

DIRECT DRIVE ACTUATORS

ABSODEX



CKD Corporation

CB-32A 2

Eco-friendly, intelligent index units compatible with different networks.

High precision/high performance

Combining 360° flexible index, intermittent revolution and continuous rotation, high precision absolute DD actuator is available now.

High Flexibility & Intelligence

Eco-friendly function

Energy and space savings, oil free and reuse, etc., environmentally friendly production equipment can be built.

Network function

One-touch connecting serial transmission slave station allows easy connection to different networks.

A B S O D E X



High precision/ high performance

Return to origin not required

An absolute resolver that recognizes the current position is used without returning to origin.

Easy operation

Index time can be set directly per 0.01 second increment.

Compact/high torque

No torque down even in high speed range.
(Excluding some models)

High precision positioning

Maintaining high resolution; 540672 pulses per rotation, high precision index is enabled.
(Repeatability of index: $\pm 5''$).

Easy installation and centering

Socket and spigot for mounting and thread hole are installed on rotational and fixed sections. Integrated wiring is achieved by hollow shaft.

Smooth cam curve drive

Cam curve of modified sine (MS), modified trapezoidal (MT), deformation constant velocity (MC, MC2) and trochoid (TR) can be selected for different applications.

Dust proof structure

Sealing applied on rotational section of actuator (excluding some models)
(AX8000 series is IP65 conformed.)



ABSODEX System configuration



Eco-friendly function

Energy saving

Electric power is consumed during index, while no power is consumed during dwell time.

Change and waste of lubricant is not required.

Troublesome lubricant change and waste of oil are not required.
No pollution by oil leakage.

To reduce equipment size by space saving body.

Origin detection sensor, reducer and motor, etc., are not required.

Easy change of specifications and reuse is possible.

Specifications can be changed by dialog terminal or PC, etc., also, reuse is possible, while difficult for mechanical index.



Network function

Open network compatible

Compatible with 2 types of open network; CC-Link and DeviceNet

Reducing wiring cost

Drastic reduced wiring enables reduction of wiring man-hours.



Compatibility

AX2000G· AX4000G series

Driver, actuator and cable are compatible. Flexible combination achieves easy maintenance and control.

Features

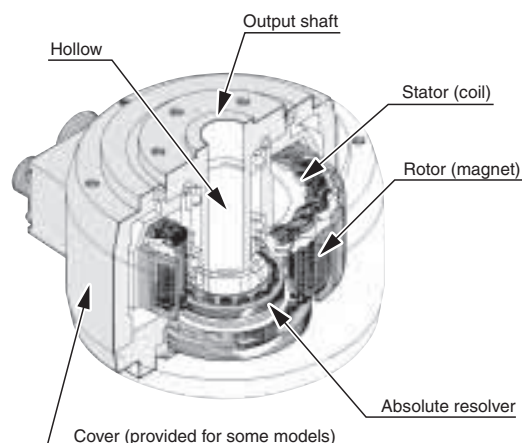
● Return to origin not required

Integrating an absolute resolver that recognizes the current position when power turned on in the direct drive actuator, troublesome origin search operation is not required. Also, restart can be done from the current position after emergency stop.

Direct drive actuator resolver consists of 2 sets. One uses R/D conversion to split the sine waveform detected every 2.7° ($360^\circ/132$) rotation angle into 4096. The other splits 360° into 4096 to detect the absolute position on 360° .

No sensor for searching for the origin need to be used as with incremental method.

The position information is recognized when power supply turned on, so back up memory is not required. This system has the reliable detection mechanism.



● High precision

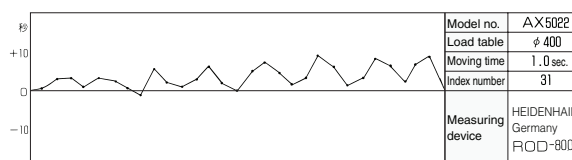
High resolution; 540672 pulses per rotation

Index accuracy: $\pm 15''$ (second), while $\pm 30''$ (second) for AX3000 and AX4000 series.

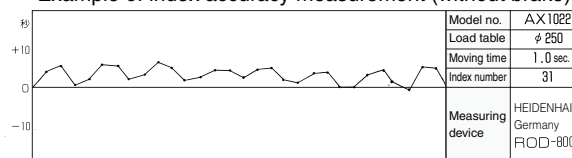
Repeat positioning accuracy: $\pm 5''$ (second) *

*1'' (second) = $1^\circ/3600$

Example of index accuracy measurement (with brake)



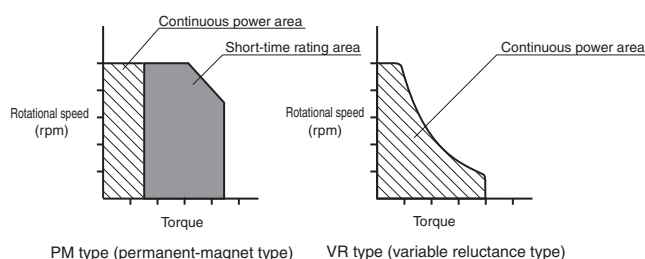
Example of index accuracy measurement (without brake)



● High torque

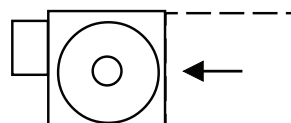
Using PM type motor appropriate for indexing, this DD motor has excellent torque characteristics without torque-down even in high speed range.

Torque-rotational speed characteristics
(If motor volume is equivalent.)



● Space saving

Compact and space saving direct drive actuator compared to circular table with [motor + reducer]



Features

● Smooth cam curve drive realized

5 types * of cam curve are provided as standard. Shock is suppressed to the minimum when moving or stopped.

* modified sine (MS), modified trapezoidal (MT), deformation constant velocity (MC and MC2) and tropecid (TR)
Four cam curves with the operating features below can be selected with parameters. This enables smooth transfer positioning not possible with simple acceleration/deceleration time setting control.

● Easy design

Providing socket and spigot on fixing side of the body and table, easy centering is achieved.

● Easy connection

Integration of driver and controller reduces man-hour of connection.

● Flexible programming

NC language enables positioning on the required point. Also, NC programs, up to 256 programs, can be stored in the driver.

● Great variety of external interfaces

Program input, parameter setting and reading of inner state, etc., are allowed by RS-232C serial communication.

Also, M code, etc., great variety of external interfaces, are available to connect to the PLC.

Using serial transmission slave stations, 2 types of open network; CC-Link and Device-Net are also available.

● Easy programming

An equal index program is created by interactively inputting the number of divisions and movement time, etc., with this dialog terminal (optional). This enables quick startup after the system is installed.

Complex operations are set by creating programs in NC language.

Driver program storage capacity is approximate 6000 characters maximum (256 programs). The use of Windows' communication software [Teaching note] allows a user to create and save programs with PC.

● CE marking

CE marking products (option) conformed to the Low Voltage Directive and EMC Directive are available. Refer to the instruction manual for installation, etc., to conforming to standards.

Refer to "CKD European standards conforming products guide" for details of applicable models and conformity standards.

Low Voltage Directive

EN60034-1, EN60034-5, EN50178

EMC Directive

EN55011, EN61800-3, EN-61000-3-2, EN61000-3-3

Certificating body

TÜV Rheinland



● Optional dowel hole to positioning is available.

● Optional movable cable is available for cable bending applications.

Characteristics and measuring examples of cam curve

Name	Acceleration	Vm	Am	Jm	Measuring example
MODIFIED SINE (MS)		1.76	± 5.53	$+ 69.5$ $- 23.2$	
MODIFIED TRAPEZOID (MT)		2.00	± 4.89	± 61.4	
MODIFIED CONSTANT VELOCITY (MC)		1.28	± 8.01	$+201.4$ $- 67.1$	
TRAPECLOID (TR)		2.18	± 6.17	± 77.5	

Working conditions of above example

Model no. AX1045

Operating conditions Index angle 90°

Index time 0.5 sec.

Load moment of inertia $1.67 \times 10^{-2} \text{ kg} \cdot \text{m}^2$

● Large diameter hollow (AX4000 and AX4000G series)

This large hollow diameter specifications allow easy piping and wiring on dial plate. If a ball spline is installed, the product can be used for θ axis of a P & P unit for small parts conveyance.

(Consult with CKD for ball spline installation)

● Non-backrush model with negative actuation electromagnetic brake (option) is also available. (AX4000 and AX4000G series).

● Brake integrated type (AX5000 and AX8000 series)

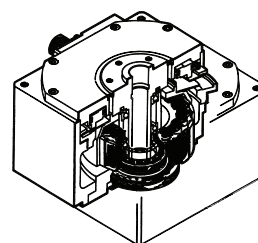
Integrated a pneumatic brake, the output shaft is clamped when stopped to increase holding rigidity.

• Available for works that torque is applied to the table

• Fine rotary vibration of table by servo is suppressed.

• Holding torque more than the maximum output torque of actuator is provided.

(At 0.5MPa)



● High grade dust proof/waterproof (AX8000 series)

IEC60529 standards IP65* conforming

TÜV Rheinland certifications

Higher grade water proof is achieved by air purge.




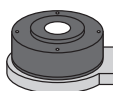
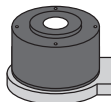
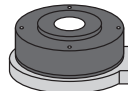

*When performing an air purge, supply a dry clean compressed air with low pressure (0.05MPa).

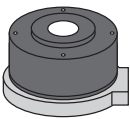
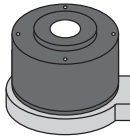
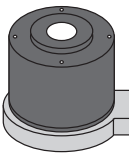



CKD

Intro 4

Direct drive motor compatible type series variation

Series		Torque (N·m)					
		6	12	18	22	45	75
Actuator	AX2000G series	 AX2006G	 AX2012G	 AX2018G			
	AX4000G series				 AX4022G	 AX4045G	 AX4075G
Available driver	GS type driver						
	GH type driver	Not available					

Torque (N·m)			Index accuracy (sec.)	Repeat accuracy (sec.)	Features	Applications	Page
150	300	500					
			±30	±5	<ul style="list-style-type: none"> • High speed revolution (300rpm) • Compact with small diameter • Large hollow diameter (ø30) 	<ul style="list-style-type: none"> • P & P • Turntable • Assembly machine 	1 to 6
 AX4150G	 AX4300G	 AX4500G	±30	±5	<ul style="list-style-type: none"> • High speed revolution (AX4022GS, AX4045GS: 240rpm and AX4075GS: 140rpm) • For large moment of inertia load (AX4150GH, AX4300GH and AX4500GH) • Large hollow diameter and great variety of size options 	<ul style="list-style-type: none"> • Turntable • Inspection machine • Assembly machine • P & P 	7 to 18
Not available			A single type of driver can handle all size of actuators. Equipped a controller function, a NC program can handle turning angle, moving time and timer, etc., of an actuator flexibly. Also, using M code output, communication to the external PLC is possible.				
							GS type 57 58 61 GH type 59 to 61

AX2000G

AX4000G

AX1000

AX2000

AX4000

AX5000

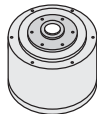

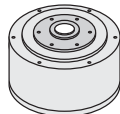


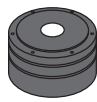
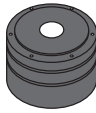

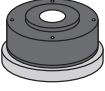
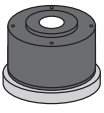
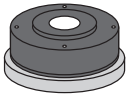
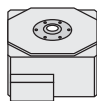
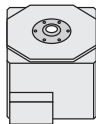
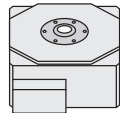
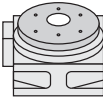
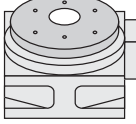

AX8000

Driver

Option

Serial transmission
slave station

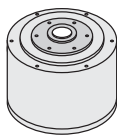

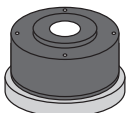
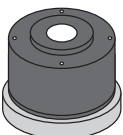
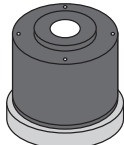
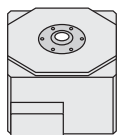
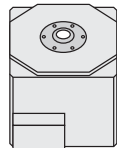

Direct drive actuator series variation

Series		Torque (N·m)					
		6	9	12	22(21)	45(42)	75(70)
Actuator	AX1000 series				 AX1022	 AX1045	 AX1075
	AX2000 series	 AX2006		 AX2012	 AX2021	 AX2042	
	AX4000 series		 AX4009		 AX4022	 AX4045	 AX4075
	AX5000 series				 AX5022	 AX5045	 AX5075
	AX8000 series					 AX8045	 AX8070
Available driver	S type driver						
	H type driver	Small and high performance S type driver is recommended.					

CE marking conformable products: Refer to [CKD European standards conforming products guide (catalog no.CC-543)].

- AX1000, AX2000, AX4000 and AX5000 series
- S and H type drivers

Examples of applications	... Intro 10
⚠ Precautions	... Intro 13
Related parts model no. table	... Page 71
Selection guide	... Page 73

Torque (N·m)				Index accuracy (sec.)	Repeat accuracy (sec.)	Features	Applications	Page
150	210	300	500					
 AX1150	 AX1210			±15	±5	High precision specifications; index accuracy and run out of output shaft, etc.	<ul style="list-style-type: none">• Precision measuring• Turntable• Inspection machine• Assembly machine	19 to 24
				±15	±5	<ul style="list-style-type: none">• Compact with small diameter (AX2006 and AX2012)• Easy cable wiring and piping due to hollow fixed shaft (AX2021 and AX2042)	<ul style="list-style-type: none">• Turntable• P & P• Assembly machine	25 to 30
 AX4150		 AX4300	 AX4500	±30	±5	<ul style="list-style-type: none">• Large hollow diameter and great variety of size options• Maximum output torque 9 to 500 N·m 7 models are available.	<ul style="list-style-type: none">• Turntable• Inspection machine• Assembly machine• P & P	31 to 40
 AX5150	 AX5210			±15	±5	<ul style="list-style-type: none">• A pneumatic brake is integrated to clamp an output shaft when stopped.• Appropriate for a work that load applied after stop.	<ul style="list-style-type: none">• Precision measuring• Turntable• Inspection machine• Assembly machine (pressfit)	41 to 47
				±15	±5	<ul style="list-style-type: none">• IP65 conformity (IEC standards)• Appropriate for rotary positioning equipment in machining or cleaning process, or in the environment containing a lot of powder dust	<ul style="list-style-type: none">• Machining and grinding such as light cutting, etc.• Turntable Note. Refer to Page 53 for precautions.	49 to 53
Not available				Equipped a controller function in a driver, a NC program allows turning angle and moving time timer, etc., of an actuator to be set flexibly. Also, communication to external PLC is allowed using M code output.				S type 57 58 61 H type 59 to 61
								

AX2000G
AX4000G
AX1000
AX2000
AX4000
AX5000
AX8000
Driver
Option
Serial transmission slave station

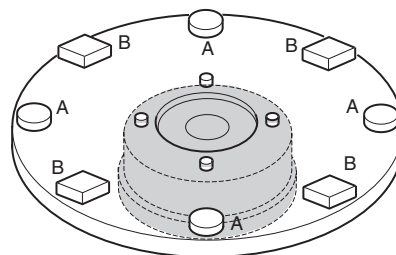
Applications

E.g. 1. index unit for rotary table type automatic machine

- Creating programs of process A and B, and switching these programs, two different workpieces can be processed by a single piece of equipment.

[Merit of direct drive actuator]

- Used an absolute resolver, no origin detection sensor is required.
- Equal index programs are easily inputted by a dialog terminal.
- Index number (or angle) and moving time (or maximum rotational speed), etc. are merely inputted to program.



E.g. 2. θ axis of P & P unit

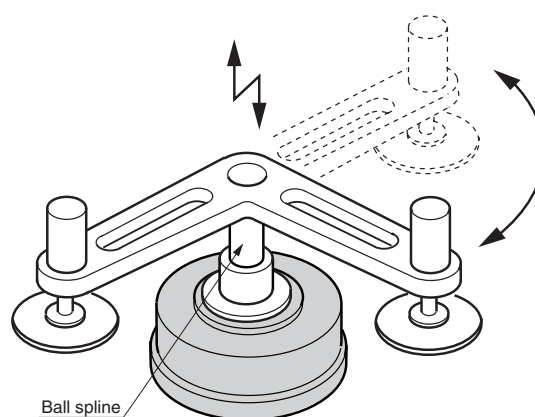
- Putting a ball spline through hollow, the unit can be used as an intelligent P & P unit.

[Merit of ABODE]

- Used an absolute resolver, the actuator will not return to the origin even when power turned on, so can move directly in the either position.

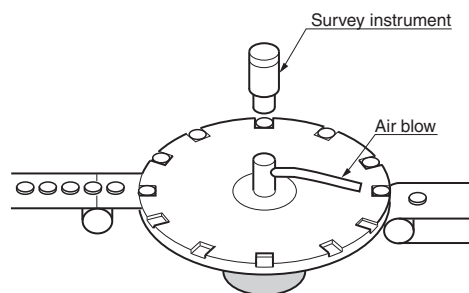
*When installing the product in mechanism or equipment, care must be taken.

(Refer to Intro 12 for cautions [Design & selection] (6).)



E.g. 3. small parts inspection equipment

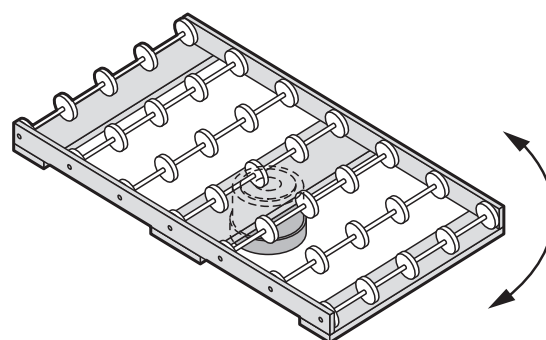
- It is appropriate for equipment that picks up a workpiece with air blow using hollow.



E.g. 4. rotation and conveyance of large panel

- It is appropriate for transferring and rotating large panels.

Note. Even if the limit of allowable load moment of inertia is reached, the product may be used depended with adjustment of parameters, etc. Consult with CKD for details.

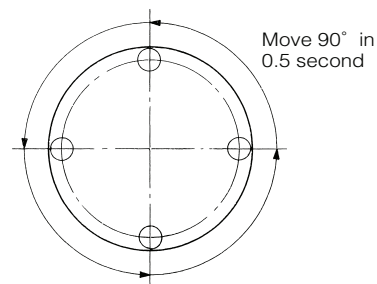


CKD Intro 10

Operation specifications 1 (operation of index unit)

Operation specifications

- 4 Index (90° equal index)
- Moving time 0.5 sec.
- Shift 1 index counterclockwise every start input from PLC.



Example of program

Main program

O1;	Use program number [1].
G11;	Set time (sec.) for unit of F of NC code.
G10 1A4;	Divid one rotation into 4 sides.
G91.1;	Set incremental dimension.
A0 F0.5;	Move to the nearest index station in 0.5 second.
N1M0;	Wait start signal input from PLC.
A-1F0.5;	Move an index in 0.5 second.
J1;	Jump to the block of sequence number 1.
M30;	Program end

(Note) When using dialog terminal or teaching note, no descriptions are required since O1 is automatically set by inputting program number 1.

Example of PLC actuating signal

Initial process: process executed once at first

Process name	I/O signal name	PLC output	PLC input	Remarks
① Program number selection	· Number selection 0 bit · Number selection 1 bit · Number selection 2 bits · Number selection 3 bits · Number setting the first digit			Selecting program number 1. (Select the program to run. In this example, no. 1 is used.)
② Return process	· Start signal · Positioning complete signal · Start input waiting output			Return process complete by positioning complete signal

Index process: process executed per index.

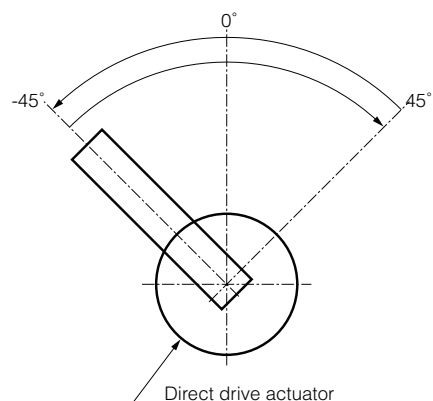
Process name	I/O signal name	PLC output	PLC input	Remarks
③ Index treatment	· Start signal · Positioning complete signal · Start input waiting output			Index complete by positioning complete signal

(Note) Program number selection and start signals must be inputted when start input waiting output turned on.

Operation specifications 2 (operation of oscillator unit)

Operation specifications

- Move $-45^{\circ} \Leftrightarrow 45^{\circ}$ repeatedly every start input from PLC.
- Moving time 0.7 sec.
- Brake is activated when stopped. (Note 1)
- Emergency stop input is to be effective. (Note 2)



Example of program

Main program

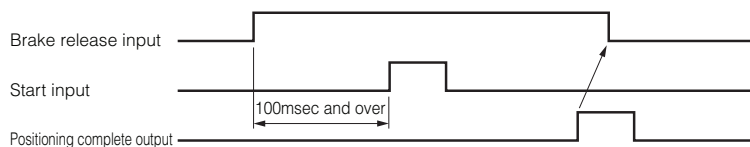
<code>Ö2;</code>	Use a program number [2].
<code>G105;</code>	Set an angle(°) for unit of A of NC code.
<code>G11;</code>	Set a time (sec.) for unit of F of NC code.
<code>G90;</code>	Absolute dimension
<code>N1M69;</code>	Brake release
<code>A45F0.7;</code>	Move until 45° position in 0.7 second
<code>M68;</code>	Brake operation
<code>M0;</code>	Waiting start input from PLC
<code>M69;</code>	Brake release
<code>A-45F0.7;</code>	Move until -45° position in 0.7 second
<code>M68;</code>	Brake operation
<code>M0;</code>	Wait start input from PLC.
<code>J1;</code>	Jump to block of sequence number 1
<code>M30;</code>	Program end

Note 1: Use a direct drive actuator with brake.

If optional electromagnetic brake is used, refer to [control method of Electromagnetic brake].

Note 2: If emergency stop is inputted during brake operation, the brake is activated after reset.

When the start signal is inputted continuously without re-selecting a program number, release the brake by brake release input after reset, then input the first start signal.





Safety precautions

When designing and manufacturing equipment using a direct drive actuator, the manufacturer is obligated to check that the safety of mechanism, and entire systems including electric controls are secured.

It is important to select, use, handle or maintain the product appropriately to ensure that CKD products be used safely.

To ensure the safety of equipment, always observe warnings and cautions.



Danger

- 1** High voltage is applied to the gland on driver front panel. Do not touch the gland during energized. Do not touch the gland approximately for 5 minutes immediately after power supply turned off, since high voltage is applied, while the charge stored in inner capacitor is discharged.
- 2** When removing a frame side cover for maintenance and inspection, and switch replacement in driver, etc., always turn power off since a risk of electric shock with high voltage could be created.
- 3** Do not install and remove a connector, etc. while power turned on, or malfunction, failure or electric shock may be caused.



Warning

- 1** Use the product within the specification range.
 - 1** If of uses out of specifications or special applications, consult with CKD for the availability.
 - 2** The use out of specification range may prevent the product from attaining its functions, and the safety is not secured.
 - 3** The use will be limited in special applications or in special environment. Secure the safety for entire equipment.
- 2** Each handling explanation and cautions of the product must be observed to prevent accidents.
 - 1** Do not rotate an actuator output shaft more than 30 rpm when power turned off.
The electricity generated by actuator may result in driver fault or create a hazard of electric shock.
 - 2** If servo-off (including emergency stop and alarm) and brake off are done with torque applied by gravity, etc., the output shaft will rotate by torque.
These operations must be done with balanced without torque, or after safety is checked.
 - 3** Sufficient care must be taken not to put a hand on the output shaft since an uncontrolled motion could occur during gain adjustment stage and trial runs. Also, when operating the actuator from the position where the actuator can not be seen, check that the safety is secured, even if the output shaft is rotated, before operation.
 - 4** The brake of actuator does not always hold the position of output shaft thoroughly.
When doing maintenance, while unbalanced load is applied and output shaft could rotate, it is not safe if the position is held by the brake only. Please keep the load with balanced, or provide a mechanical interlock.
- 3** The product is designed and manufactured as a part for general industrial machines.
Therefore, the person that has sufficient knowledge and experience must handle the product.
- 4** For the safety on equipment design, corporate standards and regulation, etc., must be observed.
- 5** Do not remove components before confirming safety.
- 6** When restarting machine and equipment, check if countermeasures are taken not to remove installations, then perform the work.

■ Safety cautions are ranked as [DANGER], [WARNING] and [CAUTION] in this section.



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



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



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

Note that some items described as [CAUTION] may lead to serious results depending on the situation. In any case, the important description that must be observed is listed.



Caution

When exporting

[Direct drive actuator] is subject to [foreign exchange and trade control laws]. Therefore, when exporting direct drive actuators from Japan, an approval of Japanese government is required.



Caution

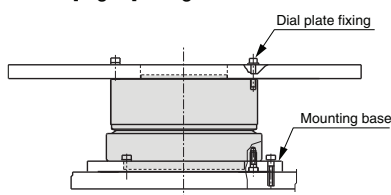
Design & selection

- 1 Actuators (excluding AX8000 series) and drivers are not water proof. When using these products in the environment where water and oil will contact to the products, take countermeasures of water proof.
- 2 Adhesions of swarf and dust, etc., on the actuator and driver may result in possible leakage of electricity and failures. Please avoid these adhesions.
- 3 The cable attached as standard can not be used with repeatedly bent. Select an optional movable cable.
- 4 If the cable length is longer than standard (4m), insert a noise filter on the motor cable. Connect the IN side of noise filter on the driver side, then install the filter near the driver as close as possible.

	Model no.	Maker	
AX * 75 or less	LF-310KA	NEC TOKIN (stock)	3-10A
AX * 150 and over	LF-320KA	NEC TOKIN (stock)	3-20A

- 5 If power and servo are turned OFF with servo turned ON (holding state), unless applying external force, the output shaft may move from the holding position.
- 6 An optional electromagnetic brake is usually used to increase holding rigidity when the output shaft stopped. Do not use the brake to stop the rotating output shaft.
- 7 The machine and equipment in which direct drive actuator is installed should be rigid enough to realize maximum direct drive actuator performance. If load equipment or the frame's mechanical vibration is relatively low (200 to 300 Hz or less), resonance could occur in the direct drive actuator and load equipment or frame. Fix rotary table and main unit mounting bolts to ensure sufficient rigidity without loosening [Fig. 1].

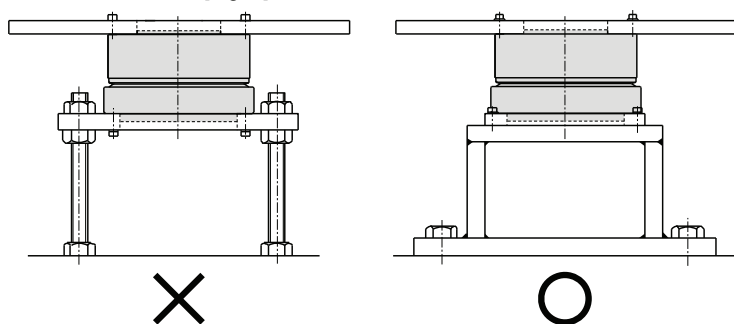
[Fig. 1] fixing of actuator



Also, gain adjustment is required depended with magnitude of load table.

Even if a direct drive actuator can not be installed on the machine directly, install the actuator on a frame with sufficient rigidity. [Fig. 2].

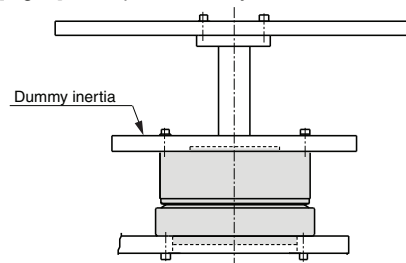
[Fig. 2] installation of actuator



- 8 If rigidity of machinery and equipment is not satisfactory, install a dummy inertia at the closest place to the actuator to reduce resonance of machinery and equipment.

- If of output shaft extension, as reference, the diameter of extended shaft is
 $\phi 60\text{mm}$ and over if of AX * 006, AX * 009, AX * 012, AX * 018, AX * 022 and AX * 045, $\phi 90\text{mm}$ and over if of AX * 075, AX * 150, AX * 210 and AX * 300, while $\phi 150\text{mm}$ and over if of AX * 500.
- As reference, the size of dummy inertia is [load inertia] X (0.2 to 1). [Fig. 3].

[Fig. 3] Example 1, dummy inertia installation

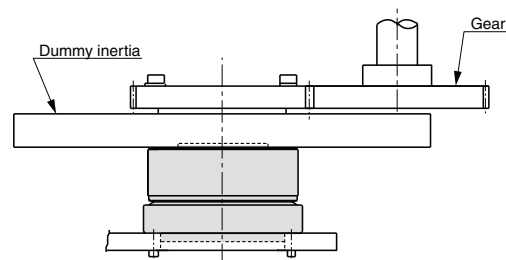


- Dummy inertia = [load inertia] X (0.5 to 2), if of connection by gears and spline, or by key.
- If speed changes with belts or gears, use load inertia with actuator output shaft converted, and install a dummy inertia on the actuator.

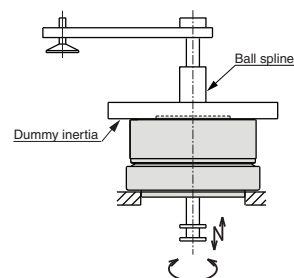
[Fig. 4] [Fig. 5]

(Caution) Install a dummy inertia as large as possible according to performance of the actuator.

[Fig. 4] Example 2, dummy inertia installation



[Fig. 5] Example 3, dummy inertia installation





Labor saving mechanisms warnings and cautions to secure safety

Always read this section before starting use.

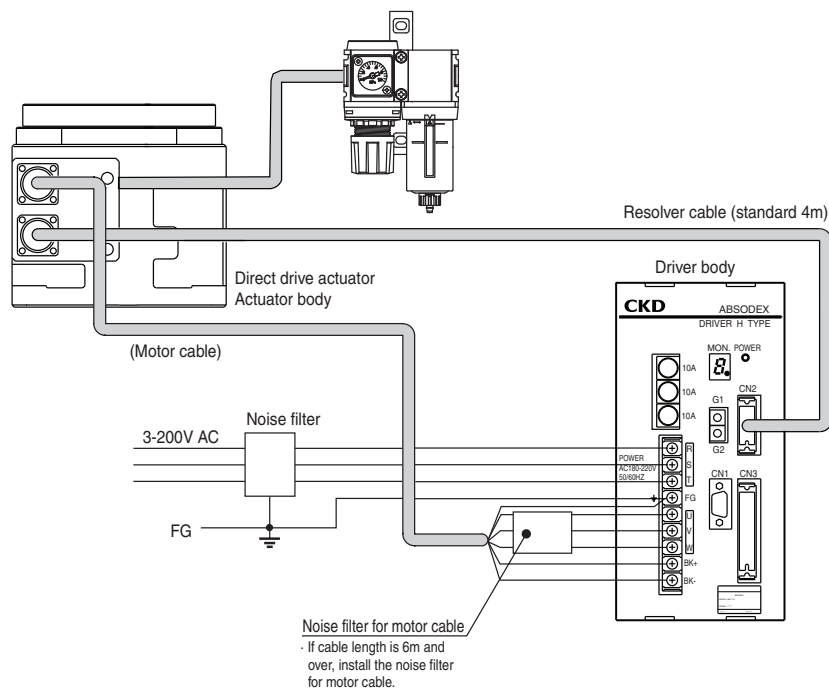


Caution

Design & selection

9 Brake connection method

- Pneumatic brake



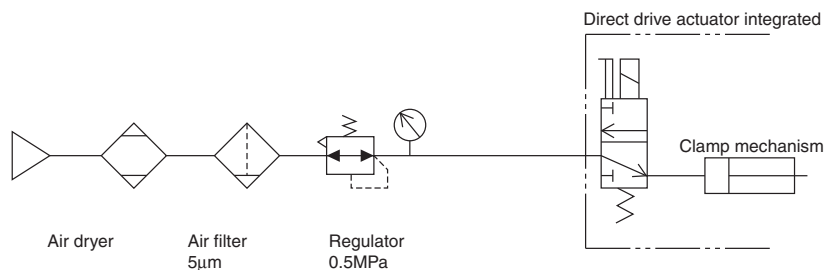
1) A valve for pneumatic brake is integrated in the direct drive actuator body.

Supply 24VDC to the external power input (1, 2 - 3, 4 pin) of I/O connector (CN3) as power supply for the valve.

2) Supply clean compressed air of 0.5MPa to the joint for brake. Do not lubricate with a lubricator, etc.

3) The integrated brake merely increases the holding rigidity when the output shaft is stopped. Do not brake the output shaft, while the shaft is rotating.

Recommended air circuit for pneumatic brake

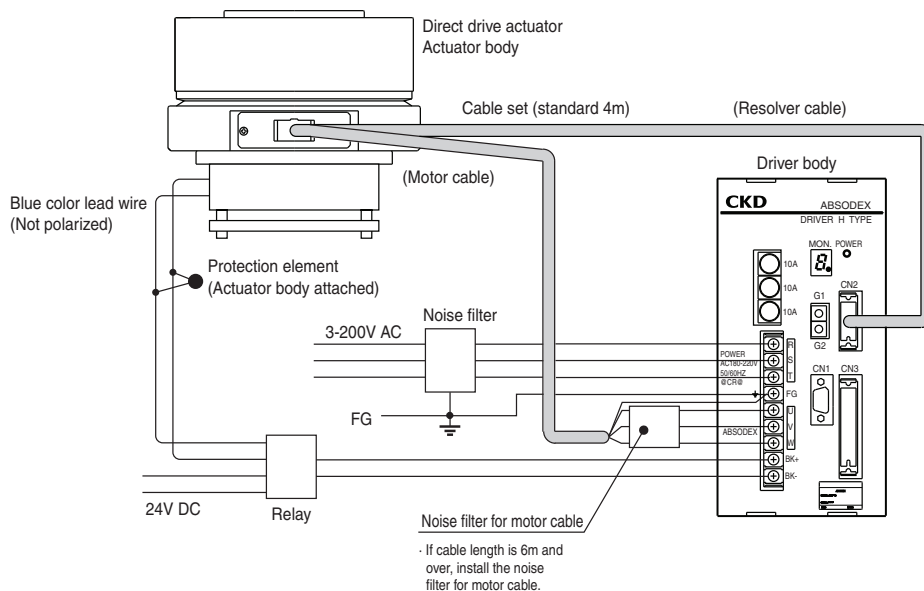




Caution

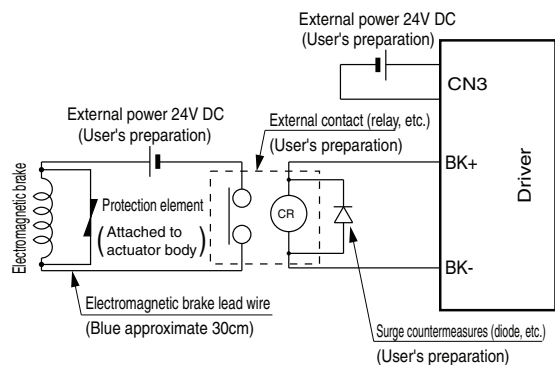
Design & selection

● Electromagnetic brake



- 1) Do not use the electromagnetic brake to brake or stop the output shaft, while the shaft is rotating.
- 2) If BK+ and BK- of the driver, and electromagnetic brakes are directly connected, the driver may be damaged.
- 3) When connecting the inductive load such as the following relay, etc., to the external contact, use a coil with rated voltage 24VDC and rated current 100mA or less, and take countermeasures for surge.
- 4) When using an electromagnetic brake, supply 24VDC to the external power input (1, 2 - 3, 4 pin) of I/O connector (CN3).

Recommended circuit for electromagnetic brake

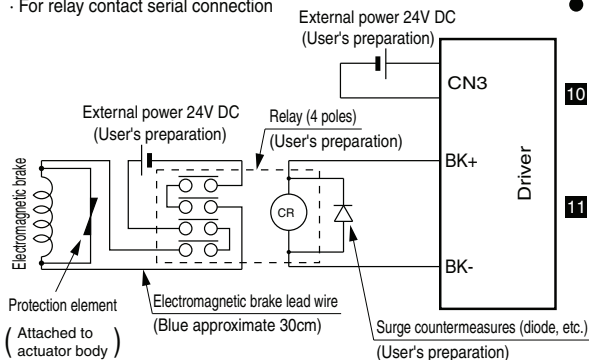


● Operation method

1. Control by NC program (M68/M69)
When running "M68" code, it is de-energized (brake operation) between BK+ and BK-, or when running "M69" code, it is energized (brake release) between BK+ and BK-.
2. Control by brake release input (I/O connector, 18 pin)
When inputting brake release with brake applied, it is energized (brake release) between BK+ and BK-.

- If an electromagnetic brake applies frequently (ON-OFF cycle), use a solid state relay (SSR) for an external contact.
Recommended model G3NA-D210B DC5-24 (OMRON)
Read the instruction manual of SSR carefully before starting use.

· For relay contact serial connection



- Use a relay whose contact capacity is 10-fold larger than rated current. Otherwise, use multi-pole relays connecting in serial. The life of relay will be longer.

- 10 When using a product with electromagnetic brake while putting the shaft through the hollow, use non magnetic materials (SUS303, etc.)
The use of a magnetic material (S45C, etc.) allows the shaft to be magnetized, this may affect peripheral devices adversely, or iron powder may be attracted onto the device.
- 11 Care must be taken since the magnetized part near electromagnetic brake may attract iron powder, etc., and affect instruments, sensors and other components adversely.



Labor saving mechanisms warnings and cautions to secure safety

Always read this section before starting use.



Caution

Installation & adjustment

- 1 Use an actuator and a driver having the same serial number combination. After opening the package, confirm that actuator, driver, and cable serial numbers are the same. When using several direct drive actuator units together, check that unlike units are not combined. Combining unlike actuator and driver may cause incorrect operation and faults.
- 2 Connect the actuator and driver only with the enclosed cable. Check that excessive force is not applied and that the cable is not damaged. Do not change the length or material of the enclosed cable, because this may cause malfunctions or faults.
- 3 Check that the correct power supply is connected. Connecting a non-designated power supply could cause faults. Wait at least 5 seconds after turning power OFF before turning it ON again.
- 4 Fix the direct drive actuator securely to the machine, and install loads such as the table before adjusting gain. Confirm that no interference exists and that the state is safe even when movable sections are rotated.
- 5 Do not tap the output shaft with a hammer nor assemble it forcibly. Doing so may prevent expected accuracy and functions from being realized and could cause faults.
- 6 Avoid placing the actuator near strong magnetic fields such as rare-earth magnets. Doing so may prevent maintenance of the expected accuracy.
- 7 The temperature of the actuator body will be high depended with working conditions. Provide a protective cover, etc., not to touch the body.
- 8 Do not do machining such as boring, etc., on the actuator body. If machining is required, consult with CKD.
- 9 Do not step on the actuator or a movable part such as dial plate, etc., installed on the actuator for maintenance work, etc.
- 10 Compatible type (AX **** GS and AX **** GH) can not be connected to conventional actuator body and driver AX **** S and AX **** H.
- 11 About compatible type (AX **** GS and AX **** GH)
 - A wrong combination of actuator and driver will give Alarm 3 after program input (after parameter setting). The combination of actuator and driver must be checked.

Note: Alarm 3 appears 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 parameters are set), a malfunction could occur or equipment could be damaged.
 - When changing cable length and type, a discrete cable must be ordered.



Caution

Usage & maintenance

- 1 Do not disassemble the actuator. Doing so may compromise expected functions or accuracy. Attempting to disassemble the resolver could critically damage it.
- 2 When testing withstand voltage of a machine or equipment in which direct drive actuator is assembled, disconnect the main power cable (L1, L2, L3) or (R, S, T) from the direct drive actuator driver and check that voltage is not applied to the driver itself. Failure to do so may cause faults.
- 3 If alarm "4" (actuator overload: electronic thermal) occurs, wait for actuator temperature to drop sufficiently before restarting. Possible causes of alarm[4] could be as following. Eliminate causes, then use the product again.
 - caused by resonance/vibration → installation rigidity be secured sufficiently.
 - caused by tact time/speed → moving time/dwell time be extended.
 - caused by structure that constricts output shaft → M68 and M69 commands be added.

Warranty

Warranty

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

1. Warranty term

1 year after delivery. One day of operation is assumed to be within 8 hours. If use is exceeded within 1 year, the warranty shall terminate at that point.

Durability (Direct drive actuator)

10,000,000 times for direct drive actuator brakes with air brakes, piston packing, and valve. Conditions: room temperature, room humidity, rated voltage, rated pneumatic pressure

2. Scope of warranty

If any faults found to be the responsibility of CKD occur within the above warranty term, the faulty part shall be repaired immediately by CKD free of charge.

Note that the following faults are excluded from the warranty term:

- ❶ Faults due to use exceeding conditions and environments in product specifications.
- ❷ Faults caused by careless or incorrect handling or improper control.
- ❸ Fault causes by factors other than those to delivered parts.
- ❹ Faults caused by improper use of the product.
- ❺ Faults due to modifications to 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.
- ❻ When using this product in the user's machine or equipment, damage that can be avoided if the user's machines or equipment have the functions and structure, etc., considered normal within the industry.
- ❼ Faults caused by matters that could not be predicted with the technology applied when the product was delivered.
- ❽ Faults caused by fire, earthquake, flood, lightning, force de majeure, acts of God, pollution, salt, gas, abnormal voltage, or other external factors.

The warranty here refers to that of the actually delivered product, and does not include damage caused by a fault in the delivered product.

3. Warranty when exporting to a foreign country

- (1) Products returned to the CKD plant or to a company or plant designated by CKD shall be repaired. All work and expenses related to return shall be excluded from compensation.
- (2) The repaired product shall be returned to a designated place in Japan with domestic packaging specifications

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



Direct drive actuator compatible type

AX2000G Series

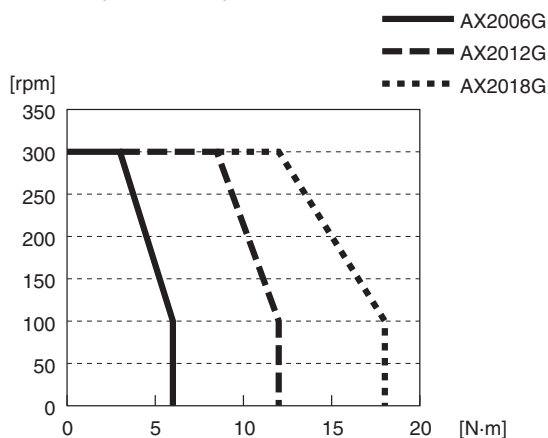
Compatibility flexibly combined with driver, actuator and cable
High speed revolution (maximum rotational speed 300rpm), compact with small diameter and large hollow diameter (ø30)

- Maximum torque: 6/12/18 N•m
- Available driver: GS type driver

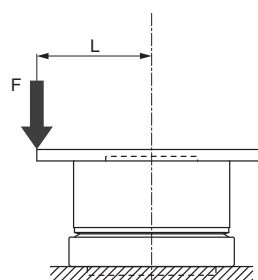
Actuator specifications

Descriptions		AX2006G	AX2012G	AX2018G
Maximum output torque	N·m	6.0	12.0	18.0
Continuous power torque	N·m	2.0	4.0	6.0
Maximum rotational speed	rpm	300		
Allowable axial load	N	1000		
Allowable moment load	N·m	40		
Output shaft moment of inertia	kg·m ²	0.00575	0.00695	0.00910
Allowable load moment of inertia	kg·m ²	0.3	0.4	0.5
Index accuracy	sec.	±30		
Repeatability	sec.	±5		
Output shaft friction torque	N·m	0.6		0.7
Resolver resolution	P/rev	540672		
Motor insulation grade		Class F		
Motor withstanding voltage		1500V AC for 1 minute		
Motor insulation resistance		10MΩ and over 500V DC		
Ambient temperature range		0 to 45 °C		
Ambient humidity range		20 to 85%RH to be no dew condensation.		
Conservation ambient temperature range		-20 to 80 °C		
Conservation ambient humidity range		20 to 90%RH to be no dew condensation.		
Mass	kg	4.7	5.8	7.5
Run out of output shaft	mm	0.03		
Surface run out of output shaft	mm	0.03		

Maximum speed/torque characteristics

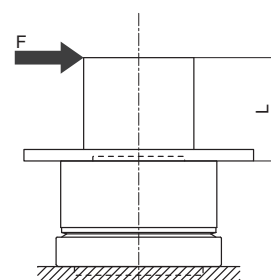


(Note) moment load



(Fig. a)

$M \text{ (N·m)} = F \text{ (N)} \times L \text{ (m)}$
M: moment load
F: load
L: distance from output shaft center

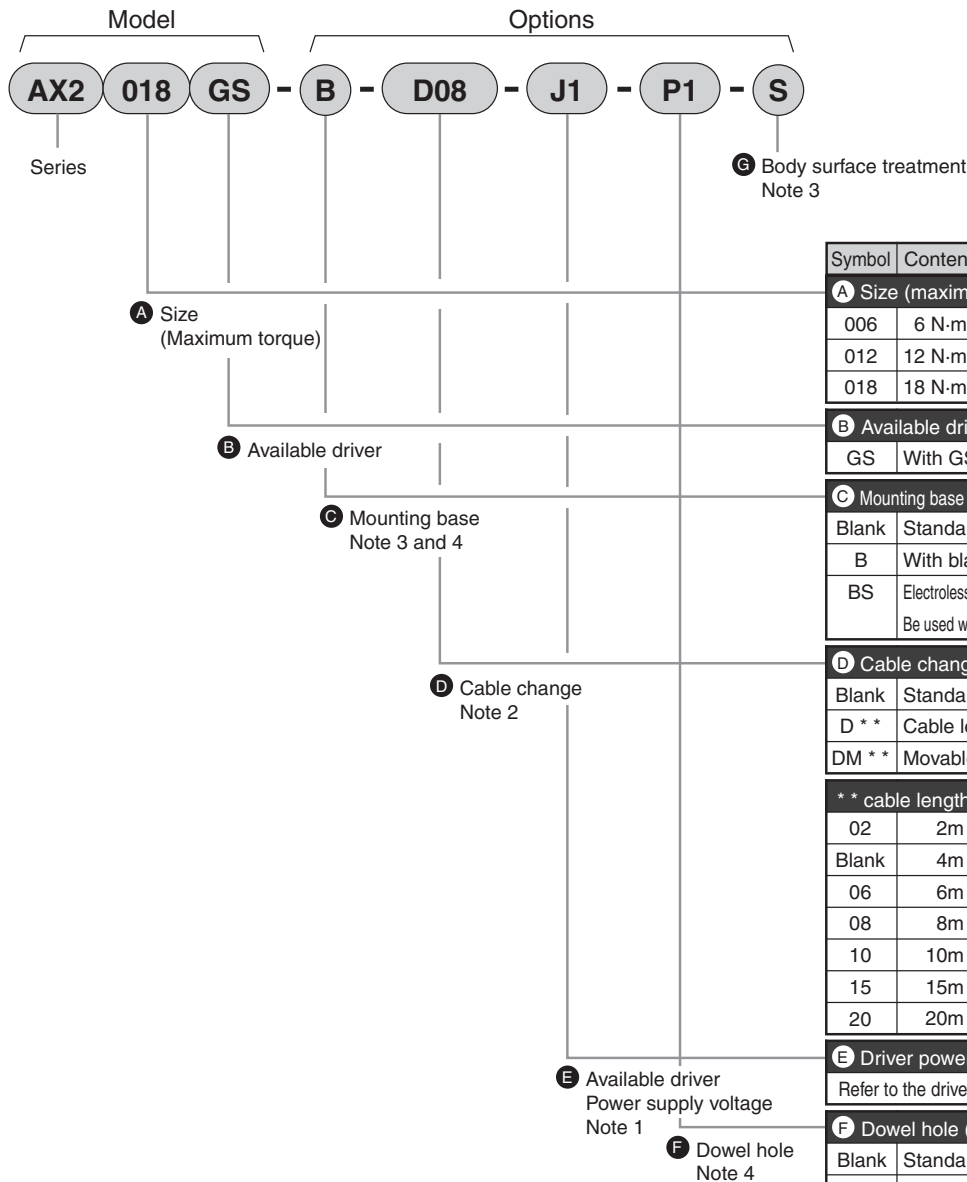


(Fig. b)

$M \text{ (N·m)} = F \text{ (N)} \times (L + 0.02) \text{ (m)}$
M: moment load
F: load
L: distance from output shaft flange plane

 Always read precautions on Intro 13 to 18 before starting use.

How to order



Symbol	Content
A Size (maximum torque)	
006	6 N·m
012	12 N·m
018	18 N·m
B Available driver	
GS	With GS type driver
C Mounting base (can not use with dowel holes P2 and P3.)	
Blank	Standard (without mounting base)
B	With blackening mounting base
BS	Electroless nickel plating surface treatment mounting base Be used with body surface treatment S.
D Cable change	
Blank	Standard (cable length 4m)
D **	Cable length change
DM **	Movable cable length change
** cable length	
02	2m
Blank	4m (Note)-DM
06	6m
08	8m
10	10m
15	15m
20	20m
E Driver power supply voltage	
Refer to the driver power supply voltage table on the left.	
F Dowel hole (Note 5)	
Blank	Standard (without dowel hole)
P1	Top 1 piece
P2	Bottom 1 piece
P3	Both top and bottom sides 1 piece each
G Body surface treatment	
Blank	Standard (blackening treatment)
S	Electroless nickel plating treatment

Note on model no. selection

Note 1: Select a driver according to the following table.

Driver power supply voltage table

Model	Available driver	
	GS type compatible driver	
	3-200V AC to 230V AC	1-100V AC to 115V AC
AX2006G	Blank	J1
AX2012G	Blank	J1
AX2018G	Blank	J1

Note 2: If the cable is bended repeatedly, use an optional movable cable.

Refer to Page 3 for dimensions of the cable.

Note 3: Specify body surface and mounting base treatments in both sections C and G.

Note 4: If section C mounting base is "B"; blackening mounting base or "BS"; electroless nickel plating surface treatment, "P2" and "P3" can not be selected.

Note 5: No surface treatment may be provided for additionally machined section.

*When ordering a discrete part for maintenance, consult with CKD.

Cable specifications

Cable dimensions	Cable minimum bending radius		
		Standard cable	Movable cable
	Resolver Cable	50mm	60mm
	Motor Cable	100mm	110mm

⚠ Precautions

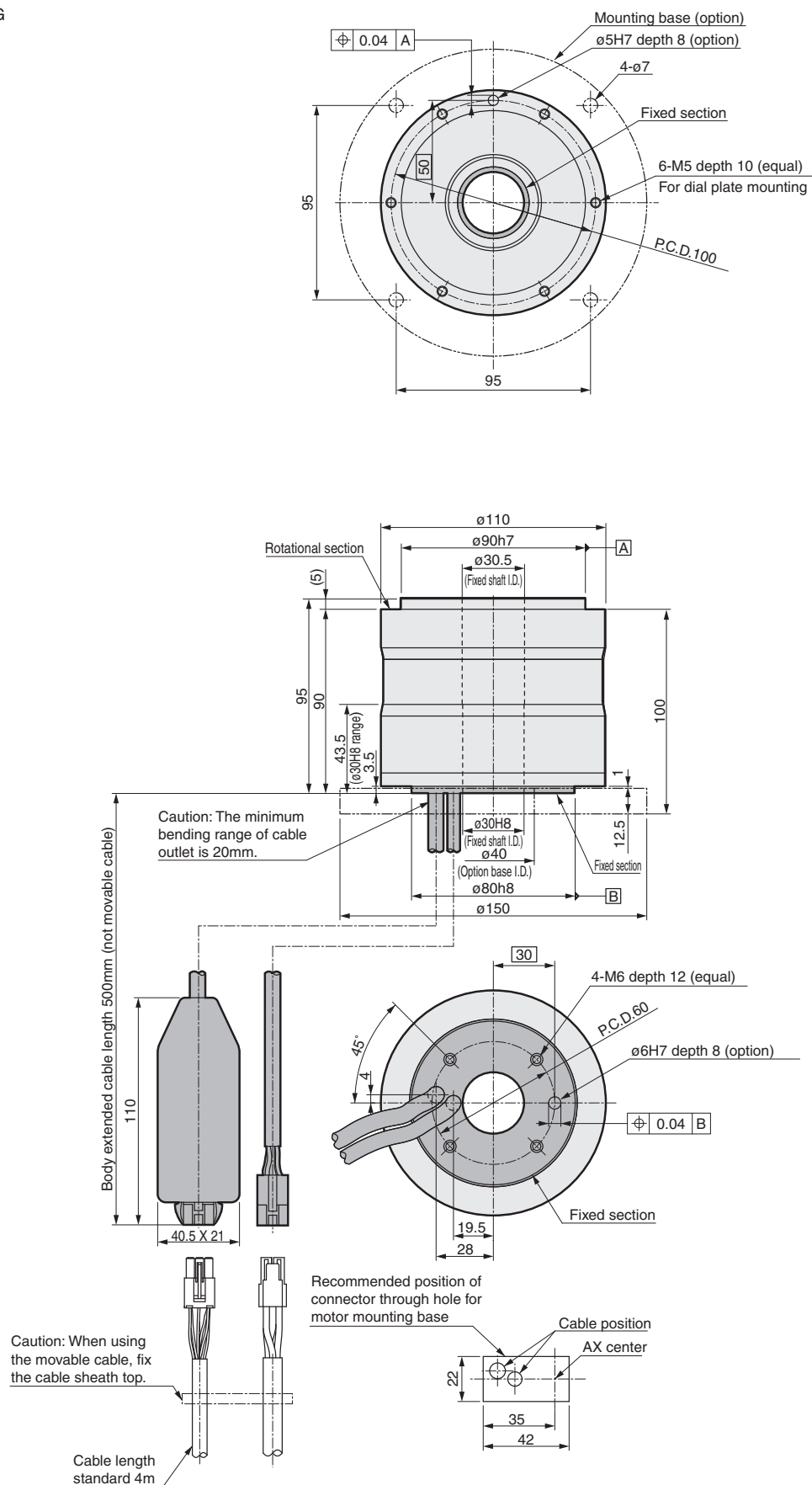
- If cable length is 6m and over, use the noise filter for motor cable (near driver).
- When connecting a motor cable to the driver, care must be taken to connect them correctly with matching the mark tube on cable and the mark on driver.
- If the cable is bended repeatedly, use a movable cable (option).
Also when using the movable cable, fix the cable sheath section near the actuator body connector.
- When selecting movable cable option, the movable cable is used between the driver and actuator connector, while standard cable is used for the body extended line between the actuator body and connector. The body extended cable must be fixed at the place not moved.
- When connecting the cable, insert a connector certainly in deep inside. Also, set screws of a connector must be tightened certainly.
- Care must be taken not to pull the body extended cable.
- Modification such as cut and extension of a cable, etc., must not be done, or failure and malfunction may be caused.

Dimensions

● AX2006G

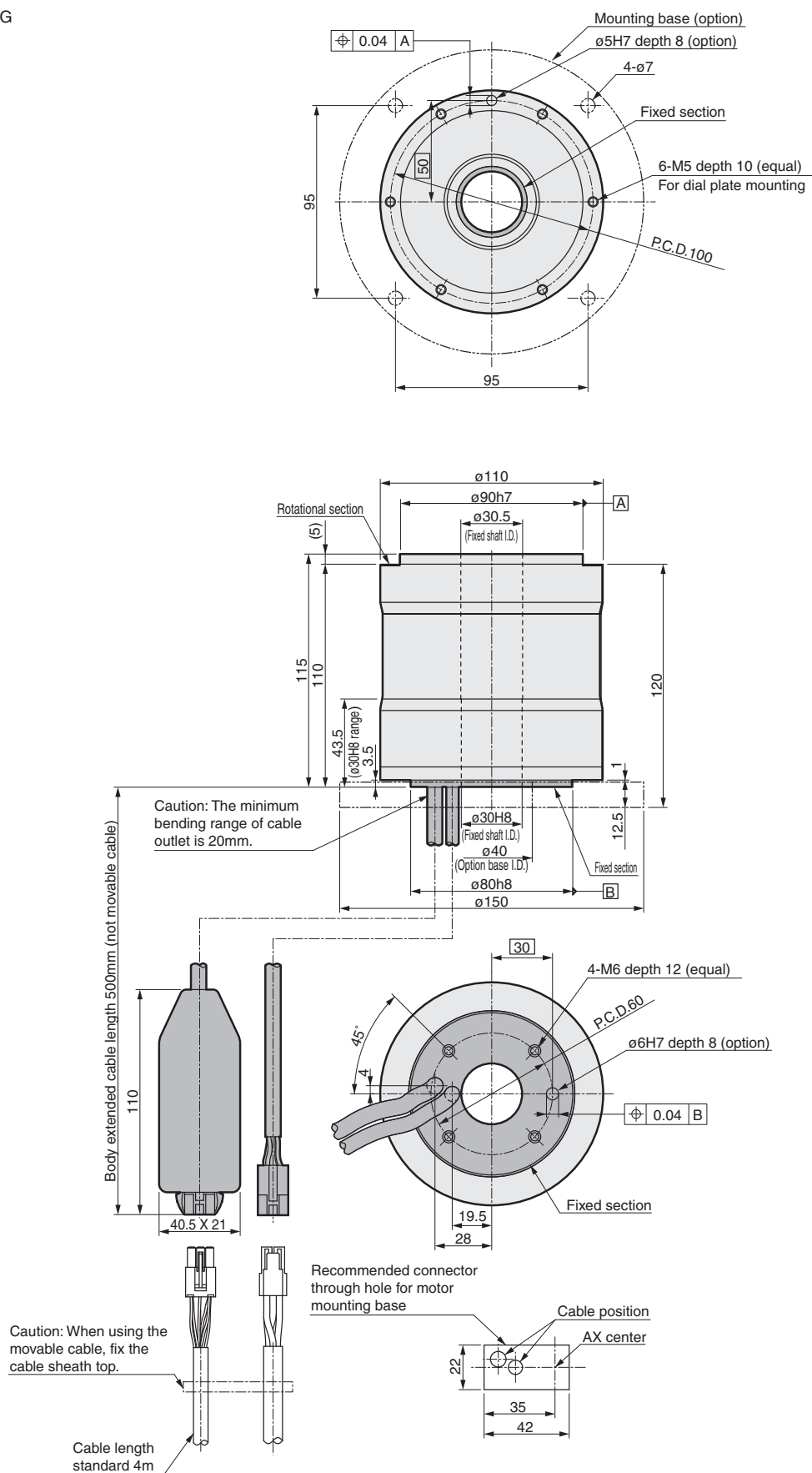
AX2000G

Actuator



Dimensions

● AX2012G

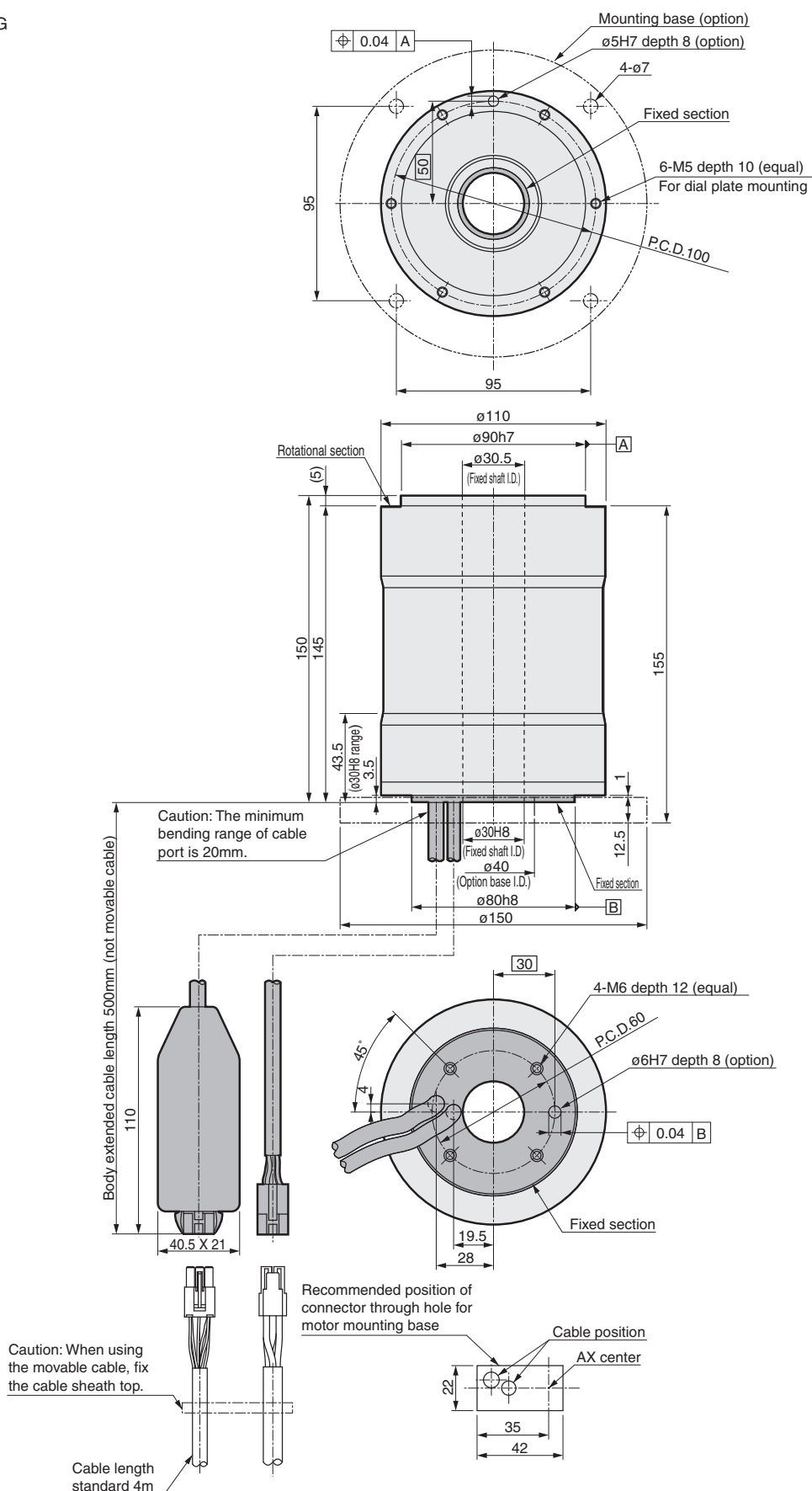


Dimensions

● AX2018G

AX2000G

Actuator





Direct drive actuator compatible type

AX4000G Series

Compatibility flexibly combined with driver, actuator and cable

High speed revolution (maximum rotational speed: AX4022GS, AX4045GS; 240rpm, AX4075GS; 140rpm) large hollow diameter for easy cable wiring and piping, and great variety of options

● Maximum torque: 22/45/75 N·m

● Available driver: GS type driver

Actuator specifications

Descriptions		AX4022G	AX4045G	AX4075G
Maximum output torque	N·m	22	45	75
Continuous power torque	N·m	7	15	25
Maximum rotational speed	rpm	240		140
Allowable axial load	N	3700		20000
Allowable moment load	N·m	60	80	200
Output shaft moment of inertia	kg·m ²	0.0206	0.0268	0.1490
Allowable load moment of inertia	kg·m ²	0.60	0.90	5.0
Index accuracy	sec.	±30		
Repeatability	sec.	±5		
Output shaft friction torque	N·m	3.5		10.0
Resolver resolution	P/rev	540672		
Motor insulation grade		Class F		
Motor withstanding voltage		1500V AC for 1 minute		
Motor insulation resistance		10MΩ and over 500V DC		
Ambient temperature range		0 to 45 °C		
Ambient humidity range		20 to 85%RH to be no dew condensation.		
Conservation ambient temperature range		-20 to 80 °C		
Conservation ambient humidity range		20 to 90%RH to be no dew condensation.		
Mass	kg	12.3	15.0	36.0
Total mas with brake set	kg	16.4	19.3	54.0
Run out of output shaft	mm	0.03		
Surface run out of output shaft	mm	0.05		

Electromagnetic brake specifications (option)

Descriptions		Applicable model	AX4022G/AX4045G	AX4075G
Type			Non-backrush dry type deenergisation operation model	
Rated voltage	V		24V DC	
Power supply wattage	W		30	55
Rated current	A		1.25	2.30
Static friction torque	N·m		35	200
Amateur disengage time (brake on)	msec.		50 or less	50 or less
Amateur suction time (brake off)	msec.		150 or less	250 or less
Holding accuracy	min.		Below 45	
Maximum cycle rate	cycle/min.		60	40

Note 1: When rotating the output shaft, a rubbing noise between the disk and fixed section of electromagnetic brake may be made.

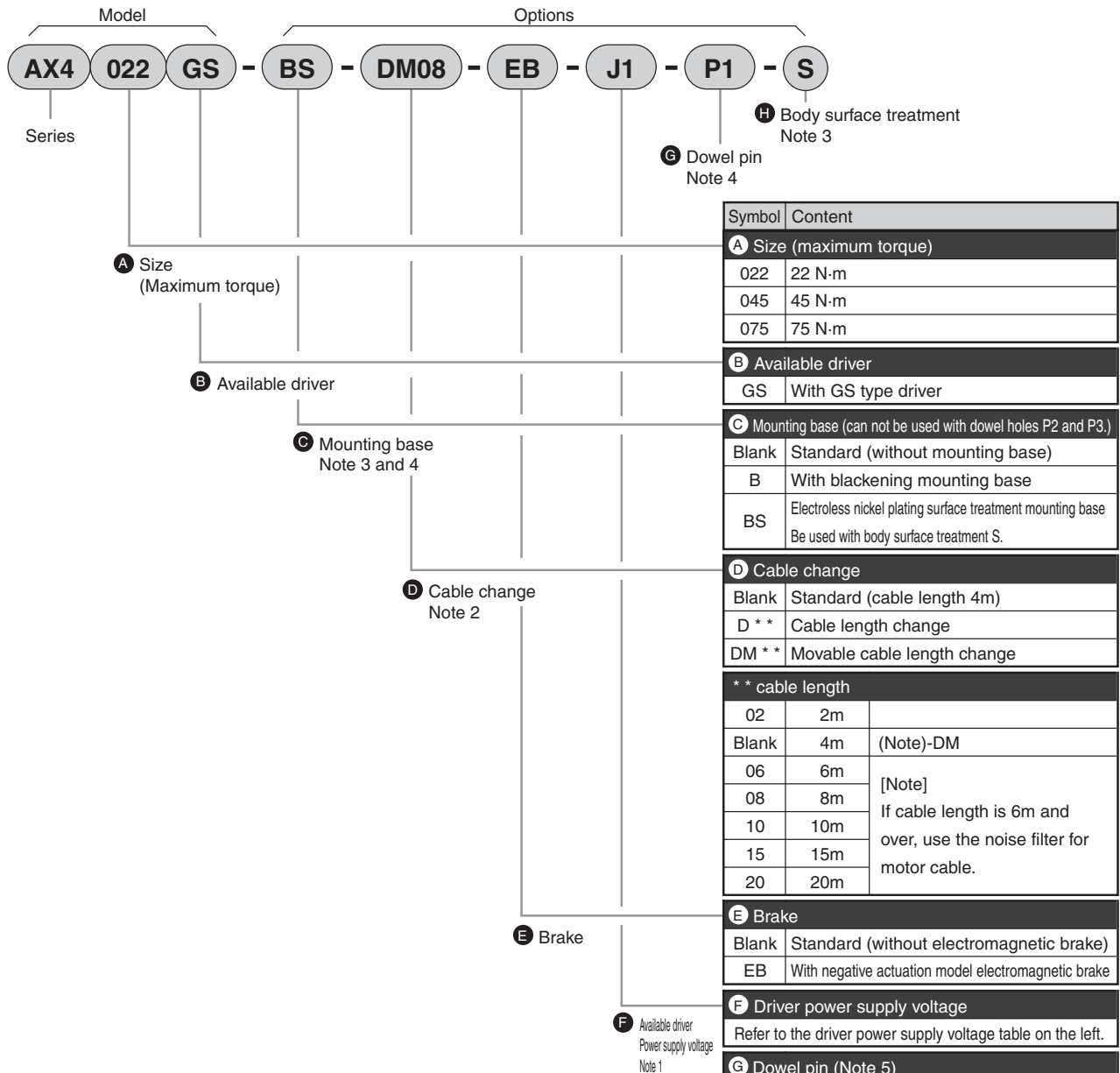
Note 2: In movement after brake off, delay time of a parameter must be changed per above amateur suction time.

Note 3: Non-backrush method is used, however, if a load is applied in rotational direction, it will be difficult to hold the fixed position.

Note 4: The amateur may contact to the electromagnetic brake fixed section during electromagnetic brake applied, making a noise.

 Always read precautions on Intro 13 to 18 before starting use.

How to order



Note on model no. selection

Note 1: Select a driver according to the following table.

Driver power supply voltage table

Model	Available driver	
	GS type compatible driver	
	3-200V AC to 230V AC	1-100V AC to 115V AC
AX4022G	Blank	J1
AX4045G	Blank	J1
AX4075G	Blank	

Note 2: If the cable is bended repeatedly, use an optional movable cable.

Refer to Page 9 for dimensions of a cable.

Note 3: Specify body surface and mounting base treatments in both sections **C** and **H**.

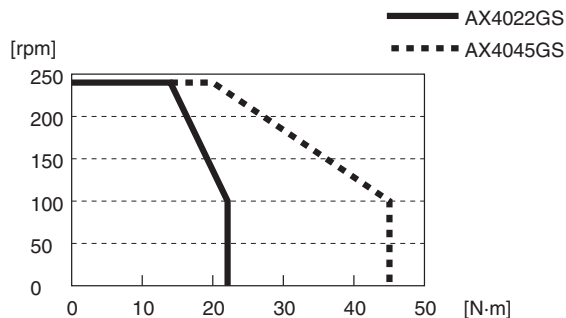
Note 4: If section **C** mounting base is "B"; with blackening mounting base or "BS"; electroless nickel plating surface treatment mounting base, "P2" and "P3" can not be selected.

Note 5: No surface treatment may be provided for additionally machined section.

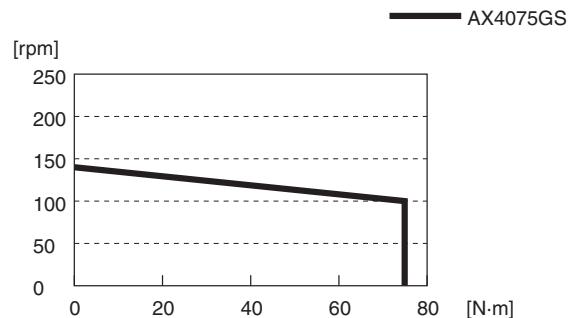
*When ordering a discrete part for maintenance, consult with CKD.

Maximum speed/torque characteristics

● AX4022GS and AX4045GS

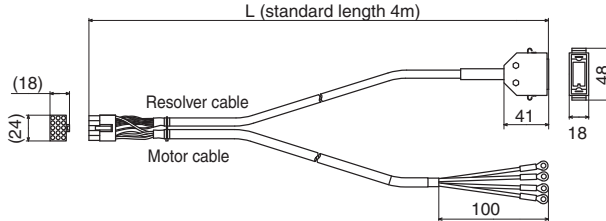


● AX4075GS



Cable specifications

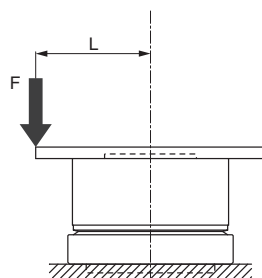
Cable minimum bending radius

Cable dimensions		Cable minimum bending radius	
		Standard cable	Movable cable
	Resolver cable	50mm	60mm
	Motor cable	90mm	90mm

⚠ Precautions

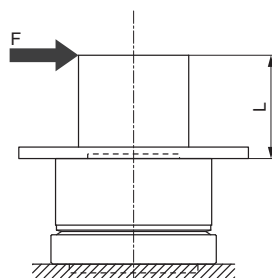
- If cable length is 6m and over, use the noise filter for motor cable for the motor cable (near driver).
- When connecting the motor cable to the driver, care must be taken to connect them correctly with matching the mark tube on cable and the mark on driver.
- If the cable is bended repeatedly, use a movable cable (option).
Also when using the movable cable, fix the cable sheath section near the actuator body connector.
- When connecting the cable, insert a connector certainly in deep inside. Also, setscrews of a connector must be tightened certainly.
- Modification such as cut and extension of a cable, etc., must not be done, or failure and malfunction may be caused.

(Note) moment load



(Fig. a)

$M \text{ (N-m)} = F \text{ (N)} \times L \text{ (m)}$
 M : moment load
 F : load
 L : distance from output shaft center



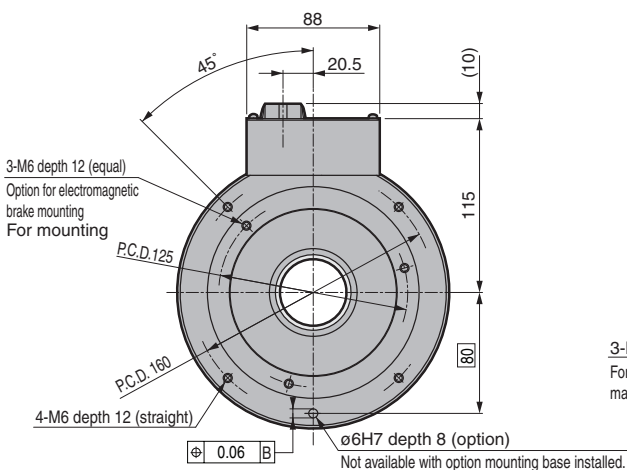
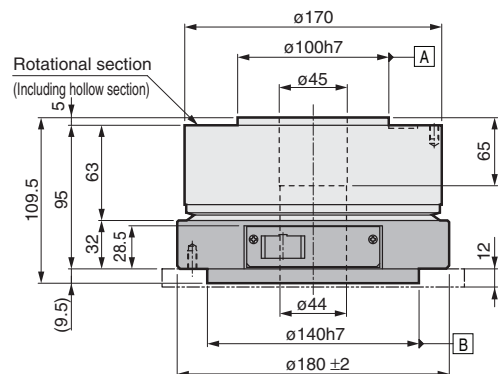
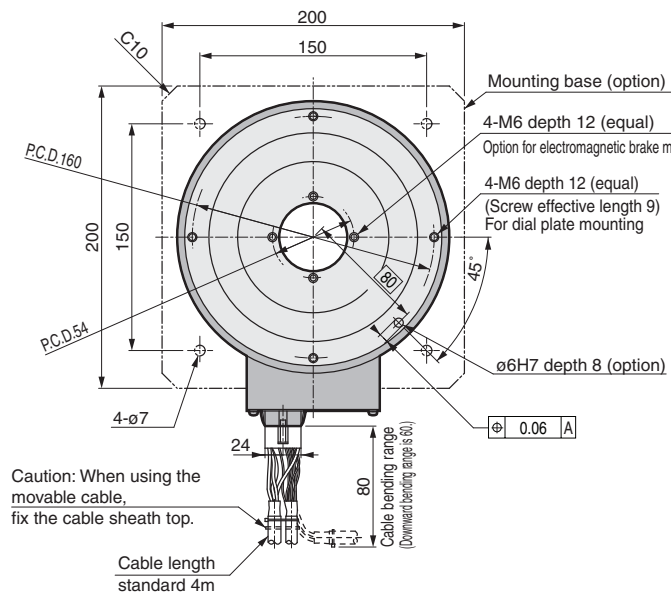
(Fig. b)

$M \text{ (N-m)} = F \text{ (N)} \times (L + 0.02) \text{ (m)}$
 M : moment load
 F : load
 L : distance from output shaft flange plane

⚠ Always read precautions on Intro 13 to 18 before starting use.

Dimensions

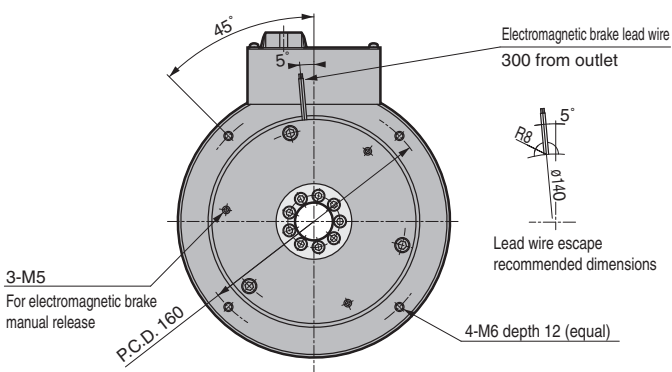
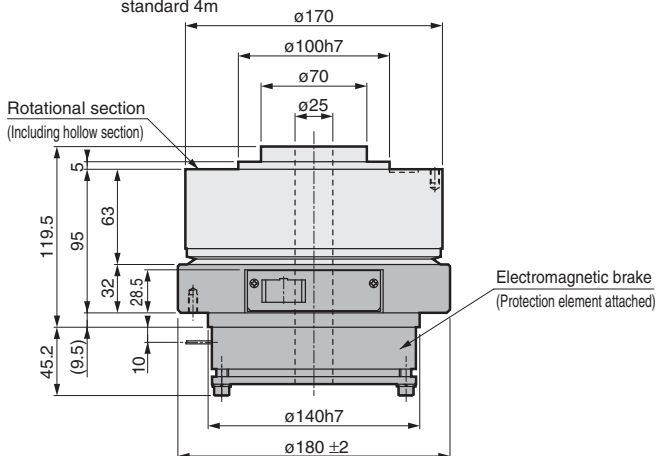
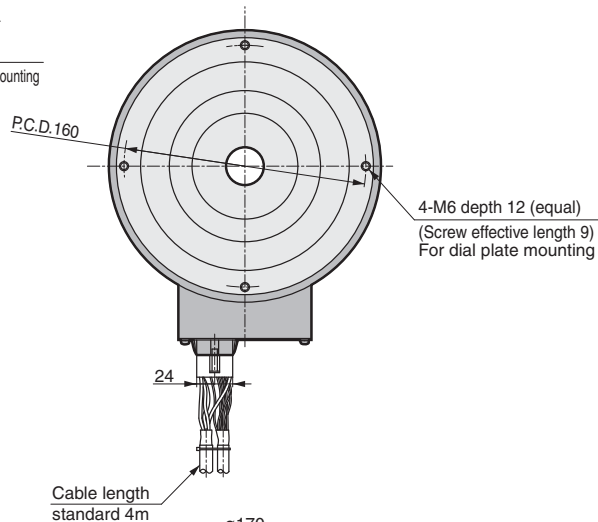
● AX4022G



● AX4022G-EB

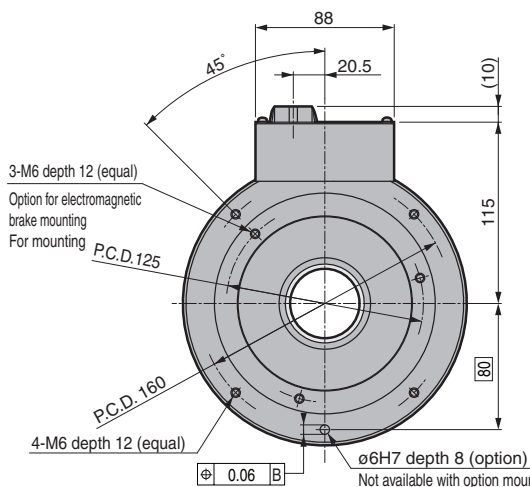
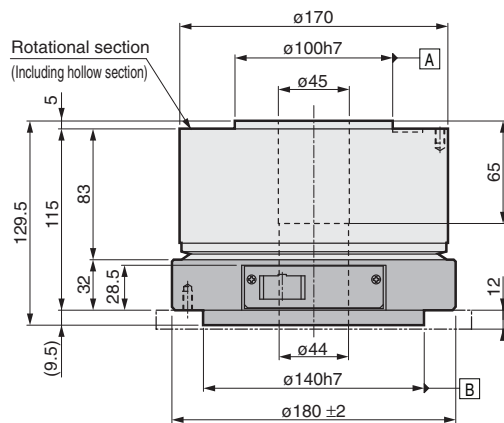
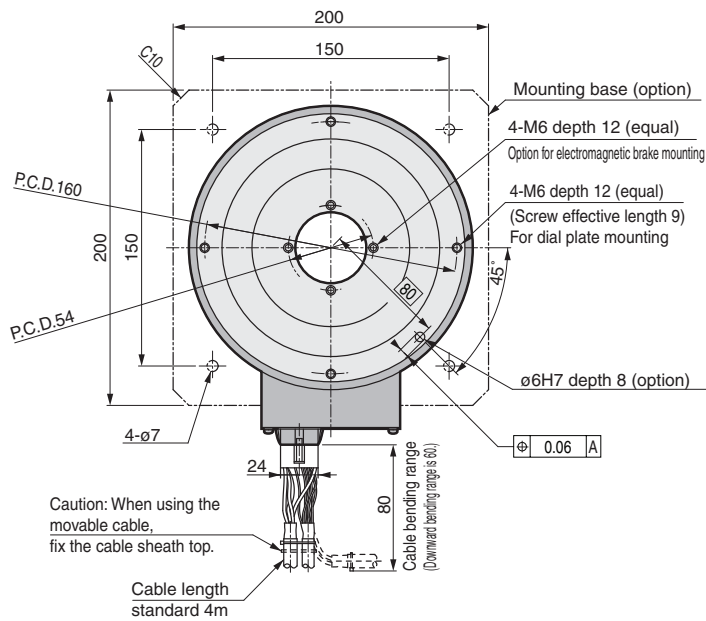
Electromagnetic brake

Refer to the left fig. for other options.



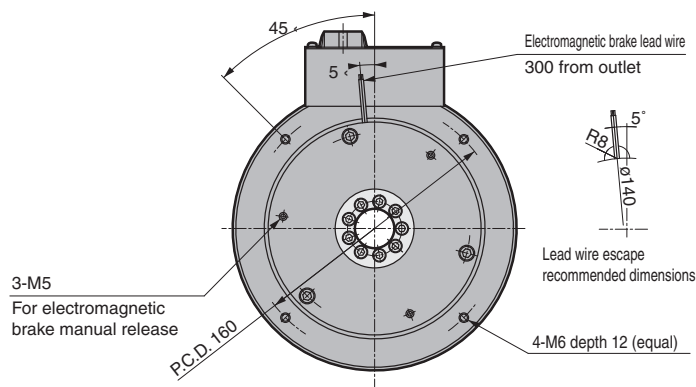
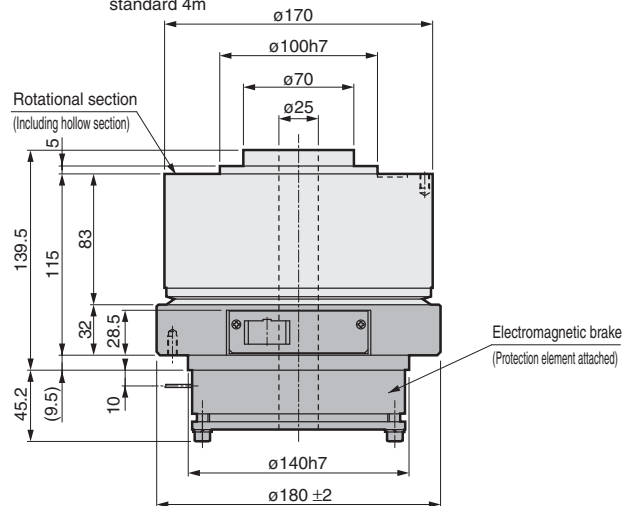
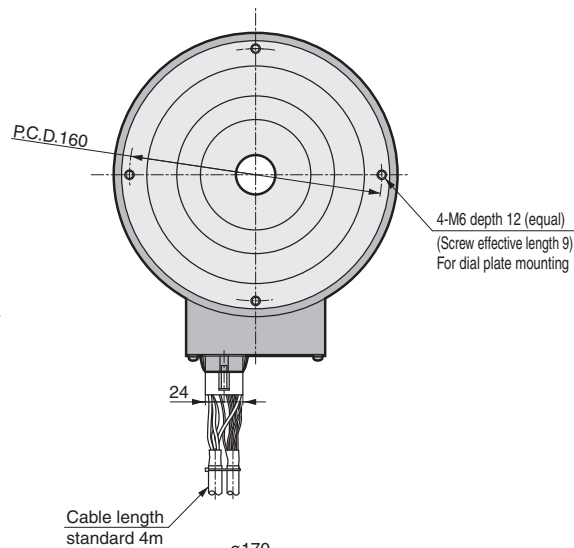
Dimensions

● AX4045G



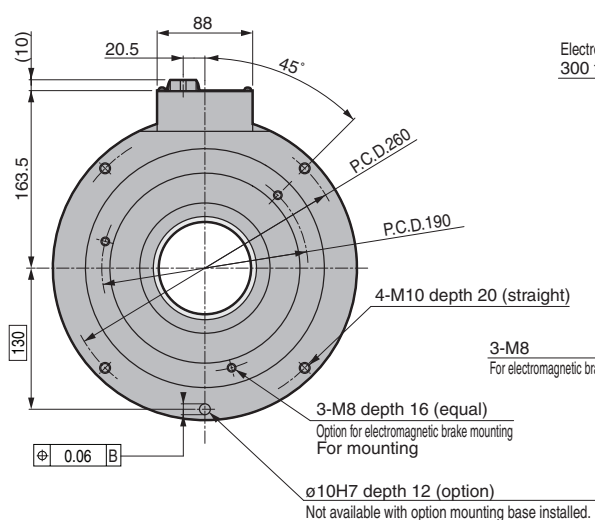
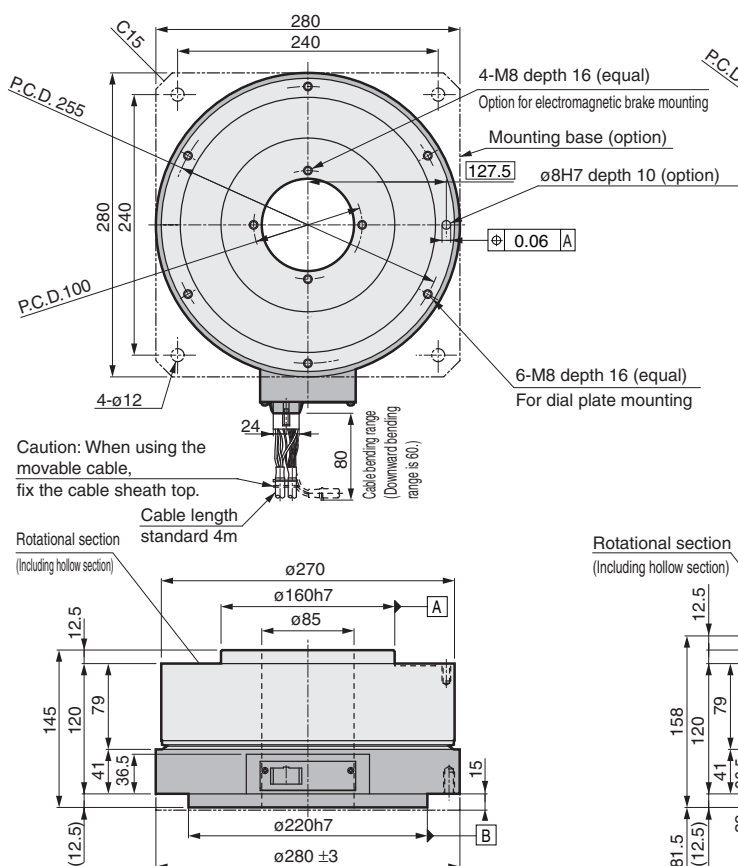
● AX4045G-EB

Electromagnetic brake
Refer to the left fig. for other options.



Dimensions

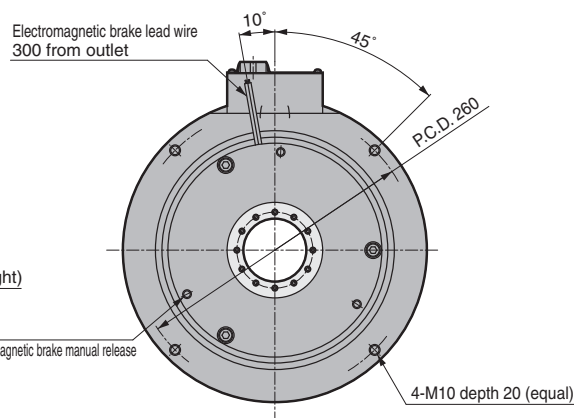
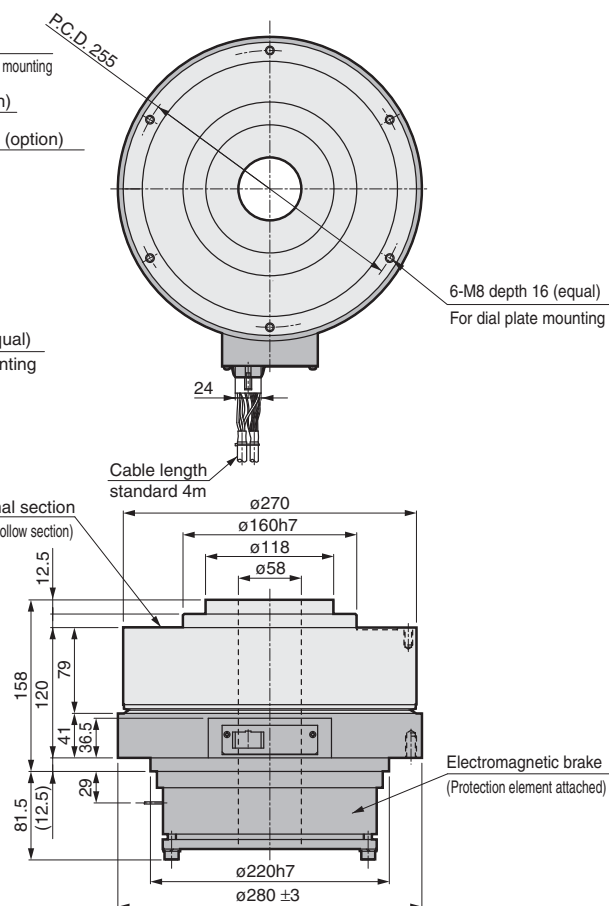
● AX4075G



● AX4075G-EB

Electromagnetic brake

Refer to the left fig. for other options.



AX4000G Actuator



Direct drive actuator compatible type

AX4000G Series

For load with large moment of inertia

Compatibility flexibly combined with driver, actuator and cable

Large hollow diameter for easy cable wiring and pipe, great variety of options

● Maximum torque: 150/300/500 N•m

● Available driver: GH type driver

Actuator specifications

Descriptions		AX4150G	AX4300G	AX4500G
Maximum output torque	N•m	150	300	500
Continuous power torque	N•m	50	100	160
Maximum rotational speed	rpm	100		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 1	180.00 Note 1	300.00 Note 1
Index accuracy	sec.	±30		
Repeatability	sec.	±5		
Output shaft friction torque	N•m	10.0		15.0
Resolver resolution	P/rev	540672		
Motor insulation grade		Class F		
Motor withstanding voltage		1500V AC for 1 min.		
Motor insulation resistance		10MΩ and over 500V DC		
Ambient temperature range		0 to 45 °C		
Ambient humidity range		20 to 85%RH to be no dew condensation.		
Conservation ambient temperature range		-20 to 80 °C		
Conservation ambient humidity range		20 to 90%RH to be no dew condensation.		
Mass	kg	44.0	66.0	115.0
Brake set total mass	kg	63.0	86.0	-
Run out of output shaft	mm	0.03		
Surface run out of output shaft	mm	0.05		

Note 1: The default setting is for large moment of inertia at shipment.

Electromagnetic brake specifications (option)

Applicable model		AX4150G/AX4300G
Descriptions		
Type		Non-backrush dry type deenergisation operation model
Rated voltage	V	24V DC
Power supply wattage	W	55
Rated current	A	2.30
Static friction torque	N•m	200
Amateur disengage time (brake on)	msec.	50 or less
Amateur suction time (brake off)	msec.	250 or less
Holding accuracy	min.	Below 45
Maximum cycle rate	cycle/min.	40

Note 2: When rotating the output shaft, a rubbing noise between the disk and fixed section of an electromagnetic brake may be made.

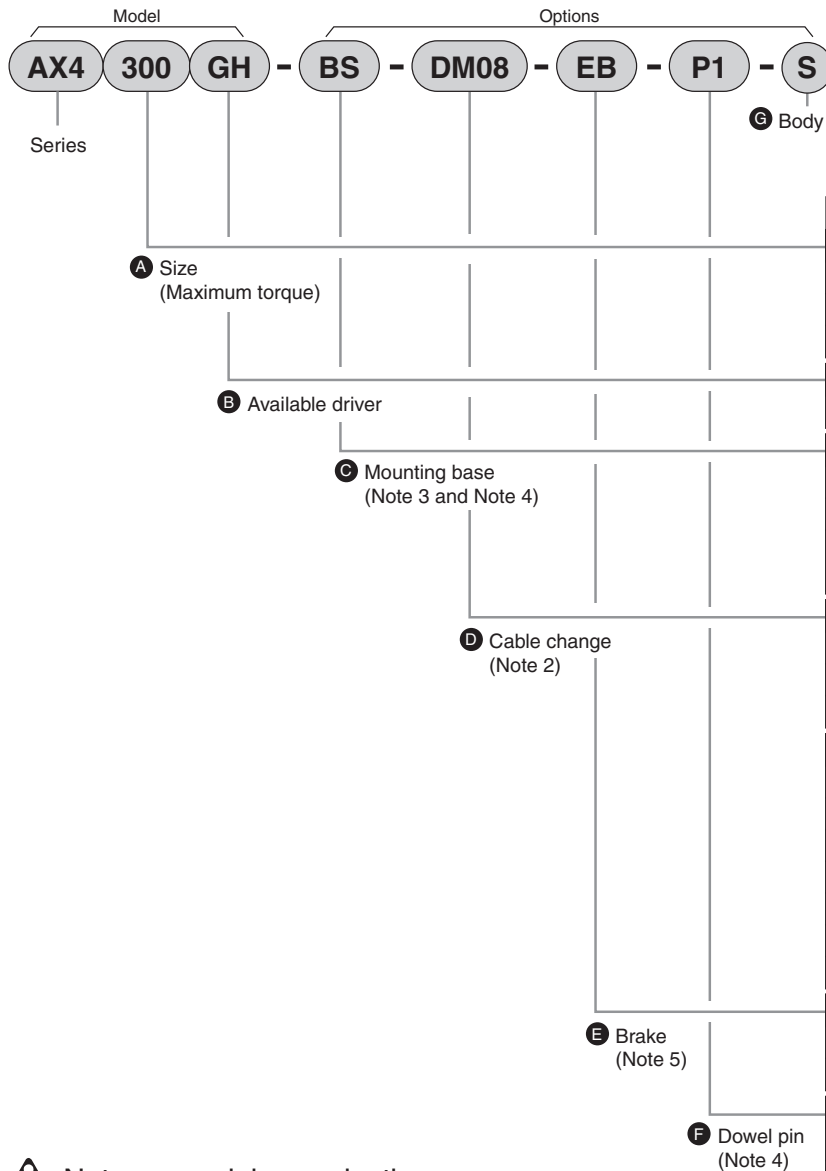
Note 3: In movement after brake off, delay time of a parameter must be changed per above amateur suction time.

Note 4: Non-backrush method is used, however, if a load is applied in rotational direction, it will be difficult to hold the fixed position.

Note 5: The amateur may contact to the electromagnetic brake fixed section during electromagnetic brake applied, making a noise.

⚠ Always read precautions on Intro 13 to 18 before starting use.

How to order



Symbol	Content
A Size (maximum torque)	
150	150 N·m
300	300 N·m
500	500 N·m
B Available driver	
GH	With GH type driver
C Mounting base (can not be used with dowel holes P2 and P3.)	
Blank	Standard (without mounting base)
B	With blackening mounting base
BS	Electroless nickel plating surface treatment mounting base Be used with body surface treatment S.
D Cable change	
Blank	Standard (cable length 4m)
D **	Cable length change
DM **	Movable cable length change
** cable length	
02	2m
Blank	4m (Note)-DM
06	6m
08	8m
10	10m
15	15m
20	20m
[Note] If cable length is 6m and over, use the noise filter for motor cable.	
E Brake	
Blank	Standard (without electromagnetic brake)
EB	Negative actuation model electromagnetic brake
F Dowel pin (Note 6)	
Blank	Standard (without dowel hole)
P1	Top 1 piece
P2	Bottom 1 piece
P3	Both top and bottom sides 1 piece each
G Body surface treatment	
Blank	Standard (rotational section-blackening/fixed section casting surface plane-paint)
S	Rotational section: electroless nickel plating treatment and stationary portion: nitriding

AX4000G Actuator

⚠ Note on model no. selection

Note 1: Select a driver according to the following table.

Driver power supply voltage table

Available driver Type	GH type compatible driver
Model	3-200V AC to 230V AC
AX4150G	Blank
AX4300G	Blank
AX4500G	Blank

Note 2: If the cable is bended repeatedly, use an optional movable cable.

Refer to Page 15 for dimensions of cable.

Note 3: Specify body surface and mounting base treatments in both sections C and G.

Note 4: If section C mounting base is "B"; with blackening mounting base or "BS"; electroless nickel plating surface treatment mounting base, "P2" and "P3" can not be selected.

Note 5: Select options according to the following [option table].

Option table

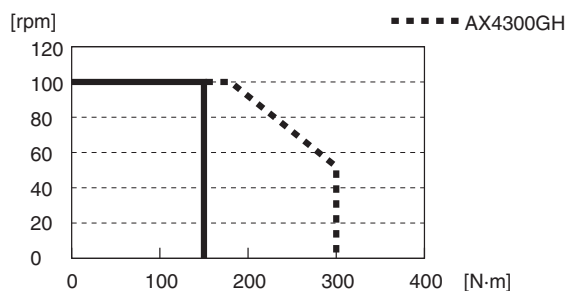
	AX4150G	AX4300G	AX4500G
Electromagnetic brake (-EB)	○	○	×

Note 6: No surface treatment may be provided for additionally machined section.

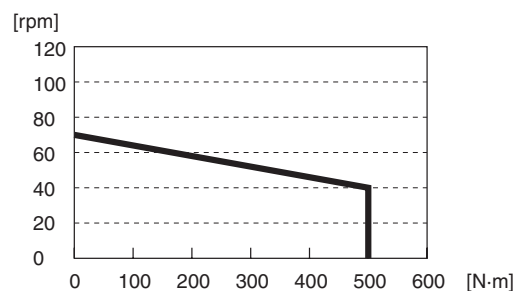
*When ordering a discrete part for maintenance, consult with CKD.

Maximum speed/torque characteristics

● AX4150GH and AX4300GH



● AX4500GH



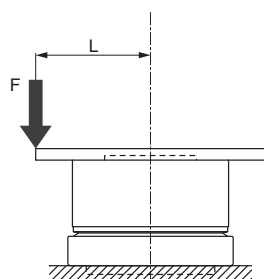
Cable specifications

Cable dimensions	Cable minimum bending radius	
	Standard cable	Movable cable
Resolver cable	50mm	60mm
Motor cable	100mm	110mm

⚠ Precautions

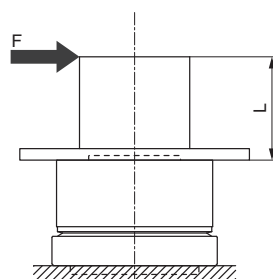
- If cable length is 6m and over, use the noise filter for motor cable (near driver).
- When connecting the motor cable to the driver, care must be taken to connect them correctly with matching the mark tube on cable and the mark on driver.
- If the cable is bended repeatedly, use a movable cable (option).
Also when using the movable cable, fix the cable sheath section near the actuator body connector.
- When connecting the cable, insert a connector certainly in deep inside. Also, setscrews of the connector must be tightened certainly.
- Modification such as cut and extension of a cable, etc., must not be done, or failure and malfunction may be caused.

(Note) moment load



(Fig. a)

$M \text{ (N-m)} = F \text{ (N)} \times L \text{ (m)}$
M: moment load
F: load
L: distance from output shaft center

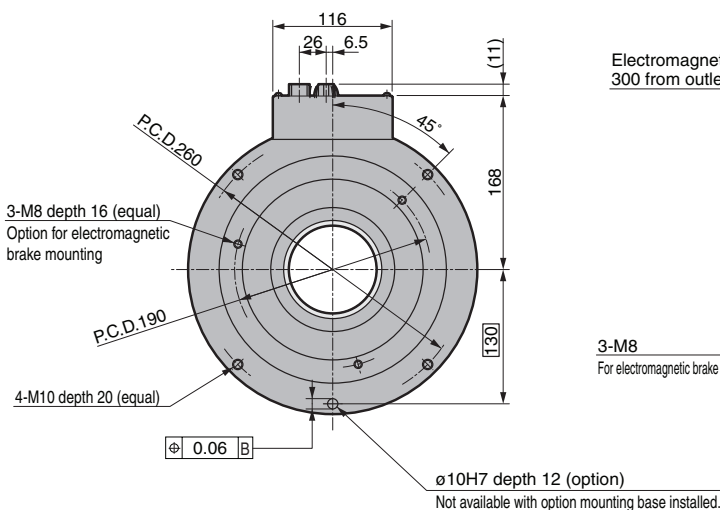
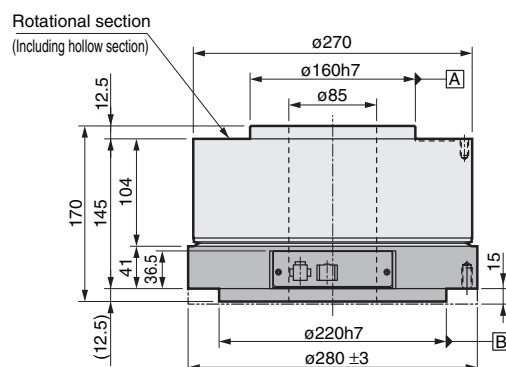
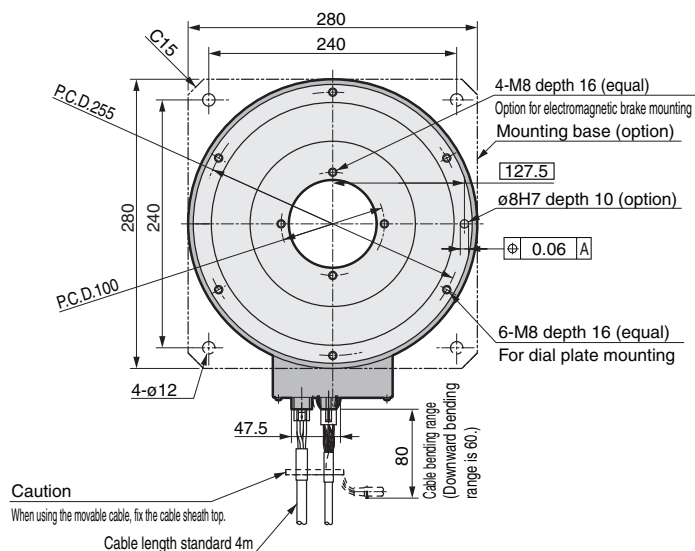


(Fig. b)

$M \text{ (N-m)} = F \text{ (N)} \times (L + 0.02) \text{ (m)}$
M: moment load
F: load
L: distance from output shaft flange plane

Dimensions

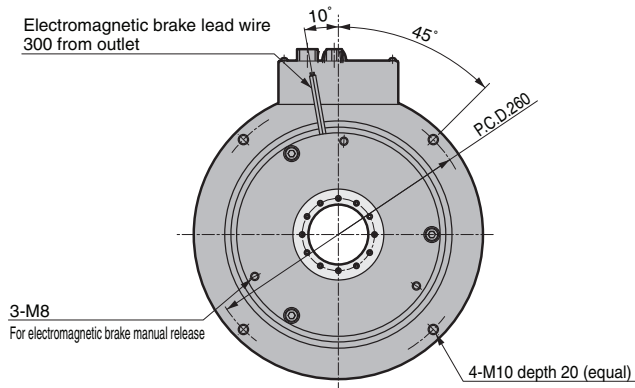
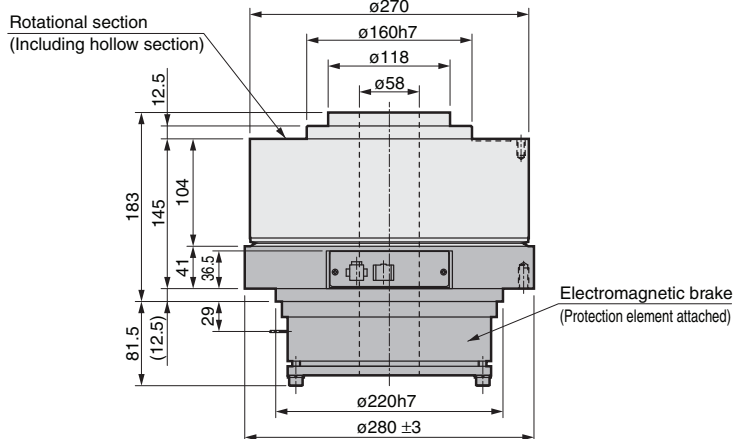
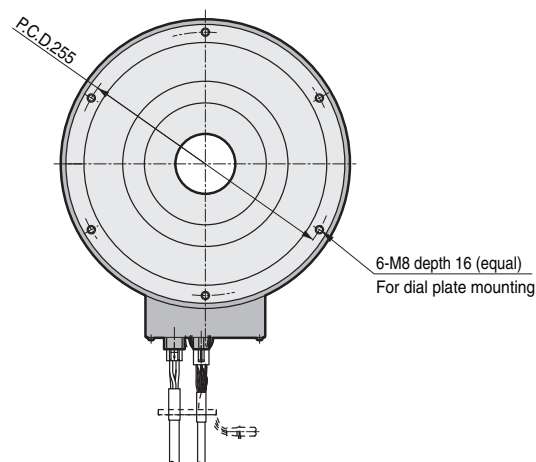
● AX4150G



● AX4150G-EB

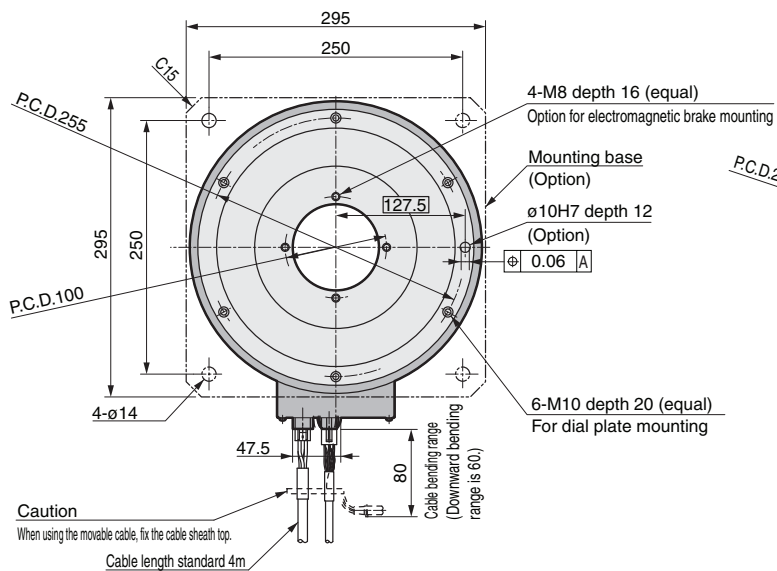
Electromagnetic brake

Refer to the left fig. for other options.



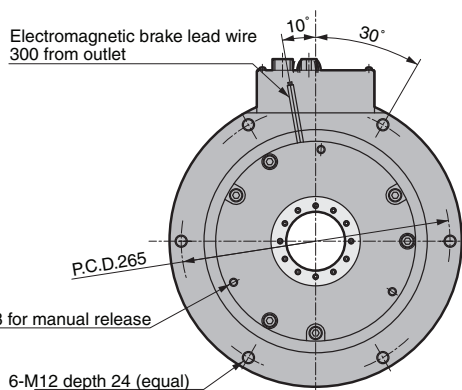
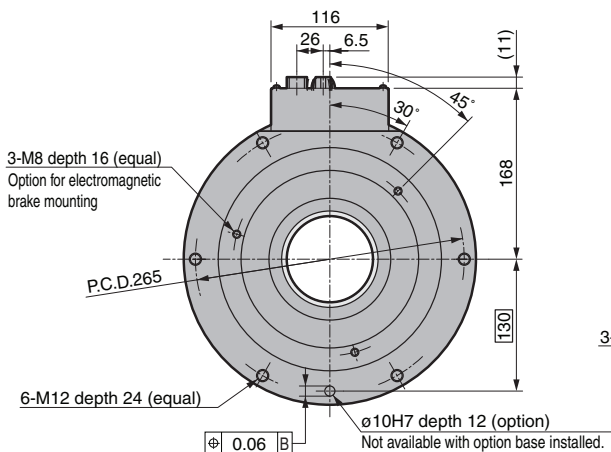
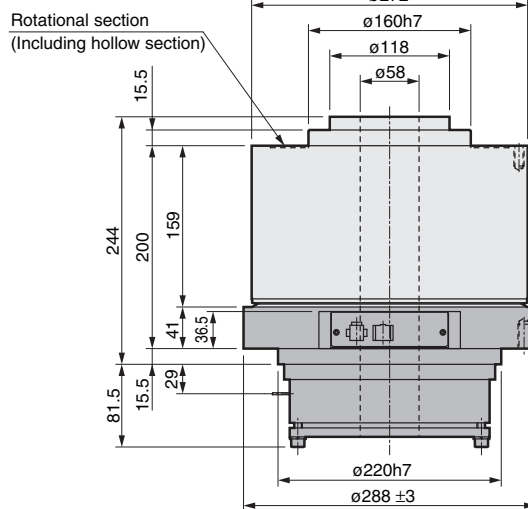
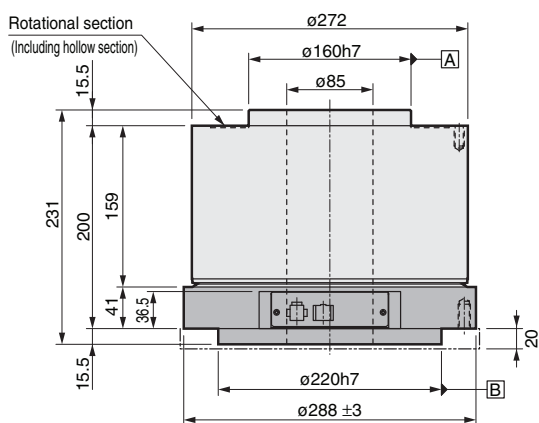
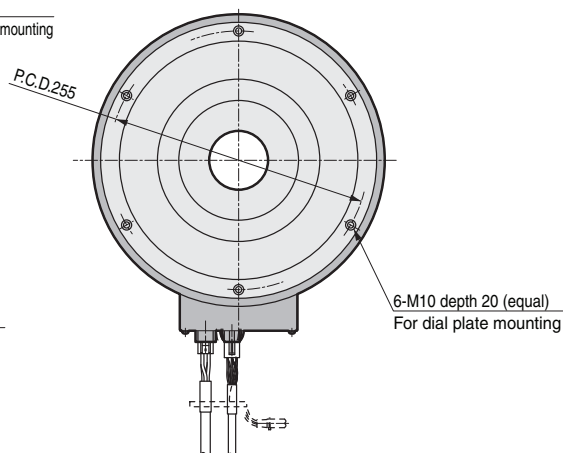
Dimensions

● AX4300G



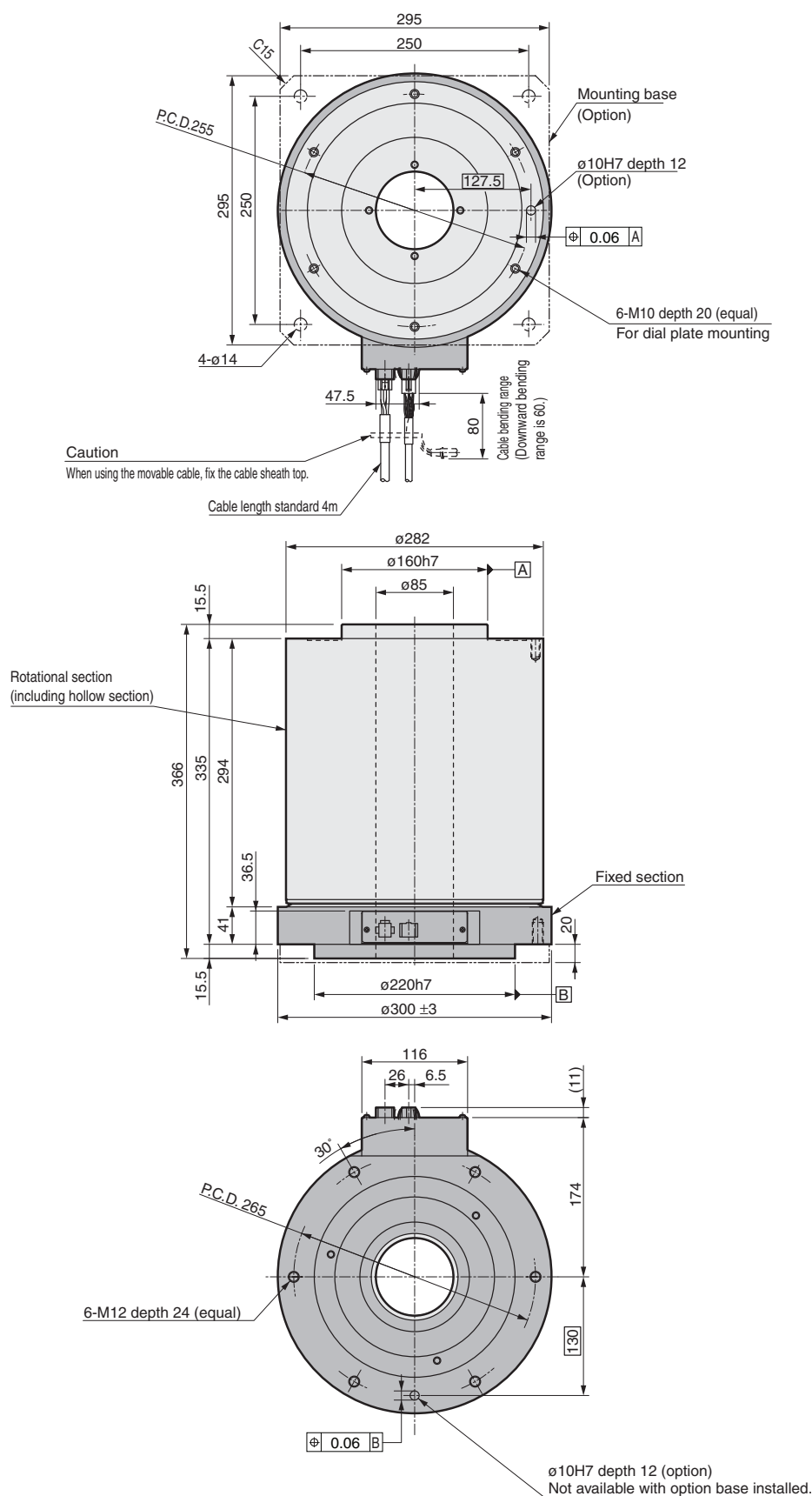
● AX4300G-EB

Electromagnetic brake
Refer to the left fig. for other options.



Dimensions

● AX4500G





Direct drive actuator

AX1000 Series actuator

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

● Maximum torque: 22/45/75/150/210 N·m

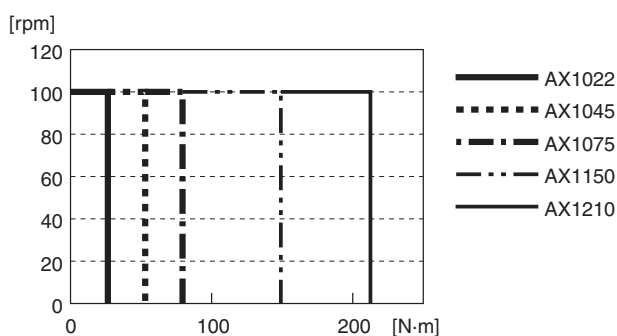
Actuator specifications

Descriptions		AX1022	AX1045	AX1075	AX1150	AX1210
Maximum output torque	N·m	22	45	75	150	210
Continuous power torque	N·m	7	15	25	50	70
Maximum rotational speed	rpm	100 (Note 1)			100	
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	sec.	±15				
Repeatability	sec.	±5				
Output shaft friction torque	N·m	2.0		8.0		
Resolver resolution	P/rev	540672				
Motor insulation grade		Class F				
Motor withstanding voltage		1500V AC for 1 min.				
Motor insulation resistance		10MΩ and over 500V DC				
Ambient temperature range		0 to 45 °C				
Ambient humidity range		20 to 85%RH to be no dew condensation.				
Conservation ambient temperature range		-20 to 80°C				
Conservation ambient humidity range		20 to 90%RH to be no dew condensation.				
Mass	kg	8.9	12.0	23.0	32.0	44.0
Run out of output shaft	mm	0.01				
Surface run out of output shaft	mm	0.01				

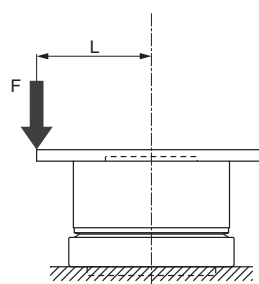
Note 1: Consult with CKD for applications with 100 rpm and over.

(Consult with CKD for customized specifications; up to 150rpm for S type driver in a model with maximum torque 45 N·m or less, while up to 180rpm for H type driver. No change in maximum rotational speed is available after shipment).

Maximum speed/torque characteristics

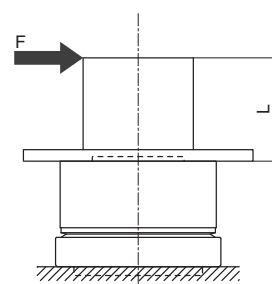


(Note) moment load



(Fig. a)

$M \text{ (N·m)} = F \text{ (N)} \times L \text{ (m)}$
M : moment load
F : load
L : distance from output shaft center

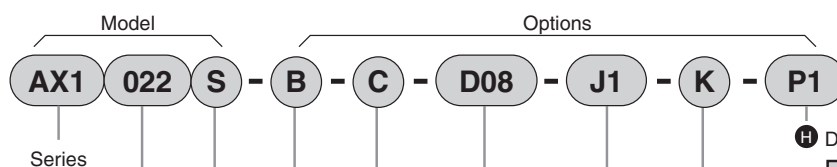


(Fig. b)

$M \text{ (N·m)} = F \text{ (N)} \times (L + 0.02) \text{ (m)}$
M : moment load
F : load
L : distance from output shaft flange plane

⚠ Always read precautions on Intro 13 to 18 before starting use.

How to order



A Size
(Maximum torque)

B Available driver
Note 1

C Mounting base

D Connector installation attitude
Note 2

E Cable change
Note 3

F Driver power supply voltage
Note 1

G CE marking
Note 2

⚠ Note on model no. selection

Note 1: Select a driver according to the following table.

Model	S type driver		H type driver		
	3-200V AC to 230V AC	1-100V AC to 115V AC	3-200V AC	1-100V AC	3-230V AC
AX1022	Blank	J1	Blank	J1	J2
AX1045	Blank	J1	Blank	J1	J2
AX1075	Blank		Blank		J2
AX1150			Blank		J2
AX1210			Blank		J2

*Small and high performance S type driver is recommended for a model with maximum torque 75 N·m or less.

Note 2: Both connector bottom installation (-C) and CE marking product (-K) can not be selected together.

Note 3: If the cable is bended repeatedly, use an optional movable cable.

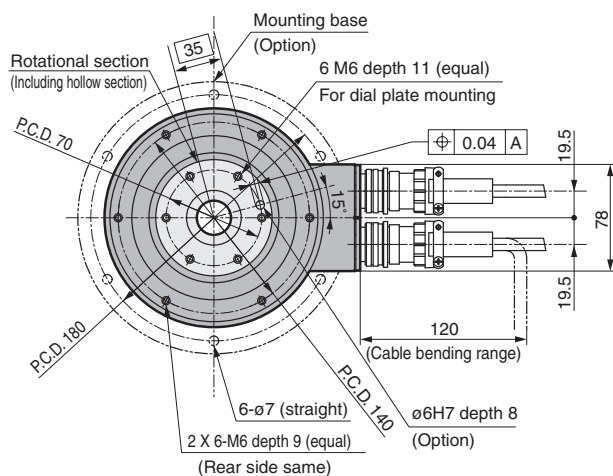
Refer to Page 55 for dimensions of a cable.

Symbol	Content
A Size (maximum torque)	
022	22 N·m
045	45 N·m
075	75 N·m
150	150 N·m
210	210 N·m
B Available driver	
S	With S type driver
H	With H type driver
C Mounting base	
Blank	Standard (without mounting base)
B	With blackening mounting base
D Connector installation attitude	
Blank	Standard (connector horizontal installation)
C	Connector bottom installation
E Cable change	
Blank	Standard (cable length 4m)
D **	Cable length change
DM **	Movable cable length change
** cable length Note: length and type can not be changed after shipment.	
02	2m
Blank	4m -DM
06	6m
08	8m
10	10m
15	15m
20	20m
25	25m
30	30m
[Note] If cable length is 6m and over, use the noise filter for motor cable.	
F Driver power supply voltage	
Refer to the driver power supply voltage table on the left.	
G CE marking	
Blank	Standard (not CE marking products)
K	CE marking products
H Dowel hole	
Blank	Standard (without dowel hole)
P1	Top 1 piece

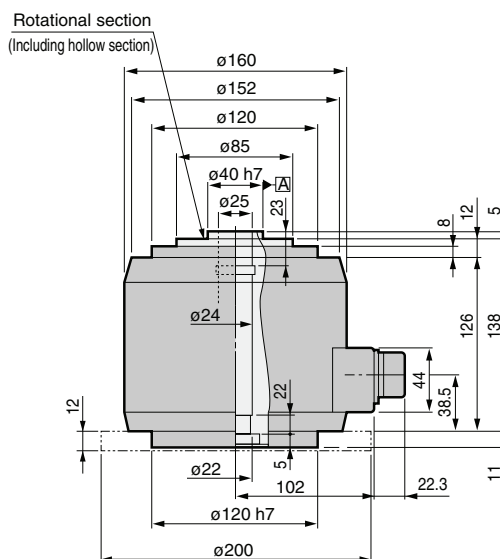
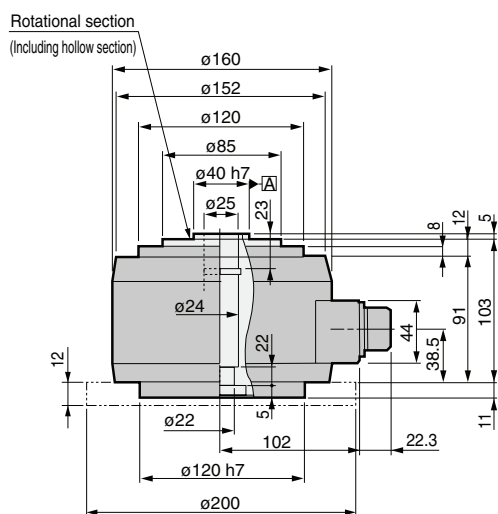
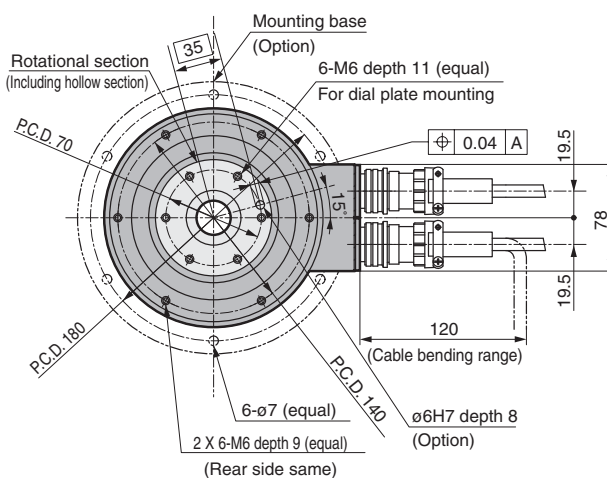
AX1000 Actuator

Dimensions

●AX1022

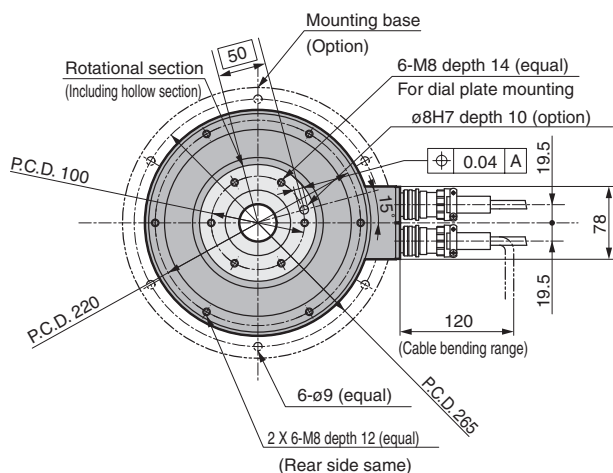


● AX1045

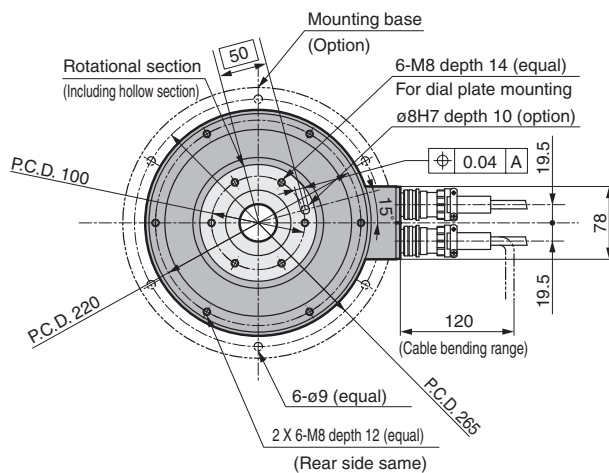


Dimensions

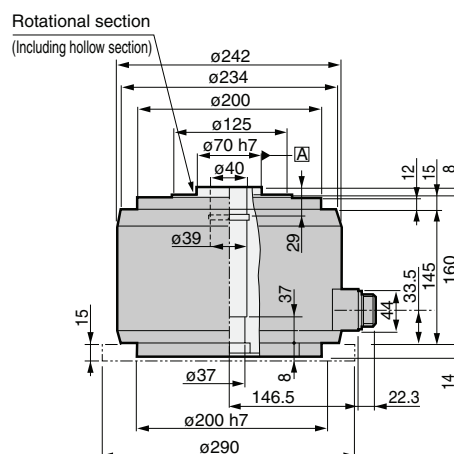
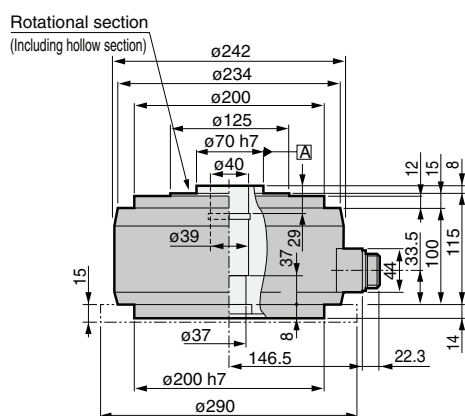
● AX1075



● AX1150

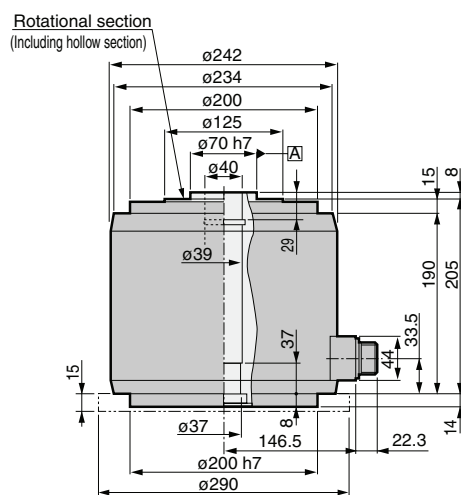
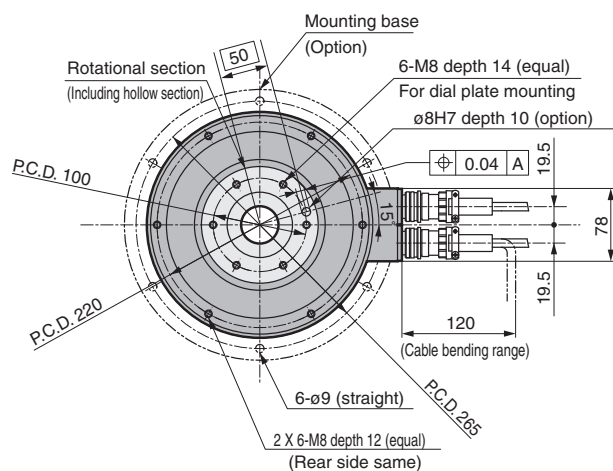


AX1000 Actuator



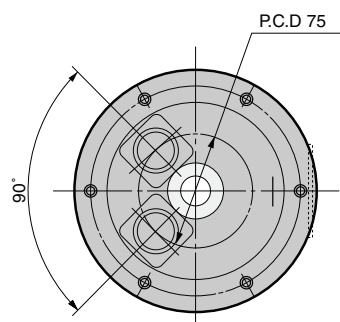
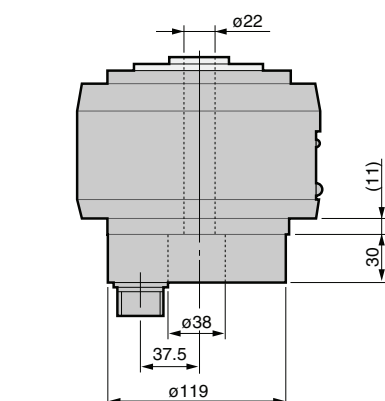
Dimensions

● AX1210

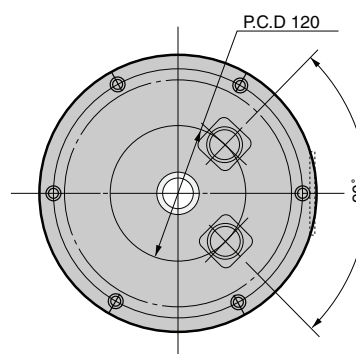
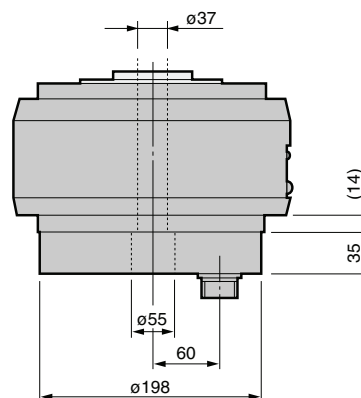


Dimensions with optional equipment

- Connector bottom installation (C)
AX1022/AX1045



- AX1075/AX1150/AX1210





Direct drive actuator

AX2000 Series actuator

Compact with small diameter (AX2006 and AX2012)

Types with fixed hollow shaft (AX2021 and AX2042) are available for easy cable wiring and piping.

● Maximum torque: 6/12/21/42 N·m

Actuator specifications

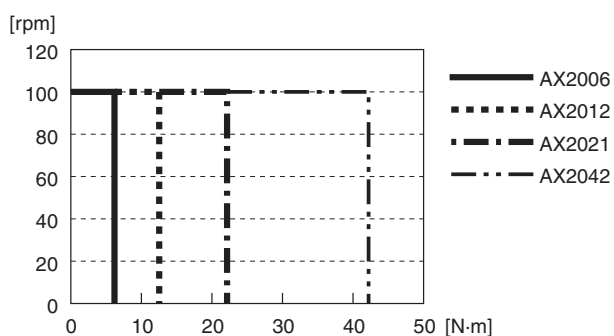
Descriptions		AX2006	AX2012	AX2021	AX2042
Maximum output torque	N·m	6	12	21	42
Continuous power torque	N·m	2	4	7	14
Maximum rotational speed	rpm	100 (Note 1)			
Allowable axial load	N	1000		2000	
Allowable moment load	N·m	40		60	
Output shaft moment of inertia	kg·m ²	0.00575	0.00695	0.03450	0.04830
Allowable load moment of inertia	kg·m ²	0.3	0.4	0.6	0.9
Index accuracy	sec.	±15			
Repeatability	sec.	±5			
Output shaft friction torque	N·m	0.4		3.0	
Resolver resolution	P/rev	540672			
Motor insulation grade		Class F			
Motor withstanding voltage		1500V AC for 1 min.			
Motor insulation resistance		10MΩ and over 500V DC			
Ambient temperature range		0 to 45 °C			
Ambient humidity range		20 to 85%RH to be no dew condensation.			
Conservation ambient temperature range		-20 to 80 °C			
Conservation ambient humidity range		20 to 90%RH to be no dew condensation.			
Mass	kg	4.7	5.8	13.0	17.0
Run out of output shaft	mm	0.03			
Surface run out of output shaft	mm	0.03			

Note 1: A direct drive actuator convertible type (AX2 *** GS) is available for applications with 100 rpm and over.

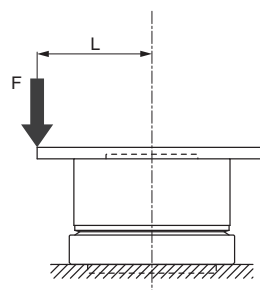
Consult with CKD for customized specifications: up to 150rpm for S type driver, while up to 180rpm for H type driver.

The maximum rotational speed can not be changed after shipment.

Maximum speed/torque characteristics

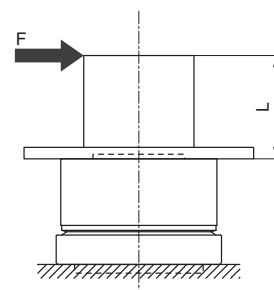


(Note) moment load



(Fig. a)

$M \text{ (N·m)} = F \text{ (N)} \times L \text{ (m)}$
 M : moment load
 F : load
 L : distance from output shaft center

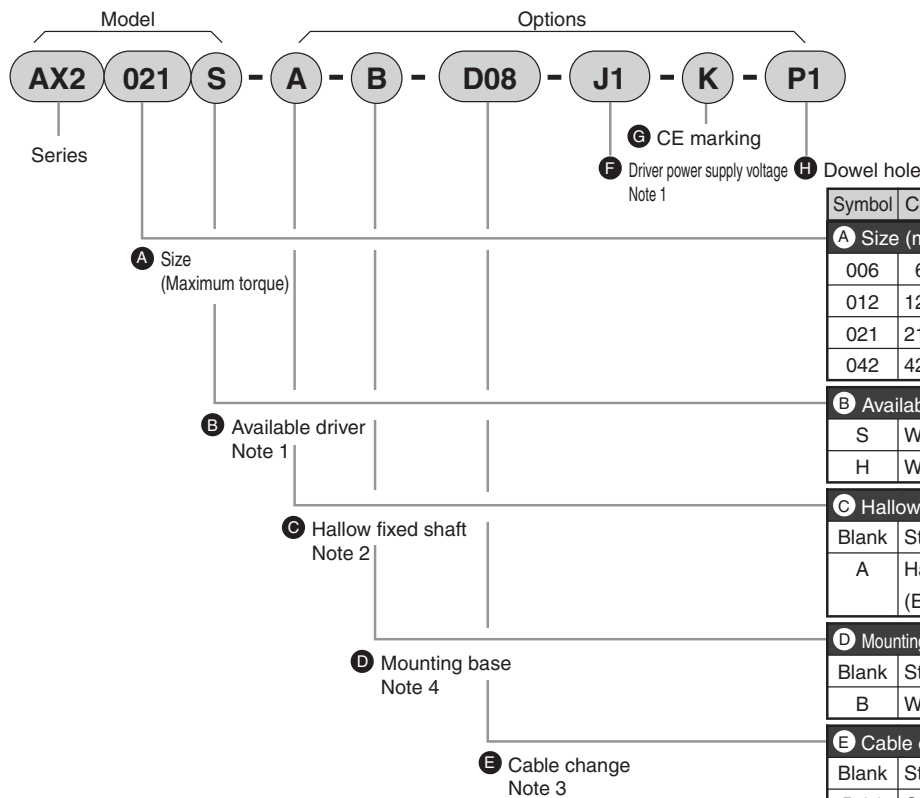


(Fig. b)

$M \text{ (N·m)} = F \text{ (N)} \times (L + 0.02) \text{ (m)}$
 M : moment load
 F : load
 L : distance from output shaft flange plane

⚠ Always read precautions on Intro 13 to 18 before starting use.

How to order



Symbol	Content
A Size (maximum torque)	
006	6 N·m
012	12 N·m
021	21 N·m
042	42 N·m

B Available driver	
S	With S type driver
H	With H type driver

C Hallow fixed shaft	
Blank	Standard
A	Hallow fixed shaft extension (Either AX2021 or AX2042)

D Mounting base (can not use with dowel holes P2 and P3.)	
Blank	Standard (without mounting base)
B	With blackening mounting base

E Cable change	
Blank	Standard (cable length 4m)
D **	Cable length change
DM **	Movable cable length change (Either AX2006 or AX2012 can be selected.)

** cable length Note: length and type can not be changed after shipment.		
02	2m	
Blank	4m	-DM
06	6m	[Note] If cable length is 6m and over, use the noise filter for motor cable.
08	8m	
10	10m	
15	15m	
20	20m	
25	25m	
30	30m	

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

G CE marking	
Blank	Standard (not CE marking products)
K	CE marking products

H Dowel hole (Note 5)	
Blank	Standard (without dowel hole)
P1	Top 1 piece
P2	Bottom 1 piece
P3	Both top and bottom sides 1 piece each

Note on model no. selection

Note 1: Select a driver according to the following table.

Model	S type driver		H type driver		
	3-200V AC to 230V AC	1-100V AC to 115V AC	3-200V AC	1-100V AC	3-230V AC
AX2006	Blank	J1	Blank	J1	J2
AX2012	Blank	J1	Blank	J1	J2
AX2021	Blank	J1	Blank	J1	J2
AX2042	Blank	J1	Blank	J1	J2

*Small and high performance S type driver is recommended.

Note 2: Select options according to the following [option table].

Option table		AX2006	AX2012	AX2021	AX2042
Hallow fixed shaft (-A)		×	×	○	○
Robot cable (-DM)		○	○	×	×
Dowel hole	Top 1 piece (-P1)	○	○	○	○
	Bottom 1 piece (-P2)	○	○	×	×
	Both top and bottom sides 1 piece each (-P3)	○	○	×	×

Note 3: If the cable is bended repeatedly, use an optional movable cable.

(Either AX2006 or AX2012 can be selected.)

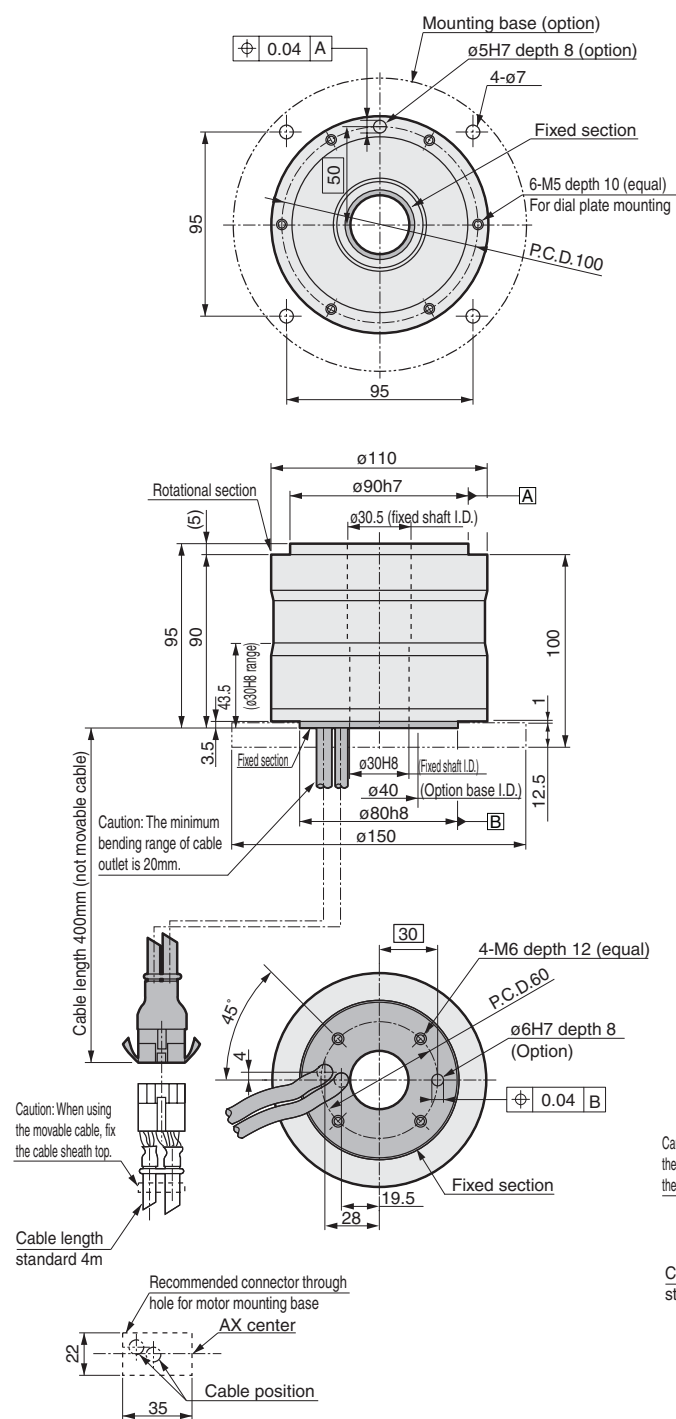
Refer to Page 55 for dimensions of a cable.

Note 4: If section D mounting base is "B"; with blackening mounting base, "P2" and "P3" can not be selected.

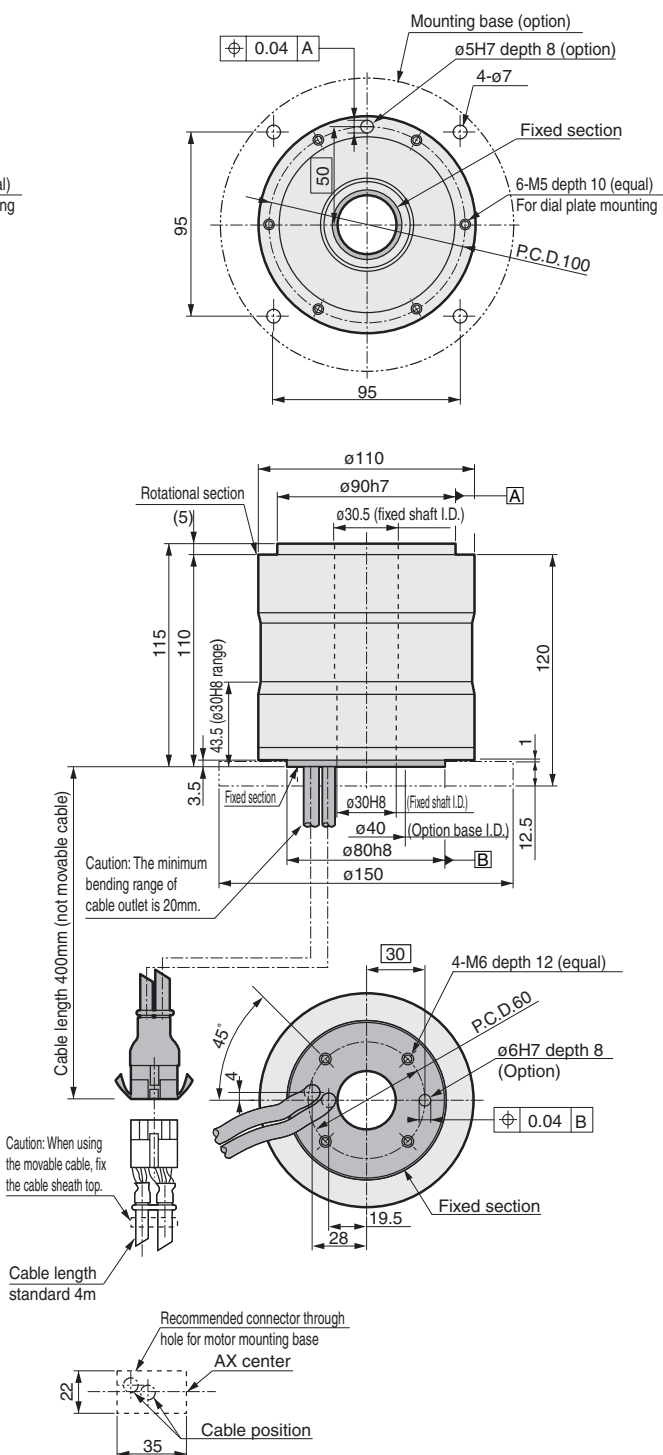
Note 5: No surface treatment may be provided for additionally machined section.

Dimensions

● AX2006



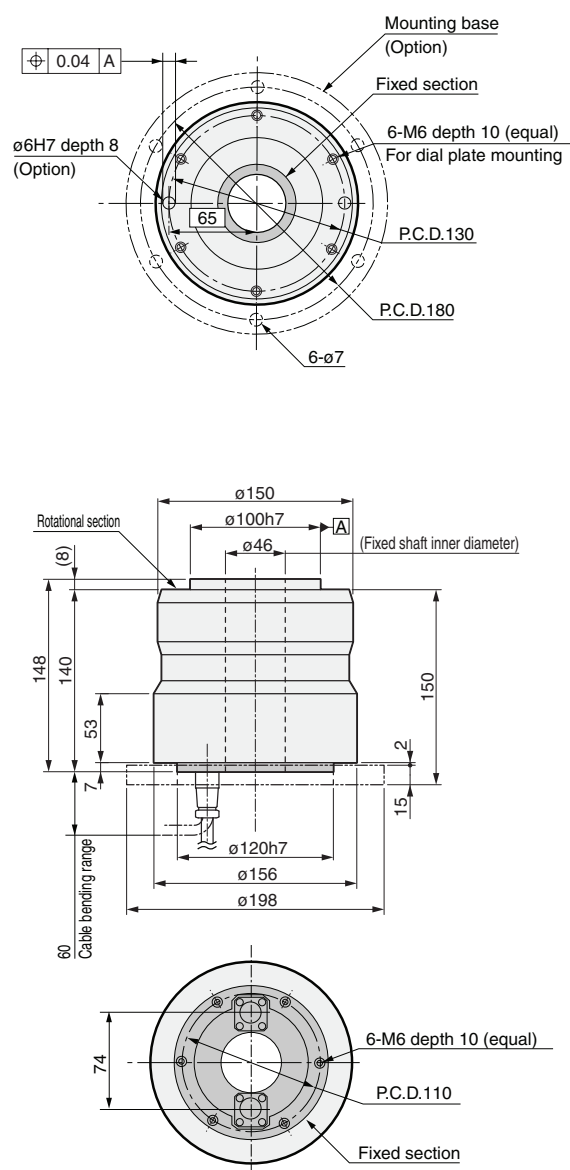
● AX2012



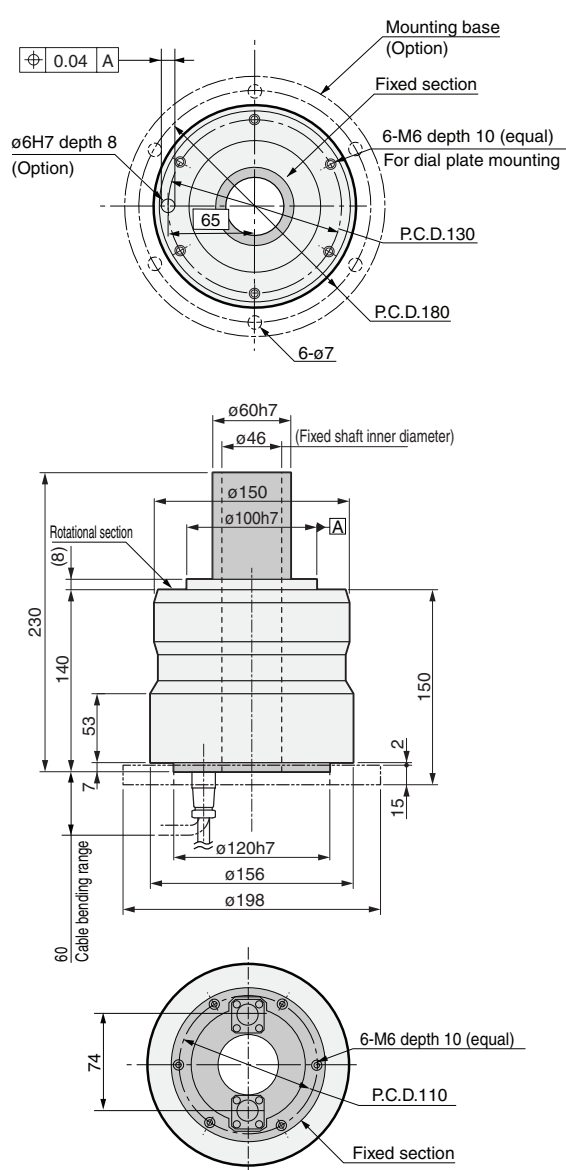
Note: The minimum bending range of a cable outlet is 20.

Dimensions

● AX2021



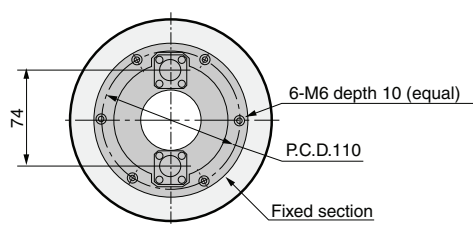
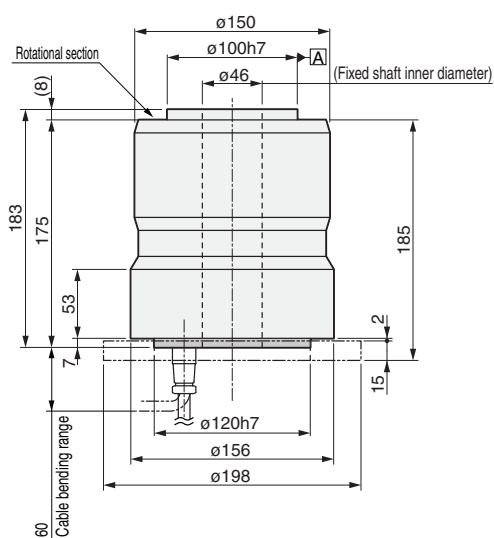
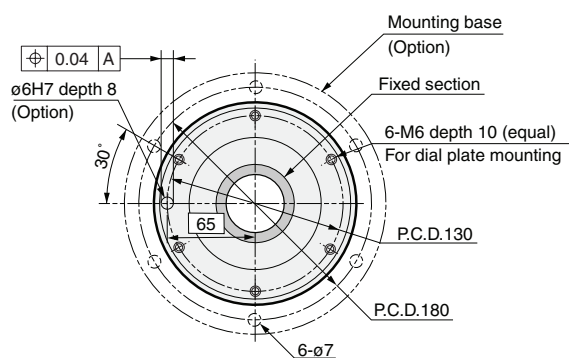
● AX2021-A



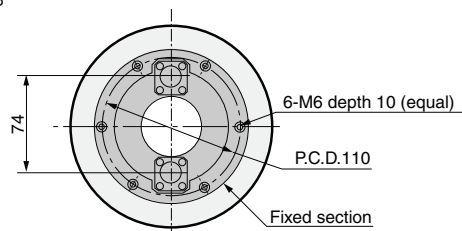
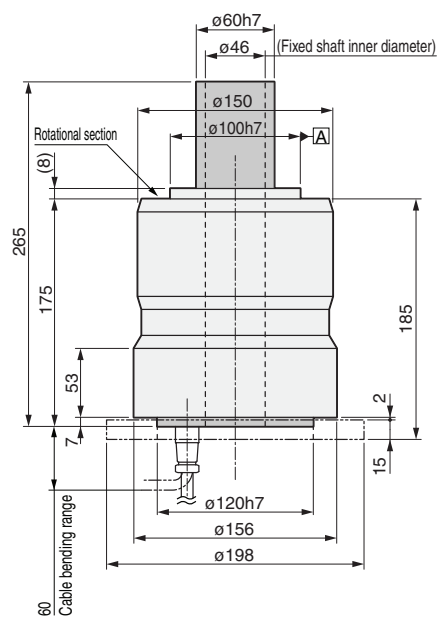
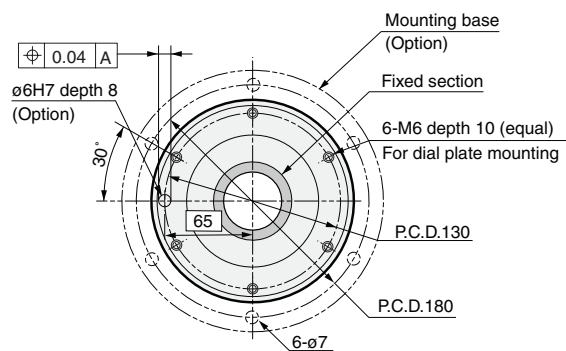
AX2000
Actuator

Dimensions

● AX2042

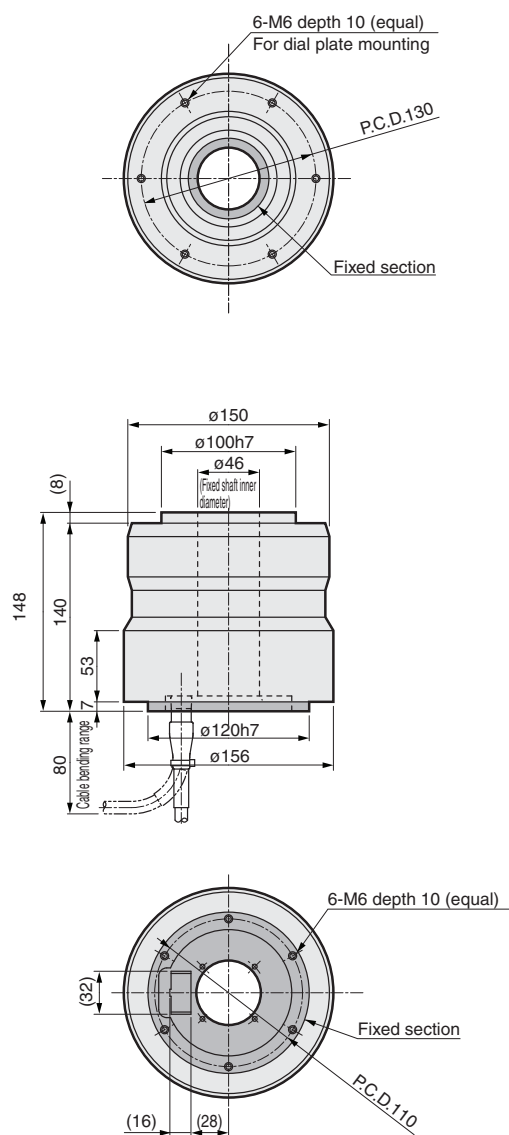


● AX2042-A

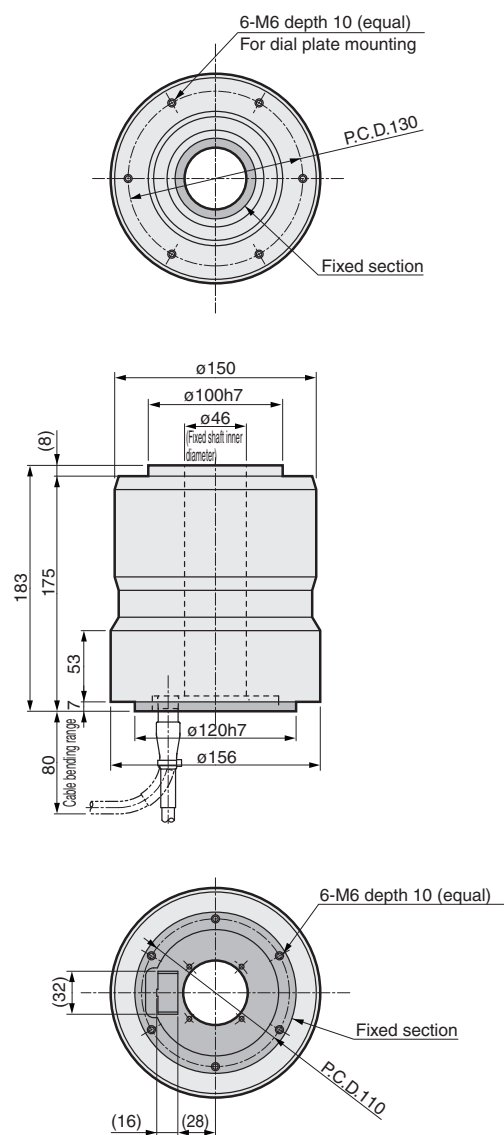


CE marking products dimensions

● AX2021-K



● AX2042-K



AX2000
Actuator



Direct drive actuator

AX4000 Series actuator

Large hollow shaft diameter for easy cable wiring and piping

A great variety of series variation and options

● Maximum torque: 9/22/45/75/150/300/500 N·m

Actuator specifications

Descriptions		AX4009	AX4022	AX4045	AX4075	AX4150	AX4300	AX4500
Maximum output torque	N·m	9	22	45	75	150	300	500
Continuous power torque	N·m	3	7	15	25	50	100	160
Maximum rotational speed	rpm	100 (Note 1)			100			70
Allowable axial load	N	800	3700		20000			
Allowable moment load	N·m	40	60	80	200	300	400	500
Output shaft moment of inertia	kg·m ²	0.0090	0.0206	0.0268	0.1490	0.2120	0.3260	0.7210
Allowable load moment of inertia	kg·m ²	0.35	0.60	0.90	5.00	7.50	18.00	30.00
Index accuracy	sec.				±30			
Repeatability	sec.				±5			
Output shaft friction torque	N·m	0.8	3.5		10.0			15.0
Resolver resolution	P/rev	540672						
Motor insulation grade		Class F						
Motor withstanding voltage		1500V AC for 1 min.						
Motor insulation resistance		10MΩ and over 500V DC						
Ambient temperature range		0 to 45 °C						
Ambient humidity range		20 to 85%RH to be no dew condensation.						
Conservation ambient temperature range		-20 to 80°C						
Conservation ambient humidity range		20 to 90%RH to be no dew condensation.						
Mass	kg	5.5	12.3	15.0	36.0	44.0	66.0	115.0
Brake set total mass	kg	-	16.4	19.3	54.0	63.0	86.0	-
Run out of output shaft	mm	0.03						
Surface run out of output shaft	mm	0.05						

Note 1: A direct drive actuator convertible type (AX4 *** GS) is available for applications with 100 rpm and over.

Consult with CKD for customized specifications; up to 150rpm for S type driver, while up to 180rpm for H type driver in a model with maximum torque 45 N·m or less. The maximum rotational speed can not be changed after shipment.

Electromagnetic brake specifications (option)

Descriptions	Applicable model	AX4022/AX4045	AX4075/AX4150/AX4300
Type		Non-backrush dry type deenergisation operation model	
Rated voltage	V	24V DC	
Power supply wattage	W	30	55
Rated current	A	1.25	2.3
Static friction torque	N·m	35	200
Amateur disengage time (brake on)	msec.	50 or less	50 or less
Amateur suction time (brake off)	msec.	150 or less	250 or less
Holding accuracy	min.	Below 45	
Maximum cycle rate	cycle/min.	60	40

Note 2: When rotating the output shaft, a rubbing noise between the disk and the fixed section of electromagnetic brake may be made.

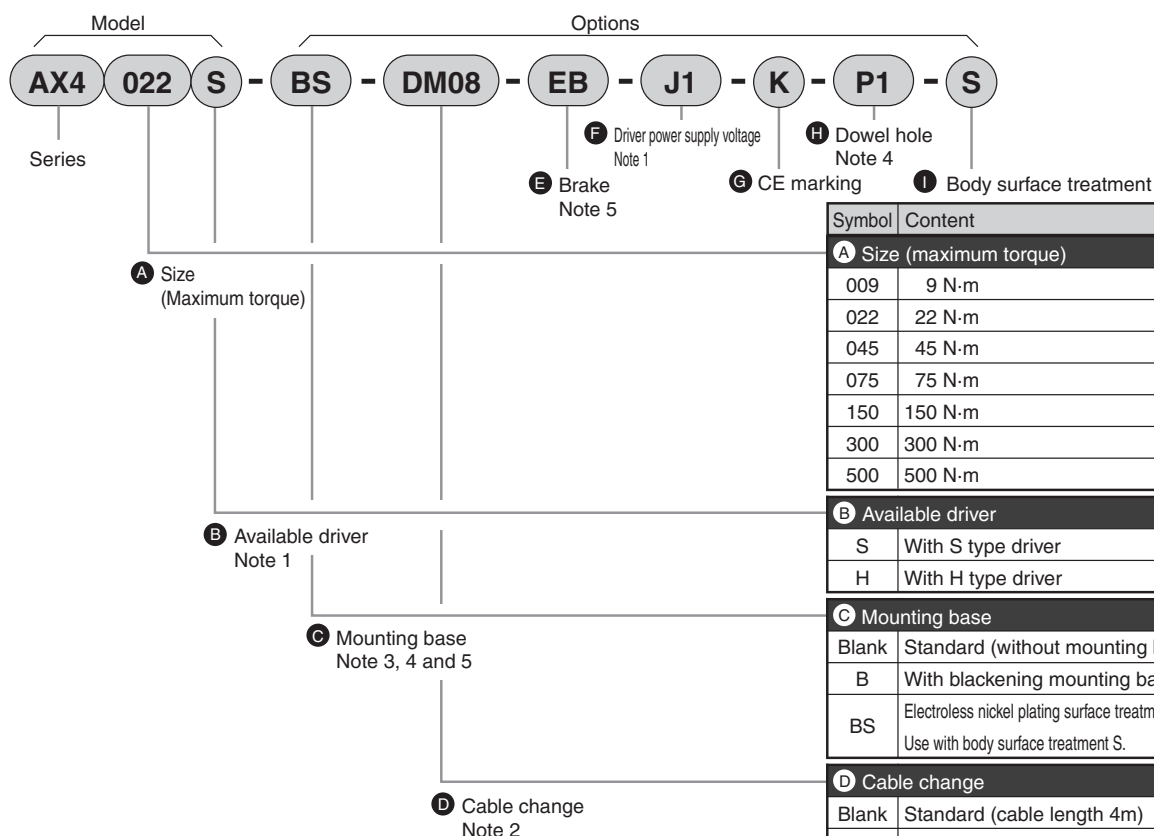
Note 3: In movement after brake off, delay time of a parameter must be changed per above amateur suction time.

Note 4: Non-backlash type is used, however, if a load is applied in the rotational direction, fixed position holding will be difficult.

Note 5: The amateur may contact to the electromagnetic brake fixed section during electromagnetic brake applied, making a noise.

 Always read precautions on Intro 13 to 18 before starting use.

How to order



⚠ Note on model no. selection

Note 1: Select a driver according to the following table.

Model	S type driver		H type driver		
	3-200V AC to 230V AC	1-100V AC to 115V AC	3-200V AC	1-100V AC	3-230V AC
AX4009	Blank	J1	Blank	J1	J2
AX4022	Blank	J1	Blank	J1	J2
AX4045	Blank	J1	Blank	J1	J2
AX4075	Blank		Blank		J2
AX4150			Blank		J2
AX4300			Blank		J2
AX4500			Blank		J2

*Small and high performance S type driver is recommended for a model with maximum torque 75 N-m or less.

Note 2: If the cable is bended repeatedly, use an optional movable cable.

Refer to Page 55 for dimensions of a cable.

Note 3: Specify body surface and mounting base treatments in both sections C and I.

Note 4: If section C mounting base is "B"; with blackening mounting base or "BS"; electroless nickel plating surface treatment mounting base, "P2" and "P3" can not be selected.

Note 5: Select options according to the following [option table].

Option table

	AX4009	AX4022	AX4045	AX4075	AX4150	AX4300	AX4500
Mounting base (-B)	x	○	○	○	○	○	○
Mounting base (-BS)	x	○	○	○	○	○	○
Brake (-EB)	x	○	○	○	○	○	x

Note 6: No surface treatment may be provided for additionally machined section.

Symbol	Content
A Size (maximum torque)	
009	9 N-m
022	22 N-m
045	45 N-m
075	75 N-m
150	150 N-m
300	300 N-m
500	500 N-m

B Available driver	
S	With S type driver
H	With H type driver

C Mounting base	
Blank	Standard (without mounting base)
B	With blackening mounting base
BS	Electroless nickel plating surface treatment mounting base Use with body surface treatment S.

D Cable change	
Blank	Standard (cable length 4m)
D **	Cable length change
DM **	Movable cable length change

** cable length Note: length and type can not be changed after shipment.		
02	2m	
Blank	4m	-DM
06	6m	[Note] If cable length is 6m and over, use the noise filter for motor cable.
08	8m	
10	10m	
15	15m	
20	20m	
25	25m	
30	30m	

E Brake	
Blank	Standard (without brake)
EB	Negative actuation model electromagnetic brake (Not available for AX4009 and AX4500)

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

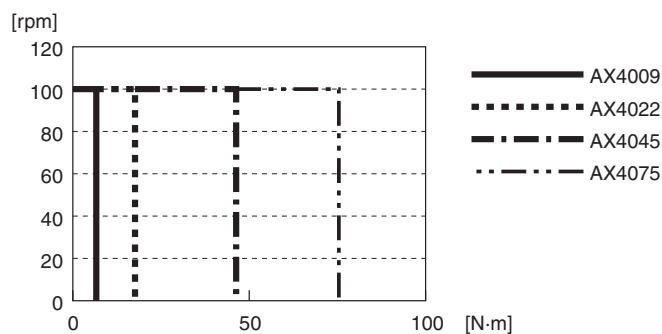
G CE marking	
Blank	Standard (not CE marking products)
K	CE marking products

H Dowel hole (Note 6)	
Blank	Standard (without dowel hole)
P1	Top 1 piece
P2	Bottom 1 piece (AX4009: bottom 2 pieces.)
P3	Both top and bottom sides 1 piece each (AX4009: top 1 piece/bottom 2 pieces.)

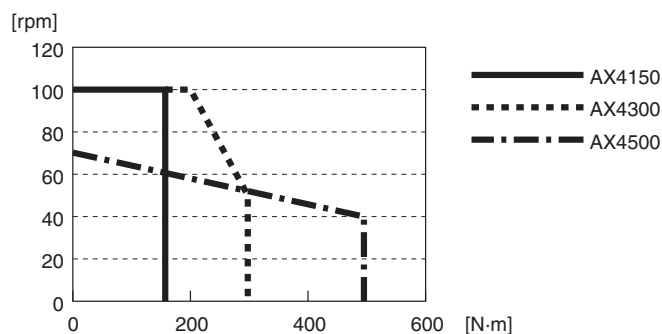
I Body surface treatment	
Blank	Standard (rotational section-blackening/fixed section casting surface plane-paint)
S	Rotational section-electroless nickel plating treatment and fixed section-nitriding

Maximum speed/torque characteristics

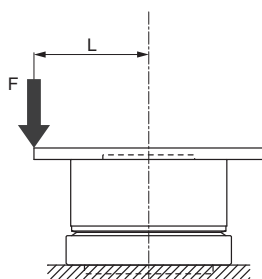
● AX4009, AX4022, AX4045 and AX4075



● AX4150, AX4300, AX4500

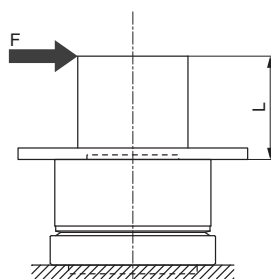


(Note) moment load



(Fig. a)

$M \text{ (N·m)} = F \text{ (N)} \times L \text{ (m)}$
 M : moment load
 F : load
 L : distance from output shaft center

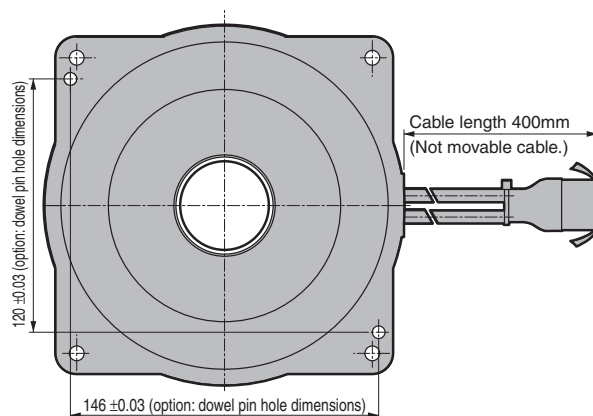
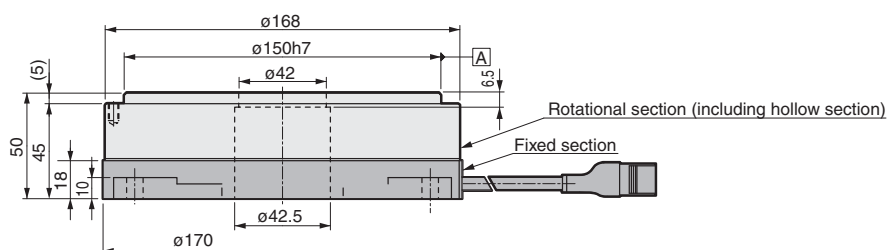
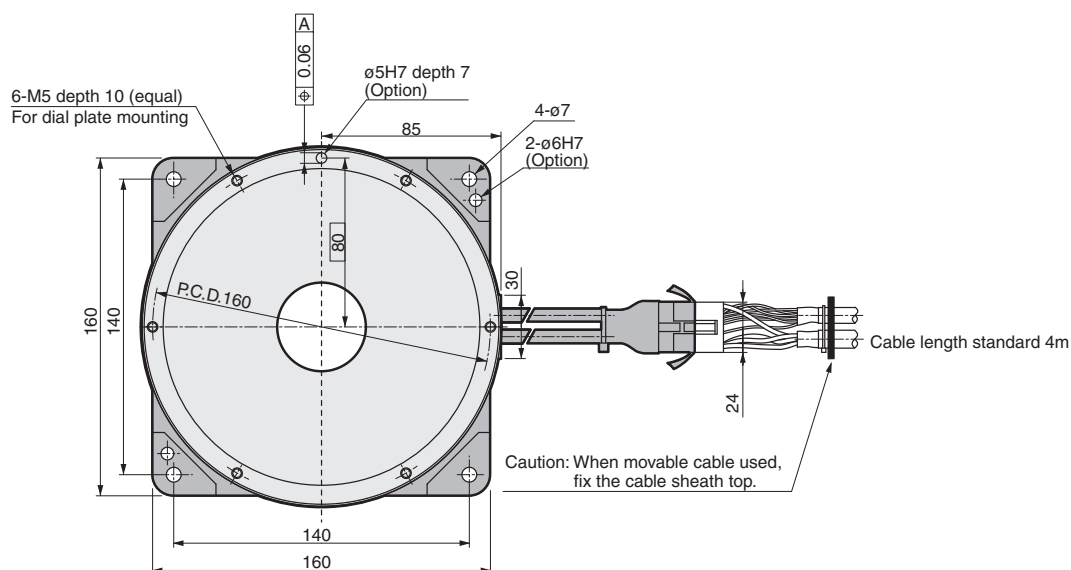


(Fig. b)

$M \text{ (N·m)} = F \text{ (N)} \times (L + 0.02) \text{ (m)}$
 M : moment load
 F : load
 L : distance from output shaft flange plane

Dimensions

● AX4009

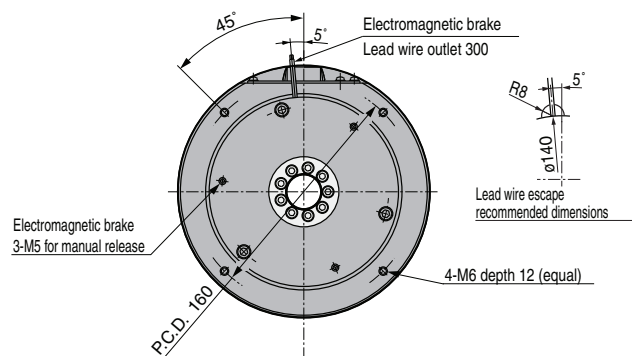
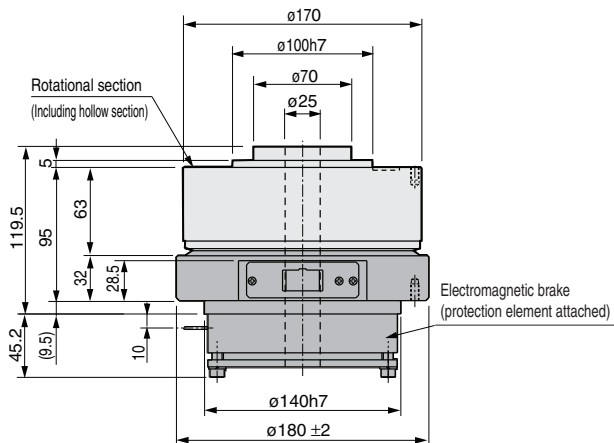
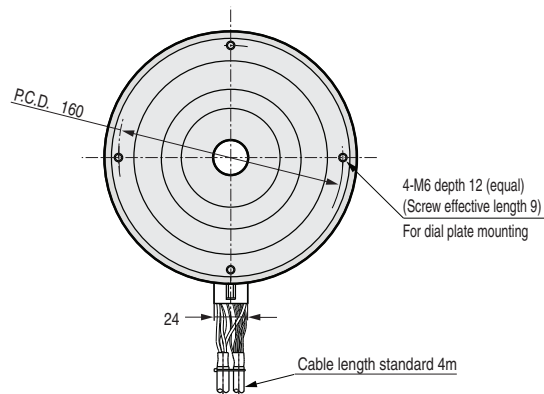


AX4000

Actuator

● AX4022-EB

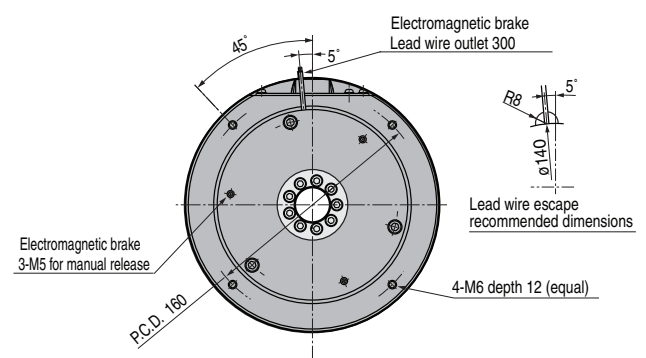
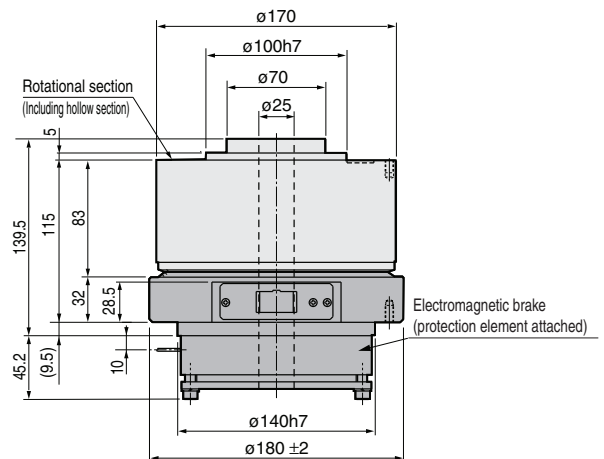
Refer to the left fig. for other options.



● AX4045

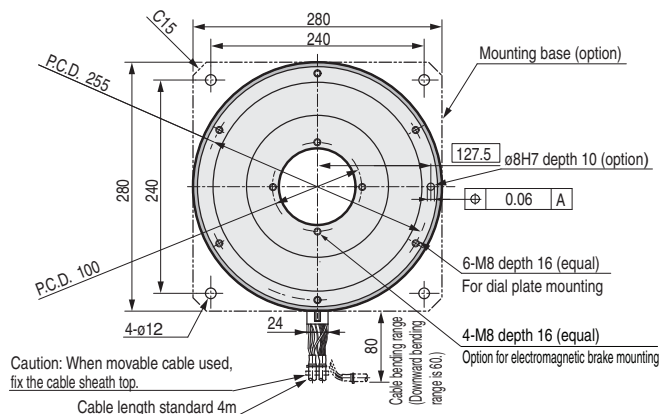


Refer to the left fig. for other options.



Dimensions

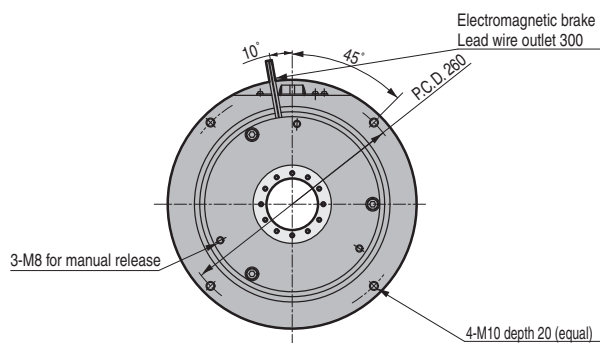
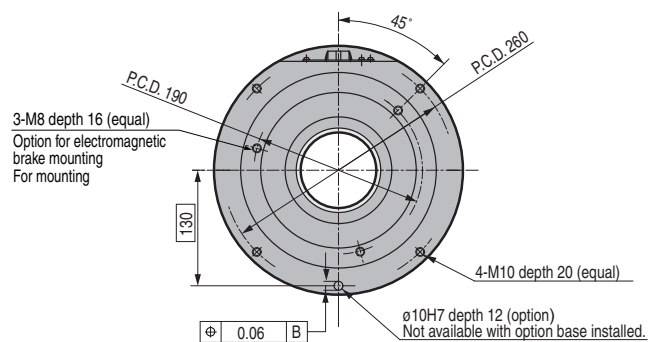
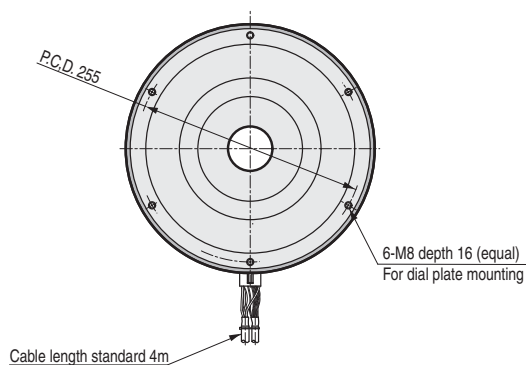
● AX4075



● AX4075-EB

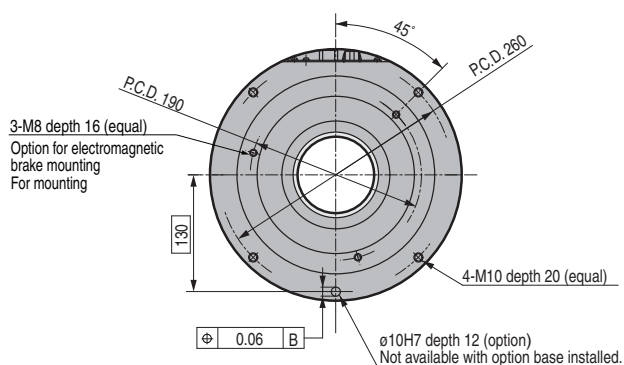
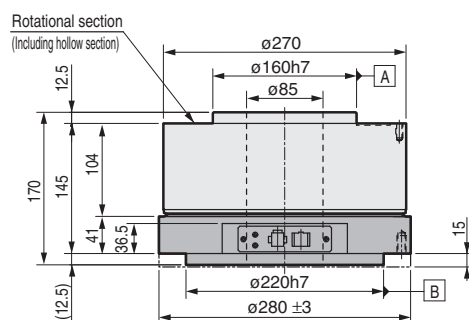
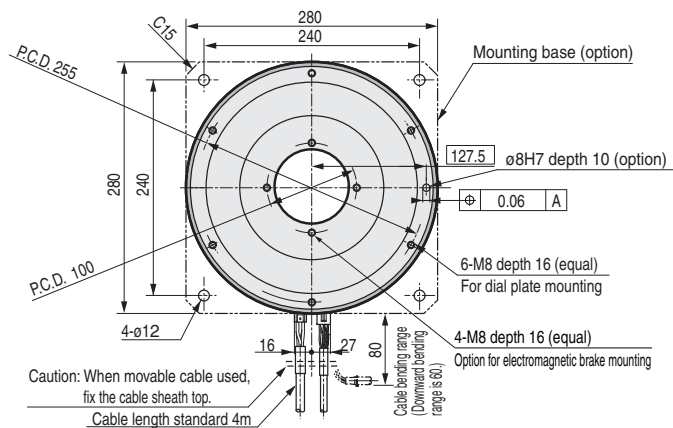
Electromagnetic brake

Refer to the left fig. for other options.



Dimensions

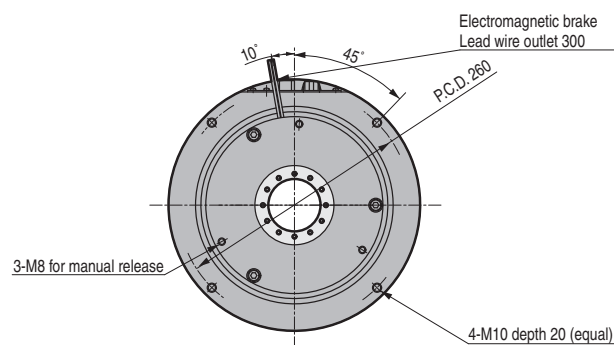
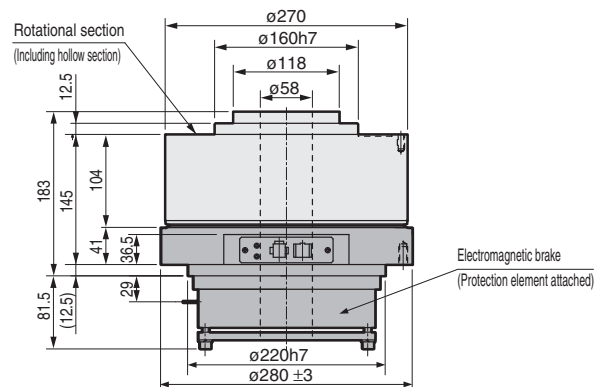
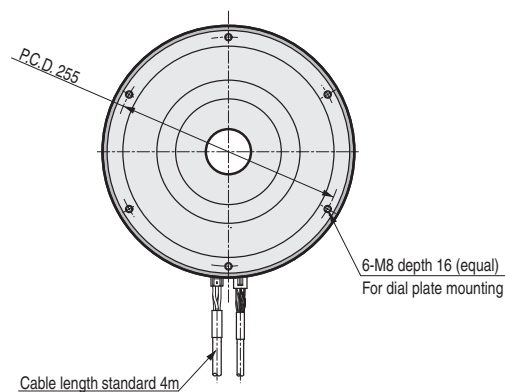
● AX4150



● AX4150-EB

Electromagnetic brake

Refer to the left fig. for other options.

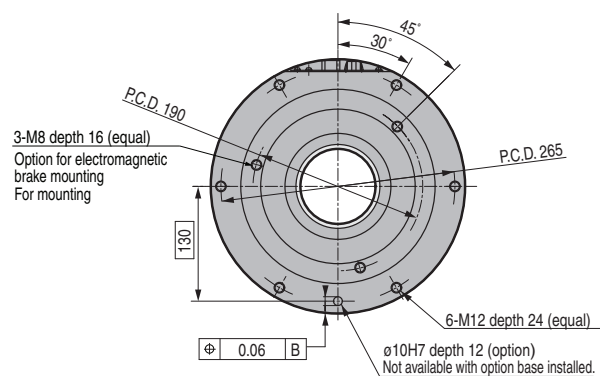
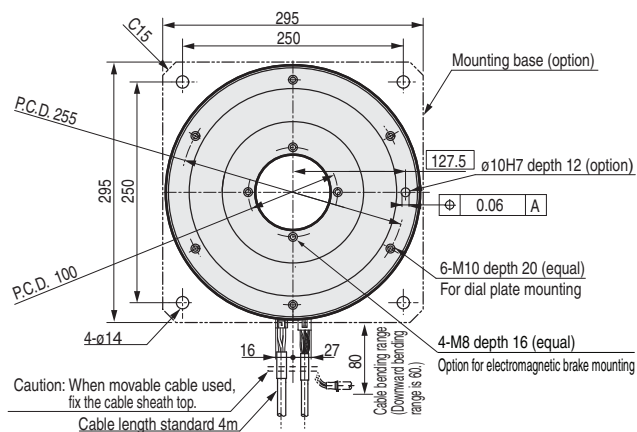


AX4000

Actuator

Dimensions

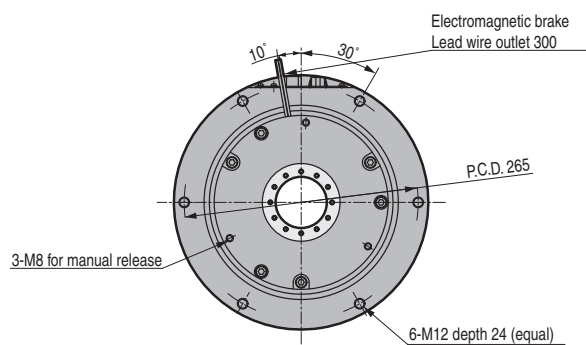
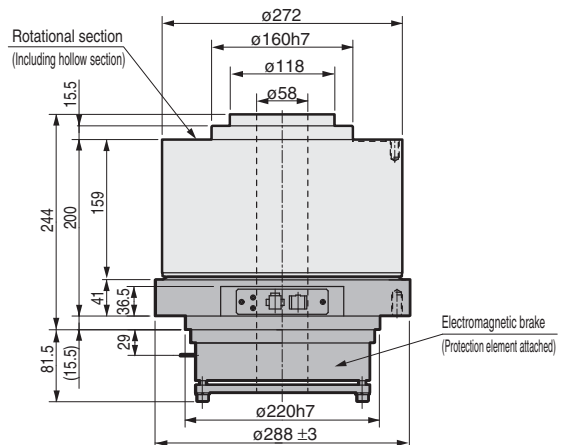
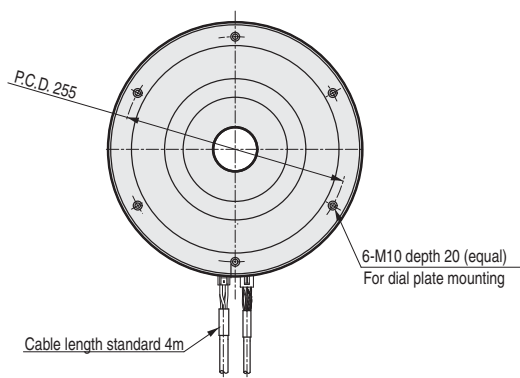
● AX4300



● AX4300-EB

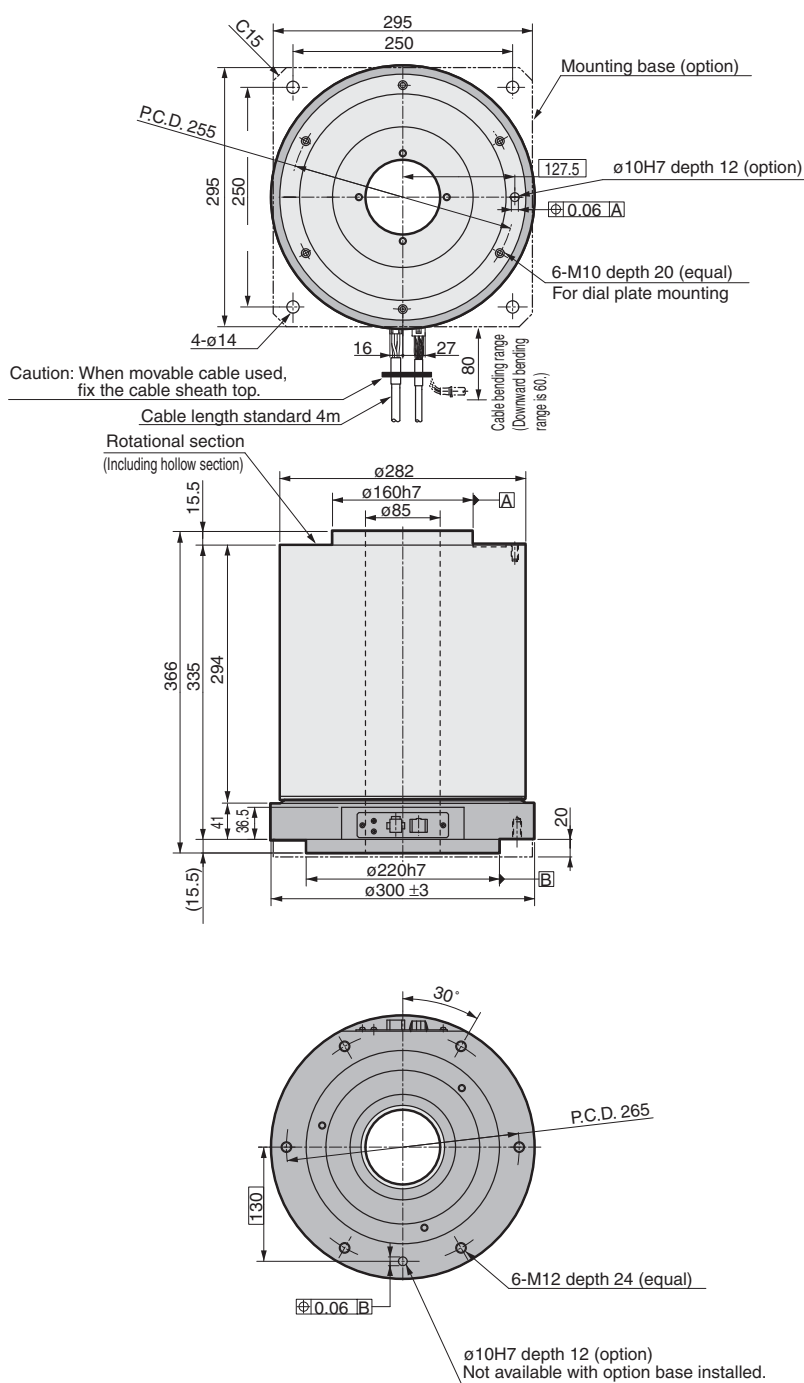
Electromagnetic brake

Refer to the left fig. for other options.



Dimensions

● AX4500



AX4000

Actuator



Direct drive actuator

AX5000 Series actuator

It is appropriate for a work that load applied after stop, since a pneumatic brake is integrated, the output shaft is clamped when stopped.

● Maximum torque: 22/45/75/150/210 N·m

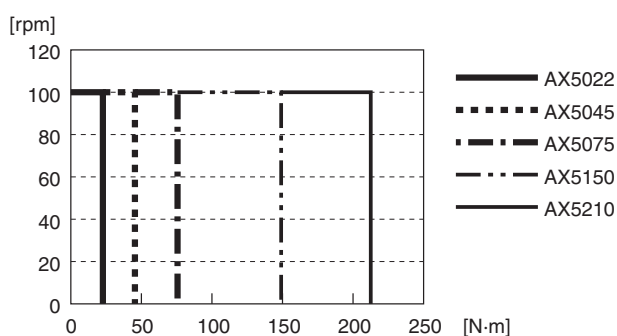
Actuator specifications

Descriptions		AX5022	AX5045	AX5075	AX5150	AX5210
Maximum output torque	N·m	22	45	75	150	210
Continuous power torque	N·m	7	15	25	50	70
Maximum rotational speed	rpm	100 (Note 1)		100		
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	0.0056	0.0085	0.0403	0.0619	0.0987
Allowable load moment of inertia	kg·m ²	0.6	0.9	4.0	6.0	10.0
Index accuracy	sec.	±15				
Repeatability	sec.	±5				
Output shaft friction torque	N·m	2.0		8.0		
Resolver resolution	P/rev	540672				
Motor insulation grade		Class F				
Motor withstanding voltage		1500V AC for 1 minute				
Motor insulation resistance		10MΩ and over 500V DC				
Ambient temperature range		0 to 45 °C				
Ambient humidity range		20 to 85%RH to be no dew condensation.				
Conservation ambient temperature range		-20 to 80 °C				
Conservation ambient humidity range		20 to 90%RH to be no dew condensation.				
Mass	kg	16.0	20.0	40.0	50.0	65.0
Run out of output shaft	mm	0.01				
Surface run out of output shaft	mm	0.01				
Brake torque	N·m	45		150		210

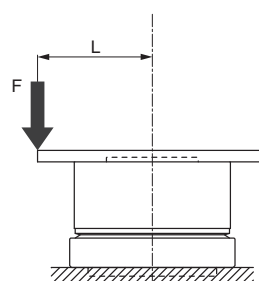
Note 1: Consult with CKD for applications with 100 rpm and over.

(Consult with CKD for customized specifications; up to 150rpm for S type driver in a model with maximum torque 45 N·m or less, while up to 180rpm for H type driver. No change in maximum rotational speed is available after shipment).

Maximum speed/torque characteristics

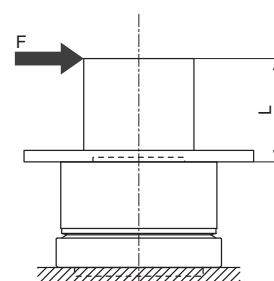


(Note) moment load



(Fig. a)

$M \text{ (N·m)} = F \text{ (N)} \times L \text{ (m)}$
M : moment load
F : load
L : distance from output shaft center

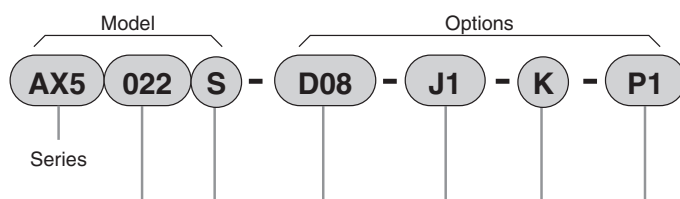


(Fig. b)

$M \text{ (N·m)} = F \text{ (N)} \times (L + 0.02) \text{ (m)}$
M : moment load
F : load
L : distance from output shaft flange plane

⚠ Always read precautions on Intro 13 to 18 before starting use.

How to order



A Size
(Maximum torque)

B Available driver
Note 1

C Cable change

D Driver power supply voltage
Note 1

E CE marking

F Dowel hole

Symbol	Content
A Size (maximum torque)	
022	22 N·m
045	45 N·m
075	75 N·m
150	150 N·m
210	210 N·m
B Available driver	
S	With S type driver
H	With H type driver
C Cable change	
Blank	Standard (cable length 4m)
D **	Cable length change
DM **	Movable cable length change
** cable length Note: length and type can not be changed after shipment.	
02	2m
Blank	4m -DM
06	6m
08	8m
10	10m
15	15m
20	20m
25	25m
30	30m
[Note] If cable length is 6m and over, use the noise filter for motor cable.	
D Driver power supply voltage	
Refer to the following drivers power supply voltages tables.	
E CE marking	
Blank	Standard (not CE marking products)
K	CE marking products
F Dowel hole	
Blank	Standard (without dowel hole)
P1	Top 1 piece

⚠ Note on model no. selection

Note 1: Select a driver according to the following table.

Model	S type driver		H type driver		
	3-200V AC to 230V AC	1-100V AC to 115V AC	3-200V AC	1-100V AC	3-230V AC
AX5022	Blank	J1	Blank	J1	J2
AX5045	Blank	J1	Blank	J1	J2
AX5075	Blank		Blank		J2
AX5150			Blank		J2
AX5210			Blank		J2

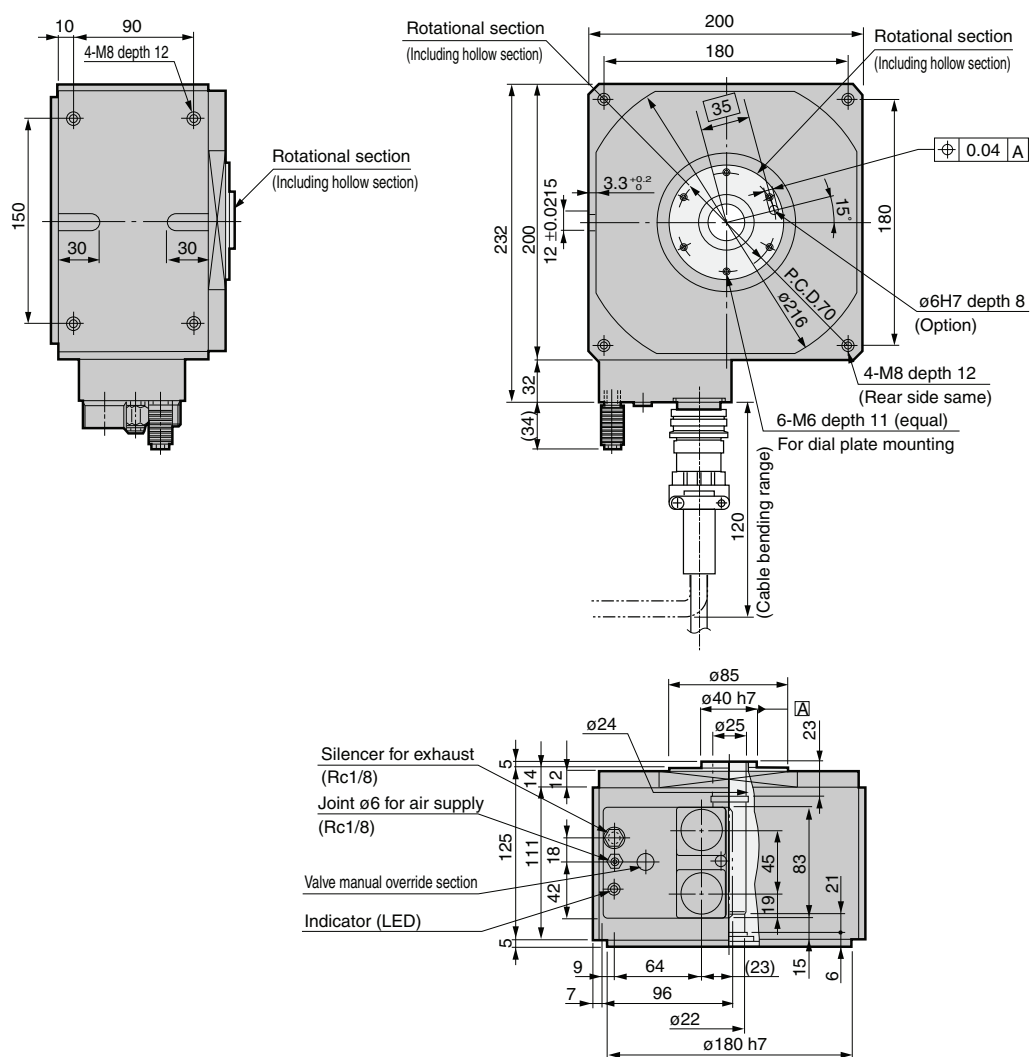
*Small and high performance S type driver is recommended for a model with maximum torque 75 N·m or less.

Note 2: If the cable is bended repeatedly, use an optional movable cable.

Refer to Page 55 for dimensions of a cable.

Dimensions

● AX5022

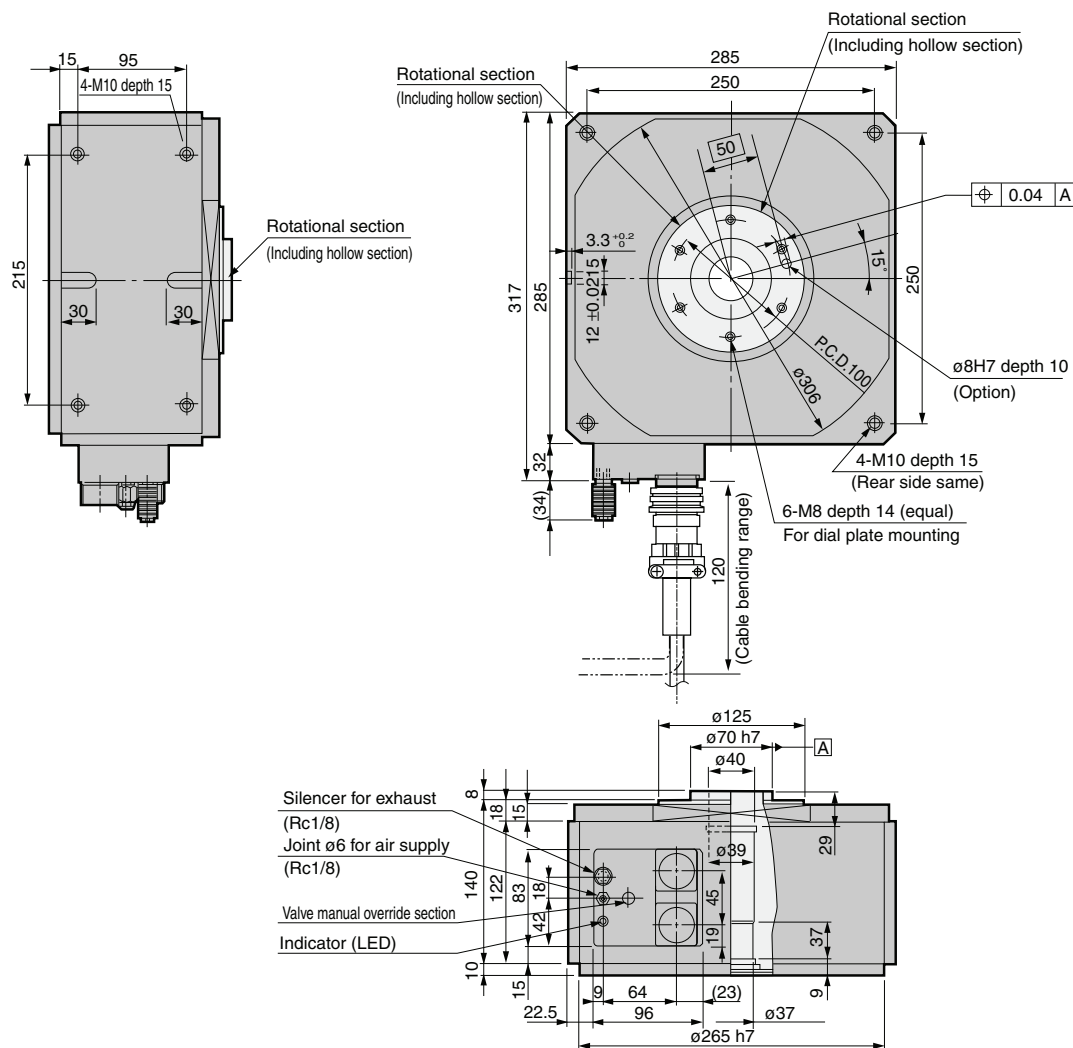


● AX5045



Dimensions

● AX5075

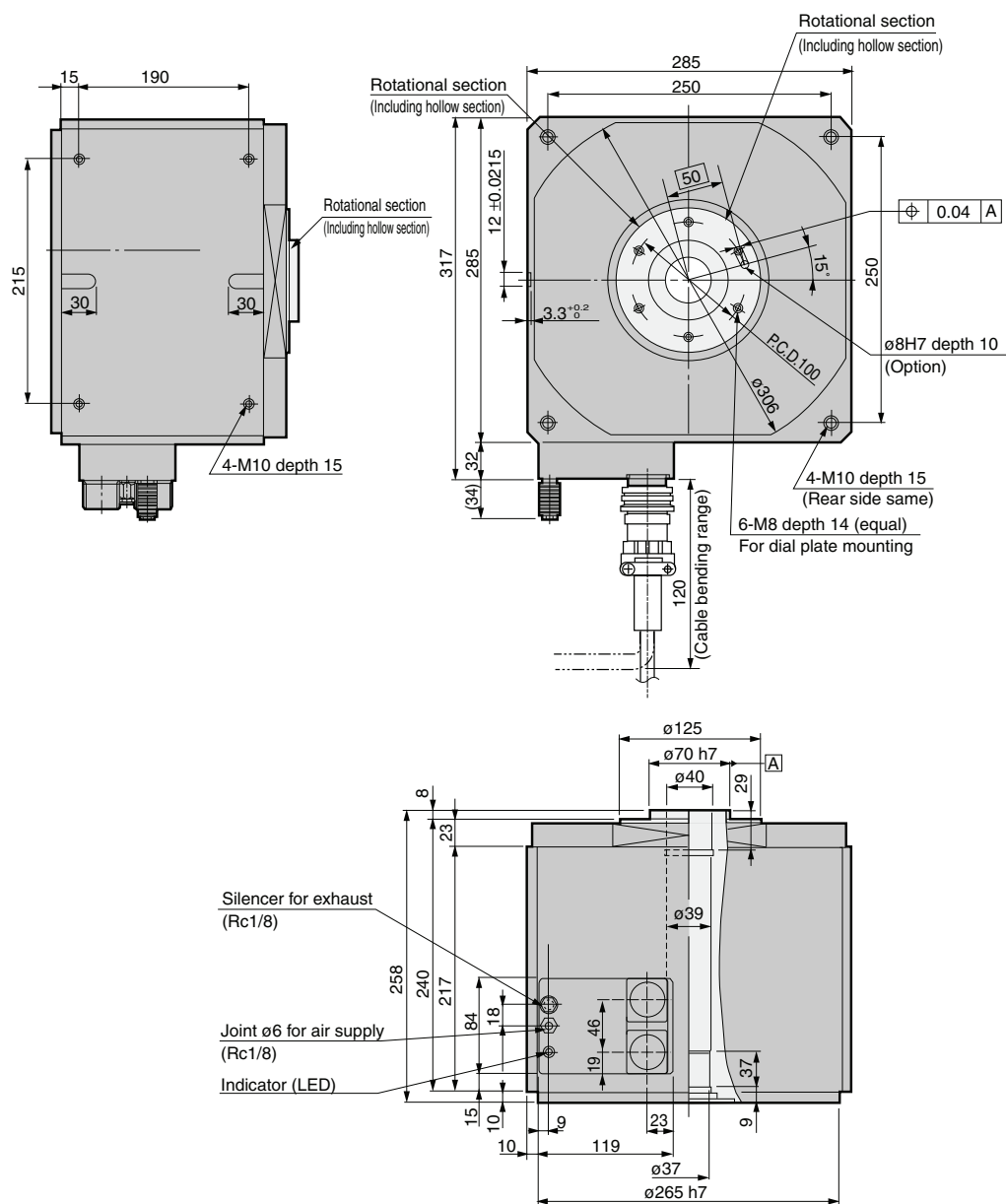


● AX5150



Dimensions

●AX5210



[illegible]



Direct drive actuator

AX8000 Series actuator

IP65 conforming product (IEC standards)

Appropriate for rotary positioning equipment in the environment with water drip splashed and a lot of powder dust existing.

● Maximum torque: 45/70 N·m

Actuator specifications

Descriptions		AX8045	AX8070
Maximum output torque	N·m	45	70
Continuous power torque	N·m	15	23
Maximum rotational speed	rpm	100 (Note 1)	100
Allowable axial load	N	1200	2200
Allowable moment load	N·m	38	73
Allowable radial load	N	1700	4000
Output shaft moment of inertia	kg·m ²	0.0330	0.1540
Allowable load moment of inertia	kg·m ²	0.9	4.0
Index accuracy	sec.	±15	
Repeatability	sec.	±5	
Output shaft friction torque	N·m	3.0	10.0
Resolver resolution	P/rev	540672	
Motor insulation grade		Class F	
Motor withstanding voltage		1500V AC for 1 min.	
Motor insulation resistance		10MΩ and over 500V DC	
Ambient temperature range		0 to 45 °C	
Conservation ambient temperature range		-20 to 80 °C	
Conservation ambient humidity range		20 to 90%RH to be no dew condensation.	
Protective structure		IP65(IEC60529) IP55(IEC60034-5)	
Mass	kg	35.0	80.0
Run out of output shaft	mm	0.015	
Surface run out of output shaft	mm	0.015	
Brake torque	N·m	80	210

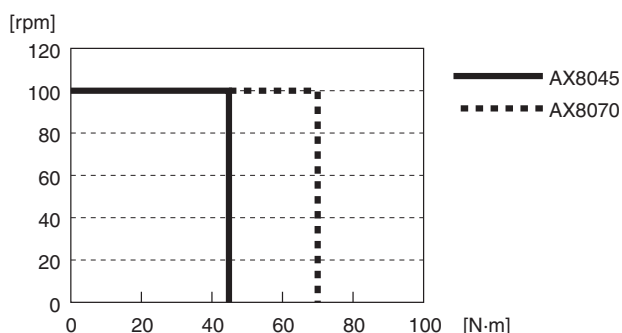
Note 1: Consult with CKD for applications with 100 rpm and over.

(Consult with CKD for customized specifications; up to 150rpm for S type driver in a model with maximum torque 45 N·m or less, while up to 180rpm for H type driver. No change in maximum rotational speed is available after shipment).

Inspection standard

Inspection item	Specification size
Straightness of table top (mm)	0.015
Run out of table top (mm)	0.015
Parallelism between table top and housing bottom (mm)	0.02
Perpendicularity between table top and housing side (mm)	0.02
Run out of table spindle hole (mm)	0.015

Maximum speed/torque characteristics



⚠ Always read precautions on Intro 13 to 18 before starting use.

49 **CKD**

- High grade dust and waterproof IEC529 standards IP65* conforming TÜV Rheinland certifications

Also, higher grade water proof is achieved by air purge.

*When air purge is done, supply a dry clean compressed air with low pressure (0.05MPa).

*IP65

IP marking that shows class of dust proof/water proof is defined by IEC60529 and IEC60034-5. AX8000 series is IP65 certificated by TÜV Rheinland.

IP6□: shows grades of contact and solid foreign materials intrusion protections, and [6] shows the maximum grade [perfect dust proof structure].

IP□5: shows grade of water proof protection, and [5] shows [protective structure from jet water in all directions].

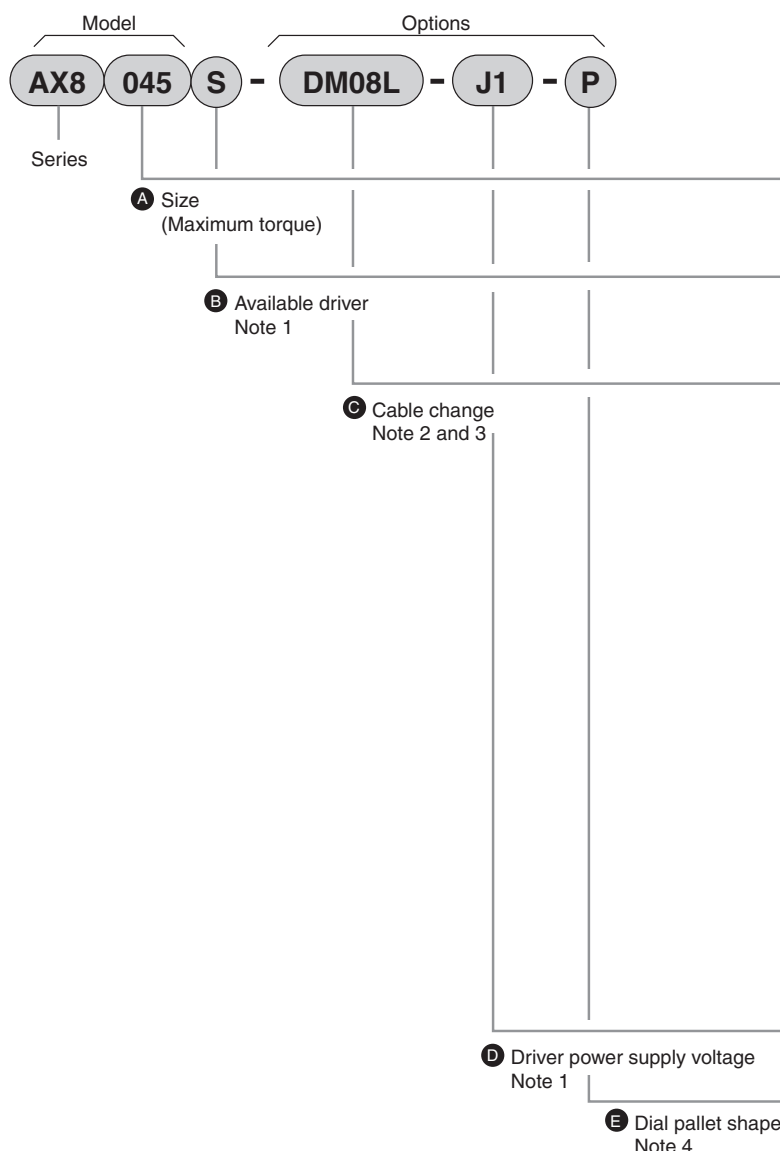
- Clamp reinforced in brake section
Clamp torque: 80 N·m (AX8045)
: 210 N·m (AX8070)

*The brake integrates a pneumatic brake to clamp the output shaft, increasing holding rigidity at stop. Refer to the recommended air circuit diagram on Intro 14.

- Both vertical and horizontal installations are available.



How to order



Symbol	Content
A Size (maximum torque)	
045	45 N·m
070	70 N·m

B Available driver	
S	Auxiliary S type driver
H	Auxiliary H type driver

C Cable change	
Blank	Standard (water proof straight plug 4m)
D **	Water proof straight plug Cable length change
D ** L	Water proof angle plug Cable length change
DM **	Water proof straight plug Movable cable length change
DM ** L	Water proof angle plug Movable cable length change

** cable length Note: length and type can not be changed after shipment.		
02	2m	
Blank	4m	-DM
06	6m	[Note] If cable length is 6m and over, use the noise filter for motor cable.
08	8m	
10	10m	
15	15m	
20	20m	
25	25m	
30	30m	

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

E Dial pallet shape	
Blank	Flange table
P	Flange table with dowel hole
T	T slot table

⚠ Note on model no. selection

Note 1: Select a driver according to the following table.

Model	S type driver		H type driver		
	3-200V AC to 230V AC	1-100V AC to 115V AC	3-200V AC	1-100V AC	3-230V AC
AX8045	Blank	J1	Blank	J1	J2
AX8070	Blank		Blank		J2

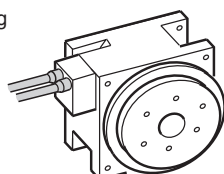
*Small and high performance S type driver is recommended.

Note 2: If the cable is bended repeatedly, use an optional movable cable.

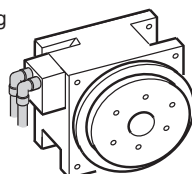
Refer to Page 55 for dimensions of a cable.

Note 3: Refer to the following diagram for a shape of a plug.

● Straight plug

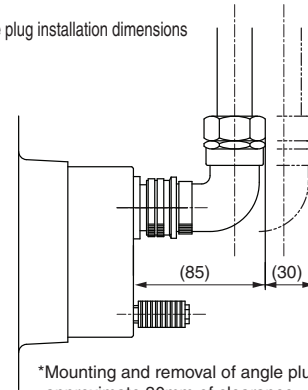
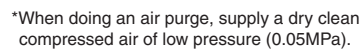


● Angle plug



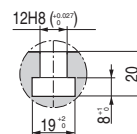
Note 4: Both "P" and "T" can not be selected together.

● AX8070

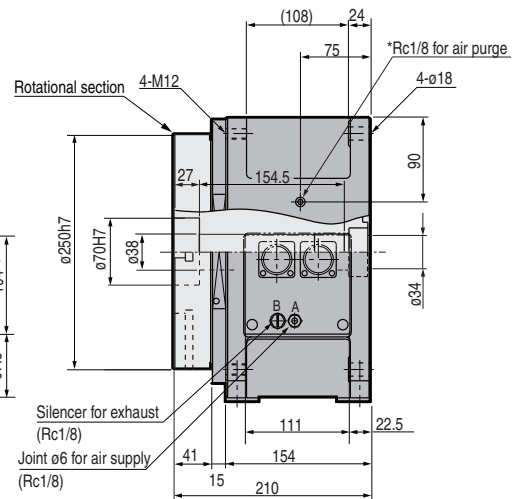


*Mounting and removal of angle plug require approximate 30mm of clearance.

●AX8070-T (T slot table)



D section details

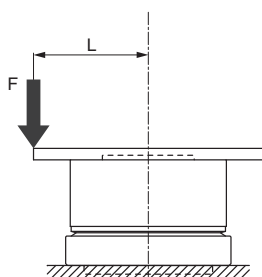


*When doing an air purge, supply a dry clean compressed air with low pressure (0.05MPa).

Precautions

- Driver, handy terminal and interactive terminal is not water proof. When using the product in the environment with water and oil splashed, induct water proof countermeasures. Rust proof treatment is not done for the actuator.
- When increasing water proof, install a joint for air purge on the body, then supply air with low pressure (0.05MPa), as same quality as the brake, to the motor inside. A noise may be made depended with external air leakage. If problems are posed, reduce air pressure.
- Performance and service life of sealing contact may be very significantly reduced per liquid type, since NBR (nitrile rubber) is used for sealing contact material.
Also, the actuator is made of steel (output shaft) and cast iron (housing), and rust proof treatment is not done. If rust proof treatment is required, consult with CKD.
- If water proof brake integrated type is used as a circular table, (when a workpiece installed on an output shaft is machined), always apply a brake during machining. However, machining is limited to light cutting and machining.
- The actuator is designed for light cutting and machining. Performing heavy machining with large cutting resistance may generate vibration.
- An application that a workpiece is machined with a direct drive actuator rotated are not allowed.

(Note) moment load



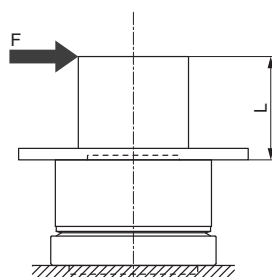
(Fig. a)

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

M: moment load

F: load

L: distance from output shaft center



(Fig. b)

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

M: moment load

F: load

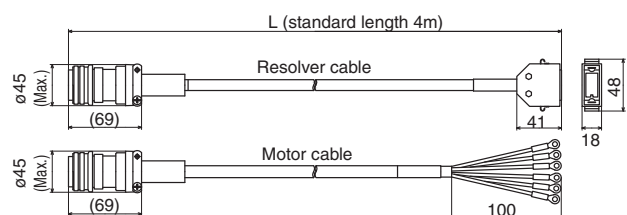
L: distance from output shaft flange plane

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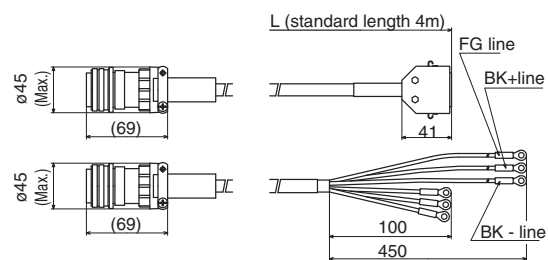
Cable specifications

Cable dimensions

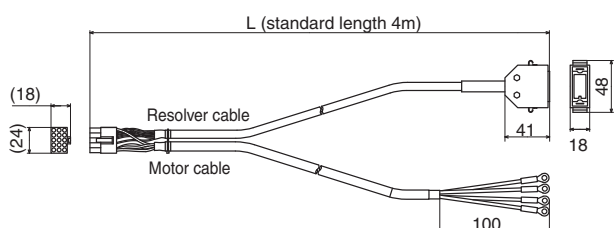
AX1000 and AX5000 series



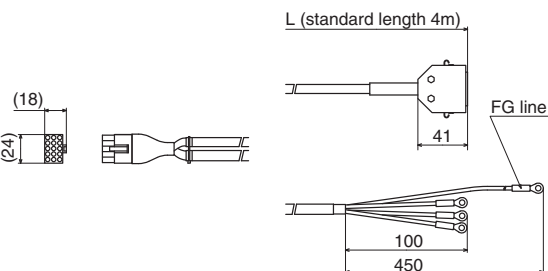
CE marking products



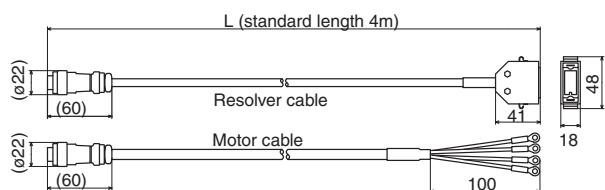
AX2000, AX3000 and AX4000 series



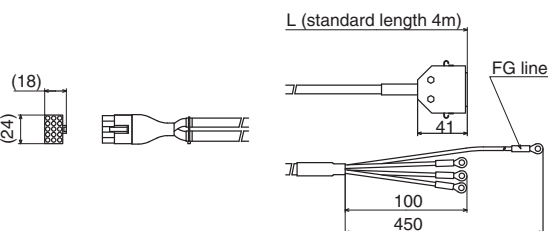
CE marking products



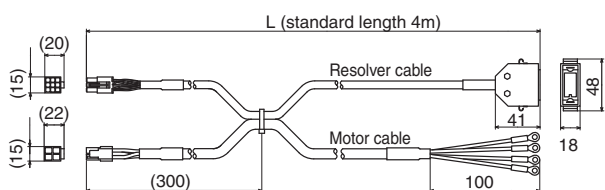
AX2021 and AX2042



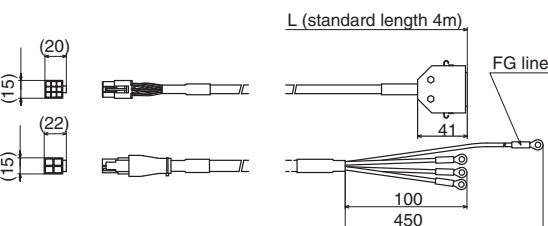
CE marking products



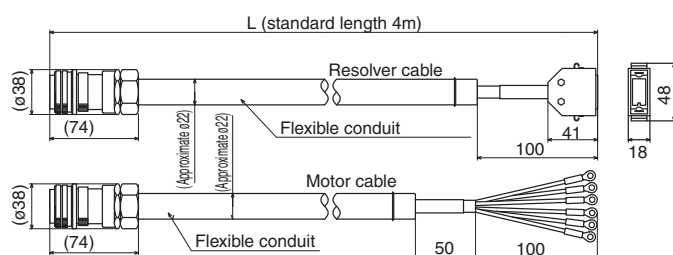
Subject to AX4300 and AX4500 only



CE marking products



AX8000 series



AX8000 series is not CE marking product.

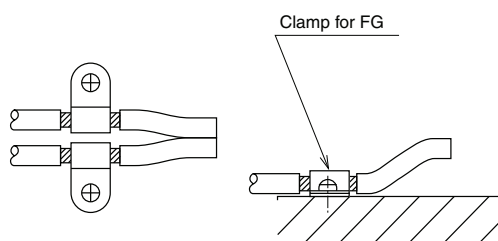
In cable of AX8000 series, flexible-conduit is installed in both standard and movable cables to increase water proof performance.

Cable bending radius

	Standard cable	Movable cable
Resolver cable	60mm	60mm
Motor cable	100mm	110mm
Resolver cable	50mm	60mm
Motor cable	90mm	90mm
Resolver cable	60mm	
Motor cable	90mm	
Resolver cable	50mm	60mm
Motor cable	100mm	110mm
Resolver cable	60mm	60mm
Motor cable	100mm	110mm

⚠ Precautions

- The actuator body, driver and cable with same serial number, must be used.
If a cable is broken, or if a change in cable length is necessary, consult with CKD.
- When connecting the motor cable to the driver, care must be taken not to connect them incorrectly, matching the mark tube of the cable and on the driver.
- If cable length is 6m and over, use the noise filter for motor cable for a motor cable (near driver).
- If the cable is bended repeatedly, use a movable cable (option). Also when using the movable cable of AX2000, AX3000, AX4000 series, fix the cable sheath section near the actuator body connector.
- When connecting the cable, insert a connector certainly in deep inside. Also, setscrews of the connector must be tightened certainly.
- Modification such as cut and extension of a cable, etc., must not be done, or failure and malfunction may be caused.
- If CE marking products (option) are used for both driver and actuator body sides, connect the cable shield to the case as earth using FG clamp, etc.



- Refer to cable length in "How to order" section for cable length L.



Direct drive actuator

GS/S type driver

Common specifications

Descriptions	Model	
	S type driver AX9***S	GS type driver AX9000GS
Power supply voltage	1.3-200V AC-10% to 230V AC + 10% (standard) (Note) 2.1-100V AC-10% to 115V AC+10% (option)	
Power supply frequency	50/60 Hz	
Configuration	Driver and controller integrated type (open frame)	
Ambient temperature range	0 to 50 °C	
Ambient humidity range	20 to 90%RH (to be no dew condensation.)	
Conservation ambient temperature range	-20 to 80 °C	
Conservation ambient humidity range	20 to 90%RH (to be no dew condensation.)	
Atmosphere	To be no corrosive gas and powder dust.	
Noise-resistance	1000V (P-P), pulse amplitude 1 micron sec. and start up 1nsec.	
Vibration resistance	4.9m/s ²	
Mass	Approximate 1.7kg	

(Note) The model with maximum torque 50 N·m or less can be used for single phase 200 to 230V AC.

Power supply wattage/breaker capacity

GS type driver

Actuator model no.	Driver model no.	Electric power supply capacity (KVA)		Breaker capacity
		Max.	Rated	Rated current (A)
AX2006G	AX9000GS	0.8	0.5	10
AX2012G				
AX2018G and AX4022G		1.0	0.5	
AX4045G		1.5	0.5	
AX4075G		2.0	0.8	

S type driver

Actuator model no.	Driver model no.	Electric power supply capacity (KVA)		Breaker capacity
		Max.	Rated	Rated current (A)
AX * 006	AX9006S	0.8	0.5	10
AX * 009 and AX * 012	AX9009S and AX9012S	1.0	0.5	
AX * 021 and AX * 022	AX9021S and AX9022S	1.5	0.5	
AX * 045 and AX * 042	AX9045S and AX9042S	2.0	0.8	
AX * 070 and AX * 075	AX9070S and AX9075S			

Performance specifications

Descriptions	Descriptions
Number of control axis	1 axis and 540672 pulse/turn (name: A axis)
Angle input increment	°(degree), pulse and index number
Angle least input increment	0.001° and pulse
Speed input increment	Second and rpm
Speed setting range	0.01 to 100 second/0.01 to 100rpm (S type) 0.01 to 100 second/0.01 to 300rpm (Note) (GS type) (Note) The maximum rotational speed may vary depended with actuator connected.
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 is set up by dialog terminal or PC, etc., through a RS232C port.
Operation mode	Automatic, MDI, jog, single block, servo OFF, pulse row input mode
Coordinates	Absolute and incremental
Acceleration curve	<5 types > Modified sine (MS), deformation constant velocity (MC/MC2), modified trapezoidal (MT) and tropecoid (TR)
Status display	Power supply display by LED
Operating indication	Display by 7 segment LED
Communication interface	RS-232C conformed
I/O signal	<Input > Return to origin command, reset, start, stop, continuous rotation stop, emergency stop, answer, program number selection, brake release, program number setting and pulse row input <Output > Alarm 1-2, positioning complete, in-position, start input waiting, M code 8 points, 1-2 during indexing, timing, M code strobing and index position strobing
Program capacity	Approximate 6000 characters (256 programs)
Electronic thermal	Overheat protection of actuator

CN3 input signal

Pin number	Signal name	Logic	Judgment
1 to 2	External power input+24V ±10%		
3 to 4	External power input GND		
5	Program number selection input (bit 0)	Positive	Level
6	Program number selection input (bit 1)	Positive	Level
7	Program number selection input (bit 2)	Positive	Level
8	Program number selection input (bit 3)	Positive	Level
9	Program number selection input (bit 4) /program number setting input 2nd digit	Positive	Level Edge
10	Program number setting input 1st digit	Positive	Edge
11	Reset input	Positive	Edge
12	Return to origin command input	Positive	Edge
13	Start input	Positive	Edge
14	Program stop input	Positive	Edge
15	Continuous rotation stop input	Positive	Edge
16	Answer input	Positive	Edge
17	Emergency stop input	Negative	Level
18	Brake release input	Positive	Level

CN3 output signal

Pin number	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	Positioning complete output	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	Positive
47	Output during indexing 2	Positive
48	Output of time	Positive
49	Index position strobing output	Positive
50	M code strobing output	Positive

CN3 pulse string input signal

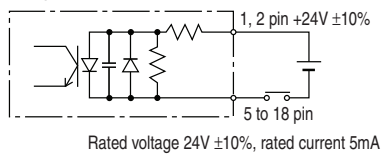
Pin number	Signal name
19	PULSE/UP/A phase
20	-PULSE/UP/-A phase
21	DIR/DOWN/B phase
22	-DIR/-DOWN/-B phase

GS/S type driver

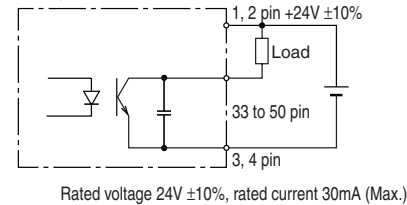
Dimensions, etc.

CN3 I/O circuit specifications

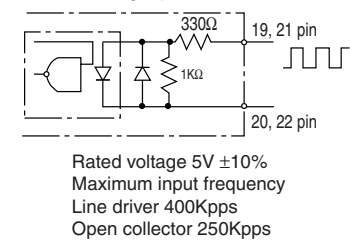
● Input circuit



● Output circuit

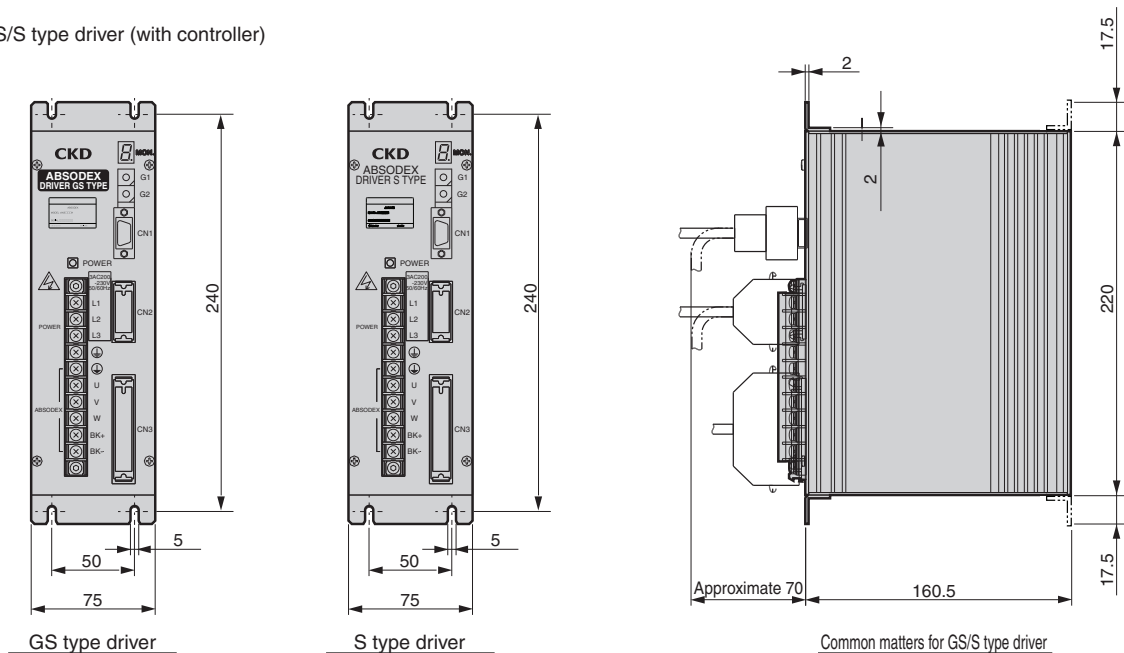


● Pulse string input circuit



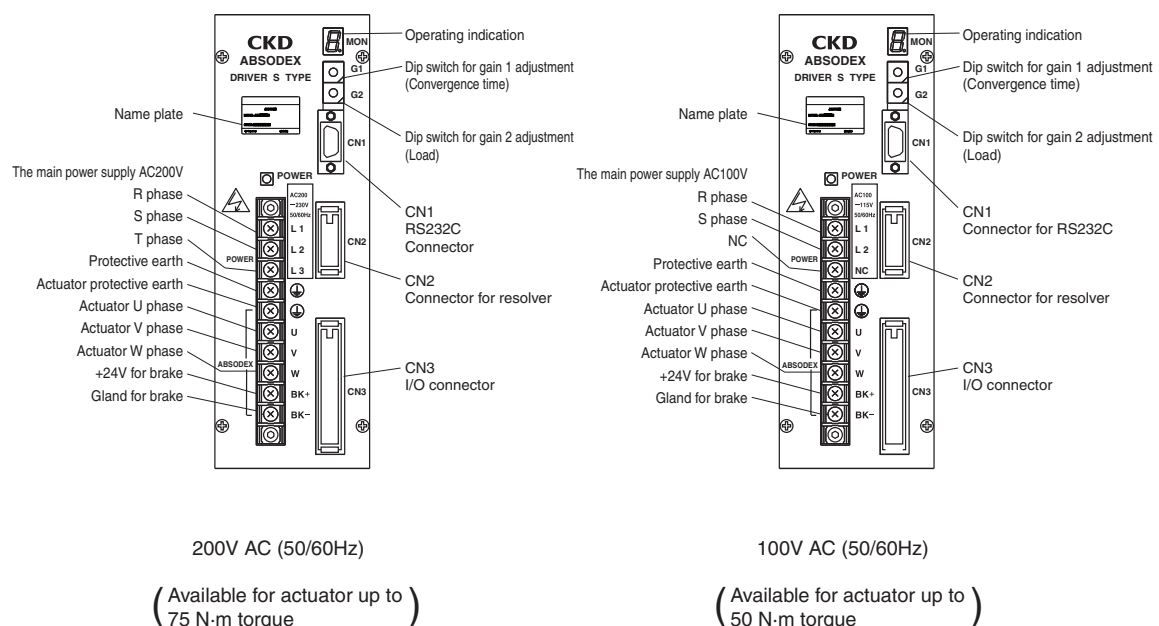
Dimensions

● GS/S type driver (with controller)



Panel explanation Note) GS and S type drivers have different front panel designs.

● GS/S type driver (with controller)



Available driver
S type driver

CKD

58



Direct drive actuator

GH/H type driver

Common specifications

Descriptions	Model	
	H type driver AX9***H	GH type driver AX9000GH
Power supply voltage	1.3-200V AC ±10% (standard) (Note 1) 2.1-100V AC ±10% (J1: option) 3.220V AC -10% to 230V AC +10%, Three phase (J2: option) (Note 2)	3-200V AC -10% to 230V AC +10%
Power supply frequency	50/60 Hz	
Configuration	Driver and controller integrated type (open frame)	
Ambient temperature range	0 to 50 °C	
Ambient humidity range	20 to 90%RH (to be no dew condensation.)	
Conservation ambient temperature range	-20 to 80 °C	
Conservation ambient humidity range	20 to 90%RH (to be no dew condensation.)	
Atmosphere	To be no corrosive gas and powder dust.	
Noise-resistance	1000V (P-P), pulse amplitude 1 micron sec. and start up 1nsec.	
Vibration resistance	4.9m/s ²	
Mass	Approximate 4kg	

(Note 1) The models with maximum torque 50 N·m or less can be used for single phase 200V AC (standard) and 230V (option).

(Note 2) "J2" option for CE marking is available for 200V AC -10% to 230V AC+10%.

Power supply wattage/breaker capacity

GH type driver

Actuator model no.	Driver model no.	Electric power supply capacity (KVA)		Breaker capacity Rated current (A)
		Max.	Rated	
AX4150G	AX9000GH	3.0	0.8	20
AX4300G		4.0	1.5	
AX4500G		4.0	2.0	

H type driver

Actuator model no.	Driver model no.	Electric power supply capacity (KVA)		Breaker capacity
		Max.	Rated	Rated current (A)
AX * 006	AX9006H	0.8	0.5	10
AX * 009 and AX * 012	AX9009H and AX9012H	1.0	0.5	
AX * 021 and AX * 022	AX9021H and AX9022H			
AX * 045 and AX * 042	AX9045H and AX9042H	1.5	0.5	
AX * 070 and AX * 075	AX9070H and AX9075H	2.0	0.8	
AX * 150	AX9150H	3.0	0.8	20
AX * 210	AX9210H	4.0	0.8	
AX * 300	AX9300H	4.0	1.5	
AX * 500	AX9500H	4.0	2.0	

CN3 input signal

Pin number	Signal name	Logic	Judgment
1 to 2	External power input +24V ±10%		
3 to 4	External power input GND		
5	Program number selection input (bit 0)	Positive	Level
6	Program number selection input (bit 1)	Positive	Level
7	Program number selection input (bit 2)	Positive	Level
8	Program number selection input (bit 3)	Positive	Level
9	Program number selection input (bit 4) /program number setting input 2nd digit	Positive	Level Edge
10	Program number setting input 1st digit	Positive	Edge
11	Reset input	Positive	Edge
12	Return to origin command input	Positive	Edge
13	Start input	Positive	Edge
14	Program stop input	Positive	Edge
15	Continuous rotation stop input	Positive	Edge
16	Answer input	Positive	Edge
17	Emergency stop input	Negative	Level
18	Brake release input	Positive	Level

CN3 pulse string input signal

Pin number	Signal name
19	PULSE/UP/A phase
20	-PULSE/UP/-A phase
21	DIR/DOWN/B phase
22	-DIR/-DOWN/-B phase

Performance specifications

Descriptions	Content
Number of control axis	1 axis and 540672 pulse/turn (name: A axis)
Angle input increment	°(degree), pulse and index number
Angle least input increment	0.001° and pulse
Speed input increment	Second and rpm
Speed setting range	0.01 to 100 sec./0.01 to 100rpm (Note) Maximum rotational speed may vary per actuator connected.
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 is set up by dialog terminal or PC, etc., through a RS232C port.
Operation mode	Automatic, MDI, jog, single block, servo OFF, pulse row input mode
Coordinates	Absolute and incremental
Acceleration curve	<5 types > Modified sine (MS), deformation constant velocity (MC/MC2), modified trapezoidal (MT) and tropecoid (TR)
Status display	Power supply display by LED
Operating indication	Display by 7-segment LED
Communication interface	RS-232C conformed
I/O signal	<Input > Return to origin command, reset, start, stop, continuous rotation stop, emergency stop, answer, program number selection, brake release, program number setting and pulse string input <Output > Alarm 1/2, positioning complete, in-position, start input waiting, M code 8 points, 1/2 during indexing, timing, M code strobing and index position strobing
Program capacity	Approximate 6000 characters (256 programs)
Electronic thermal	Overheat protection for actuator

CN3 output signal

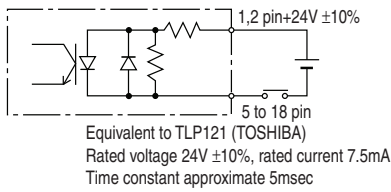
Pin number	Signal name	Logic
33	M code output (bit 0)	Positive
34	M code output (bit 1)	Positive
35	M code output (bit 2)	Positive
36	M code output (bit 3)	Positive
37	M code output (bit 4)	Positive
38	M code output (bit 5)	Positive
39	M code output (bit 6)	Positive
40	M code output (bit 7)	Positive
41	In-position output	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	Positive
47	Output during indexing 2	Positive
48	Output of time	Positive
49	Index position strobing output	Positive
50	M code strobing output	Positive

GH/H type driver

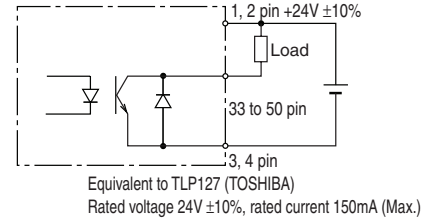
Dimensions, etc.

CN3 I/O circuit specifications

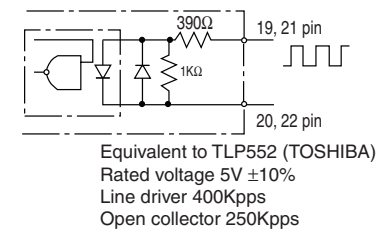
● Input circuit



● Output circuit

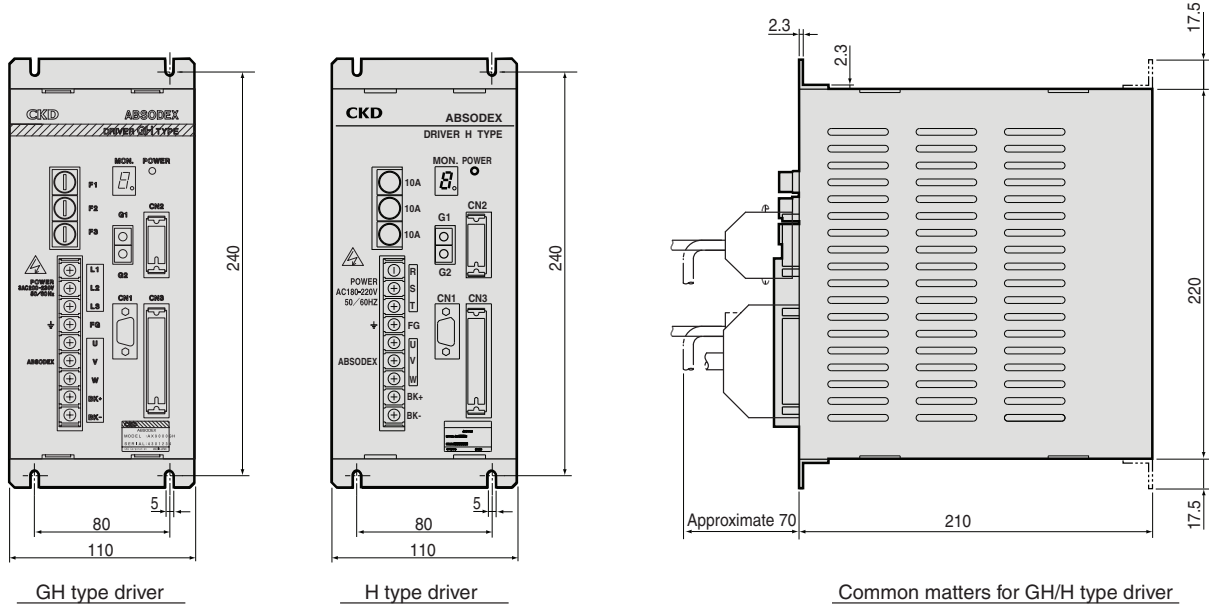


● Pulse string input circuit



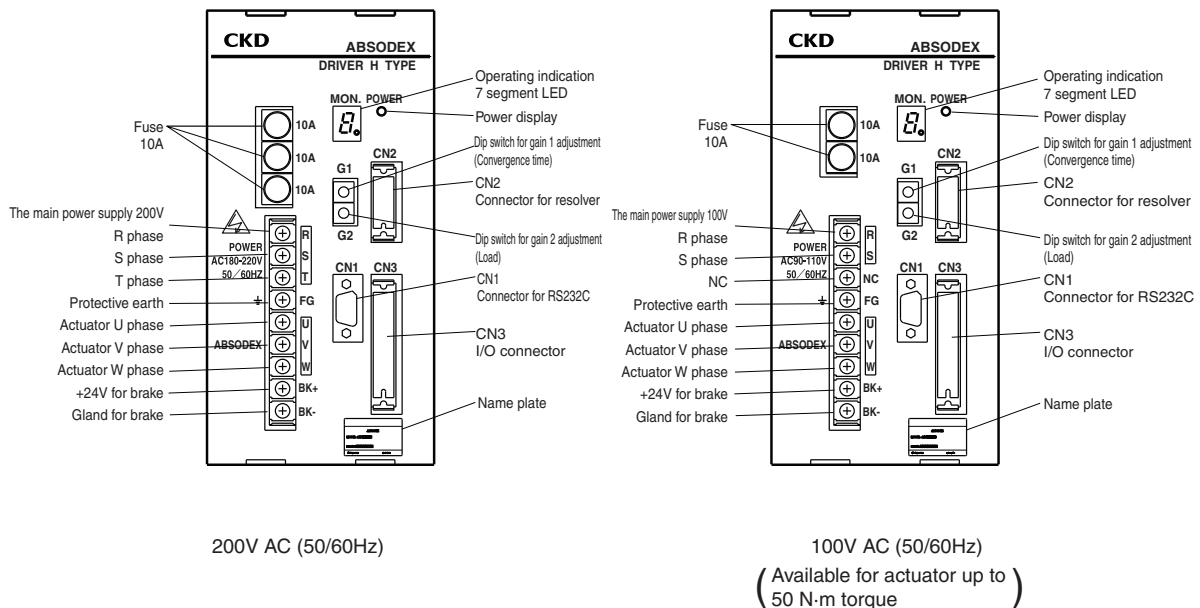
Dimensions

● H type driver (with controller)



Panel explanation Note) GH and H type drivers have different front panel designs.

● H type driver (with controller)



Available driver
H type driver

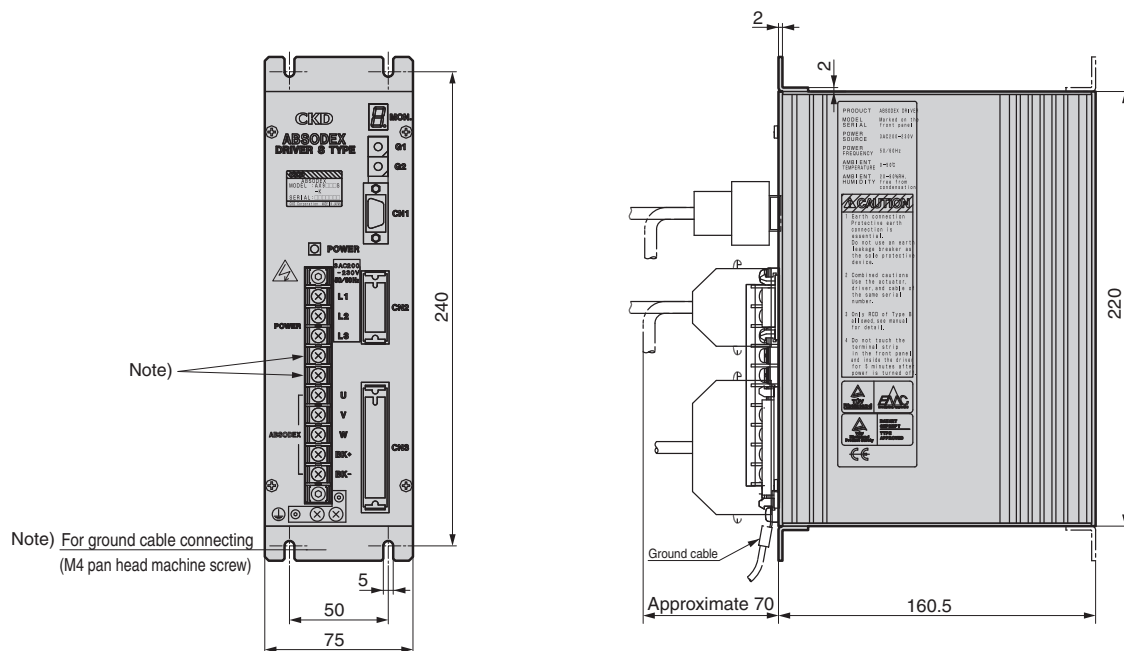
CKD

60

S H type driver

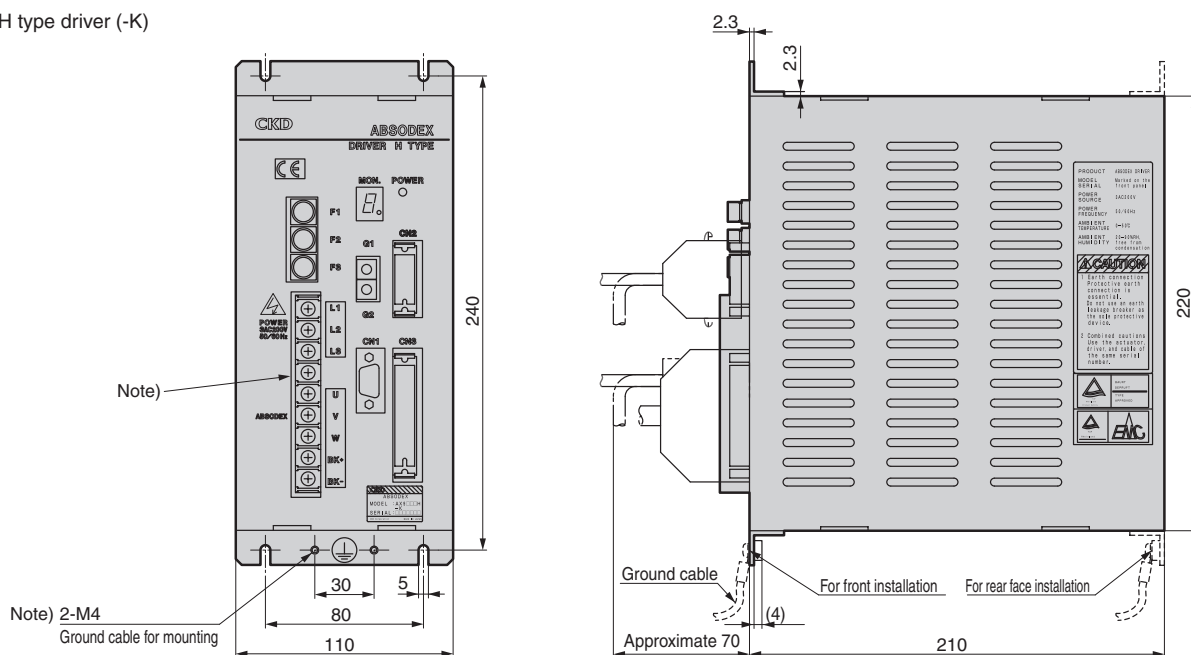
CE marking products dimensions

● S type driver (-K)



Note) Fix ground cable with setscrew for ground cable (M4).

● H type driver (-K)



Note) Fix ground cable with setscrew for ground cable (M4).

⚠ Precautions

- When piping, care must be taken to make foreign materials such as electric wire tips, etc., not intruded.
- When using the product in the environment where dust and lamp black, etc., will admit into the driver, consult with CKD.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



Direct drive motor dialog terminal AX0170H Series

● S type/H/GS/GH type driver common

Features

- ① Easy programming
A program can be easily produced only by answering questions asked by dialog terminal for equal index program.
- ② Dedicating power supply not required
Power is supplied from a direct drive actuator.
- ③ Back up possible
A program/parameter can be held to make a copy of the program.
- ④ Reducing EI (environmental impact) chemical substance
Lead free solder is used.
(Excluding parts such as semiconductor, etc.)

Specifications

Descriptions	AX0170H
Operation mode	Each mode; editing, display, parameter, operation and copy
Program capacity	Equal index or NC program 2000 characters (1program)
Program number	Equal index program: program number 0 to 999
Display	16 characters X 2 line (LCD display)
Input key	17 keys (Emergency stop key: 1, control key: 5 characters and numeral keys: 11)
Back up	Super capacitor (approximate 3 hours)
Power supply	Supply from direct drive motor driver
Cable length	2m
Ambient temperature range	0 to 50 °C
Ambient humidity range	20 to 90% (to be no dew condensation.)
Conservation ambient temperature range	-20 to 80 °C
Conservation ambient humidity range	20 to 90% (to be no dew condensation.)
Mass	Body only approximate 140g

*English version has English characters and display messages on the operation panel.

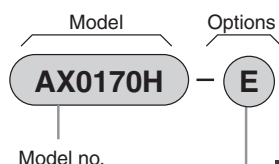
Note) For S, H, GS and GH type driver, AX0170H must be used.

AX0162 and AX0165 can not be used.

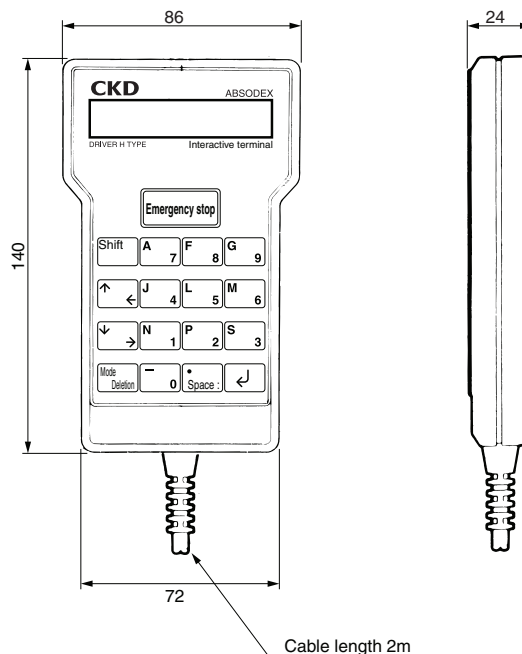
Dimensions

● Dialog terminal

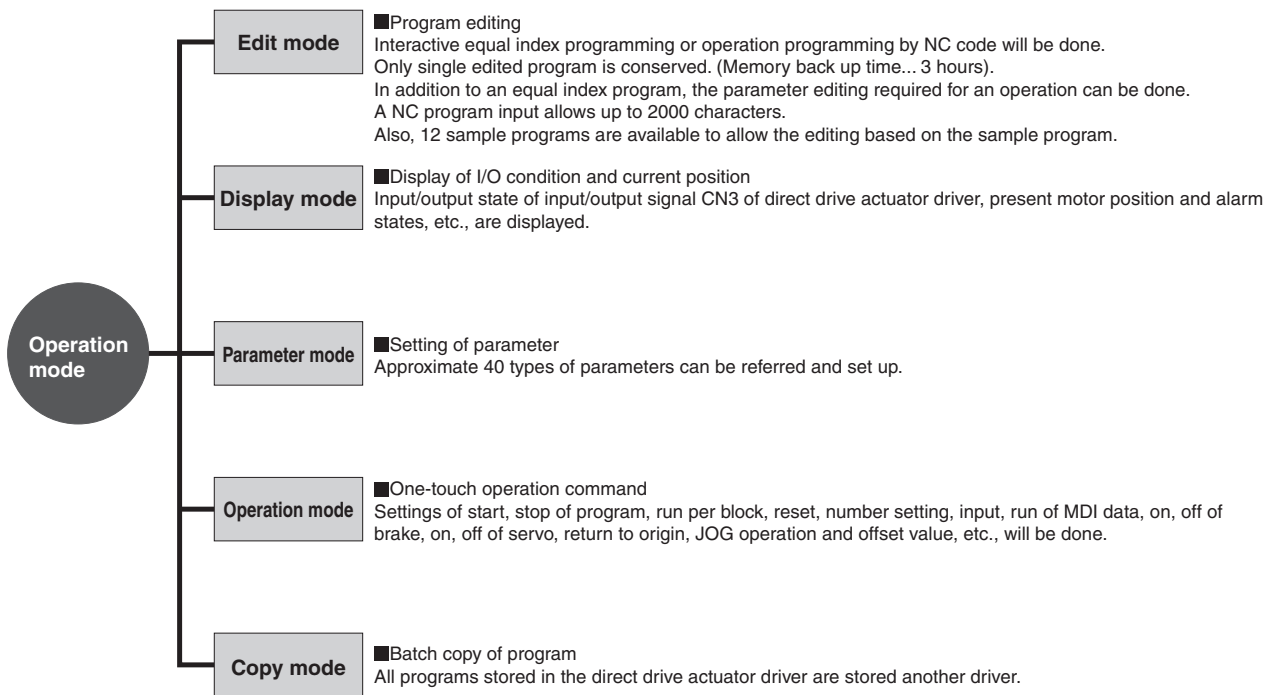
How to order



Symbol	Content
Blank	Standard (Japanese version)
E	English version



Interactive terminal



Interactive programming

A program can be easily produced by inputting the following settings.

[Example of program input]

New	programs no. [0 to 999]
Return to origin position	1. Origin 2. Index
Return direction	1. CW 2. CCW
Return speed	[1.0 to 100.0]rpm
Index number	[1 to 255]
Moving time	[0.01 to 100] second
Rotational direction	1. CW 2. CCW
Stop treatment	1. Start waiting 2. Dwell
Brake	1. Use 2. Vacant
Delay timer	[0.01 to 99.99] second
M code	1. M 2. Index position

In this case ...

To try to move direct drive actuator



Edit mode

Try the programs during adjustment, since 12 types of samples programs are stored.

To create a program of direct drive actuator and to store the program in the actuator.



Edit mode

Easy procedure to input and store programs.

To run a program stored in the direct drive actuator.



Operation mode

Indication of a program number allows the program to start easily.

To achieve the best performance of cam curve.



Parameter mode

4 types of cam curve can be selected. The best curve can be used with one-touch operation.

To restrict the torque to protect other equipment.



Parameter mode

Any torque can be set if the torque is not greater than maximum output torque. It is effective to prevent interference of other equipment.

Option
Interactive terminal



Serial transmission slave station CC-Link **AX-OPX-7G**

Features

- Connecting to the I/O connector (CN3) of S or H type driver, a direct drive actuator can be connected to field network CC-Link system (Ver. 1.10) such as MITSUBISHI PLC, MELSEC-A and QnA series, etc.
- Drastic reduced wiring is possible.
- I/O point
16 inputs and 14 outputs
- Using HLD/CLR switch, either holding of output when communication failed, or all points OFF can be selected.
- 5 types of line speed can be selected.
- External emergency stop input (b contact) can be connected in series to emergency stop signal in serial communication.

Common specifications

Descriptions	Specifications
Slave unit power supply	24V DC $\pm 10\%$ and 100mA or less
AX driver power supply	24V DC $+10\%$, -5% and 450mA or less
Ambient temperature range	5 to 50 °C
Ambient humidity range	30 to 85%RH (to be no dew condensation.)
Atmosphere	To be no corrosive gas and dust.
Vibration resistance	4.9m/s ²
Mass	0.15kg

How to order



Symbol	Content
Blank	Standard
D02	Cable for pulse string input (2m) attached

Accessory (plug)

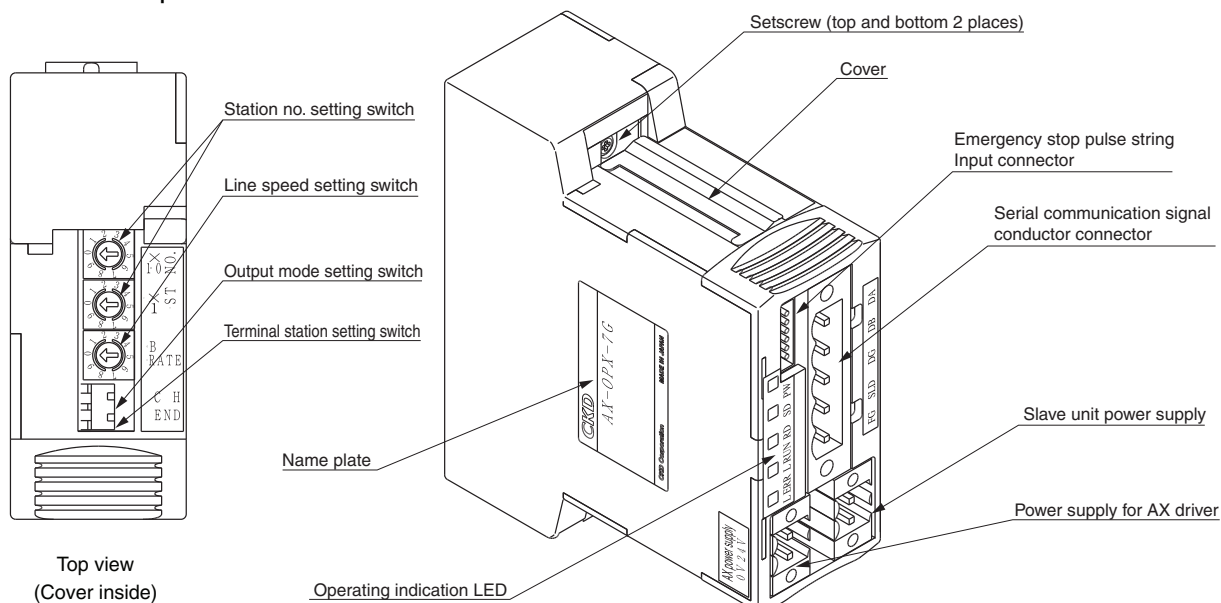
- 1) BLZ5.08/5FAU (Widmuller) 1 piece
- 2) BL3.5/2F (Widmuller) 2 pieces
- 3) ZHR-6 (JST MFG CO. LTD.) 1 piece

Note: When using emergency stop input from out side, or when activating by pulse row from external pulse generator, specify model no. of options.

Performance specifications

Descriptions	Specifications
Network protocol	CC-Link system (Ver1.10) conformed
Line speed	156K/625K/2.5M/5M/10M bps (Selection by switch)
Output no.	14 points
Input no.	16 points
Other input	Pulse row and emergency stop
Output insulation type	Photo coupler insulation
Operating indication	LED (display of slave unit power supply and communication state)
Occupied unit no.	1 station (remote I/O station)
Setting switch	Station no. line speed, HLD/CLR and terminal ON/OFF

Appearance explanation





Serial transmission slave station DeviceNet **AX-OPX-7D**

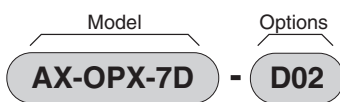
Features

- Installing onto the I/O connector (CN3) of S or H type driver allows a direct drive actuator to be compatible with DeviceNet.
- Drastic reduced wiring is possible.
- I/O point
16 inputs and 14 outputs
- Using HLD/CLR switch, either holding of output when communication failed, or all points OFF can be selected.
- 3 types of line speed can be selected.
- External emergency stop input (b contact) can be connected in series to emergency stop signal in serial communication.
- CE marking

Common specifications

Descriptions	Specifications
Slave unit power supply	24V DC $\pm 10\%$ and 100mA or less
AX driver power supply	24V DC $+10\%$, -5% and 450mA or less
Communication power supply	11V to 25V DC 50mA or less
Ambient temperature range	5 to 50 °C
Ambient humidity range	30 to 85%RH(To be no dew condensation.)
Atmosphere	To be no corrosive gas and dust.
Vibration resistance	4.9m/s ²
Mass	0.15kg

How to order



Symbol	Content
Blank	Standard
D02	Cable for pulse string input (2m) attached

Accessory (plug)

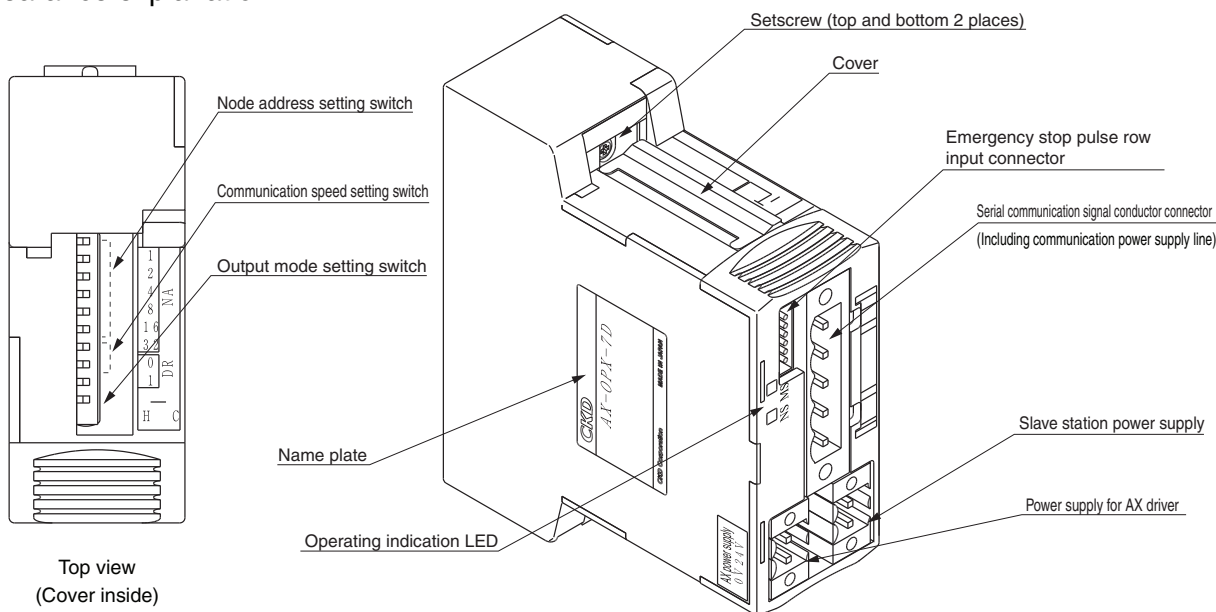
- 1) MSTB2.5/5-STF-5.08AUDVM (Phoenix contact) 1 piece
- 2) BL3.5/2F (Widemuller) 2 pieces
- 3) ZHR-6 (JST MFG CO. LTD.) 1 pieces

Note: When using emergency stop input from out side, or when activating by pulse string from external pulse generator, specify model no. of options.

Performance specifications

Descriptions	Specifications
Network protocol	Device Net conformed
Communication speed	125k/250k/500k bps (Selection by switch)
Output no.	14 points
Input no.	16 points
Other input	Pulse string and emergency stop
Output insulation type	Photo coupler insulation
Operating indication	LED (display of power supply and communication state)
Occupied byte number	Input: 2 bytes and output: 2 bytes
Setting switch	Output mode (HLD/CLR) Node address, communication speed

Appearance explanation



CC-Link/DeviceNet compatible

Serial transmission
slave station

CKD

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Slave station - AX driver input/output signal table

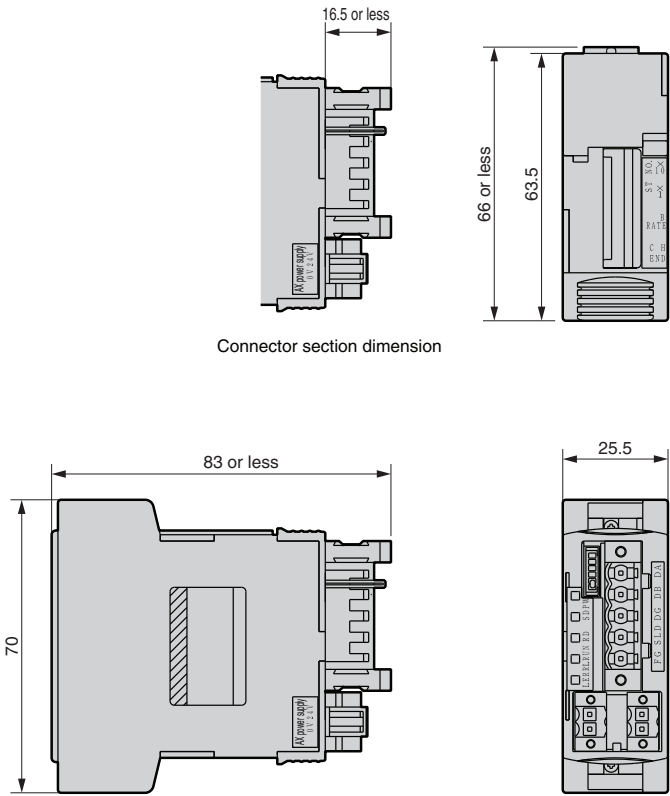
Input/output signal

Bit	AX CN3 Pin number	Slave station input signal name (AX output→ slave unit input)	AX CN3 Pin number	Slave unit output signal name (Slave unit output→ AX input)
0	33	M code output (bit 0)	5	Program number selection input (bit 0)
1	34	M code output (bit 1)	6	Program number selection input (bit 1)
2	35	M code output (bit 2)	7	Program number selection input (bit 2)
3	36	M code output (bit 3)	8	Program number selection input (bit 3)
4	37	M code output (bit 4)	9	Program number selection input (bit 4) /program number setting input 2nd digit
5	38	M code output (bit 5)	10	Program number setting input 1st digit
6	41	Positioning complete output	11	Reset input
7	42	Positioning complete output	12	Return to origin command
8	43	Start input waiting output	13	Start input
9	44	Alarm output 1	14	Program stop input
A	45	Alarm output 2	15	Continuous rotation stop input
B	46	Output during indexing 1	16	Answer input
C	47	Output during indexing 2	17	Emergency stop input
D	48	Output of time	18	Brake release input
E	49	Index position strobing output		Vacant
F	50	M code strobing output		Vacant

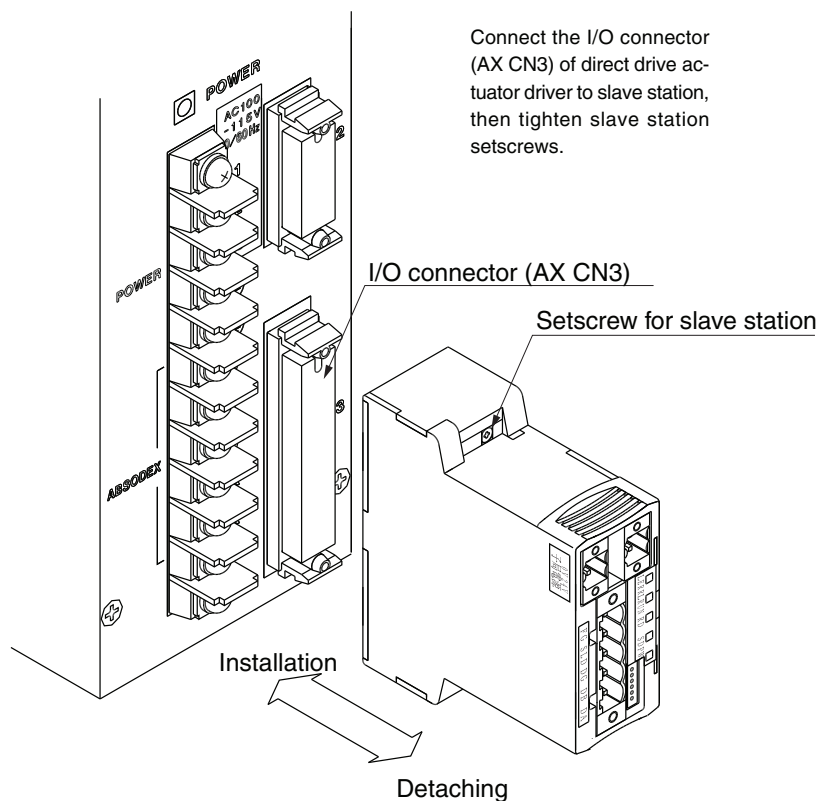
Note: M code outputs (bit 6 and 7) of AX driver can not be used.
Slave station input signal is bit 0 to F, and slave station output signal is bit 10 to 1F for AX-OPX-7G.

Dimensions (CC-Link and DeviceNet common)

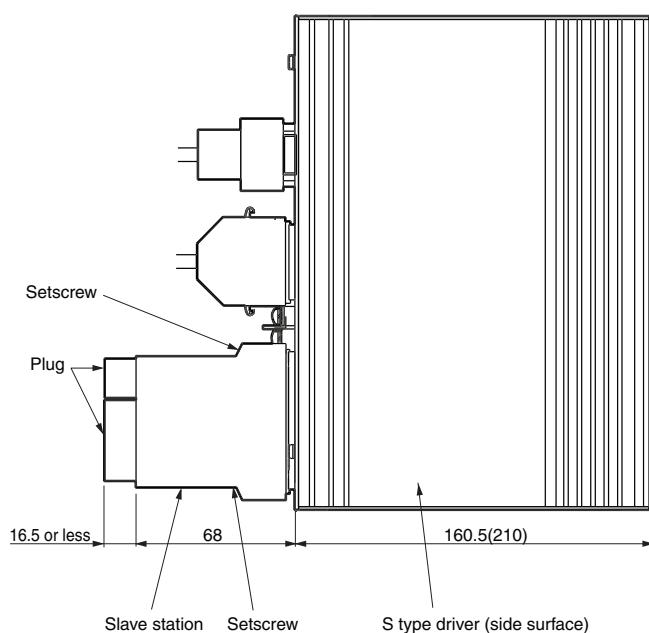
- AX-OPX-7G
- AX-OPX-7D



Slave station installation (for S type driver)



Installation dimensions (for S type driver)

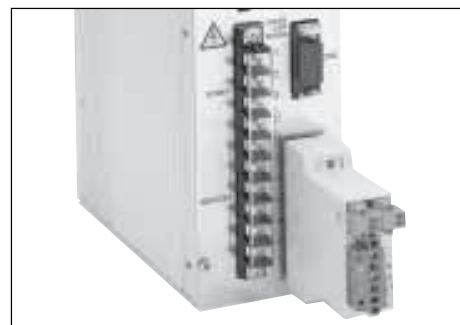


Note: Dimension in () is applied to H type driver.

⚠ Cautions for installation

- Depth of slave station is 68mm, while depth of plug is 16.5mm. The plug can be removed, while lead wire is connected.
- Fix a slave station on the driver with setscrews.

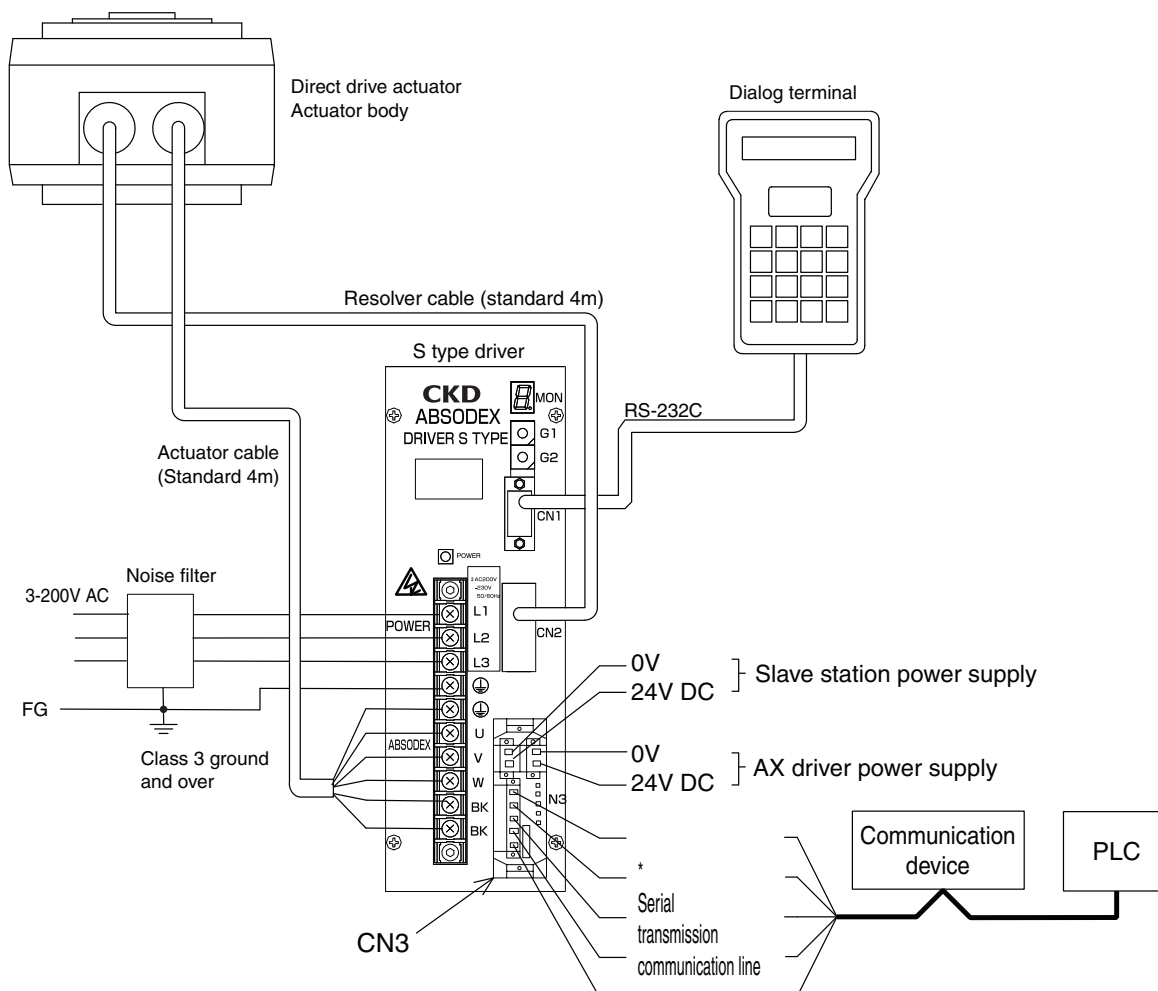
S type driver installation



CC-link/DeviceNet compatible

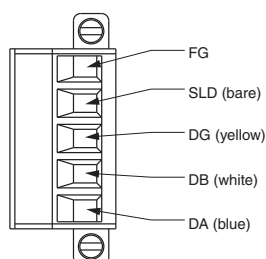
Serial transmission
slave station

Connections

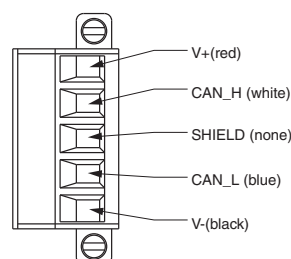


*Refer to the following transmission I/F connector section for connection of communication line.

Transmission I/F connector (for installation on S type)



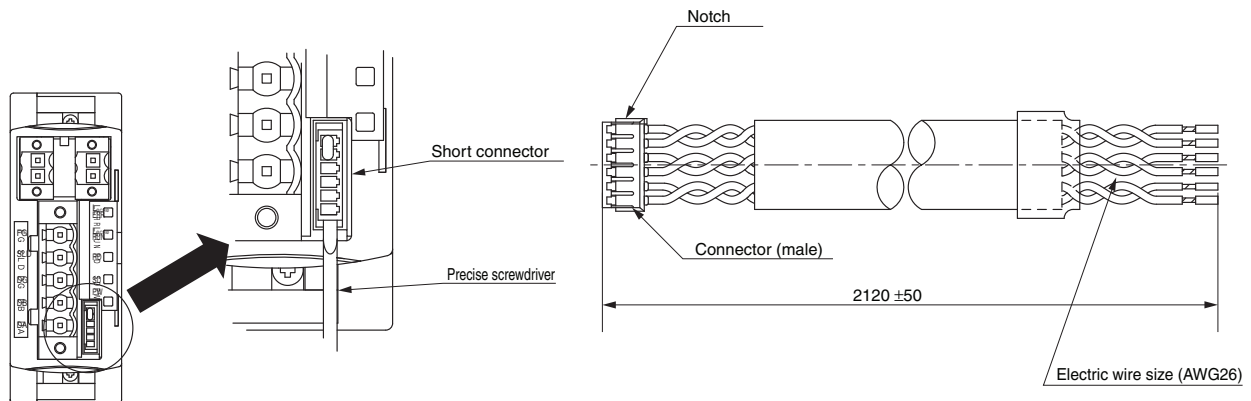
AX-OPX-7G (CC-Link)



AX-OPX-7D (DeviceNet)

*When connecting to H type driver, care must be taken since connector direction is reverse.

Connection of connector for pulse row input (option)



When connecting the cable for pulse row input (option), use a precise screwdriver with narrow tip (-), etc., to remove the short connector, then match the notches on male and female side to insert the connector.
(Do not pull the jumper line for short connector to remove the connector.)



Precautions

- Always read [precautions] of the instruction manual before using.
- Read the instruction manual for the communication system in use and thoroughly familiarize yourself with contents before starting use.
- Do not install the product at the place where water, moisture, dust or lamp black will be formed, or fire, failure or electric shock, etc., may be caused.
- If the slave station switch is set incorrectly, the direct drive actuator could malfunction. Carefully confirm switch settings before starting use. Check the slave station number, transmission speed, and output settings at a communication error when turning power on.
- When wiring, always turn power off before starting work.
- When connected to the connector, the cable could move back instead of the connector tightening, so be sure to loosen the cable fixing screw sufficiently.
- If a connector fixing screw is provided, tighten it when inserting the connector. If the screw is not tightened, the connector come loose and cause malfunctions. If a connector fixing screw is not provided, confirm that connector hooks are secure.
- Maintain sufficient bending radius for the interface cable, and do not bend the cable forcibly.
- Disconnecting the slave station by pulling on the cable or connector could cause wire breakage or damage. Hold the slave station itself when removing it.
- If electric wiring terminal section (bare live part) is touched, a risk of electric shock may be created.
- M code outputs (bit 6 and 7) of AX driver can not be used.

Installation

- Depth of slave station is 68mm, while plugs is 16.5mm. The plug can be removed, while wired.
- If installed on H type driver, the top and bottom direction of slave station is reverse. (Switch plane faces upward.)
- Fix a slave station on the driver with setscrews.

H type driver installation



CC-Link/DeviceNet compatible

Serial transmission
slave station

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
PC communication cable (old PC98) 14 pin half pitch	AX series	AX-RS232C-14P
PC communication cable (old PC98) D-sub25 pin	AX series	AX-RS232C-25P

●Maintenance part

Part name	Model	Model no.
Pneumatic valve (brake)	AX5000/AX8000 series	AX-0002
Cooling fan	H type driver	AX-0003

●Others

Part name	Model	Model no.
Slave unit option cable	AX-OPX series	AX-OPX-CABLE-D02
I/O connector	AX series	AX-CONNECTOR-MR-50LM

●Noise filter

Part name	Model	Model no.
Noise filter for power supply (three phase/10A)	AX series	AX-NSF-LF-310
Noise filter for power supply (three phase/15A)	AX series	AX-NSF-LF-315
Noise filter for power supply (single phase/10A)	AX series	AX-NSF-LF-210
Noise filter for motor cable (10A)	AX series	AX-NSF-LF-310KA
Noise filter for motor cable (20A)	AX series	AX-NSF-LF-320KA
Noise filter for power supply	AX series (CE conforming products)	AX-NSF-NF2015A-OD
Ferrite core for motor cable	AX series (CE conforming products)	AX-NSF-RC5060

●Mounting base

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

(Note 1) No mounting base is available for AX5000, AX8000 and AX4009 series.

(Note 2) Consult with CKD for mounting base model no.

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Selection guide

Unit and symbol of elements of operating condition		
Moving angle	(°)	ψ
Moving time	(s)	t_1
Cycle time	(s)	t_0
Load friction torque	(N·m)	T_f
Working torque	(N·m)	T_w
Cam curve	Selection from (MS, MC, MT, TR)	

1. Load moment of inertia

Load moment of inertia is computed, then select an actuator that allows the moment temporarily.

2. rpm

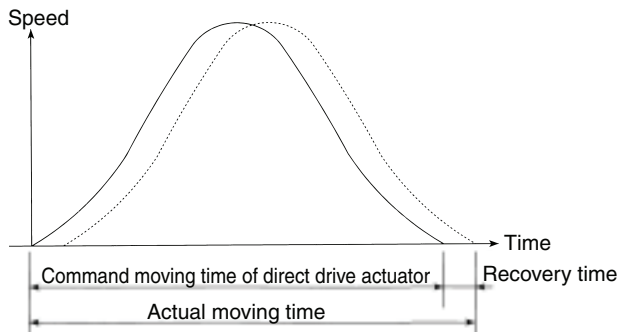
Maximum rated input speed is 100rpm. If moving angle is ψ (°), and moving time is t_1 (s),

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

V_m is the constant defined by cam curve.

[Cautions]

Actual moving time is the time that the recovery time is added to the command moving time of direct drive actuator.



Recovery time may vary between 0.05 to 0.2s per working condition.

When selecting a model, the command moving time of direct drive actuator must be used for moving time t_1 . The command moving time is also used for setting of moving time in NC program.

3. Load torque

a) Max. load torque is asked as the following formula.

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

b) Effective value of load torque is asked as the following formula.

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

Where V_m , A_m and r use values in the table below.

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

Also, J_M , T_{MF} and f are as followings.

J_M : output shaft moment of inertia (kg·m²)

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

f_c : usage factor (during normal use $f_c=1.5$)

About the actuator chosen temporarily

Max. load torque < maximum output torque

Effective value < continuous output torque

if either condition is not satisfied, increase the actuator size, then re-calculate the load torque.

Note) In AX4300 and AX4500, torque speed characteristics are reduced, limiting usage zone.

Check the condition by the selecting software if max. speed is 50rpm and over.

4. Regenerative electric power (subject to AX4300 and AX4500 only)

In AX4300 and AX4500, regenerative electric power is limited by consumption performance of regenerative resistance in the driver.

To be asked by the following simple formula.

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

$$W \leq 40$$

If this conditions are not satisfied, review operating and load conditions.

(Note) working torque shows the torque, converted from external load, etc., that operates an output shaft of a direct drive actuator as a load.

Working torque T_w is calculated by the following formula.

$$T_w = F_w \times R_w \quad (N \cdot m)$$

F_w (N): force required for work

R_w (m): working radius

(Example)

If the body is side faced (output shaft horizontal), table, workpiece and jig, etc., will be working torques.

[Working condition]

Table radius : R=0.4 (m)
Table mass : Wt=79 (kg)
Jig radius of gyration: Re=0.325 (m)
Jig mass : Wj=10 (kg/piece)
(Including workpiece mass)
Jig number : N=4

[Operating condition]

Moving angle : $\psi=90^\circ$ ($^\circ$)
Moving time : t₁=0.8 (s)
Cycle time : t₀=4 (s)
Load friction torque: inactive
Working torque : inactive
Cam curve : MS (modified sine)

STEP 1

Calculation of moment of inertia

$$\begin{aligned} \text{a) table} \quad J_1 &= \frac{W_t \times R^2}{2} = \frac{79 \times 0.4^2}{2} = 6.32 \quad (\text{kg} \cdot \text{m}^2) \\ \text{B) jig and workpiece} \quad J_2 &= N \times W_j \times R_e^2 = 4 \times 10 \times 0.325^2 = 4.225 \quad (\text{kg} \cdot \text{m}^2) \\ \text{c) total sum of moment of inertia} \quad J &= J_1 + J_2 = 6.32 + 4.225 = 10.545 \quad (\text{kg} \cdot \text{m}^2) \end{aligned}$$

STEP 2

Maximum rotational speed

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

Check that N_{\max} does not exceed max. direct drive actuator rotational speed.

STEP 3

Load torque

Compute about the smallest model allowing load moment of inertia first.

Allowable moment of inertia of AX4300 is 18.0 (kg·m²), so this load is allowed.

Load torque largest value

$$\begin{aligned} T_m &= [A_m \cdot (J + J_M) \cdot \frac{\psi \cdot \pi}{180 \cdot t_1^2} + T_F] \cdot f_c + T_{MF} \\ &= [5.53 \times (10.545 + 0.326) \times \frac{90 \times \pi}{180 \times 0.8^2} + 0] \times 1.5 + 10 \\ &= 231.3 \quad (\text{N} \cdot \text{m}) \end{aligned}$$

Load torque effective value

$$\begin{aligned} T_{rms} &= \sqrt{\frac{t_1}{t_0} \cdot [r \cdot A_m \cdot (J + J_M) \cdot \frac{\psi \cdot \pi}{180 \cdot t_1^2} \cdot f_c]^2 + (T_F \cdot f_c + T_W \cdot f_c + T_{MF})^2} \\ T_{rms} &= \sqrt{\frac{0.8}{4} \times [0.707 \times 5.53 \times 10.871 \times \frac{90 \times \pi}{180 \times 0.8^2} \times 1.5]^2 + (0 \times 1.5 + 0 \times 1.5 + 10)^2} \\ &= 70.7 \quad (\text{N} \cdot \text{m}) \end{aligned}$$

STEP 4

Regenerative electric power

*Subject to AX4300 and AX4500 only

$$\begin{aligned} W &= \left(\frac{V_m \cdot \psi \cdot \pi}{T_1 \cdot 180} \right)^2 \cdot \frac{(J + J_M)}{2 \cdot t_0} \\ &= \left(\frac{1.73 \times 90 \times \pi}{0.8 \times 180} \right)^2 \times \frac{10.871}{2 \times 4} = 15.68 \quad (\text{W}) \end{aligned}$$

$$W \leq 40 \quad (\text{W})$$

STEP 5

Selection guide

Check if temporarily selected AX4300 can be used.

Load moment of inertia total sum $10.545 \leq 18 \quad (\text{kg} \cdot \text{m}^2)$
Maximum rotational speed $33 \leq 100 \quad (\text{rpm})$
Load torque largest value $231.3 \leq 300 \quad (\text{N} \cdot \text{m})$
Load torque effective value $70.7 \leq 100 \quad (\text{N} \cdot \text{m})$
Regenerative electric power $15.68 \leq 40 \quad (\text{W})$
Therefore, AX4300 can be used.

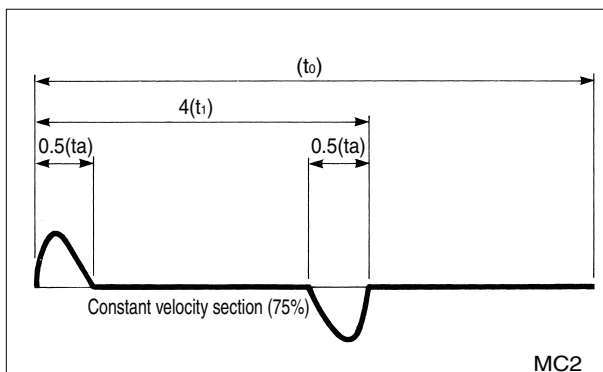
[MC2 curve] selection guide

MC2 curve is ...

MC2 curve, same as MC (deformed constant velocity) curve, has constant velocity section during movement. If acceleration or deceleration time is set, the constant velocity section can be set flexibly. In MC (common name: MCV50) curve, constant velocity section is 50%.

Note. Acceleration or deceleration time setting is 1/2 of moving time or less. If acceleration or deceleration time setting reaches 1/2 of moving time, cam curve is changed to MS (modified sine) curve automatically.

Example diagram shows the speed patterns that a constant velocity section will be 75% by setting acceleration or deceleration time (t_a): 0.5 sec. against moving time (t_1): 4 sec.



Selection method

A model is selected by a MC2 curve with a following formula.

Moving angle	: ψ (°)	Load moment of inertia	: J (kg·m ²)
Cycle time	: t_0 (s)	Output shaft moment of inertia	: J_M (kg·m ²)
Moving time	: t_1 (s)	Friction torque	: T_f (N·m)
Acceleration and deceleration time	: t_a (s)	Working torque	: T_w (N·m)
		Output shaft friction torque	: T_{MF} (N·m)

Maximum rotational speed: N_{max} (rpm)

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

Load torque (largest value): T_m (N·m)

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

Load torque (effective value): T_{rms} (N·m)

$$T_{rms} = \sqrt{\frac{2t_a}{T_0} \cdot \left[3.91 (J + J_M) \cdot \frac{\psi \cdot \left(1 - \frac{t_1 - 2t_a}{t_1 - 0.863t_a} \right) \cdot \pi}{720 \cdot t_a^2} \cdot f_c \right]^2 + [(T_f + T_w) \cdot f_c + T_{MF}]^2}$$

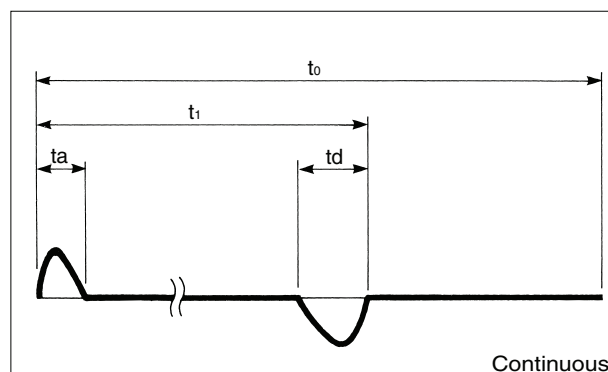
[Continuous rotation] selection guide

Continuous rotation is ...

Continuous rotation has the following functions.

1. Continuous rotation : Continuous rotation will be done with constant speed until continuous rotation stop signal be inputted.
2. Equal index position stop : Stopped at equal index position by equal index continuous rotation stop input.
3. Output of time : Output of time is pulse-outputted during rotation using equal index indication.

Example diagram shows the speed pattern that is accelerated with acceleration time: t_a until the set rotational speed: N , then stopped by continuous rotation stop input with deceleration time: t_d .



Selection method

In continuous rotation, a model is selected with a following formula.

Rotational speed : N (rpm)	Load moment of inertia : J ($\text{kg}\cdot\text{m}^2$)
Cycle time : t_0 (s)	Output shaft moment of inertia : J_M ($\text{kg}\cdot\text{m}^2$)
Acceleration time : t_a (s)	Friction torque : T_f (N·m)
Moderation time : t_d (s)	Working torque : T_w (N·m)
	Output shaft friction torque : T_{MF} (N·m)

Maximum rotational speed: N_{max} (rpm)
 $N_{\text{max}}=N$

Load torque (largest value): T_m (N·m)

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

Load torque (effective value): T_{rms} (N·m)

$$T_{\text{rms}} = \sqrt{\frac{2t_a}{T_0} \cdot \left[3.91 (J+J_M) \cdot \frac{6.82N \cdot t_a \cdot \pi}{720 \cdot t_a^2} \cdot f_c \right]^2 + [(T_f + T_w) \cdot f_c + T_{MF}]^2}$$

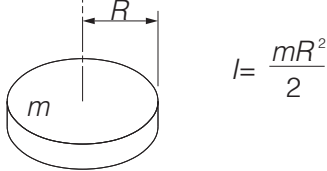
The expression above is for $t_a \leq t_d$. If for $t_a > t_d$, swap t_a to t_d , then select the product again.

Formula of moment of inertia

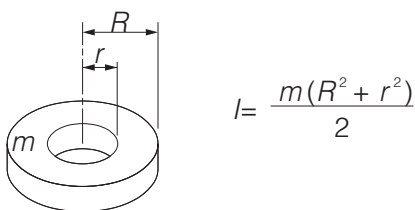
[m : Mass of object (kg)]

● A When center of rotation is its own axis.

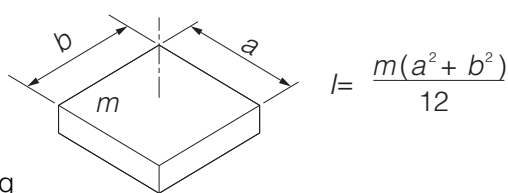
1. Disc (cylinder) Center of rotation



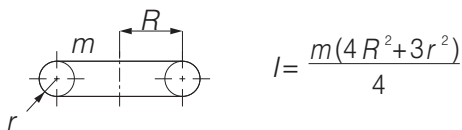
2. Hollow disc (hollow cylinder)



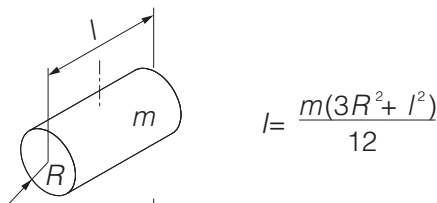
3. Direct hexagonal side finish body



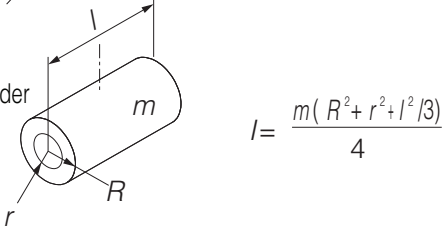
4. Ring



5. Cylinder

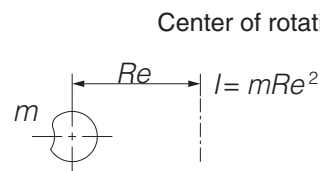


6. Hollow cylinder

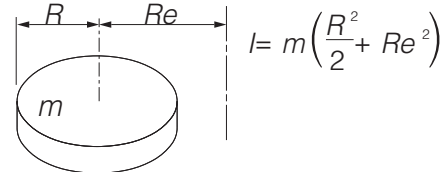


● B When center of rotation is different from its own axis.

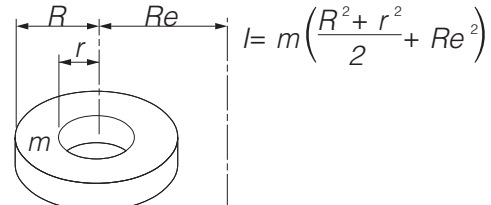
1. Any type (when sufficiently small) Center of rotation



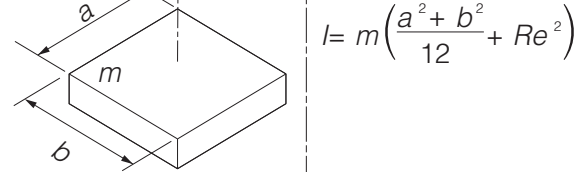
2. Disc (cylinder)



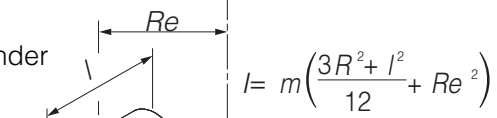
3. Hollow disc (Hollow cylinder)



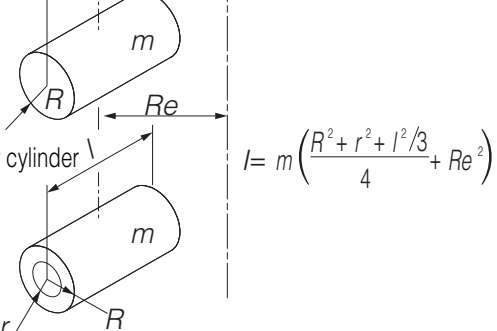
4. Direct hexagonal side finish body



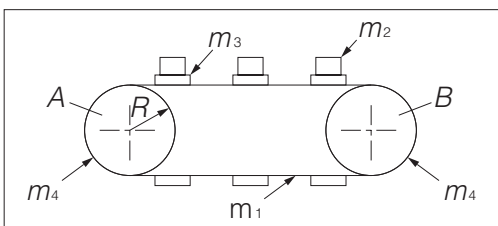
5. Cylinder



6. Hollow cylinder



● For conveyer



m_1 : Chain mass

m_2 : Workpiece total mass

m_3 : Jig (pallet) total mass

m_4 : Sprocket A (drive)+B total mass

R : Drive side sprocket radius

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

Direct drive actuator selection guide specifications check sheets		(Note) if of chain drive or gear, consult with CKD.	
Table direct drive			
Your company name		Your name	
Department			
TEL		FAX	

Operating conditions

1. Index 2. Oscillator
Moving angle ψ (°) or index number
Moving time t_1 (sec.)
Cycle time t_0 (sec.) Cycle time = moving time + dwell time

(Note) Index time = moving time + recovery time.

Depending on working conditions, recovery time may vary between 0.05 and 0.20.

Load conditions

Table

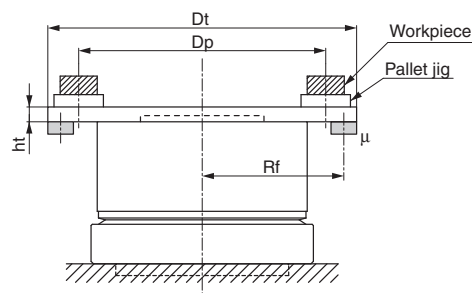
Material 1. steel 2. aluminum
Appearance D_t (mm)
Plate thickness h_t (mm)
Mass m_1 (kg)

Workpiece

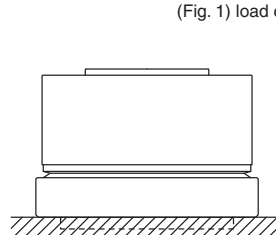
Quantity n_w (piece)
Maximum mass m_w (kg/piece)
Installation center D_p (mm)

Pallet fixture

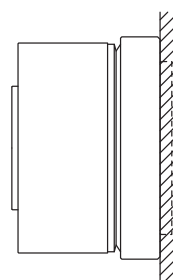
Quantity n_p (piece)
Maximum mass m_p (kg/piece)



(Fig. 1) load conditions



(Fig. 2) installation attitude: horizontal



(Fig. 3) installation attitude: vertical

Others

Installation attitude

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

External work

1. None 2. Present

(Note) Eccentric load by gravity and outside load, etc., by caulking work at vertical installation

Dial plate support form bottom

1. None, 2. Present

Coefficient of friction μ

Action radius R_f (mm)

Equipment rigidity

1. High 2. Low (Note)

(Note) Using spline, when direct fixing is not allowed on equipment (Fig. 4), or when there is mechanism such as chuck, etc., on the table.

Extension by shaft of table

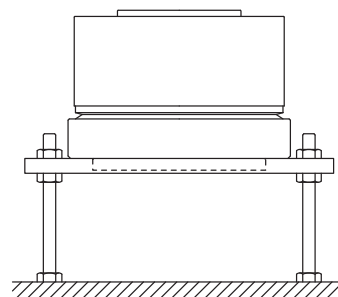
1. None 2. Present (Fig. 5)

Movable of actuator

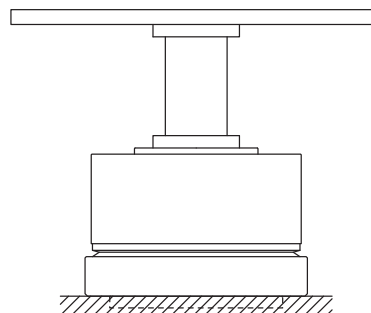
1. None, 2. Present

(Note) When a actuator is moved while the actuator is installed on the X-Y table or lift, etc.

(Note) If 2 is selected in any description, consult with CKD.



(Fig. 4) installation rigidity: low



(Fig. 5) extension by shaft

(Note) The drawings, etc., of equipment should be attached to select a model accurately.

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● Specifications are subject to change without notice.

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