

# Linear Servo Actuator

## LSA Series

### Large Type

## Operating Manual

Third Edition

Large Types	LSA-W21SS, LSA-W21SM LSA-W21HS, LSA-W21HM
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***IAI America, Inc.***









INTELLIGENT ACTUATOR

# CAUTION

## Precaution on Installation of Linear Servo Actuator

The linear servo actuator shall be installed according to the following table as a general rule. Please exercise care at installation (except for specially ordered products).

O: Can be installed

X: Cannot be installed

Model number	Horizontal installation of flat surface	Vertical installation	Installation on side	Ceiling mount
S6	O	X	O	X
S8	O	X	O	X
S10	O	X	O	X
H8	O	X	O	X
L15	O	X	X	X
N10	O	X	X	X
N15	O	X	X	X
N19	O	X	X	X
W21	O	X	X	X





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## Safety Guide

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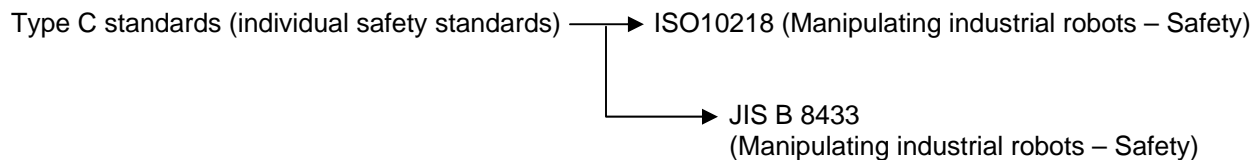
When designing and manufacturing a robot system, ensure safety by following the safety guides provided below and taking the necessary measures.

### Regulations and Standards Governing Industrial Robots

Safety measures on mechanical devices are generally classified into four categories under the International Industrial Standard ISO/DIS 12100, "Safety of machinery," as follows:

- Safety measures
  - Inherent safety design
  - Protective guards --- Safety fence, etc.
  - Additional safety measures --- Emergency stop device, etc.
  - Information on use --- Danger sign, warnings, operation manual

Based on this classification, various standards are established in a hierarchical manner under the International Standards ISO/IEC. The safety standards that apply to industrial robots are as follows:



Also, Japanese laws regulate the safety of industrial robots, as follows:

Industrial Safety and Health Law Article 59

Workers engaged in dangerous or harmful operations must receive special education.

Ordinance on Industrial Safety and Health

Article 36 --- Operations requiring special education

- No. 31 (Teaching, etc.) --- Teaching and other similar work involving industrial robots (exceptions apply)
- No. 32 (Inspection, etc.) --- Inspection, repair, adjustment and similar work involving industrial robots (exceptions apply)

Article 150 --- Measures to be taken by the user of an industrial robot





## Requirements for Industrial Robots under Ordinance on Industrial Safety and Health

Work area	Work condition	Cutoff of drive source	Measure	Article
Outside movement range	During automatic operation	Not cut off	Signs for starting operation	Article 104
			Installation of railings, enclosures, etc.	Article 150-4
Inside movement range	During teaching, etc.	Cut off (including stopping of operation)	Sign, etc., indicating that work is in progress	Article 150-3
		Not cut off	Preparation of work rules	Article 150-3
			Measures to enable immediate stopping of operation	Article 150-3
			Sign, etc., indicating that work is in progress	Article 150-3
			Provision of special education	Article 36-31
			Checkup, etc., before commencement of work	Article 151
	During inspection, etc.	Cut off	To be performed after stopping the operation	Article 150-5
			Sign, etc., indicating that work is in progress	Article 150-5
		Not cut off (when inspection, etc., must be performed during operation)	Preparation of work rules	Article 150-5
			Measures to enable immediate stopping of operation	Article 150-5
			Sign, etc., indicating that work is in progress	Article 150-5
			Provision of special education (excluding cleaning and lubrication)	Article 36-32





## Applicable Models of IAI's Industrial Robots

Machines meeting the following conditions are not classified as industrial robots according to Notice of Ministry of Labor No. 51 and Notice of Ministry of Labor/Labor Standards Office Director (Ki-Hatsu No. 340):

- (1) Single-axis robot with a motor wattage of 80 W or less
- (2) Combined multi-axis robot whose X, Y and Z-axes are 300 mm or shorter and whose rotating part, if any, has the maximum movement range of within 300 mm<sup>3</sup> including the end of the rotating part
- (3) Multi-joint robot whose movable radius and Z-axis are within 300 mm

Among the products featured in our catalogs, the following models are classified as industrial robots:

1. Single-axis ROBO Cylinders  
RCS2/RCS2CR-SS8□ and RCS3/RCS3CR/RCS3P/RCS3PCR whose stroke exceeds 300 mm
2. Single-axis robots  
The following models whose stroke exceeds 300 mm and whose motor capacity also exceeds 80 W:  
ISA/ISPA, ISDA/ISPDA, ISWA/ISPWA, IF, FS, NS
3. Linear servo actuators  
All models whose stroke exceeds 300 mm
4. Cartesian robots  
Any robot that uses at least one axis corresponding to one of the models specified in 1 to 3
5. IX SCARA robots  
All models whose arm length exceeds 300 mm  
(All models excluding IX-NNN1205/1505/1805/2515, NNW2515 and NNC1205/1505/1805/2515)





## Notes on Safety of Our Products

Common items you should note when performing each task on any IAI robot are explained below.

No.	Task	Note
1	Model selection	<ul style="list-style-type: none"><li>● This product is not planned or designed for uses requiring high degrees of safety. Accordingly, it cannot be used to sustain or support life and must not be used in the following applications:<ul style="list-style-type: none"><li>[1] Medical devices relating to maintenance, management, etc., of life or health</li><li>[2] Mechanisms or mechanical devices (vehicles, railway facilities, aircraft facilities, etc.) intended to move or transport people</li><li>[3] Important safety parts in mechanical devices (safety devices, etc.)</li></ul></li><li>● Do not use this product in the following environments:<ul style="list-style-type: none"><li>[1] Place subject to flammable gases, ignitable objects, flammables, explosives, etc.</li><li>[2] Place that may be exposed to radiation</li><li>[3] Place where the ambient temperature or relative humidity exceeds the specified range</li><li>[4] Place subject to direct sunlight or radiated heat from large heat sources</li><li>[5] Place subject to sudden temperature shift and condensation</li><li>[6] Place subject to corrosive gases (sulfuric acid, hydrochloric acid, etc.)</li><li>[7] Place subject to excessive dust, salt or iron powder</li><li>[8] Place where the product receives direct vibration or impact</li></ul></li><li>● Do not use this product outside the specified ranges. Doing so may significantly shorten the life of the product or result in product failure or facility stoppage.</li></ul>
2	Transportation	<ul style="list-style-type: none"><li>● When transporting the product, exercise due caution not to bump or drop the product.</li><li>● Use appropriate means for transportation.</li><li>● Do not step on the package.</li><li>● Do not place on the package any heavy article that may deform the package.</li><li>● When using a crane with a capacity of 1 ton or more, the crane must be operated by personnel qualified to operate cranes and perform slinging operations.</li><li>● When using a crane or other equipment, never use it to hoist any article exceeding the rated load of the applicable crane, etc.</li><li>● Use hoisting accessories suitable for the article to be hoisted. Select appropriate hoisting accessories by making sure there is an ample allowance for safety in their cutting load, etc.</li><li>● Do not climb onto the article being hoisted.</li><li>● Do not keep the article hoisted.</li><li>● Do not stand under the hoisted article.</li></ul>
3	Storage/preservation	<ul style="list-style-type: none"><li>● The storage/preservation environment should conform to the installation environment. Among others, be careful not to cause condensation.</li></ul>
4	Installation/startup	<p>(1) Installing the robot, controller, etc.</p> <ul style="list-style-type: none"><li>● Be sure to firmly secure and affix the product (including its work part). If the product tips over, drops, malfunctions, etc., damage or injury may result.</li><li>● Do not step on the product or place any article on top. The product may tip over or the article may drop, resulting in injury, product damage, loss of/drop in product performance, shorter life, etc.</li><li>● If the product is used in any of the following places, provide sufficient shielding measures:<ul style="list-style-type: none"><li>[1] Place subject to electrical noise</li><li>[2] Place subject to a strong electric or magnetic field</li><li>[3] Place where power lines or drive lines are wired nearby</li><li>[4] Place subject to splashed water, oil or chemicals</li></ul></li></ul>





No.	Task	Note
4	Installation/ startup	<p>(2) Wiring the cables</p> <ul style="list-style-type: none"><li>● Use IAI's genuine cables to connect the actuator and controller or connect a teaching tool, etc.</li><li>● Do not damage, forcibly bend, pull, loop round an object or pinch the cables or place heavy articles on top. Current leak or poor electrical continuity may occur, resulting in fire, electric shock or malfunction.</li><li>● Wire the product correctly after turning off the power.</li><li>● When wiring a DC power supply (+24 V), pay attention to the positive and negative polarities. Connecting the wires in wrong polarities may result in fire, product failure or malfunction.</li><li>● Securely connect the cables and connectors so that they will not be disconnected or come loose. Failing to do so may result in fire, electric shock or product malfunction.</li><li>● Do not cut and reconnect the cables of the product to extend or shorten the cables. Doing so may result in fire or product malfunction.</li></ul>
		<p>(3) Grounding</p> <ul style="list-style-type: none"><li>● Be sure to provide class D (former class 3) grounding for the controller. Grounding is required to prevent electric shock and electrostatic charges, improve noise resistance and suppress unnecessary electromagnetic radiation.</li></ul>
		<p>(4) Safety measures</p> <ul style="list-style-type: none"><li>● Implement safety measures (such as installing safety fences, etc.) to prevent entry into the movement range of the robot when the product is moving or can be moved. Contacting the moving robot may result in death or serious injury.</li><li>● Be sure to provide an emergency stop circuit so that the product can be stopped immediately in case of emergency during operation.</li><li>● Implement safety measures so that the product cannot be started only by turning on the power. If the product starts suddenly, injury or product damage may result.</li><li>● Implement safety measures so that the product will not start upon cancellation of an emergency stop or recovery of power following a power outage. Failure to do so may result in injury, equipment damage, etc.</li><li>● Put up a sign saying "WORK IN PROGRESS. DO NOT TURN ON POWER," etc., during installation, adjustment, etc. If the power is accidentally turned on, electric shock or injury may result.</li><li>● Implement measures to prevent the work part, etc., from dropping due to a power outage or emergency stop.</li><li>● Ensure safety by wearing protective gloves, protective goggles and/or safety shoes, as necessary.</li><li>● Do not insert fingers and objects into openings in the product. Doing so may result in injury, electric shock, product damage, fire, etc.</li><li>● When releasing the brake of a vertically installed actuator, be careful not to pinch your hand or damage the work part, etc., due to the slider dropping by its dead weight.</li></ul>
5	Teaching	<ul style="list-style-type: none"><li>● Whenever possible, perform teaching from outside the safety fences. If teaching must be performed inside the safety fences, prepare "work rules" and make sure the operator understands the procedures thoroughly.</li><li>● When working inside the safety fences, the operator should carry a handy emergency stop switch so that the operation can be stopped any time when an abnormality occurs.</li><li>● When working inside the safety fences, appoint a safety watcher in addition to the operator so that the operation can be stopped any time when an abnormality occurs. The safety watcher must also make sure the switches are not operated inadvertently by a third party.</li></ul>









No.	Task	Note
5	Teaching	<ul style="list-style-type: none"><li>● Put up a sign saying "WORK IN PROGRESS" in a conspicuous location.</li><li>● When releasing the brake of a vertically installed actuator, be careful not to pinch your hand or damage the work part, etc., due to the slider dropping by its dead weight.</li></ul> <p>* Safety fences --- Indicate the movement range if safety fences are not provided.</p>
6	Confirmation operation	<ul style="list-style-type: none"><li>● After teaching or programming, carry out step-by-step confirmation operation before switching to automatic operation.</li><li>● When carrying out confirmation operation inside the safety fences, follow the specified work procedure just like during teaching.</li><li>● When confirming the program operation, use the safety speed. Failure to do so may result in an unexpected movement due to programming errors, etc., causing injury.</li><li>● Do not touch the terminal blocks and various setting switches while the power is supplied. Touching these parts may result in electric shock or malfunction.</li></ul>
7	Automatic operation	<ul style="list-style-type: none"><li>● Before commencing automatic operation, make sure no one is inside the safety fences.</li><li>● Before commencing automatic operation, make sure all related peripherals are ready to operate in the auto mode and no abnormalities are displayed or indicated.</li><li>● Be sure to start automatic operation from outside the safety fences.</li><li>● If the product generated abnormal heat, smoke, odor or noise, stop the product immediately and turn off the power switch. Failure to do so may result in fire or product damage.</li><li>● If a power outage occurred, turn off the power switch. Otherwise, the product may move suddenly when the power is restored, resulting in injury or product damage.</li></ul>
8	Maintenance/inspection	<ul style="list-style-type: none"><li>● Whenever possible, work from outside the safety fences. If work must be performed inside the safety fences, prepare "work rules" and make sure the operator understands the procedures thoroughly.</li><li>● When working inside the safety fences, turn off the power switch, as a rule.</li><li>● When working inside the safety fences, the operator should carry a handy emergency stop switch so that the operation can be stopped any time when an abnormality occurs.</li><li>● When working inside the safety fences, appoint a safety watcher in addition to the operator so that the operation can be stopped any time when an abnormality occurs. The safety watcher must also make sure the switches are not operated inadvertently by a third party.</li><li>● Put up a sign saying "WORK IN PROGRESS" in a conspicuous location.</li><li>● Use appropriate grease for the guides and ball screws by checking the operation manual for each model.</li><li>● Do not perform a withstand voltage test. Conducting this test may result in product damage.</li><li>● When releasing the brake of a vertically installed actuator, be careful not to pinch your hand or damage the work part, etc., due to the slider dropping by its dead weight.</li></ul> <p>* Safety fences --- Indicate the movement range if safety fences are not provided.</p>
9	Modification	<ul style="list-style-type: none"><li>● The customer must not modify or disassemble/assemble the product or use maintenance parts not specified in the manual without first consulting IAI.</li><li>● Any damage or loss resulting from the above actions will be excluded from the scope of warranty.</li></ul>
10	Disposal	<ul style="list-style-type: none"><li>● When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste.</li><li>● When disposing of the product, do not throw it into fire. The product may explode or generate toxic gases.</li></ul>





## Indication of Cautionary Information

The operation manual for each model denotes safety guides under “Danger,” “Warning,” “Caution” and “Note,” as specified below.

Level	Degree of danger/loss	Symbol
Danger	Failure to observe the instruction will result in an imminent danger leading to death or serious injury.	 Danger
Warning	Failure to observe the instruction may result in death or serious injury.	 Warning
Caution	Failure to observe the instruction may result in injury or property damage.	 Caution
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.	 Note







## 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 Handling

- 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 precision 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
- 2500 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.

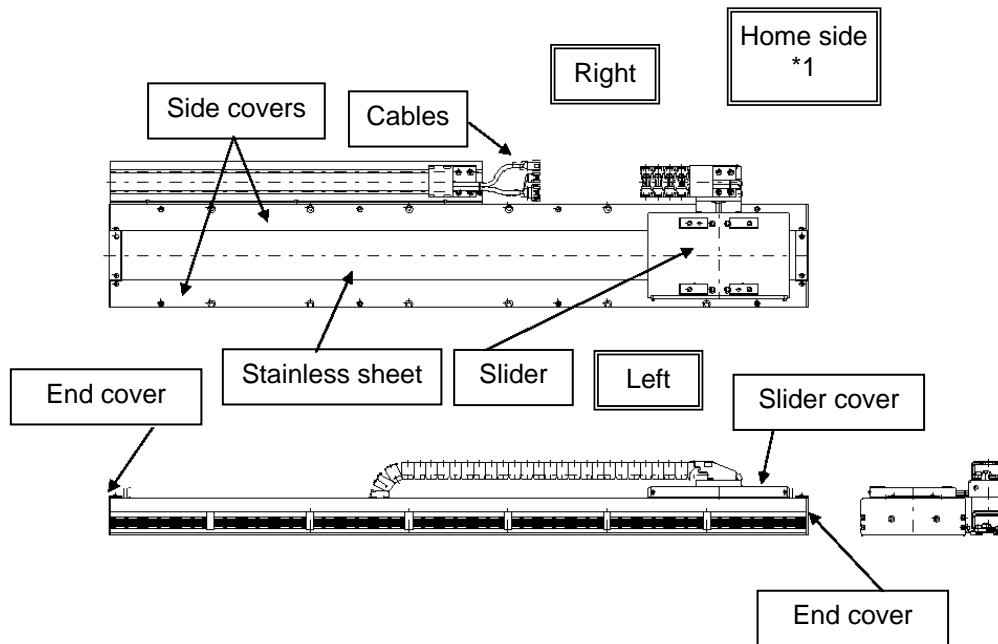




## 4. Name of Each Part

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.



\*1 In the above figure, the cables are facing top, 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 track 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.

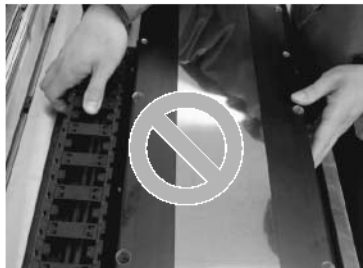
#### ● Taboos in transportation



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 track.



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. Installation, Storage/Preservation 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 ~ 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.
- Impact and vibration must not be transmitted.
- 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/Preservation Environment**

The storage/preservation environment should be similar to the operating environment. In addition, you must take pre-cautions 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/preservation interval but only up to 50°C if the storage/preservation period is longer than one month.





## 7. Installation

### Notes on Installation

#### [Stainless sheet]

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.

When installing the stainless sheet, pay attention to the following points. Also, be careful not to let a tool or work part drop onto the actuator to dent the exterior of the actuator.

Do not press the sheet directly with hands.



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.

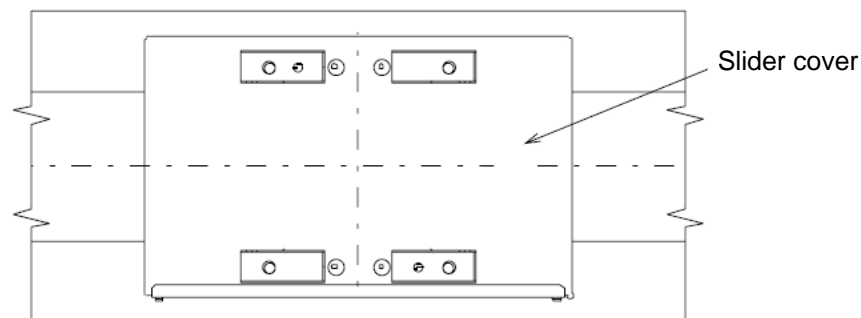
If the actuator is operated with the stainless sheet carrying foreign particles, the particles may enter the slider and damage the sheet or cause the sheet to deform, lift or present other problems.

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.

Do not press the sheet directly with hands.

#### [Slider cover]

Do not apply force on the slider cover. It may cause interference and other damages.







## 7.1 Installing the Actuator

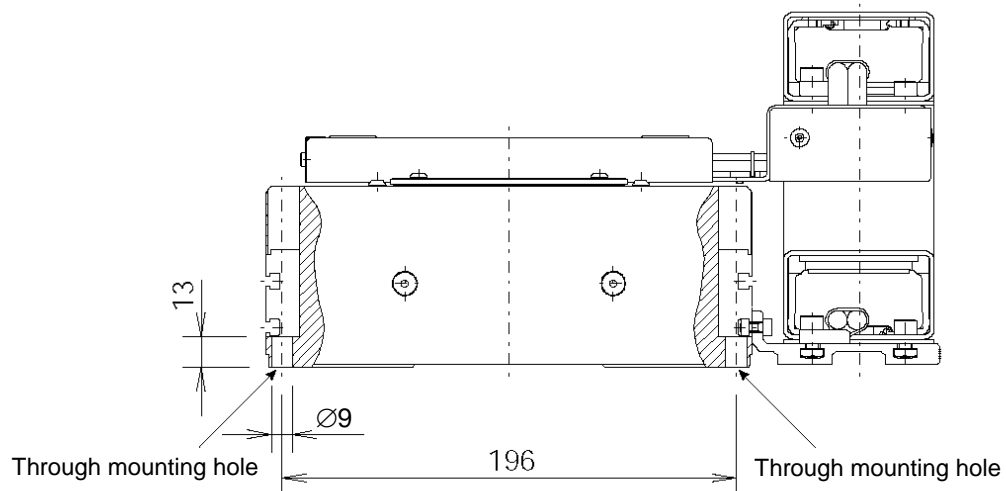
Install the actuator on a machined surface or other flat surface of equivalent precision.

This linear actuator can be affixed on its top or bottom side.

Reamed holes for accepting positioning pins are provided at the back of the base.

### 7.1.1 Affixing the Actuator on the Top Side of the Base

- The actuator base has through mounting holes. Use these holes to install the actuator. When installing the actuator, use M8 bolts of strength category 10.9 or above, together with the supplied dedicated washers. Reamed holes for accepting positioning pins are also provided at the back of the base.



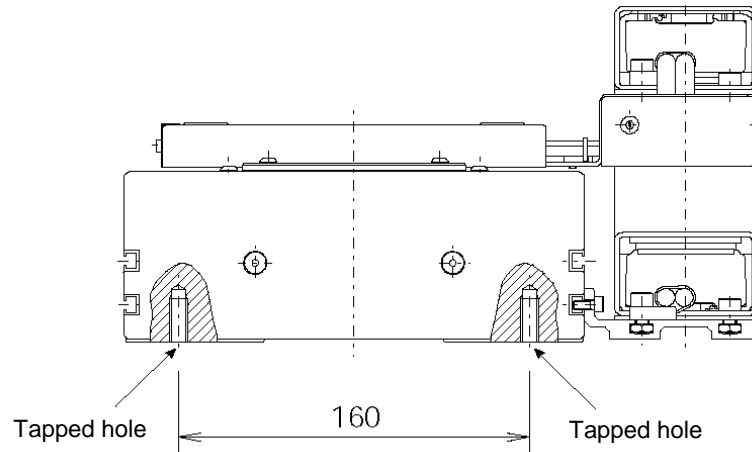
Applicable bolt	Remarks
M8	Use a dedicated washer.






### 7.1.2 Affixing the Actuator on the Bottom Side of the Base

- Tapped mounting holes are provided at the back of the actuator base. Use these tapped holes to install the actuator.



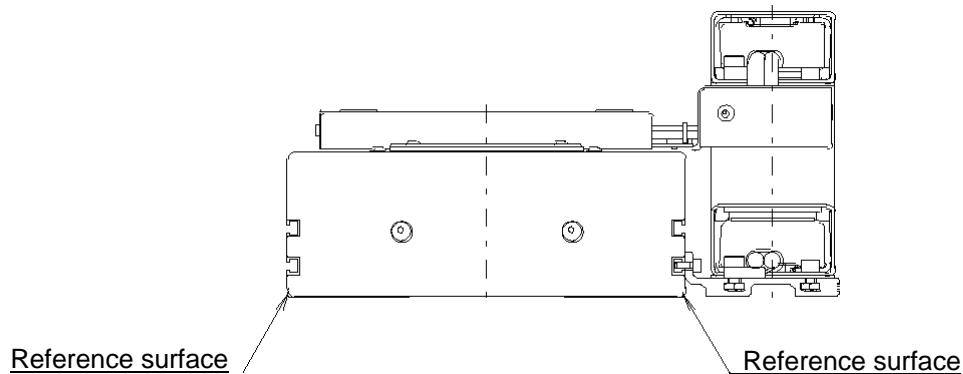
Tap diameter	Effective tap length
M8	20 mm

 **Caution:** Tapped holes are not through, so pay attention to the bolt length when selecting bolts. Use of bolts of inappropriate length may damage the tapped holes or reduce the mounting strength of the actuator, consequently leading to lower precision or unexpected accident.



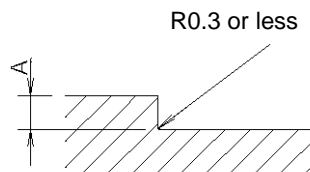
## 7.2 Installation Surface

- 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 precision. The flatness of the installation surface must be  $\pm 0.05$  mm/m 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 precision, install the actuator using these reference surfaces.



As shown above, each side surface of the base provides a reference surface used for alignment of slider travel. If you require higher traveling precision, 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 (mm)
2 ~ 3.5





### 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.

Screw nominal diameter	Tightening torque	
	Steel bolt bearing surface	Aluminum bolt bearing surface
M8	31.3 N·m (3.19 kgf·m)	14 N·m (1.43 kgf·m)

### 7.4 Installing a Connector Box Using T-slots

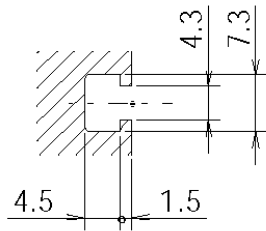
T-slots (M4) are provided on the side faces of the actuator for installation of a connector box or other external equipment.

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.

The T-slot dimensions are specified below.


- Use of square nuts is recommended in T-slots, but hex nuts can also be used.
- When installing an object using T-slots, select bolts of an appropriate length so that the end of the bolt will not contact the bottom of the T-slot.

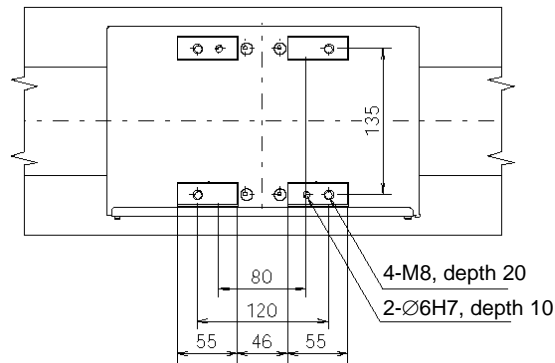




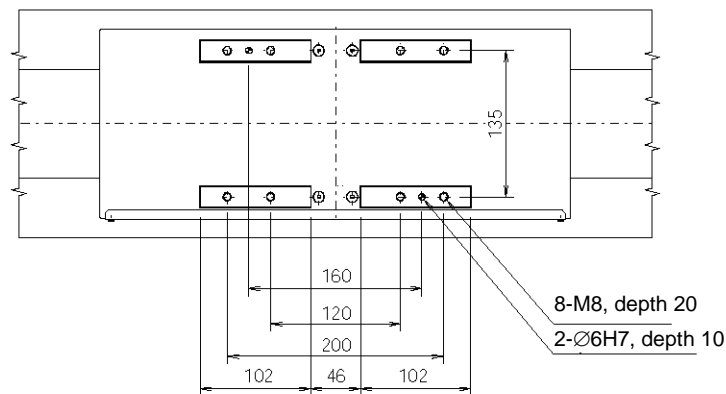
## 7.5 Installing a Load on the Slider

- 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.
- Keep the screw-in depth to 20 mm or less.
- Do not screw in the bolts to a length exceeding the above value, as it will damage the side cover or other part of the actuator.

 **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.



Installation dimensions for LSA-W21SS/LSA-W21SM slider



Installation dimensions for LSA-W21HS/LSA-W21HM slider



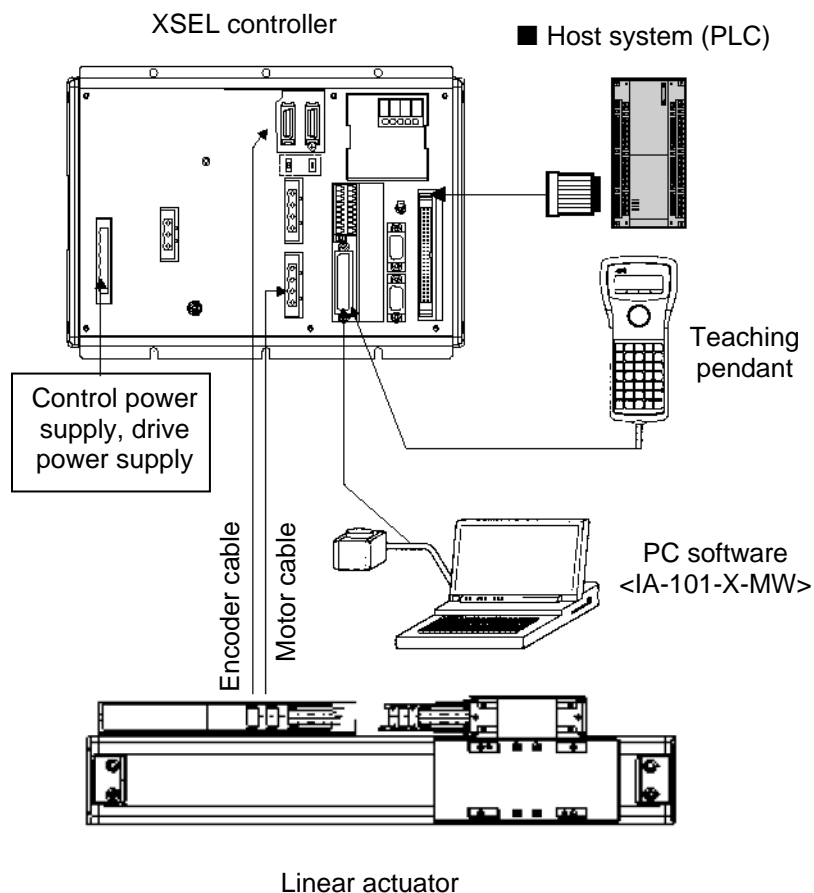
## 8. Wiring of the Cables

Unless otherwise specified, the actuator of single-axis configuration is shipped with a 3 or 5-meter single-axis cable preassembled with the actuator. Plug the connector at the end of the cable into the controller directly.

- The single-axis cable has excellent flexibility, but it is not a robot cable. Therefore, avoid storing this cable in a movable wiring duct having a small bending radius.
- In applications where the single-axis cable cannot be affixed, prevent the cable from deflecting except by the dead weight, or use a self-standing cable hose or wire the cable with a large bending radius to reduce the load received by the cable.
- 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.

If you wish to change the cable, please consult IAI.

- 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.

- Allowable load moment

Unit: N·m (kgf·m)

	Ma	Mb	Mc
LSA-W21SS, LSA-W21SM	128.7 (13.1)	128.7 (13.1)	128.7 (13.1)
LSA-W21HS, LSA-W21HM	275.2 (28.1)	275.2 (28.1)	275.2 (28.1)

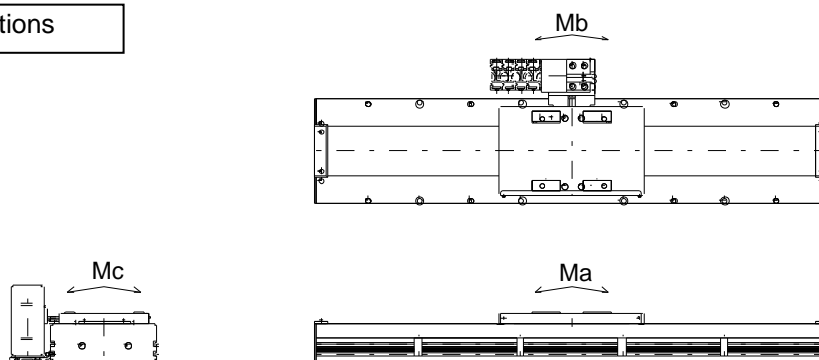
- Allowable overhang length

Unit: mm

	Ma	Mb	Mc
LSA-W21SS, LSA-W21SM	500 mm or less	500 mm or less	500 mm or less
LSA-W21HS, LSA-W21HM	750 mm or less	750 mm or less	750 mm or less

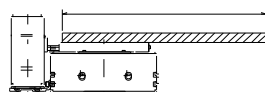
\* The above overhang length assumes that the center of gravity of the load is located at a point corresponding to one-half the overhang length.

Moment directions

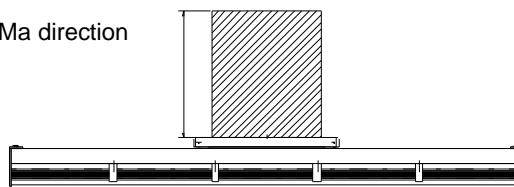


Allowable overhang directions

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 actuator is shipped with its motor revolutions after the actuator detects a home sensor signal until a Z-phase signal is output pre-adjusted.

The table below lists the standard reversing distance for each model, where the reversing distance indicates the distance moved by the slider after it detects a home sensor signal and reverses, until it stops at the home position.

Model	Reversing distance
LSA-W21SS, LSA-W21SM	Approx. 7 mm
LSA-W21HS, LSA-W21HM	

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 stroke 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.



**Warning:** The encoder not only detects position and home signals, but it also plays an important role in the switching of AC-servo power phases. Since the AC-servo power phases have been adjusted precisely, never touch the encoder to change the home.





### 9.3 Stainless Sheet

The stainless sheet is held in position by the attraction forces of rubber magnets provided on the side covers. If ambient air contains a lot of magnetic substances such as iron powder, these magnetic substances may be attracted to the rubber magnets and enter the space between the stainless sheet and magnets, thereby causing problems. Therefore, avoid using the actuator in an environment where the actuator will come in contact with a high level of magnetic substances.

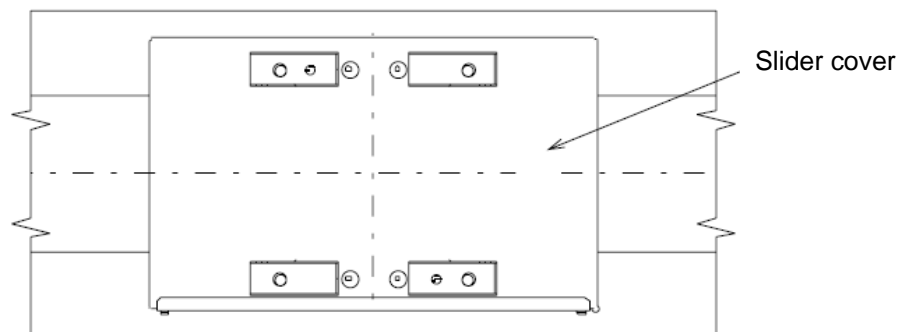
- If viscous substances such as adhesives and paints attach to the stainless sheet, slider malfunction or sheet damage may occur. Prevent viscous substances from contacting the actuator.
- Take note that applying a force only to a specific part of the stainless sheet may cause the affected part to deform 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.
- Be careful not to let a tool or work part drop onto the actuator to dent the exterior of the actuator.

Do not press the sheet directly with hands.



### 9.4 Slider Cover

Do not apply force on the slider cover. It may cause interference and other damages.







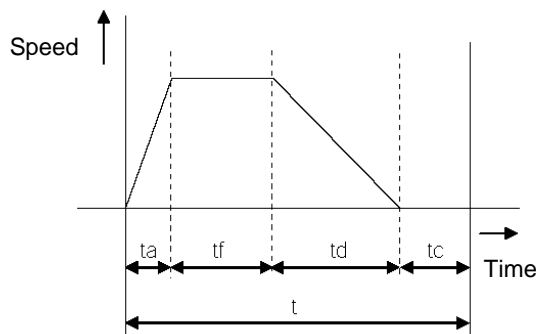
## 10. Selection Conditions

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.

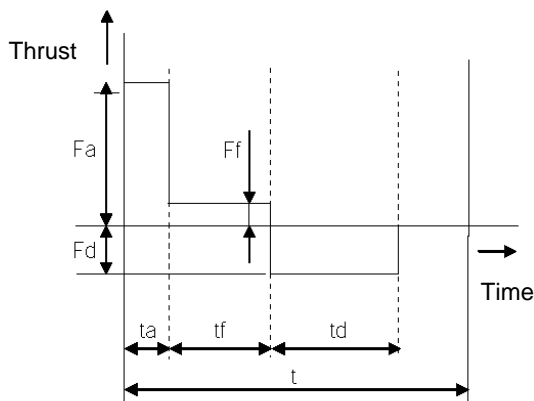
Condition [2] The thrust during continuous operation must not exceed the rated thrust of the large linear servo actuator.

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



t: Operation time per cycle (sec)  
 $t_a$ : Acceleration time (sec)  
 $t_f$ : Moving time at constant speed (sec)  
 $t_d$ : Deceleration time (sec)  
 $t_c$ : Stabilization time

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



$F_a$ : Thrust required for acceleration (N)  
 $F_f$ : Traveling resistance (N)  
 $F_d$ : Thrust required for deceleration (N)





## 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 load (kg)

a: Commanded acceleration ( $\text{m/s}^2$ )

$F_f$ : Traveling resistance (N)

[Slider weight]

● LSA-W21SS, LSA-W21SM : 10kg

● LSA-W21HS, LSA-W21HM : 20kg

In the case of a large linear servo actuator, the traveling resistance is determined by the speed and empirically calculated as specified below.

[Traveling resistance of large linear servo actuator]

$$F_f = 20 V + 70 \quad V: \text{Slider speed (m/s)}$$

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

Large linear servo actuator	LSA-W21SS, LSA-W21SM	Maximum thrust → 600 N
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Large linear servo actuator	LSA-W21HS, LSA-W21HM	Maximum thrust → 1200 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:

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

M: Slider weight  
m: Slider load (kg)  
d: Commanded deceleration ( $\text{m/s}^2$ )  
 $F_f$ : Traveling resistance (N: as described earlier)

[Slider weight]

● LSA-W21SS, LSA-W21SM : 10kg

● LSA-W21HS, LSA-W21HM : 20kg

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

Large linear servo actuator	LSA-W21SS, LSA-W21SM	Rated thrust → 200 N
Large linear servo actuator	LSA-W21HS, LSA-W21HM	Rated thrust → 400 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

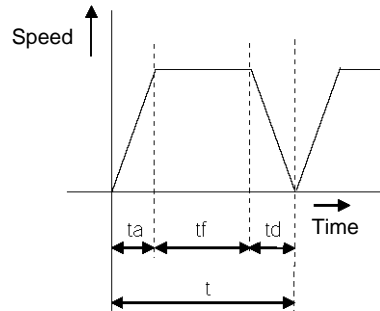
Let's select a motor by following the procedure in "Selection Method."

★ Operating conditions

- Applicable model: Large linear servo actuator LSA-W21SS, LSA-W21SM
- Speed: 2.5 m/s
- Acceleration:  $29.4 \text{ m/s}^2$  (The deceleration is assumed to be the same.)
- Travel: 2.5 m
- Slider load: 10 kg
- The actuator moves back and forth over a stroke of 2.5 m.

$$*1G = 9.8 \text{ m/s}^2$$

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 (10 kg for the large linear servo actuator LSA-W21SS/LSA-W21SM)

m: Slider load (kg) : 10 kg in this example

a: Commanded acceleration ( $\text{m/s}^2$ ) :  $29.4 \text{ m/s}^2$  in this example

Ff: Traveling resistance (N) : 120 N in this example

From above,  $F_a$  is calculated as follows:

$$F_a = (20 \times 29.4 + 120) \rightarrow 708 \text{ N}$$

The calculated value exceeds the maximum thrust 600 N of the large linear servo actuator LSA-W21SS/LSA-W21SM.

Let's lower the specified acceleration to  $19.6 \text{ m/s}^2$ .  $F_a$  changes as follows:

$$F_a = (20 \times 19.6 + 120) \rightarrow 512 \text{ N}$$

The calculated value is smaller than the maximum thrust 600 N of the large linear servo actuator LSA-W21SS/LSA-W21SM.





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  $19.6 \text{ m/s}^2$ .

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

Here,

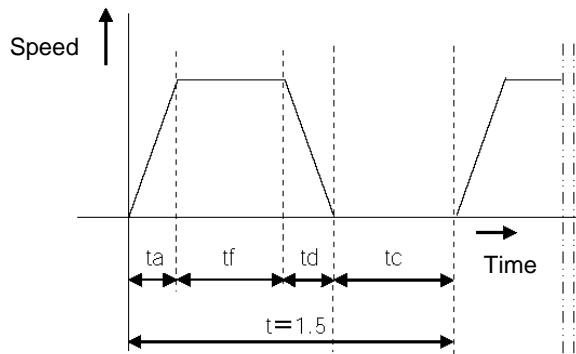
$F_a = 512 \text{ N}$ ,  $F_f = 120 \text{ N}$ ,  $F_d = 272 \text{ N}$ ,  $t_a = t_d = 0.127 \text{ sec}$ ,  $t_f = 0.873 \text{ sec}$ ,  $t = 1.277 \text{ sec}$  (including stabilization time  $t_c$  of  $0.15 \text{ sec}$ )

From the above,  $F_t$  is calculated as  $208.02 \text{ N}$ .

Since this value exceeds the rated thrust  $200 \text{ N}$  of the large linear servo actuator LSA-W21SS/LSA-W21SM, 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  $t = 1.5 \text{ sec}$  (including stabilization time  $t_c$  of  $0.15 \text{ sec}$ ).



This time,  $F_t$  is calculated as  $191.9 \text{ N}$ .

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



## 11. Maintenance and Inspection

### 11.1 Inspection Items and Schedule

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	Greasing
Start-up inspection	○		
After 1 month of operation	○		
After 6 months of operation	○	○	
After 1 year of operation	○	○	○
Every 6 months thereafter	○		
Every 1 year	○	○	○

### 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, vibration	

\* 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.

To replace the sheet, you must either bring in the actuator to IAI or have IAI's service personnel visit your site to perform replacement, as a rule.

### 11.3 Cleaning the Exterior

- 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

With the power supply turned off, turn up the stainless sheet and visually inspect the interior. Check the following items inside the actuator.

Actuator	Loosening of actuator mounting bolts, etc.
Guide	Lubrication condition, soiling

Visually check the interior condition. What you should focus are entry of dust and other foreign matters and the lubrication condition.

Even if grease has turned brown, the actuator is lubricated properly if its traveling surface is glossy. If grease has become dirty due to entry of dust and no longer looks glossy, or if the amount of grease has decreased over a long period of use, clean the respective parts and then add grease.

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 2.5 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.

## 11.5 Cleaning the Interior

- 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, neutral detergent or alcohol.





## 11.6 Greasing the Guide

### 11.6.1 Applicable Grease

Lithium grease is applied to the guide before shipment.  
IAI uses the greases specified below.

LSA-W21SS, LSA-W21SM	AFB-LF Grease (THK)
LSA-W21HS, LSA-W21HM	Albania EP Grease 2 (Showa Shell Sekiyu K.K.)

Other manufacturers are also offering greases equivalent to the above products. Inform your grease supplier of the above products and have them select their product of equivalent properties.  
For example, equivalence of the following products has been confirmed.

Showa Shell Sekiyu K.K.	Albania Grease No. 2
Mobil Sekiyu K.K.	Mobilux 2
Idemitsu Kosan Co., Ltd.	Daphne Eponex Grease No. 2
Kyodo Yushi Co., Ltd.	Multemp SRL

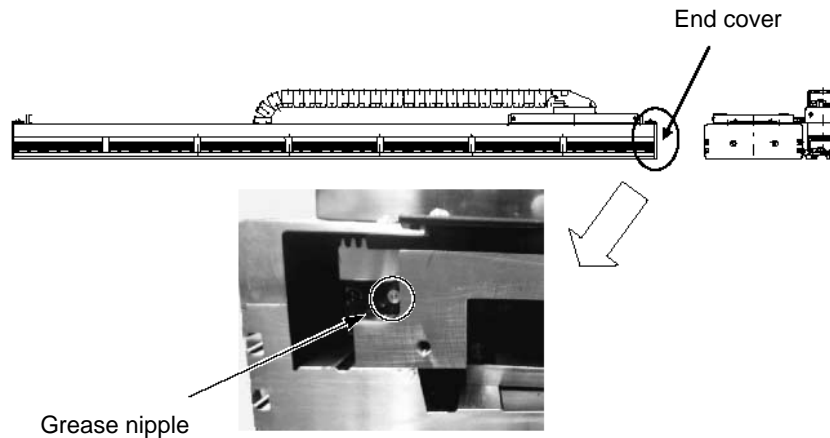




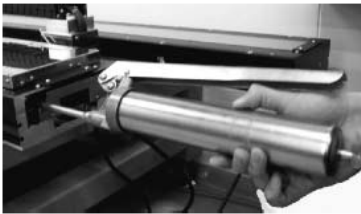
### 11.6.2 How to Add Grease

Before adding grease, turn off the actuator power.

- 1) Remove the end cover to reveal the right and left grease nipples from which to add grease.



- 2) Move the slider by hand until it contacts the mechanical end (on the side where the target grease nipple is located).
- 3) Insert the grease gun into the grease nipple and add grease. Hold the slider with the other hand when adding grease with the grease gun.



Refer to the table below to prepare a grease gun appropriate for the diameter of the grease nipple.

Model number	Nipple diameter
LSA-W21SS, LSA-W21SM	6Ø
LSA-W21HS, LSA-W21HM	4Ø

- 4) Move the slider back and forth several times by hand.
- 5) Move the slider until it contacts the mechanical end on the opposite side.
- 6) Repeat steps 2) to 5) (add grease and move the slide manually between the ends) several times.
- 7) Install the end cover.



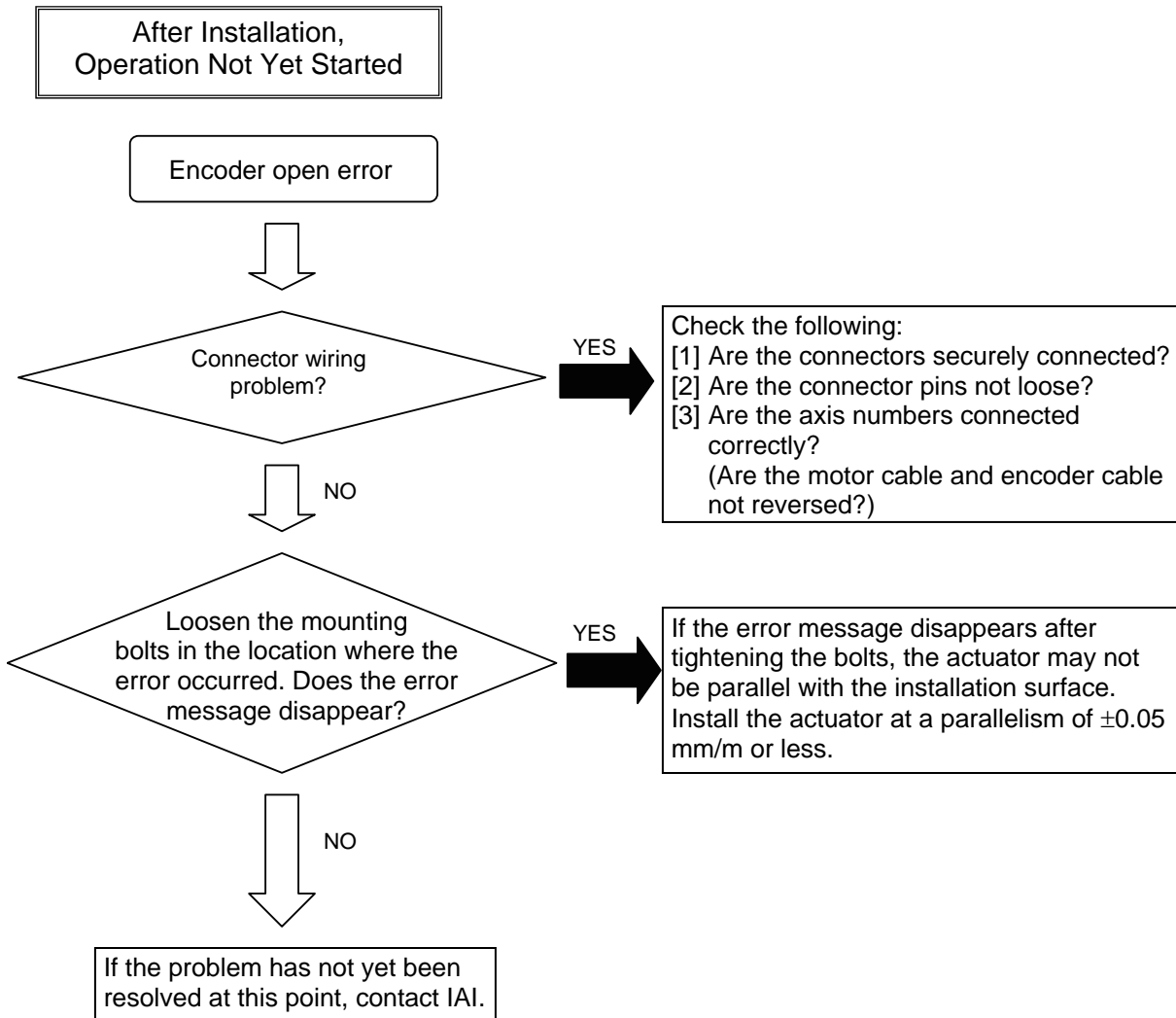
**Warning:** Do not use fluorine grease. If fluorine grease is mixed with lithium grease, the designed lubrication performance of both greases will be lost and the machine may also be damaged.



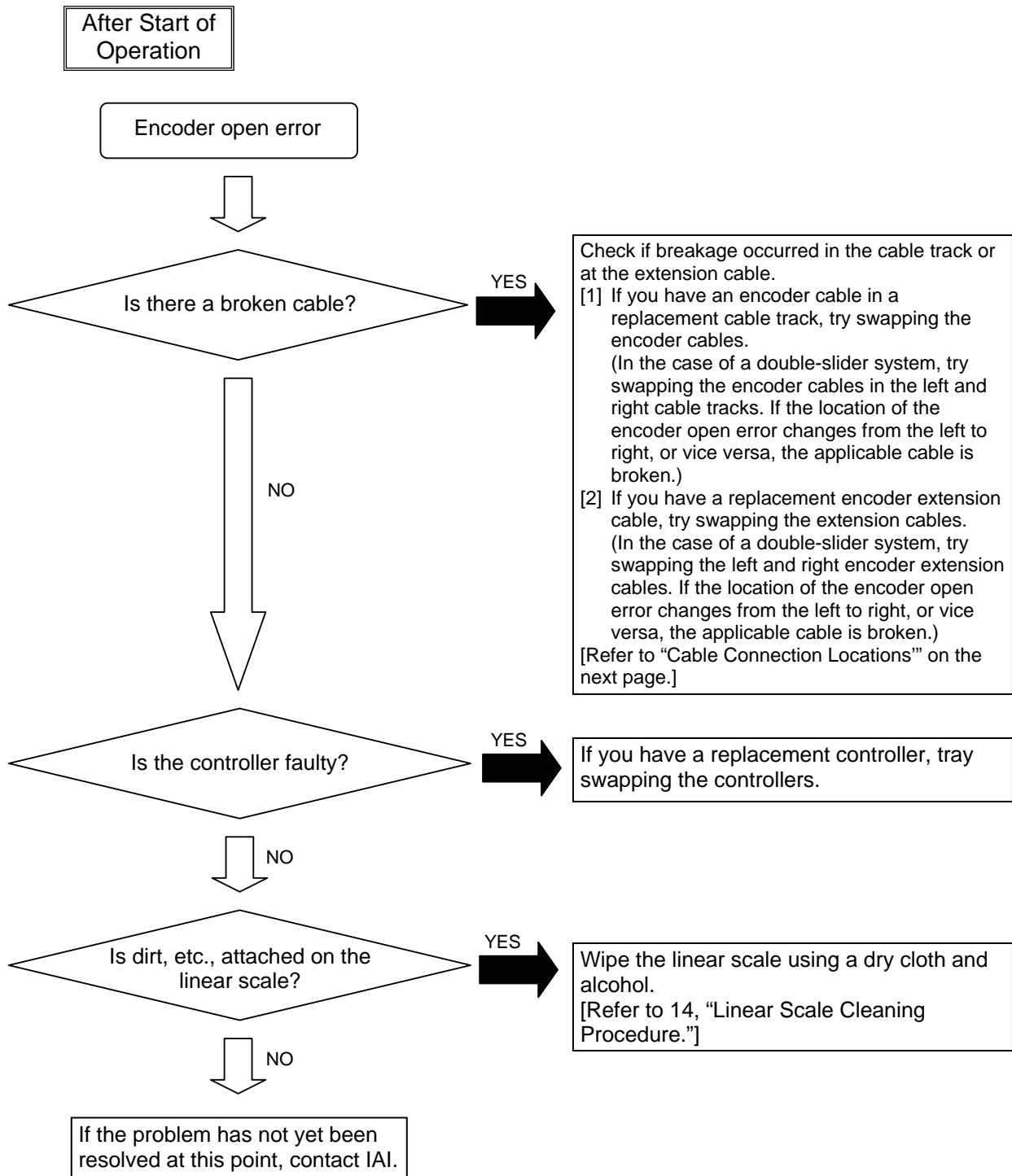
## 12. Troubleshooting

### 12.1 What to Do When You Suspect a Failure

Even when an encoder open error (error code: D12), driver overload error (error code: D0A) or deviation overflow error (error code: C6B) occurs, there may not be a physical breakdown. Before requesting repair of your robot or controller, follow the procedure below to check the location of failure/requiring repair. If the problem persists after the applicable measures have been taken, contact IAI with the detailed condition.





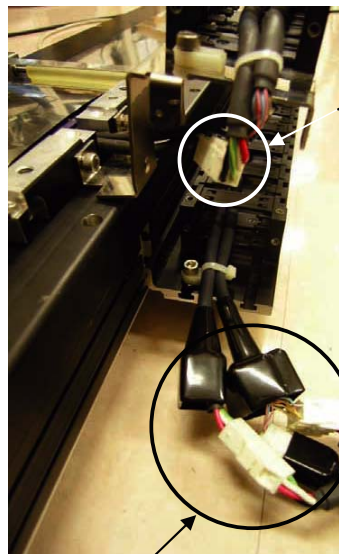
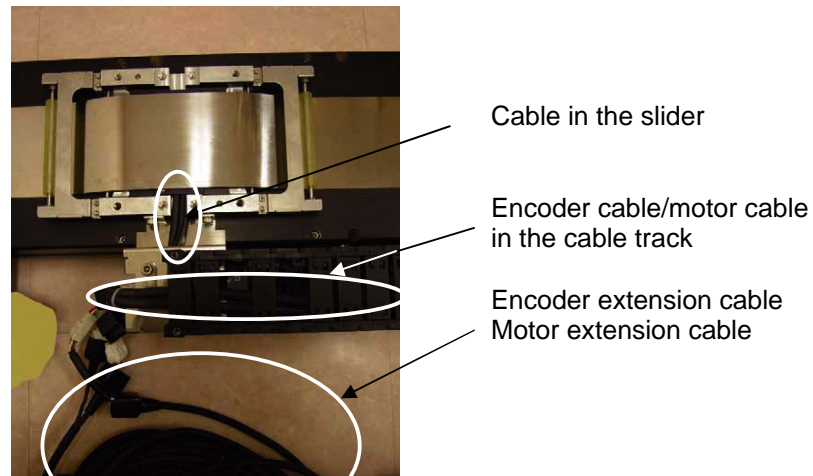




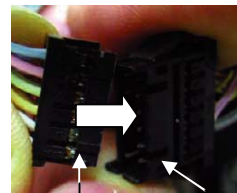


### Cable Connection Locations

The connection locations of cables on the LSA-W21 linear servo actuator are shown below.

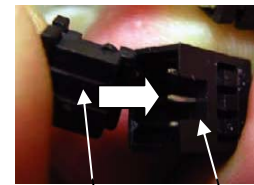


Location where the cable in the slider is connected to the encoder cable/motor cable in the cable track (The cables are connected in the case. Remove the case cover to access the connection location.)



Projection

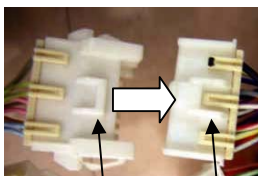
Cutout



Projection

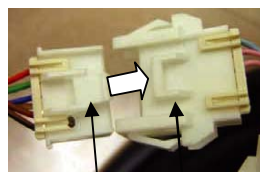
Cutout

Location where the encoder cable/motor cable in the cable track are connected to the encoder extension cable/motor extension cable



Projection

Projection



Projection

Projection

(Note) One side of each connector has a cutout in the case of a male connector, or a projection in the case of a female connector. Insert the male connector into the female connector after confirming the connecting direction.

(Note) One side of each connector has a projection in the case of both a male connector and female connector. Insert the male connector into the female connector after confirming the connecting direction.





## 13. Replacement/Adjustment of Stainless Sheet

### [Required Items]

- Replacement stainless sheet
- Hex wrench set
- Scale
- Adhesive tape

### [Notes]

#### 1. Stainless sheet tension

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

If the stainless sheet is stretched too much to the extent that the clearance with the slider cover exceeds the specified value of 1 mm, fatigue destruction may result.

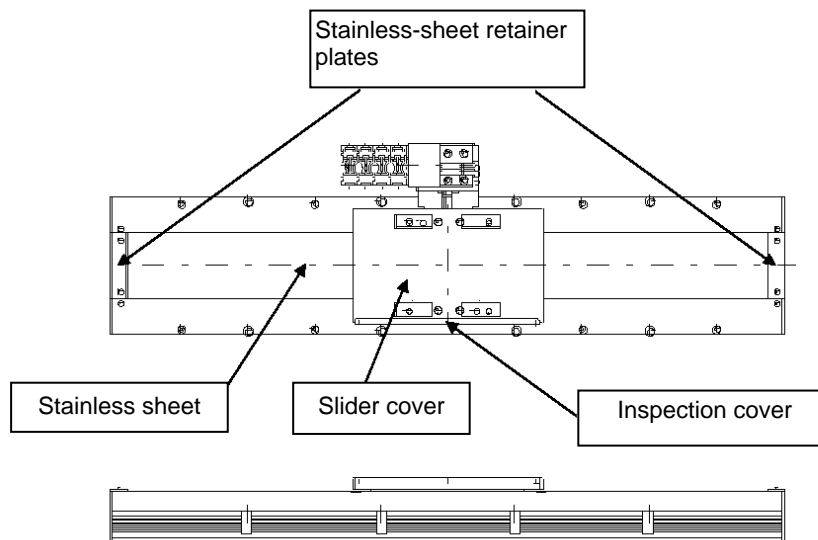
On the other hand, excessive slacks cause the stainless sheet to contact the back of the slider cover.

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

The slider cover need not be removed when replacing and adjusting the stainless sheet.

Simply remove the inspection cover located on one side of the slider cover, and you can adjust the stainless sheet by directly measuring and checking the clearance between the stainless sheet and the back of the slider cover.

### [Name of each part]

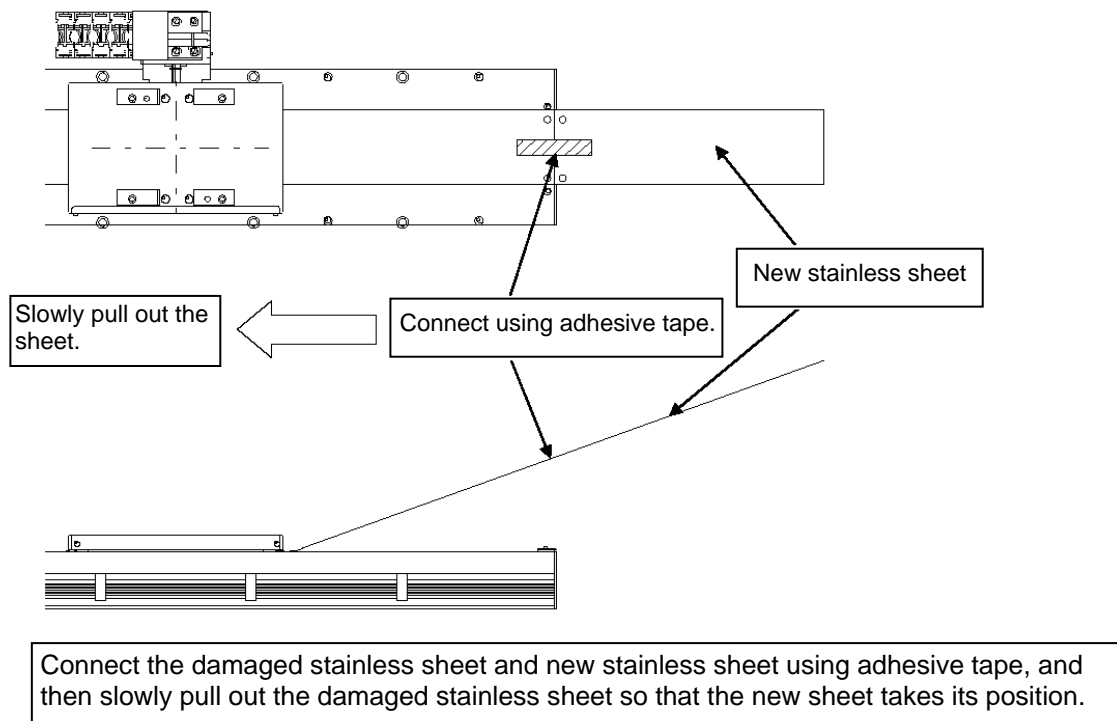






### 13.1 Replacement Procedure for Stainless Sheet

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 the end of the damaged stainless sheet so that the sheet slides over the side cover.  
\* Be careful not to allow the stainless sheet to come off of the side cover and get attracted to the permanent magnets in the base.
  - [5] Confirm that the new stainless sheet has been installed in the slider.

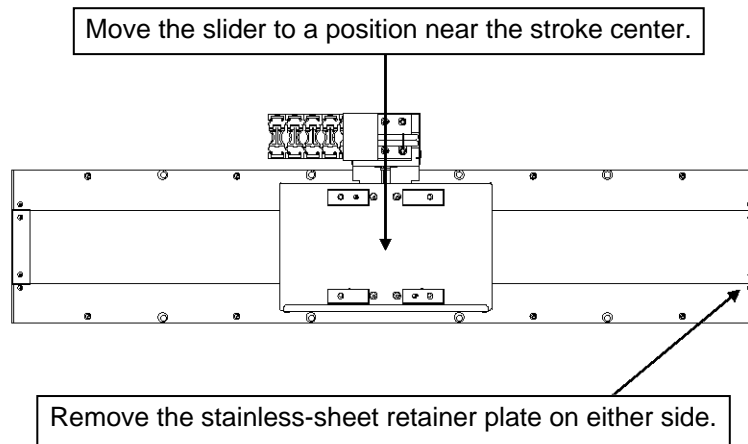




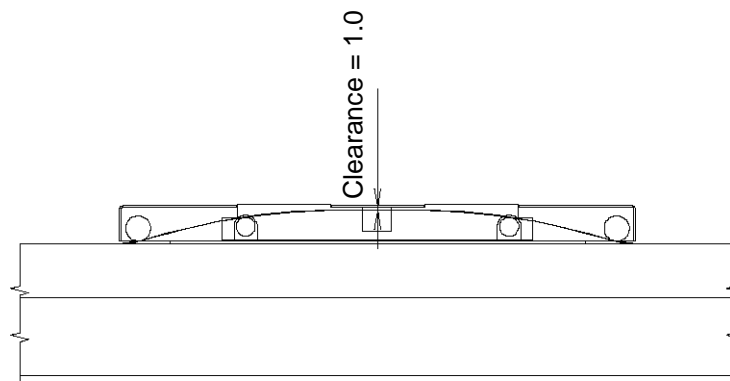


## 13.2 Adjusting the Stainless Sheet Tension

- [1] First, affix the stainless sheet uniformly on the right and left in a manner free from meandering. (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-sheet retainer plate on either side.



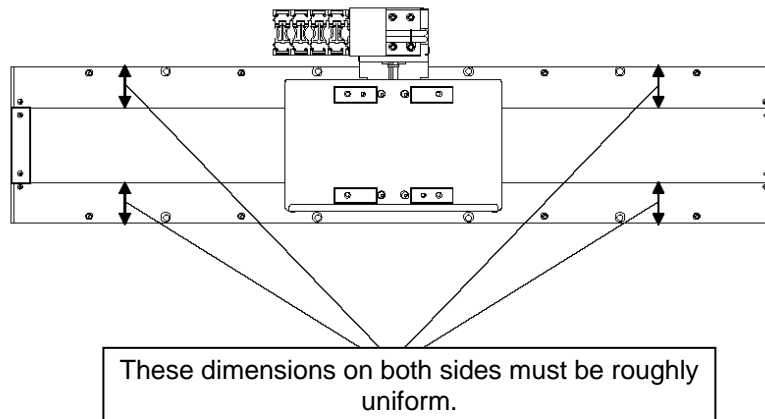
- [3] **Adjusting the Stainless Sheet Tension**  
Remove the inspection cover located on one side of the slider cover to reveal the interior of the slider.  
Adjust the sheet in the axial direction uniformly on the right and left until the height of the apex of the slider curve comes to 1.0 mm below the installation surface of the slider cover. In this position, loosely tighten the mounting screws on the sheet retainer plate (hexagonal socket head button bolt M4 x 10).





- [4] Move the slider by hand over its full stroke and see the stainless sheet from above to confirm that the specified dimensions on both sides of the stainless sheet are roughly uniform across the entire length, as shown in the figure.

If not, the stainless sheet is skewed. Repeat the adjustment from step [1] to make sure the stainless sheet extends straight.



- [5] Securely tighten the stainless-sheet retainer bolts that have only been loosely tightened, and then install the inspection cover on the side of the slider cover.
- [6] After the sheet retainer plate has been securely tightened, move the slider over its full stroke by hand to check if the dimensions on both sides of the stainless sheet change significantly or if a sound of slider contact is heard. If any problem is found, repeat the adjustment from step [1].



**Warning:**

- This actuator uses high-performance rare-earth permanent magnets. Accordingly, anyone who is using a pacemaker or other medical device should not perform this work.
- Do not bring a watch, mobile phone or any other electronic device susceptible to the magnetic field closer to the actuator.
- Wear gloves and exercise caution not to cut your hand by the stainless sheet during the procedure.
- Pay due attention not to let the permanent magnets attract iron powder or other magnetic objects during the procedure.



**Caution:**

Always use IAI's genuine stainless sheet.  
If IAI's genuine stainless sheet is not used, actuator breakdown may occur.





## 14. Linear Scale Cleaning Procedure

### [Required Items for Cleaning]

- Allen wrenches (4 mm, 3 mm and 2.5 mm across flats)
- Tweezers
- Dry cloth
- Industrial alcohol
- Marker pen

### [Procedure]



#### Warning:

- This actuator uses high-performance rare-earth permanent magnets. Accordingly, anyone who is using a pacemaker or other medical device should not perform this work.
- Do not bring a watch, mobile phone or any other electronic device susceptible to the magnetic field closer to the actuator.
- Wear gloves and exercise caution not to cut your hand by the stainless sheet during the procedure.
- Pay due attention not to let the permanent magnets attract iron powder or other magnetic objects during the procedure.

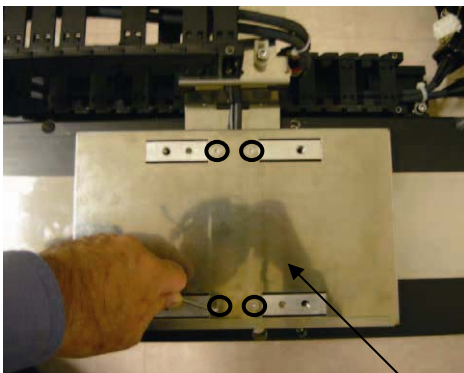


#### Caution:

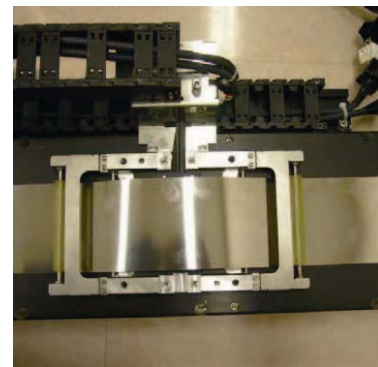
The bolts you have removed will be required when reassembling the linear scale. Keep them in a secure place by making sure you know which bolt came from where.

(1) Remove the stainless sheet.

- [1] Use an Allen wrench of 3 mm across flats to remove the bolts securing the slider cover, and take out the slider cover.



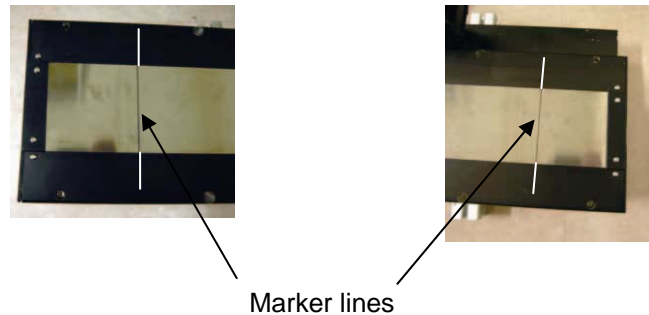
Slider cover



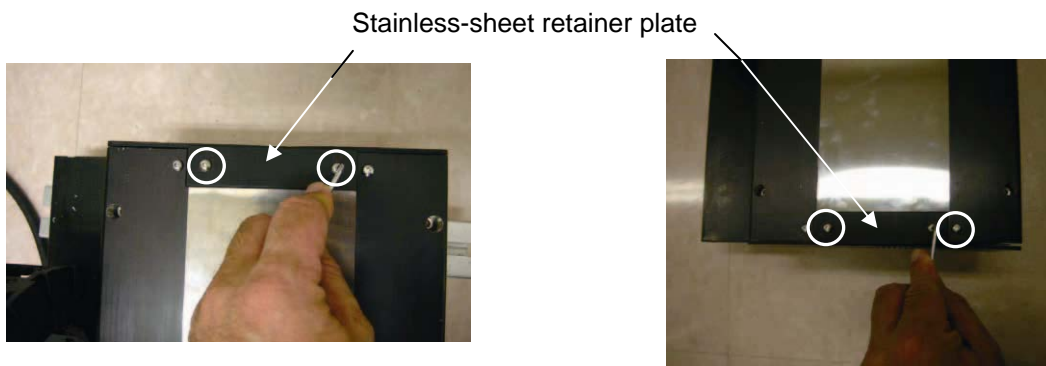




- [2] Remove the stainless sheet and clean the linear scale.  
So that the original tension can be restored when the stainless sheet is installed again later on, use a marker pen to draw marker lines near the stainless-sheet retainer plates at both ends.



- [3] Use an Allen wrench of 2.5 mm across flats to remove the bolts securing the top stainless-sheet retainer plate. Remove the bolts at both ends of the stainless-sheet retainer plate. Now the stainless sheet can be removed.

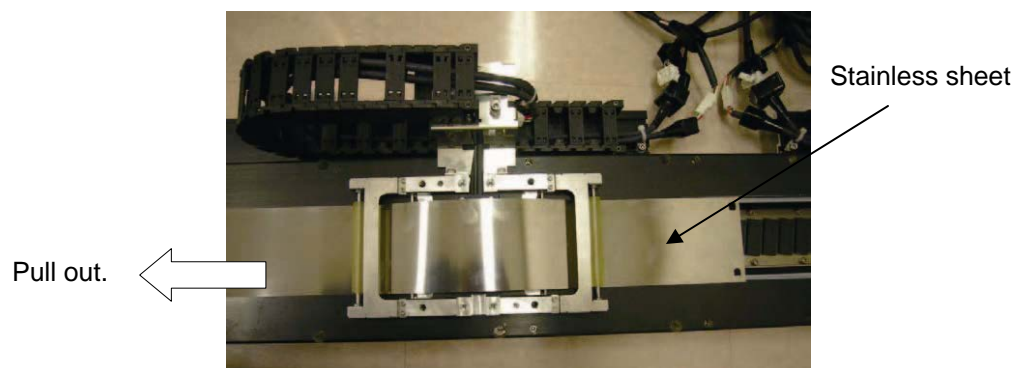


- [4] Pull out the stainless sheet from the slider to remove the sheet.



**Caution:**

The permanent magnets have very strong magnetic force, so if you are not careful, the stainless sheet may be attracted to the magnet and become bent to the point where it can no longer be used. Exercise caution.

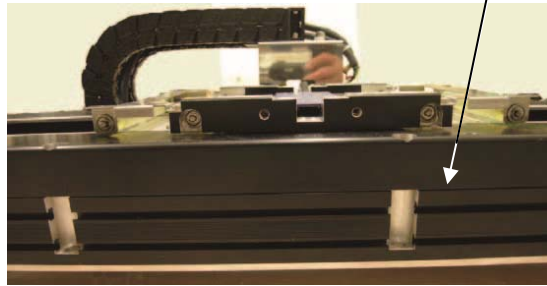






- (2) Remove the side cover from the side where there is no cable track.

Side cover

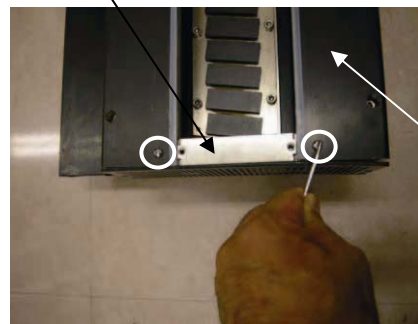


- [1] Use an Allen wrench of 2.5 mm across flats to remove the bolts securing the bottom stainless-sheet retainer plate. Remove the bolts at both ends of the bottom stainless-sheet retainer plate.

Bottom stainless-sheet retainer plate

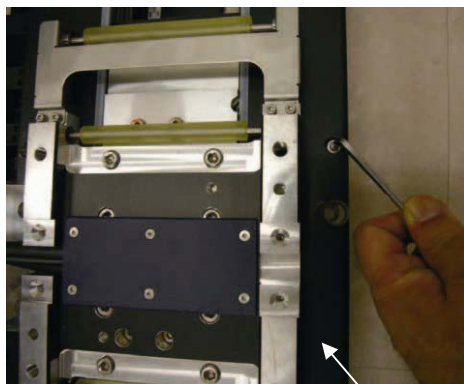


Side cover

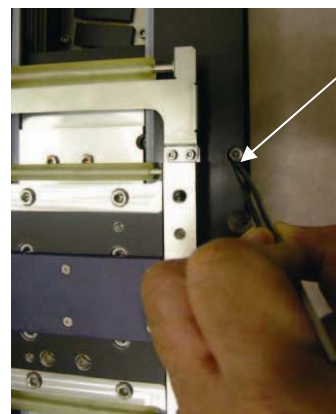


Side cover

- [2] Use an Allen wrench of 4 mm across flats to loosen all bolts securing the side cover. Even though loose, the bolts are still in the holes and cannot be taken out by hand. Use tweezers to take out the bolts.



Side cover

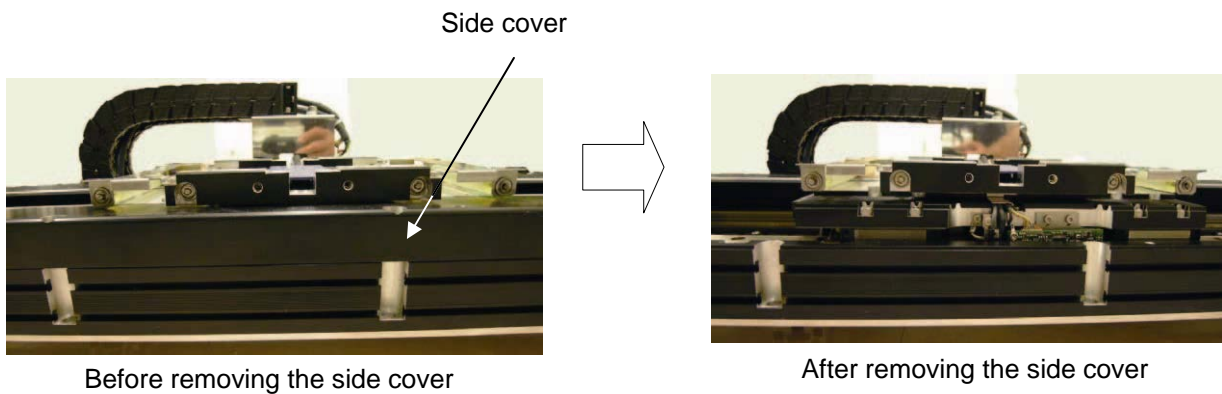


Use tweezers to take out the bolts.

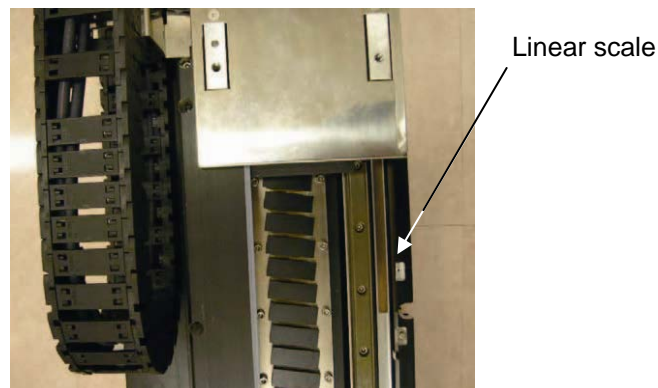




- [3] Remove the side cover.



Once the side cover is removed, you should see the linear scale at the bottom.



- (3) Take a small amount of alcohol in a dry cloth and wipe the linear scale with the cloth in gentle action to remove any soiling.



**Caution:**

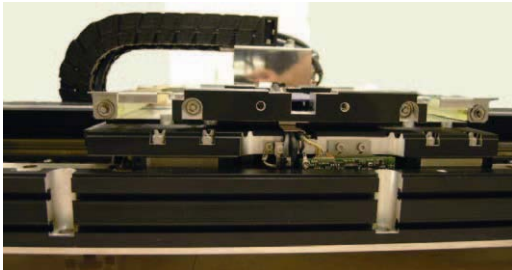
Do not wipe the linear scale with a strong force. Also, exercise caution not to scratch the scale surface. If the surface is scratched, you may no longer get the correct readings.



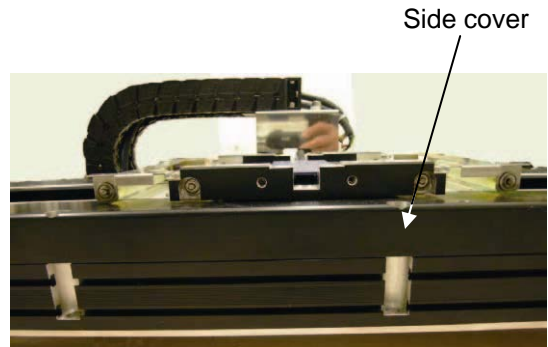




- (4) Install the side cover to its original condition.  
[1] Install the side cover you have removed earlier.

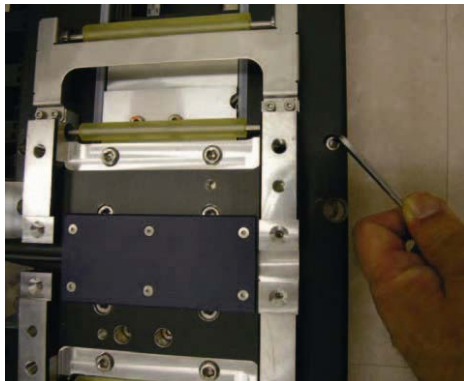


Before installing the side cover



After installing the side cover

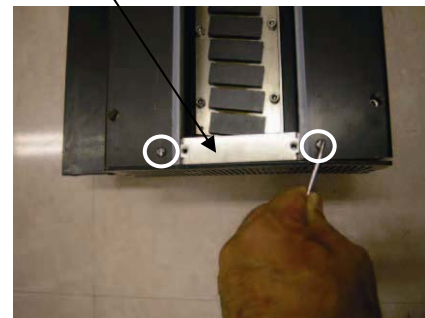
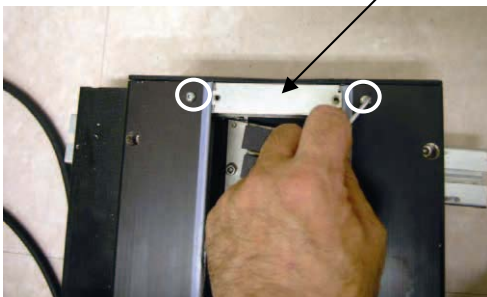
- [2] Use an Allen wrench of 4 mm across flats to tighten the bolts and secure the side cover.



Tightening torque: 411 N·cm  
(41.9 kgf·cm)

- [3] Use an Allen wrench of 2.5 mm across flats to tighten the bolts at both ends of the bottom stainless-sheet retainer plate to secure the retainer plate.

Bottom stainless-sheet retainer plate







(5) Install the stainless sheet.

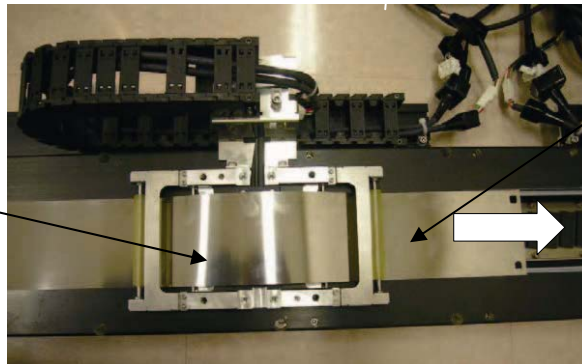
- [1] Move the slider to near the center of the stroke, and insert the stainless sheet into the slider and guide it through the slider, as shown in the figure.



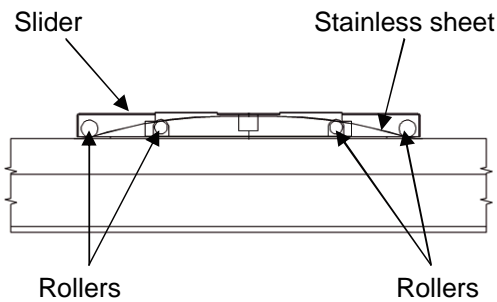
Caution:

The permanent magnets have very strong magnetic force, so if you are not careful, the stainless sheet may be attracted to the magnet and become bent to the point where it can no longer be used. Exercise caution.

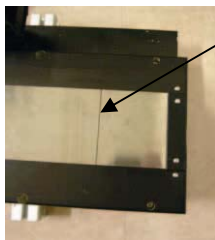
The slider should be positioned near the center of the stroke.



Stainless sheet



- [2] Align the stainless sheet with the marker lines. Put the top stainless-sheet retainer plate over the stainless sheet and tighten the bolts at one end using an Allen wrench of 2.5 mm across flats to secure the stainless sheet at one end.



Marker line

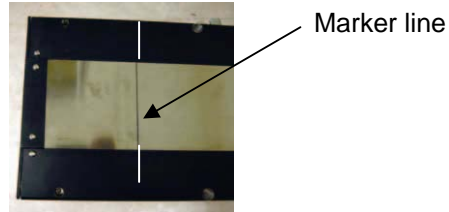


Top stainless-sheet retainer plate

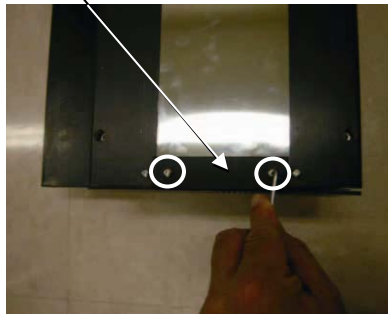




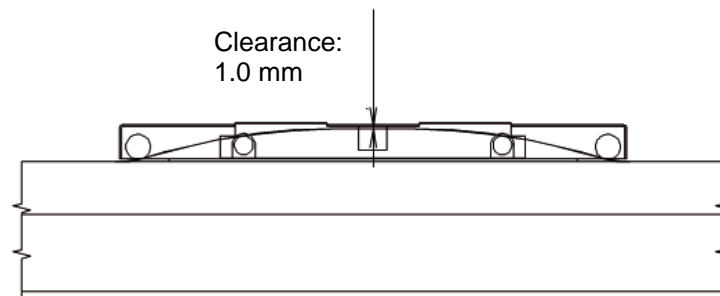
- [3] Pull the stainless sheet from the side not yet secured and align it with the marker lines in the same manner. Loosely tighten the bolts on the top stainless-sheet retainer plate just enough to keep the stainless sheet from moving.



Top stainless-sheet retainer plate



Once the stainless sheet is installed as marked, the height of the warped part of the sheet in the slider drops 1.0 mm from the installation surface of the slider cover to prevent contact with the slider cover.

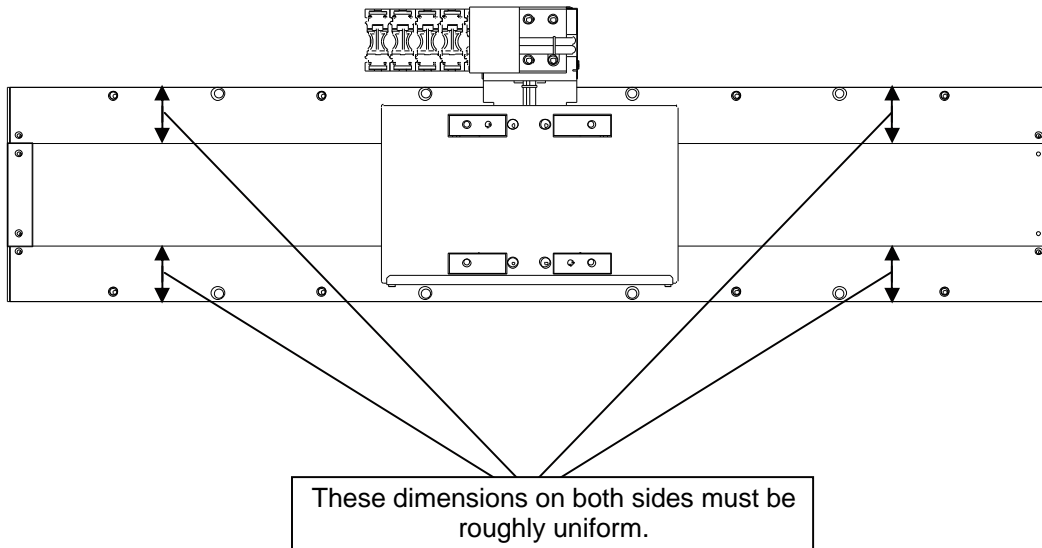






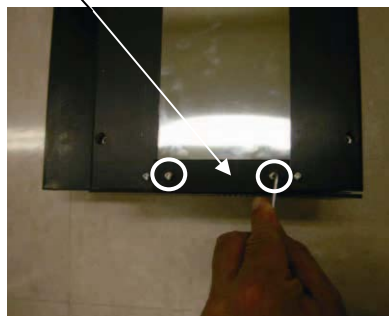
- [4] Move the slider by hand over its full stroke and see the stainless sheet from above to confirm that the specified dimensions on both sides of the stainless sheet are roughly uniform across the entire length, as shown in the figure.

If these dimensions are not uniform across the entire length, the stainless sheet is bent. Remove and install the stainless sheet again.



- [5] Use an Allen wrench of 2.5 mm across flats to securely tighten the bolts that have been tightened only loosely, to secure the stainless sheet.

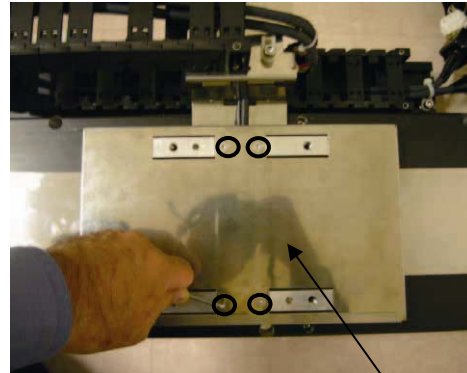
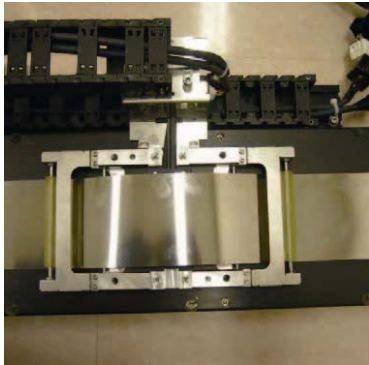
Top stainless-sheet retainer plate







- [6] Put the slider cover over the slider and tighten the bolts using an Allen wrench of 3 mm across flats to secure the slider cover.



Slider cover

- [7] Finally, move the slider by hand over its full stroke once again to confirm absence of bending and warping of the stainless sheet.  
Follow the same check method in (5) [4].  
Also confirm that the slider is not making noise from contacting the stainless sheet.  
If the two are contacting, you should hear loud rustling noise or cupping noise that generates when the stainless sheet separates from the slider.  
If any problem is found, remove and attach the stainless sheet again.



## 15. Specifications

### 15.1 Actuator

Model number	Unit	LSA-W21SS, LSA-W21SM	LSA-W21HS, LSA-W21HM
Stroke	mm	LSA-W21SS: 1050 ~ 4155 LSA-W21SS: 730 ~ 3835	LSA-W21HM: 895 ~ 4000 LSA-W21HM: 420 ~ 3525
Rated thrust	N	200	400
Maximum thrust	N	600	1200
Maximum speed	mm/sec	2500	
Maximum acceleration/ deceleration	G	3	
Maximum payload capacity	kgf	60 (When used horizontally)	120 (When used horizontally)
Positioning repeatability	± mm	0.005	
Load moment	N·m (kgf·m)	Ma: 128.7 (13.1)	Ma: 275.2 (28.1)
		Mb: 128.7 (13.1)	Mb: 275.2 (28.1)
		Mc: 128.7 (13.1)	Mc: 275.2 (28.1)
Overhang load length	mm	Ma direction: 500 or less	Ma direction: 750 or less
		Mb, Mc direction: 500 or less	Mb, Mc direction: 750 or less

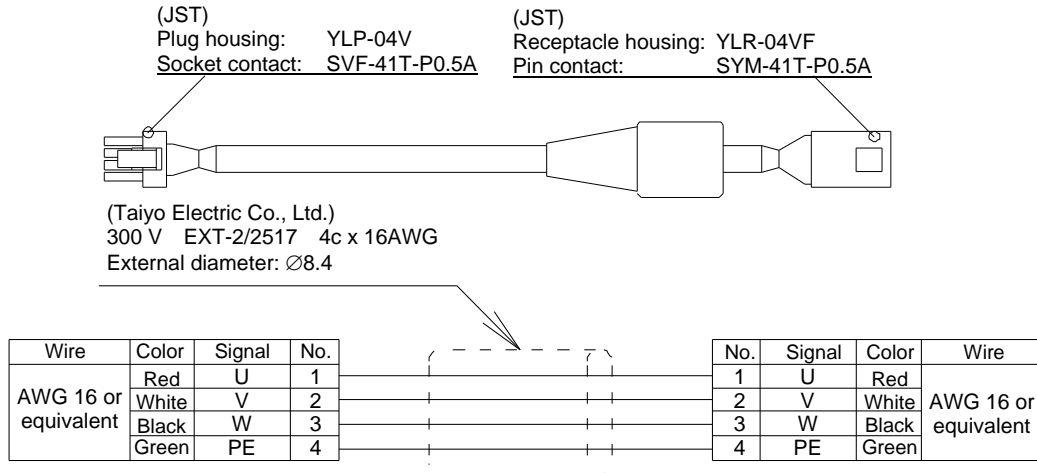
(\*1) The maximum speed may not be reached depending on the stroke.

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

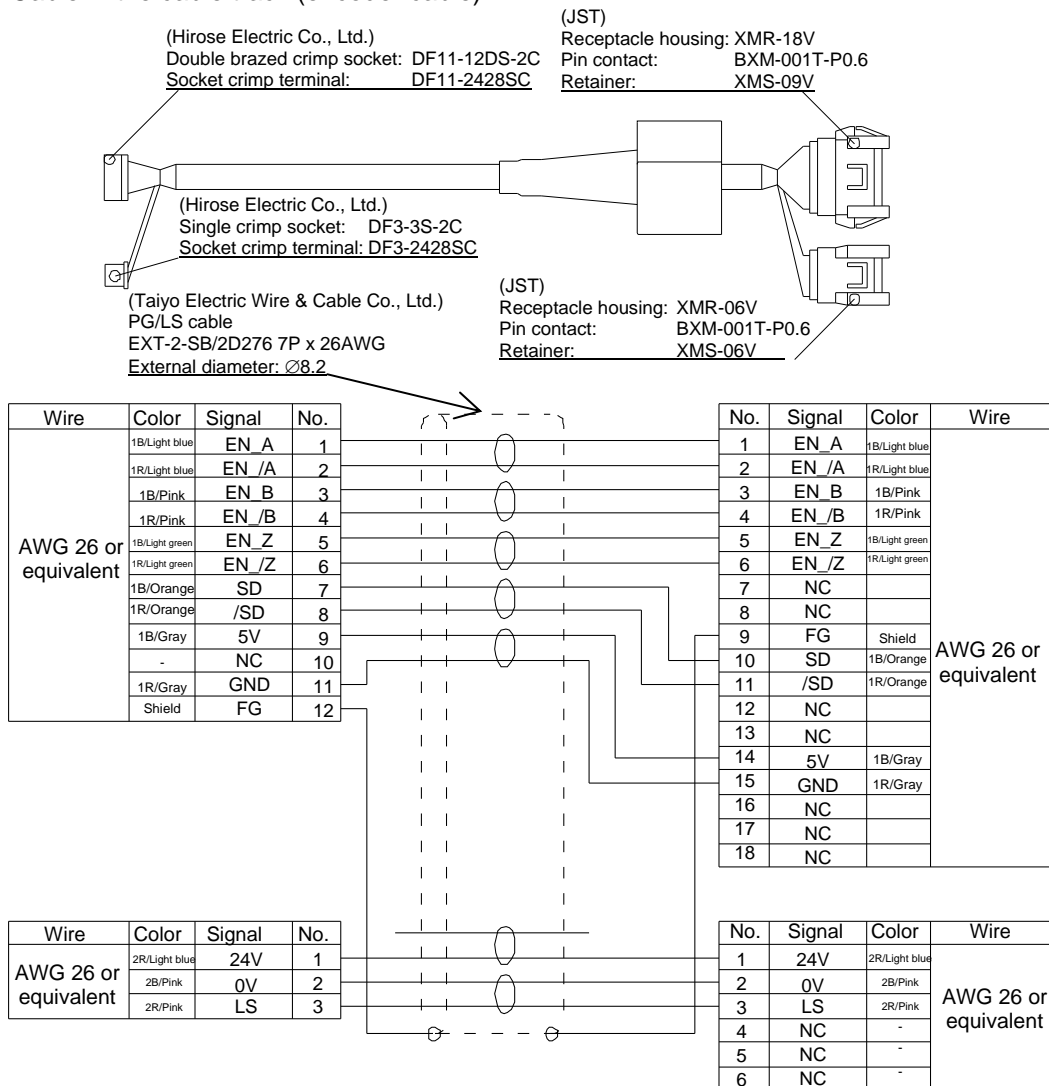


## 15.2 Cable Wiring Diagram

### [1] Cable in the cable track (motor cable)

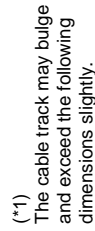


### [2] Cable in the cable track (encoder cable)





### 15.3.1 W21SS



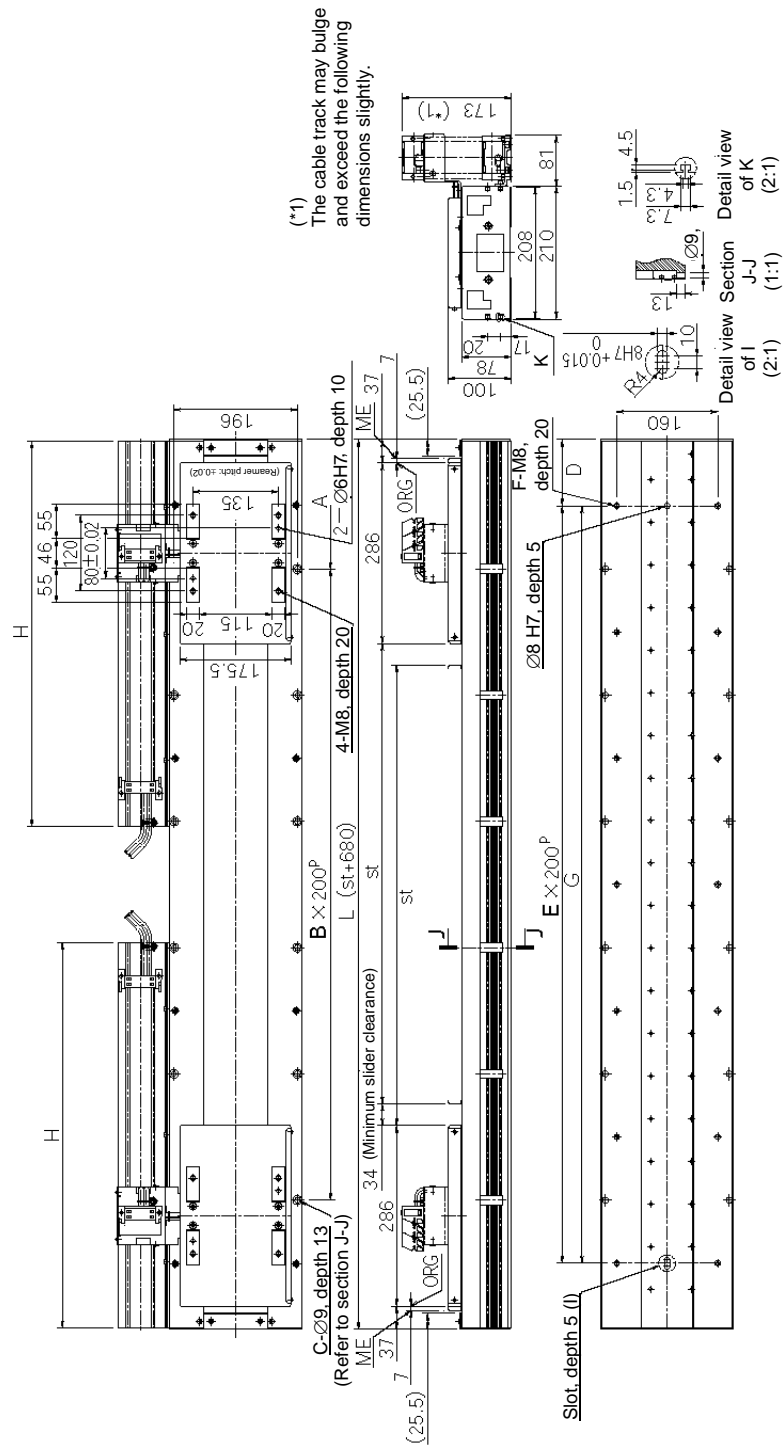




## W21SS

No.	Stroke	L	A	B	C	D	E	F	G	H
1	1050	1410	205	5	12	105	6	14	1200	760
2	1185	1545	72.5	7	16	172.5	6	14	1200	830
3	1320	1680	140	7	16	40	8	18	1600	900
4	1455	1815	207.5	7	16	107.5	8	18	1600	970
5	1590	1950	75	9	20	175	8	18	1600	1040
6	1725	2085	142.5	9	20	42.5	10	22	2000	1120
7	1860	2220	210	9	20	110	10	22	2000	1160
8	1995	2355	77.5	11	24	177.5	10	22	2000	1240
9	2130	2490	145	11	24	45	12	26	2400	1310
10	2265	2625	212.5	11	24	112.5	12	26	2400	1380
11	2400	2760	80	13	28	180	12	26	2400	1450
12	2535	2895	147.5	13	28	47.5	14	30	2800	1500
13	2670	3030	215	13	28	115	14	30	2800	1570
14	2805	3165	82.5	15	32	182.5	14	30	2800	1640
15	2940	3300	150	15	32	50	16	34	3200	1720
16	3075	3435	217.5	15	32	117.5	16	34	3200	1790
17	3210	3570	85	17	36	185	16	34	3200	1840
18	3345	3705	152.5	17	36	52.5	18	38	3600	1910
19	3480	3840	220	17	36	120	18	38	3600	1980
20	3615	3975	87.5	19	40	187.5	18	38	3600	2050
21	3750	4110	155	19	40	55	20	42	4000	2120
22	3885	4245	222.5	19	40	122.5	20	42	4000	2200
23	4020	4380	90	21	44	190	20	42	4000	2240
24	4155	4515	157.5	21	44	57.5	22	46	4400	2320







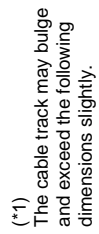


## W21SM

No.	Stroke	L	A	B	C	D	E	F	G	H
1	730	1410	205	5	12	105	6	14	1200	610
2	865	1545	72.5	7	16	172.5	6	14	1200	680
3	1000	1680	140	7	16	40	8	18	1600	760
4	1135	1815	207.5	7	16	107.5	8	18	1600	830
5	1270	1950	75	9	20	175	8	18	1600	900
6	1405	2085	142.5	9	20	42.5	10	22	2000	970
7	1540	2220	210	9	20	110	10	22	2000	1040
8	1675	2355	77.5	11	24	177.5	10	22	2000	1120
9	1810	2490	145	11	24	45	12	26	2400	1160
10	1945	2625	212.5	11	24	112.5	12	26	2400	1240
11	2080	2760	80	13	28	180	12	26	2400	1310
12	2215	2895	147.5	13	28	47.5	14	30	2800	1380
13	2350	3030	215	13	28	115	14	30	2800	1450
14	2485	3165	82.5	15	32	182.5	14	30	2800	1500
15	2620	3300	150	15	32	50	16	34	3200	1570
16	2755	3435	217.5	15	32	117.5	16	34	3200	1640
17	2890	3570	85	17	36	185	16	34	3200	1720
18	3025	3705	152.5	17	36	52.5	18	38	3600	1790
19	3160	3840	220	17	36	120	18	38	3600	1840
20	3295	3975	87.5	19	40	187.5	18	38	3600	1910
21	3430	4110	155	19	40	55	20	42	4000	1980
22	3565	4245	222.5	19	40	122.5	20	42	4000	2050
23	3700	4380	90	21	44	190	20	42	4000	2120
24	3835	4515	157.5	21	44	57.5	22	46	4400	2200



### 15.3.3 W21HS



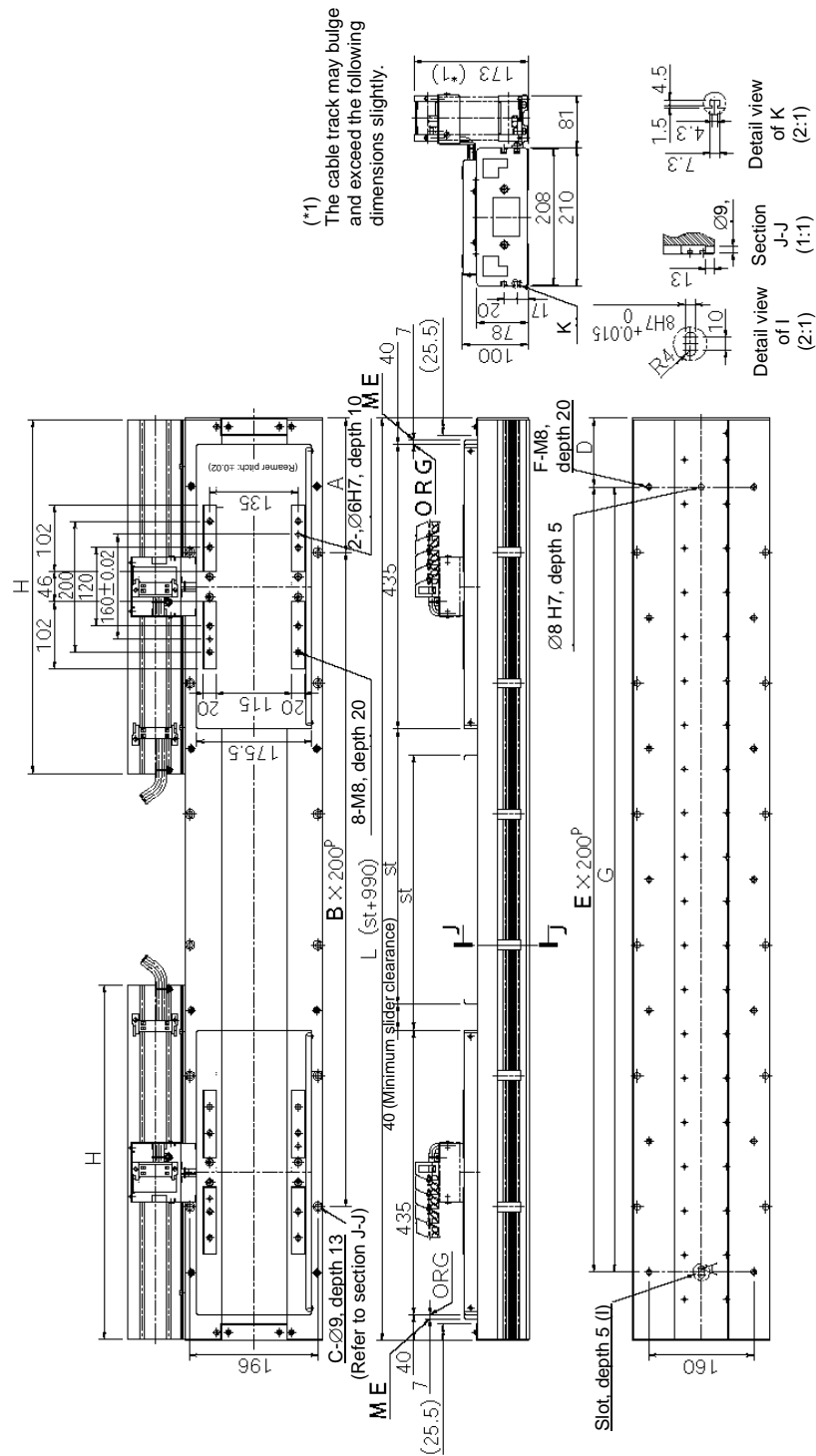




## W21HS

No.	Stroke	L	A	B	C	D	E	F	G	H
1	895	1410	205	5	12	105	6	14	1200	760
2	1030	1545	72.5	7	16	172.5	6	14	1200	830
3	1165	1680	140	7	16	40	8	18	1600	900
4	1300	1815	207.5	7	16	107.5	8	18	1600	970
5	1435	1950	75	9	20	175	8	18	1600	1040
6	1570	2085	142.5	9	20	42.5	10	22	2000	1120
7	1705	2220	210	9	20	110	10	22	2000	1160
8	1840	2355	77.5	11	24	177.5	10	22	2000	1240
9	1975	2490	145	11	24	45	12	26	2400	1310
10	2110	2625	212.5	11	24	112.5	12	26	2400	1380
11	2245	2760	80	13	28	180	12	26	2400	1450
12	2380	2895	147.5	13	28	47.5	14	30	2800	1500
13	2515	3030	215	13	28	115	14	30	2800	1570
14	2650	3165	82.5	15	32	182.5	14	30	2800	1640
15	2785	3300	150	15	32	50	16	34	3200	1720
16	2920	3435	217.5	15	32	117.5	16	34	3200	1790
17	3055	3570	85	17	36	185	16	34	3200	1840
18	3190	3705	152.5	17	36	52.5	18	38	3600	1910
19	3325	3840	220	17	36	120	18	38	3600	1980
20	3460	3975	87.5	19	40	187.5	18	38	3600	2050
21	3595	4110	155	19	40	55	20	42	4000	2120
22	3730	4245	222.5	19	40	122.5	20	42	4000	2200
23	3865	4380	90	21	44	190	20	42	4000	2240
24	4000	4515	157.5	21	44	57.5	22	46	4400	2320









## W21HM

No.	Stroke	L	A	B	C	D	E	F	G	H
1	420	1410	205	5	12	105	6	14	1200	540
2	555	1545	72.5	7	16	172.5	6	14	1200	610
3	690	1680	140	7	16	40	8	18	1600	680
4	825	1815	207.5	7	16	107.5	8	18	1600	760
5	960	1950	75	9	20	175	8	18	1600	830
6	1095	2085	142.5	9	20	42.5	10	22	2000	900
7	1230	2220	210	9	20	110	10	22	2000	970
8	1365	2355	77.5	11	24	177.5	10	22	2000	1040
9	1500	2490	145	11	24	45	12	26	2400	1120
10	1635	2625	212.5	11	24	112.5	12	26	2400	1160
11	1770	2760	80	13	28	180	12	26	2400	1240
12	1905	2895	147.5	13	28	47.5	14	30	2800	1310
13	2040	3030	215	13	28	115	14	30	2800	1380
14	2175	3165	82.5	15	32	182.5	14	30	2800	1450
15	2310	3300	150	15	32	50	16	34	3200	1500
16	2445	3435	217.5	15	32	117.5	16	34	3200	1570
17	2580	3570	85	17	36	185	16	34	3200	1640
18	2715	3705	152.5	17	36	52.5	18	38	3600	1720
19	2850	3840	220	17	36	120	18	38	3600	1790
20	2985	3975	87.5	19	40	187.5	18	38	3600	1840
21	3120	4110	155	19	40	55	20	42	4000	1910
22	3255	4245	222.5	19	40	122.5	20	42	4000	1980
23	3390	4380	90	21	44	190	20	42	4000	2050
24	3525	4515	157.5	21	44	57.5	22	46	4400	2120





## Change History

Revision Date	Description of Revision
	First edition
September 2010	Second edition <ul style="list-style-type: none"><li>Page 31 Corrected the dimension of the clearance from 1.5 to 1.0 in the drawing</li><li>Pages 7 and 16 Added the precaution; "Do not apply force on the slider cover."</li></ul>
January 2011	Third edition <ul style="list-style-type: none"><li>Removed "Safety Precautions."</li><li>Preface-1 to 7: Added "Safety Guide."</li><li>P. 6: Storage Environment → Storage/Preservation Environment</li><li>P. 10: Within <math>\pm 0.05</math> mm → Within <math>\pm 0.05</math> mm/m</li><li>P. 26 to 28: Change the content of 12.2, "Encoder Open Error" in 12, "Troubleshooting."</li><li>P. 33 to 41: Added 14, "Linear Scale Cleaning Procedure."</li></ul>









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