## 1. KH35 Ultra-high Resolution Incremental Optical Encoder (Through shaft)

1.1 Introduction：
This product is an incremental high-resolution through-shaft miniaturized ultra-thin encoder with embedded flexible spring plate for flange mounting, with Hengxiang's exclusive concentric shaft locking structure and easy installation, and is commonly used in industrial automation fields where space is tight.
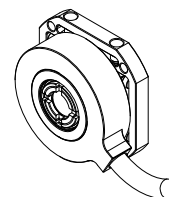
KH35-E
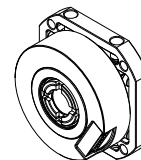
1.2 Feature：
- Encoder diameter Ø35mm (Mounting flange diameter Ø44.2mm), Thickness 16.2mm, Hollow shaft up to Ø8mm;
- Concentric shaft locking mounting structure;
- Adopt non-contact photoelectric principle;
- With short circuit protection;
- Various electrical interfaces available;
- Resolution per turn up to 19Bits.

KH35-J

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

1.4 Connection：
- Radial socket (8P SM08B-GHS-TB)
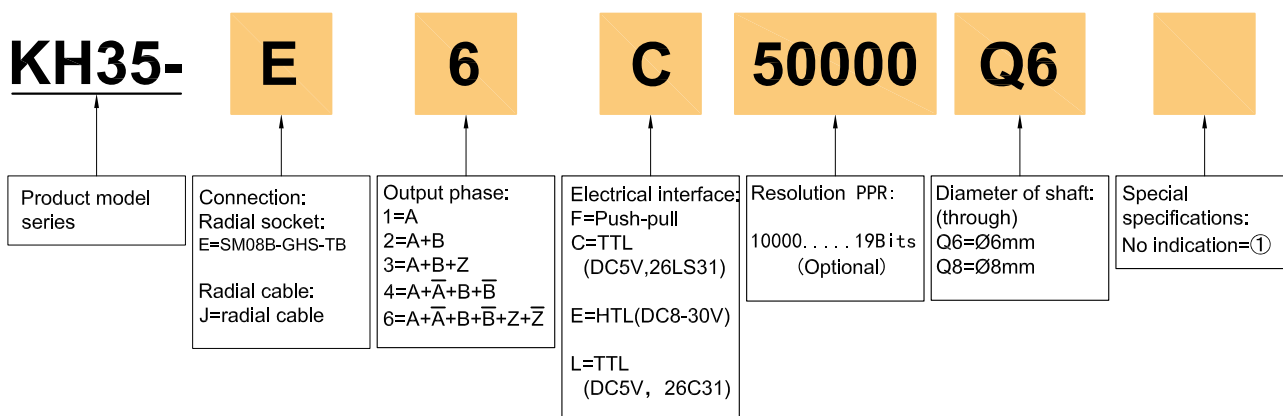- Radial cable (standard length 1000mm)

1.5 Protection：
IP50

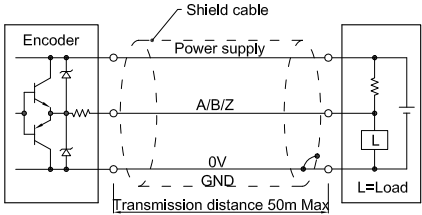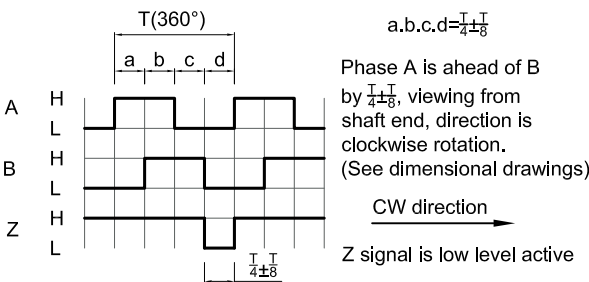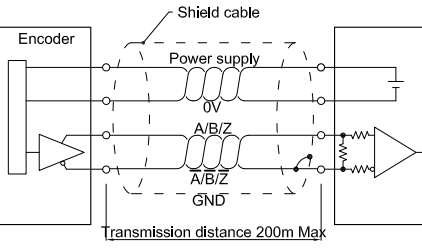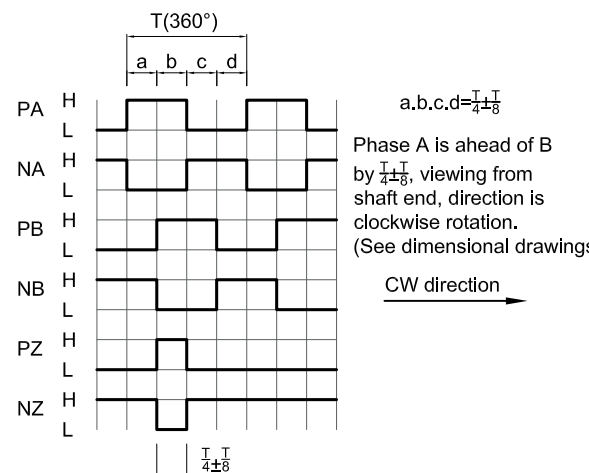### 1.6 Weight：
about 70g

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

KH35-	E	6	C	50000	Q6	

| Product model series | Connection: Radial socket: E=SM08B-GHS-TB Radial cable: J=radial cable | Output phase: 1=A 2=A+B 3=A+B+Z 4=A+$\overline{A}$+B+$\overline{B}$ 6=A+$\overline{A}$+B+$\overline{B}$+Z+$\overline{Z}$ | Electrical interface: F=Push-pull C=TTL (DC5V,26LS31) E=HTL(DC8-30V) L=TTL (DC5V，26C31) | Resolution PPR： 10000......19Bits （Optional） | Diameter of shaft: (through) Q6=Ø6mm Q8=Ø8mm | Special specifications: No indication=① |

2.2 Note
⑪. None indicated for the cable length of 1m, 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 Method

Electrical interface	Output circuit	Output wave form
Push-pull	Encoder — Shield cable — Power supply — A/B/Z — 0V — GND — L=Load — Transmission distance 50m Max	$T(360°)$, $a.b.c.d=\frac{T}{4}\pm\frac{T}{8}$ — 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
TTL (DC5V) HTL (DC8-30V)	Encoder — Shield cable — Power supply — 0V — A/B/Z — A/B/Z — GND — Transmission distance 200m Max	$T(360°)$, $a.b.c.d=\frac{T}{4}\pm\frac{T}{8}$ — 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

4. Electrical Parameters

Parameter / Item \ Output type			Push-pull	TTL	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	500KHz	800KHz
Output capacity	Output current	Input	≤30mA	≤±20mA	≤±50mA
		Output	≤10mA		
	Output voltage	"H"	≥[（Supply voltage) -2.5V]	≥2.5V	≥Vcc-3 VDC
		"L"	≤0.4V(30mA)	≤0.5V	≤ 1V VDC
	Load voltage		—		
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%		
Short-circuit protection			✔①		
Phase shift between A & B			90°±10° (frequency in low speed)		
			90°±20° (frequency in high speed)		
GND			Not connect to encoder		

① Short-circuit to another cable or GND permitted for max 30s.

5. Mechanical Characteristics

Diameter of shaft	Ø6mm；Ø8mm available
Shaft material	Stainless steel
Starting torque	5×10^{-3} N・m 以下
Operating torque	≤0.5 Ncm (at 20°C)
Permissible movement static	±0.2mm (radial)；±0.3mm (axial)
Permissible movement dynamic	±0.05mm (radial)；±0.1mm (axial)
Max.angular acceleration	≤500,000 rad/s²
Operating speed	5000min^{-1} [1]
Bearing life	Rated load 1.5×10^{9},100000 hours[2] at 2500RPM
Housing material	Aluminum alloy
Weight	Approx.70g

[1] Allow for self-heating of approx.3.0K per 1000rpm regarding the permissible operating temperature.
[2] At maximum speed and maximum temperature.

6. Environmental Parameters

Environmental temperature	Operating：－40～+85°C(repeated cable bending：－10°C)；Storage：－40～+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

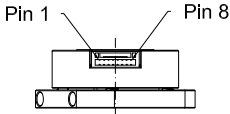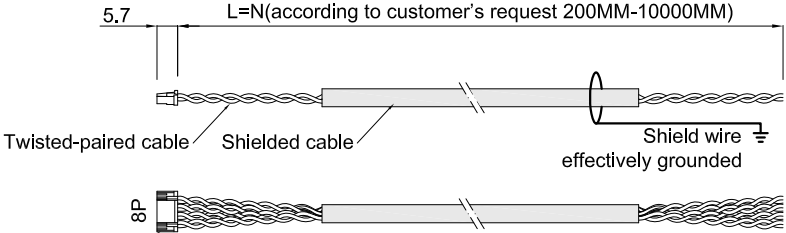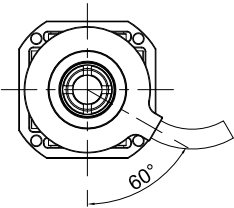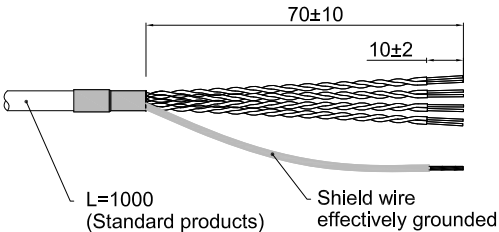### 7.1 Push-pull (Wiring table for socket connection and cable connection)

Socket pin definition	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 (Wiring table for socket connection and cable connection)

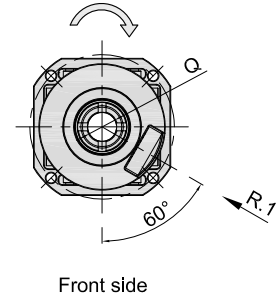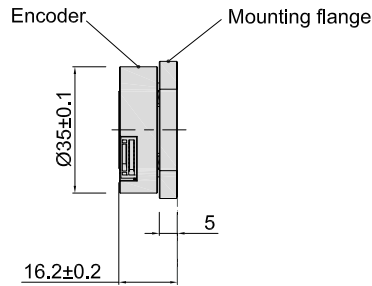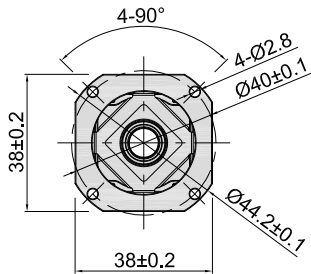| Socket pin definition	Incremental signal						Supply voltage	
	1	2	3	4	5	6	7	8
Wire color	White	White/BK	Green	Green/BK	Yellow	Yellow/BK	Red	Black
Function	A+	A-	B+	B-	Z+	Z-	Up	0V
Twisted-paired cable								

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

7.3 Socket definition and cable

Socket No: SM08B-GHS-TB	Plug+Shielding cable (order additionally)
Pin 1 Pin 8	5.7 L=N(according to customer's request 200MM-10000MM) Twisted-paired cable Shielded cable Shield wire effectively grounded 8P Plug No.GHR-08V-S
Cable connection	Connector size for cable connection
60°	70±10 10±2 L=1000 (Standard products) Shield wire effectively grounded

8. Basic dimensions

8.1 Dimensions

4-90°
4-Ø2.8
Ø40±0.1
38±0.2
38±0.2
Ø44.2±0.1

Encoder   Mounting flange
Ø35±0.1
16.2±0.2
5

Q
60°
R.1
Front side

22
Q
60°
R.2

Q (Hollow shaft)
$Ø6^{H7}(^{+0.015}_{0})$
$Ø8^{H7}(^{+0.015}_{0})$
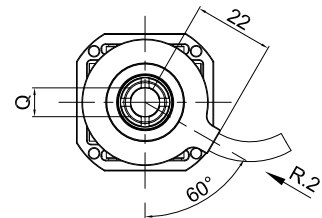
8.2 Specification for mounting shaft

Mounting screws	D(Motor shaft)
Inner hexagon bolt +flat washer Specification: M2.5*12 Material: stainless steel Quantity: 4	$Ø6_{g6}(^{-0.005}_{-0.014})$
	$Ø8_{g6}(^{-0.005}_{-0.014})$

Motor
⊥ 0.03 A
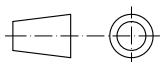A
16 Min
D
Axial runout 0.1 Max
Radial runout 0.03 Max

Ø40±0.1
4-M2.5(depth 8)
4-90°
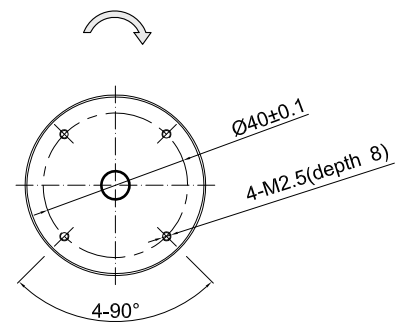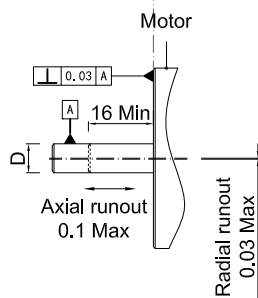
Unit: mm

= Shaft rotation direction of incremental signal output
R.1 = Radial socket(8P SM08B-GHS-TB)
R.2 = Radial cable (standard length 1000)

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. Installation Steps

First Step
   a.   Put the encoder(2) directly on
       the motor shaft and gently push
       it to the motor platform by hand.
   b.   Tighten four M2.5*12 bolts (3) at
       the same time, but do not tighten
       them too tightly.When the shaft
       sleeve and the motor shaft are
       tightened, fasten the four bolts.

Note: Please refer to page 6 for the fit tolerances
       of the encoder bushing and the motor shaft.

1	Motor
2	Encoder
3	4-M2.5*12

Motor shaft
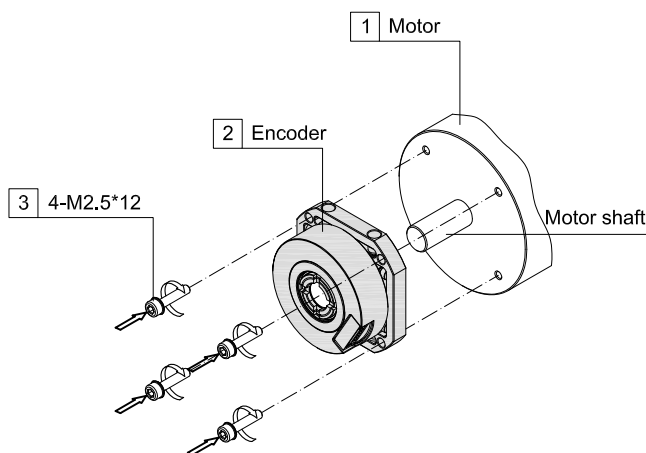
Second Step
Fix the spanner (A) on the slot of the encoder
shaft sleeve, tighten the lock nut with the
spanner (B). (the recommended tightening force
is 7-10 N.m), and then tighten the four M2.5*12
lock bolts (3).

Note:
      To avoid loosening of the lock nut during use,
      which can cause displacement and slippage
      between the encoder shaft and motor shaft,
      it is necessary to apply thread adhesive to
      the threaded surface of the lock nut during
      installation and then tighten it.

| 3 | 4-M2.5*12 |

Shaft sleeve

Lock Nut

Spanner (A)

Spanner (B)