

Linear Servo Actuator

LSA Series

[Small Type : H8SS,H8SM,H8HS,H8HM]
[Flat Type : L15SS,L15SM]

Operation Manual

===== Second Edition =====



IAI America Inc.

Precaution for Linear Servo Actuator Installation

The methods to install the linear servo actuator is basically limited as shown in the following table.

Please be careful when orienting the actuator. (Special order models are excluded)

○: Available





×: Not available



Model Code	Standard Horizontal Orientation	Vertical Orientation	Horizontally Oriented Wall Mount	Ceiling Mount
S6	○	×	○	×
S8	○	×	○	×
S10	○	×	○	×
H8	○	×	○	×
L15	○	×	×	×
N10	○	×	×	×
N15	○	×	×	×
N19	○	×	×	×
W21	○	×	×	×

Safety Precautions (Please Read Before Use)

Before installing, operating, maintaining or inspecting this product, peruse this operating manual as well as operating manuals and related documentations for all equipment and peripherals connected to this product to ensure the correct use of the product. Also keep in mind that these tasks must be performed by individuals who possess sufficient knowledge of the applicable equipment and safe operation thereof. The precautions provided below are intended to prevent bodily injury and/or property damage by making sure the product is used correctly and safely.

In this operating manual, safety precautions are classified as “danger,” “warning,” “caution” and “note.”

	Danger	Failure to observe the instruction will result in an imminent danger leading to death or serious injury.
	Warning	Failure to observe the instruction may result in death or serious injury.
	Caution	Failure to observe the instruction may result in injury or property damage.
	Note	The user should take heed of this information to ensure the proper use of the product, although failure to do so will not result in injury.

Take note that, depending on the situation, a failure to heed the directions accompanied by  **Caution** or  **Note** may still result in serious consequences.

All instructions provide important information. Read them carefully and handle the product with due care. Keep this operating manual in a convenient place so that it can be readily referenced whenever necessary, and also make sure the manual gets to the hands of the end-users.

Danger

General

● Do not use this product for the following applications:

1. Medical equipment used to maintain, control or otherwise affect human life or physical health
2. Mechanisms and machinery designed for the purpose of moving or transporting people
3. Important safety parts of machinery

This product has not been planned or designed for applications requiring high levels of safety. Use of this product in such applications may jeopardize the safety of human life. The warranty covers only the product as it is delivered.

Installation

- Do not use this product in a place exposed to ignitable, inflammable or explosive substances. The product may ignite, burn or explode.
- When installing the product, be sure to securely support and affix it (including the work). Failure to do so may cause the product to tip over, drop or malfunction, resulting in injury.
- Avoid using the product in a place where the main unit or controller may come in contact with water or oil droplets.



- Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Doing so may result in fire.

Operation

- Do not enter the machine's range of operation while the product is operating or standing by. The actuator may move suddenly, causing injury.
- If you are using a pace maker or other mechanical implant, do not come within 30 cm of the product. The strong magnetic field generated by the product may cause the pace maker, etc., to malfunction.
- Do not pour water onto the product. Spraying water over the product, washing it with water or using it in water may cause the product to malfunction, resulting in injury, electric shock, fire, etc.

Maintenance, Inspection, Repair

- Never modify the product. Unauthorized modification may cause the product to malfunction, resulting in injury, electric shock, fire, etc.
- Do not disassemble and reassemble the components relating to the basic structure of the product or its performance and function. Doing so may result in injury, electric shock, fire, etc.



Warning

General

- Do not use the product outside the specifications. Using the product outside the specifications may cause it to fail, stop functioning or sustain damage. It may also significantly reduce the service life of the product. In particular, observe the maximum loading capacity and speed.

Installation

- If the machine will stop in the case of system problem such as emergency stop or power failure, design a safety circuit or other device that will prevent equipment damage or injury.
- Be sure to provide Class D grounding (formerly Class 3 grounding: Grounding resistance at 100 Ω or less) to the actuator and the controller.
- Before supplying power to and operating the product, always check the operation area of the equipment to ensure safety. Supplying power to the product carelessly may cause electric shock or injury due to contact with the moving parts.
- Wire the product correctly by referring to the operation manual. Securely connect the cables and connectors so that they will not be disconnected or come loose. Failure to do so may cause the product to malfunction or cause fire.

Operation

- Before operating the moving parts of the product by hand (for the purpose of manual positioning, etc.), confirm that the servo is turned off (using the teaching pendant). Failure to observe this instruction may result in injury.
- Do not scratch the cables. Scratching, forcibly bending, pulling, winding, crushing with heavy object or pinching a cable may cause it to leak current or lose continuity, resulting in fire, electric shock, malfunction, etc.
- Turn off the power to the product in the event of power failure. Failure to do so may cause the product to suddenly start moving when the power is restored, thus resulting in injury or product damage.
- If the product is generating heat, smoke or a strange smell, turn off the power immediately. Continuing to use the product may result in product damage or fire.
- If noise or abnormally high vibration is detected, stop the operation immediately. Continuing to use the product may result in product damage, malfunction due to damage, runaway machine, etc.



- If any of the internal protective devices (alarms) of the product has actuated, turn off the power immediately. Continuing to use the product may result in product damage or injury due to malfunction. Once the power supply is cut off, investigate and remove the cause and then turn on the power again.
- Do not step on the product, use it as a footstool or place any object on it. You may lose your footing or the product may tip over, resulting in a fall and consequent injury, product damage, malfunction due to damage, runaway machine, etc.

Maintenance, Inspection, Repair

- Before conducting maintenance/inspection, parts replacement or other operations on the product, completely shut down the power supply. At this time, take the following measures:
 1. Display a sign that reads, "WORK IN PROGRESS. DO NOT TURN ON POWER" at a conspicuous place, in order to prevent a person other than the operator from accidentally turning on the power while the operation is working.
 2. When two or more operators are to perform maintenance/inspection together, always call out every time the power is turned on/off or an axis is moved in order to ensure safety.

Disposal

- Do not throw the product into fire. The product may burst or generate toxic gases.



Caution

Installation

- Do not use the product under direct sunlight (ultraviolet ray), in a place exposed to dust, salt or iron powder, in a humid place, or in an atmosphere of organic solvent, phosphate-ester machine oil, etc. The product may lose its function over a short period of time, or exhibit a sudden drop in performance or its service life may be significantly reduced.
- Do not use the product in an atmosphere of corrosive gases (sulfuric acid or hydrochloric acid). Rust may form and reduce the structural strength of the product.
- When using the product in any of the places specified below, provide a sufficient shield. Failure to do so may result in malfunction:
 1. Place where large current or high magnetic field is present
 2. Place where welding or other operations are performed that cause arc discharge
 3. Place subject to electrostatic noise
 4. Place with potential exposure to radiation
- Do not install the product in a place subject to large vibration or impact (4.9 m/s^2 or more). Doing so may result in the malfunctioning of the product.
- Provide an emergency-stop device in a readily accessible position so the device can be actuated immediately upon occurrence of a dangerous situation during operation. Lack of such device in an appropriate position may result in injury.
- Provide sufficient maintenance space when installing the product. Routine inspection and maintenance cannot be performed without sufficient space, which will eventually cause the equipment to stop or the product to sustain damage.
- When transporting or installing the product, exercise due caution to prevent injury. For example, securely hold the product using a lift or support or engage multiple operators to carry the product.
- Do not hold the moving parts of the product or its cables during installation. It may result in injury.
- Always use IAI's genuine cables for connection between the controller and the actuator. Also use IAI's genuine products for the key component units such as the actuator, controller and teaching pendant.
- The brake mechanism is designed to prevent the slider from dropping when the power to the vertical axis is turned off. Do not use it as a safety brake, etc.



- Before installing or adjusting the product or performing other operations on the product, display a sign that reads, "WORK IN PROGRESS. DO NOT TURN ON POWER." If the power is turned on inadvertently, injury may result due to electric shock or sudden activation of an actuator.

Operation

- Turn on the power to individual equipment one by one, starting from the equipment at the highest level in the system hierarchy. Failure to do so may cause the product to start suddenly, resulting in injury or product damage.
- Do not insert a finger or object in the openings in the product. It may cause fire, electric shock or injury.
- Do not bring a floppy disk or other magnetic media within 30 cm of the product. The magnetic field generated by the magnet may destroy the data in the floppy disk, etc.
- Do not step on the product, use it as a footstool or place any object on it. It may cause scoring, dents or deformation of the driving part, resulting in product damage, unintended stopping due to damage, or performance drop.

Maintenance, Inspection, Repair

- Wear protective goggles when applying grease to the actuator. Failure to do so may result in eye inflammation due to spattered grease.



Note

Installation

- Protection covers or other guards must be provided for the moving parts of the equipment to avoid direct contact with the operators.
- Do not configure a control circuit that will cause the work to drop in case of power failure. Configure a control circuit that will prevent the table or work from dropping when the power to the machine is cut off or an emergency stop is actuated.
- Take note of the following items to raise the straight-traveling accuracy of the table and ensure smooth movement of the ball screw and linear guide:
 1. Flatness of the mounting surface must be within 0.05 mm.
 2. The mounting surface area must be large enough to ensure the rigidity of the actuator.

Installation, Operation, Maintenance

- When handling the product, wear protective gloves, protective goggles, safety shoes or other necessary gear to ensure safety.

Maintenance, Inspection, Repair

- To grease the ball screw during maintenance, use the specified grease. In particular, do not mix fluorine grease and lithium grease, as it may cause insufficient lubrication, higher resistance or other unwanted outcomes and ultimately damage the machine.

Disposal

- When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste.

Others

- IAI shall not be liable whatsoever for any loss or damage arising from a failure to observe the items specified in "Safety Precautions."

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1. Foreword

Thank you for purchasing an IAI product.

This operating manual describes the correct handling, structure, maintenance and other aspects of your actuator.

Before using your actuator, be sure to read this operating manual and handle the actuator correctly. Keep this manual with you so that you can reference applicable information whenever necessary.

For more complete information on operating the actuator, also peruse the operating manual for your controller.

2. Safety Precautions

2.1 Basic Operating Instructions

- You must assume that any handling or operation not specifically explained in this operating manual or the controller operating manual cannot be performed, and do not perform any such handling or operation.
- Always use IAI's genuine parts for wiring between the actuator and controller.
- Entering the operation range of the machine while the machine is operating or receiving power may create a dangerous situation and must be avoided at all cost.

2.2 Maintenance and Inspection

- Be sure to turn off the controller power before performing maintenance or inspection.
- Exercise due caution so that other operator will not turn on the power inadvertently while inspection is still in progress.
- Put up a plate or other sign that clearly states "WORK IN PROGRESS," etc., in a conspicuous location.
- If two or more operators work together to perform maintenance or inspection, the operators should mutually watch out for each other's safety. Particularly when turning on/off the power or moving the axis, always call out before each action to ensure safety.

2.3 Permanent Magnets

This actuator uses high-performance rare-earth permanent magnets. Accordingly, the actuator may cause malfunction in medical devices such as pacemakers.

Those who are wearing a pacemaker or any other medical device must not come within 30 cm of the actuator.

(Note)

- The information provided in this manual is subject to change without notice for the purpose of modification and improvement.
- This manual has been written with due attention to accuracy and completeness, but there may still be inaccuracies and omissions. Should you find any error, or if you have any feedback, please contact IAI's Engineering Service Section or Sales Engineering Section.



3. Warranty

3.1 Warranty Period

Warranty period shall be either of the following periods whichever ends first:

- 18 months after shipment from our factory
- 12 months after delivery to a specified location
- 2,500 hours of operation time

3.2 Scope of Warranty

If a breakdown occurs within the period specified above and is due to the manufacturer's error, we will repair the unit at no cost. However, the following items are not covered by this warranty.

- Faded paint or other changes that occur naturally over time.
- Consumable components that wear out with use.
- Unit seems to be noisy or similar impressions that do not affect machinery performance.
- Damage resulting from improper handling by the user or lack of proper maintenance.
- Any alterations made by other than IAI or its representatives.
- Breakdowns caused by using controllers made by other manufacturers.
- Any damages caused by fire and other natural disasters or accidents.

The warranty pertains to the purchased product itself and does not cover any damages that might arise from a breakdown of the supplied product.

Any repairs will be done at our factory. Even if the product is still covered under the warranty period, we will assess a separate charge for sending technicians to the customer's site.

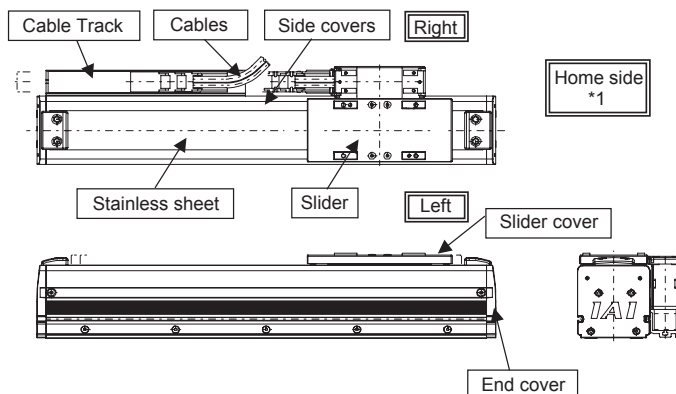
4. Names of the Parts

The name of each part of the actuator is specified below.

In this manual, the right-left directions of the actuator are indicated by viewing the actuator from its top and also from its home side, with the actuator placed horizontally. "Front" refers to the side opposite to one on which the actuator home is located.

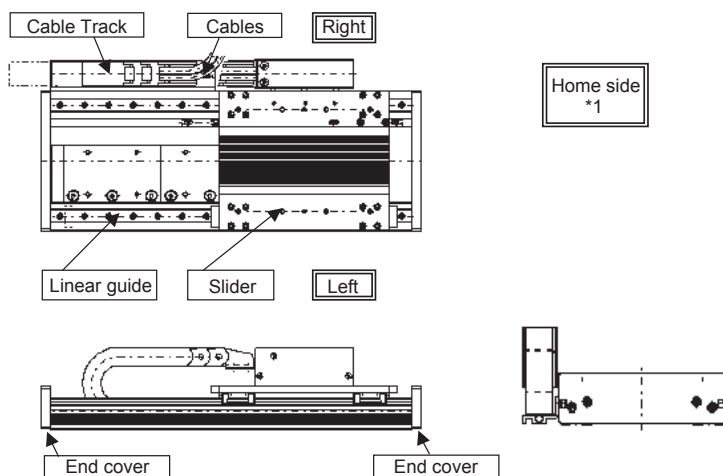
4.1 Small Type H8SS, H8SM^{*1}, H8HS, H8HM^{*1}

^{*1} Multi-slider type: There are two sliders mounted.



4.2 Flat Type L15SS, L15SM^{*1}

^{*1} Multi-slider type: There are two sliders mounted.



^{*1} In the above figure, the cables are facing up or the top side, while the home is located on the right side. The actuator is shipped with its home adjusted to the side specified by the customer. Accordingly, the home position on your actuator may be different from the direction shown in the figure.

5. Transportation and Handling

5.1 Handling the Actuator by Itself

When transporting the actuator by itself, take note of the items specified below.

5.1.1 Handling the Packed Actuator

Unless otherwise specified, the actuator of single-axis configuration is packed individually. When transporting or handling the packed actuator, exercise due caution not to hit the package against other object or drop the package.

- If the package is heavy, the operator must not attempt to carry the package alone.
- When setting down the package, place it horizontally.
- Do not step onto the package.
- Do not place on the package any heavy object or other article with an area of concentrated mass that may cause the package to deform.

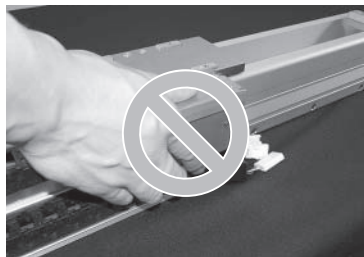
5.1.2 Handling the Unpacked Actuator

When handling the unpacked actuator, hold it by the base.

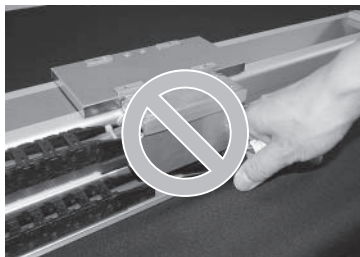
Warning:

- Do not apply excessive force on any part of the actuator. When transporting the actuator, do not hold it by the stainless sheet, cables, cable bearer or slider. In particular, never apply force on the stainless sheet.
- This actuator uses high-performance rare-earth permanent magnets. Therefore, those who are wearing a pacemaker or any other medical device must not come within 30 cm of the actuator.
- Handling precaution for the stainless sheet The stainless sheet has a thickness of only 0.1 mm or so in order to provide flexibility. Because of this very thin design, the stainless sheet easily gets dented and scratched. If the damaged stainless sheet is used continuously, the sheet may eventually break.

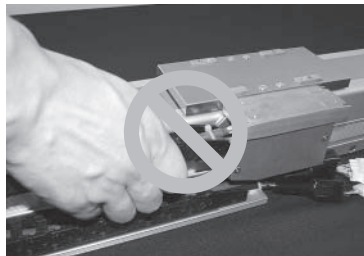
• Taboos in transportation



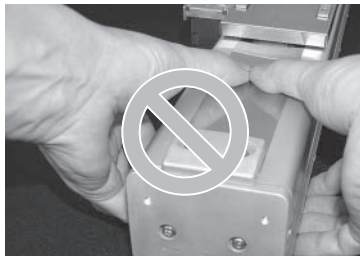
Do not transport the actuator by holding its slider.



Do not transport the actuator by holding its cables.



Do not transport the actuator by holding its cable bearer.



Do not transport the actuator by holding its stainless sheet.



5.2 Handling the Actuator Assembly

Pay attention to the following instructions when transporting an assembly of actuator axes.

5.2.1 Condition of Shipment from IAI (Assembled)

The actuators you have ordered are assembled at IAI, after which the assembly receives a shipping inspection and is shipped in an outer frame with skids.

The assembly is packed with the sliders securely affixed so that they will not move unexpectedly during transportation. In the case of a combined unit, the actuator ends are secured to prevent swinging due to external vibration.

- The package is not designed with special considerations for protection against impact due to dropping or collision, so please handle the package with care. Also, do not place any heavy object on the outer frame, as it is not strong enough to withstand loads.
- When suspending the package using ropes, etc., pass the ropes from underneath the reinforcement frames at the bottom of the skids. When lifting with a forklift, also place the forks underneath the skids.
- Set down the package carefully so as not to apply impact to the assembly or cause it to bounce.

◆ After unpacking, handle the actuator assembly correctly by observing the instructions given below.

5.2.2 Handling after Assembly with Peripheral Equipment

When transporting the actuators that have been assembled with peripheral equipment either at IAI or on your site, observe the instructions given below.

- Secure each slider to prevent unexpected movement during transportation.
- If any actuator end is protruding, secure it to prevent swinging due to external vibration.
- If the actuator ends are not secured, do not apply any impact force exceeding 0.3 G during transportation.
- When suspending the actuator-assembled peripheral equipment using ropes, etc., make sure the ropes do not contact the actuators directly.
- Pass the ropes over appropriate cushion materials, and make sure the loads from the ropes will be received by the base of each actuator.
- Secure the end of the Y-axis using a separate rope to maintain the axis in a stable horizontal position. At this time, be careful not to apply loads on the screw cover.
- Be careful not to allow the brackets, covers and connector box of each actuator to receive loads. Also protect the cables from pinching or excessive deformation.



6. Operating and Storage Environment

6.1 Operating Environment

The actuator should be set up in an environment, which meets the following criteria:

- Avoid direct sunlight.
- Avoid radiant heat from strong heat sources such as a furnace.
- Ambient temperature should be 0 to 40°C.
- The humidity should be less than 85% and there should be no condensation.
- Avoid exposure to corrosive or combustible gases.
- The area should have very little dust and be suitable for normal assembly operations.
- Avoid exposure to oil mist or fluids used in cutting.
- The unit should not be subject to vibrations greater than 0.3 G.
- Avoid extreme electromagnetic waves, ultraviolet rays and radiation.
- This product is not intended to be used in a chemical environment.

In general, the environment should be one in which an operator can work without protective gear.

6.2 Storage Environment

The storage environment should be similar to the operating environment. In addition, you must take precautions against condensation if the unit is to be stored for a long period of time.

Unless there are special instructions, we do not include moisture absorption agents when shipping the unit. If you are storing the unit where condensation might occur, then you must treat the entire package or treat the unit itself after it is unpacked to prevent condensation.

The unit can withstand up to 60°C during a short storage interval but only up to 50°C if the storage period is longer than one month.



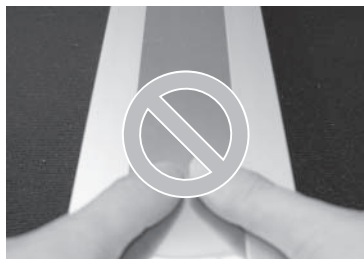
7. Installation

Notes on Installation

The stainless sheet is designed very thin (thickness: 0.1 mm) in order to ensure flexibility. Therefore, the stainless sheet is easily dented or scratched.

Once dented or scratched, the stainless sheet may break during use.

1. Do not press the sheet directly with hands.



2. Be careful not to make a dent on the sheet by dropping tools or work part.



3. Do not generate powder dust or iron powder around the stainless sheet.

If dust/powder has generated, thoroughly remove attached dust/powder from the stainless sheet after the operation.

If the actuator is operated with the stainless sheet carrying foreign particles, the particles may enter the slider and damage the sheet or cause the sheet to deform, lift or present other problems.

Also, magnets are attached to the side covers to keep the stainless sheet in position. Since these magnets attract metal debris, iron powder and other metal objects, due attention must be paid to the surrounding environment.

7.1 Installing the Actuator

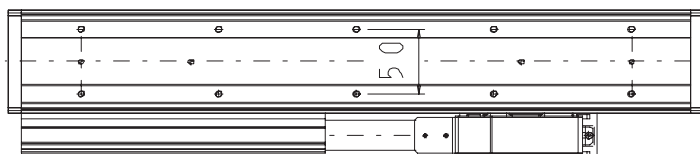
Install the actuator on a machined surface or other flat surface of equivalent accuracy.

7.1.1 Small Type H8SS, H8SM, H8HS, H8HM

There are tapped holes on the back of the actuator base for installation. Please utilize these holes to install the unit.

Effective length of screw for installation is as shown in the table below. Make sure that the thread of the screw does not exceed the base surface.

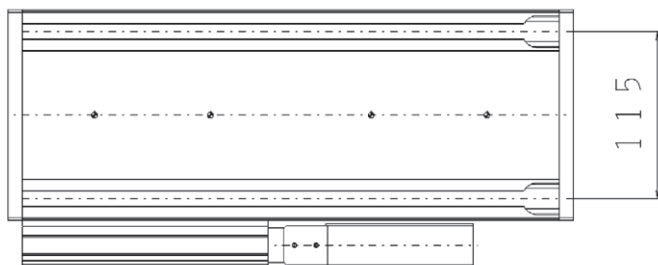
Also, there are reamed holes for positioning pins.



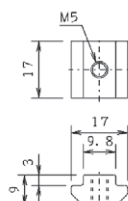
Tap diameter	Effective tap length	Reamed Hole
M5	10mm	$\phi 4$ H10, Depth 5mm

7.1.2 Flat Type L15SS, L15SM

There are T-slots on the back of the actuator base for installation. Please utilize these T-slots on the base and the nuts contained in the package. Be careful so the screw tip does not contact the bottom of the T-slot. Also, there are reamed holes for positioning pins.

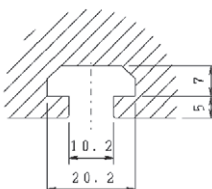


Reamed Hole
$\phi 4$ H10, Depth 6mm



[Packaged T-nut]

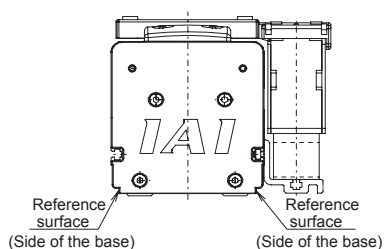
Maker : SUS
 Model No. : SFB-008
 Material : S10C or equiv.
 Surface Treatment : Unichrome plating
 Weight : Approx. 14 g/pc



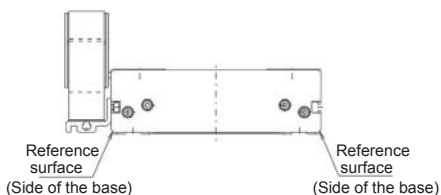
7.2 Installation Surface

- Ensure that the frame offers sufficient structural rigidity to prevent generation of vibration.
- Install the actuator on a machined surface or other flat surface of equivalent accuracy. The flatness of the installation surface must be ± 0.05 mm or less.
- Provide sufficient space to allow for maintenance work.
- The side and bottom surfaces of the actuator base provide reference surfaces used for alignment of slider travel.
- If you require higher traveling accuracy, install the actuator using these reference surfaces.

Small Type H8SS, H8SM, H8HS, H8HM

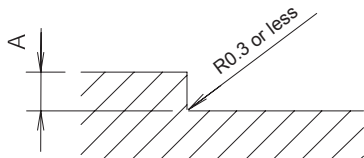


Flat Type L15SS, L15SM



Caution: As shown above, each side surface of the base provides a reference surface used for alignment of slider travel. If you require higher traveling accuracy, therefore, install the actuator with reference to either side surface of the base.

When installing the actuator on the frame using the base reference surfaces, provide the necessary machining by following the drawing below.



	Dimension A
Small Type H8SS, H8SM, H8HS, H8HM	2 to 3.5
Flat Type L15SS, L15SM	2.5 to 4

7.3 Tightening Screws

- Use hexagonal socket head bolts (male screws) for installing the base.
- Use of high-tensile bolts of ISO strength category 10.9 or above is recommended.
- Provide the following effective engagement length for the bolt and male screw.

When the male screw is made of steel → Same as the nominal diameter

When the male screw is made of aluminum → Twice the nominal diameter

- The recommended tightening torques are as follows.

Model	Tightening torque	
	Steel bolt bearing surface	Aluminum bolt bearing surface
M5	$7.5\text{N} \cdot \text{m}$ ($0.77\text{kgf} \cdot \text{m}$)	$4.3\text{N} \cdot \text{m}$ ($0.44\text{kgf} \cdot \text{m}$)

7.4 Installing a Connector Box Using T-slots

T-slots are provided on the side faces of the actuator for installation of a connector box or other external equipment.

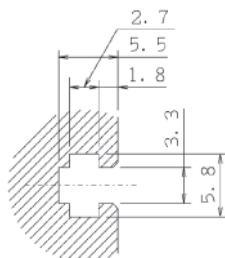
If you are using a wiring kit, install a connector box using these T-slots.

T-slots can also be used for other purposes, such as installing sensors or securing cables.

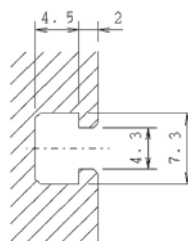
T-slot Dimensions

Model	T-slot Nut Diameter
Small Type H8SS, H8SM, H8HS, H8HM	M3
Flat Type L15SS, L15SM	M4

Small Type H8SS, H8SM, H8HS, H8HM

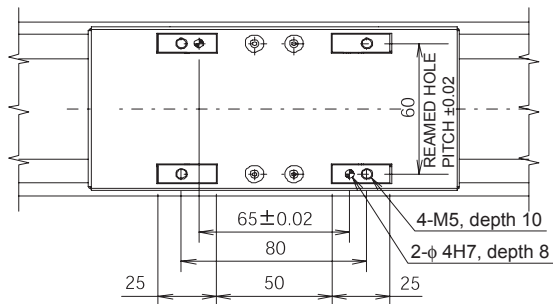


Flat Type L15SS, L15SM



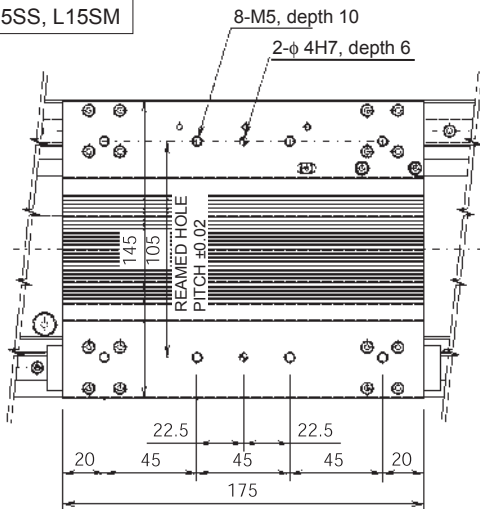
- The slider has tapped holes that can be used to affix a load. The procedure to affix a load on the slider shall conform to the actuator installation procedure.
- Even when the slider is affixed to move the actuator body, the actuator is also installed using the tapped holes.
- Two reamed holes are provided in the slider. Use these holes if the load must be installed/removed repeatedly. To fine-tune the squareness, etc., use one of these reamed holes in the slider.

Small Type H8SS, H8SM, H8HS, H8HM



*Caution: When installing the load, do not let viscous substances such as adhesives and paints attach to the stainless sheet or apply force only to a specific part of the actuator to dent the affected part. They can lead to slider malfunction or sheet damage.

Flat Type L15SS, L15SM

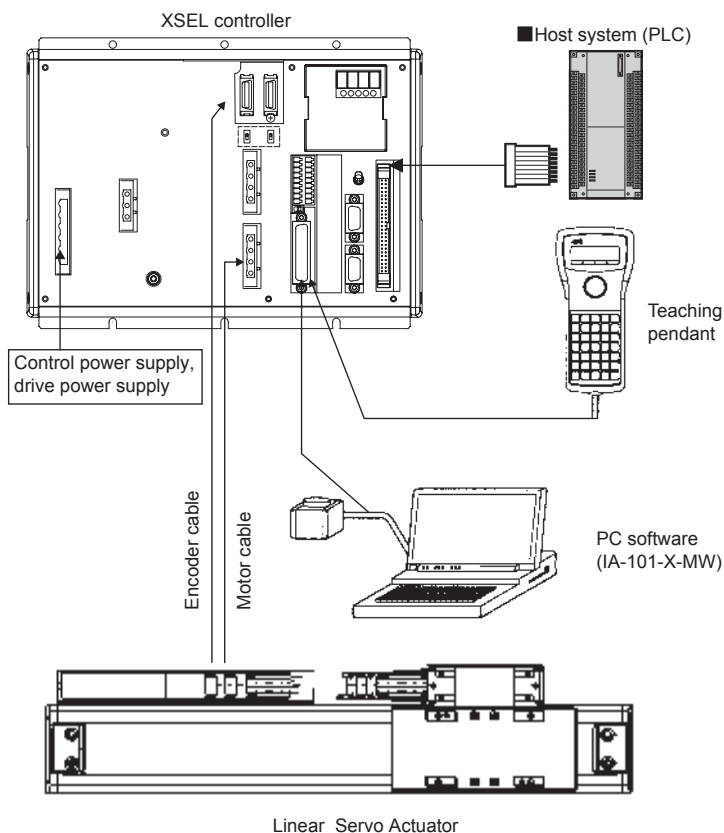


8. Wiring of the Cables

- Do not cut any of the cables to reduce its length or reconnect the cut cable with other cable to extend the wiring length or for any other purpose.
- Do not pull the cables or bend them excessively.

- Controller connection diagram

This is a connection example with the XSEL controller. This actuator can also be connected to the SSEL or SCON controller.



9. Precautions for Use

9.1 Actuator Load

Make sure the load specified in the “Specifications” section is not exceeded. In particular, pay attention to the moment applied to the slider, allowable overhang length, and load.

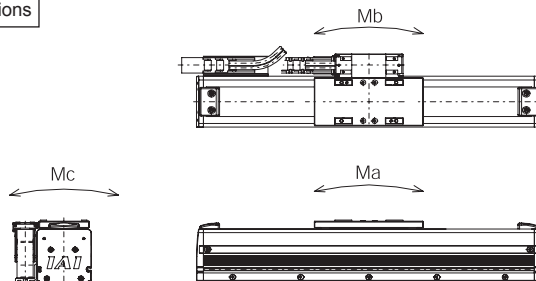
9.1.1 Small Type H8SS, H8SM, H8HS, H8HM

Allowable load moment			Unit : N•m (kgf•m)
	Ma	Mb	Mc
Small Type H8SS, H8SM, H8HS, H8HM	8.65 (0.88)	8.65 (0.88)	8.65 (0.88)

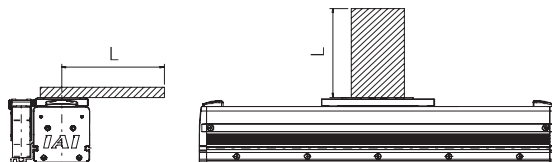
Allowable overhang length			Unit : mm
	Ma Direction	Mb Direction	Mc Direction
Small Type H8SS, H8SM, H8HS, H8HM	300 or less	300 or less	300 or less

* The above overhang length assumes that the center of gravity of the load is located at a point corresponding to one-half the overhang length.

Moment directions



Allowable overhang directions



* Caution: If an excessive load moment is applied, the guide will reach its life prematurely or other undesirable effects will result. Using the actuator in a configuration where the overhang length exceeds the allowable value may also increase vibration or reduce the service life of the guide.

9.1.2 Flat Type L15SS, L15SM

Allowable load moment

Unit : N·m (kgf·m)

	Ma	Mb	Mc
Flat Type L15SS, L15SM	24.2 (2.4)	24.2 (2.4)	24.2 (2.4)

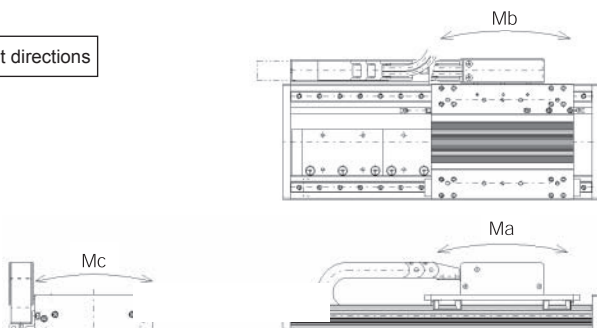
Allowable overhang length

Unit : mm

	Ma Direction	Mb Direction	Mc Direction
Flat Type L15SS, L15SM	525 or less	525 or less	525 or less

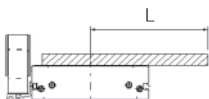
* The above overhang length assumes that the center of gravity of the load is located at a point corresponding to one-half the overhang length.

Moment directions

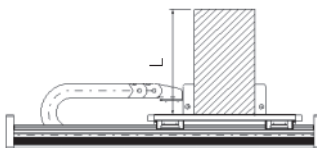


Allowable overhang directions

Mb or Mc direction



Ma direction



* Caution: If an excessive load moment is applied, the guide will reach its life prematurely or other undesirable effects will result. Using the actuator in a configuration where the overhang length exceeds the allowable value may also increase vibration or reduce the service life of the guide.

9.2 Home Return

9.2.1 Operating Principles of Home Return

Home return is performed in the sequence specified below.

- [1] When a home return command is issued, the moving direction is determined from the specified parameter.
- [2] A home sensor signal is detected during home return.
- [3] Upon detection of the home sensor signal, the actuator reverses and subsequently detects a Z phase signal to recognize this position as the reference point.
- [4] The actuator moves further by the offset specified by the applicable parameter and recognizes the achieved position as the home.

9.2.2 Fine-tuning the Home Position

The number of motor revolutions from the time the slider hits the stopper to when the Z- phase signal is generated is adjusted when the unit is shipped out. The standard value of the backing distance when the slider hits the stopper, reverses and then stops at the home position is;

Model	Reverse distance from the mechanical stopper (mm)
Small Type H8SS, H8SM, H8HS, H8HM	10
Flat Type L15SS, L15SM	15

If the home return direction remains the same, changing the parameter based on this value allows you to fine-tune the home position of your actuator. Perform this fine-tuning by following the procedure below.

- [1] Perform home return to check the home.
- [2] Thereafter, move the actuator to a desired home. Check the difference and correct the parameter accordingly. The parameter accepts a positive value to set an offset in the moving direction of the actuator. (Negative values cannot be set.)
- [3] Increasing the offset reduces the moving range by the amount incremented. If you have specified an offset exceeding 1 mm, also adjust the soft limits.

9.2.3 Changing the Home Direction

Changing the factory-set home direction after the delivery requires certain changes, such as changing the moving direction parameter. Please consult IAI.

9.3 Stainless Sheet

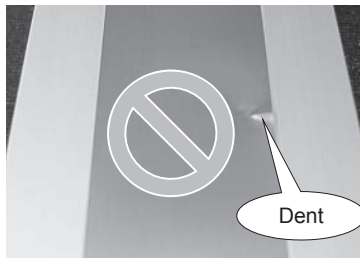
The stainless steel sheet of the small-type actuators, H8SS, H8SM, H8HS and H8HM is held by rubber magnets provided on the side covers. If the ambient air contains a lot of magnetic substances such as iron powder, these magnetic substances may be attracted between the sheet and the rubber magnets, causing increase of possible failure. Therefore, please try to avoid using under such environments.

- If viscous substances such as adhesives and paints attach to the stainless sheet, slider malfunction or sheet damage may occur. Prevent viscous substances from contacting the actuator.
- Take note that applying a force only to a specific part of the stainless sheet may cause the affected part to deform and create various problems. Also, do not grip or hold the stainless sheet when installing or transporting the actuator, as it may damage the sheet.

1. Do not press the sheet directly with hands.



2. Be careful not to make a dent on the sheet by dropping tools or work part.



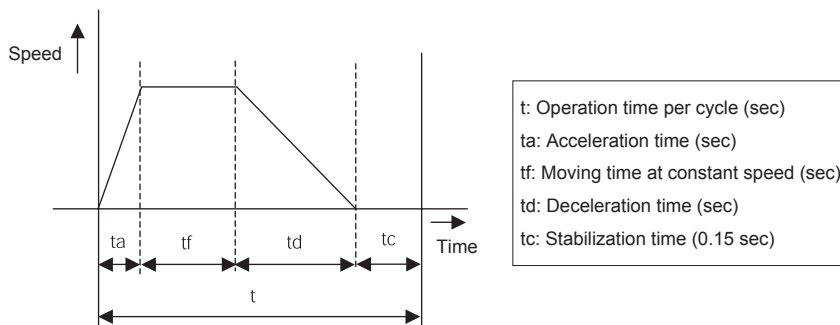
10. Selection Conditions

When using a large linear servo actuator, you must ensure that the actuator satisfies the following two conditions.

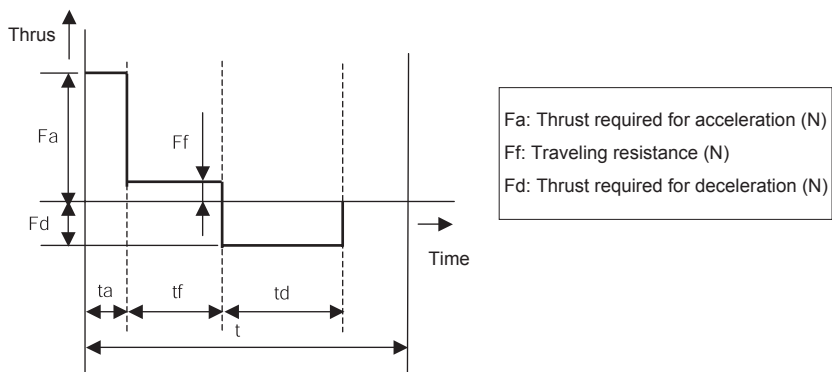
Condition [1] The thrust required for acceleration must not exceed the maximum thrust of the large linear servo actuator.

Condition [2] The thrust during continuous operation must not exceed the rated thrust of the large linear servo actuator.

The above conditions are explained by using a trapezoid operation as an example.



The above operation pattern can be expressed differently in a graph where the vertical axis represents thrust.



10.1 Selection Method

Condition [1]: Maximum thrust

For the slider to accelerate according to a command, the thrust required for acceleration, or F_a , must be smaller than the maximum thrust of the large linear servo actuator.

Thrust F_a is calculated using the equation below:

$$F_a = (M+m) \cdot a + F_f$$

Here,

M : Slider weight

m : Slider payload (kg)

a : Commanded acceleration (m/s^2) * *1G=9.8 m/s^2

F_f : Traveling resistance (N)

[Slider weight]

● Small Type H8SS, H8SM : 1.5kg

● Small Type H8HS, H8HM : 2.0kg

● Flat Type L15SS, L15SM : 1.5kg

For linear servo actuator, the traveling resistance is determined by the speed and empirically calculated as specified below.

Traveling Resistance of Liner Servo Actuator

$F_f = 2V + 10$ V: Slider speed (m/s)

If the obtained F_a is smaller than the maximum thrust of the linear servo actuator, condition 1 is satisfied.

linear servo actuator	Small Type H8SS, H8SM	Maximum thrust → 90 N
linear servo actuator	Small Type H8HS, H8HM	Maximum thrust → 180 N
linear servo actuator	Flat Type L15SS, L15SM	Maximum thrust → 90 N

Condition [2]: Thrust during continuous operation

Confirm that the thrust during continuous operation, or F_t , which also takes into consideration the load and duty, is smaller than the rated thrust of the large linear actuator.

$$F_t = \sqrt{\frac{F_a^2 \cdot t_a + F_f^2 \cdot t_f + F_d^2 \cdot t_d}{t}}$$

Here, F_d indicates the thrust required for deceleration and can be calculated as follows:

$$F_d = (M+m) \cdot d \cdot F_f$$

M : Slider weight

m : Slider payload (kg)

a : Commanded acceleration (m/s^2)

F_f : Traveling resistance (N)

[Slider weight]

- Small Type H8SS, H8SM : 1.5kg
- Small Type H8HS, H8HM : 2.0kg
- Flat Type L15SS, L15SM : 1.5kg

If the obtained thrust during continuous operation F_t is smaller than the rated thrust, the actuator can be operated in the applicable conditions.

linear servo actuator	Small Type H8SS, H8SM	Maximum thrust → 30 N
linear servo actuator	Small Type H8HS, H8HM	Maximum thrust → 60 N
linear servo actuator	Flat Type L15SS, L15SM	Maximum thrust → 30 N

The actuator can be used in any operating conditions that satisfy both conditions 1 and 2 specified above.

If either condition cannot be satisfied, take appropriate measures such as reducing the slider load, acceleration or duty.

10.2 Example

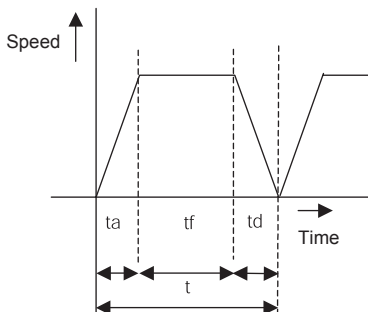
Let's select an actuator by following the procedure in "Selection Method."

★ Operating conditions

- Applicable model : Small Type H8SS
- Speed : 2.5 m/s
- Acceleration : 19.6 m/s² (The deceleration is assumed to be the same.)
- Travel : 1.5 m
- Slider payload : 3 kg
- The actuator moves back and forth over a stroke of 1.5 m.

The above operation pattern can be illustrated by the graph shown to the right.

Now, let's start calculation according to "Selection Method."



Test condition [1], "maximum thrust."

Apply the above operation pattern to the aforementioned equation of maximum thrust.

$$F_a = (M+m) \cdot a + F_f$$

Here,

M : Slider weight (1.5 kg for the small-type linear servo actuator H8SS)

m : Slider payload (kg) : 3 kg in this example

a : Commanded acceleration (m/s²) : 19.6 m/s² in this example

F_f : Traveling resistance (N) : 15 N in this example

From above, F_a is calculated as follows:

$$F_a = 4.5 \times 19.6 + 15 \rightarrow 103.2 \text{ N}$$

The calculated value exceeds the maximum thrust 90 N of the linear servo actuator Small Type H8SS.

Let's lower the specified acceleration to 14.7 m/s². F_a changes as follows:

$$F_a = 4.5 \times 14.7 + 15 \rightarrow 81.15 \text{ N.}$$

The calculated value is smaller than the maximum thrust 90 N of the linear servo actuator Small Type H8SS.

Test condition [2], "thrust during continuous operation."

Apply the above operation pattern to the aforementioned equation of thrust during continuous operation. Based on the examination result of maximum thrust, the specified acceleration is assumed as 14.7 m/s^2 .

$$F_t = \sqrt{\frac{F_a^2 \cdot t_a + F_f^2 \cdot t_f + F_d^2 \cdot t_d}{t}}$$

Here,

$F_a = 81.5 \text{ N}$, $F_f = 15 \text{ N}$, $F_d = 51.15 \text{ N}$,

$t_a = t_d = 0.17 \text{ sec}$, $t_f = 0.43 \text{ sec}$, $t = 0.92 \text{ sec}$ (including stabilization time t_c of 0.15 sec)

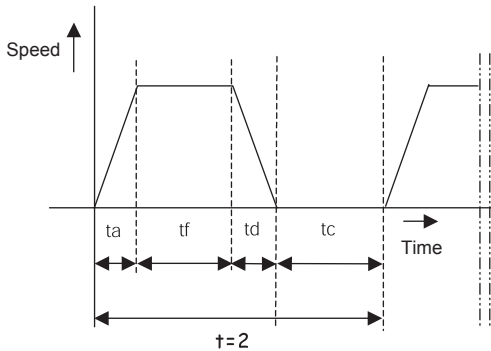
From the above,

F_t is calculated as 42.49 N .

Since this value exceeds the rated thrust 30 N of the large linear servo actuator Small Type H8SS, this actuator cannot be used in the aforementioned operation pattern.

Let's lower the duty and see what happens.

Repeat the above calculation based on $t = 2 \text{ sec}$ (including stabilization time t_c of 0.15 sec).



This time, F_t is calculated as 28.82 N .

Accordingly, the actuator can be used in this operation pattern.



11. Maintenance/Inspection

11.1 Inspection Items and Intervals

Perform maintenance and inspection at the intervals specified below.

This schedule assumes that the actuator is operated eight hours a day.

If the actuator is operated at a higher utilization, such as when the machine is used continuously day and night, reduce the inspection intervals accordingly.

	Visual inspection of exterior	Inspection of interior
Start-up inspection	○	
After 1 month of operation	○	
After 6 months of operation	○	○
After 1 year of operation	○	○
Every 6 months thereafter	○	
Every year thereafter	○	○

11.2 Visually Inspecting the Exterior

Visually check the exterior of the following items.

Inspection location	Check items	Remarks
Actuator	Loosening of actuator mounting bolts, etc.	
Cables	Scratches, connector engagement	
Stainless sheet	Scratches, loosening	Refer to Chapter 13 in this manual.
Overall	Noise, vibratio	

* As a guideline, the service life of the stainless sheet roughly corresponds to a traveled distance of 5,000 km.

However, the stainless sheet may have to be replaced earlier depending on the use condition.

11.3 Cleaning

- Clean the exterior surface as necessary.
- Wipe dirty areas using a soft cloth, etc.
- Do not blow highly compressed air onto the actuator, as it may cause dust to enter the actuator through gaps between parts.
- Do not use petroleum-based solvent as it damages resin and coated surfaces.
- To remove stubborn stains, take neutral detergent or alcohol into a soft cloth, etc., and wipe the area gently.

11.4 Inspecting the Interior

11.4.1 Small Type H8SS, H8SM, H8HS, H8HM

With the power supply turned off, turn up the stainless sheet and visually inspect the interior.

Check the following items inside the actuator.

Inspection location	Check items	Remarks
Actuator	Loosening of actuator mounting bolts, etc.	
Guide	Lubrication condition, looseness	If any abnormality, contact us

Check for the entry of dust and other foreign matters inside, the lubrication condition and the looseness of the guides.

Even if grease has turned brown, the actuator is lubricated properly if its traveling surface is glossy.

The procedure to check the interior is specified below:

- [1] Move the slider toward the home side.
- [2] Remove the screws securing the sheet using a hex wrench with a width across flats of 7 mm.
- [3] Turn up the sheet and check the interior.
- [4] After the check, assemble the parts by following the same steps in the reverse order.

Caution: When checking the interior, do not forcibly bend or scratch the stainless sheet. Do not pull the sheet, either, as it may change the initial installation condition.
 If the installation condition changes, the sheet may become offset or reach its life prematurely.
 If you have noticed any negative effect as a result of improper handling of the sheet, please contact IAI's Sales Engineering Section.
 When working with the stainless sheet, wear gloves or take other appropriate precautions to prevent cuts by the edges of the sheet.

11.4.2 Flat Type L15SS, L15SM

Perform inspection after turning the power off.

Check the following items inside the actuator.

Inspection location	Check items	Remarks
Actuator	Loosening of actuator mounting bolts, etc.	
Guide	looseness	If any abnormality, contact us

Check for the entry of dust and other foreign matters inside, the lubrication condition and the looseness of the guides.

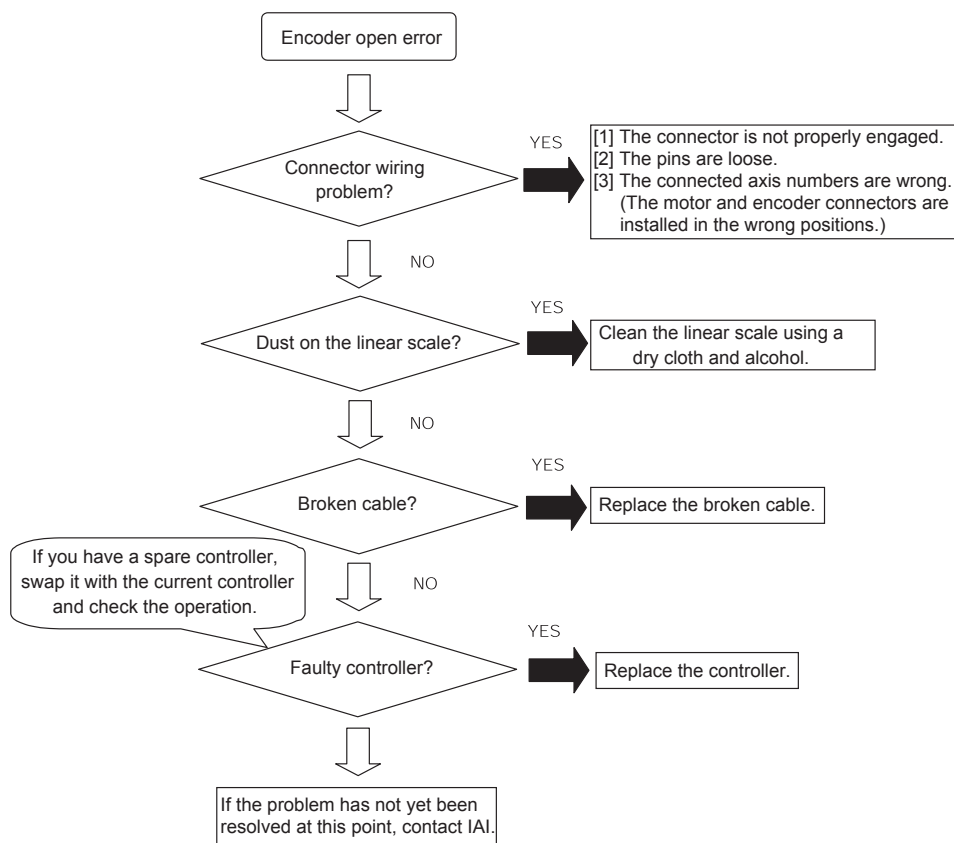
Even if grease has turned brown, the actuator is lubricated properly if its traveling surface is glossy.

12. Troubleshooting

12.1 What to Do When You Suspect a Failure

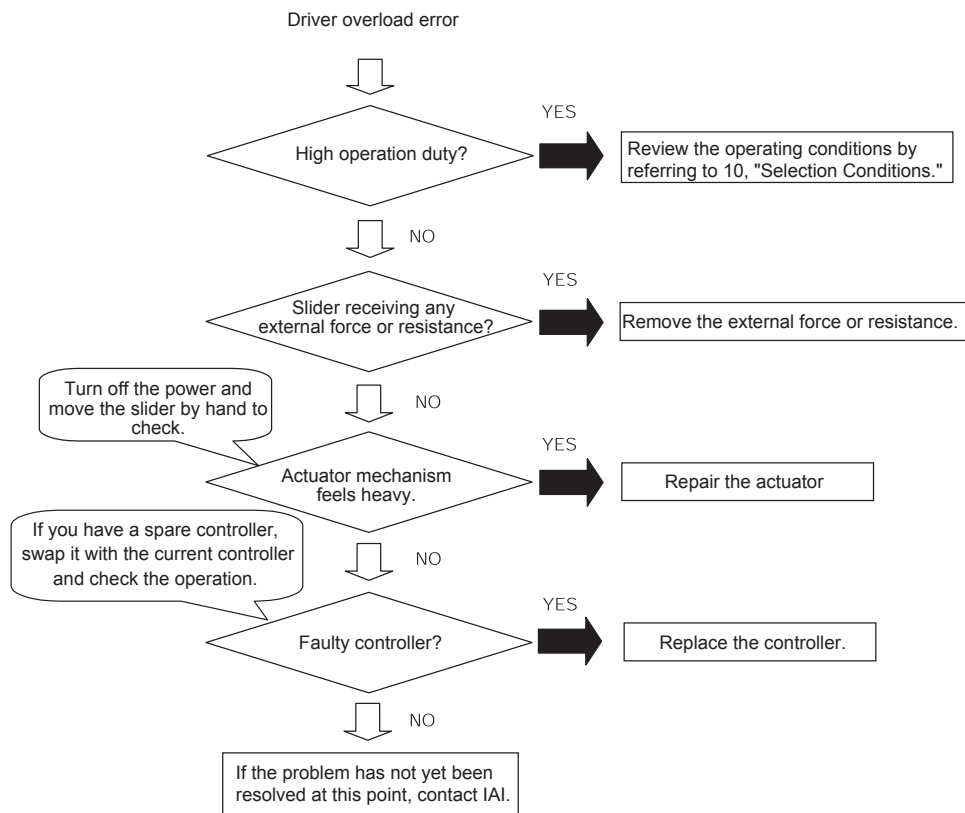
If the actuator has experienced an encoder open error, driver overload error, deviation overflow error or any other error, check the procedures explained below before concluding that the robot or controller is faulty. If the problem persists after the applicable measures have been taken, contact IAI with the detailed condition.

12.2 Encoder Open Error (Error Code: D12)



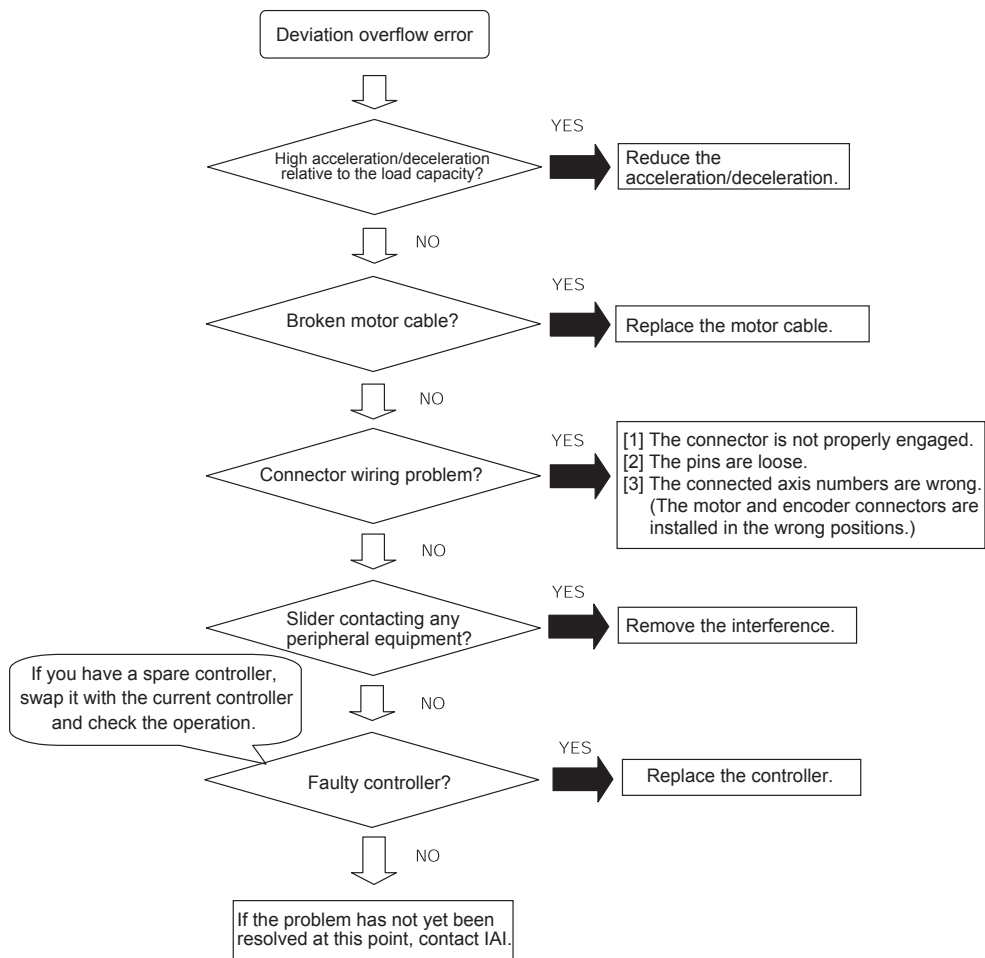


12.3 Driver Overload Error (Error Code: D0A)





12.4 Deviation Overflow Error (Error Code: C6B)



13. Replacement/Adjustment of Stainless Sheet

[Required Items]

- Replacement stainless sheet
- Hex wrench set
- Scale
- Box-end wrench
- Adhesive tape
- Oil-based marker
- Tension gauge (which has two forced hooks)

[Notes]

1. Stainless sheet tension

Improper tension of the stainless sheet can promote deterioration and wear of the sheet.

If the stainless sheet is too taut and the clearance from the slider cover becomes greater than 1 mm, the stainless sheet may undergo fatigue failure.

On the other hand, excessive slack can cause the stainless sheet to contact the back of the slider cover.

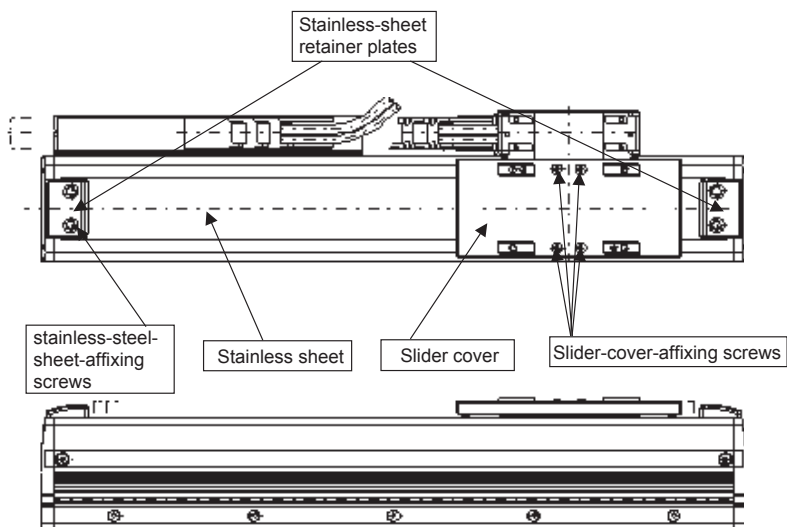
2. Checking the clearance between the stainless sheet and the back of the slider cover

The stainless steel sheet is replaced without removing the slider cover.

Therefore, the clearance between the stainless steel sheet and the back of the slider cover cannot be measured or checked directly.

This method enables to tension the stainless steel sheet so that 1mm clearance can be obtained.

[Name of each part]

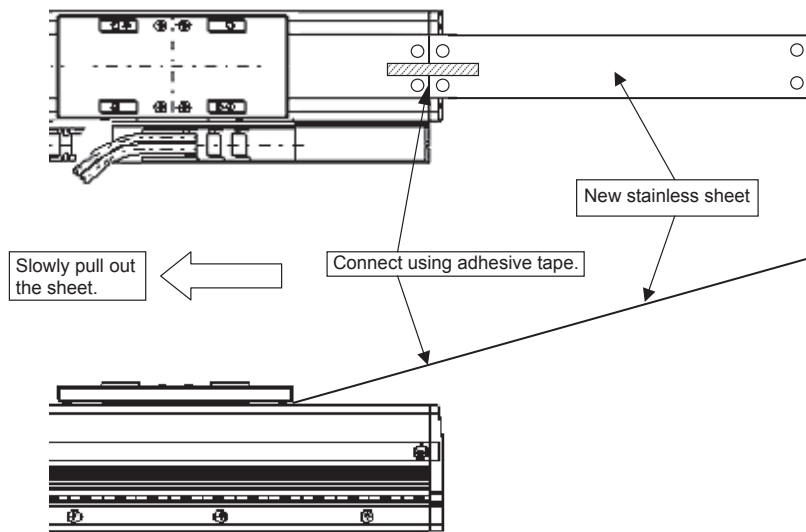




13.1 Replacement Procedure for Stainless Sheet

1. Replacing the damaged stainless sheet with a new stainless sheet

- [1] Check a new stainless sheet to confirm absence of scratches or soiling.
- [2] Loosen the screws affixing the damaged stainless sheet and remove the sheet retainer plates.
- [3] Connect the damaged stainless sheet and new stainless sheet using adhesive tape.
- [4] Slowly pull out the damaged stainless steel sheet.
- [5] Confirm that the new stainless sheet has been installed in the slider.



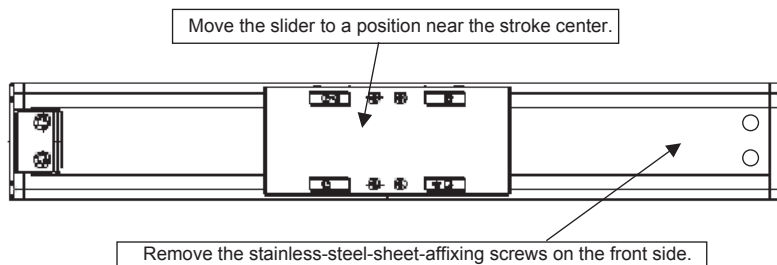
Connect the damaged stainless sheet and new stainless sheet using adhesive tape, and then slowly pull out the damaged stainless sheet so that the new sheet takes its position.

13.2 Adjusting the Stainless Sheet Tension

[1] First, affix the stainless sheet uniformly on the right and left in a manner free from shifting.

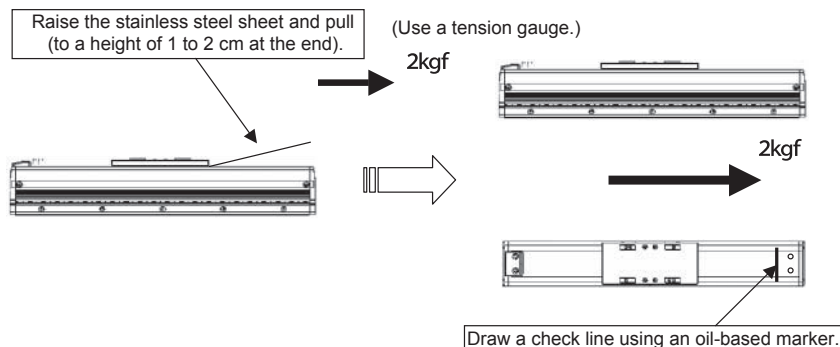
(The stainless sheet is held in position by the attraction forces of magnets. Therefore, lift the sheet from one end and then put it back in place toward the same end to achieve better result. Also adjust the stainless sheet from the slider center toward both ends.)

[2] Move the slider to a position near the stroke center, and remove the stainless-steel-sheet-affixing screws on the front (opposite of motor) side.



[3] Preparation for Tension Adjustment of the Stainless Steel Sheet

- As shown below, pull up the end of the stainless steel sheet where the screws were removed in step [2] by 1 to 2 cm, and then pull the sheet in the arrow direction shown below with 1kg force using a tension gauge. (Use a tension gauge having two forked hooks at its tips and hook it to the two holes on the stainless steel sheet.)
- With the stainless steel sheet tensioned by 2kg force, allow the stainless steel sheet to be attracted to the magnets from the slider end towards the other, and then remove the tension gauge. (The stainless steel sheet will not move once it is attracted to the magnets.)
- Use an oil-based marker and a ruler to draw a straight check line that crosses over the side covers and the stainless steel sheet. (Refer to the figure below.)

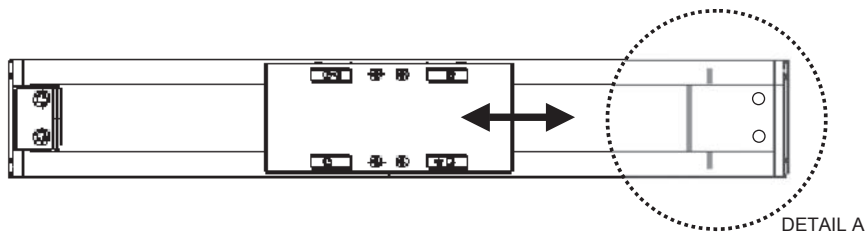




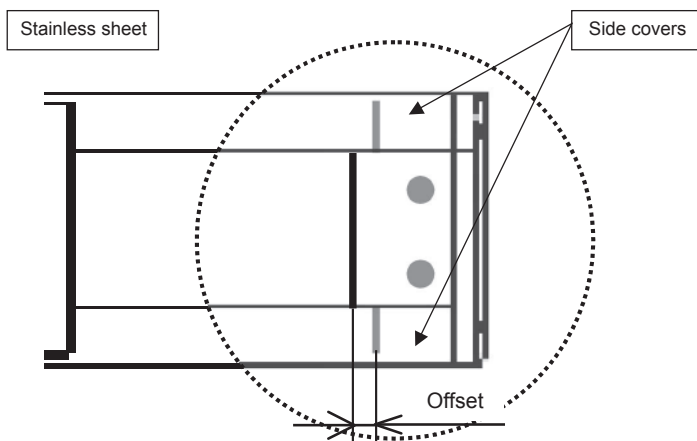
[4] Tension Adjustment of Stainless Steel Sheet

Move the stainless steel sheet in the direction of the arrow until the check lines on the side covers and on the sheet make 0.5mm offset. (Refer to the detail view A.)

(The stainless sheet is held in position by the attraction forces of magnets. Therefore, lift the sheet from one end and then put it back in place toward the same end to achieve better result.)



DETAIL A



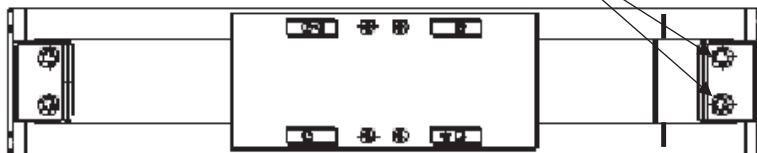
Move the stainless steel sheet in the arrow direction to fine-tune the sheet position until the check lines on the side covers and on the sheet make 0.5mm offset.

Once this adjustment is complete, an appropriate clearance has been achieved between the top surface of the stainless steel sheet and the back of the slider cover at the center of the slider cover.



- [5] Once the sheet is positioned, temporarily tighten the domed cap nuts that were removed earlier in the procedure only enough to hold the stainless steel sheet so that it would not move.

Loosely tighten the domed cap nuts removed earlier just to hold the stainless steel sheet movement.



13.3 Operation Check

- [1] Move the slider to check the tension of the stainless steel sheet.

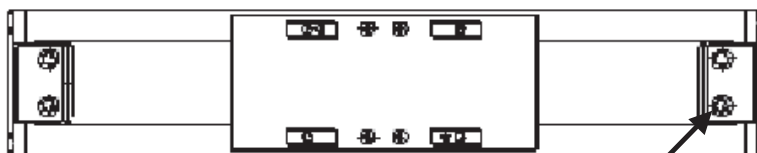
Move the slider to check whether the sheet is positioned evenly on the right and left ends, or it has any waviness over the entire stroke range.

If the stainless steel sheet is not evenly positioned on the right and left ends or is waving, repeat the adjustment process.

- [2] Securely tighten the domed cap nuts that have been temporarily tightened, to affix the stainless steel sheet completely.

Tightening torque of domed cap nuts (reference value)

359N•cm (36.7kgf•cm)



Alternately tighten the two domed cap nuts that have been temporarily tightened and finally tighten them with the even torque. If the tightness on the two nuts is uneven, the sheet may meander or lift up.

Move the slider to check once again if the stainless steel sheet is tensioned properly. To complete the process, remove the check lines using alcohol and so on.

14. Specifications

14.1 Actuator

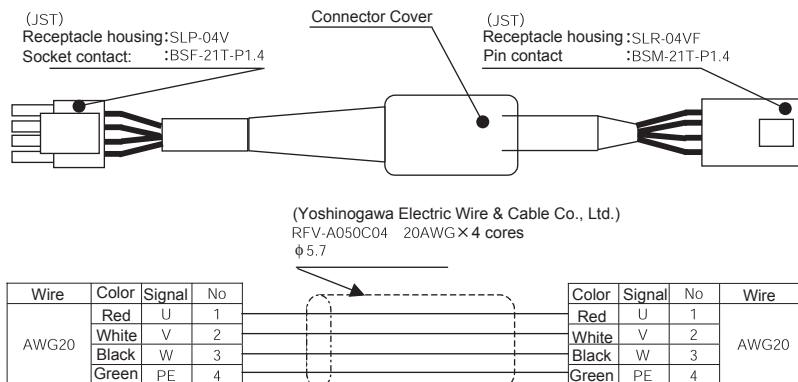
Model	Unit	H8SS, H8SM	H8HS, H8HM	L15SS, L15SM
Stroke	mm	H8SS : 50 to 1650 (in increments of 100)	H8HS : 50 to 1550 (in increments of 100)	150 to 1650 (in increments of 100)
		H8SM : 130 to 1430 (in increments of 100)	H8HM : 130 to 1230 (in increments of 100)	
Rated thrust	N	30	60	30
Maximum thrust	N	90	180	90
Maximum speed	m/sec	2,500	2,500	2,500
Maximum acceleration/ deceleration	G	3	3	3
Maximum load capacity	kgf	5	8	5
Positioning repeatability	±mm	0.005		
Load moment	N. m (kgf·m)	(Traveling life: 10,000 km)		
		Ma : 8.65 (0.88)		Ma : 24.2 (2.4)
		Mb : 8.65 (0.88)		Mc : 24.2 (2.4)
		Mc : 8.65 (0.88)		Mc : 24.2 (2.4)
Overhang load length	mm	Ma direction: 300 or less Mb, Mc direction: 300 or less		Ma direction: 525 or less Mb, Mc direction: 525 or less

(*1) The maximum speed may not be reached depending on the stroke.

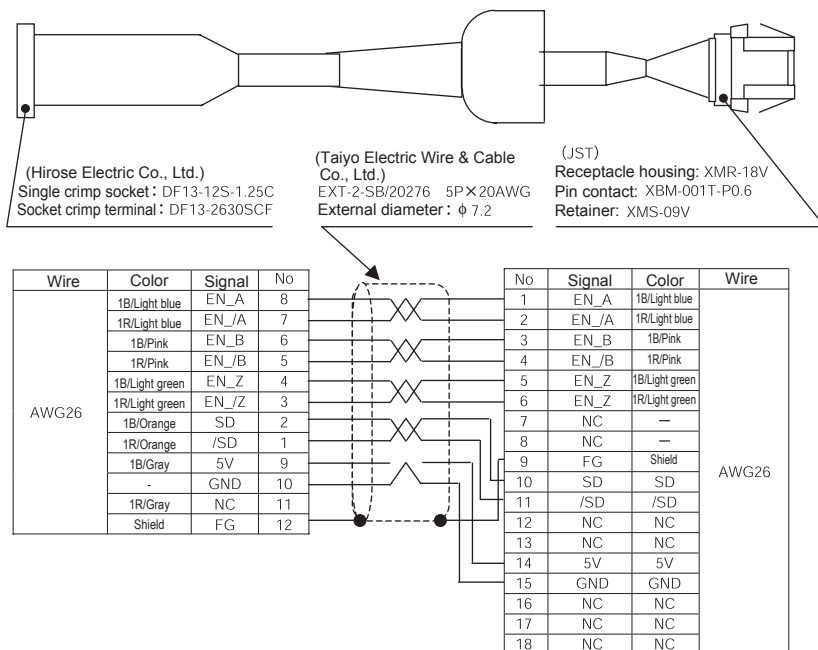
(*2) The specific value varies depending on the operating conditions.

14.2 Cable Wiring Diagram

[1] Cable in the cable bearer (motor cable)



[2] Cable in the cable bearer (encoder cable)

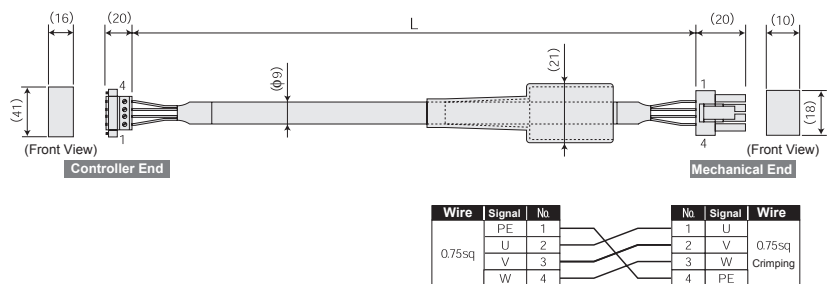


[3] Controller Cable (Motor Cable)

Type : CB-RCC-MA□□□-RB

*□□□ indicates the cable length

Example) 080 = 8m

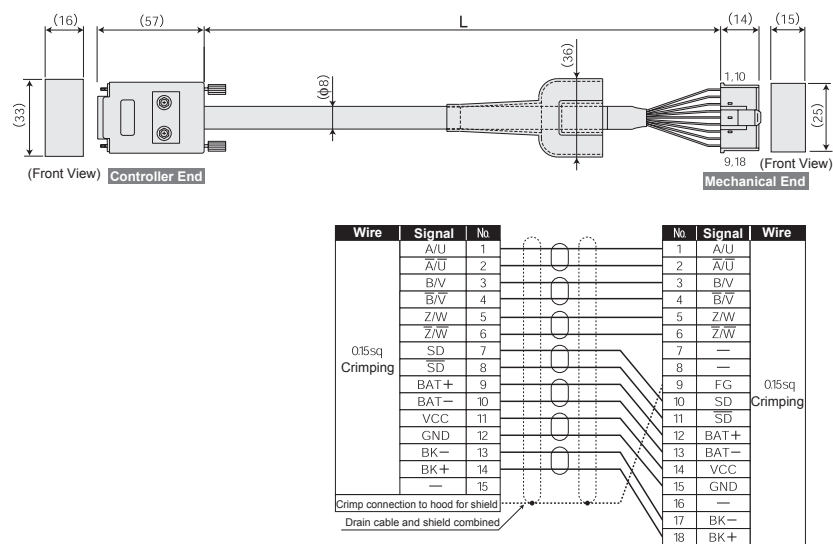


[4] Controller Cable (Encoder Cable)

Type : CB-RCBC-PA□□□-RB

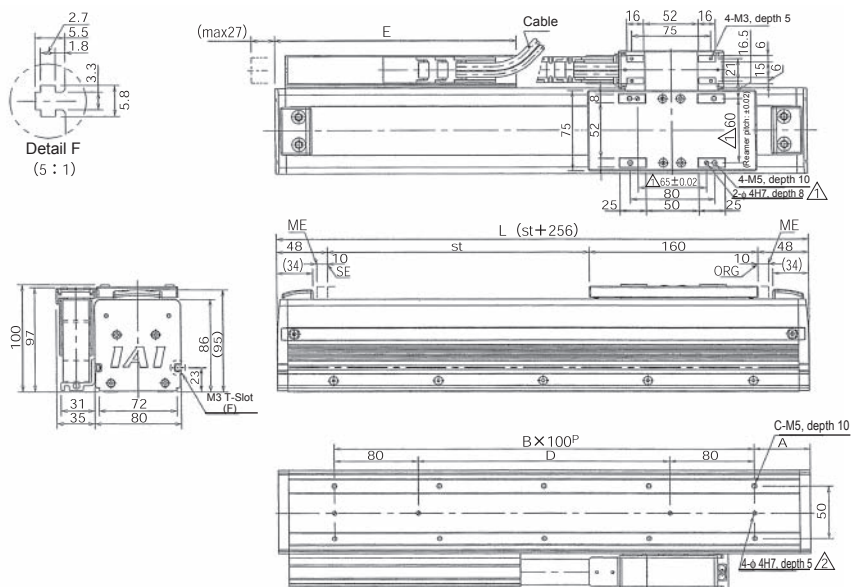
*□□□ indicates the cable length

Example) 080 = 8m



14.3 External Dimension Drawing

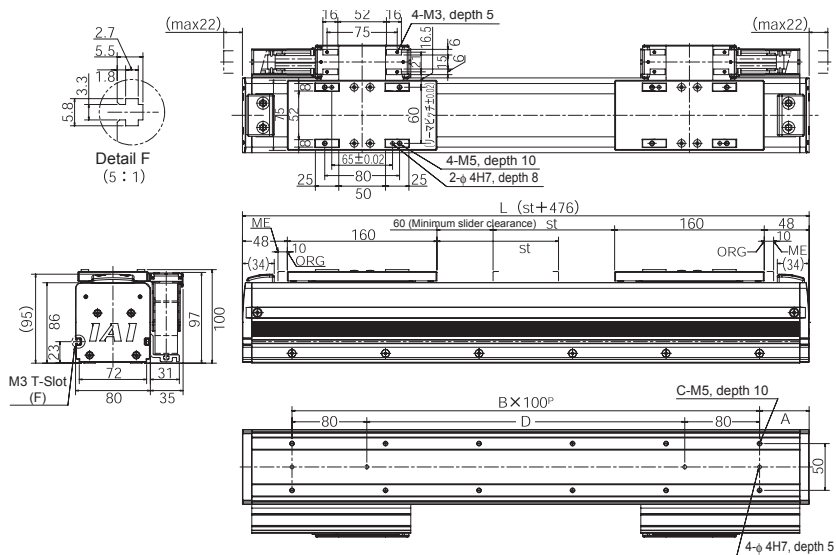
14.3.1 Small Type H8SS



Effective Stroke	50	150	250	350	450	550	650	750	850
L	306	406	506	606	706	806	906	1006	1106
A	53	53	53	53	53	53	53	53	53
B	2	3	4	5	6	7	8	9	10
C	6	8	10	12	14	16	18	20	22
D	40	140	240	340	440	540	640	740	8840
E	130	180	230	280	330	380	430	480	530
Mass (kg)	5.0	6.2	7.4	8.6	9.8	11.0	12.2	13.4	14.6

Effective Stroke	950	1050	1150	1250	1350	1450	1550	1650
L	1206	1306	1406	1506	1606	1706	1803	1906
A	53	53	53	53	53	53	53	53
B	11	12	13	14	15	16	17	18
C	24	26	28	30	32	34	36	38
D	940	1040	1140	1240	1340	1440	1540	1640
E	580	630	680	730	780	830	880	930
Mass (kg)	15.8	17.0	18.2	19.4	20.6	21.8	23.0	24.2

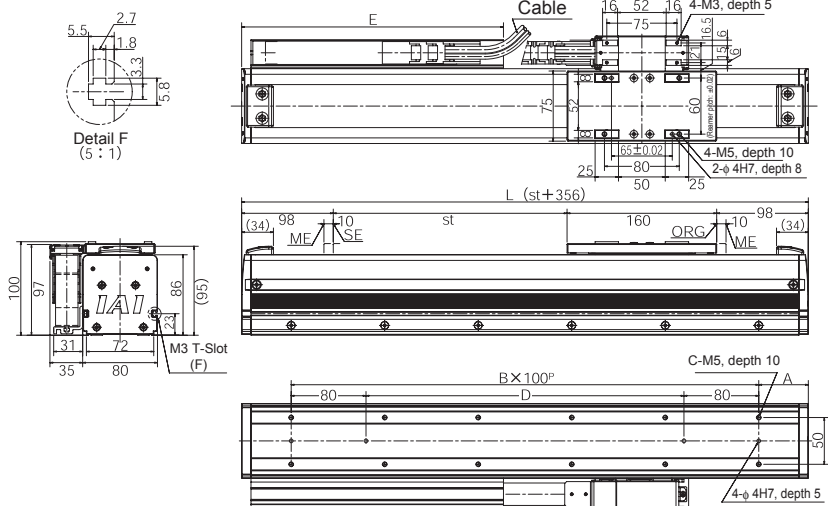
14.3.2 Small Type H8SM



Effective Stroke	130	230	330	430	530	630	730	830	930
L	606	706	806	906	1006	1106	1206	1306	1406
A	53	53	53	53	53	53	53	53	53
B	5	6	7	8	9	10	11	12	13
C	12	14	16	18	20	22	24	26	28
D	340	440	540	640	740	840	940	1040	1140
E	180	230	280	330	380	430	480	530	580
Mass (kg)	10.7	11.9	13.1	14.3	15.5	16.7	17.9	19.1	20.3

Effective Stroke	1030	1130	1230	1330	1430
L	1506	1606	1706	1806	1906
A	53	53	53	53	53
B	14	15	16	17	18
C	30	32	34	36	38
D	1240	1340	1440	1540	1640
E	630	680	730	780	830
Mass (kg)	21.5	22.7	23.9	25.1	26.3

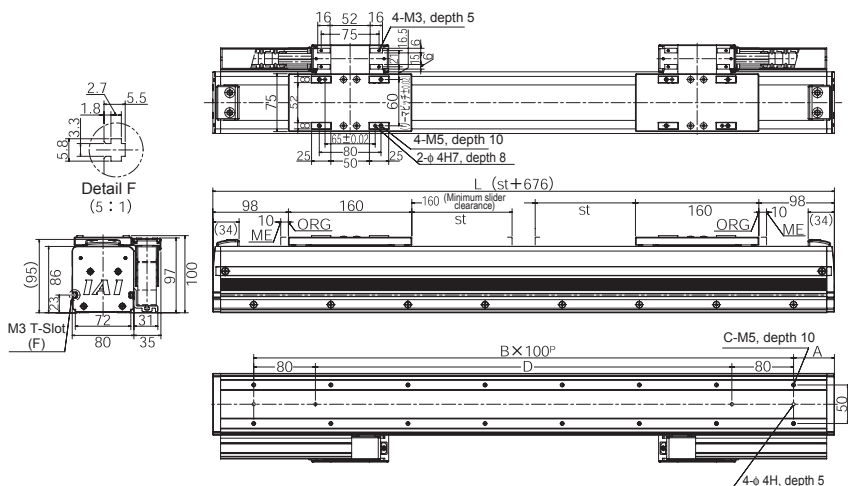
14.3.3 Small Type H8HS



Effective Stroke	60	120	180	240	300	360	420	480	540	600	660	720	780	840
L	398	458	518	578	638	698	758	818	878	938	998	1058	1118	1178
A	1	1	2	2	2	2	3	3	3	4	4	4	5	5
B	92	152	12	72	132	192	52	112	172	32	92	152	12	72
C	8	8	12	12	12	12	16	16	16	20	20	20	24	24
D	192	252	312	372	432	492	552	612	672	732	792	852	912	972
E	193	218	243	268	293	318	343	393	418	443	468	493	543	568
Mass (kg)	5.0	5.4	5.7	6.1	6.4	6.8	7.1	7.5	7.9	8.2	8.6	8.9	9.3	9.6

Effective Stroke	900	960	1020	1080	1140	1200	1260	1320	1380	1440	1500	1560	1620
L	1238	1298	1358	1418	1478	1538	1598	1658	1718	1778	1838	1898	1958
A	5	5	6	6	6	7	7	7	8	8	8	8	9
B	132	192	52	112	172	32	92	152	12	72	132	192	52
C	24	24	28	28	28	32	32	32	36	36	36	36	40
D	1032	1092	1152	1212	1272	1332	1392	1452	1512	1572	1632	1692	1752
E	593	618	643	693	718	743	768	793	843	868	893	918	943
Mass (kg)	10.0	10.4	10.7	11.1	11.4	11.8	12.1	12.5	12.9	13.2	13.6	13.9	14.3

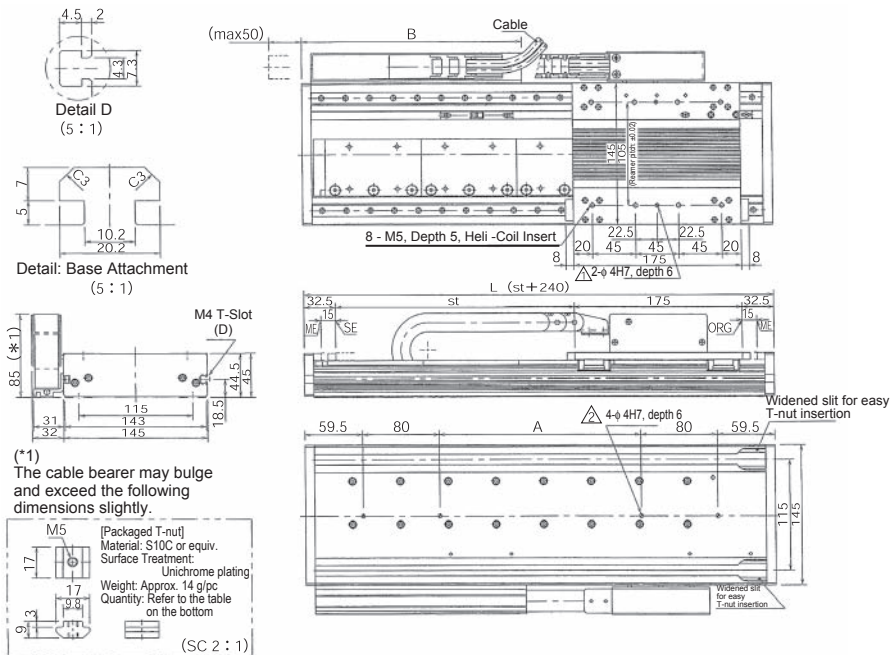
14.3.4 Small Type H8HM



Effective Stroke	130	230	330	430	530	630	730	830	930
L	806	906	1006	1106	1206	1306	1406	1506	1606
A	53	53	53	53	53	53	53	53	53
B	7	8	9	10	11	12	13	14	15
C	16	18	20	22	24	26	28	30	32
D	540	640	740	840	940	1040	1140	1240	1340
E	180	230	280	330	380	430	480	530	580
Mass (kg)	13.8	15.0	16.2	17.4	18.6	19.8	21.0	22.2	23.4

Effective Stroke	1030	1130	1230
L	1706	1806	1906
A	53	53	53
B	16	17	18
C	34	36	38
D	1440	1540	1640
E	630	680	730
Mass (kg)	24.6	25.8	27.0

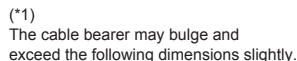
14.3.5 Flat Type L15SS



Effective Stroke	150	250	350	450	550	650	750	850
L	390	490	590	690	790	890	990	1090
A	111	211	311	411	511	611	711	811
B	179.5	229.5	279.5	329.5	379.5	429.5	479.5	529.5
C	8	10	12	14	16	18	20	22
Mass (kg)	6.5	7.9	9.3	10.6	12.0	13.4	14.8	16.2

Effective Stroke	950	1050	1150	1250	1350	1450	1550	1650
L	1190	1290	1390	1490	1590	1690	1790	1890
A	911	1011	1111	1211	1311	1411	1511	1611
B	579.5	629.5	679.5	729.5	779.5	829.5	879.5	929.5
C	24	26	28	30	32	34	36	38
Mass (kg)	17.5	18.9	20.3	21.7	23.1	24.4	25.8	27.2

14.3.6 Flat Type L15SM



Effective Stroke	50	150	250	350	450	550	650	750	850
L	490	590	690	790	890	990	1090	1190	1290
A	211	311	411	511	611	711	811	911	1011
B	179.5	229.5	279.5	329.5	329.5	429.5	479.5	529.5	579.5
C	10	12	14	16	16	20	22	24	26
Mass (kg)	10.0	11.4	12.8	14.2	14.2	17.0	18.4	19.8	21.2

Effective Stroke	950	1050	1150	1250	1350	1450
L	1390	1490	1590	1690	1790	1890
A	1111	1211	1311	1411	1511	1611
B	629.5	679.5	729.5	779.5	829.5	879.5
C	28	30	32	34	36	38
Mass (kg)	22.6	24.0	25.4	26.8	28.3	29.7



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