

# Paddle Type Flow Meter

TSK

## Technical Information

- Flow measurement and monitoring of turbid, hazardous or flammable liquids
- Horizontal and vertical installation possible
- Extremely robust design
- Outstanding clear reading due to 90° arranged scale
- Transmitter with 4...20mA, HART®, PROFIBUS-PA® or Fieldbus Foundation®
- Suitability for installation in safety-related measuring circuits according to SIL

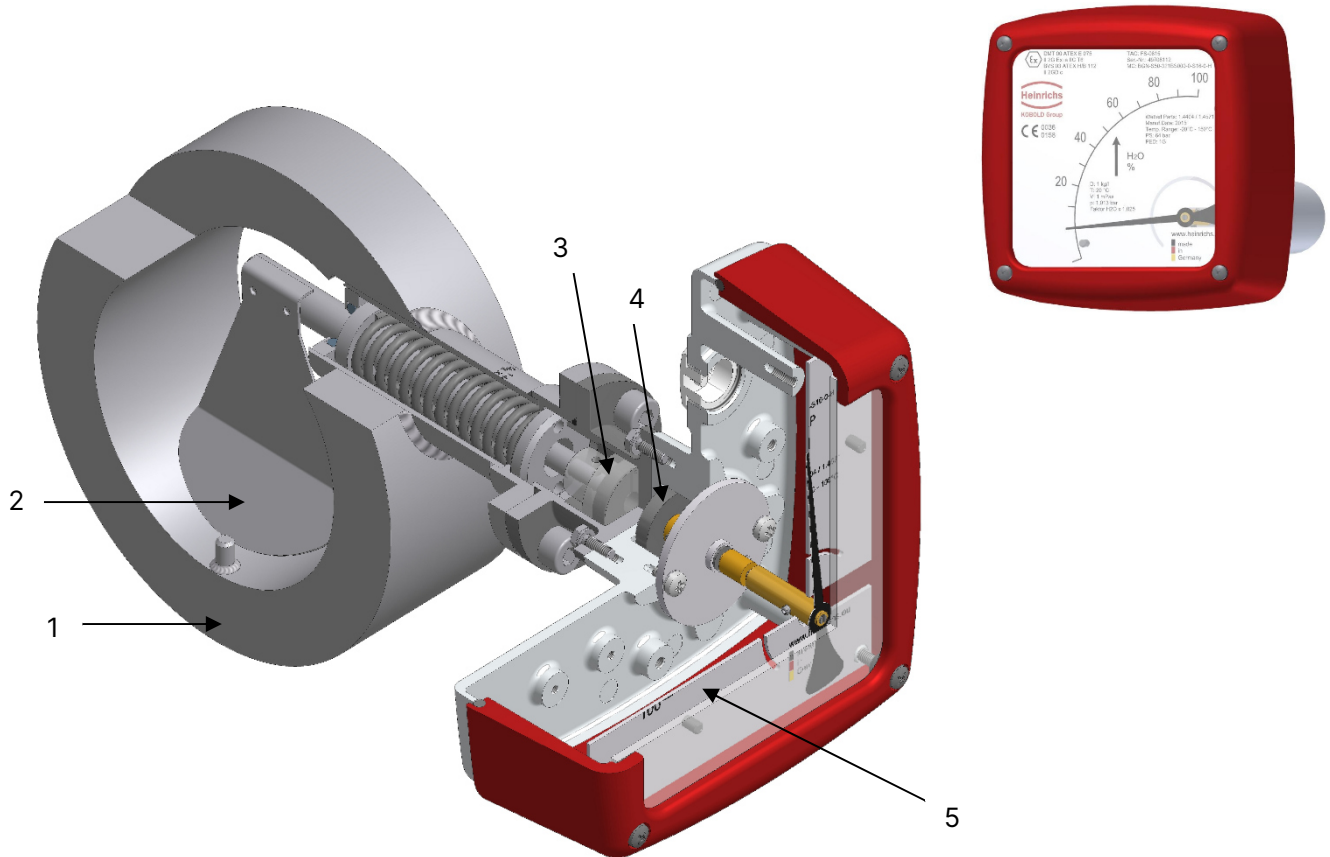


## Function

If a medium flows with sufficient velocity through the vertically or horizontally arranged TSK armature (1), the paddle (2) is pivoted about its pivot point until a state of equilibrium is reached between the force of the medium flowing through and the opposing paddle surface plus the spring force. The angular or equilibrium position of the paddle serves as the measure of the flow rate. It is transmitted by the encapsulated permanent ring magnet (3),

which is located at the end of the paddle axis, to the flow rate scale (5) and to the optional electrical transducers, in a decoupling-proof and contactless manner via the coupled magnet display system (4).

The flow values displayed on the scale apply to the calibrated medium or to a medium with the same physical data.



## Application

The paddle-type flow meter TSK is suitable for flow measurement of liquid fluids in pipes.

The special advantage of the meter is that it can be used for all mounting and flow directions. Furthermore, it is extremely robust and well-suited for rough environmental conditions.

The meter shows the actual flow rate in volume or mass per unit in time.

### Applications:

- flow measurement
- monitoring
- adjusting
- control of liquid products

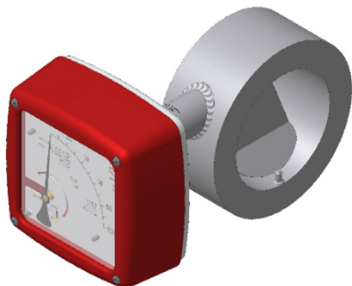
The instruments are available with additional electrical equipment for process monitoring and control.

### Features:

- Large variety of material or linings in contact with the product
- Permanent magnetic resistive signal transmission
- Applicable for high process temperatures
- Gaseous fluids (optional)

## Design / Variations

### Aluminum indicator



Optimized aluminum indicator

Large and well-arranged scale with a 90° angle for optimal reading.

Rounded edges and rims ensure a smooth draining of liquids after wet contact. A special anodization and paint finish make the indicator housing suitable for outdoor use.

Process connection: wafer style

### Stainless steel indicator



Stainless steel indicator

IP47 protection for extreme applications

Large and well-arranged scale with 90° angle for optimal reading.

The round design ensures a smooth draining of liquids after wet contact. Salty and rough environments e.g. off-shore applications do not show any problem.

### High-temperature version with displaced indicator

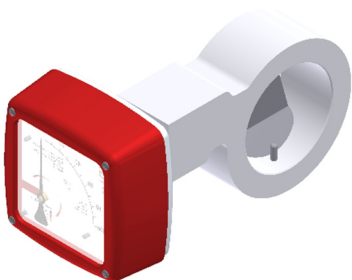


Displaced indicator for process temperatures up to 300 °C

For very high or very low process temperatures the indicator will be displaced 100 mm from the measuring pipe.

The use of limit switches or transmitters is without limitations.

### Special materials



PTFE lining for highest chemical resistance

Wetted parts made of Hastelloy

The unique design enables the usage of chemically highly resistant materials for rough industrial environments and highly corrosive processes such as e.g. acid and lye.

## Technical Data

### Armature

#### Materials:

- 1.4404 (316 L) / 1.4571 (316 Ti)
- From DN150 Steel / Stainless steel
- Hastelloy C 22
- PTFE

Special material on request.

#### Process-connection:

Wafer for flanges acc. to

- DIN EN 1092-1
- ASME B16.5
- DIN 2512

Special fittings according to customer requirements.

#### Nominal pressure:

- PN 40, ASME C1150 / 300 (Standard) (TSK-S/H)
- PN 16, ASME C1150 (Standard) (TSK-P)

Higher pressures on request.

#### Process temperature:

- -40°C ... + 200°C / max. 300°C with forward advanced indication part (TSK-S/H)
- -20°C ... + 125°C (TSK-P)

#### Environmental temperature:

- -40°C ... + 80°C without electrical accessories
- -25°C ... +70°C / +80°C with limit switches
- -40°C ... + 70°C with ES transmitter

#### Measurement deviation:

- ± 2,5% of the measured value (Liquid/Gas)
- ± 0,2% additional error with a converter (ES)

#### Repeatability:

- ± 0,5 %



### Display Part

#### Protection class:

- Aluminum IP65
- Stainless steel IP65, IP66, IP67

#### Electrical Outputs

##### Switch outputs:

- max. 2 inductive switch contacts (SJ 3,5 N)  
 Refer to type approval for elec. parameters
- max. 2 inductive switching contacts (SJ 3,5 SN)  
 (safety design)  
 Refer to type approval for elec. parameters
- max. 2 micro changeover switches  
 (Reed switch  $U_{max}:175V_{DC}$ ,  $I_{max}:0,25A$ ,  $P_{max}:5W$ )

##### Transmitter ES:




- ES with HART®
- ES with HART® and 2 NAMUR contacts
- ES with HART® and 1 NAMUR-contact / 1 pulse output
- ES with HART® and counter module.  
 (only for flow direction from bottom to top)
- ES with Profibus-PA®
- ES with Foundation FIELDBUS®

##### Power supply transmitter ES:

- 14 ... 30 V<sub>DC</sub>, 2-wire (reverse polarity protected)

##### Outputs Transmitter ES:

passive, galvanic isolated

- Analogue: 4...20 mA with HART®  
  $U_i=30 V$ ,  $I_i=150 mA$ ,  $P_i=1 W$
- Binary 1 and 2: 2x Contacts  
  $U_i=30 V$ ,  $I_i=20 mA$ ,  $P_i=100 mW$
- PPA or FF:  
  $U_i = 17.5 V_{DC}$  (FISCO), or  
 $U_i=32 V_{DC}$ ,  $I_i=280 mA$ ,  $P_i=2 W$
- Counter Module (non Ex):
  - Power Supply:  
 $U_{max}=30 V_{DC}$ ,  $I_{max}\leq 10 mA$
  - Binary input: Reset counter reading  
 $U_{max}=30 V_{DC}$
  - NPN Outputs  
 $U_{max}=30 V_{DC}$ ,  $I_{max}=20 mA$

##### Protection class transmitter ES:

- IP20 (EN60529)

##### ATEX and IECEx:

Refer to Certificates and Approvals

For electrical parameters refer to certificates

**Measuring ranges**

Nominal width DN / Inch	Measuring range	Measuring range for water $\rho = 1000 \text{ kg/m}^3$ at 20 °C		Pressure loss (mbar)
25* / 1"	A1	0,5 – 3,5	m <sup>3</sup> /h	
40* / 1½"	B1	1,5 – 6	m <sup>3</sup> /h	
	B2	1,5 – 10	m <sup>3</sup> /h	
	B3	3 – 15	m <sup>3</sup> /h	
50 / 2"	C1	1,5 – 10	m <sup>3</sup> /h	120
	C2	3 – 30	m <sup>3</sup> /h	50
65 / 2½"	D1	1,5 – 14	m <sup>3</sup> /h	40
	D2	4 – 30	m <sup>3</sup> /h	60
	D3	6 – 50	m <sup>3</sup> /h	60
80 / 3"	E1	4 – 24	m <sup>3</sup> /h	40
	E2	10 – 60	m <sup>3</sup> /h	60
100 / 4"	F1	6 – 40	m <sup>3</sup> /h	40
	F2	8 – 80	m <sup>3</sup> /h	60
125 / 5"	G1	10 – 60	m <sup>3</sup> /h	40
	G2	20 – 120	m <sup>3</sup> /h	60
150 / 6"	H1	15 – 100	m <sup>3</sup> /h	35
	H2	30 – 200	m <sup>3</sup> /h	55
200 / 8"	J1	25 – 160	m <sup>3</sup> /h	35
	J2	50 – 275	m <sup>3</sup> /h	45
	J3	60 – 400	m <sup>3</sup> /h	55
250 / 10"	K1	50 – 300	m <sup>3</sup> /h	30
	K2	75 – 400	m <sup>3</sup> /h	40
	K3	80 – 500	m <sup>3</sup> /h	40
300 / 12"	L1	80 – 400	m <sup>3</sup> /h	30
	L2	100 – 600	m <sup>3</sup> /h	40
350 / 14"	M1	120 – 700	m <sup>3</sup> /h	30
	M2	150 – 1000	m <sup>3</sup> /h	40
400 / 16"	N1	150 – 800	m <sup>3</sup> /h	30
	N2	200 – 1300	m <sup>3</sup> /h	40
500 / 20"	P1	200 – 1300	m <sup>3</sup> /h	40
	P2	200 – 1500	m <sup>3</sup> /h	40

\*Measuring range end value reduced by 15% for solid encapsulation

Reference conditions: according to IEC 770: Water at 20°C

**Calibrations for oil up to 320 cSt are possible on request.**

## Certificate and approvals

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### Explosion protection:

<b>ATEX (IEXEx) Directive</b>	<b>2014/34/EU</b>
BGN (Mechanical Device): Ex-marking:	HMT21-4151X (Conformity Statement) II 2G Ex h IIC T2...T6 Gb II 2D Ex h IIIC T85°C/T300°C Db
ES: EX-marking:	DMT 00 ATEX E 075 / IECEx BVS 16.0072 II 2G Ex ia IIC T6 Gb
SJ 3,5-N: SJ 3,5-SN: EX-marking:	PTB 99 ATEX 2219X PTB 00 ATEX 2049X II 2G Ex ia IIC T6...T1 Gb II 1D Ex ia IIIC T <sub>200</sub> 135°C Da

### KCS (Korea):

ES: Ex-marking:	19-KA4BO-0315 Ex ia IIC T6
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### NEPSI (China):

ES: Ex-marking:	GYJ22.1875 Ex ia IIC T6 Gb
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### PESO (India):

ES: Ex-marking:	P568580 Ex ia IIC T6 Gb
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### Standards applied (EX):

EN 80079-36:	Non-electrical devices: for use in potentially explosive atmospheres.
EN 80079-37:	Non-electrical equipment: protection by Design safety.
EN 60079-0:	General regulations.
EN 60079-11:	Intrinsic safety "i".

### Electromagnetic compatibility:

<b>EMV Directive</b>	<b>2014/30/EU</b>
EN 61326-1: EN 61000-6-2: EN 61000-6-3: EN 55011: NAMUR 21:	EMC requirements. Immunity industrial area. Interference emission residential area Group 1, Class B, radio interference. Process and laboratory technology.

### PED Directive: 2014/68/EU

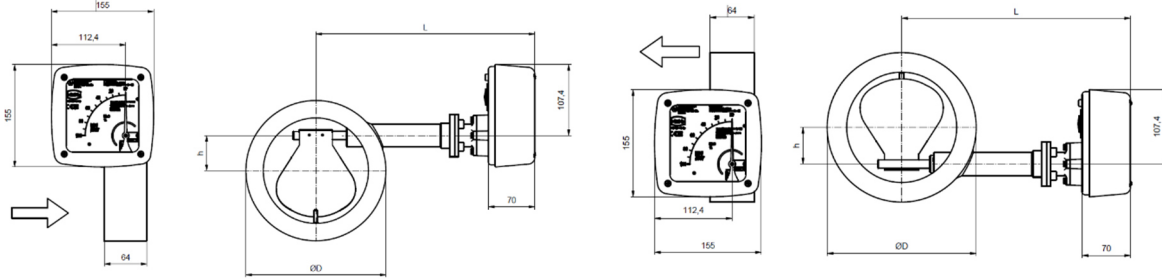
Modules H AD2000 Pamphlets	
CRN (Kanada):	0F16542.5x (x All provinces and territories)

### SIL

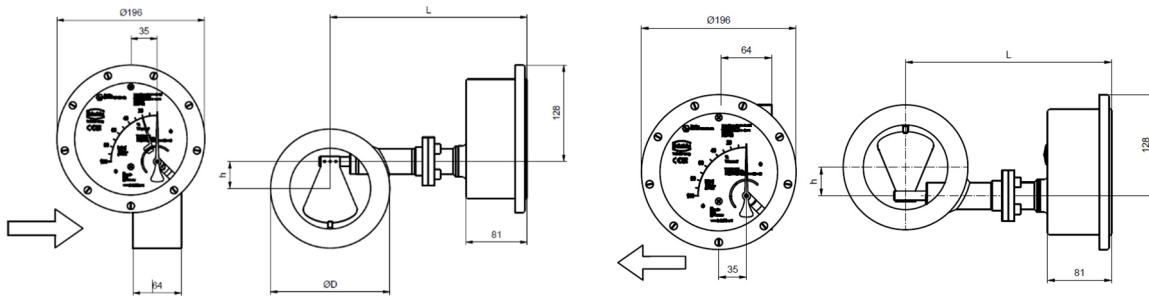
SIL 1:	EXIDA assessment acc. IEC 61508-2:2000 / :2010 (Type B, Profile 2)
SIL 2: (only with limit-switch):	EXIDA assessment acc. IEC 61508-2:2000 (Type A, Profile 2)

## Dimensions

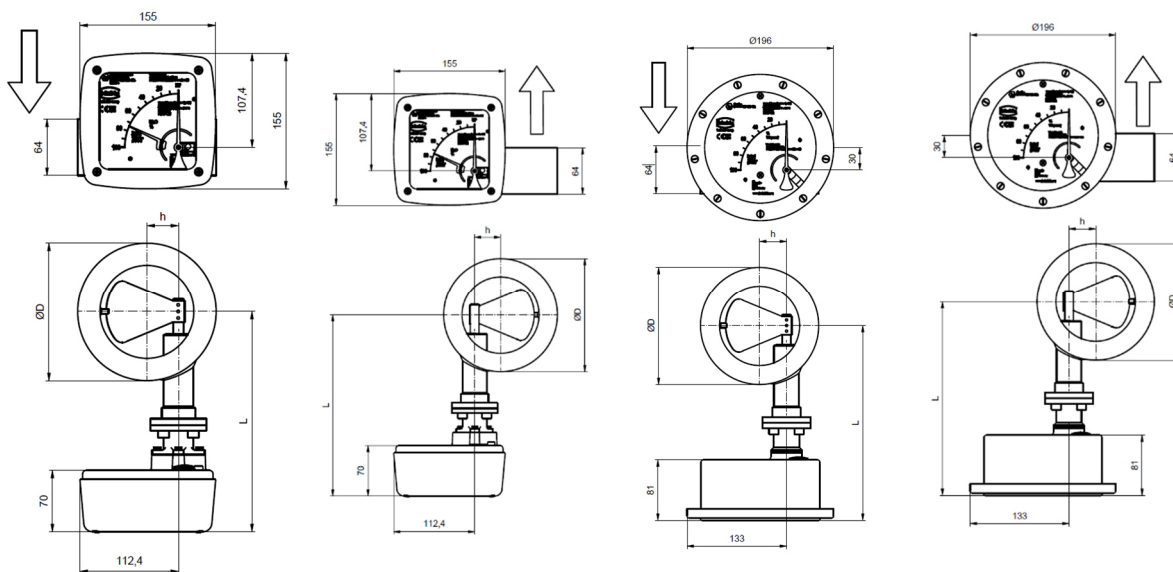
### Aluminum display part and horizontal flow direction



### Stainless Steel display part and horizontal flow direction



### Version for vertical flow directions



Nominal size DN / ASME	PN / CL	h [mm]	Stainless steel - Display L [mm]	Aluminium - Display L [mm]	DIN flanges D [mm]	ASME flanges D [mm]
25 / -	40 / (150/300)	14	255	280	68	-
40 / 1½"	40 / (150/300)	14	245	270	88	73
50 / 2"	40 / (150/300)	17	261	272	102	92,1
65 / 2½"	40 / (150/300)	21 (ASME = 17)	261	272	122	102
80 / 3"	40 / (150/300)	31	261	272	138	127
100 / 4"	16 / (150)	36	261	272	158	158
125 / 5"	16 / (150)	45	341	352	186	186
150 / 6"	16 / (150)	53	341	352	212	212
200 / 8"	16 / (150)	80	341	352	268	268
250 / 10"	16 / (150)	90	341	352	320	320
300 / 12"	10 / (150)	100	361	372	370	381
350 / 14"	10 / (150)	100	431	442	430	413
400 / 16"	10 / (150)	130	441	452	482	470
500 / 20"	10 / (150)	130	481	492	585	585



Order code

Example: TSK-S309BA1U5V0-0-S20-0-H

Model code			
TSK			
	Wetted materials	Process rating	Process temperature
S	Stainless steel	-40...+300 °C	40 bar
H	Hastelloy C-22	-40...+300 °C	40 bar
P	PTFE	-40...+125 °C	16 bar
C	Carbon steel	-20...+135 °C	16 bar from DN150
Process connection			
For device size	Flange	Measuring range (Water 20°C, 1000kg/m <sup>3</sup> , 1mPas)	
DN25	309B	DN25 PN40 Form B1 DIN EN 1092-1	A1
	309D	DN25 PN40 Form D DIN EN 1092-1	
DN40	Flange		B1 B2 B3
	317B	DN40 PN40 Form B1 DIN EN 1092-1	
	317D	DN40 PN40 Form D DIN EN 1092-1	
	205R	1½" Class 150 RF ASME B16.5-2003	
DN50	Flange		C1 C2
	321B	DN50 PN40 Form B1 DIN EN 1092-1	
	321D	DN50 PN40 Form B1 DIN EN 1092-1	
	206R	2" Class 150 RF ASME B16.5-2003	
DN65	Flange		D1 D2 D3
	326B	DN65 PN40 Form B1 DIN EN 1092-1	
	326D	DN65 PN40 Form D DIN EN 1092-1	
	207R	2½" Class 150 RF ASME B16.5-2003	
DN80	Flange		E1 E2
	331B	DN80 PN40 Form B1 DIN EN 1092-1	
	331D	DN80 PN40 Form D DIN EN 1092-1	
	208R	3" Class 150 RF ASME B16.5-2003	
DN100	Flange		F1 F2
	335B	DN100 PN16 Form B1 DIN EN 1092-1	
	335D	DN100 PN16 Form D DIN EN 1092-1	
	210R	4" Class 150 RF ASME B16.5-2003	
DN125	Flange		G1 G2
	340B	DN125 PN16 Form B1 DIN EN 1092-1	
	340D	DN125 PN16 Form D DIN EN 1092-1	
	211R	5" Class 150 RF ASME B16.5-2003	
DN150	Flange		H1 H2
	345B	DN150 PN16 Form B1 DIN EN 1092-1	
	345D	DN150 PN16 Form D DIN EN 1092-1	
	212R	6" Class 150 RF ASME B16.5-2003	
DN200	Flange		J1 J2 J3
	350B	DN200 PN16 Form B1 DIN EN 1092-1	
	213R	8" Class 150 RF ASME B16.5-2003	
DN250	Flange		K1 K2 K3
	356B	DN250 PN16 Form B1 DIN EN 1092-1	
	214R	10" Class 150 RF ASME B16.5-2003	
DN300	Flange		L1 L2
	362B	DN250 PN16 Form B1 DIN EN 1092-1	
	215R	12" Class 150 RF ASME B16.5-2003	
DN350	Flange		M1 M2
	369B	DN350 PN16 Form B1 DIN EN 1092-1	
	216R	14" Class 150 RF ASME B16.5-2003	
DN400	Flange		N1 N2
	375B	DN400 PN16 Form B1 DIN EN 1092-1	
	217R	16" Class 150 RF ASME B16.5-2003	
DN500	Flange		P1 P2
	380B	DN500 PN16 Form B1 DIN EN 1092-1	
	219R	20" Class 150 RF ASME B16.5-2003	

Flow direction			
U	Bottom to top		
O	Top to bottom		
L	Left to right		
R	Right to left		
Process temperature			
5	max.100°C	Contains: enclosure of magnet PVDF	
4	max.135°C	Contains: display forward advanced, enclosure of magnet PVDF	
3	max.200°C	Contains: display forward advanced, stainless steel enclosure of magnet	
2	max.300°C	Contains: display forward advanced, stainless steel enclosure of magnet, spring Inconel, steel sealing	
Sealing		Process temperature	
V	Viton	-20...+150°C	
F	FEP	-40...+200°C	
S	Stainless steel	-40...+300°C	
Protection against particle penetration into the transmission chamber		Process temperature	
0	without		
1	with (Viton)	from DN50	-20...+150°C
2	with (FEP)	from DN50	-40...+200°C
- Certificates			
0	without		
1	Certificate of compliance with the order 2.1		
2	Test report 2.2		
B	Inspection certificate 3.1 with material certificate (DIN EN 10204:2004)		
C	Inspection certificate 3.2 with material certificate (DIN EN 10204:2004)		
- Display			
S	Standard display housing	IP65	2)
E	Stainless steel display housing	IP65, IP66, IP67	2)
T	Standard display housing with pressure compensation	IP65	2)
Scale			
1	% -Scale (Water, $\rho$ :1000m <sup>3</sup> /h, 1mPas, 20°C)		
2	Measuring range - Scale (Water, $\rho$ :1000m <sup>3</sup> /h, 1mPas, 20°C)		
F	Double-scale (acc. to customer preference)		
4	% -Scale (Media)		
5	Measuring range - Scale (Media)		
Electrical output		Ambient temperature	
0	without		
1	1 x inductive switch, type SJ 3,5 N		-40 ... +80 °C
2	2 x inductive switch, type SJ 3,5 N		-25 ... +80 °C
3	1 x inductive switch, type SJ 3,5 SN (safety design)		-40 ... +80 °C
4	2 x inductive switch, type SJ 3,5 SN (safety design)		-40 ... +80 °C
6	Transmitter ES with HART®, 4...20 mA, Ex ia		-40 ... +70 °C
7	Transmitter ES with HART®, 4...20 mA, Ex ia /2x NAMUR-switch		-40 ... +70 °C
8	Transmitter ES with HART-protocol, 4...20 mA, Ex ia /1x NAMUR-switch, 1x pulse		-40 ... +70 °C
9	elektr. Messwertumformer ES mit Profibus PA®, Ex ia		-40 ... +70 °C
L	1 x micro switch	w/o ATEX	-25 ... +70 °C
M	2 x micro switch	w/o ATEX	-25 ... +70 °C
E	1 x inductive switch, Type SB 3,5-E2, three wire	w/o ATEX	-25 ... +70 °C
F	2 x inductive switch, Type SB 3,5-E2, three wire	w/o ATEX	-25 ... +70 °C
G	1 x inductive switch, Type NCB2-12GM40-Z0	w/o ATEX	-25 ... +70 °C
I	Transmitter ES with HART® and counter module	w/o ATEX	-20 ... +70 °C
K	Transmitter ES with Foundation Fieldbus		-40 ... +70 °C
- Accessories			
0	without		
X	Customized to customer requirements		
- Design			
H	Heinrichs		
K	Kobold		

**References:**

- 1) Recommended for solids content in the medium
- 2) Screw-in thread in base plate M20x1,5, other threads on request
- 3) SIL 1 - IEC 61508-2:2010 conformity confirmed by EXIDA
- 4) SIL 1 - IEC 61508-2:2000 conformity confirmed by EXIDA
- 5) SIL 2 - IEC 61508-2:2000 conformity confirmed by EXIDA
- 6) SIL conformity only with "Accessories" option "S"
- 7) Only in combination with "electrical output" for options "3", "4", "6", "7", "8"
- 8) Combination of stainless-steel indicator part with ES and counter module not possible. Only for flow direction bottom to top.
- 9) Not for carbon steel armature
- 10) Not for PTFE armature