

Linear Servo Actuator LSA/LSAS Series Mid-size models Instruction Manual

Fourth Edition

LSA	N10SS, N10SM, N15SS, N15SM N15HS, N15HM, N19SS, N19SM
LSAS	N10SS, N10SM, N15SS, N15SM N15HS, N15HM



IAI America, Inc.



Please Read Before Use

Thank you for purchasing our product.

This Instruction Manual describes all necessary information to operate this product safely such as the operation procedure, structure and maintenance procedure.

Before operation, read this manual carefully and fully understand it to operate this product safely.

The enclosed CD in this product package includes the Instruction Manual for this product.

For the operation of this product, print out the necessary sections in the Instruction Manual or display them using the personal computer.

After reading through this manual, keep this Instruction Manual at hand so that the operator of this product can read it whenever necessary.

[Important]

- This Instruction Manual is original.
- The product cannot be operated in any way unless expressly specified in this Instruction Manual. IAI shall assume no responsibility for the outcome of any operation not specified herein.
- Information contained in this Instruction Manual is subject to change without notice for the purpose of product improvement.
- If you have any question or comment regarding the content of this manual, please contact the IAI sales office near you.
- Using or copying all or part of this Instruction Manual without permission is prohibited.
- The company names, names of products and trademarks of each company shown in the sentences are registered trademarks.

Precaution for Linear Servo Actuator Installation

The methods to install the linear servo actuator is basically limited as shown in the following table.
Please be careful when orienting the actuator. (Special order models are excluded)

○ : Available

× : Not available

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

Table of Contents

Safety Guide	Pre-1
Handling Precautions	Pre-7
1. Name of Each Part	1
2. External Views	2
2.1 N10SS	2
2.2 N10SM	4
2.3 N15SS	6
2.4 N15SM	8
2.5 N15HS	10
2.6 N15HM	12
2.7 N19SS	14
2.8 N19SM	15
3. Cable Drawings	16
4. Options	19
4.1 Cable track Installation Direction	19
4.2 User Cable track.....	19
5. Checks after Unpacking.....	20
5.1 Included Items	20
5.2 Instruction Manuals Relating to This Product.....	20
5.3 How to Read Model Nameplate	20
5.4 How to Read Model Name	21
5.4.1 LSA.....	21
5.4.2 LSAS.....	21
6. Specifications.....	22
6.1 N10SS, N10SM	22
6.2 N15SS, N15SM, N15HS, N15HM	22
6.3 N19SS, N19SM	23
7. Selection Conditions	24
7.1 Selection Method.....	25
7.2 Example	27
8. Operating and Storage Environment.....	29
8.1 Operating Environment	29
8.2 Storage Environment.....	29

9. Installation	30
9.1 Installing the Actuator	31
9.1.1 N10SS, N10SM.....	31
9.1.2 N15SS, N15SM, N15HS, N15HM.....	32
9.1.3 N19SS, N19SM.....	33
9.2 Installation Surface.....	34
9.3 Installing a Load on the Slider	35
9.3.1 N10SS, N10SM.....	35
9.3.2 N15SS, N15SM, N15HS, N15HM.....	35
9.3.3 N19SS, N19SM.....	36
9.4 Installing a Connector Box Using T-slots : N10SS, N10SM, N15SS, N15SM, N15HS, N15HM	37
10. Connecting with the Controller.....	38
11. Notes on Operation.....	41
11.1 Actuator Load	41
11.2 Home Return	42
11.2.1 Incremental Specification	42
11.2.2 Serial Encoder Pseudo Absolute Specification	43
11.3 Handling the Stainless Sheet.....	44
12. Maintenance and Inspection.....	45
12.1 Inspection Items and Timings.....	45
12.2 Visually Inspecting the Exterior	45
12.3 Cleaning the Exterior	45
12.4 Inspecting the Interior.....	46
12.5 Cleaning the Interior	46
12.6 Greasing the Guide	47
12.6.1 Applicable Grease.....	47
12.6.2 How to Add Grease.....	48
13. Replacement/Adjustment of Stainless Sheet.....	49
13.1 N10SS, N10SM, N15SS, N15SM, N15HS, N15HM	49
13.1.1 Replacement Procedure for Stainless Sheet	50
13.1.2 Adjusting the Stainless Sheet Tension	51
13.2 N19SS, N19SM	53
14. Troubleshooting	58
14.1 Action to Be Taken upon Occurrence of Error	58
14.2 Encoder Open Error (Error Code: D12).....	58
14.3 Driver Overload Error (Error Code: D0A)	59
14.4 Deviation Overflow Error (Error Code: C6B)	60
15. Warranty	61
Change History	62

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	Precautions
1	Model Selection	<ul style="list-style-type: none"> 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. <ol style="list-style-type: none"> 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 it in any of the following environments. <ol style="list-style-type: none"> 1) Location where there is any flammable gas, flammable 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 Do not use the product outside the specifications. Failure to do so may considerably shorten its life and cause a product breakdown or facility operation stop.
2	Transportation	<ul style="list-style-type: none"> Consider well so that it is not bumped against anything or dropped during the transportation. Transport it using an appropriate transportation measure. 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	<ul style="list-style-type: none"> The storage and preservation environment conforms to the installation environment. However, especially give consideration to the prevention of condensation.



No.	Operation Description	Precautions
4	Installation and Start	<p>(1) Installation of Robot Main Body and Controller, etc.</p> <ul style="list-style-type: none">● Make sure to securely hold and fix the product (including the work). A fall, drop or abnormal motion of the product may cause damage or injury.● 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.<ol style="list-style-type: none">1) Location where electric noise is generated2) Location where high electrical or magnetic field is present3) Location with the mains or power lines passing nearby4) Location where the product may come in contact with water, oil or chemical droplets <p>(2) Cable Wiring</p> <ul style="list-style-type: none">● Use our company' s genuine cables for connecting between the actuator and controller, and for the teaching tool.● Do not scratch 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. <p>(3) Grounding</p> <ul style="list-style-type: none">● Make sure to perform the grounding of type D (Former Type 3) for the controller. 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.



No.	Operation Description	Precautions
4	Installation and Start	<p>(4) Safety Measures</p> <ul style="list-style-type: none">• 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 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	<ul style="list-style-type: none">• 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. <p>* Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.</p>



No.	Operation Description	Precautions
6	Trial Operation	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Before the automatic operation is started up, make sure that there is nobody inside the safety protection fence.• Before the automatic operation is started up, make sure that all the related peripheral machines are ready for the automatic operation and there is no error indication.• Make sure to perform the startup operation for the automatic operation, out 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.
8	Maintenance and Inspection	<ul style="list-style-type: none">• 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, 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. <p>* Safety Protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.</p>
9	Modification	<ul style="list-style-type: none">• Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.• In such case, the warranty is not applied.







No.	Operation Description	Precautions
10	Disposal	<ul style="list-style-type: none">• When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste.• Do not put the product in a fire when disposing of it. The product may burst or generate toxic gases.



Alert Indication

The safety precautions are divided into “Danger” - “Warning” - “Caution” - “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

Notes on Permanent Magnets

This actuator uses high-performance rare-earth permanent magnets.

Accordingly, the actuator may cause malfunction in medical devices such as pacemakers.

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

Handling Precautions

1. Handling the Actuator by It self

1.1 Handling the Packed Actuator

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

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

1.2 Handling the Unpacked Actuator

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

Warning

- Do not apply excessive force to any part of the actuator. Particularly, do not carry the actuator by holding the cables, cable track and slider.
- This actuator uses a high performance rare earth permanent magnet. Accordingly, do not approach near the actuator if you use a medical device such as a pacemaker.
- Handling precaution for the stainless sheet
The stainless sheet has a thickness of only 0.1 mm or so in order to provide flexibility. Because of this very thin design, the stainless sheet easily gets dented and scratched. If the damaged stainless sheet is used continuously, the sheet may eventually break.

● Taboos in transportation



Do not transport the actuator by holding its slider.



Do not transport the actuator by holding its cables.



Do not transport the actuator by holding its cable track.



Do not transport the actuator by holding its stainless sheet.



2. Handling the Actuator Assembly

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

2.1 Condition of Shipment from IAI (Assembled)

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

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

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

2.2 Handling after Assembly with Peripheral Equipment

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

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



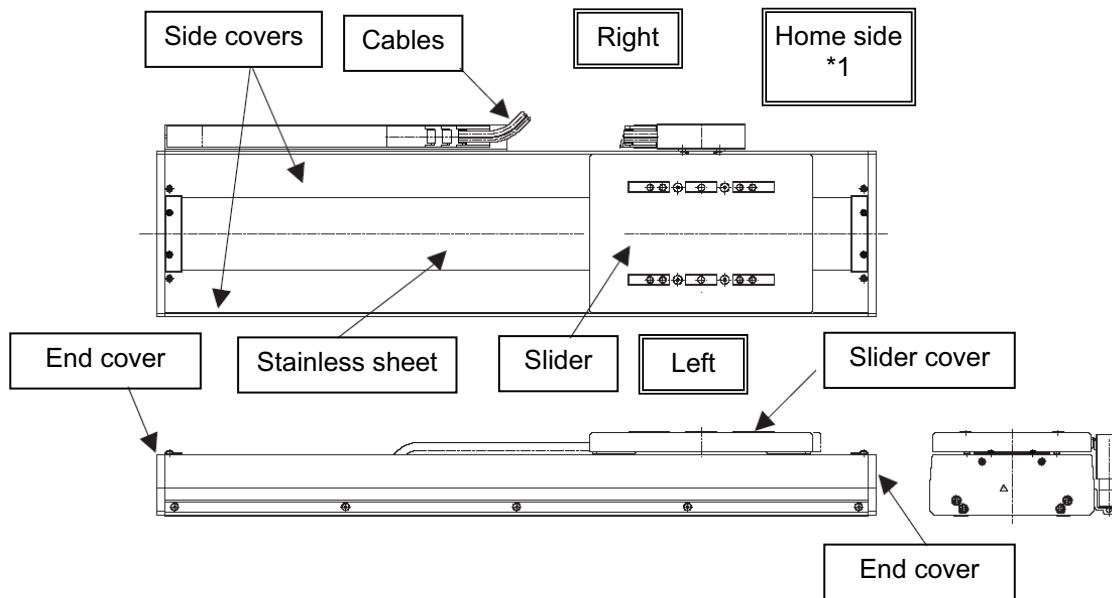
3. Handling after Assembly with Peripheral Equipment

Even when you transport the machine that has been assembled at your site, also handle the machine according to the precautions explained in 2.2, “Handling after Unpacking.”

1. Name of Each Part

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

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

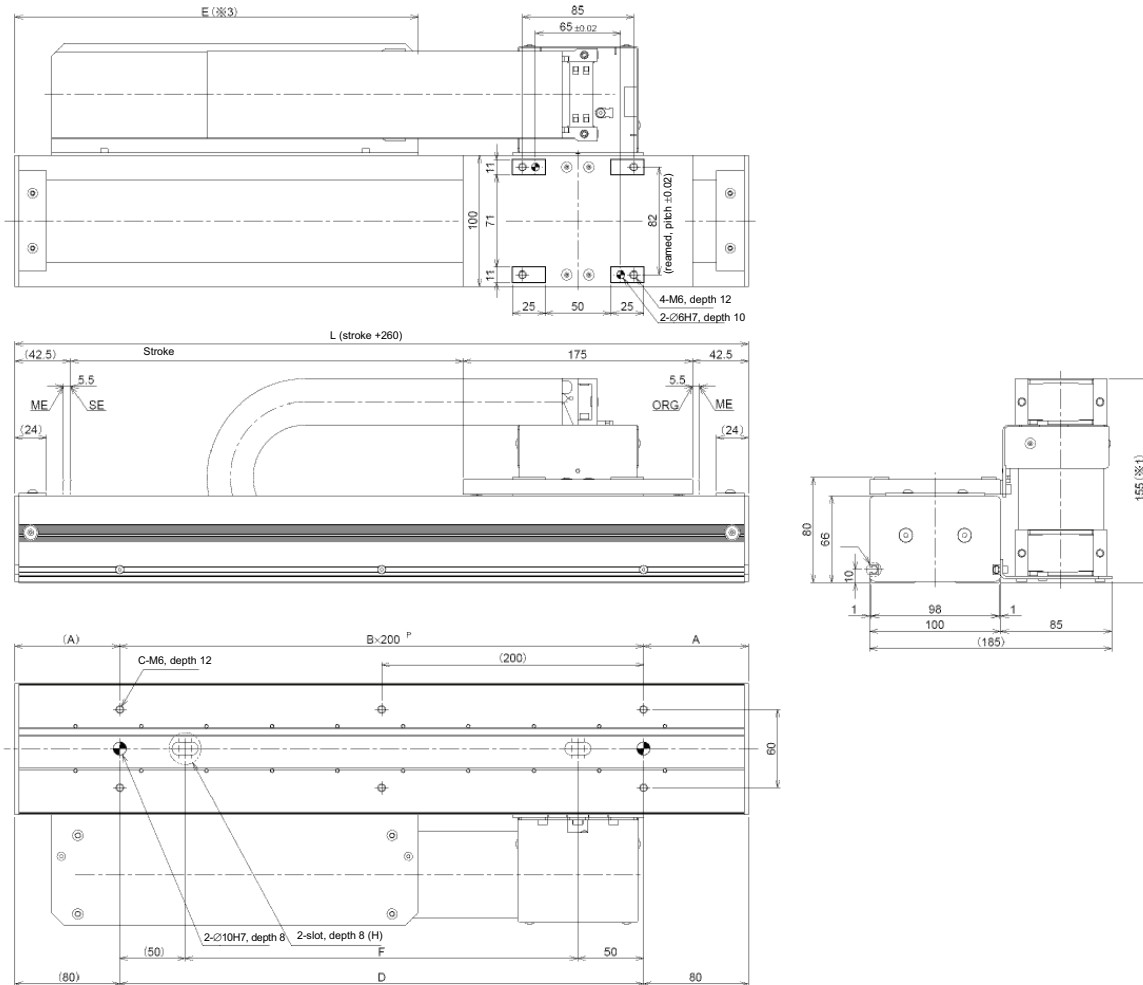


*1 In the above figure, the cables are facing top, while the home is located on the right side. The actuator is shipped with its home adjusted to the side specified by the customer. Accordingly, the home position on your actuator may be different from the direction shown in the figure.

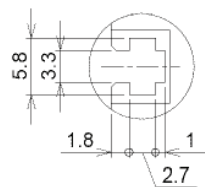
* For detailed views, refer to 2, “External Views.”

2. External Views

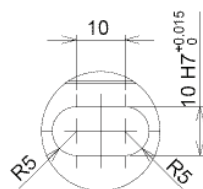
2.1 N10SS



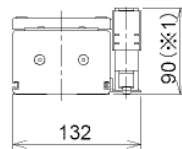
- (*1)
The cable track may bulge and slightly exceed the dimension specified below.
- (*2)
Optional and user cable tracks are supported only when the stroke is 2,000 mm or less.
- (*3)
If any optional or user cable track is used, dimension E is adjusted to "80 mm less than the dimension shown in the table."



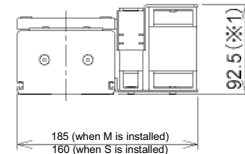
Detail View of G
(2:1)



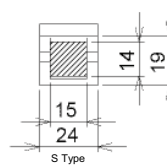
Detail View of H
(1:1)



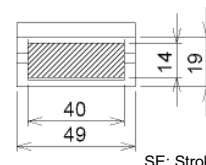
Optional Cable track
(1:5)



User Cable track, S/M Type
(1:5)



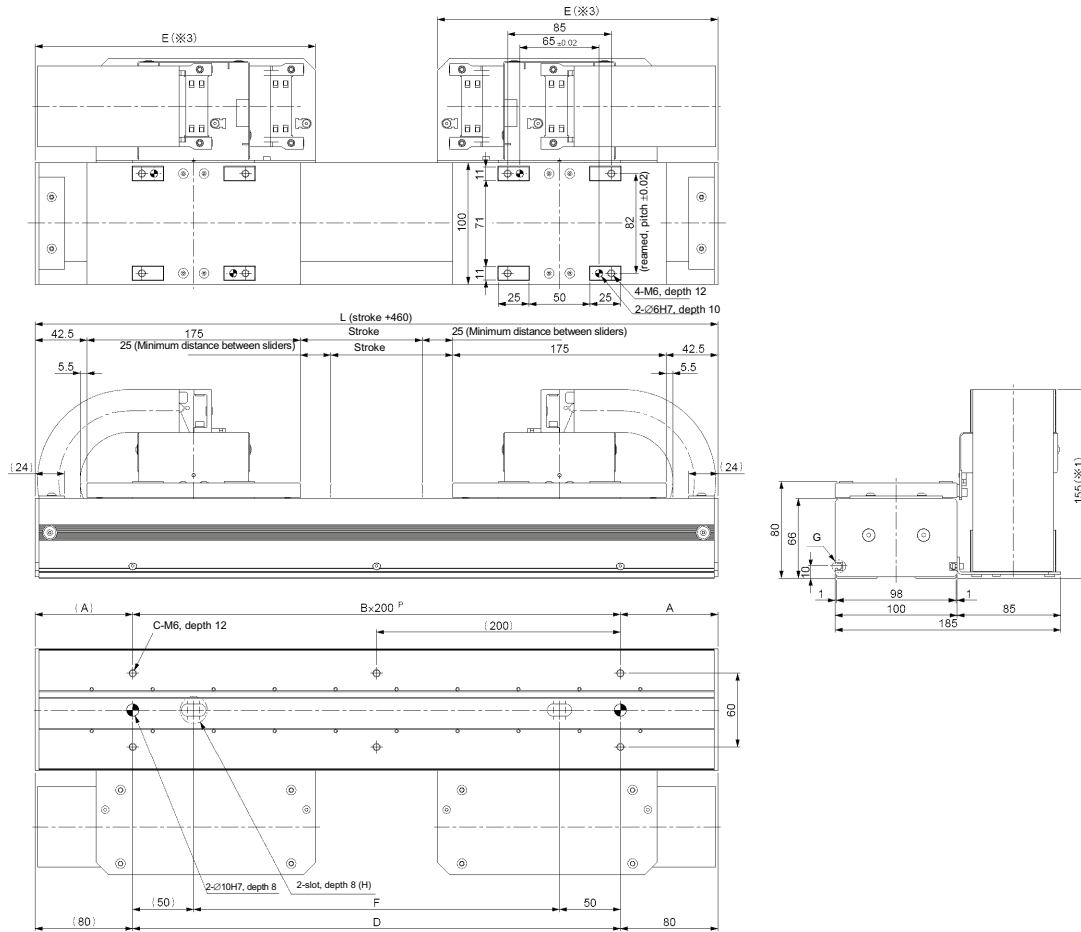
Section View of User Cable track
(1:2)



SE: Stroke end
ME: Mechanical end

Effective stroke	L	A	B	C	D	E	F
100	360	80	1	4	200	230	100
200	460	30	2	6	300	280	200
300	560	80	2	6	400	330	300
400	660	30	3	8	500	380	400
500	760	80	3	8	600	430	500
600	860	30	4	10	700	480	600
700	960	80	4	10	800	530	700
800	1060	30	5	12	900	580	800
900	1160	80	5	12	1000	630	900
1000	1260	30	6	14	1100	680	1000
1100	1360	80	6	14	1200	730	1100
1200	1460	30	7	16	1300	780	1200
1300	1560	80	7	16	1400	830	1300
1400	1660	30	8	18	1500	880	1400
1500	1760	80	8	18	1600	930	1500
1600	1860	30	9	20	1700	980	1600
1700	1960	80	9	20	1800	1030	1700
1800	2060	30	10	22	1900	1080	1800
1900	2160	80	10	22	2000	1130	1900
2000	2260	30	11	24	2100	1180	2000
2100	2360	80	11	24	2200	1230	2100
2200	2460	30	12	26	2300	1280	2200
2300	2560	80	12	26	2400	1330	2300
2400	2660	30	13	28	2500	1380	2400
2500	2760	80	13	28	2600	1430	2500
2600	2860	30	14	30	2700	1480	2600
2700	2960	80	14	30	2800	1530	2700
2800	3060	30	15	32	2900	1580	2800
2900	3160	80	15	32	3000	1630	2900
3000	3260	30	16	34	3100	1680	3000
3100	3360	80	16	34	3200	1730	3100
3200	3460	30	17	36	3300	1780	3200
3300	3560	80	17	36	3400	1830	3300
3400	3660	30	18	38	3500	1880	3400
3500	3760	80	18	38	3600	1930	3500
3600	3860	30	19	40	3700	1980	3600
3700	3960	80	19	40	3800	2030	3700
3800	4060	30	20	42	3900	2080	3800
3900	4160	80	20	42	4000	2130	3900
4000	4260	30	21	44	4100	2180	4000
4100	4360	80	21	44	4200	2230	4100

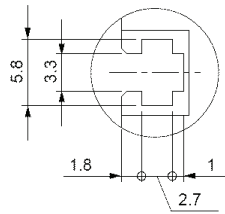
2.2 N10SM



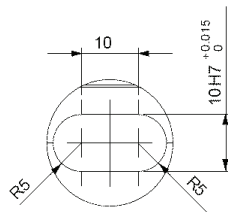
(*1)
The cable track may bulge and slightly exceed the dimension specified below.

(*2)
Optional and user cable tracks are supported only when the stroke is 2,000 mm or less.

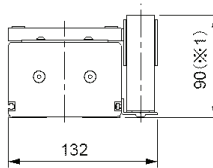
(*3)
If any optional or user cable track is used, dimension E is adjusted to "80 mm less than the dimension shown in the table."



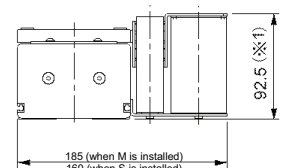
Detail View of G
(2:1)



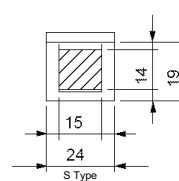
Detail View of H
(1:1)



Optional Cable track
(1:5)



User Cable track, S/M Type
(1:5)



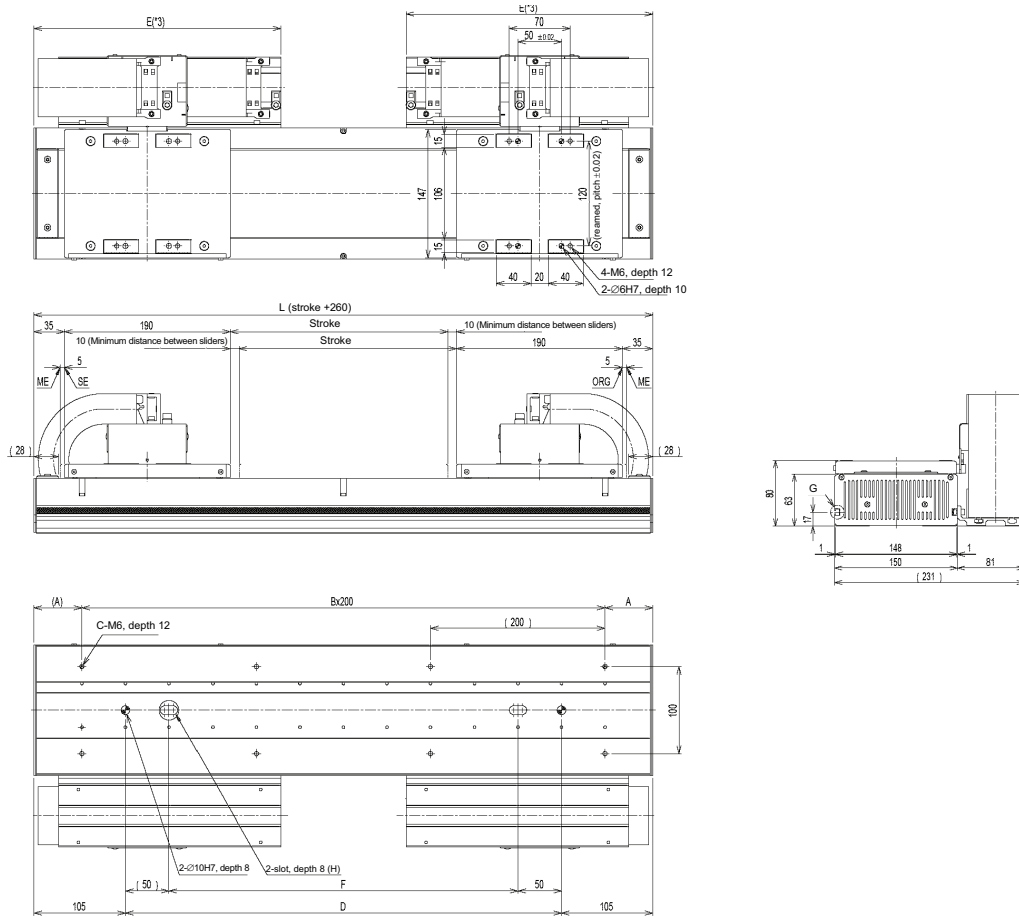
Section View of User Cable track
(1:2)



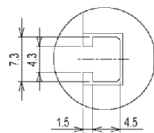
Effective stroke	L	A	B	C	D	E	F
100	560	80	2	6	400	330	300
200	660	30	3	8	500	380	400
300	760	80	3	8	600	430	500
400	860	30	4	10	700	480	600
500	960	80	4	10	800	530	700
600	1060	30	5	12	900	580	800
700	1160	80	5	12	1000	630	900
800	1260	30	6	14	1100	680	1000
900	1360	80	6	14	1200	730	1100
1000	1460	30	7	16	1300	780	1200
1100	1560	80	7	16	1400	830	1300
1200	1660	30	8	18	1500	880	1400
1300	1760	80	8	18	1600	930	1500
1400	1860	30	9	20	1700	980	1600
1500	1960	80	9	20	1800	1030	1700
1600	2060	30	10	22	1900	1080	1800
1700	2160	80	10	22	2000	1130	1900
1800	2260	30	11	24	2100	1180	2000
1900	2360	80	11	24	2200	1230	2100
2000	2460	30	12	26	2300	1280	2200
2100	2560	80	12	26	2400	1330	2300
2200	2660	30	13	28	2500	1380	2400
2300	2760	80	13	28	2600	1430	2500
2400	2860	30	14	30	2700	1480	2600
2500	2960	80	14	30	2800	1530	2700
2600	3060	30	15	32	2900	1580	2800
2700	3160	80	15	32	3000	1630	2900
2800	3260	30	16	34	3100	1680	3000
2900	3360	80	16	34	3200	1730	3100
3000	3460	30	17	36	3300	1780	3200
3100	3560	80	17	36	3400	1830	3300
3200	3660	30	18	38	3500	1880	3400
3300	3760	80	18	38	3600	1930	3500
3400	3860	30	19	40	3700	1980	3600
3500	3960	80	19	40	3800	2030	3700
3600	4060	30	20	42	3900	2080	3800
3700	4160	80	20	42	4000	2130	3900
3800	4260	30	21	44	4100	2180	4000
3900	4360	80	21	44	4200	2230	4100

Effective stroke	L	A	B	C	D	E	F
150	410	105	1	4	200	233	100
250	510	55	2	6	300	283	200
350	610	105	2	6	400	333	300
450	710	55	3	8	500	383	400
550	810	105	3	8	600	433	500
650	910	55	4	10	700	483	600
750	1010	105	4	10	800	533	700
850	1110	55	5	12	900	583	800
950	1210	105	5	12	1000	633	900
1050	1310	55	6	14	1100	683	1000
1150	1410	105	6	14	1200	733	1100
1250	1510	55	7	16	1300	783	1200
1350	1610	105	7	16	1400	833	1300
1450	1710	55	8	18	1500	883	1400
1550	1810	105	8	18	1600	933	1500
1650	1910	55	9	20	1700	983	1600
1750	2010	105	9	20	1800	1033	1700
1850	2110	55	10	22	1900	1083	1800
1950	2210	105	10	22	2000	1133	1900
2050	2310	55	11	24	2100	1183	2000
2150	2410	105	11	24	2200	1233	2100
2250	2510	55	12	26	2300	1283	2200
2350	2610	105	12	26	2400	1333	2300
2450	2710	55	13	28	2500	1383	2400
2550	2810	105	13	28	2600	1433	2500
2650	2910	55	14	30	2700	1483	2600
2750	3010	105	14	30	2800	1533	2700
2850	3110	55	15	32	2900	1583	2800
2950	3210	105	15	32	3000	1633	2900
3050	3310	55	16	34	3100	1683	3000
3150	3410	105	16	34	3200	1733	3100
3250	3510	55	17	36	3300	1783	3200
3350	3610	105	17	36	3400	1833	3300
3450	3710	55	18	38	3500	1883	3400
3550	3810	105	18	38	3600	1933	3500
3650	3910	55	19	40	3700	1983	3600
3750	4010	105	19	40	3800	2033	3700
3850	4110	55	20	42	3900	2083	3800
3950	4210	105	20	42	4000	2133	3900
4050	4310	55	21	44	4100	2183	4000
4150	4410	105	21	44	4200	2233	4100

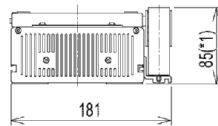
2.4 N15SM



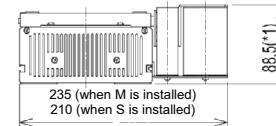
- (*1) The cable track may bulge and slightly exceed the dimension specified below.
 (*2) Optional and user cable tracks are supported only when the stroke is 2,000 mm or less.
 (*3) If any optional or user cable track is used, dimension E is adjusted to "55 mm less than the dimension shown in the table."



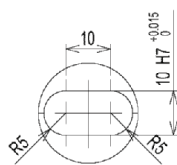
Detail View of G
(2:1)



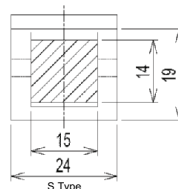
Optional Cable track
(1:5)



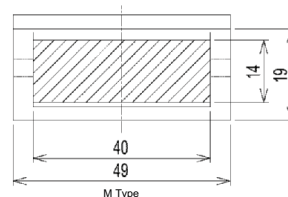
User Cable track, S/M Type
(1:5)



Detail View of H
(1:1)



Section View of User Cable track
(1:1)

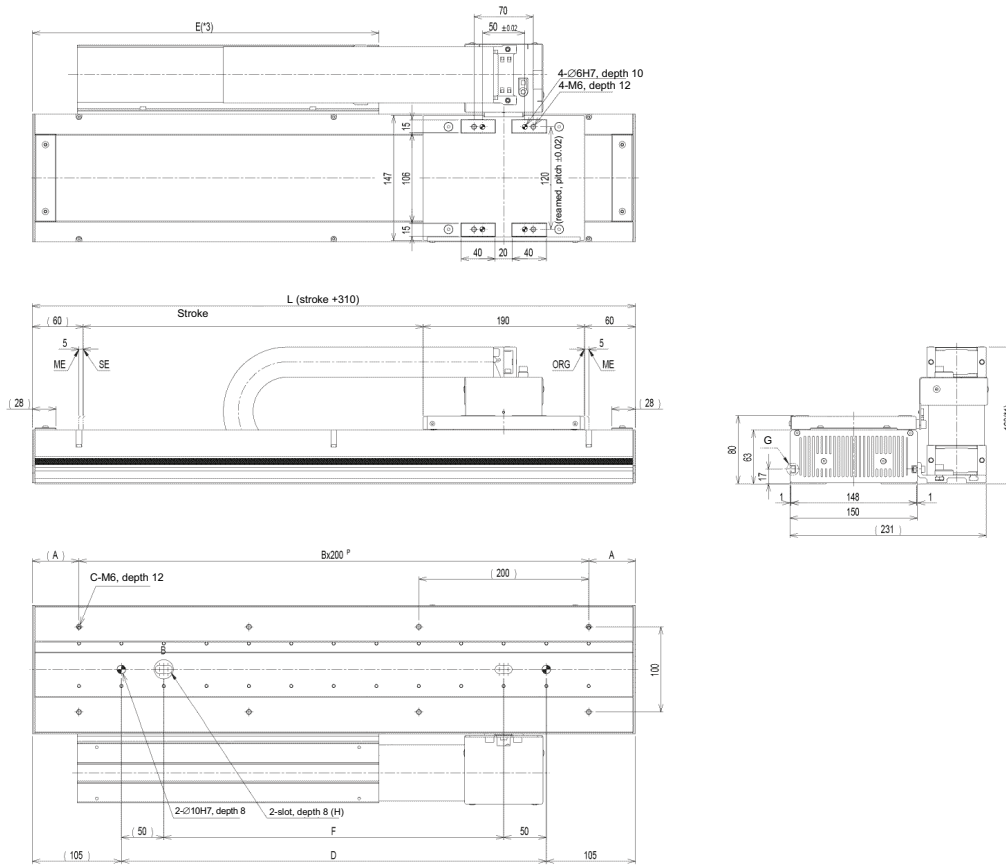


SE: Stroke end
ME: Mechanical end

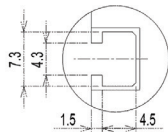


Effective stroke	L	A	B	C	D	E	F
150	610	105	2	6	400	233	300
250	710	55	3	8	500	283	400
350	810	105	3	8	600	333	500
450	910	55	4	10	700	383	600
550	1010	105	4	10	800	433	700
650	1110	55	5	12	900	483	800
750	1210	105	5	12	1000	533	900
850	1310	55	6	14	1100	583	1000
950	1410	105	6	14	1200	633	1100
1050	1510	55	7	16	1300	683	1200
1150	1610	105	7	16	1400	733	1300
1250	1710	55	8	18	1500	783	1400
1350	1810	105	8	18	1600	833	1500
1450	1910	55	9	20	1700	883	1600
1550	2010	105	9	20	1800	933	1700
1650	2110	55	10	22	1900	983	1800
1750	2210	105	10	22	2000	1033	1900
1850	2310	55	11	24	2100	1083	2000
1950	2410	105	11	24	2200	1133	2100
2050	2510	55	12	26	2300	1183	2200
2150	2610	105	12	26	2400	1233	2300
2250	2710	55	13	28	2500	1283	2400
2350	2810	105	13	28	2600	1333	2500
2450	2910	55	14	30	2700	1383	2600
2550	3010	105	14	30	2800	1433	2700
2650	3110	55	15	32	2900	1483	2800
2750	3210	105	15	32	3000	1533	2900
2850	3310	55	16	34	3100	1583	3000
2950	3410	105	16	34	3200	1633	3100
3050	3510	55	17	36	3300	1683	3200
3150	3610	105	17	36	3400	1733	3300
3250	3710	55	18	38	3500	1783	3400
3350	3810	105	18	38	3600	1833	3500
3450	3910	55	19	40	3700	1883	3600
3550	4010	105	19	40	3800	1933	3700
3650	4110	55	20	42	3900	1983	3800
3750	4210	105	20	42	4000	2033	3900
3850	4310	55	21	44	4100	2083	4000
3950	4410	105	21	44	4200	2133	4100

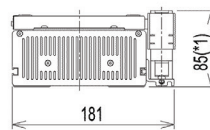
2.5 N15HS



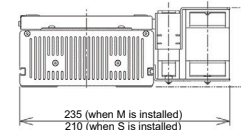
- (*1) The cable track may bulge and slightly exceed the dimension specified below.
 (*2) Optional and user cable tracks are supported only when the stroke is 2,000 mm or less.
 (*3) If any optional or user cable track is used, dimension E is adjusted to "55 mm less than the dimension shown in the table."



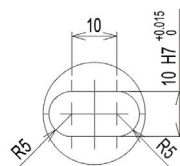
Detail View of G
(2:1)



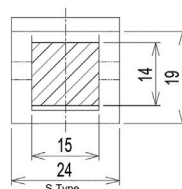
Optional Cable track
(1:5)



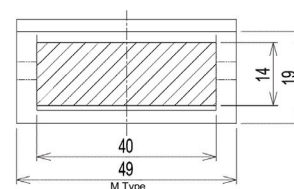
User Cable track, S/M Type
(1:5)



Detail View of H
(1:1)



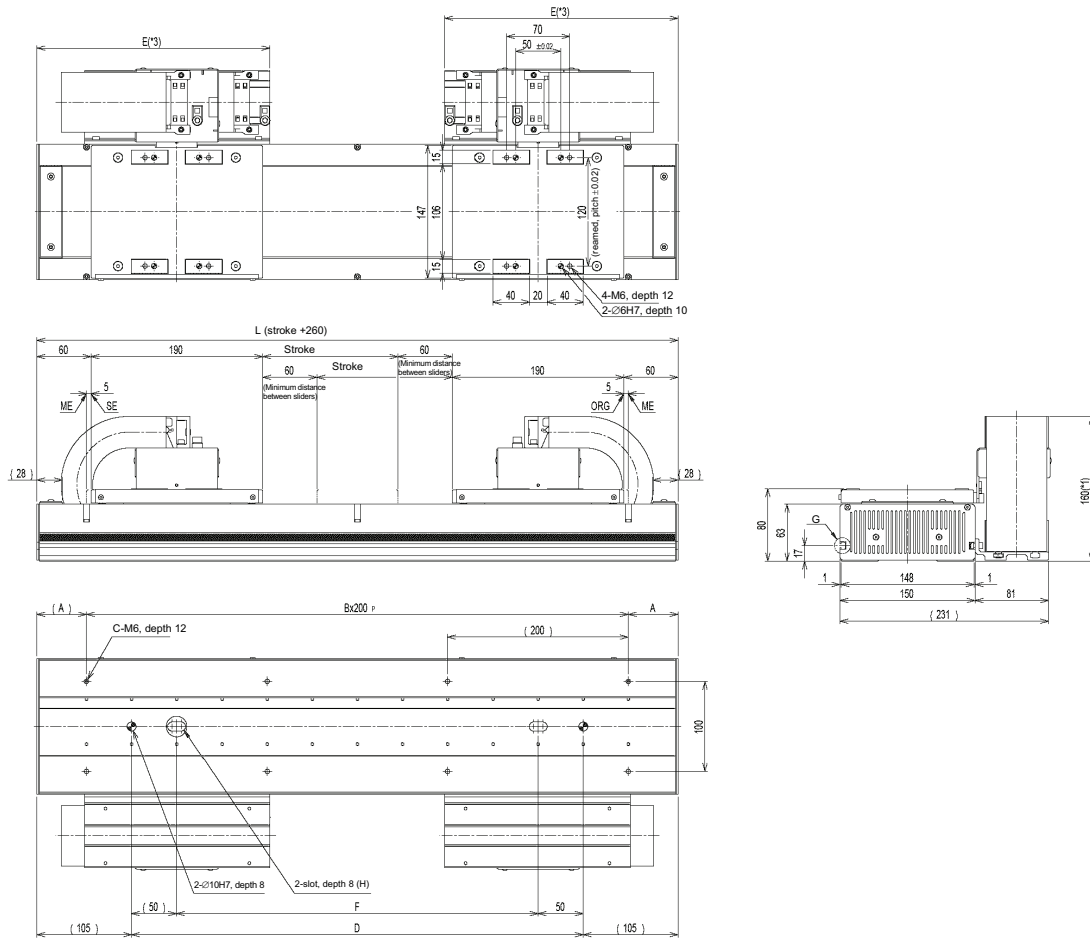
Section View of User Cable track
(1:2)



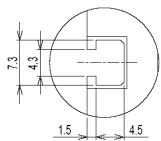
SE: Stroke end
ME: Mechanical end

Effective stroke	L	A	B	C	D	E	F
100	410	105	1	4	200	258	100
200	510	55	2	6	300	308	200
300	610	105	2	6	400	358	300
400	710	55	3	8	500	408	400
500	810	105	3	8	600	458	500
600	910	55	4	10	700	508	600
700	1010	105	4	10	800	558	700
800	1110	55	5	12	900	608	800
900	1210	105	5	12	1000	658	900
1000	1310	55	6	14	1100	708	1000
1100	1410	105	6	14	1200	758	1100
1200	1510	55	7	16	1300	808	1200
1300	1610	105	7	16	1400	858	1300
1400	1710	55	8	18	1500	908	1400
1500	1810	105	8	18	1600	958	1500
1600	1910	55	9	20	1700	1008	1600
1700	2010	105	9	20	1800	1058	1700
1800	2110	55	10	22	1900	1108	1800
1900	2210	105	10	22	2000	1158	1900
2000	2310	55	11	24	2100	1208	2000
2100	2410	105	11	24	2200	1150	2100
2200	2510	55	12	26	2300	1200	2200
2300	2610	105	12	26	2400	1250	2300
2400	2710	55	13	28	2500	1300	2400
2500	2810	105	13	28	2600	1350	2500
2600	2910	55	14	30	2700	1400	2600
2700	3010	105	14	30	2800	1450	2700
2800	3110	55	15	32	2900	1500	2800
2900	3210	105	15	32	3000	1550	2900
3000	3310	55	16	34	3100	1600	3000
3100	3410	105	16	34	3200	1650	3100
3200	3510	55	17	36	3300	1700	3200
3300	3610	105	17	36	3400	1750	3300
3400	3710	55	18	38	3500	1800	3400
3500	3810	105	18	38	3600	1850	3500
3600	3910	55	19	40	3700	1900	3600
3700	4010	105	19	40	3800	1950	3700
3800	4110	55	20	42	3900	2000	3800
3900	4210	105	20	42	4000	2050	3900
4000	4310	55	21	44	4100	2100	4000
4100	4410	105	21	44	4200	2150	4100

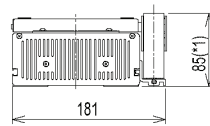
2.6 N15HM



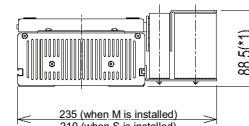
- (*1) The cable track may bulge and slightly exceed the dimension specified below.
 (*2) Optional and user cable tracks are supported only when the stroke is 2,000 mm or less.
 (*3) If any optional or user cable track is used, dimension E is adjusted to "55 mm less than the dimension shown in the table."



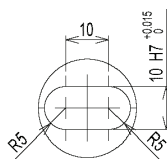
Detail View of G
(2:1)



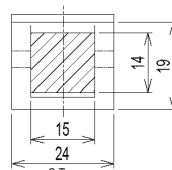
Optional Cable track
(1:5)



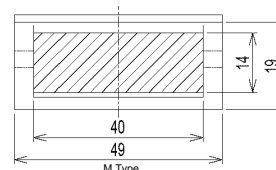
User Cable track, S/M Type
(1:5)



Detail View of H
(1:1)



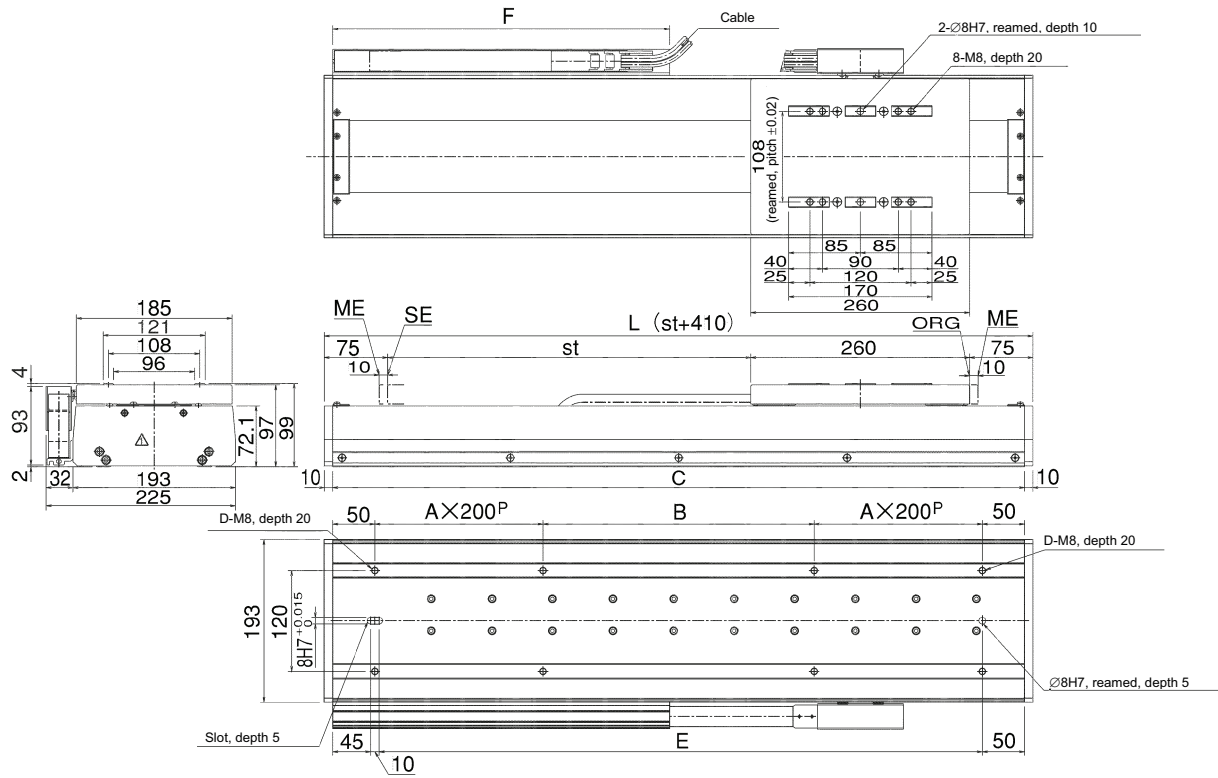
Section View of User Cable track
(1:2)



SE: Stroke end
ME: Mechanical end

Effective stroke	L	A	B	C	D	E	F
150	710	55	3	8	500	258	400
250	810	105	3	8	600	308	500
350	910	55	4	10	700	358	600
450	1010	105	4	10	800	408	700
550	1110	55	5	12	900	458	800
650	1210	105	5	12	1000	508	900
750	1310	55	6	14	1100	558	1000
850	1410	105	6	14	1200	608	1100
950	1510	55	7	16	1300	658	1200
1050	1610	105	7	16	1400	708	1300
1150	1710	55	8	18	1500	758	1400
1250	1810	105	8	18	1600	808	1500
1350	1910	55	9	20	1700	858	1600
1450	2010	105	9	20	1800	908	1700
1550	2110	55	10	22	1900	958	1800
1650	2210	105	10	22	2000	1008	1900
1750	2310	55	11	24	2100	1058	2000
1850	2410	105	11	24	2200	1108	2100
1950	2510	55	12	26	2300	1158	2200
2050	2610	105	12	26	2400	1208	2300
2150	2710	55	13	28	2500	1258	2400
2250	2810	105	13	28	2600	1308	2500
2350	2910	55	14	30	2700	1358	2600
2450	3010	105	14	30	2800	1408	2700
2550	3110	55	15	32	2900	1458	2800
2650	3210	105	15	32	3000	1508	2900
2750	3310	55	16	34	3100	1558	3000
2850	3410	105	16	34	3200	1608	3100
2950	3510	55	17	36	3300	1658	3200
3050	3610	105	17	36	3400	1708	3300
3150	3710	55	18	38	3500	1758	3400
3250	3810	105	18	38	3600	1808	3500
3350	3910	55	19	40	3700	1858	3600
3450	4010	105	19	40	3800	1908	3700
3550	4110	55	20	42	3900	1958	3800
3650	4210	105	20	42	4000	2008	3900
3750	4310	55	21	44	4100	2058	4000
3850	4410	105	21	44	4200	2108	4100

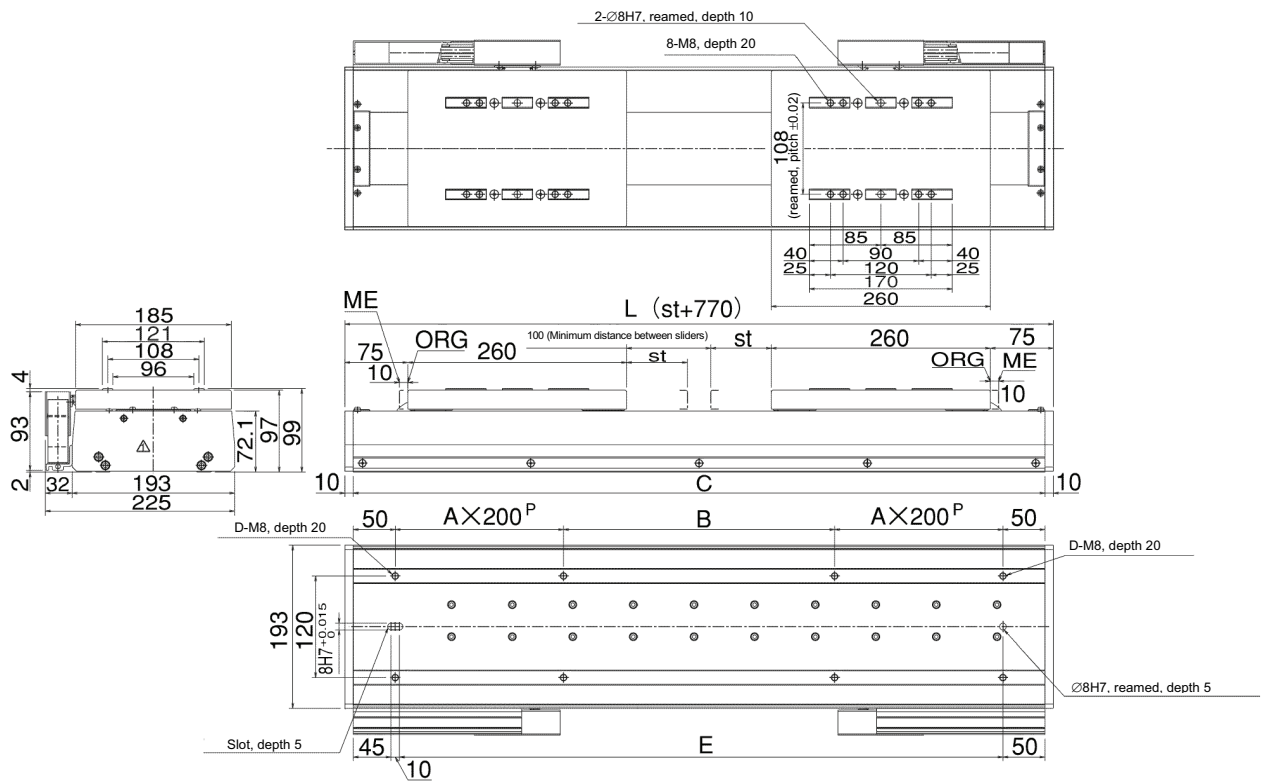
2.7 N19SS



N19SS

Effective stroke	L	A	B	C	D	E	F
144	554	1	34	534	4	429	250
288	698	1	178	678	4	573	325
432	842	1	322	822	4	717	400
576	986	2	66	966	6	861	475
720	1130	2	210	1110	6	1005	550
864	1274	2	354	1254	6	1149	625
1008	1418	3	98	1398	8	1293	700
1152	1562	3	242	1542	8	1437	775
1296	1706	3	386	1686	8	1581	850
1440	1850	4	130	1830	10	1725	925
1584	1994	4	274	1974	10	1869	1000
1728	2138	5	18	2118	12	2013	1075
1872	2282	5	162	2262	12	2157	1150
2016	2426	5	306	2406	12	2301	1225
2160	2570	6	50	2550	14	2445	1300
2304	2714	6	194	2694	14	2589	1375
2448	2858	6	338	2838	14	2733	1450
2592	3002	7	82	2982	16	2877	1525

2.8 N19SM

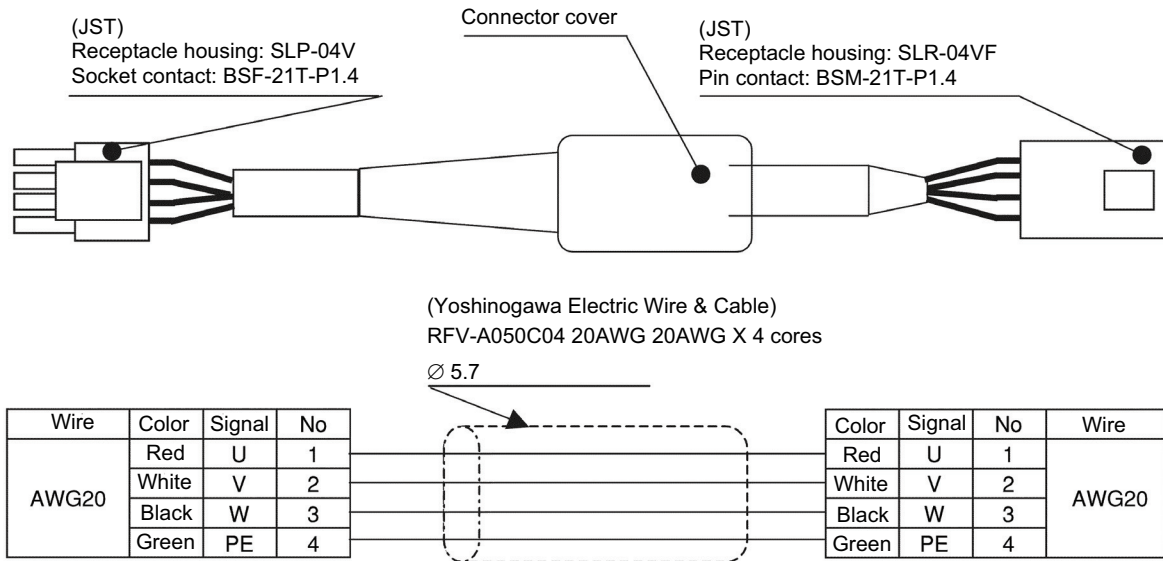


N19SM

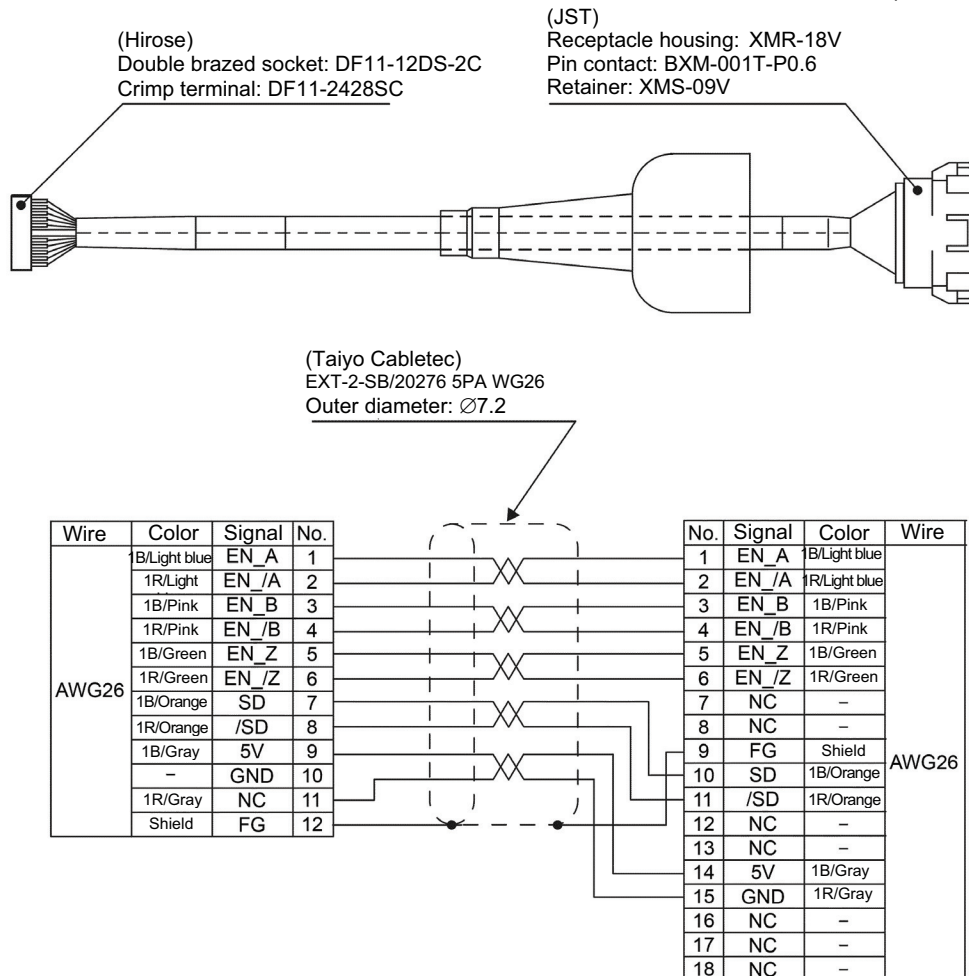
Effective stroke	L	A	B	C	D	E	F
72	842	1	322	822	4	717	200
216	986	2	66	966	6	861	275
360	1130	2	210	1110	6	1005	350
504	1274	2	354	1254	6	1149	425
648	1418	3	98	1398	8	1293	500
792	1562	3	242	1542	8	1437	575
936	1706	3	386	1686	8	1581	650
1080	1850	4	130	1830	10	1725	725
1224	1994	4	274	1974	10	1869	800
1368	2138	5	18	2118	12	2013	875
1512	2282	5	162	2262	12	2157	950
1656	2426	5	306	2406	12	2301	1025
1800	2570	6	50	2550	14	2445	1100
1944	2714	6	194	2694	14	2589	1175
2088	2858	6	338	2838	14	2733	1250
2232	3002	7	82	2982	16	2877	1325

3. Cable Drawings

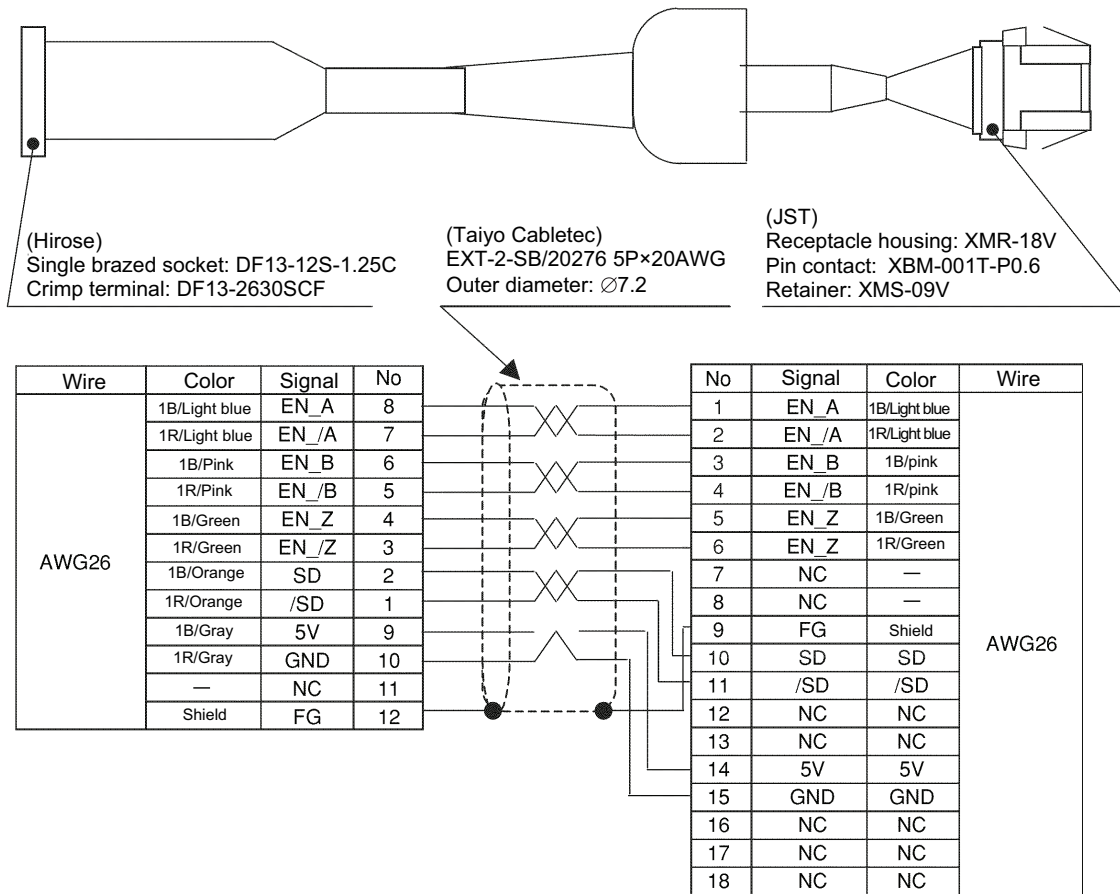
[1] Cable inside cable track (motor cable)



[2] Cable inside cable track for N10SS, N10SM, N15SS, N15SM, N15HS and N15HM (encoder cable)



[3] Cable inside cable track for N19SS and N19SM (encoder cable)

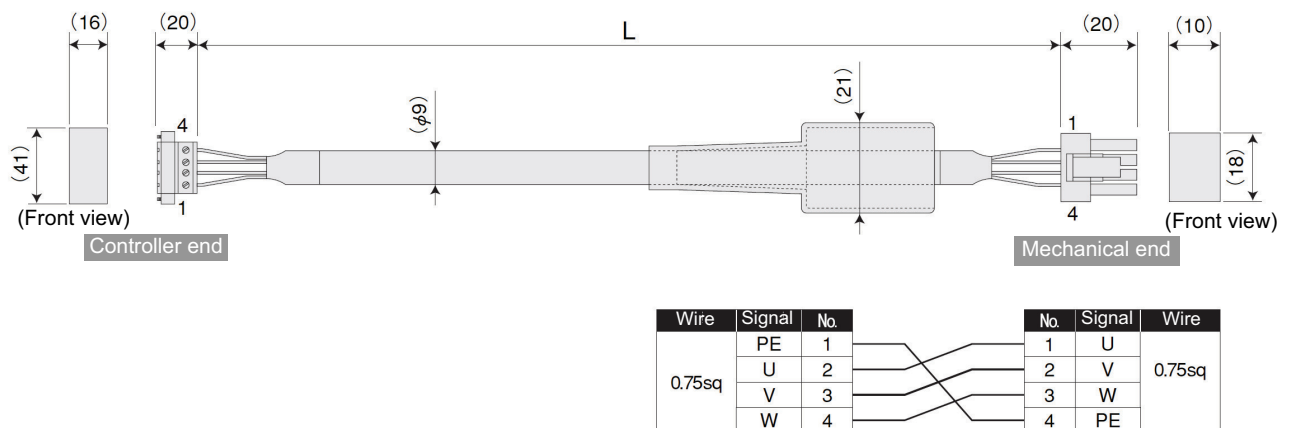


[4] Controller cable (motor cable)

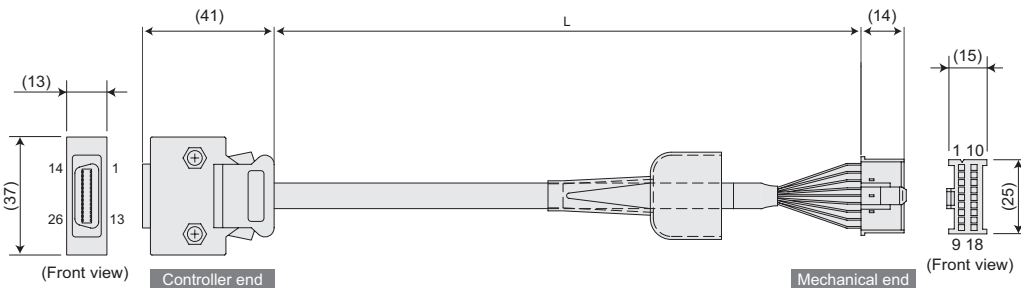
Model: CB-X-MA□□□

* □□□ indicates the cable length (L).

Example) 080 = 8 m



- [5] Controller cable (encoder cable) : LSA
 Model: CB-X2-PA□□□
 * □□□ indicates the cable length (L).
 Example) 080 = 8 m



Wire	Color	Signal	No.
—	—	—	10
—	—	—	11
—	—	E24V	12
—	—	0V	13
—	—	LS	26
—	—	CLEP	25
—	—	OT	24
—	—	RSV	23
—	—	—	9
—	—	—	18
—	—	—	19
White/Blue	A+	1	1
White/Yellow	A-	2	2
White/Red	B+	3	3
White/Black	B-	4	4
White/Purple	Z+	5	5
White/Gray	Z-	6	6
Orange	SRD+	7	7
Green	SRD-	8	8
Purple	BAT+	14	14
Gray	BAT-	15	15
Red	VCC	16	16
Black	GND	17	17
Blue	BKR-	20	20
Yellow	BKR+	21	21
—	—	—	22

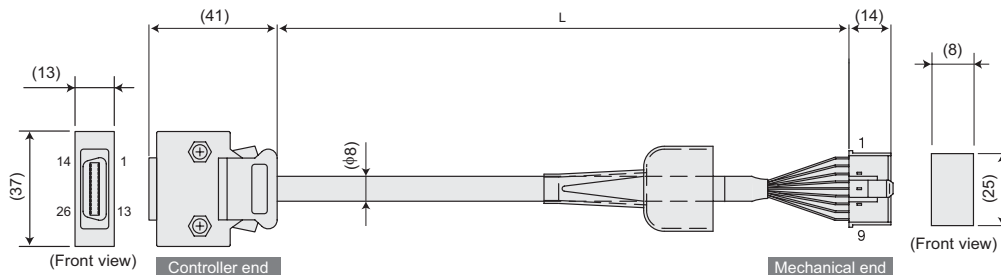
Clamp the shield to the hood.

Ground wire and braided shield wires

(* "White/Blue" in the wire color field indicates the band color and insulator color, respectively.)

No.	Signal	Color	Wire
1	A	White/Blue	AWG26 (crimped)
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	

- [6] Controller cable (encoder cable) : LSAS
 Model: CB-X1-PA□□□
 * □□□ indicates the cable length (L).
 Example) 080 = 8 m



Wire	Color	Signal	No.
—	—	—	10
—	—	—	11
—	—	E24V	12
—	—	0V	13
—	—	LS	26
—	—	CLEP	25
—	—	OT	24
—	—	RSV	23
—	—	—	9
—	—	—	18
—	—	—	19
—	—	A+	1
—	—	A-	2
—	—	B+	3
—	—	B-	4
—	—	Z+	5
—	—	Z-	6
Orange	SRD+	7	7
Green	SRD-	8	8
Purple	BAT+	14	14
Gray	BAT-	15	15
Red	VCC	16	16
Black	GND	17	17
Blue	BKR-	20	20
Yellow	BKR+	21	21
—	—	—	22

Clamp the shield to the hood.

Ground wire and braided shield wires

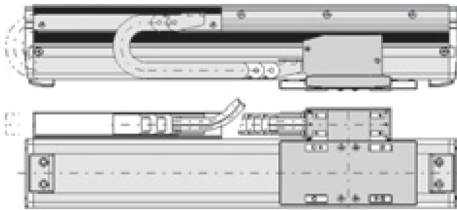
No.	Signal	Color	Wire
1	BAT+	Purple	AWG26 (crimped)
2	BAT-	Gray	
3	SD	Orange	
4	SD	Green	
5	VCC	Red	
6	GND	Black	
7	FG	Ground	
8	BK-	Blue	
9	BK+	Yellow	

4. Options

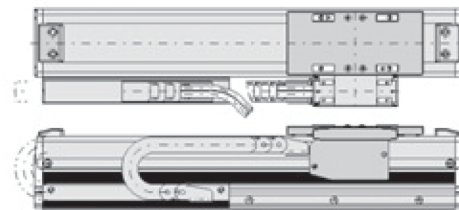
4.1 Cable track Installation Direction

With single sliders of N10SS, N15SS, H15SS and H19SS types, you can specify an option corresponding to the desired direction in which the cable track is installed.

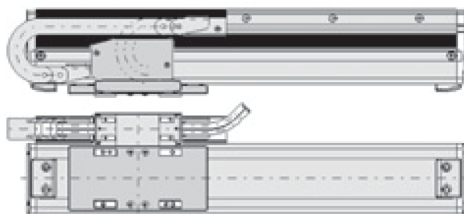
- [1] Standard direction
Option model: Not specified



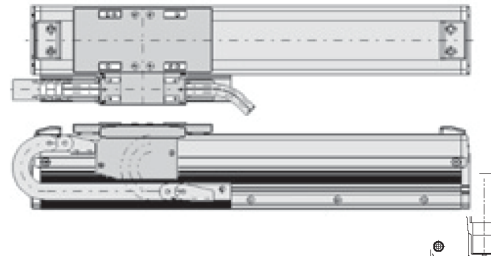
- [2] Reversed
Option model: CT2



- [3] Standard, with home on opposite side
Option model: CT3



- [4] Reversed with home on opposite side
Option model: CT4

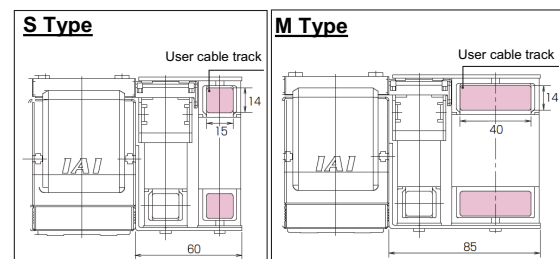


4.2 User Cable track

The cable track that comes standard is used exclusively for the linear actuator wirings and has no room for additional user wirings.

With the N10SS, N15SS and N15HS types, optional user cable tracks are available to house the additional wirings you may require.

Option model	Cable track installation direction	Size
US1	Standard	S
US2	Reversed	
US3	Standard, with home on opposite side	
US4	Reversed, with home on opposite side	
UM1	Standard	M
UM2	Reversed	
UM3	Standard, with home on opposite side	
UM4	Reversed, with home on opposite side	



5. Checks after Unpacking

After unpacking the actuator package, check the condition of the product as well as the items included in the package.

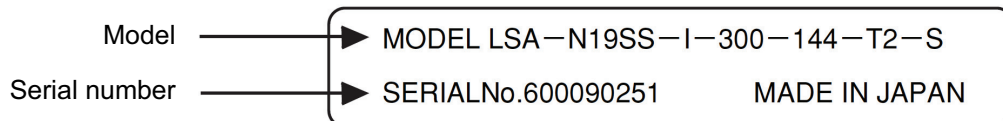
5.1 Included Items

No.	Item	Remarks
1	Actuator	Refer to “How to Read Model Nameplate” and “How to Read Model Name.”
Accessories		
2	Motor cable	CB-X-MA□□□
3	Encoder cable	CB-X2-PA□□□
4	Instruction manual	

5.2 Instruction Manuals Relating to This Product

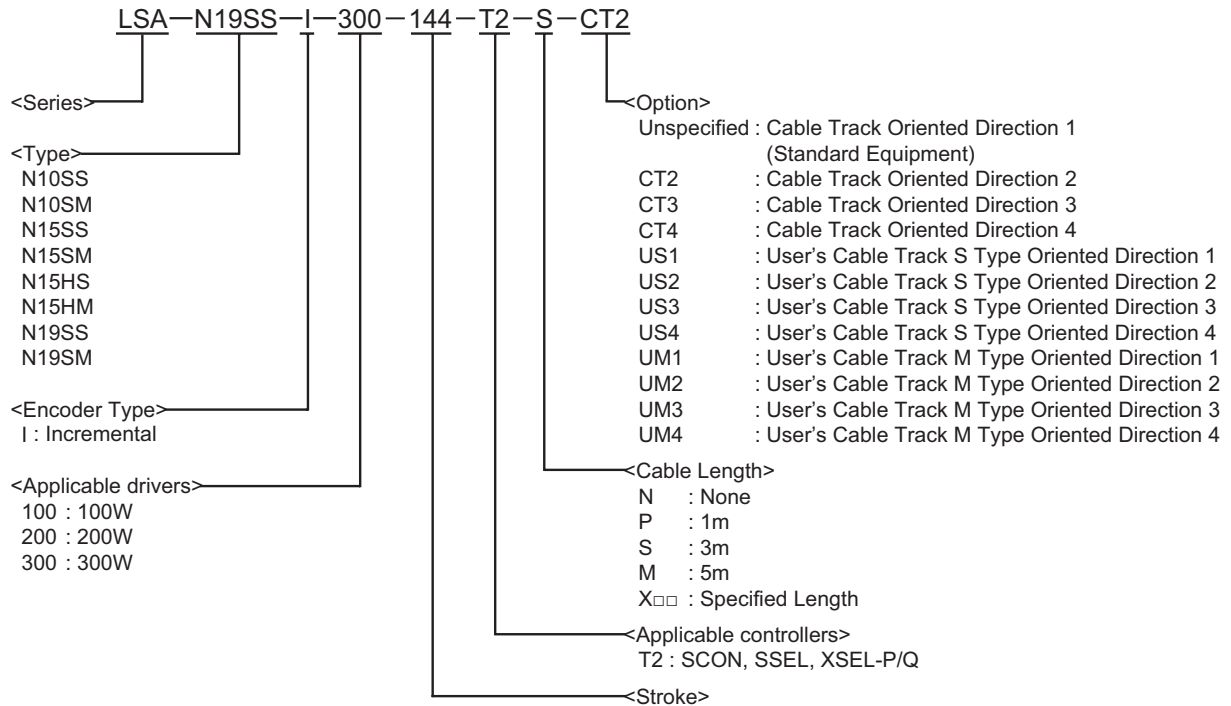
No.	Name	Manual No.
1	XSEL-P/Q Controller Instruction Manual	ME0148
2	XSEL-PX/QX Controller Instruction Manual	ME0152
3	XSEL Controller P/Q/PX/QX Gateway Function Instruction Manual	ME0188
4	PC Software IA-101-X-MW/IA-101-X-USBMW Instruction Manual	ME0154
5	Teaching Pendant SEL-T/TD Instruction Manual	ME0183
6	Teaching Pendant IA-T-X-XD Instruction Manual	ME0160
7	DeviceNet Instruction Manual	ME0124
8	CC-Link Instruction Manual	ME0123
9	Profibus-DP Instruction Manual	ME0153
10	Ethernet Instruction Manual	ME0140

5.3 How to Read Model Nameplate

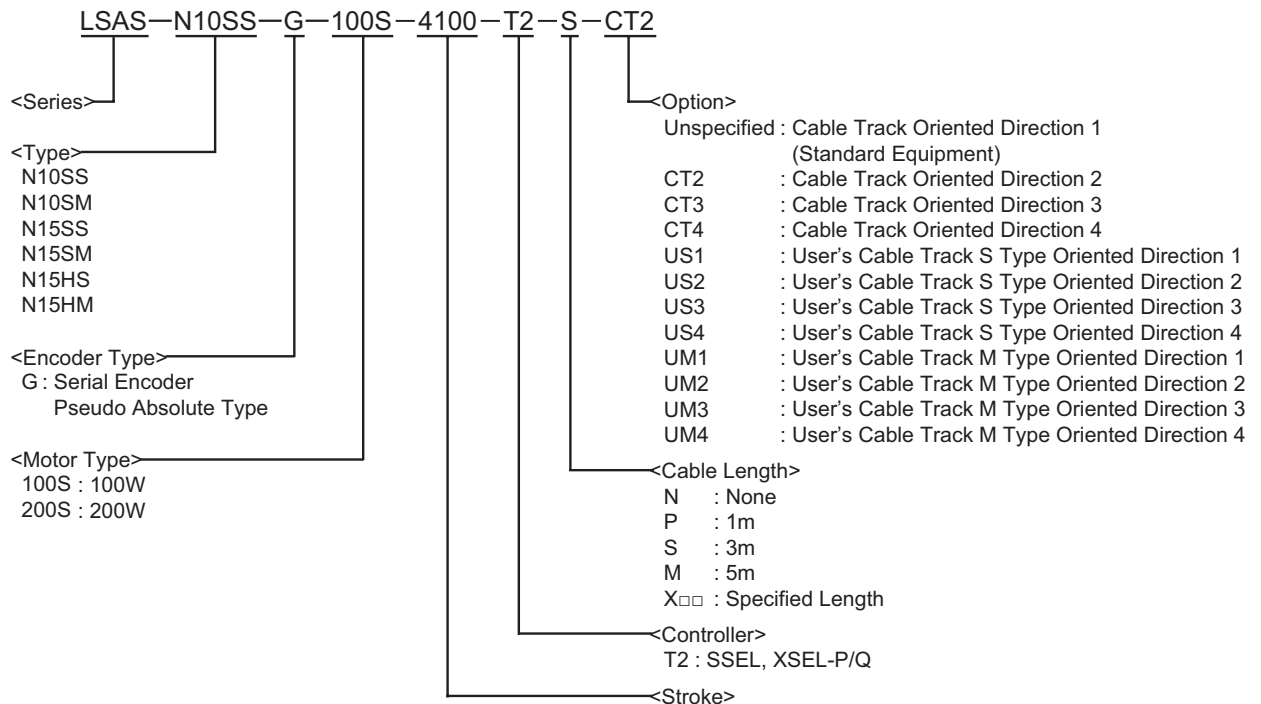


5.4 How to Read Model Name

5.4.1 LSA



5.4.2 LSAS



6. Specifications

6.1 N10SS, N10SM

Model	Unit	LSA-N10S	
Stroke	mm	100 to 4100	
Rated thrust	N	54	
Maximum thrust	N	162	
Maximum speed	mm/sec	2,500	(*1)
Maximum acceleration/deceleration	G	3	(*2)
Maximum loading capacity	kgf	15 (when used horizontally)	(*3)
Positioning repeatability	±mm	0.005	
Load moment	N. m (kgf•cm)	Ma: 76.4 (7.7)	
		Mb: 46.3 (4.7)	
		Mc: 25.7 (2.6)	
Overhang load length	mm	Ma direction: 340 max.	
		Mb/Mc directions: 340 max.	

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

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

6.2 N15SS, N15SM, N15HS, N15HM

Model	Unit	LSA-N15S	LSA-N15H	
Stroke	mm	100 to 4100		
Rated thrust	N	86	125	
Maximum thrust	N	258	375	
Maximum speed	mm/sec	2,500		(*1)
Maximum acceleration/deceleration	G	3		(*2)
Maximum loading capacity	kgf	20 (when used horizontally)	30 (when used horizontally)	(*3)
Positioning repeatability	±mm	0.005		
Load moment	N. m (kgf•cm)	Ma: 117.7 (11.3)	Ma: 155.8 (15.8)	
		Mb: 66.6 (6.7)	Mb: 91.1 (9.2)	
		Mc: 50.0 (5.1)	Mc: 71.5 (7.2)	
Overhang load length	mm	Ma direction: 450 max.	Ma direction: 450 max.	
		Mb/Mc directions: 450 max.	Mb/Mc directions: 450 max.	

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

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

6.3 N19SS, N19SM

Model	Unit	M19SS	M19SM
Stroke	mm	144 to 2592 (in 144 steps)	72 to 2232 (in 144 steps)
Rated thrust	N	100	
Maximum thrust	N	300	
Maximum speed	mm/sec	2,500	
Maximum acceleration/deceleration	G	3	
Maximum loading capacity	kgf	30	
Positioning repeatability	±mm	0.005	
Load moment	N. m (kgf•cm)	Running life: 10,000 km	
		Ma: 61.94 (6.32)	
		Mb: 61.94 (6.32)	
		Mc: 61.94 (6.32)	
Overhang load length	mm	Ma direction: 700 max.	
		Mb/Mc directions: 700 max.	

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

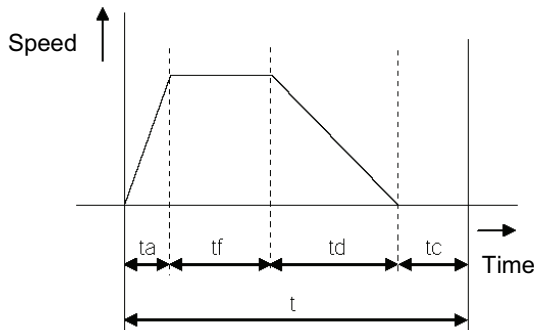
(*2) The specific value varies depending on the operating conditions.

7. Selection Conditions

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

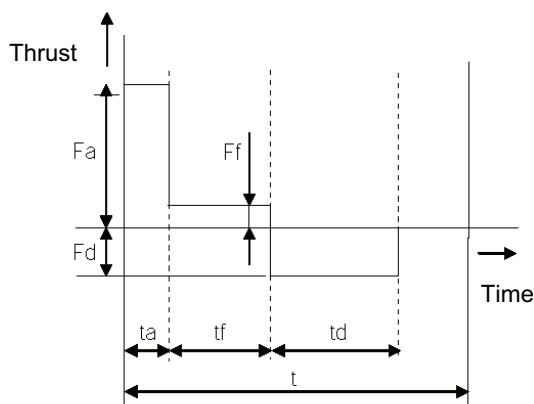
- Condition [1] The thrust required for acceleration must not exceed the maximum thrust of the mid-size linear servo actuator.
- Condition [2] The thrust during continuous operation must be the rated thrust of the mid-size linear servo actuator.

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



t: Operation time per cycle (sec)
 ta: Acceleration time (sec)
 tf: Moving time at constant speed (sec)
 td: Deceleration time (sec)
 tc: Stabilization time (0.15 sec)

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



Fa: Thrust required for acceleration (N)
 Ff: Traveling resistance (N)
 Fd: Thrust required for deceleration (N)

7.1 Selection Method

Condition [1]: Maximum thrust

For the slider to accelerate according to a command, the thrust required for acceleration, or F_a , must be smaller than the maximum thrust of the mid-size linear servo actuator. The maximum thrust of mid-size linear servo actuators differs depending on the moving speed of the slider. Particularly, exercise due caution in high-speed zones as the maximum thrust degrades in these zones. (See the F – N Characteristic Drawing at Continuous Operation.)

Thrust F_a is calculated using the equation below:

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

M: Slider weight

m: Slider load (kg)

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

F_f : Traveling resistance (N)

[Slider weight]

● N10SS, N10SM: 3.0 kg

● N15SS, N15SM: 4.0 kg

● N15HS, N15HM: 5.0 kg

● N19SS, N19SM: 5.5 kg

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

[Traveling resistance of mid-size linear servo actuator]

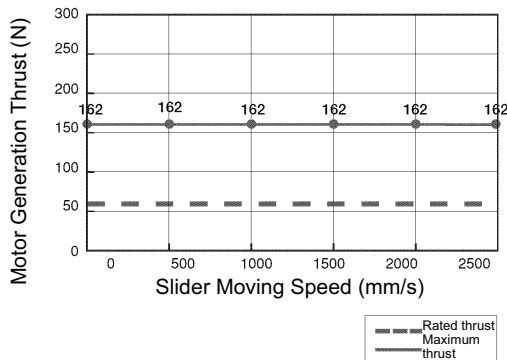
N10SS, N10SM	$F_f = 5V + 16.5$
N15SS, N15SM	$F_f = 10V + 25$
N15HS, N15HM	$F_f = 17V + 30$
N19SS, N19SM	$F_f = 16V + 12$

V: Slider speed (m/s)

If the obtained F_a is smaller than the maximum thrust of the mid-size linear servo actuator, condition 1 is satisfied. For the maximum thrusts, see the drawings below.

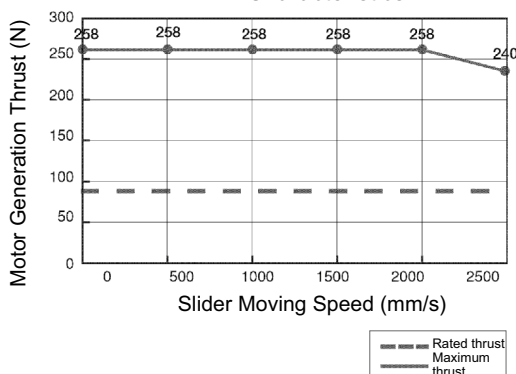
● N10SS, N10SM

F – V Characteristics



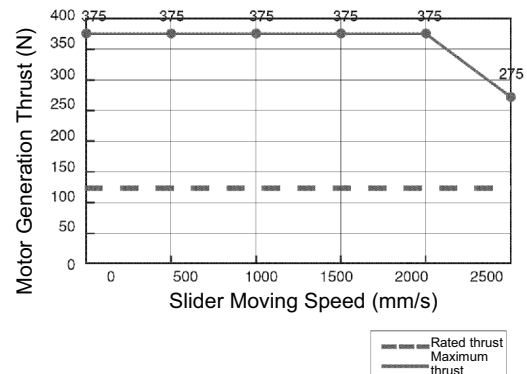
● Maximum Thrusts of N15SS and N15SM

F – V Characteristics

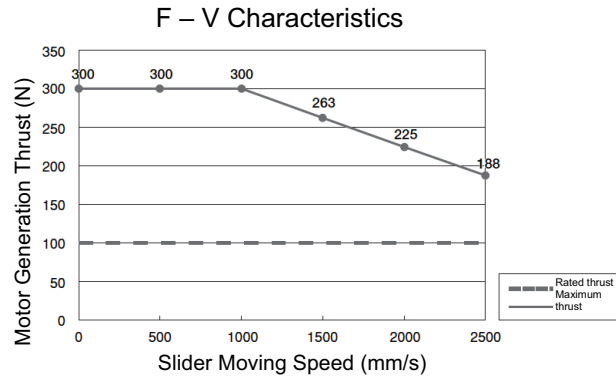


● Maximum Thrusts of N15HS and N15HM

F – V Characteristics



● Maximum Thrusts of N19SS and N19SM



Condition [2]: Thrust during continuous operation

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

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

Here, F_d is the thrust required for deceleration, which is calculated using the following equation.

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

M: Slider weight
m: Slider load
d: Commanded deceleration (m/s^2)
Ff: Traveling resistance (N)

[Slider weight]
● N10SS, N10SM: 3.0 kg
● N15SS, N15SM: 4.0 kg
● N15HS, N15HM: 5.0 kg
● N19SS, N19SM: 5.5 kg

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

[Rated thrust]
● N10SS, N10SM: 54 N
● N15SS, N15SM: 86 N
● N15HS, N15HM: 125 N
● N19SS, N19SM: 100 N

The actuator can be used in any operating conditions that satisfy both conditions 1 and 2 specified above. If either condition cannot be satisfied, take appropriate measures such as reducing the slider load, acceleration or duty.

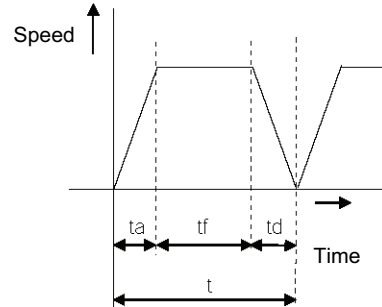
7.2 Example

Let's select a motor for the N19SS and N19SM by following the procedure in "Selection Method."

★ Operating conditions

- Speed: 2.5 m/s
- Acceleration: 14.7 m/s² (The deceleration is assumed to be the same.)
- Travel: 1.5 m
- Slider load: 8 kg
- The actuator moves back and forth over a stroke of 1.5 m.

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



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

Test condition [1], "maximum thrust."

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

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

Here,

M:	Slider weight (5.5 kg)	
m:	Slider load (kg)	: 8 kg in this example
a:	Commanded acceleration (m/s ²)	: 14.7 m/s ² in this example
F _f :	Traveling resistance (N)	: 52 N in this example

From above, F_a is calculated as follows:

$$F_a = 13.5 \times 14.7 + 52 \rightarrow 250.45 \text{ N}$$

Because the maximum thrust is 188 N at 2.5 m/s, we can see that the maximum thrust is unacceptable.

Let's lower the specified acceleration to 9.8 m/s². F_a changes as follows:

$$F_a = 13.5 \times 9.8 + 52 \rightarrow 184.3 \text{ N.}$$

Because the maximum thrust is 188 N at 2.5 m/s from F-V characteristics, we can see that the maximum thrust is acceptable.

Test condition [2], “thrust during continuous operation.”

Apply the above operation pattern to the aforementioned equation of thrust during continuous operation. Based on the examination result of maximum thrust, the specified acceleration is assumed as 9.8 m/s^2 .

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

Here,

$F_a = 184.3 \text{ N}$, $F_f = 52 \text{ N}$, $F_d = 80.3 \text{ N}$,

$t_a = t_d = 0.26 \text{ sec}$, $t_f = 0.35 \text{ sec}$, $t = 1.06 \text{ sec}$ (including 0.2 s of settling time^{*1})

^{*1} This settling time applies to N19 actuators. The settling time is 0.15 s for N10 and N15 actuators.

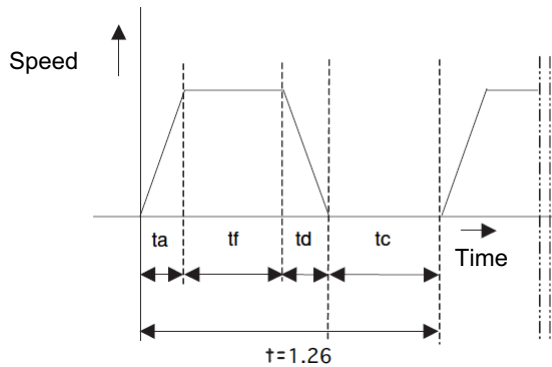
From the above, F_t is calculated as 104 N .

Since this value exceeds the rated thrust 100 N of mid-size linear servo actuators, 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 $t = 1.26 \text{ s}$ (including 0.2 s of settling time^{*1}).

^{*1} This settling time applies to N19 actuators. The settling time is 0.15 s for N10 and N15 actuators.



This time, F_t is calculated as 95.3 N .

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

8. Operating and Storage Environment

8.1 Operating Environment

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

- Avoid direct sunlight.
- Avoid radiant heat from strong heat sources such as a furnace.
- Surrounding air temperature should be 0 to 40°C.
- The humidity should be less than 85% and there should be no condensation.
- Avoid exposure to corrosive or combustible gases.
- The area should have very little dust and be suitable for normal assembly operations.
- Avoid exposure to waterdrop, oil mist or fluids used in cutting.
- Avoid exposure to sulfuric acid, hydrochloric acid and other chemicals. (The actuator is not designed by considering chemical resistance.)
- No shock and vibration should be conveyed to this unit.
- Avoid extreme electromagnetic waves, ultraviolet rays and radiation.

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

8.2 Storage Environment

- The storage environment should be similar to the operating environment.
- If the actuator is stored for a long period, pay special attention to prevent bedewing.
- We do not include moisture absorption agents when shipping the unit. If you are storing the unit where condensation might occur, then you must treat the entire package or treat the unit itself after it is unpacked to prevent condensation.
- The unit can withstand up to 60°C during a short storage interval but only up to 50°C if the storage period is longer than one month.

9. Installation

Notes on Installation

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

When installing the stainless sheet, pay attention to the following points.

Do not press the sheet directly with hands.



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

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

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

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

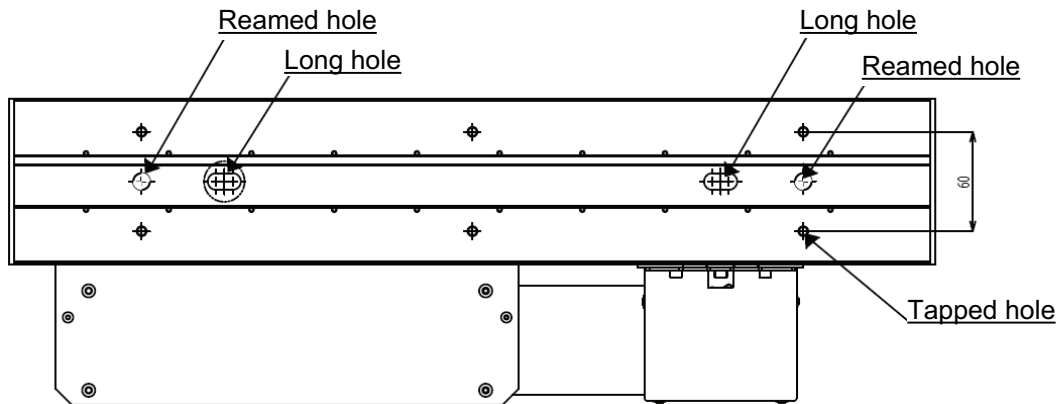
9.1 Installing the Actuator

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

9.1.1 N10SS, N10SM

Mounting tapped holes are provided on the back of the base. Use these tapped holes for mounting the actuator. The effective depth of the screws for mounting the base is as shown below. Because the taps are blind holes, exercise due caution when selecting the bolt length.

If an inappropriate bolt is used, the tapped holes may be damaged and/or the mounting strength of the actuator may become insufficient, causing the degradation of precision and/or unexpected accidents. Additionally, the reamed holes for the positioning pins are provided on the back of the base.



Tap diameter	Effective tap length	Tightening torque		Reamed hole
		Bolt bearing surface is steel	Bolt bearing surface is aluminum	
M6	12 mm	12.4 N•m (1.26 kgf•m)	5.36 N•m (0.55 kgf•m)	Ø10H7 depth 8 mm

About Tightening Screws

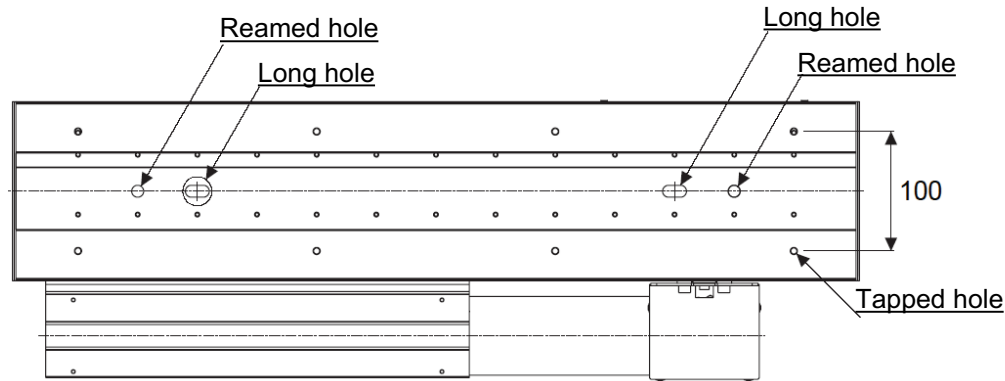
- Use hexagonal socket head bolts for the male screws used to install the base.
- Use of high-strength bolts of ISO-10.9 or greater is recommended.
- Ensure at least the following effective thread lengths for the bolts and male screws:
 - Male screw is made of steel → Same as the nominal diameter
 - Male screw is made of aluminum → Twice the nominal diameter



9.1.2 N15SS, N15SM, N15HS, N15HM

Mounting tapped holes are provided on the back of the base. Use these tapped holes for mounting the actuator. The effective depth of the screws for mounting the base is as shown below. Exercise due caution that the tip of the bolt does not stick out.

If an inappropriate bolt is used, the tapped holes may be damaged and/or the mounting strength of the actuator may become insufficient, causing the degradation of precision and/or unexpected accidents. Additionally, the reamed holes for the positioning pins are provided on the back of the base.



Tap diameter	Effective tap length	Tightening torque		Reamed hole
		Bolt bearing surface is steel	Bolt bearing surface is aluminum	
M6	12 mm	12.4 N•m (1.26 kgf•m)	5.36 N•m (0.55 kgf•m)	Ø10H7 depth 8 mm

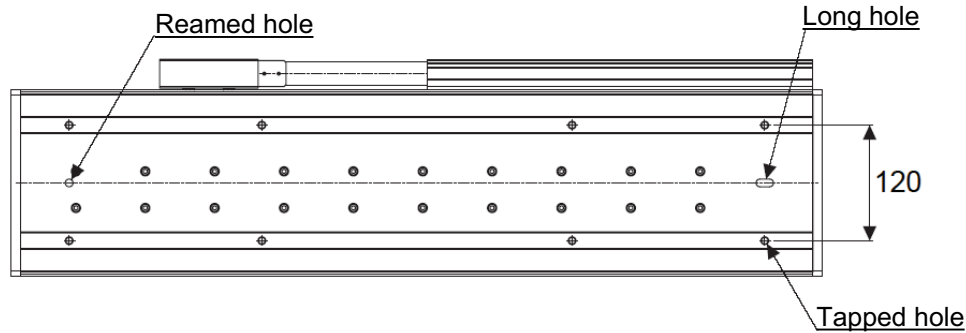
About Tightening Screws

- Use hexagonal socket head bolts for the male screws used to install the base.
- Use of high-strength bolts of ISO-10.9 or greater is recommended.
- Ensure at least the following effective thread lengths for the bolts and male screws:
 - Male screw is made of steel → Same as the nominal diameter
 - Male screw is made of aluminum → Twice the nominal diameter

9.1.3 N19SS, N19SM

Mounting tapped holes are provided on the back of the base. Use these tapped holes for mounting the actuator. The effective depth of the screws for mounting the base is as shown below. Exercise due caution that the tip of the bolt does not stick out.

If an inappropriate bolt is used, the tapped holes may be damaged and/or the mounting strength of the actuator may become insufficient, causing the degradation of precision and/or unexpected accidents. Additionally, the reamed holes for the positioning pins are provided on the back of the base.



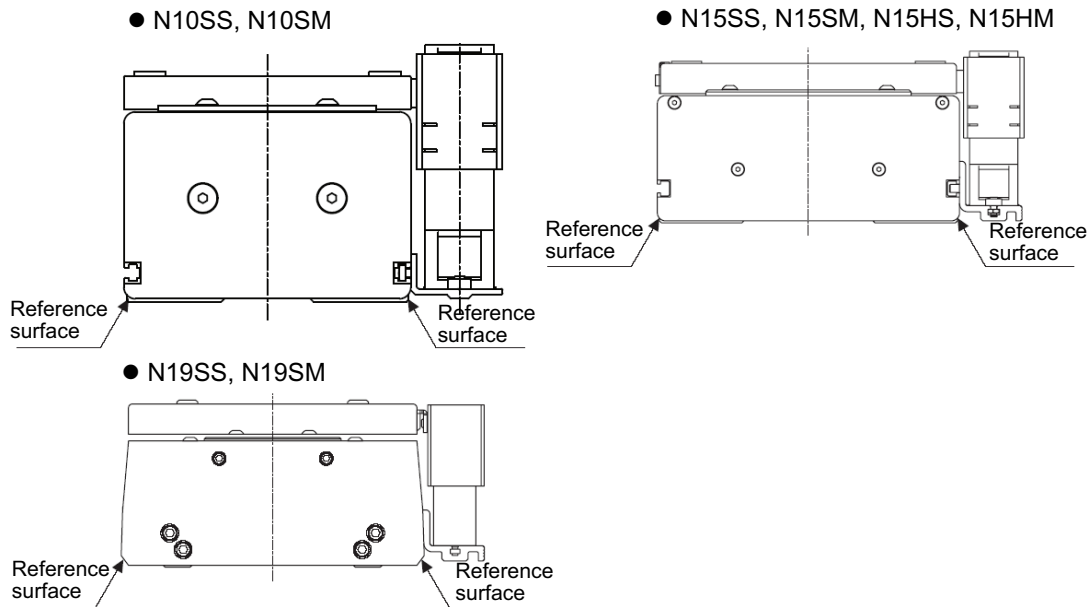
Tap diameter	Effective tap length	Tightening torque		Reamed hole
		Bolt bearing surface is steel	Bolt bearing surface is aluminum	
M8	20 mm	31.3 N•m (3.19 kgf•m)	14 N•m (1.43 kgf•m)	Ø8H7 depth 5 mm

About Tightening Screws

- Use hexagonal socket head bolts for the male screws used to install the base.
- Use of high-strength bolts of ISO-10.9 or greater is recommended.
- Ensure at least the following effective thread lengths for the bolts and male screws:
 - Male screw is made of steel → Same as the nominal diameter
 - Male screw is made of aluminum → Twice the nominal diameter

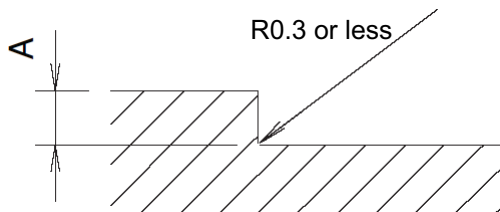
9.2 Installation Surface

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



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

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



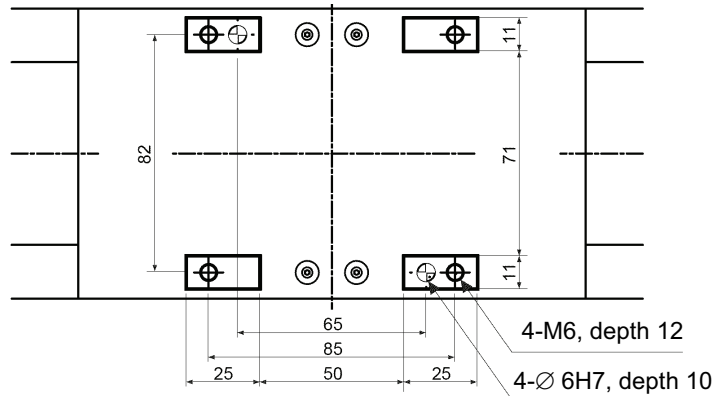
Model	Dimension A
N10SS, N10SM	2 to 3.5
N15SS, N15SM, N15HS, N15HM	2 to 3.5
N19SS, N19SM	2.5 to 4

9.3 Installing a Load on the Slider

- The slider has tapped holes that can be used to affix a load.
The procedure to affix a load on the slider shall conform to the actuator installation procedure.

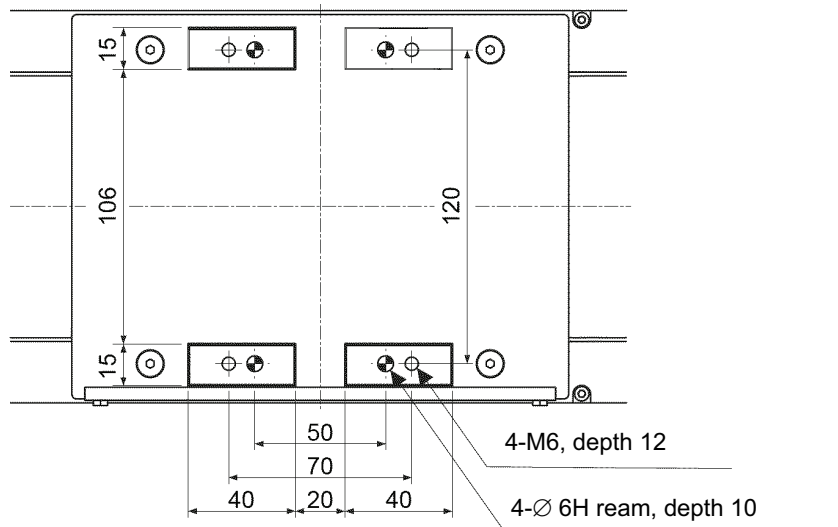
9.3.1 N10SS, N10SM

- Four reamed holes are provided in the slider. Use these holes if the load must be installed/removed repeatedly. To fine-tune the squareness, etc., use one of these reamed holes in the slider.
- Keep the screw-in depth to 12 mm or less. If the screw is inserted exceeding this depth, it will damage the actuator, such as causing scratches on the side cover.



9.3.2 N15SS, N15SM, N15HS, N15HM

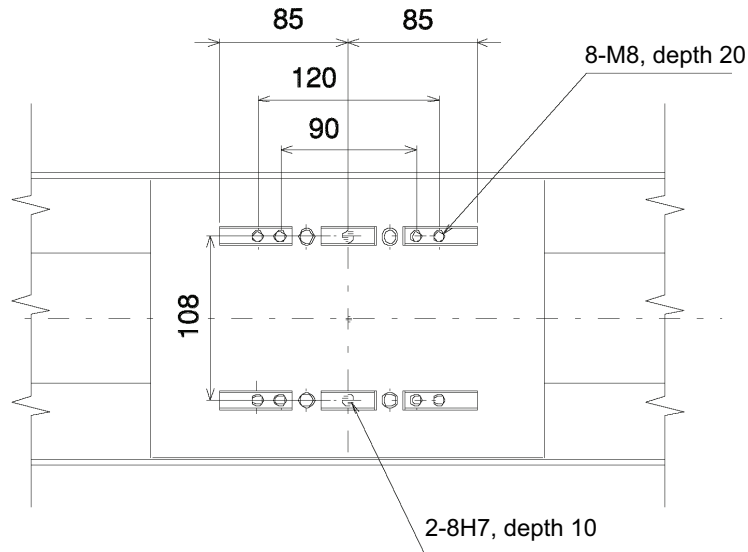
- Four reamed holes are provided in the slider. Use these holes if the load must be installed/removed repeatedly. To fine-tune the squareness, etc., use one of these reamed holes in the slider.
- Keep the screw-in depth to 12 mm or less. If the screw is inserted exceeding this depth, it will damage the actuator, such as causing scratches on the side cover.



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

9.3.3 N19SS, N19SM

- Two reamed holes are provided in the slider. Use these holes if the load must be installed/removed repeatedly. To fine-tune the squareness, etc., use one of these reamed holes in the slider.
- Keep the screw-in depth to 20 mm or less. If the screw is inserted exceeding this depth, it will damage the actuator, such as causing scratches on the side cover.



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

9.4 Installing a Connector Box Using T-slots: N10SS, N10SM, N15SS, N15SM, N15HS, N15HM

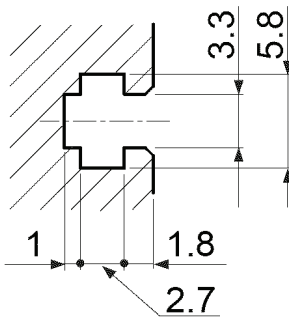
T-slots (for M4) are provided on the side faces on the main bodies of the N10SS, N10SM, N15SS, N15SM, N15HS and N15HM for installing external devices such as a connector box.

Model	T-groove size
N10SS, N10SM	M3
N15SS, N15SM, N15HS N15HM	M4

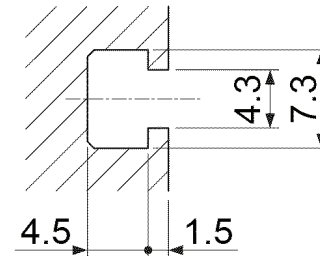
If you are using a wiring kit, install a connector box using these T-slots. T-slots can also be used for other purposes, such as installing sensors or securing cables. The T-slot dimensions are specified below.

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

● N10SS, N10SM



● N15SS, N15SM, N15HS N15HM

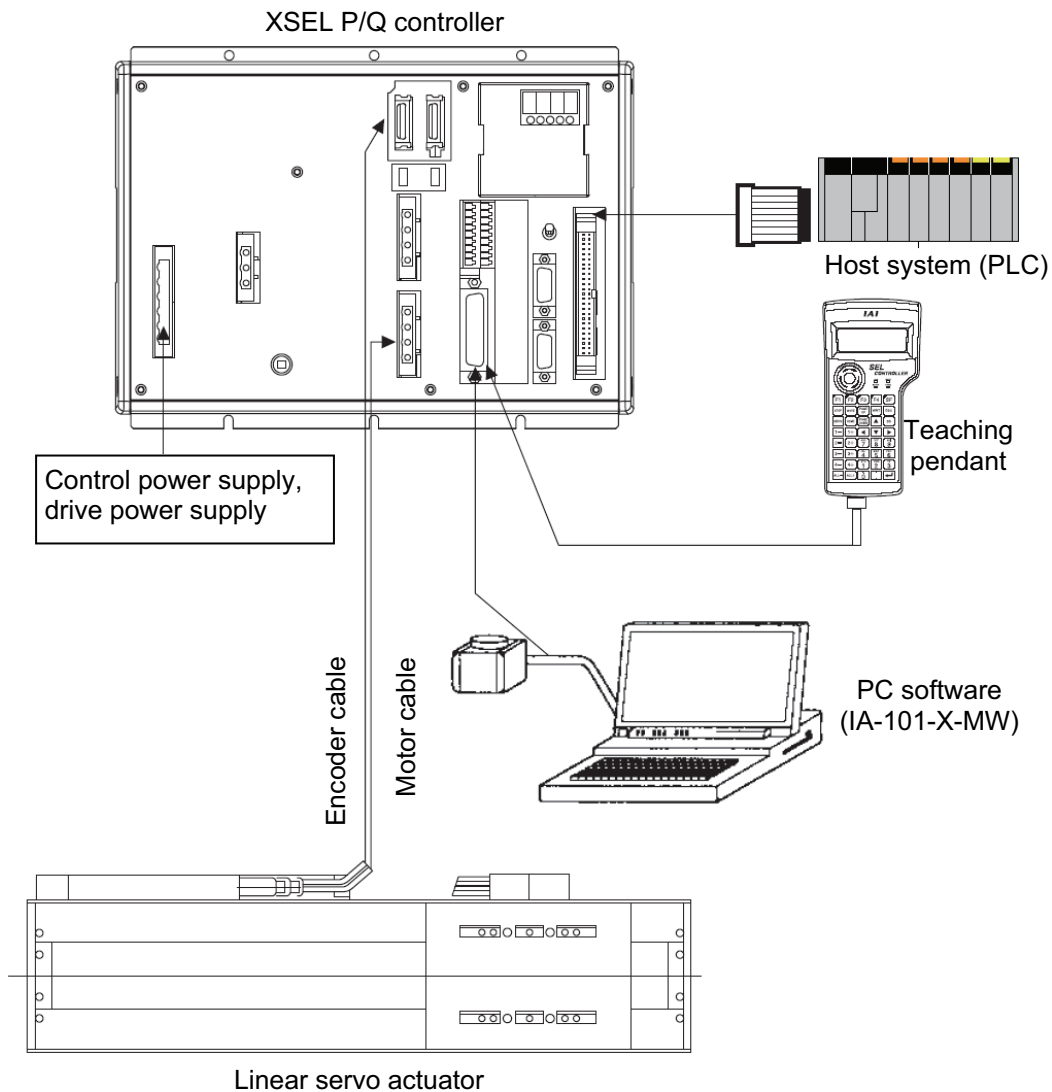


10. Connecting with the Controller

Connect the connector at the end of the cable, to the controller.

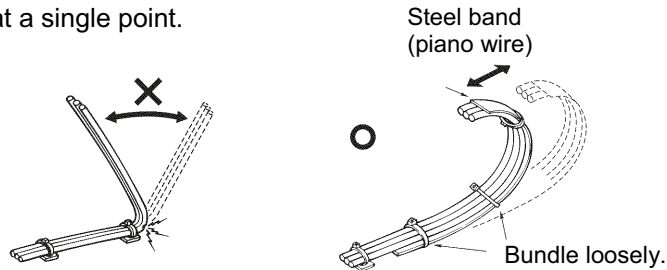
For the connection methods of the IO cable, controller power cable, PC connection cable, etc., refer to the instruction manuals for your controller and PC software.

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

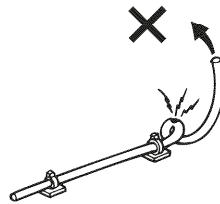


When designing an application system using actuators and controllers, incorrect wiring or connection of each cable may cause unexpected problems such as a disconnected cable or poor contact, or even a runaway system. This section explains prohibited handling of cables. Read the information carefully to connect the cables properly.

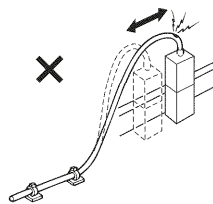
- Do not cut any of the cables to reduce its length or reconnect the cut cable with other cable to extend the wiring length or for any other purpose.
- If the cables cannot be mounted, connect them within the range in which the cables bend with their own weight or in a big radius of a standing cable hose, etc, so that the cable loads will be reduced.
- Do not let the cable flex at a single point.



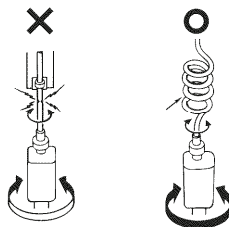
- Do not let the cable bend, kink or twist.



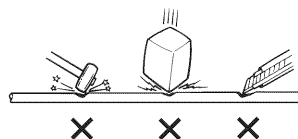
- Do not pull the cable with a strong force.



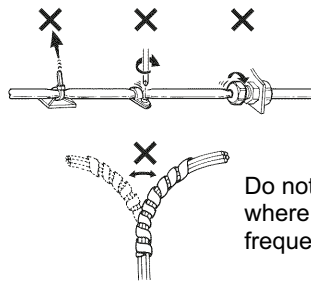
- Do not let the cable receive a turning force at a single point.



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

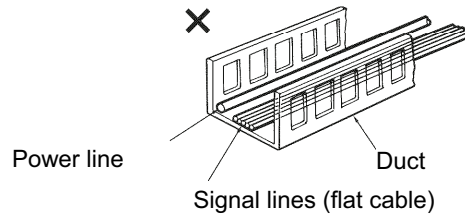


- When fixing the cable, provide a moderate slack and do not tension it too tight.

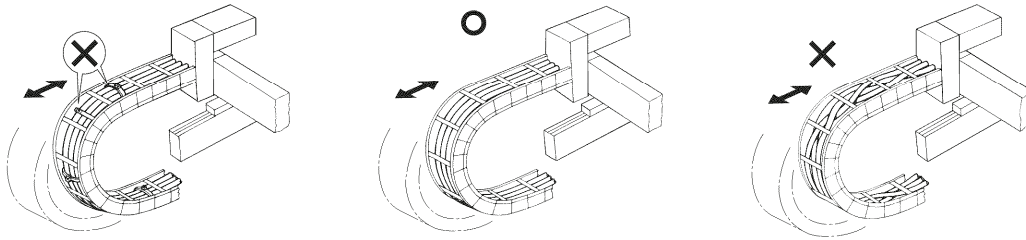


Do not use a spiral tube where the cable flexes frequently.

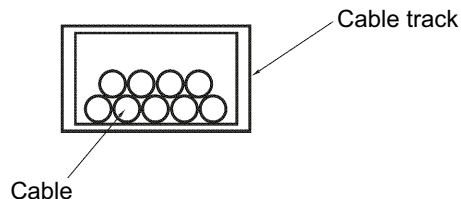
- Separate the I/O and communication lines from the power and drive lines. Do not guide them together in the duct.



- Pay attention to the following points when using the cable track.
 - Do not let the cable get tangled or kinked in a cable track or flexible tube. When bundling the cable, keep a certain degree of flexibility (so that the cable will not become too taut when bent).



- Do not cause the cables to occupy more than 60% of the space in the cable track.



Warning

- Before connecting or disconnecting any cable, be sure to turn off the controller power. If a cable is connected/disconnected while the controller power is on, the actuator may malfunction and cause serious accident or damage to the machine.
- Incompletely connected connectors may cause the actuator to malfunction and create a dangerous situation. Be sure to confirm that all connectors are connected properly.

11. Notes on Operation

11.1 Actuator Load

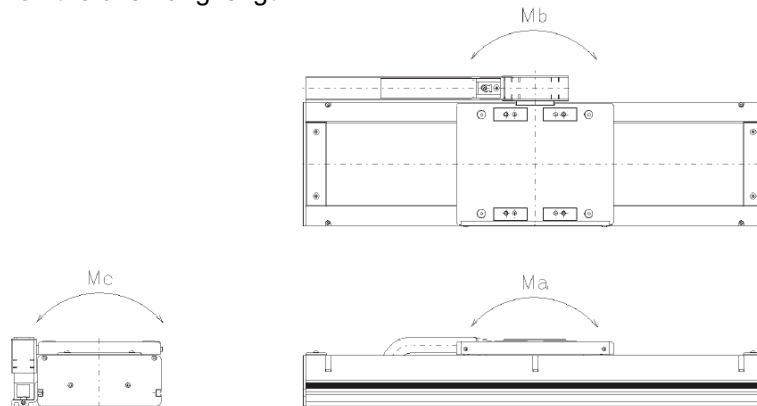
Make sure the load specified in the “Specifications” section is not exceeded. In particular, pay attention to the moment applied to the slider, allowable overhang length, and load.

Allowable load moment			Unit: N•m (kgf•m)
	Ma	Mb	Mc
N10SS, N10SM	76.4 (7.8)	46.3 (4.7)	25.7 (2.6)
N15SS, N15SM	111.7 (11.3)	66.6 (6.7)	50.0 (5.1)
N15HS, N15HM	155.8 (15.8)	91.1 (9.2)	71.5 (7.2)
N19SS, N19SM	61.94 (6.32)	61.94 (6.32)	61.94 (6.32)

Allowable overhang length			Unit: mm
	Ma	Mb	Mc
N10SS, N10SM	340 or less	340 or less	340 or less
N15SS, N15SM	450 or less	450 or less	450 or less
N15HS, N15HM	450 or less	450 or less	450 or less
N19SS, N19SM	700 or less	700 or less	700 or less

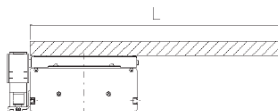
* The above overhang length assumes that the center of gravity of the load is located at a point corresponding to one-half the overhang length.

Moment directions

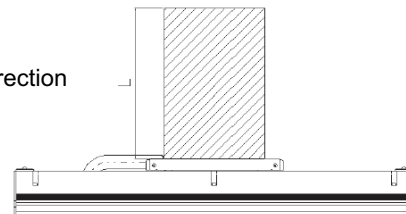


Allowable overhang directions

Mb or Mc direction



Ma direction



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

11.2 Home Return

11.2.1 Incremental Specification

(1) Operating Principles of Home Return

Home return is performed in the sequence specified below.

- [1] When a home return command is issued, the moving direction is determined from the specified parameter.
- [2] A mechanical end is detected by software during home return.
- [3] The actuator reverses upon detecting a mechanical end, and then recognizes the position where a phase Z signal is detected 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.

(2) Fine-tuning the Home Position

The amount of motor movement from the time when the slider hits the stopper until a phase Z signal is generated is pre-adjusted at the time of shipment.

The table below lists the standard reversing distance for each model from the time when the slider hits the stopper and then reverses until it stops at the home position.

Model	Reversing distance
N10SS, N10SM	Approx. 5.5 mm
N15SS, N15SM, N15HS, N15HM	Approx. 5 mm
N19SS, N19SM	Approx. 10 mm

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 increased amount. If you have specified an offset exceeding 1 mm, also adjust the soft stroke limits.

(3) Changing the Home Direction

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



Warning: Never touch the encoder by hands.

The encoder not only detects position and home signals, but it also plays an important role in the switching of AC-servo power phases. The AC-servo power phases have been adjusted precisely.

11.2.2 Serial Encoder Pseudo Absolute Specification

In the case of an actuator of the serial encoder pseudo absolute specification, when a home return command is issued the actuator moves by approx. 16 mm from the current slider position and checks the current position, after which the actuator can operate from that position.

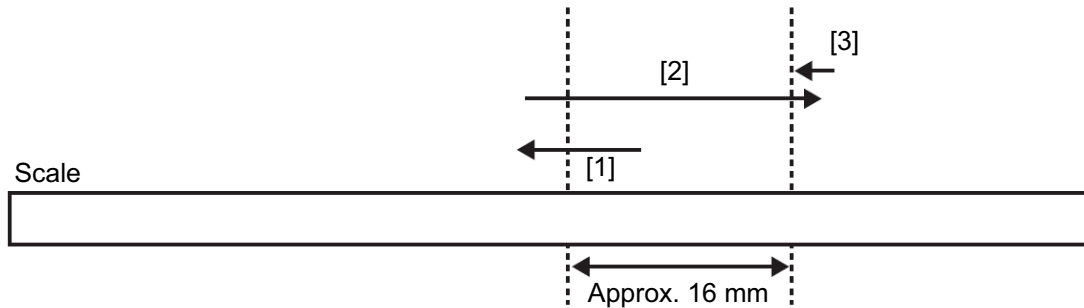
Unlike actuators of the incremental specification, home return does not require the actuator moving to its mechanical end.

(Note) If you are using an actuator of the serial encoder pseudo absolute specification, be sure to issue a home return command after turning on the power or performing a software reset.

When a home return command is issued, the actuator checks the current position according to the procedure below:

- [1] Upon receiving the home return command, the actuator moves in the direction of the parameter in which the moving direction has been set.
- [2] After moving back and forth by approx. 16 mm, the actuator reads the current position information based on the scale.
- [3] When the necessary information has been read, the actuator stops. The current position is confirmed and the actuator can operate from that point.

* If the actuator hit an obstacle, etc., while moving approx. 16 mm and the current position information could not be read, an error occurs. In this case, actuator operation is disabled.



11.3 Handling the Stainless Sheet

The stainless sheets of the mid-size models N15SS, N15SM, N15HS, N15HM, M19SS and M19SM 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 sheet and magnets, thereby causing problems. Therefore, avoid using the actuator in an environment where the actuator will come in contact with a high level of magnetic substances.

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

Do not press the sheet directly with hands.



12. Maintenance and Inspection

12.1 Inspection Items and Timings

Perform maintenance and inspection at the intervals specified below.

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

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

	Visual inspection of exterior	Inspection of interior	Grease (N10SS, N10SM, N15SS, N15SM, N15HS, N15HM)
Start-up inspection	○		
After 1 month of operation	○		
After 6 months of operation	○	○	
After 1 year of operation	○	○	○
Every 6 months thereafter	○		
Every 1 year	○	○	○

12.2 Visually Inspecting the Exterior

Visually check the exterior of the following items.

Inspection location	Check items	Remarks
Actuator	Loosening of actuator mounting bolts, etc.	
Cables	Scratches, connector engagement	
Stainless sheet	Scratches, loosening	Refer to Chapter 12 in this manual.
Overall	Noise, vibration	

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

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

12.3 Cleaning the Exterior

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

12.4 Inspecting the Interior

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

Place of Inspection	Description of Inspection	Remarks
Actuator	Loosening of actuator mounting bolts, etc.	
Guide	Lubrication condition, soiling, play	If there is any abnormality, contact IAI.

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

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

The procedure to check the interior is specified below:

- [1] Move the slider toward the home side.
- [2] Remove the screws securing the sheet using a socket wrench with a width across flats of 2.5 mm.
- [3] Turn up the sheet and check the interior.
- [4] After the check, assemble the parts by following the same steps in the reverse order.
For more information about stainless sheet tension adjustment, see 13, "Replacement/Adjustment of Stainless Sheet."

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

12.5 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.



12.6 Greasing the Guide

It is necessary to periodically grease the models N10SS, N10SM, N15SS, N15SM, N15HS and N15HM. Apply grease during the time of inspection.

12.6.1 Applicable Grease

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

AFB-LF Grease (THK)

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

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



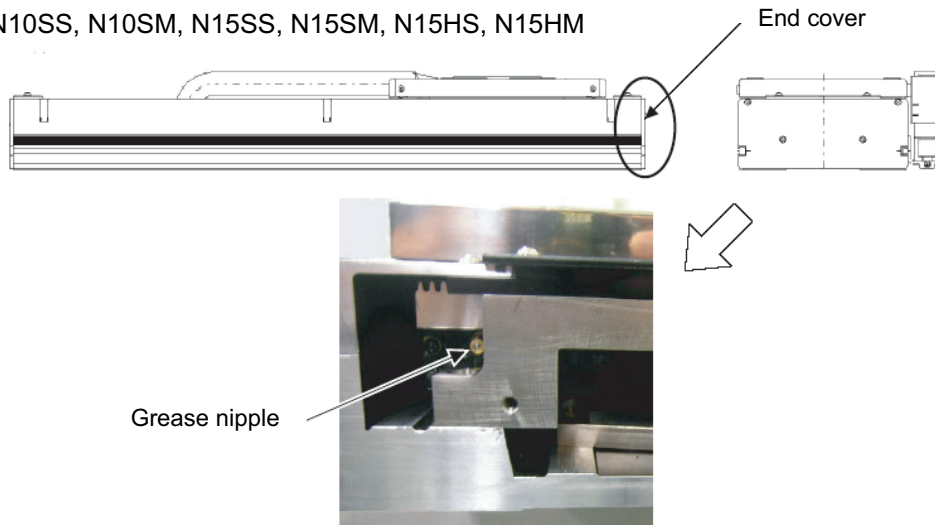
Warning: Never use fluorine grease. If it is mixed with lithium grease, not only grease performance will deteriorate but also the actuator will be damaged in some cases.

12.6.2 How to Add Grease

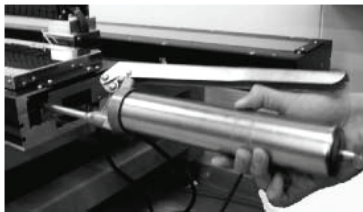
Before adding grease, turn off the actuator power.

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

● N10SS, N10SM, N15SS, N15SM, N15HS, N15HM



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



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

Nipple diameter
Ø4

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

Warning: 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.

13. Replacement/Adjustment of Stainless Sheet

13.1 N10SS, N10SM, N15SS, N15SM, N15HS, N15HM

[Required Items]

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

[Notes]

1. Stainless sheet tension

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

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

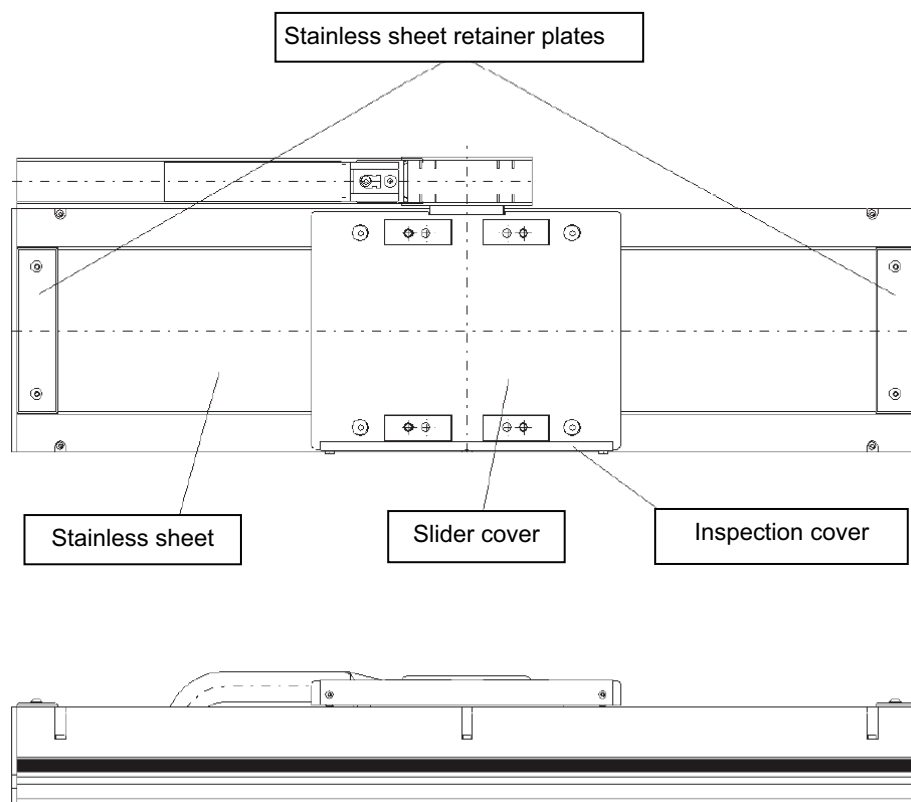
On the other hand, excessive slacks cause the stainless sheet to contact the back of the slider cover.

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

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

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

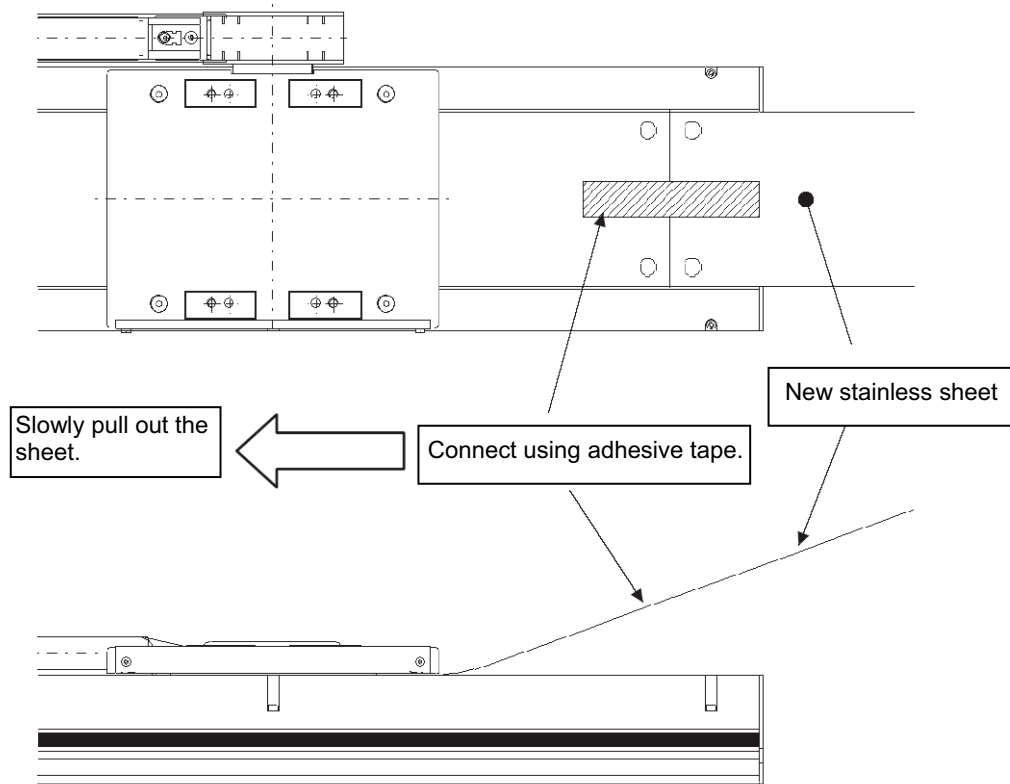
[Name of each part]



13.1.1 Replacement Procedure for Stainless Sheet

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

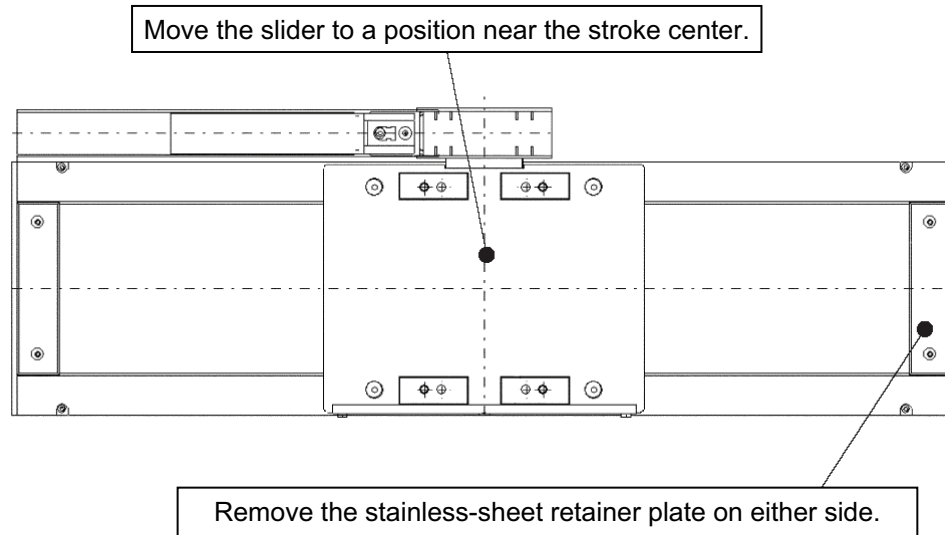
- [1] Check a new stainless sheet to confirm absence of scratches or soiling.
- [2] Loosen the screws affixing the damaged stainless sheet and remove the sheet retainer plates.
- [3] Connect the damaged stainless sheet and new stainless sheet using adhesive tape.
- [4] Slowly pull the end of the damaged stainless sheet so that the sheet slides over the side cover.
* Be careful not to allow the stainless sheet to come off of the side cover and get attracted to the permanent magnets in the base.
- [5] Confirm that the new stainless sheet has been installed in the slider.



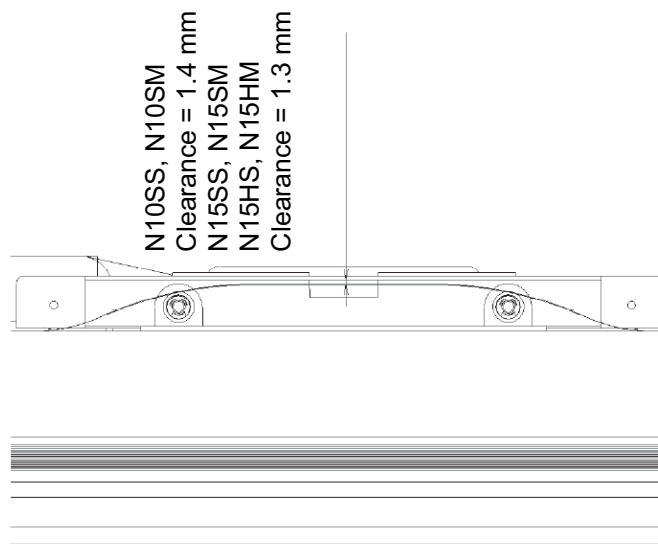
Connect the damaged stainless sheet and new stainless sheet using adhesive tape, and then slowly pull out the damaged stainless sheet so that the new sheet takes its position.

13.1.2 Adjusting the Stainless Sheet Tension

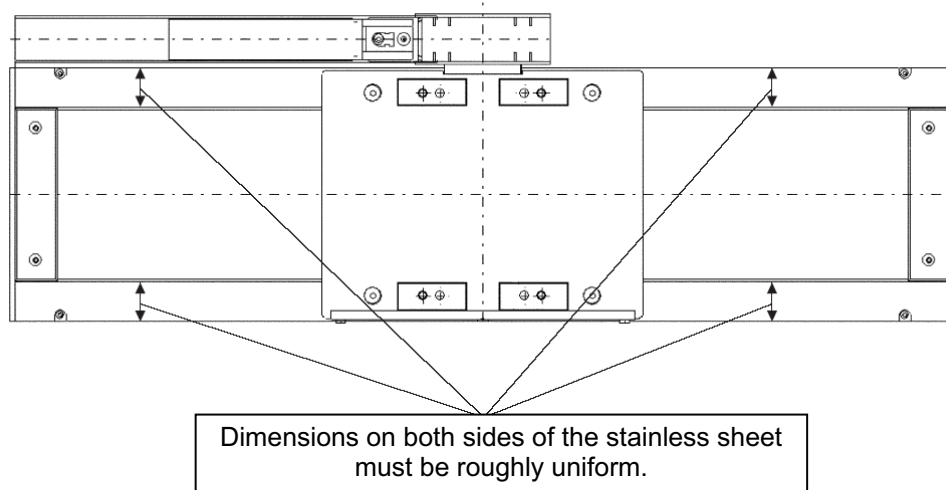
- [1] First, affix the stainless sheet uniformly on the right and left in a manner free from meandering. (The stainless sheet is held in position by the attraction forces of magnets. Therefore, lift the sheet from one end and then put it back in place toward the same end to achieve better result. Also adjust the stainless sheet from the slider center toward both ends.)
- [2] Move the slider to a position near the stroke center, and remove the stainless-sheet retainer plate on either side.



- [3] Adjusting the Stainless Sheet Tension
Remove the inspection cover located on one side of the slider cover to reveal the interior of the slider.
Adjust the sheet in the axial direction uniformly on the right and left until the height of the apex of the slider curve comes to 1.4 mm and 1.3 mm below the installation surface of the slider cover for N10SS or N10SM, and N15SS, N15SM, N15HS or N15HM, respectively. In this position, loosely tighten the mounting screws on the sheet retainer plate (hexagonal socket head button bolt M4 x 10).



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



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

This completes the replacement procedure.

Caution:

- Always use IAI's genuine stainless sheet.
- During the adjustment, wear gloves or take other appropriate safety precautions to prevent cutting hands by the stainless 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.

13.2 N19SS, N19SM

[Required Items]

- Replacement stainless sheet
- Clearance check jig (a regular slider cover with a hole)
(This jig is available at our Sales Engineering Section. Inquire before replacement. It is also available for purchase.)
- Hex wrench set
- Phillips screwdriver
- Scale

[Notes of Stainless sheet tension]

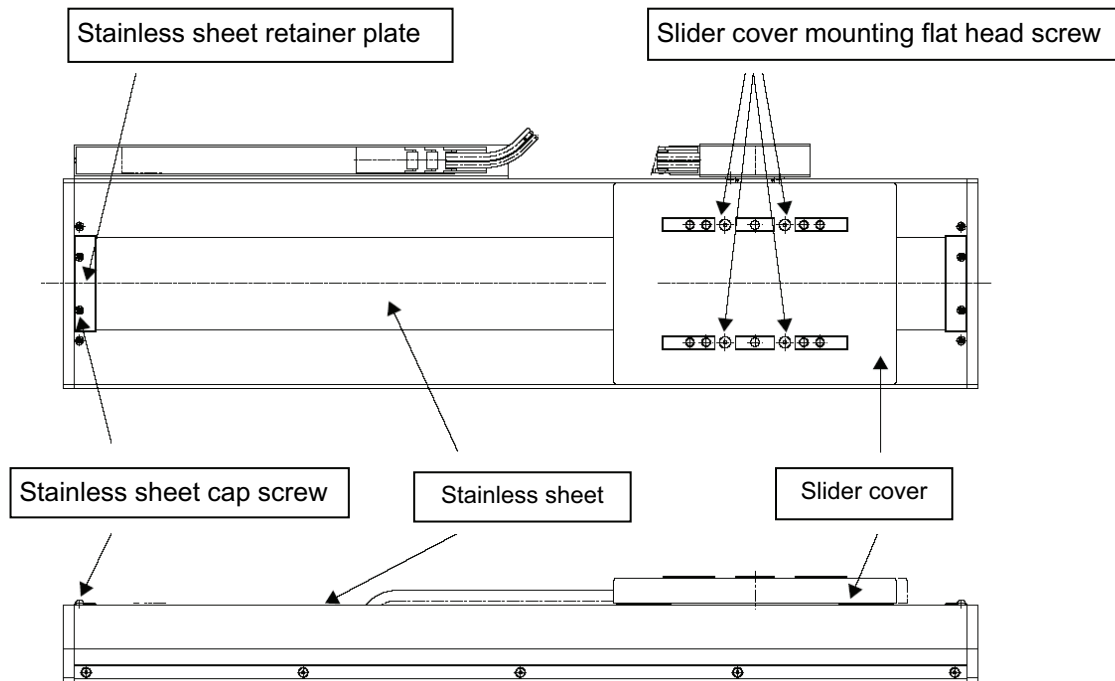
Improper tension of the stainless sheet can promote deterioration and wear of the sheet.

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

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

Therefore, adjust the tension of the stainless sheet using the special adjustment jig, so that the clearance between the stainless sheet and the back face of the slider cover satisfies the designated dimensions.

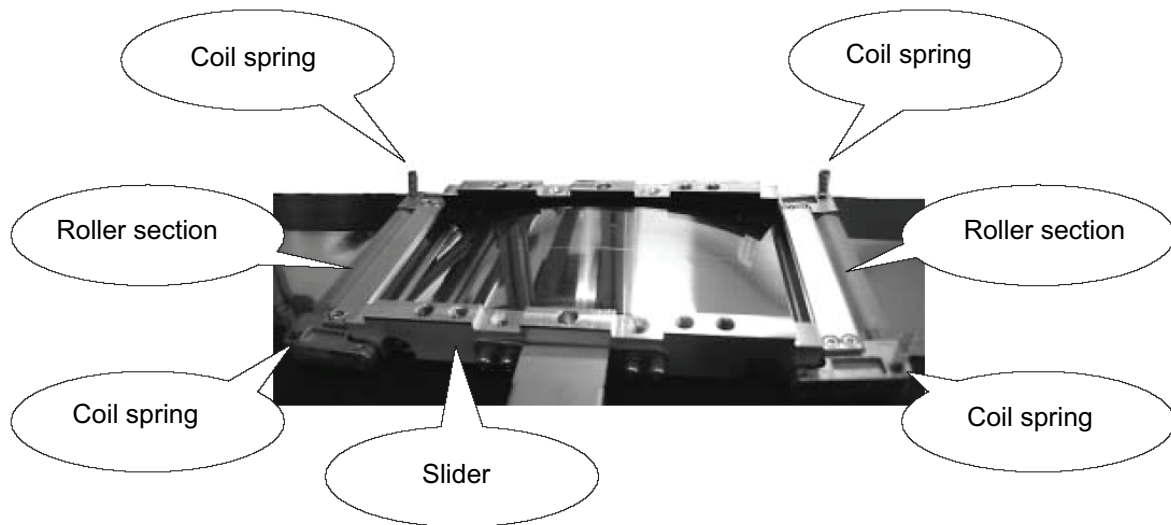
[Name of each part]



[Procedure]

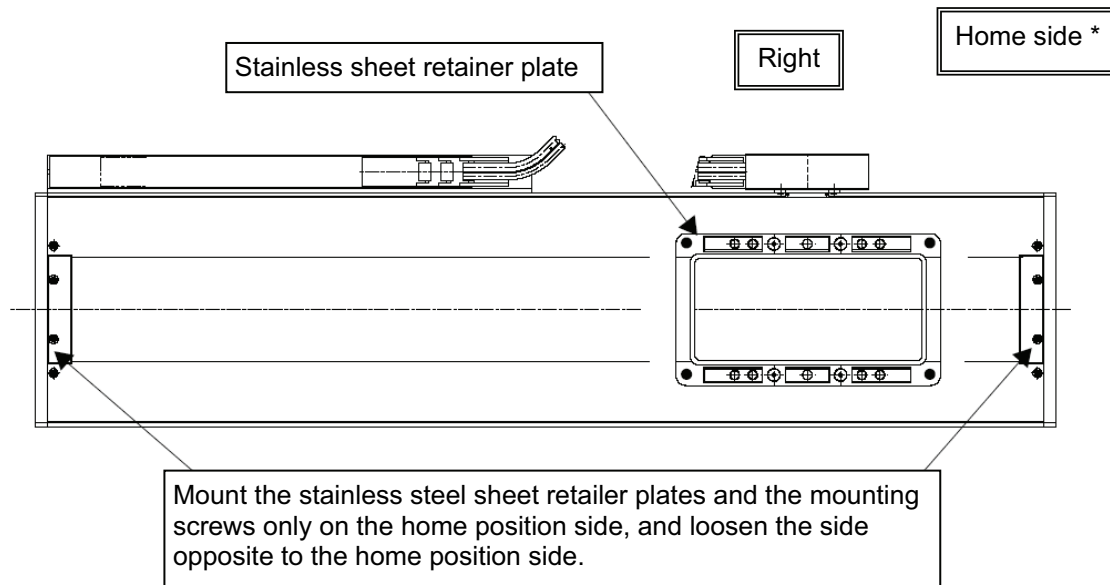
- 1) Remove the mounting screws of the slider cover and remove the slider cover.

When the slider cover is removed



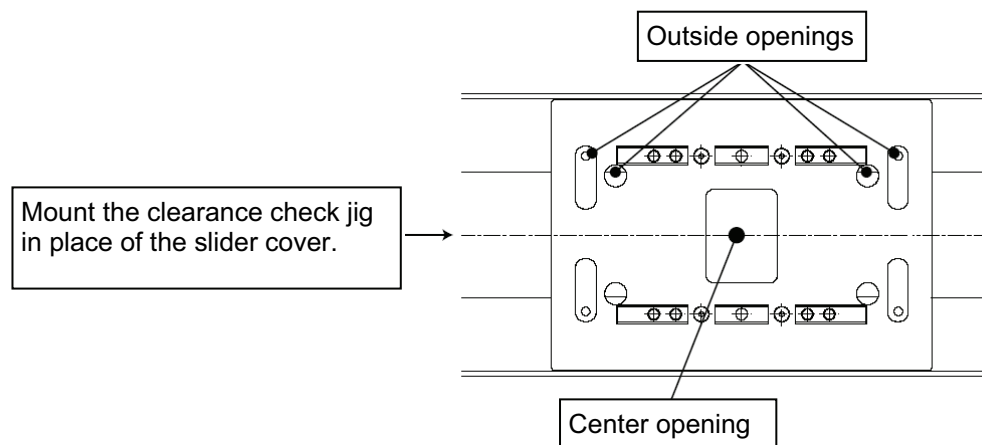
Caution: Slowly and carefully remove the slider cover. In the case of a ceiling hanging, vertical or horizontal sideway installation, place a plastic bag or similar underneath the slider cover so that the coil springs won't be lost if they fall off.

- 2) Remove the retainer screws of the old stainless sheet, and pull out the stainless sheet to remove it completely.
- 3) Place the new stainless sheet through the stainless sheet retainer plates.
- 4) Mount the stainless sheet in place with the retainer plates and the mounting screws. At this time, mount only the home position side, and loosen the side opposite to the home position side.



* In the above figure, the right side shows the home position when the cable is placed at the top.

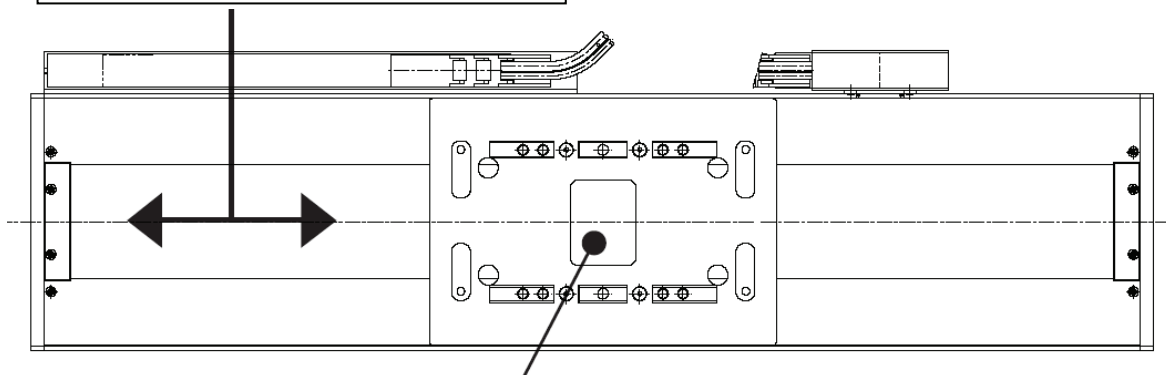
- 5) Install the clearance check jig.



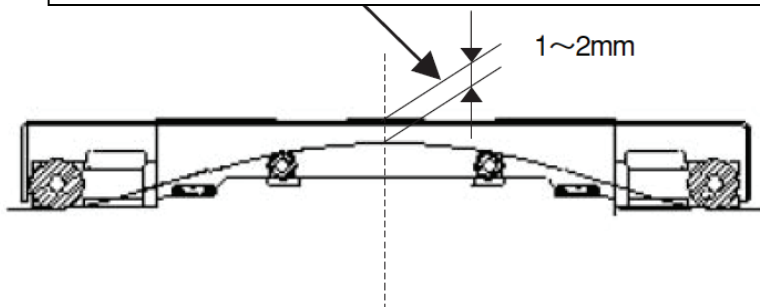
6) Adjust the tension of the stainless sheet.

- [1] While looking through the center opening of the clearance check jig, adjust by moving the stainless sheet on the loose side in the directions of the arrows, so that the clearance between the top face of the stainless sheet and the back face of the clearance check jig is within the designated range.

Adjust the tension by moving the stainless sheet in the directions of the arrows.



While looking through the center opening, check the clearance between the top surface of the stainless sheet and the back surface of the clearance check jig. (As long as the clearance is within the designated dimension tolerance, there is no problem even if a difference exists among the entire zone, left and right of the stroke.)

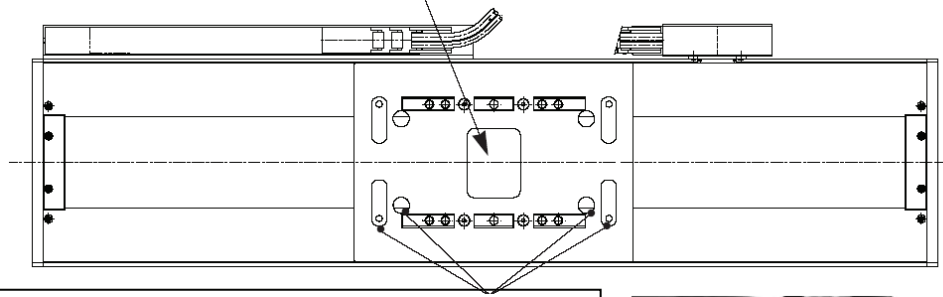


- [2] Once the position of the stainless sheet is determined, temporarily tighten the mounting screw on the loose side so that the stainless sheet will not move.

- [3] Move the slider to check the tension of the stainless sheet over the entire stroke zone.

Key Check Point – 1:

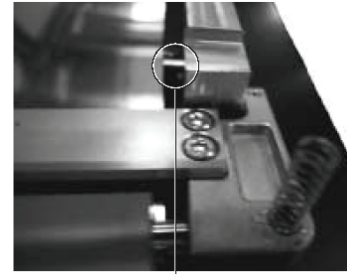
Check that the clearance between the top surface of the stainless sheet and the top surface of the slider is within the designated range over the entire stroke zone.



Key Check Point – 2:

Viewing through the outside openings, check that the edges of the stainless sheet do not touch the slider's main body. Check this at least for three roundtrip strokes over the entire stroke zone. The stainless sheet may be displaced during round-trip movements, but if the edges touch the slider's main body without increasing the displacement amount, readjust by repeating from step [1] above.

Note that the stainless sheet itself is not completely straight and has some zigzags; thus, it is not possible to make the right and left clearances uniform. There is no problem as long as the edges of the stainless sheet and the slider's main body do not touch each other over the entire stroke zone.



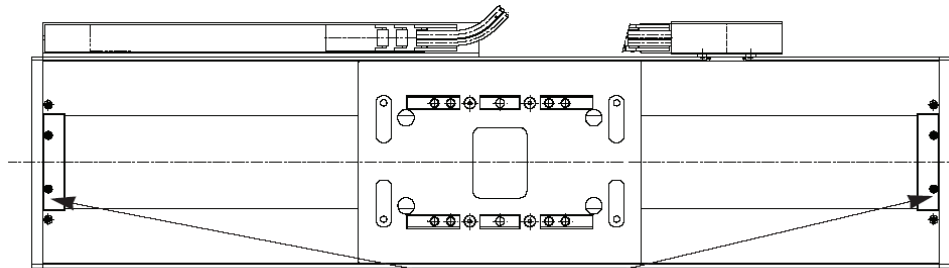
Make the clearance of this part the same as the one on the opposite side.

If Key Check Points – 1 and 2 are not satisfied, loosen the fixing screws again, and readjust the stainless sheet position and tension from step [1] above.

Note) If the readjustment of Key Check Point – 2 cannot be performed well, reversing the front and rear positions or flipping the front and back sides of the stainless sheet may make it possible to readjust.

If they still fail, replace with a new stainless sheet.

- [4] After the allocation of clearances and non-contact with the slider's main body have been confirmed, tighten the two screws on the loose side alternatively and finally clamp them with a uniform torque. If the screws are tightened with a nonuniform torque, the stainless sheet may zigzag or float.



Tighten the screws on both sides in order to fasten the stainless sheet.

Tightening torque: 204 N · cm (20.8 kgf · cm)

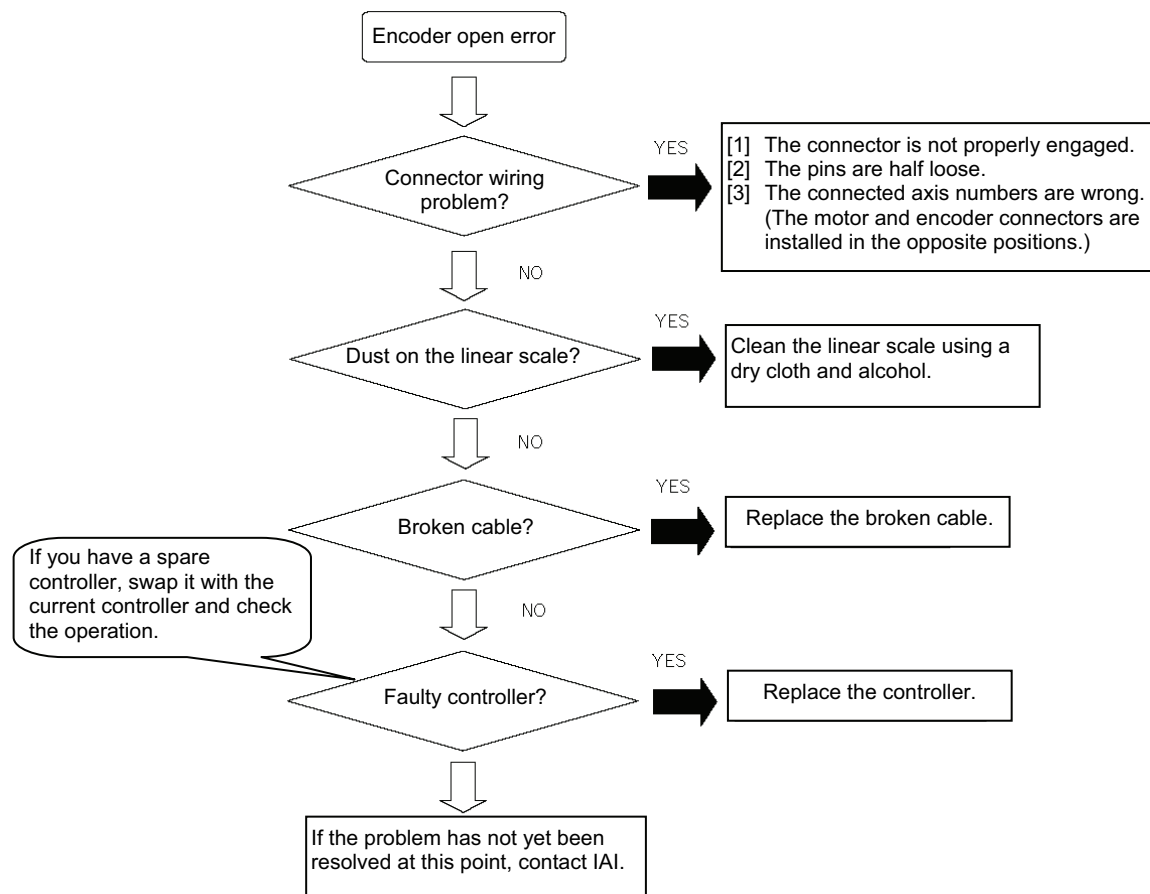
- [5] Remove the clearance check jig, and then mount the regular slider cover and motor cover.
Caution) Be careful not to lose the coil springs during this procedure.

14. Troubleshooting

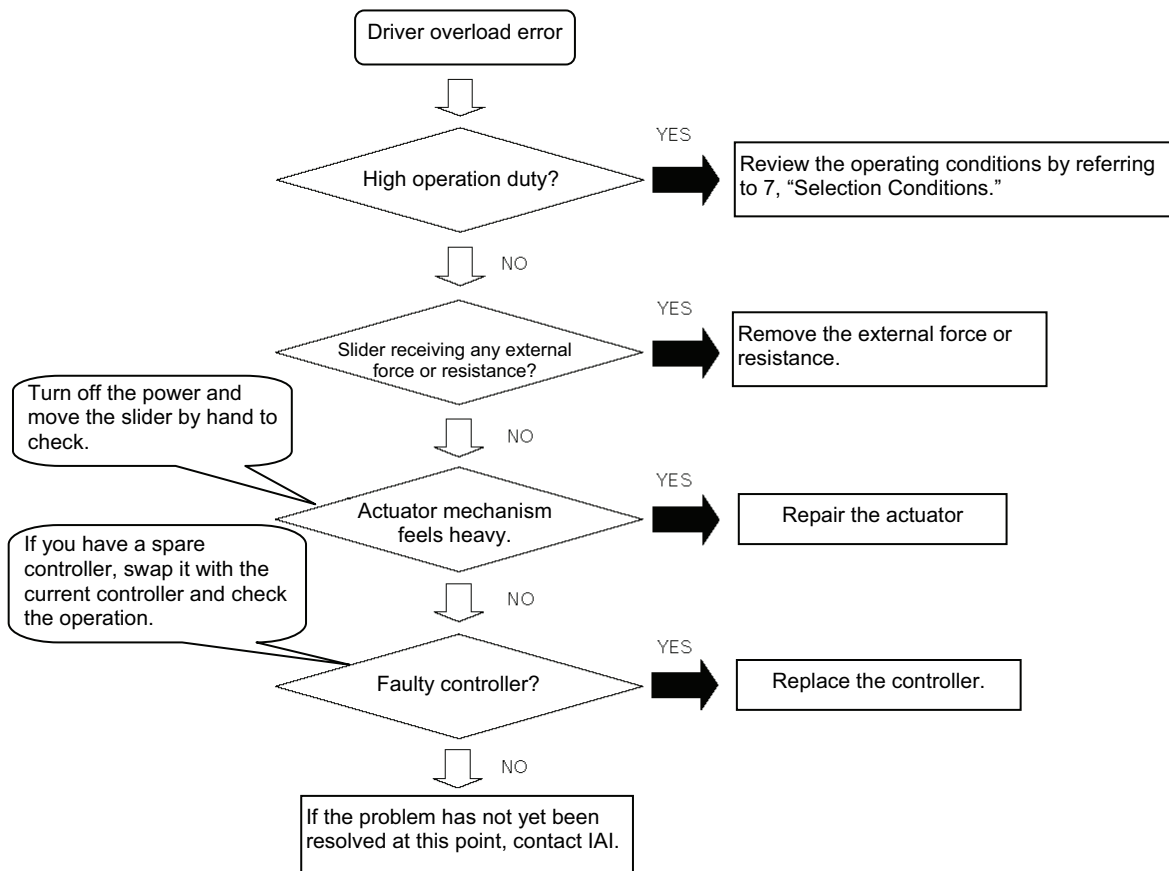
14.1 Action to Be Taken upon Occurrence of Error

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.

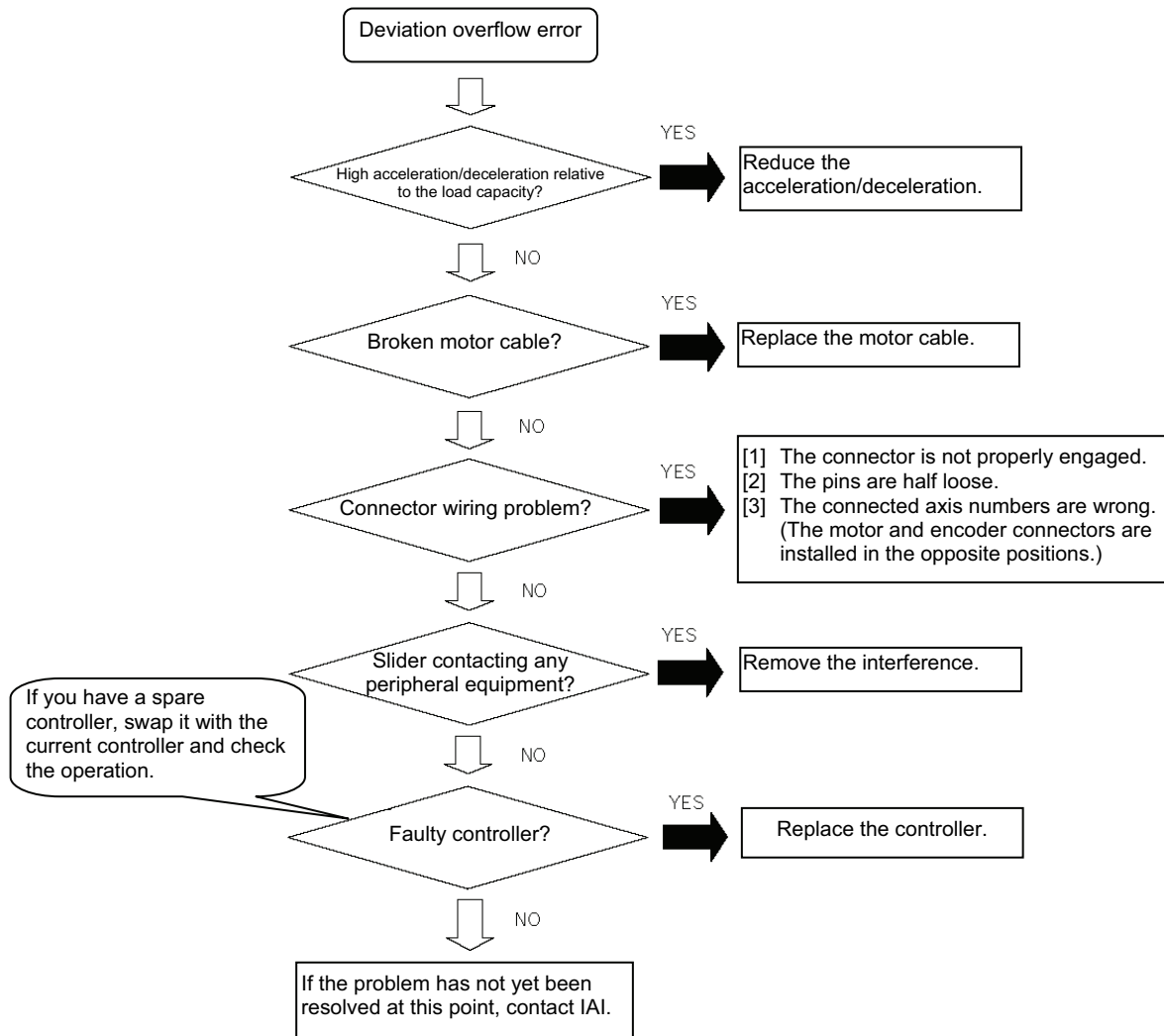
14.2 Encoder Open Error (Error Code: D12)



14.3 Driver Overload Error (Error Code: D0A)



14.4 Deviation Overflow Error (Error Code: C6B)



15. Warranty

The linear actuator you purchased has been delivered after passing the strict shipping tests conducted by IAI.

The warranty information is provided below.

(1) Warranty period

The warranty period expires upon elapse of one of the following periods, whichever occurs first.

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

(2) Scope of warranty

IAI will repair free of charge any actuator defects due to craftsmanship or material that may occur during the above warranty period despite use under appropriate conditions, or provide a replacement unit. Note, however, that the following items are expressly excluded from the scope of warranty:

- [1] Defects resulting from handling or use in any condition or environment not specified in the catalog, instruction manual, etc.
- [2] Defects not caused by IAI' s product
- [3] Defects resulting from any modification or repair not performed by IAI or IAI' s agent
- [4] Defects that could not be predicted by the level of science or technology available at the time of shipment from IAI
- [5] Defects resulting from acts of God, natural disasters, accidents and other events beyond the control of IAI
- [6] Discoloration of paints and other conditions due to aging
- [7] Defects resulting from wear and tear of consumable parts (stainless sheet, etc.)
- [8] Noises and other perceived deviations not affecting facilities

The warranty covers only the actuator and its components contained in the original package delivered by IAI, and any secondary losses arising from a failure of the delivered product is excluded from the scope of warranty.

The user must hand-carry the actuator for repair.

(3) Limited liability

Under no circumstance shall IAI be held liable for any special loss, indirect loss or passive loss arising in connection with IAI' s products.

(4) Scope of service

The price of the delivered product does not include the costs of creating programs, dispatching engineers, etc.

Accordingly, additional fees will be charged for the following services, even during the warranty period:

- Guidance on installation and adjustment or witnessing of test operation
- Maintenance and inspection
- Technical guidance and training on methods of operation, wiring, etc.
- Technical guidance and training on program creation and other aspects relating to programs
- Other services and tasks for which fees are deemed chargeable by IAI



Change History

Date revised	Description of revision
Dec. 2008	Version 2 Added N15SS, N15SM, N15HS and N15HM.
Jan. 2009	Version 3 Added N10SS and N10SM.
Dec. 2010	Version 4 P21 Added the model of LSAS to "5.4 How to Read Model Name" . P43 Added details of operation of the serial encoder pseudo absolute specification when a home return command is issued.

MEMO



IAI Corporation

Head Office: 577-1 Obane Shimizu-KU Shizuoka City Shizuoka 424-0103, Japan
TEL +81-54-364-5105 FAX +81-54-364-2589
website: www.iai-robot.co.jp/

Technical Support available in USA, Europe and China

IAI America, Inc.

Head Office: 2690 W, 237th Street Torrance, CA 90505
TEL (310) 891-6015 FAX (310) 891-0815
Chicago Office: 1261 Hamilton Parkway Itasca, IL 60143
TEL (630) 467-9900 FAX (630) 467-9912
Atlanta Office: 1220 Kennestone Circle Suite 108 Marietta, GA 30066
TEL (678) 354-9470 FAX (678) 354-9471
website: www.intelligentactuator.com

IAI Industrieroboter GmbH

Ober der Röth 4, D-65824 Schwalbach am Taunus, Germany
TEL 06196-88950 FAX 06196-889524

IAI (Shanghai) Co., Ltd.

SHANGHAI JIAHUA BUSINESS CENTER A8-303, 808, Hongqiao Rd. Shanghai 200030, China
TEL 021-6448-4753 FAX 021-6448-3992
website: www.iai-robot.com