Safety Precautions (Please Read Before Use)

Before installing, operating, maintaining or inspecting this product, peruse this operating manual as well as operating manuals and related documentations for all equipment and peripherals connected to this product to ensure the correct use of the product. Also keep in mind that these tasks must be performed by individuals who possess sufficient knowledge of the applicable equipment and safe operation thereof. The precautions provided below are intended to prevent bodily injury and/or property damage by making sure the product is used correctly and safely.

In this operating manual, safety precautions are classified as “danger,” “warning,” “caution” and “note.”

<table>
<thead>
<tr>
<th></th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️ Danger</td>
<td>Failure to observe the instruction will result in an imminent danger leading to death or serious injury.</td>
</tr>
<tr>
<td>⚠️ Warning</td>
<td>Failure to observe the instruction may result in death or serious injury.</td>
</tr>
<tr>
<td>⚠️ Caution</td>
<td>Failure to observe the instruction may result in injury or property damage.</td>
</tr>
<tr>
<td>⚠️ Note</td>
<td>The user should take heed of this information to ensure the proper use of the product, although failure to do so will not result in injury.</td>
</tr>
</tbody>
</table>

Take note that, depending on the situation, a failure to heed the directions accompanied by ⚠️ Caution or ⚠️ Note may still result in serious consequences.

All instructions provide important information. Read them carefully and handle the product with due care. Keep this operating manual in a convenient place so that it can be readily referenced whenever necessary, and also make sure the manual gets to the hands of the end-users.

⚠️ Danger

General

- Do not use this product for the following applications:
  1. Medical equipment used to maintain, control or otherwise affect human life or physical health
  2. Mechanisms and machinery designed for the purpose of moving or transporting people
  3. Important safety parts of machinery

This product has not been planned or designed for applications requiring high levels of safety. Use of this product in such applications may jeopardize the safety of human life. The warranty covers only the product as it is delivered.

Installation

- Do not use this product in a place exposed to ignitable, inflammable or explosive substances. The product may ignite, burn or explode.
- When installing the product, be sure to securely support and affix it (including the work). Failure to do so may cause the product to tip over, drop or malfunction, resulting in injury.
- Avoid using the product in a place where the main unit or controller may come in contact with water or oil droplets.
Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Doing so may result in fire.

**Operation**

- Do not enter the machine’s range of operation while the product is operating or standing by. The actuator may move suddenly, causing injury.
- If you are using a pace maker or other mechanical implant, do not come within one meter of the product. The strong magnetic field generated by the product may cause the pace maker, etc., to malfunction.
- Do not pour water onto the product. Spraying water over the product, washing it with water or using it in water may cause the product to malfunction, resulting in injury, electric shock, fire, etc.

**Maintenance, Inspection, Repair**

- Never modify the product. Unauthorized modification may cause the product to malfunction, resulting in injury, electric shock, fire, etc.
- Do not disassemble and reassemble the components relating to the basic structure of the product or its performance and function. Doing so may result in injury, electric shock, fire, etc.

**Warning**

**General**

- Do not use the product outside the specifications. Using the product outside the specifications may cause it to fail, stop functioning or sustain damage. It may also significantly reduce the service life of the product. In particular, observe the maximum loading capacity and speed.

**Installation**

- If the machine will stop in the case of system problem such as emergency stop or power failure, design a safety circuit or other device that will prevent equipment damage or injury.
- Be sure to provide Class D grounding (formerly Class 3 grounding: Grounding resistance at 100 Ω or less) to the actuator and the controller.
- Before supplying power to and operating the product, always check the operation area of the equipment to ensure safety. Supplying power to the product carelessly may cause electric shock or injury due to contact with the moving parts.
- Wire the product correctly by referring to the operation manual. Securely connect the cables and connectors so that they will not be disconnected or come loose. Failure to do so may cause the product to malfunction or cause fire.

**Operation**

- Before operating the moving parts of the product by hand (for the purpose of manual positioning, etc.), confirm that the servo is turned off (using the teaching pendant). Failure to observe this instruction may result in injury.
- Do not scratch the cables. Scratching, forcibly bending, pulling, winding, crushing with heavy object or pinching a cable may cause it to leak current or lose continuity, resulting in fire, electric shock, malfunction, etc.
- Turn off the power to the product in the event of power failure. Failure to do so may cause the product to suddenly start moving when the power is restored, thus resulting in injury or product damage.
- If the product is generating heat, smoke or a strange smell, turn off the power immediately. Continuing to use the product may result in product damage or fire.
- If noise or abnormally high vibration is detected, stop the operation immediately. Continuing to use the product may result in product damage, malfunction due to damage, runaway machine, etc.
If any of the internal protective devices (alarms) of the product has actuated, turn off the power immediately. Continuing to use the product may result in product damage or injury due to malfunction. Once the power supply is cut off, investigate and remove the cause and then turn on the power again.

Do not step on the product, use it as a footstool or place any object on it. You may lose your footing or the product may tip over, resulting in a fall and consequent injury, product damage, malfunction due to damage, runaway machine, etc.

**Maintenance, Inspection, Repair**

Before conducting maintenance/inspection, parts replacement or other operations on the product, completely shut down the power supply. At this time, take the following measures:

1. Display a sign that reads, “WORK IN PROGRESS. DO NOT TURN ON POWER” at a conspicuous place, in order to prevent a person other than the operator from accidentally turning on the power while the operation is working.
2. When two or more operators are to perform maintenance/inspection together, always call out every time the power is turned on/off or an axis is moved in order to ensure safety.

**Disposal**

Do not throw the product into fire. The product may burst or generate toxic gases.

**Caution**

**Installation**

- Do not use the product under direct sunlight (ultraviolet ray), in a place exposed to dust, salt or iron powder, in a humid place, or in an atmosphere of organic solvent, phosphate-ester machine oil, etc. The product may lose its function over a short period of time, or exhibit a sudden drop in performance or its service life may be significantly reduced.

- Do not use the product in an atmosphere of corrosive gases (sulfuric acid or hydrochloric acid). Rust may form and reduce the structural strength of the product.

- When using the product in any of the places specified below, provide a sufficient shield. Failure to do so may result in malfunction:
  1. Place where large current or high magnetic field is present
  2. Place where welding or other operations are performed that cause arc discharge
  3. Place subject to electrostatic noise
  4. Place with potential exposure to radiation

- Do not install this product in places where the product may receive large vibration or shock.

- Provide an emergency-stop device in a readily accessible position so the device can be actuated immediately upon occurrence of a dangerous situation during operation. Lack of such device in an appropriate position may result in injury.

- Provide sufficient maintenance space when installing the product. Routine inspection and maintenance cannot be performed without sufficient space, which will eventually cause the equipment to stop or the product to sustain damage.

- When transporting or installing the product, exercise due caution to prevent injury. For example, securely hold the product using a lift or support or engage multiple operators to carry the product.

- Do not hold the moving parts of the product or its cables during installation. It may result in injury.

- Always use IAI’s genuine cables for connection between the controller and the actuator. Also use IAI’s genuine products for the key component units such as the actuator, controller and teaching pendant.

- The brake mechanism is designed to prevent the slider from dropping when the power to the vertical axis is turned off. Do not use it as a safety brake, etc.
Before installing or adjusting the product or performing other operations on the product, display a sign that reads, “WORK IN PROGRESS. DO NOT TURN ON POWER.” If the power is turned on inadvertently, injury may result due to electric shock or sudden activation of an actuator.

### Operation

- Turn on the power to individual equipment one by one, starting from the equipment at the highest level in the system hierarchy. Failure to do so may cause the product to start suddenly, resulting in injury or product damage.
- Do not insert a finger or object in the openings in the product. It may cause fire, electric shock or injury.
- Do not step on the product, use it as a footstool or place any object on it. It may cause scoring, dents or deformation of the driving part, resulting in product damage, unintended stopping due to damage, or performance drop.

### Maintenance, Inspection, Repair

- Wear protective goggles when applying grease to the actuator. Failure to do so may result in eye inflammation due to spattered grease.

### Note

#### Installation

- If the product is used in a vertical setup, be sure to use the vertical specification (with brake).
- Protection covers or other guards must be provided for the moving parts of the equipment to avoid direct contact with the operators.
- Do not configure a control circuit that will cause the work to drop in case of power failure. Configure a control circuit that will prevent the table or work from dropping when the power to the machine is cut off or an emergency stop is actuated.
- Take note of the following items to raise the straight-traveling accuracy of the table and ensure smooth movement of the ball screw and linear guide:
  1. Flatness of the mounting surface must be within 0.05 mm.
  2. The mounting surface area must be large enough to ensure the rigidity of the actuator.

#### Installation, Operation, Maintenance

- When handling the product, wear protective gloves, protective goggles, safety shoes or other necessary gear to ensure safety.

#### Maintenance, Inspection, Repair

- To grease the ball screw during maintenance, use the specified grease. In particular, do not mix fluorine grease and lithium grease, as it may cause insufficient lubrication, higher resistance or other unwanted outcomes and ultimately damage the machine.

#### Disposal

- When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste.

### Others

- IAI shall not be liable whatsoever for any loss or damage arising from a failure to observe the items specified in “Safety Precautions.”
- If you have any question regarding the product, please contact your nearest IAI sales office. The addresses and phone numbers of our sales offices are provided at the end of this operation manual.
Prohibited Handling of Cables

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

1. Do not let the cable flex at a single point.

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

3. Do not pull the cable with a strong force.

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

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

6. Do not pinch, drop a heavy object onto or cut the cable.
7. Cautions for use of a cableveyor

- Do not cause the cables to occupy more than 60% of the space in the cable bearer.
- Do not lay signal lines together with circuit lines that create a strong electric field.
- Always use a robot relay cable.
- If a cableveyor is used, select one with a bending radius $r$ of at least 50 mm.
- Do not let the cable get tangled or kinked in a cable bearer or flexible tube. When bundling the cable, keep a certain degree of flexibility (so that the cable will not become too taut when bent).
- The supplied cable is not a robot cable, so never store it in a cableveyor.
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1. Foreword
Thank you for purchasing the ISAW / ISPAW Actuator. This manual explains the structure, correct operation and maintenance of the Actuator. Please read this manual carefully before using the actuator. Keep this manual in a convenient place so that you can refer to the applicable sections whenever a need arises. For more complete information on operating the actuator, please refer to the controller operating manual.

2. Overview
This actuator is capable for the transport of a heavy load by mounting 600W and 750W motors. Also, its reinforced design enables its use for large overhung loads.

3. Safety Precautions
3.1 Basic Operating Instructions
- Please do not attempt to use or operate the actuator in any manner not indicated in this manual or the controller manual.
- Please be sure to use only the cable provided by IAI to connect the actuator and controller.
- Please do not allow people within the moving range of the unit when it is in operation or when the power is ON since this is dangerous.

3.2 Maintenance and Inspection
- When doing maintenance and inspection work, always shut down the controller power first.
- When doing inspection, make sure that no one can inadvertently turn the power ON.
- Make sure that a sign indicating work in progress is clearly visible.
- If several persons are working, be sure to watch out for each other's safety. In particular, check before turning power ON or OFF and let others know if you are doing work involving axis movement.

(Note)
- The content of this manual is subject to change without notice for the purpose of improvement.
- This manual was created with utmost attention to accuracy. Should you find any error, however, or if you have any question, please contact IAI Sales Engineering or Technical Service Section.
4. Warranty

4.1 Warranty Period

The warranty period expires upon elapse of one of the following periods, whichever is the shortest.

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

4.2 Scope of Warranty

If a breakdown occurs within the period specified above due to defective material or poor craftsmanship, we will repair the actuator at no cost. However, the following items are not covered by this warranty:

- Faded paint or other changes that occur naturally over time.
- Consumable components that wear out with use.
- The actuator is noisy or similar impressions that do not affect machinery performance.
- Damage resulting from improper handling by the user or lack of proper maintenance.
- Alteration not made by IAI or its representatives.
- Breakdown caused by using a controller or controllers not manufactured by IAI.
- Damage caused by fire or other natural disaster or due to an accident.

The warranty pertains to the purchased product itself and does not cover any damage that might arise from a breakdown of the supplied product. All repairs will be done at our factory. Even if the product is still covered by the warranty, we will assess a separate charge for sending technicians to the customer's site.
5. Names of the Parts

The name of the actuator parts are shown below.

In this manual, the left and right sides are indicated by looking at the actuator from the motor end, with the actuator placed horizontally. Front end refers to the side opposite the motor end.

⚠️ Caution: Even if you specify the robot cable, the cable leading from the actuator is not a robot cable. Wire the lines so that this cable will not receive flexural force. The robot cable specification applies to the relay cable.
6. Transportation and Handling

6.1 Handling Each Axis

When transferring the Actuator itself, follow the instructions below.

6.1.1 Handling the Packed Unit

Unless otherwise specified, the actuator is shipped with each axis packed separately. Exercise due caution not to drop the shipping box or subject it to strong impact during transport.

- The operator should not carry heavy shipping boxes by themselves.
- If the shipping box is to be left standing, it should be in a horizontal position.
- Do not climb on top of the shipping box.
- Do not place heavy objects, or objects having a section where loads concentrate, on top of the shipping box.

6.1.2 Handling the Actuator after Unpacking

Hold the actuator by the base when removing it from the shipping box.

- When carrying the actuator, exercise caution not to bump it against nearby objects or structures. In particular, pay attention to the front cover, motor housing and encoder cover.
- Do not exert an excessive force on any part of the actuator.

Supplement) See 5, “Names of the Parts” for the names of the actuator parts.
6.2 Handling the Actuator Assembly

Take note of the following items when transporting the actuator with each axis assembled.

6.2.1 Shipping the Pre-assembled Actuator

The specified machine is assembled at IAI, undergoes a shipping test, and then shipped on a pallet with a cover nailed to the pallet. The sliders are secured to prevent sudden movement during transport. If multiple axes are combined, their tips are secured to prevent significant movement due to external vibration.

- The shipping box is not specially designed to protect against impact due to dropping or bumping. Therefore, pay extra attention when handling the shipping box. Also, the box cover is not very strong, so do not place heavy objects on it.
- When hanging the pallet with ropes, support the reinforced base of the pallet. When lifting the pallet with a fork lift, also put the forks below the base of the pallet.
- When setting down the shipping box, prevent it from bouncing or receiving impact.

After unpacking, handle the actuator assembly as specified below.

6.2.2 Handling the Actuator Assembled with Peripherals

After unpacking the machine pre-assembled at IAI or assembling the machine at your site, observe the following handling precautions when the actuator is transported:

- Secure the sliders to prevent sudden movement during transport.
- If any tip of the actuator is overhanging, secure it properly to avoid significant movement due to external vibration.
- If the actuator assembly is transported without the tips being secured, do not apply impact of 0.3 G or more.
- When hanging the actuator with peripherals using ropes, etc., the ropes should not touch the actuator directly. Use proper cushion materials to make sure the loads from the ropes are received by the X-axis base.
- Support the tip of the Y-axis with a separate rope to keep it in a stable horizontal position. To prevent the screw cover from receiving a load, it is recommended that a hook be installed using the M8 female screw (M6 for small actuator types) provided on the Y-axis base and a rope be passed through this hook.
- Be careful not to apply a load on any of the actuator brackets or covers or on the connector box. Also, do not allow the cable to be pinched or deformed excessively.
7. **Installation Environment and Storage Environment**

7.1 **Installation Environment**

The actuator should be installed in an environment meeting the following criteria:

- Avoid direct sunlight.
- The machine should not receive radiant heat from strong heat sources such as a furnace.
- The surrounding air temperature should be 0 to 40ºC.
- The humidity should be 85% or below and there should be no condensation.
- Avoid exposure to corrosive or combustible gases.
- The area should have very little dust and be suitable for normal assembly operations.
- Avoid exposure to oil mist or fluids using in cutting.
- The unit should not be subject to vibrations greater than 0.3G.
- Avoid extreme electromagnetic waves, ultraviolet rays and radiation.

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

7.2 **Storage Environment**

The storage environment should be similar to the operating environment. In addition, you must take precautions against condensation if the unit is to be stored for a long period of time. Unless there are special instructions, we do not include moisture absorption agents when shipping the unit. If you are storing the unit where condensation might occur, then you must treat the entire packing or treat the unit itself after it is unpacked to prevent condensation. The unit can withstand up to 60ºC during a short storage interval but only up to 50ºC if the storage period longer than one month.
8. Installation

The installation process is explained using a single-axis actuator.

8.1 Installing the Main Body

- On the actuator base, there are holes for the base installation. When installing, make sure to use M8 bolts of strength category 10.9 or higher, and use the dedicated washers that are supplied with the bolt (to prevent buckling).

<table>
<thead>
<tr>
<th>Bolt used</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>M8</td>
<td>Use the dedicated washer.</td>
</tr>
</tbody>
</table>
8.2 Installing the Payload to the Slider

- There are tapped holes in the slider where you can affix the payload. To do this, follow the mounting procedure used for the main body.
- If you are anchoring the slider and moving the main body, also install the slider using the tapped holes. (When affixing a heavy load, use also the pin.)
- The slider has two reamed holes that are used to reproduce the correct position when the slider is removed and reinstalled. Use only one of these holes when fine-tuning of perpendicularity, etc., is required.
- Keep the threaded depth 30mm or less.
8.3 Mounting Surface

- The mounting frame should have sufficient rigidity to avoid generation of vibration.
- The surface where the actuator will be mounted should be machined or be equally level, and the flatness between the actuator and the frame should be within 0.05 mm.
- Provide enough space around the actuator so that maintenance work can be carried out.
- The side and bottom of the actuator base provide reference planes for slider travel.
- When traveling precision is required, use these surfaces as the reference for mounting.

As shown in the picture above, the base side surfaces work as the datum for the slider’s run. If accuracy is required, use these surfaces as a datum for the installation.

When installing the unit on the platform using the datum surface, follow the figure shown below for the platform profile. Also, to avoid interference of the platform with the front cover and the rear cover on the sides of the actuator, take a countermeasure by either making a clearance for the cover thickness, or loosening the cover fixing screws to adjust them to clear the interference.

| Dimension A (mm) | 3 to 5 |
8.4 Clamp Screws

- For the base male set screw, use a hexagon socket head cap screws.
- For the bolts, we recommend high strength bolts of ISO-10.9 or higher.
- Make sure the bolt and screw engagement length is the following value or greater:
  - Steel screw → same length as the nominal diameter
  - Aluminum screw → twice as long as the nominal diameter
- If the material of the seat where the screws sit is aluminum, use a washer dedicated for high strength screw. (Otherwise, the screw seat surface may sink.)

The recommended screw torque is given below.

<table>
<thead>
<tr>
<th>Screw nominal diameter</th>
<th>Screw Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>When the surface is steel</td>
</tr>
<tr>
<td>M8</td>
<td>31.3N • m (3.19kgf • m)</td>
</tr>
</tbody>
</table>

8.5 Mounting the Connector Box and the T-Slot (Option)

There are T-slots (width of slot 4mm) in the base for mounting external devices such as a connector box. When using the wiring kit, mount the connector box using these T-slots. Use the slots as necessary to mount sensors or to anchor cables.

⚠️ Caution: We recommend a square nut for the T-slot but you can also use a hexagonal nut. When mounting, check the bolt length to make sure the end does not touch the bottom of the T-slot. Be especially careful during tightening.
9. Connecting the Controller

We will explain the controller wiring for a single axis actuator.

9.1 Standard Wiring Specifications

For a single axis actuator, unless otherwise specified we attach a standard 3 meter cable (5 meter option) to the actuator when we ship the unit.

Please attach the cable end directly to the controller.

- In an application where the cable cannot be anchored, try to place the cable where it will sag only under its own weight or use dedicated cable hose for large radius wire duct to limit the load on the cable.
- Do not cut the cable to lengthen, shorten, or reconnect it.
- The flexibility of the cable is considered for the standard cables. However, it is not for robot use.
  Use cables dedicated for robot use if they are required to be put into a cable drag chain (e.g. cableveyor).

If you wish to alter the cable, please consult with IAI before doing so.

9.2 Using the Dedicated Stand-alone Table

When you make an order for the special selection of the stand-alone cable that comes with a connector box, and the delivery is single axis, the unit is delivered with the specified cables, and also, the cables on the actuator are 0.3m long. (The unit will be delivered with all the cables wired and connected with accuracy when pre-assembly is ordered.)

- Using the dedicated stand-alone cable kit, connect the cable from the actuator to the connector box.
- Ten service wires (usable as signal wires) and two air hoses are supplied with the dedicated stand-alone cable. All these wires/hoses remain unconnected inside the connector box, so connect them as necessary before use.
10. Caution Regarding Usage

10.1 Regarding Maximum Speed

The maximum speed of the ISA-W and ISPA-W are limited by the motor speed and also by the constraint set to prevent resonance of the ball screw shaft. Make sure that the maximum speed of your actuator does not exceed the applicable limit specified in the table below.

Restriction in Stroke and Maximum Speed (unit: mm/s)

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacity W</th>
<th>Lead mm</th>
<th>Stroke (mm)</th>
<th>&lt;800</th>
<th>900</th>
<th>1000</th>
<th>1100</th>
<th>1200</th>
<th>1300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>600</td>
<td>10</td>
<td>500</td>
<td>415</td>
<td>345</td>
<td>290</td>
<td>250</td>
<td>215</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20</td>
<td>1000</td>
<td>835</td>
<td>695</td>
<td>585</td>
<td>500</td>
<td>430</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>40</td>
<td>2000</td>
<td>1670</td>
<td>1390</td>
<td>1170</td>
<td>1000</td>
<td>865</td>
<td></td>
</tr>
<tr>
<td></td>
<td>750</td>
<td>25</td>
<td>1250</td>
<td>1090</td>
<td>920</td>
<td>785</td>
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<td>1570</td>
<td>1360</td>
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<tr>
<td>Intermediate Support</td>
<td>600</td>
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<td>1000</td>
<td>980</td>
<td>860</td>
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<td>1200</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>50</td>
<td>2000</td>
<td></td>
<td></td>
<td>1930</td>
<td>1740</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Caution: Please obey the maximum speed restriction in regards to each actuator. Failure to do so will increase noise level due to ball screw axis resonance as well as cause oscillation, thus leading to a shorter machine life span. In addition, if you wish to operate multiple actuators simultaneously, when operating each actuator independently, please create the program in accordance with the actuator that has the lowest maximum speed setting (see chart above). Make sure to confirm the actuator maximum speed before creating a program.
10.2 Load on the Actuator

- Do not exceed the load shown in the load specification column. Please make note of the slider moment, allowable overhang length and the load weight.
- When the actuator is used in an X-Y configuration, the Ma and Mc moments of the Y-axis are derated to $1/2$ of the rated value due to the actuator not being fully supported (see diagram below).

<table>
<thead>
<tr>
<th>Allowable Load Moment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ma</td>
</tr>
<tr>
<td>139.2N • m (14.2Kgf • m)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Allowable Overhang Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ma Direction</td>
</tr>
<tr>
<td>Under 900</td>
</tr>
</tbody>
</table>

- The center of gravity for the mounted object is at the halfway point of the overhang length.

⚠️ Caution: Applying excessive load moment will physically shorten the guide life span. In addition, any usage with an excessive allowable overhang may lead to oscillation and other negative influences that affect the guide life span.
10.3 Moment Load at Overhanging

When the actuator is used in an X-Y configuration, the Ma and Mc moments of the Y-axis are derated to 1/2 of the rated value due to the actuator not being fully supported.

⚠️ Caution: Applying excessive load moment will physically shorten the guide life span. In addition, any usage with an excessive allowable overhang may lead to oscillation and other negative influences that affect the guide life span.

10.4 Duty Cycle

Please use the actuator with the duty of 50% or less to keep a long life of actuator and to avoid error stops.

\[
\text{Duty (\%)} = \frac{\text{Operation time}}{\text{Operation time} + \text{Off-operation time}} \times 100
\]

If the duty is high, an error, such as the overload error, may occur. In that case, try to lower the duty by making the off-operation time longer.
10.5 Setting the Home Position

10.5.1 Principle of the Homing Operation

(1) Actuator performs homing in the following manner.
(2) The moving direction is determined by the parameters set by the homing command. The software senses the mechanical end in the homing operation.
(3) The slider reverses direction when this end is reached and the place where the Z phase signal is detected becomes the reference point.
(4) The slider travels further by an offset amount defined by the parameters and this position becomes home.

10.5.2 Fine Control of Home Position

The amount of motor turns from detecting the home position sensor signal till the Z-phase signal is already adjusted before delivery.

Shown in the table below is the basic value for the distance from the stopper when the slider stops at the home position after it detects the home position sensor signal and starts to reverse.

<table>
<thead>
<tr>
<th>Model Name</th>
<th>Distance from Mechanical Stopper (~mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>7±2</td>
</tr>
<tr>
<td>Intermediate Support</td>
<td>15±2</td>
</tr>
</tbody>
</table>

As long as the homing direction is the same, you can make fine adjustments to the home position for each actuator by changing the parameters based on this value.

(1) Adjustments are made as follows: Initiate the homing operation and confirm home.
(2) After that, move to the desired home position, check the difference and adjust the parameters. You can reset the parameters on the plus side in the advancing direction (minus direction is not allowed).
(3) If you allow for ample offset amount the movement range is that much more limited. If the offset is greater than 1mm, you will have to reset the stroke soft limit.

10.5.3 Changing Home Direction

If you change the home direction after the unit is delivered, the move direction parameter must be changed and you may need to adjust the encoder Z-phase so please contact IAI.

⚠ Warning:
The encoder not only detects the rotation angle and home signal, but it also performs a critical function in the phase switching of the AC servo power line whose phases have been adjusted precisely. Never touch the encoder to change the setting of home.
10.6 Changing Wiring Direction of Supplied Cables

The direction of the supplied cables wiring is on the back of the rear cover. When a change in the direction is needed due to the equipment layout, follow the instructions below to change the wiring direction.

[Required Items For Replacement]
Blank plug (shown on picture on the right)
(It is included in the Operation Manual package)
• Hex wrench Set

[Procedure]
Describes below is the process to lay the cables to the right viewing the rear cover in front.
1) Dismantle the motor cover and the rear cover.
   • Unscrew the hex socket button head screws fixing the motor cover with a 2.5mm hex wrench.
   • Unscrew the hex socket head cap screws fixing the rear cover with a 3mm hex wrench.
2) Take out the supplied cables from the rear cover.
   • Unscrew the hex socket head cap screws fixing the cables with a 2.5mm hex wrench.

3) Move the cables to the right and attach them to the cable fixing plate.
   Attach the screws that are unscrewed in the previous process.
4) Put the relay connector to the gap under the motor and lay out the motor cable and encoder cable tidily.

Store the connector in the gap under the motor.

Tidy the cables.
5) Fill the cutout with the blank plug (supplied in the product set).

6) Attach the rear cover.
Take care not to pinch the cables, and loosely attach the hex socket head cap screws (M4 × 15 4pcs) with a 3mm hex wrench temporarily.

7) Attach the motor cover.
Tighten the hex socket button head screws (M4 × 5 4pcs) with a 2.5mm hex wrench.

8) Tighten the rear cover properly with the specified torque.
11. Maintenance/Inspection

11.1 Inspection Items and Intervals

Perform maintenance/inspection according to the following timetable. The operating time is assumed to be 8 hours a day. If the actuator is used continuously for 24 hours or the utilization rate is otherwise high, shorten the inspection intervals accordingly.

<table>
<thead>
<tr>
<th>At start of operation</th>
<th>Visual inspection of machine exterior</th>
<th>Interior check</th>
<th>Lubrication</th>
</tr>
</thead>
<tbody>
<tr>
<td>After 1 month of operation</td>
<td>○</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After 6 months of operation</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>After 1 year of operation</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Every 6 months thereafter</td>
<td>○</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Every year thereafter</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

11.2 Visual Inspection of the Machine Exterior

Check the following items visually.

<table>
<thead>
<tr>
<th>Main body</th>
<th>Loose mounting bolts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cables</td>
<td>Damage to cables, connection of connectors</td>
</tr>
<tr>
<td>General</td>
<td>Noise, vibration</td>
</tr>
</tbody>
</table>

11.3 Cleaning

- Clean the exterior surfaces from time to time.
- Wipe off dirt with a soft cloth.
- Do not spray compressed air on the actuator that might force dust into the crevices.
- Do not use petroleum-based solvents as they damage plastic parts and painted surfaces.
- If the unit gets badly soiled, moisten a soft cloth with a neutral detergent or alcohol and wipe the soiled area gently.
11.4 Interior Check

Turn the slider cover, stainless sheet and side cover, and visually inspect the interior. Check the following items for the interior inspection:

<table>
<thead>
<tr>
<th>Main Body</th>
<th>Loose mounting bolts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guide Area</td>
<td>Check for dirt and condition of the lubrication</td>
</tr>
<tr>
<td>Ball Screw Area</td>
<td>Check for dirt and condition of the lubrication</td>
</tr>
</tbody>
</table>

Visual Check of the Interior:
Make a visual check of the interior to see if there is any dust or foreign matter in the unit and check the lubrication. Even if the grease you see around the parts is brown, the lubrication is fine as long as the travelling surface appears shiny.

How to Inspect the Interior:

1. Dismantle the screw cover with using a 2.5mm hex wrench.
2. Check inside.
3. Perform the process in back order to put back the cover.

11.5 Cleaning the Interior

- Use a soft cloth to wipe off dirt on the inside.
- Do not blow compressed air otherwise dust may get in.
- Do not use petroleum-based solvents, neutral detergents or alcohol.
11.6  Lubricating the Guide

11.6.1 Applicable Grease

The applied grease is lithium grease.
The grease applied before delivery is that stated below.

<table>
<thead>
<tr>
<th>Kyodo Yushi</th>
<th>Mul Temp SRL</th>
</tr>
</thead>
</table>

Other companies also sell grease similar to the above product. When ordering from another manufacturer, give the name of the above grease and request something comparable. Comparable products include the following:

<table>
<thead>
<tr>
<th>Shell Oil</th>
<th>Albania Grease No. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile Oil</td>
<td>Mobilux 2</td>
</tr>
</tbody>
</table>

11.6.2 How to Lubricate

Taking off the screw cover, you will see two grease nipples on right and left sides of the slider. Supply grease from these nipples.

1. Remove the screws fixing the screw cover with a 2.5mm hex wrench.
2. Insert grease to the grease nipples on the sides of the slider with using a grease gun (refer to the picture below for the positions).
3. Move the slider back and forth several times by hand.
4. Repeat the above lubrication process one more time.
5. Wipe off the excess grease that has overflowed from the slider.

![Grease nipple diagram](image)
11.7 Lubricating the Ball Screw

11.7.1 Applicable Grease

The lithium grease applied before delivery is that stated below.

| Kyodo Yushi | Mul Temp SRL |

This product is well suited for ball screws and has excellent properties such as low heat generation. For comparable products, see guide grease (lithium grease).

⚠️ Warning:
Never use fluorine-based grease. If fluorine-based grease is mixed with lithium-based grease, the grease not only loses its performance but it can actually damage the actuator.

11.7.2 How to Lubricate

Clean the screw, and then apply grease with your finger and spread it out by moving the slider back and forth. Finally, wipe off any excess grease that has overflowed from the nut.

⚠️ Caution: If too much grease is applied, the agitation resistance increases and the ball screw generates heat more easily. Also when the ball screw rotates, excess grease is splattered on the surrounding areas. Wipe off the excess grease to avoid these issues.
11.8 Motor Replacement

[Required Items For Replacement]

- Motor for replacement (Motor with a coupling on the motor shaft: Photo to the right)
  Note: Do not pull off this coupling.

Motor type:

- 600W incremental specification: TS4613N1023E200
- 600W absolute specification: TS4613N2032E200
- 750W incremental specification: TS4614N1023E200
- 750W absolute specification: TS4614N2022E200

- Hex wrench Set
- Measurement tool

[Procedure]

1) Dismantle the motor cover and the rear cover.
   - Unscrew the hex socket button head screws fixing the motor cover with a 2.5mm hex wrench.
   - Unscrew the hex socket head cap screws fixing the rear cover with a 3mm hex wrench.
2) Adjust the slider position to turn the coupling so the coupling bolt faces upward. Move the slider with using a measurement tool as shown in the pictures below.

⚠️ Warning:
For the vertical axis, turn on the power to the controller to release the brake manually. However, there is a risk that the slider may drop suddenly. To avoid pinching your hand or damaging the work, prepare a support to hold the hand part so the slider would not drop.

- For Standard Home Type
  (Motor side is home position)

- For Home Reversed Type
  (Opposite side of motor is home position)

Distance between the inner side of the motor bracket and the side of the slider
With no intermediate support: 13mm
With intermediate support: 98mm

Distance between the side of the slider and the inner side of the front cover
With no intermediate support: 16mm
With intermediate support: 142mm
3) Loosen the coupling (on the ball screw side).
Loosen the hex socket head cap screw fixing the coupling by using a 4mm hex wrench.

4) Shut down the power and then disconnect all the connectors.
(Motor cable, encoder cable, LS cable and brake cable)

5) Take out the motor.
- Unscrew the four hex socket head cap screws fixing the motor with using a 5mm hex wrench.
- Pull out the motor slowly by hands.
6) Connect the motor connector and encoder connector on the relay cable to a new motor.

7) Align the motor shaft.
Turn on the power to the controller, and turn the motor with using the JOG operation in a PC or teaching pendant to align the slit on the coupling to the home position marked on the motor flange.
* Jog at 1 mm per second (minimum speed).
8) Mount the new motor.
Confirm that the slider position is not moved from that you have adjusted in step 2). If it is moved, adjust again. While the servo is on, insert the motor coupling to the tip of the ball screw shaft, and then mount the motor to the motor bracket.

- Insert the screws on the bottom side beforehand.
- Tighten the hex socket head cap screws (M6 × 22, 4pcs) with using a 5mm hex wrench.

![Insert screws beforehand](image1)

*Screw Torque 536N • cm (54.7kgf • cm)*

9) Fix the coupling
Loosely tighten the hex socket head cap screw (M15 × 15) that fixes the coupling for temporary, turn the servo off, and then screw the coupling again with the specified tightening torque.

![Cable side](image2)

*Screw Torque 700N • cm (71.4kgf • cm)*

10) Shut off the power to the controller once.
11) Connect the LS connector on the relay cable, and the brake connector if the unit is the brake-equipped type.

12) Attach the rear cover. Take care not to pinch the cables, and loosely attach the hex socket head cap screws M4 × 15 4pcs) with a 3mm hex wrench temporarily.

13) Attach the motor cover. Tighten the hex socket button head screws (M4 × 5 4pcs) with a 2.5mm hex wrench.

14) Tighten the rear cover properly with the specified torque.
15) Correcting for Position Deviation

(1) Turn on the power to the controller.

   Next, perform a home-return operation with using the PC software or teaching pendant to check the home position. Perform it several times to confirm that the actuator returns to the same home position.

(2) Check the amount of position deviation.

   The position may have changed slightly from where it was before the motor was replaced. Accordingly, select a desired position number that allows you to check the amount of deviation before and after the replacement, and then perform positioning to that position and measure the amount of deviation.

(3) Reflect the amount of deviation in the home offset parameter.

   Refer to "Attachment: Setting for Home Offset Value" for the settings.

* If the two positions differ significantly (one ball screw revolution or more = lead or more) or if the actuator does not return to the same position when homing is repeated, install the motor unit again by following the procedure described in this manual. It is suspected that there was a setting error in the distance from the datum surface in the slider alignment process.
Attachment 1: How to Set Home Preset Value (with XSEL)

(1) Open the position edit screen.
On the PC software, click "Position (O)" → "Edit (E)" → "Position No. Select" → "OK" to open the window shown below.

(2) Compare the current value and the value achieved by positioning the actuator to the selected position number, and check the amount of deviation.

(3) Select "Parameter (P)" → "Edit (E)".
(4) Select the axis-specific parameter tab.

(5) Change the setting of axis-specific parameter No. 21 (home preset value).
Add or subtract the value measured in (2) to/from the value currently input.
*The setting unit is 0.001 mm.
Example: When subtracting 1 mm
Current preset value = Current setting – 1000

(6) Write the new data.
SEL button→Transfer data to Controller?(Y)→Write Flash ROM?(Y)
Attachment 2: How to Set Home offset (with ECON)

(1) Open the position edit screen.
On the PC software, click "Position (T)"→ "Edit/Teach (E)"→ "Position No. Select"→ "OK" to open the window shown below.

(2) Compare the current value and the value achieved by positioning the actuator to the selected position number.

(3) Select "Parameter (P)"→ "Edit (E)".
(4) The user parameter screen appears.

(5) Change user parameter No. 22 (home offset).
   Add or subtract the value measured in (2) to/from the value currently input.
   Example: When subtracting 0.5 mm
   Home offset = Current setting – 0.5 mm

(6) Write the new data.
   Click the controller transfer button, and then click OK.
   * After the data has been written, turn off the controller power.
Attachment 3: How to Set Home offset (with P-Driver Controller)

(1) Open the jog screen.
   Click the jog button on the PC software screen.
   Next, select the pulse mode.

(2) Position the actuator to a desired position and compare the command pulse position and the position actually achieved, and write down the difference.
   Adjust the position by jogging the actuator or by turning off the servo and moving the actuator manually.
(3) Open the parameter edit screen.
"Parameter (P)" → "Edit (E)" → "Positioning"

(4) Change the setting of No. 13, “Home offset.”
Add or subtract the value measured in (2) to/from the value currently input.
Example: When subtracting 150 pulses
Home offset = Current setting – 150

(5) Write the new data.
Click the driver transfer button, click OK, and then click Yes. (The controller will restart.)
Attachment

How to Use the Homing Mark Stickers

♦ Attach these stickers to the product, as necessary, to indicate the home direction of the actuator, etc.

Sticker details

- Homing mark stickers
- Graduation mark sticker x 4
- Mark sticker x 4

(The graduations are provided for 10 mm at a 1-mm pitch.)

- Remove each sticker from the backing paper when use.
- Notes:
  1. The back side is adhesive.
  2. Remove dirt and oil from the attaching surface beforehand.
  3. Avoid attaching the stickers over the caution labels.

Examples of use

[1] For marking the home direction of the actuator

Attach to the slider.

Attach on the home side of the base.

- Attach two stickers when the actuator is stopped at home.

[2] As positioning marks

Attach to the slider.

Attach at desired moving positions.