MTS SENSORS

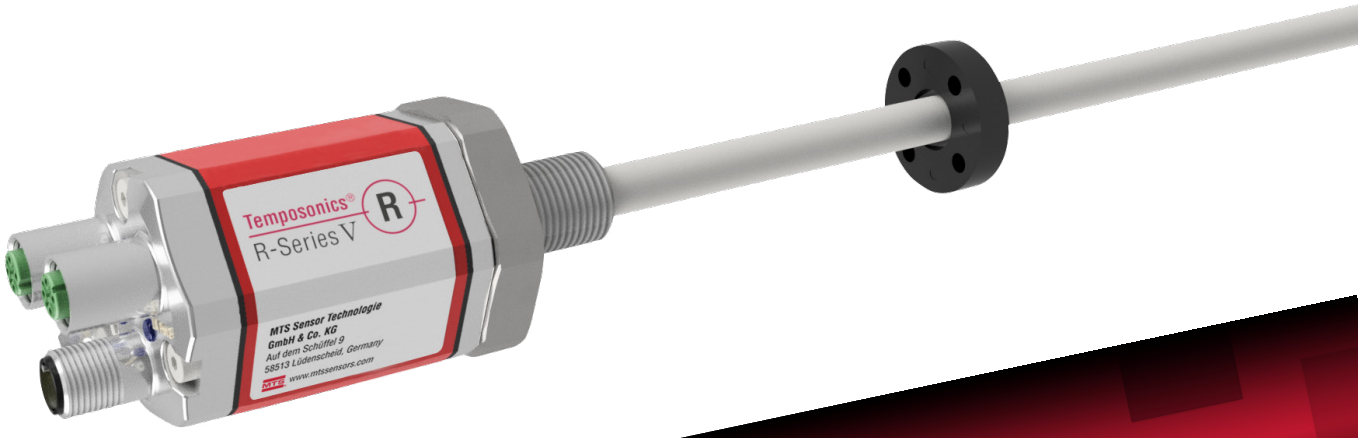
Temposonics®

Magnetostrictive Linear Position Sensors

R-Series V RH EtherNet/IP™

Data Sheet

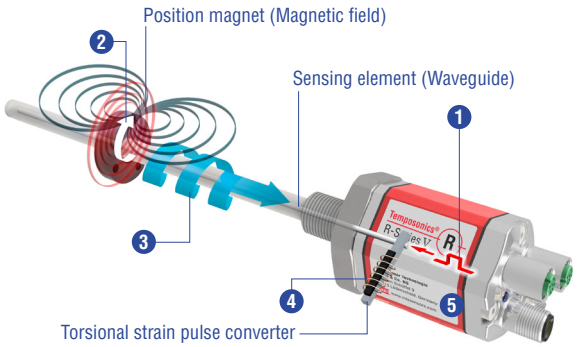
– EtherNet/IP™ with CIP Sync and DLR
– Position + velocity measurements for up to 30 magnets
– Field adjustments and diagnostics using the new TempoLink



I am the new generation

MEASURING TECHNOLOGY

The absolute, linear position sensors provided by MTS Sensors rely on the company's proprietary Temposonics® 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 end 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

RH SENSOR

Temposonics® R-Series V EtherNet/IP™ sensors represent MTS Sensors' development and product offering in networked position feedback. EtherNet/IP™ systems require only a single point of connection for both configuration and control. This is because EtherNet/IP™ supports both I/O (or implicit) messages — those that typically contain time-critical control data — and explicit messages — those in which the data field carries both protocol information and instructions for service performance. And, as a producer-consumer network that supports multiple communication hierarchies and message prioritization, EtherNet/IP™ provides more efficient use of bandwidth than a device network based on a source-destination model. EtherNet/IP™ systems can be configured to operate either in a master/slave relationship or in a distributed control architecture using peer-to-peer communication.

Fig. 2: Typical application: Steel Mill

TECHNICAL DATA

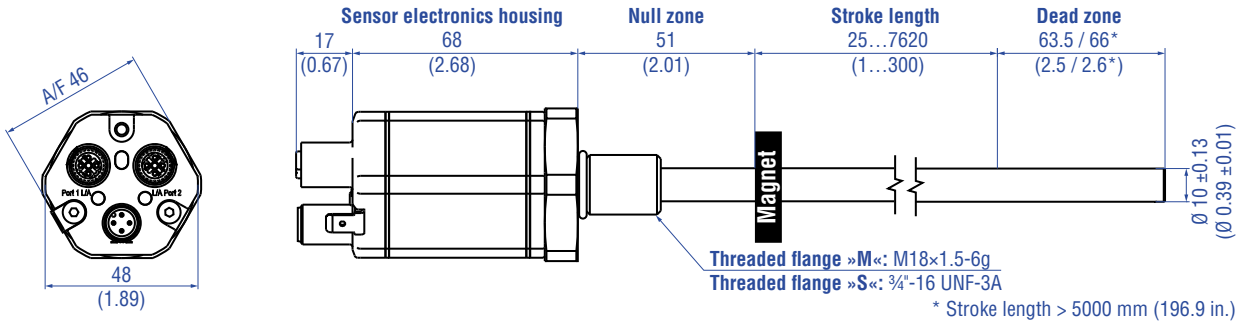
Output	
Interface	EtherNet/IP™
Data protocol	Encoder CIP device profile with CIP Sync and DLR capabilities
Data transmission rate	Max. 100 Mbit/s
Measured value	Position, velocity / Option: Simultaneous multi-position and multi-velocity measurements up to 30 magnets
Measurement parameters	
Resolution	1 to 1000 µm selectable
Cycle time	For stroke lengths: Up to 2000 mm — Cycle time: 1.0 ms For stroke lengths: Up to 4800 mm — Cycle time: 2.0 ms For stroke lengths: Up to 7620 mm — Cycle time: 3.0 ms
Linearity deviation[1]	< ±0.01 % F.S. (minimum ±50 µm)
Repeatability	< ±0.001 % F.S. (minimum ±2.5 µm) typical
Hysteresis	< 4 µm typical
Operating conditions	
Operating temperature	–40…+85 °C (–40…+185 °F)
Humidity	90 % relative humidity, no condensation
Ingress protection	IP67 (connectors correctly fitted)
Shock test	150 g / 11 ms, IEC standard 60068-2-27
Vibration test	30 g / 10…2000 Hz, IEC standard 60068-2-6 (resonance frequencies excluded)
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 EU directives and is marked with CE
Operating pressure	350 bar (5076 psi), 700 bar (10153 psi) peak (at 10 × 1 min)
Magnet movement velocity	Any
Design / Material	
Sensor electronics housing	Aluminum
Flange	Stainless steel 1.4305 (AISI 303)
Sensor rod	Stainless steel 1.4306 (AISI 304L)
Stroke length	25…7620 mm (1…300 in.)
Mechanical mounting	
Mounting position	Any
Mounting instruction	Please consult the technical drawings
Electrical connection	
Connection type	2 × M12 female connectors (4 pin), 1 × M8 male connector (4 pin), 2 × M12 female connectors (5 pin), 1 × M12 male connector (4 pin)
Operating voltage	12-30 VDC ±20%(9.6V - 36V)[2]
Current consumption	Less than 4W 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 # 201 542-2

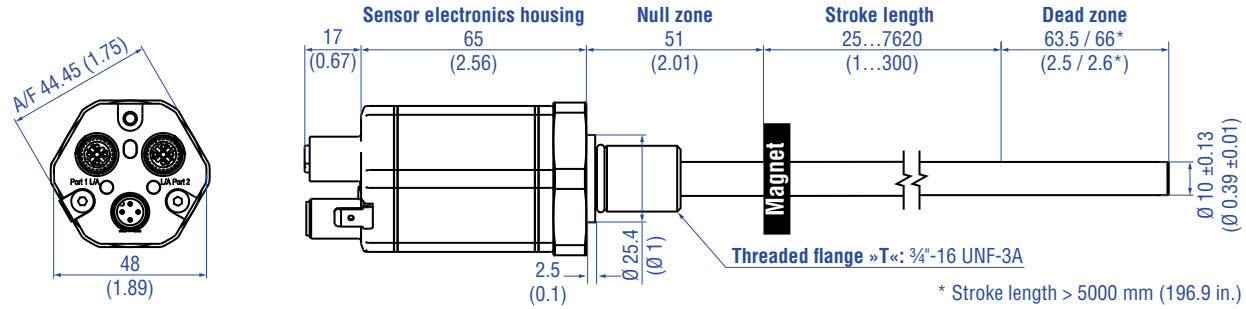
2/ Power supply must be able to provide current of 1A for power up process

TECHNICAL DRAWING

Model R-Series V RH, rod-style sensor with M or S type flange and D58 connection type

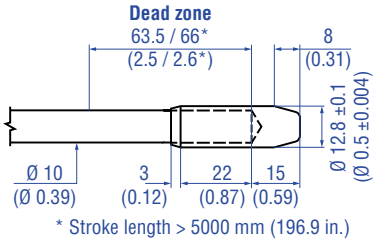


Model R-Series V RH, rod-style sensor with T type flange and D58 connection type



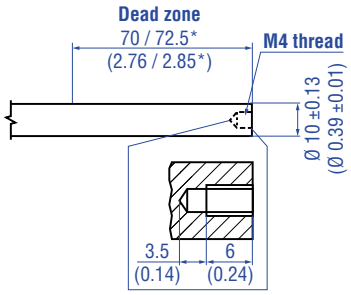
Bushing on rod end

(only for flange types M, S and T)



Female M4 threads at rod end

(only for flange types M, S and T)



Model R-Series V RH, rod-style sensor with J type flange and D58 connection type

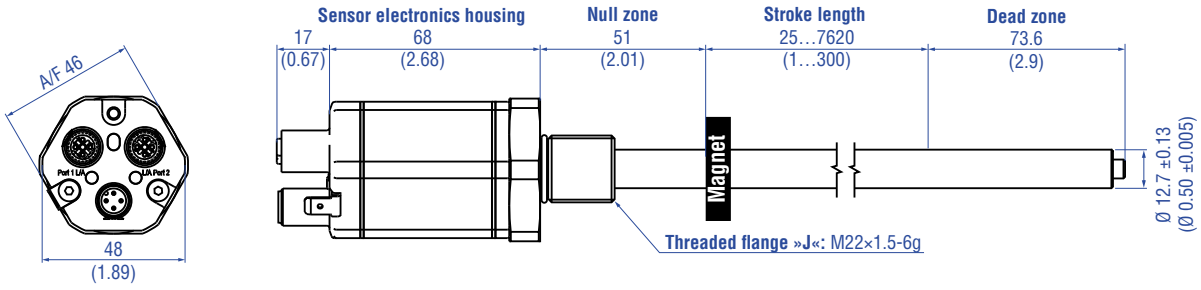


Fig. 3: Model RH5 Rod-style sensor dimension reference (shown with D58 integral connector options)
Controlling design dimensions are in millimeters and measurements in ( ) are in inches

CONNECTIONS AND WIRING

The D56 and D58 connection types provide for daisy chain topologies. A separate cable is used for the supply voltage. Unused connectors should be covered by a protective cap (370537).

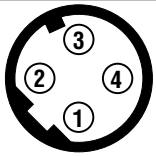
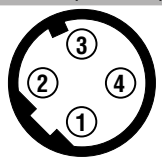
D56		
Ports		
Port 1, M12 female connector (D-coded)	**Pin**	**Function**
 View on sensor	1	Tx (+)
	2	Rx (+)
	3	Tx (–)
	4	Rx (–)
Port 2, M12 female connector (D-coded)	**Pin**	**Function**
 View on sensor	1	Tx (+)
	2	Rx (+)
	3	Tx (–)
	4	Rx (–)
Power supply		
M8 male connector	**Pin**	**Function**
 View on sensor	1	12…30 VDC (±20 %)
	2	Not connected
	3	DC Ground (0 V)
	4	Not connected

Fig. 4: Connector wiring D56

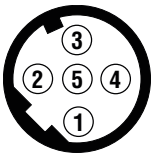
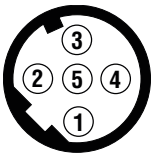
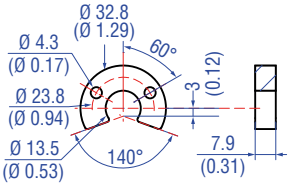
D58		
Ports		
Port 1, M12 female connector (D-coded)	**Pin**	**Function**
 View on sensor	1	Tx (+)
	2	Rx (+)
	3	Tx (–)
	4	Rx (–)
	5	Not connected
Port 2, M12 female connector (D-coded)	**Pin**	**Function**
 View on sensor	1	Tx (+)
	2	Rx (+)
	3	Tx (–)
	4	Rx (–)
	5	Not connected
Power supply		
M12 male connector (A-coded)	**Pin**	**Function**
 View on sensor	1	12…30 VDC (±20 %)
	2	Do not connect*
	3	DC Ground (0 V)
	4	Do not connect*
* As a connection to this pin may influence the correct startup of sensor		

Fig. 5: Connector wiring D58

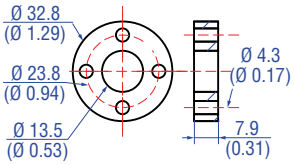
FREQUENTLY ORDERED ACCESSORIES – Additional options available in our Accessories Guide 551444

Position magnets



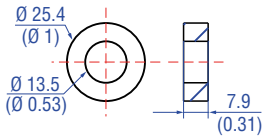
U-magnet OD33
Part no. 251 416-2

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)



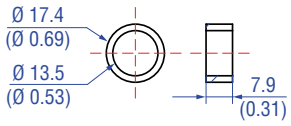
Ring magnet OD33
Part no. 201 542-2

Material: PA ferrite GF20
Weight: Approx. 14 g
Surface pressure: Max. 40 N/mm²
Fastening torque for M4 screws: 1 Nm
Operating temperature:
–40…+105 °C (–40…+221 °F)



Ring magnet OD25.4
Part no. 400 533

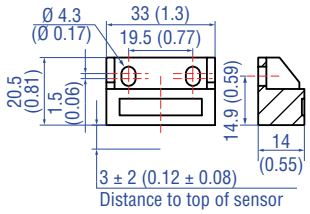
Material: PA ferrite
Weight: Approx. 10 g
Surface pressure: Max. 40 N/mm²
Operating temperature:
–40…+105 °C (–40…+221 °F)



Ring magnet OD17.4
Part no. 401 032

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

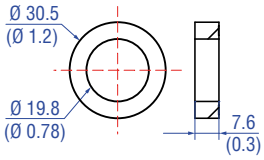
Position magnets



Block magnet L
Part no. 403 448

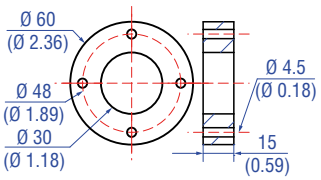
Material: Hard ferrite
Weight: Approx. 20 g
Fastening torque for M4 screws: 1 Nm
Operating temperature:
–40…+75 °C (–40…+167 °F)

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



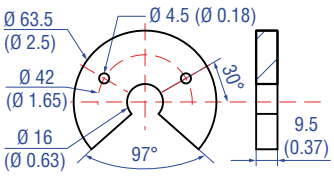
Ring magnet
Part no. 402 316

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



Ring magnet OD60
Part no. MT0162

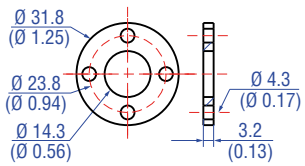
Material: Al CuMgPb,
magnets compound-filled
Weight: Approx. 90 g
Surface pressure: Max. 20 N/mm²
Fastening torque for M4 screws: 1 Nm
Operating temperature:
–40…+75 °C (–40…+167 °F)



U-magnet OD63.5
Part no. 201 553

Material: PA 66-GF30,
magnets compound-filled
Weight: Approx. 26 g
Surface pressure: 20 N/mm²
Fastening torque for M4 screws: 1 Nm
Operating temperature:
–40…+75 °C (–40…+167 °F)

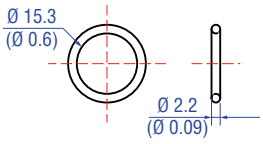
Magnet spacer



Magnet spacer
Part no. 400 633

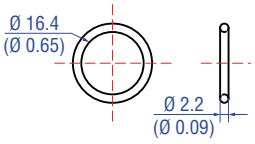
Material: Aluminum
Weight: Approx. 5 g
Surface pressure: Max. 20 N/mm²
Fastening torque for M4 screws: 1 Nm

Optional installation hardware



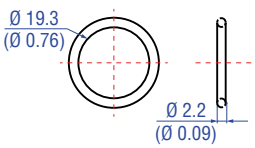
O-ring for threaded flange M18×1.5-6g
Part no. 401 133

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



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

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

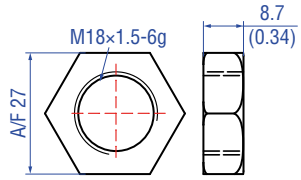


O-ring for threaded flange M22×1.5-6g
Part no. 561 337

Material: FPM
75 durometer
Operating temperature:
–20…+200 °C (–6…+392 °F)

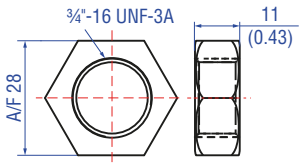
Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Optional installation hardware



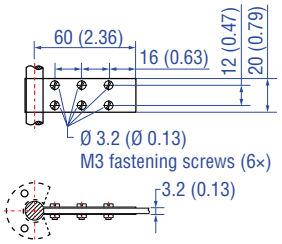
Hex jam nut M18×1.5-6g
Part no. 500 018

Material: Steel, zinc plated



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

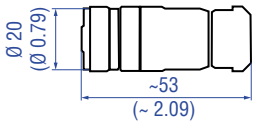
Material: Zinc plated with nylon insert



Fixing clip for rod with Ø 10 mm
Part no. 561 481

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

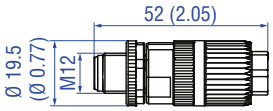
Cable connector [3]



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

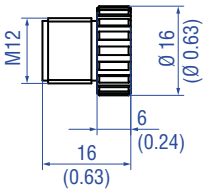
Material: GD-Zn, Ni
Termination: Screw
Contact insert: CuZn
Cable Ø: 4…8 mm (0.16…0.31 in.)
Wire: 1.5 mm²
Operating temperature: –30…+85 °C (–22…+185 °F)
Ingress protection: IP67 (correctly fitted)

Cable connector [3]



M12 D-coded male connector (4 pin), straight
Part no. 370 523

Material: Zinc nickel-plated
Termination: Insulation-displacement
Cable Ø: 5.5…7.2 mm (0.2…0.28 in.)
Operating temperature: –25…+85 °C (–13…+185 °F)
Ingress protection: IP65 / IP67 (correctly fitted)
Fastening torque: 0.6 Nm



M12 connector end cap
Part no. 370 537

Female connectors M12 should be covered by this protective cap
Material: Brass nickel-plated
Ingress protection: IP67 (correctly fitted)
Fastening torque: 0.39…0.49 Nm

Cables

Cable with M12 D-coded male connector – M12 D-coded, male connector, 5 m (16.4 ft.)
Part no. 530 064

Material: PUR jacket; green
Features: Cat 5e
Cable length: 5 m (16.4 ft)
Cable Ø: 6.5 mm (0.26 in.)
Ingress protection: IP65, IP67, IP68 (correctly fitted)
Operating temperature: –30…+70 °C (–22…+158 °F)

Cable with M12 D-coded male connector – RJ45 male connector, 5 m (16.4 ft.)
Part no. 530 065

Material: PUR jacket; green
Features: Cat 5e
Cable length: 5 m (16.4 ft)
Cable Ø: 6.5 mm (0.26 in.)
Ingress protection M12 connector: IP67 (correctly fitted)
Ingress protection RJ45 connector: IP20 (correctly fitted)
Operating temperature: –30…+70 °C (–22…+158 °F)

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

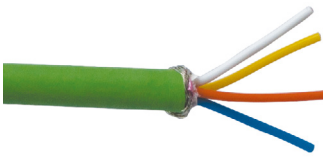
NOTICE

Follow the manufacturer‘s mounting instructions.

Cables

Power cable, female 4 pin (M8) and cable with pigtail termination
Part no.: 5 m: 530 066
10 m: 530 096
15 m: 530 093

Wire gage: 4 × 0.25 mm² shielded
Cable jacket: PUR; gray
Max. cable Ø: 8 mm



PUR cable
Part no. 530 125

Material: PUR jacket; green
Features: Cat 5
Cable Ø: 6.5 mm (0.26 in.)
Dimensions: 2×2×0.35 mm² (22/7 AWG)
Operating temperature: –20…+60 °C (–4…+140 °F)

TempoLink

TempoLink
Sensor Assistant for Temposonics
Part no. 201978

- Wireless diagnostic tool for sensor with wired USB interface option.
- Simple connectivity to the sensor via 24V DC power line.
- User friendly interface for mobile devices and desktop computers.
- Rugged ABS plastic construction for the industrial environment.

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
R	H	5										D	5		1	U	2		1
a			b	c	d					e		f			g	h			

a	Design
R H 5	Rod

b	Flange
B	Base unit (without flange/rod assembly)
J	Threaded flange M22×1.5-6g (rod ø 12.7 mm, 800 bar)
M	Threaded flange M18×1.5-6g (standard)
S	Threaded flange 3/4“-16 UNF-3A (standard)
T	Threaded flange 3/4“-16 UNF-3A (with raised-face)

c	Mechanical
A	Standard
B	Bushing on rod end (only for flange option »M«, »S« & »T«)
M	Female M4 threads at rod end (only for flange option »M«, »S« & »T«)
V	Fluorelastomer seals for the electronics housing

d	Stroke length
X X X X M	0025…7620 mm

Standard stroke length (mm)*	Ordering steps
25 … 500 mm	5 mm
500 … 750 mm	10 mm
750…1000 mm	25 mm
1000…2500 mm	50 mm
2500…5000 mm	100 mm
5000…7620 mm	250 mm

X X X . X U	001.0…300.0 in.

Standard stroke length (in.)*	Ordering steps
1 … 20 in.	0.2 in.
20 … 30 in.	0.4 in.
30 … 40 in.	1.0 in.
40…100 in.	2.0 in.
100…200 in.	4.0 in.
200…300 in.	10.0 in.

e	Number of magnets
X X	Number of magnets, 01 to 30

f	Connection type
D 5 6	2 × M12 female connectors (4 pin), 1 × M8 male connector (4 pin)
D 5 8	2 × M12 female connectors (5 pin), 1 × M12 male connector (4 pin)

g	System
1	Standard

h	Output
U 2 0 1	EtherNet/IP™, position and velocity, 1 to 30 magnets
U 2 1 1	EtherNet/IP™, position and velocity, 1 magnet with internal linearization

NOTICE

- Please specify magnet numbers for your sensing application and order separately.
- The maximum number of magnets depends on 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).

DELIVERY

RH5-B:
- Base unit

RH5-J / -M / -S / -T:
- Sensor
- O-ring

Accessories have to be ordered separately

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

NOTES

NOTES

MTS®
SENSORS

Document Part Number:
551954 Revision P1 - PRELIMINARY (EN) 10/2017

LOCATIONS

USA
MTS Systems Corporation
Sensors Division
3001 Sheldon Drive
Cary, N.C. 27513, USA
Tel. +1 919 677-0100
Fax +1 919 677-0200
info.us@mtssensors.com
www.mtssensors.com

GERMANY
MTS Sensor Technologie
GmbH & Co. KG
Auf dem Schüffel 9
58513 Lüdenscheid, Germany
Tel. +49 2351 9587-0
Fax +49 2351 56491
info.de@mtssensors.com
www.mtssensors.com

JAPAN
MTS Sensors Technology Corp.
737 Aihara-machi,
Machida-shi,
Tokyo 194-0211, Japan
Tel. +81 42 775-3838
Fax +81 42 775-5512
info.jp@mtssensors.com
www.mtssensors.com

CHINA
MTS Sensors
Room 504, Huajing Commercial Center,
No. 188, North Qinzhou Road
200233 Shanghai, China
Tel. +86 21 6485 5800
Fax +86 21 6495 6329
info.cn@mtssensors.com
www.mtssensors.com

FRANCE
MTS Systems SAS
Zone EUROPARC Bâtiment EXA 16
16/18, rue Eugène Dupuis
94046 Creteil, France
Tel. +33 1 58 4390-28
Fax +33 1 58 4390-03
info.fr@mtssensors.com
www.mtssensors.com

ITALY
MTS Systems Srl
Sensor Division
Via Camillo Golgi, 5/7
25064 Gussago (BS), Italy
Tel. +39 030 988 3819
Fax +39 030 982 3359
info.it@mtssensors.com
www.mtssensors.com

LEGAL NOTICES

EtherNet/IP® CIP Sync