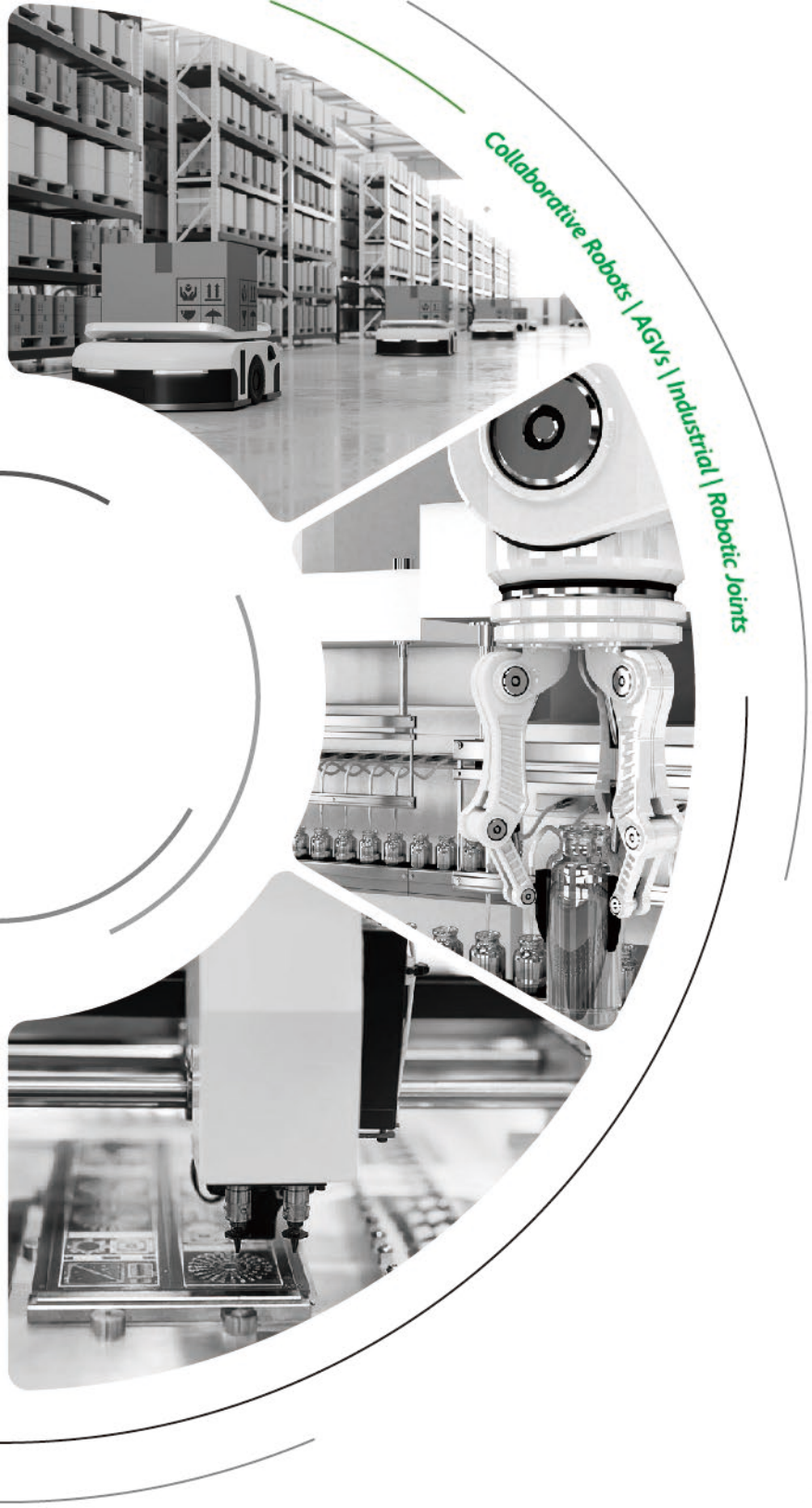
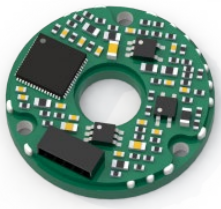


SENSNA



IAP-20 PRODUCT GUIDE

High Accuracy | Hollow Shaft | Low Profile | Non-contact

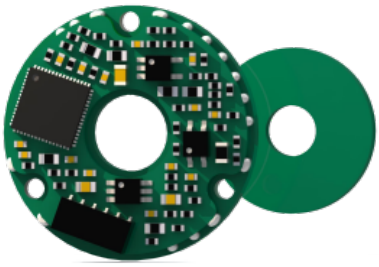
1、Introduction

IAP-20 adopts an inductance technique to measure precise angle. The output signal shows the true absolute angular position of the rotor relative to the stator without the need of any motion at power up. Non-contact makes it easy to achieve high precision, high reliability angle measurement in harsh environments. The hollow shaft and low profile allow easy integration with through-shafts, slip-rings, direct drive motors, optical-fibers, pipes or cables. Installation does not require precisely machined mounting components or couplings.

The encoders are equipped with BiSS, Asynchronous serial (UART), SSI communication interfaces and offer a range of binary resolutions up to 20 bits per revolution. Providing customized extension options when there are more special requirements to meet.

SENSNA absolute rotary encoder can be widely used in intelligent robots, medical equipment, mechanical automation, aerospace and other fields, providing innovative product combinations and solutions for customers in various industries such as environmental detection, emergency safety, life sciences, semiconductors, chemicals, energy, etc.

- √ **Non-contact**
- √ **Hollow shaft**
- √ **Low profile**
- √ **High precision**
- √ **True absolute system**
- √ **Low power consumption**
- √ **No maintenance**
- √ **No bearings**
- √ **Easy to install**
- √ **Tolerance to EMI / RFI**
- √ **Shock and Vibration Tolerance**
- √ **customized extension options**



2、Technical Specifications

General

Resolution	15-17 bit
Maximum static error	±0.05°
Repetitive error	±2 LSB
Maximum operational speed	4000 rpm
Measurement range	Single turn
Rotation direction	Adjustable CW/CCW

Mechanical

Outer\Inner\Height	20\4\6.5 mm
Allowable mounting eccentricity	±0.1 mm
Allowable axial mounting tolerance	0.6±0.1 mm
Rotor inertia	0.01 kg·mm^2
Weight (stator / rotor)	4 g
Material (stator / rotor)	FR-4

Electrical

Supply voltage	5V
Current consumption	< 80 mA
Serial output	6-pin connector、6-core cable
Communication	SSi、BiSS-C、RS-422 (UART)

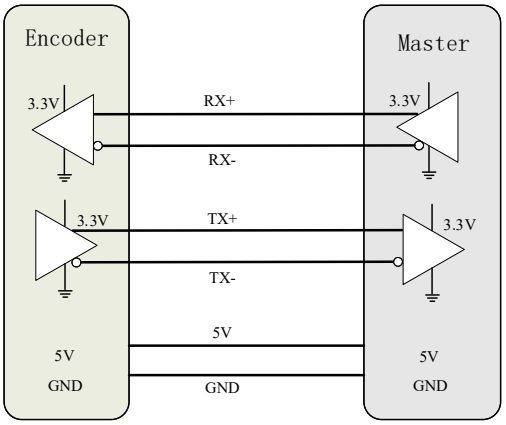
Environmental

EMC	IEC 61000-6-2、IEC 61000-6-4
Operating temperature	-20℃ - +60℃
Storage temperature	-50℃ - +100℃
Relative humidity	0 - 99%
Shock endurance / functional	100 g / 11 ms
Vibration functional	20 g (10 - 2000 Hz)
Protection	IP 40

3、Electrical Connection

3.1 Hardware Interface

IAP-20 encoder consists of a stator and a rotor, the stator integrates an angle calculation circuit and an encoding output circuit. The encoder uses a multi-core connector for output (connector interface as shown in the figure below), with the output connector located on the outer edge of the stator. The angle output uses two connectors, and can choose to output interface protocols such as SSi, BiSS-C, RS-422(UART).



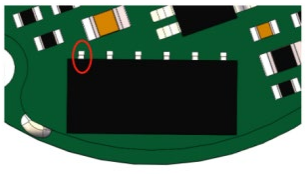
SSI/BiSS/RS-422 connections

No.	Description		Colour
1	5V	5V	Red
2	GND	GND	Black
3	CLK+	RX+	Grey
4	CLK-	RX-	Blue
5	DADT-	TX-	Yellow
6	DADT+	TX+	Green

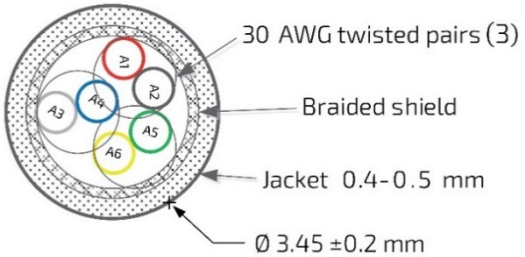
SSi/BiSS output signal parameters

Signal delay	< 50 us
Output code	Binary
Maximum data request rate	30 kHz
Clock/ Serial output	Differential RS-422

Cable: 30 AWG twisted 3 pairs
(30 AWG 25/0.05 tinned copper, Insulation: ETFE Ø 0.12-0.15 to Ø 0.6 ± 0.05 OD)
Temperature rating: -50° to +150° C
Braided shield: Thinned copper braided 95% min. coverage
Jacket: 0.4-0.5 silicon rubber Ø3.45 ±0.2 OD

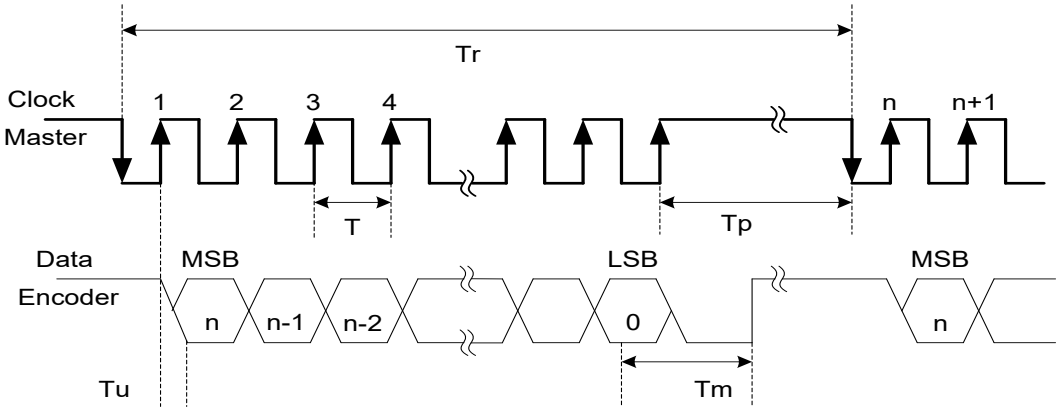


6-pin thin plug: HDGC0601WR-S-6P
Cable diameter: Ø 3.45 ± 0.2mm
Corresponding pairing plug: X0600HI-6P



3.2 SSi Interface

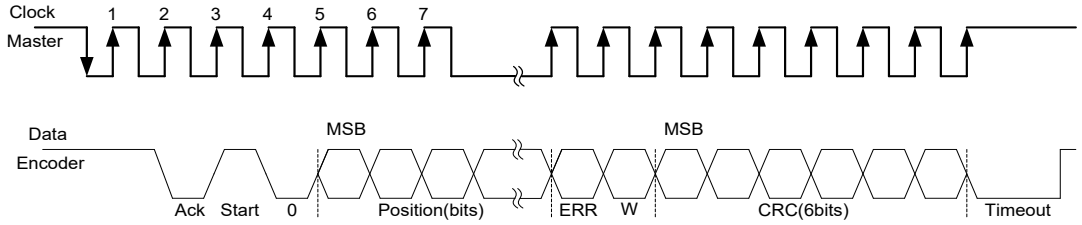
SSi (Synchronous Serial Interface) is based on the RS-422 hardware standard and is a commonly used interface for angle encoders. The master sends clock and angle encoder synchronized output data. The default clock is high level. The first low level starts data transmission, and the angle encoder transmits the angle data to the master in sequence according to the clock. The timing diagram is as follows:



n	Position resolution	12 - 21
f（T）	Clock frequency (Clock period)	0.5 - 5.0 MHz
Tu	Bit update time	50 ns
Tp	Pause time	＞ 25 us
Tm	Monoflop time	＞ 25 us
Tr	Time between 2 adjacent requests	Tr ＞ n*T +25 us
fr=1/Tr	Data request frequency	

3.3 BiSS-C Interface

The BiSS-C communication protocol is a full duplex, bidirectional, high-speed, synchronous serial communication protocol. This interface is also based on the RS-422 hardware standard and is compatible with the SSi interface. It is widely used in high-precision position control absolute encoders. The product uses BiSS-C as a point-to-point configured unidirectional interface, which can serve as one or more slaves connecting to the master, meeting the requirements of BiSS-C unidirectional interface. The timing diagram is as follows:



Bit/n		Description	Default Length	Default Length
28	Ack	Period during which the encoder calculates the absolute position, one clock cycle	0	1 bit
27	Start	Encoder signal for "start" data transmit	1	1 bit
26	"0"	"Start" bit follower	0	1 bit
8-25	Position	Absolute Position encoder data		Per resolution
7	Error	BIT (Built In Test option)	1	1 bit
6	Warn	Warning (non active)	1	1 bit
0-5	CRC	*The CRC polynomial		6 bit
--	Timeout	Elapse between the sequential "start" request cycle's		> 26 us

*The CRC polynomial for position, error and warning data is: $x^6 + x^1 + x^0$. It is transmitted MSB first and inverted. The start bit and "0" bit are omitted from the CRC calculation.

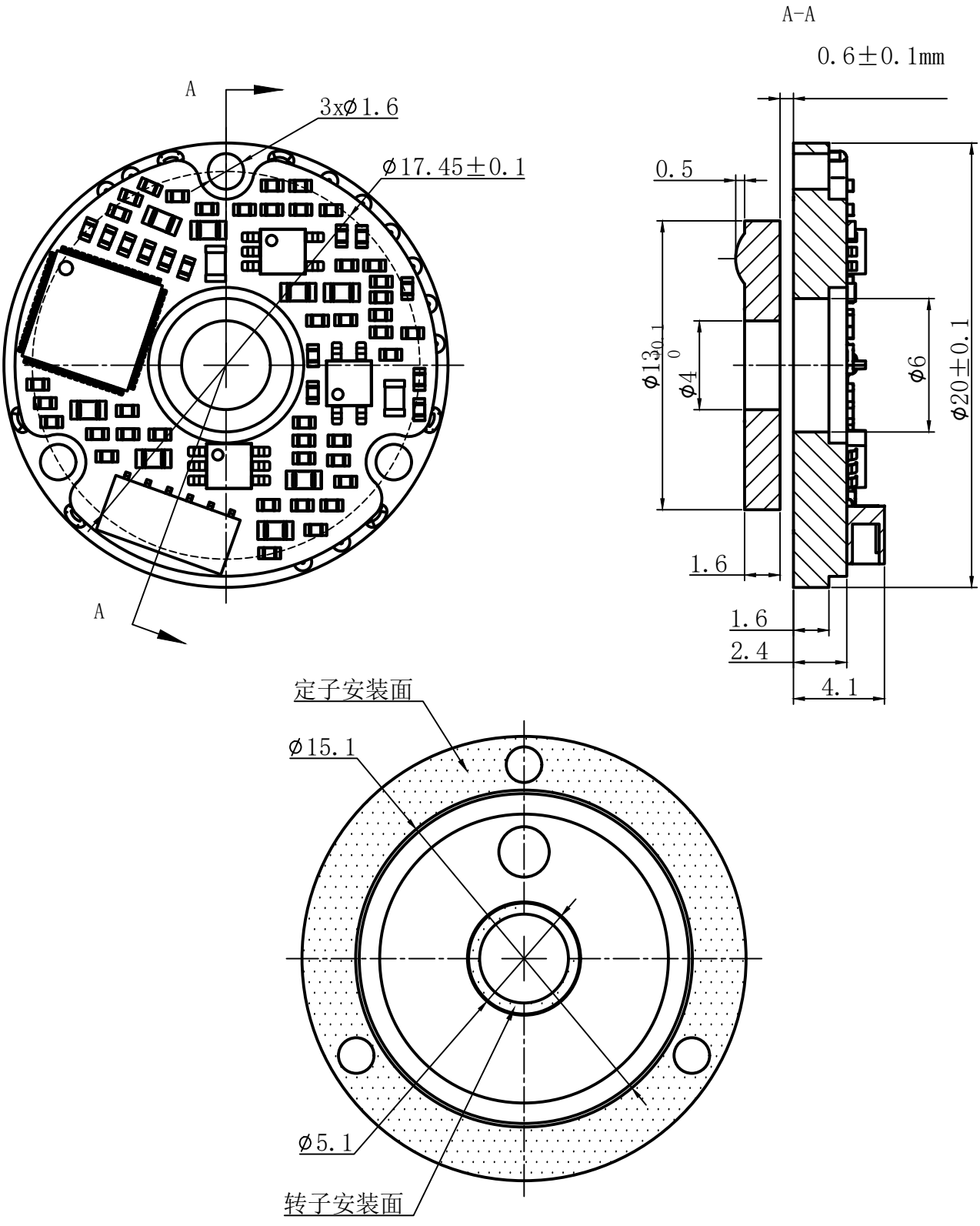
3.4 RS-422 UART Interface

Asynchronous serial communication interface over RS422 (UART), by default, the master does not need to send requests, and the encoder automatically outputs data to the master. The update rate of the encoder data is 2000Hz, the baud rate is 460800bps, and the data format is 1 start bit, 8 data bits, 1 even check bit, and 1 stop bit. Each frame of data contains 10 bytes, and the format is shown in the table below.

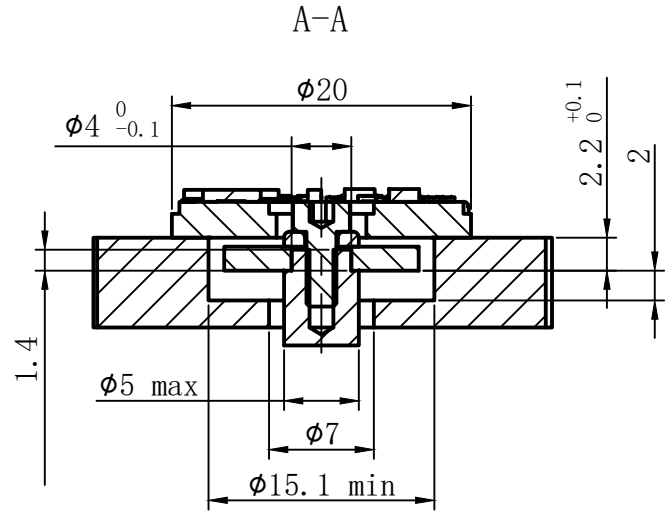
	BIT	Description	Note
Header	1	5E	Defined Header
	2	AD	
Protocol Flag Bit	3	01	Single byte
Position	4	Most Significant 8 Bits	LSB effective, MSB padding 0
	5	Middle Significant 8 Bits	
	6	Least Significant 8 Bits	
Frame Count	7	Most Significant 8 Bits	0-65535 Accumulate
	8	Least Significant 8 Bits	
Check	9	Most Significant 8 Bits	Accumulate the 3th4th, 5th6th, and 7th8th bytes, taking the lower 16 bits
	10	Least Significant 8 Bits	

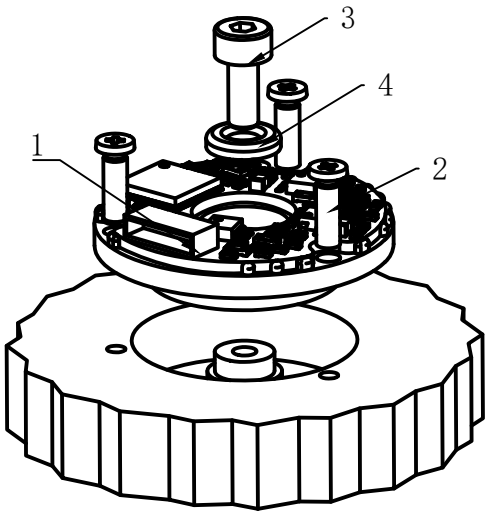
4、Mechanical Mounting

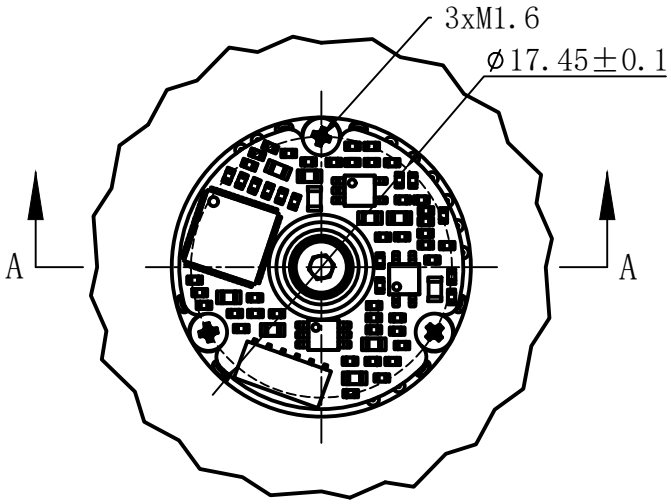
4.1 Dimensions



4.2 Installation Diagram







Linear tolerances	
0-50	±0.05mm
50～	±0.1mm

NO.		QTY	Description
1	IAP-20	1	Product
2	M1.6x5 screw	3	Install accessories
3	M2x5 screw	1	
4	IAP20 shaft spring	1	

5、Sofware Tool

The encoder of the SSi/BiSS-C/RS-422 interface can use the Encoder Test Calibration software for position data readout and installation calibration. The Encoder Test Calibration software owns functions such as position data readout, installation verification, calibration, and user zero position setting.

6、Ordering Code

IAP – 0 – 20 – 16 – SSI1 – 03 – 05

Product Line

Product outer diameter

Resolution	
15	32,768
16	65,536
17	131,072

Communication interface	
ASI1	RS-422
SSI1	SSi
BIS1	BiSS-C

Shape and connector	
01	Side flying leads 250mm
03	Side connector

Supply Voltage	
05	5V

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February 2025