1. P100 Incremental Optical Encoder (Large Diameter Through Shaft)

1.1 Introduction:
P100 adopts a unique large-aperture through-shaft concentric locking device, a bearing-less ultra-thin design, multiple electrical interfaces, and no dust protection, which can solve the installation problem of large-aperture low space limitations.

P100-E

1.2 Feature:
- Encoder external diameter Ø100mm、thickness 12.8mm、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.

P100-F

1.3 Application:
Servo motor, robot and automation control fields.

1.4 Connection:
- Radial socket (8P & 14P)
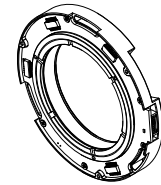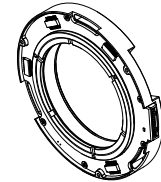- Radial cable (standard length 1.0M)

P100-J

1.5 Protection:
None

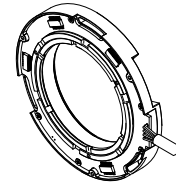### 1.6 Weight:
About 150g

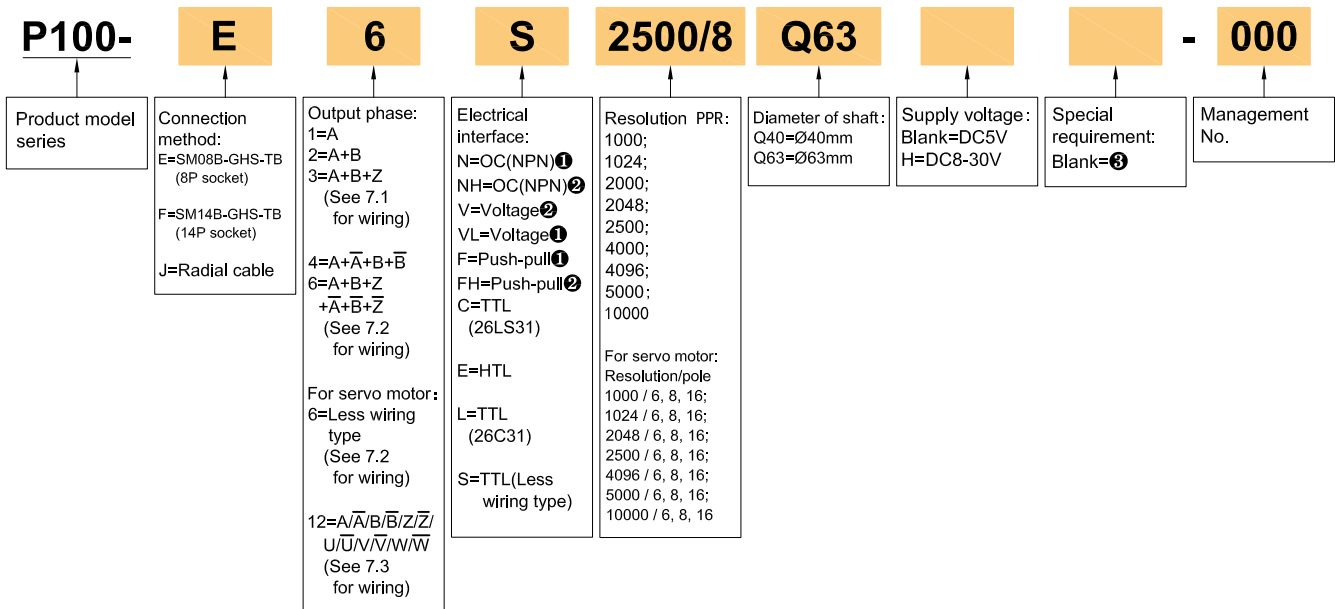## 2. Model Selection Guide

2.1 Model composition(select parameters)

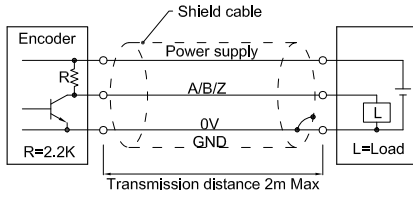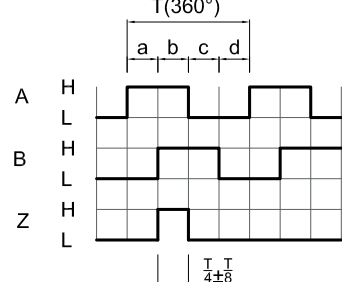| P100-	E	6	S	2500/8	Q63			- 000

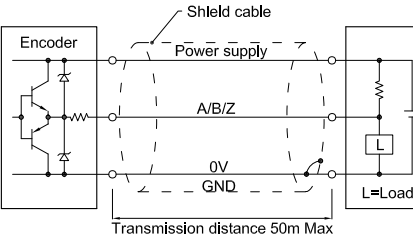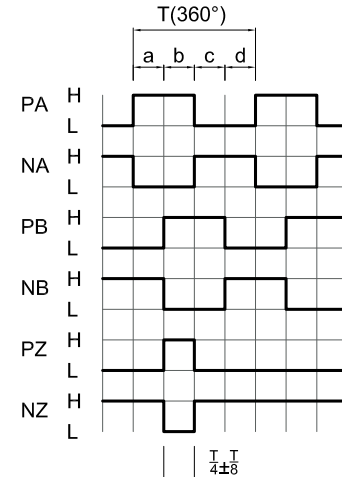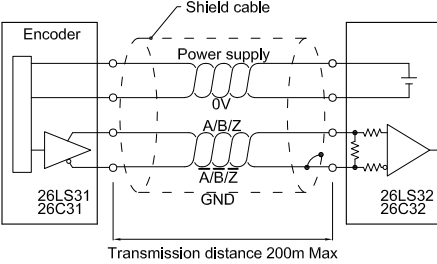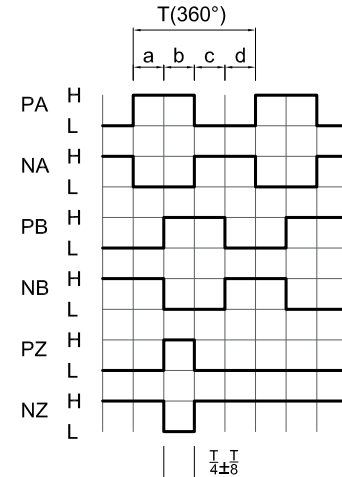| Product model series | Connection method:
E=SM08B-GHS-TB (8P socket)

F=SM14B-GHS-TB (14P socket)

J=Radial cable | Output phase:
1=A
2=A+B
3=A+B+Z
(See 7.1 for wiring)

4=A+$\overline{A}$+B+$\overline{B}$
6=A+B+Z
+$\overline{A}$+$\overline{B}$+$\overline{Z}$
(See 7.2 for wiring)

For servo motor:
6=Less wiring type
(See 7.2 for wiring)

12=A/$\overline{A}$/B/$\overline{B}$/Z/$\overline{Z}$/U/$\overline{U}$/V/$\overline{V}$/W/$\overline{W}$
(See 7.3 for wiring) | Electrical interface:
N=OC(NPN)❶
NH=OC(NPN)❷
V=Voltage❷
VL=Voltage❶
F=Push-pull❶
FH=Push-pull❷
C=TTL (26LS31)

E=HTL

L=TTL (26C31)

S=TTL(Less wiring type) | Resolution PPR:
1000;
1024;
2000;
2048;
2500;
4000;
4096;
5000；
10000

For servo motor:
Resolution/pole
1000 / 6, 8, 16;
1024 / 6, 8, 16;
2048 / 6, 8, 16;
2500 / 6, 8, 16;
4096 / 6, 8, 16;
5000 / 6, 8, 16;
10000 / 6, 8, 16 | Diameter of shaft:
Q40=Ø40mm
Q63=Ø63mm | 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. None indicated for IP00 and cable length of 1.0M, if need to change the length C+number, the longest is 100M (expressed by C100). For the specific length of use, pls refer to page P2 -P3 of the provision of output circuit.

3. Output Mode

3.1 Incremental signal

Electrical interface	Output circuit	Output wave form
OC NPN open collector circuit	Encoder — Shield cable — Power supply — A/B/Z — 0V — GND DC5V: R=220Ω DC12V: R=470Ω Ic=20mA Transmission distance 50m Max	T(360°), a b c d $a.b.c.d=\frac{T}{4}\pm\frac{T}{8}$ A, B, Z (H/L) $\frac{T}{4}\pm\frac{T}{8}$ Phase A is ahead of B by $\frac{T}{4}\pm\frac{T}{8}$, viewing from encoder front side, direction is counterclockwise rotation. (See dimensional drawings) CCW direction → Z signal is low level active
Voltage	Encoder — Shield cable — Power supply — A/B/Z — 0V — GND R=2.2K L=Load Transmission distance 2m Max	T(360°), a b c d $a.b.c.d=\frac{T}{4}\pm\frac{T}{8}$ A, B, Z (H/L) $\frac{T}{4}\pm\frac{T}{8}$ Phase A is ahead of B by $\frac{T}{4}\pm\frac{T}{8}$, viewing from encoder front side, direction is counterclockwise rotation. (See dimensional drawings) CCW direction → Z signal is high level active
Push-pull	Encoder — Shield cable — Power supply — A/B/Z — 0V — GND L=Load Transmission distance 50m Max	T(360°), a b c d PA, NA, PB, NB, PZ, NZ (H/L) $a.b.c.d=\frac{T}{4}\pm\frac{T}{8}$ Phase A is ahead of B by $\frac{T}{4}\pm\frac{T}{8}$, viewing from encoder front side, direction is clockwise rotation. (See dimensional drawings) CW direction → $\frac{T}{4}\pm\frac{T}{8}$
TTL (DC5V) HTL (DC8-30V)	Encoder — Shield cable — Power supply — 0V — A/B/Z — A/B/Z — GND 26LS31 26C31 26LS32 26C32 Transmission distance 200m Max	

3.2 For servo motor(with UVW）

Electrical interface	Output circuit	Output wave form
TTL (DC5V)	Encoder — Shield cable — Power supply — 0V — A/B/Z — Ā/B̄/Z̄ — GND — 26LS31 26C31 — 26LS32 26C32 — Transmission distance 200m Max	A, B, Z, U, V, W waveforms. Reverse signal not shown
TTL (DC5V) (Less wiring type)	Main circuit — 1, 3/5/7, 4/6/8, 2, 0. 26LS31, 26C31 Transmission distance 200m Max	

Symbol signification

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

No.	Function / Color	Mode 1	Mode 2	Mode 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		

pole	g.h.j.k.m.n	r
6	20±1°	120°
8	15±1°	90°
16	7.5±1°	45°

$a.b.c.d = \frac{T}{4} \pm \frac{T}{8}$
$e = T \pm \frac{T}{2}$
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)

Timing Chart

Supply voltage

Instantaneous power down   Power off

5±0.25
4.25±0.3

Power on   Time(ms)

35Min   35Min
7±2   7±2

Mode   1 ★☆ 2 3   1 ★☆ 2 3

1   1
510±220   22±11   510±220   22±11

4. Electrical Parameters

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 V_{DC}
		"L"	≤0.4V	≤0.7V(less than 20mA)	≤0.4V(30mA)	≤0.5V		≤ 1V V_{DC}
	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 Specifications

Diameter of shaft	Ø40mm；Ø63mm(optional)
Slew speed	≤6000 rpm
Material	Base：Die cast aluminum
Weight	About 150g

6. Environmental Parameters

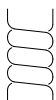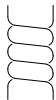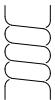| Environmental temperature	Operating：－20～+85°C(repeatable winding cable：－10°C)；Storage：－20～+90°C
Environmental humidity	Operating and storage：35～85％RH(noncondensing)
Vibration(Endurance)	Amplitude 0.75mm,5~55Hz,2h for X,Y,Z direction individually
Shock(Endurance)	940m/s² 11ms three times for X,Y,Z direction individually
Protection	None

7. Wiring Table

7.1 OC / Voltage
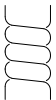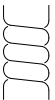
	Incremental signal						Supply voltage	
Socket pin No.	1	2	3	4	5	6	7	8
Wire color	White	-	Green	-	Yellow	-	Red	Black
Function	A	-	B	-	Z	-	Up	0V

7.2 TTL / HTL / Push-pull / Less wiring type

	Incremental signal						Supply voltage	
Socket pin No.	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-paired cable								

* For the functional status in less wiring mode, refer to the functional mode wiring table for output circuit on page3.

7.3 For servo motor

	Incremental signal												Supply voltage	
Socket pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Wire color	Grey	Grey/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-paired cable														

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

8. Socket & Cable

8.1 Socket pin definition

Connector No. SM08B-GHS-TB	Plug+shielding cable (order additionally)
Pin 8 ... Pin 1	5.7 L=N (according to customer s request, 200MM-100000MM) Twisted-paired cable — Cable with shielding — Shielding to GND 8P Plug No.GHR-08V-S
Connector No. SM14B-GHS-TB	Plug+shielding cable (order additionally)
Pin 14 ... Pin 1	5.7 L=N (according to customer s request, 200MM-100000MM) Twisted-paired cable — Cable with shielding — Shielding to GND 14P Plug No.GHR-14V-S

8.2 Radial Cable Schematic

100～200mm   70±10   10±2

Anti-interference magnetic ring

Shield wire effectively grounded

L=1000(Standard products)
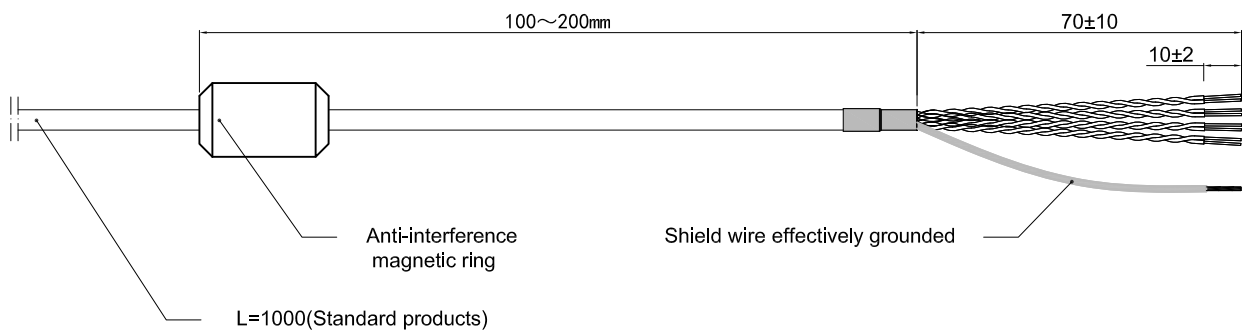
Unit: mm

9. Basic Dimension

9.1 P100-E

Q(Shaft)
$\varnothing 40^{G7}(^{+0.039}_{+0.009})$
$\varnothing 63^{G7}(^{+0.040}_{+0.010})$

$\varnothing 100 \pm 0.1$

$\varnothing 94 \pm 0.1$

3-20°

3.2

5

12.8±0.2

R.1

5°

60° 60°

3-35°

82.5°

R42

52.5° 67.5°

LED zero position indication

Encoder front side

9.2 P100-F

R.2

9.3 P100-J

R.3
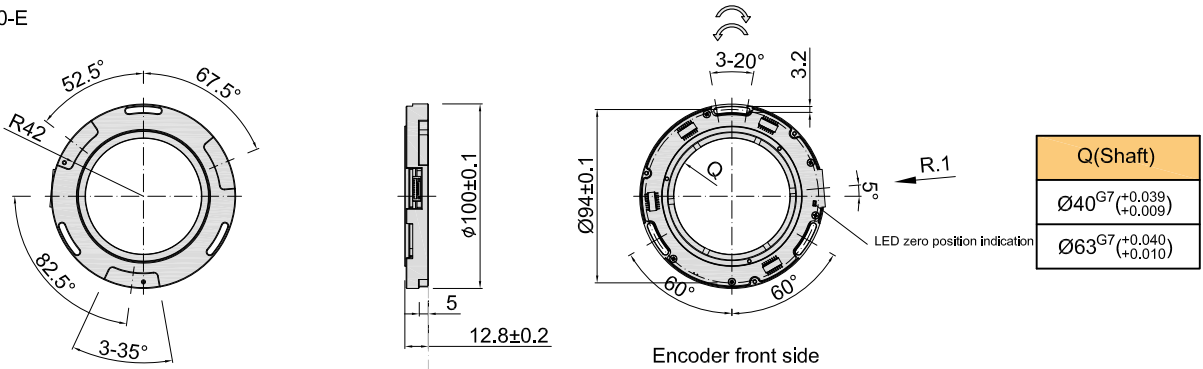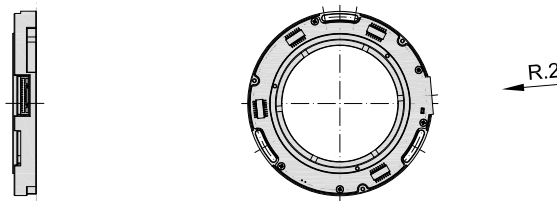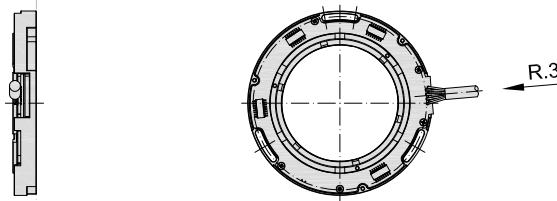
9.4 Installation shaft specification

d(motor shaft)	Mounting screws
$\varnothing 40_{g6}(^{-0.009}_{-0.025})$	Inner hexagon bolt +flat washer
$\varnothing 63_{g6}(^{-0.010}_{-0.029})$	Specification: M3*12 Material: stainless steel Quantity: 3

14(min)

Motor

d

Ⓐ

0.05
0.02 A

Axial endplay 0.02 Max

Radial run-out 0.02 Max

This angle can be determined according to actual requirements and encoder space

3-M3*6

$\varnothing 94 \pm 0.1$

R46(min)

Outlet position of motor

60° 60°
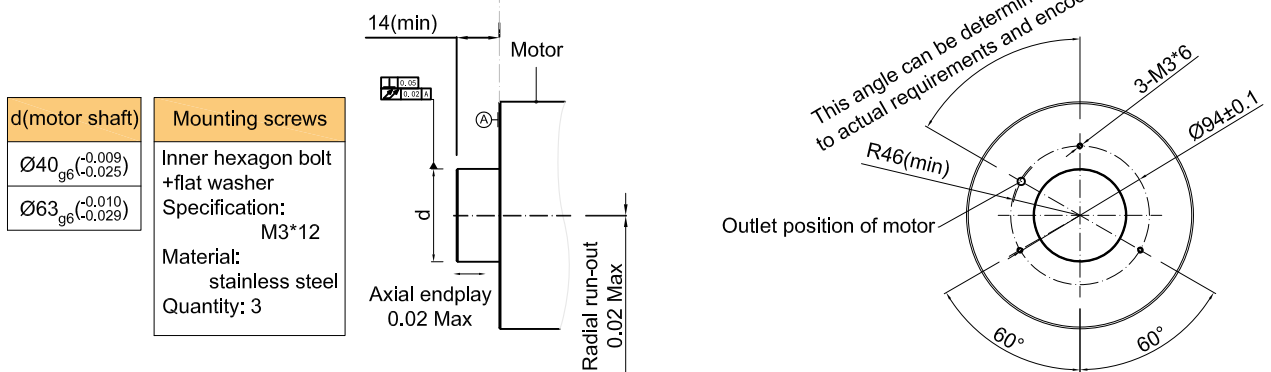
Unit: mm
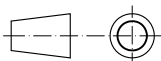
= Shaft rotation direction of TTL & HTL signal output

= Shaft rotation direction of OC signal output

R1 = Radial socket 8P (SM08B-GHS-TB).
R2 = Radial socket 14P (SM14B-GHS-TB).
R3 = Radial cable (standard length 1M).

10. Assembly Steps for Servo Motor Encoder

10.1   Encoder installation and zero position alignment with U.V.W

Step 1

a. Before installing the encoder, first confirm
   the motor's starting zero position and lock
   it to ensure that the motor shaft remains
   stationary until the encoder is installed.
   Otherwise, the encoder zero position and
   the motor zero position cannot be aligned.
b. Put the encoder (2) directly on the motor
   shaft and gently push it onto the motor
   platform by hand.
c. Tighten the three M3*12 bolts (3) at the
   same time, but do not tighten them.
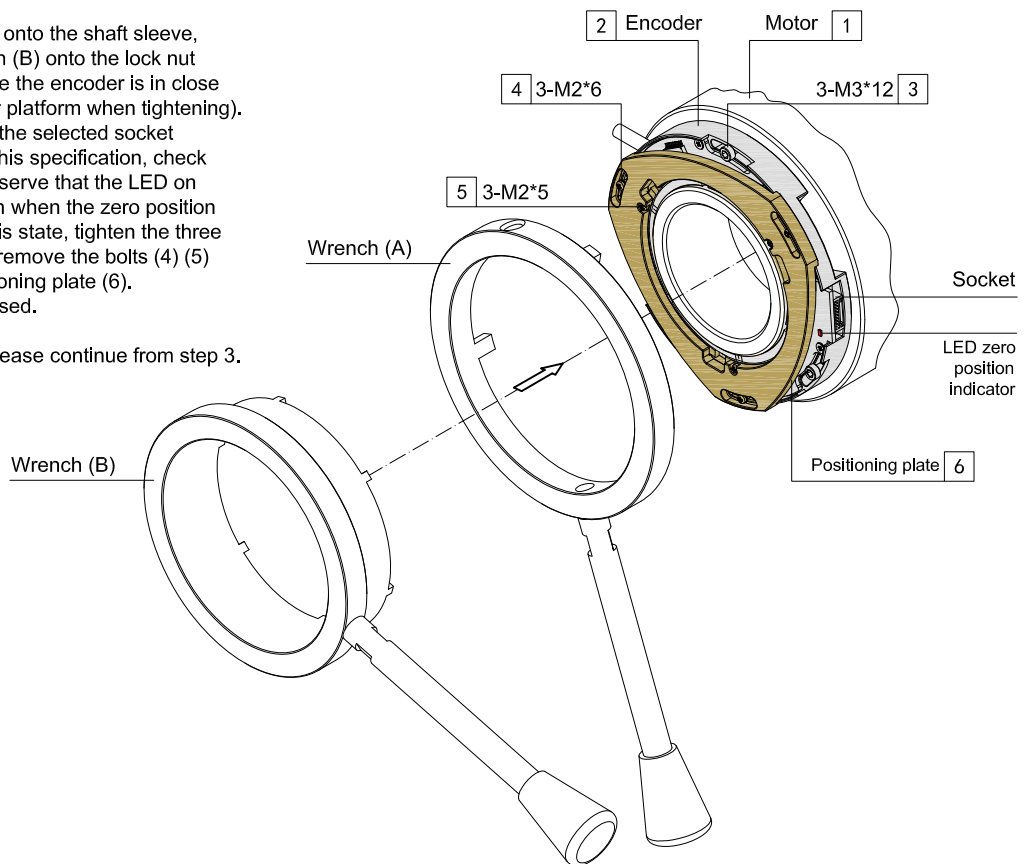   Just enough to rotate the encoder by hand.

Note：For the matching tolerance of the encoder
        sleeve and motor shaft, please refer to P7.
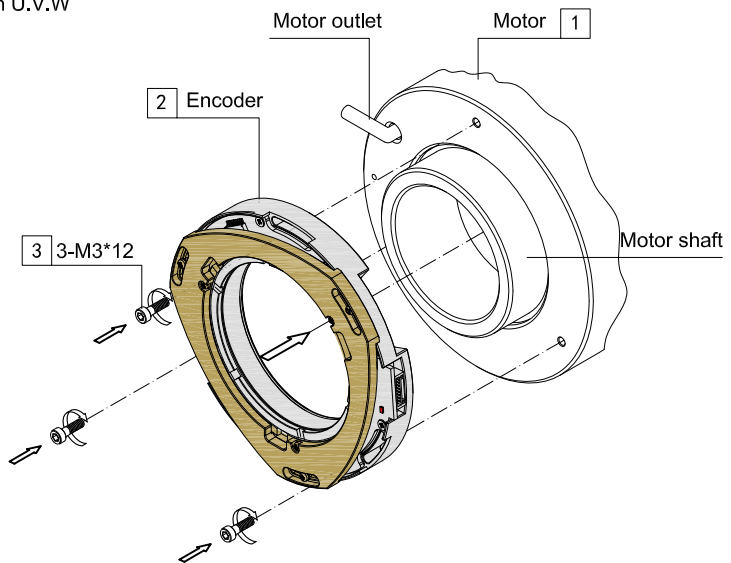
Motor outlet   Motor 1
2 Encoder
3 3-M3*12
Motor shaft

Step 2

a. Clamp the wrench (A) onto the shaft sleeve,
   then clamp the wrench (B) onto the lock nut
   and tighten (make sure the encoder is in close
   contact with the motor platform when tightening).
b. Connect according to the selected socket
   wiring table on P5 of this specification, check
   and power on, and observe that the LED on
   the encoder PCB is on when the zero position
   signal is aligned. In this state, tighten the three
   M3*12 bolts (3), then remove the bolts (4) (5)
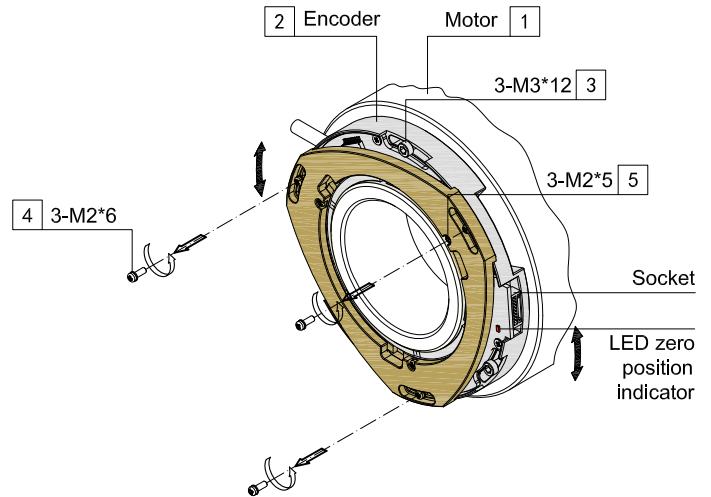   and remove the positioning plate (6).
   The encoder can be used.

   If the LED is not on, please continue from step 3.

2 Encoder   Motor 1
4 3-M2*6   3-M3*12 3
5 3-M2*5
Wrench (A)
Socket
LED zero
position
indicator
Wrench (B)
Positioning plate 6

Step 3
a. Remove the three M2*6(4) first
b. Refer to the socket wiring table selected on P5 of this specification for connection, check and power on. Please confirm again that the motor is in the zero position locked state, then turn the encoder left and tight by hand (2), and observe that the LED on the encoder PCB is on when the zero position signal is aligned. Then tighten the three M3*12 bolts (3) and keep the LED on.

Note：Because the zero position signal width is relatively narrow, it is easy to cause displacement during the tightening process, making the LED not light up. Please debug patiently or use other visual equipment as an auxiliary observation.

Step 4
a. Remove the three M2*5 bolts (5) and discard them.
b. Remove the assembly positioning plate (6) and the encoder can be used.

Note：If you need to re-zero or disassemble the encoder (2), you must reinstall the assembly positioning plate (6).
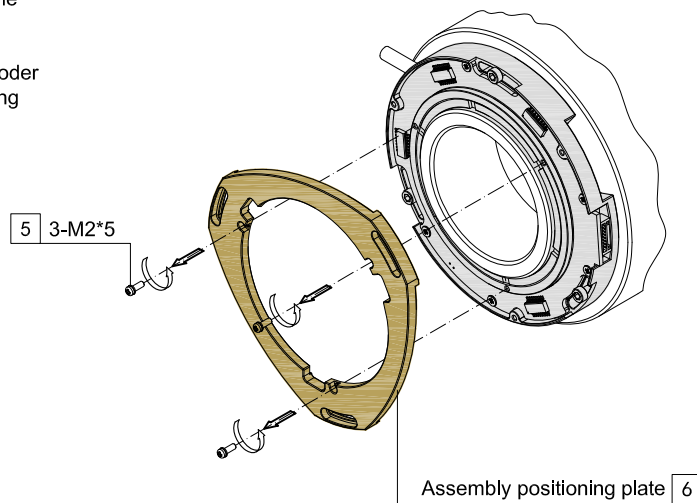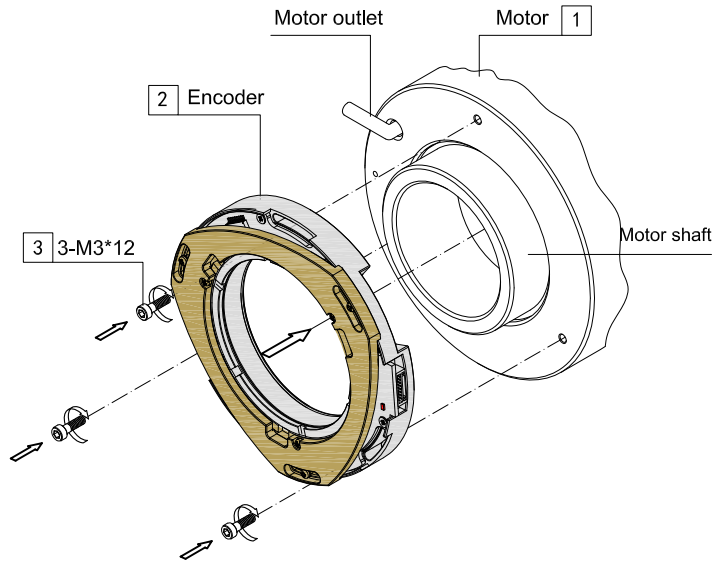
10. 2 Incremental encoder installation steps

Step 1

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

b. Screw on the three M3*12 bolts (3) at the same time, but do not tighten them tightly. Just enough to rotate the encoder by hand.

Note：For the matching tolerance of the encoder sleeve and the motor shaft, please refer to P7.

Step 2

a. Clamp the wrench (A) onto the shaft sleeve, then clamp the wrench (B) onto the lock nut and tighten it (make sure the encoder is in close contact with the motor platform when tightening), then tighten the three M3*12 bolts (3), remove the six (4) (5) bolts, and remove the positioning plate (6).

b. Refer to the selected socket wiring table on P5 of this specification for connection. After checking that everything is correct and powering on, the encoder can be used.

Note： If you want to remove the encoder (2) or reinstall it, you must reinstall the assembly positioning plate (6).
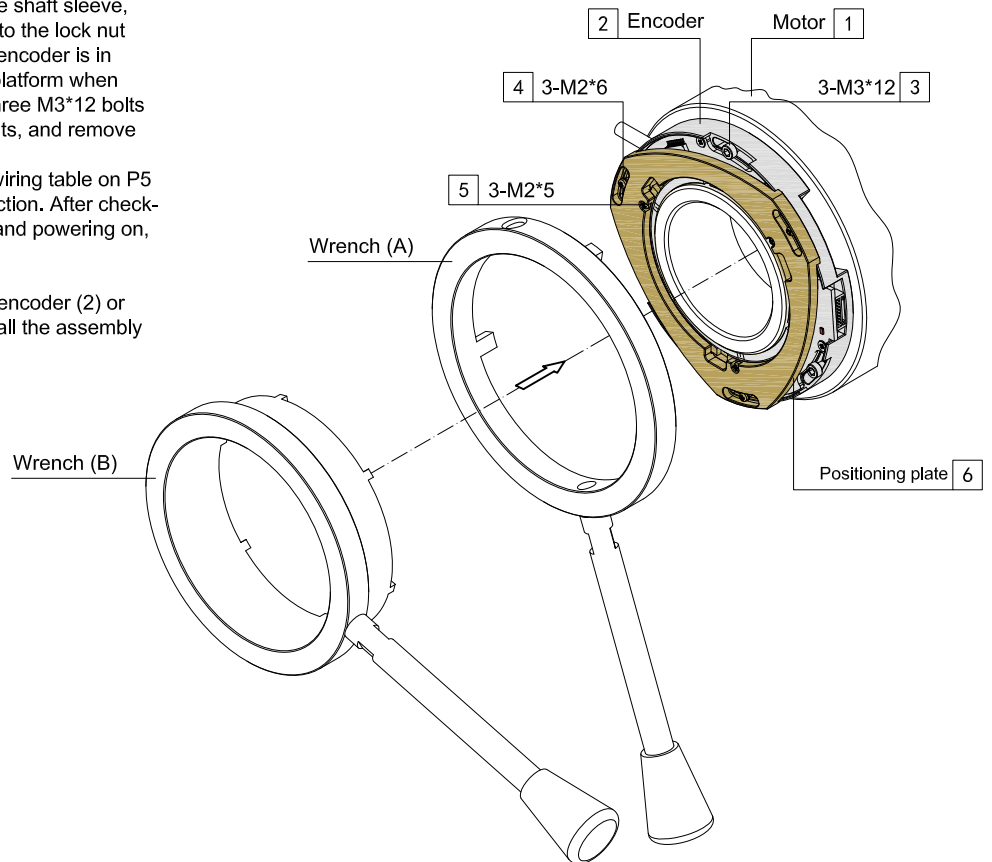
11. Caution

11.1 Caution for use
- Ambient temperature must not exceed the storage temperature.
- Relative humidity must not exceed the storage humidity.
- Not in a place with rapid temperature changes or fogging.
- Close to corrosive gases and flammable gases.
- Away from places with a lot of dust, salt, and metal powder.
- Away from places where water, oil and chemicals are used.
- Where excessive vibration and impact will be transmitted to the body.

11.2 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.

11.3 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.

HENGXIANG www. shhxgd. com

2024.7. 23

fang@shhxgd.com   Tel: 86-21-54613487   We reserve the final interpretation right of this specifications,subject to change without notice .