FN04

Liquid level sensor with continuous detection

- **Level measurement unaffected by foam formation, conductivity, pressure or temperature**
- **Remote indication over very long distances**
- **Easy installation, with only one calibration required during initial startup**
- **Detects interfaces between liquids with different densities**
- **Semi-flexible sensor also allows installation in tight, cramped spaces**
- **Sensor also available in 3A-compliant design for use in the food industry**

Description:

Model FN04 liquid level measuring sensors utilize a float fitted with permanent magnets to directly transmit information about changes in the liquid level. The sensor float is raised or lowered with the liquid level. The magnetic field exerted by the float magnets operates a reed contact / resistance measuring chain in the guide tube. The output signal is a voltage value proportional to the fluid level.

Typical Applications:

Model FN04 liquid level sensors are suitable for measuring and monitoring the level of almost all types of fluids that will not corrode or damage the sensor materials. They may be used in containers up to six meters high.

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Function

The sensor float contains a ring magnet. The magnetic field exerted by this magnet penetrates the wall of the guide tube and operates very small reed contacts that continuously pick up a measured voltage from a resistance measuring chain (voltage divider). This voltage is proportional to the liquid level. The resistance measuring chain, which is made up of very small chips soldered to a circuit board, is correspondingly very finely graduated (very fine spacing between chips). This construction means that the measured voltage is essentially continuous.
Depending on the design of the measuring sensor, the chip spacing (distance from chip to chip) can be from 5 to 15 mm.

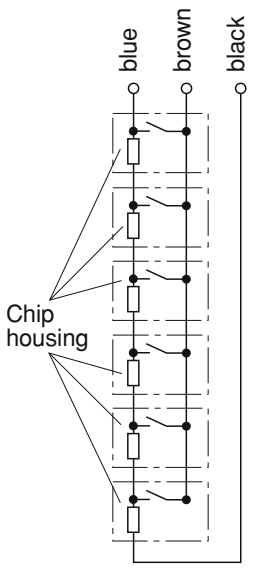


Diagram of internal circuit in the fluid level sensor

Measuring accuracy

The principle of operation for the liquid level sensor means that the measuring accuracy cannot be indicated as a constant factor. Instead, the accuracy depends on the measuring length and the chip spacing on the resistance measuring chain.
The maximum measuring error can be calculated with the following formula:

$$\frac{\text{Spacing}}{\text{Measuring length in mm}} \times 100 \quad \text{Example:} \quad \frac{12.7\ \text{mm}}{2{,}000\ \text{mm}} \times 100 = 0.635\%$$

Models

Every liquid level sensor consists of the following three main components. Different versions of these components are available to meet the technical needs of the specific application:

- Guide tube
- Float
- Process connection

There are also secondary components such as transducers, limit contact sensors, displays and isolating transformers (Zener barriers) that complete the measuring system.

Guide tube

The guide tube is the heart of the liquid level measuring sensor. It contains the measuring chain and is available in a selection of materials, diameters and resistance-chain chip spacings.
Materials and diameters:

- Brass (Ø 0.47" / 12 mm)
- Stainless steel (Ø 0.47" / 12 mm, 0.55" / 14 mm, 0.71" / 18 mm)
- PVC (Ø 0.63" / 16 mm, 0.79" / 20 mm)
- PP (Ø 0.63" / 16 mm, 0.79" / 20 mm)
- PVDF (Ø 0.63" / 16 mm, 0.79" / 20 mm)

Guide tubes made of PP with a Ø 0.63" / 16 mm are also available with semi-flexible, bendable stems for installation in tight, cramped locations.

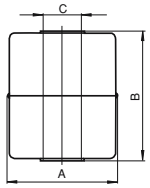
Spacing distance:

Depending on the guide tube diameters, measuring length and design (materials), the following chip spacings are available: 0.2" / 5 mm, 0.4" / 10 mm, 0.5" / 12.7 mm, 0.5" / 15 mm

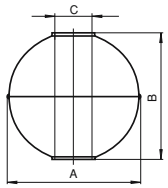
Floats

The selection of the float depends on the properties of the fluid to be monitored (corrosive/caustic properties, density), the process parameters (pressure, temperature) as well as the guide tube material and diameter.
The following float types are available:

Type	Material	Form	Ø (inch / mm)	min. density (kg/m³)	max. pressure (psi / bar)	max. temp. (°F / °C)
1	Buna rubber	Cylinder	1.18 / 30	700	87 / 6	176 / 80
2	PVC		2.17 / 55	750	14 / 1	140 / 60
3			3.15 / 80	600		
4	PP		2.17 / 55			176 / 80
5			3.15 / 80	500		
6	PVDF		2.17 / 55	800		212 / 100
7			3.17 / 80	700		
8	Stainless steel 316 TI / 1.4571		1.73 / 44	800	360 / 25	392 / 200
9		Sphere	2.05 / 52	720	580 / 40	
10			3.27 / 83	450	360 / 25	
11			3.15 / 80	600		
12			3.15 / 80	750		



Model	Ø A (inch / mm)	Ø B (inch / mm)	Ø C (inch / mm)
1	1.18 / 30	1.77 / 45	0.52 / 13
2	2.17 / 55	2.13 / 54	0.87 / 22
3	3.15 / 80	3.11 / 79	0.94 / 25
4	2.17 / 55	2.13 / 54	0.87 / 22
5	3.15 / 80	3.11 / 79	0.94 / 25
6	2.17 / 55	2.72 / 69	0.87 / 22
7	3.17 / 80	3.11 / 79	0.94 / 25
8	1.73 / 44	2.05 / 52	0.59 / 15



Model	Ø A (inch / mm)	Ø B (inch / mm)	Ø C (inch / mm)
1	2.05 / 52	2.05 / 52	0.59 / 15
2	3.23 / 82	3.19 / 81	0.59 / 15
3	3.15 / 80	2.95 / 75	0.91 / 23
4	3.15 / 80	2.87 / 73	0.91 / 23

Special-order floats (titanium, ECTFE-coated) are available upon request.

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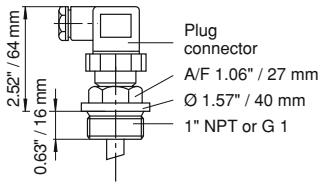
Process connection

These liquid level measuring sensors are usually attached to the inside of a container cover with a male threaded fitting (3/8",1/2", 1"). In such case, the sensor comes with a three-wire connection cable (PVC or silicone jacket) of up to 2,000 meters in length.
However, if the sensor is to be mounted from the outside of a container and inserted through the container cover, then the sensor must either come with a male threaded fitting that is compatible with the existing tank thread (1", 1-1/2", 2") or be mounted with flanges. The diameter of the tank mounting thread or the mounting flange should be sized so that the sensor float can pass through the opening in the container cover.

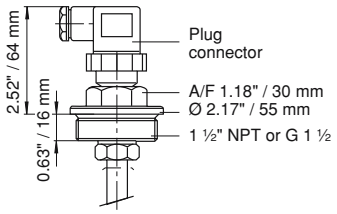
Float type	min. size of tank fitting	min. nominal size of flange
1	1"	1 1/4" / DN 32
2	2"	2 1/2" / DN 65
3	—-	3" / DN 80
4	2"	2 1/2" / DN 65
5	—-	3" / DN 80
6	2"	2 1/2" / DN 65
7	—-	3" / DN 80
8	1 1/2"	2" / DN 50
9	2"	2 1/2" / DN 65
10	—-	4" / DN 100
11	—-	3" / DN 80
12	—-	3" / DN 80

In addition, the material used for the process connection should be compatible with the materials used for the float and the guide tube.

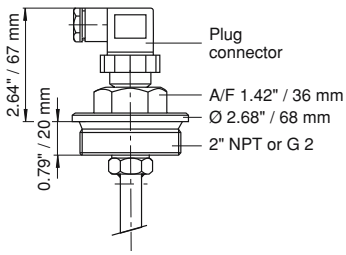
Dimensions of tank fittings and flange connections



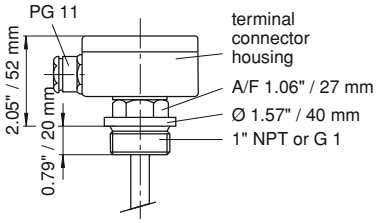
1" thread
stainless steel with ABS plug connection as per DIN 43650



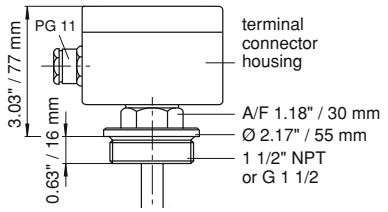
1 1/2" thread
PP, brass, steel, or stainless steel with ABS plug connection as per DIN 43650



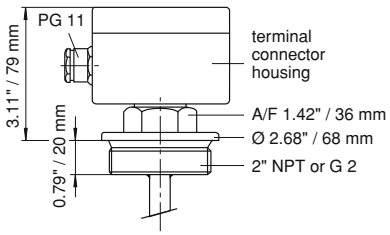
2" thread
PP, brass, steel, or stainless steel with ABS plug connection as per DIN 43650



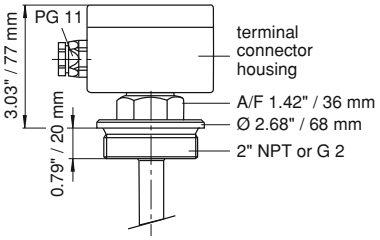
1" thread
stainless steel with aluminum terminal connector housing
2.52" x 2.28" x 1.34"
64 x 58 x 34 mm



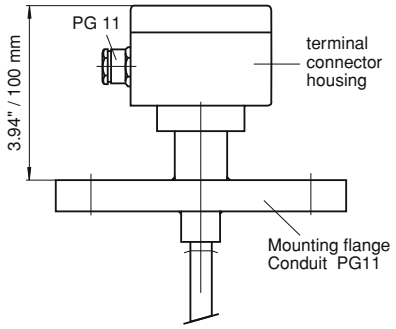
1 1/2" thread
PP, brass, steel, or stainless steel with aluminum terminal connector housing
3.15" x 2.95" x 2.24"
80 x 75 x 57 mm



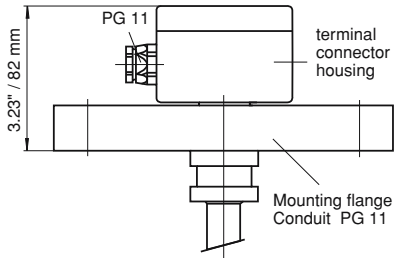
2" thread
PP, brass, steel, or stainless steel with aluminum terminal connector housing
3.15" x 2.95" x 2.24"
80 x 75 x 57 mm



2" thread
PVC, PP, PVDF with polyester terminal connector housing
3.15" x 2.95" x 2.24"
80 x 75 x 57 mm



Flange connection
ANSI 2" to ANSI 6", 150 lbs. to 600 lbs. RF / DN 50 to DN 150, PN 6 to PN 64
Steel or stainless steel with aluminum terminal connector housing
3.15" x 2.95" x 2.24"
80 x 75 x 57 mm



Flange connection
ANSI 3" to ANSI 4", 150 lbs., RF / DN 80 to DN 100, PN 10
PVC, PP, or stainless steel with PTFE plating, polyester terminal connector housing
3.15" x 2.95" x 2.24"
80 x 75 x 57 mm

Connection sizes for 3A-compliant sensors:

ANSI: 1", 1 1/2", 2"
DIN: DN 25, DN 40, DN 50

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Ordering Code (general)

Order number	FN04.	1.	1.	1.	01.	1001.	1.	0

Liquid level measuring sensor

Guide tube material:

1 = Brass
2 = Stainless steel 316 Ti / 1.4571
3 = PVC
4 = PP
5= PP, semi-flexible
6 = PVDF
9 = Special order

Guide tube diameter:

1 = 0.47" / 12mm
2 = 0.55" / 14 mm
3 = 0.63" / 16 mm
4 = 0.71" / 18 mm
5 = 0.79" / 20 mm
9 = Special order

Resolution (Chip spacing) of resistance measuring chain:

1 = 0.20" / 5 mm
3 = 0.39" / 10 mm
4 = 0.50" / 12.7 mm
5 = 0.59" / 15 mm
9 = Special order

Float type:

01…12 = see table in "Floats" section

Process connection:

1001…9999 = see "Process Connections" table on this page

Electrical connection.

1 = 40" / 1 m PVC cable
2 = 40" / 1 m silicone cable
3 = Plug connection as per DIN 43650
5 = Polyester connection socket, 3.15" x 2.95" x 2.24" / 80 x 75 x 57 mm
6 = Aluminum connection socket, 2.52" x 2.28" x 1.34" / 64 x 58 x 34 mm
7 = Aluminum connection socket, 3.15" x 2.95" x 2.24" / 80 x 75 x 57 mm

Options:

Type of resistance measuring chain:

0 = Standard
1 = High-temperature design for up to 300 °F / 150°C

Ordering Code (process connections)

Order number	x	y	y	y

Process connection

1 = Male thread
2 = Tank connector
3 = Flange connection

x = 1: Male thread — 1 0 0 1

001N = 3/8" NPT male, brass	001 = G 3/8 male, brass
002N = 3/8" NPT male, stainless steel 316 Ti / 1.4571	002 = G 3/8 male, stainless steel 316 Ti / 1.4571
003N = 1/2" NPT male, stainless steel 316 Ti / 1.4571	003 = G 1/2 male, stainless steel 316 Ti / 1.4571
004N = 1" NPT male, PVC	004 = G 1 male, PVC
005N = 1" NPT male, PP	005 = G 1 male, PP
006N = 1" NPT male, PVDF	006 = G 1 male, PVDF
999 = Special order	999 = Special order

x = 2: Tank connector — 2 0 1 1

002N = 1" NPT, stainless steel 316 Ti / 1.4571	002 = G 1, stainless steel 316 Ti / 1.4571
003N = 1 1/2" NPT, brass	003 = 1 1/2" NPT, brass
004N = 1 1/2" NPT, steel	004 = 1 1/2" NPT, steel
005N = 1 1/2" NPT, stainless steel 316 Ti / 1.4571	005 = 1 1/2" NPT, stainless steel 316 Ti / 1.4571
007N = 1 1/2" NPT, PP	007 = 1 1/2" NPT, PP
009N = 2" NPT, brass	009 = 2" NPT, brass
010N = 2" NPT, steel	010 = 2" NPT, steel
011N = 2" NPT, stainless steel 316 Ti / 1,4571	011 = 2" NPT, stainless steel 316 Ti / 1,4571
012N = 2" NPT, PVC	012 = 2" NPT, PVC
013N = 2" NPT, PP	013 = 2" NPT, PP
014N = 2" NPT, PVDF	014 = 2" NPT, PVDF
999 = Special order	

x = 3: Flange connection — 3 2 4 3

Material:

1 = Steel
2 = Stainless steel 316 Ti / 1.4571
3 = PVC
4 = PP
5 = Stainless steel with PTFE liner
999 = Special order

Nominal size:

1A = ANSI 2", RF	1 = DN50
2A = ANSI 2 ?", RF	2 = DN65
3A = ANSI 3", RF	3 = DN80
4A = ANSI 4", RF	4 = DN100
5A = ANSI 5", RF	5 = DN125
6 = ANSI 6", RF	6 = DN150
9 = Special order	

Pressure rating

	1 = PN6
	2 = PN10
3A =150 lbs.	3 = PN16
5A = 300 lbs.	5 = PN40
6A = 600 lbs.	6 = PN64
9 = Special order	

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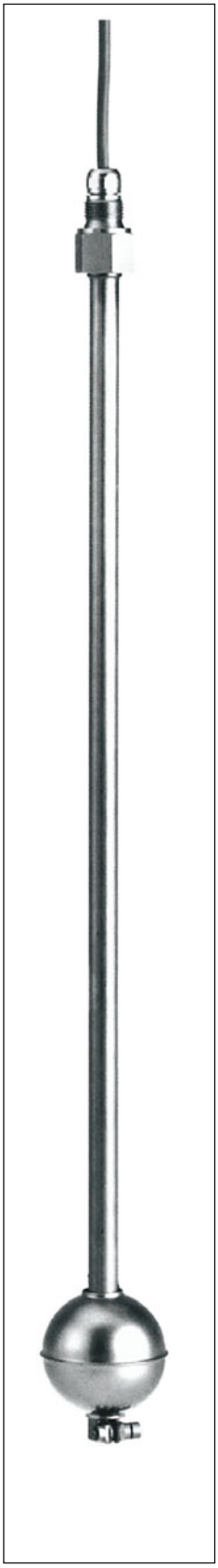
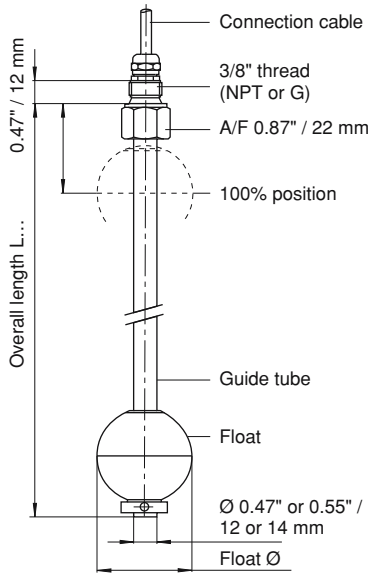
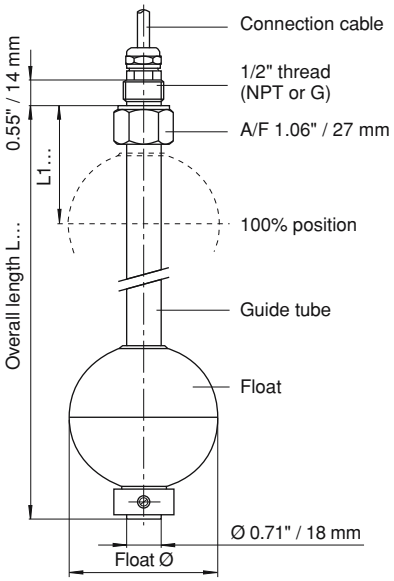
Standard level sensor of brass or stainless steel







Versions and Technical Data

Guide tube material	**Brass**	**Stainless steel**
Guide tube diameter	0.47" / 12 mm	0.47", 0.55", 0.71" / 12 mm, 14 mm, 18 mm
Guide tube length	max 120" max. 3 m	ø0.47", 0.55" / ø12, ø14 mm: max. 120" / 3 m ø 0.71" / ø18 mm: max. 240" / 6 m
Max. pressure	Depends on float used (see table in "Floats" section)	
Max. temperature	**Float and process connection of metal:** 250°F / 120°C (194°F / 90°C with PVC cable), high-temperature design 480°F / 250°C (with resolution of 0.2", 0.39", 0.59" / 5, 10, 15 mm only) **Float and/or process connection of plastic:** As per specification for float or process connection	
Resolution	0.2" / 5 mm 0.39" / 10 mm 0.5" / 12.7 mm 0.59" / 15 mm	0.2" / 5 mm (ø 0.55"and ø 0.71" / ø14 and ø18 mm only) 0.39" / 10 mm 0.5" / 12.7 mm 0.59" / 15 mm
Float	No. 1, 8, 9,	1, 8, 9, 10, 11
Total resistance of measuring chain	**Standard:** Depends on length and chip spacing **When connected to safety barrier:** approx. 40 kOhm	
Cable length (for sensors with male thread only)	PVC or silicone cable, max. 6,500 ft. / 2,000 m, 3-wire	
Process connection	**Male thread**	
	3/8"	3/8", 1/2"
	Tank connectors with terminal connection housing Polypropylene, 1 1/2", 2" with ABS plug connection or polyester terminal connection housing	
		Stainless steel, 1" with ABS plug connection or aluminum connection housing
	Brass, 1 1/2", 2", with aluminum connection housing	Steel or stainless steel, 1 1/2", 2", with aluminum connection housing
	Flange connection	
	Steel or Stainless steel ANSI 2"-6" / DN 50-DN 150, 150 lbs.-600 lbs. / PN 6-PN 64 with aluminum connection housing	Steel or stainless steel ANSI 2"-6" / DN 50-DN 150, 150 lbs.-600 lbs. / PN 6-PN 64 with aluminum connection housing
Model designation:	As per ordering code	
Other specifications	Overall length L media, density, max. pressure max. temperature, special features	

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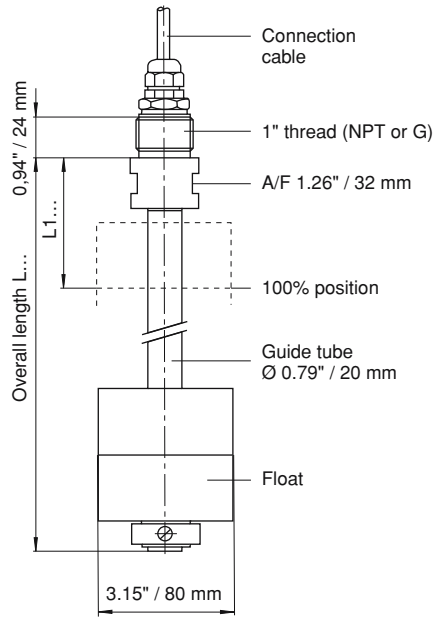
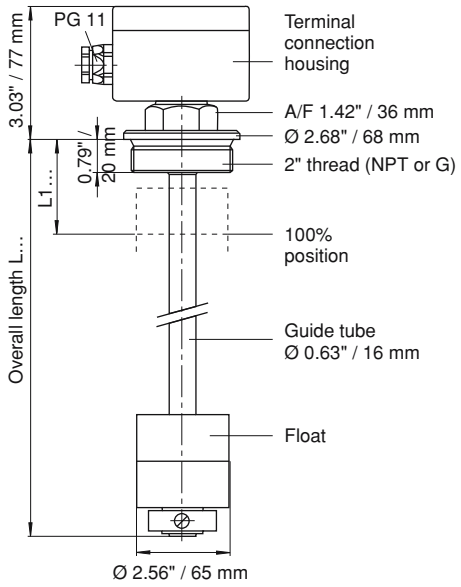
Standard level sensor of PVC, PP or PVDF





Versions and Technical Data

Guide tube material	**PVC**	**PP**	**PVDF**
Guide tube diameter	0.63" or 0.79" / 16 mm or 20 mm		
Guide tube length	max. 160" / 4 m		
Max. pressure	45 psi / 3 bar		
Max. temperature	140 °F / 60 °C	176°F / 80°C	212°F / 100°C
Resolution	0.2" / 5 mm 0.39" / 10 mm 0.5" / 12.7 mm 0.59" / 15 mm		
Float:	ø16: No. 2 ø18: No. 3	ø16: No. 4 ø18: No. 5	ø16: No. 6 ø18: No. 7
Total resistance of measuring chain	Depends on length and resolution		
Cable length (for sensors with male thread only):	PVC or silicon cable, max. 6500 ft. / 2000 m, 3-wire		
Process connection:	**Male thread**		
	1"		
	Tank threads and connection housing		
	2", PVC	2", PP	2", PVDF With polyester connection housing
	Flange connection		
	PVC	PP	Stainless steel with PTFE spacer With polyester connection housing
Model designation:	As per ordering code		
Other specifications	Overall length L... media, density, max. pressure max. temperature, special features		

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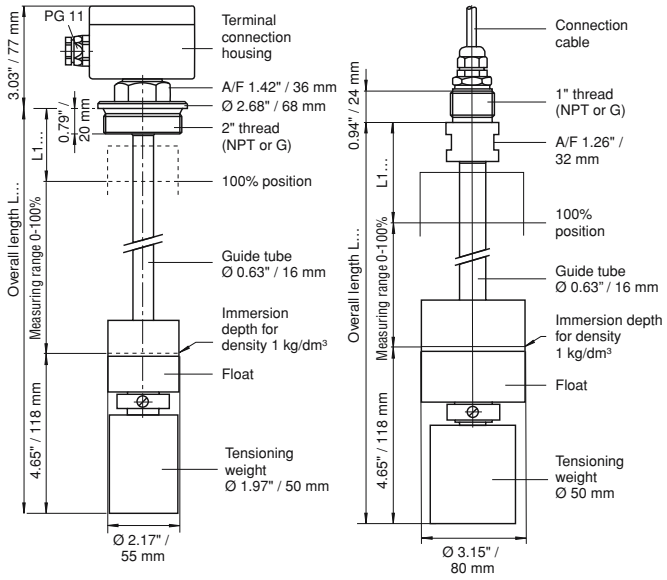
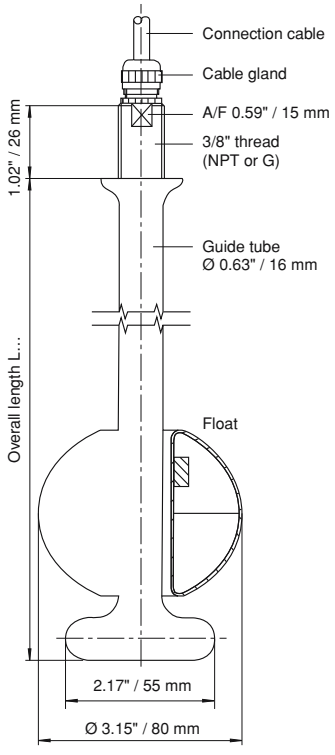
Semi-flexible sensors of PP



Semi-flexible sensors are used in cases when the available installation space will not permit use of a rigid unit, such as in tight, cramped spaces where the top edge of the container is close to the ceiling. The sensors have a minimum bending radius of 40" / 1,000, allowing them to be inserted into the container even in close quarters.

3A-compliant sensors for sanitary applications in the food and beverage industry



Our 3A-compliant level sensors meet all of the requirements set forth in the 3-A-Sanitary Standards for Liquid Pressure and Level Sensing Devices from the International Association of Milk, Food and Environmental Sanitarians, US Public Health Service and from The Dairy Industry Committee.
These sensors can be sterilized with saturated steam or water.

Versions and Technical Data

Guide tube material	**PP**
Guide tube diameter	0.63" / 16 mm
Guide tube length	max. 160" / 4 m
Max. pressure	45 psi / 3 bar
Max. temperature	176 °F / 80 °C
Resolution	0.5" / 12.7 mm
Float	With 2" tank connector: no. 4, with 1" male thread or flange: no. 5
Total resistance of measuring chain	Depends on length
Cable length (for sensors with male thread only)	PVC or silicon cable, max. 6500 ft. / 2000 m, 3-wire
Process connection	**Male thread**
	1", PP
	Tank connectors with connection housing
	2", PP, with polyester connection housing
	Flange connection (other flange types available upon request)
	PVC or PP ANSI 3" or ANSI 4", 150 lbs., RF / DN 80 or DN 100, PN10 with polyester connection housing
Tensioning weight	ø 1.97" x 3.15" / 50 x 80 mm
Model designation	As per ordering code
Other specifications	Overall length L... media, density, max. pressure max. temperature, special features

Guide tube material	**Stainless steel 316 Ti / 1.4435**
Guide tube diameter	Ø 0.63" / 16 mm
Guide tube length	max. 200" / 5 m
Max. pressure	650 psi / 45 bar
Max. temperature	194 °F / 90 °C with standard measuring chain, 356°F / 180°C with high-temp. measuring chain
Resolution	0.5" / 12. 7 mm (up to 194 °F / 90 °C) 0.2", 0.39", 0.59" / 5, 10, 15 mm (up to 356 °F / 180 °C, high-temp measuring chain)
Float	No. 12
Total resistance of measuring chain	Depends on length and resolution
Cable length (for sensors with male thread only)	PVC or silicon cable, max. 6500 ft. / 2,000 m, 3-wire
Process connection	**Male thread**
	ISO 228/1, 3/8" or 4" Tri-clamp
Model designation	As per ordering code
weitere Angaben:	Overall length L... media, density, max. pressure max. temperature, special features

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Transmitter for Resistance Measuring Chains

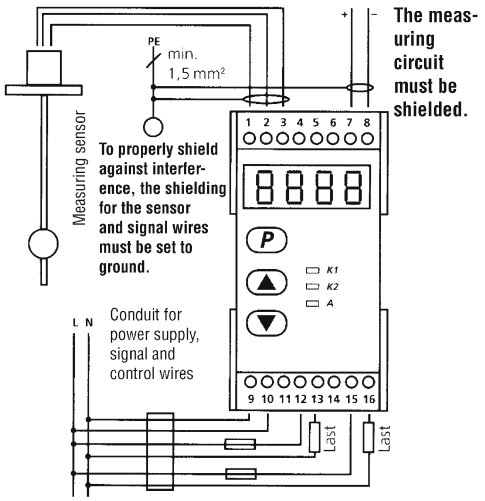
Description:

Model MULD transmitters can be connected to the resistance measuring chains in FN04 level sensors or FB01/FB04 bypass level sensors.

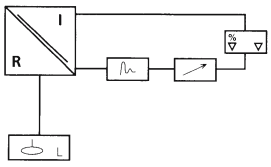
These transmitters convert the signal from the resistance-type sensor to a standard output signal (0 or 4 to 20 mA).

In addition, MULD transmitters have two programmable alarm contacts and a programmable, 4-digit LED display to represent the liquid level numerically.

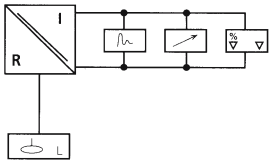
Elektrischer Anschluss



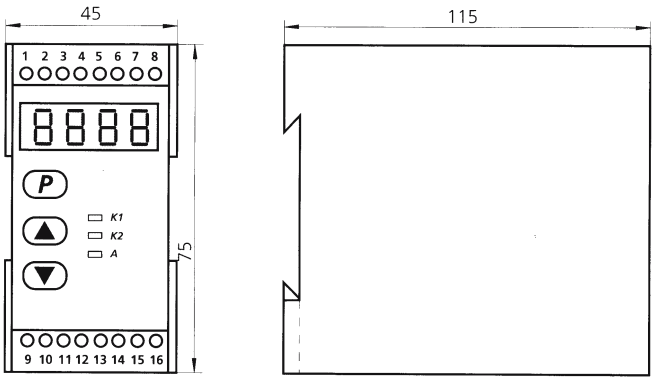
Current signal



Voltage signal



Dimensions



Ordering Code

Order number	MULD.	1.	4.

Transducer

Supply voltage

1 = 24 VDC, electrically isolated

2 = 24 VAC, 50/60 Hz

3 = 115 VAC, 50/60 Hz

4 = 230 VAC, 50/60 Hz

Output signal:

0 = 0-20 mA

4 = 4-20 mA

Technical Data

Power supply:	24 / 115 / 230 VAC, 48 to 62 Hz available or 24 VDC with electrical isolation of auxiliary power, measuring and output circuits
Power consumption:	4 VA
Input:	
Measuring circuit:	Resistance sensors, 3-wire
Meas. resistance:	1 to 100 kOhm
Output:	0/4 to 20 mA
Contact output:	2 limit-value relays, programmable as N/O or N/C, programmable hysteresis, switching capacity 500 VA, 230 VAC
Display:	Red, 4-digit LED display programmable from –999 to +9999, programmable decimal point
Housing:	Macrolone Snap-on rail mounting, as per DIN EN 50022
Protection type:	IP40, terminals IP20
Operating temperature:	32 to 122 °F / 0 to 50 °C

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