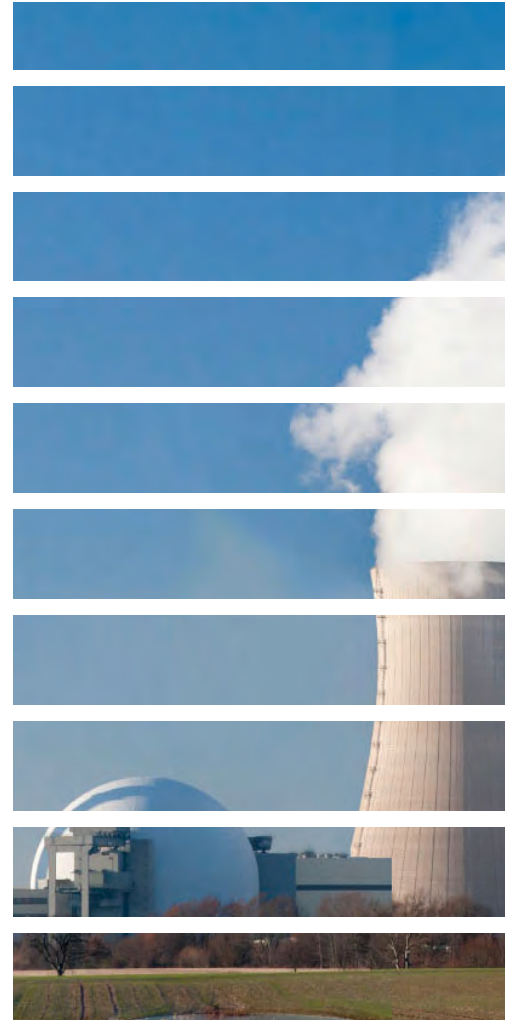


LEVEL MEASUREMENT FOR NUCLEAR POWER PLANTS



Who we are



KSR KUEBLER
Headquarter Zwingenberg

Custom-made solutions for individual requirements

















For over 50 years KSR KUEBLER Niveau-Messtechnik has been renowned as competent specialist for all level measurement needs. Reliability of its products and the willingness to meet all market challenges helped to build up the reputation as one of the leading manufacturers world-wide. Proven products and innovative solutions help us to offer optimal solutions to our customers and strengthen our market position.

KSR KUEBLER AG today manufactures a broad range of level measurement devices covering temperatures up to 450 °C and pressures up to 500 bar. Tailor-made solutions for chemical and pharmaceutical plants, offshore and oil industry, shipbuilding, plant construction, food and beverages industry, water purification plants and an ever growing number of applications in the environmental industry make up a big share of our new developments.

Our highly qualified members of staff are constantly engaged in customising new solutions to solve individual problems. The latest in production technology, an uncompromising commitment to quality and national and international approvals are the foundations that build up the reputation of our company.

Since 2008 KSR is a member of the WIKA group of companies with over 7,900 employees world-wide. More than 500 experienced personnel in our local sales organisations help customers and users by working together as partners.

Approvals

	Sanitary Standards
	American Bureau of Shipping
	ATEX Atmosphère Explosibles
	Bureau Veritas
	Det Norske Veritas
	Factory Mutual
	Germanischer Lloyd
	HP0
	ISO9000
	Lloyds Register
	NEPSI
	NSQ100
	Safety Integrity Level
WHG	Wasserhaushaltsgesetz
	GOST
	IEEE
	KTA

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Industries

Process

- Power engineering
- Chemical
- Petrochemical
- Oil & Gas
- Water, waste water



Industrial

- Machine building
- Heating, Ventilation, Air-conditioning
- Refrigeration
- Technical gases
- Semiconductor



Product overview

Accident-proof level sensor model ALM



Used to measure and transmit the level of liquids in conjunction with a customer's control unit outside of the containment area

- Based on the float principle with magnetic transmission in a 3-wire potentiometer circuit
- The resistance measuring chain is closely stepped
- Due to this assembly the generated voltage is approximately continuous
- Signal transmission over large distances and use in hazardous areas are possible

Bypass Level Indicators model BNA

Continuous level measurement with visual indication of level without power supply

- Simple, robust, and solid design
- Display proportional to the height of the level or the contents of the vessel
- Pressure- and gas-proof separation of chamber and display
- Available for applications in all areas of industry through versatile design and corrosion-resistant materials
- Explosion-proof designs
- Interface



Product overview

Magnetic Float Switches model FLS



Detection of one or more distinct levels of a liquid

- Suitable for virtually all liquids
- Switching operation is without direct contact with the liquid, free of wear and tear and does not require any power supply
- Universal signal processing of volt-free contacts:
 - PLC
 - Control circuit to DIN NAMUR 60947-5-6
- Multiple switch points in one unit (up to 8)
- Explosion-proof designs
- Interface
- Application specific designs available
- Simple installation and commissioning, maintenance-free

Level Sensors model FLR

Opto Level Switches are used for monitoring liquid levels

- Protocols: HART, Profibus, Foundation Fieldbus ®
- Signal transmission over large distances
- Simple installation and commissioning, one-time calibration only, no re-calibration necessary
- Display proportional to the height of the level or the contents of the vessel
- Set point relays continuously adjustable over full range
- High repeatability of set points
- Interface
- Application specific designs available
- Explosion-proof designs



Product overview

Opto Level Switch model OLS-H/-HT



Opto Level Switches are used for monitoring liquid levels

- Option: Interface
- High precision
- Independent of color, density, dielectric constant, conductivity and refractive index
- Small measurement volume
- Small size
- Explosion-proof designs

KSR Level Sensors for Nuclear Power Plants - Application Limits

	Level Gauge Type BNA...	Level Transmitter Type MG... & ALM...	Level Switch Type BGU... & AV4...	Rod Electrodes
Single point level detection	x		x	x
Multi point level detection	x		x	x
Continuous level detection	x	x		
Temperature sensor as option available	x	x	x	
Radiation resistance	< 50 kGy	< 5 MGy	< 1 MGy	< 250 kGy
Seismic	On request	5 g SSE (3 Axis)	8g SSE (2 Axis)	On request
Lifetime	Up to 60 years	16 years extendable to 60 years	16 years extendable to 60 years	Up to 60 years
Maintenance period	> 2 years	> 2 years	> 2 years	> 2 years

Level sensor For Nuclear Power Plants with reed chain technology Model ALM

KSR data sheet ALM



Applications

- Power generating equipment, power plants, nuclear power plants
- Water basins
- Cooling water tanks/pools

Normal operating conditions

- Process- and system-specific solutions possible
- Operating conditions:
 - Operating temperature: $T = -10^{\circ}\text{C} \dots +70^{\circ}\text{C} (+158^{\circ}\text{F})$
 - Operating pressure: ambient
- Lengths: up to 20 m (65 ft)
- Humidity: 100 %
- Operational radiation dose: $\leq 160 \text{ kGy} (16 \text{ MRad})$

Accident conditions

- Accident temperature: $156^{\circ}\text{C} (312^{\circ}\text{F})$
- Accident pressure: 7 bar (0.7 MPa)
- Accident mission time: 1 year
- Accident rad. dose: integrated 5.05 MGy (505 MRad)
- Seismic acceleration: up to 2.5 g (higher accelerations up to 5 g on demand)

Description

ALM Level Sensors are used to measure and transmit the level of liquids in conjunction with a customer's control unit outside of the containment area. It is based on the float principle with magnetic transmission in a 3-wire potentiometer circuit. The resistance measuring chain is closely stepped. Due to this assembly the generated voltage is approximately continuous. Signal transmission over large distances and use in hazardous areas are possible.



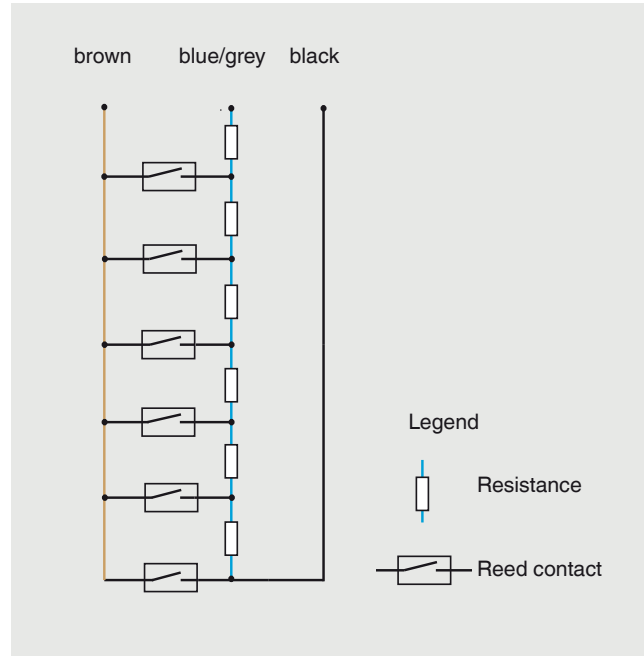
Accident-proof level measurement sensor with reed chain technology, model ALM

This device was designed without organic materials or active electronic components in any sensor and cabling part that might be affected by described accident conditions. The sensor will continue to function even in case of a Loss of Coolant Accident (LOCA) and can be fitted with a filter for protection against coarse debris. An accident-proof connection using mineral insulated cable is also available and meet the same standards as the integrated sensor units. For less critical applications, a connection using polymer insulated cable can be supplied.

This device is well-suited to retrofit the existing level measurement as part of the wide range of post-accident monitoring systems.

- The purpose of the accident level measurement is to remain functional during and after a severe accident scenario
- All used materials are inorganic and capable to withstand a high dose of gamma radiation

Internal circuit diagram of the reed sensors



Application Area

In the aftermath of the Fukushima accident, safety margins of nuclear power plants are reassessed in order to develop action plans for possible plant upgrades. One requirement of such a safety analysis is the necessity to enhance the robustness of the storage pool monitoring system. The presented ALM device is well-suited to retrofit the existing level measurement instrument as part of the wide range post-accident monitoring systems. As the device is proven against severe accident conditions inside the containment, it withstands the accident conditions in both the reactor and the fuel building.

Model overview

Sensor model	Description	Standard				Special Features			
		Reed switch unit (RSU)	Magnetic floater unit (MFU)	Material stainless steel	Floater guide tube unit (FGTU)	Filter box	Temperature sensor PT-100	Redundant measuring equipment	Modular design
ALM-D1	Accident proof Level Measurement Devices	x	x	x	x	x			
ALM-D2	Accident proof Level Measurement Devices	x	x	x					
ALM-D3	Accident proof Level Measurement Devices	x	x	x					x
ALM-D4	Accident proof Level Measurement Devices	x	x	x	x	x	x		
ALM-D5	Accident proof Level Measurement Devices	x	x	x	x	x		x	
ALM-D6	Accident proof Level Measurement Devices	x	x	x	x		x		x

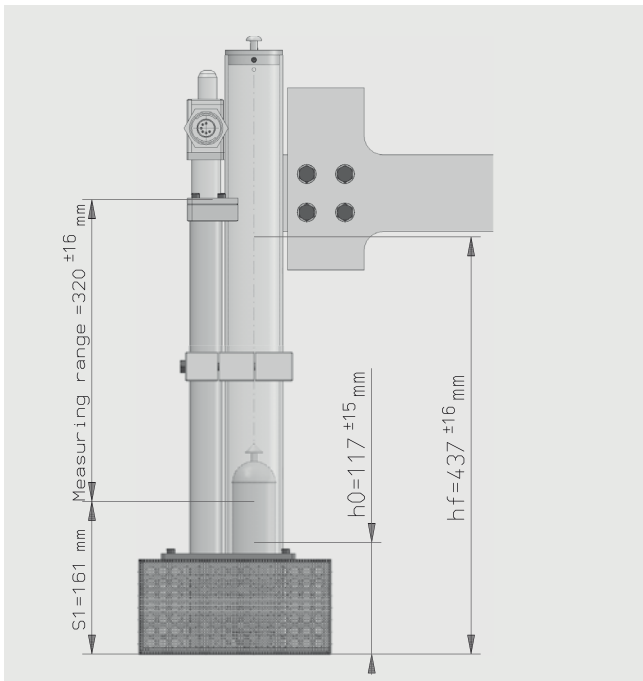
Qualification specifications

The current qualification is based on KTA 3505. Qualification includes the sensor and the cable-connector, both with electrical safety class 1E. The qualification is based on theoretical analysis and/or physical tests. Major points included in this qualification are following:

- Electromagnetic compatibility
- Shock test
- Functional test
- Behavior upon plugging and unplugging
- Climatic test
- Thermal ageing and Radiological ageing
- Accidental mechanical loads
- Debris test
- Performance during exposure to pressure, temperature and humidity
- Performance during exposure to high dose rates and post-stressing.

Products are developed for and with AREVA GmbH. The accident-proof level measurement device is part of the standard instrumentation in a recent project of AREVA.

Accident-proof Level Measurement Device, model ALM-D1 Internally mounted for sumps

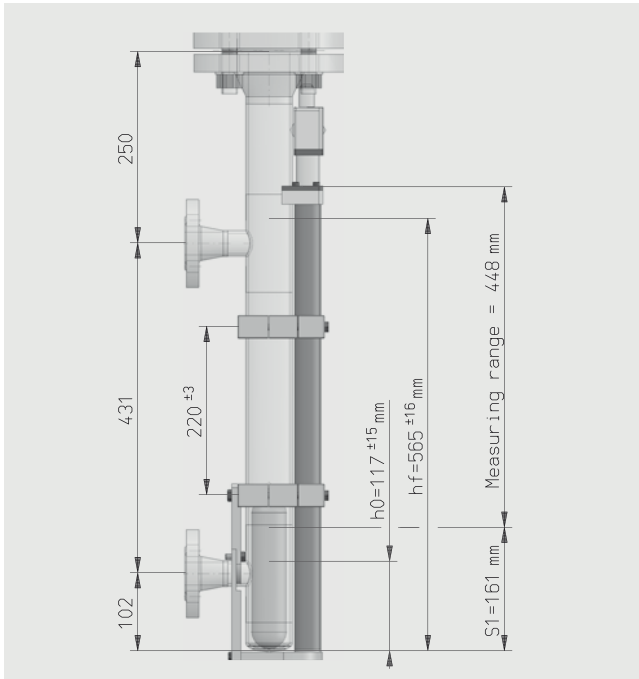


Technical specifications	
Electrical connection	Male plug
Mounting	Welding bracket
Guide tube unit diameter	60.3 mm (2")
Float	Titanium ZTS45/200/SMCO
Contact separation	16 mm (0.63")
Overall resistance of the measuring chain	< 500 Ohm
Connection cable to transmitter	Available on request
Control unit	Available on request
Mounting position	Vertical
Material	Stainless steel
Chemical resistance	Boron (B-10 32%) = 1750 ppm Chloride = 0.2 mg/kg NaOH = 0.5•wt % Na2S2O3 = 3.5•wt %

Normal operating conditions	
Temperature range	0 °C to 70 °C (32 °F to 158 °F)
Pressure	7 bar (0.7 MPa) abs.
Operating life time	min. 16 years
Humidity	100%
Radiation resistance	2.5 kGy (250 kRad) per year
Response time	< 1 s
Accuracy (for 200 mm measuring range)	≤ 16 mm

Accident conditions	
Maximum temperature	156 °C (312 °F)
Maximum pressure	5.5 bar (0.55 MPa) abs.
Humidity	100%
Radiation resistance	5.05 MGy (505 MRad) Dose rate 5kGy/h (0.5 MRad/h) (1 year)
Mechanical stress	Load test 1.68g (3 axis) Excitation type: Sine sweep Frequency: 2..50 Hz Displacement: 10 mm (0.03 ft), 1 Oct./min. Load test 2.6g (3 axis) Excitation type: Sine sweep Frequency: 2..100 Hz Displacement: 10 mm (0.03 ft), 10 Oct./min.
Response time	< 30 s
Pollution severity	3.0 kg MD2 insulation material for pipes (glass wool material) 53 g concrete particles (<250 μm) 53 g paint and coating particles (solid matter) 80 g Microtherm, microporous insulation material 300 l clear water
Accuracy (for 320 mm measuring range) under accident conditions	30 mm

Accident-proof Level Measurement Device, model ALM-D2 Externally mounted



Technical specifications	
Electrical connection	Male plug
Process connection	Clamp
Guide tube unit diameter	60.3 mm (2")
Float	Titanium ZTS45/200/SMCO
Contact separation	16 mm (0.63")
Overall resistance of the measuring chain	< 500 Ohm
Connection cable to transmitter	Available on request
Control unit	Available on request
Mounting position	Vertical
Material	Stainless steel
Chemical resistance	Boron (B-10 32%) = 1750 ppm Chloride = 0.2 mg/kg NaOH = 0.5•wt % Na2S2O3 = 3.5•wt %

Normal operating conditions	
Temperature range	0 °C to 70 °C (32 °F to 158 °F)
Pressure	7 bar (0.7 MPa) abs.
Operating time	16 years
Humidity	100%
Radiation resistance	2.5 kGy (250 kRad) per year
Response time	< 1 s
Accuracy (for 200 mm measuring range)	≤ 16 mm (0.05 ft)

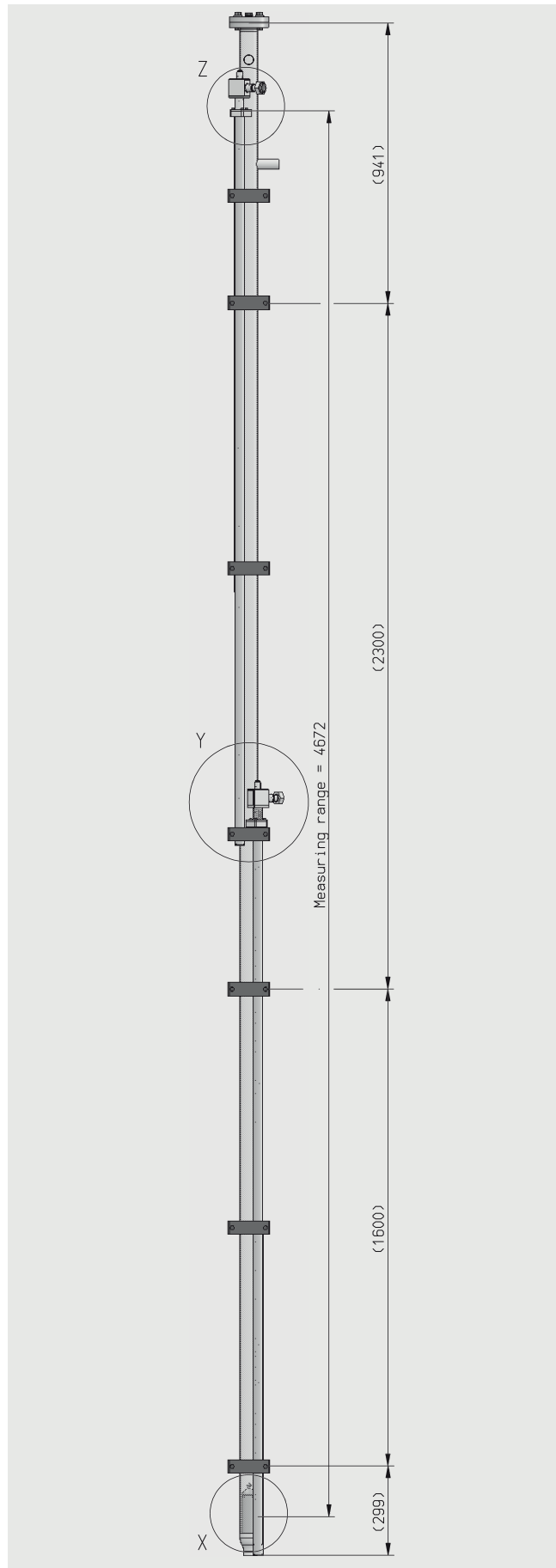
Accident conditions	
Maximum temperature	156 °C (312 °F)
Maximum pressure	5.5 bar (0.55 MPa) abs.
Humidity	100%
Radiation resistance	5.05 MGy (505 MRad) Dose rate 5kGy/h (0.5 MRad/h) (1 year)
Mechanical stress	Load test 1.68g (3 axis) Excitation type: Sine sweep Frequency: 2..50 Hz Displacement: 10 mm (0.03 ft), 1 Oct./min. Load test 2.6g (3 axis) Excitation type: Sine sweep Frequency: 2..100 Hz Displacement: 10 mm (0.03 ft), 10 Oct./min.
Response time	< 30 s
Pollution severity	No
Accuracy (for 448 mm measuring range) under accident conditions	38 mm (0.12 ft)

Accident-proof Level Measurement Device, model ALM-D3 Externally mounted with cascaded sensors

Technical specifications	
Electrical connection	Male plug
Process connection	Clamp
Guide tube unit diameter	60.3 mm (2")
Float	Titanium ZTS45/200/SMCO
Contact separation	16 mm (0.63")
Overall resistance of the measuring chain	< 500 Ohm
Connection cable to transmitter	Available on request
Control unit	Available on request
Mounting position	Vertical
Material	Stainless steel
Chemical resistance	Boron (B-10 32%) = 1750 ppm Chloride = 0.2 mg/kg NaOH = 0.5•wt % Na ₂ S ₂ O ₃ = 3.5•wt %

Normal operating conditions	
Temperature range	0 °C to 70 °C (32 °F to 158 °F)
Pressure	7 bar (0.7 MPa) abs.
Operating time	16 years
Humidity	100%
Radiation resistance	2.5 kGy (250 kRad) per year
Response time	< 1 s
Accuracy (for 200 mm measuring range)	≤ 21 mm (0.07 ft)

Accident conditions	
Maximum temperature	156 °C (312 °F)
Maximum pressure	5.5 bar (0.55 MPa) abs.
Humidity	100%
Radiation resistance	5.05 MGy (505 MRad) Dose rate 5kGy/h (0.5 MRad/h) (1 year)
Mechanical stress	Load test 1.68g (3 axis) Excitation type: Sine sweep Frequency: 2..50 Hz Displacement: 10 mm (0.03 ft), 1 Oct./min. Load test 2.6g (3 axis) Excitation type: Sine sweep Frequency: 2..100 Hz Displacement: 10 mm (0.03 ft), 10 Oct./min.
Response time	< 30 s
Pollution severity	No
Accuracy (for 4672 mm measuring range) under accident conditions	50 mm (0.16 ft)

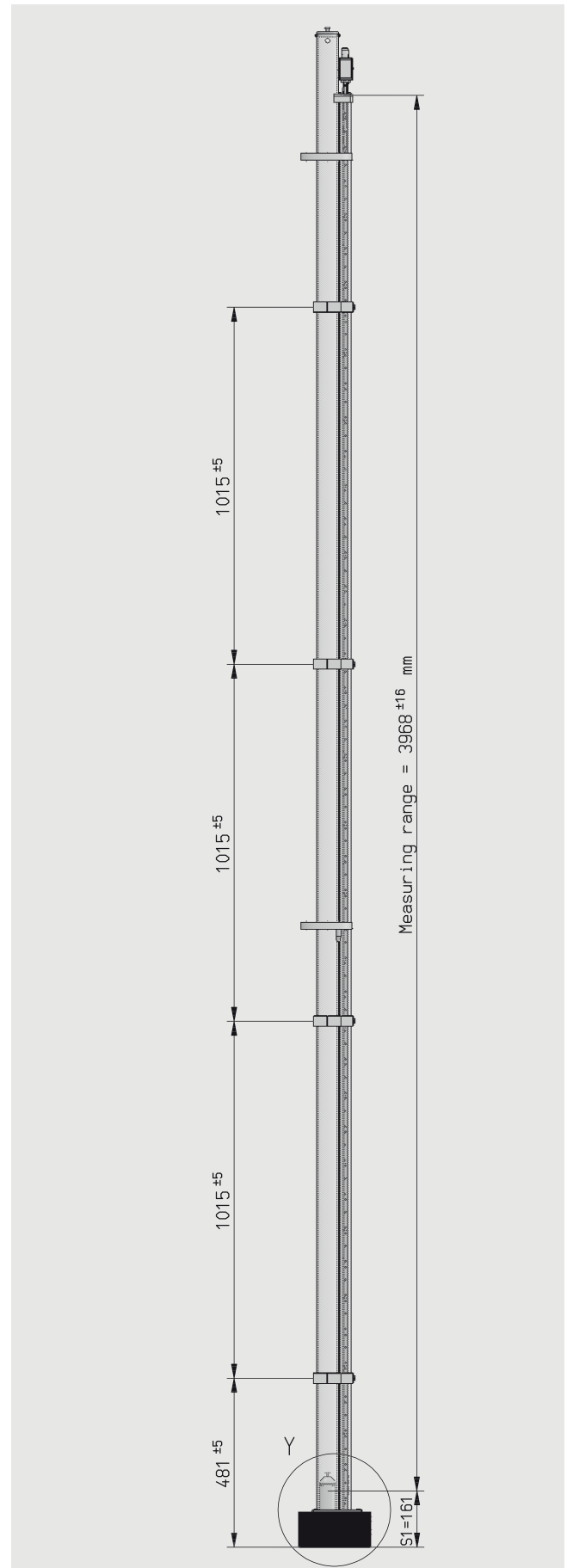


Accident-proof Level Measurement Device, model ALM-D4 Internally mounted for fuel pools

Technical specifications	
Electrical connection	Male plug
Process connection	Mounting flange
Guide tube unit diameter	60.3 mm (2")
Float	Titanium ZTS45/200/SMCO
Contact separation	16 mm (0.63")
Overall resistance of the measuring chain	< 500 Ohm
Connection cable to transmitter	Available on request
Control unit	Available on request
Mounting position	Vertical
Material	Stainless steel
Chemical resistance	Boron (B-10 32%) = 1750 ppm Chloride = 0.2 mg/kg NaOH = 0.5•wt % Na2S2O3 = 3.5•wt %

Normal operating conditions	
Temperature range	0 °C to 70 °C (32 °F to 158 °F)
Pressure	7 bar (0.7 MPa) abs.
Operating time	16 years
Humidity	100%
Radiation resistance	2.5 kGy (250 kRad) per year
Response time	< 1 s
Accuracy (for 200 mm measuring range)	≤ 16 mm (0.05 ft)

Accident conditions	
Maximum temperature	156 °C (312 °F)
Maximum pressure	5.5 bar (0.55 MPa) abs.
Humidity	100%
Radiation resistance	5.05 MGy (505 MRad) Dose rate 5kGy/h (0.5 MRad/h) (1 year)
Mechanical stress	Load test 1.68g (3 axis) Excitation type: Sine sweep Frequency: 2..50 Hz Displacement: 10 mm (0.03 ft), 1 Oct./min. Load test 2.6g (3 axis) Excitation type: Sine sweep Frequency: 2..100 Hz Displacement: 10 mm (0.03 ft), 10 Oct./min.
Response time	< 30 s
Pollution severity	3.0 kg MD2 insulation material for pipes (glass wool material) 53 g concrete particles (<250 μm) 53 g paint and coating particles (solid matter) 80 g Microtherm, microporous insulation material 300 l clear water
Accuracy (for 3968 mm measuring range) under accident conditions	30 mm (0.1 ft)



Accident-proof Level Measurement Device, model ALM-D5 Internally mounted with redundant sensor

Technical specifications

Electrical connection	Male plug
Process connection	Mounting flange
Guide tube unit diameter	60.3 mm (2")
Float	Titanium ZTS45/200/SMCO
Contact separation	16 mm (0.63")
Overall resistance of the measuring chain	< 500 Ohm
Connection cable to transmitter	Available on request
Control unit	Available on request
Mounting position	Vertical
Material	Stainless steel
Chemical resistance	Boron (B-10 32%) = 1750 ppm Chloride = 0.2 mg/kg NaOH = 0.5•wt % Na2S2O3 = 3.5•wt %

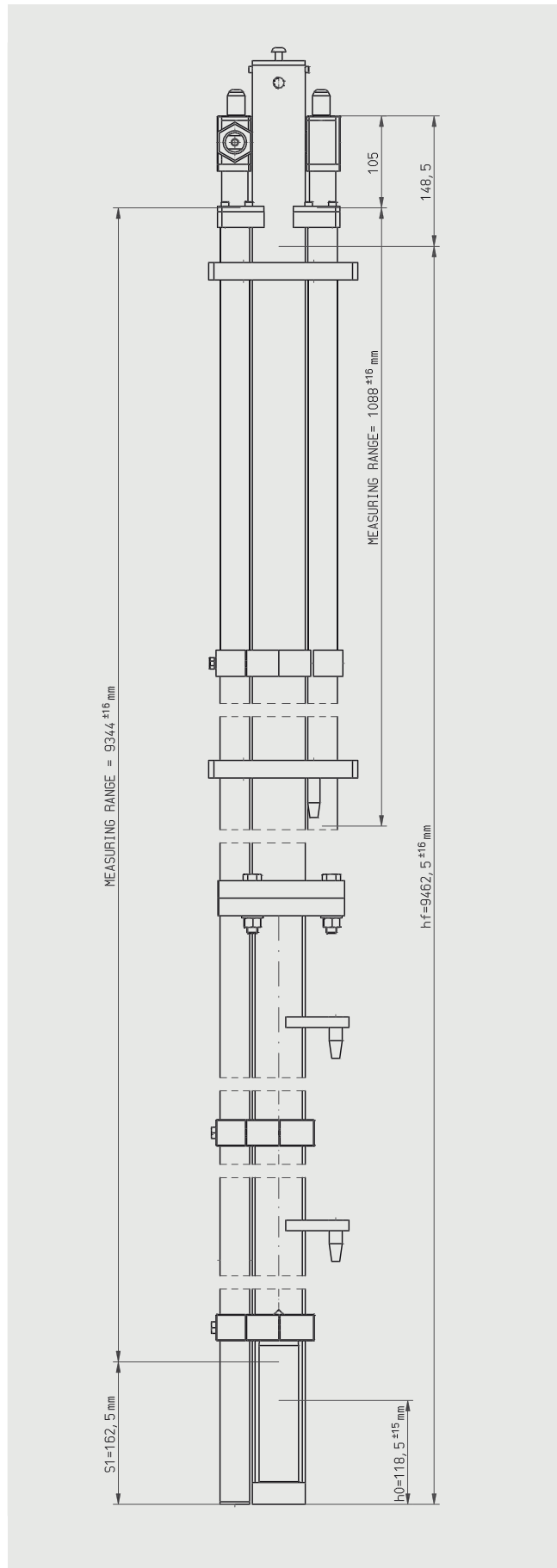
Normal operating conditions

Temperature range	0 °C to 70 °C (32 °F to 158 °F)
Pressure	7 bar (0.7 MPa) abs.
Operating time	16 years
Humidity	100%
Radiation resistance	2.5 kGy (250 kRad) per year
Response time	< 1 s
Accuracy	
Long Range/Short Range	107 mm / 19 mm (0.35 ft / 0.06 ft)

Accident conditions

Maximum temperature	156 °C (312 °F)
Maximum pressure	7.5 bar (0.75 MPa) abs.
Humidity	100%
Radiation resistance	5.05 MGy (505 MRad) Dose rate 5kGy/h (0.5 MRad/h) (1 year)
Mechanical stress	Load test 1.68g (3 axis) Excitation type: Sine sweep Frequency: 2..50 Hz Displacement: 10 mm (0.03 ft), 1 Oct./min. Load test 2.6g (3 axis) Excitation type: Sine sweep Frequency: 2..100 Hz Displacement: 10 mm (0.03 ft), 10 Oct./min.
Response time	< 30 s
Pollution severity	3.0 kg MD2 insulation material for pipes (glass wool material) 53 g concrete particles (<250 µm) 53 g paint and coating particles (solid matter) 80 g Microtherm, microporous insulation material 300 l clear water

Accuracy (for 9344 mm / 1088 mm measuring range) under accident conditions
Long Range/Short Range 481 mm / 68 mm (1.58 ft / 0.22 ft)



Accident-proof Level Measurement Device, model ALM-D6 Internally mounted with cascaded sensors

Technical specifications

Electrical connection	Male plug
Process connection	Welding bracket
Guide tube unit diameter	60.3 mm (2")
Float	Titanium ZTS45/200/SMCO
Contact separation	16 mm (0.63")
Overall resistance of the measuring chain	< 500 Ohm
Connection cable to transmitter	Available on request
Control unit	Available on request
Mounting position	Vertical
Material	Stainless steel
Chemical resistance	Boron (B-10 32%) = 1750 ppm Chloride = 0.2 mg/kg NaOH = 0.5•wt % Na ₂ S ₂ O ₃ = 3.5•wt %

Normal operating conditions

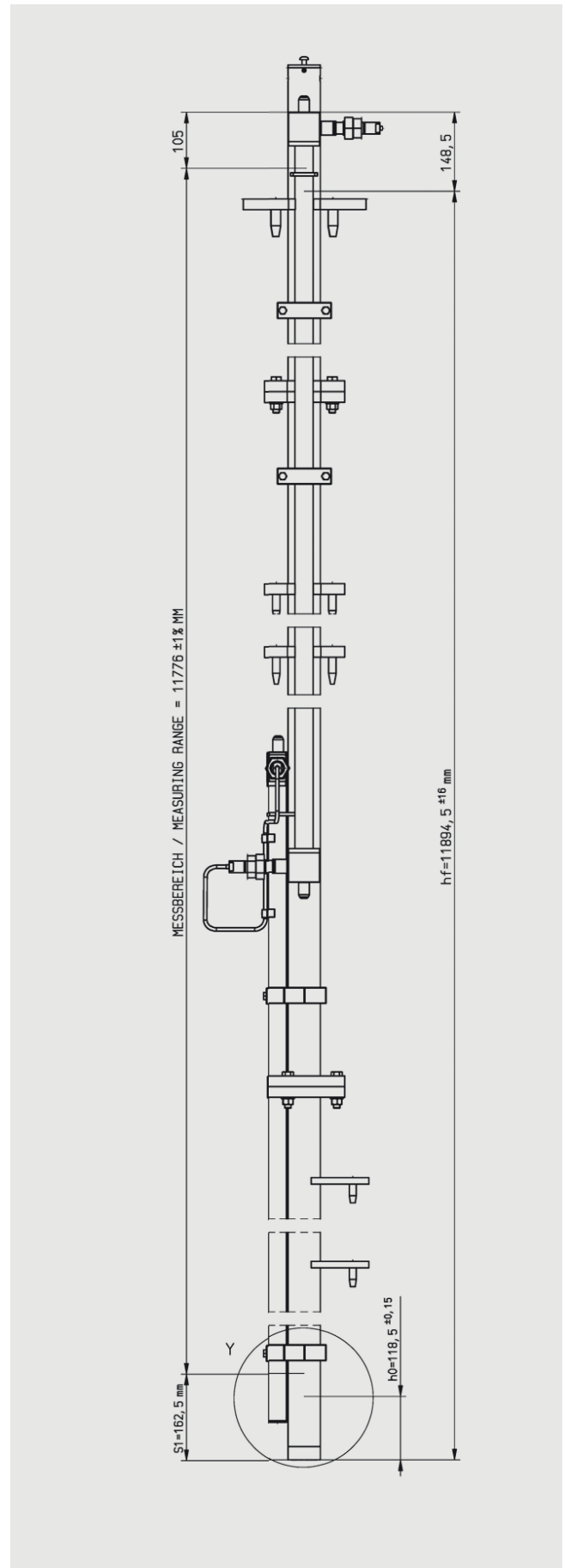
Temperature range	0 °C to 70 °C (32 °F to 158 °F)
Pressure	7 bar (0.7 MPa) abs.
Operating time	16 years
Humidity	100%
Radiation resistance	2.5 kGy (250 kRad) per year
Response time	< 1 s
Accuracy Long Range	107 mm (0.35 ft)

Accident conditions

Maximum temperature	156 °C (312 °F)
Maximum pressure	7.5 bar (0.75 MPa) abs.
Humidity	100%
Radiation resistance	5.05 MGy (505 MRad) Dose rate 5kGy/h (0.5 MRad/h) (1 year)
Mechanical stress	Load test 1.68g (3 axis) Excitation type: Sine sweep Frequency: 2..50 Hz Displacement: 10 mm (0.03 ft), 1 Oct./min. Load test 2.6g (3 axis) Excitation type: Sine sweep Frequency: 2..100 Hz Displacement: 10 mm (0.03 ft), 10 Oct./min.
Response time	< 30 s
Pollution severity	3.0 kg MD2 insulation material for pipes (glass wool material) 53 g concrete particles (<250 µm) 53 g paint and coating particles (solid matter) 80 g Microtherm, microporous insulation material 300 l clear water

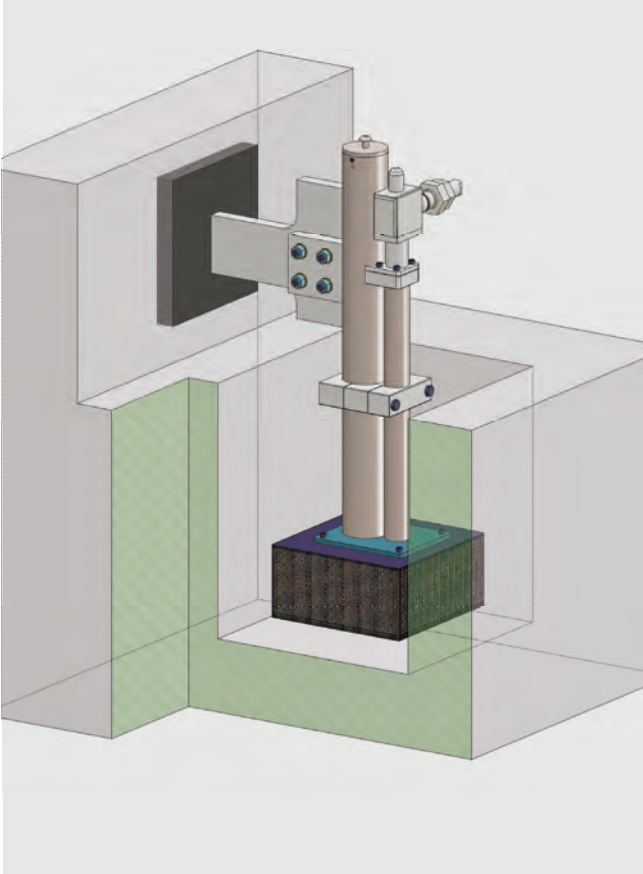
Accuracy (for 11776 mm measuring range) under accident conditions Long Range/Short Range

481 mm (1.58 ft)



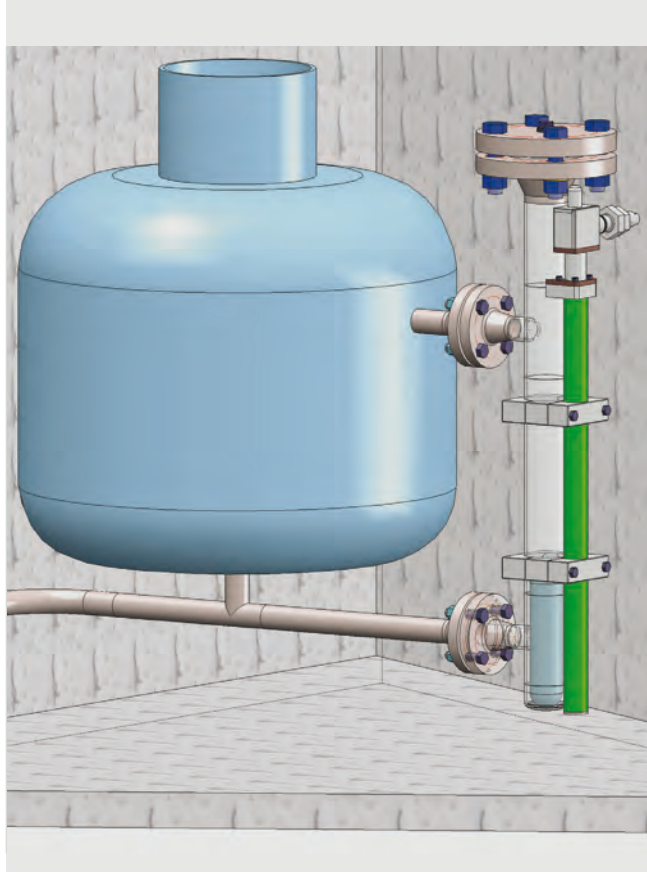
Application examples

Example for ALM-D1



The level measurement devices ALM-D1 is used to detect breaks in the pipes or leaks on valves and pumps of the Residual Heat Removal System and Containment Heat Removal System during normal operation, outages and accidents throughout the complete NPP life cycle.

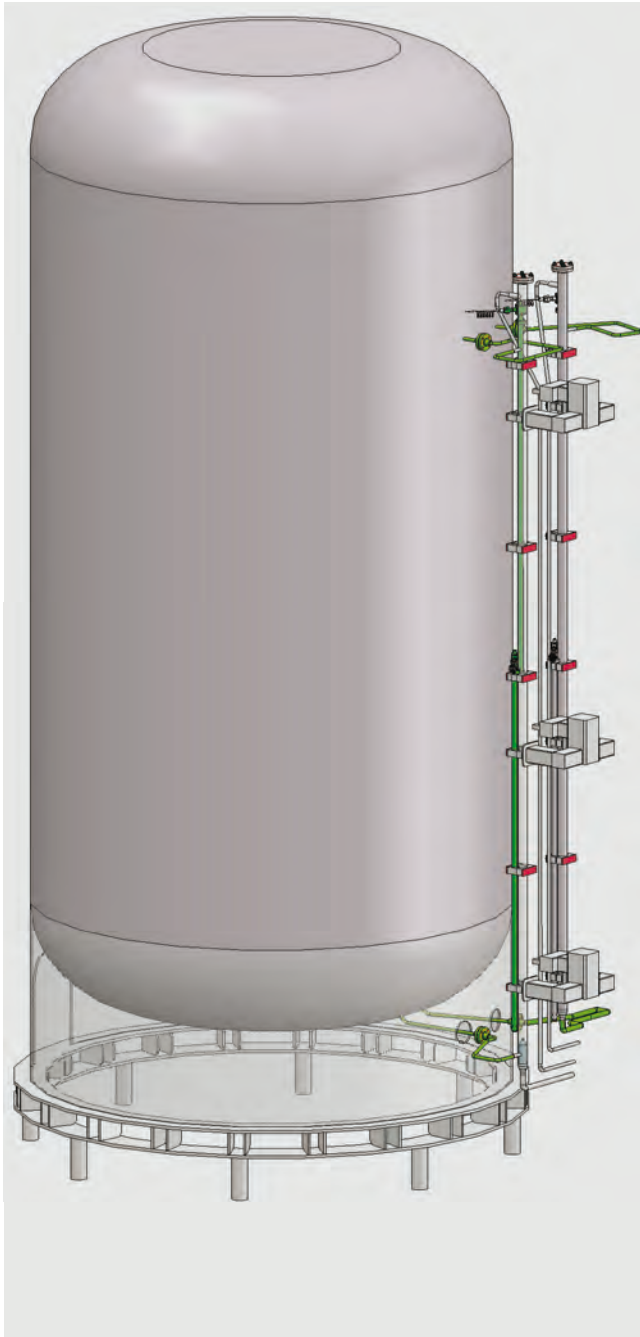
Example for ALM-D2



The purpose of the level measurement device ALM-D2 at the Flooding Valve Outlet is to reliably detect any leakage and accidental or intentional triggering of the passive flooding device valves. The valves discharge the water from the IRWST into the containment's spreading area. Premature presence of water must be avoided during normal operation of the plant due to the risk of generation of hydrogen should the molten core flow into the already flooded spreading area. During a severe accident, the passive flooding valve is essential for cooling the escaped corium melt in the spreading area.

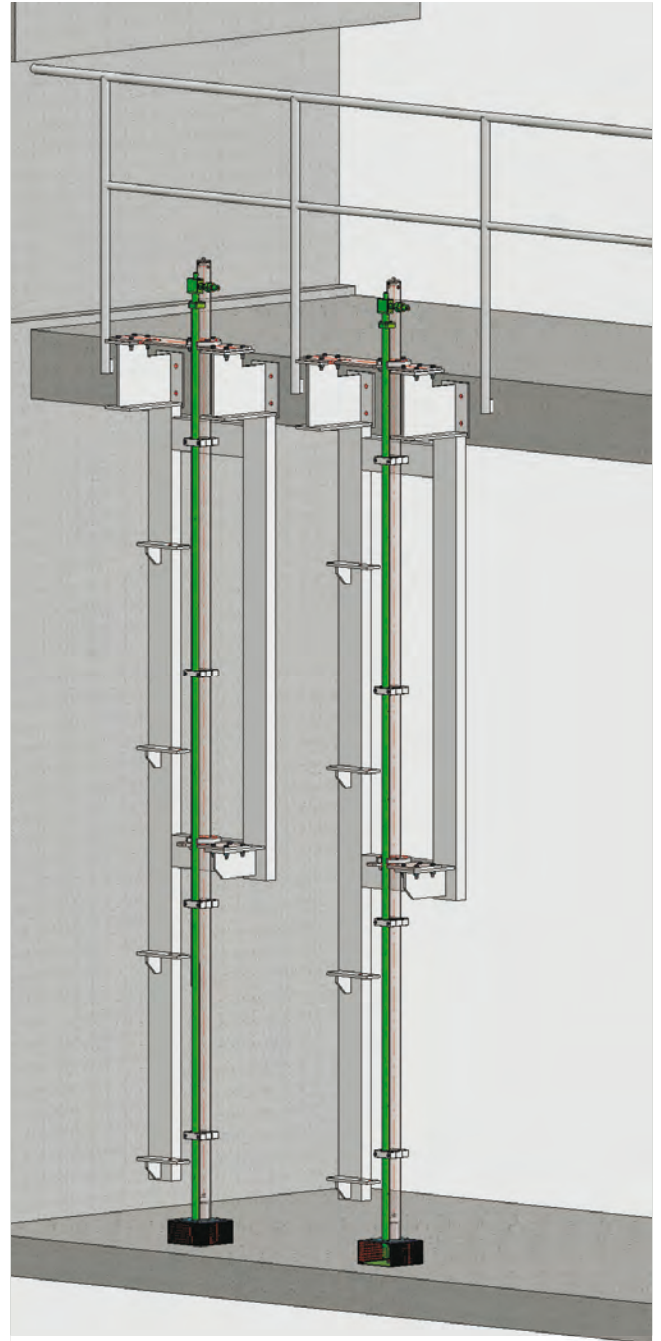
Application examples

Example for ALM-D3



Level measurement devices ALM-D3 serve to monitor the level of scrubbing liquid in Venturi Scrubber Vessel during normal operation, outages and accidents throughout the complete NPP life cycle.

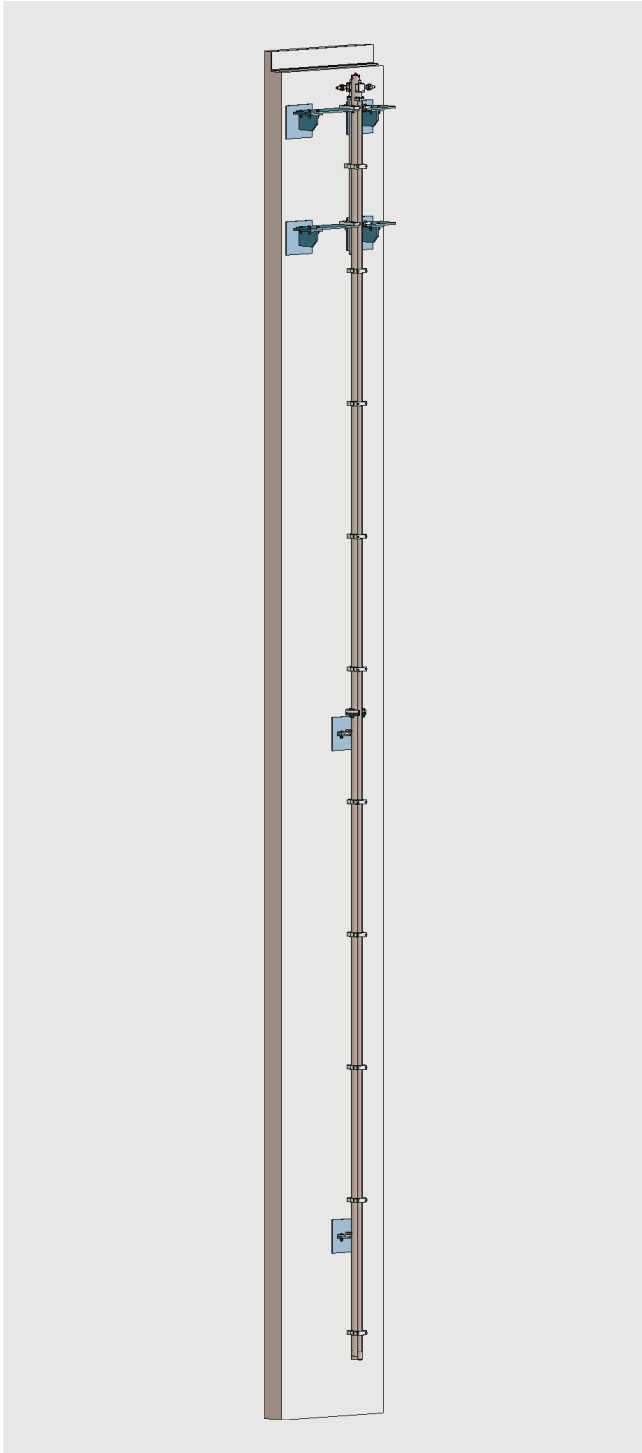
Example for ALM-D4



The task of the accident-proof level measurement devices ALM-D4 is to reliably monitor the IRWST water level during outages, normal plant operations and in case of DBC events or severe accident. Furthermore the system has to provide means of calibrations and verification during maintenance periods.

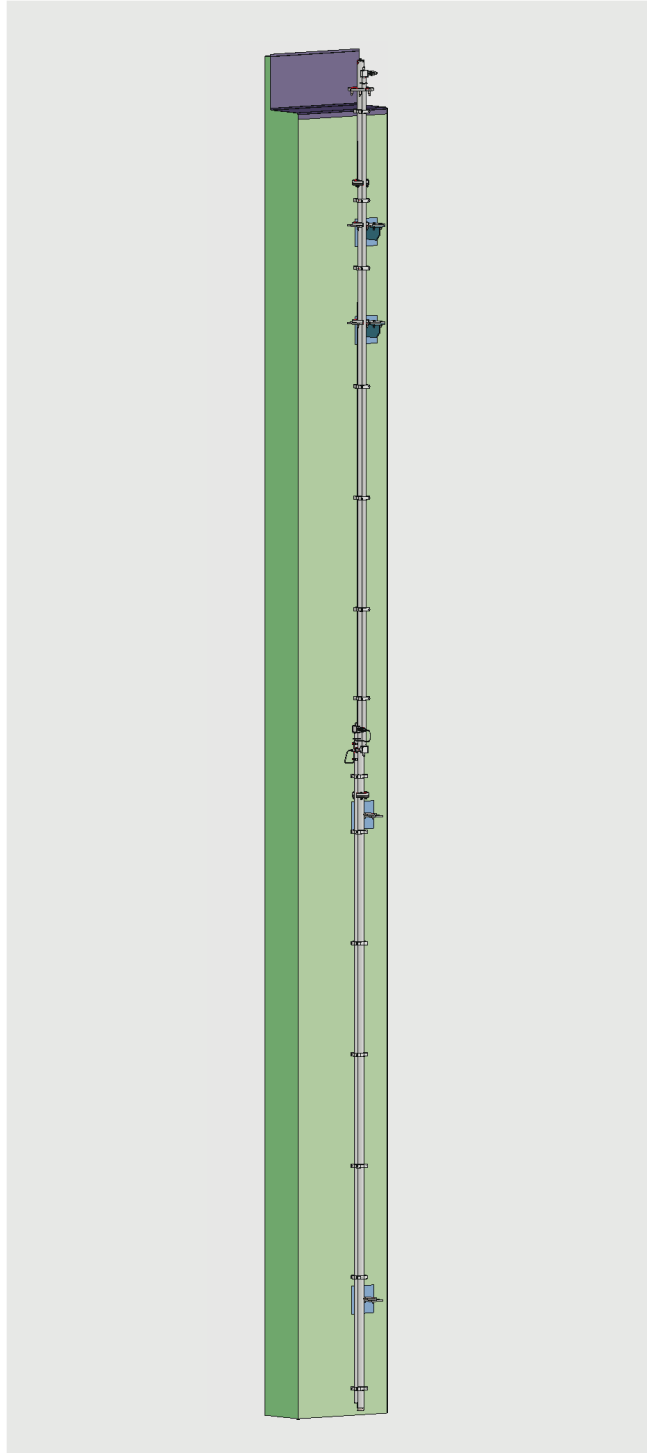
Application examples

Example for ALM-D5



Accident-proof level measurement devices ALM-D5 reliably monitor the level of coolant in the fuel pools. Level measurement devices will be installed in the fuel pools and the pools will be flooded and at no stage be emptied again. These devices should function reliably during normal operations as well as during and after a severe accident throughout the complete NPP life cycle.

Example for ALM-D6



The purpose of the level measurement device ALM-D6 is to supply a continuous measurement of the water level during refueling outage in normal plant operating conditions as well as during the LUHS-accident in empty and flooded RCAV.

Bypass level indicator With magnetic display Model BNA for nuclear power plants

KSR data sheet BNA for NPP



Applications

- Continuous level indication without power supply
- Indication of the level proportional to height
- Individual design and corrosion resistant materials make the products suitable for a broad range of applications
- Chemical, petrochemical industry, oil and natural gas extraction (on- and offshore), shipbuilding, machine building, power generating equipment, power plants
- Process water and drinking water treatment, food industry, pharmaceutical industry

Special features

- Process- and system-specific production
- Operating limits:
 - Operating temperature: $T = -196 \dots +450 \text{ }^\circ\text{C}$
 - Operating pressure: $P = \text{vacuum to } 400 \text{ bar}$
 - Limit density: $\rho \geq 340 \text{ kg/m}^3$
- Wide variety of different process connections and materials
- Mounting of level sensors and magnetic switches possible as an option
- Explosion-protected versions

Description

The bypass level indicator model BNA consists of a bypass chamber, which, as a communicating tube, is connected laterally to a vessel via at least 2 process connections (flanged, threaded or welded). Through this type of arrangement, the level in the bypass chamber corresponds to the level in the vessel. The float with a built-in permanent magnetic system, which is mounted within the bypass chamber, transmits the liquid level, contact-free, to the magnetic display mounted to the outside of the bypass chamber. In this are fitted, at 10 mm intervals, two-coloured plastic rollers or stainless steel flaps with bar magnets.



Bypass level indicator, model BNA with level sensor and magnetic switch

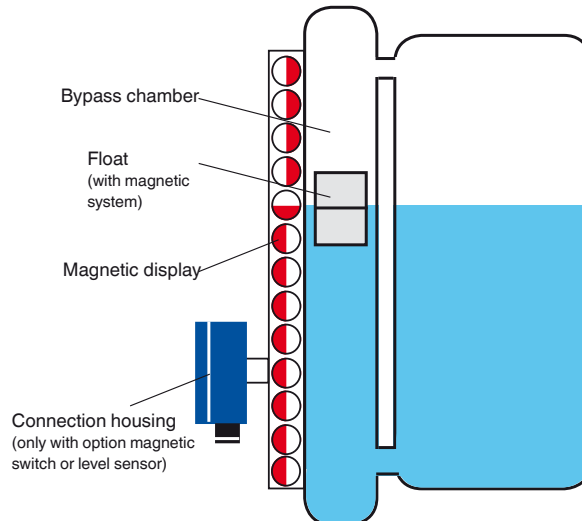
Through the magnetic field of the permanent magnetic system in the float, the display elements, through the wall of the bypass chamber, are turned through 180° . For an increasing level from white to red; for a falling level from red to white.

Thus the bypass level indicator clearly displays the level of a vessel **without power supply**.

Further special features

- Simple, robust and solid design, long service life
- Bypass chamber and float from stainless steel 1.4571, 1.4404 or special materials
- Pressure- and gas-tight separation between measuring and display chamber
- Measuring and indicating of the level of aggressive, combustible, toxic, hot and contaminated media
- Functioning of the magnetic display guaranteed even in the case of power failures
- By using a variety of corrosion-resistant materials, applicable for virtually all industrial applications
- Continuous measurement of levels, independent of physical and chemical changes of the media such as: Foaming, conductivity, dielectric constant, vapours, bubble formation, boiling effects
- Interface-layer level measurement from Δ density 100 kg/m^3
- Special versions: Food compliant, coatings, liquid gas, heating jacket
- Nuclear qualified IEEE (E1)

Illustration of the principle

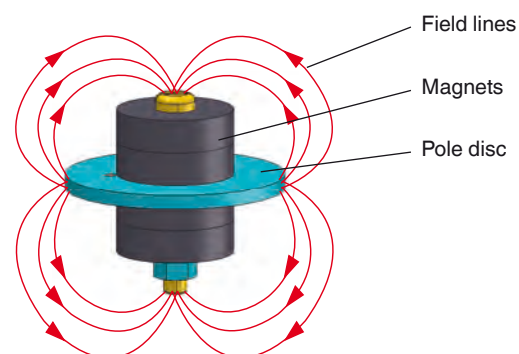


Design and operating principle

- In a communicating bypass chamber mounted to the side of a vessel a float moves with the level of the medium to be measured.
- The magnetic field of the radial-symmetric magnetic system positioned in the float activates the magnetic display attached to the outside of the bypass chamber as well as the switching and measuring elements.

Magnetic system

The magnetic system is assembled from a pole disc and various magnets. These can be individually adapted to the different chamber dimensions and for temperatures up to $450 \text{ }^\circ\text{C}$.



Model overview

Bypass level indicator	Approval								Material	Max. pressure in bar	Medium temperature in °C
	with-out	Ex c	Ex c, GL	Ex c, DNV	GL	DNV	ABS	IEEE 344			
Standard version, model BNA-S	x	x	x	x	x	x	x	x	Stainless steel 1.4571 (316Ti), 1.4404 (316L), 1.4401/1.4404 (316/316L)	64	-196 ... +450
High-pressure version, model BNA-H	x	x	x	x	x	x		*	Stainless steel 1.4571 (316Ti), 1.4404 (316L)	400	-196 ... +450
DUPlus version, standard, model BNA-SD	x	x						*	Stainless steel 1.4571 (316Ti), 1.4404 (316L), 1.4401/1.4404 (316/316L)	64	-196 ... +450
DUPlus version, high pressure, model BNA-HD	x	x						*	Stainless steel 1.4571 (316Ti), 1.4404 (316L), 1.4401/1.4404 (316/316L)	160	-196 ... +450
Special materials, model BNA-X	x	x						*	Stainless steel 6Mo 1.4547 (UNS S31254)	250	-196 ... +450
	x	x	x	x	x	x		*	Hastelloy C276 (2.4819)	160	-196 ... +450

* IEEE 344 on request

Ex approvals

Explosion protection	Ignition protection type	Model	Zone	Approval number
ATEX	Ex c	BNA-S, BNA-H, BNA-SD, BNA-HD, BNA-X	Zone 0/1, gas	KEMA 02 ATEX 2106 X II 1/2 G c T1 ... T6
	Ex c + GL	BNA-S, BNA-H, BNA-X	Zone 0/1, gas	KEMA 02 ATEX 2106 X II 1/2 G c T1 ... T6 + GL - 35 949 - 87
	Ex c + DNV	BNA-S, BNA-H, BNA-X	Zone 0/1, gas	KEMA 02 ATEX 2106 X II 1/2 G c T1 ... T6 + DNV - A-11451

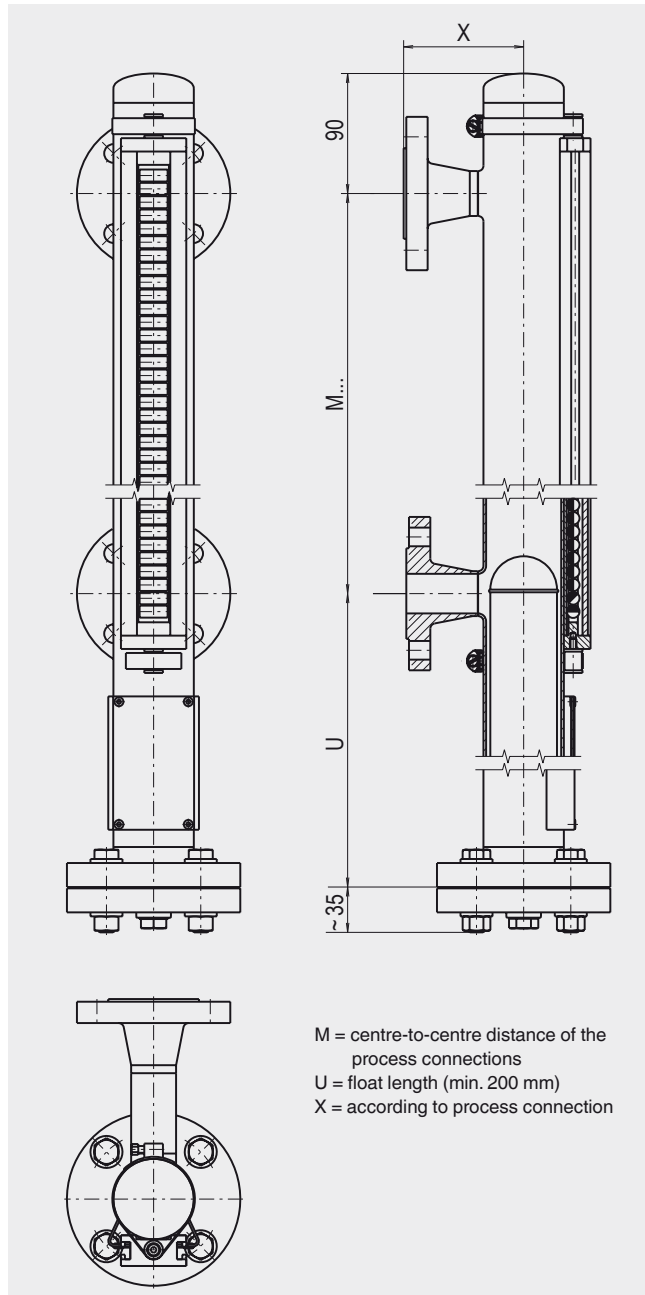
Type approval

Approval	Model	Approval number
GL	BNA-S, BNA-H, BNA-X	GL - 35 949 - 87 HH
DNV	BNA-S, BNA-H, BNA-X	DNV A-11451
ABS	BNA-S	ABS 07-HG218425-1-PDA
GOST-R	all	0959333
IEEE 344	BNA-S	-

Further approvals on request

Bypass level indicator, standard version, model BNA-S

Bypass chamber from stainless steel



M = centre-to-centre distance of the process connections
 U = float length (min. 200 mm)
 X = according to process connection

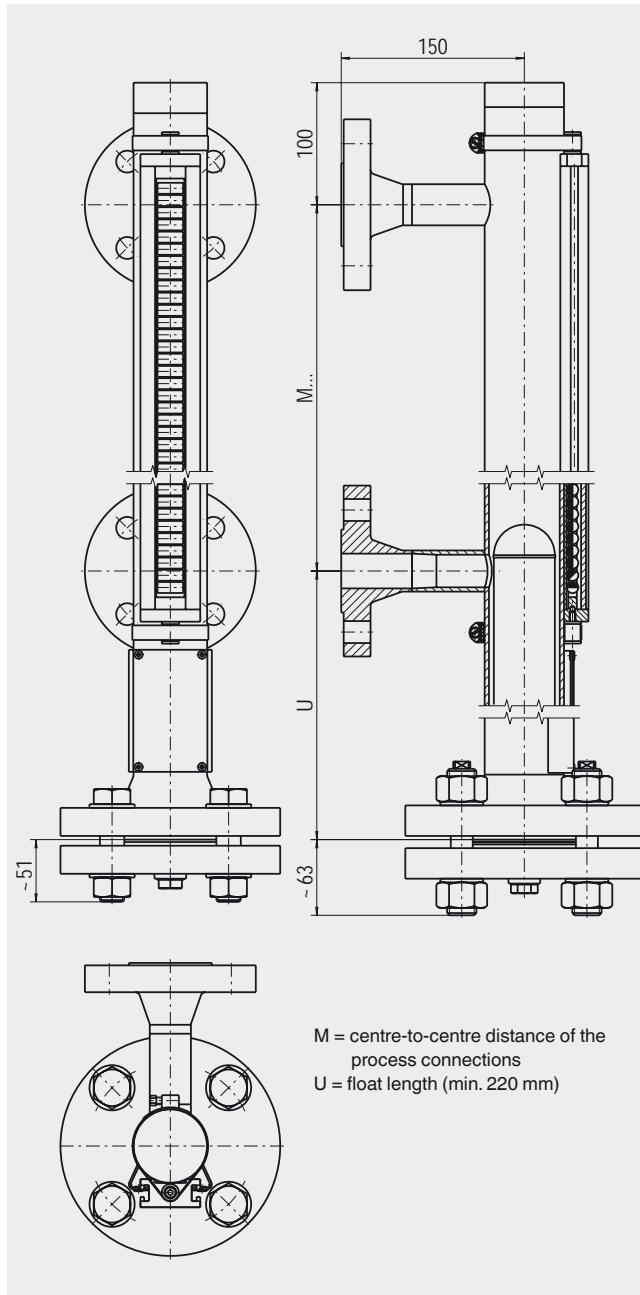
Specifications

Bypass chamber	<ul style="list-style-type: none"> Ø 60.3 x 2 mm, max. 40 bar Ø 60.3 x 2.77 mm, max. 64 bar
Chamber end top	<ul style="list-style-type: none"> Flat top or flange connection Options: <ul style="list-style-type: none"> ■ Vent screw ■ Vent valve ■ Vent flange
Chamber end bottom	<ul style="list-style-type: none"> Flange connection Options: <ul style="list-style-type: none"> ■ Drain plug ■ Drain valve ■ Drain flange
Process connections	<ul style="list-style-type: none"> 2 x lateral Flange EN 1092-1, DN 10 - DN 100, PN 6 - PN 63 Flange DIN, DN 10 - DN 100, PN 6 - PN 64 Flange ANSI B 16.5, 1/2" - 4", class 150 - class 600 Weld stub 1/2" - 1" Threaded bushing G/NPT 1/2" - 1" Threaded nipple G/NPT 1/2" - 1"
Centre-to-centre distance	Min. 150 mm to max. 6,000 mm (larger distances on request)
Material	Stainless steel 1.4571 (316Ti), 1.4404 (316L), 1.4401/1.4404 (316/316L)
Nominal pressure	Max. 64 bar
Temperature range	-196 ... +450 °C
Float	Cylindrical float, model BFT-H or corrugated float, model BFT-S, see data sheet LM 10.02
Magnetic display	<ul style="list-style-type: none"> Standard version, model BMD-S: < 200 °C High-temperature version, model BMD-F: > 200 °C, see data sheet LM 10.03
Level sensor	Reed sensor, model BLR, see data sheet LM 10.04
Magnetic switches	Magnetic switch, model BGU, see data sheet LM 10.06
Approvals	Ex c, GL, DNV, ABS, GOST-R, IEEE

Special versions on request

Bypass level indicator, high-pressure version, model BNA-H

Bypass chamber from stainless steel



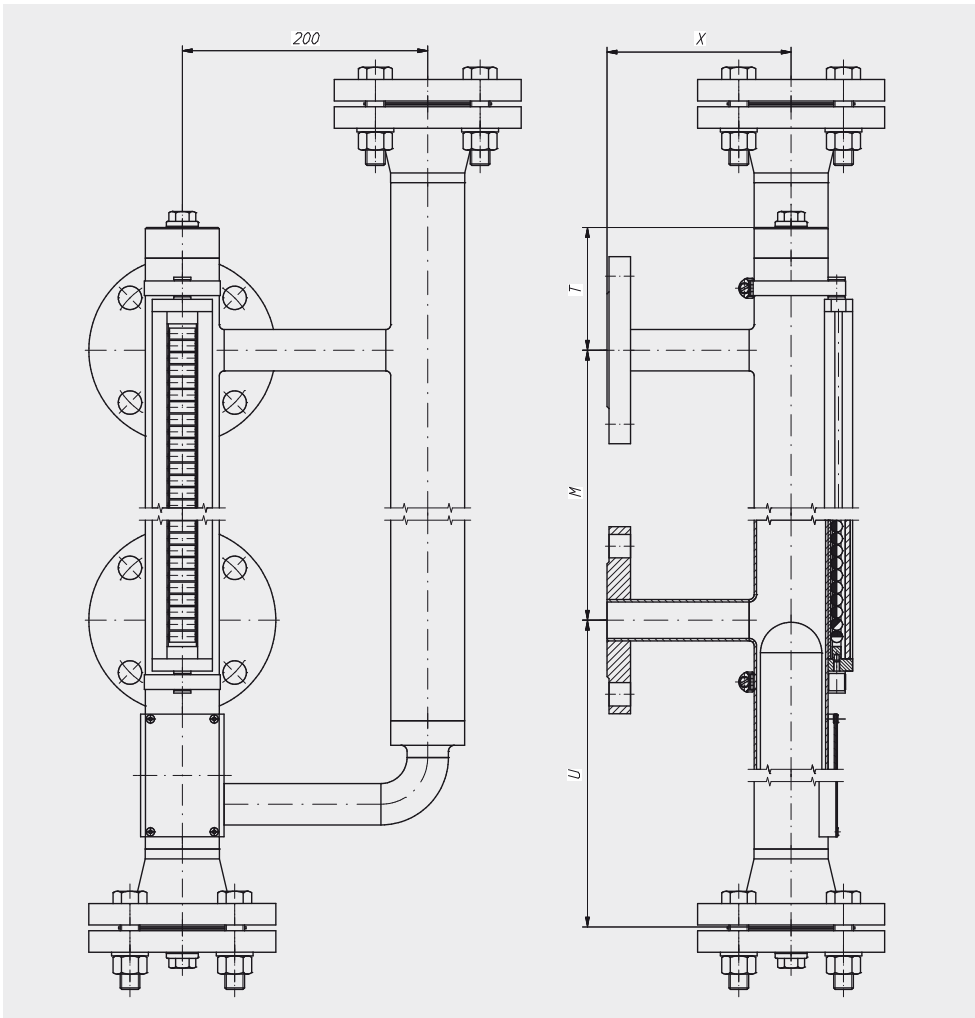
Specifications

Bypass chamber	Stainless steel 1.4571: Ø 60.3 x 3.91 mm, max. 160 bar Ø 76.1 x 5 mm, max. 160 bar Ø 71 x 7.5 mm, max. 250 bar Ø 76.1 x 10 mm, max. 420 bar Stainless steel 1.4404: Ø 60.3 x 3.91 mm, max. 100 bar Ø 60.3 x 5.54 mm, max. 150 bar Ø 73 x 7.01 mm, max. 150 bar
Chamber end top	Flat top or flange connection Options: ■ Vent screw ■ Vent valve ■ Vent flange
Chamber end bottom	Flange connection Options: ■ Drain plug ■ Drain valve ■ Drain flange
Process connections	2 x lateral Flange EN 1092-1, DN 10 - DN 100, PN 63 - PN 400 Flange DIN, DN 10 - DN 100, PN 64 - PN 400 Flange ANSI B 16.5, 1/2" - 4", class 600 - class 2,500 Weld stub 1/2" - 1" Threaded bushing G/NPT 1/2" - 1" Threaded nipple G/NPT 1/2" - 1"
Centre-to-centre distance	Min. 150 mm to max. 6,000 mm (larger distances on request)
Material	Stainless steel 1.4571 (Ø 60.3 x 3.91 mm, Ø 76.1 x 5 mm, Ø 71 x 7.5 mm, Ø 76.1 x 10 mm) or stainless steel 1.4404 (Ø 60.3 x 3.91 mm, Ø 60.3 x 5.54 mm, Ø 73 x 7.01 mm)
Nominal pressure	Max. 400 bar
Temperature range	-196 ... +450 °C
Float	Cylindrical float, model BFT-H, ball-segment float, model BFT-K or foam float, model BFT-F, see data sheet LM 10.02
Magnetic display	Standard version, model BMD-S: < 200 °C High-temperature version, model BMD-F: > 200 °C, see data sheet LM 10.03
Level sensor	Reed sensor, model BLR, see data sheet LM 10.04
Magnetic switches	Magnetic switch, model BGU, see data sheet LM 10.06
Approvals	Ex c, GL, DNV, GOST-R

Special versions on request

Bypass level indicator, DUPlus version, standard, model BNA-SD

Bypass chamber from stainless steel



Specifications

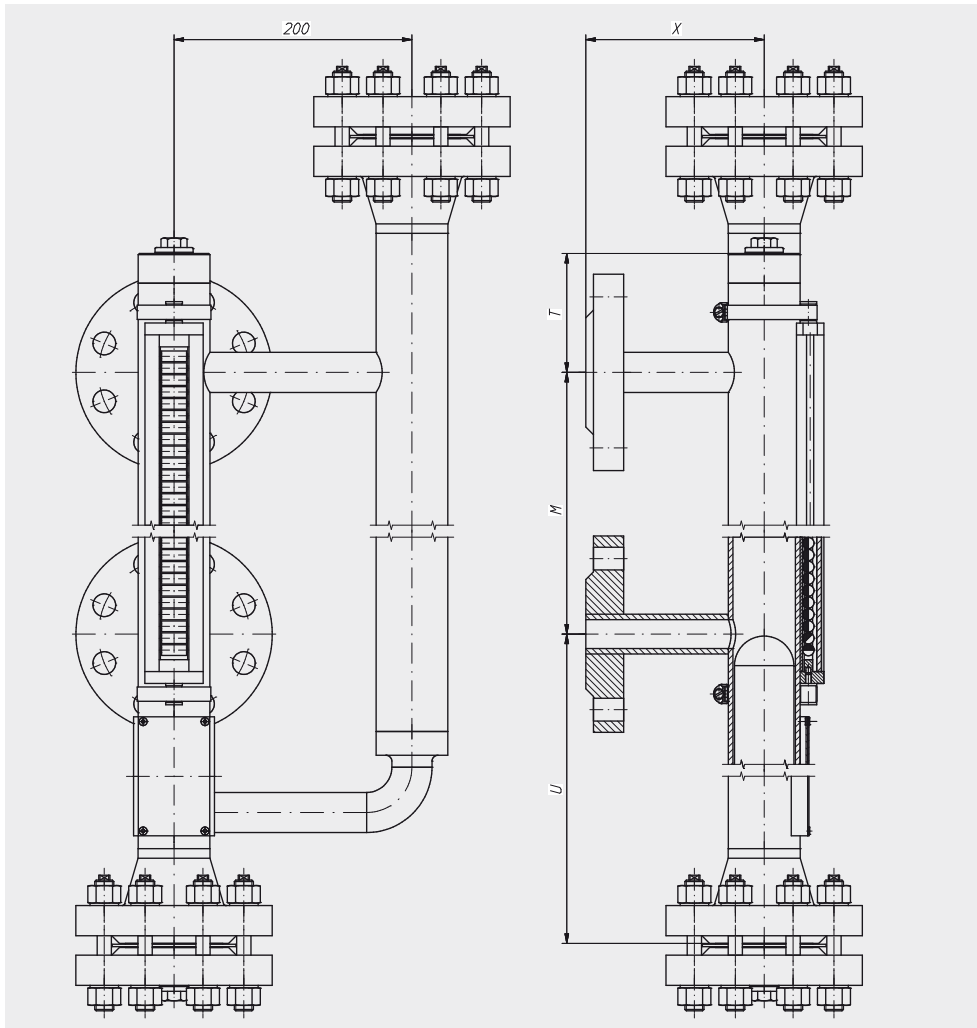
Bypass chamber	Ø 60.3 x 2 mm, max. 40 bar Ø 60.3 x 2.77 mm, max. 64 bar
Chamber end top	Flange connection Options: ■ Vent screw ■ Vent valve ■ Vent flange
Chamber end bottom	Flat top or flange connection Options: ■ Drain plug ■ Drain valve ■ Drain flange
Process connections	2 x lateral Flange DIN, DN 10 - DN 100, PN 6 - PN 64 Flange ANSI B 16.5, 1/2" - 4", class 150 - class 600 Weld stub 1/2" - 1" Threaded bushing G/NPT 1/2" - 1" Threaded nipple G/NPT 1/2" - 1"
External sensor connection	Flange EN 1092-1, DN 50, PN 6 - PN 64 Flange DIN, DN 50, PN 6 - PN 64 Flange ANSI B 16.5, 2" class 150 - class 600 Female thread G/NPT 3/4" - 2"

Centre-to-centre distance	Min. 150 mm to max. 6,000 mm (larger distances on request)
Material	Stainless steel 1.4571, 1.4404 or 1.4401/1.4404
Nominal pressure	Max. 64 bar
Temperature range	-196 ... +450 °C
Float	Cylindrical float, model BFT-H or corrugated float, model BFT-S, see data sheet LM 10.02
Magnetic display	Standard version, model BMD-S: < 200 °C High-temperature version, model BMD-F: > 200 °C, see data sheet LM 10.03
Level sensor	Reed sensor, model BLR, see data sheet LM 10.04
Magnetic switches	Magnetic switch, model BGU, see data sheet LM 10.06
Approvals	Ex c, GOST-R

Special versions on request

Bypass level indicator, DUPlus version, high pressure, model BNA-HD

Bypass chamber from stainless steel



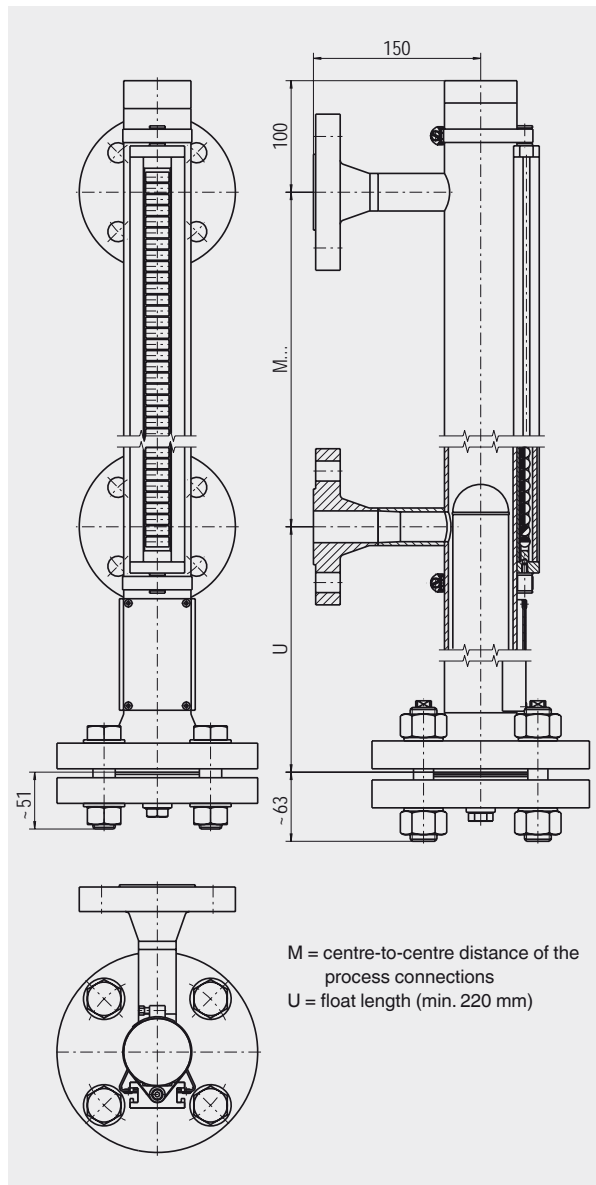
Specifications	
Bypass chamber	Ø 60.3 x 3.91 mm, max. 160 bar
Chamber end top	Flange connection Options: ■ Vent screw ■ Vent valve ■ Vent flange
Chamber end bottom	Flat top or flange connection Options: ■ Drain plug ■ Drain valve ■ Drain flange
Process connections	2 x lateral Flange DIN, DN 10 - DN 100, PN 64 - PN 160 Flange ANSI B 16.5, 1/2" - 4", class 600 - class 1,500 Weld stub 1/2" - 1" Threaded bushing G/NPT 1/2" - 1" Threaded nipple G/NPT 1/2" - 1"
External sensor connection	Flange EN 1092-1, DN 50, PN 6 - PN 160 Flange DIN, DN 50, PN 6 - PN 160 Flange ANSI B 16.5, 2" class 150 - class 1,500 Female thread G/NPT 3/4" - 2"

Centre-to-centre distance	Min. 150 mm to max. 6,000 mm (larger distances on request)
Material	Stainless steel 1.4571, 1.4404 or 1.4401/1.4404
Nominal pressure	Max. 160 bar
Temperature range	-196 ... +450 °C
Float	Cylindrical float, model BFT-H, corrugated float, model BFT-S, ball-segment float, model BFT-K or foam float, model BFT-F, see data sheet LM 10.02
Magnetic display	Standard version, model BMD-S: < 200 °C High-temperature version, model BMD-F: > 200 °C, see data sheet LM 10.03
Level sensor	Reed sensor, model BLR, see data sheet LM 10.04
Magnetic switches	Magnetic switch, model BGU, see data sheet LM 10.06
Approvals	Ex c, GOST-R

Special versions on request

Bypass level indicator, special materials, model BNA-X

Bypass chamber from Titanium, Hastelloy or stainless steel 6Mo



Specifications

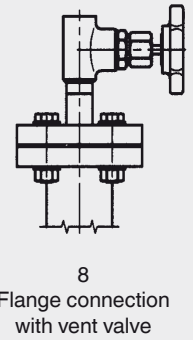
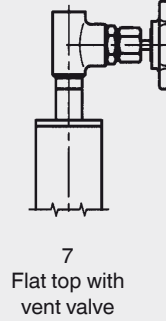
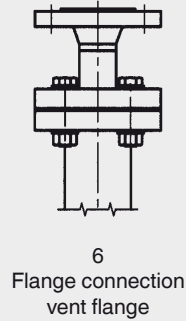
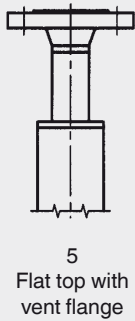
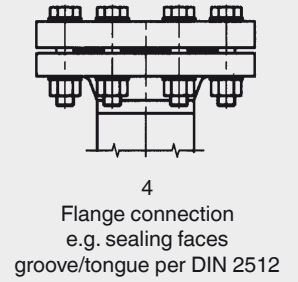
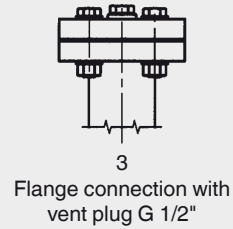
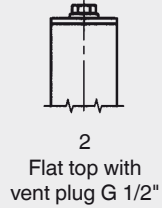
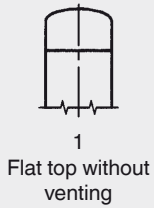
Material ¹⁾	Hastelloy C276	Stainless steel 6Mo 1.4547 (UNS S31254)
Bypass chamber	Ø 60.3 x 2.77 mm, max. 64 bar Ø 60.3 x 3.91 mm, max. 160 bar	Ø 60.3 x 2.77 mm, max. 64 bar Ø 60.3 x 3.91 mm, max. 160 bar Ø 60.3 x 5.54 mm, max. 250 bar
Chamber end top		
Chamber end bottom		
Process connections (2 x lateral, options see page 15)	Flange EN 1092-1, DN 10 - DN 100, PN 6 - PN 400 Flange DIN, DN 10 - DN 100, PN 6 - PN 400 Flange ANSI B 16.5, 1/2" - 4", class 150 - class 2,500	Flange EN 1092-1, DN 10 - DN 100, PN 63 - PN 400 Flange DIN, DN 10 - DN 100, PN 64 - PN 400 Flange ANSI B 16.5, 1/2" - 4", class 600 - class 2,500
Centre-to-centre distance		
Nominal pressure	Max. 160 bar	Max. 250 bar
Temperature range		
Float		
Magnetic display		
Level sensor		
Magnetic switches		
Approvals	Ex c, GL, DNV, GOST-R	Ex c, GOST-R

1) Other materials on request

Special versions on request

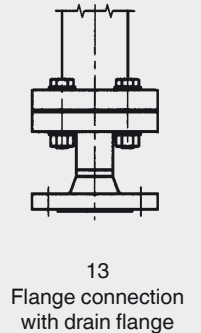
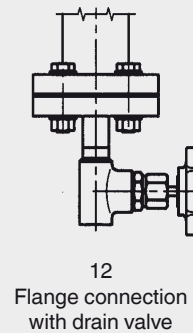
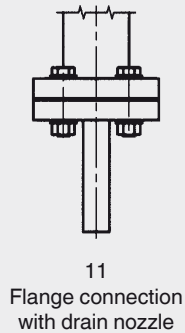
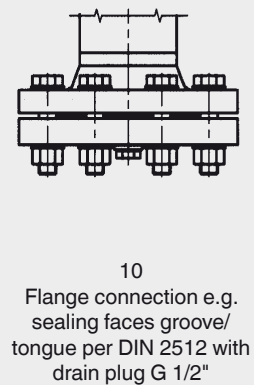
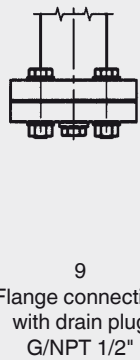
Option bypass chamber end

Bypass chamber end top (examples)



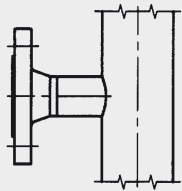
Other ends on request

Bypass chamber end bottom (examples)

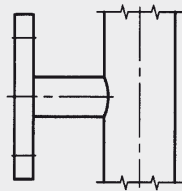


Other ends on request

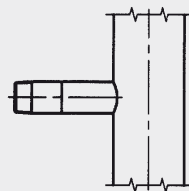
Option process connection



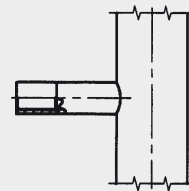
14
Welding neck flange
up to DN 25



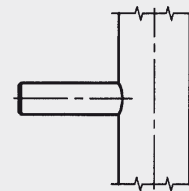
15
Blind flange
above DN 32



16
Threaded coupling
GN ... (male thread)

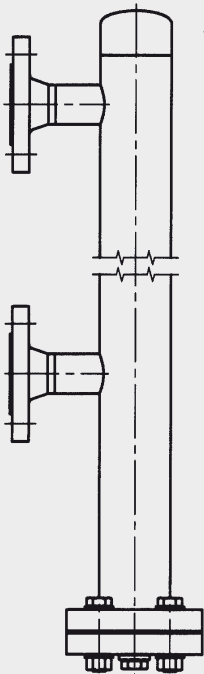


17
Threaded coupling
GM ... (female thread)

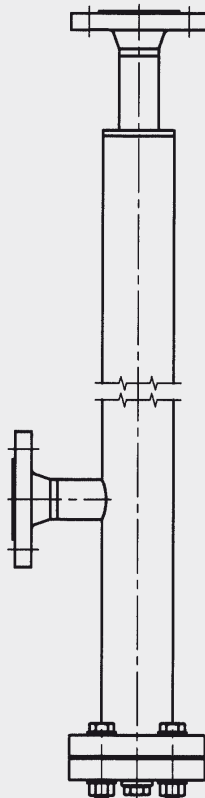


18
Weld stub S ...

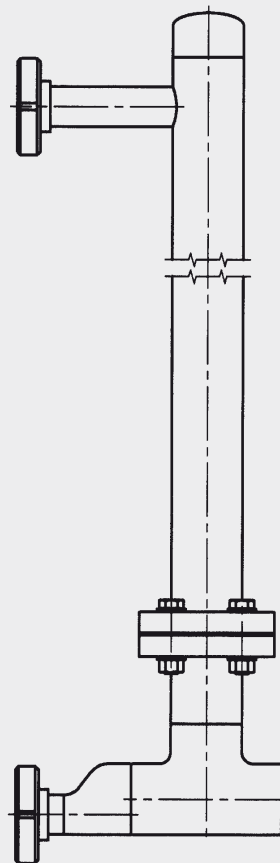
Examples



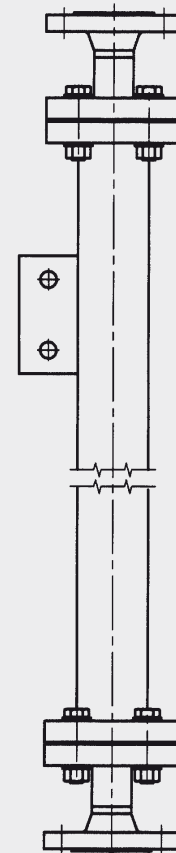
19
Standard version
Process connections
2 x lateral



20
1 process connection lateral
1 process connection vertical
(top)



21
2 process connections
to DIN 11851
Lower process connection via
eccentric reducer



22
2 process connections
vertical (top/bottom)
Option: Support bracket

Other connections on request

CE conformity

Pressure equipment directive

97/23/EC, pressure accessory

ATEX directive (option)

94/9/EC, ignition protection type Ex c, zone 0/1, gas

Approvals

- **GL**, ships, shipbuilding, offshore, Germany
 - **DNV**, ships, shipbuilding, offshore, Norway
 - **ABS**, ships, shipbuilding, offshore, USA
 - **GOST**, national standard for Russia, Kazakhstan and Belarus
 - **IEEE 344**, standard for seismic qualification of equipment for nuclear power generating stations
- Approvals and certificates, see website

Application for bypass level indicator on low-pressure pre-heater or feedwater tank



In a communicating bypass chamber mounted to the side of a vessel a float moves with the level of the medium to be measured. The magnetic field of the radially symmetric magnetic system positioned in the float at submersion height activates the magnetic roller indicator attached to the outside of the bypass chamber as well as the switching and measuring elements.

This proven measurement system can be combined with further independent measurement principles such as a guided-wave radar system, a reed measurement chain or a limit switch. Thus for independent measurements, only two process connections are required, a full redundancy in the measurement is possible and a visual level measurement is permanently available.

Float

For bypass level indicators

Model BFT for nuclear power plants

KSR data sheet BFT for NPP

Applications

- Float for the monitoring of liquids in bypass level indicators
- Individual design and corrosion resistant materials make the products suitable for a broad range of applications
- Chemical, petrochemical, natural gas, offshore, shipbuilding, machine building, power generating equipment, power plants
- Process water and drinking water treatment, food industry, pharmaceutical industry

Special features

- Sealed, pressure retaining design
- Density range from 340 kg/m³
- Pressures up to 400 bar
- Medium temperatures from -196 ... +450 °C
- Versions for interface layer



Fig. left: Corrugated float, model BFT-S
 Fig. centre: Cylindrical float, model BFT-H
 Fig. right: Ball-segment float, model BFT-K

Description

The model BFT float serves for the monitoring of liquids in bypass level indicators. The magnetic system built into the float transmits the liquid level, contact-free, to externally mounted displays, switches and sensors. Due to its omnidirectional, radial magnetic field, a guide within the tube is not needed.

The design will depend on the application, chemical resistance and the 3 physical quantities of pressure, temperature and density.

Model overview

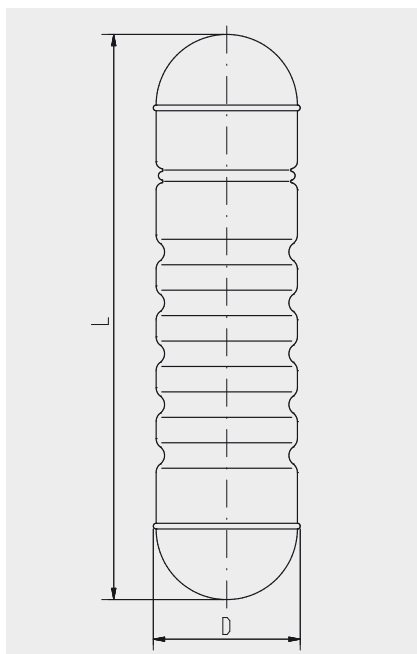
Float	Material	Density range	Pressure range	Temperature range
Cylindrical float, model BFT-H	Stainless steel 1.4571	> 470 kg/m ³	Vacuum ... 100 bar	-200 ... +450 °C
	Titanium 3.7035	> 340 kg/m ³		
Corrugated float, model BFT-S	Stainless steel 1.4571	> 470 kg/m ³	Vacuum ... 25 bar	-50 ... +200 °C
	Titanium 3.7035	> 340 kg/m ³		
Ball-segment float, model BFT-K	Titanium 3.7065	> 400 kg/m ³	Vacuum ... 250 bar	-200 ... +450 °C

Classification of the floats

Bypass level indicator	Suitable float		
	Model BFT-S	Model BFT-H	Model BFT-K
Standard version, model BNA-S	x	x	
High-pressure version, model BNA-H		x	x
DUPlus version, model BNA-SD	x	x	

Corrugated float, model BFT-S50

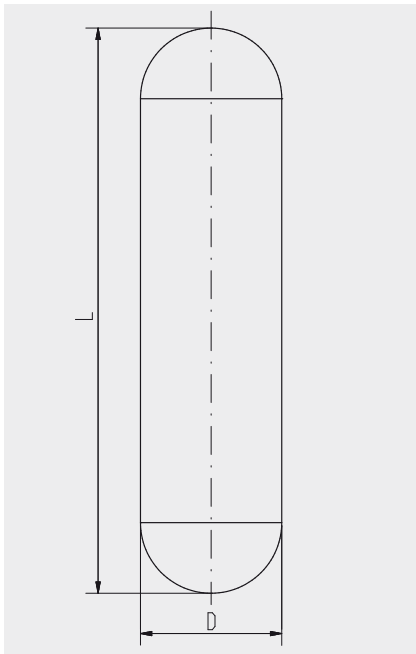
Permissible temperature: -50 ... +200 °C



PN	Density range in kg/m ³	Diameter in mm	Length in mm	Material
25	990 ... 2,000	50	150	Stainless steel (1.4571)
	830 ... 1,000	50	185	Stainless steel (1.4571)
	730 ... 840	50	225	Stainless steel (1.4571)
	640 ... 730	50	275	Stainless steel (1.4571)
	590 ... 650	50	335	Stainless steel (1.4571)
	550 ... 600	50	400	Stainless steel (1.4571)
	520 ... 560	50	470	Stainless steel (1.4571)
	490 ... 530	50	555	Stainless steel (1.4571)
	470 ... 500	50	650	Stainless steel (1.4571)
	820 ... 2,000	50.8	150	Titanium (3.7035)
	710 ... 850	50.8	180	Titanium (3.7035)
	600 ... 710	50.8	215	Titanium (3.7035)
	540 ... 610	50.8	250	Titanium (3.7035)
	480 ... 540	50.8	300	Titanium (3.7035)
	430 ... 490	50.8	355	Titanium (3.7035)
	400 ... 440	50.8	410	Titanium (3.7035)
380 ... 410	50.8	465	Titanium (3.7035)	
370 ... 390	50.8	525	Titanium (3.7035)	
360 ... 380	50.8	595	Titanium (3.7035)	
340 ... 370	50.8	680	Titanium (3.7035)	

Cylindrical float, model BFT-H

Permissible temperature: -200 ... +450 °C

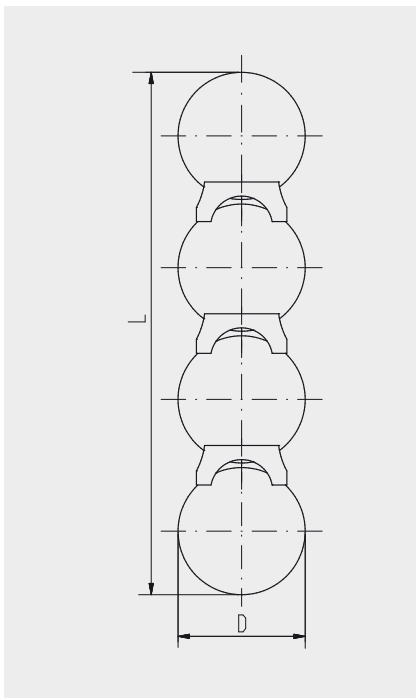


Material: Stainless steel 1.4571
Diameter: 50 mm
Length: 150 ... 650 mm (depending on pressure, density and temperature)
Weight: depending on pressure, density and temperature
Magnetic system: depending on pressure, density and temperature
Nominal density: depending on pressure, density and temperature
Density range: depending on pressure, density and temperature
Max. pressure: < 40 bar

Material: Titanium 3.7035
Diameter: 45, 50.8 or 60 mm
Length: 150 ... 650 mm (depending on pressure, density and temperature)
Weight: depending on pressure, density and temperature
Magnetic system: depending on pressure, density and temperature
Nominal density: depending on pressure, density and temperature
Density range: depending on pressure, density and temperature
Max. pressure: < 100 bar

Ball-segment float, model BFT-K

Permissible temperature: -200 ... +450 °C



Material: Titanium 3.7065
Diameter: 45, 50.8 or 60 mm
Length: 150 ... 700 mm (depending on pressure, density and temperature)
Weight: depending on pressure, density and temperature
Magnetic system: depending on pressure, density and temperature
Nominal density: depending on pressure, density and temperature
Density range: depending on pressure, density and temperature
Max. pressure: < 250 bar

Magnetic display

For bypass level indicators

Model BMD for nuclear power plants

KSR data sheet BMD for NPP

Applications

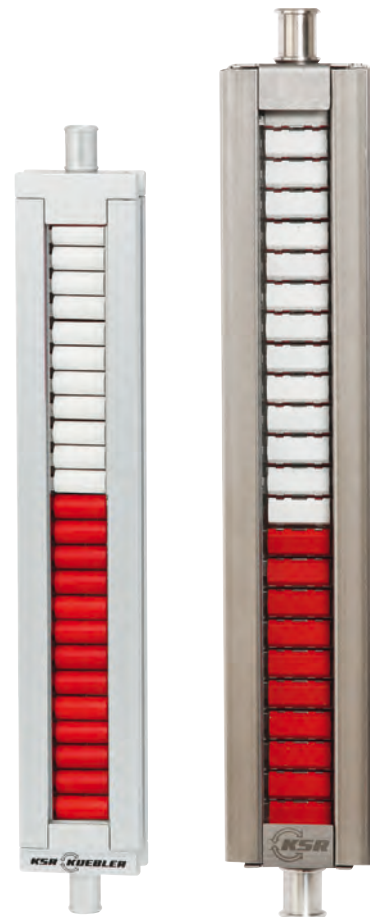
- Display bar for the visualisation of levels in combination with bypass level indicators
- Individual design and corrosion resistant materials make the products suitable for a broad range of applications
- Chemical, petrochemical, natural gas, offshore, shipbuilding, machine building, power generating equipment, power plants
- Process water and drinking water treatment, food industry, pharmaceutical industry

Special features

- Measured value display by means of rollers or flaps with permanent magnets
- Medium temperatures from -200 ... +450 °C
- Splash-proof
- Without power supply
- Hermetically sealed from the process

Description

The model BMD magnetic displays are used in combination with bypass level indicators for the display of levels. A magnetic system built into the float transmits the liquid level, contact-free, to the externally mounted display. In this are fitted, at 10 mm intervals, red/white plastic rollers or stainless steel flaps with bar magnets. Through the directional magnetic field of the permanent magnetic system in the bypass float, the magnetic rollers or flaps, through the wall of the bypass chamber, are turned through 180°. For an increasing level from white to red; for a falling level from red to white. Thus the magnetic display indicates the level of a vessel as a red column, without power supply.



Magnetic display

Fig. left: Plastic rollers, model BMD-SA

Fig. right: Stainless steel flaps, model BMD-FR

An integrated T-slot serves for the fastening of further attachment parts such as scales, sensors and switches.

For selecting the optimum magnetic display (plastic rollers/ stainless steel flaps, case, scale, measuring range etc.) we offer application-related technical advice.

Model overview

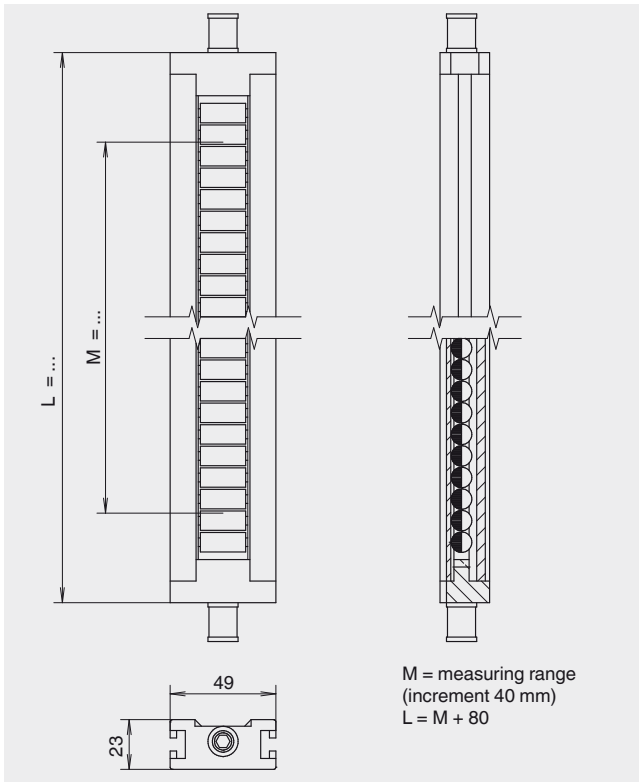
Magnetic display model	Description
BMD-SA	Plastic rollers in aluminium case, with T-slot
BMD-SR	Plastic rollers in stainless steel case with T-slot
BMD-FA	Stainless steel flaps in aluminium case, with T-slot
BMD-FR	Stainless steel flaps in stainless steel case with T-slot

Options

- Scale with adhesive foil
- Scale engraved aluminium
- Scale engraved stainless steel
- Scale in cm, mm or %
- Special scale
- Acrylic sight glass extender for insulation at low temperatures
- Purge gas connection
- Display elements in the colours red, white, black and yellow (others on request)

Magnetic display, plastic rollers in aluminium case, with T-slot, BMD-SA

Permissible temperature: -50 ... +200 °C

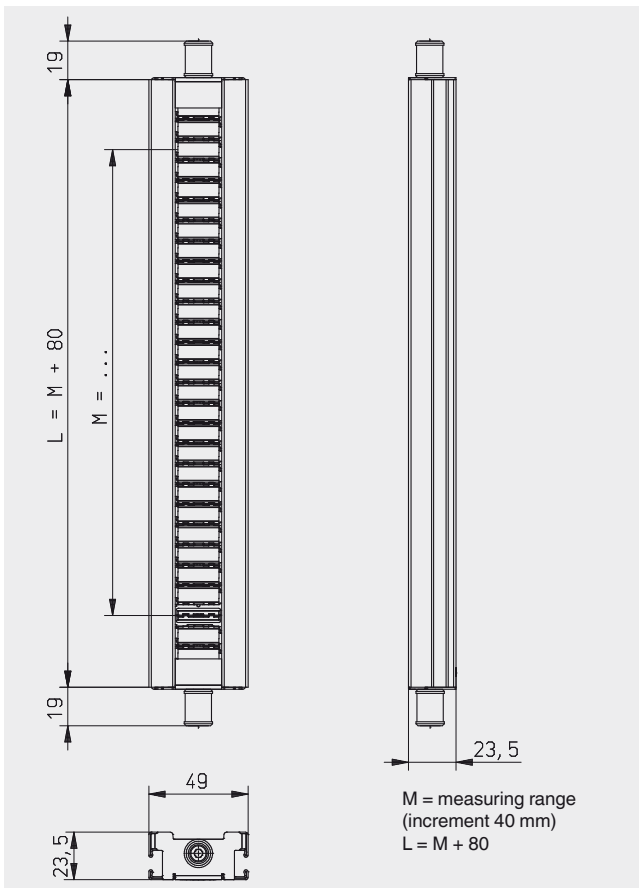


Specifications

Case	Aluminium, anodised
Length L	180 ... 6,000 mm
Display element	Plastic rollers, PBT, red/white
Indicator window	Polycarbonate

Magnetic display, plastic rollers in stainless steel case, with T-slot, BMD-SR

Permissible temperature: -50 ... +200 °C

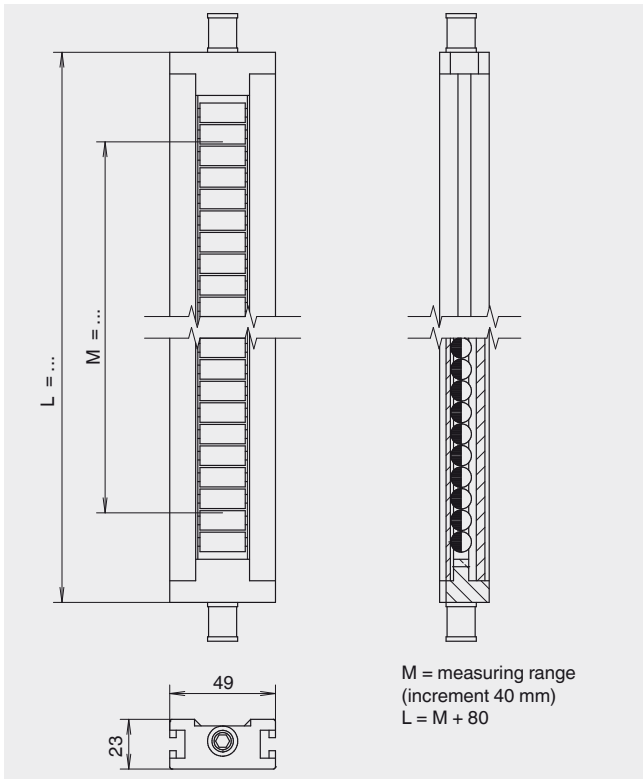


Specifications

Case	Stainless steel
Length L	180 ... 6,000 mm
Display element	Plastic rollers, PBT, red/white
Indicator window	Polycarbonate

Magnetic display, stainless steel flaps in aluminium case, with T-slot, BMD-FA

Permissible temperature: -200 ... +450 °C

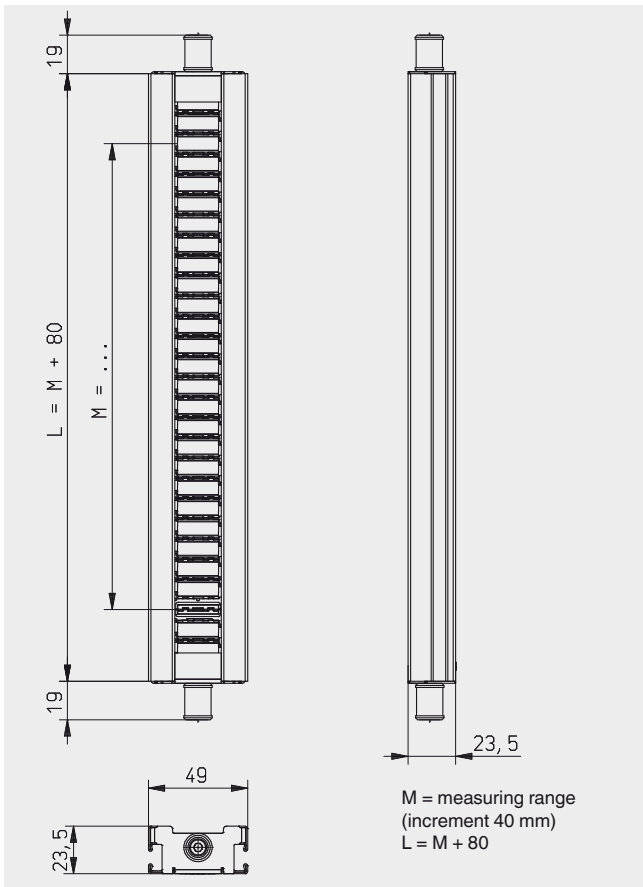


Specifications

Case	Aluminium, anodised
Length L	180 ... 6,000 mm
Display element	Stainless steel flaps, red/white
Indicator window	Glass

Magnetic display, stainless steel flaps in stainless steel case, with T-slot, BMD-FR

Permissible temperature: -200 ... +450 °C



Specifications

Case	Stainless steel
Length L	180 ... 6,000 mm
Display element	Stainless steel flaps, red/white
Indicator window	Glass

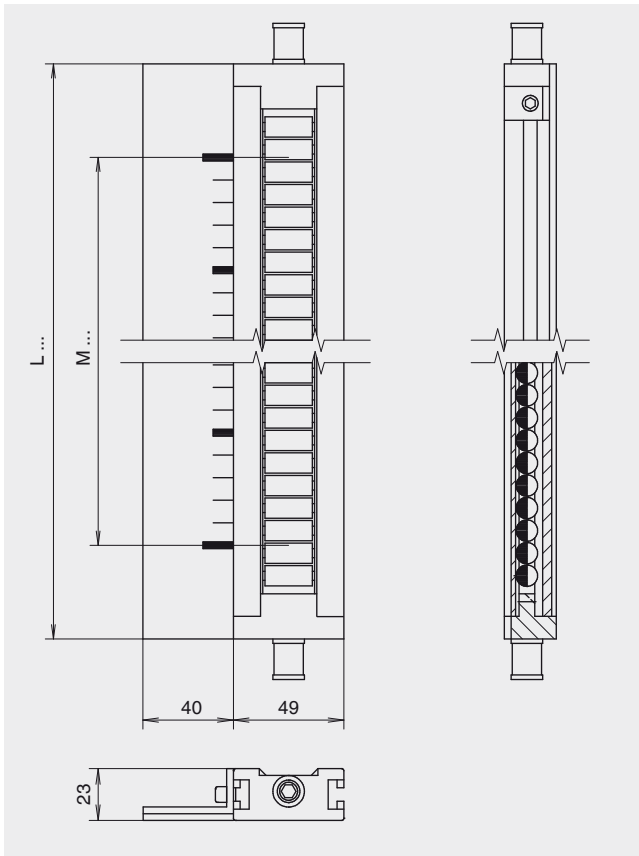
Option

Scale (adhesive foil, aluminium or stainless steel)

Aluminium with adhesive foil, cm-graduation

max. ambient temperature for the adhesive foil: 100 °C

Aluminium or stainless steel engraved, graduation selectable



Reed sensor For bypass level indicators Model BLR for nuclear power plants

KSR data sheet BLR for NPP



Applications

- Sensor for continuous level measurement of liquids in bypass level indicators
- Chemical and petrochemical industries, oil and natural gas extraction (on- and offshore)
- Shipbuilding, machine building
- Power generating equipment, power plants
- Pharmaceutical, food, water treatment, environmental engineering industries

Special features

- Installation of head-mounted transmitters in the connection housing possible
- Various contact separations selectable
- Programmable and configurable head-mounted transmitters for field signal 4 ... 20 mA, HART®, PROFIBUS® PA or FOUNDATION™ Fieldbus
- Explosion-protected versions
- Temperature ranges from -100 ... +350 °C

Description

The model BLR reed sensors are used for continuous monitoring and recording of the liquid level in connection with transmitters. They work on the float principle with magnetic transmission (permanent magnet, reed switch and resistance measuring chain) in a 3-wire potentiometer circuit.

A magnetic system built into the float actuates, through the walls of the bypass chamber and of the sensor tube, reed contacts at a resistance measuring chain (potentiometer). The measurement voltage generated by this is proportional to the fill level.



Reed sensor, model BLR-S

The resistance measuring chain is made up from reed contacts and resistors soldered onto a PCB. Depending on requirements and design several different contact separations from 5 to 18 mm are available.

For selecting the optimum sensor (sensor model, connection housing, electrical connection, sensor tube (material and total length), contact separation, head-mounted transmitter, measuring range, approval) we offer application-related technical advice.

Model overview

Sensor model	Description	Approval								Temperature range
		without	Ex i	Ex d	GL	DNV	Ex i + GL	Ex i + DNV	IEEE 323	
BLR-S	Reed sensor, standard	x			x	x			x	-50 ... +350 °C
BLR-S-Ex i	Reed sensor, intrinsically safe version Ex i		x				x	x	x	-50 ... +100 °C

Ex approvals

Explosion protection	Ignition protection type	Model	Zone	Approval number
ATEX	Ex i	BLR-S-Ex i	Zone 1, gas	KEMA 01ATEX1052 X II 2G Ex ia IIC T4 ... T6 Gb
	Ex i + GL	BLR-S-Ex i	Zone 1, gas	KEMA 01ATEX1052 X II 2G Ex ia IIC T4 ... T6 Gb + GL 35949-87 HH
	Ex i + DNV	BLR-S-Ex i	Zone 1, gas	KEMA 01ATEX1052 X II 2G Ex ia IIC T4 ... T6 Gb + DNV A-11451

Type approval

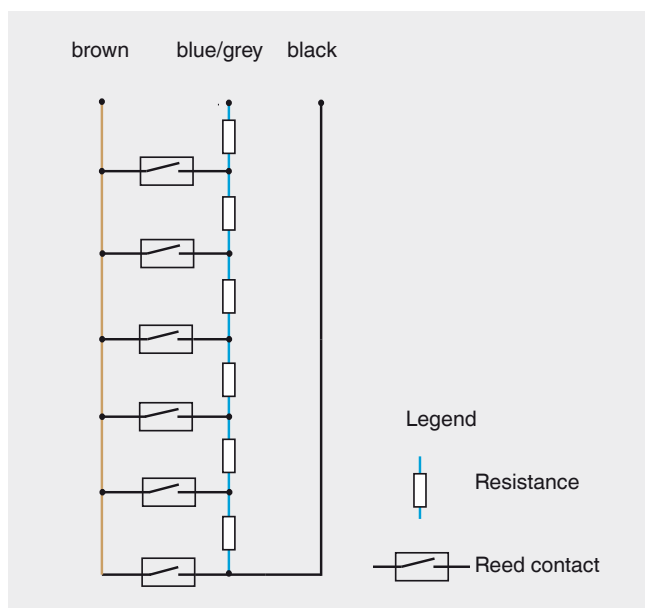
Approval	Model	Approval number
GL	BLR-S	GL - 35 949 - 87 HH
DNV	BLR-S	DNV A-11451
IEEE 323, 344	BLR-S	-
GOST-R	all	0959333

Further approvals on request

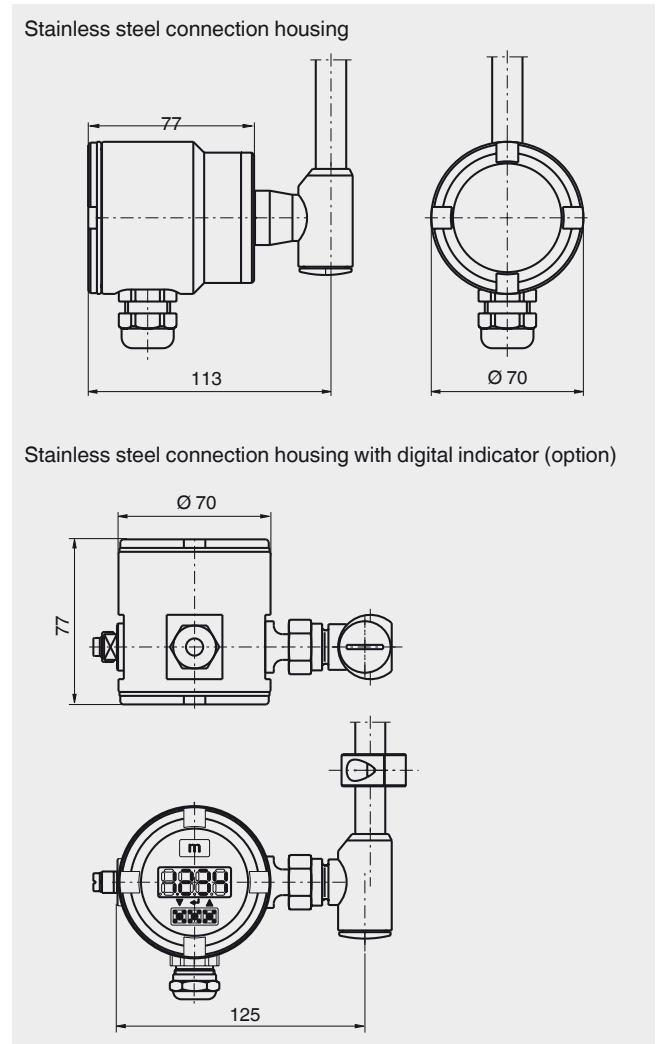
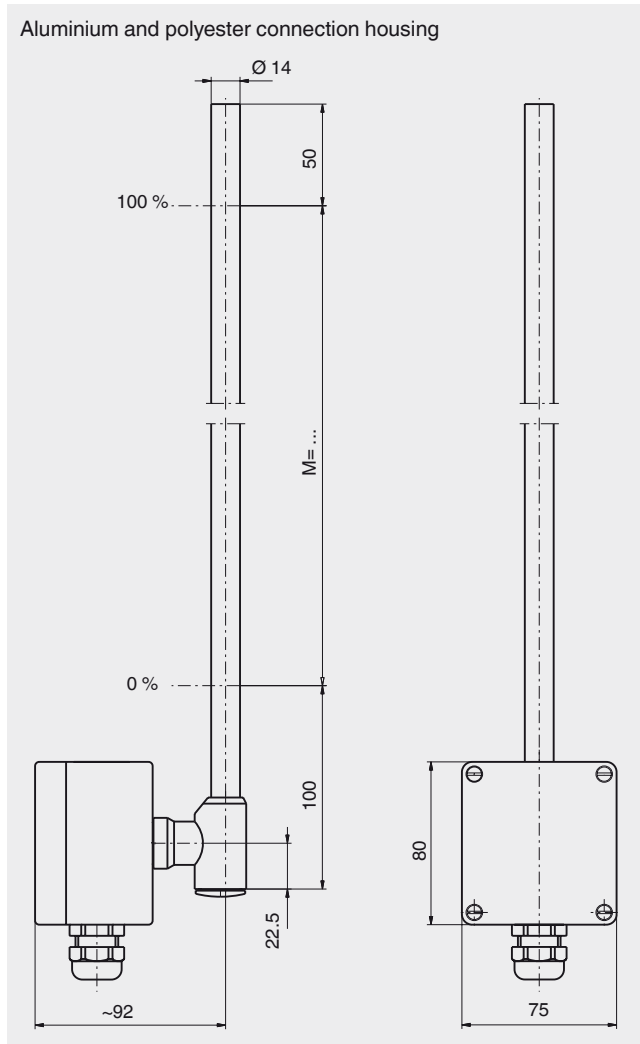
Options

- 2-wire head-mounted transmitter in the connection housing.
- Stainless steel connection housing with digital indicator.
- External transmitter can be mounted directly in switchboards.
- Nuclear qualified plug (Han® 7D) on request.

Internal circuit diagram of the reed sensors



Reed sensors, models BLR-S and BLR-S-Ex i



Model BLR-S

Specifications

Connection housing	Aluminium	80 x 75 x 57 mm
	Stainless steel 1.4571	Ø 70 x 77 mm
	Stainless steel 1.4571 with digital indicator	Ø 70 x 77 mm
Sensor tube	Stainless steel 1.4571, tube Ø 14 x 1 mm	
Contact separation	18 mm, standard	
	15 mm, high temperature, low temperature	
	10 mm, standard, high temperature, low temperature	
	5 mm, standard, high temperature, low temperature	
	5 mm, standard, high temperature, low temperature	
Overall resistance of the measuring chain	Length and separation dependent	
Ambient temperature	Standard version	-50 ... +100 °C
	High temperature version	-50 ... +200 °C
	Low temperature version	-100 ... +100 °C
	Standard version with Microtherm®	-50 ... +250 °C
	High temperature version with Microtherm®	-50 ... +350 °C
	High temperature version with Microtherm®	-50 ... +350 °C
Ingress protection	Aluminium connection housing: IP 65 Stainless steel connection housing: IP 67	

Model BLR-S-Ex i

Specifications

Connection housing	Aluminium	80 x 75 x 57 mm
	Polyester	80 x 75 x 55 mm
	Stainless steel 1.4571	Ø 70 x 77 mm
	Stainless steel 1.4571 with digital indicator	Ø 70 x 77 mm
	Stainless steel 1.4571 with digital indicator	Ø 70 x 77 mm
Sensor tube	Stainless steel 1.4571, tube Ø 14 x 1 mm	
Contact separation	18 mm	
	10 mm	
	5 mm	
Overall resistance of the measuring chain	3.2 ... 50 kΩ	
Max. permissible surface temperature at the sensor tube	T4	+100 °C
	T5	+65 °C
	T6	+50 °C
Ingress protection	Aluminium connection housing: IP 65	
	Stainless steel connection housing: IP 67	
Approval	Ex i	

Nuclear qualified plug (Han® 7D) on request.

Head-mounted transmitter



Model TE

Model T32E

Model T53F

Model TLEH

Model	4 ... 20 mA	HART®	PROFIBUS® PA	Fieldbus™	Exi	SIL2	IEEE 323, 344	Display
TE	x				x		x	
TS	x							
T32E	x	x			x	x		
T32S	x	x				x		
T53F				x	x			
T53P			x		x			
TLH	x	x						x
TLEH	x	x			x			x

CE conformity

Electromagnetic compatibility (EMC)
2004/108/EC

ATEX directive (option)
94/9/EC, ignition protection type Ex i and Ex d, zone 1, gas

Approvals

- **GL**, ships, shipbuilding, offshore, Germany
- **DNV**, ships, shipbuilding, offshore, Norway
- **GOST**, national standard for Russia, Kazakhstan and Belarus
- **IEEE 323**, standard for qualifying class 1E equipment for nuclear power generating stations
- **IEEE 344**, standard for seismic qualification of equipment for nuclear power generating stations

Approvals and certificates, see website

Magnetic switch

For bypass level indicators

Model BGU for nuclear power plants

KSR data sheet BGU for NPP



Applications

- Magnetic switches for detecting the limits of filling levels in bypass level indicators
- Chemical and petrochemical industries, oil and natural gas extraction (on- and offshore)
- Shipbuilding, machine building
- Power generating equipment, power plants
- Pharmaceutical, food, water treatment, environmental engineering industries

Special features

- Proper functioning, even under extreme environmental influences, e.g. dirt, humidity, gases, dust, chips
- Compact and operationally safe design
- Mounting of the switches with tightening strap or via T-slot at the magnetic display
- Medium temperatures from -196 ... +380 °C
- Versions with reed contact, proximity switch, micro switch or rotation magnet



Magnetic switch

Fig. left: Reed switch, model BGU

Fig. right: High-temperature reed switch, model BGU-AHT

Description

The model BGU magnetic switches serve to detect the limits of filling levels in bypass level indicators. They generate a binary signal which can be fed to down-stream signalling or control equipment. Bistable versions enable the storage of signals.

The magnetic switches are mounted directly to the bypass level indicator with a tightening strap or to the magnetic display with sliding blocks.

The magnetic switches are available with different approvals and with SIL 1.

For selecting the optimum switch (switch model, approval, switching option, cable length, cable material) we offer application-related technical advice.

Model overview

Switch model	Description	Approval						Switching power			Proximity switch	Temperature range
		with-out	Ex i	Ex d	GL	Ex i + GL	IEEE 323, 344	AC 230 V, 60 VA, 1 A	DC 230 V, 30 VA, 0.5 A	DC 30 V, 0.1 A		
BGU	Reed, aluminium case, cable outlet	x	x	x	x	x	*	x	x			-50 ... +180 °C
BGU-A	Reed, aluminium connection housing, cable gland	x	x		x	x	*	x	x			-50 ... +180 °C
BGU-M12	Reed, aluminium case, connector M12	x	x				*	x	x			-40 ... +80 °C
BGU-V	Reed, stainless steel case, cable outlet	x	x	x			x	x	x			-50 ... +180 °C
BGU-AIH	Proximity switch, high alarm, aluminium case, cable gland	x					*				x	-40 ... +80 °C
BGU-AIL	Proximity switch, low alarm, aluminium case, cable gland	x					*				x	-40 ... +80 °C

* IEEE on request.

Ex approvals

Explosion protection	Ignition protection type	Model	Zone	Approval number
ATEX	Ex i	BGU, BGU-A, BGU-M12, BGU-V	Zone 0, gas	LCIE 01 ATEX 6047 X / II 1 G Ex ia IIC T6-T3
	Ex d	BGU, BGU-V	Zone 1, gas	LCIE 01 ATEX 6047 X / II 2 G Ex d IIC T6-T3
	Ex i + GL	BGU, BGU-A	Zone 0, gas	LCIE 01 ATEX 6047 X / II 1 G Ex ia IIC T6-T3 + GL - 99 355 - 97 HH

Type approval

Approval	Model	Approval number
GL	BGU, BGU-A	GL - 99 355 - 97 HH
IEEE 323, 344	BGU-V	-
GOST-R	all	0959333

Further approvals on request

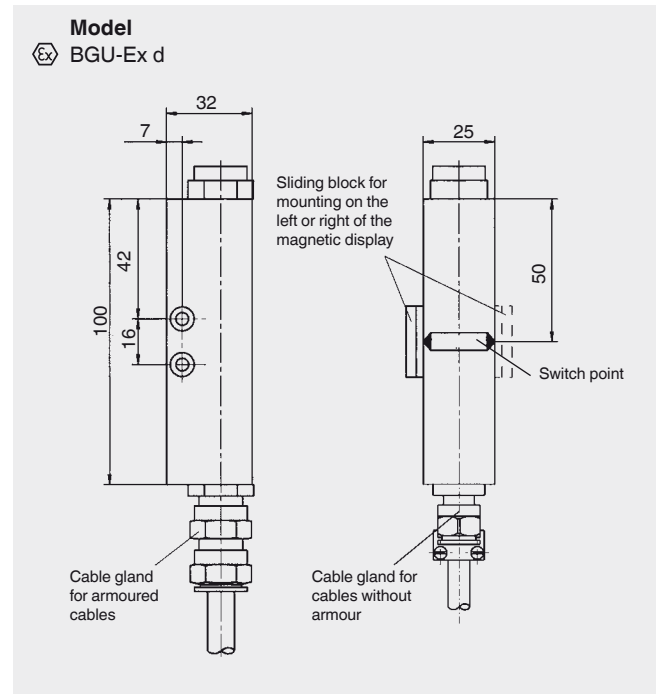
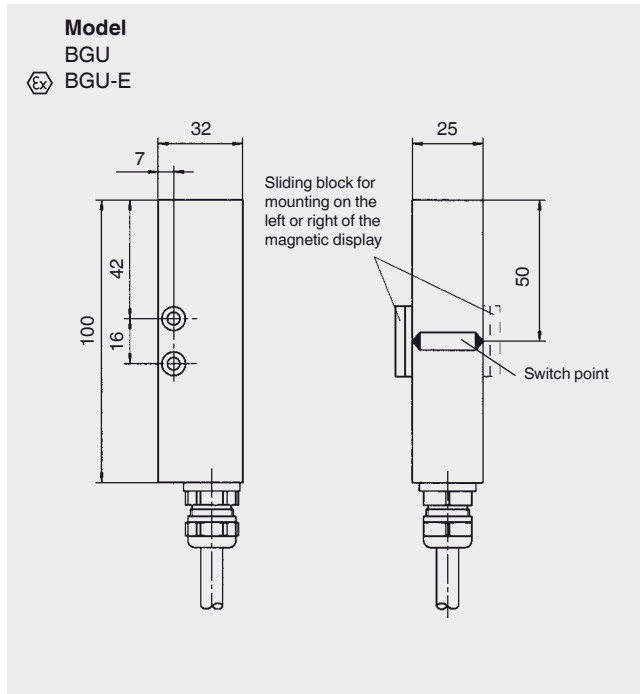
Manufacturer's declaration

Switching insert	Model	Zone
Proximity switch	BGU-AIL, BGU-AIH	Zone 1

Options

- Switching option (series resistance R22 for PLC, wiring in accordance with NAMUR per DIN EN 60497-5-6)
- Cable length (1, 2 or 3 m, others on request)
- Cable material (PVC cable, intrinsically safe PVC cable, silicone cable, armoured silicone cable, LMGSG cable for GL approval)

Magnetic switch, reed, aluminium case, cable outlet, model BGU



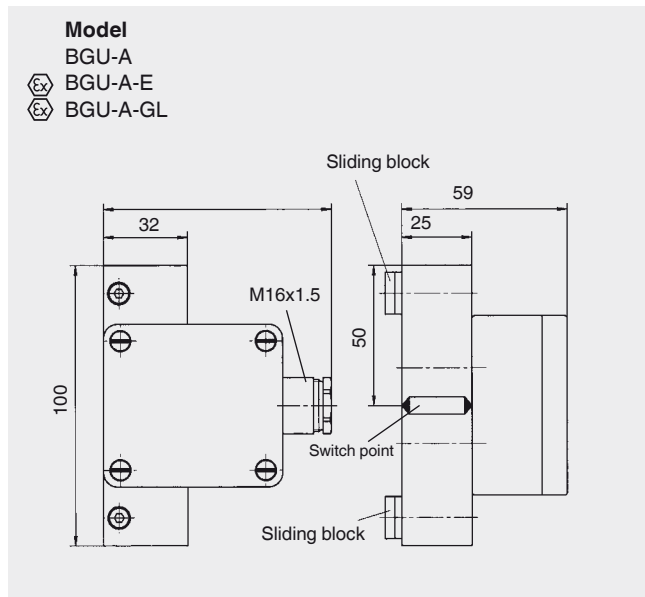
Specifications

Contact	Reed contact
Contact type	1 change-over contact
Switch behaviour	Bistable
Switching power	
■ Model BGU	AC 230 V, 60 VA, 1 A DC 230 V, 30 W, 0.5 A
■ Model BGU-E	Only for connection to a certified intrinsically safe circuit with max. 100 mA and max. 30 V
Ambient temperature	-50 ... +180 °C
Max. ambient temperature	
■ Switch with connection cable from PVC	90 °C
■ Switch with connection cable from LMGSG	150 °C
■ Switch with connection cable from silicone	180 °C
■ Switch model BGU-E with connection cable from PVC, blue	T6 to 85 °C
Case	Aluminium
Ingress protection	IP 65
Approvals	Ex i

Specifications

Contact	Reed contact
Contact type	1 change-over contact
Switch behaviour	Bistable
Switching power	AC 230 V, 60 VA, 1 A DC 230 V, 30 W, 0.5 A
Ambient temperature	-40 ... +150 °C
Max. ambient temperature	
■ Switch with connection cable from PVC, grey	T6 to 85 °C
■ Switch with connection cable from silicone or armoured silicone	T6 to 85 °C T5 to 100 °C T4 to 135 °C T3 to 150 °C
Case	Aluminium
Ingress protection	IP 68
Approvals	Ex d

Magnetic switch, reed, aluminium connection housing, cable gland, model BGU-A

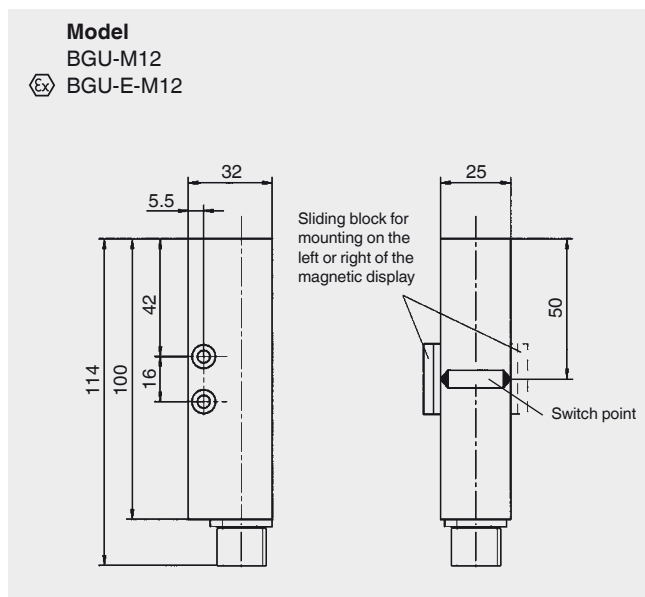


Specifications

Contact	Reed contact
Contact type	1 change-over contact
Switch behaviour	Bistable
Switching power	
■ Models BGU-A, BGU-A-GL	AC 230 V, 60 VA, 1 A DC 230 V, 30 W, 0.5 A
■ Model BGU-A-E	Only for connection to a certified intrinsically safe circuit with max. 100 mA and max. 30 V
Ambient temperature	-50 ... +180 °C
Max. ambient temperature	
■ Model BGU-A	180 °C
■ Model BGU-A-GL	150 °C
■ Model BGU-A-E	T6 to 85 °C T5 to 100 °C T4 to 135 °C T3 to 150 °C
Case	Aluminium, cable connection M16 x 1.5 *
Ingress protection	IP 65
Approvals	Ex i

* Nuclear qualified plug (Han® 7D) on request.

Magnetic switch, reed, aluminium case, connector M12, model BGU-M12



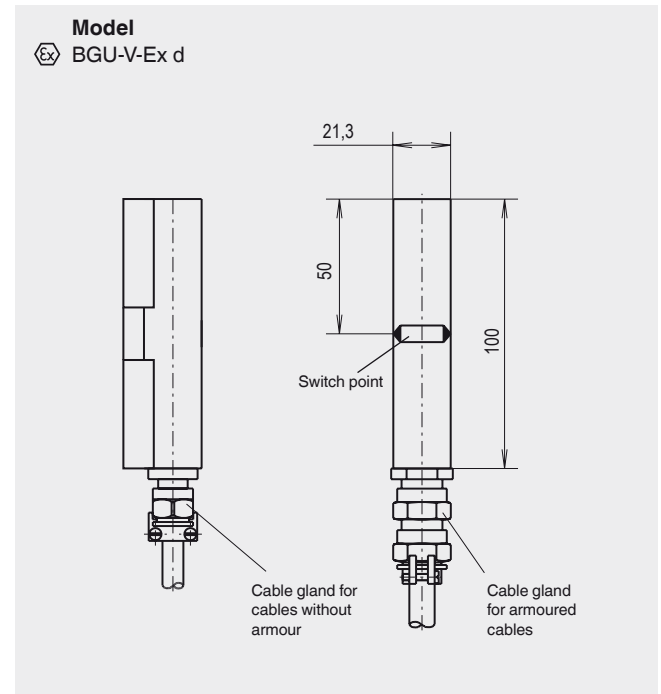
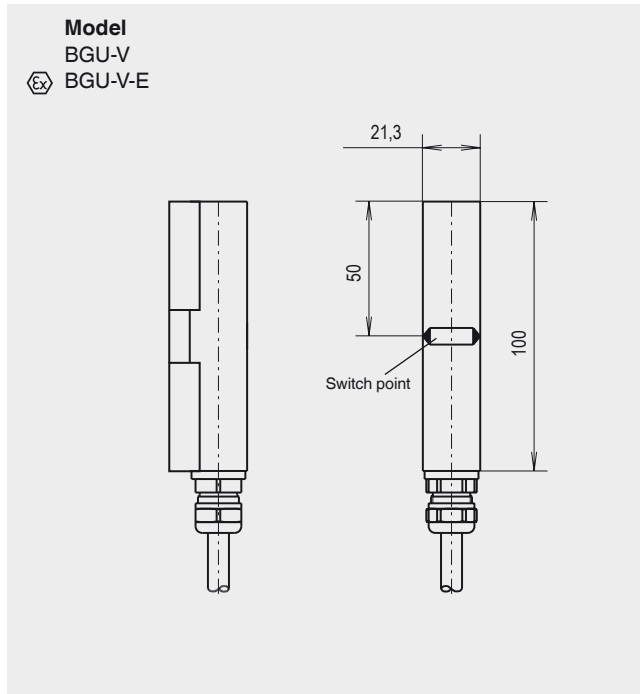
Specifications

Contact	Reed contact
Contact type	1 change-over contact
Switch behaviour	Bistable
Switching power	
■ Model BGU-M12	AC 230 V, 60 VA, 1 A DC 230 V, 30 W, 0.5 A
■ Model BGU-E-M12	Only for connection to a certified intrinsically safe circuit with max. 100 mA and max. 30 V
Ambient temperature	-40 ... +80 °C
Max. ambient temperature	
■ Model BGU-M12	80 °C
■ Model BGU-E-M12	T6 to 80 °C
Case	Aluminium
Ingress protection	IP 67
Approvals	Ex i

Model

BGU-M12, with mating connector and 2 m PVC cable

Magnetic switch, reed, stainless steel case, cable outlet, model BGU-V



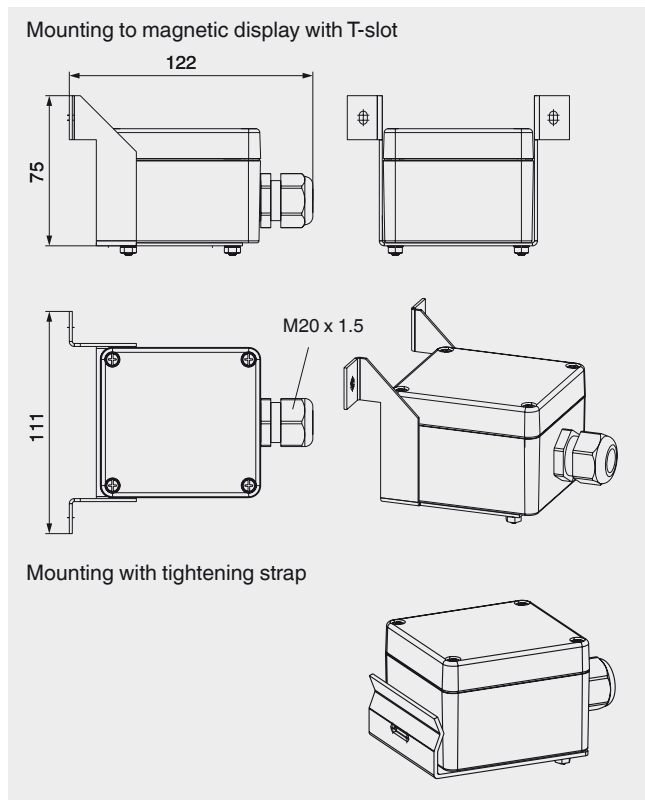
Specifications

Contact	Reed contact
Contact type	1 change-over contact
Switch behaviour	Bistable
Switching power	
■ Model BGU-V	AC 230 V, 60 VA, 1 A DC 230 V, 30 W, 0.5 A
■ Model BGU-V-E	Only for connection to a certified intrinsically safe circuit with max. 100 mA and max. 30 V
Ambient temperature	-50 ... +180 °C
Max. ambient temperature	
■ Switch with connection cable from PVC	90 °C
■ Switch with connection cable from silicone	180 °C
■ Switch model BGU-V-E with connection cable from PVC, blue	T6 to 85 °C
Case	Stainless steel 1.4571 (316Ti)
Ingress protection	IP 65
Approvals	Ex i

Specifications

Contact	Reed contact
Contact type	1 change-over contact
Switch behaviour	Bistable
Switching power	AC 230 V, 60 VA, 1 A DC 230 V, 30 W, 0.5 A
Ambient temperature	-50 ... +150 °C
Max. ambient temperature	
■ Switch with connection cable from PVC, grey	T6 to 85 °C
■ Switch with connection cable from silicone or armoured silicone	T6 to 85 °C T5 to 100 °C T4 to 135 °C T3 to 150 °C
Case	Stainless steel 1.4571 (316Ti)
Ingress protection	IP 68
Approvals	Ex d

Magnetic switch, proximity switch, aluminium case, cable gland, model BGU-AIH, high alarm and model BGU-AIL, low alarm



Model	Normally open with	Mounting
BGU-AIH	rising level	T-slot
BGU-AIL	falling level	T-slot
BGU-AIH	rising level	Tightening strap
BGU-AIL	falling level	Tightening strap

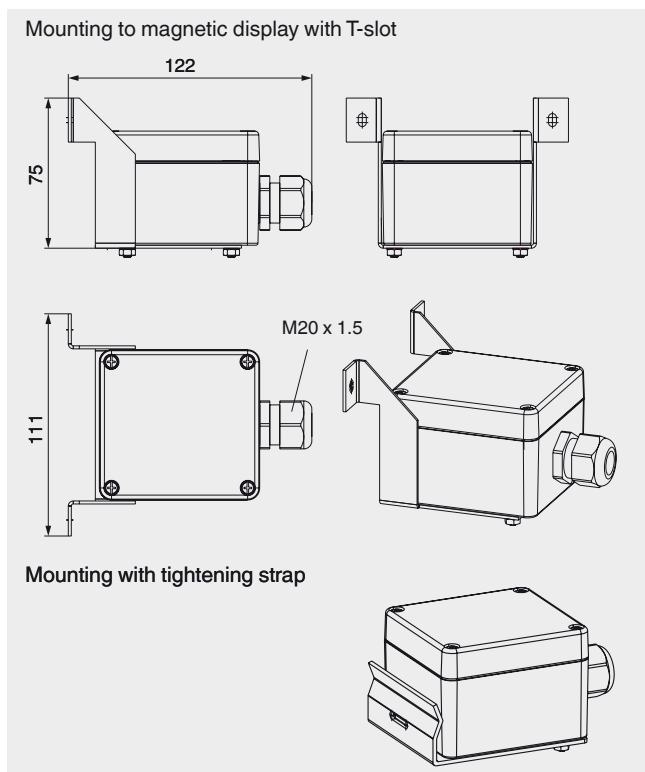
Specifications

Contact	Inductive proximity sensor SJ 3.5-SN
Contact type	Code AIH: High alarm Code AIL: Low alarm
Switch behaviour	Bistable
Nominal voltage	DC 8 V ($R_i \sim 1 \text{ k}\Omega$)
Permissible residual ripple	< 5 %
Operating voltage U_B	5 ... 25 V
Current supply	active area free: > 3 mA active area covered: > 1 mA
Permissible resistance of control cable	< 100 Ω
Self-inductance	160 μH
Self-capacitance	20 nF
Ambient temperature	-40 ... +80 °C
Case	Aluminium, 80 x 75 x 57 mm Cable connection M20 x 1.5 *
Ingress protection	IP 65

Accessories

Tightening strap Standard: OD 50-70 mm
Option: OD 30-45, 40-60, 60-80, 80-100 mm

Magnetic switch, rotational switch, aluminium case, cable gland, model BGU-AR



Model	Mounting
BGU-AR	T-slot
BGU-AR	Tightening strap
BGU-AR m	Tightening strap (with Microtherm®)

Specifications

Contact	Rotary magnet with contact rocker switch
Contact type	1 change-over contact
Switch behaviour	Bistable
Switching power	AC 250 V, 100 VA, 2 A DC 200 V, 40 W, 2 A
Ambient temperature ¹⁾	-60 ... +250 °C -60 ... +380 °C with Microtherm®
Case	Aluminium, 80 x 75 x 57 mm Cable connection M20 x 1.5 *
Ingress protection	IP 65

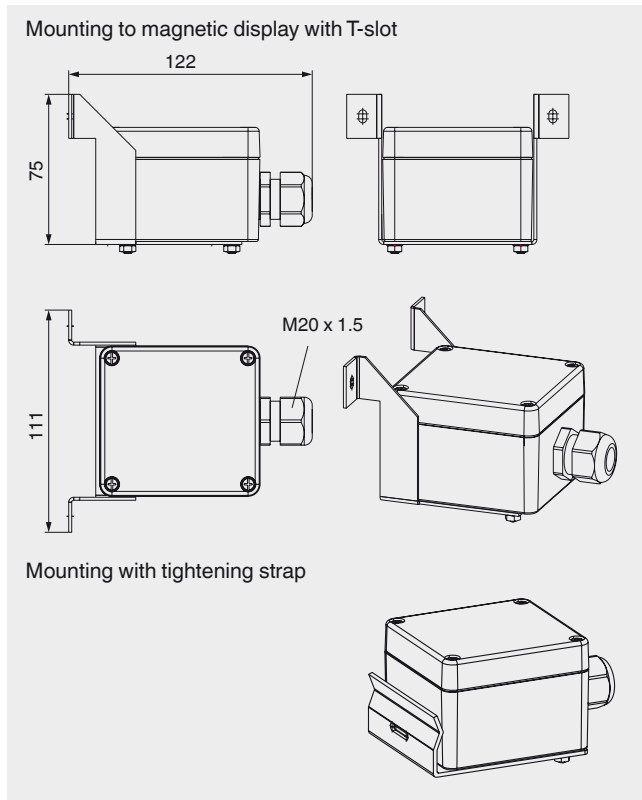
1) With additional insulation the temperature ranges can change

Accessories

Tightening strap Standard: OD 50-70 mm
Option: OD 30-45, 40-60, 60-80, 80-100 mm

* Nuclear qualified plug (Han® 7D) on request.

Magnetic switch, reed, high temperature, aluminium case, cable gland, model BGU-AHT



Model	Mounting
BGU-AHT	T-slot
BGU-AHT	Tightening strap

Specifications

Contact	Reed contact
Contact type	1 change-over contact
Switch behaviour	Bistable
Switching power	AC 230 V, 60 VA, 1 A DC 230 V, 30 W, 0.5 A
Ambient temperature ¹⁾	-196 ... +380 °C
Case	Aluminium, 80 x 75 x 57 mm Cable connection M20 x 1.5
Ingress protection	IP 65

1) With additional insulation the temperature ranges can change

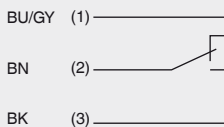
Accessories

Mounting with tightening strap, including Mikroterm®

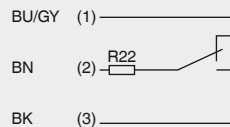
Electrical connections

Reed contact, micro switch, rotation magnet

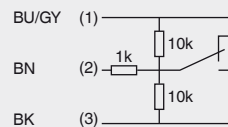
1 switch point



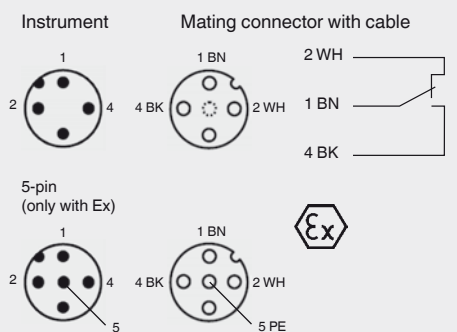
1 switch point
Wiring for operation
with a PLC



1 switch point
NAMUR circuit per
DIN EN 60947-5-6



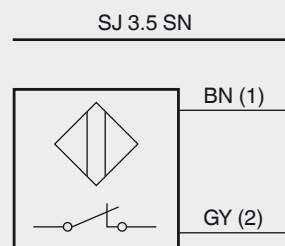
Connector M12, pin assignment (for model BGU-M12)



Nuclear qualified plug (Han® 7D) on request.

Proximity switch

(for models BGU-AIH
and BGU-AIL)



Further plugs on request.

Connection cable

(for models BGU and BGU-V)

Connection cable	Cross-section
PVC	4 x 0.5 mm ²
Silicone	4 x 0.75 mm ²
Armoured silicone	4 x 0.75 mm ²
LMGSG	3 x 1.5 mm ²

Colour coding per IEC 60757

Colour	Short symbol
Black	BK
Brown	BN
Red	RD
Orange	OG
Yellow	YE
Green	GN
Blue	BU
Violet	VT
Grey	GY
White	WH
Pink	PK
Turquoise	TQ
Green-Yellow	GNYE

CE conformity

Electromagnetic compatibility (EMC)

2004/108/EC

ATEX directive (option)

94/9/EC, ignition protection type Ex i, zone 0, gas

94/9/EC, ignition protection type Ex d, zone 1, gas, dust

Approvals

- **GL**, ships, shipbuilding, offshore, Germany
- **GOST**, national standard for Russia, Kazakhstan and Belarus
- **IEEE 323**, standard for qualifying class 1E equipment for nuclear power generating stations
- **IEEE 344**, standard for seismic qualification of equipment for nuclear power generating stations

Magnetic float switch For vertical installation Model FLS for nuclear power plants

KSR data sheet FLS for NPP



for further approvals
see page 3

Applications

- Level measurement for almost all liquid media
- Pump and level control and monitoring for distinct filling levels
- Chemical, petrochemical, natural gas, offshore, shipbuilding, machine building, power generating equipment, power plants
- Process water and drinking water treatment, food and beverage industry

Special features

- Large range of application due to the simple, proven functional principle
- For harsh operating conditions, long service life
- Operating limits:
 - Operating temperature: $T = -196 \dots +350 \text{ °C}$
 - Operating pressure: $P = \text{Vacuum to } 40 \text{ bar}$
 - Limit density: $\rho \geq 300 \text{ kg/m}^3$
- Wide variety of different electrical connections, process connections and materials
- Explosion-protected versions

Description

A float with a permanent magnet moves reliably along with the liquid level on a guide tube. Within the guide tube is fitted a reed contact (inert gas contact), which is energised, through the non-magnetic walls of the float and guide tube, by the approach of the float magnet. By using a magnet and reed contact the switching operation is non-contact, free from wear and needs no power supply. The contacts are potential-free. Magnetic float switches are also available with multiple switch points.

The switch functions always refer to a rising liquid level: normally open, normally closed or change-over contact.

Through the use of a float for a max. of 2 switch points a bistable switch operation can be achieved, meaning that the switching status also remains available, when the filling level continues to rise above or drop below the switch point.

The float switch is simple to mount and maintenance-free, so the costs of mounting, commissioning and operation are low.



Fig.: Stainless steel version, mounting thread

Further special features

- Process connection, guide tube and float from stainless steel 1.4571, plastic or Buna
- Universal signal processing: connection direct to a PLC is possible, NAMUR connection, signal amplification / contact protection relays
- Works independently of foaming, conductivity, dielectricity, pressure, vacuum, temperature, steam, condensation, bubble formation, boiling effects and vibrations.
- Multiple functionality in a single instrument - up to 8 potential-free contacts
- Exact repeatability of the switch points
- Magnetic float switches qualify as passive electrical equipment in accordance with DIN IEC 60079-11 and can be installed in 'Zone 1' hazardous areas without certification, so long as the equipment is operated in a certified intrinsically safe circuit with a minimum explosion protection of EEx ib

Options

- Customer-specific solutions
- Special versions for interface layer detection $\Delta\rho \geq 100 \text{ kg/m}^3$
- Process connection, guide tube material and float from stainless steel 1.4435, 1.4539, titanium, Hastelloy (others on request)

Model overview

Float switch model	Description	Approval						
		without	Ex i	Ex d	GL	Ex i + GL	ABS	DNV
FLS-S	Magnetic float switch, standard version	x	x	x	x	x	x	x

Float switch model	Materials			Temperature range
	Stainless steel 1.4571 (316Ti)	Stainless steel 1.4404 (316L)	Stainless steel 1.4435 (316L)	
FLS-S	x	x	x	-50 ... +350 °C

Ex approvals

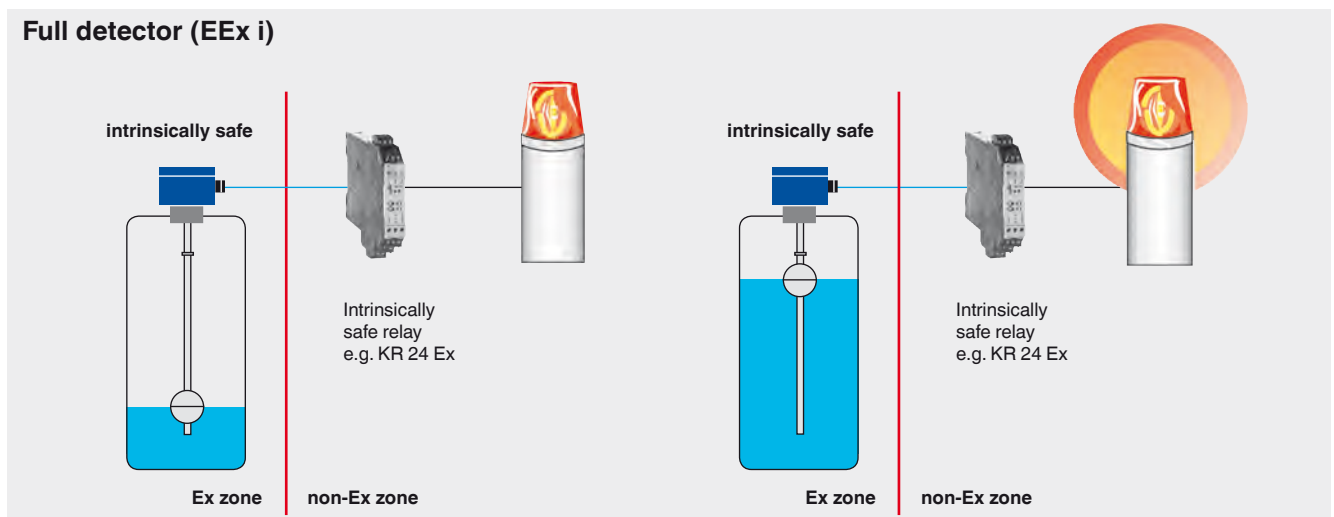
Explosion protection	Ignition protection type	Model	Zone	Approval number
ATEX	Ex i	FLS-S	Zone 0, gas	KEMA 01 ATEX1053 X II 1/2G Ex ia IIC T3 ... T6
	Ex i	FLS-M	Zone 0, gas	KEMA 01 ATEX1053 X II 1/2G Ex ia IIC T3 ... T6
	Ex d	FLS-S	Zone 1, gas/dust	TÜV 13 ATEX 7399 X II 2G Ex d IIC T6 Gb / II 2 D Ex tb IIIC T80 °C Db
	Ex i + GL	FLS-S	Zone 0, gas	KEMA 01 ATEX1053 X II 1/2G Ex ia IIC T3 ... T6 + GL - 96 716 - 95 HH

Type approval

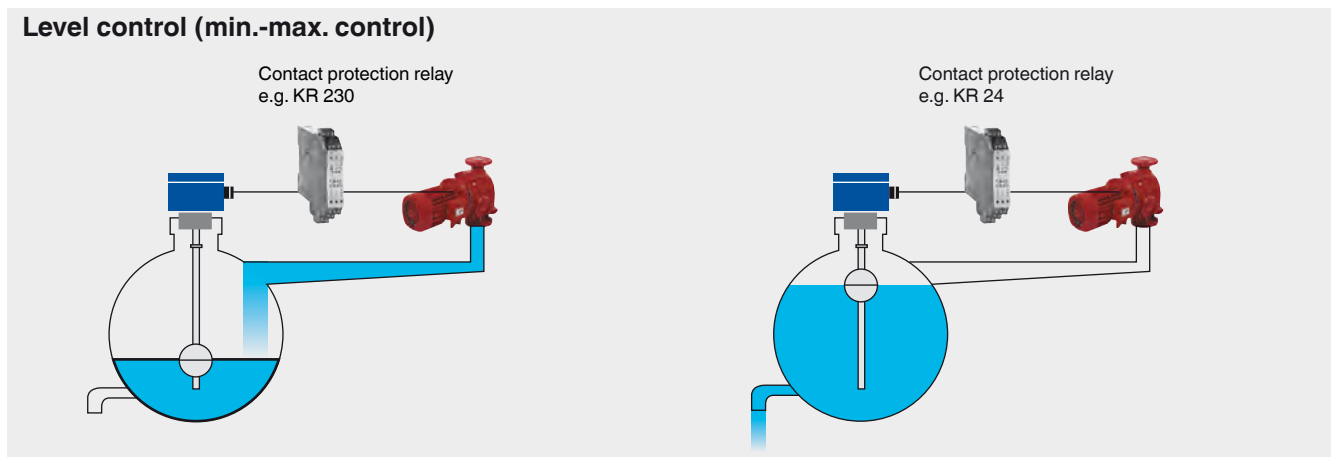
Explosion protection	Model	Approval number
GL	FLS-S	GL - 96 716 - 95 HH
ABS	FLS-S	ABS-02-HG286246-2-PDA
DNV	FLS-S	DNV - A-11453
GOST	FLS-S	959333

Application examples

Full detector (EEx i)

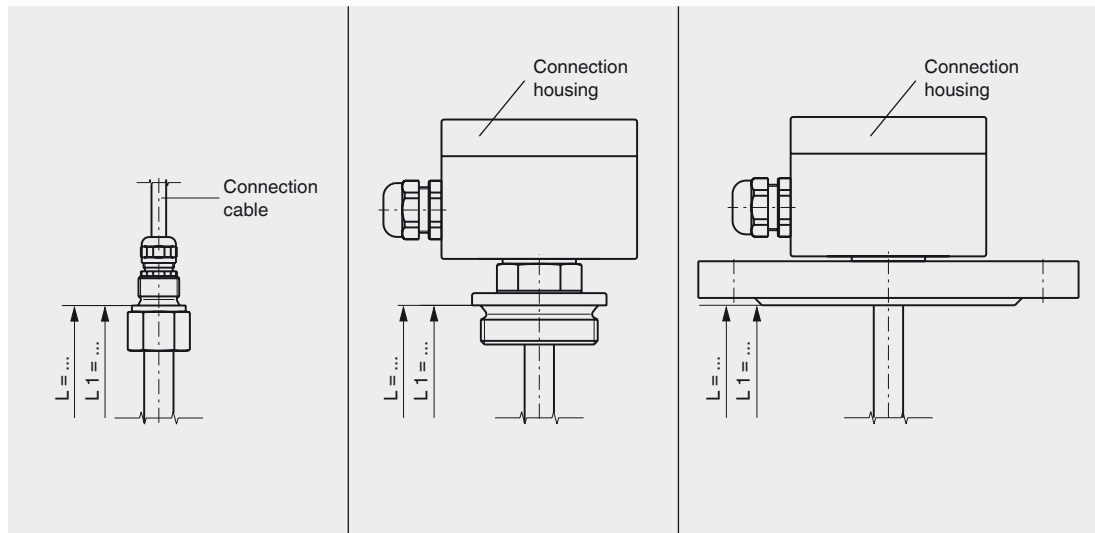


Level control (min.-max. control)



Magnetic float switch, standard version, model FLS-S

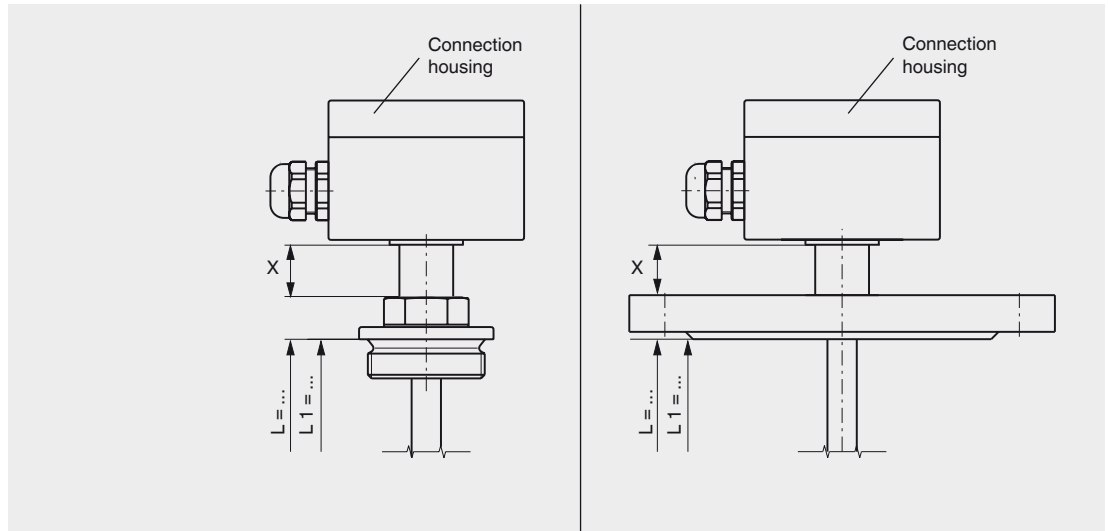
Process connection, guide tube material and float from stainless steel 1.4571 (316Ti)



	Mounting thread (without connection housing)		Mounting thread		Flange	
Electrical connection	Connection cable ■ PVC ■ Silicone ■ PUR		Connection housing ■ Aluminium 64 x 58 x 34 mm, with 1 contact ■ Aluminium 80 x 75 x 57 mm, 2 or more contacts Option: Polypropylene, polyester, stainless steel			
Process connection	Mounting thread upwards G 3/8" (others on request)		Mounting thread downwards G 1 1/2" or G 2"		Mounting flange ■ DIN DN 50 ... DN 200, PN 6 ... PN 100 ■ ANSI 2" ... 8", class 150 ... 600	
Guide tube diameter	12 or 14 mm	18 mm	12 or 14 mm	18 mm	12 or 14 mm	18 mm
Guide tube length L max.	3,000 mm	6,000 mm	3,000 mm	6,000 mm	3,000 mm	6,000 mm
Float	Material stainless steel 1.4571 Float diameter from 44 ... 120 mm Float selection depending on guide tube diameter and process conditions (see floats (K) and (Z))					
Temperature range standard	PVC cable -10 ... +80 °C Silicone cable -30 ... +130 °C		-30 ... +150 °C Option: ■ High-temperature version: +150 ... +300 °C Option: ■ Low-temperature version: -196 ... -30 °C			
Switching function	Alternatively normally open (NO), normally closed (NC) or change-over (SPDT) contact - on rising level					
max. number of contacts	PVC cable 6 x NO or NC, or 4 x SPDT Silicone cable 5 x NO or NC, or 3 x SPDT		6 x NO or NC, or 4 x SPDT			
Switch position	Dimensions L ₁ , L ₂ , L ₃ ... (from sealing face, starting from top)					
Distance between switch points	Minimum 20 mm (depending on the selection of the float and the contacts, see floats (K) and (Z))					
Switching power	Normally open	AC 230 V; 100 VA; 1 A	DC 230 V; 50 W; 0.5 A	Please observe contact protection measures!		
	Normally closed	AC 230 V; 100 VA; 1 A	DC 230 V; 50 W; 0.5 A			
	Change-over	AC 230 V; 40 VA; 1 A	DC 230 V; 20 W; 0.5 A			
	Change-over	-	DC 30 V; 0.1 A			
	Attention: Versions without protective conductor connection - operation only at safety extra-low voltage e.g. KSR contact protection relay or external grounding					
Mounting position	Vertical ±30°					
Ingress protection	IP 65 per EN 60529 / IEC 60529					
Materials	Stainless steel 1.4404, 1.4435, 1.4539, titanium, Hastelloy and others on request					

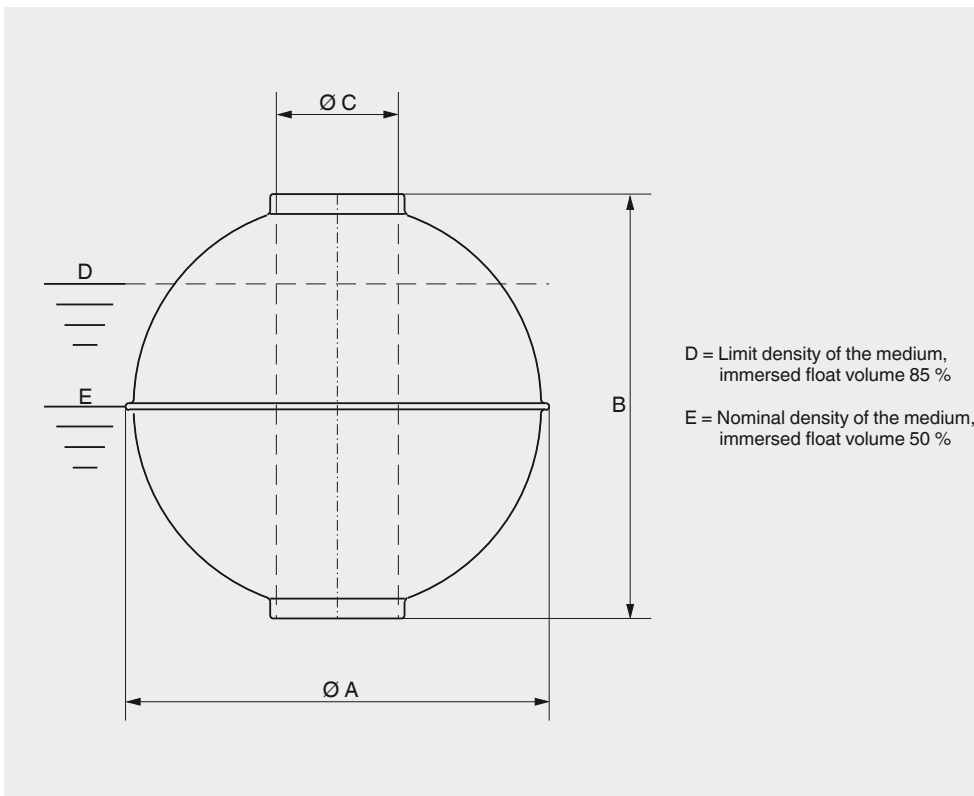
Magnetic float switch, explosion-protected version Ex i, intrinsically safe, model FLS-S

Process connection, guide tube material and float from stainless steel 1.4571 (316Ti)



Mounting thread		Flange			
Electrical connection	Connection housing ■ Aluminium 80 x 75 x 57 mm Option: Polyester, stainless steel				
Process connection	Mounting thread downwards G 1 1/2" or G 2" (others on request)			Mounting flange ■ DIN DN 50 ... DN 150, PN 6 ... PN 64 ■ ANSI 2" ... 6", class 150 ... 600	
Guide tube diameter	12 or 14 mm	18 mm	30 mm	12 or 14 mm	18 mm 30 mm
Guide tube length L max.	3,000 mm	6,000 mm	15,000 mm	3,000 mm	6,000 mm 15,000 mm
Float	Material stainless steel 1.4571 Float diameter from 44 ... 120 mm Float selection depending on guide tube diameter and process conditions (see floats (K) and (Z))				
Temperature class	T3	T4	T5	T6	
Process temperature	Max. 180 °C	130 °C	95 °C	80 °C	
Ambient temperature at connection housing	Max. 60 °C	60 °C	60 °C	60 °C	
Switching function	Alternatively normally open (NO), normally closed (NC) or change-over (SPDT) contact - on rising level				
max. number of contacts	6 x NO or NC, or 4 x SPDT				
Switch position	Dimensions L ₁ , L ₂ , L ₃ ... (from sealing face, starting from top)				
Distance between switch points	Minimum 20 mm (depending on the selection of the float and the contacts, see floats (K) and (Z))				
Switching power	Only for connection to a certified intrinsically safe circuit with U _{max} 30 V, I _{max} 100 mA				
Mounting position	Vertical ±30°				
Ingress protection	IP 65 per EN 60529 / IEC 60529				
Options	<ul style="list-style-type: none"> ■ Housing heightening X (state dimension X) ■ Temperature resistance Pt100 or Pt1000 ■ Bimetal thermal contact 40 ... 120 °C (in 5 degree steps) 				
Materials	Stainless steel 1.4435, titanium, Hastelloy on request				

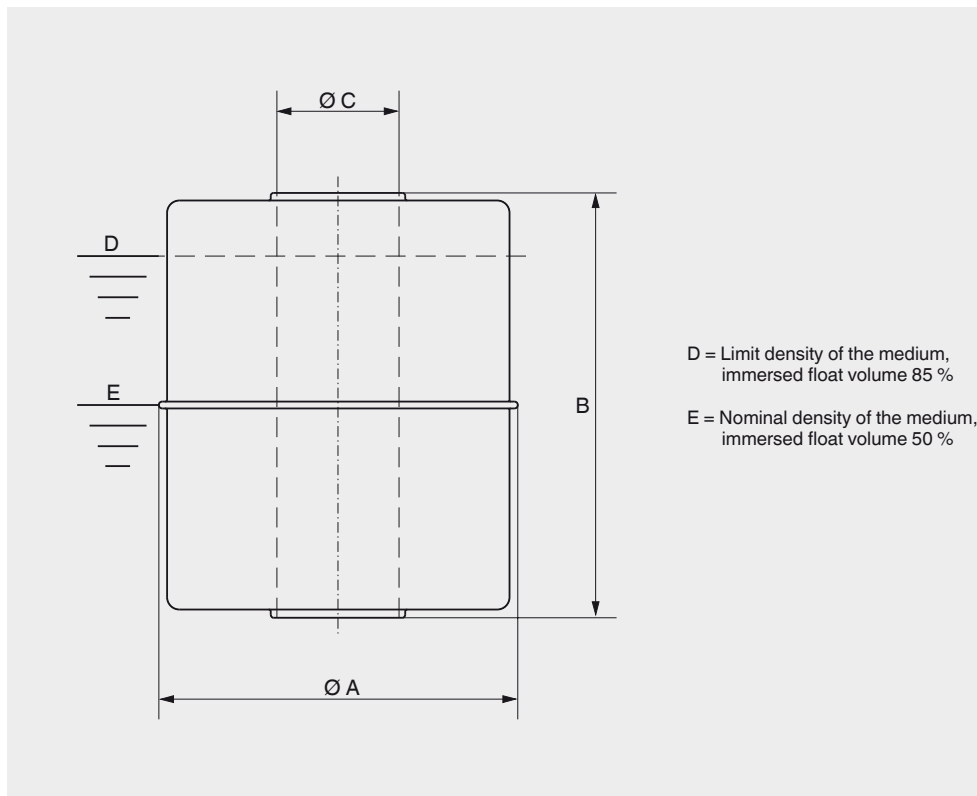
Spherical floats (K)



Material	Suits guide tube \varnothing mm	$\varnothing A$ mm	B mm	$\varnothing C$ mm	Max. operating pressure bar	Max. operating temperature °C	Limit density 85 % kg/m ³
Stainless steel 1.4571	8	29	28	9	6	100	977
	8	29	28	9	25	100	1069
	12	52	52	15	40	300	769
	12	62	61	15	32	300	597
	12	83	81	15	25	300	408
	18	80	76	23	25	300	679
	18	98	96	23	25	300	597
	18	105	103	23	25	300	533
	18	120	117	23	25	300	389
Titanium 3.7035	8	29	28	9	30	100	822
	12	52	52	15	25	300	707
	12	52	52	15	60	300	852
	12	52	52	15	80	300	1060
	12	62	62	15	25	300	505
	12	83	81	15	25	300	278
	18	80	76	23	25	300	665
	18	98	96	23	25	300	495
	18	105	103	23	25	300	369
	18	120	117	23	25	300	329
Stainless steel 1.4571	12	53	53	14	25	depending on medium	745

Note: The optimum float will be selected after a feasibility test carried out by KSR.

Cylindrical floats (Z)



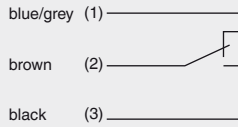
Material	Suits guide tube \varnothing mm	$\varnothing A$ mm	B mm	$\varnothing C$ mm	Max. operating pressure bar	Max. operating temperature $^{\circ}C$	Limit density 85 % kg/m^3
Stainless steel 1.4571	8	27	31	10	16	100	787
	12	44	52	15	16	300	818
Titanium 3.7035	12	44	52	15	16	300	720

Note: The optimum float will be selected after a feasibility test carried out by KSR.

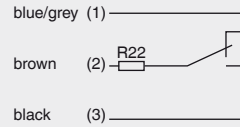
Electrical connections

Reed contact

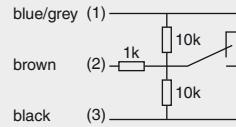
1 switch point



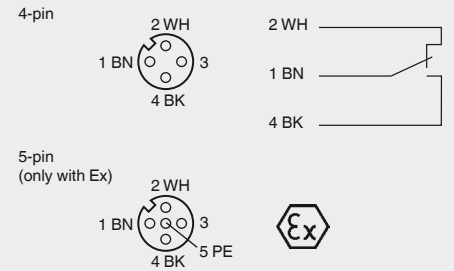
1 switch point
Wiring for operation
with a PLC



1 switch point
NAMUR circuit per
DIN EN 60947-5-6



Connector, pin assignment



Nuclear qualified plug (Han® 7D) on request.

Connection cable

Connection cable	Cross-section
PVC	4 x 0.5 mm ²
Silicone	4 x 0.75 mm ²
Armoured silicone	4 x 0.75 mm ²
LMGSG	3 x 1.5 mm ²

Colour coding per IEC 60757

Colour	Short symbol
Black	BK
Brown	BN
Red	RD
Orange	OG
Yellow	YE
Green	GN
Blue	BU
Violet	VT
Grey	GY
White	WH
Pink	PK
Turquoise	TQ
Green-Yellow	GNYE

Level sensor With reed-chain technology Model FLR for nuclear power plants

KSR data sheet FLR for NPP



Applications

- Level measurement for almost all liquid media
- Chemical, petrochemical, natural gas, offshore, shipbuilding, machine building, power generating equipment, power plants
- Process water and drinking water treatment, food industry, pharmaceutical industry

Special features

- Process- and system-specific solutions possible
- Operating limits:
 - Operating temperature: $T = -80 \dots +200 \text{ }^{\circ}\text{C}$
 - Operating pressure: $P = \text{Vacuum to } 80 \text{ bar}$
 - Limit density: $\rho \geq 400 \text{ kg/m}^3$
- Wide variety of different electrical connections, process connections and materials
- Optionally with programmable and configurable head-mounted transmitter for 4 ... 20 mA field signals, HART®, PROFIBUS® PA and FOUNDATION™ Fieldbus
- Explosion-protected versions

Description

The model FLR sensors with reed-chain technology are used for level measurement in liquid media. They work on the float principle with magnetic transmission.

The float's magnetic system in the guide tube actuates a resistance measuring chain that corresponds to a 3-wire potentiometer circuit. The measurement voltage generated by this is proportional to the fill level.

The measurement voltage is very finely-stepped due to the contact separation of the measuring chain and is thus virtually continuous. Resolutions between 5 and 18 mm are available depending on the requirements.



Level sensor with reed-chain technology,
model FLR-S, flange connection

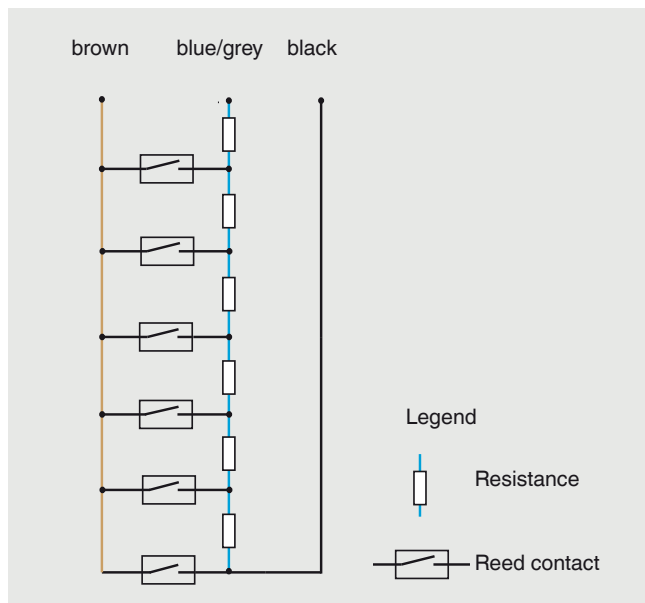
Further special features

- Large scope of application due to the simple, proven functional principle
- Process connection, guide tube and float from stainless steel 1.4571 or plastic
- For harsh operating conditions, long service life
- Continuous measurement of levels, independent of physical and chemical changes of the media such as: Foaming, conductivity, dielectric, pressure, vacuum, temperature, vapours, condensation, bubble formation, boiling effects, density change
- Signal transmission over long distances
- Simple installation and commissioning, onetime calibration only, no recalibration necessary
- Level displayed proportional to volume or height
- High repeatability
- Interface measurement and overall level from Δ density 50 kg/m³
- Level sensors with reed-chain technology qualify as passive electrical equipment in accordance with DIN IEC 60079-11 and can be installed in "zone 1" hazardous areas without certification, so long as the equipment is operated in a certified intrinsically safe circuit with a minimum explosion protection of EEx ib.

Options

- Customised solutions
- Programmable and configurable head-mounted transmitters in connection housing, output signal 4 ... 20 mA, 2-wire, for HART®, PROFIBUS® PA and FOUNDATION™ Fieldbus
- Process connection, guide tube material and float from stainless steel 1.4435, 1.4539, titanium, Hastelloy (others on request)
- In combination with limit switch, stepless setting of the limit values over the entire measuring range

Internal circuit diagram of the reed sensors



Model overview

Sensor model	Description	Materials											
		Stainless steel						Titanium	PVC	PP	PVDF	Buna	
		1.4571 (316Ti)	1.4404 (316L)	1.4435 (316L)	1.4571 (316Ti) / PP	1.4571 (316Ti) / PA	1.4571 (316Ti) / Ms	3.7035 (grade 2)					
FLR-S	Reed-chain sensor, standard version	x	x	x	x	x	x	x	x				x

Sensor model	Approval											Temperature range (process)	
	without	Ex i	Ex d	GL	Ex i + GL	ABS	DNV	Bureau Veritas	3-A	FM	GOST		
FLR-S	x	x	x	x	x	x	x	x		x			-80 ... +200 °C

Ex approvals

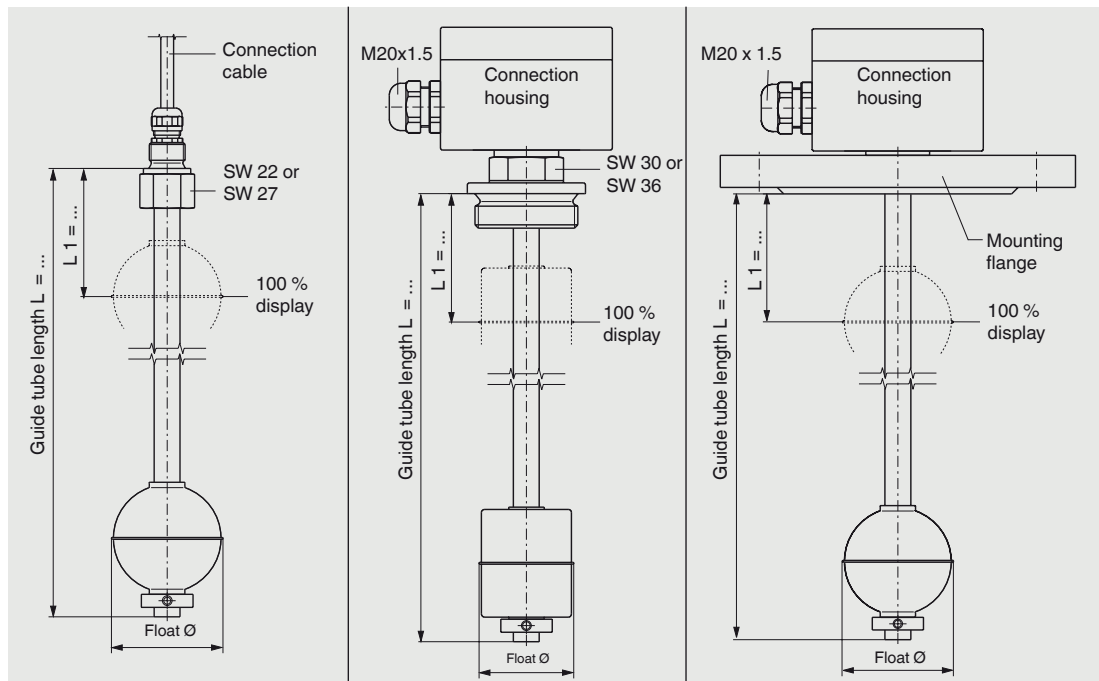
Explosion protection	Ignition protection type	Model	Zone	Approval number
ATEX	Ex i	FLR-S	Zone 0/1/2	KEMA 01 ATEX 1152 X II 1/2G Ex ia IIC T4 ... T6 - II 2 D T80 °C IP 6X TÜV 13 ATEX 7399 X II 2G Ex d IIC T6 Gb / II 2 D Ex tb IIIC T80 °C Db
	Ex d	FLR-S	Zone 1/2	
	Ex i + GL	FLR-S	Zone 1/2	KEMA 01 ATEX 1152 X II 1/2G Ex ia IIC T4 ... T6 - II 2 D T80 °C IP 6X + GL-14788-99 HH
	Ex i + DNV	FLR-S	Zone 1/2	KEMA 01 ATEX 1152 X II 1/2G Ex ia IIC T4 ... T6 - II 2 D T80 °C IP 6X + DNV-A-11452

Type approval

Explosion protection	Model	Approval number
GL	FLR-S	GL-14788-99 HH
DNV	FLR-S	DNV-A-11452
GOST	FLR-S	0959333

Sensor, standard version, model FLR-S

Process connection, guide tube material and float from stainless steel 1.4571



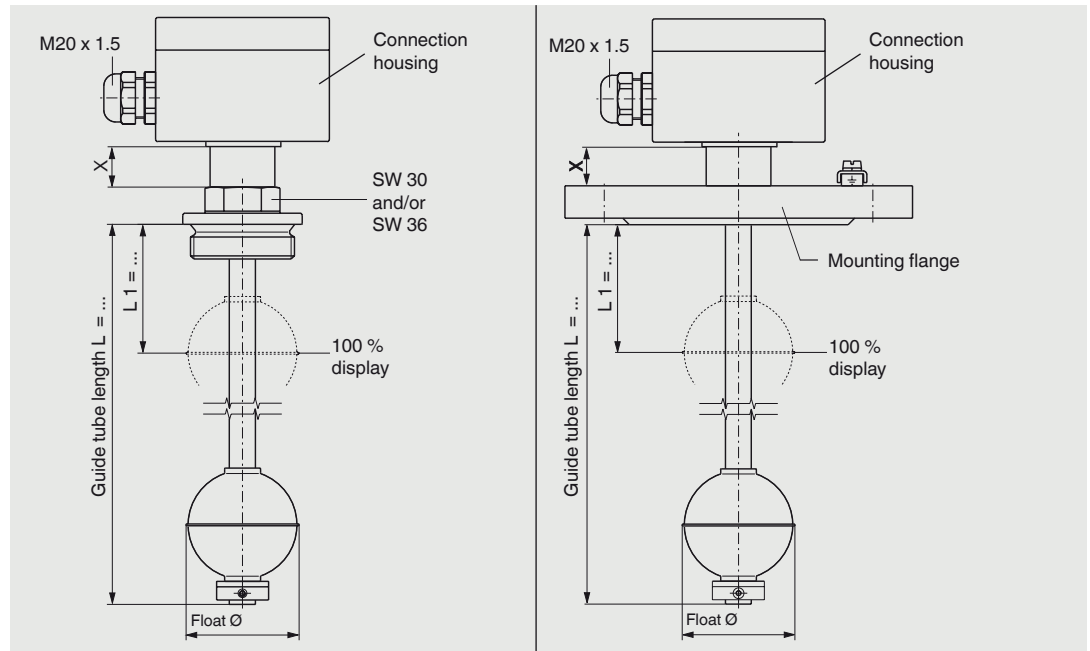
	Mounting thread (without connection housing)			Mounting thread			Flange			
Electrical connection	Connection cable ■ PVC ■ Silicone ■ PUR			Connection housing ■ Aluminium 80 x 75 x 57 mm Option: Polypropylene, polyester, stainless steel						
Process connection	Mounting thread upwards G 3/8" (others on request)		G 1/2" (others on request)	Mounting thread downwards G 1 1/2" or G 2"			Mounting flange ■ DIN DN 50 ... DN 200, PN 6 ... PN 100 ■ ANSI 2" ... 8", class 150 ... 600			
Guide tube diameter	8 mm	12 or 14 mm	18 mm	8 mm	12 or 14 mm	18 mm	8 mm	12 or 14 mm	18 mm	30 mm
Guide tube length L max.	500 mm	3,000 mm	6,000 mm	500 mm	3,000 mm	6,000 mm	500 mm	3,000 mm	6,000 mm	15,000 mm
Float	Material stainless steel 1.4571 (Option: Buna, titanium) Float diameter from 44 ... 120 mm Float selection depending on guide tube diameter and process conditions									
Max. operating pressure	80 bar, see table for floats (K) and (Z)									
Temperature range standard	PVC-/PUR cable -10 ... +80 °C Silicone cable -10 ... +120 °C		-20 ... +120 °C Option: ■ High-temperature version: +120 ... +200 °C Option: ■ Low-temperature version: -80 ... -20 °C							
Contact separation	K 18 = 18 mm (not with option high and low temperature version) K 15 = 15 mm K 10 = 10 mm K 5 = 5 mm									
Overall resistance of the measuring chain	Length and separation dependent									
Connection cable to transmitter	3-wire, screened									
Mounting position	Vertical ±30°									
Ingress protection	IP 65 per EN 60529 / IEC 60529									
Materials	Stainless steel 1.4571, 1.4404, 1.4435, 1.4439, titanium 3.7035 (grade 2), Hastelloy and others on request									

Nuclear qualified plug (Han® 7D) on request.

Sensor, explosion-protected version, intrinsically safe, model FLR-S

KEMA 01 ATEX 1052 X II 1/2G Ex ia IIC T4 ... T6 - II 2 D T80 °C IP 6X

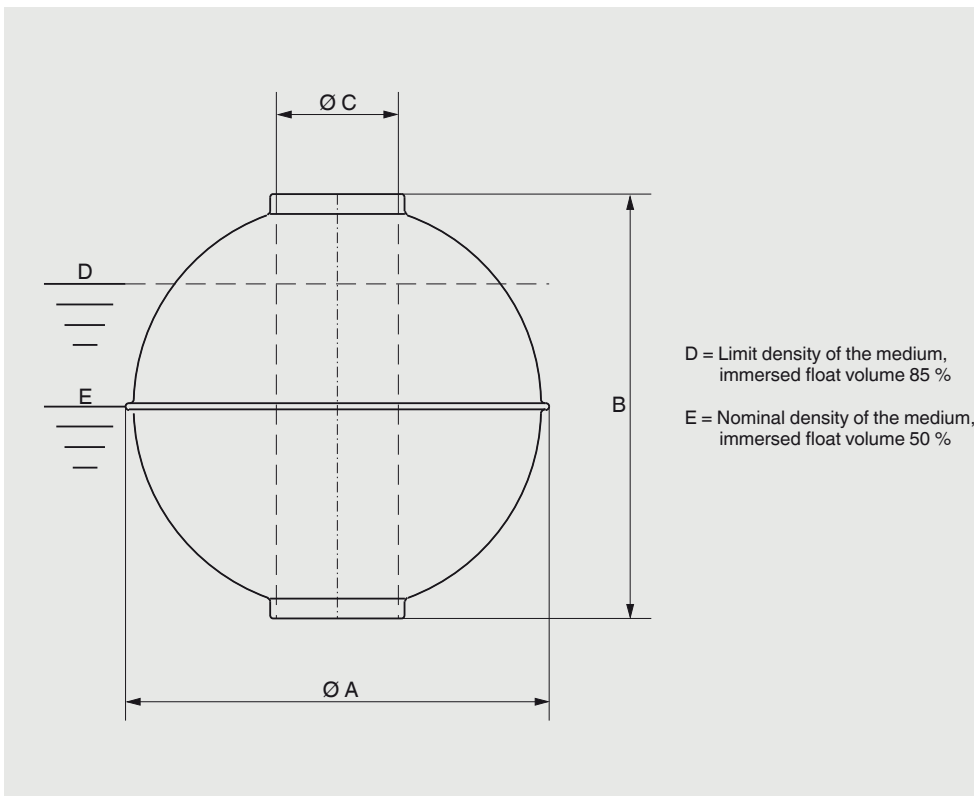
Process connection, guide tube and float from stainless steel 1.4571



Mounting thread		Flange	
Electrical connection	Connection housing ■ Aluminium 80 x 75 x 57 mm Option: Stainless steel, polyester		
Process connection	Mounting thread downwards G 1 1/2" or G 2" (others on request)	Mounting flange ■ DIN DN 50 ... DN 200, PN 6 ... PN 100 ■ ANSI 2" ... 8", class 150 ... 600	
Guide tube diameter	12, 14 or 18 mm		
Guide tube length L max.	See variants A and B		
Float	Material stainless steel 1.4571 (Option: Buna, titanium) Float diameter from 44 ... 120 mm Float selection depending on guide tube diameter and process conditions		
Max. operating pressure	see table for floats (K) and (Z)		
Temperature class	T4	T5	T6
Surface temperature	Max. 135 °C	100 °C	85 °C
Process temperature	Max. 100 °C	65 °C	50 °C
Ambient temperature at connection housing	Max. 60 °C	60 °C	60 °C
Contact separation	K 18 = 18 mm K 15 = 15 mm K 10 = 10 mm K 5 = 5 mm		
Overall resistance of the measuring chain	Length and separation dependent		
Control circuit	Ignition protection type EEx ia IIC, only for connection to a certified intrinsically safe control circuit Transmitter external with max. 120 mA, max. 28 V Head-mounted transmitter in accordance with transmitter approvals		
Connection cable to transmitter	Cable length max. 2,000 m, 3-wire, screened		
Mounting position	Vertical ±30°		
Ingress protection	IP 65 per EN 60529 / IEC 60529		
Materials	Stainless steel 1.4571, 1.4404, titanium 3.7035 (grade 2), Hastelloy and others on request		

Nuclear qualified plug (Han® 7D) on request.

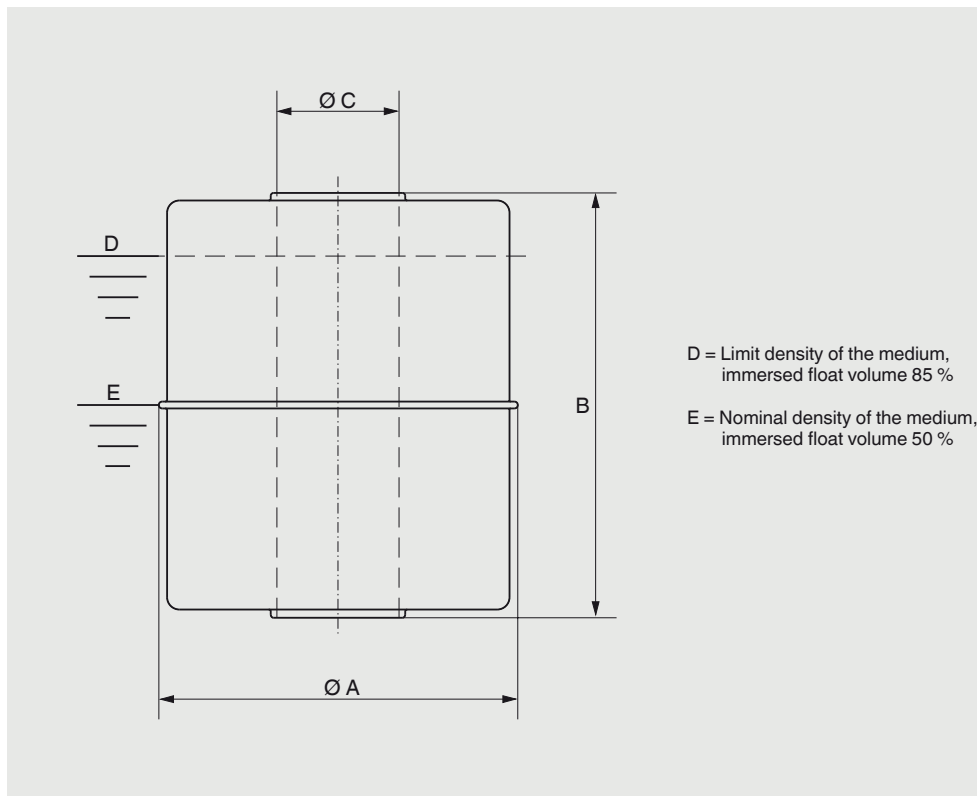
Spherical floats (K)



Material	Suits guide tube \varnothing mm	$\varnothing A$ mm	B mm	$\varnothing C$ mm	Max. operating pressure bar	Max. operating temperature °C	Limit density 85 % kg/m ³
Stainless steel 1.4571	12	52	52	15	40	250	727
	12	62	61	15	32	250	597
	12	83	81	15	25	250	412
	18	80	76	23	25	250	617
	18	98	96	23	25	250	561
	18	105	103	23	25	250	520
	18	120	117	23	25	250	394
	18-30	120	116	38	25	250	537
	18-30	200	192	56	16	250	581
Titanium 3.7035	12	52	52	15	25	250	623
	12	52	52	15	60	250	790
	12	52	52	15	80	250	997
	12	62	62	15	25	250	482
	12	83	81	15	25	250	343
	18	80	76	23	25	250	866
	18	98	96	23	25	250	536
	18	105	103	23	25	250	416
	18	120	117	23	25	250	315
Stainless steel 1.4571	18	81	77	22	25	depending on medium	634

Note: The optimum float will be selected after a feasibility test carried out by KSR.

Cylindrical floats (Z)



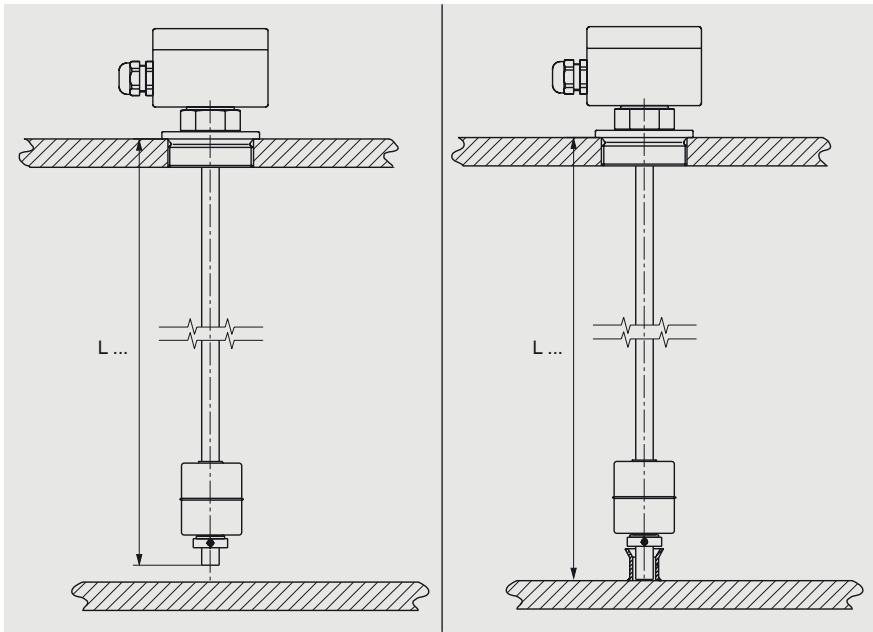
Material	Suits guide tube \varnothing mm	$\varnothing A$ mm	B mm	$\varnothing C$ mm	Max. operating pressure bar	Max. operating temperature $^{\circ}C$	Limit density 85 % kg/m^3
Stainless steel 1.4571	12	44	52	15	16	250	740
Titanium 3.7035	12	44	52	15	16	250	645

Note: The optimum float will be selected after a feasibility test carried out by KSR.

Determination of the max. guide tube length L for explosion-protected version, intrinsically safe

Version A: Fixed to the tank ceiling

Version B: Fixed to the tank ceiling and floor



Guide tube	Max. guide tube length L		
	Version A	Version B	Version C
Ø 12 x 1	660 mm	3,500 mm	
Ø 14 x 1	940 mm	5,000 mm	
Ø 14 x 2	1,600 mm	6,000 mm	
Ø 18 x 2	3,000 mm	6,500 mm	
Ø 30 x 2	max. 15,000 mm		

Version C:

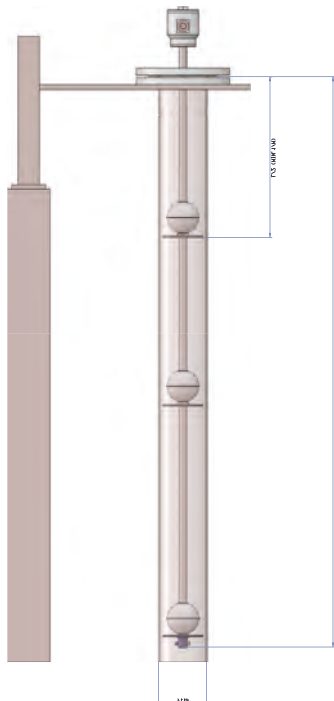
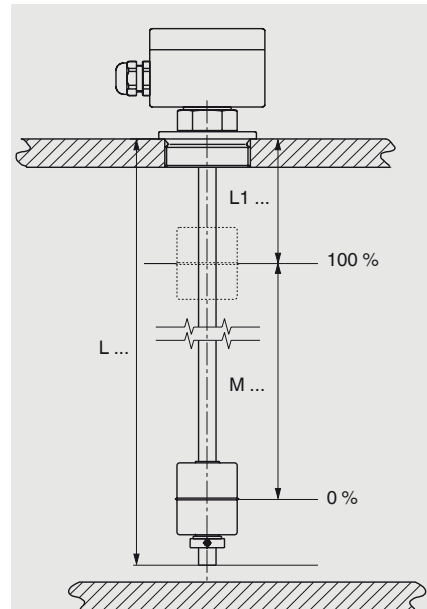


Illustration with the required dimensions for ordering



Legend

L1 = 100 % Mark (distance sealing face-float center)

M = measuring range (distance 0 ... 100 %)

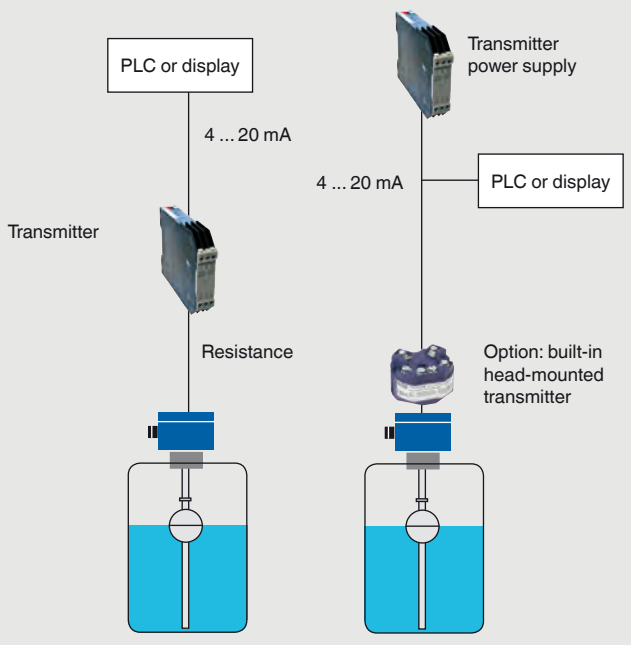
L = guide tube length and/or. insertion length of the sensor

On ordering, the dimension L1 and the guide tube length (immersion length) L must be given.

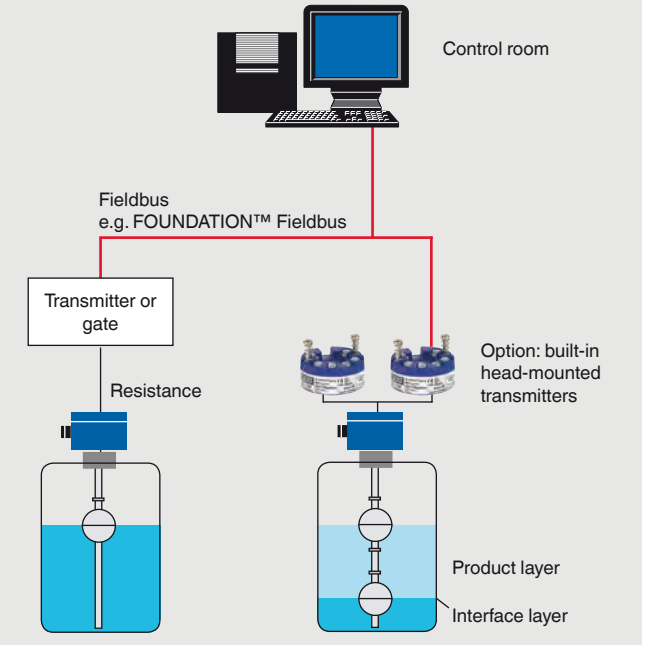
Subsequent alteration of the measuring range is not possible.

Application examples

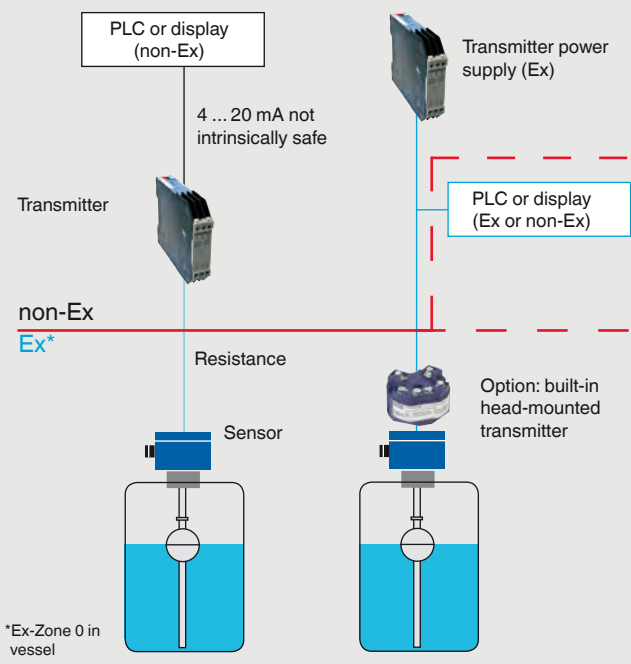
Standard applications



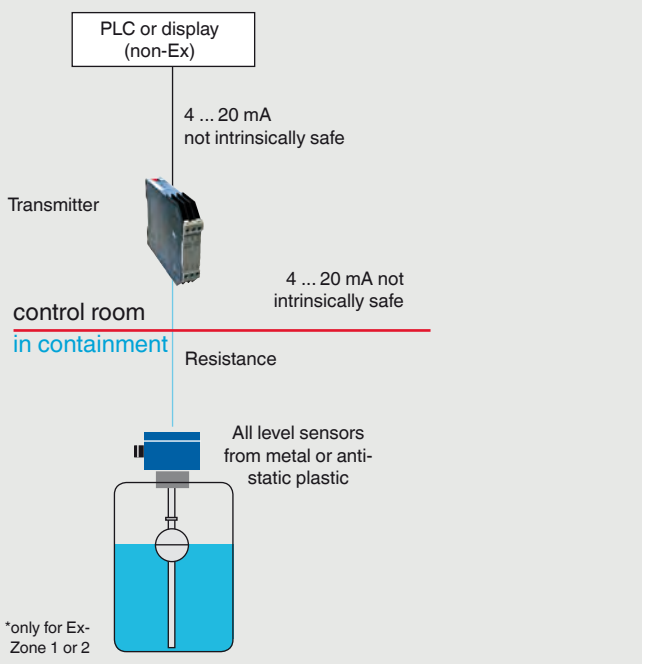
Connection to bus systems



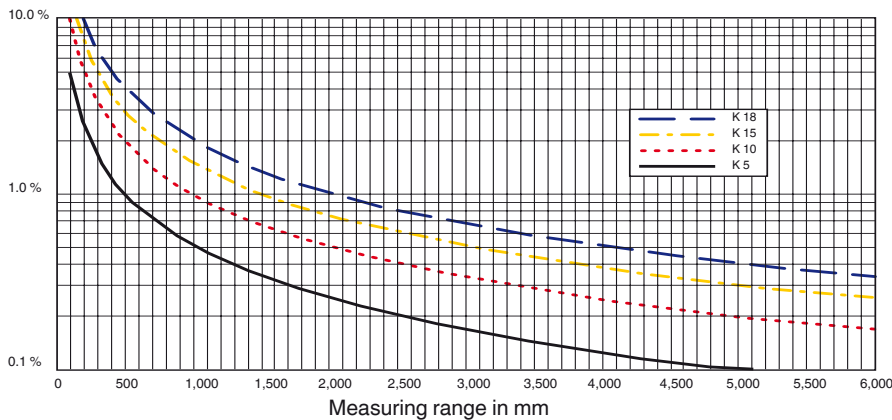
Applications for Ex-Zone 0



Applications for nuclear power plants



Measuring accuracy



Head-mounted transmitter



Model TE

Model T32E

Model T53F

Model TLEH

Model	4 ... 20 mA	HART®	PROFIBUS® PA	Fieldbus™	Exi	IEEE	Display
TE	x				x	x	
TS	x						
T32E	x	x			x		
T32S	x	x					
T53F				x	x		
T53P			x		x		
TLH	x	x					x
TLEH	x	x			x		x

Optoelectronic level switch

Model OLS-H / OLS-H-HT high-temperature

For nuclear power plants

KSR data sheet OLS-H for NPP

Applications

- Chemical, petrochemical, natural gas, offshore industries
- Shipbuilding, machine building, refrigerator units
- Power generating equipment, power plants
- Process and drinking water treatment
- Wastewater and environmental engineering

Special features

- Temperature ranges from 0 ... +350 °C
- Pressure up to 176 bar
- Signal processing is made using a separate model OSA-S switching amplifier

Description

The model OLS optoelectronic level switches are used for the detection of limit levels in liquids. This is widely independent of physical characteristics such as refractive index, colour, density, dielectric constant and conductivity. Measurement is also done in small volumes.

The switches consist of an infrared LED and a phototransistor. The light of the LED is directed into a prism. So long as the sensor tip of the prism is in the gas phase, the light is reflected within the prism to the receiver. When the liquid in the vessel rises and wets approximately 2/3 of the glass tip, the infrared lightbeam into the liquid is interrupted and only a small portion reaches the receiver. This difference is evaluated by the electronics and triggers a switching operation.

The instruments are very robust and designed for rough operating conditions.

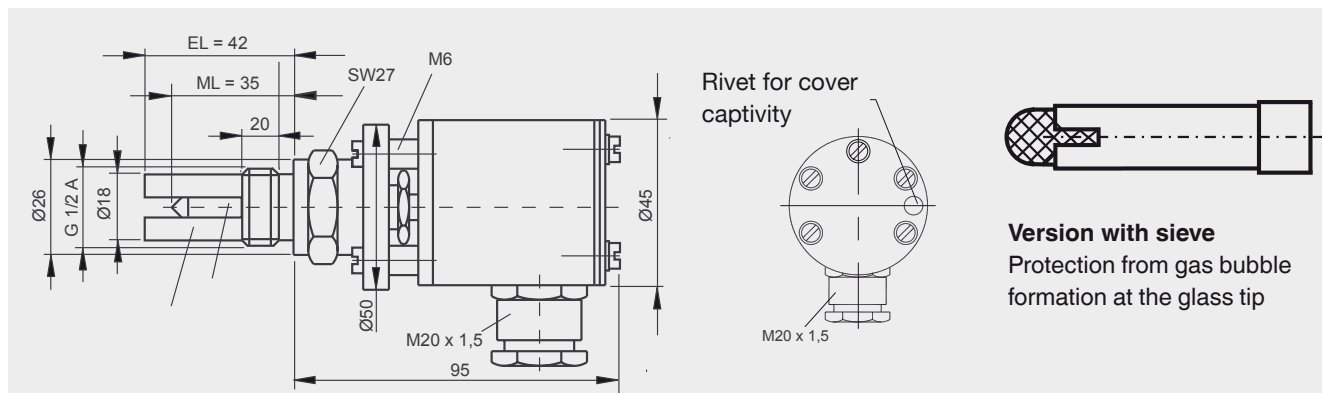


Fig. left: Optoelectronic level switch, model OLS-H
Fig. right: Switching amplifier, model OSA-S, aluminum add-on case

Model overview

Model	Description	Max. pressure in bar	Medium temperature in °C	Ambient temperature in °C	Item No.
OLS-H	Optoelectronic level switch, high-pressure version	176	0 ... +250	-65 ... +95	120552
OLS-H-HT	Optoelectronic level switch, high-pressure version for high temperature	176	0 ... +350	-65 ... +95	120551
OSA-S	Switching amplifier 230 VAC	-	-	-40 ... +40	120553
OSA-S	Switching amplifier 24 VDC	-	-	-40 ... +40	120554

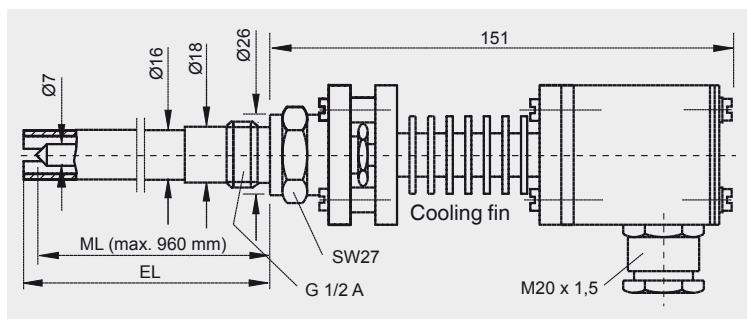
Optoelectronic level switch, model OLS-H



Specifications	
Switch point ML	35 mm
Insertion length EL	42 mm, with sieve 52 mm
Medium temperature	0 ... +250 °C
Ambient temperature	-65 ... +95 °C
Pressure range	0 ... 176 bar
Glass protection	Guard finger
Process connection	G 1/2"
Material	Stainless steel 1.4571
Light guide	Sapphire
Mounting position	As required
Measuring accuracy	±0.5 mm
Repeat accuracy	±0.1 mm
Light source	IR light 930 nm
Ambient light	Max. 100 Lux
Cable gland	M20 x 1.5 / Han 7 D connector
Terminal connection	3 x 2.5 mm ²
Ingress protection	IP 65
With additional glass protection	sieve

Option for high-temperature

Optoelectronic level switch, model OLS-H-HT

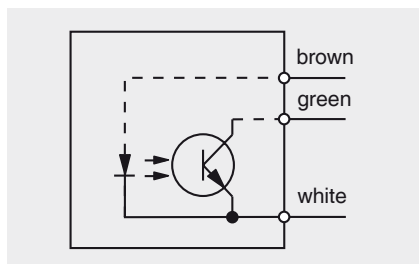


Specification: with cooling fin

Temperature range 0 ... +350 °C

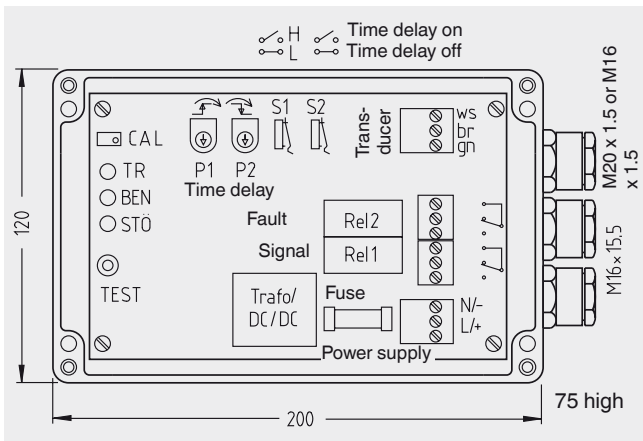
Ambient temperature -65 ... +95 °C

Electrical connection diagram



Switching amplifier model OSA-S

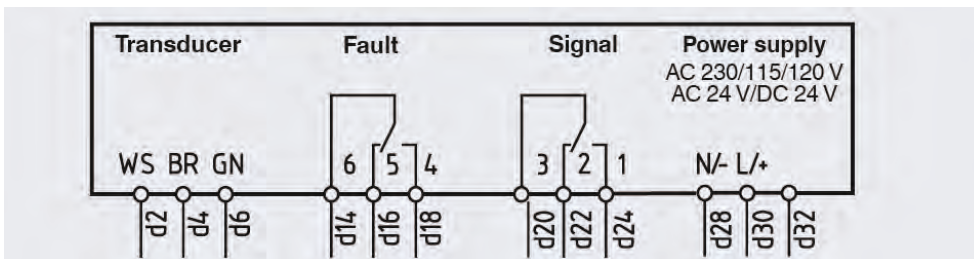
Version in aluminum add-on case



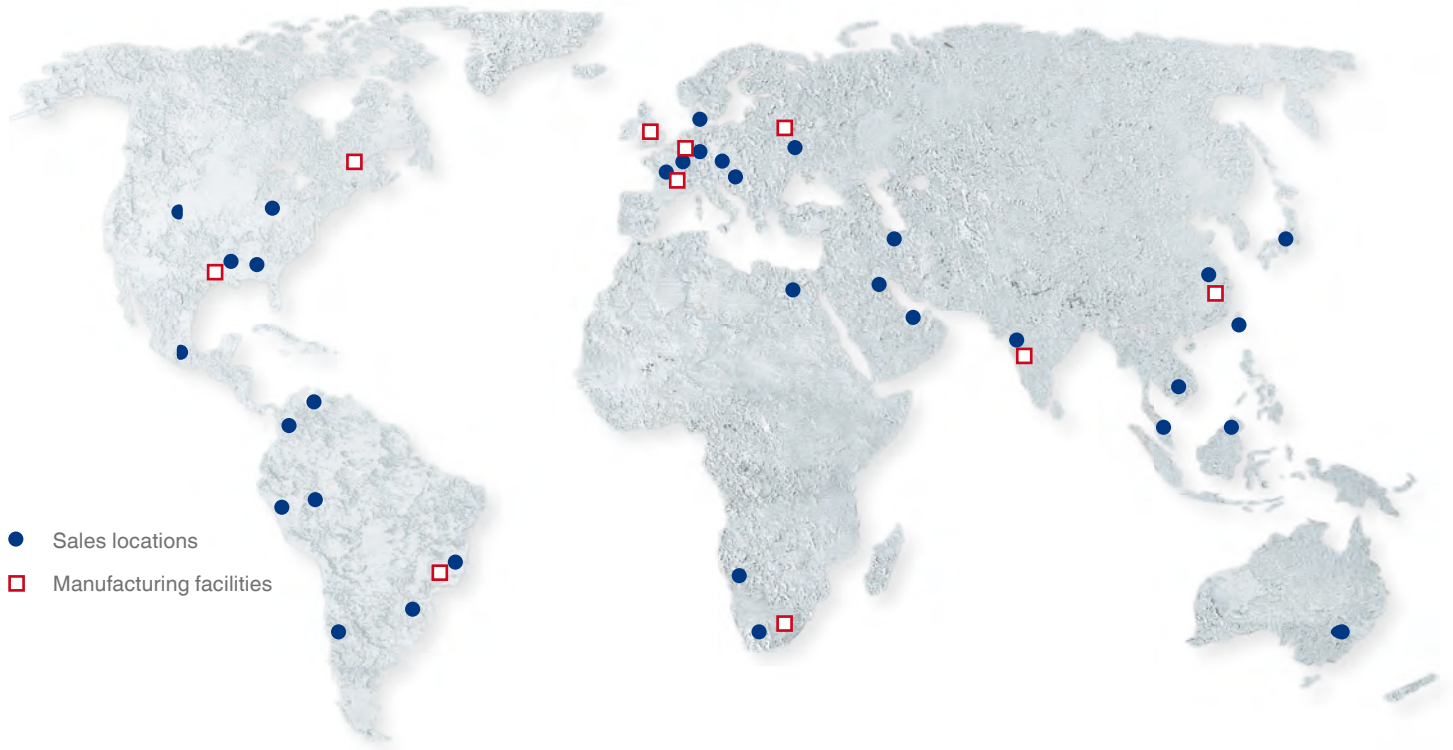
Specifications

Ambient temperature	-40 ... +40 °C
Power supply	AC 230 VAC / 24 VDC
Power consumption	2.8 VA, 3 W
Outputs	Signal relay, change-over contact, 250 V, 3 A, 100 VA Failure relay, change-over contact, 250 V, 3 A, 100 VA
Cable gland	M16 x 1.5
Max. connection cross-section	2.5 mm ²
Max. cable length	175 ... 600 m (with 0.5 ... 1.5 mm ²)
Ingress protection	IP 65







Electrical connection diagram



KSR worldwide



Further manufacturing facilities

<p style="text-align: center;">France</p> 	<p style="text-align: center;">China</p> 	<p style="text-align: center;">UK</p> 	<p style="text-align: center;">USA</p> 
<p style="text-align: center;">KUBLER France SA</p>	<p style="text-align: center;">Shanghai KSR Kuebler Automation Instrument Co. Ltd.</p>	<p style="text-align: center;">TC Fluid Control</p>	<p style="text-align: center;">WIKA Instrument - Houston Facility</p>
<p style="text-align: center;">India</p> 	<p style="text-align: center;">Canada</p> 	<p style="text-align: center;">Brazil</p> 	<p style="text-align: center;">South Africa</p> 
<p style="text-align: center;">WIKA Instruments India Pvt. Ltd.</p>	<p style="text-align: center;">WIKA Instruments Ltd - Canada Headquarters</p>	<p style="text-align: center;">WIKA DO BRASIL</p>	<p style="text-align: center;">WIKA Instruments (Pty) Ltd.</p>



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