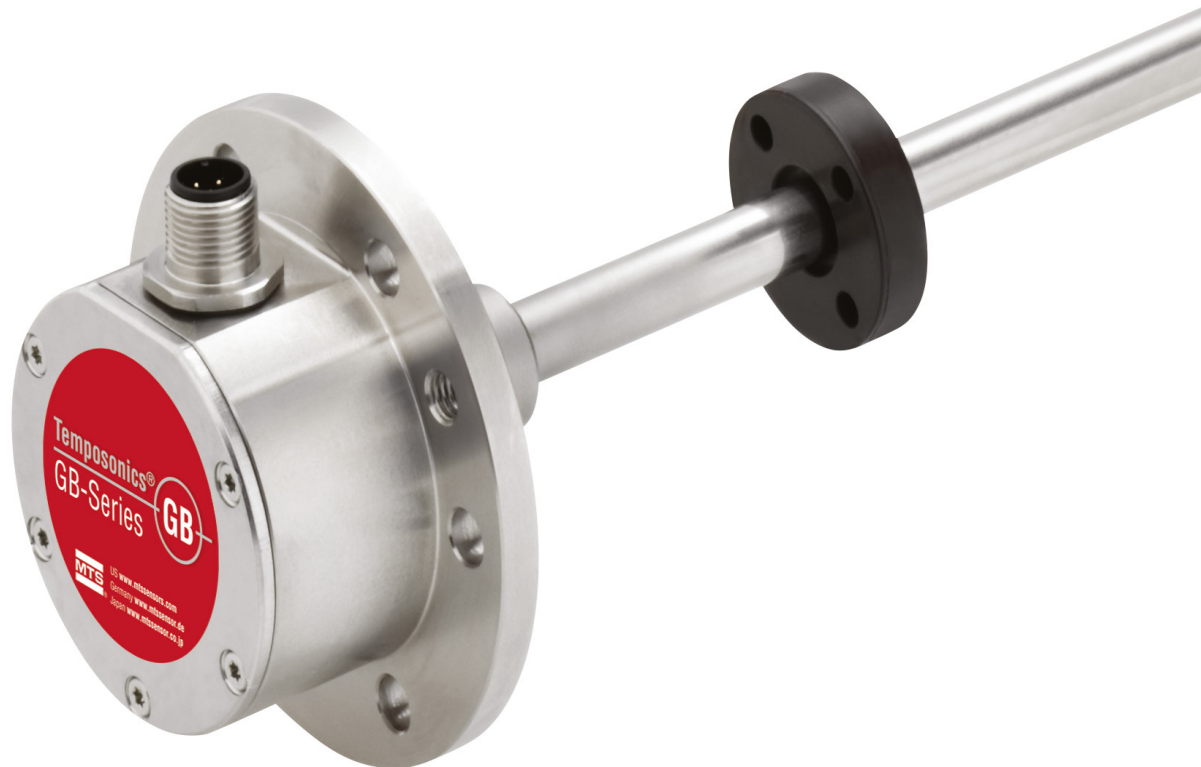


Temposonics®

Magnetostrictive Linear Position Sensors

GB-S SSI Data Sheet

- High pressure resistant sensor rod
- High operating temperature up to +100 °C (+212 °F)
- Flat & compact – ideal for the valve market



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.

GB SENSOR

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 MTS Sensors. The position magnet is mounted on the moving machine part and travels non-contact over the sensor rod with the built-in waveguide.

Temposonics® GB is a rod-style sensor for installation into hydraulic cylinders, e.g. in power engineering. With its flat and compact sensor housing and side-mounted signal connection, the sensor is ideal for small spaces. Due to the pressure-resistant sensor rod and its high operating temperature the Temposonics® GB sensor is perfectly suitable for use in fluid technology. For improved signal quality the sensor automatically adapts to the strength of the magnet used in the application.

The set points, start and end position of the measurement, can be modified after installation of the Temposonics® GB sensor. Programming can be carried out using the standard connection cable.

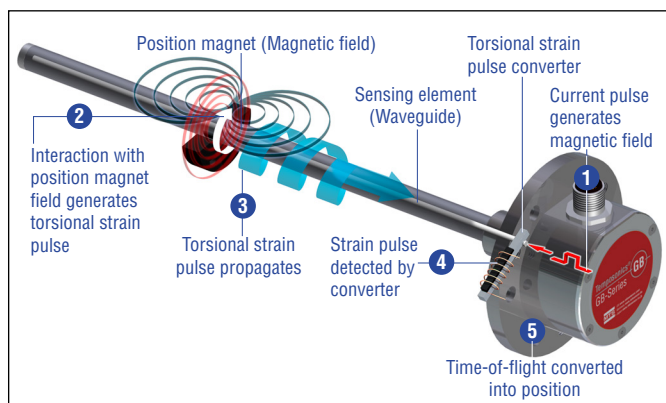


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

TECHNICAL DATA

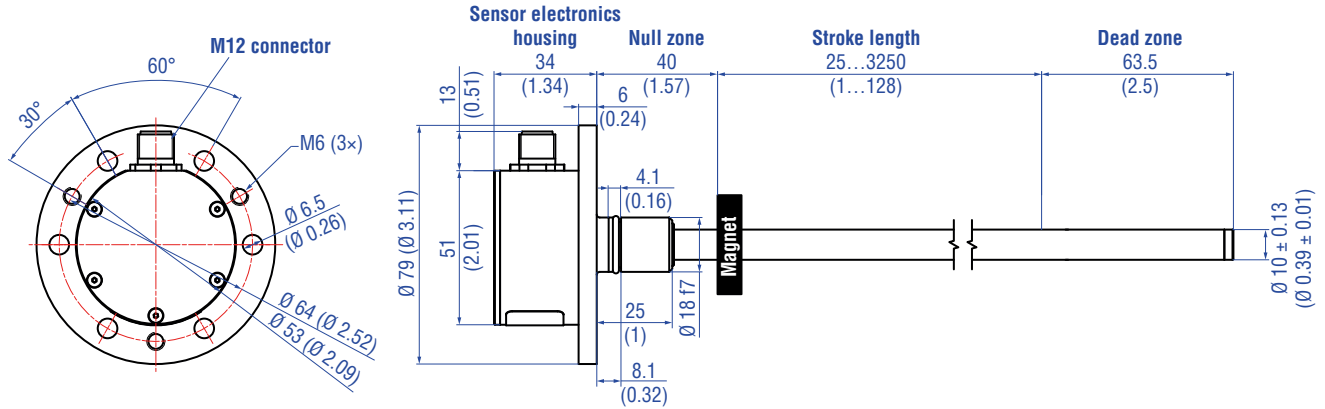
Output	
Interface	SSI (Synchronous Serial Interface) – Differential signal in SSI standard
Data format	Binary, gray
Data length	8...32 bit
Programming	Programming of set points using optional accessories
Measured value	Position
Measurement parameters	
Resolution	5 µm minimum
Cycle time	Up to 3.7 kHz depending on stroke length
Linearity ¹	≤ ±0.02 % F.S. (minimum ±60 µm) typical
Repeatability	≤ ±0.005 % F.S. (minimum ±20 µm) typical
Operating conditions	
Operating temperature	–40...+90 °C (–40...+194 °F), option: –40...+100 °C (–40...+212 °F)
Ingress protection	IP67 (correctly fitted); IP68 (for cable outlet)
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 61000-6-4 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 (5,076 psi), 700 bar (10,153 psi) peak (at 10 × 1 min), GB-J: 800 bar (11,603 psi)
Magnet movement velocity	Any
Design / Material	
Sensor electronics housing ² with flange	GB-J / GB-K / GB-S: Stainless steel 1.4305 (AISI 303), GB-N: Stainless steel 1.4404 (AISI 316L)
Sensor rod	GB-J: Stainless steel 1.4301 (AISI 304), GB-K / GB-S: Stainless steel 1.4306; 1.4307 (AISI 304L), GB-N: Stainless steel 1.4404 (AISI 316L)
Stroke length	25...3250 mm (1...128 in.)
Mechanical mounting	
Mounting position	Any
Mounting instruction	Please consult the technical drawings and the operation manual (document number: 551631)
Electrical connection	
Connection type	M12 A-coded male connector (8 pin), M16 male connector (7 pin), cable outlet
Operating voltage	+24 VDC (–15 / +20 %)
Ripple	≤ 0.28 V _{pp}
Current consumption	90 mA typical
Dielectric strength	500 VDC (DC ground to machine ground)
Polarity protection	Up to –30 VDC
Overvoltage protection	Up to 36 VDC

1/ With position magnet # 251 416-2

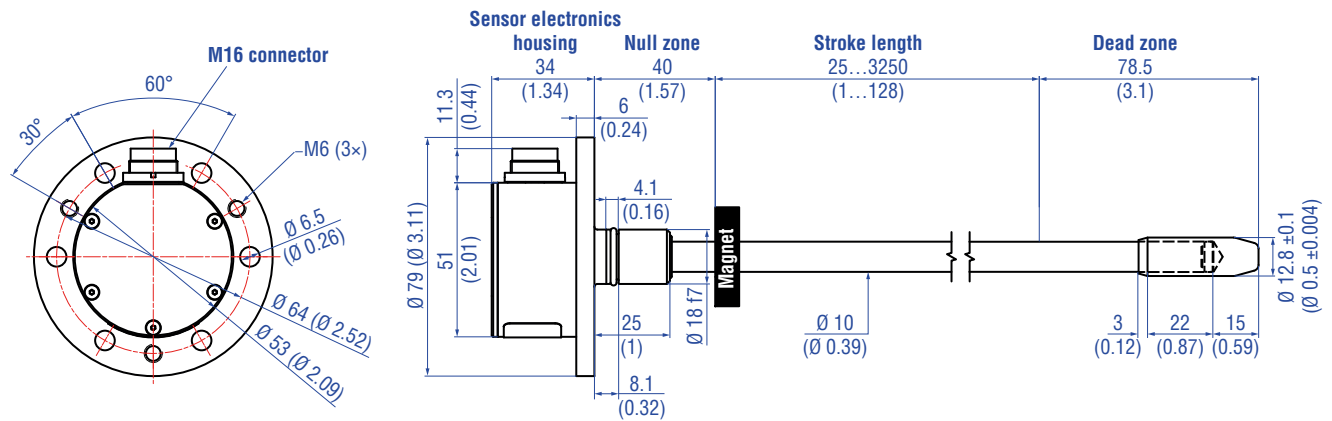
2/ For option **H** (–40...+100 °C / –40...+212 °F) an aluminum cover plate is used

TECHNICAL DRAWING

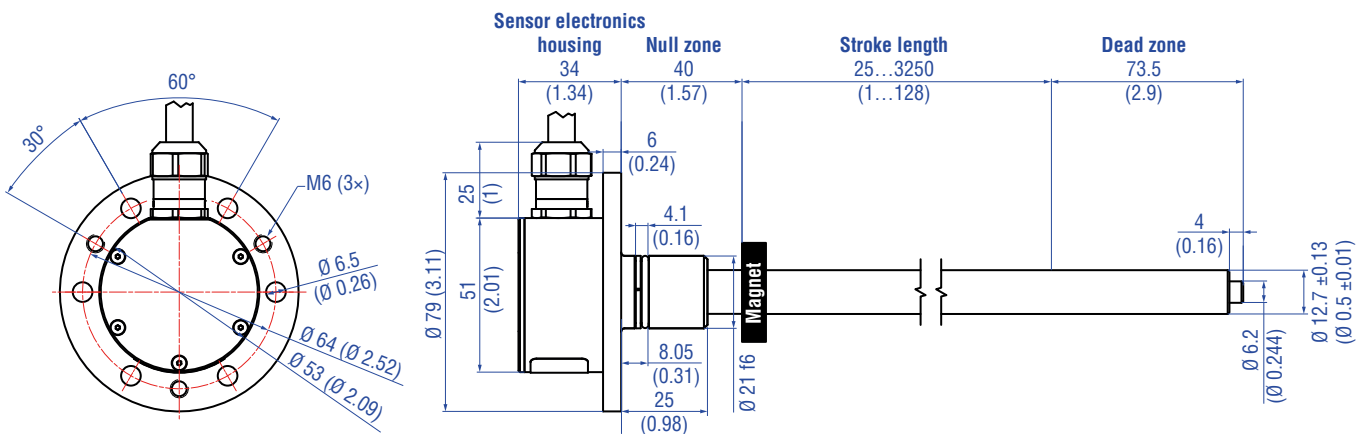
GB-N / GB-S, example: With M12 connector



GB-K, example: With M16 connector



GB-J, example: With cable outlet



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

Fig. 2: Temposonics® GB-N / GB-S / GB-K / GB-J with ring magnet

CONNECTOR WIRING


D84		
Signal + power supply		
M12 male connector (A-coded)	Pin	Function
 <p>View on sensor</p>	1	Clock (+)
	2	Clock (-)
	3	Data (+)
	4	Data (-)
	5	Not connected
	6	Not connected
	7	+24 VDC (-15 / +20 %)
	8	DC Ground (0 V)

Fig. 3: Connector wiring D84 (M12 connector)


D70		
Signal + power supply		
M16 male connector	Color	Function
 <p>View on sensor</p>	1	Data (-)
	2	Data (+)
	3	Clock (+)
	4	Clock (-)
	5	+24 VDC (-15 / +20 %)
	6	DC Ground (0 V)
	7	Not connected

Fig. 4: Connector wiring D70 (M16 connector)

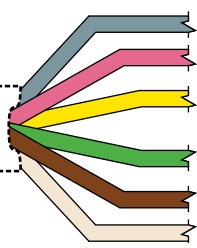
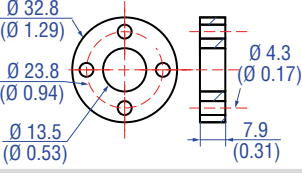
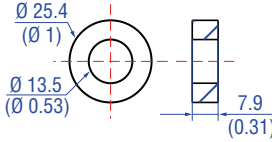
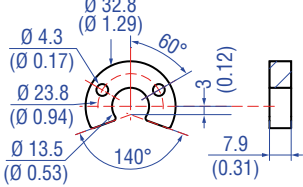
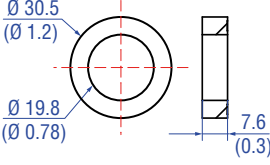
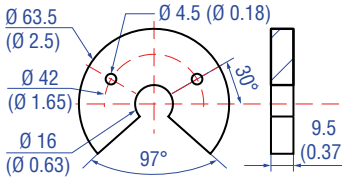
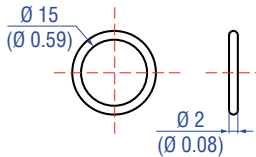
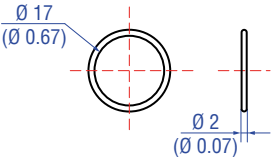
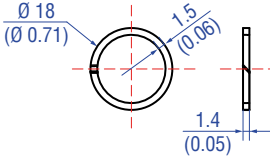
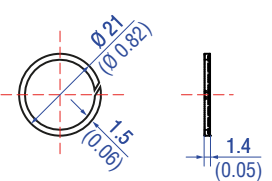
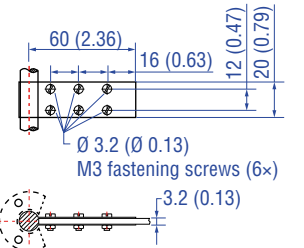
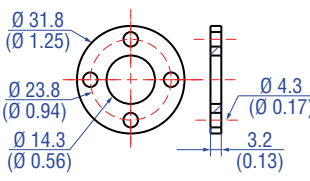
GB with cable outlet (HXX / TXX / VXX)		
Signal + power supply		
Cable	Color	Function
	GY	Data (-)
	PK	Data (+)
	YE	Clock (+)
	GN	Clock (-)
	BN	+24 VDC (-15 / +20 %)
	WH	DC Ground (0 V)

Fig. 5: Connector wiring (cable outlet)

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

Position magnets			
			
<p>Ring magnet OD33 Part no. 201 542-2</p> <p>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)</p>	<p>Ring magnet OD25.4 Part no. 400 533</p> <p>Material: PA ferrite Weight: Approx. 10 g Surface pressure: Max. 40 N/mm² Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<p>U-magnet OD33 Part no. 251 416-2</p> <p>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)</p>	<p>Ring magnet Part no. 402 316</p> <p>Material: PA ferrite coated Weight: Approx. 13 g Surface pressure: Max. 20 N/mm² Operating temperature: -40...+100 °C (-40...+212 °F)</p>

Position magnet	O-rings	Back-up ring	
			
<p>U-magnet OD63.5 Part no. 201 553</p> <p>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)</p>	<p>O-ring for pressure fit flange Ø 18 mm Part no. 560 853</p> <p>Material: Fluoroelastomer Durometer: 75 Shore A</p>	<p>O-ring for pressure fit flange Ø 21 mm Part no. 561 438</p> <p>Material: FKM Durometer: 80 Shore A</p>	<p>Back-up ring for pressure fit flange Ø 18 mm Part no. 561 115</p> <p>Material: PTFE + 60 % bronze</p>

Back-up ring	Optional installation hardware	Magnet spacer
		
<p>Back-up ring for pressure fit flange Ø 21 mm Part no. 561 439</p> <p>Material: PTFE</p>	<p>Fixing clip for rod with Ø 10 mm Part no. 561 481</p> <p>Application: Used to secure sensor rods (Ø 10 mm (Ø 0.39 in.)) when using an U-magnet or block magnet Material: Brass, non-magnetic</p>	<p>Magnet spacer Part no. 400 633</p> <p>Material: Aluminum Weight: Approx. 5 g Surface pressure: Max. 20 N/mm² Fastening torque for M4 screws: 1 Nm</p>

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

Cable connectors³

<p>M12 A-coded female connector (8 pin), straight Part no. 370 694</p>	<p>M12 A-coded female connector (8 pin), angled Part no. 370 699</p>	<p>M16 female connector (7 pin), straight Part no. 370 624</p>	<p>M16 female connector (7 pin), angled Part no. 560 779</p>
<p>Housing: GD-ZnAL Termination: Screw Contact insert: CuZn Cable Ø: 4...9 mm (0.16...0.35 in.) Wire: 0.75 mm² Operating temperature: -25...+90 °C (-13...+194 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.6 Nm</p>	<p>Housing: GD-ZnAL Termination: Screw Contact insert: CuZn Cable Ø: 6...8 mm (0.24...0.31 in.) Wire: 0.5 mm² Operating temperature: -25...+85 °C (-13...+185 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.6 Nm</p>	<p>Material: Zinc nickel plated Termination: Solder Contact insert: Silver plated Cable clamp: PG9 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: 0.7 Nm</p>	<p>Material: Zinc nickel plated Termination: Solder Contact insert: Silver plated 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: 0.5 Nm</p>

Cables

Programming tool

<p>PUR cable Part no. 530 052</p>	<p>Teflon® cable Part no. 530 112</p>	<p>Silicone cable Part no. 530 113</p>	<p>Programming kit Part no. 254 590</p>
<p>Name of cable in order code: H Material: PUR jacket; orange Features: Twisted pair, shielded, highly flexible Cable Ø: 6.4 mm (0.25 in.) Cross section: 3 × 2 × 0.25 mm² Bending radius: 5 × Ø (fixed insulation) Operating temperature: -30...+80 °C (-22...+176 °F)</p>	<p>Name of cable in order code: T Material: Teflon® jacket; black Features: Twisted pair, shielded, flexible Cable Ø: 7.6 mm (0.3 in.) Cross section: 4 × 2 × 0.25 mm² Bending radius: 8 – 10 × Ø (fixed installation) Operating temperature: -100...+180 °C (-148...+356 °F)</p>	<p>Name of cable in order code: V Material: Silicone jacket; red Features: Twisted pair, shielded, highly flexible Cable Ø: 7.2 mm (0.28 in.) Cross section: 3 × 2 × 0.25 mm² Bending radius: 5 × Ø (fixed installation) Operating temperature: -50...+180 °C (-58...+356 °F)</p>	<p>Kit includes: 1 × interface converter box, 1 × power supply 1 × cable (60 cm) with M12 female connector (8 pin), straight – D-sub female connector (9 pin), straight 1 × cable (60 cm) with M16 female connector (7 pin), straight – D-sub female connector (9 pin), straight 1 × cable (60 cm) with 6 × terminal clamp – D-sub female connector (9 pin), straight 1 × USB cable Software is available at: www.mtssensors.com</p>

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

3/ Follow the manufacturer's mounting instructions

ORDER CODE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
G	B										1	S								C
a	b	c						d	e	f						g	h			

a	Sensor model
G B	Rod

b	Design
J	Housing material stainless steel 1.4305 (AISI 303), rod material stainless steel 1.4301 (AISI 304) Pressure fit flange Ø 21 mm, Ø 12.7 mm rod, 800 bar

K	Housing material stainless steel 1.4305 (AISI 303), rod material stainless steel 1.4306; 1.4307 (AISI 304L) Pressure fit flange Ø 18 mm, Ø 10 mm rod with bushing on rod end
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N	Housing material stainless steel 1.4404 (AISI 316L), rod material stainless steel 1.4404 (AISI 316L) ⁴ Pressure fit flange Ø 18 mm, Ø 10 mm rod
---	---------------------------------------------------------------------------------------------------------------------------------------------------------------

S	Housing material stainless steel 1.4305 (AISI 303), rod material stainless steel 1.4306; 1.4307 (AISI 304L) Pressure fit flange Ø 18 mm, Ø 10 mm rod
---	---------------------------------------------------------------------------------------------------------------------------------------------------------

c	Stroke length
X X X X M	0025...3250 mm
X X X X U	001.0...128.0 in.

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...3250 mm	100 mm

Standard stroke length (in.)*	Ordering steps
1... 20 in.	0.2 in.
20... 30 in.	0.5 in.
30... 40 in.	1.0 in.
40...100 in.	2.0 in.
100...128 in.	4.0 in.

d	Connection type
D 8 4	M12 connector (8 pin)
D 7 0	M16 connector (7 pin)
H X X	PUR cable (part no. 530 052) H01...H10 (1...10 m) ⁵ H03...H33 (3...33 ft) ⁵ CAUTION: Max. operating temperature -30...+80 °C (-22...+176 °F)!

d	Connection type (continued)
T X X	Teflon® cable (part no. 530 112) T01...T10 (1...10 m) ⁵ T03...T33 (3...33 ft) ⁵
V X X	Silicone cable (part no. 530 113) V01...V10 (1...10 m) ⁵ V03...V33 (3...33 ft) ⁵

e	Operating voltage
1	+24 VDC (-15 / +20 %)

f	Output
S (14) (15) (16) (17) (18) (19)	= Synchronous Serial Interface

Data length (box no. 14)	
1	25 bit
2	24 bit

Output format (box no. 15)	
B	Binary
G	Gray

Resolution (box no. 16)	
1	0.005 mm
2	0.01 mm
3	0.05 mm
4	0.1 mm
5	0.02 mm

Filtering performance (box no. 17)	
1	No filter
2	Average filter 2
3	Average filter 4
4	Average filter 8

Signal options (box no. 18, 19)	
0 0	Measuring direction forward, asynchronous measurement
0 1	Measuring direction reverse, asynchronous measurement
0 2	Measuring direction forward, synchronised measurement
0 3	Measuring direction reverse, synchronised measurement

g	See next page
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4/ The sensor in stainless steel 1.4404 (AISI 316L) is only available with following options: **S** (-40...+90 °C / -40...+194 °F)

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

5/ Encode in meters if using metric stroke length. Encode in feet if using US customary stroke length

g	Operating temperature
H	-40...+100 °C (-40...+212 °F)
S	-40...+90 °C (-40...+194 °F)

h	Programming
C	Via cable

DELIVERY



- Sensor
- O-ring
- Back-up ring

Accessories have to be ordered separately.

Manuals, Software & 3D Models available at:
www.mtssensors.com

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