1. P58 Incremental Optical Encoder (Hollow Shaft)

1.1 Introduction:
P58 with its unique through-shaft concentric locking device, single-bearing ultra-thin design, mechanical hard connection, multiple electrical interfaces, and no dust protection, can solve the installation problem of low space restrictions.

P58-E

1.2 Feature:
- Encoder external diameter Ø58mm、thickness 11mm、diameter of shaft up to Ø24mm;
- Adopt non-contact photoelectric principle;
- Reverse polarity protection;
- Short circuit protection;
- Multiple electrical interfaces available;
- Resolution per turn up to 5000PPR.

P58-F

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

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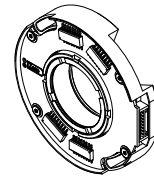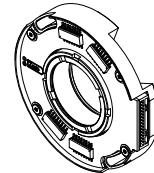- Radial cable (standard length 1.0M)

P58-J

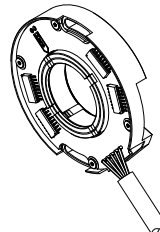### 1.5 Protection:
None

1.6 Weight:
About 80g

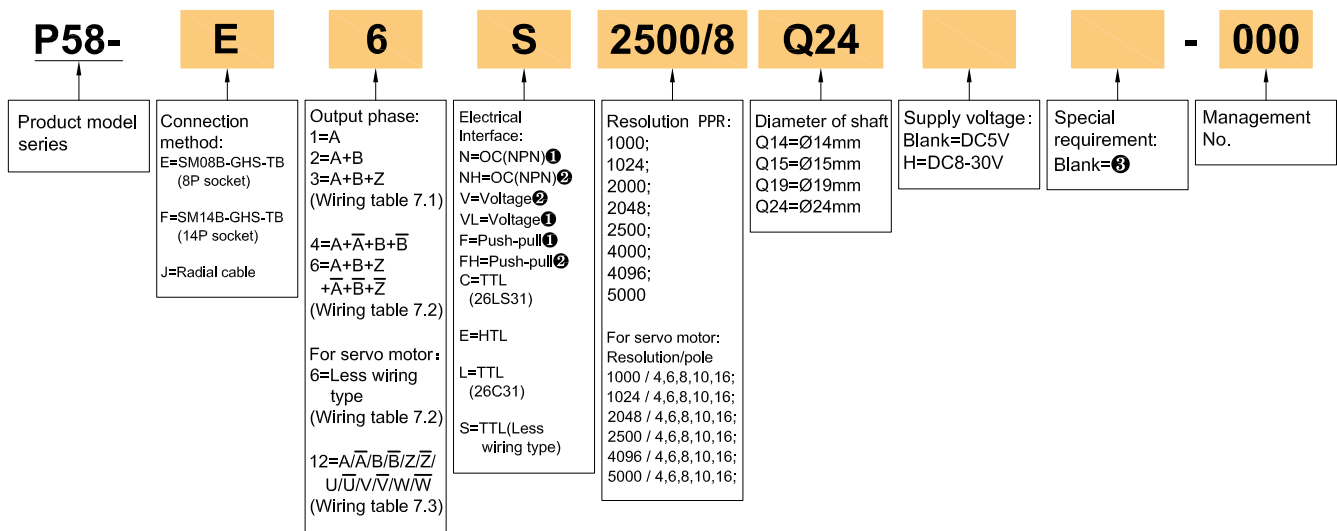## 2. Model Selection Guide
2.1 Model composition(select parameters)

P58-	E	6	S	2500/8	Q24			- 000

Product model series	Connection method:	Output phase:	Electrical Interface:	Resolution PPR:	Diameter of shaft	Supply voltage:	Special requirement:	Management No.
	E=SM08B-GHS-TB (8P socket)	1=A 2=A+B 3=A+B+Z (Wiring table 7.1)	N=OC(NPN)❶ NH=OC(NPN)❷ V=Voltage❷ VL=Voltage❶ F=Push-pull❶ FH=Push-pull❷ C=TTL 　(26LS31)	1000; 1024; 2000; 2048; 2500; 4000; 4096; 5000	Q14=Ø14mm Q15=Ø15mm Q19=Ø19mm Q24=Ø24mm	Blank=DC5V H=DC8-30V	Blank=❸	
	F=SM14B-GHS-TB (14P socket)	4=A+$\overline{A}$+B+$\overline{B}$ 6=A+B+Z 　+$\overline{A}$+$\overline{B}$+$\overline{Z}$ (Wiring table 7.2)	E=HTL	For servo motor: Resolution/pole 1000 / 4,6,8,10,16; 1024 / 4,6,8,10,16; 2048 / 4,6,8,10,16; 2500 / 4,6,8,10,16; 4096 / 4,6,8,10,16; 5000 / 4,6,8,10,16;				
	J=Radial cable	For servo motor： 6=Less wiring 　type (Wiring table 7.2) 12=A/$\overline{A}$/B/$\overline{B}$/Z/$\overline{Z}$/ U/$\overline{U}$/V/$\overline{V}$/W/$\overline{W}$ (Wiring table 7.3)	L=TTL 　(26C31) S=TTL(Less 　wiring type)					

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 R Ic=20mA Transmission distance 50m Max	T(360°) a.b.c.d=$\frac{T}{4}\pm\frac{T}{8}$ a b c d A H/L B H/L 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 clockwise 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=$\frac{T}{4}\pm\frac{T}{8}$ a b c d A H/L B H/L 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 clockwise 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 H/L NA H/L PB H/L NB H/L PZ H/L 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
A̅/B̅/Z̅
GND
26LS31 26C31
26LS32 26C32
Transmission distance 200m Max

TTL (DC5V) (Less wiring type)

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	U̅	A̅
3	green	HZ	V	B
4	green/black	HZ	V̅	B̅
5	yellow	HZ	W	Z
6	yellow/black	HZ	W̅	Z̅
7	red	DC+5V		
8	black	OV		
0	shielding	GND		

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

Output wave form

A
B
Z   T/4 T/4   T/4 T/4
e
f

U
V
W
g h j k m n
r

Reverse signal not shown

pole	g.h.j.k.m.n	r
4	30±1°	180°
6	20±1°	120°
8	15±1°	90°
10	12±1°	72°
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)

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	Ø14mm；Ø15mm；Ø19mm；Ø24mm(optional)
Starting torque	Less than 9.8×10^{-3}N·m
Inertia moment	Less than 6.5×10^{-6} kg·m²
Shaft load	Radial 30N；Axial 10N
Slew speed	≤5000 rpm
Bearing Life	1.5×10^{9} revs at rated load(100000hrs at 2500RPM)
Material	Base：Die cast aluminum
Weight	About 80g

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)	490m/s² 11ms three times for X,Y,Z direction individually
Protection	None

7. Wiring Table

7.1 OC / Voltage

Socket pin No.	Incremental signal						Supply voltage	
	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

Socket pin No.	Incremental signal						Supply voltage	
	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

Socket pin No.	Incremental signal												Supply voltage	
	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, 200-100000) 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, 200-100000) Twisted-paired cable Cable with shielding Shielding to GND 14P Plug No.GHR-14V-S

8.2 Radial Cable Schematic

L=1000±30 (Cable with shielding)

70±10

10±2

50°

Shielding to GND
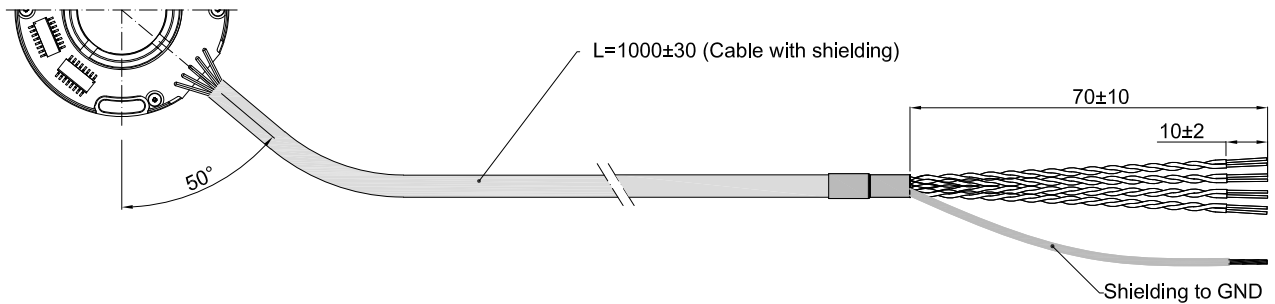
Unit: mm

9. Basic Dimension

9.1 P48-E

Q(Shaft)
Ø14^{G7}($^{+0.024}_{+0.006}$)
Ø15^{G7}($^{+0.028}_{+0.007}$)
Ø19^{G7}($^{+0.028}_{+0.007}$)
Ø24^{G7}($^{+0.028}_{+0.007}$)

Zero Mark
Red Mark

Front side
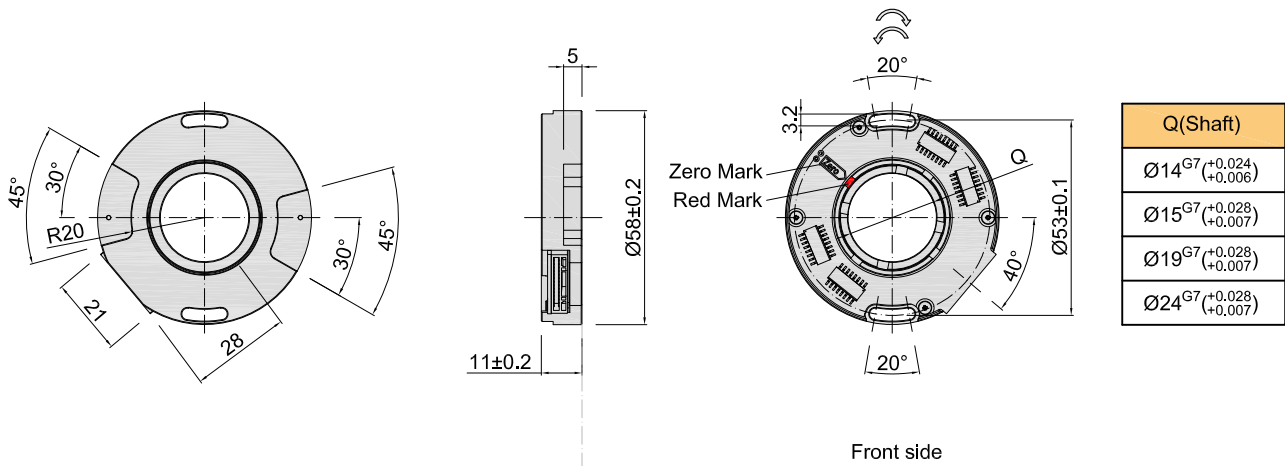
9.2 Installation shaft specification

d(motor shaft)	Mounting screws
Ø14$_{g6}$($^{-0.006}_{-0.017}$)	Inner hexagon bolt +flat washer
Ø15$_{g6}$($^{-0.006}_{-0.017}$)	Specification： M3*12
Ø19$_{g6}$($^{-0.007}_{-0.020}$)	Material： stainless steel
Ø24$_{g6}$($^{-0.007}_{-0.020}$)	Quantity：2

Motor

11(min)

Axial endplay 0.02 Max

Radial run-out 0.01 Max

2-M3*6

R24(min)

Ø53±0.1

Outlet position of motor
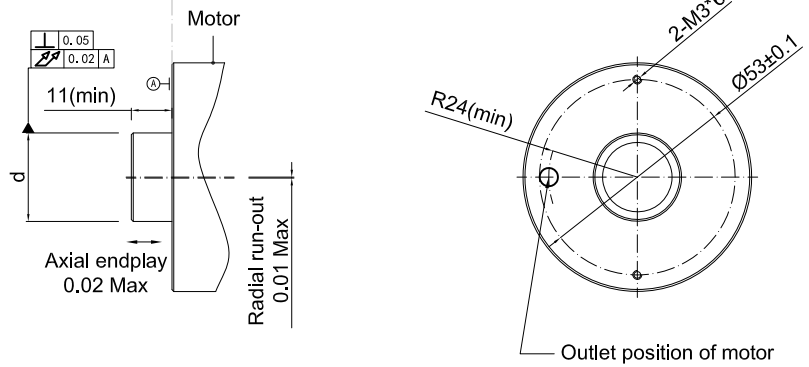
Unit: mm
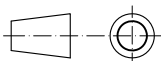
= Shaft rotate direction of incremental TTL & HTL signal output

= Shaft rotate direction of OC signal output

10. Assembly Steps

10.1 Assembling steps for encoder with UVW

Step 1

a. Before installing the encoder, first to confirm the
    starting zero position of the motor and lock it
    tightly to ensure that the motr shaft is not moving
    until the encoder is finished installation,otherwise
    the encoder and the motor's zero position cannot
    be aligned.

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

c. Screwed the two M3*12 bolts (3) at the same time,
    but do not tighten, just enough to rotate the encoder
    by hand.

Note:
    Please refer to page 8 for the matching tolerance
    of the encoder shaft sleeve and the motor shaft.

Outlet position of motor
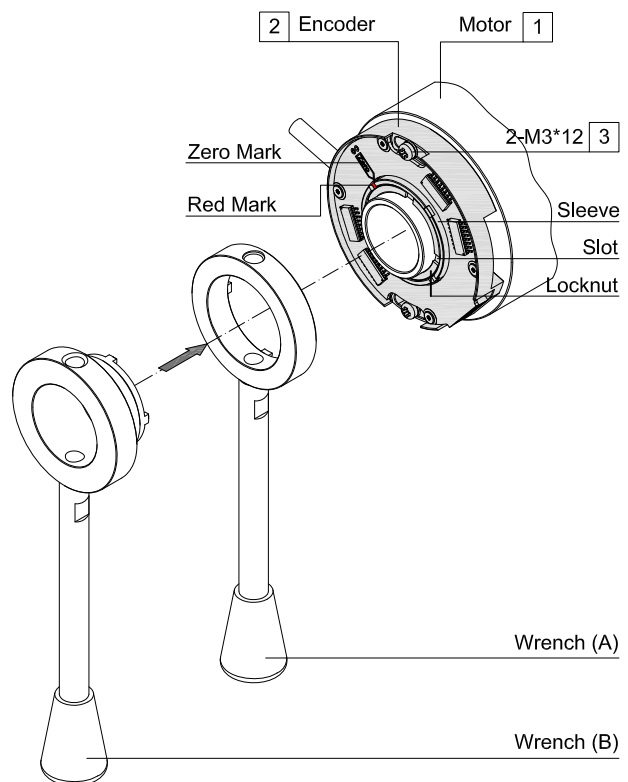
Motor 1

2 Encoder

3 2-M3*12

Motor shaft
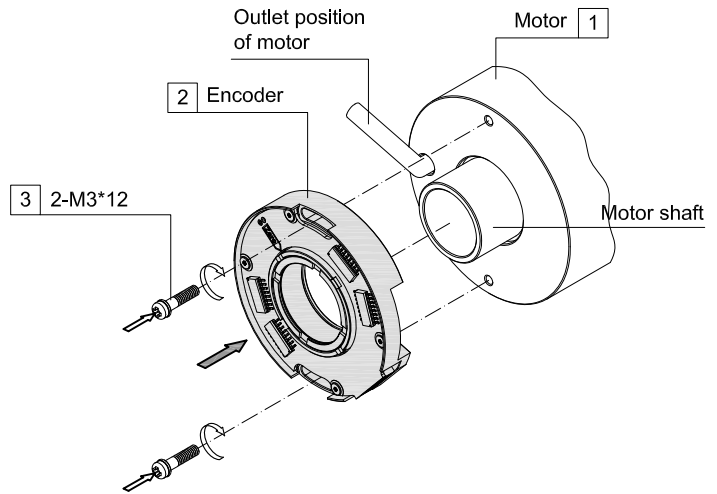
Step 2

a. Fix the spanner (A) on the slot of the encoder shaft
    sleeve (outer ring) and then use the spanner (B) to
    tighten the lock nut (recommended tightening force
    is 13-16N.m).

b. Pls refer to the cable connection table on page 6-7,
    power on after checking all are correct,please confirm
    again that the motor is in the zero locked state, and
    then turn the encoder (2) left and right by hand, make
    sure the zero signal between encoder and motor is
    aligned, then screwed two M3*12 bolts(3).

Note:
*. The red mark on the shaft sleeve is always aligned with
    the zero point.

*. After making sure that the lock nut has been tightened,
    put thread glue on the inner thread of the slot to prevent
    the screw from loosening.

*. Because the width of the zero signal is relatively narrow,
    it is easy to cause displacement during the tightening
    process. please be patient to debug.

2 Encoder   Motor 1

Zero Mark   2-M3*12 3

Red Mark   Sleeve

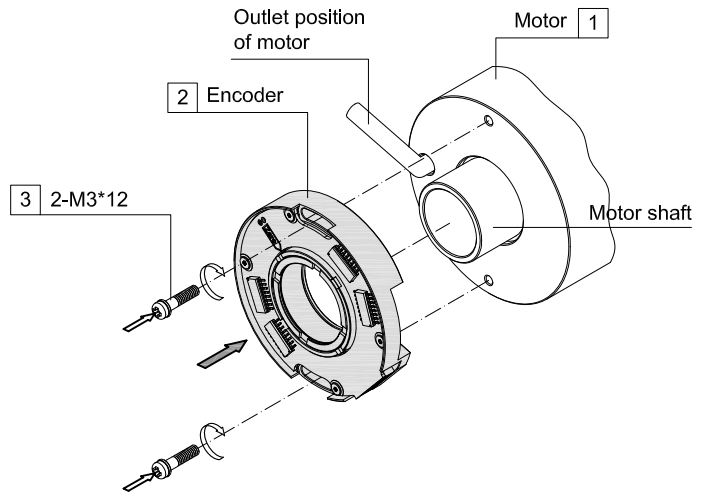Slot

Locknut

Wrench (A)

Wrench (B)

10.2 Assembling steps for encoder without UVW

Step 1
　　Put the encoder (2) directly on the motor shaft (1)
　　and gently push it to the motor platform, then tighten
　　the two M3*12 bolts (3) at the same time.

Note：
　　Please refer to page 8 for the matching tolerance of
　　the encoder shaft sleeve and the motor shaft.

Outlet position
of motor

Motor | 1 |

| 2 | Encoder

| 3 | 2-M3*12

Motor shaft

Step 2
　　Fix the spanner (A) on the slot of the
　　encoder shaft sleeve (outer ring) and
　　then use the spanner (B) to tighten
　　the lock nut to ensure tightness,
　　(recommended tightening force is 13-16nm).

Note：
*. After making sure that the lock nut has been
　　tightened, put thread glue on the inner thread
　　of the slot to prevent the screw from loosening.

| 2 | Encoder　Motor | 1 |

Zero Mark

Red Mark

Sleeve

Slot

Locknut

Wrench (A)

Wrench (B)
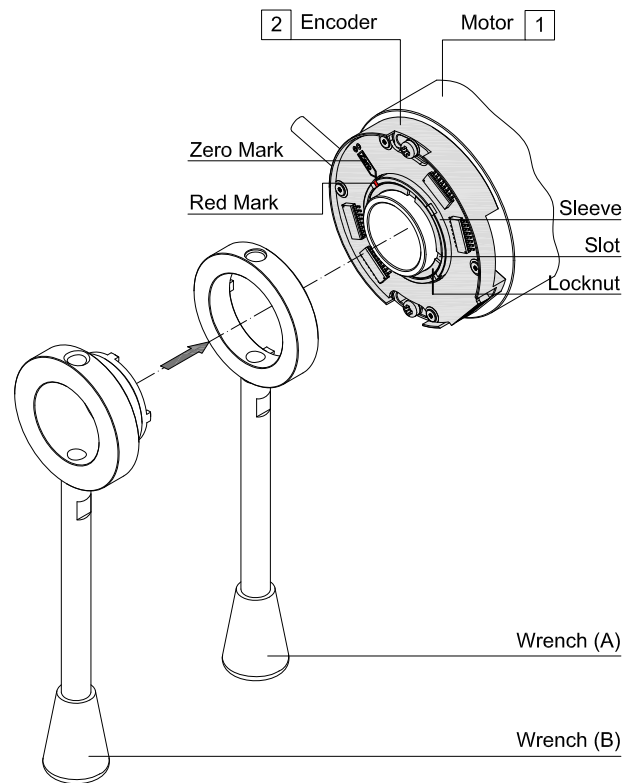
11. Caution

11.1 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.

11.2 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.