Document Number:
C-ES-AC(V1.0)

ES Operation Manual

Magnetostrictive Sensor

-Analog
-CANopen

Please keep this properly for reference.
Please read the product instruction before use

Beijing Tebeifu Electronic Technology Co., Ltd.

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1 About This Manual

This manual provides the necessary information for the safe use of TBF Magnetostrictive Displacement Sensors.
Please read it carefully before installation and operation.

1.1 Scope of Application

This manual applies to ES series products

1.2 Technical Data

characteristics, please contact TBF for assistance.
For customized versions, reference should be made to the agreed documents and drawings.
The performance characteristics and mechanical structure of the product depend on the selected configuration (according to the order code).

1.3 Symbols

Be sure to pay attention to the warning signs in the manual and the necessary measures to avoid danger.

Danger	Indicates danger that may cause death or serious injury.
Prohibited	Indicates danger that may cause injury or product damage.
Caution	Indicates possible damage or malfunction.

CE The CE mark certifies conformity with current EU directives.

2 Safety Instructions

Installation and startup may only be performed by trained specialists.

The operator is responsible for ensuring that local safety regulations are observed.In particular, the operator must take steps to ensure that a defect in the TBF will not result in hazards to persons or equipment.

If defects and unresolvable faults occur in the TBF, take it out of service and secure against unauthorized use.

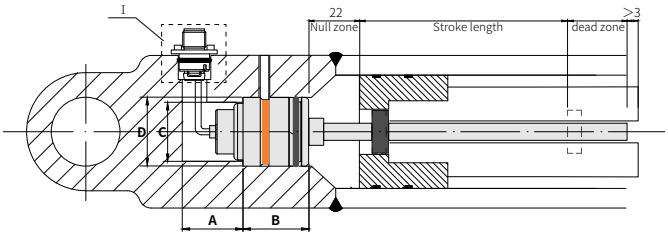
DANGER
Uncontrolled system movement When starting up, if the position measuring system is part of a closed loop system whose parameters have not yet been set, the system may perform uncontrolled movements. This could result in personal injury and equipment damage.

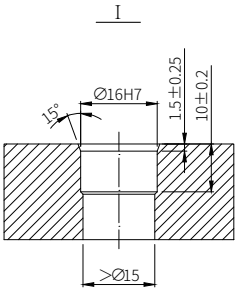
 **Danger**	Persons must keep away from the system's hazardous zones.
 **Danger**	Startup must be performed only by trained technical personnel.
 **Danger**	Observe the safety instructions of the equipment or system manufacturer.

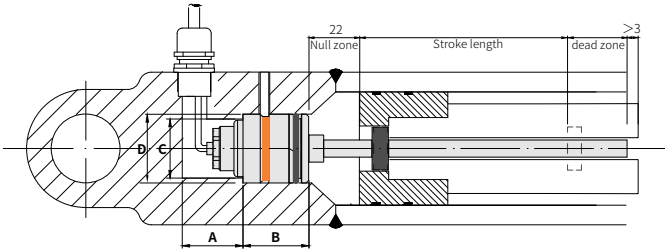
Prohibited
Incorrect installation may cause a risk of personal injury and product damage.

Prohibited	It is prohibited to use this product in a manner not in accordance with the specified instructions. The product must not be used in explosive or otherwise specially regulated areas.
Prohibited	It is strictly prohibited to disassemble or open the equipment, as the function of the measurement system may be partially or completely lost.
Prohibited	Do not route the cable between the TBF sensor, controller, and power supply near high voltage cables (inductive stray noise is possible). The cable must be routed tension-free.
Prohibited	Please use only original TBF accessories. Using any other accessories may void the product warranty.

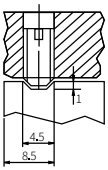
3 Installation







e.g. retaining with set screw DIN913
M5x10(with flat point!)
max. torque 0.5Nm

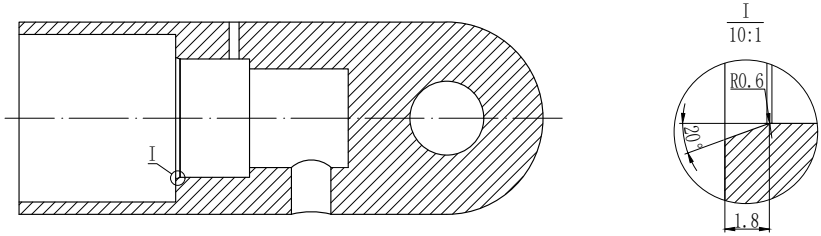


Type	A depth (mm)		B depth (mm)	C ∅ (mm)	D ∅ (mm)
	straight-out cable	connector			
Thimble type	⩾ 25	⩾ 25	$26.8^{+0.2}$	> 24	28H8

Surface Ra < 0.8mm

+ The size of hole in the piston rod depends on factors such as hydraulic pressure and piston speed. The minimum hole size is Φ10 (Φ7 measuring rods) or Φ13.5 (Φ10 measuring rods).
+ Thimble type, thimble adopts flat head wire, torque 0.5N · m.
+ The borehole depth > Stroke length + Dead zone + 3mm。

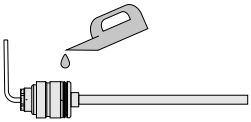
To facilitate sensor installation, a chamfered edge as shown in the figure is required.



Please note that the chamfered edge must be rounded (radius R0.6–R1).
If not properly rounded, the sharp edge may cause damage to the O-ring.

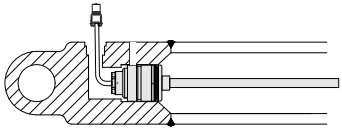
3.2 Installation Steps

3.2.1 Lubricate the O-ring and fix ring with lubricating oil.



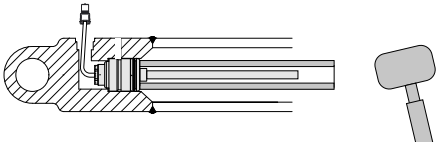
3.2.2 Insert the sensor into the mounting seat and route the cable out.

Avoid applying tensile stress to the connection cable.
Avoid contact with sharp edges to prevent damage to the cable insulation!



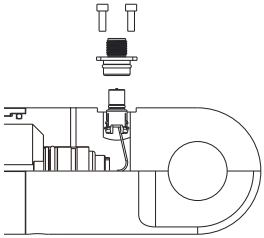
3.2.3 Use a bushing (made of materials such as polyamide) to press the sensor into the housing. If necessary, gently tap it in with a rubber mallet.

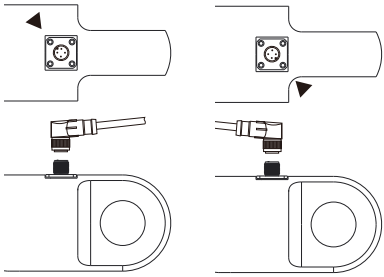
Do not use a metal hammer.
Avoid strong impacts on the sensor or tools.



3.2.4 Secure the cable / connector.

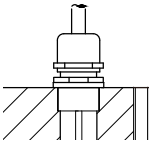
3.2.4.1
Insert the connector into the connector base and secure the connector base with M4 screws





- The connector core’ s orientation determines the direction of the 90° angled integrated cable (as shown in the figure). Please pay attention to the positioning direction.
- Use the M12 locking nut to seal the connector and prevent water ingress.
- Please use the supplied hex socket screws to secure the connector. Using screws of incorrect size may result in poor sealing (for example, an overly high screw head may prevent proper mating of the connectors).

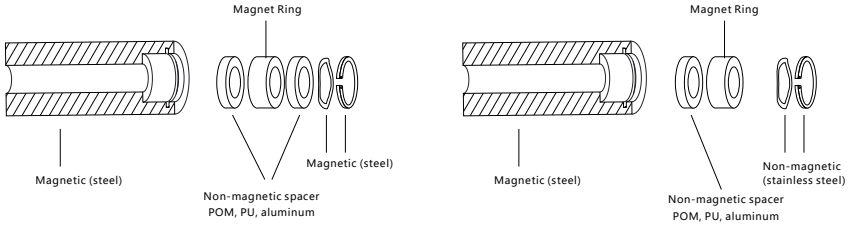
3.2.4.2
Use an IP68-rated metal waterproof connector. Pass the cable through the connector, secure it, and tighten firmly. Protect the cable end with appropriate insulation.



If the cable sheath is exposed, apply sealing material at the stripped section to prevent water ingress, and protect the core wires accordingly.

3.2.5 Install the position magnet.

Use non-magnetic spacers (such as polyamide or aluminum) to isolate the magnetic pole face from adjacent magnetic materials.
It is recommended to secure the magnet using a wave spring washer and a circlip.

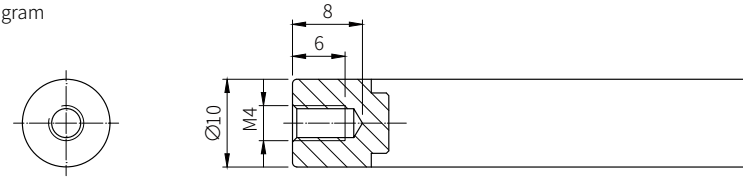


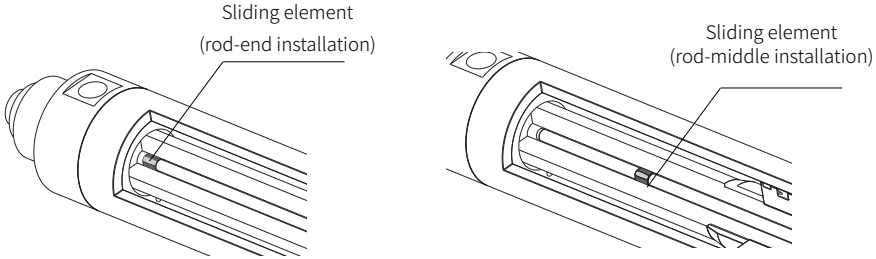
3.2.6 Installation of the sliding element.

If the measuring rod length is greater than 1500 mm, a sliding element must be installed to prevent wear at the rod end.
The material of the sliding element must be suitable for the load conditions, the medium used, and the operating temperature.
Torlon, Teflon, or bronze can be used.

For measuring rods longer than 1500 mm, the rod end is equipped by default with an M4×6 internal thread.

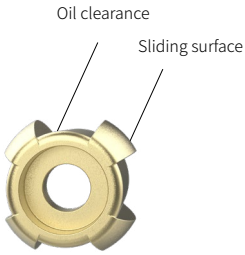
End Dimensions Diagram





-- Secure the sliding element with screws.
-- Use a suitable adhesive to bond and fix the sliding element.

Schematic Diagram of the Sliding Element Structure



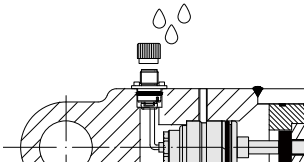
The cylinder manufacturer is responsible for determining the dimensions of the sliding element in the detailed solution.

4 Operating Precautions After Sensor Installation

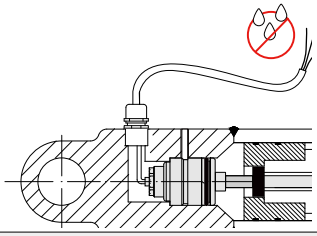
4.1 Cleaning and Drying

Usually, hydraulic cylinders need to be cleaned or degreased before painting.
For this purpose, various chemical and/or thermal treatment methods are used, where cleaning agents are sprayed onto the components at high pressure (up to 50 bar).
During this process, the following necessary precautions must be taken.

Cleaning precautions:
The connector must be protected with a protective cap to prevent cleaning fluid from entering the connector。



Cleaning precautions:
Exposed cable cores must be sealed properly to prevent chemicals or water from entering the cable.

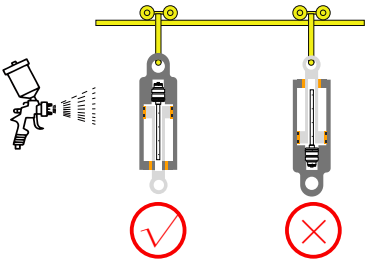


Drying precautions:
If drying is performed at a temperature above 105 ° C, the connector system should not be exposed to such temperature for more than approximately 5 minutes.

4.2 Electrostatic Coating

In the electrostatic coating process, paint is applied to the surface of parts using electrostatic forces.
The voltage used in such processes can reach up to 100 kilovolts, which may cause damage to the sensor’ s electronic components.

Electrostatic coating precautions:
The connector must be protected with a copper protective cap that has good electrical conductivity (aluminum caps must not be used).
Ensure that no paint contaminates the connector threads (including the protective cap).
Regularly clean the suspension points on the coating system, as well as all points used for wire shorting and grounding connections, to ensure low-impedance contact.

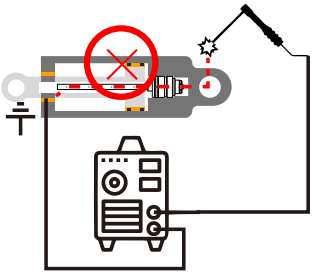


4.3Welding

After the cylinder has been installed on the machine, it may be necessary to weld adjacent components.
If the grounding clamp is placed too close to the cylinder or directly on it, the welding current may flow through the cylinder to the sensor, which could cause the sensor tube to melt or damage internal components of the sensor.

If the sensor is already installed, do not weld any part of the cylinder.

Welding precautions:
Do not attach the grounding point to the cylinder.
During welding, disconnect all sensor connections.
Do not perform welding operations near the cylinder.



4.4 Insulation Test

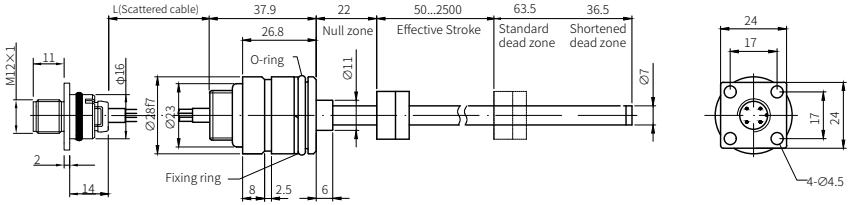
Some tests performed on mobile equipment may include insulation testing.
Such tests are intended to determine the dielectric strength (i.e., insulation resistance) between the cable and the housing by applying high voltage.

Insulation test precautions:
During testing, all sensor cables must be disconnected; otherwise, stray voltages to ground through the sensor protection circuit may damage the components and cause sensor failure.

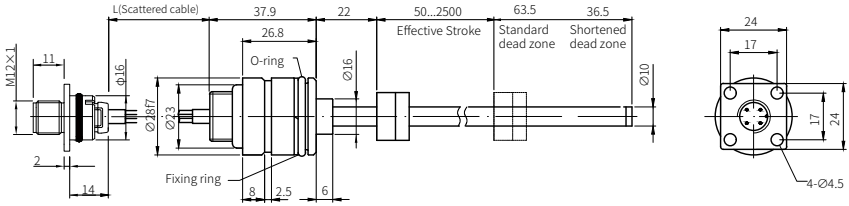
5 Technical Drawing

5.1 Aviation plug

7mm Rod

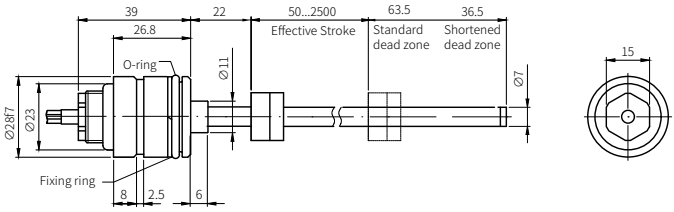


10mm Rod

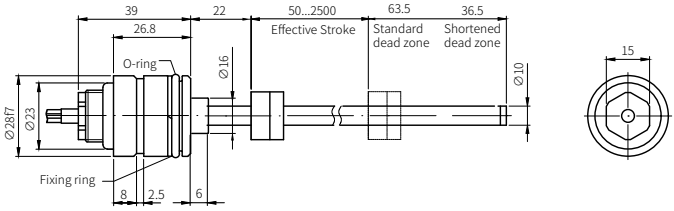


5.2 Straight-out cable

7mm Rod



10mm Rod



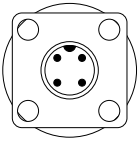
6 Electrical connection

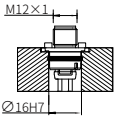
When Aviation-plug connection, defined by Pin numbuer

When Straight out cable connection, defined by line color

Illustration：Aviation pin number (view from above on TBF connector

6.1 Analog

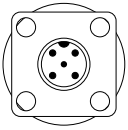


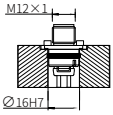


4 pin M12 connector					
	PIN	Color	DG-Function(1-3-4)	DH-Function(1-2-3)	DE-Function(2-3-4)
	1	Brown	24VDC(-15/+20%)/12VDC	24VDC(-15/+20%)/12VDC	NC
	2	Green	NC	Signal output	24VDC(-15/+20%)/12VDC
	3	White	GND	GND	GND
	4	Gray	Signal output	NC	Signal output

Straight out cable	
Color	Function
Brown	24VDC（-15/+20%) / 12VDC
White	GND
Green	Signal output

6.2 CANopen

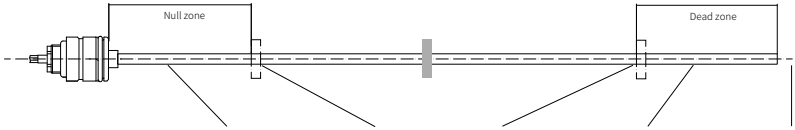




5 pin M12 connector			
	PIN	Color	Function
	1	-	NC
	2	Brown	24VDC（-15/+20%)/12VDC
	3	White	GND
	4	Yellow	CAN H
	5	Green	CAN L

7 Fault analysis and elimination-Analog

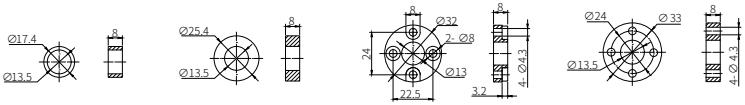
Before wiring, please check whether the power supply meets the requirements, and the output power of the power supply must be greater than the total power consumption of the product, calculated at 70mA per sensor. If the power supply does not meet the requirements, the power supply should be replaced to ensure that the sensor can work normally. The standard mode means that the signal output full-scale position is at the end of the measuring rod and the zero-point output position is at the electronic warehouse.



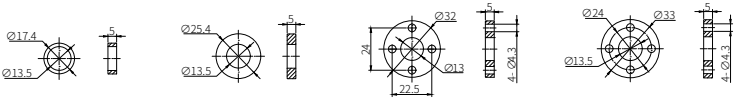
Item	Output	Magnet ring of null zone	Zero-point	Full-scale	Magnet ring of dead zone	No magnetic ring detected
Forward output	4~20mA	4 → 3.6mA (Decline, cycle)	4mA	20mA	20 → 21mA (Increase)	3.5mA
	0.25~4.75V	0.25V	0.25V	4.75V	4.75V	4.75V
	0.5~4.5V	0.5V	0.5V	4.5V	4.5V	4.5V
Reverse output	20~4mA	20 → 20.4mA (Increase)	20mA	4mA	4 → 3.6mA (Decline)	3.5mA
	4.75~0.25V	4.75V	4.75V	0.25V	0.25V	4.75V
	4.5~0.5V	4.5V	4.5V	0.5V	10.2V	4.5V

1. When the output value is still 0 V or 0 mA after adjusting the position of the magnetic ring, please check the power supply and wiring.
2. The output is unstable. Please check the power load.
3.Our anlog is more than these output types. Please contact us directly for more information. Please refer to the customization instructions if there is any customization.

8 Parts selection



Name	Ring magnet	Ring magnet	Ring magnet	Ring magnet
Order code	**12-1032**	**12-1019**	**12-1024**	**12-1001**



Fitting non-permeable gasket				
Name	Non-permeable gasket	Non-permeable gasket	Non-permeable gasket	Non-permeable gasket
Order code	**12-1037**	**12-1021**	**12-1025**	**12-1008**

9 Precautions for Use

NOTICE!	
Improper installation can compromise the function of the TBF and result in damage	
	The position measuring system is a magnetostrictive system.Be sure to provide sufficient distance of the TBF from strong external magnetic fields.
	To ensure electromagnetic compatibility (EMC), observe the following: -Connect TBF and controller using a shielded cable. Shielding: Braided copper shield with minimum 85% coverage. -Shield is internally connected to connector housing -Ensure the integrity of the cable between the sensor and controller to avoid joints in between
	-To ensure the accuracy of the magnetostrictive linear position sensor, fasten the magnet to the moving member of the machine only using non-magnetizable screws (stainless steel, brass, aluminum). -Distance between the magnet and parts made of magnetizable material must be kept to at least 10 mm. -When using multiple magnets a minimum separation of 65mm must be maintained between them.
	Isolate all unused terminals of the output signal separately to avoid short circuits.
	Do not subject the sensor to shock and vibration indicators exceeding the values specified in the data sheet, as the measured data may exceed the deviation.
	The equipment may be damaged during transportation. Please check the packaging and equipment for any damage. If there is obvious damage, please do not use it.
	It is recommended to fix the positioning magnet on non-magnetic materials. If magnetic materials are used, non magnetic gaskets should be used for isolation.
	The grounding of sensors and control cabinets must be at an equal potential.
	During use, ensure proper protection of the sensor cable cores and connector to avoid contact with moisture or corrosive gases (liquids).

Operating Notes

1、Regularly check function of the TBF and all associated components.
2、Take the TBF out of operation whenever there is a malfunction.
3、Secure the system against unauthorized use.

10 Production List

Name	No.	Unit
Sensor	1	set
User Instruction	1	volume
Production Certification	1	piece
Package List	1	piece

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