YAMAHA
YAMAHA MOTOR CO., LTD.

YAMAHA SINGLE-AXIS ROBOT TRANSERVO series

SSC04/SSC05/SSC05H

User's Manual

ENGLISH E

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General Contents

Introduction

Thank you for purchasing the YAMAHA single-axis robot TRANSERVO series.

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

- 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.
- Specifications of robot models other than standard models may be omitted in this manual if they are common to those of standard models. In this case, refer to the specifications of standard models.
- For details on specific operation of the robot, refer to the separate user's manual for the robot controller being used.

NOTES

◆ The contents of this manual are subject to change without prior notice.

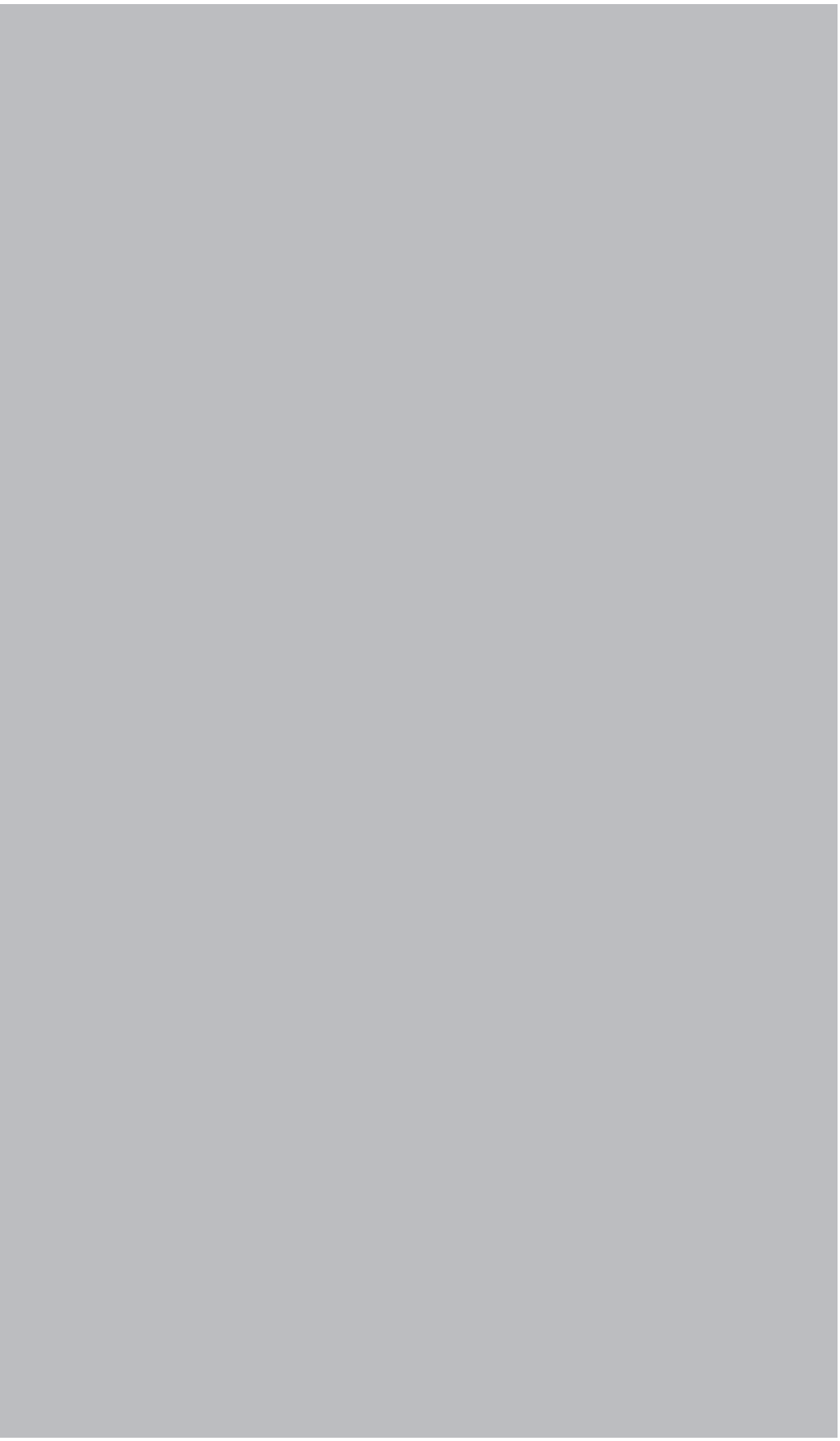
◆ While every effort has been made to ensure the contents of this manual are correct, please contact us if you find any part of this manual to be unclear, confusing or inaccurate.

YAMAHA MOTOR CO., LTD.
IM Operations

MEMO

Chapter 1 Using the Robot Safely

Contents



1-1 Safety information

To ensure correct and safe use of YAMAHA industrial robots, carefully read this manual and make yourself well acquainted with the contents. FOLLOW THE WARNINGS, CAUTIONS AND INSTRUCTIONS included in this manual. Failure to take necessary safety measures or mishandling due to not following the instructions in this manual may result in trouble or damage to the robot and injury to personnel (robot operator or service personnel) including fatal accidents.

Warning symbols and signal words used in this manual are classified as explained below. Make sure that you fully understand the meaning of each symbol and comply with the instructions.

DANGER

FAILURE TO FOLLOW DANGER INSTRUCTIONS WILL RESULT IN SEVERE INJURY OR DEATH TO THE ROBOT OPERATOR, BYSTANDERS OR PERSONS INSPECTING OR REPAIRING THE ROBOT.

WARNING

FAILURE TO FOLLOW WARNING INSTRUCTIONS COULD RESULT IN SEVERE INJURY OR DEATH TO THE ROBOT OPERATOR, BYSTANDERS OR PERSONS INSPECTING OR REPAIRING THE ROBOT.

CAUTION

Failure to follow CAUTION instructions may result in injury to the robot operator, bystanders or persons inspecting or repairing the robot, or damage to the robot and/or robot controller.

NOTE

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

Reference

Gives useful information related to the robot operation.

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

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

It is not possible to list all safety items in detail within the limited space of this manual. So it is essential that the user have a full knowledge of basic safety rules and also that the operator makes correct judgments on safety procedures during operation.
For specific safety information and standards, refer to the applicable local regulations and comply with the instructions. This manual and warning labels supplied with or attached to the robot are written in English. Unless the robot operators or service personnel understand English, do not permit them to handle the robot.

* Cautions regarding the official language of EU countries
For equipment that will be installed in EU countries, the language used for the user's manuals, CE declarations, and operation screen characters is English only. Warning labels only have pictograms or else include warning messages in English. In the latter case, Japanese messages might be added.

1-2 Essential precautions

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

(1) Observe the following cautions during automatic operation.

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

DANGER

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

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

Warning label 1

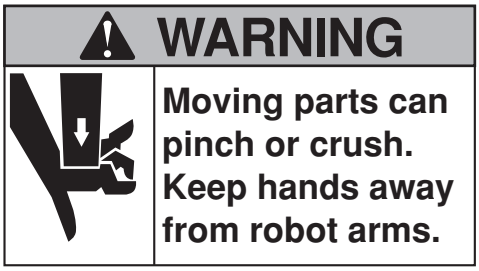
(2) Use caution to prevent hands or fingers from being pinched or crushed.

- Use caution to prevent hands or fingers from being pinched or crushed by the moving parts when carrying the robot or during teaching.
- Warning labels 2 are supplied with the robot and should be affixed to the robot or conspicuous spots near the robot.

WARNING

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

Warning label 2



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

- Be sure to read the warning labels and this manual carefully and make sure you thoroughly understand their contents before attempting installation and operation of the robot.
- Before starting robot operation, be sure to reread the procedures and cautions relating to your work as well as descriptions in this chapter (Chapter 1, "Using the Robot Safely").
- Never install, adjust, inspect or service the robot in any manner that does not comply with the instructions in this manual.
- Warning labels 3 are supplied with the robot and should be affixed to the robot or conspicuous spots near the robot.

WARNING

IMPROPER INSTALLATION OR OPERATION CAN RESULT IN SERIOUS INJURY OR DEATH.
READ THE USER'S MANUAL AND ALL WARNING LABELS BEFORE OPERATION.

Warning label 3

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

WARNING

IF WARNING LABELS ARE REMOVED OR DIFFICULT TO SEE, THEN ESSENTIAL PRECAUTIONS MIGHT NOT BE TAKEN, RESULTING IN ACCIDENTS.

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

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

WARNING

- THIS ROBOT WAS NOT DESIGNED FOR OPERATION IN ENVIRONMENTS WHERE INFLAMMABLE OR EXPLOSIVE SUBSTANCES ARE PRESENT.
- DO NOT USE THE ROBOT IN ENVIRONMENTS CONTAINING INFLAMMABLE GAS, DUST OR LIQUIDS. EXPLOSIONS OR FIRE MIGHT OTHERWISE RESULT.

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

WARNING

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

(7) Use caution when releasing the brake of a vertical use robot.

WARNING

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

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

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

WARNING

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

(9) Use caution when removing the motor. (Vertical use robots)

WARNING

THE VERTICAL AXIS WILL SLIDE DOWN WHEN THE MOTOR IS RELEASED, CAUSING A HAZARDOUS SITUATION.

- **TURN OFF THE ROBOT CONTROLLER AND PROP UP THE VERTICAL AXIS WITH A SUPPORT STAND BEFORE REMOVING THE MOTOR.**
- **BE CAREFUL NOT TO LET YOUR BODY GET CAUGHT BETWEEN THE VERTICAL AXIS PARTS AND INSTALLATION BASE.**

(10) Be careful not to touch the motor and peripheral parts when hot.

WARNING

The motor and speed reduction gear casing are extremely hot after automatic operation, so burns may occur if these are touched. Before handling these parts during inspection or servicing, turn off the controller, wait for a while and check that the parts have cooled.

(11) Consult us for corrective action when the robot is damaged or malfunctions occur.

WARNING

IF ANY PART OF THE ROBOT IS DAMAGED OR ANY MALFUNCTION OCCURS, CONTINUING THE OPERATION MAY BE VERY DANGEROUS. PLEASE CONSULT YOUR YAMAHA SALES OFFICE OR DEALER FOR CORRECTIVE ACTION.

Damage or Trouble	Possible Danger
Damage to machine harness or robot cable	Electrical shock, malfunction of robot
Damage to exterior of robot	Flying outwards of damaged parts during robot operation
Abnormal operation of robot (positioning error, excessive vibration, etc.)	Malfunction of robot
Z-axis brake trouble	Dropping of load

(12) Protective bonding

WARNING

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

(13) Be sure to make correct parameter settings.

CAUTION

The robot must be operated with correct tolerable moment of inertia and acceleration coefficients according to the manipulator tip mass and moment of inertia. If these are not correct, drive unit service life may end prematurely, and damage to robot parts or residual vibration during positioning may result.

(14) Take the following safety precautions during inspection of controller.

WARNING

- WHEN YOU NEED TO TOUCH THE TERMINALS OR CONNECTORS ON THE OUTSIDE OF THE CONTROLLER DURING INSPECTION, ALWAYS FIRST TURN OFF THE CONTROLLER POWER SWITCH AND ALSO THE POWER SOURCE IN ORDER TO PREVENT POSSIBLE ELECTRICAL SHOCK.
- NEVER TOUCH ANY INTERNAL PARTS OF THE CONTROLLER.
- REFER TO THE "YAMAHA ROBOT CONTROLLER USER'S MANUAL" FOR PRECAUTIONS ON HANDLING THE CONTROLLER.

(15) Follow the specified procedures when installing, adjusting or inspecting the robot.

WARNING

ALWAYS FOLLOW THE SPECIFIED PROCEDURES WHEN INSTALLING, ADJUSTING OR INSPECTING THE ROBOT. NEVER ATTEMPT ANY PROCEDURE NOT DESCRIBED IN THIS MANUAL.

(16) Do not attempt any repair, parts replacement and modification.

WARNING

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

(17) Location for installing the controller and the Handy Terminal

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

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

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

(19) Install an operation status light.

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

(20) Clean work tools, etc.

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

(21) Provide adequate lighting.

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

(22) Prevent the gripped object from flying outwards.

If the object or workpiece gripped by the robot might fly outward or drop and create a hazard to the operator, then protective equipment should be installed by taking the size, weight, temperature and chemical properties of the object into account.

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

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

(1) Robot operating procedures needed for tasks such as startup procedures and handling switches

(2) Robot speeds used during tasks such as teaching

(3) Methods for workers to signal each other when two or more workers perform tasks

(4) Steps that the worker should take when a problem or emergency occurs

(5) Steps to take after the robot has come to a stop when the emergency stop device was triggered, including checks for cancelling the problem or error state and safety checks in order to restart the robot.

(6) In cases other than above, the following actions should be taken as needed to prevent hazardous situations due to sudden or unexpected robot operation or faulty robot operation, as listed below.

1. Show a display on the operator panel
2. Ensure the safety of workers performing tasks within the robot movement range
3. Clearly specify position and posture during work

Position and posture where worker can constantly check robot movements and immediately move to avoid trouble if an error/problem occurs

4. Install noise prevention measures
5. Use methods for signaling operators of related equipment
6. Use methods to decide that an error has occurred and identify the type of error

Implement the "work instructions" according to the type of robot, installation location, and type of work task.
When drawing up the "work instructions", make an effort to include opinions from the workers involved, equipment manufacture's technicians, and workplace safety consultants, etc.

(24) Display a sign on operation panel during work

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

(25) Make daily and periodic inspections.

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

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

1-3 Industrial robot operating and maintenance personnel

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

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

1-4 Robot safety functions

(1) Overload detection

Detects motor overload conditions and shuts off the power.

(2) Abnormal temperature detection

This function detects abnormally high temperatures at the controller's driver, and shuts off the power. The following measures should be taken when an error (overload error, abnormal temperature error) occurs.

1. Reduce the speed.
2. Insert a "stop period" in the operation.
3. Reduce the acceleration coefficient.

(3) Soft limits

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

WARNING

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

(4) Mechanical stoppers

The mechanical stoppers prevent axis motion from exceeding the permissible motion range when the power is shut off by an emergency stop or by a safety function during high-speed robot movement.
Note: The movement range is the area limited by mechanical stoppers.

WARNING

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

(5) Vertical axis brake

Vertical axis is equipped with an electromagnetic brake to prevent the vertical axis from falling when a power shut off occurs. This brake is engaged when the robot positioner power is OFF, and when the robot positioner power is ON while the vertical axis servo is OFF.
The vertical axis brake can be released from the Handy Terminal HT1 when the robot positioner power is ON.

WARNING

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

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

1-5 Safety measures for the system

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

1-6 Trial operation

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

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

1. Use sturdy, stable posts which will not fall over easily.
2. The rope or chain should be easily visible by everyone around the robot.
3. Place a sign to keep the operator or other personnel from entering the movement range of the manipulator.

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

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

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

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

1-7 Work within the safety enclosure

(1) Work within the safety enclosure

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

1) Soft limit settings

2) Teaching

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

(2) Teaching

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

1) Check or perform the following points from outside the safety enclosure.

1. Make sure that no hazards are present within the safety enclosure by a visual check.
2. Check that the Handy Terminal is operating normally.
3. Check that no failures are found in the robot.
4. Check that emergency stop works correctly.
5. Select teaching mode and prohibit automatic operation.

2) Never enter the movement range of the manipulator while within the safety enclosure.

1-8 Automatic operation

Automatic operation described here includes all operations in AUTO mode.

(1) Check the following before starting automatic operation.

1. No one is within the safety enclosure.
2. The Handy Terminal and tools, etc., are in their prescribed positions.
3. The alarm or error lamps on the robot and peripheral equipment do not flash.
4. The safety enclosure is securely installed with safety interlocks actuated.

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

1) After automatic operation has started, check the operation status and signal light to ensure that the robot is in automatic operation.

2) Never enter the safety enclosure during automatic operation.

3) If an error occurs in the robot or peripheral equipment, observe the following procedure before entering the safety enclosure.

   1. Press the emergency stop button to set the robot to emergency stop.
   2. Place a sign on the start switch, indicating that the robot is being inspected in order to keep any other person from touching the start switch and restarting the robot.

1-9 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;

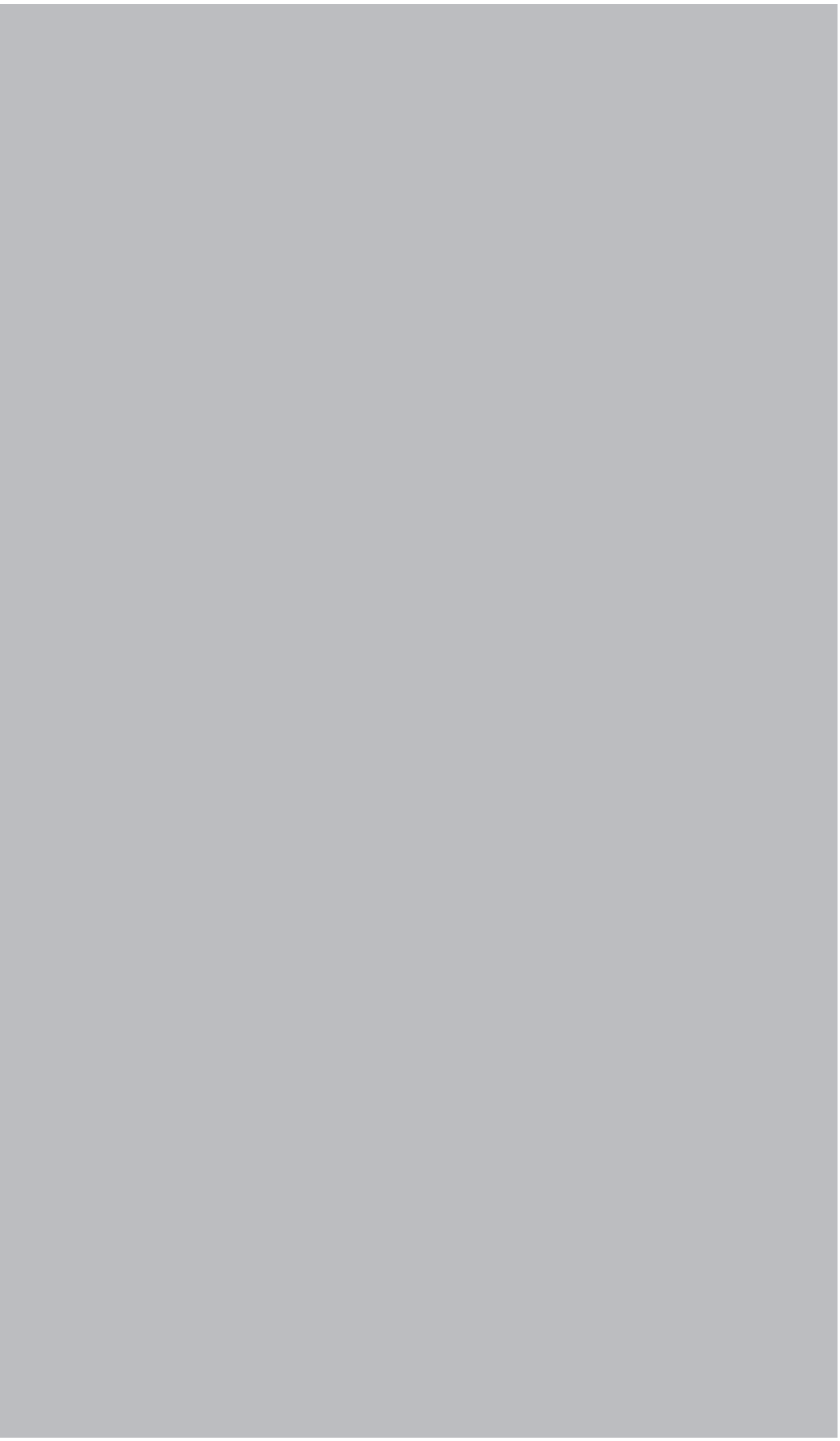
■ **The following cases are not covered under the warranty:**

1. Products whose serial number or production date (month & year) cannot be verified.
2. Changes in software or internal data such as programs or points 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.

THE WARRANTY STATED HEREIN PROVIDED BY YAMAHA ONLY COVERS DEFECTS IN PRODUCTS AND PARTS SOLD BY YAMAHA TO DISTRIBUTORS UNDER THIS AGREEMENT. ANY AND ALL OTHER WARRANTIES OR LIABILITIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY EXPRESSLY DISCLAIMED BY YAMAHA. MOREOVER, YAMAHA SHALL NOT BE HELD RESPONSIBLE FOR CONSEQUENT OR INDIRECT DAMAGES IN ANY MANNER RELATING TO THE PRODUCT.

Chapter 2 Installation and Connections

Contents



2-1 Checking the product

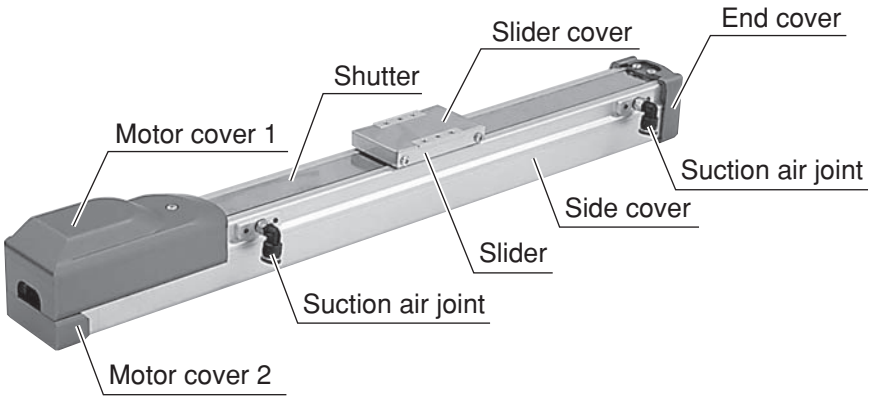
After unpacking, make sure that all components and accessories are included (as specified in your order). Also check the product for any damage on the exterior which might have occurred during shipping.
If there are any missing parts or damage due to shipping, please notify your YAMAHA sales office or representative immediately.

WARNING

- **TO REMOVE THE ROBOT UNIT FROM THE PACKING CASE, GRASP THE UNIT WITH BOTH HANDS (AT THE BOTTOM FACE) NEAR THE TWO ENDS. THE ROBOT SHOULD BE CARRIED IN AN UPRIGHT (SLIDER AT TOP) POSTURE.**
- **WHEN UNPACKING, CAREFULLY HOLD THE ROBOT NOT TO DROP IT. IF THE ROBOT FALLS, SERIOUS INJURY MAY OCCUR OR THE ROBOT MAY BE DAMAGED.**

2-2 Robot part names

SSC04



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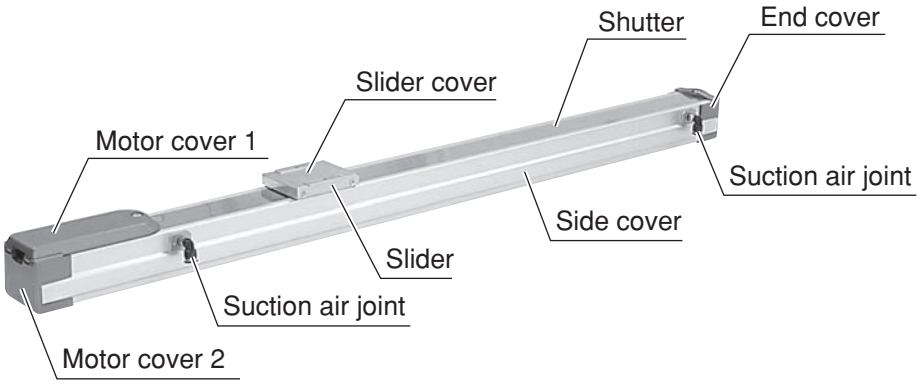

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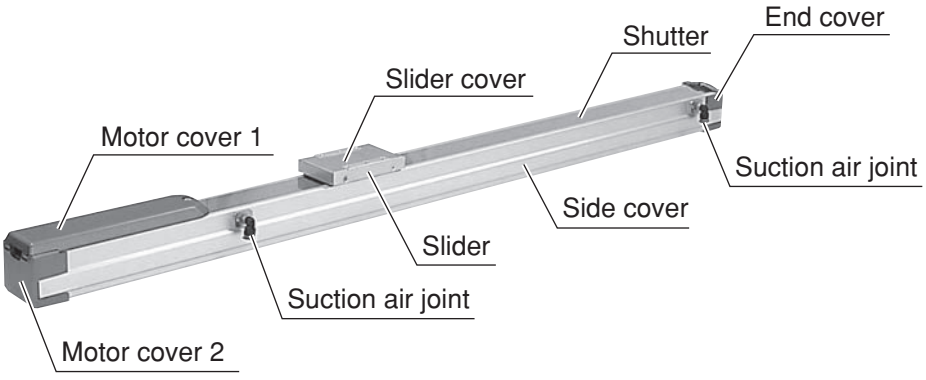


2-3 Robot installation conditions

Be sure to install the robot in the following environments.

Items	Specifications
Allowable ambient temperature	0 to 40°C
Allowable ambient humidity	35 to 85% RH (no 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 and liquid. Avoid installation near objects causing electromagnetic interference, electrostatic discharge and radio frequency interference.
Vibration	Do not subject to impacts or vibrations.
Working space	Allow sufficient space margin to perform jobs (teaching, inspection, repair, etc.)

Refer to the TS-S Controller User's Manual for details regarding the controller installation conditions.

WARNING

AVOID INSTALLING THE ROBOT IN LOCATIONS WHERE THE AMBIENT CONDITIONS MAY EXCEED THE ALLOWABLE TEMPERATURE OR HUMIDITY, OR IN ENVIRONMENTS WHERE EXCESSIVE MOISTURE, CORROSIVE GASES, METALLIC POWDER OR DUST ARE GENERATED. MALFUNCTIONS, FAILURES OR SHORT CIRCUITS MAY OTHERWISE RESULT.

WARNING

- **THIS ROBOT WAS NOT DESIGNED FOR OPERATION IN ENVIRONMENTS WHERE INFLAMMABLE OR EXPLOSIVE SUBSTANCES ARE PRESENT.**
- **DO NOT USE THE ROBOT IN ENVIRONMENTS CONTAINING INFLAMMABLE GAS, DUST OR LIQUIDS. EXPLOSIONS OR FIRE COULD OTHERWISE RESULT.**

WARNING

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

WARNING

DO NOT USE THE ROBOT IN LOCATIONS SUBJECT TO EXCESSIVE VIBRATION. ROBOT INSTALLATION BOLTS MAY OTHERWISE BECOME LOOSE CAUSING THE ROBOT TO FALL OVER.

2-4 Installation base

To mount the robot, use an installation base that satisfies the following conditions.

(1) The installation base is subjected to a great deal of stress while the robot is in operation. Prepare a sufficiently rigid and stable installation base, taking into account the robot weight including the end effector (gripper) and workpiece.

WARNING

IF THE INSTALLATION BASE IS NOT SUFFICIENTLY RIGID AND STABLE, VIBRATION (RESONANCE) MAY OCCUR DURING OPERATION, CAUSING ADVERSE EFFECTS ON THE ROBOT WORK.

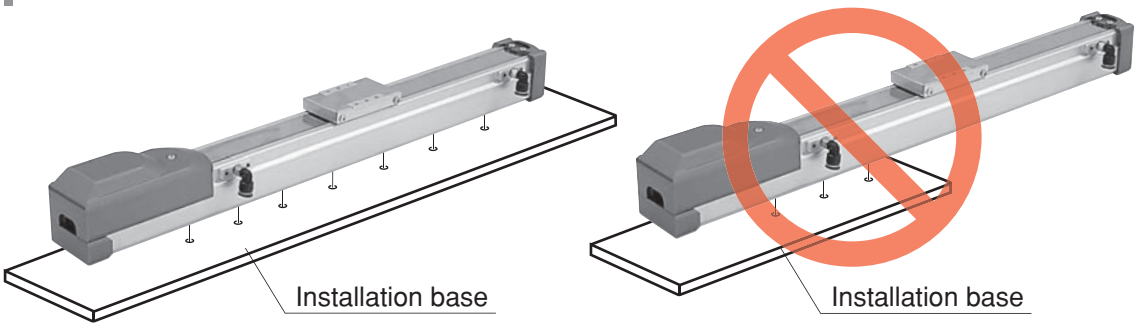
(2) The installation base surface must be machined within a flatness of ±0.05mm/500mm.

CAUTION

The robot positioning accuracy or the service life might be reduced if the installation surface precision is insufficient.

(3) Use an installation base of sufficient size to match the robot body so that the robot can be installed with the specified number of bolts. Avoid installing the robot with less than the specified number of bolts or installing the robot closer to one end as shown at the lower right.

Robot installation example



Good example　　Bad example

WARNING

WHEN INSTALLING THE ROBOT, ALWAYS USE ALL THE MOUNTING HOLES DRILLED IN THE BOTTOM OF THE ROBOT. USING LESS THAN THE SPECIFIED NUMBER OF BOLTS TO INSTALL THE ROBOT MAY CAUSE VIBRATION AND POOR POSITIONING ACCURACY. THIS MAY ALSO RESULT IN POSITIONING ERRORS AND REDUCED SERVICE LIFE IN THE WORST CASES.

NOTE

Positions of robot mounting holes differ according to the stroke length of each robot. Refer to the dimensional outlines shown in Chapter 4 "4-1 Main unit specifications".

2-5 Installing the robot

WARNING

- **BEFORE INSTALLING THE ROBOT, ALWAYS MAKE SURE THAT THE ROBOT CONTROLLER IS NOT CONNECTED TO THE ROBOT OR THE POWER TO THE CONTROLLER IS OFF. SERIOUS ACCIDENTS MAY OCCUR IF THE ROBOT STARTS TO OPERATE DURING INSTALLATION.**
- **BE SURE TO USE THE BOLTS OF THE SPECIFIED SIZE AND LENGTH AND TIGHTEN THEM SECURELY TO THE CORRECT TORQUE IN THE CORRECT POSITIONS. FAILURE TO FOLLOW THIS INSTRUCTION MAY CAUSE ROBOT VIBRATIONS, POSITION ERRORS AND SERIOUS ACCIDENTS.**
  DO NOT USE A BOLT LONGER THAN THE SPECIFIED LENGTH SINCE IT MAY INTERFERE WITH THE INTERNAL PARTS OF THE ROBOT AND CAUSE MALFUNCTIONS.

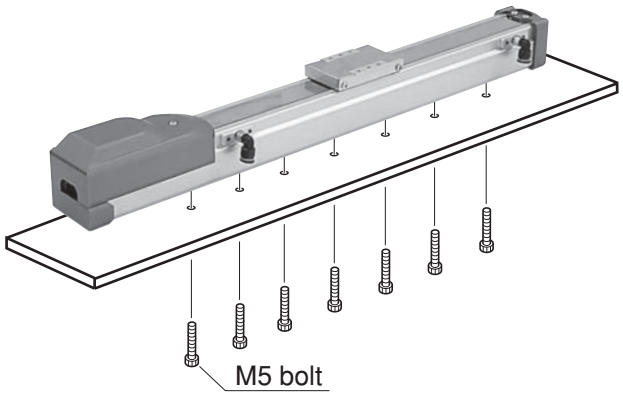
CAUTION

Do not pull the motor cable. Doing so might cause faulty wiring.

Drill holes into the surface of the installation base as shown in the figure below, and secure the robot with the prescribed bolts which are inserted from the installation base's bottom face. The bolts and tightening torques are shown below.

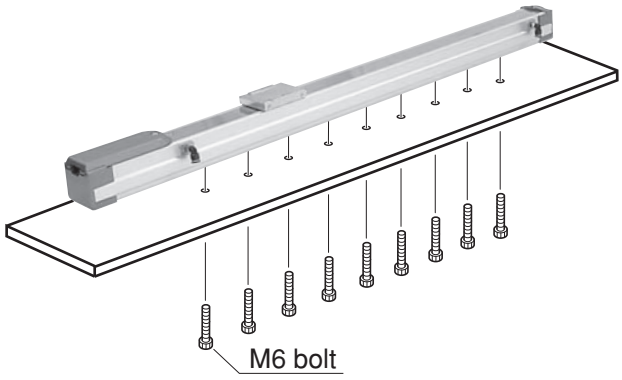
- **SSC04**

Robot	Bolt	Tightening torque
SSC04	Hex socket head cap M5 bolt, Strength: 8.8T Length: Installation base thickness + 8mm or less	60kgf•cm to 90kgf•cm



- **SSC05/SSC05H**

Robot	Bolt	Tightening torque
SSC05/ SSC05H	Hex socket head cap M6 bolt, Strength: 8.8T Length: Installation base thickness + 8mm or less	100kgf•cm to 130kgf•cm



2-6 The "Emergency Stop" stopping distance

The maximum stopping distance is 195mm (SSC05H: payload of 6kg, operation speed of 1m/sec) when the "emergency stop" button is pressed, or when power to the controller is shut off.

2-7 Connections

2-7-1 Connecting the robot to the controller

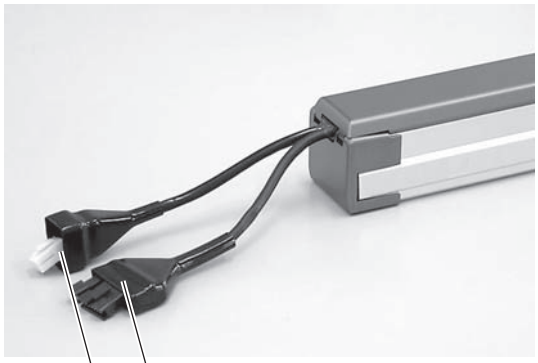
Connect the robot unit's robot cable to the robot positioner's connector as shown in the figure below. For details regarding the controller-side connector, refer to the TS-S Controller User's Manual.

WARNING

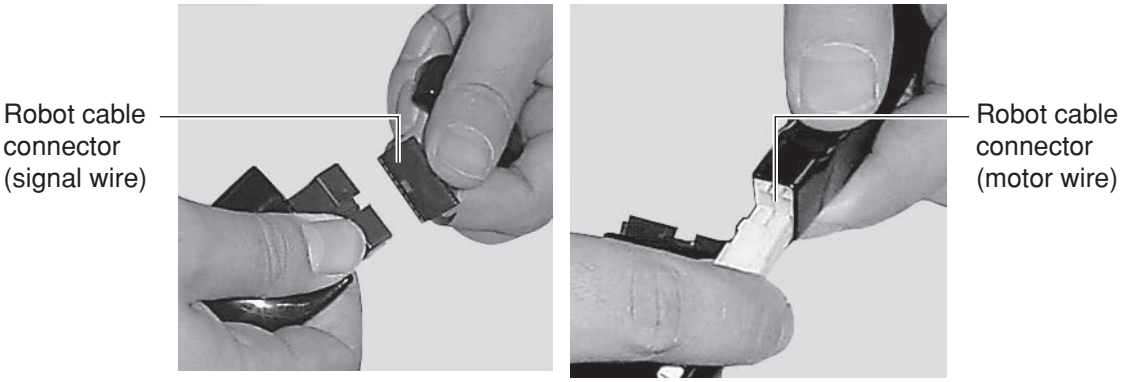
- **BEFORE CONNECTING THE CABLES, CHECK THAT THERE ARE NO BENDS OR BREAKS IN THE ROBOT CABLE CONNECTOR PINS AND THAT THE CABLES ARE NOT DAMAGED. CONTACT FAILURE MAY CAUSE ROBOT MALFUNCTIONS.**
- **ALWAYS MAKE SURE THAT THE POWER TO THE ROBOT CONTROLLER IS OFF BEFORE CONNECTING THE ROBOT CABLES TO THE CONTROLLER.**

CAUTION

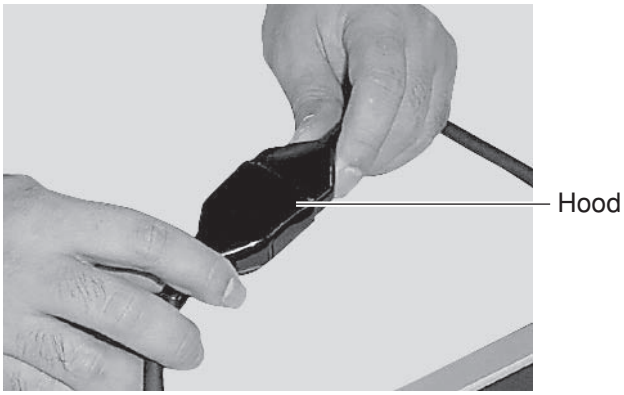
After connecting the robot cable intermediate connectors together, fit the connector hoods together securely.



1) Connect the robot cables (motor and signal wires) to the mating connectors coming out from the robot.

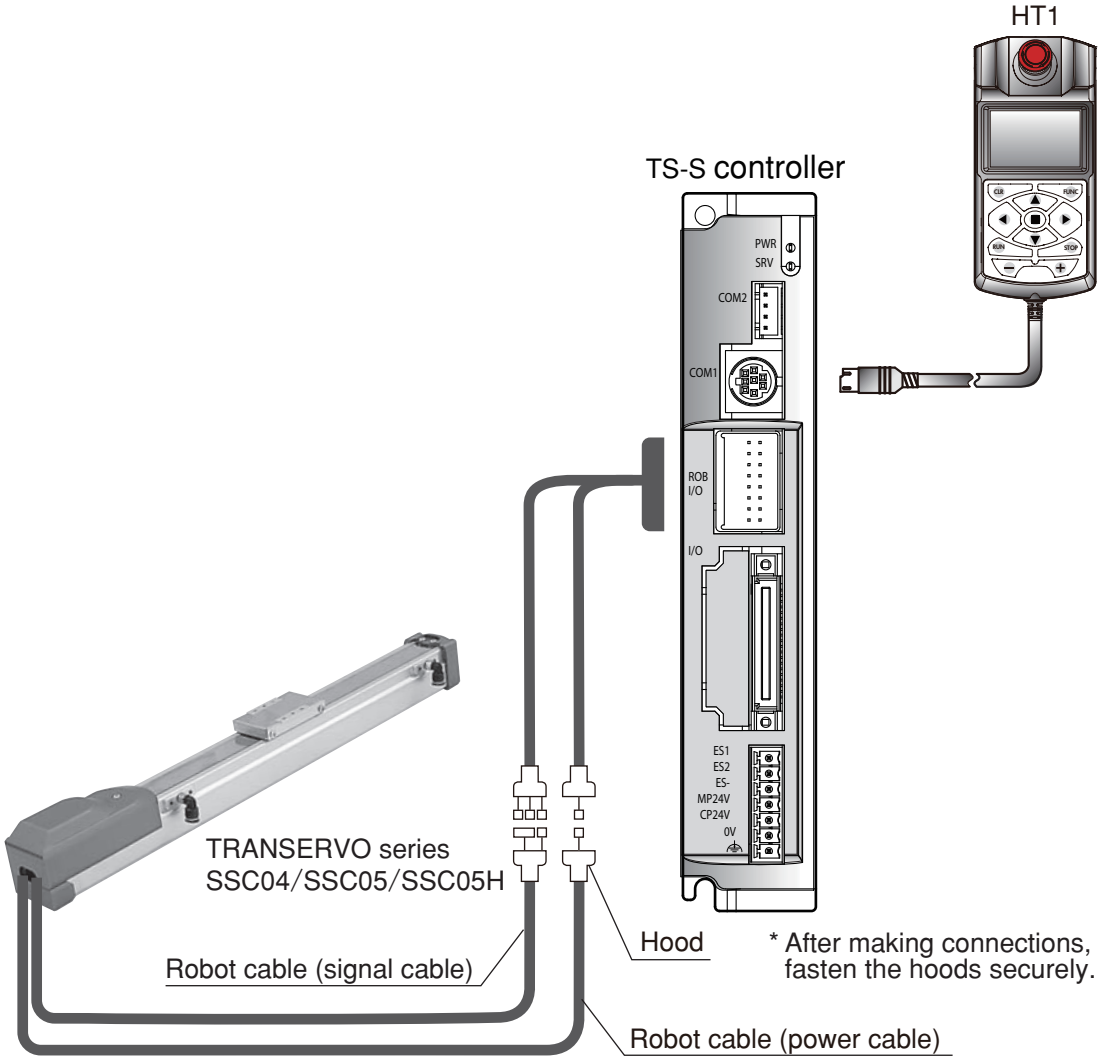


2) After making the connections, fit the connector hoods together securely.



2-7-2 Robot cable connections

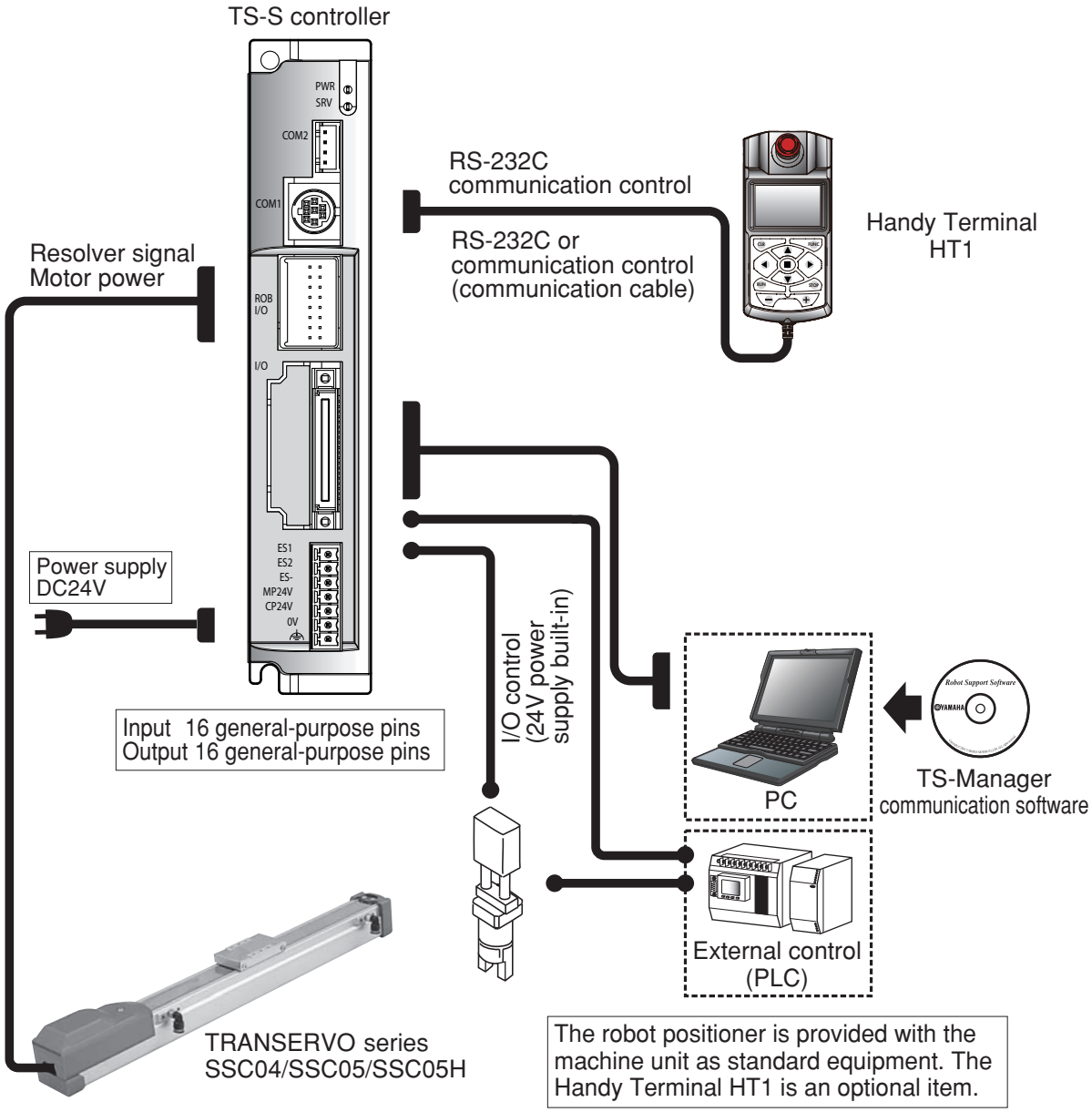
Connect the robot unit's robot cable to the TS-S controller connector as shown in the figure below.
For details regarding the controller-side connector, refer to the TS-S Controller User's Manual.



WARNING

BEFORE CONNECTING THE CABLES, CHECK THAT THERE ARE NO BENDS OR BREAKS IN THE ROBOT CABLE CONNECTOR PINS AND THAT THE CABLES ARE NOT DAMAGED.
BENT OR BROKEN PINS OR CABLE DAMAGE MAY CAUSE ROBOT MALFUNCTIONS.

2-7-3 Robot system configuration drawing



2-8 Setting the operating conditions

2-8-1 Payload

Optimal acceleration for the YAMAHA single-axis robots is automatically determined by setting the controller payload parameters. In the payload parameter, enter the total weight of the workpiece and the end effectors such as grippers attached to the robot slider.

CAUTION

Be sure to enter an accurate value when making this setting, since a mistake will cause troubles such as vibration or a shorter machine service life span.

2-8-2 Duty

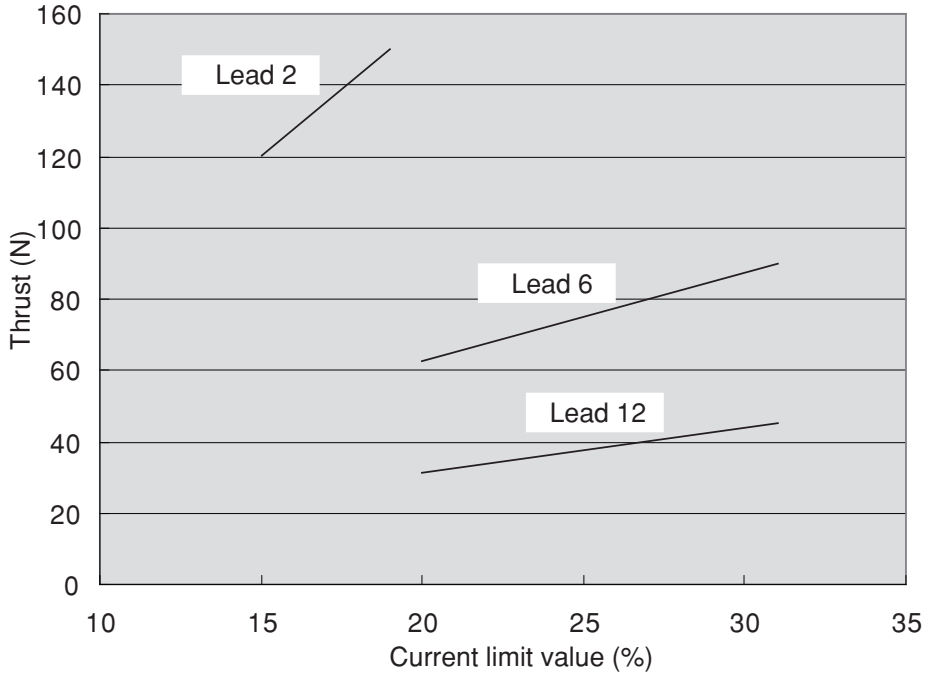
To achieve maximum service life for the YAMAHA single-axis robots, it is recommended to operate the robot within the allowable duty (50%). The duty is calculated as follows:

$$\text{Duty (\%)} = \frac{\text{Operation time}}{\text{Operation time + Non-operation time}} \times 100$$

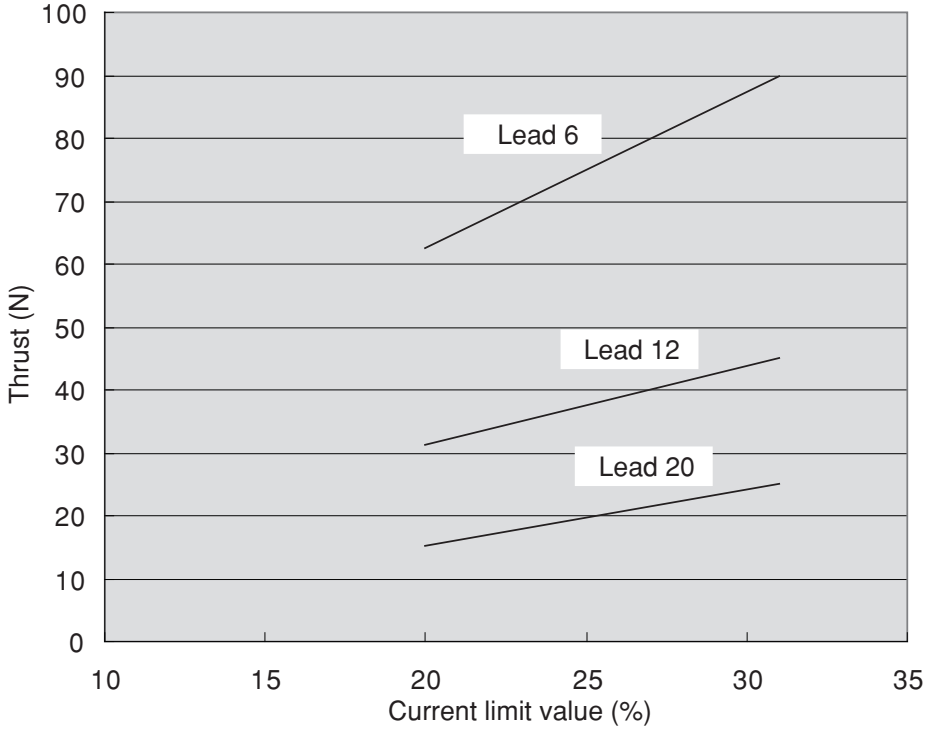
If the robot duty is too high, an error such as "overload" may occur. In this case, increase the stop time to reduce the duty.

2-8-3 Push force vs. current limit value during stop

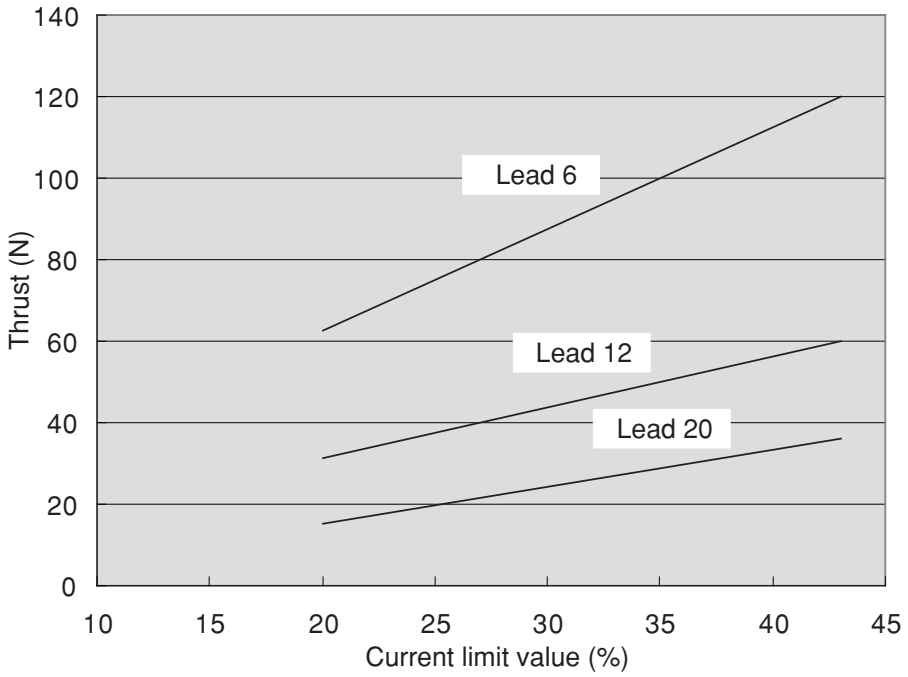
■ **SSC04 push thrust**



■ **SSC05 push thrust**



■ **SSC05H push thrust**



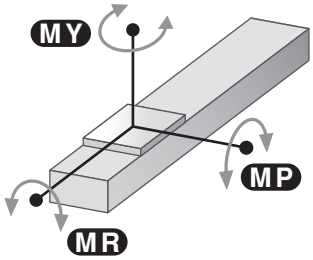
The values in the above graph are not a guarantee of the push force accuracy during stop. Use these values for reference.

- If the push force is too small or the push speed is too low, the push operation may become unstable so use caution.
- Up to 20mm/s can be set for the speed during pushing. However, it is recommended to set the speed during pushing to a level of 10mm/s or less by taking the shock during pushing or load stability into consideration.
- The sliding resistance, tool weight, or pushing position may affect the pushing load. So, when an accurate pushing load is required, it is absolutely necessary to actually measure and check the pushing load under conditions to be used.
- Determine an offset amount and thrust so that the pushing moment will be smaller than the allowable static load of each model.
- The values shown in the above graphs are for horizontal use robots.
  For vertical use robots, the push force values vary according to the weight of the tool and workpiece.

Static loading moment

(Unit: N•m)

Model	MY	MP	MR
SSC04	16	19	17
SSC05	25	33	30
SSC05H	32	38	34



2-9 Suction hoses connection

The YAMAHA SSC04/SSC05/SSC05H robots are designed to connect to an air unit that suctions air inside the robot to maintain cleanliness.
When using the robot in a clean room, adjust the suction air to the following flow rate.

Hose outside diameter : ϕ6
Number of hoses : 2
Suction rate : See the table below.

Lead	Speed	Suction rate
Lead 20	1000mm/sec	80 Nℓ/min
Lead 12	600mm/sec	50 Nℓ/min
Lead 6	300mm/sec	30 Nℓ/min
Lead 2	100mm/sec	15 Nℓ/min

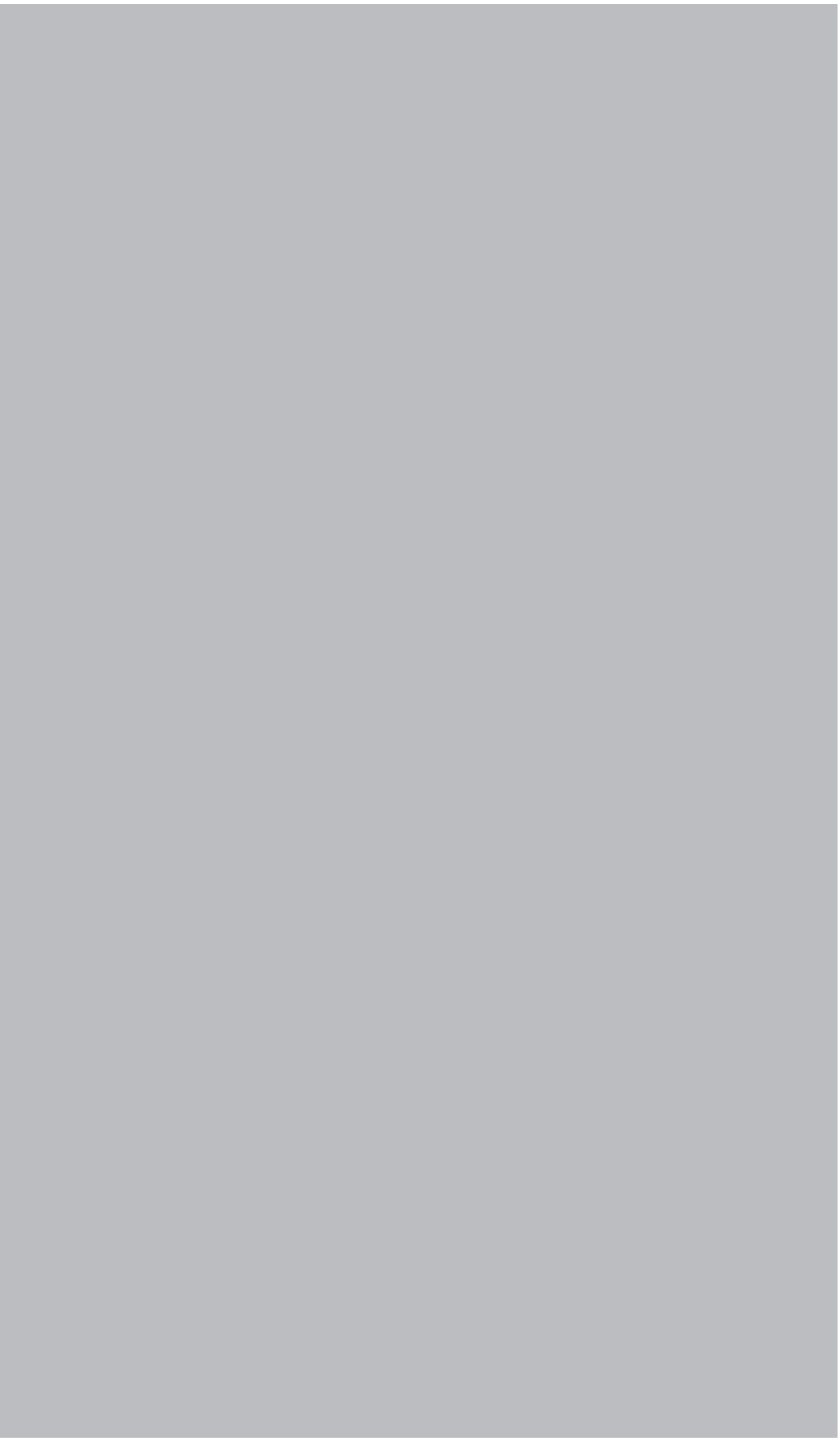
CAUTON

- **Avoid excessive bends in the air hoses. Lay out the air hoses to keep the hose length to the air unit as short as possible. Too long of a hose may prevent obtaining the specified suction flow rate.**
- **Mounting the robot on an installation base with a width larger than the robot width allows obtaining cleanliness more effectively.**

MEMO

Chapter 3 Periodic Inspection and Maintenance

Contents



3-1 Before beginning work

Periodic inspection and maintenance are essential to ensure safe and efficient operation of YAMAHA robots. This chapter describes periodic inspection items and procedures for the YAMAHA TRANSERVO series robots. Before beginning work, read the precautions below and also in Chapter 1, "Using the Robot Safety", and always follow the instructions.

DANGER

IF THE INSPECTION OR MAINTENANCE PROCEDURE CALLS FOR OPERATION OF THE ROBOT, STAY OUT OF THE WORKING AREA OF THE ROBOT DURING OPERATION. DO NOT TOUCH ANY PARTS INSIDE THE CONTROLLER.
KEEP WATCHING THE ROBOT MOVEMENT AND SURROUNDING AREA SO THAT THE OPERATOR CAN PRESS THE EMERGENCY STOP BUTTON IF ANY DANGER OCCURS.

WARNING

- **WHEN THE ROBOT DOES NOT NEED TO BE OPERATED DURING ADJUSTMENT OR MAINTENANCE, ALWAYS TURN OFF THE CONTROLLER AND THE EXTERNAL SWITCH BOARD.**
- **DO NOT TOUCH INTERNAL PARTS OF THE CONTROLLER FOR 10 MINUTES AFTER THE CONTROLLER HAS BEEN TURNED OFF.**
- **WHEN ONLY MAKING ELECTRICAL INSPECTIONS AND REQUIRING NO MECHANICAL MOVEMENT OF THE ROBOT, KEEP THE EMERGENCY STOP BUTTON PRESSED.**
- **USE ONLY LUBRICANT AND GREASES SPECIFIED BY YAMAHA SALES OFFICE OR REPRESENTATIVE.**
- **USE ONLY PARTS SPECIFIED BY YAMAHA SALES OFFICE OR REPRESENTATIVE. TAKE SUFFICIENT CARE NOT TO ALLOW ANY FOREIGN MATTER TO CONTAMINATE THEM DURING ADJUSTMENT, PARTS REPLACEMENT OR REASSEMBLY.**
- **DO NOT MODIFY ANY PARTS ON THE ROBOT OR CONTROLLER. MODIFICATION MAY RESULT IN UNSATISFACTORY SPECIFICATIONS OR THREATEN OPERATOR SAFETY.**
- **WHEN ADJUSTMENT OR MAINTENANCE IS COMPLETE, RETIGHTEN THE BOLTS AND SCREWS SECURELY.**
- **DURING ROBOT ADJUSTMENT OR MAINTENANCE, PLACE A SIGN INDICATING THAT THE ROBOT IS BEING ADJUSTED OR SERVICED TO PREVENT OTHERS FROM TOUCHING THE CONTROL KEYS OR SWITCHES. PROVIDE A LOCK ON THE SWITCH KEYS OR ASK SOMEONE TO KEEP WATCH AS NEEDED.**

When applying grease to the ball screw and linear guide, take 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 GREASE 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 GREASE GETS IN THE EYES, WASH LIBERALLY WITH PURE WATER FOR ABOUT 15 MINUTES AND CONSULT A PHYSICIAN FOR TREATMENT.**
- **IF 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 PROPER TREATMENT.**

3-2 Periodic inspection

3-2-1 Daily inspection

Check the following points on a daily basis, before and after robot operation.

Checkpoints	Check items	Notes
Cables and shutter	Check for scratches, dents, and excessively tight bends. Stain or grime on the shutter surface *1	Replace if necessary. See "3-4" in this chapter.
Ball screws and bearings	Check for unusual vibration and noise.	
Motor	Check for unusual vibration and noise, and for abnormal temperature rise.	

*1: Depending on robot operating conditions, stain or grime may appear in a stripe pattern near the slider stop point on the shutter surface. If this is found, use cloth moistened with alcohol or detergent to wipe away the stain or grime.

3-2-2 Three-month inspection

Take the following precautions when performing 3-month inspection.

WARNING

THE SLIDER OF VERTICAL USE ROBOT WILL SLIDE DOWN WHEN THE BRAKE IS RELEASED, CAUSING A HAZARDOUS SITUATION. DO NOT RELEASE THE BRAKE WHEN LUBRICATING VERTICAL USE ROBOT PARTS.

When applying grease to the ball screws and linear guide, take the following precautions.

WARNNIG

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 GREASE GETS IN THE EYES, WASH LIBERALLY WITH PURE WATER FOR ABOUT 15 MINUTES AND CONSULT A PHYSICIAN FOR TREATMENT.**
- **IF 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 PROPER TREATMENT.**

Check the following points every 3 months and apply grease if needed.

Checkpoints	Check items	Notes
Ball screw and linear guide	• Check for dirt or grime. If dirt or grime is found, clean the part. Apply grease after cleaning. • Apply grease if the items checked are dry or do not have enough grease. Recommended grease is as follows: Standard model: Use Alvania No. (Showa Shell), Daphne Eponex No.2 (Idemitsu) Clean room model: Use LG-2 (NSK)	See "3-3" in this chapter.
Shutter	Check for slack. Adjust if necessary.	See "3-5" in this chapter.
Coupling	Check if the bolts are loose. Tighten if necessary.	See "3-7" in this chapter.

CAUTION

Failing to use YAMAHA-recommended grease can shorten the life of the ball screw and the linear guide.

3-2-3 Six-month inspection

Take the following precautions when performing 6-month inspection.

WARNING

THE SLIDER OF VERTICAL USE ROBOT WILL SLIDE DOWN WHEN THE BRAKE IS RELEASED, CAUSING A HAZARDOUS SITUATION. DO NOT RELEASE THE BRAKE WHEN LUBRICATING THE VERTICAL USE ROBOT PARTS.

Check the following points every 6 months and adjust or replace parts if needed.

Checkpoints	Check items	Notes
Major bolts and screws on robot	Check for looseness. Tighten if loose.	
Ball screw, linear guide	• Check the ball screw and linear guide for backlash. Tighten if necessary. • Check for vibration during operation. Tighten bolts if necessary to secure drive unit and/or shaft. • Check for backlash due to wear.	Consult us if problem cannot be solved or there is backlash due to wear.
Controller	• Check if terminals are loose. • Check if connectors are loose	
Greasing to ball screw/nut section and linear guide	Apply grease every 6 months to ball screw/nut and linear guide. Recommended grease Albania No. 2 (Shell) Daphne Eponex No. 2 (Idemitsu)	See "3-3" in this chapter.
Coupling	Check if the bolts are loose. Tighten if necessary.	See "3-7" in this chapter

CAUTION

Failing to use YAMAHA-recommended grease can shorten the life of the ball screw and the linear guide.

3-2-4 Three-year inspection

Check the following points every 3 years or more often if the robot is used frequently.

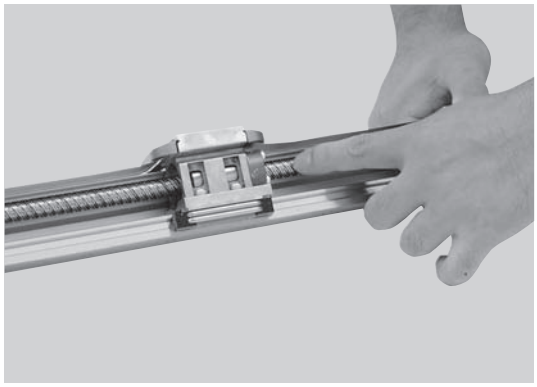
Checkpoints	Check items	Notes
Ball screw/nut section and linear guide	Check ball screw/nut and linear guide for backlash due to wear.	Consult us if abnormal condition is found.

3-3 Applying grease

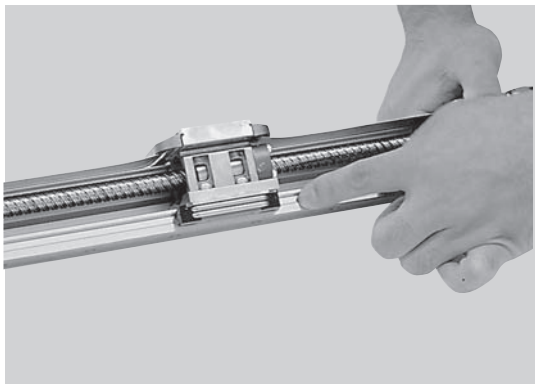
Follow these steps when applying grease to the robot ball screws and linear guides according to periodic maintenance.

1) Remove the robot's end cover, then pull off the side cover.

2) Coat the ball screw and linear guides with grease by hand and move the slider back and forth to spread the grease.



Applying grease to the ball screw



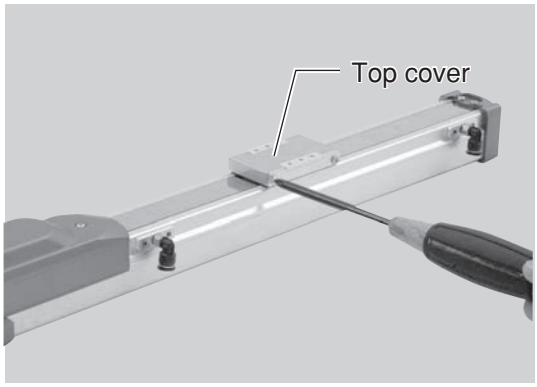
Applying grease to the linear guide

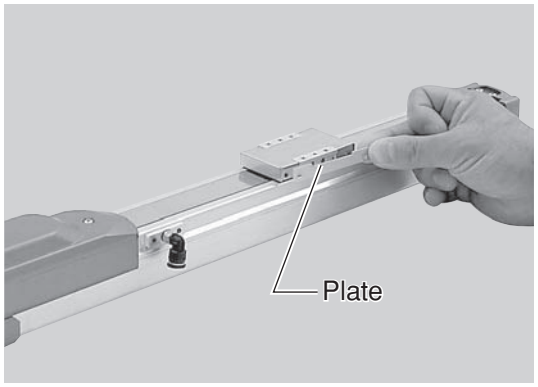
3) Reattach the side covers.

3-4 Replacing the shutter

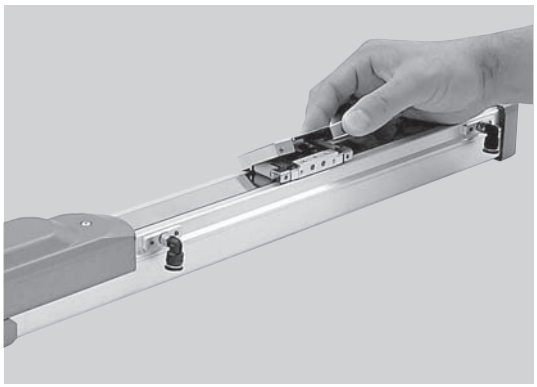
Use the following procedure when the shutter must be replaced. Make sure that the controller power switch is off before beginning work.

1) Remove the four screws on the sides of the top cover (2 each on each side), then remove the plates.

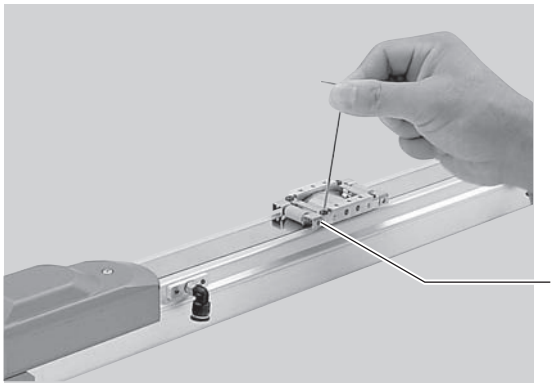




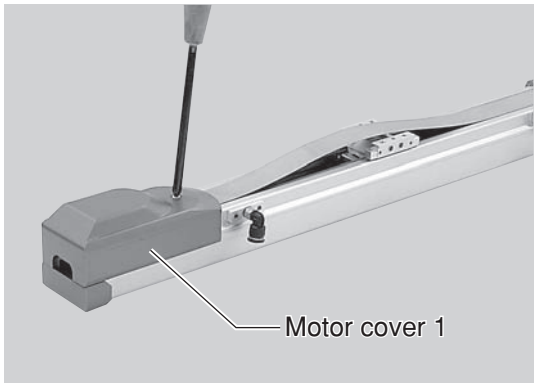
2) Remove the top cover.

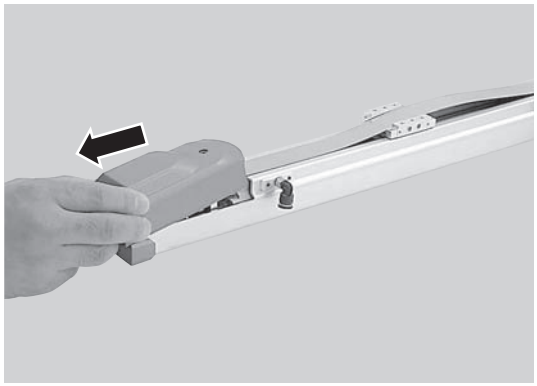


3) Remove the screws (4 locations) which secure the roller, then remove the roller.

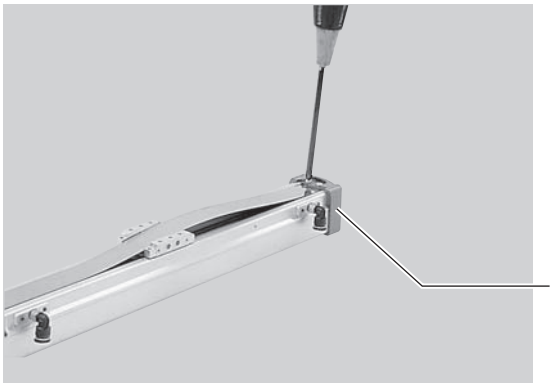


4) Remove a screw that secures motor cover 1, then remove motor cover 1 by sliding it toward the rear.

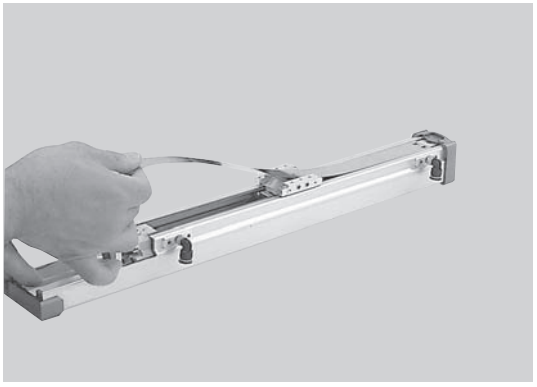




5) Remove the two screws which secure the end-cover shutter.



6) Remove the shutter.



7) Pass the new shutter through it.

8) Reinstall the shutter, motor cover 1 and slide cover by reversing their removal procedures.

NOTE

Do not fully tighten the screws to secure the shutter at this time. Fully tighten these screws after adjusting for shutter looseness in step 9.

9) While pulling lightly on the shutter with the fingers, secure it by tightening the screw until there is no looseness.

CAUTION

Do not press down on the shutter with excessive force.
Pressing down hard on the shutter may cause the shutter to warp.

3-5 Adjusting shutter looseness

The shutter may elongate with continued use. In such cases, adjust as follows.

1) Slightly loosen the screws (2 locations) which secure the shutter at the end cover side. (Do not remove them.)

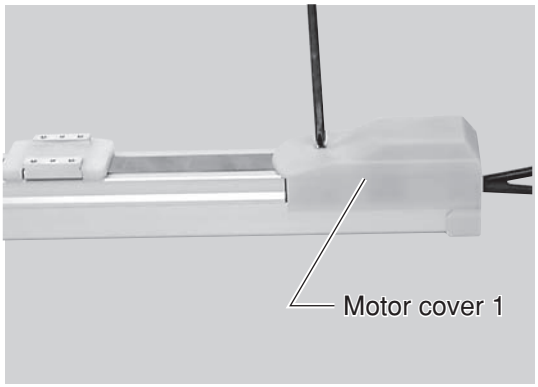
2) While pulling lightly on the shutter with the fingers, secure it by tightening the screw until there is no looseness. See step 9 of "3-4 Replacing the shutter".

3-6 Replacing the motor

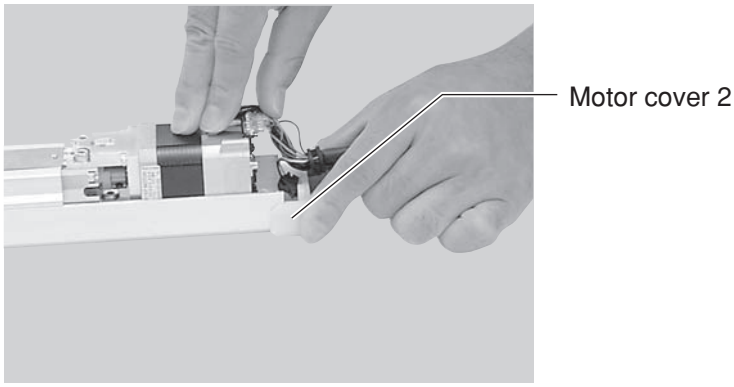
3-6-1 SSC04

1) Turn off the robot controller.

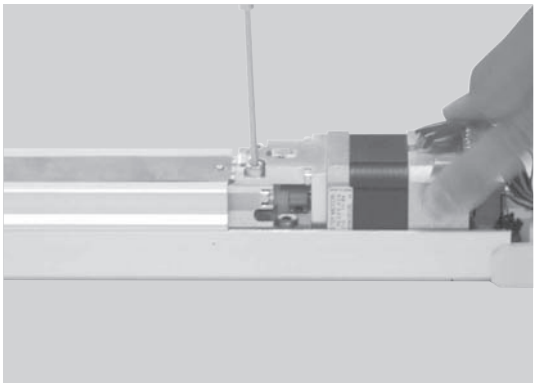
2) Remove a screw that secures motor cover 1, then remove motor cover 1 by sliding it toward the rear.



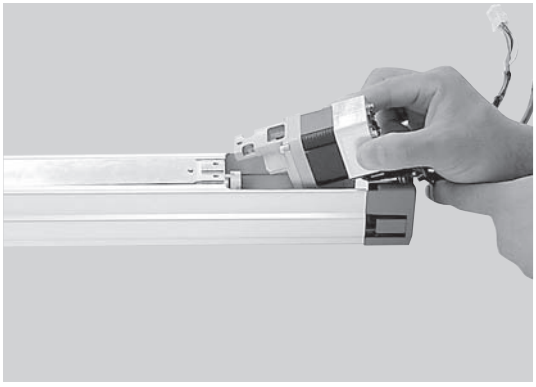
3) Remove the lower-side motor cover 2 by sliding it toward the rear.



4) Remove the two screws which secure the motor.



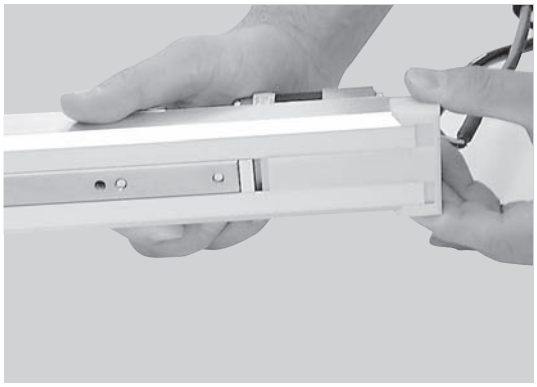
5) Remove the motor.

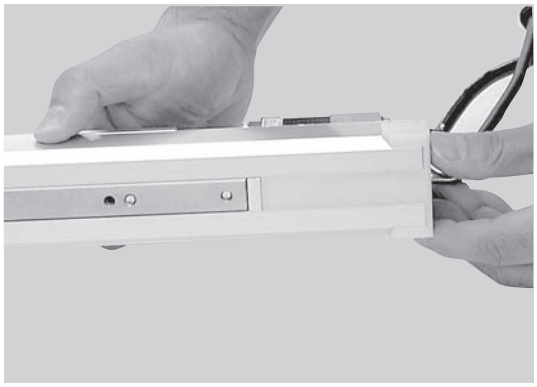


6) Mount a new motor and secure it with the screws. Reattach motor covers 1 and 2 by reversing their removal procedures. Use care to avoid over-tightening the screws which secure motor covers 1 and 2.

CAUTION

When attaching motor cover 2, be sure that it is correctly aligned with the grooves. Be careful not to let the motor cable get caught.





7) While pulling lightly on the shutter with the fingers, secure it by tightening the screw until there is no looseness.

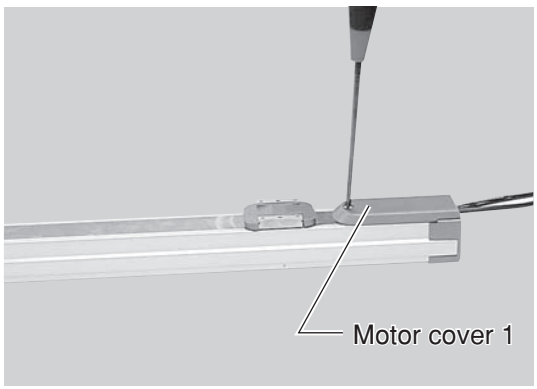
CAUTION

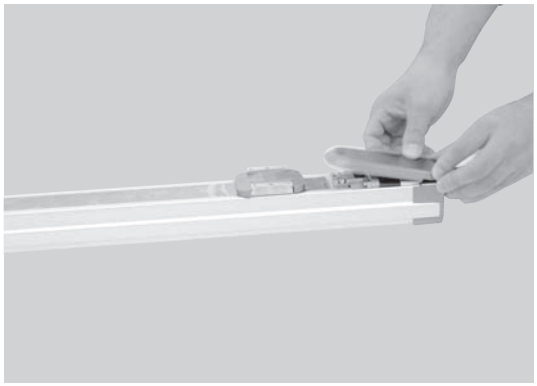
Do not press down on the shutter with excessive force.
Pressing down hard on the shutter may cause the shutter to warp.

3-6-2 SSC05/SSC05H

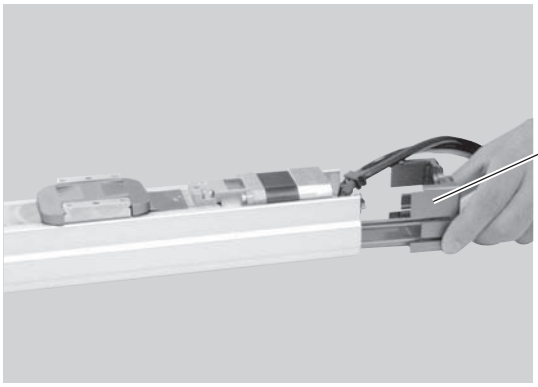
1) Turn off the robot controller.

2) Remove a screw that secures motor cover 1, then remove motor cover 1.

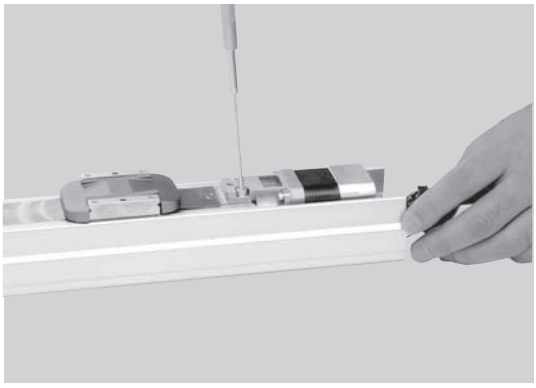




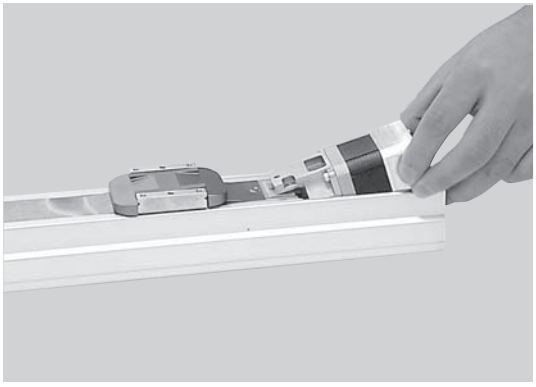
3) Remove the lower-side motor cover 2 by sliding it toward the rear.



4) Remove the two screws which secure the motor.



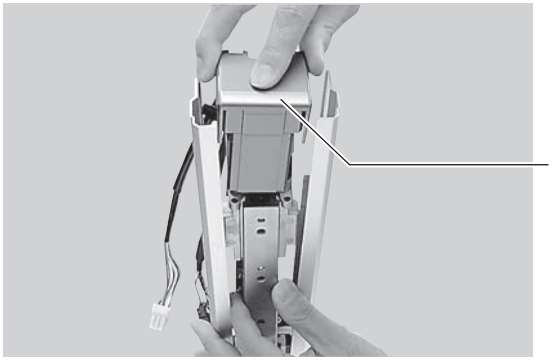
5) Remove the motor.



6) Mount a new motor and secure it with the screws. Reattach motor covers 1 and 2 by reversing their removal procedures. Use care to avoid over-tightening the screws which secure motor covers 1 and 2.

CAUTION

When attaching motor cover 2, be sure that it is correctly aligned with the grooves. Be careful not to let the motor cable get caught.



7) While pulling lightly on the shutter with the fingers, secure it by tightening the screw until there is no looseness.

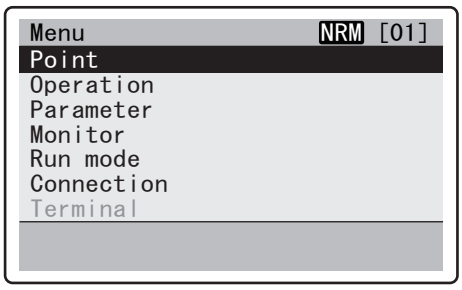
CAUTION

Do not press down on the shutter with excessive force.
Pressing down hard on the shutter may cause the shutter to warp.

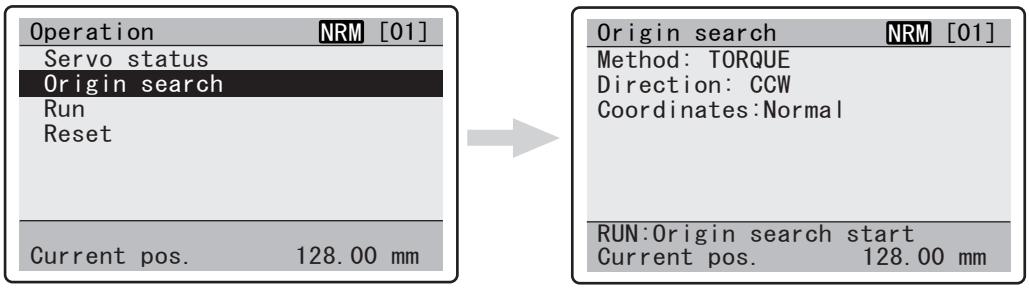
3-6-3 Verifying the machine reference

The method for verifying the machine reference is shown below. For details regarding Handy Terminal operation procedures, refer to the HT1 Operation Guide section of the TS-S Controller User's Manual.

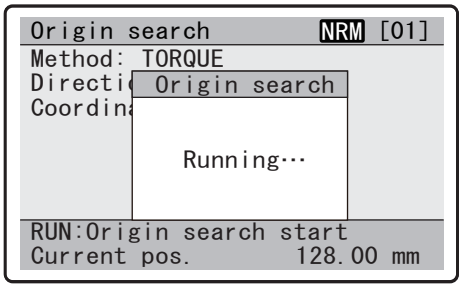
1) At the main menu screen, select Operation.
   The operation mode screen then opens, displaying operations which can be selected.



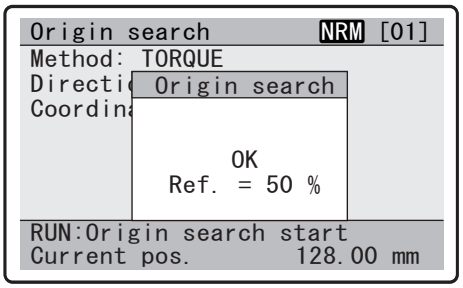
2) Position the cursor at the "Origin search" item, then press ■.
   The Origin search screen then opens, displaying the "return-to-origin method" and "return-to-origin direction" items.



3) After verifying that the area is safe for operation, press [RUN] to perform a return-to-origin operation. "Running..." displays during the return-to-origin operation. To stop this operation while it is in progress, press [STOP].

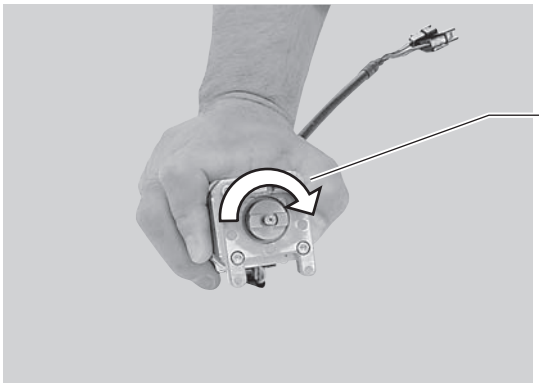


4) A message displays when the return-to-origin operation is completed. If ended without error, "OK" and the machine reference (Ref. = xx%) displays.



CAUTION

Adjust the machine reference as shown below when it is outside the permissible machine reference range (20 to 80%).



After removing the motor,
rotate the coupling 180 degrees
to adjust the machine reference.

5) Press [CLR] to return to the Origin search screen. Press [CLR] again to return to the Operation Mode screen.

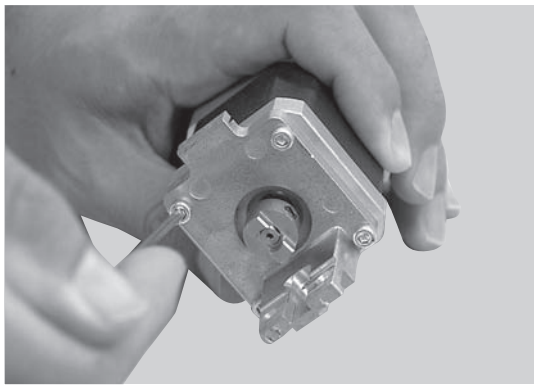
3-7 Replacing the coupling

3-7-1 SSC04

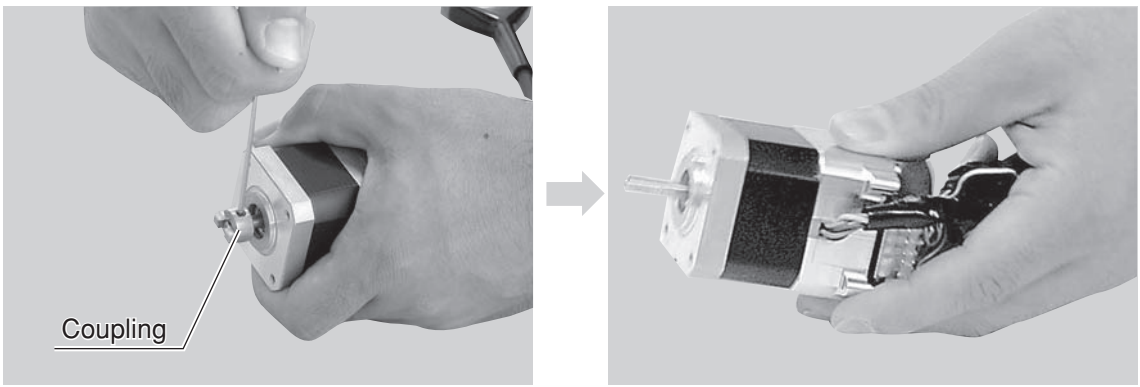
■ **Replacing the coupling on the motor side**

1) Remove the motor.
(For details regarding how to remove a motor, refer to "3-6 Replacing the motor" in Chapter 3.)

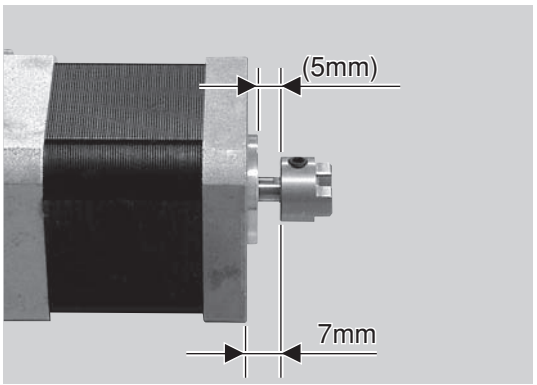
2) Remove the four screws which secure the plate motor.



3) Loosen the set screw (M4), then remove the coupling.



4) Install a new coupling.
Secure the coupling at a position which is 7mm from the end-face of the motor flange. Make sure to fix the set screw at the flat portion (cutout portion) of the shaft.



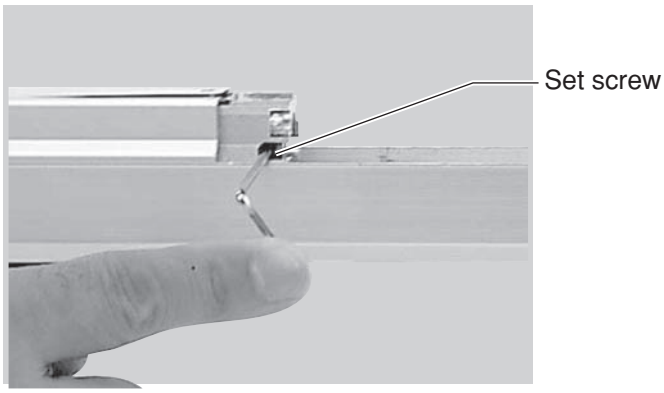
5) Mount the plate motor and tighten its mounting screws.

6) Mount the motor. (For details regarding how to mount a motor, refer to "3-6 Replacing the motor" in Chapter 3.)

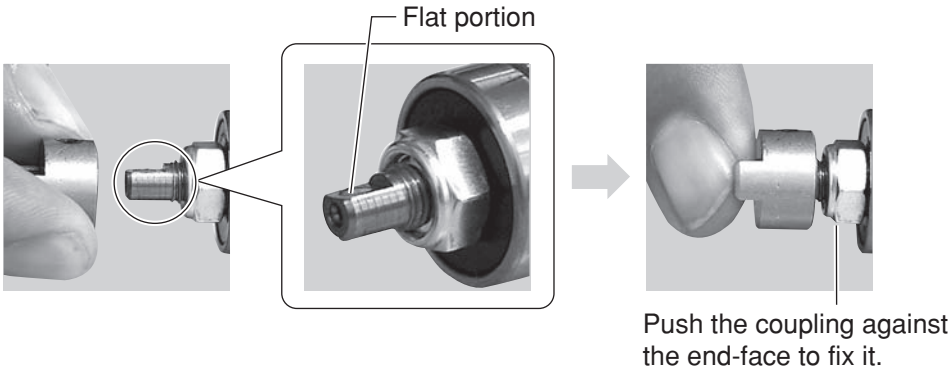
■ Replacing the coupling on the ball screw side

1) Remove the motor.
(For details regarding how to remove a motor, refer to "3-6 Replacing the motor" in Chapter 3.)

2) Loosen the set screw (M4) at the ball screw side, then remove the coupling.



3) Install a new coupling.
Push the coupling against the end-face of the ball screw. Make sure to fix the set screw at the flat portion (cutout portion) of the shaft.



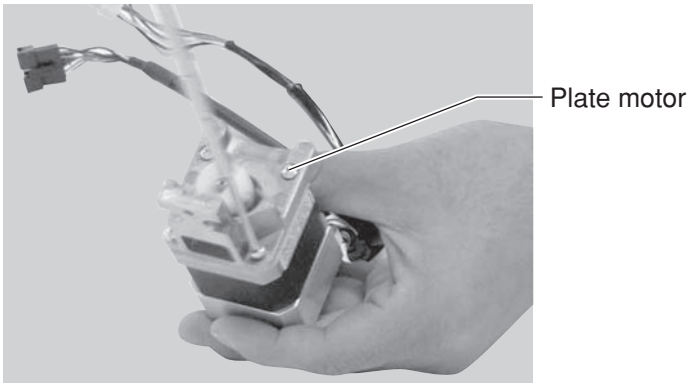
4) Mount the motor.
(For details regarding how to mount a motor, refer to "3-6 Replacing the motor" in Chapter 3.)

3-7-2 SSC05/SSC05H

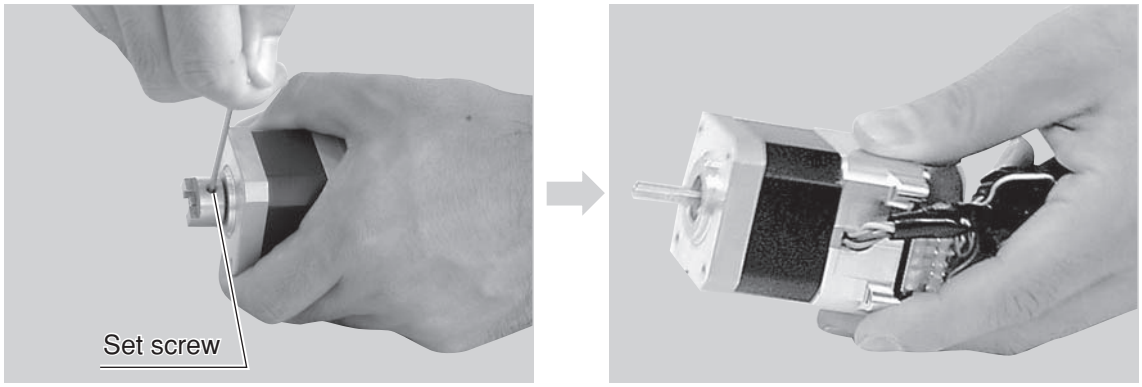
■ **Replacing the coupling on the motor side**

1) Remove the motor.
(For details regarding how to remove a motor, refer to "3-6 Replacing the motor" in Chapter 3.)

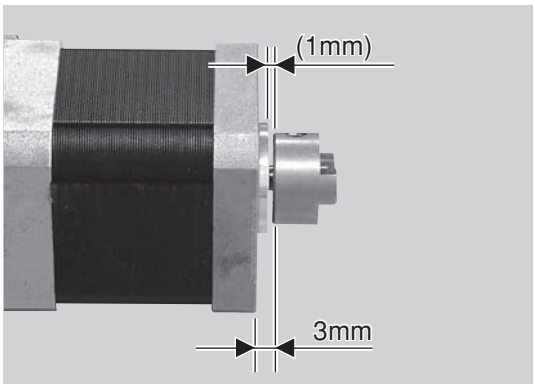
2) Remove the four screws which secure the plate motor.



3) Loosen the set screw (M4), then remove the coupling.



4) Install a new coupling.
Secure the coupling at a position which is 3mm from the end-face of the motor flange. Make sure to fix the set screw at the flat portion (cutout portion) of the shaft.



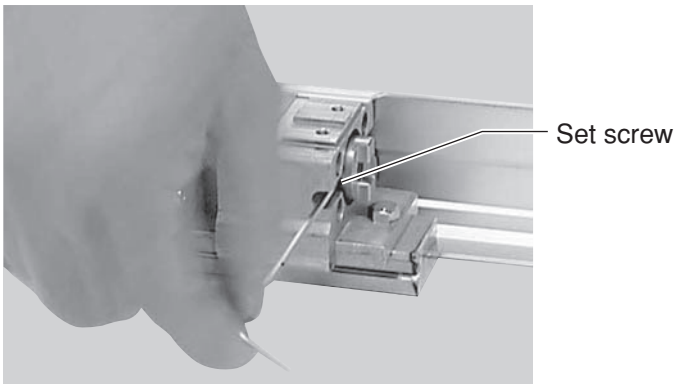
5) Mount the plate motor and tighten its mounting screws.

6) Mount the motor. (For details regarding how to mount a motor, refer to "3-6 Replacing the motor" in Chapter 3.)

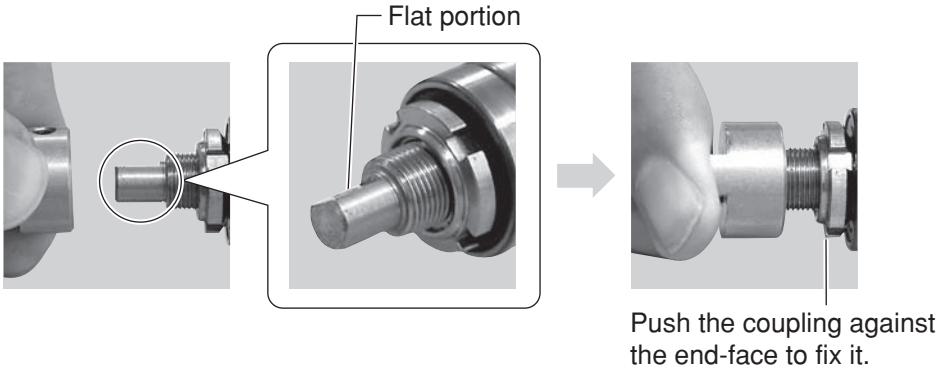
■ Replacing the coupling on the ball screw side

1) Remove the motor.
(For details regarding how to remove a motor, refer to "3-6 Replacing the motor" in Chapter 3.)

2) Loosen the set screw (M4) on the ball screw side, then remove the coupling.



3) Install a new coupling.
Push the coupling against the end-face of the ball screw. Make sure to fix the set screw at the flat portion (cutout portion) of the shaft.



4) Mount the motor. (For details regarding how to mount a motor, refer to "3-6 Replacing the motor" in Chapter 3.)

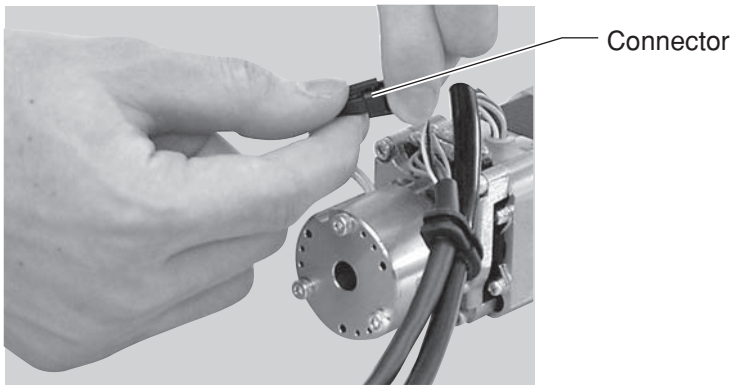
3-8 Replacing the brake

WARNING

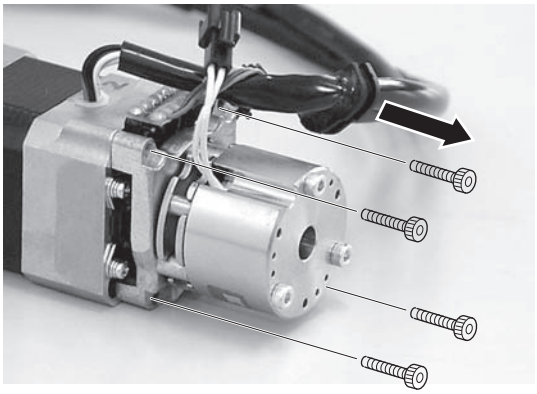
THE SLIDER WILL SLIDE DOWN WHEN THE BRAKE IS REMOVED, CAUSING A HAZARDOUS SITUATION.
TURN OFF THE CONTROLLER AND PROP UP THE SLIDER WITH A SUPPORT STAND BEFORE STARTING THE REPLACEMENT OF THE BRAKES.

1) Turn off the robot controller.

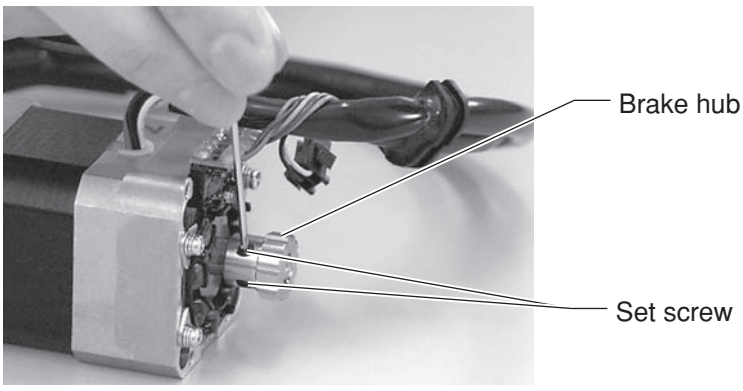
2) Disconnect the connector.



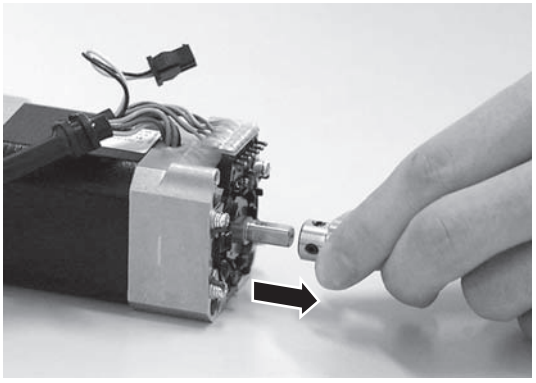
3) Remove the bolts (4 pcs.) that secure the brake to the motor and take out the brake.



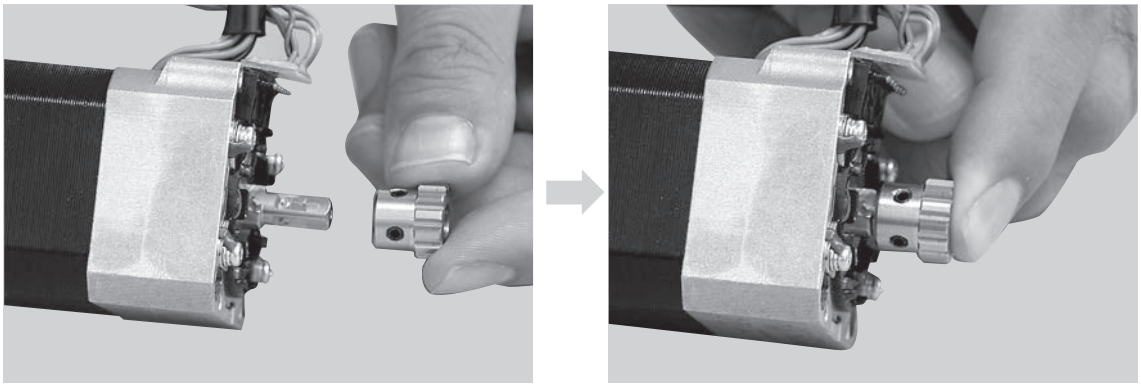
4) Loosen the set screws (2 locations) that secure the brake hub.



5) Remove the brake hub from the motor shaft.



6) Mount a new brake hub.
Being careful about the orientation of the brake hub, push it against the end-face and fix it. Make sure to locate the set screw at the flat portion (cutout portion) of the shaft.

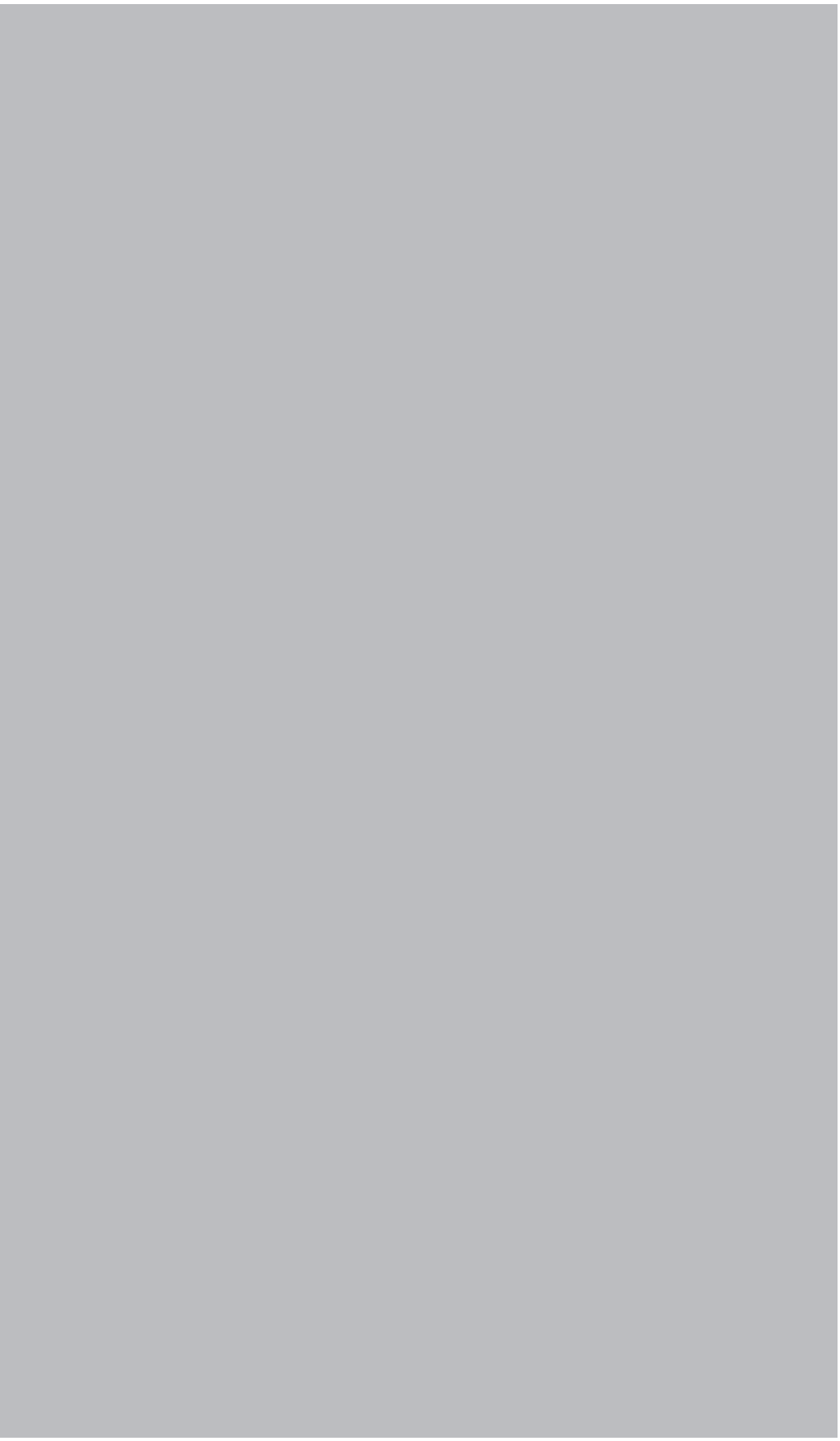


7) Mount a new brake by reversing the removal procedures.

MEMO

Chapter 4 Specifications

Contents



4-1 Main unit specifications

4-1-1 SSC04

● Basic specifications

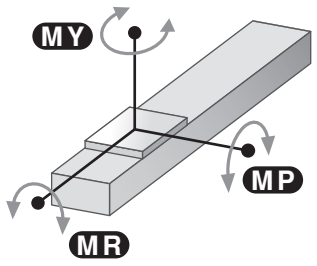
Motor		☐ 42 Step motor		
Repeated positioning accuracy (mm) *1		±0.02		
Deceleration mechanism		Ball screw ϕ8(Class C10)		
Maximum motor torque (N•m)		0.27		
Ball screw lead (mm)		2	6	12
Maximum speed (mm/sec)		100	300	600
Maximum payload (kg)	Horizontal installation	6	4	2
	Vertical installation	4	2	1
Max. pressing force (N)		150	90	45
Stroke (mm)		50 to 400 (50 pitch)		
Overall length (mm)	Horizontal installation	Stroke+216		
	Vertical installation	Stroke+261		
Maximum outside dimension of body cross-section (mm)		W49 × H59		
Cable length (m)		Standard: 1 Option: 3, 5, 10		
Controller		TS-S		
Cleanliness class		Meets CLASS 10 (0.1 μm base)		

*1: Positioning repeatability in one direction.

● Static loading moment

(Unit: N•m)

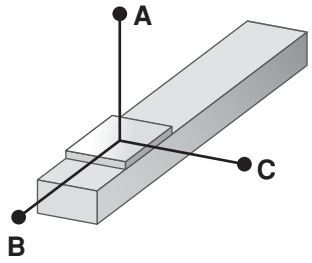
MY	MP	MR
16	19	17



● Allowable overhang*

* Distance from center of slider upper surface to carrier center-of-gravity at a guide service life of 10,000 km (Service life is calculated for 400mm stroke models).

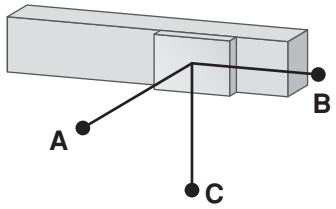
■ Horizontal installation



Horizontal installation **(Unit: mm)**

		A	B	C
Lead 12	1kg	807	218	292
	2kg	667	107	152
Lead 6	2kg	687	116	169
	3kg	556	76	112
	4kg	567	56	84
Lead 2	4kg	869	61	92
	6kg	863	40	60

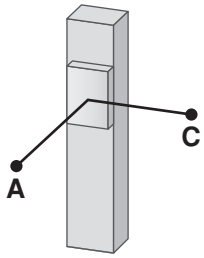
■ Wall installation



Wall installation **(Unit: mm)**

		A	B	C
Lead 12	1kg	274	204	776
	2kg	133	93	611
Lead 6	2kg	149	102	656
	3kg	92	62	516
	4kg	63	43	507
Lead 2	4kg	72	48	829
	6kg	39	26	789

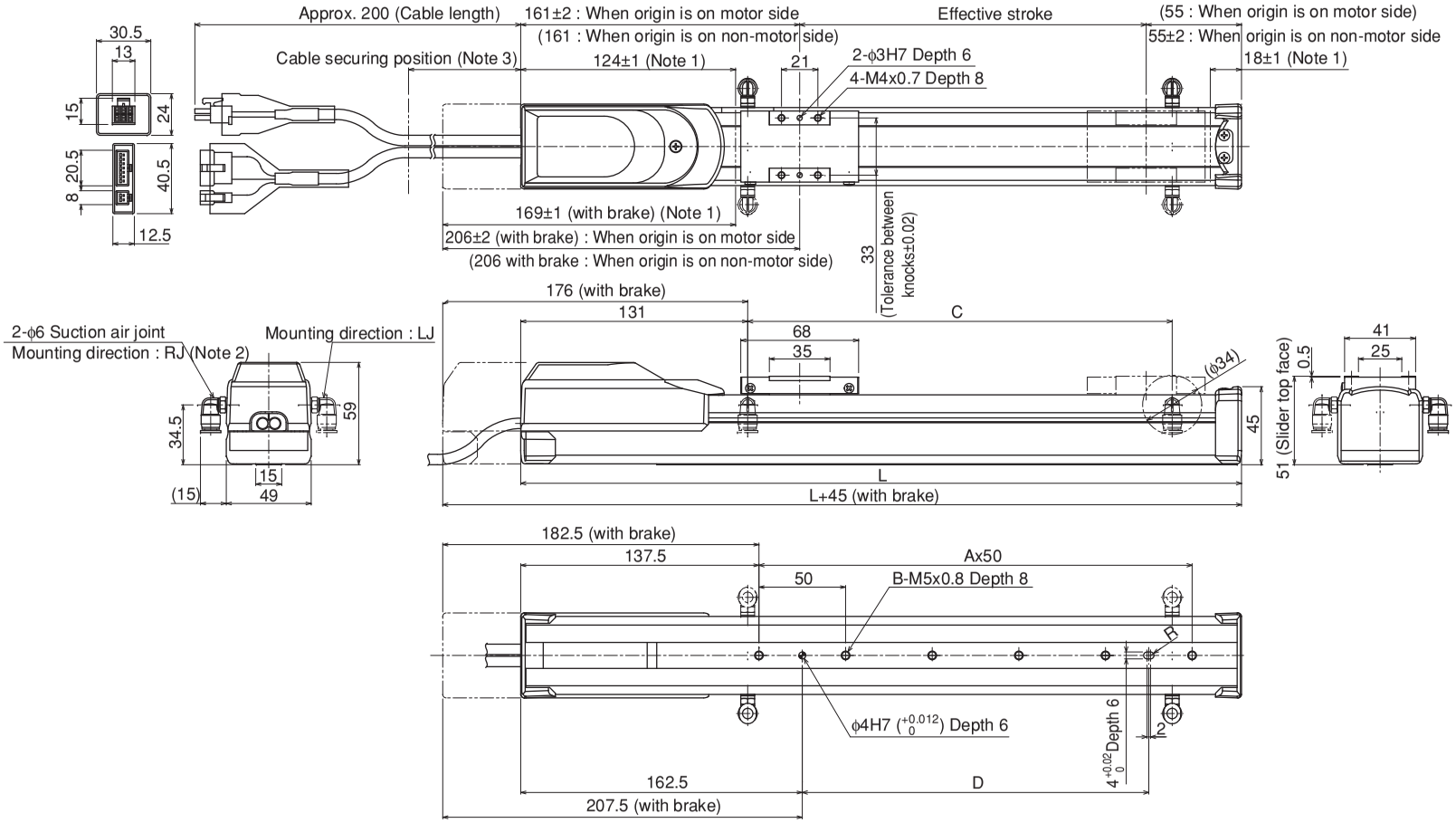
■ Vertical installation



Vertical installation **(Unit: mm)**

		A	C
Lead 12	0.5kg	407	408
	1kg	204	204
Lead 6	1kg	223	223
	2kg	107	107
Lead 2	2kg	118	118
	4kg	53	53

● SSC04 Dimensions



Note 1. Stop positions are determined by the mechanical stoppers at both ends.
Note 2. Secure the cable with a tie-band 100mm or less from unit's end face to prevent the cable from being subjected to excessive loads.
Note 3. The cable's minimum bend radius is R30.
Note 4. These are the weights without a brake. The weights are 0.2kg heavier when equipped with a brake.

Effective stroke	50	100	150	200	250	300	350	400
L	266	316	366	416	466	516	566	616
A	2	3	4	5	6	7	8	9
B	3	4	5	6	7	8	9	10
C	50	100	150	200	250	300	350	400
Weight (kg) (See note 4)	1.5	1.6	1.7	1.8	2.0	2.1	2.2	2.3

4-1-2 SSC05

● Basic specifications

Motor		☐ 42 Step motor		
Repeated positioning accuracy (mm) ✶1		±0.02		
Deceleration mechanism		Ball screw ϕ12(Class C10)		
Maximum motor torque (N•m)		0.27		
Ball screw lead (mm)		6	12	20
Maximum speed (mm/sec) ✶2		300	600	1000
Maximum payload (kg)	Horizontal installation	10	6	4
	Vertical installation	2	1	–
Max. pressing force (N)		90	45	27
Stroke (mm)		50 to 800 (50 pitch)		
Overall length (mm)	Horizontal installation	Stroke+230		
	Vertical installation	Stroke+270		
Maximum outside dimension of body cross-section (mm)		W55×H56		
Cable length (m)		Standard: 1 Option: 3, 5, 10		
Controller		TS-S		
Cleanliness class		Meets CLASS 10 (0.1 μm base)		

✶1: Positioning repeatability in one direction.

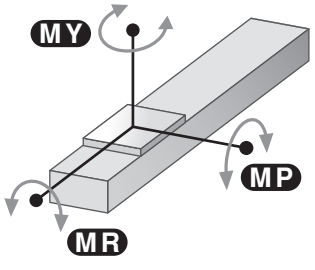
✶2: When the stroke is longer than 650mm, the ball screw may resonate depending on the moving range (critical speed). In this case, adjust to reduce the operating speed by referring to the maximum speeds shown in the table below.

Stroke		650	700	750	800
Maximum speed (mm/sec)	Lead 6	280	250	220	190
	Lead 12	560	500	440	380
	Lead 20	933	833	733	633
Speed setting		93%	83%	73%	63%

● Static loading moment

(Unit: N•m)

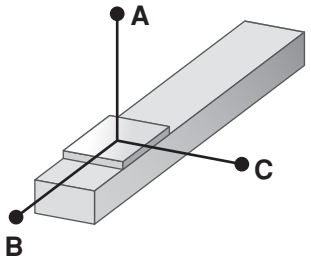
MY	MP	MR
25	33	30



● Allowable overhang*

* Distance from center of slider upper surface to carrier center-of-gravity at a guide service life of 10,000 km (Service life is calculated for 600mm stroke models).

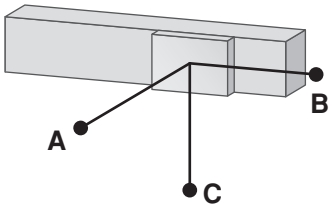
■ Horizontal installation



Horizontal installation **(Unit: mm)**

		A	B	C
Lead 20	2kg	413	139	218
	4kg	334	67	120
Lead 12	4kg	347	72	139
	6kg	335	47	95
Lead 6	4kg	503	78	165
	8kg	332	37	79
	10kg	344	29	62

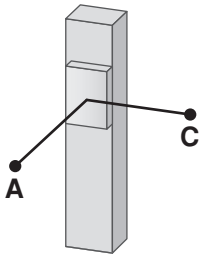
■ Wall installation



Wall installation **(Unit: mm)**

		A	B	C
Lead 20	2kg	192	123	372
	4kg	92	51	265
Lead 12	4kg	109	57	300
	6kg	63	31	263
Lead 6	4kg	134	63	496
	6kg	76	35	377
	8kg	47	22	355

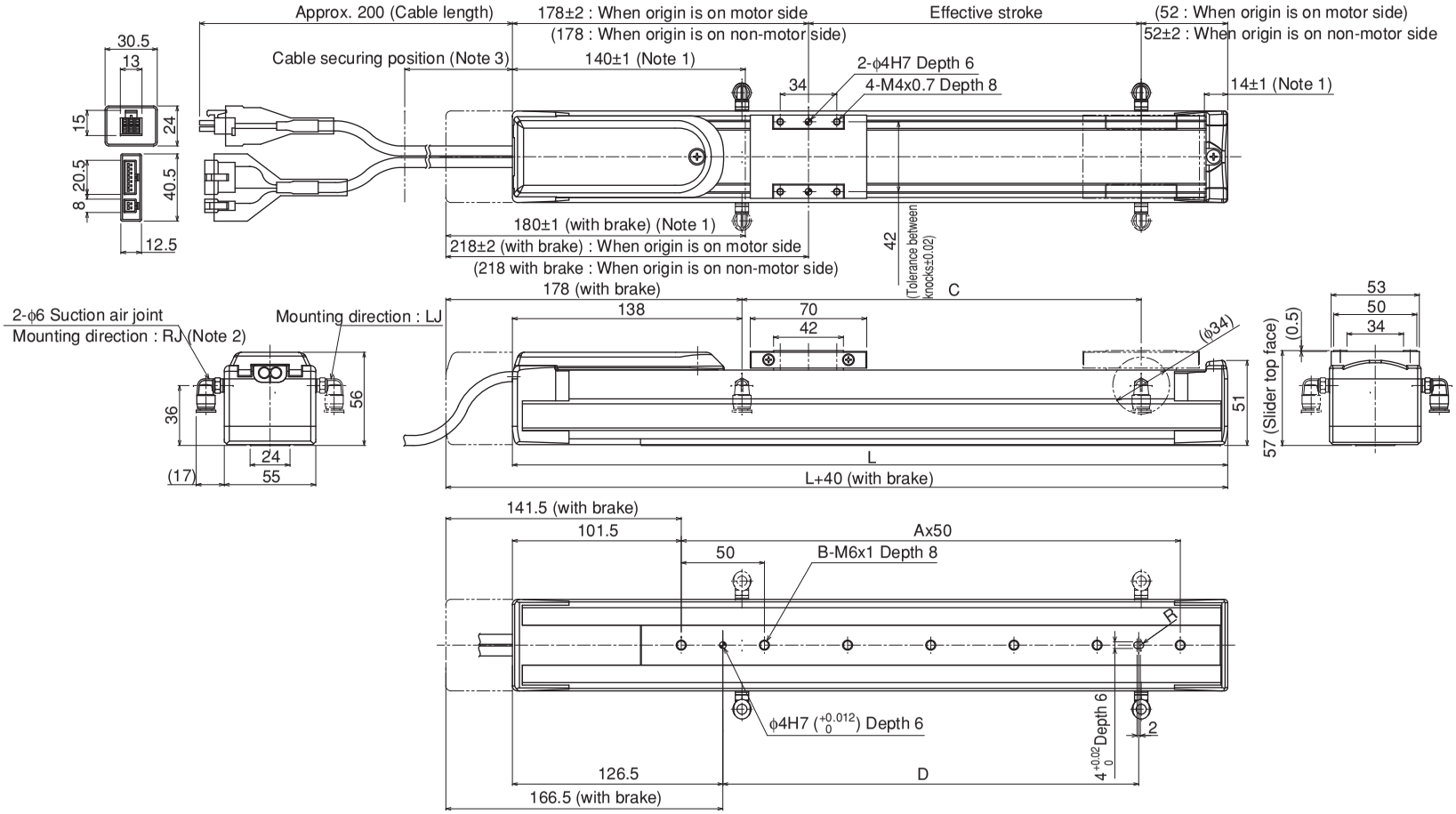
■ Vertical installation



Vertical installation **(Unit: mm)**

		A	C
Lead 12	0.5kg	578	579
	1kg	286	286
Lead 6	1kg	312	312
	2kg	148	148

● SSC05 Dimensions



Note 1. Stop positions are determined by the mechanical stoppers at both ends.
Note 2. Secure the cable with a tie-band 100mm or less from unit's end face to prevent the cable from being subjected to excessive loads.
Note 3. The cable's minimum bend radius is R30.
Note 4. These are the weights without a brake. The weights are 0.2kg heavier when equipped with a brake.

Effective stroke	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800
L	280	330	380	430	480	530	580	630	680	730	780	830	880	930	980	1030
A	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
B	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
C	100	150	200	250	300	350	400	450	500	500	500	500	500	500	500	500
Weight (kg) (See note 4)	2.1	2.3	2.5	2.7	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0

4-1-3 SSC05H

● Basic specifications

Motor		☐ 42 Step motor		
Repeated positioning accuracy (mm) ✶1		±0.02		
Deceleration mechanism		Ball screw ϕ12(Class C10)		
Maximum motor torque (N•m)		0.47		
Ball screw lead (mm)		6	12	20
Maximum speed (mm/sec) ✶2		300 (250) ✶3	600 (500) ✶3	1000
Maximum payload (kg)	Horizontal installation	12	8	6
	Vertical installation	4	2	–
Max. pressing force (N)		120	60	36
Stroke (mm)		50 to 800 (50 pitch)		
Overall length (mm)	Horizontal installation	Stroke+286		
	Vertical installation	Stroke+306		
Maximum outside dimension of body cross-section (mm)		W55×H56		
Cable length (m)		Standard: 1 Option: 3, 5, 10		
Controller		TS-S		
Cleanliness class		Meets CLASS 10 (0.1 μm base)		

✶1: Positioning repeatability in one direction.
✶2: When the stroke is longer than 650mm, the ball screw may resonate depending on the moving range (critical speed). In this case, adjust to reduce the operating speed by referring to the maximum speeds shown in the table below.
✶3: Numerical values shown in parentheses apply to vertical installation.

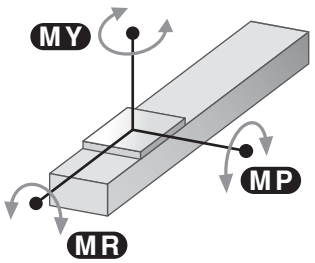
Stroke		650	700	750	800
Maximum speed (mm/sec)	Lead 6	280 (250)	250	220	190
	Lead 12	560 (500)	500	440	380
	Lead 20	933	833	733	633
Speed setting		93%	83%	73%	63%

* Numerical values shown in parentheses apply to vertical installation.

● Static loading moment

(Unit: N•m)

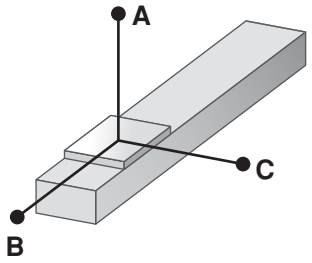
MY	MP	MR
32	38	34



● Allowable overhang*

* Distance from center of slider upper surface to carrier center-of-gravity at a guide service life of 10,000 km (Service life is calculated for 600mm stroke models).

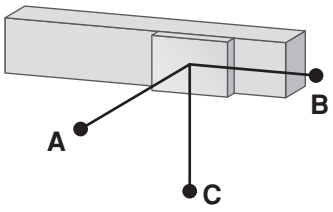
■ Horizontal installation



Horizontal installation **(Unit: mm)**

		A	B	C
Lead 20	2kg	599	225	291
	4kg	366	109	148
	6kg	352	71	104
Lead 12	4kg	500	118	179
	6kg	399	76	118
	8kg	403	56	88
Lead 6	6kg	573	83	136
	8kg	480	61	100
	10kg	442	47	78
	12kg	465	39	64

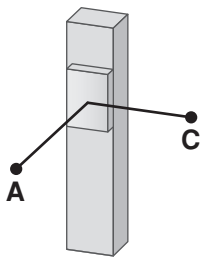
■ Wall installation



Wall installation **(Unit: mm)**

		A	B	C
Lead 20	2kg	262	203	554
	4kg	118	88	309
	6kg	71	49	262
Lead 12	4kg	146	96	449
	6kg	85	55	334
	8kg	55	34	305
Lead 6	6kg	101	62	519
	8kg	64	39	413
	10kg	43	26	355
	12kg	28	17	338

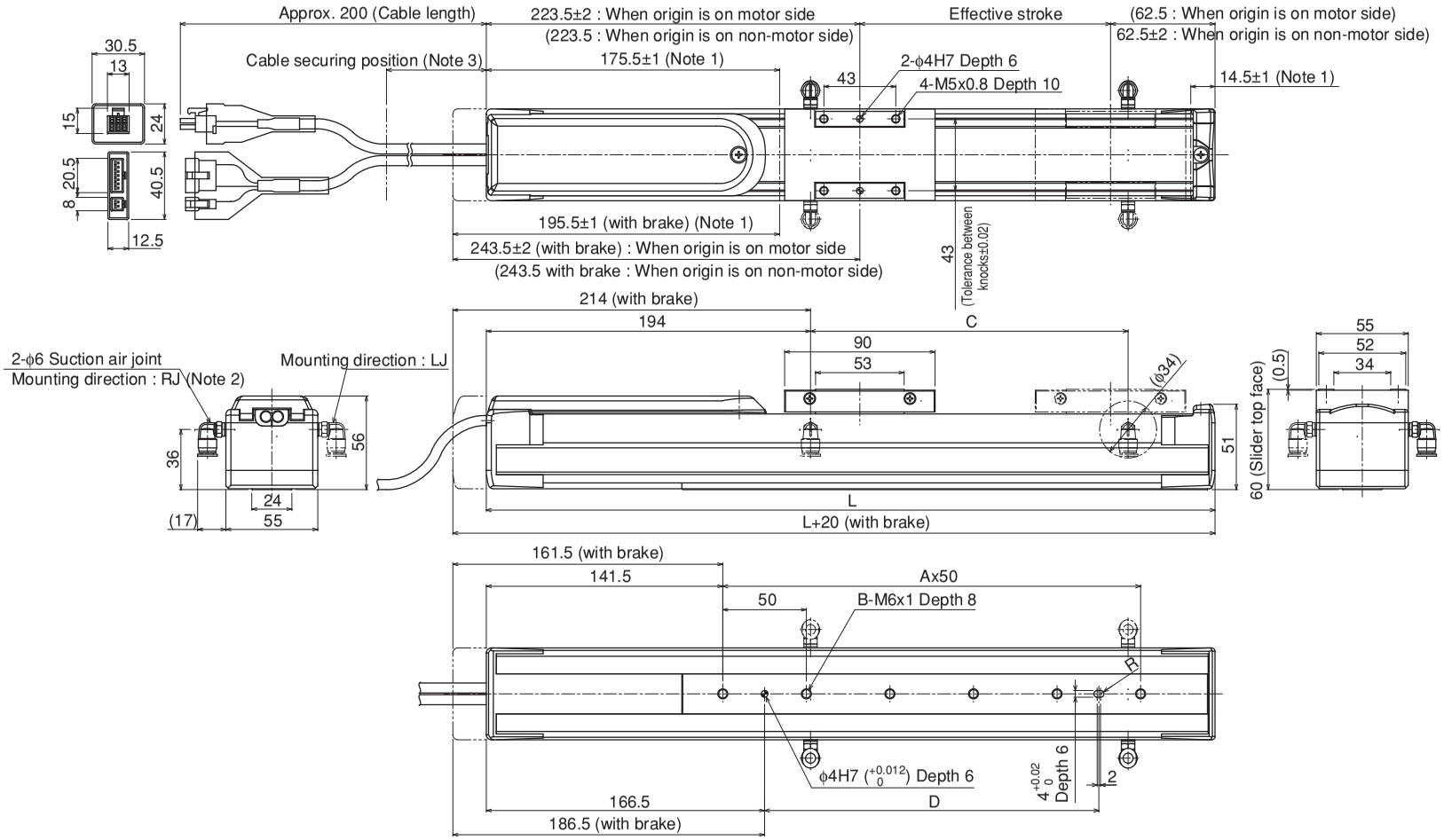
■ Vertical installation



Vertical installation **(Unit: mm)**

		A	C
Lead 12	1kg	458	459
	2kg	224	224
Lead 6	2kg	244	245
	4kg	113	113

● SSC05H Dimensions



Note 1. Stop positions are determined by the mechanical stoppers at both ends.
Note 2. Secure the cable with a tie-band 100mm or less from unit's end face to prevent the cable from being subjected to excessive loads.
Note 3. The cable's minimum bend radius is R30.
Note 4. These are the weights without a brake. The weights are 0.2kg heavier when equipped with a brake.

Effective stroke	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800
L	336	386	436	486	536	586	636	686	736	786	836	886	936	986	1036	1086
A	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
B	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
C	100	150	200	250	300	350	400	450	500	500	500	500	500	500	500	500
Weight (kg) (See note 4)	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.5	4.7	4.9	5.1	5.3

4-1-4 About noise level

The maximum sound pressure level is less than 70dB when the TRANSERVO series robot moves at its maximum speed (1m/s). (Maximum sound pressure level is measured in accordance with EN 292-2.)

4-2 Motor specifications

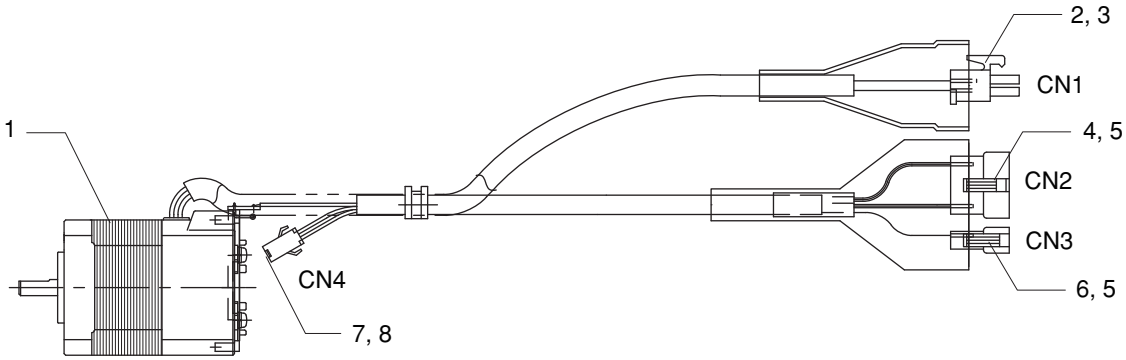
4-2-1 Motor termination

■ **Connector specifications**

No.	Parts	Type No.	Maker	Qty	Notes
1	Motor			1	
2	Plug housing	176274-1	AMP	1	CN1 (6 poles)
3	Receptacle	175155-1 or 175151-1	AMP	6	CN1
4	Receptacle housing	SMR-07V-B	JST	1	CN2 (7 poles)
5	Pin contact	BYM-001T-P0.6 or SYM-001T-P0.6	JST	9	CN2. CN3
6	Receptacle housing	SMR-02V-B	JST	2	CN3 (2 poles)
7	Plug housing	SMP-02V-BC	JST	1	CN4 (2 poles)
8	Socket contact	BHF-001T-0.8BS or SHF-001T-0.8BS	JST	2	CN4

■ Connector wiring

Connector	Pin No.	Signal	Wire Color	Connection	
CN1	1	A+	Black		Motor wire
	2	B+	Red		
	3	ACOM	Yellow		
	4	BCOM	White		
	5	A-	Green		
	6	B-	Blue		
CN2	1	S2	Blue		Signal wire
	2	S4	Orange		
	3	S1	Green		
	4	S3	Brown		
	5	R1	Gray		
	6	R2	Red		
	7	Drain wire	Transparent shrinkable tube		
CN3	1	BK+	Black		Brake wire CN4
	2	BK-	Yellow		



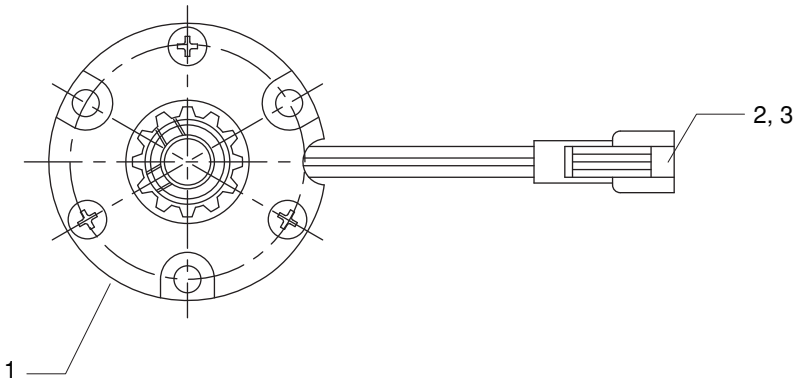
4-2-2 Brake cable termination

■ Connector specifications

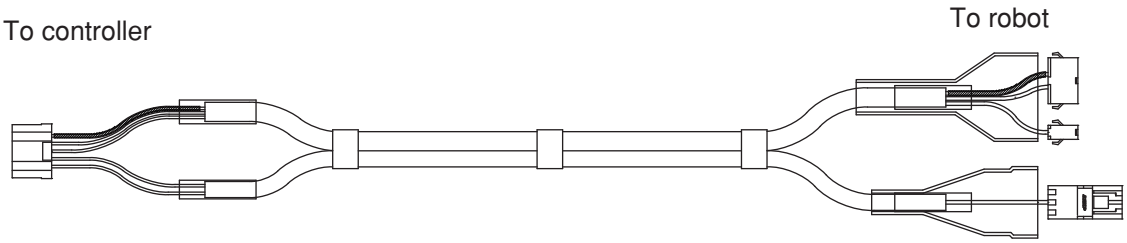
No.	Parts	Type No.	Qty	Maker	Note
1	BRAKE		1		
2	Receptacle housing	SMR-02V-B	1	JST	2 poles
3	Pin contact	BYM-001T-P0.6 or SYM-001T-P0.6	2	JST	Manual tool: YC-12

■ Connector wiring

Signal	Wire Color		Connection	
BK	Yellow			1
BK	Yellow			2



4-3 Robot cables

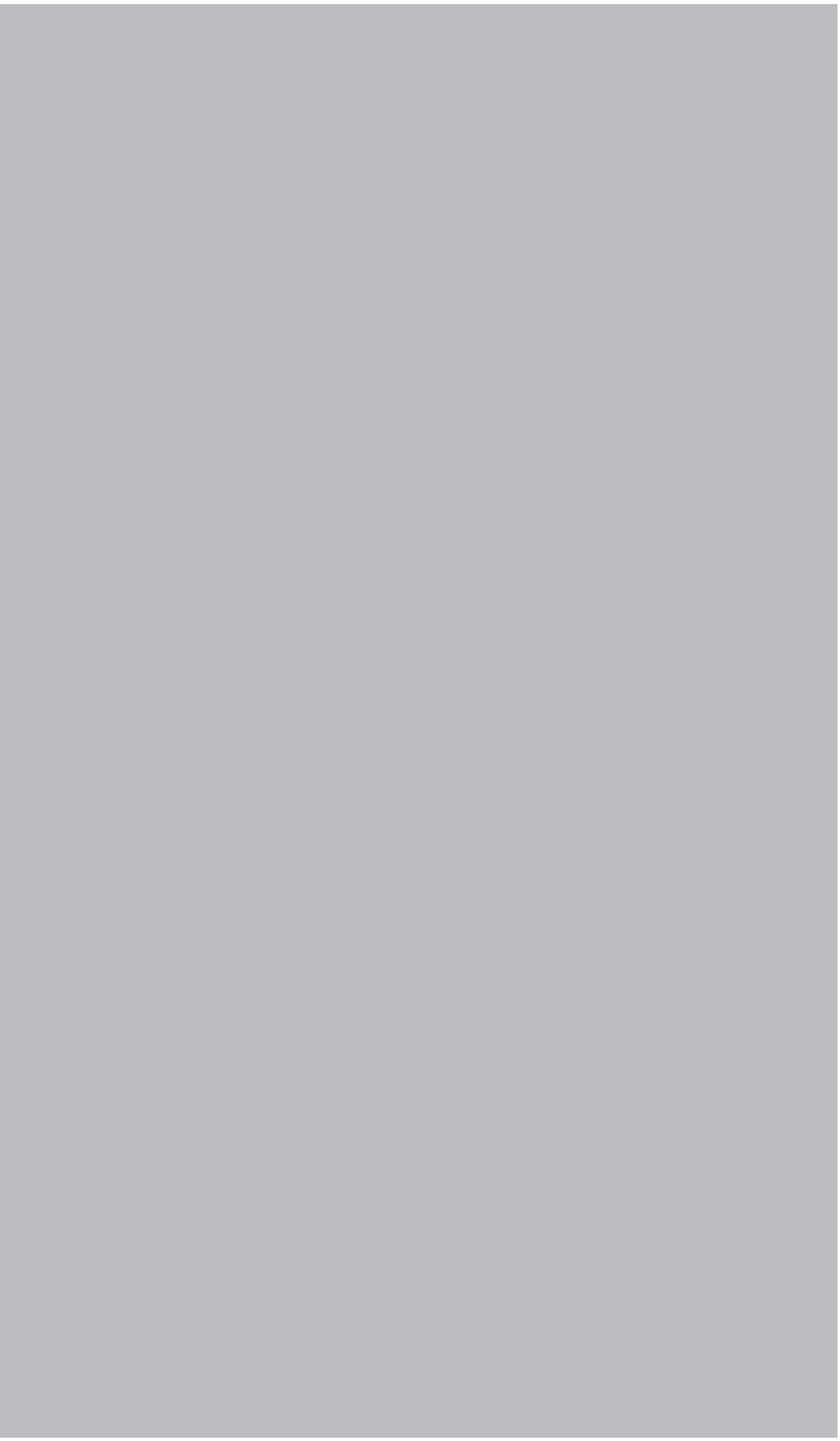


Parts	Signal	PIN	Connection	PIN	Signal	Parts	Wire
Controller CN1	D.G	4A		7	D.G	Resolver	Drain wire
	S2	1A		1	S2		0.15sq Blue
	S4	1B		2	S4		Orange
	S1	2A		3	S1		Green
	S3	2B		4	S3		Brown
	R1	3A		5	R1		Grey
	R2	3B		6	R2		Red
	BK+	5A		1	BK+	Brake	Black
	BK-	5B		2	BK-		Yellow
	A+	6A		1	A+	Motor	0.3sq White 1
	B+	6B		2	B+		White 2
	ACOM	7A		3	ACOM		White 3
	BCOM	7B		4	BCOM		White 4
	A-	8A		5	A-		White 5
	B-	8B		6	B-		White 6

MEMO

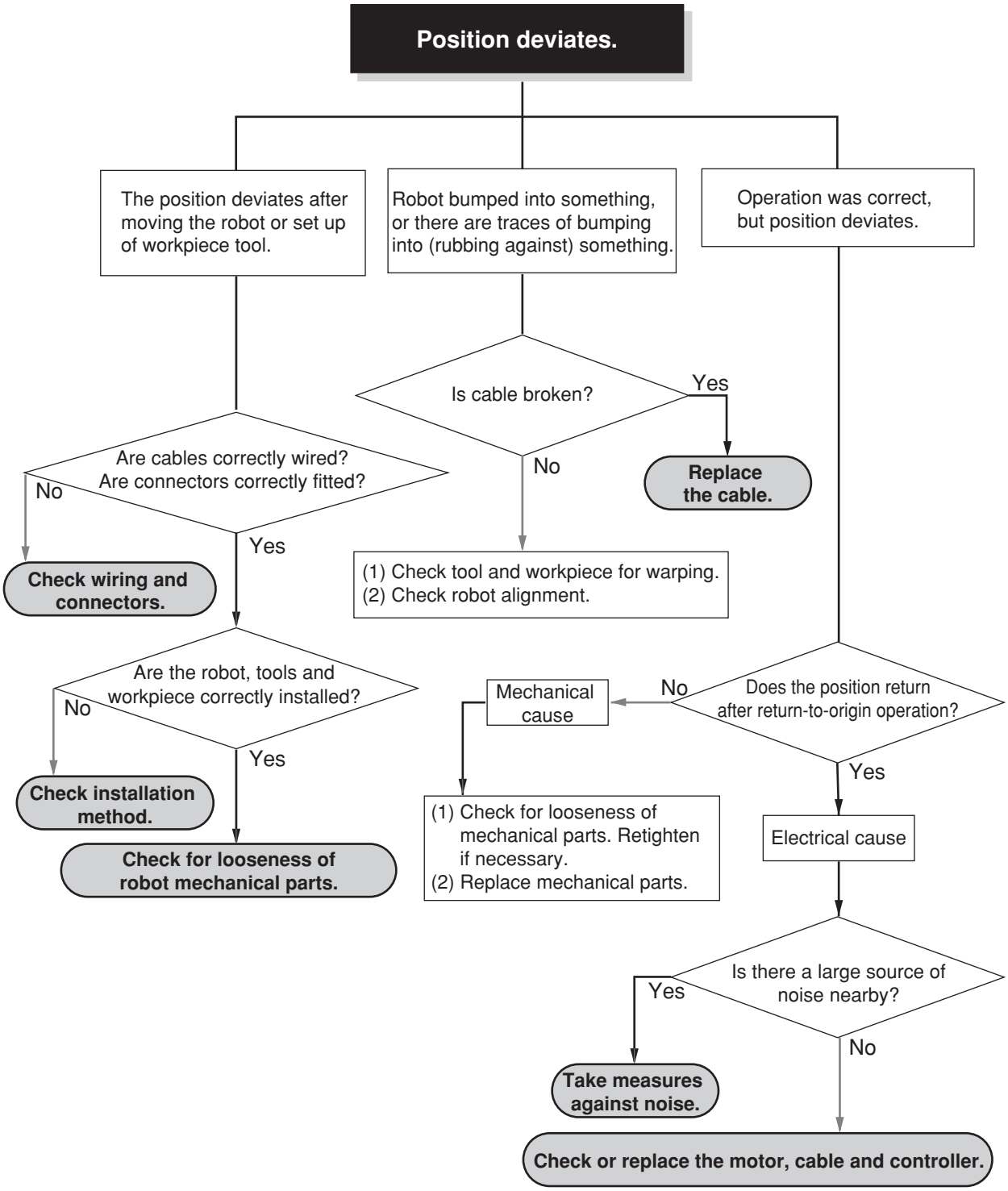
Chapter 5 Troubleshooting

Contents



5-1 Positioning error

If a positioning error occurs, check the following points to find the solution before you determine the robot or controller has malfunctioned. If the trouble still exists even after checking these points, please contact us with a detailed description of the trouble.



Revision record

Manual version	Issue date	Description
Ver. 1.00	Apr. 2009	
Ver. 1.01	Jun. 2009	The section "Setting the operating conditions" was added, etc.
Ver. 1.02	Oct. 2009	Some explanations were corrected or added in "Chapter 1 Using the Robot Safely". Clerical error corrections, etc.
Ver. 1.03	Aug. 2010	Clerical error corrections, etc.
Ver. 1.04	Jan. 2011	The description regarding "Warranty" was changed. Addition and correction of explanations in "3-6 Replacing the motor", "3-7 Replacing the coupling". Addition of "3-8 Replacing the brake". Clerical error corrections, etc.
Ver. 1.05	Jul. 2012	The description regarding "Warranty" was changed.

User's Manual

TRANSERVO series

YAMAHA SSC04/SSC05/SSC05H

Single-axis Robot

Jul. 2012
Ver. 1.05
This manual is based on Ver. 1.05 of Japanese manual.

YAMAHA MOTOR CO., LTD. IM Operations