

Temposonics®

Magnetostrictive, Absolute, Non-contact
Linear-Position Sensors



E-Series Model EP
Analog / Digital-Pulse (Start/Stop) Outputs

Document Part Number
550741 Revision C

Data Sheet



Model EP profile-style position sensor

FEATURES

- Linear, Absolute Measurement
- Non-Contact Sensing Technology
- Non-Linearity Less Than 0.02%
- Repeatability Within 0.001%
- Two Outputs Available:
 - Analog (Voltage/Current) Forward or Reverse Acting
 - Digital Position Output: Start/Stop Pulse
- Simple Sensor Parameter Upload (Digital-Pulse Output)
- Measuring Range From 50 mm (2 in.) to 1525 mm (60 in.)
- EMI Shielded and CE Certified

BENEFITS

- Rugged, Cost Effective, Precise, and Durable Non-Wear Alternative to Linear Potentiometers
- Simultaneous Multi-Position Measurements for Digital-Pulse (Start/Stop) Outputs
- Over voltage Protection to 36 Vdc and Polarity Protection up to -30 Vdc

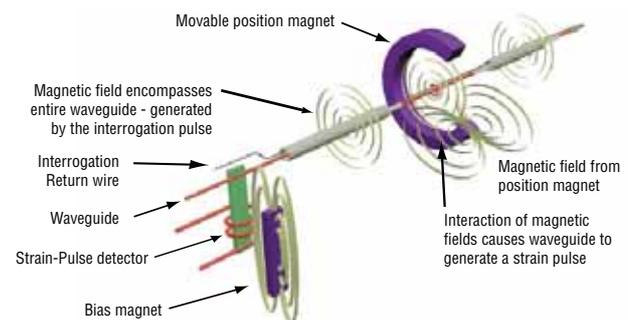
APPLICATIONS

- Continuous Operation in Harsh Industrial Conditions

TYPICAL INDUSTRIES

- Factory Automation
- Woodworking and Metal Forming
- Material Handling and Packaging

Time-based Magnetostrictive position sensing principle



Benefits of Magnetostriction

Temposonics linear-position 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 moveable 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 sonic 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. The elapsed time measurement is directly proportional to the position of the permanent magnet and is an absolute value. Therefore, the sensor’s output signal corresponds to absolute position, instead of incremental, and never requires recalibration or re-homing after a power loss. Absolute, non-contact sensing eliminates wear, and guarantees the best durability and output repeatability.

All specifications are subject to change. Contact MTS for specifications and engineering drawings that are critical to your application. Drawings contained in this document are for reference only. Go to <http://www.mtssensors.com> for the latest support documentation and related media.

Product overview

MTS Sensors continues to establish new performance standards for low-cost, fully-industrial, durable position sensors using the widely preferred magnetostrictive technology. This principle for accurate and non-contact measurement of linear-position sensing was developed 30 years ago by MTS and is used with outstanding success in a large variety of industrial applications.

The Temposonics model EP sensor consists of a robust aluminum profile-style housing that offers flexible mounting configurations and easy installation. It is ideal for demanding industrial applications where simple, reliable non-contact feedback is essential.

Product specifications

Parameters	Specifications
OUTPUT	
Measured output variables:	Position
Resolution:	Analog: Infinite (restricted by output ripple) Digital-pulse: 0.1, 0.01 and 0.005 mm (controller dependent)
Non-linearity:	< ± 0.02% full stroke (minimum ± 60 µm)
Repeatability:	< ± 0.001% full stroke (minimum ± 5 µm)
Outputs:	Analog (voltage or current) Voltage: 0 to 10 Vdc and 10 to 0 Vdc (controller input resistance RL > 5k Ohm) Current 4 to 20 mA or 20 to 4 mA (min./max. load: 0/500 Ohm)
	Digital-pulse (start/stop): RS-422 differential signal Serial parameter upload available for: Measuring range, offset, gradient, status
Position measurement:	Measurement stroke lengths: 50 mm (2 in.) to 1525 mm (60 in.)
	Update Frequency: Voltage or Current: > 1.5 kHz Start/Stop: Controller dependent

Parameters	Specifications
ELECTRONICS	
Operating voltage:	+24 Vdc nominal: -15% or +20% Polarity protection: up to -30 Vdc Over voltage protection: up to 36 Vdc Current drain: Analog: 50 - 140 mA Start/Stop: 50 - 100 mA <i>(Stroke length dependent)</i> Dielectric withstand voltage: 500 Vdc (DC ground to machine ground)
ENVIRONMENTAL	
Operating conditions:	Operating temperature: -40 °C (-40 °F) to 75 °C (167 °F) Relative humidity: 90% no condensation Ingress protection: IP 65 <i>(when mating connector is correctly fitted)</i>
EMC test:	Emissions: IEC/EN 50081-1 Immunity: IEC/EN 50082-2 IEC/EN 61000-4-2/3/4/6, Level 3/4, criterium A, CE qualified
Shock rating:	100 g (single hit)/ IEC standard 68-2-27 (survivability)
Vibration rating:	10 g/10 to 2000 Hz, IEC standard 68-2-6 (operational)
Wiring	
Connection type:	6-pin DIN (M16) male D60 integral connector
PROFILE-STYLE SENSOR	
Electronic head:	Aluminum housing
Sensor extrusion:	Aluminum (Temposonics profile style)
Mounting:	Adjustable mounting feet or T-slot nut (M5 threads) in base channel
Magnet type:	Captive-sliding magnets, open-ring magnet or block magnet

Outputs

ANALOG (VOLTAGE/CURRENT) OUTPUTS

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 (see 'Figure 1').

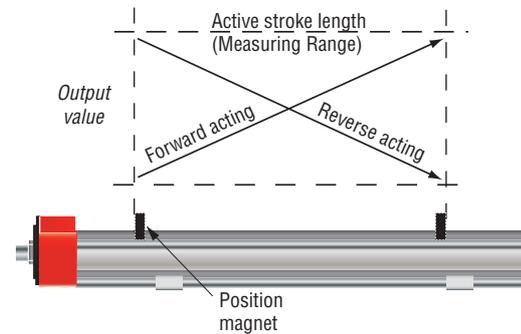


Figure 1. Analog Output signals

DIGITAL (START/STOP) OUTPUTS

The Temposonics E-Series Model EP digital-pulse (start/stop) output sensor requires a start signal from a controller or interface module 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 along the active stroke length. The controller can calculate the absolute position of the magnet from the time value and the sensor's unique gradient value (inverse of the speed for the sonic pulse traveling in the sensor's waveguide). (see 'Figure 2').

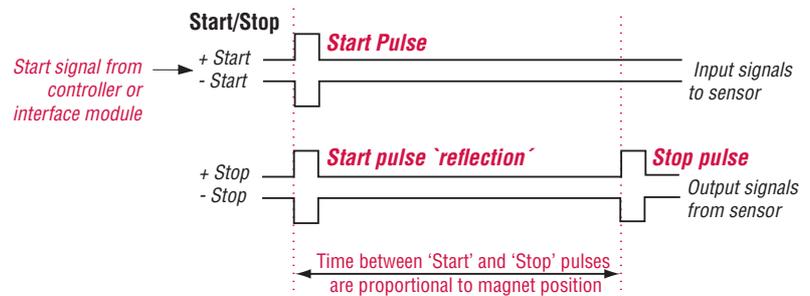


Figure 2. Start/stop output signals (RS-422 differential pairs)

Communication and programmability

SENSOR PARAMETER UPLOAD FEATURE

For applications using smart sensor interfaces, the E-Series Model EP with digital-pulse output (option R3) comes with the ability to perform sensor parameter uploads. This feature replaces the task of entering sensor data manually saving time and preventing possible entry errors during start-up or for system maintenance.

The upload feature supports the following sensor parameters:

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

The sensor's specific parameters can be retrieved by the controller/interface module at any time, via the sensor's start/stop signal lines.

The sensor parameter upload feature requires a customer supplied RS-422 interface. The data format is serial, 4800 Baud, 8-bit data length. Please contact the factory for additional parameter upload protocol details.

Model EP Rod-and-Cylinder sensor dimension references

MODEL EP, ROD-AND-CYLINDER SENSOR

Drawing is for reference only, contact applications engineering for tolerance specific information.

A robust aluminum extrusion forms the sensor housing containing the sensing element and electronics. The position magnet moves along the top of the profile extrusion housing.

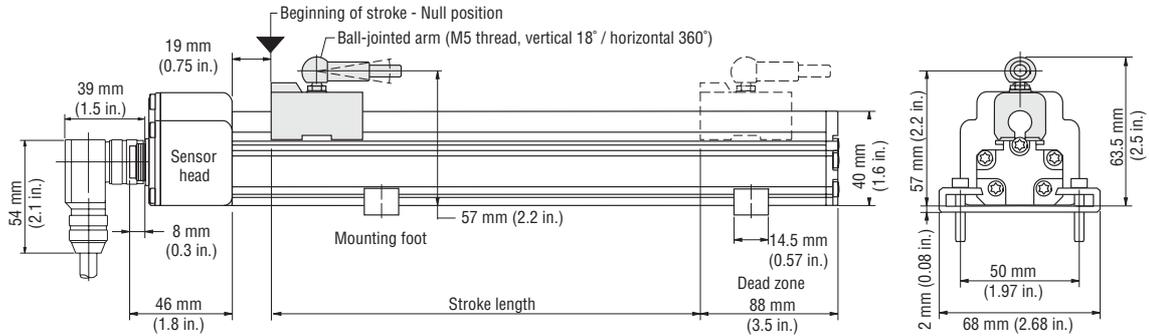


Figure 3. E-Series Model EP sensor dimension reference (Shown with Style S captive-sliding magnet)

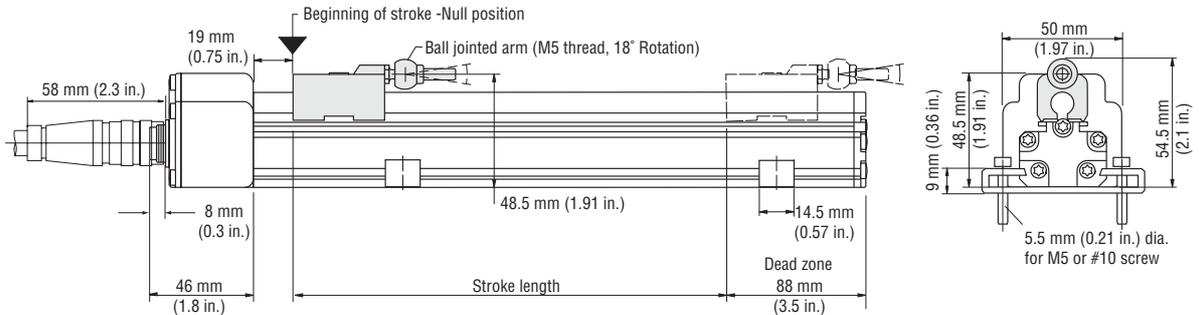


Figure 4. E-Series Model EP sensor dimension reference (Shown with Style V captive-sliding magnet)

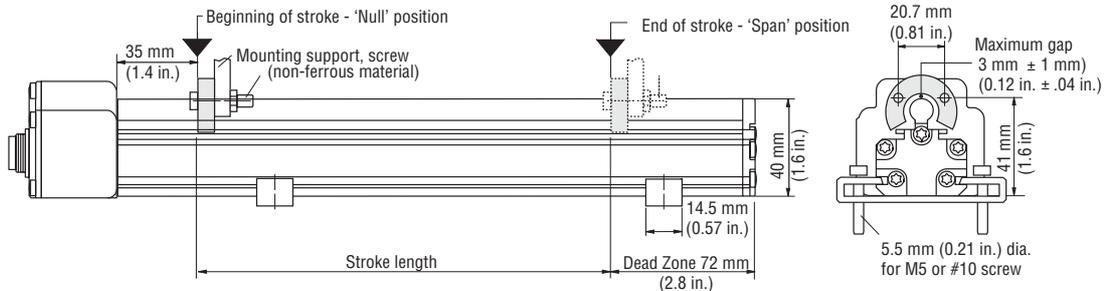


Figure 5. E-Series Model EP sensor dimension reference (Shown with Style M open-ring magnet)

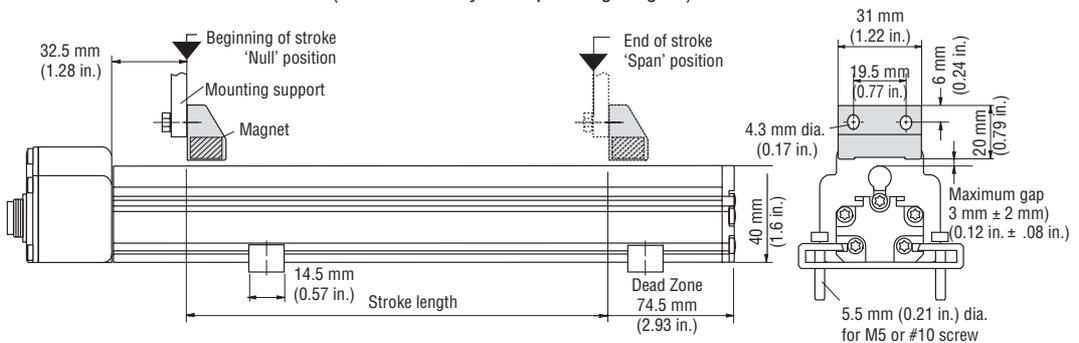


Figure 6. E-Series Model EP sensor dimension reference (Shown with Style L Block magnet)

Standard magnet selections (Model EP)

Selection of position magnets (One magnet included with Model EP sensor)

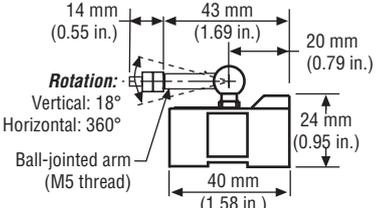
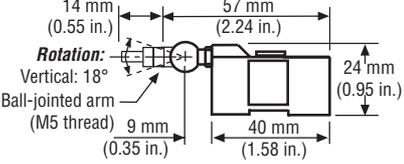
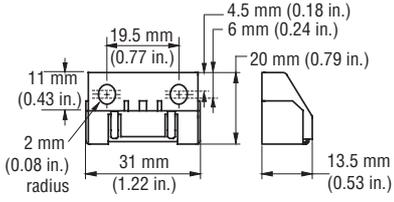
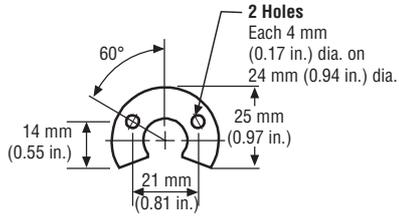
A choice of four standard magnet mounting configurations are available with the E-Series Model EP sensor; A 'captive-sliding' magnet (Styles S or V), or an 'open-ring' magnet (Style M), or the 'block' magnet (Style L). Captive-sliding magnets utilize slide bearings of special material that reduce friction, and if required, help mitigate dirt build up. The slide bearings are designed to operate dry, requiring no external lubrication or maintenance.

The Style M 'open-ring' magnet mounts on the moving machine part and travels just above the sensor's profile extrusion. The open-ring magnet requires a minimum distance away from ferrous metals to allow proper sensor output. It must be mounted using non-ferrous screws and a non-ferrous support bracket, or utilize a non-ferrous spacer of at least 5 mm (0.2 in.) thickness.

The Style L 'block' magnet (part no.: 252887), mounts on the moving machine part and travels just above the sensor's extrusion. The magnet can be mounted using ferrous metal screws on a customer supplied mounting plate or flat surface of the machine's moving part. The mounting plate or machine's moving part can not extend beyond 11 mm (0.43 in.) from the top of the magnet, unless it is made of non-ferrous material. The magnet should be installed in a perpendicular orientation relative to the top surface of the sensor extrusion. Optimal performance is achieved when this orientation remains consistent throughout the full measurement stroke range.

POSITION MAGNET SELECTIONS (One Magnet included with each Model EP sensor)

(Drawing dimensions are for reference only)

Magnet / accessory dimensions	Description	Part number
		<p>Captive-sliding magnet, Style S For Model EP profile-style sensor</p> <p>252182</p>
		<p>Captive-sliding magnet, Style V For Model EP profile-style sensor</p> <p>252184</p>
		<p>Block magnet, Style L For Model EP profile-style sensor</p> <p>252887</p>
		<p>Open-ring magnet, Style M I.D.: 13.5 mm (0.53 in.) O.D.: 33 mm (1.3 in.) Thickness: 8 mm (0.31 in.) Operating temperature: - 40 °C to 100 °C</p> <p>251416-2</p>

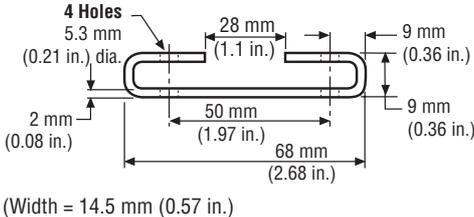
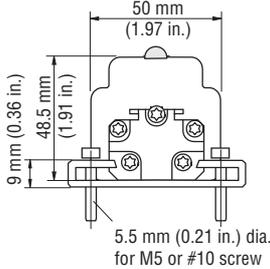
Sensor mounting

MODEL EP SENSOR MOUNTING

Temposonics model EP sensors are mounted onto the machine with moveable mounting feet. Mounting feet slide into side grooves and should be evenly distributed along the sensor extrusion to best secure the sensor for each particular application.

Notes:

1. Model EP sensors include two mounting feet, (part number 400802), for stroke lengths up to 1250 mm (50 in.). One additional mounting foot is included for longer stroke lengths.
2. MTS recommends using 10-32 cap screws (customer supplied) at a maximum torque of 44 in. lbs. when fastening mounting feet.

Model EP sensor mounting and installation reference	Mounting method	Part number
 	<p>Mounting feet, standard (304 SS) Rod-and-Cylinder sensor mounting for sensor model EP</p>	400802
	<p>Model EP mounting configuration using mounting feet and screws</p>	<p>Mounting feet, part number 400802</p>

Model EP connections and wiring

SENSOR INTEGRAL CONNECTOR (D60 MALE) PINOUT/WIRE COLOR CODE

The E-Series Model EP sensor connects directly to a controller or interface module with the standard male, 6-pin integral connector and an extension cable as described in 'Table 1'.

Attention:

The EP sensor's aluminum housing has an anodic coating which prevents the sensor's mounting feet, (part no. 400802) from providing the appropriate grounding. A grounding lug, (see 'Figure 3') is provided near the connector end of the sensor for a convenient connection to earth ground. The appropriate grounding of the cable shield is required at the controller end.

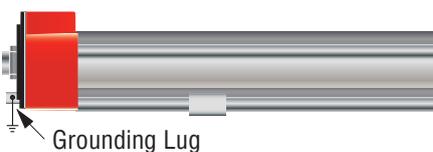


Figure 3. EP Sensor grounding lug location



Integral D6 connector (male) as viewed from the end of the sensor

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

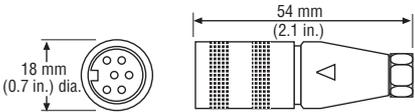
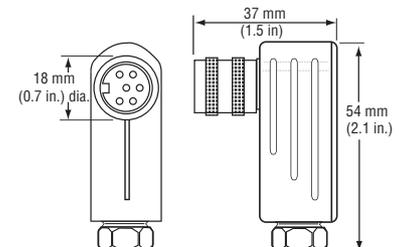
‡ The sensor model number indicates the specific analog outputs that are provided.

Table 1. ER sensor connector pinout and extension cable wiring

PRODUCT DATA SHEET

E-Series Model EP Sensor, Analog / Digital-pulse (Start/Stop) Outputs, Wiring and Connections

CABLE CONNECTOR OPTIONS FOR 6-PIN DIN (D60) FEMALE *(Drawing dimensions are for reference only)*

Connector	Connector dimensions	Description	Part number
		Female Cable Connector, Straight Exit (Field installable) 6-Pin DIN (D60) Mates with standard male (M16) integral connector	560700
		Female Cable Connector, 90° Exit (Field installable) 6-Pin DIN (D60) Mates with standard male (M16) integral connector	560778

EXTENSION CABLE WITH CONNECTORS FOR D6 (D60) CONNECTION TYPES

Extension Cable and Connector	Description	Connection type
	Female Connector, Straight Exit with Standard PVC Jacket Cable <i>(Assembly Includes D6 Connector, Part No.: 560700 and Cable, Part No.:530026)</i>	D6
	Female Connector, 90° Exit with Standard PVC Jacket Cable <i>(Assembly Includes D6 Connector, Part No.: 560778 and Cable, Part No.:530026)</i>	DA
	Female Connector, Straight Exit with Black Polyurethane Jacket Cable (for higher resistance to moisture, oil and cold temperatures) <i>(Assembly Includes D6 Connector, Part No.: 560700 and Cable, Part No.:530045)</i>	DJ
	Female Connector, 90° Exit with Black Polyurethane Jacket Cable (for higher resistance to moisture, oil and cold temperatures) <i>(Assembly Includes D6 Connector, Part No.: 560778 and Cable, Part No.:530045)</i>	DK

Ordering Information - Extension Cable with Connector for D6 (D60) Connection Types



	SENSOR CONNECTION TYPES	=	<input type="text" value="D"/> <input type="text"/>	1 - 2
D6	= Female connector, straight exit (part no. 560700) and PVC jacket cable (part no. 530026)			
DA	= Female connector, 90° exit (part no. 560788) and PVC jacket cable (part no. 530026)			
DJ	= Female connector, straight exit (part no. 560700) and black polyurethane jacket cable (part no. 530045)			
DK	= Female connector, 90° exit (part no. 560788) and black polyurethane jacket cable (part no. 530045)			
	CABLE LENGTHS	=	<input type="text"/> <input type="text"/> <input type="text"/>	3 - 5
	For standard length cables up to 100 ft			
005	= 5 ft.			
015	= 15 ft.			
025	= 25 ft.			
050	= 50 ft.			
100	= 100 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	=	<input type="text"/> <input type="text"/> <input type="text"/>	6 - 8
P0	= Pigtail cable without connector (2 digit code)			
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° exit). Only available with the DA option above.			

PRODUCT DATA SHEET

**E-Series Model EP Sensor, Analog / Digital-pulse (Start/Stop) Outputs
Ordering Information**

Use the order matrix below to configure your Model EP sensor order number.

E P								D 6 0			1		
1	2	3	4	5	6	7	8	9	10	11	12	13	14

SENSOR MODEL _____ = **E P** 1 - 2

E-Series model EP profile-style sensor (one magnet included)

HOUSING STYLE _____ = 3

- S** = Captive-sliding magnet with joint at top (part no.: 252182)
- V** = Captive -sliding magnet with joint at front (part no.: 252184)
- M** = Open-ring magnet (part no.: 251416-2)
- L** = Block magnet (part no.: 252887)

MEASURING STROKE LENGTH _____ = 4 - 8

- M** = Millimeters (Encode in 5 mm increments)
- U** = Inches (Encode in 0.1 in. increments)

Stroke length Notes:

1. Standard US Customary stroke length in inches (in.): 2 in to 60 in.
2. Metric stroke length in millimeters (mm): 50 mm to 1525 mm
3. Contact the factory for custom stroke lengths.

SENSOR CONNECTION TYPE _____ = **D 6 0** 9 - 11

D60 = 6-Pin DIN (M16), male, standard

INPUT VOLTAGE _____ = **1** 12

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

OUTPUT (VOLTAGE) _____ = 13 - 14

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

(CURRENT)

- A0** = 4 mA to 20 mA
- A1** = 20 mA to 4 mA

(DIGITAL-PULSE)

- R0** = Start/Stop
- R3** = Start/Stop with sensor parameters upload function

K

SYSTEM OPTION

Kxx = Available on request (specify at time of order)



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