

# Magnetostriictive Displacement Sensor

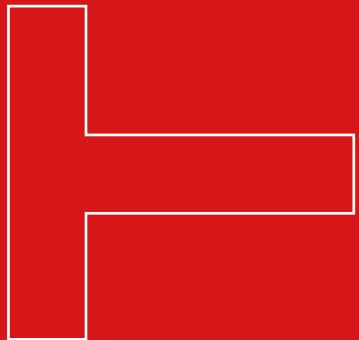
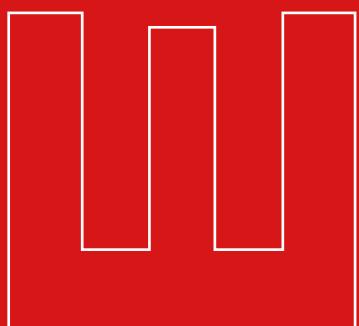
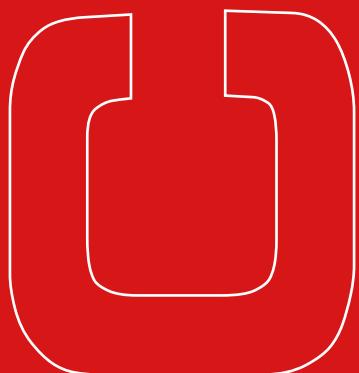
## E Series Product manual

杭州浙达精益机电技术股份有限公司

Hangzhou Zheda Jingyi Electromechanical Technology Corporation Limited

浙达精益

ZHEDA JINGYI



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# **TEC CostEffective Sensor**



## **E Series**

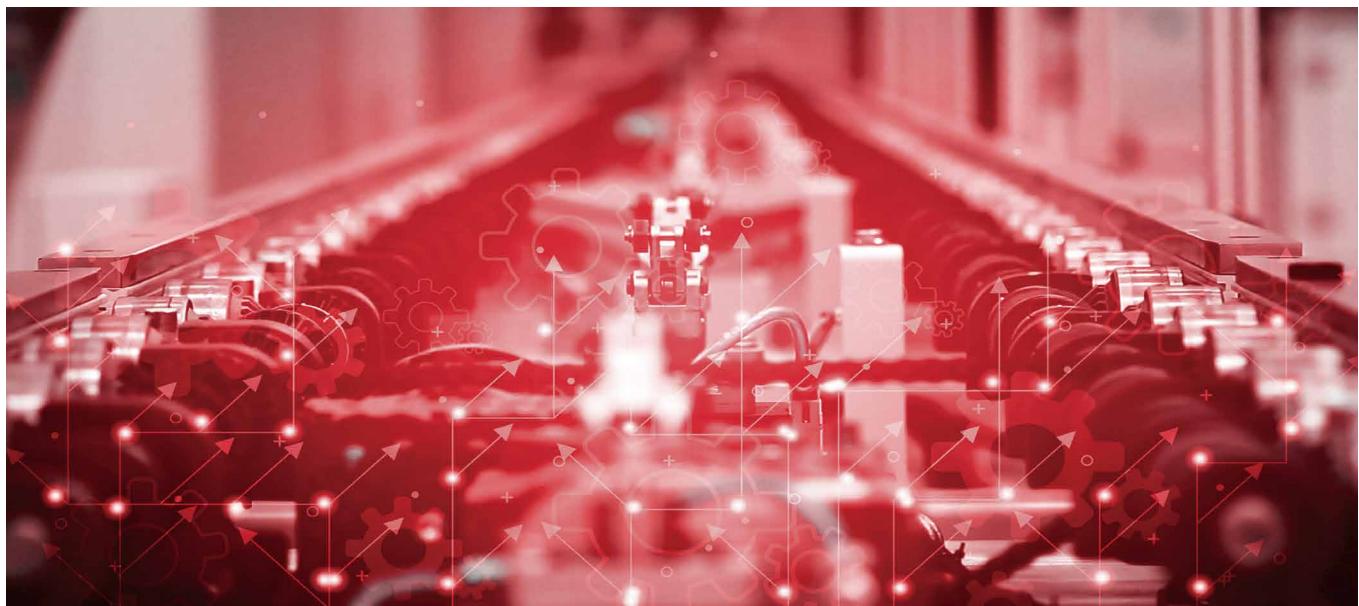


# TEC CostEffective Sensor-E Series

Sensor classification	Structure and application	Interface	Parameter
	Stell rod structure Most of them are used in hydraulic cylinder and cylinder	Analog SSI Modbus	Maximum stroke:5500mm Maximum resolution:5µm IP67 protection
EJ displacement sensor			
	Stell rod structure Most of them are used in hydraulic cylinder and liquid level measuring	Analog Modbus	Maximum stroke:3500mm Maximum resolution:10µm IP67 protection
ES displacement sensor			
	Aluminum profile structure Can be installed in narrow spaces on machine surfaces	Analog	Maximum stroke:2500mm Maximum resolution:10µm IP65 protection
EP displacement sensor			
	Aluminum profile structure Can be installed on the machine surface with guide mechanism	Analog	Maximum stroke:2500mm Maximum resolution:5µm IP65 protection
HP displacement sensor			
	Aluminum profile structure It can be installed in a narrow space on the surface of the machine	Analog	Maximum stroke:3000mm Maximum resolution:10µm IP65 protection
ED displacement sensor			
	Anticorrosive outer tube structure Most of them are used for measuring corrosion liquid	Analog	Maximum stroke:2500mm Maximum resolution:10µm IP67 protection
ESC structure			

# Company Profile

We are a science and technology innovative enterprise born from Zhejiang University, a national high-tech enterprise, the fourth batch of "small giant" enterprises of the Ministry of Industry and Information Technology, and a special enterprise of Zhejiang Province. Our company has more than 200 employees, including 4 overseas talents, 4 professors, and 2 associate professors. There are also 12 doctors, and more than 86% of employees with a bachelor degree or above.

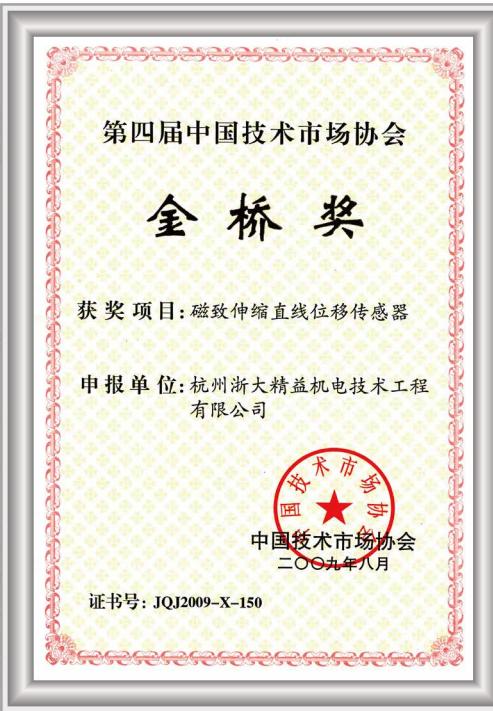
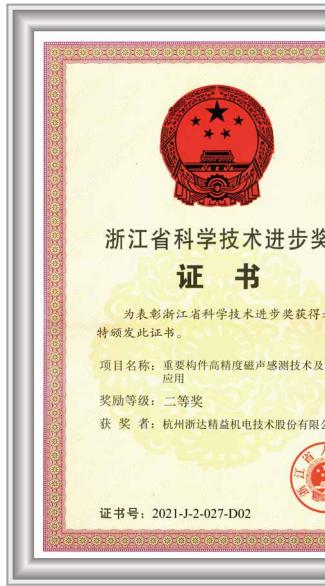


We are committed to intelligent manufacturing, high-end equipment, intelligent sensing, intelligent detection, military industry and other fields. Most of our company's products are independently researched and developed, and the market share ranks in the forefront of the domestic industry. A variety of equipment is the first set in China, which breaks the long-term monopoly of foreign companies.

We are a national high-tech enterprise integrating scientific research, product development, engineering design, and technical consulting. Besides, the company has obtained 45 invention patents, 29 utility model patents, 10 software copyrights, and 4 registered trademarks.

Taking "Created in China, Create China" as our ideal, we are committed to building a century-old national brand. Our development goal is to become a well-known leading technology and strength-based enterprise in China's high-end equipment and intelligent inspection industries.

# Honorary Qualification





# TEC Magnetostriiction Development

The magnetostrictive displacement sensor project is included in the national torch plan project

IN 2008

National Natural Science Foundation of China (Youth Fund), "Basic research on the application of GMM self-sensing components integrating sensors and actuators"

IN 2002

The international exchange and cooperation conference on ultrasonic guided wave technology was held in Hangzhou. Our company officially launched the first set of magnetostrictive ultrasonic guided wave detectors in China.

IN 2011

IN 1997

The National Natural Science Foundation of China, the first domestic and foreign giant magnetostrictive actuator for non-circular shaped pin hole processing

IN 2009

The magnetostrictive displacement sensor project won the Golden Bridge Award issued by the National Technology Association;  
National Natural Science Foundation of China (Youth Fund), "Research on the Basic Theory of New Technology of Giant Magnetostriuctive and Magnetorheological Compound Damping"

IN 2012

National Natural Science Foundation of China, "On-line detection method for corrosion and broken wires of arch bridge hangers based on the principle of magnetostrictive guided wave dynamic focusing";  
National Natural Science Foundation of China, "Research on the Theory and Practice of Real-time Quantitative Detection of Defects in High-temperature Metal Pipelines Based on Magnetostrictive Ultrasonic Guided Waves";  
Major Science and Technology Project in Zhejiang Province, "Magnetostrictive Ultrasonic Guided Wave Pipeline In-Service Non-destructive Testing Technology and Instruments"

IN 2006

China Postdoctoral Science First-Class Funding Project

National Natural Science Foundation of China, "Research on Theory and Practice of Real-time Quantitative Detection of Defects in High-temperature Metal Pipelines Based on Magnetostrictive Guided Waves"

IN 2013

National Key R&D Program, "On-line Monitoring and Inspection of Pressure Equipment and Dynamic Risk Management Technology Research"; Zhejiang Province Key R&D Program, "Usonic Guided Wave-based Track Turnout Structural Health Monitoring System"

IN 2017

Key R&D Program of Zhejiang Province, "Research and Demonstration Application of Safety Early Warning Technology for Nearshore High Tower Equipment"

IN 2016

National Major Scientific Instrument and Equipment Development Project, "R&D of Rail Broken Monitoring Equipment and Testing Network in Key Sections"

IN 2018

National Natural Science Foundation of China, "Research on the Theory and Practice of On-line Monitoring of Turnout Point Rail Defects Based on Phased Array Guided Wave Sound Field Control"; National Key R&D Project, "Research on Magnetoacoustic Compound Monitoring and Detection Technology for Typical Pressure-bearing Special Equipment Damage"

IN 2019

The fourth batch of "Small Giant" enterprises of the Ministry of Industry and Information Technology of the People's Republic of China, and the specialized and special new enterprises of Zhejiang Province

IN 2022

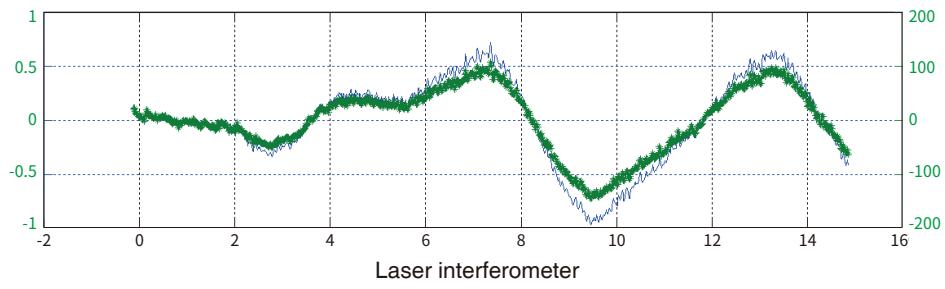


IN 2021

Science and Technology Progress Award of Zhejiang Province, "High-precision magnetoacoustic sensing technology and industrialization application of important components".

## Quality Assurance

After years of experience and precipitation, TEC magnetostrictive displacement sensor has built a modern, automatic and standardized production line, which ensures the reliability, stability and consistency of products. Before the new series of products are put into the market, they must pass EMC, vibration, impact, high and low temperature tests. Sensors need to go through signal verification before and after each manufacturing process. After assembly, they are tested and screened one by one. Finally, they pass the calibration and linearity detection of laser interferometer, and the detection results are uploaded to the database for subsequent tracking of products.



## Parts Test

### Electro Magnetic Compatibility Test (EMC)

Electrostatic discharge immunity	( GB/T17626.2, IDT IEC61000-4-2 )
Radiation immunity of radio frequency electromagnetic field	( GB/T17626.3, IDT IEC61000-4-3 )
Immunity of electrical fast transient	( GB/T17626.4, IDT IEC61000-4-4 )
Surge (shock) immunity	( GB/T17626.5, IDT IEC61000-4-5 )
RF field induced conducted disturbance immunity	( GB/T17626.6, IDT IEC61000-4-6 )
Power frequency magnetic field immunity	( GB/T17626.8, IDT IEC61000-4-8 )

### Temperature Test

Low temperature	( GB/T2423.1, IDT IEC60068-2-1 )
High temperature	( GB/T2423.2, IDT IEC60068-2-2 )
Constant damp heat	( GB/T2423.3, IDT IEC60068-2-78 )
Alternating damp heat	( GB/T2423.4, IDT IEC60068-2-30 )
Temperature change	( GB/T2423.22, IDT IEC60068-2-14 )

### Other Tests

Explosion-proof test	( GB3836.1, IDT IEC60079-0 )
Explosion-proof test	( GB3836.2, IDT IEC60079-1 )
Explosion-proof test	( GB3836.4, IDT IEC60079-11 )
Insulation resistance, insulation strength	( GB/T15479 )
Impact test	( GB/T2423.5, IDT IEC68-2-27 )
Free drop test	( GB/T2423.8, IDT IEC68-2-32 )
Vibration test	( GB/T2423.10, IDT IEC68-2-6 )

# Technical Characteristics

## • Product introduction

TEC magnetostrictive displacement sensor is a new generation of linear displacement sensor independently developed by Zheda Jingyi. It can provide users with real-time, reliable, accurate and continuous linear displacement signals under harsh operating environment, and is widely used in metallurgical equipment, wind power equipment, construction machinery, rubber machinery, port machinery, energy and other industrial automation fields.

## • Product characteristics

### High precision

The highest resolution and repetition accuracy can reach  $1\mu\text{m}$

### Strong adaptability

It can work in harsh environment such as high and low temperature, humidity, vibration, impact, corrosion, dust and so on.

### Various signal output forms

Analog,SSI,Profibus-DP,PROFINET

### Strong shell

The 304 stainless steel tube shell is precision welded, with pressure resistance, dust resistance, pollution resistance, and electrical protection grades up to IP65, IP67, and IP68.

### Easy to use

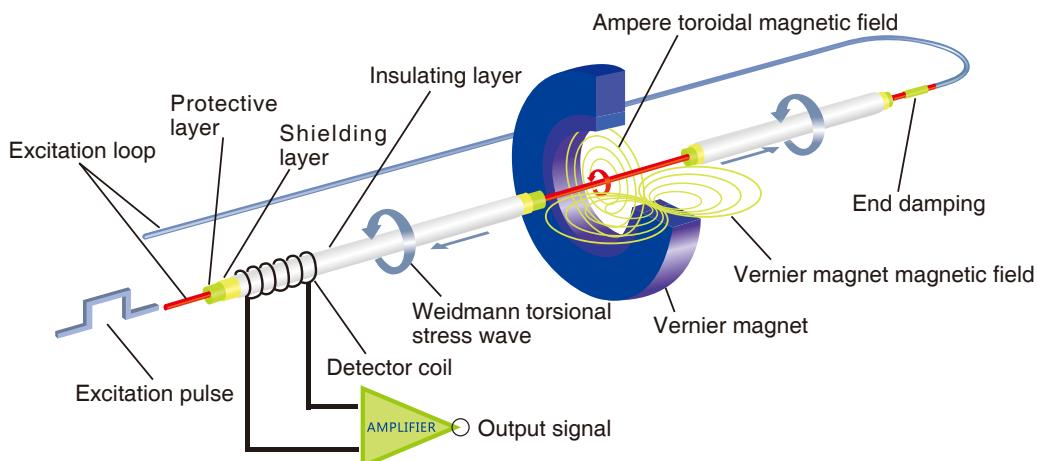
M18×1.5、M20×1.5、  
3/4"-16UNF-3A threaded installation

### Reliable operation

The core components have undergone durability test, shock test, vibration test, temperature test, absolute displacement measuring, and are not affected by power failure

## • Working Principle

The detection mechanism of the magnetostrictive displacement sensor is based on the "Weidmann effect" between the magnetostrictive waveguide wire and the vernier magnet which is the core detection element of the sensor. The excitation module in the sensor electronic bin will apply a query pulse at both ends of the loop where the sensitive detection element (magnetostrictive waveguide wire) is located, and the pulse forms a circumferential ampere annular magnetic field around the waveguide wire at speed of light. The magnetic field is coupled with the permanent magnet magnetic field at the position of the vernier magnet, and a "Weidmann effect" torsional stress wave is formed on the surface of the waveguide wire. The torsional wave transmitted to the end is absorbed by the damping device, and the signal transmitted to the excitation end is received by the detection device. The control module calculates the time difference between the inquiry pulse and the received signal, and multiplies it by the propagation speed of torsional stress wave in the waveguide material, so as to calculate the distance between the torsional wave occurrence position and the measurement reference point, and realize the real-time accurate measurement of the vernier magnet position.



Working principle of magnetostrictive linear displacement sensor

# Technical Terminology

## ● Absolute position

The output of the sensor is relative to a fixed reference point, which does not need to be reset when power supply is restored after power failure; this position is an absolute position. However the general incremental sensor, such as incremental encoder and incremental grating ruler, which needs to find the reference point again.

## ● Environmental conditions

For normal operating conditions of displacement sensors, the industry has the following standards:

- a ) Temperature:25°C ( $\pm 10^\circ\text{C}$ )
- b ) Relative humidity: 90% or less

Generally, the environment for calibrating and testing sensors is more stringent than the standard requirements.

## ● Measuring range

For the sensor, the physical quantity to be measured is indicated by upper and lower limits. The measurement range is the full scale of motion.

## ● Full scale

Full scale (abbreviated as "F.S") (see measuring range).

## ● Resolution

Refers to the minimum amount of sensor output that can be distinguished. The highest resolution of TEC magnetostrictive displacement sensor can reach 1μm.

## ● Nonlinearity

Nonlinearity is the absolute deviation as a percentage of the stroke length length. In a magnetostrictive sensor, this change is caused by the difference in the propagation velocity of the return signal propagating in the waveguide medium.

## ● Non-contact

Magnetostrictive displacement sensor uses non-contact magnetic induction technology to measure position. Non-contact measurement does not exist mechanical wear and mechanical vibration, which improves the reliability and service life of the sensor.

## ● Temperature coefficient

The temperature coefficient unit is ppm/ $^\circ\text{C}$  (one millionth per degree Celsius). It refers that the ambient temperature changes by 1 degree Celsius, the amount of change in the position value output by the sensor.

## ● Update time

The time interval between two measurements made by the sensor. The larger the range of the sensor, the longer the update time required.

## ● Multiple position measurement

Measure the position of multiple magnet rings on the sensor stroke shaft or guide rail at the same time.

## ● Precision

The difference between the indicated measured value and the true value can be calculated from the root mean square of the nonlinear deviation, repeatability, and hysteresis.

## ● Hysteresis

The difference in displayed position when reaching the same point from opposite directions along the length of stroke (Note: Magnetostrictive displacement sensors have very little hysteresis and are therefore negligible in most applications).

## ● Drift

Drift refers to the change of output signal or output value under the influence of surrounding environment, such as time or temperature. Please refer to "preheating period" and "temperature coefficient" at the same time.

## ● Shell protection class

The IP (Ingress Protection) standard for shell intrusion protection issued by the International Electrotechnical Commission. For specific IP standard instructions, please refer to the official website of IEC. The optional protection levels of sensors are IP65, IP67 and IP68.

## ● Preheating period

The time required for the sensor to be energized until the output is stable, this deviation can be seen from the calibration curve of the sensor.

## ● Load impedance

The impedance when the external circuit is connected to the output end of the sensor.

## ● Repetition accuracy

The difference in sensor output when the magnet repeatedly reaches the same position from the same direction when measured along the stroke.



# EJ Displacement Sensor



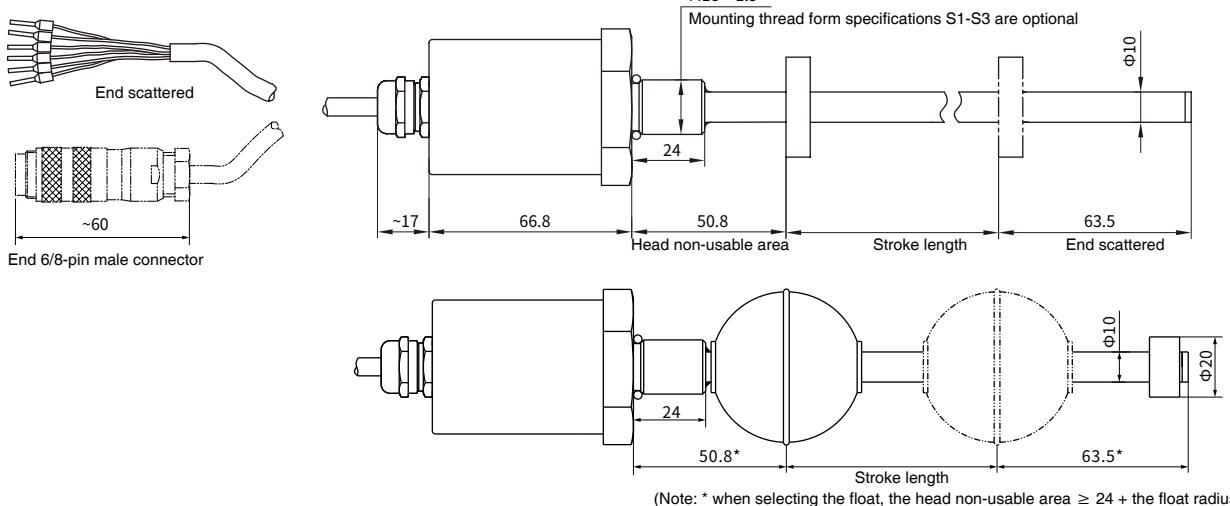
## Technical Characteristics

- Rugged and fully enclosed design
- Non-wear, non-contact measuring method
- Low power consumption design effectively reduces system heating
- Absolute position output, not affected by power failure
- Adapt to harsh environment, IP68 protection class
- Multiple interfaces are available: Analog, SSI, Modbus, etc

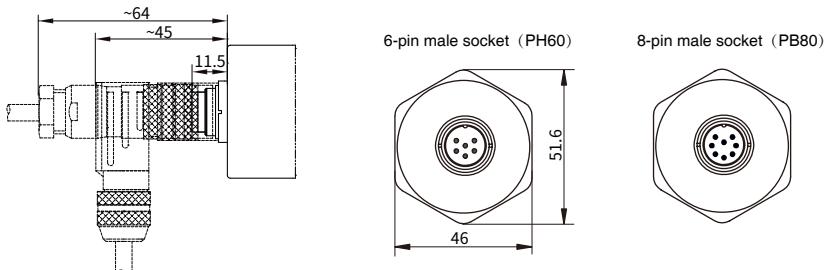
# EJ-Analog Output

## ► Structural shape

- Dimensions of cable outlet



- Dimensions of connector outlet



## ► Wiring and pin definition



- 6-pin male connector arrangement (facing the sensor head)

Pin	Cable color 1*	Cable color 2*	Function definition
1	Blue	Grey	magnet ring position signal(+)
2	Green	Pink	magnet ring position signal(-)
3	Yellow	Yellow	Reservation
4	White	Green	Reservation
5	Red	Brown	+24Vdc power supply (-20%~+20%)
6	Black	White	GND (power supply circuit)



- 8-pin male connector arrangement (facing the sensor head)

Pin	Cable color 3*	Function definition
1	Yellow	Current output
2	Grey	Current/Voltage circuit
3	Pink	Reservation
4	-	Reservation
5	Green	Voltage output
6	Blue	GND (power supply circuit)
7	Brown	+24Vdc power supply (-20%~+20%)
8	White	Reservation

Note: \* Cable color 1: cable PUR sheath, orange, -20~90°C

\* Cable color 2/3: cable PVC sheath orange, -20~105°C

## ► EJ Analog Output-Product Parameters

• Input	
Measuring data	Position magnet ring
Stroke length	25~5500 mm (customized according to customer's needs)
• Output	
Current	4 ~ 20mA or 0~20mA(min/max load 0/500Ω)
Voltage	-5 ~ 5Vdc or -10~10Vdc (minimum load resistance $\geq 10K\Omega$ )
resolution	16-bit D/A , minimum 5 $\mu m$
Nonlinearity	< $\pm 0.02\%$ of full scale, Minimum $\pm 50 \mu m$
Repeatability	< $\pm 0.001\%$ of full scale or the same as the resolution
Update time	1ms(range $\leq 1m$ )、2ms(1m<range $\leq 2m$ )、3ms(2m<range $\leq 3m$ )
• Operating conditions	
Magnet ring speed	Arbitrary
Protection class	Cable outlet mode IP68; socket mode IP67
Operating temperature	-40°C ~ +75°C
Humidity/dew point	Humidity 90%, no condensation
Impact Indicator	GB/T2423.5 50g(6ms)
Vibration index	GB/T2423.10 15g/10~2000Hz
EMC test	GB/T17626.2 Anti-interference Degree of Electrostatic Discharge, Grade 3, Class A GB/T17626.3 Radiation Immunity of Radio Frequency Electromagnetic Fields, Grade 3, Class A GB/T17626.4 Electrical Fast Transient Immunity, Grade 3, Class B GB/T17626.6 Radio Frequency Field Induced Conducted Disturbance Immunity, Grade 2, Class A GB/T17626.8 Power Frequency Magnetic Field Immunity, Grade 3, Class A CE certification
• Electrical Connections	
Input voltage	+24Vdc $\pm 20\%$ / +12Vdc $\pm 20\%$
Power consumption	<100mA
Polarity protection	Maximum -30Vdc
Oversvoltage protection	Maximum 36Vdc
Insulation resistance	>10MΩ
Insulation strength	500V
• Construction and Materials	
Electronic compartment	304L stainless steel
Measuring rod	304L stainless steel /316L stainless steel
Outer measuring rod withstand pressure	35Mpa (continuous) / 70Mpa (peak) measuring rod diameter ( $\Phi 10$ )
Installation	Any direction, mounting thread form (line specification is optional)
Position magnet	Various ring magnets
Outgoing mode	Cable outlet or connector (M16 connector)

## ► EJ Analog Output-Selection Guide



01 - 02	Sensor shell form
E   J	Pressure-resistant pipe
03 - 07	Range (0025~5500mm, others can be customized as needed)
	0025~0500mm step length 5mm
	0500~0750mm step length 10mm
	0750~1000mm step length 25mm
	1000~5500mm step length 50mm
08 - 09	Mounting thread form
S   1	M18X1.5, measuring rod diameter 10mm, 304 material
S   2	M20X1.5, measuring rod diameter 10mm, 304 material
S   3	3/4"-16UNF-3A, measuring rod diameter 10mm, 304 material
10 - 13	Connection form
10 - 11	Cable outlet mode
D   H	PUR sheath, orange, -20~90°C, end scattered, Cable color 1
D   U	PVC sheath, orange, -20~105°C, end scattered, Cable color 2
D   B	PVC sheath, orange, -20~105°C, end scattered, Cable color 3
D   I	PUR sheath, orange, -20~90°C, end 6-pin male connector
D   C	PVC sheath, orange, -20~105°C, end 8-pin male connector
12 - 13	Cable length, 01~99 unit: meter (cable outlet)
10 - 13	Connector form
P   H   6   0	M16 6-pin male socket, plug cable needs to be selected separately
P   B   8   0	M16 8-pin male socket, plug cable needs to be selected separately

14 - 17	Signal output mode
14 - 15	Communication interface
A   0	Current output, 4 ~ 20mA
A   1	Current output, 20 ~ 4mA
A   2	Current output, 0 ~ 20mA
A   3	Current output, 20 ~ 0mA
V   0	Voltage output, 0 ~ 10V
V   1	Voltage output, 10 ~ 0V
V   2	Voltage output, -10 ~ +10V
V   3	Voltage output, +10 ~ -10V
V   4	Voltage output, 0 ~ 5V
V   5	Voltage output, 5 ~ 0V
V   6	Voltage output, -5 ~ +5V
V   7	Voltage output, +5 ~ -5V
16	Reserved bit
1	Single magnet ring
2	Single floating ball
17	No magnet ring state
A	Keep the original value
B	Maximum value
C	Minimum value
18 - 19	Head and end non-used area
S   0	50.8mm+63.5mm
B   0	30mm+60mm
20-21	Country
	Refer to the country list, page 61.

### ● Selection example

For example: EJ-M0300-S1-DU02-V01B-S0-CN

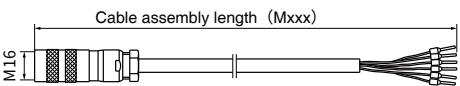
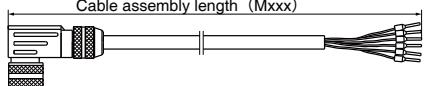
Indicates: E series EJ structure, Stroke length is 300mm, mounting thread form is M18×1.5, diameter 10, material 304 measuring rod, cable outlet PVC orange cable 2 meters (PVC orange sheath, -20~105°C, end scattered), 0-10V output, single magnet ring output (magnet ring needs to be purchased separately), the output value of no magnet ring is 10V, and the head and end non-used area is 50.8mm+63.5mm.

### ● Supply list

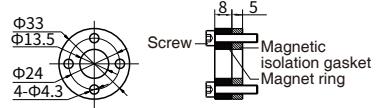
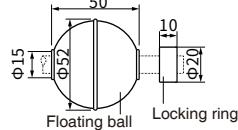
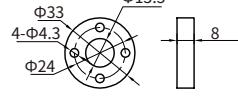
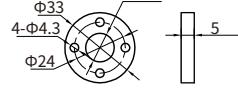
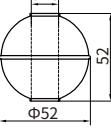
Sensor, certificate, manual, optional accessories (sold separately)

## ► EJ Analog Output-Common Options

- Plug assembly cable

Accessory name/model	Dimensions	Description
Analog wiring cable assembly Order No.:AST-Mxxx-H01 (U01/U02)		Mxxx denotes cable length in meters; H01-6-pin PUR orange sheath, temperature-resistant -20~90°C cable assembly; U01-6-pin PVC orange sheath, temperature resistance -20~105°C cable assembly; U02-8-pin PVC orange sheath, temperature -20~105°C cable assembly.
Analog wiring right angled cable assembly Order No.:AST-Mxxx-H03 (U03/U04)		Mxxx denotes cable length in meters; H03-6-pin PUR orange sheath, temperature-resistant -20~90°C cable assembly; U03-6-pin PVC orange sheath, temperature resistance -20~105°C cable assembly; U04-8-pin PVC orange sheath, temperature -20~105°C cable assembly.

- Magnet ring/floating ball

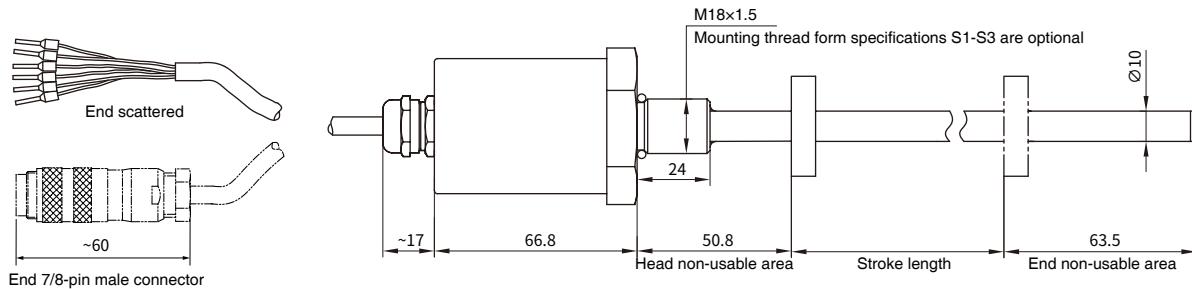
Accessory name/model	Dimensions	Description
Standard magnet ring kit Order No.:288501		One magnet ring 211501, one gasket 211521 (thickness 5mm), four M4X20 socket screws with spring washers.
Floating ball kit Order No.:266001		One floating ball 211546, a set of locking rings 211589. Floating ball material 304, pressure resistance 2.5MPa, density 0.6; locking ring material 304.
Standard magnet ring Order No.:211501		
Magnetic isolation gasket Order No.:211521		
Floating ball Order No.:211546		Material 304, pressure resistance 2.5 MPa, density 0.6
Locking ring Order No.:211589		Material 304

**Note:** For other accessories, please refer to general options

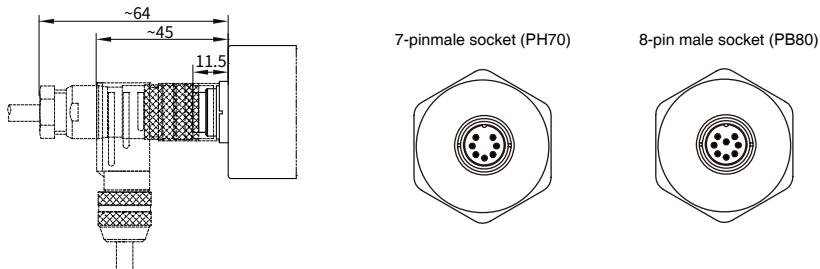
# EJ-SI Output

## ◎ Structural shape

- Dimensions of cable outlet



- Outline dimensions of connector outlet



## ◎ Wiring and pin definition

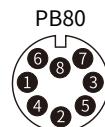


- Pin arrangement of seven-pin male connector (facing the sensor head)

Pin	Cable color 1*	Cable color 2*	Function definition
1	White	Grey	Data (-)
2	Yellow	Pink	Data (+)
3	Blue	Yellow	Clock (+)
4	Green	Green	Clock (-)
5	Red	Brown	+24Vdc power supply (-20%~+20%)
6	Black	White	GND (power supply circuit)
7	-	-	Do not connect

Note: \* Cable color 1: Cable PUR sheath, orange,-20-90°C

\* Cable color 2/3: Cable PVC sheath, orange,-20-105°C



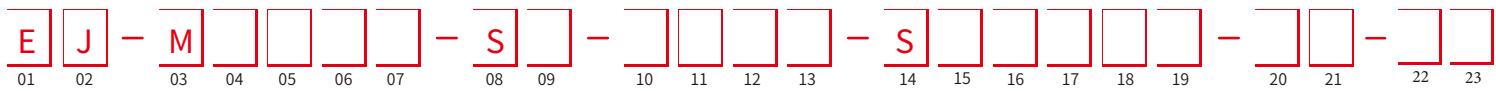
- Pin arrangement of eight-pin male connector (facing the sensor head direction)

Pin	Cable color3*	Function definition
1	Yellow	Clock (+)
2	Grey	Data (+)
3	Pink	Clock (-)
4	-	Reservation
5	Green	Data (-)
6	Blue	GND (power supply circuit)
7	Brown	+24Vdc power supply (-20%~+20%)
8	White	Reservation

## ► EJ SSI Output-Product Parameters

• Input						
Measuring data	Position magnet ring					
Stroke length	25~5500mm, customized according to customer's needs					
Number of measurings	1					
• Output						
Interface	SSI Synchronous Serial Interface					
Data format	Binary or gray code					
Data length	24/25/26 bit					
Resolution	5 / 10 / 20 / 40 / 50 / 100 $\mu\text{m}$					
Nonlinearity	<±0.01% of full scale, minimum±50 $\mu\text{m}$					
Repeatability	< ± 0.001% of full scale, minimum ± 5 $\mu\text{m}$					
Transmission rate	50KBD~1MBD Line length <3 <50 <100 <200 <400 (m) Rate 1000 <400 <300 <200 <100 (KBD)					
Update time	Stroke	300	750	1000	2000	5000 mm
	Frequency	3.7	3.0	2.3	1.2	0.5 kHz
Operating mode	Asynchronous					
Temperature coefficient	<30ppm/ $^{\circ}\text{C}$					
• Operating conditions						
Magnet ring speed	Arbitrary					
Protection class	Cable outlet mode IP68; socket way IP67					
Operating temperature	-40 $^{\circ}\text{C}$ ~ +85 $^{\circ}\text{C}$					
Humidity/dew point	Humidity 90%, no condensation					
Impact Indicator	GB/T2423.5 100g(6ms)					
Vibration index	GB/T2423.10 15g/10~2000Hz					
EMC test	GB/T17626.2/3/4/6/8, Grade 4/3/4/3/3, Class A					
• Electrical Connections				• Construction and Materials		
Input voltage	+24Vdc±20%			Electronic compartment	304L	
Power consumption	<80mA ((varying with range)			Measuring rod	304L stainless steel	
Polarity protection	Maximum -30Vdc			Outer tube pressure	35MPa (continuous) /70MPa (peak)	
Oversvoltage protection	Maximum 36Vdc			Position magnet	Standard magnet ring and various ring magnets	
Insulation resistance	>10M $\Omega$			Thread form	M18×1.5、M20×1.5、3/4"-16UNF-3A (customizable)	
Insulation strength	500V			Installation direction	Any direction	
				Outgoing mode	Cable outlet or connector	

## ► EJ SSI Output-Selection Guide



01 - 02	Sensor shell form
E [ ] J	Pressure-resistant pipe
03 - 07	Range (0025~5500mm, others can be customized as needed)
	0025~500mm step length 5mm
	0500~0750mm step length 10mm
	0750~1000mm step length 25mm
	1000~5500mm step length 50mm
08 - 09	Mounting thread form
S [ ] 1	M18X1.5, measuring rod diameter 10mm, 304 material
S [ ] 2	M20X1.5, measuring rod diameter 10mm, 304 material
S [ ] 3	3/4"-16UNF-3A, measuring rod diameter 10mm, 304 material
10 - 13	Connection form
10 - 11	Cable outlet mode
D [ ] H	PUR sheath, orange, -20~90°C, end scattered, Cable color 1
D [ ] U	PVC sheath, orange, -20~105°C, end scattered, Cable color 2
D [ ] B	PVC sheath, orange, -20~105°C, end scattered, Cable color 3
D [ ] I	PUR sheath, orange, -20~90°C, end 7-pin male connector
D [ ] V	PVC sheath, orange, -20~105°C, end 7-pin male connector
D [ ] C	PVC sheath, orange, -20~105°C, end 8-pin male connector
12 - 13	Cable length, 01~99 unit: meter (cable outlet)
10 - 13	Connector form
P [ ] H [ ] 7 [ ] 0	M16 7-pin male socket, plug cable needs to be selected separately
P [ ] B [ ] 8 [ ] 0	M16 8-pin male socket, plug cable needs to be selected separately

14 - 19	Signal output mode
15	Data length
1	24-bit
2	25-bit
3	26-bit*
	* 26-bit are parity bits, 25-bit are status bits
16	Data format
B	Binary
G	Gray code
17	Resolution
1	0.1mm
2	0.05mm
3	0.02mm
4	0.01mm
5	0.005mm
8	0.04mm
18	Direction
0	Forward (when the magnet ring or floating ball is far away from the electronic compartment, the output value increases)
1	Reverse (when the magnet ring or floating ball is far away from the electronic compartment, the output value decreases)
19	Mode
0	Asynchronous
20 - 21	Front and end non-used area
S [ ] 0	50.8mm+63.5mm
B [ ] 0	30mm+60mm
22 - 23	Country
	Refer to the country list, page 61.

### ● Selection example

For example: EJ-M0300-S1-DU02-S2B300-S0-CN

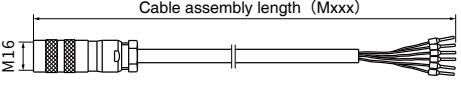
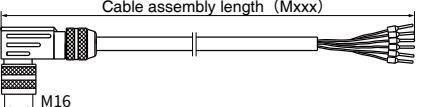
Indicates: E series EJ structure, Stroke length is 300mm, mounting thread form is M18 × 1.5, diameter is 10, material is 304 measuring rod, straight orange cable is 2 meters (PVC orange sheath, -20~105°C, end scattered), SSI interface 25-bit data binary format is 0.02 mm, resolution is forward asynchronous output, and head and end non-used area is 50.8 mm+63.

### ● Supply list

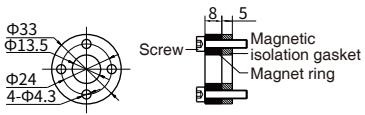
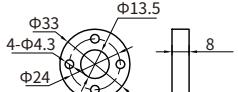
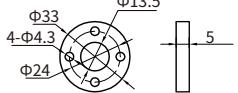
Sensor, certificate, manual, optional accessories (sold separately)

## ► EJ SSI Output-Common Options

- Plug assembly cable

Accessory name/model	Dimensions	Description
SSI Interface Cable assembly Order No.:SSI-Mxxx-H01 (U01/U02)		Mxxx represents the cable length in meters; H01-7-pin PUR orange sheath, temperature -20~90°C cable assembly; U01-7-pin PVC orange sheath, temperature -20~105°C cable assembly; U02-8-pin PVC orange sheath, temperature -20~105°C cable assembly.
SSI Interface Right angled cable assembly Order No.:SSI-Mxxx-H03 (U03/U04)		Mxxx represents the cable length in meters; H03-7-pin PUR orange sheath, temperature -20~90°C cable assembly; U03-7-pin PVC orange sheath, temperature -20~105°C cable assembly; U04-8-pin PVC orange sheath, temperature -20~105°C cable assembly.

- Magnet ring

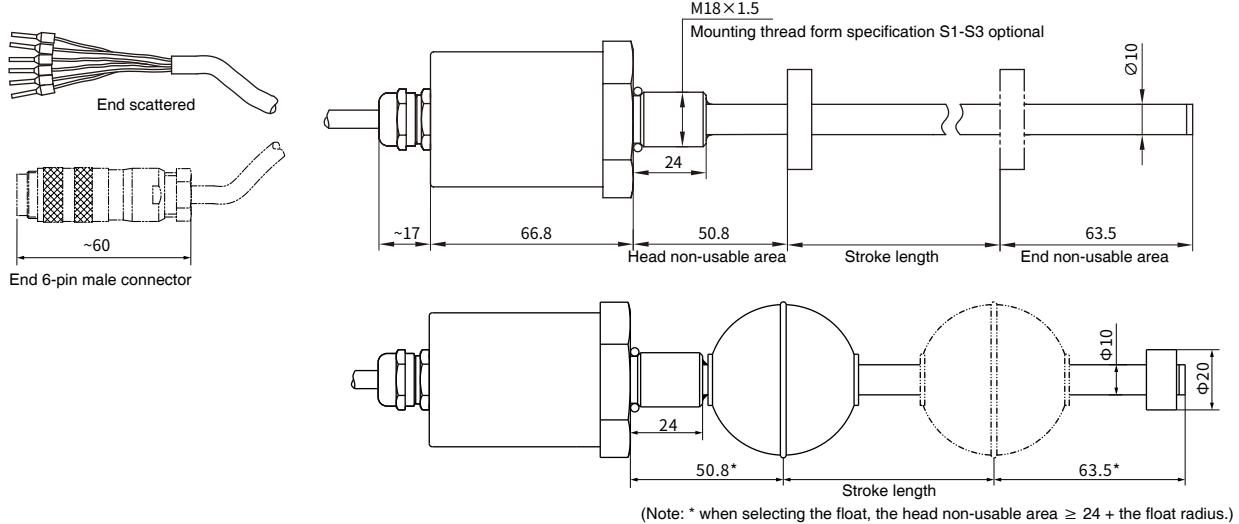
Accessory name/model	Dimensions	Description
Standard magnet ring kit Order No.:288501		One magnet ring 211501, one gasket 211521 (thickness 5mm), four M4X20 socket screws with spring washers.
Standard magnet ring Order No.:211501		
Magnetic isolation gasket Order No.:211521		

**Note:** See general options for other accessories

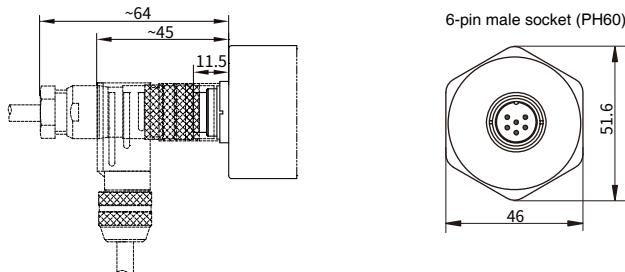
# EJ-Modbus Output

## ► Structural shape

- Dimensions of cable outlet



- Outline dimensions of connector outlet



## ► Wiring and pin definition



### • 6-pin connector pin arrangement (Sensor Oriented)

Pin	Cable color1*	Cable color2*	Function definition
1	Blue	Grey	Magnet ring position signal+
2	Green	Pink	Magnet ring position signal-
3	Yellow	Yellow	Reservation
4	White	Green	Reservation
5	Red	brown	+24Vdc power supply (-20%~+20%)
6	Black	White	GND (supply and return circuit)

Note: \* Cable color 1: Cable PUR sheath, orange, -20~90°C

\* Cable color 2: Cable PVC sheath, orange, -20~105°C

## ► EJ Modbus Output-Product Parameters

• Input	
Measuring data	Position magnet ring or position floating ball
Stroke length	25~5500 mm, others can be customized according to needs
• Output	
Interface	Modbus RTU protocol
Resolution	≤10um
Nonlinearity	Minimum ±50um(or <±0.01%F.S.)
Repeatability	Minimum ±10um(or <±0.001%F.S.)
Update time	10ms
Communication rate	4800/9600/19200/38400/57600/115200 bps
Check method	Even check
• Operating conditions	
Magnet velocity	Arbitrary
Protection class	IP67
Operating temperature	-40°C ~ +75°C
Humidity/dew point	Humidity 90%, no condensation
Impact Indicator	GB/T2423.5 50g(6ms)
Vibration index	GB/T2423.10 15g/10~2000Hz
EMC test	GB/T17626.2 Electrostatic Discharge Immunity, Grade 3, Class A GB/T17626.3 Radio Frequency Electromagnetic Field Radiation Immunity, Grade 3, Class A GB/T17626.4 Electrical Fast Transient Burst Immunity, Grade 3, Class B GB/T17626.6 Conducted Disturbance Degree Induced by Radio Frequency Field, Grade 2, Class A GB/T17626.8 Power Frequency Magnetic Field Immunity, Grade 3, Class A CE certification
• Electrical Connections	
Input voltage	24Vdc
Power consumption	<80mA
Polarity protection	Maximum -30Vdc
Oversupply protection	Maximum 36Vdc
Insulation resistance	>10MΩ
Insulation strength	500V
• Construction and Materials	
Electronic compartment	304Lstainless steel
Measuring rod	304L/316Lstainless steel
Outer tube pressure	35Mpa (continuous)/70Mpa (peak) measuring rod diameter φ 10
Installation	Any direction, mounting thread form (thread form specification is optional)
Position magnet	Various annular magnets or floating balls
Outgoing mode	Cable outlet (scattered connection) or connector (M12 connector)

# ► EJ Modbus Output-Selection Guide

E	J	-	M					-	S	J	-					-				-																																																															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23																																																													
01 - 02		Sensor shell form												14 - 19		Signal output mode																																																																			
E	J	Pressure-resistant pipe												14	Communication protocol and power supply																																																																				
03 - 07		Range (0025~5500mm, others can be customized as needed)												R	RTU, 24Vdc power supply																																																																				
0025~0500mm step length 5mm												0500~0750mm step length 10mm												15		communication rate																																																									
0750~1000mm step length 25mm												1000~5500mm step length 50mm												1		19200 bps												5	38400 bps																																												
S 1												M18X1.5, measuring rod diameter 10mm, 304 material												4		4800 bps												6	57600 bps																																												
S 2												M20X1.5, measuring rod diameter 10mm, 304 material												9		9600 bps												7	115200 bps																																												
S 3												3/4"-16UNF-3A, measuring rod diameter 10mm, 304 material												16		Output forward and reverse												0	Forward (when the magnet ring or floating ball is far away from the electronic compartment, the output value increases)												1		Reverse (when the magnet ring or floating ball is away from the direction of the electronic compartment, the output value decreases)																														
10 - 13												Connection form												17		Reserved bit												1	Single magnet ring																																												
10 - 11												Cable outlet mode												2		Single floating ball												18	No magnet ring state												C	Minimum value																															
D	H	PUR sheath, orange, -20~90°C, end scattered, Cable color 1												19		Check method												2	Even parity												20 - 21	Front and end non-usable area												S	0	50.8mm+63.5mm												22 - 23	Country												Refer to the country list, page 61.		
P	H	6	0	M16 6-pin male socket, plug cable needs to be selected separately																																																																															

### ● Selection example

For example: EJ-M0300-S1-DU02-R912-S0

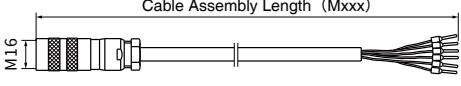
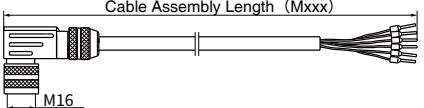
Indicates: E series EJ structure, Stroke length is 300mm, mounting thread form is M18 × 1.5, diameter is 10, material is 304 measuring rod, straight orange cable is 2 meters (PVC orange sheath, -20~105°C, end scattered), 24Vdc power supply RTU protocol output, baud rate is 9600bps, reverse output, single position magnet ring, standard head and end non-usable area is 50.8 mm + 63.5 mm. (Note: Factory default address 1)

### ● Supply list

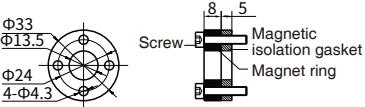
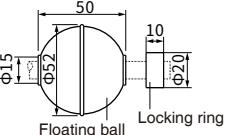
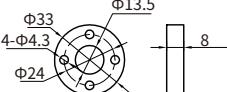
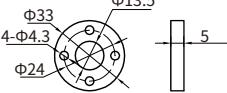
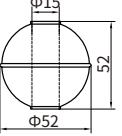
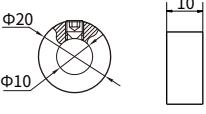
Sensor, certificate, manual, optional accessories (sold separately)

## ► EJ Modbus Output-Common Options

- Plug assembly cable

Accessory name/model	Dimensions	Description
Modbus Interface Cable assembly Order No.:AST-Mxxx-H01 (U01)		Mxxx represents the cable length in meters; H01-6-pin PUR orange sheath, temperature -20~90°C cable assembly; U01-6-pin PVC orange sheath, temperature resistance -20~105°C cable assembly.
Modbus Interface right angled Cable Assembly Order No.:AST-Mxxx-H03 (U03)		Mxxx represents the cable length in meters; H03-6-pin PUR orange sheath, temperature resistance -20~90°C cable assembly; U03-6-pin PVC orange sheath, temperature resistance -20~105°C cable assembly.

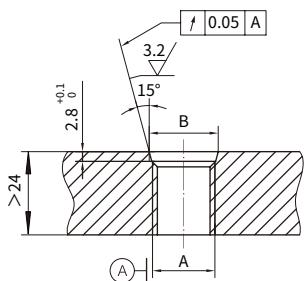
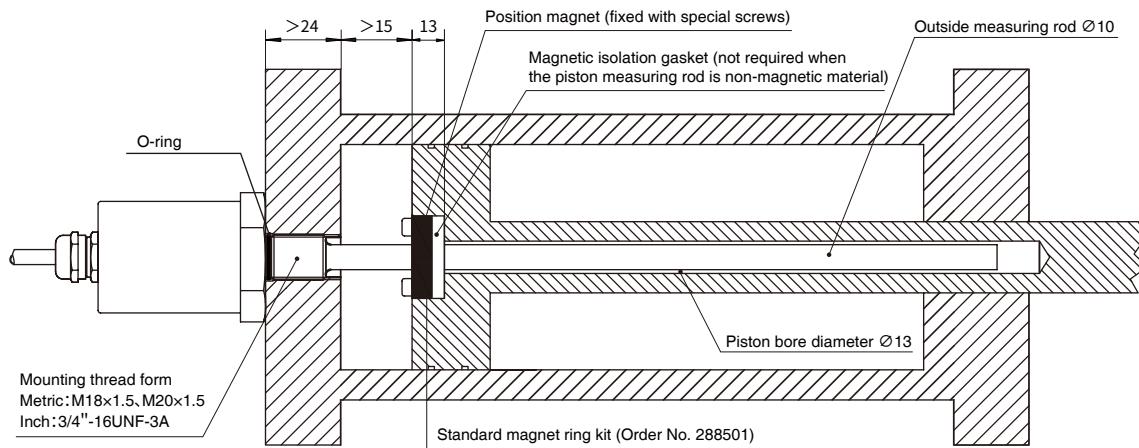
- Magnet ring/float

Accessory name/model	Dimensions	Description
Standard magnet ring kit Order No.:288501		One magnet ring 211501, one gasket 211521 (thickness 5mm), four M4X20 socket screws with spring wgreysers.
Floating ball kit Order No.:266001		One floating ball 211546, a set of locking rings 211589. Floating ball material 304, pressure resistance 2.5MPa, density 0.6; locking ring material 304.
Standard magnet ring Order No.:211501		
Magnetic isolation gasket Order No.:211521		
Floating ball Order No.:211546		Material 304, pressure resistance 2.5MPa, density 0.6
Locking ring Order No.:211589		Material 304

**Note:**For other accessories, please refer to general options

# EJ-Hydraulic cylinder Application

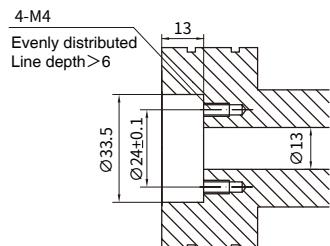
## ► Built-in installation



Installation accessories size list:

Size Code	A	B	O-ring
S1	M18×1.5	Ø19.9±0.1	15.3×2.4
S2	M20×1.5	Ø21.8±0.1	16×2.4
S3	3/4"-16UNF-3A	Ø20.8±0.1	17×2.4

Installation and sealing surface processing requirements  
Note: Recommended matching lined hole structure size



Structural dimensions and center dimensions of accessories installed on the piston measuring rod

## ► How to choose the sensor range according to the hydraulic cylinder

When selecting the sensor range for the existing hydraulic cylinder, ensure that the sensor range covers the cylinder piston measuring rod stroke, that is, the sensor range 0 point is before the piston measuring rod stroke starting point, and the sensor range end point is after the piston measuring rod stroke ends.

## ► Precautions

- Hydraulic cylinder installation—the sensor of the pressure-resistant round tube casing is usually installed with a built-in hydraulic cylinder. The mounting thread form specifications Includes: M18×1.5, M20×1.5, 3/4"-16UNF-3A. Before installation, make sure that the hydraulic cylinder is as given in the picture book. Finished to the correct size.
- Mechanical installation - The sensor has no requirements on the installation position and direction, but must ensure that the installation is firm and reliable. The position magnet should be installed on the moving part under test and maintains a proper distance from the measuring rod. Position magnet - To ensure the accuracy of measuring, the installing parts of the position magnet must be made of non-magnetic materials, such as screws, magnetic isolation gaskets, etc.
- Notes: The sensor is a magnetic sensitive device and must be kept away from the interference of strong external magnetic fields. The stability and accuracy of the power supply should also be considered when measuring with high precision. During use, it is also necessary to prevent the electronic compartment from being hit by foreign objects.



# ES Displacement Sensor



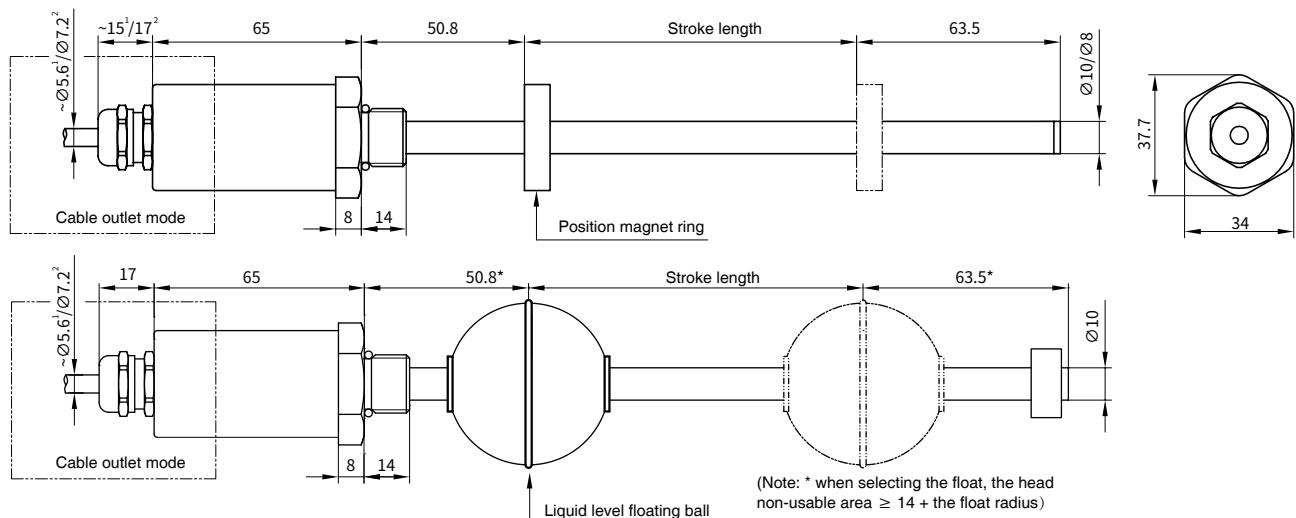
## Technical Characteristics

- Compact structure, convenient disassembly and assembly
- Linear measuring, absolute position output
- Multiple interfaces are optional, Modbus etc
- Rugged and fully enclosed design
- Non-wear, non-contact measuring method
- Adapt to harsh environment and resist high pressure sensor measuring rod

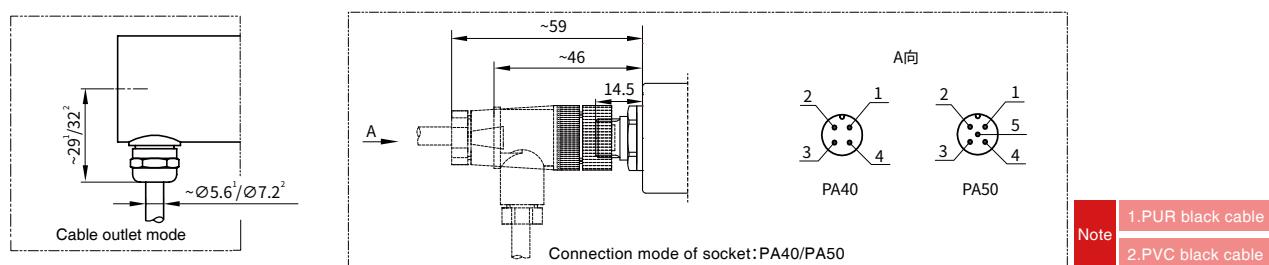
# ES-Analog Output

## ► Structural shape

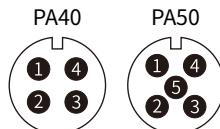
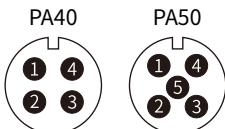
- Dimensions of cable outlet



- Outline dimensions of connector outlet



## ► Wiring and pin definition



### • PA40/PA50 pin arrangement - 2-wire system (Sensor Oriented)

Pin	Cable color1*	Cable color2* / 3*	Function definition
1	Brown	Red	+24/12Vdc power supply (-20%~+20%)
2	White	Black	GND (power supply circuit)
3	Blue	-	Do not connect
4	Black	-	Do not connect
5	Grey	-	Do not connect

### • PA40/PA50 Pin Arrangement-Four Wire (Sensor Oriented)

Pin	Cable color1*	Cable color2*	Cable color3*	Function definition
1	Brown	Red	Red	+24Vdc power supply (-20%~+20%)
2	White	Black	Black	GND (power supply circuit)
3	Blue	Blue	Brown	Magnet ring position signal +
4	Black	Green	Green	Magnet ring position signal -
5	-	-	-	Do not connect

Note: \* Cable color 1: Cable PUR sheath, black, -40~80°C, end scattered

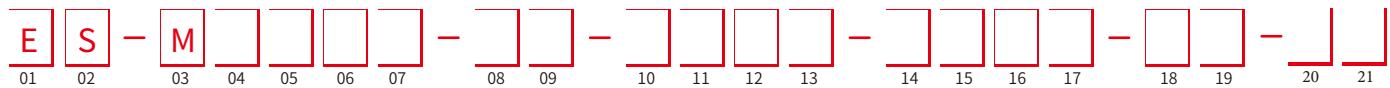
\* Cable color 2: Cable PUR sheath, orange, -20~90°C, end scattered

\* Cable color 3: Cable PVC sheath, black, -40~80°C, end scattered

## ► ES Analog Output - Product Parameters

• Input	
Measuring data	Position magnet ring
Stroke length	25~3500 mm, others can be customized according to needs
• Output	
Current	4 ~ 20mA or 0 ~ 20mA (min/max load 0/500Ω)
Voltage	0 ~ 10Vdc or 0~5Vdc (minimum load resistanc $\geq 10K\Omega$ )
Resolution	$\pm 0.01\text{mm}$ , 16bit DA, 4-wire system current $\pm 0.1\text{mm}$ , 16bit DA, 4-wire system voltage $\pm 0.1\text{mm}$ , 12bit DA, 2-wire system current
Nonlinearity	0.05% F.S
Repeatability	Same resolution
Update time	2-wire system 100 ms 4-wire system 1ms (range $\leq 1\text{m}$ ) , 2ms ( $1\text{m} < \text{range} \leq 2\text{m}$ ) , 3ms ( $\text{range} > 2\text{m}$ )
Temperature coefficient	<50ppm/ $^{\circ}\text{C}$
• Operating conditions	
Magnet velocity	Arbitrary
Protection class	IP67
Operating temperature	-40°C ~ +75°C
Humidity/dew point	Humidity 90%, no condensation
Shock index	GB/T2423.5 50g(6ms)
Vibration index	GB/T2423.10 15g/10~2000Hz
EMC test	GB/T17626.2 Anti-interference Degree of Electrostatic Discharge, Grade 3, class A GB/T17626.3 Radiation Anti-interference Degree of Radio Frequency Electromagnetic Field, Grade 3, Class A GB/T17626.4 Anti-interference Degree of Electrical Fast Transient Train, Grade 3, Class B GB/T17626.6 Conducted Disturbance Degree Induced by Radio Frequency Field, Grade 2, Class A GB/T17626.8 Power Frequency Magnetic Field Immunity, Grade 3, Class A CE certification
• Electrical Connections	
Input voltage	+24Vdc power supply (-20%~+20%): 4-wire system +24/12Vdc power supply (-20%~+20%): 2-wire system
Power consumption	<80mA
Polarity protection	Maximum-30Vdc
Oversupply protection	Maximum36Vdc
Insulation resistance	>10MΩ
Insulation strength	500V
• Construction and Materials	
Electronic compartment	304Lstainless steel
Measuring rod	304L/316Lstainless steel
Outer tube pressure	35Mpa (continuous)/70Mpa (peak) rod diameter $\phi 10$
Installation	Any direction, threaded installation (thread specification is optional)
Position magnet	Various ring magnets
Outgoing mode	Cable outlet or connector (M12 connector)

# ► ES Analog Output-Selection Guide



<b>01 - 02</b>	<b>Sensor shell form</b>
E S	Pressure-resistant pipe
<b>03 - 07</b>	<b>Measuring range (0025~5500mm, others can be customized as needed)</b>
	0025~0500mm step length 5mm
	0500~0750mm step length 10mm
	0750~1000mm step length 25mm
	1000~3500mm step length 50mm
<b>08 - 09</b>	<b>Mounting thread form</b>
S 1	M18X1.5, measuring rod diameter 10mm, 304 material
S 2	M20X1.5, measuring rod diameter 10mm, 304 material
S 3	3/4"-16UNF-3A, measuring rod diameter 10mm, 304 material
T 1	M18X1.5 mounting thread, measuring rod diameter 8mm, 316 material
T 2	M20X1.5 mounting thread, measuring rod diameter 8mm, 316 material
T 3	3/4"-16UNF-3A mounting thread, measuring rod diameter 8mm, 316 material
<b>10 - 13</b>	<b>Connection form</b>
<b>10 - 11</b>	<b>Connection</b>
D E	Cable outlet, PVC sheathed, black, -40~80°C, end scattered,Cable color 3
D W	Cable outlet, PUR sheath, black, -40~80°C, end scattered,Cable color 1
D H	Cable outlet, PUR sheath, orange, -20~90°C, end scattered,Cable color 2
C W	Side outlet, PUR sheath, black, -40~80°C, end scattered,Cable color 1
C H	Side outlet, PUR sheath, orange, -20~90°C, end scattered,Cable color 2
<b>12 - 13</b>	<b>Cable length, 01~99 unit: meter</b>
<b>10 - 13</b>	<b>Connector form</b>
P A 4 0	M12 4-pin socket, plug cable needs to be selected separately
P A 5 0	M12 5-pin socket, plug cable needs to be selected separately

<b>14 - 17</b>	<b>Signal output mode</b>
<b>14 - 15</b>	<b>Communication interface</b>
A 0	Current output, 4 ~ 20mA
A 1	Current output, 20 ~ 4mA
A 2	Current output, 0 ~ 20mA
A 3	Current output, 20 ~ 0mA
A 4	2-wire current, 4~20mA
A 5	2-wire current, 20~4mA
V 0	Voltage output, 0 ~ 10V
V 1	Voltage output, 10 ~ 0V
V 4	Voltage output, 0 ~ 5V
V 5	Voltage output, 5 ~ 0V
<b>16</b>	<b>Reserved bit</b>
1	Magnet ring
2	Floating ball
<b>17</b>	<b>No magnet ring state</b>
A	Keep the original value
B	Maximum (default)
C	Minimum value
<b>18 - 19</b>	<b>Non-usable area at head and end</b>
S 0	50.8mm+63.5mm
<b>20-21</b>	<b>Country</b>
	Refer to the country list, page 61.

## ● Selection example

For example: ES-M0300-S1-PA50-A01B-S0

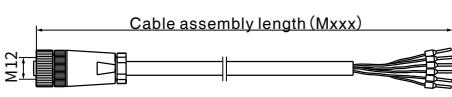
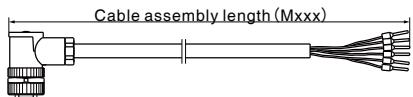
Indicates: ES rod structure series, 300mm Stroke length, M18X1.5 installation thread, 10mm diameter, 304 material measuring rod, M12 5-pin socket form, current output of 4~20mA, single position magnet ring (magnet ring needs to be selected separately), non-magnet ring status display > 20mA value, head and end non-usable area of 50.8 mm+63.5mm.

## ● Supply list

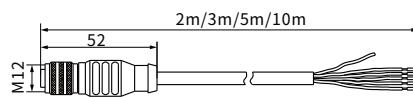
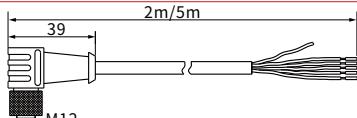
Sensor, certificate, instruction manual, optional parts (optional separately)

## ► ES Analog Output-Common Options

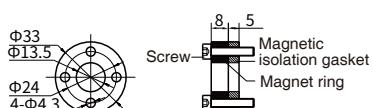
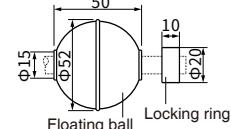
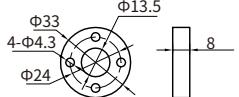
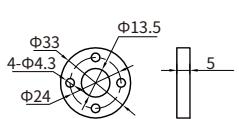
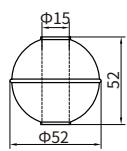
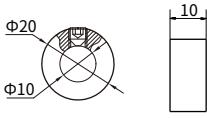
- Plug assembly cable

Accessory name/model	Dimensions	Description
Analog Output Cable assembly Order No.:AST-Mxxx-W06		Mxxx denotes cable length in meters; W06-5-pin PUR black sheath, temperature resistance of -40~80°C Cable assembly.
Analog output right angled cable assembly Order No.:AST-Mxxx-W05		Mxxx denotes cable length in meters; W05-5-pin PUR black sheath, temperature resistance of -40~80°C Cable assembly.

- Finished plug cable

Accessory name/model	Dimensions	Description
M12 female connector Order No.:521801-2 (3/5/10)		PUR black sheath, line core 1 brown, 2 white, 3 blue, 4 black, 5 gray, temperature resistance -40°C~80°C.
M12 right angle female connector Order No.:521804-2 (5)		PUR black sheath, line core 1 brown, 2 white, 3 blue, 4 black, 5 gray, temperature resistance -40°C~80°C.

- Magnet ring/floating ball

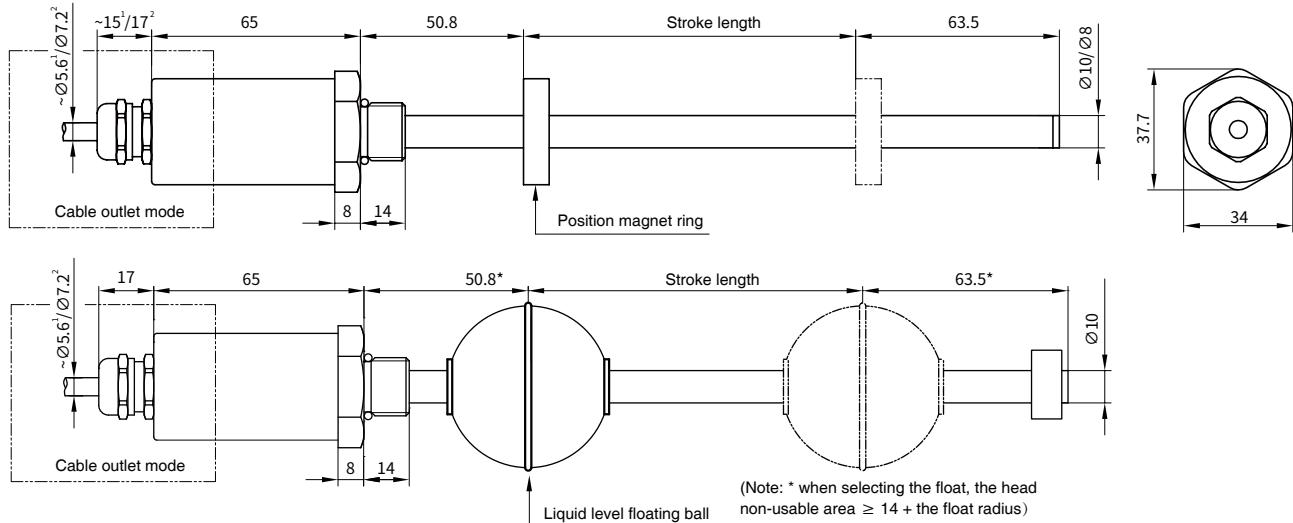
Accessory name/model	Dimensions	Description
Standard magnet ring kit Order No.:288501		One magnet ring 211501, one gasket 211521 (thickness 5mm), four M4X20 socket screws with spring washers
Floating ball kit Order No.:266001		One floating ball 211546, a set of locking rings 211589. Floating ball material 304, pressure resistance 2.5MPa; density 0.6; locking ring material 304.
Standard magnet ring Order No.:211501		
Magnetic isolation gasket Order No.:211521		
Floating ball Order No.:211546		Material 304, pressure resistance 2.5 MPa, density 0.6
Locking ring Order No.:211589		Material 304

**Note:** For other accessories, please refer to general options

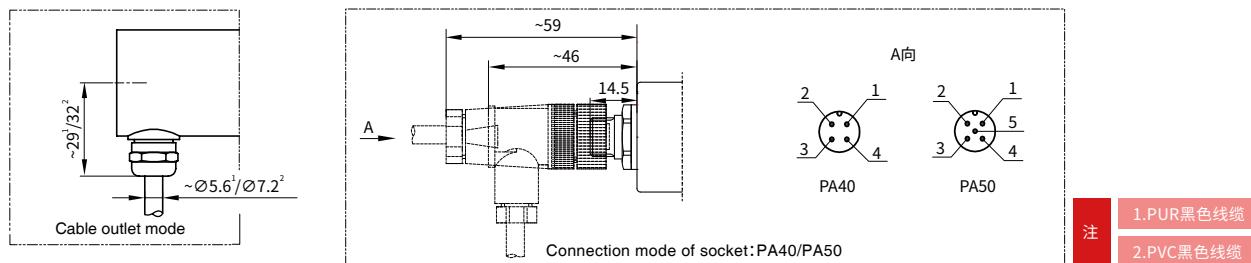
# ES-Modbus Output

## ◎ Structural shape

- Dimensions of cable outlet



- Outline dimensions of connector outlet



## ◎ Wiring and pin definition



• PA40/PA50 pin arrangement (Sensor Oriented)				
Pin	Cable color1*	Cable color2*	Cable color3*	Function definition
1	Brown	Red	Red	24Vdc power supply (-20%~+20%)
2	White	Black	Black	GND (power supply circuit)
3	Blue	Yellow	Brown	T+(A)
4	Black	White	Green	T-(B)
5	-	-	-	Do not connect

Note: \* Cable color1: Cable PUR sheath, black, -40~80°C, end scattered

\* Cable color2: Cable PUR sheath, orange, -20~90°C, end scattered

\* Cable color 3: Cable PVC sheath, black, -40~80°C, end scattered

## ► ES Modbus Output-Product Parameters

• Input	
Measuring data	Position magnet ring or position floating ball
Stroke length	25~3500 mm, others can be customized according to needs
• Output	
Interface	Modbus RTU protocol
Resolution	Minimum 10um
Nonlinearity	Minimum ± 50um or <0.01%.F.S
Repeatability	Minimum ± 10um or <0.001%.F.S
Update time	Default 20ms Adjustable according to range 1~50ms
Communication rate	1200/2400/4800/9600/19200/38400/57600/115200 bps
Check method	No/odd/even check (default no check)
Temperature coefficient	<10ppm/°C(temperature compensation required)
Temperature functional parameters	The operating temperature resolution is 0.25°C
Temperature measuring position	Electronic compartment
Operating temperature accuracy	≤1°C
• Operating conditions	
Magnet velocity	Arbitrary
Protection class	IP67
Operating temperature	-40°C ~ +75°C
Humidity/dew point	Humidity 90%, no condensation
Shock index	GB/T2423.5 50g(6ms)
Vibration index	GB/T2423.10 15g/10~2000Hz
EMC test	GB/T17626.2 Anti-interference Degree of Electrostatic Discharge, Grade 3, Class A GB/T17626.3 Radiation Anti-interference Degree of Radio Frequency Electromagnetic Field, Grade 3, Class A GB/T17626.4 Anti-interference Degree of Electrical Fast Transient Train, Grade 3, Class B GB/T17626.6 RF Field Induced Conducted Disturbance Immunity, Grade 2, Class A GB/T17626.8 Power Frequency Magnetic Field Immunity, Grade 3, Class A CE certification
• Electrical Connections	
Input voltage	9~ 30Vdc
Power consumption	<80mA
Polarity protection	Maximum-30Vdc
Oversupply protection	Maximum36Vdc
Insulation resistance	>10MΩ
Insulation strength	500V
• Construction and Materials	
Electronic compartment	304Lstainless steel
Measuring rod	304L/316L stainless steel
Outer tube pressure	35Mpa (continuous)/70Mpa (peak) rod diameter Φ10
Installation	Any direction, threaded installation (thread specification is optional)
Position magnet	Various annular magnets or floating balls
Outgoing mode	Cable outlet (scattered connection), connector (M12 connector)

# ► ES Modbus Output-Selection Guide



01 - 02	Sensor shell form
E S	Pressure-resistant pipe
03 - 07	Range (0025~5500mm, others can be customized as needed)
	0025~0500mm step length 5mm
	0500~0750mm step length 10mm
	0750~1000mm step length 25mm
	1000~3500mm step length 50mm
08 - 09	Mounting thread form
S 1	M18X1.5, measuring rod diameter 10mm, 304 material
S 2	M20X1.5, measuring rod diameter 10mm, 304 material
S 3	3/4"-16UNF-3A, measuring rod diameter 10mm, 304 material
T 1	M18X1.5 mounting thread, measuring rod diameter 8mm, 316 material
T 2	M20X1.5 mounting thread, measuring rod diameter 8mm, 316 material
T 3	3/4"-16UNF-3A mounting thread, measuring rod diameter 8mm, 316 material
10 - 13	Connection form
10 - 11	Outlet type
D E	Cable outlet, PVC sheath, black, -40~80°C, end scattered, Cable color 3
D W	Cable outlet, PUR sheath, black, -40~80°C, end scattered, Cable color 1
D H	Cable outlet, PUR sheath, orange, -20~90°C, end scattered, Cable color 2
C W	Side outlet, PUR sheath, black, -40~80°C, end scattered, Cable color 1
C H	Side outlet, PUR sheath, orange, -20~90°C, end scattered, Cable color 2
12 - 13	Cable length, 01~99 meters
10 - 13	Connector form
P A 4 0	M12 4-pin socket, plug cable needs to be selected separately
P A 5 0	M12 5-pin socket, plug cable needs to be selected separately

## ● Selection example

For example: ES-M0300-S1-PA50-R111C-S0-CN

Indicates: ES voltage-resistant round pipe structure, 300mm Stroke length, M18X1.5 installation thread, 10mm diameter, 304 material measuring rod, M12 5-pin socket connection mode, 24Vdc power supply RTU protocol output, baud rate 19200bps, reverse output, single position magnet ring, output 0 without magnet ring, standard head and end non-used area 50.8 mm+63. 5mm.(Note: Factory default address 1)

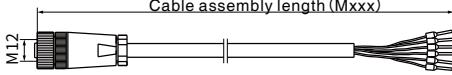
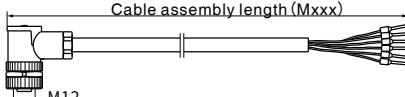
## ● Supply list

Sensor, certificate, instruction manual, optional parts (optional separately)

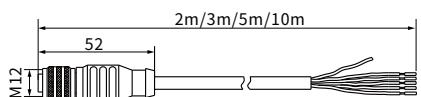
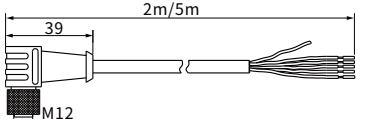
14 - 19	Signal output mode
14	Communication protocol and power supply
R	RTU protocol, 24Vdc power supply, resolution 0.1mm
K	RTU protocol 1, 9~30Vdc power supply, resolution 0.1mm
B	RTU protocol 2, 24Vdc power supply, resolution 0.01mm, with temperature measuring
15	Communication rate
1	19200 bps
2	1200 bps
3	2400 bps
4	4800 bps
5	38400 bps
6	57600 bps
7	115200 bps
9	9600 bps
16	Output forward and reverse
0	Forward (when the magnet ring or floating ball is far away from the electronic compartment, the output value increases)
1	Reverse (when the magnet ring or floating ball is far away from the electronic compartment, the output value decreases)
17	Reserved bit
1	Single magnet ring
2	Single floating ball
3	Double floating ball
4	Double magnet ring
5	Tri-magnet ring
18	No magnet ring state
A	keep the original value
B	Maximum (Output forward default value)
C	Minimum value (output reverse default value)
19	Check method
0	No check (default)
1	Odd check
2	Even check
20 - 21	Non-used area at head and end
S 0	50.8mm+63.5mm
22 - 23	Country
	Refer to the country list, page 61.

## ► ES Modbus Output-Common Options

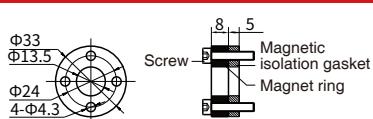
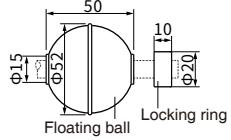
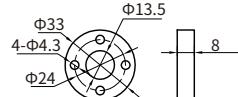
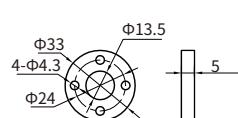
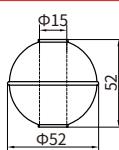
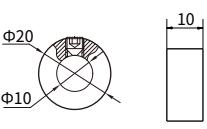
- Plug assembly cable

Accessory name/model	Dimensions	Description
Modbus interface cable assembly Order No.:AST-Mxxx-W06		Mxxx denotes cable length in meters; W06-5-pin PUR black sheath, temperature resistance of -40~80°C Cable assembly.
Modbus interface right angled cable assembly Order No.:AST-Mxxx-W05		Mxxx denotes cable length in meters; W05-5-pin PUR black sheath, temperature resistance of -40~80°C Cable assembly.

- Finished plug cable

Accessory name/model	Dimensions	Description
M12 female connector Order No.:521801-2 (3/5/10)		PUR black sheath, line core 1 brown, 2 white, 3 blue, 4 black, 5 gray, temperature resistance -40°C~80°C.
M12 Right angle female connector Order No.:521804-2 (5)		PUR black sheath, line core 1 brown, 2 white, 3 blue, 4 black, 5 gray, temperature resistance -40°C~80°C.

- Magnet ring/floating ball

Accessory name/model	Dimensions	Description
Standard magnet ring kit Order No.:288501		One magnet ring 211501, one gasket 211521 (thickness 5mm), four M4X20 socket screws with spring washers.
Floating ball kit Order No.:266001		One floating ball 211546, a set of locking rings 211589. Floating ball material 304, pressure resistance 2.5MPa, density 0.6; locking ring material 304.
Standard magnet ring Order No.:211501		
Magnetic isolation gasket Order No.:211521		
Floating ball Order No.:211546		Material 304, pressure resistance 2.5 MPa, density 0.6
Locking ring Order No.:211589		Material 304

Note: For other accessories, please refer to general options





# EP Displacement Sensor



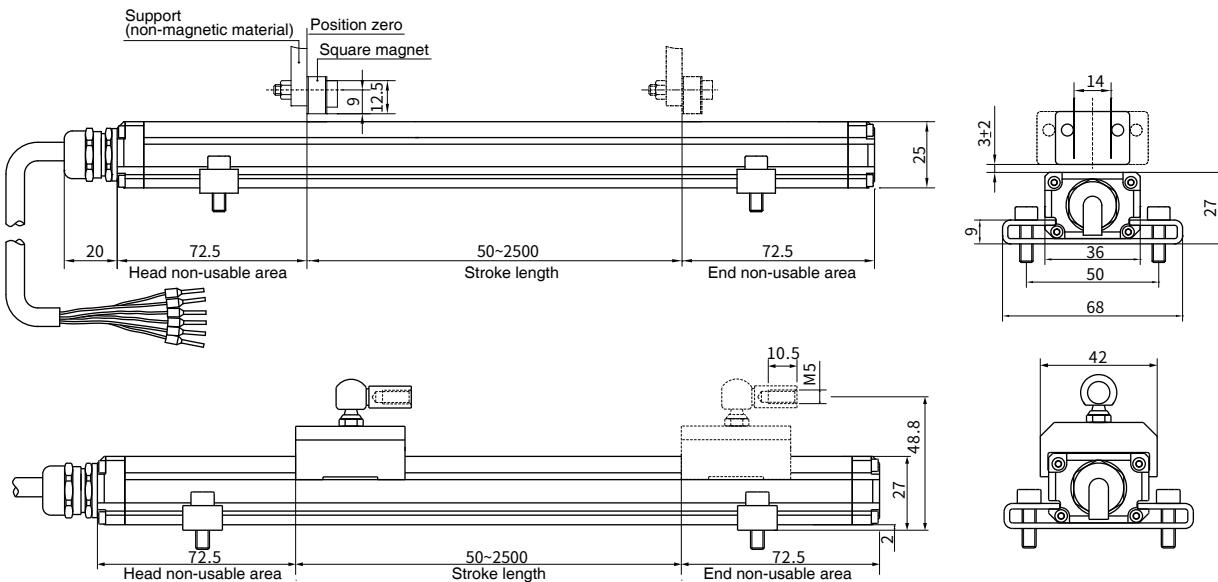
## Technical characteristics

- Compact structure, convenient disassembly and assembly
- Linear measuring, absolute position output
- Never wear and tear, not affected by power failure
- Replaceable: LVDT, electronic ruler, encoder, etc.

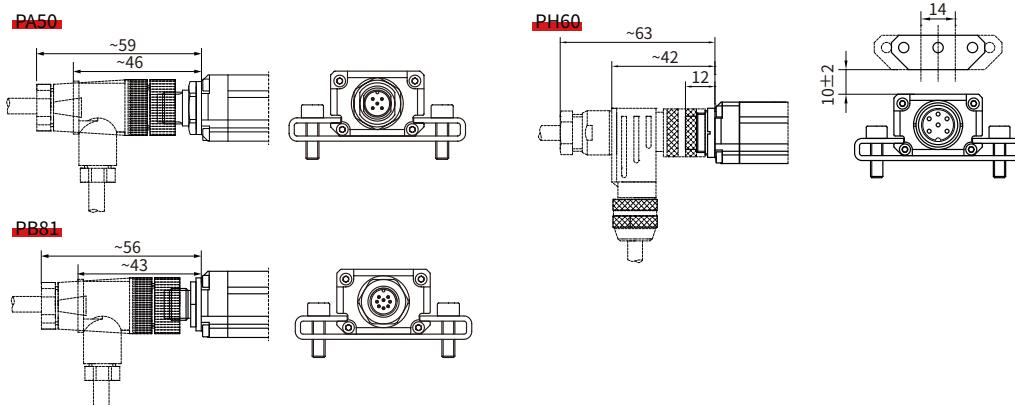
# EP-Analog Output

## ► Structural shape

- Cable outlet DHXX/DUXX/DWXX



- Connector PA50/PB81/PH60



## ► Wiring and pin definition



### • PA50 pin arrangement (Sensor Oriented)

Pin	Cable color3*	Function definition
1	Brown	+24Vdc±20% power supply
2	White	GND (power supply circuit)
3	Blue	Magnet ring position signal+
4	Black	Magnet ring position signal-
5	Grey	Sensor programming line

Note: \* Cable color 1: Cable PUR sheath, black, -20~90°C

\* Cable color 2: Cable PVC sheath, orange, -20~105°C

\* Cable color 3: Cable PUR Sheath, Black, -40~85°C

Note: The shield wire of the shielded cable is grounded

### • PH60 pin arrangement (Sensor Oriented)

Pin	Cable color1*	Cable color2*	Function definition
1	Blue	Grey	Magnet ring position signal+
2	Green	Pink	Magnet ring position signal-
3	Yellow	Yellow	Sensor programming line
4	White	Green	Sensor programming line
5	Red	Brown	+24Vdc±20% power supply
6	Black	White	GND (power supply circuit)

### • PB81 pin arrangement (Sensor Oriented)

Pin	Function definition
1	Do not connect
2	Magnet ring position signal-
3	Do not connect
4	Sensor programming line
5	Magnet ring position signal+
6	GND (power supply circuit)
7	+24Vdc power supply (-20%~+20%)
8	Sensor programming line

## ► EP Analog Output-Product Parameters

• Input	
Measuring data	Position magnet ring
Stroke length	50~2500 mm, others can be customized according to needs
• Output	
Current	0 ~ 20mA or 4 ~ 20mA (min/max load 0/500Ω)
Voltage	0 ~ 10Vdc or 0~5Vdc (minimum load resistance $\geq 10K\Omega$ )
Resolution	14-bit D/A or 0.0065% of full scale (minimum 10μm)
Nonlinearity	<±0.03% of full scale
Repeatability	<±0.005% of full scale
Update time	1ms(range≤1m) 2ms(1m<range≤2m) 3ms(2m<range≤3m)
Hysteresis	<10μm
• Operating conditions	
Magnet velocity	Arbitrary
Protection class	IP65
Operating temperature	-40°C ~ +85°C
Temperature coefficient	<30ppm/°C
Humidity/dew point	Humidity 90%, no condensation
Shock index	GB/T2423.5 50g(11ms)
Vibration index	GB/T2423.10 10g/10~2000Hz
EMC test	
GB/T17626.2 Anti-interference Degree of Electrostatic Discharge, Grade 4, Class A	
GB/T17626.3 Radiation Anti-interference Degree of Radio Frequency Electromagnetic Field, Grade 3, Class A	
GB/T17626.4 Anti-interference Degree of Electrical Fast Transient Train, Grade 4, Class A	
GB/T17626.6 RF Field Induced Conducted Disturbance Immunity, Grade 2, Class A	
GB/T17626.8 Power Frequency Magnetic Field Immunity, Grade 3, Class A	
CE certification	
• Electrical Connections	
Input voltage	+24Vdc±20%
Power consumption	<80mA
Polarity protection	Maximum-30Vdc
Overvoltage protection	Maximum36Vdc
Insulation resistance	>10MΩ
Insulation strength	500V
• Construction and Materials	
Measuring rod	Aluminum profile
Installation	Any direction, clamp installation
Position magnet	Square magnet, trapezoidal magnet
Outgoing mode	Cable outlet (scattered connection), connector (M16 or M12 connector)

## ► EP Analog Output-Selection Guide

E	P	-	M	03	04	05	06	07	-	C	08	09	-	10	11	12	13	-	14	15	16	17	-	18	19	-	20	21
01	02		Sensor shell form												Signal output mode													
E	P	Overall profile structure series												Signal output mode														
03 - 07	Range (0050~2500mm, others can be customized as needed)												Current output, 4 ~ 20mA															
		0050~0500mm step length 5mm												Current output, 20 ~ 4mA														
		0750~1000mm step length 25mm												Current output, 0 ~ 20mA														
		1000~2500mm step length 50mm												Current output, 20 ~ 0mA														
08 - 09	Magnet form												Voltage output, 0 ~ 10V															
C	2	Slider magnet (211517)												Voltage output, 10 ~ 0V														
C	3	Square magnet (211508)												Voltage output, 0 ~ 5V														
C	4	Trapezoidal magnet (211514)												Voltage output, 5 ~ 0V														
10 - 13	Connection form												Reserved bit															
10 - 11	Cable outlet mode												Single magnet ring															
D	H	PUR sheath, orange,-20~90°C, end scattered, Cable color 1												No magnet ring state														
D	U	PVC sheath, orange,-20~105°C, end scattered, Cable color 2												Keep the original value														
D	W	PUR sheath, black,-40~85°C, end scattered, Cable color 3												Maximum value														
		Cable length, 01~99 units: m (cable outlet mode)												Minimum value														
12 - 13	Connector form												18 - 19 Non-used area at head and end															
P	A	5	0	M12 5-pin male socket, plug cable needs to be selected separately												B 1 72.5mm+72.5mm												
P	H	6	0	M16 6-pin male socket, plug cable needs to be selected separately												D 2 73mm+73mm												
P	B	8	1	M12 8-pin male socket												20-21 Country												
				Refer to the country list, page 61.																								

### ● Selection example

For example: EP-M0300-C0-PB81-A01B-B1-CN

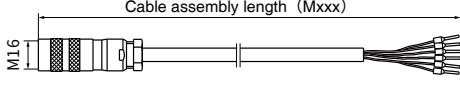
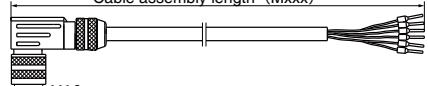
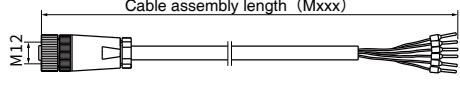
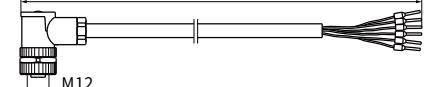
Indicates: EP integral profile structure, mounting clamp installation, 300mm Stroke length, no magnet block, M12 connector outlet form, current output of 4~20mA, output value of non-magnet ring less than 4mA, non-used area at head and end of 72.5 mm+72.5mm.

### ● Supply list

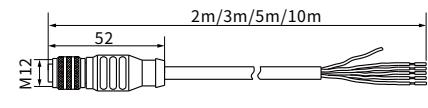
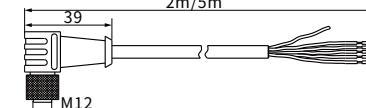
Sensor, certificate, instruction manual, optional parts (optional separately)

## ► EP Analog Output - Common Options

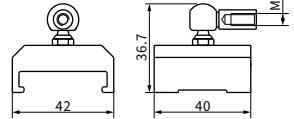
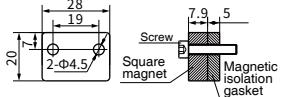
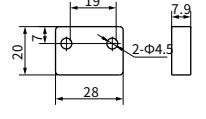
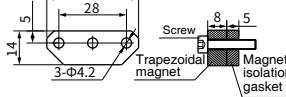
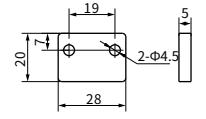
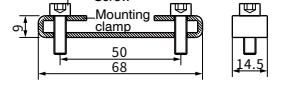
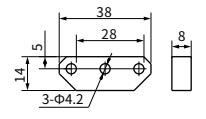
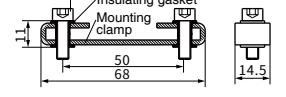
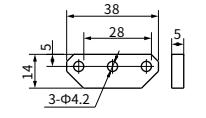
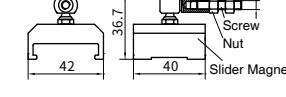
- Plug assembly cable

Accessory name/model	Dimensions	Description
Analog wiring cable assembly Order No.:AST-Mxxx-H01 (U01)	 Cable assembly length (Mxxx)	Mxxx denotes cable length in meters; H01-6-pin PUR orange sheath, temperature-resistant -20~90°C cable assembly; U01-6-pin PVC orange sheath, temperature resistance -20~105°C cable assembly.
Analog wiring right angled cable assembly Order No.:AST-Mxxx-H03 (U03)	 Cable assembly length (Mxxx)	Mxxx denotes cable length in meters; H03-6-pin PUR orange sheath, temperature-resistant -20~90°C cable assembly; U03-6-pin PVC orange sheath, temperature resistance -20~105°C cable assembly.
Analog output cable assembly Order No.:AST-Mxxx-W06	 Cable assembly length (Mxxx)	Mxxx denotes cable length in meters; W06-5-pin PUR black sheath, temperature -40~80°C cable assembly.
Analog output right angled cable assembly Order No.:AST-Mxxx-W05	 Cable assembly length (Mxxx)	Mxxx denotes cable length in meters; W05-5-pin PUR black sheath, temperature -40~80°C cable assembly.

- Finished plug cable

Accessory name/model	Dimensions	Description
M12 female connector Order No.:521801-2 (3/5/10)	 M12	PUR black sheath, line core 1 brown, 2 white, 3 blue, 4 black, 5 gray, temperature resistance -40°C~80°C.
M12 Right angle female connector Order No.:521804-2 (5)	 M12	PUR black sheath, line core 1 brown, 2 white, 3 blue, 4 black, 5 gray, temperature resistance -40°C~80°C.

- Magnet ring/floating ball

Accessory name/ model	Dimensions	Accessory name/ model	Dimensions	Description
Slider Magnet Order No.:211517		Square Magnet Order No.:288508		One square magnet 211508, one square magnet gasket 211529 (thickness 5mm), two M4X20 socket screws
Square magnet Order No.:211508		Trapezoidal magnet kit Order No.:288514		One trapezoidal magnet 211514, one trapezoidal magnet gasket 211530 (thickness 5mm), three M4X20 socket screws
Square magnet gasket Order No.:211529		Mounting clamp kit Order No.:211561		One mounting clamp, two M5X16 socket screws
Trapezoidal magnet Order No.:211514		Mounting clamp kit (With insulation) Order No.:211801		One mounting clamp, two M5X16 socket head cap screws, four insulating washers
Trapezoidal magnet gasket Order No.:211530		Slider Magnet Kit Order No.:288517		One slider Magnet 211517, one M5x25Screw, Two M5 Nuts

Note: For other accessories, please refer to general options





# HP Displacement Sensor



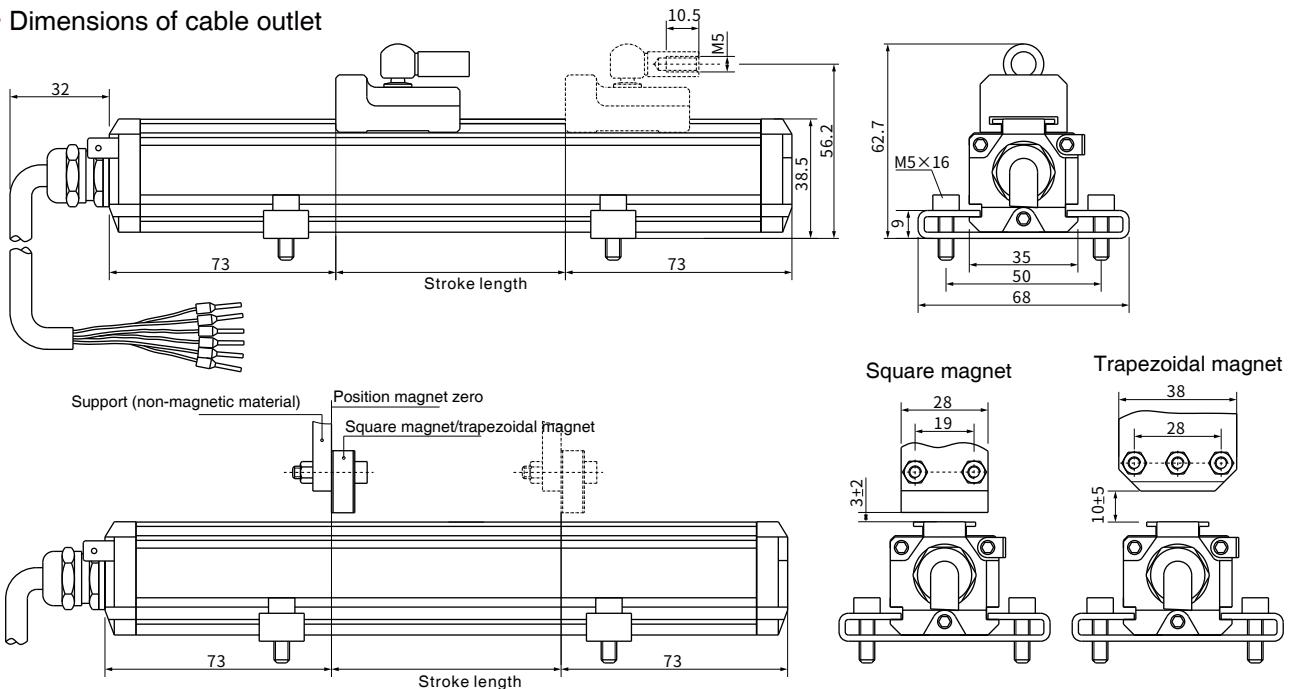
## Technical characteristics

- Compact structure, convenient disassembly and assembly
- Linear measuring, absolute position output
- Rugged and fully enclosed design
- Digital technology, stable and reliable

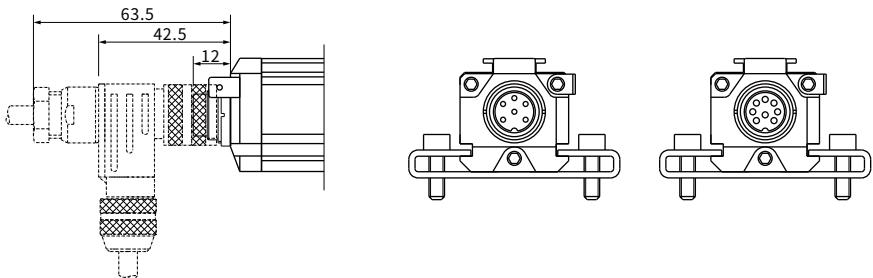
# HP-Analog Output

## ◎ Structural shape

- Dimensions of cable outlet



- Outline dimensions of connector outlet



## ◎ Wiring and pin definition



- 6-pin male connector arrangement (Sensor Oriented)

Pin	Cable color 1*	Cable color 2*	Function definition
1	Blue	Grey	Magnet ring position signal+
2	Green	Pink	Magnet ring position signal-
3	Yellow	Yellow	Reservation
4	White	Green	Reservation
5	Red	Brown	+24Vdc power supply (-20%~+20%)
6	Black	White	GND (power supply circuit)

- 8-pin male connector arrangement (Sensor Oriented)

Pin	Cable color 3*	Function definition
1	Yellow	Current output
2	Grey	current/voltage circuit
3	Pink	Reservation
4	-	Reservation
5	Green	Voltage output
6	Blue	GND (power supply circuit)
7	Brown	+24Vdc power supply (-20%~+20%)
8	White	Reservation

Note: \* Cable color 1: Cable PUR sheath, orange, -20~90°C

\* Cable color 2/3: Cable PUR sheath, orange, -20~90°C

## ► HP Analog Output-Product Parameters

• Input	
Measuring data	Position magnet ring
Stroke length	50~2500 mm (customized according to customer's needs)
• Output	
Current	4 ~ 20mA or 20~4mA(min/max load 0/500Ω)
Voltage	0 ~ 10Vdc or 0~5Vdc (minimum load resistance $\geq 10K\Omega$ )
Resolution	16-bit D/A or 0.0015% of full scale (minimum 5μm)
Nonlinearity	< 0.02% of full scale
Repetition accuracy	< ± 0.005% of full scale
Update time	1ms(range ≤ 1m)、2ms(1m < range ≤ 2m)、3ms(2m < range ≤ 3m)
Hysteresis	<10μm
• Operating conditions	
Magnet velocity	Arbitrary
Protection class	IP65
Operating temperature	-40°C ~ +85°C
Humidity/dew point	Humidity 90%, no condensation
Temperature coefficient	<30ppm/°C
Shock index	GB/T2423.5 50g(6ms)
Vibration index	GB/T2423.10 20g/10~2000Hz
	GB/T17626.2 Anti-interference Degree of Electrostatic Discharge, Grade 3, Class A
	GB/T17626.3 Radiation Anti-interference Degree of Radio Frequency Electromagnetic Field, Grade 3, Class A
	GB/T17626.4 Anti-interference Degree of Electrical Fast Transient Train, Grade 3, Class A
EMC test	GB/T17626.6 RF Field Induced Conducted Disturbance Immunity, Grade 2, Class A
	GB/T17626.8 Power Frequency Magnetic Field Immunity, Grade 3, Class A
	CE certification
• Electrical Connections	
Input voltage	+24Vdc±20%
Power consumption	<80mA
Polarity protection	Maximum-30Vdc
Oversupply protection	Maximum 36Vdc
Insulation resistance	>10MΩ
Insulation strength	500V
• Construction and Materials	
Measuring rod	Aluminum profile
Installation	Movable mounting clamp
Position magnet	Slider magnet, trapezoidal magnet
Outgoing mode	Cable outlet or connector

## ► HP Analog Output-Selection Guide

<b>H</b>	<b>P</b>	-	<b>M</b>	04	05	06	07	-	<b>C</b>	09	-	10	11	12	13	-	14	15	16	17	-	18	19	-	20	21
01 - 02	Sensor shell form																									
H P	Overall profile structure series																									
03 - 07	Range (0050~2500mm, others can be 0050~500mm step length 25mm 0500~1000mm step length 50mm 1000~2500mm step length 100mm)																									
08 - 09	Magnet form																									
C 2	Slider magnet (211513)																									
C 3	Square magnet (211508)																									
C 4	Trapezoidal magnet (211514)																									
10 - 13	Connection form																									
10 - 11	Cable outlet mode																									
D H	PUR sheath, orange,-20~90°C, end scattered, Cable color 1																									
D U	PVC sheath, orange,-20~105°C, end scattered, Cable color 2																									
D B	PVC sheath, orange,-20~105°C, end scattered, Cable color 3																									
12 - 13	Cable length, 01~99 units: m (cable outlet mode)																									
10 - 13	Connector form																									
P H 6 0	M16 6-pin socket, plug cable needs to be selected separately																									
P B 8 0	M16 8-pin socket, plug cable needs to be selected separately																									
14 - 17	Signal output mode																									
14 - 15	Communication interface																									
A 0	Current output, 4 ~ 20mA																									
A 1	Current output, 20 ~ 4mA																									
A 2	Current output, 0 ~ 20mA																									
A 3	Current output, 20 ~ 0mA																									
V 0	Voltage output, 0 ~ 10V																									
V 1	Voltage output, 10 ~ 0V																									
V 4	Voltage output, 0 ~ 5V																									
V 5	Voltage output, 5 ~ 0V																									
16	Reserved bit																									
1	1 position magnet																									
17	No magnet ring state																									
A	Keep the original value																									
B	Maximum value																									
C	minimum																									
18 - 19	Non-used area at head and end																									
B 1	72.5mm+72.5mm																									
D 2	73mm+73mm																									
20-21	Country																									
	Refer to the country list, page 61.																									

### ● Selection example

For example: HP-M0300-C2-PH60-A01B-B1-CN

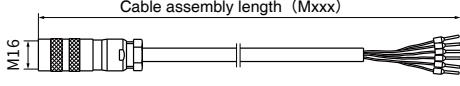
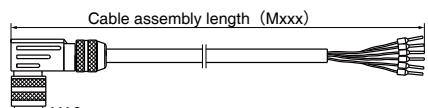
Indicates: HP structure, mounting clamp installation, 300mm Stroke length, C-type magnet, M16 male socket (without plug cable), current output of 4~20mA, output value larger than 20mA without magnet ring, non-used area at head and end of 72.5 mm+72.5 mm.

### ● Supply list

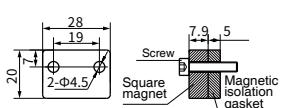
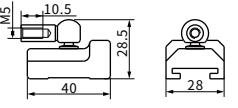
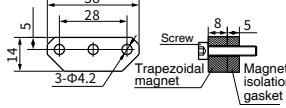
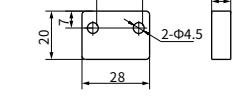
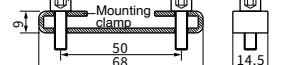
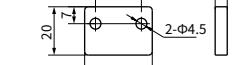
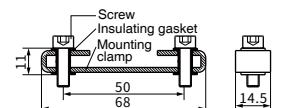
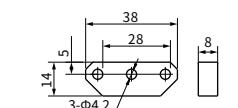
Sensor, certificate, instruction manual, optional parts (optional separately)

## ► HP Analog Output - Common Options

- Plug assembly cable

Accessory name/model	Dimensions	Description
Analog wiring cable assembly Order No.: AST-Mxxx-H01 (U01/U02)		Mxxx denotes cable length in meters; H01-6-pin PUR orange sheath, temperature-resistant-20~90°C cable assembly; U01-6-pin PVC orange sheath, temperature resistance -20~105°C cable assembly; U02-8-pin PVC orange sheath, temperature -20~105°C cable assembly.
Analog wiring right angled cable assembly Order No.: AST-Mxxx-H03 (U03/U04)		Mxxx denotes cable length in meters; H03-6-pin PUR orange sheath, temperature-resistant -20~90°C cable assembly; U03-6-pin PVC orange sheath, temperature resistance -20~105°C cable assembly; U04-8-pin PVC orange sheath, temperature -20~105°C cable assembly.

- Magnet ring

Accessory name/model	Dimensions	Description	Accessory name/model	Dimensions
Square magnet kit Order No.:288508		One square magnet 211508, one square magnet gasket 211529 (thickness 5mm), two M4X20 socket screws	Slider Magnet Order No.:211513	
Trapezoidal magnet kit Order No.:288514		One trapezoidal magnet 211514, one trapezoidal magnet gasket 211530 (thickness 5mm), three M4X20 socket screws	Square magnet Order No.:211508	
Mounting clamp kit Order No.:211561		One mounting clamp, two M5X16 socket screws	Square magnet gasket Order No.:211529	
Mounting clamp kit (With insulation) Order No.:211801		One mounting clamp, two M5X16 socket head cap screws, four insulating washers	Trapezoidal magnet Order No.:211514	
<b>Note:</b> For other accessories, please refer to general options				





# ED Displacement Sensor



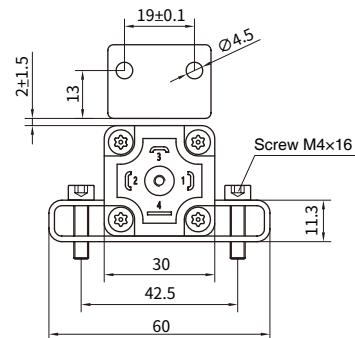
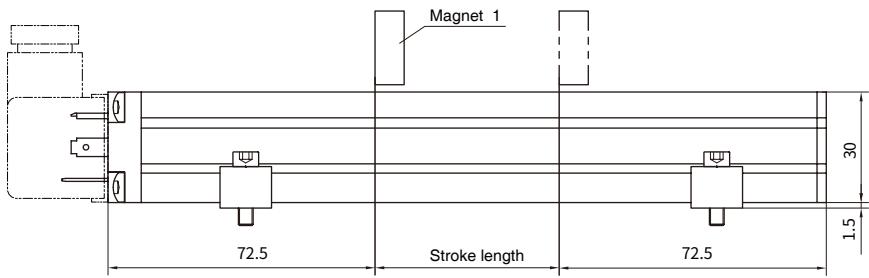
## Technical characteristics

- Non-contact measuring, never wear
- Ultra-small profile, suitable for installation in compact occasions
- Up to two position signal outputs

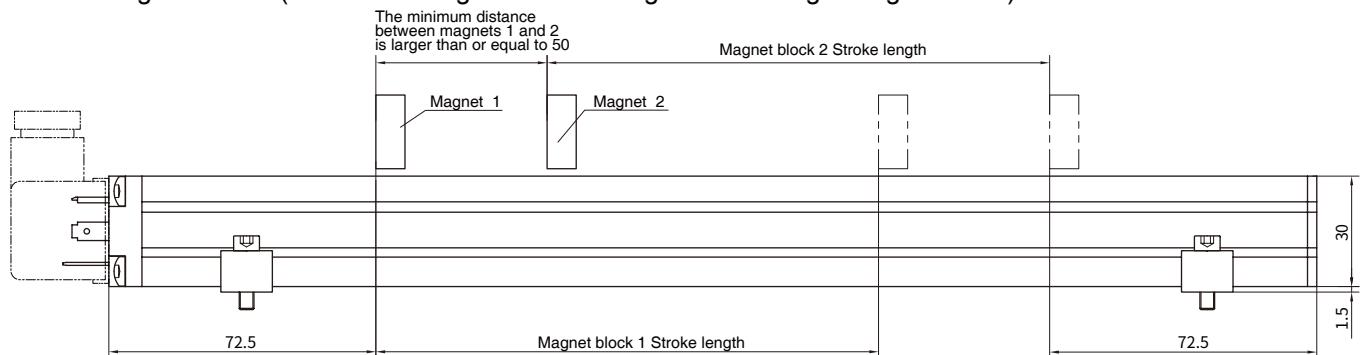
# ED-Analog Output

## ◎ Structural shape

- Single magnet



- Two magnet blocks (the sensor length is 50mm longer than a single magnet block)



## ◎ Wiring and pin definition

No.	Single magnet block pin definition	Two magnet blocks pin definition
1	0~10VDC or 10~0VDC Magnet block1	0~10VDC or 10~0VDC Magnet block2
2	10~0VDC or 0~10VDC Magnet block1	10~0VDC or 0~10VDC Magnet block1
3	+24VDC	+24VDC
4	GND	GND

## ► ED Analog Output - Product Parameters

• Output	
Measuring data	Position magnet ring
Stroke length	50~3000 mm,dual position output 50~3000
Voltage	0~10V/10~0V,single/dual
Resolution	0.025% of full scale (minimum 10um)
Nonlinearity	< ± 0.05% of full scale
Repetition accuracy	< ± 0.01% of full scale
Update time	2ms
• Operating conditions	
Magnet velocity	Arbitrary
Protection class	IP65
Operating temperature	-40°C ~ +75°C
Humidity/dew point	Humidity 90%, no condensation
Shock index	GB/T2423.5 50g(11ms)
Vibration index	GB/T2423.10 5g/10~2000Hz
EMC test	GB/T17626.2 Anti-interference Degree of Electrostatic Discharge, Grade 4, Class A GB/T17626.3 Radiation Anti-interference Degree of Radio Frequency Electromagnetic Field, Grade 3, Class B GB/T17626.4 Anti-interference Degree of Electrical Fast Transient Train, Grade 4, Class B GB/T17626.6 RF Field Induced Conducted Disturbance, Grade 2, Class B GB/T17626.8 Power Frequency Magnetic Field Anti-interference Degree, Grade 3, Class A CE certification
• Electrical Connections	
Input voltage	+24Vdc±20%
Power consumption	< 80mA
Polarity protection	Maximum -30Vdc
Overvoltage protection	Maximum 36Vdc
Insulation resistance	>10MΩ
Insulation strength	500V
• Construction and Materials	
Measuring rod	Aluminum alloy
Outgoing line connection	DIN46530(A)
Installation	Any direction, clamp installation
Position magnet	Suspension magnet

## ► ED Analog Output-Selection Guide



01 - 02	Sensor shell form
E D	Integral profile structure series
03 - 07	Measuring range (0025~3000mm, others can be customized according to needs)
	0025~0750mm step length 5mm
	0750~1000mm step length 25mm
	1000~3000mm step length 50mm
08 - 09	Magnet form
	C3 square magnet
10 - 13	Outgoing mode/Cable length
P D 4 0	DIN46530, A-type socket and Connector
14 - 16	Communication interface
V A 1	Single magnet block, voltage 0~10V
V B 1	Single magnet block, voltage 10~0V
V A 2	Two magnet blocks, voltage 0~10V and voltage 0~10V
V B 2	Two magnet blocks, voltage 0~10V and voltage 10~0V
V C 2	Two magnet blocks, voltage 10~0V and voltage 10~0V
V D 2	Two magnet blocks, voltage 10~0V and voltage 0~10V
17 - 18	Non-usable area at head and end
B 1	72.5mm+72.5mm
19 - 20	Country
	Refer to the country list, page 61.

### ● Selection example

For example: ED-M0300-C3-PD40-VA1-B1

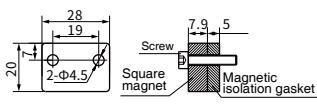
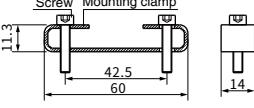
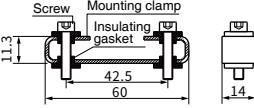
Indicates: ED structure, mounting clamp installation, 300mm Stroke length, standard DIN46530, A-type socket and Connector, single magnet block, output signal 0~10V, non-useable area at head and end 72.5mm+72.5mm.

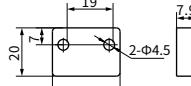
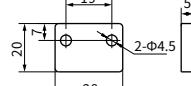
### ● Supply list

Sensor, certificate, instruction manual, optional parts (optional separately)

## ► ED Analog Output-Common Options

- Magnet ring

Accessory name/ model	Dimensions	Description
Square magnet kit Order No.:288508		One square magnet 211508, one square magnet spacer 211529 (thickness 5mm), two M4X20 socket head cap screws.
Mounting clamp kit Order No.:211584		One mounting clamp, two M4X20 socket screws.
Mounting clamp kit (With insulation) Order No.:211584A		One mounting clamp, two M4X20 socket screws, Four insulating washers.

Accessory name/ model	Dimensions
Square magnet Order No.:211508	
Square magnet gasket Order No.:211529	

**Note:** For other accessories, please refer to general options



# ESC Displacement Sensor

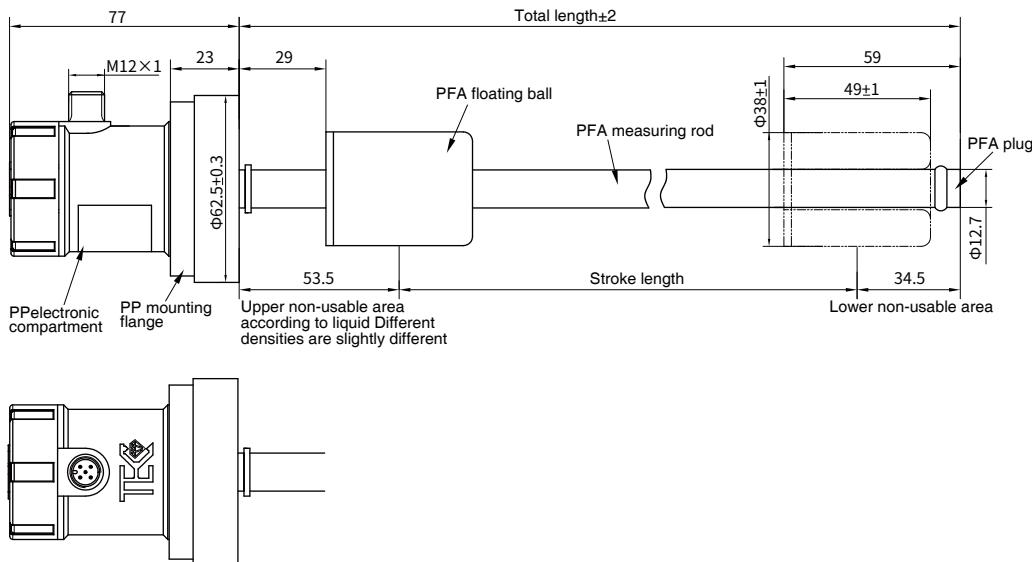


## Technical characteristics

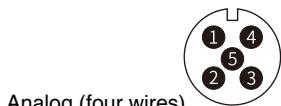
- Non-contact measuring, never wear
- PFA material shell, strong acid and alkali corrosion resistance
- Resolution 0.01, high precision liquid level detection
- The communication interface is rich and can be customized according to needs

# ESC-Analog Output

## ► Structural shape



## ► Wiring and pin definition



- PA50 pin arrangement (Sensor Oriented)

Pin	Cable color	Function definition
1	Brown	+24Vdc±20% Power Supply
2	White	GND (power supply circuit)
3	Blue	Magnet ring position signal+
4	Black	Magnet ring position signal-
5	Grey	Shielded wire

## ► ESC Analog Output-Product Parameters

• Input	
Measuring data	Position magnet ring
Stroke length	25~2500 mm, others can be customized according to needs
• Output	
Current	4 ~ 20mA or 20 ~ 4mA(min/max load 0/500Ω)
Voltage	0 ~ 10Vdc or 0~5Vdc (minimum load resistance $\geq 10K\Omega$ )
Resolution	$\pm 0.01\text{mm}$ , 16bitDA, current $\pm 0.1\text{mm}$ , 12bitDA, Voltage
Nonlinearity	0.05%F.S
Repetition accuracy	Same resolution
Update time	1ms ( range $\leq 1\text{m}$ )、2ms ( $1\text{m} < \text{range} \leq 2\text{m}$ )、3ms ( $\text{range} > 2\text{m}$ )
• Operating conditions	
Magnet velocity	Arbitrary
Protection class	IP67
Operating temperature	-40°C ~ +75°C
Humidity/Dew Point	Humidity 90%, no condensation
Impact Indicator	GB/T2423.5 50g(6ms)
Vibration index	GB/T2423.10 15g/10~2000Hz
EMC test	GB/T17626.2 Anti-interference Degree of Electrostatic Discharge, Grade 3, Class A GB/T17626.3 Radiation Anti-interference Degree of Radio Frequency Electromagnetic Field, Grade 3, Class A GB/T17626.4 Anti-interference Degree of Electrical Fast Transient Train, Grade 3, Class B GB/T17626.6 RF Field Induced Conducted Disturbance, Grade 2, Class A GB/T17626.8 Power Frequency Magnetic Field Anti-interference Degree, Grade 3, Class A CE certification

• Electrical Connections		• Construction and Materials	
Input voltage	+24Vdc $\pm 20\%$ / +12Vdc $\pm 20\%$	Electronic compartment	PP
Power consumption	<80mA	Measuring rod	PFA
Polarity protection	Maximum -30Vdc	Outgoing connection	Connector (M12 connector)
Oversupply protection	Maximum36Vdc	Installation	Any direction, threaded mounting (M50) or movable flange mounting
Insulation resistance	$>10M\Omega$	Position magnet	Built-in magnet in floating ball
Insulation strength	500V		

## ► ESC Analog Output-Selection Guide



01 - 03	Sensor shell form
E S C	Integral profile structure series
04 - 08	Measuring range (0025~2500mm, others can be customized according to needs)
	0025~0750mm step length 5mm
	0750~1000mm step length 25mm
	1000~2500mm step length 50mm
09 - 10	Installation mode
S 0	Unthreaded flange installation
11 - 14	Outgoing mode, cable length
P A 5 0	M12 5-pin male socket, plug cable needs to be selected separately
15 - 18	Communication interface
A 1 2 C	Single floating ball, 20~4mA output
19 - 20	Non-usable area at head and end
F 5	29mm+59mm
21 - 22	Country
	Refer to the country list, page 61.

### ● Selection example

For example: ESC-M0520-S0-PA50-A12C-F5-CN

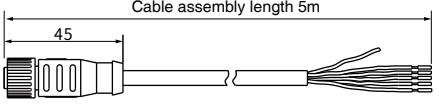
Indicates: ESC structure, non-threaded flange installation, 520mm Stroke length, M12, 5-pin socket, single floating ball, 20~4mA output, head and end non-usuable area 29mm + 59mm.

### ● Supply list

Sensor, certificate, instruction manual, optional parts (optional separately)

## ► ESC Analog Output-Common Options

### • Finished plug cable

Accessory name/model	Dimensions	Description
M12 Right angle female connector Order No.:521816-5		Mxxx denotes cable length in meters; PP black sheath,-pin 1 brown, 2 white, 3 blue, 4 black, 5 gray, Temperature resistance-40°C~80°C.

**Note:** For other accessories, please refer to general options



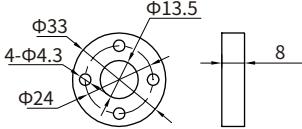
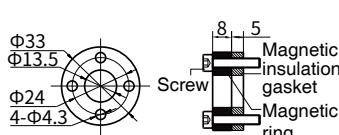
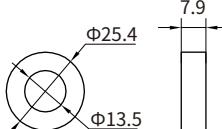
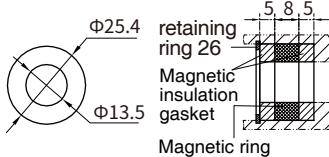
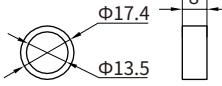
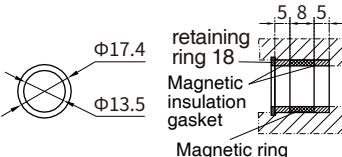
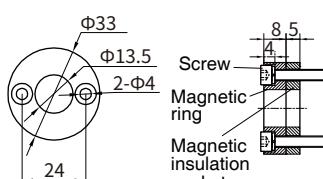


# General Options-Programming Tools

Accessory name/model	Dimensions	Description
Handheld programmer Order No.:TEC612801A/B (A:Current B:Voltage)		It is suitable for analog output sensor, and can set the starting position and full range point of analog output displacement sensor Includes: handheld programmer, 220V power supply, sensor adapter × 2
Interface converter Order No.:TEC612802		Applicable to SSI output sensor, the digital tube displays the displacement value of the output vernier magnet ring in real time. Includes: interface converter, 220V power supply, sensor adapter cable × 2
USB dongle Order No.:TEC612811		Applicable to analog output sensor, PC is connected with sensor through USB port, and TEC sensor configuration software is used for programming: 1) setting sensor measuring direction; 2) Setting sensor zero point and full-scale point; 3) Graphical display of magnet ring position value; 4) Diagnosing sensor online through error code. Includes: USB converter, USB data cable, sensor adapter × 2, software
USB dongle Order No.:TEC612812		Suitable for SSI output sensor, through USB port to connect PC and sensor, using TEC sensor configuration software for programming: 1) Set sensor parameters (data length, data format, measuring direction); 2) Graphic display of magnet ring position value; 3) Users arbitrarily set sensor zero point and measuring display value; 4) On-line diagnosis of sensor through error code. Includes: USB converter, USB data cable, sensor adapter × 2, software

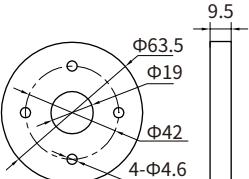
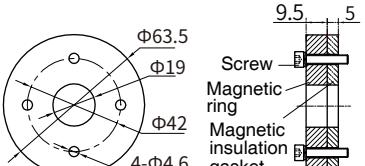
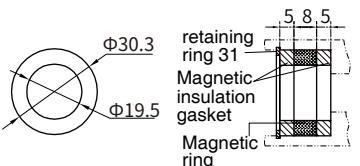
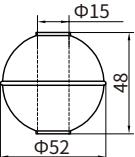
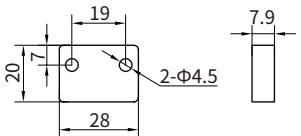
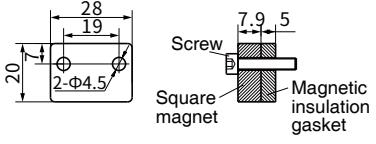


# General Option-Magnet Ring Floating Ball

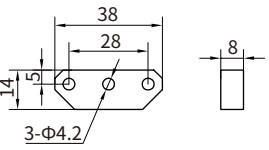
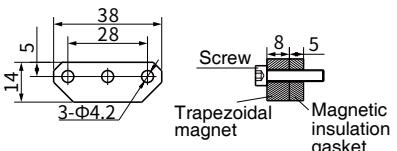
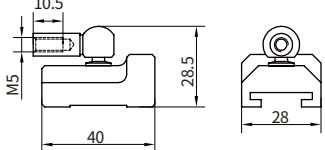
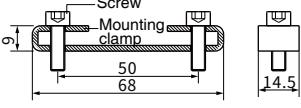
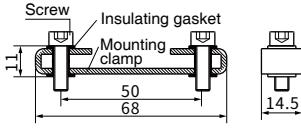
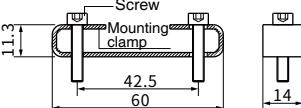
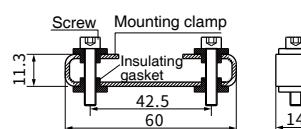
Accessory name/model	Dimensions	Description
 Standard magnet ring Order No.:211501		Includes:1 magnet ring Application:EJ/ES
 Standard magnet ring kit Order No.:288501		Magnetic isolation gasket: same size as magnet ring, thickness 5mm Screw: GB/T70.1, M4X18 , Material 304 Spring gasket: GB/T93, φ 4, Material 304 Includes:1 magnet ring, 1 spacer, 4 screws with spring washers Application:EJ/ES
 Magnet ring Order No.:211506		Includes:1 magnet ring Application:EJ/ES
 Magnet ring Kit Order No.:288501		Magnetic isolation gasket: same size as magnet ring, thickness 5mm Retaining ring: GB/T893 , 26 Includes:1 magnet ring, 2 spacer, 1 retaining ring Application:EJ/ES
 Magnet Order Order No.:211507		Includes:1 magnet ring Application:EJ/ES
 Ring Kit Order No.:288507		Magnetic isolation gasket: same size as magnet ring, thickness 5mm Retaining ring: GB/T893 , 18 Includes:1 magnet ring, 2 spacer, 1 retaining ring Application:EJ/ES
 Magnet ring 33 Kit Order No.:288511		Magnetic isolation gasket: same size as magnet ring, thickness 5mm Screw: GB/T70.1, M4x20 Includes:1 magnet ring, 1 spacer, 2 screws with elastic cushion Application:EJ/ES



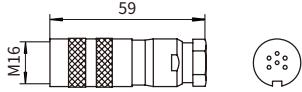
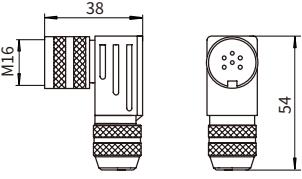
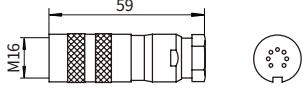
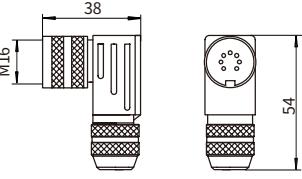
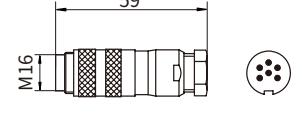
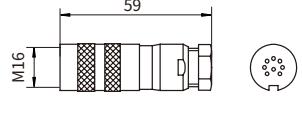
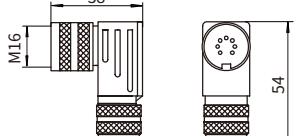
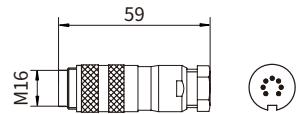
# General Option-Magnet Ring Floating Ball

Accessory name/model	Dimensions	Description
 Enlarge ring magnet ring Order No.:211504	 Φ63.5 Φ19 Φ42 4-Φ4.6 9.5	Includes:1 magnet ring Application:EJ/ES
 Enlarged ring magnet ring kit Order No.:288504	 Φ63.5 Φ19 Φ42 4-Φ4.6 9.5 5 Screw Magnetic ring Magnetic insulation gasket	Magnetic isolation gasket: same size as magnet ring, thickness 5mm Screw: GB/T70.1, M4X20 Spring wgreyer: GB/T 93, φ 4, material304 Includes:1 magnet ring, 1 spacer, 2 screws with spring wgreyer Application:EJ/ES
 Magnet ring Kit Order No.:288509	 Φ30.3 Φ19.5 retaining ring 31 Magnetic insulation gasket Magnetic ring 5.8.5	Magnetic isolation gasket: same size as magnet ring, thickness 5mm Retaining ring: GB/T893 ,31 Includes:1 magnet ring, 2 spacer, 1 retaining ring Application:ES/EJ
 Floating ball Order No.:211546	 Φ15 48 Φ52	Density: 0.6g/cm³ Surface material: 304 Pressure resistance: 2.5MPa Includes:1 float Application:ES/EJ
 Locking ring Order No.:211589	 Φ20 Φ10 10	material 304 Application:ES/EJ
 Square magnet Order No.:211508	 19 20 28 2-Φ4.5 7.9	Includes:1 magnet Application:EP/HP/ED
 Square Magnet Kit Order No.:288508	 28 19 20 2-Φ4.5 7.9 5 Screw Square magnet Magnetic insulation gasket	Magnetic isolation gasket: same size as magnet, thickness 5mm Screw: GB/T70.1, M4X20 , material 304 Spring gasket: GB/T93, φ 4, material 304 Includes:1 magnet ring, 1 gasket, 2 screws with elastic cushion Application:EP/HP/ED

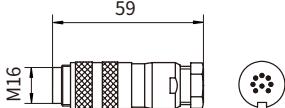
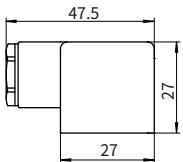
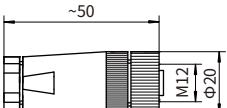
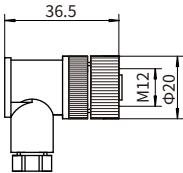
# General Options-Magnet Ring Floating Ball

Accessory name/model	Dimensions	Description
 Trapezoidal magnet Order No.:211514	 38 28 14 5 3-Φ4.2 8	Includes:1 Magnet Application:EP/HP/ED
 Trapezoidal magnet kit Order No.:288514	 38 28 14 5 3-Φ4.2 Screw Trapezoidal magnet Magnetic insulation gasket	Magnetic isolation gasket: same size as magnet , thickness 5mm Screw: GB/T70.1, M4X20 , Material 304 Spring gasket: GB/T93, $\phi$ 4, Material 304 Includes:1 Magnet ring, 1 gasket, 3 screws with elastic cushion Application:EP/HP/ED
 Slider magnet Order No.:211513	 10.5 M5 28.5 40 28	Includes:1 slider Application:HP
 Mounting clamp kit Order No.:211561	 Screw Mounting clamp 50 68 14.5	Screw: GB/T70.1, M5X16 , Material 304 Includes:1 clamp, 2 screws Application:EP/HP
 Mounting clamp kit (including insulation washer) Order No.:211801	 Screw Insulating gasket Mounting clamp 50 68 14.5	Screw: GB/T70.1, M5X16 , Material 304 Includes:1 clamp, 2 screws, 4insulating washers Application:EP/HP
 Mounting clamp kit Order No.:211584	 Screw Mounting clamp 11.3 42.5 60 14	Screw: M4X20 Includes:1 mounting clamp, 2 Screws Application:ED
 Mounting clamp kit (including insulation washer) Order No.:211584A	 Screw Mounting clamp 11.3 42.5 60 14	Screw: M4X20 Includes:1 mounting clamp, 2 Screws, 4 insulating washers Application:ED

# General Option-Connector

Accessory name/model	Dimensions	Application
 6-pin female connector Order No.:312701	 M16 59 38 54	EJ/EP/HP-Analog
 6-pin 90°female connector Order No.:312702	 M16 38 54	EJ/EP/HP-Analog
 7-pin female connector Order No.:312703	 M16 59 38 54	EJ/HP-SSI
 7-pin 90° female connector Order No.:312704	 M16 38 54	EJ/HP-SSI
 6-pin male connector Order No.:312714	 M16 59 38 54	EJ/EP/HP-Analog
 8-pin female connector Order No.:312720	 M16 59 38 54	EJ-Analog/SSI HP-Analog
 8-pin 90° connector female Order No.:312724	 M16 38 54	EJ-Analog/SSI HP-Analog
 7-pin male connector Order No.:312718	 M16 59 38 54	EJ/HP-SSI

# General Option-Connector

Accessory name/model	Dimensions	Application
 8-pin male connector Order No.:312721	 59 M16	EJ-Analog/SSI
 Plug kit Order No.:312725	 47.5 27 27	ED-Analog
 M12 5-pin female Order No.:312301	 ~50 M12 Φ20	ES/EP-Analog ES-Modbus
 M12 5-pin90°right angle Order No.:312302	 36.5 M12 Φ20	ES/EP-Analog ES-Modbus



# General Options-Cable

Accessory name/model	Dimensions	Application
 PUR Orange Cable Order No.:511802	3P×0.25mm <sup>2</sup> ;φ 7.8±0.2mm Conductor: 6-pin, red/black, blue/green, yellow/white Sheath color: Orange Shielding layer: tinned copper wire mesh + aluminum foil Application characteristics: Linear softness, oil resistance and bending resistance Temperature:-20~90°C	EJ/EP/ES/HP-Analog ES-Modbus
 PVC Orange Cable Order No.:511807	7x24AWG;φ 6.7±0.3mm Conductor: 7-pin, brown/white/yellow/green/gray/pink/blue Sheath color: Orange Shielding layer: tinned copper wire mesh + aluminum foil Application characteristics: Linear extremely soft, oil resistance, bending resistance, resistance High temperature, in line with European color code Temperature:-20~105°C	EJ/EP/ES/HP-Analog
 PUR Black Cable Order No.: 511809	5x0.25mm <sup>2</sup> ;φ 5.6±0.2mm Conductor: 5-pin, brown/white/blue/black/grey Application characteristics: cable sheath PUR black, with shielding Temperature:-40~80°C	EP/ES-Analog ES-Modbus
 PVC Black Cable Order No.: 511813	7x0.2mm <sup>2</sup> ;φ 5.8±0.2mm Conductor: 7-pin, red/black/blue/green/yellow/white/brown Application characteristics: Cost performance, cable sheath P V C black, with shielding Temperature:-40~80°C	EP/ES-Analog ES-Modbus
 4-pin/5-pin M12 female connector Order No.:521801-2(3/5/10)	5x0.25mm <sup>2</sup> ;φ 5.6±0.2mm Conductor: 5-pin, brown/white/blue/black/gray Application characteristics: Cable sheath PUR black, with shielding Temperature:-40~80°C Line length: 2m (optional 3m/5m/10m)	EP/ES-Analog ES-Modbus
 4-pin/5-pin M12 right angle female connector Order No.:521804-2(5)	5x0.25mm <sup>2</sup> ;φ 5.6±0.2mm Conductor: 5-pin, brown/white/blue/black/gray Application characteristics: Cable sheath PUR black, with shielding Temperature:-40~80°C Line length: 2m (optional 5m)	EP/ES-Analog ES-Modbus
 M12 right angle female connector Order No.:521816-5	5x0.25mm <sup>2</sup> ;φ 5.6±0.2mm Conductor: 5-pin, brown/white/blue/black/gray Application characteristics: Cable sheath PP black, with shielding Temperature:-40~80°C Line length: 5m	ESC-Analog



# Industrial Application



Metallurgical industry



Port machinery



Hydraulic machinery



Wind power industry



Injection molding machinery



Vulcanizing machinery



Die casting machinery



Vertical mill machinery



Construction machinery



Papermaking machinery



Liquid level tank



Forming machinery

# Country list

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- |   |  |
|---|--|
| AF - Afghanistan 阿富汗                        | CV - Cape Verde 佛得角                    |
| AL - Albania 阿尔巴尼亚                          | KY - Cayman Islands 开曼群岛               |
| DZ - Algeria 阿尔及利亚                          | CF - Central African Republic 中非       |
| AS - American Samoa 东萨摩亚                    | TD - Chad 乍得                           |
| AD - Andorra 安道尔                            | CL - Chile 智利                          |
| AO - Angola 安哥拉                             | CN - China 中国                          |
| Av - Anguilla 安圭拉岛                          | CX - Christmas Island 圣诞岛              |
| AQ - Antarctica 南极洲                         | CC - Cocos (Keeling) Islands 可可斯群岛     |
| AG - Antigua and Barbuda 安提瓜和巴布达            | CO - Colombia 哥伦比亚                     |
| AR - Argentina 阿根廷                          | KM - Comoros 科摩罗                       |
| AM - Armenia 亚美尼亚                           | CG - Congo 刚果                          |
| AA - Aruba 阿鲁巴                              | CD - Congo, Democratic Republic 刚果     |
| AU - Australia 澳大利亚                         | CK - Cook Islands 库克群岛                 |
| AT - Austria 奥地利                            | CR - Costa Rica 哥斯达黎加                  |
| AZ - Azerbaijan 阿塞拜疆                        | CI - Cote D'Ivoire (Ivory Coast) 象牙海岸  |
| BF - Bahamas 巴哈马                            | HR - Croatia (Hrvatska) 克罗地亚           |
| BH - Bahrain 巴林                             | CU - Cuba 古巴                           |
| BB - Barbados 巴巴多斯                          | CY - Cyprus 塞普路斯                       |
| BD - Bangladesh 孟加拉                         | CZ - Czech Republic 捷克                 |
| BY - Belarus 白俄罗斯                           | CS - Czechoslovakia (former) 捷克斯洛伐克    |
| BE - Belgium 比利时                            | DK - Denmark 丹麦                        |
| BZ - Belize 伯里兹                             | DJ - Djibouti 吉布提                      |
| BJ - Benin 贝宁                               | DM - Dominica 多米尼加共和国                  |
| BM - Bermuda 百慕大                            | DO - Dominican Republic 多米尼加联邦         |
| BS - Bahamas 巴哈马                            | TP - East Timor 东帝汶                    |
| BT - Bhutan 不丹                              | EC - Ecuador 厄瓜多尔                      |
| BW - Botswana 博茨瓦纳                          | EG - Egypt 埃及                          |
| BO - Bolivia 玻利维亚                           | SV - El Salvador 萨尔瓦多                  |
| BA - Bosnia and Herzegovina 波黑              | GQ - Equatorial Guinea 赤道几内亚           |
| BV - Bouvet Island 布韦岛                      | ER - Eritrea                           |
| BR - Brazil 巴西                              | EE - Estonia 爱沙尼亚                      |
| IO - British Indian Ocean Territory 英属印度洋领地 | ET - Ethiopia 埃塞俄比亚                    |
| BN - Brunei Darussalam 文莱布鲁萨兰               | FK - Falkland Islands (Malvinas) 福兰克群岛 |
| BG - Bulgaria 保加利亚                          | FO - Faroe Islands 法罗群岛                |
| BF - Burkina Faso 布基纳法索                     | FJ - Fiji 斐济                           |
| BI - Burundi 布隆迪                            | FI - Finland 芬兰                        |
| KH - Cambodia (Internet) 柬埔寨                | FR - France 法国                         |
| CB - Cambodia (CIA World Fact Book) 柬埔寨     | FX - France, Metropolitan              |
| CM - Cameroon 喀麦隆                           | GF - French Guiana 法属圭亚那               |
| CA - Canada 加拿大                             | PF - French Polynesia 法属玻里尼西亚          |

TF - French Southern Territories 法国南部领地	KP - Korea (North) 朝鲜
MK - F.Y.R.O.M. (Macedonia)	KR - Korea (South) 韩国
GA - Gabon 加蓬	KW - Kuwait 科威特
GM - Gambia 冈比亚	KG - Kyrgyzstan 吉尔吉斯斯坦
GE - Georgia 格鲁吉亚	LA - Laos 老挝
DE - Germany 德国	LV - Latvia 拉托维亚
GH - Ghana 加纳	LB - Lebanon 黎巴嫩
GI - Gibraltar 直布罗陀	LI - Liechtenstein 列支顿士登
GB - Great Britain (UK) 英国	LR - Liberia 利比里亚
GR - Greece 希腊	LY - Libya 利比亚
GL - Greenland 格陵兰岛	LS - Lesotho 莱索托
GD - Grenada 格林纳达	LT - Lithuania 立陶宛
GP - Guadeloupe 法属德洛普群岛	LU - Luxembourg 卢森堡
GU - Guam 关岛	MO - Macau 中国澳门特区
GT - Guatemala 危地马拉	MG - Madagascar 马达加斯加
GN - Guinea 几内亚	MW - Malawi 马拉维
GW - Guinea-Bissau 几内亚比绍	MY - Malaysia 马来西亚
GY - Guyana 圭亚那	MV - Maldives 马尔代夫
HT - Haiti 海地	ML - Mali 马里
HM - Heard and McDonald Islands 赫德和麦克唐纳群岛	MT - Malta 马耳他
HN - Honduras 洪都拉斯	MH - Marshall Islands 马绍尔群岛
HK - Hong Kong 中国香港特区	MQ - Martinique 法属马提尼克群岛
HU - Hungary 匈牙利	MR - Mauritania 毛里塔尼亚
IS - Iceland 冰岛	MU - Mauritius 毛里求斯
IN - India 印度	YT - Mayotte
ID - Indonesia 印度尼西亚	MX - Mexico 墨西哥
IR - Iran 伊朗	FM - Micronesia 米克罗尼西亚
IQ - Iraq 伊拉克	MC - Monaco 摩纳哥
IE - Ireland 爱尔兰	MD - Moldova 摩尔多瓦
IL - Israel 以色列	MA - Morocco 摩洛哥
IT - Italy 意大利	MN - Mongolia 蒙古
JM - Jamaica 牙买加	MS - Montserrat 蒙塞拉特岛
JP - Japan 日本	MZ - Mozambique 莫桑比克
JO - Jordan 约旦	MM - Myanmar 缅甸
KZ - Kazakhstan 哈萨克斯坦	NA - Namibia 纳米比亚
KE - Kenya 肯尼亚	NR - Nauru 瑙鲁
KI - Kiribati 基里巴斯	NP - Nepal 尼泊尔
	NL - Netherlands 荷兰
	AN - Netherlands Antilles 荷属安德列斯
	NT - Neutral Zone 中立区(沙特-伊拉克间)
	NC - New Caledonia 新卡里多尼亚

NZ - New Zealand (Aotearoa) 新西兰	SG - Singapore 新加坡
NI - Nicaragua 尼加拉瓜	SI - Slovenia 斯罗文尼亚
NE - Niger 尼日尔	SK - Slovak Republic 斯洛伐克
NG - Nigeria 尼日利亚	Sb - Solomon Islands 所罗门群岛
NU - Niue 纽爱	SO - Somalia 索马里
NF - Norfolk Island 诺福克岛	ZA - South Africa 南非
MP - Northern Mariana Islands 北马里亚纳群岛	ES - Spain 西班牙
NO - Norway 挪威	LK - Sri Lanka 斯里兰卡
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PK - Pakistan 巴基斯坦	PM - St. Pierre and Miquelon 圣皮埃尔和密克隆群岛
PW - Palau 帕劳	SD - Sudan 苏丹
PA - Panama 巴拿马	SR - Suriname 苏里南
PG - Papua New Guinea 巴布亚新几内亚	SJ - Svalbard and Jan Mayen Islands 斯瓦尔巴特和扬马延岛
PY - Paraguay 巴拉圭	SZ - Swaziland 斯威士兰
PE - Peru 秘鲁	SE - Sweden 瑞典
PH - Philippines 菲律宾	CH - Switzerland 瑞士
PN - Pitcairn 皮特克恩岛	SY - Syria 叙利亚
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RU - Russian Federation 俄罗斯	TO - Tonga 汤加
RW - Rwanda 卢旺达	TT - Trinidad and Tobago 特立尼达和多巴哥
GS - S. Georgia and S. Sandwich Isls.	TN - Tunisia 突尼斯
KN - Saint Kitts and Nevis 圣基茨和尼维斯	TR - Turkey 土耳其
LC - Saint Lucia 圣卢西亚	TM - Turkmenistan 土库曼斯坦
VC - Saint Vincent and the Grenadines 圣文森特和格林纳丁斯	TC - Turks and Caicos Islands 特克斯和凯科斯群岛
WS - Samoa 西萨摩亚	TV - Tuvalu 图瓦卢
SM - San Marino 圣马力诺	UG - Uganda 乌干达
ST - Sao Tome and Principe 圣多美和普林西比	UA - Ukraine 乌克兰
SA - Saudi Arabia 沙特阿拉伯	AE - United Arab Emirates 阿联酋
SN - Senegal 塞内加尔	UK - United Kingdom 英国
SC - Seychelles 塞舌尔	US - United States 美国
SL - Sierra Leone 塞拉利昂	UM - US Minor Outlying Islands 美国海外领地
	UY - Uruguay 乌拉圭

SU - USSR (former) 前苏联

UZ - Uzbekistan 乌兹别克斯坦

VU - Vanuatu 瓦努阿鲁

VA - Vatican City State (Holy See) 梵蒂岗

VE - Venezuela 委内瑞拉

VN - Viet Nam 越南

VG - Virgin Islands (British) 英属维京群岛

VI - Virgin Islands (U.S.) 美属维京群岛

WF - Wallis and Futuna Islands 瓦里斯和福

图纳群岛

EH - Western Sahara 西撒哈拉

YE - Yemen 也门

YU - Yugoslavia 南斯拉夫

ZM - Zambia 赞比亚

(ZR - Zaire) - See CD Congo, Democratic  
Republic 扎伊尔

ZW - Zimbabwe 津巴布韦

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