Temposonics®
Magnetostrictive Linear Position Sensors

TH SSI
Data Sheet

– ATEX / IECEx / CEC / NEC / EAC Ex / CCC certified / Japanese approval
– Continuous operation under harsh industrial conditions
– Flameproof / Explosionproof / Increased safety
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.

TH 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 contactlessly over the sensor rod with the built-in waveguide.

The TH sensor is extremely robust and ideal for continuous operation under harsh industrial conditions. T-Series sensors are certified for hazardous areas in Zone 0/1, Zone 1, Zone 2, Zone 21 and Zone 22 for Europe (ATEX), the global (IECEx), the Russian (EAC Ex), the Chinese (CCC) and the Japanese market, as well as for use in Class I, II, III, Division 1, Division 2 for Canada (CEC) and USA (NEC). The sensor electronics housing contains the active signal conditioning and a complete integrated electronics interface. The sensor rod is capable of withstanding high pressures such as those found in hydraulic cylinders. Furthermore the sensor is also suitable for petro chemical plants and caustic environments. In addition the sensor meets the IP protection IP66/IP67/IP68 (100 m for 7 days)/IP69 and NEMA 4 (for sensor assembly in stainless steel 1.4305 (AISI 303)) or NEMA 4x (for sensor assembly in stainless steel 1.404 (AISI 316L)).
## TECHNICAL DATA

### Output

<table>
<thead>
<tr>
<th>Interface</th>
<th>SSI (Synchronous Serial Interface) – differential signal in SSI standard (RS 422)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data format</td>
<td>Binary or gray, optional parity and error bit or temperature of sensor electronics</td>
</tr>
<tr>
<td>Data length</td>
<td>8…32 bit</td>
</tr>
</tbody>
</table>
| Data transmission rate | 70 kBaud ¹…1 MBaud, depending on cable length:  
  Cable length:  
  - `< 3 m`  
  - `< 50 m`  
  - `< 100 m`  
  - `< 200 m`  
  - `< 400 m`  
  Baud rate:  
  - `1 Mbd`  
  - `< 400 kbd`  
  - `< 300 kbd`  
  - `< 200 kbd`  
  - `< 100 kbd` |
| Measured value    | Position, differentiation measurement, velocity, temperature of sensor electronics |

### Measurement parameters

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Position: 0.5 μm, 1 μm, 2 μm, 5 μm, 10 μm, 20 μm, 50 μm, 100 μm / Velocity over 10 measured values: 0.1 mm/s (at 1 ms cycle time)</th>
</tr>
</thead>
</table>
| Cycle time         | Stroke length:  
  - `300 mm`  
  - `750 mm`  
  - `1000 mm`  
  - `2000 mm`  
  - `5000 mm`  
  Measurement rate:  
  - `3.7 kHz`  
  - `3.0 kHz`  
  - `2.3 kHz`  
  - `1.2 kHz`  
  - `0.5 kHz` |
| Linearity²         | `< ±0.01 % F.S. (minimum ±40 μm)` |
| Repeatability      | `< ±0.001 % F.S. (minimum ±2.5 μm) typical` |
| Hysteresis         | `< 4 μm typical` |
| Temperature coefficient | `< 15 ppm/K typical` |

### Operating conditions

<table>
<thead>
<tr>
<th>Operating temperature</th>
<th>–40…+75 °C (–40…+167 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity</td>
<td>90 % relative humidity, no condensation</td>
</tr>
<tr>
<td>Ingress protection</td>
<td>IP66/IP67/IP68 (100 m for 7 days)/IP69 and NEMA 4 (for sensor assembly in stainless steel 1.4305 (AISI 303)) or NEMA 4X (for sensor assembly in stainless steel 1.404 (AISI 316L)) (if appropriate pipes, glands, etc. are connected properly)</td>
</tr>
<tr>
<td>Shock test</td>
<td>100 g/6 ms according to IEC 60068-2-27</td>
</tr>
<tr>
<td>Repeated shock events</td>
<td>160 g/2 ms according to IEC 60068-2-27 (for shock improved option [A], see order code for Operating Voltage on page 13)</td>
</tr>
<tr>
<td>Vibration test</td>
<td>15 g/10…2000 Hz according to IEC 60068-2-6 (excluding resonant frequencies)</td>
</tr>
</tbody>
</table>
| 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 static (5076 psi static) |
| Magnet movement velocity³ | Any |

### Design/Material

| Sensor electronics housing | Stainless steel 1.4305 (AISI 303); option: Stainless steel 1.4404 (AISI 316L) |
| Flange                    | See “Table 1: TH rod sensor threaded flange type references” on page 7 |
| Sensor rod                | Stainless steel 1.4306 (AISI 304L); option: Stainless steel 1.4404 (AISI 316L) |
| Stroke length             | 25…7620 mm (1…300 in.) (for shock improved option [A], see order code on page 13: 25…3760 mm (1…148 in.)) |

### Mechanical mounting

| Mounting position        | Any |
| Mounting instruction     | Please consult the technical drawings and the operation manual (document number: 551902) |

See next page for “Electrical connection”

1/ With standard one shot of 16 μs
2/ With position magnet # 201 542-2
3/ If there is contact between the moving magnet including the magnet holder and the sensor rod, make sure that the maximum speed of the moving magnet is ≤ 1 m/s  
(Safety requirement due to ESD [Electro Static Discharge])
### Electrical connection

<table>
<thead>
<tr>
<th>Connection type</th>
<th>T-Series terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage</td>
<td>+24 VDC (-15/+20 %)</td>
</tr>
<tr>
<td>Ripple</td>
<td>≤ 0.28 Vpp</td>
</tr>
<tr>
<td>Current consumption</td>
<td>100 mA typical</td>
</tr>
<tr>
<td>Dielectric strength</td>
<td>700 VDC (DC ground to machine ground)</td>
</tr>
<tr>
<td>Polarity protection</td>
<td>Up to −30 VDC</td>
</tr>
<tr>
<td>Overvoltage protection</td>
<td>Up to 36 VDC</td>
</tr>
</tbody>
</table>
## CERTIFICATIONS

<table>
<thead>
<tr>
<th>Certification required</th>
<th>Version E</th>
<th>Version D</th>
<th>Version G</th>
<th>Version N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IECEEx / ATEX</strong></td>
<td>Ex db eb IIC T4 Ga/Gb</td>
<td>Ex db eb IIC T3130°C Ga/Db</td>
<td>Ex db IIC T4 Ga/Gb</td>
<td>No hazardous area approval</td>
</tr>
<tr>
<td>(IECEEx: Global market; ATEX: Europe)</td>
<td>Zone 0/1, Zone 20</td>
<td>Zone 0/1, Zone 20</td>
<td>Zone 0/1, Zone 20</td>
<td>Zone 0/1, Zone 20</td>
</tr>
<tr>
<td></td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
</tr>
<tr>
<td><strong>NEC</strong> (USA)</td>
<td>—</td>
<td>—</td>
<td>Explosionproof</td>
<td>No hazardous area approval</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Class I Div. 1</td>
<td>Class I Div. 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Class II/III Div. 1</td>
<td>Class II/III Div. 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Groups E, F, G T130°C</td>
<td>Groups E, F, G T130°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
</tr>
<tr>
<td><strong>CEC</strong> (Canada)</td>
<td>—</td>
<td>—</td>
<td>Explosionproof</td>
<td>No hazardous area approval</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Class I Div. 1</td>
<td>Class I Div. 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Groups B, C, D T4</td>
<td>Groups B, C, D T4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Class II/III Div. 1</td>
<td>Class II/III Div. 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Groups E, F, G T130°C</td>
<td>Groups E, F, G T130°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
</tr>
<tr>
<td><strong>EAC Ex</strong> (Russian market)</td>
<td>GaGb Ex db eb IIC T4 X Da/Db Ex tb IIIC T130°C X Zone 0/1, Zone 20</td>
<td>GaGb Ex db IIC T4 X Da/Db Ex tb IIIC T130°C X Zone 0/1, Zone 20</td>
<td>GaGb Ex db IIC T4 X Da/Db Ex tb IIIC T130°C X Zone 0/1, Zone 20</td>
<td>No hazardous area approval</td>
</tr>
<tr>
<td></td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
</tr>
<tr>
<td><strong>Japanese approval</strong></td>
<td>Ex d e IIC T4 GaGb Ex t IIIC T130°C Db Zone 0/1, Zone 20</td>
<td>Ex d IIC T4 GaGb Ex t IIIC T130°C Db Zone 0/1, Zone 20</td>
<td>Ex d IIC T4 GaGb Ex t IIIC T130°C Db Zone 0/1, Zone 20</td>
<td>No hazardous area approval</td>
</tr>
<tr>
<td></td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
</tr>
<tr>
<td><strong>CCC</strong> (China)</td>
<td>Ex d e IIC T4 Gb Ex tD A21 IP66/67 T130°C Zone 1, Zone 21</td>
<td>Ex d IIC T4 Gb Ex tD A21 IP66/67 T130°C Zone 1, Zone 21</td>
<td>Ex d IIC T4 Gb Ex tD A21 IP66/67 T130°C Zone 1, Zone 21</td>
<td>No hazardous area approval</td>
</tr>
<tr>
<td></td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
<td>−40 °C ≤ Ta ≤ 75 °C</td>
</tr>
</tbody>
</table>

**Fig. 3: Certifications**
Threaded flange with raised-face

**Version D & G**

<table>
<thead>
<tr>
<th>Sensor electronics housing</th>
<th>Null zone</th>
<th>Stroke length</th>
<th>Dead zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>132.5 (5.22)</td>
<td>2.5 (0.1)</td>
<td>25…7620 (1…300)</td>
<td>63.5 (2.5) / 66* (2.6)*</td>
</tr>
</tbody>
</table>

- M18x1.5-6g: Φ 23.8 ± 0.2 (Ø 0.94 ± 0.01)  
- 1/4"-16 UNF-3A: Φ 25.4 ± 0.2 (Ø 1 ± 0.01)

Refer to “Table 1” for “TH rod sensor threaded flange type references” on page 7

See order code section “d” for connection types

* Stroke length > 5000 mm (196.9 in.)

**Version E & N**

<table>
<thead>
<tr>
<th>Sensor electronics housing</th>
<th>Null zone</th>
<th>Stroke length</th>
<th>Dead zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>112.5 (4.43)</td>
<td>2.5 (0.1)</td>
<td>25…7620 (1…300)</td>
<td>63.5 (2.5) / 66* (2.6)*</td>
</tr>
</tbody>
</table>

- M18x1.5-6g: Φ 23.8 ± 0.2 (Ø 0.94 ± 0.01)  
- 1/4"-16 UNF-3A: Φ 25.4 ± 0.2 (Ø 1 ± 0.01)

Refer to “Table 1” for “TH rod sensor threaded flange type references” on page 7

See order code section “d” for connection types

* Stroke length > 5000 mm (196.9 in.)

Threaded flange with flat-face

**Version D & G**

<table>
<thead>
<tr>
<th>Sensor electronics housing</th>
<th>Null zone</th>
<th>Stroke length</th>
<th>Dead zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>132.5 (5.22)</td>
<td>2.5 (0.1)</td>
<td>25…7620 (1…300)</td>
<td>63.5 (2.5) / 66* (2.6)*</td>
</tr>
</tbody>
</table>

Refer to “Table 1” for “TH rod sensor threaded flange type references” on page 7

See order code section “d” for connection types

* Stroke length > 5000 mm (196.9 in.)

**Version E & N**

<table>
<thead>
<tr>
<th>Sensor electronics housing</th>
<th>Null zone</th>
<th>Stroke length</th>
<th>Dead zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>112.5 (4.43)</td>
<td>2.5 (0.1)</td>
<td>25…7620 (1…300)</td>
<td>63.5 (2.5) / 66* (2.6)*</td>
</tr>
</tbody>
</table>

Refer to “Table 1” for “TH rod sensor threaded flange type references” on page 7

See order code section “d” for connection types

* Stroke length > 5000 mm (196.9 in.)

Controlling design dimensions are in millimeters and measurements in ( ) are in inches.
### CONNECTION OPTIONS

#### Side connection C01 / N01 (with adapter) / M01 (without adapter)

![Side connection diagram]

**C01 / N01:** Connector on 6 different positions at 60° each

#### Top connection C10 / N10 (with adapter) / M10 (without adapter)

![Top connection diagram]

**Top connection C10 / N10:**

- Connector on 6 different positions at 60° each

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**Fig. 5: Temposonics® TH connection options**

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#### Threaded flange type references

<table>
<thead>
<tr>
<th>Threaded flange type</th>
<th>Description</th>
<th>Threaded flange</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>Threaded flange with flat-face stainless steel 1.4404 (AISI 316L)</td>
<td>( \frac{3}{8} )-16 UNF-3A</td>
</tr>
<tr>
<td>G</td>
<td>Threaded flange with raised-face stainless steel 1.4404 (AISI 316L)</td>
<td>( \frac{3}{8} )-16 UNF-3A</td>
</tr>
<tr>
<td>M</td>
<td>Threaded flange with flat-face stainless steel 1.4305 (AISI 303)</td>
<td>M18×1.5-6g</td>
</tr>
<tr>
<td>N</td>
<td>Threaded flange with raised-face stainless steel 1.4305 (AISI 303)</td>
<td>M18×1.5-6g</td>
</tr>
<tr>
<td>S</td>
<td>Threaded flange with flat-face stainless steel 1.4305 (AISI 303)</td>
<td>( \frac{3}{8} )-16 UNF-3A</td>
</tr>
<tr>
<td>T</td>
<td>Threaded flange with raised-face stainless steel 1.4305 (AISI 303)</td>
<td>( \frac{3}{8} )-16 UNF-3A</td>
</tr>
<tr>
<td>W</td>
<td>Threaded flange with flat-face stainless steel 1.4404 (AISI 316L)</td>
<td>M18×1.5-6g</td>
</tr>
</tbody>
</table>

**Table 1: TH rod sensor threaded flange type references**

---
**ZONE CLASSIFICATION**

**Version D & G (example: Threaded flange with raised-face)**
Flameproof (explosionproof) housing with flameproof (explosionproof) connection chamber
Version D: ATEX / IECEx / EAC Ex / CCC / Japanese Approval
Version G: ATEX / IECEx / CEC / NEC / EAC Ex / CCC / Japanese Approval

**Version E (example: Threaded flange with raised-face)**
Flameproof housing with increased safety connection chamber
ATEX / IECEx / EAC Ex / CCC / Japanese Approval

![Diagram of Zone Classification](image-url)

**NOTICE**
Seal sensor according to ingress protection IP67 between Zone 0 and Zone 1.
## CONNECTOR WIRING

**Version D & G**

suitable for connection types: C01, C10, N01, N10

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>Data (−)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Data (+)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Clock (+)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Clock (−)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>+24 VDC (−15/+20 %)</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>DC Ground (0 V)</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Cable shield</td>
</tr>
</tbody>
</table>

![Fig. 7: TH (version D & G) wiring diagram (2.5 mm² conductor)](image)

**Version E & N**

suitable for connection types: C01, C10, M01, M10, N01, N10

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>Data (−)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Data (+)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Clock (+)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Clock (−)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>+24 VDC (−15/+20 %)</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>DC Ground (0 V)</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Cable shield</td>
</tr>
</tbody>
</table>

![Fig. 8: TH (version E & N) wiring diagram (1.5 mm² conductor)](image)
BE SURE THAT THE FLOAT SPECIFIC GRAVITY IS AT LEAST 0.05 LESS THAN THAT OF THE MEASURED LIQUID AS A SAFETY MARGIN AT AMBIENT TEMPERATURE

FOR INTERFACE MEASUREMENT: A MINIMUM OF 0.05 SPECIFIC GRAVITY DIFFERENTIAL IS REQUIRED BETWEEN THE UPPER AND LOWER LIQUIDS

WHEN THE MAGNET IS NOT SHOWN, THE MAGNET IS POSITIONED AT THE CENTER LINE OF FLOAT

AN OFFSET WEIGHT IS INSTALLED IN THE FLOAT TO BIAS OR TILT THE FLOAT INSTALLED ON THE SENSOR TUBE. SO THE FLOAT REMAINS IN CONTACT WITH THE SENSOR TUBE AT ALL TIMES AND GUARANTEES PERMANENT POTENTIAL EQUALIZATION OF THE FLOAT. THE OFFSET IS REQUIRED FOR INSTALLATIONS THAT MUST CONFORM TO HAZARDOUS LOCATION STANDARDS

CONTROLLING DESIGN DIMENSIONS ARE IN Millimeters AND MEASUREMENTS IN ( ) ARE IN INCHES

FREQUENTLY ORDERED ACCESSORIES – ADDITIONAL OPTIONS AVAILABLE IN OUR ACCESSORIES GUIDE

POSITION MAGNETS

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
Fastening torque for M4 screws: 1 Nm
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/mm²
Fastening torque for M4 screws: 1 Nm
Operating temperature: –40...+105 °C (–40...+221 °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...+175 °C (–40...+347 °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

FLOATS

FLOAT
Part no. 251 387-2
Material: Stainless steel (AISI 316L)
Weight offset: Yes
Pressure: 22.4 bar (325 psi)
Magnet offset: No
Specific gravity: Max. 0.48
Operating temperature: –40...+125 °C (–40...+257 °F)

FLOAT
Part no. 200 938-2
Material: Stainless steel (AISI 316L)
Weight offset: Yes
Pressure: 8.6 bar (125 psi)
Magnet offset: No
Specific gravity: Max. 0.74
Operating temperature: –40...+125 °C (–40...+257 °F)

FLOAT
Part no. 251 469-2
Material: Stainless steel (AISI 316L)
Weight offset: Yes
Pressure: 29.3 bar (425 psi)
Magnet offset: No
Specific gravity: Max. 0.45
Operating temperature: –40...+125 °C (–40...+257 °F)
**Floats**

<table>
<thead>
<tr>
<th>Float</th>
<th>Part no.</th>
<th>Description</th>
<th>Material</th>
<th>Weight offset</th>
<th>Pressure</th>
<th>Magnet offset</th>
<th>Specific gravity</th>
<th>Operating temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>201 605-2</td>
<td>Ø 18 (Ø 0.71)</td>
<td>Stainless steel 1.4571 (AISI 316 Ti)</td>
<td>Yes</td>
<td>4 bar (60 psi)</td>
<td>Yes</td>
<td>0.6</td>
<td>−40…+125 °C (−40…+257 °F)</td>
</tr>
<tr>
<td>Float</td>
<td>201 606-2</td>
<td>Ø 18 (Ø 0.71)</td>
<td>Stainless steel 1.4571 (AISI 316 Ti)</td>
<td>Yes</td>
<td>4 bar (60 psi)</td>
<td>Yes</td>
<td>0.6</td>
<td>−40…+125 °C (−40…+257 °F)</td>
</tr>
<tr>
<td>Float</td>
<td>251 982-2</td>
<td>Ø 18 (Ø 0.71)</td>
<td>Stainless steel (AISI 316L)</td>
<td>Yes</td>
<td>29.3 bar (425 psi)</td>
<td>No</td>
<td>0.93 ± 0.01</td>
<td>−40…+125 °C (−40…+257 °F)</td>
</tr>
<tr>
<td>Float</td>
<td>251 983-2</td>
<td>Ø 18 (Ø 0.71)</td>
<td>Stainless steel (AISI 316L)</td>
<td>Yes</td>
<td>29.3 bar (425 psi)</td>
<td>No</td>
<td>1.06 ± 0.01</td>
<td>−40…+125 °C (−40…+257 °F)</td>
</tr>
</tbody>
</table>

**Collar**

<table>
<thead>
<tr>
<th>Collar</th>
<th>Optional installation hardware</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop collar for Ø 10 mm</td>
<td>Provides end of stroke stops for float</td>
</tr>
<tr>
<td>Fixing clip</td>
<td></td>
</tr>
</tbody>
</table>

**Stop collar for Ø 10 mm**

<table>
<thead>
<tr>
<th>Material</th>
<th>Stainless steel (AISI 316L)</th>
<th>Specific gravity</th>
<th>Weight</th>
<th>Operating temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stainless steel 1.4301 (AISI 304)</td>
<td>0.67</td>
<td>Approx. 30 g</td>
<td>−40…+125 °C (−40…+257 °F)</td>
</tr>
</tbody>
</table>

**Fixing clip**

<table>
<thead>
<tr>
<th>Application</th>
<th>Used to secure sensor rods (Ø 10 mm (Ø 0.39 in.)) when using an U-magnet or block magnet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>Brass, non-magnetic</td>
</tr>
</tbody>
</table>

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

5/ Be sure that the float specific gravity is at least 0.05 less than that of the measured liquid as a safety margin at ambient temperature

• For interface measurement: A minimum of 0.05 specific gravity differential is required between the upper and lower liquids

• When the magnet is not shown, the magnet is positioned at the center line of float

6/ Standard float that can be expedited

• An offset weight is installed in the float to bias or tilt the float installed on the sensor tube. So the float remains in contact with the sensor tube at all times and guarantees permanent potential equalization of the float. The offset is required for installations that must conform to hazardous location standards
<table>
<thead>
<tr>
<th>O-rings</th>
<th>Programming tool</th>
</tr>
</thead>
</table>

**O-ring for threaded flange**
- **M18×1.5-6g**
  - Part no. 401133
  - Material: Fluoroelastomer
  - Durometer: 75 ± 5 Shore A
  - Operating temperature: −40…+204 °C (−40…+400 °F)

**O-ring for threaded flange**
- **⅞”-16 UNF-3A**
  - Part no. 560315
  - Material: Fluoroelastomer
  - Durometer: 75 ± 5 Shore A
  - Operating temperature: −40…+204 °C (−40…+400 °F)

**Programming kit**
- Part no. 253135-1 (EU)
- Part no. 253310-1 (US)
  - Kit includes:
    - 1 × interface converter box,
    - 1 × power supply
    - 1 × cable (60 cm) with M16 female connector (7 pin), straight – D-sub female connector (9 pin), straight

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

7/ The programming tool is not approved for use in hazardous environments
<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
<th>h</th>
<th>i</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor model</td>
<td>Design</td>
<td>Stroke length</td>
<td>Connection type</td>
<td>Operating voltage</td>
<td>Version</td>
<td>Functional safety type</td>
<td>Additional option type</td>
<td>See next page</td>
</tr>
<tr>
<td><strong>T</strong></td>
<td><strong>H</strong></td>
<td><strong>X</strong></td>
<td><strong>C</strong></td>
<td><strong>0</strong></td>
<td><strong>1</strong></td>
<td><strong>0</strong></td>
<td><strong>0</strong></td>
<td><strong>N</strong></td>
</tr>
<tr>
<td>Rod</td>
<td>Enclosure Type 4:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TH rod sensor with housing material stainless steel 1.4305 (AISI 303) and rod material stainless steel 1.4306 (AISI 304L)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enclosure Type 4X:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TH rod sensor with housing material stainless steel 1.4404 (AISI 316L) and rod material stainless steel 1.4404 (AISI 316L)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>W</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke length</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard stroke length (mm)*</td>
<td>Ordering steps</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 … 500 mm</td>
<td>5 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500 … 750 mm</td>
<td>10 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>750 … 1000 mm</td>
<td>25 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000 … 2500 mm</td>
<td>50 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2500 … 5000 mm</td>
<td>100 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5000 … 7620 mm</td>
<td>250 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard stroke length (in.)*</td>
<td>Ordering steps</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.1 … 20 in.</td>
<td>0.2 in.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 … 30 in.</td>
<td>0.4 in.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 … 40 in.</td>
<td>1.0 in.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 … 100 in.</td>
<td>2.0 in.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 … 200 in.</td>
<td>4.0 in.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200 … 300 in.</td>
<td>10.0 in.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S (17) (18) (19) (20) (21) (22) (23) (24) (25)</td>
</tr>
<tr>
<td></td>
<td>= Synchronous Serial Interface</td>
</tr>
<tr>
<td></td>
<td>Data length (box no. 17)</td>
</tr>
<tr>
<td>1</td>
<td>25 bit</td>
</tr>
<tr>
<td>2</td>
<td>24 bit</td>
</tr>
<tr>
<td>3</td>
<td>26 bit</td>
</tr>
<tr>
<td></td>
<td>Output format (box no. 18)</td>
</tr>
<tr>
<td>B</td>
<td>Binary</td>
</tr>
<tr>
<td>G</td>
<td>Gray</td>
</tr>
<tr>
<td></td>
<td>Resolution (box no. 19)</td>
</tr>
<tr>
<td>1</td>
<td>0.005 mm</td>
</tr>
<tr>
<td>2</td>
<td>0.01 mm</td>
</tr>
<tr>
<td>3</td>
<td>0.05 mm</td>
</tr>
<tr>
<td>4</td>
<td>0.1 mm</td>
</tr>
<tr>
<td>5</td>
<td>0.02 mm</td>
</tr>
<tr>
<td>6</td>
<td>0.002 mm</td>
</tr>
<tr>
<td>8</td>
<td>0.001 mm</td>
</tr>
<tr>
<td>9</td>
<td>0.0005 mm</td>
</tr>
<tr>
<td></td>
<td>Filtering performance (box no. 20)</td>
</tr>
<tr>
<td>A</td>
<td>No filter + error delay (4 cycles)</td>
</tr>
<tr>
<td>C</td>
<td>No filter + error delay (8 cycles)</td>
</tr>
<tr>
<td>1</td>
<td>Standard (no filters)</td>
</tr>
<tr>
<td>8</td>
<td>Noise reduction filter (8 measurements)</td>
</tr>
<tr>
<td>D</td>
<td>No filter + error delay (10 cycles)</td>
</tr>
<tr>
<td>G</td>
<td>Noise reduction filter (8 measurements) + error delay (10 cycles)</td>
</tr>
<tr>
<td>K</td>
<td>Peak reduction filter (8 measurements)</td>
</tr>
<tr>
<td>N</td>
<td>Peak reduction filter (8 measurements) + error delay (10 cycles)</td>
</tr>
<tr>
<td></td>
<td>Signal options (box no. 21, 22)</td>
</tr>
<tr>
<td>0 0</td>
<td>Measuring direction forward, asynchronous mode</td>
</tr>
<tr>
<td>0 1</td>
<td>Measuring direction reverse, asynchronous mode</td>
</tr>
<tr>
<td>0 2</td>
<td>Measuring direction forward, synchronous mode 1</td>
</tr>
<tr>
<td>0 5</td>
<td>Measuring direction forward, asynchronous mode, bit 25 = alarm, bit 26 = parity even</td>
</tr>
<tr>
<td>9 9</td>
<td>Write “9” in box no. 21 and 22 for using further combinations in boxes 23, 24, 25</td>
</tr>
</tbody>
</table>

### Output (continued)

|   | Measurement contents (optional: Box no. 23) |
|   | Note: Choose “9” in box no. 21 and 22 |
| 1 | Position measurement |
| 2 | Differentiation measurement 
| 3 | Velocity measurement |
| 4 | Position measurement + temperature measurement (only with data length = 24 bit) |
| 5 | Differentiation measurement + temperature measurement (only with data length = 24 bit) |
| 6 | Velocity measurement + temperature measurement (only with data length = 24 bit) |
|   | Direction and sync. mode (optional: Box no. 24) |
|   | Note: Choose “9” in box no. 21 and 22 |
| 1 | Measuring direction forward, asynchronous mode |
| 2 | Measuring direction forward, synchronous mode 1 |
| 3 | Measuring direction forward, synchronous mode 2 |
| 4 | Measuring direction forward, synchronous mode 3 |
| 5 | Measuring direction reverse, asynchronous mode |
| 6 | Measuring direction reverse, synchronous mode 1 |
| 7 | Measuring direction reverse, synchronous mode 2 |
| 8 | Measuring direction reverse, synchronous mode 3 |
|   | Diagnostics (optional: Box no. 25) |
|   | Note: Choose “9” in box no. 21 and 22 |
| 0 | No further options |
| 2 | Additional alarm bit + parity even bit (not available for temperature output, only with data length = 24 bit) |

### NOTICE

Use magnets of the same type (e.g. 2 ring magnets with part no. 201 542-2) for differentiation measurement.

### DELIVERY

- **Sensor**
- **Accessories** have to be ordered separately

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8/ You need a second magnet for differentiation measurement