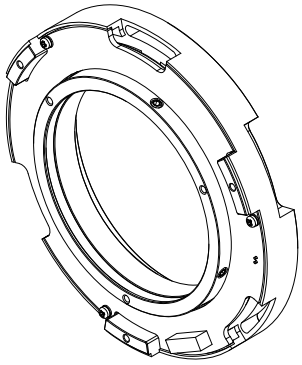
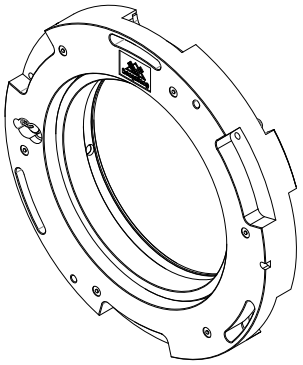
1. Z100 Off-axis Photoelectric Encoder (Through Shaft, Bearing-less)





1.1 Introduction:

Z100 is an ultra-thin off-axis bearing-less large shaft encoder with compact structure and simple installation and debugging. It is widely used in servo motors and industrial automation fields.

1.2 Feature:

- Encoder external diameter Ø100mm、thickness 16mm、diameter of shaft up to Ø63mm;
- Adopt non-contact photoelectric principle;
- Reverse polarity protection;
- Short circuit protection;
- Multiple electrical interfaces available;
- Resolution per turn up to 10000PPR.

1.3 Application:

Robot, servo motor, CNC and other automation control fields.

1.4 Connection:

- Radial cable (length 0.3M)

1.5 Protection:

None

1.6 Weight:

About 200g

2. Model Selection Guide

2.1 Model composition(select parameters)

Z100-	J	12	C	2500/8	B63			-	000
Product model series	Connection method: J=Radial cable Radial socket: E=SM08B-GHS-TB F=SM14B-GHS-TB	Output phase: 1=A 2=A+B 3=A+B+Z (Wiring table 7.1) 4=A+$\overline{A}$+B+$\overline{B}$ 6=A+B+Z +$\overline{A}$+$\overline{B}$+$\overline{Z}$ (Wiring table 7.2) For servo motor: 6=Less wiring type (Wiring table 7.3) 12=A/$\overline{A}$/B/$\overline{B}$/Z/$\overline{Z}$/U/$\overline{U}$/V/$\overline{V}$/W/$\overline{W}$ (Wiring table 7.4)	Electrical interface: N=OC(NPN)❶ NH=OC(NPN)❷ V=Voltage❷ VL=Voltage❶ F=Push-pull C=TTL (26LS31) E=HTL L=TTL (26C31) S=TTL(Less wiring type)	Resolution PPR: 1000; 1024; 2000; 2048; 2500; 4000; 4096; 5000; 8192; 10000 For servo motor: Resolution/pole 1000/8, /10, /16; 1024/8, /10, /16; 2048/8, /10, /16; 2500/8, /10, /16; 4096/8, /10, /16; 5000/8, /10, /16; 8192/8, /10, /16; 10000/8, /10, /16	Diameter of shaft: B40=Ø40mm B63=Ø63mm Other shaft diameters can be customized, up to Ø65mm	Supply voltage: Blank=DC5V H=DC8-30V	Special requirement: Blank=❸		Management No.

2. 2 Note

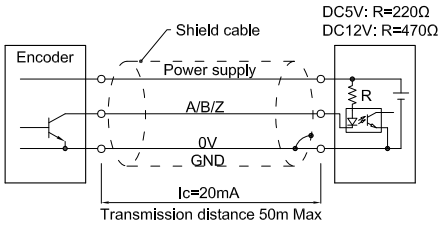
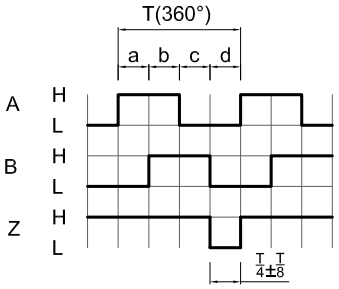
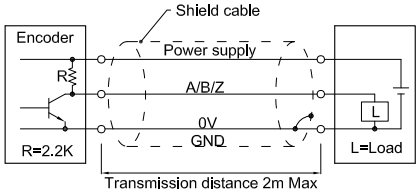
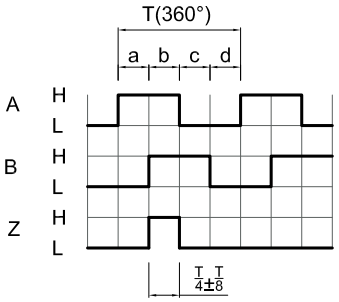
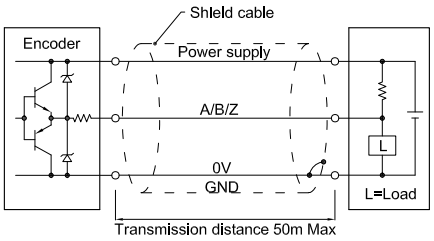
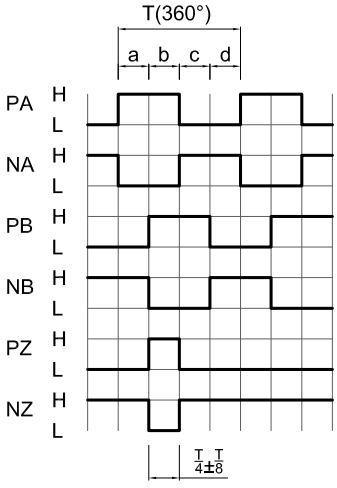
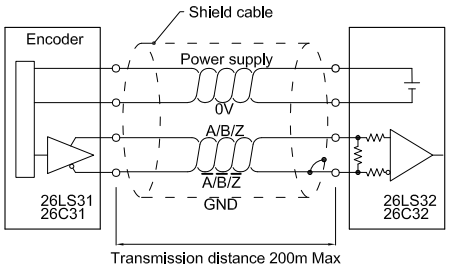
❶. Z signal is low level active.

❷. Z signal is high level active.

❸. Blank means IP00, cable length is 0.3M, if need to change the length C+number, the longest is 10M (expressed by C10). For the specific length of use, pls refer to page P2 -P3 of the provision of output circuit.

3. Output Method

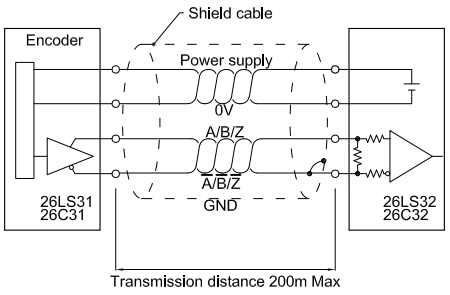
3.1 Incremental signal

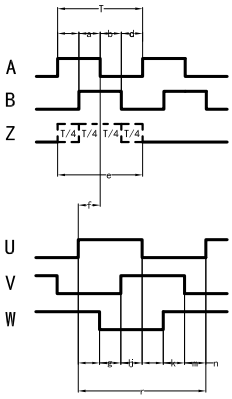
Electrical interface	Output circuit	Output wave form
OC NPN open collector circuit		 a.b.c.d=T/4±T/8 Phase A is ahead of B by T/4±T/8, viewing from encoder front side, direction is counterclockwise rotation. (See dimensional drawings) CCW direction Z signal is low level active
Voltage		 a.b.c.d=T/4±T/8 Phase A is ahead of B by T/4±T/8, viewing from encoder front side, direction is counterclockwise rotation. (See dimensional drawings) CCW direction Z signal is high level active
Push-pull		 a.b.c.d=T/4±T/8 Phase A is ahead of B by T/4±T/8, viewing from encoder front side, direction is clockwise rotation. (See dimensional drawings) CW direction
TTL (DC5V) HTL (DC8-30V)		

3.2 For servo motor(with UVW）

Electrical interface	Output circuit	Output wave form

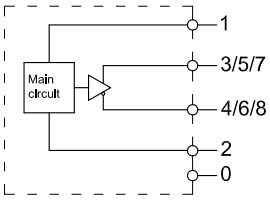
TTL (DC5V)





Reverse signal not shown

TTL (DC5V) (Less wiring type)



26LS31, 26C31
Transmission distance 200m Max

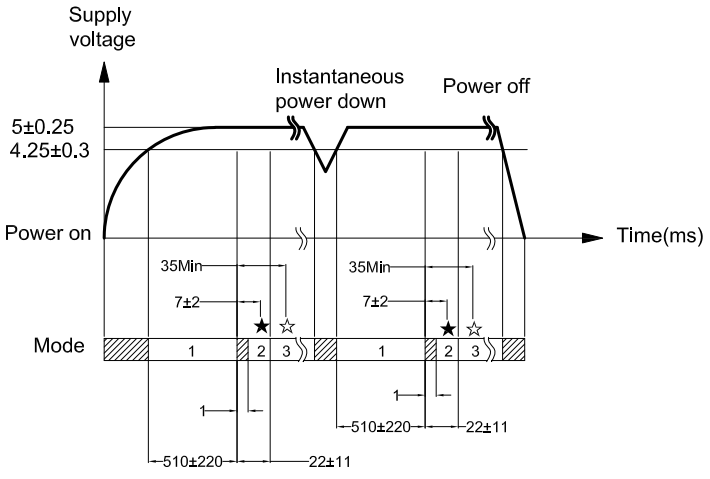
No.	Function / Color	Mode 1	2	3
1	white	HZ	U	A
2	white/ black	HZ	$\overline{U}$	$\overline{A}$
3	green	HZ	V	B
4	green/ black	HZ	$\overline{V}$	$\overline{B}$
5	yellow	HZ	W	Z
6	yellow/ black	HZ	$\overline{W}$	$\overline{Z}$
7	red	DC+5V		
8	black	OV		
0	shielding	GND		

Symbol signification

★: indicate position of UVW channel
☆: position to start counting ABZ channel
▨: non-using zone
HZ: high impedance

pole	g.h.j.k.m.n	r
8	15±1°	90°
10	12±1°	72°
16	7.5±1°	45°

Timing Chart



$a.b.c.d=\frac{T}{4}\pm\frac{T}{8}$
$e=T\pm\frac{T}{2}$
f: center of phase Z to rise point of phase U,that is ±1°

CW direction →

Viewed from encoder front side direction is clockwise rotation. (See dimensional drawings)

4. Electrical Parameter

Parameter / Output type / Item			OC	Voltage	Push-pull	TTL	TTL (Less wiring type)	HTL
Supply voltage			DC+5V±5%；DC8V-30V±5%			DC+5V±5%		DC8-30V±5%
Consumption current			100mA Max			120mA Max		
Allowable ripple			≤3%rms					
Top response frequency			100KHz			300KHz		500KHz
Output capacity	Output current	Input	≤30mA	Load resistance 2.2K	≤30mA	≤±20mA		≤±50mA
		Output	—		≤10mA			
	Output voltage	"H"	—	—	≥[(Supply voltage) -2.5V]	≥2.5V		≥Vcc-3 VDC
		"L"	≤0.4V	≤0.7V(less than 20mA)	≤0.4V(30mA)	≤0.5V		≤ 1V VDC
	Load voltage		≤DC30V	—		—		
Rise & Fall time			Less than 2us(cable length：2m)			Less than 1us(Cable length：2m)		
Insulation strength			AC500V 60s					
Insulation resistance			10MΩ					
Mark to space ratio			45% to 55%					
Reverse polarity protection			✔					
Short-circuit protection			—		✔❶			
Phase shift between A & B			90°±10° (frequency in low speed)					
			90°±20° (frequency in high speed)					
Delay motion time ❷			—				510±220ms	—
GND			Not connect to encoder					

❶ Short-circuit to another channel or GND permitted for max.30s.
❷ Phase A.B.Z are back of phase U.V.W when power on.

5. Mechanical Specification

Shaft diameter	Ø40mm；Ø63mm (Optional)
Shaft sleeve material	Aluminum alloy
Max allowable speed	(Max response frequency/ resolution)*60
Base material	PPS
Weight	About 200g

6. Environment Specification

Environment temperature	Working：−20～+95℃(repeated bending cable: -10℃)；Storing：−25～+95℃
Environment humidity	Working,storing: 35～85%RH (no condensation)
Protection grade	None

7. Wiring Table

7.1 OC & Voltage (table 1)

	Incremental signal						Supply voltage	
Socket pin definition	1	2	3	4	5	6	7	8
Wire color	White	/	Green	/	Yellow	/	Red	Black
Function	A	/	B	/	Z	/	Up	0V

7.2 TTL & HTL & Push-pull (table 2)

	Incremental signal						Supply voltage	
Socket pin definition	1	2	3	4	5	6	7	8
Wire color	White	White/BK	Green	Green/BK	Yellow	Yellow/BK	Red	Black
Function	A+	A−	B+	B−	Z+	Z−	Up	0V
Twisted wire								

7.3 Less wiring type for servo motor (table 3)

	Incremental signal						Supply voltage	
Socket pin definition	1	2	3	4	5	6	7	8
Wire color	White	White/BK	Green	Green/BK	Yellow	Yellow/BK	Red	Black
Function	A+ (U+)*	A- (U-)*	B+ (V+)*	B- (V-)*	Z+ (W+)*	Z- (W-)*	Up	0V
Twisted wire								

* For the functional status in the less wiring mode, refer to the functional mode wiring table of the output circuit on page 3.

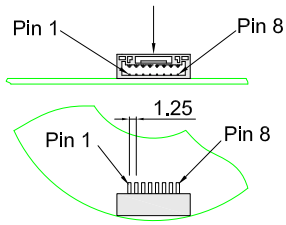
7.4 For servo motor (table 4)

	Incremental signal												Supply voltage	
Socket pin definition	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Wire color	Gray	Gray/BK	Blue/BK	Blue	Pink/BK	Pink	Yellow	Yellow/BK	Green	Green/BK	White	White/BK	Black	Red
Function	V+	V-	U−	U+	W−	W+	Z+	Z−	B+	B−	A+	A−	0V	Up
Twisted wire														

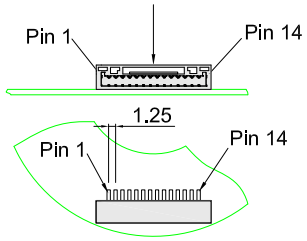
Up=Supply voltage.
The shield wire is not connected to the internal circuit of the encoder.

7. 5 Socket definition

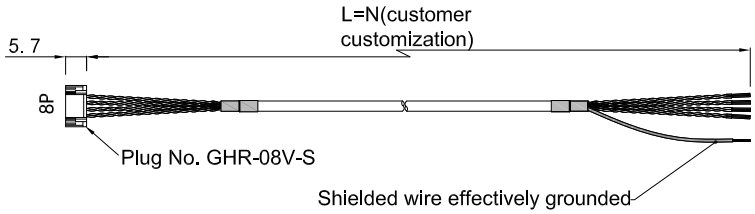
Socket No. SM08B-GHS-TB

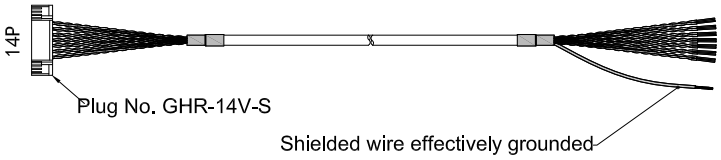


Socket No. SM14B-GHS-TB

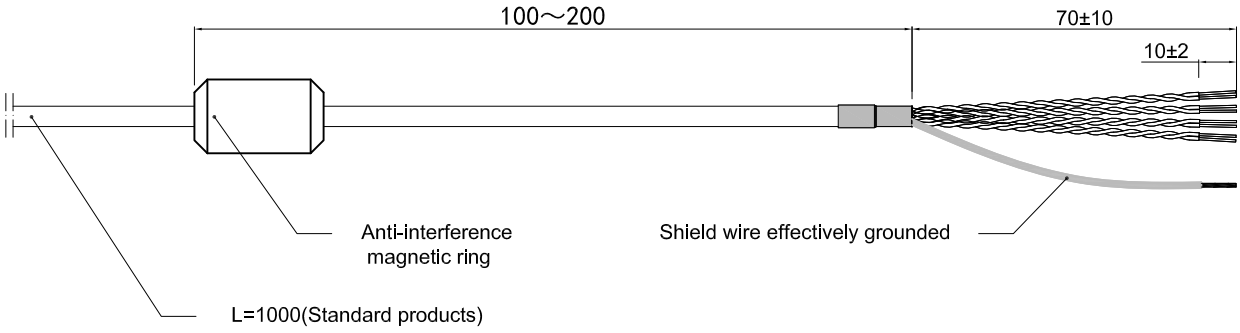


Plug+cable (customer purchase)





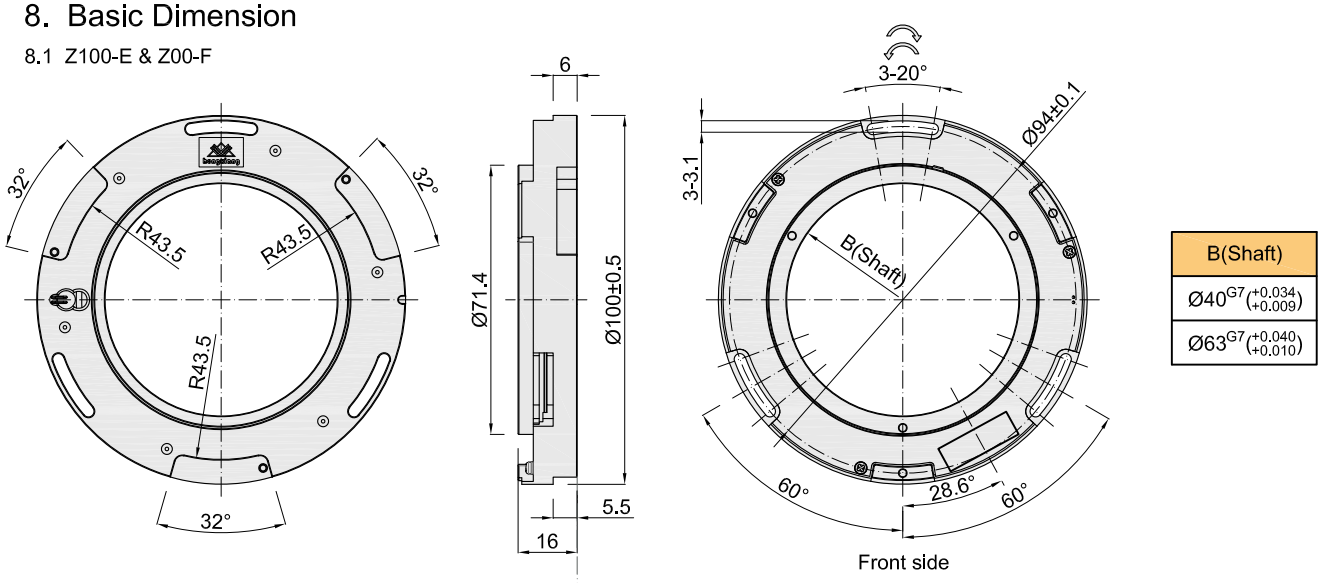
7. 6 Radial cable schematic



Unit: mm

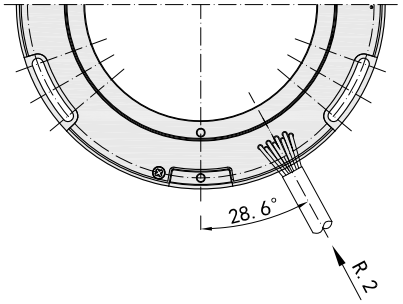
8. Basic Dimension

8.1 Z100-E & Z00-F

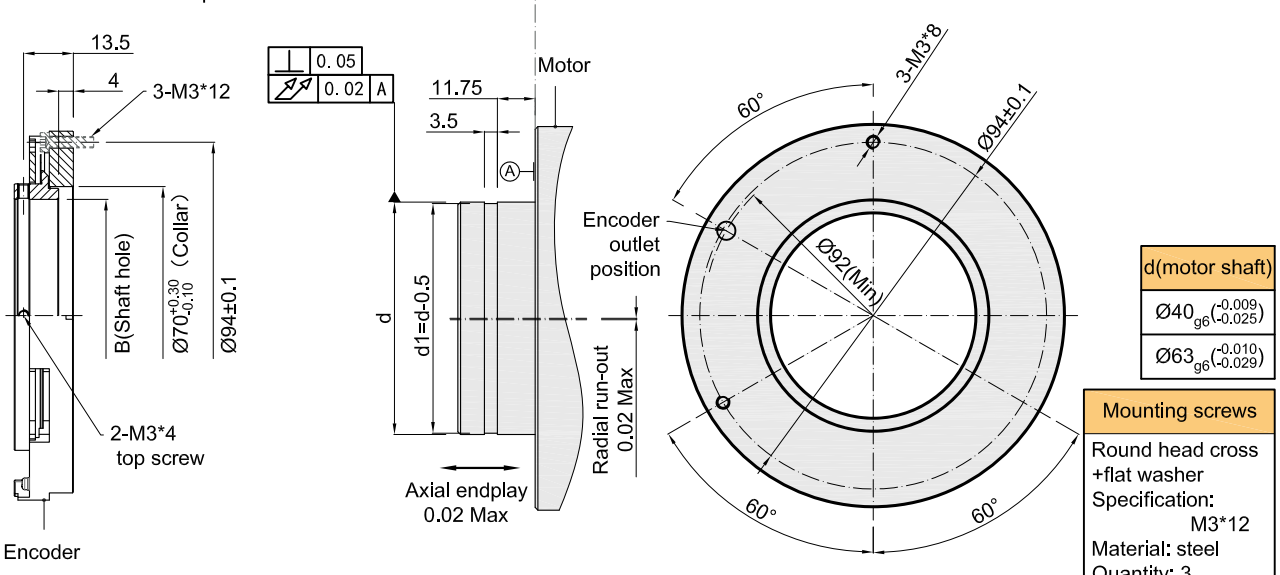


B(Shaft)
$Ø40^{G7}_{(+0.009)}^{(+0.034)}$
$Ø63^{G7}_{(+0.010)}^{(+0.040)}$

8.2 Z100-J



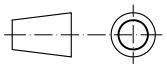
8. 3 Installation shaft specification



d(motor shaft)
$Ø40_{g6}^{(-0.009)}_{(-0.025)}$
$Ø63_{g6}^{(-0.010)}_{(-0.029)}$

Mounting screws
Round head cross +flat washer Specification: M3*12 Material: steel Quantity: 3

Unit: mm



= Shaft rotation direction of TTL & HTL signal output
= Shaft rotation direction of OC signal output

R1 = Radial socket 8P (SM08B-GHS-TB) & 14P (SM14B-GHS-TB)
R2 = Radial cable (standard length 0.3M).

9. Installation steps

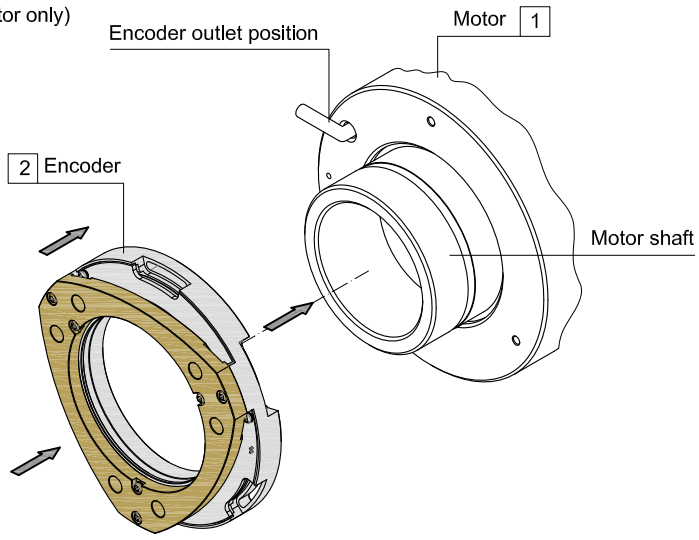
9.1 Installation steps for A+B+Z+U+V+W signal encoder (for servo motor only)

Step 1

a. Before installing the encoder, first confirm the starting zero position of the motor and lock it tightly to ensure the motor shaft won't moving until the encoder completed installation, otherwise the zero position of the encoder cannot be aligned with the zero position of the motor.

b. put the encoder (2) directly on the motor shaft and gently push it to the motor platform by hand.

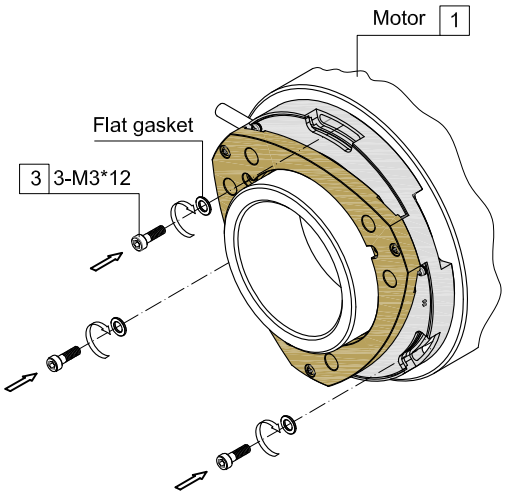
Note: For the tolerance of the encoder shaft sleeve and the motor shaft,please refer to page 7.



Step 2

Apply thread glue to the front of the three M3*12 bolts (3), and fix them on the motor (1) together with the spring washer and flat gasket.

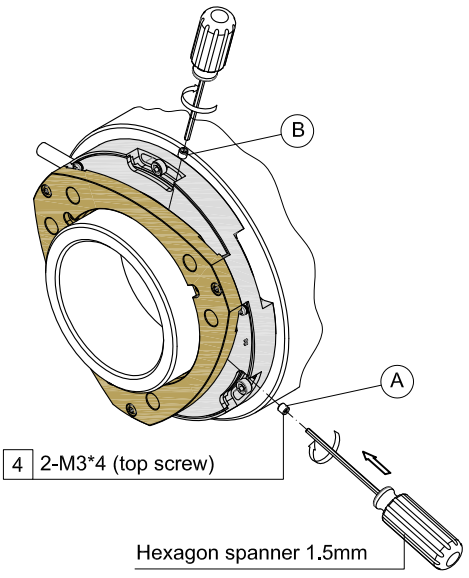
Note: At this time,the screws do not need to be tightened or loosened too much.
The force is based on the ability to turn the encoder by hand.



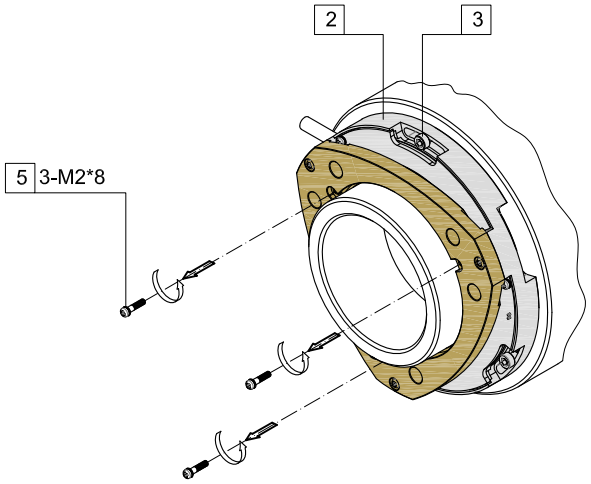
Step 3

Apply thread glue to the front of the two M3*4 top screws (4) on the side of the encoder and tighten them to fix the encoder's disk to the motor shaft.

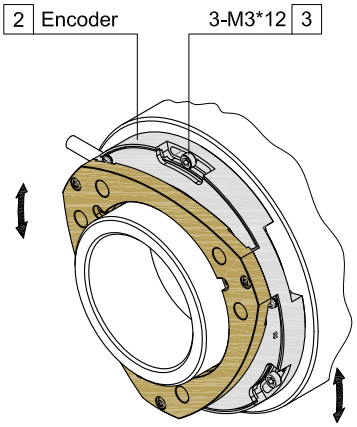
Note:
Follow the tightening sequence of the two screws as figure,first A then B.
Recommended tightening force is 0.6N.m



Step 4
Remove the three M2*8 bolts (5) and discard them to complete the separation between the encoder disk and the encoder body.

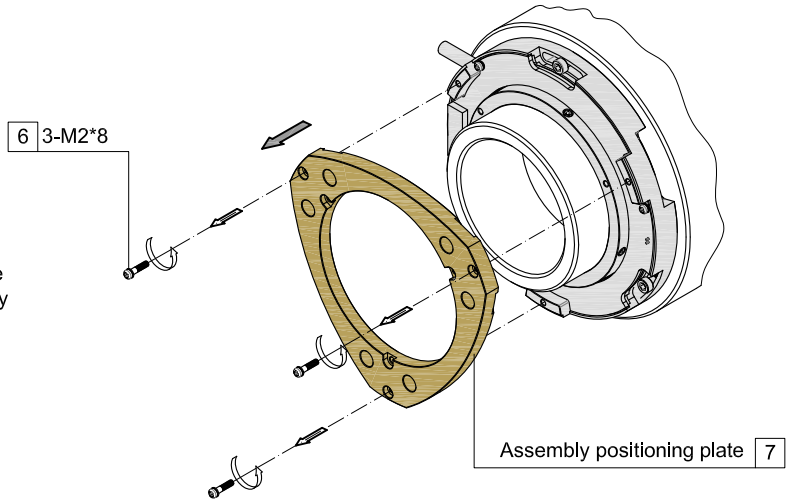


Step 5
a. Connect the encoder signal wires, power on, and connect to the oscilloscope or other testing equipment that can read the zero signal of the motor and encoder.
b. Turn the encoder (2) from left to right and observe the testing equipment until the zero position of the encoder is aligned with the zero position signal of the motor.
c. Then tighten the three M3*12 bolts (3), (recommended tightening force is 0.6 N.m).
d. The zero position of the motor can be unlocked at this time, but the motor still can't be rotated.



Step 6
a. Remove the three M2*8 bolts (6).
b. Take off the assembly positioning plate (7), the encoder is ready to use.

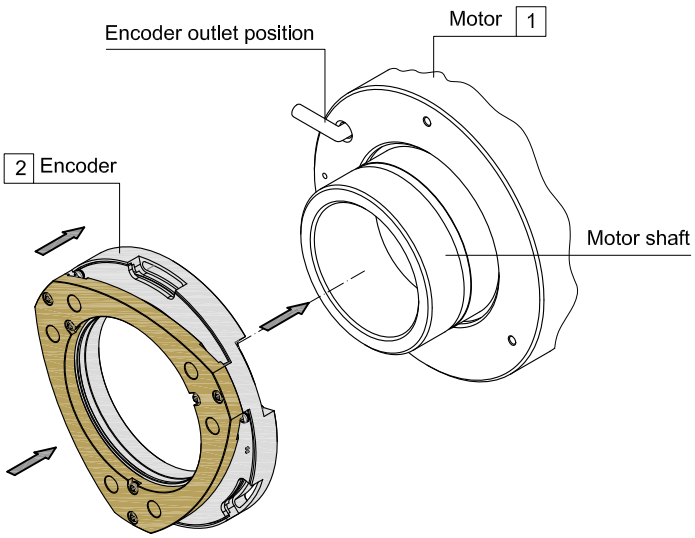
Note: If you want to reset the zero position or remove the encoder (2), you must replace the assembly positioning plate (7).



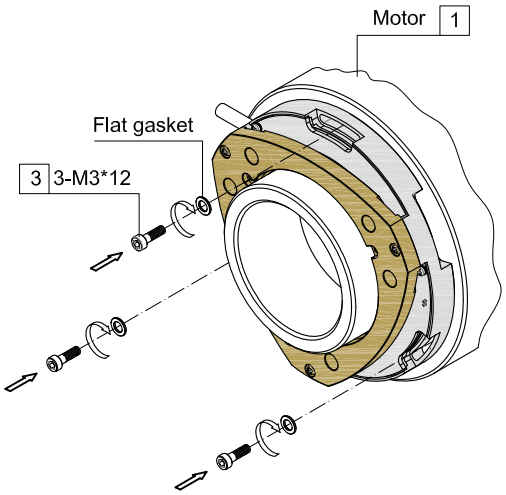
9.2 Assembling steps for UVW signal encoder

Step 1
Put the encoder (2) directly on the motor shaft and gently push it to the motor platform by hand.

Note: For the tolerance of the encoder shaft sleeve and the motor shaft, please refer to page 7.

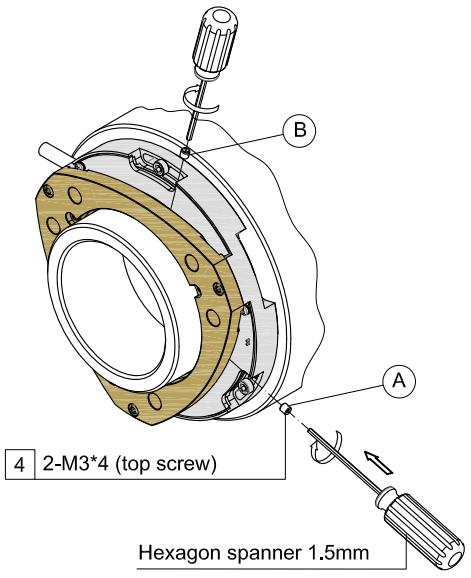


Step 2
Apply thread glue to the front of the three M3*12 bolts (3), and fix them to the motor (1) together with spring washer and flat gasket, and then tighten them with a fixed torque of 0.6N.m.



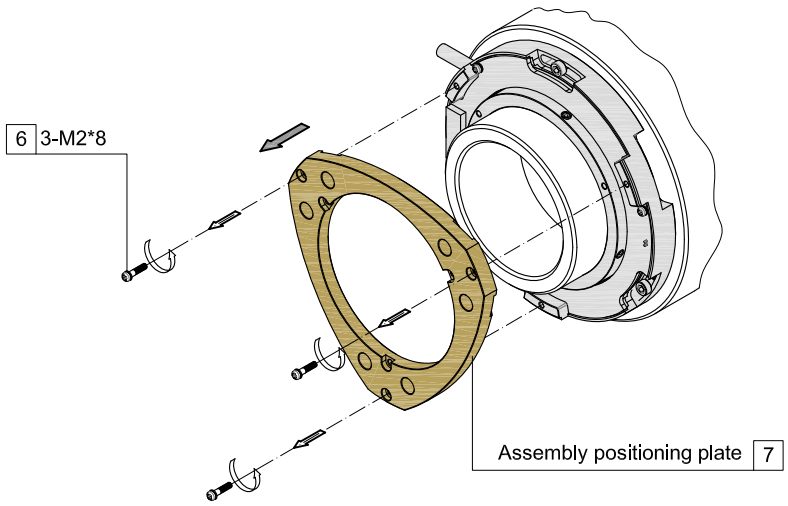
Step 3
Apply thread glue to the front of the two M3*4 top screws (4) on the side of the encoder and tighten them to fix the encoder's disk on the motor shaft.

Note:
Follow the tightening sequence of the two top screws as figure,first A then B.
Recommended tightening force is 0.6N.m



Step 4
a. Remove the three M2*8 bolts (6) in turn.
b. Take off the assembly positioning plate (7), the encoder is ready to use.

Note： If you want to reset the zero starting point or remove the encoder (2)， you must replace the assembly positioning (7).



10. Caution

10.1 About vibration

Vibration act on encoder always cause wrong pulse, so we should pay attention to working place.More pulse per revolution, narrower groovy spacing of grating, more effect to encoder by vibration, when rev is low or stop, vibration act on shaft or main body would cause grating vibrating, so encoder might make wrong pulse.

10.2 Caution for wiring

- Use the encoder under the specified supply voltage. Please note that the supply voltage range may drop due to the wiring length.
- Do not put the encoder wiring and other power lines through the same duct, and do not use them by bundling in parallel.
- Please do not apply excessive force to the cable of encoder, or it will may be damaged.

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