CKD

"Instantaneous positioning" quick response direct drive actuator ABSODEX

Direct drive actuator quick response type ABSODEX AX1000T, AX2000T, and AX4000T Series

New product

DIRECT DRIVE ACTUATOR QUICK RESPONSE TYPE, AX1000T, AX2000T, AX4000T SERIES

CKD Corporation

CC-995A 6

Setup easier than ever before!

“Instantaneous positioning! Quick response direct drive actuator ABSODEX”

AX 1000T 2000T 4000T Series

Quick setup!

Quick positioning!

High precision, multi-functions

High precision absolute DD actuator that can be indexed anywhere in its 360°range. Combination of intermittent and continuous rotation is possible.

Environmental design

Energy efficient, space saving, oil free, reusable the features you need to build ecological production facilities.

Highly compatible (AX1000T, AX2000T, and AX4000T)

Drivers, actuators, and cables are compatible. Service and maintenance are easy.

BIBUS

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RoHS

1. Shorter tact time for equipment

- Improved response reduces time loss
  Instantaneous positioning reduces stabilization time to 1/4 (based on CKD measurement result)
- Start time reduced by linking with peripheral components
  By adding A/B phase output signal, peripheral components are easier to synchronize.

2. Improved usability

- Optimal tuning in no time.
  Semi-automatic tuning function added.
- Increased I/O signals
  Ready output, servo ON, etc. added.
- Easier setup
  Adjustment software (AX tools) preinstalled.
- Control is on even when the motor is off
  Power supply separated between motor and control

3. Safety Standards

- Safety standard certifications (Safe Torque Off function)

4. Overseas Standards

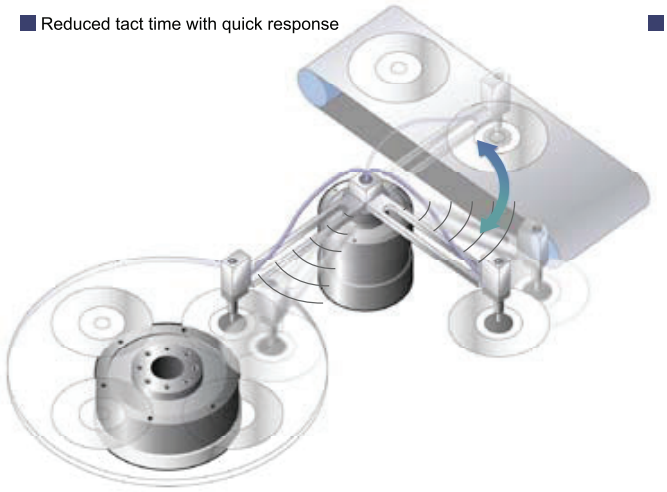
- UL/cUL, CE compliant

c US c UL US LISTED CE TÜVRheinland

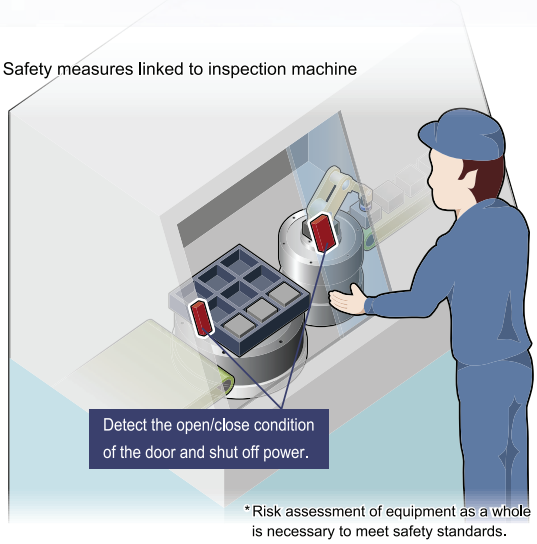
5. Downsized GH/WGH type drivers

- Volume reduced to 65%. 50mm shorter depth

■ Reduced tact time with quick response



■ Safety measures linked to inspection machine



*Risk assessment of equipment as a whole is necessary to meet safety standards.

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What's new in the TS/TH driver?

● Quick response

The faster CPU in the driver improves response and drastically reduces stabilization time. It helps you to reduce tact time.

● Compact and light weight

The volume of the large models (maximum output torque of 150 N•m or higher) has been reduced to 65% of CKD's equivalent conventional models.
The adoption of the resin body has reduced the weight.

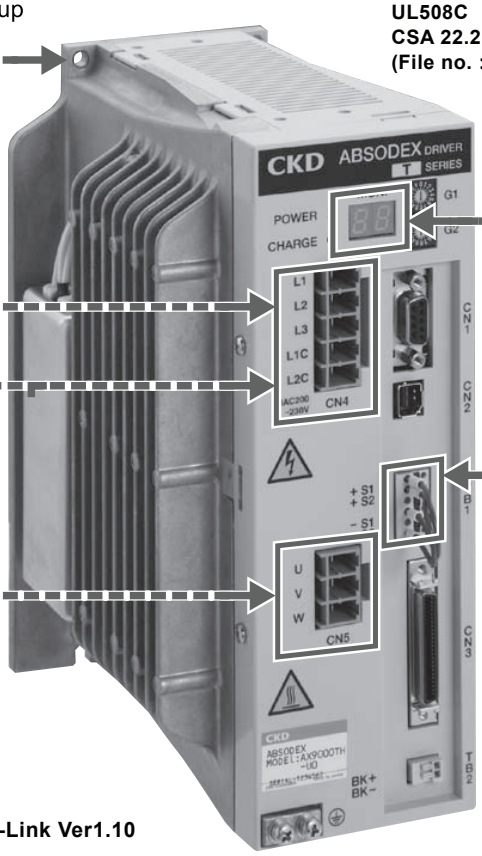
● New encoder output

The new A-B phase output function that specifies the current position makes it possible to easily and accurately control the position using pulse control.

● UL/cUL Certified

- **The actuator is certified by the following standards.**
  UL1004-1
  CSA 22.2 No.100
  (File no. : E328765)
- **The driver is certified by the following standards.**
  UL508C
  CSA 22.2 No.14
  (File no. : E325064)

● Mounting holes eliminate the need for using mounting brackets, which saves setup time.



● Separate main power supply and control power supply

It is now possible to cut off only the main power supply for emergency.

● Connector provided

Easy crimping free wiring. Risks of electric shock lowered since the terminal is not exposed.

● 7 segment LED 2-digit display

Improved visibility and indication of alarm details make maintenance easier. The set value for gain adjustment will be shown on the LED as well.

● Terminal for safety

Create a power cut off circuit easily with the STO function (safe torque off).

● Supoorted fieldbus

CC-Link Ver1.10

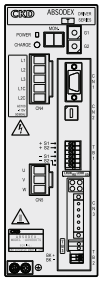
DeviceNet

PROFIBUS DP

● Monitor with serial communication

Program no, position and alarm could be monitored from the PLC.

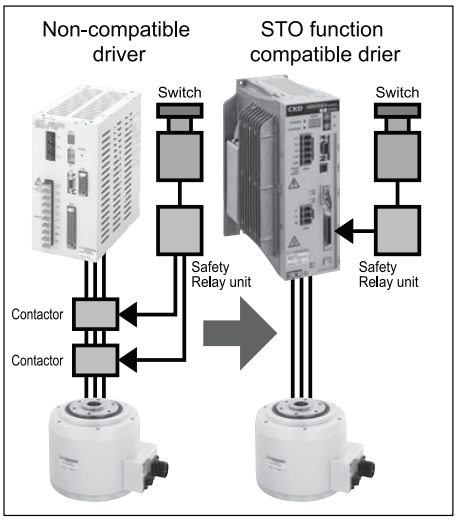
AX9000TS/TH-U2(U3,U4)



Position
Program no.
Rotation speed
Alarm, etc.

Start, stop, select program, etc.

Master unit (PLC, etc.)



Installation of contactor for cutting off motor power is no longer required.

Useful features

● Additional functions on the quick response type

■I/O function

- Ready output
- Servo State Output
- Encoder output
- Servo ON Input
- Position deviation counter clear input

■Parameters

- Positioning completion signal output time setting
  Can be set in the range of 0 to 100 ms.
- Mode selection of in-position output
  Select either ON at all times within the position deviation range or ON only when stopped.

■Additional program selection method

- Select programs with 6-bit input (0 to 63)
- Start operation with selection input + start input
  Program number selection input can be omitted, which reduces the time from program selection to operation. This reduces tact time.

■Free-run prevention during alarms

When an alarm indicating that the servo is in an uncontrollable state occurs during operation, this function decelerates and stops the servo to prevent accidents.

● Return to origin not required

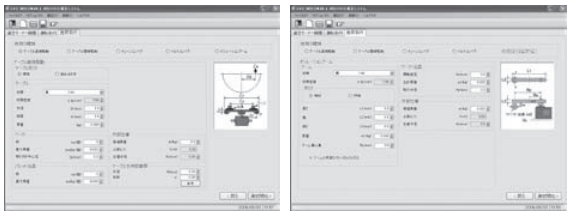
The Absodex has a built-in absolute resolver that detects the current position when power is turned on, eliminating bothersome origin searches. You can alsorestart from the current position after an emergency stop.

● Smooth cam curve drive

Five types of cam curves are provided as a standard. Shock during movement and stopping is minimized.

● Model selection software (free)

Select the best model with ease.



● Starting adjustment support tool "AX Tools" provided for free

This tools enables you to make adjustments in less time.

■Teaching note

- Create programs and set parameters
- Origin offset
- Test operation
- Semi-automatic tuning (TS type only)

  After auto tuning, you can increase the machine performance by adjusting a single parameter.

■Speed wave

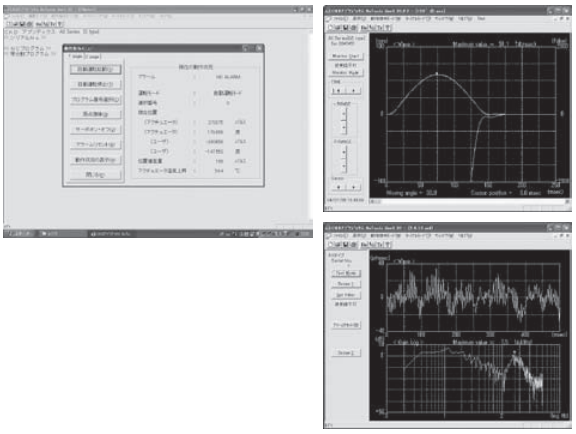
Evaluate tuning by measuring the actual speed change and convergence waveforms.

■FFT

Set a notch filter and low-pass filter to suppress mechanical resonance.

■I/O check

Evaluate the status of I/O communication with the host device.



● Eco-friendly features

■Energy saving

Power is consumed only during indexing. Almost no power is consumed while the output shaft is stopped.

■No need to replace or dispose lubricant

Bothersome lubricant replacement and waste oil disposal are no longer required. This also eliminates pollution that may be caused by oil leakage.

■Compact, space saving

No need for origin detection sensors, reducers, etc.

■Easy to change specifications, reusable

Change specifications using an interactive terminal, PC, etc. Makes reuse possible, which is difficult with mechanical indexed actuators.

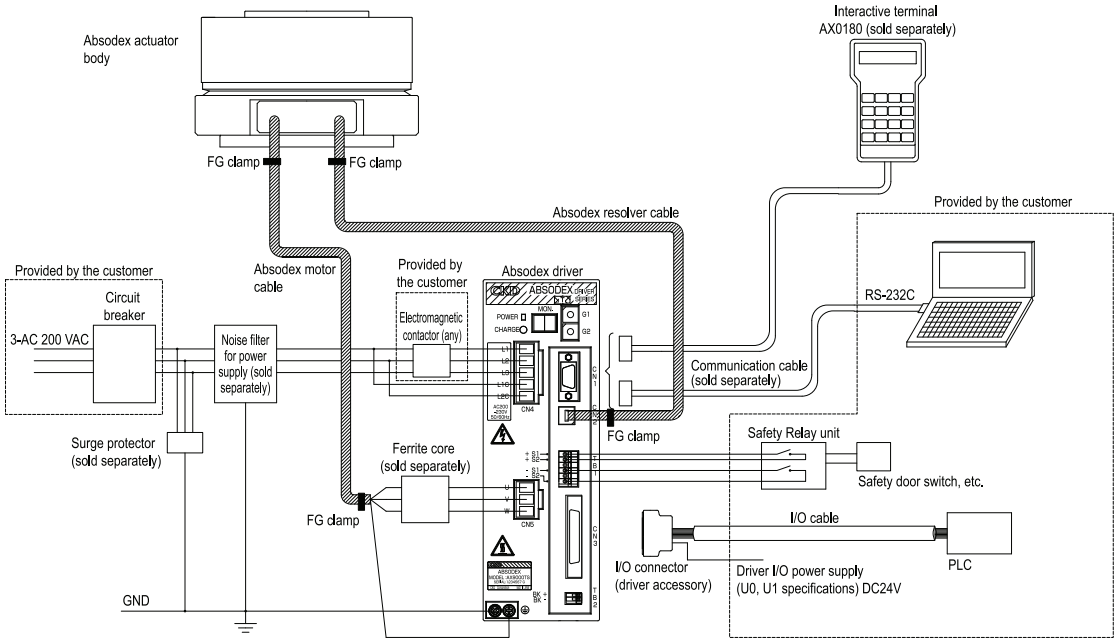
System Configuration

● **Basic setting items**

1. Input the program from a personal computer or interactive terminal.
2. Required parameters are input in the same way.
3. Gain is adequately set.

● **Basic drive methods**

1. A program to be executed is selected at the PLC.
2. Start signal is input at the PLC.
3. After operation, the driver outputs a positioning completion signal.



To comply with CE marking requirements, the following parts as well as overcurrent protection, short-circuit protection, and other components are required. In addition, the driver must be installed inside the switchboard. For details on how to select these devices and how to install and wire these devices, refer to the instruction manual or the technical information (ABSODEX AX Series TS Type/TH Type Technical Information).

Parts name	Application	Model no.	Manufacturer
Noise filter	3-AC, 1-AC 200 VAC to 230 VAC	3SUP-EF10-ER-6	Okaya Electric
	1-AC, 100 VAC to 115 VAC	NF2015A-OD	Soshin Electric
Ferrite core	Common	RC5060	Soshin Electric
Surge protector	Common	R•A•V-781BXZ-4	Okaya Electric
FG clamp*	Common	FGC-5, FGC-8	Kitagawa Industries

* FG clamp is used to ground the shield of motor and resolver cables.

Configuration (set model no. selection)

	Name	Quantity
Standard configuration	**Actuator body**	**1**
	Driver (with controller)	**1**
	Motor cable and resolver cable	**1 each**

Accessories: I/O connector, power supply connector, motor cable connector

Programming tool

- **Interactive terminal "AX0180" is available.**
- **Starting adjustment support tool "AX Tools" is available. (Windows version, free)**

Absodex programs are created, parameters set, and operation commands, etc., issued from the personal computer. Created programs can be saved.
Communication cable RS-232C (D-sub 9-pin (2 m) model: AX-RS232C-9P) is required.

Note) The communication cable is designed specifically for Absodex. You cannot use a cable available on the market. If you do, the driver or PC may be damaged.

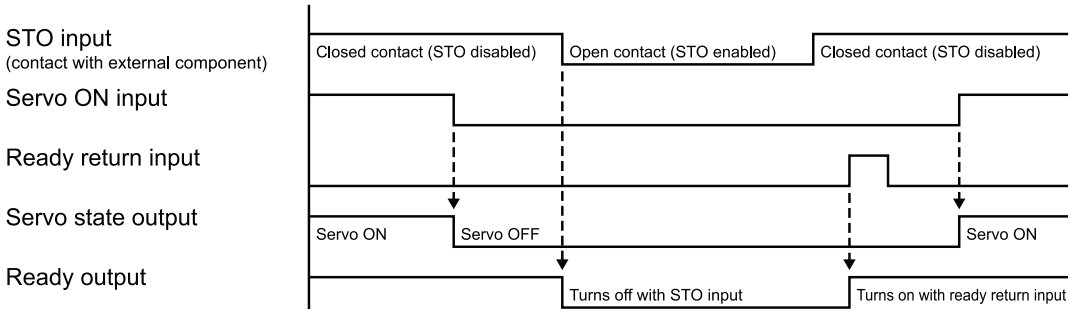
Note) Connect the interactive terminal only when making adjustments. Remove the cable from CN1 during normal operation.

Note) Do not allow the PC to enter the standby mode when a USB-serial adapter cable is connected. If it does, communication errors may result when the PC returns from the standby mode.

Note) Download the latest version of the Starting adjustment support tool "AX Tools" from our website.

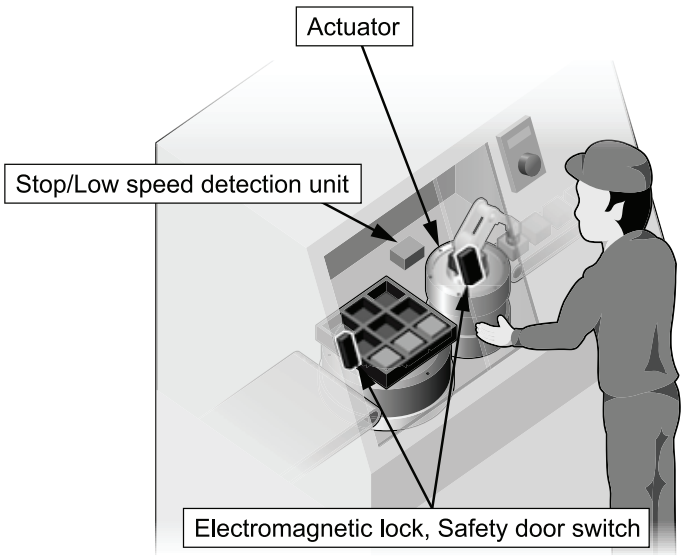
Example of a safety circuit timing chart

The Safe Torque Off function, a safety feature provided on this product, allows you to turn off the motor by the opening/closing of a contact of an external safety component.
An example of a timing chart using the safety terminal (TB1) is shown below.

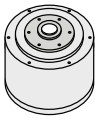
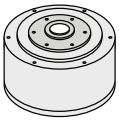
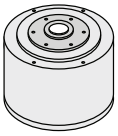
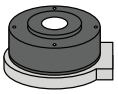
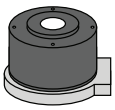
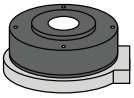
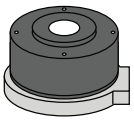


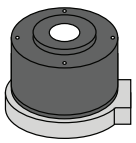
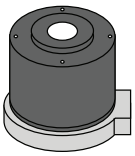
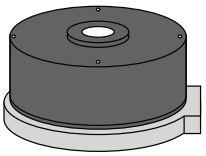
- **In normal cases, use the safety feature with the servo OFF.**
- **Be sure to conduct a risk assessment of the device when using the safety feature.**

Example



ABSODEX compatible types Series Variation

	Series	Torque (N•m) 6	9	12	18	22	45	75	150
Actuator	AX1000T Series					 AX1022T	 AX1045T	 AX1075T	 AX1150T
	AX2000T Series	 AX2006T		 AX2012T	 AX2018T				
	AX4000T Series		 AX4009T			 AX4022T	 AX4045T	 AX4075T	 AX4150T
Compatible driver	TS type Driver								
	TH type Driver								

Torque (N•m)				Index accuracy (sec.)	Repeatability (sec.)	Features	Applications	Page
210	300	500	1000					
 AX1210T				±15	±5	• High precision model withindexing accuracy and lowdisplacement • High speed rotation (AX1022TS: 240 rpm, AX1045TS: 240 rpm, AX1075TS: 140 rpm, AX1150TH: 120 rpm, AX1210TH: 120 rpm)	• Precision measurement • Turntable • Inspection machine • Assembly machine	1 to 6
				±30	±5	• High speed rotation (300 rpm) • Small diameter and compact • Large hollow shaft (Φ30)	• P&P • Turntable • Assembly machine	7 to 10
	 AX4300T	 AX4500T	 AX410WT	±30	±5	• High speed rotation (AX4009TS: 240 rpm, AX4022TS: 240 rpm, AX4045TS: 240 rpm, AX4075TS: 140 rpm) • Capable of handing loads with large moment of inertia • Large hollow shaft, a variety of size options	• Turntable • Inspection machine • Assembly machine • P&P	11 to 28
				One driver can operate actuators of any size that are compatible. The controller function enables the actuator's rotation angle, movement time and timer, etc., to be set as desired with an NC program. M code output, encoder output, etc. can be used to connect to an external PLC, motion controller, etc.				29 to 37

Safety precautions

Always read this section before starting use.

When designing and manufacturing devices using Absodex, the manufacturer has an obligation to manufacture a safe device, and to check that the safety of the device's mechanical mechanism and the system operated by the electrical control that controls the device is secured.
It is important to select, use, handle, and maintain the product appropriately to ensure that the CKD product is used safely.
Observe warnings and precautions to ensure device safety.
Check that device safety is ensured, and manufacture a safe device.

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 within the product's specification range.

This product must be used within its stated specifications. Do not attempt to modify oradditionally machine the product.
This product is intended for use as a general-purpose industrial device or part. It is not intended for use outdoors or for use under the following conditions or environment.
(Note that this product can be used 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.)

(1) Use for special applications including nuclear energy, railway, aircraft, marine vessel, vehicle, medical equipment, equipment, or applications coming into contact with beverage or food, amusement equipment, emergency shutoff circuits, press machine, brake circuits, or for safeguard.
(2) Use for applications where life or assets could be adversely affected, and special safety measures are required.

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

4 Do not remove devices until safety is confirmed.

(1) Inspect and service the machine and devices after securing the safety of the system, such as by turning off the peripheral devices and other devices connected to this product.
(2) Exercise caution when inspecting, maintaining, and handling the product, as high temperature and charged parts can be present even when operation is stopped.
(3) Before starting device inspection or maintenance, turn off device power and other power to related devices, release compressed air, and check leakage current.

5 Observe warnings and cautions in the instruction manual of each product.

(1) Do not rotate the actuator outputs shaft by 30 rpm or more while power is off.
The driver could fail or electrical shock result from actuator power generation.
(2) If the servomotor is turned off (including emergency stop or alarm) or brakes are turned off while a rotational force, such as gravity, is applied, the output shaft may rotate by rotational force.
Conduct these operations flat where rotational force is not applied, or confirm safety before starting.
(3) Unexpected movement may occur during gain adjustment or test operation, so keep hands, etc., away from the outputs shaft. When conducting operations with the actuator not visible, confirm before starting that it is safe even if the outputs shaft turns.
(4) The brake built-in actuator series do not completely clamp the output axis in all cases.
If safety must be ensured, such as in maintenance with an application that rotates the output shaft in unbalanced mode, or when stopping the machine for a long time, it may not be sufficient to stop the shaft with brakes alone. Make sure equipment is maintained balanced or provide a mechanical locking means.
(5) It may take several seconds to stop in an emergency, depending on rotation speed and load.

6 To prevent electric shock, observe warnings and cautions.

(1) High voltage is supplied to the terminal block at the driver's front panel and the motor cable connection terminal. For a terminal block, be sure to install the supplied terminal cover before operation. Do not touch the terminal block while power is on.
Even after the power is turned off, a high voltage is applied until the charge accumulated in the internal capacitor is discharged. Wait at least five minutes after turning the power off before touching these sections.
(2) In work with side cover off, such as for maintenance and inspection or changing driver switches, turn power off and wait at least five minutes before starting work because a risk of electrical shock from high voltage exists.
(3) Do not connect or disconnect connectors while power is on. Misoperation, faults, or electrical shock may occur.

7 Before restarting a machine or system, check that measures are taken so that parts do not come off.

8 Install an over-current protective device.

In accordance with "JIS B 9960-1:2008 Safety of machinery - Electrical equipment of machines - Part 1: General requirements," install over-current protective devices (circuit breakers, etc.) for the main power and control power (L1, L2, L3, L1C and L2C of the terminal block) and I/O power (connector number CN3-DC24V).

(Translation of an Excerpt from JIS B 9960-1 7.2.1 General Requirements)
Overcurrent protection shall be provided where the current in a machine circuit can exceed either the rating of any component or the current carrying capacity of the conductors,whichever is the lesser value. The ratings or settings to be used are detailed in 7.2.10.

9 Observe the cautions on the following pages to prevent accidents.

■ The safety cautions 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, or 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.
In any case, important information that must be observed is explained.

WARRANTY

Terms of warranty

Conditions related to the warranty term and scope are as follows:

1. Warranty period

"Warranty Period" of this product is one (1) year from the first delivery to the customer. (One year after delivery, where one day's operation shall be within eight hours. If durability is reached within one year, the warranty term shall be terminated at that point.)
Durability (ABSODEX)
10,000,000 times for Absodex brakes with air brakes, piston packing and valve. Conditions: room temperature, room humidity, rated voltage, rated pneumatic pressure

2. Scope of warranty

If any faults found to be the responsibility of the CKD occur during the above warranty term, the part shall be repaired immediately by CKD free of charge.
Note that the following faults are excluded from the warranty:

① Operation under the conditions or in the environment derailing from those specified in the product specifications.
② Failure caused by lack of attention or erroneous control.
③ Failure caused by other than the delivered product.
④ Failure caused by operation derailing from the purposes for which the product is designed.
⑤ Failure caused by modification in the structure, performance, specification or other features made by other than us after delivery, or failure caused by repairs done by other than our designated contractor.
⑥ Loss in our product assembled to your machine or equipment, which would be avoided if your machine or equipment were provided with general functions, structures or other features common in the industry.
⑦ Failure caused by reason that is unforeseeable with technology put into practical use at the time of delivery.
⑧ Failure caused by fire, earthquake, flood, lightning, or other acts of God, earth shock, pollution, salt hazard, gas intoxication, excessive voltage, or other external causes.

The warranty mentioned here covers the discrete delivered product. Only the scope of warranty shall not cover losses induced by the failure of the delivered product.

3. Warranty for exported products

(1) Products returned to the CKD factory or to a company or factory designated by CKD shall be repaired. Work and cost necessary for transportation shall not be compensated for.

(2) The repaired product shall be returned to a designated place in Japan with domestic packaging specifications.

This warranty specifies basic conditions. If warranty details in individual specification drawings or specifications differ from these warranty conditions, specification drawings or specifications shall take priority.

4. Compatibility confirmation

In no event shall CKD be liable for merchantability or fitness for a particular purpose, notwithstanding any disclosure to CKD of the use to which the product is to be put.

1 Actuators and the drivers are not water-proof type. Provide waterproofing when using this where water or oil enter.

2 Current leakage and faults could occur if swarf or dust get onto the actuator or driver. Check that these do not come in contact with devices.

3 Frequent repetition of power-on and -off can cause damage to the elements inside the driver.

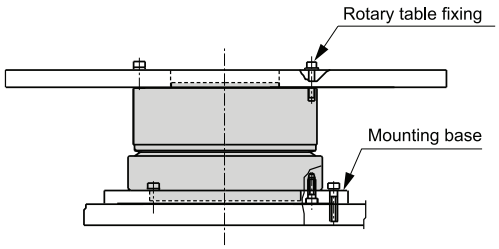
4 If power is turned off and servomotor turnoff is executed while the servomotor is on (holding), the output shaft may move from the held position even without external force.

5 Optional electromagnetic brakes enhance holding rigidity when the output shaft is stopped.
Do not use these brakes to brake or stop a rotating output shaft.

6 Actuators and drivers do not guarantee rustproofing. Give careful consideration to storage, installation, and environment.

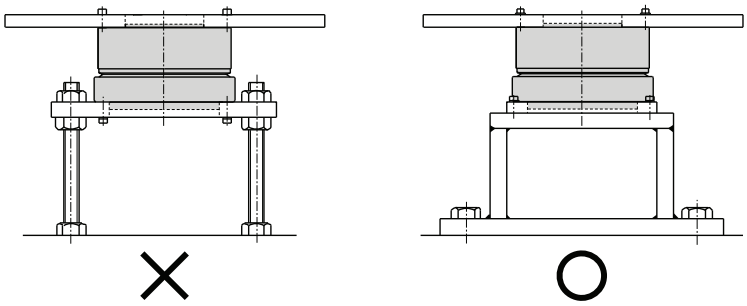
7 Equipment in which Absodexes are installed should have sufficient rigidity to realize full Absodex performance. If the load equipment or frame's mechanical unique vibration is relatively low (200 to 300 Hz or less), resonance could occur in the Absodex and load equipment or frame. Secure the rotary table and main unit installation bolts, and ensure sufficient rigidity without loosening, etc. [Fig. 1]

[Fig. 1] Actuator Installation



Gain must be adjusted based on load table size, etc. Even when the Absodex is not directly installed, it should be installed on a highly rigid frame. [Fig. 2]

[Fig. 2] Actuator attachment



8 When extending the output shaft, refer to the references given in Table 1 for the extended shaft's diameter and length. In addition, add dummy inertia by using Fig. 3 as a reference.

[Table 1] Extended out shaft's diameter guideline

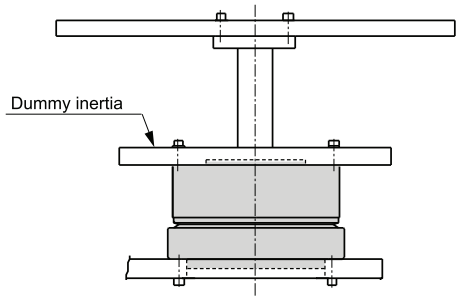
Max. torque [N•m]	Shaft extension (mm)				
	50	100	200	300	500
6	Φ35	Φ40	Φ46	Φ50	Φ60
9,12	Φ40	Φ46	Φ55	Φ60	Φ70
18,22	Φ45	Φ55	Φ65	Φ70	Φ80
45	Φ55	Φ65	Φ75	Φ85	Φ95
75	Φ62	Φ75	Φ90	Φ95	Φ110
150	Φ75	Φ90	Φ110	Φ115	Φ130
210	Φ80	Φ95	Φ115	Φ125	Φ140
300	Φ90	Φ105	Φ125	Φ140	Φ155
500	Φ100	Φ120	Φ145	Φ160	Φ180
1000	Φ120	Φ140	Φ170	Φ185	Φ210

Note) The figures in the above table are extended output shaft's diameter references for steel materials (solid shafts).
Contact CKD for references for other materials and hollow shafts.

9 If sufficient rigidity cannot be attained, machine resonance is suppressed to some degree by installing dummy inertia as close to the actuator as possible.
Examples of adding dummy inertia are shown below.

- As a reference, dummy inertia is [load inertia] × (0.2 to 1). [Fig. 3]

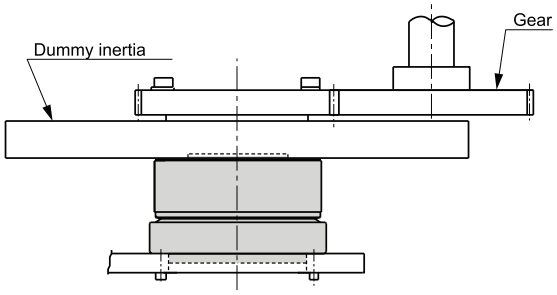
[Fig. 3] Dummy inertia attachment example 1



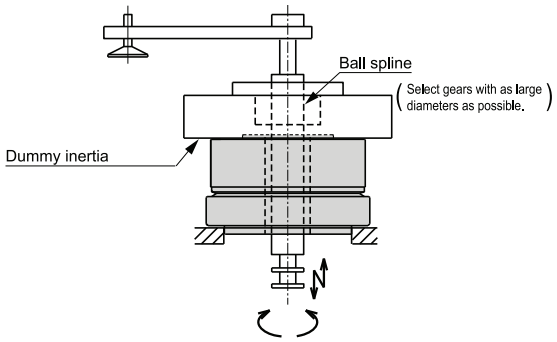
- When coupling with a belt, gears, or spline, or when joining with a key, dummy inertia should be [load inertia] × (0.5 to 2).
- If speed changes with belts or gears, use load inertia as the actuator output shaft conversion value, and install dummy inertia on the actuator. [Fig. 4] [Fig. 5]

(Note) Install dummy inertia as large as possible within the actuator's capacity. (Use steel that has a large specific gravity.)

[Fig. 4] Dummy inertia attachment example 2



[Fig. 5] Dummy inertia attachment example 3



10 The Absodex has a built-in absolute resolver (magnetic position detector).
Do not place strong magnetic fields such as rare earth magnets near the actuator.
Do not pass high-current wiring through the hollow hole.
If you do, the full performance may not be achieved, and malfunction or fault may result.

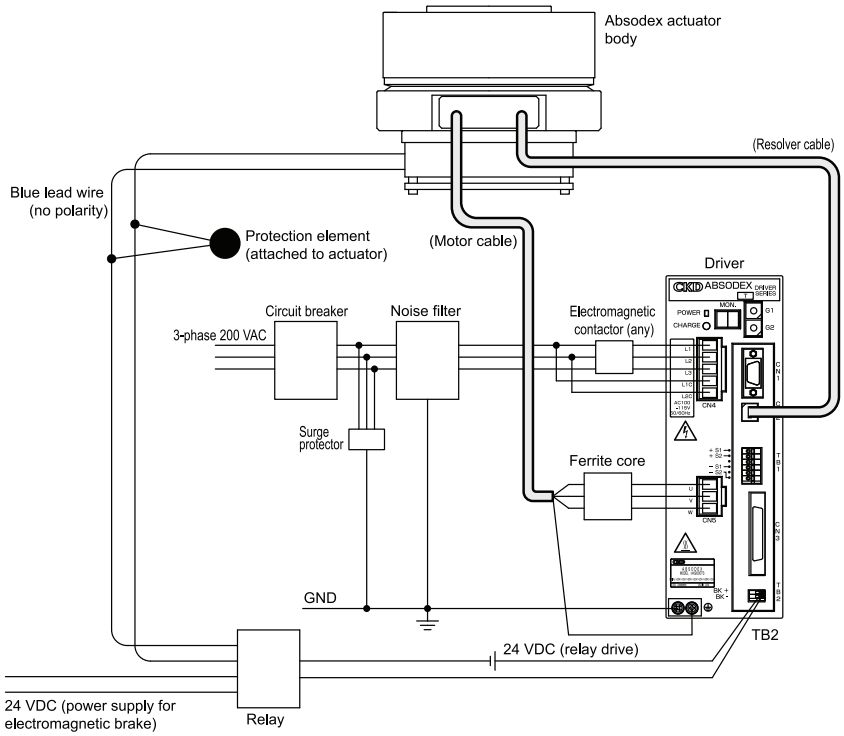
11 We recommend that you install a surge protector if there is a possibility that the device may fail due to indirect lightning surges.

For other precautions, be sure to read the precautions given in the following materials.

1. From the Internet
   AX_T Data Download
   Quick response type direct drive actuator
   ABSODEX
   AX1000T/AX2000T/AX4000T
   http://www.ckd.co.jp/kiki/caddata/ax_t.htm
   • Instruction manual, supplementary description

2. Ask us for the following material.
   ABSODEX AX Series TS Type/TH Type Technical Information

12 Connecting magnetic brakes

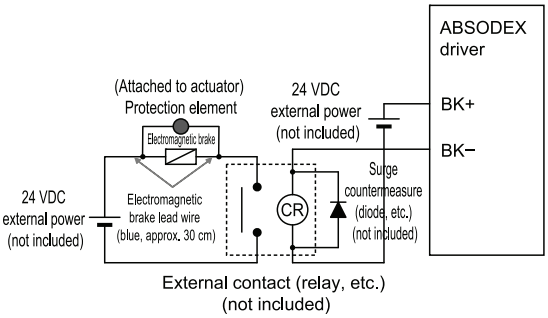


1) Do not use magnetic brakes to brake or stop a rotating output shaft.

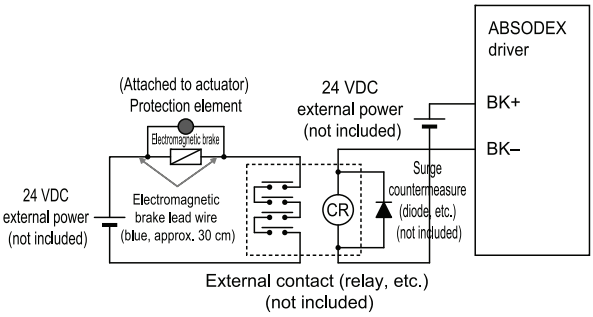
2) The driver will be damaged if the driver's BK+ and BK- and magnetic brakes are directly connected.

3) When connecting the following inductive load, such as a relay, to the external contact, set the coil rated voltage to 24 VDC and the rated current to 100 mA or less, and provide measures against surge current.

<Recommended circuit for magnetic brakes>



<Serial relay contact connection>



● **Control methods**

1. Control using a NC program (M68 or M69)
Execute an "M68" code to disconnect across BK+ and BK- (to apply the brake), or execute an "M69" code to connect across BK+ and BK- (to release the brake).

2. Control using brake release input (I/O connector pin 18)
Supply a brake release input in a state with the applied brake to connect across BK+ and BK- (to release the brake).

● **If magnetic brakes are used frequently (ON/OFF), use a solid-state relay (SSR) for the external contact.**
Recommended model G3NA-D210B DC5-24 (OMRON)
Refer to the SSR instruction manual before using.

● **Check that relay contact capacity is 10 times or more than the rated current. If less, use a multipole relay and use two or more relay contacts serially. Reed life is extended.**

13 When passing a shaft through the hollow hole in the type with magnetic brakes, use a non-magnetic material (SUS303, etc.).
If magnetic material (S45C, etc.) is used, the shaft will be magnetized. This could cause iron powder to stick on the device or the peripheral devices to be affected by the magnetic properties.

14 Note that the magnetic force of the electromagnetic brake may cause stuck iron powder or effects on measuring instruments, sensors or other devices.

15 For other precautions, refer to the technical information (ABSODEX AX Series TS Type/TH Type Technical Information).

Safety precautions

Labor saving mechanisms: Warnings, cautions

Always read this section before starting use.

⚠ CAUTION Installation & Adjustment

1. Connect the enclosed cable between the actuator and driver. Check that excessive force is not applied and that the cable is not damaged. Do not modify the enclosed cable (change the length or material) because this could cause malfunction or faults.
2. Connect the correct power supply. Connecting a nondesignated power supply could cause faults. Wait at least 10 seconds after turning power off (check that the motor output shaft is stopped) before turning it on again.
3. Securely fix the Absodex to the machine, and securely install loads such as the table before adjusting gain. Confirm that no interference occurs and that the state is safe even when flexible sections are rotated.
4. Do not tap the output shaft with a hammer, nor assemble it forcibly. Failure to observe this would prevent the expected accuracy or functions, and could cause faults.
5. Do not place strong magnetic fields such as rare earth magnets near the actuator. It may not be able to maintain expected accuracy.
6. The actuator may become hot depending on operating conditions. Provide a cover, etc., so that it will not be touched by accident.
7. The driver surface may become hot depending on operating conditions. Put it inside the switchboard, etc. so that it cannot be touched.
8. Do not drill holes into the actuator. Contact CKD when machining is required.
9. Do not get on the actuator or flexible parts such the rotary table on the actuator during maintenance, etc.
10. Compatible models
    - If the actuator and driver are combined mistakenly after program input (parameter setting), alarm 3 will be generated. Check the actuator and driver combination.
      (Note) Alarm 3 occurs to prevent malfunction if the actuator and driver combination differ from when the program was input. Alarm 3 is reset when the program and parameters are input again.
    - If operation is started with an incorrect actuator and driver combination after the program is input (after parameter setting), malfunctions could occur or equipment be damaged.
    - When changing the cable length, order the cable separately.
    - If other than the compatible driver is connected, the actuator may be burned.
11. When using a circuit breaker, select one that has higher harmonic measures for inverter use.
12. The position of the output shaft in the actuator dimension drawing does not indicate the actuator's origin. When using it at the output shaft shown in dimension drawings, the origin must be adjusted to the origin offset.
13. The cables for the AX4009T and AX2000T Series are not movable cables. Be sure to fix the cables in place at the connectors so that they do not move. Do not lift up the body by the cable or apply excessive force to the cable as the cable may break.
14. For other precautions, conditions for compliance with overseas standards, etc., refer to the technical information (ABSODEX AX Series TS Type/TH Type Technical Information).

⚠ CAUTION During Use & Maintenance

1. Do not disassemble the actuator, because this may compromise expected functions and accuracy. This is especially so with the resolver leading to fatal damage.
2. When testing withstand voltage of the machine or equipment containing the Absodex, disconnect the main power cable to the Absodex driver and check that the voltage is not applied to the driver. Doing so could cause a failure.
3. If alarm "4" (actuator overload: electronic thermal) is generated, wait for the actuator temperature to drop before restarting.
   Alarm "4" could occur in the cases below. Remove the cause before resuming use.
   - Resonance or vibration: Ensure sufficient installation rigidity.
   - Tact or speed: Increase movement time or stopping time.
   - Structure that locks the output shaft: Add M68, M69 commands.
4. Actuator coordinates are recognized after power is turned on so check that the output shaft does not move for several seconds after power is turned on.
5. For other precautions and troubleshooting of alarm displays, refer to the technical information (ABSODEX AX Series TS Type/TH Type Technical Information).

For other precautions, be sure to read the precautions given in the following materials.

1. From the Internet
   AX_T Data Download
   Quick response type direct drive actuator
   ABSODEX
   AX1000T/AX2000T/AX4000T
   http://www.ckd.co.jp/kiki/caddata/ax_t.htm
   • Instruction manual, supplementary description

2. Ask us for the following material.
   ABSODEX AX Series TS Type/TH Type Technical Information

Direct drive actuator ABSODEX

AX1000T Series

High precision specifications (index precision, run out of output shaft, etc.)

●Maximum torque: 22, 45, 75, 150, 210 N•m

RoHS

Actuator specifications

Descriptions		AX1022T	AX1045T	AX1075T	AX1150T	AX1210T
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 shaft moment of inertia	kg•m^2	0.00505	0.00790	0.03660	0.05820	0.09280
Allowable load inertia Moment	kg•m^2	0.6	0.9	4.0	6.0	10.0
Index precision (Note 2)	sec.	±15				
Repeatability (Note 2)	sec.	±5				
Output shaft friction torque	N•m	2.0		8.0		
Resolver resolution	P/rev	540672				
Motor insulation class		F				
Motor withstand voltage		1500 VAC for 1 minute				
Motor insulation resistance		10MΩ and over at 500 VDC				
Ambient temperature range		0 to 45°C (0 to 40°C: Note 3)				
Ambient humidity range		20 to 85%RH (with no dew condensation)				
Storage temperature range		–20 to 80°C				
Storage humidity range		20 to 90%RH (with no dew condensation)				
Atmosphere		Free of corrosive and explosive gases and dust				
Weight	kg	8.9	12.0	23.0	32.0	44.0
Run out of output shaft (Note 2)	mm	0.01				
Surface run out of output shaft (Note 2)	mm	0.01				
Protection		IP20				

Note 1: Use 80 rpm or less during continuous rotary operation.
Note 2: For details on index precision, repeatability, run out of output shaft, and surface run out of output shaft, refer to "Terminology" on page 42.
Note 3: The temperature upper limit is 40°C when the product is being used as a UL certified product.

⚠ Read the precautions on Intro 9 to 14 before use.

How to order

● Set model no. (actuator, driver, and cable)

Model: AX1 022 TS – B – C – DM04 – J1 – P1 – U0
Model no. of options: B – C – DM04 – J1 – P1 – U0

- AX1 022 TS: Model no.
- Ⓐ Size (maximum torque)
- Ⓑ Driver type Note 1
- Ⓒ Mounting base
- Ⓓ Connector installation orientation
- Ⓔ Cable length Note 3
- Ⓕ Driver power supply voltage Note 1
- Ⓖ Dowel hole Note 4
- Ⓗ Interface specifications

Symbol	Descriptions
Ⓐ Size (maximum torque)	
022	22 N•m
045	45 N•m
075	75 N•m
150	150 N•m
210	210 N•m
Ⓑ Driver type	
TS	With TS type driver
TH	With TH type driver
Ⓒ Mounting base	
Blank	Standard (without mounting base)
B	With blackening mounting base
Ⓓ Connector installation orientation	
Blank	Standard (connector horizontal installation)
C	Connector bottom installation
Ⓔ Cable length	
DM02	2m
DM04	4m (standard length)
DM06	6m
DM08	8m
DM10	10m
DM15	15m
DM20	20m
Ⓕ Driver power supply voltage	
Refer to the driver power supply voltage table on the left.	
Ⓖ Dowel hole	
Blank	Standard (without dowel hole)
P1	Top 1 piece
P2	Bottom 1 piece
P3	Both top and bottom sides 1 piece each
Ⓗ Interface specifications	
U0	Parallel I/O (NPN specifications)
U1	Parallel I/O (PNP specifications)
U2	CC-Link
U3	PROFIBUS-DP
U4	DeviceNet

⚠ Note on model no. selection

Note 1: Refer to the table below and select the appropriate driver.

Driver power supply voltage table

Driver type / Model	TS Type Driver: 3-phase, 1-phase 200 VAC to 230 VAC	TS Type Driver: 1-phase 100 VAC to 115 VAC	TH Type Driver: 3-phase, 1-phase 200 VAC to 230 VAC
AX1022T	Blank Note 2	J1	
AX1045T	Blank Note 2	J1	
AX1075T	Blank Note 2		
AX1150T			Blank Note 2
AX1210T			Blank Note 2

Note 2: For models whose maximum torque is 75 N•m or more, if you are using 1-AC 200 VAC, the calculation of the torque limit is different from the norm. Contact CKD to determine whether the driver can be used.

Note 3: The cable is a movable cable.
Refer to page 38 for cable dimensions.

Note 4: Ⓒ For a "B" blackening mounting base, "P2" or "P3" cannot be selected.

Note 5: In some cases, the dowel hole may not be surface-treated.

● Actuator model no.

AX1 ○ T – B – C – P1

- ○: Ⓐ Size
- B: Ⓒ Mounting base
- C: Ⓓ Connector installation orientation
- P1: Ⓖ Dowel hole

● Driver model no.

•200 VAC to 230 VAC

AX9000TS – U0

AX9000TH – U0

•100 VAC to 115 VAC

AX9000TS – J1 – U0

- U0: Ⓗ Interface specifications

● Cable model no.

•Motor cable

AX – CBLM5 – DM04

•Resolver cable

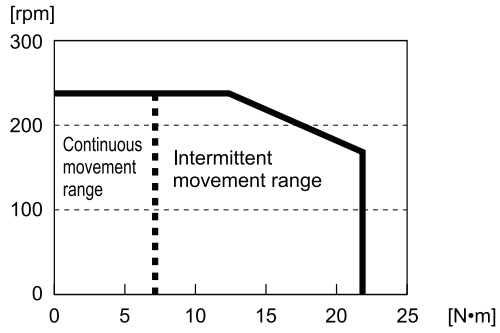
AX – CBLR5 – DM04

- DM04: Ⓔ Cable length (Note: "04" if the cable length is 4m)

* Custom order models will not support CE, UL/cUL, or RoHS. Consult with CKD for details.

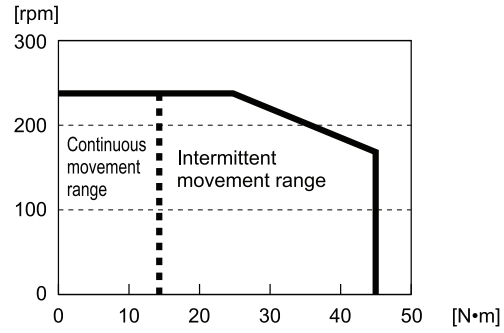
Speed and maximum torque characteristics

●AX1022TS



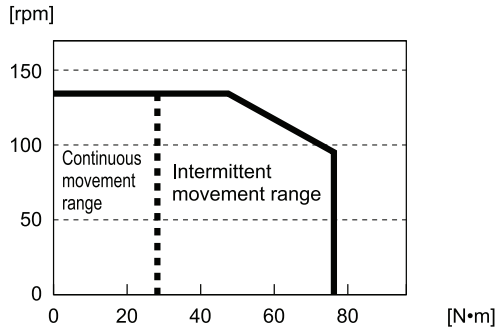
* This graph shows the characteristics for 3-phase 200 VAC.

●AX1045TS



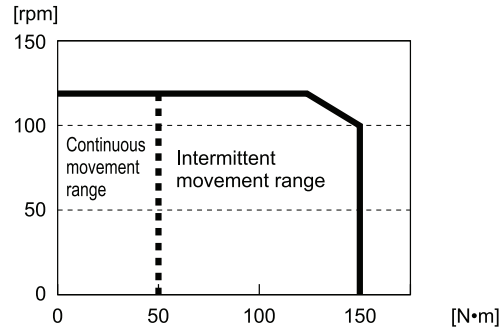
* This graph shows the characteristics for 3-phase 200 VAC.

●AX1075TS



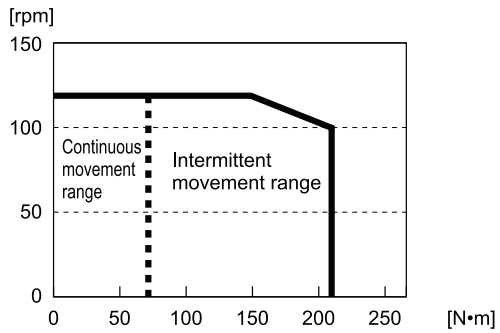
* This graph shows the characteristics for 3-phase 200 VAC.

●AX1150TH



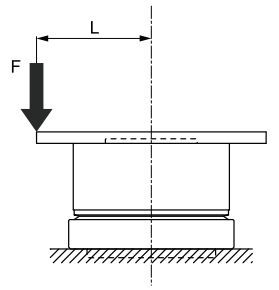
* This graph shows the characteristics for 3-phase 200 VAC.

●AX1210TH



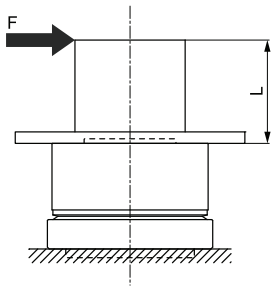
* This graph shows the characteristics for 3-phase 200 VAC.

(Note) moment load



(Fig. a)

M(N•m)=F(N)×L(m)
M: Moment load
F: Load
L: Distance from output shaft center



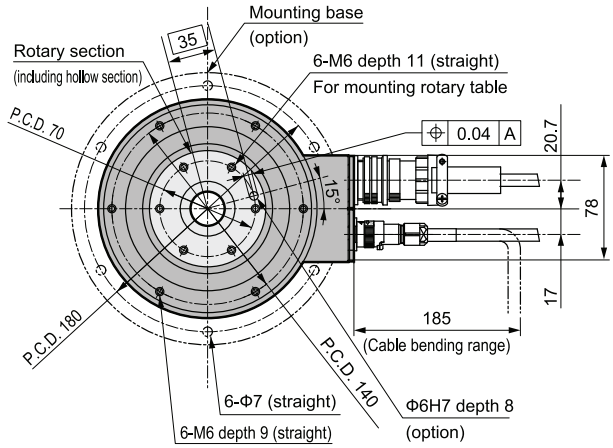
(Fig. b)

M(N•m)=F(N)×(L+0.02)(m)
M: Moment load
F: Load
L: Distance from output shaft flange

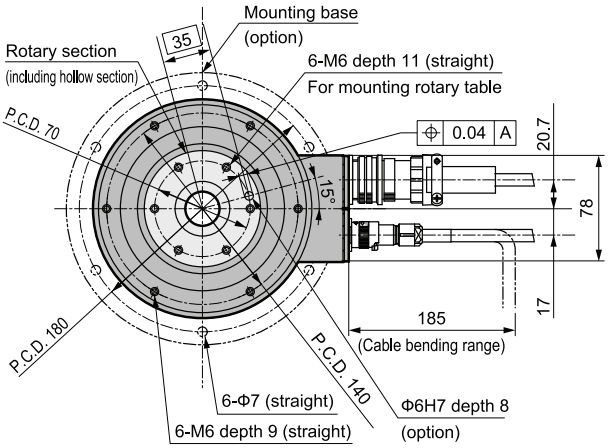
⚠ Read the precautions on Intro 9 to 14 before use.

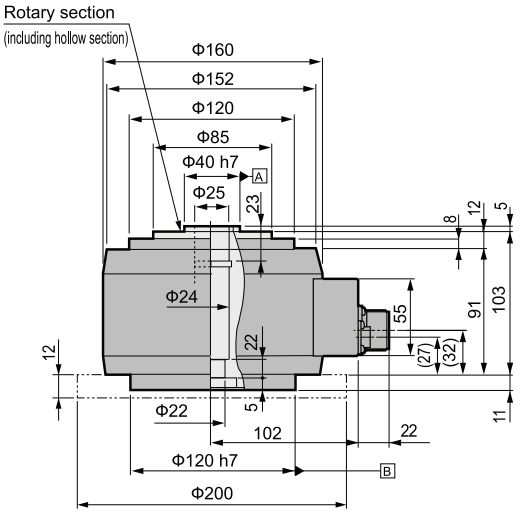
Dimensions

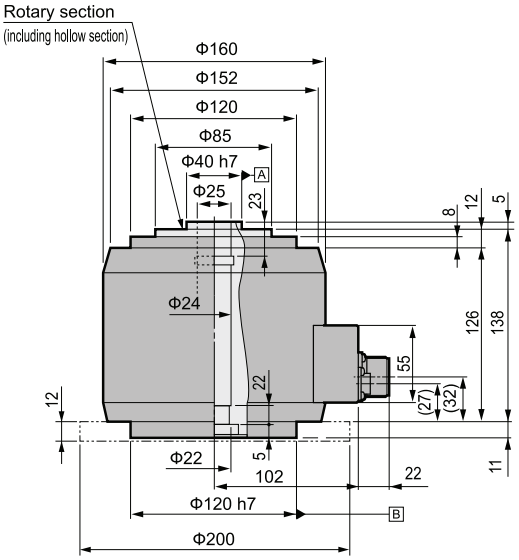
● **AX1022T**

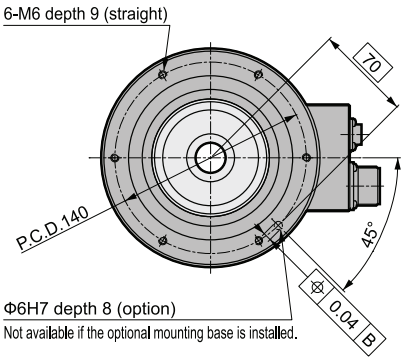


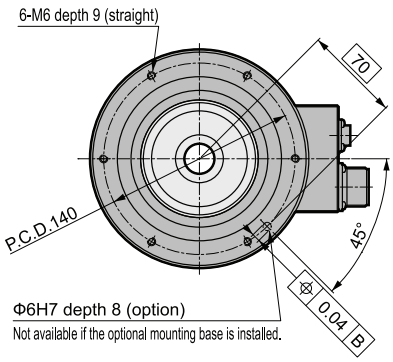
● **AX1045T**







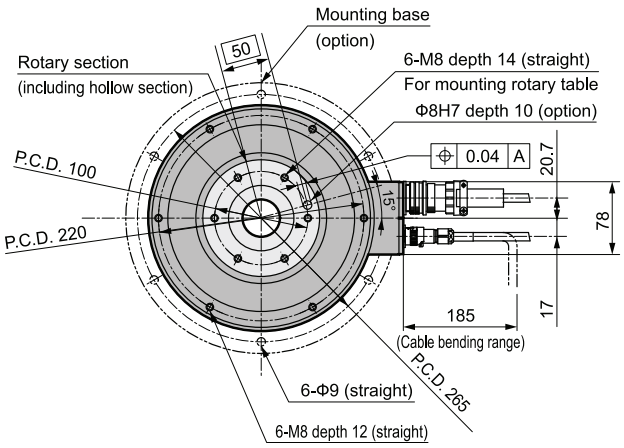




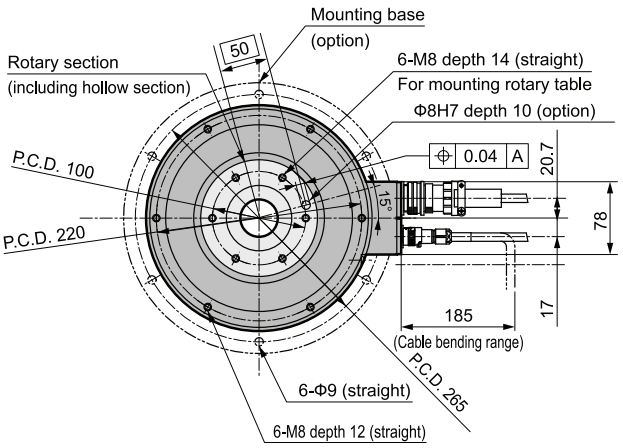
Note 1) The actuator's origin may differ from that in the dimensional drawing.
The origin offset feature enables you to set the origin to any position you choose.

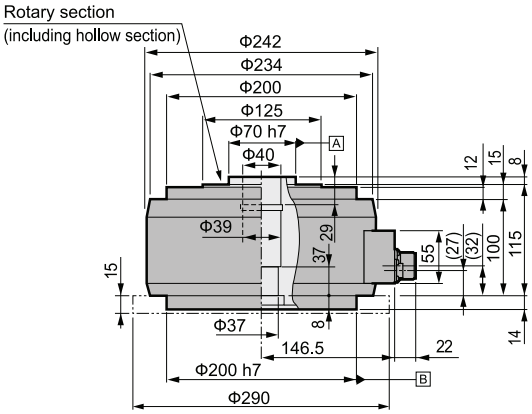
Dimensions

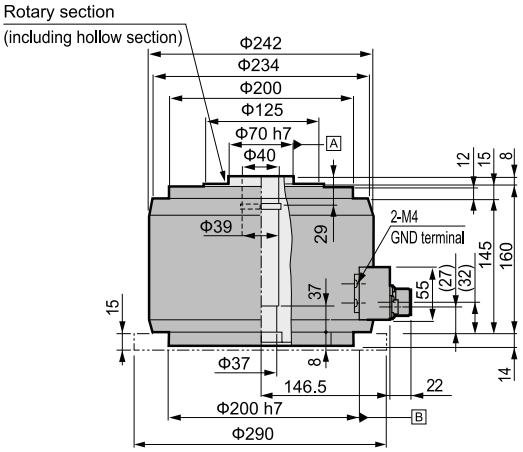
● **AX1075T**

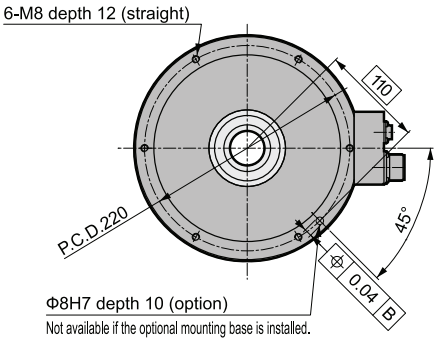


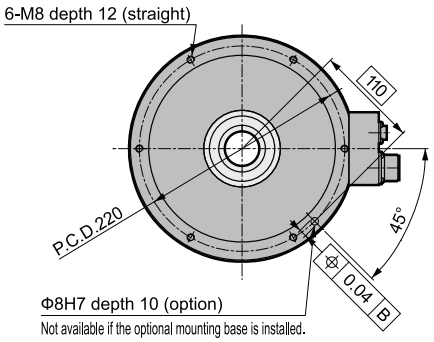
● **AX1150T**







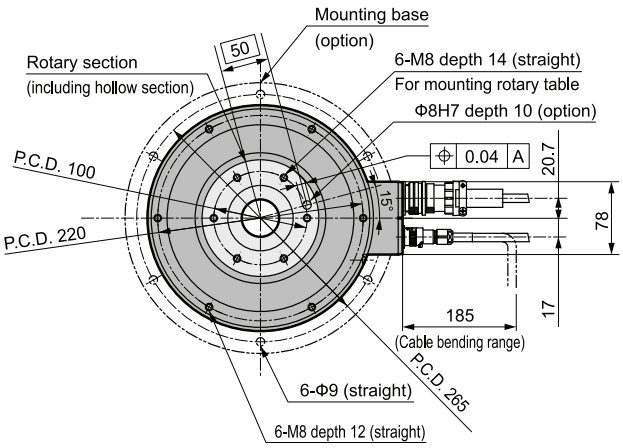


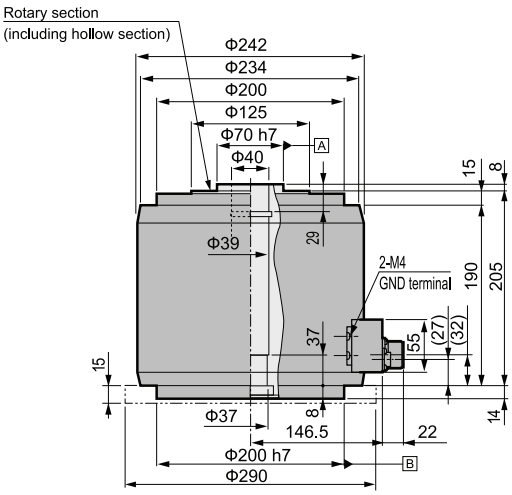


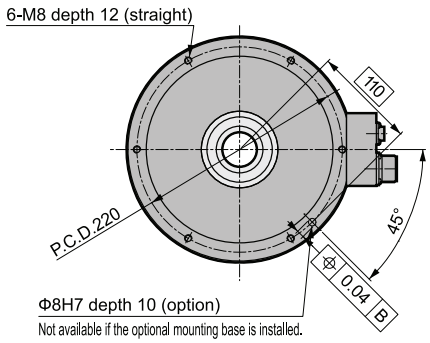
Note 1) The actuator's origin may differ from that in the dimensional drawing.
The origin offset feature enables you to set the origin to any position you choose.

Dimensions

● **AX1210T**

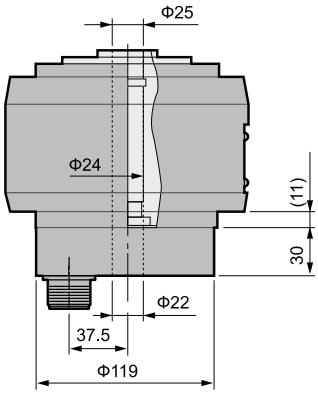


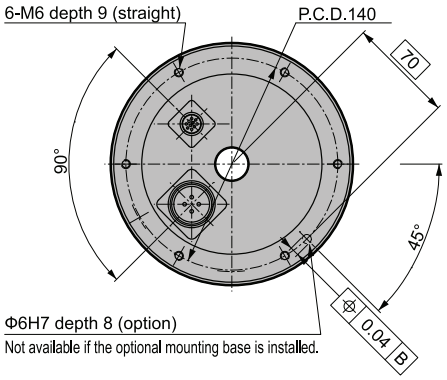




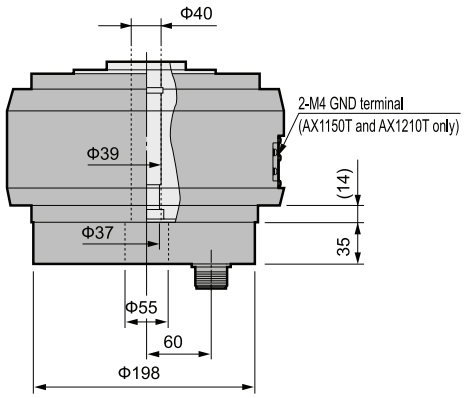
Dimensions with options

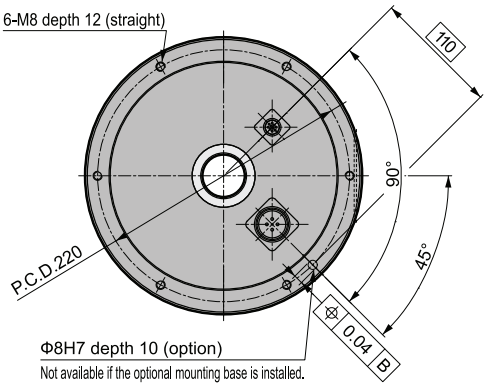
● **Connector bottom installation (C)**
AX1022T/AX1045T





AX1075T/AX1150T/AX1210T





Note 1) The actuator's origin may differ from that in the dimensional drawing.
The origin offset feature enables you to set the origin to any position you choose.

Direct drive actuator ABSODEX

AX2000T Series

Compatible function with free driver, actuator, and cable combinations

High speed (maximum speed 300 rpm), small diameter and compact, and large hollow shaft (Φ30)

●Maximum torque: 6, 12, 18 N•m

●Compatible driver: TS type driver

RoHS

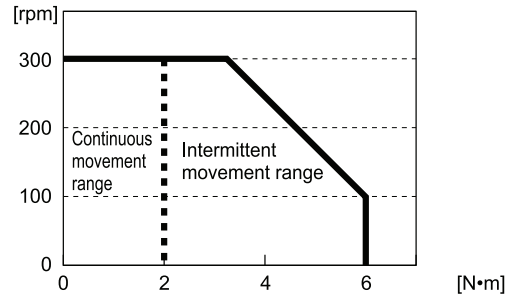
Actuator specifications

Descriptions		AX2006T	AX2012T	AX2018T
Maximum output torque	N•m	6	12	18
Continuous output torque	N•m	2	4	6
Maximum speed	rpm	300 (Note 1)		
Allowable axial load	N	1000		
Allowable moment load	N•m	40		
Output shaft moment of inertia	kg•m^2	0.00575	0.00695	0.00910
Allowable load inertia Moment	kg•m^2	0.3	0.4	0.5
Index precision (Note 2)	sec.	±30		
Repeatability (Note 2)	sec.	±5		
Output shaft friction torque	N•m	0.6		0.7
Resolver resolution	P/rev	540672		
Motor insulation class		F		
Motor withstand voltage		1500 VAC for 1 minute		
Motor insulation resistance		10MΩ and over at 500 VDC		
Ambient temperature range		0 to 45°C (0 to 40°C: Note 3)		
Ambient humidity range		20 to 85%RH (with no dew condensation)		
Storage temperature range		–20 to 80°C		
Storage humidity range		20 to 90%RH (with no dew condensation)		
Atmosphere		Free of corrosive and explosive gases and dust		
Weight	kg	4.7	5.8	7.5
Run out of output shaft (Note 2)	mm	0.03		
Surface run out of output shaft (Note 2)	mm	0.03		
Protection		IP20		

Note 1: Use 80 rpm or less during continuous rotary operation.
Note 2: For details on index precision, repeatability, run out of output shaft, and surface run out of output shaft, refer to "Terminology" on page 42.
Note 3: The temperature upper limit is 40°C when the product is being used as a UL certified product.

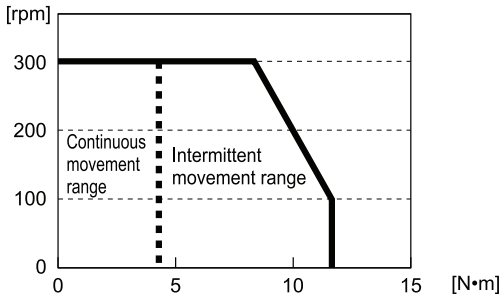
Speed and maximum torque characteristics

●AX2006TS



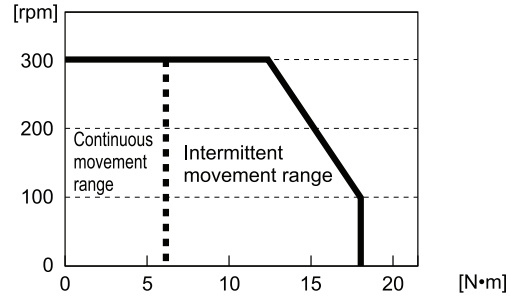
* This graph shows the characteristics for 3-phase 200 VAC.

●AX2012TS



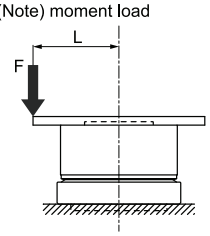
* This graph shows the characteristics for 3-phase 200 VAC.

●AX2018TS



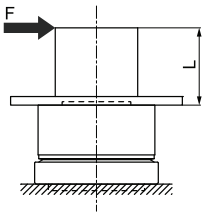
* This graph shows the characteristics for 3-phase 200 VAC.

(Note) moment load



(Fig. a)

M(N•m)=F(N)×L(m)
M: Moment load
F: Load
L: Distance from output shaft center



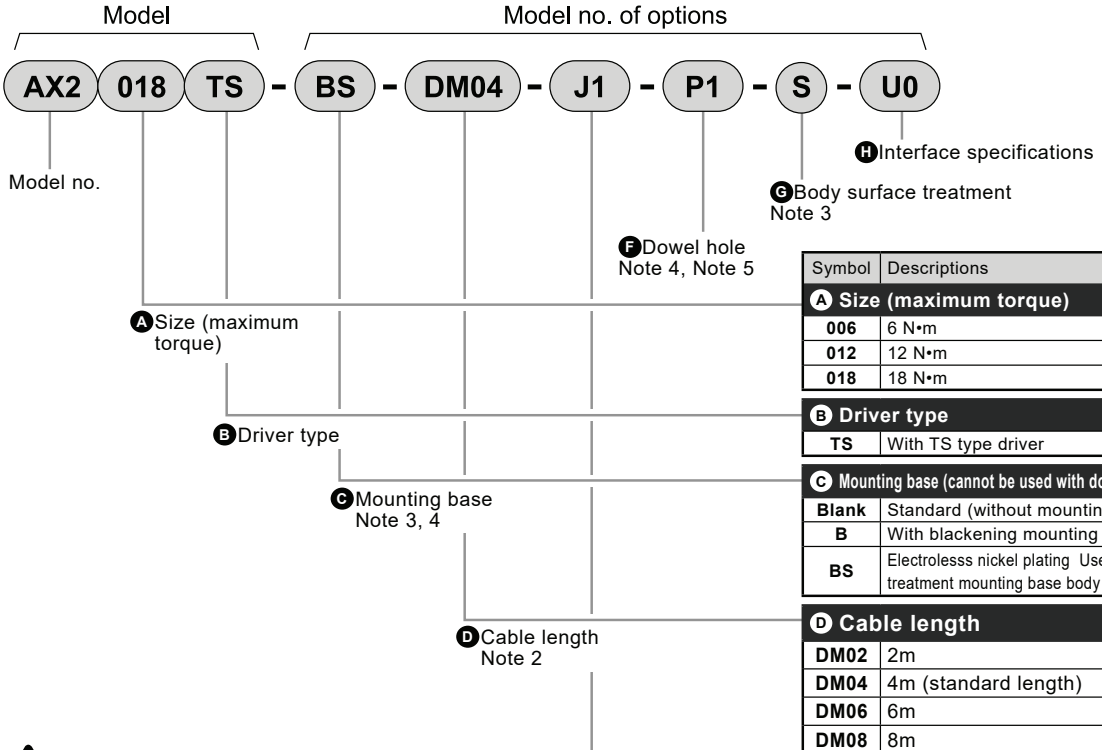
(Fig. b)

M(N•m)=F(N)×(L+0.02)(m)
M: Moment load
F: Load
L: Distance from output shaft flange

Read the precautions on Intro 9 to 14 before use.

How to order

● Set model no. (actuator, driver, and cable)



Symbol	Descriptions
Ⓐ Size (maximum torque)	
006	6 N•m
012	12 N•m
018	18 N•m
Ⓑ Driver type	
TS	With TS type driver
Ⓒ Mounting base (cannot be used with dowel holes P2 and P3)	
Blank	Standard (without mounting base)
B	With blackening mounting base
BS	Electrolesss nickel plating Use with surface treatment mounting base body surface treatment S.
Ⓓ Cable length	
DM02	2m
DM04	4m (standard length)
DM06	6m
DM08	8m
DM10	10m
DM15	15m
DM20	20m
Ⓔ Driver power supply voltage	
Refer to the driver power supply voltage table on the left.	
Ⓕ Dowel hole	
Blank	Standard (without dowel hole)
P1	Top 1 piece
P2	Bottom 1 piece
P3	Both top and bottom sides 1 piece each
Ⓖ Body surface treatment	
Blank	Standard (blackening treatment)
S	Electroless nickel plating treatment
Ⓗ Interface specifications	
U0	Parallel I/O (NPN specifications)
U1	Parallel I/O (PNP specifications)
U2	CC-Link
U3	PROFIBUS-DP
U4	DeviceNet

⚠ Note on model no. selection

Note 1: Refer to the table below and select the appropriate driver.

Driver power supply voltage table

Model \ Driver type	TS Type Driver	
	3-phase, 1-phase 200 VAC to 230 VAC	1-phase 100 VAC to 115 VAC
AX2006T	Blank	J1
AX2012T	Blank	J1
AX2018T	Blank	J1

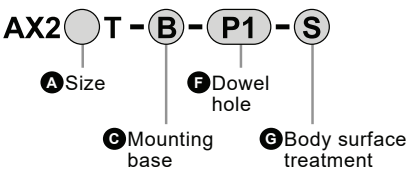
Note 2: The cable is a movable cable. Refer to page 38 for cable dimensions. The cables are not movable cables.

Note 3: Designate body surface treatment and mounting base surface treatment with Ⓒ and Ⓗ. If you select the optional electroless nickel plating treatment, you can expect higher rustproofing performance than the standard specification.

Note 4: ⒸFor a "B" blackening mounting base or "BS" electroless nickel plating surface treatment mounting base, "P2" or "P3" cannot be selected.

Note 5: In some cases, the dowel hole may not be surface-treated.

● Actuator model no.



● Driver model no.

- 200 VAC to 230 VAC: AX9000TS - U0
- 100 VAC to 115 VAC: AX9000TS - J1 - U0

Ⓗ Interface specifications

● Cable model no.

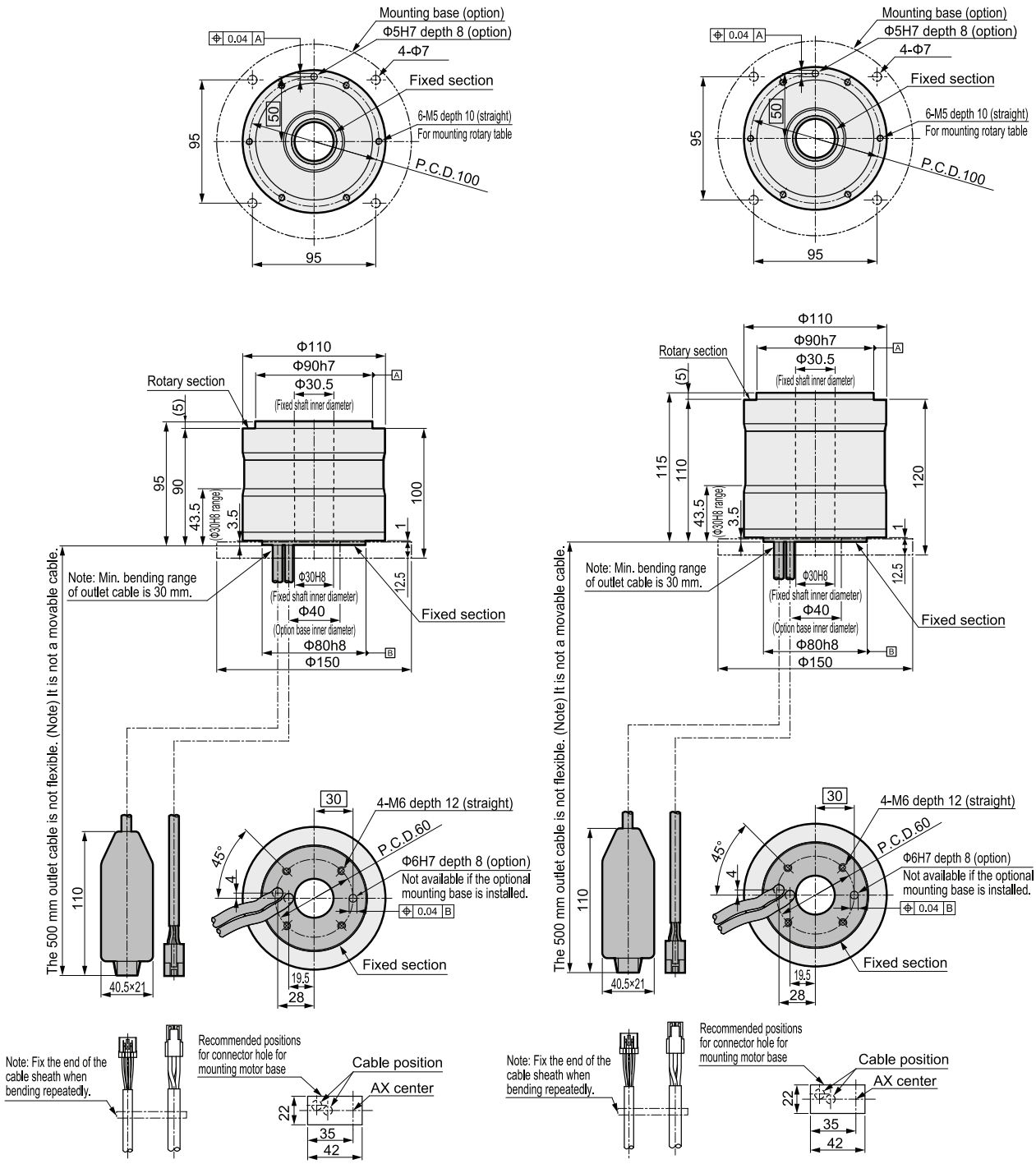
- Motor cable: AX - CBLM6 - DM04
- Resolver cable: AX - CBLR6 - DM04

Ⓓ Cable length (Note: "04" if the cable length is 4m)

* Custom order models will not support CE, UL/cUL, or RoHS. Consult with CKD for details.

Dimensions

● **AX2006T**

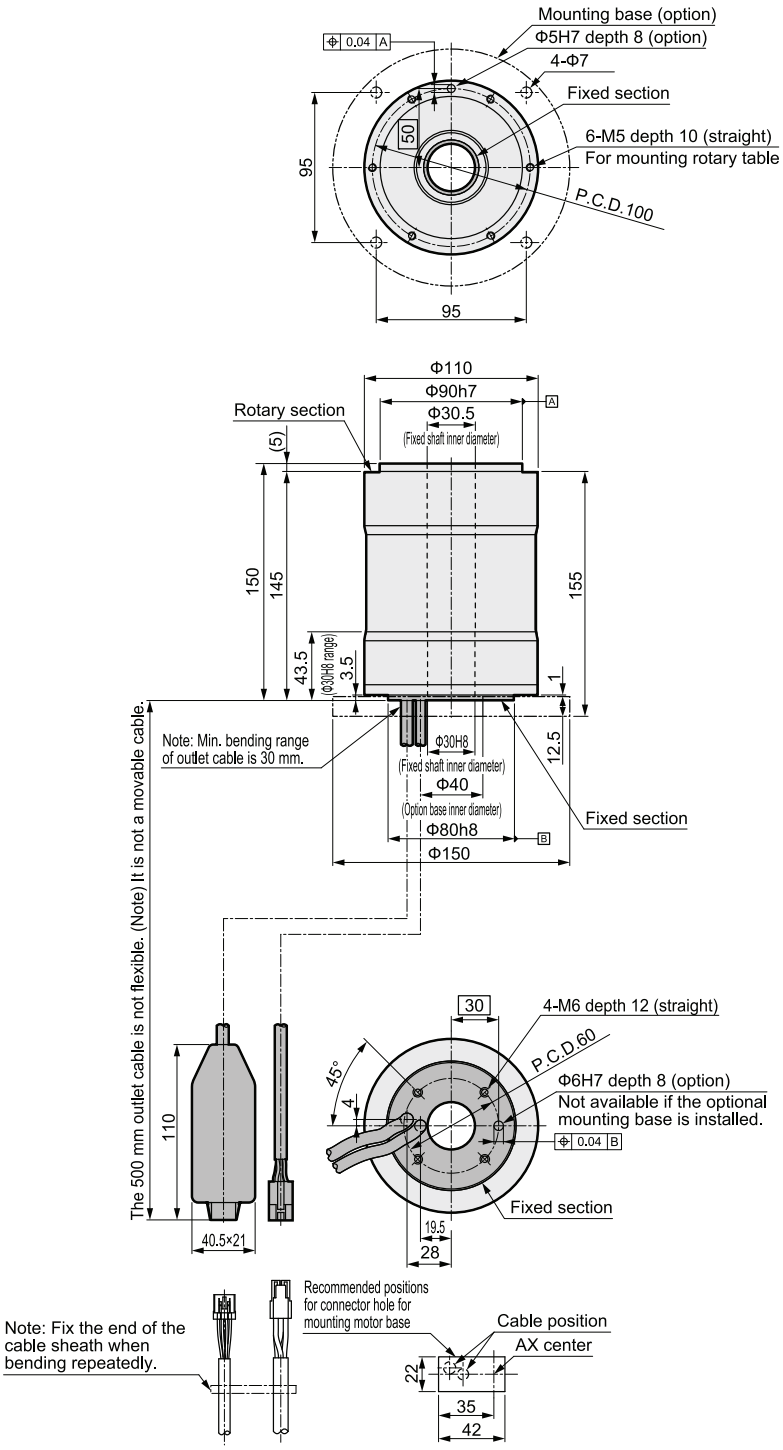


● **AX2012T**

Note 1) The actuator's origin may differ from that in the dimensional drawing.
The origin offset feature enables you to set the origin to any position you choose.

Dimensions

● **AX2018T**



Note 1) The actuator's origin may differ from that in the dimensional drawing.
The origin offset feature enables you to set the origin to any position you choose.

Direct drive actuator ABSODEX

AX4000T Series

Capable of handing loads with large moment of inertia
Compatible function with free driver, actuator, and cable combinations
Large hollow shaft handy for cable wiring and piping, and a variety of options.

- Maximum torque: 9, 22, 45, 75 N•m
- Compatible driver: TS type driver

RoHS

Actuator specifications

Descriptions		AX4009T	AX4022T	AX4045T	AX4075T
Maximum output torque	N•m	9	22	45	75
Continuous output torque	N•m	3	7	15	25
Maximum speed	rpm	240 (Note 1)			140 (Note 1)
Allowable axial load	N	800	3700		20000
Allowable moment load	N•m	40	60	80	200
Output shaft moment of inertia	kg•m^2	0.009	0.0206	0.0268	0.1490
Allowable load inertia Moment	kg•m^2	0.35 (1.75) (Note 2)	0.60 (3.00) (Note 2)	0.90 (5.00) (Note 2)	5.00 (25.00) (Note 2)
Index precision (Note 4)	sec.	±30			
Repeatability (Note 4)	sec.	±5			
Output shaft friction torque	N•m	0.8	3.5		10.0
Resolver resolution	P/rev	540672			
Motor insulation class		F			
Motor withstand voltage		1500 VAC for 1 minute			
Motor insulation resistance		10MΩ and over at 500 VDC			
Ambient temperature range		0 to 45°C (0 to 40°C: Note 5)			
Ambient humidity range		20 to 85%RH (with no dew condensation)			
Storage temperature range		–20 to 80°C			
Storage humidity range		20 to 90%RH (with no dew condensation)			
Atmosphere		Free of corrosive and explosive gases and dust			
Weight	kg	5.5	12.3	15.0	36.0
Weight when brake is set	kg	—	16.4	19.3	54.0
Run out of output shaft (Note 4)	mm	0.03			
Surface run out of output shaft (Note 4)	mm	0.05			
Protection		IP20			

Note 1: Use 80 rpm or less during continuous rotary operation.
Note 2: In the load conditions up to values in ( ), set parameter 72 (integral gain magnification) to 0.3 (reference).
Note 3: Contact CKD when using continuous rotary operation and parameter 72 (integral gain magnification) together.
Note 4: For details on index precision, repeatability, run out of output shaft, and surface run out of output shaft, refer to "Terminology" on page 42.
Note 5: The temperature upper limit is 40°C when the product is being used as a UL certified product.

Electromagnetic brake specifications (option)

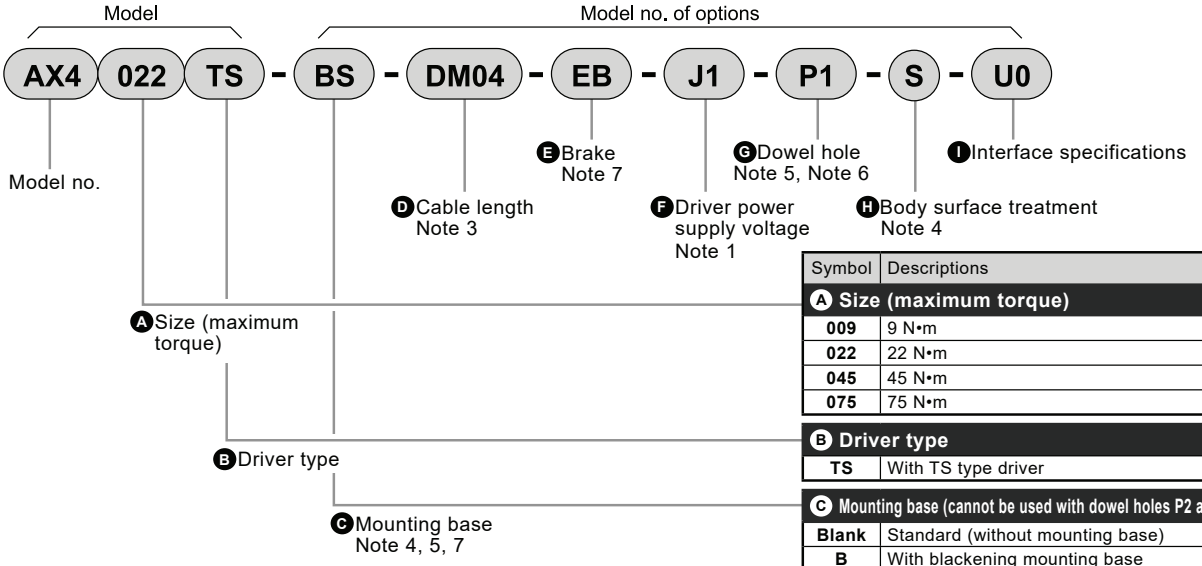
Descriptions \ Supported models		AX4022T•AX4045T	AX4075T
Type		Non-backlash dry non-excitation activation type	
Rated voltage	V	DC24 V	
Power supply capacity	W	30	55
Rated current	A	1.25	2.30
Static friction torque	N•m	35	200
Amateur release time (brake on)	msec	50 (reference value)	50 (reference value)
Amateur absorption time (brake off)	msec	150 (reference value)	250 (reference value)
Retention precision	min	45 (reference value)	
Maximum usage frequency	cycles/min	60	40

Note 1: When the output shaft is rotating, rubbing may be generated at the electromagnetic brake's disk and fixing section.
Note 2: When moving after brakes are turned OFF, the delay time parameter must be changed based on armature suction time.
Note 3: This is a nonbacklash type, but it may be hard to hold a set position if load is applied in the direction of rotation.
Note 4: When electromagnetic brakes function, the armature may contact the magnetic brake's fixed section and generate noise.
Note 5: Brakes are manually released by alternately screwing screws into manual release taps (three positions). Lightly tighten screws until they stop, then turn them another 90°. When finished with manual release, remove the three bolts immediately and apply brakes.

⚠ Read the precautions on Intro 9 to 14 before use.

How to order

● Set model no. (actuator, driver, and cable)



Symbol	Descriptions
Ⓐ Size (maximum torque)	
009	9 N•m
022	22 N•m
045	45 N•m
075	75 N•m
Ⓑ Driver type	
TS	With TS type driver
Ⓒ Mounting base (cannot be used with dowel holes P2 and P3)	
Blank	Standard (without mounting base)
B	With blackening mounting base
BS	Electrolesss nickel plating Use with surface treatment mounting base body surface treatment S.
Ⓓ Cable length	
DM02	2m
DM04	4m (standard length)
DM06	6m
DM08	8m
DM10	10m
DM15	15m
DM20	20m
Ⓔ Brake	
Blank	Standard (no electromagnetic brake)
EB	With negative activation electromagnetic brake
Ⓕ Driver power supply voltage	
Refer to the driver power supply voltage table on the left.	
Ⓖ Dowel hole	
Blank	Standard (without dowel hole)
P1	Top 1 piece
P2	Bottom 1 piece (2 pieces for the AX4009T)
P3	Both top and bottom sides 1 piece each (top 1 piece and bottom 2 pieces for the AX4009T)
Ⓗ Body surface treatment	
Blank	Standard (rotational section-blackening/ fixed section casting surface plane-paint)
S	Rotational section-electroless nickel plating treatment and fixed section-nitriding
Ⓘ Interface specifications	
U0	Parallel I/O (NPN specifications)
U1	Parallel I/O (PNP specifications)
U2	CC-Link
U3	PROFIBUS-DP
U4	DeviceNet

Note on model no. selection

Note 1: Refer to the table below and select the appropriate driver.

Driver power supply voltage table

Model \ Driver type	TS Type Driver	
	3-phase, 1-phase 200 VAC to 230 VAC	1-phase 100 VAC to 115 VAC
AX4009T	Blank Note 2	J1
AX4022T	Blank Note 2	J1
AX4045T	Blank Note 2	J1
AX4075T	Blank Note 2	

Note 2: For models whose maximum torque is 75 N•m, if you are using 1-AC 200 VAC, the calculation of the torque limit is different from the norm. Contact CKD to determine whether the driver can be used.

Note 3: The cable is a movable cable.
Refer to page 38 for cable dimensions.
The cables are not movable cables.

Note 4: Designate body surface treatment and mounting base surface treatment with Ⓒ and Ⓗ. If you select the optional electroless nickel plating treatment, you can expect higher rustproofing performance than the standard specification.

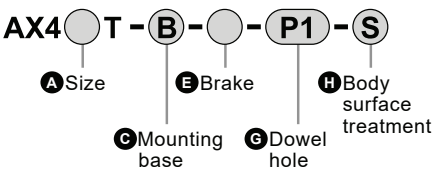
Note 5: ⒸFor a "B" blackening mounting base or "BS" electroless nickel plating surface treatment mounting base, "P2" or "P3" cannot be selected.

Note 6: In some cases, the dowel hole may not be surface-treated.

Note 7: Refer to the Option Table below and select required options.
Option Table

	AX4009T	AX4022T	AX4045T	AX4075T
Mounting base (–B)	×	○	○	○
Mounting base (–BS)	×	○	○	○
Brake (–EB)	×	○	○	○

● Actuator model no.



● Driver model no.

●200 VAC to 230 VAC
AX9000TS - U0

●100 VAC to 115 VAC
AX9000TS - J1 - U0

Ⓘ Interface specifications

● Cable model no.

●Motor cable
AX - CBLM6 - DM04

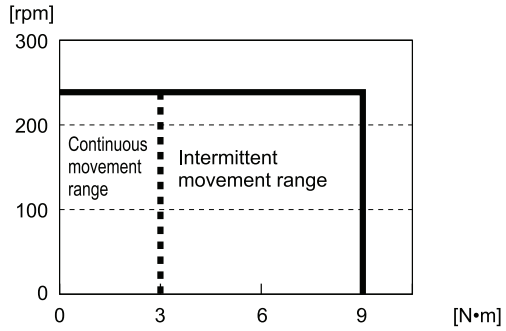
●Resolver cable
AX - CBLR6 - DM04

Ⓓ Cable length
(Note: "04" if the cable length is 4m)

* Custom order models will not support CE, UL/cUL, or RoHS. Consult with CKD for details.

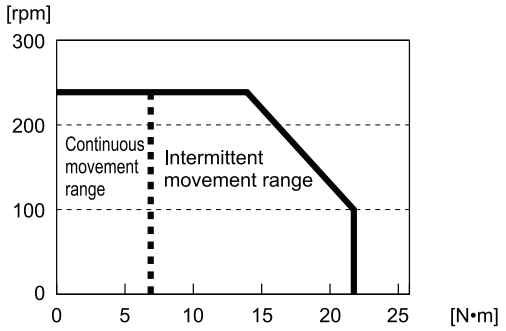
Speed and maximum torque characteristics

●AX4009TS



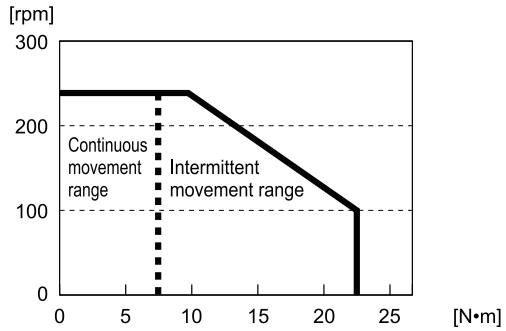
* This graph shows the characteristics for 3-phase 200 VAC.

●AX4022TS



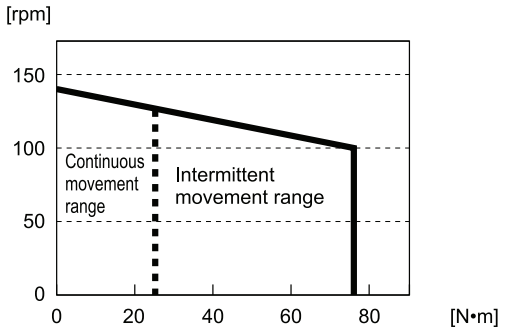
* This graph shows the characteristics for 3-phase 200 VAC.

●AX4045TS



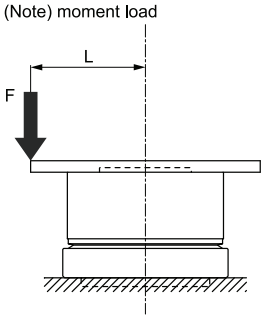
* This graph shows the characteristics for 3-phase 200 VAC.

●AX4075TS



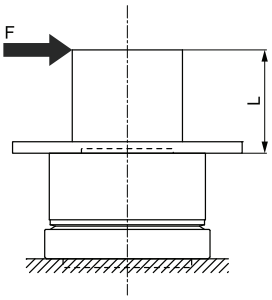
* This graph shows the characteristics for 3-phase 200 VAC.

(Note) moment load



M(N•m)=F(N)×L(m)
M: Moment load
F: Load
L: Distance from output shaft center

(Fig. a)



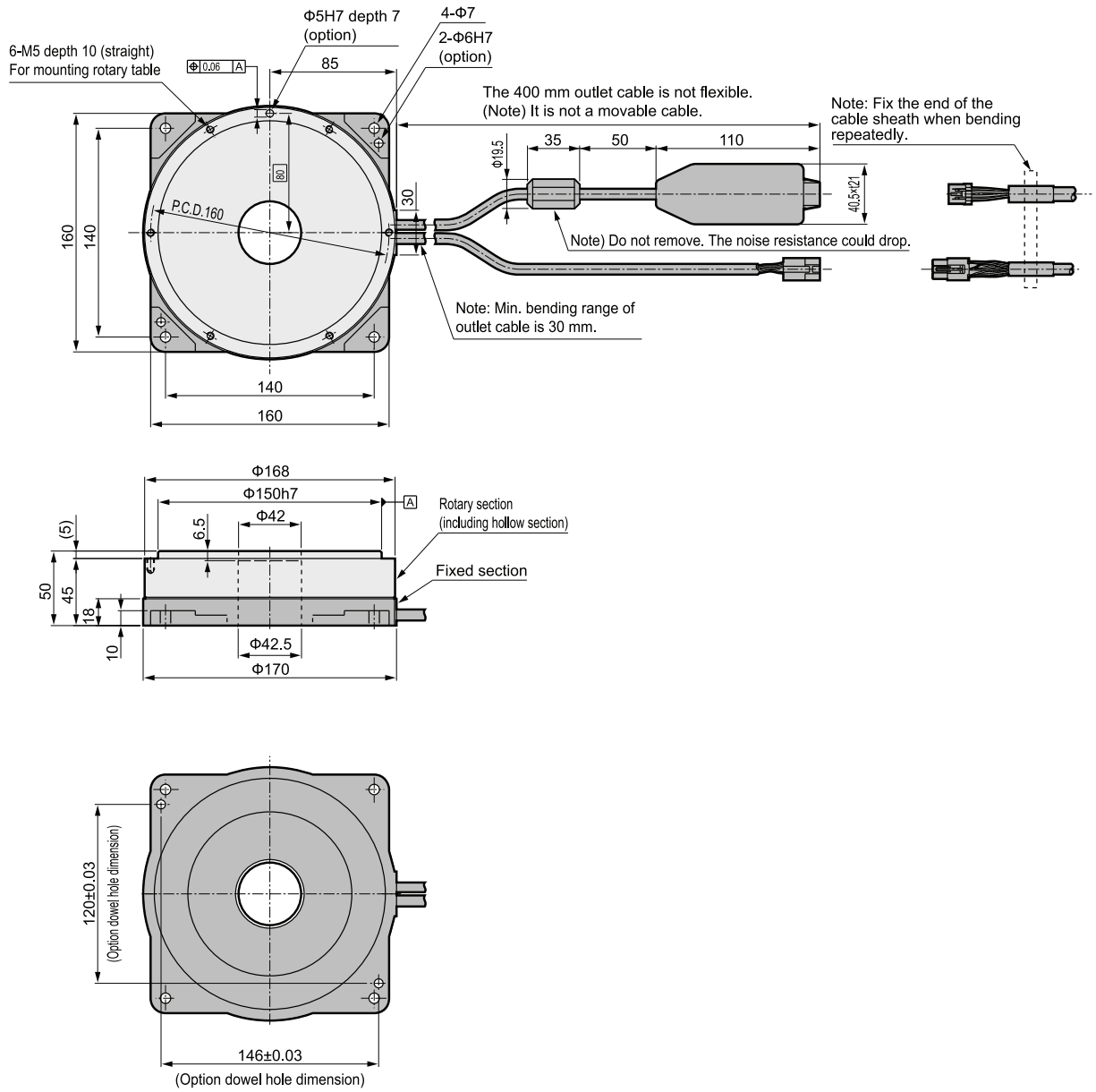
M(N•m)=F(N)×(L+0.02)(m)
M: Moment load
F: Load
L: Distance from output shaft flange

(Fig. b)

⚠ Read the precautions on Intro 9 to 14 before use.

Dimensions

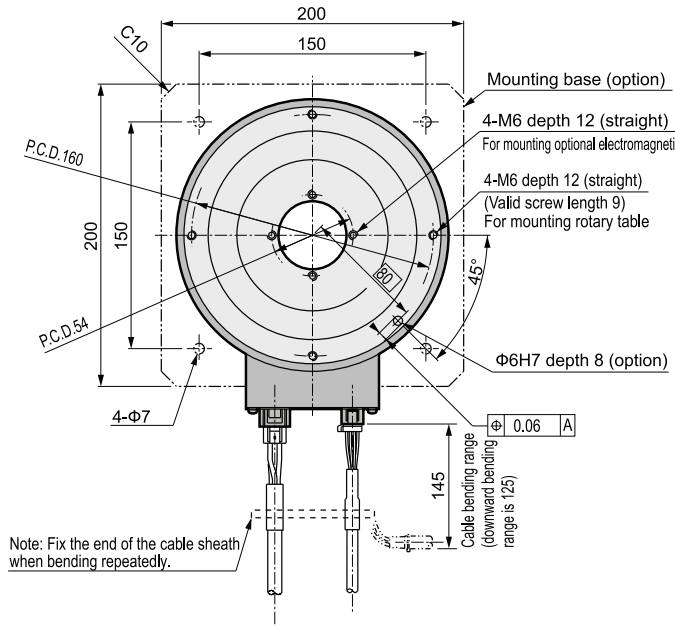
● **AX4009T**

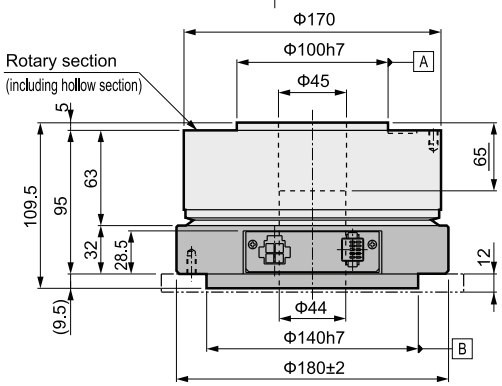


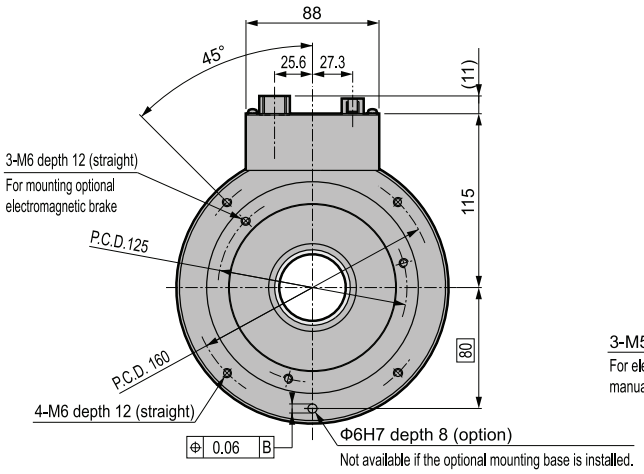
Note 1) The actuator's origin may differ from that in the dimensional drawing.
The origin offset feature enables you to set the origin to any position you choose.

Dimensions

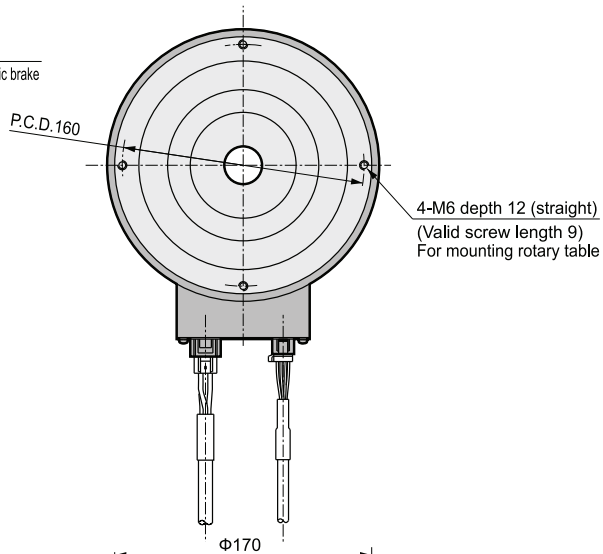
● **AX4022T**

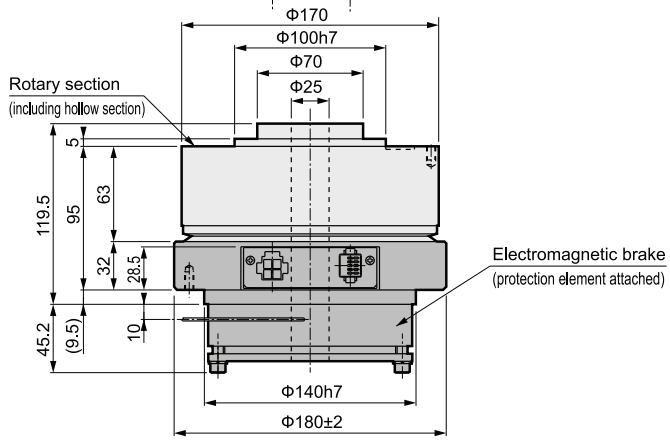


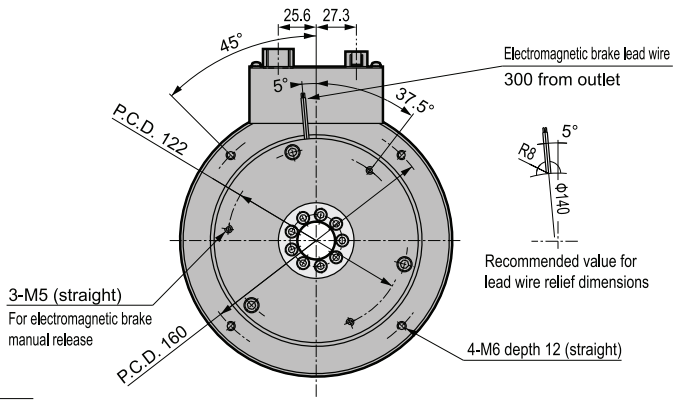




● **AX4022T-EB**
With electromagnetic brake
For other options, refer to the drawing on the left.



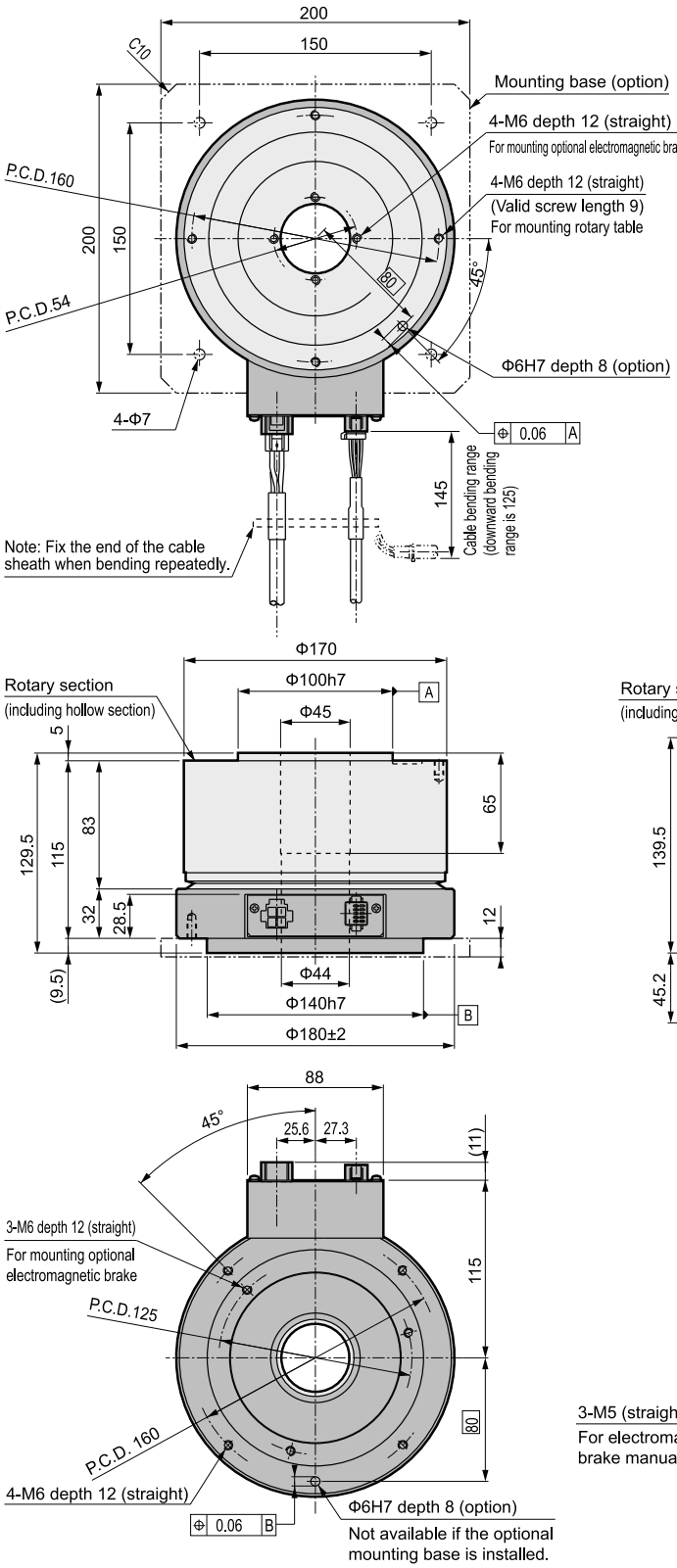




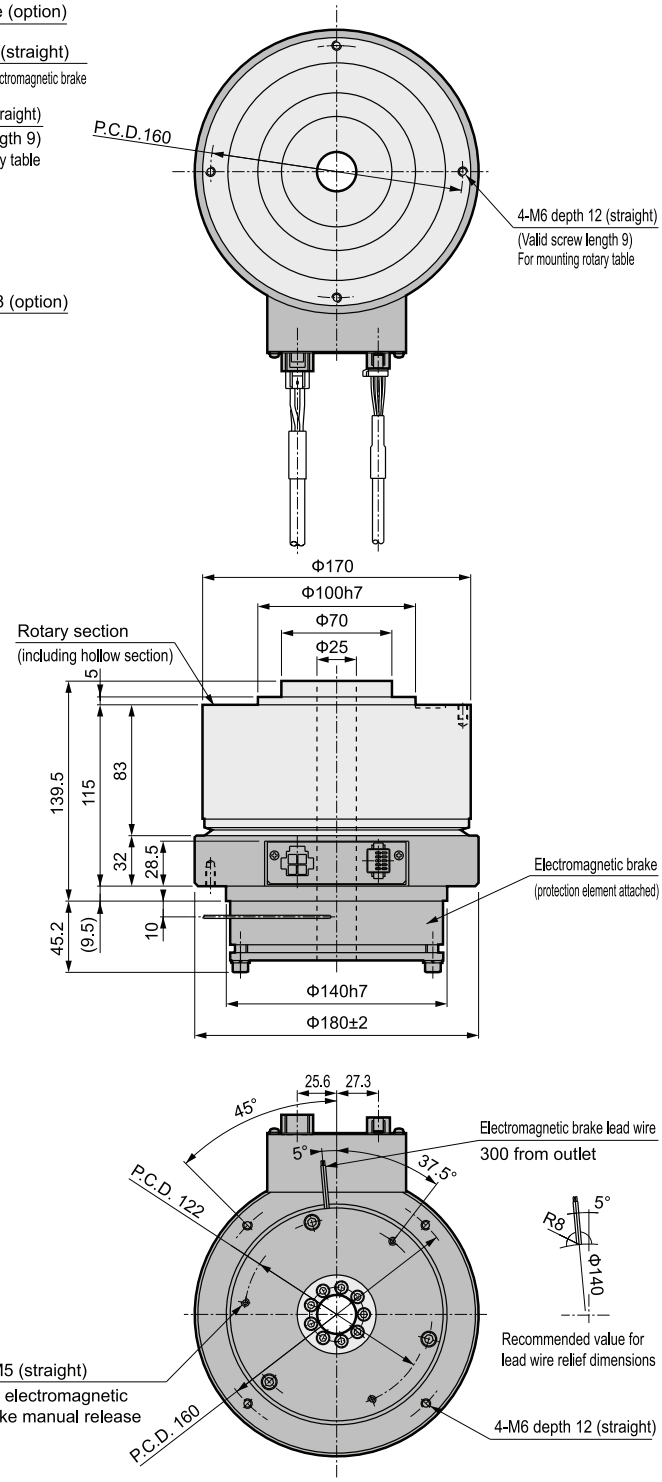
Note 1) The actuator's origin may differ from that in the dimensional drawing.
The origin offset feature enables you to set the origin to any position you choose.

Dimensions

● **AX4045T**



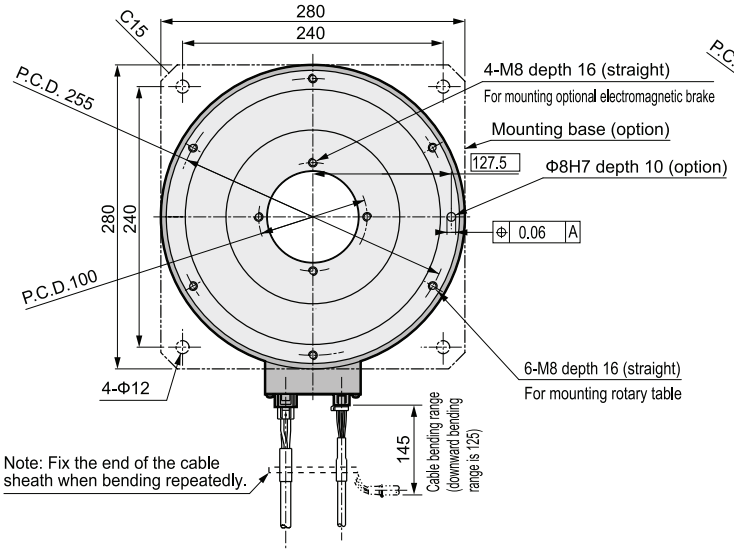
● **AX4045T-EB**
With electromagnetic brake
For other options, refer to the drawing on the left.



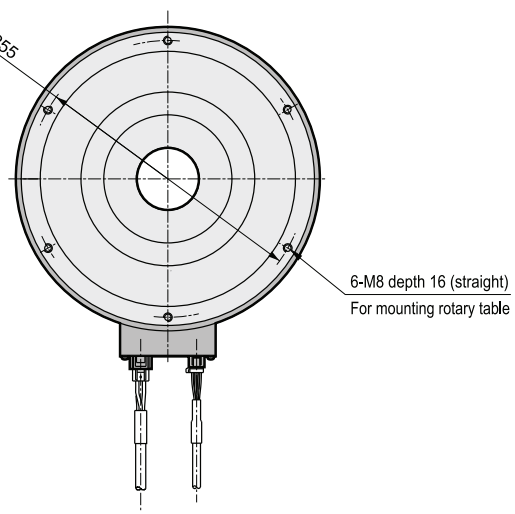
Note 1) The actuator's origin may differ from that in the dimensional drawing.
The origin offset feature enables you to set the origin to any position you choose.

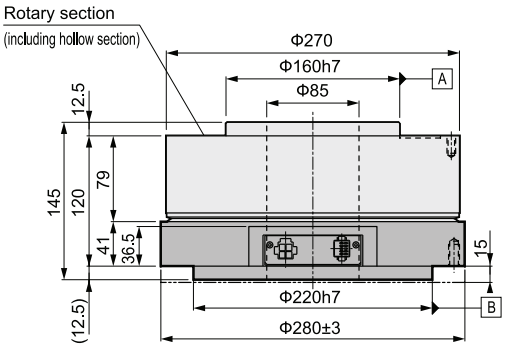
Dimensions

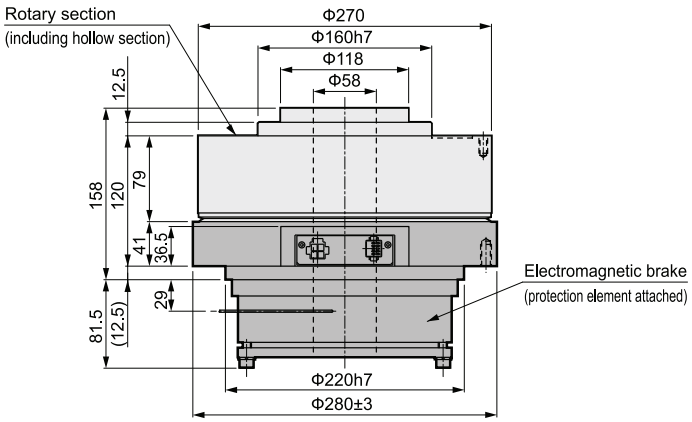
● **AX4075T**

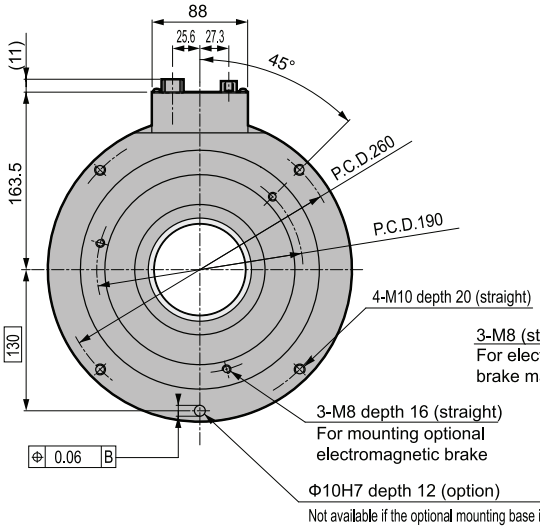


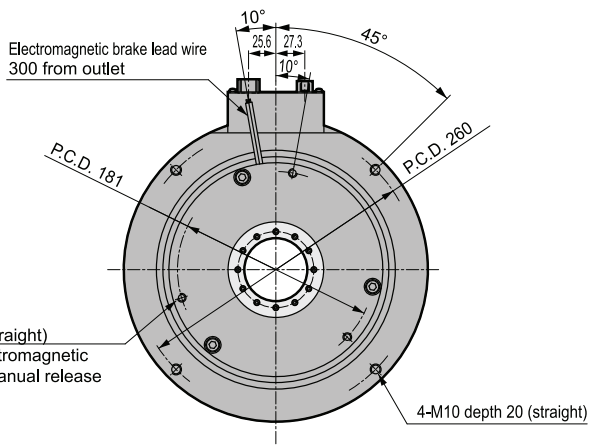
● **AX4075T-EB**
With electromagnetic brake
For other options, refer to the drawing on the left.



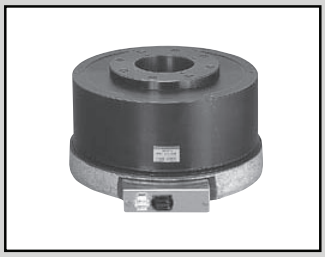








Note 1) The actuator's origin may differ from that in the dimensional drawing.
The origin offset feature enables you to set the origin to any position you choose.



Direct drive actuator ABSODEX

AX4000T Series

Capable of handing loads with large moment of inertia
Compatible function with free driver, actuator, and cable combinations
Large hollow shaft handy for cable wiring and piping, and a variety of options

- Maximum torque: 150/300/500 N•m
- Compatible driver: TH type driver

RoHS

Actuator specifications

Descriptions		AX4150T	AX4300T	AX4500T
Maximum output torque	N•m	150	300	500
Continuous output torque	N•m	50	100	160
Maximum speed	rpm	100 (Note 1)		70
Allowable axial load	N	20000		
Allowable moment load	N•m	300	400	500
Output shaft moment of inertia	kg•m^2	0.2120	0.3260	0.7210
Allowable load inertia Moment	kg•m^2	75.00 (Note 2)	180.00 (Note 2)	300.00 (Note 2)
Index precision (Note 3)	sec.	±30		
Repeatability (Note 3)	sec.	±5		
Output shaft friction torque	N•m	10.0		15.0
Resolver resolution	P/rev	540672		
Motor insulation class		F		
Motor withstand voltage		1500 VAC for 1 minute		
Motor insulation resistance		10MΩ and over at 500 VDC		
Ambient temperature range		0 to 45°C (0 to 40°C: Note 4)		
Ambient humidity range		20 to 85%RH (with no dew condensation)		
Storage temperature range		–20 to 80°C		
Storage humidity range		20 to 90%RH (with no dew condensation)		
Atmosphere		Free of corrosive and explosive gases and dust		
Weight	kg	44.0	66.0	115.0
Weight when brake is set	kg	63.0	86.0	-
Run out of output shaft (Note 3)	mm	0.03		
Surface run out of output shaft (Note 3)	mm	0.05		
Protection		IP20		

Note 1: Use 80 rpm or less during continuous rotary operation.
Note 2: When shipped from the factory, the actuator is set to support large moment of inertia.
Note 3: For details on index precision, repeatability, run out of output shaft, and surface run out of output shaft, refer to "Terminology" on page 42.
Note 4: The temperature upper limit is 40°C when the product is being used as a UL certified product.

Electromagnetic brake specifications (option)

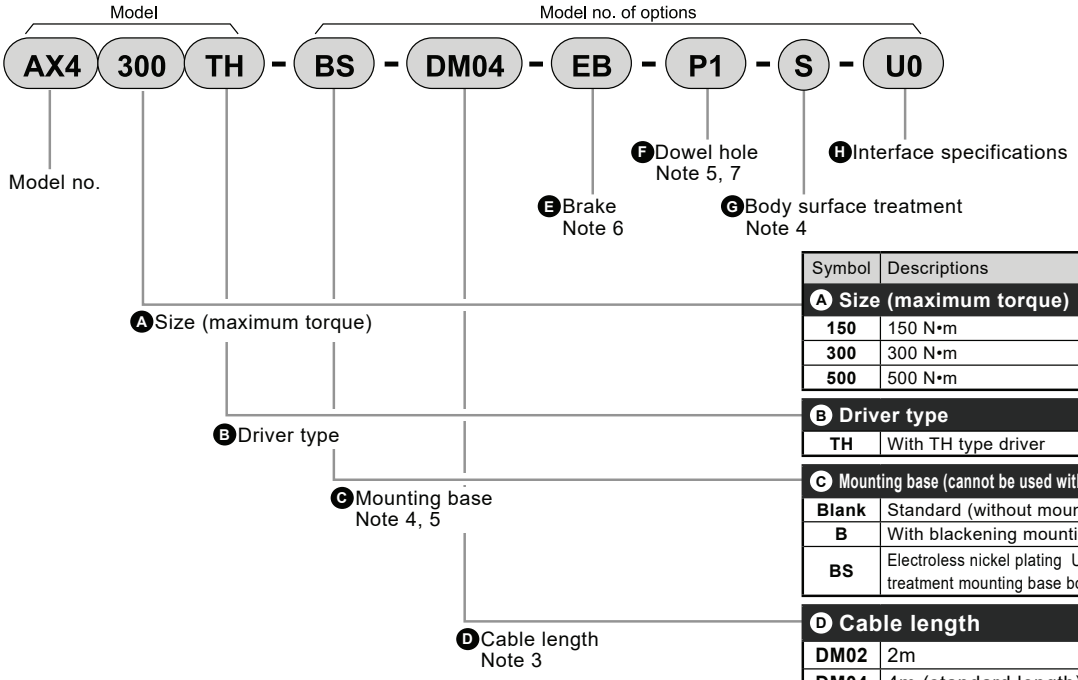
Descriptions \ Supported models		AX4150T/AX4300T
Type		Non-backlash dry non-excitation activation type
Rated voltage	V	DC24 V
Power supply capacity	W	55
Rated current	A	2.30
Static friction torque	N•m	200
Amateur release time (brake on)	msec	50 (reference value)
Amateur absorption time (brake off)	msec	250 (reference value)
Retention precision	min	45 (reference value)
Maximum usage frequency	cycles/min	40

Note 1: When the output shaft is rotating, rubbing may be generated at the electromagnetic brake's disk and fixing section.
Note 2: When moving after brakes are turned OFF, the delay time parameter must be changed based on armature suction time.
Note 3: This is a nonbacklash type, but it may be hard to hold a set position if load is applied in the direction of rotation.
Note 4: When electromagnetic brakes function, the armature may contact the magnetic brake's fixed section and generate noise.
Note 5: Brakes are manually released by alternately screwing screws into manual release taps (three positions). Lightly tighten screws until they stop, then turn them another 90°. When finished with manual release, remove the three bolts immediately and apply brakes.

⚠ Read the precautions on Intro 9 to 14 before use.

How to order

● Set model no. (actuator, driver, and cable)



Symbol	Descriptions
Ⓐ Size (maximum torque)	
150	150 N•m
300	300 N•m
500	500 N•m
Ⓑ Driver type	
TH	With TH type driver
Ⓒ Mounting base (cannot be used with dowel holes P2 and P3)	
Blank	Standard (without mounting base)
B	With blackening mounting base
BS	Electroless nickel plating Use with surface treatment mounting base body surface treatment S.
Ⓓ Cable length	
DM02	2m
DM04	4m (standard length)
DM06	6m
DM08	8m
DM10	10m
DM15	15m
DM20	20m
Ⓔ Brake	
Blank	Standard (no electromagnetic brake)
EB	With negative activation electromagnetic brake
Ⓕ Dowel hole	
Blank	Standard (without dowel hole)
P1	Top 1 piece
P2	Bottom 1 piece
P3	Both top and bottom sides 1 piece each
Ⓖ Body surface treatment	
Blank	Standard (rotational section-blackening/fixed section casting surface plane-paint)
S	Rotational section-electroless nickel plating treatment and fixed section-nitriding
Ⓗ Interface specifications	
U0	Parallel I/O (NPN specifications)
U1	Parallel I/O (PNP specifications)
U2	CC-Link
U3	PROFIBUS-DP
U4	DeviceNet

⚠ Note on model no. selection

Note 1: Refer to the table below and select the appropriate driver.

Driver power supply voltage table

Driver type / Model	TH type driver 3-phase, 1-phase 200 VAC to 230 VAC
AX4150T	Blank Note 2
AX4300T	Blank Note 2
AX4500T	Blank Note 2

Note 2: If you are using 1-AC 200 VAC, the calculation of the torque limit is different from the norm. Contact CKD to determine whether the driver can be used.

Note 3: The cable is a movable cable.
Refer to page 38 for cable dimensions.

Note 4: Designate body surface treatment and mounting base surface treatment with Ⓒ and Ⓖ. If you select the optional electroless nickel plating treatment, you can expect higher rustproofing performance than the standard specification.

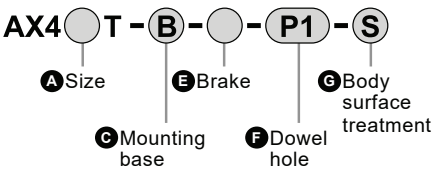
Note 5: Ⓒ For a "B" blackening mounting base or "BS" electroless nickel plating surface treatment mounting base, "P2" or "P3" cannot be selected.

Note 6: Refer to the Option Table below and select required options.
Option Table

	AX4150T	AX4300T	AX4500T
Electromagnetic brake (-EB)	○	○	×

Note 7: In some cases, the dowel hole may not be surface-treated.

● Actuator model no.



● Driver model no.

●200 VAC to 230 VAC

AX9000TH - U0

Ⓗ Interface specifications

● Cable model no.

●Motor cable

AX - CBLM6 - DM04

●Resolver cable

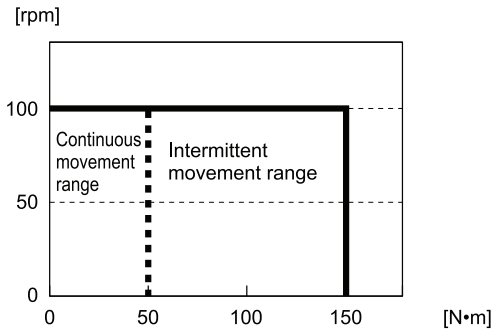
AX - CBLR6 - DM04

Ⓓ Cable length
(Note: "04" if the cable length is 4m)

* Custom order models will not support CE, UL/cUL, or RoHS. Consult with CKD for details.

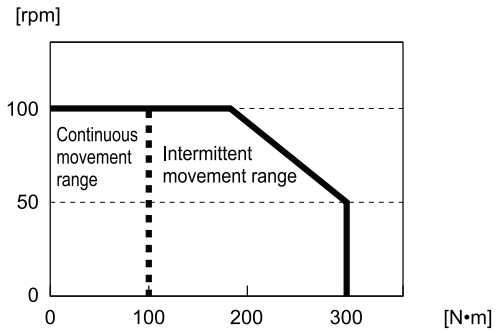
Speed and maximum torque characteristics

●AX4150TH



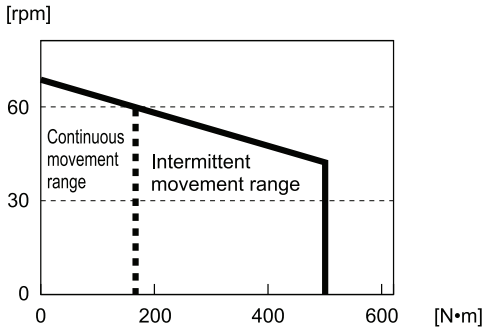
* This graph shows the characteristics for 3-phase 200 VAC.

●AX4300TH



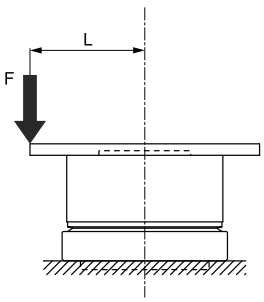
* This graph shows the characteristics for 3-phase 200 VAC.

●AX4500TH



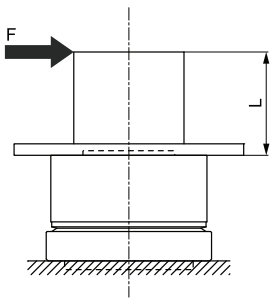
* This graph shows the characteristics for 3-phase 200 VAC.

(Note) moment load



(Fig. a)

M(N•m)=F(N)×L(m)
M: Moment load
F: Load
L: Distance from output shaft center



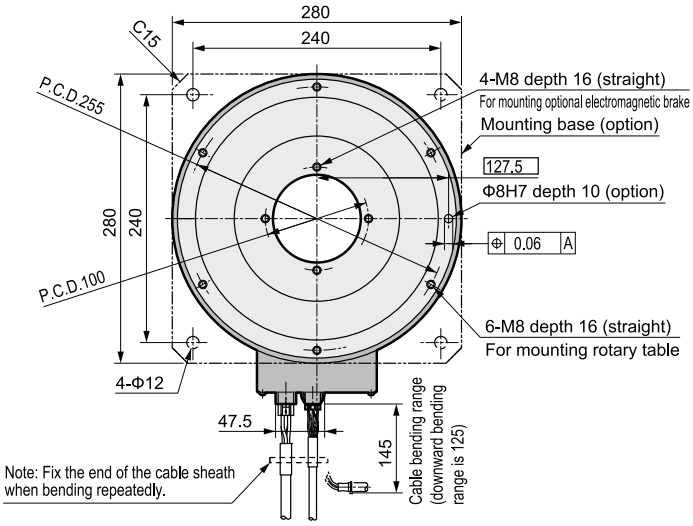
(Fig. b)

M(N•m)=F(N)×(L+0.02)(m)
M: Moment load
F: Load
L: Distance from output shaft flange

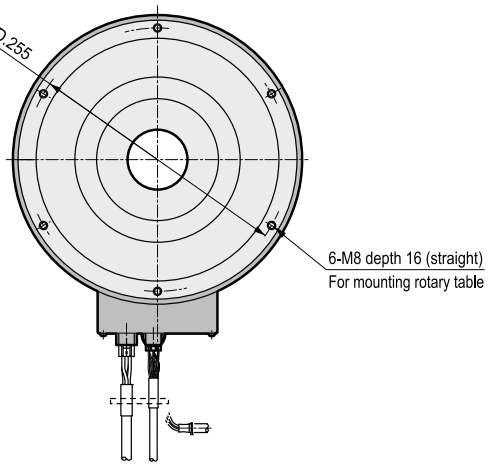
⚠ Read the precautions on Intro 9 to 14 before use.

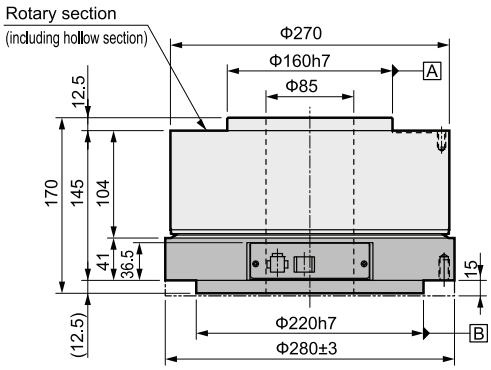
Dimensions

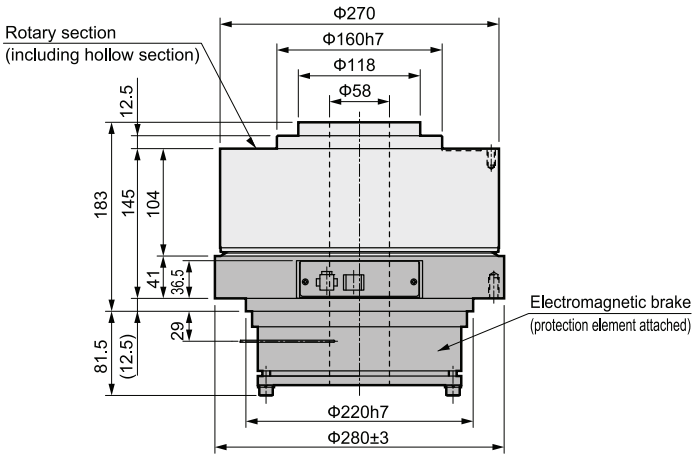
● **AX4150T**

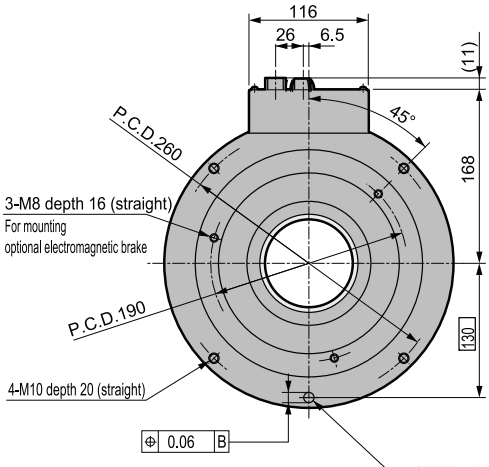


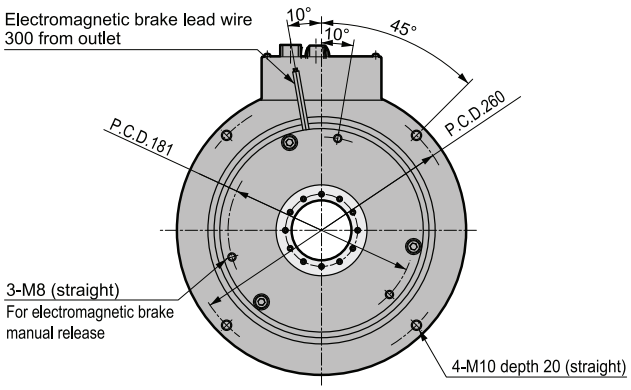
● **AX4150T-EB**
With electromagnetic brake
For other options, refer to the drawing on the left.









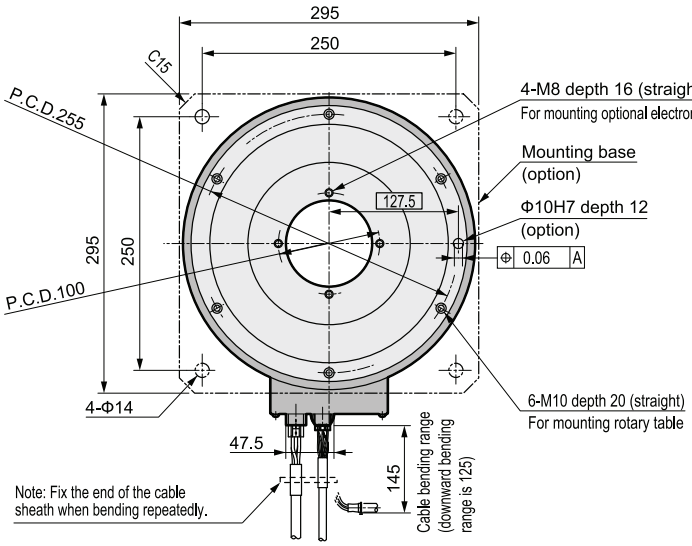


Φ10H7 depth 12 (option)
Not available if the optional mounting base is installed.

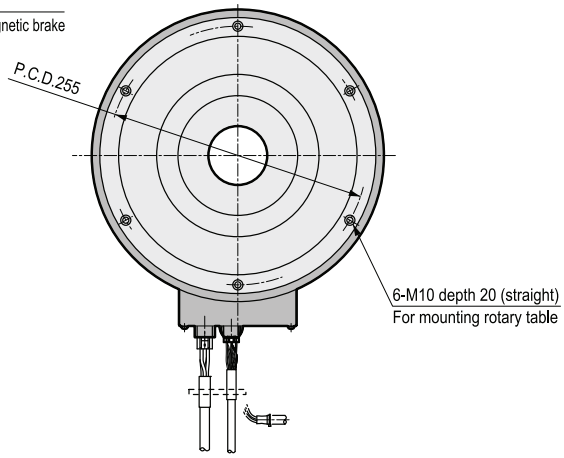
Note 1) The actuator's origin may differ from that in the dimensional drawing.
The origin offset feature enables you to set the origin to any position you choose.

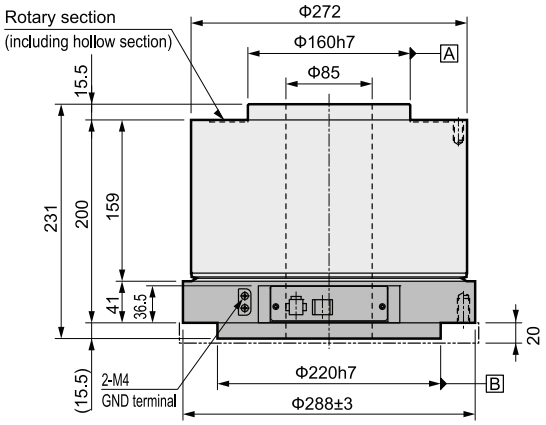
Dimensions

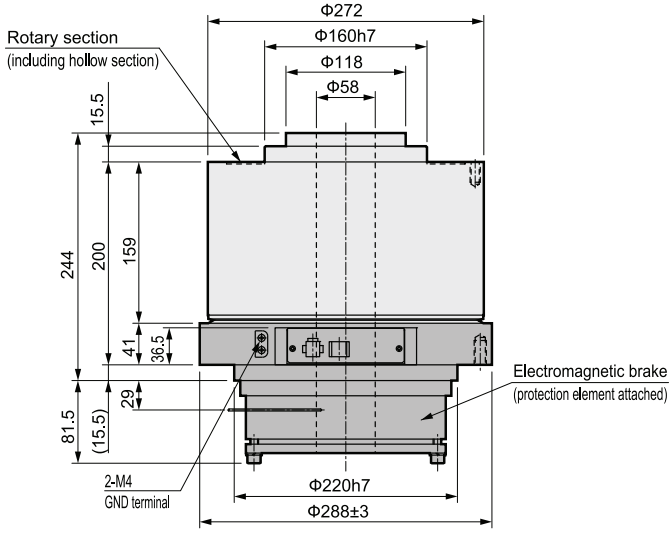
● **AX4300T**

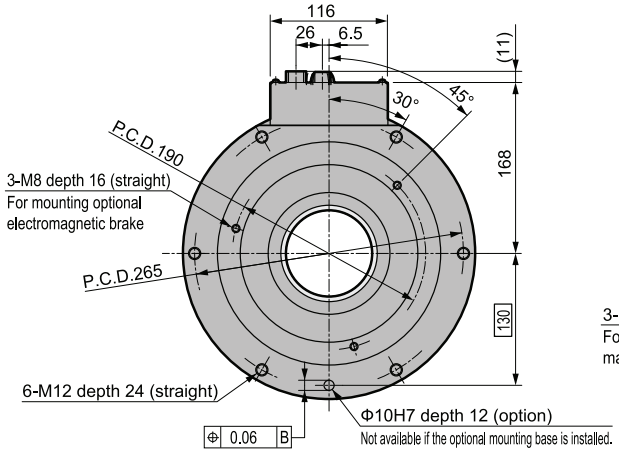


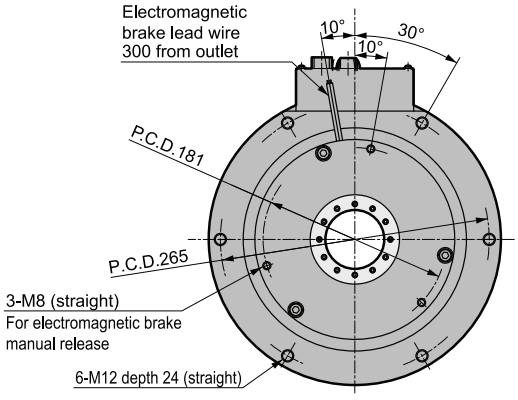
● **AX4300T-EB**
With electromagnetic brake
For other options, refer to the drawing on the left.







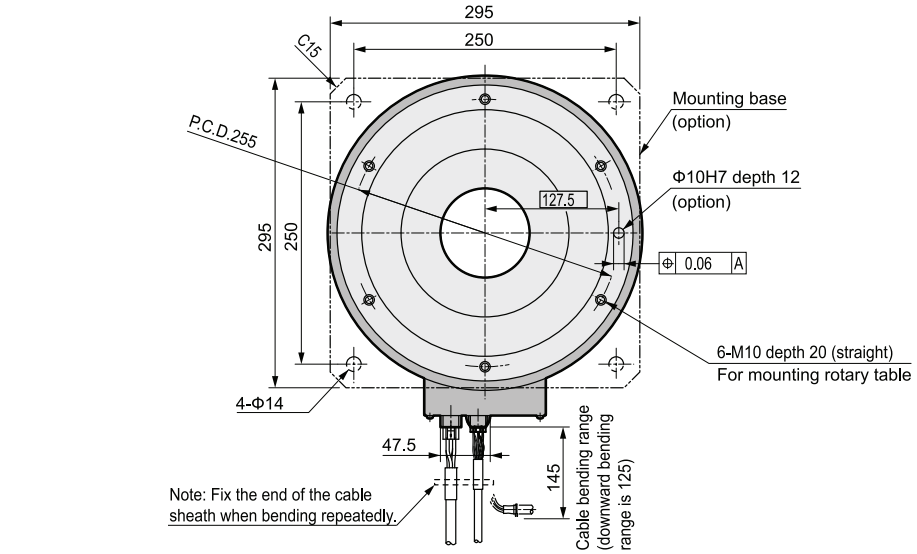


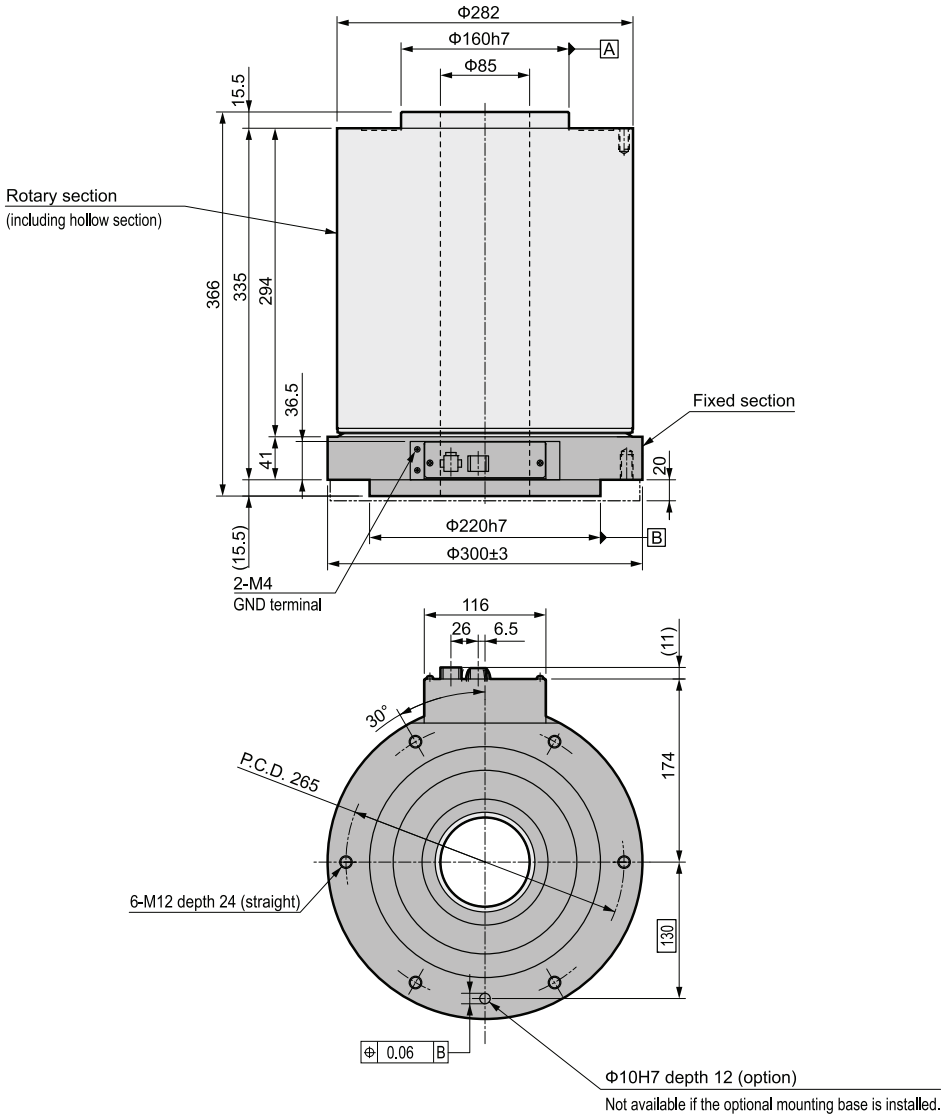


Note 1) The actuator's origin may differ from that in the dimensional drawing.
The origin offset feature enables you to set the origin to any position you choose.

Dimensions

● **AX4500T**





Note 1) The actuator's origin may differ from that in the dimensional drawing.
The origin offset feature enables you to set the origin to any position you choose.

Large type direct drive actuator ABSODEX

AX400WT Series

Maximum torque 1000 N•m

Interchangeable functions enabling free driver, actuator, and cable combinations, large hollow shaft handy for cable wiring and piping, and a variety of options

- Maximum torque: 1000 N•m
- Compatible driver: TH type driver

RoHS

Actuator specifications

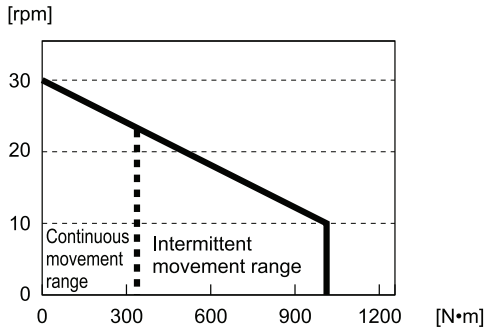
Descriptions		AX410WT
Maximum output torque	N•m	1000
Continuous output torque	N•m	330
Maximum speed	rpm	30
Allowable axial load	N	20000
Allowable moment load	N•m	400
Output shaft moment of inertia	kg•m^2	2.72
Allowable load inertia Moment	kg•m^2	600.00
Index precision (Note 1)	sec.	±30
Repeatability (Note 1)	sec.	±5
Output shaft friction torque	N•m	20.0
Resolver resolution	P/rev	540672
Motor insulation class		F
Motor withstand voltage		1500 VAC for 1 minute
Motor insulation resistance		10MΩ and over at 500 VDC
Ambient temperature range		0 to 45°C (0 to 40°C: Note 2)
Ambient humidity range		20 to 85%RH (with no dew condensation)
Storage temperature range		–20 to 80°C
Storage humidity range		20 to 90%RH (with no dew condensation)
Atmosphere		Free of corrosive and explosive gases and dust
Weight	kg	198
Run out of output shaft (Note 1)	mm	0.03
Surface run out of output shaft (Note 1)	mm	0.08
Protection		IP20

Note 1: For details on index precision, repeatability, run out of output shaft, and surface run out of output shaft, refer to "Terminology" on page 42.

Note 2: The temperature upper limit is 40°C when the product is being used as a UL certified product.

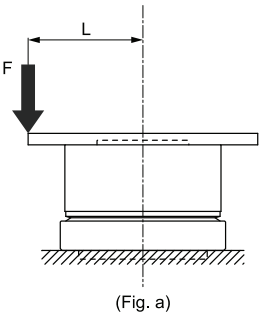
Speed and maximum torque characteristics

●AX410WTH



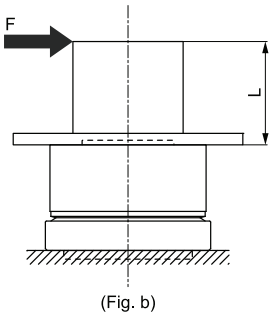
* This graph shows the characteristics for 3-phase 200 VAC.

(Note) moment load



(Fig. a)

M(N•m)=F(N)×L(m)
M: Moment load
F: Load
L: Distance from output shaft center



(Fig. b)

M(N•m)=F(N)×(L+0.02)(m)
M: Moment load
F: Load
L: Distance from output shaft center

Safety precautions

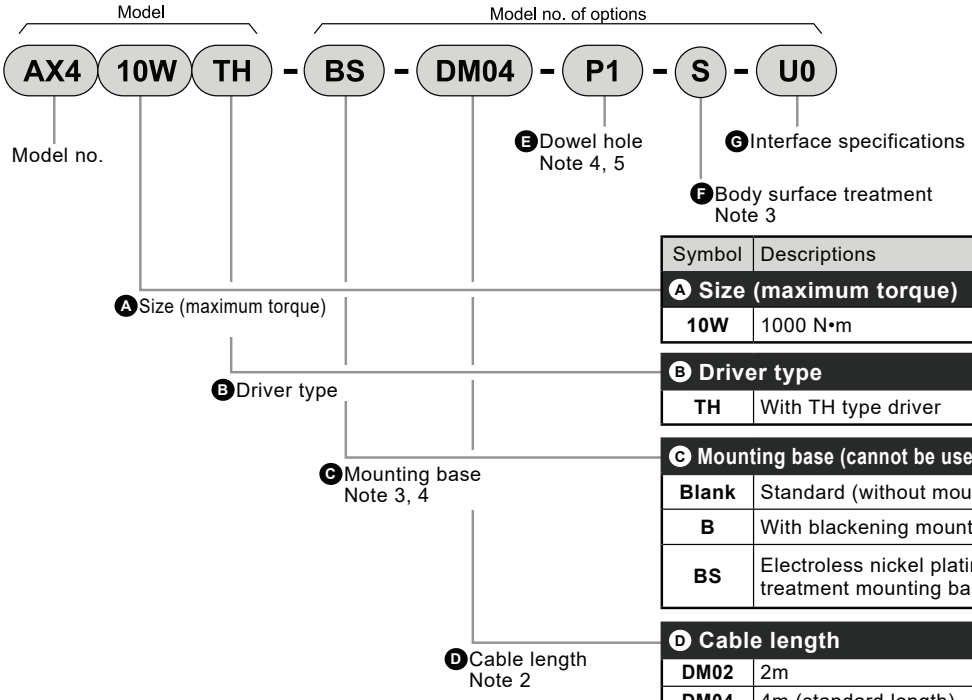
WARNING

In an emergency stop, it may take several seconds to stop depending on the rotation speed and the load inertial moment.

Read the precautions on Intro 9 to 14 before use.

How to order

● Set model no. (actuator, driver, and cable)



Symbol	Descriptions
A Size (maximum torque)	
10W	1000 N•m
B Driver type	
TH	With TH type driver
C Mounting base (cannot be used with dowel holes P2 and P3)	
Blank	Standard (without mounting base)
B	With blackening mounting base
BS	Electroless nickel plating Use with surface treatment mounting base body surface treatment S.
D Cable length	
DM02	2m
DM04	4m (standard length)
DM06	6m
DM08	8m
DM10	10m
DM15	15m
DM20	20m
E Dowel hole	
Blank	Standard (without dowel hole)
P1	Top 1 piece
P2	Bottom 1 piece
P3	Both top and bottom sides 1 piece each
F Body surface treatment	
Blank	Standard (rotational section-blackening/fixed section casting surface plane-paint)
S	Rotational section-electroless nickel plating treatment and fixed section-nitriding
G Interface specifications	
U0	Parallel I/O (NPN specifications)
U1	Parallel I/O (PNP specifications)
U2	CC-Link
U3	PROFIBUS-DP
U4	DeviceNet

⚠ Note on model no. selection

Note 1: If you are using 1-phase 200 VAC, the calculation of the torque limit is different from the norm. Contact CKD to determine whether the driver can be used.

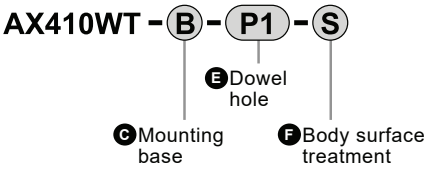
Note 2: The cable is a movable cable. Refer to page 38 for cable dimensions.

Note 3: Designate body surface treatment and mounting base surface treatment with Ⓒ and Ⓔ. If you select the optional electroless nickel plating treatment, you can expect higher rustproofing performance than the standard specification.

Note 4: Ⓒ For a "B" blackening mounting base or "BS" electroless nickel plating surface treatment mounting base, "P2" or "P3" cannot be selected.

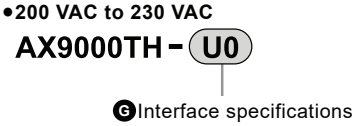
Note 5: In some cases, the dowel hole may not be surface-treated.

● Actuator model no.



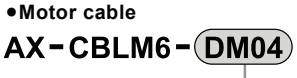
● Driver model no.

●200 VAC to 230 VAC

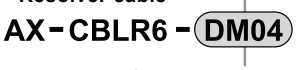


● Cable model no.

●Motor cable



●Resolver cable

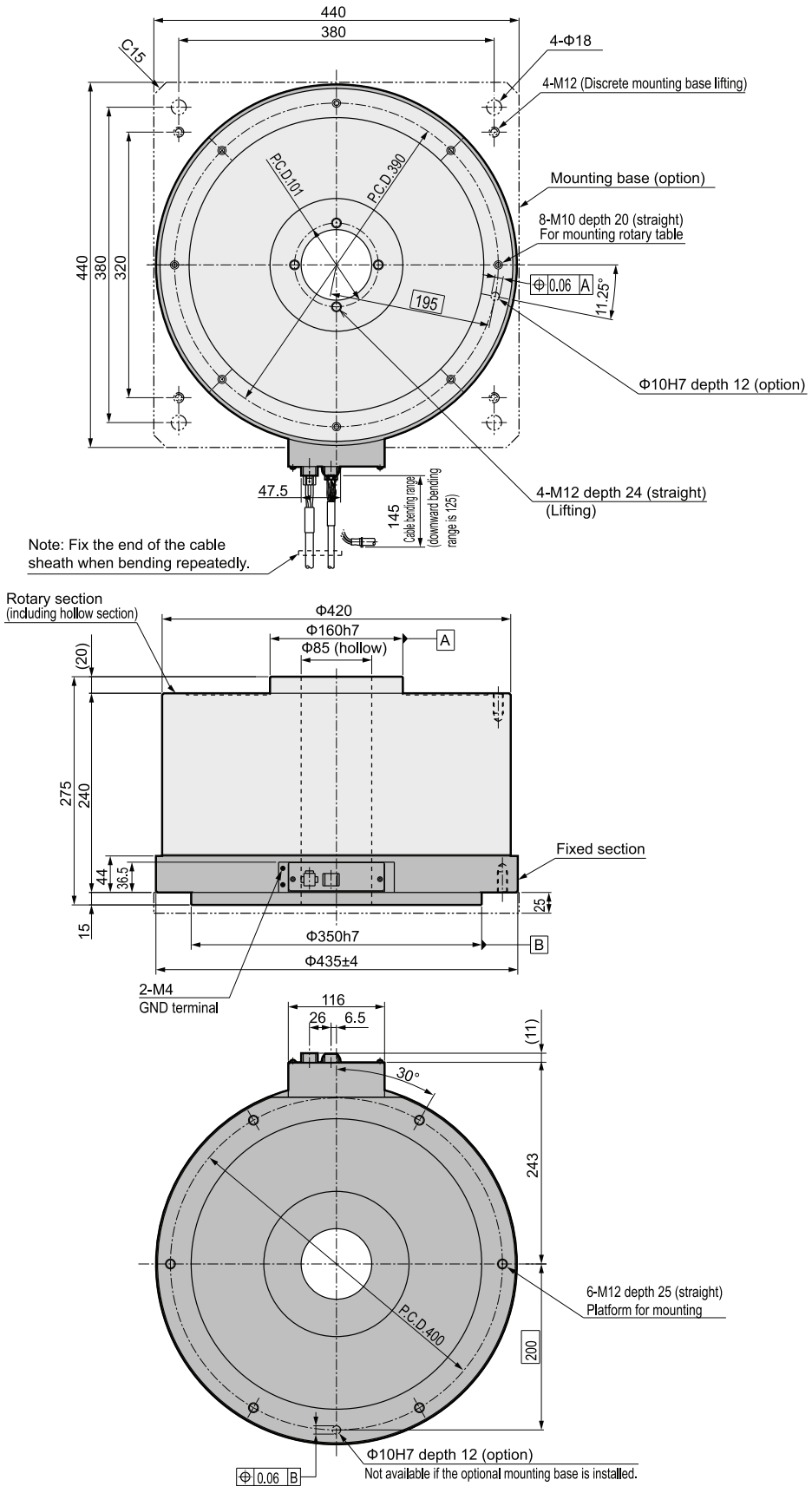


D Cable length
(Note: "04" if the cable length is 4m)

*Custom order models will not support CE, UL/cUL, or RoHS. Consult with CKD for details.

Dimensions

●AX410WT



Note 1) The actuator's origin may differ from that in the dimensional drawing.
The origin offset feature enables you to set the origin to any position you choose.

Direct drive actuator ABSODEX

TS·TH type driver

Interface specifications: Parallel I/O (NPN specifications)
Parallel I/O (PNP specifications)
CC-Link
PROFIBUS-DP
DeviceNet

RoHS

Features

- Power supply separated into main power supply and control power supply
- Wiring method changed from terminal block to connector
- Compact and light (resin body)
- 7 segment LED 2-digit display
- Additional encoder output (parallel I/O only)
- Serial communication option (built into circuit board)
- Additional monitoring feature for positioning and alarms (U2, U3, and U4 options only)

Common specifications

Descriptions		Model	
		TS type driver AX9000TS	TH type driver AX9000TH
Power supply voltage	Main power supply	3-phase, 1-phase 200 VAC ± 10% to 230 VAC ± 10% (Note 1) 100 VAC ± 10% to 115 VAC ± 10% (J1 option) (Note 2) (Note 3)	
	Control power supply	200 VAC ± 10% to 230 VAC ± 10% 100 VAC ± 10% to 115 VAC ± 10% (J1 option) (Note 2) (Note 3)	
Power frequency		50/60 Hz	
Rated input current		AC200 V: 1.8 A AC100 V: 2.4 A	AC200 V: 5.0 A
Rated output current		1.9 A	5.0 A
Construction		Integrated driver and controller (open type)	
Ambient temperature range		0 to 50°C	
Ambient humidity range		20 to 90%RH (with no dew condensation)	
Storage temperature range		–20 to 80°C	
Storage humidity range		20 to 90%RH (with no dew condensation)	
Atmosphere		No corrosive gases or powder dust	
Noise resistance		1000 V (P-P), pulse width 1 µs, rising edge 1 ns, impulse noise test, induction noise (capacitive coupling)	
Vibration resistance		4.9m/s^2	
Weight		Approx. 1.6 kg	Approx. 2.1 kg
Protection		IP2X (excluding CN4, CN5)	

Note 1) For models whose maximum torque is 75 N•m or more, if you are using 1-AC 200 VAC, the calculation of the torque limit is different from the norm. Contact CKD to determine whether the driver can be used.
Note 2) If you connect 200 VAC to 230 VAC to a driver with 100 VAC to 115 VAC power supply voltage specification (-J1 option), the driver's internal circuitry will be damaged.
Note 3) You cannot select "-J1" for models whose maximum torque is 75 N•m or more.
Note 4) If the main power supply is turned off while the actuator is rotating, the rotation may continue due to momentum.
Note 5) After the main power is turned off, the motor may turn due to the voltage remaining in the driver.

How to order

•200 VAC to 230 VAC

AX9000TS – U0
AX9000TH – U0

•100 VAC to 115 VAC

AX9000TS – J1 – U0

Interface specifications
U0: Parallel I/O (NPN)
U1: Parallel I/O (PNP)
U2: CC-Link
U3: PROFIBUS-DP
U4: DeviceNet

Performance specifications

Descriptions	Descriptions
Control shafts	1 shaft, 540672 pulses/1 rotation
Angle setting unit	° (degrees), pulses, index numbers
Min. angle setting unit	0.001°, 1 pulse
Speed setting unit	sec. rpm
Speed setting range	0.01 to 100 s; 0.01 to 300 rpm (Note 1)
Equal divisions	1 to 255
Max. command value	7-digit number input ± 9999999
Timer	0.01 s to 99.99 s
Program language	NC language
Programming method	Data can be set with an interactive terminal or personal computer, etc., using the RS-232C port.
Operation Mode	Auto, MDI, job, single block, servo OFF, pulse string input
Coordinates	Absolute, incremental
Acceleration curve	<5 types> Modified sine (MS), modified constant velocity (MC, MC2), modified trapezoidal (MT), and trapecloid (TR)
Status display	LED power display
Operating indication	7-segments LED display (2 digits)
Communication interface	RS-232C compliant
I/O signals	Refer to the relevant interface specifications page.
Program size	Approx. 6000 characters (256 lines)
Electronic thermal	Actuator overheat protection

Note 1) Maximum rotation speed varies depending on the actuator to be connected.

Power supply and circuit breaker capacities

TS Type Driver

Actuator Model	Driver Model	Power supply capacity (KVA)		Inrush current (A)		Breaker capacity
		Max. value	Rated value	1-phase 100 V	1-phase, 3-phase 200 V	Rated current (A)
AX2006T	AX9000TS	0.8	0.5	16 (Note 1)	56 (Note 1)	10
AX1022T, AX2012T, AX2018T AX4009T, AX4022T		1.0	0.5			
AX1045T, AX4045T		1.5	0.5			
AX1075T, AX4075T		2.0	0.8	—		

Note 1) The inrush current values are typical values for AC115 V and AC230 V.

TH Type Driver

Actuator Model	Driver Model	Power supply capacity (KVA)		Inrush current (A)	Breaker capacity
		Max. value	Rated value	3-phase 200 V	Rated current (A)
AX1150T, AX4150T	AX9000TH	3.0	0.8	56 (Note 1)	20
AX1210T, AX4300T		4.0	1.5		
AX4500T		4.0	2.0		
AX410WT		4.0	2.0		

Note 1) The inrush current value is a typical value for AC230 V.

Parallel I/O (NPN specifications)

CN3 Input signal

Pin no.	Signal	Logic	Decision
1 to 2	External power supply input +24 V ± 10%		
3 to 4	External power supply input GND		
5	Program number selection input (bit 0)	Positive	Level
6	Program number selection input (bit 1)	Positive	Level
7	Program number selection input (bit 2)	Positive	Level
8	Program number selection input (bit 3)	Positive	Level
9	Program number selection input 2nd digit/program number selection input (bit 4)	Positive	Edge Level
10	Program number selection input 1st digit/program number selection input (bit 5)	Positive	Edge Level
11	Reset input	Positive	Edge
12	Home Positioning Instruction Input	Positive	Edge
13	Start input	Positive	Edge
14	Servo ON input/program stop input	Positive	Level Edge
15	Ready return/continuous rotation stop input	Positive	Edge
16	Answer input/position deviation counter reset	Positive	Edge
17	Emergency Stop Input	Negative	Level
18	Brake Release Input	Positive	Level

CN3 output signal

Pin no.	Signal	Logic
33	M code output (bit 0)	Positive
34	M code output (bit 1)	Positive
35	M code output (bit 2)	Positive
36	M code output (bit 3)	Positive
37	M code output (bit 4)	Positive
38	M code output (bit 5)	Positive
39	M code output (bit 6)	Positive
40	M code output (bit 7)	Positive
41	In-position output	Positive
42	Positioning completion output	Positive
43	Start input waiting output	Positive
44	Alarm output 1	Negative
45	Alarm output 2	Negative
46	Intermediate index output 1/origin output	Positive
47	Intermediate index output 2/servo state output	Positive
48	Ready output	Positive
49	Segment position strobe output	Positive
50	M code strobe output	Positive

CN3 pulse string input signal

Pin no.	Signal
19	PULSE/UP/A phase
20	-PULSE/-UP/-A phase
21	DIR/DOWN/B phase
22	-DIR/-DOWN/-B phase

CN3 encoder output signal (incremental)

Pin no.	Signal
23	A phase (line driver output)
24	-A phase (line driver output)
25	B phase (line driver output)
26	-B phase (line driver output)
27	Z phase (line driver output)
28	-Z phase (line driver output)

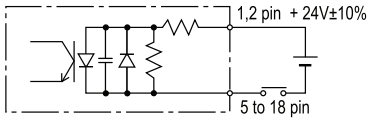
I/O circuit specifications

Descriptions	1 circuit current (mA)	Max. points (circuit)	Max. current (mA)	Max. current consumption (mA)
Input circuit	4	14	56	1106
Output circuit	50	18	900	
Brake output (BK+, BK-)	75	2	150	

* The maximum number of simultaneous output points for the output circuits is 14 out of 18.

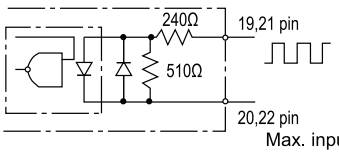
CN3 I/O circuit specifications

● Input circuit



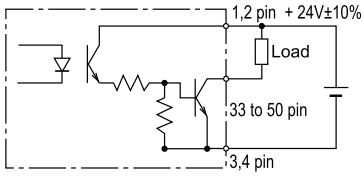
Rated voltage 24 V ± 10%
Rated current 4 mA (at DC24 V)

● Pull string input circuit



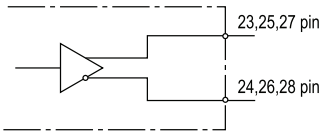
Rated voltage 5 V ± 10%
Max. input frequency
Line driver 1 Mpps
Open collector 250 Kpps

● Output circuit



Rated voltage 24 V ± 10%
Rated current 50 mA (Max.)

● Encoder output circuit



Output type: line driver
Line driver to use: DS26C31
Recommended line receiver: DS26C32 or equivalent

⚠ Read the precautions on Intro 9 to 14 before use.

*Custom order models will not support CE, UL/cUL, or RoHS.

Parallel I/O (PNP specifications)

CN3 Input signal

Pin no.	Signal	Logic	Decision
1 to 2	External power supply input GND (Note 1)		
3 to 4	External power supply input +24 V ± 10% (Note 1)		
5	Program number selection input (bit 0)	Positive	Level
6	Program number selection input (bit 1)	Positive	Level
7	Program number selection input (bit 2)	Positive	Level
8	Program number selection input (bit 3)	Positive	Level
9	Program number selection input 2nd digit/program number selection input (bit 4)	Positive	Edge Level
10	Program number selection input 1st digit/program number selection input (bit 5)	Positive	Edge Level
11	Reset input	Positive	Edge
12	Home Positioning Instruction Input	Positive	Edge
13	Start input	Positive	Edge
14	Servo ON input/program stop input	Positive	Level Edge
15	Ready return/continuous rotation stop input	Positive	Edge
16	Answer input/position deviation counter reset	Positive	Edge
17	Emergency Stop Input	Negative	Level
18	Brake Release Input	Positive	Level

Note 1) The wiring is different from the PNP specifications of the AX9000GS/ AX9000GH.

CN3 pulse string input signal

Pin no.	Signal
19	PULSE/UP/A phase
20	-PULSE/-UP/-A phase
21	DIR/DOWN/B phase
22	-DIR/-DOWN/-B phase

I/O circuit specifications

Descriptions	1 circuit current (mA)	Max. points (Circuit)	Max. current (mA)	Max. current consumption (mA)
Input circuit	4	14	56	1106
Output circuit	50	18	900	
Brake output (BK+, BK-)	75	2	150	

* The maximum number of simultaneous output points for the output circuits is 14 out of 18.

CN3 output signal

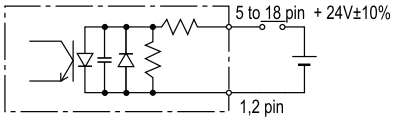
Pin no.	Signal	Logic
33	M code output (bit 0)	Positive
34	M code output (bit 1)	Positive
35	M code output (bit 2)	Positive
36	M code output (bit 3)	Positive
37	M code output (bit 4)	Positive
38	M code output (bit 5)	Positive
39	M code output (bit 6)	Positive
40	M code output (bit 7)	Positive
41	In-position output	Positive
42	Positioning completion output	Positive
43	Start input waiting output	Positive
44	Alarm output 1	Negative
45	Alarm output 2	Negative
46	Intermediate index output 1/origin output	Positive
47	Intermediate index output 2/servo state output	Positive
48	Ready output	Positive
49	Segment position strobe output	Positive
50	M code strobe output	Positive

CN3 encoder output signal (incremental)

Pin no.	Signal
23	A phase (line driver output)
24	-A phase (line driver output)
25	B phase (line driver output)
26	-B phase (line driver output)
27	Z phase (line driver output)
28	-Z phase (line driver output)

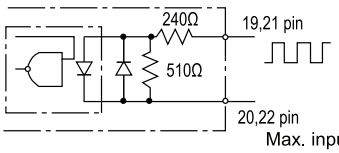
CN3 I/O circuit specifications

● Input circuit



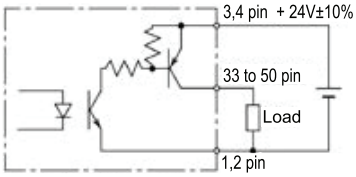
Rated voltage 24 V ± 10%
Rated current 4 mA (at DC24 V)

● Pull string input circuit



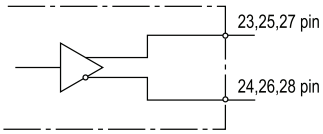
Rated voltage 5 V ± 10%
Max. input frequency
Line driver 1 Mpps
Open collector 250 Kpps

● Output circuit



Rated voltage 24 V ± 10%
Rated current 50 mA (Max.)

● Encoder output circuit



Output type: line driver
Line driver to use: DS26C31
Recommended line receiver: DS26C32 or equivalent

*Custom order models will not support CE, UL/cUL, or RoHS.

CC-Link specifications

Communication specifications

Descriptions	Specifications
Power supply	Supplies DC5 V from the servo amp
CC-Link version	Ver.1.10
Occupied stations (station type)	2 (remote device station)
Remote input points	48 points
Remote output points	48 points
Remote register I/O	Input 8 words, output 8 words
Communication speed	10M, 5M, 2.5M, 625k, 156kbps (selection by parameter)
Coupling cable	CC-Link Ver.1.10 cable (shielded 3-core twist pair cable)
Transmission format	HDLC compliant
Remote station No.	1 to 63 (set by parameter)
Connections	With only remote device stations: 32 max., 2 stations occupied
Monitor function	Current position within 1 rotation (degrees, pulses), amount of position deviation, program number, electronic thermal, rotation speed, alarm

I/O signals

PLC → AX (Input)

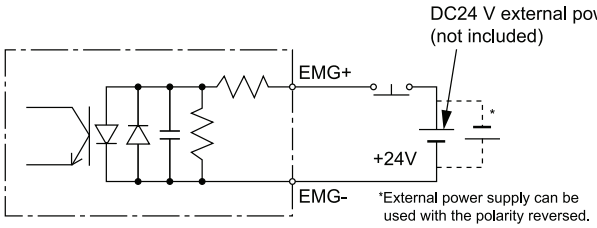
Device No.	Signal	Logic	Decision
RYn0	Program number selection input (bit 0)	Positive	Level
RYn1	Program number selection input (bit 1)	Positive	Level
RYn2	Program number selection input (bit 2)	Positive	Level
RYn3	Program number selection input (bit 3)	Positive	Level
RYn4	Program number selection input 2nd digit/ program number selection input (bit 4)	Positive	Edge level
RYn5	Program number selection input 1st digit/ program number selection input (bit 5)	Positive	Edge level
RYn6	Reset input	Positive	Edge
RYn7	Home Positioning Instruction Input	Positive	Edge
RYn8	Start input	Positive	Edge
RYn9	Servo-on Input/ program stop input	Positive	Level edge
RYnA	Ready return input/ continuous rotation stop input	Positive	Edge
RYnB	Answer input/ position deviation counter reset	Positive	Edge
RYnC	Emergency Stop Input	Negative	Level
RYnD	Brake Release Input	Positive	Level
RYnE	Not available		
RYnF	Not available		
RY(n+1)0 to RY(n+1)F	Not available		
RY(n+2)0	Monitor output execution request	Positive	Edge
RY(n+2)1	Instruction code execution request	Positive	Edge
RY(n+2)2 to RY(n+2)F	Not available		

AX → PLC (Output)

Device No.	Signal	Logic
RXn0	M code output (bit 0)	Positive
RXn1	M code output (bit 1)	Positive
RXn2	M code output (bit 2)	Positive
RXn3	M code output (bit 3)	Positive
RXn4	M code output (bit 4)	Positive
RXn5	M code output (bit 5)	Positive
RXn6	M code output (bit 6)	Positive
RXn7	M code output (bit 7)	Positive
RXn8	In-position output	Positive
RXn9	Positioning completion output	Positive
RXnA	Start input waiting output	Positive
RXnB	Alarm output 1	Negative
RXnC	Alarm output 2	Negative
RXnD	Intermediate index output 1/ origin output	Positive
RXnE	Intermediate index output 2/ Servo state output	Positive
RXnF	Ready output	Positive
RX(n+1)0	Segment position strobe output	Positive
RX(n+1)1	M code strobe output	Positive
RX(n+1)2 to RX(n+1)F	Not available	
RX(n+2)0	Monitor	Positive
RX(n+2)1	Instruction code execution complete	Positive
RX(n+2)2 to RX(n+2)F	Not available	

* n is a value that is determined by the station No. setting.

TB3 input circuit specifications (emergency stop)



Rated voltage 24 V ± 10%, rated current 5 mA or less

Safety precautions

- Provide adequate spacing between communication cables and power lines (motor cables, power cables, etc.).
- If communication cables and power lines are brought close together or bundled, communication will become unstable, and communication errors and retransmission may occur due to noise.
- For details on laying communication cables, refer to the CC-Link laying manual and other related information.

DeviceNet specifications

Communication specifications

Descriptions	Specifications
Communication power supply	11 to 25 VDC
Communication power supply current consumption	50mA or less
Communication protocol	DeviceNet compliant: Remote I/O
Occupied nodes	Input 8 bytes, output 8 bytes
Communication speed	500k, 250k, 125kbps (selection by parameter)
Coupling cable	DeviceNet cable (shielded 5-wire cable, 2 signal lines, 2 power lines, 1 shield)
Node address	0 to 63 (set by parameter)
Connections	64 units max. (including the master)
Monitor function	Current position within 1 rotation (degrees, pulses), amount of position deviation, program number, electronic thermal, rotation speed, alarm

I/O signals

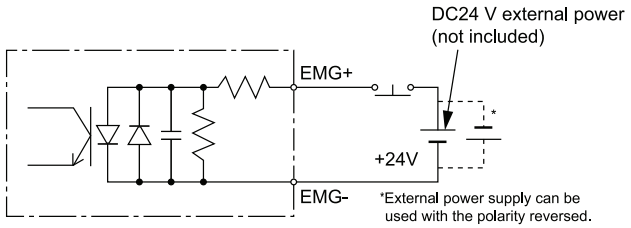
PLC → AX (Input)

Byte No.	Signal	Logic	Decision
0.0	Program number selection input (bit 0)	Positive	Level
0.1	Program number selection input (bit 1)	Positive	Level
0.2	Program number selection input (bit 2)	Positive	Level
0.3	Program number selection input (bit 3)	Positive	Level
0.4	Program number selection input (bit 4)/ program number selection input 2nd digit	Positive	Level edge
0.5	Program number selection input 1st digit/program number selection input (bit 5)	Positive	Level edge
0.6	Reset input	Positive	Edge
0.7	Home Positioning Instruction Input	Positive	Edge
1.0	Start input	Positive	Edge
1.1	Servo ON Input/ program stop input	Positive	Level edge
1.2	Ready return input/ continuous rotation stop input	Positive	Edge
1.3	Answer input/ position deviation counter reset	Positive	Edge
1.4	Emergency Stop Input	Negative	Level
1.5	Brake Release Input	Positive	Level
1.6	Not available		
1.7	Not available		
2.0 to 2.5	Not available		
2.6	Monitor output execution request	Positive	Level
2.7	Instruction code execution request	Positive	Edge

AX → PLC (Output)

Byte No.	Signal	Logic
0.0	M code output (bit 0)	Positive
0.1	M code output (bit 1)	Positive
0.2	M code output (bit 2)	Positive
0.3	M code output (bit 3)	Positive
0.4	M code output (bit 4)	Positive
0.5	M code output (bit 5)	Positive
0.6	M code output (bit 6)	Positive
0.7	M code output (bit 7)	Positive
1.0	In-position output	Positive
1.1	Positioning completion output	Positive
1.2	Start input waiting output	Positive
1.3	Alarm output 1	Negative
1.4	Alarm output 2	Negative
1.5	Intermediate index output 1/ origin output	Positive
1.6	Intermediate index output 2/ Servo state output	Positive
1.7	Ready output	Positive
2.0	Segment position strobe output	Positive
2.1	M code strobe output	Positive
2.2 to 2.5	Not available	
2.6	Monitor	Positive
2.7	Instruction code execution complete	Positive

TB3 input circuit specifications (emergency stop)



Rated voltage 24 V ± 10%, rated current 5 mA or less

Safety precautions

- Provide adequate spacing between communication cables and power lines (motor cables, power cables, etc.).
- If communication cables and power lines are brought close together or bundled, communication will become unstable, and communication errors and retransmission may occur due to noise.
- For details on laying communication cables, refer to the DeviceNet laying manual and other related information.

PROFIBUS-DP specifications

Communication specifications

Descriptions	Specifications
Communication protocol	PROFIBUS DP-V0 compliant
I/O data	Input 8 bytes, output 8 bytes
Communication speed	12M, 6M, 3M, 1.5M, 500k,187.5k, 93.75k, 45.45k,19.2k, 9.6kbps (auto baud rate function)
Coupling cable	PROFIBUS cable (shielded 2-core twist pair cable)
Node address	0 to 125 (set by parameter)
Connections	Without repeaters: 32 stations max. in a segment With repeaters: 126 stations max. total
Monitor function	Current position within 1 rotation (degrees, pulses), amount of position deviation, program number, electronic thermal, rotation speed, alarm

I/O signals

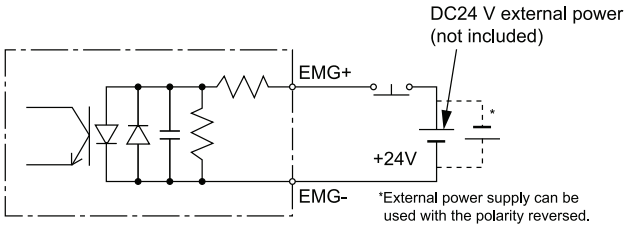
PLC → AX (Input)

Byte No.	Signal	Logic	Decision
0.0	Program number selection input (bit 0)	Positive	Level
0.1	Program number selection input (bit 1)	Positive	Level
0.2	Program number selection input (bit 2)	Positive	Level
0.3	Program number selection input (bit 3)	Positive	Level
0.4	Program number selection input (bit 4)/ program number selection input 2nd digit	Positive	Level edge
0.5	Program number selection input 1st digit/ program number selection input (bit 5)	Positive	Level edge
0.6	Reset input	Positive	Edge
0.7	Home Positioning Instruction Input	Positive	Edge
1.0	Start input	Positive	Edge
1.1	Servo ON Input/ program stop input	Positive	Level edge
1.2	Ready return input/ continuous rotation stop input	Positive	Edge
1.3	Answer input/ position deviation counter reset	Positive	Edge
1.4	Emergency Stop Input	Negative	Level
1.5	Brake Release Input	Positive	Level
1.6	Not available		
1.7	Not available		
2.0 to 2.5	Not available		
2.6	Monitor output execution request	Positive	Level
2.7	Instruction code execution request	Positive	Edge

AX → PLC (Output)

Byte No.	Signal	Logic
0.0	M code output (bit 0)	Positive
0.1	M code output (bit 1)	Positive
0.2	M code output (bit 2)	Positive
0.3	M code output (bit 3)	Positive
0.4	M code output (bit 4)	Positive
0.5	M code output (bit 5)	Positive
0.6	M code output (bit 6)	Positive
0.7	M code output (bit 7)	Positive
1.0	In-position output	Positive
1.1	Positioning completion output	Positive
1.2	Start input waiting output	Positive
1.3	Alarm output 1	Negative
1.4	Alarm output 2	Negative
1.5	Intermediate index output 1/ origin output	Positive
1.6	Intermediate index output 2/ Servo state output	Positive
1.7	Ready output	Positive
2.0	Segment position strobe output	Positive
2.1	M code strobe output	Positive
2.2 to 2.5	Not available	
2.6	Monitor	Positive
2.7	Instruction code execution complete	Positive

TB3 input circuit specifications (emergency stop)



Rated voltage 24 V ± 10%, rated current 5 mA or less

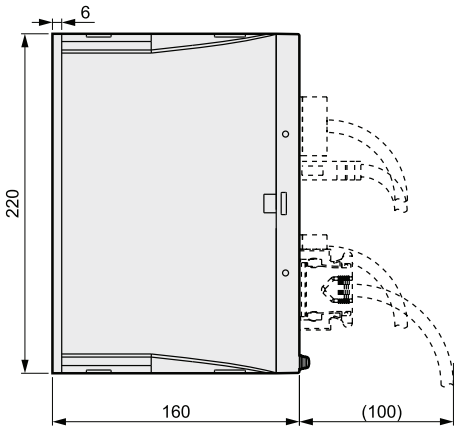
Safety precautions

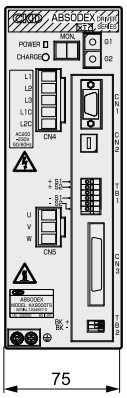
■ For details on laying communication cables, refer to "Installation Guideline for PROFIBUS DP/FMS" issued by the PROFIBUS Organization, the PROFIBUS wiring guide, etc.

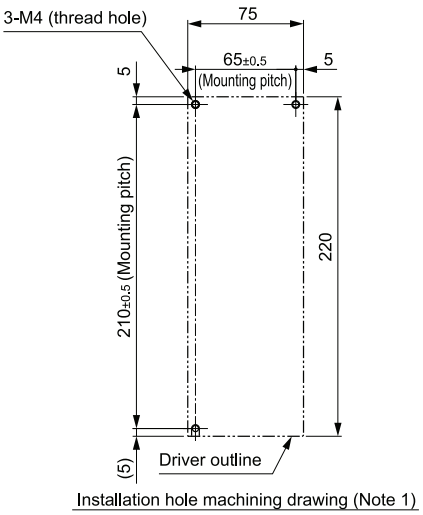
TS·TH type driver

Dimensions

● **TS Type Driver**

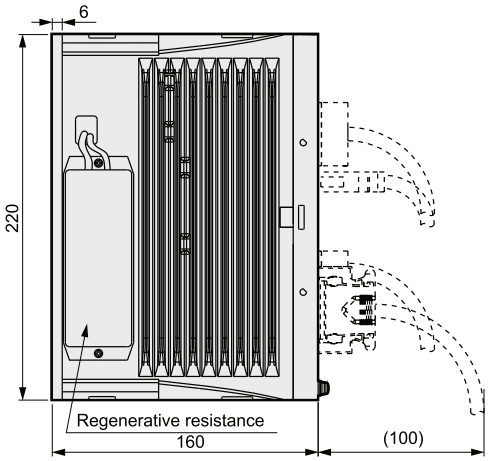


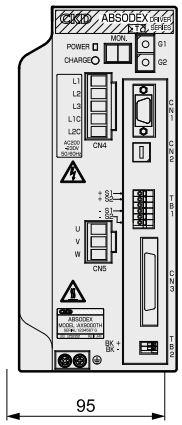


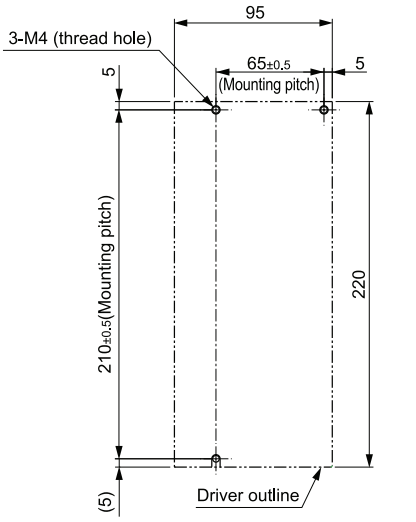


Installation hole machining drawing (Note 1)

● **TH Type Driver**







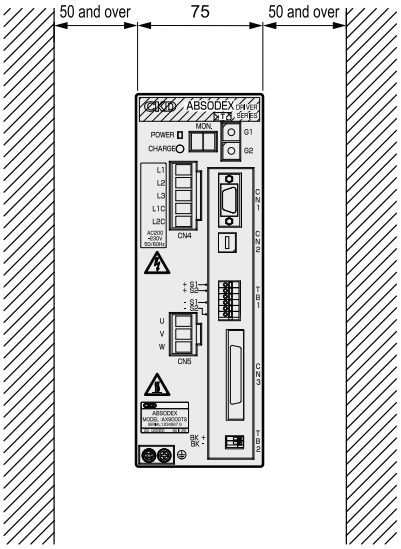
Installation hole machining drawing (Note 1)

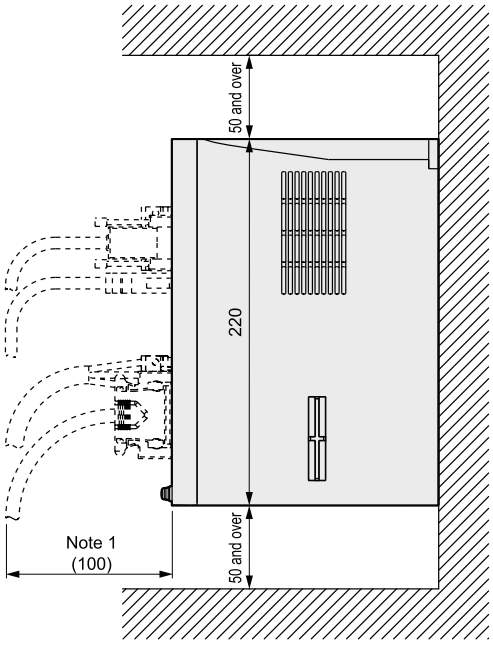
Note 1) Mounting pitch is different from the conventional models (AX9000GS/AX9000GH).

Installation dimensions

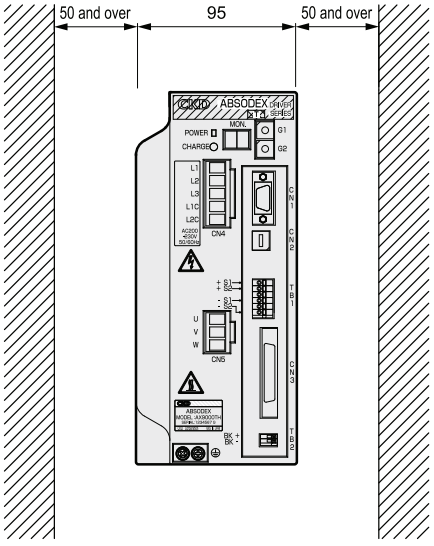
● TS Type Driver

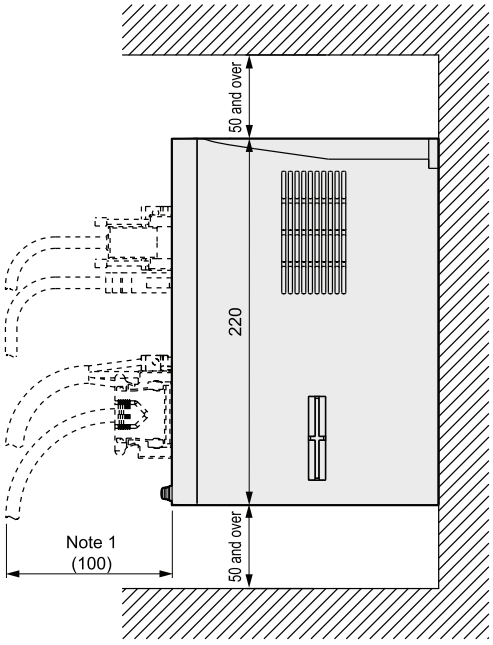
- The Absodex driver is not dustproof or waterproof.
  Protect the driver so that dust, water, oil, etc. do not enter the driver.
- If you are installing the Absodex driver in the control box, make sure that the temperature inside the box does not exceed 50°C, and install the driver as shown in the following diagram to secure space around it.





● TH Type Driver



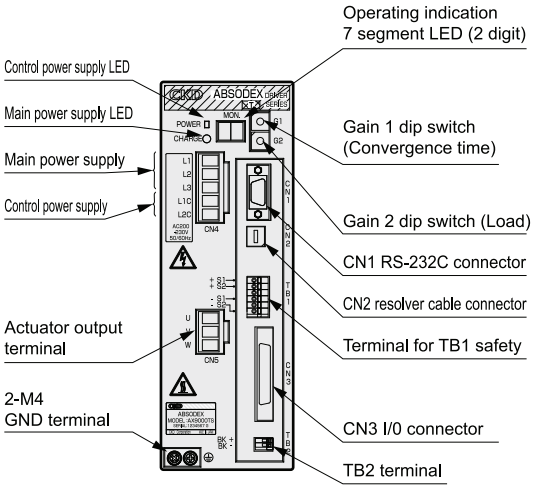


Note 1) Determine a dimension that is more than sufficient for the cable that you are using.

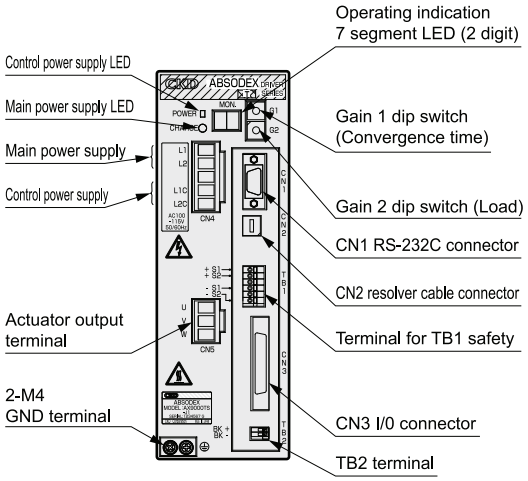
Panel description

● Parallel I/O (NPN, PNP specifications)

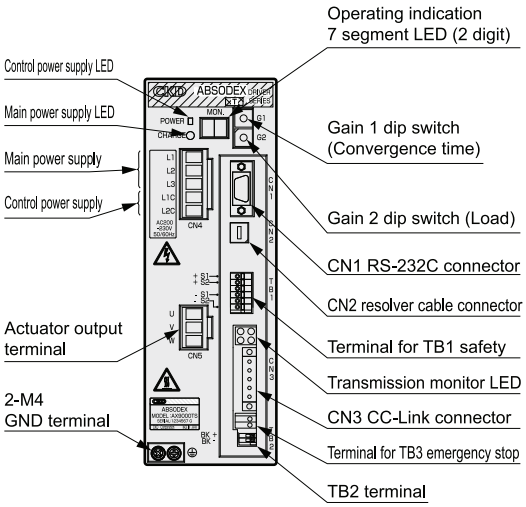
•200 VAC



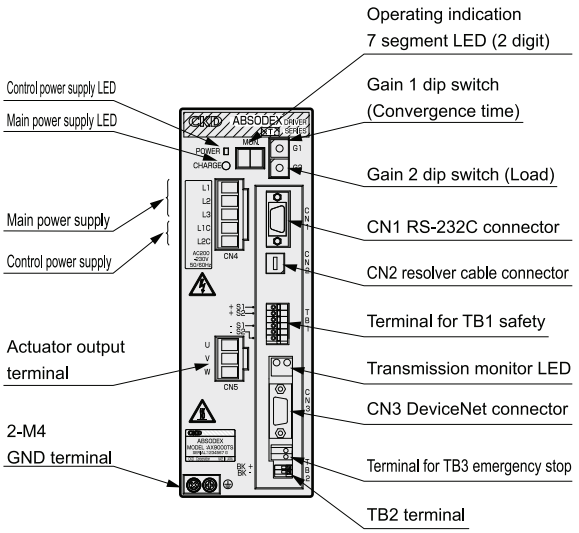
•100 VAC



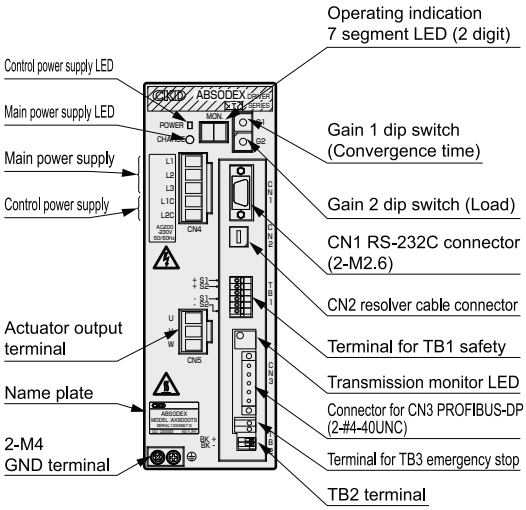
● CC-Link specifications



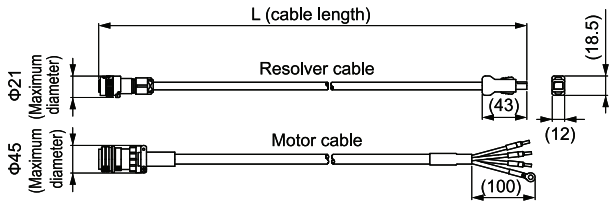
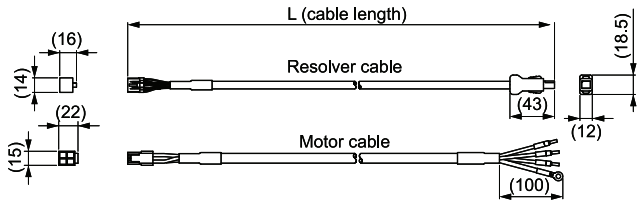
● DeviceNet specifications



● PROFIBUS-DP specifications



Cable specifications

Cable dimensions	Minimum cable bending radius	
● AX1000T 	Resolver cable	60 mm
	Motor cable	110 mm
● AX2000T, AX4000T 	Resolver cable	60 mm
	Motor cable	110 mm

Safety precautions

- When connecting the motor cable and driver, check that the cable's mark tubes and the driver's indications are correct.
- When the cable needs to be bent numerous times, fix the cable sheath near the actuator connector.
- The cables for the AX4009T and AX2000T Series are not movable cables. Be sure to fix the cables in place at the connectors so that they do not move. Do not lift up the body by the cable or apply excessive force to the cable as the cable may break.
- When connecting the cable, insert the connector securely to the back. Tighten the connector's set screws and fixing screws.
- Do not modify the cable by cutting or extending it. Failure to observe this could result in faults or malfunctions.
- For cable length L, refer to the cable lengths in "How to order".

Direct drive actuator ABSODEX (Interactive Terminal)

AX0180

●For TS type and TH type drivers

RoHS

Features

(1) Programming is easy.
Equal index programs are created easily by answering questions interactively with the dialog terminal.

(2) No dedicated power supply required.
Power is supplied from the Absodex.

(3) Backup is possible.
Program parameters can be saved. Programs can be copied.

(4) Can be used with conventional models.
This terminal can be used with S, GS, H, GH, and WGH type drivers, in the same manner as the conventional interactive terminal (AX0170H).

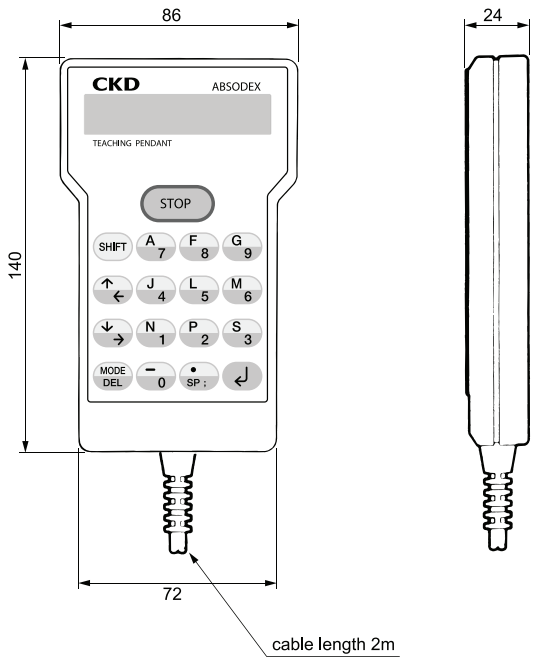
Specifications

Descriptions	AX0180
Operation mode	Edit, view, parameter, operation, and copy
Program size	Equal divisions, or 2000 NC program characters (1 program)
Program no.	Equal division programs: Program No. 0 to 999
Indicator	16 characters × 2 lines (LCD)
Input keys	17 keys (Stop key: 1, control keys: 5, numeric keys: 11)
Backup	Super capacitor (approx. 3 hours)
Power supply	Supplied from the Absodex
Cable length	2m
Ambient temperature range	0 to 50°C
Ambient humidity range	20 to 90% (with no dew condensation)
Storage temperature range	–20 to 80°C
Storage humidity range	20 to 90% (with no dew condensation)
Atmosphere	No corrosive gases or powder dust
Weight	Terminal only approx. 140 g

* The English version displays English messages. The operation panel keys are the same as those of the Japanese version.

Dimensions

● **Dialog Terminal**



How to order

Model: **AX0180** – Model no. of options: **E**

Model no.

Symbol	Descriptions
Blank	Standard (Japanese version)
E	English version

Dialog Terminal

Edit mode

■ Program editing
Equal division programs created interactively and operation programs created with NC codes are edited.
Only one edited program can be saved. (Memory backup: 3 hours)
After the equal division program is edited, parameters required for operation are edited.
Up to 2000 characters are input for the NC program.
Twelve sample programs are used for editing.

Display mode

■ I/O state and current position display
The Absodex driver's input/output signal CN3's input/output status, the current motor position, and the alarm status, etc., are displayed.

Parameter mode

■ Parameter setting
You can reference and set the parameters of the Absodex.
* With the AX9000TS/AX9000TH serial communication option, you can set the station number, baud rate, etc.

Operation mode

■ One-touch operation commands
Start and stop programs, execute one block, reset, set numbers, input and execute MDI data, communicate in terminal mode, brake ON and OFF, servo ON and OFF, return to origin, execute a JOG operation, set offset, etc.

Copy mode

■ Batch copying the programs
All programs stored in the Absodex driver are stored in another driver.

Tuning mode

■ Absodex adjustment (AX9000TS only)
Adjust the gain using the Absodex auto tuning function.

Interactive programming

You can easily create programs by entering settings similar to those shown below.

[Program input example]

New	Program No. [0 to 999]
Origin return position	1. Origin 2. Index
Return direction	1. CW 2. CCW 3. Shortest route
Return speed	[1.0 to 20.0] rpm
Divisions	[1 to 255]
Movement time	[0.01 to 100] secs
Rotational direction	1. CW 2. CCW
Stop process	1. Start wait 2. Dwell
Brake	1. Use 2. Not use
Delay timer	[0.01 to 99.99] secs
M code	1. M code 2. Segment position

Examples of use

Try operating the Absodex. ⇒ **Edit mode**
Twelve types of sample programs are selectable, so try these during adjustment.

Create an Absodex program and store it in the Absodex. ⇒ **Edit mode**
Programs and parameters are stored, and programs are copied.

Start a program stored in the Absodex. ⇒ **Operation mode**
Programs are created easily by inputting the following setting items.

Use features of each cam curve. ⇒ **Parameter mode**
Five types of cam curves are selectable. Drives that use features of each type are realized in one-touch operation.

Check the I/O ON/OFF state. ⇒ **Display mode**
You can view the I/O state.

How to order Absodex related parts

● Related parts

Part name	Applicable model	Model no.
PC communication cable (DOS/V)	AX Series	AX-RS232C-9P

Note) Starting adjustment support tool "AX Tools" (Windows version) is provided for free. Download the latest version from our website.

● Mounting base

Part name	Applicable model	Model no.
Mounting base	AX Series (Note 1)	AX-AX****-BASE-* (Note 2)

(Note 1) Mounting base does not support the AX4009T.

(Note 2) Please contact our sales department regarding mounting base model numbers.

● Noise filter

Part name	Applicable model	Model no.
Noise filter for power supply (3-AC 10A)	AX Series	AX-NSF-3SUP-EF10-ER-6
Noise filter for power supply (1-AC 15A)	AX Series	AX-NSF-NF2015A-OD
Surge protector	AX Series	AX-NSF-RAV-781BXZ-4
Ferrite core for motor cable	AX Series	AX-NSF-RC5060

(Note 1) The parts listed on this page can be purchased from CKD.

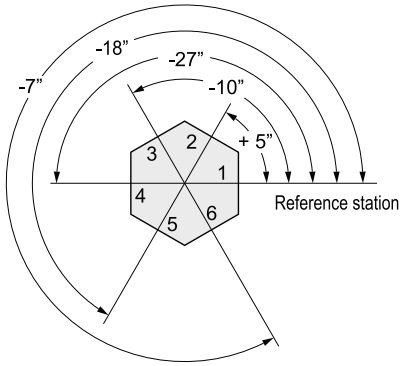
(Note 2) To comply with EU Standards (CE marking) and UL standards, peripheral components such as circuit breakers and FG clamps must be provided by the customer. For details, refer to the instruction manual or the technical information (ABSODEX AX Series TS Type TH Type Technical Information).

Terminology

Index precision

The Absodex index precision is the difference between the target position set by an NC program and the actual stop position.
The target position is an angle (s) from the reference station (origin return position).
As shown in the diagram on the right, the index precision is calculated from the maximum and minimum values of the differences between the target positions and the actual stop positions. Measurement is expressed in terms of the width using positive and negative seconds, as shown on the right.
A high precision encoder is used for the angular measurement.

Example of index accuracy measurement



Measuring position	Measured value
1	0
2	+ 5”
3	-10”
4	-27”
5	-18”
6	-7”

Index precision ±16

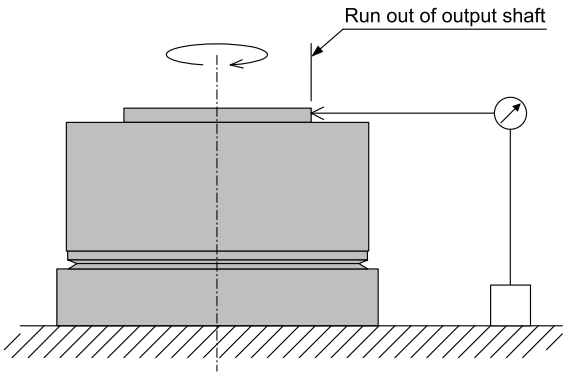
Repeatability

Repeatability expresses the deviation in the angles of the stop positions measured repeatedly under the same conditions for the same target position. It is expressed as an angle in seconds.
Depending on the precision characteristics that the machine requires, repeatability and index precision must be used separately.

* Second A unit used to express angles (degrees, minutes, and seconds). 1 degree = 60 minutes = 3600 seconds

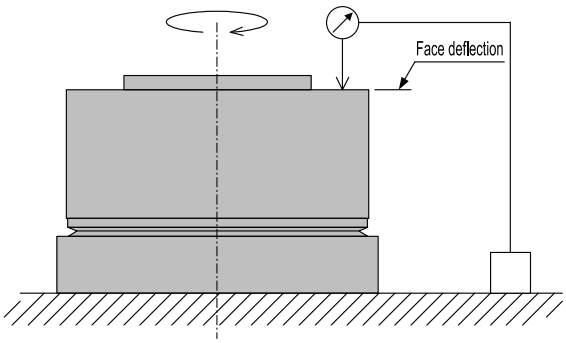
Run out of output shaft

The out-of-roundness of the spigot side of the table installation surface.



Surface run out of output shaft

The out-of-roundness of the table installation surface.

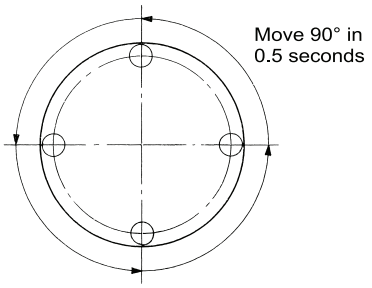


Use cases (1)

Operation specifications 1 (index unit operation)

Operation specifications

- 4 divisions (equally divided by 90°)
- Movement time 0.5 secs
- Index 1 in counterclockwise direction each time start is input from a PLC.



Program example

Main program

Ō1;	Use program No. "1"
G11;	Set the time (sec.) in the NC code F unit.
G101A4;	Split one rotation into 4.
G91.1;	Set the incremental dimensions.
A0F0.5;	Move to the closest index station in 0.5 sec.
N1M0;	Wait for the start signal input from the PLC.
A-1F0.5;	Move one index in 0.5 sec.
J1;	Jump to the sequence No. 1 block.
M30;	Program end

(Note) When using the interactive terminal or Teaching Note, if the program No. 1 is input, Ō1 will be automatically set and does not need to be described.

PLC operation signal example

Initial process: process done only once in the beginning

Process name	I/O signal name	PLC output	PLC input	Remarks
(1) Program no. selection	· No. selection bit 0 · No. selection bit 1 · No. selection bit 2 · No. selection bit 3 · No. setting first digit			Select program No. 1 (Select the program number you will be using. Program No.1 isselected in this example.)
(2) Return process	· Start signal · Positioning completion signal · Start input waiting output			Return complete by using positioning complete signal

Indexing process: process done each time when indexing

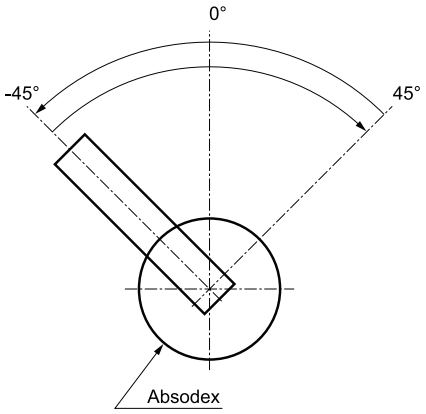
Process name	I/O signal name	PLC output	PLC input	Remarks
(3) Index	· Start signal · Positioning completion signal · Start input waiting output			Return complete by using positioning complete signal

(Note) Input the program No. selection and start signal when the start input waiting output turns ON.

Operation specifications 2 (oscillator unit operation)

Operation specifications

- Movement between -45° and 45° is repeated each time start is input from a PLC.
- Movement time 0.7 secs
- Applies the brakes when stopping (Note 1)
- Enables emergency stop input (Note 2)



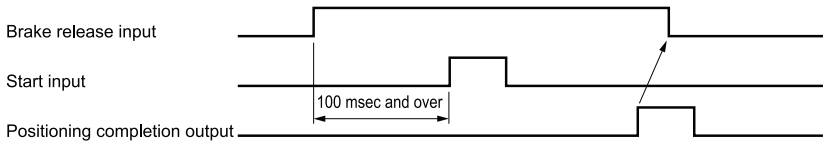
Program example

Main program

O2;	Use program No. "2".
G105;	Set the unit of NC code A to angle (°).
G11;	Set the time (sec.) in the NC code F unit.
G90;	Set the absolute dimensions.
N1M69;	Release brake.
A45F0.7;	Move to 45°in 0.7 seconds.
M68;	Activate brake.
M0;	Wait for the start signal input from the PLC.
M69;	Release brake.
A-45F0.7;	Move to -45°in 0.7 seconds.
M68;	Activate brake.
M0;	Wait for the start signal input from the PLC.
J1;	Jump to the sequence No. 1 block.
M30;	Program end

Note 1: Use an Absodex with brakes.
When using the type with optional magnetic brakes, refer to the section "Using the magnetic brakes" (on page 13 in the introduction).

Note 2: If an emergency stop is input during braking, the brakes will function even after the emergency stop is reset.
When inputting the start signal without selecting the program No. again, release the brakes with the brake release signal, and then input the first start signal.



Selection guide

Units and symbols for operation condition specifications	
Load inertia moment (kg•m²)	J
Movement angle (°)	ψ
Movement time (s)	t_1
Cycle time (s)	t_0
Load friction torque (N•m)	T_F
Work torque (N•m)	T_W
Cam curve	Select from MS, MC, MT, and TR

1. Load inertia moment

Calculate the load movement of inertia, and temporarily select an actuator that handles inertia movement.

2. Rotation speed

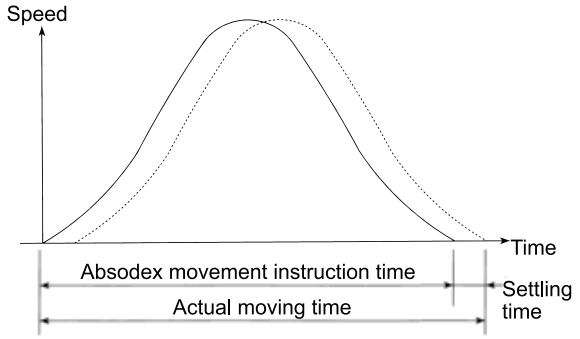
The maximum rotation speed Nmax is determined by

$$N_{max}=V_m \cdot \frac{\psi}{6 \cdot t_1} \quad \text{(rpm)}$$

where ψ (°) is the movement angle and t_1(s) is the movement time. V_m is a constant that is determined by the cam curve.

Confirm that Nmax does not exceed the actuator's specified maximum rotation speed.

<Precautions>
The actual movement time is the result of adding the settling time to the Absodex movement instruction time.



The settling time differs according to the working condition, but generally is between 0.025 and 0.2 s.
Use the Absodex movement instruction time for the movement time t_1 in model selection. In addition, use the Absodex movement instruction time for the designation of the movement time in an NC program.

(Note) Frictional torque is applied to the output shaft due to the bearing or sliding surface or other friction. Friction torque is calculated with a relational formula.
Tf = μ•Ff•Rf (N•m)
Ff = m•g
where μ : Coefficient of friction

Rolling friction	Sliding friction
μ = 0.03 to 0.05	μ = 0.1 to 0.3

Ff : Force applied to rolling surface and bearings, etc. (N)
Rf : Average friction radius (m)
m : Weight (kg)
g : Gravitational acceleration (m/s²)

3. Load torque

a) The maximum load torque is obtained with the following formula.

$$T_m=[A_m \cdot (J+J_M) \cdot \frac{\psi \cdot \pi}{180 \cdot t_1^2}+T_F+T_W] \cdot fc+T_{MF}$$

b) The effective value of the load torque is obtained with the following formula.

$$T_{rms}=\sqrt{\frac{t_1}{t_0} \cdot [r \cdot A_m \cdot (J+J_M) \cdot \frac{\psi \cdot \pi}{180 \cdot t_1^2} \cdot fc]^2+(T_F \cdot fc+T_W \cdot fc+T_{MF})^2}$$

Here, use the values in the following table for Vm, Am, and r.

Cam curve	V_m	A_m	r
MS	1.76	5.53	0.707
MC	1.28	8.01	0.500
MT	2.00	4.89	0.866
TR	2.18	6.17	0.773

J_M, T_{MF}, and f are as follows:
J_M : Output shaft's moment of inertia (kg•m²)
T_{MF} : Output shaft friction torque (N•m)
fc : Usage factor (fc = 1.5 under normal use)

Regarding the actuator selected temporarily
Maximum load torque < Maximum output torque
Effective load torque value < Continuous output torque
If either of the conditions above is not met, increase the actuator size, and recalculate the load torque.

Note) There is a torque limit region where the maximum torque is reduced during high-speed rotation.
When using the actuator in the torque limit region, use the model selection software to check whether the actuator can be used.

(Note) The work torque expresses, with a torque value, the external load, etc., applied on the output shaft as a load.

Calculate the work torque TW using the following formula.
$T_W=F_W \times R_W$ (N•m)
F_W (N) : Force required for work
R_W (m) : Work radius
(e.g.)
If the actuator is oriented horizontally (the output shaft is horizontal), table, work, and jig, etc. are the work torque.

4. Regenerative power

For AX9000TS and AX9000TH type drivers, use the following simplified formula to calculate the regenerative power and determine whether the drivers can be used.

●AX9000TS type driver

AX9000TS type driver does not have a built-in regenerative resistor.
Therefore, check that the energy that can be charged with the capacitor (table below) does not exceed the regenerative energy value determined using the simplified formula below.

$$E=\left(\frac{V_m \cdot \psi \cdot \pi}{t_1 \cdot 180}\right)^2 \cdot \frac{(J+J_M)}{2} \text{ (J)}$$

Power specifications	Processable regenerative energy (J)	Remarks
AC200V	17.2	When the input voltage to the main voltage supply is 200 VAC
AC100 V (-J1)	17.2	When the input voltage to the main voltage supply is 100 VAC

If this condition cannot be met, consult with CKD.

●AX9000TH type driver

With AX9000TH type driver, the power regenerated by the consumption capacity of the regenerative resistor is limited.
It is determined using the following simplified formula.

$$W=\left(\frac{V_m \cdot \psi \cdot \pi}{t_1 \cdot 180}\right)^2 \cdot \frac{(J+J_M)}{2 \cdot t_0} \text{ (W)}$$

$W \leqq 40$

If this condition is not satisfied, reconsider operation and load conditions.

<Usage conditions>
Table radius : R = 0.4 (m)
Table weight : Wt = 79 (kg)
Jig rotational radius : Re = 0.325 (m)
Jig weight : Wj = 10 (kg/piece)
(includes the work weight)
Number of jigs : N = 4

<Operating conditions>
Movement angle : ψ = 90 (°)
Movement time : t_1 = 0.8 (s)
Cycle time : t_0 = 4 (s)
Load friction torque : T_F = 0 (N•m)
Work torque : T_W = 0 (N•m)
Output shaft friction torque : T_{MF} (N•m) depends on the actuator specifications
Cam curve : MS (modified sine)

STEP 1 Calculation of moment of inertia

a) Table $J_1 = \frac{W_t \times R^2}{2} = \frac{79 \times 0.4^2}{2} = 6.32$ (kg•m²)

b) Jig and workpiece $J_2 = N \times W_j \times R_e^2 = 4 \times 10 \times 0.325^2 = 4.225$ (kg•m²)

c) Total sum of moment of inertia $J = J_1 + J_2 = 6.32 + 4.225 = 10.545$ (kg•m²)

STEP 2 Max. rotation speed

$$N_{max} = V_m \cdot \frac{\psi}{6 \cdot t_1} = 1.76 \times \frac{90}{6 \times 0.8} = 33 \text{ (rpm)}$$

Confirm that Nmax does not exceed the Absodex's maximum rotation speed.

STEP 3 Load torque

Calculate the smallest model that can tolerate the load moment of inertia.
The AX4300T allowable moment of inertia is 180 (kg•m²) or over, so this load is allowable.

Max. load torque

$$T_m = [A_m \cdot (J + J_M) \cdot \frac{\psi \cdot \pi}{180 \cdot t_1^2} + T_F + T_W] \cdot fc + T_{MF}$$

$$= [5.53 \times (10.545 + 0.326) \times \frac{90 \times \pi}{180 \times 0.8^2} + 0 + 0] \times 1.5 + 10$$

$$= 231.3 \text{ (N•m)}$$

Effective load torque

$$T_{rms} = \sqrt{\frac{t_1}{t_0} \cdot [r \cdot A_m \cdot (J + J_M) \cdot \frac{\psi \cdot \pi}{180 \cdot t_1^2} \cdot fc]^2 + (T_F \cdot fc + T_W \cdot fc + T_{MF})^2}$$

$$T_{rms} = \sqrt{\frac{0.8}{4} \times [0.707 \times 5.53 \times 10.871 \times \frac{90 \times \pi}{180 \times 0.8^2} \times 1.5]^2 + (0 \times 1.5 + 0 \times 1.5 + 10)^2}$$

$$= 70.7 \text{ (N•m)}$$

STEP 4 Regenerative electric power

$$W = \left(\frac{V_m \cdot \psi \cdot \pi}{t_1 \cdot 180} \right)^2 \cdot \frac{(J + J_M)}{2 \cdot t_0}$$

$$= \left(\frac{1.76 \times 90 \times \pi}{0.8 \times 180} \right)^2 \times \frac{10.871}{2 \times 4} = 16.23 \text{ (W)}$$

$W \leqq 40$ (W)

STEP 5 Selection guide

Determine if the selected AX4300T can be used.

Total sum of load moment of inertia	10.545 ≦ 180	(kg•m²)
Max. rotation speed	33 ≦ 100	(rpm)
Max. load torque	231.3 ≦ 300	(N•m)
Effective load torque	70.7 ≦ 100	(N•m)
Regenerative electric power	16.23 ≦ 40	(w)

Thus, AX4300T can be used.

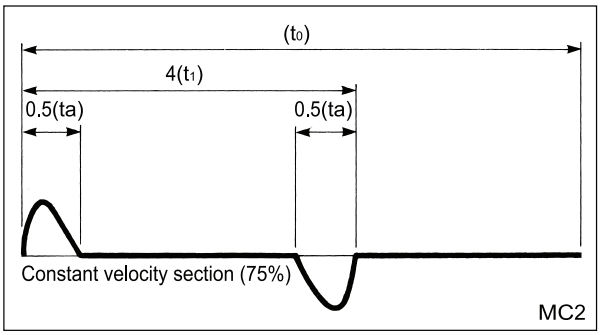
When selecting a model for "MC2 curve"

What is the MC2 curve?

The MC2 curve has a constant velocity in movement the same as the MC (modified constant velocity) curve, but by setting an acceleration/deceleration time, the constant velocity is set freely. With the MC (general name: MCV50) curve, the constant velocity section is 50%.

Note. Acceleration/deceleration time is set to one-half or less of movement time. If acceleration/deceleration time setting exceeds one-half of movement time, the cam curve is automatically changed to an MS (modified sine wave) curve.

In the example, acceleration/deceleration time (ta) is set to 0.5 sec. for movement time (t_1): 4 sec., a speed pattern that sets the constant velocity to 75% is created.



Selection procedure

With the MC2 curve, the model is selected using the following formula:

Movement angle	: ψ (°)
Cycle time	: t_0 (s)
Movement time	: t_1 (s)
Acceleration/deceleration time	: ta (s)
Load inertia moment	: J (kg•m^2)
Output shaft moment of inertia	: J_M (kg•m^2)
Friction torque	: Tf (N•m)
Work torque	: T_w (N•m)
Output shaft friction torque	: T_{MF} (N•m)

Maximum speed: Nmax (rpm)

$$Nmax = \frac{\psi}{6(t_1-0.863ta)}$$

Load torque (max.): T_m (N•m)

$$Tm = \left[5.53(J+J_M) \cdot \frac{\psi \cdot \left(1-\frac{t_1-2ta}{t_1-0.863ta}\right) \cdot \pi}{720 \cdot ta^2} + Tf + T_w\right] \cdot fc + T_{MF}$$

Load torque (min.): Trms (N•m)

$$Trms = \sqrt{\frac{2ta}{t_0} \cdot \left[3.91(J+J_M) \cdot \frac{\psi \cdot \left(1-\frac{t_1-2ta}{t_1-0.863ta}\right) \cdot \pi}{720 \cdot ta^2} \cdot fc\right]^2 + [(Tf+Tw) \cdot fc+T_{MF}]^2}$$

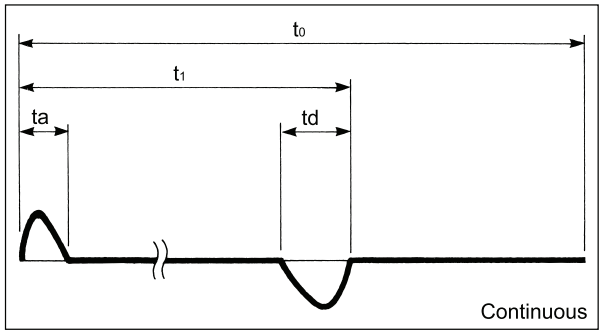
When selecting a model for "continuous rotation"

What is continuous rotation?

Continuous rotation has the following features.

1. Continuous Rotation	: Continuously rotates at a set speed until the continuous rotation stop signal is input.
2. Equal division position stop	: If used with equal division designation, stops at an equal division when the continuous rotation stop signal is input.

In the example, the shaft accelerates at acceleration time ta to set speed N, and when a continuous rotation stop is input, stops with deceleration time td.



Selection procedure

With continuous rotation, the model is selected using the following formula:

Speed	: N (rpm)
Cycle time	: t_0 (s)
Acceleration time	: ta (s)
Deceleration time	: td (s)
Load inertia moment	: J (kg•m^2)
Output shaft moment of inertia	: J_M (kg•m^2)
Friction torque	: Tf (N•m)
Work torque	: Tw (N•m)
Output shaft friction torque	: T_{MF} (N•m)

Maximum speed: Nmax (rpm) (Note 1)

Nmax = N

Load torque (max.): Tm (N•m)

$$Tm = \left[5.53(J+J_M) \cdot \frac{6.82N \cdot ta \cdot \pi}{720 \cdot ta^2} + Tf + Tw\right] \cdot fc + T_{MF}$$

Load torque (min.): Trms (N•m)

$$Trms = \sqrt{\frac{2ta}{t_0} \cdot \left[3.91(J+J_M) \cdot \frac{6.82N \cdot ta \cdot \pi}{720 \cdot ta^2} \cdot fc\right]^2 + [(Tf+Tw) \cdot fc+T_{MF}]^2}$$

The above formula applies for ta≦td. If ta>td, then replace ta with td, and select.

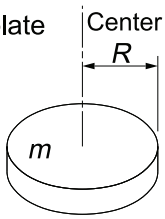
Note 1) When continuous rotation is used, the maximum speed is limited. Follow the actuator specifications.

Inertia moment formulas

[*m*: Weight of object (kg)]

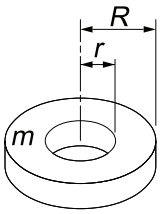
● A When rotation center is own shaft

1. Circular plate (cylinder)



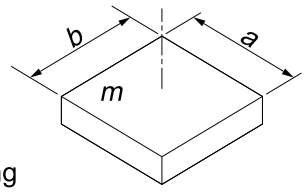
$$I = \frac{mR^2}{2}$$

2. Hollow circular plate (hollow cylinder)



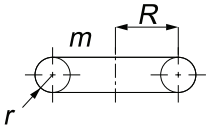
$$I = \frac{m\,(R^2 + r^2)}{2}$$

3. Cuboid



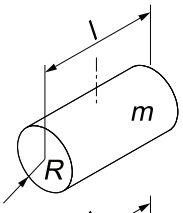
$$I = \frac{m\,(a^2 + b^2)}{12}$$

4. Ring



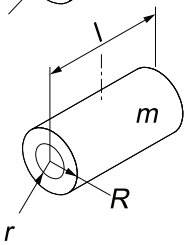
$$I = \frac{m\,(4R^2 + 3r^2)}{4}$$

5. Cylinder



$$I = \frac{m\,(3R^2 + l^2)}{12}$$

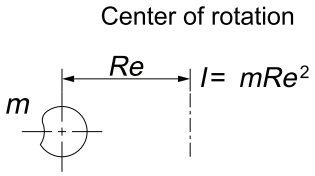
6. Hollow cylinder



$$I = \frac{m(R^2 + r^2 + l^2/3)}{4}$$

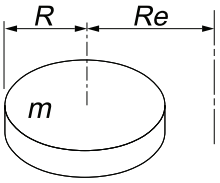
● B When rotation center differs from own shaft

1. Any shape (if sufficiently small)



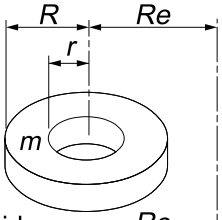
$$I = mRe^2$$

2. Circular plate (cylinder)



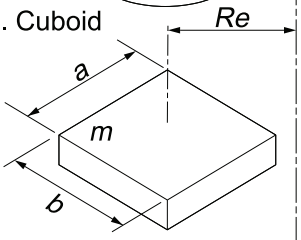
$$I = m\left(\frac{R^2}{2} + Re^2\right)$$

3. Hollow circular plate (hollow cylinder)



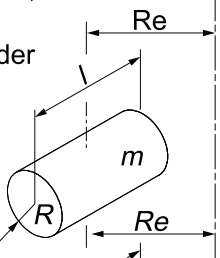
$$I = m\left(\frac{R^2 + r^2}{2} + Re^2\right)$$

4. Cuboid



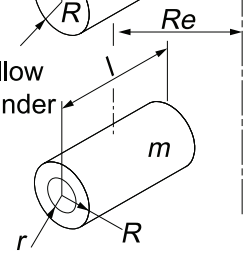
$$I = m\left(\frac{a^2 + b^2}{12} + Re^2\right)$$

5. Cylinder



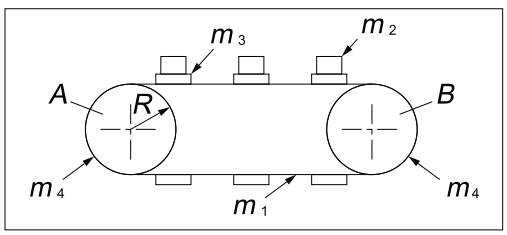
$$I = m\left(\frac{3R^2 + l^2}{12} + Re^2\right)$$

6. Hollow cylinder



$$I = m\left(\frac{R^2 + r^2 + l^2/3}{4} + Re^2\right)$$

● For conveyor



m_1 : Chain weight
m_2 : Workpiece total weight
m_3 : Jig (pallet) total weight
m_4 : Sprocket A (drive) + B total weight
R : Drive side sprocket radius

$$I = (m_1 + m_2 + m_3 + \frac{m_4}{2}) \cdot R^2$$

Absodex selection guide specifications check sheet Table direct drive			(Note) Contact CKD for chain drives and gear drives.
Your company name		Your name	
Division			
TEL		FAX	

■ Operating conditions

1. Index	2. Oscillator		
Movement angle	Ψ (°)		or no. of indexes
Movement time	t1 (sec.)		
Cycle time	t0 (sec.)		cycle time=moving time+dwelling time

(Note) Index time is movement time + settling time.
The settling time differs according to the working condition, but generally is between 0.025 and 0.20 s.

■ Load conditions

Table

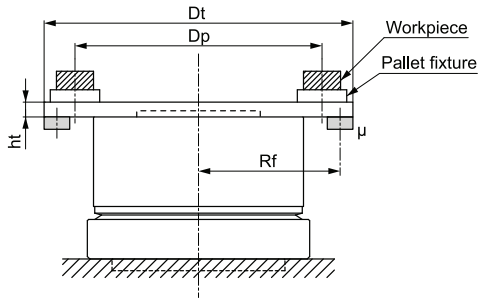
Material	1. Steel 2. Aluminum	
Outline	Dt (mm)	
Plate thickness	ht (mm)	
Weight	m1 (kg)	

Workpiece

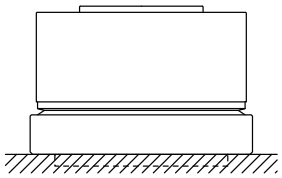
Quantity	nw (pc.)	
Max. weight	mw (kg/pc.)	
Installation center	Dp (mm)	

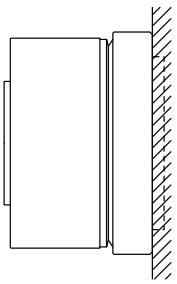
Pallet fixture

Quantity	nw (pc.)	
Max. weight	mw (kg/pc.)	



(Fig.1) Load conditions


(Fig.2) Installation orientation: Horizontal


(Fig.3) Installation orientation: Vertical

■ Others

Installation orientation

1. Horizontal (Fig.2) 2. Vertical (Fig. 3)	

External job

1. No	2. Yes	

(Note) Eccentric load caused by gravity from vertical installation, external load caused by caulking work.

Dial plate support form bottom

1. No	2. Yes	
Coefficient of friction	μ	
Work radius	Rf (mm)	

Device rigidity

1. High	2. Low (Note)	

(Note) When using a spline, when unit cannot be fixed directly onto the device (Fig. 4), when there is a mechanism such as a chuck on the table.

Extension with table shaft

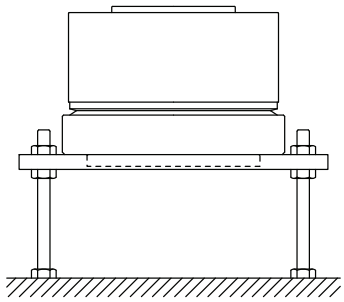
1. No	2. Yes (Fig.5)	

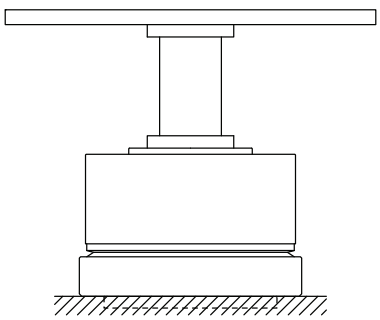
Actuator movement

1. No	2. Yes	

(Note) When actuator is mounted on X-Y table or vertical mechanism, etc., and mounted actuator moves.

(Note) If 2 is selected for any item, contact CKD.


(Fig.4) Installation rigidity: Low


(Fig. 5) Extension with shaft

(Note) Attach system outline and reference drawings so that the optimal model can be selected.

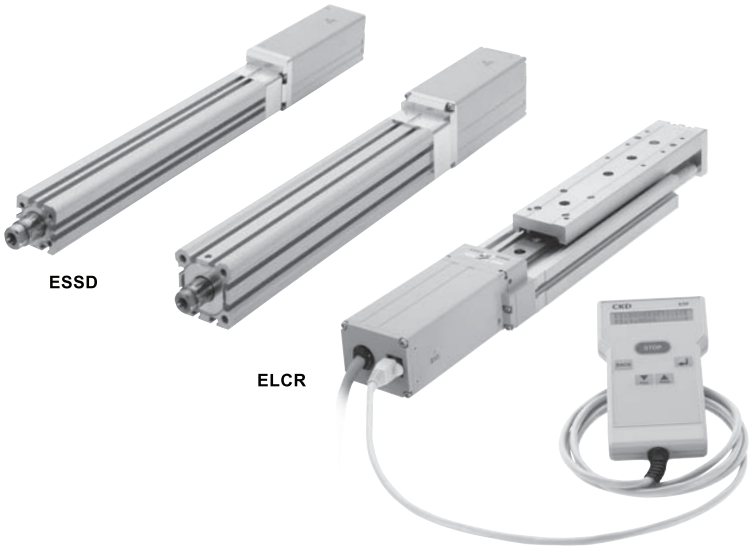
A wide range of variations to help save space

Electrical actuator ESSD/ELCR Series

New electric actuators that are easy to use as pneumatic components

Main features

- Built-in controller
- Designable like a pneumatic cylinder
- Flexible control
- Easy teaching
- Improved reliability



Environmentally friendly
Replacements for pneumatic cylinders

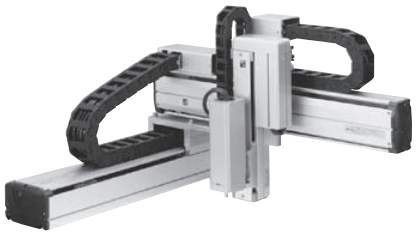
Electrical actuator
KBB Series

Combination of up to 4 shafts.
4 motor installation positions for each shaft.
Select the best arrangement for the installation space to save space.

Main features

- Wide range: 50 to 400 W
- High speed and high precision
- Absolute specifications
- 2 types: ball screw and timing belt drive
- Reduction of repair parts inventory through BBS

KBB



Ultra-thin, small, light weight

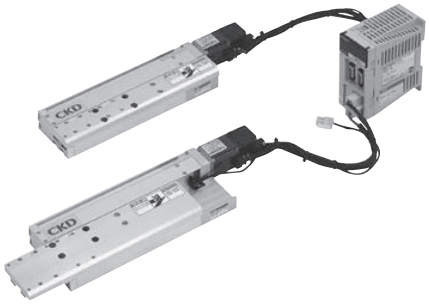
Electrical compact table slider
KSA Series

Ultra compact electric actuator with 30 mm thickness.
Flexible positioning, easy to combine 2 shafts.

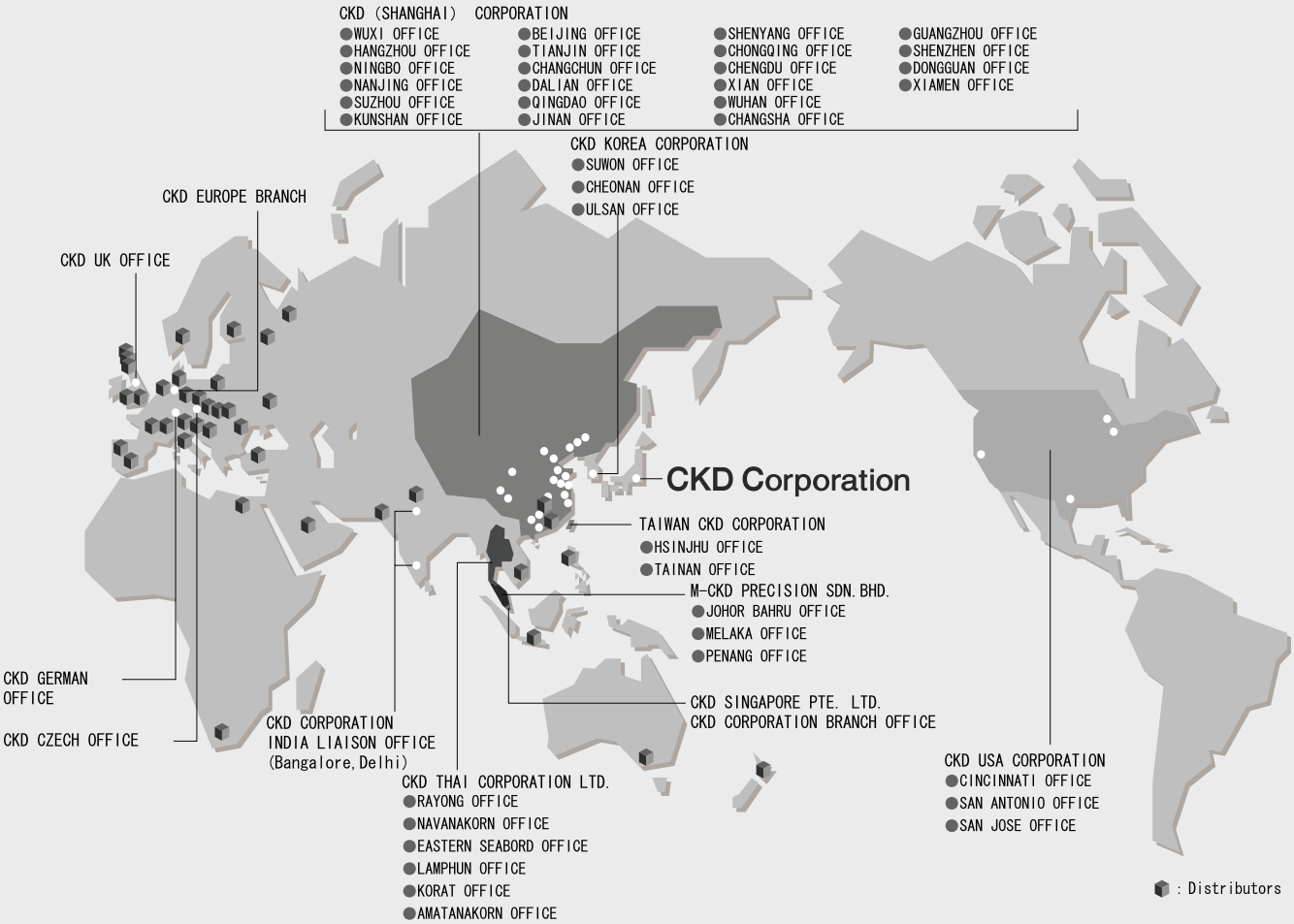
Main features

- 30 W miniature AC servo motor
- High precision linear guide
- 2 types for different loads
- High speed transfer, 500 mm/s max.
- Supports 15 point designation and pulse string input

KSA



WORLD-NETWORK



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