INTELLIGENT ACTUATOR

IX

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Horizontal Articulated Robot – IX Series
Tabletop Type, Arm Length 120/150

IX-NNN-1205, IX-NNN-1505

Operation Manual First Edition

IAI America, Inc.

Introduction

Thank you for purchasing an IAI Horizontal Articulated Robot.

This manual describes the handling, structure, maintenance and other important aspects of the IX-Series Horizontal Articulated Robot (IX-NNN-1205/1505), and provides the user with information necessary to the safe operation of the robot.

To ensure safe operation, be sure to read this manual and fully understand its content before using your IX-Series robot. After reading this manual, keep it in a convenient place for reference whenever needed.

Please refer to the separate manual for other arm sizes, cleanroom specifications, dust-proof/splash-proof specifications and wall-mount specifications. The standard specifications and items that apply commonly to all specification types are covered in this manual.

Please refer to the separate controller manual for operation programs and other specifications or instructions involving the controller.

Caution

Contact us at:

IAI America, Inc.

2690 W. 237th Street, Torrance, CA 90505

Tel: (310) 891-6015
Fax: (310) 891-0815

Table of Contents

1. For Safe Use of Robots

1.1 Safety Symbols

Industrial robots are machines offering an advanced programming function and capable of realizing highly flexible movements. When using industrial robots, therefore, be sure to observe the safety instructions and precautions applicable to these robots. Failure to provide the necessary safety measures or incorrect handling of the robot may not only cause the robot to break down or sustain damage, but it can also lead to a major accident involving the operator (person who installs, operates, adjusts/inspects or otherwise handles the robot) including injury or even death.

 Danger	Failure to observe this instruction is likely to result in serious injury or death.
 Warning	Failure to observe this instruction may result in serious injury or death.
 Caution	Failure to observe this instruction may result in injury or damage to the equipment.
 Note	Failure to observe this instruction will not result in injury, but it should be heeded to ensure proper use of the product.

1.2 Safety Precautions

General precautions regarding the handling of robots are provided on the following pages. For any work that must be performed with the robot's operating range, specify a work procedure, etc., and make sure it is communicated to, and fully understood by, each operator.

Precautions for Installation of the Robot

(1) Ensuring a proper service environment
Refer to the section entitled “Installation Environment and Storage Environment” to secure a proper service environment for the robot.

(2) Ensuring a space to cover the robot’s operating range
Refer to the section entitled “Robot Operation Area” to secure a sufficient operation area for the robot.

(3) Ensuring work/maintenance space
Ensure a sufficient range of operation for work and maintenance so that operation, adjustment and inspection can be carried out without a problem.

(4) Location for installation of control unit
Install the control unit, such as a controller, at a location outside the robot’s range of movement, from which robot operation can be observed in its entirety.

(5) Installation of a safety cage
Install a safety cage or enclosure, or stretch ropes or chains, around the perimeter of the robot’s range of movement, so that the operator and bystanders cannot easily enter or bring objects into the robot’s operation area.

(6) Installation of interlocks
Install a switch (sensor) at the entrance to the safety cage, enclosure or other safety barrier and interlock it to the robot, so that the robot will stop operating the moment the door, ropes, chains, etc., are opened. Additionally, make sure that entry into the operating range is not possible other than from the interlocked entrance.

(7) Installation of an emergency-stop switch
Provide an emergency-stop switch at a location that is instantly accessible by the operator in case of an emergency.

(8) Attachment of caution labels
Be sure to attach the supplied caution labels at the entrance to and exit from the operation area or other location, placing such labels where the operator can easily see and recognize them. Also, maintain the legibility of caution labels by making sure they are not removed or smudged.

(9) Prohibition of robot modification
Never attempt to modify the robot or controller.

(10) Protection against flying work
If there is a possibility that the work held by the robot may be released and allowed to fly off, drop or otherwise jeopardize the operator’s safety, implement appropriate protective measures in consideration of the size, weight, temperature, chemical properties and other characteristics of the work.

⚠ Danger

- The safety of the operator and bystanders cannot be assured if the above precautions for installation are not heeded. Failure to observe these precautions may result in a serious accident or damage to the robot.

Precautions for Work Near the Robot

Contact with a moving robot may result in a serious accident. Be sure to observe the following items:

(1) Prohibition against entering the robot's range of movement during operation
Never enter the robot's range of movement while it is operating or in the ready mode.

(2) Before entering the robot's range of movement
If you must enter the robot's range of movement, always press the emergency-stop switch or turn off the power to halt the robot's operation before entering.

(3) Operation inside the safety cage
For teaching, inspection and other operations that require the operator to work in the safety cage or enclosure while the robot is operating, specify a work procedure and make sure it is communicated to, and fully understood by, each operator. Additionally, the following measures should be taken:

- The operator shall carry a hand-held emergency-stop switch at all times so that the robot can be stopped as soon as an abnormal condition arises.
- A person other than the operator shall monitor the work to ensure that operation of the robot can be stopped as soon as an abnormal condition arises.
- A person other than the operator shall monitor the work in order to make sure that no unauthorized person will inadvertently operate the switches or controls.
- A "Work in Progress" sign must be displayed in a conspicuous location.

⚠ Danger **⚠ Warning**

- Failure to observe the above precautions for work near the robot may result in serious injury or death.
- Do not enter the robot's range of movement while it is operating.
- Always press the emergency-stop switch or turn off the power before entering the robot's range of movement.
- A person other than the operator must be sure to monitor the work whenever the operator enters the robot's range of movement.

Precautions for Operation of the Robot

(1) Power on
Before turning on the power, confirm that no one is working in the immediate vicinity of the robot.

(2) Performing work when the robot is operating
Before entering the robot's range of movement to perform setup or any other task, always press the emergency-stop switch to disable operation of the robot.

(3) Action to take upon detection of abnormality
If noise or vibration is detected when the robot is operating, immediately stop the robot, investigate the cause, and take appropriate action. Continuing to operate the robot without correcting the problem will damage the robot.

(4) Acceleration setting
Operate the robot at an appropriate rate of acceleration in accordance with the load being carried. Failure to set the acceleration properly will shorten the service life of the drive part, cause damage, and generate vibration during positioning. (See "Reference Acceleration/Deceleration Settings.")

(5) Program operation check
Prior to running your program, be sure to confirm its proper operation at safe speeds. If the program contains an error, the robot may move to an unexpected position and damage the work or its own components.

⚠ Danger | **⚠ Warning** | **⚠ Caution**

- Failure to observe the above precautions for robot operation may result in a serious accident or damage to the robot.
- Always press the emergency-stop switch before entering the robot's range of operation.
- If the robot is found abnormal, stop the robot immediately and investigate the cause. Failure to do so may damage the robot.

Precautions for Teaching and Inspection/Maintenance/Adjustment Operations

(1) Special training for teaching personnel
Teaching operators must receive “special training on industrial robots.”

(2) Special training for inspection/maintenance/adjustment personnel
Inspection, maintenance and adjustment must be performed by qualified personnel who have received “special training on industrial robots.”

(3) Participation of inspection/maintenance/adjustment personnel in IAI’s seminar on robots
Inspection, maintenance and adjustment must be performed by qualified personnel who have participated in the robot seminar organized by IAI or in the presence of personnel who have participated in the seminar.

(4) Understanding the robot’s characteristics and work procedure
Do not perform teaching, inspection, maintenance or adjustment without a full understanding of the robot’s characteristics and work procedure. Any attempt to perform work without the required knowledge may result in a serious accident.

(5) Items to note on teaching and inspection/maintenance/adjustment
Observe the following items in addition to the aforementioned precautions:

- Before commencing the work, confirm that all emergency-stop devices are functioning properly.
- Turn off the power to the robot if work can be performed without the robot being operated.
- Do not enter the robot’s range of operation unless necessary.
- If any externally connected equipment is used, make sure it is not operating. Alternatively, make an arrangement so that only the operator can control the equipment.
- 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 operate abnormally, resulting in a serious accident.

⚠ Danger **⚠ Warning**

- Failure to observe the above precautions for teaching and inspection/maintenance/adjustment operations may result in a serious accident. Additionally, it may cause the robot to operate abnormally or sustain damage.
- Always confirm that all emergency-stop devices are functioning properly before commencing the work.
- Always press the emergency-stop button before entering the robot’s range of movement.

1.3 Conducting Special Training on Industrial Robots

IAI's horizontal articulated robots IX120/150 are classified as industrial robots under JIS B 0134, but they are not regarded as the dangerous/harmful robots defined under Article 59 of the Occupational Health and Safety Law and other relevant ministerial ordinances, etc.
To ensure safe use of these robots, however, operators who perform any operation (teaching, programming, operation check, inspection, adjustment, repair, etc.) involving industrial robots must receive "special training on industrial robots."

1.4 Warranty Period and Scope of Warranty

Your IX-Series robot has passed the inspections performed by IAI prior to shipment.
However, we offer the following warranty to cover an unforeseen failure.

Warranty Period

The warranty period will end when any of the following periods elapses:

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

Scope of Warranty

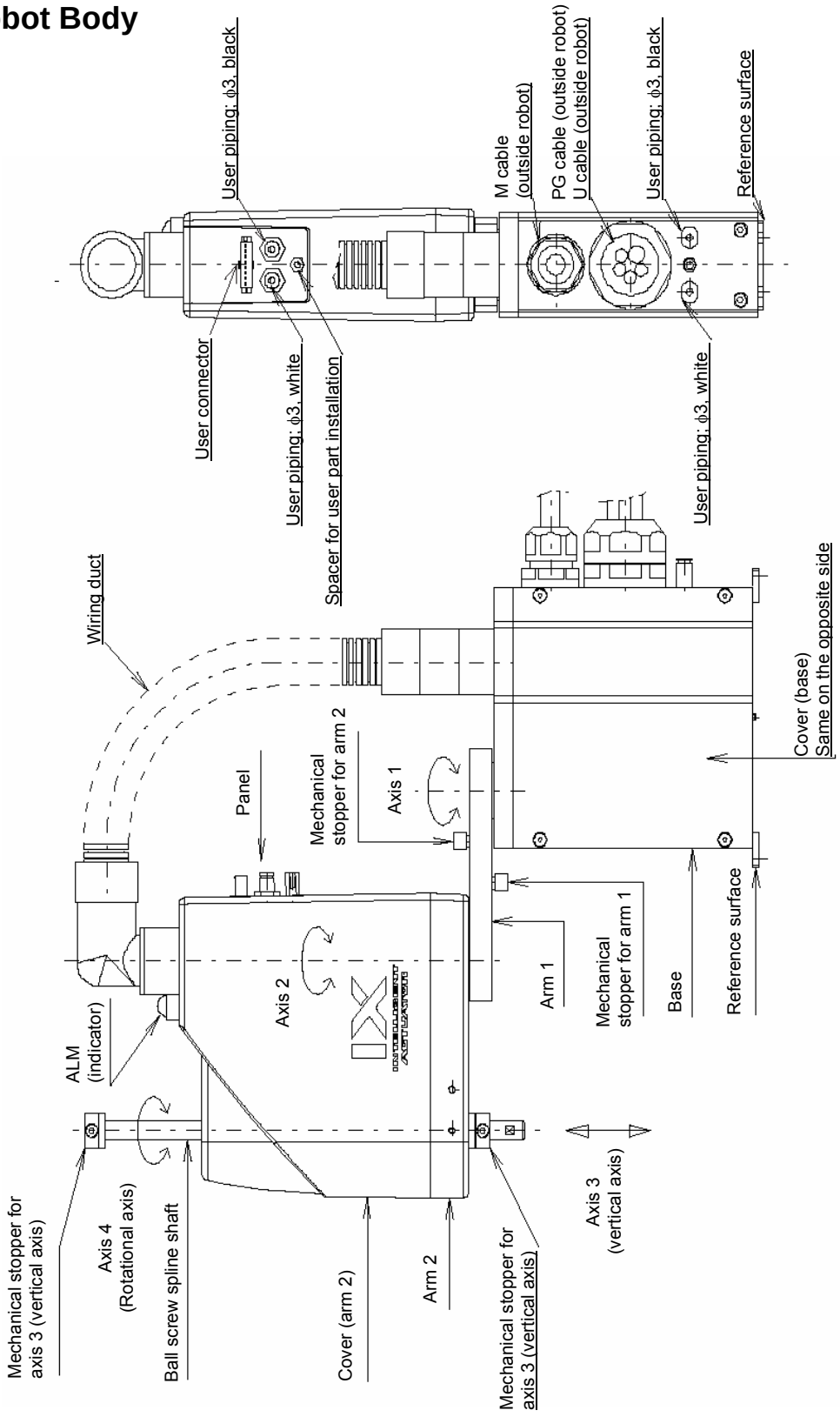
Should a manufacturing defect be found during the above warranty period despite proper use of the product, IAI will repair the defect free of charge.
However, the following items are not covered by the warranty:

- Result of aging, such as natural discoloration of paint
- Consumption of consumable parts (battery, timing belt, cable, etc.) due to use
- A minor irregularity, such as noise, whose severity depends on subjective judgment but does not affect product quality or function
- A defect arising from improper use or handling by the user
- A defect arising from inappropriate or erroneous maintenance/inspection
- A defect arising from modification not approved by IAI or its agent
- A defect arising from the use of parts other than genuine IAI parts
- A defect arising from an act of God, such as an earthquake, storm, flood or lightning, accident, fire or other unforeseen event

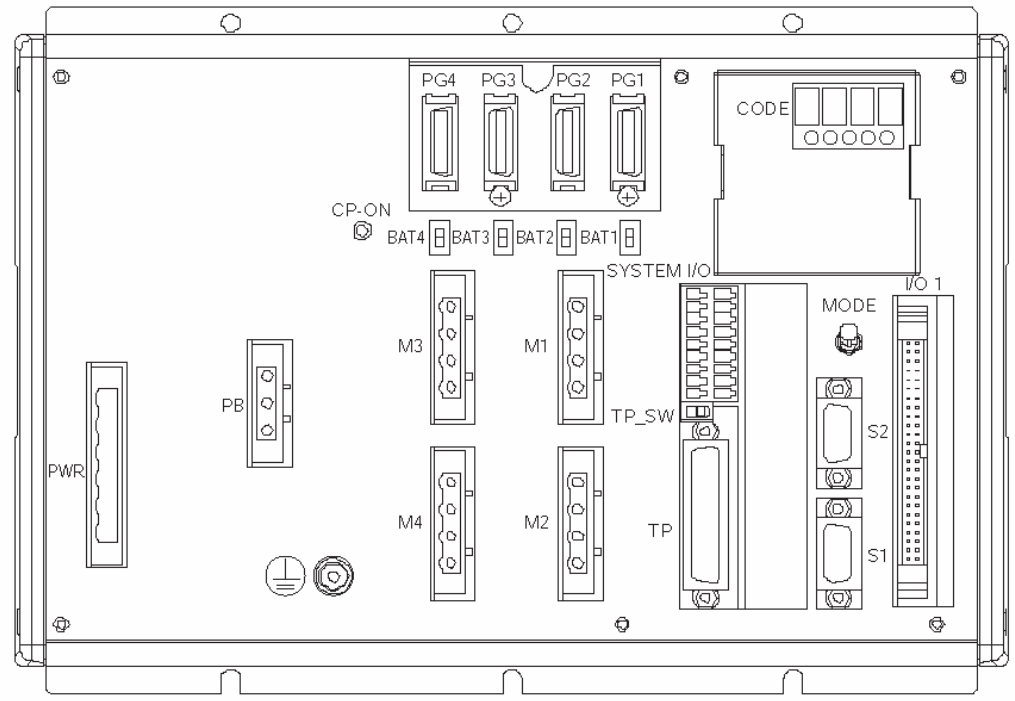
This warranty only covers the product unit delivered. IAI shall bear no responsibility for any secondary loss caused by a defect in the delivered product.
The user must bring the defective product to our factory in order to have it repaired.
Separate fees will apply if an engineer is sent to the user's site, even during the warranty period.

2. Names of Robot Parts

2.1 Robot Body



2.2 Robot Controller



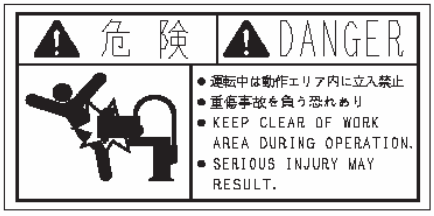
Robot Controller

2.3 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

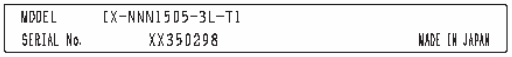
Prohibition of entry into the operation area



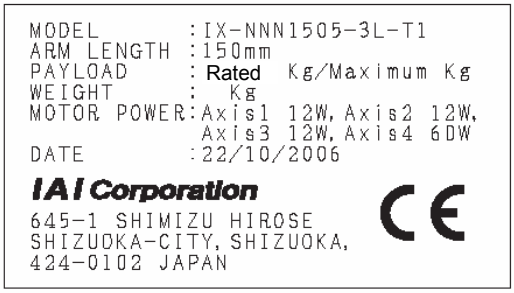
Warning on handling of the vertical axis

Warning against electric shock

Robot serial number

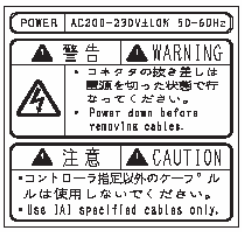


CE-certified robot (Provided only for CE-certified models)

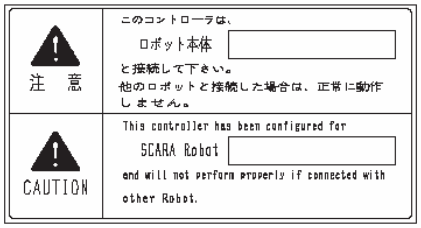


(2) Labels on the Controller

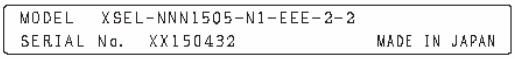
Caution/warning on handling of the controller



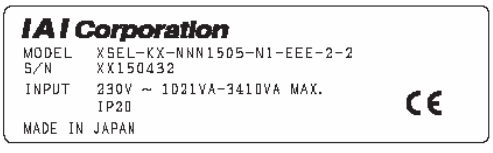
Designation of the connected robot



Controller serial number (Other than CE-certified models)



Controller serial number (CE-certified models)

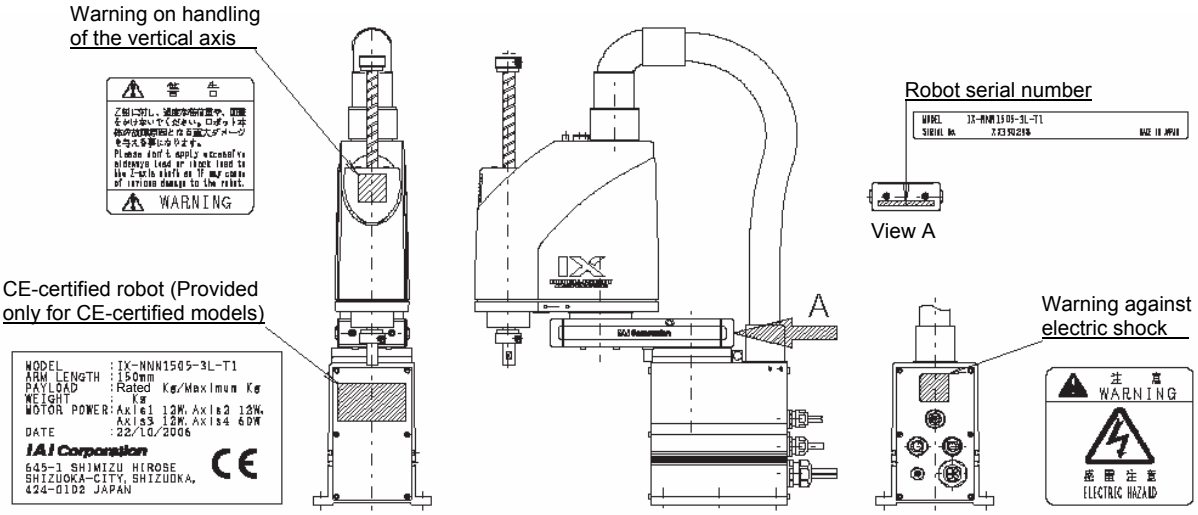


Danger **Warning** **Caution**

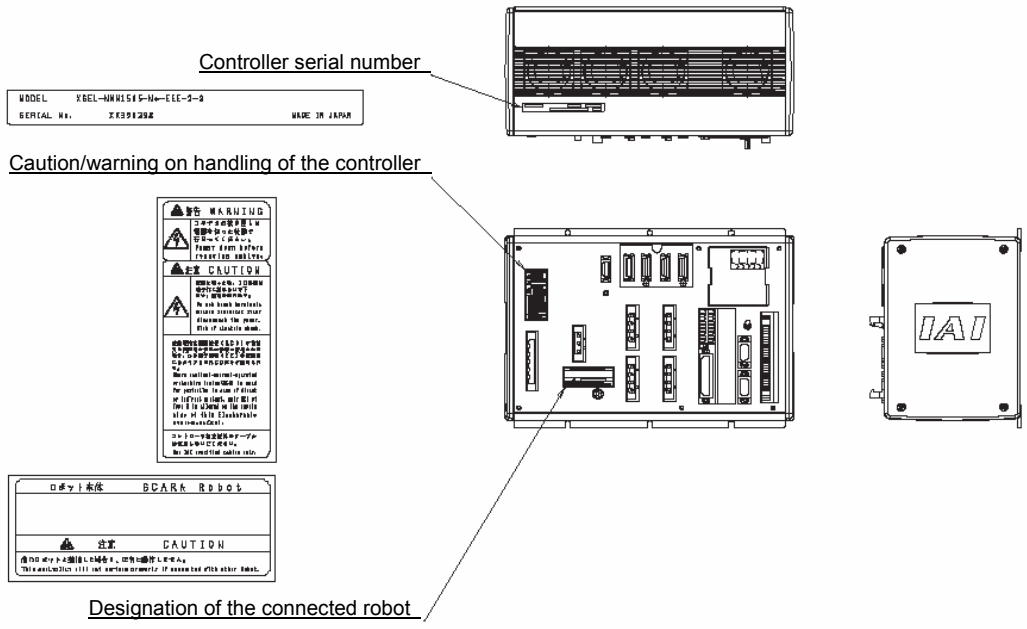
- Failure to observe the cautionary information provided on the labels may result in serious injury or damage to the robot.

2.4 Label Positions

Label Positions on the Robot



Label Positions on the Controller



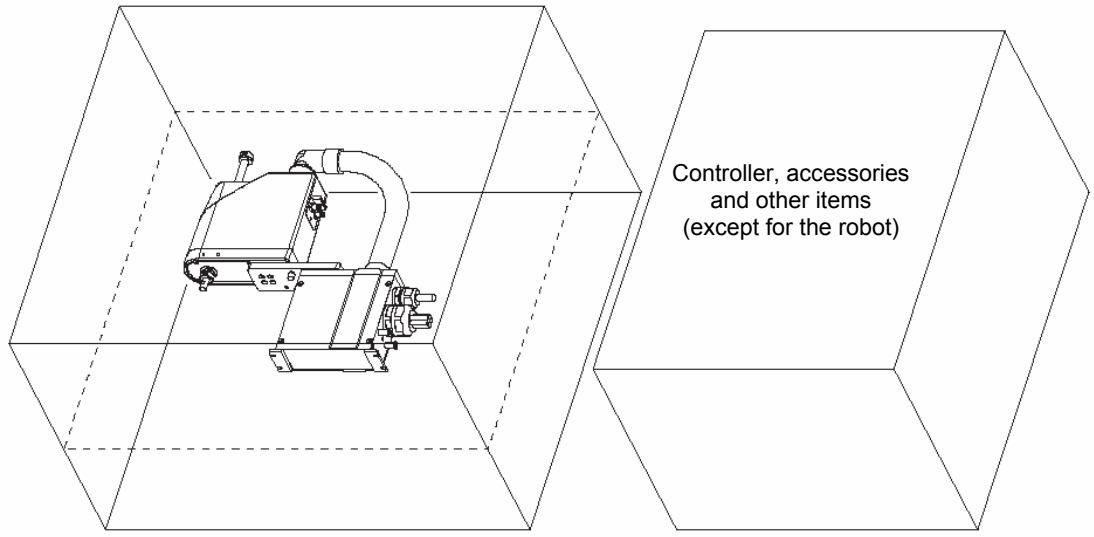
3. Transportation and Handling

3.1 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.

3.2 Packing Condition of the Robot



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.

3.3 Handling of Individual Components

The robot and controller are supplied as a set.
The combination is indicated on the “designation of the connected robot” label attached on the controller.
When handling multiple robots, be careful not to lose their correct pairings with 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.

3.4 Checking after Unpacking

After unpacking the carton, check the condition of the robot and other items contained in the carton.

Standard parts

Robot	1
Controller	1
Operation manual for robot	1
Operation manual for controller	1

Accessories

Eyebolt	1
D-sub connector	1
Hood set (for D-sub connector)	1
Caution label	2
Positioning label	1
PIO flat cable	1

Optional parts

PC software (type: IA-*******)

Floppy disk	2
PC connection cable	1
Hand-held emergency-stop switch	1
Operation manual for PC software	1

Absolute reset adjustment jig (type: JG-*)

Positioning jig for axes 1 and 2 (pin)	1
Positioning jig for axis 4 (plate)	1

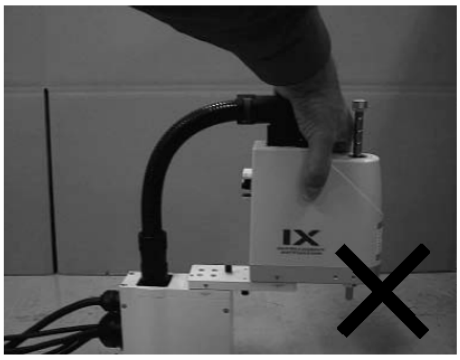
Absolute-data backup battery (AB-3)

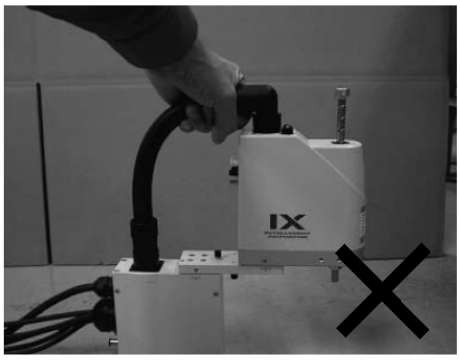
Caution **Note**

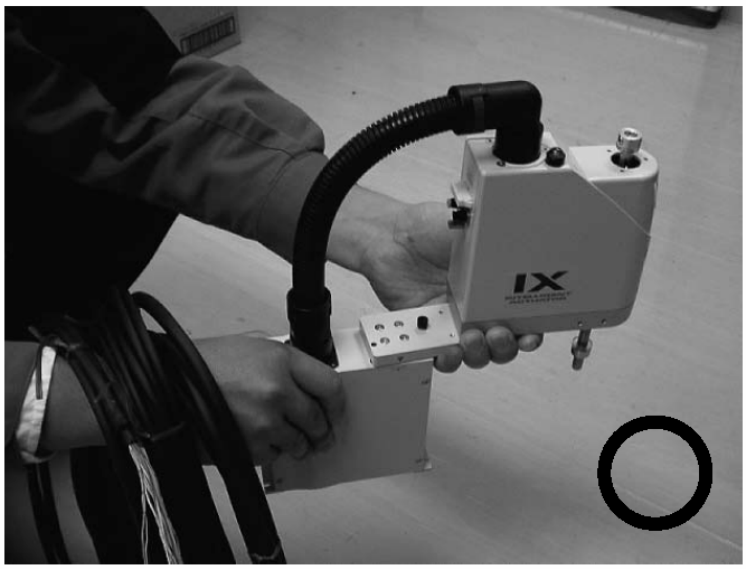
- Always operate the robot using the controller supplied with the robot in the same carton. Using another controller may result in an unexpected operation, damaged motor or other problem.
- After unpacking, be sure to confirm the condition of the robot and other items contained in the carton. Should you find a damaged or missing part, please contact IAI immediately.

3.5 Transporting the Robot

When transporting the robot alone, hang the cable over your arm and carry the robot by holding the base and arm 2 with both hands.
Do not hold the robot only by arm 2 or the wiring duct.



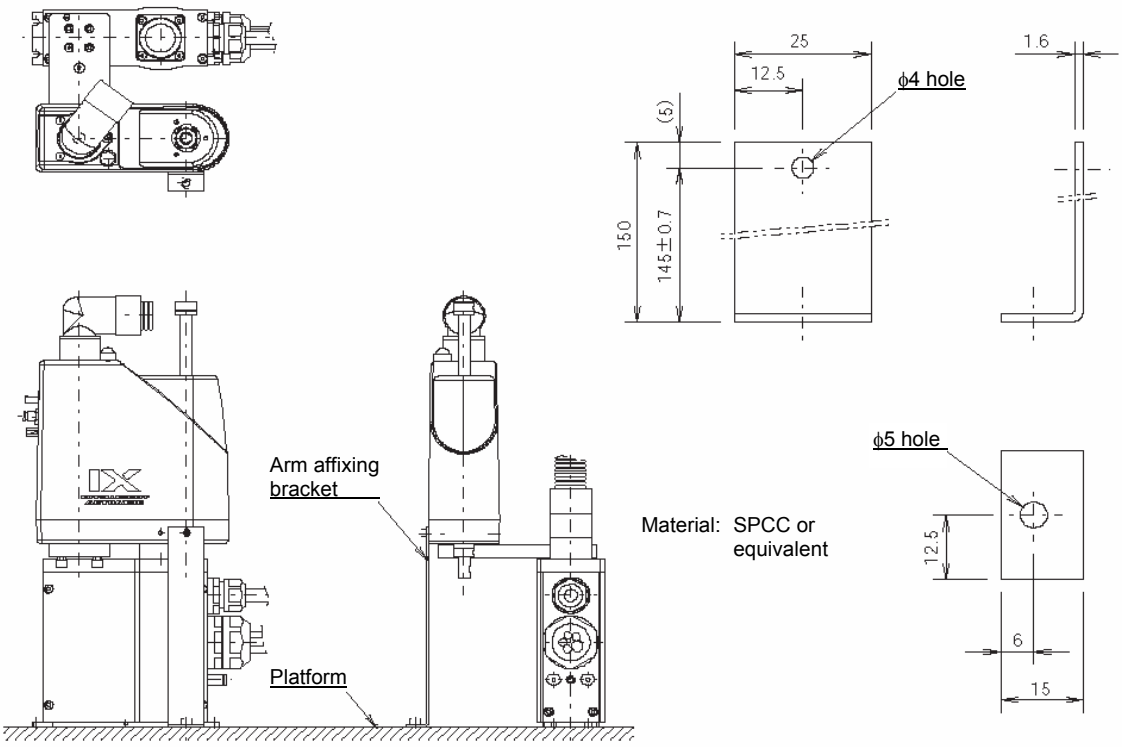




Danger **Warning**

- If the robot is held only by arm 2 or an excessive load is applied to arm 2, the robot may be damaged.
- While transporting the robot, be careful not to drop the robot as it may result in injury or damage to the robot.

When transporting the robot that has been assembled with an equipment, etc., produce a bracket conforming to the specifications below and affix arm 2 to the equipment's platform, etc., using the bracket.



During the transport, move the equipment slowly by paying attention to the balance of the robot and avoid applying vibration or impact to the robot.

The tapped holes on the side face of arm 2 are through holes. Do not use screws that are 6 mm or longer, because they may contact the mechanical parts inside the arm.

⚠ Danger **⚠ Warning**

- If the robot is held only by arm 2 or an excessive load is applied to arm 2, the robot may be damaged.
- While transporting the robot, be careful not to drop the robot as it may result in injury or damage to the robot.
- When transporting the robot that has been assembled with an equipment, etc., be sure to affix arm 2. During the transport, pay attention not to apply vibration or impact to the robot.

4. Installation Environment and Storage Environment

4.1 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
- Ambient 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.

4.2 Installation Platform

Since the platform on which the robot is installed receives a reactive force, ensure that the platform has sufficient rigidity.

- 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.
- Drill tapped holes of the following dimensions in the mounting surface of the platform.

Model	Tap size	Remarks
IX-NNN12**/15**	M3 or M4	M3: Effective threads --- 3 mm min. (steel platform) (or 6 mm min. (aluminum platform)) M4: Effective threads --- 4 mm min. (steel platform) (or 8 mm min. (aluminum platform))

- 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.

4.3 Storage Environment

The storage environment conforms to the installation environment. If the robot is to be stored 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 kept in an environment subject to condensation, provide preventive measures from over the carton or directly to the robot after unpacking.
The maximum storage temperature is 60°C for a short storage period. If the robot is to be stored for more than a month, the ambient temperature should not exceed 50°C.

Danger **Warning**

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

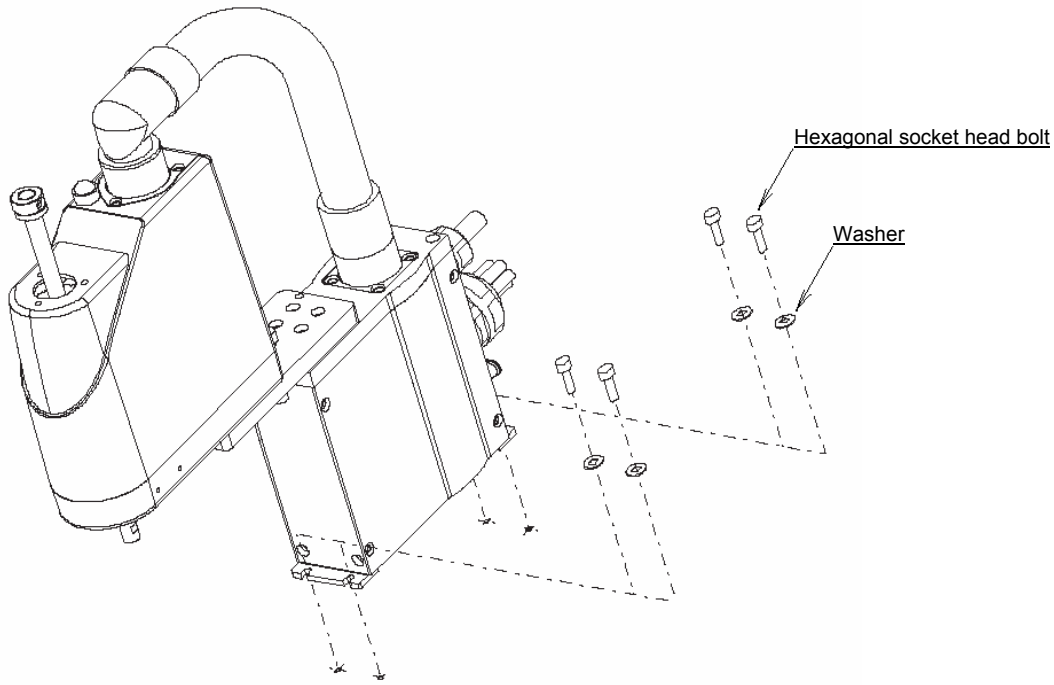
5. Installation of the Robot

5.1 Installing the Robot

Install the robot on a level surface.
Securely affix the robot using four M3 or M4 hexagonal socket head bolts and washers.

Bolt size	Tightening torque	Remarks
M3	0.81 N·m	Be sure to use a flat washer (outer diameter ϕ7 mm, inner diameter ϕ3.2 mm, thickness 0.5 mm)
M4	1.41 N·m	With a M4 bolt, using a flat washer will cause the washer to protrude from the reference surface. Use flat washers for M4 bolts only if it does not affect the robot operation in your application.

For the hexagonal socket head bolts, use high-tension bolts with an ISO rating of 10.9 or higher.



⚠ Warning **⚠ Caution**

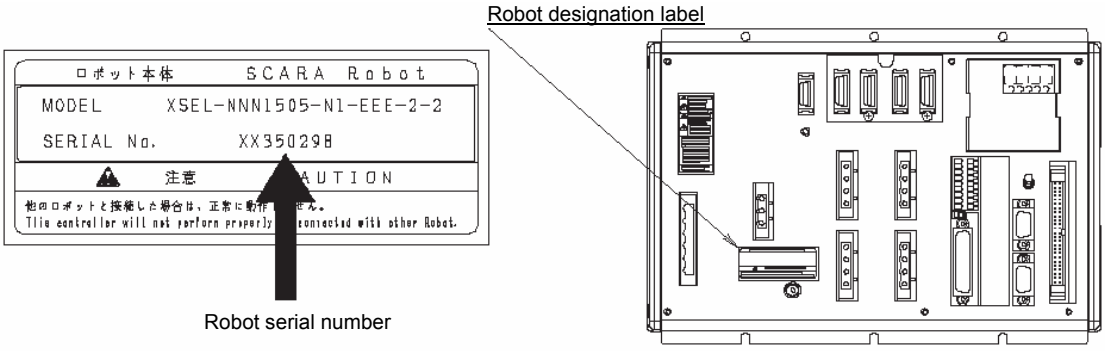
- Be sure to use a washer with a M3 bolt. Without a washer, the bearing surface may sink.
- Tighten the hexagonal socket head bolts securely to the correct torque. Improperly tightened bolts may reduce the accuracy of robot operation, and in the worst case cause the robot to overturn.

5.2 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.

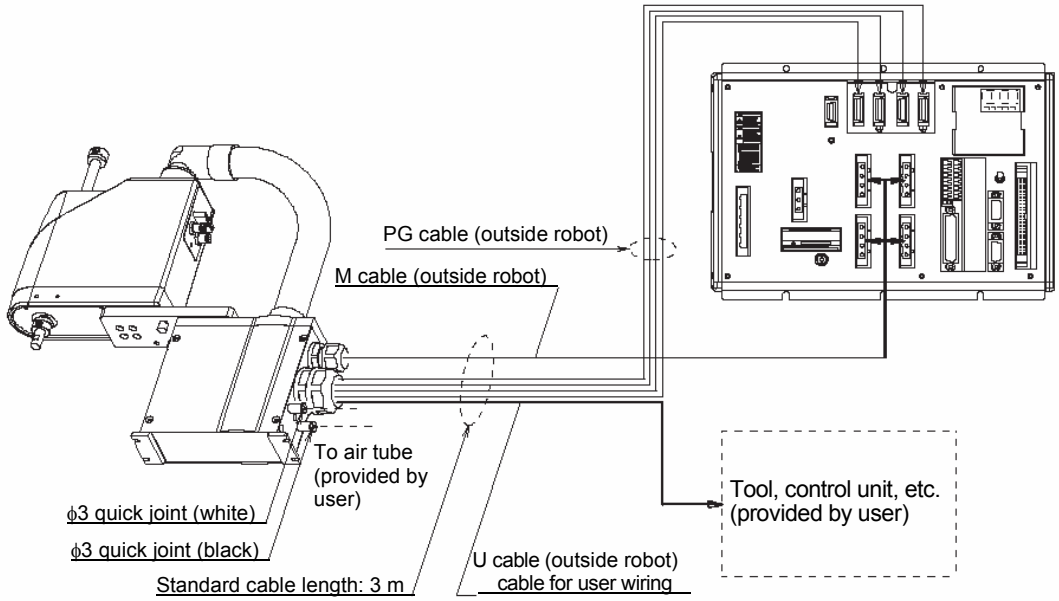


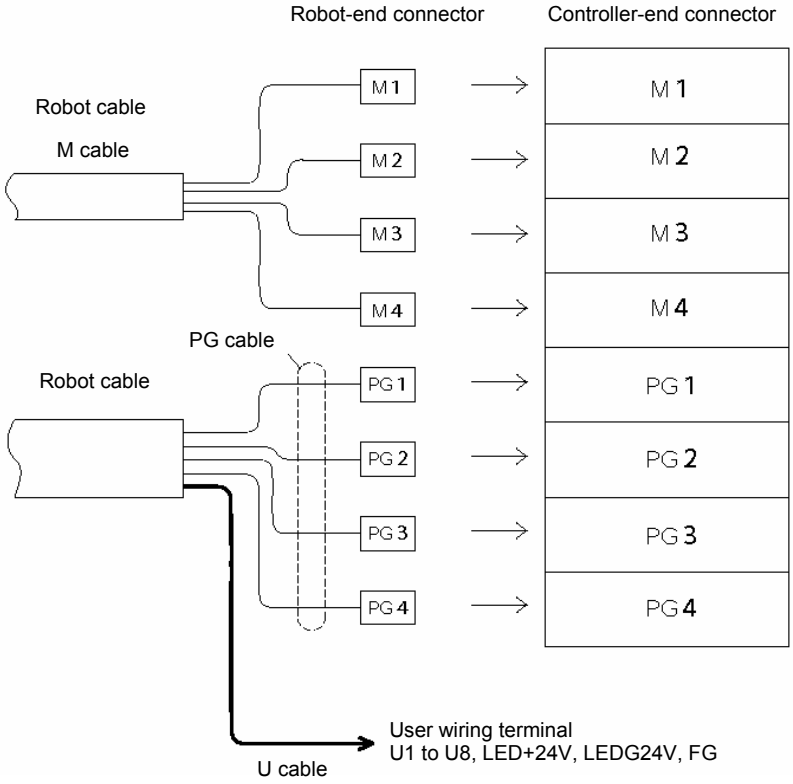
Warning

- 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.
- The brake power circuit is provided on the primary side (high-voltage side). Therefore, provide a dedicated 24 VDC power supply for the brake. The brake must not share the I/O power supply or the power supply for the secondary circuit.
  The brake power supply requires an output voltage of 24 VDC ± 10% and a current capacity of 20 to 30 watts.

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.


PG cable (outside robot)
M cable (outside robot)
To air tube
(provided by
user)
Tool, control unit, etc.
(provided by user)
ϕ3 quick joint (white)
ϕ3 quick joint (black)
Standard cable length: 3 m
U cable (outside robot)
cable for user wiring


Robot-end connector
Controller-end connector
Robot cable
M cable
M1
M2
M3
M4
M 1
M 2
M 3
M 4
PG cable
Robot cable
PG1
PG2
PG3
PG4
PG 1
PG 2
PG 3
PG 4
User wiring terminal
U1 to U8, LED+24V, LEDG24V, FG
U cable

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.

5.3 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

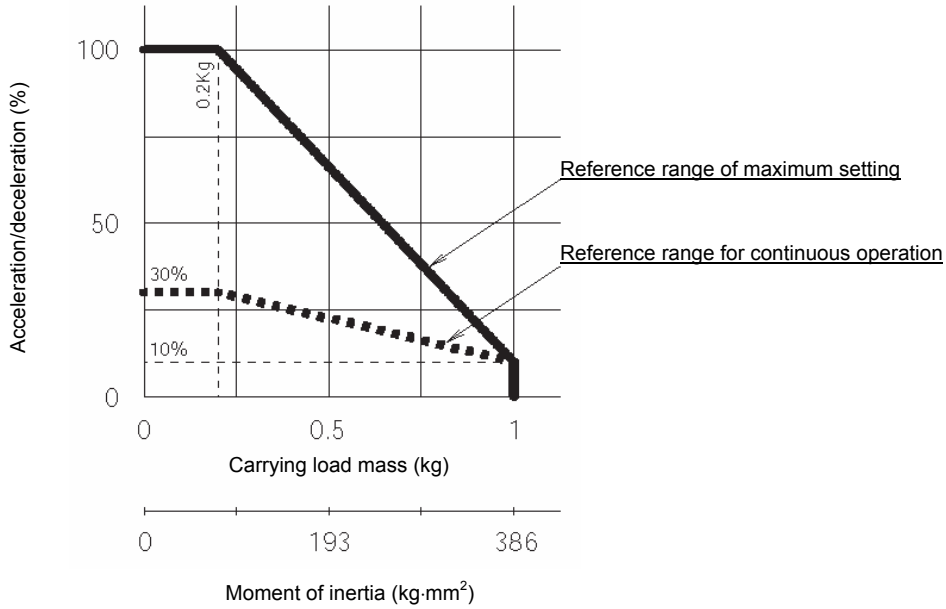
- Failure to perform these checks may result in a malfunctioning robot or a damaged controller or robot.

6. Precautions for Use

6.1 Reference Acceleration/Deceleration Settings

Use the robot based on appropriate acceleration/deceleration settings by referring to the following graph:
(1) PTP operation (Set using the SEL language commands ACCS and DCLS.)

IX120/150: Reference acceleration/deceleration settings for PTP operation

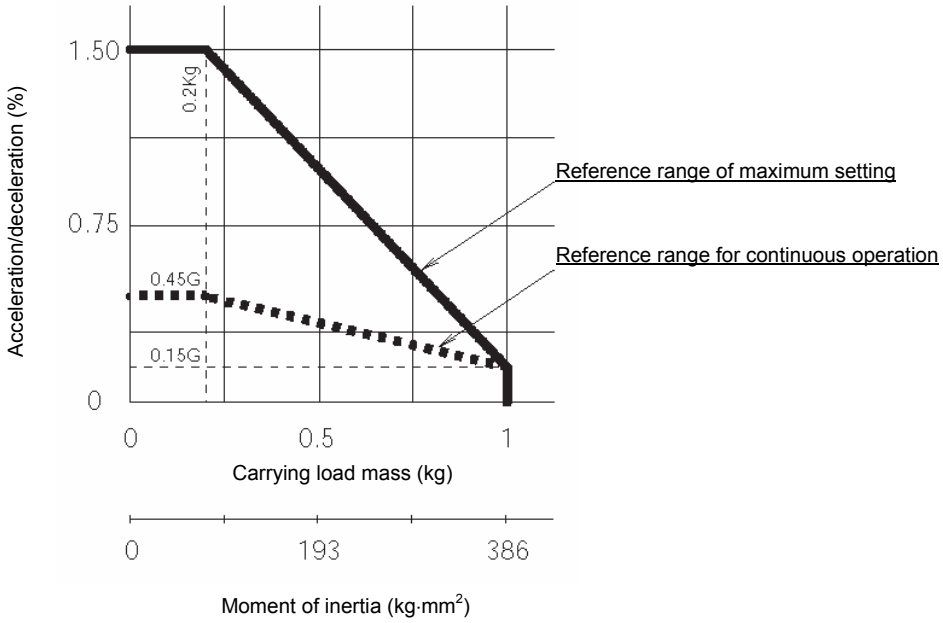


Caution

- Acceleration/deceleration settings are common to arm lengths of 120 and 150 mm.
- To operate the robot at the maximum acceleration/deceleration, provide a stopping period of three seconds or more after each acceleration/deceleration.
- To operate axes 1 and 2 simultaneously at full stroke, use the reference settings for acceleration/deceleration during continuous operation as the reference settings for maximum acceleration/deceleration. Actual acceleration/deceleration during continuous operation should be one-third the appropriate reference setting 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 permissible moment of inertia of axis 4 to 386 kg·mm^2 or less.
- The carrying load indicates a load above the rotational center of axis 4.
- Operate the robot by using an appropriate acceleration/deceleration coefficient as determined by the mass of the tip. Failure to do so may cause the drive part to wear prematurely or may result in damage or vibration.

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

IX120/150: Reference acceleration/deceleration settings for CP operation



Caution

- Acceleration/deceleration settings are common to arm lengths of 120 and 150 mm.
- To operate the robot at the maximum acceleration/deceleration, provide a stopping period of three seconds or more after each acceleration/deceleration.
- 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 permissible moment of inertia of axis 4 to 386 kg·mm^2 or less.
- The carrying load indicates a load above the rotational center of axis 4.
- Operate the robot by using an appropriate acceleration/deceleration coefficient as determined by the mass of the tip. Failure to do so may cause the drive part to wear prematurely or may result in damage or vibration.

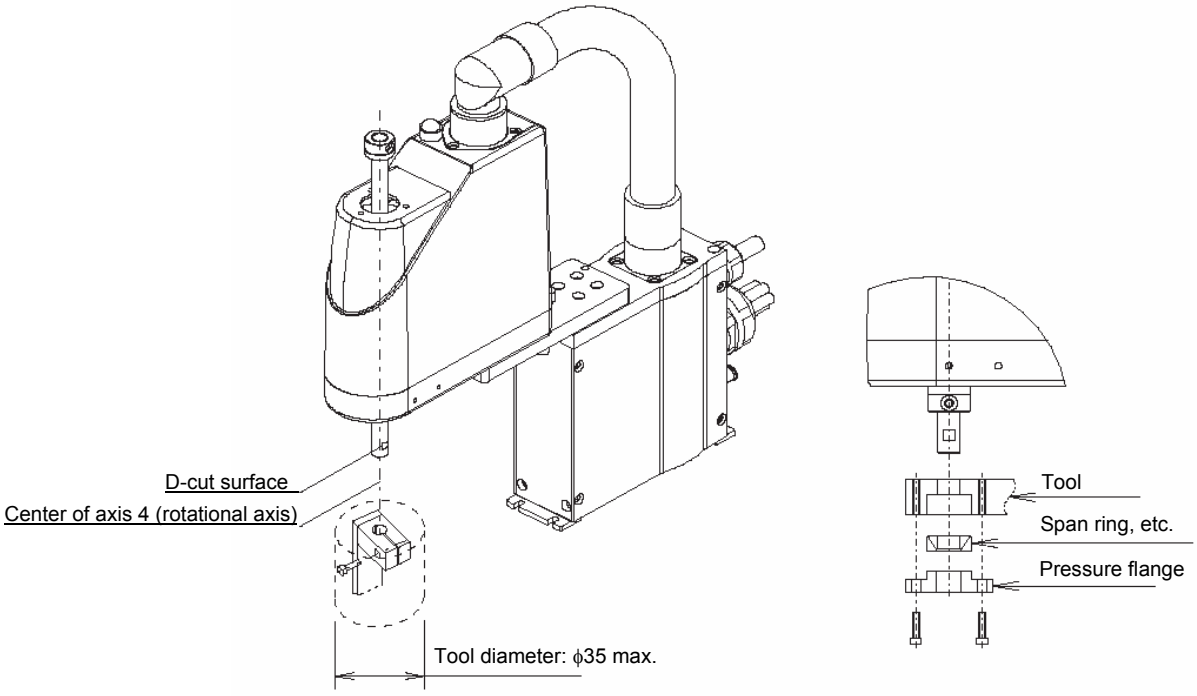
6.2 Tools

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.
Also, the moment of inertia of the tool and work should not exceed 386 kg·mm^2.

Use the D-cut surface at the tip 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.)



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.

6.3 Carrying Load

Load capacity

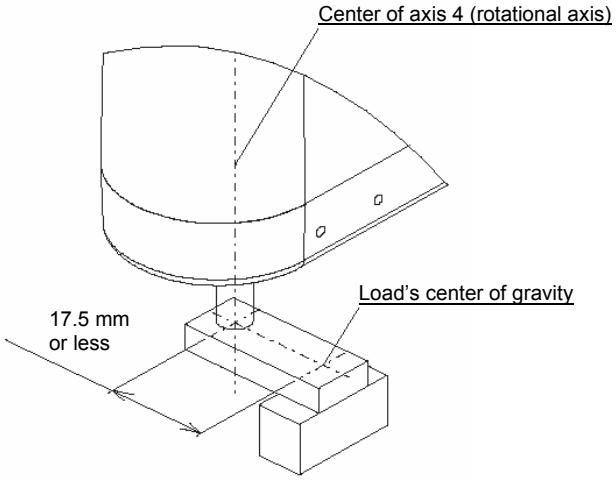
Model	Rated load capacity	Maximum load capacity
IX-NNN12**/15**	0.2 kg	1.0 kg

Load's permissible moment of inertia

Model	Permissible moment of inertia	
	Rated	Maximum
IX-NNN12**/15**	96.5 kg·mm^2	386 kg·mm^2

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

17.5 mm or less

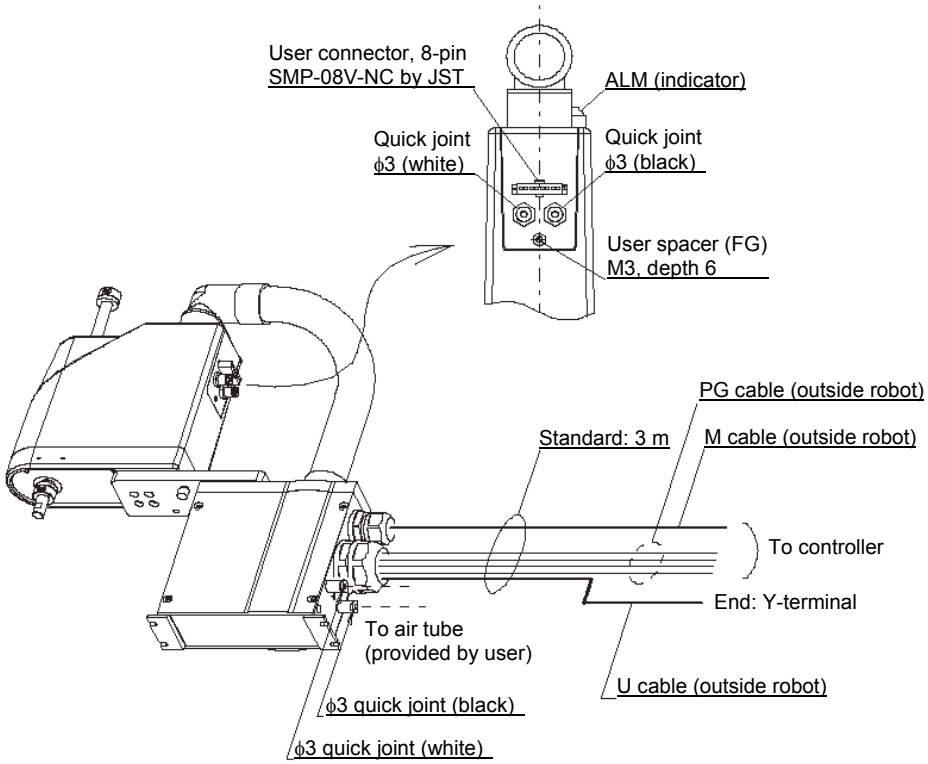


⚠ Caution

- Set appropriate acceleration/deceleration according to the mass of the tip 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.

6.4 User Wiring and Piping

The IX-NNN1205/1505 comes standard with the user wiring connector and air tube joints.
The applicable user wires and air tubes are specified in the tables below.



User wiring 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

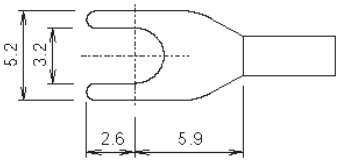
Piping specifications

Normal service pressure	0.7 MPa
Dimensions (outer diameter x inner diameter) and number of tubes	ϕ 3 mm x ϕ 2 mm, 2 pieces
Working medium	Air

ALM (indicator) specifications

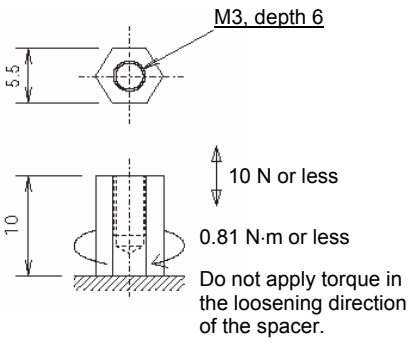
Rated voltage	24 VDC
Rated current	12 mA
Illumination color	Red LED

Shape of Y-terminal



Shape of Y-terminal

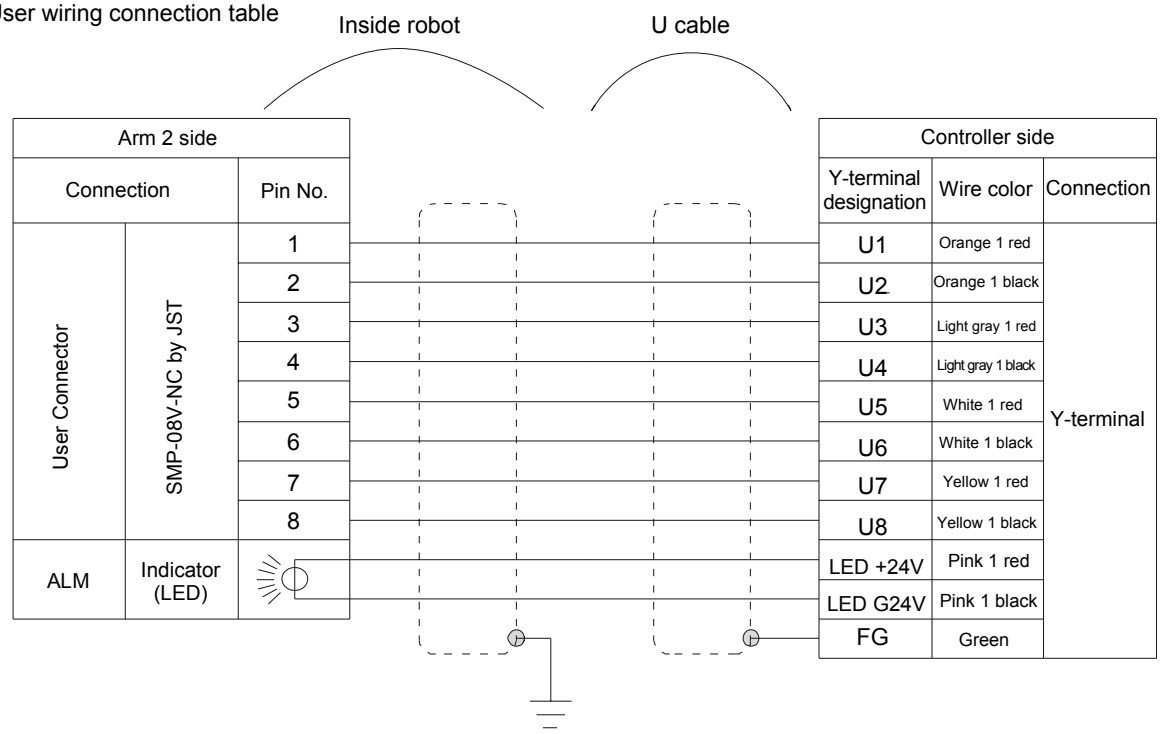
Spacer for user part installation

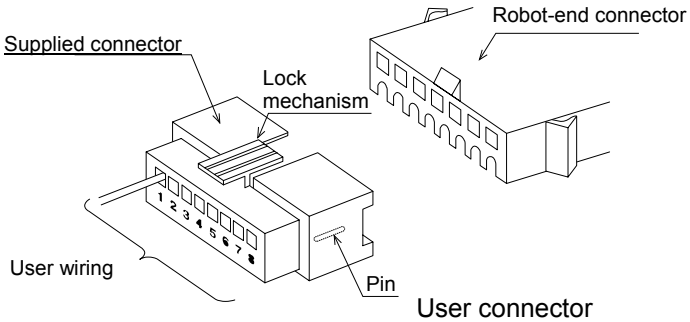


A mating receptacle housing (SMR-08V-N, 1 pc) and pin contacts (BYM-001T-P0.6, 10 pcs) are supplied (both are manufactured by JST) with the user connector.
Pressure-bond the user-provided wires to pin contacts, insert the pin contacts into the receptacle housing, and then plug the receptacle housing into the user connector. Pressure bonding of pin contacts requires a manual pressure bonder YC-121R (manufactured by JST). Pin contacts should be pressure-bonded by skilled operators in accordance with the procedure recommended by the manufacturer.

To turn on the ALM (indicator), the user must configure a dedicated circuit that uses the controller I/O output signal, etc.

User wiring connection table





Warning

- Before commencing wiring/piping work, turn off the power to the controller and the power/air supplies to the robot. Failure to do so may cause the robot to malfunction.
- Use cables and tubes within their specifications. Failure to do so may result in fire or short circuit due to an overheated cable, or may cause air leaks.
- Connect the shielded cable to the hood. Otherwise, the robot may malfunction due to noise.
- Secure the supplied D-sub connector using the screws on the hood.

7. Inspection/Maintenance

7.1 Inspection Items

Your horizontal articulated robot must be inspected daily and on a regular basis to ensure safe, efficient operation. The details of inspection items are explained in this section. Perform the necessary inspections after thoroughly understanding the details.

Do not inspect, adjust or repair the robot or controller or replace any robot/controller part unless otherwise specifically instructed in this manual. In particular, the following items must be adjusted at our factory, so do not disassemble the applicable parts or cut cables at the user site:

Disassembly of servo motor
Disassembly of ball-screw spline
Disassembly of bearing
Disassembly of harmonic speed reducer
Disassembly of brake
Cutting of cable

If any of the above is performed at the user site, IAI may not be able to correct or repair the malfunctions and failures the robot may exhibit or suffer thereafter.

Periodic inspection may be performed with the controller power turned on or off. In either case, take appropriate measures to prevent other operators from turning on/off the controller power accidentally during the inspection.

⚠ Warning

- Performing inspection or maintenance without fully understanding the details of work may result in a serious accident.
- If inspections are neglected, the drive part may wear prematurely or the robot may malfunction unexpectedly.

(1) Daily Inspection

Check the following items daily before and after operating the robot.

Check location	Description
Safety cage	• Correct the deformation or positional shift of the cage. • Confirm that the interlock mechanism is operating properly.
Robot	• Check the robot mounting bolts for looseness. • Check the exterior for abnormality, loose covers, flaws, dents, etc. • Check for abnormal move, vibration or noise while the robot is operating. (If the robot has flaws or other abnormalities, please contact IAI.)
Cables	• Check the cables for flaws and dents. • Check the cable mounting parts for looseness.
Emergency stop operation	• Does an emergency stop actuate properly when the emergency-stop switch is pressed? (Does the brake of axis 3 also actuate properly?)

(2) Six-Month Inspection

Check the following items every six months.

Check location	Description
Robot	Check the arm mounting sections for looseness. (If any of the arm mounting sections is loose, tighten the fastening parts securely.)
Ball-screw spline	• Check the ball screw and spline for looseness. • Remove old grease using a waste cloth, etc., and apply new grease. (Standard specification: Multemp LRL No. 3 by Kyodo Yushi or equivalent)
Timing belts of axes 3 and 4	• Check the belt tension for axes 3 and 4. • Check the belts for flaws, cracks, wear, etc.
Reduction gear unit of axis 4	Add grease. (Multemp AC-D by Kyodo Yushi or equivalent)
Connectors	Check the connectors for looseness.
Controller	• Check the vent holes for attachment of dust, etc. • Check the controller installation screws, etc., for looseness. • Check the connector connections for looseness. For details on the above checks, refer to the operating manual for the controller.

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

(3) Yearly Inspection

Check the following items every year.

Check location	Description
Harmonic speed reducer	• Check for play in the rotational and axial directions. (Contact IAI if an abnormality is found.) • Change the grease. (Contact IAI.)*
Joint bearing	Check for play in the rotational and axial directions. (Contact IAI if an abnormality is found.)

* Based on 24-hour operation. Change the grease every three years or so if the robot is operated eight hours a day.

⚠ Warning

- Performing inspection or maintenance without fully understanding the details of work may result in a serious accident.
- If inspections are neglected, the drive part may wear prematurely or the robot may malfunction unexpectedly.
- Display a “Work in Progress” sign so that other operators will not operate the controller, operation panel, etc.

7.2 Encoder Battery Replacement

7.2.1 Preparation

The following items are required when replacing the encoder batteries:

- Hex wrench (size: 2 mm)
- New dedicated batteries for IX120/150: AB-* (4 pcs)

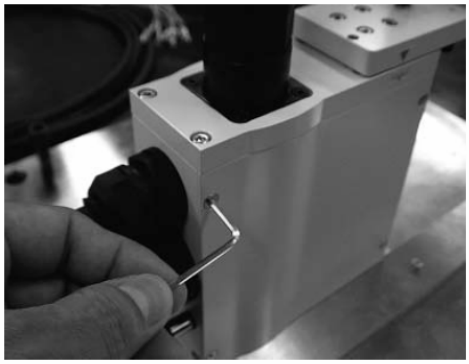
Before replacing the batteries, turn off the power to the controller, control panel and other relevant units.

⚠ Warning **⚠ Caution**

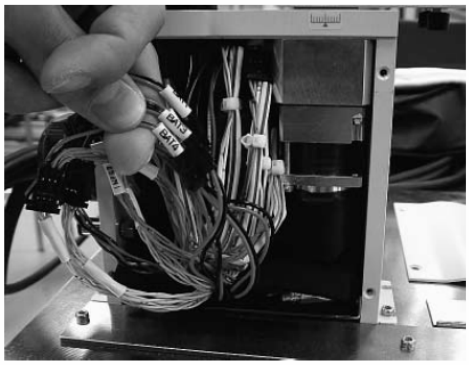
- Performing inspection or maintenance without fully understanding the details of work may result in a serious accident.
- Display a “Work in Progress” sign so that other operators will not operate the controller, operation panel, etc.
- Use the dedicated battery for IX120/150. Batteries for old models (IH) (IX250 to 800) cannot be used.

7.2.2 Encoder Battery Replacement Procedure

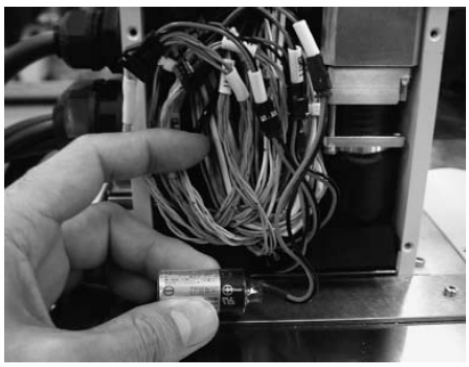
(1) Remove the four hexagonal countersunk bolts from the base cover, and remove the cover (base).



(2) Select the connector (BAT*) corresponding to the battery you want to replace.



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



- After the battery is removed, install a new battery within 1 to 2 minutes (reference). This time applies to each battery being replaced.
- If the replacement takes a longer time, the rotation data will be lost and an absolute reset will become necessary.
- Replace the battery for one axis at a time. If all batteries are replaced at once, the replacement may not complete within the limit time.

(4) Store the batteries into the battery holder.

(5) Affix the cover (base) using the four hexagonal countersunk bolts (tightening torque: 0.8 N·m).

⚠ Caution

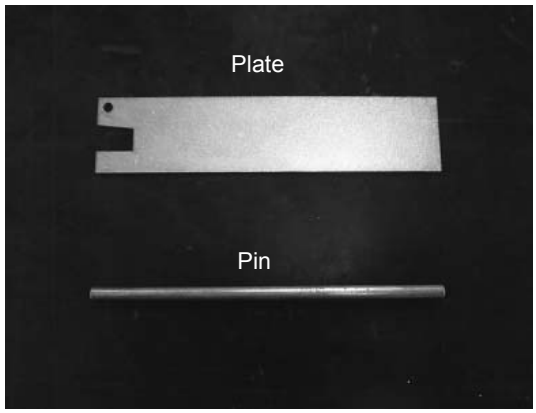
- When installing the cover (base), be careful not to pinch the internal wires.

7.3 Absolute Reset Procedure

The robot is shipped after complete home position adjustment.
Since the IX-NNN-1205/1505 uses an absolute encoder, the home position is set when an absolute reset is performed.
The absolute data in the encoder is backed up by the batteries, which means that once an absolute reset is performed, you need not perform an absolute reset the next time the power is turned on.
However, if the motor has been replaced, an encoder-battery voltage low alarm has been detected, or the absolute data in the encoder has otherwise been lost, you must perform an absolute reset.

7.3.1 Absolute Reset Procedure

(1) Prepare an absolute reset jig.
The following absolute reset adjustment jig is required when performing an absolute reset:
Model: JG-* (IX-NNN12**/15**)
An absolute reset adjustment jig is always required for an absolute reset of the rotational axis or vertical axis. However, this jig is not always necessary for an absolute reset of arm 1 (axis 1) or arm 2 (axis 2).



Absolute reset adjustment jig

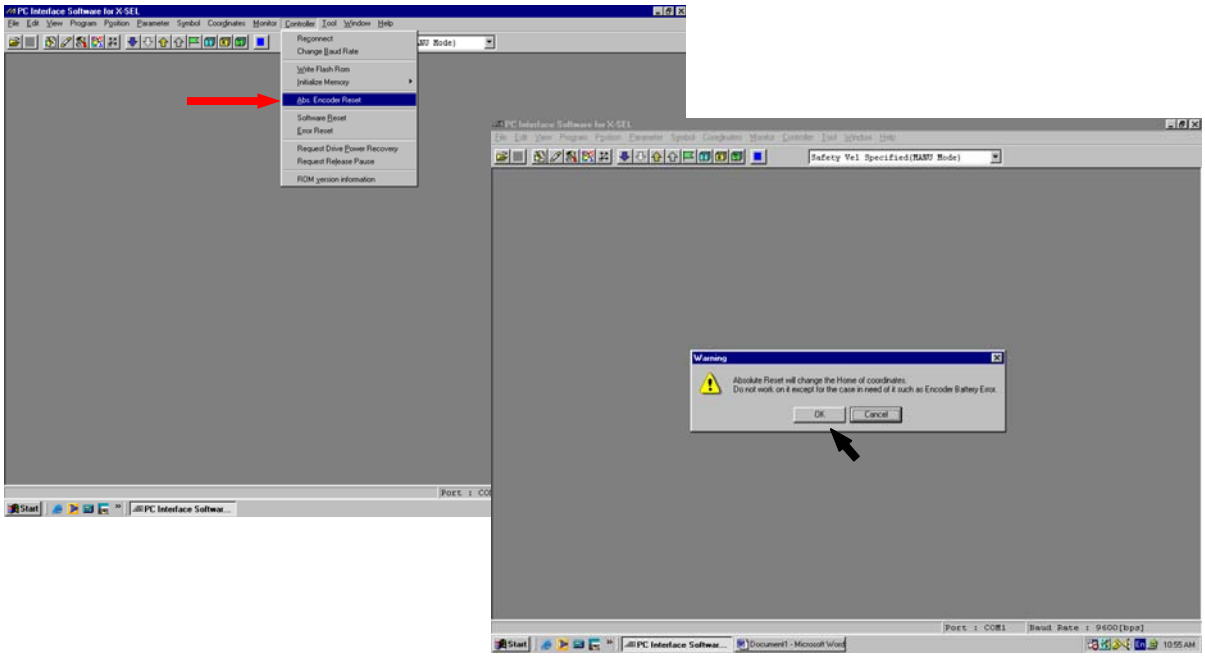
(2) Connect the robot, controller and PC cables so that the robot can be operated using the PC software.
Before commencing the work, always confirm that the emergency-stop switch is functioning properly.
(3) Back up the parameters.
Be sure to back up the parameters before performing an absolute reset.
(4) Start the absolute reset menu.
(5) Perform an absolute reset.
(6) Perform a software reset.

Warning

- Performing inspection or maintenance without fully understanding the details of work may result in a serious accident.
- Display a “Work in Progress” sign so that other operators will not operate the controller, operation panel, etc.
- Back up the parameters before performing an absolute reset.

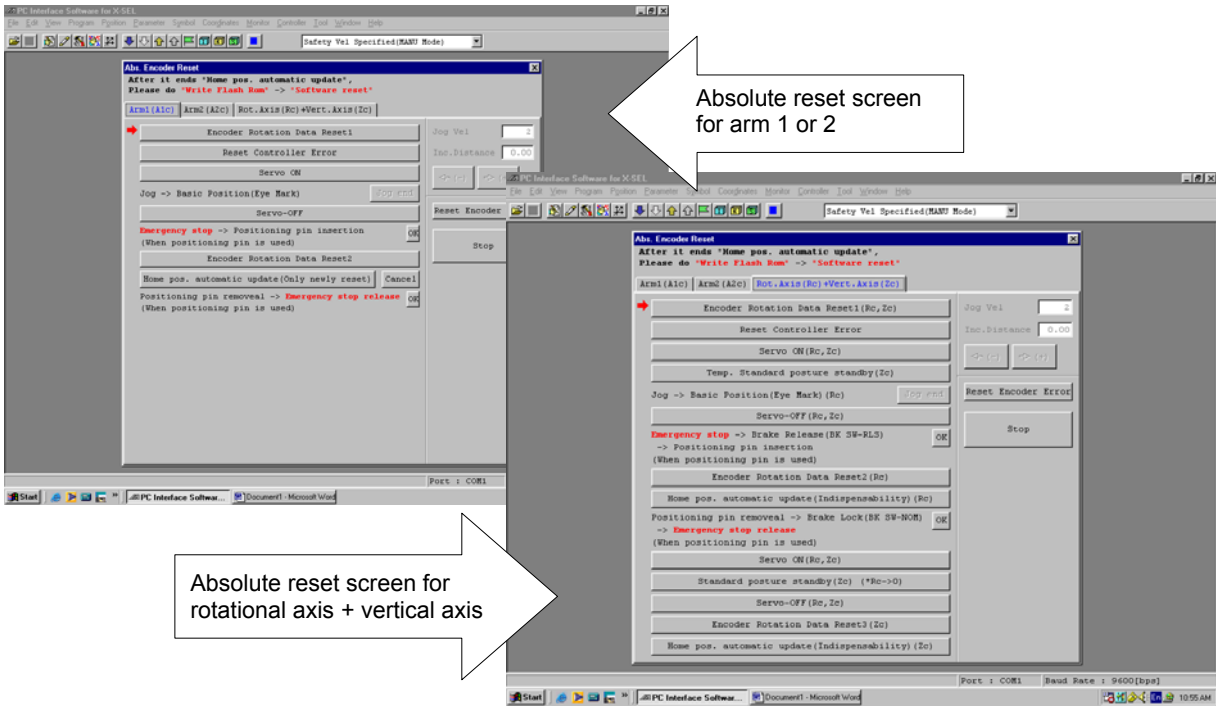
7.3.2 Starting the Absolute Reset Menu

(1) Open the absolute reset window from the PC software.



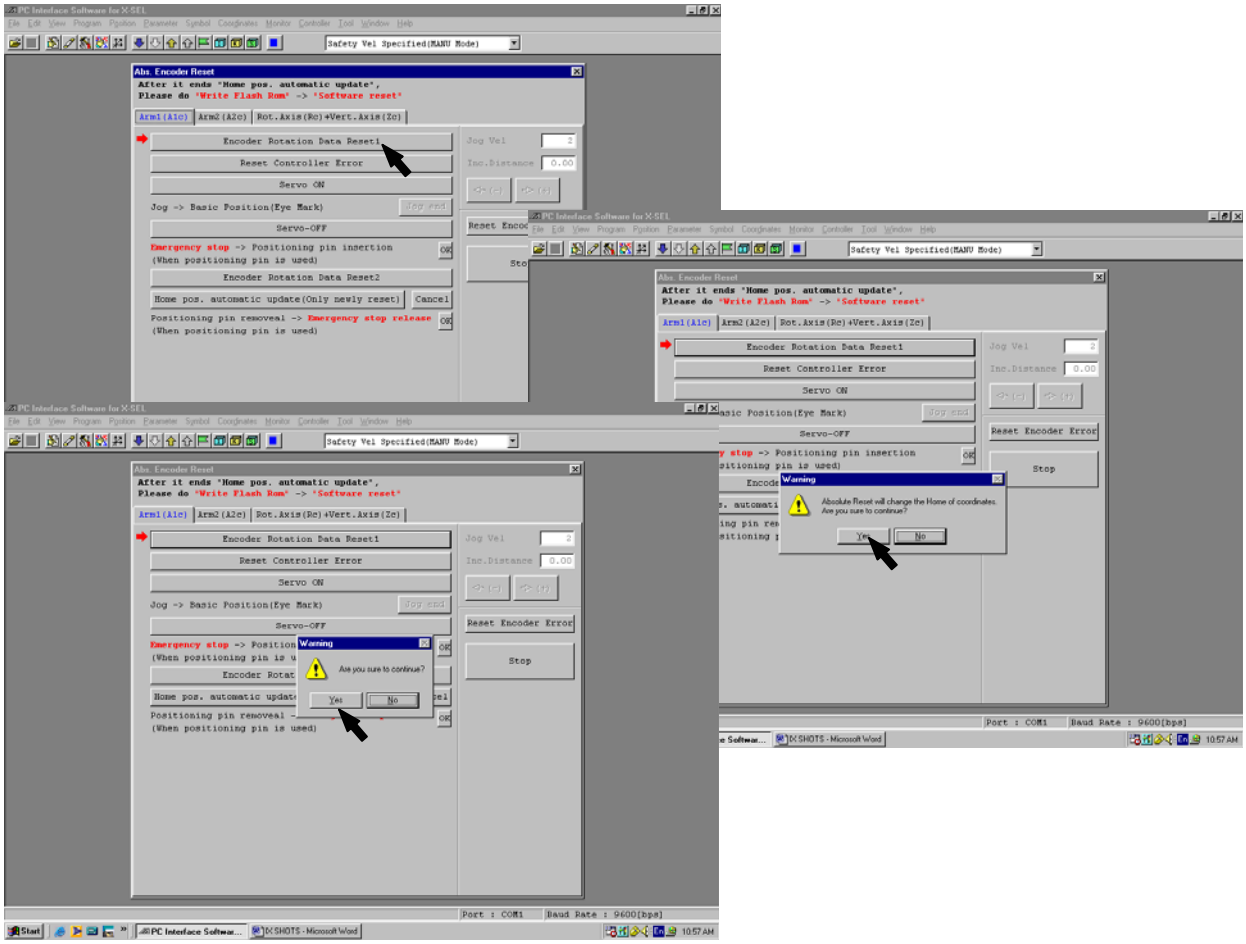
(2) The absolute reset window opens.

- One of three absolute reset screens—for arm 1, arm 2 and rotational axis + vertical axis—is displayed when a corresponding tab is clicked.

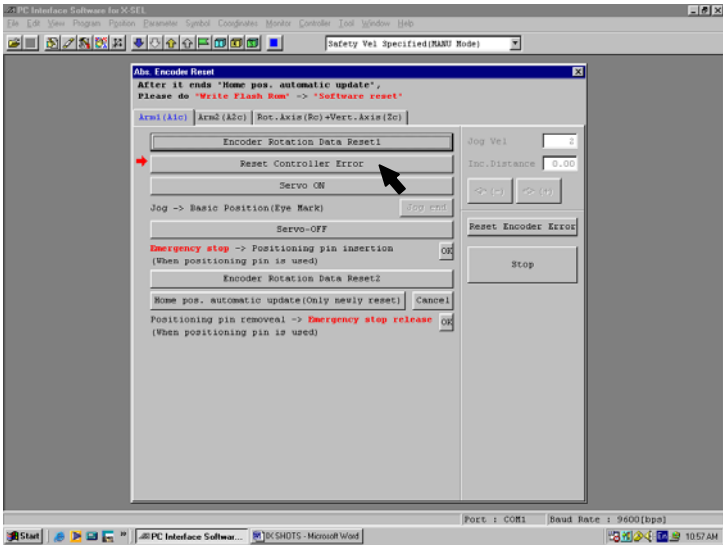


7.3.3 Absolute Reset Procedure for Arm 1 or 2

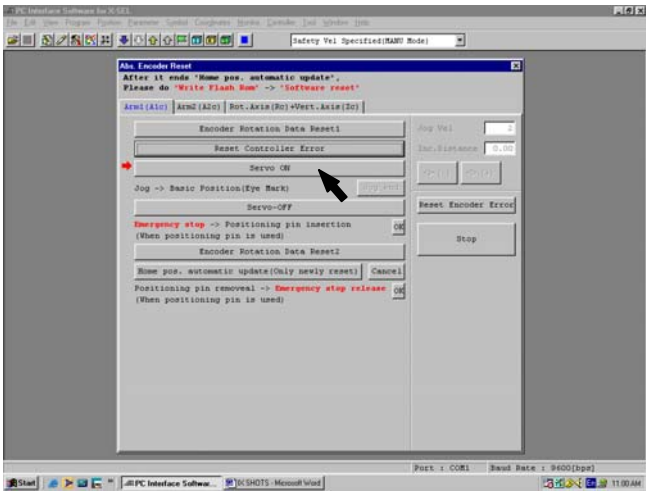
(1) Click the “Encoder Rotation Data Reset1” button.



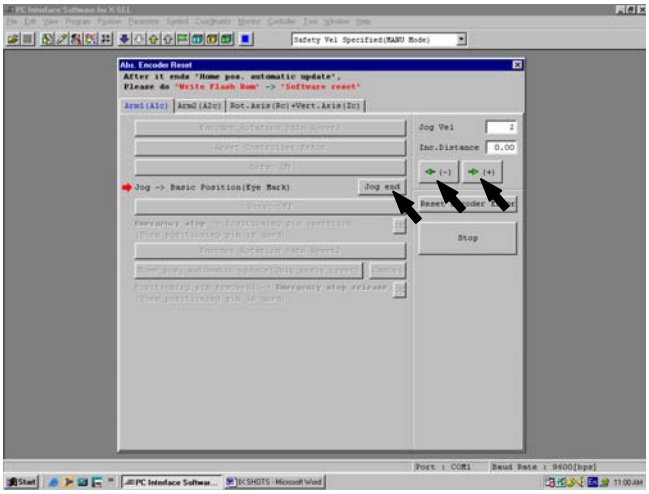
(2) Click the “Reset Controller Error” button.



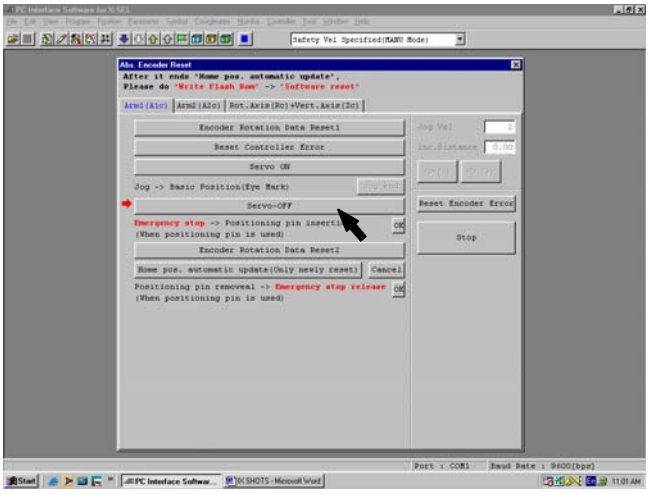
(3) Click the “Servo ON” button.



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

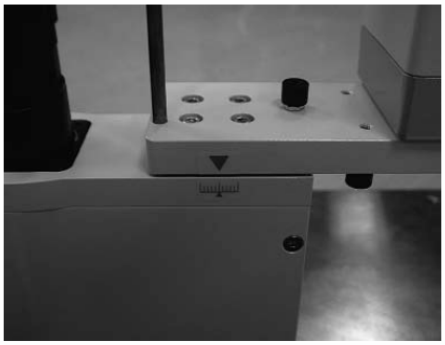


(5) Click the “Servo-OFF” button.



(6) Press the emergency-stop switch.

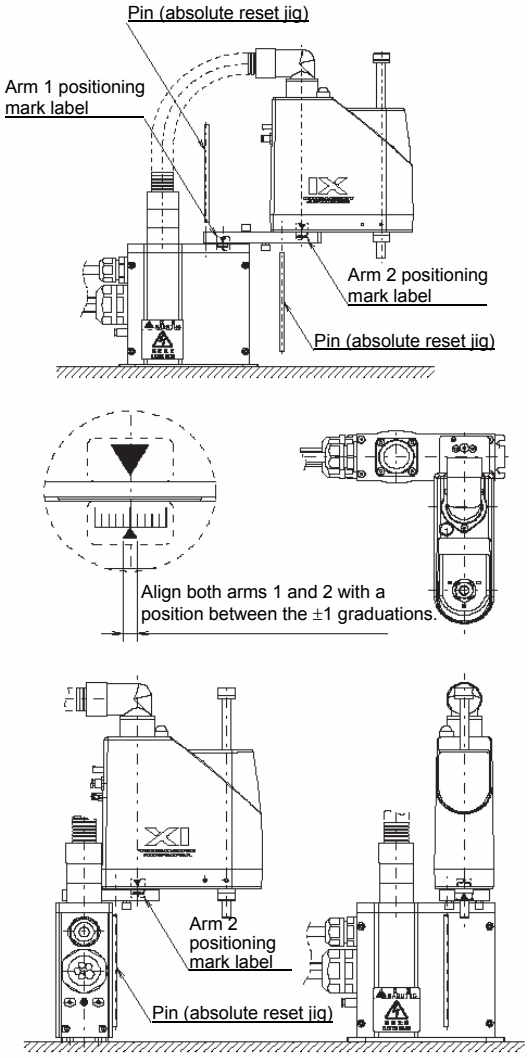
(7) Set an adjustment jig (pin) in arm 1 or 2 to fix the arm at the reference position.
- Set the jig after confirming that the emergency-stop switch is pressed.
- Set the jig after adjusting the arm to the reference position, using the positioning mark label as a guide.
- It is recommended that an adjustment 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.
- To perform an absolute reset of the IX-NNN1205’s arm 2, turn arm 1 by 90° and set the jig.



Arm 1

Arm 2 (IX-NNN1505)

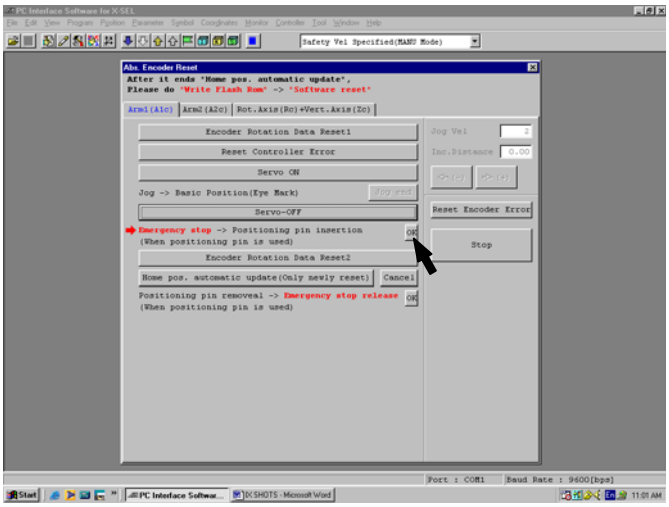
Arm 2 (IX-NNN1205)



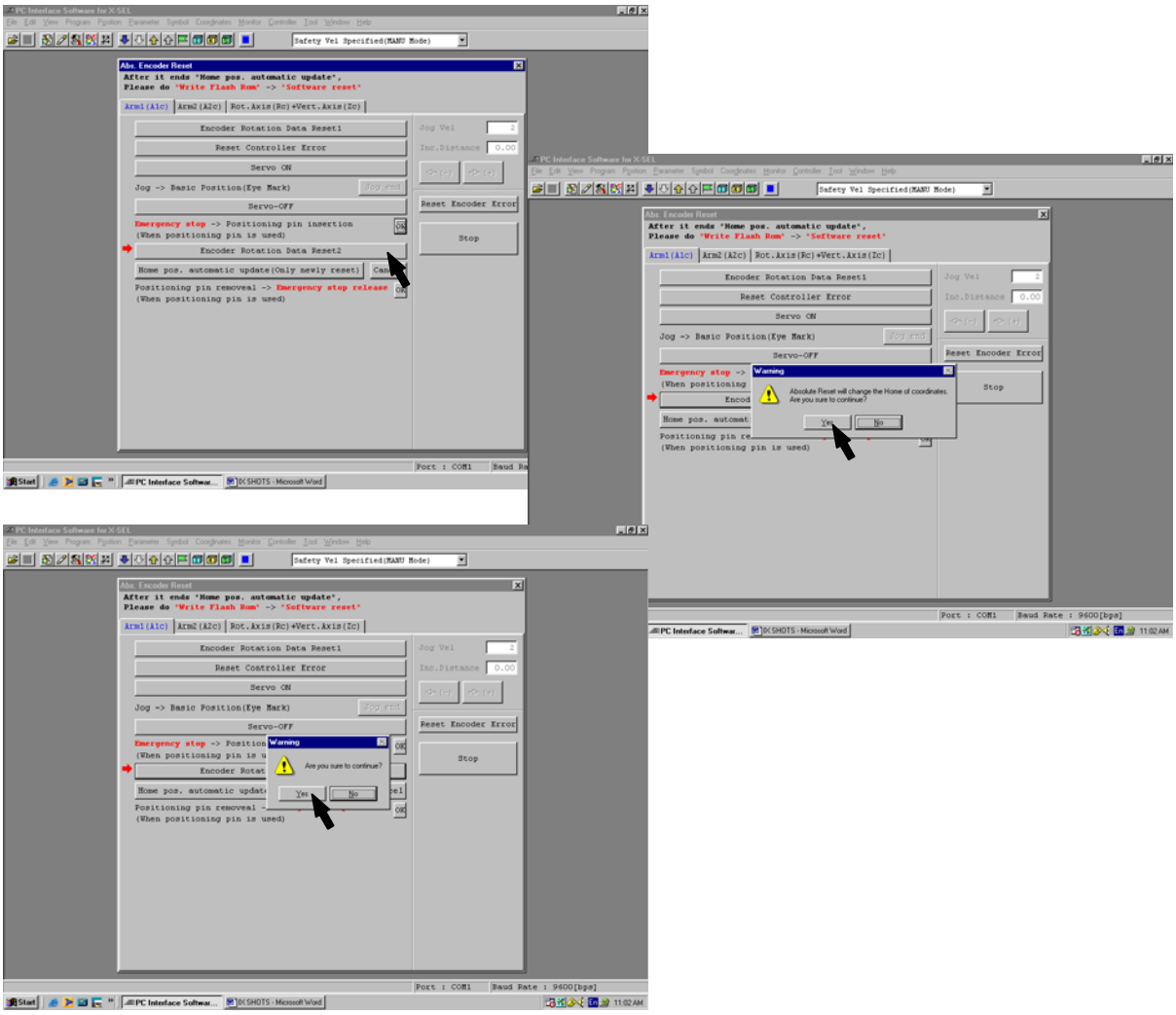
Warning

- 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.



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

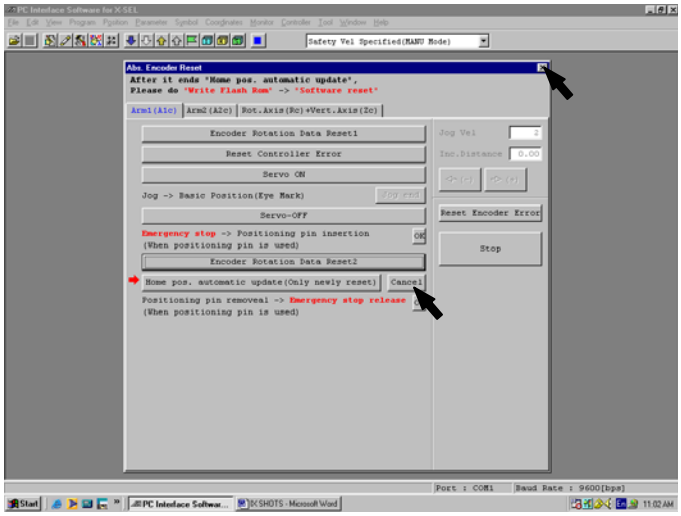


(10) Remove the adjustment jig.

(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.
- If home position automatic update was performed by mistake, do not write the flash ROM, but perform a software reset instead. (This will return the robot to the condition before the home position automatic update.)
- Always click the “OK” button after removing the jig and releasing the emergency-stop switch.



(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.

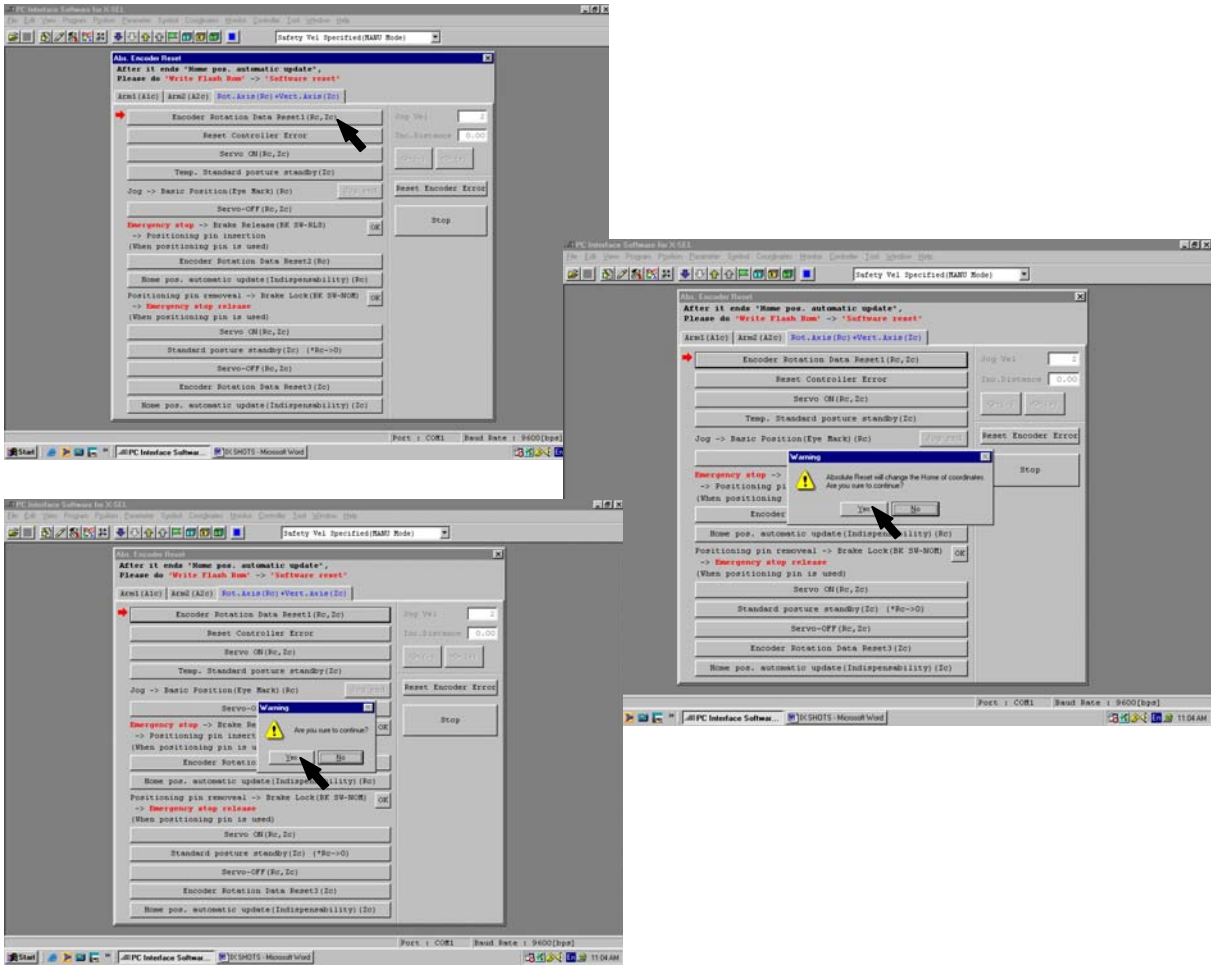
(14) Perform a software reset.

Caution

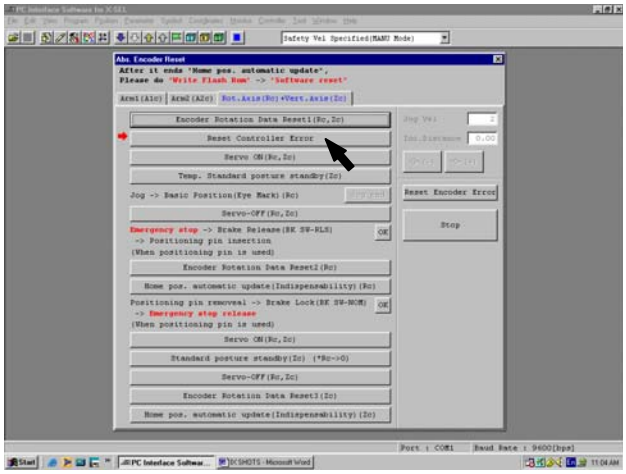
- Be careful not to perform a reset using an incorrect sequence, since it may cause the arm position to become offset.
- Home position automatic update should be performed only after a mechanical change (involving a robot joint), such as replacement of an arm.

7.3.4 Absolute Reset Procedure for the Rotational Axis + Vertical Axis

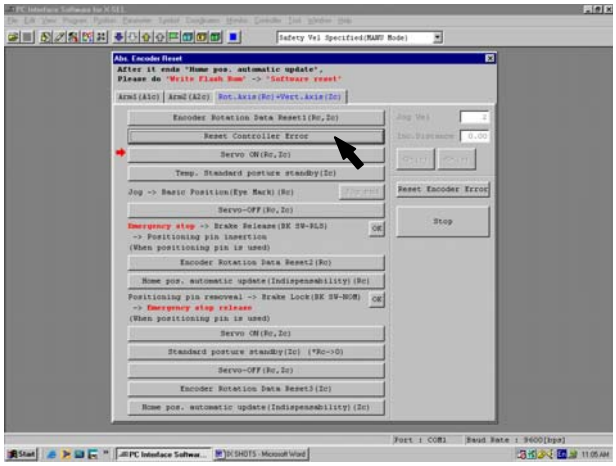
(1) Click “Encoder Rotation Data Reset1” button.



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

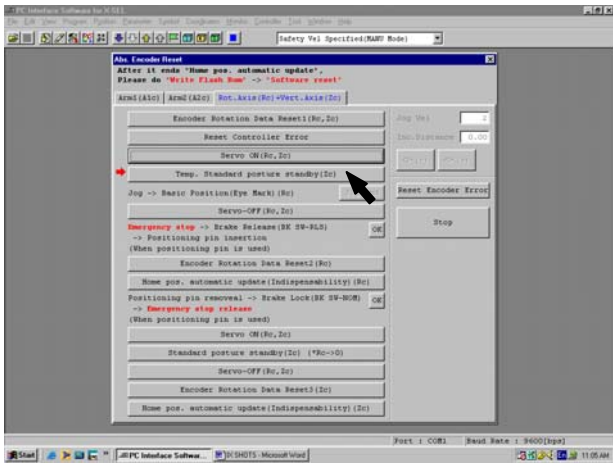


(3) Click the “Servo ON” button.

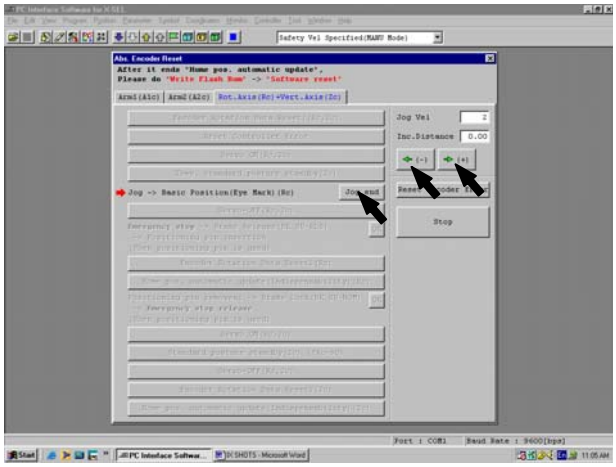


(4) Click the “Temp. Standard posture standby” button.

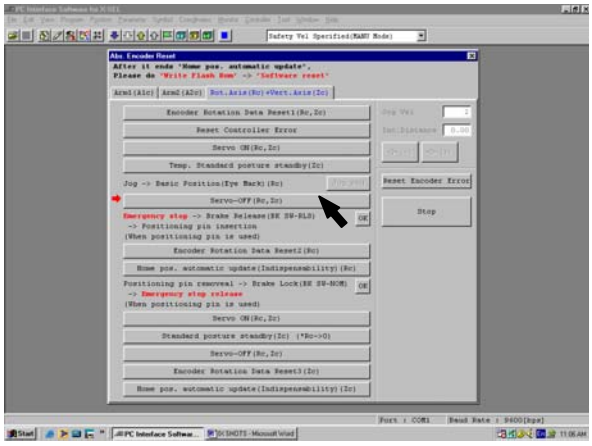
- The vertical axis returns to its home position. Exercise caution so as not to be injured by the axis during movement.



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



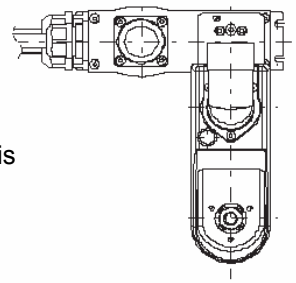
(6) Click the “Servo-OFF” button.

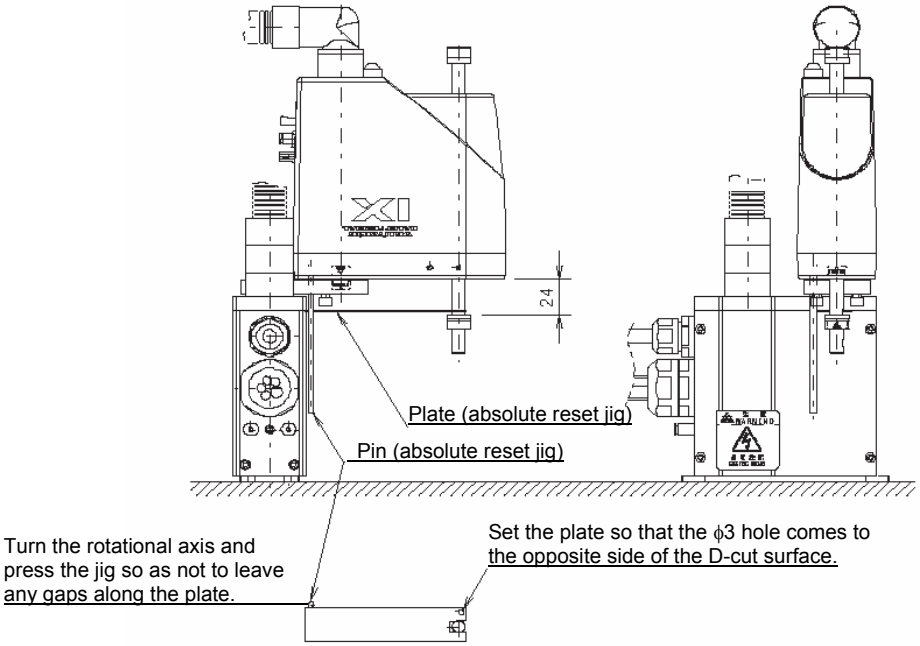


(7) Press the emergency-stop switch.

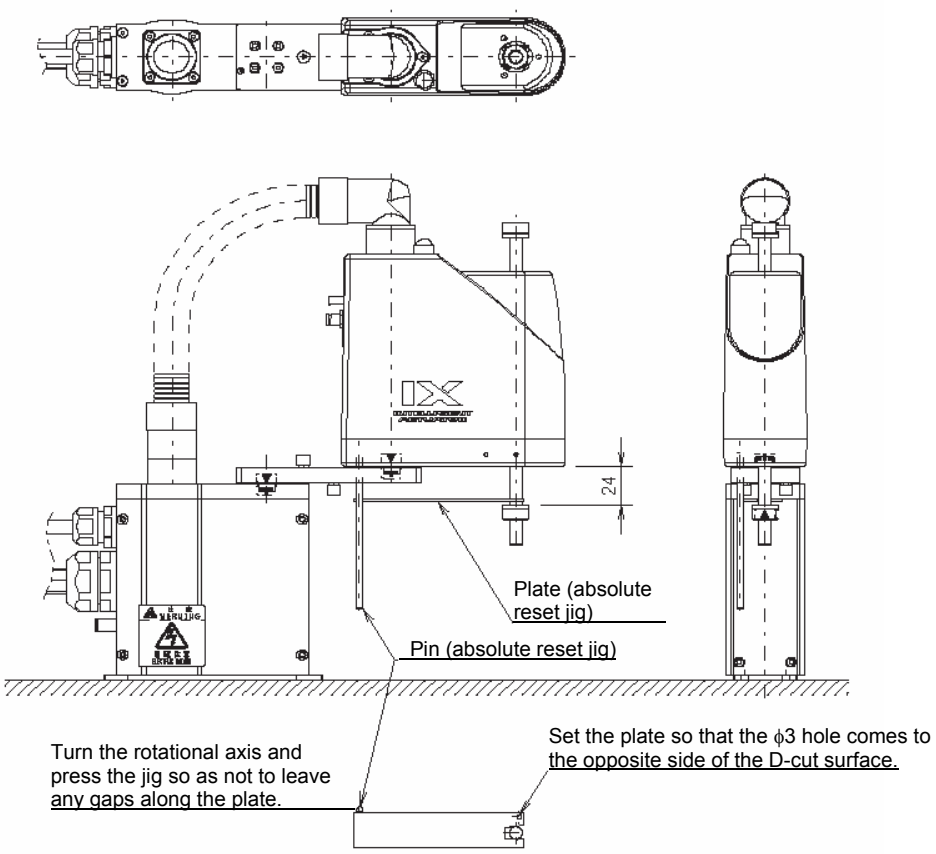
(8) Affix the rotational axis at the reference position by setting the plate and pin of the adjustment jig as illustrated below.
- Set the jig after confirming that the emergency-stop switch is pressed.

Reference position of IX-NNN1205 vertical axis





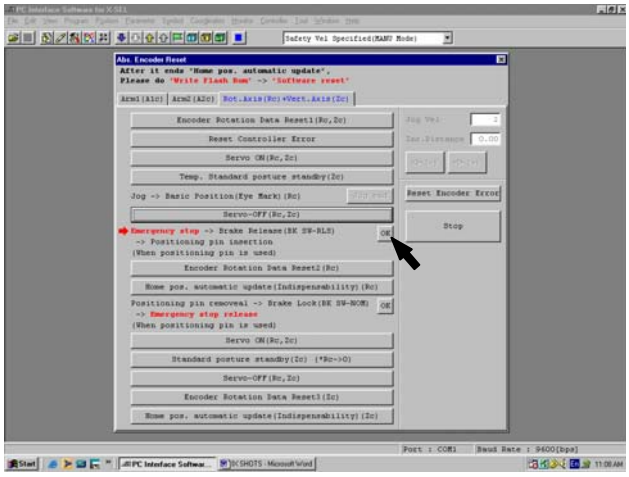
Reference position of IX-NNN1505 vertical axis



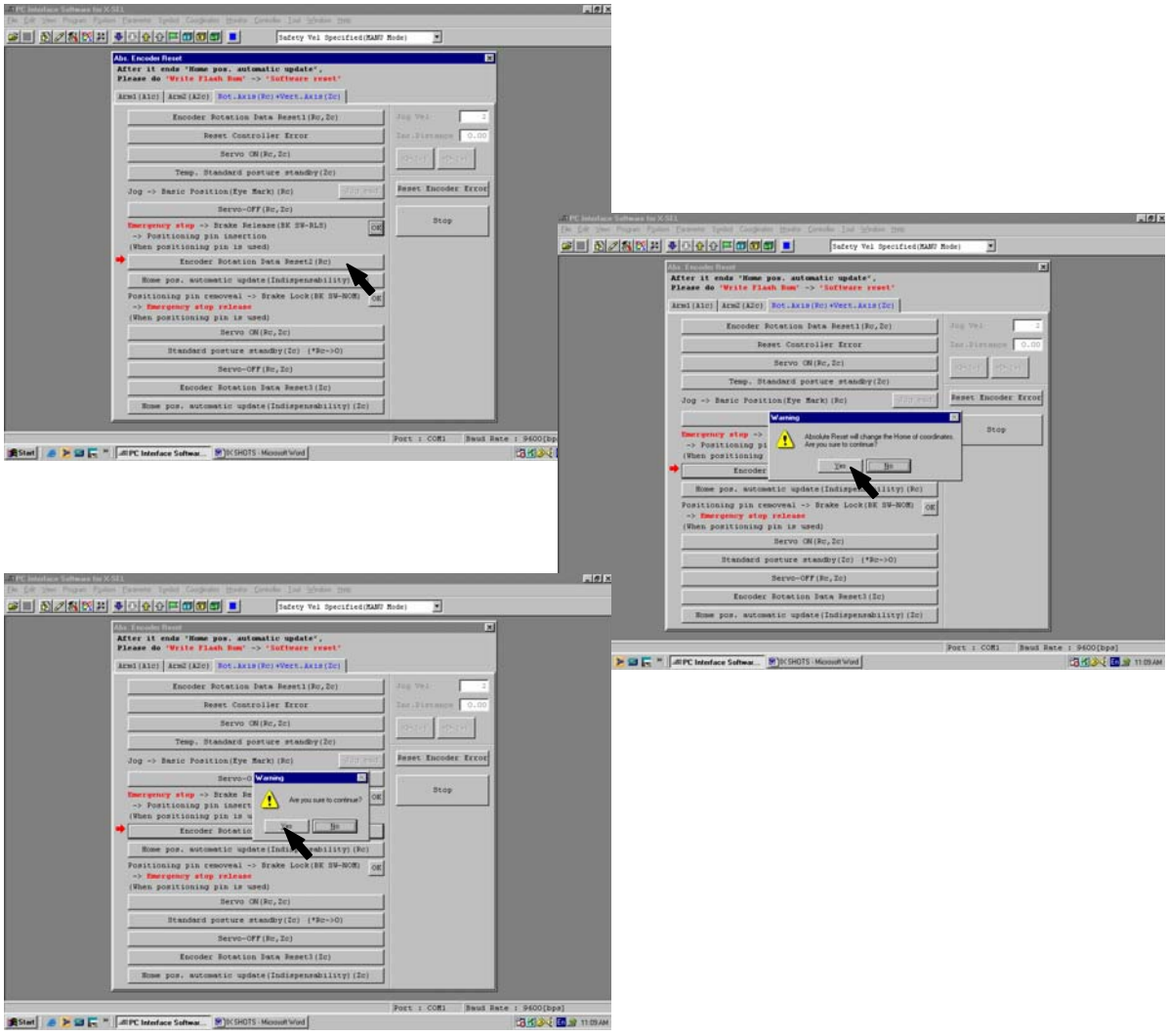
Warning

- 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 pressing direction of the D-cut surface of the plate jig.

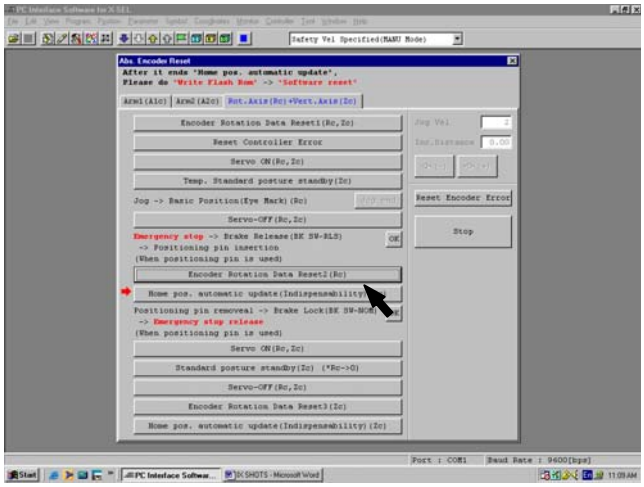
(9) Click the “OK” button.



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



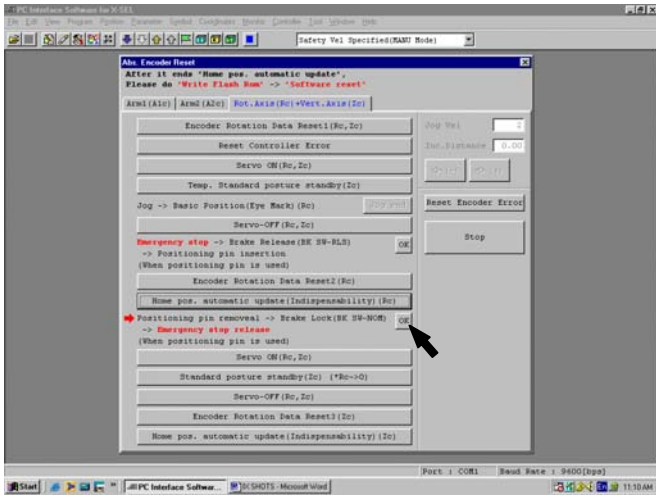
(11) Click the “Home pos. automatic update” button.



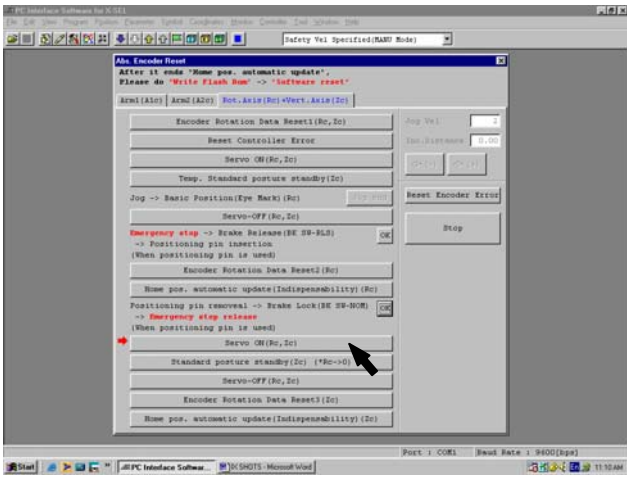
(12) Remove the adjustment jig.

(13) Release the emergency-stop switch.

(14) Click the “OK” button.

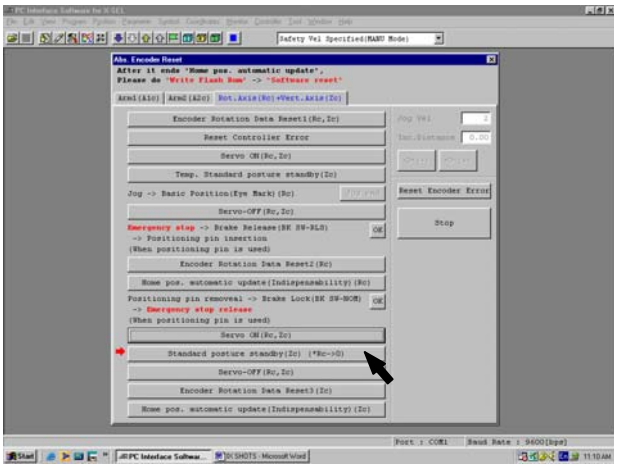


(15) Click the “Servo ON” button.

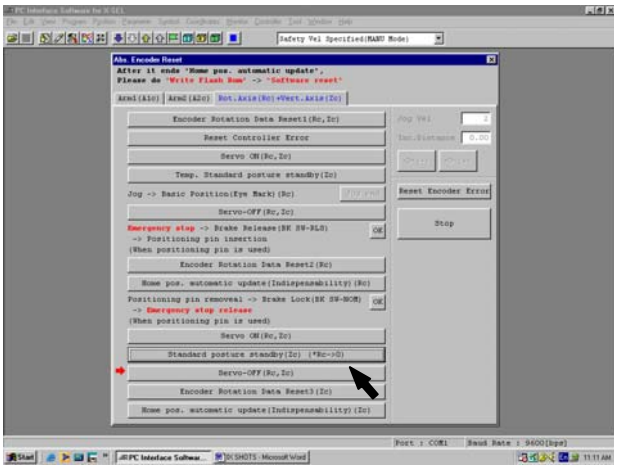


(16) Click the “Standard posture standby” button.

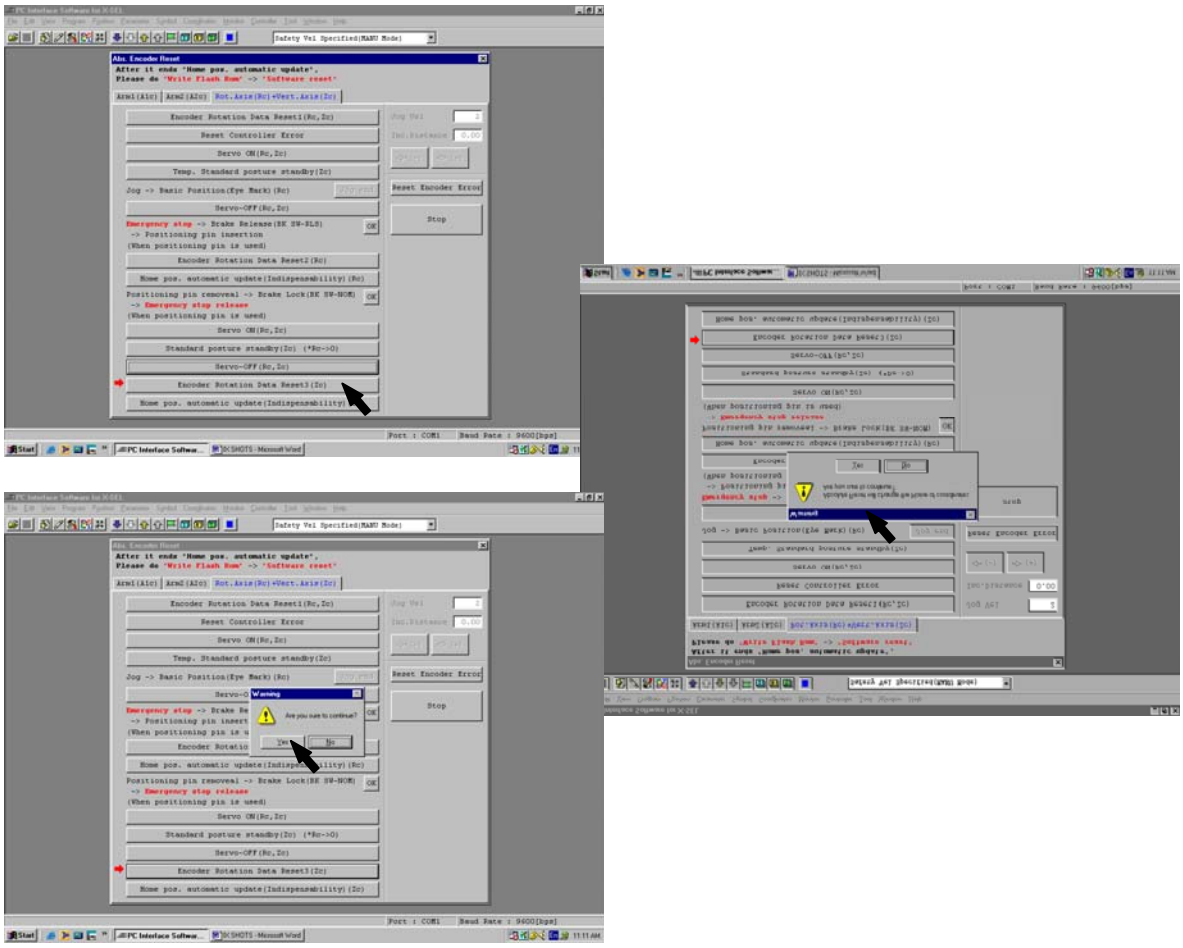
- The vertical axis returns to its home position. Exercise caution so as not to be injured by the axis during movement.



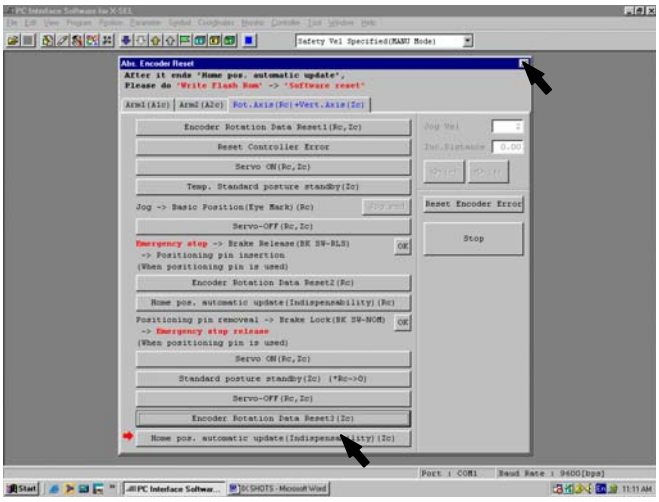
(17) Click the “Servo-OFF” button.



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

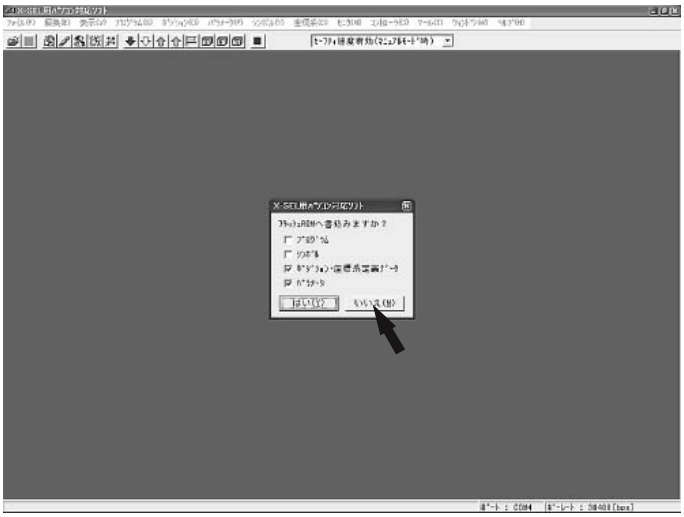


(19) Click the “Home pos. automatic update” button, and then click “X” in the top right-hand corner to exit the absolute reset window.



(20) If an absolute reset was performed on both the rotational axis and vertical axis, or home position automatic update was performed for arm 1 or 2 by mistake, closing the absolute reset window will display the following screen. Click the “No” button.

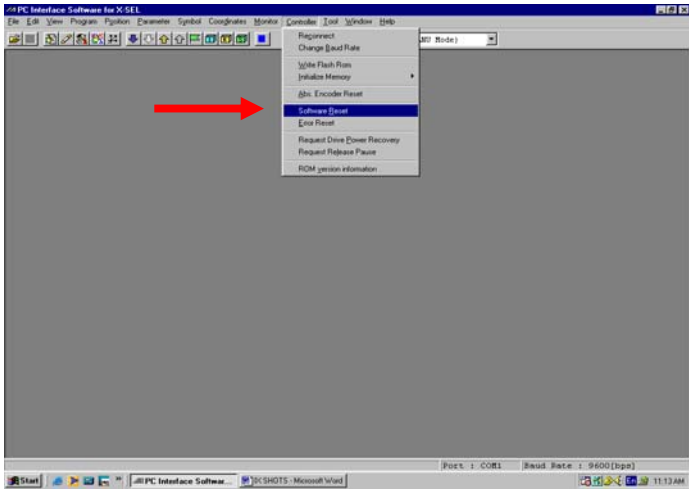
- Click “Yes” only if you have released any mechanically fastened part, such as an arm or belt.
- Even if you have replaced a cable, you should still click “No.”
- Once the absolute reset is complete, be sure to reset the software.



(21) Perform a software reset.

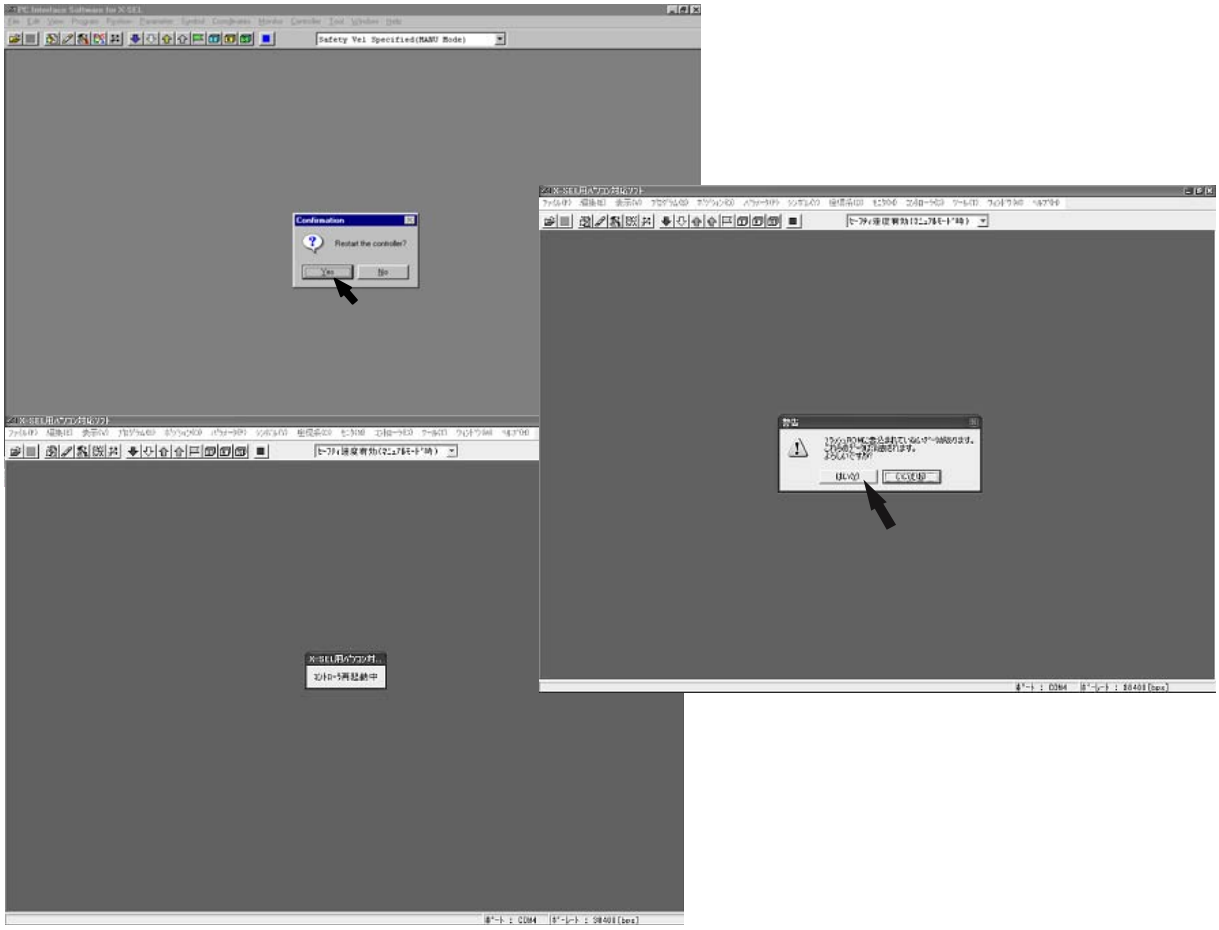
7.3.5 Resetting the Software

(1) Select “Software Reset” from the Controller menu on the tool bar.



(2) Click the “Yes” button twice. The controller will be reset and restarted.

- The message asking whether to delete data that has not written to the flash ROM appears. Click “Yes.”



8. Specifications

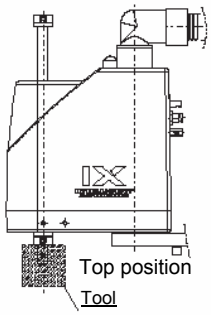
8.1 Specification Table

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

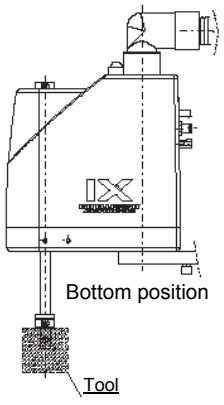
Item			Specifications
Type			IX-NNN1205-**L
Degree of freedom			Four degrees of freedom
Overall arm length		mm	120
Arm 1 length			45
Arm 2 length			75
Drive method	Axis 1 (arm 1)		AC servo motor + Speed reducer
	Axis 2 (arm 2)		AC servo motor + Speed reducer
	Axis 3 (vertical axis)		AC servo motor + Belt + Ball-screw spline
	Axis 4 (rotational axis)		AC servo motor + Spline (direct coupling)
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) (*1)	mm	50
	Axis 4 (rotational axis)	degree	±360
Maximum operating speed (*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 (*3)	Axis 1 + Axis 2	mm	±0.005
	Axis 3 (vertical axis)		±0.010
	Axis 4 (rotational axis)	degree	±0.005
Cycle time (*4)		sec	0.35
Load capacity	Rated	kg	0.2
	Maximum		1.0
Push-in thrust of axis 3 (vertical axis)	Dynamic (*8)	N (kgf)	17.8 (1.8)
	Static (*9)		9.8 (1.0)
Permissible load on axis 4	Permissible moment of inertia (*5)	kg·mm^2	386
	Permissible torque	N·m (kgf·cm)	0.13 (1.3)
Permissible tool diameter (*6)		mm	ϕ35
Origin detection			Absolute
User wiring			8-core, AWG26 shielded cable, with connector (SMP-08V-NC by JST)
Alarm indicator (*7)			One small, red LED indicator (rated voltage: 24 V)
User piping			Two air tubes (outer diameter: ϕ3, inner diameter: ϕ2) (normal service pressure: 0.7 MPa)

Item			Specifications
Operating environment	Ambient 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		Three-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

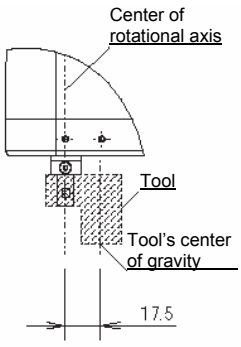
*1 To move the robot horizontally at high speed, perform teaching so that the vertical axis stays as close to the top position as possible. (Fig. 1)
To operate the robot with its vertical axis at the bottom position, the speed and acceleration must be reduced as appropriate. (Fig. 2)
*2 Assuming PTP instruction operation.
*3 Measured at a constant ambient temperature of 20°C.
*4 Measured when the robot is operated at the maximum speed, carrying a load of 0.2 kg. (Back and forth over 100 mm in the horizontal direction or 25 mm in the vertical direction)
*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)
Align the center of the rotational axis with the tool's center of gravity as closely as possible.
If the tool's center of gravity is further away from the rotational center of axis 4, the speed and acceleration must be reduced as appropriate.
*6 If the tool exceeds the permissible diameter, it will contact the robot inside the robot's range of movement. (Fig. 4)
*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.
*8 A force of up to three times the dynamic push-in thrust may be applied at any given moment.
*9 The static thrust refers to thrust generated within the robot's range of operation based on PAPR instruction.



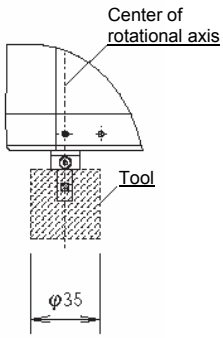
(Fig. 1)



(Fig. 2)



(Fig. 3)



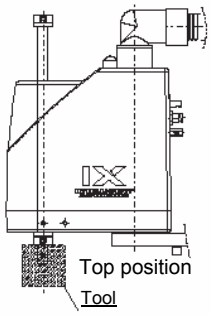
(Fig. 4)

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

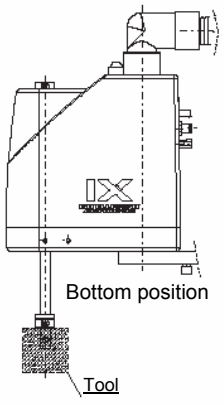
Item			Specifications
Type			IX-NNN1505-**L
Degree of freedom			Four degrees of freedom
Overall arm length		mm	150
Arm 1 length			75
Arm 2 length			75
Drive method	Axis 1 (arm 1)		AC servo motor + Speed reducer
	Axis 2 (arm 2)		AC servo motor + Speed reducer
	Axis 3 (vertical axis)		AC servo motor + Belt + Ball-screw spline
	Axis 4 (rotational axis)		AC servo motor + Spline (direct coupling)
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) (*1)	mm	50
	Axis 4 (rotational axis)	degree	±360
Maximum operating speed (*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 (*3)	Axis 1 + Axis 2	mm	±0.005
	Axis 3 (vertical axis)		±0.010
	Axis 4 (rotational axis)	degree	±0.005
Cycle time (*4)		sec	0.35
Load capacity	Rated	kg	0.2
	Maximum		1.0
Push-in thrust of axis 3 (vertical axis)	Dynamic (*8)	N (kgf)	17.8 (1.8)
	Static (*9)		9.8 (1.0)
Permissible load on axis 4	Permissible moment of inertia (*5)	kg·mm^2	386
	Permissible torque	N·m (kgf·cm)	0.13 (1.3)
Permissible tool diameter (*6)		mm	ϕ35
Origin detection			Absolute
User wiring			8-core, AWG26 shielded cable, with connector (SMP-08V-NC by JST)
Alarm indicator (*7)			One small, red LED indicator (rated voltage: 24 V)
User piping			Two air tubes (outer diameter: ϕ3, inner diameter: ϕ2) (normal service pressure: 0.7 MPa)

Item			Specifications
Operating environment	Ambient 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		Three-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

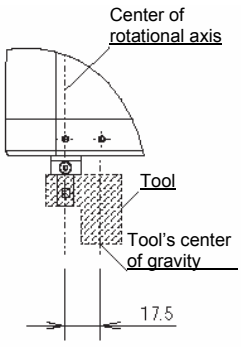
*1 To move the robot horizontally at high speed, perform teaching so that the vertical axis stays as close to the top position as possible. (Fig. 1)
To operate the robot with its vertical axis at the bottom position, the speed and acceleration must be reduced as appropriate. (Fig. 2)
*2 Assuming PTP instruction operation.
*3 Measured at a constant ambient temperature of 20°C.
*4 Measured when the robot is operated at the maximum speed, carrying a load of 0.2 kg. (Back and forth over 100 mm in the horizontal direction or 25 mm in the vertical direction)
*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)
Align the center of the rotational axis with the tool's center of gravity as closely as possible.
If the tool's center of gravity is further away from the rotational center of axis 4, the speed and acceleration must be reduced as appropriate.
*6 If the tool exceeds the permissible diameter, it will contact the robot inside the robot's range of movement. (Fig. 4)
*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.
*8 A force of up to three times the dynamic push-in thrust may be applied at any given moment.
*9 The static thrust refers to thrust generated within the robot's range of operation based on PAPR instruction.



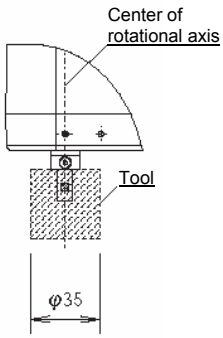
(Fig. 1)



(Fig. 2)



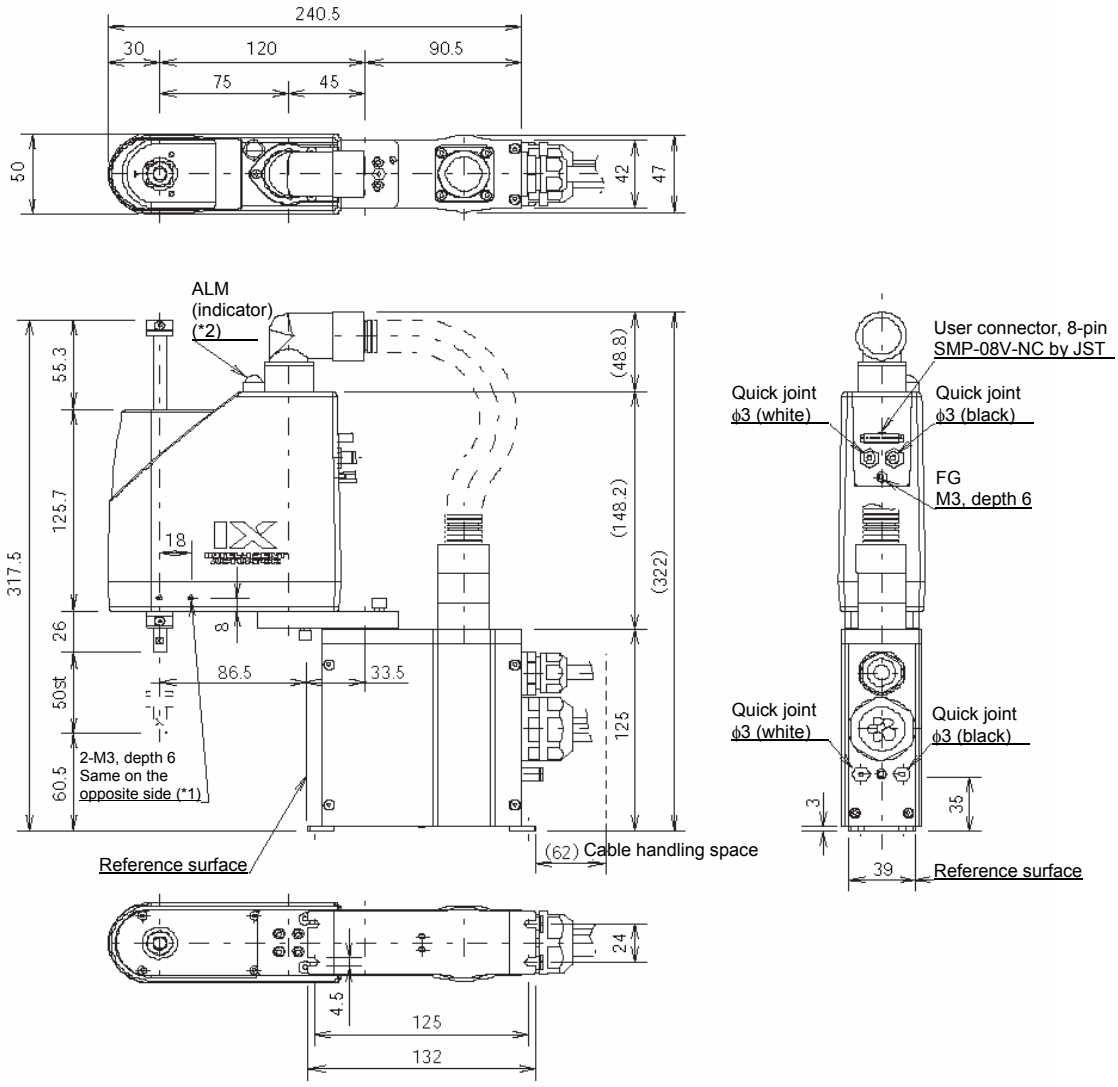
(Fig. 3)

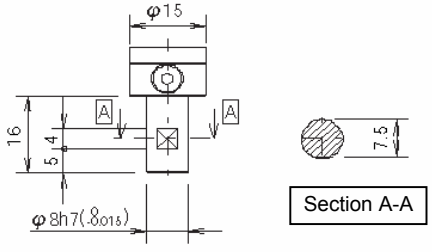


(Fig. 4)

8.2 External Dimensions

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





Detailed view of tip (1/1)

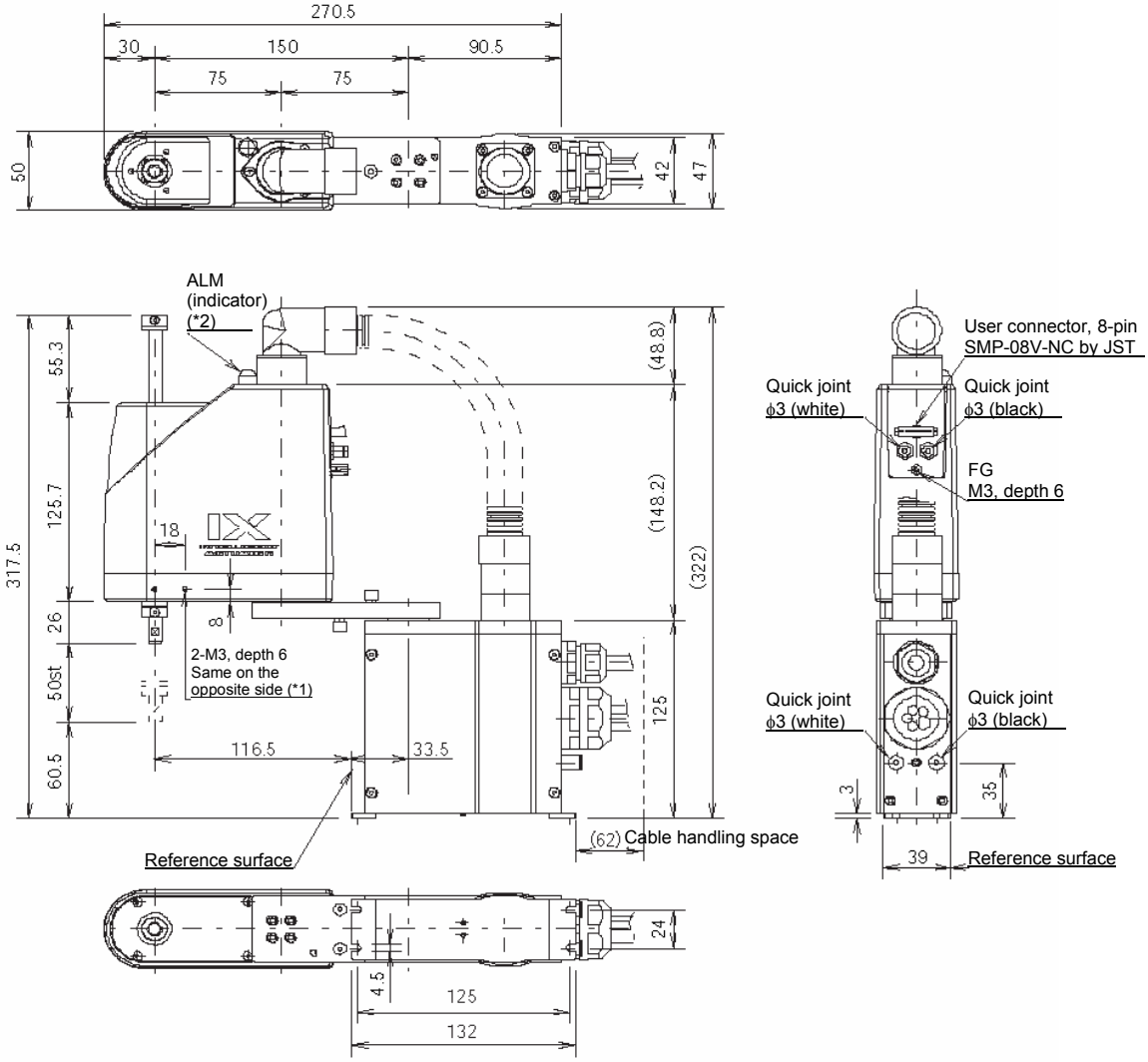
Section A-A

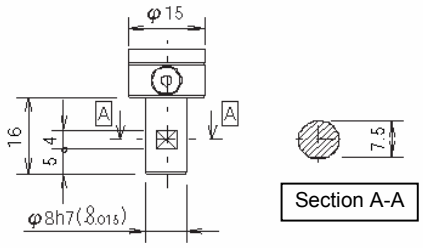
*1: The hole denoted by “2-M3, depth 6” is running through the arm. Take note that use of an excessively long mounting screw may cause the screw to contact the mechanical parts inside the arm.

*2: For the ALM indicator to illuminate, the user must provide a circuit that receives the controller I/O output signal and supplies 24 VDC to the LED terminal in the user connector.

*3: The vertical axis has no brake. Therefore, the vertical axis may drop if the servo is turned off in a condition where the axis is receiving the maximum load capacity.

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





Detailed view of tip (1/1)

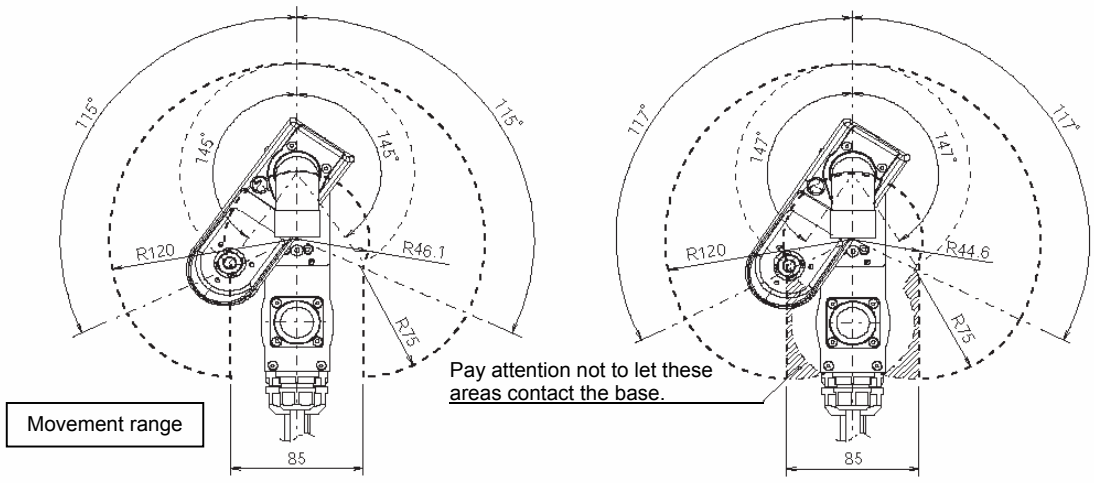
*1: The hole denoted by “2-M3, depth 6” is running through the arm. Take note that use of an excessively long mounting screw may cause the screw to contact the mechanical parts inside the arm.

*2: For the ALM indicator to illuminate, the user must provide a circuit that receives the controller I/O output signal and supplies 24 VDC to the LED terminal in the user connector.

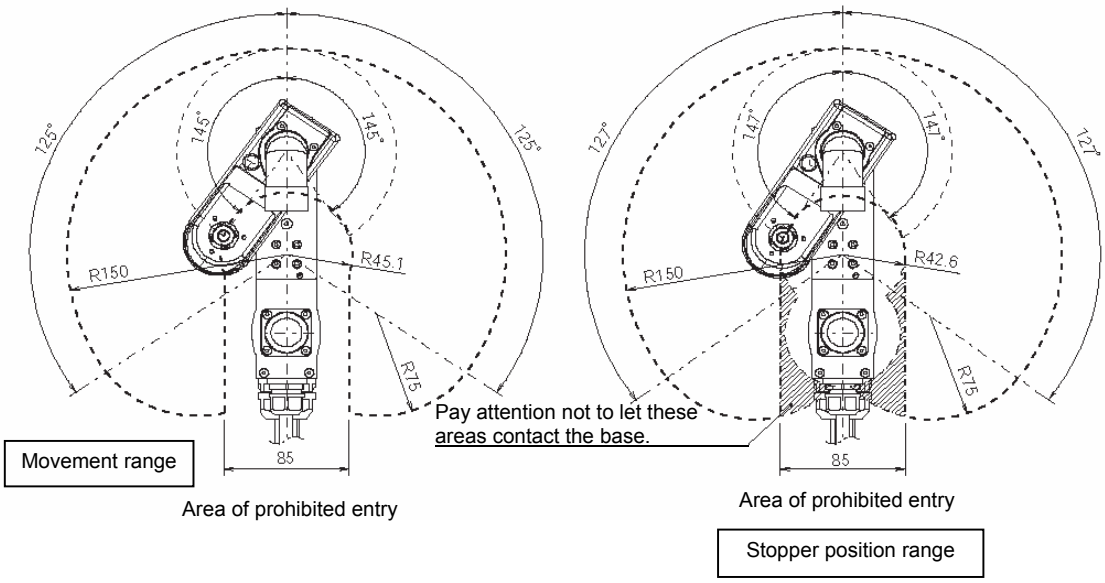
*3: The vertical axis has no brake. Therefore, the vertical axis may drop if the servo is turned off in a condition where the axis is receiving the maximum load capacity.

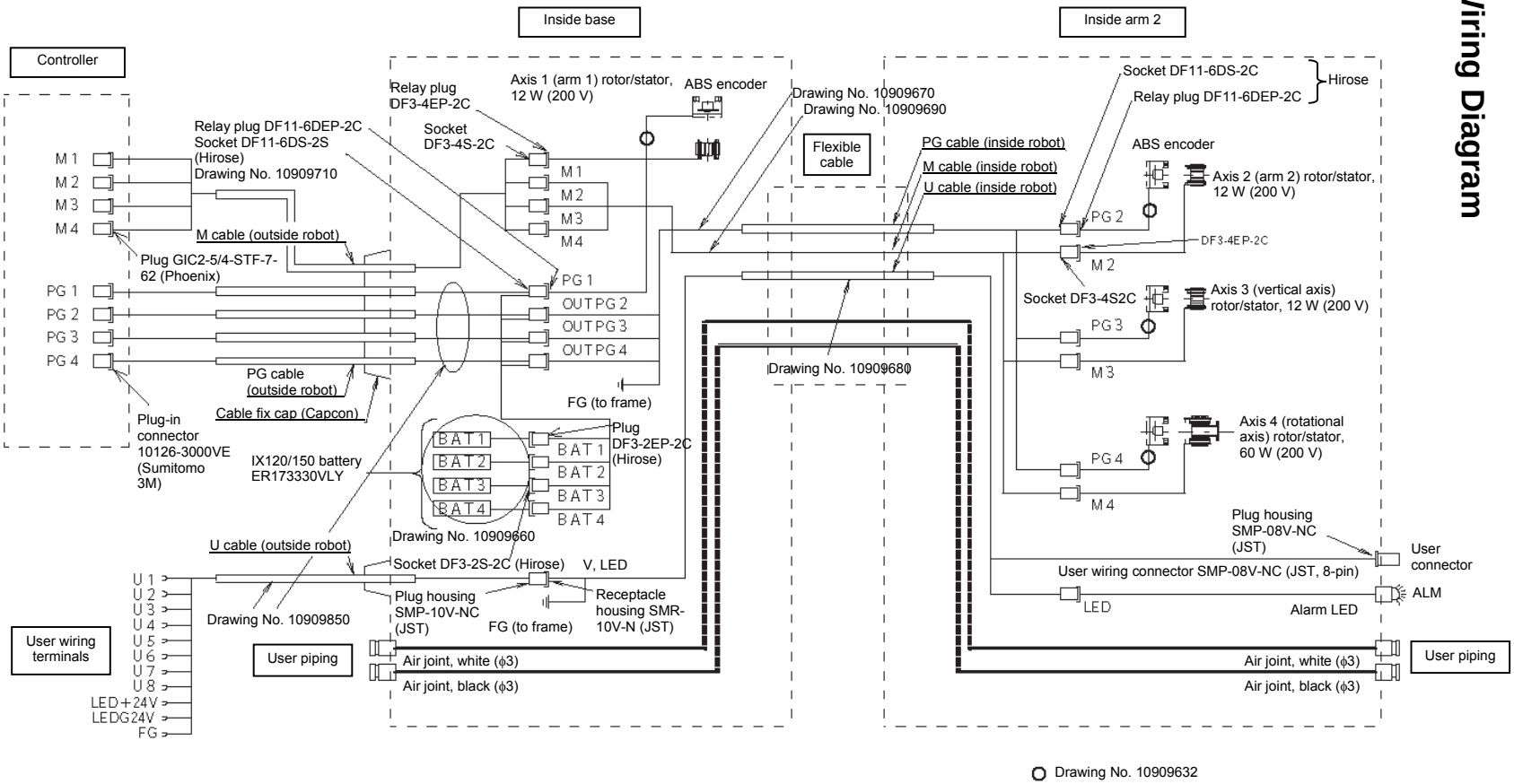
8.3 Robot Operation Area

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

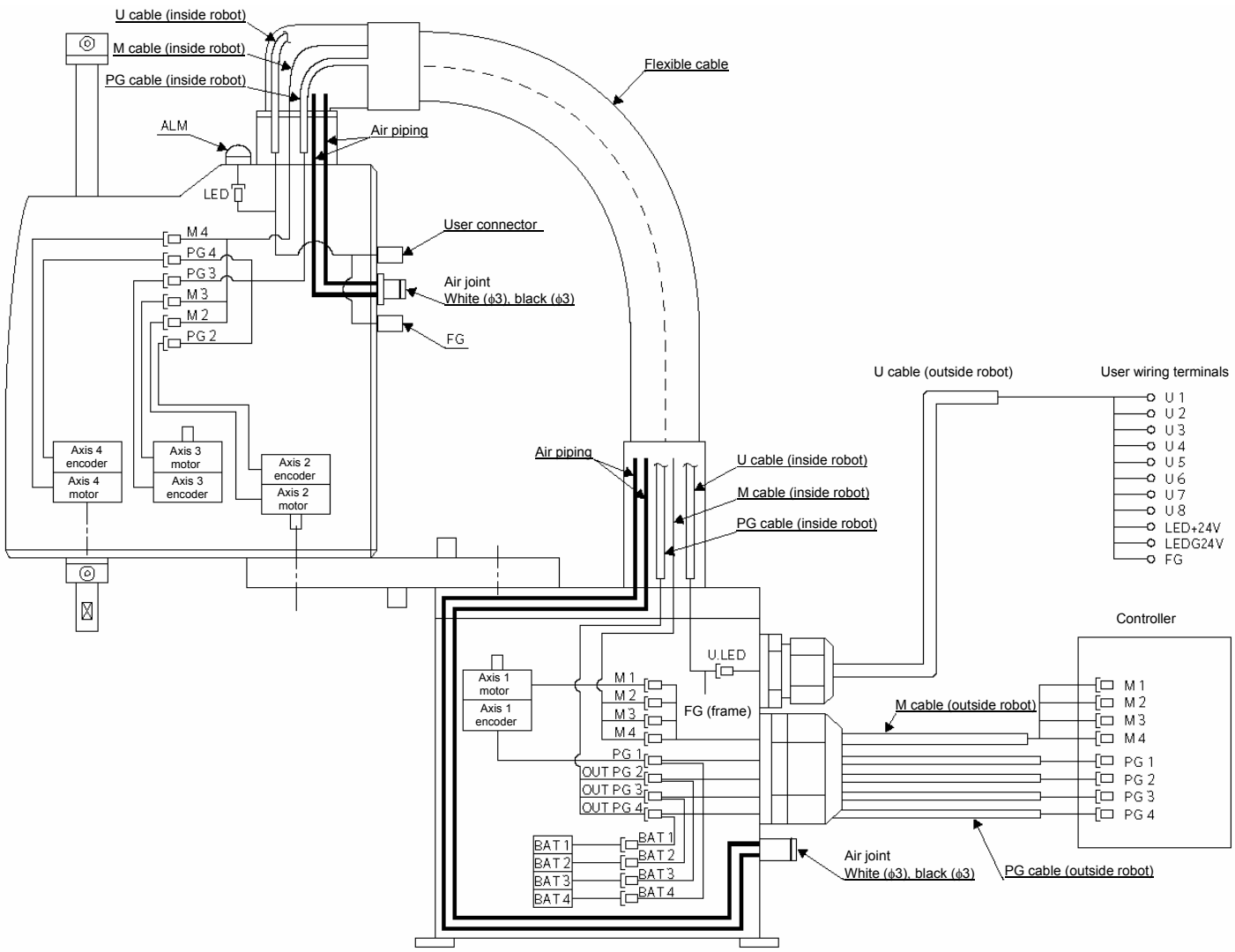


IX – NNN – 1505 (Arm Length 150, Standard Specification)





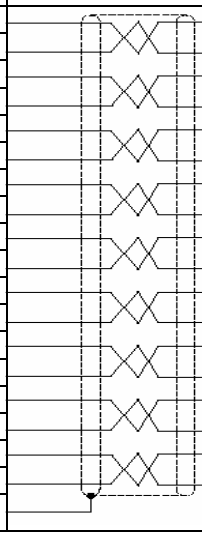
Notes (1) To operate the alarm LED, the user must provide a circuit that uses the controller I/O output signal.


U cable (inside robot)
M cable (inside robot)
PG cable (inside robot)
Flexible cable
ALM
Air piping
LED
User connector
M4
PG4
PG3
M3
M2
PG2
Air joint
White (ϕ3), black (ϕ3)
FG
Axis 4 encoder
Axis 4 motor
Axis 3 motor
Axis 3 encoder
Axis 2 encoder
Axis 2 motor
U cable (outside robot)
User wiring terminals
U1
U2
U3
U4
U5
U6
U7
U8
LED+24V
LEDG24V
FG
Air piping
U cable (inside robot)
M cable (inside robot)
PG cable (inside robot)
Controller
U.LED
Axis 1 motor
Axis 1 encoder
M1
M2
M3
M4
FG (frame)
M cable (outside robot)
PG1
OUT PG2
OUT PG3
OUT PG4
BAT1
BAT2
BAT3
BAT4
Air joint
White (ϕ3), black (ϕ3)
PG cable (outside robot)

Machine Harness Wiring Table

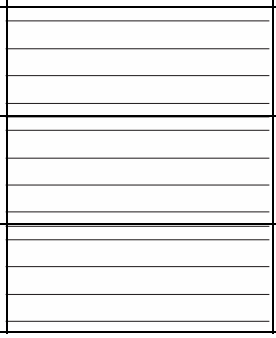
(1) PG cable (inside robot): Drawing No. 10909670

Base end / Arm 2 end

Tube symbol	Connector	Signal	Pin No.	Connection	Pin No.	Signal	Connector	Tube symbol	ID No.	Wire
OUT PG2	Relay plug DF11-6DEP-2C (Hirose)	BAT+	1		1	BAT+	Socket DF11-6DS-2C (Hirose)	PG2	1R/light blue	0.12-mm² 20-core, shielded twisted pair cable
		BAT-	2		2	BAT-			1B/light blue	
		SD	3		3	SD			1R/pink	
		-SD	4		4	-SD			1B/pink	
		Vcc	5		5	Vcc			1R/light green	
		GND	6		6	GND			1B/light green	
OUT PG3	Same as above.	BAT+	1		1	BAT+	Same as above.	PG3	1R/orange	
		BAT-	2		2	BAT-			1B/orange	
		SD	3		3	SD			1R/gray	
		-SD	4		4	-SD			1B/gray	
		Vcc	5		5	Vcc			2R/light blue	
		GND	6		6	GND			2B/light blue	
OUT PG4	Same as above.	BAT+	1		1	BAT+	Same as above.	PG4	2R/pink	
		BAT-	2		2	BAT-			2B/pink	
		SD	3		3	SD			2R/light green	
		-SD	4		4	-SD			2B/light green	
		Vcc	5		5	Vcc			2R/orange	
		GND	6		6	GND			2B/orange	
FG	Round terminal	FG	-						Green	0.12-mm² insulated wire

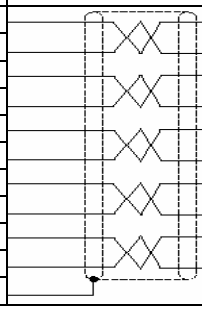
(2) M cable (inside robot): Drawing No. 10909690

Base end / Arm 2 end

Tube symbol	Connector	Signal	Pin No.	Connection	Pin No.	Signal	Connector	Tube symbol	ID No.	Wire
M2	Relay plug DF3-4EP-2C (Hirose)	U	1		1	U	Socket DF3-4S2C (Hirose)	M2	Red	0.2 mm²
		V	2		2	V			White	
		W	3		3	W			Black	
		E	4		4	E			Green	
M3	Same as above	U	1		1	U	Same as above	M3	Red	
		V	2		2	V			White	
		W	3		3	W			Black	
		E	4		4	E			Green	
M4	Same as above	U	1		1	U	Same as above	M4	Red	
		V	2		2	V			White	
		W	3		3	W			Black	
		E	4		4	E			Green	

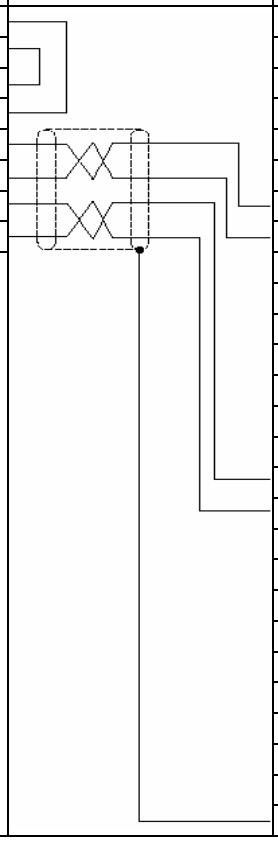
(3) U cable (inside robot): Drawing No. 10909680

Base end / Arm 2 end

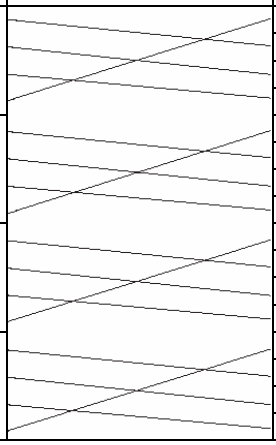
Tube symbol	Connector	Signal	Pin No.	Connection	Pin No.	Signal	Connector	Tube symbol	ID No.	Wire
U	Receptacle housing SMR-10V-N (JST)	U1	1		1	U1	Plug housing SMP-08V-NC (JST)	U	1R/light blue	0.12-mm² 10-core, shielded twisted pair cable
		U2	2		2	U2			1B/light blue	
		U3	3		3	U3			1R/pink	
		U4	4		4	U4			1B/pink	
		U5	5		5	U5			1R/light green	
		U6	6		6	U6			1B/light green	
		U7	7		7	U7			1R/orange	
		U8	8		8	U8			1B/orange	
		LED+24	9		1	LED+24	Socket DF3-2S-2C (Hirose)	LED	1R/gray	0.12-mm² insulated wire
		UEDG24	10		2	UEDG24			1B/gray	
FG	Round terminal	FG	-							

Robot Cable Wiring Table

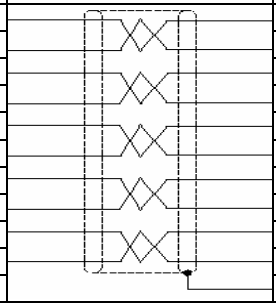
(1) PG cable (outside robot): Drawing No. 10909850

Robot end					Controller end					
Tube symbol	Connector	Signal	Pin No.	Connection	Pin No.	Signal	Connector	Tube symbol	ID No.	Wire
BAT1 ~ BAT4	Plug DF3-2EP-2C (Hirose)	BAT+	1		1	-	Plug connector 10126-3000VE (Sumitomo 3M)	PG1 ~ PG4	-	0.12-mm² 4-core, shielded twisted pair cable
		BAT-	2		2	-			-	
INPG1 ~ INPG4	Socket DF11-6DS-2S (Hirose)	BAT+	1		3	-			-	
		BAT-	2		4	-				
		SD	3		5	-			-	
		-SD	4		6	-			-	
		Vcc	5		7	SD			Orange 1 red	
		GND	6		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	-			-	
					Hood	-			-	

(2) M cable (outside robot): Drawing No. 10909710

	Robot end				Controller end					
Tube symbol	Connector	Signal	Pin No.	Connection	Pin No.	Signal	Connector	Tube symbol	ID No.	Wire
M1	Socket DF3-4S2C (Hirose)	U	1		1	C・G	Plug GIC2-5/4 -STF-7-62 (Phoenix)	M1		0.2-mm^2 16-core
		V	2		2	U				
		W	3		3	V				
		C・G	4		4	W				
M2	Same as above	U	1		1	C・G	Same as above	M2		
		V	2		2	U				
		W	3		3	V				
		C・G	4		4	W				
M3	Same as above	U	1		1	C・G	Same as above	M3		
		V	2		2	U				
		W	3		3	V				
		C・G	4		4	W				
M4	Same as above	U	1		1	C・G	Same as above	M4		
		V	2		2	U				
		W	3		3	V				
		C・G	4		4	W				

(3) U cable (outside robot): Drawing No. 10909850

	Robot end				Controller end					
Tube symbol	Connector	Signal	Pin No.	Connection	Pin No.	Signal	Connector	Tube symbol	ID No.	Wire
U	Plug housing SMR-10V-N (JST)	U1	1		1	U1	Y-terminal	U1	Orange 1 red	0.12-mm^2 10-core, shielded twisted pair cable
		U2	2		2	U2		U2	Orange 1 black	
		U3	3		3	U3		U3	Light gray 1 red	
		U4	4		4	U4		U4	Light gray 1 black	
		U5	5		5	U5		U5	White 1 red	
		U6	6		6	U6		U6	White 1 black	
		U7	7		7	U7		U7	Yellow 1 red	
		U8	8		8	U8		U8	Yellow 1 black	
		LED+24	9		9	LED+24		LED+24	Pink 1 red	
		UEDG24V	10		10	UEDG24V		UEDG24V	Pink 1 black	
					-	FG		FG	Green	

IX-NNN1205/1505

No.	Code name	Manufacturer	Remarks
1	Axis 1/2/3 servo motor	IAI	AC servo motor, 12 W
2	Axis 4 servo motor		AC servo motor, 60 W
3	M cable (inside robot)		Wire: 300 V, 125°C (rated), AWG24 (0.84 mm^2), UL3266

9. Contacting Us

This product has been designed and manufactured by incorporating all possible measures and quality controls. However, should you find any defect, or if you have any question regarding the handling of the product, please contact IAI.

IAI Corporation
645-1 Shimizu Hirose, Shizuoka City, Shizuoka Prefecture 424-0102 Japan
TEL: 0543-64-5105 FAX: 0543-64-5182

IAI America, Inc.
2690 W. 237th Street, Torrance, CA 90505
TEL: (310) 891-6015 FAX: (310) 891-0815

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

Catalog No.: IX-MJ3643-1A-Mar1606-1

IAI
Quality and Innovation

IAI America, Inc.

Head Office: 2690 W. 237th Street, Torrance, CA 90505
TEL (310) 891-6015 FAX (310) 891-0815
Chicago Office: 1261 Hamilton Parkway, Itasca, IL 60143
TEL (630) 467-9900 FAX (630) 467-9912
New Jersey Office: 7 South Main St., Suite-F, Marlboro, NJ 07746
TEL (732) 683-9101 FAX (732) 683-9103

Home page: www.intelligentactuator.com

IAI Industrieroboter GmbH

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