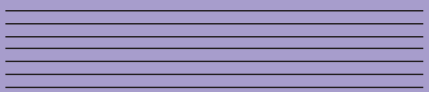
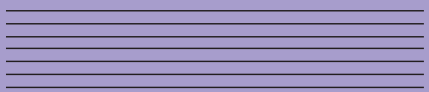


Linear Servo Actuator LSA Series Large Models Instruction Manual

 **Fourth Edition** 

W21SS, W21SM

W21HS, W21HM

IAI Corporation

Please Read Before Use

Thank you for purchasing our product.

This instruction manual explains the handling methods, structure and maintenance of this product, providing the information you need in order to use the product safely.

Before using the product, be sure to read this manual and fully understand the contents explained herein to ensure safe use of the product.

Please download the user's manual from our website.

You can download it free of charge. User registration is required for the first time downloading.

URL : www.iai-robot.co.jp/data_dl/CAD_MANUAL/

When using the product, print out of the necessary portions of the relevant manual, or please display it on your computer, tablet terminal, etc. so that you can check it immediately.

After reading the instruction manual, keep it in a convenient place so that whoever is handling the product can refer to it quickly when necessary

[Important]

- This instruction manual is an original document dedicated for this product.
- This product cannot be used in ways not shown in this instruction manual. IAI shall not be liable for any result whatsoever arising from the use of the product in any other way than what is noted in the manual.
- The information contained in this instruction manual is subject to change without notice for the purpose of product improvement.
- If any issues arise regarding the information contained in this instruction manual, contact our customer center or the nearest sales office.
- Use or reproduction of this instruction manual in full or in part without permission is prohibited.
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INTELLIGENT ACTUATOR

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Safety Guide

“Safety Guide” has been written to use the machine safely and so prevent personal injury or property damage beforehand. Make sure to read it before the operation of this product.

Safety Precautions for Our Products

The common safety precautions for the use of any of our robots in each operation.

No.	Operation Description	Description
1	Model Selection	- This product has not been planned and designed for the application where high level of safety is required, so the guarantee of the protection of human life is impossible. Accordingly, do not use it in any of 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 (For vehicle, railway facility or air navigation facility) 3) Important safety parts of machinery (Safety device, etc.) - Do not use the product outside the specifications. Failure to do so may considerably shorten the life of the product. - Do not use it in any of the following environments. 1) Location where there is any inflammable gas, inflammable object or explosive 2) Place with potential exposure to radiation 3) Location with the ambient temperature or relative humidity exceeding the specification range 4) Location where radiant heat is added from direct sunlight or other large heat source 5) Location where condensation occurs due to abrupt temperature changes 6) Location where there is any corrosive gas (sulfuric acid or hydrochloric acid) 7) Location exposed to significant amount of dust, salt or iron powder 8) Location subject to direct vibration or impact - For an actuator used in vertical orientation, select a model which is equipped with a brake. If selecting a model with no brake, the moving part may drop when the power is turned OFF and may cause an accident such as an injury or damage on the work piece.

No.	Operation Description	Description
2	Transportation	• When carrying a heavy object, do the work with two or more persons or utilize equipment such as crane. • When the work is carried out with 2 or more persons, make it clear who is to be the “leader” and who to be the “follower(s)” and communicate well with each other to ensure the safety of the workers. • When in transportation, consider well about the positions to hold, weight and weight balance and pay special attention to the carried object so it would not get hit or dropped. • Transport it using an appropriate transportation measure. The actuators available for transportation with a crane have eyebolts attached or there are tapped holes to attach bolts. Follow the instructions in the instruction manual for each model. • Do not step or sit on the package. • Do not put any heavy thing that can deform the package, on it. • When using a crane capable of 1t or more of weight, have an operator who has qualifications for crane operation and sling work. • When using a crane or equivalent equipments, make sure not to hang a load that weighs more than the equipment’s capability limit. • Use a hook that is suitable for the load. Consider the safety factor of the hook in such factors as shear strength. • Do not get on the load that is hung on a crane. • Do not leave a load hung up with a crane. • Do not stand under the load that is hung up with a crane.
3	Storage and Preservation	• The storage and preservation environment conforms to the installation environment. However, especially give consideration to the prevention of condensation. • Store the products with a consideration not to fall them over or drop due to an act of God such as earthquake.
4	Installation and Start	(1) Installation of Robot Main Body and Controller, etc. • Make sure to securely hold and fix the product (including the work part). A fall, drop or abnormal motion of the product may cause a damage or injury. Also, be equipped for a fall-over or drop due to an act of God such as earthquake. • Do not get on or put anything on the product. Failure to do so may cause an accidental fall, injury or damage to the product due to a drop of anything, malfunction of the product, performance degradation, or shortening of its life. • When using the product in any of the places specified below, provide a sufficient shield. 1) Location where electric noise is generated 2) Location where high electrical or magnetic field is present 3) Location with the mains or power lines passing nearby 4) Location where the product may come in contact with water, oil or chemical droplets

No.	Operation Description	Description
4	Installation and Start	(2) Cable Wiring • Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool. • Do not scratch on the cable. Do not bend it forcibly. Do not pull it. Do not coil it around. Do not insert it. Do not put any heavy thing on it. Failure to do so may cause a fire, electric shock or malfunction due to leakage or continuity error. • Perform the wiring for the product, after turning OFF the power to the unit, so that there is no wiring error. • When the direct current power (+24V) is connected, take the great care of the directions of positive and negative poles. If the connection direction is not correct, it might cause a fire, product breakdown or malfunction. • Connect the cable connector securely so that there is no disconnection or looseness. Failure to do so may cause a fire, electric shock or malfunction of the product. • Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Failure to do so may cause the product to malfunction or cause fire. (3) Grounding • The grounding operation should be performed to prevent an electric shock or electrostatic charge, enhance the noise-resistance ability and control the unnecessary electromagnetic radiation. • For the ground terminal (PE) on the AC power cable of the controller and the grounding plate in the control panel, make sure for grounding work. For security grounding, it is necessary to select an appropriate wire thickness suitable for the load. Perform wiring that satisfies the specifications (electrical equipment standards and criteria). For detail, follow the description in [an instruction manual of each controller or controller built-in actuator]. • Conduct functional grounding on the FG terminal for a controller supplying 24V DC or a controller built-in type actuator. In order to minimize influence to mechanical operation given by electromagnetic interference (noise) to an electrical device or insulation failure, conduct grounding on a terminal or a conductor that is electrically stable. The reference impedance should be Type D (Former Class 3, ground resistance 100Ω or less).

No.	Operation Description	Description
4	Installation and Start	(4) Safety Measures • When the work is carried out with 2 or more persons, make it clear who is to be the “leader” and who to be the “follower(s)” and communicate well with each other to ensure the safety of the workers. • When the product is under operation or in the ready mode, take the safety measures (such as the installation of safety and protection fence) so that nobody can enter the area within the robot’s movable range. When the robot under operation is touched, it may result in death or serious injury. • Make sure to install the emergency stop circuit so that the unit can be stopped immediately in an emergency during the unit operation. • Take the safety measure not to start up the unit only with the power turning ON. Failure to do so may start up the machine suddenly and cause an injury or damage to the product. • Take the safety measure not to start up the machine only with the emergency stop cancellation or recovery after the power failure. Failure to do so may result in an electric shock or injury due to unexpected power input. • When the installation or adjustment operation is to be performed, give clear warnings such as “Under Operation; Do not turn ON the power!” etc. Sudden power input may cause an electric shock or injury. • Take the measure so that the work part is not dropped in power failure or emergency stop. • Wear protection gloves, goggle or safety shoes, as necessary, to secure safety. • Do not insert a finger or object in the openings in the product. Failure to do so may cause an injury, electric shock, damage to the product or fire. • When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity.
5	Teaching	• When the work is carried out with 2 or more persons, make it clear who is to be the “leader” and who to be the “follower(s)” and communicate well with each other to ensure the safety of the workers. • Perform the teaching operation from outside the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the “Stipulations for the Operation” and make sure that all the workers acknowledge and understand them well. • When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. • When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. • Place a sign “Under Operation” at the position easy to see. • When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.

No.	Operation Description	Description
6	Trial Operation	• When the work is carried out with 2 or more persons, make it clear who is to be the “leader” and who to be the “follower(s)” and communicate well with each other to ensure the safety of the workers. • After the teaching or programming operation, perform the check operation one step by one step and then shift to the automatic operation. • When the check operation is to be performed inside the safety protection fence, perform the check operation using the previously specified work procedure like the teaching operation. • Make sure to perform the programmed operation check at the safety speed. Failure to do so may result in an accident due to unexpected motion caused by a program error, etc. • Do not touch the terminal block or any of the various setting switches in the power ON mode. Failure to do so may result in an electric shock or malfunction.
7	Automatic Operation	• Check before starting the automatic operation or rebooting after operation stop that there is nobody in the safety protection fence. • Before starting automatic operation, make sure that all peripheral equipment is in an automatic-operation-ready state and there is no alarm indication. • Make sure to operate automatic operation start from outside of the safety protection fence. • In the case that there is any abnormal heating, smoke, offensive smell, or abnormal noise in the product, immediately stop the machine and turn OFF the power switch. Failure to do so may result in a fire or damage to the product. • When a power failure occurs, turn OFF the power switch. Failure to do so may cause an injury or damage to the product, due to a sudden motion of the product in the recovery operation from the power failure.

No.	Operation Description	Description
8	Maintenance and Inspection	- When the work is carried out with 2 or more persons, make it clear who is to be the “leader” and who to be the “follower(s)” and communicate well with each other to ensure the safety of the workers. - Perform the work out of the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the “Stipulations for the Operation” and make sure that all the workers acknowledge and understand them well. - When the work is to be performed inside the safety protection fence, basically turn OFF the power switch. - When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. - When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. - Place a sign “Under Operation” at the position easy to see. - For the grease for the guide or ball screw, use appropriate grease according to the instruction manual for each model. - Do not perform the dielectric strength test. Failure to do so may result in a damage to the product. - When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. - The slider or rod may get misaligned OFF the stop position if the servo is turned OFF. Be careful not to get injured or damaged due to an unnecessary operation. - Pay attention not to lose the removed cover or screws, and make sure to put the product back to the original condition after maintenance and inspection works. Use in incomplete condition may cause damage to the product or an injury. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.
9	Modification and Dismantle	Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.
10	Disposal	- When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste. - When removing the actuator for disposal, pay attention to drop of components when detaching screws. - Do not put the product in a fire when disposing of it. The product may burst or generate toxic gases.
11	Other	- Do not come close to the product or the harnesses if you are a person who requires a support of medical devices such as a pacemaker. Doing so may affect the performance of your medical device. - See Overseas Specifications Compliance Manual to check whether complies if necessary. - For the handling of actuators and controllers, follow the dedicated instruction manual of each unit to ensure the safety. - Using the devise in a way not indicated by IAI may lose the protection performance equipped to the device.

Alert Indication

The safety precautions are divided into “Danger”, “Warning”, “Caution” and “Notice” according to the warning level, as follows, and described in the Instruction Manual for each model.

Level	Degree of Danger and Damage	Symbol
Danger	This indicates an imminently hazardous situation which, if the product is not handled correctly, will result in death or serious injury.	 Danger
Warning	This indicates a potentially hazardous situation which, if the product is not handled correctly, could result in death or serious injury.	 Warning
Caution	This indicates a potentially hazardous situation which, if the product is not handled correctly, may result in minor injury or property damage.	 Caution
Notice	This indicates lower possibility for the injury, but should be kept to use this product properly.	 Notice

Caution in Handling

1. **Make sure to follow the usage condition, environment and specification range of the product.**
In case it is not secured, it may cause a drop in performance or malfunction of the product.
2. **Back and forth operation in a short distance may cause wear of grease.**
If the actuators are moved back and forth continuously over a short distance of 30 mm or less, grease film may run out. As a guide, move the actuators back and forth repeatedly for around 5 cycles over a distance of 50 mm or more after every 5,000 to 10,000 cycles. Keep using the actuators with the grease worn out may cause malfunction.
3. **Make sure to attach the actuator properly by following this Instruction manual.**
Using the product with the actuator not being certainly retained or affixed may cause abnormal noise, vibration, malfunction or shorten the product life.



Warning: Do not get closer than 30cm if you are a person who needs a support of a medical device such as a pacemaker. This actuator uses high-performance rare-earth permanent magnets. Therefore an unexpected operation may be caused to a medical device especially when using such a device such as a pacemaker.



Caution:

- Do not attempt to get a magnetic card close to the product. Having a magnetic storage medium close to the product may disable the medium by destroying data.
- Do not attempt to get a precision instrument such as an electric watch close to the product. Doing so may cause a trouble to the instrument

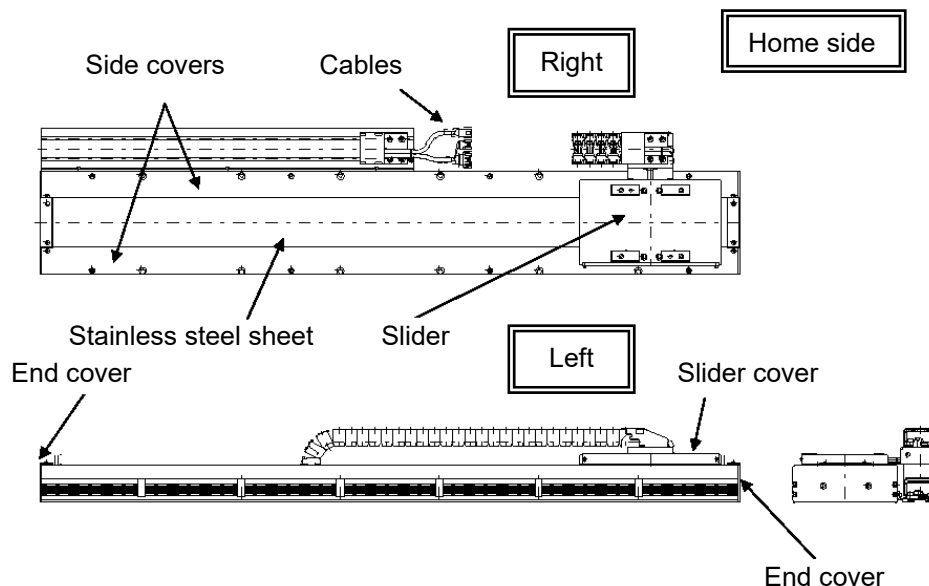
International Standards Compliances

This actuator complies with the following overseas standard.
Refer to Overseas Standard Compliance Manual (ME0287) for more detailed information.

RoHS3 Directive	CE Marking
○	×

Names of the Parts

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.



(Reference)

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.

1. Specifications Check

1.1 Checking the Product

The standard configuration of this product is comprised of the following parts.
See the component list for the details of the enclosed components. If you find any fault or missing parts, contact your local IAI distributor.

1.1.1 Parts

No.	Name	Model number	Quantity	Remarks
1	Actuator	Refer to "How to Read the Model Nameplate" and "How to Read the Model Number."	1	
Accessories				
2	Motor • encoder cables ^(Note1)		1set	
3	Safety Guide		1	

Note1 The enclosed motor encoder cable differs for the standard and robot cable. [Refer to 1.5, "Motor • Encoder Cables."]

1.1.2 Instruction Manuals for the Controllers Related to this Product

(1) Manuals Related to XSEL-P/Q controllers

No.	Name	Control No.
1	Instruction Manual for XSEL-P/Q/PCT/QCT Controller	ME0148
2	Instruction Manual for XSEL-P/Q/PX/QX RC Gateway Function	ME0188
3	Instruction Manual for PC Software IA-101-X-MW/IA-101-X-USBMW	ME0154
4	Instruction Manual for Teaching Pendant SEL-T/TD/TG	ME0183
5	Instruction Manual for Teaching Pendant IA-T-X/XD	ME0160
6	Instruction Manual for DeviceNet	ME0124
7	Instruction Manual for CC-Link	ME0123
8	Instruction Manual for PROFIBUS-DP	ME0153

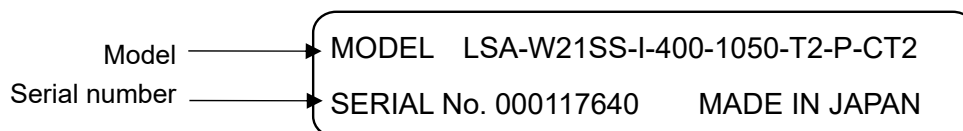
(2) Manuals Related to SSEL controllers

No.	Name	Control No.
1	Instruction Manual for SSEL Controller	ME0157
2	Instruction Manual for PC Software IA-101-X-MW/IA-101-X-USBMW	ME0154
3	Instruction Manual for Teaching Pendant SEL-T/TD/TG	ME0183
4	Instruction Manual for Teaching Pendant IA-T-X/XD	ME0160
5	Instruction Manual for DeviceNet	ME0124
6	Instruction Manual for CC-Link	ME0123
7	Instruction Manual for PROFIBUS-DP	ME0153

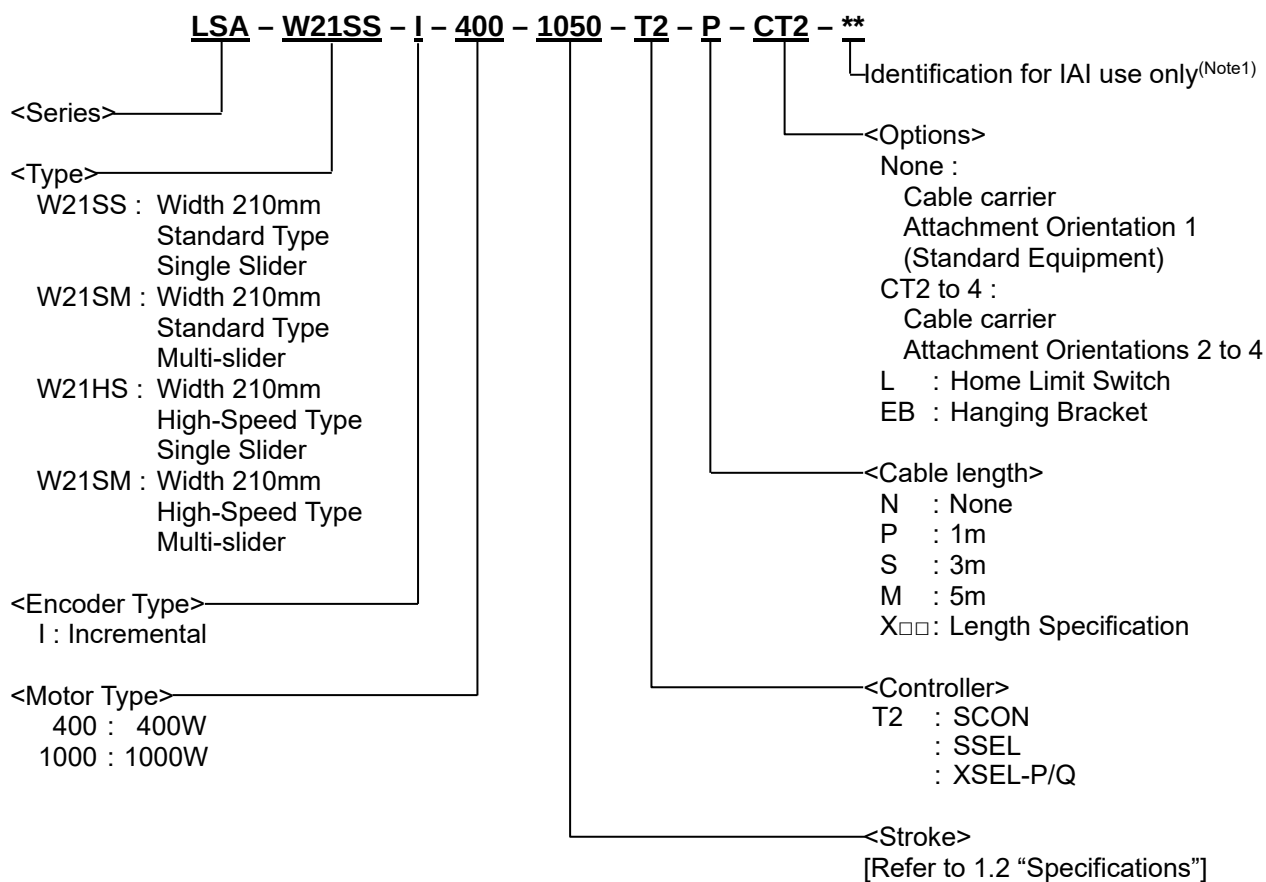
(3) Manuals Related to SCON controllers

No.	Name	Control No.
1	Instruction Manual for SCON Controller	ME0161
2	Instruction Manual for SCON-CA Controller	ME0243
3	Instruction Manual for PC Software RCM-101-MW/RCM-101-USB	ME0155
4	Instruction Manual for Teaching Pendant CON-T/TG	ME0178
5	Instruction Manual for Touch Panel Teaching Pendant CON-PT/PD/PG	ME0227
6	Instruction Manual for Simple Teaching Pendant RCM-E	ME0174
7	Instruction Manual for Data Setter RCM-P	ME0175
8	Instruction Manual for Touch Panel Display RCM-PM-01	ME0182
9	Instruction Manual for DeviceNet	ME0124
10	Instruction Manual for CC-Link	ME0123
11	Instruction Manual for PROFIBUS-DP	ME0153

1.1.3 How to Read the Model Nameplate



1.1.4 How to Read the Model Number



Note 1 Identification for IAI use only : It may be displayed for IAI use. It is not a code to show the model type.

1.2 Specification

1.2.1 Speed

[1] W21SS

Speed limits (Unit: mm/s)

Motor Type	Minimum Speed	Stroke [mm]											
		1050	1185	1320	1455	1590	1725	1860	1995	2130	2265	2400	2535
400	1	2500											
		2670	2805	2940	3075	3210	3345	3480	3615	3750	3885	4020	4155
		2500											

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

[2] W21SM

Speed limits (Unit: mm/s)

Motor Type	Minimum Speed	Stroke [mm]											
		730	865	1000	1135	1270	1405	1540	1675	1810	1945	2080	2215
400	1	2500											
		2350	2485	2620	2755	2890	3025	3160	3295	3430	3565	3700	3835
		2500											

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

[3] W21HS

Speed limits (Unit: mm/s)

Motor Type	Minimum Speed	Stroke [mm]											
		895	1030	1165	1300	1435	1570	1705	1840	1975	2110	2245	2380
1000	1	2500											
		2515	2650	2785	2920	3055	3190	3325	3460	3595	3730	3865	4000
		2500											

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

[4] W21HM

Speed limits (Unit: mm/s)

Motor Type	Minimum Speed	Stroke [mm]											
		420	555	690	825	960	1095	1230	1365	1500	1635	1770	1905
1000	1	2500											
		2040	2175	2310	2445	2580	2715	2850	2985	3120	3255	3390	3525
		2500											

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

1.2.2 Maximum Acceleration/Deceleration, Maximum Load Capacity and Rated Thrust

Type	Item	Performance
W21SS, W21SM	Maximum acceleration/deceleration ^(Note1)	3G
	Maximum loading capacity ^(Note1)	60kg
	Rated thrust	200N
W21HS, W21HM	Maximum acceleration/deceleration ^(Note1)	3G
	Maximum loading capacity ^(Note1)	120kg
	Rated thrust	400N

Note 1 The available acceleration/deceleration and the load capacity may differ depending on the operational conditions.
[Refer to 1.3 “Operating conditions”]

1.2.3 No. of Encoder Pulses

Type	No. of Encoder Pulses	Lead Length [mm]
W21SS, W21SM	45000	45
W21HS, W21HM	45000	45

1.2.4 Positioning Precision

Type	Item	Specifications
W21SS, W21SM	Positioning Repeatability	±0.005mm
	Lost Motion	0.02mm or less
W21HS, W21HM	Positioning Repeatability	±0.005mm
	Lost Motion	0.02mm or less

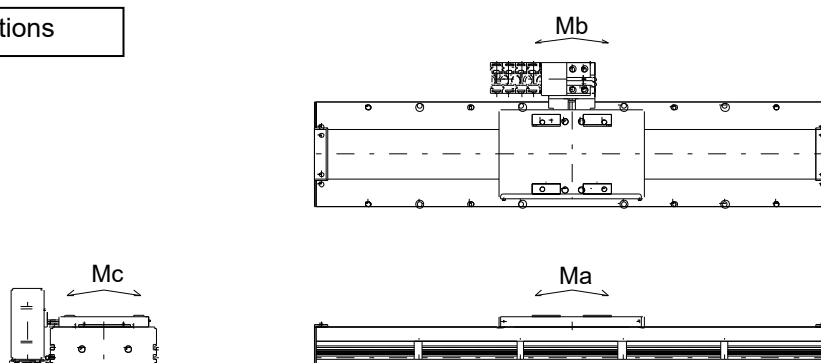
The values shown above are the accuracy at the delivery from the factory.
It does not include the consideration of time-dependent change as it is used.

1.2.5 Allowable Load Moments of the Actuator

Type	Allowable Dynamic Load Moment [N·m]			Allowable Overhang Load Length (L) (Note 1)
	Ma	Mb	Mc	
W21SS, W21SM	128.7	128.7	128.7	Ma direction 500mm or less Mb, Mc direction 500mm or less
W21HS, W21HM	275.2	275.2	275.2	Ma direction 750mm or less Mb, Mc direction 750mm or less

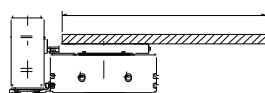
Note 1: The values for allowable overhang load length are those when the center of the gravity of the load is at 1/2 of the overhang length.

Moment directions

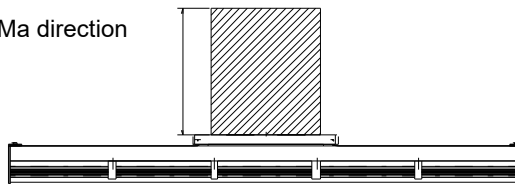


Allowable overhang directions

Mb or Mc direction



Ma direction



Caution: Using the product above the allowable moment or overhang load length may cause not only to generate abnormal noise or vibration, but also to shorten the product life remarkably.



1.2.6 Duty Ratio in Continuous Operation

The duty ratio may differ depending on the acceleration/deceleration and transported mass.
[Refer to 1.3 “Operating conditions”]

1.3 Operating conditions

1.3.1 Available Conditions for Operation

When selecting a desired model of large models linear servo actuator, you must ensure that the selected actuator satisfies the following two conditions.

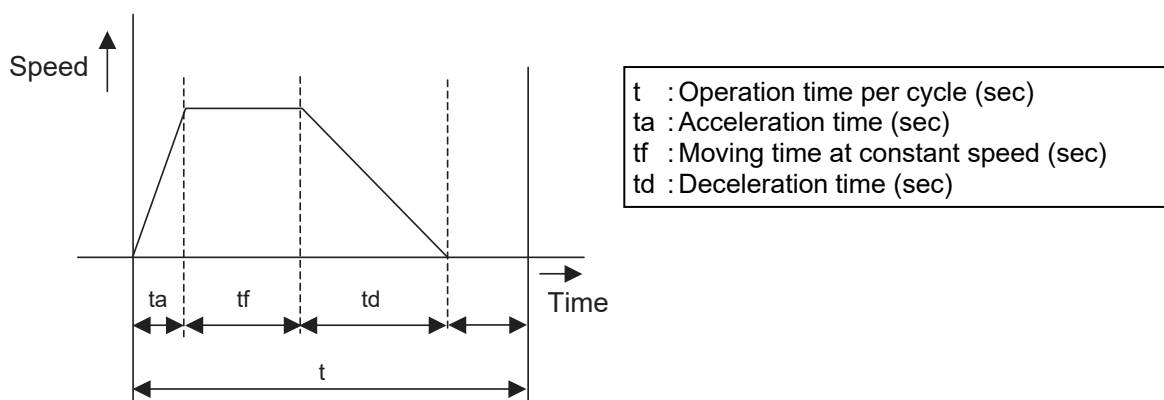
[Condition 1]

The thrust required for acceleration must not exceed the maximum thrust of the linear servo actuator.

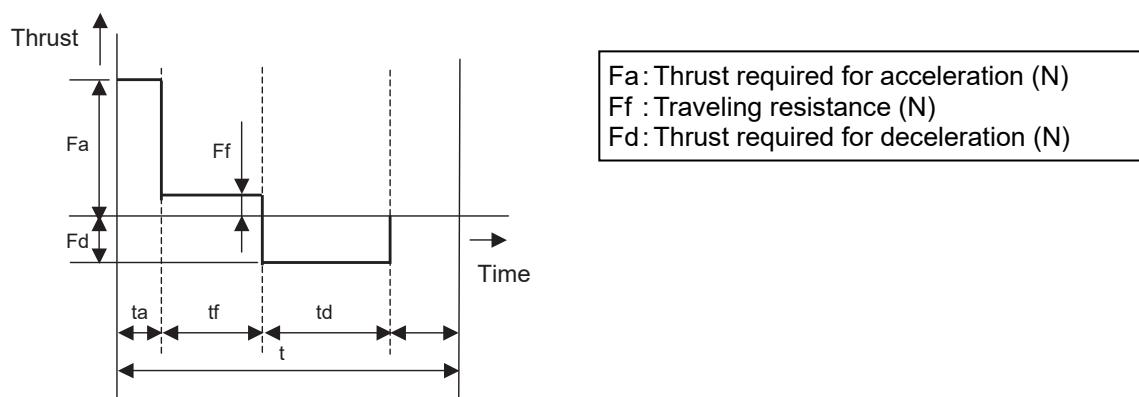
[Condition 2]

The thrust during continuous operation must not exceed the rated thrust of the 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.



1.3.2 Availability Judgment for each Operational Condition

[1] Condition 1 Judgment of Thrust Necessary for Acceleration

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

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

Here,

M : Slider weight [kg]

m : Slider payload [kg]

a : Commanded acceleration [m/s^2] (Note 1)

F_f : Traveling resistance [N]

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

[Slider weight]

• W21SS, W21SM : 10kg

• W21HS, W21HM : 20kg

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

[Traveling resistance]

The table below lists the traveling resistance of each model.

$$F_f = 20V + 70$$

V : Slider speed [m/s]

(Achieved speed is used in a triangle wave operation.)

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

• Maximum Thrusts of W21SS and W21SM : 600N

• Maximum Thrusts of W21HS and W21HM : 1200N



[2] Condition 2 Judgment of Thrust for Continuous Operation

It is necessary that the continuous operational thrust F_t considering the load and duty is smaller than the rated thrust.

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

- F_a : Thrust required for acceleration [N]
 t_a : Acceleration time [sec]
 t_d : Deceleration time [sec]
 F_f : Traveling resistance [N]
 t_f : Moving time at constant speed [sec]
 t : Operation time per cycle [sec] ($t = t_a + t_f + t_d + t_c^{*1}$)
 $*1$: T_c is 0.15 seconds.

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 (kg)
 m : Slider payload (kg)
 d : Commanded deceleration (m/s^2)
 F_f : Traveling resistance (N)

Condition 2 is satisfied if the continuous operational thrust F_t figured out as described above is smaller than the rated thrust.

- Maximum Thrusts of W21SS and W21SM : 200N
- Maximum Thrusts of W21HS and W21HM : 400N

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.

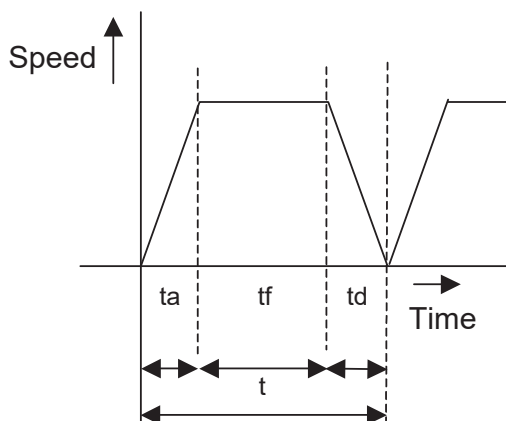
1.3.3 Example for Judging Operation Availability by Operational Conditions

[Operating conditions]

- Applicable model : W21SS and W21SM type
- Speed : 2.5m/s
- Acceleration : 29.4m/s² (The deceleration is assumed to be the same.)
- Travel : 2.5m
- Slider payload : 10kg
- The actuator moves back and forth over a stroke of 2.5m.

$$1G = 9.8m/s^2$$

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



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

- 1) Figure out the maximum thrust of Condition 1.

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

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

Here,

M : Slider weight (In the case of large models linear servo actuator W21SS and W21SM, it is 10kg.)

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

a : Commanded acceleration (m/s²) : 29.4m/s² in this example

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

From above, F_a is calculated as follows:

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

Because the maximum thrust is 600N for large models linear servo actuator W21SS and W21SM types, we can see that the maximum thrust is unacceptable.

Let's lower the specified acceleration to 19.6m/s². F_a changes as follows:

$$F_a = (20 \times 19.6 + 120) \rightarrow 512N.$$

Because the maximum thrust is 600N for large models linear servo actuator W21SS and W21SM types, we can see that the maximum thrust is acceptable.



- 2) Figure out the continuous operational thrust of Condition 2.

Substitute the operation pattern above to the continuous operational thrust formula.

Based on the examination result of maximum thrust, the specified acceleration is assumed as 19.6m/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,

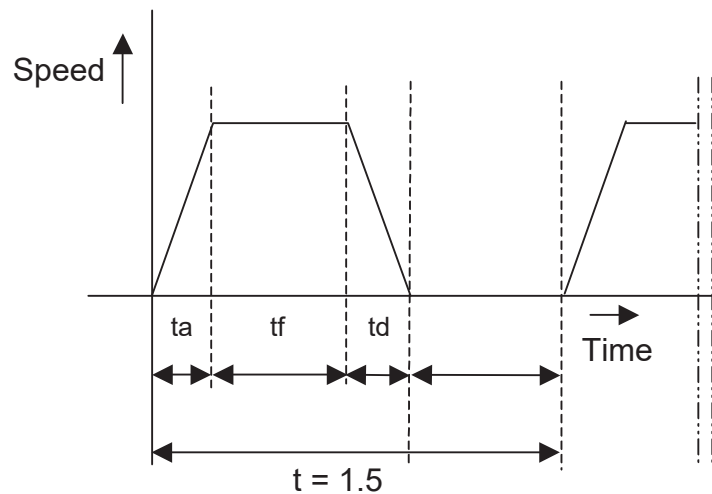
$F_a=512\text{N}$, $F_f=120\text{N}$, $F_d=272\text{N}$, $t_a=t_d=0.127\text{s}$, $t_f=0.873\text{s}$, $t=1.277\text{s}$

From the above, F_t is calculated as 208.02N .

Since this value exceeds the rated thrust 200 N of large models linear servo actuators W21SS and W21SM types, this actuator cannot be operated using the aforementioned operation pattern.

Let's lower the duty and see what happens.

Now, the above formula is calculated again based on $t = 1.5\text{s}$



This time, F_t is calculated as 191.9N .

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

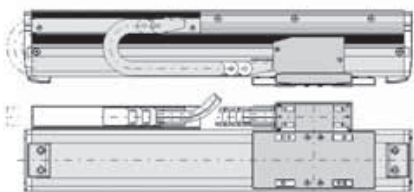
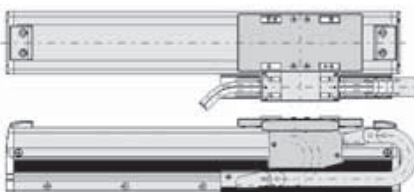
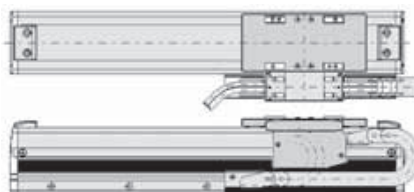
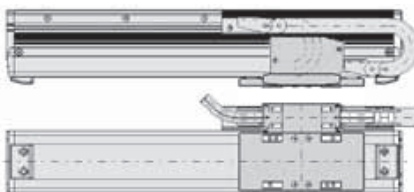
1.4 Option

1.4.1 Cable carrier Attachment Orientations 2 to 4 (Model: CT2 to CT4)

These are the attachment orientation indications with no cable carrier for user (option).
The attachment orientation of cable carrier is either the four orientations.
Refer to the table below for the availability of Single Slider and Multi Slider.

Option Model	Attachment Orientation	Single Slider	Multi Slider
None	Attachment Orientation 1	○	○
CT2	Attachment Orientation 2	○	×
CT3	Attachment Orientation 3	○	×
CT4	Attachment Orientation 4	○	×

[Attachment Orientation]

Attachment Orientation 1 (Standard)	Attachment Orientation 2 (Opposite Type) CT2
Single Slider is to be attached in the orientation shown in the figure below. Multi Slider is to be attached in the orientation shown in the figure below on both right and left sides. 	It is the opposite type in the attachment to Attachment Orientation 1 (Standard). 
Attachment Orientation 3 CT3	Attachment Orientation 4 CT4
It is the type with the home position on the opposite side from Attachment Orientation 1 (Standard). 	It is the opposite type in the attachment to and also the home position on the opposite side from Attachment Orientation 1 (Standard). 



1.4.2 Home Limit Switch (Model: L)

Home Limit Switch is equipped in standard.

For the actuators with no Home Limit Switch, "Pressing System" is adopted for the home return operation which determines the home position by detecting the Z-phase after pressing the slider to the stopper and reversing it. As this reversing operation is conducted with using proximity sensors, not by pressing, for large linear actuators, it is equipped with Home Limit Switch in standard.

For those with Home Limit Switch, it is equipped with three proximity sensors, one for home detection (HOME), another for over-travel on the side opposite the motor (+OT) and the other for over-travel on the motor side (-OT). (For HOME and -OT, it is the integrated twin sensor.)

The stroke may get shortened if the sensor is moved in large amount.

1.4.3 Hanging Bracket (Model: EB)

It is an option to enable to attach eye bolts at four places on an actuator and lift the actuator up for transportation.

There are eye bolts, attachment brackets, hex socket head cap screws and hex nuts enclosed.

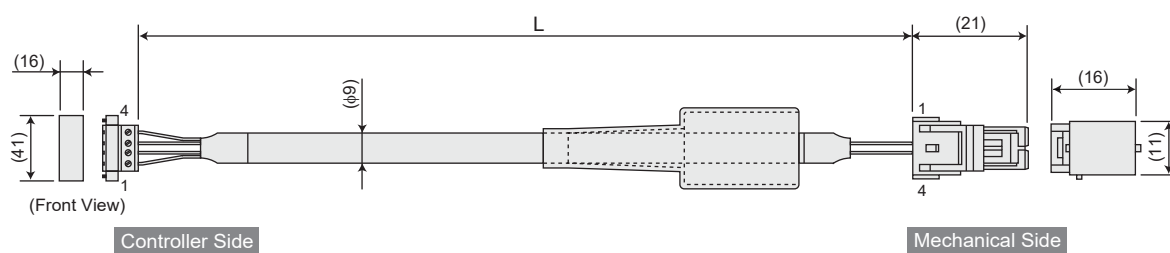
[Refer to 2.1 Transportation [1] Handling of the Actuator (3) Transportation Using Hanging Bracket]

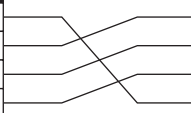
1.5 Motor • Encoder Cables

1.5.1 Cables for Connecting Between the Actuator and Controller

[1] Motor Cable (Model : CB-XMC-MA□□□)

□□□ indicates the cable length (L) (Example: 080=8m),
Max. XSEL-P/Q : 30m, SSEL and SCON : 20m



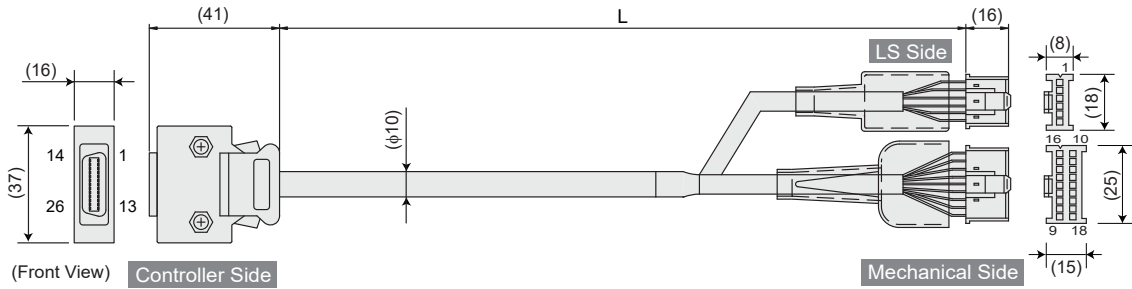
Thickness	Wiring Color	Signal Abbreviation	Pin No.		Pin No.	Signal Abbreviation	Wiring Color	Thickness
AWG 16 (1.25mm ²)	Green	PE	1		1	U	Red	AWG 16 (1.25mm ²) (Solderless)
	Red	U	2		2	V	White	
	White	V	3		3	W	Black	
	Black	W	4		4	PE	Green	

Minimum Bending Radius

When used under moving condition : 55mm
When used in fixed condition : 37mm

[2] Encoder Cable (Model : CB-X2-PLA□□□)

□□□ indicates the cable length (L) (Example: 080=8m),
Max. XSEL-P/Q : 30m, SSEL and SCON : 20m



Minimum Bending Radius

When used under moving condition : 58mm

When used in fixed condition : 38mm

Thickness	Wiring Color	Signal Abbreviation	Pin No.
AWG 26 (0.12mm ²) (Soldered)	-	-	10
	-	-	11
	White/Orange	E24V	12
	White/Green	0V	13
	Brown/Blue	LS	26
	Brown/Yellow	CREEP	25
	Brown/Red	OT	24
	Brown/Black	RSV	23
	-	-	9
	-	-	18
	-	-	19
	White/Blue	A +	1
	White/Yellow	A -	2
	White/Red	B +	3
	White/Black	B -	4
	White/Purple	Z +	5
	White/Gray	Z -	6
	Orange	SRD +	7
	Green	SRD -	8
	Purple	BAT +	14
	Gray	BAT -	15
	Red	VCC	16
	Black	GND	17
	Blue	BKR -	20
	Yellow	BKR +	21
	-	-	22
The shield is clamped to the hood			
Ground wire and braided shield wires			

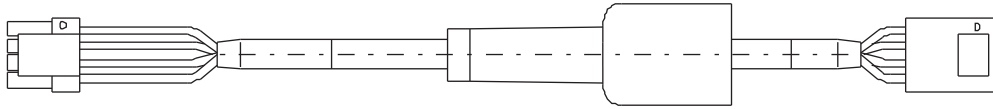
Pin No.	Signal Abbreviation	Wiring Color	Thickness
1	E24V	White/Orange	AWG 26 (0.12mm ²) (Solderless)
2	0V	White/Green	
3	LS	Brown/Blue	
4	CREEP	Brown/Yellow	
5	OT	Brown/Red	
6	RSV	Brown/Black	

Pin No.	Signal Abbreviation	Wiring Color	Thickness
1	A	White/Blue	AWG 26 (0.12mm ²) (Solderless)
2	A	White/Yellow	
3	B	White/Red	
4	B	White/Black	
5	Z	White/Purple	
6	Z	White/Gray	
7	-	-	
8	-	-	
9	FG	Ground	
10	SD	Orange	
11	SD	Green	
12	BAT+	Purple	
13	BAT-	Gray	
14	VCC	Red	
15	GND	Black	
16	-	-	
17	BK-	Blue	
18	BK+	Yellow	

(White/blue in cable color indicates the colors of line/insulator.)

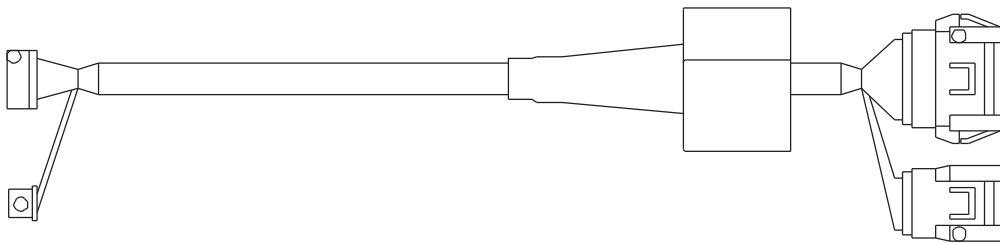
1.5.2 Cable in the Cable carrier

[1] Motor Cable



Thickness	Wiring Color	Signal Abbreviation	Pin No.	Pin No.	Signal Abbreviation	Wiring Color	Thickness
AWG 16 (1.25mm ²) (Solderless)	Red	U	1	1	U	Red	AWG 16 (1.25mm ²) (Solderless)
	White	V	2	2	V	White	
	Black	W	3	3	W	Black	
	Green	PE	4	4	PE	Green	

[2] Encoder Cable



Thickness	Wiring Color	Signal Abbreviation	Pin No.	Pin No.	Signal Abbreviation	Wiring Color	Thickness
AWG 26 (0.12mm ²)	1B/Sky Blue	EN_A	1	1	EN_A	1B/Sky Blue	AWG 26 (0.12mm ²)
	1R/Sky Blue	EN_/A	2	2	EN_/A	1R/Sky Blue	
	1B/Pink	EN_B	3	3	EN_B	1B/Pink	
	1R/Pink	EN_/B	4	4	EN_/B	1R/Pink	
	1B/Light Green	EN_Z	5	5	EN_Z	1B/Light Green	
	1R/Light Green	EN_/Z	6	6	EN_/Z	1R/Light Green	
	1B/Orange	SD	7	7	NC		
	1R/Orange	/SD	8	8	NC		
	1B/Gray	5V	9	9	FG	Shield	
	-	NC	10	10	SD	1B/Orange	
	1R/Gray	GND	11	11	/SD	1R/Orange	
	Shield	FG	12	12	NC		
AWG 26 (0.12mm ²)	2R/Sky Blue	24V	1	1	24V	2R/Sky Blue	AWG 26 (0.12mm ²)
	2B/Pink	0V	2	2	0V	2B/Pink	
	2R/Pink	LS	3	3	LS	2R/Pink	
AWG 26 (0.12mm ²)	-	-	4	4	NC	-	
	-	-	5	5	NC	-	
	-	-	6	6	NC	-	



INTELLIGENT ACTUATOR

2. Installation

2.1 Transportation

 **Warning:** 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 30cm of the actuator.

[1] Handling of the Actuator

Unless otherwise specified, the actuator is shipped with 1 axis unit packaged separately.

(1) Handling the Packed Unit

- Do not damage or drop. The package is not applied with any special treatment that enables it to resist an impact caused by a drop or crash.
- Transport a heavy package with at least more than two operators. Consider an appropriate method for transportation.
- Keep the unit in a horizontal orientation when placing it on the ground or transporting. Follow the instruction if there is any for the packaging condition.
- Do not step or sit on the package.
- Do not put any load that may cause a deformation or breakage of the package.

(2) Handling the Actuator After Unpacking

- Do not carry the actuator by its motor unit or its cable or attempt to move it by pulling the cable.
- Hold the base part or bracket part of the body when transporting the actuator main body.
- Do not hit or drop the actuator during transportation.
- Do not attempt to force any part of the actuator. Do not apply force especially on the stainless steel sheet.

[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 carrier.

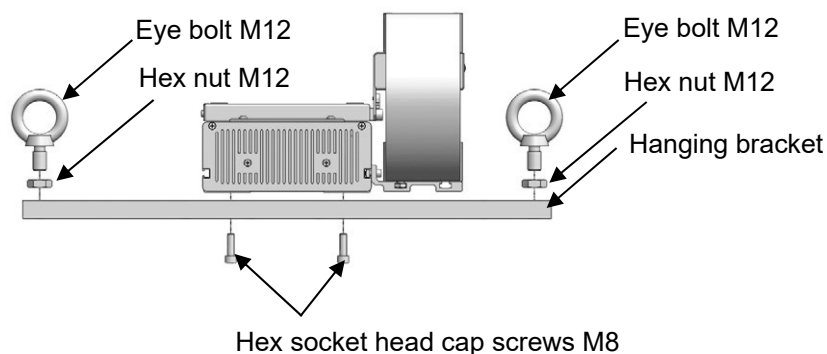


Do not transport the actuator by holding its stainless sheet.

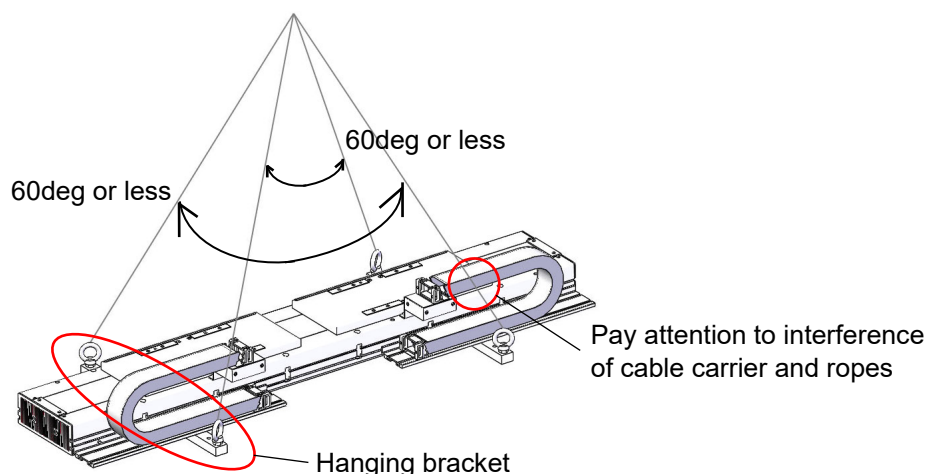
(3) Transportation Using Hanging Bracket (Option model : EB)

Subject Models : LSA-W21SS/W21SM/W21HS/W21HM

When handling an actuator after taking it out of the package, attach the enclosed eyebolts to the hanging brackets installed on the body and lift it up on a crane using four points of brackets with four ropes. Perform transportation following the caution note in the next page. After transportation, detach the hex socket head cap screws M8 to take off the hanging bracket.



- Pay attention to the actuator balance during transportation, and carry it calmly without apply vibration or impact.
- In case the carried actuator has dropped, becoming crushed under it could cause serious injury. Do not attempt to go under the hanged load.
- Use a hoist and ropes capable enough with margin to carry the actuator weight.
* Hoist : A small device used for lifting or lowering a load or transporting a load by means of a lift-wheel
- Keep the hanging angle at 60deg or less when lifting.
- Make sure that an operator who has appropriate certificates operate the transportation when equipment or method that requires specific qualifications is necessary.
- Affix cables so they would not get pinched.



[Enclosure]

Components	Quantity
Eye bolt M12	4
Hex nut M12	4

[How to Attach Eye bolt]

Attach the eyebolts at the four points following the procedures below.

(1) Move the slider to the center.

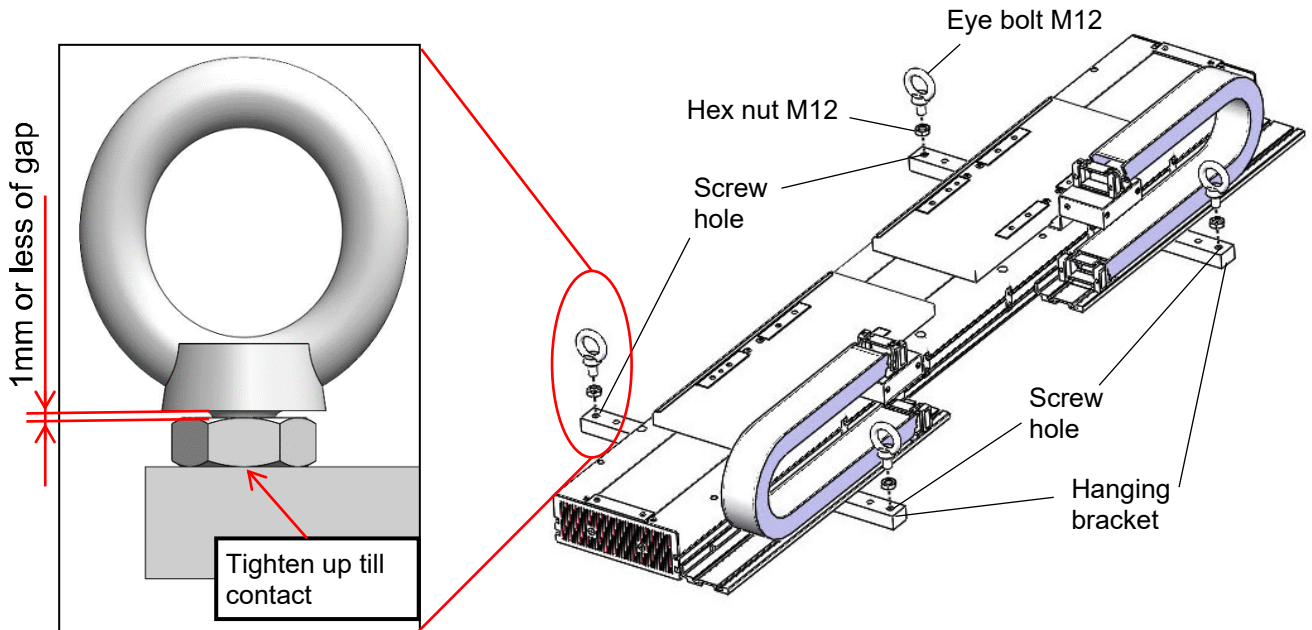
(2) Using hex nuts, affix the eyebolts on the hanging bracket.

At this time, affix them in the gist of double nut.

Tighten the hex nut so the gap between the eyebolt seat and the hex nut comes to 1mm or less.

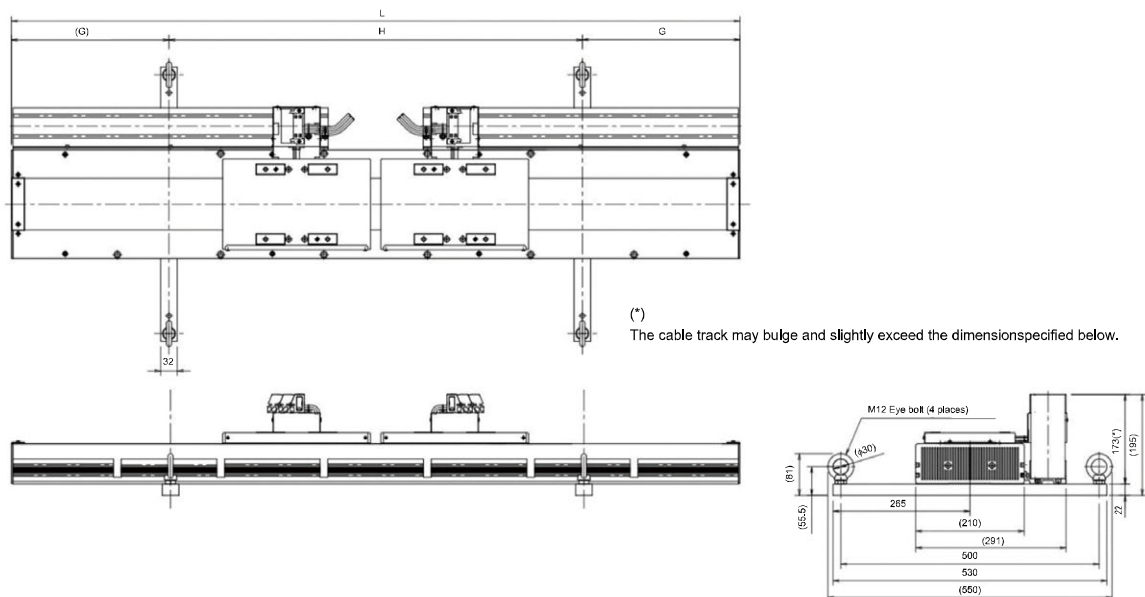
Tighten them up till the hex nuts and the bracket contact with each other.

Adjust the orientation of the eye bolt as required.



[Dimensions with Hanging Brackets Attached]

◆ LSA-W21SS/W21SM/W21HS/W21HM



Stroke (mm)	W21SS	Single	1050	1185	1320	1455	1590	1725	1860	1995	2130	2265	2400	2535	2670	2805	2940
	W21SM	Multi	730	865	1000	1135	1270	1405	1540	1675	1810	1945	2080	2215	2350	2485	2620
	W21HS	Single	895	1030	1165	1300	1435	1570	1705	1840	1975	2110	2245	2380	2515	2650	2785
	W21HM	Multi	420	555	690	825	960	1095	1230	1365	1500	1635	1770	1905	2040	2175	2310
L (mm)			1410	1545	1680	1815	1950	2085	2220	2355	2490	2625	2760	2895	3030	3165	3300
G (mm)			305	372.5	440	307.5	375	442.5	510	577.5	445	512.5	580	647.5	715	782.5	650
H (mm)			800	800	800	1200	1200	1200	1200	1200	1600	1600	1600	1600	1600	1600	2000
Used Rope Length (mm)			2500														

Stroke (mm)	W21SS	Single	3075	3210	3345	3480	3615	3750	3885	4020	4155
	W21SM	Multi	2755	2890	3025	3160	3295	3430	3565	3700	3835
	W21HS	Single	2920	3055	3190	3325	3460	3595	3730	3865	4000
	W21HM	Multi	2445	2580	2715	2850	2985	3120	3255	3390	3525
L (mm)			3435	3570	3705	3840	3975	4110	4245	4380	4515
G (mm)			717.5	785	852.5	920	787.5	855	922.5	990	1057.5
H (mm)			2000	2000	2000	2000	2400	2400	2400	2400	2400
Used Rope Length (mm)			2500								

* Weight When Hanging Bracket Option Selected: Actuator Weight + 6.3kg

[2] Handling in the Assembled Condition

This is the case when the product is delivered from our factory under a condition that it is assembled with other actuators. The combined axes are delivered in a package that the frame is nailed on the lumber base. The sliders are fixed so they would not accidentally move. The actuators are also fixed so the tip of it would not shake due to the external vibration.

(1) How to Handle the Package

- Do not hit or drop the package. No special treatment is conducted on this package to endure a drop or impact on it.
- Do not attempt to carry a heavy package with only one worker. Also, have an appropriate method for transportation.
- When hanging up with ropes, support on the reinforcement frame on the bottom of the lumber base. When bringing up the package with a forklift, also support on the bottom of the lumber base.
- Handle with care when putting the package down to avoid impact or bounce. Hanging bracket
- Do not step on the package.
- Do not put anything on the package that could deform or damage it.

(2) How to Handle after Unpackaged

- Fix the slider so they would not accidentally move during transportation.
- If the tip of an actuator is overhanging, have an appropriate way to fix it to avoid shake due to the external vibration. In the transportation without the tip being fixed, do not apply any impact with 0.3G or more.
- When hanging up with ropes, have appropriate cushioning to avoid any deformation of the actuator body. Also keep it in stable horizontal orientation. Make a fixture utilizing the attachment holes and the tapped holes on the actuator body if necessary.
- Do not attempt to apply load on the actuators or the connector box. Also pay attention not to pinch cables and bend or deform them forcefully.

[3] Handling in Condition of being assembled in Machinery Equipment (System)

These are some caution notes for when transporting the actuator being assembled in the machinery equipment (system):

- Fix the slider so it would not move during transportation.
- If the tip of an actuator is overhanging, have an appropriate way to fix it to avoid shake due to the external vibration. In the transportation without the tip being fixed, do not apply any impact with 0.3G or more.
- When hanging up the machinery equipment (system) with ropes, do not attempt to apply load on the actuators or the connector box. Also pay attention not to pinch cables and bend or deform them forcefully.

2.2 Installation and Storage • Preservation Environment

[1] Installation Environment

The actuator should be installed in a location other than those specified below.
Also provide sufficient work space required for maintenance inspection.

- Where the actuator receives radiant heat from strong heat sources such as heat treatment furnaces
- Where the ambient temperature exceeds the range of 0 to 40°C
- Where the temperature changes rapidly and condensation occurs
- Where the relative humidity exceeds 85% RH
- Where the actuator receives direct sunlight
- Where the actuator is exposed to corrosive or combustible gases
- Where the ambient air contains a large amount of powder dust, salt or iron (at level exceeding what is normally expected in an assembly plant)
- Where the actuator is subject to splashed water, oil (including oil mist or cutting fluid) or chemical solutions
- Where the actuator receives impact or vibration

If the actuator is used in any of the following locations, provide sufficient shielding measures:

- Where noise generates due to static electricity, etc.
- Where the actuator is subject to a strong electric or magnetic field
- Where the actuator is subject to ultraviolet ray or radiation

[2] Storage • Preservation Environment

- The storage and preservation environment should comply with the same standards as those for the installation environment. In particular, when the machine is to be stored for a long time, pay close attention to environmental conditions so that no dew condensation forms.
- Unless specially specified, moisture absorbency protection is not included in the package when the machine is delivered. In the case that the machine is to be stored and preserved in an environment where dew condensation is anticipated, take the condensation preventive measures from outside of the entire package, or directly after opening the package.
- For storage and preservation temperature, the machine withstands temperatures up to 60°C for a short time, but in the case of the storage and preservation period of 1 month or more, control the temperature to 50°C or less.
- Storage and preservation should be performed in the horizontal condition. In the case it is stored in the packaged condition, follow the posture instruction if any displayed on the package.

2.3 How to Install

 **Warning:** 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 30cm of the actuator.

This chapter explains how to install the actuator on your mechanical system.

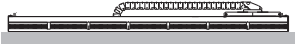
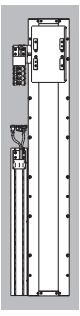
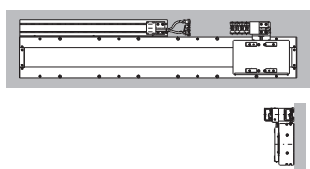
2.3.1 Installation

Follow the information below when installing the actuator, as a rule.
Do pay attention to these items (except with custom-order models).

○ : Available △ : Daily inspection is mandatory × : Not available

Horizontal installation	Vertical installation	Horizontally Oriented Wall Mount installation	Ceiling Mount installation
○	×	×	×

Installation Orientation

Horizontal	Vertical	Horizontally Oriented Wall Mount	Ceiling Mount
			

2.3.2 Installation of Main Unit

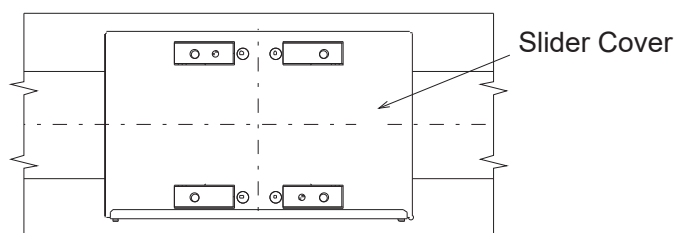
Caution: The stainless steel sheet is designed very thin (thickness: 0.1 mm) in order to ensure flexibility. Therefore, the stainless steel sheet is easily dented or scratched.
When installing the stainless steel sheet, pay attention to the following points:

1. Do not press the sheet directly with hands.



2. Be careful not to drop a tool or a work piece on the sheet and make a dent mark.
3. Do not generate powder dust or iron powder around the stainless steel sheet. There are magnets attached on the side cover to grip the stainless steel sheet. Handle the product with special care so the magnets would not grip metal pieces and dusts.
If dust/powder has generated, thoroughly remove attached dust/powder from the stainless steel sheet after the operation.
If the actuator is operated with the stainless steel 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.

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



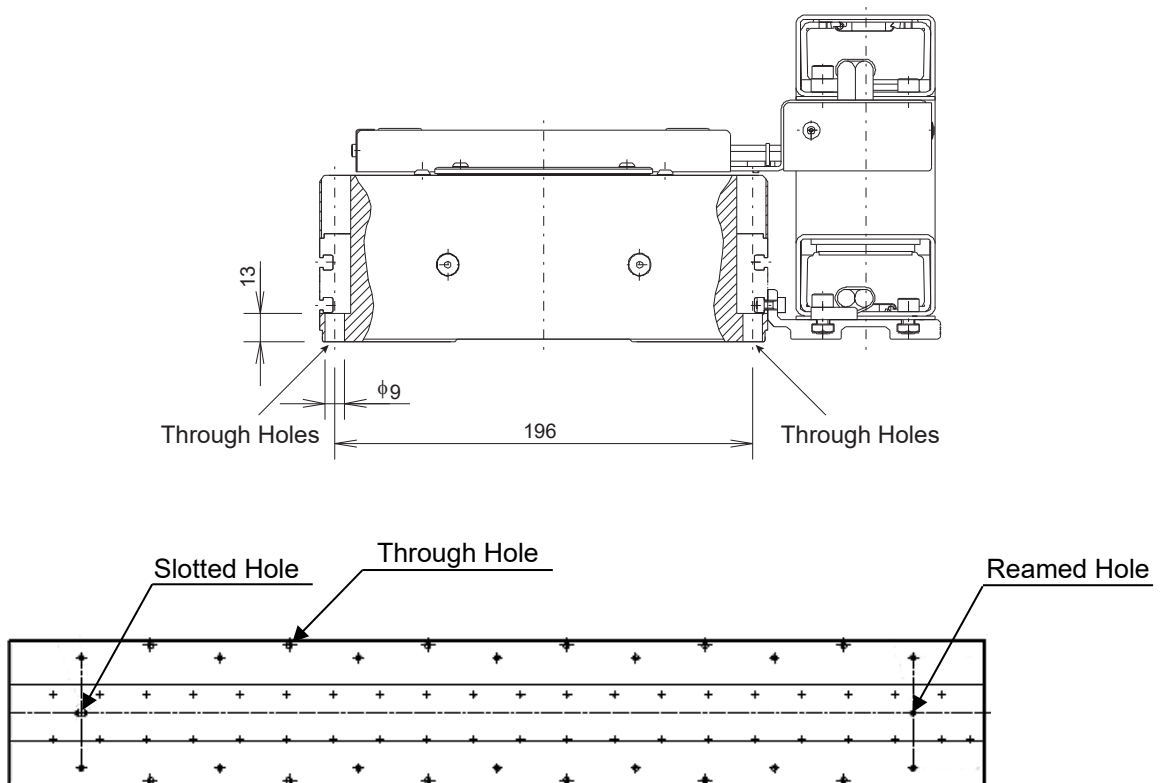
The surface to mount the main unit should be a machined surface or a plane that possesses an equivalent accuracy and the flatness should be within 0.05mm/m.

The side surfaces and bottom surface of the base of the body have good parallelism to the guide. Utilize these surfaces when accuracy in the actuator drive is required.

[1] Installation from Top Side

This actuator is equipped with through holes for attachment so it can be fixed at the top side. (Refer to the figures below and 8. External Dimensions.)

Additionally, the reamed holes and slotted holes for the positioning pins are provided



Screw		Tightening Torque	Through Hole [mm]	Reamed Hole [mm]
M8	Should use dedicated washer	14N·m (1.43kgf·m)	φ9, depth 13	φ8H7, depth 5

About Tightening Screws

- Use a hex socket head cap bolt for the attachment to the base.
- It is recommended to use high-tensile bolts with ISO-10.9 or more.
- Make sure to have the effective length of bolt engagement described below or more for the tightening of a bolt and a female screw.

When female screw is on steel → Thread length same as nominal diameter

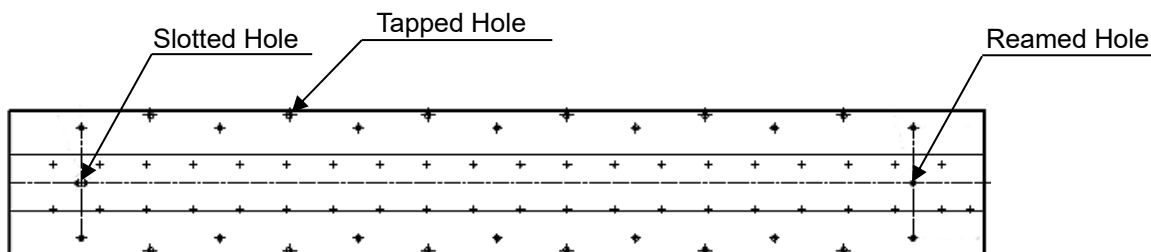
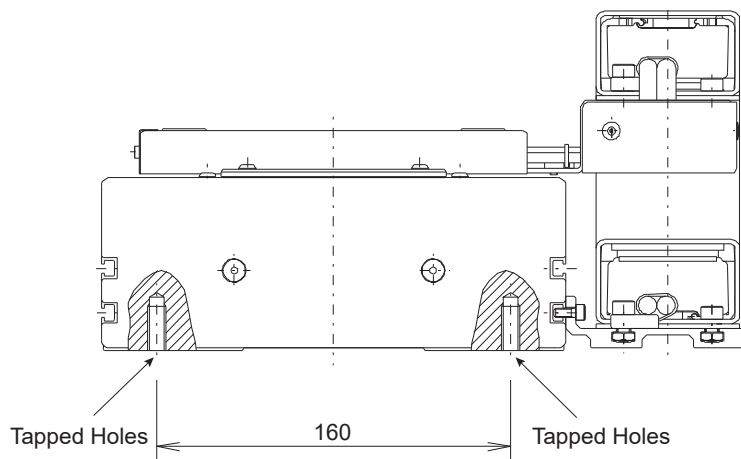
When female screw is on aluminum → Thread length 1.8 times longer than nominal diameter

Caution: Pay special attention when selecting the bolt length. In case that an inappropriate length of a bolt is applied, it may cause damage on the tapped holes or insufficiency in attachment strength, which may result in a drop in the operation accuracy or an unexpected accident.

[2] Installation from Back Side

This actuator is equipped with tapped holes for attachment so it can be fixed at the back side.
(Refer to the figures below and 8. External Dimensions.)

Additionally, the reamed holes and slotted holes for the positioning pins are provided



Tapped Hole Size	Tapped Holes Depth	Tightening Torque		Reamed Hole [mm]
		In the case that steel is used for the bolt seating surface:	In the case that aluminum is used for the bolt seating surface:	
M8	8mm or more 20mm or less	31.3N·m (31.9kgf·m)	14N·m (1.43kgf·m)	φ8H7, depth 5

About Tightening Screws

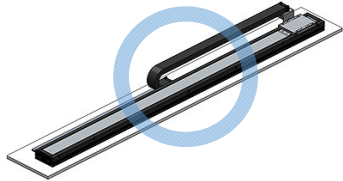
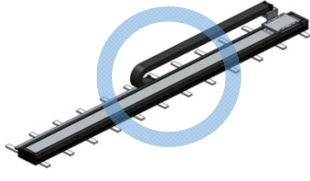
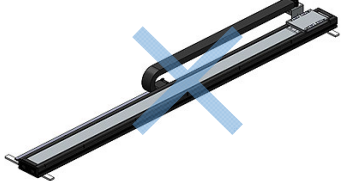
- Use a hex socket head cap bolt for the attachment to the base.
- It is recommended to use high-tensile bolts with ISO-10.9 or more.
- Make sure to have the length of at least 1.8 times to the nominal diameter for the effective length of screw engagement for the tightening of a bolt and a female screw.



Caution: Pay special attention when selecting the bolt length. In case that an inappropriate length of a bolt is applied, it may cause damage on the tapped holes or insufficiency in attachment strength, which may result in a drop in the operation accuracy or an unexpected accident.

◎ Caution for Installation of Main Unit

- Basically, all of the through holes or tapped holes should be used in order to hold on the whole area.
- In case that the accuracy in drive is not required, it is available to make foot brackets to hold the unit. In this case also, all the through holes or tapped holes are to be used to hold the unit.
- Do not attempt to hold only on ends. It could make the base warped and sliding resistance may get high on ends. It could cause an error.

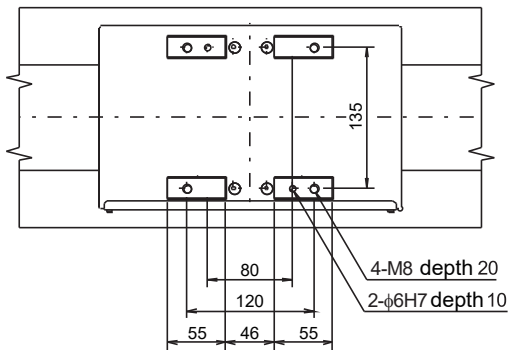
Hold on Whole Area Use All of Through Holes or All of Tapped Holes	Hold with Foot Brackets Use All of Through Holes or All of Tapped Holes	Hold Only on Ends
		

2.3.3 Attachment of Transported Object

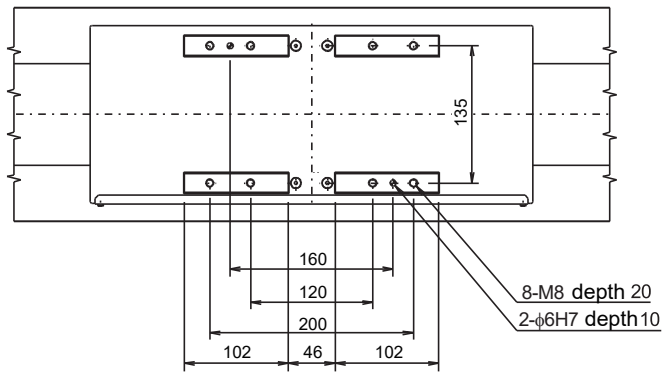
- There are tapped holes on the top surface of the slider. Affix the work part (transported object) here.
- The procedure to affix a load on the slider shall conform to the actuator installation procedure.
- There are two reamed holes on the top surface of the slider. Use these reamed holes if repeatability of attaching and detaching is required. Also, if small tuning such as perpendicularity is required, use one of the reamed holes for the tuning.
- Refer to the following figure for the screwed depth and reamed depth. Screwing further than indicated in the figure may destroy the tapped hole or lower the reinforcement of the attachment of the work part, result in the drop of the accuracy or an unexpected accident.

 **Caution:** Keep the screw-in depth to 20mm or less. If the screw is inserted exceeding this depth, it will damage the actuator, such as causing scratches on the side cover.

[W21SS, W21SM]



[W21HS, W21HM]



About Tightening Screws

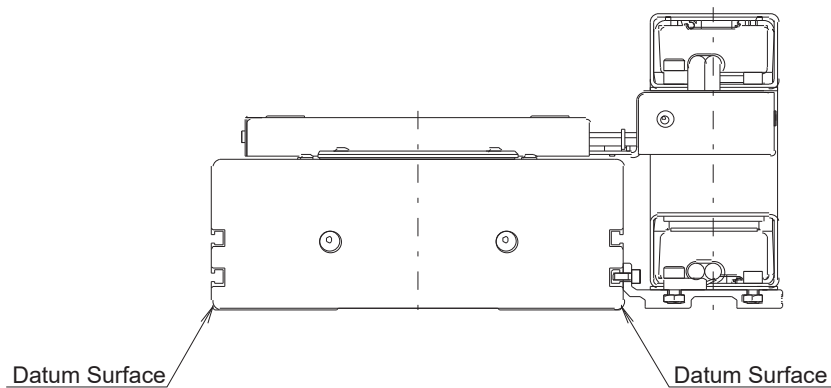
- Use a hex socket head cap bolt for the attachment to the base.
- It is recommended to use high-tensile bolts with ISO-10.9 or more.
- Make sure to have the length of at least 1.8 times to the nominal diameter for the effective length of screw engagement for the tightening of a bolt and a female screw.

 **Caution:**

- Pay attention at screw selection. If a screw with inappropriate length is used, it may cause damage on the tapped holes, insufficient mounting strength of actuator or interference of driving part, which may result in drop of accuracy or cause of an accident.
- When installing the load, do not let viscous substances such as adhesives and paints attach to the stainless steel 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.

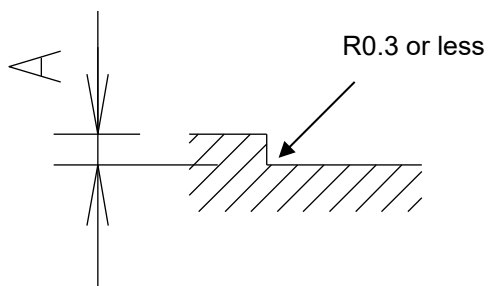
2.3.4 Installation Surface

- For the platform to install the actuator, ensure the structure that possesses enough stiffness to avoid vibration being generated.
- Install the actuator on a machined surface or other flat surface of equivalent accuracy. The flatness of the installation surface must be 0.05mm/m or less.
- Provide sufficient space to allow for maintenance work.
- The side and bottom surfaces of the actuator base provide datum surfaces used for alignment of slider travel.
- If you require higher traveling accuracy, install the actuator using these datum surfaces.



As shown above, each side surface of the base provides a datum 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 datum surfaces, provide the necessary machining by following the drawing below.



Dimension A [mm]
2 to 3.5 or less



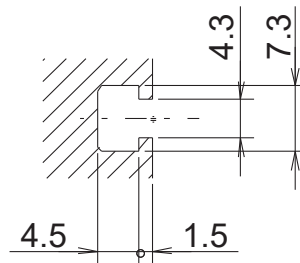
2.3.5 Mount of Connector Box and Others

There is a T-groove equipped on the side of the body for the models below so an external device such as a connector box can be mounted.

T-groove size
M4

If you are using a wiring kit, install a connector box using these T-grooves. T-grooves can also be used for other purposes, such as installing sensors or securing cables. The T-groove dimensions are specified below.

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





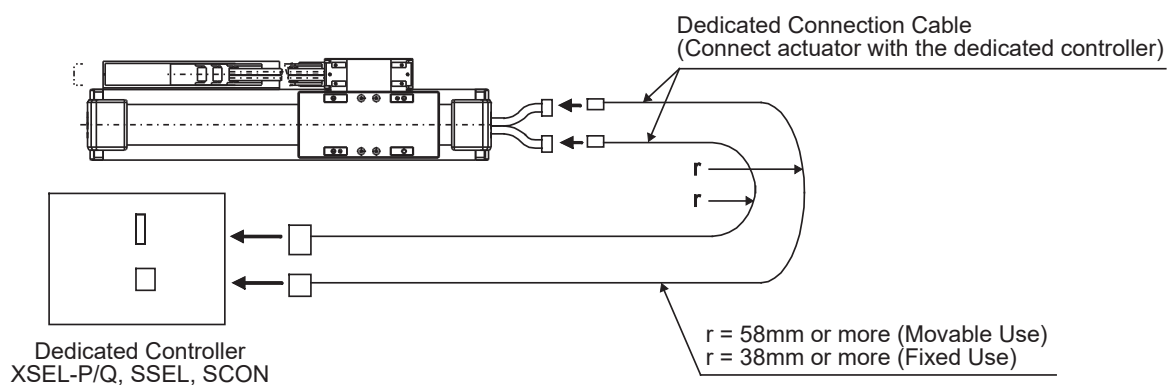
INTELLIGENT ACTUATOR

3. Connecting with the Controller

Use the IAI dedicated connection cable for the connection of the actuator to the controller.

- If the dedicated connection cable cannot be secured, reduce the load on the cable by allowing it to deflect only by the weight of the cable or wire it in a self-standing cable hose, etc., having a large radius.
- Do not cut and reconnect the dedicated connection cable for extension or shorten the cable.
- Do not pull on the dedicated connection cable or bend it forcibly.
- The actuator cable coming out of the motor unit is not meant to be bent. Fix the cable so it would not be bent repeatedly.

Please consult with IAI if you require a different kind of cable than the one supplied.



Dedicated cables

- Motor Cable CB-XMC-MA□□□
- Encoder Cable CB-X2-PLA□□□

□□□ indicates the cable length.

30m at the maximum can be applied to XSEL-P/Q.

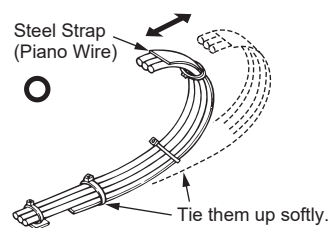
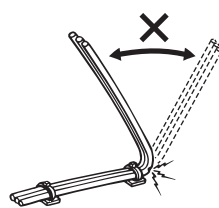
20m at the maximum can be applied to SSEL and SCON.

Example) 080 = 8m

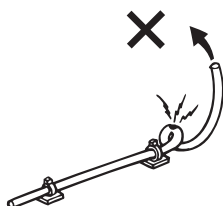


Warning: For wiring, please follow the warnings stated below. When constructing a system as the machinery equipment, pay attention to the wiring and connection of each cable so they are conducted properly. Not following them may cause not only a malfunction such as cable breakage or connection failure, or an operation error, but also electric shock or electric leakage, or may even cause a fire.

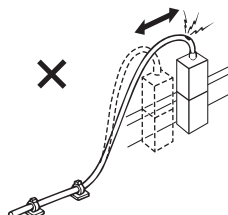
- Use dedicated cables of IAI indicated in this Instruction manual. Contact us if you wish to have a change to the specifications of the dedicated cables.
- Make sure to turn the power off in the process of power line or cable connection or disconnection.
- Do not attempt to cut a dedicated cable with connectors on both ends to extend, shorten or re-joint it.
- Hold the dedicated cable to avoid mechanical force being applied to the terminals and connectors.
- Use a cable pipe or duct to have an appropriate protection when there is a possibility of mechanical damage on a dedicated cable.
- In case a dedicated cable is to be used at a moving part, make sure to lay out the cable without applying any force to pull the connector or extreme bend on the cable. Do not attempt to use the cable with a bending radius below the allowable value.
- Make certain that the connectors are plugged properly. Insufficient connection may cause an operation error, thus it is extremely risky.
- Do not lay out the cables to where the machine runs over them.
- Pay attention to the cable layout so it would not hit peripherals during an operation. In case it does, have an appropriate protection such as a cable carrier.
- When a cable is used hanging on the ceiling, prevent an environment that the cable swings with acceleration or wind velocity.
- Make sure there is not too much friction inside the cable storage equipment.
- Do not apply radiated heat to power line or cables.
- Have a sufficient radius for bending, and avoid a bend concentrating on one point.



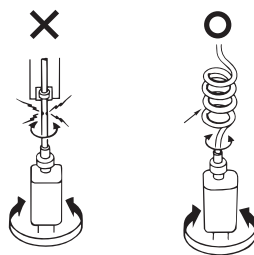
- Do not let the cable bend, kink or twist.



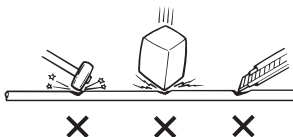
- Do not pull the cable with a strong force.



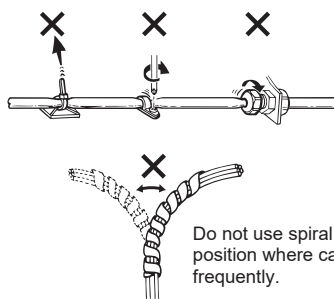
- Pay attention not to concentrate the twisting force to one point on a cable.



- Do not pinch, drop a heavy object onto or cut the cable.

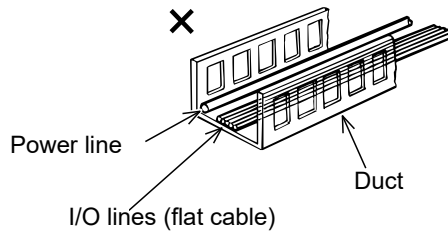


- When a cable is fastened to affix, make sure to have an appropriate force and do not tighten too much.





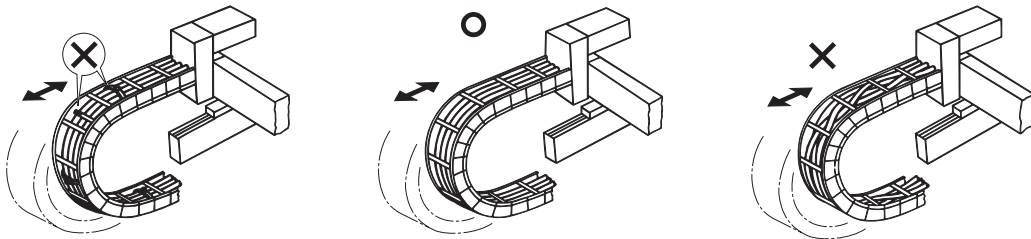
- PIO line, communication line, power and driving lines are to be put separately from each other and do not tie them together. Arrange so that such lines are independently routed in the duct.



Follow the instructions below when using a cable carrier.

- If there is an indication to the cable for the space factor in a cable carrier, refer to the wiring instruction given by the supplier when storing the cable in the cable carrier.
- Avoid the cables to get twined or twisted in the cable carrier, and also to have the cables move freely and do not tie them up. (Avoid tension being applied when the cables are bent.)

Do not pile up cables. It may cause faster abrasion of the sheaths or cable breakage.



4. Operation

4.1 Home Return

4.1.1 Principle of Home Return Operation

[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) During home return, the mechanical end is detected via the software.
- 3) The actuator reverses upon contacting the mechanical end, after which it detects a Z phase signal and recognizes 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.

4.1.2 Fine-tuning the Home Position

The actuator is shipped with its motor travel after the actuator contacts the stopper 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 contacts the stopper and reverses, until it stops at the home position.

Reversing distance from mechanical stopper
Approx.7mm

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 1mm, also adjust the soft limits.

4.1.3 Changing the Home Direction

Changing the factory-set home direction after the delivery requires the moving direction parameter to be changed and the encoder readjusted. 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.

4.2 Caution for Stainless Steel Sheet

The stainless steel sheets are 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 steel 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 steel 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 steel sheet may cause the affected part to deform and create various problems. Also, do not grip or hold the stainless steel sheet when installing or transporting the actuator, as it may damage the sheet.

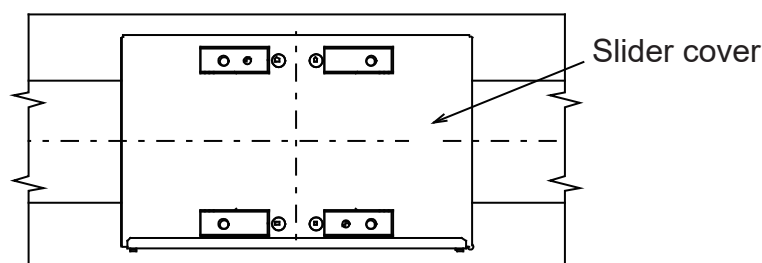
Do not press the sheet directly with hands.



- Be careful not to let a tool or work drop onto the actuator to dent the exterior of the actuator.

4.3 Caution regarding Slider Cover

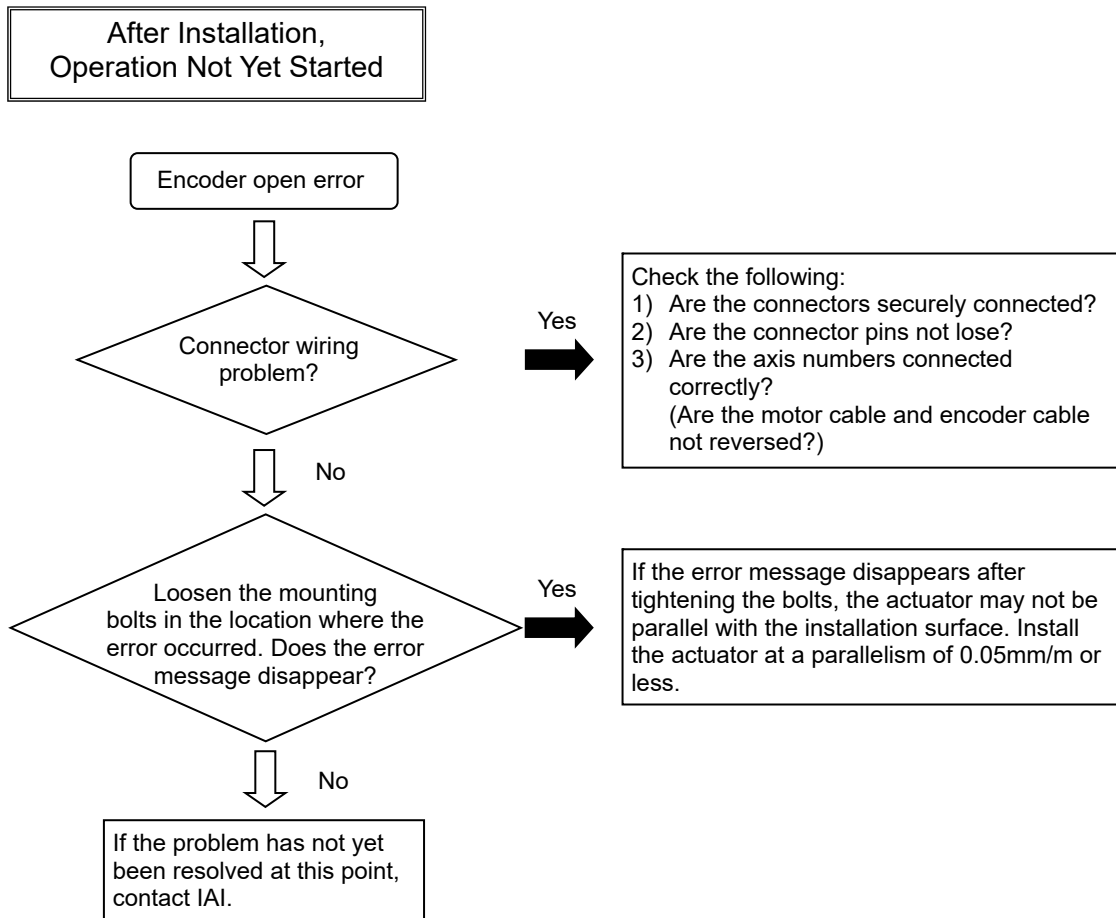
Do not apply force on the slider cover. It may cause interference and other damages.

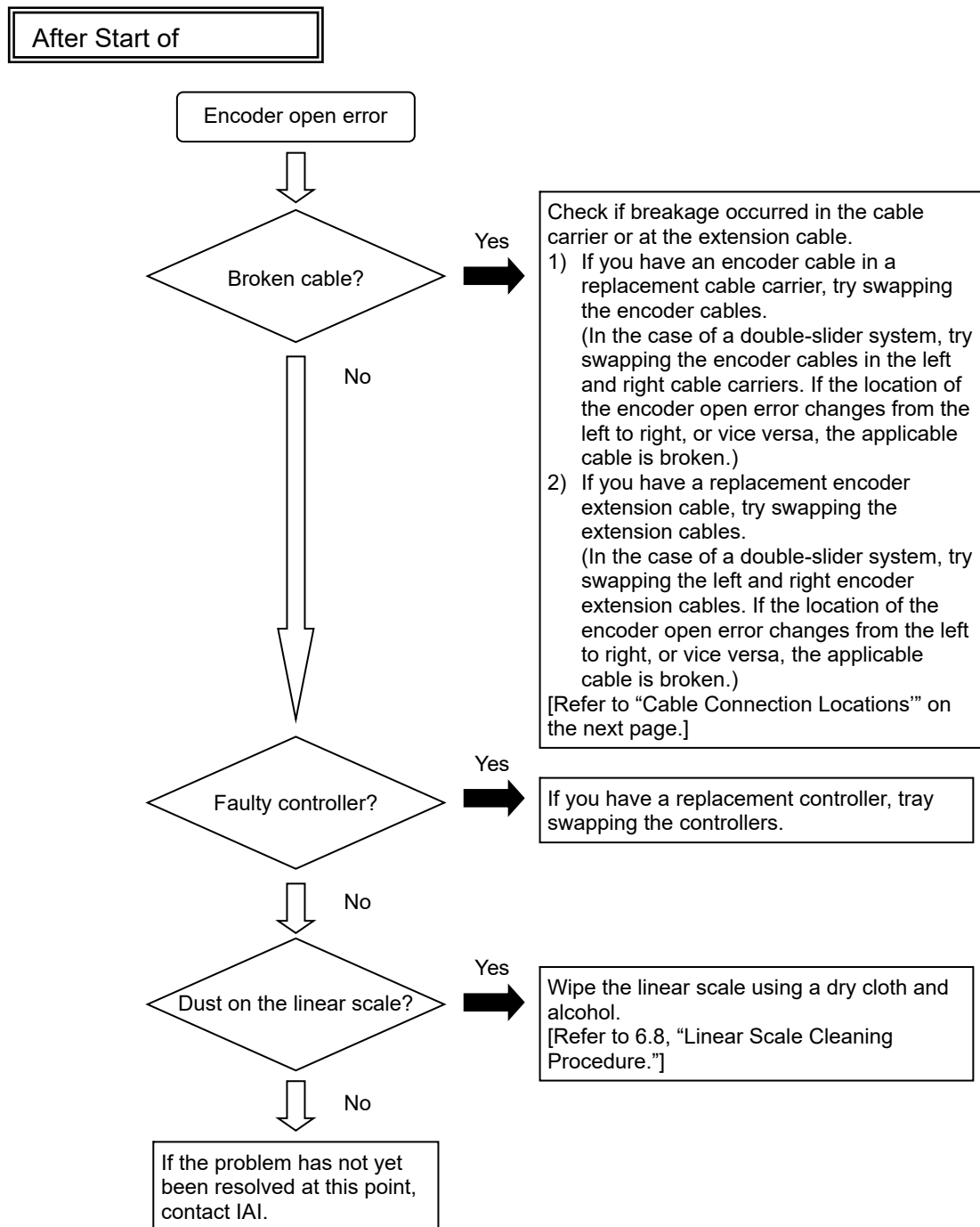


5. Troubleshooting

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.

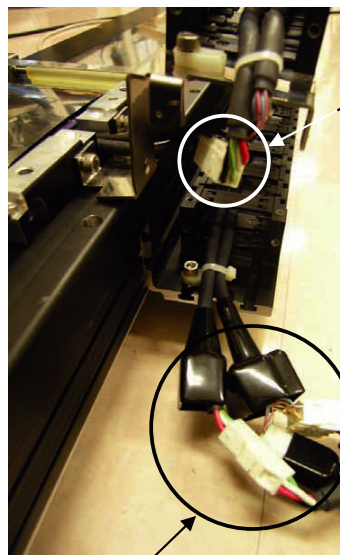
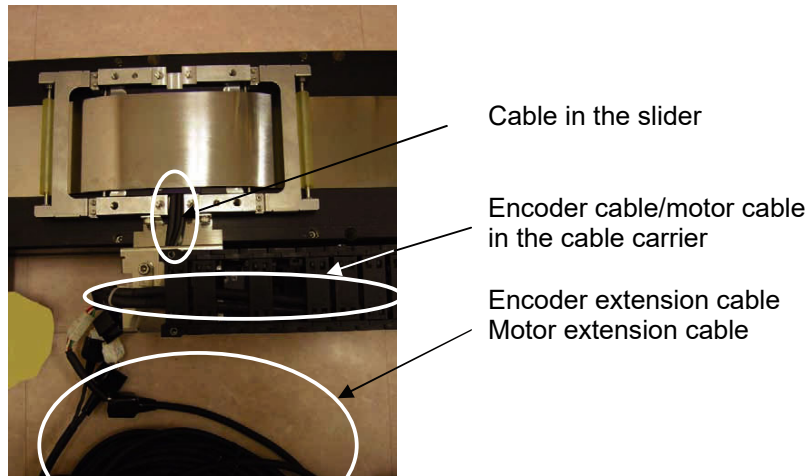
5.1 Encoder Open Error (Error Code: D12)



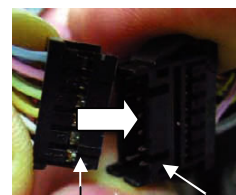


Cable Connection Locations

The connection locations of cables on the large linear servo actuator are shown below.

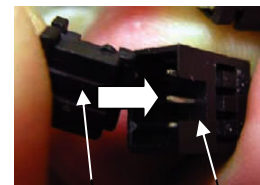


Location where the cable in the slider is connected to the encoder cable/motor cable in the cable carrier (The cables are connected in the case. Remove the case cover to access the connection location.)



Projection

Cutout

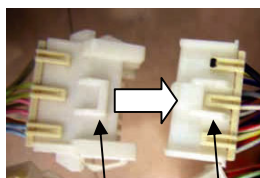


Projection

Cutout

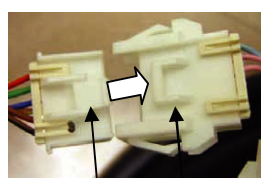
(Note) One side of each connector has a cutout in the case of a male connector, or a projection in the case of a female connector. Insert the male connector into the female connector after confirming the connecting direction.

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



Projection

Projection

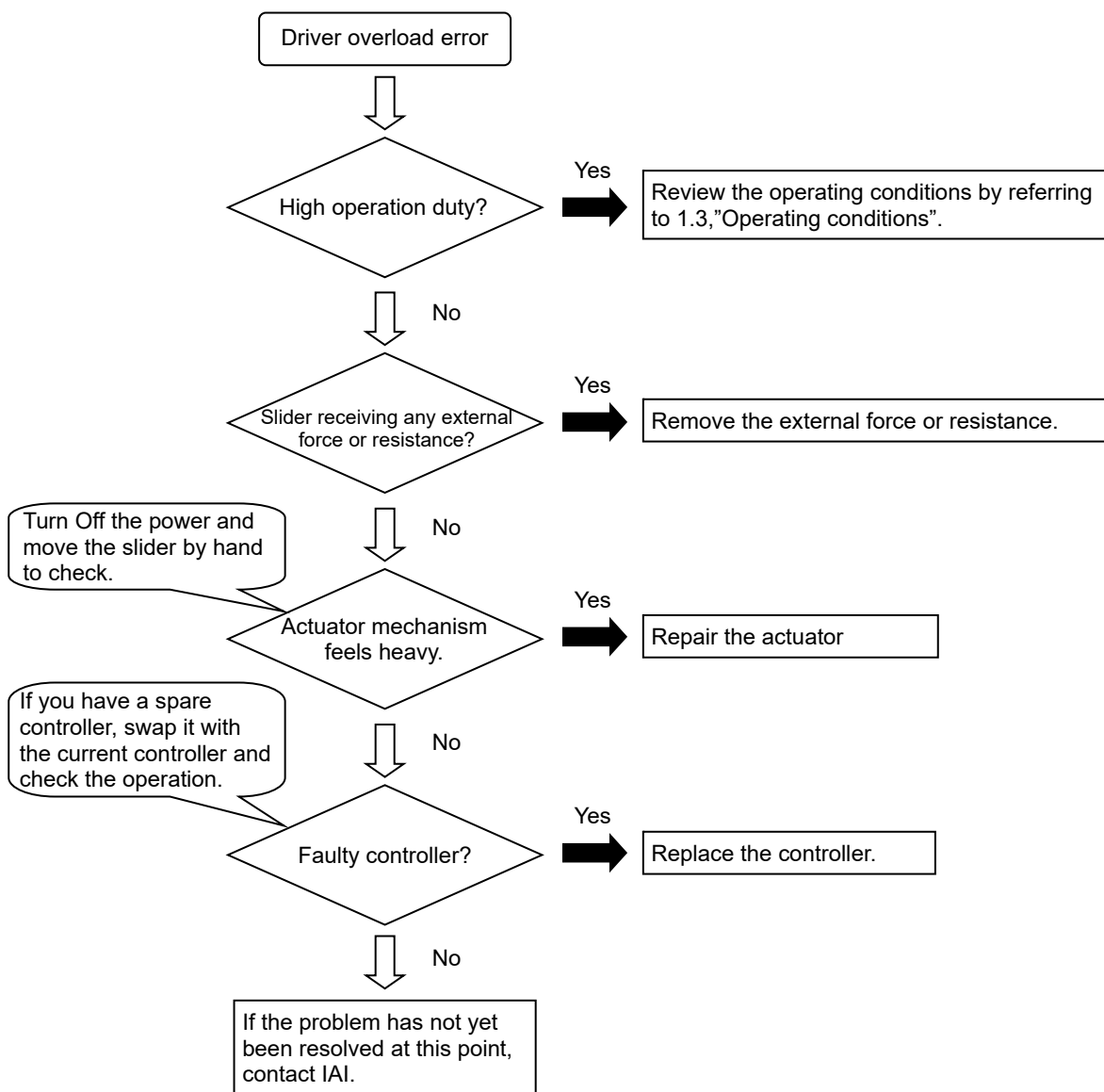


Projection

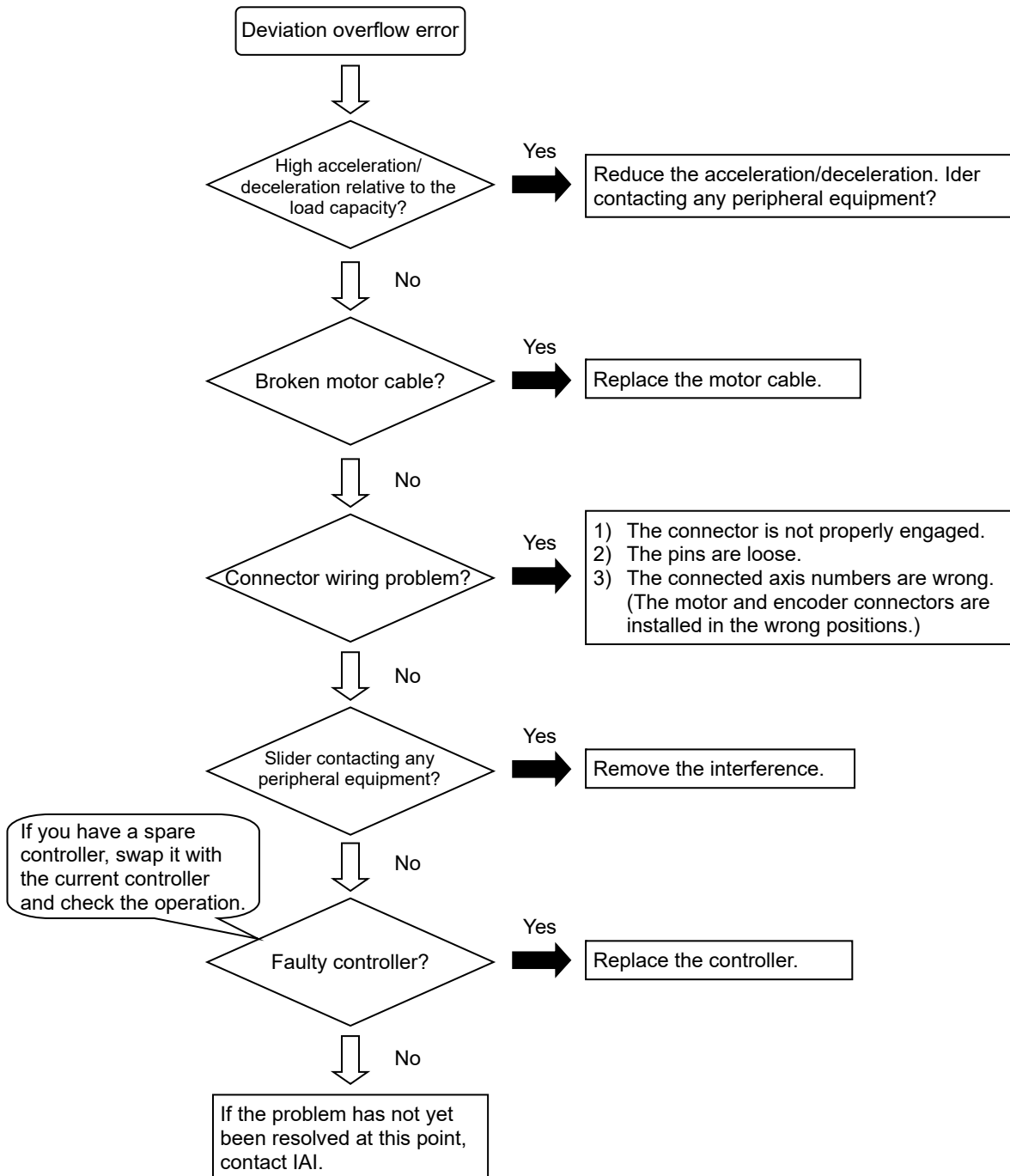
Projection

(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.

5.2 Driver Overload Error (Error Code: D0A)



5.3 Deviation Overflow Error (Error Code: C6B)





INTELLIGENT ACTUATOR

6. Maintenance and Inspection

 **Warning:** This actuator uses high-performance rare-earth permanent magnets. Do not get closer than 30cm if you are a person who needs a support of a medical device such as a pacemaker.

6.1 Inspection Items and Schedule

Follow the maintenance inspection schedule below.

It is assumed that the equipment is operating 8 hours per day.

If the equipment is running continuously night and day or otherwise running at a high operating rate, inspect more often as needed.

Period of Time	External visual inspection	Internal inspection	Greasing
Start of work inspection	○		
1 month inspection	○		
3 month inspection			○
3 months after starting operation			Depends on grease supply timing (reference)
6 month inspection	○	○(Note 1)	
Every 6 months thereafter	○	○(Note 1)	

Note 1 Check the condition of grease, and wipe off the grease before supplying new in case it is extremely dirty.

[Grease Supply Timing (Reference)]

Perform grease supply when it has reached to either the operation distance or spent months described in the table below.

Maximum Speed of Use [mm/s]	Grease Supply Timing (Reference)	
	Operated Distance	Months
0 to 750 or less	625 km	6 months
750 to 1500 or less	1,250 km	
1500 to 2500 or less	2,500 km	

 **Caution:**

- An actuator after 6 months of storage may have caused a degradation of the grease.
Supply grease before start using. [Refer to 6.6 “Greasing the Guide”]
- Degradation speed of grease may differ depending on the environment of use (temperature, humidity and ambient conditions). It is recommended to shorten the grease supply period if the actuator is used under a bad condition such as in high temperature, high humidity or in dusty ambience.
Also, it is recommended to improve the environment conditions in case the grease changes its color due to the bad condition of use.

6.2 External Visual Inspection

An external visual inspection should check the following things.

Actuator	Loosening of actuator mounting bolts, etc.
Cables	Scratches, connector engagement
Stainless steel sheet	Scratches, deviation, slack
Overall	Noise, vibration

- Adjust the tension of the stainless steel sheet in case it is deviated or slacked. [Refer to 6.7 “How to Replace and Adjust Stainless Steel Sheet”.]
- The life of the stainless steel sheet should be 5000km of driving distance as a reference. However, replace the stainless steel sheet when it is necessary depending on the condition of use.
The sheet can be replaced by the user, but make sure there is no deviation or slack on the stainless steel sheet. Deviation or slack on the stainless steel sheet may damage the sheet. It is recommended that you bring the unit to us or have our service engineer visit your site for replacement work if you have any concern in the work.

6.3 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.

6.4 Interior Inspection

With the power supply turned OFF, turn up the stainless steel 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. Focus on 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. Contact IAI if an abnormality is found on the guide part.

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 2.5mm.
- 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.
For more information about stainless steel sheet tension adjustment, see 6.7 "Replacement/ Adjustment of Stainless Steel Sheet."



Caution:

- When peeling off the stainless steel sheet, be careful not to get pulled in the body by the strong magnetic force of the magnets inside.
In case of getting pulled by the magnets inside, the stainless steel sheet may get damaged and may not be used any more. Contact IAI if the sheet is damaged.
- 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.
- When working with the stainless steel sheet, wear gloves or take other appropriate precautions to prevent cuts by the edges of the sheet.

6.5 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.

6.6 Greasing the Guide

6.6.1 Applicable Grease

IAI uses the greases specified below.

W21SS, W21SM	THK	AFB-LF Grease
W21HS, W21HM	Showa Shell Oil	Alvania EP Grease 2

Other manufacturers are also offering greases equivalent to the above products. Inform your grease supplier of the products and have them select their product of equivalent properties.

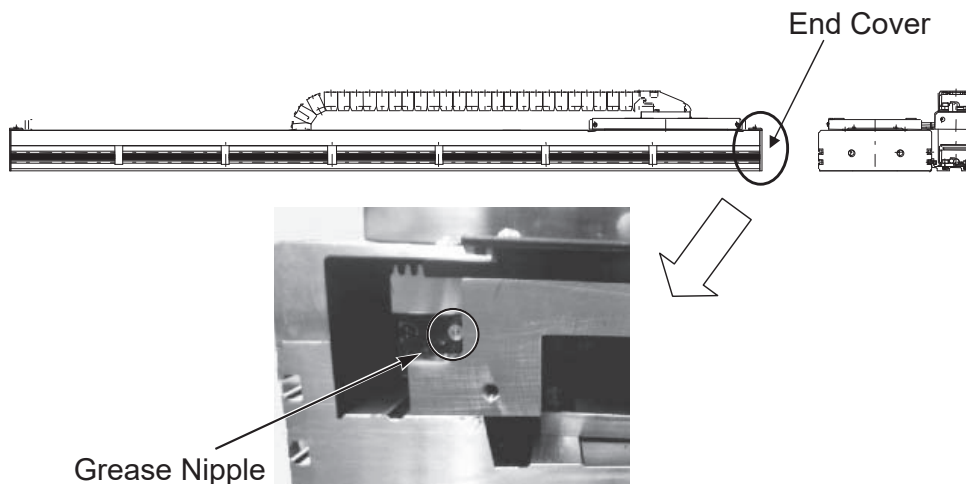


Warning: Never use fluorine grease. If it is mixed with lithium grease, not only grease performance will deteriorate but also the actuator will be damaged in some cases.

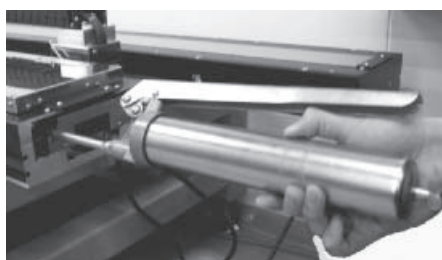
6.6.2 How to Add Grease

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.



Grease supply volume (reference)

0.5cc to 1cc

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

Model	Nipple diameter
W21SS, W21SM	φ6
W21HS, W21HM	φ6

Model	Grease gun	Nozzle	Supplier of Nozzle
W21SS, W21SM	Grease gun of attachment screw R1/8 (Example) GC-57K (Yamada Corporation)	H model	THK
W21HS, W21HM	Commercially available general formulas grease gun	B-5240V	IKO

- 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.



Caution: In case the grease got into your eye, immediately go see the doctor to get appropriate care.
After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

6.7 How to Replace and Adjust Stainless Steel Sheet

Those parts such as screws taken off for replacement work are necessary when assembling the product back. It is recommended to prepare a storage box in advance to starting the work, so the taken off parts can be kept in it.

[Required Items]

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

[Notes]

(1) Stainless steel sheet tension

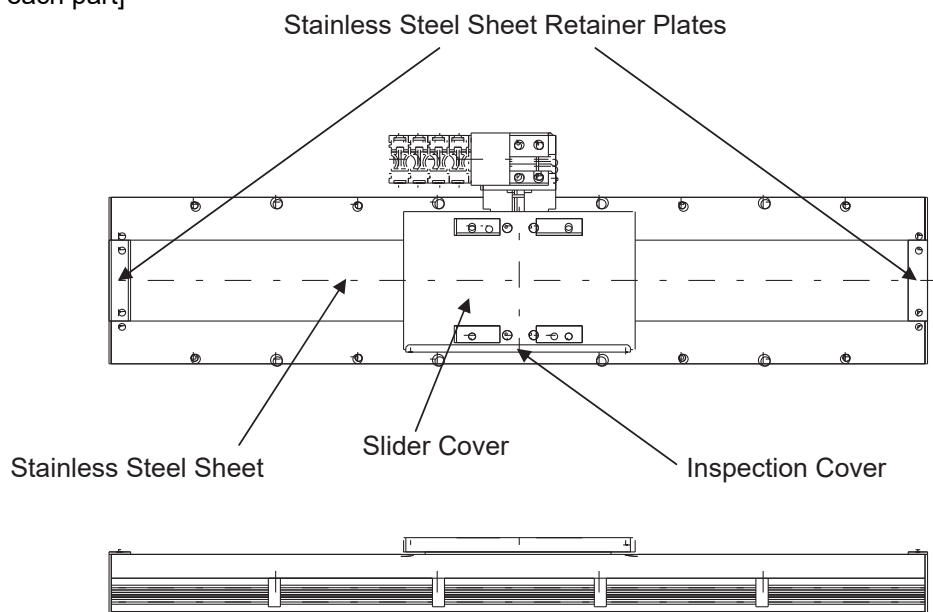
Improper tension of the stainless steel sheet can promote deterioration and wear of the sheet. If the tension of the stainless steel sheet is too taut and the clearance from the slider cover becomes too long, it may cause the stainless steel sheet to undergo fatigue failure.

Conversely, if the tension is too loose, interference will occur between the stainless steel sheet and the back face of the slider cover.

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

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

[Name of each part]



Replace the stainless steel sheet with the procedures from [1] to [2].
Adjust the tension of the stainless steel sheet with the procedures in [2].

[1] Replacement Procedure for Stainless Steel Sheet

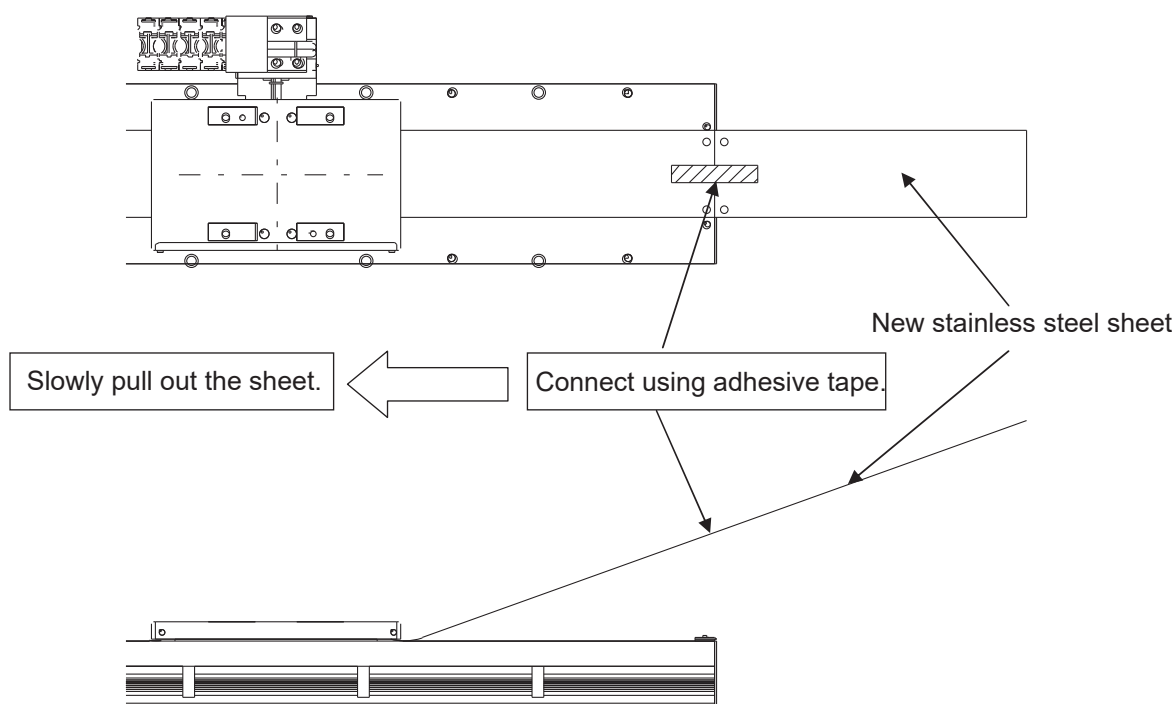
Replace the degraded stainless steel sheet with a new one by following the steps described below.

- 1) Check a new stainless steel sheet to confirm absence of scratches or soiling.
- 2) Loosen the screws affixing the degraded stainless steel sheet, and detach the sheet retainer plate.
- 3) Connect the damaged stainless steel sheet and new stainless steel sheet using adhesive tape.
- 4) Pull out the degraded stainless steel sheet slowly by sliding it on the side cover.



Caution: Pay attention not to have the stainless steel sheet go off the side cover and get adhered to the permanent magnet inside the base.

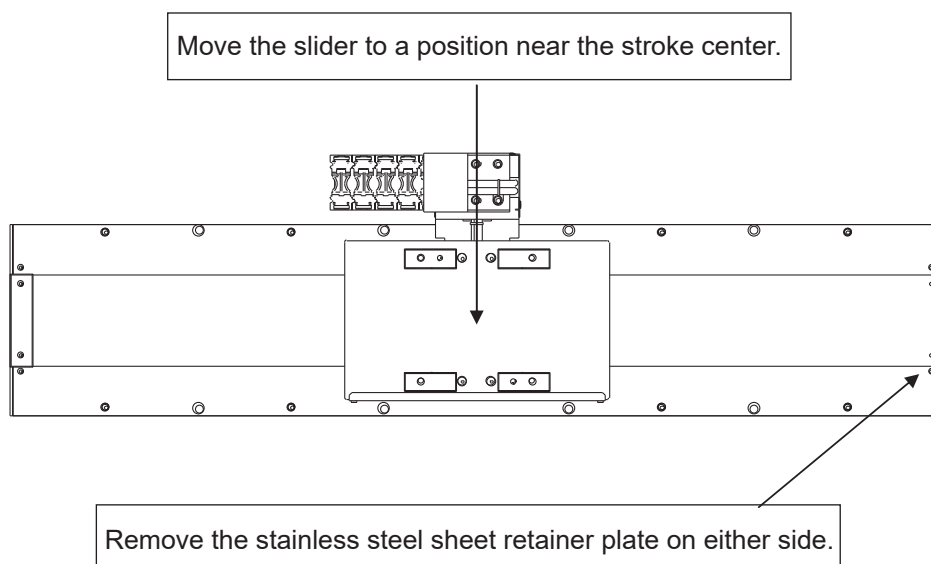
- 5) Confirm that the new stainless steel sheet has been installed in the slider.



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

[2] Adjusting the Stainless Steel Sheet Tension

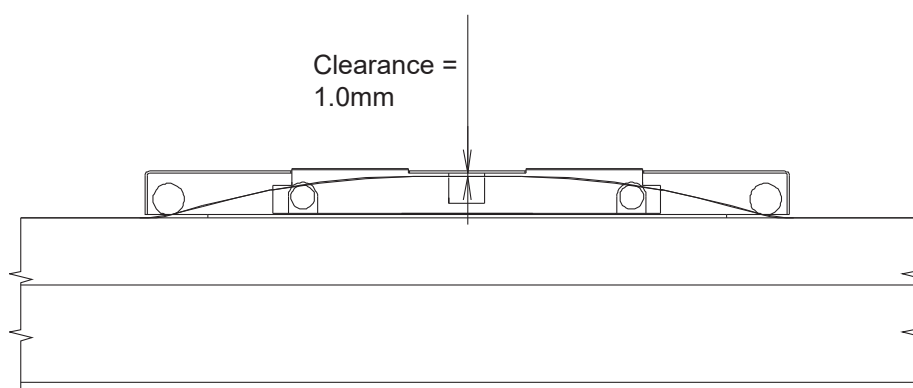
- 1) First, affix the stainless steel sheet uniformly on the right and left in a manner free from meandering.
(The stainless steel sheet is gripped on with the magnets. Detach the sheet in a manner of peeling it once from one edge. Also adjust the stainless steel sheet from the slider center toward both ends.)
- 2) Move the slider to a position near the stroke center, and unscrew the screws holding the stainless steel sheet on one side and remove the retainer plate.



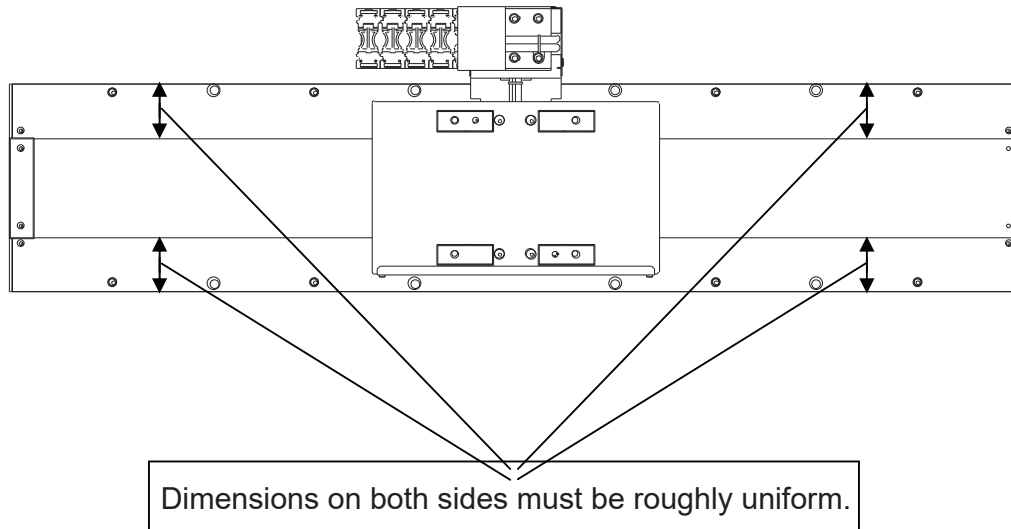
3) Adjusting the Stainless steel sheet Tension

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 1.0mm below the installation surface of the slider cover respectively. In this position, loosely tighten the mounting screws on the sheet retainer plate (hexagonal socket head button bolt M4 × 10).



- 4) Move the slider over its full stroke by hand to confirm that the dimensions on both sides of the stainless steel sheet are roughly uniform, as shown below.
If not, the stainless steel sheet is skewed. Repeat the adjustment from step [1] to make sure the stainless steel sheet extends straight.



- 5) Securely tighten the stainless steel 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 steel sheet change significantly or if a sound of slider contact is heard.
If any problem is found, repeat the adjustment from step [1].



Caution:

- Always use IAI's genuine stainless steel sheet.
- During the adjustment, wear gloves or take other appropriate safety precautions to prevent cutting hands by the stainless steel sheet.
- Exercise due caution not to let the permanent magnets attract magnetic substances during the adjustment.
- Those wearing a pacemaker or any other medical device must not perform this adjustment.

6.8 Linear Scale Cleaning Procedure

Those parts such as screws taken off for replacement work are necessary when assembling the product back. It is recommended to prepare a storage box in advance to starting the work, so the taken off parts can be kept in it.

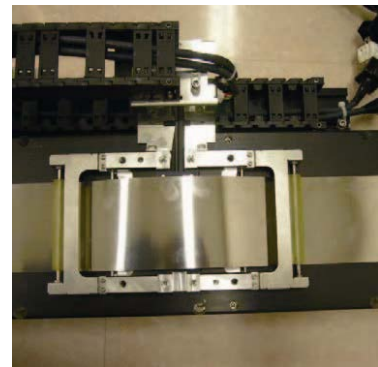
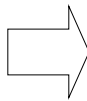
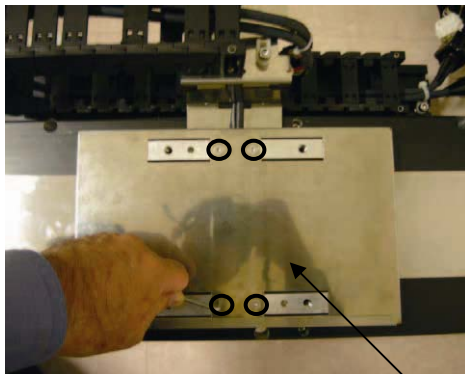
[Required Items for Cleaning]

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

[Procedure]

(1) Remove the stainless steel sheet.

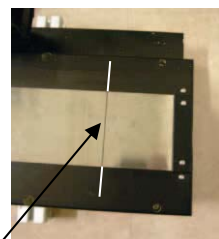
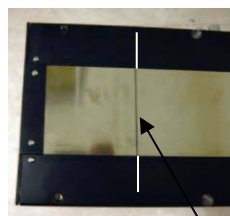
- 1) Use an Allen wrench of 3mm across flats to remove the bolts securing the slider cover, and take out the slider cover.



Slider cover

- 2) Remove the stainless steel sheet and clean the linear scale.

So that the original tension can be restored when the stainless steel sheet is installed again later on, use a marker pen to draw marker lines near the stainless steel sheet retainer plates at both ends.

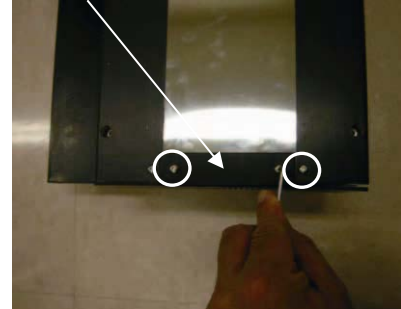
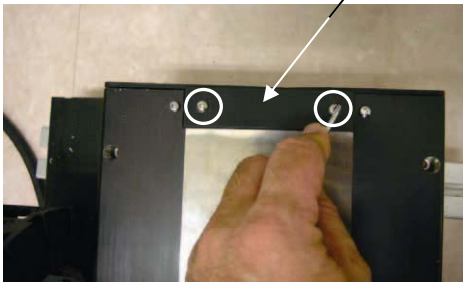


Marker lines



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

Stainless steel sheet retainer plate

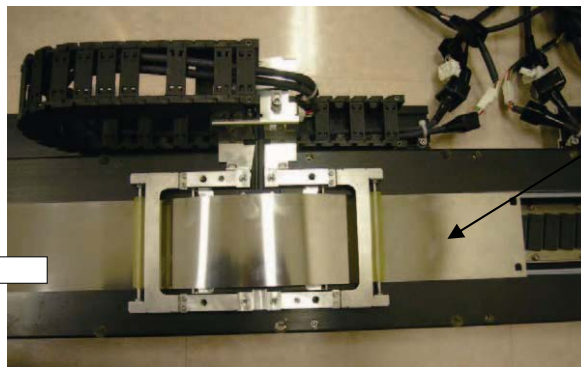


- 4) Pull out the stainless sheet from the slider to remove the sheet.



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

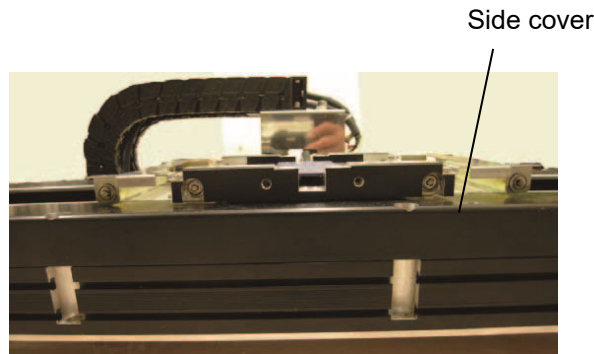
Pull out.



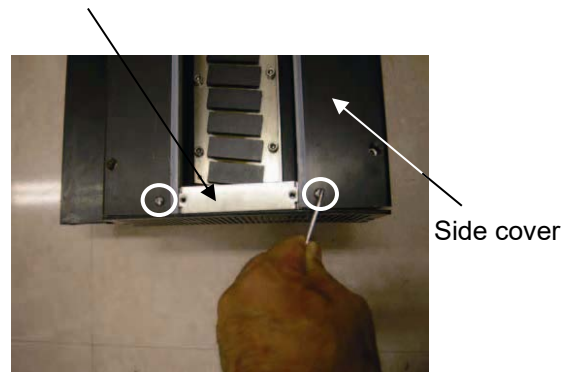
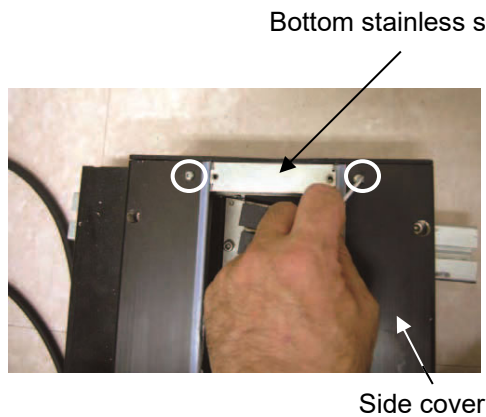
Stainless steel sheet



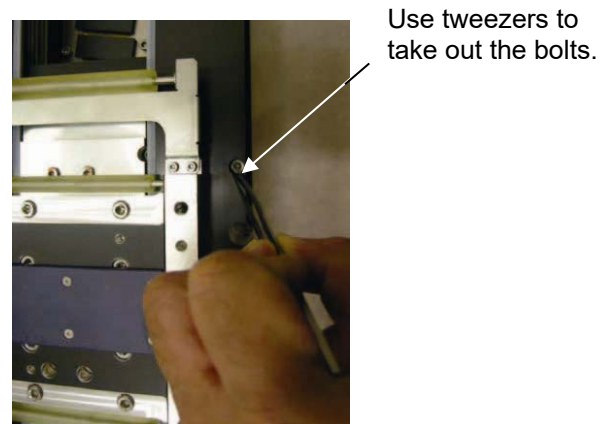
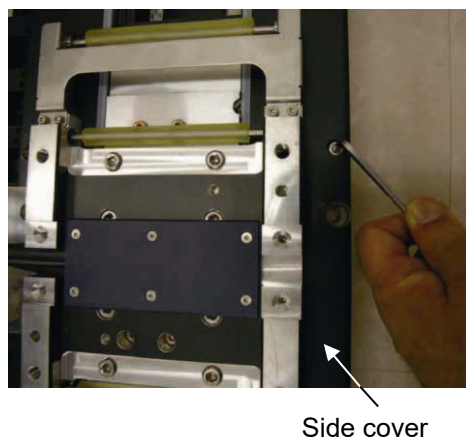
- (2) Remove the side cover from the side where there is no cable carrier.



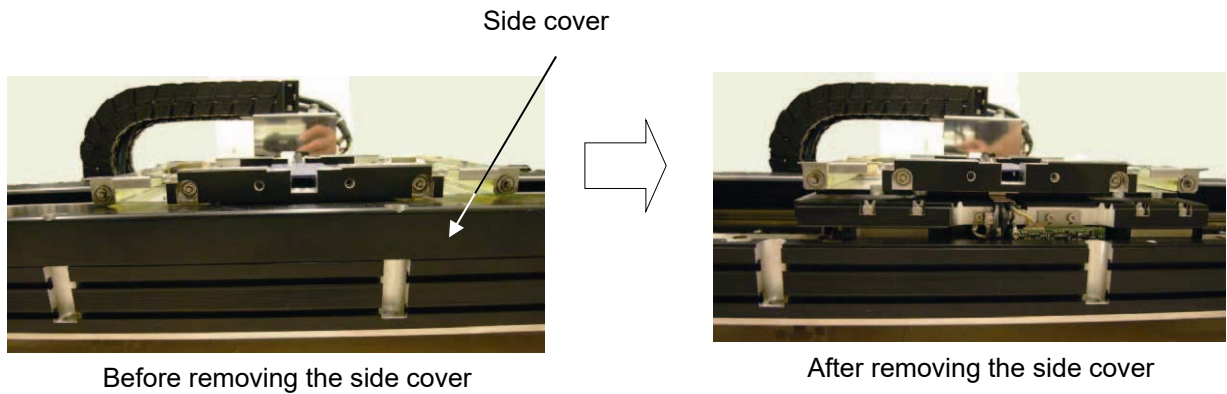
- 1) Use an Allen wrench of 2.5mm across flats to remove the bolts securing the bottom stainless-steel retainer plate. Remove the bolts at both ends of the bottom stainless steel sheet retainer plate.



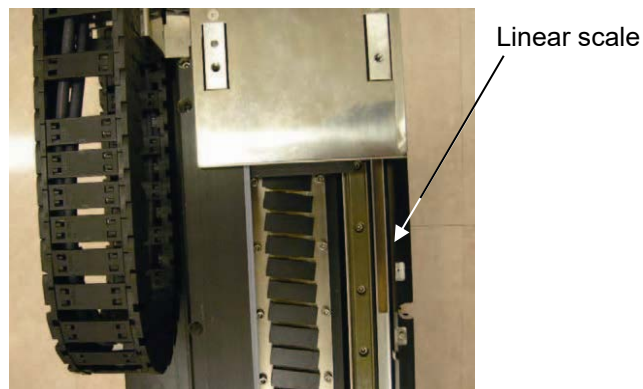
- 2) Use an Allen wrench of 4mm across flats to loosen all bolts securing the side cover. Even though loose, the bolts are still in the holes and cannot be taken out by hand. Use tweezers to take out the bolts.



- 3) Remove the side cover.



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



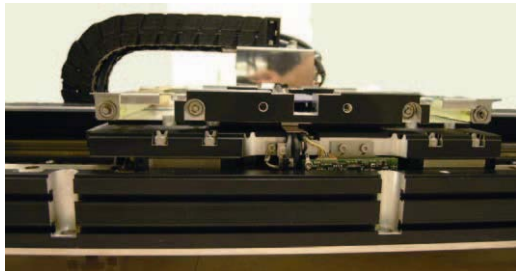
- (3) Take a small amount of alcohol in a dry cloth and wipe the linear scale with the cloth in gentle action to remove any soiling.



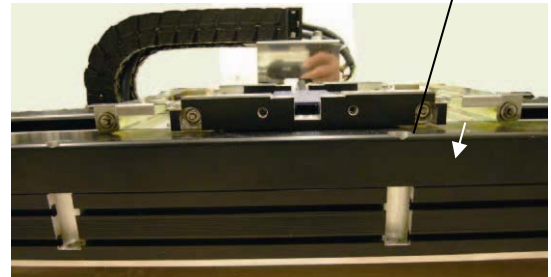
Caution: Do not wipe the linear scale with a strong force. Also, exercise caution not to scratch the scale surface. If the surface is scratched, you may no longer get the correct readings.



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

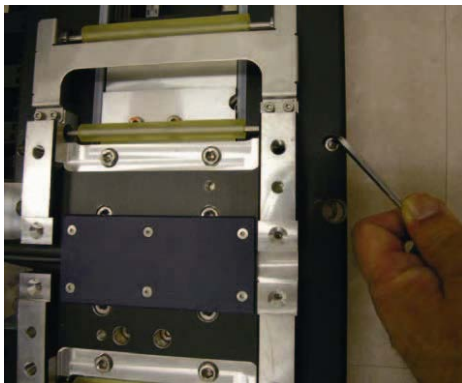


Before installing the side cover



After installing the side cover

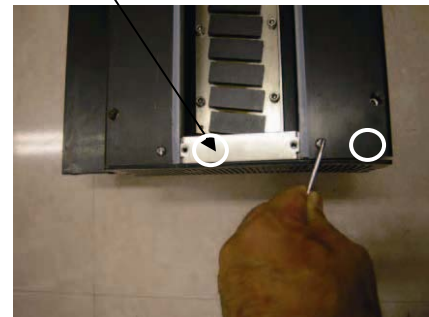
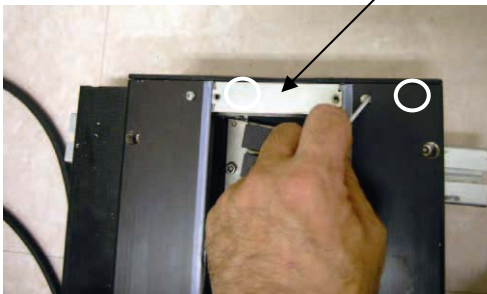
- 2) Use an Allen wrench of 4mm across flats to tighten the bolts and secure the side cover.



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

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

Bottom stainless steel sheet retainer plate



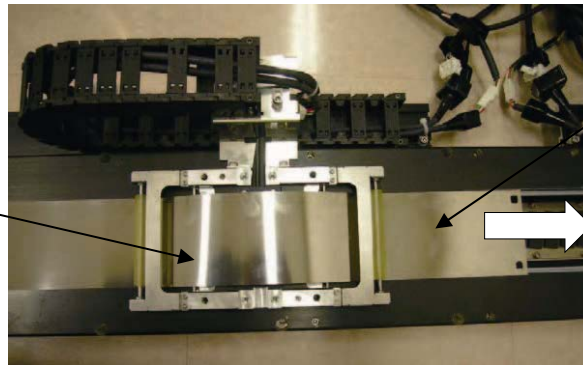
(5) Install the stainless steel sheet.

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

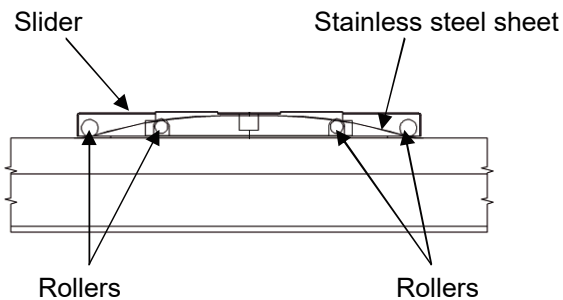


Caution: The permanent magnets have very strong magnetic force, so if you are not careful, the stainless steel sheet may be attracted to the magnet and become bent to the point where it can no longer be used. Exercise caution.

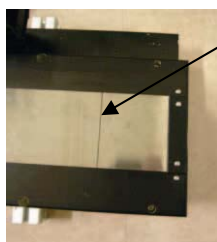
The slider should be positioned near the center of the stroke.



Stainless steel 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 steel sheet at one end.



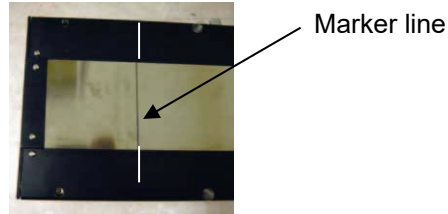
Marker line



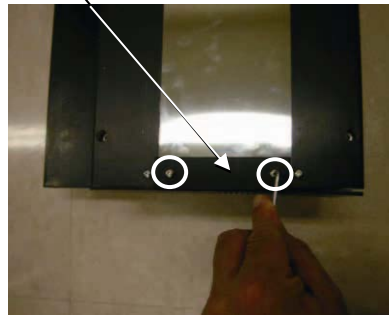
Top stainless steel sheet retainer plate



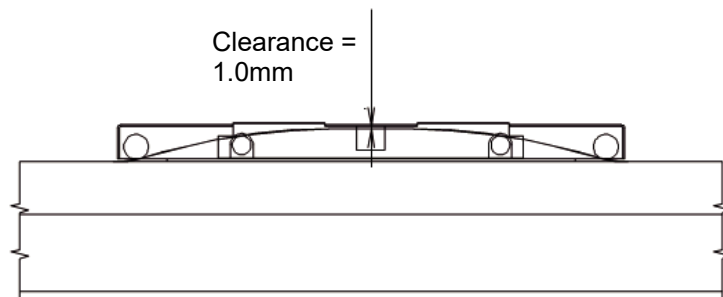
- 3) Pull the stainless steel sheet from the side not yet secured and align it with the marker lines in the same manner. Loosely tighten the bolts on the top stainless steel sheet retainer plate just enough to keep the stainless steel sheet from moving.



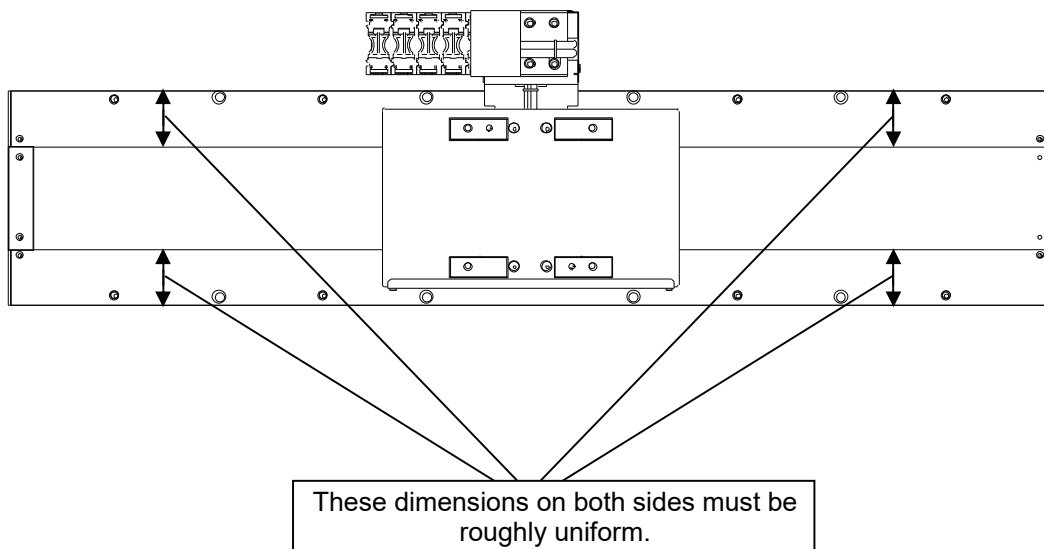
Top stainless steel sheet retainer plate



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

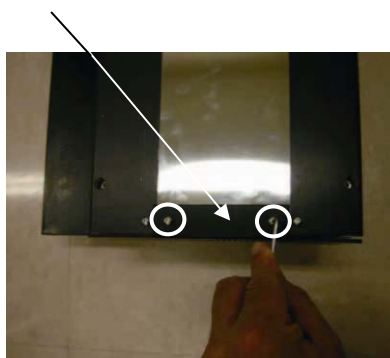


- 4) Move the slider by hand over its full stroke and see the stainless sheet from above to confirm that the specified dimensions on both sides of the stainless steel sheet are roughly uniform across the entire length, as shown in the figure.
If these dimensions are not uniform across the entire length, the stainless steel sheet is bent. Remove and install the stainless steel sheet again.



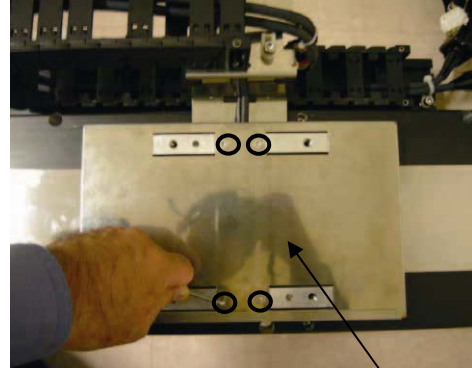
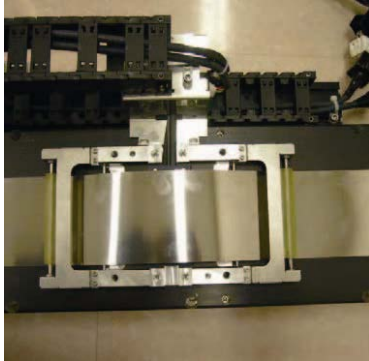
- 5) Use an Allen wrench of 2.5mm across flats to securely tighten the bolts that have been tightened only loosely, to secure the stainless steel sheet.

Top stainless steel sheet retainer plate





- 6) Put the slider cover over the slider and tighten the bolts using an Allen wrench of 3mm 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 steel sheet. Follow the same check method in (5) [4]. Also confirm that the slider is not making noise from contacting the stainless steel sheet. If the two are contacting, you should hear loud rustling noise or cupping noise that generates when the stainless steel sheet separates from the slider. If any problem is found, remove and attach the stainless steel sheet again.



7. Life

The product life is assumed to be 10,000km (reference) under the condition that it runs with maximum load capacity and maximum acceleration/deceleration.

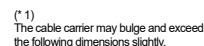


INTELLIGENT ACTUATOR

8.1 W21SS

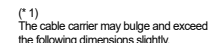
No.	Stroke	L	A	B	C	D	E	F	G	H	Mass [kg]
1	1050	1410	205	5	12	105	6	14	1200	760	46.0
2	1185	1545	72.5	7	16	172.5	6	14	1200	830	50.0
3	1320	1680	140	7	16	40	8	18	1600	900	54.0
4	1455	1815	207.5	7	16	107.5	8	18	1600	970	58.0
5	1590	1950	75	9	20	175	8	18	1600	1040	62.0
6	1725	2085	142.5	9	20	42.5	10	22	2000	1120	66.0
7	1860	2220	210	9	20	110	10	22	2000	1160	70.0
8	1995	2355	77.5	11	24	177.5	10	22	2000	1240	74.0
9	2130	2490	145	11	24	45	12	26	2400	1310	78.0
10	2265	2625	212.5	11	24	112.5	12	26	2400	1380	82.0
11	2400	2760	80	13	28	180	12	26	2400	1450	86.0
12	2535	2895	147.5	13	28	47.5	14	30	2800	1500	90.0
13	2670	3030	215	13	28	115	14	30	2800	1570	94.0
14	2805	3165	82.5	15	32	182.5	14	30	2800	1640	98.0
15	2940	3300	150	15	32	50	16	34	3200	1720	102.0
16	3075	3435	217.5	15	32	117.5	16	34	3200	1790	106.0
17	3210	3570	85	17	36	185	16	34	3200	1840	110.0
18	3345	3705	152.5	17	36	52.5	18	38	3600	1910	114.0
19	3480	3840	220	17	36	120	18	38	3600	1980	118.0
20	3615	3975	87.5	19	40	187.5	18	38	3600	2050	122.0
21	3750	4110	155	19	40	55	20	42	4000	2120	126.0
22	3885	4245	222.5	19	40	122.5	20	42	4000	2200	130.0
23	4020	4380	90	21	44	190	20	42	4000	2240	134.0
24	4155	4515	157.5	21	44	57.5	22	46	4400	2320	138.0

* 1 The slider goes up the ME in the home-return operation. Pay attention to interference to peripherals.
ME: Mechanical End
SE :Stroke End



No.	Stroke	L	A	B	C	D	E	F	G	H	Mass [kg]
1	730	1410	205	5	12	105	6	14	1200	610	57.0
2	865	1545	72.5	7	16	172.5	6	14	1200	680	61.0
3	1000	1680	140	7	16	40	8	18	1600	760	65.0
4	1135	1815	207.5	7	16	107.5	8	18	1600	830	69.0
5	1270	1950	75	9	20	175	8	18	1600	900	73.0
6	1405	2085	142.5	9	20	42.5	10	22	2000	970	77.0
7	1540	2220	210	9	20	110	10	22	2000	1040	81.0
8	1675	2355	77.5	11	24	177.5	10	22	2000	1120	85.0
9	1810	2490	145	11	24	45	12	26	2400	1160	89.0
10	1945	2625	212.5	11	24	112.5	12	26	2400	1240	93.0
11	2080	2760	80	13	28	180	12	26	2400	1310	97.0
12	2215	2895	147.5	13	28	47.5	14	30	2800	1380	101.0
13	2350	3030	215	13	28	115	14	30	2800	1450	105.0
14	2485	3165	82.5	15	32	182.5	14	30	2800	1500	109.0
15	2620	3300	150	15	32	50	16	34	3200	1570	113.0
16	2755	3435	217.5	15	32	117.5	16	34	3200	1640	117.0
17	2890	3570	85	17	36	185	16	34	3200	1720	121.0
18	3025	3705	152.5	17	36	52.5	18	38	3600	1790	125.0
19	3160	3840	220	17	36	120	18	38	3600	1840	129.0
20	3295	3975	87.5	19	40	187.5	18	38	3600	1910	133.0
21	3430	4110	155	19	40	55	20	42	4000	1980	137.0
22	3565	4245	222.5	19	40	122.5	20	42	4000	2050	141.0
23	3700	4380	90	21	44	190	20	42	4000	2120	145.0
24	3835	4515	157.5	21	44	57.5	22	46	4400	2200	149.0

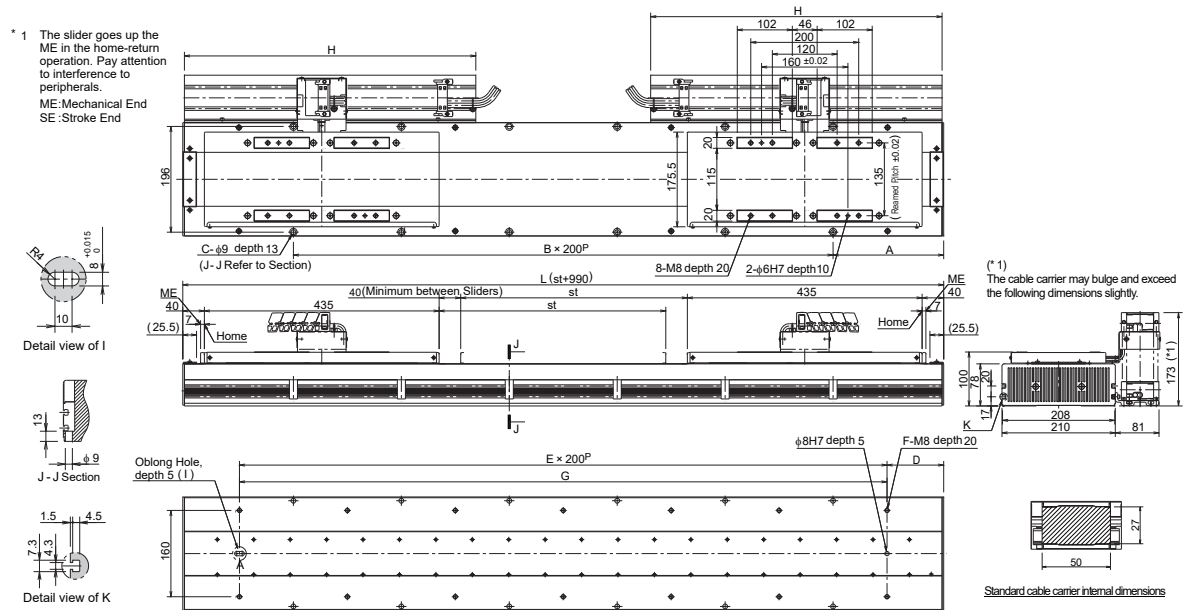
* 1 The slider goes up the ME in the home-return operation. Pay attention to interference to peripherals.
ME: Mechanical End
SE :Stroke End



Standard cable carrier internal dimensions

No.	Stroke	L	A	B	C	D	E	F	G	H	Mass [kg]
1	895	1410	205	5	12	105	6	14	1200	760	50.0
2	1030	1545	72.5	7	16	172.5	6	14	1200	830	54.0
3	1165	1680	140	7	16	40	8	18	1600	900	58.0
4	1300	1815	207.5	7	16	107.5	8	18	1600	970	62.0
5	1435	1950	75	9	20	175	8	18	1600	1040	66.0
6	1570	2085	142.5	9	20	42.5	10	22	2000	1120	70.0
7	1705	2220	210	9	20	110	10	22	2000	1160	74.0
8	1840	2355	77.5	11	24	177.5	10	22	2000	1240	78.0
9	1975	2490	145	11	24	45	12	26	2400	1310	82.0
10	2110	2625	212.5	11	24	112.5	12	26	2400	1380	86.0
11	2245	2760	80	13	28	180	12	26	2400	1450	90.0
12	2380	2895	147.5	13	28	47.5	14	30	2800	1500	94.0
13	2515	3030	215	13	28	115	14	30	2800	1570	98.0
14	2650	3165	82.5	15	32	182.5	14	30	2800	1640	102.0
15	2785	3300	150	15	32	50	16	34	3200	1720	106.0
16	2920	3435	217.5	15	32	117.5	16	34	3200	1790	110.0
17	3055	3570	85	17	36	185	16	34	3200	1840	114.0
18	3190	3705	152.5	17	36	52.5	18	38	3600	1910	118.0
19	3325	3840	220	17	36	120	18	38	3600	1980	122.0
20	3460	3975	87.5	19	40	187.5	18	38	3600	2050	126.0
21	3595	4110	155	19	40	55	20	42	4000	2120	130.0
22	3730	4245	222.5	19	40	122.5	20	42	4000	2200	134.0
23	3865	4380	90	21	44	190	20	42	4000	2240	138.0
24	4000	4515	157.5	21	44	57.5	22	46	4400	2320	142.0

8.4 W21HM



W21HM

No.	Stroke	L	A	B	C	D	E	F	G	H	Mass [kg]
1	420	1410	205	5	12	105	6	14	1200	540	65.0
2	555	1545	72.5	7	16	172.5	6	14	1200	610	69.0
3	690	1680	140	7	16	40	8	18	1600	680	73.0
4	825	1815	207.5	7	16	107.5	8	18	1600	760	77.0
5	960	1950	75	9	20	175	8	18	1600	830	81.0
6	1095	2085	142.5	9	20	42.5	10	22	2000	900	85.0
7	1230	2220	210	9	20	110	10	22	2000	970	89.0
8	1365	2355	77.5	11	24	177.5	10	22	2000	1040	93.0
9	1500	2490	145	11	24	45	12	26	2400	1120	97.0
10	1635	2625	212.5	11	24	112.5	12	26	2400	1160	101.0
11	1770	2760	80	13	28	180	12	26	2400	1240	105.0
12	1905	2895	147.5	13	28	47.5	14	30	2800	1310	109.0
13	2040	3030	215	13	28	115	14	30	2800	1380	113.0
14	2175	3165	82.5	15	32	182.5	14	30	2800	1450	117.0
15	2310	3300	150	15	32	50	16	34	3200	1500	121.0
16	2445	3435	217.5	15	32	117.5	16	34	3200	1570	125.0
17	2580	3570	85	17	36	185	16	34	3200	1640	129.0
18	2715	3705	152.5	17	36	52.5	18	38	3600	1720	133.0
19	2850	3840	220	17	36	120	18	38	3600	1790	137.0
20	2985	3975	87.5	19	40	187.5	18	38	3600	1840	141.0
21	3120	4110	155	19	40	55	20	42	4000	1910	145.0
22	3255	4245	222.5	19	40	122.5	20	42	4000	1980	149.0
23	3390	4380	90	21	44	190	20	42	4000	2050	153.0
24	3525	4515	157.5	21	44	57.5	22	46	4400	2120	157.0

9. Warranty

9.1 Warranty Period

One of the following periods, whichever is shorter:

- 18 months after shipment from IAI
- 12 months after delivery to the specified location
- 2,500 hours of operation

9.2 Scope of the Warranty

Our products are covered by warranty when all of the following conditions are met. Faulty products covered by warranty will be replaced or repaired free of charge:

- (1) The breakdown or problem in question pertains to our product as delivered by us or our authorized dealer.
- (2) The breakdown or problem in question occurred during the warranty period.
- (3) The breakdown or problem in question occurred while the product was in use for an appropriate purpose under the conditions and environment of use specified in the instruction manual and catalog.
- (4) The breakdown of problem in question was caused by a specification defect or problem, or by a quality issue with our product.

Note that breakdowns due to any of the following reasons are excluded from the scope of warranty:

- Anything other than our product
- Modification or repair performed by a party other than us (unless we have approved such modification or repair)
- Anything that could not be easily predicted with the level of science and technology available at the time of shipment from our company
- A natural disaster, man-made disaster, incident or accident for which we are not liable
- Natural fading of paint or other symptoms of aging
- Wear, depletion or other expected result of use
- Operation noise, vibration or other subjective sensation not affecting function or maintenance

Note that the warranty only covers our product as delivered and that any secondary loss arising from a breakdown of our product is excluded from the scope of warranty.

9.3 Honoring the Warranty

As a rule, the product must be brought to us for repair under warranty.

9.4 Limited Liability

- (1) We shall assume no liability for any special damage, consequential loss or passive loss such as a loss of expected profit arising from or in connection with our product.
- (2) We shall not be liable for any program or control method created by the customer to operate our product or for the result of such program or control method.

9.5 Conditions of Conformance with Applicable Standards/Regulations, Etc., and Applications

- (1) If our product is combined with another product or any system, device, etc., used by the customer, the customer must first check the applicable standards, regulations and/or rules. The customer is also responsible for confirming that such combination with our product conforms to the applicable standards, etc. In such a case we will not be liable for the conformance of our product with the applicable standards, etc.
- (2) Our product is for general industrial use. It is not intended or designed for the applications specified below, which require a high level of safety. Accordingly, as a rule our product cannot be used in these applications. Contact us if you must use our product for any of these applications:
 - Medical equipment pertaining to maintenance or management of human life or health
 - A mechanism or mechanical equipment intended to move or transport people (such as a vehicle, railway facility or aviation facility)
 - Important safety parts of mechanical equipment (such as safety devices)
 - Equipment used to handle cultural assets, art or other irreplaceable items
- (3) Contact us at the earliest opportunity if our product is to be used in any condition or environment that differs from what is specified in the catalog or instruction manual.

9.6 Other Items Excluded from Warranty

The price of the product delivered to you does not include expenses associated with programming, the dispatch of engineers, etc. Accordingly, a separate fee will be charged in the following cases even during the warranty period:

- Guidance for installation/adjustment and witnessing of test operation
- Maintenance and inspection
- Technical guidance and education on operating/wiring methods, etc.
- Technical guidance and education on programming and other items related to programs

Change History

Revision Date	Description of Revision
September 2010	First edition Second edition • Page 31 Corrected the dimension of the clearance from 1.5 to 1.0 in the drawing • Pages 7 and 16 Added the precaution; "Do not apply force on the slider cover."
January 2011	Third edition • Removed "Safety Precautions." • Preface-1 to 7: Added "Safety Guide." • P. 6: Storage Environment → Storage/Preservation Environment • P. 10: Within ± 0.05 mm → Within ± 0.05 mm/m • P. 26 to 28: Change the content of 12.2, "Encoder Open Error" in 12, "Troubleshooting." • P. 33 to 41: Added 14, "Linear Scale Cleaning Procedure."
January 2014	Fifth edition Revised overall
June 2015	Edition 4C • P. 52: Grease supply volume, Recommended grease gun added
October 2015	Edition 4D • P. 26 Correction made The wire color of the mechanical side was changed • P. 49 Change made to grease supply period
May 2015	Edition 4E • P. 53 Grease gun changed
November 2016	Edition 4F • P. 25, 26, 38 Note added stating cable length is 20m at maximum for SSEL and SCON
February 2017	Edition 4G • P. 50 Change made in the caution note for stainless steel sheet external visual inspection
March 2019	Edition 4H • P. 36 Note added for caution for installation of main unit
October 2020	Edition 4I • Hanging bracket option added
February 2026	Edition 4J • Changes due to discontinuation of including the Instruction Manual DVD • Changes due to discontinuation of including the First Step Guide • International Standards Compliances complied with RoHS3 Directive

Revision Date	Description of Revision
July 2026	Edition 4K • Terms integrated (cable carrier)



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