

Data Sheet

Level Plus[®] Model LLE

Magnetostrictive Liquid Level Transmitters with Temposonics[®] Technology

- Compact Level Measurement
- Inherent Accuracy ± 0.5 mm
- No Scheduled Maintenance or Recalibration
- Optional Integral Temperature Measurement



MEASURING TECHNOLOGY

The absolute, linear position sensors provided by Temposonics 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.

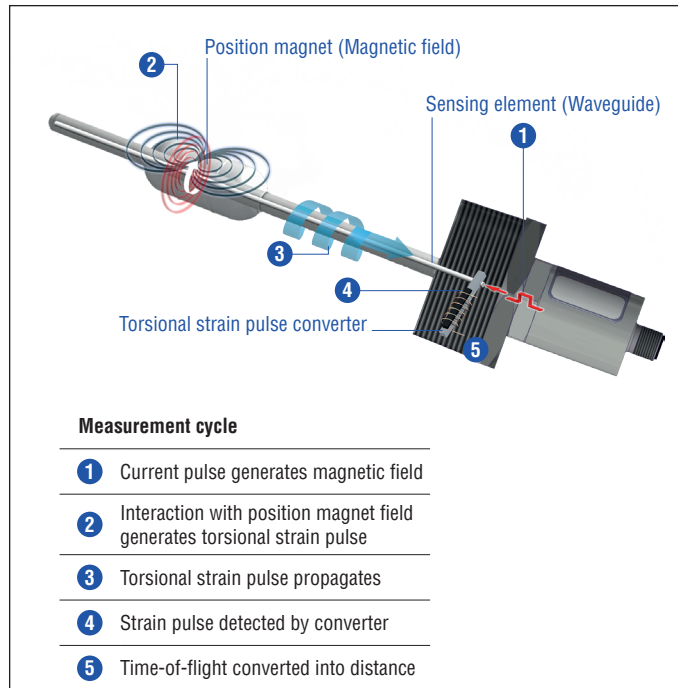


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

LLE LEVEL TRANSMITTER

The Level Plus LLE satisfies the demand for an accurate and robust liquid level transmitter for general purpose applications. The LLE can provide product level and/or interface level in a compact mechanical design. The LLE can also be ordered with an optional temperature measurement of a straight RTD output. There is no requirement for scheduled maintenance or recalibration for the expected 10 year life of the sensor. **Set it and Forget it!**

The LLE liquid level transmitter can be mounted on most tanks offering NPT and RF flanged connections from 3/4 to 6 inches. The LLE also offers a variety of outputs including Analog, CANbus, SSI and IO-Link. Included in the model number is the selection of float, cable, and stop collar options. The single model offers everything needed for level measurement in a variety of applications.

Features:

- Product and Interface Level
- No scheduled maintenance or recalibration
- Inherent Accuracy ± 0.5 mm
- IP69K
- 100 g Shock/15 g Vibration
- Optional Integral Temperature Measurement

Applications:

- Hydraulic Reservoir
- Industrial Printers
- Firefighting Airplanes
- Waste Management
- Generators
- Process Tanks
- Skids



Fig. 2: Example of product and interface level measurement

TECHNICAL DATA

Level Output	
Voltage	0...10 VDC or 10...0 VDC, 0...10 VDC and 10...0 VDC (controller input resistance $R_L > 5 \text{ k}\Omega$)
Current	4...20 mA or 20...4 mA (minimum / maximum load: 0 / 500 Ω)
SSI (Synchronous Serial Interface)	Binary or Gray, 24 or 25 bit
CANbus	CANopen: CIA standard DS 301 V3.0 / encoder profile DS 406 V3.1, CAN System ISO-11898
IO-Link	V1.1, 32 bit signed, COM3 (230.4 kBaud)
Measured value	Product Level and/or Interface Level
Measurement parameters	
Resolution	0.1 mm
Inherent accuracy	$\pm 0.5 \text{ mm}$
Repeatability	$\leq \pm 0.005 \text{ \% F.S.}$ (minimum $\pm 20 \text{ }\mu\text{m}$)
Temperature Output	
Measured Variable	Single point temperature
Accuracy	Class A RTD
Output	PT100 RTD
Operating conditions	
Operating temperature	$-40...+75 \text{ }^\circ\text{C}$ ($-40...+167 \text{ }^\circ\text{F}$)
Humidity	90 % relative humidity, no condensation
Ingress protection ¹	IP67/IP69K (correctly fitted)
Shock test	100 g (single shock) IEC standard 60068-2-27
Vibration test	15 g/10...2000 Hz IEC standard 60068-2-6 (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
Design/Material	
Sensor electronics housing/Flange	Stainless steel 1.4305 (AISI 303); option: Stainless steel 1.4404 (AISI 316L)
Sensor rod	7 mm (0.28 in.) rod \varnothing : Stainless steel 1.4301 (AISI 304) 10 mm (0.39 in.) rod \varnothing : Stainless steel 1.4404 (AISI 316L)
Stroke length	165...2646 mm (6.5...104.2 in.)
Operating pressure	7 mm (0.28 in.) rod \varnothing : 300 bar (4351 psi), 450 bar (6527 psi) peak 10 mm (0.39 in.) rod \varnothing : 350 bar (5076 psi), 530 bar (7687 psi) peak
Mounting	
Rigid Pipe	NPT ($\frac{3}{4}$ ", 1", 1.5", 2", 2.5", 3", 4"), ANSI RF Flange (2", 3", 4", 5", 6") (150#, 300#, 600#)

Electrical connection See next page

¹/ The IP rating is not part of the UL recognition

Electrical connection	
Connection type	Analog: M12 male connector (5 pin) SSI: M12 male connector (8 pin) IO-Link: M12 male connector (4 pin) CAN: M12 male connector (5 pin)
Operating voltage	+24 VDC (-15 / +20 %); UL recognition requires an approved power supply with energy limitation (UL 61010-1), or Class 2 rating according to the National Electrical Code (USA) / Canadian Electrical Code
Ripple	$\leq 0.28 V_{pp}$
Current consumption	Analog: 50...140 mA, SSI, CANbus & IO-Link: 60 mA
Dielectric strength	500 VDC (DC ground to machine ground)
Polarity protection	Up to -30 VDC
Overvoltage protection	Up to 36 VDC

TECHNICAL DRAWING

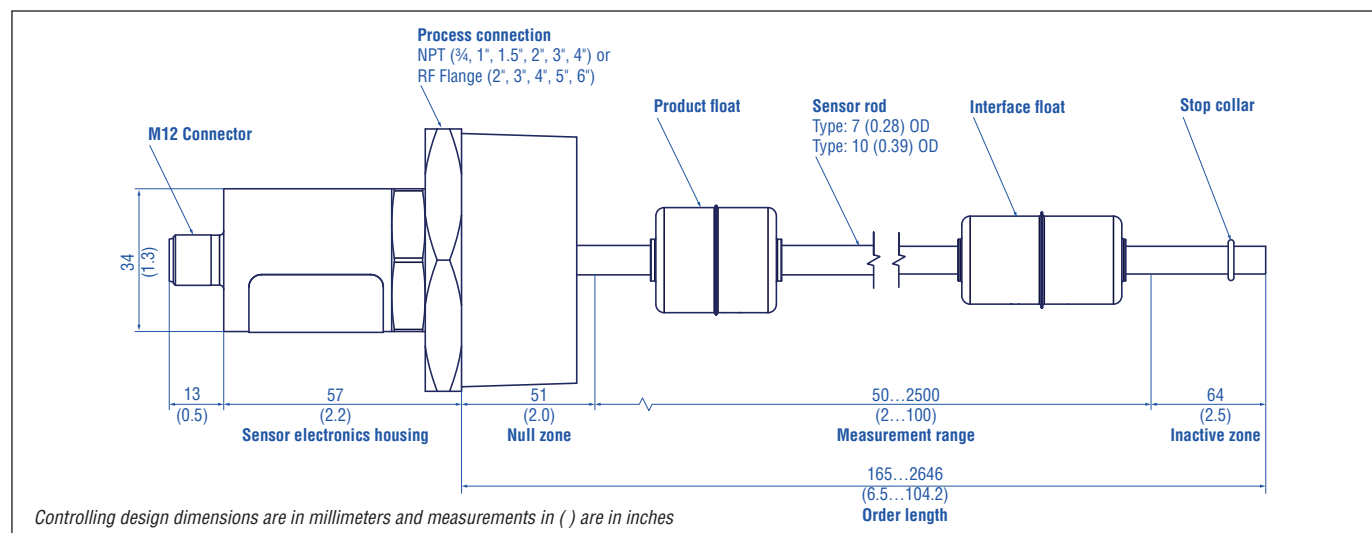


Fig. 3: Technical drawing LLE

CONNECTOR WIRING


D34 Analog		
Signal + power supply		
M12 male connector (A-coded)	Pin	Function
 <p>View on sensor</p>	1	+24 VDC (-15/+20 %)
	2	Output 1
	3	DC Ground (0 V)
	4	Output 2
	5	DC Ground

Fig. 4: D34 Analog


D34 CAN		
Signal + power supply		
M12 male connector (A-coded)	Pin	Function
 <p>View on sensor</p>	1	Shield
	2	+24 VDC (-15/+20 %)
	3	DC Ground (0 V)
	4	CAN_H
	5	CAN_L

Fig. 7: D34 CAN


D84 SSI		
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. 6: D84 SSI


T84 Analog + RTD		
Signal + power supply		
M12 male connector (A-coded)	Pin	Function
 <p>View on sensor</p>	1	Output 1
	2	DC Ground (0 V)
	3	Output 2
	4	Chassis Ground
	5	RTD
	6	RTD
	7	+24 VDC (-15/+20 %)
	8	DC Ground (0 V)

Fig. 9: T84 Analog + RTD


D44 IO-Link		
Signal + power supply		
M12 A-coded	Pin	Function
 <p>View on sensor</p>	1	+24 VDC (± 25 %)
	2	DI/DQ
	3	DC Ground (0 V)
	4	C/Q

Fig. 8: D44 IO-Link

Level Plus Model LLE

Data Sheet

ORDER CODE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
L	L	E																	
a			b	c					d			e	f	g		h		i	

a	Sensor model			
L	L	E	E-Series	

b	Sensors pipe	
G	7 mm 304 SS Pipe	
H	10 mm 316 SS Pipe	

c	Order length				
X	X	X	X	M	0156...2646 mm
X	X	X	X	U	006.2...104.2 in.

d	Output - No Temperature				Description	
V	1	1	0	10...0 Vdc (1 output channel with 1 position magnet)		
V	1	2	0	10...0 Vdc (2 output channels with 2 position magnets)		
A	1	1	0	20...4 mA (1 output channel with 1 position magnet)		
A	1	2	0	20...4 mA (2 output channels with 2 position magnets)		
L	0	0	0	IO-Link		
S	1	B	0	SSI, 25 bit, Binary, 0.1 mm resolution*		
S	1	G	0	SSI, 25 bit, Gray, 0.1 mm resolution*		
S	2	B	0	SSI, 24 bit, Binary, 0.1 mm resolution*		
S	2	G	0	SSI, 24 bit, Gray, 0.1 mm resolution*		
C	3	1	1	CANopen, 1000 kBit/s, 20 um, 1 magnet		
C	3	2	1	CANopen, 500 kBit/s, 20 um, 1 magnet		
C	3	3	1	CANopen, 250 kBit/s, 20 um, 1 magnet		
C	3	4	1	CANopen, 125 kBit/s, 20 um, 1 magnet		
C	3	1	2	CANopen, 1000 kBit/s, 20 um, 2 magnets		
C	3	2	2	CANopen, 500 kBit/s, 20 um, 2 magnets		
C	3	3	2	CANopen, 250 kBit/s, 20 um, 2 magnets		
C	3	4	2	CANopen, 125 kBit/s, 20 um, 2 magnets		

*/ Measurement direction is set to measure away from housing towards tip.

d	Output				Description	
C	4	1	1	CANopen (bus terminator), 1000 kBit/s, 20 um, 1 magnet		
C	4	2	1	CANopen (bus terminator), 500 kBit/s, 20 um, 1 magnet		
C	4	3	1	CANopen (bus terminator), 250 kBit/s, 20 um, 1 magnet		
C	4	4	1	CANopen (bus terminator), 125 kBit/s, 20 um, 1 magnet		
C	4	1	2	CANopen (bus terminator), 1000 kBit/s, 20 um, 2 magnets		
C	4	2	2	CANopen (bus terminator), 500 kBit/s, 20 um, 2 magnets		
C	4	3	2	CANopen (bus terminator), 250 kBit/s, 20 um, 2 magnets		
C	4	4	2	CANopen (bus terminator), 125 kBit/s, 20 um, 2 magnets		

d	Output - Temperature (10 mm pipe only)				Description	
V	1	1	T	10...0 VDC (2 output channels) w/RTD		
V	1	2	T	10...0 VDC (2 output channels) w/RTD		
A	1	1	T	20...4 mA (1 output channel) w/RTD		
A	1	2	T	20...4 mA (2 output channels) w/RTD		

Note: Sensor pipe H = 10 mm is required RTD at 2 in. (50 mm) if length is less than 20 in. (508 mm). RTD at 10% of length for all other lengths.

e	Process Connection Type	
1	NPT	
6	150# RF Flange	
S	SAE	
Z	Custom Flange	
f	See next page	

f	Process Connection Size
A	¾"
B	1"
C	1½"
D	2"
E	2½"
F	3"
G	4"
H	5"
S	SAE 5 bolt
3	SAE-12

i	Options
B	Stop Collar and Cable
C	5 m cable
S	Stop Collar
X	None (o-ring is used to hold float during installation)

Manuals, Software & 3D models available at:
www.temposonics.com

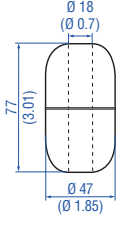
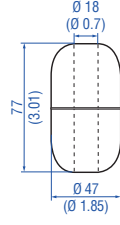
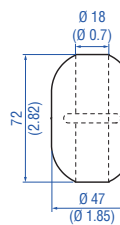
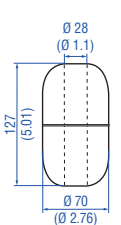
g	Float 1
7 0	404834 ** (SG 0.72, 7 mm pipe only)
7 1	404835 ** (SG 0.72, 7 mm pipe only)
7 2	201999 ** (SG 0.7, 7 mm pipe only)
7 3	201611 ** (SG 0.83, 7 mm pipe only)
1 0	561612 (SG 0.64)
1 1	254886 (SG 0.53)
1 2	201120 (SG 0.75)
L 1	251981-2 *** (SG 0.67, 10 mm pipe, stop collar required)
L 2	254526-2 *** (SG 0.68, 10 mm pipe, stop collar required)
L 3	201250-2 *** (SG 0.4, 10 mm pipe, stop collar required)
L 4	252961-2 *** (SG 0.54, 10 mm pipe, stop collar required)
L 5	201232-2 *** (SG 0.7, 10 mm pipe, stop collar required)
L 6	251982-2 *** (SG 0.93, 10 mm pipe, stop collar required)
L 7	254894-2 *** (SG 0.93, 10 mm pipe, stop collar required)
L 8	252962-2 *** (SG 0.93, 10 mm pipe, stop collar required)
L 9	201233-2 *** (SG 0.93, 10 mm pipe, stop collar required)

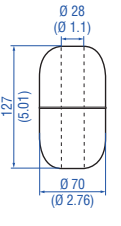
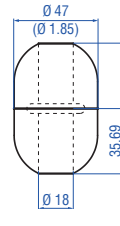
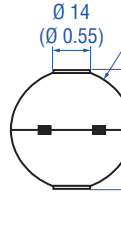
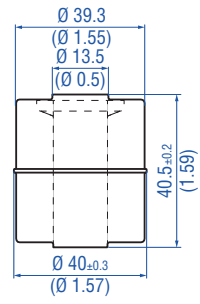
h	Float 2
X X	None
L 6	251982-2 *** (SG 0.93, 10 mm pipe, stop collar required)
L 7	254894-2 *** (SG 0.93, 10 mm pipe, stop collar required)
L 8	252962-2 *** (SG 0.93, 10 mm pipe, stop collar required)
L 9	201233-2 *** (SG 0.93, 10 mm pipe, stop collar required)

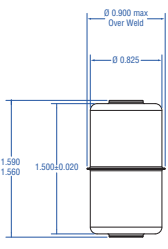
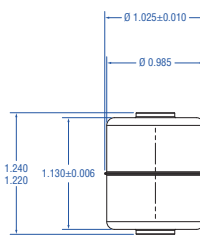
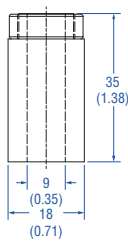
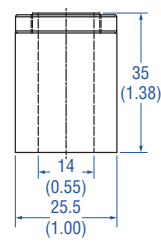
**/ requires G = 7 mm pipe

***/ requires Options B or S with Stop Collar for larger I.D. floats. Not to be used with 7 mm pipe.

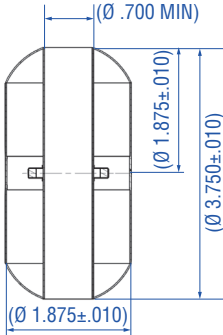
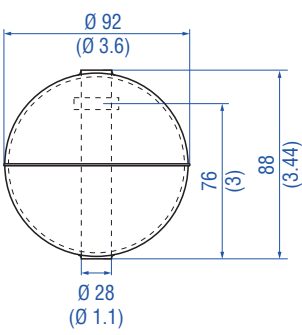
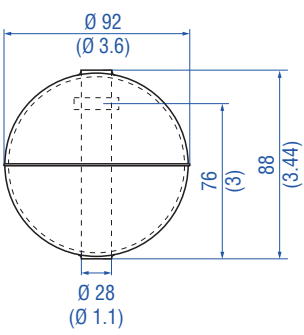
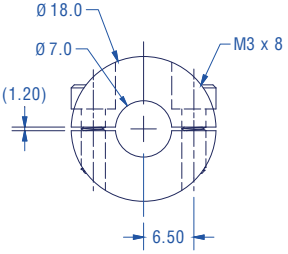
ACCESSORY DETAILS – Accessories shown can be included in the model number when selected.

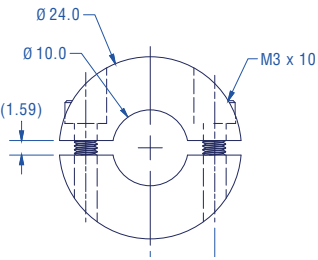


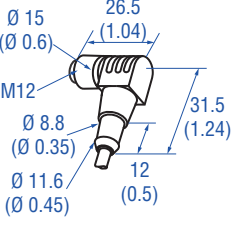
Floats			
			
Float Part no. 251 981-2 Order Code Option „L1“ Material: Stainless steel (AISI 316L) Pressure: 29.3 bar (425 psi) Specific gravity: Max. 0.67 Operating temperature: -40...+125 °C (-40...+257 °F)	Float Part no. 251 982-2 Order Code Option „L6“ Material: Stainless steel (AISI 316L) Pressure: 29.3 bar (425 psi) Specific gravity: Max. 0.93 Operating temperature: -40...+125 °C (-40...+257 °F)	Float Part no. 254 526-2 Order Code Option „L2“ Material: Stainless steel (AISI 316) Specific gravity: Max. 0.68 Pressure: Max. 69 bar (1000 psi) Operating temperature: -40...+149 °C (-40...+300 °F)	Float Part no. 201 232-2 Order Code Option „L5“ Material: Stainless steel (AISI 316) Specific gravity: Max. 0.70 Pressure: Max. 22.4 bar (250 psi) Operating temperature: -40...+149 °C (-40...+300 °F)

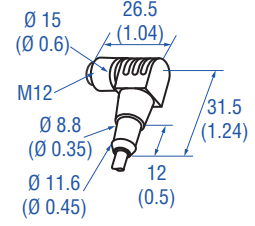
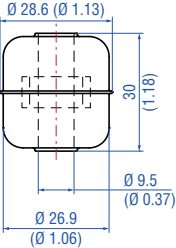
Floats			
			
Float Part no. 201 233-2 Order Code Option „L9“ Material: Stainless steel (AISI 316) Specific gravity: Max. 0.70 Pressure: Max. 22.4 bar (250 psi) Operating temperature: -40...+149 °C (-40...+300 °F)	Float Part no. 254 894-2 Order Code Option „L7“ Material: Stainless steel (AISI 316) Specific gravity: Max. 0.93 Pressure: Max. 69 bar (1000 psi) Operating temperature: -40...+149 °C (-40...+300 °F)	Float Part no. 561 612 Order Code Option „L10“ Material: Stainless steel (AISI 304) Density: 720 kg/m³ Specific gravity: Max. 0.64 Pressure: Max. 40 bar Operating temperature: -40...+125 °C	Float Part no. 254 886 Order Code Option „L11“ Material: PP, Moplen5, red Specific gravity: Max. 0.53 g/cm³ Pressure: Max. 4 bar Operating temperature: -20...+80 °C

Float			
			
Float Part no. 404 834 Order Code Option „70“ Material: Stainless steel (AISI 316) Weight: Ca. 42 ± 3 g Specific gravity: Max. 0.72 Pressure: Max. 10.3 bar (150 psi) Operating temperature: -40...+125 °C (-40...+257 °F)	Float Part no. 404 835 Order Code Option „71“ Material: Stainless steel (AISI 316) Weight: Ca. 42 ± 3 g Specific gravity: Max. 0.72 Pressure: Max. 19 bar (275 psi) Operating temperature: -40...+125 °C (-40...+257 °F)	Float Part no. 201 999 Order Code Option „72“ Material: Nitrile Specific gravity: Max. 0.7 Pressure: Max. 17.2 bar (250 psi) Operating temperature: -40...104 °C (-40...220 °F)	Float Part no. 201 120 Order Code Option „12“ Material: Nitrile Specific gravity: Max. 0.75 Pressure: Max. 17.2 bar (250 psi) Operating temperature: -40...104 °C (-40...220 °F)

ACCESSORY DETAILS – Accessories shown can be included in the model number when selected.

Floats			Collar
			
<p>Float Part no. 201 250-2 Order Code Option „L3“</p> <p>Material: Titanium Specific gravity: Max. 0.4 Pressure: Max. 20.7 bar (300 psi) Operating temperature: –40...150 °C (–40...66 °F)</p>	<p>Float Part no. 252 961-2 Order Code Option „L4“</p> <p>Material: Stainless steel (AISI 316) Weight: Ca. 42 ± 3 g Specific gravity: Max. 0.54 Pressure: Max. 29.3 bar (425 psi) Operating temperature: –40...+149 °C (–40...+300 °F)</p>	<p>Float Part no. 252 962-2 Order Code Option „L8“</p> <p>Material: Stainless steel (AISI 316) Weight: Ca. 42 ± 3 g Specific gravity: Max. 0.93 Pressure: Max. 29.3 bar (425 psi) Operating temperature: –40...+149 °C (–40...+300 °F)</p>	<p>Stop collar for Ø 7 mm Part no. 562 392</p> <p>Provides end of stroke stops for float Material: Stainless steel 1.4305 (AISI 303) Hex key 2.5 mm required</p>

Collar	Cord sets		
			
<p>O-ring Stop for 10 mm pipe Part no. 562 348</p> <p>Provides end of stroke stops for float Material: Stainless steel (AISI 316)</p>	<p>O-ring Stop for 10 mm pipe Part no. 562 355</p> <p>Provides end of stroke stops for float Material: Viton</p>	<p>O-ring Stop for 7 mm pipe Part no. 562 354</p> <p>Provides end of stroke stops for float Material: Viton</p>	<p>Cable with M12 A-coded female connector (5 pin), angled – pigtail Part no. 370 675</p> <p>Material: PUR jacket; black Feature: Shielded Cable length: 5 m (16.4 ft) Ingress protection: IP67 (correctly fitted) Operating temperature: –25...+80 °C (–13...+176 °F)</p>

Cord sets	Float
	
<p>Cable with M12 A-coded female connector (8 pin), angled – pigtail Part no. 370 676</p> <p>Cable: Shielded Cable length: 5 m (16.4 ft) Ingress protection: IP67 (correctly fitted)</p>	<p>Float Part no. 201 611 Order Code Option „73“</p> <p>Material: Stainless steel (AISI 316) Specific gravity: Max. 0.83 Weight: ca. 10.5 g Operating temperature: –40...+300 °F</p>

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