



"Instantaneous positioning" quick response direct drive actuator ABSODEX

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

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



User friendly driver with
serial communication



CC-Link

DeviceNet

PROFIBUS-DP

CKD Corporation

CC-995A 9

Setup easier than ever before!
 “Instantaneous positioning! Quick response
 direct drive actuator ABSODEX”

RoHS

AX 1000T 2000T 4000T Series



Quick setup!
Quick positioning!

High precision, high-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

Production facilities can be built on eco-friendly features such as energy saving, space saving, oil free, and reusability.

Highly compatible (AX1000T, AX2000T, and AX4000T)

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

1. Shorter tact time for equipment

- Improved response reduces time loss
 Instantaneous positioning reduces stabilization time to 1/4 (based on CKD measurement result)
- Reduced start time 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) as standard.
- Control is on even when the motor is off
 Power supply separated from control power supply.

3. Safety Standards

- Safety standard certifications (Safe Torque Off function)

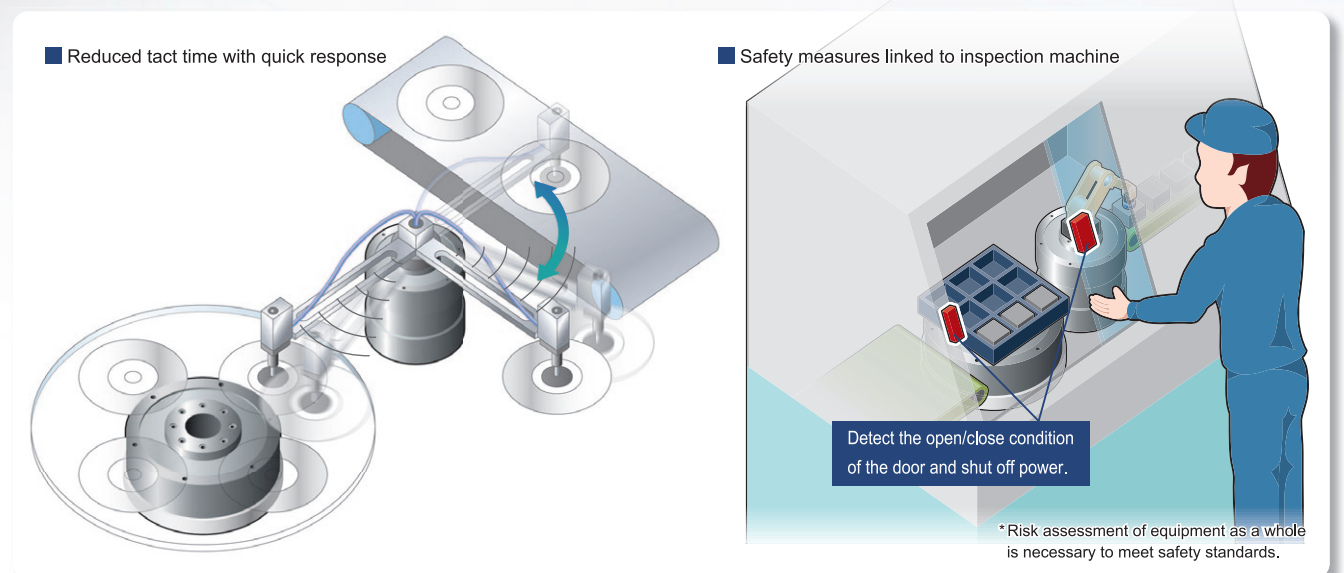
4. Overseas Standards

- UL/cUL, CE compliant



5. Downsized GH/WGH type drivers

- Volume reduced to 65%, 50 mm shorter depth



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

Advantages of TS/TH-type drivers

● 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 (max. 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.

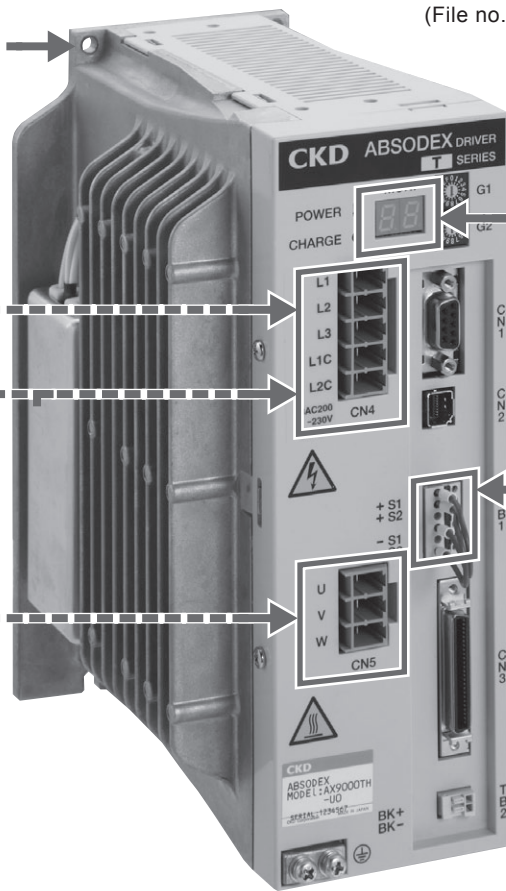
● There are mounting holes on the body. They eliminate the need for using mounting brackets, which saves setup time.

● 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

- Actuator
Conforms to UL1004-1.
Conforms to CSA 22.2 No.100.
(File no. : E328765)
- Driver
Conforms to UL508C.
Conforms to CSA 22.2 No.14.
(File no. : E325064)



● Power supply separated from control power supply
It is now possible to cut off only the main power supply for emergency.

● Connector provided
Easy wiring without crimped terminal. Risks of electric shock lowered since the terminal is not exposed.

● 7 segment LED 2-digit display
Alarm details have been added. They make maintenance easier. The set value for gain adjustment will be shown on the LED. This has improved visibility considerably.

● Terminal for safety function
A power cut off circuit can be provided easily with the STO function (safe torque off).

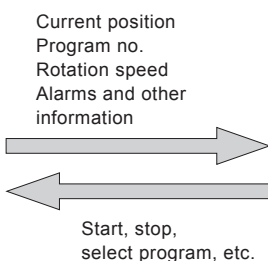
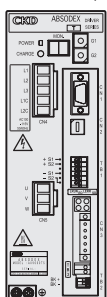
● Supported field bus

- CC-Link Ver1.10
- DeviceNet
- PROFIBUS DP

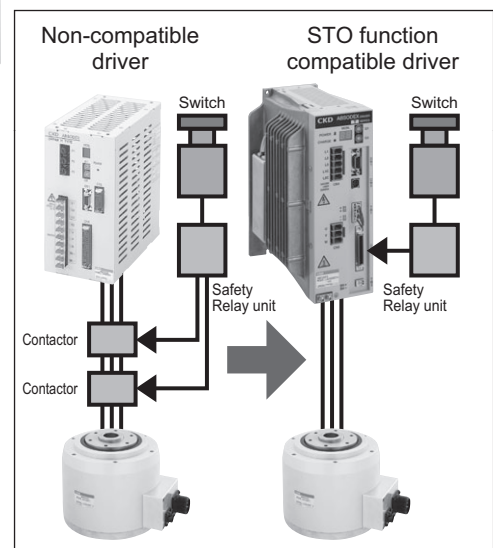
● Monitor with serial communication

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

AX9000TS/TH-U2 (U3, U4)



Master unit
(PLC, etc.)



Installation of contactor for cutting off motor power can be eliminated.

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
Setting in the range of 0 to 100 ms is possible.
- 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 start input + selection 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 also restart 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 tool 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

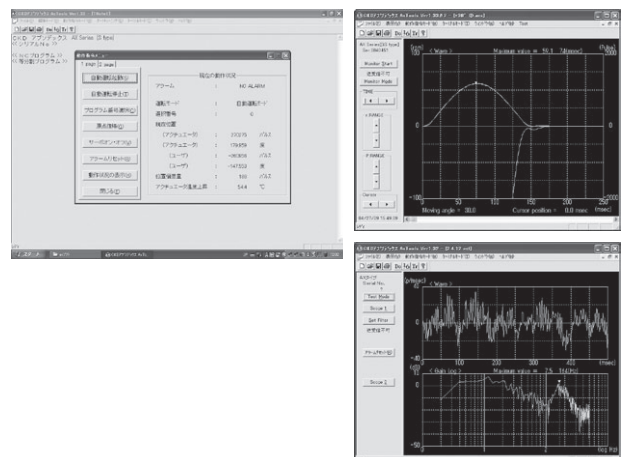
Evaluate tuning by measuring the actual speed change and convergence waveforms.

■ 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 specifications change and reusability

Specifications can be changed by using an interactive terminal, PC, etc. Reuse, which is difficult with mechanical indexed actuator, is also possible.

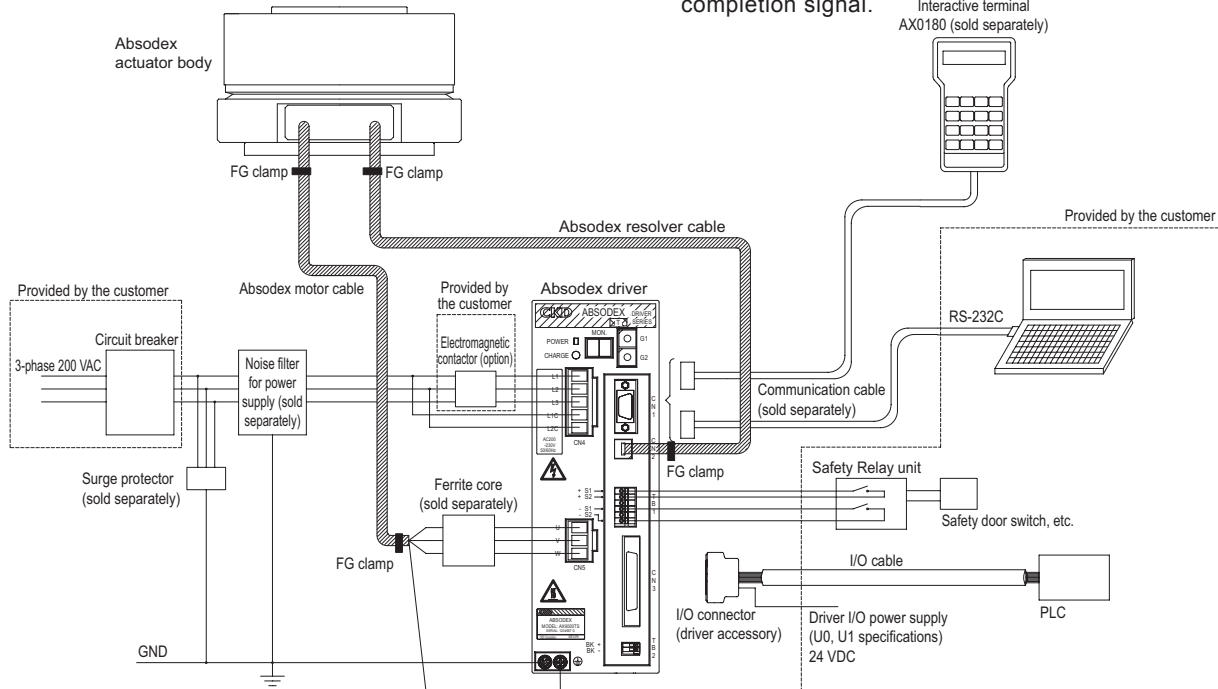
System Configuration

● Basic setting items

1. Input the program from a personal computer or interactive terminal.
2. Specify required parameters in the same way.
3. Set the gain adequately.

● Basic drive methods

1. A program to be executed is selected at the PLC.
2. Start signal is input at the PLC.
3. After driving is started, 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. A PC communication cable (model: AX-RS232C-9P) is required.

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

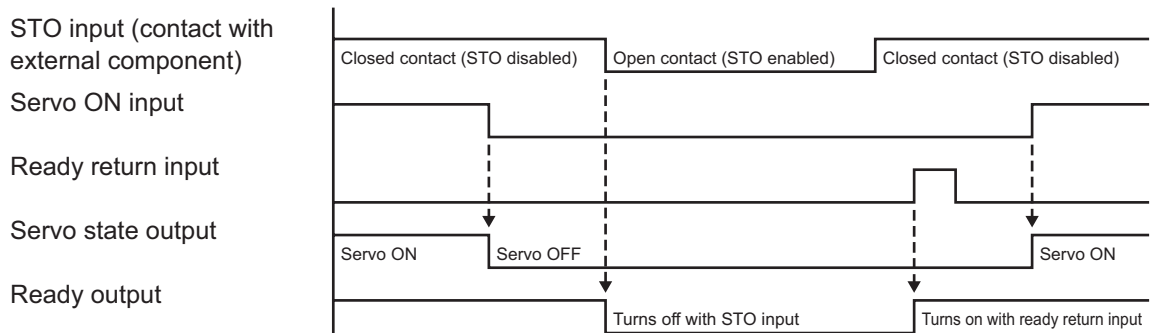
Note) Connect the interactive terminal only when adjusting. Remove the cable from CN1 during normal operation.

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.

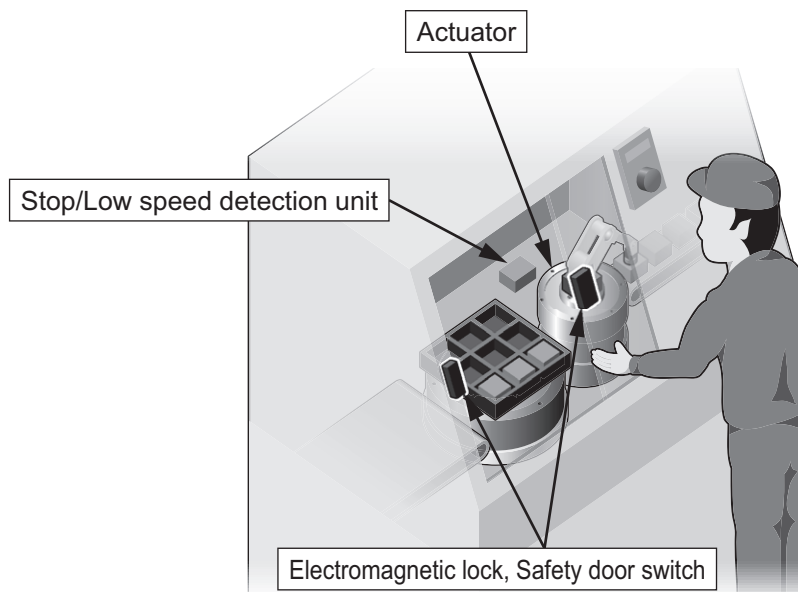
Example of a safety circuit timing chart

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.

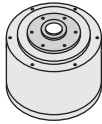

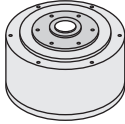
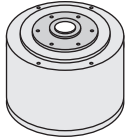




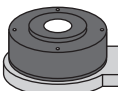
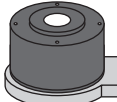
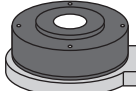
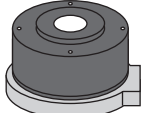



- In normal cases, use the safety feature with the servo OFF.
- Be sure to conduct a risk assessment of the device when using the safety feature.

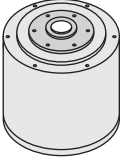
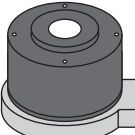
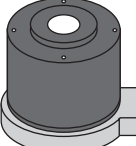
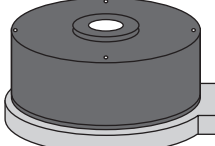

Usage example



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 drivers	TS type driver								
	TH type driver								

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	Torque (N·m)				Index precision (sec.)	Repeatability (sec.)	Features	Applications	Page
	210	300	500	1000					
 AX1210T					±15	±5	<ul style="list-style-type: none"> • High precision model with indexing accuracy and run out of output shaft • High-speed rotation (AX1022TS: 240 rpm, AX1045TS: 240 rpm, AX1075TS: 140 rpm, AX1150TH: 120 rpm, AX1210TH: 120 rpm) 	<ul style="list-style-type: none"> • Precision measurement • Turntable • Inspection machine • Assembly machine 	1 to 6
					±30	±5	<ul style="list-style-type: none"> • High speed rotation (300 rpm) • Small diameter and compact • Large hollow shaft (ø30) 	<ul style="list-style-type: none"> • P&P • Turntable • Assembly machine 	7 to 10
	 AX4300T	 AX4500T	 AX410WT		±30	±5	<ul style="list-style-type: none"> • High speed rotation (AX4009TS: 240 rpm, AX4022TS: 240 rpm, AX4045TS: 240 rpm, AX4075TS: 140 rpm) • Capable of handling loads with large moment of inertia • Large hollow shaft, a variety of size options 	<ul style="list-style-type: none"> • Turntable • Inspection machine • Assembly machine • P&P 	11 to 28
					<p>One driver can operate actuators of any size that are compatible.</p> <p>The controller function enables the actuator's rotation angle, movement time and timer, etc., to be set as desired with an NC program.</p> <p>M code output, encoder output, etc. can be used to connect to an external PLC, motion controller, etc.</p>				29 to 37

AX1000T
AX2000T
AX4000T
AX9000TS
AX9000TH
Cable
AX0180



Safety Precautions

Always read this section before 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 or additionally 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 could 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 in a balanced condition 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 and I/O power.


(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 allowable current 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.

Items listed under "caution" can also possibly lead to serious results depending on the situation. Important details are listed for each; please make sure to follow them.

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.)

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 term:

- 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 Faults 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.

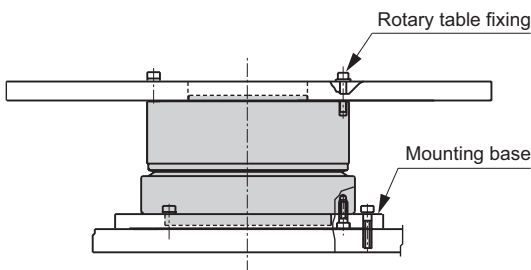


Caution

Design & Selection

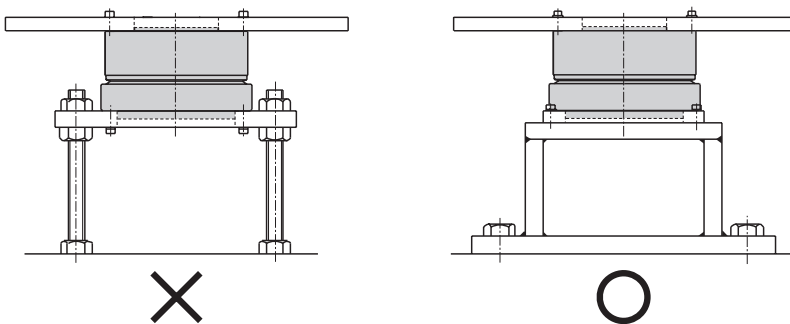
- 1** Actuators and the drivers are not water-proof type. Provide waterproofing when using this where water or oil enters.
- 2** Current leakage and faults could occur if chips or dust get onto the actuator or driver. Check that these do not come in contact with devices.
- 3** Frequent repetition of 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	ø35	ø40	ø46	ø50	ø60
9,12	ø40	ø46	ø55	ø60	ø70
18,22	ø45	ø55	ø65	ø70	ø80
45	ø55	ø65	ø75	ø85	ø95
75	ø62	ø75	ø90	ø95	ø110
150	ø75	ø90	ø110	ø115	ø130
210	ø80	ø95	ø115	ø125	ø140
300	ø90	ø105	ø125	ø140	ø155
500	ø100	ø120	ø145	ø160	ø180
1000	ø120	ø140	ø170	ø185	ø210

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.



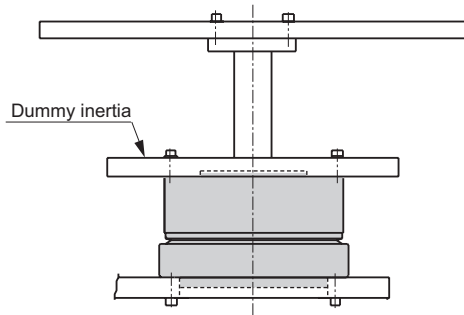
Caution

Design & Selection

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 $[\text{load inertia}] \times (0.2 \text{ to } 1)$. [Fig. 3]

[Fig. 3] Dummy inertia installation example 1

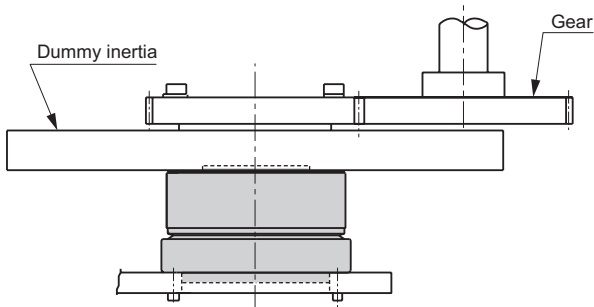


- When coupling with a belt, gears, or spline, or when joining with a key, dummy inertia should be $[\text{load inertia}] \times (0.5 \text{ to } 2)$.
- If speed changes with belts or gears, use load inertia as the actuator output shaft conversion value, and install dummy inertia on the actuator.

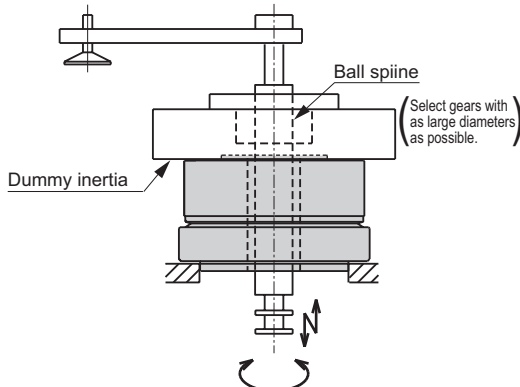
[Fig. 4] [Fig. 5]

(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 installation example 2



[Fig. 5] Dummy inertia installation 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 stroke surges.

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

1. From the Internet

AX_T Data Download

Direct drive actuator quick response type 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.

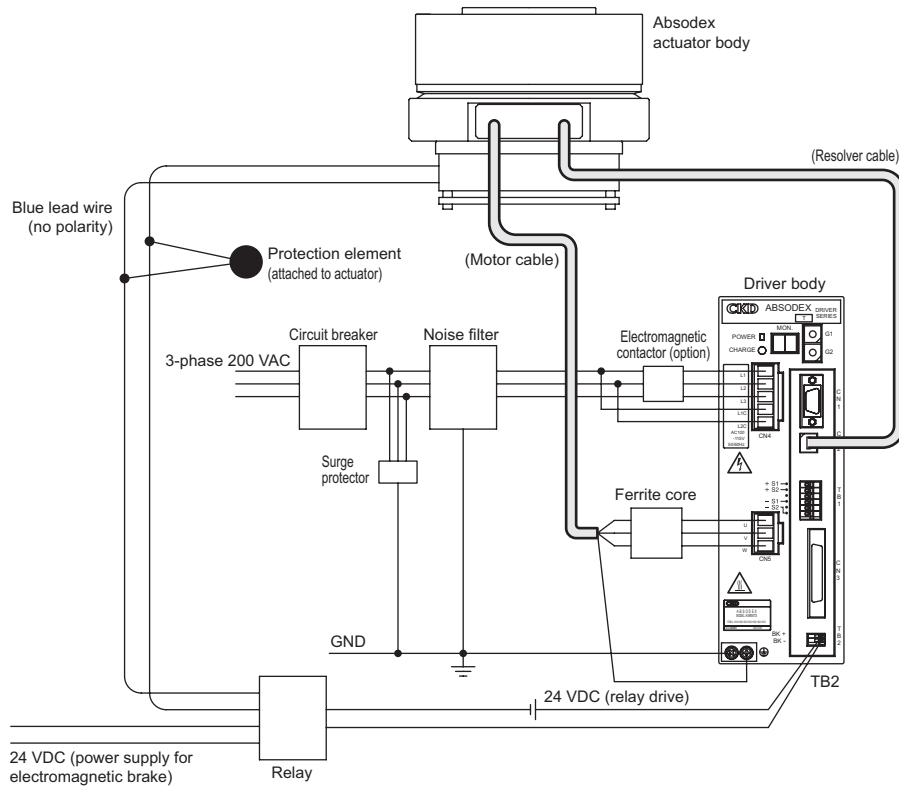
ABSODEX AX Series TS Type/TH Type Technical Information



Caution

Design & Selection

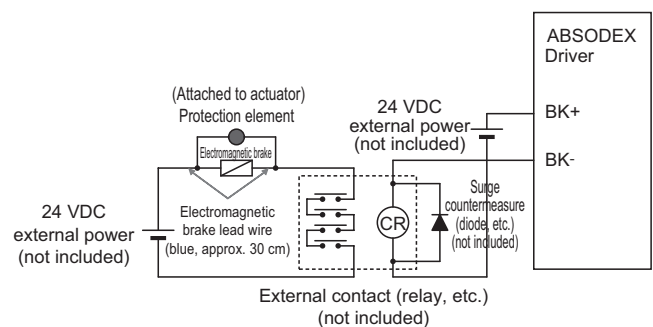
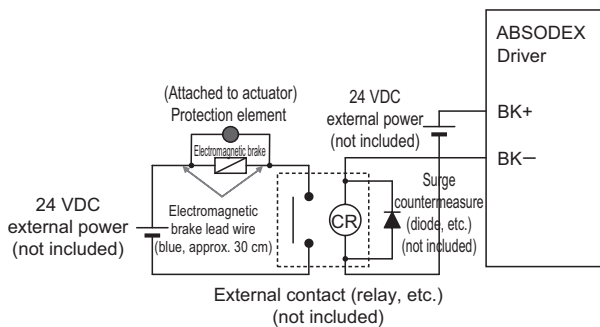
12 Connecting magnetic brakes



- (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 can be 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 use.



Caution

Installation and 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 frequency 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 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 and maintenance

- 1** Do not disassemble the actuator, because this may compromise expected functions and accuracy. Especially, the one with the resolver may lead 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 prevent 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
Direct drive actuator quick response type 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.)

- Max. torque: 22, 45, 75, 150, 210 N·m




Actuator specifications

Descriptions		AX1022T	AX1045T	AX1075T	AX1150T	AX1210T
Max. output torque	N·m	22	45	75	150	210
Continuous output torque	N·m	7	15	25	50	70
Max. 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 moment of inertia	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		
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				
Operating ambient temperature		0 to 45°C (0 to 40°C: Note 3)				
Operating ambient humidity		20 to 85%RH (with no dew condensation)				
Storage ambient temperature		-20 to 80°C				
Storage ambient humidity		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				
Degree of protection		IP20				

Note 1: Use at 80 rpm or less during continuous rotary operation.

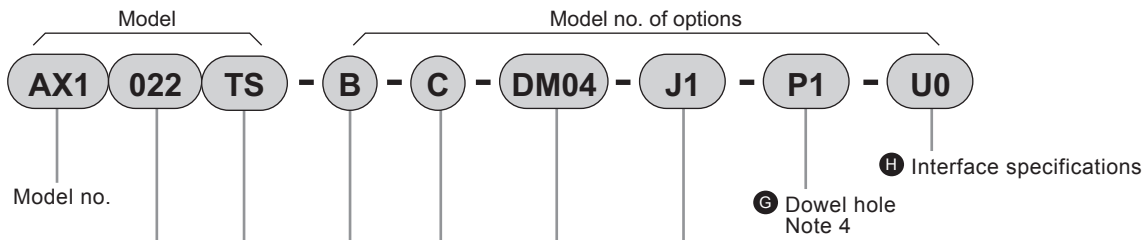
Note 2: For details on index precision, repeatability, run out of output shaft, and surface run out of output shaft, refer to "Terminology" on page 42.

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)



Symbol	Descriptions
A Size (max. torque)	
022	22 N·m
045	45 N·m
075	75 N·m
150	150 N·m
210	210 N·m

B Driver type	
TS	With TS type driver
TH	With TH type driver

C Mounting base	
Blank	Standard (without mounting base)
B	With blackening mounting base

D Connector installation direction	
Blank	Standard (connector horizontal installation)
C	Connector bottom installation

E Cable length	
DM02	2 m
DM04	4 m (standard length)
DM06	6 m
DM08	8 m
DM10	10 m
DM15	15 m
DM20	20 m

F Driver power supply voltage	
Refer to the driver power supply voltage table on the left.	

G Dowel hole	
Blank	Standard (without dowel hole)
P1	Top 1 piece
P2	Bottom 1 piece
P3	Both top and bottom sides 1 piece each

H 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	TS type driver		TH type driver
	3-phase, 1-phase 200 VAC to 230 VAC	1-phase 100 VAC to 115 VAC	3-phase, 1-phase 200 VAC to 230 VAC
AX1022T	Blank	J1	
AX1045T	Blank	J1	
AX1075T	Blank Note 2		
AX1150T			Blank Note 2
AX1210T			Blank Note 2

Note 2: For models whose max. 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.

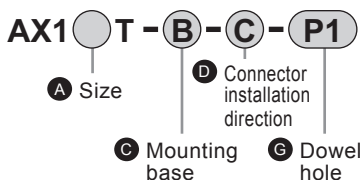
Note 3: The cable is a movable cable.

Refer to page 38 for cable dimensions.

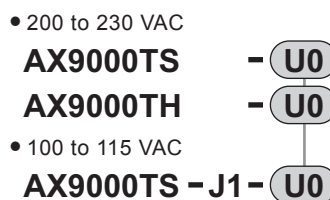
Note 4: **C** For a "B" blackening mounting base, "P2" or "P3" cannot be selected.

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

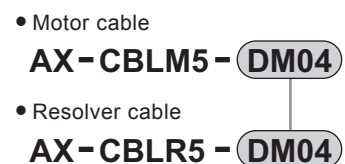
- Actuator model no.



- Driver model no.



- Cable model no.



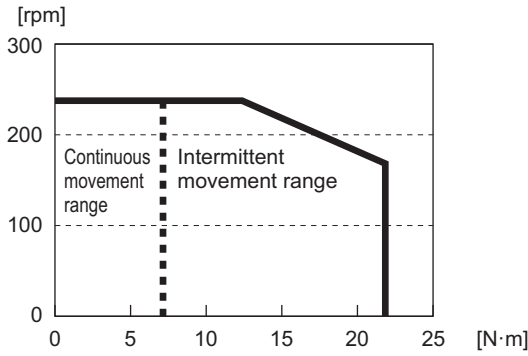
E Cable length
(Note: "04" if the cable length is 4 m)

H Interface specifications

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

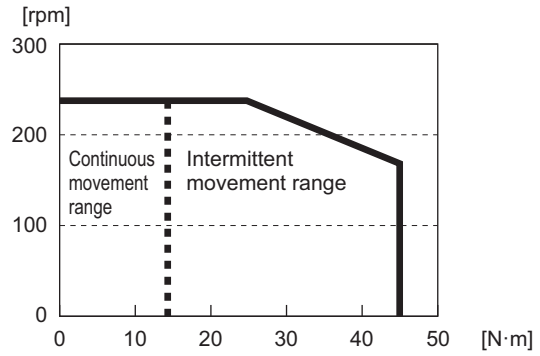
Speed and max. torque characteristics

● AX1022TS



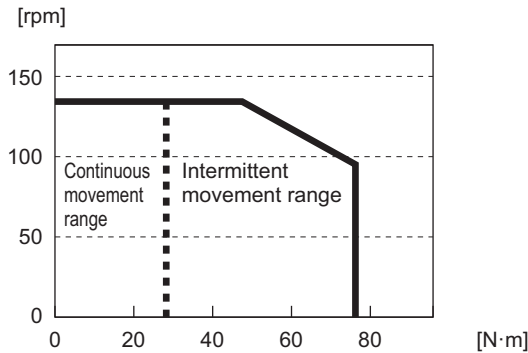
* This graph shows the characteristics for 3-phase 200 VAC.

● AX1045TS



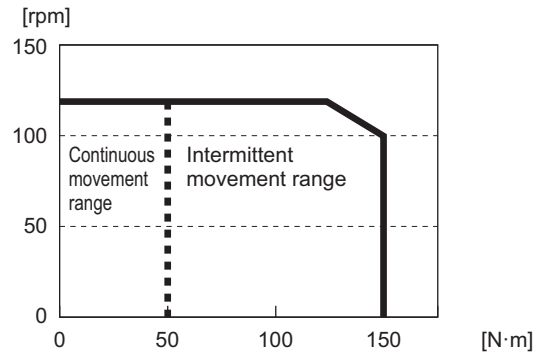
* This graph shows the characteristics for 3-phase 200 VAC.

● AX1075TS



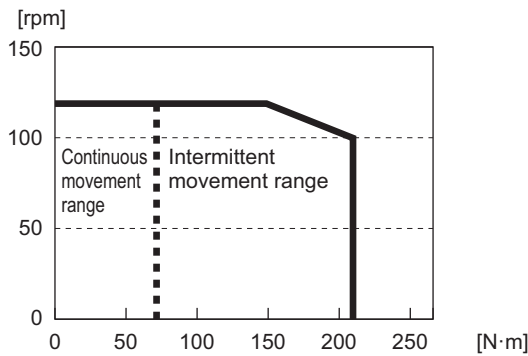
* This graph shows the characteristics for 3-phase 200 VAC.

● AX1150TH



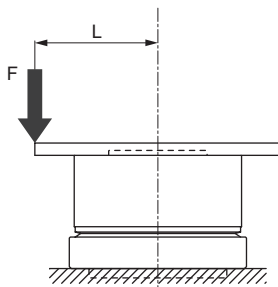
* This graph shows the characteristics for 3-phase 200 VAC.

● AX1210TH



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

(Note) moment load



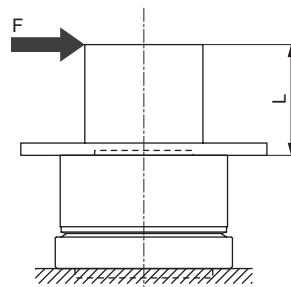
(Fig. a)

$$M \text{ (N}\cdot\text{m)} = F \text{ (N)} \times (L) \text{ (m)}$$

M: Moment load

F: Load

L: Distance from output shaft center




(Fig. b)

$$M \text{ (N}\cdot\text{m)} = F \text{ (N)} \times (L + 0.02) \text{ (m)}$$

M: Moment load

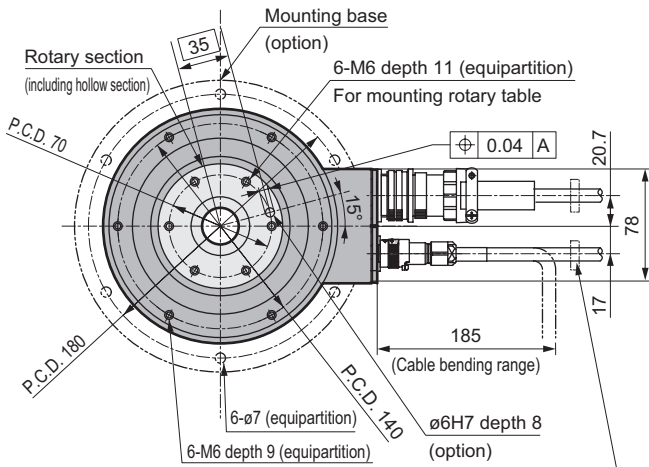
F: Load

L: Distance from output shaft flange

 Read the precautions on Intro 9 to 14 before use.

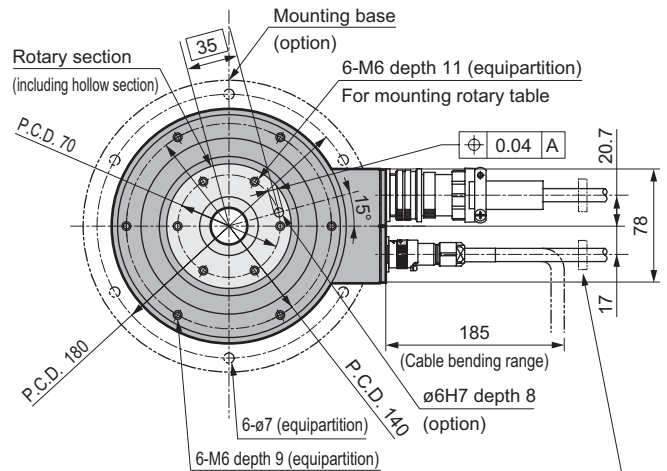
Dimensions

● AX1022T

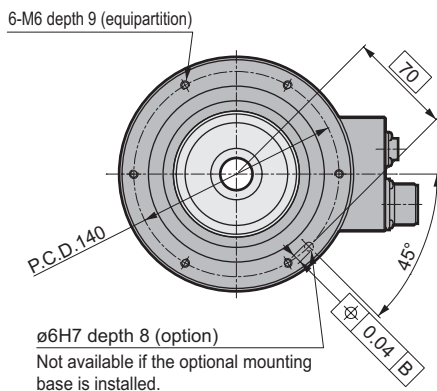
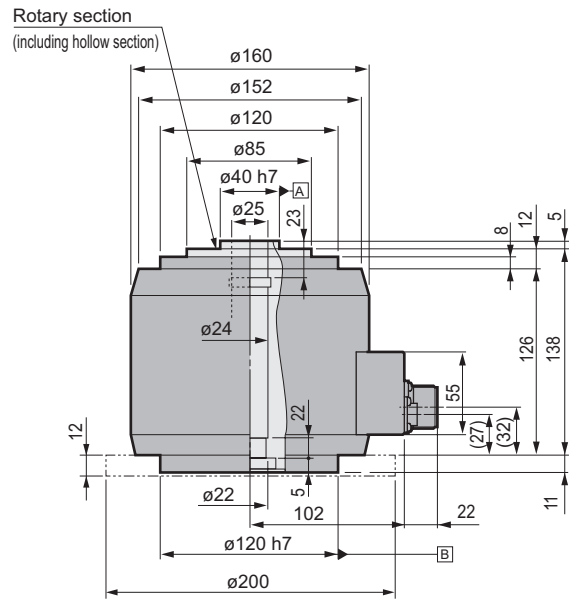
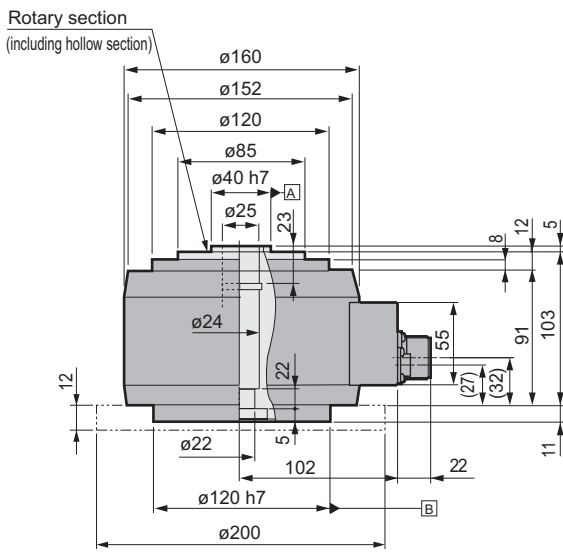


Note)
When the cable needs to be bent repeatedly, fix the cable sheath near the actuator connector.

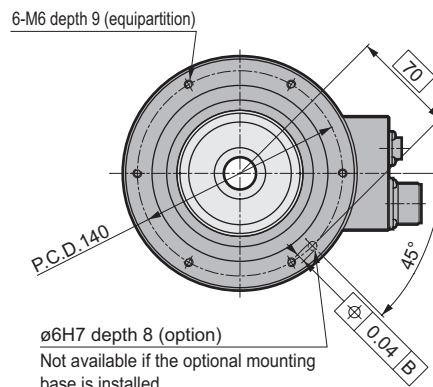
● AX1045T



Note)
When the cable needs to be bent repeatedly, fix the cable sheath near the actuator connector.



ø6H7 depth 8 (option)
Not available if the optional mounting base is installed.



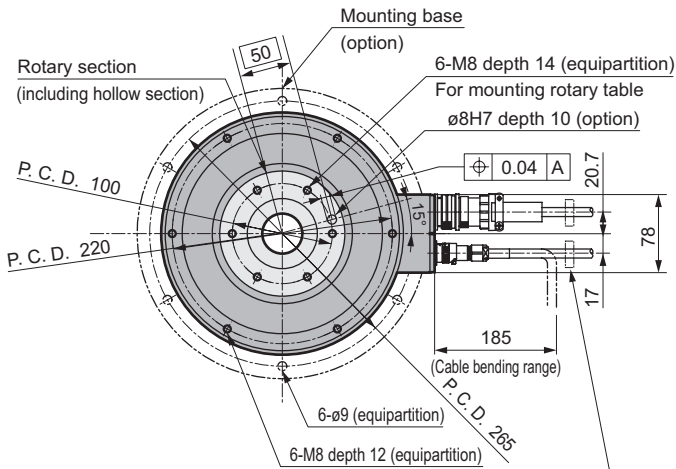
ø6H7 depth 8 (option)
Not available if the optional mounting base is installed.

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

AX1000T Series

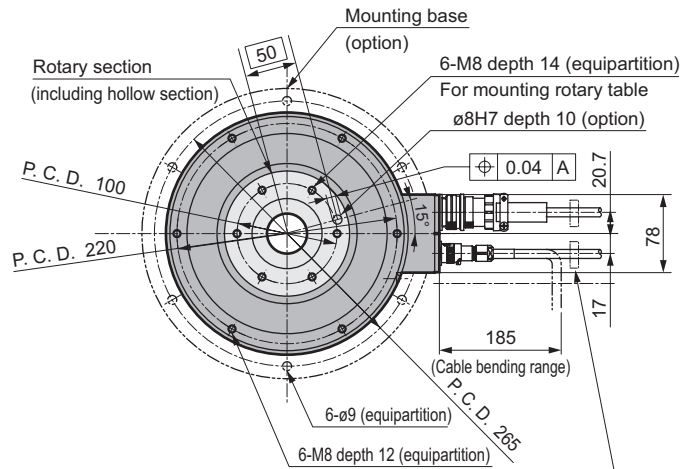
Dimensions

● AX1075T

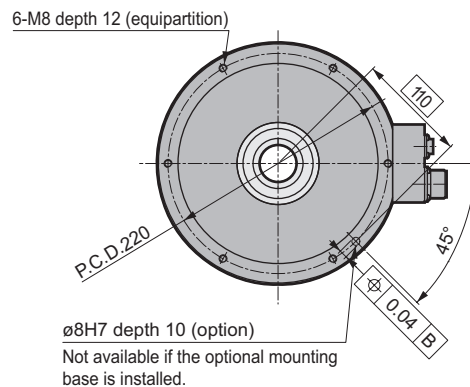
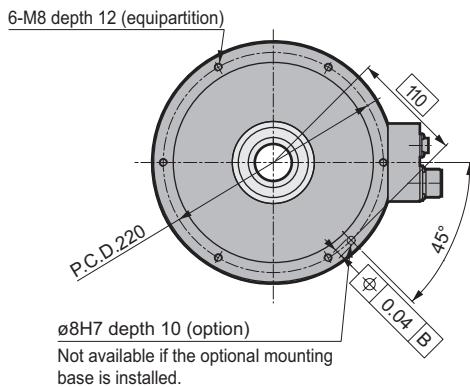
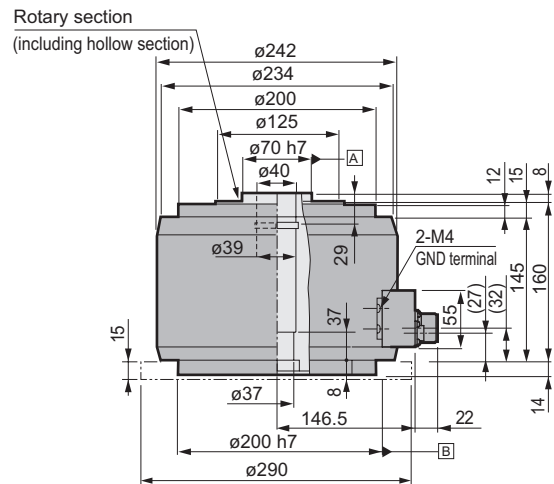
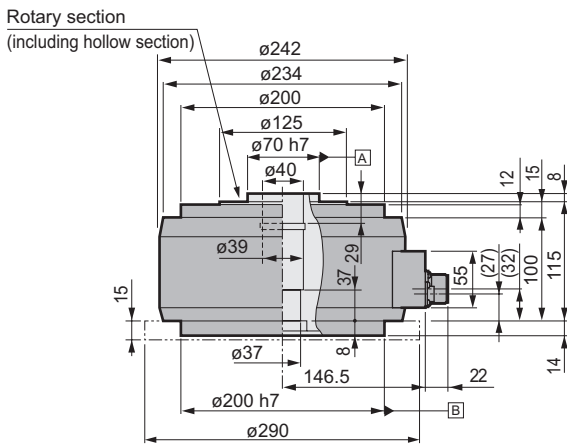


Note)
 When the cable needs to be bent repeatedly, fix the cable sheath near the actuator connector.

● AX1150T



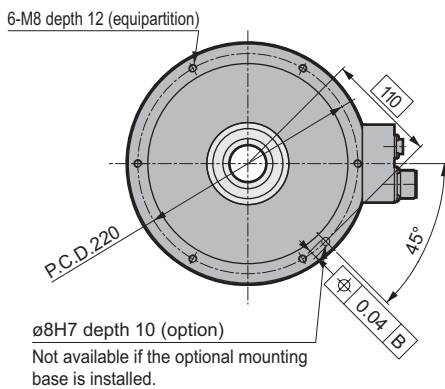
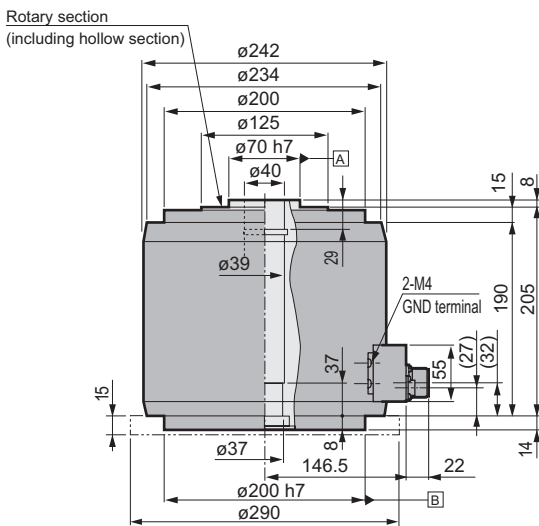
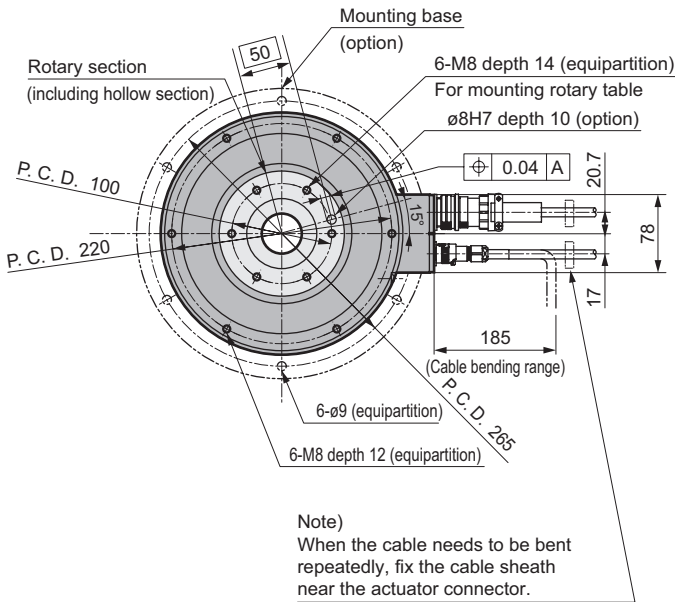
Note)
 When the cable needs to be bent repeatedly, fix the cable sheath near the actuator connector.



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

Dimensions

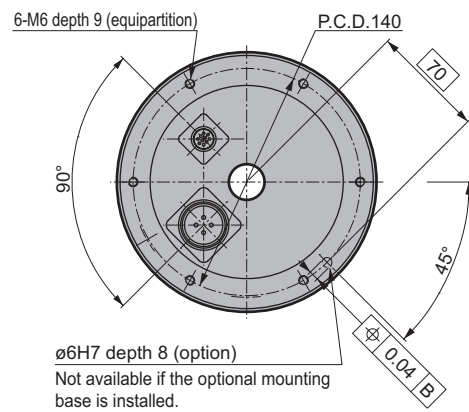
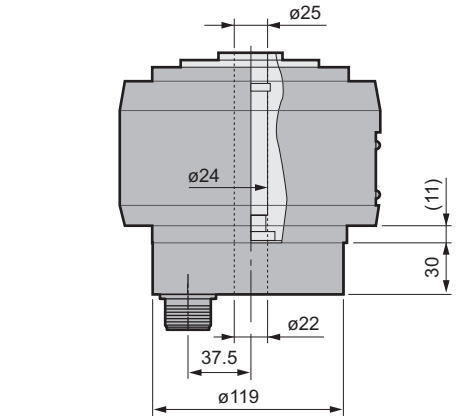
● AX1210T



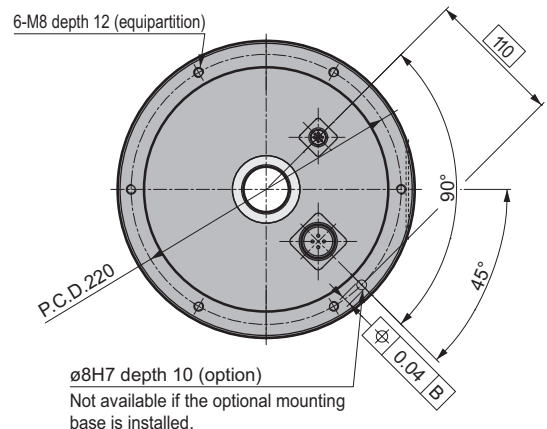
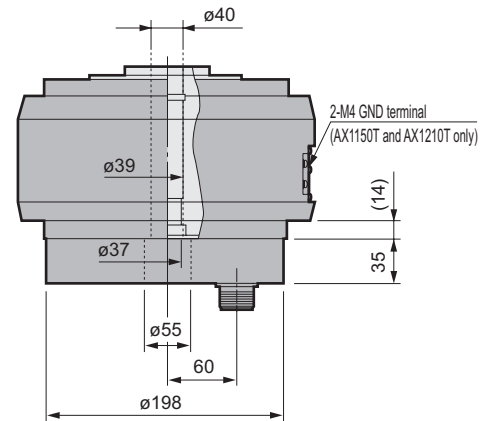
Note 1) The actuator's origin may differ from that in the dimensional drawing.
 The origin offset feature enables you to set the origin at any position.

Dimensions with options

● Connector bottom installation (C)
 AX1022T/AX1045T



AX1075T/AX1150T/AX1210T





Direct drive actuator ABSODEX

AX2000T Series

Compatible function with free combinations of driver, actuator, and cable

High speed (Max. speed 300 rpm), small diameter and compact, and large hollow shaft (ø30)

● Max. torque: 6, 12, 18 N·m

● Compatible driver: TS type driver



Actuator specifications

Descriptions		AX2006T	AX2012T	AX2018T
Max. output torque	N·m	6	12	18
Continuous output torque	N·m	2	4	6
Max. rotation 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 moment of inertia	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
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		
Operating ambient temperature		0 to 45°C (0 to 40°C: Note 3)		
Operating ambient humidity		20 to 85%RH (with no dew condensation)		
Storage ambient temperature		-20 to 80°C		
Storage ambient humidity		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		
Degree of protection		IP20		

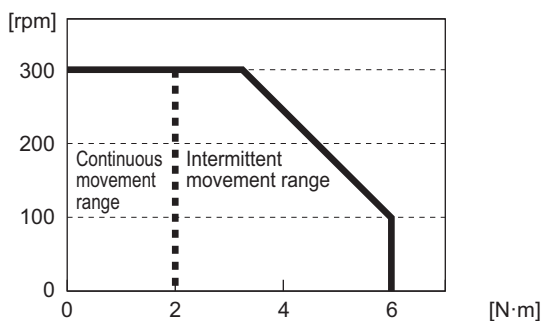
Note 1: Use at 80 rpm or less during continuous rotary operation.

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.

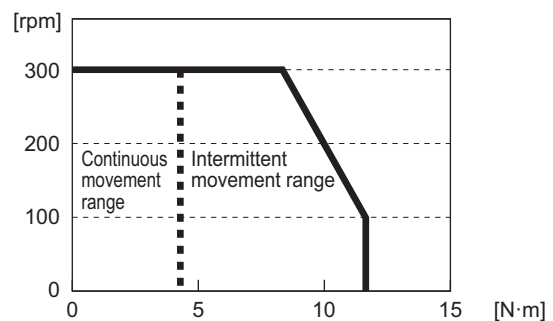
Speed and max. torque characteristics

● AX2006TS



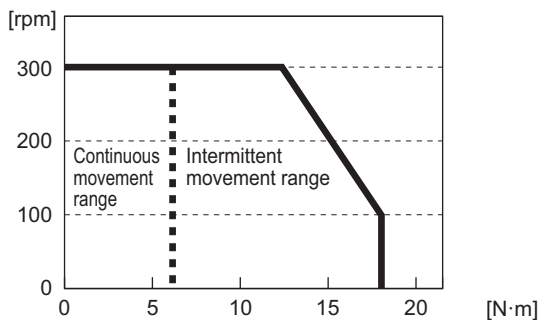
* This graph shows the characteristics for 3-phase 200 VAC.

● AX2012TS



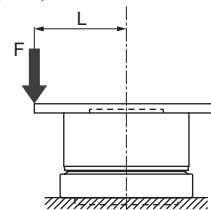
* This graph shows the characteristics for 3-phase 200 VAC.

● AX2018TS



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

(Note) moment load



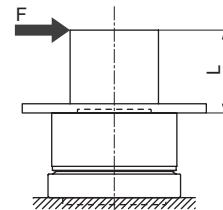
(Fig. a)

$$M \text{ (N·m)} = F \text{ (N)} \times L \text{ (m)}$$

M: Moment load

F: Load

L: Distance from output shaft center



(Fig. b)

$$M \text{ (N·m)} = F \text{ (N)} \times (L + 0.02) \text{ (m)}$$

M: Moment load

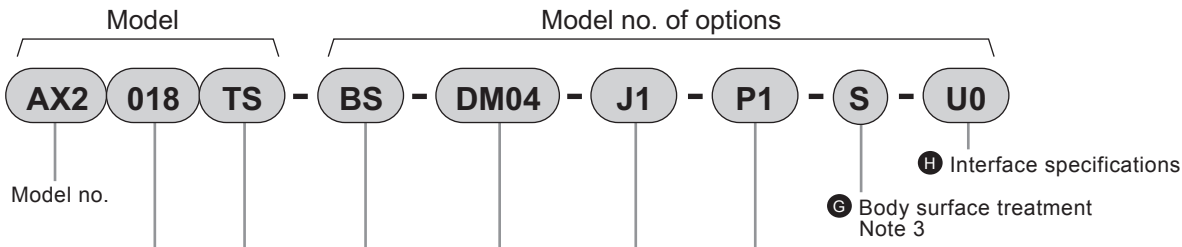
F: Load

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
A Size (max. torque)	
006	6 N·m
012	12 N·m
018	18 N·m
B Driver type	
TS	With TS 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	2 m
DM04	4 m (standard length)
DM06	6 m
DM08	8 m
DM10	10 m
DM15	15 m
DM20	20 m
E Driver power supply voltage	
Refer to the driver power supply voltage table on the left.	
F Dowel hole	
Blank	Standard (without dowel hole)
P1	Top 1 piece
P2	Bottom 1 piece
P3	Both top and bottom sides 1 piece each
G Body surface treatment	
Blank	Standard (blackening treatment)
S	Electroless nickel plating treatment
H 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 to 230 VAC	1-phase 100 to 115 VAC
AX2006T		Blank	J1
AX2012T		Blank	J1
AX2018T		Blank	J1

Note 2: The cable is a movable cable.

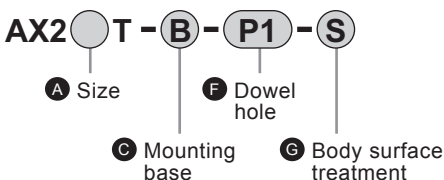
Refer to page 38 for cable dimensions. The lead cables are not movable cables.

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

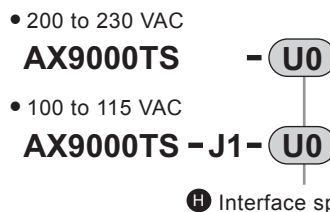
Note 4: C For a "B" blackening mounting base or "BS" electroless nickel plating surface treatment mounting base, "P2" or "P3" cannot be selected.

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

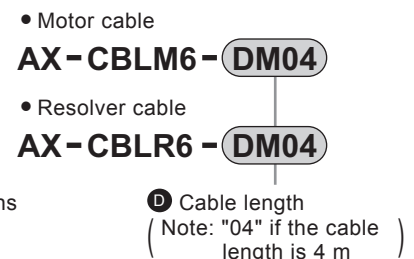
- Actuator model no.



- Driver model no.



- Cable model no.

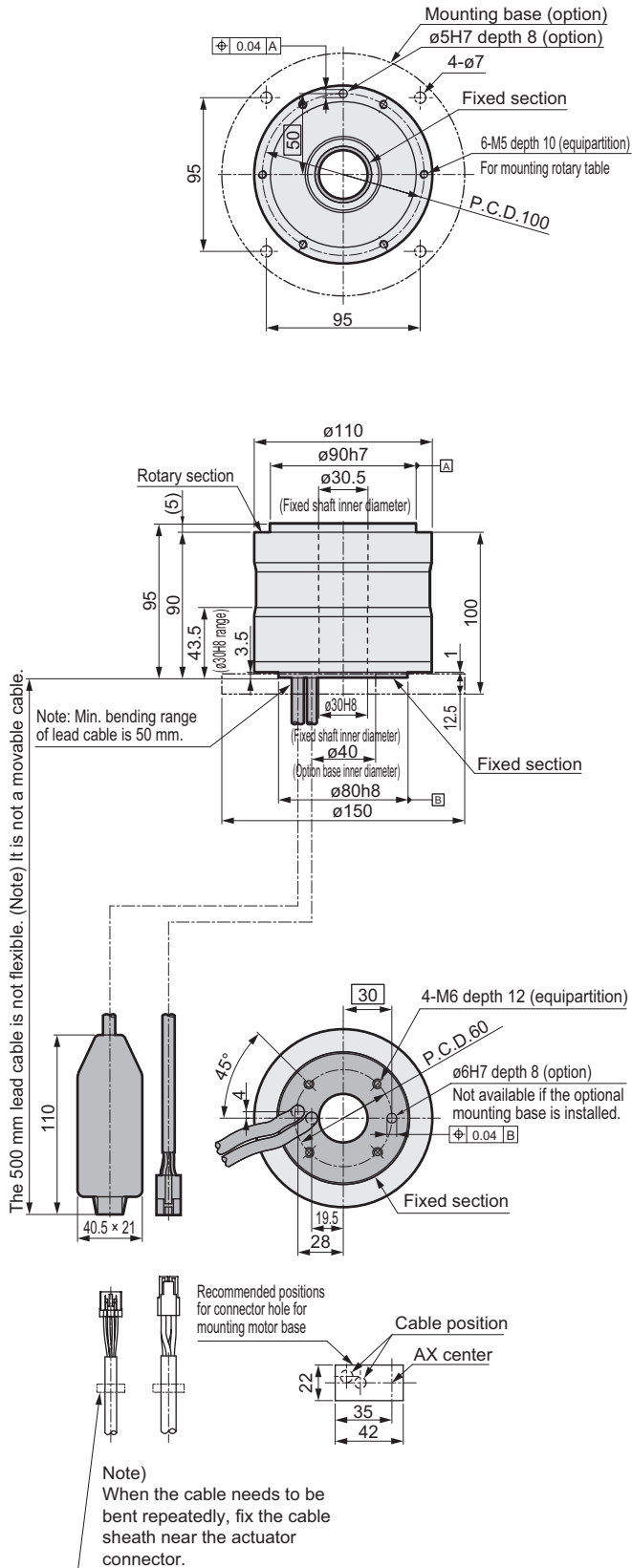


* Custom order models will not support CE, UL/cUL, or RoHS. Consult with CKD for details.

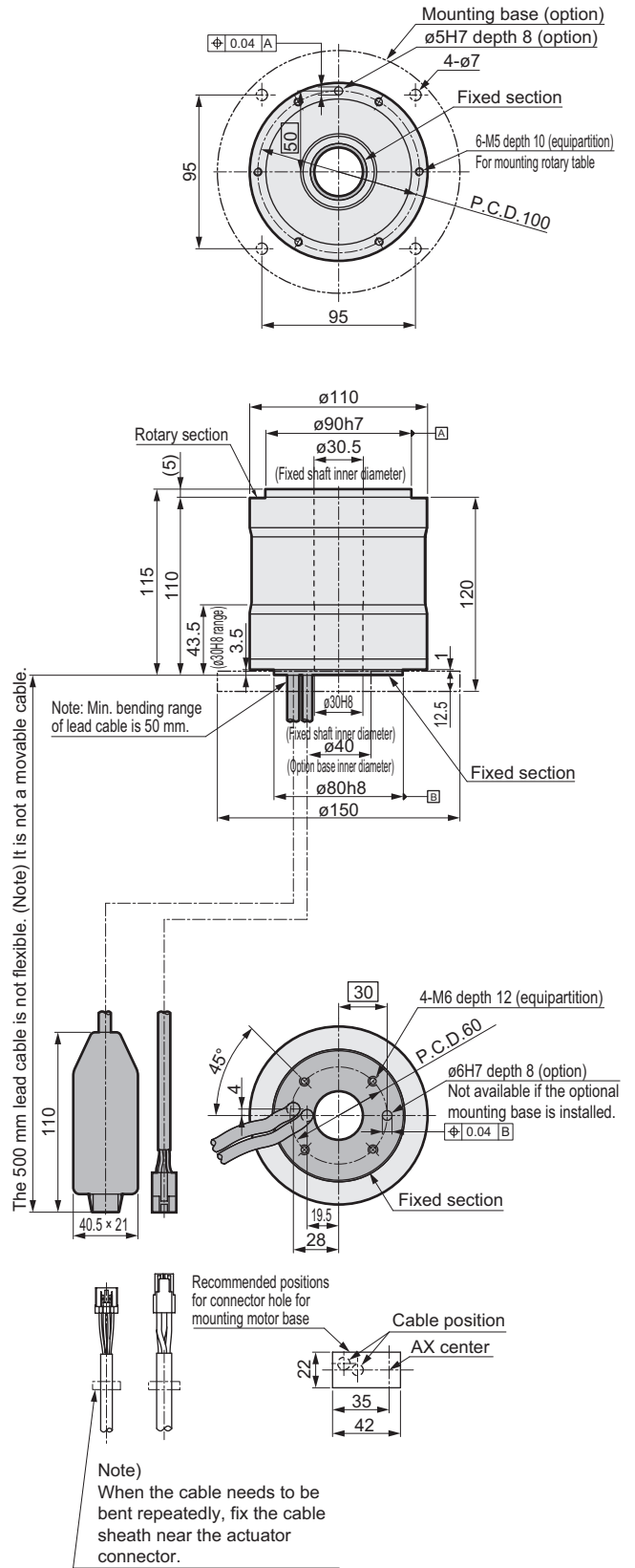
AX2000T Series

Dimensions

● AX2006T



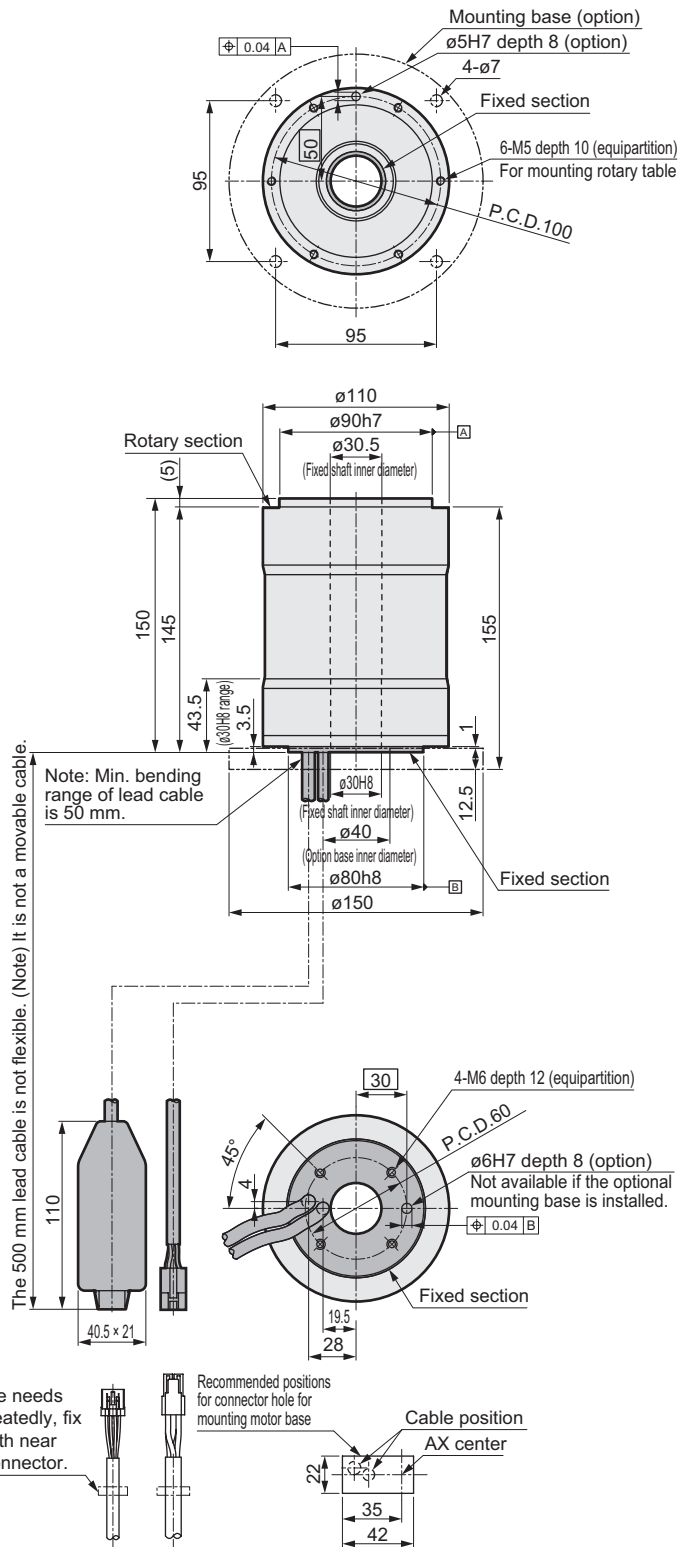
● AX2012T



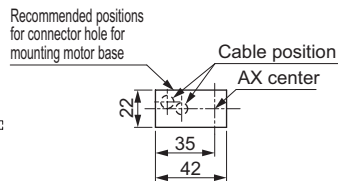
Note 1) The actuator's origin may differ from that in the dimensional drawing. The origin offset feature enables you to set the origin at any position.

Dimensions

● AX2018T



Note)
When the cable needs to be bent repeatedly, fix the cable sheath near the actuator connector.



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



Direct drive actuator ABSODEX

AX4000T Series

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

- Max. torque: 9, 22, 45, 75 N·m
- Compatible driver: TS type driver



Actuator specifications

Descriptions		AX4009T	AX4022T	AX4045T	AX4075T
Max. output torque	N·m	9	22	45	75
Continuous output torque	N·m	3	7	15	25
Max. rotation 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 moment of inertia	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
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			
Operating ambient temperature		0 to 45°C (0 to 40°C: Note 5)			
Operating ambient humidity		20 to 85%RH (with no dew condensation)			
Storage ambient temperature		-20 to 80°C			
Storage ambient humidity		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			
Degree of protection		IP20			

Note 1: Use at 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	24 VDC	
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)	
Max. usage frequency	cycles/min	60	40

Note 1: When the output shaft is rotating, rubbing sound may be generated at the electromagnetic brake's disc 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.

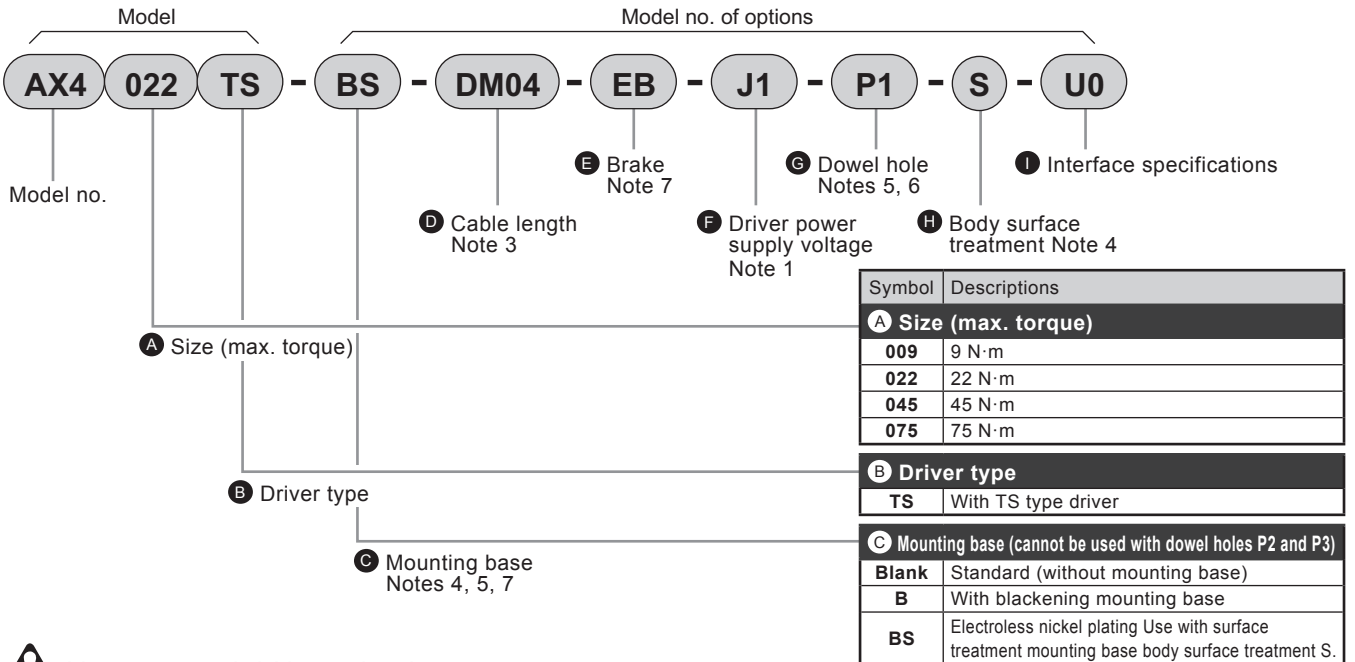
Note 4: When electromagnetic brakes function, the armature may contact the magnetic brake's fixed section and generate noise.

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
A Size (max. torque)	
009	9 N·m
022	22 N·m
045	45 N·m
075	75 N·m

B Driver type	
TS	With TS 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	2 m
DM04	4 m (standard length)
DM06	6 m
DM08	8 m
DM10	10 m
DM15	15 m
DM20	20 m

E Brake	
Blank	Standard (no electromagnetic brake)
EB	With negative activation electromagnetic brake

F Driver power supply voltage	
Refer to the driver power supply voltage table on the left.	

G 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)

H Body surface treatment	
Blank	Standard (rotational section-blackening/fixd section casting surface plane-paint)
S	Rotational section: electroless nickel plating treatment, fixed section: nitriding

I 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	TS type driver	
	3-phase, 1-phase 200 to 230 VAC	1-phase 100 to 115 VAC
AX4009T	Blank	J1
AX4022T	Blank	J1
AX4045T	Blank	J1
AX4075T	Blank Note 2	

Note 2: For models whose max. 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 lead cables are not movable cables.

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

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

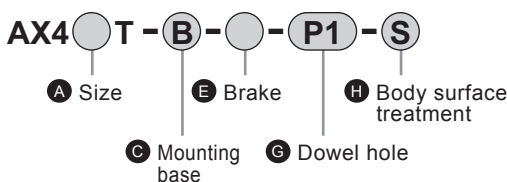
Note 6: In some cases, the dowel hole may not be surface-treated.

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

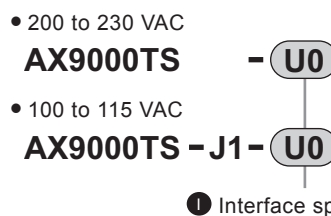
Option Table

	AX4009T	AX4022T	AX4045T	AX4075T
Mounting base (-B)	X	○	○	○
Mounting base (-BS)	X	○	○	○
Brake (-EB)	X	○	○	○

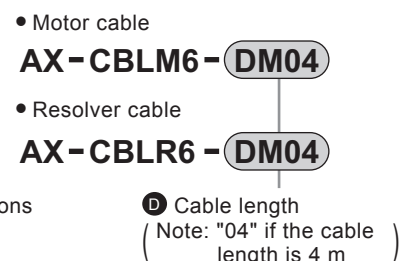
- Actuator model no.



- Driver model no.



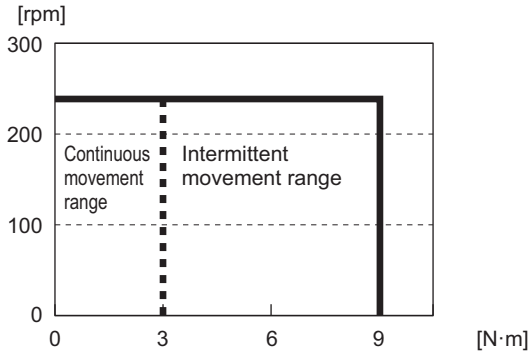
- Cable model no.



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

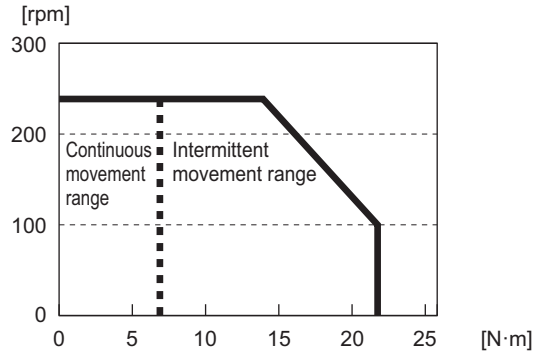
Speed and max. torque characteristics

● AX4009TS



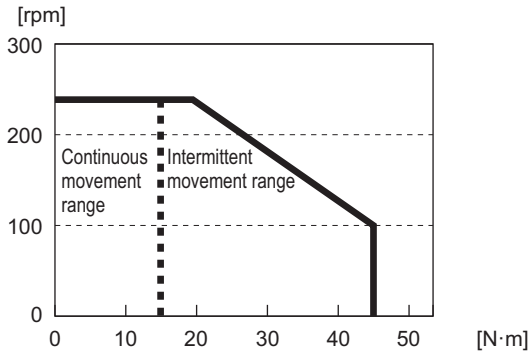
* This graph shows the characteristics for 3-phase 200 VAC.

● AX4022TS



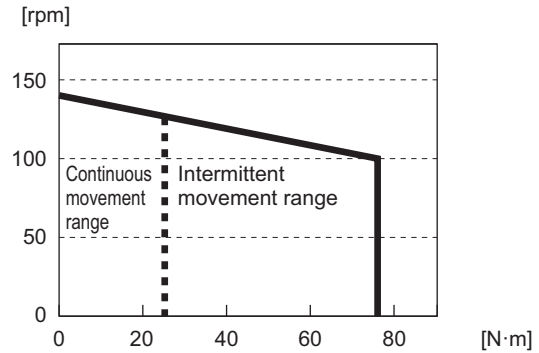
* This graph shows the characteristics for 3-phase 200 VAC.

● AX4045TS



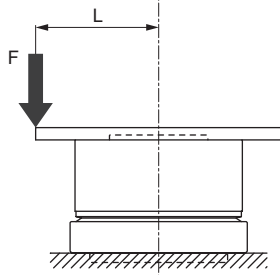
* This graph shows the characteristics for 3-phase 200 VAC.

● AX4075TS



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

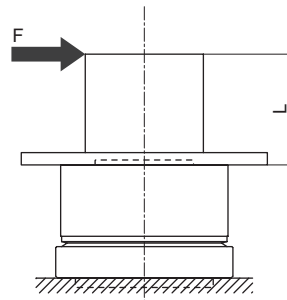
(Note) moment load



(Fig. a)

$$M \text{ (N}\cdot\text{m)} = F \text{ (N)} \times (L) \text{ (m)}$$

M: Moment load
F: Load
L: Distance from output shaft center



(Fig. b)

$$M \text{ (N}\cdot\text{m)} = F \text{ (N)} \times (L + 0.02) \text{ (m)}$$

M: Moment load
F: Load
L: Distance from output shaft flange

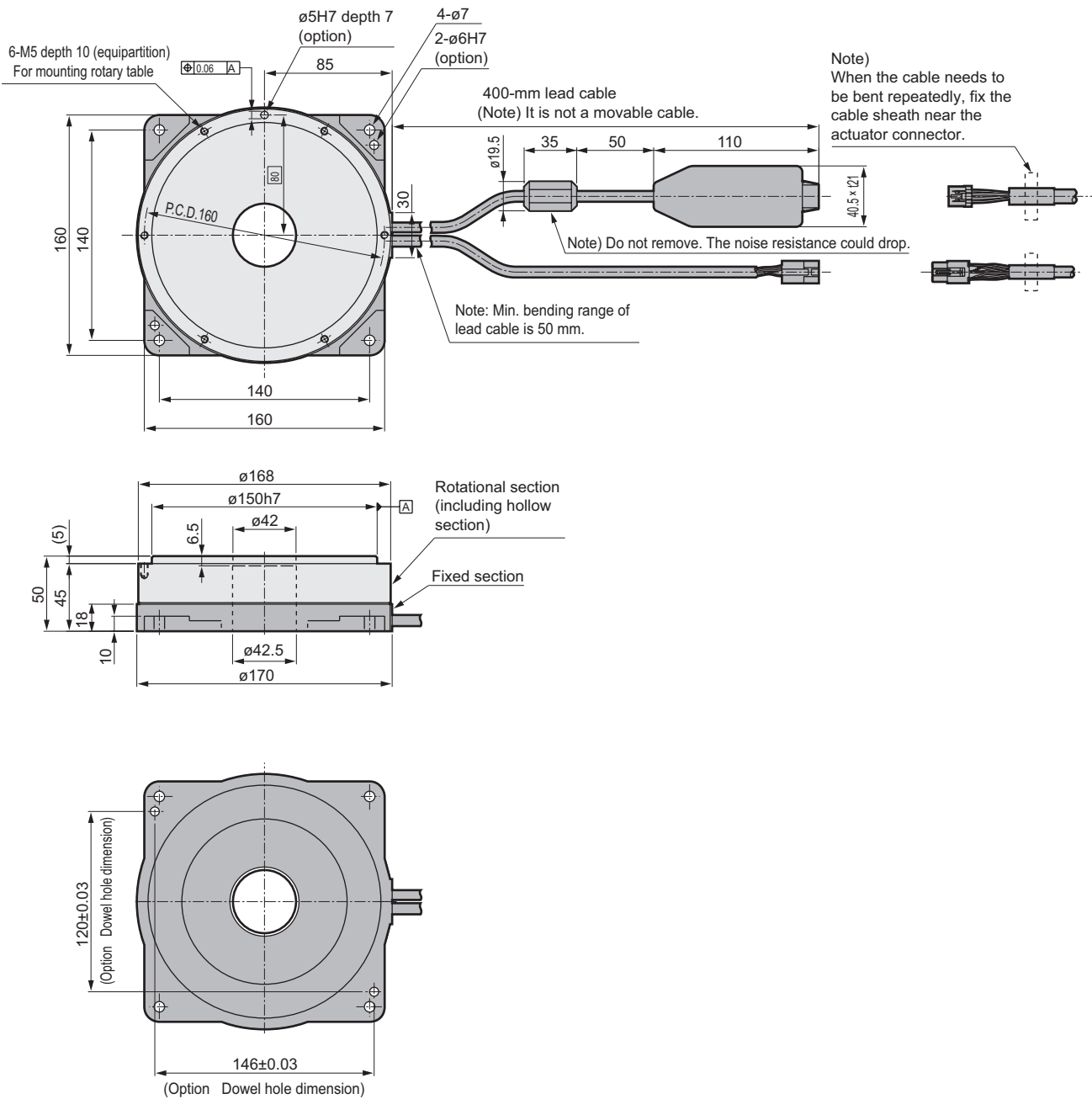
! Read the precautions on Intro 9 to 14 before use.

MEMO

AX4000T Series

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 at any position.

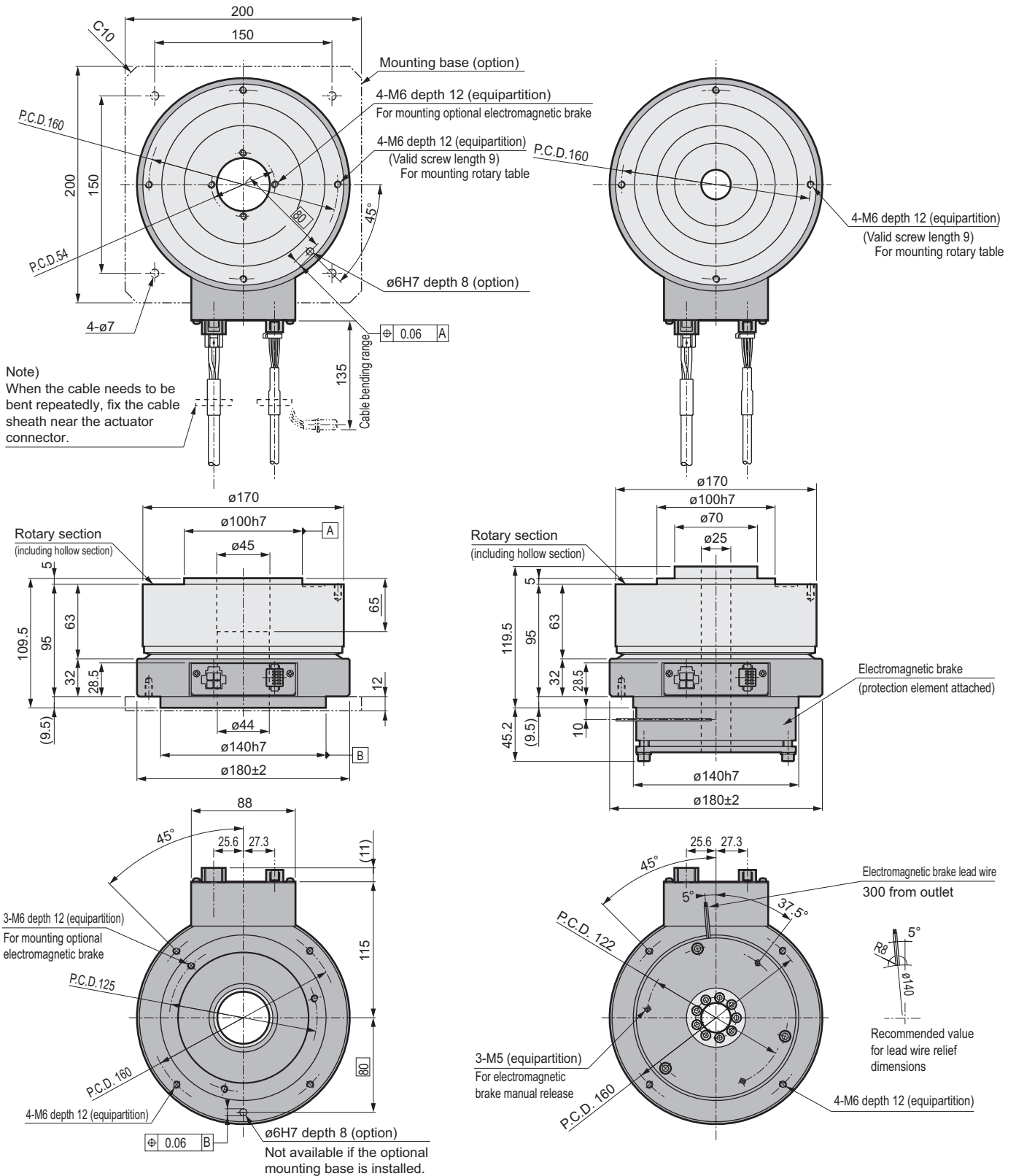
Dimensions

● AX4022T

● AX4022T-EB

With electromagnetic brake

For other options, refer to the drawing on the left.



AX4000T

Actuator

AX4000T Series

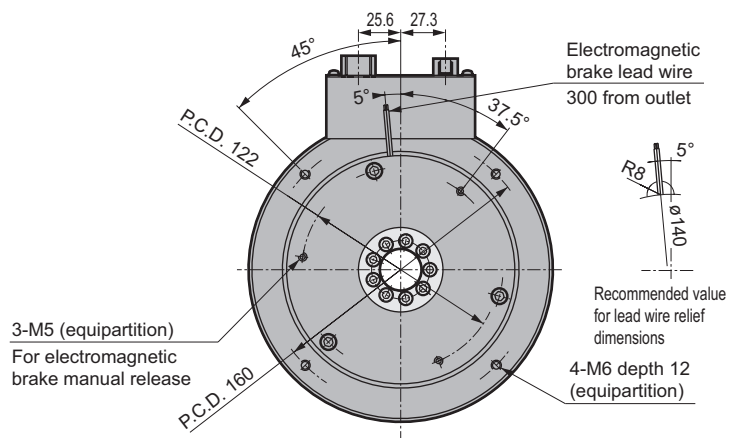
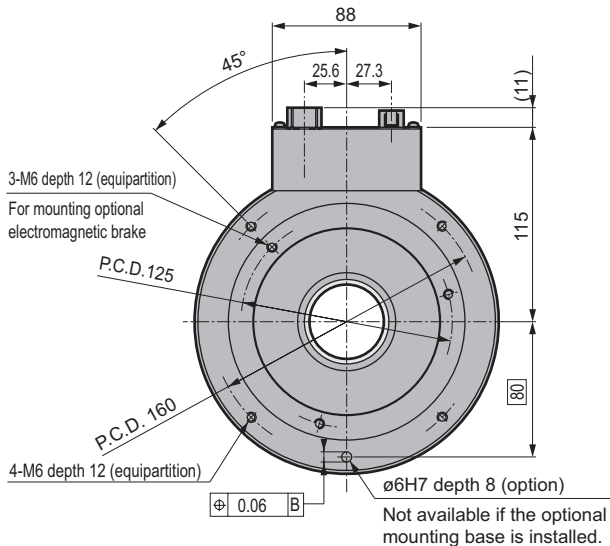
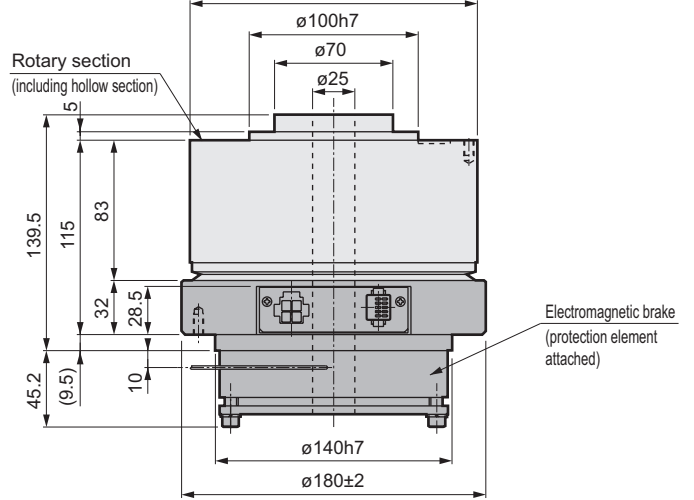
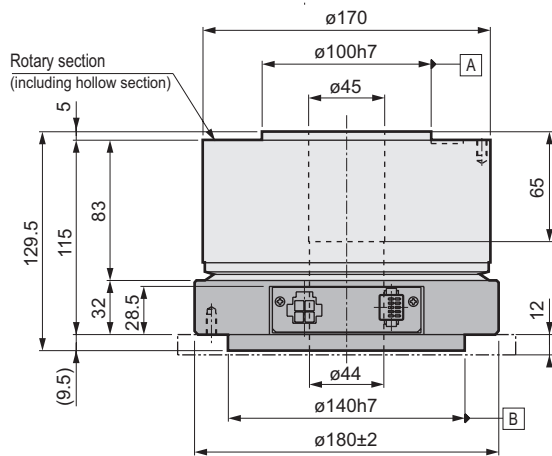
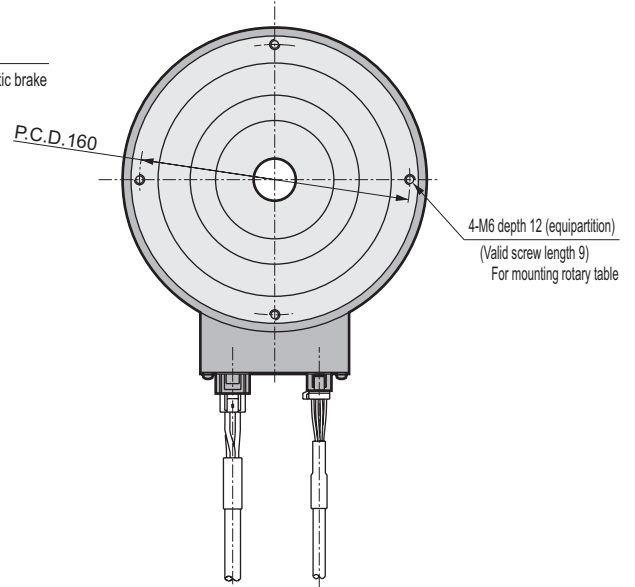
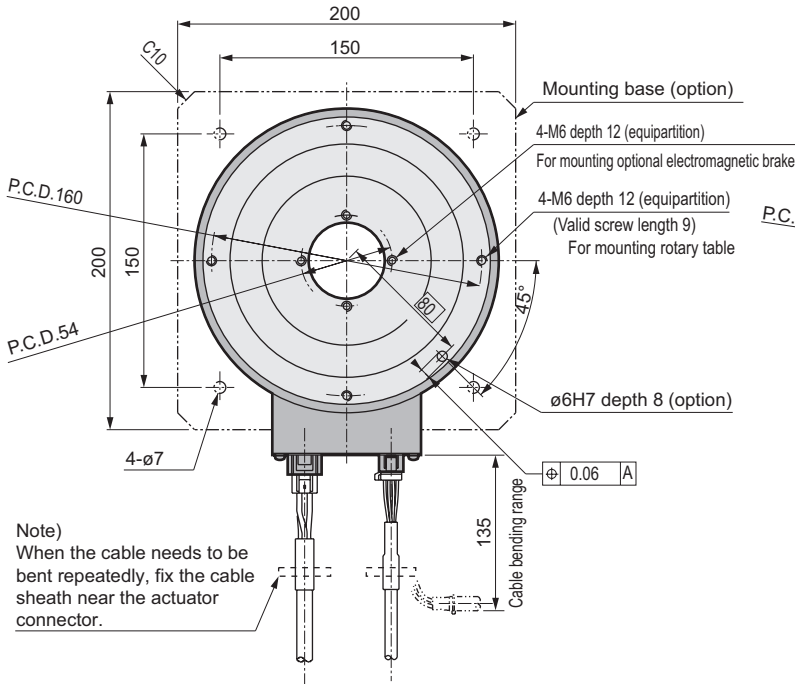
Dimensions

● 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 at any position.

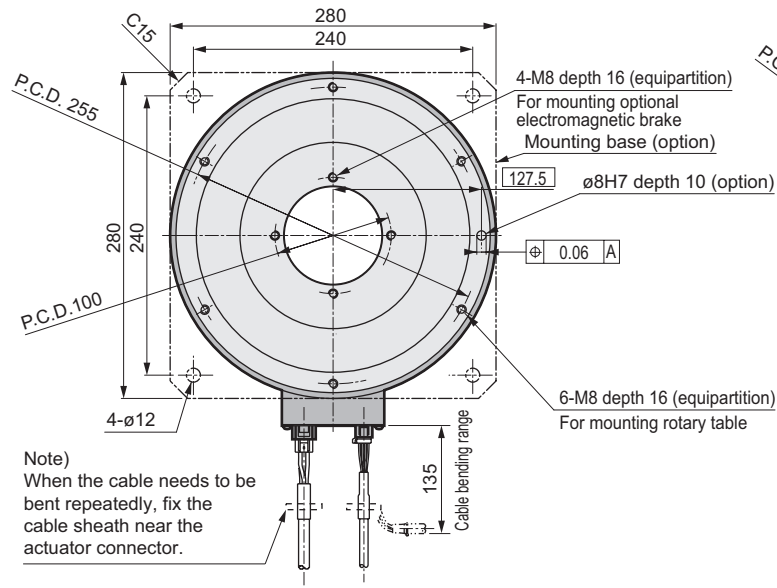
Dimensions

● AX4075T

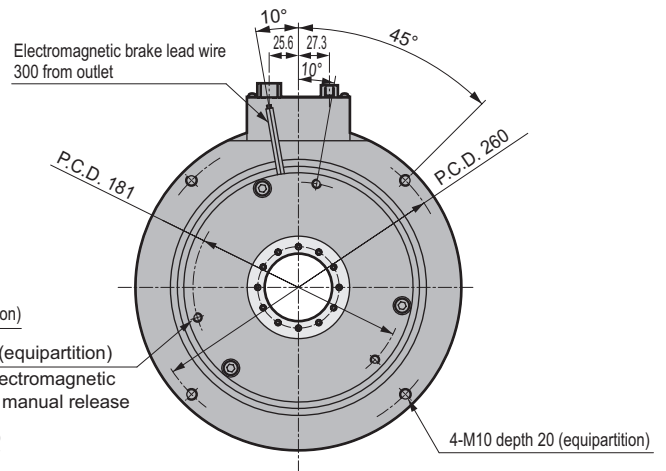
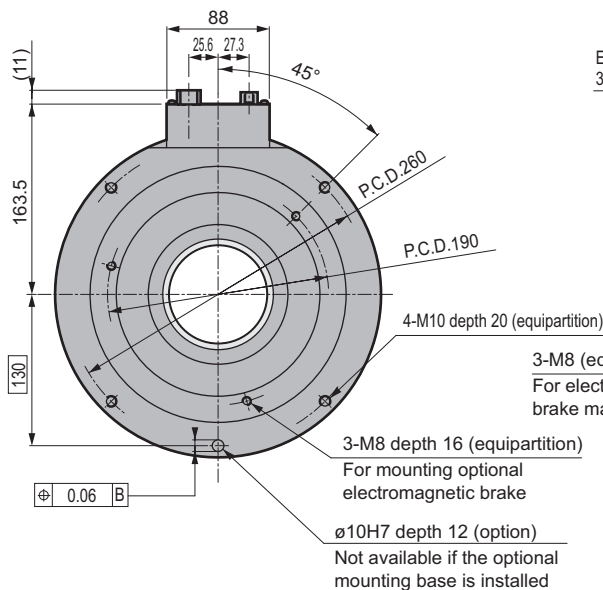
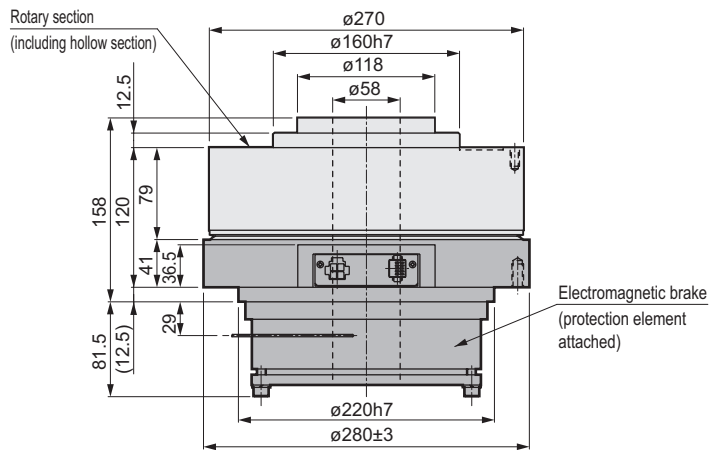
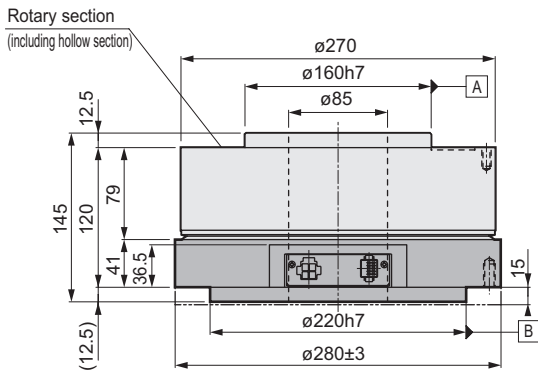
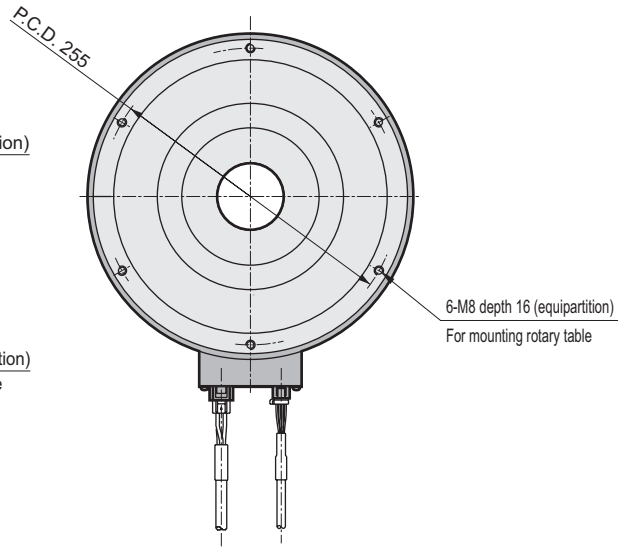
● AX4075T-EB

With electromagnetic brake

For other options, refer to the drawing on the left.



Note)
When the cable needs to be bent repeatedly, fix the cable sheath near the actuator connector.



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



Direct drive actuator ABSODEX

AX4000T Series

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

- Max. torque: 150, 300, 500 N·m
- Compatible driver: TH type driver



Actuator specifications

Descriptions		AX4150T	AX4300T	AX4500T
Max. output torque	N·m	150	300	500
Continuous output torque	N·m	50	100	160
Max. rotation 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 moment of inertia	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
Resolution	P/rev	540672		
Motor insulation class		F		
Motor withstand voltage		1500 VAC for 1 minute		
Motor insulation resistance		10 MΩ and over at 500 VDC		
Operating ambient temperature		0 to 45°C (0 to 40°C: Note 4)		
Operating ambient humidity		20 to 85%RH (with no dew condensation)		
Storage ambient temperature		-20 to 80°C		
Storage ambient humidity		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		
Degree of protection		IP20		

Note 1: Use at 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)

Supported models		AX4150T, AX4300T
Descriptions		
Type		Non-backlash dry non-excitation activation type
Rated voltage	V	24 VDC
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)
Max. usage frequency	cycles/min	40

Note 1: When the output shaft is rotating, rubbing sound may be generated at the electromagnetic brake's disc 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.

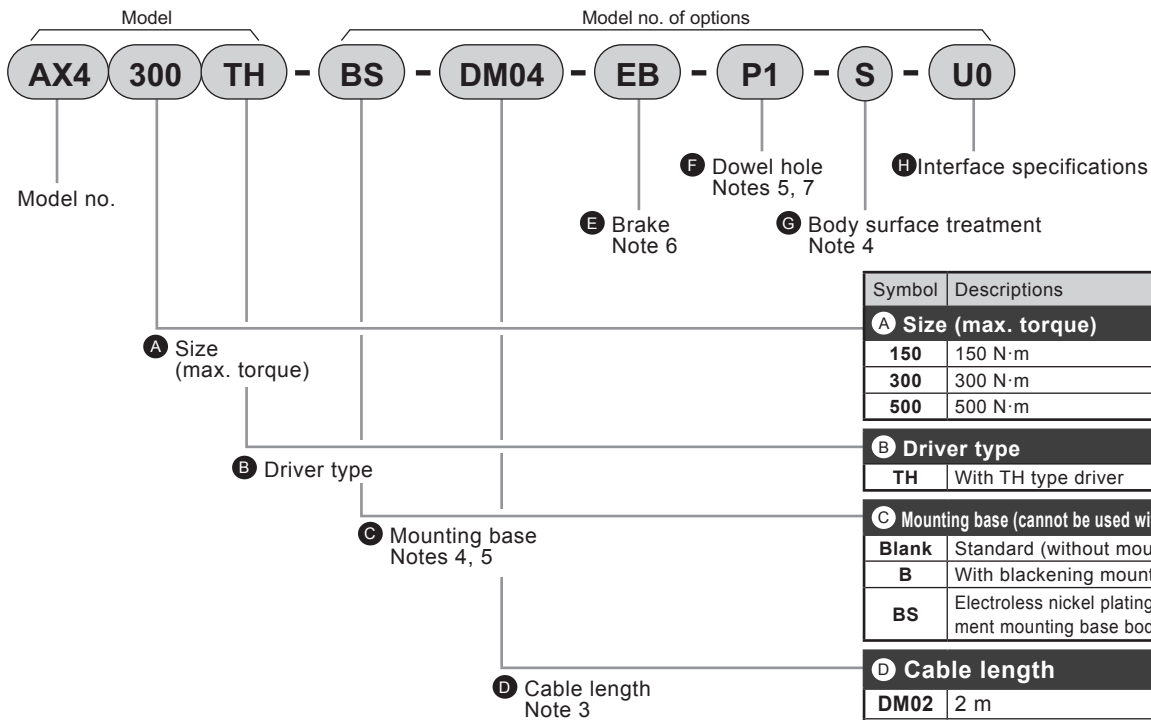
Note 4: When electromagnetic brakes function, the armature may contact the magnetic brake's fixed section and generate noise.

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
A Size (max. torque)	
150	150 N·m
300	300 N·m
500	500 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	2 m
DM04	4 m (standard length)
DM06	6 m
DM08	8 m
DM10	10 m
DM15	15 m
DM20	20 m
E Brake	
Blank	Standard (no electromagnetic brake)
EB	With negative activation electromagnetic brake
F Dowel hole	
Blank	Standard (without dowel hole)
P1	Top 1 piece
P2	Bottom 1 piece
P3	Both top and bottom sides 1 piece each
G Body surface treatment	
Blank	Standard (rotational section:blackening/fixd section casting surface plane-paint)
S	Rotational section: electroless nickel plating treatment, fixed section: nitriding
H 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	TH type driver
AX4150T		Blank Note 2
AX4300T		Blank Note 2
AX4500T		Blank Note 2

Note 2: When 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 **C** and **G**. If you select the optional electroless nickel plating treatment, you can expect higher rustproofing performance than the standard specification.

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

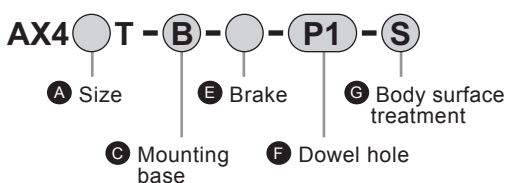
Note 6: Refer to the Option Table below and select required options.

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 to 230 VAC

AX9000TH - U0

H Interface specifications

- Cable model no.

- Motor cable

AX-CBLM6 - DM04

- Resolver cable

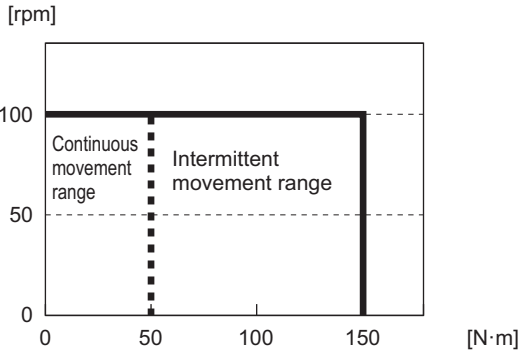
AX-CBLR6 - DM04

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

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

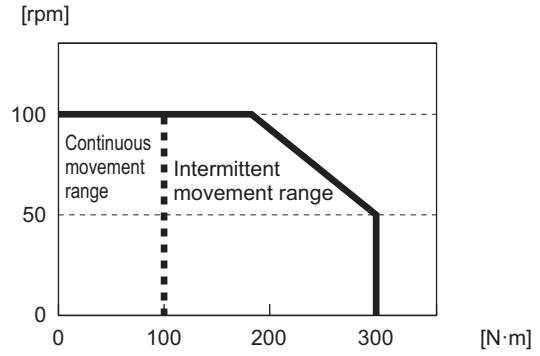
Speed and max. torque characteristics

● AX4150TH



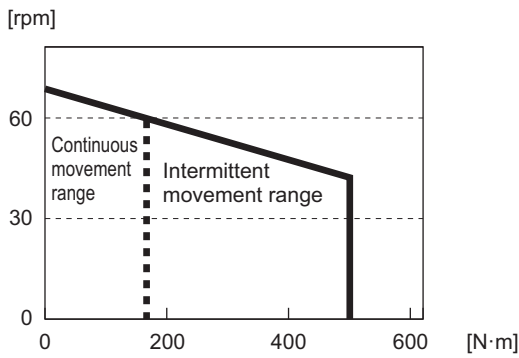
* This graph shows the characteristics for 3-phase 200 VAC.

● AX4300TH



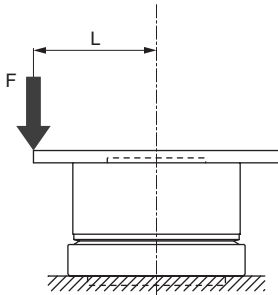
* This graph shows the characteristics for 3-phase 200 VAC.

● AX4500TH



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

(Note) moment load



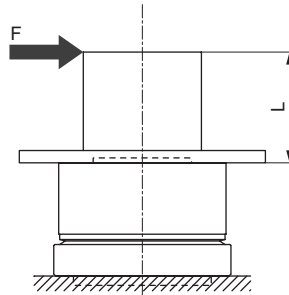
(Fig. a)

$$M \text{ (N}\cdot\text{m)} = F \text{ (N)} \times L \text{ (m)}$$

M: Moment load

F: Load

L: Distance from output shaft center



(Fig. b)

$$M \text{ (N}\cdot\text{m)} = F \text{ (N)} \times (L + 0.02) \text{ (m)}$$

M: Moment load

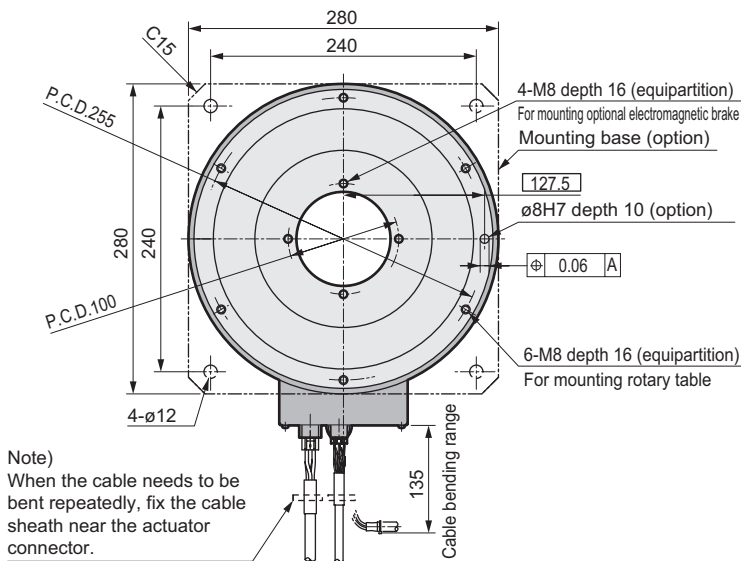
F: Load

L: Distance from output shaft flange

Read the precautions on Intro 9 to 14 before use.

Dimensions

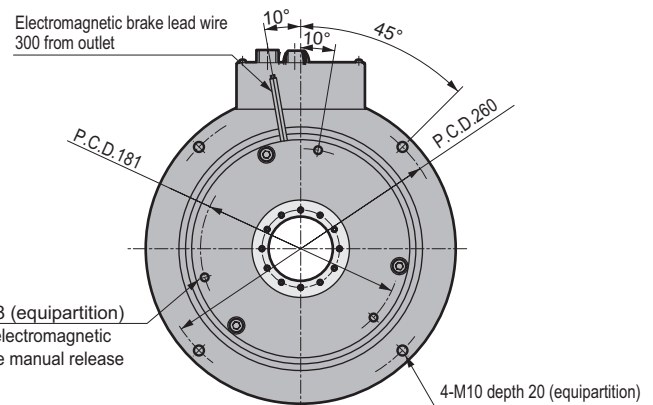
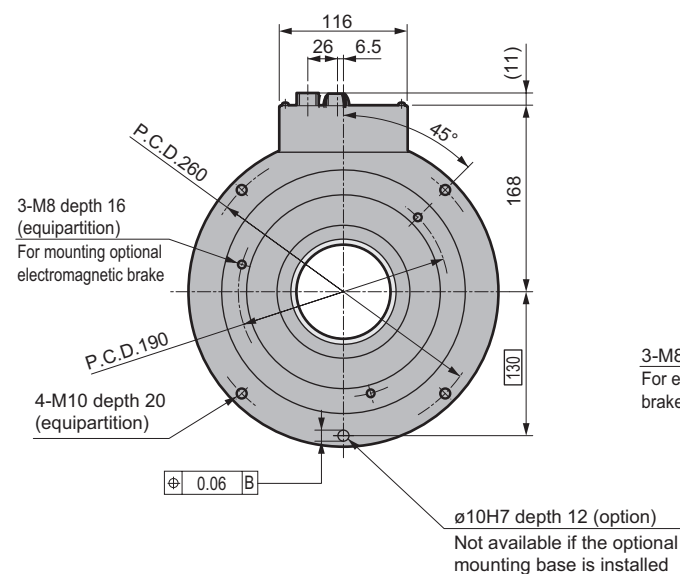
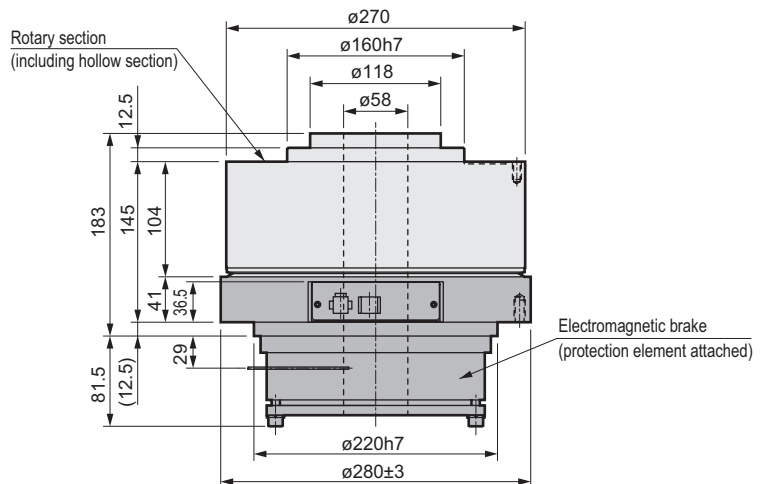
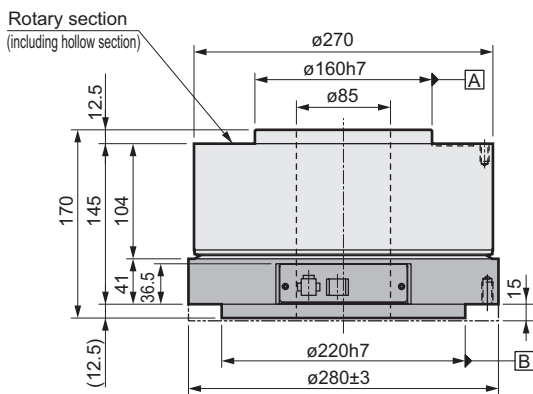
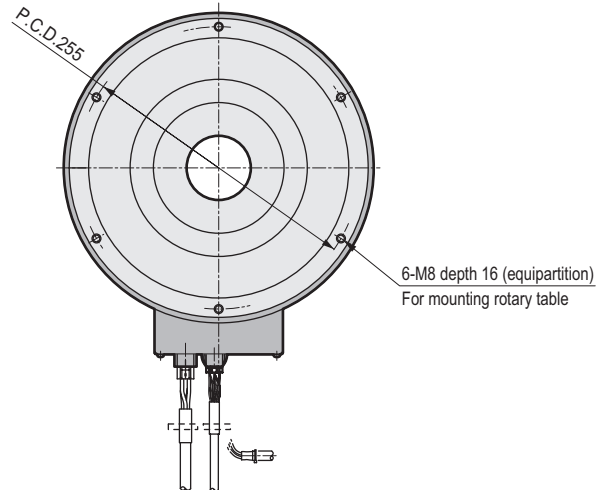
● AX4150T



● AX4150T-EB

With electromagnetic brake

For other options, refer to the drawing on the left.

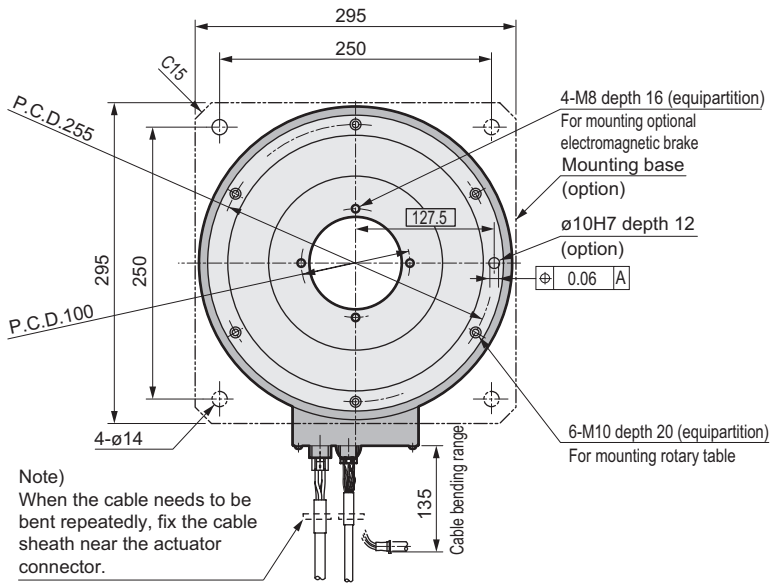


Note 1) The actuator's origin may differ from that in the dimensional drawing.
The origin offset feature enables you to set the origin at any position.

AX4000T Series

Dimensions

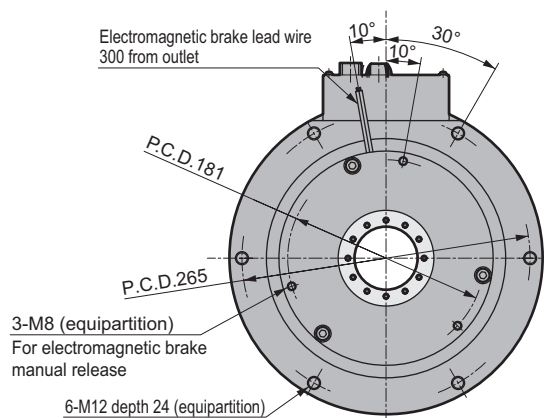
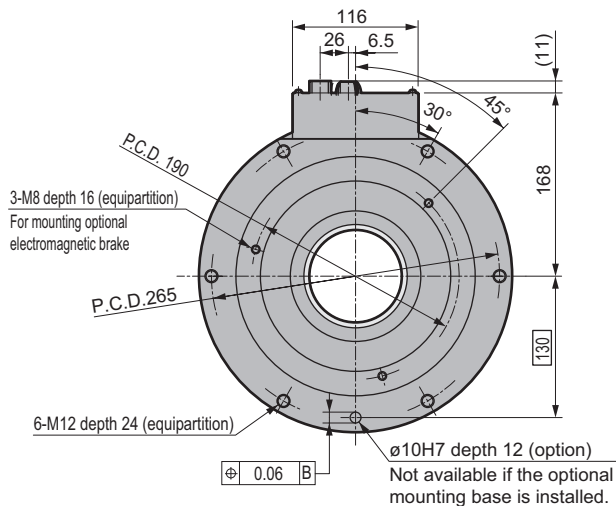
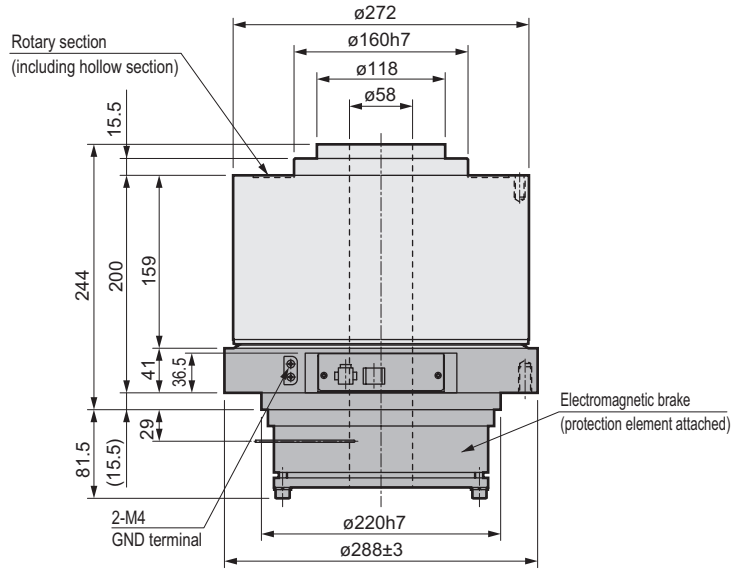
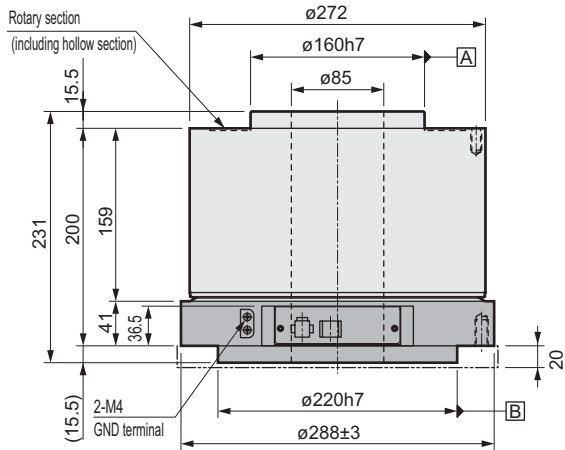
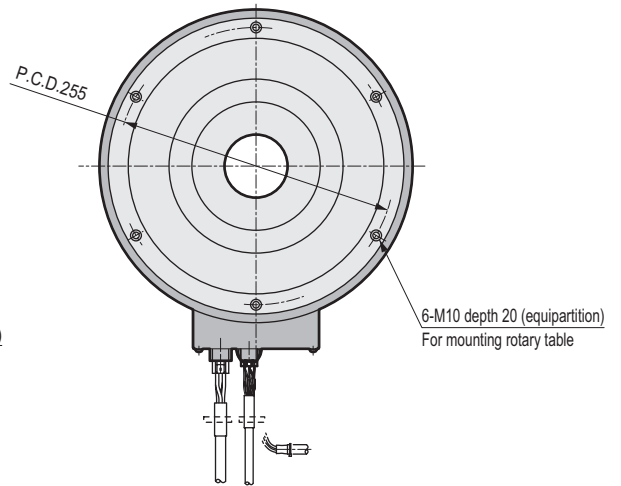
● AX4300T



● AX4300T-EB

With electromagnetic brake

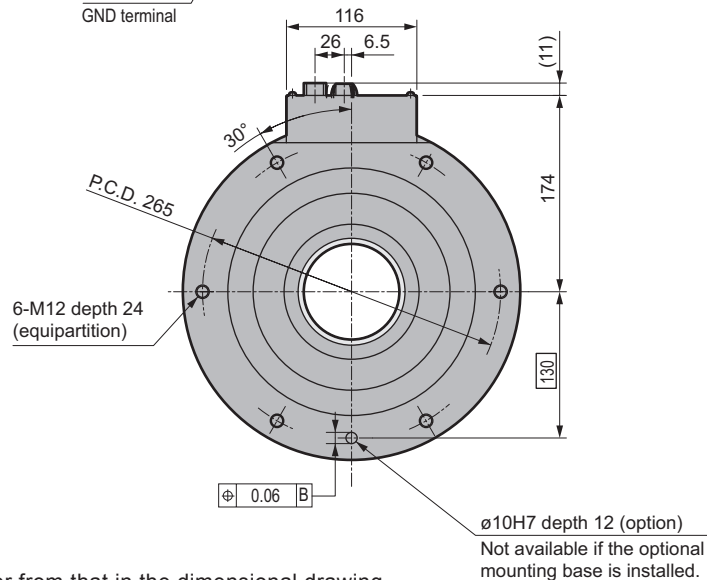
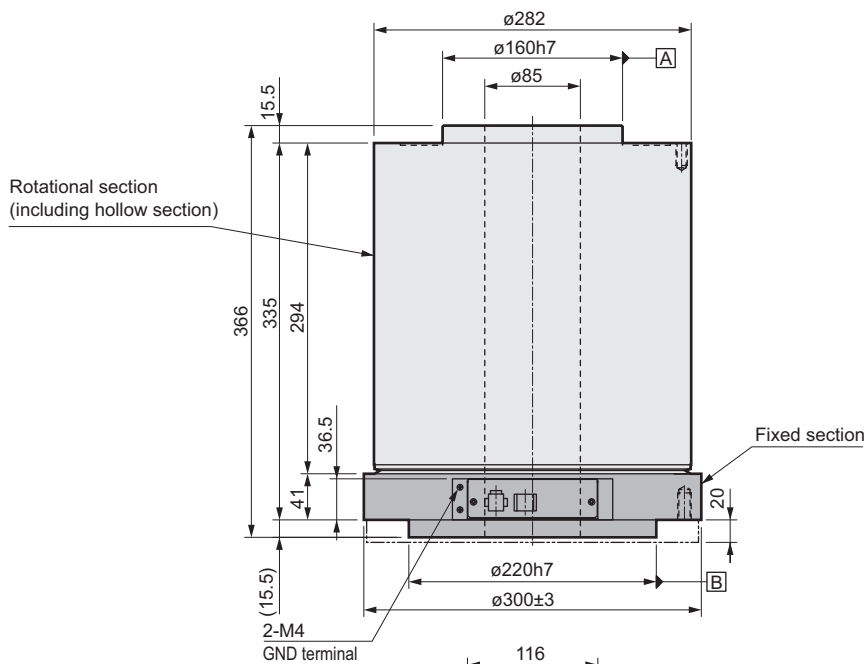
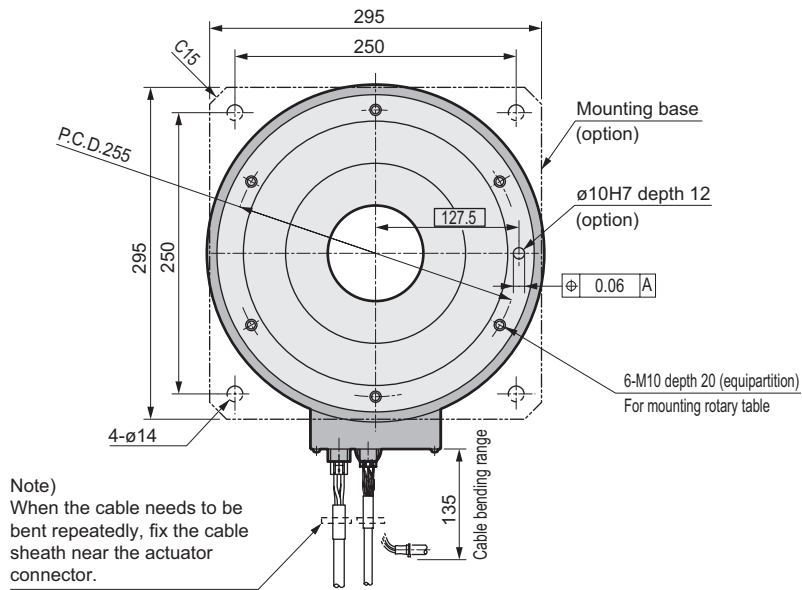
For other options, refer to the drawing on the left.



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

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 at any position.



Large type direct drive actuator ABSODEX

AX400WT Series

Max. torque 1000 N·m

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

- Max. torque: 1000 N·m
- Compatible driver: TH type driver



Actuator specifications

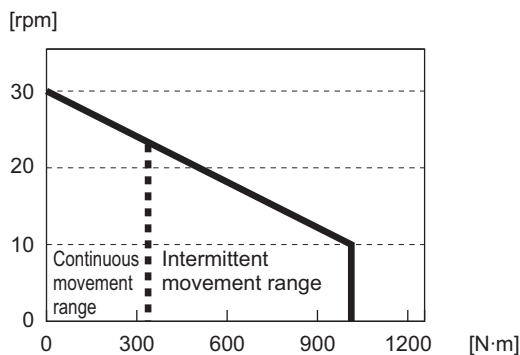
Descriptions		AX410WT
Max. output torque	N·m	1000
Continuous output torque	N·m	330
Max. rotation speed	rpm	30
Allowable axial load	N	20000
Allowable moment load	N·m	400
Output shaft moment of inertia	kg·m ²	2.72
Allowable load moment of inertia	kg·m ²	600.00
Index precision (Note 1)	sec.	±30
Repeatability (Note 1)	sec.	±5
Output shaft friction torque	N·m	20.0
Resolution	P/rev	540672
Motor insulation class		F
Motor withstand voltage		1500 VAC for 1 minute
Motor insulation resistance		10 MΩ and over at 500 VDC
Operating ambient temperature		0 to 45°C (0 to 40°C: Note 2)
Operating ambient humidity		20 to 85%RH (with no dew condensation)
Storage ambient temperature		-20 to 80°C
Storage ambient humidity		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
Degree of 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 max. torque characteristics

● AX410WTH



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

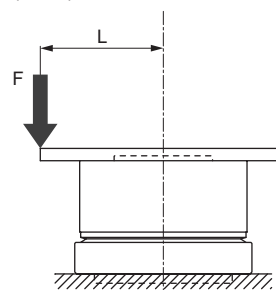
Safety precautions

⚠ 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.

(Note) moment load



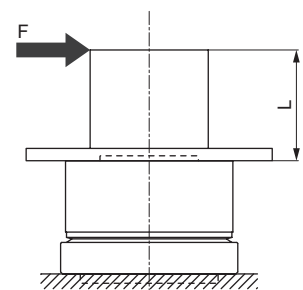
(Fig. a)

$$M (\text{N}\cdot\text{m}) = F (\text{N}) \times (L) (\text{m})$$

M: Moment load

F: Load

L: Distance from output shaft center



(Fig. b)

$$M (\text{N}\cdot\text{m}) = F (\text{N}) \times (L + 0.02) (\text{m})$$

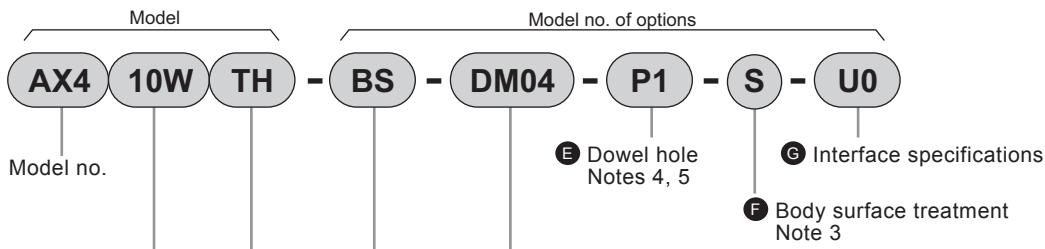
M: Moment load

F: Load

L: Distance from output shaft flange

How to order

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

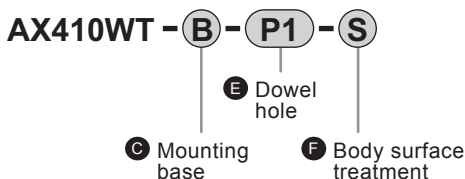


Symbol	Descriptions
A Size (max. torque)	
10 W	1000 N·m
B Driver type	
TH	With TH type driver
C Mounting base (cannot be used with dowel holes P2 and P3)	
Blank	Standard (without mounting base)
B	With blackening mounting base
BS	Surface treatment mounting base with electroless nickel plating treatment Use it with body surface treatment S.
D Cable length	
DM02	2 m
DM04	4 m (standard length)
DM06	6 m
DM08	8 m
DM10	10 m
DM15	15 m
DM20	20 m
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, 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: When 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: 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 **C** and **E**.
If you select the optional electroless nickel plating treatment, you can expect higher rustproofing performance than the standard specification.
- Note 4: **C** 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 to 230 VAC



- Cable model no.

- Motor cable



- Resolver cable



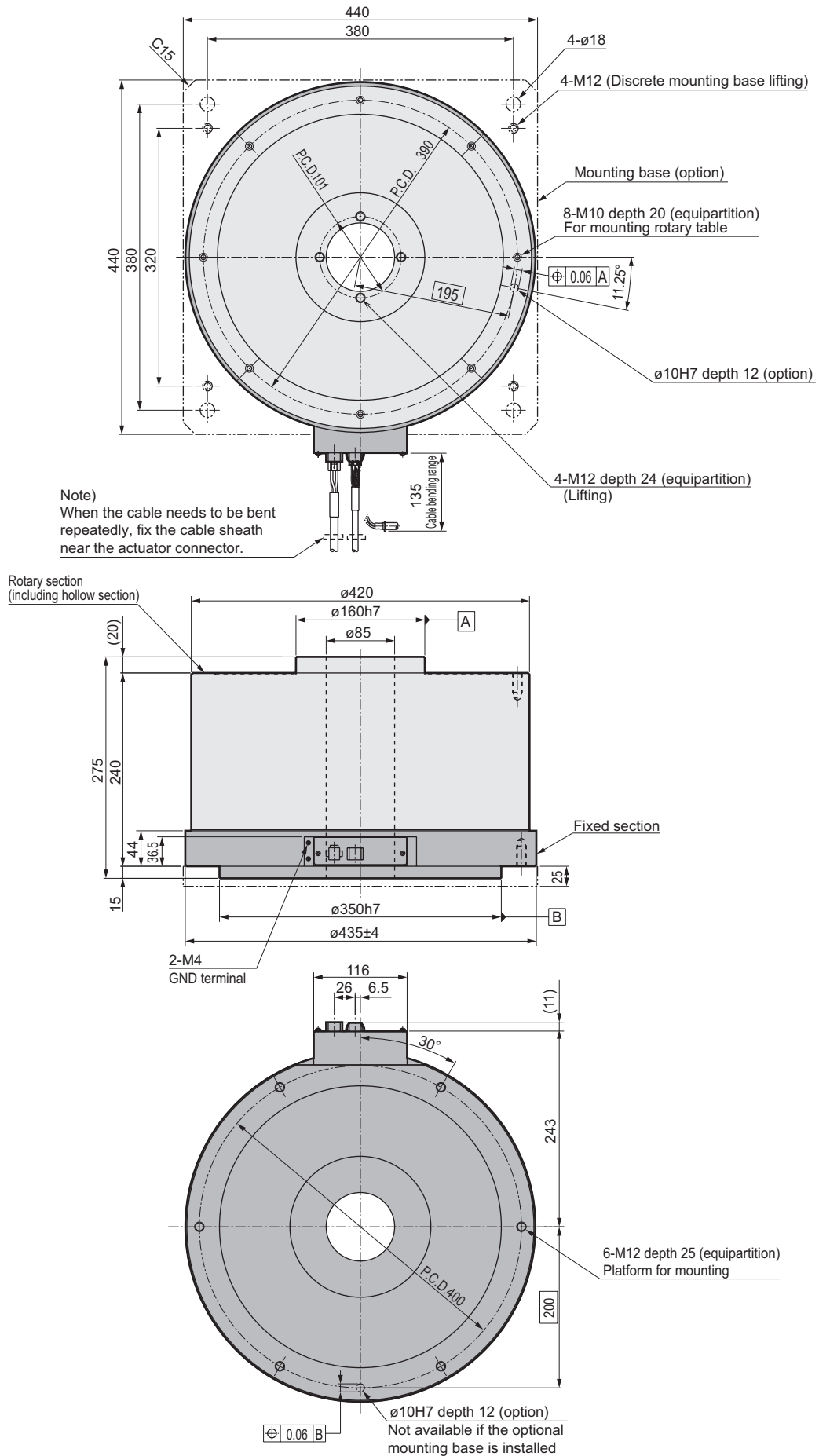
- Cable length
(Note: "04" if the cable length is 4 m)

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

AX400WT Series

Dimensions

● AX410WT



MEMO



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



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)

How to order

- 200 to 230 VAC

AX9000TS - U0

AX9000TH - U0

- 100 to 115 VAC

AX9000TS-J1 - U0

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

Common specifications

Descriptions		Model	
		TS type driver AX9000TS	TS type driver AX9000TH
Power 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		200 VAC: 1.8 A 100 VAC: 2.4 A	200 VAC: 5.0 A
Rated output current		1.9 A	5.0 A
Structure Integrated driver and controller (open type)			
Operating ambient temperature 0 to 50°C			
Operating ambient humidity 20 to 90% RH (with no dew condensation)			
Storage ambient temperature -20 to 65°C			
Storage ambient humidity 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 4.9 m/s ²			
Weight		Approx. 1.6 kg	Approx. 2.1 kg
Degree of protection IP2X (excluding CN4, CN5)			

Note 1) For models whose max. 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 max. 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 drive due to the voltage remaining in the driver.

Breaker capacity

TS type driver

Actuator Model	Driver Model	Inrush current (A)		Breaker capacity
		1-phase 100 V	1-phase, 3-phase 200 V	Rated current (A)
AX2006T	AX9000TS	16 (Note 1)	56 (Note 1)	10
AX1022T, AX2012T, AX2018T				
AX4009T, AX4022T				
AX1045T, AX4045T				
AX1075T, AX4075T				

Note 1) The inrush current values are typical values for 115 and 230 VAC.

TH type driver

Actuator Model	Driver Model	Inrush current (A)	Breaker capacity
		3-phase 200 V	Rated current (A)
AX1150T, AX4150T	AX9000TH	56 (Note 1)	20
AX1210T, AX4300T			
AX4500T			
AX410WT			

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

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 <5 types>
Acceleration curve	Modified sine (MS), modified constant velocity (MC, MC2), modified trapezoidal (MT), and trapezoid (TR)
Status display	LED power display
Operating indication	7-segments LED display (2 digits)
Communication interface	RS-232 compatible
I/O signals	Refer to the relevant interface specifications page.
Program size	Approx. 6000 characters (256 lines)
Electronic thermal	Actuator overheat protection

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

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	Origin return 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 input	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)

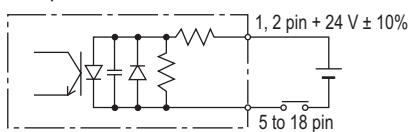
I/O circuit specifications

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 max. number of simultaneous output points for the output circuits is 14 out of 18.

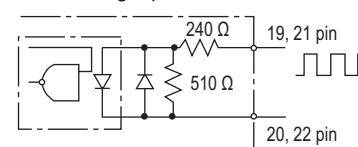
CN3 I/O circuit specifications

● Input circuit



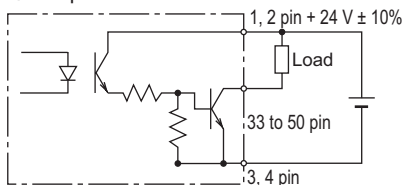
Rated voltage 24 V ± 10%
Rated current 4 mA (for 24 VDC)

● Pull string input circuit



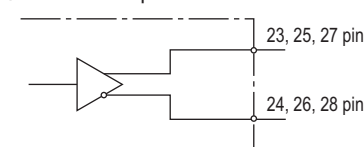
Rated voltage 5 V ± 10%
Max. input frequency
Line driver 1 Mpps
Open collector 250 Kpps

● Output circuit



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

● Encoder output circuit



Output type: line driver
Line driver to use: DS26C31

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

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

TS/TH type driver

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	Origin return 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 input	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

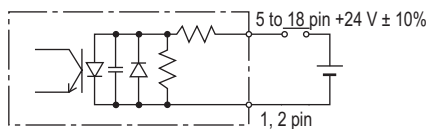
I/O circuit specifications

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 max. number of simultaneous output points for the output circuits is 14 out of 18.

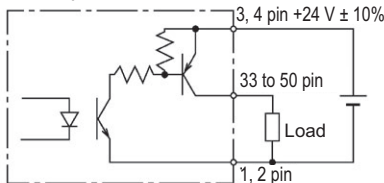
CN3 I/O circuit specifications

● Input circuit



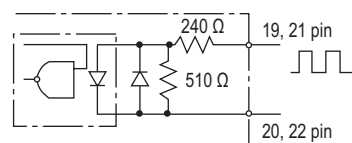
Rated voltage 24 V ± 10%
Rated current 4 mA (for 24 VDC)

● Output circuit



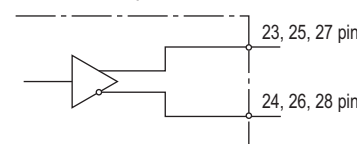
Rated voltage 24 V ± 10%
Rated current 50 mA (max)

● Pull string input circuit



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

● Encoder output circuit



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

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)

CC-Link specification

Communication specifications

Item	Specifications
Power supply	Supplies DC5 V from the servo amp
CC-Link version	Ver.1.10
Occupied stations (station type)	2 stations (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-compatible cable (shielded 3-core cable)
Transmission format	HDLC compliant
Remote station No.	1 to 63 (set by parameter)
Connections	Remote device stations (2 stations) occupy 32 units (max).
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)

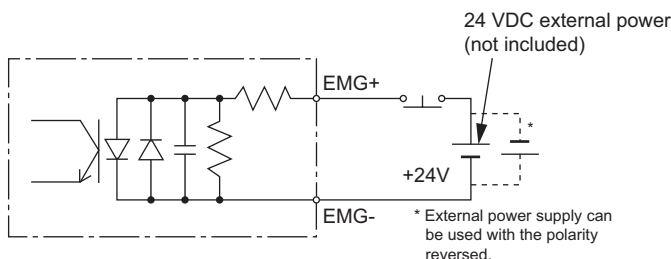
Device No.	Signal	Logic	Decision
RYn0	Program number selection input (bit 0)	Positive	Level
RYn1	Program number selection input (bit 1)	Positive	Level
RYn2	Program number selection input (bit 2)	Positive	Level
RYn3	Program number selection input (bit 3)	Positive	Level
RYn4	Program number selection input 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	Origin return 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 input	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 (Output) -> PLC

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	Monitoring	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.

TS/TH type driver

DeviceNet specifications

Communication specifications

Item	Specifications
Communication power supply	11 to 25 VDC
Communication power supply current consumption	50 mA or less
Communication protocol	DeviceNet compliant: Remote I/O
Occupied nodes	Input 8 bytes, output 8 bytes
Communication speed	500, 250, 125 kbps (selected by parameter)
Coupling cable	DeviceNet (shielded 5-core 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

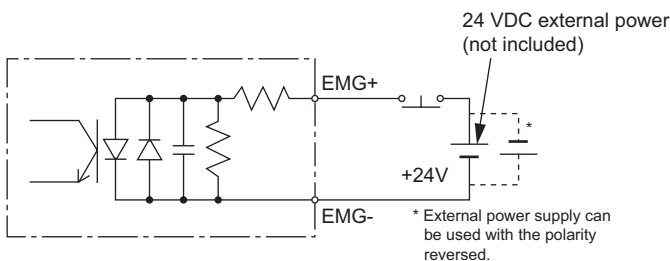
PLC -> AX (Input)

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	Origin return 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 input	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 (Output) -> PLC

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	Monitoring	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

Item	Specifications
Communication protocol	PROFIBUS DP-V0 compliant
I/O data	Input 8 bytes, output 8 bytes
Communication speed	12 M, 6 M, 3 M, 1.5 M, 500 k, 187.5 k, 93.75 k, 45.45 k, 19.2 k, 9.6 kbps (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. per segment With repeaters: 126 stations max. in total
Monitor function	Current position within 1 rotation (degrees, pulses), amount of position deviation, program number, electronic thermal, rotation speed, alarm

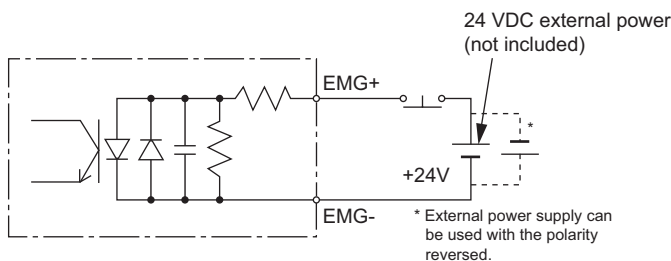
I/O signals

PLC -> AX (Input)

AX (Output) -> PLC

Byte No.	Signal	Logic	Decision	Byte No.	Signal	Logic
0.0	Program number selection input (bit 0)	Positive	Level	0.0	M code output (bit 0)	Positive
0.1	Program number selection input (bit 1)	Positive	Level	0.1	M code output (bit 1)	Positive
0.2	Program number selection input (bit 2)	Positive	Level	0.2	M code output (bit 2)	Positive
0.3	Program number selection input (bit 3)	Positive	Level	0.3	M code output (bit 3)	Positive
0.4	Program number selection input (bit 4) / program number selection input 2nd digit	Positive	Level edge	0.4	M code output (bit 4)	Positive
0.5	Program number selection input 1st digit / program number selection input (bit 5)	Positive	Level edge	0.5	M code output (bit 5)	Positive
0.6	Reset input	Positive	Edge	0.6	M code output (bit 6)	Positive
0.7	Origin return instruction input	Positive	Edge	0.7	M code output (bit 7)	Positive
1.0	Start input	Positive	Edge	1.0	In-position output	Positive
1.1	Servo ON input / program stop input	Positive	Level edge	1.1	Positioning completion output	Positive
1.2	Ready return input / continuous rotation stop input	Positive	Edge	1.2	Start input waiting output	Positive
1.3	Answer input / position deviation counter reset input	Positive	Edge	1.3	Alarm output 1	Negative
1.4	Emergency stop input	Negative	Level	1.4	Alarm output 2	Negative
1.5	Brake release Input	Positive	Level	1.5	Intermediate index output 1 / origin output	Positive
1.6	Not available			1.6	Intermediate index output 2 / Servo state output	Positive
1.7	Not available			1.7	Ready output	Positive
2.0 to 2.5	Not available			2.0	Segment position strobe output	Positive
				2.1	M code strobe output	Positive
				2.2 to 2.5	Not available	
2.6	Monitor output execution request	Positive	Level	2.6	Monitoring	Positive
2.7	Instruction code execution request	Positive	Edge	2.7	Instruction code execution complete	Positive

TB3 input circuit specifications (emergency stop)



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

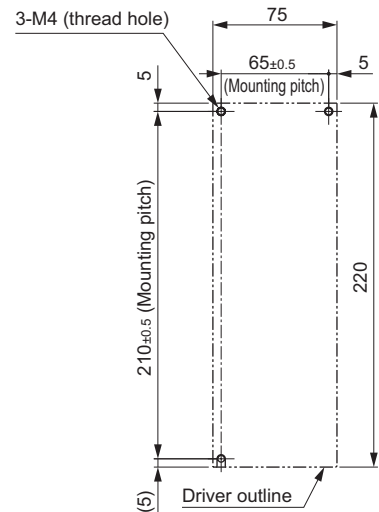
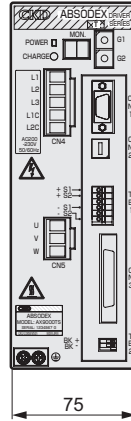
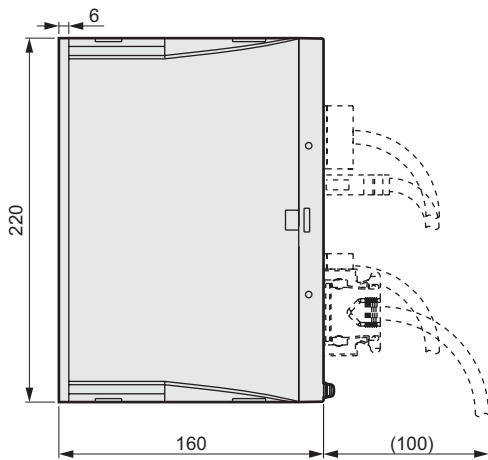
Safety precautions

- 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

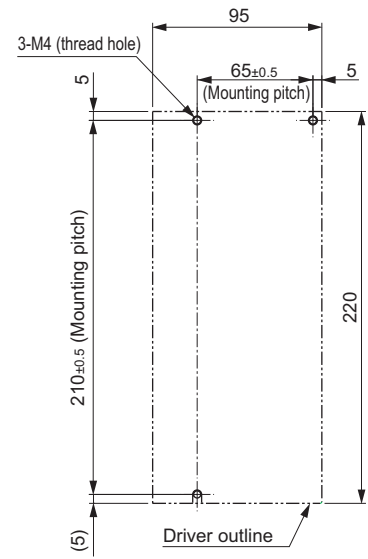
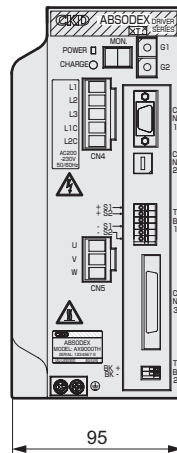
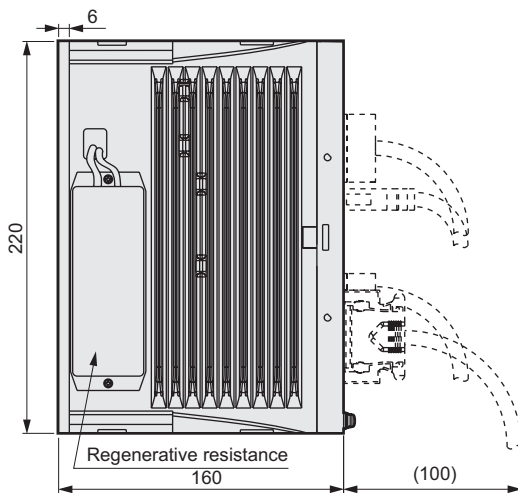
Dimensions

● TS type driver



Installation hole machining drawing (Note 1)

● TH type driver



Installation hole machining drawing (Note 1)

Driver accessories

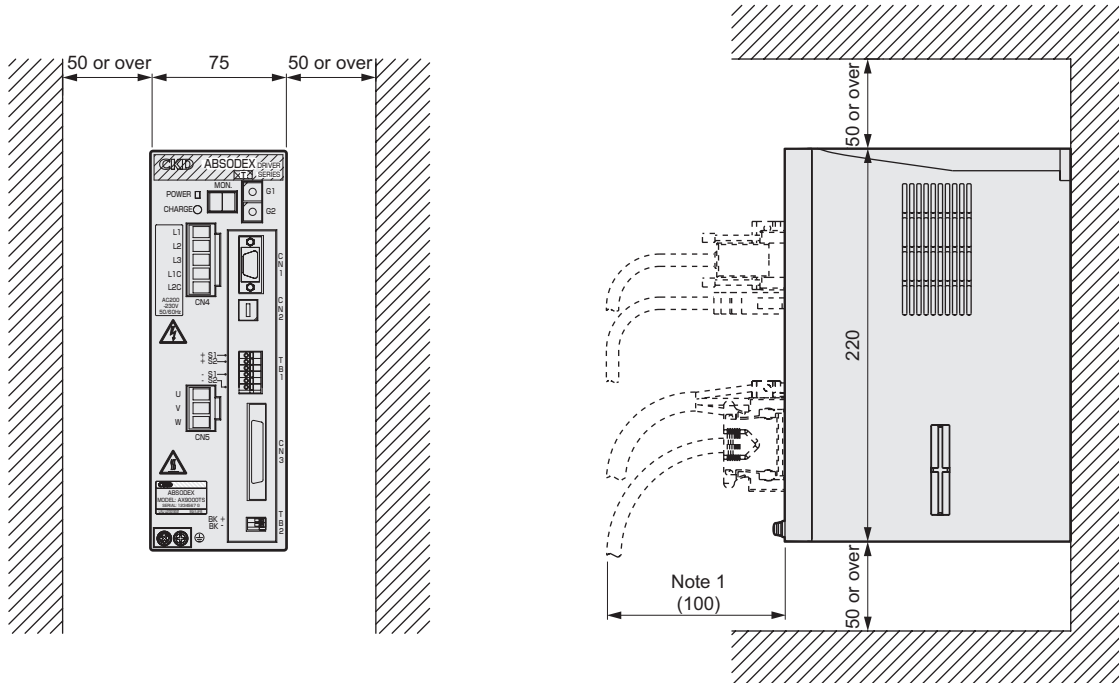
Model no.	Specifications	Power supply connector (CN4)	Motor cable connector (CN5)	CN3 connector
AX9000TS-U0	Parallel I/O (NPN)	PC4/5-ST-7.62 PHOENIX CONTACT	PC4/3-ST-7.62 PHOENIX CONTACT	10150-3000PE (plug) 10350-52A0-008 (shell) Sumitomo 3M
AX9000TS-U1	Parallel I/O (PNP)	PC4/5-ST-7.62 PHOENIX CONTACT	PC4/3-ST-7.62 PHOENIX CONTACT	10150-3000PE (plug) 10350-52A0-008 (shell) Sumitomo 3M
AX9000TS-U2	CC-Link specification	PC4/5-ST-7.62 PHOENIX CONTACT	PC4/3-ST-7.62 PHOENIX CONTACT	BLZ5.08/FAU Weidmüller
AX9000TS-U3	PROFIBUS-DP specifications	PC4/5-ST-7.62 PHOENIX CONTACT	PC4/3-ST-7.62 PHOENIX CONTACT	Not included
AX9000TS-U4	DeviceNet specifications	PC4/5-ST-7.62 PHOENIX CONTACT	PC4/3-ST-7.62 PHOENIX CONTACT	MSTB2.5/5-STF-5.08AUM PHOENIX CONTACT

To order additional parts, see the table for how to order.

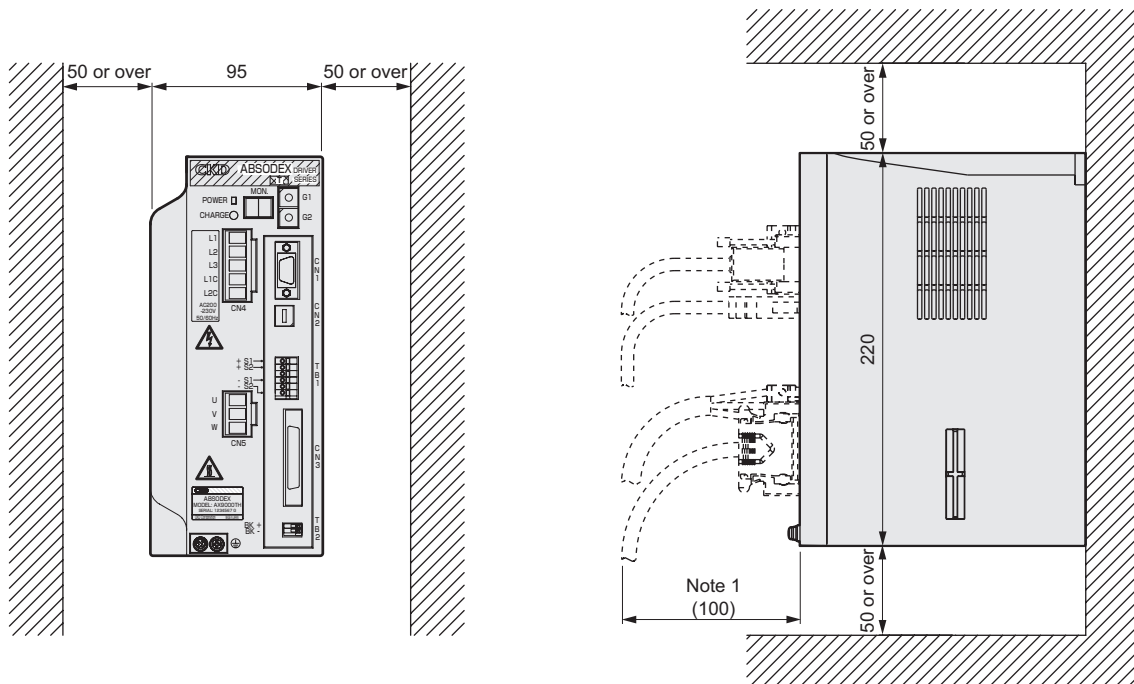
Installation dimensions

● 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



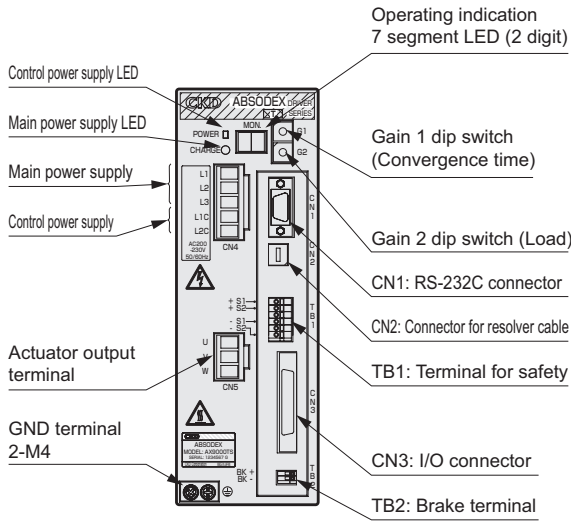
Note 1) Determine a dimension that is sufficient for the cable that you are using.

TS/TH type driver

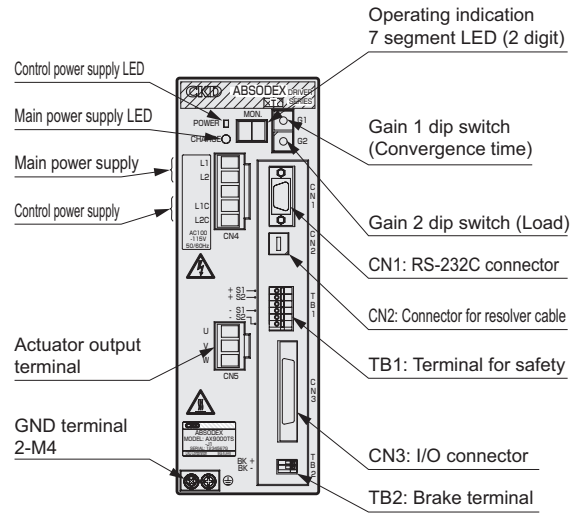
Panel description

● Parallel I/O (NPN, PNP specifications)

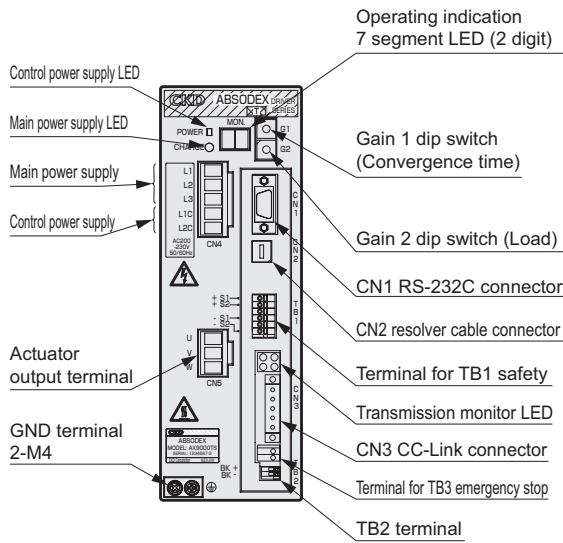
- For 200 VAC



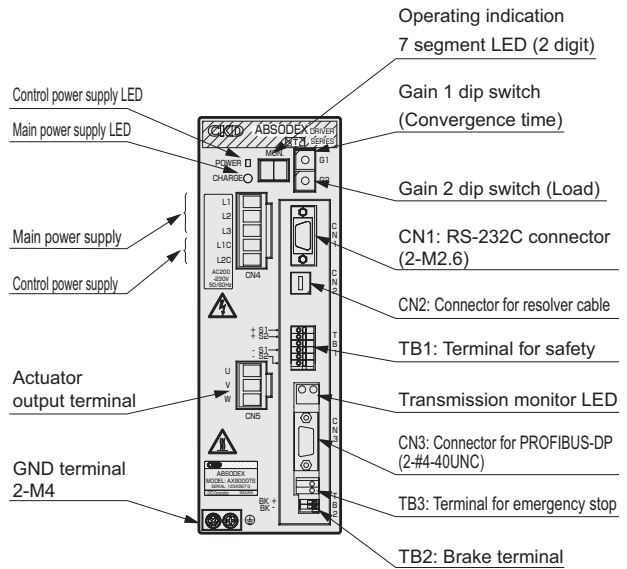
- For 100 VAC



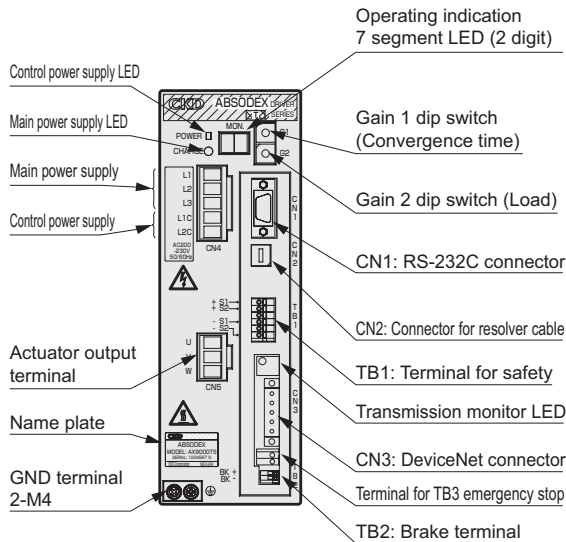
● CC-Link specification



● PROFIBUS-DP specifications



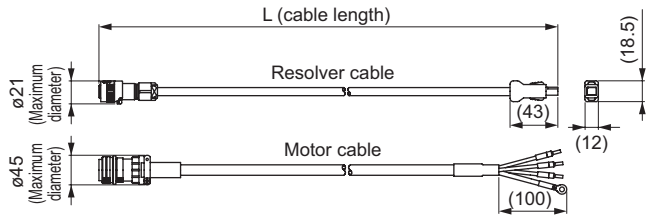
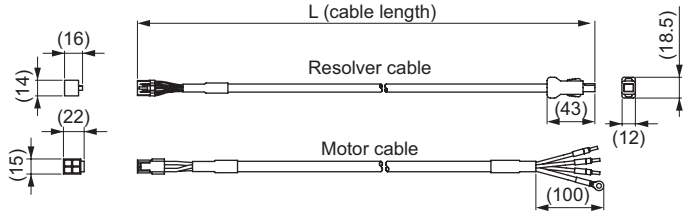
● DeviceNet specifications



Cable specifications

Cable dimensions

Min. cable bending radius

<p>● AX1000T</p> 	Resolver cable	60 mm
<p>● AX2000T, AX4000T</p> 	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 repeatedly, 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 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



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).

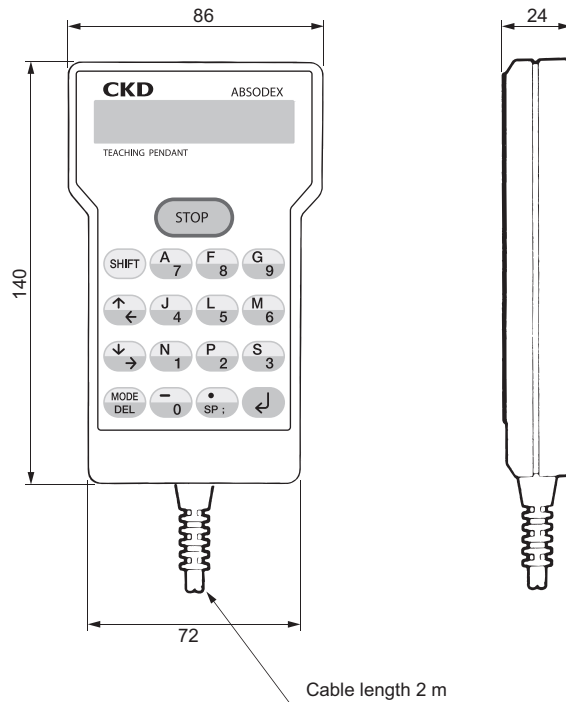
Specifications

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
Display	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	2 m
Operating ambient temperature	0 to 50°C
Operating ambient humidity	20 to 90% (with no dew condensation)
Storage ambient temperature	-20 to 80°C
Storage ambient humidity	20 to 90% (with no dew condensation)
Atmosphere	No corrosive gases or powder dust
Weight	Terminal only approx. 140 g

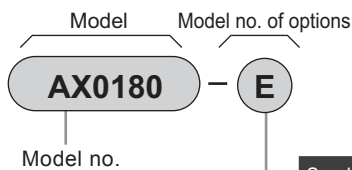
* The English version displays English messages. The operation panel keys are the same as those of the Japanese version.

Dimensions

- Dialog Terminal

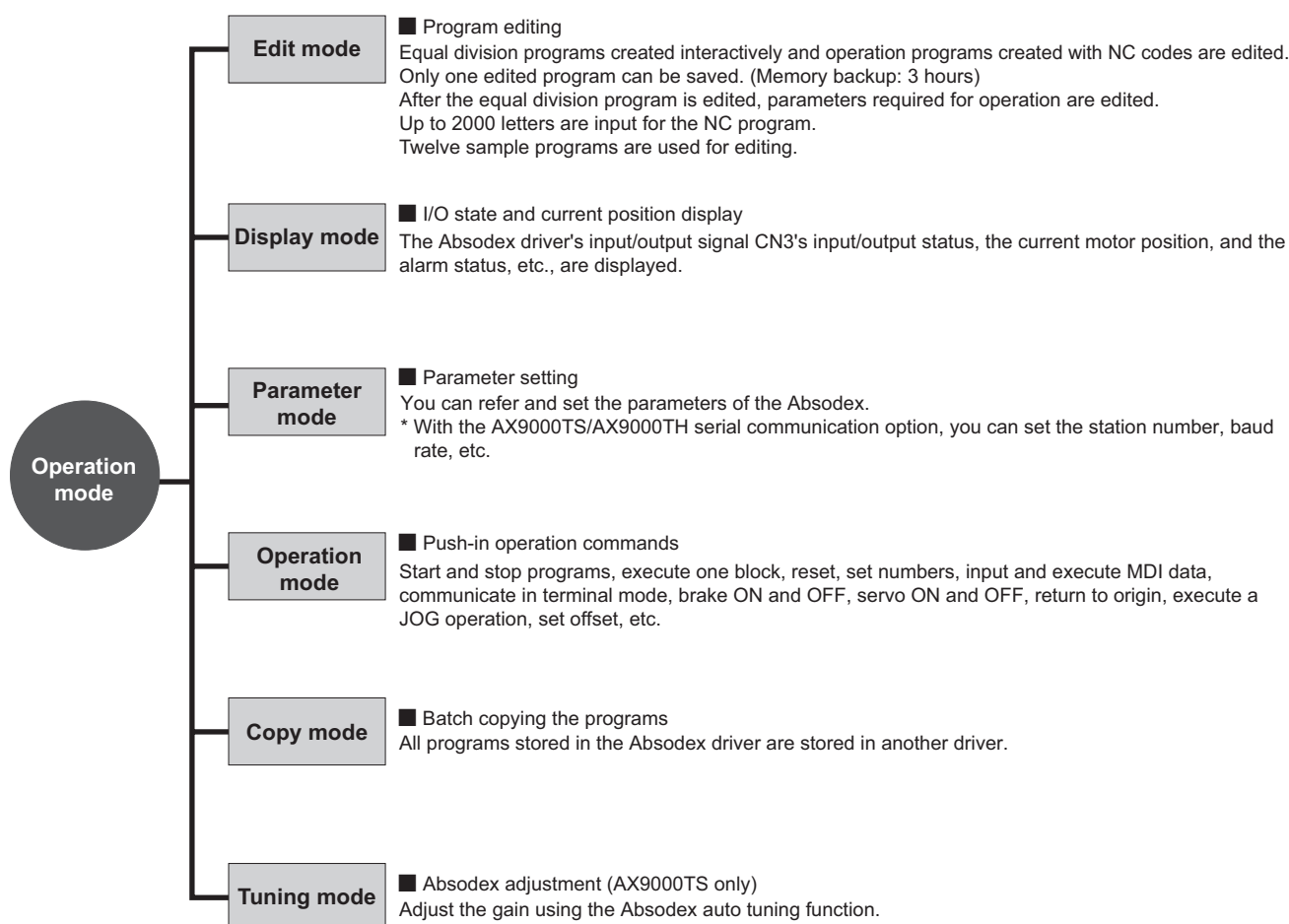


How to order



Symbol	Descriptions
Blank	Standard (Japanese version)
E	English version

Dialog Terminal



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] sec
Rotational direction	1. CW 2. CCW
Stop process	1. Start wait 2. Dwell
Brake	1. Used 2. Not used
Delay timer	[0.01 to 99.99] sec
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 Push-in 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	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.
http://www.ckd.co.jp/kiki/caddata/ax_t.htm

● 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).

● Others

Part name	Applicable model	Model no.
Power supply connector (CN4)	AX Series	AX-CONNECTOR-PC45
Motor cable connector (CN5)	AX Series	AX-CONNECTOR-PC43
Housing (cover) (CN4: power connector)	AX Series	AX-COVER-KGG-PC45
Connector housing (cover) (CN5: Motor cable)	AX Series	AX-COVER-KGG-PC43
I/O connector (CN3: for parallel I/O)	AX Series (-U0, U1)	AX-CONNECTOR-MDR
I/O connector (CN3: for CC-Link)	AX Series (-U2)	AX-CONNECTOR-BLZ5
I/O connector (CN3: for DeviceNet)	AX Series (-U4)	AX-CONNECTOR-MSTB
Protection element for electromagnetic brake	AX Series (-EB)	AX-PARTS-TNR20V121K

Terminology

Index precision

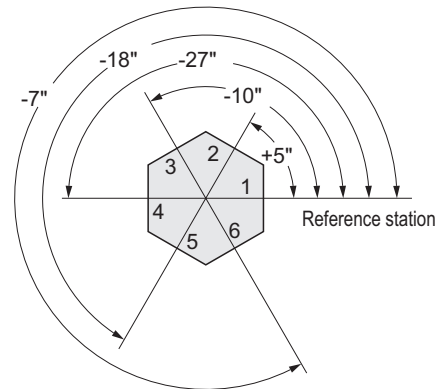
The Absodex index precision is the difference between the target position set by an NC program and the actual stop position.

The target position is an angle (seconds) 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

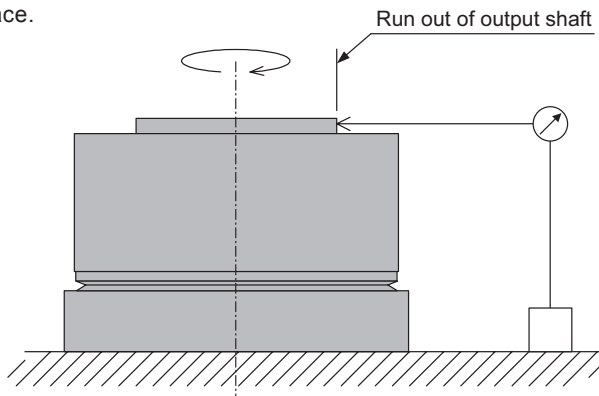
Repeatability expresses the deviation in the angles of the stop positions measured repeatedly under the same conditions for the same target position. It is expressed as an angle (seconds).

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

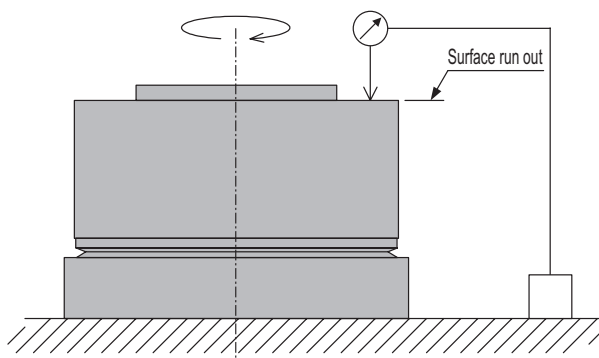
Run out of output shaft

The run-out accuracy of the inside-low section of the table installation surface.



Surface run out of output shaft

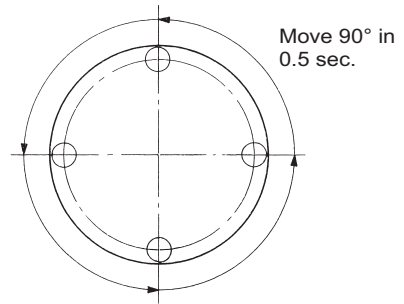
The run-out accuracy of the table installation surface.



Operation specifications 1 (index unit operation)

Operation specifications

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



Program example

Main program	
<code>01;</code>	Use program No. "1"
<code>G11;</code>	Set the time (sec.) in the NC code F unit.
<code>G10 1A4;</code>	Split one rotation into 4.
<code>G91.1;</code>	Set the incremental dimensions.
<code>A0 F0.5;</code>	Move to the closest index station in 0.5 sec.
<code>N1M0;</code>	Wait for the start signal input from the PLC.
<code>A-1F0.5;</code>	Move one index in 0.5 sec.
<code>J1;</code>	Jump to the sequence No. 1 block.
<code>M30;</code>	Program end

(Note) When using the interactive terminal or Teaching Note, if the program No. 1 is input, `01` 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 is selected 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

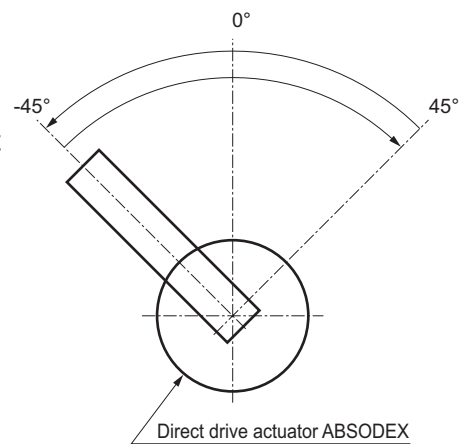
Process name	I/O signal name	PLC output	PLC input	Remarks
(3) Index	- Start signal - Positioning completion signal - Start input waiting output			Index complete by using positioning complete signal

(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 sec.
- Applies the brakes when stopping (Note 1)
- Enables emergency stop input (Note 2)



Program example

Main program

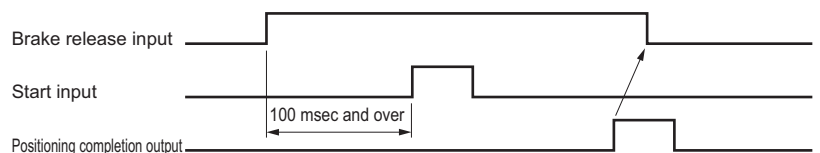
<code>Q̄2;</code>	Use program No. "2".
<code>G105;</code>	Set the unit of NC code A to angle (°).
<code>G11;</code>	Set the time (sec.) in the NC code F unit.
<code>G90;</code>	Set the absolute dimensions.
<code>N1M69;</code>	Release brake.
<code>A45F0.7;</code>	Move to 45° in 0.7 sec..
<code>M68;</code>	Activate brake.
<code>M0;</code>	Wait for the start signal input from the PLC.
<code>M69;</code>	Release brake.
<code>A-45F0.7;</code>	Move to -45° in 0.7 sec..
<code>M68;</code>	Activate brake.
<code>M0;</code>	Wait for the start signal input from the PLC.
<code>J1;</code>	Jump to the sequence No. 1 block.
<code>M30;</code>	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 moment of inertia (kg·m ²)	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 moment of inertia

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

2. Rotation speed

The max. rotation speed N_{max} is determined by

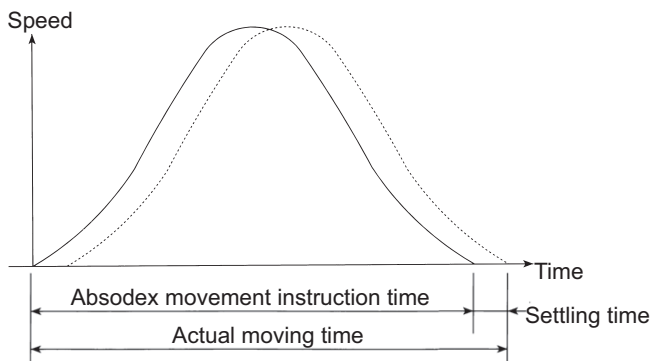
$$N_{max} = V_m \cdot \frac{\psi}{6 \cdot t_1} \quad (\text{rpm})$$

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 N_{max} does not exceed the actuator's specified max. 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.

$$T_f = \mu \cdot F_f \cdot R_f \quad (\text{N} \cdot \text{m})$$

$$F_f = m \cdot g$$

where, μ : Coefficient of friction

Rolling friction	Sliding friction
$\mu = 0.03$ to 0.05	$\mu = 0.1$ to 0.3

F_f : Force applied to rolling surface and bearings, etc. (N)

R_f : Average friction radius (m)

m : Mass (kg)

g : Gravitational acceleration (m/s²)

3. Load torque

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

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

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

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

Here, use the values in the following table for V_m , A_m , 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 moment of inertia (kg·m²)

T_{MF} : Output shaft friction torque (N·m)

f_c : Usage factor ($f_c = 1.5$ under normal use)

Regarding the actuator selected temporarily

Max. load torque < Max. 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 area where the max. torque is reduced during high-speed rotation.

When using the actuator in the torque limit area, 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 T_W using the following formula.

$$T_W = F_W \times R_W \quad (\text{N} \cdot \text{m})$$

F_W (N) : Force required for work

R_W (m) : Work radius

(Example)

If the actuator is installed 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.

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

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

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

$$W \leq 40$$

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

<Usage conditions>		<Operating conditions>	
Table radius	: R = 0.4 (m)	Movement angle	: $\psi = 90$ (°)
Table weight	: Wt = 79 (kg)	Movement time	: $t_1 = 0.8$ (s)
Jig rotational radius	: Re = 0.325 (m)	Cycle time	: $t_0 = 4$ (s)
Jig weight	: Wj = 10 (kg/piece)	Load friction torque	: $T_F = 0$ (N·m)
	(includes the work weight)	Work torque	: $T_W = 0$ (N·m)
Number of jigs	: N = 4	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·m ²)
(b) Jig and workpiece	$J_2 = N \times W_j \times R_e^2 = 4 \times 10 \times 0.325^2 = 4.225$	(kg·m ²)
(c) Total sum of moment of inertia	$J = J_1 + J_2 = 6.32 + 4.225 = 10.545$	(kg·m ²)

STEP 2

Max. rotation speed

$N_{max} = V_m \cdot \frac{\psi}{6 \cdot t_1} = 1.76 \times \frac{90}{6 \times 0.8} = 33$	(rpm)
Confirm that N_{max} 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·m ²) or over, so this load is allowable.	
Max. load torque	
$T_m = [A_m \cdot (J + J_M) \cdot \frac{\psi \cdot \pi}{180 \cdot t_1^2} + T_F + T_W] \cdot fc + T_{MF}$	
$= [5.53 \times (10.545 + 0.326) \times \frac{90 \times \pi}{180 \times 0.8^2} + 0 + 0] \times 1.5 + 10$	
$= 231.3$ (N·m)	
Effective load torque	
$T_{rms} = \sqrt{\frac{t_1}{t_0} \cdot [r \cdot A_m \cdot (J + J_M) \cdot \frac{\psi \cdot \pi}{180 \cdot t_1^2} \cdot fc]^2 + (T_F \cdot fc + T_W \cdot fc + T_{MF})^2}$	
$T_{rms} = \sqrt{\frac{0.8}{4} \times [0.707 \times 5.53 \times 10.871 \times \frac{90 \times \pi}{180 \times 0.8^2} \times 1.5]^2 + (0 \times 1.5 + 0 \times 1.5 + 10)^2}$	
$= 70.7$ (N·m)	

STEP 4

Regenerative power

$W = \left(\frac{V_m \cdot \psi \cdot \pi}{t_1 \cdot 180} \right)^2 \cdot \frac{(J + J_M)}{2 \cdot t_0}$	
$= \left(\frac{1.76 \times 90 \times \pi}{0.8 \times 100} \right)^2 \times \frac{10.871}{2 \times 4} = 16.23$	(W)
$W \leq 40$	(W)

STEP 5

Selection guide

Determine if the selected AX4300T can be used.		
Total sum of load moment of inertia	10.545 ≤ 180	(kg·m ²)
Max. rotation speed	33 ≤ 100	(rpm)
Max. load torque	231.3 ≤ 300	(N·m)
Effective load torque	70.7 ≤ 100	(N·m)
Regenerative power	16.23 ≤ 40	(w)
Thus, AX4300T can be used.		

When selecting a model for "MC2 curve"

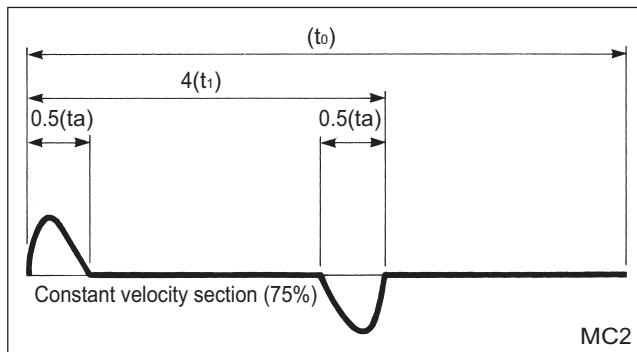
What is the MC2 curve?

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 (t_a) 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	: t_a (s)
Load moment of inertia	: J (kg·m ²)
Output shaft moment of inertia	: J_M (kg·m ²)
Friction torque	: T_f (N·m)
Work torque	: T_w (N·m)
Output shaft friction torque	: T_{MF} (N·m)

Max. speed: N_{max} (rpm)

$$N_{max} = \frac{\psi}{6(t_1 - 0.863t_a)}$$

Load torque (max.): T_m (N·m)

$$T_m = \left[5.53(J + J_M) \cdot \frac{\psi \cdot \left(1 - \frac{t_1 - 2t_a}{t_1 - 0.863t_a}\right) \cdot \pi}{720 \cdot t_a^2} + T_f + T_w \right] \cdot f_c + T_{MF}$$

Load torque (min.): T_{rms} (N·m)

$$T_{rms} = \sqrt{\frac{2t_a}{t_0} \cdot \left[3.91(J + J_M) \cdot \frac{\psi \cdot \left(1 - \frac{t_1 - 2t_a}{t_1 - 0.863t_a}\right) \cdot \pi}{720 \cdot t_a^2} \cdot f_c \right]^2 + [(T_f + T_w) \cdot f_c + T_{MF}]^2}$$

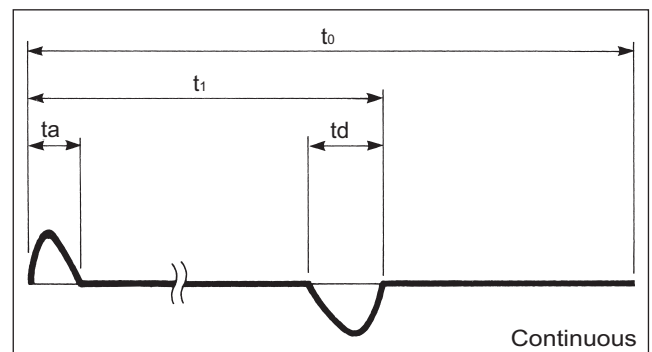
When selecting a model for "continuous rotation"

What is continuous rotation?

Continuous rotation has the following features.

1. Continuous rotation : To continuously rotates at a set speed until the continuous rotation stop signal is input.
2. Equal division position stop : To stop at an equal division when the continuous rotation stop signal is input if used with equal division designation.

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



Selection procedure

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

Rotation speed	: N (rpm)
Cycle time	: t_0 (s)
Acceleration time	: t_a (s)
Deceleration time	: t_d (s)
Load moment of inertia	: J (kg·m ²)
Output shaft moment of inertia	: J_M (kg·m ²)
Friction torque	: T_f (N·m)
Work torque	: T_w (N·m)
Output shaft friction torque	: T_{MF} (N·m)

Max. speed: N_{max} (rpm) (Note 1)

$N_{max} = N$

Load torque (max.): T_m (N·m)

$$T_m = \left[5.53(J + J_M) \cdot \frac{6.82N \cdot t_a \cdot \pi}{720 \cdot t_a^2} + T_f + T_w \right] \cdot f_c + T_{MF}$$

Load torque (min.): T_{rms} (N·m)

$$T_{rms} = \sqrt{\frac{2t_a}{t_0} \cdot \left[3.91(J + J_M) \cdot \frac{6.82N \cdot t_a \cdot \pi}{720 \cdot t_a^2} \cdot f_c \right]^2 + [(T_f + T_w) \cdot f_c + T_{MF}]^2}$$

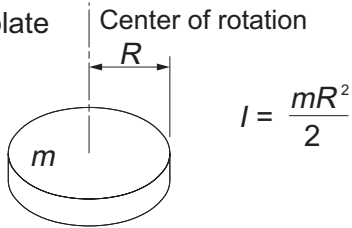
The above formula applies for the case of $t_a \leq t_d$. If $t_a > t_d$, then replace t_a with t_d , and select.

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

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

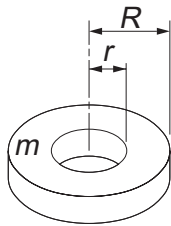
● A When rotation center is own shaft

1. Circular plate (cylinder)



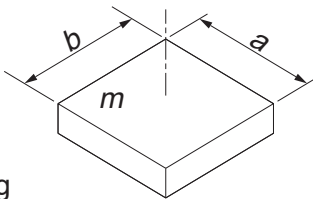
$$I = \frac{mR^2}{2}$$

2. Hollow circular plate (hollow cylinder)



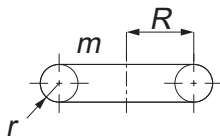
$$I = \frac{m(R^2 + r^2)}{2}$$

3. Cuboid



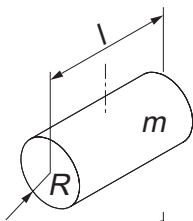
$$I = \frac{m(a^2 + b^2)}{12}$$

4. Ring



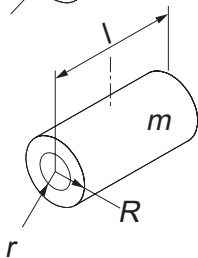
$$I = \frac{m(4R^2 + 3r^2)}{4}$$

5. Cylinder



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

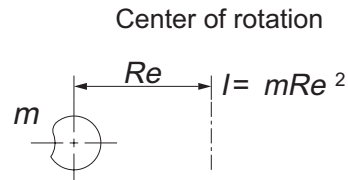
6. Hollow cylinder



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

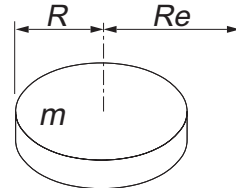
● B When rotation center differs from own shaft

1. Any shape (if sufficiently small)



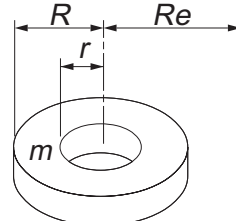
$$I = mRe^2$$

2. Circular plate (cylinder)



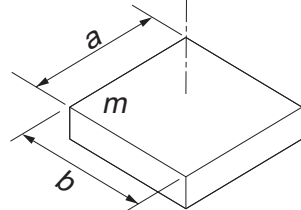
$$I = m\left(\frac{R^2}{2} + Re^2\right)$$

3. Hollow circular plate (hollow cylinder)



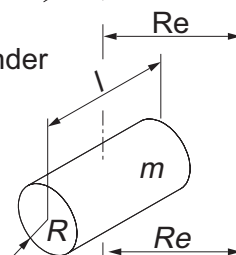
$$I = m\left(\frac{R^2 + r^2}{2} + Re^2\right)$$

4. Cuboid



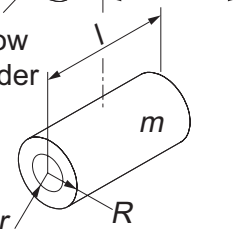
$$I = m\left(\frac{a^2 + b^2}{12} + Re^2\right)$$

5. Cylinder



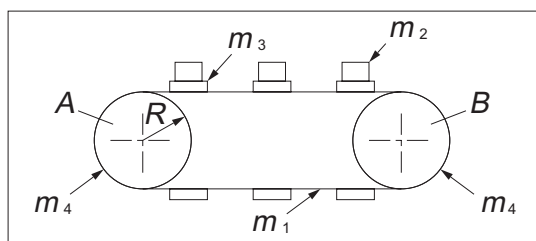
$$I = m\left(\frac{3R^2 + l^2}{12} + Re^2\right)$$

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		(Note) Contact CKD for chain drives and gear drives.	
Table direct drive			
Your company name		Name	
Department			
TEL		FAX	

■ Operating conditions

1. Index 2. Oscillator

Movement angle ψ (°) or, Index numbers

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 (pcs)

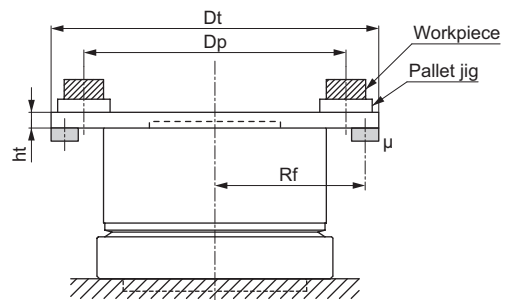
Max. weight mw (kg/pcs)

Installation center Dp (mm)

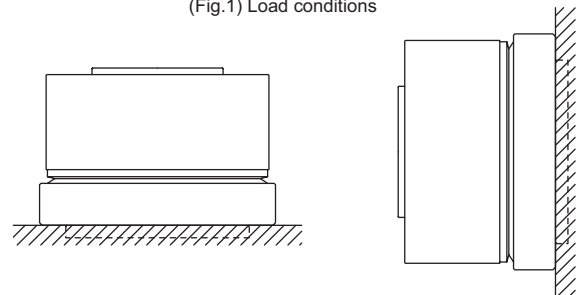
Pallet jig

Quantity np (pcs)

Max. weight mw (kg/pcs)



(Fig.1) Load conditions



(Fig.2) Installation direction: Horizontal

(Fig.3) Installation direction: Vertical

■ Others

Mounting orientation

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

External work

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.

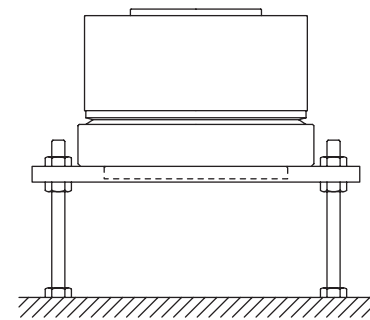
Extension with table shaft

1. No 2. Yes (Fig. 5)

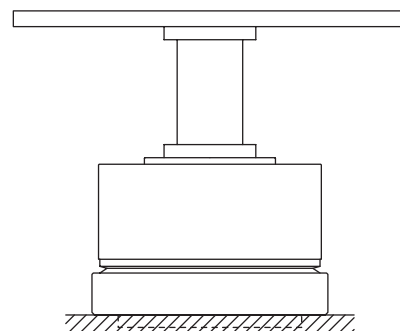
Actuator movement

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.

Related products

Absodex Compact type AX6000M series

■ Space saving

With the smallest dimensions in the industry and the concentric circle shape (the rotation axis and the fixed axis are the same), you can design space-saving compact equipment.

■ Flexible

The extensive programming features enable your desired operations. Simple operation settings are also supported including automatic creation of point specification programs.

■ Highly reliable and maintenance free

The direct drive method (no gears) provides stable operation without accuracy degradation through damage or attrition of gears during overloaded operation.

Electric driven actuator ERL2/ESD2 series

■ Free combination

- Common controller for all models
- Automatic recognition of actuator
Less spare parts required

■ Controller

- 63-point positioning now available
- Most compact model in the industry

■ Optional selection tool

- Setting software "E Tools" for easy setting
- Easy operation with the teaching pendant
The next button to be pressed is indicated by illumination. Easy even for novices

Electric driven actuator motor-less type

■ Ball screw driven type ETS series

- Motor size: 8 types, Lead: 7 types, Motor mounting orientation: 5 types
- Install your favorite motor
- Selectable installation specifications of the origin sensor and the limit sensor
- 100 to 1500 mm (50 mm pitch) strokes are selectable.
- Wide range of use with a maximum load capacity of 150 kg and a maximum speed of 2000 mm/s

■ Ball screw driven type Low dust generation ECS series

- Based on the ETS series, this model realizes low dust generation with the fully covered structure and suction ports.
- Motor size: 7 types, Lead: 7 types, Motor mounting orientation: 5 types
- Install your favorite motor
- Selectable installation specifications of the origin sensor and the limit sensor
- 100 to 1500 mm (50 mm pitch) strokes are selectable.
- Wide range of use with a maximum load capacity of 150 kg and a maximum speed of 2000 mm/s

■ Belt-driven type ETV series

- Belt-driven type based on the ETS series.
- A stroke of 100 to 3500 mm (50 mm pitch) can be selected. Long strokes and high speeds are realized with a maximum speed of 2000 mm/s.
- Motor size: 6 types, Motor mounting orientation: 6 types
- Install your favorite motor

Catalog No.CC-1148A



Catalog No.CC-1219A



Catalog No.CC-1165A, CC-1216A, CC-1217A



Electric driven actuator KBZ series

- **High tact**
Operation with a maximum speed of 800 mm/s
- **Use of servo motors**
Servo motors are used with compact shafts. Realization of high speed, high acceleration/deceleration and a high load capacity through a servo motor
- **Absolute specifications**
Adopting an absolute specification with no origin return required
- **Compact controller**
Thorough downsizing has been made.

Catalog No.CC-1102A



Electric driven actuator ESSD/ELCR series

- **Space saving**
With the built-in controller, the controller space and wiring are not necessary.
- **Install it like a pneumatic cylinder**
External shape, controls, and the usage are like a pneumatic cylinder.
- **Flexible control of operation**
Three control modes, speed and acceleration controls, and a positioning completion range (in-position) can be set.
- **Easy teaching**
Handy direct teaching with five buttons

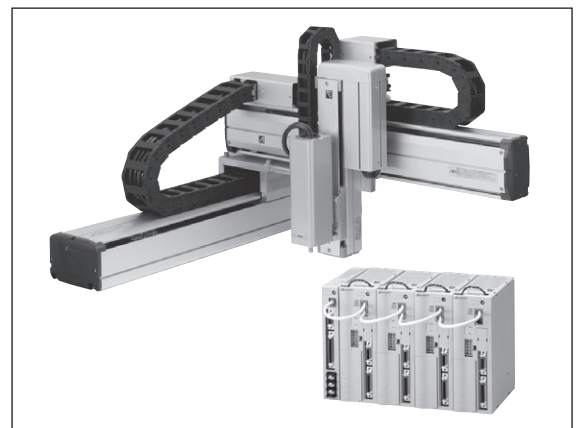
Catalog No.CC-1002A

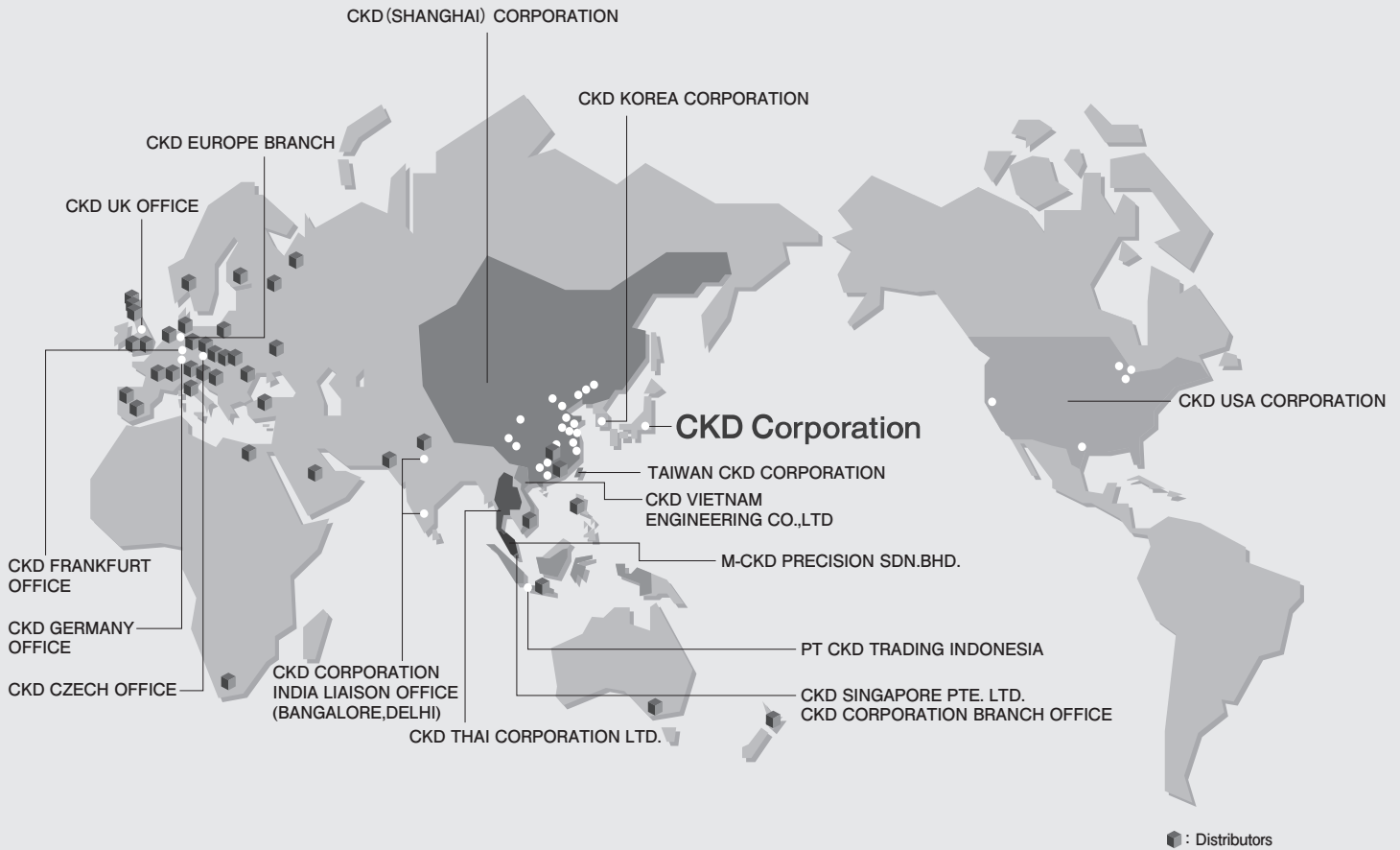


Electric driven actuator KBB series

- **High tact**
Maximum of 2000 mm/s (timing belt driven)
- **High precision**
Repeatability: ± 0.01 mm (ball screw driven)
- **Absolute specifications**
All models use long-life lithium battery (lifespan: 50,000 hours) and do not require origin returning.
- **High-performance processing with high-speed CPU**
The high-speed CPU provides high performance.
- **Abundant variations**
Ball screw: 7 types, Timing belt: 6 types
Motor mounting position: 4 directions are provided for each axis.

Catalog No.CC-783A





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