		6		Gray	Twisted pair	
DG				7		Gray	Shield	
Y-axis motor	YM	U		1	YM	Brown	0.75mm	
		W		2		Red		
		V		3		Orange		
Z-axis motor	ZM	U		1	ZM	Blue	0.75mm	
		W		2		Purple		
		V		3		Gray		
R-axis motor	RM	U		1	RM	Black	0.75mm	
		W		2		White		
		V		3		Brown		
Z-axis brake	ZBK	1		1	ZBK	White	0.3mm	
Z-axis brake		2		2		Black	0.3mm	
User signal line		1		1	IO1	Brown	0.2mm ²	
		2		2		Red		
		3		3		Orange		
		4		4		Blue		
		5		5		Purple		
		6		6		Gray		
		7		7		White		
		8		8		Brown	0.2mm ²	
		9		9		Red		
		10		10		Orange		
		11		11				
		12		12				
User signal line		1		1	IO2	Brown		
		2		2		Red		
		3		3		Orange		
		4		4		Blue		
		5		5		Purple		
		6		6		Gray		
		7		7		White		
		8		8		Black		
Frame ground	YORG	9		9	YORG	Gray	Shield	
Frame ground				1		Gray	Shield	
Origin Sensor		24V		1		White	0.2mm ²	
	RORG	ORG		2	YORG	Purple		
		GND		3		Gray		
Origin Sensor		24V		1	RORG	Brown	0.2mm ²	
	RORG	ORG		2		Red		
		GND		3		Orange		
		Round terminal			Round terminal	Yellow/Green	0.75sq	
		Round terminal			Round terminal	Black	0.75sq	

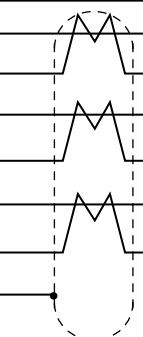
Motor wiring table

Signal	Color	P	Connection	P	Remarks	Connector
U	Red	Motor		CN3	1	U
V	White				2	V
W	Black				3	W
PE	Green/Yellow			Round terminal	PE	

Cable wiring table (Motor Robot cable) YK400XE

Signal	No.	Connection	No.	Wire	Connector
S2	1		4	0.3sq Blue	X,Y,Z,RP
S4	2		6	Orange	
S1	3		3	Bright green	
S3	4		5	Brown	
R1	5		1	Gray	
R2	6		2	Red	
FG	7			Drain wire	

Cable wiring table (Motor Robot cable) YK510XE / YK610XE / YK710XE

Signal	No.	Connection	No.	Wire	Connector
S2	1		4	0.3sq Gray	X,Y,Z,RP
S4	2		6	Black	
S1	3		3	Yellow	
S3	4		5	White	
R1	5		1	Red	
R2	6		2	Blue	
FG	7			Drain wire	

Origin sensor wiring table

Signal	Color	Connection	No.	Connector
+24V	Brown		1	XORG, YORG
ORG	Black		2	
0V	Blue		3	

Brake wiring table

Signal	Color	Connection	No.	Connector
+24V	Black		1	ZBK
0V	Black		2	

Brake release switch wiring table

Signal	Color	Connection	No.	Wire	Connector
Z24V NO	Brown		1	0.2sg White	ZSW
ZSW COM	Blue		2	Black	

Brake release switch Arm side intermediate cable wiring diagram

Connector	Signal	No.	Connection	P	Wire	Connector
ZSW	24V	1		1	0.2sg Black	RORG
	Brake MB+	2		2	White	
ZBK	Brake MB+	1		3		ZBK
	Brake MB-	2		1	0.2sg White	
				2	Black	

Brake release switch Base side intermediate cable wiring diagram

Connector	Signal	No.	Connection	No.	Wire	Connector
RORG	24V	1		1	0.2sg White	ZORG
		2		2		
		3		3		
				1	0.2sg Black	RORG
				2		
				3		

Original version



DECLARATION OF INCORPORATION OF PARTLY COMPLETED MACHINERY

according to EC directive 2006/42/EC on machinery (Annex II 1 B)

Manufacturer YAMAHA MOTOR CO., LTD. Robotics Operations
127 Toyooka, Kita-ku, Hamamatsu, Shizuoka 433-8103, Japan

Representative Yamaha Motor Europe N.V., Niederlassung Deutschland, German Branch, IM Business
Hansemannstrasse 12, 41468 Neuss, Germany

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Product Name	Industrial Robot
Model	Flip-X series : T4LH, T5LH, T6L, T9, T9H, F8, F8L, F8LH, F10, F10H, F14, F14H, F17, F17L, F20, F20N, C4LH, C5LH, C6L, C8, C8L, C8LH, C10, C14, C14H, C17, C17L, C20, B10, B14, B14H, R5, R10, R20, N15, N18, GF14XL, GF17XL PHASER series : MR12, MR12A, MF7, MF7A, MF15, MF15A, MF20, MF20A, MF30, MF30A, MF75, MF75A XY-X series : PXYx, FXYx, SXYx, MXYx, FXYBx, SXYBx, HXYx, HXYLx, SXYxC, NXY, NXY-W YP-X series : YP220BX, YP220BXR, YP320X, YP320XR, YP330X, YP340X YK series : YK180X, YK220X, YK1200X, YK180XC, YK220XC, YK500XC, YK600XC, YK700XC, YK800XC, YK1000XC, YK120XG, YK150XG, YK180XG, YK250XG, YK350XG, YK400XG, YK500XG, YK500XGL, YK600XG, YK600XGL, YK600XGH, YK700XG, YK700XGL, YK800XG, YK900XG, YK1000XG, YK300XGS, YK400XGS, YK500XGS, YK600XGS, YK700XGS, YK800XGS, YK900XGS, YK1000XGS, YK250XGC, YK350XGC, YK400XGC, YK500XGLC, YK600XGLC, YK250XGP, YK350XGP, YK400XGP, YK500XGP, YK500XGLP, YK600XGP, YK600XGLP, YK600XGHP, YK700XGP, YK800XGP, YK900XGP, YK1000XGP, YK350TW, YK500TW, YK400XR, YK400XE, YK510XE, YK610XE, YK710XE with RCX340 controller and PBX-E and Gripper Option : YRG-2005SS, YRG-2010S, YRG-2815S, YRG-4225S, YRG-2005W, YRG-2810W, YRG-4220W, YRG-2020FS, YRG-2840FS, YRG-2020FT, YRG-2840FT, YRG-2004T, YRG-2013T, YRG-2820T, YRG-4230T and iVY2 Option : CAMERA, 1(0.3M/1.3M/2M/5M Pixel) and iVY2+ Option : CAMERA, 1(0.4M/1.6M/3.2M/5M Pixel)

The object of the above declarations meets the following standards and directives:

Directive	Reference Standard
Machinery 2006/42/EC	EN ISO 12100:2010
	EN ISO 10218-1:2011
	EN 60204-1:2006/AC:2010

The following essential requirements have been fulfilled:

1.1.2, 1.1.3, 1.1.5, 1.1.6, 1.2.1, 1.2.6, 1.3.1, 1.3.2, 1.3.4, 1.3.9, 1.5.1, 1.5.2, 1.5.4, 1.5.5, 1.5.6, 1.5.8, 1.5.9, 1.5.11, 1.6.1, 1.7.1, 1.7.1.1, 1.7.2, 1.7.3, 1.7.4, 1.7.4.1, 1.7.4.2, 1.7.4.3

It is declared that the relevant technical documentation has been compiled in accordance with Part B of Annex VII of the Machinery Directive.

EMC	2014/30/EU	EN 55011:2009/A1:2010
		EN 61000-6-2:2005 /AC:2005
RoHS	2011/65/EU	EN 50581:2012

If there are reasonable requests from the national authorities on this product, we will send them electronically or otherwise.

This partly completed machinery must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of the Machinery Directive.

Signed and on behalf of : YAMAHA MOTOR CO., LTD. Robotics Operations
Place and date of issue : Hamamatsu, Japan July 1, 2020
name : Yoshiyuki Matsumoto J. Matsumoto
position : Senior General Manager of FA Section, Robotics Operations

Revision record

Manual version	Issue date	Description
Ver. 1.01	Oct. 2018	First edition
Ver. 1.11	Apr. 2020	Addition of models (YK610XE, YK710XE)
Ver. 1.21	Sept. 2020	Addition of model (YK510XE)
Ver. 1.22	Sept. 2020	Clerical error corrections, etc
Ver. 1.30	Feb. 2021	Addition of optional types; Brake release switch type and User wiring/tubing through cap type
Ver. 1.31	Apr. 2021	Addition of description about Origin position change to "3. Changing the origin position of X/Y-axis YK510XE YK610XE YK710XE" in Chapter 4.
Ver. 1.32	Sept. 2021	Added connector wiring example to "5. User wiring and user tubing" in Chapter 3.

Installation Manual

SCARA Robots YK-XE Series

Sept. 2021
Ver. 1.32

YAMAHA MOTOR CO., LTD. Robotics Operations

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Robot manuals can be downloaded from our company website.
Please use the following for more detailed information.
<https://global.yamaha-motor.com/business/robot/>



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