1．PC58 Incremental Optical Encoder (Hollow Shaft)

1.1 Introduction：
PC58 with its unique through-shaft concentric locking device, single-bearing ultra-thin design, mechanical hard connection, multiple electrical interfaces, protection grade IP50, can solve the installation problem of low space restrictions.

PC58-E

1.2 Feature：
- Encoder external diameter Ø58mm、thickness min 14mm、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.

PC58-F

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

1.4 Connection：
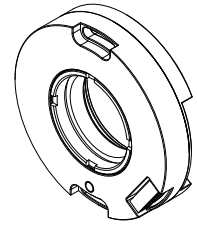- Radial socket (8P & 14P)
- Radial cable (standard length 1.0M)
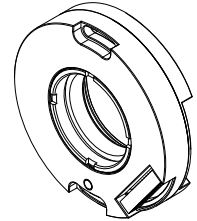
PC58-J

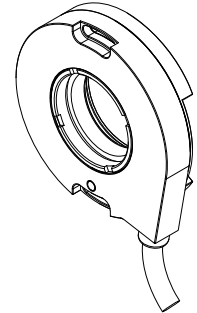1.5 Protection：
IP50

1.6 Weight：
About 100g

2．Model Selection Guide

2.1 Model composition(select parameters)

| PC58- | E | 6 | S | 2500/8 | Q24 | | | - 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
(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 7.2)

12=A/$\overline{A}$/B/$\overline{B}$/Z/$\overline{Z}$/
U/$\overline{U}$/V/$\overline{V}$/W/$\overline{W}$
(Wiring table 7.3) | 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

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; | Diameter of shaft:
Q14=Ø14mm
Q15=Ø15mm
Q19=Ø19mm
Q24=Ø24mm | 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 IP50, cable length is 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 Method

3.1 Incremental signal

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

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)	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	2	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		

Reverse signal not shown

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
5±0.25
4.25±0.3
Power on
Instantaneous power down
Power off
Time(ms)
Mode
35Min   7±2   35Min   7±2
510±220   22±11   510±220   22±11
1   1

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 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 Specification

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	$1.5X10^{9}$ revs at rated load(100000hrs at 2500RPM)
Material	Base：Die cast aluminum
Weight	About 100g

6．Environmental Parameter

|	
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	IP50

7. Wiring Table

7.1 OC / Voltage

	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

	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

	Signal												Supply voltage	
Socket pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Wire color	Blue	Blue/Bk	Grey	Grey/Bk	Pink	Pink/Bk	Yellow	Yellow/BK	Green	Green/BK	White	White/BK	Black	Red
Function	U+	U-	V+	V-	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 1 Pin 8	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 1 Pin 14	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

100～200   70±10

10±2

Anti-interference magnetic ring   Shield wire effectively grounded

L=1000(Standard products)
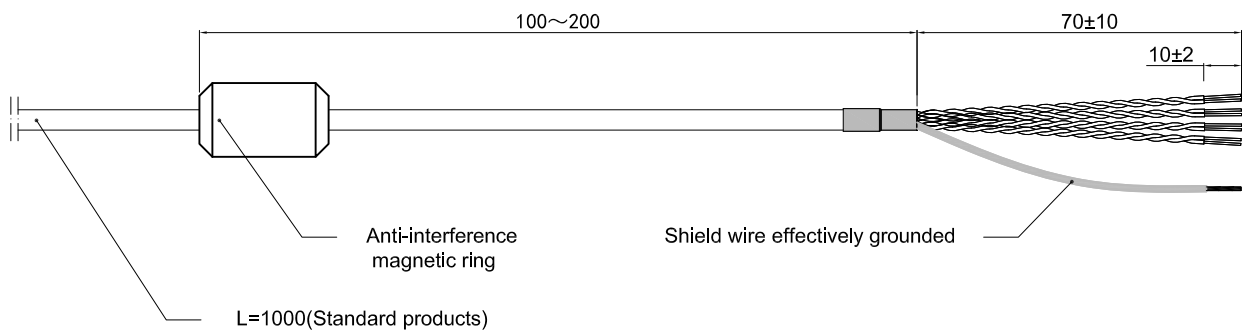
Unit: mm

9. Basic Dimension

9.1 PC58-E

R20
60°

4

Ø58±0.2

14±0.2

20°
3.2

Ø53±0.1

Q

35°

R.1

Red mark
LED Zero point
indicating

20°

Front side

Q(Shaft)
Ø14^{G7}($^{+0.024}_{+0.006}$)
Ø15^{G7}($^{+0.024}_{+0.006}$)
Ø19^{G7}($^{+0.028}_{+0.007}$)
Ø24^{G7}($^{+0.028}_{+0.007}$)
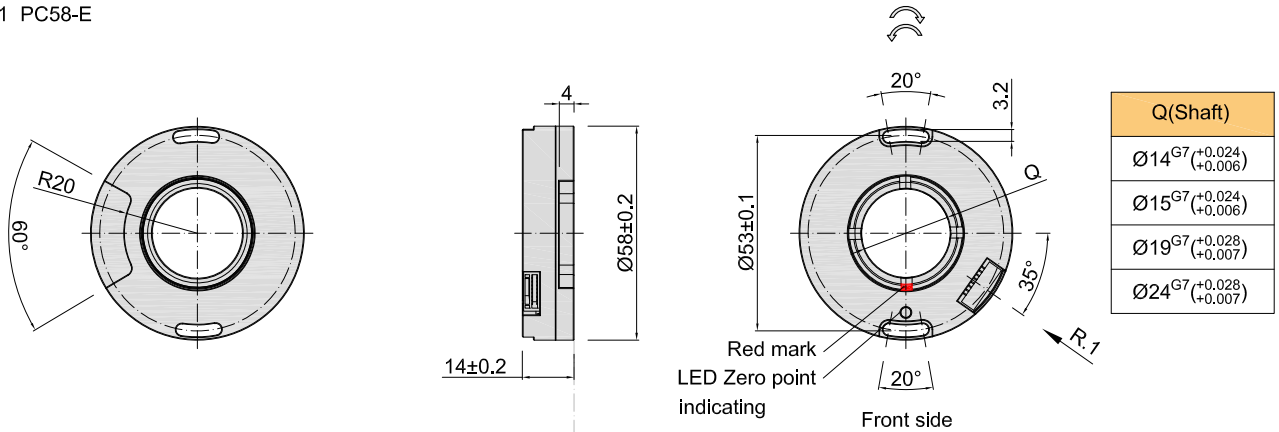
9.2 PC58-F (other dimension are the same as PC58-E)

R.2
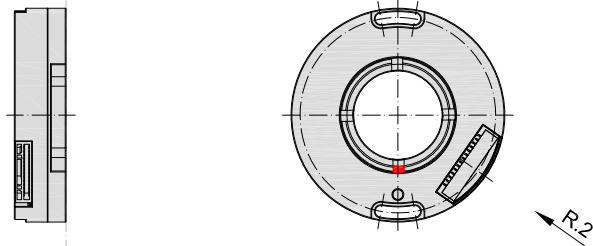
9.3 PC58-J (other dimension are the same as PC58-E)

10°

32.4±0.5

R.3

L=1000(Standard products)
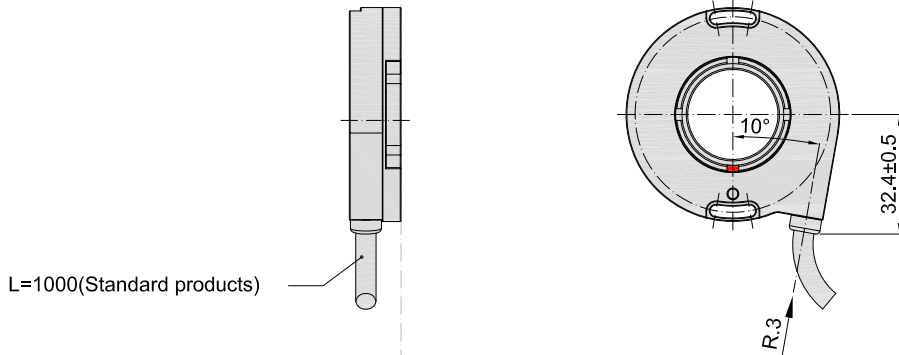
9.4 Installation shaft specification

d(motor shaft)	Mounting screws
Ø14$_{g6}$($^{-0.006}_{-0.017}$)	Inner hexagon bolt +flat washer Specification： M3*15 Material： stainless steel Quantity：2
Ø15$_{g6}$($^{-0.006}_{-0.017}$)	
Ø19$_{g6}$($^{-0.007}_{-0.020}$)	
Ø24$_{g6}$($^{-0.007}_{-0.020}$)	

Motor

0.05
0.02 A

Ⓐ

14(Min)

d

Axial endplay
0.02 Max

Radial run-out
0.01 Max

2-M3*8

Ø53±0.1

Outlet
position
of motor

R24(Min)
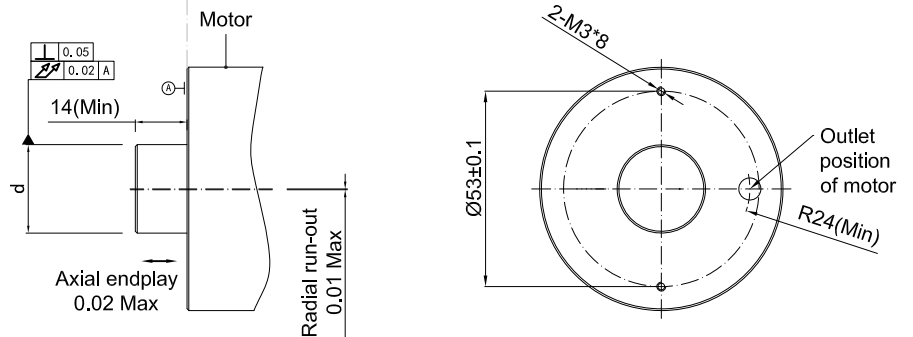
Unit: mm
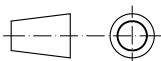
= Shaft rotate direction of incremental TTL & HTL signal output
= Shaft rotate direction of OC signal output

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 to confirm the
     starting zero position of the motor and lock it
     tightly to ensure that the motor 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*15 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
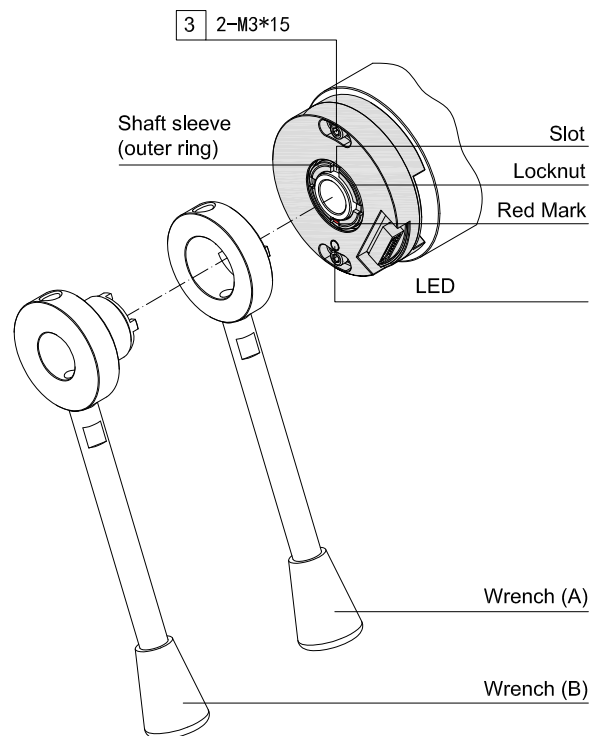   of the encoder shaft sleeve and the motor shaft.
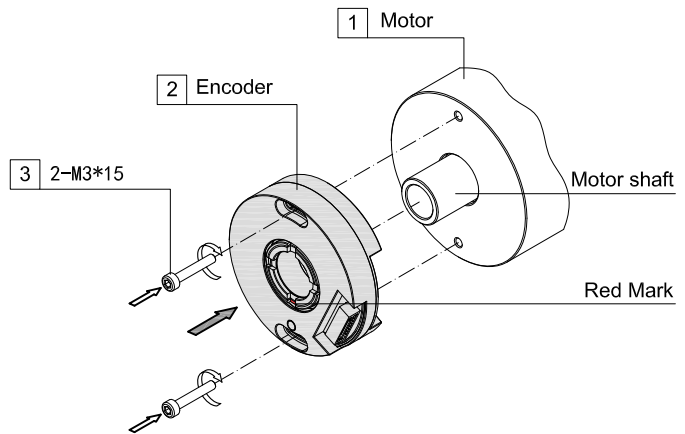
Step 2
a. Fix the spanner (A) on the slot of the encoder shaft
     sleeve (outer ring) and then use the spanner (B) to
     tighten the lock nut (recommended tightening force
     is 13-16N.m).
b. Pls refer to the socket connection table on page 6-7 for
     connection, power on after checking all are correct,
     please confirm again that the motor is in the zero locked
     state, and then turn the encoder (2) left and right by hand,
     observe the LED on the encoder, when it is on,the zero
     signal is aligned, then tighten the two M3*15 bolts (3) and
     keep the LED on.

Note:
*. The red mark on the shaft sleeve is always aligned with
     the LED indicator.
*. 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 and the LED may not light up. please be patient
     to debug or use other testing equipments as auxiliary
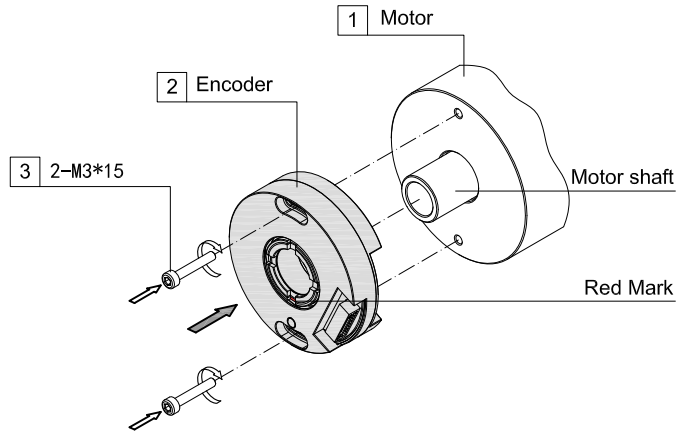   observation.

10.2 Incremental encoder installation steps

Step 1
    Put the encoder (2) directly on the motor (1) shaft
    and gently push it to the motor platform, then tighten
    the two M3*15 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.

1 Motor

2 Encoder

3 2-M3*15

Motor shaft

Red Mark

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.
    (recommended tightening force is 13-16N.m).

Note：
*. The red mark on the shaft sleeve is aligned
    with the LED indicator light for the zero primary
    position.
    When the power is turned on and the LED light
    is on, it is the precise zero position.
*. 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.

3 2-M3*15

Shaft sleeve
(outer ring)

Slot

Locknut

Red Mark

LED

Wrench (A)

Wrench (B)
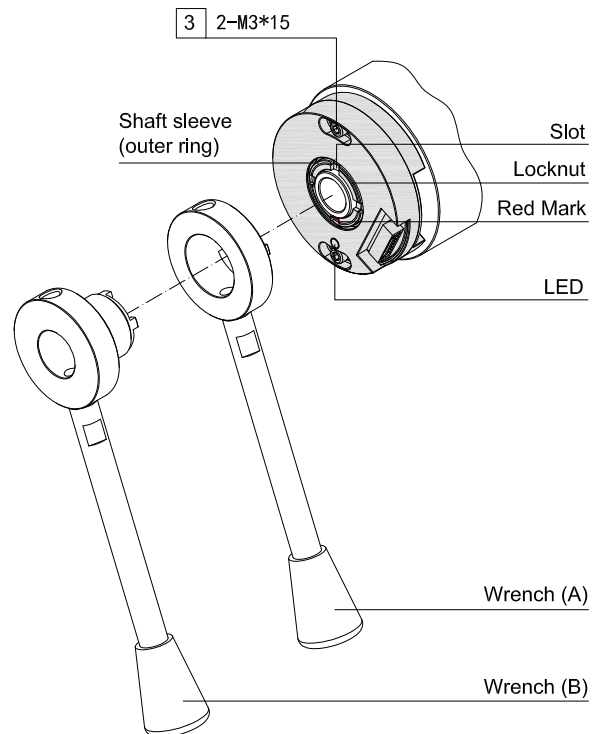
11. Caution

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.

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