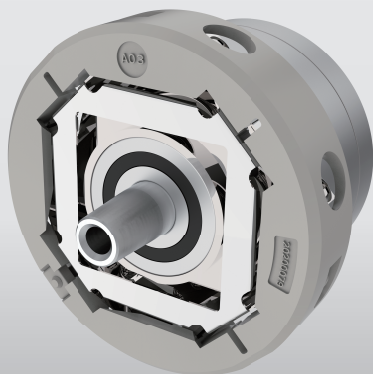




ES53CA Series Sin/Cos Photoelectric Encoder User Guide



Industrial
Automation



Intelligent
Elevator



New Energy
Vehicle



Industrial
Robot



Rail
Transit



Data code P500013534 A00

Preface

Introduction

The sin/cos photoelectric encoder outputs sine waves, and by detecting the waveform changes of both the sine and cosine waves, it is capable of obtaining subdivided voltage values. Further, by subdividing the encoder output signals as required, the resolution of the encoder can be enhanced. It incorporates a novel cone shaft and expander ring mounting structure, which facilitates easy installation and fixation, thereby further simplifying the configuration of the motor control system.

The product is suitable for a variety of applications including elevators, servos, machine tools, and industrial automation control systems, with a primary application in permanent magnet synchronous elevator control systems.

This guide covers product information, application circuits and wiring, installation guidance, and so on.

Revision History

Date	Version	Description
June 2024	A00	First release

Access to the Guide

This guide is not delivered with the product. You can obtain the PDF version in the following ways:

- Visit www.inovance.com, go to Support > Download, search by keyword, and then download the PDF file.
- Scan the QR code on the product with your smart phone.
- Scan the QR code below to install the application, where you can search for and download manuals.



Warranty Disclaimer

If your product becomes defective under normal use conditions, we will offer guaranteed repair services within the warranty period. You will be charged for any repair work after the warranty period expires.

Within the warranty period, maintenance fee will be charged for the following damage:

- Damage caused by operations not following the instructions in the user guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by unintended use of the product
- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

The maintenance fee is charged according to the latest Price List of Inovance. If otherwise agreed upon, the terms and conditions in the agreement shall prevail.

For details, see the Product Warranty Card.

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1 Product Information

1.1 Model Description

$\overline{\text{E}} \quad \overline{\text{S}} \quad \overline{53} \quad \overline{\text{C}} \quad \overline{\text{A}}$
① ② ③ ④ ⑤

① Encoder type E: Encoder	④ Shaft type C: External cone shaft
② Incremental S: Sin/Cos analog output (with CD signal)	⑤ Cone shaft size A: 9.25 mm B: 11.25 mm
③ Outer diameter 53: Enclosure diameter of 53 mm	

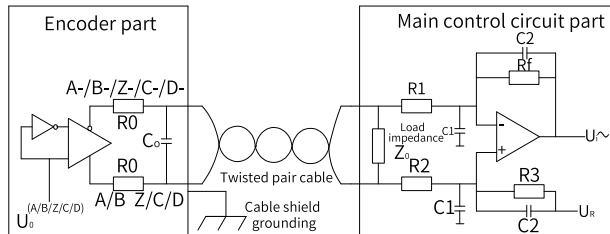
1.2 Technical Specifications

Item	Specifications
Supply voltage	5 V±5%
Current consumption	≤ 100 mA
Response frequency	≤ 50 kHz
Transmission distance	15 m
Insulation resistance	> 200 MΩ (500 VAC)
Output sin/cos differential signal amplitude (Vpp)	Vpp = 1 V±0.1 V
Output Z-code signal amplitude (Vz)	≥ 200 mV
DC offset voltage	Vd = 2.5 V±20 mV
Waveform distortion	≤ 2%
Resolution	2048 P/R
Output waveform	Sine wave analog signal
Output signal	A, A-, B, B-, Z, Z-, C, C-, D, D-
Signal phase relationship	Phase A advancing phase B by 90° and phase C advancing phase D by 90° for clockwise rotation of the shaft
Shaft hole diameter	Ø9.25 mm (conical shaft 1:10)
Connection method	Expander ring
Maximum speed	2000 rpm
Starting torque	5 x 10 ⁻³ N·m
Axial load	10 N
Radial load	10 N

Item	Specifications
Shock resistance	980 m/s ² , 6 ms, 3 times each in directions X, Y, and Z
Vibration resistance	50 m/s ² , 40 Hz to 200 Hz, 2 hours in directions X, Y, and Z
Moment of inertia	4 x 10 N · m/s ²
IP rating	IP40 (IP50 or IP54 options available)
Ambient temperature	–20°C to +100°C
Storage temperature	–40°C to +100°C
Humidity	95% RH (non-condensing)

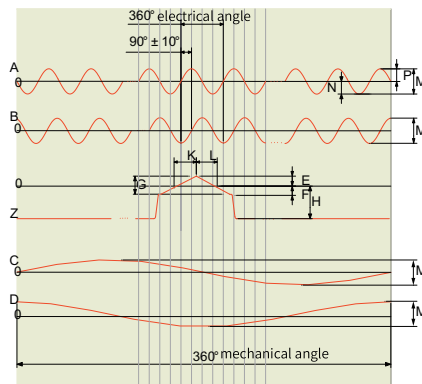
2 Application Circuits and Wiring

Application Circuits



- Recommended ABZ signal load resistance Z_0 : 120 Ω
- Recommended CD signal load resistance Z_0 : 1 k Ω
- $R_0 \leq 50 \Omega$

Waveform (A, B, Z, C, and D signals are differentially measured by the oscilloscope)



Sinusoidal signal	Z signal
• Signal amplitude M: 0.9 V to 1.1 V, 1 Vpp • Symmetric tolerance: $P-N /2: \leq 0.065 \text{ V}$ • Phase difference between A and B/C and D: $90^\circ \pm 10^\circ$	• Effective component G: 0.2 V to 0.85 V • Static level: $\leq 1.7 \text{ V}$ • Switching threshold: 0.04 V to 0.68 V • Zero-point width K, L: $180^\circ \pm 90^\circ$

Wiring Terminal Requirements

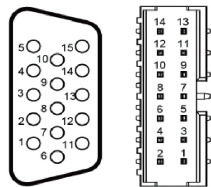


Figure 2-1 Terminal pin layout

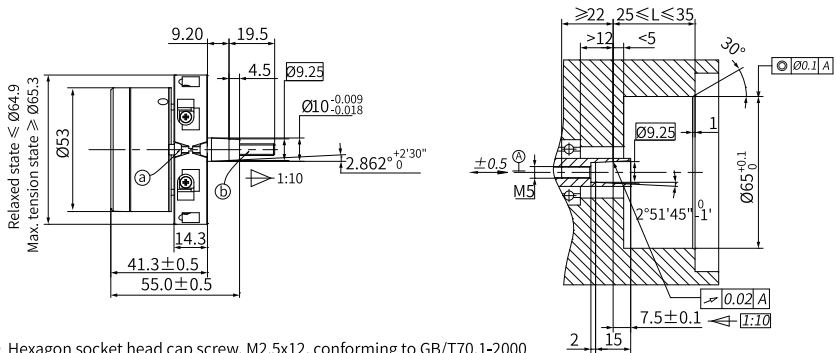
Terminal name	Definition of pins						
2 x 7 socket	3	12	9	6	7	8	1
DB15 socket	5	6	8	1	3	4	11
Function	A	A-	B	B-	Z	Z-	C
2 x 7 socket	14	11	4	2/13	5/10	Housing	-
DB15 socket	10	12	13	9	7	Housing	-
Function	C-	D	D-	+5V	0V	Shield	-

Note

You need to purchase cables for the DB15 socket separately. The standard length of the cable is 7.5 m. Check that the sequence of pins of different PG cards is consistent, and connect cables by referring to the table above.

3 Installation Guide

3.1 Installation Dimensions

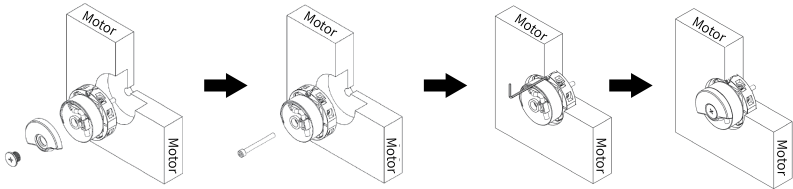


- ① Hexagon socket head cap screw, M2.5x12, conforming to GB/T70.1-2000 standard, made of stainless steel, recommended tightening torque from 0.6 N·m to 0.8 N·m
- ② Hexagon socket head cap screw, M5x50, conforming to GB/T70.1-2000 standard, 8.8 grade strength level, recommended tightening torque from 5 N·m to 5.5 N·m

Figure 3-1 Installation dimensions of the encoder and motor

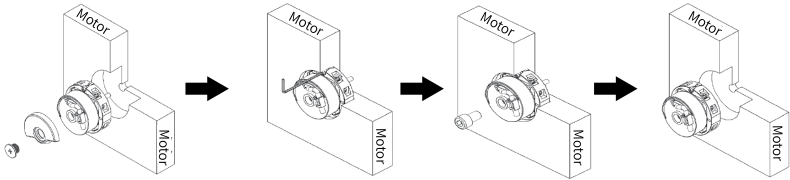
3.2 Installation and Removal Description

Installation Diagram



1. Remove the front cover of the encoder to expose the hollow shaft.
2. Push the encoder into the positioning hole of the motor until the cone shaft fits closely with the tapered hole. Pass the M5x50 hexagon screw into the center hole of the cone shaft and fasten it with the tapered hole of the motor. The required tightening torque is 5 N·m to 5.5 N·m. Make sure the cone shaft is concentric with the tapered hole.
3. Tighten the fixing screw of the expander ring clockwise to ensure the ring is secured. The required tightening torque is 0.6 N·m to 0.8 N·m.
4. Install the front cover of the encoder. The installation is complete.

Removal Procedure



1. Remove the front cover of the encoder to expose the hollow shaft.
2. Undo the fixing screw counterclockwise to allow the expander ring to return to a relaxed state.
3. Unscrew the M5x50 screw counterclockwise for two to three turns. Then, screw the M10x20 screw clockwise into the center hole of the cone shaft to jack up the M5 screw until the cone shaft leaves the hole.
4. Remove the M10 screw and the M5x50 screw in sequence, then take off the encoder.

4 Cable Shielding

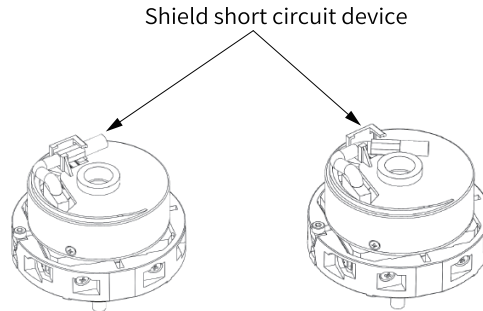


Figure 4-1 Shielding cable connection

1. Connect the shielded cable to the ground through the housing of the encoder.
2. Before removing the cable shield from the traction machine, remove the housing gland, and isolate the grounding shield ring of the cable from the housing of the encoder.

Note

- If the stall occurs, the encoder may be installed improperly. Remove the encoder and install it again.
 - Connect cables by strictly following the wiring diagram to avoid encoder failures.
 - When pushing the encoder into the tapered hole of the motor, ensure that the cone shaft and tapered hole are concentric.
 - The encoder is a precision optical component. Therefore, handle it with extreme care during installation and removal.
 - To avoid interference, do not run the encoder cables in the same duct with the power cable. The shielded cable must be well grounded. For poor grounding at the site, disconnect the encoder shield short circuit device.
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Shenzhen Inovance Technology Co., Ltd.

www.inovance.com

Suzhou Inovance Technology Co., Ltd.

www.inovance.com

Add.: Inovance Headquarters Tower, High-tech Industrial Park,
Guanlan Street, Longhua New District,
Shenzhen 518000, P.R. China

Tel: (0755) 2979 9595

Fax: (0755) 2961 9897

Add.: No.52, Tian'e Dang Road, Wuzhong District,
Suzhou 215104, P.R. China

Tel: (0512) 6637 6666

Fax: (0512) 6285 6720