YAMAHA

YAMAHA SINGLE-AXIS ROBOT

F10

Maintenance Procedures

MM-JMKX6-0000
Ver.1.00

Maintenance Procedures
F10/F10-BK

Contents

About this document

- YAMAHA shall not be held responsible for any trouble arising from incorrect use of this document.
- The work described in this document shall be conducted at the work personnel's risk after understanding the contents fully.
- Make sure to accept "Terms of Use for the Content" at the end of the document before use.

Safety Information

Strictly follow "Safety Instructions" in the manual.

Signal words used in this manual

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

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

WARNING
This indicates 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 explains the key point in the operation in a simple and clear manner.

Use a jig. (Refer to "Preparation" in this document.


Use thread sealer.

Use a torque wrench.

Flow

Because of the actuator's structure, the order of disassembling is brake, motor, and ball screw, and all the procedures are described in this document. When replacing only brake (and motor), skip unnecessary steps (removing/installing ball screw, and so on).

Preparation

1. Replacement parts

№	Part Name		Part Number	Q'ty	Brake	Motor	Ball Screw	Remarks
1	Brake		KX7-M4891-A0	1	○			For models with brake
2	Set screw for brake hub		KX7-M2297-00	1	○	○	○	For models with brake
3	Brake hub fixing bolt		KX7-M2296-00	1	○	○	○	For models with brake Left-hand thread M5-12
4	Wave washer		KX5-M2294-00	1	○	○	○	
5	Motor		90K92-610230	1		○		100W
6	Support bearing		KX7-M2232-00	1		○	○	Motor side
7	Damper for adjusting grid position		Refer to Step2 of 10.			○	○	
8	Sim for adjusting grid position		Refer to Step2 of 10.			○	○	
9	Bearing		KX7-M2231-00	1			○	Angular bearing
10	Support bearing		KX5-M2232-10	1			○	Non-motor side
11	Cir clip		99009-12400	1			○	Non-motor side
12	Key		90990-04J001	1			○	For ball screw
13	Ball screw	F10-20-XXX	KX5-M2272-XX	1			○	Lead: 20 mm
		F10-10-XXX	KX5-M22P1-XX				○	Lead: 10 mm
		F10-05-XXX	KX5-M22P3-XX				○	Lead: 5 mm
		F10-20BK-XXX	KX5-M2271-XX				○	Lead: 20 mm
		F10-10BK-XXX	KX5-M2275-XX				○	Lead: 10 mm
		F10-05BK-XXX	KX5-M2279-XX				○	Lead: 5 mm

Note:

- Required parts depend on the item (brake, motor, ball screw) to be replaced.
  "○" indicates the necessary part for replacing the item.
- №1 and №2 parts are required only for models with brake.
- The numbers in this document hereafter will refer to these tables.
  For the parts without "○" indication, use the one originally installed.

2. Specialized Tools

	Name	Brake	Motor	Ball Screw	Remarks
A	Torque wrench	○	○	○	M3 for hex socket head bolt, 2·0 Nm (20 kgcm)
B	Torque wrench		○	○	M4 for hex socket head bolt,3·8 Nm (38 kgcm)
C	Torque wrench			○	M5 for hex socket head bolt, 7·5 Nm (75 kgcm)
D	Torque wrench			○	M6 for hex socket head bolt, 13·0 Nm (130 kgcm)
E	Torque spanner	○	○	○	For spanner 14, 20·0 Nm (200 kgcm)

3. General Tools

Name	Part Number	Brake	Motor	Ball Screw	Remarks
Phillips screwdriver		○	○	○	
Hex keys		○	○	○	
Wrench (12mm/14mm)		○	○	○	
LOCTITE		○	○	○	№648 (Green) / №241 (Blue)
Plastic hammer			○	○	
Molybdenum grease	KV7-M718H-00			○	NET: 25g
Alvania grease	S02D-MTT01-000			○	NET: 400g
Jig for motor replacing	S01E-M6302-000		○	○	

4. Bolt indication

Indication example	Description
3 - M5 - 30	3 M5-size, 30mm-long hex socket head bolts
Q'ty - Size - Length	

Maintenance procedures

1. Cautions before work

WARNING

- At replacement, make sure to disconnect the robot and the controller or turn OFF the controller. If the robot moves during work, it may cause serious accidents.
- Only personnels trained by Yamaha or your distributor should remove the cover.
- Make sure to tighten all the screws and bolts. If the cover is not secured firmly, this may cause noise, cover dropping and flying, hand entanglement in drive unit during teaching, or burn due to hand in contact with hot surface.

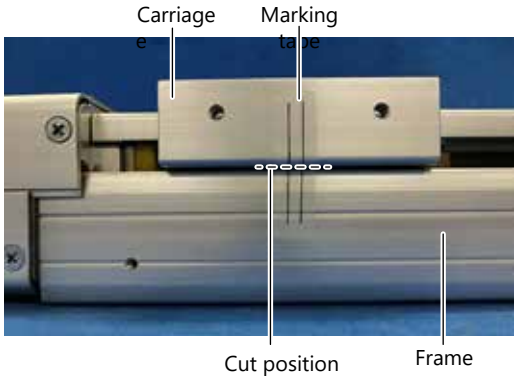
CAUTION

- Be sure to wear safety gloves before starting the work. If you touch any steel material part with bare hands, this may cause rust.
- Be careful not to drop any screws and bolts when removing the cover and other parts.
  (It is recommended to cover under the working area with a plastic sheet or something to avoid losing screws and bolts.)

2. Removing cover

Step 1 Connect the robot and controller. Move the robot to the point where the coordinate on the controller is 0 mm with a handy terminal or else.
Then tape between the carriage and frame, mark straight lines, and cut the between them with a cutter or something.

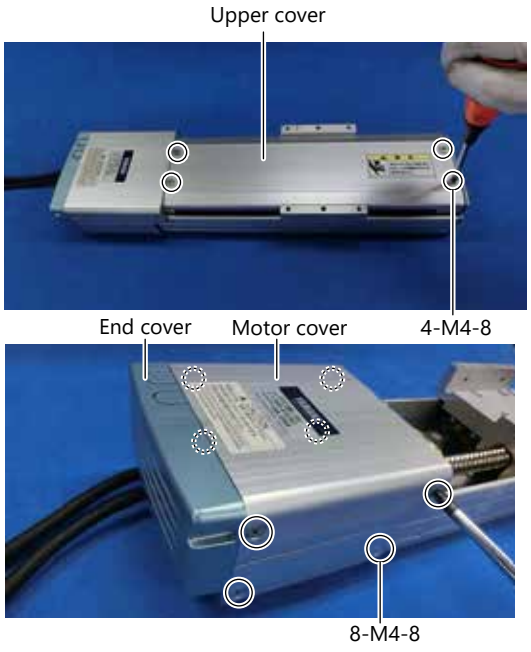
▶ Step 1 Marking



Step 2 Remove the screws (4-M4-8) to take off the upper cover. Remove the screws (8-M4-8) on the motor side, then take off the motor cover and end cover.

Skip to "4. Removing motor" when replacing the motor and ball screw of robot without brake.

▶ Step 2 Removing cover

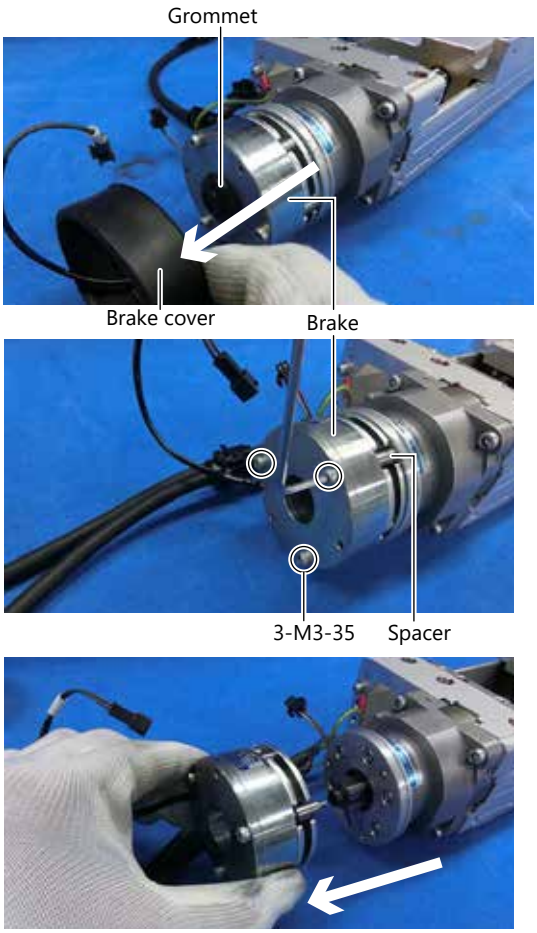


3. Removing brake

Step 1 Take measures to prevent the robot from dropping. Otherwise, remove the robot from the base and place horizontally. Remove the grommet and brake cover, and then the brake fixing bolts (3-M3-35). Remove the brake slowly as the spacers easily drop, and take care not to lose the bolts and spacers.

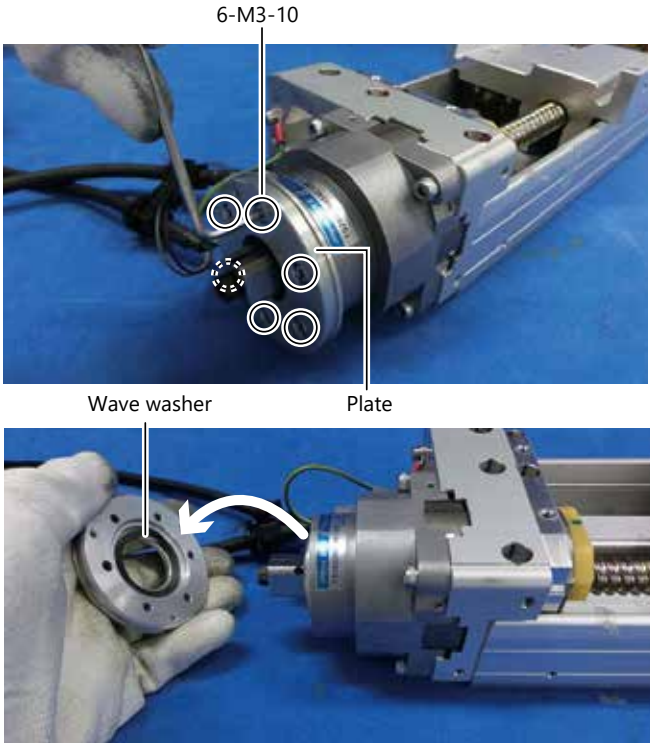
DANGER
Removing the brake with the robot installed vertically may cause the slider to drop resulting in death or serious injury by being hit or getting caught in.

Step 1 Removing brake



Step 2 Remove the plate fixing bolts (6-M3-10) to take off the plate.

Step 2 Removing plate



Step 3 Loosen and remove the left-hand thread bolt (1-M5-12).

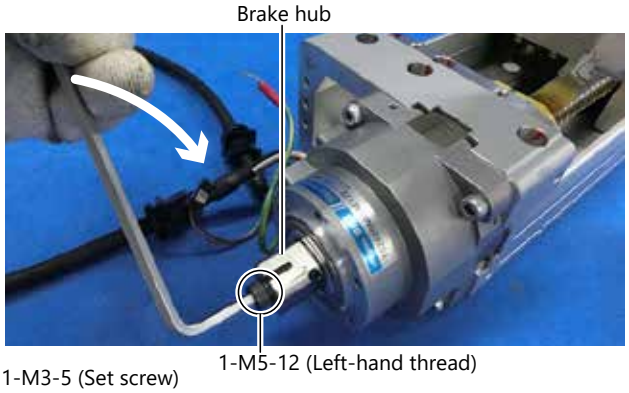
CAUTION
As the bolt is left-hand thread type, turn it in clockwise to loosen.

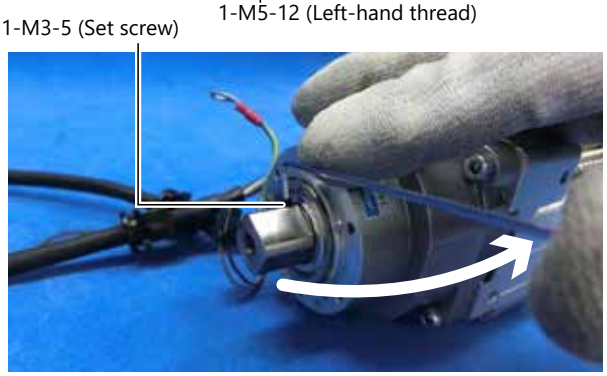
Loosen the set screw (1-M3-5).

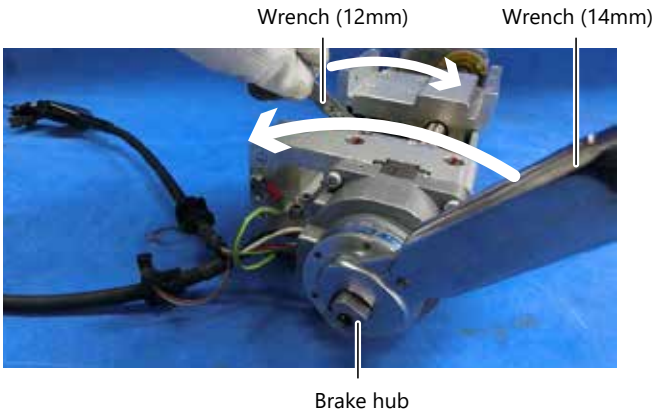
Use wrenches (12 mm / 14 mm) to loosen and remove the brake hub.
Wrench (14 mm): for brake hub
Wrench (12 mm): for cut part of ball screw close to the motor.

Skip to "8. Installing brake" when replacing only the brake.

▶ Step 3 Removing brake hub





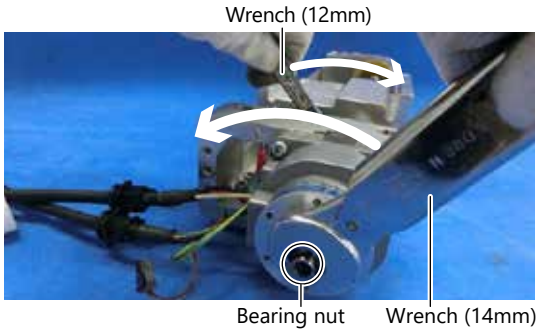


4. Removing motor

Step 1 Use wrenches (12 mm / 14 mm) to loosen and remove the bearing nut.
Wrench (14 mm): for brake hub
Wrench (12 mm): for cut part of ball screw close to the motor.

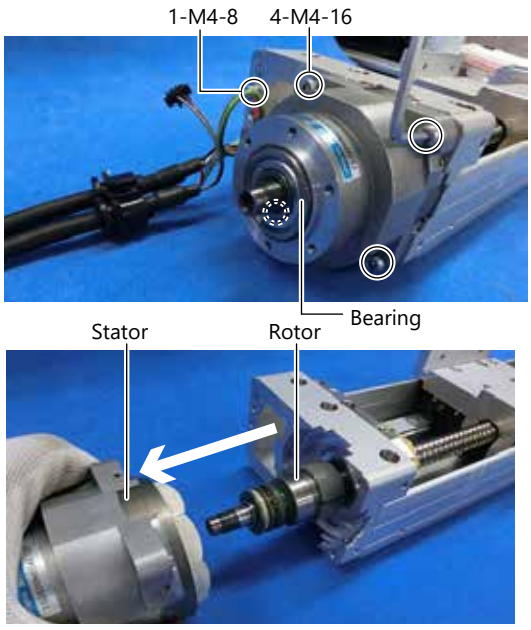
Skip this step when the brake hub has been already removed in the previous step.

▶ Step 1 Removing bearing fixing nut



Step 2 Remove the motor fixing bolts (4-M4-16) and ground wire fixing screw (1-M4-8) to pull the stator with bearing out.

▶ Step 2 Removing motor (stator)



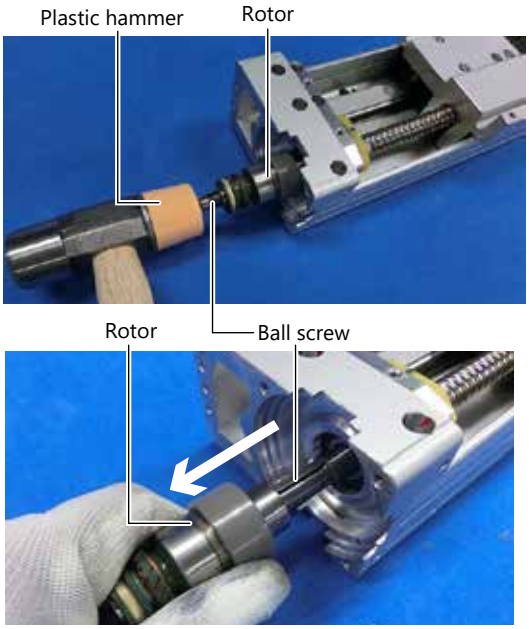
Step 3 Pull the rotor out next. When it does not work by hand, pat the end face of the ball screw with a plastic hammer to loosen.

CAUTION

The stator and rotor are a set. Make sure to replace them as a set since a different combination causes an error.

Skip to "7. Installing motor" when replacing only the motor.

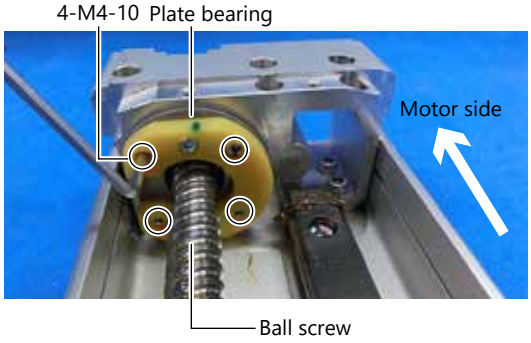
▶ Step 3 Removing motor (rotor)



5. Removing ball screw

Step 1 Remove the bolts (4-M4-10) and then plate bearing.

▶ Step 1 Removing plate bearing



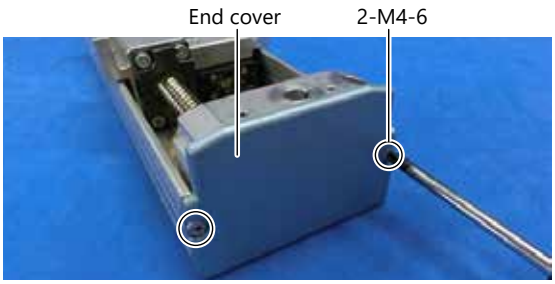
Step2 Remove the screws (2-M4-6) to take off the end cover.

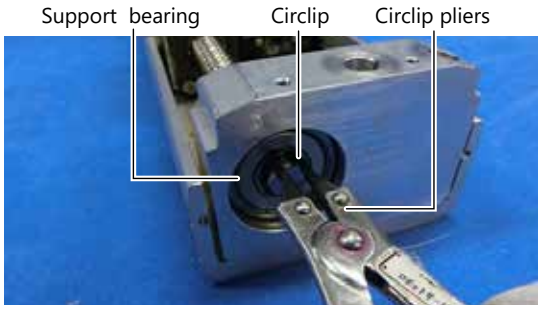
Remove the circlip using circlip pliers.

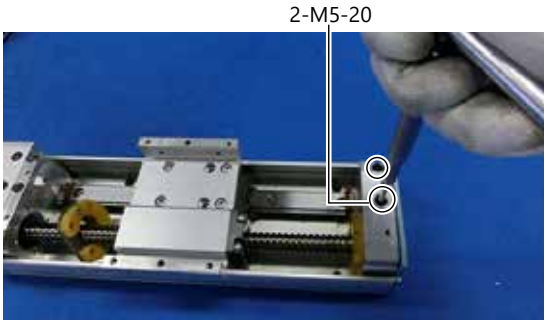
Remove the bolts (2-M5-20) and then the support block.

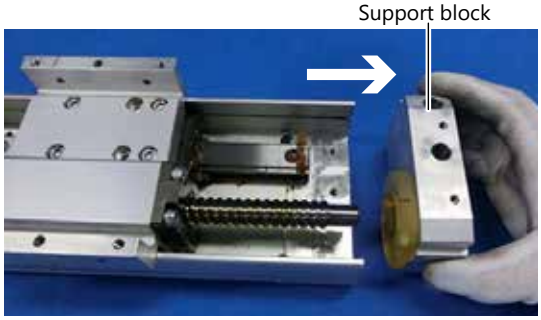
Remove the support bearing from the support block.

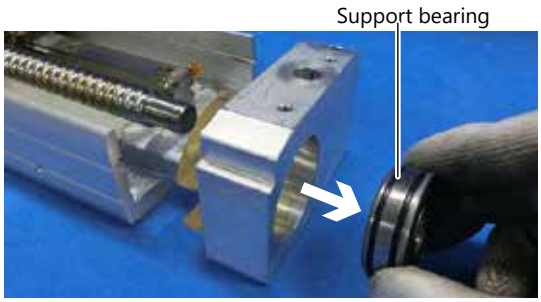
Step 2 Removing support block and bearing





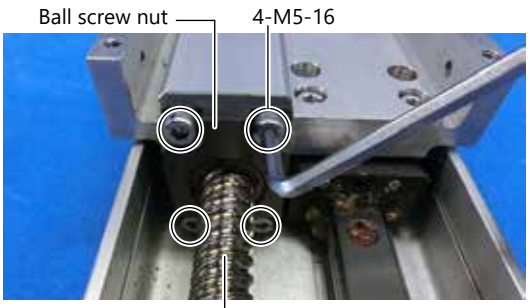


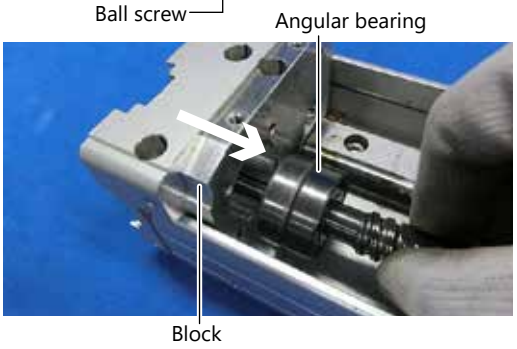




02 ▶ Step 3 Removing angular bearing

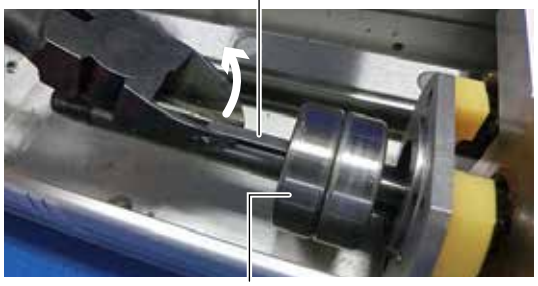
Step 3 Remove the ball screw nut fixing bolts (4-M5-16) and pull out the ball screw from the block.



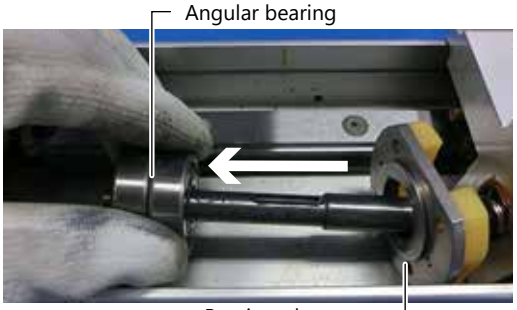


02 ▶ Step 4 Removing ball screw

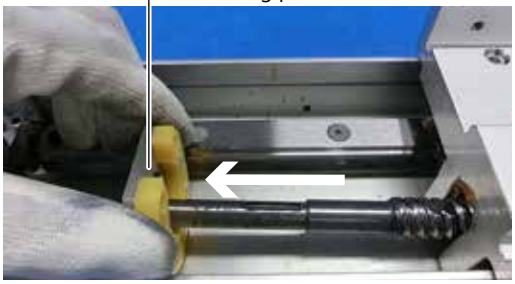
Step 4 Remove the key from the ball screw using nippers.



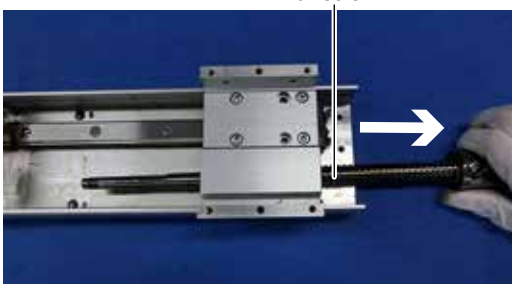
Pull out the angular bearing from the ball screw.



Pull out the bearing plate from the ball screw.



Pull out the ball screw.



This is the end of removing processes.
Next step is installing.

6. Installing ball screw

Step 1 Insert the ball screw (№13) into the carriage.

NOTE
Refer to the tables of "Replacement parts" (P2) for the mentioned numbers written in ().

Insert the bearing plate into the ball screw.

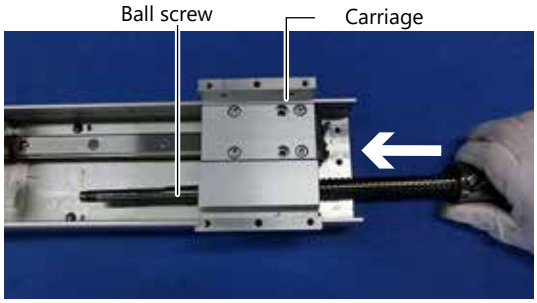
Refer to the photo in the right to match the face of the angular bearing (№9).

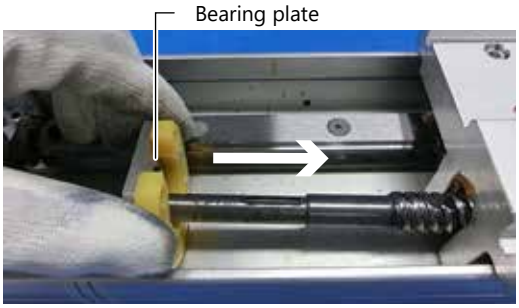
Insert the angular bearing into the ball screw.

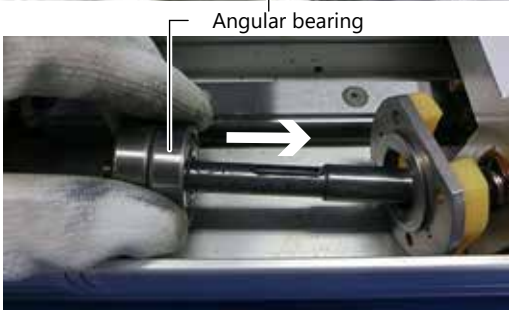
Step 2 Attach the key (№12) to the ball screw.

Use pliers on the key protected with waste cloth or else to put into the key all the way.

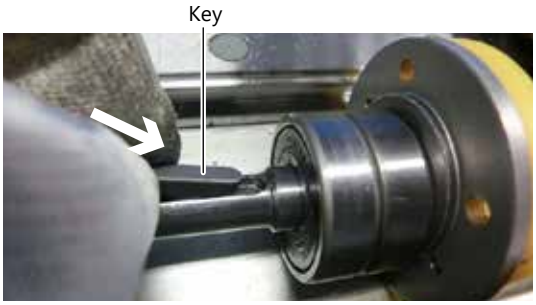
▶ Step 1 Installing ball screw





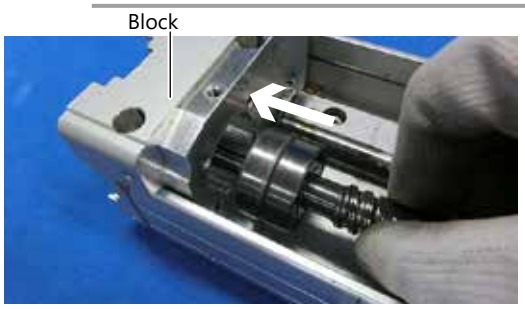


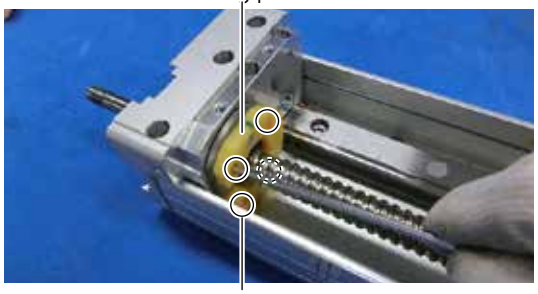
▶ Step 2 Installing key



Step 3 Insert the angular bearing into the block and tighten the bolts (4-M4-10) in a diagonal pattern to fix the bearing plate.

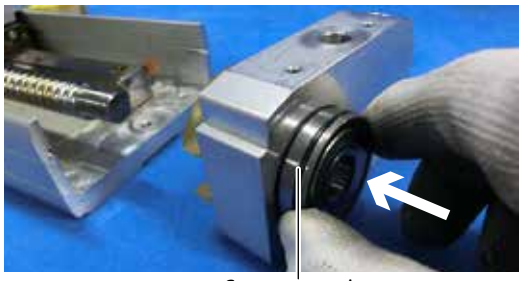
▶ Step 3 Installing bearing plate



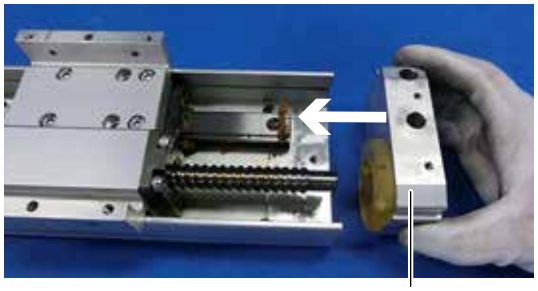


Step 4 Insert the support bearing into the support block (№10).

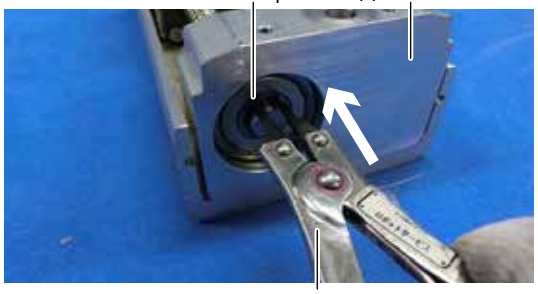
▶ Step 4 Installing bearing plate



Insert the support block with installing support bearing into the ball screw.



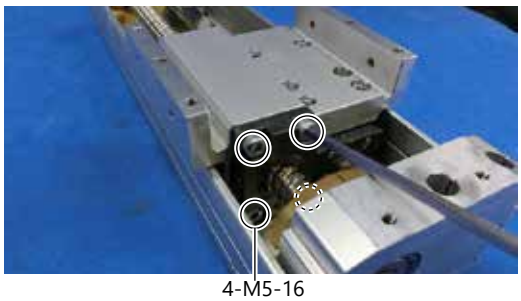
Attach the circlip (№11) into the groove at then of the ball screw using circlip pliers.



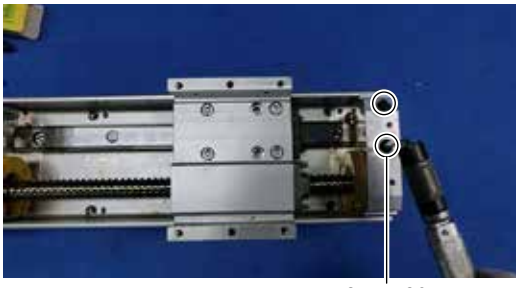
Temporarily fix the block with the support block bolts (2-M5-20).

▶ Step 5 Adjusting alignment

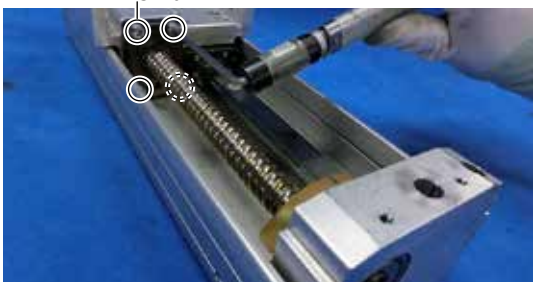
Step 5 Move the carriage close to the non-motor side and temporarily tighten the bolts (4-M5-16) of ball screw nut.



With keeping above, tighten the bolts (2-M5-20) of support block with a torque wrench.
Tightening torque: 7.5Nm



Then tighten the bolts (4-M5-16) of ball screw nut with a torque wrench in a diagonal pattern.
Tightening torque: 7.5Nm



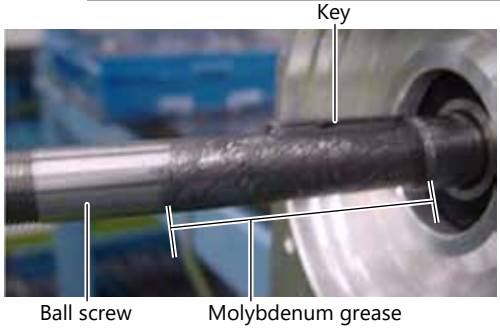
Step 6 Apply appropriate amount of Alvania grease all over the ball screw and move the carriage by hand to make it smooth.

CAUTION
Extra grease will be spattered when the robot moves.

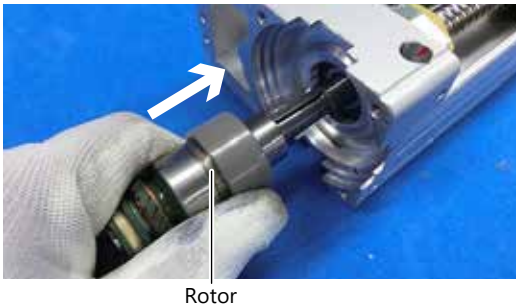
7. Installing motor

▶ Step 1 Installing motor (rotor)

Step 1 Apply Molybdenum grease onto the shaft part of ball screw. Refer to the photo in the right for the area of applying grease.



Insert the rotor (№5) into the shaft in the direction shown in the right photo.



CAUTION
The stator and rotor are a set. Make sure to replace them as a set since a different combination causes an error.

Step 2 Install the stator inserting jig on the ball screw to insert stator (№5).

CAUTION
Take care not to get your fingers caught as the magnet force pulls the stator to the non-motor side after inserting it to a certain extent.

Tighten the motor fixing bolts (4-M4-16) in a diagonal pattern with a torque wrench.
Tightening torque: 3.8Nm

Step 3 Thinly apply Alvania grease around the support bearing (№6).

Insert the support bearing (№6) into the stator.

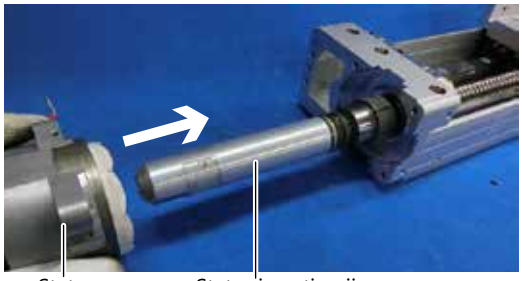
Skip to "8. Installing brake" for the models with brake.

Step 4 Confirm the bearing nut direction. The convex surface touches the bearing.

Apply LOCTITE (№648 [Green]) onto the threaded part at the end of ball screw, and tighten the bearing nut with a torque spanner (14 mm) and wrench (12 mm).
Tightening torque: 20Nm

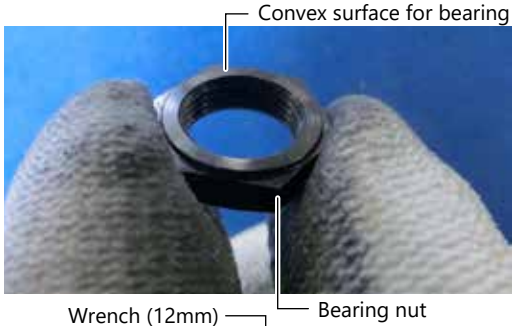
Skip to "9. Assembling cover" for the models without brake.

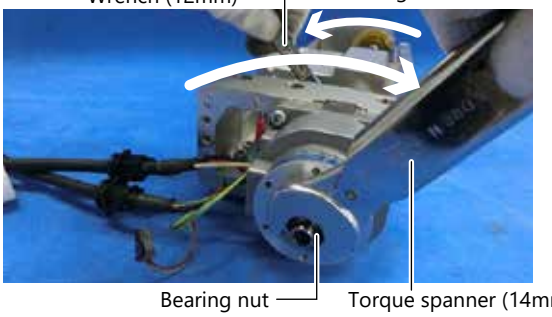
Step 2 Installing motor (stator)



Step 3 Installing bearing

Step 4 Installing Motor (Stator)





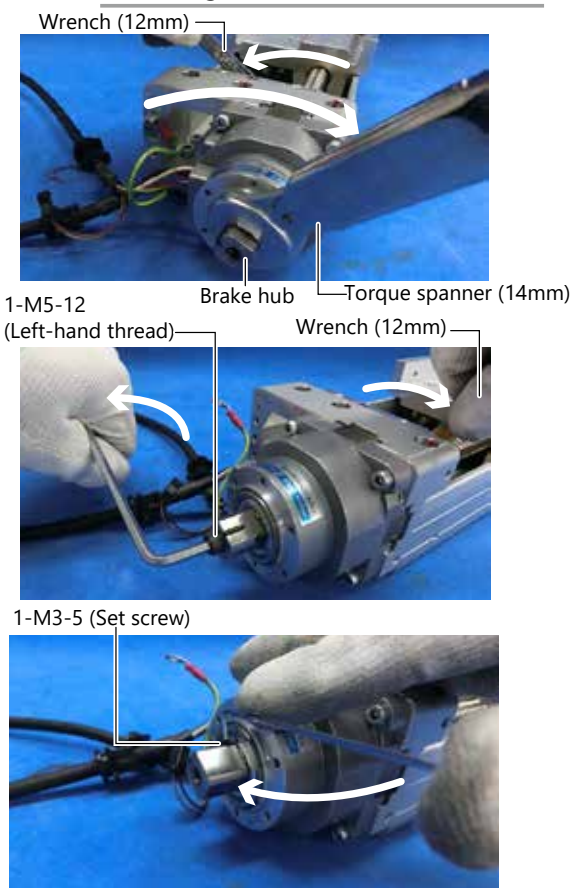
8. Installing brake

Step 1 Apply LOCTITE (№648 [Green]) onto the threaded part at the end of ball screw on motor side, install the brake hub and tighten it with a torque spanner (14 mm) and wrench (12 mm).
Tightening torque: 20Nm

Apply LOCTITE (№241 [Blue]) onto the bolts (№ 3, 1-M5-12, left-hand thread). Fix the ball screw shaft with a wrench (12 mm) to tighten the bolts.

Tighten the set screw (№ 2, 1-M3-5).

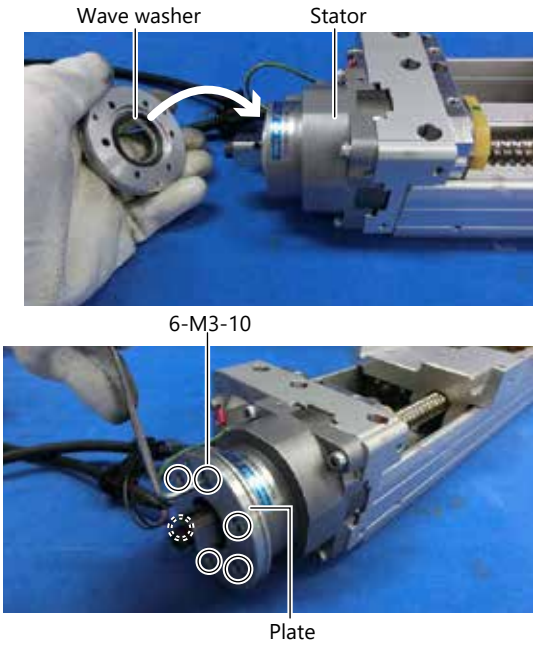
▶ Step 1 Installing brake hub



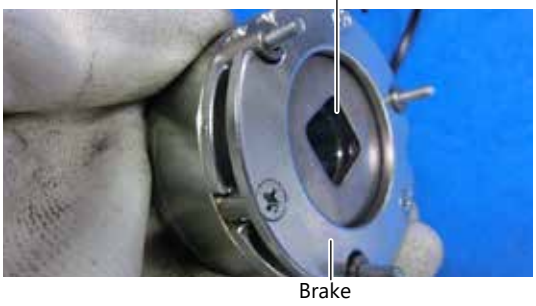
Step 2 Put the wave washer (№4) inside the plate and install it to the stator.

Tighten the bolts (6-M3-10) to fix the plate.
Tightening torque: 2Nm

▶ Step 2 Installing plate



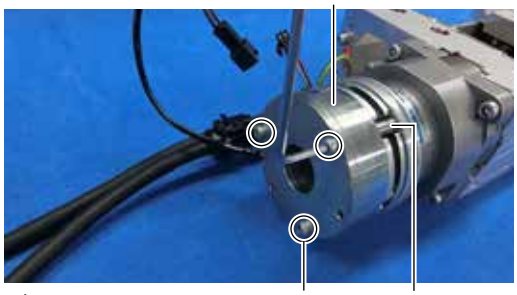
Step 3 Check the square hole of the brake (№1).



Insert the brake with matching its hole and the brake hub.

Tighten the bolts (3-M3-35) to fix the brake with taking care not to drop any spacers.
Tightening torque: 2Nm

Trq

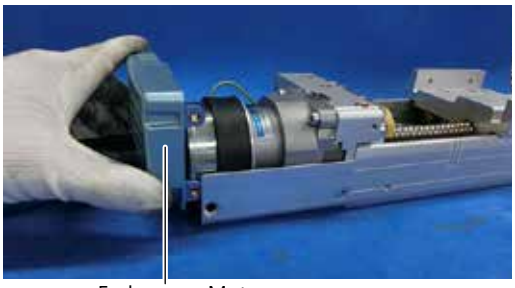


Install the brake cover and grommet.

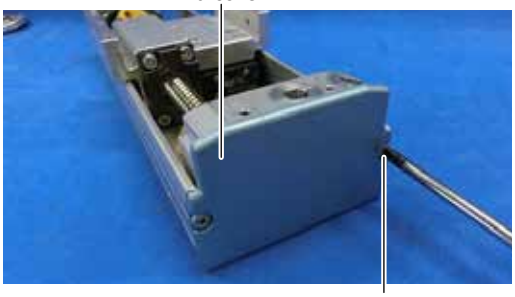
9. Assembling cover

Step 1 Fix three types of motor covers with flat head screws (8-M4-8).

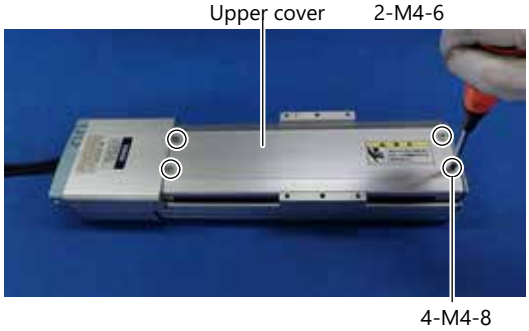
▶ Step 1 Assembling cover



Fix the end cover with screws (2-M4-6).



Fix the upper cover with screws (4-M4-8).



10. Confirming after work

Step 1 Check the grid position.
Refer to "Checking the grid position" of the Maintenance Manual for FLIP-X Series.

Model	Lead (mm)	Standard value (%)
F10	5,10	30 to 70
	20	20 to 80

NOTE
Grid position is within the standard value range:
⇒ 11. Confirming position shift
Grid position is within the standard value range:
⇒ Step 2

Step 2 Adjust the grid position.

CAUTION
When adding sims to the motor side, jointly tighten the sims with sandwiched between the bearing plate and damper.

NOTE
- Check the parameter to make sure the origin direction is motor side / non-motor side.
- Replace the damper or adjust the number of sims referring to the tables below as it depends on the lead, origin direction and the result of initial value. Although not required, it is recommended to adjust the grid position. If there is a big gap, it may cause the standard position gap after performing return-to-origin in the future.

▶ Step 2 Removing bearing plate

Motor side

Damper (Bearing plate)

Non-motor side

F10-05(BK)-***

	Return-to-Origin on Motor Side		Return-to-Origin on Non-motor Side	
Initial Grid Position	0-29%	71-100%	0-29%	71-100%
Damper Replacement	Change to KX7-M22J2-01	No replacement	Change to KX6-M22J2-00	No replacement
Sim Addition	Add KX7-M2295-00 *1	Add KX7-M2295-00 *1	Add KX6-M2295-00 *1	Add KX6-M2295-00 *1

F10-10(BK)-***

	Return-to-Origin on Motor Side		Return-to-Origin on Non-motor Side	
Initial Grid Position	0-29%	71-100%	0-29%	71-100%
Damper Replacement	Change to KX7-M22J2-01	Change to KX7-M22J2-02	Change to KX6-M22J2-01	No replacement
Sim Addition	No addition	No addition	No addition	Add KX6-M2295-00 *2

F10-20(BK)-***

	Return-to-Origin on Motor Side		Return-to-Origin on Non-motor Side	
Initial Grid Position	0-19%	71-100%	0-19%	71-100%
Damper Replacement	Change to KX7-M22J2-01	Change to KX7-M22J2-02	Change to KX6-M22J2-01	No replacement
Sim Addition	No addition	No addition	No addition	Add KX6-M2295-00 *2

11. Confirming position shift

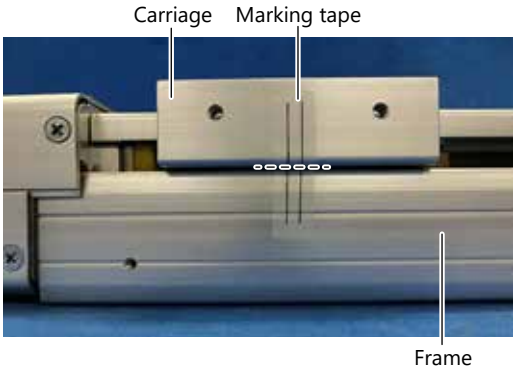
Step 1 Connect to the controller and move the robot to the 0 mm position.

CAUTION
Do not enter the safety enclosure and work during the robot servo ON.

Step 2 Check the marking taped in "2. Removing cover". If there is a gap, adjust the origin shift of the controller parameter.

Refer to the manuals for adjusting parameters.

▶ Step 1 Confirming position shift



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Revision Record

Issue date	Description
Jul. 2020	First edition

Maintenance Procedures

YAMAHA SINGLE-AXIS ROBOT

F10

Jul. 2020

Version 1.00

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