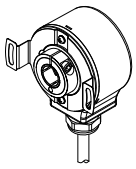
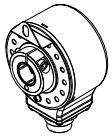
1. K52 Incremental Optical Encoder (Hollow shaft)

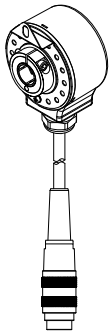
K52-T



K52-C



K52-TE



1.1 Introduction:

K52 is an encoder with multiple connection methods and electrical interfaces and resolutions, through or blind shaft, optional alarm and sensor functions with highest protection grade IP65, compact and sturdy structure, and is widely used in industrial automation fields such as servo motor, textiles, CNC, packaging, etc.,

1.2 Feature:

- Encoder external diameter Ø51mm、thickness 39mm、 diameter of shaft up to Ø15mm;
- The shaft is installed by clamping and fixed with a flexible spring plate;
- Adopt non-contact photoelectric principle;
- Alarm/sensing function optional;
- Reverse polarity protection;
- Short circuit protection;
- Multiple electrical interfaces available;
- Resolution per turn up to 48000PPR.

1.3 Application:

Servo motor, textile, CNC, packaging, industrial assembly line and other fields.

1.4 Connection:

- Radial cable (length 1M)
- Radial socket
- Radial socket with plug

1.5 Protection:

IP50 & IP65

1.6 Weight:

about 310g

2. Model Selection Guide

2.1 Model composition(select parameters)

K52-	T	6	C	1024	B15			-	000
Product model series	Connection method: T=Radial cable C=Radial socket TE=Radial cable with plug	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) A=HTL (Push-Pull compatible) (DC8-30V) (Alarm/Sense) B=TTL(DC5V) (Alarm/Sense)	Resolution PPR: 50; 100; 360; 400; 450; 500; 512; 600; 720; 750; 800; 900; 1000; 1024; 1500; 1800; 2000; 2048; 2400; 2500; 2880; 3000; 3600; 4000; 4096; 4800; 5000; 5760; 6000; 8000; 8192; 10000; 11520; 12000; 16000; 16384; 20000; 23040; 24000; 32000; 32768; 40000; 46080; 48000; 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 (B=Blind hole): B8=Ø8mm B10=Ø10mm B12=Ø12mm B14=Ø14mm B15=Ø15mm (Q=Through hole): Q8=Ø8mm Q10=Ø10mm Q12=Ø12mm Q14=Ø14mm Q15=Ø15mm	Supply voltage: Blank=DC5V H=DC8-30V	Special requirement: Blank=❸ D=IP65		Management No.

2. 2 Note

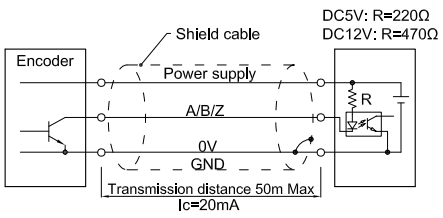
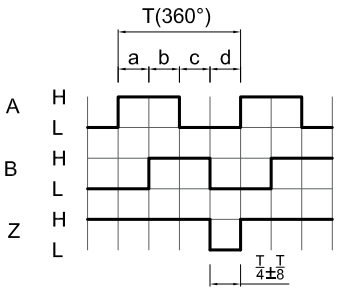
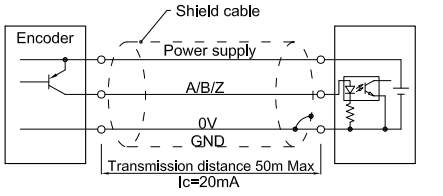
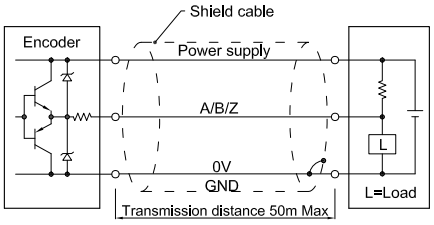
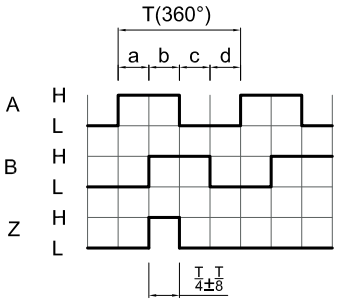
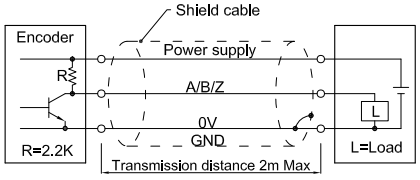
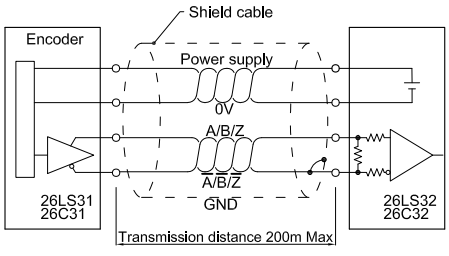
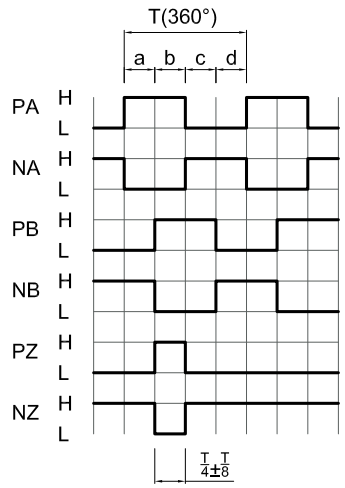
❶. Z signal is low level active.

❷. Z signal is high level active.

❸. None indicated for IP50 and 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 and page 4 of the provision of output circuit.

3. Output Method

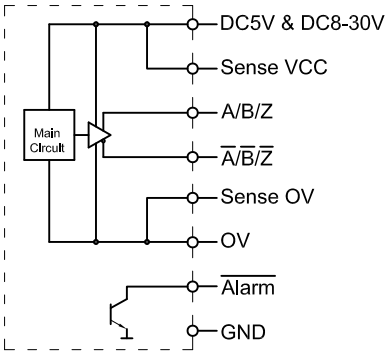
3.1 Incremental signal

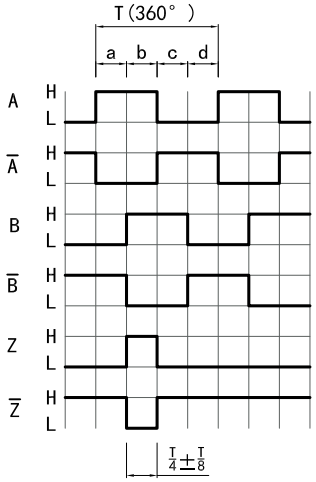
Electrical interface	Output circuit	Output wave form
OC NPN open collector circuit		 a.b.c.d=$\frac{T}{4}\pm\frac{T}{8}$ Phase A is ahead of B by $\frac{T}{4}\pm\frac{T}{8}$, viewing from shaft end, direction is clockwise rotation. (See dimensional drawings) CW direction Z signal is low level active
OC PNP open collector circuit		
Push-pull		 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
Voltage		
TTL (DC5V) HTL (DC8-30V)		 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

3.2 Incremental signal (continued)

Electrical interface	Output circuit

HTL(DC8-30V) (with Alarm/Sense)





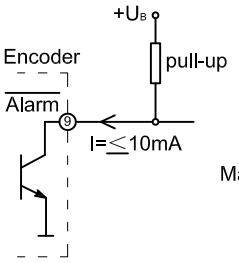
a. b. c. d=$\frac{T}{4}\pm\frac{T}{8}$

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 →

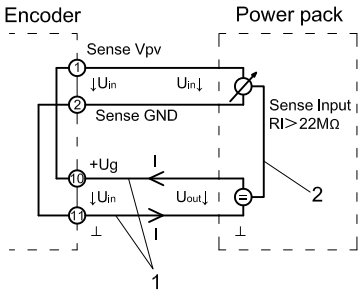
Push-Pull (DC8-30V) (with Alarm/Sense)

Output-Alarm



Output	NPN-Open collctor
Output load max	5mA/24V at UB=DC10-24V
Output level	Output active(failure condition)：L≤DC0.7V
	Output inactive: high impedance(if necessary: get H-level by an external pull-up resistor)
Malfunction indication time	≥20ms
Function	-Overtemperature +85°C
	-Overload (e.g.current at 500mA due to short circuit)
	-Voltage range ±10%(for DC5V only)
	-Voltage drop on the supply lines

TTL(DC5V) (with Alarm/Sense)

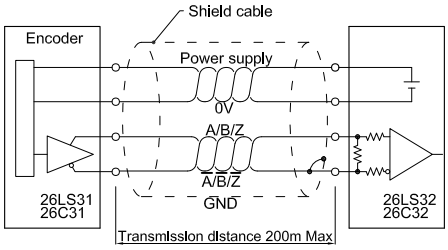
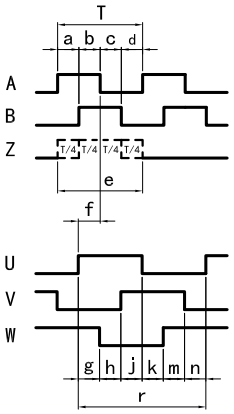
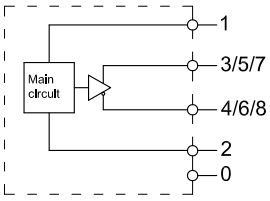


The sense wires enable measuring of the actual encoder supply voltage(compensates for voltage drops due to supply current and cable resistance).

Due to the voltage drop in the cables and the voltage supply, the encoder input voltage Uin is less than the power pack output voltage U_{out}.
The present input voltage Uin is now output to the Sense Vcc and Sense GND cables and returns as data to the power pack.
The input resisance R on the power pack should amount to at least 22MΩ,so that no voltage drop occurs on these cables.
In case of power packs with sense input,it is now possible to readjust the output voltage Uout automatically.

1. Voltage drop due to long cable lengths
2. Automatic readjustment of the output voltage (only for power packs with sense input)

3.3 For servo motor(with UVW）

Electrical interface	Output circuit	Output wave form
TTL (DC5V)		
TTL (DC5V) (Less wiring type)		Reverse signal not shown

26LS31, 26C31
Transmission distance 200m Max

No.	Function / Color	Mode 1	2	3
3	white	HZ	U	A
4	white/ black	HZ	$\overline{U}$	$\overline{A}$
5	green	HZ	V	B
6	green/ black	HZ	$\overline{V}$	$\overline{B}$
7	yellow	HZ	W	Z
8	yellow/ black	HZ	$\overline{W}$	$\overline{Z}$
1	red	DC+5V		
2	black	OV		
0	shielding	GND		

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

Symbol signification

★: indicate position of UVW channel

☆: position to start counting ABZ channel

▨: non-using zone

HZ: high impedance

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

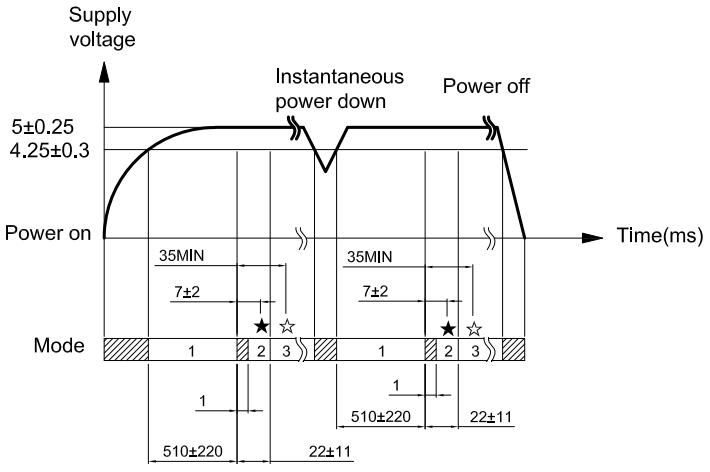
e=$T\pm\frac{T}{2}$

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



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 VDC
		"L"	≤0.4V	≤0.7V(less than 20mA)	≤0.4V(30mA)	≤0.5V		≤ 1V VDC
	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 Specification

Diameter of shaft	Ø8mm; Ø10mm; Ø12mm; Ø14mm; Ø15mm (optional)
Starting torque	Less than 9.8×10^{-3}N·m
Inertia moment	Less than 6.5×10^{-6} kg·m²
Shaft load	Radial 50N; Axial 30N
Slew speed	≤5000 rpm; IP65≤3000 rpm; (Through hole) IP65≤2000 rpm
Bearing Life	$1.5X10^{9}$ revs at rated load(100000hrs at 2500RPM)
Shell	Aluminium alloy
Weight	about 310g

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 1.52mm,5~55Hz,2h for X,Y,Z direction individually
Shock(Endurance)	490m/s² 11ms three times for X,Y,Z direction individually
Protection	IP50 & IP65

7. Wiring Table

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

	Supply voltage		Signal					
Socket pin definition (M16 8-pin male socket)	1	2	3	4	5	6	7	8
Wire color	Red	Black	White	Green	Yellow	-	-	-
Function	Up	0V	A	B	Z	-	-	-

7.2 TTL / HTL / (Push-pull compatible) (Table 2)

	Supply voltage		Signal											
Socket pin definition (M16 8-pin male socket)	1	2	3	4	5	6	7	8	-	-	-	-	-	-
Socket pin definition (M16 14-pin)	A	C	L	U	J	T	G	S	E	R	P	M	N	O
Wire color	Red	Black	White	White/BK	Green	Green/BK	Yellow	Yellow/BK	Blue	Pink	Grey	-	-	-
Function	Up	0V	A+	A-	B+	B-	Z+	Z-	$\overline{\text{Alarm}}$	Sense VCC	Sense 0V	-	-	-
Twisted-paired cable												-	-	-

7.3 Less wiring type (Table 3)

	Supply voltage		Signal					
Socket pin definition (M16 8-pin male socket)	1	2	3	4	5	6	7	8
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								

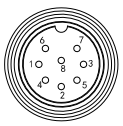
* For the functional status in less wiring mode, refer to the functional mode wiring table for output circuit on page4.

7.4 For servo motor （Table 4）

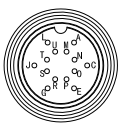
	Supply voltage		Signal											
Socket pin definition (M16 14-pin male socket)	A	C	L	U	J	T	G	S	E	M	P	N	R	O
Wire color	Red	Black	White	White/BK	Green	Green/BK	Yellow	Yellow/BK	Blue	Blue/BK	Grey	Grey/BK	Pink	Pink/BK
Function	Up	0V	A+	A-	B+	B-	Z+	Z-	U+	U-	V+	V-	W+	W-
Twisted-paired cable														

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

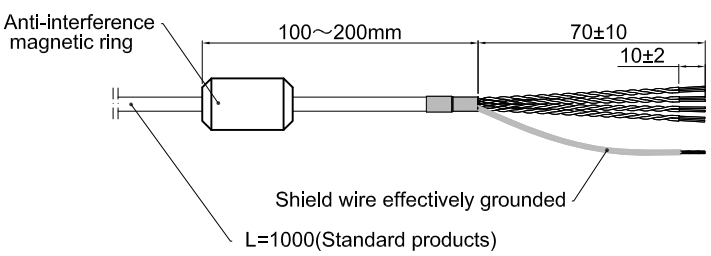
Socket pin definition (M16 8-pin male socket)



Socket pin definition (M16 14-pin male socket)

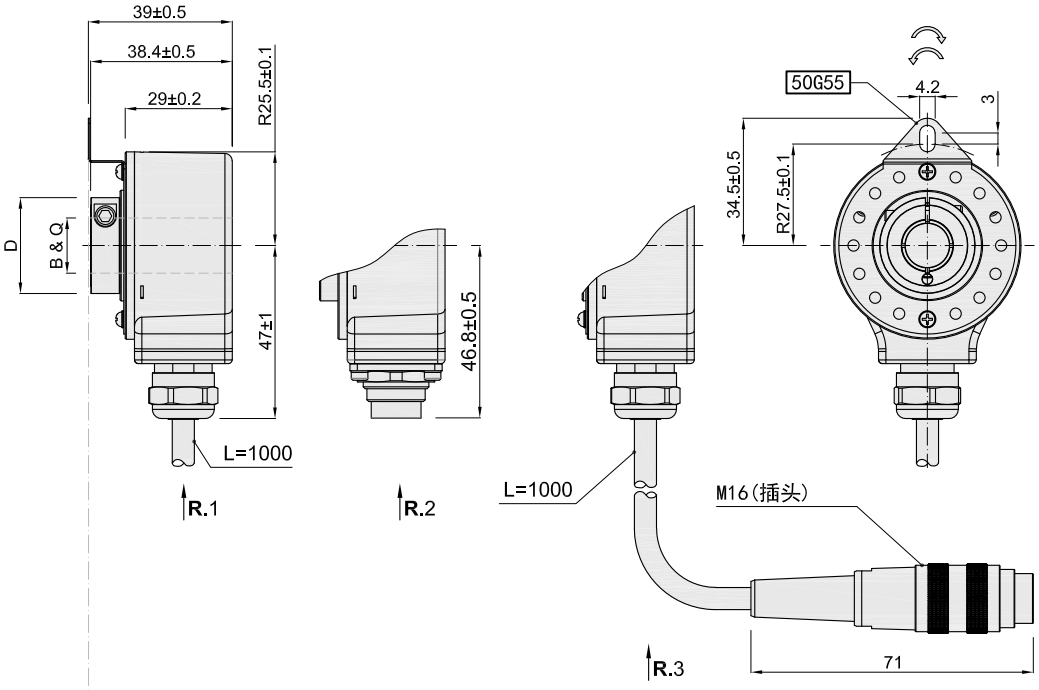


Cable

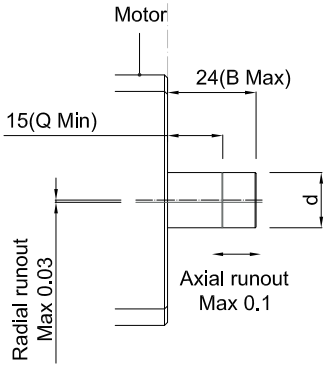


8. Basic Dimension

B & Q(Shaft)	D
Ø8$^{G7}_{(+0.005)}^{(+0.020)}$	Ø24
Ø10$^{G7}_{(+0.006)}^{(+0.024)}$	
Ø12$^{G7}_{(+0.006)}^{(+0.024)}$	Ø26
Ø14$^{G7}_{(+0.006)}^{(+0.024)}$	Ø28
Ø15$^{G7}_{(+0.006)}^{(+0.024)}$	



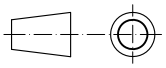
9. Mounting Shaft Requirements



d
Ø8$_{g4}$($^{-0.005}_{-0.009}$)
Ø10$_{g4}$($^{-0.006}_{-0.011}$)
Ø12$_{g4}$($^{-0.006}_{-0.011}$)
Ø14$_{g4}$($^{-0.006}_{-0.011}$)
Ø15$_{g4}$($^{-0.006}_{-0.011}$)

Mounting screws
Inner hexagon bolt +flat washer Specification: M4*8 Material: stainless steel Quantity: 1

Unit：mm



= Direction of shaft rotation for incremental signal output

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

50G55 = Spring plate
R.1 = Radial cable
R.2 = Radial socket
R.3 = Radial cable with plug

10. Caution

10. 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.

10. 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.

fang@shhxgd.com Tel: 86-21-54613487