"Instantaneous positioning " quick response direct drive actuator

Quick response type direct drive actuator AX1000T, AX2000T or AX4000T series

New product

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

CKD Corporation
CC-995A 4

“Instant positioning! Quick response absodex” with even easier setup!

AX 1000T 2000T 4000T Series

Quick positioning!

Quick setup!

High precision, multi-functions

High precision absolute DD actuator that can index 360°anywhere and combine intermittent and continuous rotation.

Environmental design

Low profile, oil free, reusable and energy efficient....the features you need to build an ecological equipment.

NEW

Better compatibility for AX 1000T

Easier service and maintenance thanks to improved compatibility among drivers, actuators and cables.

RoHS

1. Shorter tact time for your equipment

Reduce time loss with improved response
”Instant positioning”; positioning time reduced by 75%.

Reduce start up time by linking with peripheral component
Easier to link with other components with the A/B phase encoder output.

2. Improved usability

Optimal tuning in no time
Newly added semi-automatic tuning function

Easier setup
Adjustment software included (AX tools)

Increased I/O signals
Newly added ready output, servo on, etc.

Control is on even when the motor is off
Separate motor and control power supply

3. Safety standards

IEC standards, category 3 for “safe torque off function”

4. Conformity marks

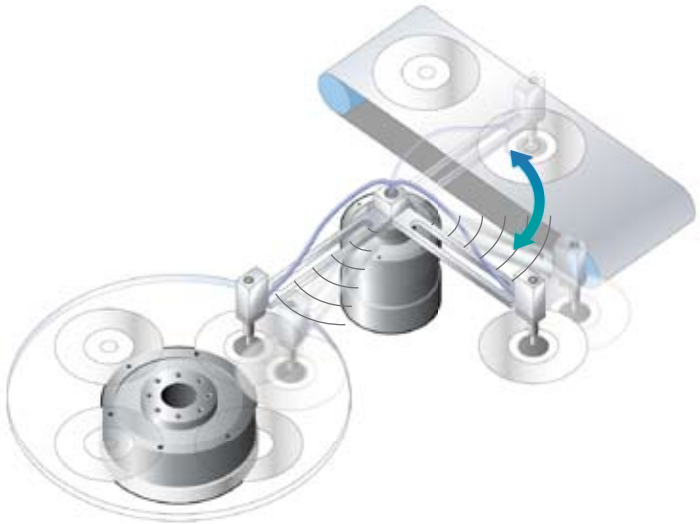
UL/cUL, CE compliant

c US c UL US LISTED CE TÜVRheinland

5. Downsized GH/WGH type drivers

65% smaller volume, 50mm shorter depth

Reduced tact time with quicker response.



Bringing safety by linking to the inspection machine.

What's new in the TS/TH driver?

● Quick response

Improved response and reduced stabilization time with the faster CPU allows you to reduce tact time even further.

● Compact and light weight

Footprint of large models with max. output torque of 150N•m ore more has been reduced by 65.
(Compared to CKD's GH type driver)
Due to, light weight was made.

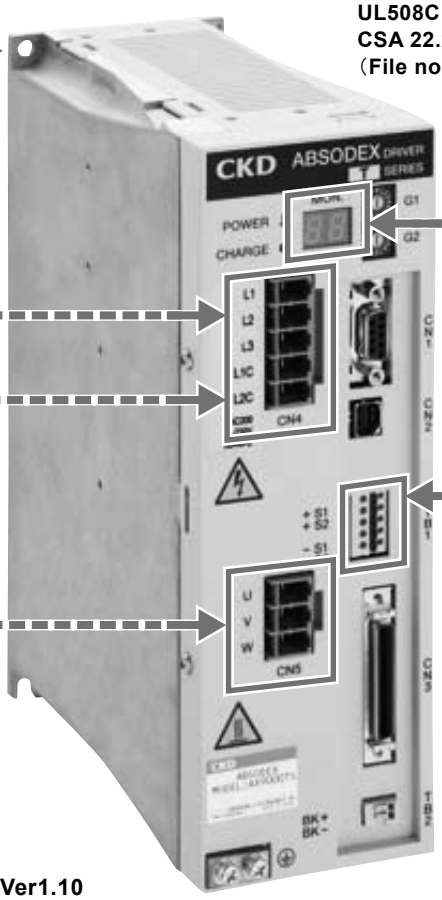
● An encoder output is added.

By adding the A-B phase output for current position, position control using pulse is now easier and certain.

● UL/cUL Certified

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

●Mounting hole eliminates the task of using a mounting bracket



● Separate main power supply and control power supply

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

● 7 segment LED2-digit display

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

● Terminal for safety

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

● Connector provided

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

Supoorted fieldbus

CC-Link **CC-Link Ver1.10**

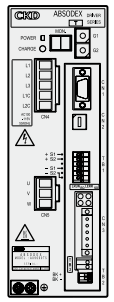
DeviceNet **DeviceNet**

PROFIBUS **PROFIBUS DP**

Monitor with serial communication

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

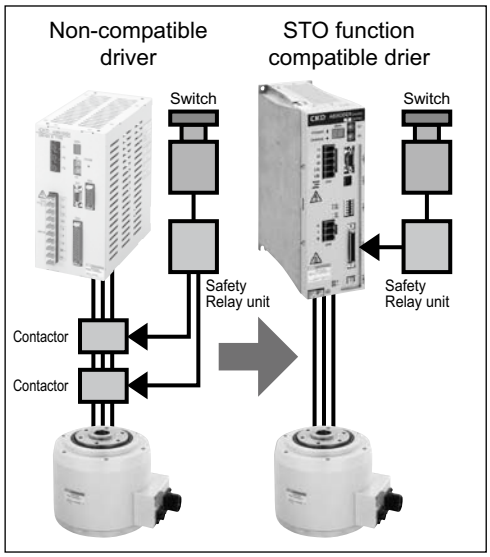
AX9000TS/TH-U2□ U3□U4□



Position
Program no.
Speed
Alarm, etc.

Start, stop program selection, etc.

PLC



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

Convenience

● Adjustment and installation support tool (AX tools) comes standard.

Get the right adjustments in less time.

■Teaching note

- **Create programs and set parameter**
- **Origin offset**
- **Trial run**
- **Semi-automatic tuning (TS type only)** New
  By adjusting one parameter after auto tuning, the equipment can achieve higher performance.

■Speed wave New

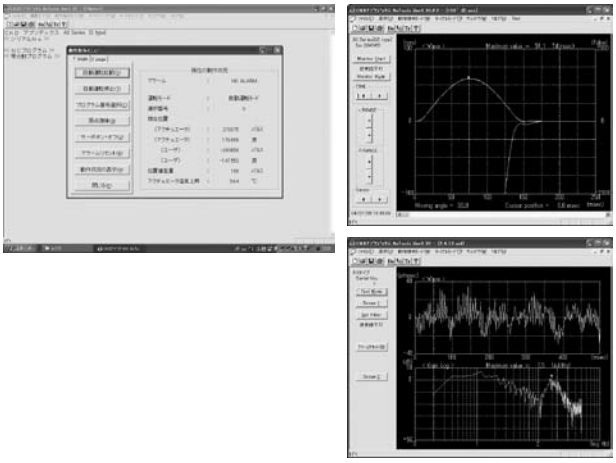
Review the tuning by measuring the actual change in velocity and convergent time.

■FFT New

Deter resonance of mechanisms by setting a notch filter and low-pass filter.

■I/O check New

I/O status of host component and can be checked.



● Additional functions New

■Input/output function

- **Ready output**
- **Servo state output**
- **Encoder output**
- **Servo on input**
- **Position deviation counter clear input**

■Parameter

- **Setting positioning complete signal output duration**
  Can be set h 0 to 100ms range.
- **Mode selection of in position input**
  Position output ON all the time within the in-position range or ON only when it is stopped within the in-position range.

■Additional program selection method

- **Select programs with 6bit input (0 to 63)**
- **Operation start with selection input + start input**
  Reduce tact time by reducing the time required to operate after program selection by abbreviating the program number setting input.

■Prevents free-run when alarm is on

Slows down and stops the servo when an alarm caused by coasting goes off to prevent accidents

Features of the Absodex

● Return to origin not required

Because the absodex has an absolute resolver that can detect the current position right after being turned on, you don't need to do an return to origin operation each and every time. You can also restart form the current position after and emergency stop also.

● Smooth cam curve drive

5 types of cam curves are installed as standard. Minimizes the shock during rotation and stop.

● Model selection software (free)

Select the model you need with ease.

● Green technology

■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

No more task of replacing and disposing lubricants. Eliminates pollution caused by oil leakage.

■Smaller components, smaller equipment

Does not require origin detection sensor, reducer and etc.

■Easy to change specifications, reusable

Can be reused unlike mechanical indexes by changing specifications using computers and the teaching pendant.

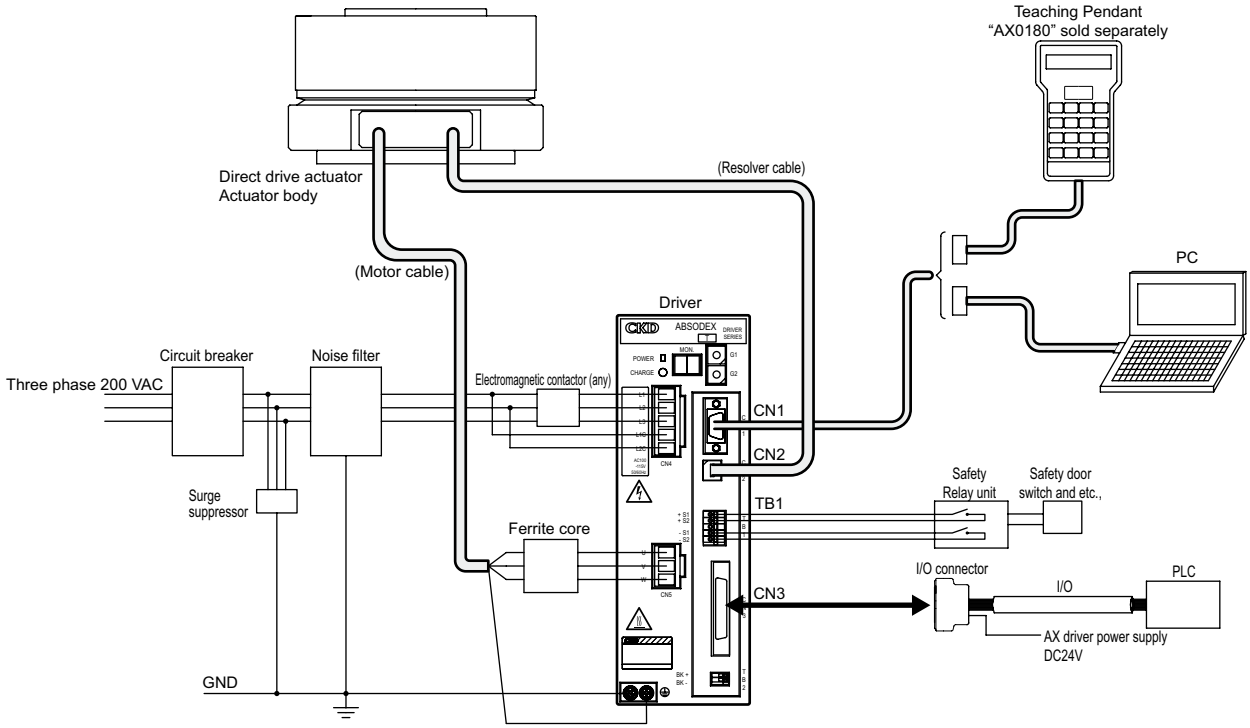
System configuration

● **Basic settings**

1. Input the program from a personal computer or from the teaching pendant.
2. Set required parameters the same way.
3. Set the appropriate gain.

● **Basic drive methods**

1. The program which is selected to do wants from PLC.
2. Provide start signal from a PLC.
3. Postioning complete signal will be output from the driver after a movement.



The parts below and over current/short circuit protection components are required to comply with the CE marking. Also, the driver must be placed withing the switch board. Refer to the manual or technical documents for Absodex AX Series TS/TH type to find out how to install them.

Product name	Application	Model no.	Manufacturer
Noise filter	Three phase/Single phase AC200V to 230V	3SUP-EF10-ER-6	Okaya Electric
	Single phase AC100V to 115V	NF2015A-OD	Soshin Electric
Ferrite core	Common	RC5060	Soshin Electric
Surge protector	Common	R/A/V-81BXZ-4	Okaya Electric
FG clamp*	Common	FGC-5, FGC-8	Kitagawa Industries

*FG clamp is used to earth the sheild for motor cable and resolver cable.

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, connector for power supply, connector for motor cable	

Programming tool

- **Teaching pendant "AX0180" available.**
- **Adjustment and installation support tool (AX tools) available. (Free, OS:Windows)**
- **Create and save programs, set parameters, enter commands using a PC. Communication cable RS-232C(for9 pin D-sub(2m) model no.:AX-RS232C-9P) is required.**

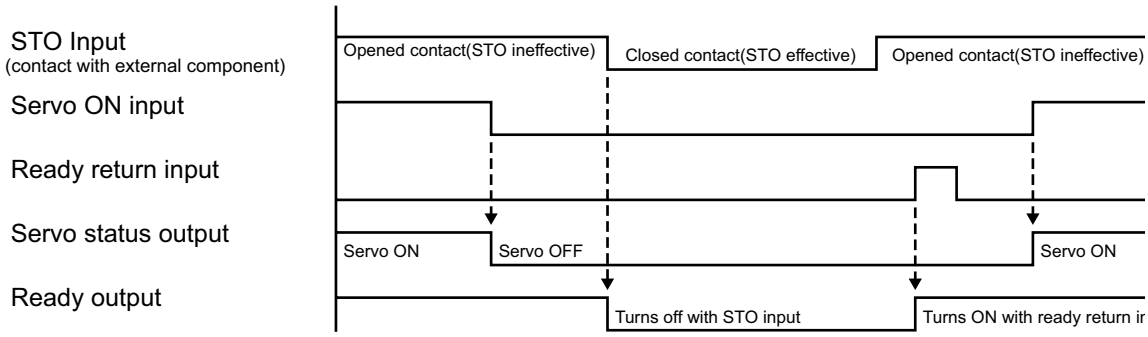
Note) The communication cable is designed only to be used for Absodex. If other cables are used, the drive and pc may be damaged.

Note) Disconnect the teaching pendant or PC from CN1 during normal operation. Connect them only during setting and adjustment.

Note) Do not put the PC in "stand by" with the USB-Serial conversion cable is connected. This will result in an error after returning from stand by.

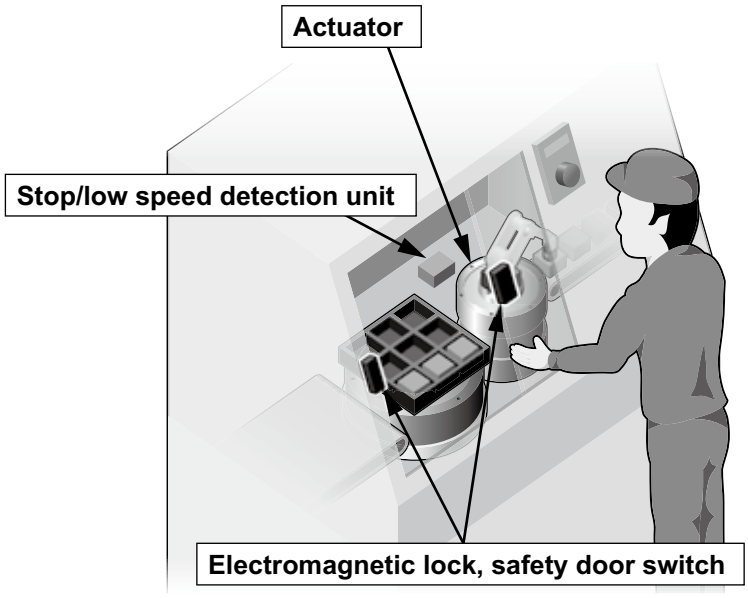
Example of a STO timing chart

The Safe Torque Off function allows you to turn off the motor by the opening/closeing of a contact of an external safety component.
An example of a timing chart using the STO terminal (TB1) is shown below.

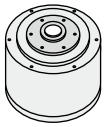
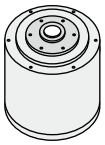
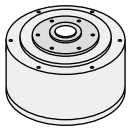
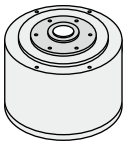
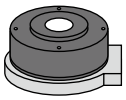
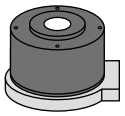
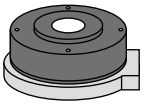
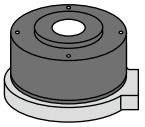


- **Use the safe torque off function with the servo off in normal conditions.**
- **Always conduct a risk assesment off of the entire equipment when using the safe torque off function.**

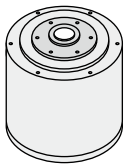
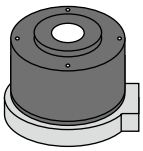
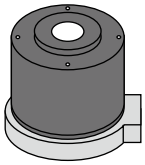
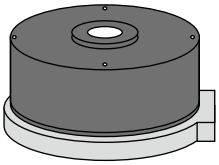
Example



Direct drive actuator 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 drier	TS type Driver									
	TH type Driver									

Applications	Page: 41
⚠Safety precautions	: Intro 9
Related parts model no. table	Page: 39
Selection guide	Page: 43

Torque (N•m)				Index accuracy (sec.)	Repeatability (sec.)	Features	Applications	Page
210	300	500	1000					
 AX1210T				±15	±5	• High precision model with indexing accuracy and low displacement • High speed rotation (AX1022TS: 240rpm, AX1045TS:240rpm, AX1075TS:140rpm, AX1150TS:120rpm, AX1210TS:120rpm)	• Precision measurment • Turntable • Inspection machine • Assembly machine	1 to 6
				±30	±5	• High speed rotation (300rpm) • Small diameter and low profile • Large diameter of the hollow hole (Φ30)	• P&P • Turntable • Assembly machine	7 to 10
	 AX4300T	 AX4500T	 AX410WT	±30	±5	• High speed rotation (AX4009TS: 240rpm, AX4022TS:240rpm, AX4045TS:240rpm, AX4075TS:140rpm) • Capable of handling load of large moment of inertia • Hollow diameter is wide large size option.	• Turntable • Inspection machine • Assembly machine • P&P	11 to 28
				One driver can operate actuators of any size that are compatible. The controller function enables the actuator's rotation angle, movement time and timer, etc., to be set as desired with an NC program. Data is exchanged with an external PLC using M code output, etc.				TS type;29 to 34 TH type; 29 to 34

Safety precautions

Always read this section before starting use.

When designing and manufacturing devices using direct drive actuator, 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 this product in accordance of specifications.

This product must be used within its stated specifications. It must not be modified or machined.
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.)

❶Use for special applications including nuclear energy, railway, aircraft, marine vessel, vehicle, medicinal devices, devices coming into contact with beverages or foodstuffs, amusement devices, emergency cutoff circuits (cutoff, open, etc.), press machines, press circuits or safety devices.
❷Use for applications where life or assets could be adversely affected, and special safety measures are required.

3 Observe association standards and regulations, etc., to ensure safe device design.

4 Do not remove devices until safety is confirmed.

❶Inspect and service the machine and devices after confirming safety of the entire system related to this product.
❷Note that there may be hot or charged sections even after operation is stopped.
❸Before starting device inspection or maintenance, turn off device power and other power to related devices, release compressed air, and check leakage current.

5 Observe the Instruction Manual and Precautions for each product to prevent accidents.

❶Do not rotate the actuator outputs shaft by 30 rpm or more while power is off.
The driver could fail or electrical shock result from actuator power generation.
❷If the servomotor is turned off (including emergency stop or alarm) or brakes are turned off while a rotational force, such as gravity is applied, the output shaft may rotate by rotational force.
Conduct these operations flat where rotational force is not applied, or confirm safety before starting.
❸Unexpected movement may occur during gain adjustment or test operation, so keep hands, etc., away from the output shaft. When conducting operations with the actuator is not visible, confirm before starting that it is safe even if the output shaft turns.
❹The brakes of the type with brake do not necessarily hold the outputs shaft completely in all situations. When 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. Use the system flat or provide a mechanical lock.
❺It may take several seconds to stop in an emergency, depending on rotation speed and load.

6 Observe the precautions to prevent electrical shock.

❶High voltage is supplied to the terminal block at the driver's front panel. Install the enclosed 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.
❷When working with the side cover off, such as for maintenance and inspection or changing driver switches, turn the power off to prevent damages and injuries caused by electrical shock from high voltages.
❸Do 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 protection component.

Wire according to "JIS B 9960-1: 2008 Safety of Machinery - Electrical Equipment of Machines - Part 1 : General Requirements", and install an overcurrent protection device (such as molded case circuit breakers and circuit protectors) to the main•control power (terminal gland no. L1, L2, L3, L1C, L2C) and power supply for I/O (connector no. CN3-DV24V)

(Translation of an excerpt from JIS B9960-1 7.2.1 general requirements)
Overcurrent protection shall be provided in cases where the circuit current in a machine (electrical equipment) can exceed the lesser of either the rating of a component or allowable ampacity of the conductor. Ratings or settings to be assigned are set in 7.2.10.

9 Observe precautions on the pages that follow to prevent accidents.

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

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

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

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

Note that some items described as “CAUTION” may lead to serious results depending on the situation.
In any case, important information that must be observed is explained.

WARRANTY

Scope of warranty

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

1. Term of warranty

This product comes with a 1 year warranty from delivery. (this warranty is effective if the product is not operated for more than 8 hours a day. The warranty will expire if the product reaches its durability shown below)
Durability (direct drive actuator)
Absodex brake with air brake, piston packing, valves

2. Scope of warranty

If any faults found to be the responsibility of 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 Product abuse/misuse contrary to conditions/environment recommended in its catalogs/specifications.
② Faults caused by careless or incorrect handling, or improper control.
③ Faults caused by factors other than delivered parts.
④ Faults caused by improper product use.
⑤ Faults due to modifications to the product structure , performance, or specifications by a party other than CKD after the product is delivered, or faults caused by repairs not designated by CKD.
⑥ Damage that could have been avoided if the user's machine or equipment had functions and structures, etc., considered normal within the industry.
⑦ Failure due to causes not foreseeable with the technology at the time of delivery.
⑧ Failure due to fires, earthquakes, water damage, lightning, other acts of nature, acts of God, pollution, salt damage, gas damage, abnormal voltage, or other external forces.

The warranty here refers to the warranty of the actually delivered product, and does not include any damage resulting from a fault in the delivered product.

3. Warranty for exported products

(1) Product returned to our factories or companies/factories designated by CKD will be repaired. CKD is not liable for the costs and engineering required that is required for the return.

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.

1 The actuators and drivers are not waterproof. Provide waterproofing for use in places where water or oil could come in contact with these devices.

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

3 Turning the main power on and off frequently may cause damage to the element in the driver.

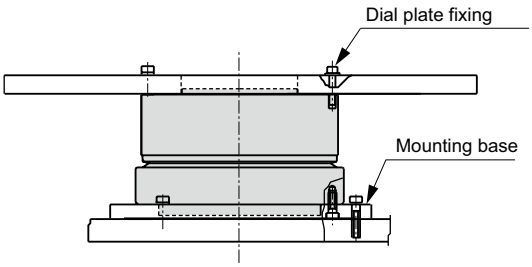
4 The output axis may move from the holding position even without an external force if the power or servo is turned off.

5 Optional magnetic brakes are used to enhance holding rigidity during output shaft stoppage. Do not use these brakes to brake or stop a rotating output shaft.

6 The actuator and driver do not have a rust proof guarantee.

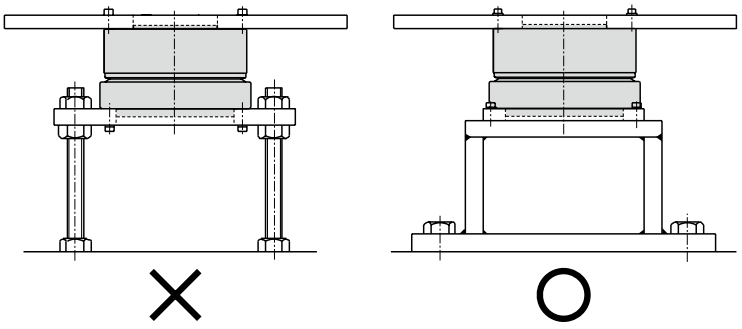
7 Equipment in which direct drive actuators are installed should have sufficient rigidity to realize full direct drive actuator performance. If the load equipment or frame's mechanical unique vibration is relatively low (200 to 300Hz or less), resonance could occur in the direct drive actuator and load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

Installing the actuator [Fig.1]



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

[Fig.2] Mounting the actuator



8 When extending the outuput shaft, refer to table 1 as a reference for deciding the extended shaft diameter and length. Also, install a dummy inertia using fig. 3 as a reference.

[Table1] Reference of diameter for extended output shaft

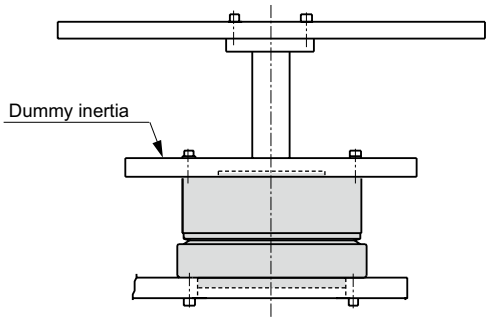
Max. torque	Shaft extension(mm)				
[N・m]	50	100	200	300	500
6	φ35	φ40	φ46	φ50	φ60
9,12	φ40	φ46	φ55	φ60	φ70
18,22	φ45	φ55	φ65	φ70	φ80
45	φ55	φ65	φ75	φ85	φ95
75	φ62	φ75	φ90	φ95	φ110
150	φ75	φ90	φ110	φ115	φ130
210	φ80	φ95	φ115	φ125	φ140
300	φ90	φ105	φ125	φ140	φ155
500	φ100	φ120	φ145	φ160	φ180
1000	φ120	φ140	φ170	φ185	φ210

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.

- **When extending the output shaft, the following dimensions apply as a guide to the extended shaft's diameter:**
  AX2006T, AX4009T, AX2012T, AX2018T, AX□022T, AX□045T:Φ60mm and over, AX□075T, AX□150T, AX1210T, AX4300T:Φ90mm and over, AX4500T: Φ150mm and over.
- **As a reference, dummy inertia is [load inertia] x (0.2 to 1). [Fig.3]**

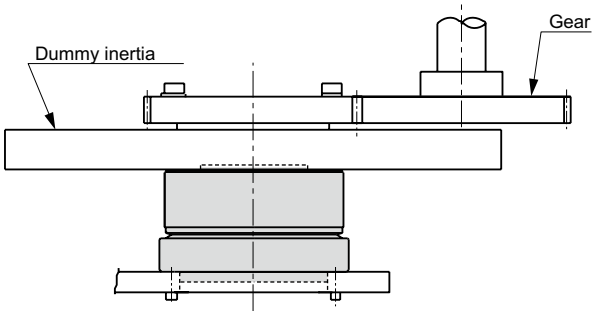
[Fig.3] Example 1. for dummy inertia installation



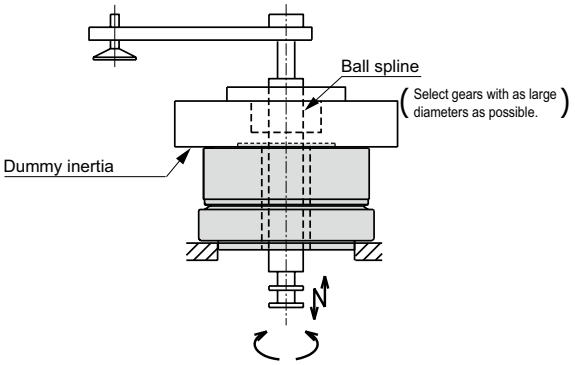
- **When coupling with belts, gears or spline or when joining with a key, dummy inertia should be [load inertia] x (0.5 to 2).**
- **If speed changes with belts or gears, use load inertia as the actuator output shaft conversion value, and install dummy inertia on the actuator. [fig.4] [fig.5].**

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

[Fig.4] Example 2. for dummy inertia installation



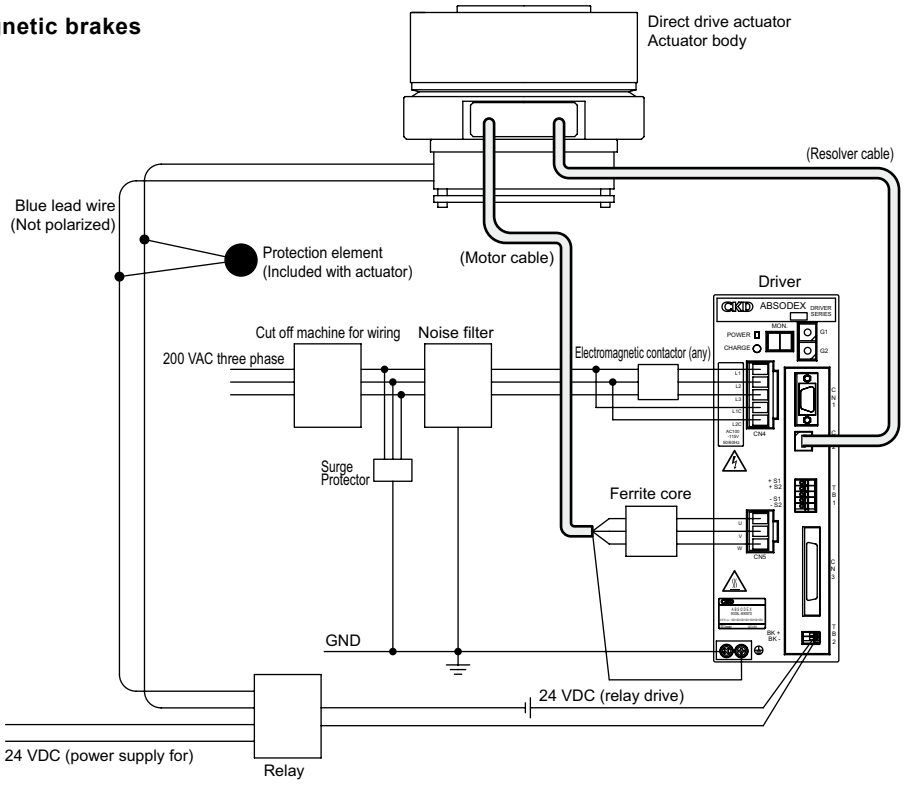
[Fig.5] Example 3. for dummy inertia installation



10 **Do not place the actuator where it may contact strong magnetic field.**
Do not pass cables with high voltage through the central hollow hole.
It may lead to malfunctioning, lower performance and damage.

11 **Use of surge protector is recommended when there is a risk of damage caused by lightning surge.**

Connecting magnetic brakes

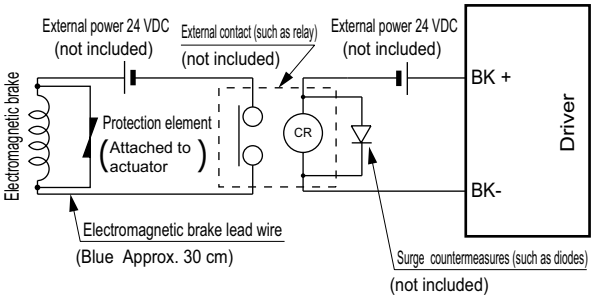


1) Do not use magnetic brakes to stop or control the rotating output shaft.

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's 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



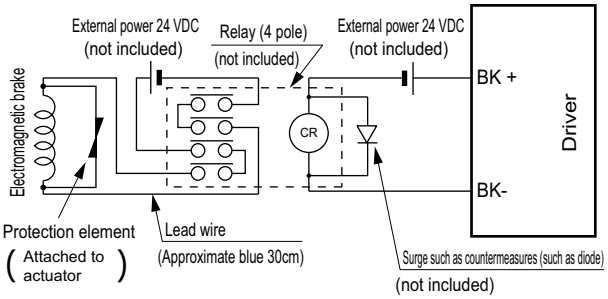
●Operation method

1. Control with NC program (M68, M69)
When the "M68" code is executed, BK+ to BK- will not be energized (brakes are applied), and when the "M69" code is executed, BK+ to BK- will be energized (brakes are released).

2. Control with brake release input (I/O connector/18 pin)
If brake release is input while the brakes are applied, BK+ to BK- will be energized (brakes are released).

●If magnetic brakes are frequently turned on and off, use a solid-state relay (SSR) for the external contact.
Recommended model G3NA-D210BDC5-24 (OMRON)
Refer to the SSR instruction manual before using.

• Relay contact serial connection



●Check that relay contact capacity is 10 times or more than the rated current. If less, use a multiple 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 around the magnetic brakes, iron powder, etc., could be attracted by the magnetic properties, or measuring instruments, sensors and other devices could be affected.

15 Refer to the Technical Documents of the Absodex AX Series TS,TH type driver for other precautions.

Safety precautions

Labor saving mechanisms warning

Always read this section before starting use.

CAUTION Installation & Adjustment

1. Connect the enclosed cable between the actuator and driver. Check that excessive force is not applied and 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 undesignated power supply could cause faults. Wait at least 5 seconds after turning power off before turning it on again.
3. Securely fix the direct drive actuator to the machine, and securely install loads such as the table before adjusting gain. Confirm that no interference occurs and that safety is secured 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. Failure to observe this may cause failures 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 actuator may become hot depending on operating conditions.
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 type
    - If the actuator and driver are combined mistakenly after program input (parameter setting), alarm 3 will go off. Check the actuator and driver combination.

      Note: Alarm 3 is 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), it may result in malfunctions and damages.
    - When changing the cable length or type, order the cable separately.
    - Actuator may catch fire if an incompatible driver is connected.
11. When using a circuit breaker, select one that has higher harmonic measures for inverter use.
12. The position of the output shaft in the actuator dimension drawing does not indicate the actuator's origin. When using it at the output shaft shown in dimension drawings, the origin must be adjusted to the origin offset.
13. The body outlet cable on AX4009T and AX200T series can not be moved. Always fix it at the connector section so that it will not move. Also, refrain from applying excess force onto the cable or pulling on the cable since it may damage it.
14. Refer to the technical documents of the Abxodex AX Series TS, TH type for other precautions and conformity to standards.

CAUTION During Use & Maintenance

1. Do not disassemble the actuator, because this may compromise expected functions and accuracy. Any modification to the resolver could cause critical damage.
2. When testing withstand voltage of the machine or equipment containing the direct drive actuator, disconnect the power cable for the driver and check that the voltage is not applied to the driver. Failure to observe this could result in faults.
3. If alarm "4" (actuator overload: electronic thermal) goes off, 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. Refer to the technical documents of the Abxodex AX Series TS, TH type for other precautions and conformity to standards.

Direct drive actuator

AX1000T Series actuator

High precision specification with
high indexing accuracy and output shaft run out
●Max. torque: 22, 45/75/150/210N•m

RoHS

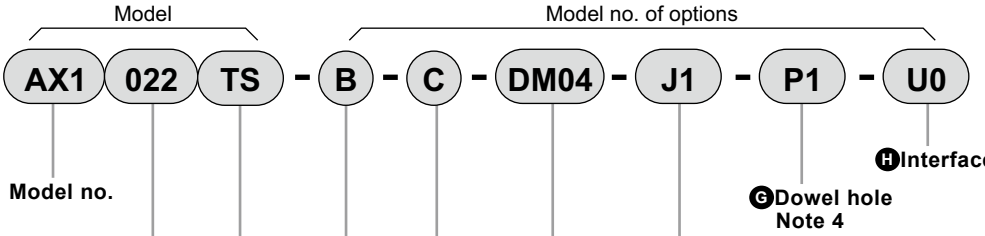
Actuator specifications

Descriptions		AX1022T	AX1045T	AX1075T	AX1150T	AX1210T
Maximum output torque	N•m	22	45	75	150	210
Continuous output torque	N•m	7	15	25	50	70
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
Allowable radial load	N	1000		4000		
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 accuracy (Note 3)	sec.	±15				
Repeatability (Note 3)	sec.	±5				
Output shaft friction torque	N•m	2.0		8.0		
Resolver resolution	P/rev	540672				
Motor isolations class		Class F				
Motor withstanding voltage		1500 VAC for one minute				
Motor isolation resistance		10MΩ 500 VDC and over				
Working ambient temperature range		0 to 45°C				
Ambient humidity range		20 to 85%RH with no dew condensation				
Storage ambient temperature range		-20 to 80°C				
Storage ambient humidity range		20 to 90%RH with no dew condensation				
Atmosphere		No corrosive gas, flammable or powder dust				
Weight	kg	8.9	12.0	23.0	32.0	44.0
Run out of output shaft	mm	0.01				
Run out of output shaft surface	mm	0.01				
Protection		IP20				

Note1: The speed must be kept below 80rpm during continuous rotation.
Contact CKD for CE certification requirements.
Note2: Refer to "Technical explanations" on page 49 for the details on index accuracy and repeatability.
Note3: The max ambient temperature is 40°C if used as an UL certified product.

How to order

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



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

Ⓐ Size (max. torque)
Ⓑ Driver type Note 1
Ⓒ Mounting base
Ⓓ Connector direction
Ⓔ Cable length Note 3
Ⓕ Driver power voltage Note 1

⚠ Note on model no. selection

Note 1: Use the table below to select the appropriate driver.

Driver-power voltage table

Model \ Driver Type	TS type driver		TH type driver
	Three phase/ single phase 200 to 230 VAC	Single phase 100 to 115 VAC	Three phase 200 to 230 VAC
AX1022T	Blank Note 2	J1	
AX1045T	Blank Note 2	J1	
AX1075T	Blank Note 2		
AX1150T			Blank
AX1210T			Blank

Note 2: Single phase 200 to 230 VAC is available for models with a torque of 45N•m or less.

Note 3: Flexible cable
Refer to page 35 for the dimensions of the cable.

Note 4: Ⓒ If the mounting base is "B" (with blackened mounting base), "P2" and "P3" can not be selected.

● Discrete actuator body model no.

AX1 ◯ T - B - C - P1

Ⓐ Size
Ⓓ Connector direction
Ⓒ Mounting base
Ⓖ Dowel hole

● Discrete driver model no.

- Three phase 200 to 230 VAC

AX9000TS - U0
AX9000TH - U0

- Single phase 100 to 115 VAC

AX9000TS - J1 - U0

Ⓗ Interface specifications

● Discrete cable model no.

- Motor cable

AX - CBLM5 - DM04

- Resolver cable

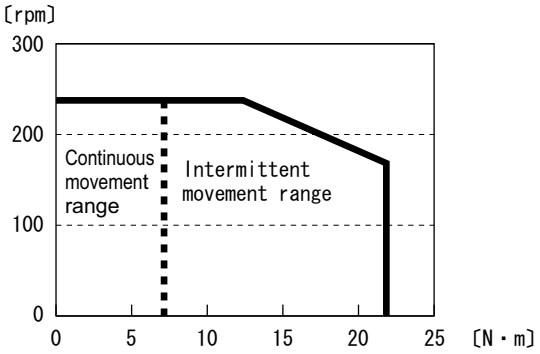
AX - CBLR5 - DM04

Ⓔ Cable change
(Note: "04" for cable length 4 m)

***Custom orders are not CE, UL/cUL, RoHS certified. Consult with CKD for details.**

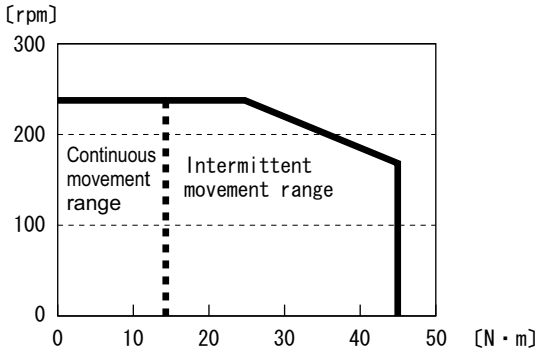
Speed/max. torque characteristics

●AX1022TS

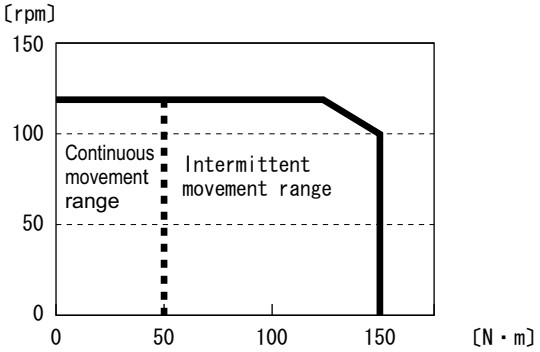


*This graph shows the characteristics under 3 phase AC200V

●AX1045TS

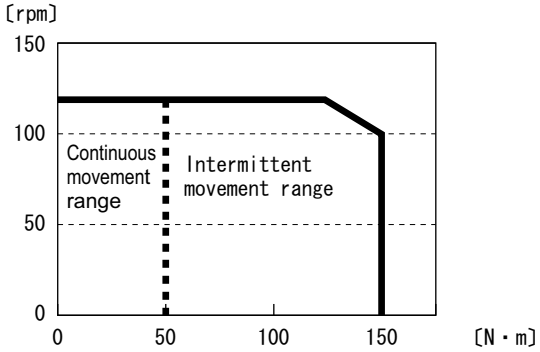


*This graph shows the characteristics under 3 phase AC200V



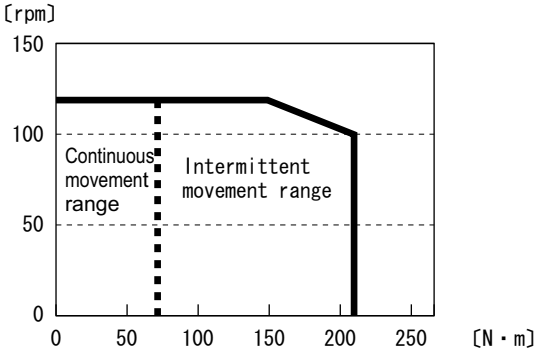
*This graph shows the characteristics under 3 phase AC200V

●AX1150TH



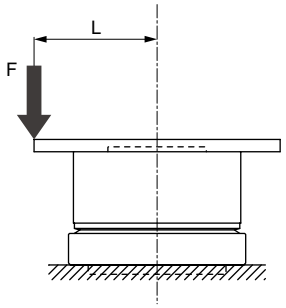
*This graph shows the characteristics under 3 phase AC200V

●AX1210TH



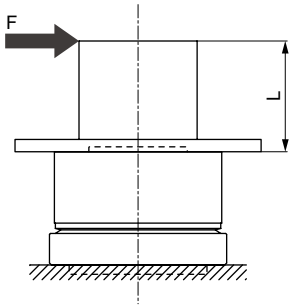
*This graph shows the characteristics under 3 phase AC200V

(Note) moment load



(Fig. a)

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

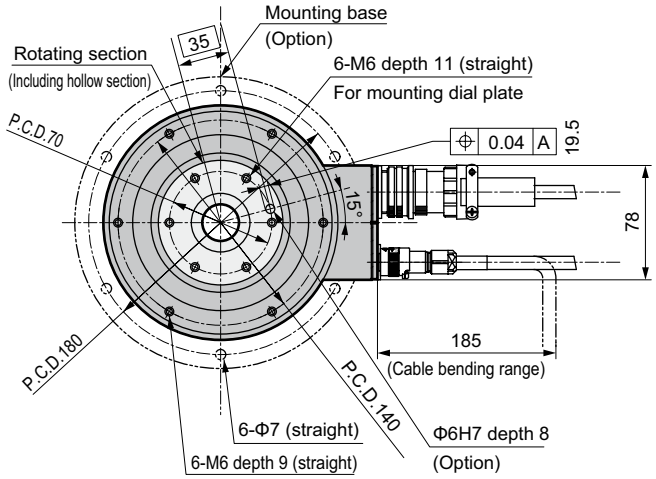


(Fig. b)

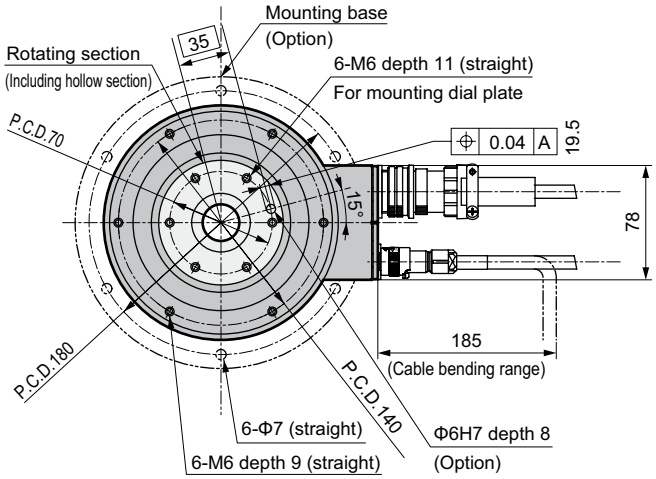
M(N・m)=F(N)×(L+0.02)(m)
M: Moment load
F: Load
L: Distance from output shaft flange

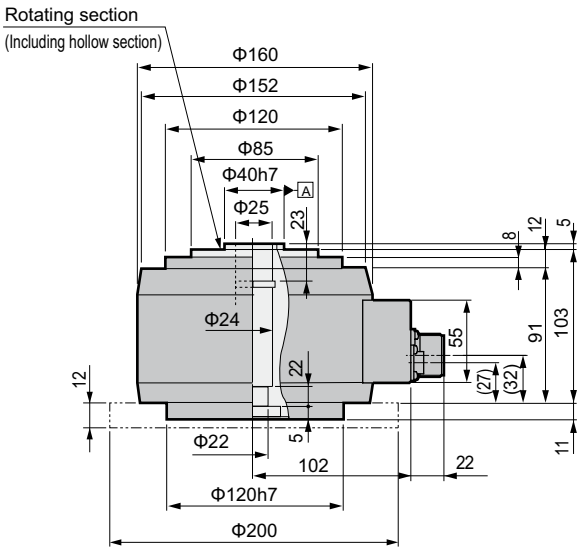
Dimensions

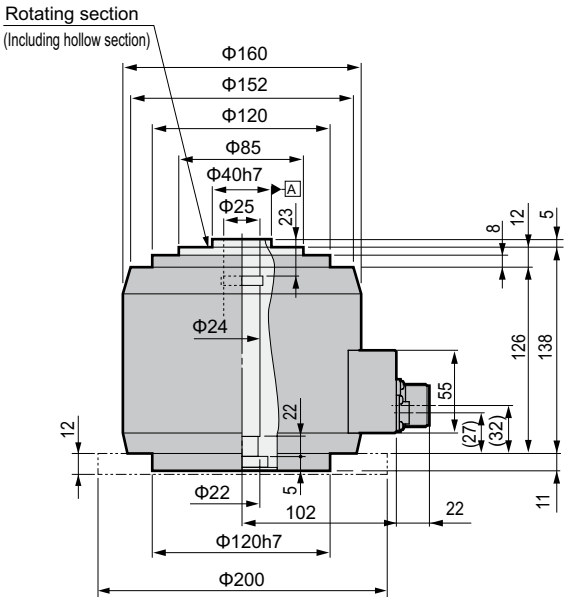
● **AX1022T**

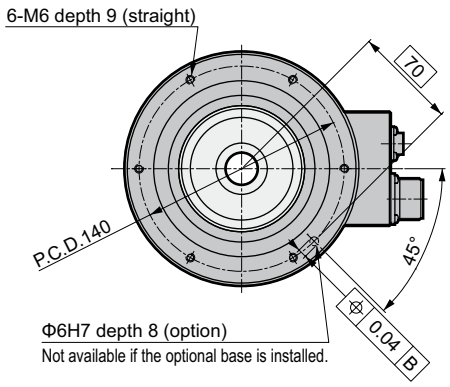


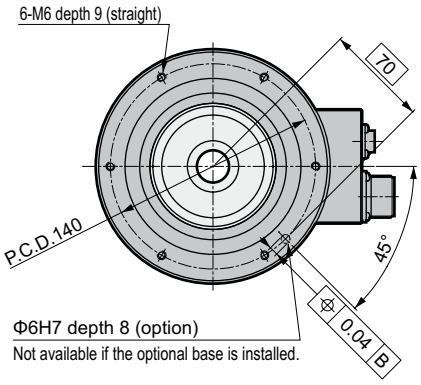
● **AX1045T**







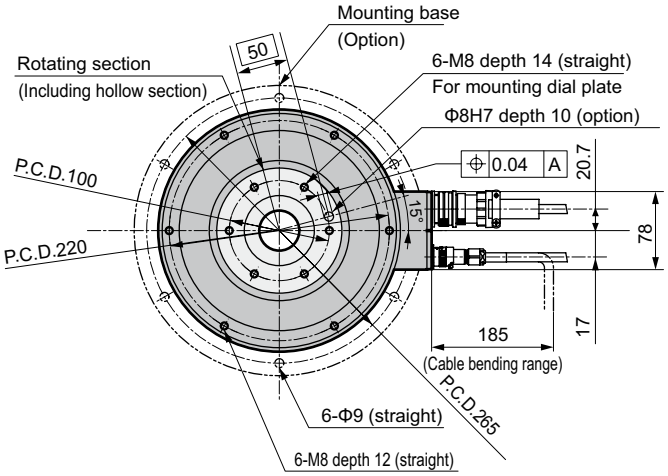




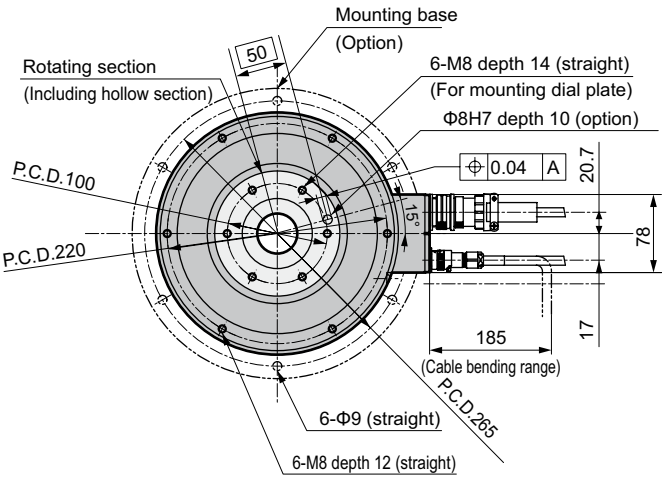
Note 1) The origin of the actuator may differ from the dimensions shown above.
Origin can be configured randomly using the origin offset function.

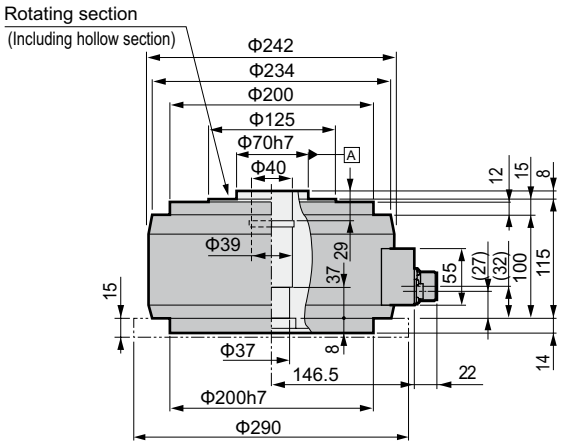
Dimensions

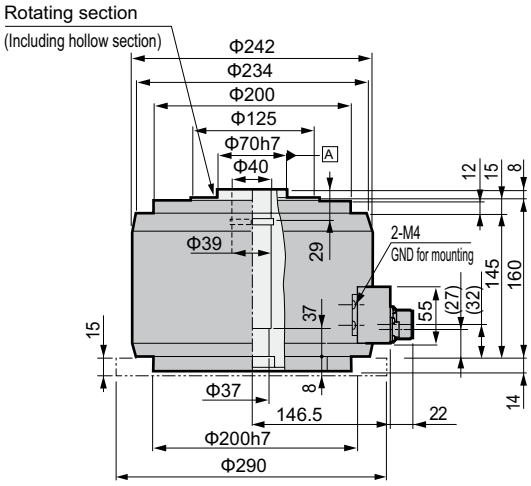
● **AX1075T**

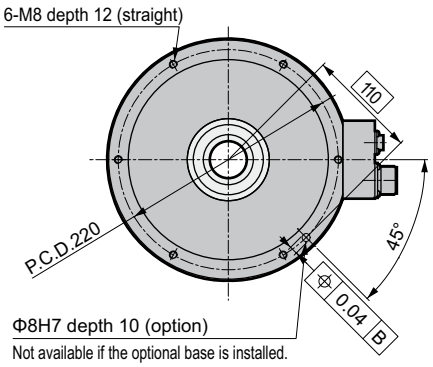


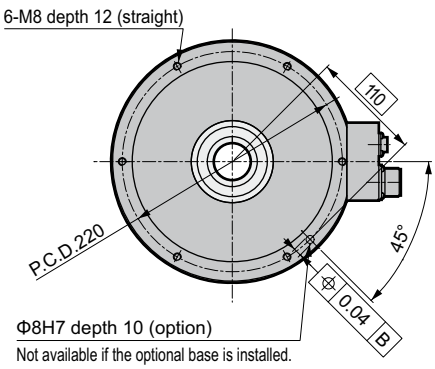
● **AX1150T**







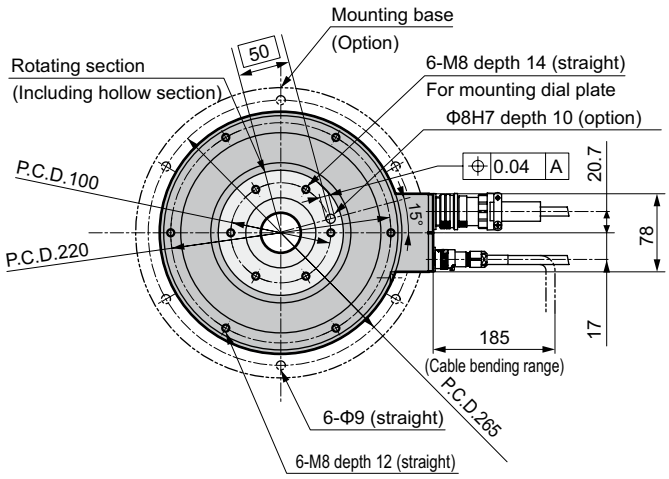


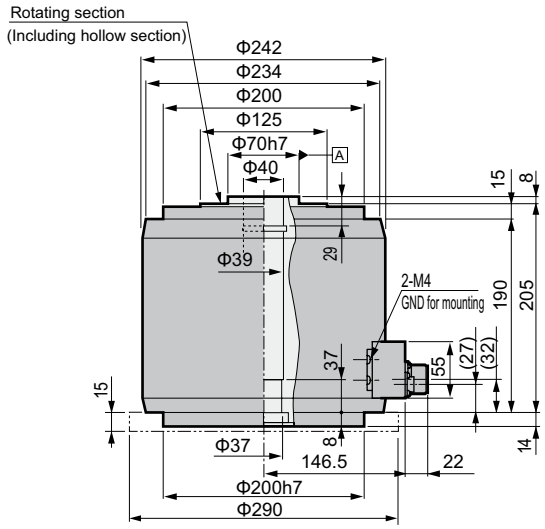


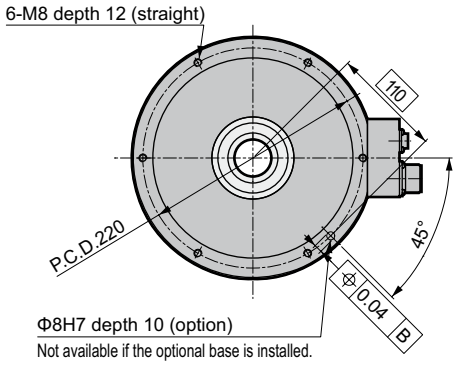
Note 1) The origin of the actuator may differ from the dimensions shown above.
Origin can be configured randomly using the origin offset function.

Dimensions

● **AX1210T**

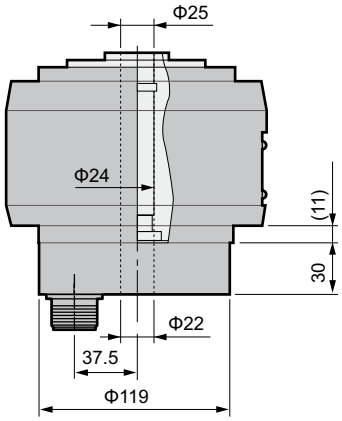


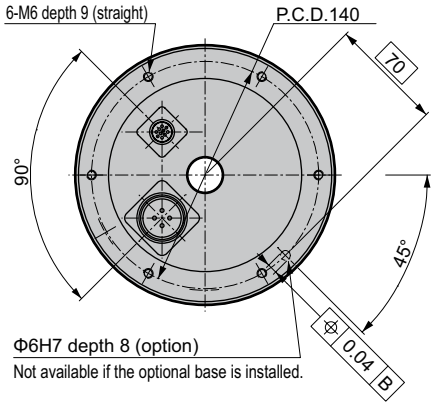




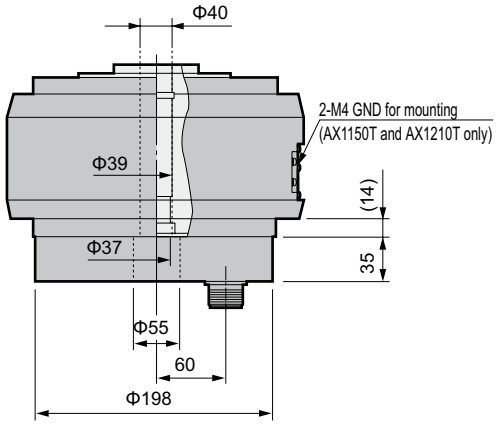
Dimensions with options

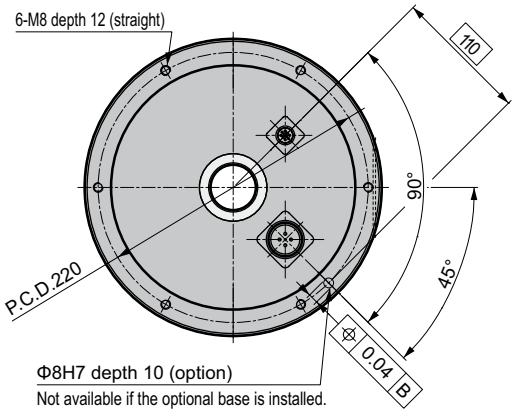
● **Bottom connector (C)**
AX1022T/AX1045T





AX1075T/AX1150T/AX1210T





**Note 1) The origin of the actuator may differ from the dimensions shown above.
Origin can be configured randomly using the origin offset function.**

Direct drive actuator

AX2000T Series

High speed rotation(max. 300rpm). low profile, large hollow diameter (Φ30)

- Max. torque: 6/12, 18 N•m
- Compatible drier: TS type driver

RoHS

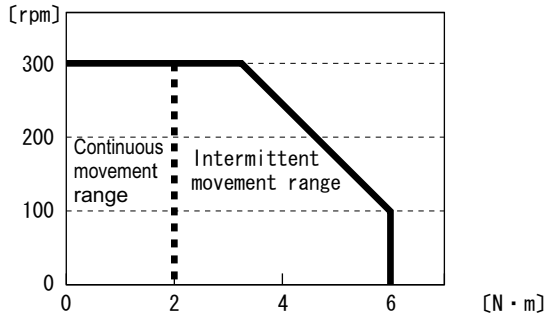
Actuator specifications

Descriptions		AX2006T	AX2012T	AX2018T
Maximum output torque	N•m	6.0	12.0	18.0
Continuous output torque	N•m	2.0	4.0	6.0
Max. rotation speed	rpm	300 (Note 1)		
Allowable axial load	N	1000		
Allowable moment load	N•m	40		
Output shaft moment of inertia	kg/m²	0.00575	0.00695	0.00910
Allowable load moment of inertia	kg/m²	0.3	0.4	0.5
Index precision (Note 2)	sec.	±30		
Repeatability (Note 2)	sec.	±5		
Output shaft friction torque	N•m	0.6		0.7
Resolver resolution	P/rev	540672		
Motor isolation class		Class F		
Motor withstanding voltage		1500 VAC for one minute		
Motor isolation resistance		10MΩ 500 VDC and over		
Ambient temperature range		0 to 45°C		
Ambient humidity range		20 to 85%RH with no dew condensation		
Storage ambient temperature range		-20 to 80°C		
Storage ambient humidity range		20 to 90%RH with no dew condensation		
Atmosphere		No corrosive gas, flammable or powder dust		
Weight	kg	4.7	5.8	7.5
Run out of output shaft	mm	0.03		
Surface run out of output shaft	mm	0.03		
Protection		IP20		

Note1: The speed must be kept below 80rpm during continuous rotation.
Note2: Refer to "Technical explanations" on page 49 for the details on index accuracy and repeatability.
Note3: The max ambient temperature is 40°C if used as a UL certified product.

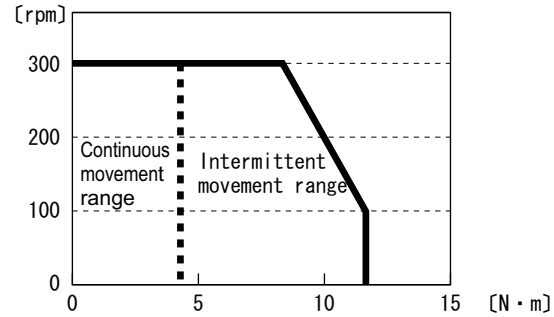
Speed/max. torque characteristics

●AX2006TS



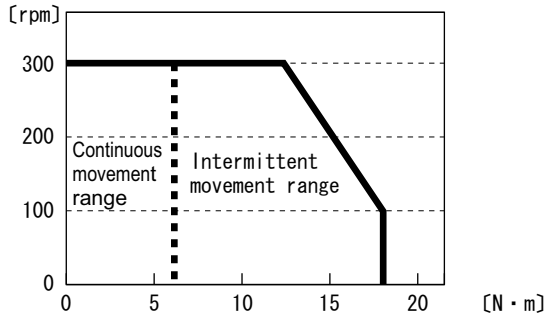
*This graph shows the characteristics under 3 phase AC200V

●AX2012TS



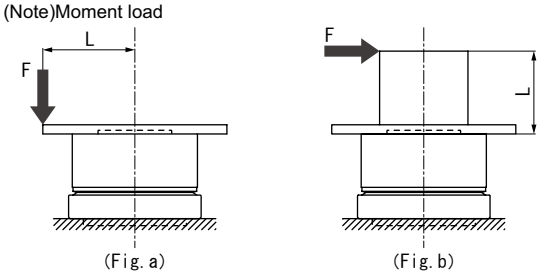
*This graph shows the characteristics under 3 phase AC200V

●AX2018TS



*This graph shows the characteristics under 3 phase AC200V

(Note)Moment load



(Fig. a)

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

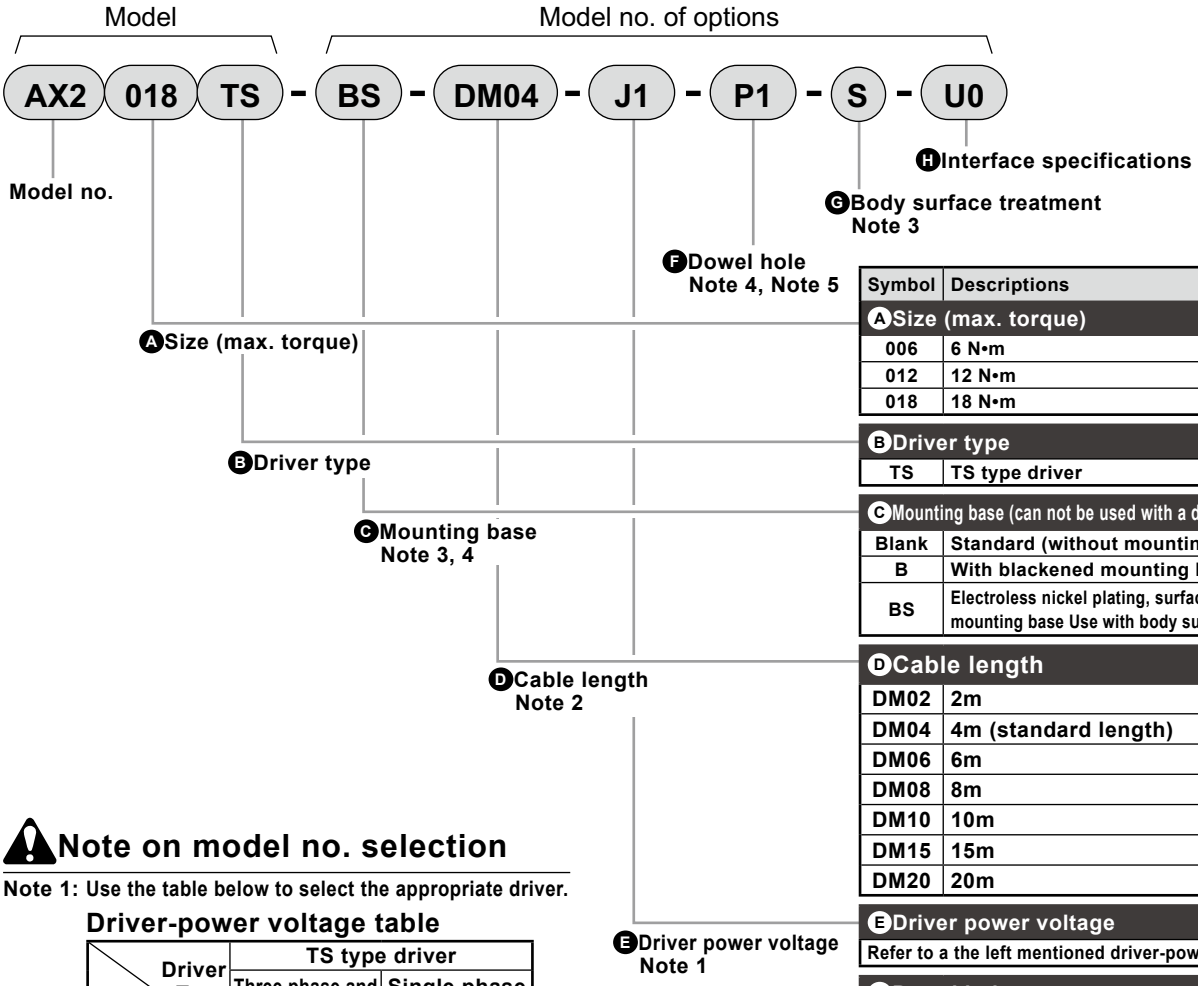
(Fig. b)

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

Always read the precautions on Intro 9 to 13 before starting use.

How to order

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



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

⚠ Note on model no. selection

Note 1: Use the table below to select the appropriate driver.

Driver-power voltage table

Model \ Driver Type	TS type driver	
	Three phase and single phase 200 230 to VAC	Single phase 100 115 to VAC
AX2006T	Blank	J1
AX2012T	Blank	J1
AX2018T	Blank	J1

Note 2: The cable is a flexible cable.
Refer to page 35 for dimensions of a cable. The body outlet cable is not a flexible cable.

Note 3: Designate surface treatment and mounting base surface treatment with Ⓒand Ⓗ. By selecting the optional electroless nickel plating, higher resistance to rusting can be expected.

Note 4: "P2" and "P3" cannot be selected if "B" with blackened mounting base or "BS" electroless nickel plating surface treatment mounting base is designated for Ⓒ Mounting base.

Note 5: Additionally machined sections may not have a treated surface.

● **Discrete actuator body model no.**

AX2◯T - B - P1 - S

Ⓐ Size · Ⓕ Dowel hole · Ⓒ Mounting base · Ⓖ Body surface treatment

● **Discrete driver model no.**

• Three phase 200 to 230 VAC

AX9000TS - U0

• Single phase 100 to 115 VAC

AX9000TS - J1 - U0

Ⓗ Interface specifications

● **Discrete cable model no.**

• Motor cable

AX - CBLM6 - DM04

• Resolver cable

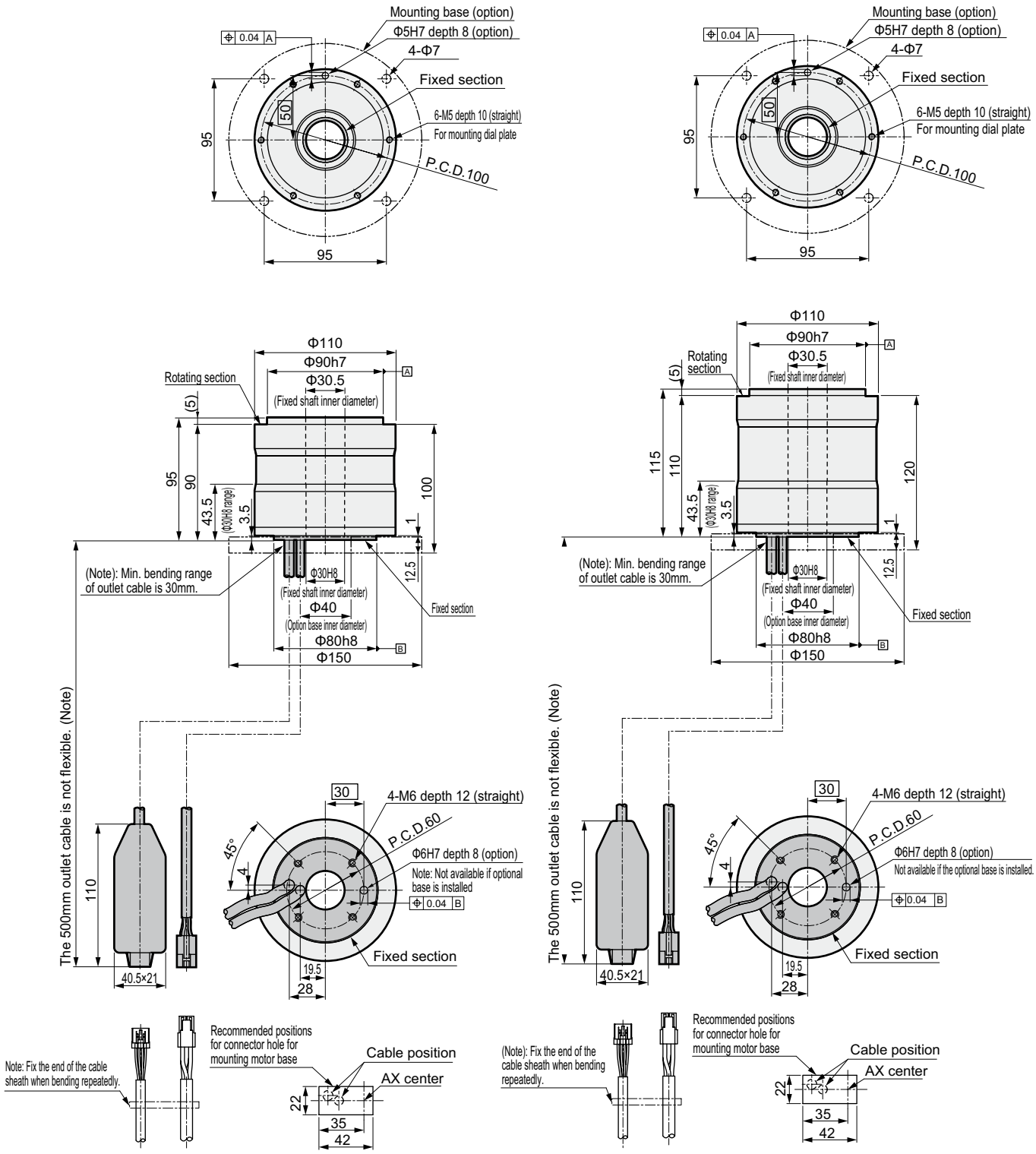
AX - CBLR6 - DM04

Ⓓ Cable change (Note: "04" for cable length 4 m)

*Custom orders are not CE, UL/cUL, RoHS certified. Consult with CKD for details.

Dimensions

● AX2006T

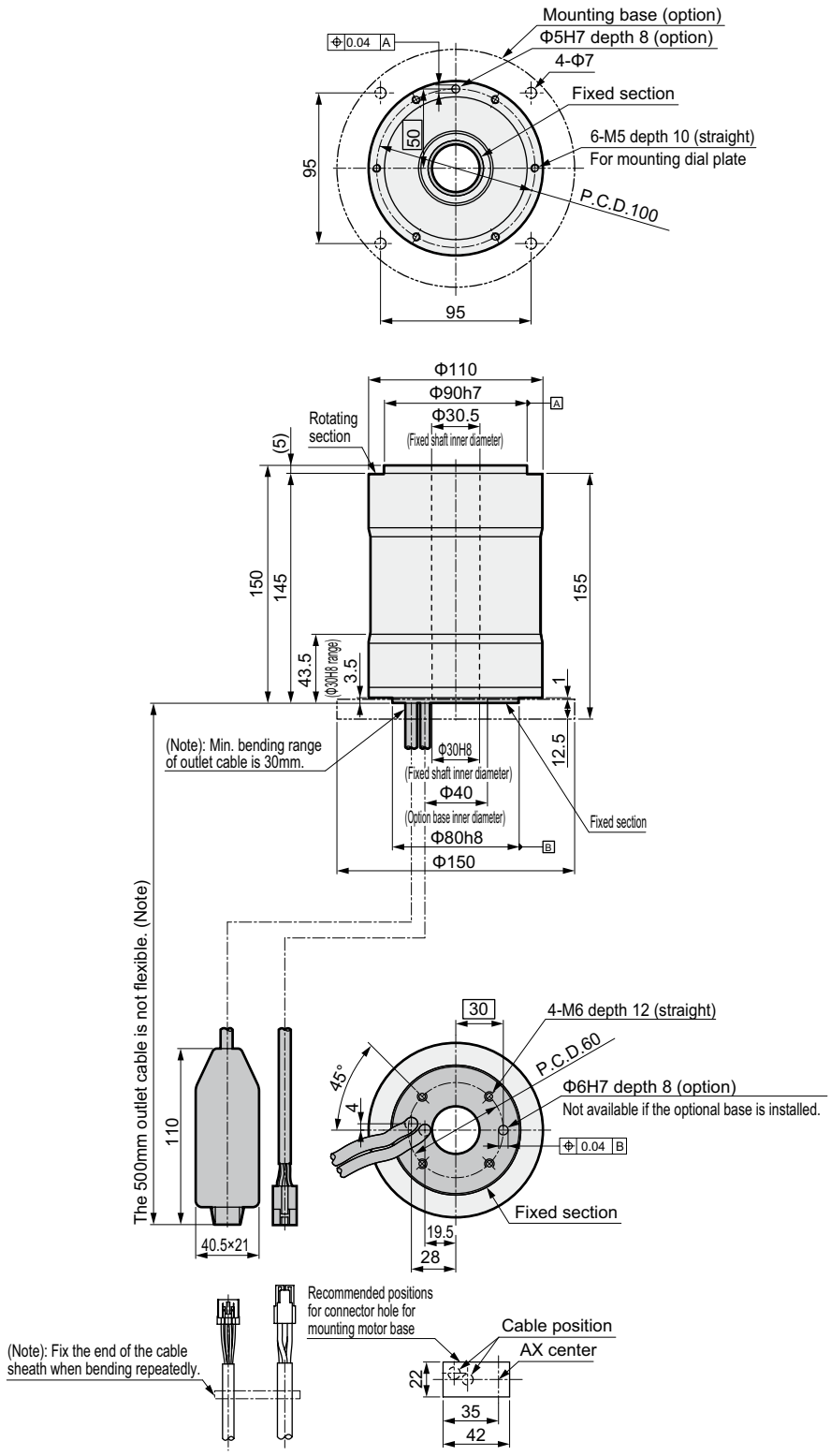


● AX2012T

Note 1) The origin of the actuator may differ from the dimensions shown above.
Origin can be configured randomly using the origin offset function.

Dimensions

● **AX2018T**



Note 1) The origin of the actuator may differ from the dimensions shown above.
Origin can be configured randomly using the origin offset function.

Direct drive actuator

AX4000T Series

Resistance to load of large moment of inertia
Wide variety of options
Easier to pipe and wire with large inner diameter
●Max. torque: 9/22, 45/75 N•m
●Compatible drier: TS type driver

RoHS

Actuator specifications

Descriptions		AX4009T	AX4022T	AX4045T	AX4075T
Maximum output torque	N•m	9	22	45	75
Continuous output torque	N•m	3	7	15	25
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 accuracy (Note 4)	sec.	±30			
Repeatability (Note 4)	sec.	±5			
Output shaft friction torque	N•m	0.8	3.5		10.0
Resolver resolution	P/rev	540672			
Motor isolation class		Class F			
Motor withstanding voltage		1500 VAC for one minute			
Motor isolation resistance		10MΩ 500 VDC and over			
Ambient temperature range		0 to 45°C			
Ambient humidity range		20 to 85%RH with no dew condensation			
Storage ambient temperature range		-20 to 80°C			
Storage ambient humidity range		20 to 90%RH with no dew condensation			
Atmosphere		No corrosive gas, flammable or powder dust			
Weight	kg	5.5	12.3	15.0	36.0
Brake total weight when set	kg	—	16.4	19.3	54.0
Run out of output shaft	mm	0.03			
Run out of output shaft surface	mm	0.05			
Protection		IP20			

Note1: The speed must be kept below 80rpm during continuous rotation.
Note2: When using within the load conditions shown in the parenthesis, set parameter 72(multiplier for integral gain) to 0.3(reference value).
Note3: Consult CKD each time when using parameter 72 (multiplier for integral gain) during continuous rotation.
Note4: Refer to "Technical explanations" on page 49 for the details on index accuracy and repeatability.
Note5: Max. ambient temperature is 40°C when used as a UL certified product.

Specifications (option)

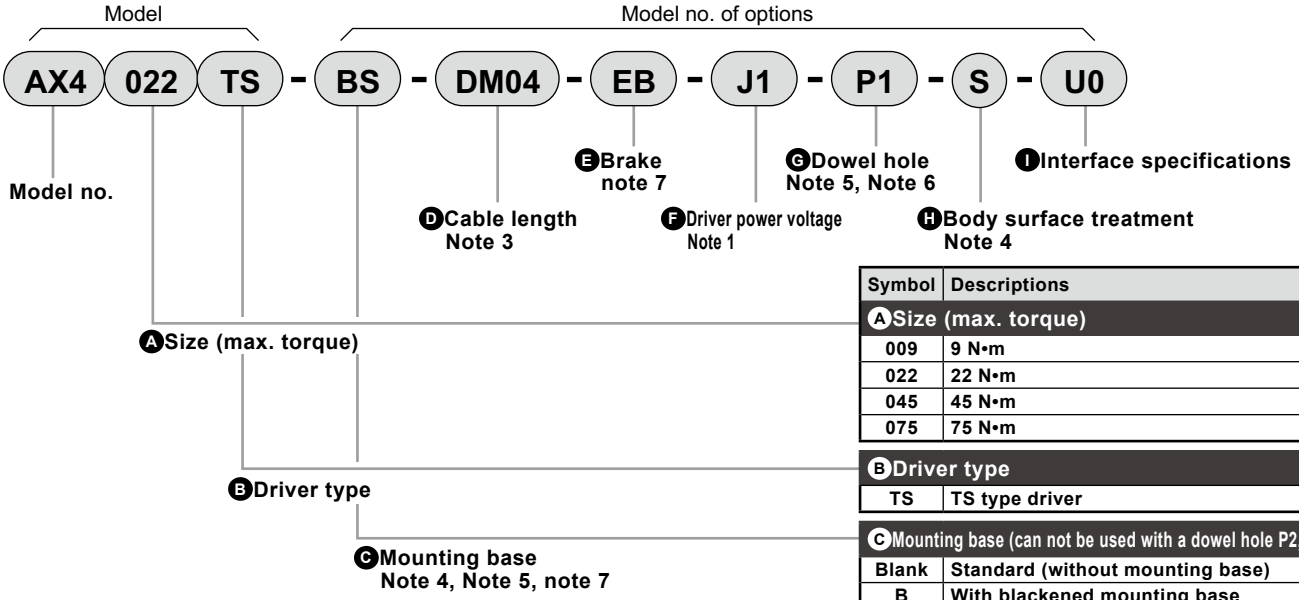
Descriptions \ Compatible models		AX4022T/AX4045T	AX4075T
Type		Non-backlash dry non-excitation operation type	
Rated voltage	V	DC24V	
Power supply wattage	W	30	55
Rated current	A	1.25	2.30
Static friction torque	N•m	35	200
Armature release time (brake on)	msec	50 (reference value)	50 (reference value)
Armature suction time (brake off)	msec	150 (reference value)	250 (reference value)
Holding precision	Minute	45 (reference value)	
Max. cycle rate	Time/min.	60	40

Note 1: When the output shaft is rotating, rubbing noise may be generated at the electromagnetic brake's disk and fixing section.
Note 2: When moving after brakes are turned OFF, the delay time parameter must be changed based on armature suction time.
Note 3: This is a nonbacklash type, but it may be hard to hold a set position if load is applied in the direction of rotation.
Note 4: When electromagnetic brakes function, the armature may contact the magnetic brake's fixed section and generate noise.
Note 5: Brakes are manually released by alternately screwing screws into manual release taps (3 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.

⚠Refer to the precautions on Intro 9 to 13 before starting use.

How to order

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



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

Ⓑ Driver type	
TS	TS type driver

Ⓒ Mounting base (can not be used with a dowel hole P2, P3.)	
Blank	Standard (without mounting base)
B	With blackened mounting base
BS	Use with an electroless nickel plating table plane treatment mounting base body surface treatment S.

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

Ⓔ Brake	
Blank	Standard (without electromagnetic brake)
EB	With negative actuation type electromagnetic brake

Ⓕ Driver power voltage
Refer the driver-power voltage table on the left.

Ⓖ Dowel hole	
Blank	Standard (without dowel hole)
P1	1 on top
P2	1 on bottom (2 pc. on bottom for AX4009T)
P3	1 each on both top and bottom (2 piece on 1 pc. on top and bottom for AX4009T)

Ⓗ Body surface treatment	
Blank	Standard (Rotating section-blackened, fixed section outside circumference-painted)
S	Rotating section: electroless nickel plating, fixed section: nitrating

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

⚠ Note on model no. selection

Note 1: Use the table below to select the appropriate driver.

Driver-power voltage table

Model \ Driver Type	TS type driver	
	Three phase and single phase 200 230 to VAC	Single phase 100 115 to VAC
AX4009T	Blank Note 2	J1
AX4022T	Blank Note 2	J1
AX4045T	Blank Note 2	J1
AX4075T	Blank Note 2	

Note 2: Single phase 200 to 230 VAC is available for models with a torque of 45N•m or less.

Note 3: The cable is a flexible cable
Refer to page 35 for dimensions of the cable.
The body outlet cable is not a flexible cable.

Note 4: Select surface treatment and mounting base surface treatment with Ⓒ and Ⓗ. By selecting the optional electroless nickel plating treatment, you can expect higher rust resistance compared to standard specifications.

Note 5: "P2" and "P3" cannot be selected if "B" with blackened mounting base or "BS" electroless nickel plating surface treatment mounting base is selected for Ⓒ Mounting base.

Note 6: Additionally machined sections such as dowel holes may not have a treated surface.

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

Option table

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

● **Discrete actuator body model no.**

AX4 ○ T - B - ○ - P1 - S

Ⓐ Size · Ⓔ Brake · Ⓗ Body surface treatment · Ⓒ Mounting base · Ⓖ Dowel hole

● **Discrete driver model no.**

- Three phase 200 to 230 VAC
  AX9000TS - U0
- Single phase 100 to 115 VAC
  AX9000TS - J1 - U0

Ⓘ Interface specifications

● **Discrete cable model no.**

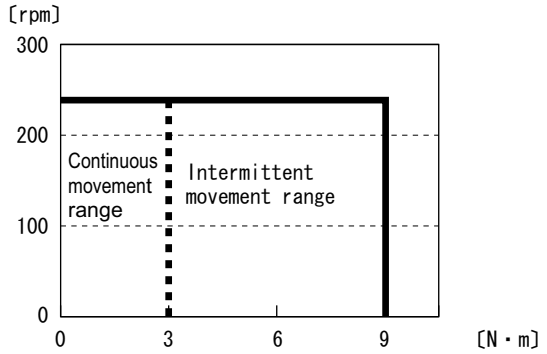
- Motor cable
  AX - CBLM6 - DM04
- Resolver cable
  AX - CBLR6 - DM04

Ⓓ Cable change (Note: "04" for cable length 4 m)

*Custom orders are not CE, UL/cUL, RoHS certified. Consult with CKD for details.

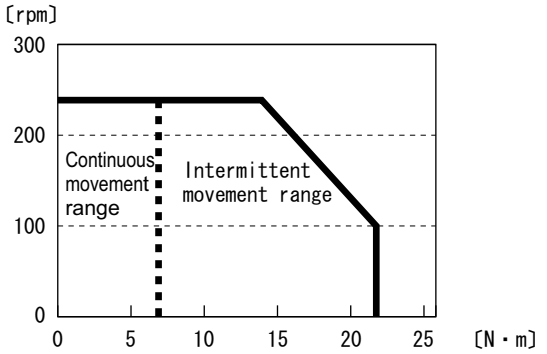
Speed/max. torque characteristics

●AX4009TS



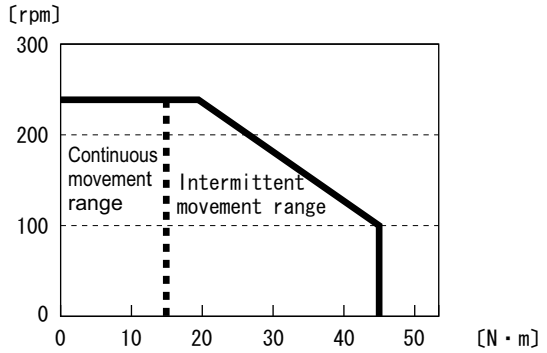
*This graph shows the characteristics under 3 phase AC200V

●AX4022TS



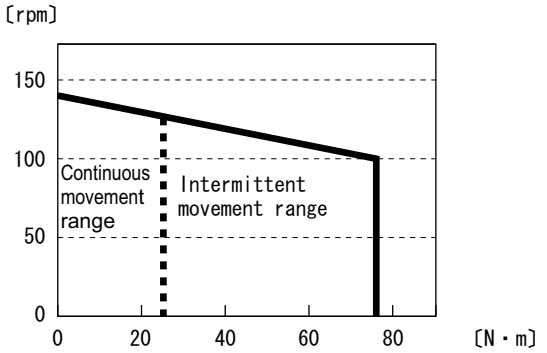
*This graph shows the characteristics under 3 phase AC200V

●AX4045TS



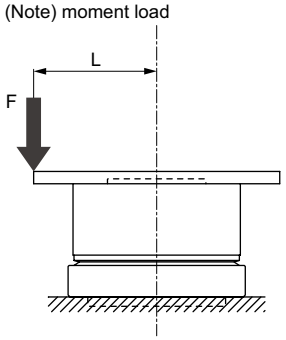
*This graph shows the characteristics under 3 phase AC200V

●AX4075TS



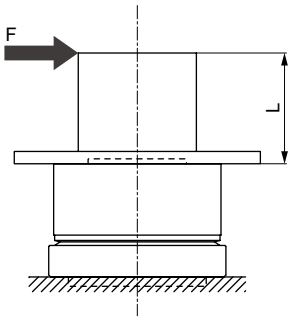
*This graph shows the characteristics under 3 phase AC200V

(Note) moment load



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

(Fig. a)



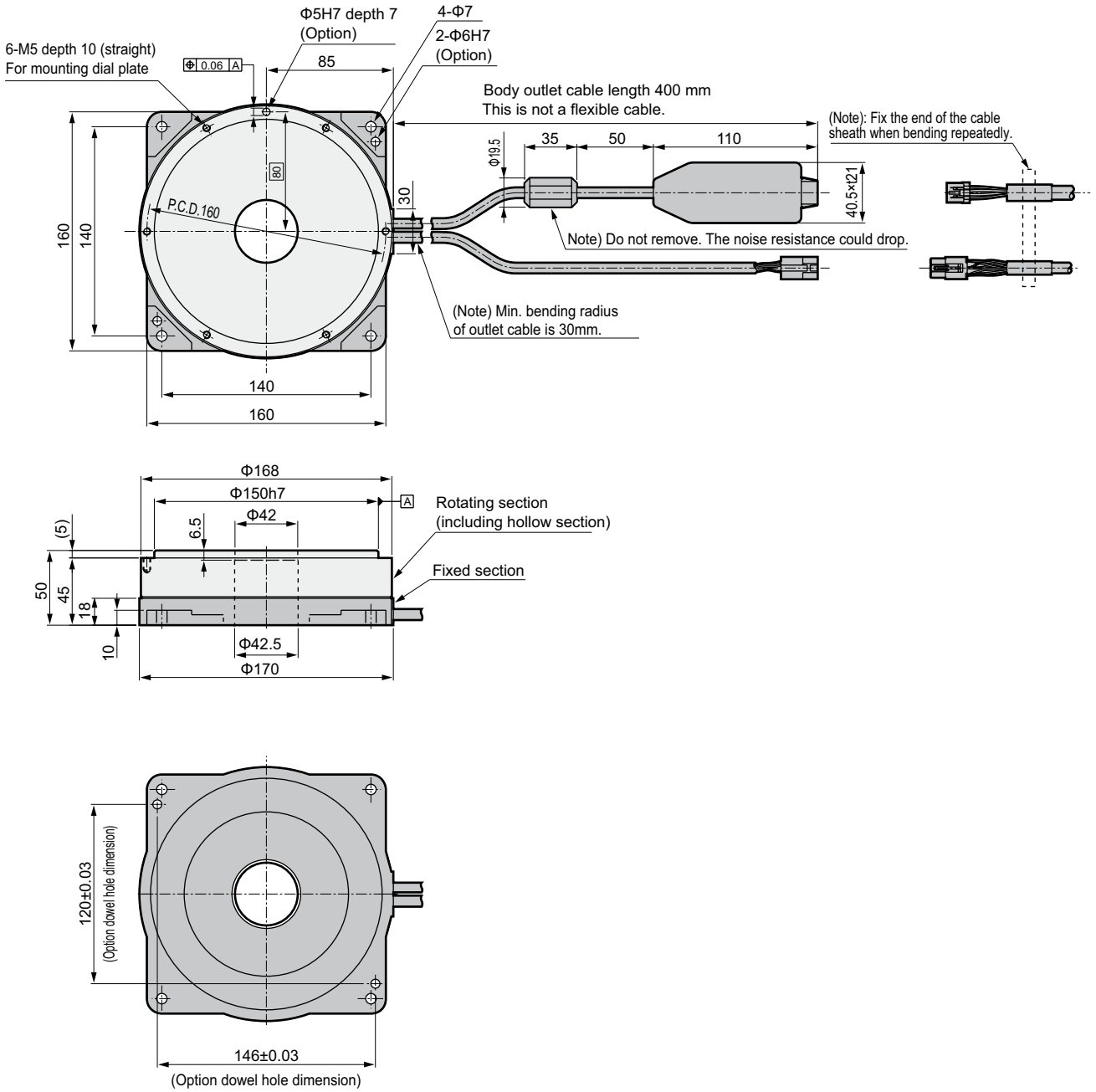
M(N•m)=F(N)×(L+0.02)(m)
M: Moment load
F: Load
L: Distance from output shaft flange

(Fig. b)

Refer to the precautions on Intro 9 to 13 before starting use.

Dimensions

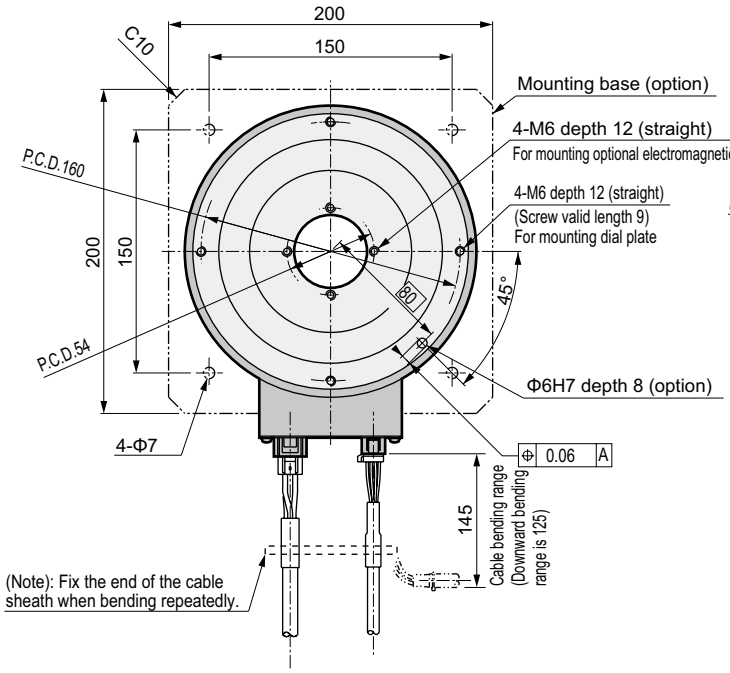
● **AX4009T**



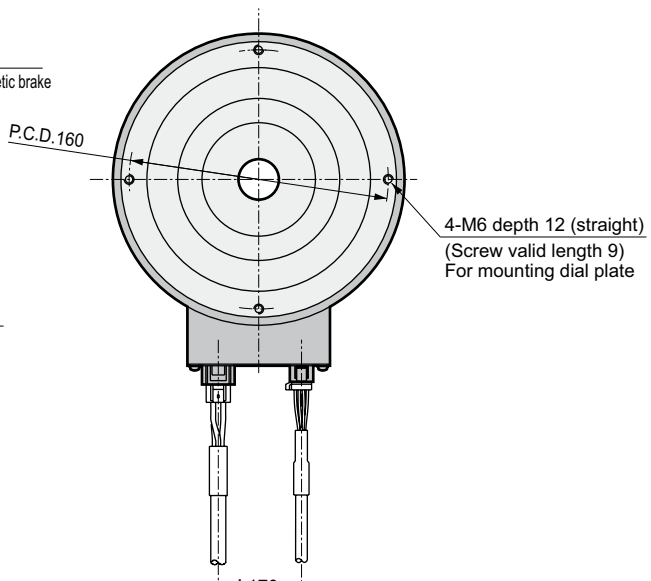
Note 1) The origin of the actuator may differ from the dimensions shown above.
Origin can be configured randomly using the origin offset function.

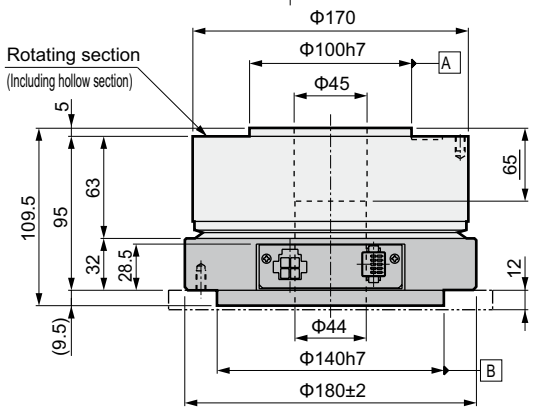
Dimensions

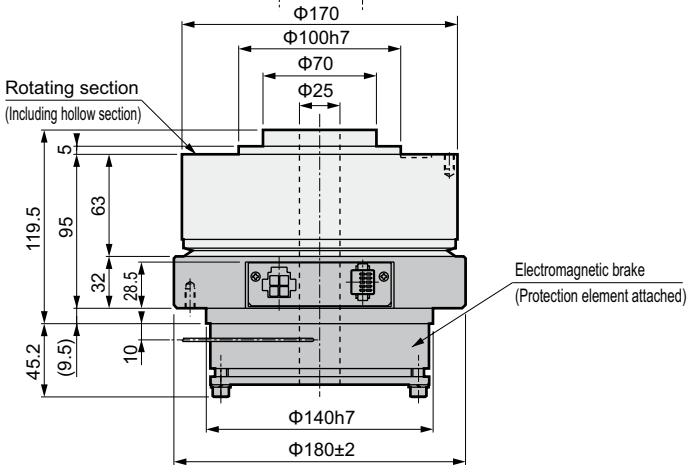
● **AX4022T**

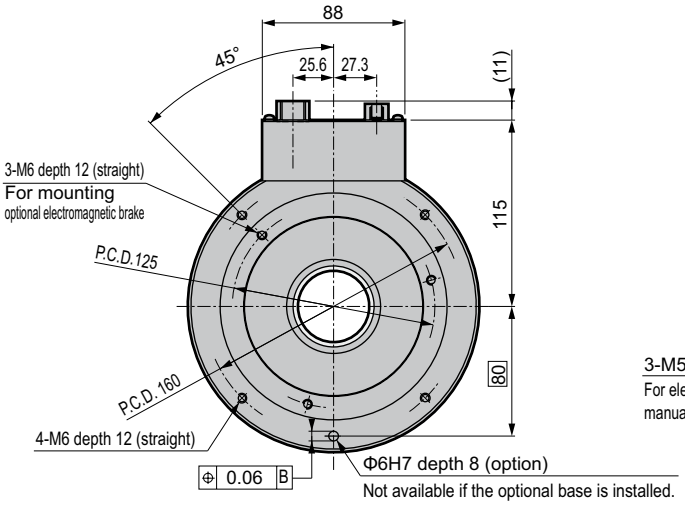


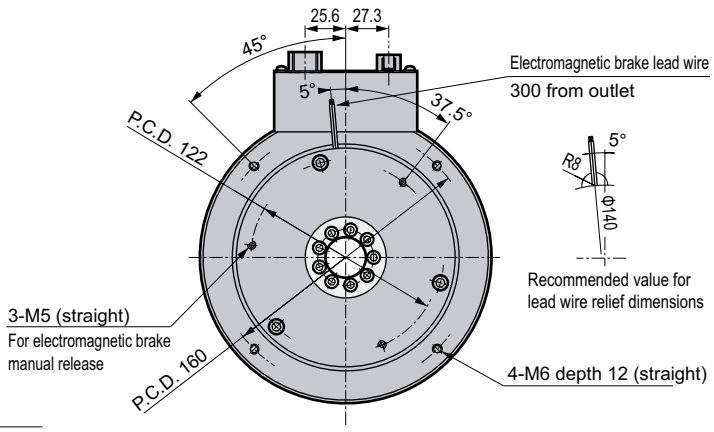
● **AX4022T-EB**
With electromagnetic brake
Refer to the left drawings for options.







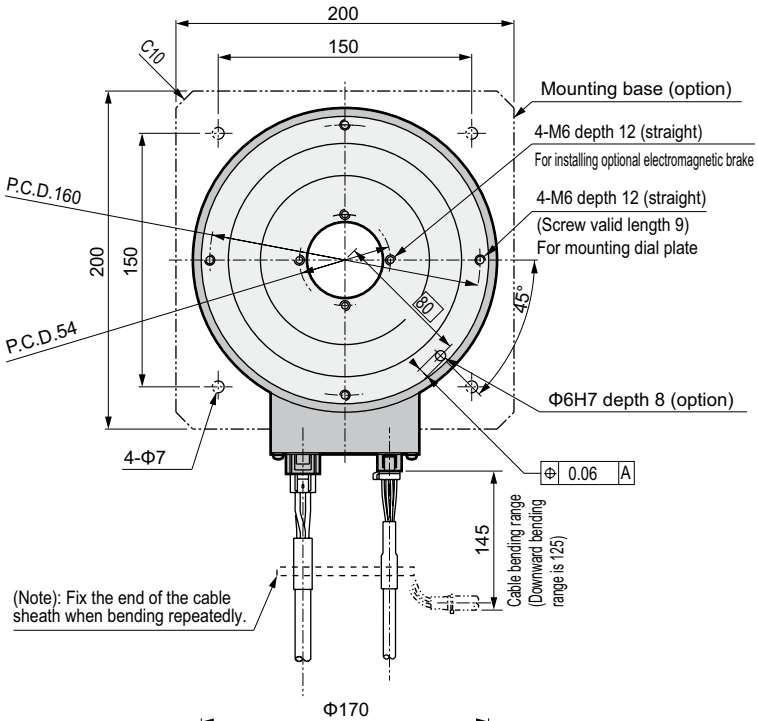


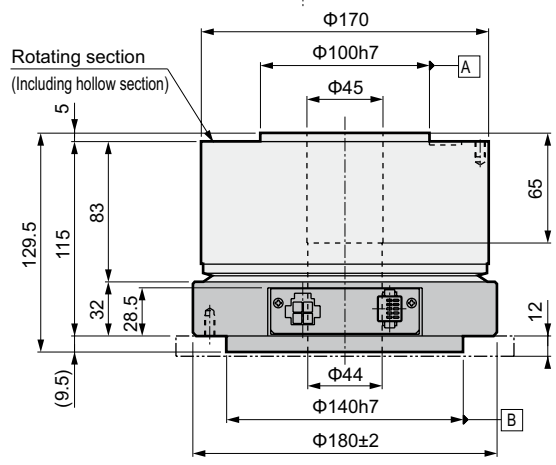


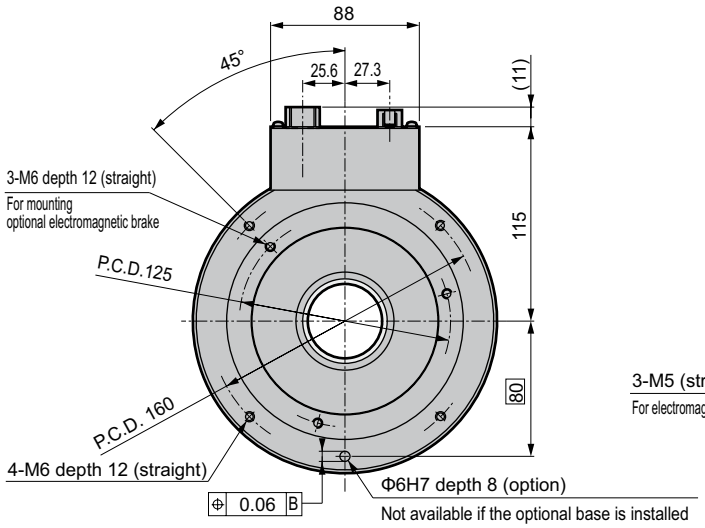
Note 1) The origin of the actuator may differ from the dimensions shown above.
Origin can be configured randomly using the origin offset function.

Dimensions

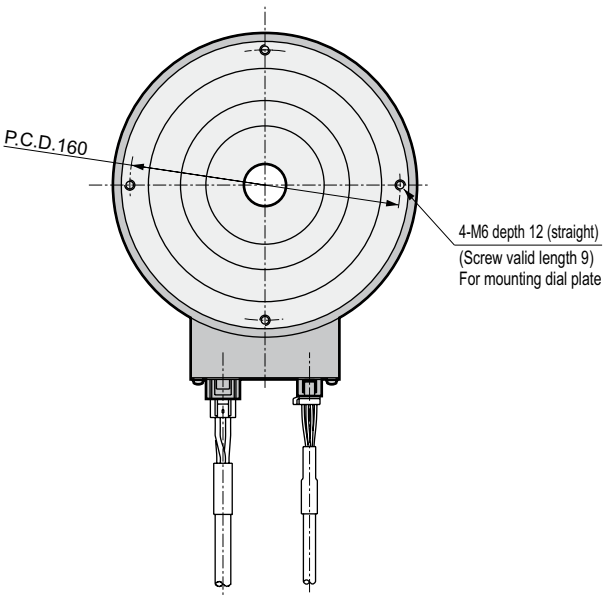
● **AX4045T**

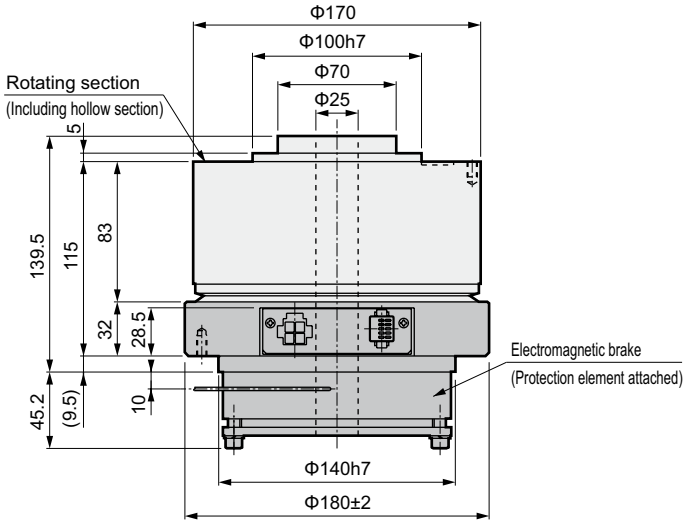


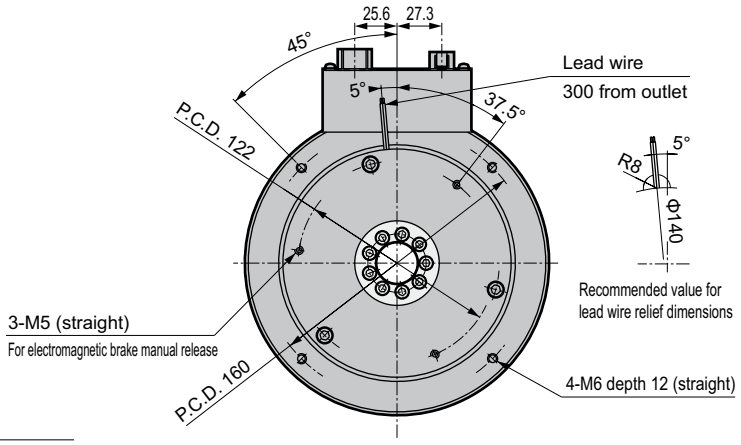




● **AX4045T-EB**
With electromagnetic brake
Refer to the left drawings for options.



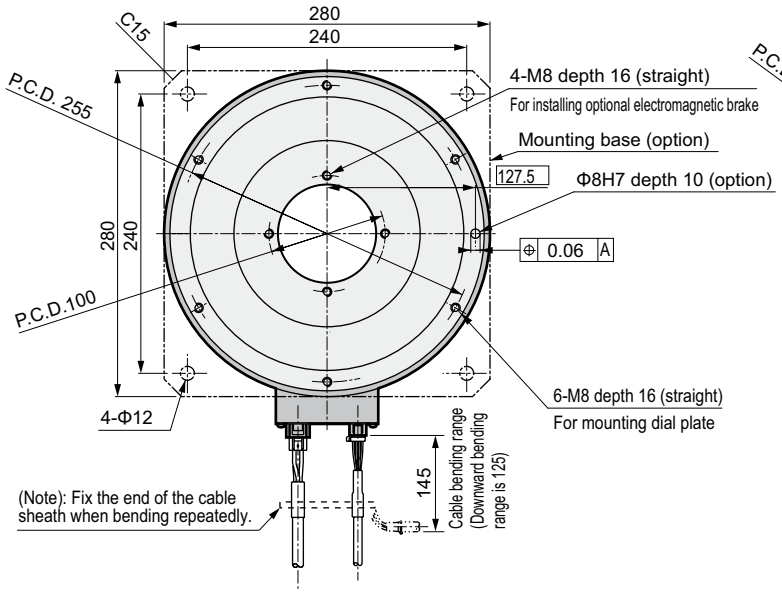




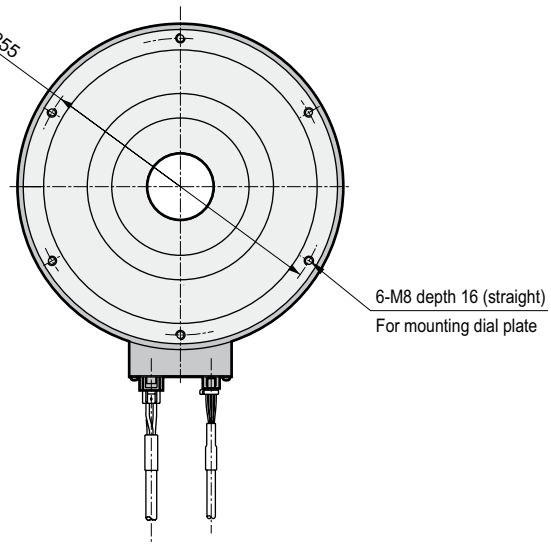
Note 1) The origin of the actuator may differ from the dimensions shown above.
Origin can be configured randomly using the origin offset function.

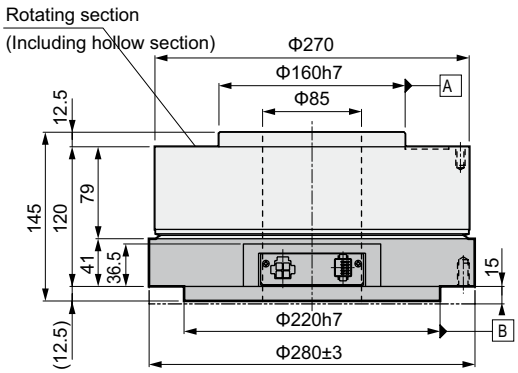
Dimensions

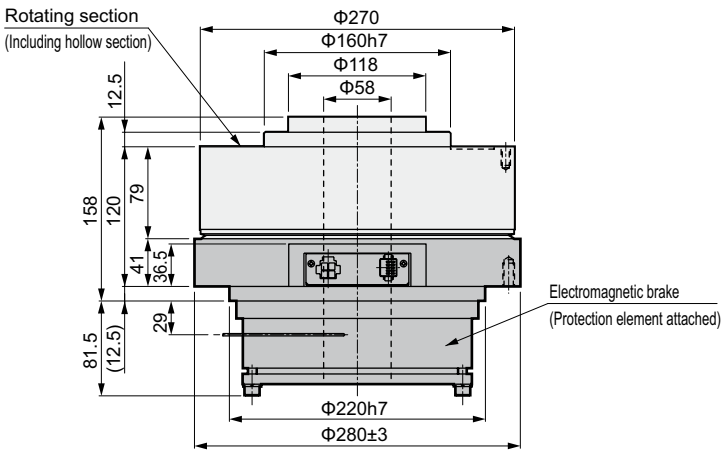
● **AX4075T**

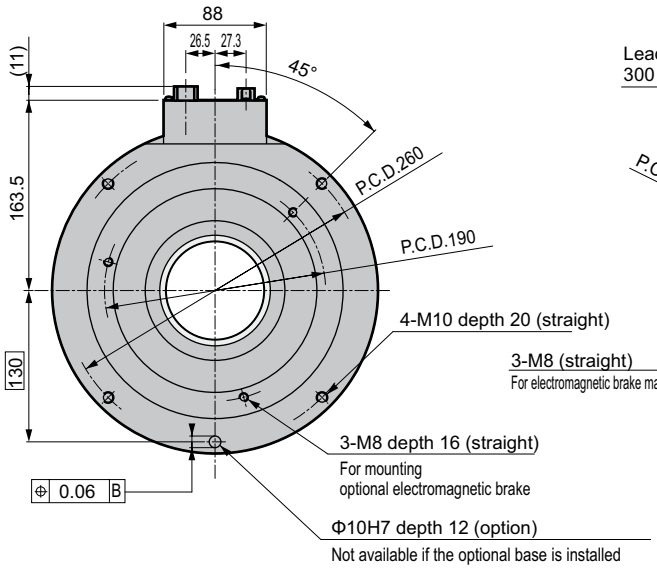


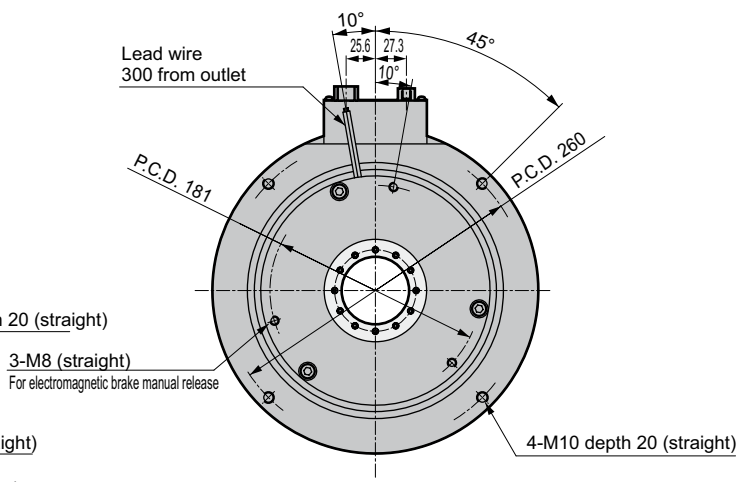
● **AX4075T-EB**
With electromagnetic brake
Refer to the left drawings for options.



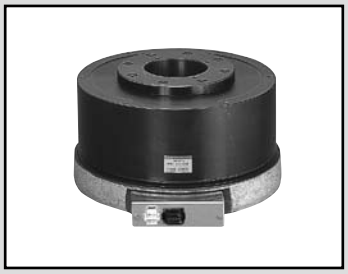








Note 1) The origin of the actuator may differ from the dimensions shown above.
Origin can be configured randomly using the origin offset function.



Direct drive actuator

AX4000T Series

Capable of handling large moment inertia
Wide variety of options
Easier to pipe and wire with large inner diameter
●Max. torque: 150/300/500N•m
●Compatible drier: TH type driver

RoHS

Actuator specifications

Descriptions		AX4150T	AX4300T	AX4500T
Maximum output torque	N•m	150	300	500
Continuous output torque	N•m	50	100	160
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 accuracy (Note 3)	sec.	±30		
Repeatability (Note 3)	sec.	±5		
Output shaft friction torque	N•m	10.0		15.0
Resolver resolution	P/rev	540672		
Motor isolation class		Class F		
Motor withstanding voltage		1500 VAC for one minute		
Motor isolation resistance		10MΩ 500 VDC and over		
Ambient temperature range		0 to 45°C		
Ambient humidity range		20 to 85%RH with no dew condensation		
Storage ambient temperature range		-20 to 80°C		
Storage ambient humidity range		20 to 90%RH with no dew condensation		
Atmosphere		No corrosive gas, flammable or powder dust		
Weight	kg	44.0	66.0	115.0
Total weight with brake	kg	63.0	86.0	-
Run out of output shaft	mm	0.03		
Run out of output shaft surface	mm	0.05		
Protection		IP20		

Note1: The speed must be kept below 80rpm during continuous rotation.
Note2: The default setting will be large inertia moment compatible
Note3: Refer to "Technical explanations" on page 49 for the details on index accuracy and repeatability.
Note4: The max. ambient temperature is 40 °C if used as an UL certified product.

Electromagnetic brake specifications (option)

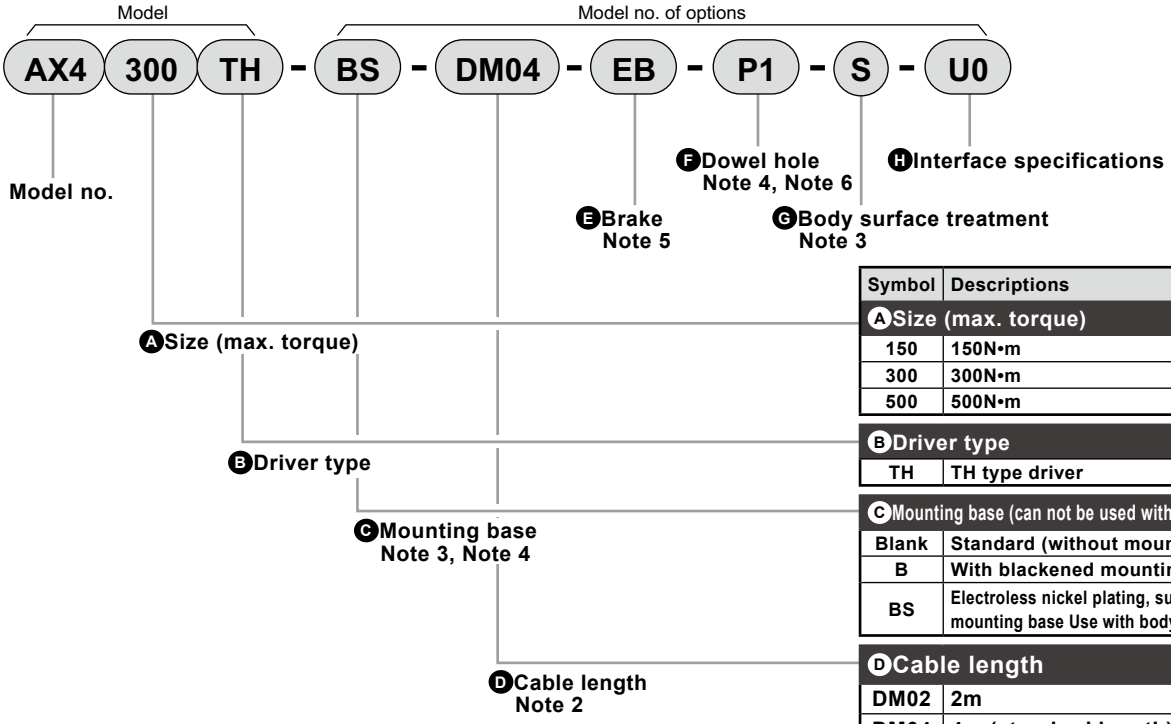
Descriptions \ Compatible models		AX4150T/AX4300T
Type		Non-backlash dry non-excitation operation type
Rated voltage	V	DC24V
Power supply wattage	W	55
Rated current	A	2.30
Static friction torque	N•m	200
Armature release time (brake on)	msec	50 (reference value)
Armature suction time (brake off)	msec	250 (reference value)
Holding precision	Minute	45 (reference value)
Max. cycle rate	Time/min.	40

Note 1: When the output shaft is rotating, rubbing noise may be generated at the electromagnetic brake's disk and fixing section.
Note 2: When moving after brakes are turned OFF, the delay time parameter must be changed based on armature suction time.
Note 3: This is a nonbacklash type, but it may be hard to hold a set position if load is applied in the direction of rotation.
Note 4: When electromagnetic brakes function, the armature may contact the magnetic brake's fixed section and generate noise.
Note 5: Brakes are manually released by alternately screwing screws into manual release taps (3 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 13 during use.

How to order

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



Symbol	Descriptions
Ⓐ Size (max. torque)	
150	150N•m
300	300N•m
500	500N•m

Ⓑ Driver type	
TH	TH type driver

Ⓒ Mounting base (can not be used with a dowel hole P2, P3)	
Blank	Standard (without mounting base)
B	With blackened mounting base
BS	Electroless nickel plating, surface treatment mounting base Use with body surface treatment S.

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

Ⓔ Brake	
Blank	Standard (without electromagnetic brake)
EB	With negative actuation type electromagnetic brake

Ⓕ Dowel hole	
Blank	Standard (without dowel hole)
P1	1 on top
P2	1 on bottom
P3	1 each on both top and bottom

Ⓖ Body surface treatment	
Blank	Standard (Rotating section-blackening fixed section outside circumference-paint)
S	Rotating section: electroless nickel plating, fixed section: nitrating

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

⚠ Note on model no. selection

Note 1: Use the table below to select the appropriate driver.

Driver-power voltage table

Driver Type / Model	TH type driver Three phase 200 230 to VAC
AX4150T	Blank
AX4300T	Blank
AX4500T	Blank

Note 2: The cable is a flexible cable.
Refer to page 35 for dimensions of a cable.

Note 3: Select surface treatment and mounting base surface treatment with Ⓒ and Ⓖ. By selecting the optional electroless nickel plating treatment, you can expect higher rust resistance compared to standard specifications.

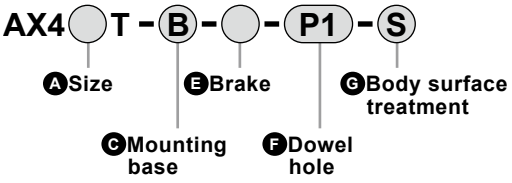
Note 4: "P2" and "P3" cannot be selected if "B" with blackened mounting base or "BS" electroless nickel plating surface treatment mounting base is selected for Ⓒ Mounting base.

Note 5: Refer to the Option Table below and select required options.
Option table

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

'Note 6: Additionally machined sections such as dowel holes may not have a treated surface.

● **Discrete actuator body model no.**



● **Discrete driver model no.**

● Three phase 200 to 230 VAC

AX9000TH - U0

Ⓗ Interface specifications

● **Discrete cable model no.**

● Motor cable

AX - CBLM6 - DM04

● Resolver cable

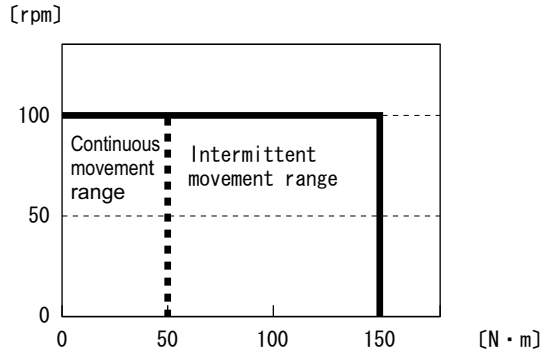
AX - CBLR6 - DM04

Ⓓ Cable change
(Note: "04" for cable length 4 m)

***Custom orders are not CE, UL/cUL, RoHS certified. Consult with CKD for details.**

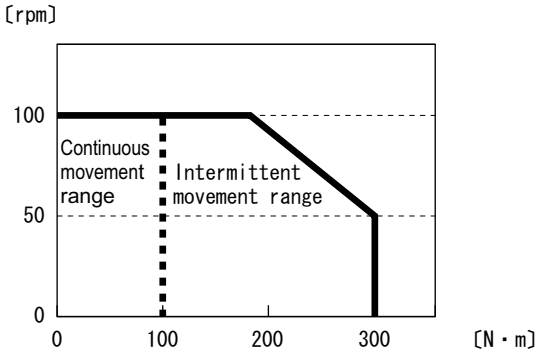
Speed/max. torque characteristics

●AX4150TH



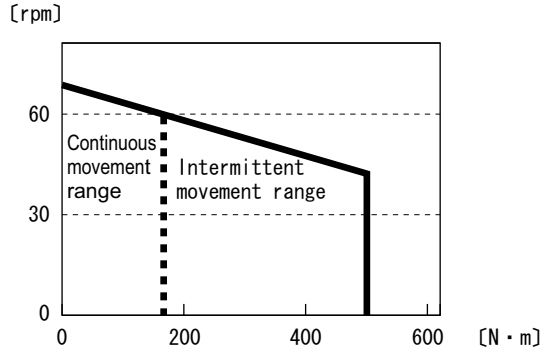
*This graph shows the characteristics under 3 phase AC200V

●AX4300TH



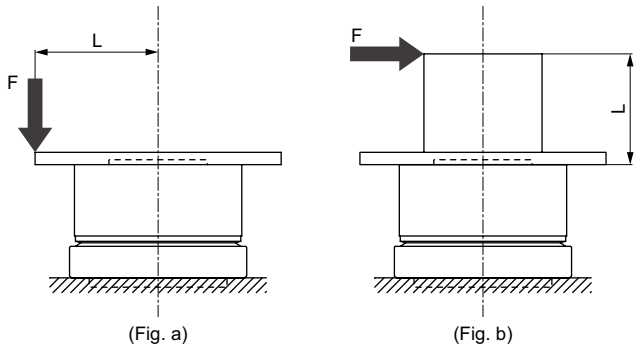
*This graph shows the characteristics under 3 phase AC200V

●AX4500TH



*This graph shows the characteristics under 3 phase AC200V

(Note) moment load



(Fig. a)

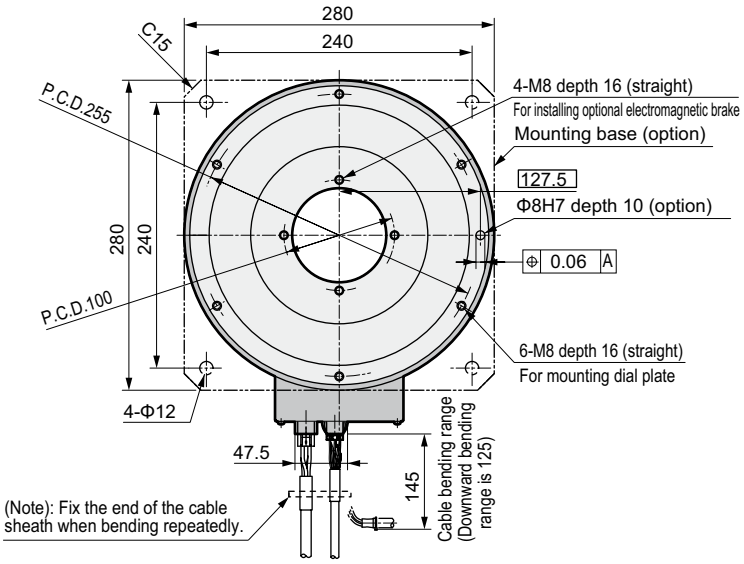
M(N•m)=F(N)×L(m)
M: Moment load
F: Load
L: Distance from output shaft center

(Fig. b)

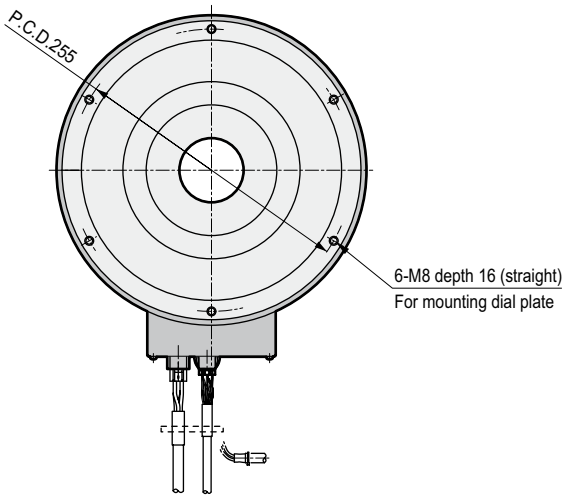
M(N•m)=F(N)×(L+0.02)(m)
M: Moment load
F: Load
L: Distance from output shaft flange

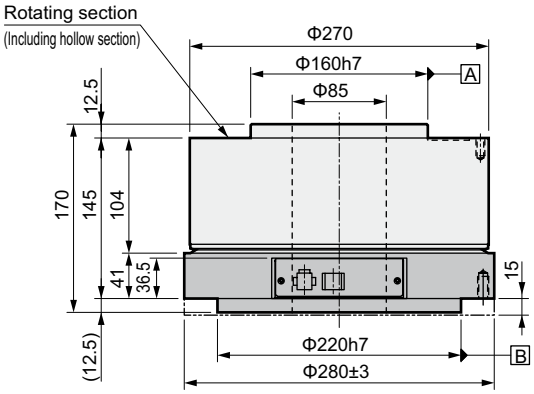
Dimensions

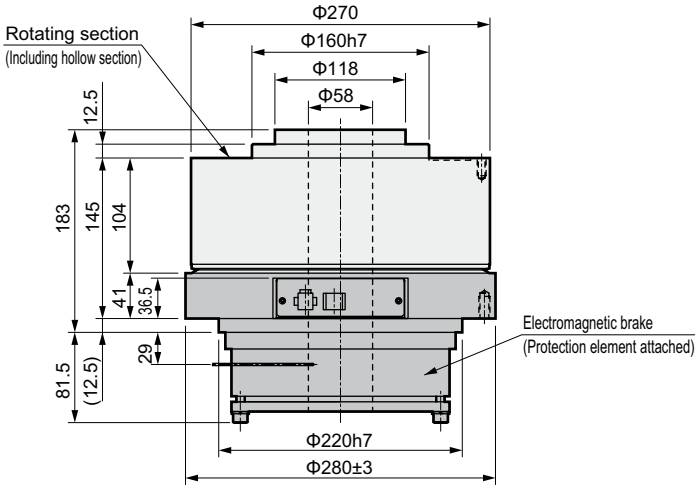
● **AX4150T**

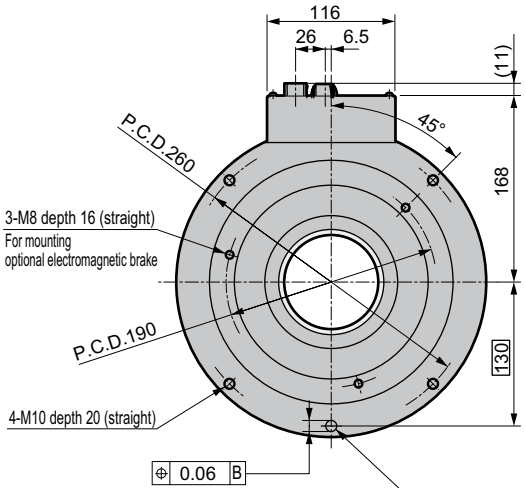


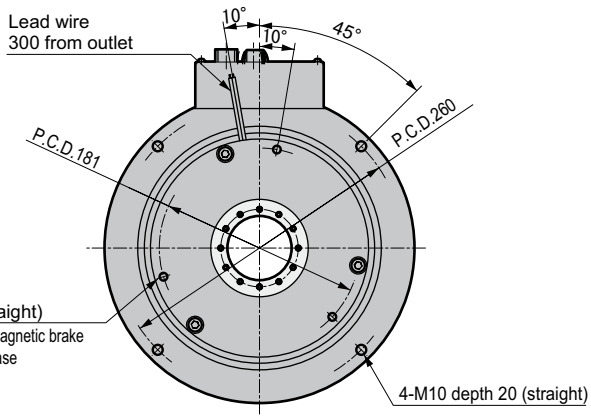
● **AX4150T-EB**
With electromagnetic brake
Refer to the left drawings for options.









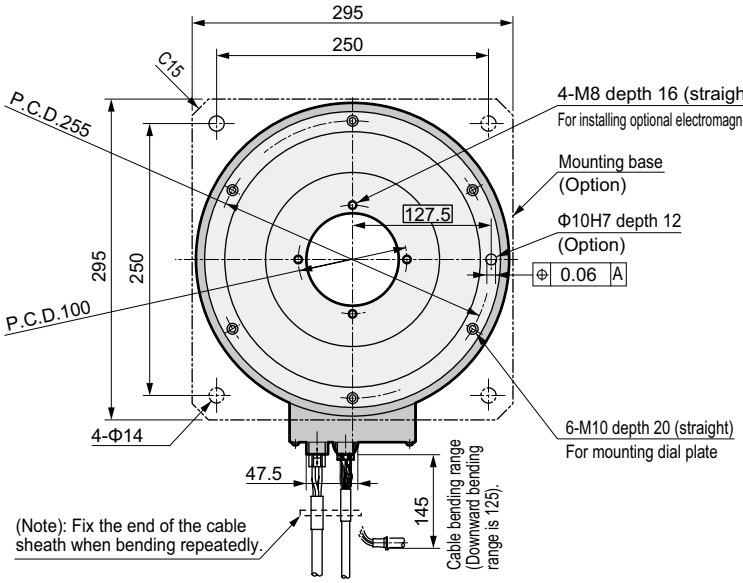


Φ10H7 depth 12 (option)
Not available when using optional mounting base

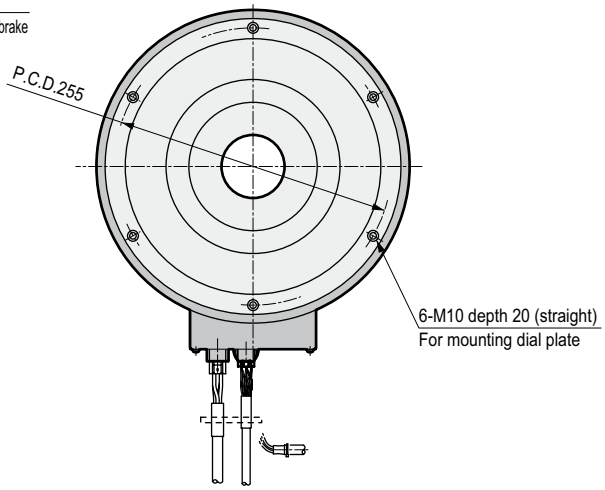
Note 1) The origin of the actuator may differ from the dimensions shown above.
Origin can be configured randomly using the origin offset function.

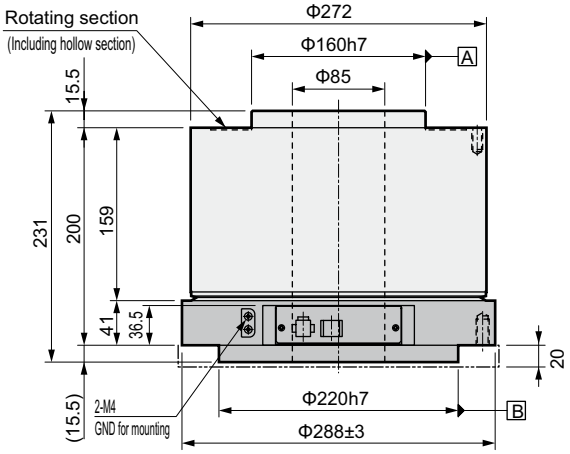
Dimensions

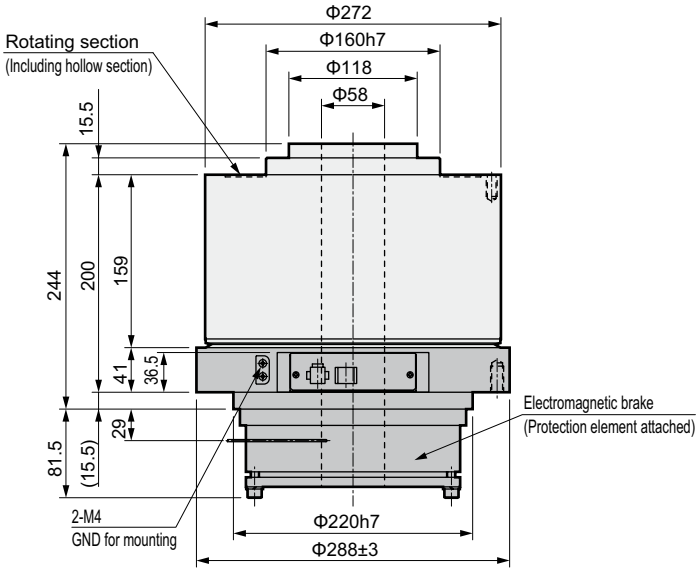
● **AX4300T**

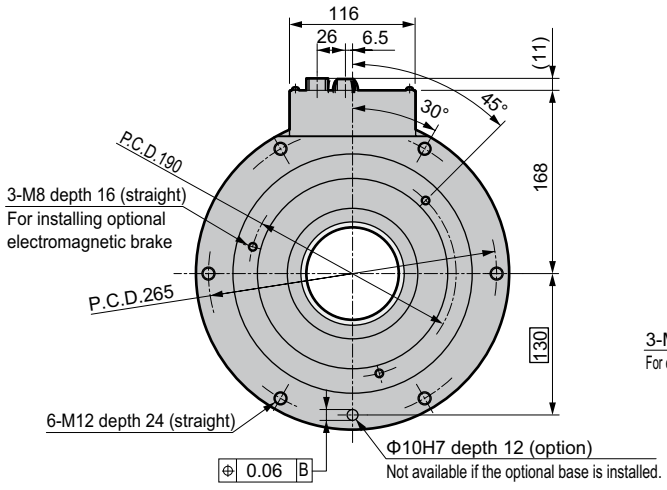


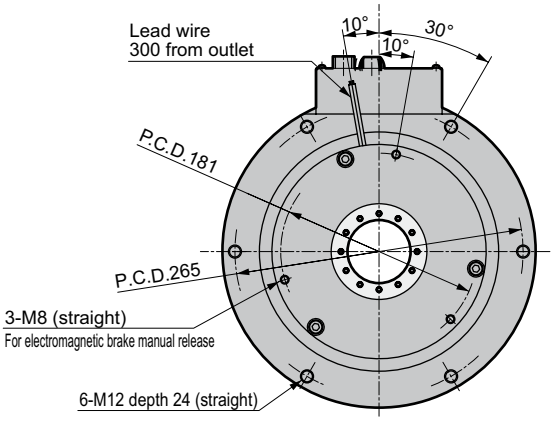
● **AX4300T-EB**
With electromagnetic brake
Refer to the left drawings for options.







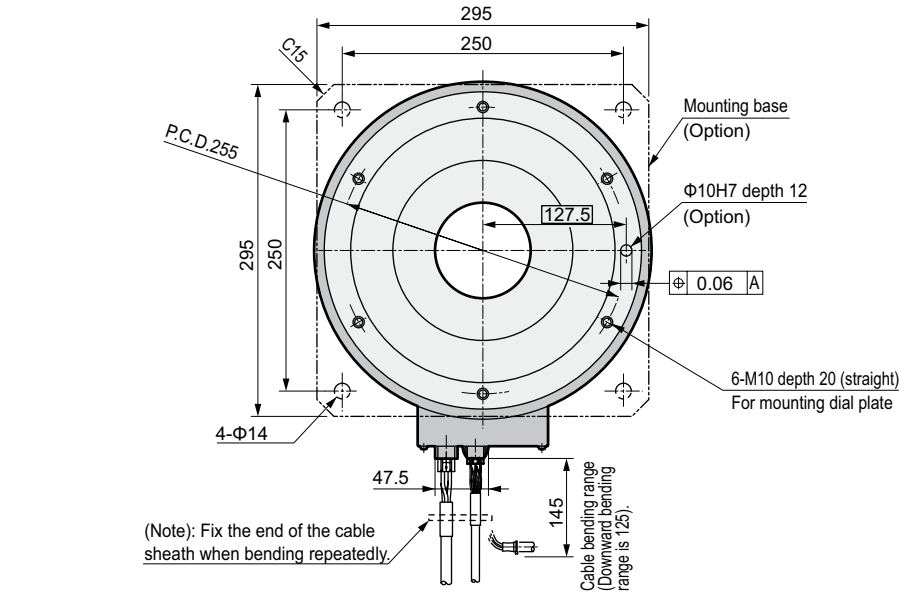


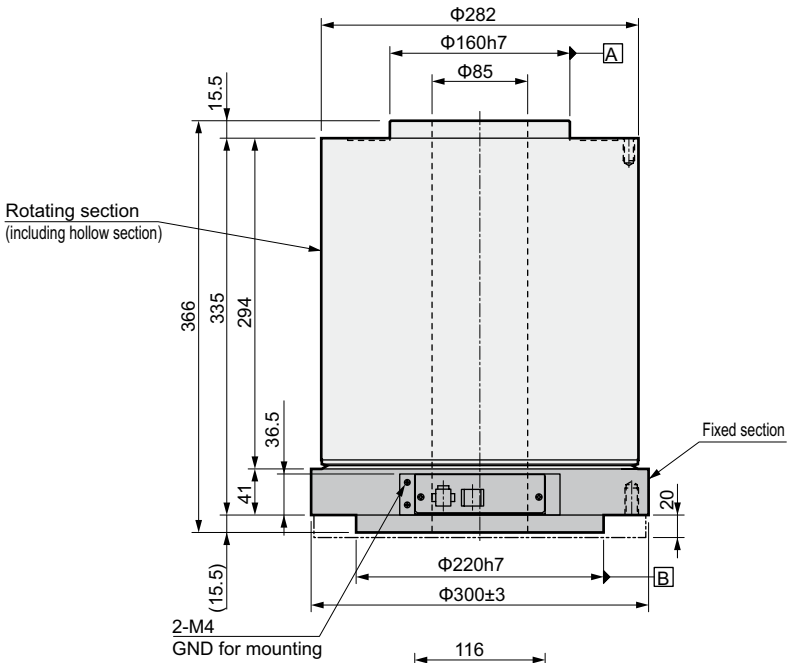


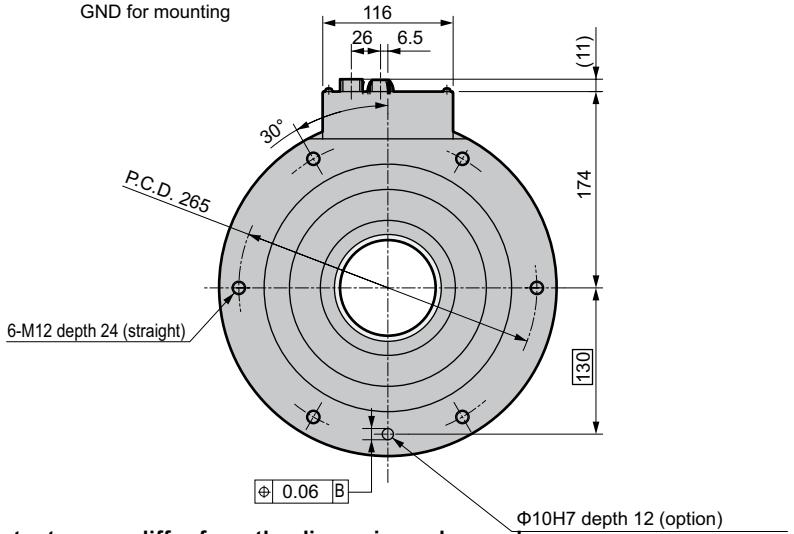
Note 1) The origin of the actuator may differ from the dimensions shown above.
Origin can be configured randomly using the origin offset function.

Dimensions

● **AX4500T**







Note 1) The origin of the actuator may differ from the dimensions shown above.
Origin can be configured randomly using the origin offset function.

Large direct drive actuator

AX400WT Series

Max. torque 1000N•m
large hollow shaft handy for cable wiring and piping, and a variety of options

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

RoHS

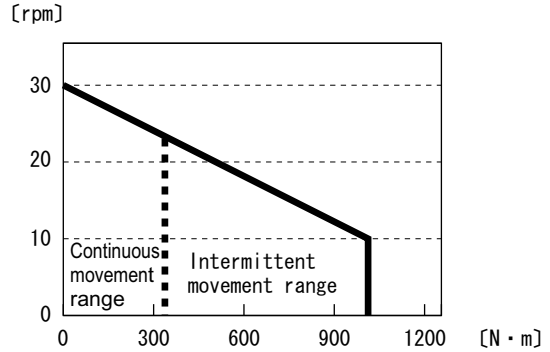
Actuator specifications

Descriptions		AX410WT
Maximum 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 accuracy (Note 1)	sec.	±30
Repeatability (Note 1)	sec.	±5
Output shaft friction torque	N•m	20.0
Resolver resolution	P/rev	540672
Motor isolation class		Class F
Motor withstanding voltage		1500 VAC for one minute
Motor isolation resistance		10MΩ 500 VDC and over
Ambient temperature range		0 to 45°C
Ambient humidity range		20 to 85%RH with no dew condensation
Storage ambient temperature range		-20 to 80°C
Storage ambient humidity range		20 to 90%RH with no dew condensation
Atmosphere		No corrosive gas, flammable or powder dust
Weight	kg	198
Run out of output shaft	mm	0.03
Run out of output shaft surface	mm	0.08
Protection		IP20

Note1: Refer to "Technical explanations" on page 49 for the details on index accuracy and repeatability.
Note2: The max. ambient temperature is 40°C if used as an UL certified product.

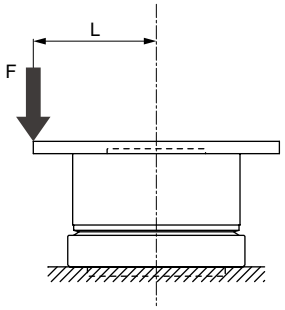
Speed/max. torque characteristics

●AX410WTH



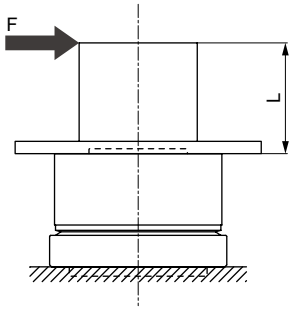
*This graph shows the characteristics under 3 phase AC200V

(Note) moment load



(Fig. a)

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



(Fig. b)

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

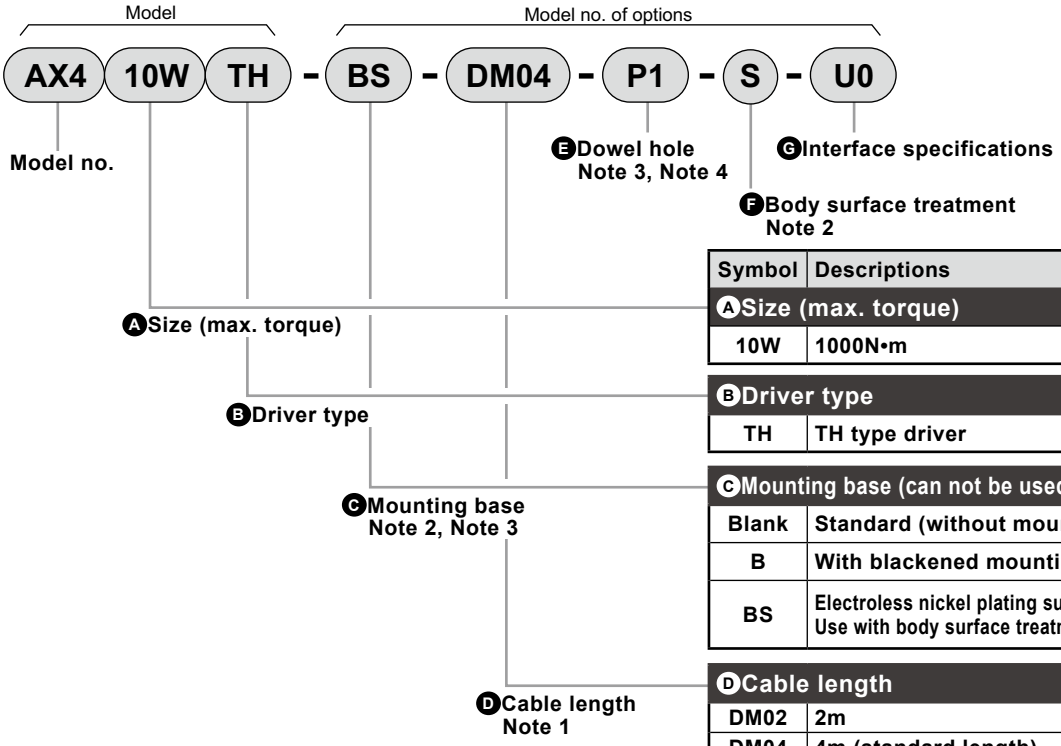
Safety precautions

⚠ WARNING

It may take a few seconds to stop depending on the speed and load conditions, even with emergency stop.

How to order

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



Symbol	Descriptions
Ⓐ Size (max. torque)	
10W	1000N•m

Ⓑ Driver type	
TH	TH type driver

Ⓒ Mounting base (can not be used with a dowel hole P2, P3.)	
Blank	Standard (without mounting base)
B	With blackened mounting base
BS	Electroless nickel plating surface treatment mounting base Use with body surface treatment S.

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

Ⓔ Dowel hole	
Blank	Standard (without dowel hole)
P1	1 on top
P2	1 on bottom
P3	1 each on both top and bottom

Ⓕ Body surface treatment	
Blank	Standard (Rotating section-blackening fixed section outside circumference-paint)
S	Rotating section: electroless nickel plating, fixed section: nitrating

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

⚠ Note on model no. selection

Note 1: The cable is a flexible cable. Refer to page 35 for dimensions of a cable.

Note 2: Select surface treatment and mounting base surface treatment with Ⓒand Ⓔ. By selecting the optional electroless nickel plating treatment, you can expect higher rust resistance compared to standard specifications.

Note 3: "P2" and "P3" cannot be selected if "B" with blackened mounting base or "BS" electroless nickel plating surface treatment mounting base is designated for Ⓒ Mounting base.

Note 4: The dowel hole section may not have a surface treatment.

● **Discrete actuator body model no.**

AX410WT－(B)－(P1)－(S)

ⒺDowel hole

ⒸMounting base　ⒻBody surface treatment

● **Discrete driver model no.**

•Three phase 200 to 230 VAC

AX9000TH－(U0)

ⒼInterface specifications

● **Discrete cable model no.**

•Motor cable

AX－CBLM6－(DM04)

•Resolver cable

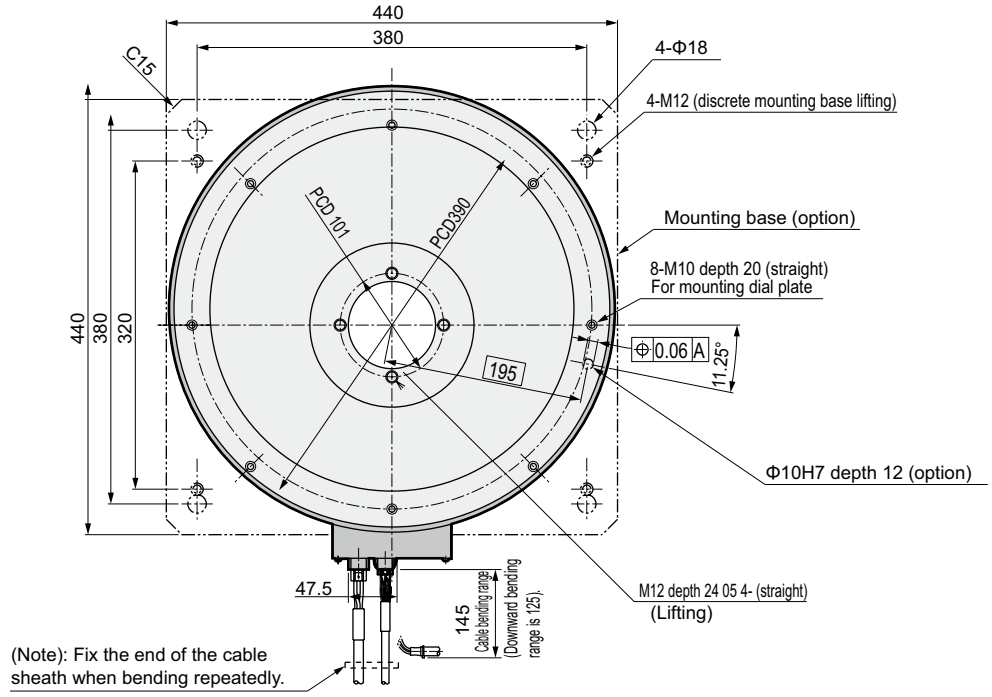
AX－CBLR6－(DM04)

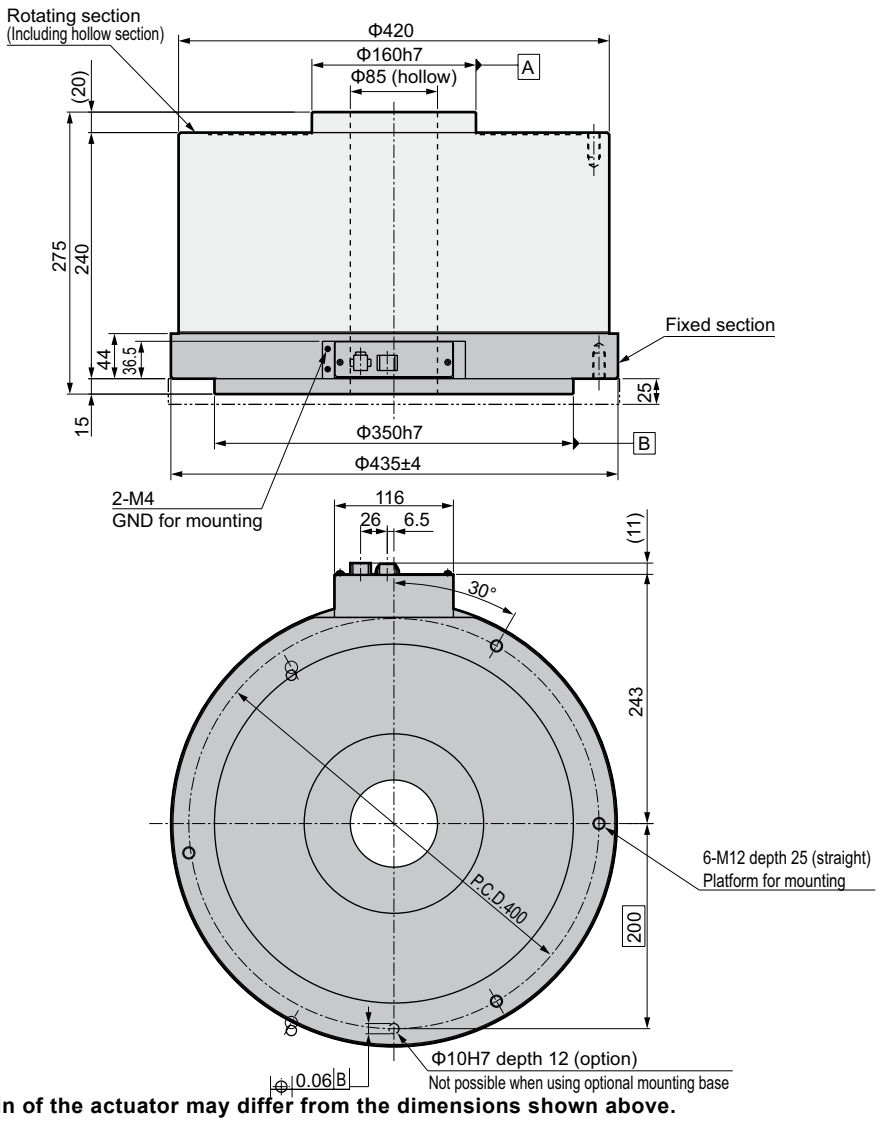
ⒹCable change
(Note: "04" for cable length 4 m)

*Custom orders are not CE, UL/cUL, RoHS certified. Consult with CKD for details.

Dimensions

● **AX410WT**





Note 1) The origin of the actuator may differ from the dimensions shown above.
Origin can be configured randomly using the origin offset function.

Direct drive actuator

TS·TH type driver

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

RoHS

Features

- **Separated main and control power supply**
- **Wiring methods changed from terminal block to connector**
- **Compact and light weight (resin body)**
- **7 segment 2-digit LED display**
- **Encoder output added (only for parallel I/O)**
- **Optional serial communication (circuit board integrated)**
- **Add a monitor for positioning information and alarm condition. (Only U2,U3,U4 option)**

How to order

•Three phase 200 to 230 VAC

AX9000TS－U0

AX9000TH－U0

•Single phase 100 to 115 VAC

AX9000TS－J1－U0

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

Common specifications

Descriptions		Model	
		TS type driver AX9000TS	TH type driver AX9000TH
Power voltage	Main power supply	Three phase 200V±10% to AC230 VAC ±10% (Note 1) Single phase 200V±10% to AC230 VAC ±10% (Option J1) (Note2, 3)	
	Control power supply	Single phase 200V±10% to AC230 VAC ±10% Single phase 200V±10% to AC230 VAC ±10% (Option J1) (Note2, 3)	
Power supply frequency		50/60 Hz	
Rated input current		AC200V: 1.8A AC100V: 2.4A	AC200V: 5.0A
Rated output current		1.9A	5.0A
Structure		Driver and controller integrated type (open frame)	
Ambient temperature range		0 to 50°C	
Ambient humidity range		20 to 90%RH (with no dew condensation)	
Storage ambient temperature range		-20 to 80°C	
Storage ambient humidity range		20 to 90%RH (with no dew condensation)	
Atmosphere		With no corrosive gas and powder dust	
Noise-resistance		1000V(P-P), pulse amplitude 1μsec, start up 1nsec EMI test inductive noise (capacity coupling)	
Vibration resistance		4.9m/s²	
Weight		1.6k g	2.1k g
Protection		IP2X(excluding CN4,CN5)	

Note 1: Single phase 200 to 230 VAC is available for models with a torque of 45N•m or less.
Note 2: Connecting 200 to 230 VAC to 100 to 115VAC specifications (option -J1) will destroy the driver.
Note 3: (-J1) cannot be selected for models with a max. torque of 75N•m or more.
Note 4: If the power has been cut off while the actuator is rotating, the rotation may continue due to inertia.
Note 5: In some cases, the motor will move due to the remaining electricity in the drive, even after the power has been cut off.

Performance specifications

Descriptions	Descriptions
Number of control axis	1 shaft and 540672 pulse/1 rotation
Angle input increment	° (degree), pulse, index number
Min. angle setting unit	0.001° and 1 pulse
Speed input increment	seconds, rpm
Speed setting range	0.01 to 100 second/0.01 to 300rpm (Note 1)
Equal index number	1 to 255
Maximum command value	7-digits input ±9999999
Timer	0.01 to 99.99 sec.
Programming language	NC language
Programming method	Data can be set with an Teaching Pendant or personal computer, etc., using the RS-232-C port.
Operation mode	Automatic, MDI, jog, single block, servo OFF, pulse string input mode
Coordinates	Absolute, incremental
Acceleration curve	<5 type> Modified sine（MS）, modified constant velocity（MC・MC2）, modified trapezoidal（MT）, Trapecloid（TR）
Status display	LED power display
Operating indication	7-segments LED display (2 digit)
Communication interface	RS-232C compliant
I/O signal	Refer to page of each interface specifications.
Program capacity	Approx. 6000 character (256 programs)
Electronic thermal	Overheat protection of actuator

Note 1) max. rotation speed differs depending on the actuator to be connected.

Power supply wattage and breaker capacity

TS type driver

Actuator model no.	Driver model no.	Power supply wattage (KVA)		Rush current (A)		Breaker capacity
		Max.	Rated	Single phase 100V	Single phase and three phase 200V	Rated current (A)
AX2006T	AX9000TS	0.8	0.5	16(Note1)	56(Note1)	10
AX4009T,AX2012T,AX2018T, AX4009T,AX4022T		1.0	0.5			
AX1045T,AX4045T		1.5	0.5			
AX1075T,AX4075T		2.0	0.8	—		

Note 1)Rush current value is typical value in AC115V and AC230V.

TH type driver

Actuator model no.	Driver model no.	Power supply wattage (KVA)		Rated input current (A)	Driver output (A)	Rush current (A)	Breaker capacity
		Max.	Rated	Three phase 200V	Max.	Three phase 200V	Rated current (A)
AX4150T and AX1150T	AX9000TH	3.0	0.8	4.2	16.7	50	20
AX4300T and AX1210T		4.0	1.5	6.1	25.0		
AX4500T		4.0	2.0	6.1	25.0		
AX410WT		4.0	2.0	6.1	25.0		

Note 1)Rush current value is typical value in AC230V.

Parallel I/O (NPN specifications)

CN3 input signal

Pin No.	Signal name	Logic	Judgment
1 to 2	External power input + 24V±10%		
3 to 4	External power input GND		
5	Program no. selection input (bit 0)	Positive	Level
6	Program no. selection input (bit 1)	Positive	Level
7	Program no. selection input (bit 2)	Positive	Level
8	Program no. selection input (bit 3)	Positive	Level
9	Program no. setting input 2nd digit/ program no. selection input (bit 4)	Positive	Edge Level
10	Program no. setting input 1st digit/ program no. selection input (bit 5)	Positive	Edge Level
11	Reset input	Positive	Edge
12	Return to origin command 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 count reset input	Positive	Edge
17	Emergency stop input	Negative	Level
18	Brake release input	Positive	Level

CN3 output signal

Pin No.	Signal name	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	Inposition input	Positive
42	Positioning complete output	Positive
43	Start input waiting output	Positive
44	Alarm output 1	Negative
45	Alarm output 2	Negative
46	Output during indexing 1/origin position output	Positive
47	Output during indexing 2/servo state output	Positive
48	Ready output	Positive
49	Output	Positive
50	M code strobe output	Positive

CN3 pulse string input signal

Pin No.	Signal name
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 name
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)

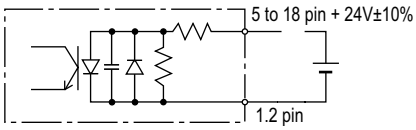
I/O circuit specifications

Descriptions	1 circuit current (mA)	Max. point (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 output circuit can only output 14 points out of 18 points simultaneously.**

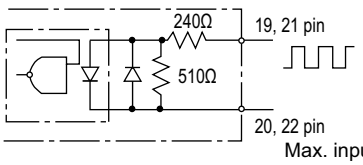
CN3 I/O circuit specifications

● Input circuit



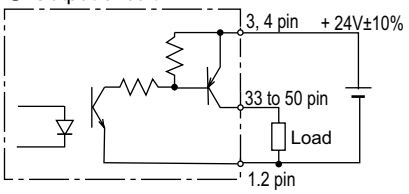
Rated voltage 24V±10%
Rated current 4mA (at DC24 V)

● Pulse string input circuit



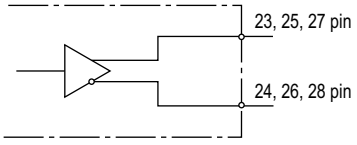
Rated voltage 5V±10%
Max. input frequency
Line driver 1Mpps
Open collector 250Kpps

● Output circuit



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

● Encoder output circuit



Output type: line driver
Use line driver: DS26C31
Recommended line receiver: DS26C32 equivalent

***Custom orders are not CE, UL/cUL, RoHS certified.**

Parallel I/O (PNP specifications)(coming soon)

CN3 input signal

Pin No.	Signal name	Logic	Judgment
1 to 2	External power input GND(Note 1)		
3 to 4	External power input + 24V±10%(Note 1)		
5	Program no. selection input (bit 0)	Positive	Level
6	Program no. selection input (bit 1)	Positive	Level
7	Program no. selection input (bit 2)	Positive	Level
8	Program no. selection input (bit 3)	Positive	Level
9	Program no. setting input 2nd digit/ program no. selection input (bit 4)	Positive	Edge Level
10	Program no. setting input 1st digit/ program no. selection input (bit 5)	Positive	Edge Level
11	Reset input	Positive	Edge
12	Return to origin command 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 count reset input	Positive	Edge
17	Emergency stop input	Negative	Level
18	Brake release input	Positive	Level

Note 1) Wire differs from PNP specifications of AX9000GS/GH.

CN3 output signal

Pin No.	Signal name	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	Inposition input	Positive
42	Positioning complete output	Positive
43	Start input waiting output	Positive
44	Alarm output 1	Negative
45	Alarm output 2	Negative
46	Output during indexing 1/origin position output	Positive
47	Output during indexing 2/servo state output	Positive
48	Ready output	Positive
49	Output	Positive
50	M code strobe output	Positive

CN3 pulse string input signal

Pin No.	Signal name
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 name
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)

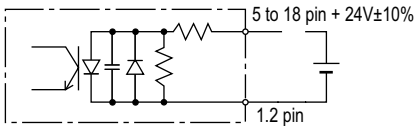
I/O circuit specifications

Descriptions	1 circuit current (mA)	Max. point (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 output circuit can only output 14 points out of 18 points simultaneously.**

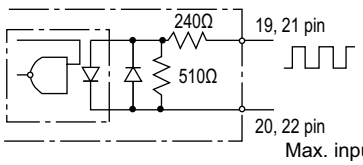
CN3 I/O circuit specifications

● Input circuit



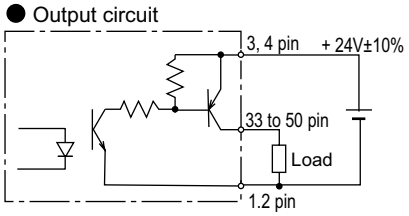
Rated voltage 24V±10%
Rated current 4mA (at DC24 V)

● Pulse string input circuit



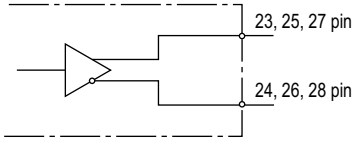
Rated voltage 5V±10%
Max. input frequency
Line driver 1Mpps
Open collector 250Kpps

● Output circuit



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

● Encoder output circuit



Output type: line driver
Use line driver: DS26C31
Recommended line receiver: DS26C32 equivalent

***Custom orders are not CE, UL/cUL, RoHS certified.**

CC-Link specifications

Communication specifications

Descriptions	Specifications
Power supply	DC5V supplied from servo amp
CC-Link version	Ver.1.10
Occupied station no. (station type)	2 stations (remote device station)
Remote input no.	48 point
Remote output no.	48 point
Remote register I/O	Input 8 words/ Output 8 words
Communication speed	10M/5M/2.5M/625k/156kbps (select with the parameter setting)
Communication method	Broadcast polling method
Synchronization method	Frame synchronization method
Symbol method	NRZI
Line type	Bus type (EIA RS-485 compliant)
Incorrect control method	CRC($X^{16}+X^{12}+X^{6}+1$)
Connection cable	CC-Link Ver.1.10 cable (shielded 3 wire twisted pair cable)
Transmission format	HDLC compliant
Remote station no.	1 to 63 (setting by parameter)
Connection quantity	At only remote device station Max.32 unit/2 station occupied
Monitor functions	Current position (degrees,. pulse), position deviation, program no., electric thermal, rotation speed, alarm

I/O signal

PLC→AX(Input)

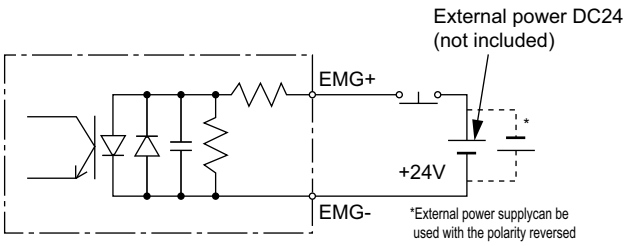
Device No.	Signal name	Logic	Judgment
RYn0	Program no. selection input (bit 0)	Positive	Level
RYn1	Program no. selection input (bit 1)	Positive	Level
RYn2	Program no. selection input (bit 2)	Positive	Level
RYn3	Program no. selection input (bit 3)	Positive	Level
RYn4	Program no. setting input the second digit /program no. selection input (bit 4)	Positive	Edge level
RYn5	Program no. setting input the first digit /program no. selection input (bit 5)	Positive	Edge level
RYn6	Reset input	Positive	Edge
RYn7	Return to origin command 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 count reset	Positive	Edge
RYnC	Emergency stop input	Negative	Level
RYnD	Brake release input	Positive	Level
RYnE	Not available		
RYnF	Not available		
RY(n+1)0 to RY(n+1)F	Not available		
RY(n+2)0	Monitor output action request	Positive	Edge
RY(n+2)1	Command execution request	Positive	Edge
RY(n+2)2 to RY(n+2)F	Not available		

AX→PLC(Output)

Device No.	Signal name	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	Inposition input	Positive
RXn9	Positioning complete output	Positive
RXnA	Start input waiting output	Positive
RXnB	Alarm output 1	Negative
RXnC	Alarm output 2	Negative
RXnD	Output during indexing 1 /origin position output	Positive
RXnE	Output during indexing 2 /servo state output	Positive
RXnF	Ready output	Positive
RX(n+1)0	Output	Positive
RX(n+1)1	M code strobe output	Positive
RX(n+1)2 to RX(n+1)F	Not available	
RX(n+2)0	Monitor medium	Positive
RX(n+2)1	Command completion	Positive
RX(n+2)2 to RX(n+2)F	Not available	

"n" is a value that depends on the station no. setting

TB3 input circuit specifications (emergency stop)



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

Safety precautions

- Maintain sufficient distance between the communication cable and the power and motor cable.
- Do not bundle communication and power cable as it may cause communication errors and failures due to instability caused by noise.
- Refer to materials such as CC-Link laying manual for details on laying the cables.

DeviceNet specifications (available soon)

Communication specifications

Descriptions	Specifications
Power supply for communication	11 to 25 VDC
Current consumption of power supply for communication	50mA or less
Communication protocol	DeviceNet compliant: remote I/O
Occupying nodes	Input 8 byte/output 8 byte
Communication speed	500k/250k/125kbps (Select with the parameter setting.)
Connection cable	DeviceNet compatible cable (Shielded 5 wire cable, 2 signal lines, 2 power lines, 1 shield)
Node address	0 to 63 (set with parameter)
Connection quantity	Max.64 unit (including master)

I/O signal

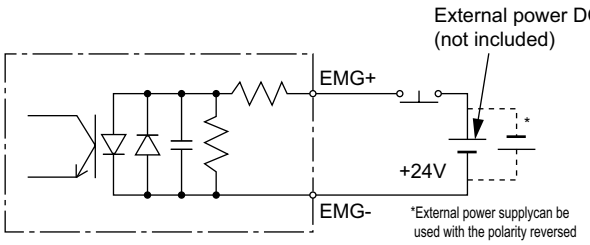
PLC→AX(Input)

Byte No.	Signal name	Logic	Judgment
0.0	Program no. selection input (bit 0)	Positive	Level
0.1	Program no. selection input (bit 1)	Positive	Level
0.2	Program no. selection input (bit 2)	Positive	Level
0.3	Program no. selection input (bit 3)	Positive	Level
0.4	Program no. selection input (bit 4) /program no. setting input the second digit	Positive	Level edge
0.5	Program no. setting input the first digit /program no. selection input (bit 5)	Positive	Level edge
0.6	Reset input	Positive	Edge
0.7	Return to origin command 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 count reset	Positive	Edge
1.4	Emergency stop input	Negative	Level
1.5	Brake release input	Positive	Level
1.6	Not available		
1.7	Not available		
2.0 to 2.5	Not available		
2.6	Monitor output action request	Positive	Level
2.7	Command execution request	Positive	Edge

AX→PLC(Output)

Byte No.	Signal name	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	Inposition input	Positive
1.1	Positioning complete output	Positive
1.2	Start input waiting output	Positive
1.3	Alarm output 1	Negative
1.4	Alarm output 2	Negative
1.5	Output during indexing 1 /origin position output	Positive
1.6	Output during indexing 2 /servo state output	Positive
1.7	Ready output	Positive
2.0	Output	Positive
2.1	M code strobe output	Positive
2.2 to 2.5	Not available	
2.6	Monitor medium	Positive
2.7	Command completion	Positive

TB3 input circuit specifications (emergency stop)



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

Safety precautions

- Maintain sufficient distance between the communication cable and the power and motor cable.
- Do not bundle communication and power cable as it may cause communication errors and failures due to instability caused by noise.
- Refer to materials such as DeviceNet laying manual for details on laying the cables.

Communication specifications

Description	Specifications
Communication protocol	PROFIBUS DP-V0 compliant
I/O data	Input 8 byte/output 8 byte
Communication speed	12M/6M/3M/1.5M/500k/187.5k/ 93.75k/45.45k/19.2k/9.6kbps (auto baud rate function)
Connection cable	PROFIBUS cable (shielded 2 wire twisted pair cable)
Node address	0 to 125 (set with parameter)
Connection quantity	Without repeater: Max. 32 stations for each segment With repeater Max. total of 126 stations
Monitor function	Current position (degrees,. pulse), position deviation, program no., electric thermal, rotation speed, alarm

I/O signal

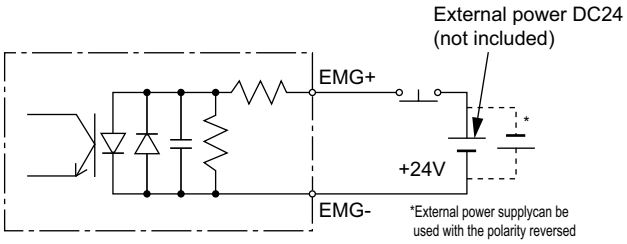
PLC→AX(Input)

Byte No.	Signal name	Logic	Judgment
0.0	Program no. selection input (bit 0)	Positive	Level
0.1	Program no. selection input (bit 1)	Positive	Level
0.2	Program no. selection input (bit 2)	Positive	Level
0.3	Program no. selection input (bit 3)	Positive	Level
0.4	Program no. selection input (bit 4) /program no. setting input the second digit	Positive	Level edge
0.5	Program no. setting input the first digit /program no. selection input (bit 5)	Positive	Level edge
0.6	Reset input	Positive	Edge
0.7	Return to origin command 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 count reset	Positive	Edge
1.4	Emergency stop input	Negative	Level
1.5	Brake release input	Positive	Level
1.6	Not available		
1.7	Not available		
2.0 to 2.5	Not available		
2.6	Monitor output action request	Positive	Level
2.7	Command execution request	Positive	Edge

AX→PLC(Output)

Byte No.	Signal name	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	Inposition input	Positive
1.1	Positioning complete output	Positive
1.2	Start input waiting output	Positive
1.3	Alarm output 1	Negative
1.4	Alarm output 2	Negative
1.5	Output during indexing 1 /origin position output	Positive
1.6	Output during indexing 2 /servo state output	Positive
1.7	Ready output	Positive
2.0	Output	Positive
2.1	M code strobe output	Positive
2.2 to 2.5	Not available	
2.6	Monitor medium	Positive
2.7	Command completion	Positive

TB3 input circuit specifications (emergency stop)



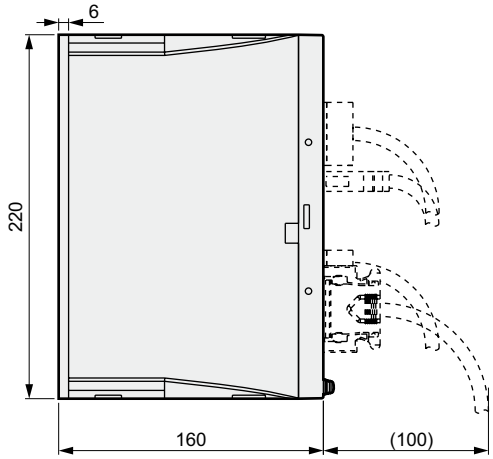
Rated voltage 24V±10%, rated current 5mA or less

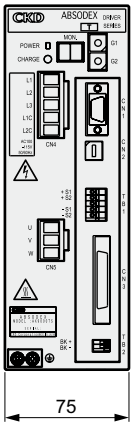
Safety precautions

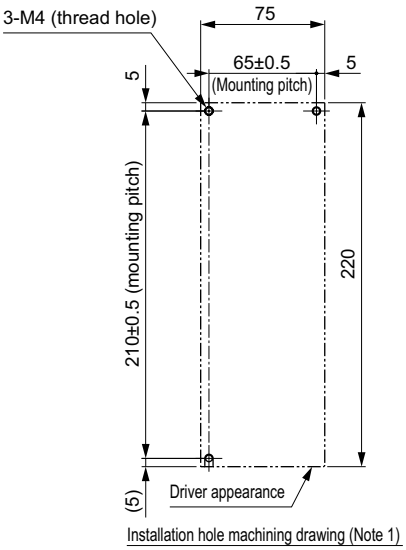
■ **Refer to materials such as "Installation Guideline for PROFIBUS DP/FMS" for details on laying the cables.**

Dimensions

● **TS type driver**

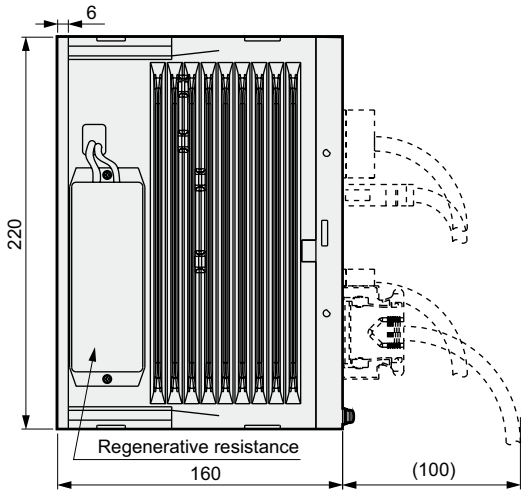


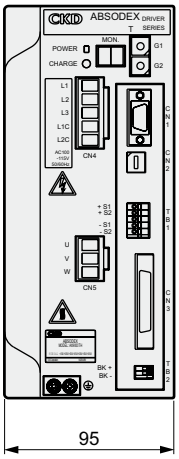


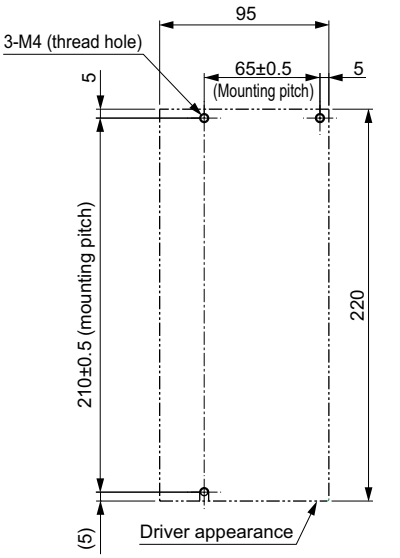


Installation hole machining drawing (Note 1)

● **TH type driver**







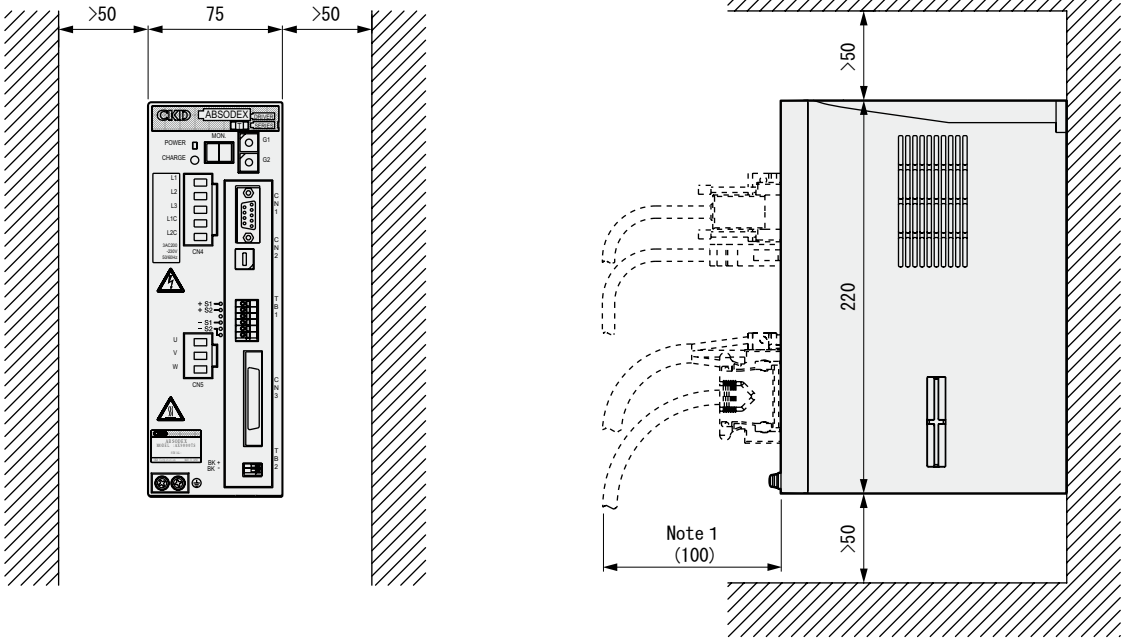
Installation hole machining drawing (Note 1)

Note : The mounting pitch differs from conventional models (AX9000GS/AX9000GH)

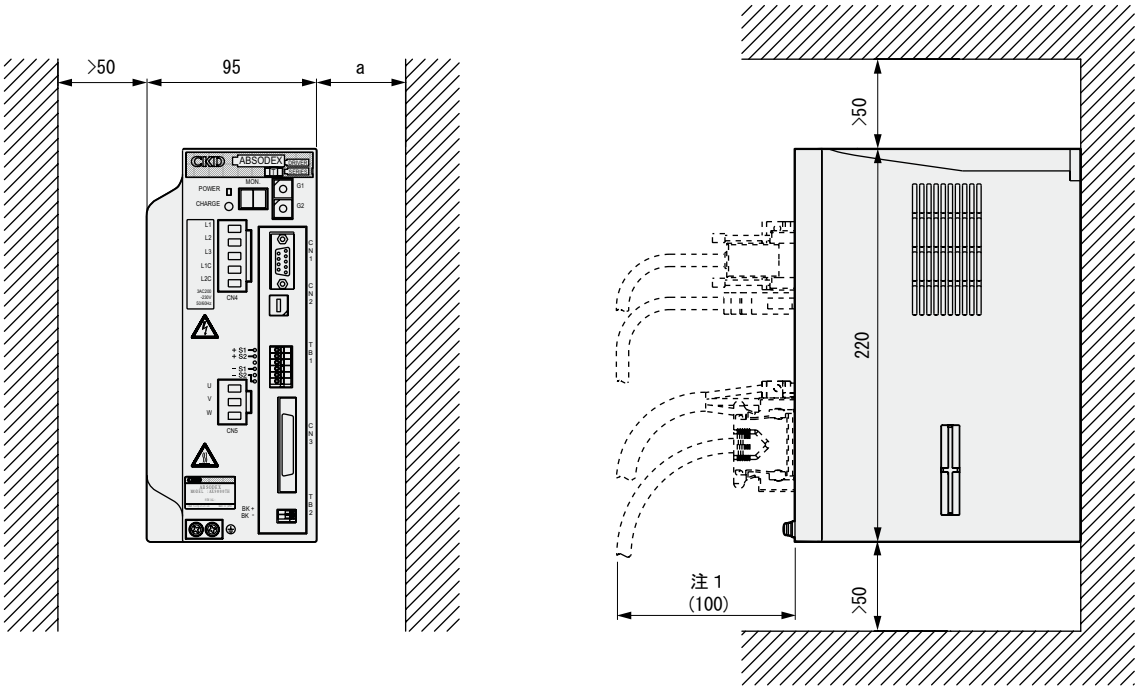
Footprint

● **TS type driver**

The driver is not dustproof and waterproof.
Protect the direct driver to keep out dust,water and oil fumes if there is any in your environment.
Keep the temperture of the control box below 50 ℃ and maintain space as shown below, if placed in a control box.



● **TH type driver**

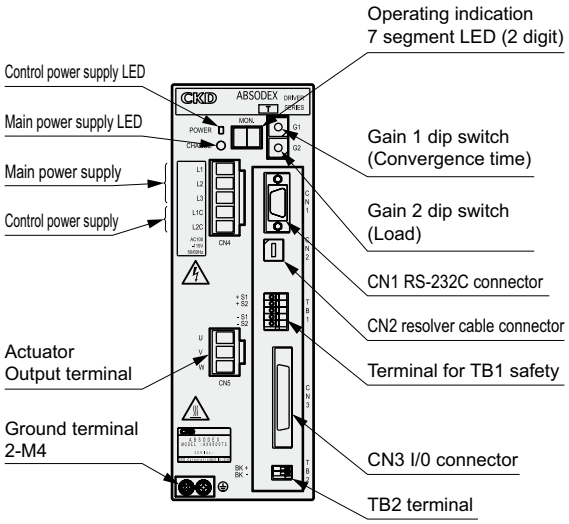


Note 1) Provide extra space depending on your cable.

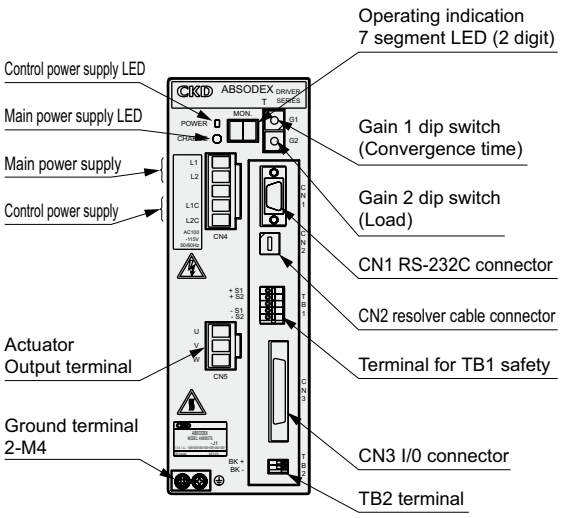
Panel explanation

● Parallel I/O (NPN,NPN specifications)

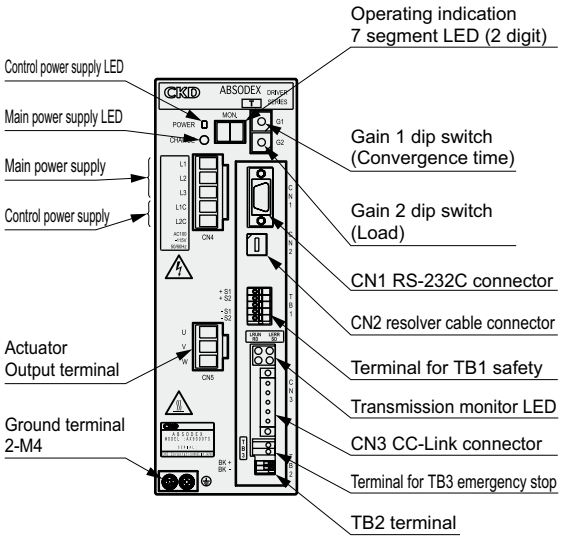
•200 VAC



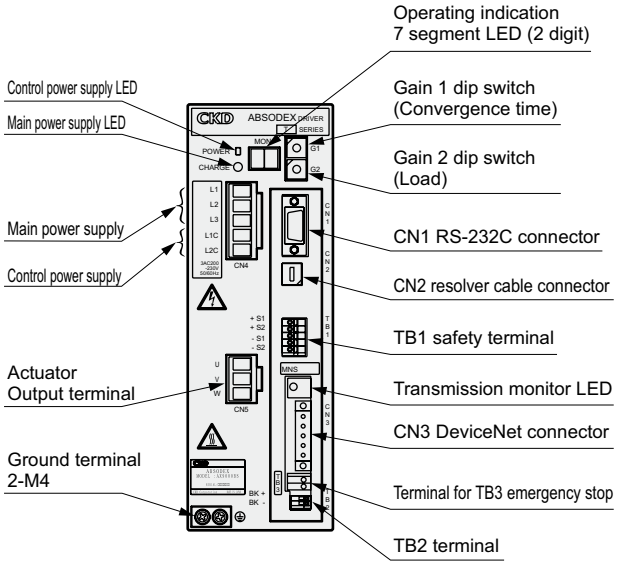
•100 VAC



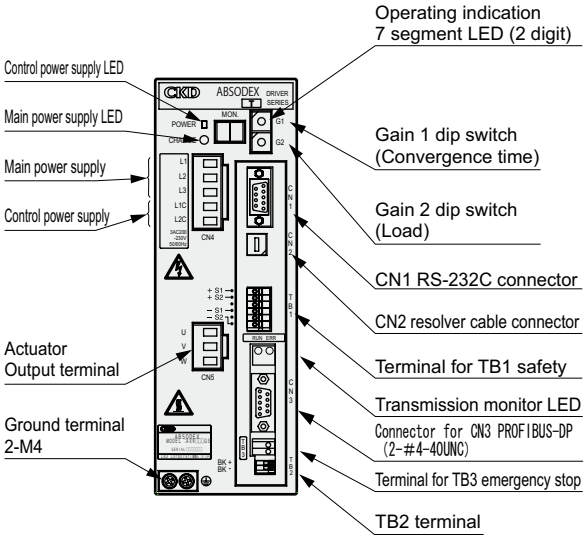
● CC-Link specifications



● DeviceNet specifications

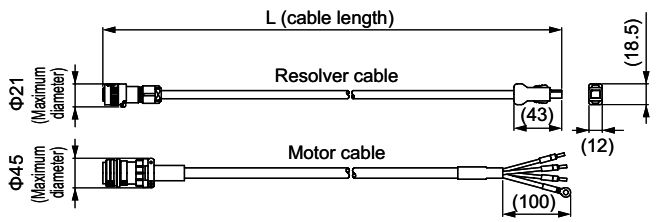
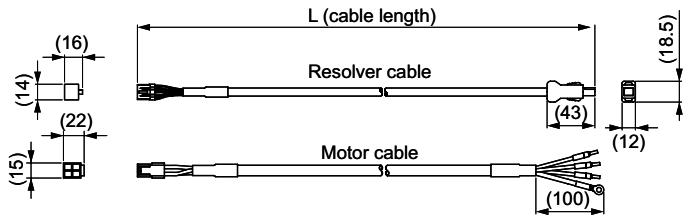


● PROFIBUS-DP specifications



Cable specifications

Cable dimensions | **Cable min. bending radius**

● AX1000T 	Resolver cable	60mm
	Motor cable	110mm
● AX2000T and AX4000T 	Resolver cable	60mm
	Motor cable	110mm

Safety precautions

- When connecting the motor cable and driver, check that the cable's mark tubes and the driver's indications are correct.
- Fix the cable by the cable sheath near the actuator if the cable will be bent repeatedly.
- The outlet cable of the AX4009T and AX2000T are not flexible. Always fix these cables near the connector to prevent it from moving. Pulling and applying excessive force to the cable may damage the cable.
- When connecting the cable, insert the connector securely to the back. Tighten the connector's set screws and fixing screws.
- Do not modify cable by cutting or extending it as it may lead to faults or malfunctions.
- Refer to "How to order" for cable length of L.

Direct drive actuator Teaching Pendant

AX0180

●Common for TS/TH type driver

RoHS

Features

(1) Easy programming
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 teaching pendant.

(3) Back up possible
Programs and parameters can be stored, and programs can be copied.The conventional model can also be used.

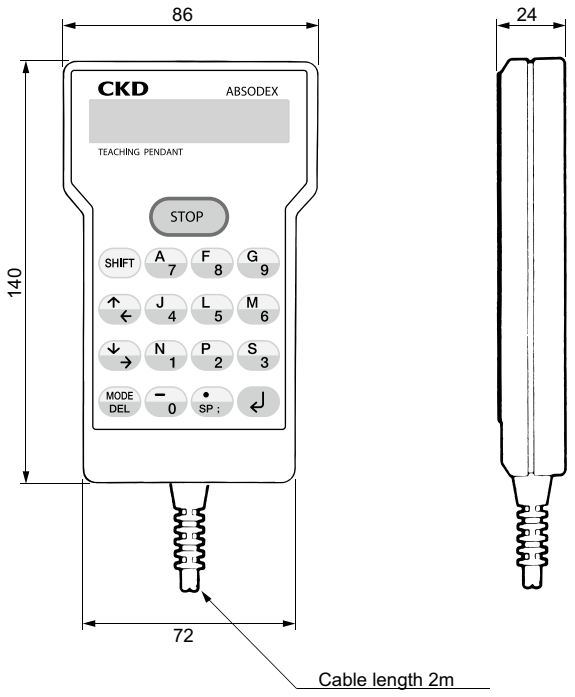
(4) The conventional model can also be used.

Specifications

Descriptions	AX0180
Operation mode	Edit, display, parameter, operation or copy
Program capacity	Equal index or NC program 2000 character (1 program)
Program No.	Equal index program: program No. 0 to 999
Indicator	16 character x 2 line (LCD display)
Input key	17key (Emergency stop key: 1, control key: 5 characters, numerals key: 11)
Back up	Super capacitor (approx. 3 hours)
Power supply	Supply from direct drive actuator driver
Cable length	2m
Ambient temperature range	0 to 50°C
Ambient humidity range	20 to 90% (with no dew condensation)
Conservation ambient temperature range	-20 to 80°C
Conservation ambient humidity range	20 to 90% (with no dew condensation)
Atmosphere	With no corrosive gas and powder dust
Weight	140g (does not include weight of cable)

Dimensions

● Teaching Pendant



How to order

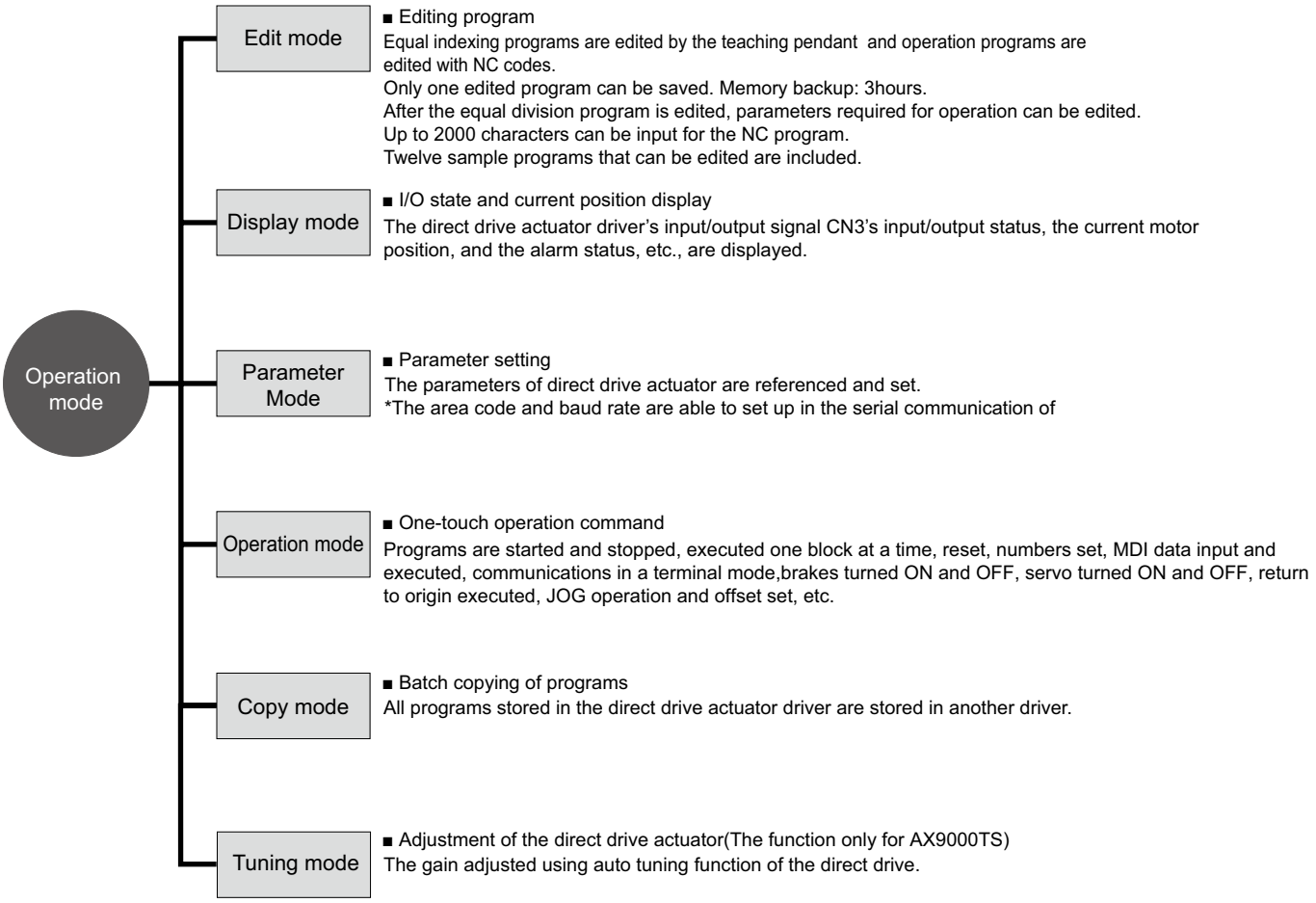
Model — Model no. of options

AX0180 – **E**

Model no.

Symbol	Descriptions
Blank	Standard (Japanese ver.)
E	English version

Teaching Pendant



Interactive programming

Programs are created easily by inputting the following settings:

[Example of program input]

Create program	Program No. (0 to 999)
Return to origin position	1. Origin 2. Index
Return direction	1. CW 2. CCW
Return speed	(1.0 to 20.0) rpm
Index number	(1 to 255)
Moving time	[0.01 to 100] second
Rotational direction	1. CW 2. CCW
Stop process	1. Start waiting 2. Dwell
Brake	1. Used 2. Vacant
Delay timer	[0.01 to 99.99] second
M code	1. M code 2. Index position

Examples of use

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

Create a program and store it in the direct drive actuator. ⇒ **Edit mode**
Programs are input and stored in easy steps.

Start a program stored in the direct drive actuator. ⇒ **Operation mode**
Programs are started easily by designating the program number.

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

Confirm a I/O on/off. ⇒ **Display mode**
The condition of I/O can display.

Direct drive actuator related parts model no. table

● Related parts

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

(Note) This cable is not compact with C type drivers and old models (black drivers). Consult our sales representative when using for these drivers.

● Mounting base

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

(Note 1) Mounting base is not compatible with AX4009T.

(Note 2) Consult our sales representative for the model number of the mounting base.

● Noise filter

Part name	Model	Model no.
Noise filter for power supply (three phase 10A)	AX Series	AX-NSF-3SUP-EF10-ER-6
Noise filter for power supply (single phase 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)Parts of this page are lists of the parts which you can buy.

(Note 2)The parts below and over current/short circuit protection components are required to comply with the CE marking. Also, the driver must be placed withing the switch board. Refer to the manual or technical documents for Absodex AX Series TS/TH type to find out how to install them.

Explanation of technical term

Index precision

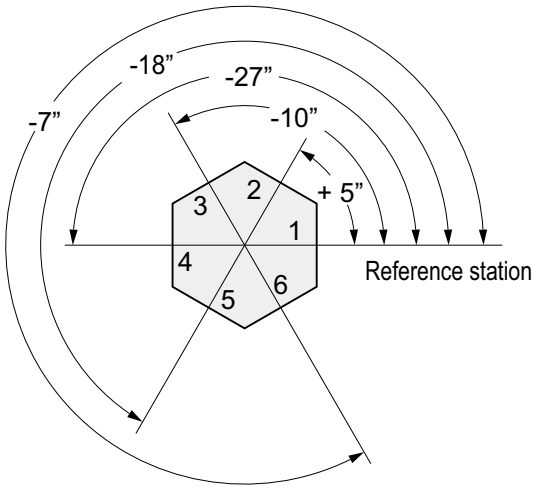
The indexing accuracy of the Absodex is the gap between the target position set by the NC program and the actual position.
This target position is the angle (sec.) from the standard station (return to origin position)
As shown to the right, the accuracy is calculated from the target position and the remainder of the actual result with the smallest and largest value.
A high precision encoder is used to measure the angle.

Repeatability

Repeat accuracy is the maximum dispersion expressed in angle (sec.) when stopping repeatedly on the specified target position under the same condition.
The required accuracy may be repeat or indexing depending on the characteristics of the machine.

***Seconds (sec.)= Unit that expresses angle by degrees, minutes and seconds. 1degrees=60minutes=3600seconds**

Example of index accuracy measurement



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

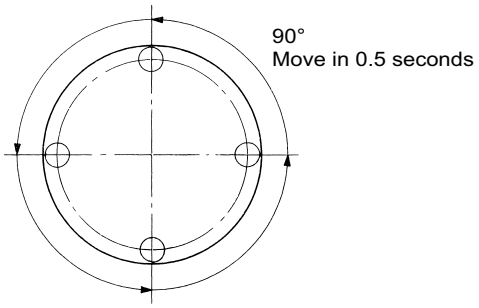
Index accuracy ±16

Applications (1)

Movement specifications 1 (operation of index unit)

Movement specifications

- 4 index (equal index of 90°)
- Moving time 0.5 second
- Index once counter clockwise every time there is a start signal from the PLC.



Example of program

Main program

O1;	Use program No. "1"
G11;	Set the time (sec.) in the NC code F unit.
G10\1A4;	Split one rotation into 4.
G91.1;	Set the incremental dimensions.
A0\F0\.5;	Move to the closest index station in 0.5 sec.
N1M0\;	Waiting for start signal from PLC.
A-1F0\.5;	Move one index in 0.5 sec.
J1;	Jump to the sequence No. 1 block.
M30\;	Program end

(Note) When using the Teaching note, O1will be automatically configured by entering program no. 1.

Example of PLC operation signal

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 0 bit ・No. selection 1 bit ・No. selection 2 bit ・No. selection 3 bit ・No. setting the first digit			Select program No. 1 (Select the program number you will be using. Program No.1 is only selected as an example.)
(2) Return process	・Start signal ・Positioning complete signal ・Start input waiting output			Return complete by positioning complete signal

Indexing process: process done each time when indexing

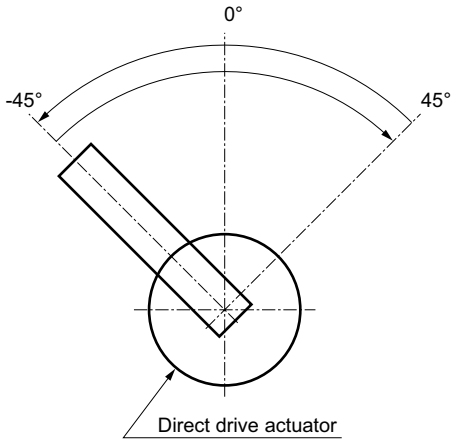
Process name	I/O signal name	PLC output	PLC input	Remarks
(3) Index	・Start signal ・Positioning complete signal ・Start input waiting output			Index complete by positioning complete signal

(Note) Program selection and start signal input must be done when the stand by signal is on.

Movement specifications 2 (operation of oscillator unit)

Movement specifications

- Repeat -45°↔45°every time there is a start signal from the PLC.
- Moving time 0.7 second
- Apply the brakes when stopping (Note 1)
- Enable emergency stop input. (Note 2)



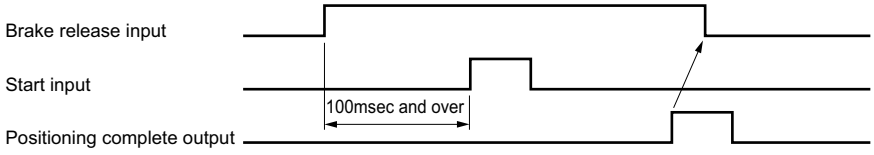
Example of program

Main program

O2;	Use program No. “2”.
G10\5;	NC code’s Unit A is set to angle (°).
G11;	NC code’s Unit F is set to time (sec.).
G90\;	Set the absolute dimensions.
N1M69;	Brake release
A45F0\.7;	Move to 45°in 0.7 seconds.
M68;	Brake operation
M0\;	Waiting for start input from PLC
M69;	Brake release
A-45F0\.7;	Move to 45°in -0.7 seconds.
M68;	Brake operation
M0\;	Waiting for start input from PLC
J1;	Jump to block of sequence No. 1
M30\;	Program end

Note 1: Use the direct drive actuator with brakes.
When using the type with optional magnetic brakes, refer to the section "Using the magnetic brakes".

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



Selection guide

Unit of elements of operating condition and symbol	
Load moment of inertia (kg/m²)	J
Moving angle (°)	ψ
Moving time (s)	t_1
Cycle time (s)	t_0
Load friction torque (N•m)	T_F
Working torque (N•m)	Tw
Cam curve	Selection from (MS, MC, MT, TR)

1. Load moment of inertia

Calculate the load movement of inertia, and temporarily select an actuator that can handle the inertia momentum.

2. Rotation speed

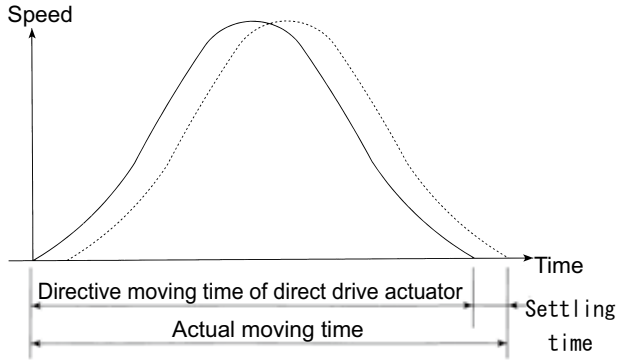
Max. rotation speed Nmax is obtained using movement angle ψ(°) and movement time t_1(s).

$$N\bullet max. = Vm/\frac{\psi}{6,\ t_1}\ (rpm)$$

V_m is a constant determined by the cam curve.

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

(Cautions)
Actual movement time is the direct drive actuator command movement time plus setting.



The settling time differs based on the working condition, but generally is between 0.025 and 0.2s.
Movement time t_1 used for selecting the model should be the direct drive actuator command movement time. The direct drive actuator command movement time is also used for settling the movement time in the NC program.

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

μ : Coefficient of friction

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

Ff : Force applied on sliding surface or bearings (N)
Rf : Average friction radius (m)
m : Weight (kg)
g : Gravity acceleration (m/s²)

3. Load torque

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

$$Tm=[Am\bullet(J+J_M)\bullet\frac{\psi\bullet\pi}{180,\ t_{12}}+T_F+Tw)/fc+T_{MF}$$

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

$$Trms=\sqrt{\frac{t_1}{t_0}\bullet(r/Am/(J+J_M)/\frac{\psi\bullet\pi}{180,\ t_{12}}\bullet fc}$$

Vm Am r is the below table value for here.

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} f is as follows.

J_M : Output shaft moment of inertia (kg/m²)
T_{MF} : Output shaft friction torque (N•m)
fc : Usage factor (fc = 1.5 during normal use)

If the temporarily selected actuator does not satisfy either of the following conditions, increase the actuator size and calculate again.
Maximum load torque <maximum output torque
Effective value of load torque <continuous output torque

Note) The max. torque will be limited when rotating at high speeds.
Check with the model selection software when using at these speed ranges..

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

Working torque TW is calculated with the following formula:
Tw=Fw×Rw(N•m)
Fw(N) : Force required for work
Rw(m) : Radius for work
(Example)
When setting the output shaft horizontal, the table workpiece , and jig, etc., are the working torque.

4. Regenerative electric power

Use the simplified formula below to calculate the regenerative power to determine if it can be used.

● AX9000TS type driver

AX9000TS type driver does not have a regenerative resistor. Make sure that the regenerative energy calculated from the following simplified formula does not exceed the energy rechargeable with the capacitor (table below).

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

Power supply specifications	Max. acceptable regenerative energy (J)	Remarks
AC200V	17.2	Value if the main power runs on 200VAC
100 VAC (-J1)	17.2	Value if the main power runs on 100VAC

Consult CKD if these conditions are not satisfied.

● For AX9000TH type driver

For AX9000TH, there is a restriction of regenerative power due to the power consumption of the regenerative resistor.
Calculate using the simplified formula below.

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

W= 40

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

(working conditions)
- **Table radius : R = 0.4 (m)**
- **Table weight : Wt = 79 (kg)**
- **Jig radius of rotation : Re = 0.325 (m)**
- **Jig weight : Wj = 10 (kg/pc.)** (Including workpiece weight)
- **Jig number : N = 4**

(operation conditions)
- **Moving angle : ψ=90(°)**
- **Moving time : t_1=0.8(s)**
- **Cycle time : t_0=4(s)**
- **Load friction torque : T_F=0(N•m)**
- **Working torque : T_W = 0 (N•m)**
- **Output shaft friction torque : T_{MF}(N•m)** Follows actuator specifications
- **Cam curve : MS (modified sine)**

STEP 1
Calculation of moment of inertia

a) Table $J1 = \frac{Wt \times R2}{2} = \frac{79 \times 0.42}{2} = 6.32$ (kg•m²)

b) Jig and workpiece $J2 = N \times Wj \times Re2 = 4 \times 10 \times 0.3252 = 4.225$ (kg•m²)

c) Total sum of moment of inertia $J = J1+J2 = 6.32+4.225 = 10.545$ (kg•m²)

STEP 2
Max. rotation speed

$N\text{•max.} = \frac{Vm/\psi}{6 \cdot t_1} = 1.76 \times \frac{90}{6 \times 0.8} = 33$ (rpm)

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

STEP 3
Load torque

Calculate the smallest model that can tolerate the load moment of inertia.

The AX allowable moment of inertia is 18.0 (kg•m²) or over, so this load is allowable.

Max load torque

$$Tm = [Am \cdot (J+J_M) \cdot \frac{\psi \cdot \pi}{180 \cdot t_{12}} + T_F + T_W] \cdot fc + T_{MF}$$

$$= [5.53 \times (10.545+0.326) \times \frac{90 \times \pi}{180 \times 0.82} + 0 + 0] \times 1.5 + 10$$

$$= 231.3 \text{ (N•m)}$$

Effective load torque

$$Trms = \sqrt{\frac{t_1}{t_0} \cdot [r \cdot Am \cdot (J+J_M) \cdot \frac{\psi \cdot \pi}{180 \cdot t_{12}} \cdot fc]^2 + (T_F \cdot fc + T_W \cdot fc + T_{MF})^2}$$

$$Trms = \sqrt{\frac{0.8}{4} \times [0.707 \times 5.53 \times 10.871 \times \frac{90 \times \pi}{180 \times 0.82} \times 1.5]^2 + (0 \times 1.5 + 0 \times 1.5 + 10)^2}$$

$$= 70.7 \text{ (N•m)}$$

STEP 4
Regenerative electric power

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

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

$W \geqq 40$ (W)

STEP 5
Selection guide

Determine if the selected AX4300T can be used.

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

Thus, AX4300T can be used.

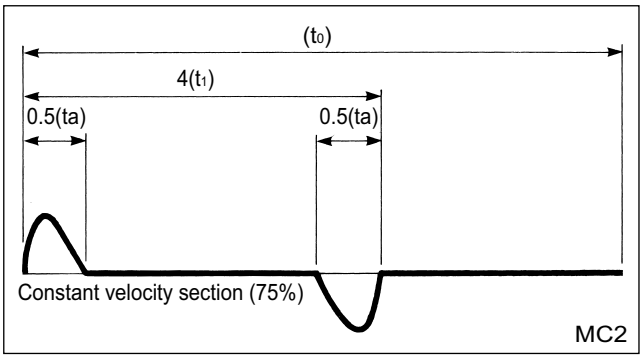
For "MC2 curve " selection guide

What is 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: Accelleration/decelleration time is set to one-half or less of movement time. If accelleration/decelleration time setting exceeds one-half of movement time, the cam curve is automatically changed to an MS (modified sine wave) curve.

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



Selection guide

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

Moving angle	: ψ(°)
Cycle time	: t_0(s)
Moving time	: t_1(s)
Acceleration or deceleration time	: ta(s)
Load moment of inertia	: J(kg•m²)
Output shaft moment of inertia	: J_M(kg•m²)
Friction torque	: Tf (N•m)
Working torque	: T_W(N•m)
Output shaft friction torque	: T_{MF}(N•m)

Max. rotation speed: N•max. (rpm)

$$N\bullet max. = \frac{\psi}{6\,(t_1 - 0.863ta)}$$

Load torque (max.): T_m (N•m)

$$Tm = \left[5.53\,(J + JM)/ \frac{\psi\bullet\left(1 - \frac{t_1 - 2ta}{t_1 - 0.863ta}\right)\bullet\pi}{720,\ ta2} + Tf + TW \right] \bullet fc + TMF$$

Load torque (effective): Trms (N•m)

$$Trms = \sqrt{\frac{2ta}{t_0}\bullet\left[3.91\,(J + JM)/ \frac{\psi\bullet\left(1 - \frac{t_1 - 2ta}{t_1 - 0.863ta}\right)\bullet\pi}{720,\ ta2}\bullet fc\right]^2 + (\,(Tf + Tw)/fc + TMF)^2}$$

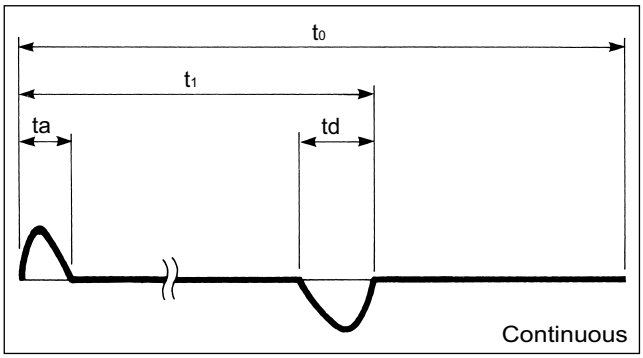
When " continuous rotation " is selected

Continuous rotation.

Continuous rotation has with or less.

1. Continuous rotation	: Continuously rotates at a set speed until the continuous rotation stop signal is input.
2. Equal index position stop	: If used with equal division designation, stops at an equal division when the continuous rotation stop signal is input.
3. Timing output	: If used with equal division designation, the timing output pulse is output at the equal division during rotation.

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



Selection guide

For continuous rotation, select the model with the following formula.

Rotation speed	: N(rpm)
Cycle time	: t_0(s)
Acceleration hour	: ta(s)
Deceleration hour	: td(s)
Load moment of inertia	: J(kg•m²)
Output shaft moment of inertia	: J_M(kg•m²)
Friction torque	: Tf (N•m)
Working torque	: Tw (N•m)
Output shaft friction torque	: T_{MF}(N•m)

Max. rotation speed :Nmax(rpm) (Note 1)

N•max. = N

Load torque (max.): Tm (N•m)

$$Tm = \left[5.53\,(J + J_M)/ \frac{6.82N/ta/\pi}{720,\ ta2} + Tf + Tw \right] \bullet fc + T_{MF}$$

Load torque (effective): Trms (N•m)

$$Trms = \sqrt{\frac{2ta}{t_0}\bullet\left[3.91\,(J + J_M)/ \frac{6.82N/ta/\pi}{720,\ ta2}\bullet fc\right]^2 + (\,(Tf + Tw)/fc + T_{MF})^2}$$

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

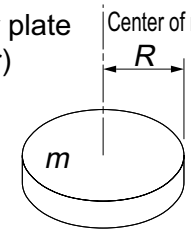
Note 1) The maximum rotation speed will be limited during continuous rotation. Use accordingly to actuator specifications.

Formula of moment of inertia

〔 m: Weight of object (kg)〕

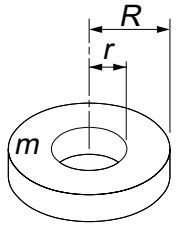
● A When rotation center is own shaft

1. Circular plate (cylinder)



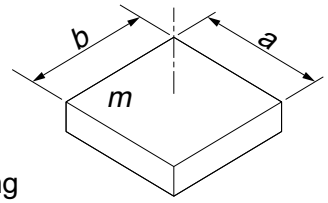
$$I = \frac{mR^2}{2}$$

2. Hollow circular plate (hollow cylinder)



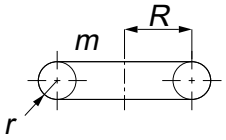
$$I = \frac{m(R^2 + r^2)}{2}$$

3. Direct hexagonal side finish body



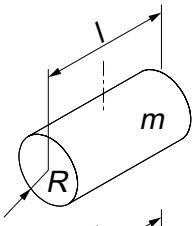
$$I = \frac{m(a^2 + b^2)}{12}$$

4. Ring



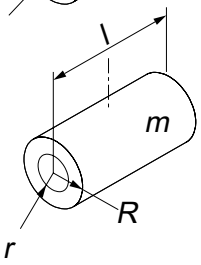
$$I = \frac{m(4R^2 + 3r^2)}{4}$$

5. Cylinder



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

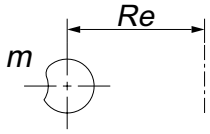
6. Hollow cylinder



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

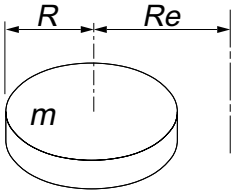
● B When rotation center differs from own shaft

1. Shape of any (if small very well)



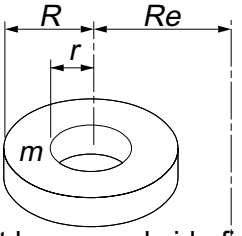
$$I = mRe^2$$

2. Circular plate (cylinder)



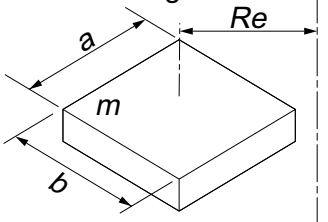
$$I = m\left(\frac{R^2}{2} + Re^2\right)$$

3. Hollow circular plate (Hollow cylinder)



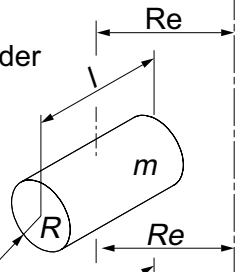
$$I = m\left(\frac{R^2 + r^2}{2} + Re^2\right)$$

4. Direct hexagonal side finish body



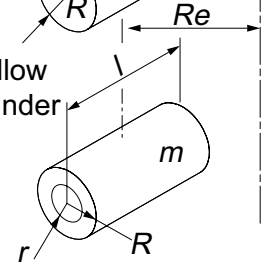
$$I = m\left(\frac{a^2 + b^2}{12} + Re^2\right)$$

5. Cylinder



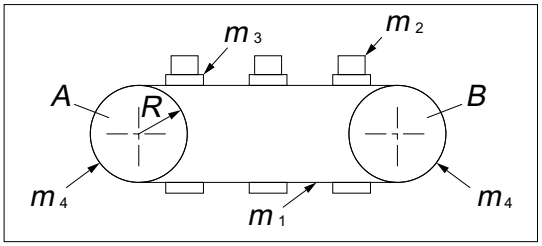
$$I = m\left(\frac{3R^2 + l^2}{12} + Re^2\right)$$

6. Hollow cylinder



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

● For conveyer



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

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

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

■ Operating conditions

1. Index 2. oscillator			
Movement angle	Ψ (°)		or no. of indexes
Moving 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 0.05 and 0.2s.

■ Load conditions

Table

Material	1. steel 2. aluminum	
Appearance	Dt (mm)	
Plate thickness	ht (mm)	
Weight	m1 (kg)	

Workpiece

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

Pallet fixture

Quantity	np (pc.)	
Max. weight	mp (kg/pc.)	

Others

Installation attitude
1. Horizontal (fig.2) 2. vertical (fig.3)

External job
1. NO / 2. YES
(note) Eccentric load caused by gravity from vertical installation, external load caused by caulking work.

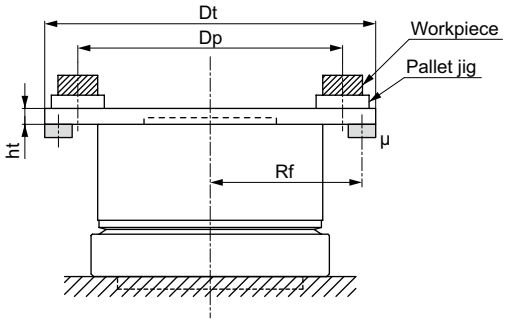
Dial plate support form bottom
1. NO / 2. YES
Coefficient of friction μ
Work radius Rf (mm)

Device rigidity
1. High 2. Low (note)
(note) When using a spline, when unit cannot be fixed directly onto the device (Fig.4), when there is a mechanism such as a chuck on the table.

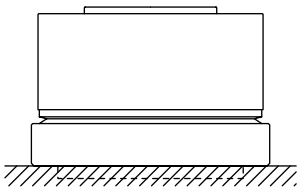
Extension with table shaft
1. NO / 2. YES (fig.5)

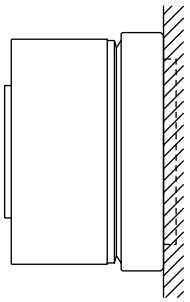
Actuator movement
1. NO / 2. YES
(note) When actuator is mounted on X-Y table or vertical mechanism, etc., and mounted actuator moves.

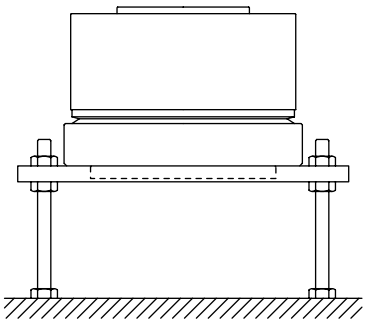
(note) If 2 is selected for any item, contact CKD

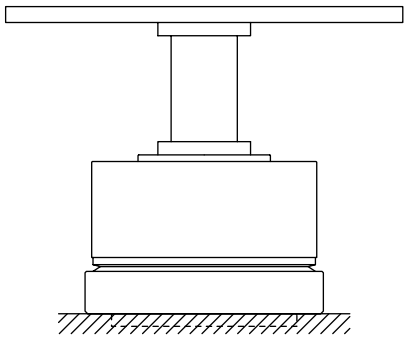


(Fig.1) load conditions


(Fig.2) installation attitude: Horizontal


(Fig.3) installation attitude: Vertical


(Fig.4) installation rigidity: Low


Extension caused by (fig.5) shaft

(note) The system overview and reference drawing should be attached for optimal model selection.

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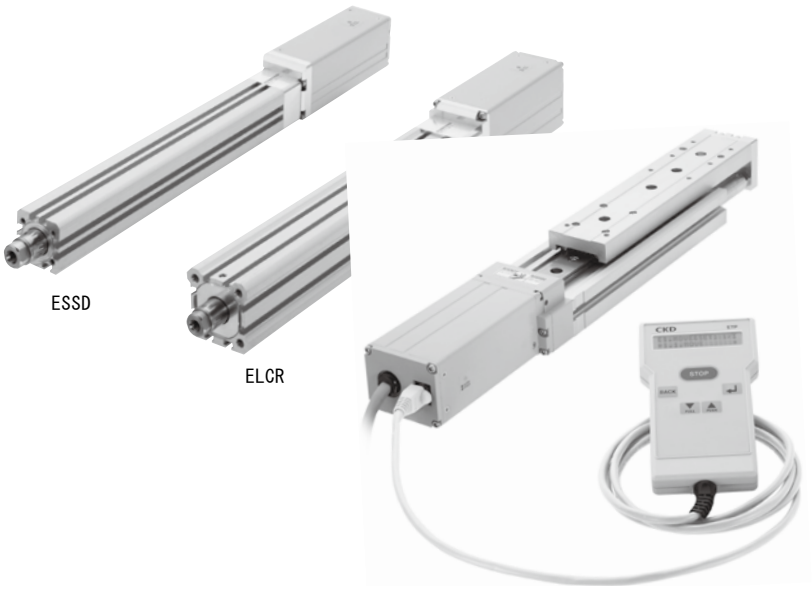

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