CKD

AX1R Series
AX2R Series
AX4R Series
Direct Drive Actuator

INSTRUCTION MANUAL

Before operating the product, read this instruction manual without fail.
Among all, carefully read the description related to safety.
Keep this instruction manual in a safe place so that it can be referred to whenever necessary.

2023-09-14 SM-A83981-A

INTRODUCTION

Thank you for selecting our ABSODEX.

ABSODEX is a direct drive indexing unit developed to drive intermittently operated turntables or the like of general industrial assembling machines and testing machines flexibly and accurately.

This instruction manual is exclusively for ABSODEX AX1R, AX2R, and AX4R series. It is inapplicable to other types.

If your use method or handling method is not appropriate, its functions cannot be performed fully, an unexpected accident may occur and the product life may be shortened.

Before starting operation of our product, read through this instruction manual to keep the initial performance and operate without failures.

The matters, specifications and appearance given in this instruction manual are subject to change without notice.

FOR SAFETY OPERATION

When designing and manufacturing equipment using this product, it is your duty to manufacture safe equipment. To do this, make sure that the safety of the mechanical mechanism of the equipment and the system that controls it electrically can be ensured.
For safety related to the design and management of the equipment, be sure to observe the organization standards and regulations.
To operate our product safely, selection, operation and handling of the product as well as adequate maintenance procedures are important.
Be sure to observe the warnings and precautions described in this instruction manual to assure the safety of the equipment.
Although various safety measures have been taken for this product, your handling of the product not described in this instruction manual may result in an accident. Be sure to read this instruction manual carefully and fully understand its contents before use.

In this instruction manual, precautions are classified into three categories, DANGER, WARNING, and CAUTION, to clearly indicate the magnitude of harm or damage and the likelihood of occurrence.

DANGER	Improper handling may cause imminent death or serious injury.
WARNING	Improper handling may cause death or serious injury.
CAUTION	Improper handling may cause personal injury or property damage.

Even items described under "CAUTION" may cause serious results.
Observe without fail because these safety precautions are important.

< WARNING Symbols >

	Indicates a generic mark that shows prohibited (must-not-do) activities.		Indicates a mark that prohibits the act of touching the device.
	Indicates a mark that prohibits the act of putting fingers inside.		Indicates a generic mark that warns the risk of electric shock or burns.
	Indicates a mark that alerts dangers that may occur when you activate an automatic device.		Indicates a generic mark that instructs you what you MUST do.
	Indicates a mark that instructs you to read the instruction manual carefully.		Indicates a mark that instructs you to connect a ground wire.

Precautions for Using the Product

DANGER

Do not attach or remove connectors with the power on.
- A malfunction, failure or electric shock may be caused.

Do not operate in explosive or fire atmosphere.

Do not use this product for the following purposes.
- Medical devices related to the maintenance and management of human life and body.
- Mechanisms and mechanical equipment for human movement and transportation.
- Important maintenance parts of mechanical equipment.

WARNING

Never modify or rework the product.
- Modification or rework may result in fire, electric shock, or other hazards, as well as failure to meet the specifications described in this instruction manual.

Do not handle this product, or install or remove any device until safety is confirmed.
- Before inspecting or servicing the machine or equipment, make sure that the safety of all systems connected to this product has been ensured. In addition, turn off the power supply to the equipment and applicable facilities to avoid electric shock.
- Even after operation is stopped, there may be hot or charged section. Therefore, be careful when handling this product, installing or removing the device.

WARNING

Handling should be done by persons with sufficient knowledge and experience.

- This product is designed and manufactured as equipment and part for general industrial machinery.

Use within the specifications of the product.

- This product cannot be used outside of the product-specific specifications.
- The use of this product as equipment and parts for general industrial machinery falls within the applicable scope of use, therefore the use of this product under the following conditions is outside the scope of use. If you consult with us prior to adoption and understand the specifications of our product, such adoption will fall within the applicable scope. However, even in this case, take safety measures to avoid danger in case of unexpected failure.

  ◎ When used in conditions or environments other than those specified in the specifications, or when used outdoors.

  ◎ When used for nuclear power, railways, aviation, ships, vehicles, medical machinery, or equipment or applications that come into direct contact with beverages or food.

  ◎ When used in applications where safety is required, such as entertainment equipment, emergency shutoff circuits, press machines, brake circuits, and for safety measures.

  ◎ When used in applications where significant impact on people or property is anticipated and safety is especially required.

For safety related to the equipment design, observe the organization standards and laws.

CONTENTS

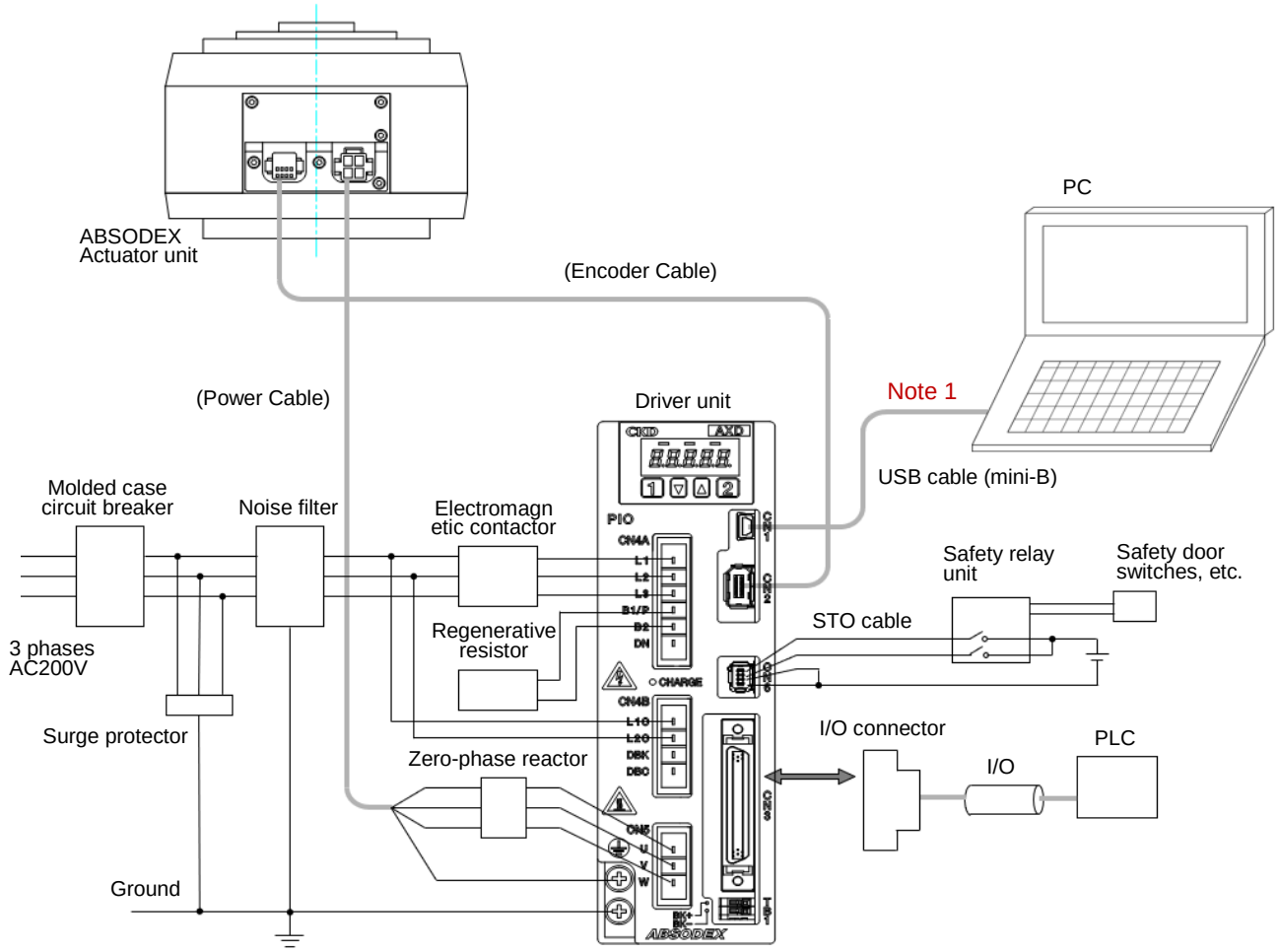
1. PRODUCT OVERVIEW

1.1. System Configuration

When in use, the AX1R, AX2R, and AX4R series must be connected to the AXD series driver.

1.1.1. System Configuration Example

< System Configuration >



Note 1: Do not connect the CN1 Connector unless for programming, parameter entry or test operation.

CAUTION

Do not use the power line noise filter as a power cable noise filter.

If other than the compatible driver is connected, the actuator may be burned.

If the main power is turned on while there is position deviation, the actuator will rotate due to the function to clear the position deviation caused.

- If the main power and control power are turned on separately, make sure that ABSODEX is in servo-off state before turning on power.
- When the control power is turned on again, a malfunction may be caused, so turn it on with the main power off, or turn both the main power and control power on simultaneously.

Route the power cables such as the power cable and power supply cable separately from the signal cables such as the encoder cable and I/O cable. Do not tie the cables belonging to different groups or do not route them in the same conduit.

A wrong combination between the actuator and driver will cause alarm 3 when the power is turned on.

- Check the combination between the actuator and driver.

Main power and control power must branch off from one power supply system; otherwise, the driver may break down.

To avoid accidents, install an over-current protective device in the main power and control powers (L1, L2, L3, L1C and L2C).

When using a circuit breaker, select one that has high frequency countermeasures for inverter use.

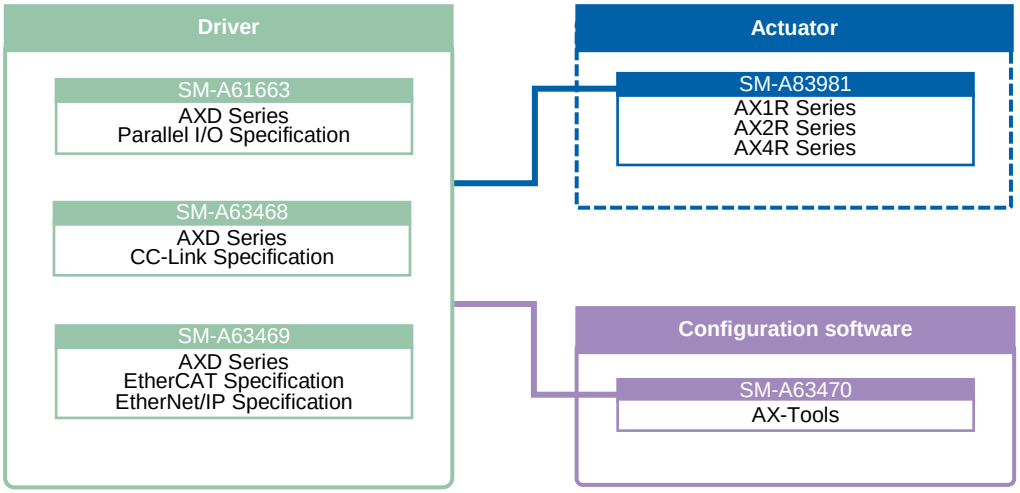
1.1.2. List of Peripheral Devices

	Component	Product name and model number	Manufacturer
This product	Actuator	AX1R Series AX2R Series AX4R Series	CKD Corporation
Sold separately	Driver	AXD Series	
	Power Cable	AXP-CBLM1-□□□	
	Encoder Cable	AXP-CBLE1-□□□	
Free-of-charge	Software for PC setting	AX-Tools Windows Version Note 1	

Note 1: The software may not run in some environments.

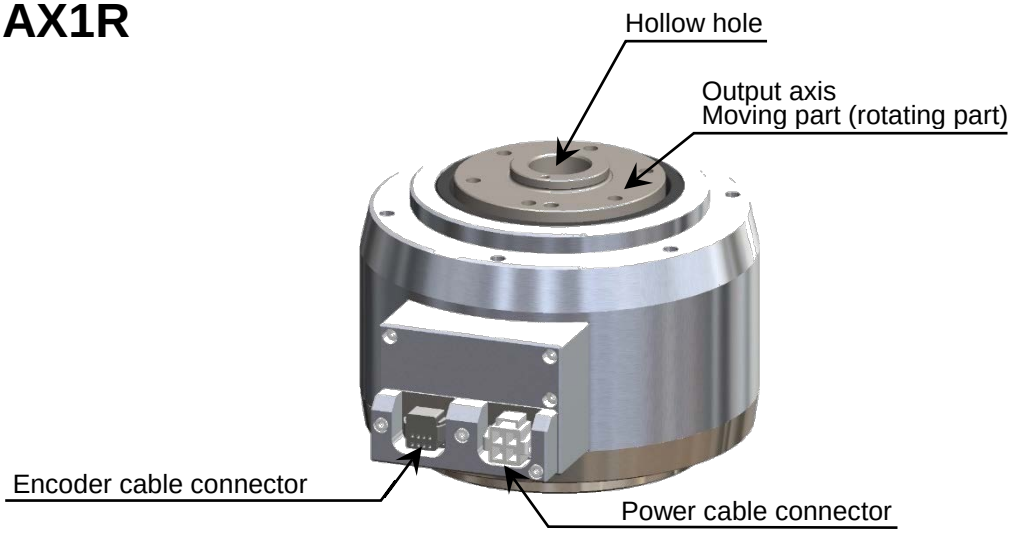
1.2. Instruction Manual for the Product

This instruction manual is the "SM-A83981."
The instruction manual for this product is as follows.

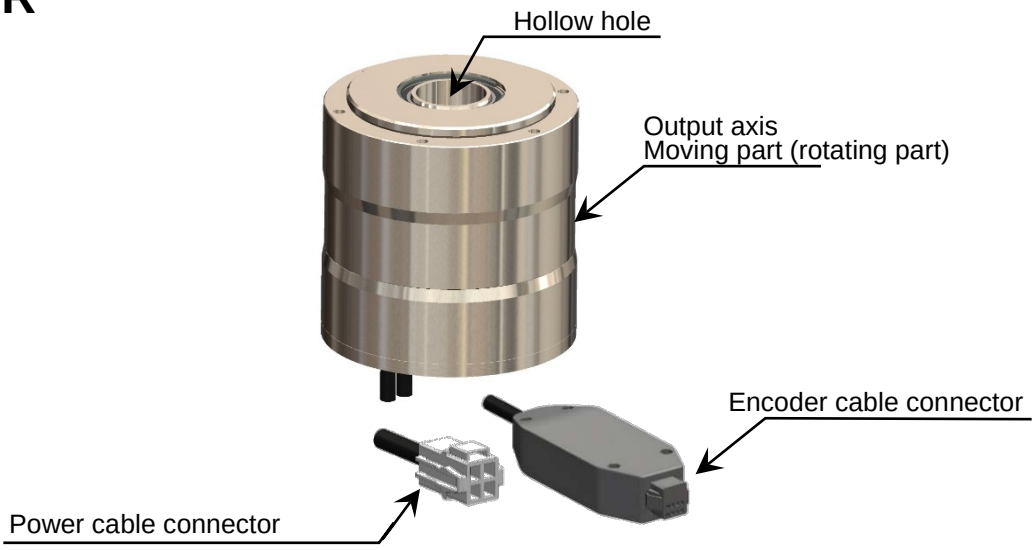


1.3. Name of Each Part

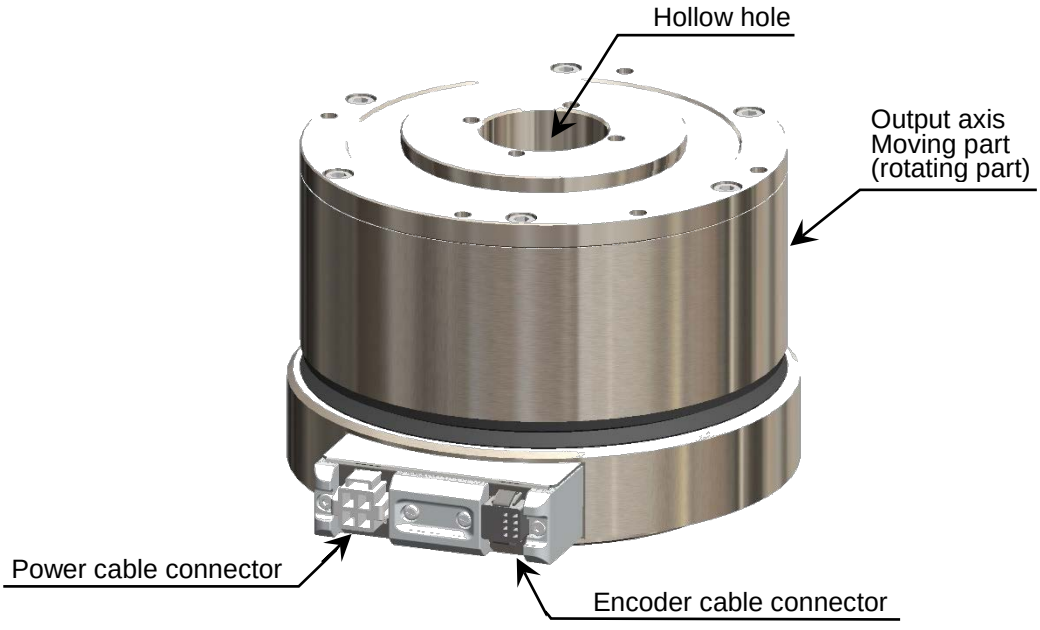
AX1R



AX2R



AX4R



1.4. Model Number Indication

1.4.1. AX1R Series

AX1R- 022 N - NN NN

Size (maximum output torque)	
022	22N·m
045	45N·m
075	75N·m
150	150N·m
210	210N·m

Connector installation direction	
N	Standard (connector side installation)
D	Connector lower installation

Installation base	
NN	Standard (without installation base)
BS	With installation base

1.4.2. AX2R Series

AX2R- 006 N - NN NN

Size (maximum output torque)	
006	6N·m
012	12N·m
018	18N·m

Installation base	
NN	Standard (without installation base)
BS	With installation base

1.4.3. AX4R Series

AX4R- 009 N - NN NN

Size (maximum output torque)	
009	9N·m
022	22N·m
045	45N·m
075	75N·m
150	150N·m
300	300N·m
500	500N·m
10W	1000N·m

Installation base	
NN	Standard (without installation base)
BS	With installation base

Brake	
NN	Standard (without electromagnetic brake)
EB	With negative-actuated electromagnetic brake

2. INSTALLATION

DANGER

Do not use in areas where dangerous materials such as igniters, flammables and explosives are present.
- This may cause ignition, flames, or explosions.

Do not work with wet hands.
- This may cause electric shock.

Do not attach or remove connectors with the power on.
- A malfunction, failure or electric shock may be caused.

When installing the product, secure the workpiece while holding the product and the workpiece securely.
- Falling, dropping or malfunction of the product may cause injury.

WARNING

Safety design shall be achieved by design in accordance with organization standards and laws.
Do not install the product on combustible materials.
- Installing the product on or near combustible materials may cause fire.

Do not place heavy objects on or pinch the cable.
- Damage or excessive stress on the cable sheathing may lead to poor conduction and insulation degradation.

Since the product contains precision equipment, do not overturn it or subject it to vibration or shock during transportation.
- Doing so may damage the part.

Do not disassemble or modify the product except as instructed in this instruction manual.
- Doing so may cause injury, accident, malfunction, or failure, as well as failure to meet the specifications in this instruction manual.

Wiring not in use shall be insulated.
- Failure to do so may result in malfunction, failure, or electric shock.

When restarting after an emergency or abnormal stop, make sure that the actuator is safe to operate.

WARNING

Safety circuits or safety devices shall be designed to prevent equipment damage or personal injury in the event that the machine stops due to a system malfunction, such as an emergency stop or power failure.
Waterproof the actuator when used in an environment with water or oil.

Check the wiring of the product in this instruction manual and related instruction manuals to ensure that there are no wiring errors or loose connectors.
- Malfunction or overcurrent flow may occur. Overcurrent flow may cause malfunction, damage, or fire.

Make sure of the safety in the full revolution of the actuator.

Make sure that the wiring is insulated.
- Malfunction or overcurrent flow may occur. Overcurrent flow may cause malfunction, damage, or fire.

Make sure that there is no contact with other circuits, ground fault, or insulation failure between terminals.
- Malfunction or overcurrent flow may occur. Overcurrent flow may cause malfunction, damage, or fire.

Consider the possibility of actuator or power source failure.
- Take appropriate measures to prevent personal injury or equipment failure even if the actuator or power source fails.

CAUTION

Do not perform the withstand voltage test or the insulation resistance test on the equipment to which this product is installed.

- In this circuit design, the product may be damaged if the withstand voltage test and the insulation resistance test are performed on the equipment to which the product is installed. If withstand voltage and insulation resistance tests are required for the equipment, they should be performed after removing the product.

Do not store or use in an area exposed to ultraviolet rays or in an atmosphere containing corrosive gases or salt.

- This may lead to reduced performance, and deterioration of strength due to rust.

Do not install the product in a place where large vibrations or shocks can be transmitted.

- Large vibrations or shocks may cause malfunction.

Do not use in an area where condensation occurs due to sudden changes in ambient temperature.

- This may lead to product malfunction or deterioration of its strength.

Use only dedicated cables to connect the product.

- Failure to do so may result in malfunction or unexpected accidents.

Do not hold the connector part or cable part of the product during transportation or installation.

- This may cause injury, damage, or disconnection.

Do not hit the output axis with a hammer or other tool or forcibly assemble it.

- The product may not be able to demonstrate its original accuracy and performance.

CAUTION

Carry out the wiring in such a way that inductive noise is not applied.
- Avoid areas with high current or strong magnetic fields.
- Do not use the same piping/wiring (with multi-core cables) as the power line of a large motor other than this product.

Secure space necessary for maintenance and inspection.
- Otherwise, maintenance and inspection cannot be performed, resulting in equipment stoppage, damage, and injury.

Customers are responsible for confirming the compatibility of the CKD product with their system, machine, and device.

When transporting or installing the product, ensure the safety of workers by supporting the product securely with lifts and supports and by using more than one worker.

Adjust the gain.
- The full performance is not achieved in the shipment state.

Before making any gain adjustments, the actuator unit should be firmly fixed to a rigid device.

When using in a place where high frequencies, high voltages, strong electric or magnetic fields, electrical discharges, radiation, etc. are generated, take measures such as noise filter shielding.
- Malfunction or damage may be caused.

2.1. Installation Environment

- Check the ambient temperature and atmosphere of the product specifications before storing or using the product.
- Use in a place where the ambient temperature is 0 to 40 °C. Ventilate if heat builds up.
- Use in a place where the ambient humidity is 20 to 85% RH. Use in a non-condensing environment.
- When storing, make sure that there is no condensation or freezing in a place where the ambient temperature is -20 to 80 °C and the ambient humidity is 20 to 90% RH.
- Avoid direct sunlight exposure and near heating elements. Place the product in an area free of dust, corrosive gases, explosive gases, flammable gases, and combustibles. This product is not considered for chemical resistance.
- Install the actuator on a smooth surface.
- If the actuator is installed on a smooth but dented surface, it may cause malfunction or damage to the actuator.

2.2. Unpacking

CAUTION

Heavy products should not be carried by the worker alone.

Never climb on the packing.

Do not place heavy items so as to deform the packing, or load-concentrated items.

Do not apply excessive force to parts of the product.

When transporting or handling, give due consideration to avoid impact such as falling.

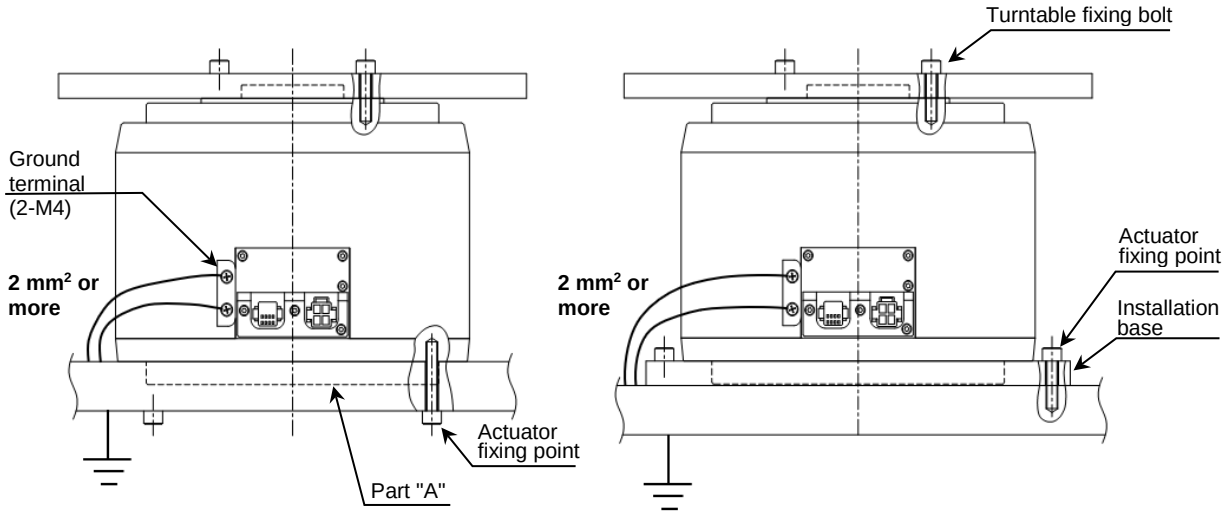
When stationary, the product should be in a horizontal state.

Make sure that the model number you ordered is the same as the one shown on the product.
Make sure that there is no damage to the product external.

2.3. Installation Method

2.3.1. Precautions for Installation

The machine for which ABSODEX is installed should have the maximum rigidity, so that ABSODEX will perform as designed.
This rigidity requirement bases on that relatively low number of mechanical natural frequency (approximately 200 to 300Hz) of a load machine, and deck will cause ABSODEX to resonate with the machine and its deck.
Make sure that all fixing bolts of a turntable and the actuator are completely tight to maintain sufficient rigidity. With models listed below, use the ground terminal on the side of the actuator to ground the casing of the actuator.
(Applicable Models: AX1R-150, AX1R-210, AX4R-300, AX4R-500, AX4R-10W)



WARNING

Never loosen the bolts in Part A, because precision parts for position detection are incorporated in Part A.

Do not attach parts or apply excessive force to Part A.

- The product may not be able to demonstrate its original accuracy and functionality.

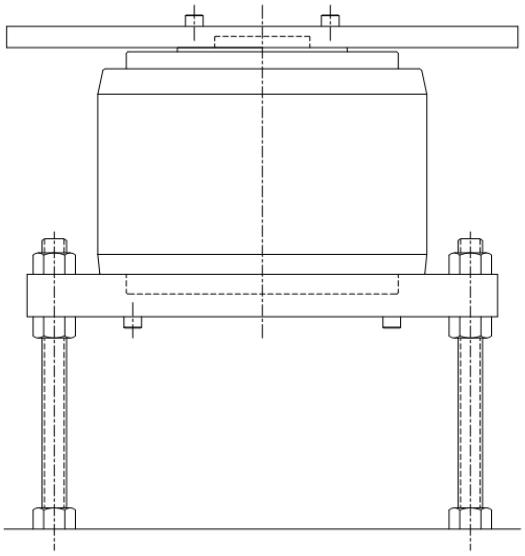
Do not hit the main unit or output axis with a hammer or other tool, or forcibly assemble them.

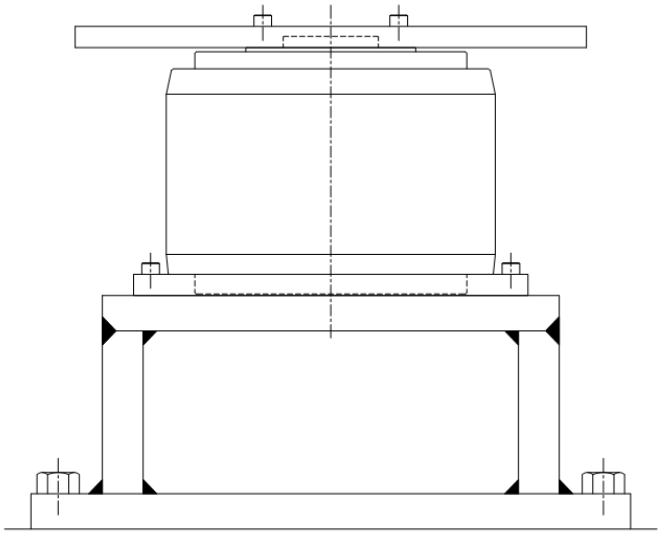
- The product may not be able to demonstrate its original accuracy and functionality.

Make sure that the components are securely installed before restarting the equipment.

Make sure that the safety is assured to operate the actuator in case the unit is operated from the place unable to confirm the motion.

When ABSODEX cannot be directly mounted on a machine, it should be mounted on the deck having as much rigidity as possible.



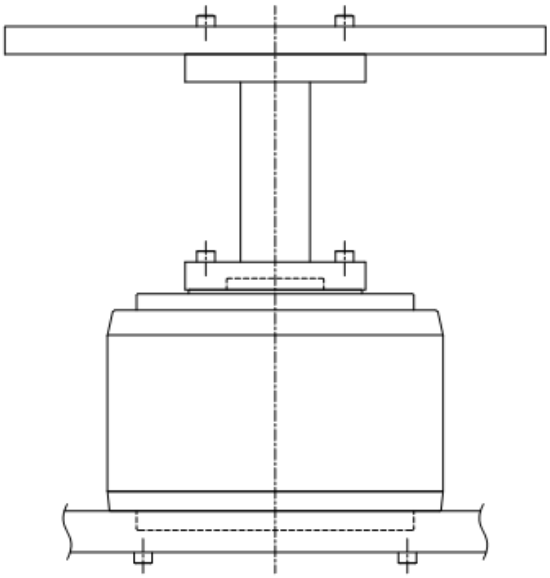


Example: Mounting with the shafts

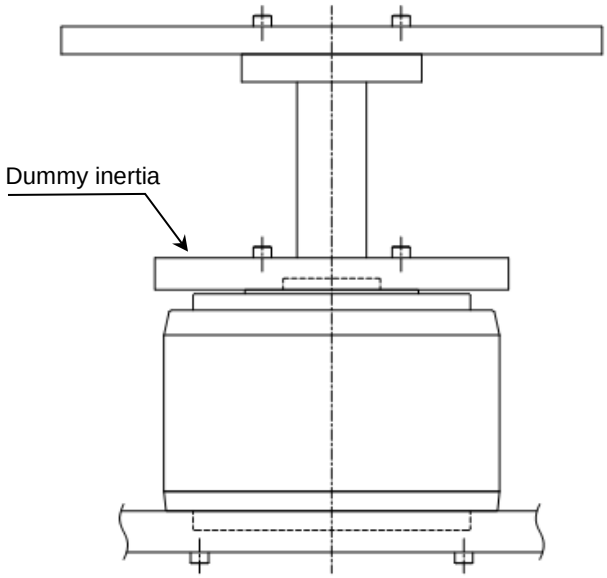
2.3.2. Anti-vibration Using Dummy Inertia Plate

When sufficient rigidity is not available for a machine, a dummy inertia plate at the nearest position to the actuator will help reduce resonance with the machine.
The following explains the installation of a dummy inertia plate.
Guideline for the magnitude of a dummy inertia is: Load inertia x (0.2 to 1).

Before Dummy Inertia Installation



After Dummy Inertia Installation

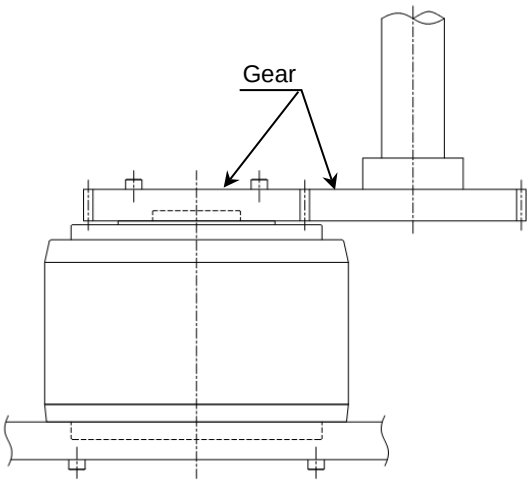


When extending the output axis, use the following as guidelines for the diameter and length of the extension axis.

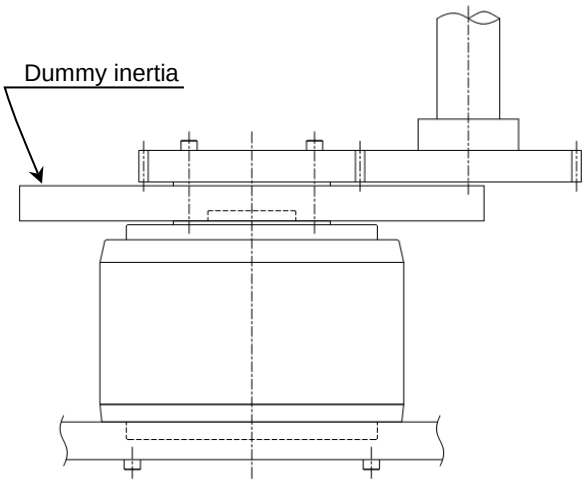
Maximum output torque [N·m]	The length of the extension [mm]				
	50	100	200	300	500
6	φ35	φ40	φ46	φ50	φ60
9	φ40	φ46	φ55	φ60	φ70
12	φ40	φ46	φ55	φ60	φ70
18	φ45	φ55	φ65	φ70	φ80
22	φ45	φ55	φ65	φ70	φ80
45	φ55	φ65	φ75	φ85	φ95
75	φ62	φ75	φ90	φ95	φ110
150	φ75	φ90	φ110	φ115	φ130
210	φ80	φ95	φ115	φ125	φ140
300	φ90	φ105	φ125	φ140	φ155
500	φ100	φ120	φ145	φ160	φ180
1000	φ120	φ140	φ170	φ185	φ210

Connections by belts, a gear, a spline, and a key will cause machine rigidity to be reduced.
In such instance, dummy inertia should be assumed to be load inertia x (0.5 to 2).
When speed is reduced using belts or gear, load inertia should be the value converted by the actuator output axis, and dummy inertia plate should be installed at the actuator side.

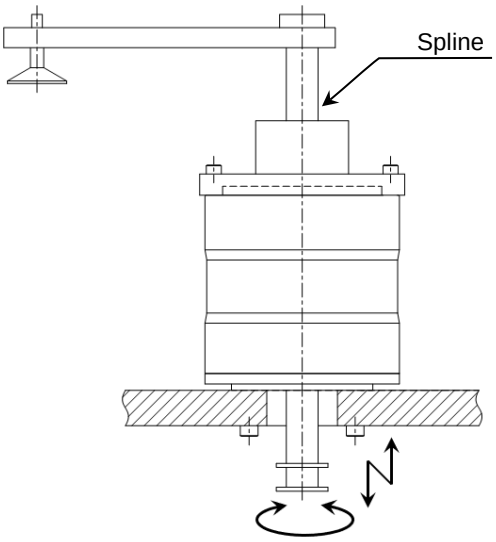
Before Dummy Inertia Installation



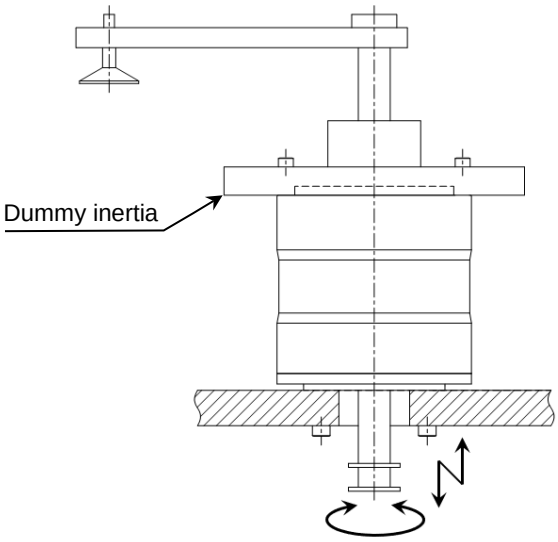
After Dummy Inertia Installation



Before Dummy Inertia Installation



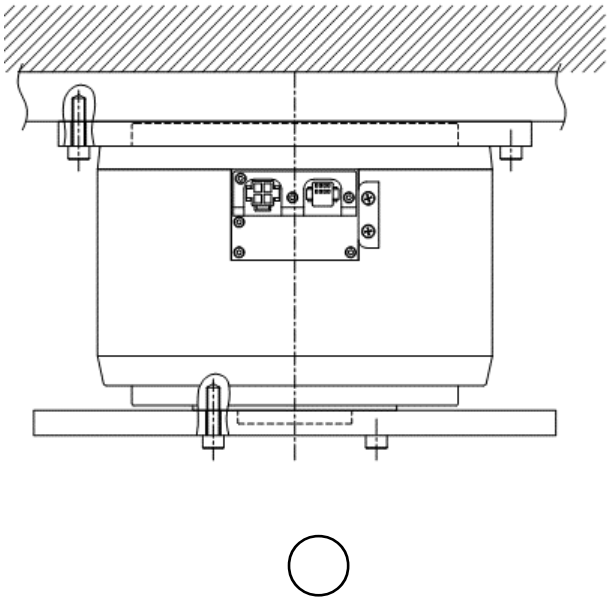
After Dummy Inertia Installation



Dummy inertia plate shall be as large as possible within the specification of the actuator.

2.3.3. Installation Direction

The actuator can be installed horizontally (on the floor or on the ceiling) or vertically.



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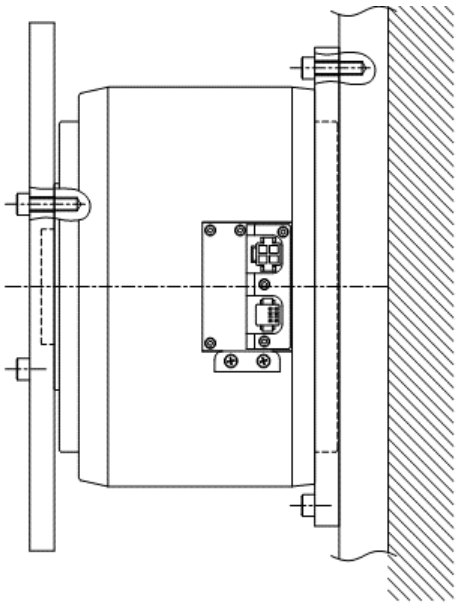


○

WARNING

If the servo is turned off (including safety function, forced stop, and alarm) while rotational force is applied by gravity or other force action, the rotational force may cause the actuator to rotate. Operate the actuator in the balanced condition so that rotational force is not applied for these operations after all safety aspects are confirmed.

3. USAGE

DANGER

Do not enter the operating area while the actuator is ready for operation.
- There is a risk of injury.

Do not work with wet hands.
- This may cause electric shock.

WARNING

Do not rotate the actuator output axis at 30 rpm or more with the power off.
- There is a risk of a failure of the driver or electric shock due to the power generation action of the actuator.

Do not turn on the main power supply when position deviation occurs.
- The actuator swivels by the function of eliminating the position deviation that occurs.

Do not touch the moving part (rotating part) when adjusting the gain or during operation.
- There is a risk of unexpected operation.

Do not touch the machine body with your hands or body during operation or immediately after stopping.
- There is a risk of burns due to contact with hot spots.

Before supplying power to the product, ensure that the product is wired with peripherals and that the equipment is safe to operate.
- Supplying electricity without due care can cause electric shock or injury.

Make sure that the safety is assured to operate the actuator in case the unit is operated from the place unable to confirm the motion.

Turn off the controller power in the event of a power failure.
- The product may suddenly activate when the power is restored, resulting in an accident.

The servo should be turned off (including safety function, forced stop, and alarm) in the balanced condition or after all safety aspects are confirmed.
- If the load is unbalanced, the output axis may rotate.

Measures should be taken so as not to cause damage to the human body or equipment even if the power supply fails.
- Failure to do so may result in unexpected accidents.

CAUTION

Do not frequently turn the power on and off.
- Doing so may damage the internal elements of the controller.

Do not operate the output axis for several seconds after power-on.
- An alarm may occur.

When changing the combination of the actuator and the controller, be sure to check the program and parameters before operating.
- Failure to do so may lead to accidents.

Use the actuator so that no shock is applied to the moving actuator parts.
Before turning on the main power supply and the control power supply separately, check the status of the servo off.
- Failure to do so may result in unexpected accidents.

If there is an external mechanical retention mechanism such as the brake, stagger the retention mechanism resetting timing from the power-on timing.
- An alarm may occur.

Periodically perform a turning movement of one or more revolutions when operating at a specified very small angle.
- Failure to do so may result in damage to parts due to fretting, etc.

Be careful that the output axis may move from the holding position even without an external force if the power or servo is turned off (including safety function, forced stop, and alarm) and the torque limit setting is reduced from the servo-on state (retention state).

4. MAINTENANCE INSPECTION

DANGER

TURN OFF POWER when making maintenance inspection or changing switches in the driver with the side cover removed as electrical shock due to high voltage can occur.
- There is a risk of injury.

Do not work with wet hands.
- This may cause electric shock.

WARNING

Do not disassemble or modify the product except as instructed in this instruction manual.
- Doing so may cause injury, accident, malfunction, or failure, as well as failure to meet the specifications in this instruction manual.

Do not attach or remove wires or connectors with the power on.
- Doing so may result in malfunction, failure, or electric shock.

Do not perform maintenance inspection work on the actuator and a moving part such as a rotary table installed on the actuator.

Do not remove devices until the safety is confirmed.

Install the product before wiring.
- Otherwise electric shock may be caused.

Do not work for a while after the main power supply is shut off.
- The actuator may swirl due to the electric charge inside the driver.

Inspection work should be performed at least 5 minutes have passed after the power supply has been turned off and the voltage has been checked with a tester or similar device.
- Otherwise electric shock may be caused.

CAUTION

In the case of maintenance, inspection and repair, alert others so that a third party will not turn the power on carelessly.

Wiring and inspection work should be performed by professional engineers.

Use a power cable that can sufficiently allow the instantaneous maximum current.

- Heat generation and damage may occur during operation.

If the product generates abnormal heat, smoke, odors, noise, or vibration, turn the power off immediately.

- Failure to do so may lead to product damage or fire.

4.1. Periodical Inspection

For using ABSODEX a long time, make a periodical inspection (once or twice a year). Turn off power for inspection except for the items 3 and 5 which require to be inspected with power ON.

< Periodical Inspection Items >

No.	Inspection Item	Inspection Method	Countermeasures
1	**External Appearance (Any dust or dirt on the surface)**	Inspect visually.	Remove any dust or dirt found.
2	**Loose screws and connectors.**	Inspect for looseness.	Re-tighten screws and connectors.
3	**Abnormal noise from actuator.**	Confirm by hearing.	Request CKD to repair.
4	**Cuts and crack in cable.**	Inspect visually.	Replace faulty cable.
5	**Power voltage**	Confirm the supply voltage with a tester.	Check the power supply system to supply power within the specified voltage range.

※ The product may not be accepted for repair depending on its condition.

※ Do not disassemble or modify the product, as this can result in product failure or malfunction.

4.2. Precautions for Product Disposal

CAUTION

The product is disposed by a specialized waste-disposal company in accordance with the "Waste Disposal and Public Cleansing Law."

5. TROUBLESHOOTING

< Troubleshooting (1/4) >

Symptom	Probable Cause	Countermeasures
Power does not turn on.	・Voltage is not measured (confirmed by a tester). ・Fuse inside the driver is blown.	・Check the power system. ・Replace or repair the driver.
Output axis rotates when power is turned ON.	・Gain adjustments are not made. ・Cable between the actuator and driver is broken or the connectors are loose. ・Wrong UVW connection ・The main power is turned on when there is position deviation.	・Adjust the gain. ・Check the cable connector. ・Change the wiring connection of the cable. ・Turn the main power on in the servo-off state.
Alarm F will light when power is turned on.	・Encoder cable between the actuator and driver is broken or the connectors are loose. ・Excessive moment and lateral loads are applied to the actuator. ・When the power is turned on, abnormal coordinate recognition occurs.	・Check the cable connector. ・Check the equipment alignment. ・Remove excessive load. ・Check that the output axis does not rotate during power-on.
Unable to communicate with the PC.	・USB cable is broken or connectors are loose. ・COM ports on the PC do not match.	・Check the cable connector. ・Check the COM port number.
Load table vibrates.	・Gain adjustments are not sufficient. ・Load is not fixed tight. ・Load does not have enough rigidity. ・Friction load is large. ・Loose connection of the actuator	・Adjust the gain. ・Tighten bolts. ・Increase load rigidity by reinforcement or reduce the gain. ・Install dummy inertia. ・Use anti-vibration filter. ・Reduce friction load. ・Tighten bolts.
Not be positioned to a target position (Position deviation occurs)	・Gain adjustments are not sufficient.	・Adjust the gain.
The 7-segment LED shows "-" (hyphen) or "_" (underscore).	・The safety function is activated.	・Check the wiring for the safety function.
Alarm 0 turns on.	・NC program error ・Program number setting input has been made while writing a program. ・An unknown program number is selected and started. ・Started in servo-off mode (G12P0)	・Review the NC program. ・DO NOT turn on number setting while writing a program. ・Change the program number. Or enter the program. ・Turn the servo on (G12P100) before a rotation code.

< Troubleshooting (2/4) >

Symptom	Probable Cause	Countermeasures
Alarm 1 lights.	· The actuator is loosely tightened.	· Tighten bolts. Be sure to carry out.
	· Load is excessive.	· Reduce speed.
	· Connection of the drive to actuator is not right.	· Cable connection check
	· Output axis is restricted by machine clamp mechanism.	· Apply or release the brake in the program.
	· Load is not fixed tight.	· Tighten bolts.
	· Gain adjustment has not been performed at G2:-1.	· Adjust the gain.
	· Gain adjustments are not sufficient.	· Adjust the gain.
	· DC power (24V) is not supplied for brake built-in series.	· Supply 24VDC.
Alarm 2 lights.	· Acceleration/deceleration cycles are many.	· Set stop time longer (Take time for heat reduction to re-start).
Alarm 4 lights.	· Acceleration/deceleration cycles are many.	· Set stop time longer (Take time for heat reduction to re-start).
	· Moving time is short.	· Revise the program.
	· Load equipment resonates.	· Install dummy inertia. · Use anti-vibration filter.
	Output axis is restricted by machine clamp mechanism.	· Apply or release the brake in the program.
	· Rotation and friction torque of load equipment is large.	· Reduce the load torque. Increase the size of ABSODEX.
Alarm 5 lights.	· Failure or faulty insulation of actuator Check for damage or deformation of connector parts. Foreign matter (metal chips, chips, dust, etc.) biting or entrance	· Foreign matter removal · Actuator repair and replacement
	· Faulty insulation of power cable	· Check around wiring
	Power cable breakage and damage and core short circuit and disconnection check	· Replacement of cable
	· Driver failure and insulation defect	· Foreign matter removal
	Foreign matter (metal chips, chips, dust, etc.) entrance	· Driver repair and replacement
	· Others	
	Noise filter selection mistake	· Connect a zero-phase reactor to the power cable (the noise filter for power supply 3SUP-EF10-ER-6 cannot be used).
	Wrong wiring and installation environment	· Check the cable connectors, and installed environment. · Cable connection check · Decrease the ambient temperature.

< Troubleshooting (3/4) >

Symptom	Probable Cause	Countermeasures
Alarm 6 lights.	· Power voltage is low. · Instantaneous power failure has occurred. · Power resumed immediately after power off. · The regenerative energy caused an over-voltage error.	· Check the power system. · Check the power system. · Turn off power, and turn it on after a few seconds. · Reduce the traveling speed.
Alarm 9 lights.	· Forced stop is input. · 24VDC is not supplied.	· Check I/O signal. Confirm the PRM 23. · Supply 24VDC.
Alarm A lights.	· An attempt was made to rotate with brake-on. The brake is applied in a travel. · PRM 28 is set for motion.	· Review the program. · Parameter correction Review the program.
Alarm H lights.	· Answer input is not made for M code, and positioning completion. · No answer input is supplied. · Parameter was changed by mistake. · A start input or home positioning input is supplied in the state waiting for an answer input.	· Check I/O signal. Confirm the PRM 11,12 and 13. · Confirm program and timing of programmable logic controller. · Confirm the PRM 12 and 13. · Check I/O signal.
Alarm C lights.	· Internal coordinate system has overflowed (G92 user coordinate system). · Parameter was changed by mistake.	· Review the program (reset the G92 coordinate system). · Confirm the PRM 8, 9 and 10.
Alarm F lights.	· There is a fault in power-on coordinate recognition. · The actuator vibrates during operation, causing an error in coordinate recognition.	· Check the encoder cable wiring. · Check if the output axis rotates during power-on. · Refer to Symptom (Load table vibrates.).
Alarm P lights.	· The driver is faulty.	· Replace or repair the driver.
Alarm L lights.	· There is a communication error between the actuator and driver. · Mismatch between actuator and driver	· Check the cable wiring. · Check the combination between the actuator and driver.
Alarm 3 lights.	· There is a combination error.	· Check the combination between the actuator and driver. · Enter the program and parameters again.

< Troubleshooting (4/4) >

Symptom	Probable Cause	Countermeasures
When the program is stored, alarm 7 lights up and the program is not stored.	・ The program area is full. ・ Program data is broken. ・ Write protection state The program being executed is not completed.	・ Delete unnecessary programs. ・ Clear the program memory area and enter again. (L17_9999) ・ Check the start input wait output. The program can be stored during start input wait output state. ・ Change the pulse string input mode to the automatic operation mode. ・ Check of I/O signal (start input wait output and answer output) Adjust the gain.
Start signal input will not cause motion to be made.	・ Program is not input. ・ Brake is applied. ・ 24VDC I/O power is not supplied. ・ Input signal is shorter than 20m sec. ・ No automatic operation. ・ The servo-on input is not supplied. ・ The safety function is activated. ・ The program being executed is not completed.	・ Input motion programs. ・ Release the brake. ・ Check the power system. ・ Set longer input signal time. ・ Set to auto mode. Confirm the PRM 29. ・ Supply the servo-on input. ・ Change PRM52 to "2" and do not use the servo-on input. ・ Check the wiring for the safety function. ・ Adjust the gain.
The start signal supplied after recovery from a forced stop does not cause a start.	・ Position in the program where start input wait (M0) is written	・ Change the position of "M0".
The electromagnetic brake does not release.	・ 24VDC I/O power is not supplied. ・ 24VDC is not supplied to the electromagnetic brake.	・ Check the power supply and wiring. ・ Check the power supply, wiring and relay.
Repetitive five-segment (72-degree) indexing operations cause deviation.	・ Accumulated error due to incremental dimension	・ Use the equal segment program (G101).
Parameters are not stored.	・ Pulse string input (M6) operation mode ・ The program being executed is not completed.	・ Change to the automatic operation (M1) or single block (M2) operation mode and store. ・ Check of I/O signal (start input wait output and answer output) ・ Adjust the gain.
Alarm U lights.	・ Friction load is large. ・ Brake is applied. ・ Interference of rotating parts with jigs or equipment	・ Increase PRM 87 setting. ・ Release the brake. ・ Remove peripheral devices.
Oscillation after auto tuning	・ No gain adjustment at panel ・ The rigidity of the equipment is too small.	・ Set to G2:-1. ・ Install a dummy inertia and perform auto tuning. ・ Adjust the gain manually.

6. SUPPORT FOR UL STANDARD

If this product is used as UL-compliant product, be sure to read this section before use. A product on which a UL mark is attached is a UL-compliant product. A product on which no mark is attached is not a UL-compliant product.

Operation of this equipment requires detailed installation and operation instructions provided in the instruction manual intended for use with this product.

Manufacturer's name: CKD Corporation

6.1.1. Applicable Standards

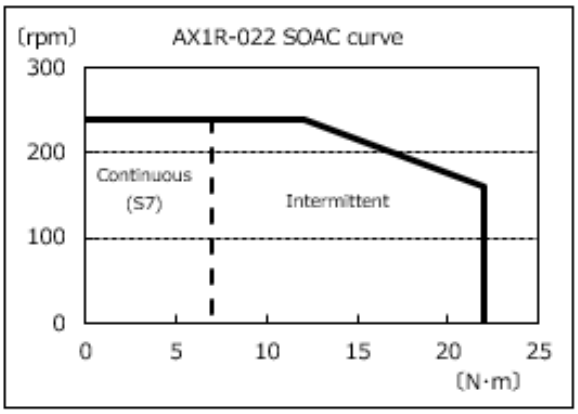
Item	UL Standard	Description
Actuator	UL1004-1	Rotating Electrical Machines General Requirements
	UL1446	Systems of Insulating Materials General

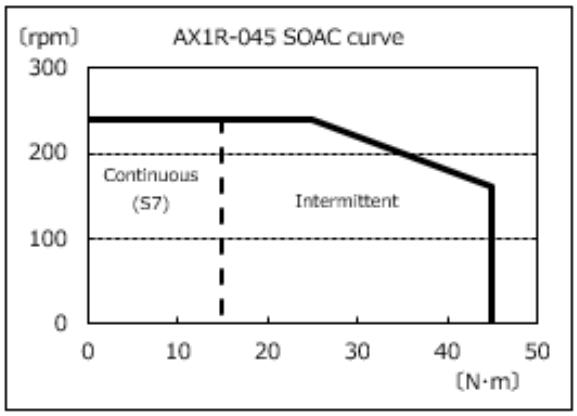
6.1.2. Precautions

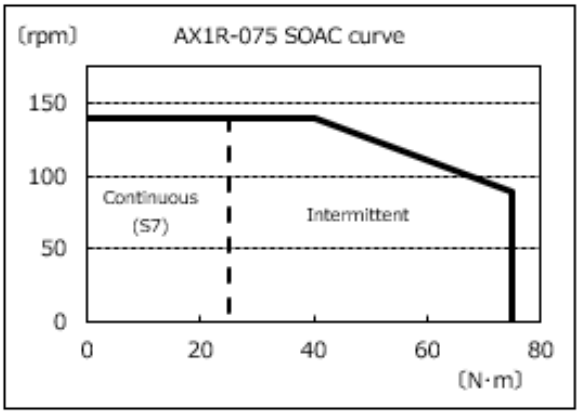
■ SOAC (Safe Operating Area of Continuous operation) curve

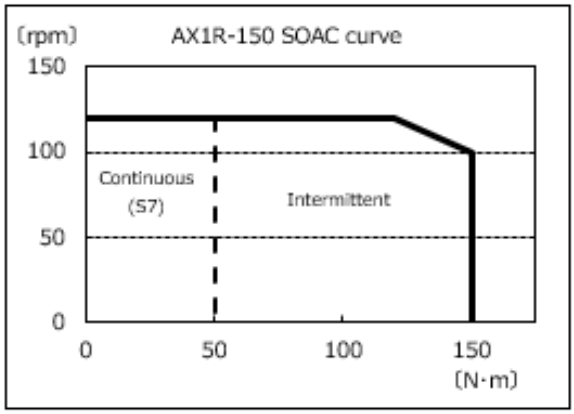
The load condition being used must be within the SOAC curve.

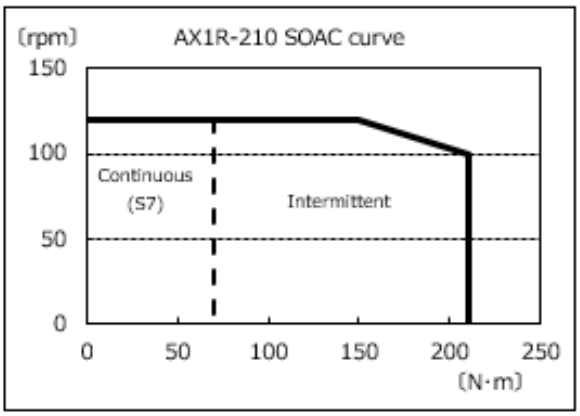
AX1R Series

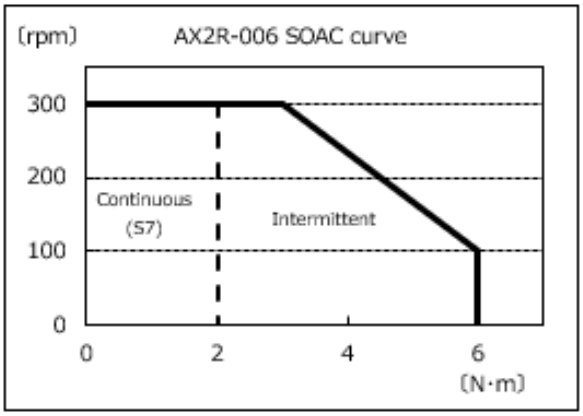


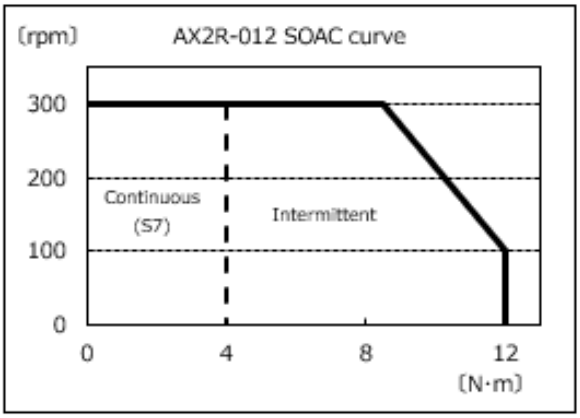


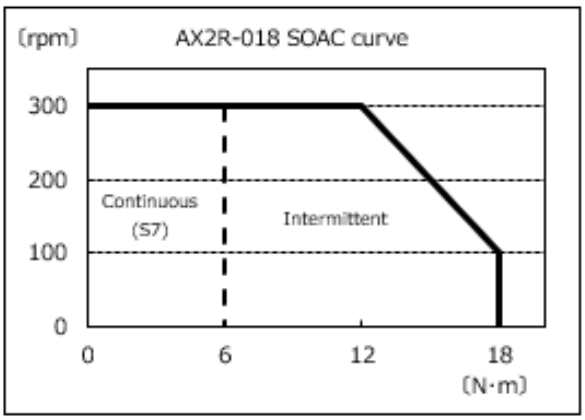


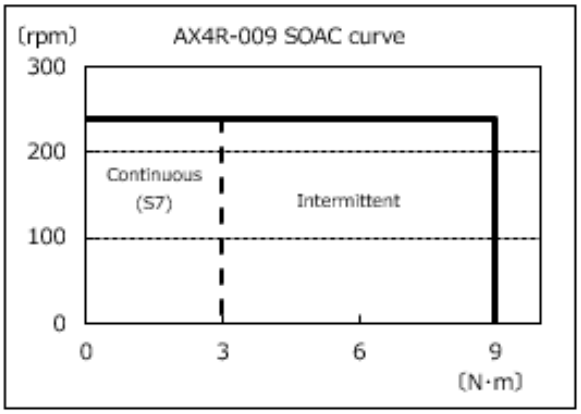


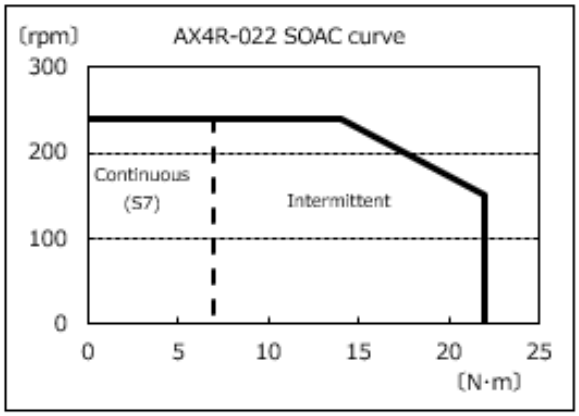


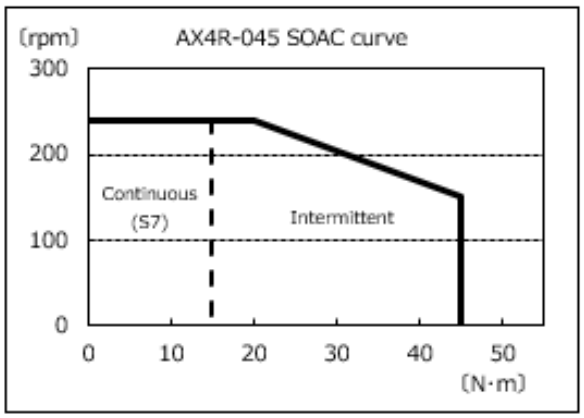

(rpm)
AX2R-006 SOAC curve
300
200
100
0
Continuous
(S7)
Intermittent
0
2
4
6
(N·m)

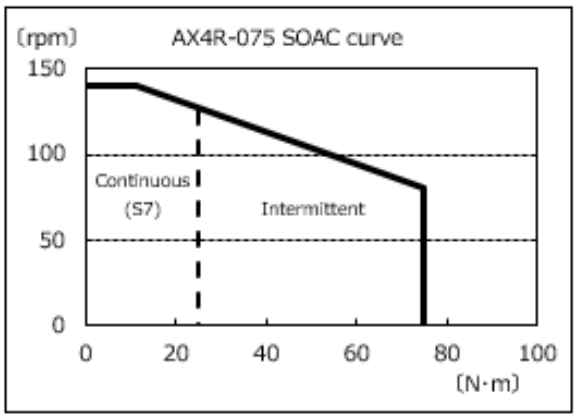

(rpm)
AX2R-012 SOAC curve
300
200
100
0
Continuous
(S7)
Intermittent
0
4
8
12
(N·m)

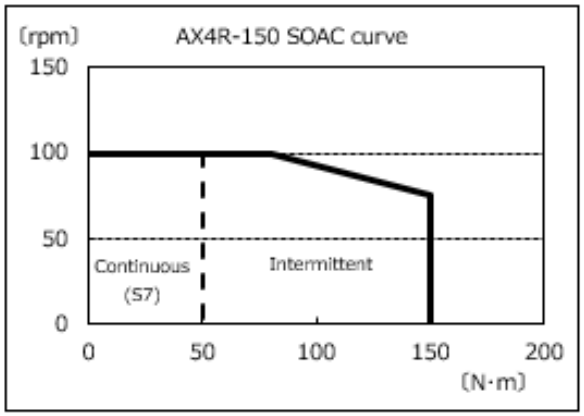

(rpm)
AX2R-018 SOAC curve
300
200
100
0
Continuous
(S7)
Intermittent
0
6
12
18
(N·m)

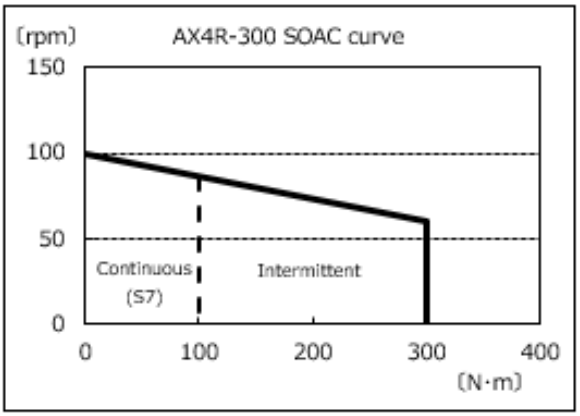

(rpm)
AX4R-009 SOAC curve
300
200
100
0
Continuous
(S7)
Intermittent
0
3
6
9
(N·m)

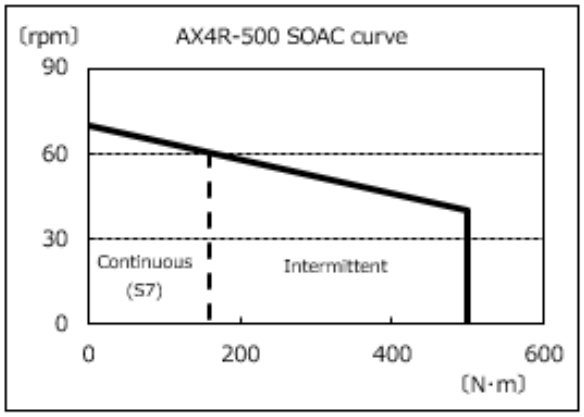

(rpm)
AX4R-022 SOAC curve
300
200
100
0
Continuous
(S7)
Intermittent
0
5
10
15
20
25
(N·m)

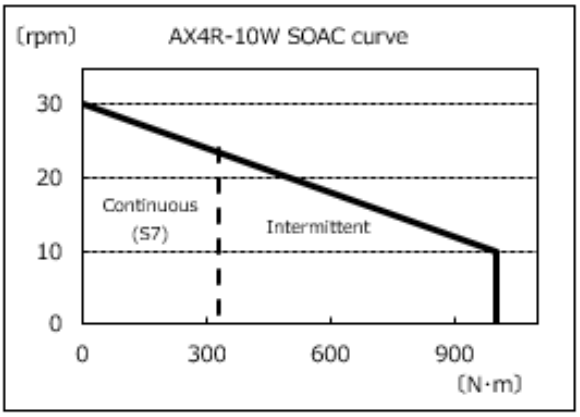

(rpm)
AX4R-045 SOAC curve
300
200
100
0
Continuous
(S7)
Intermittent
0
10
20
30
40
50
(N·m)


(rpm)
AX4R-075 SOAC curve
150
100
50
0
Continuous
(S7)
Intermittent
0
20
40
60
80
100
(N·m)


(rpm)
AX4R-150 SOAC curve
150
100
50
0
Continuous
(S7)
Intermittent
0
50
100
150
200
(N·m)


(rpm)
AX4R-300 SOAC curve
150
100
50
0
Continuous
(S7)
Intermittent
0
100
200
300
400
(N·m)


(rpm)
AX4R-500 SOAC curve
90
60
30
0
Continuous
(S7)
Intermittent
0
200
400
600
(N·m)


(rpm)
AX4R-10W SOAC curve
30
20
10
0
Continuous
(S7)
Intermittent
0
300
600
900
(N·m)

6.1.3. Specification

AX1R Series

Item	AX1R-022	AX1R-045	AX1R-075	AX1R-150	AX1R-210
1. Continuous Output Torque (N·m)	7	15	25	50	70
2. Maximum Output Torque (N·m)	22	45	75	150	210
3. Rated Speed (rpm)	240(S7)	240(S7)	140(S7)	120(S7)	120(S7)
4. Rated Input Voltage (V)	190	190	190	190	190
5. Rated Input Current (A)	1.3	1.9	1.9	3.3	4.3
6. Inertia of motor ($kg \cdot m^2$)	0.00505	0.00790	0.03660	0.05820	0.09280
7. Moment of inertia of the maximum load ($kg \cdot m^2$)	0.6	0.9	4.0	6.0	10.0
8. Insulation Class	Class F				
9. Ambient Temperature	40ºC				

AX2R Series

Item	AX2R-006	AX2R-012	AX2R-018
1. Continuous Output Torque (N·m)	2.0	4.0	6.0
2. Maximum Output Torque (N·m)	6.0	12.0	18.0
3. Rated Speed (rpm)	300(S7)	300(S7)	300(S7)
4. Rated Input Voltage (V)	200	200	200
5. Rated Input Current (A)	0.6	1.1	1.3
6. Inertia of motor ($kg \cdot m^2$)	0.00575	0.00695	0.00910
7. Moment of inertia of the maximum load ($kg \cdot m^2$)	0.3	0.4	0.5
8. Insulation Class	Class F		
9. Ambient Temperature	40ºC		

Item	AX4R-009	AX4R-022	AX4R-045	AX4R-075
1. Continuous Output Torque (N·m)	3	7	15	25
2. Maximum Output Torque (N·m)	9	22	45	75
3. Rated Speed (rpm)	240(S7)	240(S7)	240(S7)	127(S7)
4. Rated Input Voltage (V)	190	190	190	200
5. Rated Input Current (A)	1	1.2	1.9	1.7
6. Inertia of motor ($kg \cdot m^2$)	0.009	0.0206	0.0268	0.1490
7. Moment of inertia of the maximum load ($kg \cdot m^2$)	1.75	3.00	5.00	25.00
8. Insulation Class	Class F			
9. Ambient Temperature	40ºC			

Item	AX4R-150	AX4R-300	AX4R-500	AX4R-10W
1. Continuous Output Torque (N·m)	50	100	160	330
2. Maximum Output Torque (N·m)	150	300	500	1000
3. Rated Speed (rpm)	100(S7)	100(S7)	60(S7)	24(S7)
4. Rated Input Voltage (V)	200	200	210	230
5. Rated Input Current (A)	2.6	3.7	4.2	4.2
6. Inertia of motor ($kg \cdot m^2$)	0.2120	0.3260	0.7210	2.72
7. Moment of inertia of the maximum load ($kg \cdot m^2$)	75.00	180.00	300.00	600.00
8. Insulation Class	Class F			
9. Ambient Temperature	40ºC			

7. SUPPORT FOR EUROPEAN STANDARDS

If this product is used as EN-compliant application, be sure to read this section before use.
A product on which a CE and a UKCA marks are attached is compliant with European Standards. A product on which no marks are attached is not compliant with European Standards.

7.1. European Standards

- **Low voltage directives**

  Actuator: IEC/EN 60034-1
  IEC/EN 60034-5

7.2. Precautions on Operation in EU member countries and U.K.

7.2.1. Installation Conditions

Be sure to observe the following installation conditions to operate our product safely.
Over voltage category: III
Pollution degree: 3

7.2.2. Protective Earthing

Connection of only one protective earth wire to one terminal is permitted.
The diameter of the wire for the protective earthing conductor shall be larger than or equal to that of the power supply cable (2 mm^2).
When using the following models, the touch current exceeds 3.5 mA AC.
Use the protective earthing terminal of the actuator for installation.
(AX1R-150,AX1R-210,AX4R-300,AX4R-500,AX4R-10W)
The minimum size of the protective earth conductor shall comply with the local safety regulations.

7.2.3. Operating Environment

Condition	Temperature	Humidity	Atmospheric Pressure
During operation	0 to 40°C	20 to 85%RH, no condensation	86 kPa to 106 kPa
During storage	-20 to 80°C	20 to 90%RH, no condensation	86 kPa to 106 kPa
During transportation	-20 to 80°C	20 to 90%RH, no condensation	86 kPa to 106 kPa

8. TERMS OF WARRANTY

■ Period

The warranty period of the product is one year since the date of delivery to your designated place.

■ Scope

In the event of a failure that is clearly CKD's responsibility during the warranty period described above, we will provide a replacement for this product or any necessary replacement parts free of charge, or repair at CKD Plant free of charge.
However, the scope of warranty shall not cover the following cases.

(1) Failure caused by handling and use under conditions and environments other than those described in catalogs, specifications, and instruction manuals.
(2) Failure caused by exceeding durability (frequency, distance, time, etc.) and for reasons related to consumables.
(3) Failure caused by reasons other than the product.
(4) Failure caused by operation derailing from the purposes for which the product is designed.
(5) Failure caused by modification or repair not involving CKD.
(6) Failure caused by reason that is unforeseeable with technology put into practical use at the time of delivery.
(7) Failure caused by natural disasters, calamities, or other reasons for which CKD is not responsible.

The warranty herein shall apply only to the delivered product and shall exclude any losses induced by a defect in the delivered product.

■ Confirmation of compatibility

Customers are responsible for confirming the compatibility of the CKD product with their system, machine, and device.

9. REFERENCE INFORMATION

9.1. Specification

Item	AX1R-022	AX1R-045	AX1R-075	AX1R-150	AX1R-210
Maximum Output Torque N·m	22	45	75	150	210
Continuous Output Torque N·m	7	15	25	50	70
Maximum Rotation Speed rpm	240 Note 1		140 Note 1	120 Note 1	
Allowable Axial Load N	600		2200		
Allowable Moment Load N·m	19	38	70	140	170
Output Axis Inertia Moment kg·m²	0.00505	0.00790	0.03660	0.05820	0.09280
Allowable Load Inertia Moment kg·m²	0.6	0.9	4.0	6.0	10.0
Indexing Accuracy sec	±15				
Repeating Accuracy sec	±5				
Output Axis Friction Torque N·m	2.0		8.0		
Resolution P/rev	2097152/540672				
Heat-resistant Class	F				
Dielectric Strength	1500 VAC for 1 minute				
Insulation Resistance	10 MΩ minimum, 500 VDC				
Operating Ambient Temperature/Humidity	0 to 40°C 20 to 85%RH, no condensation				
Storage Ambient Temperature/Humidity	-20 to 80°C 20 to 90%RH, no condensation				
Mass kg	8.9 (10.8) Note 2	12.0 (13.9) Note 2	23.0 (27.1) Note 2	32.0 (36.1) Note 2	44.0 (48.1) Note 2
Output Axis Run-out mm	0.01				
Output Axis Side Run-out mm	0.01				
Protection	IP20				

Note 1: Operate at 140 rpm or smaller speeds under the 2097152 P/rev resolution condition.
Note 2: The figures in parentheses indicate the mass of the actuator with an installation base option.

Item	AX2R-006	AX2R-012	AX2R-018
Maximum Output Torque N·m	6.0	12.0	18.0
Continuous Output TorqueN·m	2.0	4.0	6.0
Maximum Rotation Speed rpm	300 Note 1		
Allowable Axial Load N	1000		
Allowable Moment Load N·m	40		
Output Axis Inertia Moment kg·m²	0.00575	0.00695	0.00910
Allowable Load Inertia Moment kg·m²	0.3	0.4	0.5
Indexing Accuracy sec	±30		
Repeating Accuracy sec	±5		
Output Axis Friction Torque N·m	0.6		0.7
Resolution P/rev	2097152/540672		
Heat-resistant Class	F		
Dielectric Strength	1500 VAC for 1 minute		
Insulation Resistance	10 MΩ minimum, 500 VDC		
Operating Ambient Temperature/Humidity	0 to 40°C 20 to 85%RH, no condensation		
Storage Ambient Temperature/Humidity	-20 to 80°C 20 to 90%RH, no condensation		
Mass kg	4.7 (6.0) Note 2	5.8 (7.1) Note 2	7.5 (8.8) Note 2
Output Axis Run-out mm	0.03		
Output Axis Side Run-out mm	0.03		
Protection	IP20		

Note 1: Operate at 140 rpm or smaller speeds under the 2097152 P/rev resolution condition.
Note 2: The figures in parentheses indicate the mass of the actuator with an installation base option.

Item	AX4R-009	AX4R-022	AX4R-045	AX4R-075
Maximum Output Torque N·m	9	22	45	75
Continuous Output Torque N·m	3	7	15	25
Maximum Rotation Speed rpm	240 Note 1			140
Allowable Axial Load N	800	3700	3700	20000
Allowable Moment Load N·m	40	60	80	200
Output Axis Inertia Moment kg·m²	0.0090	0.0206	0.0268	0.1490
Allowable Load Inertia Moment kg·m²	1.75	3.00	5.00	25.00
Indexing Accuracy sec	±30			
Repeating Accuracy sec	±5			
Output Axis Friction Torque N·m	0.8	3.5		10.0
Resolution P/rev	2097152/540672			
Insulation Class	F			
Dielectric Strength	1500 VAC for 1 minute			
Insulation Resistance	10 MΩ minimum, 500 VDC			
Operating Ambient Temperature/Humidity	0 to 40°C 20 to 85%RH, no condensation			
Storage Ambient Temperature/Humidity	-20 to 80°C 20 to 90%RH, no condensation			
Mass kg	5.5	12.3 (14.6) Note 2	15.0 (17.3) Note 2	36.0 (41.0) Note 2
Total Mass Including Brake kg	-	16.4 (18.7) Note 2	19.3 (21.6) Note 2	54.0 (59.0) Note 2
Output Axis Run-out mm	0.03			
Output Axis Side Run-out mm	0.05			
Protection	IP20			

Note 1: Operate at 140 rpm or smaller speeds under the 2097152 P/rev resolution condition.
Note 2: The figures in parentheses indicate the mass of the actuator with an installation base option.

Item	AX4R-150	AX4R-300	AX4R-500	AX4R-10W
Maximum Output Torque N·m	150	300	500	1000
Continuous Output Torque N·m	50	100	160	330
Maximum Rotation Speed rpm	100		70	30
Allowable Axial Load N	20000			
Allowable Moment Load N·m	300	400	500	400
Output Axis Inertia Moment kg·m²	0.2120	0.3260	0.7210	2.7200
Allowable Load Inertia Moment kg·m²	75.00	180.00	300.00	600.00
Indexing Accuracy sec	±30			
Repeating Accuracy sec	±5			
Output Axis Friction Torque N·m	10.0		15.0	20.0
Resolution P/rev	2097152/540672			
Insulation Class	F			
Dielectric Strength	1500 VAC for 1 minute			
Insulation Resistance	10 MΩ minimum, 500 VDC			
Operating Ambient Temperature/Humidity	0 to 40°C 20 to 85%RH, no condensation			
Storage Ambient Temperature/Humidity	-20 to 80°C 20 to 90%RH, no condensation			
Mass kg	44.0 (49.0) Note 1	66.0 (74.0) Note 1	115.0 (123.0) Note 1	198.0 (217.0) Note 1
Total Mass Including Brake kg	63.0 (68.0) Note 1	86.0 (94.0) Note 1	-	-
Output Axis Run-out mm	0.03			
Output Axis Side Run-out mm	0.05			0.08
Protection	IP20			

Note 1: The figures in parentheses indicate the mass of the actuator with an installation base option.