Safety Precautions

Always read this section before use.

When designing equipment using electric actuators, the manufacturer is obligated to ensure that the safety of the mechanism and the electrically controlled system are secured.
It is important to select, use, handle and maintain CKD products appropriately to ensure their safe usage.
Observe warnings and precautions to ensure device safety.
Check that device safety is ensured and a safe device is manufactured.

WARNING

1 This product is designed and manufactured as a general industrial machine part.
It must be handled by an operator having sufficient knowledge and experience in handling.

2 Use the product within specifications range.

This product must be used within its stated specifications. It must not be modified or machined additionally.
This product is intended for use as a device or part for general-purpose industrial machinery. It is not intended for use outdoors (except for outdoor type) or for use under the following conditions or environment.
(Note that this product can be used under the following conditions only when CKD is consulted prior to use and the customer consents to CKD product specifications. The customer must provide safety measures to avoid risks in the event of problems.)

❶ Use for special applications which require the safety, including nuclear energy, railways, aircrafts, marine vessels, vehicles, medicinal devices, devices or applications coming into contact with beverages or foodstuffs, amusement devices, emergency operations (cutoff circuits, opening etc.) circuits, press machines, brake circuits, or safety devices or applications.

❷ Use for applications where life or assets could be adversely affected and special safety measures are required.

3 Observe organization standards and regulations, etc. related to the safety of device design.

4 Never remove devices before confirming safety.

❶ Inspect and service on the machine and devices after confirming safety of the entire system related to this product.

❷ Note that there may be hot or charged sections even after operation is stopped.

❸ When inspecting or maintaining device, be sure to shut down the power supply of the equipment and the relevant power supply, using caution to avoid electric shock.

5 Observe instruction manual and precautions attached the product surely to prevent accidents.

❶ The product could operate unexpectedly during teaching operation or trial operation. Be especially careful not to touch the actuator. If operating the product from a position where the shaft body cannot be seen, be sure to first confirm that the safety is secured even if the actuator moves.

6 Observe precautions to prevent electric shock.

❶ Do not touch the heat sink, cement friction, or motor inside the controller.
These will heat up, and could cause burns. Wait an appropriate amount of time prior to performing inspections or other tasks.
A high voltage is applied until the electrical load stored in the internal capacitors is discharged after the power is turned OFF.
Do not touch for around three minutes after the power OFF.

❷ Make sure to turn the switch on the controller power supply source OFF, before maintenances and inspections.
There is a danger of high voltage electric shocks.

❸ Do not attach or remove connector, while the power is on. Otherwise, this may cause malfunction, failure, or electric shock.

7 Install overcurrent protector.

The wiring of the connector should be in accordance with JIS B 9960-1:2008 Safety of Machinery - Electrical Equipment of Machines - Part 1: General Requirements. Install an overcurrent protector (a shutoff mechanism for wiring or a circuit protector) for inputs (power supply connector, power supply terminal) and controls (input/output connector) power primary side.

(Extracted from JIS B 9960-1 7.2.1, General Requirements)
Overcurrent protection must be installed if the circuit current inside a machine (electrical equipment) could exceed the rated value of the components or the allowable current capacity of the conductor (whichever is smaller).

8 Observe precautions below to prevent accidents.

■ The precautions are ranked as "DANGER", "WARNING" and "CAUTION" in this section.

DANGER: When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries, and when there is a high degree of emergency to a warning.

WARNING: When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries.

CAUTION: When a dangerous situation may occur if handling is mistaken leading to minor injuries or physical damage.

Note that some items described as "CAUTION" may lead to serious results depending on the situation.
Every item provides important information and must be observed.

Warranty

1 Warranty period

The product specified herein is warranted for one (1) year from the date of delivery to the location specified by the customer.

2 Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified above, CKD will promptly provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD's facilities free of charge.

However, following failures are excluded from this warranty:

1) Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or the Instruction Manual.
2) Failure caused by use of the product exceeding its durability (cycles, distance, time, etc.) or caused by consumable parts.
3) Failure not caused by the product.
4) Failure caused by use not intended for the product.
5) Failure caused by modifications/alterations or repairs not carried out by CKD.
6) Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
7) Failure caused by acts of nature and disasters beyond control of CKD.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.

Note: For details on the durability and consumable parts, contact your nearest CKD sales office.

3 Compatibility confirmation

The customer is responsible for confirming the compatibility of CKD products with the customer's systems, machines and equipment.

4 Range of service

The delivered product price does not include engineer dispatch service fees. Separate fees will be charged in the following cases.

(1) Instruction of installation and adjustment, and presence on test operation
(2) Maintenance and inspection, adjustment, and repair
(3) Technical instructions and technical education (operation, program, wiring method, safety education, etc.)

Precautions for export

Products and related technologies in this catalog
Those of the products and related technologies in this catalog which are subject to US Export Administration Regulations
(EAR) are marked on the product page as "Product subject to the EAR (EAR99) or (EAR99 and 3A991)".
For export or provision of products or related technologies subject to EAR regulations, we request that the US Export Administration Regulations (EAR) be observed appropriately.

Main standards and laws regarding safety of industrial robots

The international industrial standard ISO/DIS12100 "Safety of Machinery" defines the risk reduction measures for machines.
Step 1: Intrinsically safe design … Power, speed, energy limits, etc.
Step 2: Safety protection … Installation of safety fences, etc.
Additional protective measures … Installation of emergency stop devices, etc.
Step 3: Information on use … Warning sign, alarm, instruction manual, etc.

Based on this, the international standards ISO/IEC define what is called "Guide 51", which is a classification of various standards in a hierarchical structure.
Safety standards for industrial robots are standardized in Tier C, individual machine safety standards.

- ISO 10218, ISO 10218-1

Providing users with residual risk information after conducting a risk assessment is standardized.

- IEC 82079-1

Be sure to follow the standards and laws in each country where the industrial robot is used.

The major standards and laws for industrial robots in Japan are as follows.

Safety standards for industrial robots have been stipulated in the Japanese Industrial Standard (JIS) without changing the technical details and configurations in ISO 10218 and ISO 10218-1.

- JIS B 8433, JIS B 8433-1

The laws and regulations in Japan regarding the safety of industrial robots are as follows.

- Industrial Safety and Health Law: Article 59 (Safety and Health Education)

"A company must provide special education on safety or hygiene to workers engaged in dangerous or harmful work."

The duties that require special education in handling industrial robots are defined as follows.

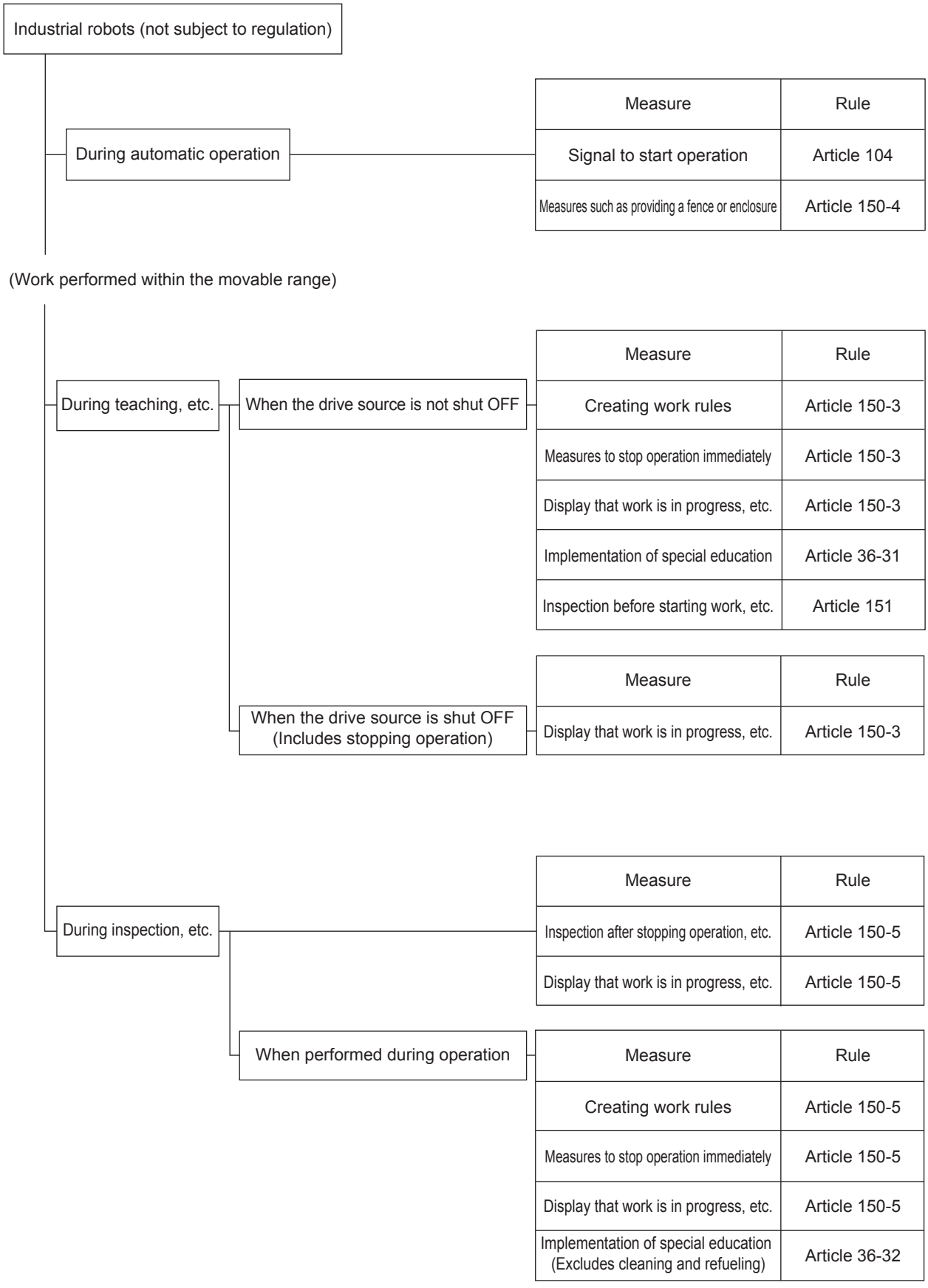
- Ordinance on Industrial Safety and Health … Article 36 (Businesses requiring special education)
  - No. 31 … Duties such as teaching industrial robots
  - No. 32 … Duties such as inspecting industrial robots

The measures to be taken in order to prevent danger in handling industrial robots are as follows.

- Ordinance on Industrial Safety and Health … Section 9 (Industrial robots)
  - Article 150-3 … Teaching, etc.
  - Article 150-4 … Preventing danger while driving
  - Article 150-5 … Inspection, etc.
  - Article 151 … Inspection

The provision of residual risk information is stipulated by law as an effort to "notify the other company to whom the machine is transferred or loaned regarding the danger of the machine".

- Ordinance on Industrial Safety and Health … Article 24-13 (Notifying dangers related to the machine, etc.)
- Guidelines for promoting the transferrer, etc. to notify of dangers, etc. related to the machine as established based on the paragraph 2 above



System diagram for Ordinance on Industrial Safety and Health

Safety Precautions

Be sure to read this section before use.

Product-specific cautions: SCARA robot KHL/KHE Series

Design/selection

⚠DANGER

- Do not install and operate the product if it is found to be damaged when it is delivered or parts such as accessories are missing.
  Doing so may cause electric shock, fire or failure.
- Do not install the product where it will be exposed to liquids such as water.
  Doing so may cause electric shock, fire or failure.
- Do not place flammable materials nearby.
  If there is an ignition due to a failure, etc., it may cause a fire.
- Use at the specified power supply voltage and power capacity.
  Failure to do so may lead to failure or fire.
- Be sure to use the specified electric wire.
  Failure to do so may cause a fire or an accident.
- Be careful not to make a mistake when connecting the connector and electric wiring in the terminal array.
  Check with a tester after connecting.
- When moving the robot by hand while the power is ON, be sure to ensure safety and set it to the emergency stop state.
- When working with the 3rd axis brake release switch pressed, be sure to do so with two people.
  One person should perform the work while the other person observes from outside the dangerous area.
- The observer should monitor the work and be ready to shut OFF the controller power immediately in the event of a problem.
  When the controller power is shut OFF, the motor brake will activate even if the 3rd axis brake release switch is pressed.
- If the 3rd axis brake release switch is pressed while the robot is holding a heavy object, the 3rd axis may drop suddenly.
- Workers engaged in tasks related to industrial robots must receive safety education as specified by the laws and regulations of their respective country.
- Do not enter the dangerous area around the robot while it is operating.
  Doing so could lead to serious injury.
- Do not leave any equipment in the work space that may disrupt operation.
  If it leads to an error with the device, it may result in injury or accidents.
- Do not let anyone other than the operator approach the equipment.
  Unexpected behavior such as unknowingly touching a hazardous section of the device may result in injuries or serious accidents.
- Do not perform inappropriate operations not described in the instruction manual.
  Inappropriate operation may cause the equipment to malfunction, resulting in injuries or serious accidents.
- If you feel any danger or abnormality in the operation of the equipment, engage the emergency stop to stop the equipment.
  Otherwise, injuries or serious accidents may result.
- Be sure to keep the device cover closed during operation.
  Opening the device cover during operation may cause electric shock or injury.
- Only well-trained personnel should operate the device.
  Inappropriate operation may cause the equipment to malfunction, resulting in injuries or serious accidents.
- In the event of a failure, shut OFF the power, eliminate the cause of the problem, perform maintenance on the peripheral components, and operate at low speeds until after confirming the issue is completely resolved.
  If any problem remains unresolved, the device may malfunction and cause a serious accident.

⚠WARNING

- Do not enter the robot's movable range.
  There is a risk of personal injury.
- Keep your hands away from the movable parts of the robot.
  There is a risk of injury if caught.

⚠CAUTION

- When changing the operating range, design and manufacture a mechanical stopper according to the usage conditions.
- When changing the mechanical stopper and the movement range, be sure to change the software limit to prevent contact with the mechanical stopper while operating the robot.
- The mechanical stopper does not reliably limit the robot's movable range.
  When robot is powered, never enter the robot's operating area.
- If the robot collides with the mechanical stopper, the robot will detect the collision and stop, but there is a risk that the mechanical stopper will become damaged.
  Do not reuse the mechanical stopper.

- Use the lower limit mechanical stopper to change the operating range.
  If the operating range is changed with the upper limit mechanical stopper, it will be in a similar state as the Z-axis being extended. Operating the 1st, 2nd or 4th axes in this state may prematurely damage the ball screw spline.
- When installing a chuck on the hand, use wiring or air piping that ensures the workpiece is not released when the power is turned OFF.
  By not using such wiring and air piping for the chuck may result in the workpiece being released when the power goes OFF or when the emergency stop switch is pressed. This may result in damaging the robot or workpiece.
- The customer must prepare the solenoid valve and air tubes.
- Wiring tied to the main harness may apply excessive force to the main harness, which may result in disconnection.
- Never use the robot under conditions that exceed the tolerance values.
  Robot service life and safety is not guaranteed under such circumstances.
- Be sure to use the PAYLOAD command.
  Failure to do so may cause failures and shorten the mechanical service life. It may also damage the mechanical parts in some cases.
- Even when using the PAYLOAD command, be sure to make adjustments with the SPEED or DECEL command while checking the movement of the workpiece to be handled.
- Even if there is no offset in the center of gravity of load, the robot may vibrate if the moment of inertia is large.
  Calculate the virtual center of gravity offset L (mm) from the moment of inertia J ($kg \cdot m^2$) and weight M (kg), and specify the PAYLOAD.
- If the load weight or center of gravity offset is large when manually guiding, the robot may vibrate.
  Set and switch to a servo gain that matches the load conditions.
- If a current exceeding the rated output current is applied, the controller may be damaged or the internal base may be burnt out, so be sure to use the unit within the rated output current. The hand output signal total for 8 points must be 0.8 A or less.
- Be sure to connect the connectors securely.
  Failure to do so may result in malfunction.
- Use a flexible robot cable and fix it at the bottom of the arm with a cable clamp, etc.
  Failure to use the robot cable may cause disconnection.
- For wiring and piping of tools, the customer must carefully consider the measures against disconnection due to rubbing, etc.
- Be careful not to apply a load on the connector while the robot is operating.
- When operating the robot, make sure that the fixing stay does not interfere with the 1st arm, etc.
- Moving the 1st and 2nd axes near the operating range limit and releasing the hand may cause the 1st and 2nd axes to move due to the reaction force of the cable.
- In accordance with the requirements in the ISO10218-1 Industrial Robots -Safety Requirements- "5.6.2 Deceleration control operation", the arm tip speed during test operation is set not to exceed 250 mm/sec.
- At initial setting, the speed of automatic operation is 100% of the robot max. speed.
  When the servo of the robot is turned OFF, the arm may move due to the reaction force of the twisting of the main harness.
- Do not change the data in the system configuration file.
  Changing it may cause the robot to malfunction and result in an accident or failure.
- For the controller, be sure to maintain a designated ventilation space.
  Heat generated from the controller may cause failure.
- If the main power supply is not supplied to the controller normally due to phase loss or voltage drop, "8-027 Slow charge error" will occur when the servo is turned ON.
  If this error occurs, check if the power supply voltage at the controller power supply connector meets the controller's input power specifications and that it is stable.
- Be sure to supply the external power supply (24 VDC).
  Failure to do so will disable the safety signal and the controller servo power will not turn ON.
- Make and install a push button for the control unit that is to be attached to the robot controller in such a way that it will prevent accidental activation, such as by installing a guard to prevent accidental operation.
- If there are multiple controllers in the device, make sure that the robot operates only in the same operation mode. Also, be sure to have the operation mode of each controller displayed on the operating device.

Mounting, installation and adjustment

⚠DANGER

- When transporting the robot, be sure to fix it with the supplied fixing brackets.
  Failure to do so may cause the arm to move and cause injury when the robot is lifted.
- Install the unit before wiring.
  Wiring before installation may result in electric shock or injury.
- Use the specified electric wire for the power supply line.
  Use of non-specified items may result in fire or failure.
- Be sure to connect the ground wire securely.
  Failure to do so may lead to electric shock or fire in the event of failure or electrical leakage. In addition, noise may result in malfunctions.

⚠CAUTION

- Do not lift the 2nd arm cover during transportation.
  Otherwise, excessive force will be applied to the robot's main mechanism, which may result in failure.
- When storing the robot, be sure to firmly fix it to the base.
  Placing the robot without fixing it may make it unstable and cause it to fall.
- When operating the robot after it has been stopped at low temperatures (10°C or less) for long periods, be sure to perform continuous operation at a low speed (about 20% of the max. speed) for several minutes before full operation.
  If continuous operation is not performed at a low speed, motor overload error may occur due to grease being solidified.
- Depending on the posture of the robot, slight vibrations may occur at the tip of the robot hand.
  If slight vibrations occur, be sure to reduce the acceleration before use.
- Move the 1st, 2nd and 4th axes with the Z-axis (3rd axis) retracted as much as possible.
  Operating the 1st, 2nd and 4th axes in with the Z-axis extended may prematurely damage the ball screw spline. If the 1st, 2nd and 4th axes need to be operated while the Z-axis is extended, adjust the operation speed and acceleration with the SPEED and ACCEL/DECEL commands so that the ball screw spline does not vibrate. When moving the 1st, 2nd and 4th axes with the Z-axis extended, make sure that it does not collide with an obstacle.
- Even if the 1st, 2nd and 4th axes are operated at a low speed, the ball screw spline (Z-axis shaft) may be damaged before the alarm is issued due to collision with an obstacle.
- When manually transporting the robot, be careful not to get hands or feet caught.
- Be sure to transport it with two or more people.
- Never touch the ball screw spline shaft with bare hands.
  Touching with bare hands may lead to premature rusting. Be sure to wear gloves.
- If the battery for motor position detection is alkaline (standard specification) and the unit is used at high temperatures, the risk of battery heat generation, liquid leakage and explosion increases.
  Contact CKD when using the robot in a high temperature environment.
- Operating the unit at high speed at startup in a low temperature environment may cause the torque to increase and cause an error to occur.
  When operating the robot in a low-temperature environment, be sure to perform continuous operation at a low speed for several minutes at startup to soften the grease before transitioning to a high speed.
- The robot operates with extreme acceleration/deceleration. When installing the unit on a base, make sure that the base is sufficiently rigid.
  If it is installed on a base that is not rigid, vibration may occur while the robot is operating or failure may occur. When installing the unit on the floor, be sure to firmly fix it with foundation bolts, etc.
- Install the robot on a level surface.
  Failure to do so may cause performance degradation or failure.
- Fix the base to the exterior (floor or wall).
- Some errors may occur depending on the adjustment method.
  In some cases, it may be necessary to re-teach the teaching points.

Use/maintenance

⚠DANGER

- Do not incinerate, disassemble or charge the battery.
  Otherwise, it may result in damage.
- When approaching the robot for maintenance and inspection, remove the power plug of the controller from the power supply before starting the work.
- When moving the robot by hand while the power is connected, be sure to ensure safety and set it to the emergency stop state.
- When opening the cover, be careful not to let water or foreign matter get inside the robot.
  It is extremely dangerous to energize the unit with water or foreign matter inside, as it may cause electric shock or failure.
- Be sure to disconnect the power plug of the controller before replacement.
  Doing so while the power is ON may cause electric shock or failure and is extremely dangerous.
- When placing the controller on the floor, be careful not to get your hands or feet caught.

- If the power is kept ON, the servo power supply circuit board, servo circuit board, switching power supply etc., remain energized.
  To avoid electric shock, be sure to disconnect the power plug before starting the work.
- When disposing of the battery, be sure to follow the regulations of your company.

⚠CAUTION

- The parts should not be replaced or modified by the customer.
  Doing so may cause performance degradation, failure or an accident.
- Use the specified spare parts when replacing parts.
- Periodically perform maintenance and inspection.
  Failure to do so may cause equipment failure or an accident.
- Since the 4th axis motor does not have a brake, the axis may rotate when the servo is turned OFF due to the weight of the tool or hand, the state of the offset or being touched.
  Be careful not to get your hands or feet caught as the rotation of the 4th axis will cause the 3rd axis to move up and down.
- A brake release switch is installed on the back of the base.
  Pressing the switch with a heavy object such as a hand or workpiece attached to the 3rd axis will cause it to drop. Be careful not to get your hands or feet caught at this time.
- After unpacking the unit, be sure to dispose of cardboard, plastic bags, cushioning materials, etc. that are no longer needed according to your company's regulations.
- Be sure to firmly fix the base to prevent the unit from falling.
  Placing the robot without fixing it may make it unstable and cause it to fall.
- Store the robot away from direct sunlight, high temperatures, and high humidity.
  The resin cover and timing belt are prone to deterioration.
- When storing the robot, seal it in a plastic bag with a desiccant to prevent rust and dust from entering.
  As the ball screw spline shaft is prone to rusting, be sure to apply a anti-rust agent in advance, or apply grease to the entire ball screw spline shaft.
- Apply grease to the ball screw spline shaft before use.
- When operating the unit, be sure to perform a full break-in.
- Backup battery life is shortened during storage so replacing it before use is recommended.
- When installing the 2nd arm cover and base cover, be careful not to pinch the cables.
  Forcibly bending the cable and pushing it in may cause disconnection. Since the cable is fixed to the sheet metal with a cable tie, etc., check the cable position when removing the cover, and replace it so that the wiring is not strained.
- When replacing the motor, be careful not to apply a large impact to the motor shaft.
  The impact may damage the motor and encoder.
- Never disassemble the motor and encoder.
  Otherwise, they may become misaligned and unusable.
- When the motor is replaced, the mechanical origin will shift and normal control will not be possible.
  After replacing the motor, origin return must be performed.
- Be careful not to forget to attach the O-ring.
  Failure to do so may cause the grease to leak from the motor mounting surface.
- The 3rd axis motor has a brake. This brake will not work when replacing the 3rd axis motor, so be sure to lower the ball screw spline to the lower limit before starting.
  There is a risk that the shaft will drop due to the weight of the shaft and workpiece, which may cause your hands or fingers to get caught.
- When the timing belt is removed, the mechanical origin will shift and normal control will not be possible.
  After replacing the timing belt, it is necessary for the motor to be returned to the origin.
- It is structurally necessary to disassemble the 3rd axis when the 4th axis timing belt is replaced.
  Be sure to strictly observe the precautions for replacing the 3rd axis timing belt and motor.
- Be careful not to pull out the ball screw spline shaft from the ball screw nut, and remove them together as a unit.
  If separated, the balls in the ball screw nut will pop out which makes the product unusable.
- Be careful not to get your hands or fingers caught when moving the ball screw up or down by hand.
- Make sure to cover the peripherals to prevent grease from dripping on them.
- Make sure that the grease does not run out, as it may cause the slide, etc., to get damaged, which causes deterioration in performance.
- Apply an anti-rust agent when it drys out.
  If a rust preventive agent is not applied, the spline unit may become rusted.
- Be sure to handle the ball screw spline unit with care.
  The unit may become unusable due to the impact upon falling or the application of an excessive external force.
- Replacing the ball screw spline unit involves attaching and removing the 3rd and 4th axis motors and timing belts.
  Be sure to strictly observe the precautions in each section.
- When the motor, timing belt, nuts and pulleys are removed, the mechanical origin will shift and normal control will not be possible.
  After replacing the ball screw spline unit, it is necessary to perform origin return for the 3rd and 4th axes.
- When the reducer is removed, the mechanical origin will shift and normal control will not be possible.
  After replacing the reducer, it is necessary for the motor to be returned to the origin.
- Be sure to install and remove the arm with two or more people. Removing the arm mounting bolts may cause the arm to fall, which is dangerous.
  Excessive impact on the arm may cause failure.
- Be sure to handle the reducer with care.
  The unit may become unusable due to the impact upon falling or the application of an excessive external force.
- Be sure to use the elliptical cam that came with the new reducer.
  Using an old elliptical cam without considering the compatibility with the new reducer may not only cause abnormal noise, but also shorten the service life and positioning accuracy.

■ Use the new O-ring that is included with the reducer. Be careful not to forget to insert it.
Forgetting to insert the O-ring will cause the grease to leak from the mounting surface of the 2nd axis reducer. When installing the reducer, make sure that the O-ring does not break.

■ Be sure to use the specified grease.
A high internal pressure may adversely affect the starting torque and damage the internal seal. Be sure to apply the proper amount of grease.

■ Be careful not to forget to tighten the coupling that connects the reducer and motor shaft.

■ When the battery voltage drops, a "battery alarm" will occur. If the battery is replaced immediately after the "battery alarm" occurs, the battery voltage will return to normal and the "battery alarm" will be automatically reset.
If the battery is not replaced immediately after the "battery alarm" occurs, the battery voltage will drop further and a "battery error" will occur.
Since the position data detected by the encoder in this state cannot be trusted, a position detection error will occur and the robot will enter the emergency stop state in which the servo cannot be turned ON. If the power is turned OFF in this state, the position data will be lost. Be sure to replace the battery during the annual inspection.

■ For safety, replace the battery with the power turned ON and in the emergency stop state.

■ Do not change the data in the system parameter file other than with USER.PAR and without permission.
Otherwise, it may cause the robot to malfunction and result in an accident or failure.

■ As a general rule, teaching operations should be performed outside the robot's dangerous area. When it is necessary to perform teaching within the dangerous area, take the following measures.

(1) Be sure to work with two people. One person should perform the work and the other person should observe from outside the dangerous area. They should prevent each other from making any mistakes.
(2) To prevent the unit from being operated by a third party when performing teaching in the dangerous area, the worker must keep the controller master key and handy terminal in their possession.
(3) The worker should be able to press the emergency stop button at any time. It is also necessary for the worker to thoroughly check the robot's operating area and for any obstacles, and work in a position where they can immediately evacuate in the event of an abnormality.
(4) The observer must monitor the work from a position overlooking the entire robot and be ready to immediately press the emergency stop button in the event of an abnormality. Also, be sure to keep other people away from the dangerous area.

■ If an abnormality occurs when turning the device ON, or if the "POWER LED" of the controller does not light up, turn OFF the power immediately and check the wiring.
This may cause electric shock or fire.

■ If the robot does not move in the specified direction during manual guidance, perform an emergency stop of the device.
This may cause an accident or failure.

■ Be sure to visually confirm the button operation of the handy terminal.
Misoperation may cause an accident.

■ When the power is turned ON, be sure to reset the program before starting automatic operation.
If the program execution environment is continued, it may interfere with peripheral components and cause equipment failure or an accident.

■ Before operating the device, be sure to perform the following preliminary inspections. Failure to do so may cause device failure or an accident.

(1) Make sure that the appearance of the robot, controller, peripheral components and cables are normal.
(2) Make sure that there are no obstacles in or near the operating range of the robot and peripheral components.
(3) Make sure that the emergency stop and other safety measures are working properly.
(4) Make sure that there is no abnormal noise or vibration when the robot operates.

■ When disassembling or disposing of the unit, be sure to wear protective safety gear (safety glasses, protective footwear, gloves, etc.).
When disassembling the unit, broken pieces may fly into eyes, corner sections of parts may cut fingers, and raised parts may fall on hands or feet.

■ Store the controller away from direct sunlight.
Failure to do this may cause the temperature inside the controller to rise, which may cause failure.

■ When storing the controller, seal it in a plastic bag with a desiccant to prevent rust and dust from entering.

■ Be sure to dedicate space for ventilation on the side of the controller so that the vent holes are not blocked. Also, leave enough space on the bottom surface for the length of the rubber feet.
Failure to do so may cause the cooling capacity to drop and the controller to fail.

■ Do not stack the controllers.

■ Do not place anything on top of the controller.

■ If the control panel, etc., is completely sealed, make a vent hole to prevent heat from being trapped in the control panel, perform forced ventilation with a fan, or provide indirect cooling.
Failure to do so may cause heat to be trapped inside the control panel and controller, which may result in failure.

■ When removing the controller cover for maintenance and inspection, remove the power plug of the controller from the power supply before starting. When connecting or disconnecting the power line, be sure to also turn OFF the breaker for the power supply.

■ Do not touch the servo driver for 2 minutes after the power is turned OFF.
The voltage remaining in the large-capacity capacitor in the servo driver may cause electric shock.

■ Do not remove the battery connector except when replacing the battery.
Otherwise, the files stored in the storage device will be erased.

■ Be sure to turn OFF the power before replacing the switching power supply.

■ The switching power supplies for PS1 and PS2 have the same mounting pitch.
Install them so that the top, bottom, left and right are not reversed, and ensure that PS1 and PS2 are not reversed.

■ To prevent direct and indirect contacts, take protective measures such as incorporating the robot controller in an enclosure, and ensure that there is sufficient distance from the operator.

■ When installing in an enclosure, use a structure with a fixed cover or a key so that the enclosure cannot be opened and closed freely. In addition, provide protective measures at the cable port to the enclosure to prevent damage to the cables.

■ If a current exceeding the rated output current is applied, the controller may be damaged or the internal base may be burnt out, so be sure to use the unit within the rated output current.

■ The hand output signal total for 8 points must be 0.8 A or less. When using the hand I/O function, connect from the P24 V supply line for I/O on the front of the controller.