Bypass - Level Indicators 1015

Bypass - Level Indicators 1015
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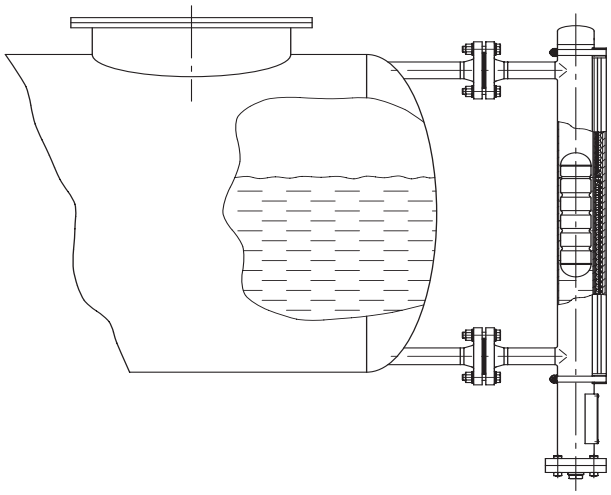
Instructions for instrument selection in the catalogue

So that the customer gets the best equipment solution according to his requirements, we recommend this simple procedure using the following pages:

- Define the dimension of the fitting or interface (e.g. thread G2“, DIN-flange DN25/PN16, etc.)
- Determine the electrical connection (e.g. terminal box, cable entry, plug, etc.)
- Find out the operating conditions, min. and max. operating pressure, temperature and specific gravity of the media at the max. operating temperature.
- With the size of the fitting and material of the instrument, a guide specification can be selected on pages 202 to 220.
- The full and final specification can now be generated by reference to the „type key“ on pages 232 to 235.
- With the type description and the technical operating conditions a price quotation can be made or the instrument can be ordered.
- Specification of the requested approval.

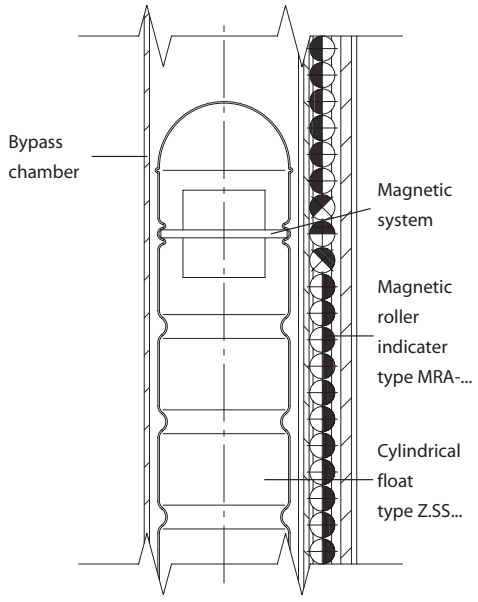
Bypass - Level Indicators 1015
Description and function

The bypass level indicator forms an integral part of a pressure vessel. A chamber is mounted on the side of a tank or container by means of two process connections. This direct connection ensures that the level in the chamber corresponds precisely to the level of the liquid in the tank or container (communicating pipes). Inside the bypass chamber is a cylindrical float with a built-in magnetic system. The concentrated magnetic field produced by the permanent magnet gives a precise reading for the level of liquid in the chamber. A signal is transmitted by the magnetic field through the wall of the chamber to an externally mounted indicator, as well as to recording and switchgear elements.



Magnetic Roller Indicators
are used for displaying the level visually. Small plastic or aluminium rollers with inlaid bar magnets are held in an aluminium or stainless steel profile bar. Depending on the level in the chamber, these rollers turn from white to red as the level rises and from red to white as the level falls. The level inside the vessel can thus be indicated continually without requiring any outside power source.

Level Sensors
are used for the electrical continuous remote indicator of levels. The magnetic field of the permanent magnet in the cylindrical float acts through the wall to activate very small reed contacts that continually register the measurement voltage on a resistance measurement chain. This measurement voltage is proportional to the level (3-wire potentiometer circuit). The resolution of the reed contacts is produced with spacings of 5, 10 and 15mm. When used in connection with a control unit, the resistance value can be converted into a standardized analogous signal.



Magnetic Switches
are used as limit value switches for various filling levels. The permanent magnet in the cylindrical float activates a potential-free bistable reed contact. Completely contactless, it sends out a binary signal that can be used as a „full/empty“, a „pump on/off“ or a „valve open/close“ signal. However, reed contacts are also ideally suited for forwarding signals directly to SPS control units.

Technical advantages

- Simple, robust and unbreakable design
- Pressure- and gas-proof separation between the measurement and the indicator chambers
- Detection and indication of the filling levels of aggressive, combustible, poisonous, hot , turbulent and severely contaminated media
- Guaranteed operation of the magnetic roller indicator without requiring an auxiliary power source, even in the case of power system failures
- Usable in all fields of industry thanks to the use of a wide range of corrosion-proof materials
- Designs available for pressure ranges from a vacuum up to 400 bar
- Designs available for temperature ranges from -160°C to +400°C
- Designs available for density as of 350 kg/m³

Bypass - Level Indicators 1015
Certificates / Approvals

Certificates

SCHWEIZERISCHER VEREIN FÜR QUALITÄTS- UND MANAGEMENTSYSTEME
Certified according to ISO 9000 rev. 2000

SWISS TECHNICAL SERVICES AG
Approval as production factory, welding examination and procedure qualification incl. restamping certificate for the production of pressure tanks according to SVTI-regulation 501, 201

Approvals

The company Heinrich Kübler AG can manufacture bypass-level indicators to most national and industrial approvals. Therefore a wide range of instruments with approvals requirements can be produced according to customer's requests.

TECHNISCHER ÜBERWACHUNGSVEREIN DEUTSCHLAND (PED)
Approval as production factory for manufacture of pressure tanks according to AD HP 0, PED Pressure Equipment Directive 97/23/EG

SOCIETE NATIONALE DE CERTIFICATION ET D'HOMOLOGATION (ATEX)
Approval for the production of bypass-level indicators according to EU-Directive 94/9/EG

GERMANISCHER LLOYD (Building of ships)
Approval for the production of bypass-level indicators according to GL-regulations

BUREAU VERITAS (Building of ships)
Approval for the production of bypass-level indicators according to BV-regulations

REGISTRO ITALIANO NAVALE (Building of ships)
Approval for the production of bypass-level indicators according to RINA-regulations

DET NORSKE VERITAS (Building of ships)
Approval for the production of bypass-level indicators according to DNV-regulations

Bypass - Level Indicators 1015
Approvals

As an innovative manufacturer of instruments for level control, we can offer to our customers systems according to different directives. The types of approval, applications and limits of use can be taken from the following specifications.

Approvals

Ex

A large number of bypass-level indicators from our standard range, or to customer requests, can be built according to the ATEX-Directive 94/9/EG with the protection types EEx ia IIC T1 to T6 or according to the corresponding electrical components in EEx d T4 to T6. By the combination of the instruments with the type key the catalogue shows with the Ex hexagonal logo which components can be used for Ex-instruments.

Medium temperature:

EEx ia-instruments	
T1	300 °C
T3	180 °C
T4	130 °C
T5	95 °C
T6	80 °C

EEx d-instruments	
T4	120 °C
T5	95 °C
T6	80 °C

PED

Under the Pressure Equipment Directive 97/23/EG, any pressure vessel or instrument used within a pressurised system at 0,5 bar or above, has to conform to various categories. Depending on the design data or customer needs, manufacture of instruments is to either of the categories below.

Category II	
Module	A1

Category IV	
Module	B+D

GL / BV / RINA / DNV

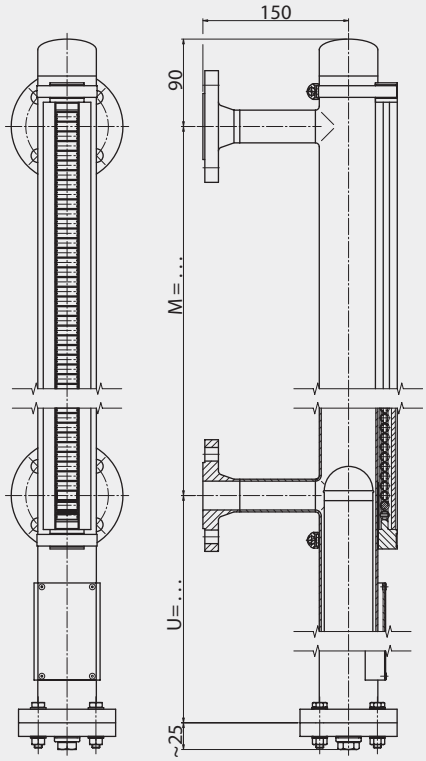
Bypass-level indicators for use in shipping can be manufactured to GL (Germanischer Lloyd), BV (Bureau Veritas), RINA (Registro Italiano Navale) or DNV (Det Norske Veritas) standards in large variety of design possibilities complete with controllers.

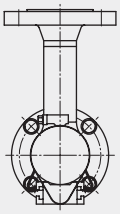
Bypass - Level Indicators 1015
Stainless steel PN16 and PN40

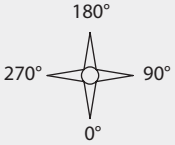
Technical data

BNA - .. / .. - M .. - V .. - .. - Z.S ..
BMG - .. / .. - .. - .. - .. K .. - M .. - V .. - .. - Z.S ..

Material:	1.4404 / 316 L 1.4435 / 316 L 1.4571 / 316 Ti
Chamber:	ø 60.3 mm x 2 mm ø 63.5 mm x 2 mm
Chamber end top:	- Welding cap (standard) - Flat top with venting - Options see page 230
Chamber end bottom:	- Flange connection with drain plug - Options see page 230
Process connections:	- Flange acc. to DIN - Flange acc. to Ansi - Thread female - Thread male - Welding ends
Distance centre to centre:	M = 150 mm ... 25000 mm
Magnetic roller indicator:	- MRA / MRK - MNA / MNAV / MNK - MNAN / MNKV / MKAP
Scale:	- ../SK /../SG / ../VSG
Magnetic switch:	- See pages 223-227
Level sensor:	- See pages 228-229
Insulation thickness:	- 30 mm - 60 mm
Approvals:	- See pages 200-201
Float:	- Acc. to table (standard) page 203 - Acc. to protocol
Interface:	- Acc. to protocol
Lower chamber extension:	U = float length L-30mm







Operating parameters

Operating temp. standard:	- 40 °C ... +250 °C
Operating temp. on request:	-160 °C ... +400 °C
Pressure:	-1 ... 16 bar -1 ... 40 bar
Specific gravity:	≥ 460 kg/m³
Accuracy:	5 mm
Repeatability:	+/- 2 mm

Type combination see type key Bypass - Level Indicators

Bypass - Level Indicators 1015
Cylindrical float PN16 and PN40

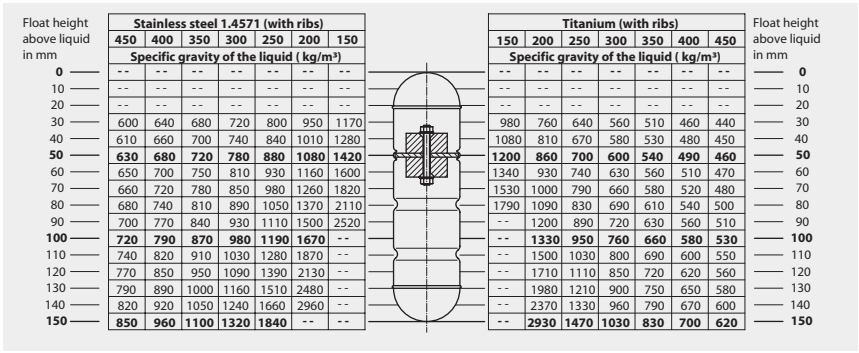
Technical data

	Stainless steel PN16	Titanium PN16
Material:	Stainless steel	Titanium
Operating temperature:	-40 °C ... +250 °C	-10 °C ... +150 °C
Operating pressure:	max. 20 bar	max. 16 bar
Test pressure:	max. 33 bar	max. 28 bar
Diameter:	50 mm	50.8 mm
Type of float:	ZVSS ...	ZTSS ...

Float data:

Length L [mm]	**450**	**400**	**350**	**300**	**250**	**200**	**150**
Volume [cm³]	851	753	654	556	458	360	262
Weight [g]	485	455	415	368	332	300	256

Length L [mm]	**150**	**200**	**250**	**300**	**350**	**400**	**450**
Volume [cm³]	262	360	458	556	654	753	851
Weight [g]	222	247	271	294	317	341	366



Float height above liquid in mm	Stainless steel 1.4571 (with ribs) Specific gravity of the liquid (kg/m³)						
	450	**400**	**350**	**300**	**250**	**200**	**150**
0	--	--	--	--	--	--	--
10	--	--	--	--	--	--	--
20	--	--	--	--	--	--	--
30	600	640	680	720	800	950	1170
40	610	660	700	740	840	1010	1280
50	**630**	**680**	**720**	**780**	**880**	**1080**	**1420**
60	650	700	750	810	930	1160	1600
70	660	720	780	850	980	1260	1820
80	680	740	810	890	1050	1370	2110
90	700	770	840	930	1110	1500	2520
100	**720**	**790**	**870**	**980**	**1190**	**1670**	--
110	740	820	910	1030	1280	1870	--
120	770	850	950	1090	1390	2130	--
130	790	890	1000	1160	1510	2480	--
140	820	920	1050	1240	1660	2960	--
150	**850**	**960**	**1100**	**1320**	**1840**	--	--

Titanium (with ribs) Specific gravity of the liquid (kg/m³)							Float height above liquid in mm
150	**200**	**250**	**300**	**350**	**400**	**450**	
--	--	--	--	--	--	--	**0**
--	--	--	--	--	--	--	10
--	--	--	--	--	--	--	20
980	760	640	560	510	460	440	30
1080	810	670	580	530	480	450	40
1200	**860**	**700**	**600**	**540**	**490**	**460**	**50**
1340	930	740	630	560	510	470	60
1530	1000	790	660	580	520	480	70
1790	1090	830	690	610	540	500	80
--	1200	890	720	630	560	510	90
--	**1330**	**950**	**760**	**660**	**580**	**530**	**100**
--	1500	1030	800	690	600	550	110
--	1710	1110	850	720	620	560	120
--	1980	1210	900	750	650	580	130
--	2370	1330	960	790	670	600	140
--	**2930**	**1470**	**1030**	**830**	**700**	**620**	**150**

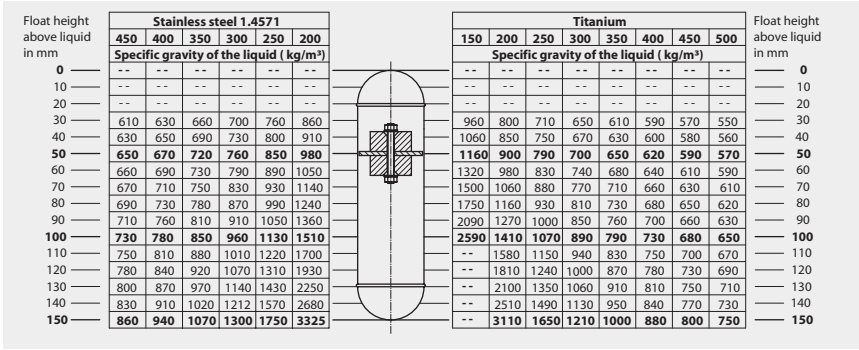
Technical data

	Stainless steel PN40	Titanium PN40
Material:	Stainless steel	Titanium
Operating temperature:	-70 °C ... +250 °C	-10 °C ... +200 °C
Operating pressure:	max. 40 bar	max. 40 bar
Test pressure:	max. 66 bar	max. 97 bar
Diameter:	50 mm	50.8 mm
Type of float:	ZVS ...	ZTS ...

Float data:

Length L [mm]	**450**	**400**	**350**	**300**	**250**	**200**	
Volume [cm³]	851	753	654	556	458	360	
Weight [g]	491	419	402	361	314	272	

Length L [mm]	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**
Volume [cm³]	262	360	458	556	654	753	851	978
Weight [g]	218	262	306	346	399	429	473	517



Float height above liquid in mm	Stainless steel 1.4571 Specific gravity of the liquid (kg/m³)						
	450	**400**	**350**	**300**	**250**	**200**	
0	--	--	--	--	--	--	
10	--	--	--	--	--	--	
20	--	--	--	--	--	--	
30	610	630	660	700	760	860	
40	630	650	690	730	800	910	
50	**650**	**670**	**720**	**760**	**850**	**980**	
60	660	690	730	790	890	1050	
70	670	710	750	830	930	1140	
80	690	730	780	870	990	1240	
90	710	760	810	910	1050	1360	
100	**730**	**780**	**850**	**960**	**1130**	**1510**	
110	750	810	880	1010	1220	1700	
120	780	840	920	1070	1310	1930	
130	800	870	970	1140	1430	2250	
140	830	910	1020	1212	1570	2680	
150	**860**	**940**	**1070**	**1300**	**1750**	**3325**	

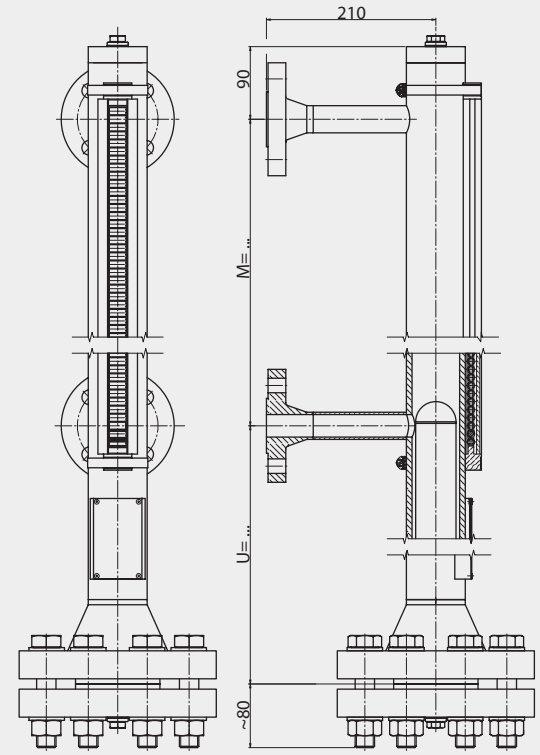
Titanium Specific gravity of the liquid (kg/m³)								Float height above liquid in mm
150	**200**	**250**	**300**	**350**	**400**	**450**	**500**	
--	--	--	--	--	--	--	--	**0**
--	--	--	--	--	--	--	--	10
--	--	--	--	--	--	--	--	20
960	800	710	650	610	590	570	550	30
1060	850	750	670	630	600	580	560	40
1160	**900**	**790**	**700**	**650**	**620**	**590**	**570**	**50**
1320	980	830	740	680	640	610	590	60
1500	1060	880	770	710	660	630	610	70
1750	1160	930	810	730	680	650	620	80
2090	1270	1000	850	760	700	660	630	90
2590	**1410**	**1070**	**890**	**790**	**730**	**680**	**650**	**100**
--	1580	1150	940	830	750	700	670	110
--	1810	1240	1000	870	780	730	690	120
--	2100	1350	1060	910	810	750	710	130
--	2510	1490	1130	950	840	770	730	140
--	**3110**	**1650**	**1210**	**1000**	**880**	**800**	**750**	**150**

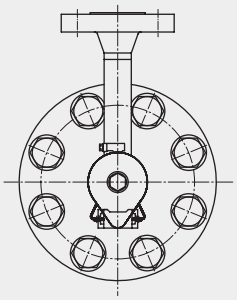
Bypass - Level Indicators 1015
Stainless steel PN64 and PN100

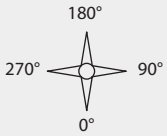
BNA - .. / .. - M .. - V .. - .. - Z.S ..
BMG - .. / .. - .. - .. - .. K .. - M .. - V .. - .. - Z.S ..

Technical data

Material:	1.4404 / 316 L 1.4435 / 316 L 1.4571 / 316 Ti
Chamber:	ø 60.3x2.6mm (PN64) ø 73.03x5.16mm (PN100)
Chamber end top:	- Flat top with venting - Options see page 230
Chamber end bottom:	- Flange connection with drain plug - Options see page 230
Process connections:	- Flange acc. to DIN - Flange acc. to Ansi - Thread female - Thread male - Welding ends - ...
Distance centre to centre:	M = 150 mm ... 25000 mm
Magnetic roller indicator:	- MRA / MRK - MNA / MNAV / MNK - MNAN / MNKV / MNAP
Scale:	- ../SK /../SG / ../VSG
Magnetic switch:	- See pages 223-227
Level sensor:	- See pages 228-229
Insulation thickness:	- 30 mm - 60 mm
Approvals:	- See pages 200-201
Float:	- Acc. to protocol
Interface:	- Acc. to protocol
Lower chamber extension:	U = float length L-30 mm







Operating parameters

Operating temp. standard:	- 40 °C ... +250 °C
Operating temp. on request:	-160 °C ... +400 °C
Pressure:	-1 ... 64 bar -1 ... 100 bar
Specific gravity:	Acc. to calculation
Accuracy:	5 mm
Repeatability:	+/- 2 mm

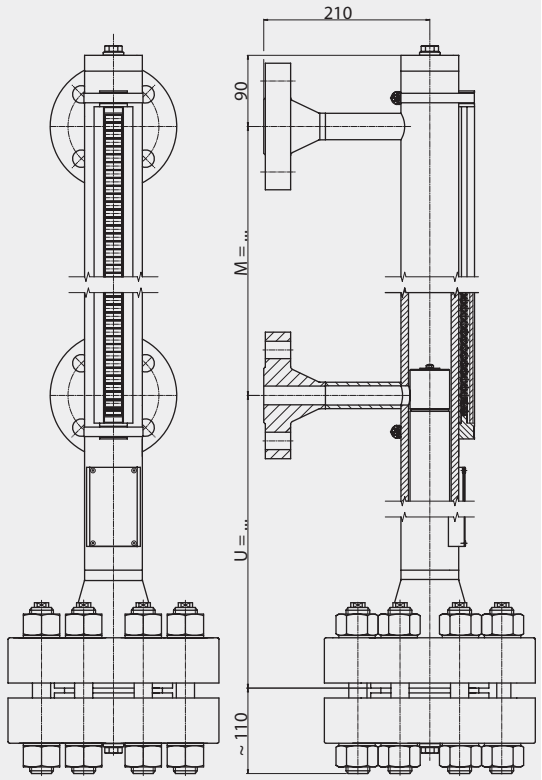
Type combination see type key Bypass - Level Indicators

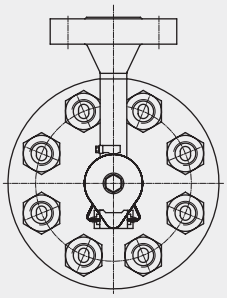
Bypass - Level Indicators 1015
Stainless steel PN160, PN250, PN320 and PN400

Technical data

BNA - .. / .. - M .. - V .. - .. - Z.S ..
BMG - .. / .. - .. - .. - .. K .. - M .. - V .. - .. - Z.S ..

Material:	1.4404 / 316 L 1.4435 / 316 L 1.4571 / 316 Ti
Chamber:	ø 73.03 x 7.01 (PN160-250) ø 73.03 x 9.53 (PN250-400)
Chamber end top:	- Flat top with venting - Options see page 230
Chamber end bottom:	- Flange connection with drain plug - Options see page 230
Process connections:	- Flange acc. to DIN - Flange acc. to Ansi - Thread female - Thread male - Welding ends - ...
Distance centre to centre:	M = 200 mm ... 25000 mm
Magnetic roller indicator:	- MRA / MRK - MNA / MNAV / MNK - MNAN / MNKV / MNAP
Scale:	- ../SK /../SG / ../VSG
Magnetic switch:	- See pages 223-227
Level sensor:	- See pages 228-229
Insulation thickness:	- 30 mm - 60 mm
Approvals:	- See pages 200-201
Float:	- Acc. to protocol
Interface:	- Acc. to protocol
Lower chamber extension:	U = float length L-30mm





Operating parameters

Operating temp. standard:	- 40 °C ... +250 °C
Operating temp. on request:	-160 °C ... +400 °C
Pressure:	-1 ... 160 - 400 bar
Specific gravity:	Acc. to calculation
Accuracy:	5 mm
Repeatability:	+/- 2 mm

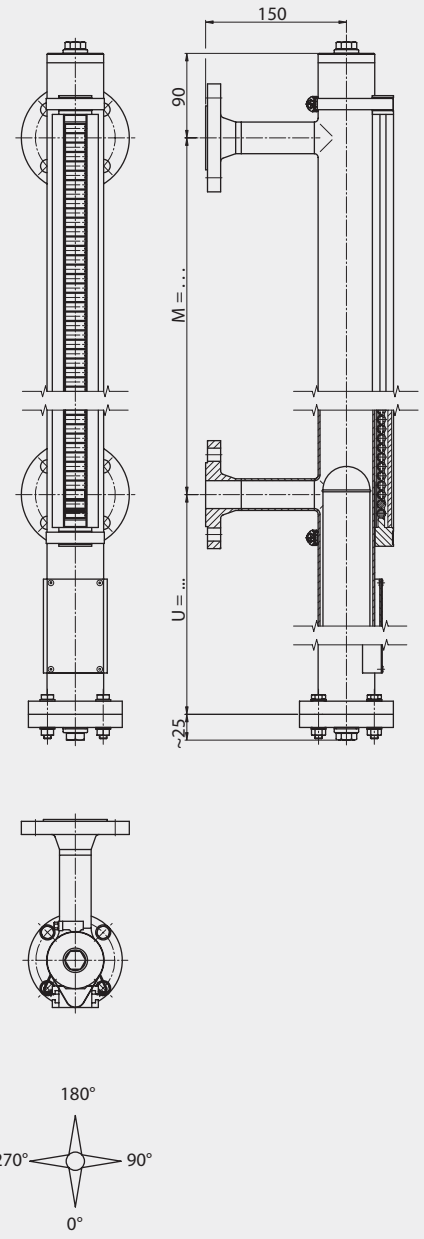
Type combination see type key Bypass - Level Indicators

Bypass - Level Indicators 1015
Titanium PN16 and PN40

Technical data

BNA - .. / .. - M .. - Ti.. - .. - ZTS ..
BMG - .. / .. - ..- ..- .. K ..- M.. - Ti .. - .. - ZTS ..

Material:	3.7025 Gr. 1 3.7035 Gr. 2
Chamber:	ø 60.3 x 2.77 mm
Chamber end top:	- Flat top with venting - Options see page 230
Chamber end bottom:	- Flange connection with drain plug - Options see page 230
Process connections:	- Flange acc. to DIN - Flange acc. to Ansi - Thread female - Thread male - Welding ends - ...
Distance centre to centre:	M = 150 mm ... 25000 mm
Magnetic roller indicator:	- MRA / MRK - MNA / MNAV / MNK - MNAN / MNKV / MNAP
Scale:	- ../SK /../SG / ../VSG
Magnetic switch:	- See pages 223-227
Level sensor:	- See pages 228-229
Insulation thickness:	- 30 mm - 60 mm
Approvals:	- See pages 200-201
Float:	- Acc. to table (standard) page 203 - Acc. to protocol
Interface:	- Acc. to protocol
Lower chamber extension:	U = float length L-30mm



Operating parameters

Operating temp. standard:	-10 °C ... +150 °C
Operating temp. on request:	-30 °C ... +300 °C
Pressure:	-1 ... 16 bar -1 ... 40 bar
Specific gravity:	≥ 480 kg/m³
Accuracy:	5 mm
Repeatability:	+/- 2 mm

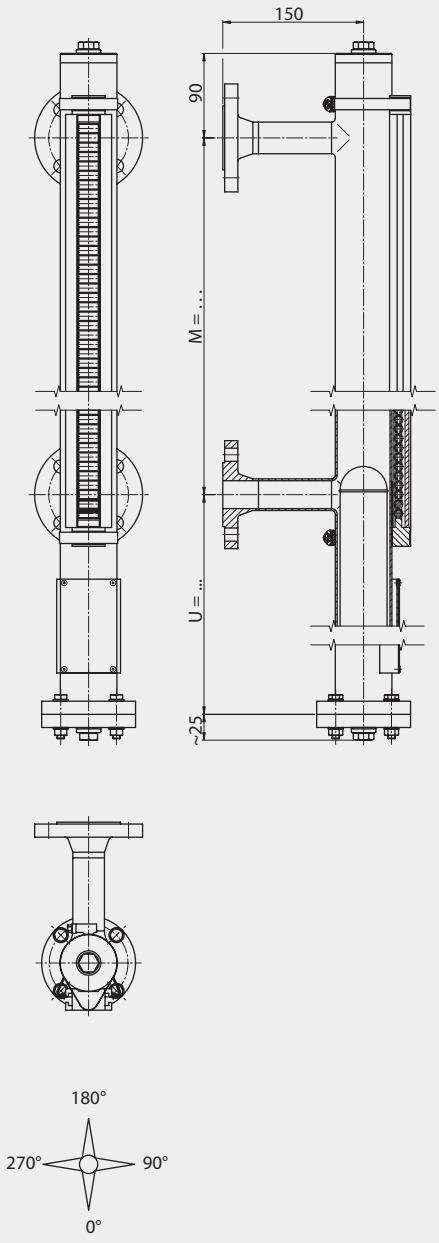
Type combination see type key Bypass - Level Indicators

Bypass - Level Indicators 1015
Alloy PN16 and PN40

Technical data

BNA - .. / .. - M .. - H .. - .. - ZH.S ..
BMG - .. /.. - .. - .. - .. K ..- M .. - H .. - .. - ZH.S ..

Material:	Ni-Mo Material Alloy B, C
Chamber:	ø 60.33 x 2.77 mm
Chamber end top:	- Flat top with venting - Options see page 230
Chamber end bottom:	- Flange connection with drain plug - Options see page 230
Process connections:	- Flange acc. to DIN - Flange acc. to Ansi - Thread female - Thread male - Welding ends - ...
Distance centre to centre:	M = 150 mm ... 25000 mm
Magnetic roller indicator:	- MRA / MRK - MNA / MNAV / MNK - MNAN / MNKV / MNAP
Scale:	- ../SK /../SG / ../VSG
Magnetic switch:	- See pages 223-227
Level sensor:	- See pages 228-229
Insulation thickness:	- 30 mm - 60 mm
Approvals:	- See pages 200-201
Float:	- Acc. to protocol
Interface:	- Acc. to protocol
Lower chamber extension:	U = float length L-30mm



Operating parameters

Operating temp. standard:	- 40 °C ... +250 °C
Operating temp. on request:	-160 °C ... +400 °C
Pressure:	-1 ... 16 bar -1 ... 40 bar
Specific gravity:	Acc. to calculation
Accuracy:	5 mm
Repeatability:	+/- 2 mm

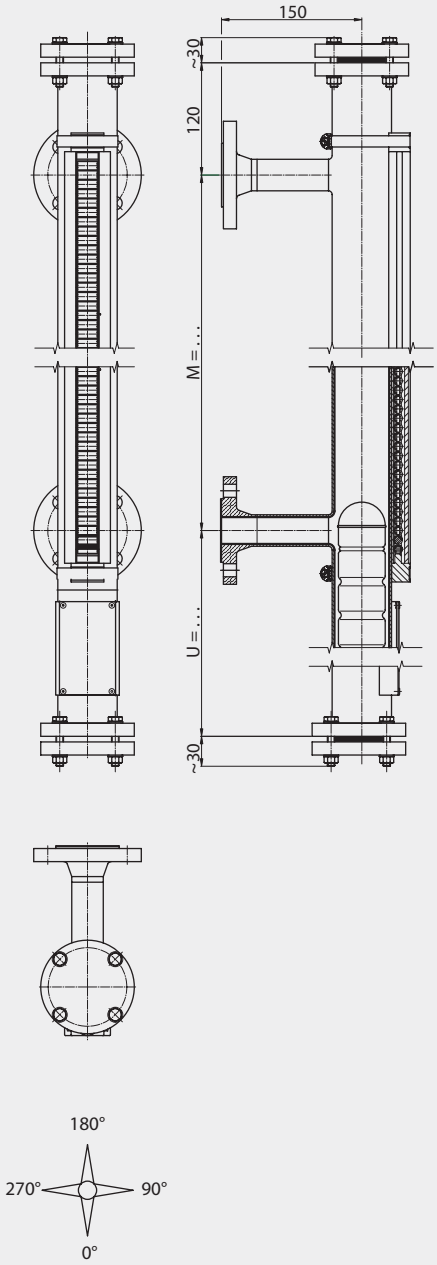
Type combination see type key Bypass - Level Indicators

Bypass - Level Indicators 1015
Stainless steel E-CTFE coated to PN16

BNA - .. / .. - M .. - EEC .. - .. - Z.EECS ..
BMG - .. /. . - .. - .. - .. K .. - M .. - EEC .. - .. - Z.EECS ..

Technical data

Material:	1.4404 / 316 L E-CTFE coated 1.4435 / 316 L E-CTFE coated 1.4571 / 316 TI E-CTFE coated
Chamber:	ø 63.5 x 2 mm
Chamber end top:	- Flange connection - Options see page 230
Chamber end bottom:	- Flange connection - Options see page 230
Process connections:	- Flange acc. to DIN - Flange acc. to Ansi - ...
Distance centre to centre:	M = 150 mm ... 25000 mm
Magnetic roller indicator:	- MRA / MRK - MNA / MNAV / MNK - MNAN / MNKV / MNAP
Scale:	- ../SK /../SG / ../VSG
Magnetic switch:	- See pages 223-227
Level sensor:	- See pages 228-229
Insulation thickness:	- 30 mm - 60 mm
Approvals:	- See pages 200-201
Float:	- Acc. to table (standard) page 209 - Acc. to protocol
Interface:	- Acc. to protocol
Lower chamber extension:	U = float length L-30mm



Operating parameters

Medium temperature:	-40 °C ... +150 °C
Pressure:	-1 ... 16 bar
Specific gravity:	≥ 540 kg/m³
Accuracy:	5 mm
Repeatability:	+/- 2 mm

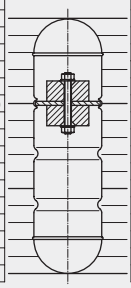
Type combination see type key Bypass - Level Indicators

Bypass - Level Indicators 1015
Cylindrical float E-CTFE coated

Technical data	Stainless steel	Titanium
Material:	Stainless steel	Titanium
Coating:	E-CTFE	E-CTFE
Operating temperature:	depending on medium	depending on medium
Operating pressure:	max. 20 bar	max. 16 bar
Test pressure:	max. 33 bar	max. 28 bar
Diameter:	ca. 53 mm	ca. 54 mm
Type of float:	ZVEECSS ...	ZTEECSS ...

Float data:														
Length L [mm]	**450**	**400**	**350**	**300**	**250**	**200**	**150**	**150**	**200**	**250**	**300**	**350**	**400**	**450**
Volume [cm³]	885	782	680	578	476	374	272	272	374	476	578	680	782	885
Weight [g]	551	514	467	413	369	330	279	242	270	302	332	364	401	434

Float height above liquid in mm	Stainless steel 1.4571 (with ribs)							Float height above liquid in mm	Titanium (with ribs)							Float height above liquid in mm
	450	**400**	**350**	**300**	**250**	**200**	**150**		**150**	**200**	**250**	**300**	**350**	**400**	**450**	
	Specific gravity of the liquid (kg/m³)								Specific gravity of the liquid (kg/m³)							
0	--	--	--	--	--	--	--	**0**	--	--	--	--	--	--	--	**0**
10	--	--	--	--	--	--	--	10	--	--	--	--	--	--	--	10
20	--	--	--	--	--	--	--	20	--	--	--	--	--	--	--	20
30	660	700	730	770	850	1000	1220	30	990	820	700	620	570	540	520	30
40	670	720	760	800	900	1070	1350	40	1100	870	730	650	590	560	530	40
50	**690**	**740**	**780**	**840**	940	**1140**	**1490**	**50**	**1200**	**930**	**770**	**670**	**610**	**570**	**540**	**50**
60	710	760	810	870	**1000**	1230	1680	60	1370	1010	810	700	630	590	560	60
70	730	780	840	910	1050	1330	1910	70	1550	1090	860	730	660	610	570	70
80	750	810	870	960	1120	1450	2220	80	1790	1190	920	770	680	630	590	80
90	770	830	910	1000	1190	1590	2650	90	--	1300	980	810	710	650	600	90
100	**790**	**860**	**950**	**1060**	**1280**	**1770**	--	**100**	--	**1440**	**1040**	**850**	**740**	**670**	**620**	**100**
110	810	890	990	1110	1370	1980	--	110	--	1620	1120	900	770	700	640	110
120	840	930	1030	1180	1490	2260	--	120	--	1850	1220	950	800	720	660	120
130	870	960	1080	1250	1620	2630	--	130	--	2150	1330	1010	840	750	680	130
140	890	1000	1130	1330	1780	--	--	140	--	2570	1460	1070	880	780	700	140
150	**930**	**1040**	**1190**	**1430**	**1970**	--	--	**150**	--	--	**1620**	**1150**	**930**	**810**	**730**	**150**

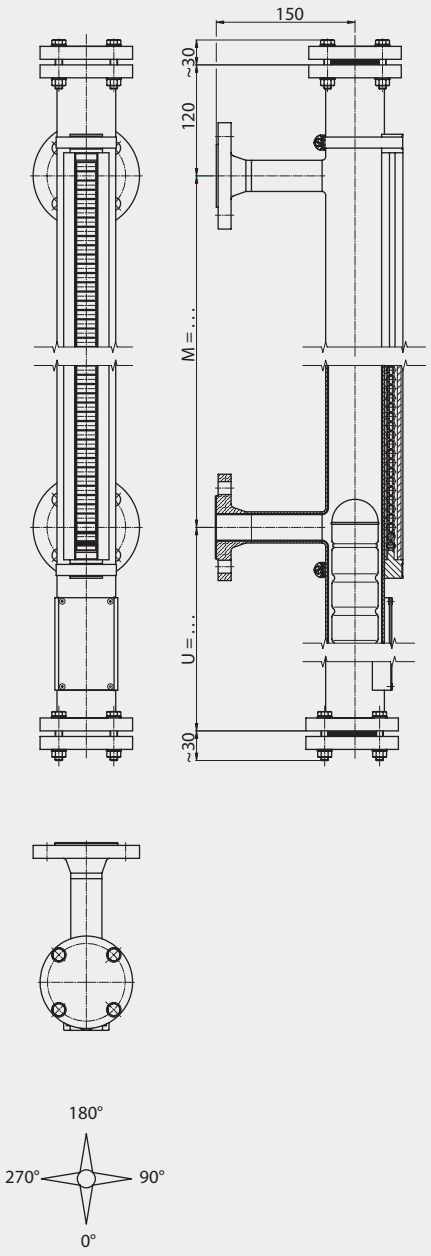


Bypass - Level Indicators 1015
Stainless steel PFA coated to PN16

BNA - .. / .. - M .. - PFA .. - .. - Z.PFAS ..
BMG - .. / .. - .. - .. -.. K .. - M .. - PFA .. - .. - Z.PFAS ..

Technical data

Material:	1.4404 / 316 L PFA coated 1.4435 / 316 L PFA coated 1.4571 / 316 Ti PFA coated
Chamber:	ø 63.5 x 2 mm (with glass float ø 46) ø 73.03 x 5.16 mm
Chamber end top:	- Flange connection - Options see page 230
Chamber end bottom:	- Flange connection - Options see page 230
Process connections:	- Flange acc. to DIN - Flange acc. to Ansi - ...
Distance centre to centre:	M = 150 mm ... 25000 mm
Magnetic roller indicator:	- MRA / MRK - MNA / MNAV / MNKV - MNAN / MNKV / MNAP
Scale:	- ../SK /../SG / ../VSG
Magnetic switch:	- See pages 223-227
Level sensor:	- See pages 228-229
Insulation thickness:	- 30 mm - 60 mm
Approvals:	- See pages 200-201
Float:	- Acc. to protocol
Interface:	- Acc. to protocol
Lower chamber extension:	U = float length L-30mm



Operating parameters

Medium temperature:	-40 °C ... +200 °C
Pressure:	-1 ... 16 bar
Specific gravity:	Acc. to calculation
Accuracy:	5 mm
Repeatability:	+/- 2 mm

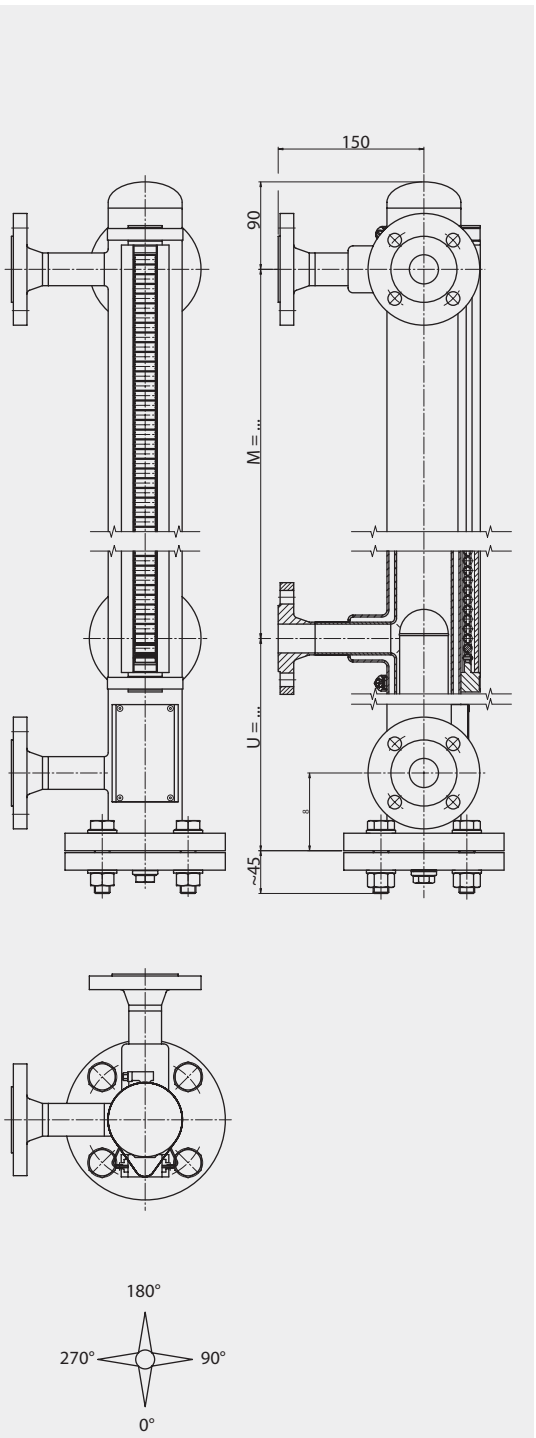
Type combination see type key Bypass - Level Indicators

Bypass - Level Indicators 1015
Heating jacket design PN16 to PN40

BNA - .. / .. - M .. - V60/76 .. - .. - Z . S ..
BMG - .. /.. - .. - .. - ..K.. - M .. - V60/76 .. - .. - Z . S ..

Technical data

Material:	1.4404 / 316 L 1.4435 / 316 L 1.4571 / 316 Ti
Chamber:	ø 60.3x2mm standard ø 76.1x2mm heating jacket
Chamber end top:	- Welding cap (standard) - Flat top - Options see page 230
Chamber end bottom:	- Flange connection with drain plug - Options see page 230
Process connections:	- Flange acc. to DIN - Flange acc. to Ansi - Thread female - Thread male - Welding ends - ...
Distance centre to centre:	M = 150 mm ... 5500 mm
Magnetic roller indicator:	- MRA / MRK - MNA / MNAV / MNK - MNAN / MNAP
Scale:	- ../SK /../SG / ../VSG
Magnetic switch:	- See pages 223-227
Level sensor:	- See pages 228-229
Insulation thickness:	- 30 mm - 60 mm
Approvals:	- See pages 200-201
Float:	- Acc. to table (standard) page 213 - Acc. to protocol
Interface:	- Acc. to protocol
Lower chamber extension:	U = float length L-30mm



Operating parameters

Operating temp. standard:	- 40 °C ... +250 °C
Operating temp. on request:	-160 °C ... +400 °C
Pressure process connection:	- 1 ... 25 bar
Pressure heating jacket connec.:	+1 ... 16 bar
Specific gravity:	≥580 kg/m³
Accuracy:	5 mm
Repeatability:	+/- 2 mm

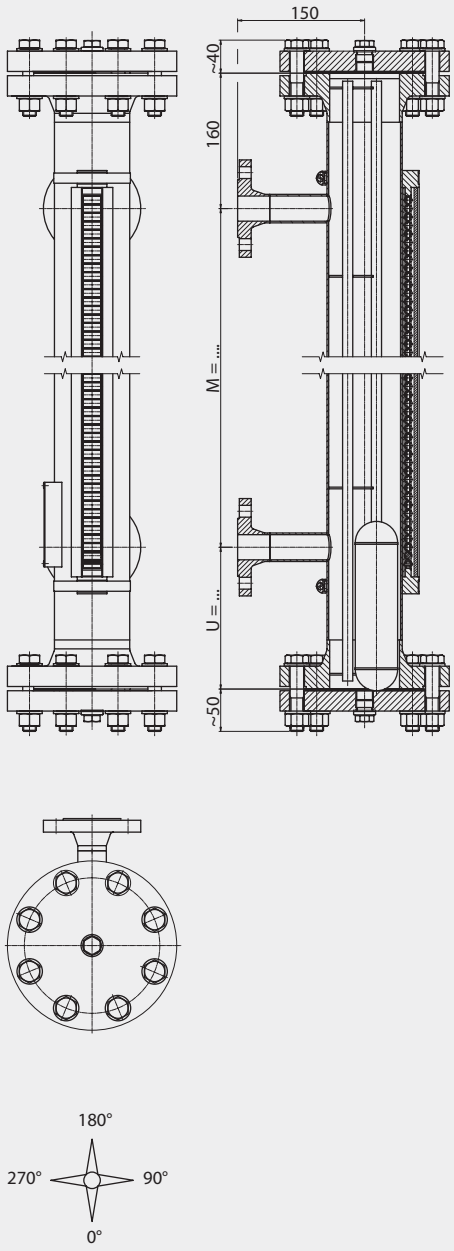
Type combination see type key Bypass - Level Indicators

Bypass - Level Indicators 1015
Liquid gas design PN16 to PN40

BNA - .. / .. - M .. - V88- .. - Z . S ..
BMG - .. / .. - .. - .. - ..K .. - M .. - V88- .. - Z . S ..

Technical data

Material:	1.4404 / 316 L 1.4435 / 316 L 1.4571 / 316 Ti
Chamber:	ø 88.9 x 2 mm ø 88.9 x 2.6 mm
Float guidance device:	Longitudinal tubes (3)
Chamber end top:	- Flange connection - Options see page 230
Chamber end bottom:	- Flange connection with drain plug - Options see page 230
Process connections:	- Flange acc. to DIN - Flange acc. to Ansi - Thread female - Thread male - Welding ends - ...
Distance centre to centre:	M = 150 mm ... 5500 mm
Magnetic roller indicator:	- MRA / MRK - MNA / MNAV / MNK - MNAN / MNKV / MNAP
Scale:	- ../SK /../SG / ../VSG
Magnetic switch:	- See pages 223-227
Level sensor:	- See pages 228-229
Insulation thickness:	- 30 mm - 60 mm
Approvals:	- See pages 200-201
Float:	- Acc. to table (standard) page 213 - Acc. to protocol
Interface:	- Acc. to protocol
Lower chamber extension:	U = float length L-30mm



Operating parameters

Operating temp. standard:	- 40 °C ... +250 °C
Operating temp. on request:	-160 °C ... +400 °C
Pressure:	-1 ... 25 bar
Specific gravity:	≥ 580 kg/m³
Accuracy:	5 mm
Repeatability:	+/- 2 mm

Type combination see type key Bypass - Level Indicators

Bypass - Level Indicators 1015
Cylindrical float for heating jacket and liquid gas design

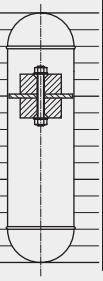
Technical data	Stainless steel PN16	Titanium PN16
Material:	Stainless steel	Titanium
Operating temperature:	-70 °C ... +250 °C	-10 °C ... +200 °C
Operating pressure:	max. 16 bar	max. 16 bar
Test pressure:	max. 26 bar	max. 39 bar
Diameter:	50 mm	50.8 mm
Type of float:	ZVS ... /16/250/K74	ZTS ... /16/200/K74

Float data:

Length L [mm]	450	400	350	300	250	200
Volume [cm³]	851	753	654	556	458	360
Weight [g]	523	481	439	402	360	318

Length L [mm]	150	200	250	300	350	400	450	500
Volume [cm³]	270	371	472	574	675	776	878	979
Weight [g]	264	298	327	362	396	430	464	494

Float height above liquid in mm	Stainless steel 1.4571						Titanium								Float height above liquid in mm
	450	400	350	300	250	200	150	200	250	300	350	400	450	500	
	Specific gravity of the liquid (kg/m³)						Specific gravity of the liquid (kg/m³)								
0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0**
10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10
20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20
30	650	680	720	780	860	1000	1170	910	760	680	620	580	550	530	30
40	670	700	740	810	910	1070	1290	980	800	710	640	600	570	540	40
50	**680**	**720**	**770**	**850**	**960**	**1150**	**1410**	**1030**	**840**	**730**	**660**	**620**	**590**	**550**	**50**
60	700	740	790	890	1010	1230	1600	1120	890	770	690	640	600	570	60
70	720	770	820	920	1070	1330	1820	1200	940	810	720	660	610	580	70
80	740	790	850	970	1130	1450	--	1310	1000	850	750	680	630	590	80
90	760	820	890	1010	1210	1590	--	1450	1070	890	780	700	650	600	90
100	**780**	**840**	**920**	**1070**	**1300**	**1760**	**--**	**1600**	**1140**	**930**	**810**	**720**	**670**	**620**	**100**
110	800	870	960	1120	1390	1970	--	1800	1220	990	840	750	690	640	110
120	830	900	1000	1200	1500	--	--	--	1320	1040	880	780	710	660	120
130	860	940	1050	1270	1640	--	--	--	1440	1110	920	810	730	680	130
140	880	980	1110	1350	1800	--	--	--	1560	1180	980	840	760	700	140
150	**910**	**1020**	**1170**	**1440**	**1990**	--	--	--	**1750**	**1260**	**1020**	**870**	**790**	**720**	**150**



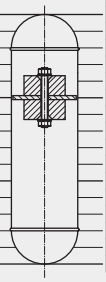
Technical data	Stainless steel PN25	Titanium PN25
Material:	Stainless steel	Titanium
Operating temperature:	-70 °C ... +250 °C	-10 °C ... +200 °C
Operating pressure:	max. 25 bar	max. 25 bar
Test pressure:	max. 41 bar	max. 60 bar
Diameter:	50 mm	50.8 mm
Type of float:	ZVS ... /25/250/K74	ZTS ... /25/200/K74

Float data:

Length L [mm]	450	400	350	300	250	200
Volume [cm³]	851	753	654	556	458	360
Weight [g]	537	495	453	411	369	327

Length L [mm]	150	200	250	300	350	400	450	500
Volume [cm³]	270	371	472	574	675	776	878	979
Weight [g]	268	303	337	376	410	449	483	522

Float height above liquid in mm	Stainless steel 1.4571						Titanium								Float height above liquid in mm
	450	400	350	300	250	200	150	200	250	300	350	400	450	500	
	Specific gravity of the liquid (kg/m³)						Specific gravity of the liquid (kg/m³)								
0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0**
10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10
20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20
30	670	700	740	800	890	1040	1180	920	780	710	650	610	570	560	30
40	680	720	760	830	930	1100	1300	980	820	730	670	630	590	570	40
50	**690**	**740**	**790**	**860**	**980**	**1160**	**1430**	**1050**	**860**	**760**	**690**	**650**	**610**	**580**	**50**
60	710	760	820	900	1030	1270	1620	1130	910	800	720	670	630	590	60
70	730	780	850	940	1100	1380	1850	1200	970	840	750	690	650	600	70
80	750	800	880	990	1160	1490	--	1330	1030	880	780	710	670	620	80
90	780	830	910	1030	1240	1630	--	1480	1100	920	800	730	690	640	90
100	**800**	**860**	**950**	**1100**	**1320**	**1800**	**--**	**1620**	**1180**	**980**	**830**	**760**	**710**	**660**	**100**
110	820	890	1000	1150	1420	--	--	1820	1270	1030	870	790	730	680	110
120	850	920	1040	1220	1540	--	--	--	1380	1090	910	820	750	700	120
130	880	960	1090	1300	1690	--	--	--	1490	1150	950	850	770	720	130
140	900	1000	1150	1390	1850	--	--	--	1630	1220	1000	880	790	740	140
150	**930**	**1040**	**1200**	**1480**	--	--	--	--	**1800**	**1300**	**1060**	**920**	**810**	**760**	**150**

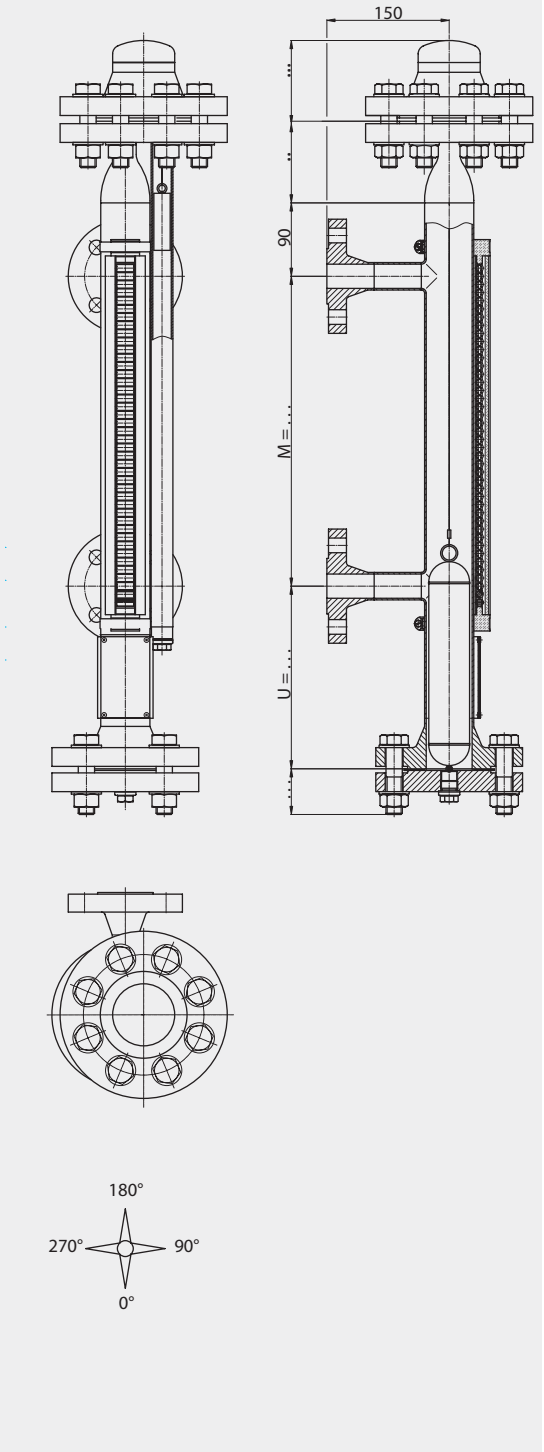


Bypass - Level Indicators 1015
Differential compensated ≥ 350kg/m³ PN16 to PN250

BNA - .. / .. - M .. - V .. - .. - Z . S .. - DIF
BMG - .. / .. - .. - .. - ..K .. - M .. - V .. - .. - Z . S .. - DIF

Technical data

Material:	1.4404 / 316 L 1.4435 / 316 L 1.4571 / 316 Ti
Chamber:	ø 60.3 mm PN16/40/64 ø 73.0 mm PN 250/160
Chamber end top:	- Welding cap / Flat top - Options see page 230
Chamber end bottom:	- Flange connection with drain plug - Options see page 230
Process connections:	- Flange acc. to DIN - Flange acc. to Ansi - Thread female - Thread male - Welding ends - ...
Distance centre to centre:	M = 150 mm ... 25000 mm
Magnetic roller indicator:	- MRA / MRK - MNA / MNAV / MNK - MNAN / MNKV / MNAP
Scale:	- ../SK /../SG / ../VSG
Magnetic switch:	- See pages 223-227
Level sensor:	- See pages 228-229
Insulation thickness:	- 30 mm - 60 mm
Approvals:	- See pages 200-201
Float:	- Acc. to protocol
Interface:	- Acc. to protocol
Lower chamber extension:	U = float length L-30mm



Operating parameters

Medium temperature:	-40 °C ... +150 °C
Pressure:	-1 ... 250 bar
Specific gravity:	≥ 350 kg/m³
Accuracy:	5 mm
Repeatability:	+/- 2 mm

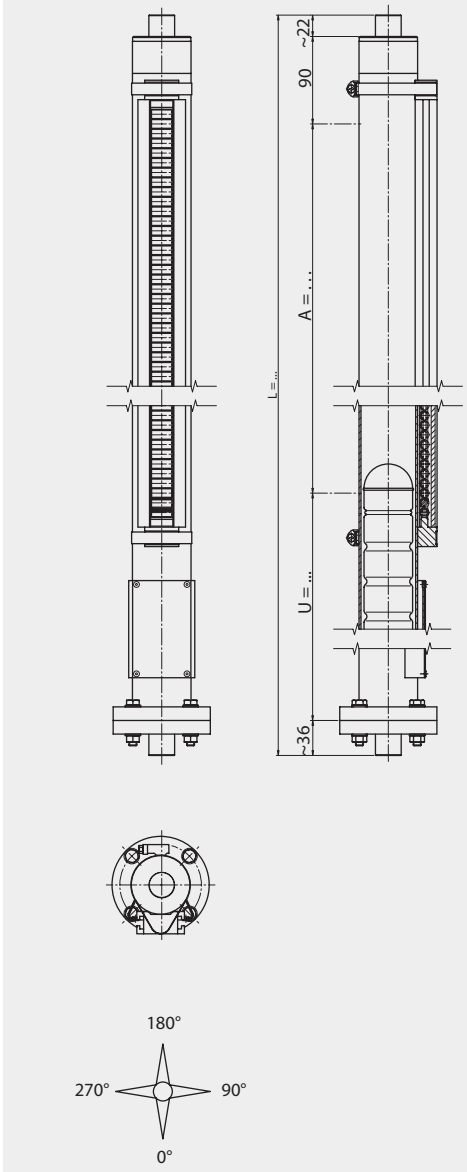
Type combination see type key Bypass - Level Indicators

Bypass - Level Indicators 1015
Stainless steel without lateral connections PN16 and PN40

Technical data

BNA - OS - M .. - V .. - .. - Z . S ..
BMG - OS .. - .. - .. - ..K .. - M .. - V .. - .. - Z . S ..

Material:	1.4404 / 316 L 1.4435 / 316 L 1.4571 / 316 Ti
Chamber:	ø 60 x 2 mm
Chamber end top:	- Flat top with welded socket and dampening spring
Chamber end bottom:	- Flat top with welded socket and dampening spring
Process connections:	- Without lateral connections
Length of instrument:	L = 300 mm ... 25000 mm
Indicating range:	A = L- ~ 148 -U
Magnetic roller indicator:	- MRA / MRK - MNA / MNAV / MNK - MNAN / MNKV / MNAP
Scale:	- ../SK /../SG / ../VSG
Magnetic switch:	- See pages 223-227
Level sensor:	- See pages 228-229
Insulation thickness:	- 30 mm - 60 mm
Approvals:	- See pages 200-201
Float:	- Acc. to table 16 bar page 203 - Acc. to table 40 bar page 203
Lower chamber extension:	U = float length L-30mm



Operating parameters

Operating temp. standard:	- 40 °C ... +250 °C
Operating temp. on request:	-160 °C ... +400 °C
Pressure:	-1 ... 40 bar
Specific gravity:	≥ 460 kg/m³
Accuracy:	5 mm
Repeatability:	+/- 2 mm

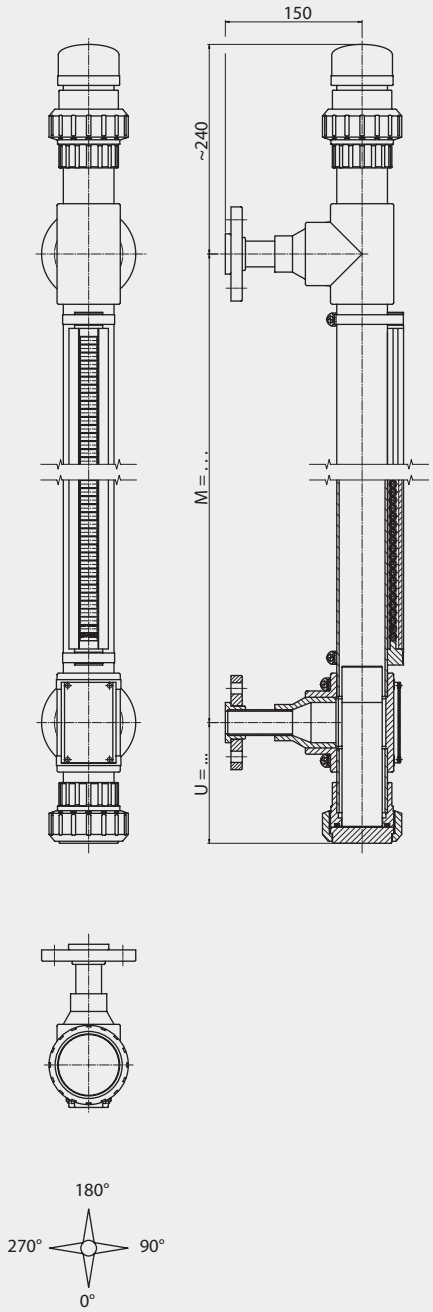
Type combination see type key Bypass - Level Indicators

Bypass - Level Indicators 1015
PVC / Polyvinylchloride

Technical data

BNA - .. / .. - M .. - P63- .. - ZPS ..
BMG - .. / .. - .. - .. - ..K .. - M .. - P63- .. - ZPS ..

Material:	PVC / Polyvinylchloride
Chamber:	ø 63.5 x 3 mm
Chamber end top:	- Welding cap - Screwed connection - Options see page 230
Chamber end bottom:	- Welding cap - Screwed connection - Options see page 230
Process connections:	- Flange acc. to DIN - Flange acc. to Ansi - Thread female - Thread male - Tube ends - ...
Distance centre to centre:	M = 300 mm ... 4000 mm
Magnetic roller indicator:	- MRA - MNA / MNAV - MNAN / MNAP
Scale:	- ../SK /../SG / ../VSG
Magnetic switch:	- See pages 223-227
Level sensor:	- See pages 228-229
Insulation thickness:	-
Approvals:	-
Float:	- Acc. to table (standard) page 219 - Acc. to protocol
Interface:	- Acc. to protocol
Lower chamber extension:	U = float length L-30mm



Measuring range = M - 220 mm

Operating parameters

Temperature:	-10 °C ... +60 °C
Pressure:	-1 ... 4 bar
Specific gravity:	≥ 740 kg/m³
Accuracy:	5 mm
Repeatability:	+/- 2 mm

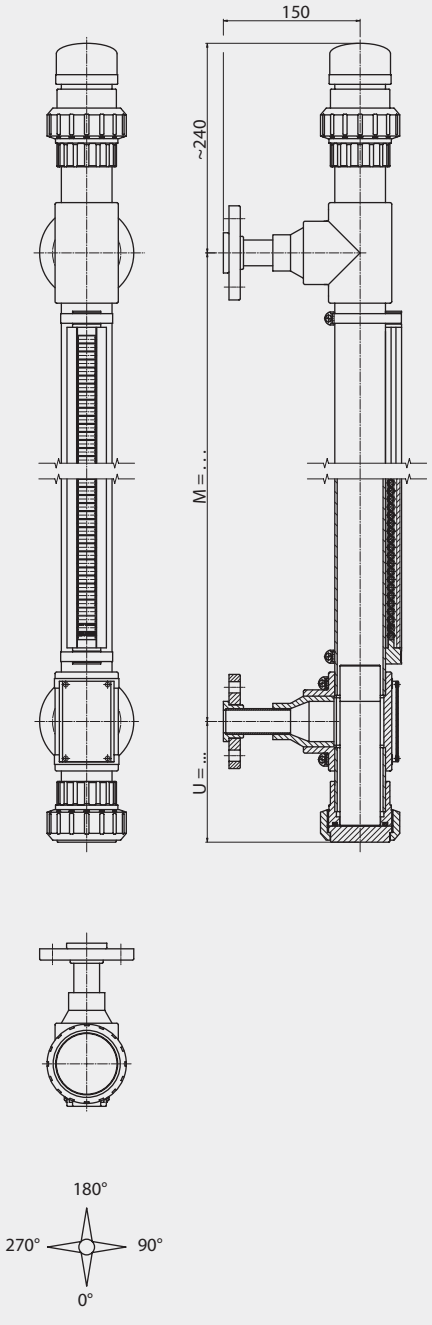
Type combination see type key Bypass - Level Indicators

Bypass - Level Indicators 1015
PP / Polypropylene

Technical data

BNA - .. / .. - M .. - PP63- .. - ZPPS ..
BMG - .. / .. - .. - .. - ..K .. - M .. - PP63- .. - ZPPS ..

Material:	PP / Polypropylene
Chamber:	ø 63.5 x 3.6 mm
Chamber end top:	- Welding cap - Screwed connection - Options see page 230
Chamber end bottom:	- Welding cap - Screwed connection - Options see page 230
Process connections:	- Flange acc. to DIN - Flange acc. to Ansi - Thread female - Thread male - Welding ends - ...
Distance centre to centre:	M = 300 mm ... 4000 mm
Magnetic roller indicator:	- MRA - MNA / MNAV - MNAN / MNAP
Scale:	- ../SK /../SG / ../VSG
Magnetic switch:	- See pages 223-227
Level sensor:	- See pages 228-229
Insulation thickness:	-
Approvals:	-
Float:	- Acc. to table (standard) page 219 - Acc. to protocol
Interface:	- Acc. to protocol
Lower chamber extension:	U = float length L-30mm



Measuring range = M - 210 mm

Operating parameters

Temperature:	-5 °C ... + 80 °C
Pressure:	-1 ... 4 bar
Specific gravity:	≥ 640 kg/m³
Accuracy:	5 mm
Repeatability:	+/- 2 mm

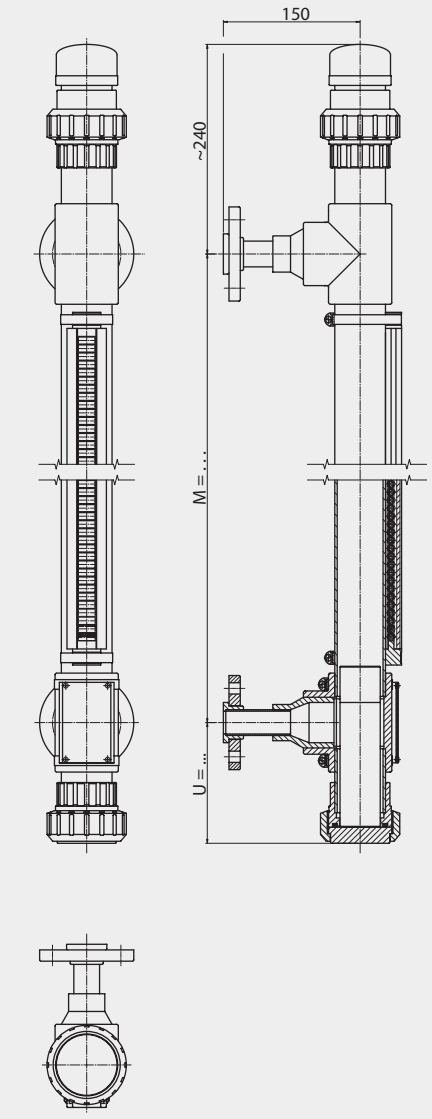
Type combination see type key Bypass - Level Indicators

Bypass - Level Indicators 1015
PVDF / Polyvinylidenfluoride

Technical data

BNA - .. / .. - M .. - PF63- .. - ZPFS ..
BMG - .. / .. - .. - .. - ..K .. - M .. - PF63- .. - ZPFS ..

Material:	PVDF Polyvinylidenfluoride
Chamber:	ø 63.5 x 3 mm
Chamber end top:	- Welding cap - Screwed connection - Options see page 230
Chamber end bottom:	- Welding cap - Screwed connection - Options see page 230
Process connections:	- Flange acc. to DIN - Flange acc. to Ansi - Welding ends - ...
Distance centre to centre:	M = 300 mm ... 4000 mm
Magnetic roller indicator:	- MRA - MNA / MNAV - MNAN / MNAP
Scale:	- ../SK /../SG / ../VSG
Magnetic switch:	- See pages 223-227
Level sensor:	- See pages 228-229
Insulation thickness:	-
Approvals:	-
Float:	- Acc. to table (standard) page 219 - Acc. to protocol
Interface:	- Acc. to protocol
Lower chamber extension:	U = float length L-30mm



Measuring range = M - 210 mm

Operating parameters

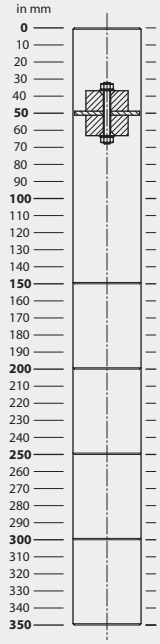
Temperature:	-5 °C ... +100 °C
Pressure:	-1 ... 4 bar
Specific gravity:	≥ 750 kg/m³
Accuracy:	5 mm
Repeatability:	+/- 2 mm

Type combination see type key Bypass - Level Indicators

Bypass - Level Indicators 1015
Cylindrical float in PVDF, PP or PVC

Technical data	PVDF	PP	PVC
Material:	PVDF	PP	PVC
Operating temperature:	-5 °C ... +100 °C	-5 °C ... +80 °C	-10 °C ... +60 °C
Operating pressure:	max. 6 bar	max. 6 bar	max. 6 bar
Test pressure:	max. 9 bar	max. 9 bar	max. 9 bar
Diameter:	50 mm	50 mm	50 mm
Type of float:	ZPFS ...	ZPPS ...	ZPS ...

Float data:	PVDF					PP					PVC				
Length L [mm]	**150**	**200**	**250**	**300**	**350**	**150**	**200**	**250**	**300**	**350**	**150**	**200**	**250**	**300**	**350**
Volume [cm³]	295	393	491	589	687	295	393	491	589	687	295	393	491	589	687
Weight [g]	278	319	360	401	442	246	279	311	344	376	275	316	356	397	437



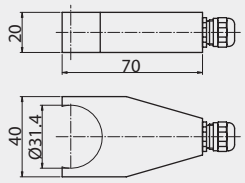
Float height above liquid in mm	PVDF					PP					PVC					Float height above liquid in mm
	150	200	250	300	350	150	200	250	300	350	150	200	250	300	350	
	Specific gravity of the liquid (kg/m³)															
0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0**
10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10
20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20
30	1180	960	830	760	700	1040	840	720	650	600	1170	950	820	750	700	30
40	1290	1020	870	790	730	1140	890	750	670	620	1270	1010	860	780	720	40
50	**1420**	**1080**	**920**	**820**	**750**	**1250**	**950**	**790**	**700**	**640**	**1400**	**1070**	**910**	**810**	**740**	**50**
60	1570	1160	960	850	780	1390	1010	830	730	660	1560	1150	950	840	770	60
70	1770	1250	1020	890	800	1570	1090	880	760	680	1750	1240	1010	880	790	70
80	2020	1350	1080	930	830	1790	1180	930	800	710	2000	1340	1070	920	820	80
90	2360	1480	1150	970	870	2090	1290	990	830	740	2330	1460	1130	960	860	90
100	**2830**	**1620**	**1220**	**1020**	**900**	**2510**	**1420**	**1060**	**880**	**770**	**2800**	**1610**	**1210**	**1010**	**890**	**100**
110	--	1810	1310	1070	940	--	1580	1130	920	800	--	1790	1300	1060	930	110
120		2030	1410	1130	980		1780	1220	970	830		2010	1390	1120	970	120
130		2320	1530	1200	1020		2030	1320	1030	870		2300	1510	1190	1010	130
140		2710	1670	1280	1070		2370	1440	1090	910		2680	1650	1260	1060	140
150		--	**1830**	**1360**	**1130**		**2840**	**1580**	**1170**	**960**		--	**1810**	**1350**	**1110**	**150**
160			2040	1460	1180		--	1760	1250	1010			2010	1440	1170	160
170			2290	1570	1250			1980	1350	1060			2270	1550	1240	170
180			2620	1700	1320			2260	1460	1130			2590	1680	1310	180
190			--	1860	1410			2640	1590	1200			--	1840	1390	190
200				**2040**	**1500**			--	**1750**	**2780**				**2020**	**1480**	**200**
210				2270	1610				1950	1370				2250	1590	210
220				2550	1730				2190	1470				2530	1710	220
230				2920	1880				2500	1600				2890	1850	230
240				--	2050				2920	1740				3370	2020	240
250					**2250**				--	**1910**				--	**2230**	**250**
260					2500					2130					2470	260
270					2810					2390					2780	270
280					--					2740					3180	280
290										--					--	290
300																**300**
310																310
320																320
330																330
340																340
350																**350**

Bypass - Level Indicators 1015
PVC / Polyvinylchloride transparent

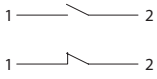
Technical data

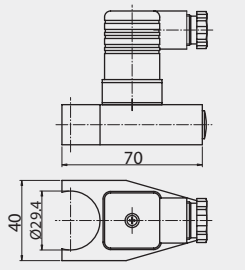
BNA - .. / .. - M .. - P32- .. - ZPS ..

Material:	PVC / Polyvinylchloride transparent
Chamber:	ø 32.0 x 1.8 mm
Chamber end top:	- Screwed connection - Options see page 230
Chamber end bottom:	- Screwed connection - Options see page 230
Process connections:	- Flange acc. to DIN - Flange acc. to Ansi - Thread female - Thread male - Tube ends - ...
Distance centre to centre:	M = 200 mm ... 4000 mm
Approvals:	-
Float:	- SP 24/80 red - SP 24/120 red
Magnetic switch:	

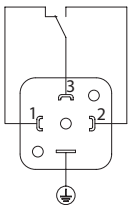


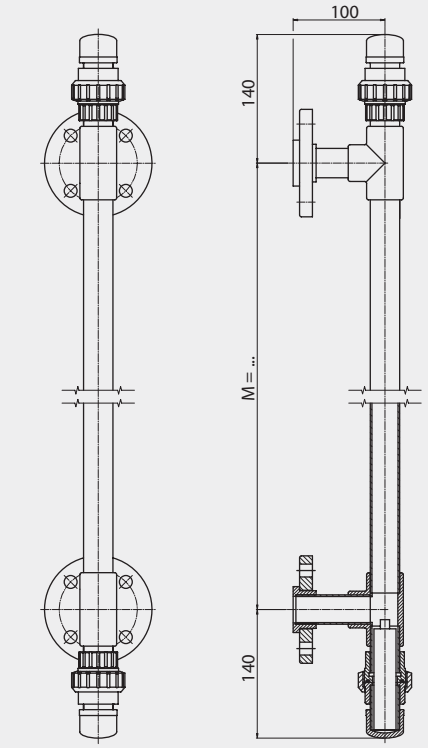
- FKSM-B32-S- ..PVC
- FKSM-B32-O- ..PVC
- FKSM-B32-U- ..PVC

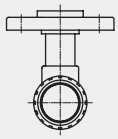


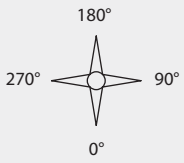


- FKSM-B32-U-plug









Operating parameters

Temperature:	-10 °C ... +60 °C
Pressure:	-1 ... 1 bar
Specific gravity:	≥ 900 kg/m³ SP24/80 ≥ 600 kg/m³ SP24/120
Accuracy:	5 mm
Repeatability:	+/- 2 mm

Type combination see type key Bypass - Level Indicators

Bypass - Level Indicators 1015
Magnetic roller indicator

Magnetic roller indicator
MRA - M ..
MRK - M ..

Housing:
- aluminium anodized

Indicator rolls MRA:
- material: pocan
- colours: white / red

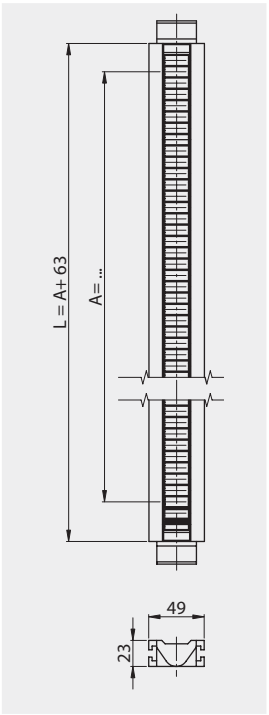
Indicator rolls MRK:
- material: ceramics
- colours: white / red

Cover:
- macrolon (MRA)
- glass (MRK)

Ambient temperature:
- MRA -40 °C ... +200 °C
- MRK 0 °C ... +400 °C

Protection rating:
- IP 64

Approval:
- See pages 200-201



Magnetic roller indicator
MNA - M ..
MNK - M ..

Housing:
- aluminium anodized

Indicator rolls MNA :
- material: pocan
- colours: white / red

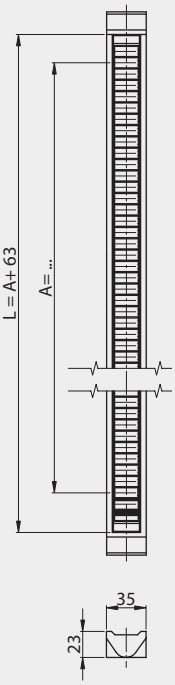
Indicator rolls MNK:
- material: ceramics
- colours: white / red

Cover:
- macrolon (MNA)
- glass (MNK)

Ambient temperature:
- MNA -40 °C ... +200 °C
- MNK 0 °C ... +400 °C

Protection rating:
- IP 64

Approval:
- See pages 200-201



Magnetic roller indicator
MNAV - M ..
MNKV - M ..

Housing:
- aluminium with stainless steel covered

Indicator rolls MNAV:
- material: pocan
- colours: white / red

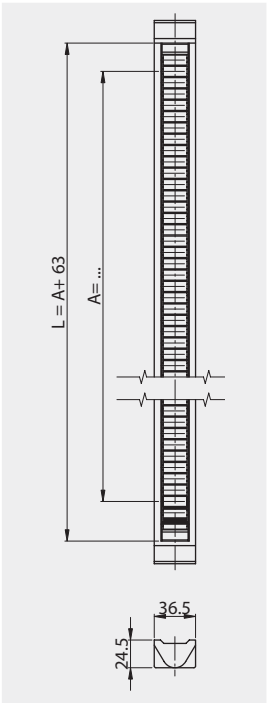
Indicator rolls MNKV:
- material: ceramics
- colours: white / red

Cover:
- macrolon (MNAV)
- glass (MNKV)

Ambient temperature:
- MNAV -40 °C ... +200 °C
- MNKV 0 °C ... +400 °C

Protection rating:
- IP 64

Approval:
- See pages 200-201



Magnetic roller indicator
MNAN - M ..

Housing:
- aluminium anodized

Indicator rolls MNAN:
- material: pocan
- colours: white / red

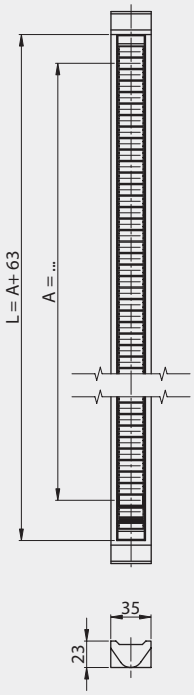
Shock proof design:
- rollers turning max. 180°

Cover:
- macrolon
- glass

Ambient temperature:
- MNAN -40 °C ... +200 °C

Protection rating:
- IP 64

Approval:
- See pages 200-201



Type combination see type key Bypass-Level Indicators

Bypass - Level Indicators 1015
Scale

Scale
.. / SK

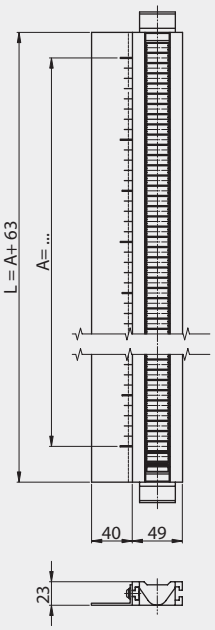
Angle profile:
- aluminium

Width:
- 40 mm

Scale:
- adhesive foil

Separation:
- in cm

Ambient temperature:
-40 °C ... +200 °C



Scale
.. / SG

Angle profile:
- aluminium

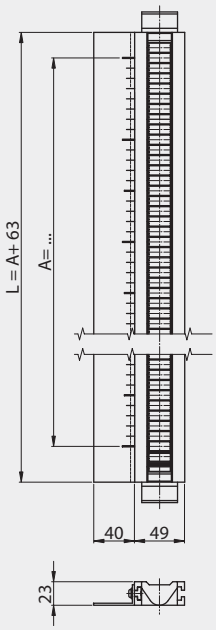
Width:
- 40 mm

Scale:
- engraved

Separation:
- acc. to specification

Ambient temperature:
-40 °C ... +200 °C

Approval:
- pages 200-201



Scale
.. / VSG

Angle profile:
- stainless steel

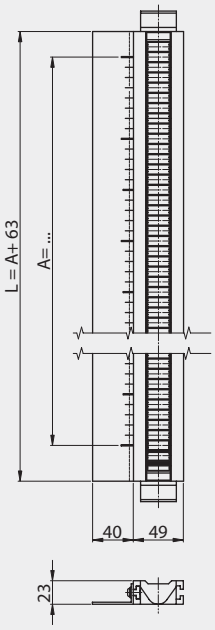
Width:
- 40 mm

Scale:
- engraved

Separation:
- acc. to specification

Ambient temperature:
-40 °C ... +400 °C

Approval:
- pages 200-201



Indicator isolation with acrylic glass extender
.. / P

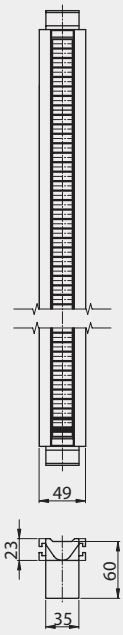
Material:
- acrylic glass

Width:
- 35 mm

Height:
- 60 mm

Mounting:
- onto magnetic roller indicator

Ambient temperature:
-20 °C ... +100 °C



Type combination see type key Bypass-Level Indicators

Bypass - Level Indicators 1015
Magnetic switch

Technical data

Housing:
- aluminium anodized

Contact function:
- change over

Switching action:
- bistable

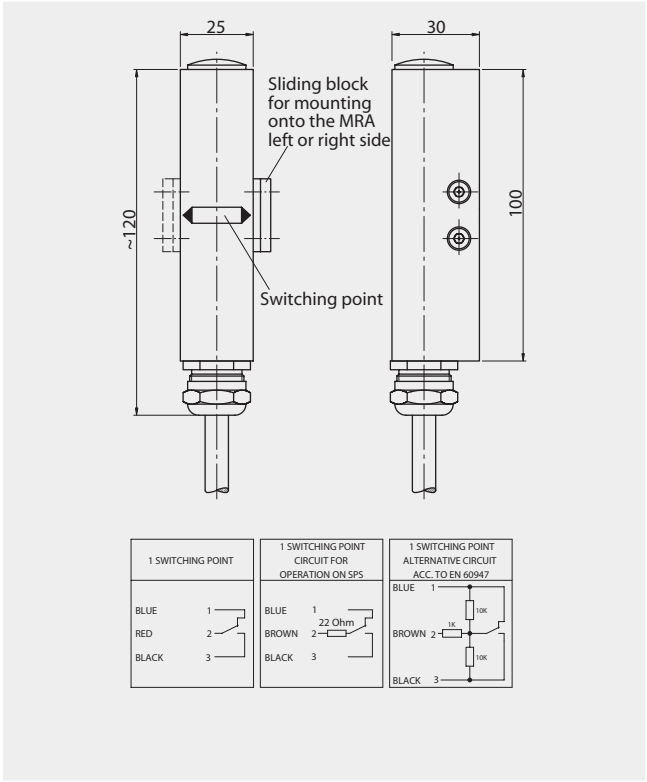
Switching capacity:
- 230 V AC / 60 VA / 1.0 A
- 230 V DC / 30 VA / 0.5 A

Protection rating:
- IP65

Ambient temperature:
- with PVC-cable max. +80 °C
- with Silicone-cable max. +180 °C

Options:
- with code addition .. / R
  (with 22 Ohm protection resistor)
  (temperature reduction by 5 °C under
  T-classification by Ex applications)
- with code addition .. / N (acc. to Namur EN 60947)
  (temperature reduction by 5 °C under
  T-classification by Ex applications)

BGU - .. PVC / BGU - .. SIL



Technical data

Housing:
- aluminium anodized

Contact function:
- change over

Switching action:
- bistable

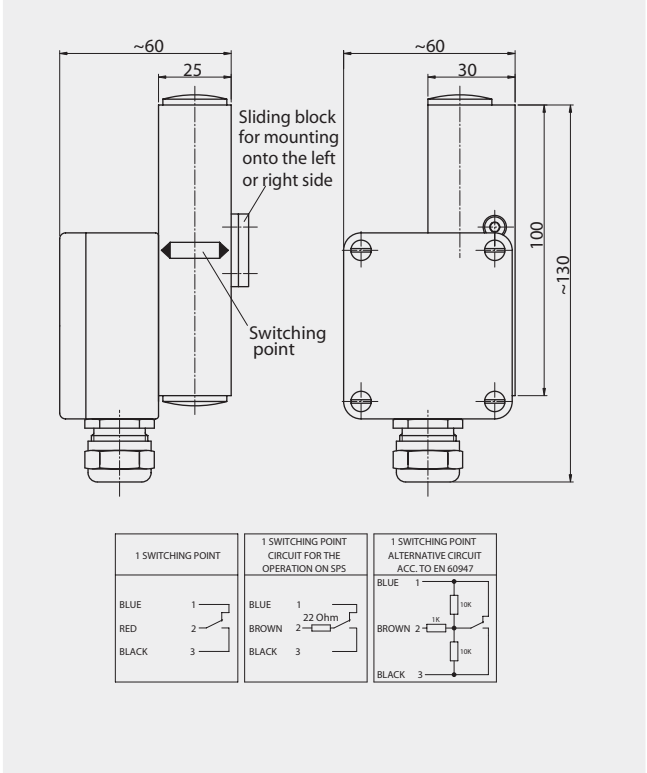
Switching capacity:
- 230 V AC/60 VA/1.0 A
- 230 V DC/30 VA/0.5 A

Protection rating:
- IP65

Ambient temperature:
- max. +130 °C

Options:
- with code addition .. / R
  (with 22 Ohm protection resistor)
  (temperature reduction by 5 °C under
  T-classification by Ex applications)
- with code addition .. / N (acc. to Namur EN 60947)
  (temperature reduction by 5 °C under
  T-classification by Ex applications)

BGU - A



Type combination see type key Bypass-Level Indicators

Bypass - Level Indicators 1015
Magnetic switch

Technical data

Housing:
- aluminium anodized

Contact function:
- change over

Switching action:
- bistable

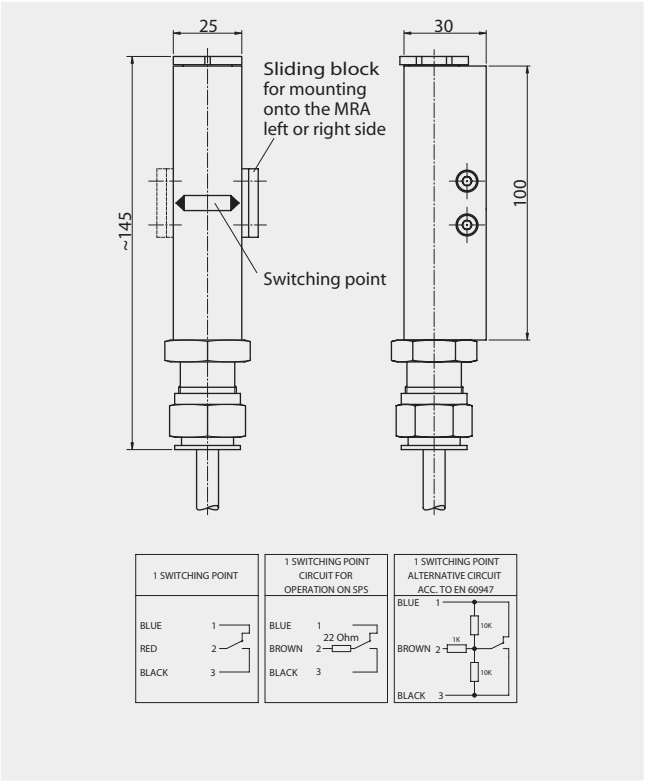
Switching capacity:
- 230 V AC / 60 VA / 1.0 A
- 230 V DC / 30 VA / 0.5 A

Protection rating:
- IP65

Ambient temperature:
- with PVC-cable max. +80 °C
- with Silicone-cable max. +120 °C

Options:
- with code addition .. / R
  (with 22 Ohm protection resistor)
  (temperature reduction by 5 °C under
  T-classification by Ex applications)
- with code addition .. / N (acc. to Namur EN 60947)
  (temperature reduction by 5 °C under
  T-classification by Ex applications)

BGU - .. .. - EExd



Technical data

Housing:
- aluminium anodized

Contact function:
- change over

Switching action:
- bistable

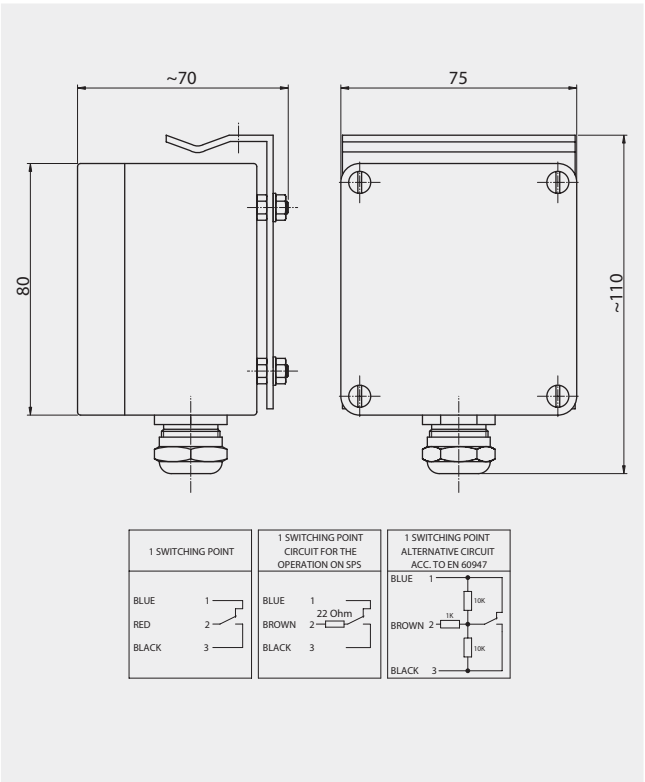
Switching capacity:
- 230 V DC / 50 VA / 1.5 A

Protection rating:
- IP22

Ambient temperature:
- max. +300 °C (incl. Ex)

Options:
- with code addition .. / R
  (with 22 Ohm protection resistor)
  (max. 240 °C)
- with code addition .. / N (acc. to Namur EN 60947)
  (max. 240 °C)

STMU



Type combination see type key Bypass-Level Indicators

Bypass - Level Indicators 1015
Magnetic switch

Technical data

Housing:
- aluminium anodized

Contact function:
- change over

Switching action:
- bistable

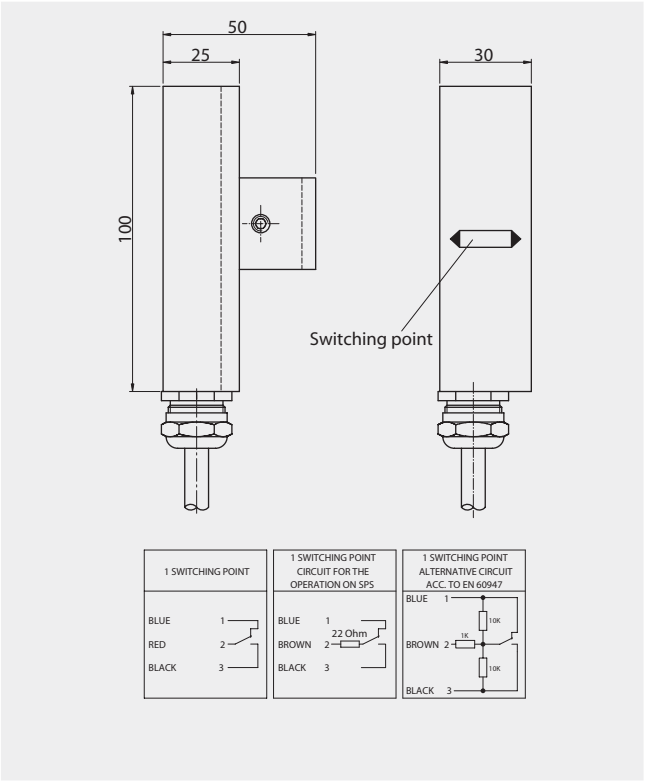
Switching capacity:
- 230 V AC / 60 VA / 1.0 A
- 230 V DC / 30 VA / 0.5 A

Protection rating:
- IP65

Ambient temperature:
- with PVC-cable max. +80 °C
- with Silicone-cable max. +180 °C

Options:
- with code addition .. / R
  (with 22 Ohm protection resistor)
  (temperature reduction by 5 °C under
  T-classification by Ex applications)
- with code addition .. / N (acc. to Namur EN 60947)
  (temperature reduction by 5 °C under
  T-classification by Ex applications)

BMUM - .. PVC / BMUM - .. Sil



Technical data

Housing:
- stainless steel

Contact function:
- change over

Switching action:
- bistable

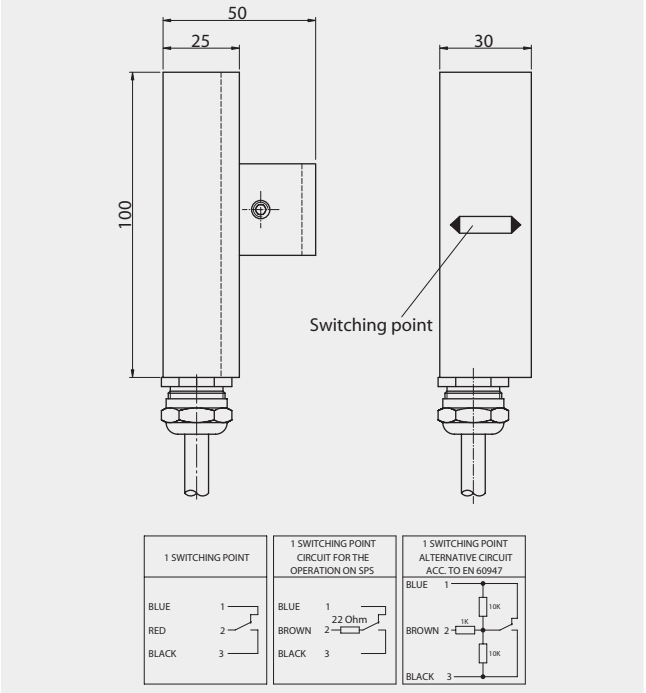
Switching capacity:
- 230 V AC / 60 VA / 1.0 A
- 230 V DC / 30 VA / 0.5 A

Protection rating:
- IP65

Ambient temperature:
- with PVC-cable max. +80 °C
- with Silicone-cable max. +180 °C

Options:
- with code addition .. / R
  (with 22 Ohm protection resistor)
  (temperature reduction by 5 °C under
  T-classification by Ex applications)
- with code addition .. / N (acc. to Namur EN 60947)
  (temperature reduction by 5 °C under
  T-classification by Ex applications)

BMUMV - .. PVC / BMUMV - .. Sil



Type combination see type key Bypass-Level Indicators

Bypass - Level Indicators 1015
Magnetic switch

Technical data

Housing:
- aluminium

Contact function:
- change over

Switching action:
- bistable

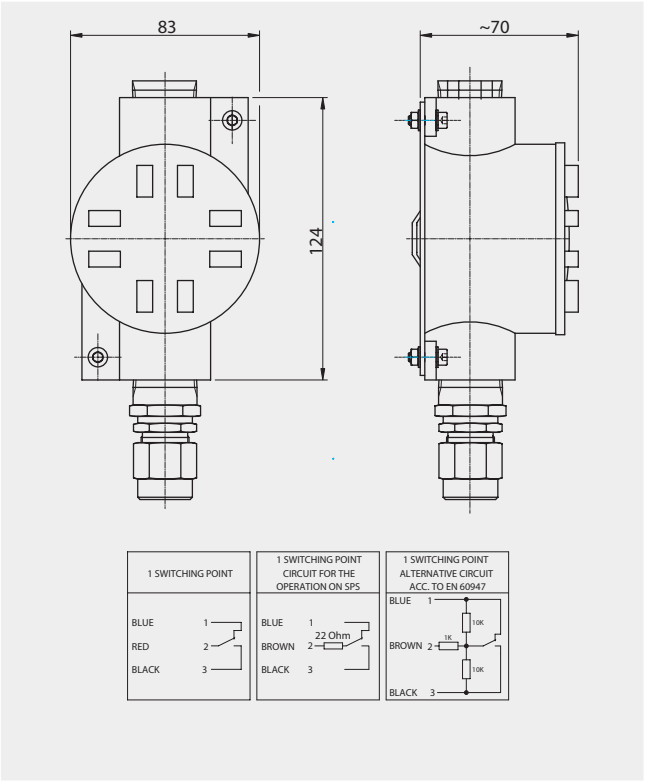
Switching capacity:
- 230 V AC / 60 VA / 1.0 A
- 230 V DC / 30 VA / 0.5 A

Protection rating:
- IP65

Ambient temperature:
- max. +85 °C

Options:
- with code addition .. / R
  (with 22 Ohm protection resistor)
  (max. temp. +85 °C)
- with code addition .. / N (acc. to Namur EN 60947)
  (max. temp. +85 °C)

BMUM - ALDC - EExd



Technical data

Housing:
- stainless steel

Contact function:
- change over

Switching action:
- bistable

Switching capacity:
- 230 V AC / 60 VA / 1.0 A
- 230 V DC / 30 VA / 0.5 A

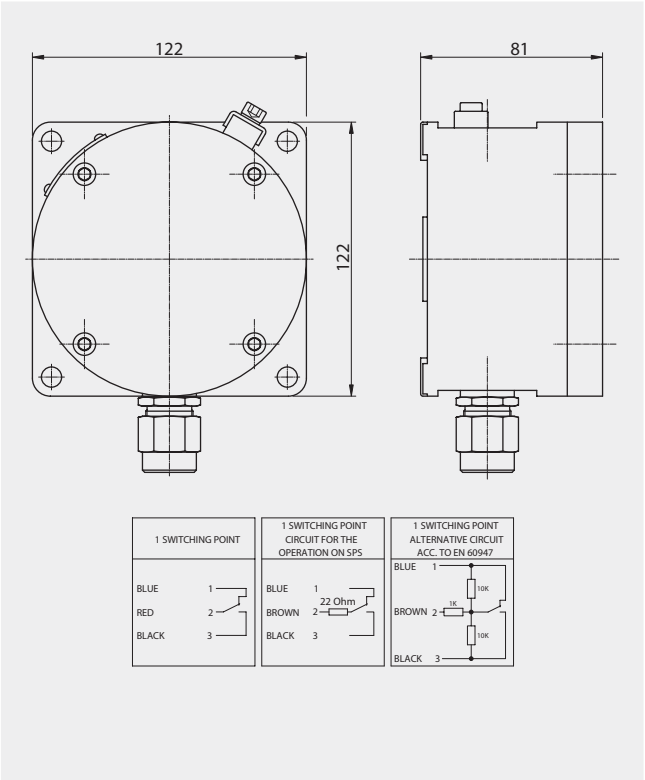
Protection rating:
- IP65

Ambient temperature:
- max. +55 °C (EExd)

Cable entry:
- M20 x 1.5 mm

Options:
- with code addition .. / R
  (with 22 Ohm protection resistor)
  (max. temp. +55 °C)
- with code addition .. / N (acc. to Namur EN 60947)
  (max. temp. +55 °C)

BMUM - AVD - EExd



Type combination see type key Bypass-Level Indicators

Bypass - Level Indicators 1015
Magnetic switch

Technical data

Housing:
- aluminium anodized

Contact function:
- change over

Switching action:
- bistable

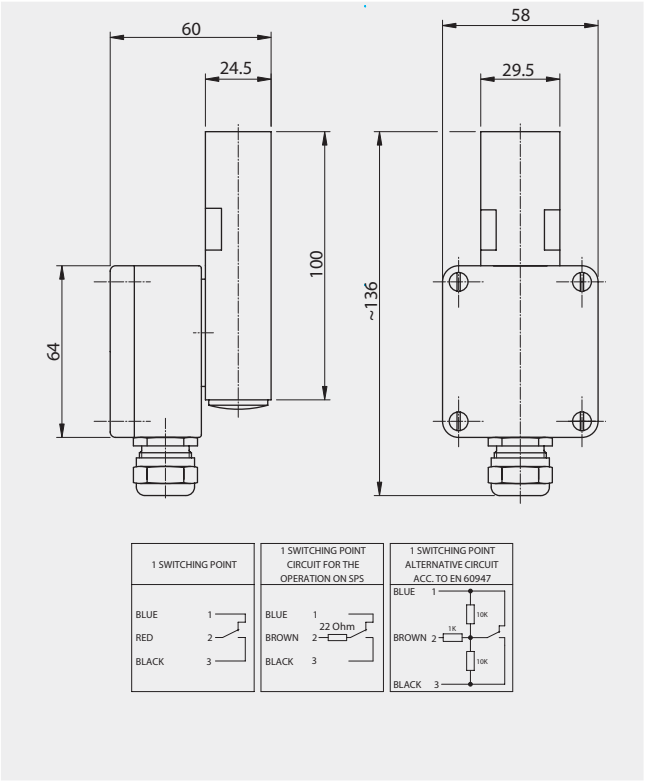
Switching capacity:
- 230 V AC / 60 VA / 1.0 A
- 230 V DC / 30 VA / 0.5 A

Protection rating:
- IP65

Ambient temperature:
- max. +130 °C

Options:
- with code addition .. / R
  (with 22 Ohm protection resistor)
  (temperature reduction by 5 °C under
  T-classification by Ex applications)
- with code addition .. / N (acc. to Namur EN 60947)
  (temperature reduction by 5 °C under
  T-classification by Ex applications)

AUM - 80



Technical data

Housing:
- stainless steel
- electrical connection box polyester

Contact function:
- change over

Switching action:
- bistable

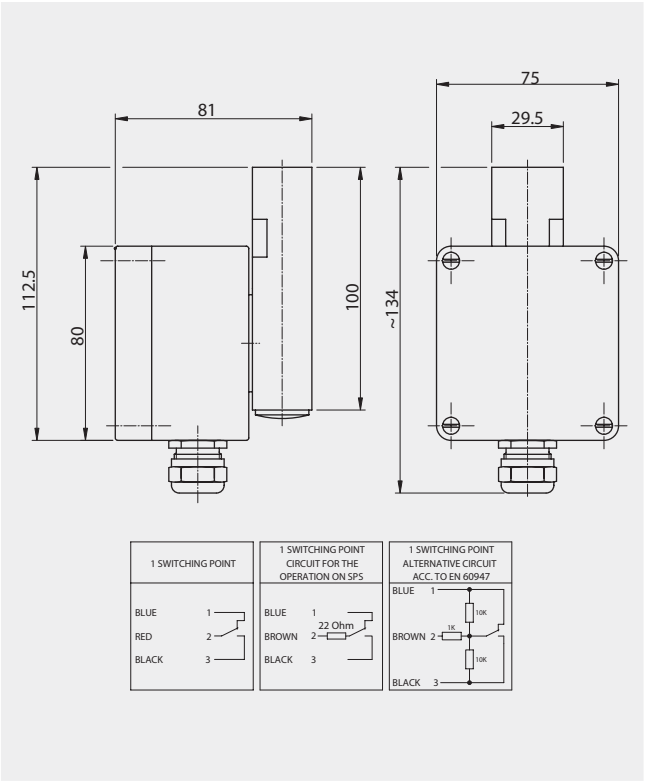
Switching capacity:
- 230 V AC / 60 VA / 1.0 A
- 230 V DC / 30 VA / 0.5 A

Protection rating:
- IP65

Ambient temperature:
- max. +100 °C

Options:
- with code addition .. / R
  (with 22 Ohm protection resistor)
  (temperature reduction by 5 °C under
  T-classification by Ex applications)
- with code addition .. / N (acc. to Namur EN 60947)
  (temperature reduction by 5 °C under
  T-classification by Ex applications)

APMUMV



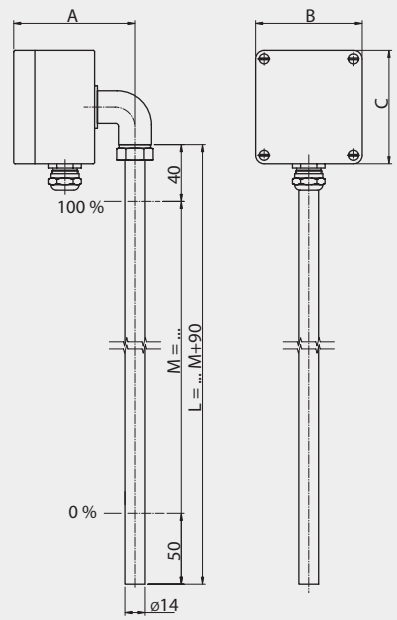
Type combination see type key Bypass-Level Indicators

Bypass - Level Indicators 1015
Level sensor

Technical data

AL - .. - VK .. - M

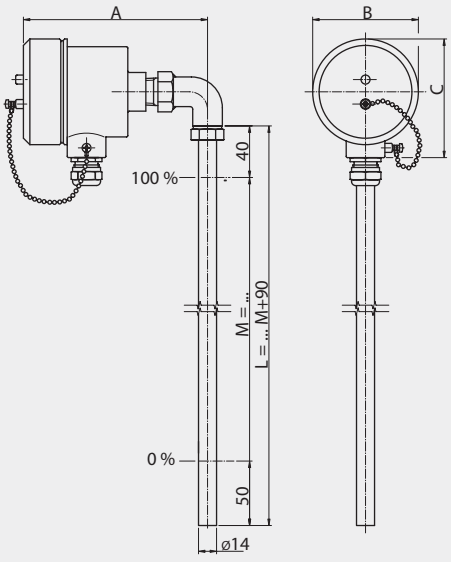
Terminal box:	Aluminium **A 105:** 80 x 75 x 57 **A 101:** 64 x 58 x 34
Dimensions:	**A 105** A = 85.5 mm B = 75.0 mm C = 89.0 mm **A 101** A = 62.5 mm B = 50.0 mm C = 68.0 mm
Guide tube:	ø 14 mm
Resolution:	5.0 mm -30 °C ... +120 °C 10.0 mm -30 °C ... +120 °C 15.0 mm -30 °C ... +120 °C 5.0 mm (HTF) -30 °C ... +200 °C 10.0 mm (HTF) -30 °C ... +200 °C 15.0 mm (HTF) -30 °C ... +200 °C 5.0 mm (HT) -100 °C ... +250 °C 10.0 mm (HT) -100 °C ... +250 °C 15.0 mm (HT) -100 °C ... +250 °C
Control unit:	TP5343A/B TP5350A/B TD5335A/B XT-42-SI



Technical data

AV - .. - VK .. - M ..

Terminal box:	Stainless steel 92 x 82 x 95 mm
Cable gland:	Brass nickel-plated (standard)
Dimensions:	A = ~145 mm B = ~ 82 mm C = ~ 92 mm
Guide tube:	ø 14 mm
Resolution:	5.0 mm -30 °C ... +120 °C 10.0 mm -30 °C ... +120 °C 12.7 mm -30 °C ... +120 °C 15.0 mm -30 °C ... +120 °C 5.0 mm (HTF) -30 °C ... +200 °C 10.0 mm (HTF) -30 °C ... +200 °C 15.0 mm (HTF) -30 °C ... +200 °C 5.0 mm (HT) -100 °C ... +250 °C 10.0 mm (HT) -100 °C ... +250 °C 15.0 mm (HT) -100 °C ... +250 °C
Control unit:	TP5343A/B TP5350A/B TD5335A/B XT-42-SI
Option:	Cable gland in stainless steel

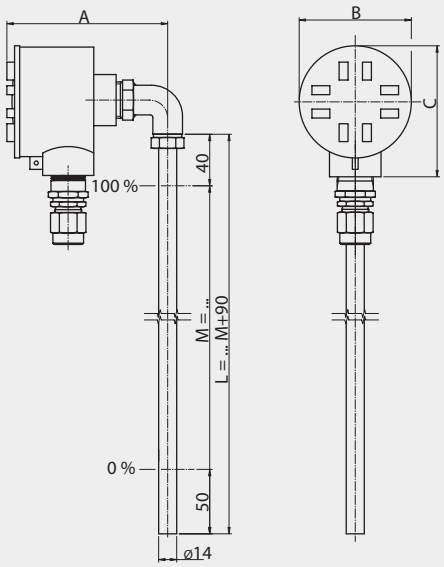


Type combination see type key Bypass-Level Indicators

Bypass - Level Indicators 1015
Level sensor

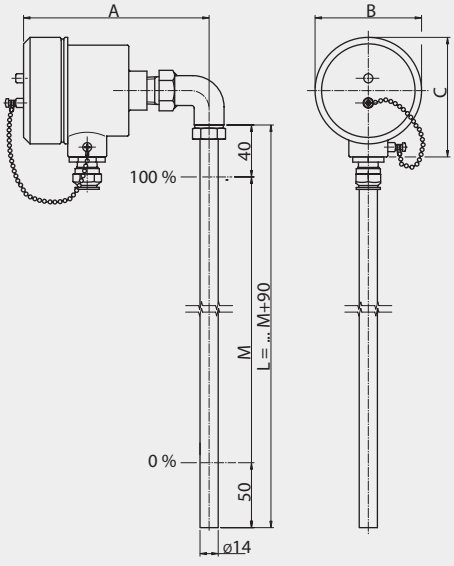
Technical data	
Terminal box:	Aluminium 102 x 87 x 85 mm
Dimensions:	A = ~125 mm B = ~ 87 mm C = ~102 mm
Guide tube:	ø 14 mm
Resolution:	5.0 mm -30 °C ... +120 °C 10.0 mm -30 °C ... +120 °C 15.0 mm -30 °C ... +120 °C
Control unit:	TP5343A/B TP5350A/B TD5335A/B XT-42-SI
Ambient temperature EExd:	+85 °C

ALDC - .. - VK .. - M .. - EExd



Technical data	
Terminal box:	Stainless steel (max. +40 °C) 92 x 82 x 95 mm
Cable gland:	Brass nickel-plated (standard)
Dimensions:	A = ~145 mm B = ~ 82 mm C = ~ 92 mm
Guide tube:	ø 14 mm
Resolution:	5.0 mm -30 °C ... +120 °C 10.0 mm -30 °C ... +120 °C 15.0 mm -30 °C ... +120 °C
Control unit:	TP5343A/B TP5350A/B TD5335A/B XT-42-SI
Option:	Cable gland in stainless steel

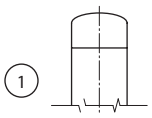
AVD - .. - VK .. - M .. - EExd



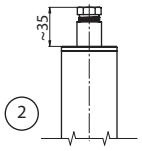
Type combination see type key Bypass-Level Indicators

Bypass - Level Indicators 1015
Options chamber ends

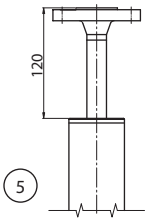
Chamber end top



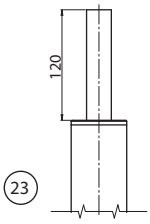
Welding cap
Standard



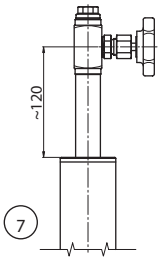
Flat top with
vent plug G / NPT
(G > 1/2" with socket)
(NPT with socket)



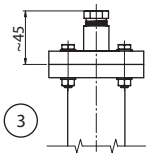
Flat top with
vent flange
DIN/ANSI flange



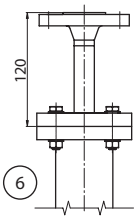
Flat top with
vent nozzle



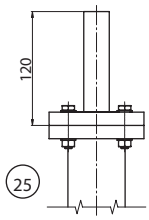
Flat top with
vent needle valve



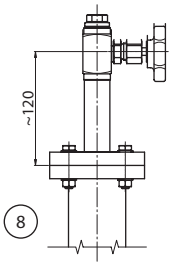
Blind flange with
vent plug G / NPT
(G > 1/2" with socket)
(NPT with socket)



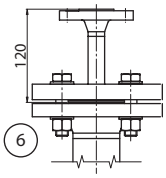
Blind flange with
vent flange
DIN / ANSI flange



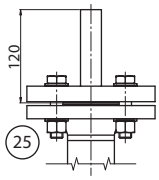
Blind flange with
vent nozzle



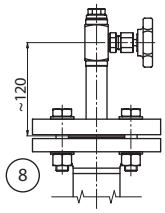
Blind flange with
vent needle valve



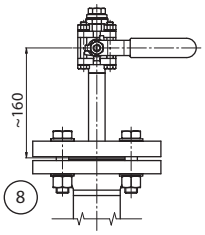
Welding neck flange
with vent flange
DIN / ANSI flange



Welding neck flange
with vent nozzle



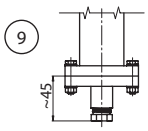
Welding neck flange
with vent needle valve



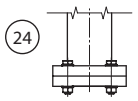
Welding neck flange
with vent ball valve

Chamber end bottom

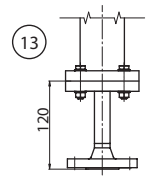
Blind flange with
drain plug G / NPT
(G > 1/2" with socket)
(NPT with socket)



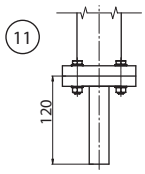
Blind flange



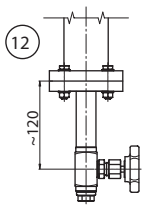
Blind flange with
drain flange
DIN / ANSI flange



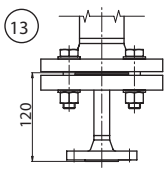
Blind flange with
drain nozzle



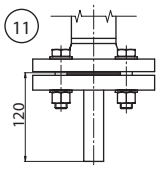
Blind flange with
drain needle valve



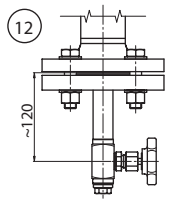
Welding neck flange
with drain flange
DIN / ANSI flange



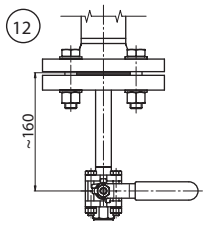
Welding neck flange
with drain nozzle



Welding neck flange
with drain needle valve



Welding neck flange
with drain ball valve

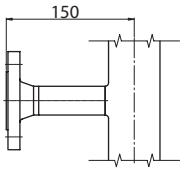


Bypass - Level Indicators 1015
Options process connections

Options process connections

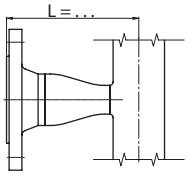
Standard
Welding neck flange

14



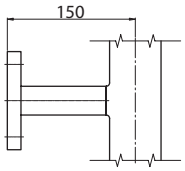
Welding neck flange
reduced

14



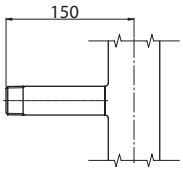
Blind flange

15



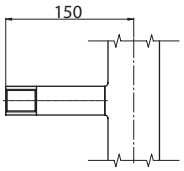
G or NPT thread
male (nipple)

16



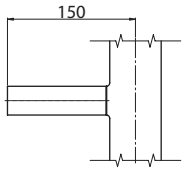
G or NPT thread
female (socket)

17



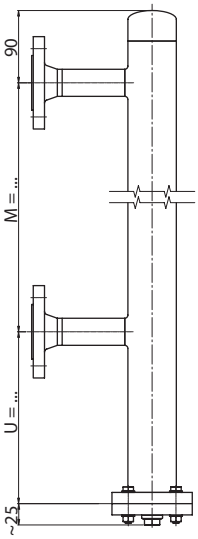
Welding tube

18



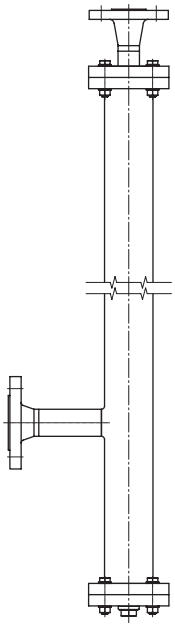
Standard

19



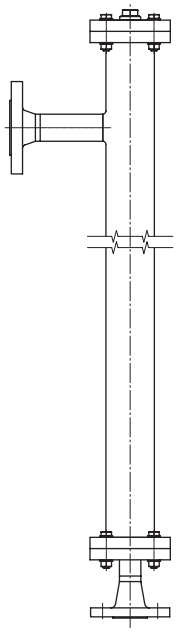
1 Process connection side bottom
1 Process connection vertical top

20



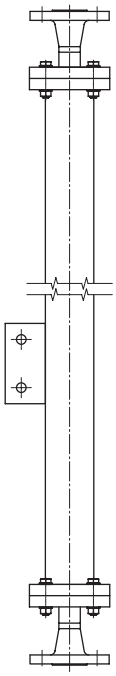
1 Process connection side top
1 Process connection vertical bottom

20

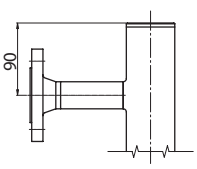


2 Process connections vertical
Option: support brackets

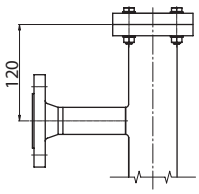
22



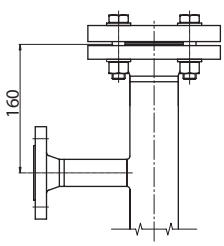
Flat top



Blind flange DIN/ANSI



Welding neck flange DIN/ANSI



Bypass - Level Indicators 1015
Type key

Code 1	Key 1		ATEX
	BNA -	Bypass - Level Indicators	
	BMG -	Bypass - Level Indicators with level sensor	

Code 2	Key 1	Design process connections			ATEX
	.. / .. / .. -	Flange norm	1. nom.width	2. nom.pressure	3. form
		DIN	DN 6 .. 500	PN 6 .. 400	C, F, N,B ..
		ANSI	1/2" .. 24"	150 lbs .. 2500	SF, RTJ, RF..
		JIS B 2010	2" .. 20"	5K .. 63K	A .. T
		BSI BS 4504	DN 10 .. 500	PN 2.5 .. 400	
		S	Special flange with outside diameter mm		
	G .. -	GM thread female .."			
		GN thread male .."			
	NPT .. -	NPTM thread female .."			
		NPTN thread male .."			
	SE .. -	Welding ends .."			
	OS -	Without lateral connections			

Code 3	Key 1	Electrical connection for level sensor	ATEX
	AL -	Aluminium terminal box	
	AV -	Stainless steel terminal box	
	ALDC -	Aluminium terminal box EExd explosion proof	
	ALD -	Aluminium terminal box EExd explosion proof	
	AVD -	Stainless steel terminal box EExd explosion proof	
	AP -	Terminal box polyester	
	AB -	Terminal box ABS	
	E -	Connection cable	
	.. -	Various	
	U .. -	Connection mountend on bottom (with appropriate electrical connection)	

Type combination

Code	1	2	3	4	5	6	7	8	9
Key	1	1/2/3	1/2/3	1	1	1/2	1	1	1

Example	BMG -	25/16/C -	AL-VK10 -	M700 -	V60 -	MRA/SG -	1/BGU-A -	ZVS250 -	Ex

Bypass - Level Indicators 1015
Type key

Code 3	Key 2	2-wire control unit in terminal box	ATEX
	ZMU -	XT-42-SI	
	ZMUP -	956045	
	ZMUL -	2251	
	TP -	TP 5333B	
	TPA -	TP 5333A	
	TP43 -	TP 5343B	
	TP43A -	TP 5343A	
	TP50 -	TP 5350B	
	TP50A -	TP 5350A	
	TD -	TD 5335B	
	TDA -	TD 5335A	
	...	Various	

	Key 3	Design resolution in stainless steel tube	ATEX
	VK5 -	Resolution 5.0 mm	
	VK5 (HTF) -	Resolution 5.0 mm high temperature	
	VK5 (HT) -	Resolution 5.0 mm high temperature	
	VK10 -	Resolution 10.0 mm	
	VK10 (HTF) -	Resolution 10.0 mm high temperature	
	VK10 (HT) -	Resolution 10.0 mm high temperature	
	VK15 -	Resolution 15.0 mm	
	VK15 (HTF) -	Resolution 15.0 mm high temperature	
	VK15 (HT) -	Resolution 15.0 mm high temperature	

Code 4	Key 1	Distance centre to centre / length in mm	ATEX
	- M .. -	Distance middle process connection to middle process connection	
	- L .. -	Lenght of instrument for bypasses without lateral connections	

Code 5	Key 1	Material of chamber	ATEX
	V .. -	Stainless steel	
	Ti .. -	Titanium	
	H .. -	Alloy	
	EEC .. -	Stainless steel E-CTFE coated	
	PFA .. -	Stainless steel PFA coated	
	P .. -	Polyvinylchloride PVC	
	PP .. -	Polypropylene PP	
	PF .. -	Polyvinylidenfluoride PVDF	
	... -	Various	

Type combination

Code	1	2	3	4	5	6	7	8	9
Key	1	1/2/3	1/2/3	1	1	1/2	1	1	1

Example	BMG -	25/16/C -	AL-VK10 -	M700 -	V60 -	MRA/SG -	1/BGU-A -	ZVS250 -	Ex

Bypass - Level Indicators 1015
Type key

Code 5	Key 2	Diameter of chamber	ATEX
	60 -	60.0 mm	
	64 -	63.5 mm	
	73 -	73.0 mm	
	76 -	76.0 mm	
	88 -	88.0 mm	
	114 -	114.0 mm	

Code 6	Key 1	Magnetic roller indicator	ATEX
	MRA	Aluminium profile with plastic rollers and switch-rail profile	
	MNA	Aluminium profile with plastic rollers	
	MNAN	Aluminium profile with plastic rollers shock proof	
	MRK	Aluminium profile with ceramics rollers and switch-rail profile	
	MNK	Aluminium profile with ceramics rollers	
	MNAV	Stainless steel profile with plastic rollers	
	MNKV	Stainless steel profile with ceramics rollers	

	Key 2	Scale for mounting onto magnetic roller indicator	ATEX
	/ SK -	Aluminium scale with adhesive foil, separation in cm	
	/ SG -	Aluminium engraved, separation acc. to specification	
	/ VSG -	Stainless steel engraved, separation acc. to specification	
	/ P -	Acrylic glass extender for refrigeration applications	

Code 7	Key 1	Magnetic switches see pages 224-227

Code 8	Key 1	Float designs with length of float	ATEX
	ZVS .. -	Stainless steel	
	ZTS .. -	Titanium	
	ZHS .. -	Alloy	
	ZVEECS .. -	Stainless steel E-CTFE coated	
	ZTEECS .. -	Titanium E-CTFE coated	
	ZVPFAS .. -	Stainless steel PFA coated	
	ZTPFA .. -	Titanium PFA coated	
	ZPS .. -	Polyvinylchloride PVC	
	ZPPS .. -	Polypropylene PP	
	ZPFS .. -	Polyvinylidenfluoride PVDF	
	.. -	Various	

Type combination

Code	1	2	3	4	5	6	7	8	9
Key	1	1/2/3	1/2/3	1	1	1/2	1	1	1
Example	BMG -	25/16/C -	AL-VK10 -	M700 -	V60 -	MRA/SG -	1/BGU-A -	ZVS250 -	Ex

Bypass - Level Indicators 1015
Type key

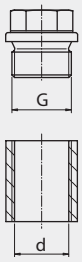
Code 9	Key 1	Approvals and options	ATEX
	Ex	Intrinsically safe design acc. to EExia	
	EExd	Explosion proof design acc. to EExd	
	GL	Germanischer Lloyd	
	BV	Bureau Veritas	
	RINA	Registro Italiano Navale	
	DNV	Det Norske Veritas	
			

Type combination

Code	1	2	3	4	5	6	7	8	9
Key	1	1/2/3	1/2/3	1	1	1/2	1	1	1
Example	BMG -	25/16/C -	AL-VK10 -	M700 -	V60 -	MRA/SG -	1/BGU-A -	ZVS250 -	Ex

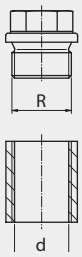
Bypass - Level Indicators 1015
Design process connections

Thread G ..."



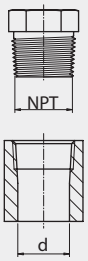
Size	Diameter G [mm]	Core ø d [mm]	Bore [mm]
1/8"	9.7	8.5	8.0
1/4"	13.2	11.4	11.0
3/8"	16.7	14.9	14.5
1/2"	21.0	18.9	18.0
3/4"	26.5	24.1	23.5
1"	33.3	30.2	29.5
1 1/2"	47.8	44.9	44.0
2"	59.7	56.6	56.0

Thread R ..."



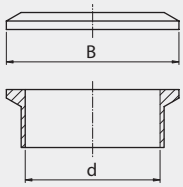
Size	Diameter R [mm]	Core ø d [mm]	Bore [mm]
1/8"	9.7	8.5	8.0
1/4"	13.2	11.4	11.0
3/8"	16.7	14.9	14.5
1/2"	21.0	18.6	18.0
3/4"	26.5	24.1	23.5
1"	33.3	30.2	29.5
1 1/2"	47.8	44.8	44.0
2"	59.7	56.6	56.0

Thread NPT ..."



Size	Diameter NPT [mm]	Core ø d [mm]	Bore [mm]
1/8"	9.6	8.4	8.5
1/4"	12.8	11.2	11.0
3/8"	16.2	14.6	14.5
1/2"	19.9	18.2	18.0
3/4"	25.6	23.4	23.0
1"	31.8	29.8	29.0
1 1/2"	46.8	44.2	44.0
2"	58.6	56.4	56.0

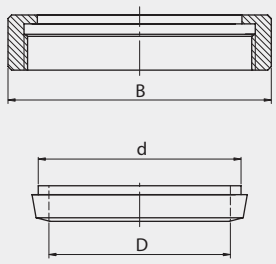
Flange Tri - clamp DIN 32676



Size	Diameter B [mm]	Inside ø d [mm]	Bore [mm]
DN15 / 1/2"	34.0	16.0	15.0
DN20 / 3/4"	34.0	20.0	19.0
DN25 / 1"	50.5	26.0	25.0
DN50 / 2"	64.0	50.0	48.0
DN65 / 2 1/2"	91.0	66.0	64.0
DN80 / 3"	106.0	88.0	86.0
DN100 / 4"	119.0	100.0	98.0

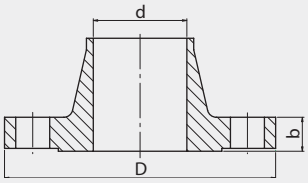
Bypass - Level Indicators 1015
Design process connections

Tube connection DIN 11851



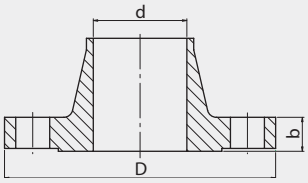
Size	Bore ø D [mm]	Inside ø d [mm]	Union nut B [mm]
DN10	18	12	38
DN15	24	18	44
DN20	30	22	54
DN25	35	28	63
DN40	48	40	78
DN50	61	52	92
DN65	79	68	112
DN80	93	83	127
DN100	114	102	148

Flange DIN 16 bar



Size	Flange ø D [mm]	Inside ø d [mm]	Flange thickness b [mm]
DN10	90	13.2	14
DN15	95	17.3	14
DN20	105	22.9	16
DN25	115	29.7	16
DN40	150	44.3	16
DN50	165	56.3	18
DN65	185	72.1	18
DN80	200	84.9	20
DN100	220	110.3	20

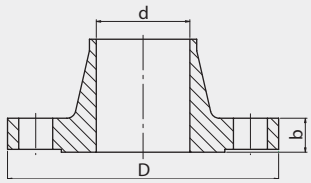
Flange Ansi 150 lbs



Size	Flange ø D [mm]	Inside ø d [mm]	Flange thickness b [mm]
½"	88.9	15.7	11.2
¾"	98.6	20.8	12.7
1"	108.0	26.7	14.2
1½"	127.0	40.9	17.5
2"	152.4	52.6	19.1
2½"	177.8	62.7	22.4
3"	190.5	78.0	23.9
4"	228.6	102.4	23.9

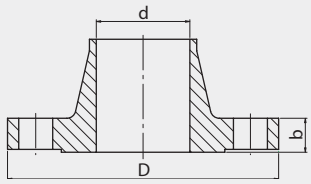
Bypass - Level Indicators 1015
Design process connections / Materials

Flange DIN 40 bar



Size	Flange ø D [mm]	Inside ø d [mm]	Flange thickness b [mm]
DN10	90	13.2	16
DN15	95	17.3	16
DN20	105	22.9	18
DN25	115	29.7	18
DN40	150	44.3	18
DN50	165	56.3	20
DN65	185	72.1	22
DN80	200	84.9	24
DN100	235	110.3	24

Flange Ansi 300 lbs



Size	Flange ø D [mm]	Inside ø d [mm]	Flange thickness b [mm]
½"	95.2	15.7	14.2
¾"	117.3	20.8	15.7
1"	124.0	26.7	17.5
1½"	155.4	40.9	20.6
2"	165.1	52.6	22.4
2½"	190.5	62.7	25.4
3"	209.6	78.0	28.4
4"	254.0	102.0	31.8

Materials

Material temperatures	Material	Temperature min.	Temperature max.
V	Stainless steel	- 196 °C	+ 400 °C
Ti	Titanium	- 10 °C	+ 300 °C
H	Alloy / Ni Mo	- 196 °C	+ 400 °C
EEC	Stainless steel E-CTFE coated	- 78 °C	+ 150 °C
PFA	Stainless steel PFA coated	- 100 °C	+ 250 °C
P	Polyvinylchloride PVC	- 15 °C	+ 60 °C
PP	Polypropylene PP	- 5 °C	+ 100 °C
PF	Polyvinylidenfluoride PVDF	- 5 °C	+ 150 °C
PA	Polyamide PA	- 40 °C	+ 110 °C
M	Brass	- 196 °C	+ 250 °C
AL	Auminium	- 196 °C	+ 150 °C