Catalog No.CN-0006

G+® 吉嘉

PRODUCT CATALOGUE

Hollow Rotary Actuator

CS Type Closed Loop Stepper Motor

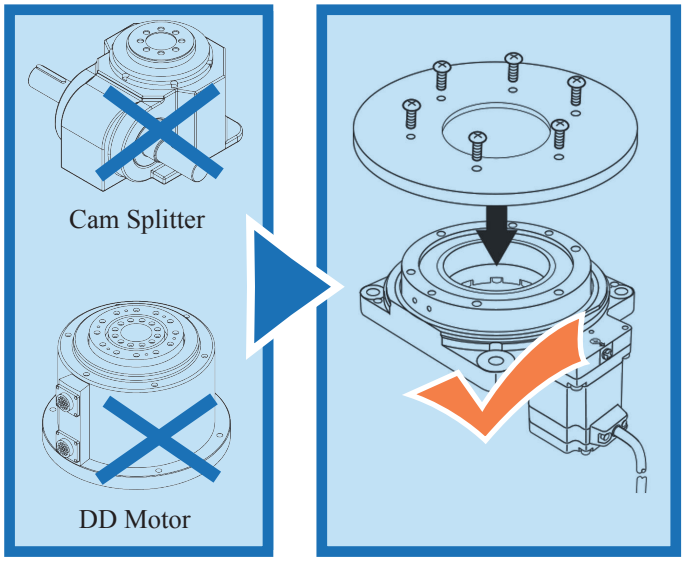
G+® HOLLOW ROTARY ACTUATOR

Revolutionary New Solution for Rotary Motion Control

CS Type Closed Loop Stepper Motor Hollow Rotary Actuators

The CS type of GIGAGER Hollow Rotary Actuator is a line of products that combine a high rigidity hollow rotary table with a dedicated closed loop stepper motor and driver package. It retains the ease of use of a stepper motor, while also allowing for highly accurate positioning of large inertia loads.

- Integrated actuator and stepper motor makes design easier
- Large-diameter hollow output table
- Stepper motor provides excellent performance
  - High precision
  - Agile responsiveness
  - Stability at low speeds
  - Tuning--free
  - High torque output
  - Simple setting
- Pulse Input, 4-digit display, 4-digit function button type driver



- **Improve Reliability and Reduce Cost Through Direct Connections**
  Equipment table and the robot arm can be directly installed on the rotating platform. Compared with the use of mechanical parts such as pulleys and belt, it can reduce the time and cost of mechanical design, parts deployment, belt state adjustment and other aspects.

- **Motor Configuration**
  Can freely equip with Stepper Motor or Servo Motor
  *GSN series Stepper Motor Excluded

- High Precision Positioning without Backlash
  No backlash, positioning accuracy ≦ 2 arc min, repeat positioning accuracy up to ±5 arc seconds.

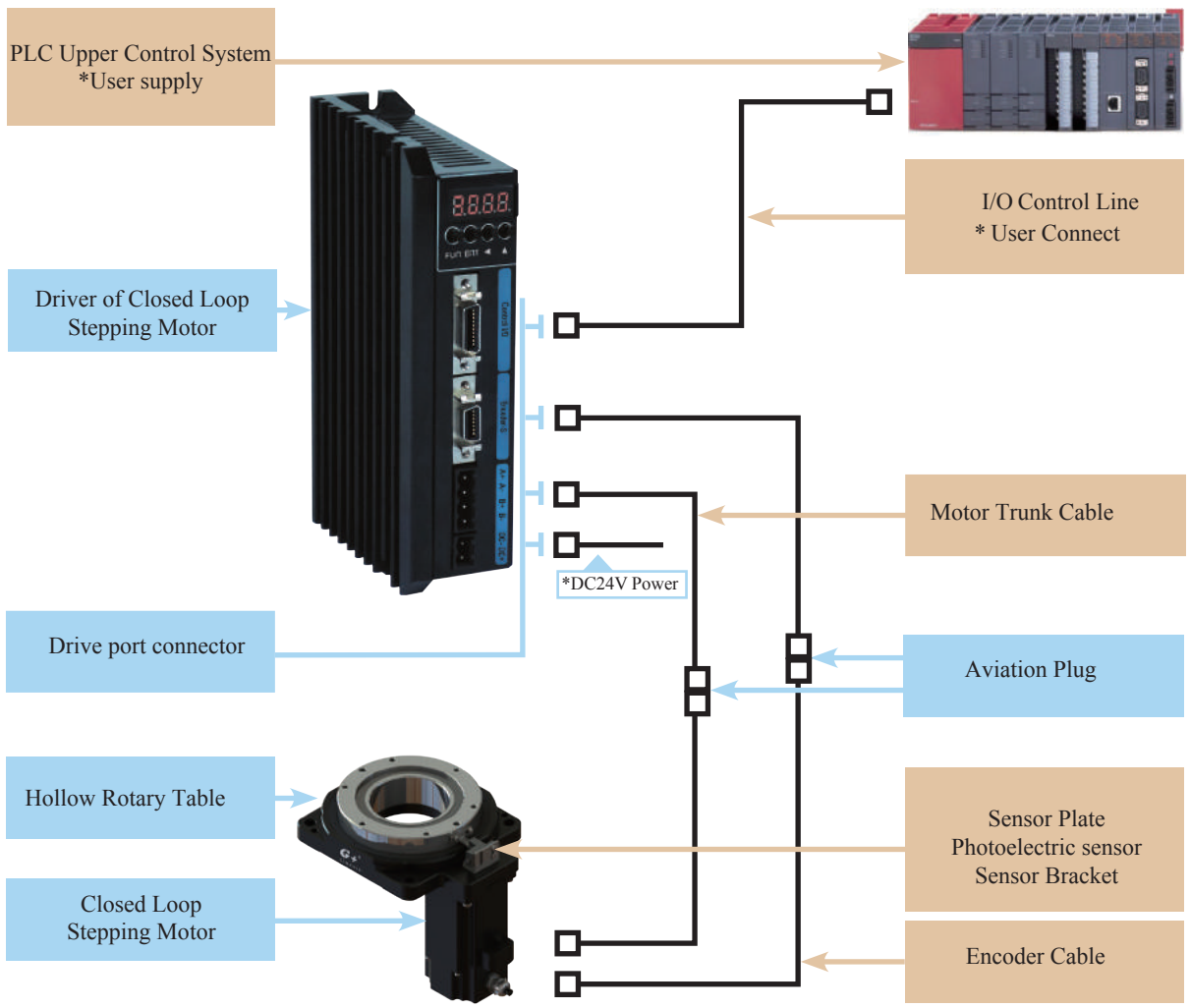
- Large Diameter Hollow Structure
  Wiring and piping are more convenient and simple, and the advantages of this feature are particularly prominent in complicated wiring and piping environments.

System of Hollow Rotary Actuator • CS

Standard Configuration	Actuator × 1 set
	Closed Loop Stepping Motor × 1 set
	Driver of CS motor × 1 set
	Drive port connector × 4 pcs
	Aviation plug × 2 pcs

Optional Accessories	Motor Trunk × 1 pcs (2.5M)
	Encoder Trunk × 1 pcs (2.5M)
	I/O Control Line × 1 pcs (1M)
	Sensor Plate × 1 pcs (See P32)
	Photoelectric sensor × 1 set
	Sensor Bracket × 1 set (See P32)

System Diagram

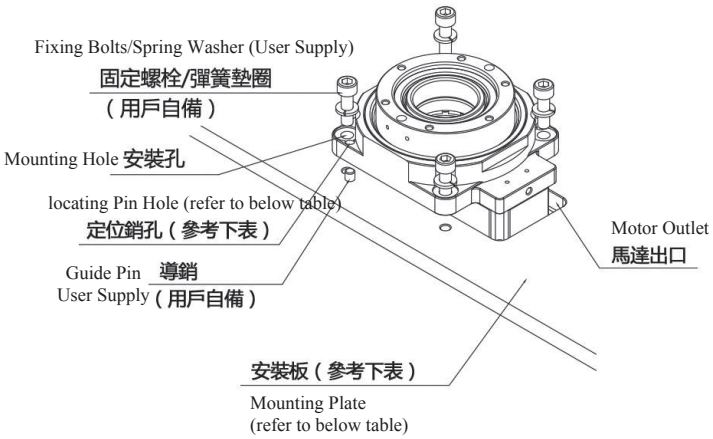


* Accessories Options：the above Accessories Options are for user's reference only, user can purchase as per the requirement.

Installation Instruction of Hollow Rotary Actuator

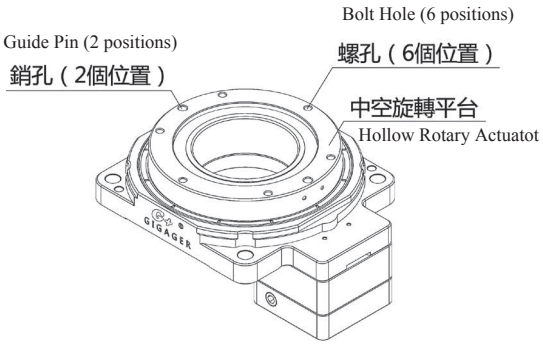
■How to install a hollow rotating actuator?

Leave a motor outlet on the machine mounting plate to expose the motor. Use the two locating pin holes (the locating pin holes in GSB60 and GSN60 are common to the mounting holes) and mount the hollow rotating actuator to the machine mounting plate shown below. These mounting holes are used to accurately position the hollow rotating actuator on the machine, making sure to secure the locating pins to the mounting plate.



■How to install a load on a hollow rotating actuator

Install the load using the 6 mounting holes on the hollow rotating actuator. There are 2 pin holes for mounting the load on the hollow rotating actuator, which can be used to determine the position of the load. Be sure to fix the positioning pin firmly on the load.



■Installation Precautions

Before installation, read the following installation precautions and install as follows。

- Indoor (area not directly in contact with sunlight)
- Area without heat radiation
- Working environment temperature: 0~+50°C
- Temperature below the origin sensor: 0~+40°C
- Working environment humidity: less than 85%
- There is no flammable or explosive acid gas
- Place to block dust, oil and splashes
- Place without direct shock or excessive impact

●Locating pin hole size

Actuator Model	Diameter (mm)	Depth (mm)	Quantity
GSN85	Ø5 $+^{0.012}_{0}$ (H7)	9.5 (THRU)	2
GSN130		14.5 (THRU)	2
GSN200	Ø8 $+^{0.015}_{0}$(H7)	16 (THRU)	2
GSB100	Ø4 $+^{0.012}_{0}$(H7)	13 (THRU)	2
GSB130	Ø6 $+^{0.015}_{0}$(H7)	15 (THRU)	2
GSB200	Ø8 $+^{0.015}_{0}$(H7)	23 (THRU)	2

●Mounting plate thickness

Actuator Model	Thickness
GSN60	More than 5mm
GSB60	
GSN85	More than 8mm
GSB100	
GSN130	More than 10mm
GSB130	
GSN200	
GSB200	

Calculation Reference of Hollow Rotary Actuator

■Load Calculation / Loads Moment of Inertia (J_W)

The moment of inertia of the load shall be less than 30 times the moment of inertia of the transmission.

■Calculate the Acceleration Torque (T_a) . Refer to below fomula.

Acceleration Torque $Ta[N \cdot m]=(J_M + J_A + J_W) * \frac{\pi}{30} * \frac{(N_2-N_1)}{t_1}$

J_M : Motor Moment of Inertia [kg· m^2]

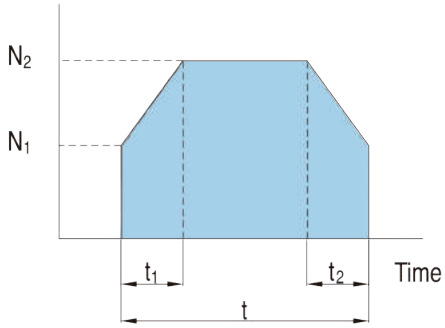
J_A : Mechanism Moment of Inertia [kg· m^2]

J_W : Load Moment of Inertia [kg· m^2]

N_2 : Working Speed [r/min]

N_1 : Starting Speed [r/min]

t_1 : Acceleration (deceleration) Time [S]



■Calculate the Required Torque

The required torque is calculated by multiplying the sum of the load torque caused by the frictional resistance and the acceleration torque caused by the moment of inertia by the safety factor.

Required Torque T = (Load torque [N.m]+ Acceleration torque [N.m]) x Safety factor

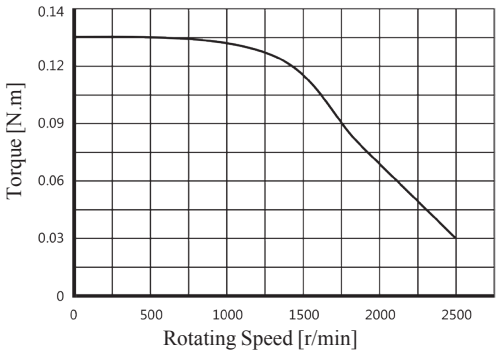
= (T_L+T_a) x S

Safety factor S more than 1.5。

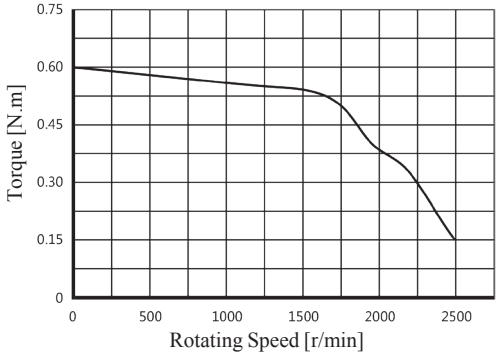
■The torque required of the selected motor T must be within the scope of speed - torque

Stepping Motor Speed Torque Characteristic Curve

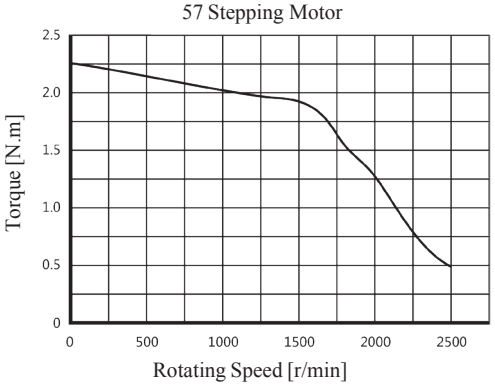
28 Stepping Motor



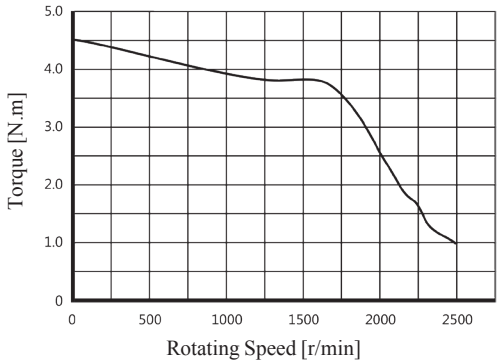
42 Stepping Motor



57 Stepping Motor

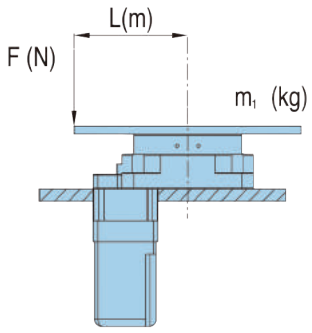


86 Stepping Motor



Axial Load, Calculation of Inertia Moment Load

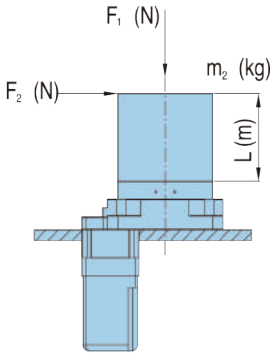
When applying the load on the hollow rotating actuator as shown below, be sure to calculate that the axial load and the moment of inertia load are within the specified range of calculation of the following formula.



Axial Load [N]：$F_t=F+m_1xg$

Inertia Moment Load [N.m]：M=FxL

g：Gravity Acceleration 9.807[m/s^2]



Axial Load [N]：$F_t=F_1+m_2xg$

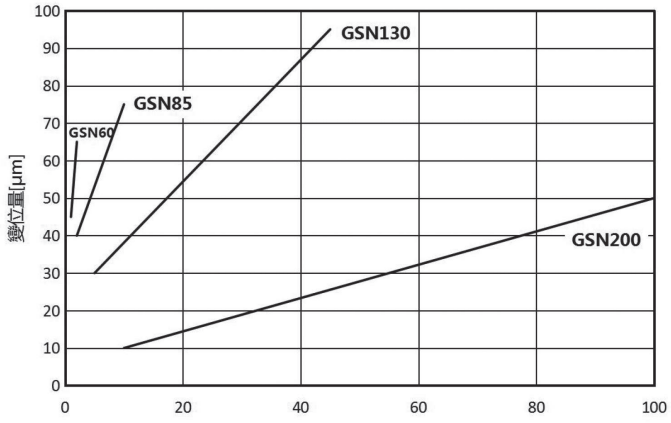
Inertia Moment Load [N.m]：$M=F_2x$（L+A）

g：Gravity Acceleration 9.807[m/s^2]

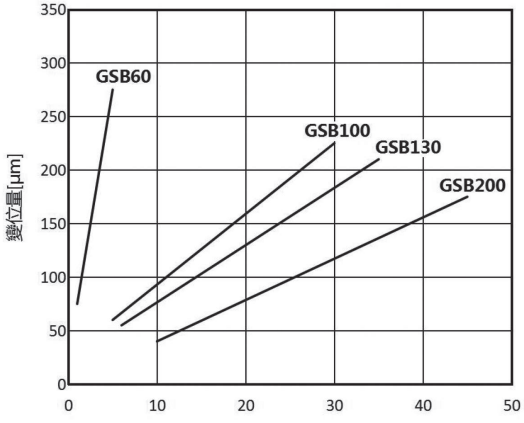
Model	A
GSN60	0.010
GSB60	0.010
GSN85	0.015
GSB100	0.015
GSN130	0.017
GSB130	0.017
GSN200	0.033
GSB200	0.033

Actuator Rigid Reference

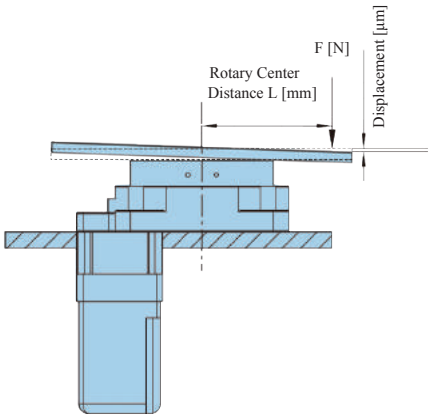
Different types of rotating actuators use different types of support bearings, which have a certain influence on the Permissible Moment of Inertia Load of the rotating platform, that is, the larger the model, the greater the permissible moment of inertia load. However, the amount of displacement for the moment of inertia load will be smaller. For details, refer to the following chart (L = 200mm).



GSN Series Inertia Moment Load [N.m]



GSB Series Inertia Moment Load [N.m]



Terminology of Hollow Rotary Actuator

Motor Type	Rotating actuator adaptable motor type
Rotary Actuator Bearing	The type of bearing used for Rotary Actuator.
Permissible Torque Note 1	The mechanical strength thresholds of the speed reduction mechanism, including the acceleration torque and the load inertia, must be used within this Permissible Torque range.
Permissible Speed	The table surface speed allowed by the mechanical strength of the speed reduction mechanism.
Moment of Inertia	The sum of values of Moment of inertia of the motor rotor + the inertia of the deceleration mechanism on the rotating actuator.
Permissible Axial Load	Allowable value of axial load applied to the axis of the rotating platform.
Permissible Moment of Inertia Load	The load is applied at a position deviating from the center of the rotating platform, so that the force of the tilting of the rotating platform will occur when the center of the eccentricity × the load is calculated as the allowable value of the inertia moment load.
Positioning Accuracy	The error between the theoretical rotation angle and the actual rotation angle when the rotary platform is positioned at any point within 360°.
Repetitive Positioning Accuracy	Indicates the error value generated when the same position is repeatedly positioned from the same direction.
Platform Flatness	Operating amplitude of the table surface.
Platform Concentricity	Concentricity error value of inner and outer diameter of rotating platform without load.
Permissible Input Speed	The allowable input speed of the mechanical strength of the reducer structure.
Backlash	Refers to the gear clearance of the rotating platform after fixing the motor shaft.
Destructive Torque	When the reducer is subjected to this torque, the structure will be destroyed.
Precision Lifespan	Designed life span that maintains accuracy under normal use of the reducer.
Ingress Protection Note 3	For the protection structure of machines based on IEC529 and EN60034-5 (= IEC60034-5), it can be classified according to the degree of dustproof and waterproof.

Note 1：Unit Exchange of Torque

Torque Unit	1 N.m	1 N.cm	1 kgf.m	1 kgf.cm	1 lbf.ft	1 lbf.in
1 N.m	1	10^{2}	0.10197	10.197	0.7376	8.8509
1 N.cm	10^{-2}	1	1.0197×10^{-3}	0.10197	7.376×10^{-3}	8.8509×10^{-2}
1 kgf.m	9.8066	980.665	1	10^{2}	7.233	86.79
1 kgf.cm	9.8066×10^{-2}	9.8066	10^{-2}	1	7.233×10^{-2}	0.8680
1 lbf.ft	1.356	1.356×10^{2}	0.1383	13.83	1	12
1 lbf.in	0.113	11.3	1.152×10^{-2}	1.152	8.333×10^{-2}	1

Note 2：Angle Units

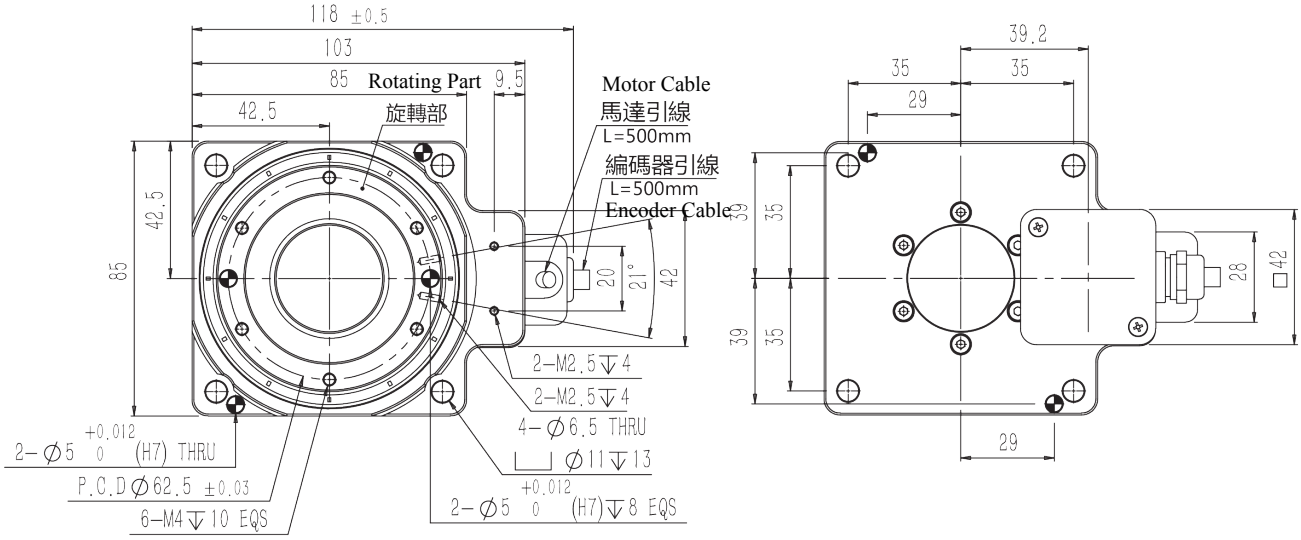
Angle Units	Value	Symbol	Shorthand
Degree	1/360 Circle	°	Deg
Arc minute	1/60 degree	’ (prime number)	arcmin,amin,MOA
Arc-second	1/60 arcmin	” (Double prime number)	arcsec
1/1000 Arc Second	1/1000 arcsec		mas

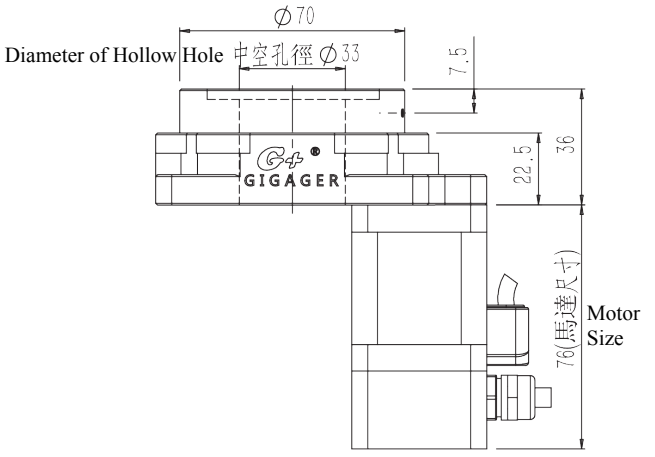
Note 3：IP Ingress Protection

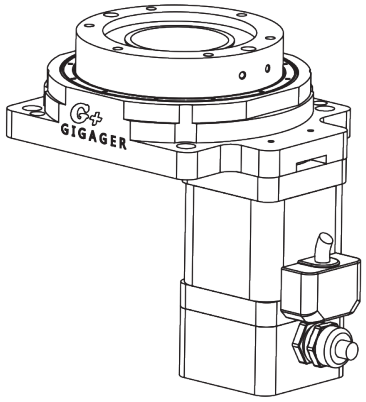
IP No.	Dustproof (first number)
IP 0 X	No special protection
IP 1 X	Objects over 50mm in diameter cannot enter
IP 2 X	Objects over 80mm in length and over 12mm in diameter cannot enter
IP 3 X	Objects with a diameter or thickness exceeding 2.5 mm and a diameter exceeding 2.5 mm cannot enter
IP 4 X	Objects with a thickness exceeding 1.0 mm and a diameter exceeding 1.0 mm cannot enter
IP 5 X	Prevent incoming dust from affecting equipment operation
IP 6 X	Completely prevent dust from entering

IP No.	Waterproof (second number)
IP X 0	No special protection
IP X 1	Drops falling vertically will not cause damage to the appliance
IP X 2	Prevents water droplets from immersing when tilted 15 degrees
IP X 3	In the range of 60° from the vertical direction, the sprayed water spray is not damaged.
IP X 4	Spilled by water in any direction without damage
IP X 5	Directly affected by water spray in any direction without damage
IP X 6	Impact water in any direction directly subjected to strong currents does not enter the interior
IP X 7	Underwater immersion can still be used normally under certain conditions
IP X 8	Can be used underwater

■ GSN85-18K-CS





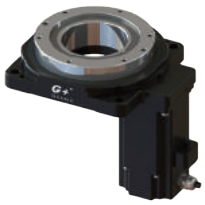


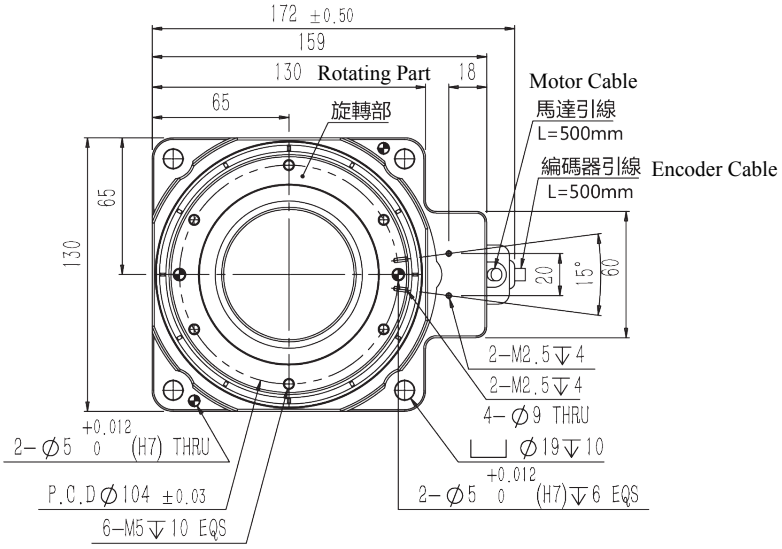
Parameter		
Motor Type		Dedicated Closed Loop Stepper Motor
Rotary Platform Bearing		Cross Roller Bearing
Permissible Torque	N.m	3.2
Permissible Speed	rpm	160 (Table Surface)
Gear Ratio		1:18
Moment of Inertia	$kg.m^2$	2534×10^{-6}
Permissible Axial Load	N	500
Permissible Moment of Inertia Load	N.m	10
Positioning Accuracy	min	≦2
Repeatability	sec	±5 (0.001°)
Platform Flatness	mm	±0.005
Platform Concentricity	mm	±0.01
Ingress Protection	IP	40
Precision Lifespan	H	20000
Weight	kg	1.4 (including motor)

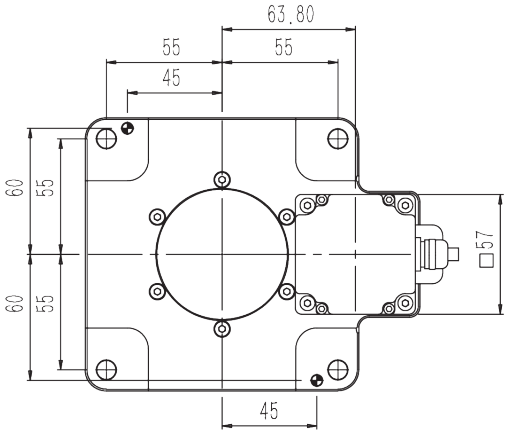
Motor Parameter		
Dimension	mm	42
Rated Voltage V/phase		3.25
Rated Current A/phase		1.3
Coil Impedance Ω/phase		2.5
Coil Inductance	mh	6.0
Holding Torque	N.m	0.6
Moment of Inertia	$g.cm^2$	82
Motor Length	mm	76
Encoder Resolution	P/R	2500
Ingress Protection	IP	20
Step Angle		1.8°
Lead		4

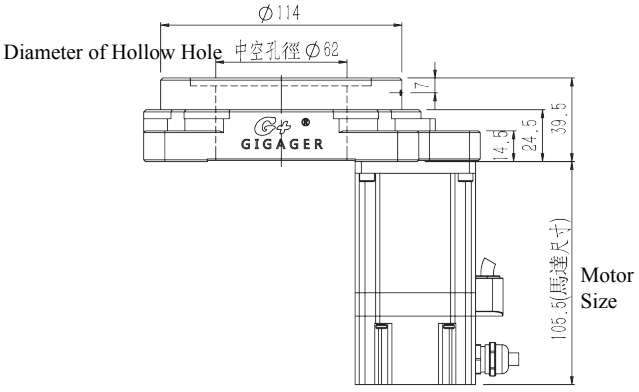
Dedicated Driver	
Input Voltage	DC24V
Command Input	Pulse + Direction DC5V

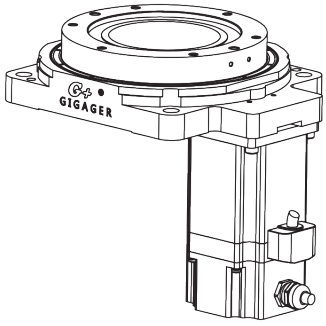
■ GSN130-18K-CS









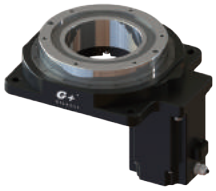


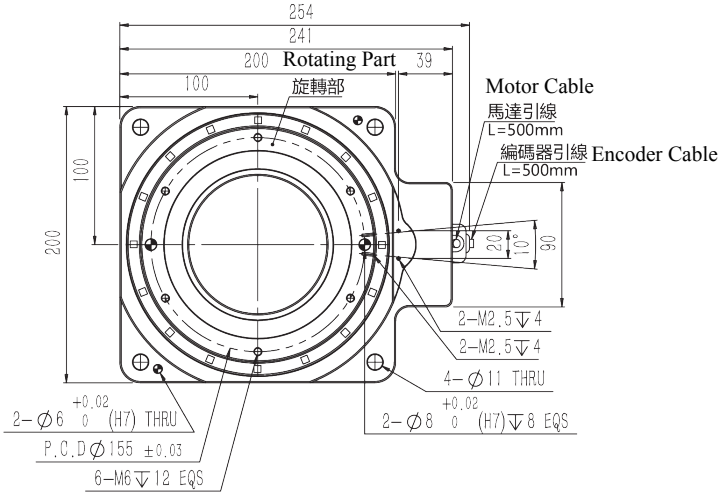
Parameter		
Motor Type		Dedicated Closed Loop Stepper Motor
Rotary Platform Bearing		Cross Roller Bearing
Permissible Torque	N.m	20
Permissible Speed	rpm	120 (Table Surface)
Gear Ratio		1:18
Moment of Inertia	$kg.m^2$	15874×10^{-6}
Permissible Axial Load	N	2000
Permissible Moment of Inertia Load	N.m	50
Positioning Accuracy	min	≦2
Repeatability	sec	±5 (0.001°)
Platform Flatness	mm	±0.005
Platform Concentricity	mm	±0.01
Ingress Protection	IP	40
Precision Lifespan	H	20000
Weight	kg	3.3 (including motor)

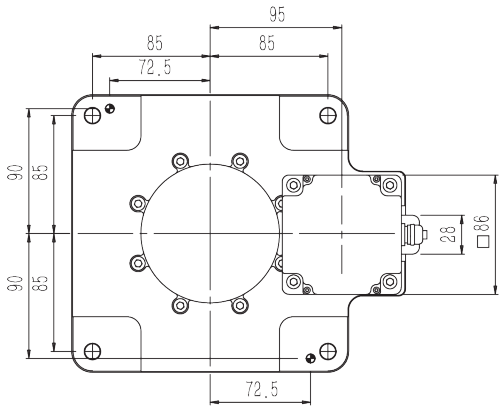
Motor Parameter		
Dimension	mm	57
Rated Voltage	V/phase	3.6
Rated Current	A/phase	3.0
Coil Impedance	Ω/phase	1.2
Coil Inductance	mh	4.2
Holding Torque	N.m	2.2
Moment of Inertia	$g.cm^2$	460
Motor Length	mm	105.5
Encoder Resolution	P/R	2500
Ingress Protection	IP	20
Step Angle		1.8°
Lead		4

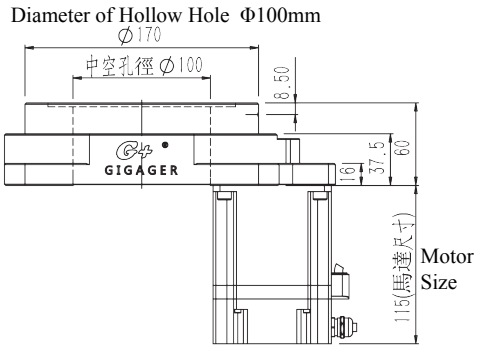
Dedicated Driver	
Input Voltage	DC24V
Command Input	Pulse + Direction DC5V

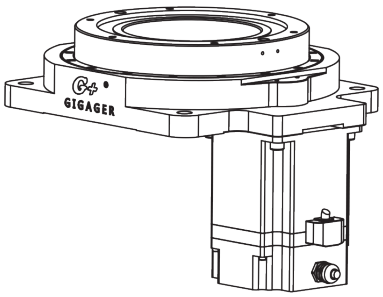
■ GSN200-18K-CS









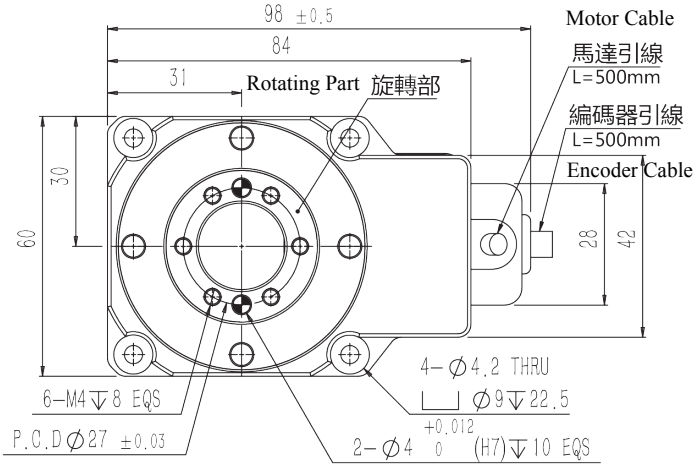


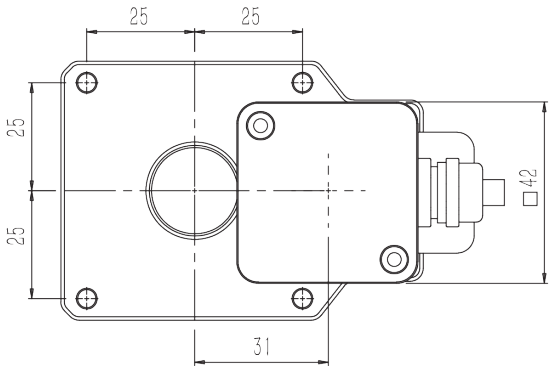
Parameter		
Motor Type		Dedicated Closed Loop Stepper Motor
Rotary Platform Bearing		Cross Roller Bearing
Permissible Torque	N.m	50
Permissible Speed	rpm	100 (Table Surface)
Gear Ratio		1:18
Moment of Inertia	$kg.m^2$	108160×10^{-6}
Permissible Axial Load	N	4000
Permissible Moment of Inertia Load	N.m	100
Positioning Accuracy	min	≦2
Repeatability	sec	±5 (0.001°)
Platform Flatness	mm	±0.005
Platform Concentricity	mm	±0.01
Ingress Protection	IP	40
Precision Lifespan	H	20000
Weight	kg	10 (including motor)

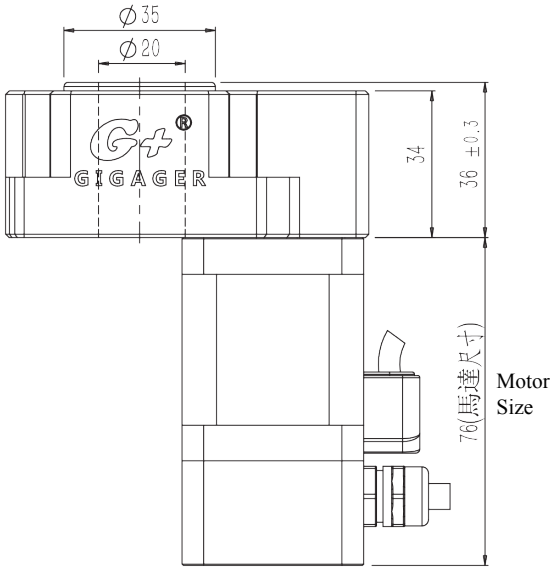
Motor Parameter		
Dimension	mm	86
Rated Voltage	V/phase	3.36
Rated Current	A/phase	5.6
Coil Impedance	Ω/phase	0.6
Coil Inductance	mh	5.2
Holding Torque	N.m	9.5
Moment of Inertia	$g.cm^2$	2500
Motor Length	mm	115
Encoder Resolution	P/R	2500
Ingress Protection	IP	20
Step Angle		1.8°
Lead		4

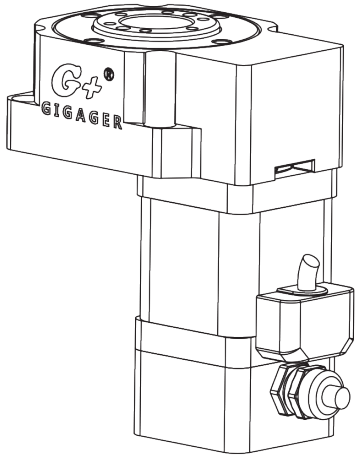
Dedicated Driver	
Input Voltage	DC48V
Command Input	Pulse + Direction DC5V

■ GSB60-05K-CS





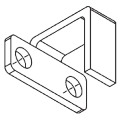




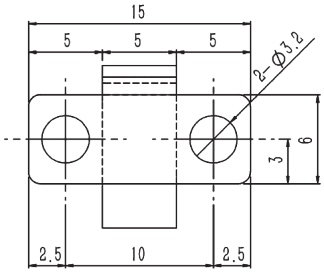
Parameter		
Motor Type		Dedicated Closed Loop Stepper Motor
Rotary Platform Bearing		Tapered Roller Bearings
Permissible Torque	N.m	4.9
Permissible Speed	rpm	300 (Table Surface)
Gear Ratio		1:5
Moment of Inertia	kg.m^2	2330×10^{-7}
Permissible Axial Load	N	100
Permissible Moment of Inertia Load	N.m	5
Positioning Accuracy	min	≦2
Repeatability	sec	±5 (0.001°)
Platform Flatness	mm	±0.005
Platform Concentricity	mm	±0.01
Ingress Protection	IP	40
Precision Lifespan	H	20000
Weight	kg	1 (including motor)

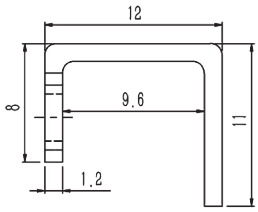
Motor Parameter		
Dimension	mm	42
Rated Voltage	V/phase	3.25
Rated Current	A/phase	1.3
Coil Impedance	Ω/phase	2.5
Coil Inductance	mh	6.0
Holding Torque	N.m	0.6
Moment of Inertia	g.cm^2	82
Motor Length	mm	76
Encoder Resolution	P/R	2500
Ingress Protection	IP	20
Step Angle		1.8°
Lead		4

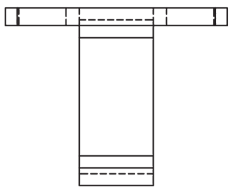
Dedicated Driver	
Input Voltage	DC24V
Command Input	Pulse + Direction DC5V

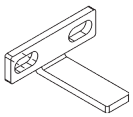


■ B-G1 (GSB series sensor plate)

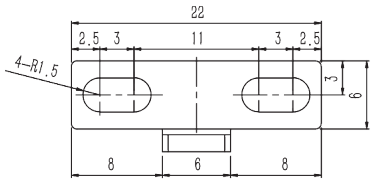


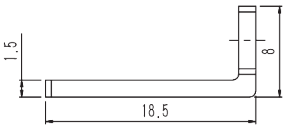


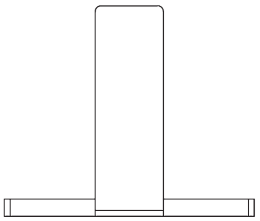


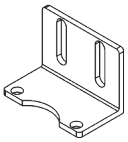


■ N-G1 (GSN series sensor plate)

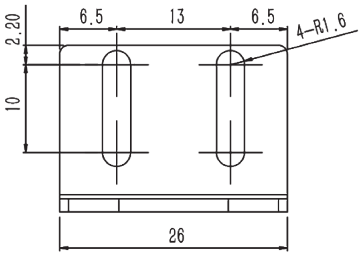


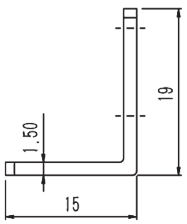


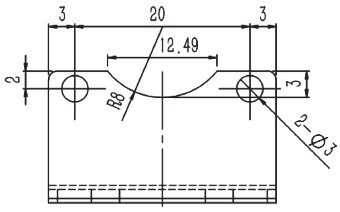




■ N-G2 (GSN series sensor bracket)







- GSB series no need sensor bracket
- Home sensor set：GSB series equipped with OMRON EE-SX672，GSN series equipped with OMRON EE-SX674

Precautions of Using Hollow Rotary Actuator

Be sure to read the precautions described below to avoid damaging the device or causing injury to the user. Failure to read and understand the following precautions may damage the product, related equipment and systems, or cause serious or potential damage.

- Avoid hammering the product with a hammer or dropping the product.
- Be careful when connecting the product to the load side.
- Be careful when handling the edges and key sides of the product.
- Avoid touching the rotating shaft with your hands and other foreign objects when using the product.
- Avoid excessive impact on the product when assembling pulleys, linkages, and mechanical keys.
- Do not exceed Permissible Torque, as this may result in loose, vibrating or damaged bolts.
- Do not disassemble and reassemble the product to avoid damage or affect product performance.
- If the product is abnormal, stop the operation immediately, otherwise it may adversely affect the system.

Warranty

GIGA PRECISION promises to provide customers with lifelong product maintenance service from the date of product sale. For faulty products that are under warranty but do not meet the warranty conditions and products that exceed the warranty period, GIGA PRECISION provides paid repair service. See the detailed provisions below for specific repair services.

Warranty Scope

- The free warranty period will take effect from the date of purchase; it will expire 12 months after the date of purchase. If the product fails during the warranty period, GIGA PRECISION will provide customers with repair or replacement products according to this warranty;
- Free warranty provided by GIGA PRECISION in case of defects in materials or workmanship;
- The failure of the product and its components during the warranty period in accordance with normal operating conditions or conditions specified by GIGA PRECISION.

The following conditions occur during the warranty period, GIGA PRECISION does not provide free warranty service.

- Damage to the product caused by improper handling;
- The faulty product that the customer has dismantled without permission;
- Products that fail to properly use the product for direct damage or accidental damage;
- Damage caused by natural disasters and other accidents.

- 4-digit digital display, 4-position function button, easy to use, no need for cumbersome parameter adjustment
- High precision, high response, no loss of step, absolutely static when stopped
- Match 10000PPR encoder to achieve accurate walking at 0.036° per second
- Overturning the concept of traditional stepper motor, truly realizing the servoization of closed-loop stepping

●Simple Parameter Setting

In order to fully improve the control performance, the most critical step is to adjust the gain of the servo system. Adjusting parameters based on load changes is a long-term, cumbersome, and costly task for application engineers. This closed-loop stepper servo system uses a unique closed-loop stepper motor control algorithm that eliminates these cumbersome steps and improves performance. This closed-loop stepper servo system is suitable for low-rigidity loads and solves the common problems of most common servo systems, maintaining optimum performance under different rigid loads.

●Innovative Closed-loop Stepper Servo System

The high-resolution encoder is used to continuously monitor the position of the current motor shaft. The encoder feedback function is used to update the current position information every 20μs. If a position deviation occurs, the closed-loop step servo system immediately takes corrective action to correct the position deviation.

●No Adjustment Problem When the Motor Stops

In contrast to conventional servo systems, the closed-loop stepper servo utilizes the unique performance of a closed-loop stepper motor to make the motor stop without adjustment, and after reaching the desired target position, there is no positional fluctuation.

●High Command Responsiveness

The closed-loop step servo system has good command synchronization, realizes high response and fast positioning reaction, and has the characteristics of short-distance fast action.

●Large Torque Output

Outputs a large torque over a very wide speed range. The drive can run continuously at 100% load without worrying about the ability of the motor to drive the load. Different from the traditional micro-step (subdivided) drive, the original current control technology can be used to achieve high-speed stable output of large torque according to the motor speed.

●Smooth and High Precision

Standard equipped with an encoder of accuracy 10,000 pulse/turn, unlike standard microstep (subdivided) drivers, it uses 32-bit high-speed DSP+ vector control and filtering to achieve smoothness and high accuracy. The minimum smoothing and creep-free speed is less than 0.2 rpm and the angular accuracy is <0.036°.

Safety Precautions

In order to prevent danger or injury to users and workers, please use this product correctly and thoroughly read and understand these precautions before use.

[Warning]

- Never open the case or touch any devices and connectors on the backplate during operation.
- If the drive is accidentally damaged during operation, the company is only responsible for the repair and replacement of the drive within the warranty.
- The company does not bear any compensation for motor loss or personal injury or property damage caused by accidental damage to the drive.
- Do not use this product in an area exposed to explosive, flammable, corrosive gases, water splashes, or nearby. Or it may cause fire, electric shock, or body injury.
- Trained technicians are allowed to install, connect, operate, and perform inspection/removal of product failures. Failure to do so may result in fire, electric shock, personal injury, or equipment damage.
- Do not move, install, connect, or inspect the product while the drive is powered. You must turn off the power when performing these operations, as this may result in electric shock.
- The terminal marked with a symbol ⚠⚠ on the front panel of the drive is to indicate the presence of a high voltage. Do not touch these terminals to avoid the risk of fire or electric shock.
- Do not use non-electromagnetic brakes in vertical applications. Otherwise, when the protection function of the drive is activated, the motor may not stop and the moving part of the device may fall, resulting in personal injury or equipment damage.
- When installing, the protective earth terminal of the motor and driver must be connected. Failure to do so may result in electric shock.
- Do not bend, pull or pinch the cable forcibly, as this may cause fire or electric shock.
- Check the terminals and tighten the screws of the terminals, otherwise it may cause electric shock or fire.
- Always keep the drive's power supply voltage below the rated value. Otherwise it may result in fire or damage to the drive.
- Always turn off the power before performing maintenance/inspection, as this may result in electric shock.
- Do not touch the connection terminals on the drive immediately after turning off the power (within 30 seconds, or until the power LED is turned off), residual voltage may cause electric shock.
- Regularly check and clean the dust accumulated in the open part of the drive, otherwise it may cause a fire.
- Do not disassemble or repair the motor and the drive. Doing so may result in electric shock, injury or equipment damage. If you need to inspect or repair internal parts, please contact the product supplier.

General Specifications

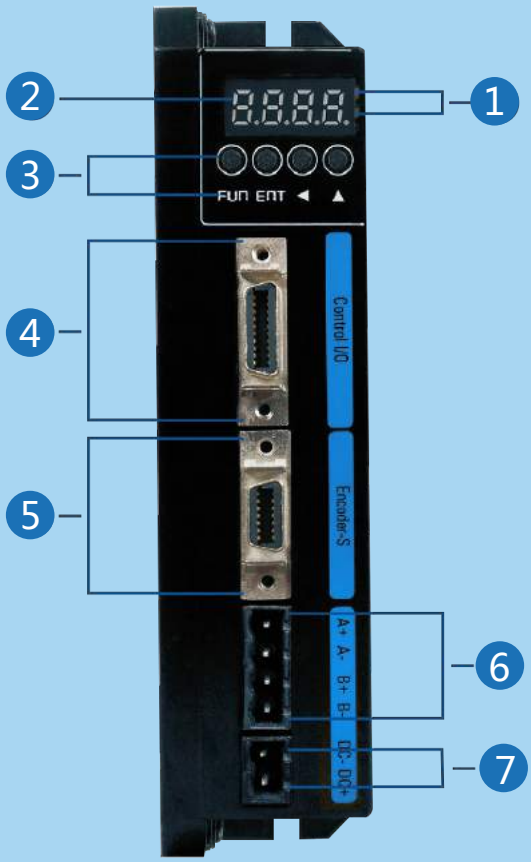
Item		Closed Loop Stepping Driver
Insulation Resistance		After continuous operation under normal temperature and humidity, the resistance between the power terminal and the protective ground terminal, between the power terminal and the I/O terminal is measured by the DC500V high resistance meter to 100MΩ or more.
Insulation withstand voltage		After continuous operation under normal temperature and humidity, the power input and the heat sink are applied at 50Hz, AC0.5kV for 1 minute without abnormality.
Temperature Rises		After continuous operation under normal temperature and humidity, the temperature rise of the heat sink measured by the thermocouple method is below 50 ° C.
Using Environment	Ambient Temperature	-5~+50° C (No icing)
	Environment Humidity	Under 85% (No condensation)
	Altitude	Under altitude 1000m
	Media Environment	Non-corrosive gases, dust, etc., should not be used in special environments containing radioactive materials, magnetic fields, and vacuum.
	Vibration	Continuous vibration or excessive shock shall not be applied. According to JIS C600C-2-6 Sinusoidal vibration test method Frequency range: 10-55Hz Single amplitude: 0.15mm Swing direction: 3 Direction (X, Y, Z) Swing times: 20 times
Keeping Environment	Ambient Temperature	-5~+70° C (No icing)
	Environment Humidity	Under 85% (No condensation)
	Altitude	Under altitude 3000m
Ingress Protection		IP27

Driver Selection Reference Table

Actuator Model	Motor Base	Driver Model	
GSN60	28	D42	-A -B
GSB60	42		
GSN85			
GSN130	57	D57	
GSN200	86	D86	

*A-OS B-CS

■Name of Driver Front Part



①Status monitor display　LED display

Color	Function	Lighting condition
Green	Power display	when input power
Yellow	Servo lock shaft	when motor lock shaft
Red	Warning display	When protection function activated

②Four digit display

Parameter number	Description	Value	Unit
d0	Drive shows motor speed	0~3000	RPM
d1	Drive encoder position	5000	1PPR
d2	The drive shows the current internal temperature	15~85	° C
d3	Motor running direction	0,1	
d4	Drive shows current software version	1000	Version

③Four-digit button

Symbol	Function	Description
FUN	Function	Choose various functions
ENT	Confirm	Confirm input data or enter a parameter setting item
◄	Move	Data cyclic shift
▲	Self-added	Data cyclic self-addition

④Control I/O Interface

Interface	Description	Note
1	Pulse(CW+) Pulse Positive Input	Please use multi-core twisted-pair shielded cable of 0.15mm² or more
2	Pulse(CW-) Pulse Negative Input	
3	Dir+(CCW+) Direction Positive Input	
4	Dir+(CCW-) Direction Negative Input	
5	Encoder A+ Output	
6	Encoder A- Output	
7	Encoder B+ Output	
8	Encoder B- Output	
9	Encoder Z+ Output	
10	Encoder Z- Output	
11	Alarm Signal Output (OC)	
12	Positioning completion signal output (OC)	
13	Servo Lock Shaft Input	
14	Alarm Reset Input	
15	Encoder Z Output (OC)	
16	Brake Signal Positive Output Break+	
17	Brake Signal Negative Output Break-	
18	Drive Internal Reference Ground GND	
19	External Power Supply OV	
20	External Power Supply +24V	

⑤Encoder Interface

Interface	Description	Note
1	Encoder A+ Input	Please use 8-core twisted-pair shielded cable of 0.15mm^2 or more.
2	Encoder A- Input	
3	Encoder B+ Input	
4	Encoder A- Input	
5	Encoder Z+ Input	
6	Encoder Z- Input	
7	5VDC Output (5V Encoder Power +)	
8	0VDC Output (5V Encoder Power -)	
9	FG (Case Ground)	
10/11/12/13/14	Not Connected	

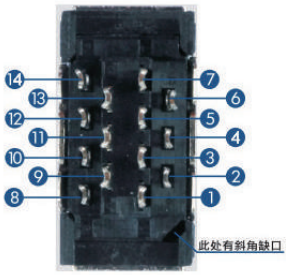
⑥Motor Power Supply Interface

Interface	Description	Note
A+	Positive Drive Output of Motor Winding A	Please use a 4-core cable of 0.5mm^2 or more.
A-	Negative Drive Output of Motor Winding A	
B+	Positive Drive Output of Motor Winding B	
B-	Negative Drive Output of Motor Winding B	

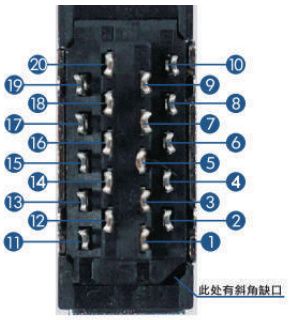
⑦Power Input interface

Interface	Description	Scope of Power
DC+	Power Input + , Voltage Range Vs	24VDC(28mm-60mm base) 40-70VDC(86mm base)
DC-	Power Input - , Power Reference Ground GND	

Connector Pin Number



14P Male Plug



20P Male Plug

●Digital Tube Display Meaning

Symbol	Meaning	Description
0	Display Parameter	The data items at the beginning of 0 indicate display options
P	Set Parameter	The data item at the beginning of P indicates the settable operating parameter selection
EPR	Memory Function	Save the currently used parameters in the EEPROM
FUN	Assistant Function	Data items beginning with FUN indicate assistant function

● P Parameter Related Content

Parameter Number	Value	Description
PO	0~4	Display content
P1	1~9	Segmentation settings
P2	0~15	Gain setting
P3	0~15	Positioning setting
P4	0 or 1	Single and double pulse setting
P5	0 or 1	Direction reversal
P6	1~9999	Display refresh rate
P7	1257	Restore factory parameter password

●Subdivision Description

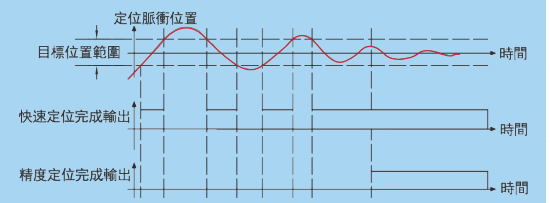
Parameter Number	P1									
Parameter Value	1	2	3	4	5	6	7	8	9	10
Pulse / Turn (PPR)	500	1000	1600	2000	3600	5000	6400	7200	10000	50000

●Gain Setting

Parameter Number	Parameter Value	Adjustment Level	Proportional Gain	Parameter Value	Adjustment Level	Proportional Gain
P2	0	A	1	11	C	1
	1	A	2	12	C	2
	2	A	3	13	C	3
	3	A	4	14	C	4
	4	A	5	15	C	5
	5	A	6			
	6	B	1			
	7	B	2			
	8	B	3			
	9	B	4			
	10	B	5			

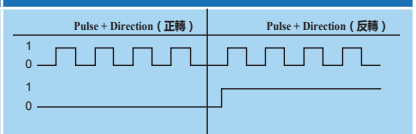
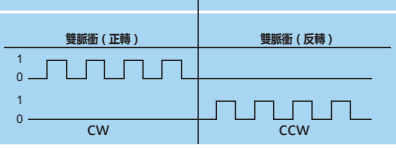
* The adjustment level ABC represents three automatic adjustment levels, the A-level adjustment speed is the fastest, and the C-level adjustment speed is the slowest. The smaller the proportional gain value, the faster the response speed. For large inertia loads, it is recommended to increase this value. Generally, no adjustment is needed.

●Positioning Setting

Parameter Number	Parameter Value	Adjustment Level	Proportional Gain	Parameter Value	Adjustment Level	Proportional Gain
P3	0	F	0	11	S	3
	1	F	1	12	S	4
	2	F	2	13	S	5
	3	F	3	14	S	6
	4	F	4	15	S	7
	5	F	5			
	6	F	6			
	7	F	7			
	8	S	0			
	9	S	1			
	10	S	2			

* The positioning modes F, S represent the two modes of fast positioning and precise positioning, respectively. When set to the fast positioning mode F, after the motor is positioned, the positioning completion signal is sent as soon as the number of "positioning completion pulses" is reached. When set to the precise response mode S, the positioning completion signal is output after the motor is positioned and it is determined that the motor has been controlled within the range of "number of positioning completion pulses".

●Single/Double Pulse

Parameter Number	Parameter Value	Description
P4	1	
	0	

●Single/Double Pulse

Parameter Number	Parameter Value	Description
P5	0	CW Dir 
	1	CCW Dir 

●Display Refresh Time

Parameter Number	Parameter Value	Description
P6	1~9999	The larger the value, the longer the display refresh interval

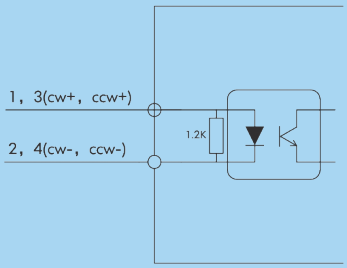
● FUN Assistant Function

Parameter Number	Description
FUN00	Save User's Parameters
FUN01	Recover User's Parameters
FUN02	Recover Default Setting

Control Interface Details

CW/CCW Pulse input (1~4)

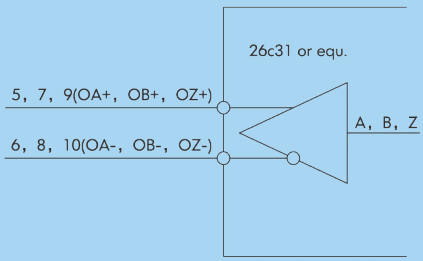
The pulse input port is a unidirectional optocoupler input port with a 5V pulse signal. The input pulse positive and negative poles cannot be reversed. Although the reverse connection will not cause damage to the drive, it will cause the internal CPU of the drive to receive no signal and the motor will not operate. The driver pulse input port can be adapted to the OC gate input wiring mode, and is also compatible with the linear differential output mode. Pulse subdivision can be changed with the P1 parameter setting. If P1 is set to 9 (10000 pulses/turn), the input pulse 100KHz will operate the motor at 600 rpm. By changing the P4 parameter, CW/CCW (double pulse mode) can be switched to PULSE/DIR (single pulse operation) the way). By changing the P5 parameter, you can reverse the motor running direction.



脈衝輸入電路

Encoder Differential Output (5~10)

The drive has a built-in differential output that provides the A, B, and Z phase signals of the motor encoder for external control devices such as PLCs and motion control cards. If the pulse frequency of the control device is too high, or the acceleration setting is too large, the load or the Moment of Inertia of the motor is large, which may cause the drive to lose the step because the actual position of the motor cannot keep up with the target position in real time. Since the drive provides the motor encoder A, B, Z phase signals, it can be used as the actual position detection of the motor rotor.



編碼器輸出電路

ALARM (OC Gate) Ouput (11 , 19)

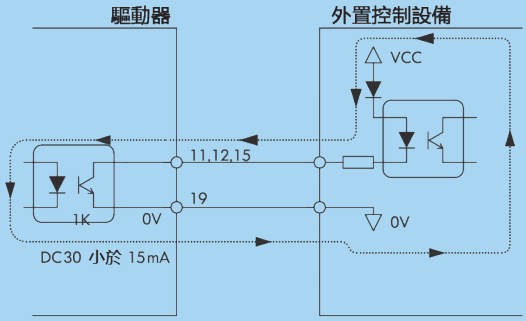
When the drive itself detects that the work is not working properly, not only the error will be displayed, but also the external power supply ground (19-pin) will be OC open-circuited through the alarm port (11-pin). Until the drive is powered back on, or there is a signal input from the alarm reset port, the alarm status of the drive can be cleared and re-run. The alarm signal is in the closed state when the drive is in normal operation, and is in an open state when the alarm is in operation.

Positioning Completed (OC Gate) Output (12 , 19)

When the drive is positioned according to the positioning mode set by P5, the external power ground (19-pin) is turned on through the positioning completion port (12-pin).

Z Phase (OC Gate) Output (15 , 19)

In addition to the Z-phase signal of the encoder in the form of a differential output, the driver also derives the Z-phase signal in the form of an OC gate. When the encoder reaches the zero position, the Z-phase output (15-pin) is turned on with the external power ground (19-pin). Once the zero position has passed, the Z-phase output (15-pin) is immediately disconnected from the external power supply ground (19-pin).



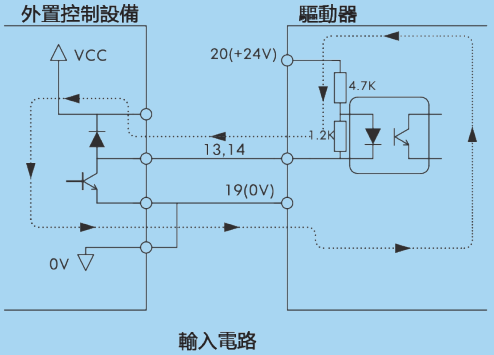
輸出電路

Servo Lock Shaft (optocoupler) Input (13 , 19 , 20)

If (19-pin, 20-pin) is connected to the external power supply, short-circuit the servo-off input port (13-pin) and the external power supply ground (19-pin) to turn off the servo function, and the motor no longer locks the axis.

Alarm Reset (optocoupler) Input (14 , 19 , 20)

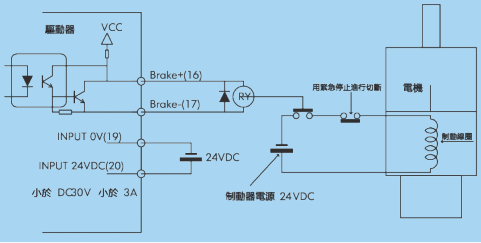
If the (19-pin, 20-pin) is connected to the external power supply, the alarm reset input port (14-pin) and the external power supply ground (19-pin) are short-circuited to clear the internal alarm signal. If the error occurs again, this method does not have the effect of blocking the alarm.



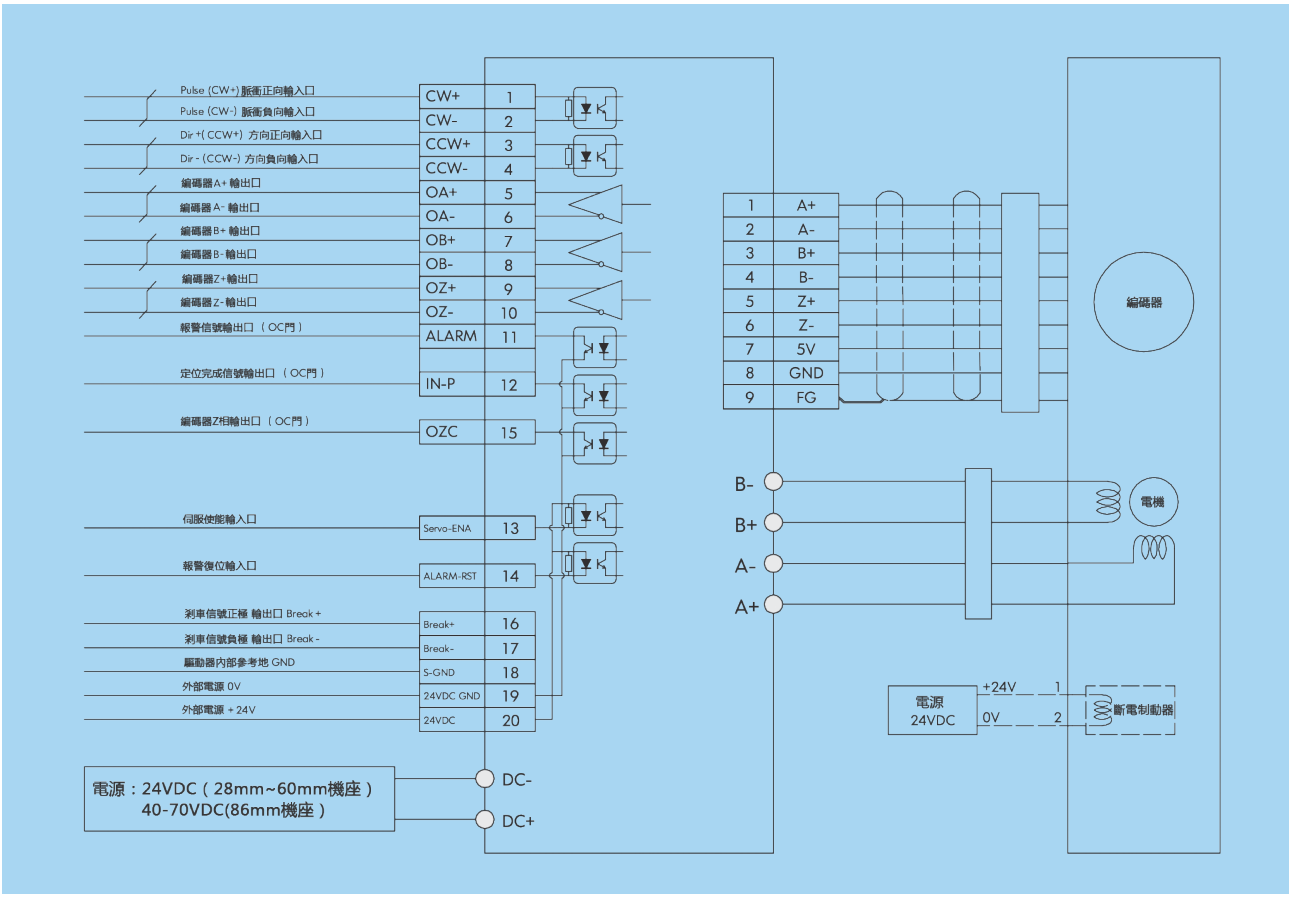
輸入電路

Break+,Break- Brake Output (16 , 17 , 19 , 20)

When the drive is running normally, the drive pulls the external power supply from (16-pin, 17-pin). When the drive detects an error alarm, the Break-output (17-pin) is disconnected from the external power supply (19-pin). This output can be used to drive the external brake coil of the stepper motor.

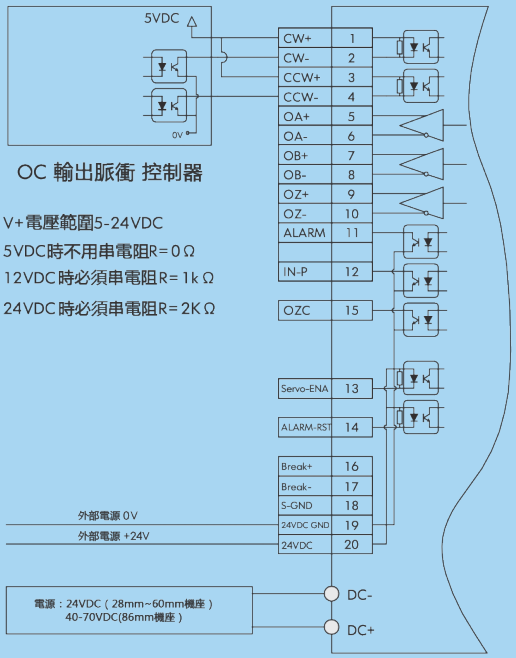


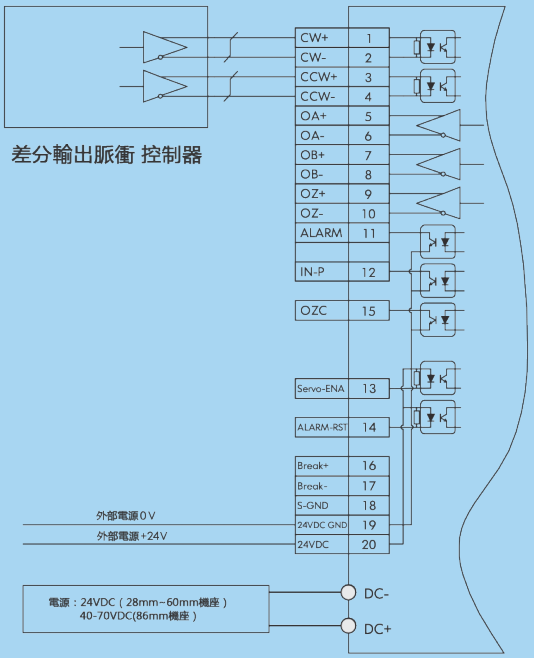
Wiring Diagram



Wiring Scheme

Pulse Port Wiring Definition





Reference Conditions of Use

Conditions of Use and Instructions	Unit	Range		
		Minimum	Standard	Maximum
Power input voltage	V	20.0 (40.0)	24.0 (48.0)	28.0 (70.0)
Power input current	A	5.0 (6.0)	5.0 (6.0)	
High voltage of the input pulse port	V	3.3		24.0
Low voltage of the input pulse port	V	0.0	0.6	0.8
Input pulse current	mA	8.0	15.0	
Encoder signal output load impedance	KΩ	0.3	1.0	
Encoder signal output current	mA	3.0	5.0	10
Alarm signal conduction current (OC gate output)	mA	2.0	4.0	5.0
Positioning completion signal conduction current (OC gate output)	mA	2.0	4.0	5.0
Servo off signal on current (input optocoupler)	mA	3.0	5.0	8.0
Alarm signal bit re-conducting current (input optocoupler)	mA	3.0	5.0	8.0
External power supply voltage	V	5	24	30
Brake signal output current	A		1.0	2.0
Drive internal 5V power output internal resistance	Ω	10	15	
Drive internal 5V power output current	mA		300	500
Encoder signal input high level voltage	V	3.0	5.0	5.5
Encoder signal input low level voltage	V		0.4	0.6
Encoder signal input high level current	mA		+5.0	+8.0
Encoder signal input low level current	mA		-5.0	-8.0
Working temperature	° C	0	25	85
Storage ambient temperature	° C	0	25	85

Extreme Use Condition

Conditions of Use and Instructions	Unit	Range	
		Minimum	Maximum
Power input voltage	V	10.0 (25.0)	30.0 (70.0)
Power input current	A	4.6 (6.0)	
Input pulse voltage	V	-0.6	30.0
Input pulse current	mA	4.2	
Alarm signal conduction current (OC gate output)	mA		20
Positioning completion signal conduction current (OC gate output)	mA		20
Z-phase signal conduction current (OC gate output)	mA		20
Servo off signal on current (input optocoupler)	mA	0.7	20
Alarm signal bit re-conducting current (input optocoupler)	mA	0.7	20
External power supply voltage	V	5	80
Break output current when braking	A		3.0
5V power supply output current	mA		500
Encoder signal input voltage	V	-0.6	5.5
Encoder signal input high level voltage	mA	+0.6	
Encoder signal input low level voltage	mA	-6	85
Working temperature	° C	0	85
Storage ambient temperature	° C	0	

Electrical Characteristics

Conditions of Use and Instructions		Unit	Range		
			Minimum	Standard	Maximum
Input signal threshold when the logic is low	I/O □	V		0.6	0.8
Input signal threshold when the logic is high		V	3.3	24	
Input pulse current		mA	8.0	15	
Encoder signal input high level voltage		V	3.0		4.0
Encoder signal input low level voltage		V	0.1		0.4
Encoder signal output short circuit current		mA			80
Alarm signal conduction current (OC gate output)		mA		4.0	7.0
Positioning completion signal output current (OC gate output)		mA		4.0	7.0
Servo off signal input current (input optocoupler)		mA	0.7	5.0	20
Alarm signal bit input current (input optocoupler)		mA	0.7	5.0	20
External power breakdown voltage		V		80	
Brake signal output current		A		1.0	3.0
5V Power output voltage (15V = 500mA)	Encoder Interface	V	5.0		5.1
5V Power supply short circuit current		A			4.7
Input signal threshold when the logic is low		V			0.6
Input signal threshold when the logic is high		V	3.0		5.0
Encoder signal input high level current		mA			+8.0
Encoder signal input low level current		mA			-8.0
Power supply static input current		mA	100		160
Quiescent current in the servo enable state of the driver		A		0.5	

Response Characteristics

Conditions of Use and Instructions	Unit	Range		
		Minimum	Standard	Maximum
Pulse input signal maximum frequency	kHZ		500	560
Motor no-load straight-running running pulse frequency (1000 pulses / rev)	kHZ			500
High pulse width time of minimum pulse signal	ns	500		
Low pulse width time of minimum pulse input signal	ns	700		
Pulse delay time	ns		250	
Response time of closed-loop system pulse command (no load)	us	690	750	1000
Dynamic response frequency of the motor (no load)	kHZ	1.45	1.33	1.0
Minimum high pulse width of retaliation reset signal	s	0.1		
EEPROM Storage delay time	s	0.5	2	4

■Error Alert and Troubleshooting Method

●Error Alert

Due to some industrial factors, when the driver indicates error due to improper use, the display panel will display the following error alarm code.

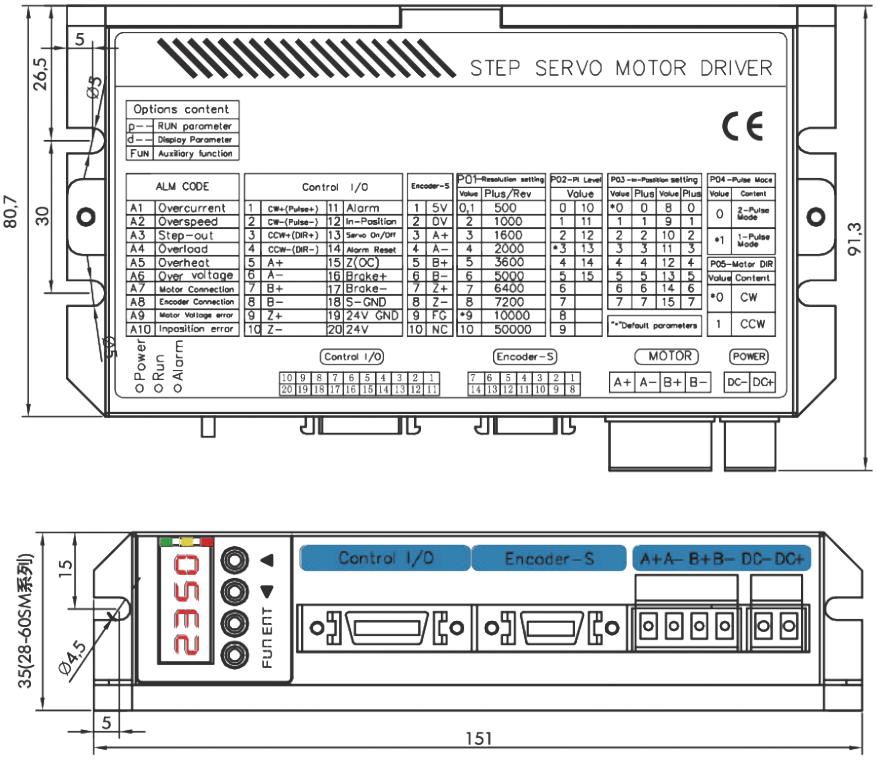
Alarm Code	Description	Failure Cause
A1	Overflow	Driver output current is greater than control current range
A2	Overspeed	Motor running speed exceeds rated speed
A3	Step out	The input pulse target position is too far from the actual position of the motor
A4	Overload	The motor cannot start or does not reach the required operating speed within a certain period of time.
A5	Overheating	The internal temperature of the drive exceeds the rated temperature
A6	Overvoltage	Drive bus voltage is too high
A7	Motor line misconnection	Motor cable connection is incorrect or there is no wiring
A8	Encoder line misconnection	Motor encoder connection error or no wiring
A9	Under voltage	The internal motor bus voltage of the driver is too low
		Input driver power supply voltage is too low
A10	Positioning error	When the drive is positioned, it detects a position error.
A11	System error	Drive internal system error
A12	Program error	Drive internal program error
A13	Reversing error	Drive internal reversing error
A14	Power overvoltage	Input driver power supply voltage is too high

●Troubleshooting Method

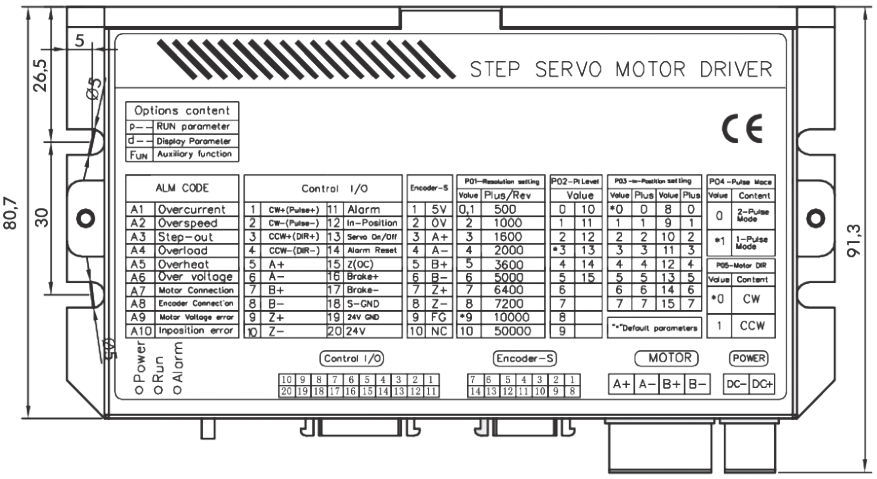
Alarm Code	Error Analysis and Troubleshooting
A1	Check motor wiring for short circuit
A2	Check if the P1 subdivision setting is correct and check if the input signal pulse frequency is correct.
A3	Check if the input pulse frequency is correct, check whether the acceleration setting of the pulse signal is appropriate, and check whether the motor is short-circuited or missing phase.
A4	Check if the motor is blocked externally.
A5	Check if the heat sink temperature of the drive is too high.
A6	The motor accelerates and decelerates for a long time, resulting in insufficient discharge capacity of the bleeder resistor to generate a high voltage alarm. Check if the deceleration setting of the pulse signal is appropriate. It is recommended to lengthen the deceleration time.
A7	Check motor winding wiring.
A8	Check motor encoder wiring.
A9	Try to run the motor at no load. If there is no alarm, please check if the power supply is sufficient.
	Check if the power supply voltage is too low.
A10	Check encoder wiring.
A11	Return to factory for repair.
A12	Return to factory for repair.
A13	Return to factory for repair.
A14	Check if the power supply voltage is too high.
Digital tube no display	A 5V short circuit to the encoder's power supply may cause the internal protection circuit to start. Please disconnect the motor encoder cable and turn off the power for 3 minutes. If it can be displayed normally after power-on, it can be determined that there is a short circuit in the encoder cable connection and carefully check the code cable. If it cannot be displayed normally, the internal power supply of the drive will be damaged and need to be returned to the factory for repair.
The motor cannot be reversed	Please check whether the pulse control mode is correct, whether the setting and wiring are normal, whether there is wire breakage or poor contact. If it is normal, please contact the motor supplier for problem analysis.

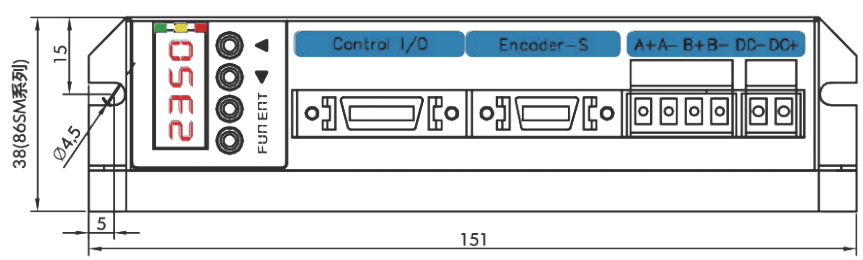
■Appearance and Installation Dimensions

D28~57-B驅動器 Driver



D86-B驅動器 Driver





*D28~57-B drive and D86-B drive only differ in thickness, the rest of the size is completely same.

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