Nut Rotary Actuator
NS Series

Small type: SXMS, SXMM, SZMS, SZMM
Medium type: MXMS, MXMM, MXMXS, MZMS, MZMM
Large type: LXMS, LXMM, LXMXS, LZMS, LZMM

Operating Manual

Fourth Edition

IAI America, Inc.

Please Read Before Use

Thank you for purchasing our product.

This Operating Manual explains the handling methods, structure and maintenance of this product, among others, providing the information you need to know to use the product safely.

Before using the product, be sure to read this manual and fully understand the contents explained herein to ensure safe use of the product.
The CD or DVD that comes with the product contains operation manuals for IAI products.
When using the product, refer to the necessary portions of the applicable operation manual by printing them out or displaying them on a PC.

After reading the Operating Manual, keep it in a convenient place so that whoever is handling this product can reference it quickly when necessary.

[Important]

- This Operating Manual is original.
- The product cannot be operated in any way unless expressly specified in this Operating Manual. IAI shall assume no responsibility for the outcome of any operation not specified herein.
- Information contained in this Operating 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 Operating Manual without permission is prohibited.
- The company names, names of products and trademarks of each company shown in the sentences are registered trademarks.

Safety Guide

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

Safety Precautions for Our Products

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

No.	Operation Description	Description
1	Model Selection	● This product has not been planned and designed for the application where high level of safety is required, so the guarantee of the protection of human life is impossible. Accordingly, do not use it in any of the following applications. 1) Medical equipment used to maintain, control or otherwise affect human life or physical health. 2) Mechanisms and machinery designed for the purpose of moving or transporting people (For vehicle, railway facility or air navigation facility) 3) Important safety parts of machinery (Safety device, etc.) ● Do not use it in any of the following environments. 1) Location where there is any inflammable gas, inflammable object or explosive 2) Place with potential exposure to radiation 3) Location with the ambient temperature or relative humidity exceeding the specification range 4) Location where radiant heat is added from direct sunlight or other large heat source 5) Location where condensation occurs due to abrupt temperature changes 6) Location where there is any corrosive gas (sulfuric acid or hydrochloric acid) 7) Location exposed to significant amount of dust, salt or iron powder 8) Location subject to direct vibration or impact ● Do not use the product outside the specifications. Failure to do so may considerably shorten

No.	Operation Description	Description
2	Transportation	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● 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	● The storage and preservation environment conforms to the installation environment. However, especially give consideration to the prevention of condensation.
4	Installation and Start	(1) Installation of Robot Main Body and Controller, etc. ● Make sure to securely hold and fix the product (including the work part). A fall, drop or abnormal motion of the product may cause a damage or injury. ● Do not get on or put anything on the product. Failure to do so may cause an accidental fall, injury or damage to the product due to a drop of anything, malfunction of the product, performance degradation, or shortening of its life. ● When using the product in any of the places specified below, provide a sufficient shield. 1) Location where electric noise is generated 2) Location where high electrical or magnetic field is present 3) Location with the mains or power lines passing nearby 4) Location where the product may come in contact with water, oil or chemical droplets
		(2) Cable Wiring ● Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool. ● Do not scratch on the cable. Do not bend it forcibly. Do not pull it. Do not coil it around. Do not insert it. Do not put any heavy thing on it. Failure to do so may cause a fire, electric shock or malfunction due to leakage or continuity error. ● Perform the wiring for the product, after turning OFF the power to the unit, so that there is no wiring error. ● When the direct current power (+24V) is connected, take the great care of the directions of positive and negative poles. If the connection direction is not correct, it might cause a fire, product breakdown or malfunction. ● Connect the cable connector securely so that there is no disconnection or looseness. Failure to do so may cause a fire, electric shock or malfunction of the product. ● Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Failure to do so may cause the product to malfunction or cause fire.

No.	Operation Description	Description
4	Installation and Start	(3) Grounding ● 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.
		(4) Safety Measures ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When the product is under operation or in the ready mode, take the safety measures (such as the installation of safety and protection fence) so that nobody can enter the area within the robot's movable range. When the robot under operation is touched, it may result in death or serious injury. ● Make sure to install the emergency stop circuit so that the unit can be stopped immediately in an emergency during the unit operation. ● Take the safety measure not to start up the unit only with the power turning ON. Failure to do so may start up the machine suddenly and cause an injury or damage to the product. ● Take the safety measure not to start up the machine only with the emergency stop cancellation or recovery after the power failure. Failure to do so may result in an electric shock or injury due to unexpected power input. ● When the installation or adjustment operation is to be performed, give clear warnings such as "Under Operation; Do not turn ON the power!" etc. Sudden power input may cause an electric shock or injury. ● Take the measure so that the work part is not dropped in power failure or emergency stop. ● Wear protection gloves, goggle or safety shoes, as necessary, to secure safety. ● Do not insert a finger or object in the openings in the product. Failure to do so may cause an injury, electric shock, damage to the product or fire. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity.

No.	Operation Description	Description
5	Teaching	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the teaching operation from outside the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the “Stipulations for the Operation” and make sure that all the workers acknowledge and understand them well. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign “Under Operation” at the position easy to see. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.
6	Trial Operation	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● After the teaching or programming operation, perform the check operation one step by one step and then shift to the automatic operation. ● When the check operation is to be performed inside the safety protection fence, perform the check operation using the previously specified work procedure like the teaching operation. ● Make sure to perform the programmed operation check at the safety speed. Failure to do so may result in an accident due to unexpected motion caused by a program error, etc. ● Do not touch the terminal block or any of the various setting switches in the power ON mode. Failure to do so may result in an electric shock or malfunction.
7	Automatic Operation	● 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.

No.	Operation Description	Description
8	Maintenance and Inspection	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the work out of the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the “Stipulations for the Operation” and make sure that all the workers acknowledge and understand them well. ● When the work is to be performed inside the safety protection fence, basically turn OFF the power switch. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign “Under Operation” at the position easy to see. ● For the grease for the guide or ball screw, use appropriate grease according to the Instruction Manual for each model. ● Do not perform the dielectric strength test. Failure to do so may result in a damage to the product. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.
9	Modification and Dismantle	● Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.
10	Disposal	● When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste. ● 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” and “Notice” according to the warning level, as follows, and described in the Instruction Manual for each model.

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

Handling Precautions

1. Handling the Actuator by Itself

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.
- Cable tracks and guide rails are vulnerable to damage and deformation. Accordingly, exercise due caution when handling the packed actuator so as not to apply excessive forces to the cable tracks and guides rails.

1.2 Handling the Unpacked Actuator

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

- When transporting the actuator, be careful not to bump it or otherwise apply impact on it. In particular, pay attention to the end brackets, end covers and guide rails.
- Do not apply excessive forces to various parts of the actuator. In particular, pay attention to the screw covers and cables.

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 base of a squared log. When lifting with a forklift, also place the forks underneath 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.”

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1. Names of the Parts

The names of the actuator parts are indicated below.

In this manual, the left and right sides are indicated by looking at the horizontally positioned actuator from the motor in the top view. The front side corresponds to the opposite motor end.
(Note) On an actuator of single-slider specification, the motor end corresponds to the side where the IAI logo is shown.

*** The installation direction of the cable track varies depending on the specification of the delivered product.**

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

2. Exterior Views

2.1 Actuator Types

2.1.1 SXMS

Detail View of P
(2 locations)
Scale 2:1

Stroke	L	A	B	C	D	E
400	630	600	1	100	450	10
500	730	700	1	150	550	10
600	830	800	1	200	650	10
700	930	900	2	100	750	14
800	1030	1000	2	150	850	14

2.1.2 SXMM

Detail View of P
(2 locations)
Scale 2:1

Stroke	L	A	B	C	D	E
200	630	600	1	100	450	10
300	730	700	1	150	550	10
400	830	800	1	200	650	10
500	930	900	2	100	750	14
600	1030	1000	2	150	850	14
700	1130	1100	2	200	950	14
800	1230	1200	2	100	1050	18

(Note) The effective stroke is calculated as “Nominal stroke + 30 mm.”

2.1.3 SZMS

Detail View of P
(2 locations)
Scale 2:1

Stroke	L	A	B	C	D	E
400	680	650	1	125	500	10
500	780	750	1	175	600	10
600	880	850	1	225	700	10
700	980	950	2	125	800	14
800	1080	1050	2	175	900	14

(Note) The effective stroke is calculated as “Nominal stroke + 20 mm

2.1.4 SZMM

Detail View of P
(2 locations)
Scale 2:1

Stroke	L	A	B	C	D	E
200	640	650	1	125	500	10
300	740	750	1	175	600	10
400	840	850	1	225	700	10
500	940	950	2	125	800	14
600	1040	1050	2	175	900	14
700	1140	1150	2	225	1000	14
800	1240	1250	2	125	1100	18

(Note) The effective stroke is calculated as “Nominal stroke + 20 mm

2.1.5 MXMS

Detail View of Q: T-groove in Base
Scale 2:1

Detail View of P
(2 locations)
Scale 1:1

Stroke	L	A	B	C	D	E
500	770	734	0	317	584	6
600	870	834	1	167	684	10
700	970	934	1	217	784	10
800	1070	1034	1	267	884	10
900	1170	1134	1	317	984	10
1000	1270	1234	2	167	1084	14
1100	1370	1334	2	217	184	14
1200	1470	1434	2	267	1284	14
1300	1570	1534	2	317	1384	14
1400	1670	1634	3	167	1484	18
1500	1770	1734	3	217	1584	18

2.1.6 MXMM

Detail View of Q: T-groove in Base
Scale 2:1

Detail View of P
(2 locations)
Scale 1:1

Stroke	L	A	B	C	D	E
300	828	784	1	142	634	10
400	928	884	1	182	734	10
500	1028	984	1	242	834	10
600	1128	1084	1	282	934	10
700	1228	1184	2	142	1034	14
800	1328	1284	2	182	1134	14
900	1428	1384	2	242	1234	14
1000	1528	1484	2	282	1334	14
1100	1628	1584	3	142	1434	18
1200	1728	1684	3	182	1534	18
1300	1828	1784	3	242	1634	18
1400	1928	1884	3	282	1734	18
1500	2028	1984	4	142	1834	22

(Note) The effective stroke is calculated as “Nominal stroke + 30 mm.”

2.1.7 MXMXS

Detail View of Q: T-groove in Base
Scale 2:1

Detail View of P
(2 locations)
Scale 1:1

Stroke	L	A	B	C	D	E
1600	1978	1934	3	317	1784	18
1700	2078	2034	4	167	1884	22
1800	2178	2134	4	217	1984	22
1900	2278	2234	4	267	2084	22
2000	2378	2334	4	317	2184	22
2100	2478	2434	5	167	2284	26
2200	2578	2534	5	217	2384	26

2.1.8 MZMS

Stroke	L	A	B	C	D	E
500	828	784	1	142	634	10
600	928	884	1	192	734	10
700	1028	984	1	242	834	10
800	1128	1084	1	292	934	10

(Note) The effective stroke is calculated as “Nominal stroke + 10 mm.”

2.1.9 MZMM

Detail View of Q: T-groove in Base
Scale 2:1

Detail View of P
(2 locations)
Scale 1:1

Stroke	L	A	B	C	D	E
300	878	834	1	167	684	10
400	978	934	1	217	784	10
500	1078	1034	1	267	884	10
600	1178	1134	1	317	984	10
700	1278	1234	2	167	1084	14
800	1378	1334	2	217	1184	14

2.1.10 LXMS

Detail View of P
Scale 1:1

Detail View of Q
Scale 1:1

Detail View of Base
Mounting Hole
Scale 1:2

Stroke	L	A	B	C	D	E
500	828	776	1	138	676	10
600	928	876	1	188	776	10
700	1028	976	1	238	876	10
800	1128	1076	1	288	976	10
900	1228	1176	2	138	1076	14
1000	1328	1276	2	188	1176	14
1100	1428	1376	2	238	1276	14
1200	1528	1476	2	268	1376	14
1300	1628	1576	3	138	1476	18
1400	1728	1676	3	188	1576	18
1500	1828	1776	3	238	1676	18
1600	1928	1876	3	268	1776	18
1700	2028	1976	4	138	1876	22
1800	2128	2076	4	188	1976	22
1900	2228	2176	4	238	2076	22
2000	2328	2276	4	268	2176	22
2100	2428	2376	5	138	2276	26
2200	2528	2476	5	188	2376	26

2.1.11 LXMM

Detail View of P
Scale 1:1

Detail View of Q
Scale 1:1

Detail View of Base
Mounting Hole
Scale 1:2

Stroke	L	A	B	C	D	E
250	828	776	1	138	676	10
350	928	876	1	188	776	10
450	1028	976	1	238	876	10
550	1128	1076	1	288	976	10
650	1228	1176	2	138	1076	14
750	1328	1276	2	188	1176	14
850	1428	1376	2	238	1276	14
950	1528	1476	2	288	1376	14
1050	1628	1576	3	138	1476	18
1150	1728	1676	3	188	1576	18
1250	1828	1776	3	238	1676	18
1350	1928	1876	3	288	1776	18
1450	2028	1976	4	138	1876	22
1550	2128	2076	4	188	1976	22
1650	2228	2176	4	238	2076	22
1750	2328	2276	4	288	2176	22
1850	2428	2376	5	138	2276	26
1950	2528	2476	5	188	2376	26
2050	2628	2576	5	238	2476	26
2150	2728	2676	5	288	2576	26
2250	2828	2776	6	138	2676	30

2.1.12 LXMXS

Slot, depth 10

Detail View of P
Scale 1:1

Detail View of Q
Scale 1:1

Detail View of Base
Mounting Hole
Scale 1:2

Stroke	L	A	B	C	D	E
2300	2728	2676	5	288	2576	26
2400	2828	2776	6	138	2676	30
2500	2928	2876	6	188	2776	30
2600	3028	2976	6	238	2876	30
2700	3128	3076	6	288	2976	30
2800	3228	3176	7	138	3076	34
2900	3328	3276	7	188	3176	34
3000	3428	3376	7	238	3276	34

2.1.13 LZMS

Detail View of P
Scale 1:1

Detail View of Q
Scale 1:1

Detail View of Base
Mounting Hole
Scale 1:2

Stroke	L	A	B	C	D	E
500	878	826	1	163	726	10
600	978	926	1	213	826	10
700	1078	1026	1	263	926	10
800	1178	1126	2	113	1026	14
900	1278	1226	2	163	1126	14
1000	1378	1326	2	213	1226	14

2.1.14 LZMM

Detail View of P
Scale 1:1

Detail View of Q
Scale 1:1

Detail View of Base
Mounting Hole
Scale 1:2

Stroke	L	A	B	C	D	E
500	828	876	1	138	776	10
600	928	976	1	188	876	10
700	1028	1076	1	238	976	10
800	1128	1176	1	288	1076	10
900	1228	1276	2	138	1176	14
1000	1328	1376	2	188	1276	14
1100	1428	1476	2	238	1376	14
1200	1528	1576	2	288	1476	14

3. Cable Drawings

[1] Motor cable

Model: CB-X-MA□□□

Wire size	Color	Signal	No.
0.75sq	Green	PE	1
	Red	U	2
	White	V	3
	Black	W	4

No.	Signal	Color	Wire size
1	U	Red	0.75sq (crimped)
2	V	White	
3	W	Black	
4	PE	Green	

[2] Encoder cable

Model: CB-X2-PA□□□

Plug housing: XMP-09V (JST)
Socket contact: BXA-001T-P0.6 (JST) x 18
Retainer: XMS-09V (JST)
*6: Use the crimping machine recommended by the connector manufacturer.

Wire size	Color	Signal	No.
AWG26 (soldered)	—	—	10
	—	—	11
	—	E24V	12
	—	OV	13
	—	LS	26
	—	CLEEP	25
	—	OT	24
	—	RSV	23
	—	—	9
	—	—	18
	—	—	19
	—	A+	1
	—	A−	2
	—	B+	3
	—	B−	4
	—	Z+	5
	—	Z−	6
	Orange	SRD+	7
	Green	SRD−	8
	Purple	BAT+	14
	Gray	BAT−	15
	Red	VCC	16
	Black	GND	17
	Blue	BKR−	20
	Yellow	BKR+	21
	—	—	22
Clamp the shield to the hood.			

Drain wire or braided shield wire

(“White/blue” in the “Color” field indicates that the cable is white and the insulator is blue.)

No.	Signal	Color	Wire size
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	Drain	
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	

[3] Encoder cable with LS

Model: CB-X2-PLA□□□

Wire size	Color	Signal	No.
AWG26 (soldered)	—	—	10
	—	—	11
	White/Orange	E24V	12
	White/Green	OV	13
	Red/Blue	LS	26
	Brown/Yellow	CLEEP	25
	Brown/Red	OT	24
	Brown/Black	RSV	23
	—	—	9
	—	—	18
	—	—	19
	White/Blue	A+	1
	White/Yellow	A—	2
	White/Red	B+	3
	White/Black	B—	4
	White/Purple	Z+	5
	White/Gray	Z—	6
	Orange	SRD+	7
	Green	SRD—	8
	Purple	BAT+	14
	Gray	BAT—	15
	Red	VCC	16
	Black	GND	17
	Blue	BKR—	20
	Yellow	BKR+	21
	—	—	22
Clamp the shield to the hood.			

No.	Signal	Color	Wire size
1	E24V	White/Blue	AWG26 (crimped)
2	OV	White/Yellow	
3	LS	White/Red	
4	CLEEP	White/Black	
5	OT	White/Purple	
6	RSV	White/Gray	

No.	Signal	Color	Wire size
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	Drain	
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	

Drain wire or braided shield wire

("White/blue" in the "Color" field indicates that the cable is white and the insulator is blue.)

4. Options

4.1 Cable track Installation Direction

With single sliders, you can specify an option corresponding to the desired direction in which the cable track is installed.

[1] Standard direction
Option model: CT1 (Standard cable track)
ET1 (Extended cable track)

[2] Reversed
Option model: CT2 (Standard cable track)
ET2 (Extended cable track)

[3] Standard, with home on opposite side
Option model: CT3 (Standard cable track)
ET3 (Extended cable track)

[4] Reversed, with home on opposite side
Option model: CT4 (Standard cable track)
ET4 (Extended cable track)

4.2 Extended Cable track

The standard cable track that comes pre-assembled on large nut rotary actuators is used exclusively for the wirings of the nut rotary actuator and has no space for accommodating any additional wirings the user may require.
Accordingly, extended cable tracks are provided as options to accommodate user wirings.
The standard cable tracks that come with small and medium types have a space to accommodate user cables. Refer to the following page.

Model of extended cable track option	Cable track installation direction
ET1	Standard
ET2	Reversed
ET3	Standard, with home on opposite side
ET4	Reversed, with home on opposite side

Standard cable track specification

Extended cable track specification (optional)

The points to note when storing cables/hoses in an extended cable track (optional) are specified below:
[1] Provide a minimum clearance of 2 mm between the outer diameter of the cable/hose bundle and the interior wall of the cable track, and also between the individual cables and hoses.
[2] Use cables/hoses with an outer diameter of ϕ16.8 or less, and arrange the cables/hoses horizontally by making sure they don't cross with one another.
Take note that if the cables/hoses are stored without observing the above precautions, the cables/hoses will receive an excessive force and their life will become significantly shorter.

The available spaces in the standard cable tracks for small and medium types are shown below.

Medium types: MXMS, MXMM, MXMXS, MZMS, MZMM

Small types: SXMS, SXMM, SZMS, SZMM

The points to note when storing cables/hoses in small type and large type cable tracks are specified below:

[1] Provide a minimum clearance of 2 mm between the outer diameter of the cable/hose bundle and the interior wall of the cable track, and also between the individual cables and hoses.

[2] Use cables/hoses with an outer diameter of ∅12.0 or less, and arrange the cables/hoses horizontally by making sure they don't cross with one another.

Take note that if the cables/hoses are stored without observing the above precautions, the cables/hoses will receive an excessive force and their life will become significantly shorter.

4.3 Creep Sensor

This sensor is used to perform home return at high speed.
Since home return is implemented by causing the slider to contact the stroke-end stopper and then reverse its direction, the home return speed is kept to a range of 10 to 20 mm/sec.
If the axis stroke is longer, the time required for home return becomes longer.
The creep sensor is a proximity sensor used to reduce the time required for home return.
The slider returns at high speed until immediately before the creep sensor and once the creep sensor signal turns ON, the slider speed is lowered and home return is performed. Accordingly, less time is required for home return.

When home return is performed on an axis whose stroke is longer, it takes a longer time for the axis to reach the mechanical end.

A sensor is installed immediately before the mechanical end and once the sensor signal turns ON, the speed is lowered and a normal home return operation is performed.

4.4 Limit Switches

The limit switches are used to perform a home return operation by reversing the slider upon sensing by the proximity sensor, not by letting the slider contact the mechanical stopper.
Three limit switches are installed including HOME (home side), +OT (over-travel on counter-motor side), and –OT (over-travel on motor side).
You can use these limit switches to fine-tune the reversing position or increase the reliability of home return.
Take note, however, that moving the limit switch on home side considerably away from the specified position may shorten the stroke.

5. Reviewing Contents 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	Standard specification	CB–X2-PA□□□
		With limit switch	CB–X2-PLA□□□
4	Operation manual		

5.2 Operation Manuals Relating to This Product

No.	Name	Control No.
1	XSEL-P/Q Controller Operation Manual	MJ0148
2	SSEL Controller Operation Manual	MJ0157
3	SCON Controller Operation Manual	MJ0161
4	XSEL Controller P/Q/PX/QX RC Gateway Function Operation Manual	MJ0188
5	PC Software IA-101-X-MW/IA-101-X-USBMW Operation Manual	MJ0154
6	Teaching Pendant SEL-T/TD Operation Manual	MJ0183
7	Teaching Pendant IA-T-X-XD Operation Manual	MJ0160
8	DeviceNet Operation Manual	MJ0124
9	CC-Link Operation Manual	MJ0123
10	ProfiBus-DP Operation Manual	MJ0153
11	Ethernet Operation Manual	MJ0140

5.3 How to Read Model Nameplate

5.4 How to Read Model Name

NS−LXMS−I−400−20−1000−T2−S−AQ−CT1−RT

<Series>

<Type>
Small type
SXMS
SXMM
SZMS
SZMM
Medium type
MXMS
MXMM
MXMXS
MZMS
MZMM
Large type
LXMS
LXMM
LXMXS
LZMS
LZMM

<Encoder type>
I: Incremental

<Applicable drivers>
Small type
60: 60 W
Medium type
200: 200 W
Large type
400: 400 W

<Lead>
Small type
12
Medium type
MXMS, MXMM, MXMXS
20/30
MZMS, MZMM
20
Large type
4LXMS, LXMM, LXMXS
20/40
LZMS, LZMM
20

<Stroke>

<Applicable controllers>
T2: SCON, SSEL
XSEL-P/Q

<Cable length>
N: None
S: 5 m
M: 10 m
X□□: Specified length

AQ seal

<Options>
B: With brake*1
C: Creep sensor
L: Limit switches
- Standard cable track direction
  CT1: Standard
  CT2: Reversed
  CT3: Standard, with home on opposite side
  CT4: Reversed, with home on opposite side
- Extended cable track direction
  ET1: Standard
  ET2: Reversed
  ET3: Standard, with home on opposite side
  ET4: Reversed, with home on opposite side

Guide with ball retention mechanism

*1 A brake is a standard feature on vertical specification models such as the SZMS, SZMM, MZMS, MZMM, LZMS and LZMM.

6. Specifications

6.1 Small type

Model	Unit	SXMS, horizontal specification	SXMM, horizontal specification	SZMS, vertical specification	SZMM, vertical specification
Lead		12	12	12	12
Stroke	mm	400 to 800	230 to 830	420 to 820	220 to 820
Rated thrust	N	70.8	70.8	70.8	70.8
Maximum speed	mm/sec	720	720	600	600
Rated acceleration*3	G	0.3	0.3	0.3	0.3
Maximum acceleration/deceleration*3	G	0.8	0.8	0.7	0.7
Loading capacity at rated acceleration*2	kgf	15 (When used horizontally)	15 (When used horizontally)	3 (When used vertically)	3 (When used vertically)
Loading capacity at maximum acceleration*2	kgf	0.5	0.5	0.5	0.5
Positioning repeatability	mm	±0.02	±0.02	±0.02	±0.02
Load moment*1	N. m (kgf•cm)	Ma: 28.4 (2.9)	Ma: 28.4 (2.9)	Ma: 28.4 (2.9)	Ma: 28.4 (2.9)
		Mb: 40.2 (4.1)	Mb: 40.2 (4.1)	Mb: 40.2 (4.1)	Mb: 40.2 (4.1)
		Mc: 65.7 (6.7)	Mc: 65.7 (6.7)	Mc: 33.3 (3.4_	Mc: 33.3 (3.4_
Overhang load length	mm	Ma direction: 450 max.	Ma direction: 450 max.	Ma direction: 450 max.	Ma direction: 450 max.
		Mb/Mc directions: 450 max.	Mb/Mc directions: 450 max.	Mb/Mc directions: 450 max.	Mb/Mc directions: 450 max.

*1 Based on an acceleration of 0.3 G and the maximum speed.
*2 The maximum speed is assumed.
*3 The table below shows the relationship of acceleration/deceleration and loading capacity.
These values are not guaranteed and should be used only as a guide.
Even when the acceleration is equal to or below the rated acceleration, the loading capacity remains the same as the value at the rated acceleration.

Type	Lead	Maximum speed	Loading capacity by acceleration (kg)					
			0.3G	0.4G	0.5G	0.6G	0.7G	0.8G
SXMS SXMM	12 mm	720 mm/sec	15	7	5	3	1	0.5
SZMS SZMM	12 mm	600 mm/sec	3	2	1.5	1	0.5	

Caution:
- Use each actuator by observing its maximum speed.
- Take note that resonance may still occur at speeds below the applicable limit specified above, depending on the installation condition or operating conditions.
- Resonance of the ball screw shaft may increase the noise level or cause vibration, resulting in a shorter service life of the machine.
- If each actuator is used independently, write a program conforming to the maximum speed of the actuator (refer to the table above). If multiple actuators are used in a synchronized operation, write a program conforming to the lowest of the maximum speeds applicable to all synchronized actuators.
- In either way, always check the maximum speed of each applicable actuator when writing a program.

6.2 Medium type

Model	Unit	MXMS, horizontal specification		MXMM, horizontal specification	
Lead		20	30	20	30
Stroke	mm	500 to 1500	500 to 1500	330 to 1530	330 to 1530
Rated thrust	N	170.9	113.9	170.9	113.9
Maximum speed	mm/sec	1200	1800	1200	1800
Rated acceleration*3	G	0.3	0.3	0.3	0.3
Maximum acceleration/deceleration*3	G	0.8	1.0	0.8	1.0
Loading capacity at rated acceleration*2	kgf	40 (When used horizontally)	25 (When used horizontally)	40 (When used horizontally)	25 (When used horizontally)
Loading capacity at maximum acceleration*2	kgf	2.5 (When used horizontally)	0.5 (When used horizontally)	2.5 (When used horizontally)	0.5 (When used horizontally)
Positioning repeatability	mm	±0.01	±0.01	±0.01	±0.01
Load moment*1	N. m (kgf•cm)	Ma: 69.6 (7.1)	Ma: 69.6 (7.1)	Ma: 69.6 (7.1)	Ma: 69.6 (7.1)
		Mb: 99.0 (10.1)	Mb: 99.0 (10.1)	Mb: 99.0 (10.1)	Mb: 99.0 (10.1)
		Mc: 161.7 (16.5)	Mc: 161.7 (16.5)	Mc: 161.7 (16.5)	Mc: 161.7 (16.5)
Overhang load length	mm	Ma direction: 600 max.	Ma direction: 600 max.	Ma direction: 600 max.	Ma direction: 600 max.
		Mb/Mc directions: 600 max.	Mb/Mc directions: 600 max.	Mb/Mc directions: 600 max.	Mb/Mc directions: 600 max.

*1 Based on an acceleration of 0.3 G and the maximum speed.
*2 The maximum speed is assumed.
*3 The table below shows the relationship of acceleration/deceleration and loading capacity.
These values are not guaranteed and should be used only as a guide.
Even when the acceleration is equal to or below the rated acceleration, the loading capacity remains the same as the value at the rated acceleration.

Type	Lead	Maximum speed	Loading capacity by acceleration (kg)							
			0.3G	0.4G	0.5G	0.6G	0.7G	0.8G	0.9G	1.0G
MXMS	20 mm	1200 mm/sec	40	28	18	10	5	2.5		
MXMM	30 mm	1800 mm/sec	25	16	10	6	3.5	2	1	0.5

Caution:
- Use each actuator by observing its maximum speed.
- Take note that resonance may still occur at speeds below the applicable limit specified above, depending on the installation condition or operating conditions.
- Resonance of the ball screw shaft may increase the noise level or cause vibration, resulting in a shorter service life of the machine.
- If each actuator is used independently, write a program conforming to the maximum speed of the actuator (refer to the table above). If multiple actuators are used in a synchronized operation, write a program conforming to the lowest of the maximum speeds applicable to all synchronized actuators.
- In either way, always check the maximum speed of each applicable actuator when writing a program.

Model	Unit	MXMXS, horizontal specification		MZMS, vertical specification	MZMM, vertical specification
Lead		20	30	20	30
Stroke	mm	1600 to 2200	1600 to 2200	510 to 810	300 to 800
Rated thrust	N	170.9	113.9	170.9	170.9
Maximum speed	mm/sec	1200	1800	1000	1000
Rated acceleration*3	G	0.3	0.3	0.3	0.3
Maximum acceleration/deceleration*3	G	0.3	0.3	0.5	0.5
Loading capacity at rated acceleration*2	kgf	40 (When used horizontally)	25 (When used horizontally)	6 (When used vertically)	6 (When used vertically)
Loading capacity at maximum acceleration*2	kgf	40 (When used horizontally)	25 (When used horizontally)	3 (When used vertically)	3 (When used vertically)
Positioning repeatability	mm	±0.01	±0.01	±0.01	±0.01
Load moment*1	N. m (kgf•cm)	Ma: 69.6 (7.1)	Ma: 69.6 (7.1)	Ma: 69.6 (7.1)	Ma: 69.6 (7.1)
		Mb: 99.0 (10.1)	Mb: 99.0 (10.1)	Mb: 99.0 (10.1)	Mb: 99.0 (10.1)
		Mc: 161.7 (16.5)	Mc: 161.7 (16.5)	Mc: 81.3 (8.3)	Mc: 81.3 (8.3)
Overhang load length	mm	Ma direction: 600 max.	Ma direction: 600 max.	Ma direction: 600 max.	Ma direction: 600 max.
		Mb/Mc directions: 600 max.	Mb/Mc directions: 600 max.	Mb/Mc directions: 600 max.	Mb/Mc directions: 600 max.

*1 Based on an acceleration of 0.3 G and the maximum speed.
*2 The maximum speed is assumed.
*3 The table below shows the relationship of acceleration/deceleration and loading capacity.
These values are not guaranteed and should be used only as a guide.
Even when the acceleration is equal to or below the rated acceleration, the loading capacity remains the same as the value at the rated acceleration.
As for actuator types with mid-support, the maximum acceleration is the same as the rated acceleration. Accordingly, the loading capacity at the maximum acceleration corresponds to the loading capacity at the rated acceleration.

Type	Lead	Maximum speed	Loading capacity by acceleration (kg)		
			0.3G	0.4G	0.5G
MXMXS	20 mm	1200 mm/sec	40	–	–
	30 mm	1800 mm/sec	25	–	–
MZMS MZMM	20 mm	1000 mm/sec	6	4	3

Caution:
- Use each actuator by observing its maximum speed.
- Take note that resonance may still occur at speeds below the applicable limit specified above, depending on the installation condition or operating conditions.
- Resonance of the ball screw shaft may increase the noise level or cause vibration, resulting in a shorter service life of the machine.
- If each actuator is used independently, write a program conforming to the maximum speed of the actuator (refer to the table above). If multiple actuators are used in a synchronized operation, write a program conforming to the lowest of the maximum speeds applicable to all synchronized actuators.
- In either way, always check the maximum speed of each applicable actuator when writing a program.

6.3 Large type

Model	Unit	LXMS, horizontal specification		LXMM, horizontal specification	
Lead		20	40	20	40
Stroke	mm	500 to 2200	500 to 2200	250 to 2250	250 to 2250
Rated thrust	N	340.1	170.0	340.1	170.0
Maximum speed	mm/sec	1300	2400	1300	2400
Rated acceleration*3	G	0.3	0.3	0.3	0.3
Maximum acceleration/deceleration*3	G	1.0	1.0	1.0	1.0
Loading capacity at rated acceleration*2	kgf	80 (When used horizontally)	40 (When used horizontally)	80 (When used horizontally)	40 (When used horizontally)
Loading capacity at maximum acceleration*2	kgf	24 (When used horizontally)	10 (When used horizontally)	24 (When used horizontally)	10 (When used horizontally)
Positioning repeatability	mm	±0.01	±0.01	±0.01	±0.01
Load moment*1	N. m (kgf•cm)	Ma: 104.9 (10.7)	Ma: 104.9 (10.7)	Ma: 104.9 (10.7)	Ma: 104.9 (10.7)
		Mb: 149.9 (15.3)	Mb: 149.9 (15.3)	Mb: 149.9 (15.3)	Mb: 149.9 (15.3)
		Mc: 248.9 (25.4)	Mc: 248.9 (25.4)	Mc: 248.9 (25.4)	Mc: 248.9 (25.4)
Overhang load length	mm	Ma direction: 750 max.	Ma direction: 750 max.	Ma direction: 750 max.	Ma direction: 750 max.
		Mb/Mc directions: 750 max.	Mb/Mc directions: 750 max.	Mb/Mc directions: 750 max.	Mb/Mc directions: 750 max.

*1 Based on an acceleration of 0.3 G and the maximum speed.
*2 The maximum speed is assumed.
*3 The table below shows the relationship of acceleration/deceleration and loading capacity.
These values are not guaranteed and should be used only as a guide.
Even when the acceleration is equal to or below the rated acceleration, the loading capacity remains the same as the value at the rated acceleration.

Type	Lead	Maximum speed	Loading capacity by acceleration (kg)							
			0.3G	0.4G	0.5G	0.6G	0.7G	0.8G	0.9G	1.0G
LXMS	20 mm	1300 mm/sec	80	60	48	40	34	30	27	24
LXMM	40 mm	2400 mm/sec	40	30	25	20	17	15	13	10

Caution:
- Use each actuator by observing its maximum speed.
- Take note that resonance may still occur at speeds below the applicable limit specified above, depending on the installation condition or operating conditions.
- Resonance of the ball screw shaft may increase the noise level or cause vibration, resulting in a shorter service life of the machine.
- If each actuator is used independently, write a program conforming to the maximum speed of the actuator (refer to the table above). If multiple actuators are used in a synchronized operation, write a program conforming to the lowest of the maximum speeds applicable to all synchronized actuators.
- In either way, always check the maximum speed of each applicable actuator when writing a program.

Model	Unit	LXMXS, horizontal specification		LZMS, vertical specification	LZMM, vertical specification
Lead		20	40	20	20
Stroke	mm	2300 to 3000	2300 to 3000	500 to 1000	250 to 950
Rated thrust	N	340.1	170.0	340.1	340.1
Maximum speed	mm/sec	1300	2400	1000	1000
Rated acceleration*3	G	0.3	0.3	0.3	0.3
Maximum acceleration/deceleration*3	G	0.3	0.3	0.8	0.8
Loading capacity at rated acceleration*2	kgf	80 (When used horizontally)	40 (When used horizontally)	16 (When used vertically)	16 (When used vertically)
Loading capacity at maximum acceleration*2	kgf	80 (When used horizontally)	40 (When used horizontally)	6 (When used vertically)	6 (When used vertically)
Positioning repeatability	mm	±0.01	±0.01	±0.01	±0.01
Load moment*1	N. m (kgf•cm)	Ma: 104.9 (107)	Ma: 104.9 (107)	Ma: 104.9 (107)	Ma: 104.9 (107)
		Mb:104.9 (15.3)	Mb:104.9 (15.3)	Mb:104.9 (15.3)	Mb:104.9 (15.3)
		Mc: 248.9 (25.4)	Mc: 248.9 (25.4)	Mc: 248.9 (25.4)	Mc: 248.9 (25.4)
Overhang load length	mm	Ma direction: 750 max.	Ma direction: 750 max.	Ma direction: 750 max.	Ma direction: 750 max.
		Mb/Mc directions: 750 max.	Mb/Mc directions: 750 max.	Mb/Mc directions: 750 max.	Mb/Mc directions: 750 max.

*1 Based on an acceleration of 0.3 G and the maximum speed.
*2 The maximum speed is assumed.
*3 The table below shows the relationship of acceleration/deceleration and loading capacity.
These values are not guaranteed and should be used only as a guide.
Even when the acceleration is equal to or below the rated acceleration, the loading capacity remains the same as the value at the rated acceleration.
As for actuator types with mid-support, the maximum acceleration is the same as the rated acceleration.
Accordingly, the loading capacity at the maximum acceleration corresponds to the loading capacity at the rated acceleration.

Type	Lead	Maximum speed	Loading capacity by acceleration (kg)					
			0.3G	0.4G	0.5G	0.6G	0.7G	0.8G
LXMXS	20 mm	1300 mm/sec	80	–	–	–	–	–
	40 mm	2400 mm/sec	40	–	–	–	–	–
LZMS LZMM	20 mm	1000 mm/sec	16	12.3	11.1	10.1	9.2	6

Caution:
- Use each actuator by observing its maximum speed.
- Take note that resonance may still occur at speeds below the applicable limit specified above, depending on the installation condition or operating conditions.
- Resonance of the ball screw shaft may increase the noise level or cause vibration, resulting in a shorter service life of the machine.
- If each actuator is used independently, write a program conforming to the maximum speed of the actuator (refer to the table above). If multiple actuators are used in a synchronized operation, write a program conforming to the lowest of the maximum speeds applicable to all synchronized actuators.
- In either way, always check the maximum speed of each applicable actuator when writing a program.

7. Operating and Storage Environment

7.1 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.

7.2 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.

8. Installation

How to install the actuator is explained based on a single-axis configuration.

8.1 Installing the Actuator

The surface on which to install the actuator shall be a machined surface or a flat surface having equivalent accuracy.

- Mounting holes are provided in the actuator base, so use these holes to install the actuator. Use M8 bolts conforming to strength category 10.9 or above, together with the dedicated washers that came with the actuator (to prevent buckling).

	Applicable bolt	Tightening torque		Dimension A	Dimension B	Dimension C
		Bolt bearing surface is steel	Bolt bearing surface is aluminum			
Small type SXMS, SXMM, SZMS, SZMM	M6	12.3 N•m (1.26 kgf•m)	5.4 N•m (0.55 kgf•m)	50	7	6
Medium type MXMS, MXMM, MXMXS, MZMS, MZMM	M8	31.3 N•m (3.19 kgf•m)	14 N•m (1.43 kgf•m)	70	9	5
Large type LXMS, LXMM, LXMXS, LZMS, LZMM	M8			90	9	8

About tightening screws

- Use hexagonal socket head bolts as the male threads with which to install the actuator base.
- Use of high-strength bolts conforming to ISO 10.9 or above is recommended.
- The effective engagement length between the bolt and female thread shall be at least the value specified below:

When the male thread is made of steel → Same as the nominal diameter
When the male thread is made of aluminum → 1.8 times of nominal diameter

- If the bolt bearing surface is made of aluminum, also use a dedicated washer for high-strength bolt. (If the bolt is applied without an appropriate washer, the bearing surface may buckle.)

- On an actuator of single-slider specification, the home is located on the end where the IAI logo is attached on the side face of the screw cover. Pay attention to the direction when installing the actuator.

8.2 Installation Surface

- The frame shall have sufficient structural rigidity to prevent vibration.
- The surface on which to install the actuator shall be a machined surface or a flat surface having equivalent accuracy, where the surface flatness shall be within ±0.05 mm.
- Provide the space needed to carry out maintenance work.
- The side and bottom faces of the actuator base are used as reference surfaces for slider travel alignment.
- If high traveling accuracy is required, install the actuator using these surfaces as a reference.

As shown above, the side faces of the base are used as reference surfaces for slider travel alignment. If high traveling accuracy is required, install the actuator using these surfaces as a reference.

When installing the actuator on a frame using the reference surfaces of the base, provide the required machining by following the figure below.
When machining the surface, provide a margin corresponding to the thickness of the cover to prevent the ends of the actuator from contacting the front cover and rear cover.

Dimension A (mm)
3 to 5

8.3 Installing a Load on the Slider

- Tapped holes are provided in the slider, so use these holes to securely affix a load.
  The affixing method varies depending on how the actuator is installed.
- If the slider is affixed to move the actuator body, also use the slider's tapped holes for installation. (When installing a heavy object, also use pins.)

- Two reamed holes are provided in the slider, so use these holes if position accuracy must be maintained after removal/reinstallation. If the application requires fine-tuning of the squareness, etc., use one of the slider's reamed holes for adjustment.
- Keep the screw-in depth to 20 mm or less.
  If the bolt is screwed in beyond the above dimension, the tip of the bolt may damage the side cover and consequently the actuator.

- Small type
  SXMS, SXMM, SZMS, SZMM

- Medium type
  MXMS, MXMM, MXMXS, MZMS, MZMM

- Large type
  LXMS, LXMM, LXLMXS, LZMS, LZMM

8.4 Installing the Connector Box, and T-groove

On the nut rotary actuators of medium and large types, M4 T-grooves are provided on the side face of the base for installing the connector box, cable track receiver and other items required by the combination specification. (See the figure below.)
If the combined specification requires a wiring kit, use this T-slot to install the kit.
The T-slot can also be used to install sensors or secure wires or for various other purposes as deemed necessary.

Caution:
- Although square nuts are recommended, general hexagonal nuts can also be used with the T-slot.
- When installing a bolt in the T-slot, pay attention to the bolt length to make sure the tip of the bolt will not contact the bottom of the T-slot.

9. Connecting to the Controller

How to wire the actuator with the controller is explained based on a single-axis configuration.

If you ordered a single-axis actuator, your actuator should have a 3-meter or 5-meter single-axis cable preassembled with the actuator body. Plug the connector at the end of the cable directly into the connector.
If the actuator is of multi-slider specification, make sure the connectors are joined correctly by referring to the marker tubes (M1, M2, PG1, PG2) at the cable ends.

- Do not extend or shorten the cable by cutting, or reconnect the cable.
- Although the standard cable offers excellent flexibility, it is not a robot cable. Use a robot cable if the cable is to be stored in a moving cable duct (cable track, etc.).

If you wish to change the cable specification, contact IAI.

- Connecting to the controller
  An example of connection with a XSEL controller is shown below. The actuator can also be connected to SSEL and SCON controllers.

Controller connection cables

	Motor cable	Encoder cable
Standard	CB-X-MA□□□	CB-X2-PA□□□
With LS/creep sensors	CB-X-MA□□□	CB-X2-PLA□□□

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.

- 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 got 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.

10. Notes on Operation

10.1 Load Applied to the Actuator

- The load specified in the specification table must not be exceeded.
  In particular, pay attention to the moments applied to the slider, allowable overhang length and loaded mass.
- If the actuator is used as the Y-axis in a cantilever X-Y robot, the base becomes vulnerable to deformation. Accordingly, keep the Ma and Mc moments to one half the rated moment or below. (Refer to the figure below.)

Small type SXMS, SXMM, SZMS, SZMM

Allowable load moments

Ma	Mb	Mc
28.4 N·m (2.9 kgf·m)	40.2 N·m (4.1 kgf·m)	65.7 N·m (6.7 kgf·m)

Allowable overhang lengths

Ma direction	Mb direction	Mc direction
450 mm max.	450 mm max.	450 mm max.

Medium type MXMS, MXMM, MXMXS, MZMS, MZMM

Allowable load moments

Ma	Mb	Mc
69.6 N·m (7.1 kgf·m)	99.0 N·m (10.1 kgf·m)	161.7 N·m (16.5 kgf·m)

Allowable overhang lengths

Ma direction	Mb direction	Mc direction
600 mm max.	600 mm max.	600 mm max.

Large type LXMS, LXMM, LXMXS, LZMS, LZMM

Allowable load moments

Ma	Mb	Mc
104.9 N·m (10.7 kgf·m)	149.9 N·m (15.3 kgf·m)	248.9 N·m (25.4 kgf·m)

Allowable overhang lengths

Ma direction	Mb direction	Mc direction
750 max.	750 max.	750 max.

- The allowable overhang lengths are based on a configuration where the center of gravity of the installed article is positioned at one half the overhang length.

Application of an excessive load moment may lead to unwanted outcomes such as a shorter service life of the guide. If the overhang length exceeds the allowable value, vibration may occur or the service life of the guide may be negatively affected.

10.2 Duty

Keep the duty to 50% or below so that the actuator will last for a long time without stopping due to errors.

Duty (%) = Operating time / (Operating time + Stopped time) x 100

If the duty is too high, an overload error and other errors may generate.
If the actuator generated an error, increase the stopped time to lower the duty.

10.3 About Home Return

10.3.1 Operating Principles of Home Return

This actuator implements a home return in the following steps:

[1] Upon receiving a home return command, the actuator determines the moving direction based on the specified parameter.
[2] The actuator detects a home sensor signal during the return operation.
[3] After detecting the home sensor signal, the actuator reverses its direction and operates until a phase Z signal is detected, upon which the actuator defines the applicable position as the reference point.
[4] The actuator travels further by the offset specified by a parameter, and defines the achieved position as the home.

10.3.2 Fine-tuning the Home Position

The motor revolution after a home sensor signal is detected until a phase Z signal generates has been adjusted prior to shipment.
The table below shows the standard distances from the stopper, reached by the slider when it reverses its direction upon detecting a home sensor signal and eventually stops at the home position.

Lead	Distance from mechanical stopper (mm)
20 mm or less	5 ± 1
Over 20 mm	5 ± 2

If the direction of home return remains the same, the home position for each actuator can be fine-tuned using the applicable distance shown above by changing the parameter. Follow the steps below to fine-tune the home position:

[1] Perform a home return operation to check the home.
[2] Calculate the difference between the current home position and desired home position, and correct the parameter accordingly.
The value set in the parameter represents an offset in the positive moving direction of the actuator. (The position cannot be corrected in the negative direction.)
[3] Increasing the offset will narrow the moving range of the actuator.
If an offset exceeding 1 mm has been set, also adjust the stroke soft limits.

⚠ Warning

The encoder not only detects angles of rotation and home signals, but it also serves an important role in the switching of phases in the AC-servo power line. For this reason, the encoder phases have been adjusted precisely. Never touch the encoder to change the home.

11. Maintenance

11.1 Maintenance Schedule

Perform maintenance work according to the schedule below.
The schedule is set assuming eight hours of operation a day. When the operation time is long such as 24-hour operation, shorten the maintenance intervals as needed.

	External visual inspection	Internal inspection	Grease supply	Mid-support wire
Start of operation	○			
After 1 month of operation	○			
Every 3 months		○	○*1	
After 6 months of operation	○	○		
After 1 year of operation	○	○	○	
Every 6 months thereafter	○			
Every year	○	○	○	○*2

*1 Add grease if degradation of grease is observed in the internal inspection.

*2 Carry out the required adjustment if the actuator has a mid-support.

11.2 External Visual Inspection

Check the following items in the external visual inspection.

Body	Loose mounting bolts?
Cables	Damage to cables or connection to connector box?
General	Unusual noise or vibrations?

11.3 Cleaning

- Clean the exterior as needed.
- Wipe off dirt with a soft cloth.
- Do not use strong compressed air on the actuator, as it may force dust into the crevices.
- Do not use petroleum-based solvents, as they may damage resin or coated surfaces.
- If the unit is badly soiled, apply a neutral detergent or alcohol to a soft cloth and wipe lightly.

11.4 Internal Inspection

Turn off the power and remove the screw cover to visually inspect the interior.
Check the following items in the internal inspection.

Body	Loose mounting bolts?
Guide	Lubrication condition okay? Soiling?
Ball screw	Lubrication condition okay? Soiling?

Visually check the condition inside the actuator. Specifically, check for entry of dust and other foreign matters and the lubrication condition.
Even if the grease on the guide and ball screw has turned brown, a good lubrication condition is maintained if the traveling surface is wet and glossy.
If the grease has become dirty and is no longer glossy, or when you notice a shortage of grease after a long period of use, clean each area and add grease.
The internal inspection procedure is specified below.

An example of how to check the interior of large types is given below. Follow the same procedure to check the interior of small and medium types.

[1] Use an Allen wrench of 1.5 mm in width across flats to take out the end cover.

[2] Remove the screw cover using an Allen wrench of 2.0 mm across flats.
(For small types, use an Allen wrench of 1.5 mm in width across flats.)

[3] Check the interior.

[4] After the check, assemble the parts by following the same steps in reverse.
When installing the screw cover, make sure the side face bearing the IAI logo is on the same side as the serial number label on the base.

Screw-cover affixing bolt	[M4 x 5] Tightening torque = 0.6 N•m
	[M3 x 5] Tightening torque = 0.7 N•m
End-cover affixing bolt	[M3 x 6] Tightening torque = 0.4 N•m

Caution: The hollow-shaft motor has been adjusted at the factory prior to installation. Never loosen the mounting bolts of the hollow-shaft motor.

11.5 Internal Cleaning

- Clean each area using a soft cloth, etc.
- Do not blow compressed air onto the internal parts, as dust may enter through gaps and openings.
- Do not use petroleum solvent, neutral detergent or alcohol.

11.6 Greasing the Guide

11.6.1 Applicable Grease

Lithium grease is used.
The following grease has been applied prior to shipment.

Kyodo Yushi	Daphne Eponex 2

Other manufacturers offer different greases equivalent to the above product. Contact each manufacturer and ask them to suggest equivalent greases corresponding to the product specified above. Examples of equivalent grease products are listed below.

Showa Shell Sekiyu	Albania Grease 2
Mobil Sekiyu	Mobilux 2

⚠ Warning!!

Never use fluorine grease. If fluorine grease is mixed with lithium grease, lithium grease will lose its intended lubrication property and the machine may be damaged.

11.6.2 How to Add Grease

(1) Small type: SXMS, SXMM, SZMS, SZMM
Medium type: MXMS, MXMM, MXMXS, MZMS, MZMM

A grease nipple is provided inside the home-side stopper of the slider, so add grease from this grease nipple.

[1] Use an Allen wrench of 1.5 mm in width across flats to remove the two screws and take out the end cover on the home side.

[2] Move the slider all the way to the home side.
[3] Insert a grease gun into the hole provided at the end bracket, secure the slider so that it won't move, and then add grease. (For the specific positions, see the figures on the next page.)

● Small type: SXMS, SXMM, SZMS, SZMM

● Medium type: MXMS, MXMM, MXMXS, MZMS, MZMM

[4] Move the slider back and forth several times by hand.
[5] Repeat the above steps to add grease.
[6] Use a waste cloth, etc., to wipe off grease that has overflowed from the slider.

(2) Large type: LXMS, LXMM, LXMXS, LZMS, LZMM

Two grease nipples are found, one each on the right and left sides of the slider. Apply grease from these nipples.

[1] Using a grease gun, apply grease from the grease nipples located on the end faces of the slider. (Refer to the figure below for the positions of grease nipples.)

Grease nipple positions on the slider

[2] Move the slider back and forth several times by hand.
[3] Repeat the above steps to apply more grease.
[4] Use a waste cloth, etc., to wipe off grease that has overflowed from the slider.

11.7 How to Add Grease to the Ball Screw

11.7.1 Applicable Grease

The following lithium grease has been applied prior to shipment.

Kyodo Yushi	Multemp LRL 3

This grease has excellent properties including low heat generation and is suitable for ball screws.
For information on equivalent products (lithium greases), refer to the section on greasing the guide.

> ⚠ Warning
>
> Never use fluorine grease. If fluorine grease is mixed with lithium grease, lithium grease will lose its intended lubrication property and the machine may be damaged.

11.7.2 How to Apply Grease

Clean the ball screw before applying grease. Apply grease by hand, and then move the slider back and forth to let grease spread evenly. Finally, wipe off excess grease that has overflowed from the nut.

Apply grease on the ball screw.

Move the slider. If the actuator is equipped with a brake, release the brake.

> Caution: Adding too much grease may increase the agitation resistance and cause the ball screw to generate heat easily or the excess grease attached to the ball screw may scatter and dirty the surrounding area. Be sure to wipe off excess grease.

11.8 Adjusting the Mid-support Wire Tension

[Items required for adjustment]
- Allen wrenches
- Tension gauge (capable of exerting a push force of at least 1 kg (9.8 N))

[Procedure]
[1] Remove the end cover using an Allen wrench of 1.5 mm across flats.

[2] Remove the screw cover using an Allen wrench of 2.0 mm across flats.

[3] Loosen the two screws (M3 x 5) affixing one wire hook (base side) of the mid-support wire located at the center of the base, so that the wire hook can be moved.
<u>Loosen the screws for only one wire hook on either the home side or counter-home side.</u>

[4] Use a tension gauge to push the loosened wire hook with the specified push force, and tighten the two wire hook screws (M3 x 5).

Specified push force: 9.31 to 9.8 N

Tighten the screws while pushing the wire hook with the specified push force.

Tightening torque: 1.5 (N•m)

[5] After the check, assemble the parts by following the same steps in reverse.
When installing the screw cover, make sure the side face bearing the IAI logo is on the same side as the serial number label on the base.

Screw-cover affixing bolt	[M4 x 5] Tightening torque = 0.6 N•m
End-cover affixing bolt	[M3 x 6] Tightening torque = 0.4 N•m

Caution: The hollow-shaft motor has been adjusted at the factory prior to installation. Never loosen the mounting bolts of the hollow-shaft motor.

11.9 Replace the Mid-support Wire

[Items required for replacement]

- Mid-support wire Model: WR-LXMXS-(stroke)
- Wire hook (base side): As a replacement when the wire catch of the original hook is deformed.
- Wire hook (motor side): As a replacement when the wire catch of the original hook is deformed.
- Allen wrenches
- Tension gauge (capable of exerting a push force of at least 1 kg (9.8 N))

[Procedure]

[1] Remove the end cover using an Allen wrench of 1.5 mm across flats.

[2] Remove the screw cover using an Allen wrench of 2.0 mm across flats.

[3] Loosen the two screws (M3 x 5) affixing one wire hook (base side) of the mid-support wire located at the center of the base, so that the wire hook can be moved.
Loosen the screws for only one wire hook on either the home side or counter-home side.

If the wire catch of the hook (base side) is deformed, replace the wire hook as follows:

◎ Replace the wire hook on one side (base side) with a replacement hook, and tighten the two screws (M3 x 5) by keeping approx. 5 mm between the slot end and each screw as shown below. Also replace the wire hook on the other side (base side) with a replacement hook, and loosely tighten the two screws (M3 x 5) so that the wire hook can be moved.

[4] Remove the wire from the wire hook whose screws have been loosened.
Remove the wire from the wire hook (base side). Next, pull out the wire through the delrin bearing at the mid-support and remove it from the wire hook (motor side).

[5] Follow the same steps to also remove the wire from the wire hook (base side) whose screws have not been loosened.

[6] Hook one end of the replacement wire on the wire hook (base side) whose screws have not been loosened. Guide the other end of the wire under the motor and bring it to the mid-support, and hook the wire on the delrin bearing at the mid-support. Next, pull the wire further to the motor and hook it on the wire hook at the motor.

Hook one end of the replacement wire on the wire hook.

Guide the replacement wire under the motor.

Hook the replacement wire on the delrin bearing by looping the wire over the bearing from below.

Hook the replacement wire on the wire hook (motor side).

When hooking the wire in step [6], you may find the wire catch of the hook (motor side) deformed. In this case, replace the wire hook as follows:

◎ Replace the wire hook with a replacement wire hook (motor side), and tighten the two screws (M3 x 6).

[7] Follow the same steps to also attach the wire to the wire hook (base side) whose screws have been loosened. Specifically, guide the wire from the wire hook (base side) to the delrin bearing at the mid-support, and attach it to the wire hook (motor side).

When hooking the wire in step [7], you may find the wire catch of the hook (motor side) deformed. In this case, replace the wire in the same manner.

[8] Use a tension gauge to push the wire hook (base side) whose screws have been loosened with the specified push force, and tighten the two wire hook screws (M3 x 5).

Specified push force: 9.31 to 9.8 N

Tighten the screws while pushing the wire hook with the specified push force.

Tightening torque: 1.5 (N•m)

[9] After the check, assemble the parts by following the same steps in reverse.
When installing the screw cover, make sure the side face bearing the IAI logo is on the same side as the serial number label on the base.

Screw-cover affixing bolt	[M4 x 5] Tightening torque = 0.6 N•m
End-cover affixing bolt	[M3 x 6] Tightening torque = 0.4 N•m

Caution: The hollow-shaft motor has been adjusted at the factory prior to installation. Never loosen the mounting bolts of the hollow-shaft motor.

12. Troubleshooting

12.1 What to Do When an Error Occurs

If an encoder open error, driver overload error, deviation overflow error or any other error occurs, do not hastily determine that the robot or controller is faulty. Refer to the information below and check if the problem can be corrected by the applicable procedure. If the problem still persists after the troubleshooting procedure, contact IAI and provide us with detailed information regarding the problem condition.

12.2 Encoder Open Error (Error Code: D12)

12.3 Driver Overload Error (Error Code: D0A)

12.4 Deviation Overflow Error (Error Code: C6B)

13. Warranty

13.1 Warranty period

One of the following periods, whichever is shorter:

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

13.2 Scope of warranty

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

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

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

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

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

13.3 Honoring the warranty

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

13.4 Limited liability

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

13.5 Conditions of conformance with applicable standards/regulations, etc., and applications

1) If our product is combined with another product or any system, device, etc., used by the customer, the customer must first check the applicable standards, regulations and/or rules. The customer is also responsible for confirming that such combination with our product conforms to the applicable standards, etc. In such a case we will not be liable for the conformance of our product with the applicable standards, etc.
2) Our product is for general industrial use. It is not intended or designed for the applications specified below, which require a high level of safety. Accordingly, as a rule our product cannot be used in these applications. Contact us if you must use our product for any of these applications:

   [1] Medical equipment pertaining to maintenance or management of human life or health
   [2] A mechanism or mechanical equipment intended to move or transport people (such as a vehicle, railway facility or aviation facility)
   [3] Important safety parts of mechanical equipment (such as safety devices)
   [4] Equipment used to handle cultural assets, art or other irreplaceable items

3) Contact us at the earliest opportunity if our product is to be used in any condition or environment that differs from what is specified in the catalog or operation manual.

13.6 Other items excluded from warranty

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

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

14. Change History

Date revised	Description of revision
Feb. 2009	Version 2 Small types: SXMS, SXMM, SZMS, SZMM Medium types: MXMS, MXMM, MXMXS, MZMS, MZMM
Aug. 2011	Version 3 • “Please Read Before Use” is changed • “Safety Precautions” is changed to “Safety Guide” • P.49 9,800 N → 9.8 N • P.50 9,310 to 9,800 N → 9.31 N to 9.8 N • P.51 9,800 N → 9.8 N • P.56 9,310 to 9,800 N → 9.31 N to 9.8 N • P.60, 61 Contents changed in 13. Warranty
Mar. 2012	Version 4 • P.26 Graph added for MXMXS transportable weight • P.27 Graph of transportable weight for each speed Lead 20mm 2400mm/sec → 1300/sec Lead 40mm 1200mm/sec → 2400/sec • P.28 Graph added for LXMXS transportable weight • P.30 Note changed to 1.8 times more of the nominal diameter for the length of thread engagement on aluminum

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