Temposonics
AN AMPHENOL COMPANY

Operation Manual

E-Series Start/Stop

Magnetostrictive Linear Position Sensors

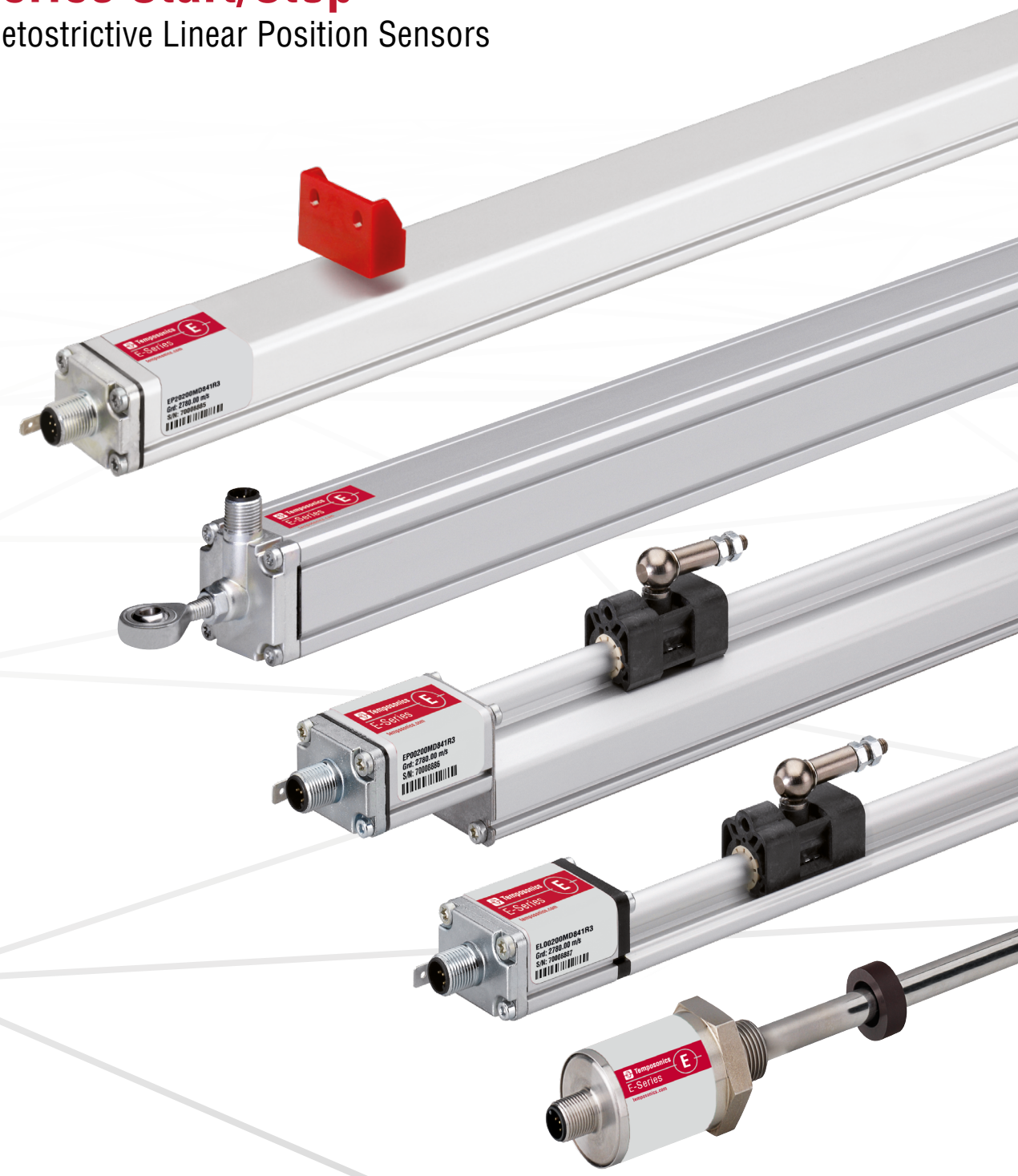


Table of contents

1. Introduction

1.1 Purpose and use of this manual

Before starting the operation of Temposonics® position sensors, read this documentation thoroughly and follow the safety information. Keep this manual for future reference!

The content of this technical documentation and of its appendix is intended to provide information on mounting, installation and commissioning by qualified automation personnel [1] or instructed service technicians who are familiar with the project planning and dealing with Temposonics® sensors.

1.2 Used symbols and warnings

Warnings are intended for your personal safety and for avoidance of damage to the described product or connected devices. In this documentation, safety information and warnings to avoid dangers that might affect the life and health of operating or service personnel or cause material damage are highlighted by the pictogram defined below.

Symbol	Meaning
NOTICE	This symbol is used to point to situations that may lead to material damage, but not to personal injury.

2. Safety instructions

2.1 Intended use

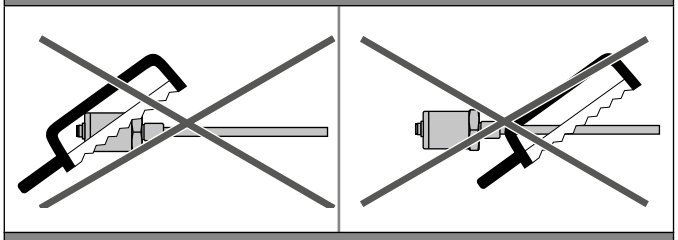
This product may be used only for the applications defined under item 1 and only in conjunction with the third-party devices and components recommended or approved by Temposonics. As a prerequisite of proper and safe operation the product requires correct transport, storage, mounting and commissioning and must be operated with utmost care.

1. The sensor systems of all Temposonics® series are intended exclusively for measurement tasks encountered in industrial, commercial and laboratory applications. The sensors are considered as system accessories and must be connected to suitable evaluation electronics, e.g. a PLC, IPC, indicator or other electronic control unit.

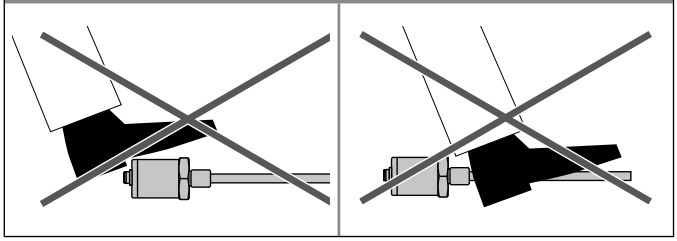
2.2 Forseeable misuse

Foreseeable misuse	Consequence
Wrong sensor connection	The sensor will not work properly or can be damaged
Operate the sensor out of the operating temperature range	No signal output – the sensor can be damaged
Power supply is out of the defined range	Signal output is wrong/ no signal output/ the sensor will be damaged
Position measurement is influenced by an external magnetic field	Signal output is wrong
Cables are damaged	Short circuit – the sensor can be damaged/sensor does not respond
Spacers are missing/ installed in a wrong order	Error in position measurement
Wrong connection of ground/shield	Signal output is disturbed – the electronics can be damaged
Use of a magnet that is not specified by Temposonics	Error in position measurement

Do not alter the sensor afterwards.
➔ The sensor might be damaged.



Do not step on the sensor.
➔ The sensor might be damaged.



1/ The term “qualified technical personnel” characterizes persons who:
- are familiar with the safety concepts of automation technology applicable to the particular project
- are competent in the field of electromagnetic compatibility (EMC)
- have received adequate training for commissioning and service operations
- are familiar with the operation of the device and know the information required for correct operation provided in the product documentation

2.3 Installation, commissioning and operation

The position sensors must be used only in technically safe condition. To maintain this condition and to ensure safe operation, installation, connection and service, work may be performed only by qualified technical personnel. If danger of injury to persons or of damage to operating equipment is caused by sensor failure or malfunction, additional safety measures such as plausibility checks, limit switches, EMERGENCY STOP systems, protective devices etc. are required. In the event of trouble, shut down the sensor and protect it against accidental operation.

Safety instructions for commissioning
To maintain the sensor's operability, it is mandatory to follow the instructions given below.

1. Protect the sensor against mechanical damage during installation and operation.
2. Do not open or dismantle the sensors.
3. Connect the sensors very carefully and pay attention to the polarity of connections and power supply.
4. Use only approved power supplies.
5. Ensure the sensor is operating within the defined limits for supply voltage, environmental conditions, etc..
6. Check the function of the sensor regularly and provide documentation of the checks.
7. Before applying power, ensure that nobody's safety is jeopardized by starting machines.

2.4 Safety instructions for use in explosion-hazardous areas

The sensors are not suitable for operation in explosion-hazardous areas.

2.5 Warranty

Temposonics grants a warranty period [2] for its position sensors and supplied accessories relating to material defects and faults that occur despite correct use in accordance with the intended application. The Temposonics obligation is limited to repair or replacement of any defective part of the unit. No warranty can be provided for defects that are due to improper use or above average stress of the product, as well as for wear parts. Under no circumstances will Temposonics accept liability in the event of offense against the warranty rules, no matter if these have been assured or expected, even in case of fault or negligence of the company.
Temposonics explicitly excludes any further warranties. Neither the company's representatives, agents, dealers nor employees are authorized to increase or change the scope of warranty.

2.6 Return

For diagnostic purposes, the sensor can be returned to Temposonics or a repair facility explicitly authorized by Temposonics. Any shipment cost is the responsibility of the sender [2]. For a corresponding form, see chapter “9. Appendix – Safety declaration” on page 34.

NOTICE

When returning sensors, place protective caps on male and female connectors of the sensor. For pigtail cables, place the cable ends in a static shielding bag for electrostatic discharge (ESD) protection. Fill the outer packaging around the sensor completely to prevent damage during transport.

2/ See also applicable Temposonics terms of sales and delivery on: www.temposonics.com

3. Identification

3.1 Order code of Temposonics® EH

1	2	3	4	5	6	7	8	9	10	11	12	13	14
E	H							D	8	4	1	R	3
a		b	c					d			e	f	

a	Sensor model
E H	Rod

b	Design
EH rod-style sensor with housing material 1.4305 (AISI 303) and rod material 1.4301 (AISI 304)	
K	Threaded flange M18×1.5-6g, Ø 7 mm rod
L	Threaded flange ¾"-16 UNF-3A, Ø 7 mm rod
EH rod-style sensor with housing material 1.4305 (AISI 303) and rod material 1.4306 (AISI 304L)	
M	Threaded flange M18×1.5-6g, Ø 10 mm rod
S	Threaded flange ¾"-16 UNF-3A, Ø 10 mm rod
EH rod-style sensor with housing material 1.4404 (AISI 316L) and rod material 1.4404 (AISI 316L)	
F	Threaded flange ¾"-16 UNF-3A, Ø 10 mm rod
W	Threaded flange M18×1.5-6g, Ø 10 mm rod

c	Stroke length
X X X X M	0050…2540 mm

Standard stroke length (mm)	Ordering steps
50… 500 mm	5 mm
500… 750 mm	10 mm
750…1000 mm	25 mm
1000…2540 mm	50 mm

X X X X U	002.0…100.0 in.

Standard stroke length (in.)	Ordering steps
2… 20 in.	0.2 in.
20… 30 in.	0.4 in.
30… 40 in.	1.0 in.
40…100 in.	2.0 in.

Non-standard stroke lengths are available;
must be encoded in 5 mm/0.1 in. increments.

d	Connection type
D 8 4	M12 male connector (8 pin)

e	Operating voltage
1	+24 VDC (–15/+20 %)

f	Output
R 3	Start/Stop with sensor parameters upload function

NOTICE

- Multi-position measurement with up to 2 magnets is possible.
- The number of magnets is limited by the stroke length. The minimum allowed distance between magnets (i.e. front face of one to the front face of the next one) is 75 mm (3 in.)
- Use magnets of the same type for multi-position measurement.
- Order the magnets separately.

3.2 Order code of Temposonics® EP/EL

1	2	3	4	5	6	7	8	9	10	11	12	13	14
E		0						D	8	4	1	R	3
a		b	c					d			e	f	

a	Sensor model
E	P	Profile
E	L	Low profile

b	Design
0	Without position magnet

c	Stroke length					
X	X	X	X	M	0050…3000 mm	
Standard stroke length (mm)						**Ordering steps**
50… 500 mm						25 mm
500…3000 mm						50 mm
X	X	X	X	U	002.0…118.0 in.	
Standard stroke length (in.)						**Ordering steps**
2… 20 in.						1.0 in.
20…118 in.						2.0 in.
Non-standard stroke lengths are available; must be encoded in 5 mm/0.1 in. increments.						

d	Connection type
D	8	4	M12 male connector (8 pin)

e	Operating voltage
1	+24 VDC (–15/+20 %)

f	Output
R	3	Start/Stop with sensor parameters upload function

NOTICE

- Multi-position measurement with up to 2 magnets is possible.
- The number of magnets is limited by the stroke length. The minimum allowed distance between magnets (i.e. front face of one to the front face of the next one) is 75 mm (3 in.)
- Use magnets of the same type for multi-position measurement.
- Order the magnets separately.

3.3 Order code of Temposonics® EP2

1	2	3	4	5	6	7	8	9	10	11	12	13	14
E	P	2						D	8	4	1	R	3
a			b					c			d	e	

a	Sensor model
E P 2	Flat profile

b	Stroke length	
X X X X M	0050…3000 mm	
Standard stroke length (mm)		**Ordering steps**
50… 500 mm		25 mm
500…3000 mm		50 mm
X X X X U	002.0…118.0 in.	
Standard stroke length (in.)		**Ordering steps**
2… 20 in.		1.0 in.
20…118 in.		2.0 in.
Non-standard stroke lengths are available; must be encoded in 5 mm/0.1 in. increments.		

c	Connection type
D 8 4	M12 male connector (8 pin)

d	Operating voltage
1	+24 VDC (–15/+20 %)

e	Output
R 3	Start/Stop with sensor parameters upload function

NOTICE

- Multi-position measurement with up to 2 magnets is possible.
- The number of magnets is limited by the stroke length. The minimum allowed distance between magnets (i.e. front face of one to the front face of the next one) is 75 mm (3 in.)
- Use magnets of the same type for multi-position measurement.
- Align all block magnets for a multi-position measurement so that the air gap of all magnets has the same height.
- Order the magnets separately.

3.4 Order code of Temposonics® ER

1	2	3	4	5	6	7	8	9	10	11	12	13	14
E	R							D	8	4	1	R	3
a		b	c					d			e	f	

a	Sensor model
E R	Aluminum housing with a guided rod

b	Design
M	Inside thread M6 at end of rod (For metric stroke length measurement)
S	Inside thread ¼"-28 UNF at end of rod (For US customary stroke length measurement)

c	Stroke length
X X X X M	0050…1500 mm

Standard stroke length (mm)	Ordering steps
50… 500 mm	25 mm
500…1500 mm	50 mm

X X X X U	002.0…060.0 in.

Standard stroke length (in.)	Ordering steps
2…20 in.	1.0 in.
20…60 in.	2.0 in.

Non-standard stroke lengths are available;
must be encoded in 5 mm/0.1 in. increments.

d	Connection type
D 8 4	M12 male connector (8 pin)

e	Operating voltage
1	+24 VDC (–15/+20 %)

f	Output
R 3	Start/Stop with sensor parameters upload function

3.5 Nameplate

Fig. 1: Example of nameplate of E-Series EH sensor with Start/Stop output

3.6 Approvals

- CE declaration
- UKCA declaration
- EAC declaration
- UL certified

NOTICE

For a detailed overview of the certifications, see:
www.temposonics.com

3.7 Scope of delivery

EH (rod sensor):
- Sensor
- O-ring

EP (profile sensor):
- Sensor
- 2 mounting clamps up to 1250 mm (50 in.) stroke length + 1 mounting clamp for each 500 mm (20 in.) additional stroke length

EL (low profile sensor):
- Sensor
- 2 mounting clamps up to 1250 mm (50 in.) stroke length + 1 mounting clamp for each 500 mm (20 in.) additional stroke length

EP2 (flat profile sensor):
- Sensor
- 2 mounting clamps up to 1250 mm (50 in.) stroke length + 1 mounting clamp for each 500 mm (20 in.) additional stroke length

ER (aluminum housing with a guided rod):
- Sensor

4. Product description and commissioning

4.1 Functionality and system design

Product designation
- Position sensor Temposonics® E-Series

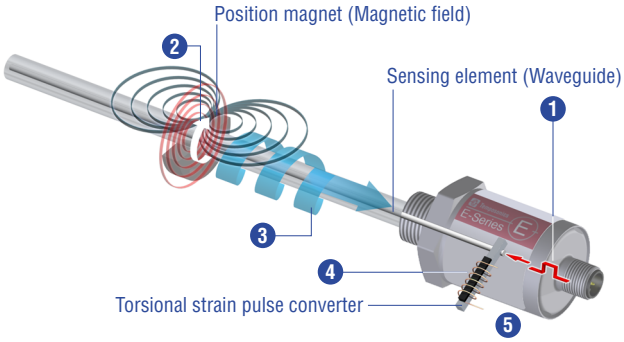
Sensor model
- Temposonics® E-Series EH (rod sensor)
- Temposonics® E-Series EP (profile sensor)
- Temposonics® E-Series EL (low profile sensor)
- Temposonics® E-Series EP2 (flat profile sensor)
- Temposonics® E-Series ER (aluminum housing with a guided rod sensor)

Stroke length
- Temposonics® E-Series EH: 50…2540 mm (2…100 in.)
- Temposonics® E-Series EP: 50…3000 mm (2…118 in.)
- Temposonics® E-Series EL: 50…3000 mm (2…118 in.)
- Temposonics® E-Series EP2: 50…3000 mm (2…118 in.)
- Temposonics® E-Series ER: 50…1500 mm (2… 60 in.)

Output signal
- Start/Stop

Application
The Temposonics® position sensors are used for measurement and conversion of the length (position) variable in the fields of automated systems and mechanical engineering.

Principle of operation and system construction
The absolute, linear position sensors provided by Temposonics rely on the company's proprietary magnetostrictive technology, which can determine position with a high level of precision and robustness. Each Temposonics® position sensor consists of a ferromagnetic waveguide, a position magnet, a strain pulse converter and supporting electronics. The magnet, connected to the object in motion in the application, generates a magnetic field at its location on the waveguide. A short current pulse is applied to the waveguide. This creates a momentary radial magnetic field and torsional strain on the waveguide. The momentary interaction of the magnetic fields releases a torsional strain pulse that propagates the length of the waveguide. When the ultrasonic wave reaches the beginning of the waveguide it is converted into an electrical signal. Since the speed of the ultrasonic wave in the waveguide is precisely known, the time required to receive the return signal can be converted into a linear position measurement with both high accuracy and repeatability.



Measurement cycle

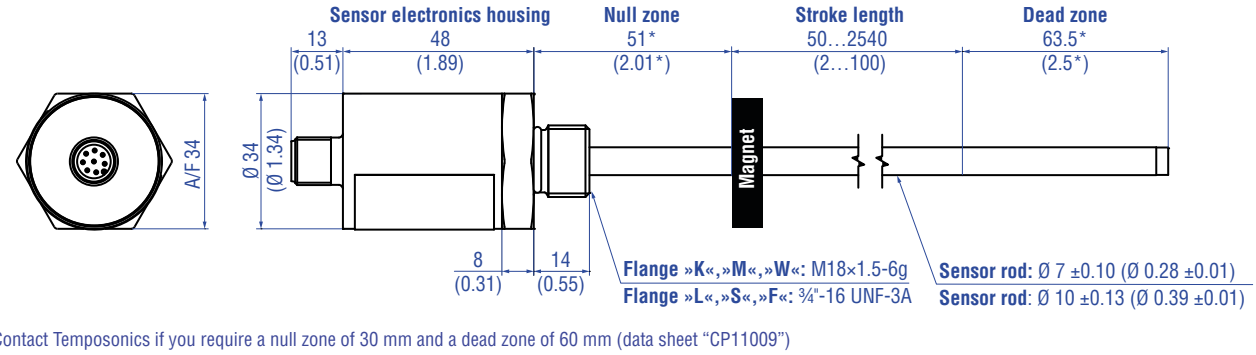
1	Current pulse generates magnetic field
2	Interaction with position magnet field generates torsional strain pulse
3	Torsional strain pulse propagates
4	Strain pulse detected by converter
5	Time-of-flight converted into position

Fig. 2: Time-of-flight based magnetostrictive position sensing principle

Modular mechanical and electronic construction
- The sensor profile or rod protects the inner sensor element.
- The sensor electronics housing, a rugged construction, contains the complete electronic interface with active signal conditioning.
- The external position magnet is a permanent magnet. Mounted on the mobile machine part, it travels along the sensor profile or rod and triggers the measurement through the sensor profile/rod wall.
- The sensor can be connected directly to a control system. Its electronics generates a strictly position proportional signal output between start and end position.

4.2 Installation and design of Temposonics® EH

EH with threaded flange M18×1.5-6g or ¾"-16 UNF-3A



* Contact Temposonics if you require a null zone of 30 mm and a dead zone of 60 mm (data sheet "CP11009")

Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Fig. 3: Temposonics® EH with ring magnet

Installation of EH with threaded flange

Fix the sensor rod via threaded flange M18×1.5-6g or ¾"-16 UNF-3A. Note the fastening torque shown in Fig. 4. Lightly oil the thread before tightening.

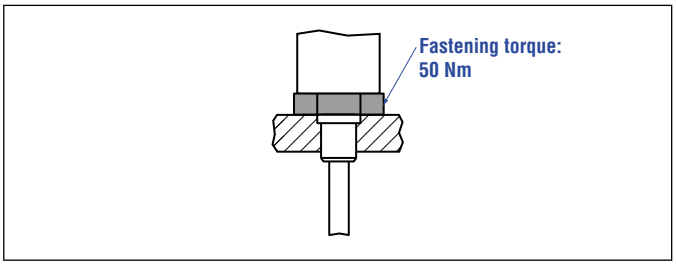


Fig. 4: Mounting example of threaded flange

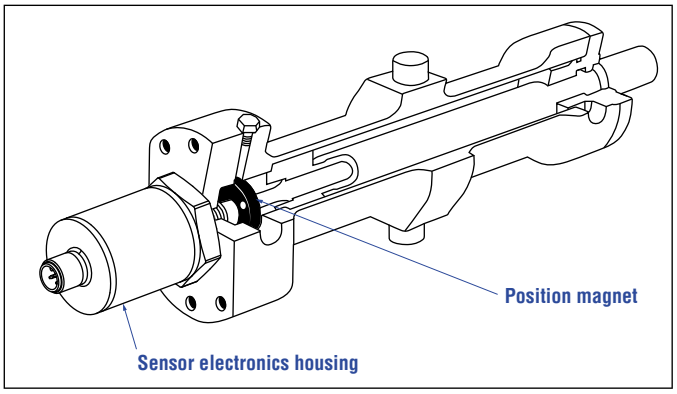


Fig. 5: Sensor in cylinder

Installation of a rod-style sensor in a fluid cylinder

The rod-style version has been developed for direct stroke measurement in a fluid cylinder. Mount the sensor via threaded flange or a hex nut.

- Mounted on the face of the piston, the position magnet travels over the rod without touching it and indicates the exact position through the rod wall – independent of the hydraulic fluid.
- The pressure resistant sensor rod is installed into a bore in the piston rod.
- Insert the sensor into the cylinder with the piston rod retracted.

Hydraulics sealing

Seal the flange contact surface via O-ring in the undercut (Fig. 6).
For threaded flange (¾"-16 UNF-3A) »F«/»L«/»S«:
O-ring 16.4 × 2.2 mm (0.65 × 0.09 in.) (part no. 560 315)
For threaded flange (M18×1.5-6g) »K«/»M«/»W«:
O-ring 15.3 × 2.2 mm (0.60 × 0.09 in.) (part no. 401 133)

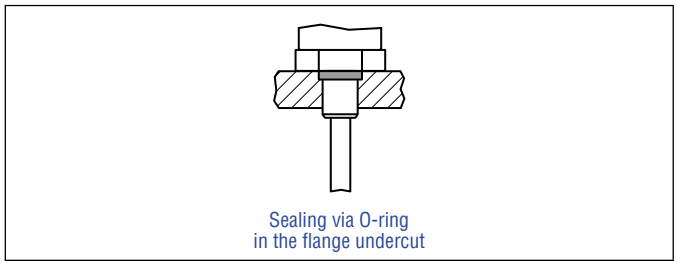
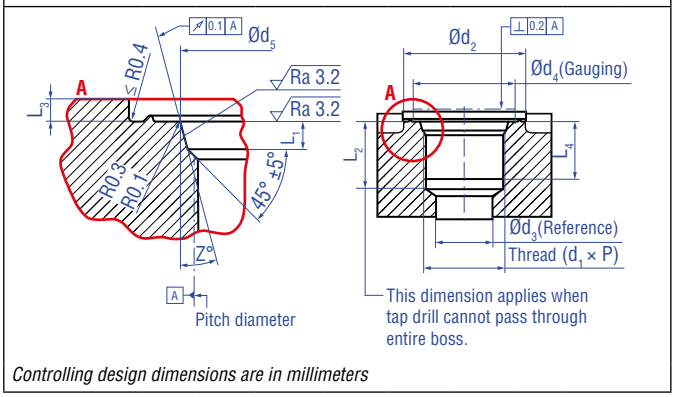


Fig. 6: Possibility of sealing

In the case of threaded flange M18×1.5-6g provide a screw hole based on DIN EN ISO 6149-1 (Fig. 7). See DIN EN ISO 6149-1 for further information.

- Seat the flange contact surface completely on the cylinder mounting surface.
- The cylinder manufacturer determines the pressure-resistant gasket (copper gasket, O-ring, etc.).
- The position magnet should not grind on the sensor rod.
- The piston rod drilling
  (EH-K/L: Ø 7 mm rod: ≥ Ø 10 mm (≥ Ø 0.40 in.);
  EH-M/S/F/W: Ø 10 mm rod: ≥ Ø 13 mm (≥ Ø 0.52 in.))
  depends on the pressure and piston speed.
- Adhere to the information relating to operating pressure.
- Protect the sensor rod against wear.

Notice for metric threaded flanges									
Thread (d_1×P)	**d_2**	**d_3**	**d_4**	**d_5 +0.1 0**	**L_1 +0.4 0**	**L_2**	**L_3**	**L_4**	**Z° ±1°**
EH-K (Ø 7 mm rod)									
M18×1.5	55	≥ 10	24.5	19.8	2.4	28.5	2	26	15°
EH-M/W (Ø 10 mm rod)									
M18×1.5	55	≥ 13	24.5	19.8	2.4	28.5	2	26	15°

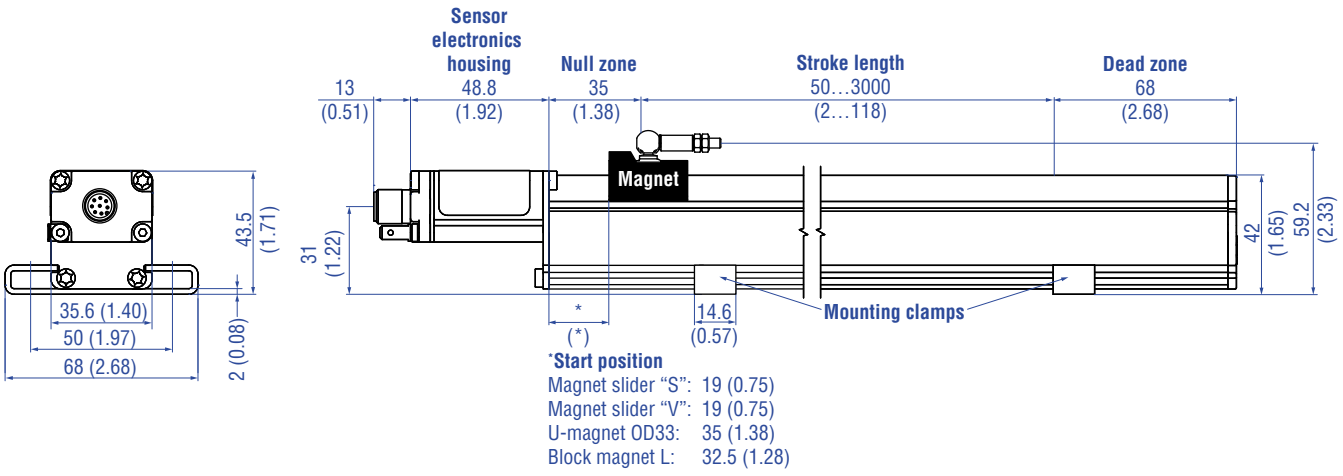


Controlling design dimensions are in millimeters

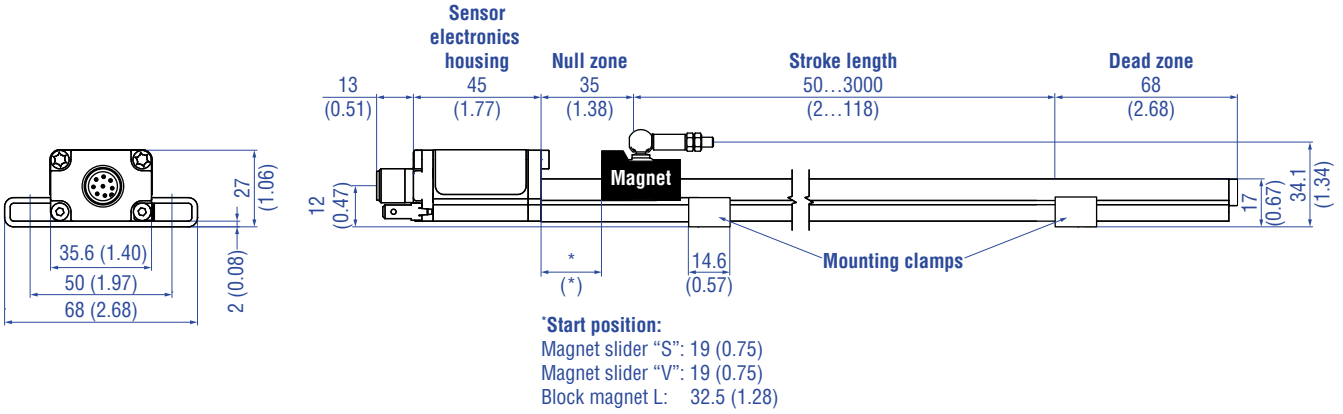
Fig. 7: Notice for metric threaded flange M18×1.5-6g based on DIN EN ISO 6149-1

4.3 Installation and design of Temposonics® EP/EL

EP



EL



Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Fig. 8: Temposonics® EP/EL with magnet slider

Installation of EP/EL

The position sensor can be installed in any position. Normally, the sensor is firmly installed and the position magnet is fastened to the mobile machine part. Thus it can travel along the sensor profile. The sensor is fitted on a flat machine surface using the mounting clamps (Fig. 9/Fig. 10). A length-dependent number of these clamps are delivered with the sensor and must be distributed over the profile at regular distances. For fastening use M5×20 screws to DIN 6912 that should be tightened with a fastening torque of 5 Nm.

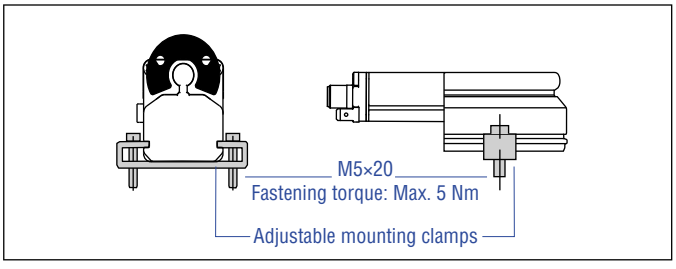


Fig. 9: EP with mounting clamps with cylinder screw M5×20 (part no. 403 508)

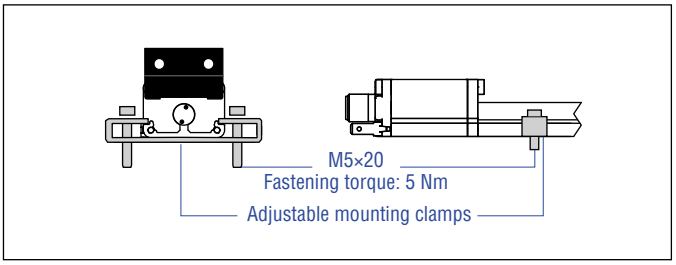


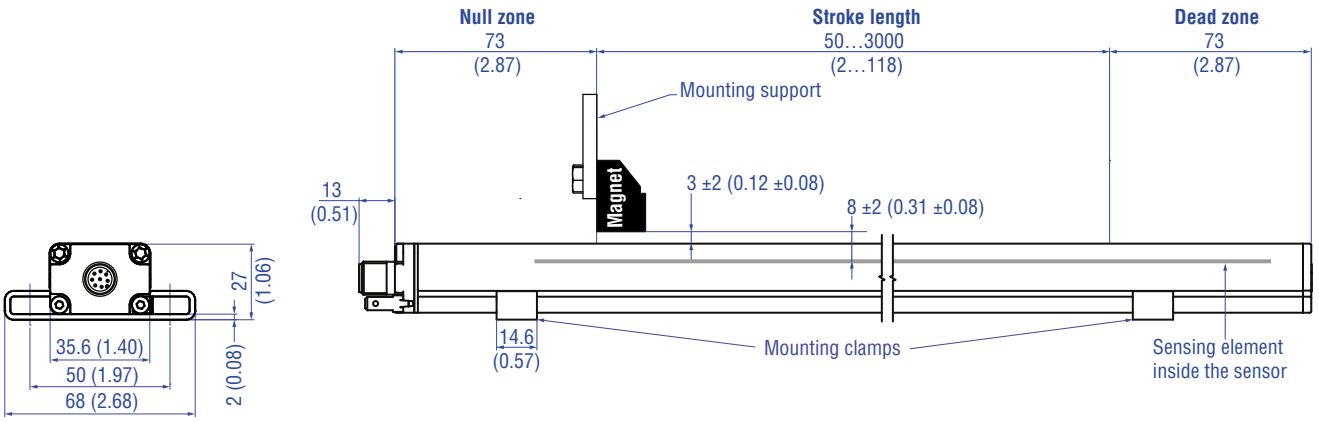
Fig. 10: EL with mounting clamps with cylinder screw M5×20 (part no. 403 508)

NOTICE

Take care to mount the sensor in an axially parallel position to avoid damage to magnet and sensor.

4.4 Installation and design of Temposonics® EP2

EP2



Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Fig. 11: Temposonics® EP2 with block magnet

Installation of EP2

The position sensor can be installed in any position. Normally, the sensor is firmly installed and the position magnet is fastened to the mobile machine part. Thus it can travel along the sensor profile without touching it. The sensor is fitted on a flat machine surface using the mounting clamps (Fig. 12). A length-dependent number of these clamps are delivered with the sensor and must be distributed over the profile at regular distances. For fastening use M5×20 screws to DIN 6912 that should be tightened with a fastening torque of 5 Nm.

NOTICE

- Take care to mount the sensor in an axially parallel position to avoid impairment of the position measurement.
- To ensure a reliable position measurement align all block magnets for a multi-position measurement so that the air gap of all magnets has the same height.

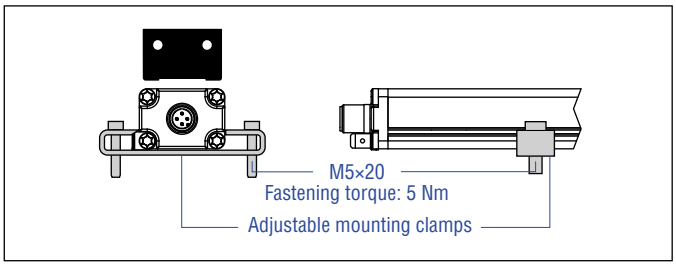
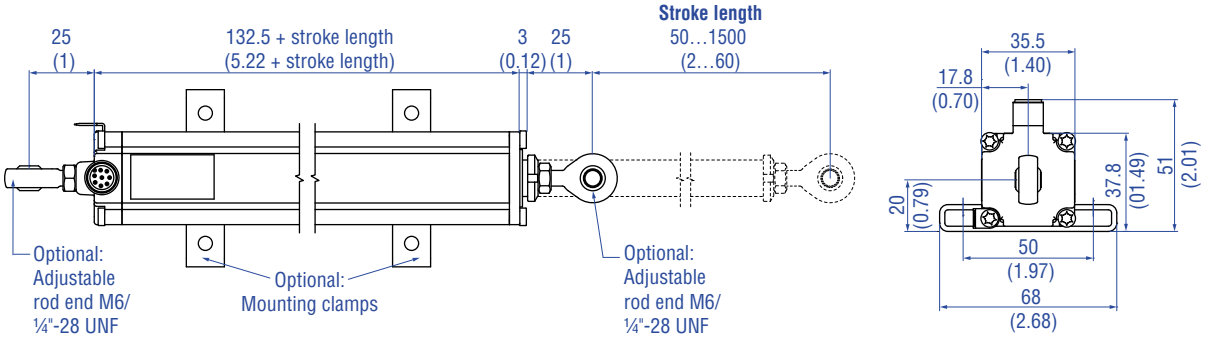


Fig. 12: Mounting clamps with cylinder screw M5×20 (part no. 403 508)

4.5 Installation and design of Temposonics® ER

ER



Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Fig. 13: Temposonics® ER

There are two ways to install the sensor ER:

1. Via the mounting clamps
   The position sensor can be installed in any position. The sensor is fitted on a flat machine surface using the mounting clamps (Fig. 14), while the guided driving rod is attached to the moving machine part. The mounting clamps are supplied in length-dependent quantities and must be evenly distributed on the profile. For fastening use M5×20 screws to DIN 6912 that should be tightened with a fastening torque of 5 Nm. The guided driving rod is fitted with an internal thread M6 or ¼" for connection to the moving machine part. Alternatively, the connection can also be made using the M6 or ¼" rod end available as an accessory.

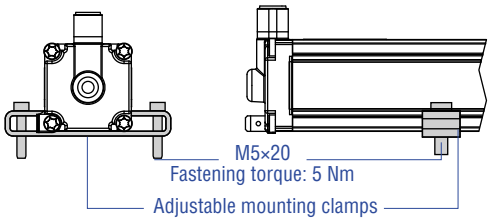


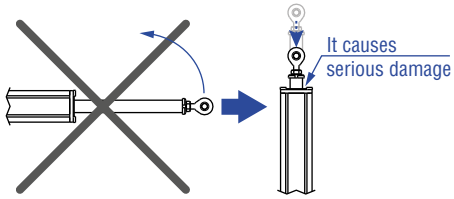
Fig. 14: Mounting clamps with cylinder screw M5×20 (part no. 403 508)

NOTICE
Take care to mount the sensor in an axially parallel position to avoid damage to the sensor.

2. Suspension via the adjustable rod ends
   The position sensor can be installed in any position. Tighten the M6 or ¼" rod ends, which are available as accessories, into the M6 or ¼" internal threads on both sides of the sensor. Suspend the sensor in the machine via the rod ends so that the guided driving rod is connected to the moving part of the machine.

NOTICE
Do not extend the driving rod more than 75 % of the stroke length to avoid the driving rod from getting caught.

NOTICE
Do not raise up the ER sensor, if the driving rod is extended.



4.6 Magnet installation

Typical use of magnets

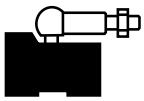
Magnet	Typical sensors	Benefits
Ring magnets 	**Rod model** (EH)	• Rotationally symmetrical magnetic field
U-magnets 	**Profile & rod models** (EH, EP)	• Height tolerances can be compensated, because the magnet can be lifted off
Block magnets 	**Profile & rod models** (EH, EP, EL, EP2)	• Height tolerances can be compensated, because the magnet can be lifted off
Magnet sliders 	**Profile models** (EP, EL)	• The magnet is guided by the profile • The distance between the magnet and the waveguide is strictly defined • Easy coupling via the ball joint

Fig. 15: Typical use of magnets

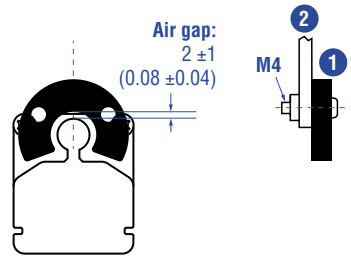
Mounting the ring magnets, U-magnets & block magnets

Install the magnet using non-magnetic material for mounting device, screws, spacers etc.. The magnet must not grind on the sensor rod/profile. Alignment errors are compensated via the air gap.

- Permissible surface pressure: Max. 40 N/mm² (only for ring magnets and U-magnets)
- Fastening torque for M4 screws: 1 Nm; use washers, if necessary
- Minimum distance between position magnet and any magnetic material has to be 15 mm (0.6 in.) (Fig. 18).
- If no other option exists and magnetic material is used, observe the specified dimensions (Fig. 18).

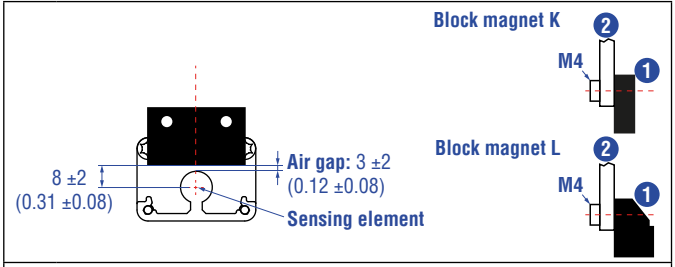
NOTICE

- Mount ring magnets and U-magnets concentrically.
- Mount block magnets centrically over the sensor rod or the sensor profile. The maximum permissible air gap must not be exceeded (Fig. 16, Fig. 17).
- Take care to mount the primary sensor axis in parallel to the magnet path in order to avoid damage to the carriage, magnet and sensor rod/profile.



1 U-magnet
2 Non-magnetic mounting plate

Fig. 16: Mounting of U-magnet (part no. 251 416-2), example of EP sensor



1 Block magnet
2 Non-magnetic mounting plate

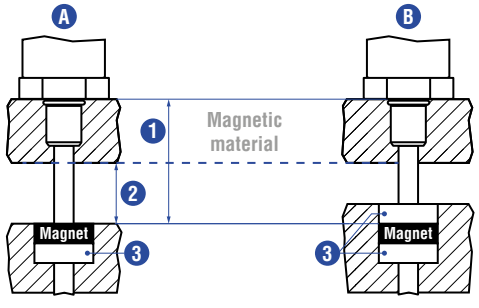
Fig. 17: Mounting of block magnet K (part no. 251 298-2) and block magnet L (part no. 403 448), example of EL sensor

Magnet mounting with magnetic material

When using magnetic material the dimensions of Fig. 18 must be observed.

A. If the position magnet aligns with the drilled piston rod

B. If the position magnet is set further into the drilled piston rod, install another non-magnetic spacer (e.g. part no. 400 633) above the magnet.



1 Null zone, depends on sensor model
2 Distance between position magnet and any magnetic material (≥ 15 mm (≥ 0.6 in.))
3 Non-magnetic spacer (≥ 5 mm (≥ 0.2 in.)) – Recommendation: 8 mm (0.31 in.)

Fig. 18: Installation with magnetic material

Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Rod sensors with stroke lengths ≥ 1 meter (3.3 ft.)

Support horizontally installed rod sensors with a stroke length from 1 meter (3.3 ft.) mechanically at the rod end. Without the use of a support, rod and position magnet may be damaged. A false measurement result is also possible. Longer rods require evenly distributed mechanical support over the entire length (e.g. part no. 561 481). Use an U-magnet (Fig. 19) for measurement.

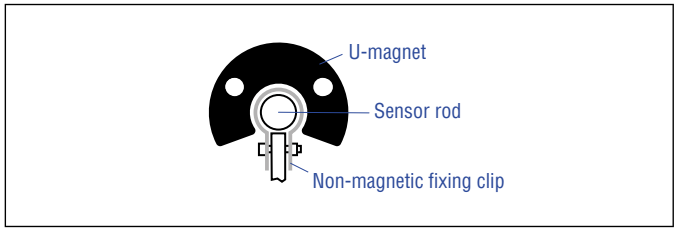


Fig. 19: Example of sensor support (part no. 561 481)

Start and end positions of the position magnets

Consider the start and end positions of the position magnets during the installation. To ensure that the entire stroke length is electrically usable, the position magnet must be mechanically mounted as follows.

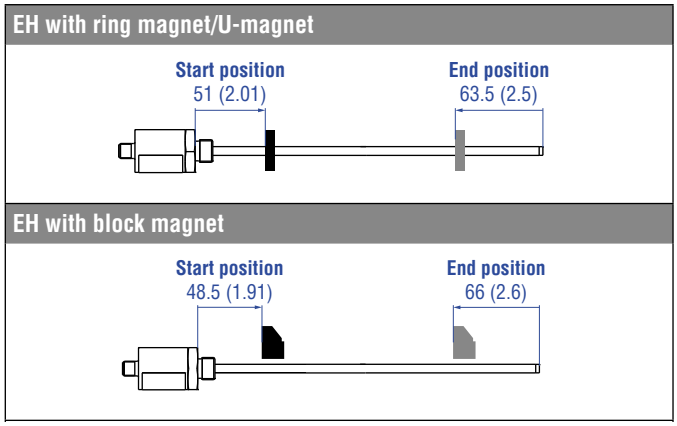


Fig. 20: Start- and end positions of magnets for EH

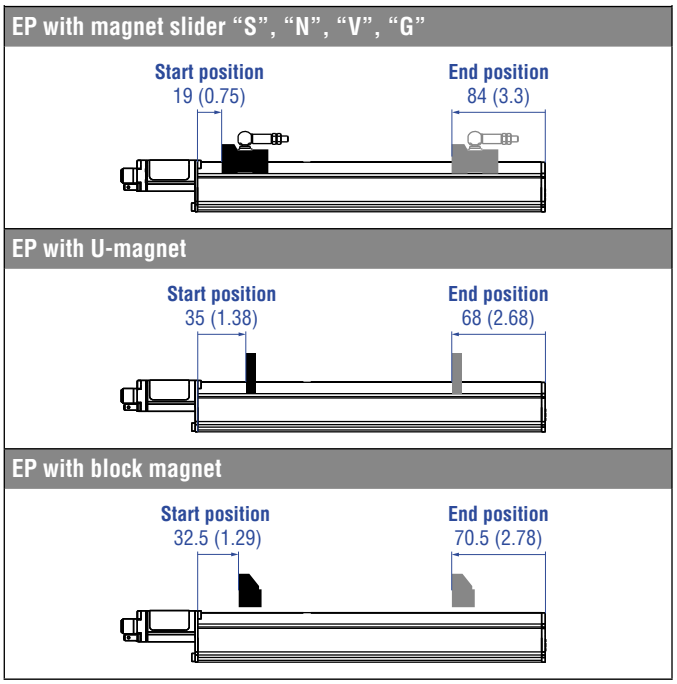


Fig. 21: Start- and end positions of magnets for EP

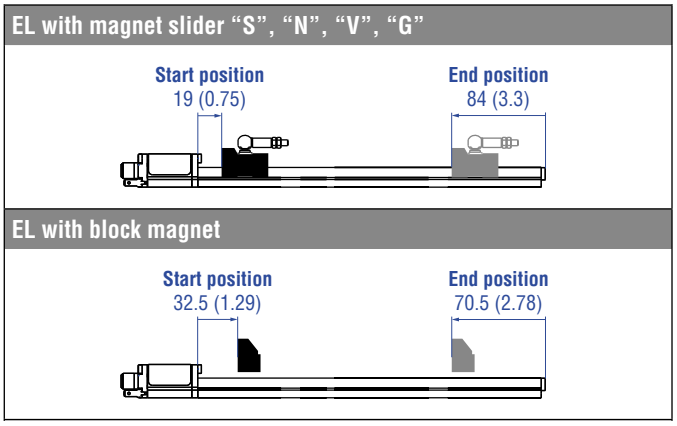


Fig. 22: Start- and end positions of magnets for EL

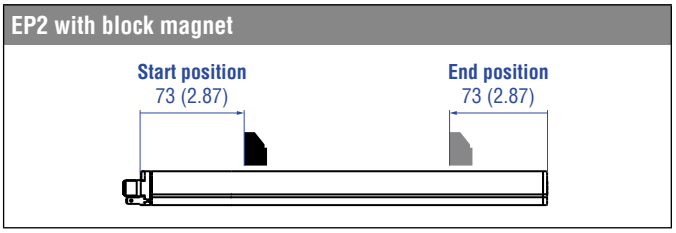


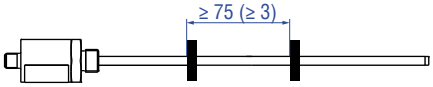
Fig. 23: Start- and end positions of magnets for EP2

Controlling design dimensions are in millimeters and measurements in ( ) are in inches

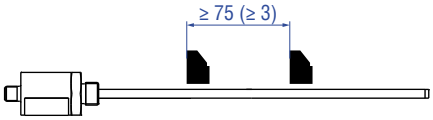
Multi-position measurement

The minimum distance between the magnets is 75 mm (3 in.).

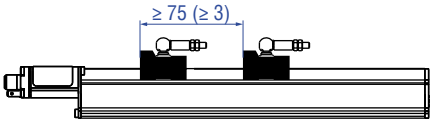
EH with ring magnets/U-magnets



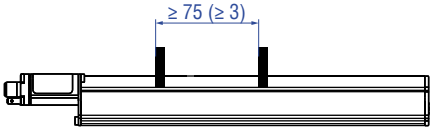
EH with block magnets



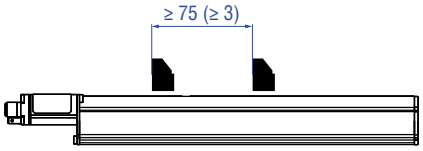
EP with magnet sliders



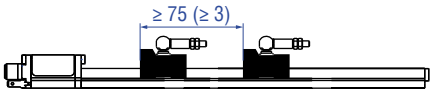
EP with U-magnets



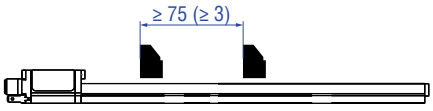
EP with block magnets



EL with magnet sliders



EL with block magnets



EP2 with block magnets

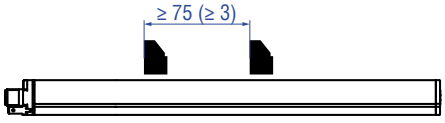


Fig. 24: Minimum distance for multi-position measurement (EH, EP, EL, EP2)

NOTICE

Use magnets of the same type for multi-position measurement.
Do not go below a minimal distance of 75 mm (3 in.) between the magnets for multi-position measurement. Contact Temposonics if you need a magnet distance, which is smaller than 75 mm (3 in.).

Controlling design dimensions are in millimeters and measurements in ( ) are in inches

4.7 Electrical connections

Placement of installation and cabling have decisive influence on the sensor's electromagnetic compatibility (EMC). Hence correct installation of this active electronic system and the EMC of the entire system must be ensured by using suitable metal connectors, shielded cables and grounding. Overvoltages or faulty connections can damage its electronics despite protection against wrong polarity.

NOTICE

1. Do not mount the sensors in the area of strong magnetic or electric noise fields.
2. Never connect/disconnect the sensor when voltage is applied.

Instructions for connection

- Use low-resistant twisted pair and shielded cables. Connect the shield to ground externally via the control system equipment.
- Keep control and sign leads separate from power cables and sufficiently far away from motor cables, frequency inverters, valve lines, relays, etc..
- Use only connectors with metal housing and connect the shielding to the connector housing.
- Keep the connection surface at both shielding ends as large as possible. Connect the cable clamps to function as a ground.
- Keep all non-shielded leads as short as possible.
- Keep the earth connection as short as possible with a large cross section. Avoid ground loops.
- With potential differences between machine and electronics earth connections, no compensating currents are allowed to flow across the cable shielding.
  Recommendation:
  Install potential compensating leads with large cross section or use cables with separate double shielding, and connect only one end of the shield.
- Use only stabilized power supplies in compliance with the specified electrical ratings.

Grounding of profile and rod sensors

Connect the sensor electronics housing to machine ground. Ground sensor types EP, EL, EP2 and ER via ground lug as shown in Fig. 25. The sensor type EH is grounded via thread.

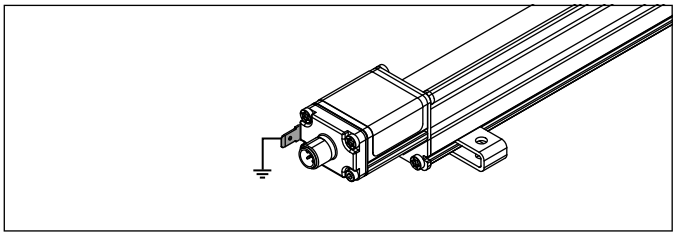


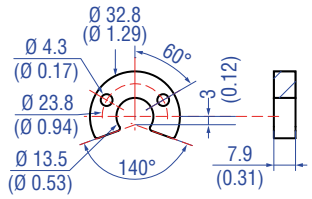
Fig. 25: Grounding via ground lug on the example of an EP sensor

D84		
Signal + power supply		
M12 male connector (A-coded)	**Pin**	**Function**
 View on sensor	1	Start (+)
	2	Start (–)
	3	Stop (+)
	4	Stop (–)
	5	Not connected
	6	Not connected
	7	+24 VDC (–15/+20 %)
	8	DC Ground (0 V)

Fig. 26: Connector wiring D84

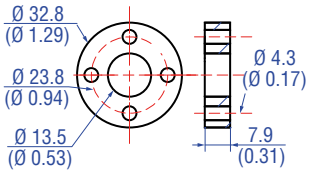
4.8 Frequently ordered accessories for Temposonics® EH – Additional options available in our Accessories Catalog 551 444

Position magnets



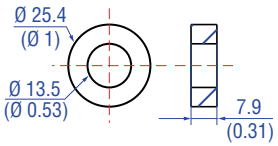
U-magnet OD33
Part no. 251 416-2

Material: PA ferrite GF20
Weight: Approx. 11 g
Surface pressure: Max. 40 N/mm²
Fastening torque for M4 screws: 1 Nm
Operating temperature:
–40…+120 °C (–40…+248 °F)



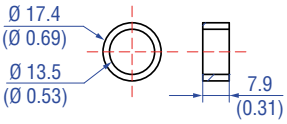
Ring magnet OD33
Part no. 201 542-2

Material: PA ferrite GF20
Weight: Approx. 14 g
Surface pressure: Max. 40 N/mm²
Fastening torque for M4 screws: 1 Nm
Operating temperature:
–40...+120 °C (–40...+248 °F)



Ring magnet OD25.4
Part no. 400 533

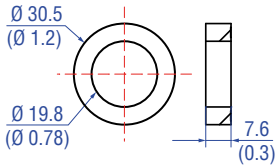
Material: PA ferrite
Weight: Approx. 10 g
Surface pressure: Max. 40 N/mm²
Operating temperature:
–40…+120 °C (–40…+248 °F)



Ring magnet OD17.4
Part no. 401 032

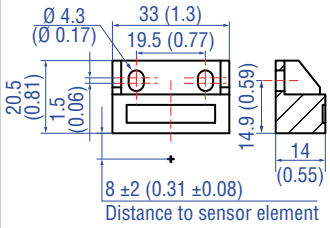
Material: PA neobond
Weight: Approx. 5 g
Surface pressure: Max. 20 N/mm²
Operating temperature:
–40…+105 °C (–40…+221 °F)

Position magnets



Ring magnet
Part no. 402 316

Material: PA ferrite coated
Weight: Approx. 13 g
Surface pressure: Max. 20 N/mm²
Operating temperature:
–40…+100 °C (–40…+212 °F)

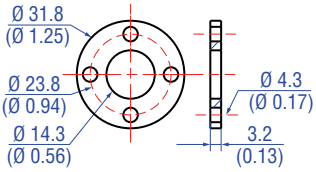


Block magnet L
Part no. 403 448

Material: Plastic carrier with neodymium magnet
Weight: Approx. 20 g
Fastening torque for M4 screws: 1 Nm
Operating temperature:
–40…+75 °C (–40…+167 °F)

This magnet may influence the sensor performance specifications for some applications.

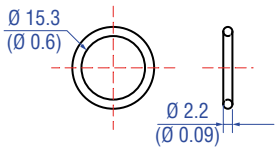
Magnet spacer



Magnet spacer
Part no. 400 633

Material: Aluminum
Weight: Approx. 5 g
Surface pressure: Max. 20 N/mm²
Fastening torque for M4 screws: 1 Nm

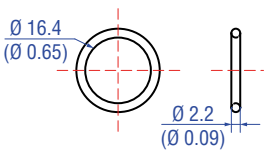
O-ring



O-ring for threaded flange
M18×1.5-6g
Part no. 401 133

Material: Fluoroelastomer
Durometer: 75 ±5 Shore A
Operating temperature:
–40…+204 °C (–40…+400 °F)

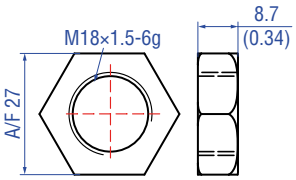
O-ring



O-ring for threaded flange
¾"-16 UNF-3A
Part no. 560 315

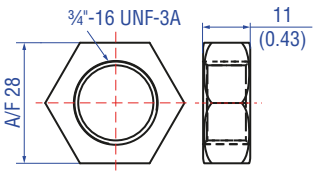
Material: Fluoroelastomer
Durometer: 75 ±5 Shore A
Operating temperature:
–40…+204 °C (–40…+400 °F)

Mounting accessories



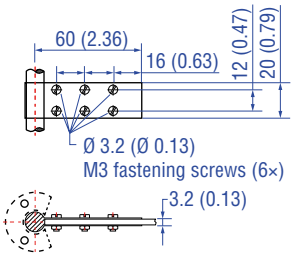
Hex jam nut M18×1.5-6g
Part no. 500 018

Material: Steel, zinc plated



Hex jam nut ¾"-16 UNF-3A
Part no. 500 015

Material: Steel, zinc plated



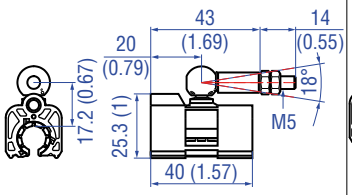
Fixing clip
Part no. 561 481

Application: Used to secure sensor rods (Ø 10 mm (Ø 0.39 in.)) when using an U-magnet or block magnet
Material: Brass, non-magnetic

Controlling design dimensions are in millimeters and measurements in ( ) are in inches

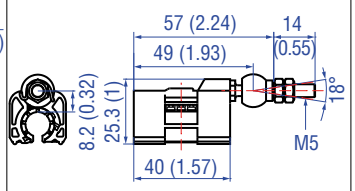
4.9 Frequently ordered accessories for Temposonics® EP – Additional options available in our Accessories Catalog 551 444

Position magnets



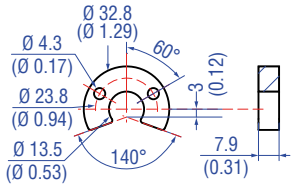
Magnet slider S,
joint at top
Part no. 252 182

Material: GRP, magnet hard ferrite
Weight: Approx. 35 g
Operating temperature:
–40…+85 °C (–40…+185 °F)



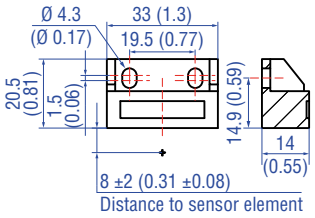
Magnet slider V,
joint at front
Part no. 252 184

Material: GRP, magnet hard ferrite
Weight: Approx. 35 g
Operating temperature:
–40…+85 °C (–40…+185 °F)



U-magnet OD33
Part no. 251 416-2

Material: PA ferrite GF20
Weight: Approx. 11 g
Surface pressure: Max. 40 N/mm²
Fastening torque for M4 screws: 1 Nm
Operating temperature:
–40…+120 °C (–40…+248 °F)

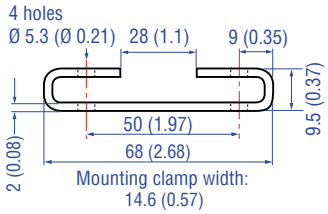


Block magnet L
Part no. 403 448

Material: Plastic carrier with neodymium magnet
Weight: Approx. 20 g
Fastening torque for M4 screws: 1 Nm
Operating temperature:
–40…+75 °C (–40…+167 °F)

This magnet may influence the sensor performance specifications for some applications.

Mounting accessory



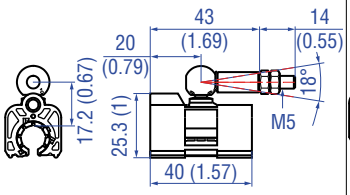
Mounting clamp
Part no. 403 508

Material: Stainless steel 1.4301/1.4305
(AISI 304/303)

Controlling design dimensions are in millimeters and measurements in ( ) are in inches

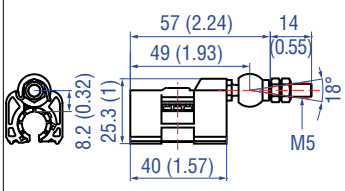
4.10 Frequently ordered accessories for Temposonics® EL – Additional options available in our Accessories Catalog 551 444

Position magnets



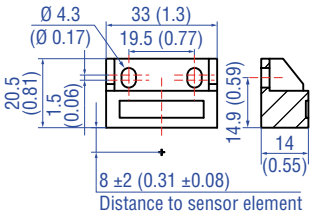
Magnet slider S,
joint at top
Part no. 252 182

Material: GRP, magnet hard ferrite
Weight: Approx. 35 g
Operating temperature:
–40…+85 °C (–40…+185 °F)



Magnet slider V,
joint at front
Part no. 252 184

Material: GRP, magnet hard ferrite
Weight: Approx. 35 g
Operating temperature:
–40…+85 °C (–40…+185 °F)

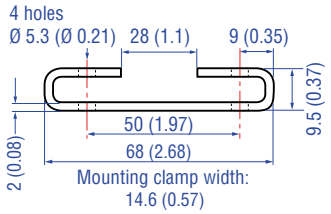


Block magnet L
Part no. 403 448

Material: Plastic carrier with neodymium magnet
Weight: Approx. 20 g
Fastening torque for M4 screws: 1 Nm
Operating temperature:
–40…+75 °C (–40…+167 °F)

This magnet may influence the sensor performance specifications for some applications.

Mounting accessory

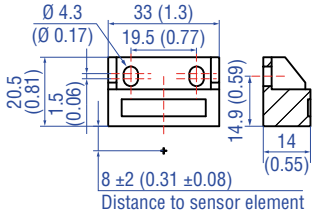
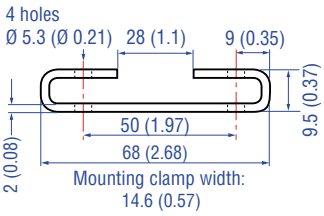


Mounting clamp
Part no. 403 508

Material: Stainless steel 1.4301/1.4305 (AISI 304/303)

Controlling design dimensions are in millimeters and measurements in ( ) are in inches

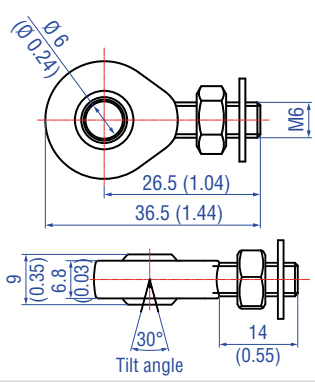
4.11 Frequently ordered accessories for Temposonics® EP2 – Additional options available in our Accessories Catalog 551 444

Position magnet	Mounting accessory
	
Block magnet L **Part no. 403 448**	**Mounting clamp** **Part no. 403 508**
Material: Plastic carrier with neodymium magnet Weight: Approx. 20 g Fastening torque for M4 screws: 1 Nm Operating temperature: –40…+75 °C (–40…+167 °F) This magnet may influence the sensor performance specifications for some applications.	Material: Stainless steel 1.4301/1.4305 (AISI 304/303)

Controlling design dimensions are in millimeters and measurements in ( ) are in inches

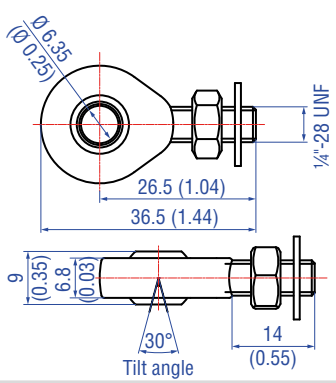
4.12 Frequently ordered accessories for Temposonics® ER – Additional options available in our Accessories Catalog 551 444

Mounting accessories



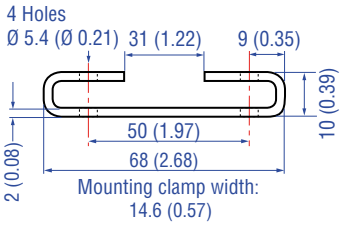
Rod end with M6 thread
Part no. 254 210

Material: Galvanized steel



Rod end with ¼"-28 UNF thread
Part no. 254 235

Material: Galvanized steel



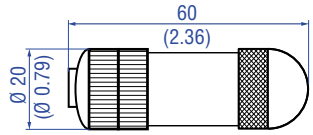
Mounting clamp
Part no. 403 508

Material: Stainless steel 1.4301/1.4305
(AISI 304/303)

Controlling design dimensions are in millimeters and measurements in ( ) are in inches

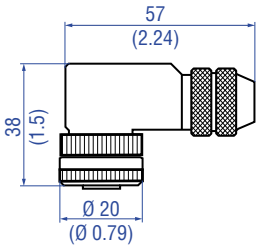
4.13 Frequently ordered accessories for Start/Stop output – Additional options available in our Accessories Catalog 551 444

Cable connectors*



M12 A-coded female connector (8 pin), straight
Part no. 370 694

Housing: GD-ZnAL
Termination: Screw
Contact insert: CuZn
Cable Ø: 4…9 mm (0.16…0.35 in.)
Wire: 0.75 mm²
Operating temperature:
–25…+90 °C (–13…+194 °F)
Ingress protection: IP67 (correctly fitted)
Fastening torque: 0.6 Nm



M12 A-coded female connector (8 pin), angled
Part no. 370 699

Housing: GD-ZnAL
Termination: Screw
Contact insert: CuZn
Cable Ø: 6…8 mm (0.24…0.31 in.)
Wire: 0.5 mm²
Operating temperature:
–25…+85 °C (–13…+185 °F)
Ingress protection: IP67 (correctly fitted)
Fastening torque: 0.6 Nm

Cable sets

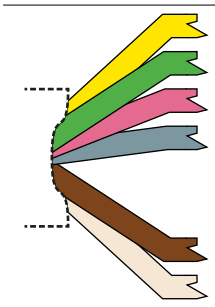
Cable with M12 A-coded female connector (8 pin), straight – pigtail
Part no. 370 789

Material: PUR jacket; orange
Features: Twisted pair, shielded
Cable length: 5 m (16.4 ft)
Ingress protection: IP67/IP69K (correctly fitted)
Operating temperature:
–25…+80 °C (–13…+176 °F)

Cable with M12 A-coded female connector (8 pin), angled – pigtail
Part no. 370 821

Material: PUR jacket; orange
Features: Twisted pair, shielded
Cable length: 5 m (16.4 ft)
Ingress protection: IP67/IP69K (correctly fitted)
Operating temperature:
–25…+80 °C (–13…+176 °F)

Wiring



Wires	Color		Pin
	YE	↔	1
	GN	↔	2
	PK	↔	3
	GY	↔	4
	–	↔	5
	–	↔	6
	BN	↔	7
	WH	↔	8

M12 A-coded female connector (8 pin)

*/ Follow the manufacturer's mounting instructions
Color of connectors and cable jacket may change. Color codes for the individual wires and technical properties remain unchanged.
Controlling design dimensions are in millimeters and measurements in ( ) are in inches

5. Commissioning

5.1 Getting started

The sensor is set at the factory according to the order code and adjusted, i.e. the required output signal corresponds exactly to the selected stroke length.

NOTICE

Observe during commissioning

1. Before switching on for the first time, check the connection of the sensor carefully.
2. Position the magnet in the measuring range of the sensor during first commissioning and after replacement of the magnet.
3. Ensure that the controller, to which the sensor is connected, does not react in an uncontrolled way.
4. Ensure that the sensor is ready and in operation mode after switching on.

5.2 Programming and configuration

The functional diagram of the sensor with Start/Stop interface is shown in Fig. 27. The start pulse of the controller is acknowledged by the sensor with a stop pulse; the position measurement starts. At the end of the measurement the sensor generates a second stop pulse. The time between the start pulse and the second stop pulse is the travel time.

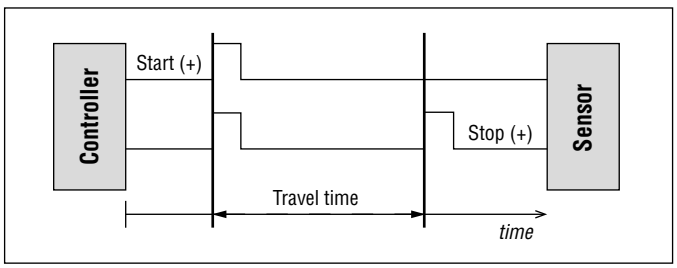


Fig. 27: Functional diagram of sensor with Start/Stop interface

Set the start pulse width and the cycle time according to the stroke length on the controller:

- Start impuls width: 1…2.5 µs
- Minimal cycle time:
  50…1000 mm (2 … 40 in.) stroke length: 500 µs
  1001…2000 mm (40… 79 in.) stroke length: 900 µs
  2001…3000 mm (79…118 in.) stroke length: 1250 µs

If the position magnet is out of the stroke length, the sensor does not send a reply signal. This behavior can be evaluated and used for monitoring by the controller.

NOTICE

If the stroke length is exceeded only insignificantly, the sensor generates a reply signal.

Parameter upload

The parameter upload function allows transfer of sensor parameters to the controller. It is easy to measure and store the sensor parameters given below using the same physical interface without additional connections via the communication mode to the controller.

Technical data:
Interface: RS-422
Data format: Serial, 4800 baud, 1 start bit, 8 data bits, no parity, 1 stop bit

The diagram of the data transfer for parameter upload of the sensor with Start/Stop interface is shown in Fig. 28. The start pulse width has to be > 10 µs to start the parameter upload function. A start pulse width > 2.5 µs and < 10 µs is not permitted. The data is sent to the controller with the low bit first (one start bit “0”, one stop bit “1”, no parity).

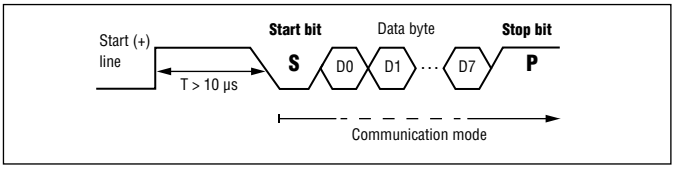


Fig. 28: Diagram of data transfer for parameter upload

The following parameters are transfered via parameter upload function:

1. Gradient
The gradient specifies the travelling speed of the measuring pulse. Gradient and travel time between start pulse and stop pulse are used to determine the position of the position magnet.
Position = gradient × travel time

The speed of the measuring pulse is approx. 2780 m/s (9.14 µs/inch.). The exact value is determined during final component checking and specified as a gradient on the nameplate.

2. Offset
The offset indicates the value of the position magnet’s position at span start. It is used as a reference value to detect when the stroke length is left and to adapt the position values.
Position = gradient × travel time – offset

NOTICE Check gradient after replacing the sensor to avoid errors in position measurement.

3. Stroke length
Indicates the useful measurement displacement of the sensor.

4. Serial number
Every sensor is provided with a unique serial number, which is printed on the nameplate and stored in the sensor.

5. Manufacturer identification
Due to the manufacturer identification, the controller can take manufacturer specific particularities into account.

6. Status
Provides information on the sensor status.

7. Minimum cycle time
The minimum cycle time specifies the time, which has to be between two consecutive start pulses of position measurement. The start pulse for each measurement is generated by the controller.

Data communication
As shown in Fig. 27 communication between controller and sensor is performed via the already provided connections. So the start lines are used for sending from the controller to the sensor, while the stop lines are used for receiving. For data exchange using the parameter upload function the start line is set to level High. The start pulse width has to be > 10 µs to ensure that the sensor switches over safely to the communication mode. Subsequently, the required command can be transmitted to the sensor.

NOTICE

Setting the start line to Low level is considered as a start bit of data transfer and treated accordingly by the sensor. Note that a bit combination which does not correspond to the controller command set is treated as a data fault and re-activates the Start/Stop operation (measuring mode). The occurrence of a data fault can be detected subsequently by a status request.

Read command	Code hex.	Transmitted bytes hex.	Note
Gradient	0x55	4	in cm/s
Offset	0x57	4	in µm
Stroke length	0x59	4	in mm
Serial number	0x5D	4	
Manufacturer recognition Temposonics	0x61	4	0
Status	0x5F	4	
Minimum cycle time	0x73	4	in µs
General commands			
Stop communication	0x3D	—	

Fig. 29: Command set for parameter upload function

Telegram formats
Read commands:
Data is transmitted from the sensor to the controller. For this purpose, the controller sends a request command and receives the required data, after the sensor has processed the command. Only after data transmission to the controller, the sensor is ready to receive and process further commands. The communication is shown in Fig. 30:

1. Data request: E.g. "read gradient"
Controller → command 0x55 → sensor

2. Data reception: Output of gradient (message with a length of 4 bytes)
Sensor → **Byte 3** (High byte) → controller
Sensor → **Byte 2** → controller
Sensor → **Byte 1** → controller
Sensor → **Byte 0** (Low byte) → controller

Fig. 30: Communication telegram

NOTICE

The High byte is sent first!

The pause time between bytes is approximately 6 ms.

Status:
The status command is an exception, since the command can be used to retrieve current sensor status information. After requesting the status, the controller can receive the following message:

1. Everything o.k.
Sensor ⟶ **0x00 00 00 00** ⟶ controller
The sensor did not detect an error.

2. Unknown command
Sensor ⟶ **0x00 00 00 AA** ⟶ controller
An unknown command which is not mentioned in Fig. 29 was received by the sensor. This can be due to trouble on the data line or malfunction of the controller. In this case, the sensor sets the status to 0xAA, leaves the communication mode and starts operating in Start/Stop mode for position determination and position output. After restarting the communication mode, the status byte which is reset to 0x00 can be retrieved. Thus the controller realizes that cancellation is due to trouble.

3. Defective data set in EEPROM
Sensor ⟶ **0x00 00 00 FF** ⟶ controller
When checking the EEPROM data set during start-up, divergence of the calculated checksum from the stored checksum was found. Consequently, there is a risk to use faulty data.
If this should be the case, the status is set to 0xFF and the sensor must be re-adjusted. Therefore it is recommended to start a status request after switching on the supply voltage.

Fig. 31: Status command

Terminate communication
Changing from the communication mode to the Start/Stop mode is performed by the command “terminating the communication”:

Sensor ⟶ **0x3D** ⟶ controller

This command terminates the communication. The operation is continued with the operation in Start/Stop mode for position determination and position output.

6. Maintenance and troubleshooting

6.1 Error conditions, troubleshooting

See chapter “5. Commissioning” on page 26.

6.2 Maintenance

The sensor is maintenance-free.

6.3 Repair

Repairs of the sensor may be performed only by Temposonics or a repair facility explicitly authorized by Temposonics. For return see chapter “2.6 Return” on page 4.

6.4 List of spare parts

No spare parts are available for this sensor.

6.5 Transport and storage

The conditions of transport and storage of the sensor match the operating conditions mentioned in this document.

7. Removal from service/dismantling

The product contains electronic components and must be disposed of in accordance with the local regulations.

8. Technical data

8.1 Technical data of Temposonics® EH

Output	
Start/Stop	RS-422 differential signal Serial parameter upload available for: Stroke length, offset, gradient, status, serial number and manufacturer number
Measured value	Position (of up to 2 magnets)
Measurement parameters	
Resolution	Controller dependent
Cycle time	Controller and stroke length dependent Recommendation: Stroke length | ≤ 1000 mm | ≤ 2000 mm | ≤ 2540 mm Cycle time | 500 µs | 900 µs | 1250 µs
Linearity deviation [3]	≤ ±0.02 % F.S. (minimum ±60 µm)
Repeatability	≤ ±0.005 % F.S. (minimum ±20 µm)
Operating conditions	
Operating temperature	–40…+75 °C (–40…+167 °F)
Humidity	90 % relative humidity, no condensation
Ingress protection	IP67/IP69K (connectors correctly fitted)
Shock test	100 g (single shock), IEC standard 60068-2-27
Vibration test	15 g/10…2000 Hz, IEC standard 60068-2-6 (excluding resonant frequencies)
EMC test	Electromagnetic emission according to EN 61000-6-3 Electromagnetic immunity according to EN 61000-6-2 The EH sensors fulfill the requirements of the EMC directives 2014/30/EU, UKSI 2016 No. 1091 and TR CU 020/2011.
Operating pressure	7 mm (0.28 in.) rod Ø: 300 bar (4351 psi), 450 bar (6527 psi) peak 10 mm (0.39 in.) rod Ø: 350 bar (5076 psi), 530 bar (7687 psi) peak
Magnet movement velocity	Any
Design/Material	
Sensor electronics housing	Stainless steel 1.4305 (AISI 303); option: Stainless steel 1.4404 (AISI 316L)
Sensor flange	Stainless steel 1.4305 (AISI 303); option: Stainless steel 1.4404 (AISI 316L)
Sensor rod	7 mm (0.28 in.) rod Ø: Stainless steel 1.4301 (AISI 304) 10 mm (0.39 in.) rod Ø: Stainless steel 1.4306 (AISI 304L); option: Stainless steel 1.4404 (AISI 316L)
RoHS compliance	The used materials are compliant with the requirements of EU directive 2011/65/EU and EU regulation 2015/863 as well as UKSI 2022 No. 622 with amendments
Stroke length	50…2540 mm (2…100 in.)
Mechanical mounting	
Mounting position	Any
Mounting instruction	Please consult the technical drawing on page 11

Technical data “Electrical connection” on page 30

3/ With position magnet # 251 416-2

Electrical connection	
Connection type	M12 male connector (8 pin)
Operating voltage	+24 VDC (–15/+20 %); The EH sensors must be power supplied via an external Class 2 power source in accordance with the UL approval
Ripple	≤ 0.28 V_{PP}
Current consumption	50…100 mA
Dielectric strength	500 VDC (DC ground to machine ground)
Polarity protection	Up to –30 VDC
Overvoltage protection	Up to 36 VDC

8.2 Technical data of Temposonics® EP/EL

Output	
Start/Stop	RS-422 differential signal Serial parameter upload available for: Stroke length, offset, gradient, status, serial number and manufacturer number
Measured value	Position (of up to 2 magnets)
Measurement parameters	
Resolution	Controller dependent
Cycle time	Controller and stroke length dependent Recommendation: Stroke length | ≤ 1000 mm | ≤ 2000 mm | ≤ 3000 mm Cycle time | 500 µs | 900 µs | 1250 µs
Linearity deviation [4]	≤ ±0.02 % F.S. (minimum ±60 µm)
Repeatability	≤ ±0.005 % F.S. (minimum ±20 µm)
Operating conditions	
Operating temperature	–40…+75 °C (–40…+167 °F)
Humidity	90 % relative humidity, no condensation
Ingress protection [5]	IP67 (connectors correctly fitted)
Shock test	100 g (single shock), IEC standard 60068-2-27
Vibration test	15 g/10…2000 Hz, IEC standard 60068-2-6 (excluding resonant frequencies)
EMC test	Electromagnetic emission according to EN 61000-6-3 Electromagnetic immunity according to EN 61000-6-2 The EP/EL sensors fulfill the requirements of the EMC directives 2014/30/EU, UKSI 2016 No. 1091 and TR CU 020/2011.
Magnet movement velocity	Magnet slider: ≤ 5 m/s; U-magnet: Any; block magnet: Any
Design/Material	
Sensor electronics housing	Aluminum
Sensor profile	Aluminum
RoHS compliance	The used materials are compliant with the requirements of EU directive 2011/65/EU and EU regulation 2015/863 as well as UKSI 2022 No. 622 with amendments
Stroke length	50…3000 mm (2…118 in.)
Mechanical mounting	
Mounting position	Any
Mounting instruction	Please consult the technical drawings on page 13
Electrical connection	
Connection type	M12 male connector (8 pin)
Operating voltage	+24 VDC (–15/+20 %); The EP/EL sensors must be power supplied via an external Class 2 power source in accordance with the UL approval
Ripple	≤ 0.28 V_{PP}
Current consumption	50…100 mA
Dielectric strength	500 VDC (DC ground to machine ground)
Polarity protection	Up to –30 VDC
Overvoltage protection	Up to 36 VDC

4/ With magnet slider # 252 182 and # 252 184, U-magnet # 251 416-2
5/ The IP rating IP67 is only valid for the sensor electronics housing, as water and dust can get inside the profile.

8.3 Technical data of Temposonics® EP2

Output	
Start/Stop	RS-422 differential signal Serial parameter upload available for: Stroke length, offset, gradient, status, serial number and manufacturer number
Measured value	Position (of up to 2 magnets)
Measurement parameters	
Resolution	Controller dependent
Cycle time	Controller and stroke length dependent Recommendation: Stroke length: ≤ 1000 mm: Cycle time 500 µs; ≤ 2000 mm: 900 µs; ≤ 3000 mm: 1250 µs
Linearity deviation [6]	≤ ±0.02 % F.S. (minimum ±90 µm)
Repeatability	≤ ±0.005 % F.S. (minimum ±20 µm)
Operating conditions	
Operating temperature	–40…+75 °C (–40…+167 °F)
Humidity	90 % relative humidity, no condensation
Ingress protection [7]	IP67 (connectors correctly fitted)
Shock test	100 g (single shock), IEC standard 60068-2-27
Vibration test	8 g/10…2000 Hz, IEC standard 60068-2-6 (excluding resonant frequencies)
EMC test	Electromagnetic emission according to EN 61000-6-3 Electromagnetic immunity according to EN 61000-6-2 The EP2 sensors fulfill the requirements of the EMC directives 2014/30/EU, UKSI 2016 No. 1091 and TR CU 020/2011.
Magnet movement velocity	Any
Design/Material	
Sensor lid	Zinc die-cast
Sensor profile	Aluminum
RoHS compliance	The used materials are compliant with the requirements of EU directive 2011/65/EU and EU regulation 2015/863 as well as UKSI 2022 No. 622 with amendments
Stroke length	50…3000 mm (2…118 in.)
Mechanical mounting	
Mounting position	Any
Mounting instruction	Please consult the technical drawing on page 14
Electrical connection	
Connection type	M12 male connector (8 pin)
Operating voltage	+24 VDC (–15/+20 %); The EP2 sensors must be power supplied via an external Class 2 power source in accordance with the UL approval
Ripple	≤ 0.28 V_{PP}
Current consumption	50…100 mA
Dielectric strength	500 VDC (DC ground to machine ground)
Polarity protection	Up to –30 VDC
Overvoltage protection	Up to 36 VDC

6/ With block magnet # 403 448
7/ The IP rating IP67 is only valid for the sensor electronics housing, as water and dust can get inside the profile.

8.4 Technical data of Temposonics® ER

Output	
Start/Stop	RS-422 differential signal Serial parameter upload available for: Stroke length, offset, gradient, status, serial number and manufacturer number
Measured value	Position
Measurement parameters	
Resolution	Controller dependent
Cycle time	Controller and stroke length dependent Recommendation: Stroke length | ≤ 1000 mm | ≤ 1500 mm Cycle time | 500 µs | 900 µs
Linearity deviation	≤ ±0.02 % F.S. (minimum ±60 µm)
Repeatability	≤ ±0.005 % F.S. (minimum ±20 µm)
Operating conditions	
Operating temperature	–40…+75 °C (–40…+167 °F)
Humidity	90 % relative humidity, no condensation
Ingress protection [8]	IP67 (connectors correctly fitted)
Shock test	100 g (single shock), IEC standard 60068-2-27
Vibration test	5 g/10…2000 Hz, IEC standard 60068-2-6 (excluding resonant frequencies)
EMC test	Electromagnetic emission according to EN 61000-6-3 Electromagnetic immunity according to EN 61000-6-2 The ER sensors fulfill the requirements of the EMC directives 2014/30/EU, UKSI 2016 No. 1091 and TR CU 020/2011.
Magnet movement velocity	≤ 5 m/s
Design/Material	
Sensor electronics housing	Aluminum
Guided driving rod	Aluminum
RoHS compliance	The used materials are compliant with the requirements of EU directive 2011/65/EU and EU regulation 2015/863 as well as UKSI 2022 No. 622 with amendments
Stroke length	50…1500 mm (2…60 in.)
Mechanical mounting	
Mounting position	Any
Mounting instruction	Please consult the technical drawing on page 15
Electrical connection	
Connection type	M12 male connector (8 pin)
Operating voltage	+24 VDC (–15/+20 %); The ER sensors must be power supplied via an external Class 2 power source in accordance with the UL approval
Ripple	≤ 0.28 V_{pp}
Current consumption	50…100 mA
Dielectric strength	500 VDC (DC ground to machine ground)
Polarity protection	Up to –30 VDC
Overvoltage protection	Up to 36 VDC

8/ The IP rating IP67 is only valid for the sensor electronics housing, as water and dust can get inside the profile.

Temposonics
AN AMPHENOL COMPANY

9. Appendix – Safety declaration

Dear Customer,
If you return one or several sensors for checking or repair, we need you to sign a safety declaration. The purpose of this declaration is to ensure that the returned items do not contain residues of harmful substances and/or that people handling these items will not be in danger.

Temposonics order code: _____ Sensor model(s): _____

Serial number(s): _____ Stroke length(s): _____

The sensor has been in contact with the following materials:

Do not specify chemical formulas.
Please include safety data sheets of the substances, if applicable.

In the event of suspected penetration of substances into the sensor, consult Temposonics to determine measures to be taken before shipment.

Short description of malfunction:

Corporate information

Company: _____

Address: _____

_____

Contact partner

Phone: _____

Fax: _____

Email: _____

We hereby certify that the measuring equipment has been cleaned and neutralized.
Equipment handling is safe. Personnel exposure to health risks during transport and repair is excluded.

Stamp

Signature _____

Date _____

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