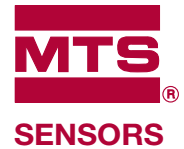


Temposonics®

Magnetostrictive Linear-Position Sensors



E-Series Model ER Sensor
Analog and Digital Pulse Outputs

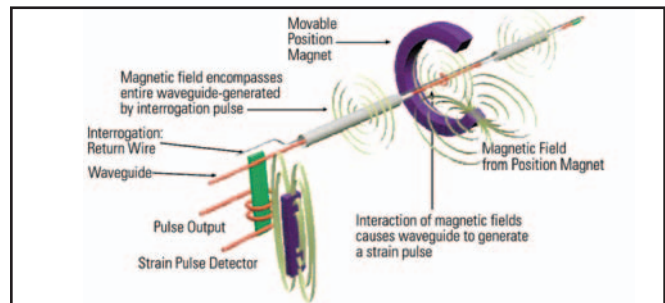
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Product Specification



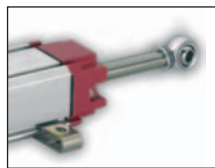
Temposonics Model ER sensor

- Rugged industrial sensor
- Linear, absolute measurement
- Non-contact sensing technology
- Non-linearity less than 0.02 %
- Repeatability within 0.001 %
- EMI shielded and CE certified
- Analog output, (voltage or current)
- Start/Stop digital pulse output, (upload of sensor parameters available)



Model ER rod-and-cylinder sensor

The innovative Temposonics model ER sensor brings the proven benefits of magnetostrictive feedback to the versatile rod-and-cylinder sensor package. It is ideal for demanding industrial applications where high performance non-contact feedback is essential.



and protected at all times, ensuring reliable sensor performance in the toughest industrial environments.

The model ER sensor's rod-and-cylinder design has a stainless steel "sensing rod" that can extend from the sensor housing. As the rod is extended and retracted, the sensing magnet remains completely contained

The ER model sensor provides a very precise, durable and cost effective alternative to the wear problems associated with linear potentiometers.

The benefits of magnetostrictive sensing

Temposonics linear sensors use the time-based magnetostrictive position sensing principle developed by MTS. Within the sensing element, a sonic strain pulse is induced in a specially-designed magnetostrictive waveguide by the momentary interaction of two magnetic fields. One field comes from a movable permanent magnet that passes along the outside of the sensor. The other field comes from an "interrogation" current pulse applied along the waveguide. The resulting strain pulse travels at ultrasonic speed along the waveguide and is detected at the

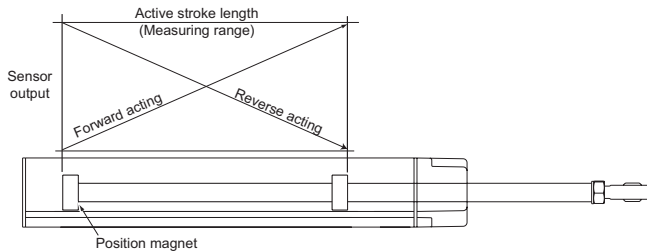
head of the sensing element. The position of the magnet is determined with high precision and speed by accurately measuring the elapsed time between the application of the interrogation pulse and the arrival of the resulting strain pulse with a high speed counter. Using the elapsed time to determine position of the permanent magnet provides an absolute position reading that never needs recalibration or re-homing after a power loss. Non-contact sensing eliminates wear, and guarantees the best durability and output repeatability.



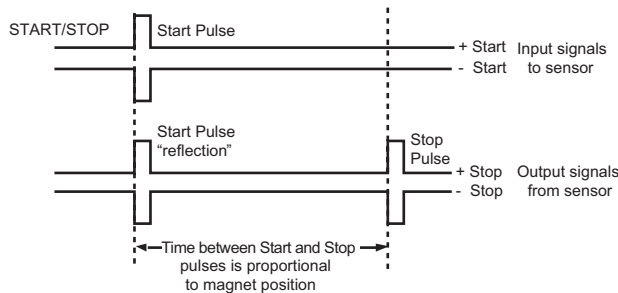
All specifications are subject to change. Please contact MTS for specifications that are critical to your needs.

Temposonics Model ER linear-position sensor

Temposonics E-Series model ER, rod-and-cylinder sensors are available with analog output or digital-pulse output. The analog outputs include voltage, (0 to 10 VDC, forward and reverse acting), and current, (4 to 20 mA, forward or reverse acting). Since the outputs are direct, no signal conditioning electronics are needed when interfacing with controllers or meters.



The available digital-pulse output is Start/Stop. Here the sensor requires a start signal from a controller or interface card to initiate the measurement cycle. The sensor generates a stop signal at the end of the measurement cycle that is used to stop the controller's counter clock. The elapsed time between the Start and Stop signals is directly proportional to the magnet's position within the sensor housing. The controller can calculate the absolute position of the magnet from the time value and the sensor's unique gradient value, (inverse of the average speed for the ultrasonic pulse traveling in the sensor's waveguide).



For applications using smart sensor interfaces the Start/Stop output, (option R3), can provide a sensor parameter upload ability. The following sensor parameters are available for upload:

- **Measuring range**
- **Offset**
- **Gradient** (Inverse speed of sensing pulse)
- **Status**
- **Manufacturer number**

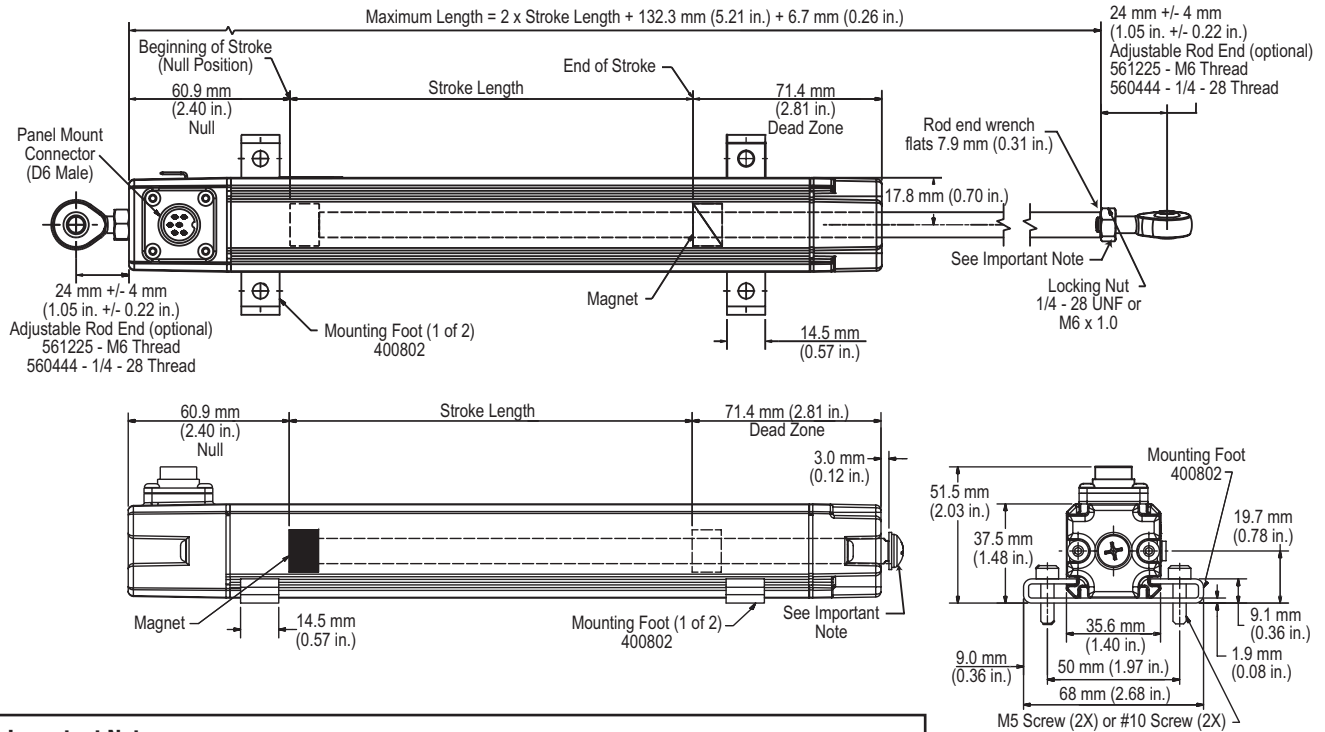
The sensor also features over-voltage protection to 36 Vdc and reverse polarity protection to 30 Vdc on input voltage connections. All outputs are absolute rather than incremental so that power-down situations do not require re-homing.

Parameters	Specification
Measured Variable:	Displacement
Resolution:	Analog: Infinite Digital: $1 \div [\text{gradient} \times \text{crystal freq. (MHz)} \times \text{circulation}]$; controller dependent.
Non-Linearity:	$\leq \pm 0.02\%$ Full stroke (minimum $\pm 60\mu\text{m}$)
Repeatability:	$\leq \pm 0.001\%$ Full stroke
Outputs:	Voltage: 0 to 10 Vdc and 10 to 0 Vdc (controller input resistance $R_L > 5\text{k}\Omega$) Current: 4 to 20 mA or 20 to 4 mA (min/max load: 0/500 Ohm) Start/Stop: RS-422 differential signal (Serial parameter upload available for: measuring range, offset, gradient, status, and manufacturer number)
Update Frequency:	Voltage or Current: $> 1.5 \text{ kHz}$ Start/Stop: Controller dependent
Measuring Range:	75 to 1500 mm (3 to 60 in.) ER sensors standard stroke ranges are 3, 6, 9, 12, 15, 18, 21, 24, 30, 36, 42, 48, 54 and 60 inches (75, 100, 150, 200, 300, 400, 500, 600, 750, 1000, 1250, 1500 mm) Custom stroke lengths available.
Operating Conditions:	Temperature: - 40 to 75°C Relative humidity: 90% no condensation. Ingress protection: IP65 if mating cable connector is correctly fitted. Shock test: 100 g (single hit) IEC-Standard 68-2-27 Vibration rating: 10 g/10 - 2000 Hz IEC-Standard 68-2-6
EMC Test:	Electromagnetic emission EN 50081-1 Electromagnetic immunity EN 50082-2 EN 61000-4-2/3/4/6, Level 3/4, Criteria A, CE qualified
Operating Voltage:	+24 Vdc nominal (-15 or +20%) Polarity protection: up to -30 Vdc Overvoltage protection: up to 36 Vdc Current drain: Analog: 50 - 140 mA Start/Stop: 50 - 100 mA (stroke length dependent) Dielectric withstand voltage: 500 V, (DC ground to machine ground)
Connection type:	6-pin male D60 connector
Sensor housing:	Aluminum
Sensor rod:	Stainless steel type 303
Mounting:	Adjustable mounting feet or dual rod ends.

Temposonics Model ER linear-position sensor

A robust aluminum extrusion forms the sensor housing, containing the sensor rod, magnet, sensing element and electronics. The permanent magnet is mounted on a sliding carrier attached to the end of the stainless steel rod. As the rod moves in and out, the magnet travels above the sensing element inside the sensor housing.

Dimensions



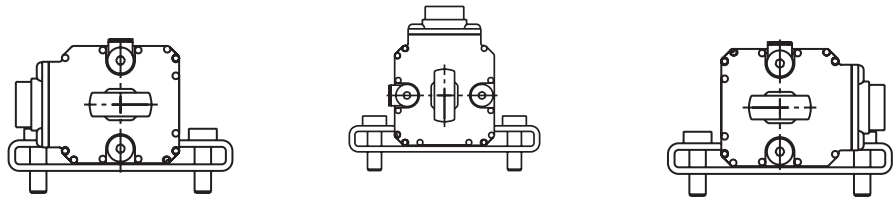
Important Note:

To avoid possible sensor damage, the washer, (or the locking nut for a rod end), must remain at the end of the rod to provide a mechanical stop when the rod is fully retracted.

Mounting

The ER sensors are designed for external installation on machines. The sensor housing is typically secured on the machine using the standard mounting feet and screws that can be easily adjusted. The rod end is then attached to the moving machine part.

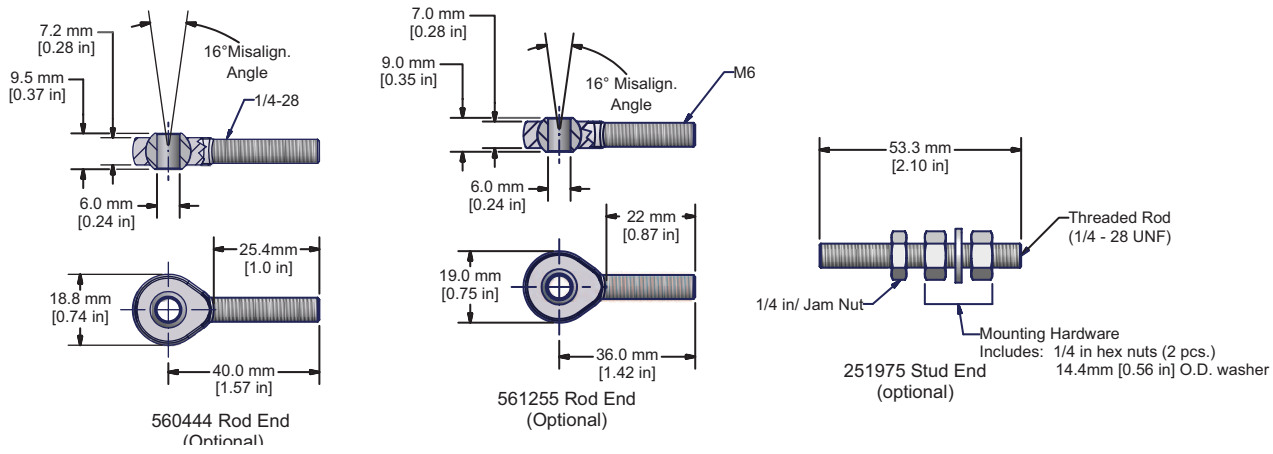
Slots for the mounting feet are available on three sides of the sensor housing, allowing versatile mounting orientations for the sensor connector and extension cable.



Temposonics Model ER linear-position sensor

Mounting (C0ntinued)

Optional rod ends can be used to simplify sensor installation design and facilitate articulated motion sensing. Using dual rod ends the ER sensor can be mounted between two independent moving points, such as, swinging door applications. Please note that articulated or unsupported sensor applications must be limited to a maximum of 750 mm (30 in.) stroke length.



Wiring and Connectors

Sensor integral connector (D60 Male)

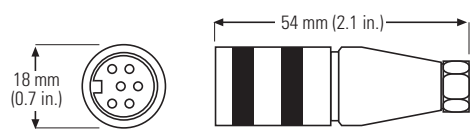
Pinout/wire color code (extension cable)

Pin no.	Wire color	Function	Function
		Digital-pulse outputs	Analog outputs
1	Gray	(-) Stop for Start/Stop	0 to 10 Vdc or 4 to 20 mA
2	Pink	(+) Stop for Start/Stop	Return for pin 1
3	Yellow	(+) Start for Start/Stop	10 to 0 Vdc or 20 to 4 mA
4	Green	(-) Start for Start/Stop	Return for pin 3
5	Red or Brown	+24 Vdc (+20%, -15%)	+24 Vdc (+20%, -15%)
6	White	DC Ground (for supply)	DC Ground (for supply)

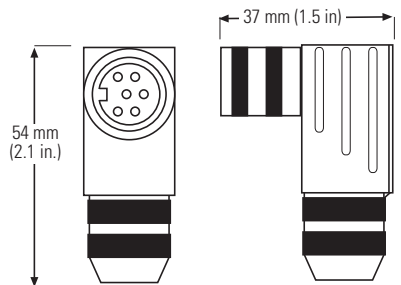
Cable connectors (field-installed D6 female)

Mates with sensor's integral connector

D6 Straight-exit connector
part no. 560700



D6 90° connector
part no. 560778

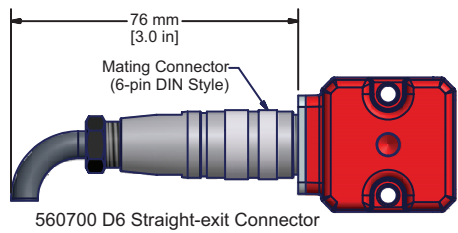


Integral D6 connector (male) as viewed from side of sensor



Note:
Appropriate grounding of cable shield is required at the controller end.

Attention:
A grounding lug is provided near the connector end of the sensor for a convenient connection to earth ground. Since the ER sensor's aluminum housing has an anodic coating the sensor mounting feet, (part no. 400802), do not provide proper grounding. A ground wire connection to the grounding lug is required.



How to order

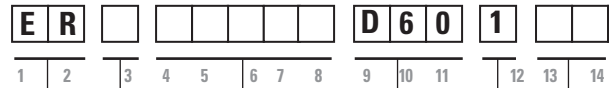
Position sensor

When placing an order, build the desired model number using the model number guide (right). A wide range of E-Series position sensor configurations are available to meet the demands of your particular application.

If you have any questions about how to apply E-Series position sensor, please contact MTS Applications Engineering or your local MTS distributor. Both of these resources are available to assist you in designing an effective position sensing system to fit your application.

Notes:

- Articulated or unsupported sensor applications using dual rod ends must be limited to a maximum of 750 mm (30 in.) stroke length.
- If mounting feet will be used, they must be ordered separately. Order 2 mounting feet, (part no. 400802), for sensors up to 750 mm (30 in.). At least one additional mounting foot is recommended for longer lengths.



SENSOR MODEL

ER = Rod & cylinder style

TYPE OF THREAD

S = Inside thread 1/4 - 28 (English). Must be used for ER sensors having US Customary stroke lengths.

M = Inside thread M6 (Metric). Must be used for ER sensors having metric stroke lengths.

STROKE LENGTH

--- **M** = Millimeters (Encode in 5 mm increments for custom stroke lengths)

--- **U** = Inches and tenths (Encode in 0.1 in. increments for custom stroke lengths)

CONNECTION TYPE

Connector

D60 = 6-pin DIN, connector, integral, standard

INPUT VOLTAGE

1 = +24 Vdc (+20%, -15%),

OUTPUT

Analog - Voltage

V0 = 0 to +10 Vdc and +10 to 0 Vdc

Analog - Current

A0 = 4 to 20 mA

A1 = 20 to 4 mA

Digital - Pulse

R0 = Start/Stop

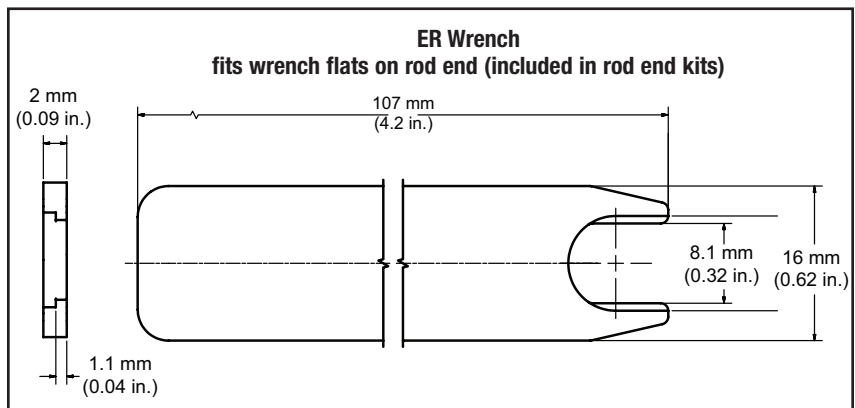
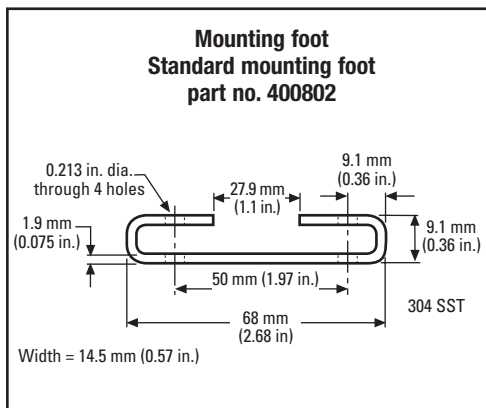
R3 = Start/Stop with sensor parameters upload

Stroke length notes:

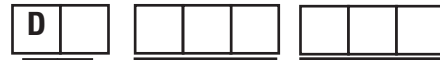
ER sensor standard stroke ranges are 3, 6, 9, 12, 15, 18, 21, 24, 30, 36, 42, 48, 54 and 60 inches (75, 100, 150, 200, 300, 400, 500, 600, 750, 1000, 1250, 1500 mm). Custom stroke lengths are available.

Accessories

Description	Function/Notes	Part no.
Mounting feet	Standard, see notes	400802
6-Pin DIN connector, straight	Female, straight exit, mates to D60 connection type. See page 4.	560700
6-Pin DIN connector, 90°	Female, 90° exit, mates to D60 connection type. See page 4.	560778
Stud End Attachment	Male 1/4 - 28, see page 3.	251975
Rod End Kit (Standard)	Male 1/4 - 28 rod ends (2 pcs), plus special wrench. See pages 3 and 5.	253346
Rod End Kit (Metric)	Male M6 rod ends (2 pcs), plus special wrench. See pages 3 and 5.	253347
Rod End Attachment (Standard)	Male 1/4 - 28, see page 3.	560444
Rod End Attachment (Metric)	Male M6, see page 3.	561255



Extension cable with connectors for the D6, (D60), connection type



SENSOR CONNECTION TYPE

- D6** = Female connector, (straight exit), and standard (part no. 530026) cable (PVC jacket) for sensors with D6 or D60 connector
- DA** = Female connector, (90° exit), and standard (part no. 530026) cable (PVC jacket) for sensors with D6 or D60 connector
- DJ** = Female connector, (straight exit), and (part no. 530045) cable, (black polyurethane jacket for higher resistance to moisture and oil), for sensors with D6 or D60 connector
- DK** = Female connector, (90° exit), and (part no. 530045) cable, (black polyurethane jacket for higher resistance to moisture and oil), for sensors with D6 or D60 connector

CABLE LENGTHS

For standard length cables up to 100 ft

- 005** = 5 ft. **050** = 50 ft.
- 015** = 15 ft. **100** = 100 ft.
- 025** = 25 ft.

For custom length cables over 100 ft

--- = Cable length (maximum cable length is dependent on the output selected; consult MTS Applications Engineering.)

CABLE TERMINATION (2 or 3 characters depending on option selected)

- P0** = Pigtail connection, (no connector).
- D6M** = D6 male connector, (straight exit). Only available with the D6 option above.
- D6F** = D6 Female connector, (straight exit). Only available with the D6 option above.
- DAF** = D6 Female connector, (90 degrees exit). Only available with the DA option above.

Part Number: 09-06 550996 Revision C

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All Temposonics sensors are covered by US patent number 5,545,984. Additional patents are pending.

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