Temposonics
AN AMPHENOL COMPANY

Data Sheet

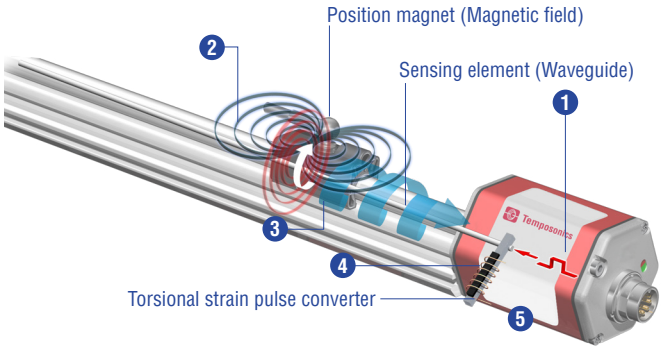
R-Series – RP CANbus

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.



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. 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

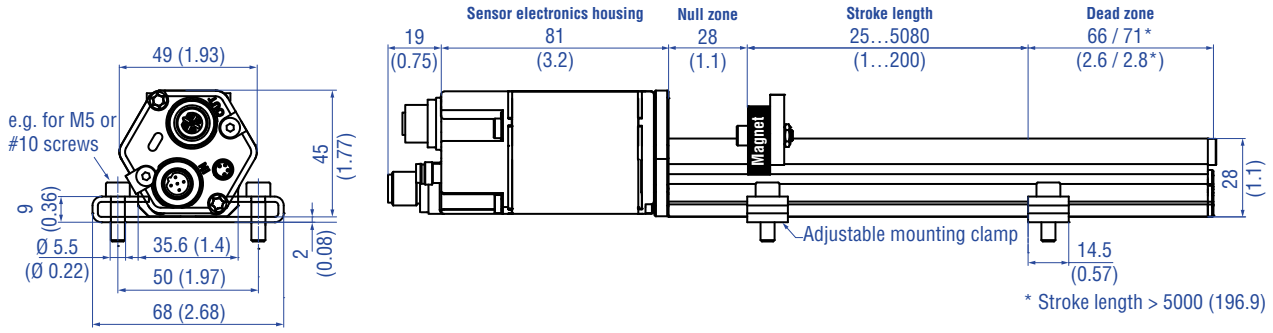
TECHNICAL DATA

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 [1]	< ±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 CE
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 page 4
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
Overvoltage protection	Up to 36 VDC

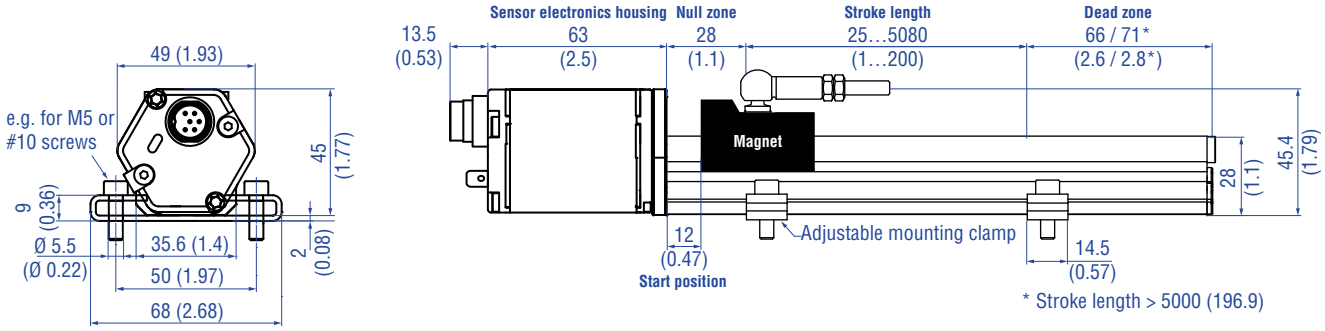
1/ With position magnet # 251 416-2

TECHNICAL DRAWING

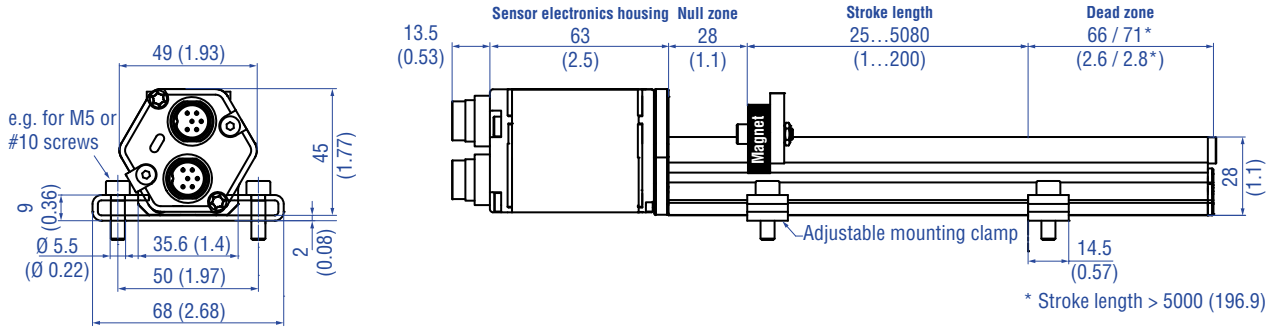
RP-M, example: Connection type D54 (connector outlet)



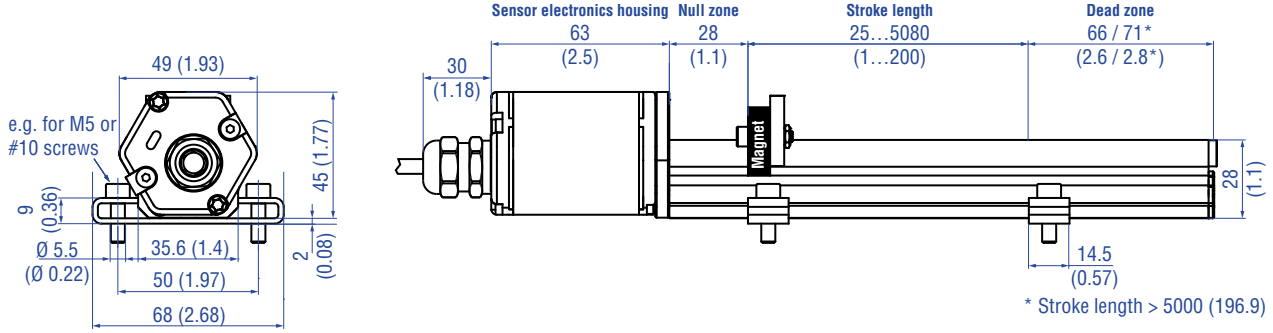
RP-S, example: Connection type D60 (connector outlet)



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
 View on sensor	1	Shield
	2	Not connected
	3	Not connected
	4	CAN_H
	5	CAN_L

M12 female connector (A-coded)	Pin	Function
 View on sensor	1	Shield
	2	Not connected
	3	Not connected
	4	CAN_H
	5	CAN_L

Power supply

M8 male connector	Pin	Function
 View on sensor	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
 View on sensor	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
 View on sensor	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
 View on sensor	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

P*XX* / H*XX*

Signal + power supply

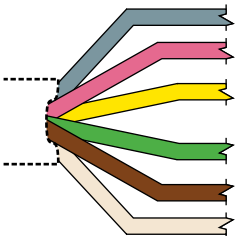
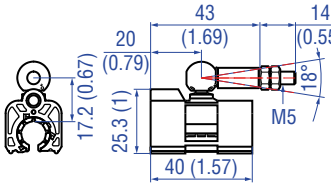
Cable	Color	Function
	GY	CAN_L
	PK	CAN_H
	YE	Not connected
	GN	Not connected
	BN	+24 VDC (–15/+20 %)
	WH	DC Ground (0 V)

Fig. 7: Cable wiring PXX/HXX

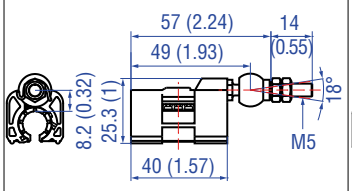
FREQUENTLY ORDERED ACCESSORIES – Additional options available in our Accessories Guide 551444

Position magnets



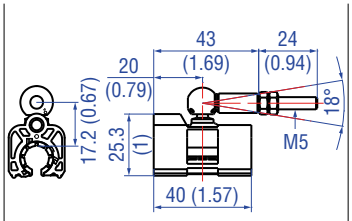
Magnet slider S, joint at top
Part no. 252 182

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



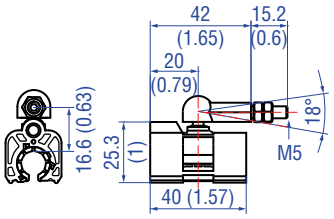
Magnet slider V, joint at front
Part no. 252 184

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



Magnet slider N
longer ball-joint arm
Part no. 252 183

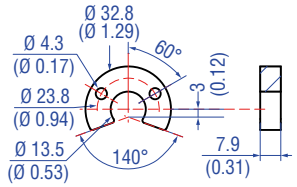
Material: GRP, magnet hard ferrite
Weight: Approx. 35 g
Operating temperature:
–40…+85 °C (–40…+185 °F)



Magnet slider G, backlash free
Part no. 253 421

Material: GRP, magnet hard ferrite
Weight: Approx. 25 g
Operating temperature:
–40…+85 °C (–40…+185 °F)

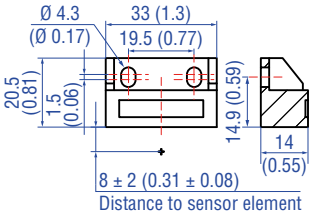
Position magnets



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…+105 °C (–40…+221 °F)

Marked version for sensors with internal linearization: Part no. 254 226

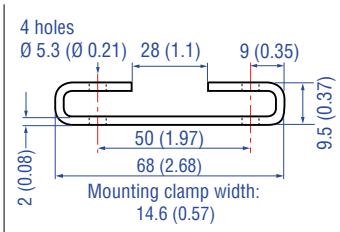


Block magnet L
Part no. 403 448

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)

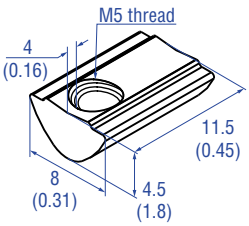
This magnet may influence the sensor performance specifications for some applications.

Mounting accessories



Mounting clamp
Part no. 400 802

Material: Stainless steel (AISI 304)

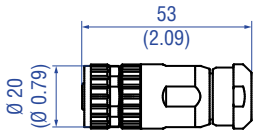


T-nut
Part no. 401 602

Fastening torque for M5 screw: 4.5 Nm

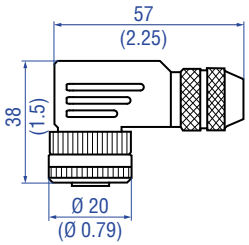
Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Cable connectors (M12)*



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

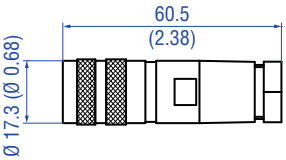
Material: GD-Zn, Ni
Termination: Screw
Contact insert: CuZn
Cable Ø: 4…8 mm (0.16…0.31 in.)
Wire: 1.5 mm²
Operating temperature:
–30…+85 °C (–22…+185 °F)
Ingress protection: IP67 (correctly fitted)
Fastening torque: 0.6 Nm



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

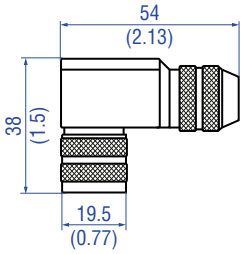
Material: GD-Zn, Ni
Termination: Screw; max. 0.75 mm²
Contact insert: CuZn
Cable Ø: 5…8 mm (0.2…0.31 in.)
Wire: 0.75 mm² (18 AWG)
Operating temperature:
–25…+85 °C (–13…+185 °F)
Ingress protection: IP67 (correctly fitted)
Fastening torque: 0.4 Nm

Cable connectors (M16)*



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

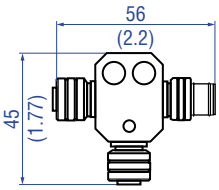
Material: Zinc nickel plated
Termination: Solder
Cable Ø: 6…8 mm (0.24…0.31 in.)
Operating temperature:
–40…+100 °C (–40…+212 °F)
Ingress protection: IP65/IP67
(correctly fitted)
Fastening torque: 0.6 Nm



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

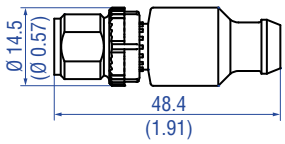
Material: Zinc nickel plated
Termination: Solder
Cable Ø: 6…8 mm (0.24…0.31 in.)
Wire: 0.75 mm² (20 AWG)
Operating temperature:
–40…+95 °C (–40…+203 °F)
Ingress protection: IP67 (correctly fitted)
Fastening torque: 0.6 Nm

Connection accessories*



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

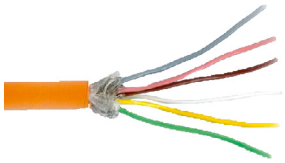
Selfcuring coupling nut
2 × female connector
1 × male connector
Feature: Shielded
Ingress protection: IP67 (correctly fitted)



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

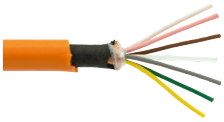
Material: PUR
Termination: Screw
Contact insert: Au
Operating temperature:
–25…+85 °C (–13…+121 °F)
Ingress protection: IP68 (correctly fitted)

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 mm²
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 mm²
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

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
R	P											C									
a		b	c					d			e	f				g	h	i	j		

optional

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 ≥ 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 × 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 "O")
- 2 × mounting clamps up to 1250 mm (50 in.) stroke length + 1 × 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

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Document part number:
551780 Revision A (EN) 03/2026

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