

## 1. K48 Incremental Optical Encoder (Hollow shaft)

### 1.1 Introduction:

K48 is a general economic encoder, compact and miniaturized, commonly used in servo motors and industrial automations.

### 1.2 Feature:

- Encoder external diameter  $\varnothing 48\text{mm}$ , thickness 34mm, diameter of shaft up to  $\varnothing 12\text{mm}$ ;
- Adopt non-contact photoelectric principle;
- Reverse polarity protection;
- Short circuit protection;
- Multiple electrical interfaces available;
- Resolution per turn up to 10000PPR.

### 1.3 Application:

Servo motor, packaging machinery, CNC and other automation control fields.

### 1.4 Connection:

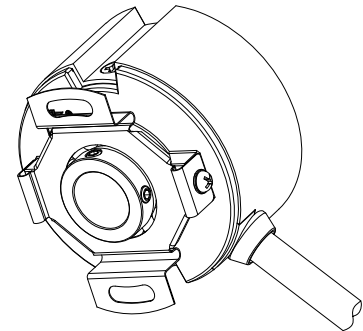
- Radial cable (length 0.5M)

### 1.5 Protection:

IP40

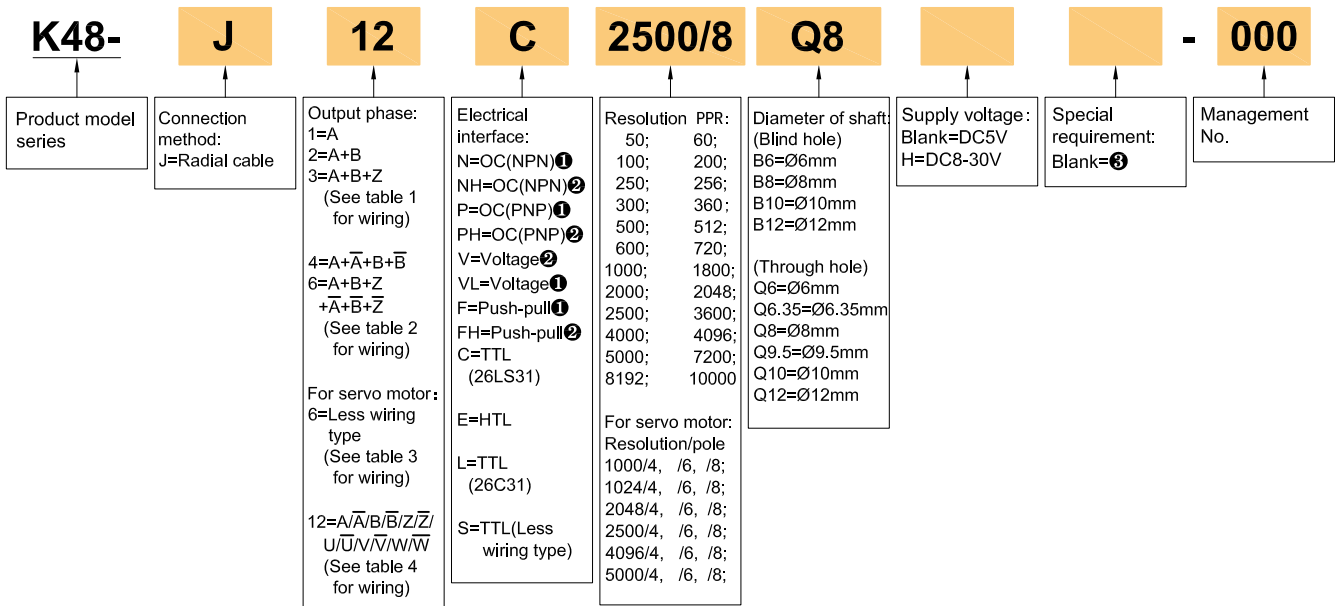
### 1.6 Weight:

about 140g



## 2. Model Selection Guide

### 2.1 Model composition(select parameters)



### 2.2 Note

- Z signal is low level active.
- Z signal is high level active.
- 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
<p>OC NPN open collector circuit</p>		<p>a.b.c.d=<math>\frac{1}{4} \pm 8\%</math></p> <p>Phase A is ahead of B by <math>\frac{1}{4} \pm 8\%</math>, viewing from shaft end, direction is clockwise rotation. (See dimensional drawings)</p> <p>CW direction →</p> <p>Z signal is low level active</p>
<p>OC PNP open collector circuit</p>		<p>Z signal is high level active</p>
<p>Push-pull</p>		<p>Z signal is high level active</p>
<p>Voltage</p>		<p>Z signal is high level active</p>
<p>TTL (DC5V)</p> <p>HTL (DC8-30V)</p>		<p>a.b.c.d=<math>\frac{1}{4} \pm 8\%</math></p> <p>Phase A is ahead of B by <math>\frac{1}{4} \pm 8\%</math>, viewing from shaft end, direction is clockwise rotation. (See dimensional drawings)</p> <p>CW direction →</p> <p>Z signal is high level active</p>

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3.2 For servo motor(with UVW)

Electrical interface	Output circuit	Output wave form																																																																	
<p>TTL (DC5V)</p>																																																																			
<p>TTL (DC5V) (Less wiring type)</p>	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>26LS31, 26C31 Transmission distance 200m Max</p> <p><b>Symbol signification</b></p> <ul style="list-style-type: none"> <li>★: indicate position of UVW channel</li> <li>☆: position to start counting ABZ channel</li> <li>▨: non-using zone</li> <li>HZ: high impedance</li> </ul> </div> <div style="width: 50%;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">No.</th> <th rowspan="2">Function Color</th> <th colspan="3">Mode</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>white</td> <td>HZ</td> <td>U</td> <td>A</td> </tr> <tr> <td>4</td> <td>white/black</td> <td>HZ</td> <td><math>\bar{U}</math></td> <td><math>\bar{A}</math></td> </tr> <tr> <td>5</td> <td>green</td> <td>HZ</td> <td>V</td> <td>B</td> </tr> <tr> <td>6</td> <td>green/black</td> <td>HZ</td> <td><math>\bar{V}</math></td> <td><math>\bar{B}</math></td> </tr> <tr> <td>7</td> <td>yellow</td> <td>HZ</td> <td>W</td> <td>Z</td> </tr> <tr> <td>8</td> <td>yellow/black</td> <td>HZ</td> <td><math>\bar{W}</math></td> <td><math>\bar{Z}</math></td> </tr> <tr> <td>1</td> <td>red</td> <td colspan="3">DC+5V</td> </tr> <tr> <td>2</td> <td>black</td> <td colspan="3">OV</td> </tr> <tr> <td>0</td> <td>shielding</td> <td colspan="3">GND</td> </tr> </tbody> </table> </div> </div>	No.	Function Color	Mode			1	2	3	3	white	HZ	U	A	4	white/black	HZ	$\bar{U}$	$\bar{A}$	5	green	HZ	V	B	6	green/black	HZ	$\bar{V}$	$\bar{B}$	7	yellow	HZ	W	Z	8	yellow/black	HZ	$\bar{W}$	$\bar{Z}$	1	red	DC+5V			2	black	OV			0	shielding	GND			<p>Reverse signal not shown</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th>pole</th> <th>g,h,j,k,m,n</th> <th>r</th> </tr> </thead> <tbody> <tr> <td>4</td> <td><math>30 \pm 1^\circ</math></td> <td><math>180^\circ</math></td> </tr> <tr> <td>6</td> <td><math>20 \pm 1^\circ</math></td> <td><math>120^\circ</math></td> </tr> <tr> <td>8</td> <td><math>15 \pm 1^\circ</math></td> <td><math>90^\circ</math></td> </tr> </tbody> </table> <p> <math>a.b.c.d = \frac{T}{4} \pm \frac{T}{8}</math>  <math>e = T \pm \frac{T}{2}</math>                      f: center of phase Z to rise point of phase U, that is <math>\pm 1^\circ</math> </p> <p>CCW direction <math>\rightarrow</math></p> <p>Viewed from shaft end when installing. (See dimensional drawings)</p>	pole	g,h,j,k,m,n	r	4	$30 \pm 1^\circ$	$180^\circ$	6	$20 \pm 1^\circ$	$120^\circ$	8	$15 \pm 1^\circ$	$90^\circ$
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<p><b>Timing Chart</b></p>																																																																			

## 4. Electrical Parameters

Parameter Item	Output type	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"	—	—	≥ $\left[ \begin{array}{l} \text{(Supply voltage)} \\ -2.5V \end{array} \right]$	≥2.5V	≥V <sub>cc</sub> -3 V <sub>bc</sub>
		"L"	≤0.4V	≤0.7V(less than 20mA)	≤0.4V(30mA)	≤0.5V	≤ 1V V <sub>bc</sub>
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		—			✓①		
Phase shift between A & B		90°±10° ( frequency in low speed)					
		90°±20° ( frequency in high speed)					
Delay motion time ②		—				510±220ms	—
GND		Not connect to encoder					

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

② Phase A,B,Z are back of phase U,V,W when power on.

## 5. Mechanical Specifications

Diameter of shaft	Ø6mm; Ø6.35mm; Ø8mm; Ø9.5mm; Ø10mm; Ø12mm(optional)
Starting torque	Less than $9.8 \times 10^{-3} \text{N}\cdot\text{m}$
Inertia moment	Less than $6.5 \times 10^{-6} \text{kg}\cdot\text{m}^2$
Shaft load	Radial 30N; Axial 20N
Slew speed	≤5000 rpm
Bearing Life	$1.5 \times 10^9$ revs at rated load(100000hrs at 2500RPM)
Material	Base: Die cast aluminum; Cover: PVC
Weight	about 140g

## 6. Environmental Parameters

Environmental temperature	Operating: $-20 \sim +85^\circ\text{C}$ (repeatable winding cable: $-10^\circ\text{C}$ ); Storage: $-20 \sim +90^\circ\text{C}$
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)	$490\text{m/s}^2$ 11ms three times for X,Y,Z direction individually
Protection	IP40

7. Wiring Table

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

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

7.2 TTL/HTL/Less wiring type (Table 2)

	Supply voltage		Incremental signal					
Wire color	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								

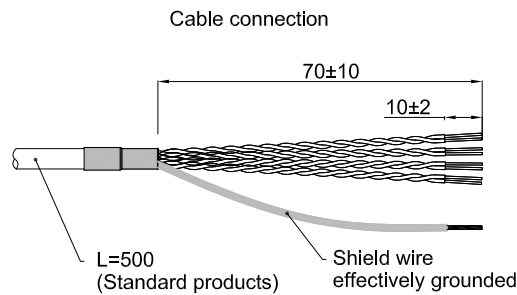
\* For the functional status in less wiring mode, refer to the functional mode wiring table for output circuit on page3.

7.3 For servo motor (Table 3)

	Supply voltage		Incremental signal											
Wire color	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.

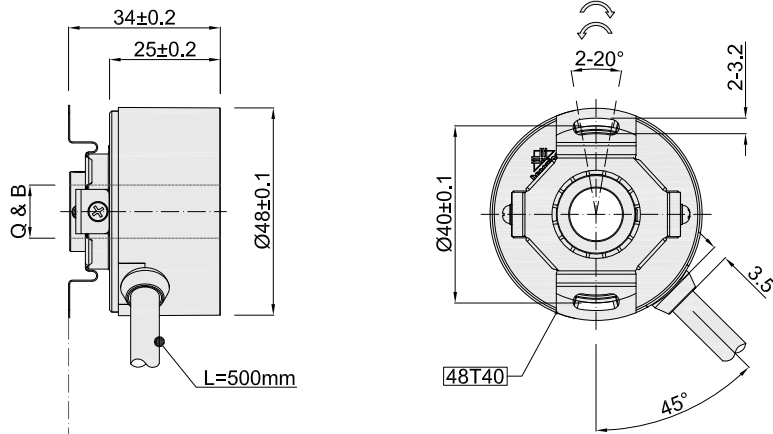
Shield wire is not connected to the internal circuit of encoder.



8. Basic Dimensions

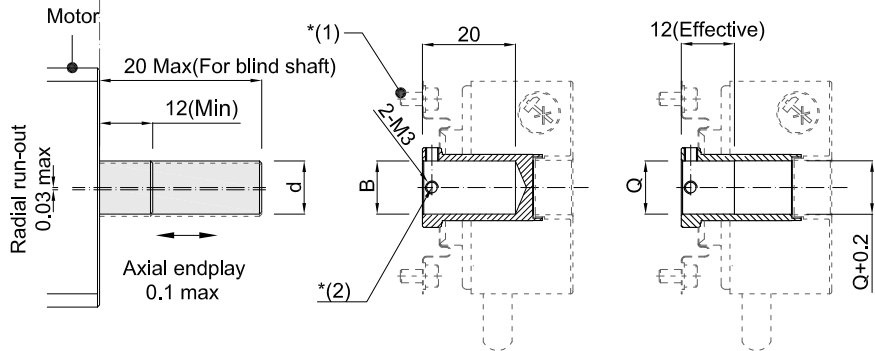
8.1 Dimensions

Q(Through shaft)	B(Blind shaft)
$\phi 6^{G7}_{+0.005}^{+0.020}$	$\phi 6^{G7}_{+0.005}^{+0.020}$
$\phi 6.35^{G7}_{+0.005}^{+0.020}$	-
$\phi 8^{G7}_{+0.005}^{+0.020}$	$\phi 8^{G7}_{+0.005}^{+0.020}$
$\phi 9.5^{G7}_{+0.005}^{+0.020}$	-
$\phi 10^{G7}_{+0.005}^{+0.020}$	$\phi 10^{G7}_{+0.005}^{+0.020}$
$\phi 12^{G7}_{+0.006}^{+0.024}$	$\phi 12^{G7}_{+0.006}^{+0.024}$

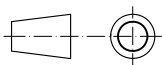


8.2 Mounting shaft requirements

d	Mounting screws
$\phi 6_{g6}^{(-0.005)}_{(-0.014)}$	Inner hexagon bolt +flat washer Specification: M3*6 Material: stainless steel Quantity: 2
$\phi 6.35_{g6}^{(-0.005)}_{(-0.014)}$	
$\phi 8_{g6}^{(-0.005)}_{(-0.014)}$	
$\phi 9.5_{g6}^{(-0.005)}_{(-0.014)}$	
$\phi 10_{g6}^{(-0.005)}_{(-0.014)}$	
$\phi 12_{g6}^{(-0.006)}_{(-0.017)}$	



Unit: mm



- = Direction of shaft rotation for incremental signal output
- = Direction of shaft rotation for servo motor-specific signal output

**48T40** = Install spring plate

Note:

- \*(1): Round-headed screw M3\*6 with flat gasket and spring ring is recommended to use
- \*(2): Apply thread glue to the surface of the two M3\*3 screws Tightening force is 0.6N.m

## 9. Caution

### 9.1 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.

### 9.2 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 use twisted pair wires for the signal and power wires of encoder.
- Please do not apply excessive force to the cable of encoder, or it will may be damaged.