



Single Axis Robot RS Series Rotary Type Instruction Manual

===== **Fourth Edition** =====

RS-30, RS-60

IAI America, Inc.

Please Read Before Use

Thank you for purchasing our product.

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

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

Please download the user's manual from our website.

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

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

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

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

[Important]

- This Instruction Manual is 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.

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Safety Guide

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

Safety Precautions for Our Products

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

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

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

No.	Operation Description	Description
4	Installation and Start	(2) Cable Wiring • Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool. • Do not scratch on the cable. Do not bend it forcibly. Do not pull it. Do not coil it around. Do not insert it. Do not put any heavy thing on it. Failure to do so may cause a fire, electric shock or malfunction due to leakage or continuity error. • Perform the wiring for the product, after turning OFF the power to the unit, so that there is no wiring error. • When the direct current power (+24V) is connected, take the great care of the directions of positive and negative poles. If the connection direction is not correct, it might cause a fire, product breakdown or malfunction. • Connect the cable connector securely so that there is no disconnection or looseness. Failure to do so may cause a fire, electric shock or malfunction of the product. • Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Failure to do so may cause the product to malfunction or cause fire. (3) Grounding • The grounding operation should be performed to prevent an electric shock or electrostatic charge, enhance the noise-resistance ability and control the unnecessary electromagnetic radiation. • For the ground terminal on the AC power cable of the controller and the grounding plate in the control panel, make sure to use a twisted pair cable with wire thickness 0.5mm² (AWG20 or equivalent) or more for grounding work. For security grounding, it is necessary to select an appropriate wire thickness suitable for the load. Perform wiring that satisfies the specifications (electrical equipment technical standards). • Perform Class D Grounding (former Class 3 Grounding with ground resistance 100Ω or below).

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

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

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

Alert Indication

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

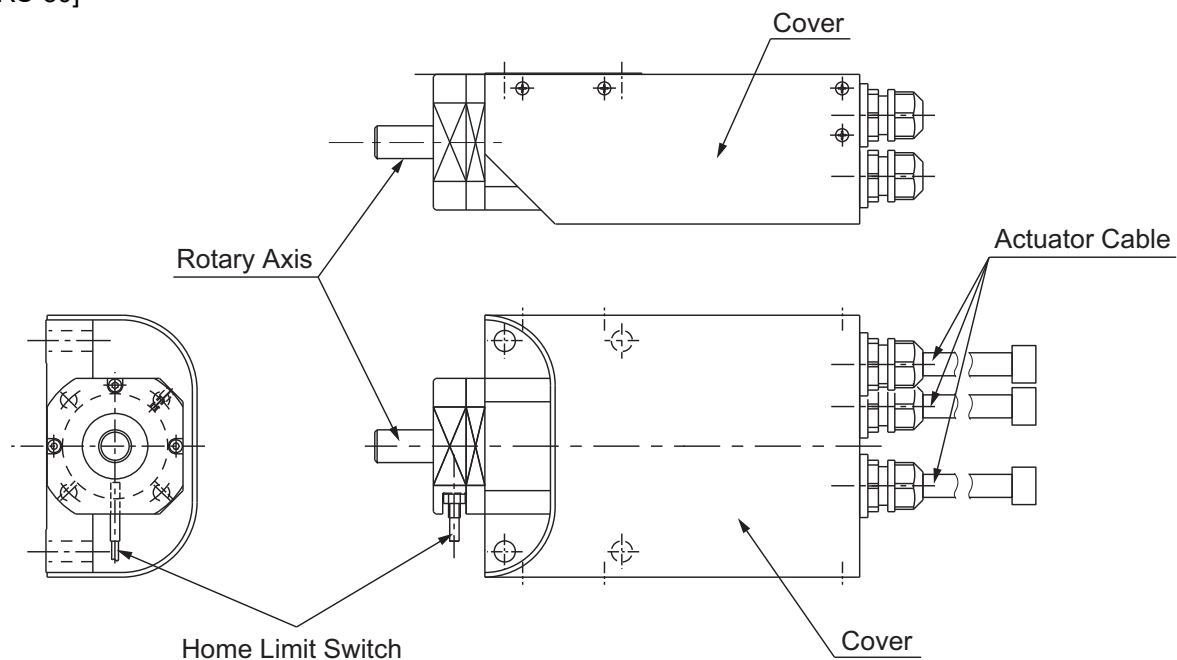
Level	Degree of Danger and Damage	Symbol
Danger	This indicates an imminently hazardous situation which, if the product is not handled correctly, will result in death or serious injury.	 Danger
Warning	This indicates a potentially hazardous situation which, if the product is not handled correctly, could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

Precautions

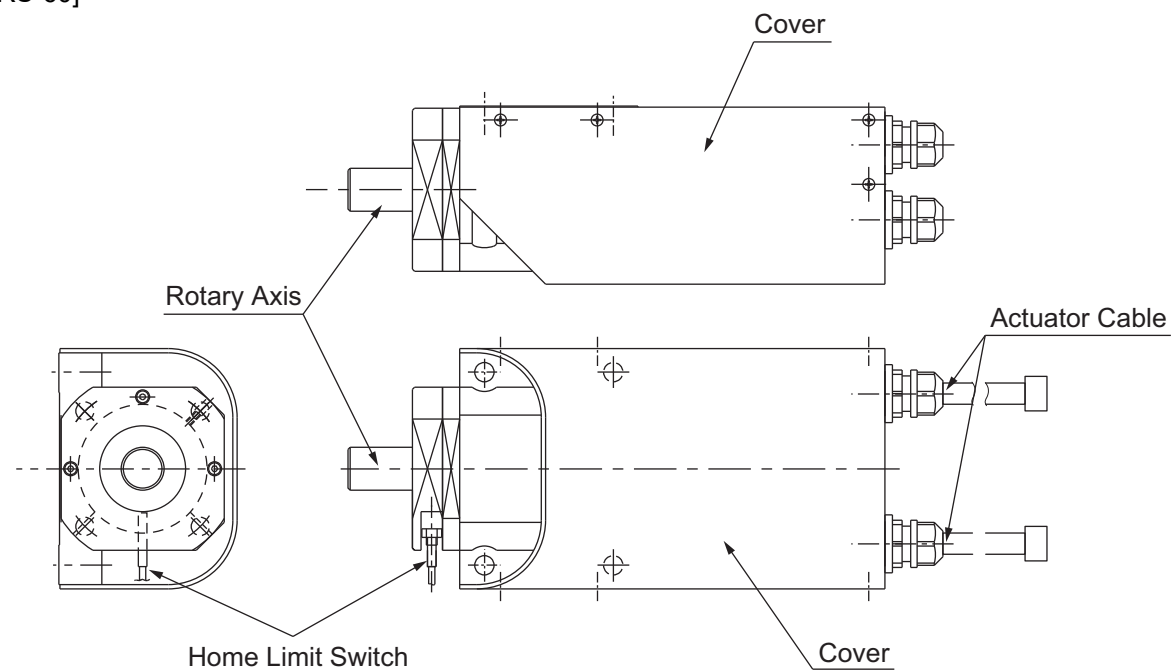
1. Do not set speeds and accelerations/decelerations equal to or greater than the respective ratings.
If the actuator is operated at a speed or acceleration/deceleration exceeding the allowable value, abnormal noise or vibration, failure, or shorter life may result.
2. Set the load inertia and allowable load moment within the range of allowable range.
It may cause a shortened life of the product, abnormal noise, vibration or malfunction if operation is performed with the load beyond the load inertia or allowable load moment.
3. Ensure use of the product in the specified conditions, environments and ranges.
Operation out of the guarantee could cause a drop in performance or malfunction of the product.

Names of the Parts

[RS-30]



[RS-60]



1. Specifications Check

1.1 Product Check

The standard configuration of this product is comprised of the following parts.

Check the packed items against the packing specification. Should you find a wrong model or any missing item, please contact your IAI dealer or IAI.

1.1.1 Parts

No.	Name	Model number	Quantity	Remarks
1	Main Body	Refer to "How to Read the Model Nameplate" and "How to Read the Model Number".	1	
Accessories				
2	Motor • Encoder Cables (Note 1)		1 set	
3	Safety Guide		1	

Note 1 The motor • encoder cables differ between the standard model and robot cable. [Refer to 1.4 "Motor • Encoder Cables".]

1.1.2 Related Instruction Manuals for the Each Controller Supported by this Product

Shown below is a list of the instruction manuals for the controllers related to this product.

(1) XSEL-J/K Controller

No.	Name	Manual No.
1	XSEL-J/K Controller Instruction Manual	ME0116
2	PC software IA-101-X-MW/IA-101-X-USBMW Instruction Manual	ME0154
3	Teaching Pendant SEL-T/TD/TG Instruction Manual	ME0183
4	Teaching Pendant IA-T-X/XD Instruction Manual	ME0160
5	DeviceNet Instruction Manual	ME0124
6	CC-Link Instruction Manual	ME0123
7	PROFIBUS Instruction Manual	ME0153
8	XSEL Ethernet Instruction Manual	ME0140
9	Multi-Point I/O Board Instruction Manual	ME0138
10	Multi-Point I/O Board Dedicated Terminal Board Instruction Manual	ME0139

(2) XSEL-P/Q Controller

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

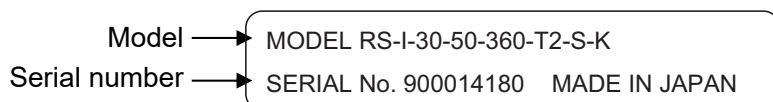
(3) SSEL Controller

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

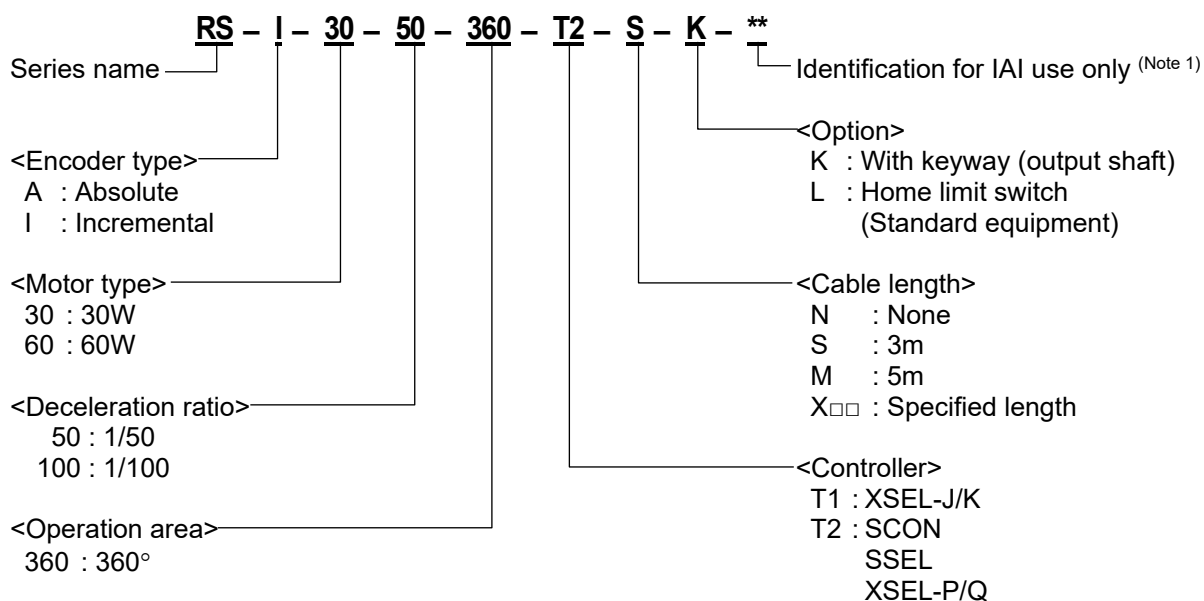
(4) SCON Controller

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

1.1.3 How to Read the Model Nameplate



1.1.4 How to Read the Model Number



Note 1 Identification for IAI use only: This may be marked for the purpose of IAI. This is not to indicate the manufacturing model code.

1.2 Specification

Model		RS-30	
Deceleration ratio		1/50	1/100
Operation area	rad (°)	0 to 2π (360)	
Rated output	W	30	
Rated speed	rad/sec (°/sec)	2π (360)	π (180)
Rated torque	N•m (kgf•cm)	3.3 (34.1)	6.65 (68.2)
Positioning repeatability	rad (°)	$\pm 4.9 \times 10^{-4}$ (± 0.028)	
Lost motion	rad (°)	8.7×10^{-4} (0.05)	4.35×10^{-4} (0.025)
Number of encoder pulses	P/R	16,384	
Allowable thrust load	N (kgf)	392 (40)	

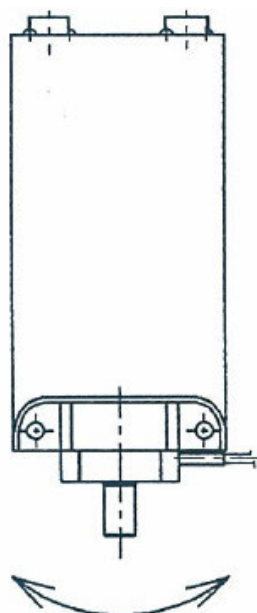
Model		RS-60	
Deceleration ratio		1/50	1/100
Operation area	rad (°)	0 to 2π (360)	
Rated output	W	60	
Rated speed	rad/sec (°/sec)	2π (360)	π (180)
Rated torque	N•m (kgf•cm)	5.58 (57)	11.1 (113)
Positioning repeatability	rad (°)	$\pm 4.9 \times 10^{-4}$ (± 0.028)	
Lost motion	rad (°)	4.35×10^{-4} (0.025)	4.35×10^{-4} (0.025)
Number of encoder pulses	P/R	16,384	
Allowable thrust load	N (kgf)	980 (100)	

(1) Transportable Weight
[Refer to 4.2 Weight of the Loaded Object]

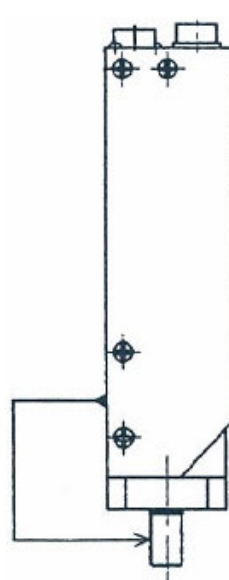
(2) Allowable Load Moment of Actuator

Type	Deceleration ratio	Allowable load moment (Fig. 1)	Load inertia	Deflection of the output shaft (Fig. 2)
		N·m (kgf·cm)	kg·m ² (kgf·cm·s ²)	mm
RS-30	1/50	9.8 (100) or less	0.058 (0.59)	0.045 or less
	1/100		0.23 (2.35)	
RS-60	1/50	23.5 (240) or less	0.11 (1.1)	0.066 or less
	1/100		0.42 (4.3)	

(Fig. 1)



(Fig. 2)





1.3 Option

1.3.1 With keyway (Model code: K)

It is available as an option with a keyway for positioning on the output shaft of rotary axis.

1.3.2 Home Limit Switch (Model code: L)

In ordinary home-return operation, the “pressing method” is adopted in which the actuator is pressed against the stopper and detects the Z-phase after reversing.

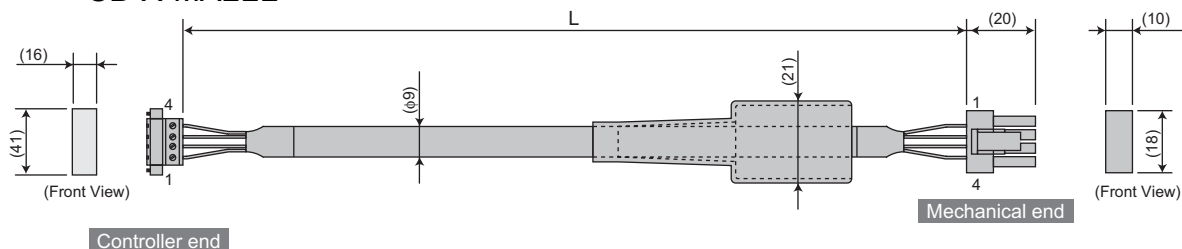
The “Home limit switch” is an option that does not adopt this pressing method but adopts a proximity sensor to perform the home-return operation.

It is the equipment in standard for RS.

1.4 Motor • Encoder Cables

1.4.1 Motor Cable (for XSEL-J/K/P/Q, SSEL, SCON)

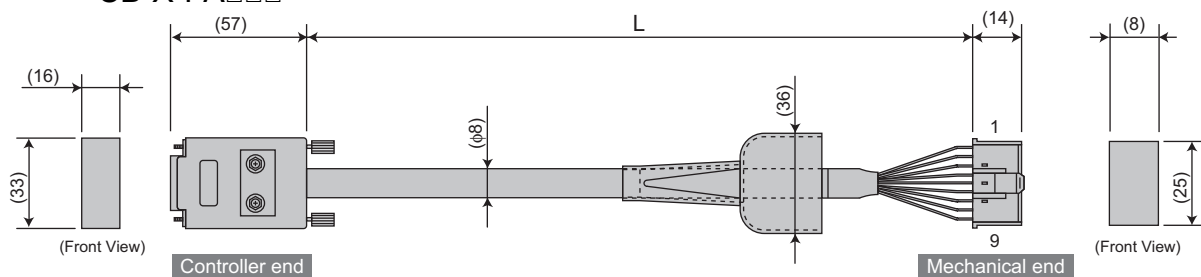
CB-X-MA□□□



Wiring	Color	Signal	No.	No.	Signal	Color	Wiring
0.75sq	GN	PE	1	1	U	RD	0.75sq (Crimped)
	RD	U	2	2	V	WT	
	WT	V	3	3	W	BK	
	BK	W	4	4	PE	GN	

1.4.2 Encoder Cable (for XSEL-J/K)

CB-X-PA□□□



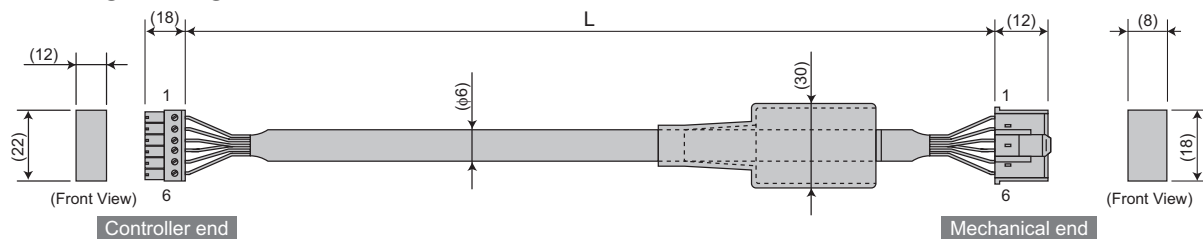
Wiring	Color	Signal	No.	No.	Signal	Color	Wiring
0.15sq (Crimped)	—	—	1	1	BAT+	BK	0.15sq (Crimped)
	—	—	2	2	BAT-	YW	
	—	—	3	3	SD	BL	
	—	—	4	4	SD	OR	
	—	—	5	5	VCC	GN	
	—	—	6	6	GND	BR	
	BL	SD	7	7	FG	Ground	
	OR	SD	8	8	BK-	GY	
	BK	BAT+	9	9	BK+	RD	
	YW	BAT-	10				
	GN	VCC	11				
	BR	GND	12				
	GY	BK-	13				
	RD	BK+	14				
	—	—	15				

The shield is clamped to the hood

Ground wire and braided shield wires

1.4.3 Limit Switch Cable (for XSEL-J/K)

CB-X-LC□□□

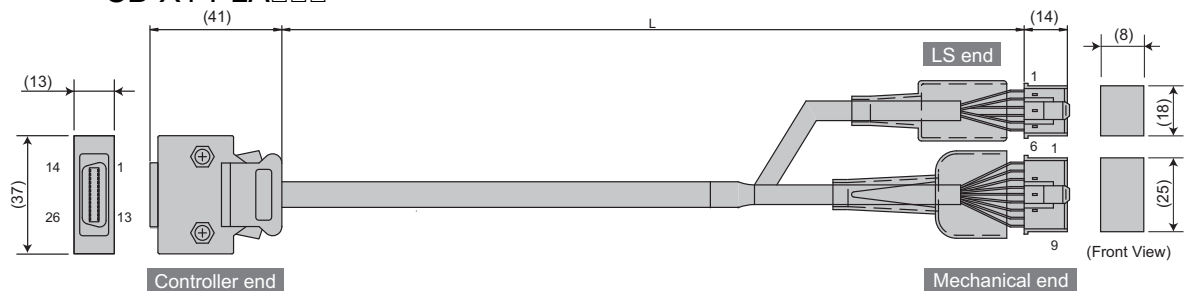


Wiring	Color	Signal	No.	No.	Signal	Color	Wiring
AWG24	LBL	24VOUT	6	1	24VOUT	LBL	AWG24 (Crimped)
	PK	N	5	2	N	PK	
	GN	LS	4	3	LS	GN	
	OR	CREEP	3	4	CREEP	OR	
	GY	OT	2	5	OT	GY	
	1B/LBL	RSV	1	6	RSV	1B/LBL	

Note) 1B indicates one black dot mark.

1.4.4 Encoder Cable (for XSEL-P/Q, SSEL, SCON, LS equipped type connection)

CB-X1-PLA□□□



Wiring	Color	Signal	No.	No.	Signal	Color	Wiring
AWG26 (Soldered)	—	—	10	1	E24V	WT/BL	AWG26 (Crimped)
	—	—	11	2	0V	WT/YW	
	WT/BL	E24V	12	3	LS	WT/RD	
	WT/YW	0V	13	4	CREEP	WT/BK	
	WT/RD	LS	26	5	OT	WT/PL	
	WT/BK	CREEP	25	6	RSV	WT/GY	
	WT/PL	OT	24	—	—	—	AWG26 (Crimped)
	WT/GY	RSV	23	—	—	—	
	—	—	9	1	BAT+	PL	
	—	—	18	2	BAT-	GY	
	—	—	19	3	SD	OR	
	—	A+	1	4	SD	GN	
	—	A-	2	5	VCC	RD	
	—	B+	3	6	GND	BK	
	—	B-	4	7	FG	Ground	
	—	Z+	5	8	BK-	BL	
	—	Z-	6	9	BK+	YW	
	OR	SRD+	7	—	—	—	
	GN	SRD-	8	—	—	—	
	PL	BAT+	14	—	—	—	
	GY	BAT-	15	—	—	—	
	RD	VCC	16	—	—	—	
	BK	GND	17	—	—	—	
	BL	BKR-	20	—	—	—	
	YW	BKR+	21	—	—	—	
	—	—	22	—	—	—	

The shield is clamped to the hood

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

Ground wire and braided shield wires

2. Installation

2.1 Transportation

[1] Handling of the Robot

Unless otherwise specified, the actuators are wrapped individually when the product is shipped out.

(1) Handling of the Packed Product

- Do not damage or drop. The package is not applied with any special treatment that enables it to resist an impact caused by a drop or crash.
- An operator should never attempt to carry a heavy package on their own. Also, use an appropriate way for transportation.
- If the shipping box is to be left standing, it should be in a horizontal position. Follow the instruction if there is any for the packaging condition.
- Do not step or sit on the package.
- Do not put any load that may cause a deformation or breakage of the package.

(2) Handling after Unpackaged

- Do not carry the actuator by holding the cable, or do not move it by pulling the cable.
- Hold the body base when transporting the actuator.
- Do not hit or drop the product while carrying.
- Do not give any excessive force to any of the sections in the actuator.

[2] Handling of Multi-Axes Type

This is the case that this product is delivered with other actuators being combined. Multi-axes type will be delivered in a package with an outer case fixed to a wooden base.

(1) Handling of the Packed Product

- Do not damage or drop. The package is not applied with any special treatment that enables it to resist an impact caused by a drop or crash.
- An operator should never attempt to carry a heavy package on their own. Also, use an appropriate way for transportation.
- When suspending the package using ropes, pass the ropes from underneath the reinforcement frames at the bottom of the base. When lifting with a forklift, also place the forks underneath the base.
- Do not apply an impact on the package or let it bounce when putting it down.
- Do not step or sit on the package.
- Do not put any load that may cause a deformation or breakage of the package.

(2) Handling after Unpackaged

- Appropriately fix the end of the actuators if it is overhanging so it would not widely shake with external vibration. If the actuator assembly is transported without the ends being secured, do not apply an impact of 0.3G or more.
- In the case that the actuator needs to be carried up with ropes or another method, be sure to use an appropriate cushioning to avoid the robot being deformed or put on an excessive pressure. And also, be sure to keep the robot in a stable and horizontal posture. Make a tool to utilize the attachment holes and tapped holes on the actuator and attach it if necessary.
- Do not attempt to apply load to the actuator. Also, avoid the cables being pinched or caused an excessive deformation.

[3] Handling of Robot Mounted on Mechanical Equipment (System)

Followings are the cautions for when transporting the actuators installed in the machinery equipment (system) in the whole system.

- If any end of the actuator is overhanging, secure it properly to avoid significant movement due to external vibration. If the actuator assembly is transported without the ends being secured, do not apply an impact of 0.3G or more.
- Do not attempt to apply load to actuators when hanging the machinery equipment (system) with tools such as a rope. Also, avoid the cables being pinched or caused an excessive deformation.

2.2 Installation and Storage • Preservation Environment

[1] Installation Environment

The actuator should be installed in a location other than those specified below.

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

Also provide sufficient work space required for maintenance inspection.

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

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

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

[2] Storage • Preservation Environment

The storage • preservation environment should be similar to the installation environment. In addition, make sure condensation will not occur when the actuator is to be stored or preserved for a long period of time. Unless specified, we do not include drying agents when shipping the actuator. If you are storing the actuator in an environment where condensation might occur, you must treat the entire shipping box, or treat the actuator itself after unpacking, to prevent condensation. The unit can withstand temperatures up to 60°C during a short storage/preservation period, but only up to 50°C if the storage/preservation period is longer than one month.

The actuator should be lying flat during storage • preservation.

If the actuator is to be stored in a packed state, follow the specified actuator position if indicated.

[3] Handling of the Robot Mounted on Mechanical Equipment (System)

The following are the cautions for when transporting the actuators installed in the machinery equipment (system) in the whole system.

- Affix the table so they would not move while transporting.
- If any end of the actuator is overhanging, secure it properly to avoid significant movement due to external vibration. If the actuator assembly is transported without the ends being secured, do not apply an impact of 0.3G or more.
- Do not attempt to apply load to actuators or connector box when hanging the machinery equipment (system) with tools such as a rope. Also, avoid the cables being pinched or caused an excessive deformation.

2.3 Installation

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

[1] Installation

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

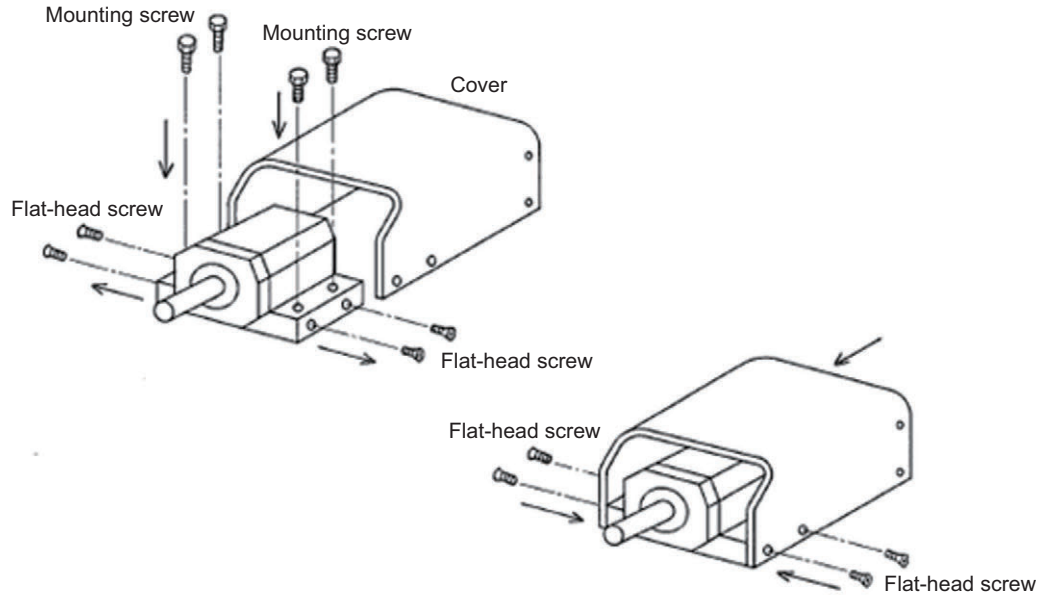
○ : Possible × : Not possible

Horizontal installation	Vertical installation	Sideway installation	Ceiling mount installation
○	○	○	○

[2] Installation of the Main Unit

Have the unit attached following the steps below;

- 1) Unscrew the flat-head screws on the sides of the unit cover and remove the cover.
- 2) There are 9mm through holes at 4 points on the main unit. Affix the unit with M8 screws.
- 3) Put the cover back on the unit and affix with the flat-head screws.



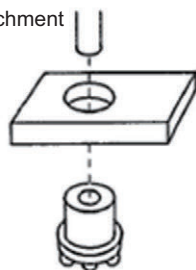
Tightening screws

- Use hexagonal socket head bolts for the male threads for installing the base.
- Use of high-tension bolts meeting at least ISO-10.9 is recommended.
- Use appropriate screws suitable for the attachment holes and attachment grooves.
- Do not attempt to use a general-purposed spring washer. Doing so may make the screws even looser.

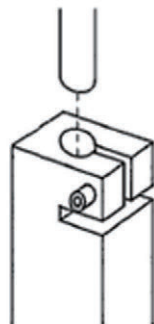
[3] Attachment of the Arm and Tools

Apply split tightening or shrink discs when attaching an arm or tools to the spindle (main shaft) on the main body.

Tool attachment plate



Power lock, etc.

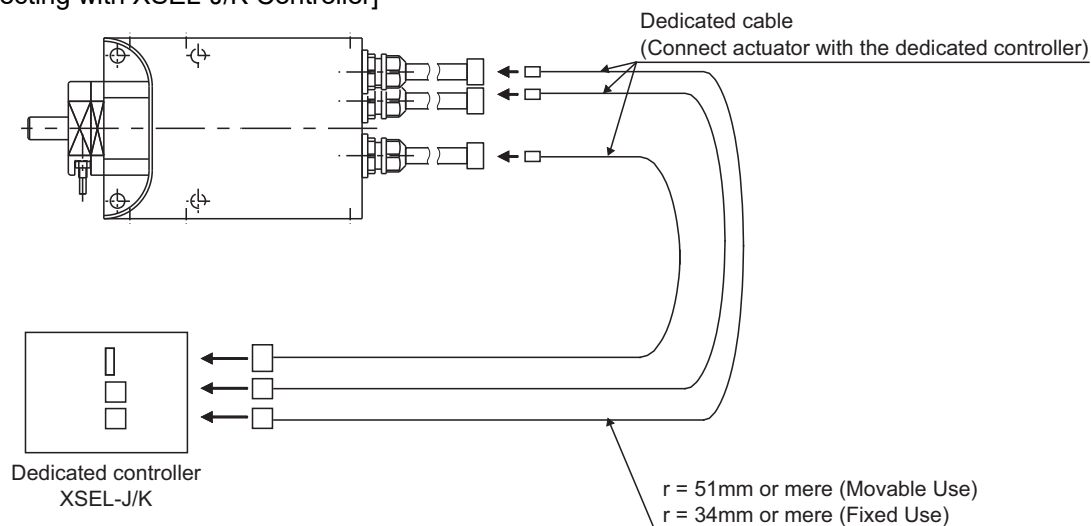


To attach a tool such as a gripper to the end

3. Connecting with the Controller

For the controller, only the dedicated controller manufactured by our company can be used. Using other controllers may cause a problem such as burning the product, ignition or generating heat. Use the dedicated cable enclosed in the package when connecting the actuator and the controller.

[Connecting with XSEL-J/K Controller]



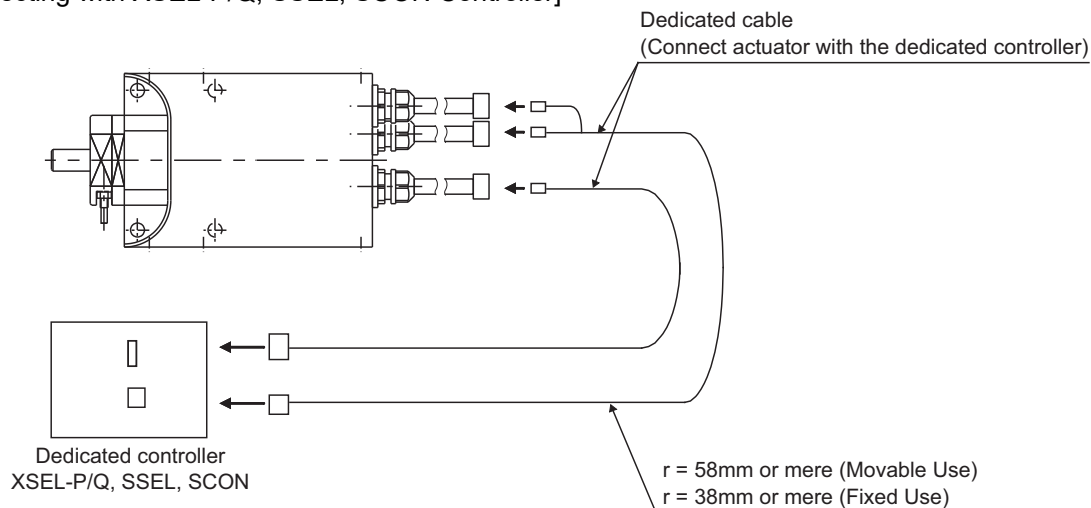
- Motor Cable CB-X-MA***
- Encoder Cable CB-X-PA***
- Limit Switch Cable CB-X-LC***

*** indicates the cable length.

Up to 30m can be specified.

Example) 080 = 8 m

[Connecting with XSEL-P/Q, SSEL, SCON Controller]



- Motor Cable CB-X-MA***
- Encoder Cable with LS CB-X1-PLA***

*** indicates the cable length.

Up to 30m can be specified.

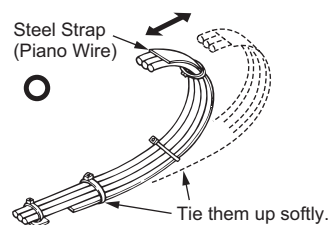
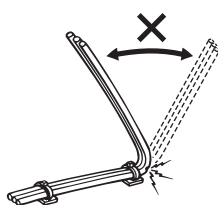
Example) 080 = 8 m

When designing an application system, incorrect wiring or connection of each cable may cause unexpected problems such as a disconnected cable or poor contact. The following explains examples of prohibited handling of cables.

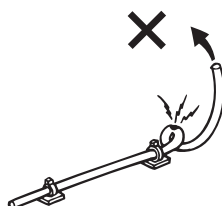


Warning: For wiring, please follow the warnings stated below. When constructing a system as the machinery equipment, pay attention to the wiring and connection of each cable so they are conducted properly. Not following them may cause not only a malfunction such as cable breakage or connection failure,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

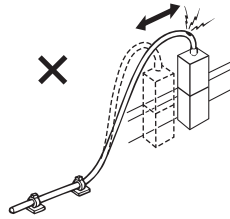
- Use dedicated cables of IAI indicated in this instruction manual. Contact us if you wish to have a change to the specifications of the dedicated cables.
- Make sure to turn the power off in the process of power line or cable connection or disconnection.
- Do not attempt to cut a dedicated cable with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



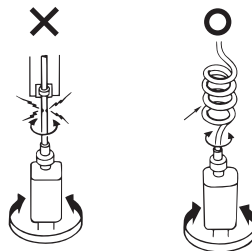
- Do not let the cable bend, kink or twist.



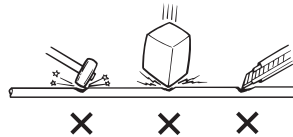
- Do not pull the cable with a strong force.



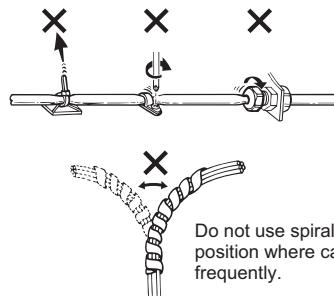
- Pay attention not to concentrate the twisting force to one point on a cable.



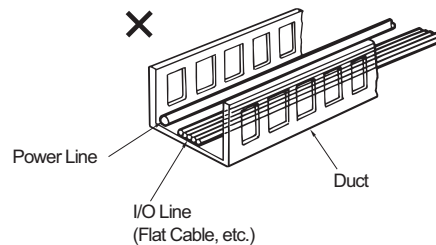
- Do not pinch, drop a heavy object onto or cut the cable.



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



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

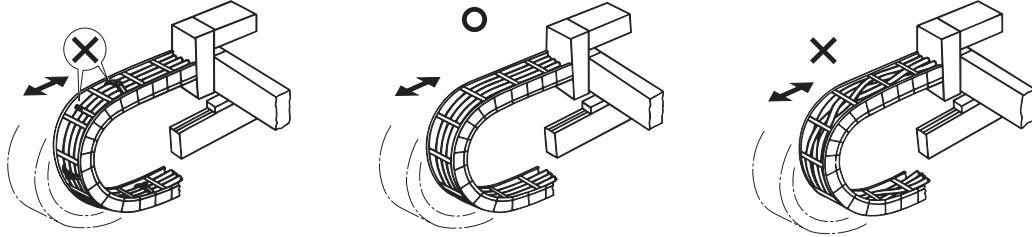




Follow the instructions below when using a cable carrier.

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

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



4. Operational Conditions

4.1 Load Inertia

Operate with the load inertia within the allowable range.

Type	Deceleration ratio	Load inertia
		kg•m ² (kgf•cm•s ²)
RS-30	1/50	0.058 (0.59)
	1/100	0.23 (2.35)
RS-60	1/50	0.11 (1.1)
	1/100	0.42 (4.3)

◎ Regarding the load inertia

The rotary actuator is an actuator that applies a rotational torque to the loaded work piece and makes the work piece have a rotational motion.

The rotational torque applies the load inertia and angular acceleration that can be figured out with the following formula.

$$T = J \cdot \alpha$$

T : Torque N•m (kgf•cm)

J : Load inertia kg•m² (kgf•cm•s²)

α : Angular acceleration rad/s²

typically ω is used for angular velocity

i.e. applying a torque to an object with load inertia generates an angular acceleration. Therefore, for the rotary actuator, the loadable amount is expressed with the load inertia.

◎ Calculation of the Load Inertia

Load inertia is a specific value for an object determined by the weight and profile.

It is to be calculated as;

$$J = \int r^2 dM$$

r : Distance from center

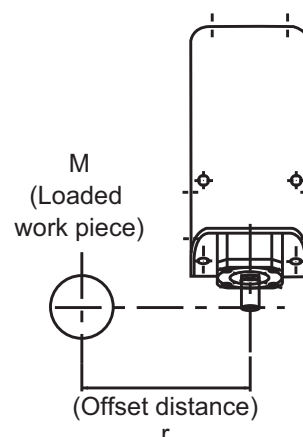
dM : Small mass

For example, if the loaded work piece is offset from the rotary shaft, the following formula can be applied.

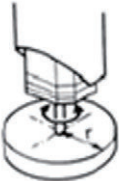
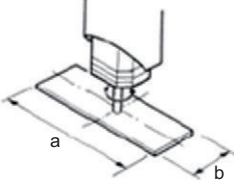
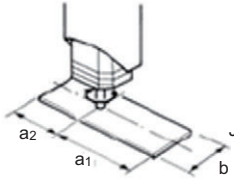
$$J = M \cdot r^2$$

M : Mass of the loaded piece (kg)

r : Distance from the center (Offset distance) (m)



Shown below is the formula for the load inertial applied to a cylinder and rectangular parallelepiped.

1) Cylinder (including thin disc)	2) Thin rectangular (rectangular parallelepiped)	3) Thin rectangular plate (rectangular parallelepiped)
Point of rotation : Center shaft  $J = M \cdot \frac{r^2}{2}$	Point of rotation : Point that goes through the center of the gravity of the plate and perpendicular to the plate (same for when the plate is thickened)  $J = M \cdot \frac{a^2 + b^2}{12}$	Point of rotation : Perpendicular to the plate and one-ended  $J = M_1 \cdot \frac{4a_1^2 + b^2}{12} + M_2 \cdot \frac{4a_2^2 + b^2}{12}$

J : Load inertia (kg•m²)

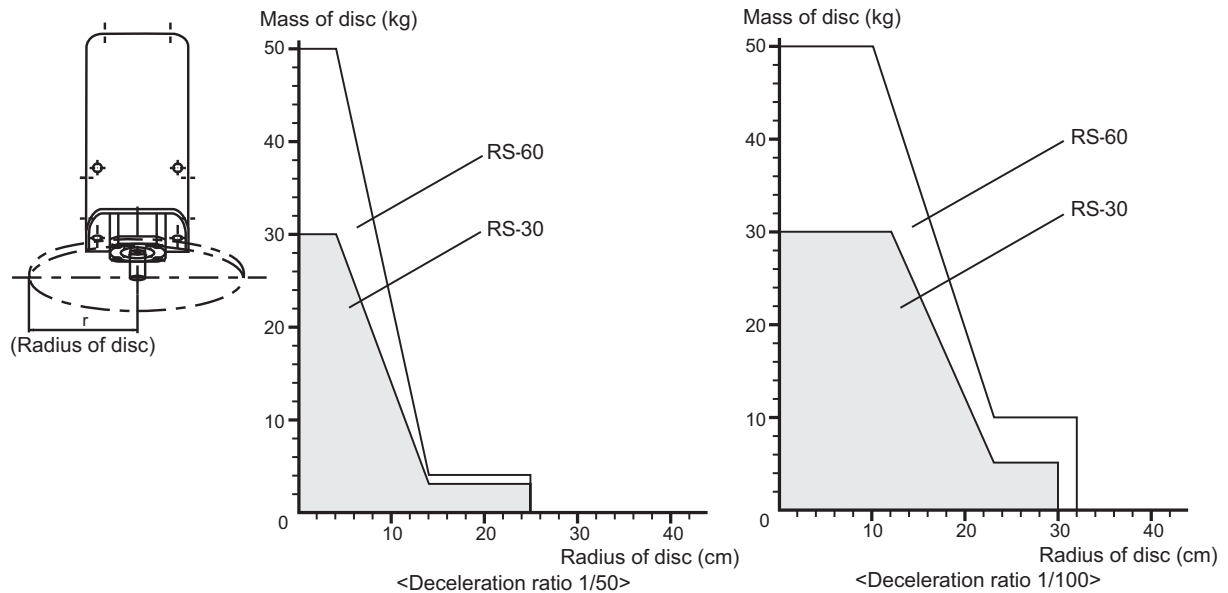
M : Mass (kg)

r, a, b, a₁, a₂ : Distance (m)

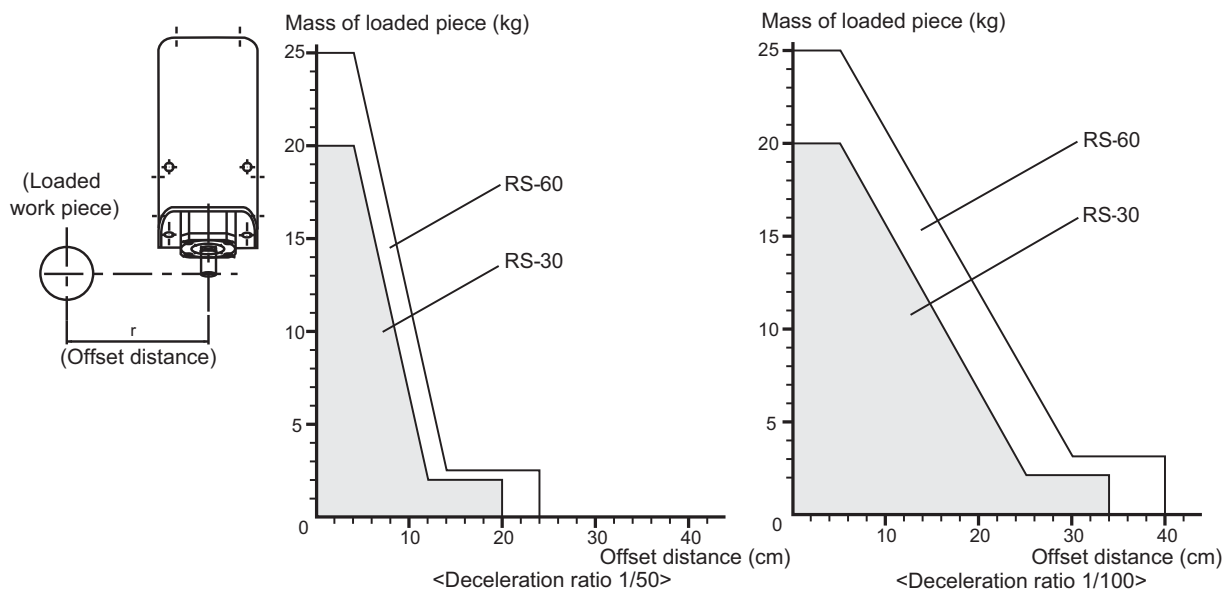
4.2 Weight of the Loaded Object

Take the following as a reference for the weight of the loaded work piece applied to the rotary axis output shaft.

A For loaded object with a disc shape just below rotary axis shaft



B For a loaded object offset from rotary axis shaft



4.3 Operation Range and Home-Return Operation

4.3.1 Operation Range

The operation range of RS is 360deg.

As there is no stopper, the position may exceed the home position in case the rotary axis is turned with hand when the servo is OFF. As the direction of home-return operation is always in one way, the axis will turn in approximately 360deg at maximum if the home position is exceeded. Exercise caution to interference with peripherals around the rotary. Pay attention not to make the actuator cable entangled. [Refer to 4.3.2 Home-Return Operation]

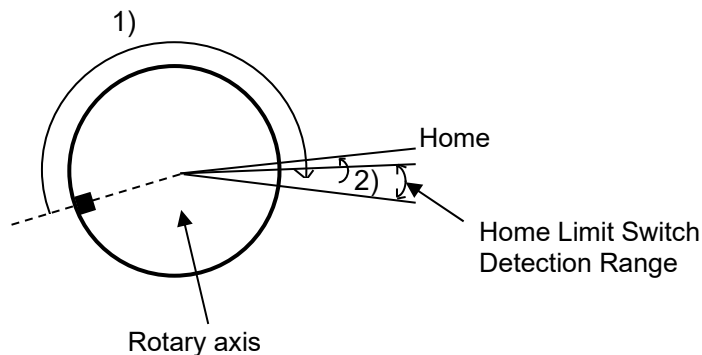
4.3.2 Home-Return Operation

When performing home-return operation on RS, the direction to home-return changes as shown below depending on the position that the rotary axis stopped at the start of the home-return operation. The position around the home limit switch becomes the home position.

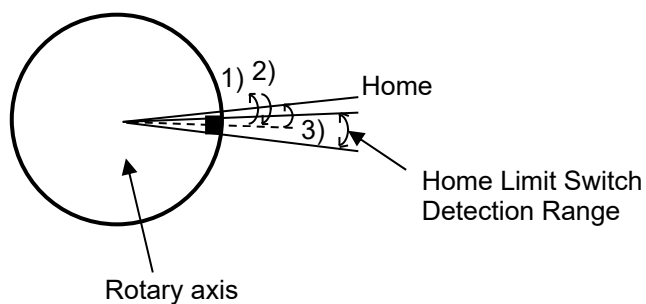
[Refer to Name of Each Part for the position of the home limit switch]

- [1] When Home Limit Switch is not Detected by Rotary Axis at Home-Return Start
It turns clockwise 1) in view of rotary axis, reverses 2) once the home limit switch gets detected, performs the offset movement once the Z-phase gets detected and then stops. (Refer to the figure below.)

It may turn in approximately 360deg at maximum depending on the position of the rotary axis. Exercise caution to interference with peripherals around the rotary. Pay attention not to make the actuator cable entangled.



- [2] When Home Limit Switch is Detected by Rotary Axis at Home-Return Start
 It turns counterclockwise 1) once from that position, and gets out of the home limit switch detection range.
 After that, as it does in the ordinary home-return operation, it turns clockwise 2), reverses 3) once the home limit switch gets detected, performs the offset movement once the Z-phase gets detected and then stops.



5. Maintenance Inspection

5.1 Inspection Items and Schedule

Have an appearance check at the start of operation.

5.2 Appearance Check

An appearance check should check the following things.

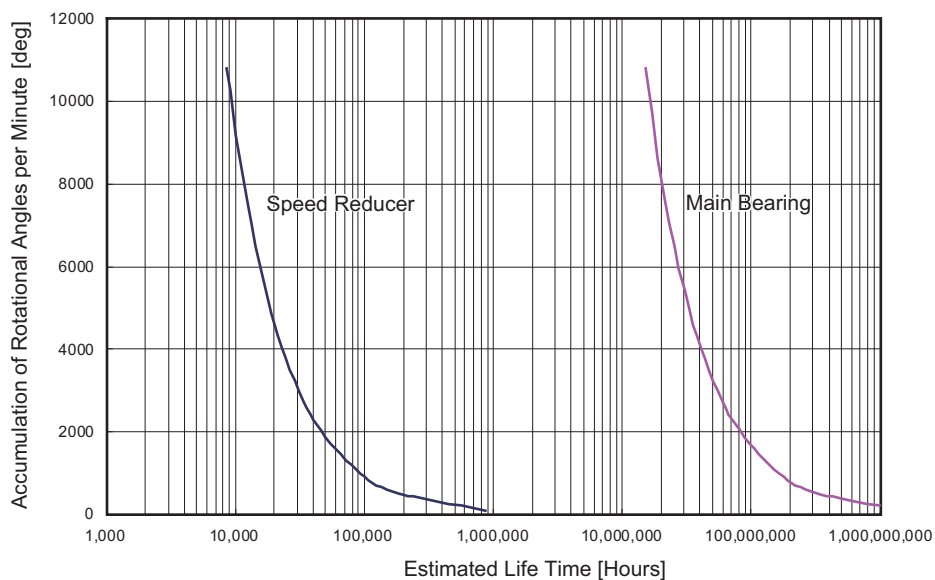
Main Body	Loose actuator mounting bolts, other loose items
Cables	Scratches, proper connections
Overall	Irregular noise, vibration

5.3 Cleaning

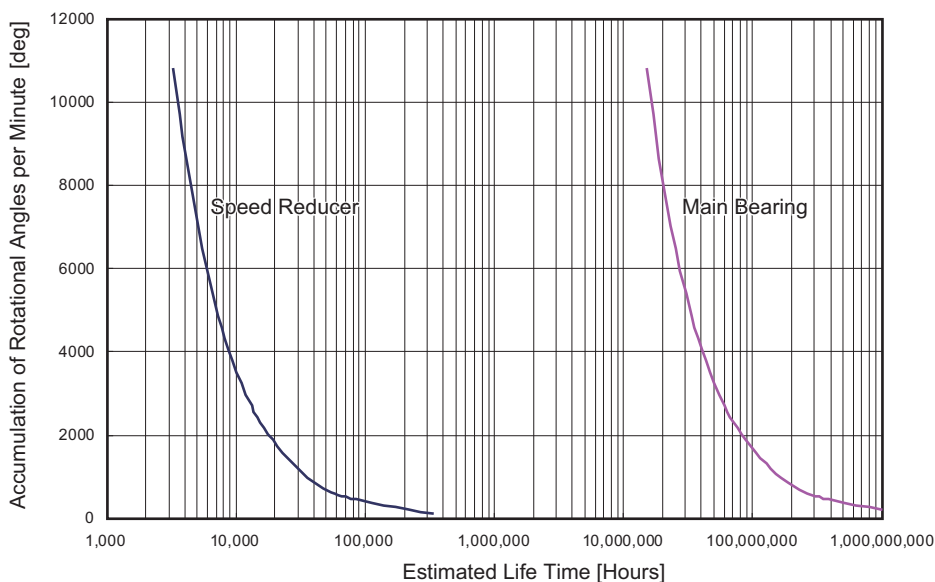
- Clean exterior surfaces as necessary.
- Use a soft cloth to wipe away dirt and buildup.
- Do not blow too hard with compressed air as it may cause dust to get in through the gaps.
- Do not use oil-based solvents as they can harm lacquered and painted surfaces.
- To remove severe buildup, wipe gently with a soft cloth soaked in a neutral detergent or alcohol.

7. Life

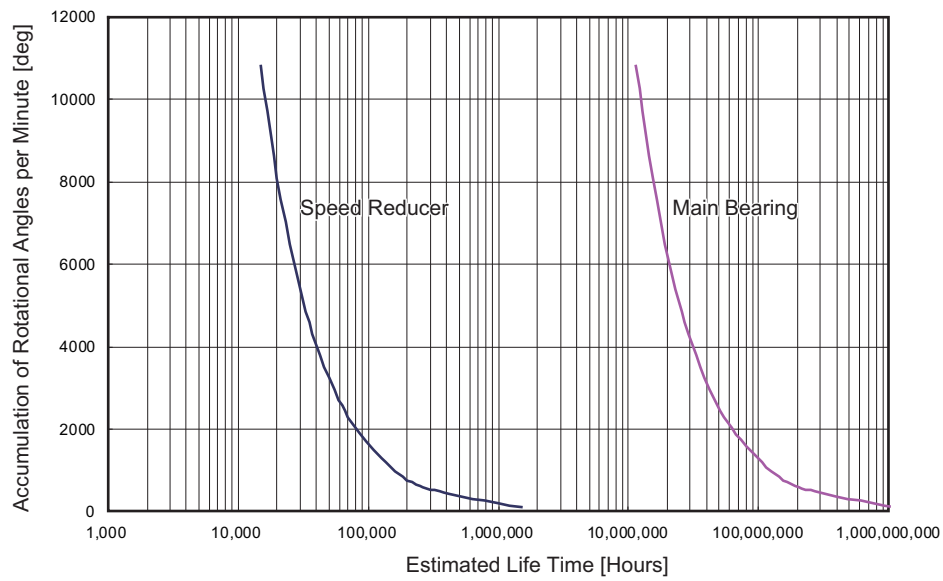
Shown in the graph is the life of the main bearing and the speed reducer (reference). The graph shows the case in which a load of dynamic allowable moment is applied. Calculate the accumulation of rotational angles per minute to read the life (reference).



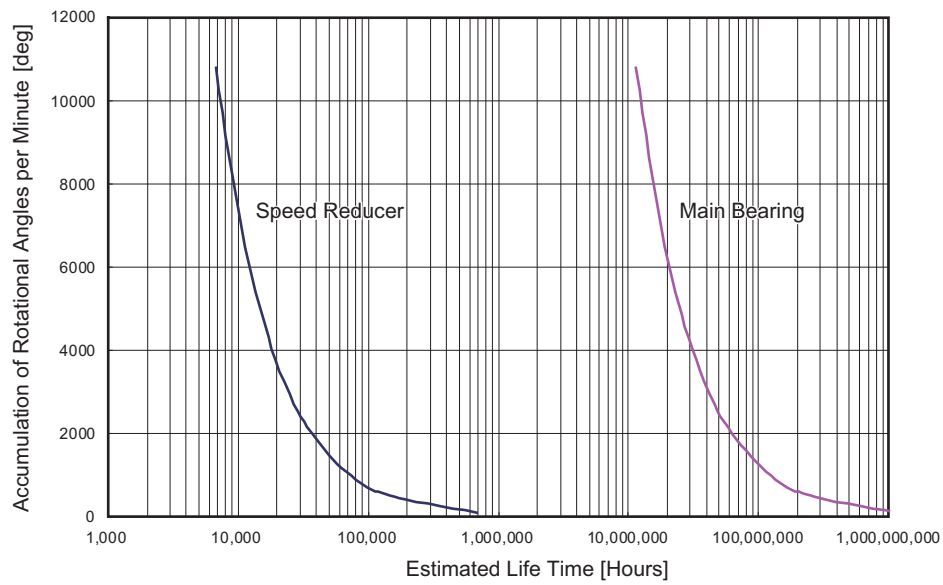
RS-30, Gear Ratio = 1/50



RS-30, Gear Ratio = 1/100



RS-60, Gear Ratio = 1/50



RS-60, Gear Ratio = 1/100

8. Warranty

8.1 Warranty Period

One of the following periods, whichever is shorter:

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

8.2 Scope of the Warranty

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

- (1) The breakdown or problem in question pertains to our product as delivered by us or our authorized dealer.
- (2) The breakdown or problem in question occurred during the warranty period.
- (3) The breakdown or problem in question occurred while the product was in use for an appropriate purpose under the conditions and environment of use specified in the Instruction Manual and catalog.
- (4) The breakdown 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.

8.3 Honoring the Warranty

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

8.4 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.

8.5 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 Instruction Manual.

8.6 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

Change History

Revision Date	Description of Revision
June 2012	Third edition Revised overall
June 2015	Fourth edition Pg. 13, 16 Note added to state home limit switch (L) is equipment in standard Pg. 28 Change made in caution note for connection to controller Pg. 32, 33 Note added about operation range and home-return operation
August 2016	4B edition Pg. 14 Corrected the Number of encoder pulses 2,048 → 16,384
June 2026	4C edition Changes due to discontinuation of including the Instruction Manual DVD Changes due to discontinuation of including the First Step Guide Terms integrated (cable carrier)



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