



IX

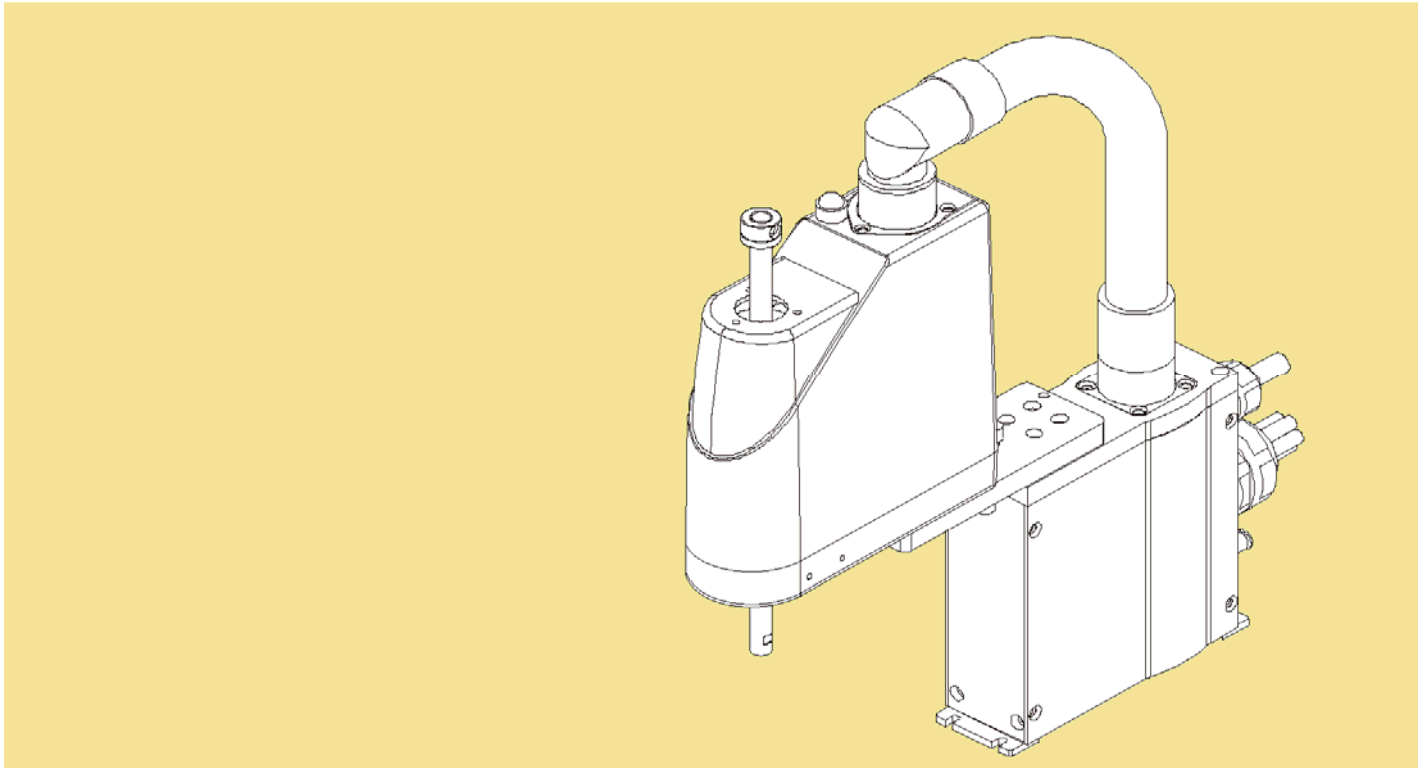
INTELLIGENT ACTUATOR

Horizontal Articulated Robot – IX Series

Tabletop Specification, for Arm Length 120/150/180
IX-NNN-1205/IX-NNN-1505/IX-NNN-1805

Clean room Specification
IX-NNC-1205/IX-NNC-1505/IX-NNC-1805

Operation Manual Sixth Edition



IAI America, Inc.



Please Read Before Use

Thank you for purchasing our product.

This Operation 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 Operation Manual, keep it in a convenient place so that whoever is handling this product can reference it quickly when necessary.

[Important]

- This Operation Manual is original.
- The product cannot be operated in any way unless expressly specified in this Operation Manual. IAI shall assume no responsibility for the outcome of any operation not specified herein.
- Information contained in this Operation 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 Operation 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	<ul style="list-style-type: none"> • This product has not been planned and designed for the application where high level of safety is required, so the guarantee of the protection of human life is impossible. Accordingly, do not use it in any of the following applications. <ol style="list-style-type: none"> 1) Medical equipment used to maintain, control or otherwise affect human life or physical health. 2) Mechanisms and machinery designed for the purpose of moving or transporting people (For vehicle, railway facility or air navigation facility) 3) Important safety parts of machinery (Safety device, etc.) • Do not use 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. <ol style="list-style-type: none"> 1) Location where there is any inflammable gas, inflammable object or explosive 2) Place with potential exposure to radiation 3) Location with the ambient temperature or relative humidity exceeding the specification range 4) Location where radiant heat is added from direct sunlight or other large heat source 5) Location where condensation occurs due to abrupt temperature changes 6) Location where there is any corrosive gas (sulfuric acid or hydrochloric acid) 7) Location exposed to significant amount of dust, salt or iron powder 8) Location subject to direct vibration or impact • For an actuator used in vertical orientation, select a model which is equipped with a brake. If selecting a model with no brake, the moving part may drop when the power is turned OFF and may cause an accident such as an injury or damage on the work piece.



No.	Operation Description	Description
2	Transportation	<ul style="list-style-type: none">• 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 operation 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	<ul style="list-style-type: none">• The storage and preservation environment conforms to the installation environment. However, especially give consideration to the prevention of condensation.• 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	<p>(1) Installation of Robot Main Body and Controller, etc.</p> <ul style="list-style-type: none">• Make sure to securely hold and fix the product (including the work 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.<ol style="list-style-type: none">1) Location where electric noise is generated2) Location where high electrical or magnetic field is present3) Location with the mains or power lines passing nearby4) Location where the product may come in contact with water, oil or chemical droplets

No.	Operation Description	Description
4	Installation and Start	<p>(2) Cable Wiring</p> <ul style="list-style-type: none"> ● Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool. ● Do not scratch 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. <p>(3) Grounding</p> <ul style="list-style-type: none"> ● 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 0.5mm^2 (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	<p>(4) Safety Measures</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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. <p>* Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.</p>

No.	Operation Description	Description
6	Trial Operation	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 Operation 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. <p>Use in incomplete condition may cause damage to the product or an injury.</p> <p>* Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.</p>
9	Modification and Dismantle	<ul style="list-style-type: none"> • Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.
10	Disposal	<ul style="list-style-type: none"> • When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste. • 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. <p>The product may burst or generate toxic gases.</p>
11	Other	<ul style="list-style-type: none"> • 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 operation manual of each unit to ensure the safety.

Alert Indication

The safety precautions are divided into “Danger”, “Warning”, “Caution” and “Notice” according to the warning level, as follows, and described in the operation 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 Precaution

1. Positioning Repeatability Does Not Change Even If the Positioning Band is Changed.

Positioning repeatability does not change even if the positioning band is changed.

If the positioning band is narrower than the default value, the positioning repeatability does not change, but the time it takes for the positioning complete signal to be output takes longer. The execution of next operation instruction (e.g., MOVP, MOVL) is delayed and, as a result, the tact time of the entire cycle may be delayed.

2. Make sure to attach the Horizontal Articulated Robot properly by following this operation manual.

Using the product with the Horizontal Articulated Robot not being certainly retained or affixed may cause abnormal noise, vibration, malfunction or shorten the product life.

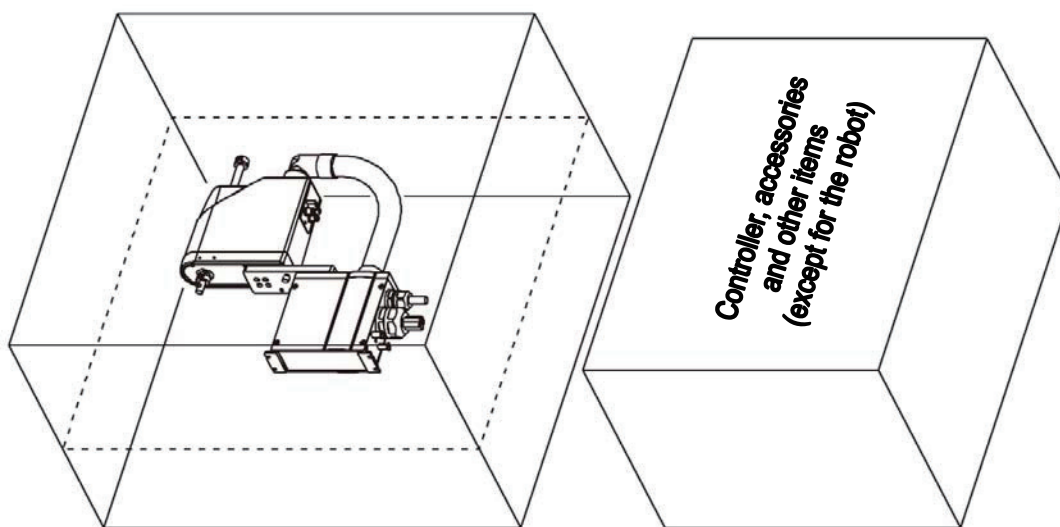
3. Handling of the Carton

Each robot is packed with a controller prior to shipment.

When transporting the carton containing the robot and controller, observe the following items and be careful not to drop the carton or apply impact due to forcible contact:

- If the carton is heavy, one operator should not attempt to carry it alone.
- Place the carton on a level surface if it is to be left there for a while.
- Do not climb upon the carton.
- Do not place on the carton any heavy object that may cause the carton to deform, or an article whose shape allows a load to be concentrated at one point.

[Carton]



Warning



Caution

- The robot and controller are very heavy. When transporting the carton containing the robot and controller, handle it with extra care so as not to drop the carton or apply impact due to forcible contact, as it may cause injury or damage to the robot or controller.
- Serious injury may result if the carton is dropped onto a person during transportation.
- Never stand below the carton as it is hoisted.
- Use a carrier device with sufficient loading capacity.
- If a machine or method is used that requires specified skills, it must be operated/performed by a person having the proper qualifications.



4. Handling of Individual Components

The robot and controller are supplied as a set.

Your robot cannot be used with the controller supplied with another robot.

When handling multiple robots, check that the serial number described on the robot is the same as the one on the controller and be careful not to switch the controllers.

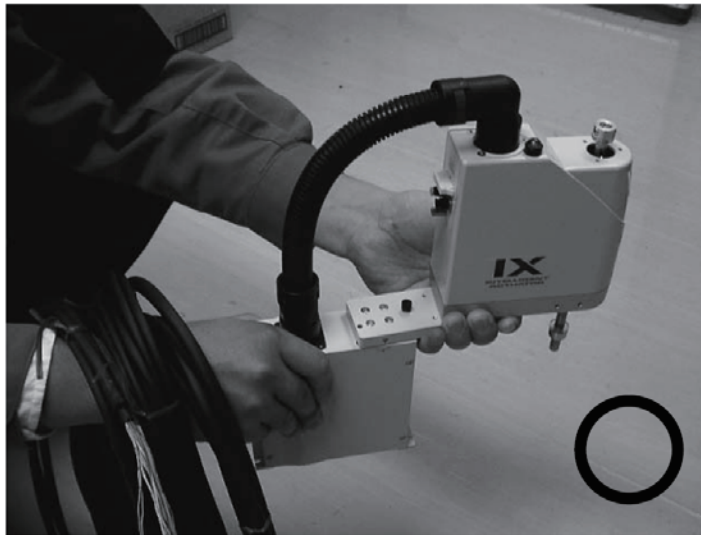
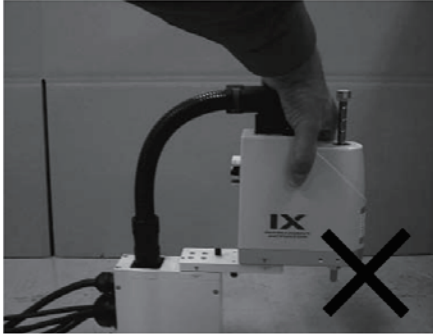
The robot will not stand on its own after being unloaded from the carton pallet.

Hold it by hand, or place a cushioning material on the floor and place the robot on its side upon the cushion.

5. Transportation

When transporting the robot in a standalone state, put the cables over your shoulder and hold the base and arm 2 with both hands.

Do not transport the robot by holding it by arm 2 only or by the wiring duct only.



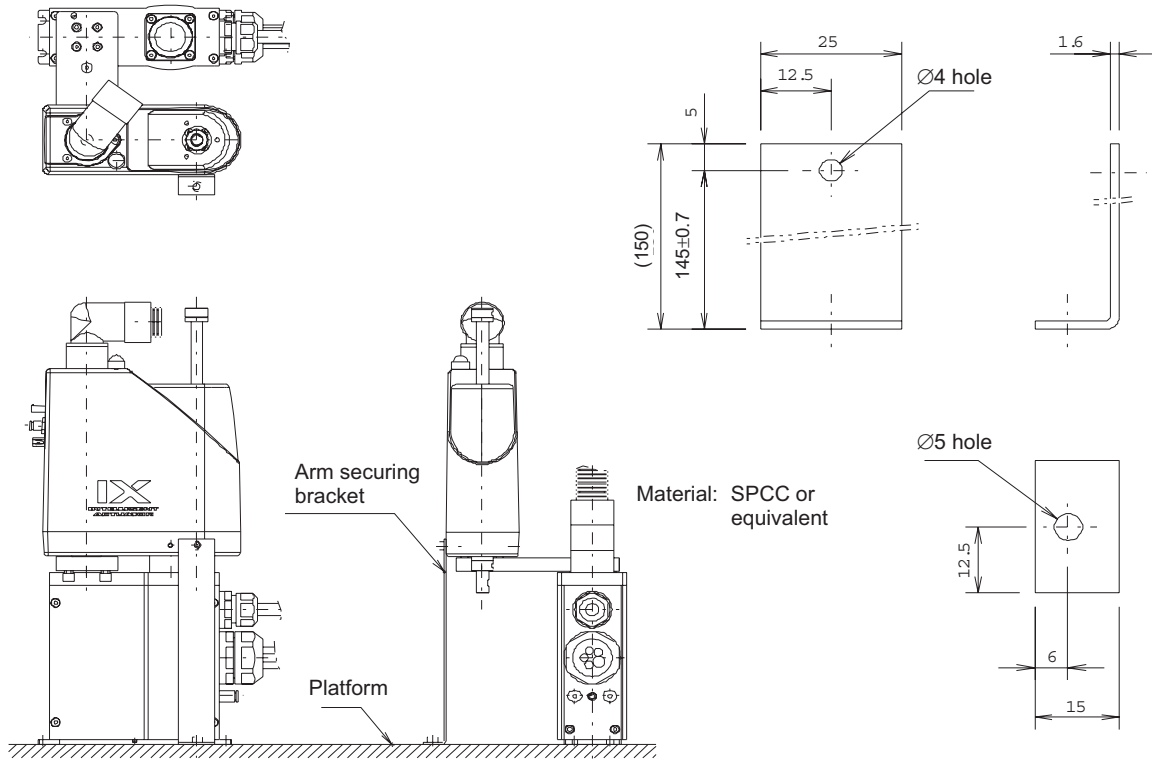
Danger



Warning

- If you hold the robot only by arm 2 or an excessive load is applied on arm 2, the robot may be damaged.
- If the robot is dropped during transport, injury may occur or the robot may be damaged.

When transporting the robot while it is still attached to the equipment, etc., fabricate a metal bracket like the one shown below and use the bracket to secure arm 2 to a platform, etc.



Move the robot slowly by paying attention to the balance of the robot and being careful not to apply vibration or shock.

The tapped holes on both sides of arm 2 are through holes, so do not use screws of 6 mm or longer. Such longer screws may contact the internal mechanism.



Danger



Warning

- If you hold the robot only by arm 2 or an excessive load is applied on arm 2, the robot may be damaged.
- If the robot is dropped during transport, injury may occur or the robot may be damaged.
- When transporting the robot while it is still attached to the equipment, etc., be sure to secure arm 2. Also be careful not to apply vibration or shock during transport.

International Standards Compliances

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

RoHS Directive	CE Marking
○	To be scheduled

(Note) Please be aware that the product does not comply with the CE marking (European EC Directive) if the nameplate does not indicate that it is CE-certified.

Nameplate for CE-certified products

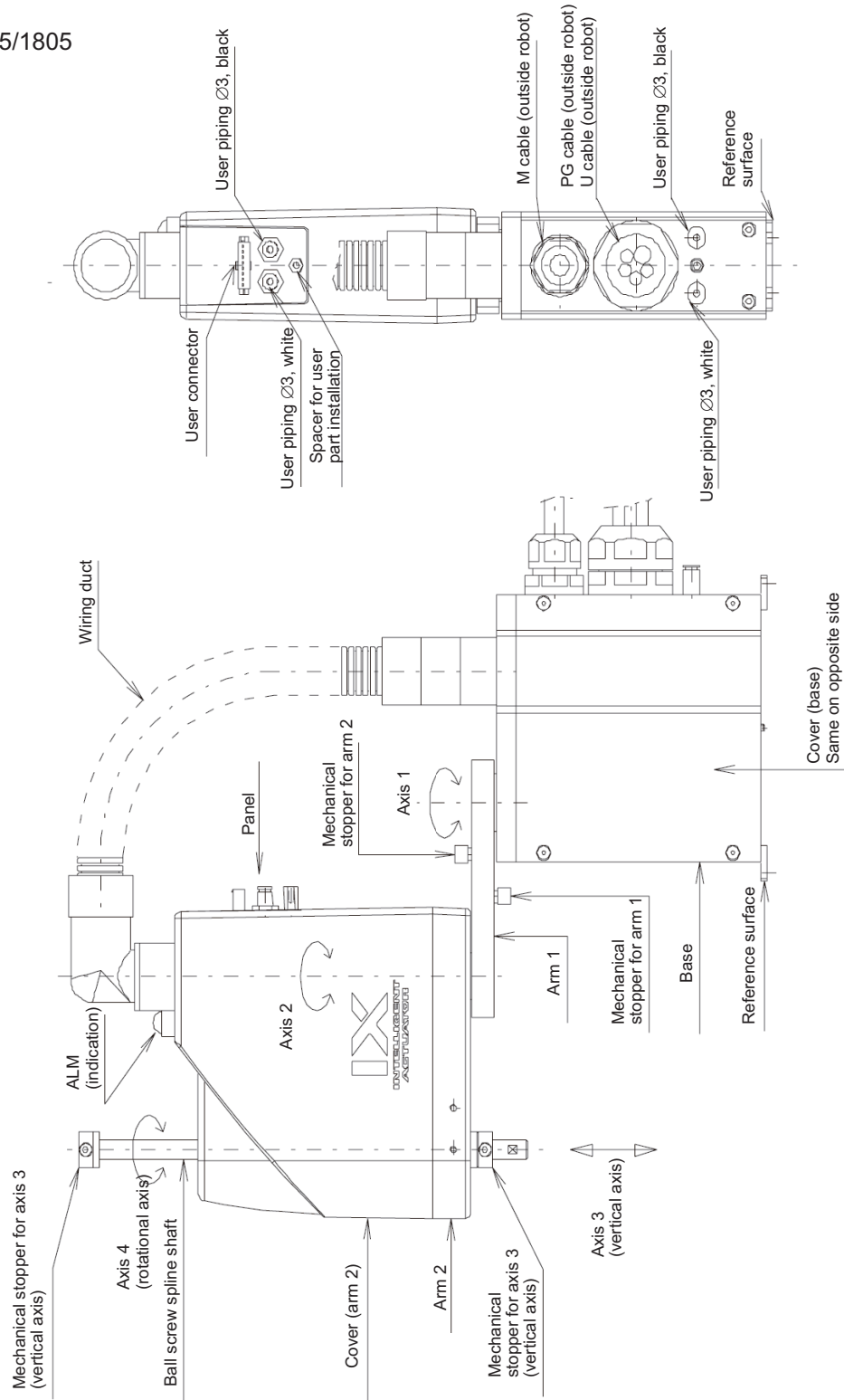
MODEL	: IX-NNN1505-3L-T2
ARM LENGTH	: 150mm
PAYLOAD	: Rated Kg/Maximum Kg
WEIGHT	: Kg
MOTOR POWER	: Axis1 12W, Axis2 12W, Axis3 12W, Axis4 60W
DATE	: 22/10/2006
IAI Corporation	
645-1 SHIMIZU HIROSE	
SHIZUOKA-CITY, SHIZUOKA,	
424-0102 JAPAN	



1. Name of Each Part

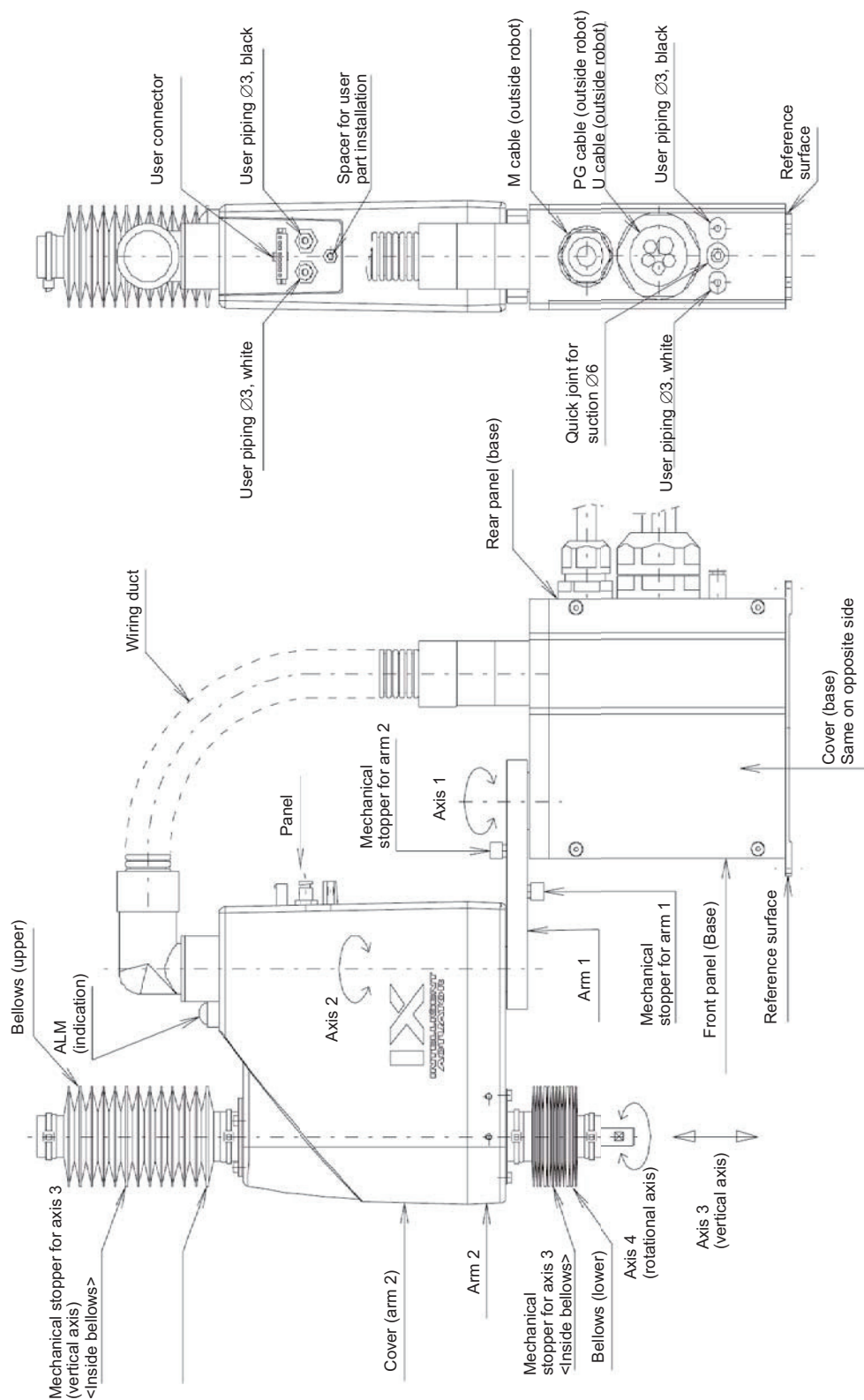
1.1 Robot

IX-NNN1205/1505/1805



IX-NNC1205/1505/1805

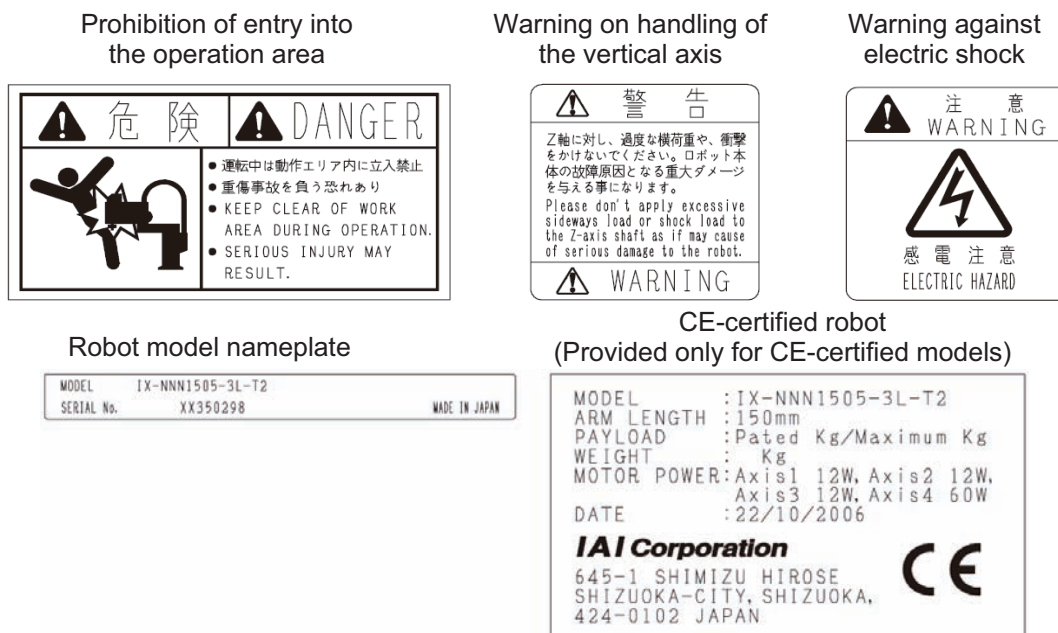
1. Name of Each Part



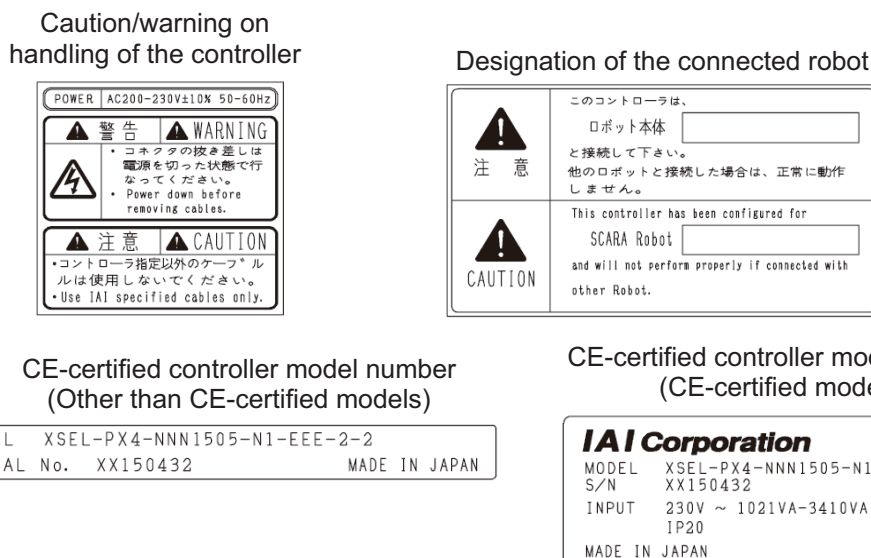
1.2 Labels

The following labels are attached on the robot and controller. Be sure to observe the instructions and cautions written on the labels to ensure the correct use of the robot/controller.

(1) Labels on the Robot



(2) Labels on the Controller

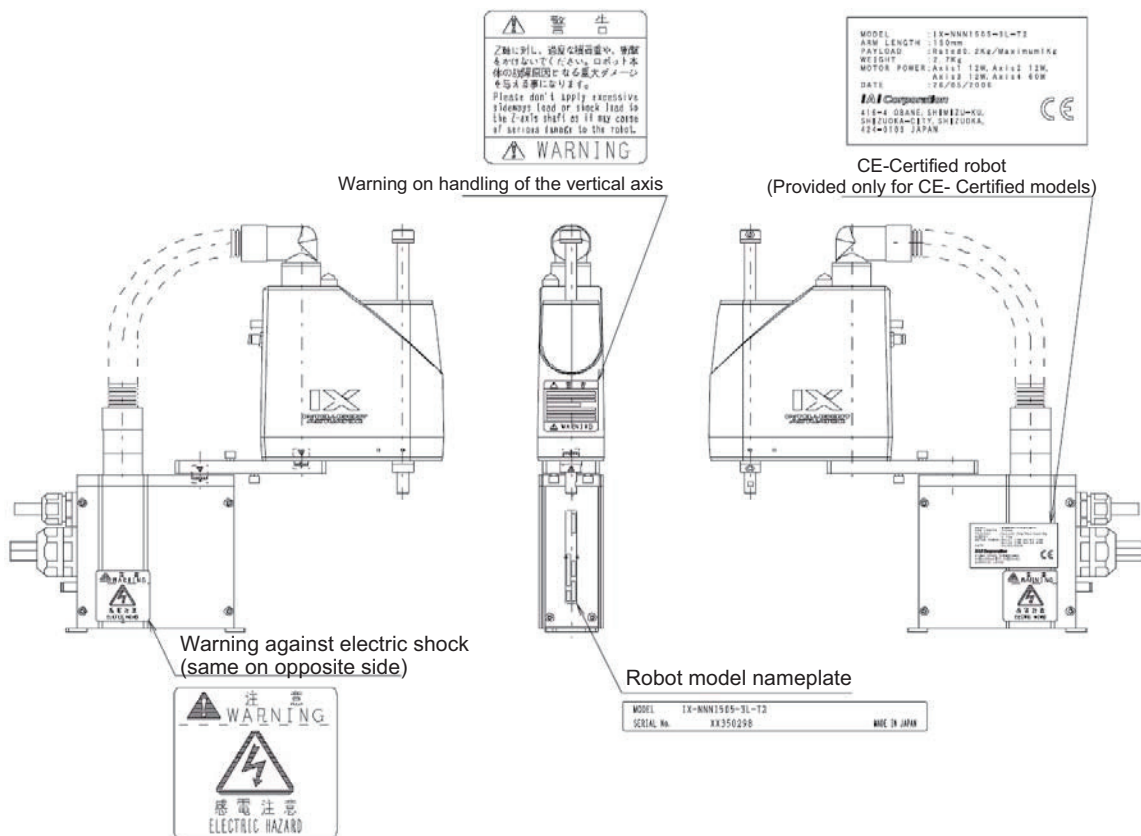


Danger **Warning** **Caution**

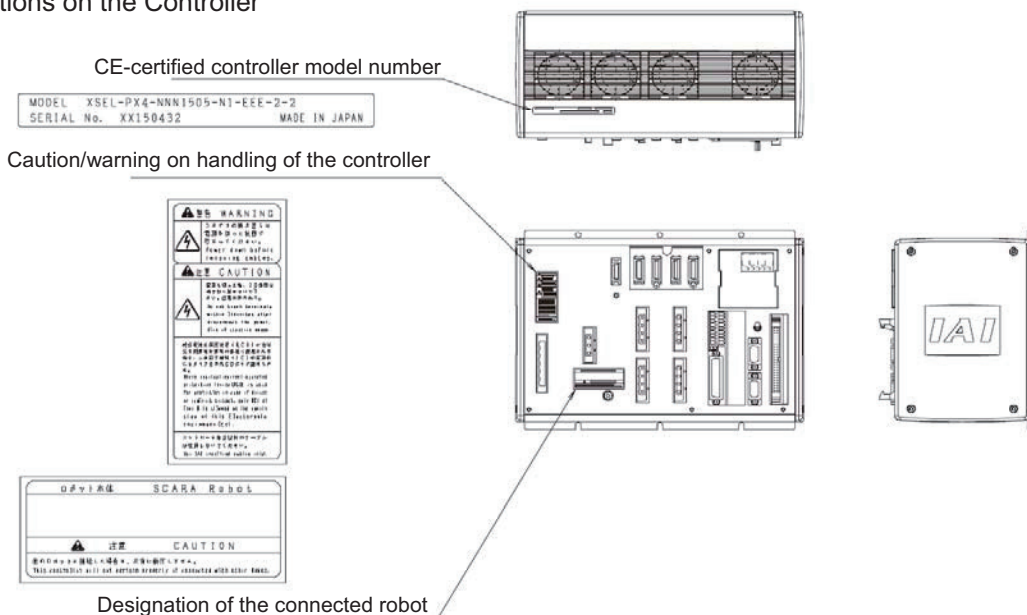
- Failure to observe the cautionary information provided on the labels may result in serious injury or damage to the robot.

1.3 Label Positions

Label Positions on the Robot

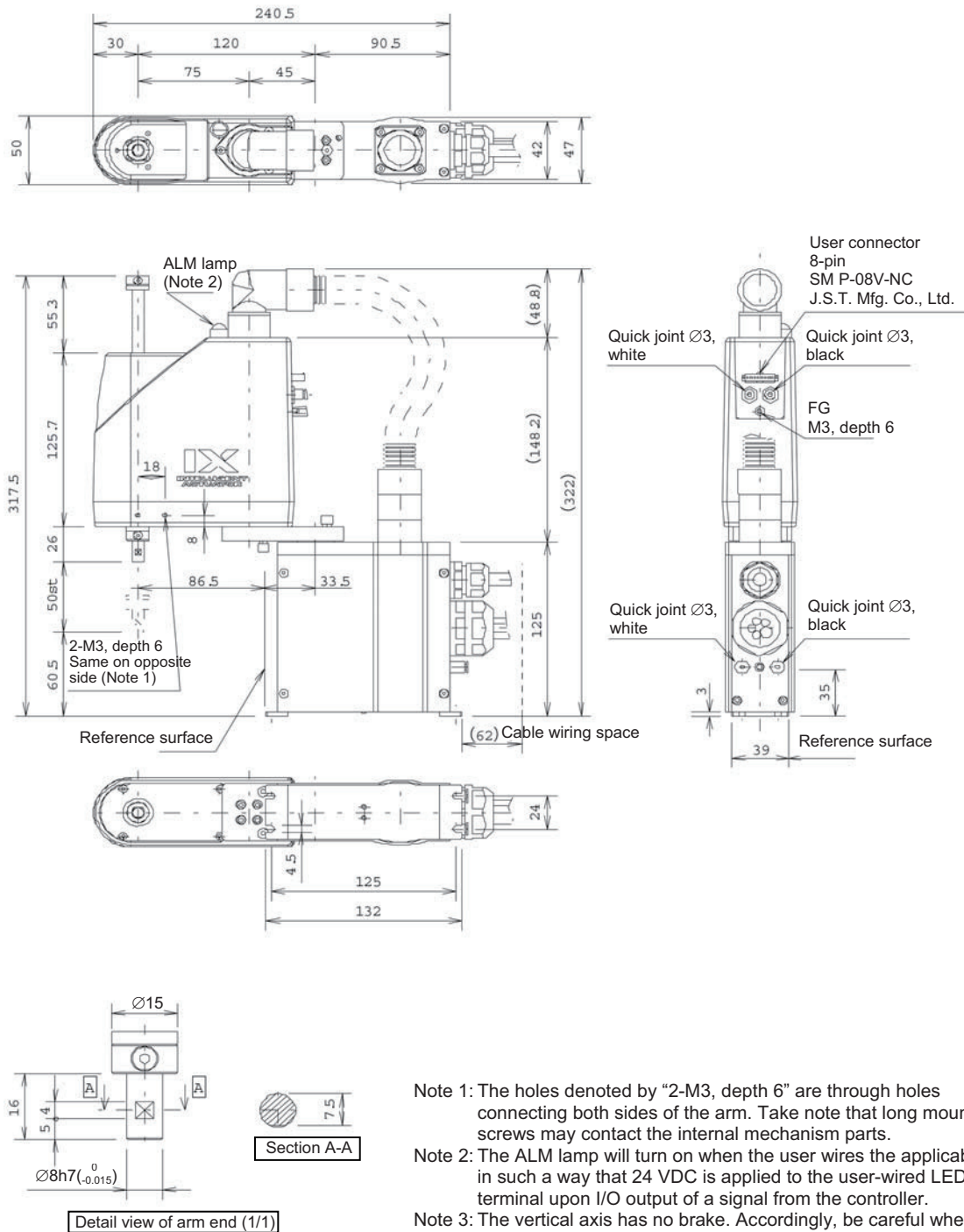


Label Positions on the Controller



2. External Dimensions

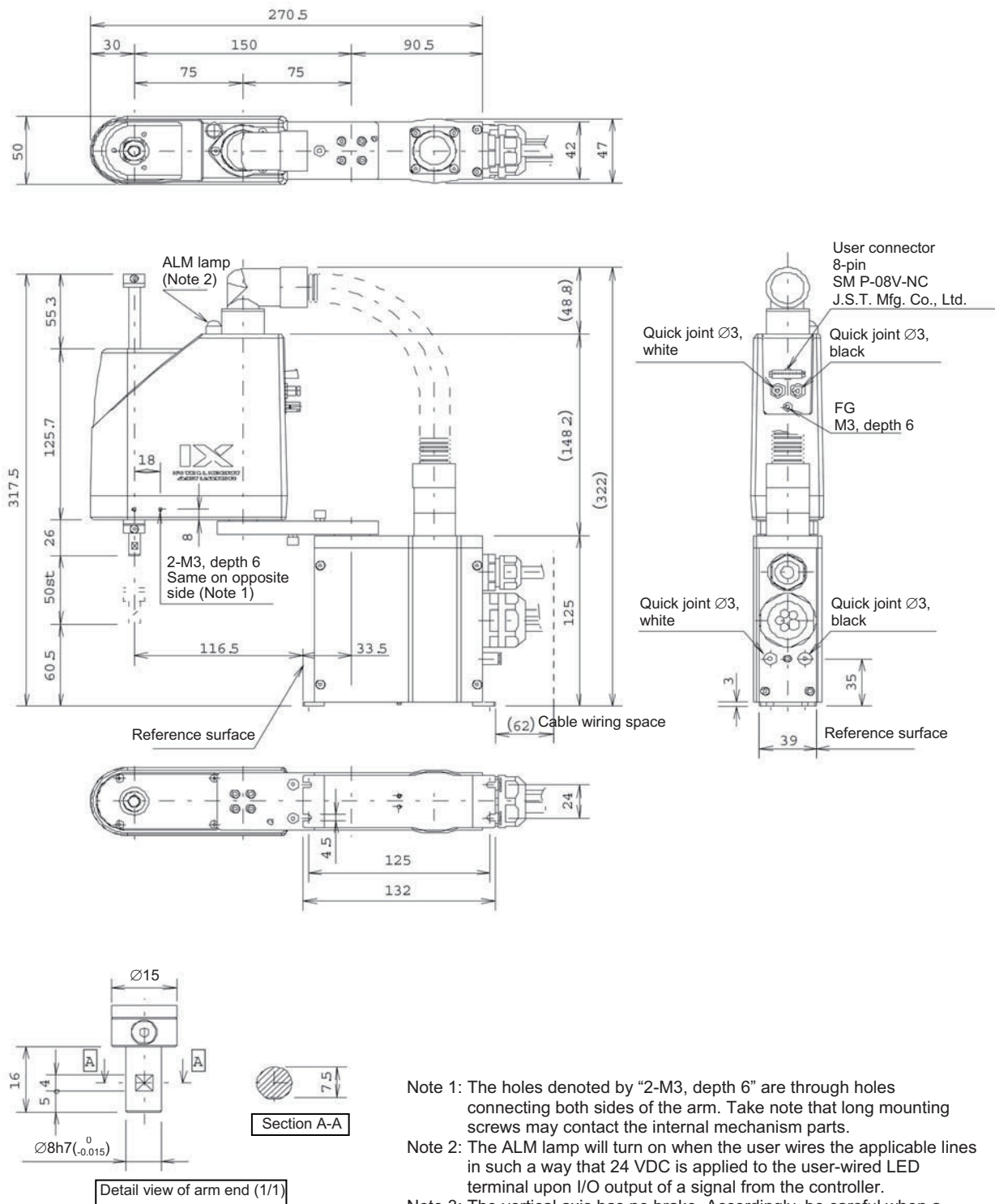
IX-NNN-1205 (Arm Length 120, Standard Specification)



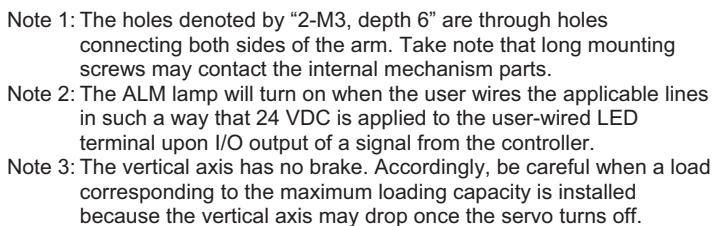
- Note 1: The holes denoted by "2-M3, depth 6" are through holes connecting both sides of the arm. Take note that long mounting screws may contact the internal mechanism parts.
- Note 2: The ALM lamp will turn on when the user wires the applicable lines in such a way that 24 VDC is applied to the user-wired LED terminal upon I/O output of a signal from the controller.
- Note 3: The vertical axis has no brake. Accordingly, be careful when a load corresponding to the maximum loading capacity is installed because the vertical axis may drop once the servo turns off.

IX-NNN-1505 (Arm Length 150, Standard Specification)

2. External Dimensions



2. External Dimensions



Technical drawing of the SM P-08V-NC quick joint assembly, showing three views: top, front, and side.

Top View Dimensions:

- Overall width: 240.5
- Section 1: 30, 120, 75, 45
- Section 2: 90.5
- Section 3: 50, 42, 47

Front View Dimensions:

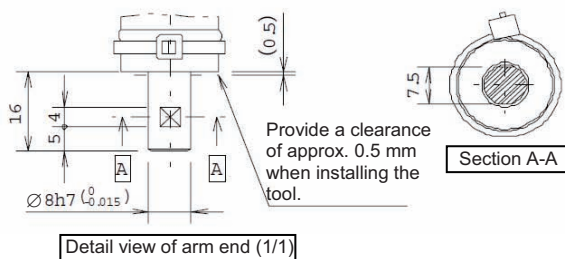
- Overall height: 360.2
- Section 1: 97.5, 126.2, 18
- Section 2: 62, 50st, 24.5
- Section 3: 126, 125, 148.7, 48.8, 322.5

Side View Dimensions:

- Overall width: 132
- Section 1: 4.5, 125, 24

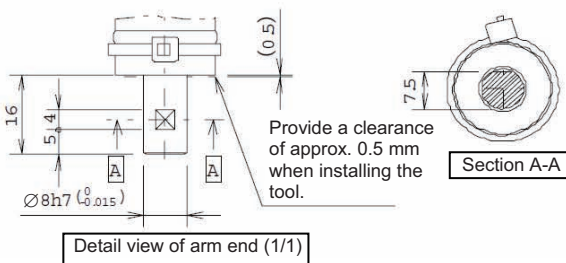
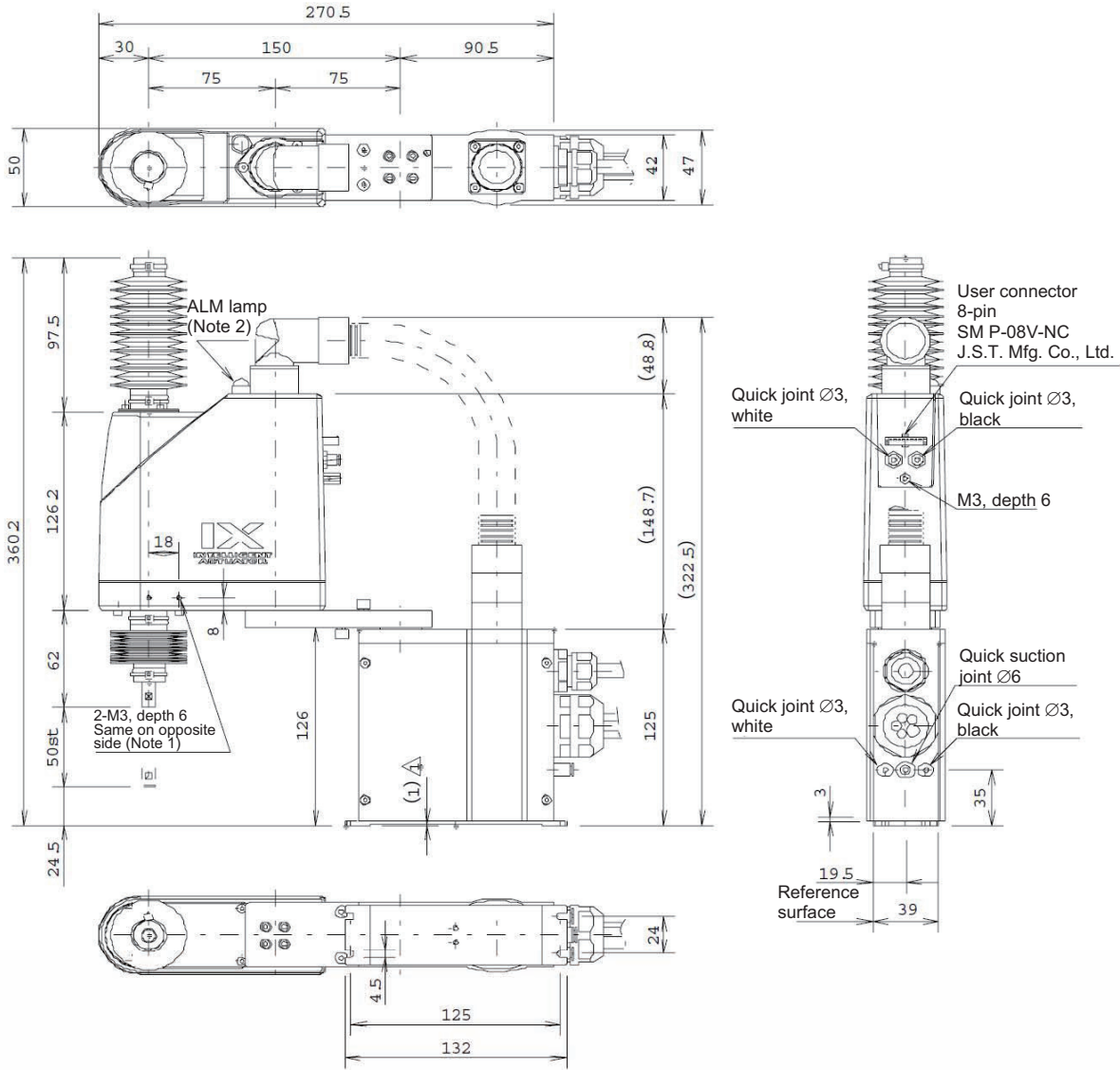
Callouts and Notes:

- ALM lamp (Note 2)
- 2-M3, depth 6 Same on opposite side (Note 1)
- User connector 8-pin SM P-08V-NC J.S.T. Mfg. Co., Ltd.
- Quick joint Ø3, white
- Quick joint Ø3, black
- M3, depth 6
- Quick suction joint Ø6
- Quick joint Ø3, black
- Reference surface



Note 4: The cleaning performance is demonstrated when air inside the robot is suctioned from the suction joint to create vacuum.
(Take note that dust will be raised if suction is not provided.)

IX-NNC-1505 (arm length 150, clean room specification)



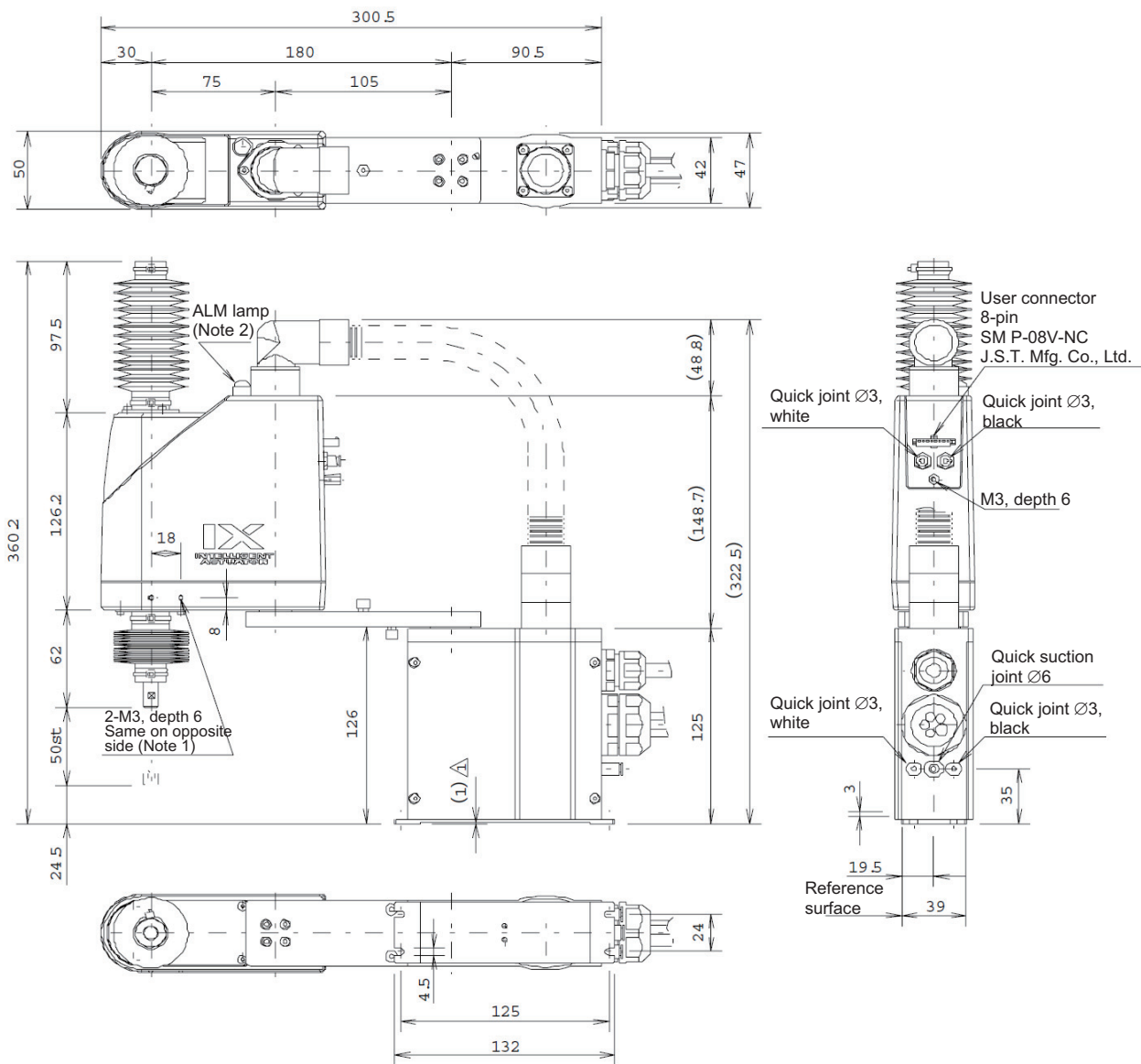
Note 1: These holes are plugged with setscrews. Also, the holes denoted by "2-M3, depth 6" are through holes connecting both sides of the arm. Take note that long mounting screws may contact the internal mechanism parts.

Note 2: The ALM lamp will turn on when the user wires the applicable lines in such a way that 24 VDC is applied to the user-wired LED terminal upon I/O output of a signal from the controller.

Note 3: The vertical axis has no brake. Accordingly, be careful when a load corresponding to the maximum loading capacity is installed because the vertical axis may drop once the servo turns off.

Note 4: The cleaning performance is demonstrated when air inside the robot is suctioned from the suction joint to create vacuum. (Take note that dust will be raised if suction is not provided.)

IX-NNC-1805 (arm length 180, clean room specification)



Note 1: These holes are plugged with setscrews. Also, the holes denoted by "2-M3, depth 6" are through holes connecting both sides of the arm. Take note that long mounting screws may contact the internal mechanism parts.

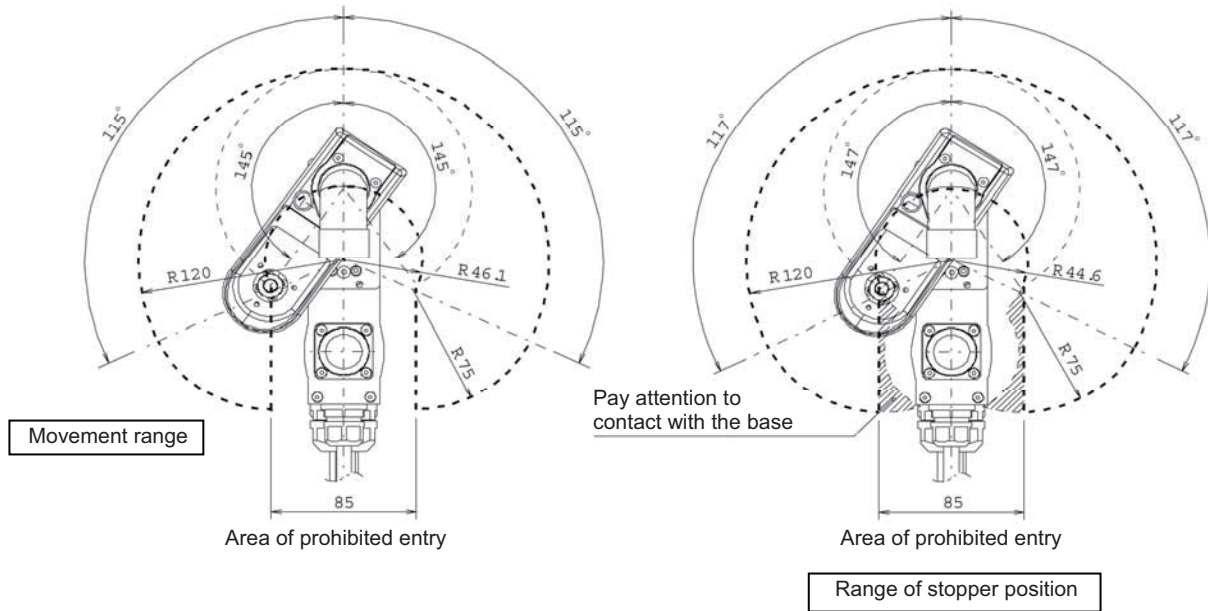
Note 2: The ALM lamp will turn on when the user wires the applicable lines in such a way that 24 VDC is applied to the user-wired LED terminal upon I/O output of a signal from the controller.

Note 3: The vertical axis has no brake. Accordingly, be careful when a load corresponding to the maximum loading capacity is installed because the vertical axis may drop once the servo turns off.

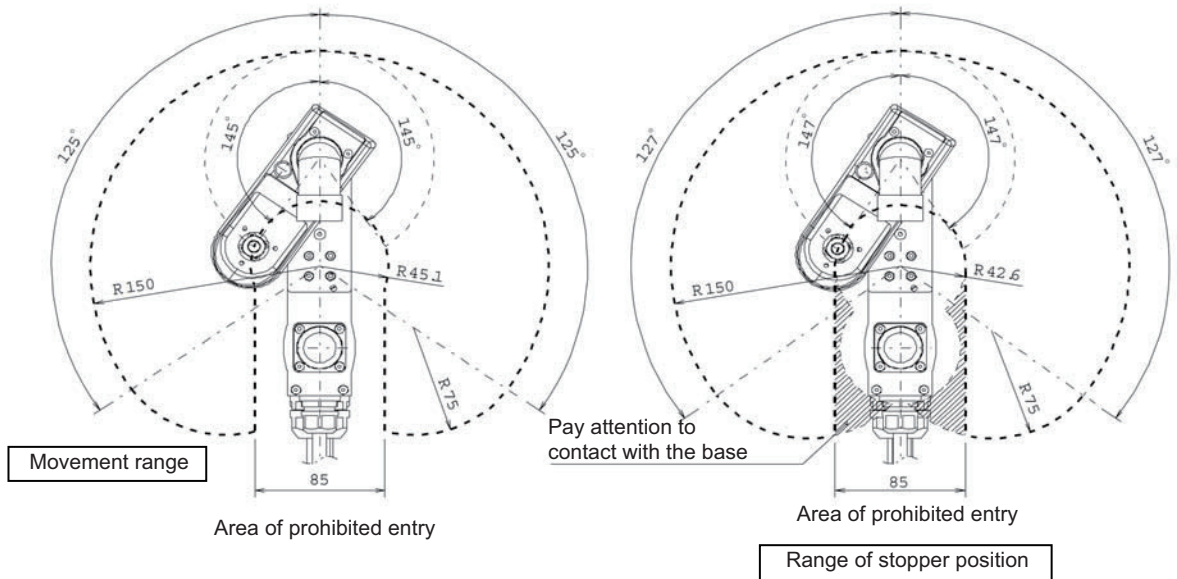
Note 4: The cleaning performance is demonstrated when air inside the robot is suctioned from the suction joint to create vacuum. (Take note that dust will be raised if suction is not provided.)

3. Robot Operation Area

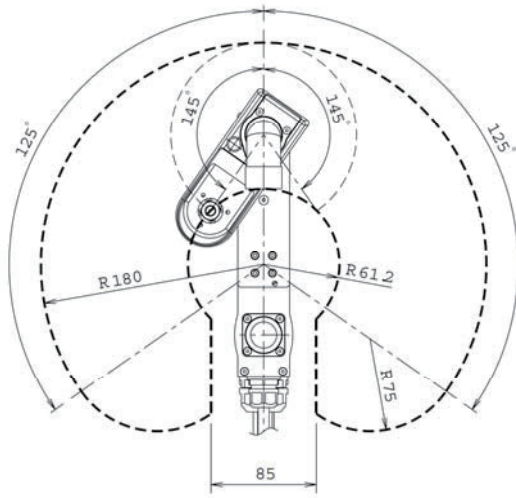
IX-NNN-1205 (Arm Length 120, Standard Specification)



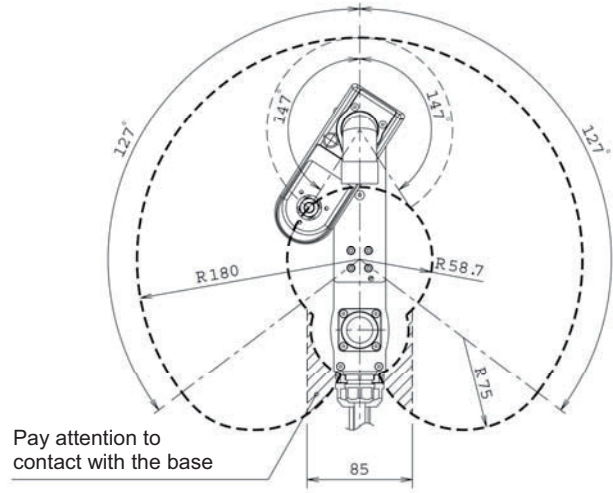
IX-NNN-1505 (Arm Length 150, Standard Specification)



IX-NNN-1805 (Arm Length 180, Standard Specification)

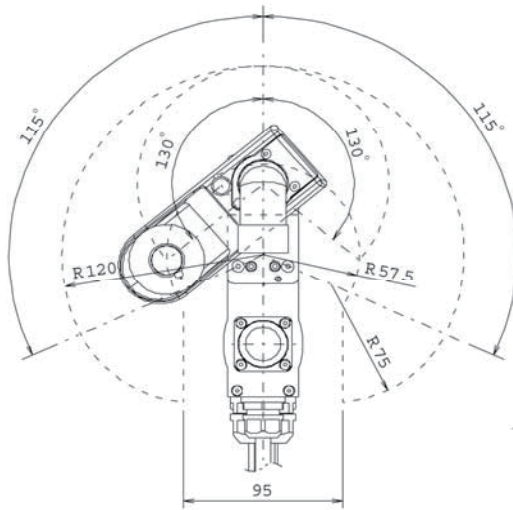


Movement range

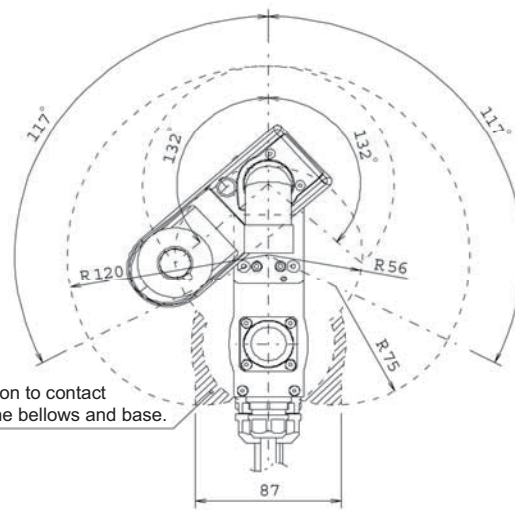


Range of stopper position

IX-NNC-1205 (arm length 120, clean room specification)

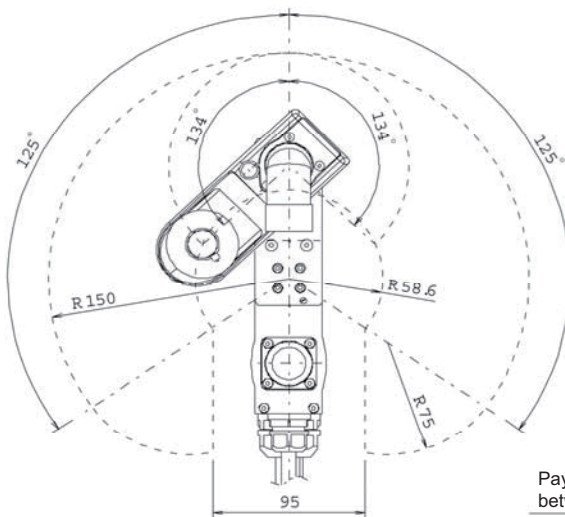


Movement range

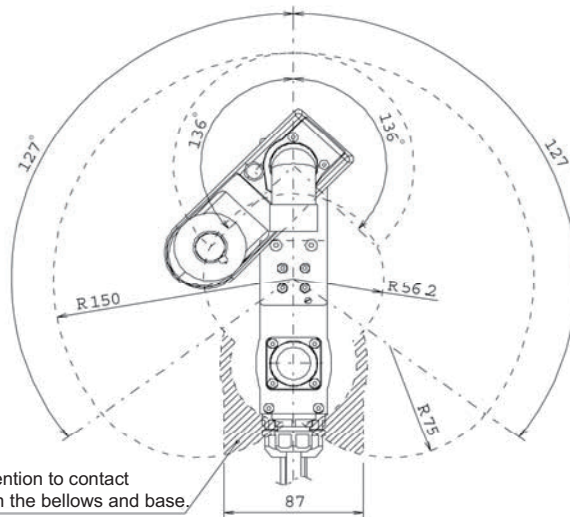


Range of stopper position

IX-NNC-1505 (arm length 150, clean room specification)

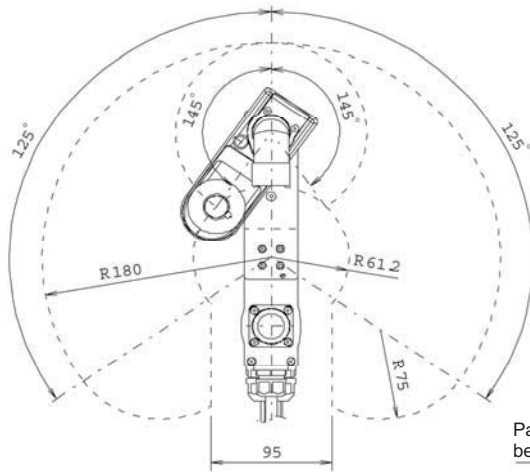


Movement range

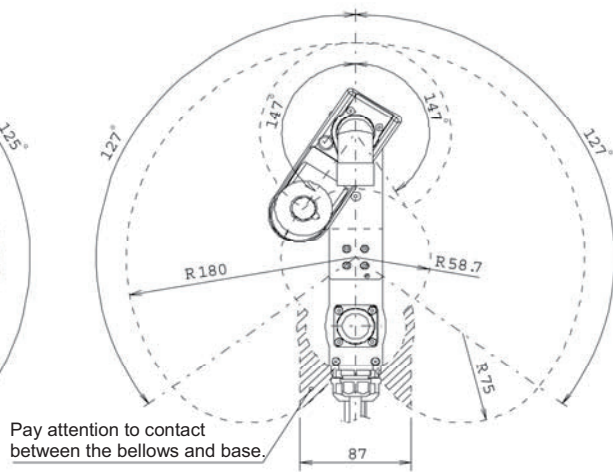


Range of stopper position

IX-NNC-1805 (arm length 180, clean room specification)

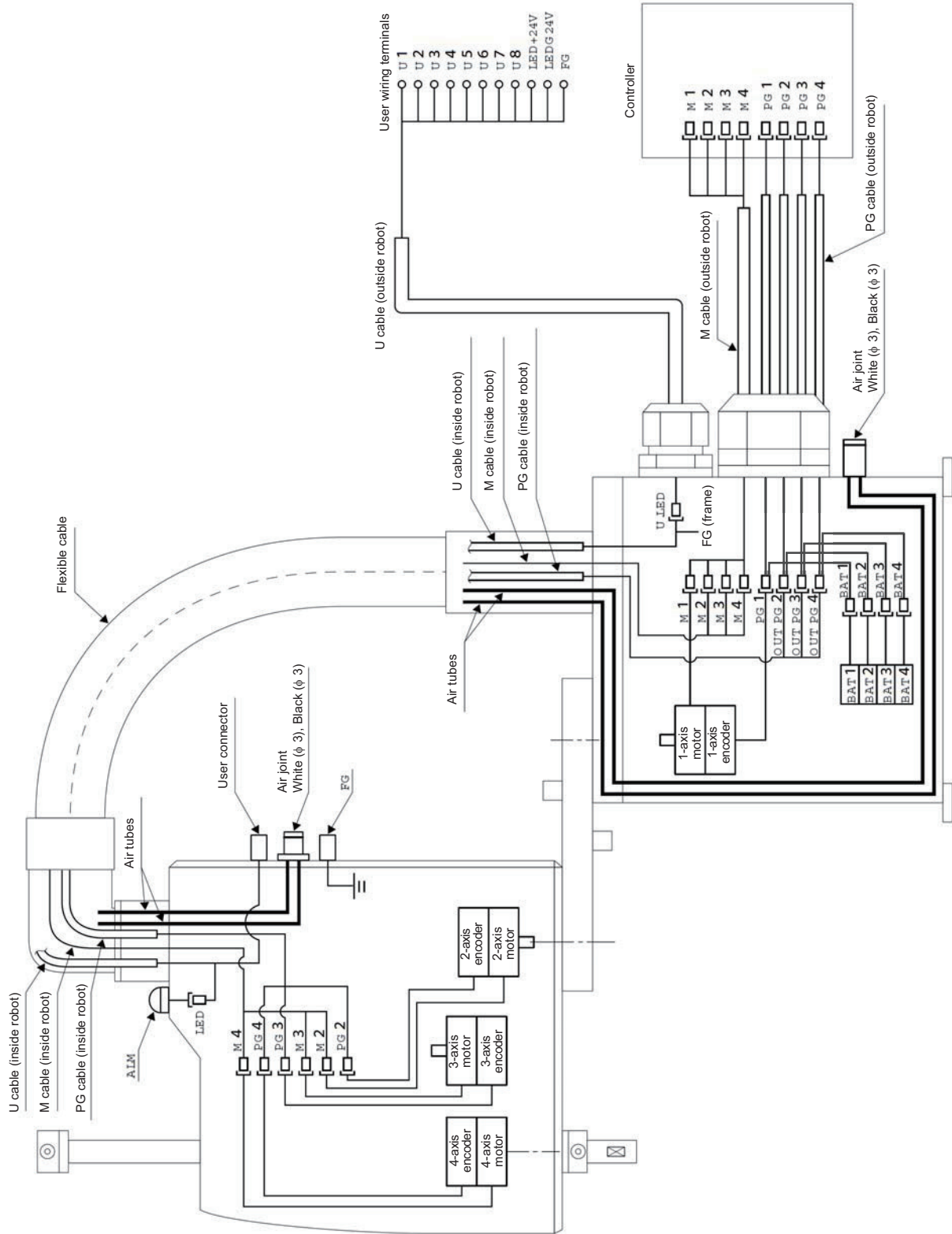


Movement range

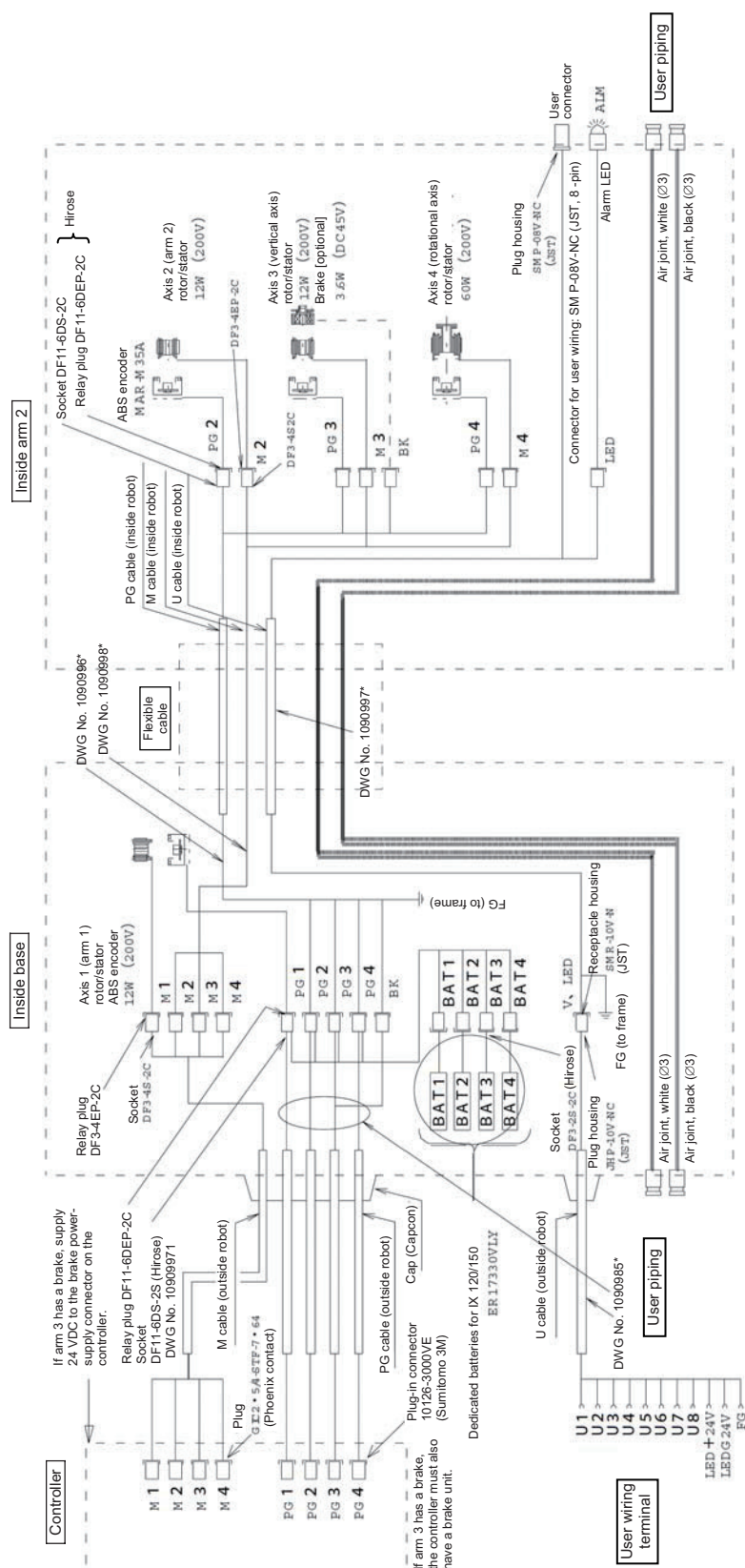


Range of stopper position

4. Wiring Diagram

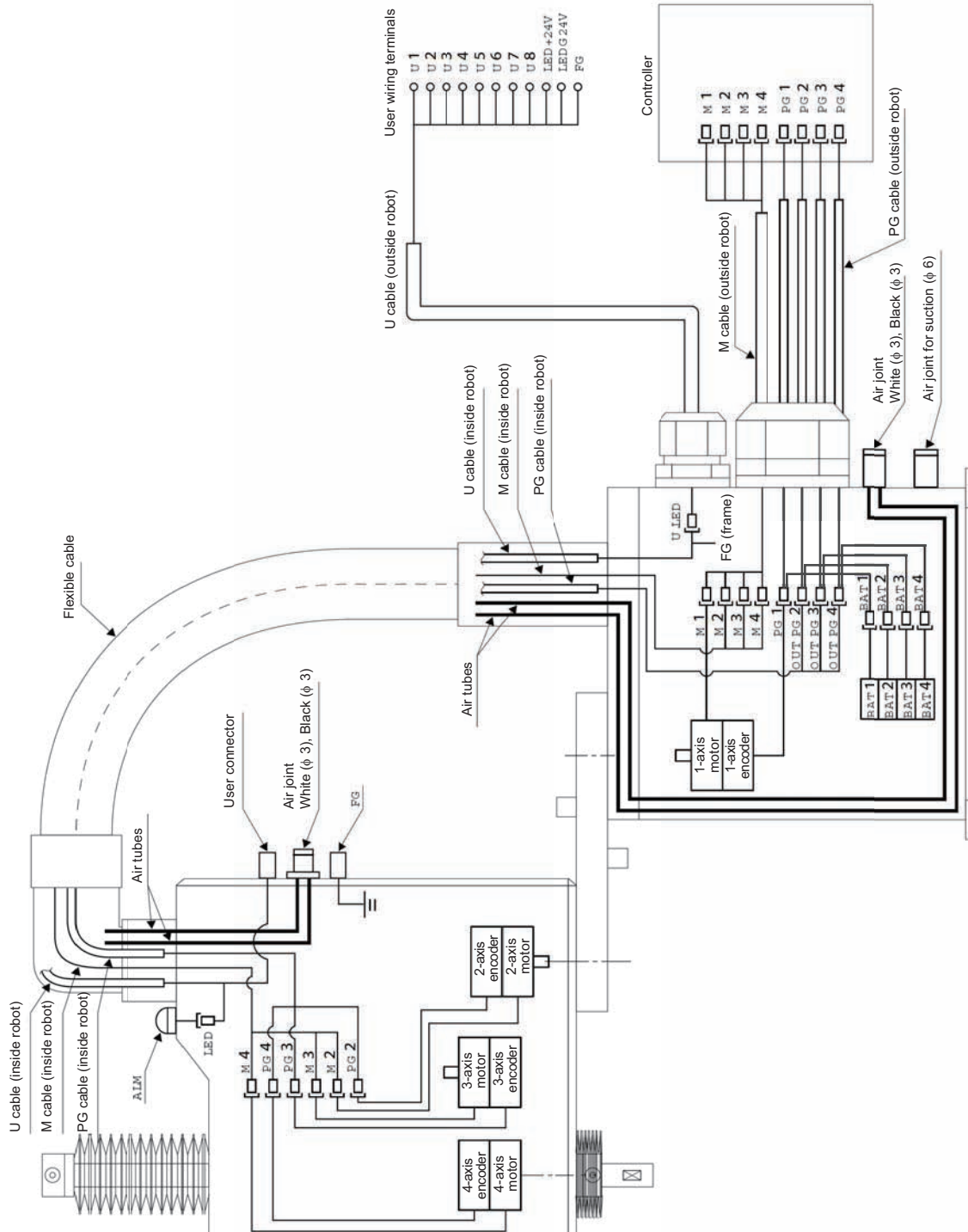


4. Wiring Diagram



- | | |
|-------|--|
| Notes | <p>(1) To operate the alarm LED, the user must provide a circuit that uses the controller I/O output signal.</p> <p>(2) If 24 VDC is not supplied to the brake power-supply connector on the controller, the brake cannot be released.</p> |
|-------|--|

4. Wiring Diagram



4.2 Machine Harness Wiring Table

(1) PG cables (inside robot) DWG No. 1090996*

Base end				Arm 2 end						
Tube symbol	Connector	Signal	Pin No.	Connection	Pin No.	Signal	Connector	Tube symbol	ID No.	Cable
OUT PG 2	Relay plug DF11-6DEP-2C (Hirose)	BAT+	1							

(2) M cables (inside robot) DWG No. 1090998*

Base end				Arm 2 end						
Tube symbol	Connector	Signal	Pin No.	Connection	Pin No.	Signal	Connector	Tube symbol	ID No.	Cable
M 2	Relay plug DF11-4EP-2C (Hirose)	U	1		1	U	Socket DF3-4S2C (Hirose)	M 2	Red White Black Green	0.3mm ²
		V	2		2	V				
		W	3		3	W				
		E	4		4	E				
M 3	Same as above	U	1		1	U	Same as above	M 3	Red White Black Green	
		V	2		2	V				
		W	3		3	W				
		E	4		4	E				
M 4	Same as above	U	1		1	U	Same as above	M 4	Red White Black Green	
		V	2		2	V				
		W	3		3	W				
		E	4		4	E				

(3) U cables (inside robot) DWG No. 1090997*

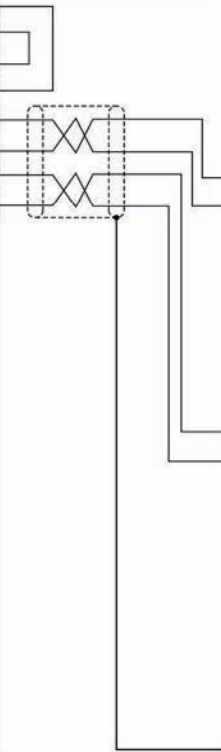
Base end				Arm 2 end						
Tube symbol	Connector	Signal	Pin No.	Connection	Pin No.	Signal	Connector	Tube symbol	ID No.	Cable
U	Receptacle housing SM R-10V-N (JST)	U 1	1		1	U 1	Plug housing SMP-08V-NC (JST)	U	Black	0.3-mm ² 10-core shielded cable
		U 2	2		2	U 2				
		U 3	3		3	U 3				
		U 4	4		4	U 4				
		U 5	5		5	U 5				
		U 6	6		6	U 6				
		U 7	7		7	U 7				
		U 8	8		8	U 8				
		LED+24	9		1	LED+24	Socket DF3-2S-2C (Hirose)	LED	Black	
		LEDG24	10		2	LEDG24				
FG	Round terminal	FG	-							

4.3 Cable Wiring Table

(1) PG cables (outside robot) DWG No. 1090985*

Robot end

Controller end

Tube symbol	Connector	Signal	Pin No.	Connection	Pin No.	Signal	Connector	Tube symbol	ID No.	Cable
BAT1, BAT2, BAT4	Plug DF3-2EP-2C (by Hirose Electric)	BAT- 1 BAT+ 2	1 2		1	—	Plug connector 10126-3000VE (Sumitomo 3M)	PG 1 PG 2 PG 4	—	0.12-mm ² twisted- pair, 4-core shielded cable
		BAT+ 1 BAT- 2	1 2		2	—			—	
					3	—			—	
					4	—			—	
					5	—			—	
					6	—			—	
					7	SD			Orange 1 red	
					8	—SD			Orange 1 black	
					9	—			—	
					10	—			—	
					11	—			—	
					12	—			—	
					13	—			—	
					14	—			—	
					15	—			—	
					16	VCC			Light gray 1 red	
					17	GND			Light gray 1 black	
					18	—			—	
					19	—			—	
					20	—			—	
					21	—			—	
					22	—			—	
					23	—			—	
					24	—			—	
					25	—			—	
					26	—			—	

Robot end

Controller end

Tube symbol	Connector	Signal	Pin No.	Connection	Pin No.	Signal	Connector	Tube symbol	ID No.	Cable
BAT 3	Plug DF3-2EP-2C (by Hirose Electric)	BAT- BAT+ BAT+ BAT-	1 2 1 2		1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	- - - - - - SD -SD - - - - - - - VCC GND - - BK- BK+ - - - - - -	Plug connector 10126-3000VE (Sumitomo 3M)	PG 3	- - - - - - Orange 1 red Orange 1 black - - - - - Light gray 1 red Light gray 1 black - - White 1 black White 1 red - - - - - -	0.12-mm ² twisted- pair, 3-core shielded cable
PG 3	Socket DF11-6DS-2S (by Hirose Electric)	SD -SD VCC GND	3 4 5 6		5 6 7 8	- - SD -SD				
BK	Socket DF3-3S-2C (by Hirose Electric)	BK+ BK- -	1 2 3		9 10 11	- - -				

(2) M cables (outside robot) DWG No. 1090971*

Robot end				Controller end						
Tube symbol	Connector	Signal	Pin No.	Connection	Pin No.	Signal	Connector	Tube symbol	ID No.	Cable
M 1	Socket DF3-4S-2C (by Hirose)	U V W C • G	1 2 3 4		1 2 3 4	C • G U V W	Plug GIC2•5/4 -STF-7•62 (by Phoenix Contact)	M 1		0.2-mm ² 16-core
M 2	Same as above	U V W C • G	1 2 3 4		1 2 3 4	C • G U V W	Same as above	M 2		
M 3	Same as above	U V W C • G	1 2 3 4		1 2 3 4	C • G U V W	Same as above	M 3		
M 4	Same as above	U V W C • G	1 2 3 4		1 2 3 4	C • G U V W	Same as above	M 4		

(3) U cables (outside robot) DWG No. 1090985*

Robot end				Controller end						
Tube symbol	Connector	Signal	Pin No.	Connection	Pin No.	Signal	Connector	Tube symbol	ID No.	Cable
U	Plug housing SMR-10V-N (by JST)	U 1 U 2 U 3 U 4 U 5 U 6 U 7 U 8 LED +24V LEDG 24V	1 2 3 4 5 6 7 8 9 10		1 2 3 4 5 6 7 8 9 10 —	U 1 U 2 U 3 U 4 U 5 U 6 U 7 U 8 LED +24V LEDG 24V FG	Y terminal	U 1 U 2 U 3 U 4 U 5 U 6 U 7 U 8 LED +24V LEDG 24V FG	Orange 1 red Orange 1 black Light gray 1 red Light gray 1 black White 1 red White 1 black Yellow 1 red Yellow 1 black Pink 1 red Pink 1 black Green	0.12-mm ² twisted-pair, 10-core shielded cable



4.4 230 V Circuit Components

No.	Code name	Manufacturer	Remarks
1	Axis 1 to 3 servo motor	IAI	AC servo motor, 12 W
2	Axis 4 servo motor		AC servo motor, 60 W
3	M cable (inside robot)		Wire: 250 V, 150°C (rated), 0.3 mm ³

5. Option

5.1 Absolute Reset Jig

This jig is used to perform an absolute reset in the event that absolute data in the encoder was lost.

Model number	Remarks
JG-5	For arm length 120/150/180

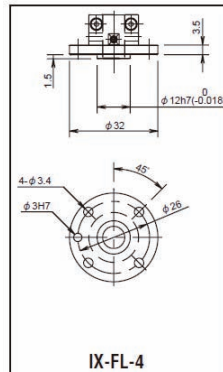


JG-5

5.2 Flange

This flange is used to install a load at the end of the Z-axis arm.

Model number	Remarks
IX-FL-4	For arm length 120/150/180



IX-FL-4

5.3 Absolute Data Backup Battery

This battery is used to retain absolute data in the encoder. (Set the battery inside the cover of the SCARA robot.)

Model number	Remarks
AB-6	For arm length 120/150/180

* Four batteries are needed for each robot (all SCARA robot models). Since AB-6 batteries are packed individually, specify the required number in your order.



AB-6

6. Checking after Unpacking

After unpacking the carton, check the condition of the product and items included in the carton.

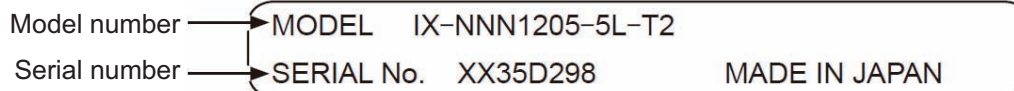
6.1 Items Included in the Carton

No.	Item	Remarks	Remarks
1	Robot	Refer to "How to Read Model Nameplate" and "How to Read Model Number."	
2	Controller		
Accessories			
3	Receptacle housing		
4	Pin contact		
5	PIO flat cable		
6	First step-by-step guide		
7	Operation manual (CD/DVD)		
8	Safety guide		

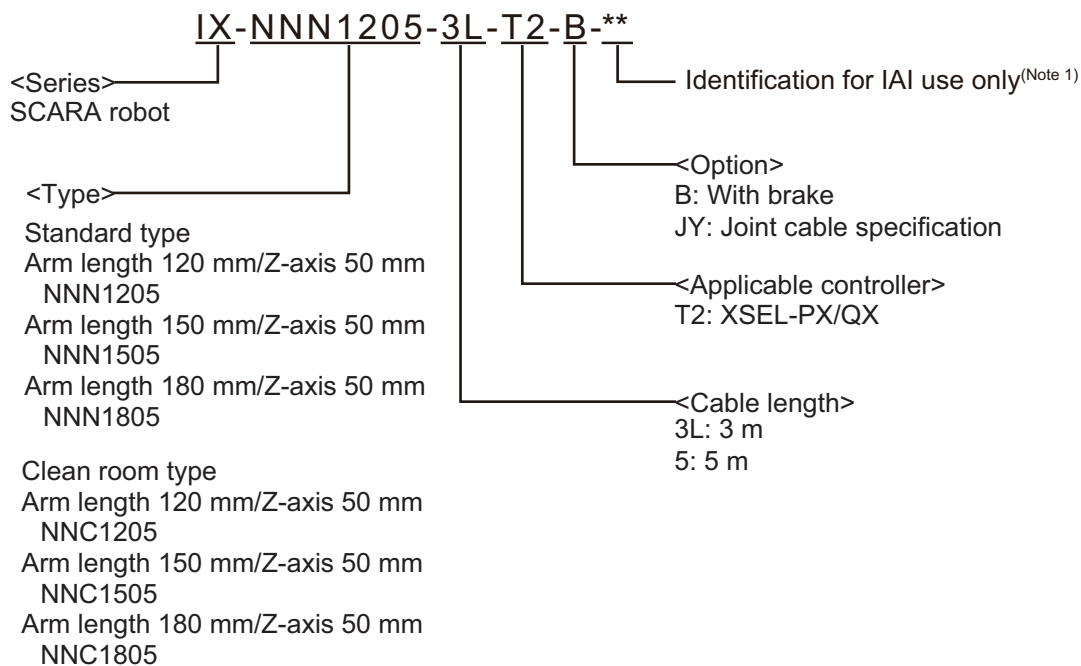
6.2 Operation Manuals Relating to This Product

No.	Item	Control No.
1	Operation Manual for XSEL-PX/QX Controller	ME0152
2	Operation Manual for XSEL-R/S/RX/SX/RXD/SXD Controller	ME0313
3	Operation Manual for XSEL Controller P/Q/PX/QX – RC Gateway Function	ME0188
4	Operation Manual for PC Software IA-101-X-MW/IA-101-X-USBMW	ME0154
5	Operation Manual for Teaching Pendant SEL-T/TD/TG	ME0183
6	Operation Manual for Teaching Pendant IA-T-X/XD	ME0160
7	Operation Manual for DeviceNet	ME0124
8	Operation Manual for CC-Link	ME0123
9	Operation Manual for PROFIBUS	ME0153
10	Operation Manual for X-SEL Ethernet	ME0140
11	Operation Manual for Multi-point I/O Board	ME0138
12	Operation Manual for Dedicated Terminal Block for Multi-point I/O Board	ME0139
13	Operation Manual for IA Net	ME0307

6.3 How to Read Model Nameplate



6.4 How to Read Model Number



Note 1 This may be displayed for the manufacturing reason.
(This is not to indicate the manufacturing model code.)

7. Specifications

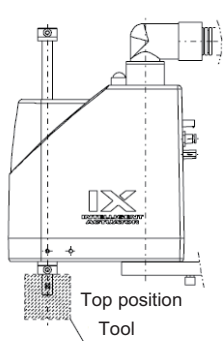
7.1 IX-NNN1205/1505/1805

IX-NNN-1205 (Arm Length 120, Standard Specification)

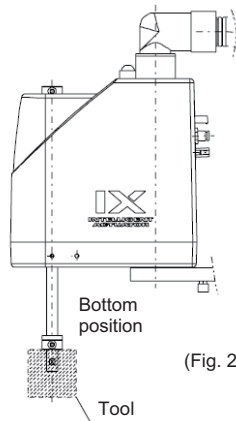
Item			Specifications
Model number			IX-NNN1205-**L
Degree of freedom			Four degrees of freedom
Overall arm length	mm		120
Arm 1 length			45
Arm 2 length			75
Drive method	Axis 1 (arm 1)		AC servo motor + Speed reducer
	Axis 2 (arm 2)		AC servo motor + Speed reducer
	Axis 3 (vertical axis)		AC servo motor + Belt + Ball-screw spline
	Axis 4 (rotational axis)		AC servo motor + Spline (directly coupled)
Motor capacity	Axis 1 (arm 1)	W	12
	Axis 2 (arm 2)		12
	Axis 3 (vertical axis)		12
	Axis 4 (rotational axis)		60
Movement range	Axis 1 (arm 1)	degree	±115
	Axis 2 (arm 2)		±145
	Axis 3 (vertical axis) (Note 1)	mm	50
	Axis 4 (rotational axis)	degree	±360
Maximum operating speed (Note 2)	Axis 1 + Axis 2 (maximum composite speed)	mm/sec	2053
	Axis 3 (vertical axis)		720
	Axis 4 (rotational axis)	degree/sec	1800
Positioning repeatability (Note 3)	Axis 1 + Axis 2	mm	±0.005
	Axis 3 (vertical axis)		±0.010
	Axis 4 (rotational axis)	degree	±0.005
Cycle time (Note 4)		sec	0.35
Load capacity	Rated	kg	0.2
	Maximum		1.0
Push force of axis 3 (vertical axis)	Upper limit (Note 8)	N (kgf)	14.7 (1.5)
	Lower limit (Note 9)		9.8 (1.0)
Permissible load on axis 4	Permissible moment of inertia (Note 5)	kg-m ²	386
	Permissible torque	N·m (kgf·cm)	0.13 (1.3)
Permissible tool diameter (Note 6)		mm	φ 35
Home detection			Absolute
User wiring			Connector with 8-core AWG26 shielded cable: SMP-08V-NC (JST)
Alarm indicator (Note 7)			One small, red LED indicator (rated voltage: 24 V)
User piping			Two air tubes (outer diameter: φ 3 inner diameter: φ 2) (normal service pressure: 0.7 MPa)

Item		Specifications	
Operating environment	Surrounding air temperature/humidity	Temperature: 0 to 40°C, humidity: 20 to 85%RH or less (non-condensing)	
	Altitude	m	1,000 or less
Noise		dB	52 to 59
Robot weight		kg	2.7
Controller	Power supply		3-phase 200/230 V 50/60 Hz 2.2 A
	Allowable supply voltage fluctuation	%	±10
	Overvoltage category (IEC60664-1)		Category III
	Pollution degree (IEC60664-1)		Pollution degree 3

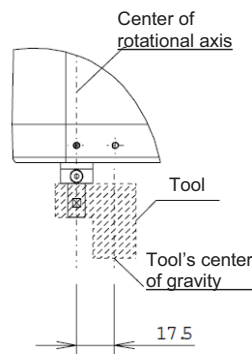
- Note 1) To move the robot horizontally at high speed, perform teaching so that the vertical axis stays as close to the top position as possible. (Fig. 1)
To operate the robot with its vertical axis at the bottom position, the speed and acceleration must be reduced as appropriate. (Fig. 2)
- Note 2) Assuming PTP instruction operation.
- Note 3) Positioning precision when the robot is operated repeatedly to one specified position from the same starting position at the same speed and acceleration/deceleration using the same arm (at a constant surrounding air temperature of 20°C). Take note that this is not the absolute positioning precision. Also note that the positioning repeatability may deviate from the specified value if the arm is changed, positioning is performed to one specified position from multiple positions, or any of the operating conditions such as operating speed and acceleration/deceleration setting is changed.
- Note 4) When 0.2 kg is carried at the maximum speed (with the robot moving back and forth over 100 mm in horizontal direction and 25 mm in vertical direction).
- Note 5) The permissible moment of inertia converted to a value at the rotational center of axis 4. The offset from the rotational center of axis 4 to the tool's center of gravity is assumed to be 17.5 mm or less. (Fig. 3)
Make the center of the rotational axis agree with the center of gravity of the tool as close as possible. If the gravity-center position of the tool is away from the center position of axis 4, the speed and/or acceleration must be lowered as deemed appropriate.
- Note 6) If the tool exceeds the permissible diameter, it will contact the robot inside the robot's range of movement. (Fig. 4)
- Note 7) To enable the alarm LED indicator, the user must provide a circuit that supplies 24 VDC to the LED terminal in the user connector in response to the controller I/O output signal, etc.
- Note 8) Push force when driver card parameter No. 38, "Push torque limit during positioning" is set to 70%.
- Note 9) Push force when driver card parameter No. 38, "Push torque limit during positioning" is set to 50%. Although this parameter can be set to a desired value from 15 to 70%, push force will not stabilize if the set value is outside the range of 50 to 70%.



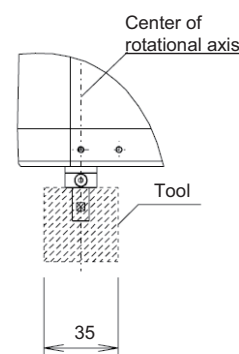
(Fig. 1)



(Fig. 2)



(Fig. 3)



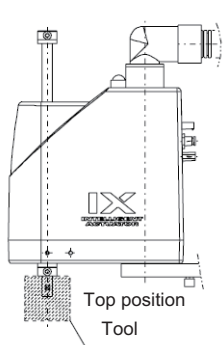
(Fig. 4)

IX-NNN-1505 (Arm Length 150, Standard Specification)

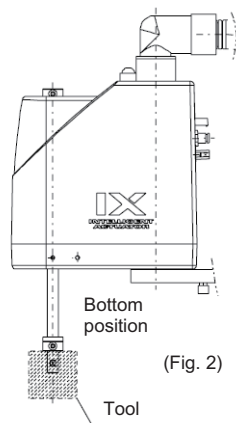
Item			Specifications
Model number			IX-NNN1505-**L
Degree of freedom			Four degrees of freedom
Overall arm length	mm		150
Arm 1 length			75
Arm 2 length			75
Drive method	Axis 1 (arm 1)		AC servo motor + Speed reducer
	Axis 2 (arm 2)		AC servo motor + Speed reducer
	Axis 3 (vertical axis)		AC servo motor + Belt + Ball-screw spline
	Axis 4 (rotational axis)		AC servo motor + Spline (directly coupled)
Motor capacity	Axis 1 (arm 1)	W	12
	Axis 2 (arm 2)		12
	Axis 3 (vertical axis)		12
	Axis 4 (rotational axis)		60
Movement range	Axis 1 (arm 1)	degree	±125
	Axis 2 (arm 2)	degree	±145
	Axis 3 (vertical axis) (Note 1)	mm	50
	Axis 4 (rotational axis)	degree	±360
Maximum operating speed (Note 2)	Axis 1 + Axis 2 (maximum composite speed)	mm/sec	2304
	Axis 3 (vertical axis)	mm/sec	720
	Axis 4 (rotational axis)	degree/sec	1800
Positioning repeatability (Note 3)	Axis 1 + Axis 2	mm	±0.005
	Axis 3 (vertical axis)	mm	±0.010
	Axis 4 (rotational axis)	degree	±0.005
Cycle time (Note 4)		sec	0.35
Load capacity	Rated	kg	0.2
	Maximum		1.0
Push force of axis 3 (vertical axis)	Upper limit (Note 8)	N (kgf)	14.7 (1.5)
	Lower limit (Note 9)		9.8 (1.0)
Permissible load on axis 4	Permissible moment of inertia (Note 5)	kg·m ²	386
	Permissible torque	N·m (kgf·cm)	0.13 (1.3)
Permissible tool diameter (Note 6)		mm	φ 35
Home detection			Absolute
User wiring			Connector with 8-core AWG26 shielded cable: SMP-08V-NC (JST)
Alarm indicator (Note 7)			One small, red LED indicator (rated voltage: 24 V)
User piping			Two air tubes (outer diameter: φ 3 inner diameter: φ 2) (normal service pressure: 0.7 MPa)

Item			Specifications
Operating environment	Surrounding air temperature/humidity		Temperature: 0 to 40°C, humidity: 20 to 85%RH or less (non-condensing)
	Altitude	m	1,000 or less
Noise		dB	52 to 59
Robot weight		kg	2.7
Controller	Power supply		3-phase 200/230 V 50/60 Hz 2.2 A
	Allowable supply voltage fluctuation	%	±10
	Overvoltage category (IEC60664-1)		Category III
	Pollution degree (IEC60664-1)		Pollution degree 3

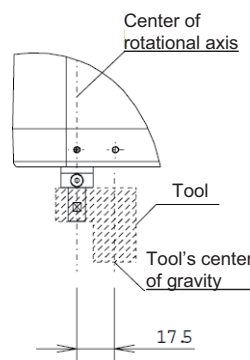
- Note 1) To move the robot horizontally at high speed, perform teaching so that the vertical axis stays as close to the top position as possible. (Fig. 1)
To operate the robot with its vertical axis at the bottom position, the speed and acceleration must be reduced as appropriate. (Fig. 2)
- Note 2) Assuming PTP instruction operation.
- Note 3) Positioning precision when the robot is operated repeatedly to one specified position from the same starting position at the same speed and acceleration/deceleration using the same arm (at a constant surrounding air temperature of 20°C). Take note that this is not the absolute positioning precision. Also note that the positioning repeatability may deviate from the specified value if the arm is changed, positioning is performed to one specified position from multiple positions, or any of the operating conditions such as operating speed and acceleration/deceleration setting is changed.
- Note 4) When 0.2 kg is carried at the maximum speed (with the robot moving back and forth over 100 mm in horizontal direction and 25 mm in vertical direction).
- Note 5) The permissible moment of inertia converted to a value at the rotational center of axis 4. The offset from the rotational center of axis 4 to the tool's center of gravity is assumed to be 17.5 mm or less. (Fig. 3)
Make the center of the rotational axis agree with the center of gravity of the tool as close as possible. If the gravity-center position of the tool is away from the center position of axis 4, the speed and/or acceleration must be lowered as deemed appropriate.
- Note 6) If the tool exceeds the permissible diameter, it will contact the robot inside the robot's range of movement. (Fig. 4)
- Note 7) To enable the alarm LED indicator, the user must provide a circuit that supplies 24 VDC to the LED terminal in the user connector in response to the controller I/O output signal, etc.
- Note 8) Push force when driver card parameter No. 38, "Push torque limit during positioning" is set to 70%.
- Note 9) Push force when driver card parameter No. 38, "Push torque limit during positioning" is set to 50%. Although this parameter can be set to a desired value from 15 to 70%, push force will not stabilize if the set value is outside the range of 50 to 70%.



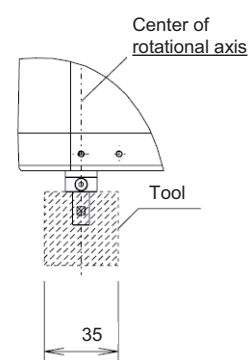
(Fig. 1)



(Fig. 2)



(Fig. 3)



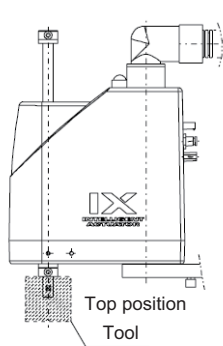
(Fig. 4)

IX-NNN-1805 (Arm Length 180, Standard Specification)

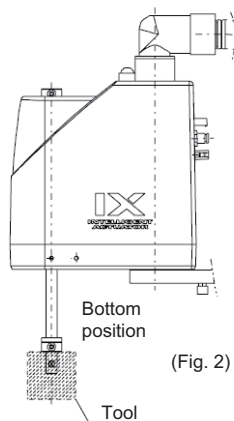
Item			Specifications
Model number			IX-NNN1805-**L
Degree of freedom			Four degrees of freedom
Overall arm length	mm		180
Arm 1 length			105
Arm 2 length			75
Drive method	Axis 1 (arm 1)		AC servo motor + Speed reducer
	Axis 2 (arm 2)		AC servo motor + Speed reducer
	Axis 3 (vertical axis)		AC servo motor + Belt + Ball-screw spline
	Axis 4 (rotational axis)		AC servo motor + Spline (directly coupled)
Motor capacity	Axis 1 (arm 1)	W	12
	Axis 2 (arm 2)		12
	Axis 3 (vertical axis)		12
	Axis 4 (rotational axis)		60
Movement range	Axis 1 (arm 1)	degree	±125
	Axis 2 (arm 2)	degree	±145
	Axis 3 (vertical axis) (Note 1)	mm	50
	Axis 4 (rotational axis)	degree	±360
Maximum operating speed (Note 2)	Axis 1 + Axis 2 (maximum composite speed)	mm/sec	2555
	Axis 3 (vertical axis)	mm/sec	720
	Axis 4 (rotational axis)	degree/sec	1800
Positioning repeatability (Note 3)	Axis 1 + Axis 2	mm	±0.010
	Axis 3 (vertical axis)	mm	±0.010
	Axis 4 (rotational axis)	degree	±0.005
Cycle time (Note 4)		sec	0.38
Load capacity	Rated	kg	0.2
	Maximum		1.0
Push force of axis 3 (vertical axis)	Upper limit (Note 8)	N (kgf)	14.7 (1.5)
	Lower limit (Note 9)		9.8 (1.0)
Permissible load on axis 4	Permissible moment of inertia (Note 5)	kg-m ²	386
	Permissible torque	N·m (kgf·cm)	0.13 (1.3)
Permissible tool diameter (Note 6)		mm	φ 35
Home detection			Absolute
User wiring			Connector with 8-core AWG26 shielded cable: SMP-08V-NC (JST)
Alarm indicator (Note 7)			One small, red LED indicator (rated voltage: 24 V)
User piping			Two air tubes (outer diameter: φ 3 inner diameter: φ 2) (normal service pressure: 0.7 MPa)

Item			Specifications
Operating environment	Surrounding air temperature/humidity		Temperature: 0 to 40°C, humidity: 20 to 85%RH or less (non-condensing)
	Altitude	m	1,000 or less
Noise		dB	52 to 59
Robot weight		kg	3.0
Controller	Power supply		3-phase 200/230 V 50/60 Hz 2.2 A
	Allowable supply voltage fluctuation	%	±10
	Overvoltage category (IEC60664-1)		Category III
	Pollution degree (IEC60664-1)		Pollution degree 3

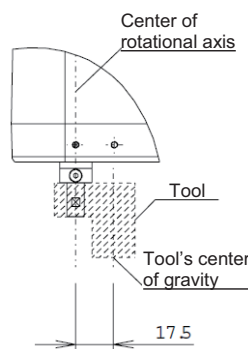
- Note 1) To move the robot horizontally at high speed, perform teaching so that the vertical axis stays as close to the top position as possible. (Fig. 1)
To operate the robot with its vertical axis at the bottom position, the speed and acceleration must be reduced as appropriate. (Fig. 2)
- Note 2) Assuming PTP instruction operation.
- Note 3) Positioning precision when the robot is operated repeatedly to one specified position from the same starting position at the same speed and acceleration/deceleration using the same arm (at a constant surrounding air temperature of 20°C). Take note that this is not the absolute positioning precision. Also note that the positioning repeatability may deviate from the specified value if the arm is changed, positioning is performed to one specified position from multiple positions, or any of the operating conditions such as operating speed and acceleration/deceleration setting is changed.
- Note 4) When 0.2 kg is carried at the maximum speed (with the robot moving back and forth over 100 mm in horizontal direction and 25 mm in vertical direction).
- Note 5) The permissible moment of inertia converted to a value at the rotational center of axis 4. The offset from the rotational center of axis 4 to the tool's center of gravity is assumed to be 17.5 mm or less. (Fig. 3)
Make the center of the rotational axis agree with the center of gravity of the tool as close as possible. If the gravity-center position of the tool is away from the center position of axis 4, the speed and/or acceleration must be lowered as deemed appropriate.
- Note 6) If the tool exceeds the permissible diameter, it will contact the robot inside the robot's range of movement. (Fig. 4)
- Note 7) To enable the alarm LED indicator, the user must provide a circuit that supplies 24 VDC to the LED terminal in the user connector in response to the controller I/O output signal, etc.
- Note 8) Push force when driver card parameter No. 38, "Push torque limit during positioning" is set to 70%.
- Note 9) Push force when driver card parameter No. 38, "Push torque limit during positioning" is set to 50%. Although this parameter can be set to a desired value from 15 to 70%, push force will not stabilize if the set value is outside the range of 50 to 70%.



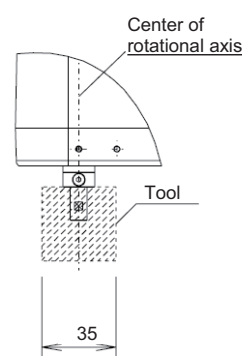
(Fig. 1)



(Fig. 2)



(Fig. 3)

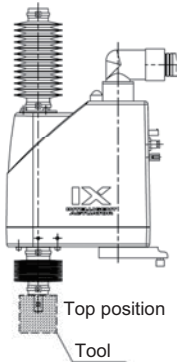
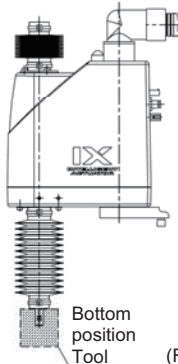
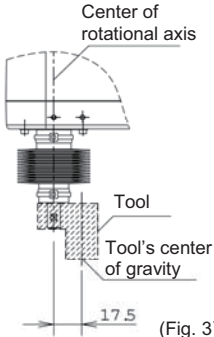
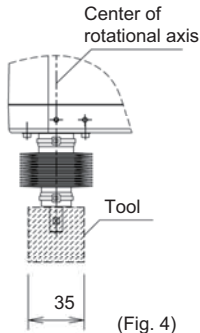


(Fig. 4)

7.2 IX-NNC1205/1505/1805

IX-NNC-1205 (arm length 120, clean room specification)

Item			Specifications
Type			IX-NNC1205-**L-T1
Cleanness (Note 10)			Class 10 (0.1 μm)
Degree of freedom			Four degrees of freedom
Overall arm length		mm	120
Arm 1 length			45
Arm 2 length			75
Drive method	Axis 1 (arm 1)		AC servo motor + Speed reducer
	Axis 2 (arm 2)		AC servo motor + Speed reducer
	Axis 3 (vertical axis)		AC servo motor + Belt + Ball-screw spline
	Axis 4 (rotational axis)		AC servo motor + Spline (directly coupled)
Motor capacity	Axis 1 (arm 1)	W	12
	Axis 2 (arm 2)		12
	Axis 3 (vertical axis)		12
	Axis 4 (rotational axis)		60
Movement range	Axis 1 (arm 1)	degree	±115
	Axis 2 (arm 2)		±130
	Axis 3 (vertical axis) (Note 1)	mm	50
	Axis 4 (rotational axis)	degree	±360
Maximum operating speed (Note 2)	Axis 1 + Axis 2 (maximum composite speed)	mm/sec	2053
	Axis 3 (vertical axis)		720
	Axis 4 (rotational axis)	degree/sec	1800
Positioning repeatability (Note 3)	Axis 1 + Axis 2	mm	±0.005
	Axis 3 (vertical axis)		±0.010
	Axis 4 (rotational axis)	degree	±0.005
Cycle time (Note 4)		sec	0.35
Load capacity	Rated	kg	0.2
	Maximum		1.0
Push-in thrust of axis 3 (vertical axis)	Upper limit (Note 8)	N (kgf)	14.7 (1.5)
	Lower limit (Note 9)		9.8 (1.0)
Permissible load on axis 4	Permissible moment of inertia (Note 5)	kg·m ²	386
	Permissible torque	N·m (kgf·cm)	0.13 (1.3)
Permissible tool diameter (Note 6)		mm	φ 35
Home detection			Absolute
User wiring			Connector with 8-core AWG26 shielded cable: SMP-08V-NC (JST)
Alarm indicator (Note 7)			One small, red LED indicator (rated voltage: 24 V)

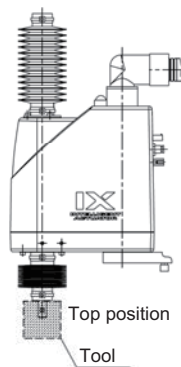
Item			Specifications
User piping			Outer diameter ϕ 3, inner diameter ϕ 2, air tube x 2 pcs (service pressure 0.7 MPa)
Operating environment	Surrounding air temperature/humidity		Temperature: 0 to 40°C, humidity: 20 to 85%RH or less (non-condensing)
	Altitude	m	1,000 or less
Noise		dB	52 to 59
Robot weight		kg	2.8
Controller	Power supply		230 V 50/60 Hz 15 A
	Allowable supply voltage fluctuation	%	± 10
	Overvoltage category (IEC60664-1)		Category III
	Pollution degree (IEC60664-1)		Pollution degree 3
Note 1)	To move the robot horizontally at high speed, perform teaching so that the vertical axis stays as close to the top position as possible. (Fig. 1) To operate the robot with its vertical axis at the bottom position, the speed and acceleration must be reduced as appropriate. (Fig. 2)		
Note 2)	Assuming PTP instruction operation.		
Note 3)	Positioning precision when the robot is operated repeatedly to one specified position from the same starting position at the same speed and acceleration/deceleration using the same arm (at a constant surrounding air temperature of 20°C). Take note that this is not the absolute positioning precision. Also note that the positioning repeatability may deviate from the specified value if the arm is changed, positioning is performed to one specified position from multiple positions, or any of the operating conditions such as operating speed and acceleration/deceleration setting is changed.		
Note 4)	When 0.2 kg is carried at the maximum speed (with the robot moving back and force over 100 mm in horizontal direction and 25 mm in vertical direction). 0.39 sec for the vertical axis with brake.		
Note 5)	The permissible moment of inertia converted to a value at the rotational center of axis 4. The offset from the rotational center of axis 4 to the tool's center of gravity is assumed to be 17.5 mm or less. (Fig. 3) If the gravity-center position of the tool is away from the center position of axis 4, the speed and/or acceleration must be lowered as deemed appropriate.		
Note 6)	If the tool exceeds the permissible diameter, it will contact the robot inside the robot's range of movement. (Fig. 4)		
Note 7)	To enable the alarm LED indicator, the user must provide a circuit that supplies 24 VDC to the LED terminal in the user connector in response to the controller I/O output signal, etc.		
Note 8)	Push force when driver card parameter No. 38, "Push torque limit during positioning" is set to 70%.		
Note 9)	Push force when driver card parameter No. 38, "Push torque limit during positioning" is set to 50%. Although this parameter can be set to a desired value from 15 to 70%, push force will not stabilize if the set value is outside the range of 50 to 70%.		
Note 10)	When the suction rate is 90 NI/min (-2025 mmAq).		
<div><div><p>Top position Tool</p><p>(Fig. 1)</p></div><div><p>Bottom position Tool</p><p>(Fig. 2)</p></div><div><p>Center of rotational axis Tool Tool's center of gravity 17.5</p><p>(Fig. 3)</p></div><div><p>Center of rotational axis Tool 35</p><p>(Fig. 4)</p></div></div>			

IX-NNC-1505 (arm length 150, clean room specification)

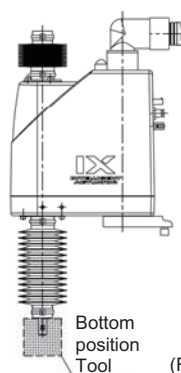
Item			Specifications
Type			IX-NNC1505-**L-T1
Cleanness (Note 10)			Class 10 (0.1 μm)
Degree of freedom			Four degrees of freedom
Overall arm length		mm	150
Arm 1 length			75
Arm 2 length			75
Drive method	Axis 1 (arm 1)		AC servo motor + Speed reducer
	Axis 2 (arm 2)		AC servo motor + Speed reducer
	Axis 3 (vertical axis)		AC servo motor + Belt + Ball-screw spline
	Axis 4 (rotational axis)		AC servo motor + Spline (directly coupled)
Motor capacity	Axis 1 (arm 1)	W	12
	Axis 2 (arm 2)		12
	Axis 3 (vertical axis)		12
	Axis 4 (rotational axis)		60
Movement range	Axis 1 (arm 1)	degree	±125
	Axis 2 (arm 2)		±134
	Axis 3 (vertical axis) (Note 1)	mm	50
	Axis 4 (rotational axis)	degree	±360
Maximum operating speed (Note 2)	Axis 1 + Axis 2 (maximum composite speed)	mm/sec	2304
	Axis 3 (vertical axis)		720
	Axis 4 (rotational axis)	degree/sec	1800
Positioning repeatability (Note 3)	Axis 1 + Axis 2	mm	±0.005
	Axis 3 (vertical axis)		±0.010
	Axis 4 (rotational axis)	degree	±0.005
Cycle time (Note 4)		sec	0.38
Load capacity	Rated	kg	0.2
	Maximum		1.0
Push force of axis 3 (vertical axis)	Upper limit (Note 8)	N (kgf)	14.7 (1.5)
	Lower limit (Note 9)		9.8 (1.0)
Permissible load on axis 4	Permissible moment of inertia (Note 5)	kg·m ²	386
	Permissible torque	N·m (kgf·cm)	0.13 (1.3)
Permissible tool diameter (Note 6)		mm	φ 35
Home detection			Absolute
User wiring			Connector with 8-core AWG26 shielded cable: SMP-08V-NC (JST)
Alarm indicator (Note 7)			One small, red LED indicator (rated voltage: 24 V)

Item			Specifications
User piping			Two air tubes (outer diameter: $\phi 3$, inner diameter: $\phi 2$) (normal service pressure: 0.7 MPa)
Operating environment	Surrounding air temperature/humidity		Temperature: 0 to 40°C, humidity: 20 to 85%RH or less (non-condensing)
	Altitude	m	1,000 or less
Noise		dB	52 to 59
Robot weight		kg	2.8
Controller	Power supply		230 V 50/60 Hz 15 A
	Allowable supply voltage fluctuation	%	± 10
	Overvoltage category (IEC60664-1)		Category III
	Pollution degree (IEC60664-1)		Pollution degree 3

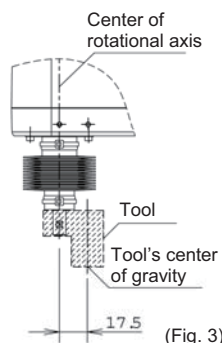
- Note 1) To move the robot horizontally at high speed, perform teaching so that the vertical axis stays as close to the top position as possible. (Fig. 1)
To operate the robot with its vertical axis at the bottom position, the speed and acceleration must be reduced as appropriate. (Fig. 2)
- Note 2) Assuming PTP instruction operation.
- Note 3) Positioning precision when the robot is operated repeatedly to one specified position from the same starting position at the same speed and acceleration/deceleration using the same arm (at a constant surrounding air temperature of 20°C). Take note that this is not the absolute positioning precision. Also note that the positioning repeatability may deviate from the specified value if the arm is changed, positioning is performed to one specified position from multiple positions, or any of the operating conditions such as operating speed and acceleration/deceleration setting is changed.
- Note 4) When 0.2 kg is carried at the maximum speed (with the robot moving back and forth over 100 mm in horizontal direction and 25 mm in vertical direction). 0.39 sec for the vertical axis with brake.
- Note 5) The permissible moment of inertia converted to a value at the rotational center of axis 4. The offset from the rotational center of axis 4 to the tool's center of gravity is assumed to be 17.5 mm or less. (Fig. 3)
If the gravity-center position of the tool is away from the center position of axis 4, the speed and/or acceleration must be lowered as deemed appropriate.
- Note 6) If the tool exceeds the permissible diameter, it will contact the robot inside the robot's range of movement. (Fig. 4)
- Note 7) To enable the alarm LED indicator, the user must provide a circuit that supplies 24 VDC to the LED terminal in the user connector in response to the controller I/O output signal, etc.
- Note 8) Push force when driver card parameter No. 38, "Push torque limit during positioning" is set to 70%.
- Note 9) Push force when driver card parameter No. 38, "Push torque limit during positioning" is set to 50%. Although this parameter can be set to a desired value from 15 to 70%, push force will not stabilize if the set value is outside the range of 50 to 70%.
- Note 10) When the suction rate is 90 NI/min (-2025 mmAq).



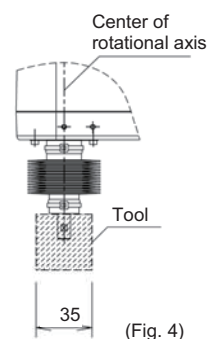
(Fig. 1)



(Fig. 2)



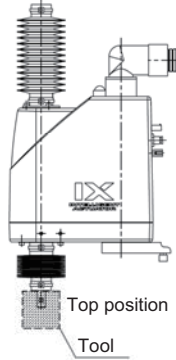
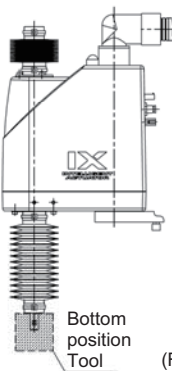
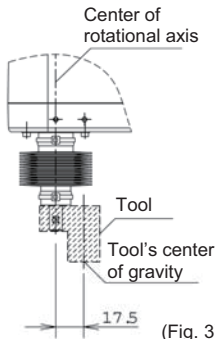
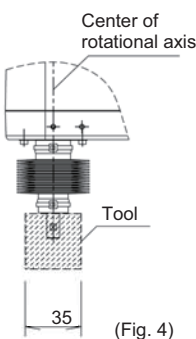
(Fig. 3)



(Fig. 4)

IX-NNC-1805 (arm length 180, clean room specification)

Item			Specifications
Type			IX-NNC1805-**L-T1
Cleanness (Note 10)			Class 10 (0.1 μ m)
Degree of freedom			Four degrees of freedom
Overall arm length	mm		180
Arm 1 length			105
Arm 2 length			75
Drive method	Axis 1 (arm 1)		AC servo motor + Speed reducer
	Axis 2 (arm 2)		AC servo motor + Speed reducer
	Axis 3 (vertical axis)		AC servo motor + Belt + Ball-screw spline
	Axis 4 (rotational axis)		AC servo motor + Spline (directly coupled)
Motor capacity	Axis 1 (arm 1)	W	12
	Axis 2 (arm 2)		12
	Axis 3 (vertical axis)		12
	Axis 4 (rotational axis)		60
Movement range	Axis 1 (arm 1)	degree	± 125
	Axis 2 (arm 2)		± 145
	Axis 3 (vertical axis) (Note 1)	mm	50
	Axis 4 (rotational axis)	degree	± 360
Maximum operating speed (Note 2)	Axis 1 + Axis 2 (maximum composite speed)	mm/sec	2555
	Axis 3 (vertical axis)		720
	Axis 4 (rotational axis)	degree/sec	1800
Positioning repeatability (Note 3)	Axis 1 + Axis 2	mm	± 0.010
	Axis 3 (vertical axis)		± 0.010
	Axis 4 (rotational axis)	degree	± 0.005
Cycle time (Note 4)		sec	0.41
Load capacity	Rated	kg	0.2
	Maximum		1.0
Push force of axis 3 (vertical axis)	Upper limit (Note 8)	N (kgf)	14.7 (1.5)
	Lower limit (Note 9)		9.8 (1.0)
Permissible load on axis 4	Permissible moment of inertia (Note 5)	kg-m ²	386
	Permissible torque	N·m (kgf·cm)	0.13 (1.3)
Permissible tool diameter (Note 6)		mm	ϕ 35
Home detection			Absolute
User wiring			Connector with 8-core AWG26 shielded cable: SMP-08V-NC (JST)
Alarm indicator (Note 7)			One small, red LED indicator (rated voltage: 24 V)

Item			Specifications
User piping			Outer diameter ϕ 3, inner diameter ϕ 2, air tube x 2 pcs (service pressure 0.7 MPa)
Operating environment	Surrounding air temperature/humidity		Temperature: 0 to 40°C, humidity: 20 to 85%RH or less (non-condensing)
	Altitude	m	1,000 or less
Noise		dB	52 to 59
Robot weight		kg	2.9
Controller	Power supply		230 V 50/60 Hz 15 A
	Allowable supply voltage fluctuation	%	± 10
	Overvoltage category (IEC60664-1)		Category III
	Pollution degree (IEC60664-1)		Pollution degree 3
Note 1)	To move the robot horizontally at high speed, perform teaching so that the vertical axis stays as close to the top position as possible. (Fig. 1) To operate the robot with its vertical axis at the bottom position, the speed and acceleration must be reduced as appropriate. (Fig. 2)		
Note 2)	Assuming PTP instruction operation.		
Note 3)	Positioning precision when the robot is operated repeatedly to one specified position from the same starting position at the same speed and acceleration/deceleration using the same arm (at a constant surrounding air temperature of 20°C). Take note that this is not the absolute positioning precision. Also note that the positioning repeatability may deviate from the specified value if the arm is changed, positioning is performed to one specified position from multiple positions, or any of the operating conditions such as operating speed and acceleration/deceleration setting is changed.		
Note 4)	When 0.2 kg is carried at the maximum speed (with the robot moving back and force over 100 mm in horizontal direction and 25 mm in vertical direction). 0.42 sec for the vertical axis with brake.		
Note 5)	The permissible moment of inertia converted to a value at the rotational center of axis 4. The offset from the rotational center of axis 4 to the tool's center of gravity is assumed to be 17.5 mm or less. (Fig. 3) If the gravity-center position of the tool is away from the center position of axis 4, the speed and/or acceleration must be lowered as deemed appropriate.		
Note 6)	If the tool exceeds the permissible diameter, it will contact the robot inside the robot's range of movement. (Fig. 4)		
Note 7)	To enable the alarm LED indicator, the user must provide a circuit that supplies 24 VDC to the LED terminal in the user connector in response to the controller I/O output signal, etc.		
Note 8)	Push force when driver card parameter No. 38, "Push torque limit during positioning" is set to 70%.		
Note 9)	Push force when driver card parameter No. 38, "Push torque limit during positioning" is set to 50%. Although this parameter can be set to a desired value from 15 to 70%, push force will not stabilize if the set value is outside the range of 50 to 70%.		
Note 10)	When the suction rate is 90 NI/min (-2025 mmAq).		
<div><div><p>Top position</p><p>Tool</p><p>(Fig. 1)</p></div><div><p>Bottom position</p><p>Tool</p><p>(Fig. 2)</p></div><div><p>Center of rotational axis</p><p>Tool</p><p>Tool's center of gravity</p><p>17.5</p><p>(Fig. 3)</p></div><div><p>Center of rotational axis</p><p>Tool</p><p>35</p><p>(Fig. 4)</p></div></div>			

8. Installation Environment and Storage Environment

8.1 Installation Environment

Install the robot in an environment that satisfies the following conditions:

- Away from direct sunlight
- Not subject to radiated heat from a high-capacity energy source such as a heat-treating furnace
- Surrounding air temperature: 0°C to 40°C
- Humidity: 85% or less (non-condensing)
- Not exposed to corrosive or flammable gases
- Not subject to impact or vibration
- Not exposed to a significant amount of electromagnetic waves, ultraviolet rays or radiation
- Sufficient space is available to ensure safety in teaching and maintenance/inspection operations

Generally, the robot must be installed where the operator need not wear protective gear in order to work.

8.2 Installation Platform

The platform on which to install the robot receives a significant reactive force. Be certain the platform has sufficient rigidity to withstand the anticipated force.

- The surface on which the robot is fixed must have a thickness of 8 mm or more.
The levelness of the robot installation surface must be at least ± 0.05 mm.
- Machine tapped holes of the size shown in the table below in the mounting surface of the platform.

Model number	Tapping size	Remarks
IX-NNN1205/1505/1805 IX-NNC1205/1505/1805	M3 or M4	M3: The effective thread shall be 3 mm or more (for steel, or 6 mm or more for aluminum). M4: The effective thread shall be 4 mm or more (for steel, or 8 mm or more for aluminum).

- The platform must have sufficient rigidity to withstand not only the weight of the robot but also the dynamic moment of inertia that is generated when the robot is operated at maximum speed.
- Secure the platform to the floor or other rigid structure in a manner that prevents any movement due to operation of the robot.
- The installation platform must allow the robot to be mounted on a level surface.

8.3 Storage/Preservation Environment

The storage/preservation environment conforms to the installation environment. If the robot is to be stored/preserved for a prolonged period of time, be sure the robot will not be exposed to dew condensation. Unless otherwise specified, desiccant is not placed in the carton when shipped. If the robot is to be stored/preserved in an environment subject to condensation, provide preventive measures from over the carton or directly to the robot after unpacking.

The maximum storage/preservation temperature is 60°C for a short storage period. If the robot is to be stored for more than a month, the temperature should not exceed 50°C.



Danger



Warning

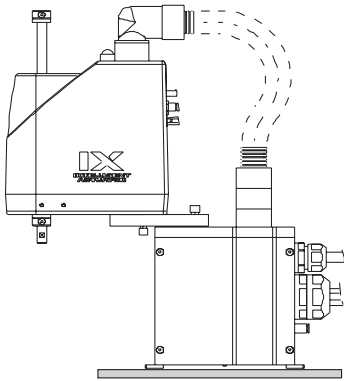
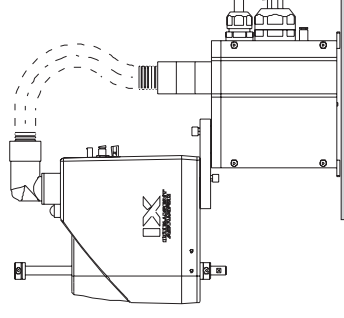
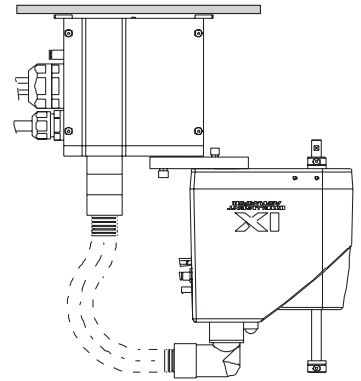
- Failure to provide a proper environment for installation and storage/preservation may shorten the service life of the robot, reduce its operation precision, or cause a malfunction or failure.
- Never use the robot in a flammable atmosphere. The robot may explode or ignite.

9. How to Install

Shown below is how to install SCARA Robot.

9.1 Installation Posture

○ : Available × : Not available △ : Please contact us.

Horizontally Oriented Mount	Wall-Mount	Ceiling-Mount
		
○	×	△

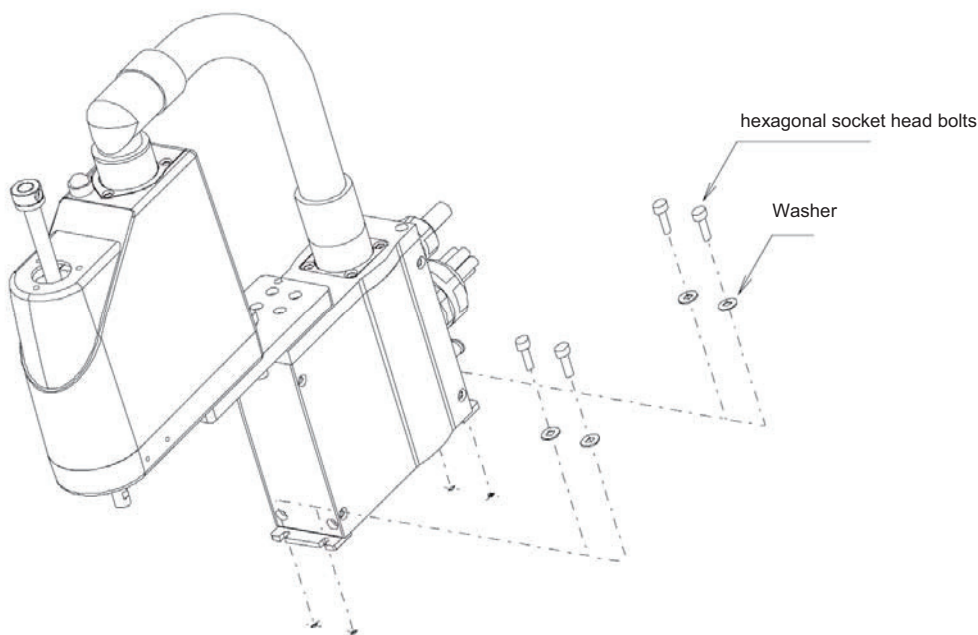
9.2 Installing the Robot

Install the robot horizontally.

Use four M3 or M4 hexagonal socket head bolts and washers to securely affix the robot.

Model number	Bolt size	Tightening torque	Remarks
IX-NNN1205/1505/1805	M3	0.81 N·m	Be sure to use a flat washer (outer diameter $\varnothing 7$, inner diameter $\varnothing 3.2$, $t = 0.5$).
IX-NNC1205/1505/1805	M4	1.41 N·m	If the bolt size is M4, use of a flat washer causes the washer to project from the reference surface. Use a flat washer only when doing so does not affect your specific purpose of use.

For the hexagonal socket head bolts, use high-strength bolts of ISO10.9 or higher.



Warning



Caution

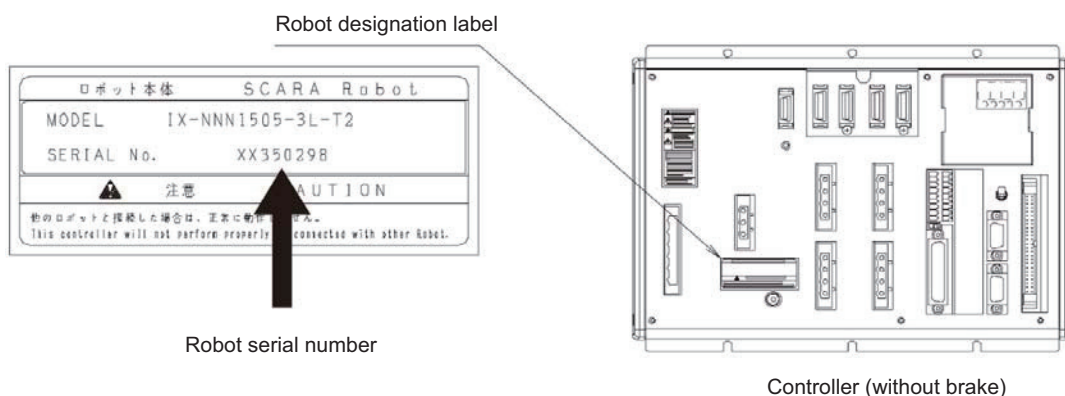
- Be sure to use washers. If not, the bearing surface may cave in.
- Tighten the hexagonal socket head bolts securely to the correct torque. If not, precision may drop and in the worst case the robot may topple and cause an accident.

10. Connecting the Controller

The controller connection cables are attached on the robot (standard cable: 3 m).

Pay attention to the following items when connecting the controller:

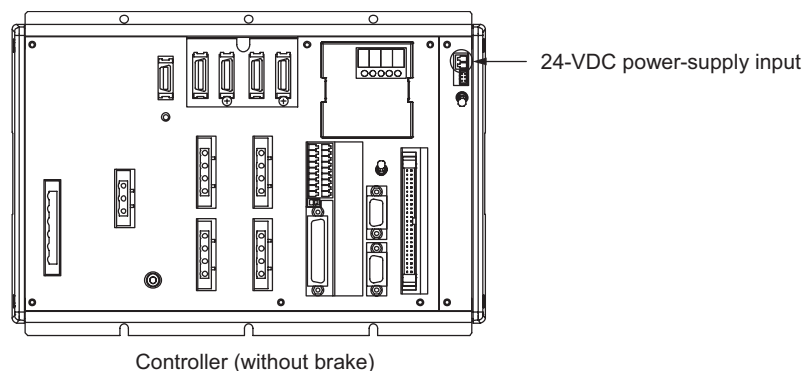
- Connect to the robot of the serial number specified on the robot designation label provided on the front panel of the controller.



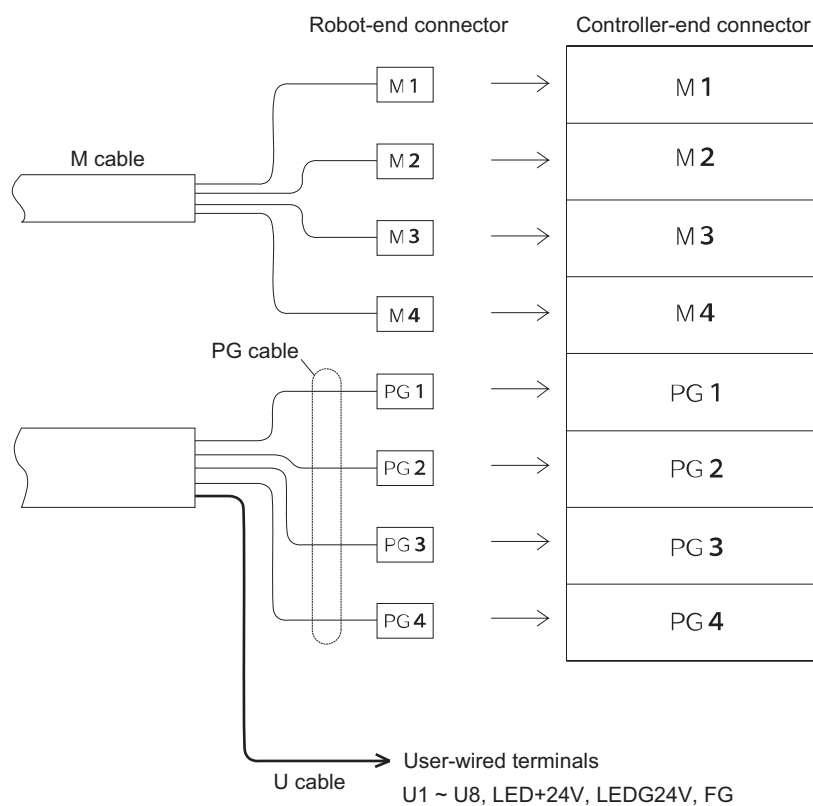
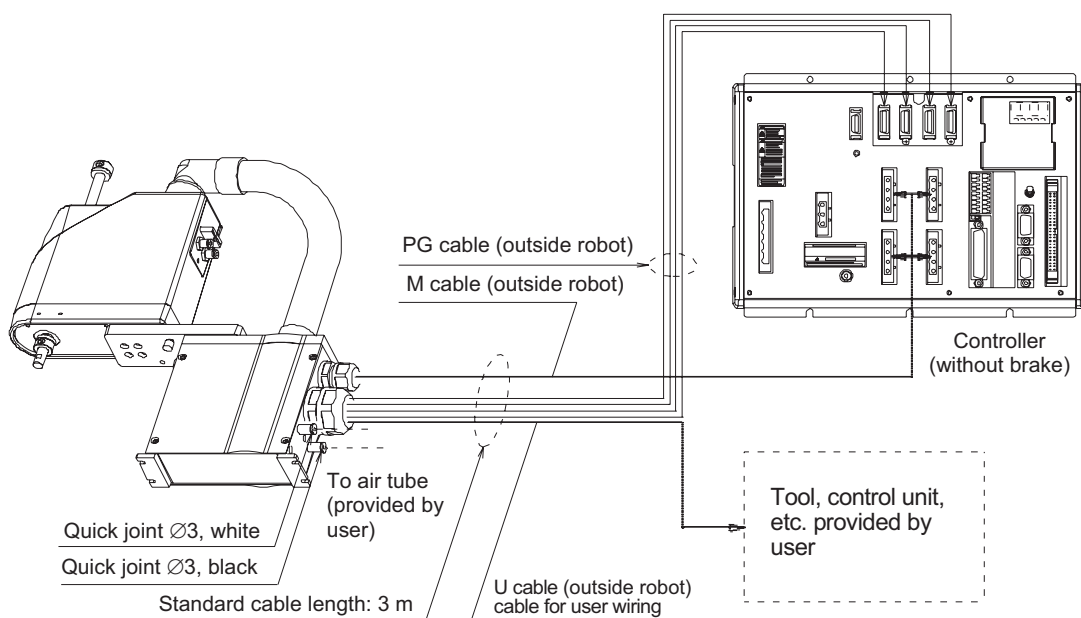
Warning

- Be sure to connect to the robot of the serial number specified on the front panel of the controller. The controller will not operate properly if any other robot is connected. Failure to observe this warning may cause the robot to malfunction, resulting in a serious accident.
- Before connecting or disconnecting a cable, always turn off the power to the controller. Connecting/disconnecting a cable with the power supplied to the controller may cause the robot to malfunction, resulting in a serious accident.
- Installing the connectors into the wrong sockets may cause the robot to malfunction. Be sure to check the designation on the cable with that on the controller panel before plugging in any connector.
- If the connectors are not inserted securely, the robot may malfunction and generate the risk of danger. Be sure to affix each connector with the supplied screws.

- Connect the cables securely after confirming that they are free from damage or bent connector pins.
 - Connect each cable by aligning the indication on the marking tube on the cable with the indication on the controller panel.
 - When installing the PG connector (D-sub connector), ensure correct orientation of the connector.
 - In the case of a controller with brake, provide a dedicated DC power supply for the brake. Do not use the I/O power supply or power supply for secondary circuit.
- This power supply must have an output voltage of 24 VDC \pm 10% and capacity of approx. 5 W.



Refer to the operation manuals for the controller and PC software for the procedures to connect the I/O cable, controller power cable, PC connection cable, etc.





Warning

- Before connecting or disconnecting a cable, always turn off the power to the controller. Connecting/disconnecting a cable with the power supplied to the controller may cause the robot to malfunction, resulting in a serious accident.
- Installing the connectors into the wrong sockets may cause the robot to malfunction. Be sure to check the designation on the cable with that on the controller panel before plugging in any connector.
- If the connectors are not inserted securely, the robot may malfunction and generate the risk of danger. Be sure to affix each connector with the supplied screws.

11. Checking after Installation

Once the robot has been installed, check the following items:

- Visually check the robot, controller and cables for dents and other abnormalities.
- Confirm that the cables are connected properly and that the connectors are inserted securely.



Warning

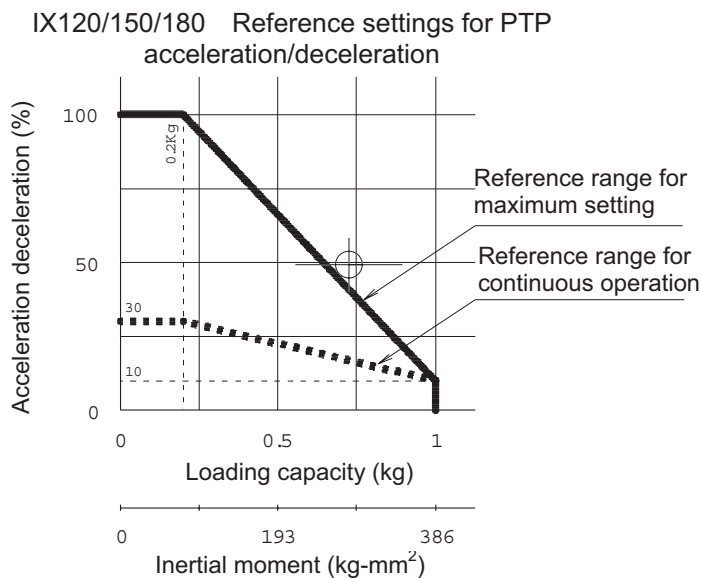
- Failure to perform these checks may result in a malfunctioning robot or a damaged controller or robot.

12. Precautions for Use

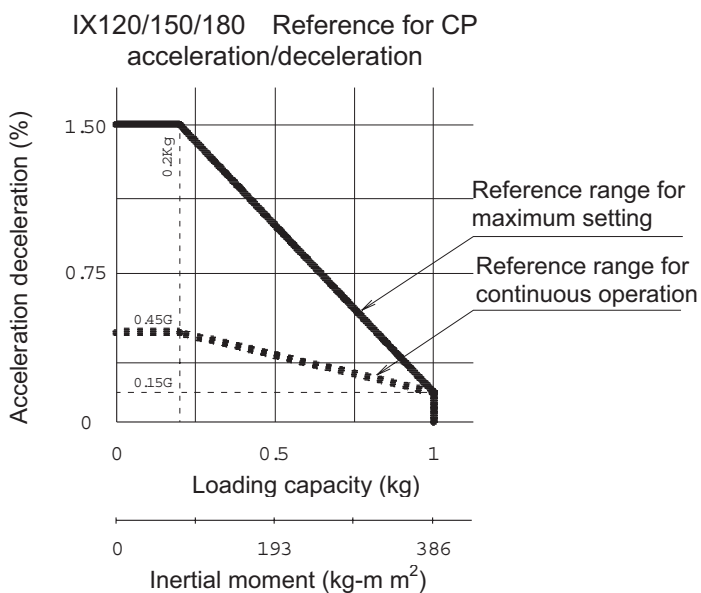
12.1 Reference Settings for Acceleration/Deceleration

Set the acceleration/deceleration by referring to the graphs below.

- (1) PTP operation (Setting the acceleration/deceleration using the SEL commands ACCS/DCLS languages)



- (2) CP operation (Set using the SEL language commands ACC and DCL.)



Maximum speed of CP operation IX120: 300 mm/sec
 IX150/180: 500mm/sec



Caution

- To operate the robot at the maximum acceleration/deceleration, provide a stopping period of 3 seconds or more after each acceleration/deceleration.
- If arm 1 operates by 125 degrees or more, use the reference settings for acceleration/deceleration during continuous operation as the reference settings for maximum acceleration/deceleration. Also, set to 1/3 of that value as the reference settings for continuous operation.
- Start from the appropriate reference setting for acceleration/deceleration during continuous operation, and then gradually raise the value for the purpose of adjustment.
- If an overload error occurs, lower the acceleration/deceleration setting as appropriate or provide an appropriate stopping time following each acceleration/deceleration.
- Depending on the position of the vertical axis, the robot may generate vibration when axis 1, axis 2 or the rotational axis turns. If vibration occurs, lower the acceleration/deceleration as appropriate.
- To move the robot horizontally at high speed, keep the vertical axis as close as possible to the top position. If the vertical axis is operated at the bottom position, the spline shaft for the ball screw will bend and the vertical axis will be disabled.
- Keep the inertial moment of axis 4 to the allowable value or less. (Refer to 12.3, "Carrying Load.")
- The carrying load refers to the load at the center of rotation of axis 4.
- Operate the robot by using an appropriate acceleration/deceleration coefficient as determined by the mass of the end. Failure to do so may cause the drive part to wear prematurely or may result in damage or vibration.

12.2 Tools

The tool mounting part must have sufficient strength and rigidity, along with adequate fastening power to prevent positional shift.

It is recommended that a tool be installed over a split ring, span ring or other appropriate part. A sample configuration of tool installation is given below.

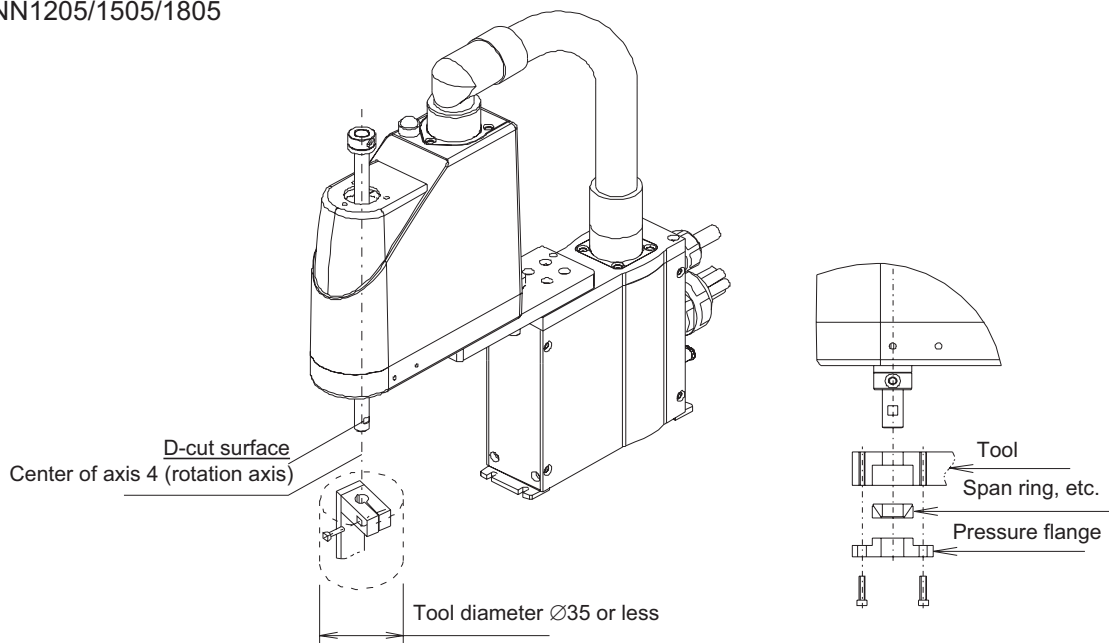
If the tool diameter exceeds 35 mm, the tool will interfere with the robot within the robot's operation area. If the tool diameter exceeds 35 mm or the tool interferes with peripheral equipment, decrease the soft limit to reduce the operation area.

Keep the inertial moment of the tool and load at $386 \text{ kg}\cdot\text{m}^2$ or less.

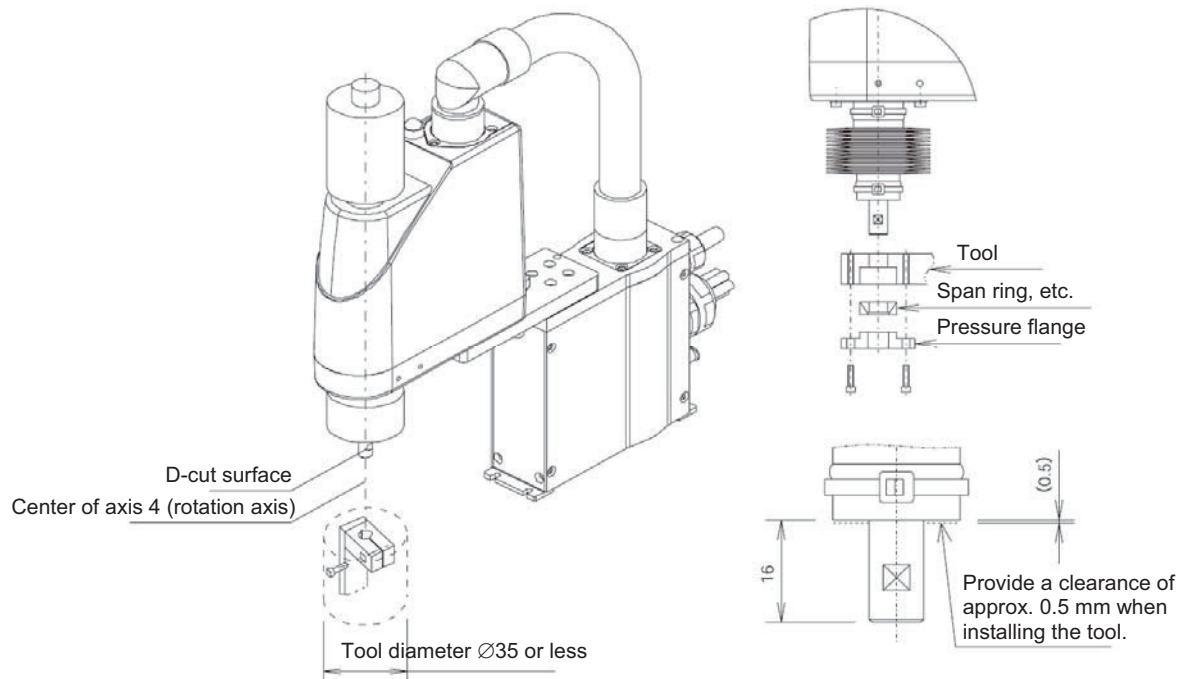
Use the D-cut surface at the end of axis 4 (rotational axis) to adjust the position (direction) of axis 4. To set the rotating direction using the D-cut surface and setscrews, be sure to use setscrews with resin or brass pad or set pieces made of soft material.

(Avoid attachment of the tool at the D-cut surface via thread fastening. Doing so may damage the D-cut positioning surface.)

IX-NNN1205/1505/1805



IX-NNC1205/1505/1805



Warning



Caution

- Turn off the power to the controller and robot before installing a tool.
- If the tool mounting part does not have sufficient strength, it may break while the robot is operating and cause the tool to detach and fly off.
- If the tool diameter exceeds 35 mm, the tool will interfere with the robot within the robot's operation area. Decrease the soft limit to reduce the operation area.
- Avoid attachment of the tool at the D-cut surface via thread fastening. Doing so may damage the D-cut positioning surface.

12.3 Carrying Load

Loading capacity

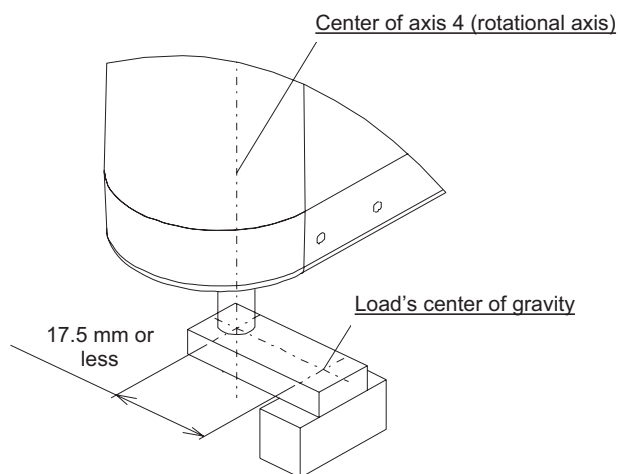
Model number	Rated loading capacity	Maximum loading capacity
IX-NNN1205/1505/1805 IX-NNC1205/1505/1813	0.2 kg	1.0 kg

Load's permissible moment of inertia

Model number	Permissible moment of inertia	
	Rated	Maximum
IX-NNN1205/1505/1805 IX-NNC1205/1505/1813	96.5 kg-mm ²	386 kg-mm ²

Load offset (from the center of axis 4 (rotational axis))

17.5 mm or less



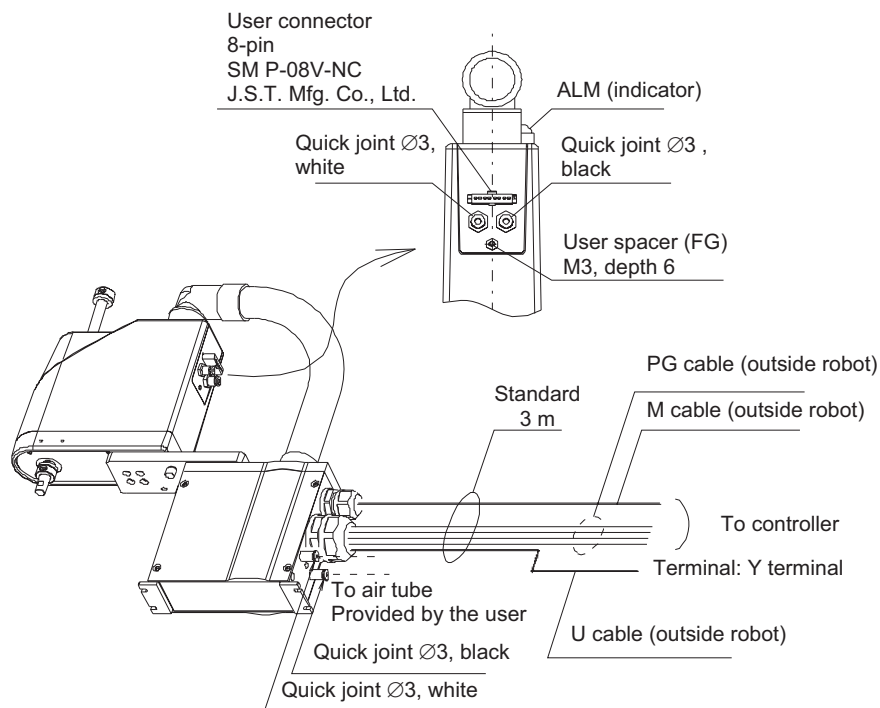
Caution

- Set appropriate acceleration/deceleration according to the mass of the end and moment of inertia. Failure to do so may cause the drive part to wear prematurely or may result in damage or vibration.
- If vibration occurs, lower the acceleration/deceleration as appropriate.
- If the load gets offset, the robot becomes more likely to cause vibration. Design the tools so that the load's center of gravity aligns with the center of axis 4.
- Do not move the robot horizontally with axis 3 (vertical axis) extended. It may cause the vertical axis to bend and disable the axis. To move the robot horizontally with axis 3 extended, adjust the speed and acceleration/deceleration as appropriate.

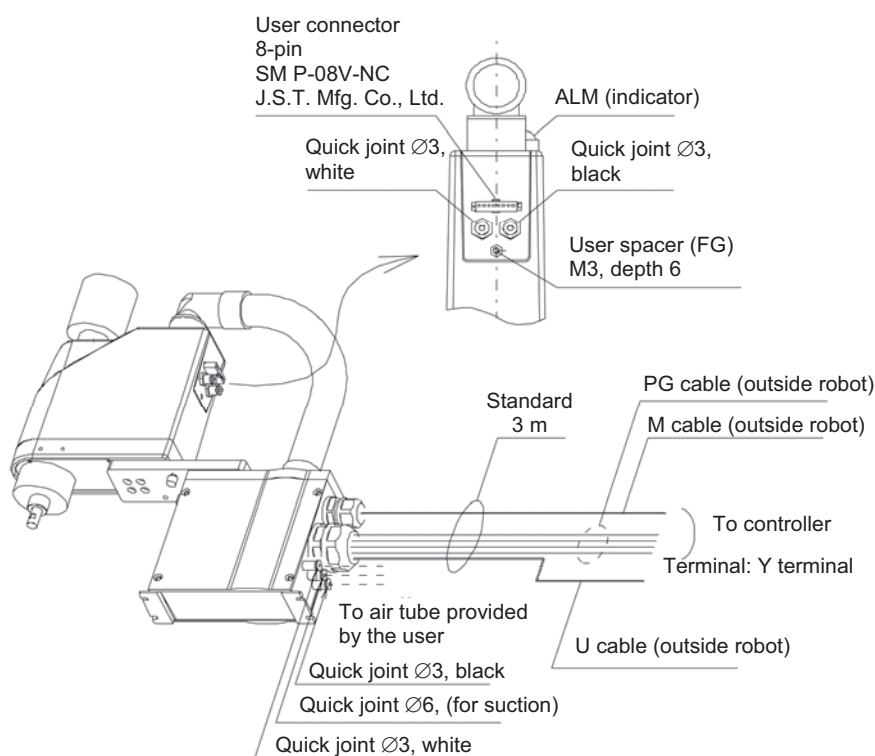
12.4 User Wiring and Piping

The IX-NNN1205/1505/1805 and IX-NNC1205/1505/1805 robots come with standard cables and air tubes that the user can use in a desired wiring/piping configuration. The available cables and air tubes are shown in the table below.

IX-NNC1205/1505/1805



IX-NNC1205/1505/1805



User connector specifications

Rated voltage	30 V
Permissible current	1.1 A
Conductor size and number of wires	AWG 26 (0.15 mm ²), 8 wires (U1 to U8)
Other	Shielded

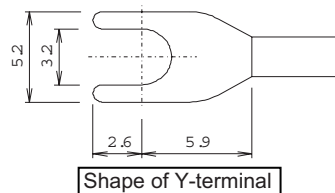
Piping specifications

Normal service pressure	0.7 MPa
Dimensions (outer diameter x inner diameter) and number of tubes	Ø3 mm x Ø2 mm, 2 pieces
Working medium	Air

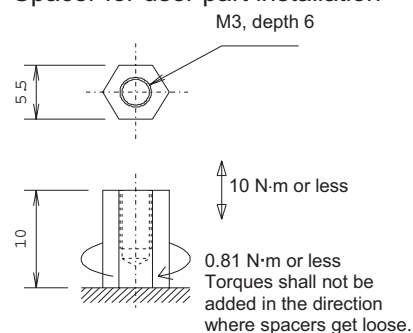
ALM (indicator) specifications

Rated voltage	24 VDC
Rated current	12 mA
Illumination color	Red LED

Shape of Y-terminal



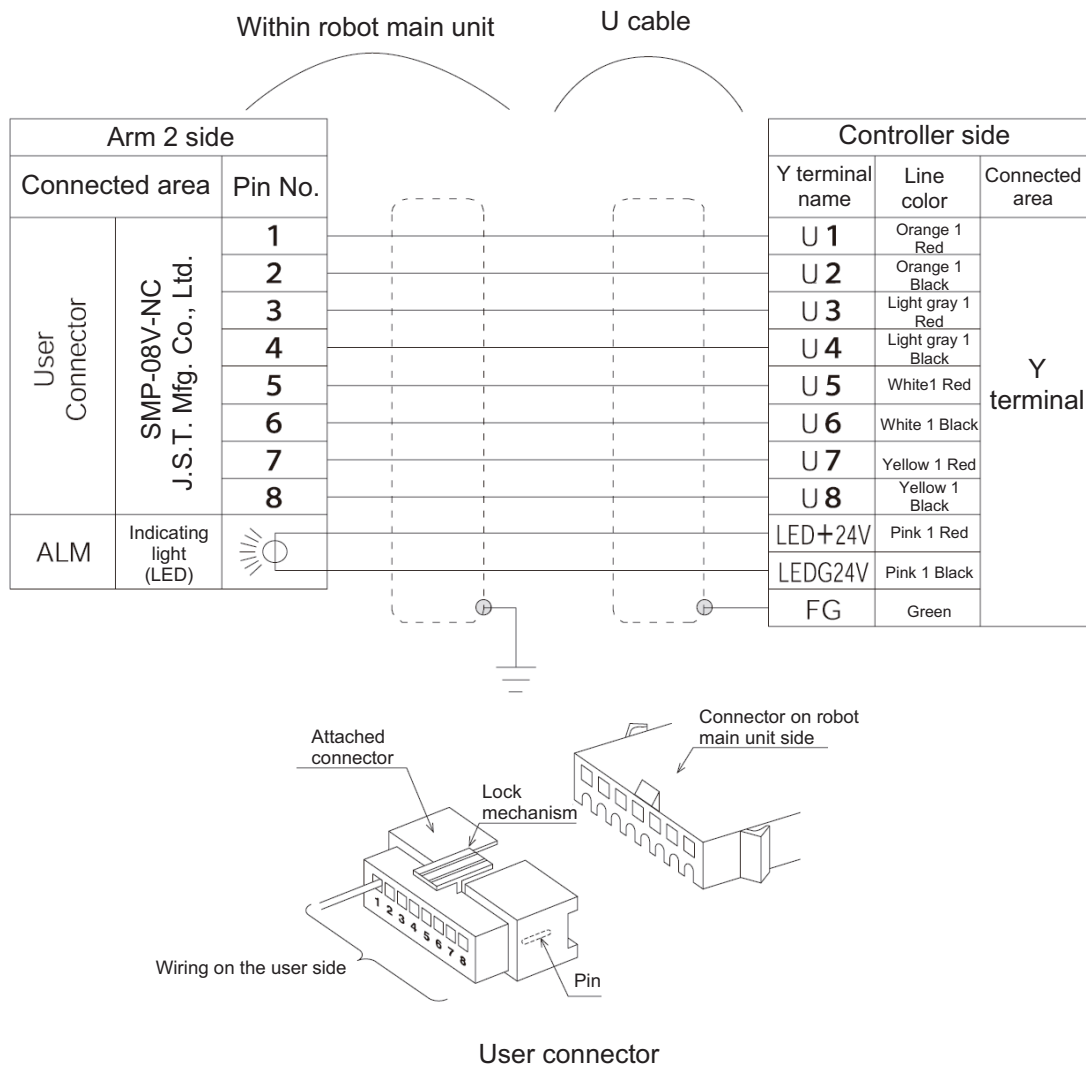
Spacer for user part installation



Receptacle housing SMR-08V-N (1) and pin contact BYM-001T-P0.6 (10) for the mating side of user connectors is provided (made by JST).

Press fit cables provided by the customer on the pin contact and insert them to the receptacle housing and connect to the user connector. Note that manual crimping tool YC-121R (made by JST) is required to press fit to the pin contact. The crimping task must be performed by an operator with required techniques according to the procedure recommended by the manufacturer. In order to turn ALM (indicating light) on, the customer must assemble a circuit from I/O outputs of controller, etc.

Table of user wiring connection



Warning

- Turn the controller power supply and device power supply off and shut air supply off when performing wiring and piping tasks. Otherwise, the robot may malfunction, which is risky.
- Use wires and pipes conforming to the specifications. Otherwise, cables may be heated to cause fire, current leakage, air leakage, and other dangers.

12.5 Suction Rate of Clean Room Specification IX-NNC 1205/1505/1805

Cleanness of class 10 can be achieved when air is suctioned at the specified rate from the quick suction joint provided on the base/rear panel.

- The user must provide the suction device and air tube for suction (Ø6).

Suction rate (NR/min)
90


Quick suction joint
(Applicable tube: Outer diameter
Ø6, inner diameter Ø4)



Caution

- The clean room must have a down-flow environment.
- Cleanness class 10 corresponds to the particle size of 0.1µm.
- Dust will be raised if suction is not provided.

13. Maintenance and Inspection

-  **Warning:** Do not attempt to disassemble or cut the cable of the following items. By doing so, recovery to normal condition cannot be done, and it may cause a critical accident such as error operation, fire or malfunction.
- Disassembly of the servo motor
 - Disassembly of the ball reduction gear
 - Disassembly of the ball screw and spline shaft
 - Disassembly of the bearing
 - Disassembly of the harmonic speed reducer
 - Disassembly of the brake
 - Cutting of the cable

13.1 Inspection Items and Periods

Have daily inspections and regular inspections to use the robot in a stable condition for a long term. Make sure to follow the caution for maintenance and inspection in Safety Guide.

[1] Daily Maintenance Inspections

Have a maintenance and inspection for those described below before starting up in everyday operation, and if any problem is found, have an appropriate treatment.

Maintenance Inspection Area	Maintenance Inspection Details
Safety Cage	Correct the deformation or positional shift of the cage. Confirm that the interlock mechanism is operating properly.
Appearance of Robot	Check the exterior for abnormality, flaws, dents, etc. (If the robot has flaws or other abnormalities, please contact IAI.)
Operation of Robot	Check for abnormal operation, vibration or noise
Cables	Check for damage and pinch of cables Check the cable mounting parts for looseness.
Emergency-Stop Switch	Confirm that the emergency-stop switch functions properly.

[2] Half a Year Maintenance Inspection

Have a maintenance and inspection for the following items once in half a year (every 6 months). If the robot main body has flaws or other abnormalities, please contact IAI.

Maintenance Inspection Area	Maintenance Inspection Details
Robot Main Body	Check for any looseness of the attachment bolts on the robot body and play on cover related components. (Tighten if any loosened bolt is found.)
Ball Spline	Supply grease to ball screw and ball splined. <ul style="list-style-type: none"> • Other Types than Dustproof/Splash proof type and Clean type: Multemp LRL No. 3 Grease by Kyodo Yushi or AFG Grease by THK • Dustproof/Splash proof type and Clean type: AFF Grease by THK [Refer to 13.2, "Ball Screw Spline Grease Supply".]
Connectors	Check the connectors for looseness.

[3] Yearly Maintenance Inspection

Have a maintenance and inspection for the following items every year.

Maintenance Inspection Area	Maintenance Inspection Details
Robot Main Body Arm Attachment Bolts	Check for any looseness of the bolts on the arm. (If any play is found on the arm attachment, tighten up the bolts.) [Refer to 13.3, "Check for Looseness of Arm Attachment Bolts".]

[4] 2.5 Years Maintenance Inspection

Have a maintenance and inspection for the following items once every 2.5 years.

If the robot main body has flaws or other abnormalities, please contact IAI.

Maintenance Inspection Area	Maintenance Inspection Details
Battery Replacement	Replace the absolute data backup battery. The battery life may vary depending on the condition and environment of the robot use, but it is approximately three years. It is recommended to have the battery replaced every 2.5 years. (Battery model code: AB-6, Quantity to use: 4 units) [Refer to 13.4, "Replacement of Absolute Backup Battery".]
Third Axis Belt	Check the third axis (vertical axis) timing belt surface for any defect or excessive wear. (Check it five years later from the operation start, and after that, check it every year). When any defect is found, the replacement of the timing belt is required. (If any defect is found, contact IAI). [Refer to 13.5, "Third Axis Timing Belt Visual Check".]

Note 1: In case the duty of the robot operation is high, or ambient temperature is high, supply the grease frequently (every year).

[5] 5 Years Maintenance Inspection

Have a maintenance and inspection for the following items once every 5 years.

After 5 years has passed, have a maintenance and inspection for the following items every year.

If the robot main body has flaws or other abnormalities, please contact IAI.

Maintenance Inspection Area	Maintenance Inspection Details
First axis and Second axis speed reducer Bearings on joints	Lost motion measurement If the lost motion value exceeds the allowable range, it is considered the end of life for speed reducer or bearing. It is necessary to have the unit disassembled for such work as replacement of the speed reducer. (Please contact IAI if any abnormality is found.) (Note) The life of the speed reducer may vary depending on the duration of operation, speed or load, but it is approximately five to seven years. [Refer to 13.6, "How to Measure Lost Motion".]
Forth Axis Belt	Check the forth axis (rotational axis) timing belt surface for any defect or excessive wear. (Check it five years later from the operation start, and after that, check it every year). When any defect is found, the replacement of the timing belt is required. [Refer to 13.7, "Forth Axis Timing Belt Visual Check".]

13.2 Ball Screw Spline Grease Supply


The Ball Screw Spline on the vertical axis require grease to be supplied.

13.2.1 Applicable Grease and Supply Period

Types	Grease to Apply		Supply Period
Other Types than Dustproof/Splash proof type and Clean type	Kyodo Yushi	Multemp LRL No. 3	Every half a year
Dustproof/Splash proof type and Clean type	THK	AFF	

For the types except for dust and rainproof type, the use of the following grease is also available.

Types	Grease to Apply		Supply Period
Other Types than Dustproof/Splash proof type and Clean type	THK	AFG	Every half a year

 **Caution:** Do not attempt to apply fluorine grease. When mixed with lithium grease or urea grease, not only decrease the grease characteristics, but also may damage the driving part.

13.2.2 Grease Supply

Tool necessary for work
Grease, Cloth

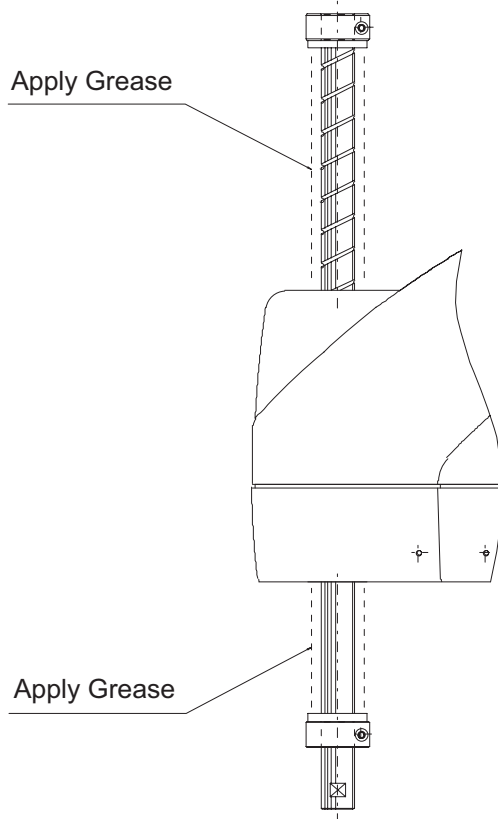
Procedure

- 1) Wipe old grease away from entire surface of the ball screw spline axis using a cloth.
- 2) Apply new grease on the entire surface of the ball screw spline axis.
- 3) Apply grease two or three times and after the grease application, move the ball screw spline up and down so that grease is spread smoothly all over the inside bearing.

[Apply grease]

Quantity
4 to 18 cc (4 to 7g)

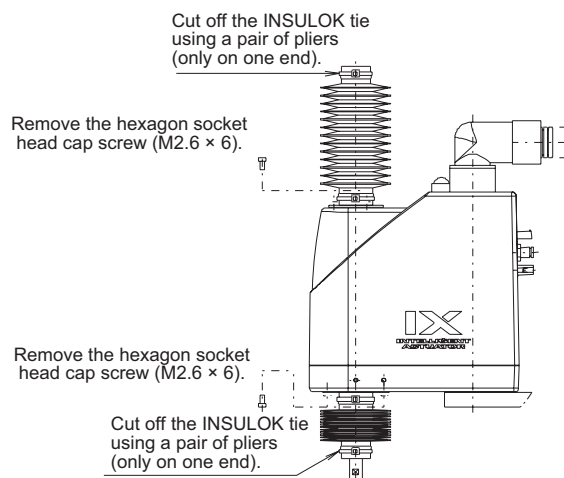
- 4) Wipe off excessive grease on the ball screw spline axis surface (to the extent that grease does not fly off when the spline axis is operated).



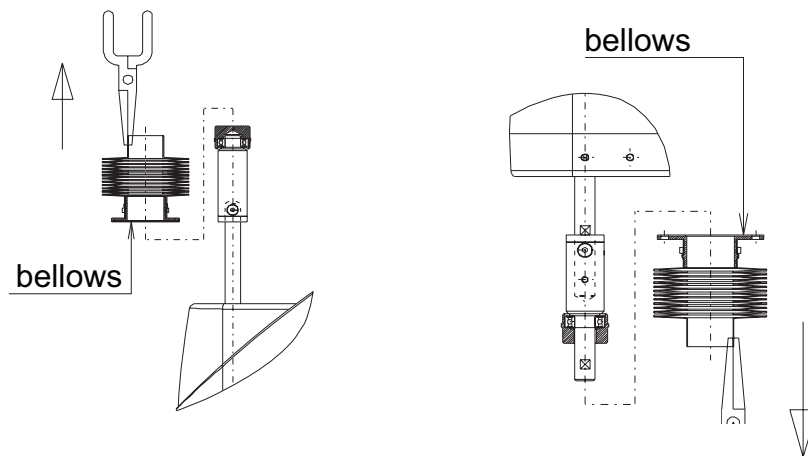
⚠ Caution: In case the grease got into your eye, immediately go see the doctor to get appropriate care. After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

In the case of the clean type, it is required to remove the bellows unit fixed on the arm 2 to expose the ball screw spline.

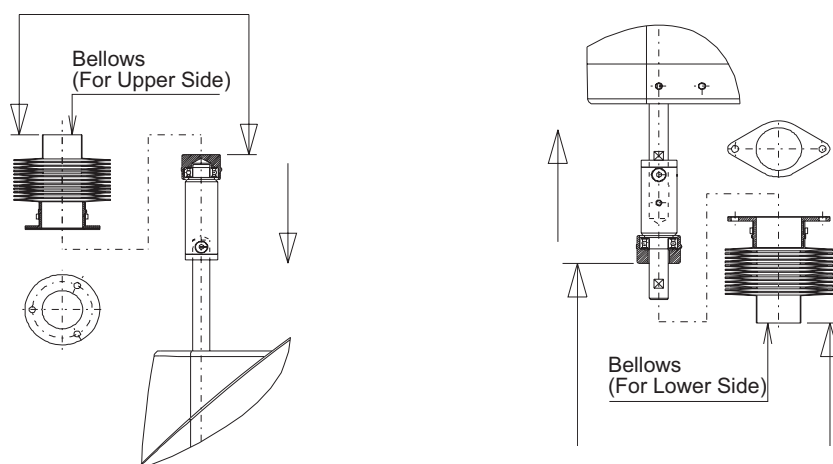
1) Cut off the INSULOK tie and remove the bellows set bolt.



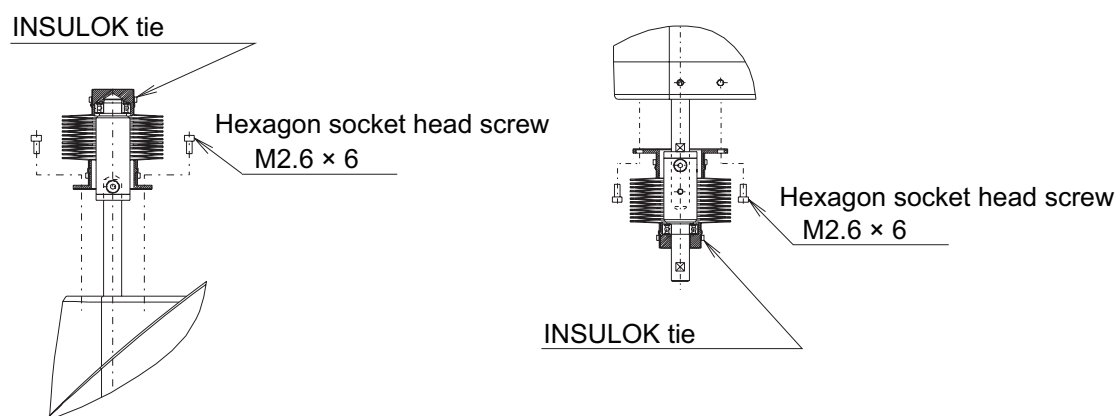
2) Pull the bellows with the needle nose pliers to remove.



(Note) When the bellows is to be attached, align the bellows and ball screw spline surface.



After the attachment of the bellows, fix it using the INSULOK tie.



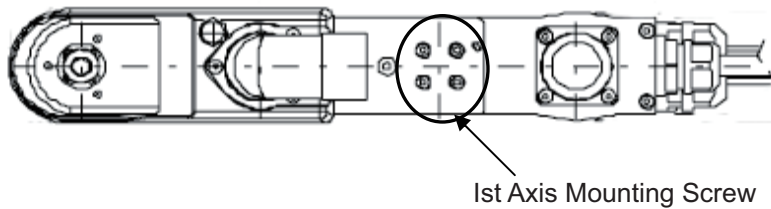
13.3 Check for Looseness of Arm Attachment Screws

Tool necessary for work
Hex wrench set

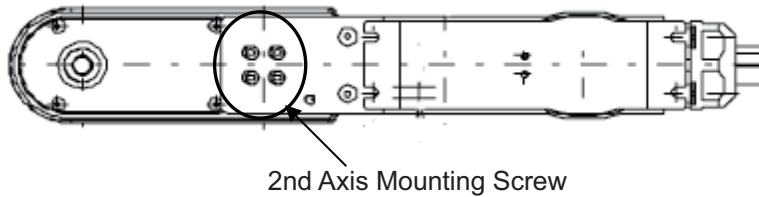
Procedure

- 1) Check for any looseness of the set screws for each axis using the hex wrench.
(Tighten if any loosened screw is found.)

View from the upper side



View from the lower side



Tightening Torque [N•m]		Remarks
1st axis	2nd axis	
0.9		1st axis: Hexagon socket-head screws M3 strength class A2-70 2nd axis: Hexagon socket-head screws M3 strength class A2-70

13.4 Replacement of Absolute Backup Battery

13.4.1 Preparation

The following items are required when replacing the batteries:

- Hexagonal wrench (size: 2 mm)
- New battery for IX 120/150/180: AB-6 (4)

Before replacing the batteries, turn off the power to the controller, control panel and other relevant units.



Warning

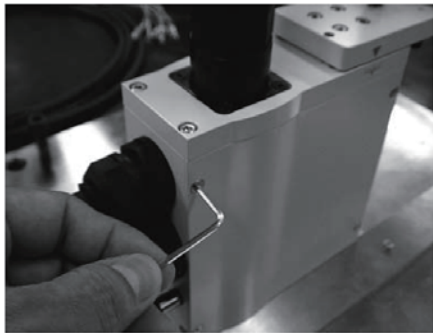


Caution

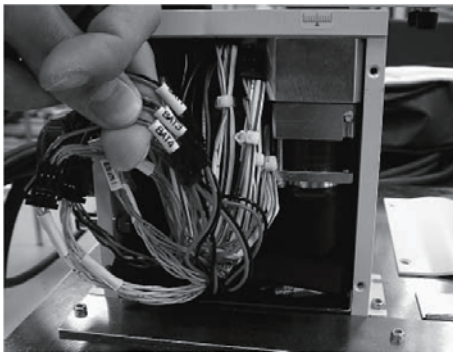
- Serious accidents resulting in injury and death may occur if you perform inspection or maintenance tasks without proper knowledge.
- Display “WORK IN PROGRESS” signs to prevent other operators from operating the controller, operation panel, etc.
- Use batteries dedicated to IX 120/150/180. Battery for old models (IH) IX250 to 800 must not be used.

13.4.2 Encoder Battery Replacement Procedure

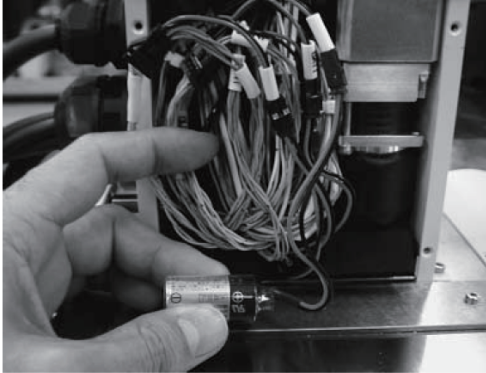
- (1) Remove the hexagonal countersunk head bolts (4 pcs) from the base and take out the cover (base).



- (2) Select the battery connector (BAT*) to be replaced.

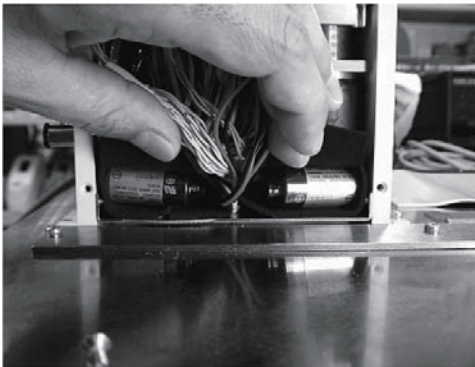


- (3) Unplug the BAT connector and connect a new battery.



- After removing each battery, set a new battery within 1 to 2 minutes (reference).
- If replacement takes a longer time, multi-rotation data will be cleared and an absolute reset will become necessary.
- Replace the batteries axis by axis. If all batteries are replaced at once, the replacement may not finish within the time limit.

- (4) Store the battery in the battery holder.



- (5) Secure the cover (base) using the hexagonal countersunk head bolts (4 pcs). (Tightening torque: 0.8 N·m)



Caution

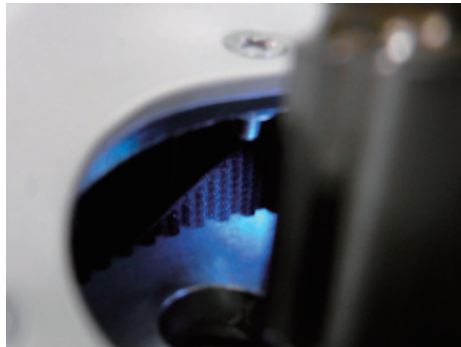
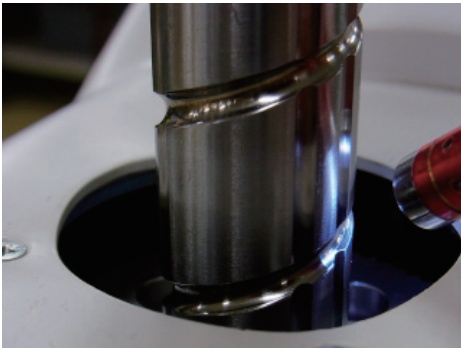
- When installing the cover (base), be careful not to pinch the internal wiring.

13.5 Third Axis Timing Belt Visual Check

Tool necessary for work
Penlight

Procedure

Check the timing belt surface using a penlight as shown in the pictures for any defect or excessive wear.



13.6 How to Measure Lost Motion

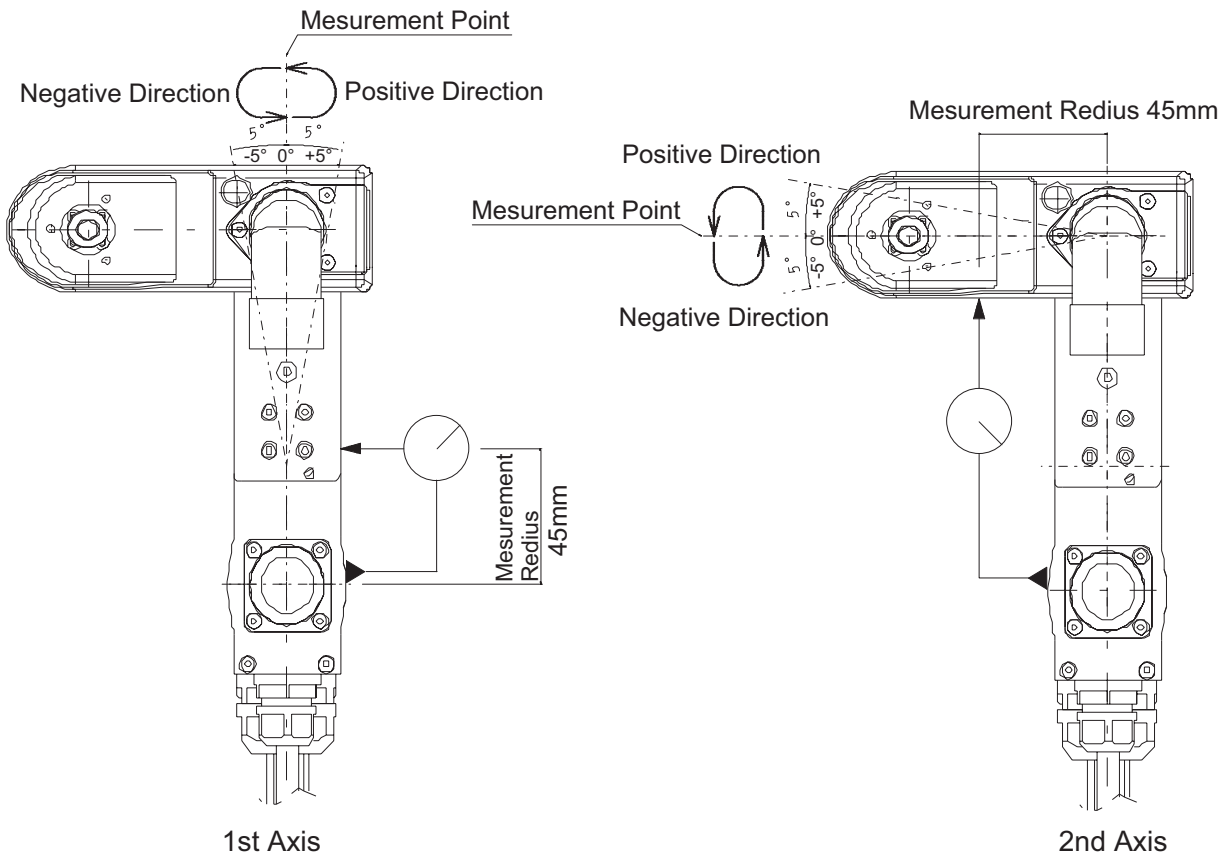
Tool necessary for work

Digimatic Indicator (Measurement range 10mm or more, minimum display 0.001mm) or equivalent acceptable

Magnet stand

Procedure

- 1) Create a position and a program to operate first Axis and second Axis in $\pm 5\text{deg}$ with PTP Operation.
 - 2) Take off the cover (on Arm 2) on one side and allocate the measurement equipment as shown in the figure below.
- Measurement Point: See figure below
 - Operation Command: PTP Operation (MOVP Command)
 - Operation Speed: 30%
 - Acceleration/Deceleration : 30%



- a. Move the axis from $+5\text{deg}$ towards 0deg , the measurement point, in the positive direction, and measure the position.
 - b. After moving from 0deg towards -5deg in the positive direction, move it from -5deg towards 0deg , the measurement point, in the negative direction, and measure the position.
 - c. In addition, after moving from 0deg towards $+5\text{deg}$ in the negative direction, move it from $+5\text{deg}$ towards 0deg , the measurement point, in the positive direction, and measure the position.
- Repeat the measurements of b and c for seven times in each positive and negative direction. The difference of the average of the measurement results is determined as the lost motion.



Example for Lost Motion Measurement

Number of Times	Positive Direction	Negative Direction
1	+0.003	-0.003
2	-0.003	+0.003
3	+0.003	+0.005
4	-0.003	-0.005
5	+0.003	-0.005
6	+0.003	-0.004
7	+0.003	-0.006
Average	+0.0013	-0.0021
Difference (mm)	$ +0.0013 - (-0.0021) = 0.0034$	
Measurement Radius (mm)	100	
Lost Motion (arc min)	$[\text{atan}(0.0034/100)] \times 60$ nearly equals 0.12	

How to decide

It is normal as long as the figured out values are below the allowable values shown in the table below.

Lost Motion Allowance

Lost Motion (arc min.)		Measurement Radius (mm)
1st axis	2nd axis	
2.6	4.0	45

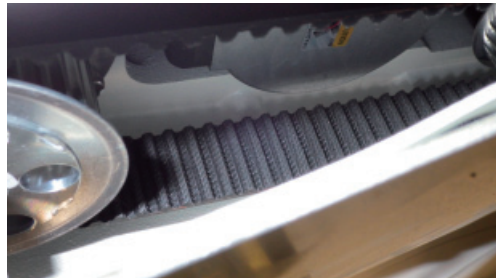
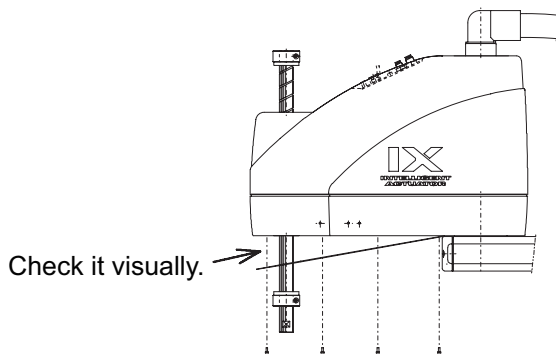
13.7 Forth Axis Timing Belt Visual Check

Tool necessary for work

Penlight, Hex Wrench Set, Phillips Screwdriver (M3 Flat-head screw)

Procedure

- 1) Move the up/down axis to the position of approximately 50mm.
- 2) Remove the set screw for the arm 2 lower cover.
- 3) Check the timing belt surface using a penlight for any defect or excessive wear.
- 4) Attach the cover.



13.8 Absolute Encoder Reset Method

13.8.1 Preparation for Absolute Reset

The following jigs are required to perform an absolute reset.

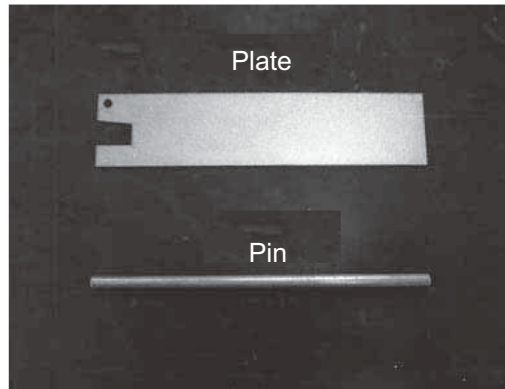
- Absolute reset adjustment jigs

Model number	Remarks
JG-5	For arm length 120/150/180

Connect the robot, controller and PC cables so that the robot/controller can be operated using the PC software. Be sure to check the EMG switch operation beforehand.

An absolute reset of the rotational and vertical axes requires absolute reset adjustment jigs, but jigs are not always required for an absolute reset of arms 1 and 2.

(A multi-rotation reset can be performed as long as the current position is within ± 1 graduation on the positioning mark sticker.)



Example of Absolute Reset Adjustment Jig (Model number JG-5)

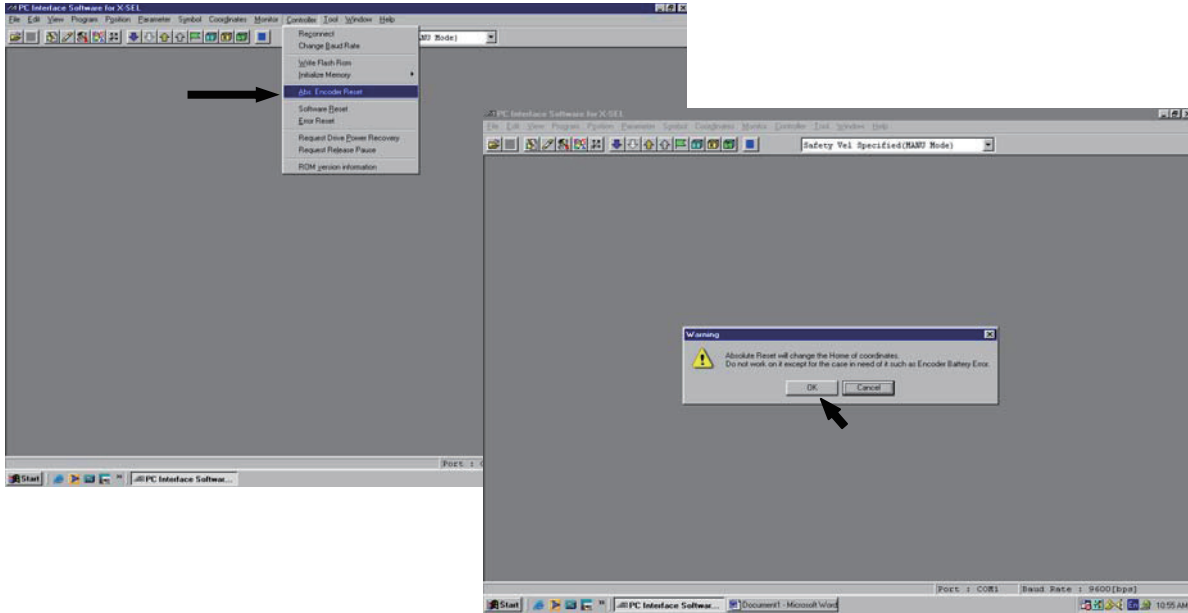


Warning

- Fully understand the applicable inspection/maintenance work, because failure to do so may result in a serious injury accident.
- Put up a "WORK IN PROGRESS" sign to prevent other operators from accidentally operating the controller, operation panel, etc. Remember to insert the seal washer

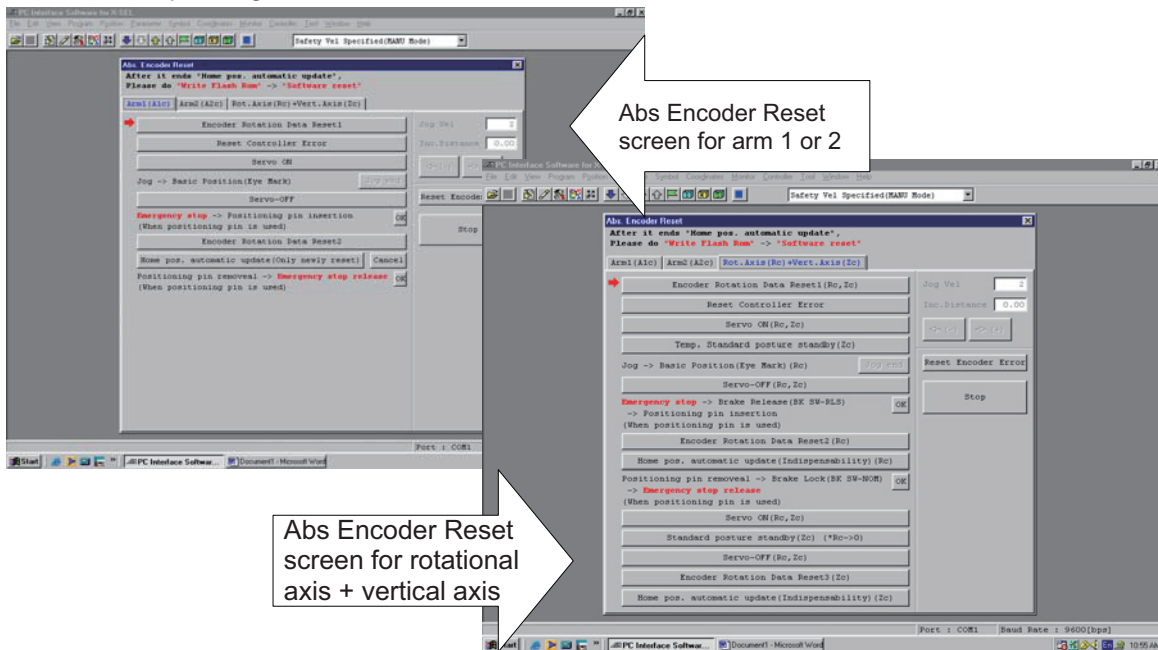
13.8.2 Starting the Absolute Reset Menu

- (1) Open the Abs Encoder Reset window from the PC software.
- (*) Select "Absolute Reset (SCARA Axis) (Y)" if you are using an X-SEL-PX/QX controller.



Starting Up Absolute Reset Window

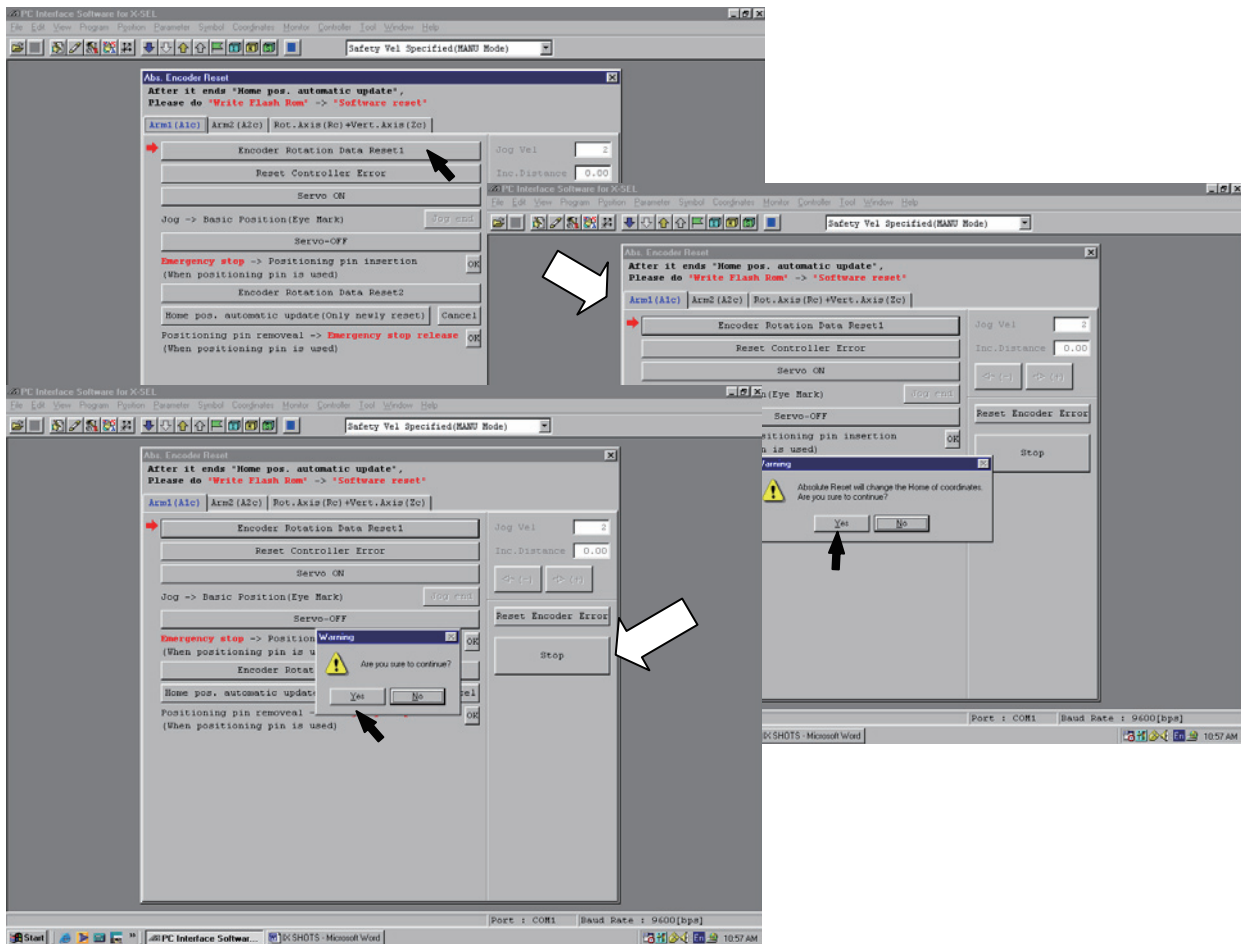
2. The Abs Encoder Reset window opens.
 - One of three absolute reset screens –for arm 1, arm 2 and rotational axis + vertical axis –is displayed when a corresponding tab is clicked.



Absolute Reset Window

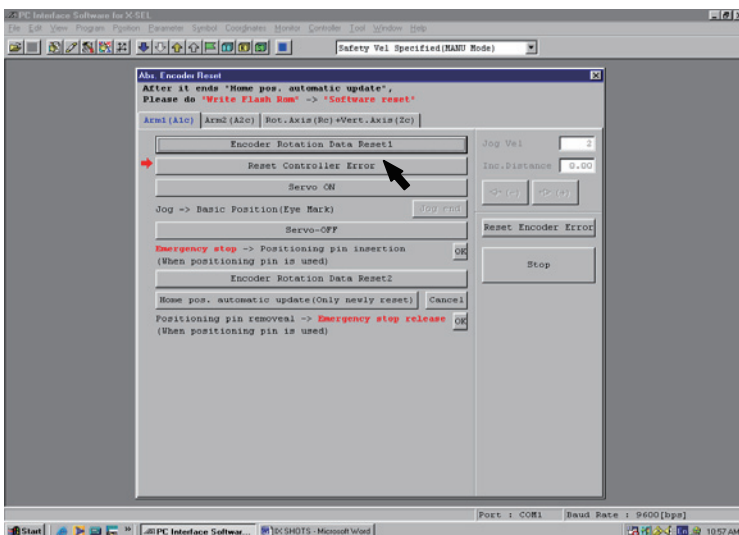
13.8.3 Absolute Reset Procedure for Arm 1 or 2

- (1) Click the “Encoder Rotation Data Reset1” button.



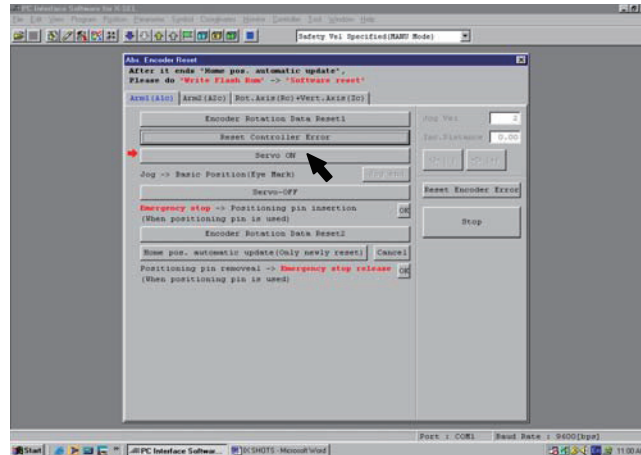
Encoder Multi-rotation Data Reset 1

- (2) Click the “Reset Controller Error” button.



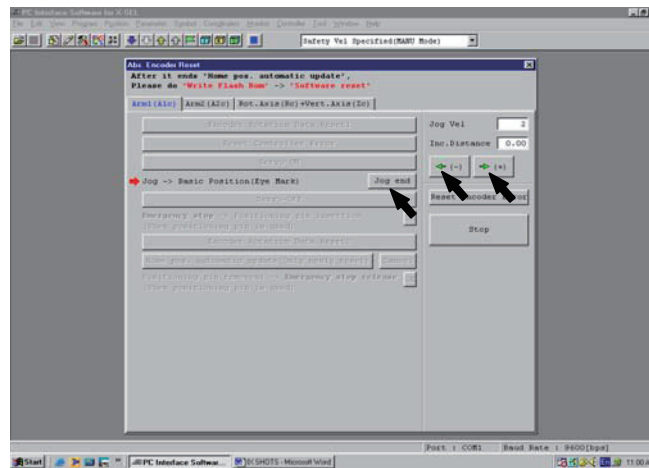
Controller Reset

- (3) Click the “Servo ON” button.



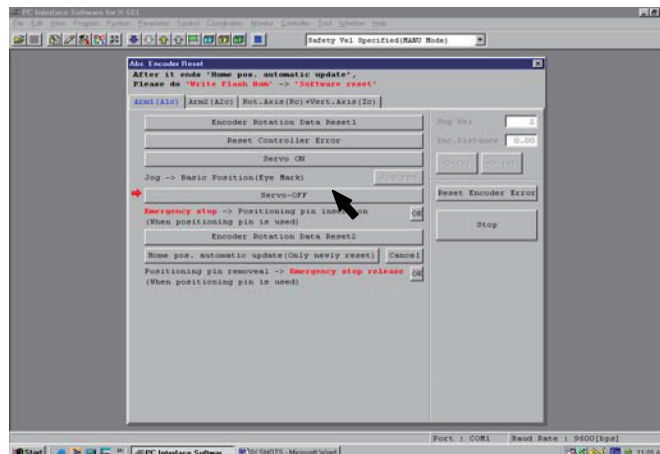
Servo ON

- (4) Jog the arm to near the reference position (see reference position drawing in step (7), and click the “Jog end” button.



Jogging

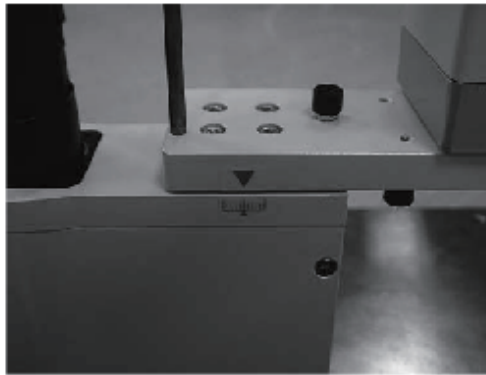
- (5) Click the “Servo-OFF” button.



Servo OFF



- (6) Press the emergency-stop switch.
- (7) When performing an absolute reset of arm 1, set the adjustment jig (pin) on arm 1 to secure the arm in its reference position. You can move arm 2 when securing arm 1. When performing an absolute reset of arm 2, set the adjustment jig (pin) on arm 2 to secure the arm in its reference position. You can move arm 1 when securing arm 2.
 - Set the jig after confirming that the emergency-stop switch is pressed.
 - Set the jig after adjusting the arm to the reference position, using the positioning mark label as a guide.
 - Arm 1 has a cover (not arm 2), which is fixed with setscrews. Remove the setscrews and detach the cover before setting the jig.
 - It is recommended that an adjustment jig be used to perform an absolute reset. With arm 1 or 2, however, rotation data can be reset as long as a positioning accuracy of “center of positioning mark label ± 1 graduation” is ensured.
 - For an absolute reset of arm 2 whose length is 120, rotate arm 1 straight to side according to the basic posture shown in the next page and set the jigs.



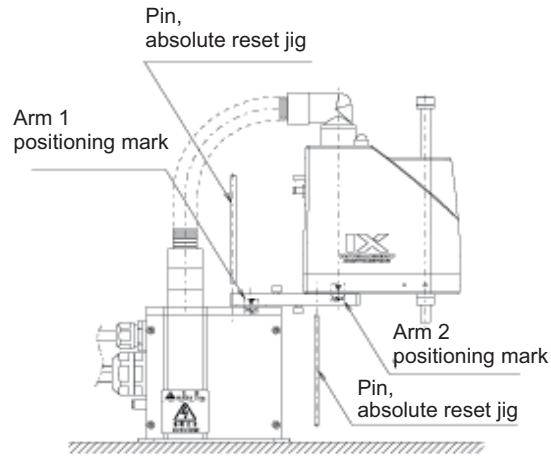
Arm 1 (arm length 120/150/180)



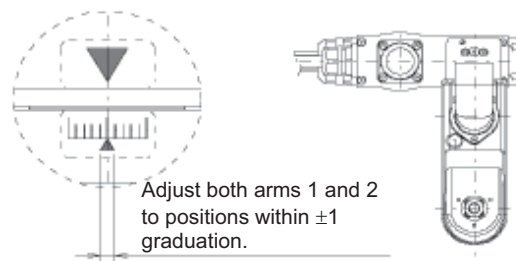
Arm 2 (arm length 150/180)



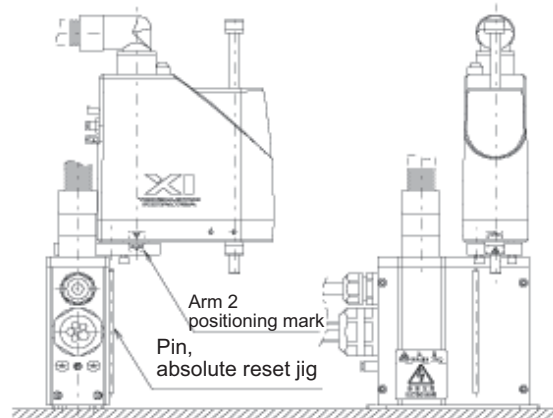
Arm 2 (arm length 120)



Reference Posture for Arm Length 120^{*1}/150/180
*1 Absolute reset of arm 1 whose length is 120



Adjust both arms 1 and 2
to positions within ± 1
graduation.



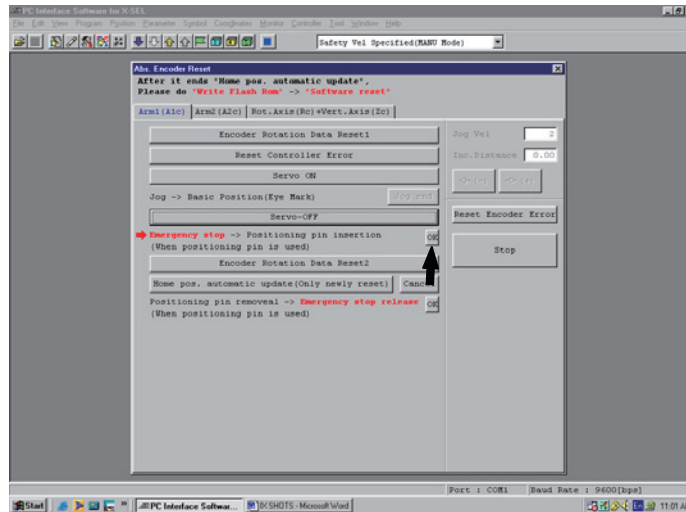
Reference Posture for Arm Length 120^{*2}
*2 Absolute reset of arm 2 whose length is 120



Warning

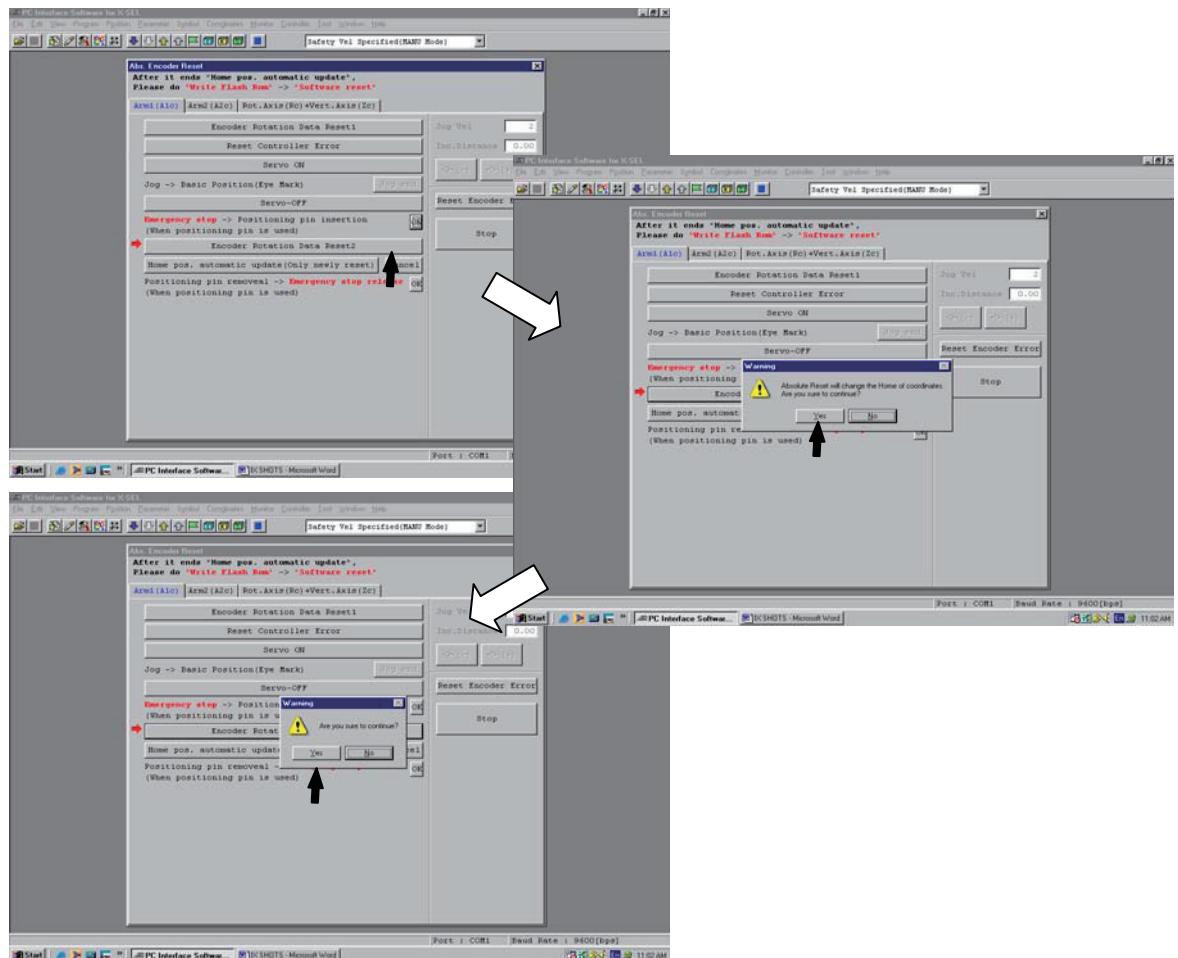
- Always press the emergency-stop switch before setting an adjustment jig. Failure to do so may cause the robot to malfunction and result in a serious accident.

(8) Click the “OK” button.



Confirmation

(9) Click the “Encoder Rotation Data Reset2” button.



Encoder Multi-rotation Data Reset 2

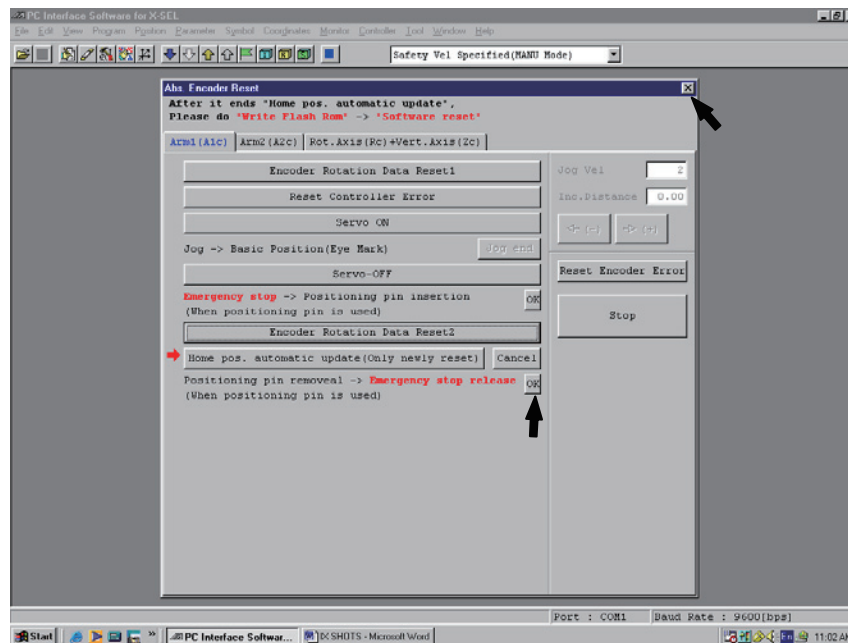
(10) Remove the adjustment jig.

- If you are working on arm 1, install the cover and secure it with the setscrews (not required for arm 2).

(11) Release the emergency-stop switch.

(12) Click the “OK” button.

- An arrow is shown next to the “Home pos. automatic update” button. Do not set this item. (In particular, be sure this item is not set when performing an absolute reset without using a jig).
- If the home position is updated automatically when a reset is performed without using an adjustment jig, the home position will become offset.
- If you have allowed the home preset value to be updated automatically by mistake, do not write the updated data to the flash ROM. Instead, perform a software reset. (After the software reset, the data will return to the original condition before the home preset value was automatically updated.)
- Always click the “OK” button after removing the jig and releasing the emergency-stop switch.



Confirmation

(13) Click “X” in the top right-hand corner to exit the absolute reset window.

- Once the absolute reset is complete, be sure to reset the software.

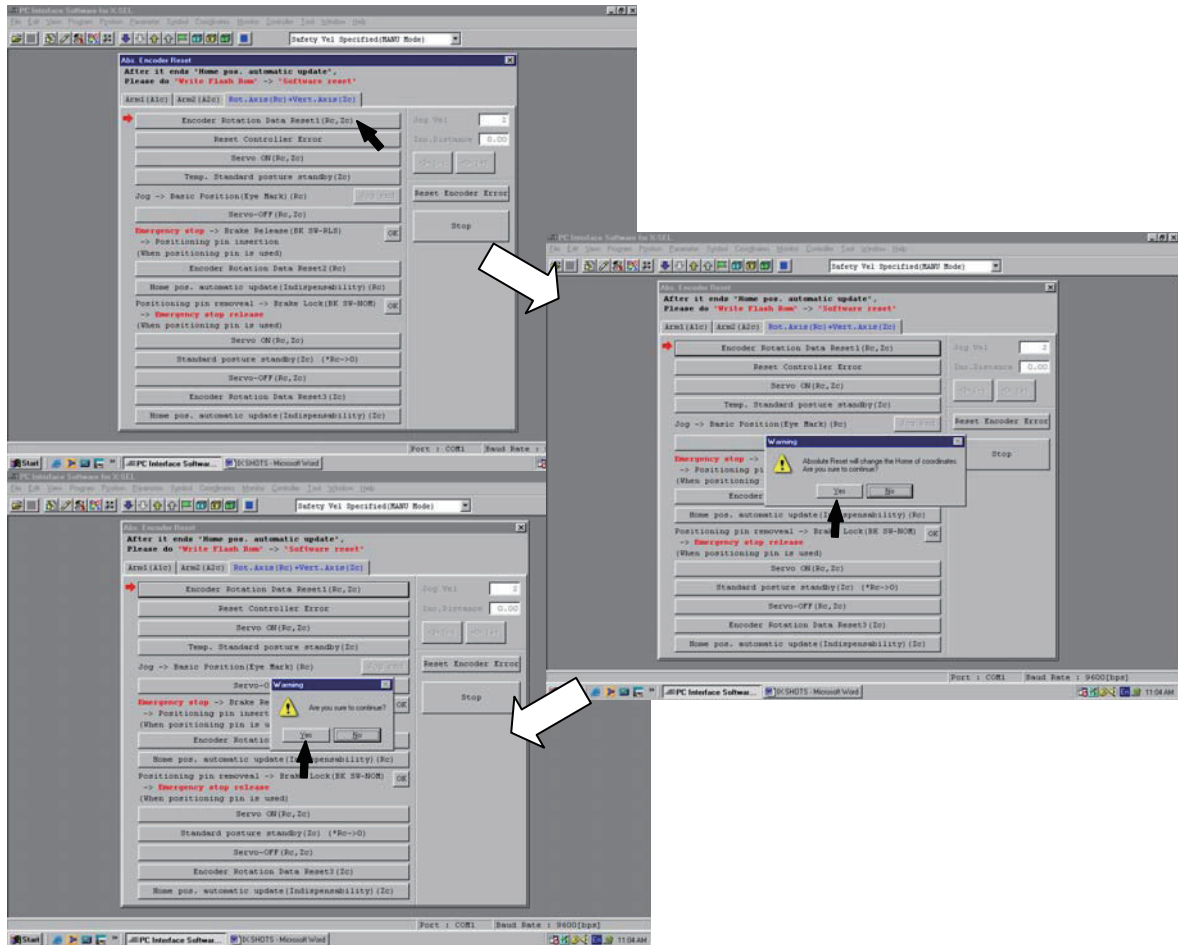


Caution

- Be careful not to perform a reset using an incorrect sequence, since it may cause the arm position to become offset.
- Update the home preset value only if any of the mechanical settings has been changed, such as after an arm has been replaced. (Changes relating to joints only)

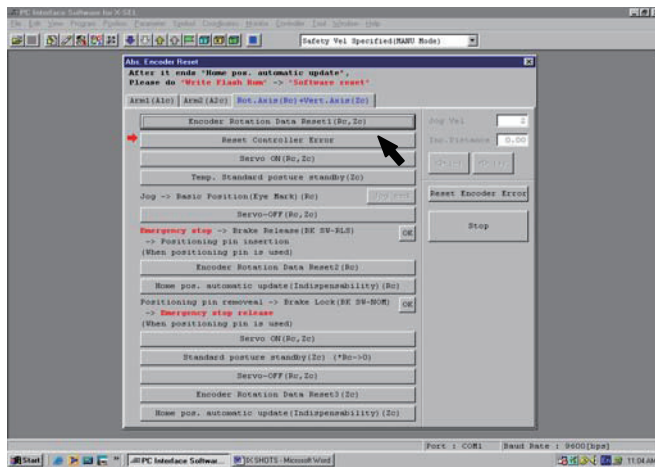
13.8.4 Absolute Reset Procedure for the Rotational Axis + Vertical Axis

(1) Click “Encoder Rotation Data Reset1” button.



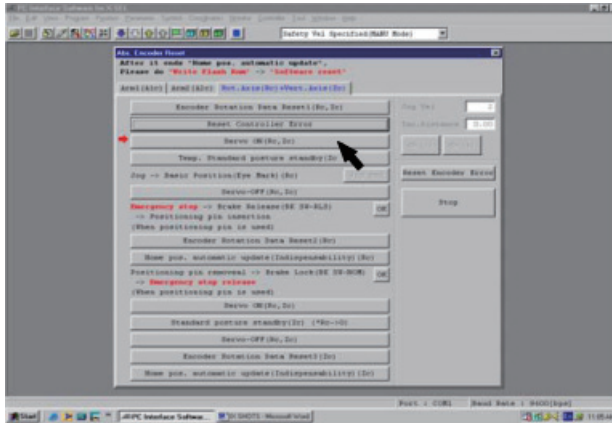
Encoder Multi-rotation Data Reset 1

(2) Click the “Reset Controller Error” button.



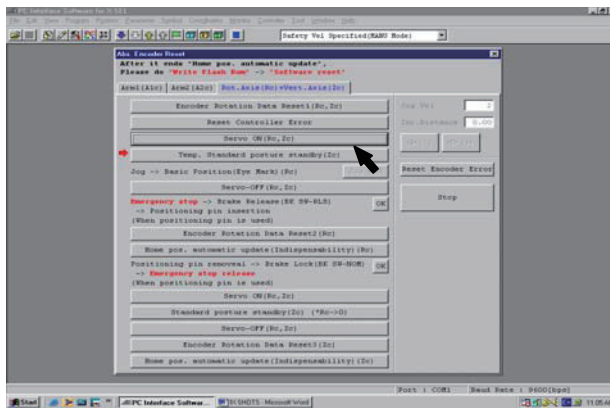
Controller Reset

- (3) Click the “Servo ON” button.



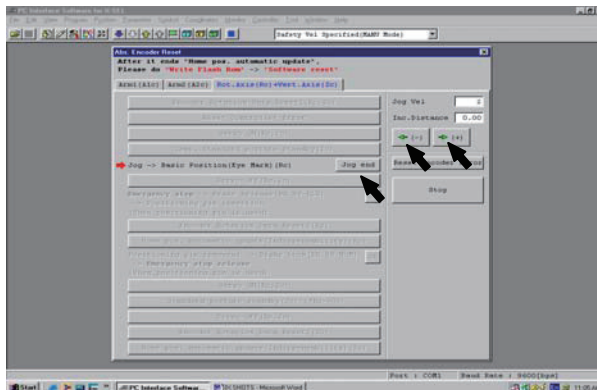
Servo ON

- (4) Click the “Temp. Standard posture standby” button.
 • The vertical axis returns to its home position. Exercise caution.



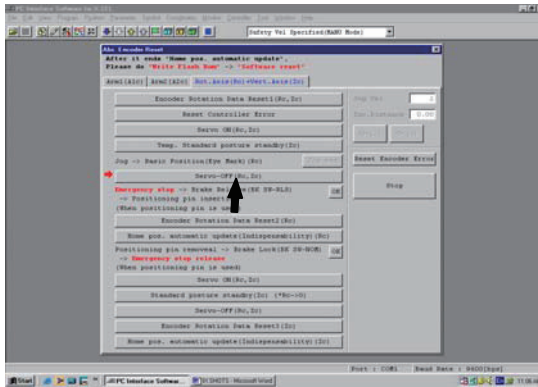
Standing By at Tentative Home Position

- (5) Jog the rotational axis to the reference position (see reference position drawing in step 8), and click the “Jog end” button.



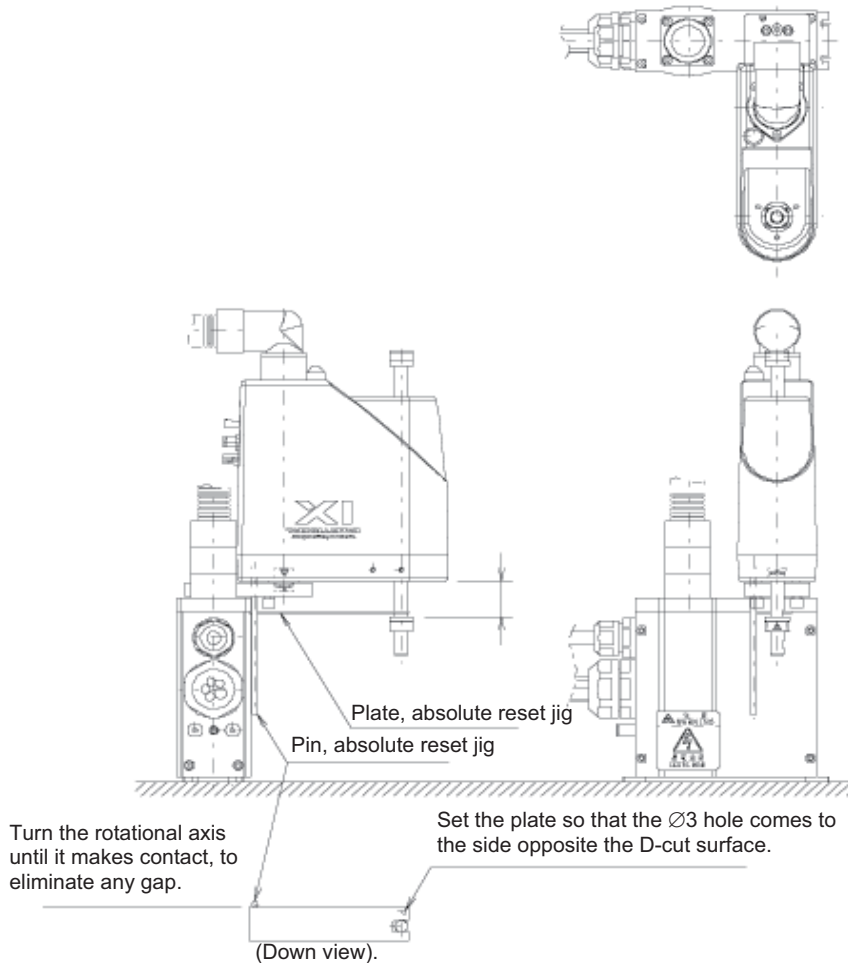
Jogging

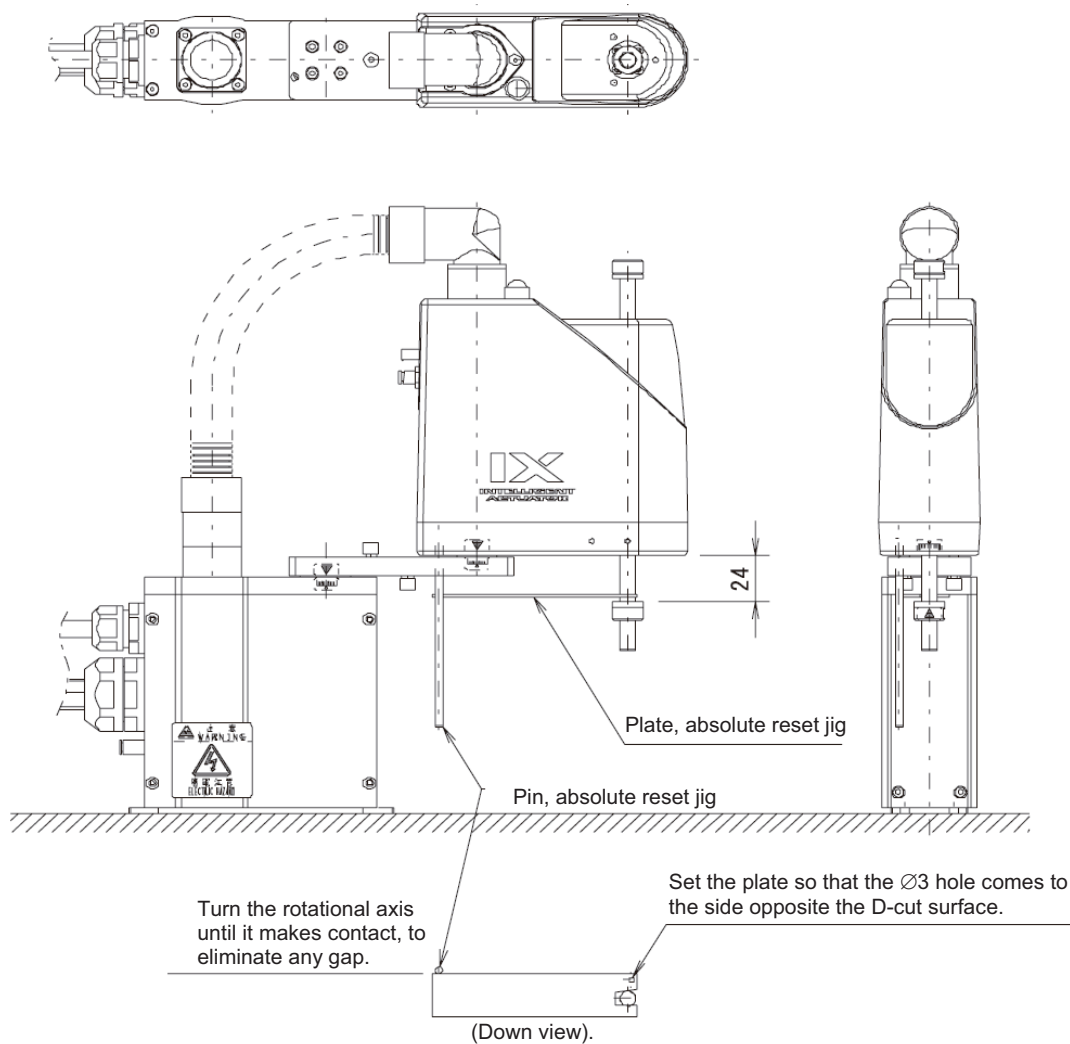
(6) Click the “Servo-OFF” button.



Servo OFF

- (7) Press the emergency-stop switch.
- (8) Affix the rotational axis at the reference position by setting the plate and pin of the adjustment jig as illustrated below.
 - Set the jig after confirming that the emergency-stop switch is pressed.
 - Set the jigs by using the positioning mark as a reference.
 - Make sure the top surface of the stopper roughly matches in height with the bottom surface of arm 2.





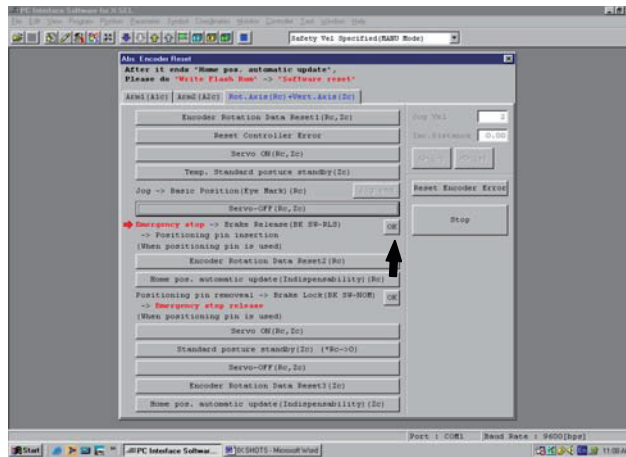
Reference Posture for Arm Length 150/180



Warning

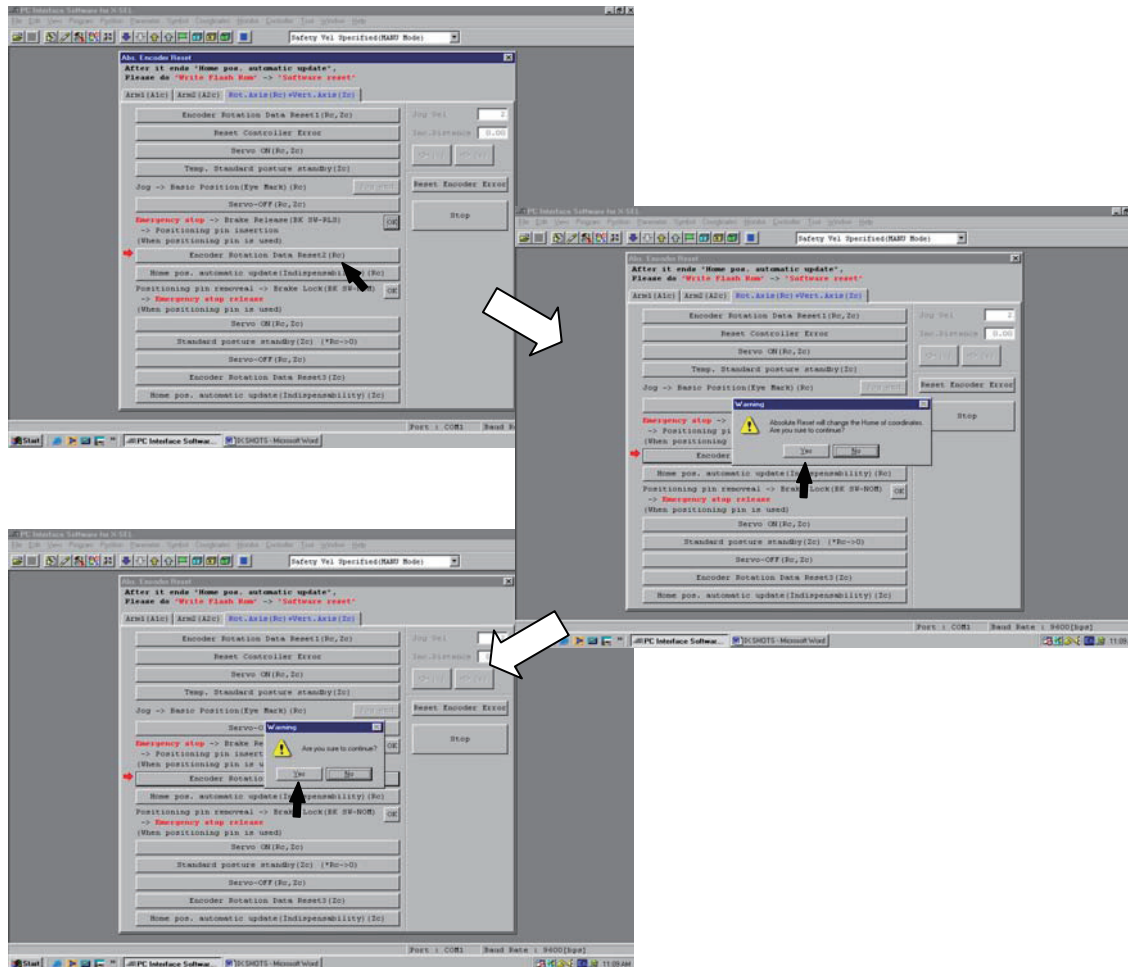
- Always press the emergency-stop switch before setting an adjustment jig. Failure to do so may cause the robot to malfunction and result in a serious accident.
- Pay attention to the orientation of the side of the plate jig that comes in contact with the D-cut surface.

(9) Click the “OK” button.



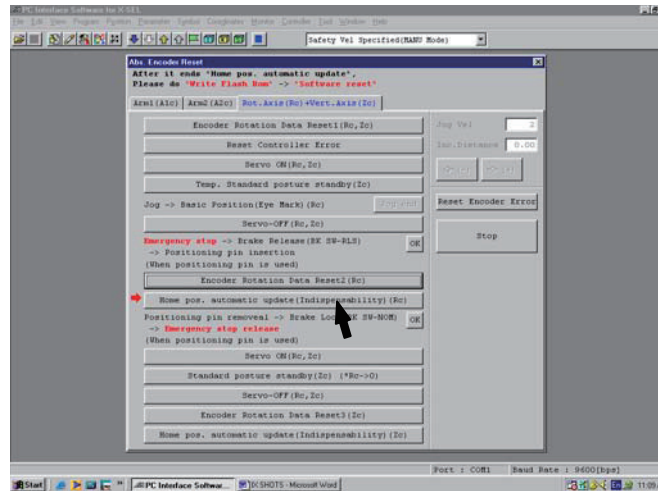
Confirmation

(10) Click the “Encoder Rotation Data Reset2” button.



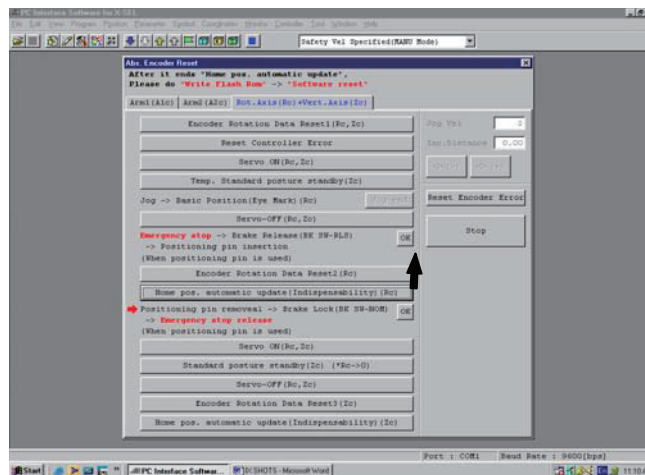
Encoder Multi-rotation Data Reset 2

(11) Click the “Home pos. automatic update” button.



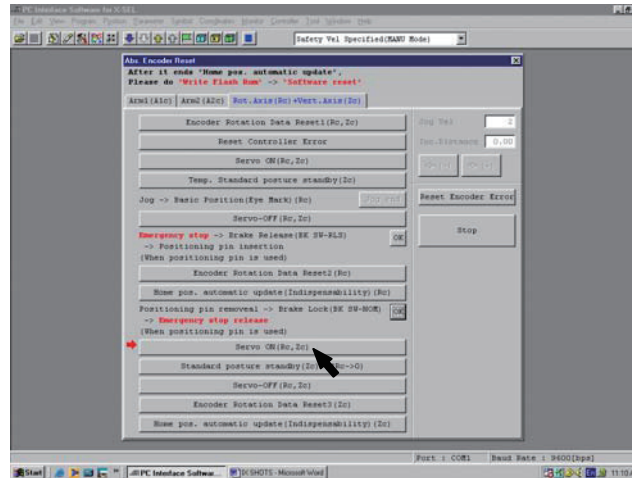
Automatic Refresh of Home Preset Value

- (12) Remove the adjustment jig.
- (13) Release the emergency-stop switch.
- (14) Click the “OK” button.



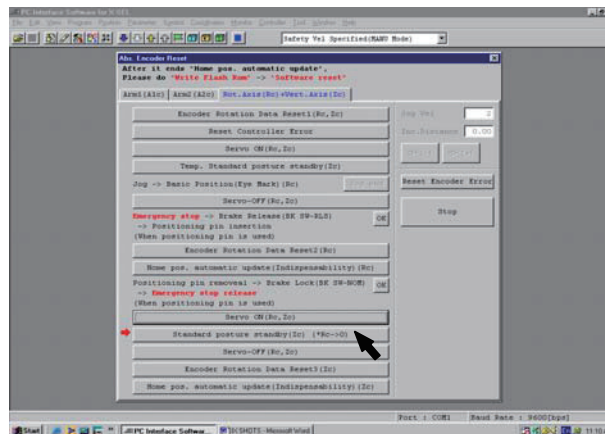
Confirmation

- (15) Click the “Servo ON” button.



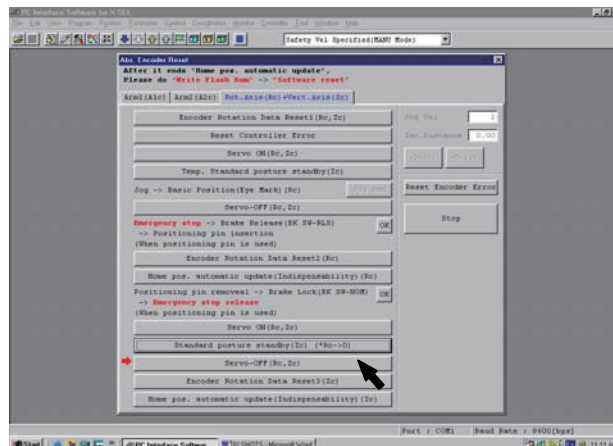
Confirmation

- (16) Click the “Standard posture standby” button.
- The vertical axis returns to its home position. Exercise caution.



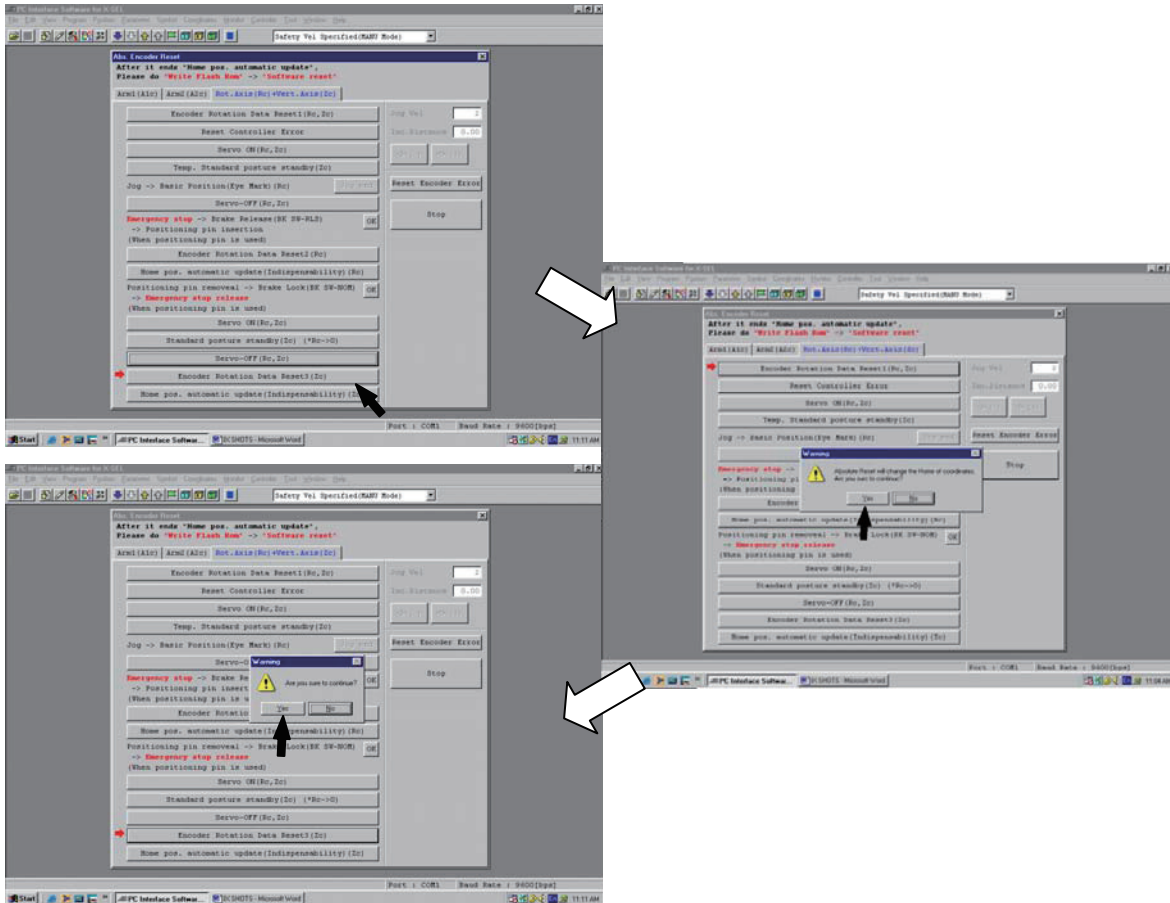
Standing By at Reference Posture

- (17) Click the “Servo-OFF” button.



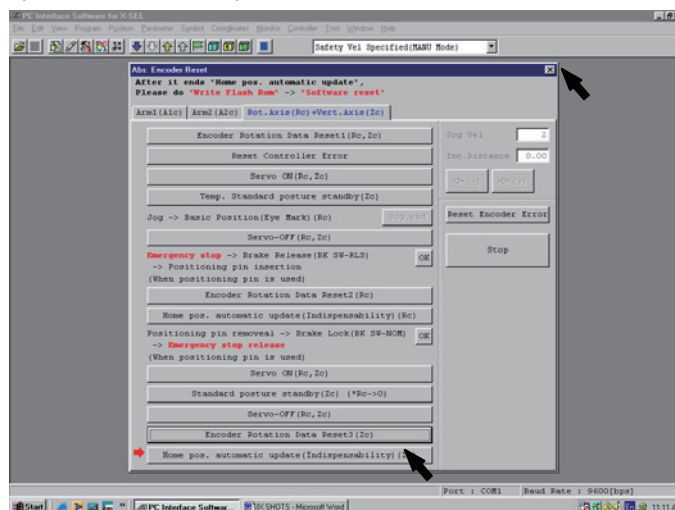
Servo OFF

(18) Click the “Encoder Rotation Data Reset3” button.



Encoder Multi-rotation Data Reset 3

(19) Click the “Home pos. automatic update” button, and then click “X” in the top right-hand corner to exit the absolute reset window.
?After the reset is completed, be sure to perform “Software reset.”



Automatic Refresh of Home Preset Value



14. Warranty

14.1 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

14.2 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 of problem in question was caused by a specification defect or problem, or by a quality issue with our product.

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

- [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.

14.3 Honoring the Warranty

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

14.4 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.

14.5 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.

14.6 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
August 2010	First edition
March 2012	Second edition P. 1 to 7 Contents added and changed in Safety Guide P. 8 Precautions in Handling Note "Certainly attach the Horizontal Articulated Robot by following this operation manual." added P. 70 Caution notes added telling to go to see the doctor to have an appropriate treatment when the grease got into an eye P. 89, 90 Contents changed in 14. Warranty
August 2012	Third edition 9.1 Installation Posture added
January 2013	Fourth edition P. 71 Grease applied to ball screw spline changed to Multemp LRL No. 3 for standard type Grease applied to ball screw spline changed to AFF grease (Manufactured by THK) for Cleanroom type
July 2013	Fifth edition <ul style="list-style-type: none"> A page of CE Marking deleted and a page for International Standards Compliances added Overall Revised 13. Maintenance and Inspection
February 2014	Sixth edition P. 42 to 53 "Dynamic" and "Static" changed to "Top Limit" and "Bottom Limit" for push force of axis 3 (vertical axis) Contents changed in (Note 8) and (Note 9)
August 2014	6B edition P. 30 and 32 Note corrected
May 2015	6D edition P. 73 Note corrected AB-3 → AB-6



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