

## Data Sheet

### **R-Series – RP CANbus**

Magnetostrictive Linear Position Sensors

- For mounting on machines
- Rugged industrial sensor
- Diagnostics LEDs



## MEASURING TECHNOLOGY

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.

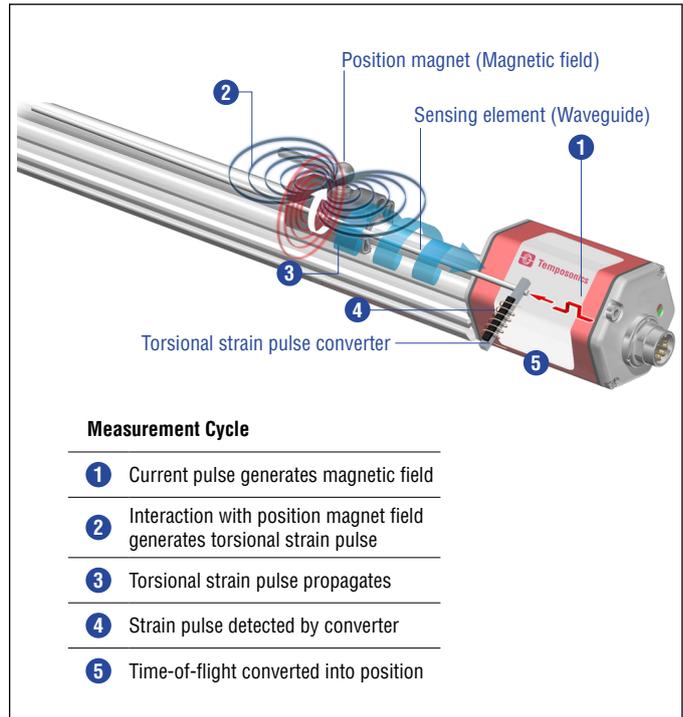


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

## RP SENSOR CANbus

Robust, non-contact and wear free, the Temposonics linear position sensors provide best durability and accurate position measurement solutions in harsh industrial environments. The position measurement accuracy is tightly controlled by the quality of the waveguide which is manufactured by Temposonics. The position magnet is mounted on the moving machine part and travels contactlessly over the sensing element with the built-in waveguide.

Temposonics® RP is a high-performance sensor for external mounting. The position magnet, mounted to the movable machine part, can either be an U-magnet or a captive-sliding magnet. The free magnets travel along the sensor profile with a defined distance. This kind of installation tolerates a lateral offset as well as a height offset. Therefore the robust sensor is very versatile. A superior performance for instance in plastic and rubber as well as in paper and wood processing industry is guaranteed.

Temposonics position sensors fulfill - as slave devices - all requirements of the CAN-Bus (ISO 11898). The sensors electronics convert the position measurements into bus oriented outputs and transfer these data directly to the control unit. The bus interface is appropriate for serial data transfer of 1 Mbit/s maximum. Sensor integrated software supports the profiles CANopen and CANbasic for a comprehensive customized configuration of the sensor-bus system.

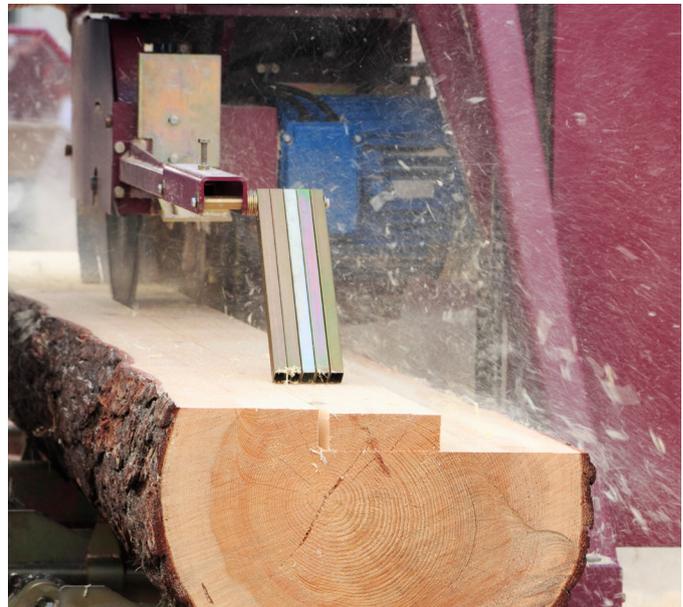


Fig. 2: Typical application: Wood processing industry

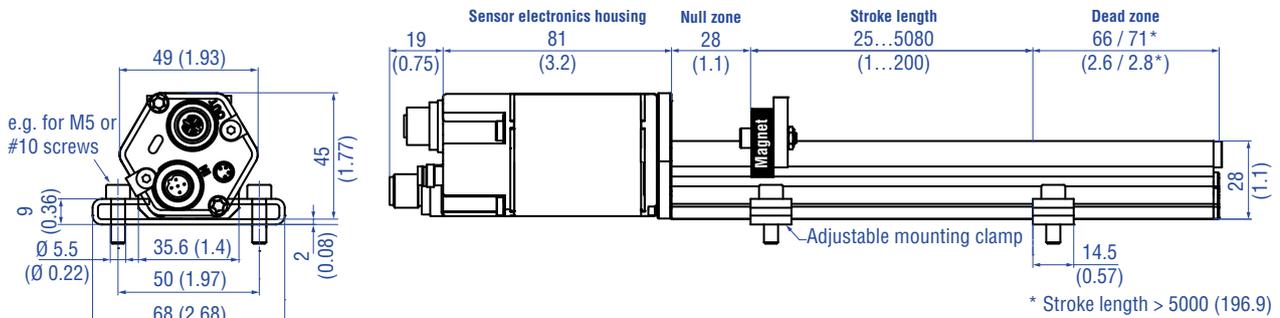
## TECHNICAL DATA

Output								
Interface	CAN fieldbus system according to ISO 11898							
Data protocol	CANopen: CIA standard DS301 V3.0/Encoder profile DS 406 V3.1; CANbasic: CAN 2.0 A							
Baud rate	Transfer rate	1000 kBit/s	800 kBit/s	500 kBit/s	250 kBit/s	125 kBit/s	50 kBit/s	20 kBit/s
	Cable length	< 25 m	< 50 m	< 100 m	< 250 m	< 500 m	< 1000 m	< 2500 m
Measured value	Position, velocity/option: Simultaneous multi-position and multi-velocity measurements up to 20 magnets							
Measurement parameters								
Resolution	Protocol	CANopen			CANbasic			
	Position	5 µm	2 µm	5 µm	2 µm			
	Velocity	0.5 mm/s	0.2 mm/s	1.0 mm/s	0.1 mm/s			
Cycle time	Stroke length	< 2400 mm	< 4800 mm	< 5080 mm				
	Cycle time	1.0 ms	2.0 ms	4.0 ms				
	0.5 ms to 1200 mm additional for CANbasic							
Linearity deviation <sup>1</sup>	< ±0,01 % F.S. (minimum ±40 µm)							
	Option internal linearization (Applies for the first magnet for multi-position measurement)							
	Stroke length	< 300 mm	< 600 mm	< 1200 mm	< 3000 mm	< 5080 mm		
	Tolerance	max. ±25 µm	max. ±30 µm	max. ±50 µm	max. ±90 µm	max. ±150 µm		
Repeatability	< ±0.001 % F.S. (Minimum ±2.5 µm) typical							
Hysteresis	< 4 µm typical							
Temperature coefficient	< 15 ppm/K typical							
Operating conditions								
Operating temperature	-40...+75 °C (-40...+167 °F)							
Humidity	90 % relative humidity, no condensation							
Ingress protection	IP65 (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 sensor meets the requirements of the EC directives and is marked with <b>CE</b>							
Magnet movement velocity	Any							
Design / Material								
Sensor electronics housing	Aluminum (painted), zinc die cast							
Sensor profile	Aluminum							
Stroke length	25...5080 mm (1...200 in.)							
Mechanical mounting								
Mounting position	Any							
Mounting instruction	Please consult the technical drawings on <a href="#">page 4</a>							
Electrical connection								
Connection type	1 × M12 female connector (5 pin), 1 × M12 male connector (5 pin), 1 × M12 male connector (4 pin) or 1 × M16 female connector (6 pin) or 2 × M16 female connectors (6 pin) or cable outlet							
Operating voltage	+24 VDC (-15/+20 %); UL recognition requires an approved power supply with energy limitation (UL 61010-1), or Class 2 rating according to the National Electrical Code (USA)/Canadian Electrical Code.							
Power consumption	90 mA typical							
Dielectric strength	500 VDC (DC ground to machine ground)							
Polarity protection	Up to -36 VDC							
Oversvoltage protection	Up to 36 VDC							

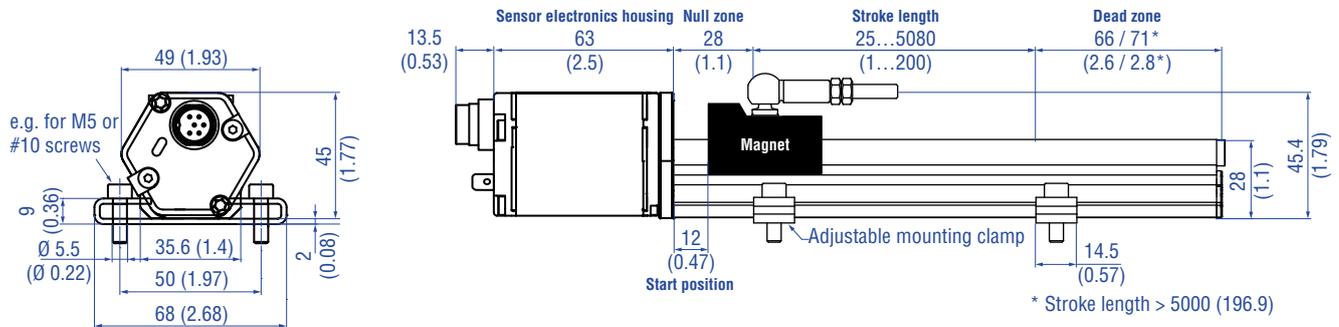
1/ With position magnet # 251 416-2

## TECHNICAL DRAWING

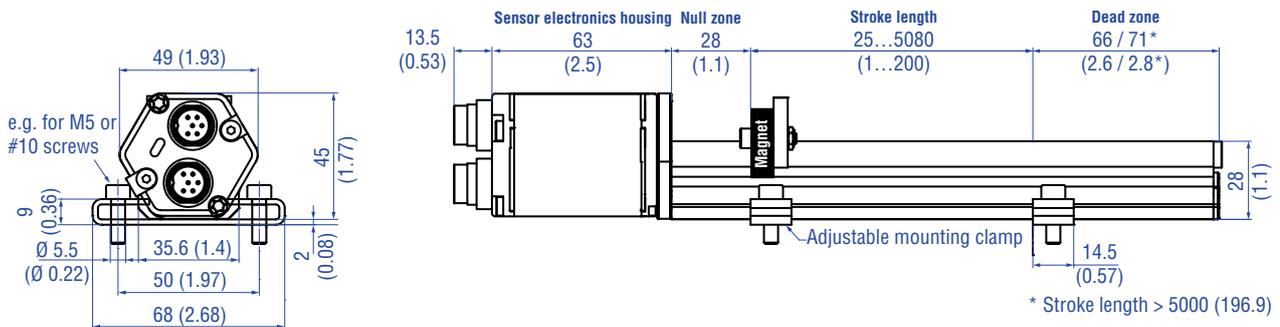
### RP-M, example: Connection type D54 (connector outlet)



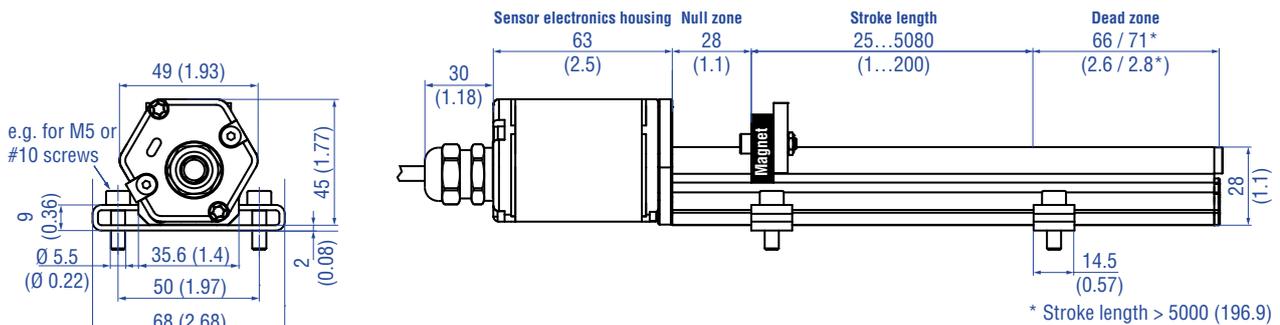
### RP-S, example: Connection type D60 (connector outlet)



### RP-M, example: Connection type D62 (connector outlet)



### RP-M, example: Connection type HXX/PXX (cable outlet)



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

Fig. 3: Temposonics® RP with U-magnet (connection type example D54, D62 and HXX/PXX) and magnet slider (connection type example D60)

## CONNECTOR WIRING

D54		
Signal		
M12 male connector (A-coded)	Pin	Function
 <p>View on sensor</p>	1	Shield
	2	Not connected
	3	Not connected
	4	CAN_H
	5	CAN_L
M12 female connector (A-coded)	Pin	Function
 <p>View on sensor</p>	1	Shield
	2	Not connected
	3	Not connected
	4	CAN_H
	5	CAN_L
Power supply		
M8 male connector	Pin	Function
 <p>View on sensor</p>	1	+24 VDC (-15/+20 %)
	2	Not connected
	3	DC Ground (0 V)
	4	Not connected

Fig. 4: Connector wiring D54

D60		
Signal + power supply		
M16 male connector	Pin	Function
 <p>View on sensor</p>	1	CAN_L
	2	CAN_H
	3	Not connected
	4	Not connected
	5	+24 VDC (-15/+20 %)
	6	DC Ground (0 V)

Fig. 5: Connector wiring D60

D62		
Signal + power supply		
M16 male connector	Pin	Function
 <p>View on sensor</p>	1	CAN_L
	2	CAN_H
	3	Not connected
	4	Not connected
	5	+24 VDC (-15/+20 %)
	6	DC Ground (0 V)
M16 male connector	Pin	Function
 <p>View on sensor</p>	1	CAN_L
	2	CAN_H
	3	Not connected
	4	Not connected
	5	+24 VDC (-15/+20 %)
	6	DC Ground (0 V)

Fig. 6: Connector wiring D62

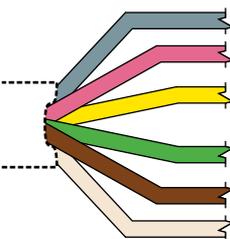
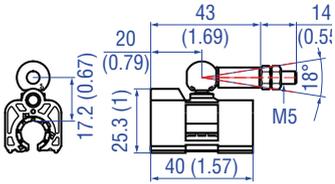
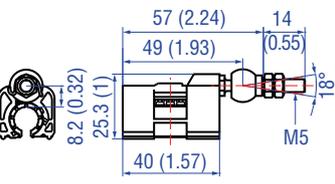
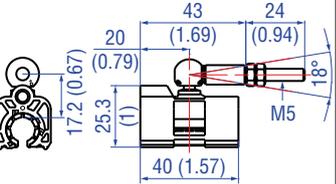
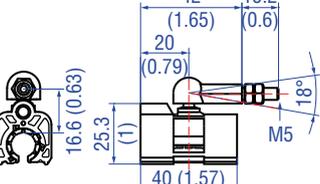
PXX / HXX		
Signal + power supply		
Cable	Color	Function
	GY	CAN_L
	PK	CAN_H
	YE	Not connected
	GN	Not connected
	BN	+24 VDC (-15/+20 %)
	WH	DC Ground (0 V)

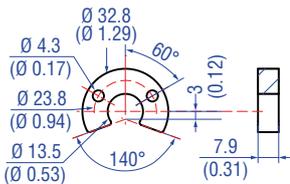
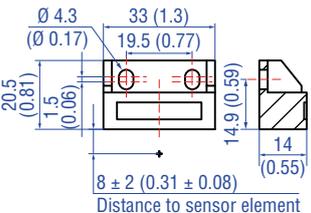
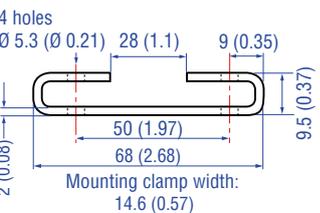
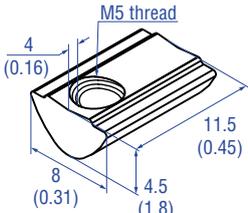
Fig. 7: Cable wiring PXX/HXX

**FREQUENTLY ORDERED ACCESSORIES** – Additional options available in our [Accessories Guide](#)  551444

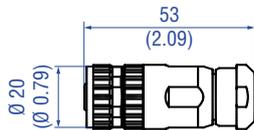
**Position magnets**

			
<p><b>Magnet slider S, joint at top</b> Part no. 252 182</p> <p>Material: GRP, magnet hard ferrite Weight: Approx. 35 g Operating temperature: -40...+85 °C (-40...+185 °F)</p>	<p><b>Magnet slider V, joint at front</b> Part no. 252 184</p> <p>Material: GRP, magnet hard ferrite Weight: Approx. 35 g Operating temperature: -40...+85 °C (-40...+185 °F)</p>	<p><b>Magnet slider N longer ball-joint arm</b> Part no. 252 183</p> <p>Material: GRP, magnet hard ferrite Weight: Approx. 35 g Operating temperature: -40...+85 °C (-40...+185 °F)</p>	<p><b>Magnet slider G, backlash free</b> Part no. 253 421</p> <p>Material: GRP, magnet hard ferrite Weight: Approx. 25 g Operating temperature: -40...+85 °C (-40...+185 °F)</p>

**Position magnets** | **Mounting accessories**

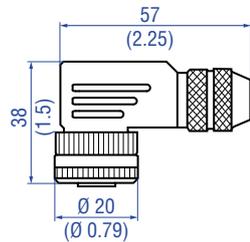
			
<p><b>U-magnet OD33</b> Part no. 251 416-2</p> <p>Material: PA ferrite GF20 Weight: Approx. 11 g Surface pressure: Max. 40 N/mm<sup>2</sup> Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+105 °C (-40...+221 °F)</p> <p>Marked version for sensors with internal linearization: Part no. 254 226</p>	<p><b>Block magnet L</b> Part no. 403 448</p> <p>Material: Plastic carrier with hard ferrite magnet Weight: Approx. 20 g Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+75 °C (-40...+167 °F)</p> <p>This magnet may influence the sensor performance specifications for some applications.</p>	<p><b>Mounting clamp</b> Part no. 400 802</p> <p>Material: Stainless steel (AISI 304)</p>	<p><b>T-nut</b> Part no. 401 602</p> <p>Fastening torque for M5 screw: 4.5 Nm</p>

**Cable connectors (M12)\***



**M12 A-coded female connector (4 pin/5 pin), straight**  
Part no. 370 677

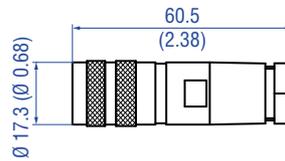
Material: GD-Zn, Ni  
Termination: Screw  
Contact insert: CuZn  
Cable Ø: 4...8 mm (0.16...0.31 in.)  
Wire: 1.5 mm<sup>2</sup>  
Operating temperature:  
-30...+85 °C (-22...+185 °F)  
Ingress protection: IP67 (correctly fitted)  
Fastening torque: 0.6 Nm



**M12 A-coded female connector (5 pin), angled**  
Part no. 370 678

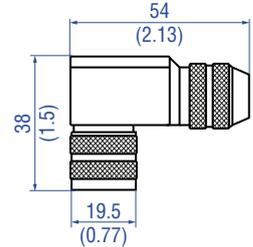
Material: GD-Zn, Ni  
Termination: Screw; max. 0.75 mm<sup>2</sup>  
Contact insert: CuZn  
Cable Ø: 5...8 mm (0.2...0.31 in.)  
Wire: 0.75 mm<sup>2</sup> (18 AWG)  
Operating temperature:  
-25...+85 °C (-13...+185 °F)  
Ingress protection: IP67 (correctly fitted)  
Fastening torque: 0.4 Nm

**Cable connectors (M16)\***



**M16 female connector (6 pin), straight**  
Part no. 370 423

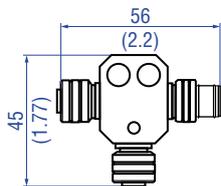
Material: Zinc nickel plated  
Termination: Solder  
Cable Ø: 6...8 mm (0.24...0.31 in.)  
Operating temperature:  
-40...+100 °C (-40...+212 °F)  
Ingress protection: IP65/IP67 (correctly fitted)  
Fastening torque: 0.6 Nm



**M16 female connector (6 pin), angled**  
Part no. 370 460

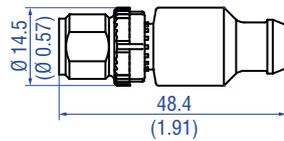
Material: Zinc nickel plated  
Termination: Solder  
Cable Ø: 6...8 mm (0.24...0.31 in.)  
Wire: 0.75 mm<sup>2</sup> (20 AWG)  
Operating temperature:  
-40...+95 °C (-40...+203 °F)  
Ingress protection: IP67 (correctly fitted)  
Fastening torque: 0.6 Nm

**Connection accessories\***



**M12 A-coded T connector (5 pin)**  
Part no. 370 691

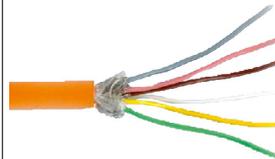
Selfcuring coupling nut  
2 × female connector  
1 × male connector  
Feature: Shielded  
Ingress protection: IP67 (correctly fitted)



**Passive M12 A-coded male bus terminator (5 pin)**  
Part no. 370 700

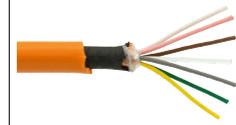
Material: PUR  
Termination: Screw  
Contact insert: Au  
Operating temperature:  
-25...+85 °C (-13...+121 °F)  
Ingress protection: IP68 (correctly fitted)

**Cables**



**PUR cable**  
Part no. 530 052

Material: PUR jacket; orange  
Features: Twisted pair, shielded, highly flexible, halogen free, suitable for drag chains, mostly oil & flame resistant  
Cable Ø: 6.4 mm (0.25 in.)  
Cross section: 3 × 2 × 0.25 mm<sup>2</sup>  
Bending radius: 5 × D (fixed installation)  
Operating temperature:  
-30...+80 °C (-22...+176 °F)



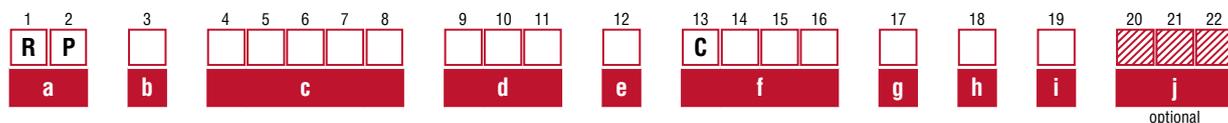
**PUR cable**  
Part no. 530 175

Material: PUR jacket; orange  
Features: Flexible, additional EMC protection  
Cable Ø: 6.5 mm (0.26 in.)  
Cross section: 6 × 0.14 mm<sup>2</sup>  
Bending radius: 10 × D (fixed installation)  
Operating temperature:  
-30...+90 °C (-22...+194 °F)

\*/ Follow the manufacturer's mounting instructions.

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

## ORDER CODE



a Sensor model	
R	P Profile

b Design	
G	Magnet slider, backlash free (part no. 253 421) suitable for internal linearization
L	Block magnet L (part no. 403 448)
M	U-magnet, OD33 (part no. 251 416-2) suitable for internal linearization
N	Magnet slider, longer ball-jointed arm (part no. 252 183) suitable for internal linearization
O	No position magnet
S	Magnet slider, joint at top (part no. 252 182) suitable for internal linearization
V	Magnet slider, joint at front (part no. 252 184) suitable for internal linearization

c Stroke length	
X X X X M	0025...5080 mm
Standard stroke length (mm)	Ordering steps
25...500 mm	25 mm
500...2500 mm	50 mm
2500...5080 mm	100 mm
X X X X U	001.0...200.0 in.
Standard stroke length (mm)	Ordering steps
1...20 in.	1 in.
20...100 in.	2 in.
100...200 in.	4 in.
Non standard stroke lengths are available; must be encoded in 5 mm / 0.1 in. increments	

d Connection type	
D 5 4	1 × M12 female connector (5 pin), 1 × M12 male connector (5 pin) 1 × M8 male connector (4 pin)
D 6 0	1 × M16 male connector (6 pin)
D 6 2	2 × M16 male connector (6 pin)
H X X	XX m PUR cable (part no. 530 052) H01...H10 (1...10 m/3...33 ft.)* (see chapter "frequently ordered accessories" for cable specifications and note the temperature range of the cable)
P X X	XX m PUR cable (part no. 530 175) P01...P10 (1...10 m/3...33 ft.)* (see chapter "frequently ordered accessories" for cable specifications and note the temperature range of the cable)
*/ Encode in meters if using metric stroke length. Encode in feet if using US customary stroke length.	

e Operating voltage	
1	+24 VDC (-15/+20 %)
A	+24 VDC (-15/+20 %), vibration resistant (stroke length 25...2000 mm / 1...79 in.)

f Output	
C 1 0 1	CANbasic, position and velocity (1 position)
C 2 0 7	CANbasic, position (1...20 position(s))
C 3 0 4	CANopen, position and velocity (1...4 position(s))
C 5 0 4	CANopen, position and velocity, internal linearization (1...4 position(s))

g Baud rate	
1	1000 kBit/s
2	500 kBit/s
3	250 kBit/s
4	125 kBit/s

h Resolution	
1	5 µm
2	2 µm

i Options	
1	Standard

### Optional

j Number of magnets for multi-position measurement			
Z	X	X	Z02...Z20 (2...20 magnets)

### NOTICE

- Select the C207, C304 or C504 in **f** “Output” for multi-position measurement (number of magnets  $\geq 2$ ).
- Specify magnet numbers for your sensing application and order separately.
- 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, e.g. 2 x U-magnets (part no. 251 416-2).
- If the option for internal linearization (C504) in **f** “Output” is chosen, select a suitable magnet.

### DELIVERY



- Sensor
- Position magnet (not valid for RP with design “0”)
- 2 x mounting clamps up to 1250 mm (50 in.) stroke length + 1 x mounting clamp for each 500 mm (20 in.) additional stroke length

Accessories have to be ordered separately.

Manuals, Software & 3D Models available at:  
[www.temposonics.com](http://www.temposonics.com)

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