1. KN40 Incremental Optical Encoder (Hollow shaft)

1.1 Introduction:
KN40 is an ultra-thin multiple shaft type encoder, compact and miniaturized, commonly used in servo motors and industrial automations.

1.2 Feature:
- Encoder external diameter Ø40mm、thickness 20mm、diameter of shaft up to Ø10mm;
- Adopt non-contact photoelectric principle;
- Reverse polarity protection;
- Short circuit protection;
- Multiple electrical interfaces available;
- Resolution per turn up to 40000PPR.

1.3 Application:
Servo motor, underground, elevator, CNC and other automation control fields.
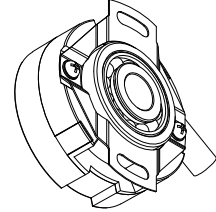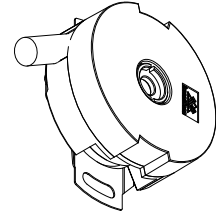
1.4 Connection:
- Radial cable (length 0.5M)
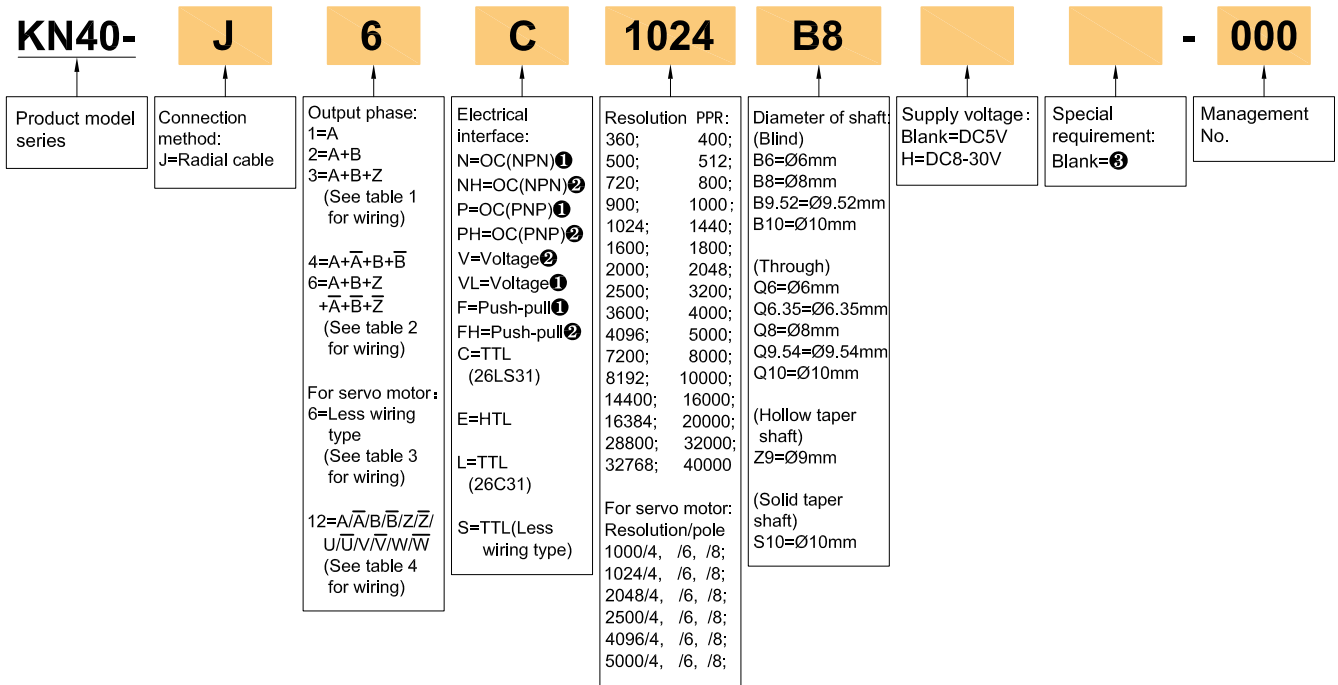
1.5 Protection:
IP40

1.6 Weight:
about 90g

2. Model Selection Guide

2.1 Model composition(select parameters)

KN40- | J | 6 | C | 1024 | B8 | | | -000

| Product model series | Connection method: J=Radial cable | Output phase: 1=A 2=A+B 3=A+B+Z (See table 1 for wiring) 4=A+$\overline{A}$+B+$\overline{B}$ 6=A+B+Z +$\overline{A}$+$\overline{B}$+$\overline{Z}$ (See table 2 for wiring) For servo motor: 6=Less wiring type (See table 3 for wiring) 12=A/$\overline{A}$/B/$\overline{B}$/Z/$\overline{Z}$/ U/$\overline{U}$/V/$\overline{V}$/W/$\overline{W}$ (See table 4 for wiring) | Electrical interface: N=OC(NPN)❶ NH=OC(NPN)❷ P=OC(PNP)❶ PH=OC(PNP)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: 360; 400; 500; 512; 720; 800; 900; 1000; 1024; 1440; 1600; 1800; 2000; 2048; 2500; 3200; 3600; 4000; 4096; 5000; 7200; 8000; 8192; 10000; 14400; 16000; 16384; 20000; 28800; 32000; 32768; 40000 For servo motor: Resolution/pole 1000/4, /6, /8; 1024/4, /6, /8; 2048/4, /6, /8; 2500/4, /6, /8; 4096/4, /6, /8; 5000/4, /6, /8; | Diameter of shaft: (Blind) B6=Ø6mm B8=Ø8mm B9.52=Ø9.52mm B10=Ø10mm (Through) Q6=Ø6mm Q6.35=Ø6.35mm Q8=Ø8mm Q9.54=Ø9.54mm Q10=Ø10mm (Hollow taper shaft) Z9=Ø9mm (Solid taper shaft) S10=Ø10mm | 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 IP40 and cable length of 0.5M, 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 2 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	Shield cable / Power supply / DC5V: R=220Ω / DC12V: R=470Ω / Encoder / A/B/Z / 0V / GND / R / Transmission distance 50m Max / Ic=20mA	T(360°) a b c d / $a.b.c.d=\frac{T}{4}\pm\frac{T}{8}$ / Phase A is ahead of B by $\frac{T}{4}\pm\frac{T}{8}$, viewing from shaft end, direction is clockwise rotation. (See dimensional drawings) / CW direction / Z signal is low level active / A B Z / $\frac{T}{4}\pm\frac{T}{8}$
OC PNP open collector circuit	Shield cable / Power supply / Encoder / A/B/Z / 0V / GND / Transmission distance 50m Max / Ic=20mA	
Push-pull	Shield cable / Power supply / Encoder / A/B/Z / 0V / GND / L=Load / Transmission distance 50m Max	T(360°) a b c d / $a.b.c.d=\frac{T}{4}\pm\frac{T}{8}$ / Phase A is ahead of B by $\frac{T}{4}\pm\frac{T}{8}$, viewing from shaft end, direction is clockwise rotation. (See dimensional drawings) / CW direction / Z signal is high level active / A B Z / $\frac{T}{4}\pm\frac{T}{8}$
Voltage	Shield cable / Power supply / Encoder / A/B/Z / 0V / GND / R=2.2K / L=Load / Transmission distance 2m Max	
TTL (DC5V) / HTL (DC8-30V)	Shield cable / Power supply / Encoder / 0V / A/B/Z / A/B/Z / GND / 26LS31 26C31 / 26LS32 26C32 / Transmission distance 200m Max	T(360°) a b c d / $a.b.c.d=\frac{T}{4}\pm\frac{T}{8}$ / Phase A is ahead of B by $\frac{T}{4}\pm\frac{T}{8}$, viewing from shaft end, direction is clockwise rotation. (See dimensional drawings) / CW direction / PA NA PB NB PZ NZ / $\frac{T}{4}\pm\frac{T}{8}$

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
T/4 T/4 T/4 T/4
e
f

U
V
W
g h j k m n
r

Reverse signal not shown

TTL (DC5V) (Less wiring type)

1
3/5/7
4/6/8
2
0

Main circuit

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		Mode		
	Color		1	2	3
3	white		HZ	U	A
4	white/ black		HZ	Ū	Ā
5	green		HZ	V	B
6	green/ black		HZ	V̄	B̄
7	yellow		HZ	W	Z
8	yellow/ black		HZ	W̄	Z̄
1	red		DC+5V		
2	black		0V		
0	shielding		GND		

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

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

f: center of phase Z to rise point of phase U,that is ±1°

CCW direction ⟶

Viewed from shaft end when installing.
(See dimensional drawings)

Timing Chart

Supply voltage

5±0.25
4.25±0.3

Power on

Instantaneous power down

Power off

Time(ms)

35MIN
7±2

35MIN
7±2

Mode

★ ☆
1 2 3
★ ☆
1 2 3

1
510±220
22±11

1
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)		≤100ns
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	Ø6mm；Ø6.35mm；Ø8mm；Ø9.52mm；Ø9.54mm；Ø10mm；Ø9mm taper shaft；Ø10mm taper shaft（optional）
Starting torque	Less than $5.9×10^{-3}$N·m
Inertia moment	Less than $1.5×10^{-6}$ kg·m²
Shaft load	Radial 30N；Axial 20N
Slew speed	≤5000 rpm
Bearing Life	$1.5×10^9$ revs at rated load(100000hrs at 2500RPM)
Shell	Aluminium alloy
Weight	about 90g

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	IP40

7. Wiring Table

7.1 OC/Voltage/Push-pull (Table 1)

Wire color	Supply voltage		Incremental signal		
	Red	Black	White	Green	Yellow
Function	Up	0V	A	B	Z

7.2 TTL/HTL (Table 2)

Wire color	Supply voltage		Incremental signal					
	Red	Black	White	White/BK	Green	Green/BK	Yellow	Yellow/BK
Function	Up	0V	A+	A-	B+	B-	Z+	Z-
Twisted-paired cable								

7.3 Less wiring type (Table 3)

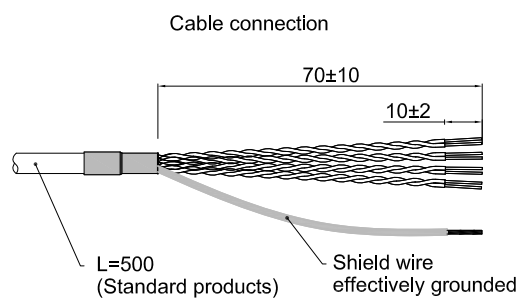| Wire color	Supply voltage		Incremental signal					
	Red	Black	White	White/BK	Green	Green/BK	Yellow	Yellow/BK
Function	Up	0V	A+ (U+)*	A- (U-)*	B+ (V+)*	B- (V-)*	Z+ (W+)*	Z- (W-)*
Twisted-paired cable								

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

7.4 For servo motor （Table 4）

Wire color	Supply voltage		Incremental signal											
	Red	Black	White	White/BK	Green	Green/BK	Yellow	Yellow/BK	Blue	Blue/BK	Grey	Grey/BK	Pink	Pink/BK
Function	Up	0V	A+	A-	B+	B-	Z+	Z-	U+	U-	V+	V-	W+	W-
Twisted-paired cable														

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

Cable connection

70±10

10±2

L=500
(Standard products)

Shield wire
effectively grounded

8. Basic Dimensions

8.1 Z (Hollow taper shaft)

20±0.2
18±0.2
Ø40±0.1
5.5

40T34
20°
R17
60°

40T40
20°
R20

17
15
1:10
1
M5
Ø8
Ø9^{G6}$(^{+0.014}_{+0.005})$
0.02 C

8.2 B (Blind shaft)

40T34

40T40

17
15
1
M5
Ø8
B
0.02 C

B
Ø6^{G6}$(^{+0.014}_{+0.005})$
Ø8^{G6}$(^{+0.014}_{+0.005})$
Ø9.52^{G6}$(^{+0.014}_{+0.005})$
Ø10^{G6}$(^{+0.014}_{+0.005})$

8.3 S (Solid taper shaft)

29.8±0.2
19.8±0.2
5.3

40Z40
20°
R20

1:10
Ø10g6$(^{-0.005}_{-0.014})$
M6
Ø6.2
Ø9
0.02 C
10
24

8.4 Q（Through shaft）

23.5±0.2
9

40G40
20°
R20

21.5
10
2-M3
Ø18±0.05
Q
Q+0.2

Q
Ø6^{G6}$(^{+0.014}_{+0.005})$
Ø6.35^{G6}$(^{+0.014}_{+0.005})$
Ø8^{G6}$(^{+0.014}_{+0.005})$
Ø9.54^{G6}$(^{+0.014}_{+0.005})$
Ø10^{G6}$(^{+0.014}_{+0.005})$
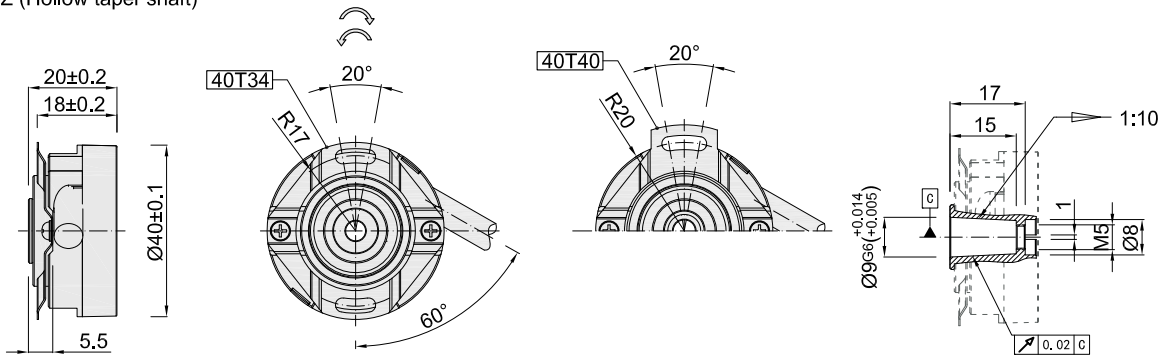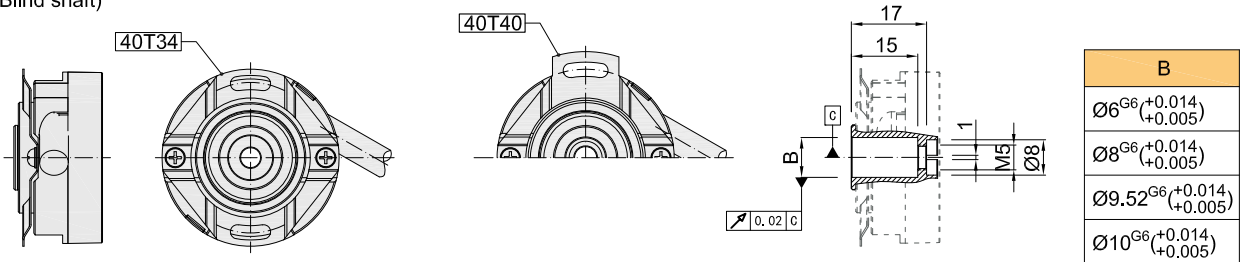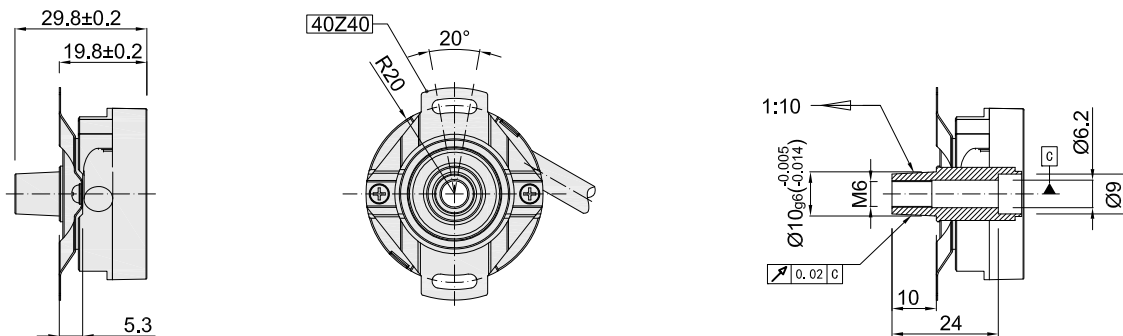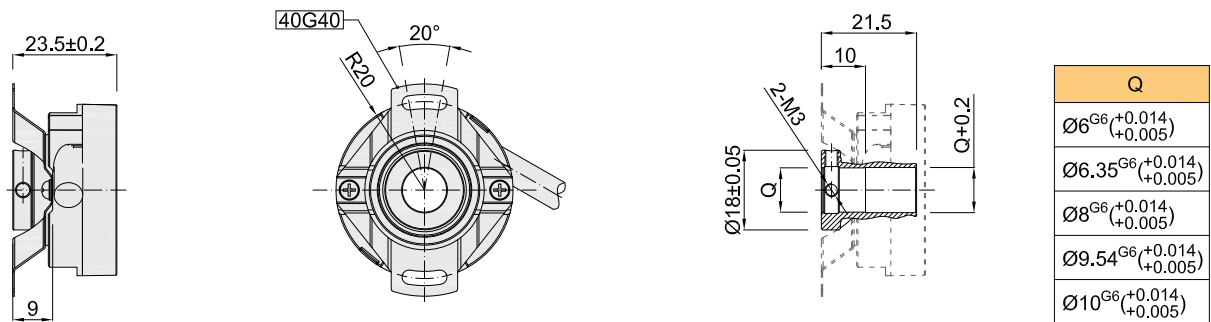
Unit：mm
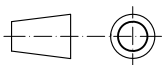
⌒ = Direction of shaft rotation for incremental signal output

⌒ = Direction of shaft rotation for servo motor-specific signal output
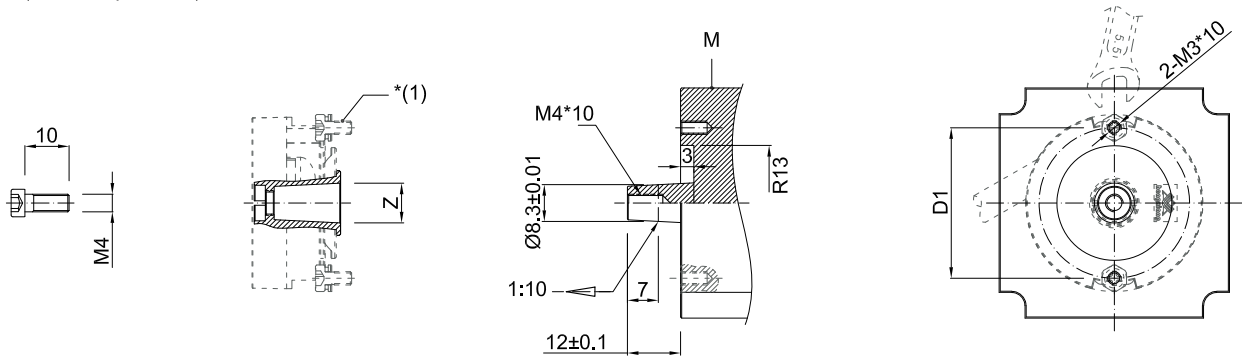
40T34 40T40 40Z40 40G40 = Install spring plate (Please refer to page 9 of specification)
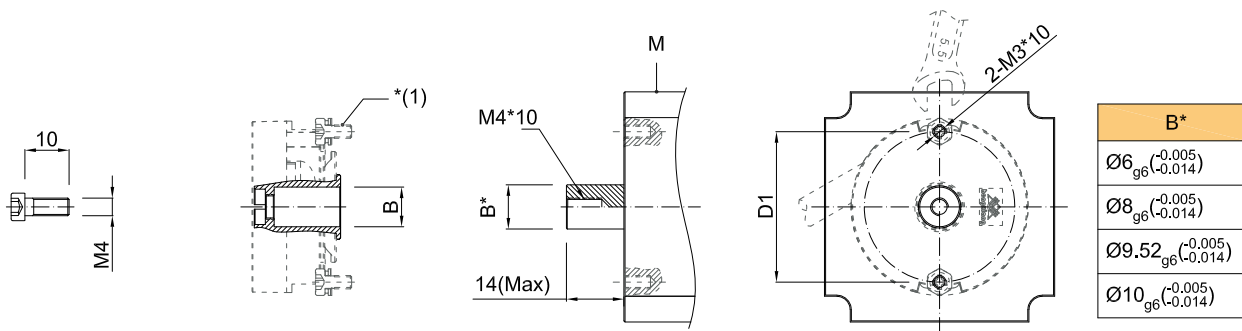
About vibration
   Vibration act on encoder always cause wrong pulse, so we should pay attention to working place.More pulse per revolution, narrower groovy spacing of grating, more effect to encoder by vibration, when rev is low or stop, vibration act on shaft or main body would cause grating vibrating, so encoder might make wrong pulse.
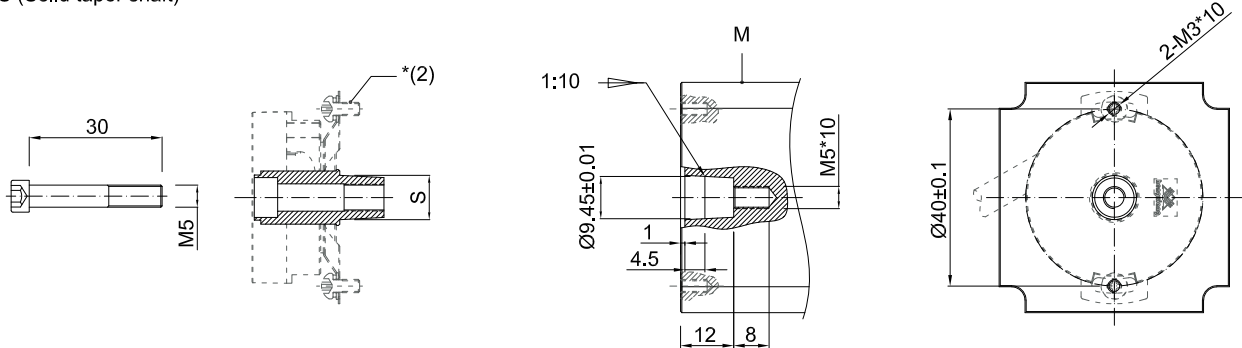
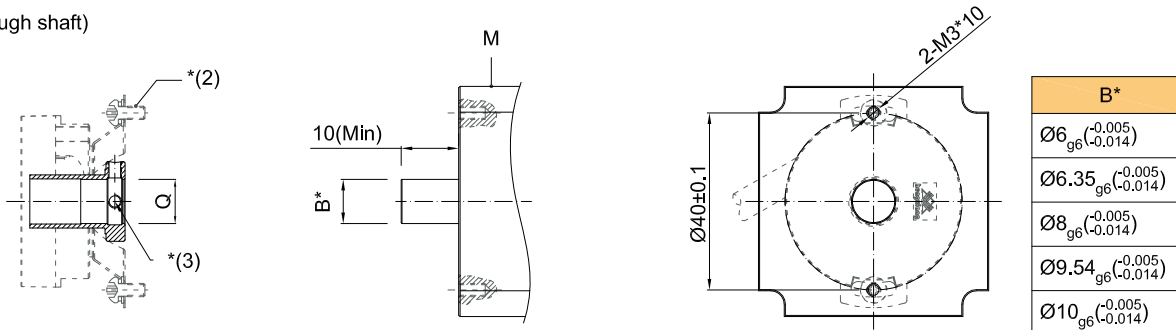## 9．Mounting Shaft Requirements
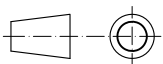
9.1 Z (Hollow taper shaft)

9.2 B (Blind shaft)

B*
$\varnothing 6_{g6} \binom{-0.005}{-0.014}$
$\varnothing 8_{g6} \binom{-0.005}{-0.014}$
$\varnothing 9.52_{g6} \binom{-0.005}{-0.014}$
$\varnothing 10_{g6} \binom{-0.005}{-0.014}$

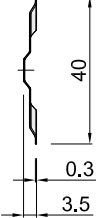### 9.3 S (Solid taper shaft)

9.4 Q(Through shaft)

B*
$\varnothing 6_{g6} \binom{-0.005}{-0.014}$
$\varnothing 6.35_{g6} \binom{-0.005}{-0.014}$
$\varnothing 8_{g6} \binom{-0.005}{-0.014}$
$\varnothing 9.54_{g6} \binom{-0.005}{-0.014}$
$\varnothing 10_{g6} \binom{-0.005}{-0.014}$

Unit: mm
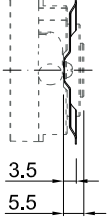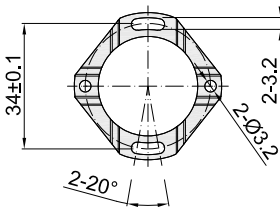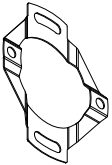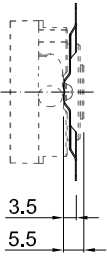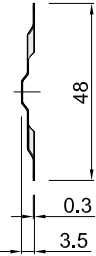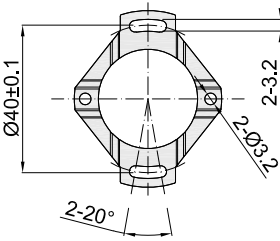
M=Motor

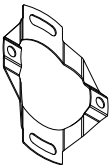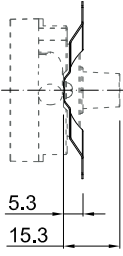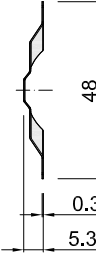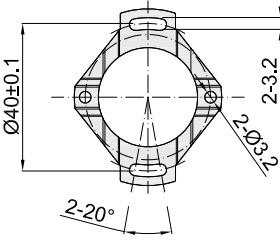* Motor shaft radial runout max 0.3mm；
  axial runout max 0.1mm

Note：
*(1)：Outer hexagon screw M3*10 with flat gasket and spring ring is recommended to use
*(2)：Round-headed screw M3*10 with flat gasket and spring ring is recommended to use
*(3)：Apply thread glue to the surface of the two M3*3 screws Tightening force is 0.6N.m
D1：Ø34±0.1 & Ø40±0.1 (Choose the spring plate to determine the installation size)

10. Accessories (Spring plate options)

40T34 No:03700112	
	3.5 / 5.5 40 / 0.3 / 3.5 34±0.1 2-3.2 2-Ø3.2 2-20°
40T40 No:03700111	
	3.5 / 5.5 48 / 0.3 / 3.5 Ø40±0.1 2-3.2 2-Ø3.2 2-20°
40Z40 No:03700121	
	5.3 / 15.3 48 / 0.3 / 5.3 Ø40±0.1 2-3.2 2-Ø3.2 2-20°
40G40 No:03700113	
	9 48 / 0.3 / 9 Ø40±0.1 2-3.2 2-Ø3.2 2-20°

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2024.3.19

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