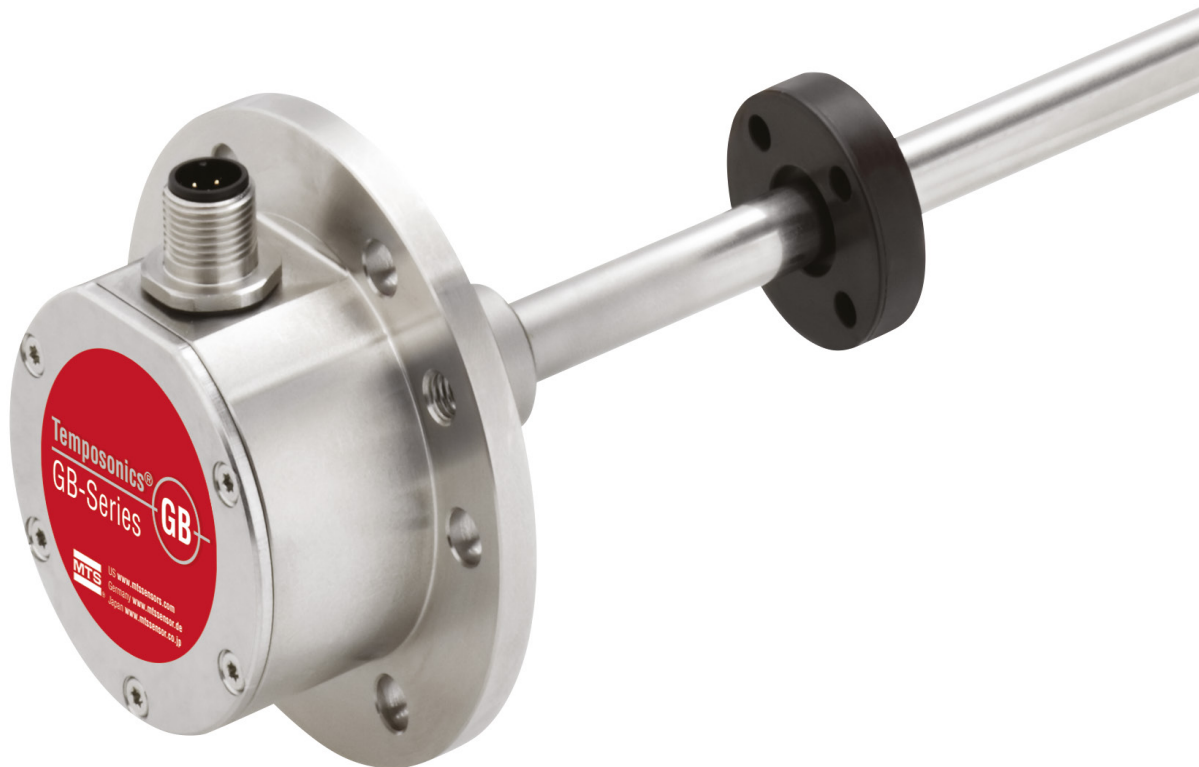


Tempsonics®

Magnetostrictive Linear Position Sensors

GB-S Analog 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.

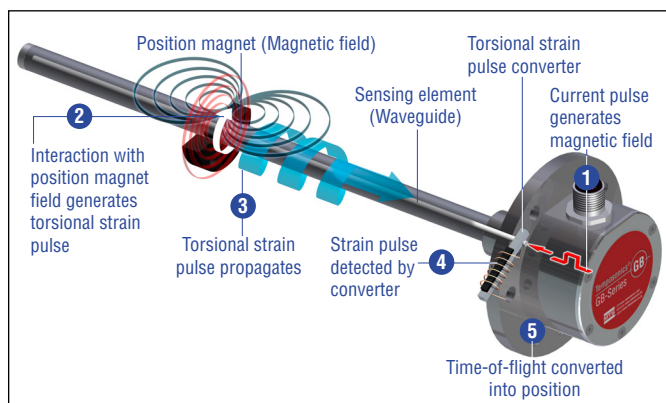


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

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. Optionally the sensor offers Bluetooth® ¹ connectivity for programming. In the case of Bluetooth® connectivity, set points can be modified even when the sensor is no longer accessible. The maximum range between sensor and receiver is 5 m (16 ft). With this option it is still possible to program the sensor via the cable connection.




Fig. 2: Bluetooth wireless technology²

1/ The Bluetooth® word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. and any use of such marks by MTS Sensor Technology is under license. Other trademarks and trade names are those of their respective owners.

2/ Montage of MTS Sensors and © Tsiumpa - Fotolia.com
For iOS operating system available in the future.

TECHNICAL DATA

Output				
Voltage	0...10 VDC and 10...0 VDC (minimum load controller: > 5 kΩ)			
Current	4(0)...20 mA or 20...4(0) mA (minimum / maximum load: 0 / 500 Ω)			
Programming	Programming of set points using optional accessories ³			
Bluetooth® version	2.1			
Measured value	Position			
Measurement parameters				
Resolution	16 bit (minimum 1 μm depending on stroke length) ⁴			
Cycle time	Cycle time	0.5 ms	1.0 ms	2.0 ms
	Stroke length	≤ 1200 mm	≤ 2400 mm	> 2400 mm
Linearity ⁵	≤ ±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 			
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 ⁶ 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: 551511)			
Electrical connection				
Connection type	M12 male connector (5 pin); M16 male connector (6 pin); cable outlet			
Operating voltage	+24 VDC (−15 / +20 %)			
Ripple	≤ 0.28 V _{pp}			
Current consumption	100 mA typical, dependent on stroke length			
Dielectric strength	500 VDC (DC ground to machine ground)			
Polarity protection	Up to −30 VDC			
Overvoltage protection	Up to 36 VDC			

3/ Programming via Bluetooth wireless technology is disabled from an operating temperature of +55 °C (+131 °F) typical

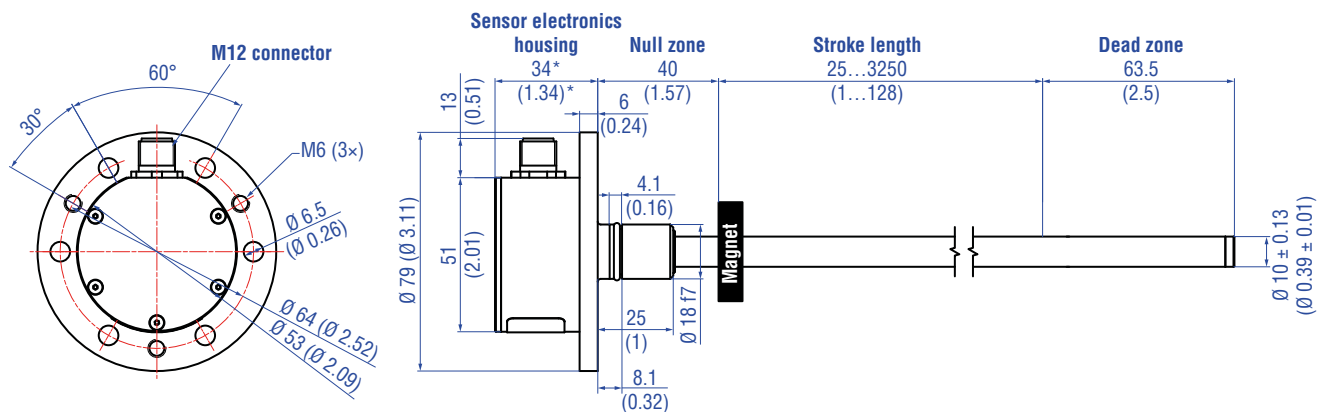
4/ The internal digital value is transferred via a 16-bit D/A converter into a proportional, analog current or voltage signal

5/ With position magnet # 251 416-2

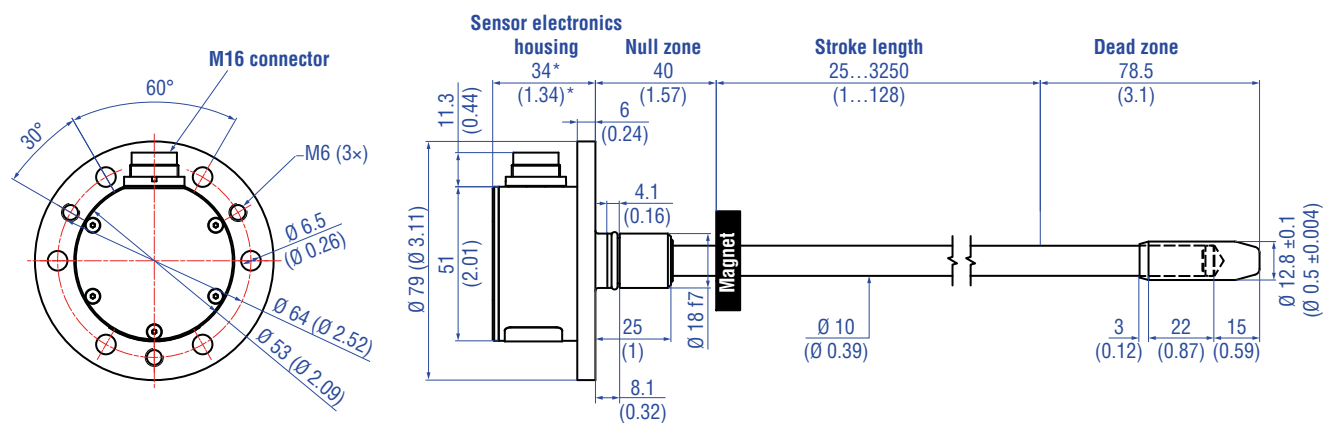
6/ For option **H** (-40...+100 °C / -40...+212 °F) and option **W** (programming via Bluetooth wireless technology) an aluminum cover plate is used

TECHNICAL DRAWING

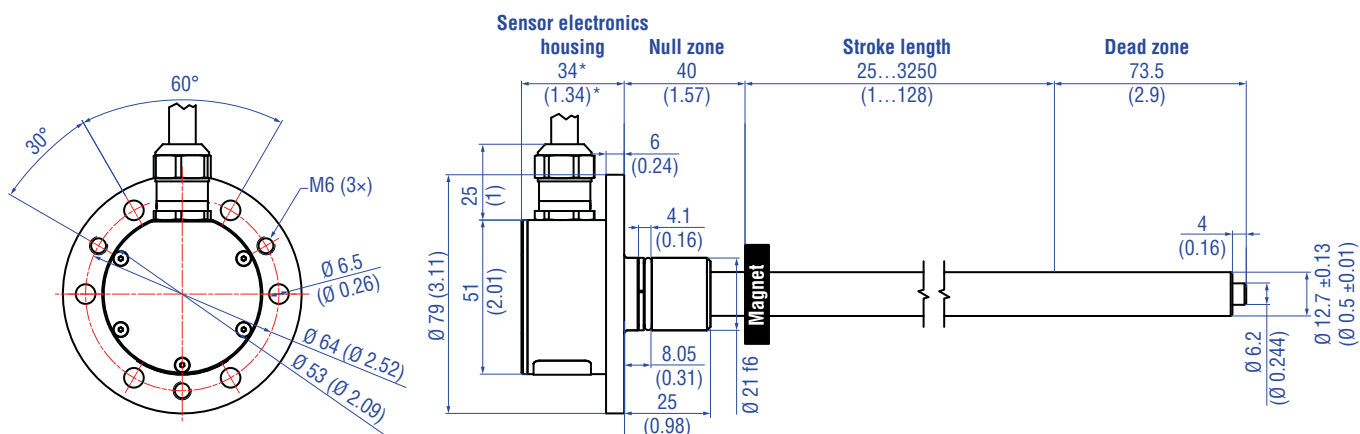
GB-N / GB-S, example: With M12 connector



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

* / 34.5 mm (1.36 in.) for sensors with Bluetooth wireless technology (option **W**)

CONNECTOR WIRING


D34 (for outputs: V0, A0, A1, A2, A3 in order code)			
Signal + power supply			
M12 male connector (A-coded)	Pin	Voltage	Current
 <p>View on sensor</p>	1	+24 VDC (-15 / +20 %)	+24 VDC (-15 / +20 %)
	2	0...10 VDC	4(0)...20 mA or 20... 4(0) mA
	3	DC Ground (0 V)	DC Ground (0 V)
	4	10...0 VDC	Not connected ⁷
	5	DC Ground	DC Ground

Fig. 4: Connector wiring D34 (M12) for outputs V0, A0, A1, A2 and A3


D34 (for output: A4 in order code)		
Signal + power supply		
M12 male connector (A-coded)	Pin	Current
 <p>View on sensor</p>	1	+24 VDC (-15 / +20 %)
	2	4...20 mA ⁸
	3	DC Ground (0 V)
	4	20...4 mA
	5	DC Ground

Fig. 7: Connector wiring D34 (M12) for output A4


D60 (for outputs: V0, A0, A1, A2, A3 in order code)			
Signal + power supply			
M16 male connector	Pin	Voltage	Current
 <p>View on sensor</p>	1	0...10 VDC	4(0)...20 mA or 20... 4(0) mA
	2	DC Ground	DC Ground
	3	10...0 VDC	Not connected ⁷
	4	DC Ground	DC Ground
	5	+24 VDC (-15 / +20 %)	+24 VDC (-15 / +20 %)
	6	DC Ground (0 V)	DC Ground (0 V)

Fig. 5: Connector wiring D60 (M16) for outputs V0, A0, A1, A2 and A3


D60 (for output: A4 in order code)		
Signal + power supply		
M16 male connector	Pin	Current
 <p>View on sensor</p>	1	4...20 mA ⁸
	2	DC Ground
	3	20...4 mA
	4	DC Ground
	5	+24 VDC (-15 / +20 %)
	6	DC Ground (0 V)

Fig. 8: Connector wiring D60 (M16) for output A4

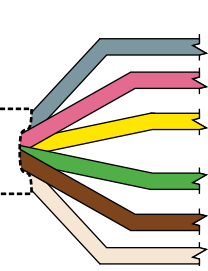
HXX / TXX / VXX (for outputs: V0, A0, A1, A2, A3 in order code)			
Signal + power supply			
Cable	Color	Voltage	Current
	GY	0...10 VDC	4(0)...20 mA or 20... 4(0) mA
	PK	DC Ground	DC Ground
	YE	10...0 VDC	Not connected ⁷
	GN	DC Ground	DC Ground
	BN	+24 VDC (-15 / +20 %)	+24 VDC (-15 / +20 %)
	WH	DC Ground (0 V)	DC Ground (0 V)

Fig. 6: Connector wiring cable outlet for outputs V0, A0, A1, A2 and A3

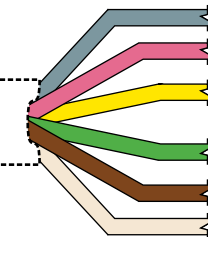
HXX / TXX / VXX (for output: A4 in order code)		
Signal + power supply		
Cable	Color	Current
	GY	4...20 mA ⁸
	PK	DC Ground
	YE	20...4 mA
	GN	DC Ground
	BN	+24 VDC (-15 / +20 %)
	WH	DC Ground (0 V)

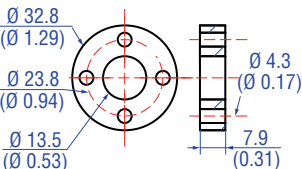
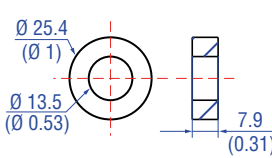
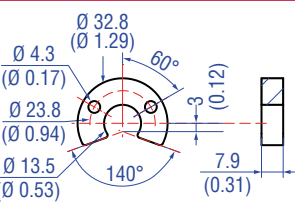
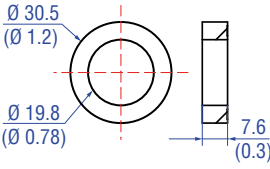
Fig. 9: Connector wiring cable outlet for output A4

^{7/} Connection necessary for programming with hand or cabinet programmer

^{8/} Connect the first output (4...20 mA) at low-resistance, if you only use the second output (20...4 mA)

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

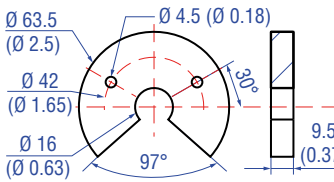
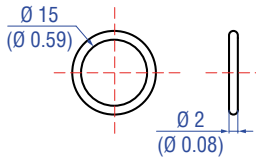
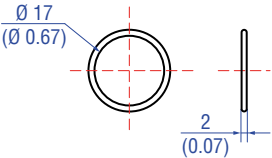
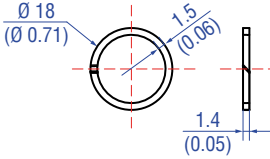
Position magnets

			
Ring magnet OD33 Part no. 201 542-2 Material: PA ferrite GF20 Weight: Approx. 14 g Surface pressure: Max. 40 N/mm ² 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/mm ² Operating temperature: -40...+105 °C (-40...+221 °F)	U-magnet OD33 Part no. 251 416-2 Material: PA ferrite GF20 Weight: Approx. 11 g Surface pressure: Max. 40 N/mm ² Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+105 °C (-40...+221 °F)	Ring magnet Part no. 402 316 Material: PA ferrite coated Weight: Approx. 13 g Surface pressure: Max. 20 N/mm ² Operating temperature: -40...+100 °C (-40...+212 °F)

Position magnet

O-rings

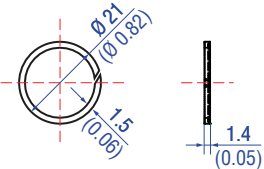
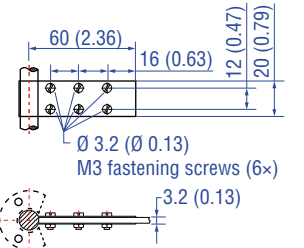
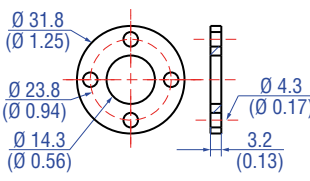
Back-up ring

			
U-magnet OD63.5 Part no. 201 553 Material: PA 66-GF30, magnets compound-filled Weight: Approx. 26 g Surface pressure: 20 N/mm ² Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+75 °C (-40...+167 °F)	O-ring for pressure fit flange Ø 18 mm Part no. 560 853 Material: Fluoroelastomer 75 ± 5 durometer	O-ring for pressure fit flange Ø 21 mm Part no. 561 438 Material: FKM 80 durometer	Back-up ring for pressure fit flange Ø 18 mm Part no. 561 115 Material: PTFE + 60 % bronze

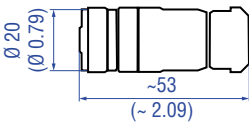
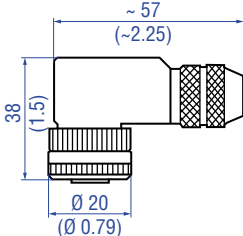
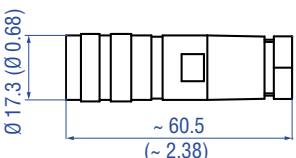
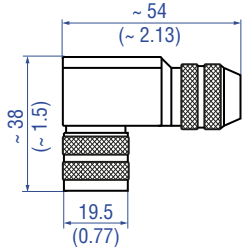
Back-up ring

Optional installation hardware

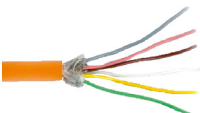
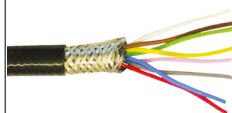

Magnet spacer

		
Back-up ring for pressure fit flange Ø 21 mm Part no. 561 439 Material: PTFE	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 or block magnet Material: Brass, non-magnetic	Magnet spacer Part no. 400 633 Material: Aluminum Weight: Approx. 5 g Surface pressure: Max. 20 N/mm ² Fastening torque for M4 screws: 1 Nm




Cable connectors⁹

			
M12 A-coded female connector (5 pin), straight Part no. 370 677	M12 A-coded female connector (5 pin), angled Part no. 370 678	M16 female connector (6 pin), straight Part no. 370 423	M16 female connector (6 pin), angled Part no. 370 460
Material: GD-Zn, Ni Termination: Screw Contact insert: CuZn Cable Ø: 4...8 mm (0.16...0.31 in.) Wire: 1.5 mm ² Operating temperature: -30...+85 °C (-22...+185 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.6 Nm	Material: GD-Zn, Ni Termination: Screw; max. 0.75 mm ² Contact insert: CuZn Cable Ø: 5...8 mm (0.2...0.31 in.) Wire: 0.75 mm ² (18 AWG) Operating temperature: -25...+85 °C (-13...+185 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.4 Nm	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	Material: Zinc nickel plated Termination: Solder Cable Ø: 6...8 mm (0.24...0.31 in.) Wire: 0.75 mm ² (20 AWG) Operating temperature: -40...+95 °C (-40...+203 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.6 Nm

Cables

		
PUR cable Part no. 530 052	Teflon® cable Part no. 530 112	Silicone cable Part no. 530 113
Name of cable in order code: H Material: PUR jacket; orange Features: Twisted pair shielded Cable Ø: 6.4 mm (0.25 in.) Cross section: 3 × 2 × 0.25 mm ² Bending radius: 5 × Ø (fixed insulation) Operating temperature: -30...+80 °C (-22...+176 °F)	Name of cable in order code: T Material: Teflon® jacket; black Features: Twisted pair shielded Cable Ø: 7.6 mm (0.3 in.) Cross section: 4 × 2 × 0.25 mm ² Bending radius: 8 – 10 × Ø (fixed installation) Operating temperature: -100...+180 °C (-148...+356 °F)	Name of cable in order code: V Material: Silicone jacket; red Features: Twisted pair, shielded Cable Ø: 7.2 mm (0.28 in.) Cross section: 3 × 2 × 0.25 mm ² Bending radius: 5 × Ø (fixed installation) Operating temperature: -50...+180 °C (-58...+356 °F)

Programming tools

		
Hand programmer for analog output Part no. 253 124	Cabinet programmer for analog output Part no. 253 408	Programming kit Part no. 254 555
Easy teach-in-setups of stroke length and direction on desired zero / span positions. For sensors with 1 magnet.	Features snap-in mounting on standard DIN rail (35 mm). This programmer can be permanently mounted in a control cabinet and includes a program / run switch. For sensors with 1 magnet.	Kit includes: Interface converter box, power supply and cable Software is available at: www.mtssensors.com

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

^{9/} Follow the manufacturer's mounting instructions

ORDER CODE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
G	B										1				
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
N	Housing material stainless steel 1.4404 (AISI 316L), rod material stainless steel 1.4404 (AISI 316L) ¹⁰ 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 3 4	M12 male connector (5 pin)
D 6 0	M16 male connector (6 pin)
H X X	PUR cable (part no. 530 052) H01...H10 (1...10 m) ¹¹ H03...H33 (3...33 ft) ¹¹ 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) ¹¹ T03...T33 (3...33 ft) ¹¹
V X X	Silicone cable (part no. 530 113) V01...V10 (1...10 m) ¹¹ V03...V33 (3...33 ft) ¹¹

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

f	Output
V 0	0...10 VDC and 10...0 VDC
A 0	4...20 mA
A 1	20...4 mA
A 2	0...20 mA
A 3	20...0 mA
A 4	4...20 mA and 20...4 mA

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

h	Programming
C	Via cable
W	Via Bluetooth® wireless technology

DELIVERY



- Sensor
- O-ring
- Back-up ring

Accessories have to be ordered separately.

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

¹⁰/The sensor in stainless steel 1.4404 (AISI 316L) is only available with following options: **S** (-40...+90 °C / -40...+194 °F) and **C** (programming via cable)

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

¹¹/Encode in meters if using metric stroke length. Encode in feet if using US customary stroke length

UNITED STATES 3001 Sheldon Drive
MTS Systems Corporation Cary, N.C. 27513
Sensors Division Phone: +1 919 677-0100
E-mail: info.us@mtssensors.com

GERMANY Auf dem Schüffel 9
MTS Sensor Technologie 58513 Lüdenscheid
GmbH & Co. KG Phone: +49 2351 9587-0
E-mail: info.de@mtssensors.com

ITALY Phone: +39 030 988 3819
Branch Office E-mail: info.it@mtssensors.com

FRANCE Phone: +33 1 58 4390-28
Branch Office E-mail: info.fr@mtssensors.com

GREAT BRITAIN Phone: +44 79 44 15 03 00
Branch Office E-mail: info.uk@mtssensors.com

CHINA Phone: +86 21 6485 5800
Branch Office E-mail: info.cn@mtssensors.com

JAPAN Phone: +81 42 707 7710
Branch Office E-mail: info.jp@mtssensors.com

Document Part No.
551460 Revision C (EN) 02/2018



www.mtssensors.com

MTS, Temposonics and Level Plus are registered trademarks of MTS Systems Corporation in the United States; MTS SENSORS and the MTS SENSORS logo are trademarks of MTS Systems Corporation within the United States. These trademarks may be protected in other countries. All other trademarks are the property of their respective owners. Copyright © 2018 MTS Systems Corporation. No license of any intellectual property rights is granted. MTS reserves the right to change the information within this document, change product designs, or withdraw products from availability for purchase without notice. Typographic and graphics errors or omissions are unintentional and subject to correction. Visit www.mtssensors.com for the latest product information.