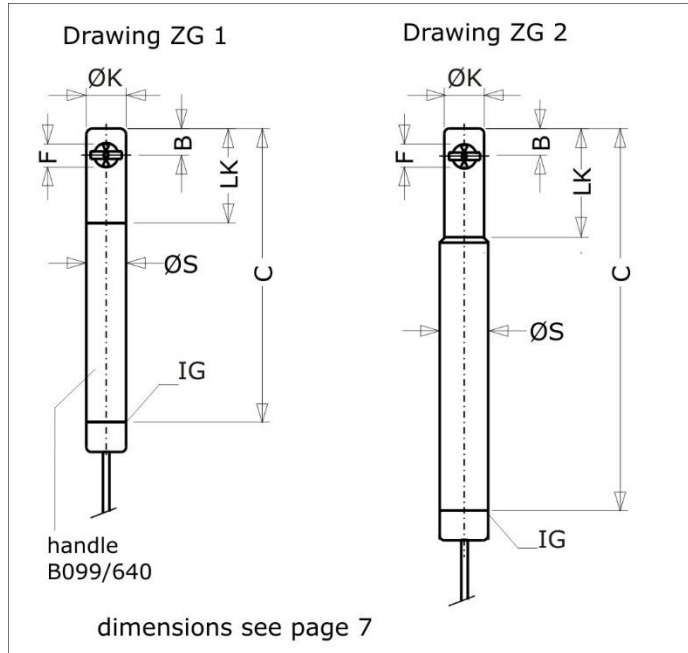


**Extendable vane wheel flow sensors,
 optional with \pm directional sensing and integrated PT100 sensor and accessories
 for connection to a fixed or portable evaluation unit**



Measurable variables

- flow velocity v [m/s] and
- flow rate [m³/h] in air/gases and water/liquids
- conversion to standard velocity/standard flow rate by measuring or entering working pressure and temperature parameters

Measuring range

- 0.2 ... 120 m/s gases
- 0.01 ... 10 m/s liquids

Medium

- air, gas mixtures and clean gases
- water/liquids

Funktionsprinzip

- vane wheel flow sensor
- sensing the vane rotation; non-contact by means of inductive proximity switch

Design

- insertion probe with fixed cable, extendable

Examples of application

- flow measurement e.g. of air, exhaust gas, process gas
- in processes with varying and/or unknown gas compositions
- flow monitoring in pharmaceutical installations
- monitoring neutralisation processes
- use up to 550 °C
- measurement of flammable liquids
- measuring in surface waters
- measuring in non-conducting liquids, for example such as ultra pure water in the semiconductor industry
- recommended according to DIN EN ISO 16911, normative for verification of automatic measuring equipment

Connection possibilities

- portable and fixed evaluation units with sensor input

Advantages

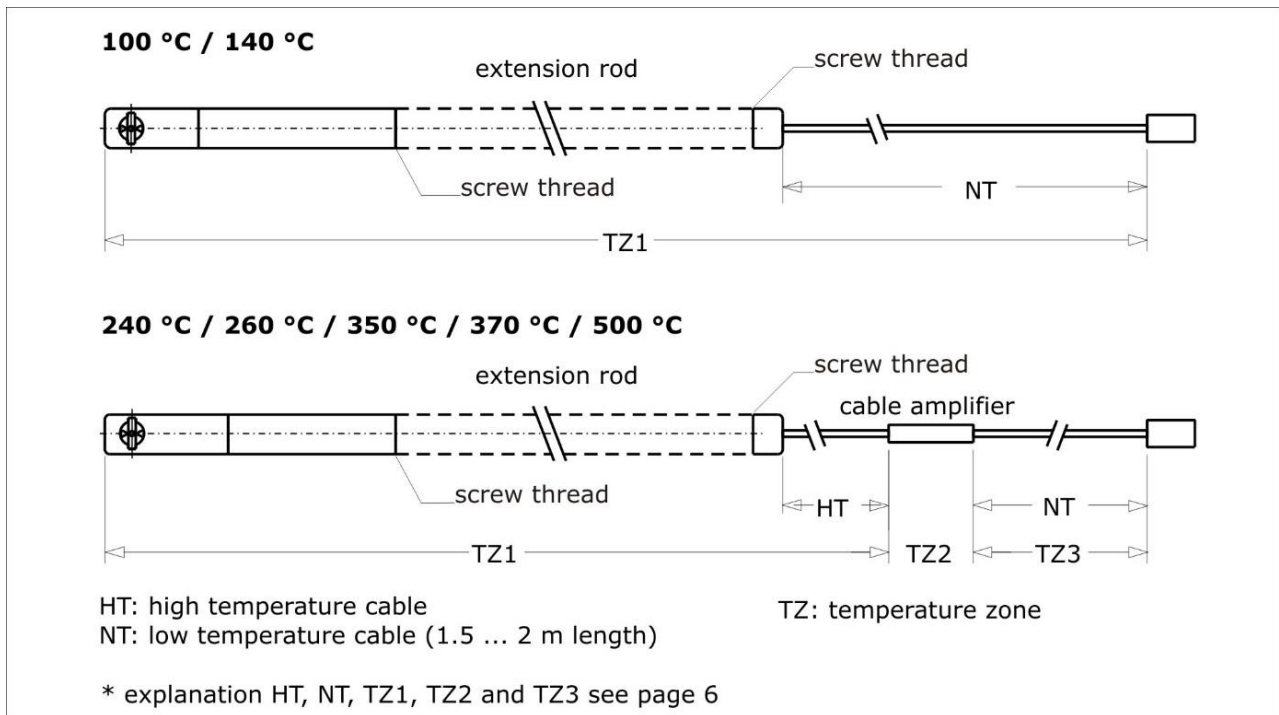
- accurate measured values even in varying and/or unknown gas compositions
- turndown ration approx. 1:100
- no distortion of values due to thermal radiation
- optional application in category 2 (zone 1)
- universal application spectrum
- extendable
- optional with \pm directional sensing
- optional with integrated PT100 sensor
- small pressure loss

Humidity in teh sample gas

- relative gas humidity of less than 100 % has no impact on the measurement uncertainty

Particles in the medium

- can cause restriction in the fatigue strength of the vane wheel set



Basic types

measurement in air and other gaseous media

type	article no.	alt. MR*	article no.	alt. MR*	article no.	alt. MR*	article no.
extendable sensors Ø 25 mm (s. page 1, drawing ZG1)							
mn20 D25A C170 T140	HB02-a000	mn40	HB02-a001	mn80	HB02-a002	mn120	HB02-a003
mn20 D25E C169 T100	HB02-a100	mn40	HB02-a101	mn80	HB02-a102	mn120	HB02-a103
mn20 D25E C169 T260	HB02-a112	mn40	HB02-a113	mn80	HB02-a114	mn120	HB02-a115
mn20 D25T C169 T100	HB02-a400	mn40	HB02-a401	mn80	HB02-a402	mn120	HB02-a403
mn20 D25T C169 T260	HB02-a412	mn40	HB02-a413	mn80	HB02-a414	mn120	HB02-a415
extendable high temperature sensors Ø 25 mm (s. page 1, drawing ZG2)							
mn20 D27E C315 T370	HB02-a140	mn40	HB02-a141	mn80	HB02-a142	mn120	HB02-a143
mn20 D27E C315 T500	HB02-a152	mn40	HB02-a153	mn80	HB02-a154	mn120	HB02-a155
extendable sensors Ø 25 mm with ± directional sensing (s. page 1, drawing ZG1)							
mn20 DR25A C166 T140	HB02-a500	mn40	HB02-a501	mn80	HB02-a502	mn120	HB02-a503
mn20 DR25E C154 T100	HB02-a504	mn40	HB02-a505	mn80	HB02-a506	mn120	HB02-a507
mn20 DR25E C154 T240	HB02-a512	mn40	HB02-a513	mn80	HB02-a514	mn120	HB02-a515
mn20 DR25T C154 T100	HB02-a508	mn40	HB02-a509	mn80	HB02-a510	mn120	HB02-a511
mn20 DR25T C154 T240	HB02-a516	mn40	HB02-a517	mn80	HB02-a518	mn120	HB02-a519

*alt. MR = alternative measuring ranges

Basic types (cont.)

measurement in air and other gaseous media

type	article no.	alt. MR*	article no.	alt. MR*	article no.	alt. MR*	article no.
extendable sensors Ø 25 mm with integrated PT100 sensor (s. page 1, drawing ZG1)							
mn20 DT25A C160 T140	HB02-a600		mn40 HB02-a601		mn80 HB02-a602		mn120 HB02-a603
mn20 DT25E C169 T100	HB02-a604		mn40 HB02-a605		mn80 HB02-a606		mn120 HB02-a607
mn20 DT25E C169 T260	HB02-a608		mn40 HB02-a609		mn80 HB02-a610		mn120 HB02-a611
mn20 DT25T C169 T100	HB02-a612		mn40 HB02-a613		mn80 HB02-a614		mn120 HB02-a615
mn20 DT25T C169 T260	HB02-a616		mn40 HB02-a617		mn80 HB02-a618		mn120 HB02-a619

extendable sensors Ø 30 mm (s. page 1, drawing ZG1)

mn20 D30A C170 T140	HB14-a000						
mn20T D30E C170 T100	HB14-a100						
mn20T D30E C170 T260	HB14-a101						
mn20T D30E C170 T350	HB14-a102						
mn20 D30T C170 T100	HB14-a300						

extendable sensors Ø 30 mm with ± directional sensing (s. page 1, drawing ZG1)

mn20 DR30A C178 T140	HB14-a500						
mn20T DR30E C178 T100	HB14-a501						
mn20T DR30E C178 T240	HB14-a503						
mn20 DR30T C178 T100	HB14-a502						
mn20 DR30T C178 T240	HB14-a504						

extendable sensors Ø 30 mm with integrated PT100 sensor (s. page 1, drawing ZG1)

mn20 DT30A C178 T140	HB14-a600						
mn20T DT30E C170 T260	HB14-a602						

measurement in water and other liquids

extendable sensors Ø 25 mm (s. page 1, drawing ZG1)

mn20 D25FA C170 T140	HB02-a060		mn40 HB02-a061				
mn20 D25FE C169 T100	HB02-a160		mn40 HB02-a161				
mn20 D25FE C169 T260	HB02-a162		mn40 HB02-a163				
mn20 D25FT C169 T100	HB02-a460		mn40 HB02-a461				

extendable sensors Ø 25 mm with ± directional sensing (s. page 1, drawing ZG1)

mn20 DR25FA C166T140	on request		mn40 HB02-a560				
mn20 DR25FE C154 T100	HB02-a561		mn40 HB02-a562				
mn20 DR25FE C154 T240	HB02-a565		mn40 on request				

extendable sensors Ø 25 mm with integrated PT100 sensor (s. page 1, drawing ZG1)

mn20 DT25FA C160 T140	HB02-a660		mn40 HB02-a661				
mn20 DT25FE C169 T100	HB02-a662		mn40 HB02-a663				
mn20 DT25FE C169 T260	HB02-a664		mn40 HB02-a665				
mn20 DT25FT C169 T100	HB02-a666		mn40 HB02-a667				
mn20 DT25FT C169 T260	HB02-a668		mn40 HB02-a669				

***alt. MR = alternative measuring ranges**

Basic types (cont.)

measurement in water and other liquids

type	article no.
------	-------------

extendable sensors Ø 30 mm (s. page 1, drawing ZG1)

mn20 D30FA C170 T140	HB14-a060
mn20T D30FE C170 T100	HB14-a160
mn20T D30FE C170 T260	HB14-a161
mn20T D30FE C170 T350	HB14-a162
mn20T D30FT C170 T100	HB14-a360

Model designation (examples)

FA	Flow Sensor	mn20	D	25	A	C170	T140	
FA	Flow Sensor	mn40	D	25	FE	C169	T260	Ex

(1) Sensor type

Description	Design
D	cylindrical probe
DR	cylindrical probe with ± directional sensing
DT	cylindrical probe with integrated PT100 sensor

(2) Sensor diameter

diameter of sensor head ØK (see page 1)	
25	head diameter 25 mm
30	head diameter 30 mm

(3) Shaft diameter

diameter of sensor shaft ØS (s. page 1, drawing ZG2)	
/27	shaft diameter 27 mm

(4) Medium

... ..	air/gases
... F ...	air/gases and water/liquids

Ingress protection cable outlet

sensor design ... F ...	IP68
sensor design	IP50

(5) Materials in contact with the medium *

Design	Material sensor	Material Sealing	others
... A ... aluminium	AlCuMgPb or AlCuBiPb	FKM, silicone	PSU, PVDF
... E ... stainless steel	stainless steel 1.4404/AISI 316L, 1.4305, 1.4571	FKM, PTFE, graphite	PVDF, vespel, ceramics Al ₂ O ₃
... T ... titanium	titanium 3.7035 (grade 2)	FKM, PTFE	PVDF, vespel, ceramics Al ₂ O ₃

* Not all mentioned materials are used in every sensor. Materials may differ for individual sensors. Detailed information about a desired sensor on request!

(6) (7) Measuring ranges (with an air/gas density of approx. 1.2 kg/m³) / vane wheel type if the vane wheel material differs to the sensor material, a material code is added to the vane wheel type (e.g. „T“ at md3T)

sensors with Ø 25 mm

material sensor	material vane wheel	vane wheel type	measuring range air/gases	measuring range water/liquids (no cavitation)
aluminium	aluminium	mn20	0.3 ... 20 m/s	0.03 ... 7.5 m/s
		mn40	0.4 ... 40 m/s	0.04 ... 10 m/s
		mn80	0.8 ... 80 m/s	
		mn120	1.2 ... 120 m/s	
stainless steel	stainless steel	mn20	0.4 ... 20 m/s	0.04 ... 7.5 m/s
		mn40	0.5 ... 40 m/s	0.05 ... 10 m/s
		mn80	1.0 ... 80 m/s	
		mn120	1.4 ... 120 m/s	
titanium	titanium	mn20	0.3 ... 20 m/s	0.03 ... 7.5 m/s
		mn40	0.4 ... 40 m/s	0.04 ... 10 m/s
		mn80	0.8 ... 80 m/s	
		mn120	1.2 ... 120 m/s	

sensors with Ø 30 mm

material sensor	material vane wheel	vane wheel type	measuring range air/gases	measuring range water/liquids (no cavitation)
aluminium	aluminium	md20	0.2 ... 20 m/s	0.01 ... 3 m/s
stainless steel, titanium	titanium	md20T	0.3 ... 20 m/s	0.01 ... 3 m/s
		md3T	0.3 ... 3 m/s	

Measurement uncertainty / repeatability with a gas density of approx. 1.2 kg/m³

Linearisation of characteristics	all types	up to < 0.9 % of measured value + 0.25 % of terminal value ***
Frequency response characteristics (interchangeability is guaranteed)	D, DR, DT	< 1.5 % of measured value + 0.5 % of terminal value (up to 40 m/s)
Repeatability		±(0.05 % of measured value + 0.02 m/s)

The lowest measurement uncertainties in the field are attained with calibrations as close as possible to the operating conditions. For this, the measurement results obtained can be implemented as characteristic in the evaluation unit. Information and details on the measurement uncertainties according to the calibrated measurement standards can be found in the calibration documents 'U325 and U183'.

*** on request, in the calibration range of the respective accredited test bench

Measurement uncertainty / repeatability in water *

Linearisation of characteristics	all types	< 1 % of measured value + 0.5 % of terminal value **
Frequency response characteristics (interchangeability is guaranteed)	D, DR	< 1.5 % of measured value + 0.5 % of terminal value
Repeatability		±(0.05 % of measured value + 0.02 m/s)

The lowest measurement uncertainties in the field are attained with calibrations as close as possible to the operating conditions. For this, the measurement results obtained can be implemented as characteristic in the evaluation unit. Information and details on the measurement uncertainties according to the calibrated measurement standards can be found in the calibration documents 'U325 and U183'.

* for water and liquids with a viscosity of up to approx. 0.0002 m²/s (200 cSt)

** on request, in the calibration range of the respective test bench

optional

ISO or DAkkS Calibration certificate v/FA*

calibration medium air, 6 calibration values in the measuring range

article no.: KLB

* An engraved dot on the sensor head indicates the upstream side during calibration. Details of additional calibration values or customised calibrations can be found in document 'U183 Calibration' or are available on request

(8) Permissible temperature of the medium / ambient temperature

design	temperature of the medium	ambient temperature (see drawings, page 2)		
		TZ1	TZ2	TZ3
... 100 ...	-20 ... +100 °C (c)	-20 ... +100 °C	-	-
... 140 ...	-20 ... +140 °C (c)	-20 ... +140 °C	-	-
... 240 ...	-40 ... +240 °C (c)	-40 ... +240 °C	-40 ... +125 °C	-40 ... +125 °C
... 260 ...	-40 ... +260 °C (c) -40 ... +300 °C (s)	-40 ... +260 °C	-40 ... +125 °C	-40 ... +125 °C
... 370 ...	-40 ... +370 °C (c) -40 ... +400 °C (s)	-40 ... +400 °C	-40 ... +125 °C	-40 ... +125 °C
... 500 ...	-40 ... +500 °C (c) -40 ... +550 °C (s)	-40 ... +550 °C	-40 ... +125 °C	-40 ... +125 °C

(c) continuous; (s) short-time = max. 2 minutes

(9) Cable lengths of high temperature cable (HT-cable) in front of cable amplifier

design	description
for sensor design up to 240 °C, 260 °C, 370 °C and 500 °C*	
...-2/...	2 m fixed high temperature cable in front of cable amplifier * + 1.5 m low temperature cable (max. +125 °C) behind cable amplifier *

* special cable lengths for HT-cable in front of cable amplifier and standard cable after cable amplifier on request

Maximal lengths for high temperature cable (HT-cable) in front of cable amplifier

sensor type	max. temperature of sensor	max. length of HT-cable
DR	240 °C	4 m
D	260 °C	6 m
DT	260 °C	4 m
D	370 °C	6 m
D	500 °C	6 m

(10) Max. working pressure

... p3 ...	up to 3 bar / 0.3 MPa overpressure
... p6 ...	up to 6 bar / 0.6 MPa overpressure
... p10 ...	up to 10 bar / 1 MPa overpressure

Design / dimensions

head	sensor-material A, E, T	drawing ZG ...	Ø K head [mm]	Ø S shaft [mm]	F vane wheel [mm]	LK length of head [mm]	B over- hang [mm]	C length with HG [mm]	IG inside thread
D25	A	ZG1	25	25	18.2	60	13.4	170	M 22 x 1.5
D25	E, T	ZG1	25	25	18.2	81	13.9	169	M 22 x 1.5
D27	E	ZG2	25	27	18.2	75	13.9	315	M 22 x 1.5
DT25	A	ZG1	25	25	18.2	60	13.4	160	M 22 x 1.5
DT25	E, T	ZG1	25	25	18.2	81	13.9	169	M 22 x 1.5
DR25	A	ZG1	25	25	18.2	66	13.9	166	M 22 x 1.5
DR25	E, T	ZG1	25	25	18.2	66	13.9	154	M 22 x 1.5
D30	A, E, T	ZG1	30	30	24	90	18	170	M 26 x 1.5
DR30	A, E, T	ZG1	30	30	24	90	18	178	M 26 x 1.5
DT30	A	ZG1	30	30	24	90	18	178	M 26 x 1.5
DT30	E, T	ZG1	30	30	24	90	18	170	M 26 x 1.5

Option 'Ex-protexion'

type of protection	article no.	remark
CE <Ex> II 3 G Ex ec IIC T6 Gc X gas-Ex: category 3G (zone 2)	FAEX2E	in conjunction with evaluation unit
CE <Ex> II 3 D Ex tc IIIC TX Dc X dust-Ex: category 3D (zone 22)	FAEX2E	in conjunction with evaluation unit
CE <Ex> II 2 G Ex ia IIC T6 Gb gas-Ex: category 2G (zone 1)	FAEX1	only in conjunction with: - isolation-/supply unit LDX2 and 'non-Ex evaluation unit' or - ATEX-conform, separate evaluation unit with v/FA-Ex or v/FAR-Ex input - not valid for FT-sensors

Smallest measurable values, density influence

The smallest measurable value for measurements in air/gases specified in our documents results from a measuring medium density $\rho \cong 1.204 \text{ kg/m}^3$. The smallest measurable value v_0 is also increased/decreased negligibly even with a considerably different medium density from 1.204 kg/m^3 and follows in good approximation the relation:

$$v_{0,real} = v_{0,specif.} * \sqrt{1.204 \text{ kg/m}^3 / \rho_{real}}$$

The characteristic is displaced by the difference

$$v_{0,specif.} - v_{0,real} = \Delta v$$

Readout of measured values is too great by the amount Δv when measuring in gases of a density of ρ_{real} greater than 1.204 kg/m^3 , and too small by the amount Δv when measuring in gases of a density of ρ_{real} less than 1.204 kg/m^3 . Δv is to be added to or subtracted from the respective output value.

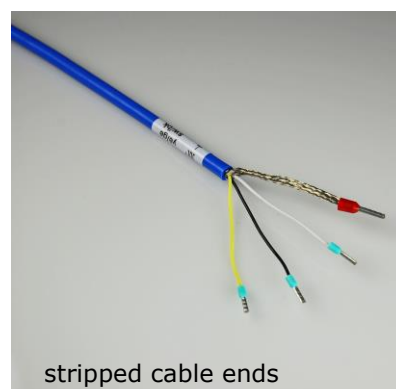
Evaluation unit connection

for unit with 8-pin screw-type connector

		article no.
plug 423-8	type of protection IP67	HB99-b056
plug 680-8	type of protection IP40	HB99-b055

for unit with connecting terminals

stripped cable end	marked strands with end sleeves	HB99-b110
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Extension rods

description	material	length	outside diameter	article no.
VS25A-350	aluminium, FKM-O-ring	350 mm	25 mm	HB99-a003
VS25A-1000	aluminium, FKM-O-ring	1000 mm	25 mm	HB99-a004
VS25E-350	stainless steel, FKM-O-ring	350 mm	25 mm	HB99-a005
VS25E-1000	stainless steel, FKM-O-ring	1000 mm	25 mm	HB99-a006
SR27E-400	stainless steel, graphite	400 mm	27 mm	HB99-a506
SR27E-1000	stainless steel, graphite	1000 mm	27 mm	HB99-a507
SR27E-1500	stainless steel, graphite	1500 mm	27 mm	HB99-a508
VS30A-350	aluminium, FKM-O-ring	350 mm	30 mm	HB99-a007
VS30A-1000	aluminium, FKM-O-ring	1000 mm	30 mm	HB99-a007-S01
VS30E-350	stainless steel, FKM-O-ring	350 mm	30 mm	HB99-a008
VS30E-1000	stainless steel, FKM-O-ring	1000 mm	30 mm	HB99-a009

direction indicator

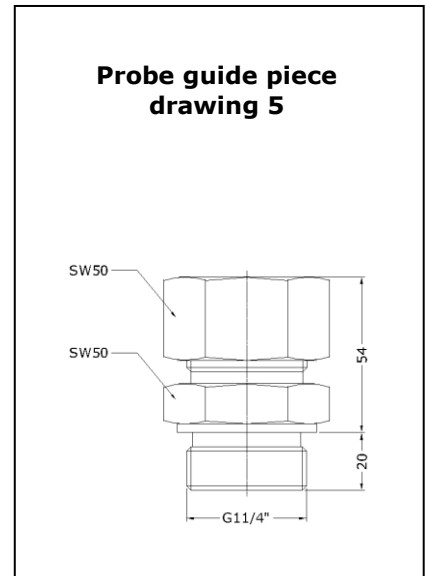
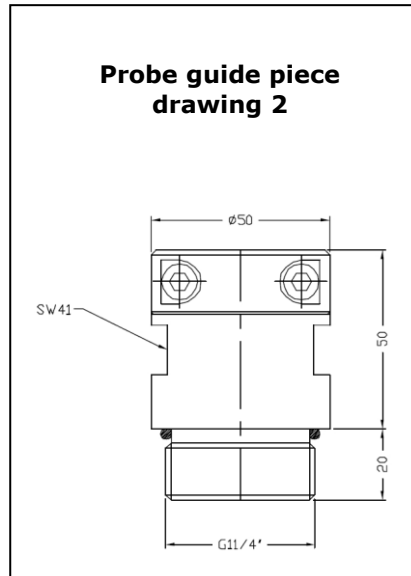
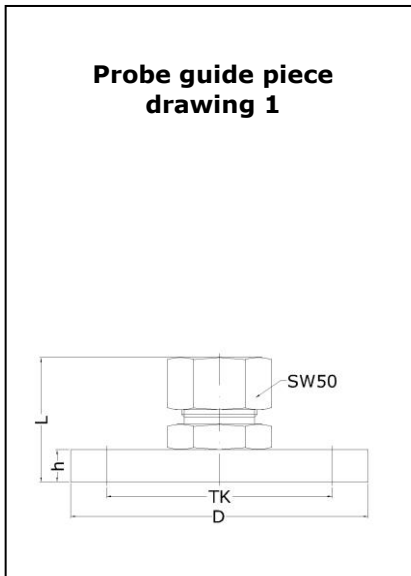


description	article no.
direction indicator RZ25	HB99-a953
direction indicator RZ27	HB99-a954
direction indicator RZ30	HB99-a955

probe guide pieces *		
designation	description	articles no.
for diameter 25 mm		
SFB 25 E-70 / F-DN50 PN16 according drawing 1 (see page 11)	connection: flange DN50PN16 EN1092-1 max. pressure: 2 bar / 200 kPa temperature: -40 ... 550 °C materials: stainless steel, graphite fixation: clamping bush length: 70 mm	HB04-a110
SFB 25 E-70 / F-ANSI 2" 150 lbs according drawing 1 (see page 11)	connection: flange 2" 150 lbs ANSI B16.5 max. pressure: 2 bar / 200 kPa temperature: -40 ... +240 °C materials: stainless steel, PTFE fixation: clamping bush length: 70 mm	HB04-a110-S02
SFK 25 E-50 / G 1 1/4" according drawing 2 (see page 11)	connection: outside thread G 1 1/4" max. pressure: 10 bar / 1 MPa temperature: -20 ... +240 °C materials: stainless steel, FKM fixation: clamp yoke length: 50 mm	HB04-a211
SFK 25 E-50 / NPT 1 1/4" according drawing 2 (see page 11)	connection: outside thread NPT 1 1/4" max. pressure: 10 bar / 1 MPa temperature: -20 ... +240 °C materials: stainless steel, FKM fixation: clamp yoke length: 50 mm	HB04-a209
SFB 25 E-54 / G 1 1/4" according drawing 5 (see page 11)	connection: outside thread G 1 1/4" max. pressure: 2 bar / 200 kPa temperature: -20 ... +240 °C materials: stainless steel, FKM, PTFE fixation: clamping bush length: 54 mm	HB04-a510
SFB 25 E-50 / NPT 1 1/4 " according drawing 5 (see page 11)	connection: outside thread NPT 1 1/4" max. pressure: 2 bar / 200 kPa temperature: -20 ... +240 °C materials: stainless steel, PTFE fixation: clamping bush length: 50 mm	HB04-a523

* Probe guide pieces enable a process connection via threaded sleeve or flange connection. They are moveable and rotatable on the probe shaft. Other probe guide pieces on request.

probe guide pieces * (cont.)		
designation	description	articles no.
for diameter 27 mm		
SFB 27 E-70 / F-DN50 PN16 according drawing 1 (see page 11)	connection: flange DN50PN16 EN1092-1 max. pressure: 2 bar / 200 kPa temperature: -40 ... 550 °C materials: stainless steel, graphite fixation: clamping bush length: 70 mm	HB04-a102- GRAPHIT
SFK 27 E-50 / G 1 1/4" according drawing 2 (see page 11)	connection: outside thread G 1 1/4" max. pressure: 10 bar / 1 MPa temperature: -20 ... +240 °C materials: stainless steel, FKM fixation: clamp yoke length: 50 mm	HB04-a212
SFB 27 E-54 / G 1 1/4" according drawing 5 (see page 11)	connection: outside thread G 1 1/4" max. pressure: 2 bar / 200 kPa temperature: -40 ... 550 °C materials: stainless steel, graphite fixation: clamping bush length: 54 mm	HB04-a502-S04
SFB 27 E-50 / NPT 1 1/2" according drawing 5 (see page 11)	connection: outside thread NPT 1 1/2" max. pressure: 2 bar / 200 kPa temperature: -40 ... 550 °C materials: stainless steel, graphite fixation: clamping bush length: 50 mm	HB04-a502-S05
for diameter 30 mm		
SFB 30 E-45 / G 1 1/2" according drawing 5 (see page 11)	connection: outside thread G 1 1/2" max. pressure: 2 bar / 200 kPa temperature: -20 ... +240 °C materials: stainless steel, FKM, PTFE fixation: clamping bush length: 45 mm	HB04-a508
* Probe guide pieces enable a process connection via threaded sleeve or flange connection. They are moveable and rotatable on the probe shaft. Other probe guide pieces on request.		

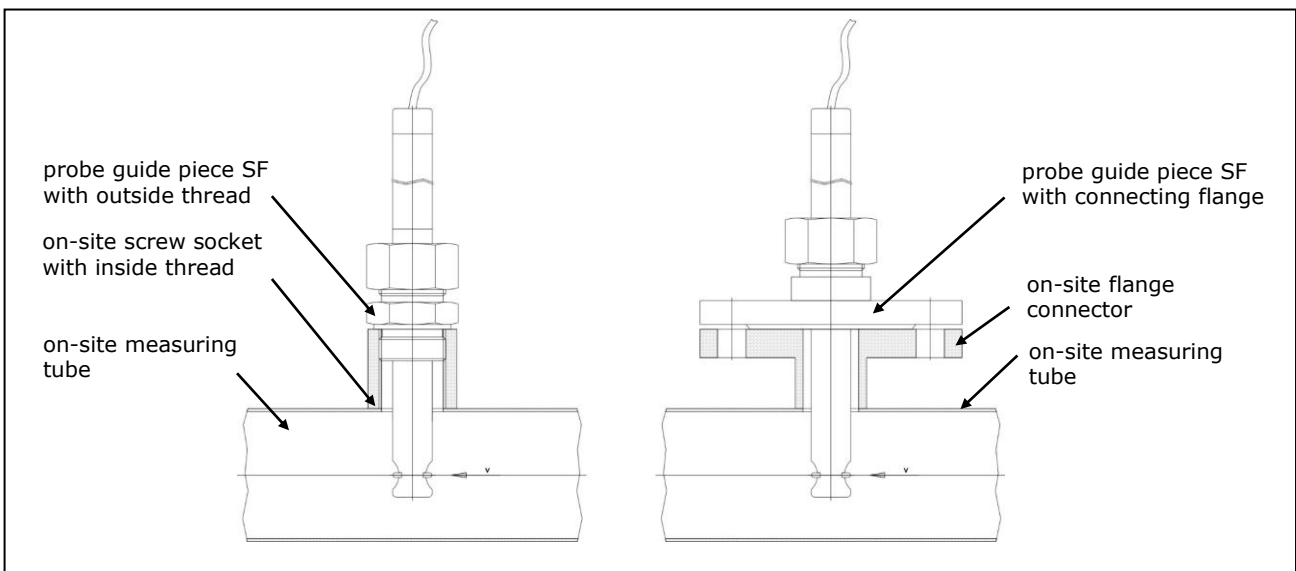


Profile factors depending on pipe inside diameter

measuring tube inside diameter Di [mm]	profile factor PF* [-]	measuring tube inside diameter Di [mm]	profile factor PF* [-]
50	0.735	120	0.882
60	0.760	170	0.938
70	0.784	180	0.945
80	0.807	220	0.955
90	0.829	230	0.960
100	0.849	...	0.960

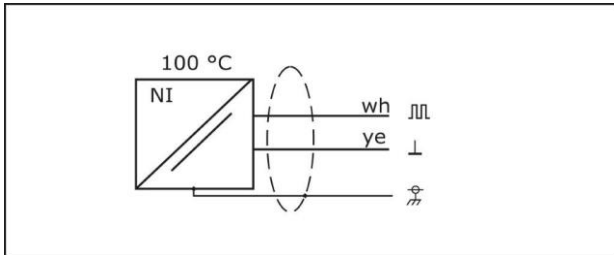
* These profile factors are only accurate with centric sensor positioning, turbulent, non-rotational inlet flow and sufficiently dimensioned input and output sections (see Operating Instructions). The profile factor describes the ratio of average flow velocity in the measurement cross section area and the flow velocity measured from the sensor. The above mentioned operating conditions apply.

Sensor installation

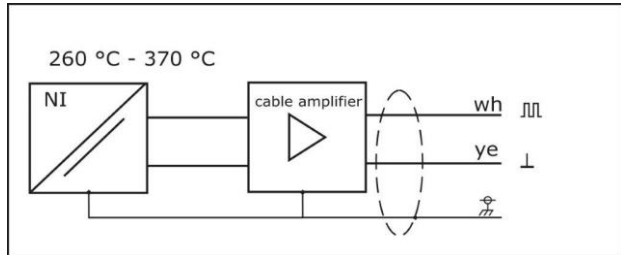


Wiring diagrams

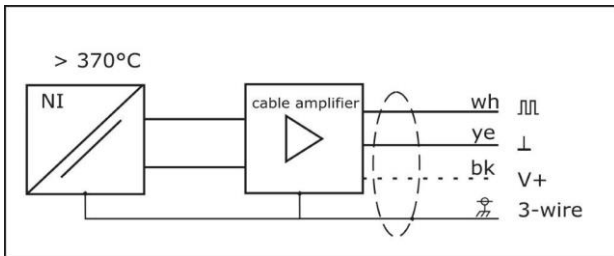
D25_D30_100 °C_140 °C sensors



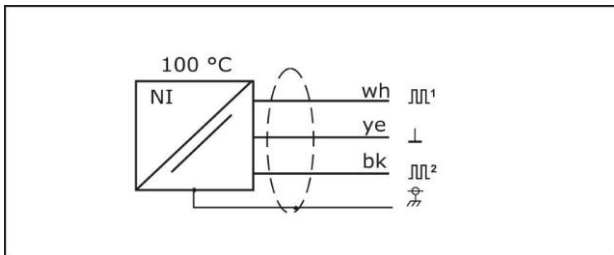
D25_D30_260 °C_350 °C_370 °C sensors



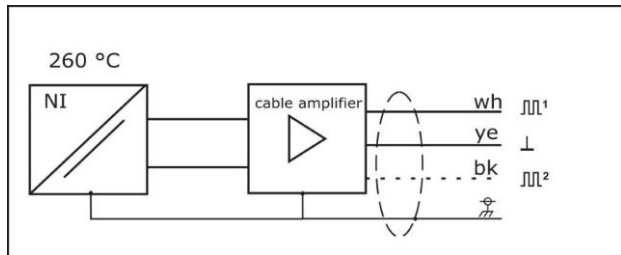
D25_500 °C sensors



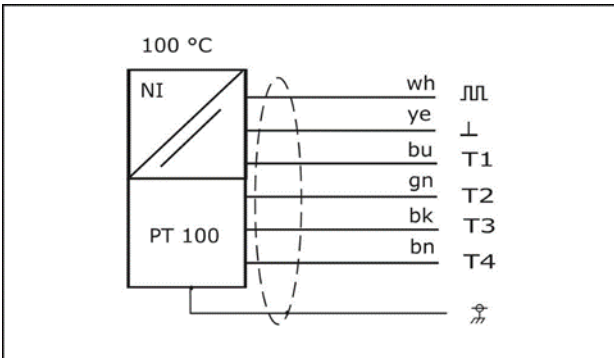
DR25_DR30_100 °C_140 °C sensors



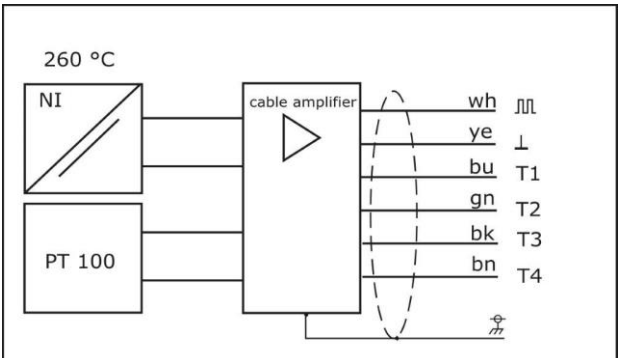
DR25_DR30_240 °C_ sensors



DT25_DT30_100 °C_140 °C sensors



DT25_DT30_260 °C sensors



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Subject to alteration