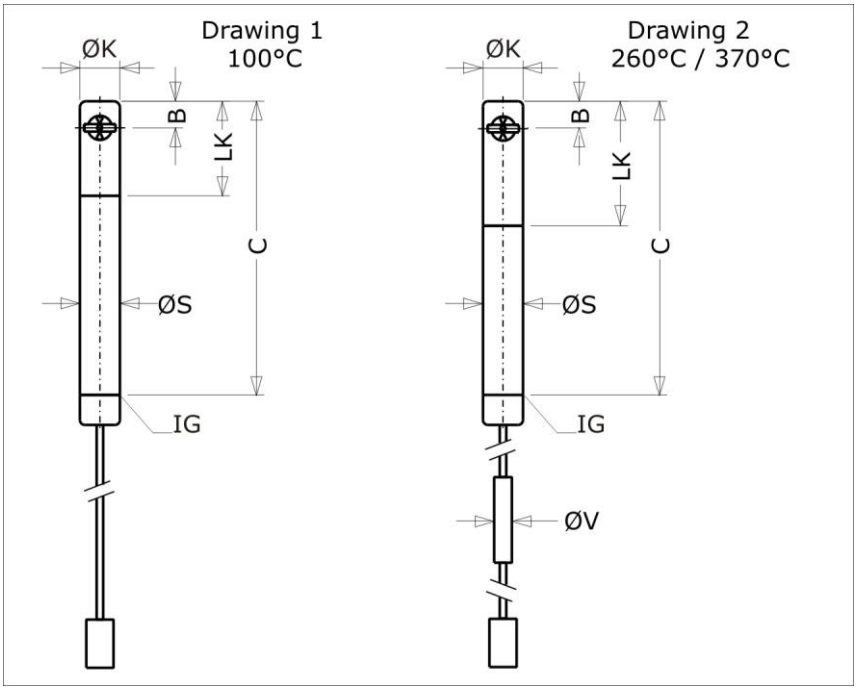
Extendable vane wheel flow sensor
ZS16 with connection cable

höntzsch
flow measuring technology

Flow and flow rate measurement with vane wheel flow sensor FA as 16 mm cylinder probe at working temperatures of –40 ... 370 °C 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 (measuring in air/gases) by entering working pressure and temperature parameters

Measuring range
- 0.6 ... 120 m/s gases
- 0.06 ... 10 m/s liquids

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

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
- measurement of flammable liquids
- measuring in surface waters
- measuring in non-conducting liquids such as ultra pure water, for example in the semiconductor industry

- no distortion of values due to thermal radiation
- optional application in category 2 (zone 1)
- small insertion opening
- universal application spectrum
- extendable
- small pressure loss

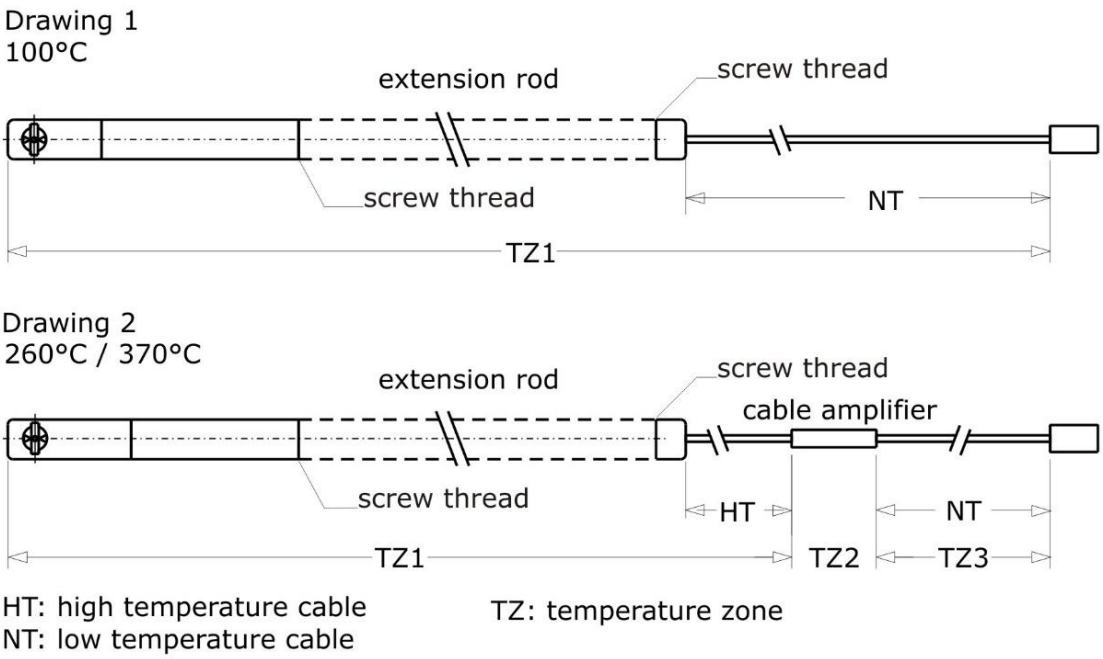
Connection possibilities
- portable and fixed evaluation units with sensor input v/FA, v/FAR or v/FA-Ex, v/FAR-Ex

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

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

Advantages
- accurate measured values even in varying and/or unknown gas compositions
- turndown ratio approx. 1 : 100

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



Model designation for ZS16 (example)						
ZS16	**GF**	**E**	**100**	**P6**	**2m**	**ZG1**
(1)	(2)	(3)	(4)	(5)	(6)	(7)

Basic types			
'aluminium'	**vane wheel types**	**cable length**	**article no.**
ZS16GFA/100/p3/**2m**/ZG1	mc20A, mc40A, mc80A, mc120A	2.0 m	B005/200
ZS16GFA/100/p3/**3.5m**/ZG1	mc20A, mc40A, mc80A, mc120A	3.5 m	B005/201
ZS16GFA/100/p3/**5m**/ZG1	mc20A, mc40A, mc80A, mc120A	5.0 m	B005/202
'stainless steel'			
ZS16GFE/100/p6/**2m**/ZG1	mc20T, mc40T, mc80T	2.0 m	B005/210
ZS16GFE/100/p6/**4m**/ZG1	mc20T, mc40T, mc80T	4.0 m	B005/211
ZS16GFE/100/p6/**6m**/ZG1	mc20T, mc40T, mc80T	6.0 m	B005/212
ZS16GFE/260/p6/**2m**/ZG2	mc20T, mc40T, mc80T	HT 2 m*	B005/220
ZS16GFE/260/p6/**4m**/ZG2	mc20T, mc40T, mc80T	HT 4 m*	B005/221
ZS16GFE/260/p6/**6m**/ZG2	mc20T, mc40T, mc80T	HT 6 m*	B005/222
ZS16GE/370/p6/**2m**/ZG2	mc20T, mc40T, mc80T	HT 2 m*	B005/230
ZS16GE/370/p6/**4m**/ZG2	mc20T, mc40T, mc80T	HT 4 m*	B005/231
ZS16GE/370/p6/**6m**/ZG2	mc20T, mc40T, mc80T	HT 6 m*	B005/232

* HT : length of high temperature cable plus length of low temperature cable (s. page 4, point 6)

Basic types (cont.)			
'titanium'	**vane wheel types**	**cable length**	**article no.**
ZS16GFT/100/p6/**2m**/ZG1	mc20T, mc40T, mc80T	2.0 m	B005/240
ZS16GFT/100/p6/**4m**/ZG1	mc20T, mc40T, mc80T	4.0 m	B005/241
ZS16GFT/100/p6/**6m**/ZG1	mc20T, mc40T, mc80T	6.0 m	B005/242
ZS16GFT/260/p6/**2m**/ZG2	mc20T, mc40T, mc80T	HT 2 m*	B005/250
ZS16GFT/260/p6/**4m**/ZG2	mc20T, mc40T, mc80T	HT 4 m*	B005/251
ZS16GFT/260/p6/**6m**/ZG2	mc20T, mc40T, mc80T	HT 6 m*	B005/252
* HT : length of high temperature cable plus length of low temperature cable (s. page 4, point 6)			

(1) Sensor type / probe diameter
Vane wheel flow sensor ZS16 with probe Ø 16 mm

(2) Medium	
... GF ...	air / gases and water / liquids
... G ...	air / gases (probes '370 °C')

(3) Materials in contact with the medium	
Design	**Material**
... A ... aluminium	AlCuMgPb, PSU, FKM seal
... E ... stainless steel	stainless steel 1.4404 / AISI 316L, titanium 3.7035 (grade 2), ceramics Al_2O_3 99.9 %, 100 °C: pure graphite seal, FKM 260 °C: pure graphite seal, PTFE 370 °C: pure graphite seal
... T ... titanium	titanium 3.7035 (grade 2), ceramics Al_2O_3 99.9 %, 100 °C: pure graphite seal, FKM 260 °C: pure graphite seal, PTFE

(4) 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	-	-
... 260 ...	-40 ... +260 °C (c) -40 ... +300 °C (s)	-40 ... +260 °C	-40 ... +105 °C	-40 ... +105 °C
... 370 ...	-40 ... +370 °C (c) -40 ... +400 °C (s)	-40 ... +400 °C	-40 ... +105 °C	-40 ... +105 °C
(c) continuous; (s) short-time = max. 2 minutes				
* When used in hazardous areas, the media and ambient temperature are limited according to the valid operating instructions				

(5) Max. working pressure	
... p3 ...	up to 3 bar / 0.3 MPa overpressure
... p6 ...	up to 6 bar / 0.6 MPa overpressure

Ingress protection cable outlet	
sensor design 100 °C and 260 °C	IP68
sensor design 370 °C	IP50

(6) Cable length	
Design	**Description**
sensor design up to 100 °C *	
... 2m ...	2 m fixed cable
... 3.5m ...	3.5 m fixed cable
... 4m ...	4 m fixed cable
... 5m ...	5 m fixed cable
... 6m ...	6 m fixed cable
sensor design up to 260 °C and 370 °C *	
... 2m ...	2 m fixed high temperature cable in front of cable amplifier + 1.5 m low temperature cable (max. +105 °C) behind cable amplifier
... 4m ...	4 m fixed high temperature cable in front of cable amplifier + 1.5 m low temperature cable (max. +105 °C) behind cable amplifier
... 6m ...	6 m fixed high temperature cable in front of cable amplifier + 1.5 m low temperature cable (max. +105 °C) behind cable amplifier

* special cable lengths on request

(7) Design / dimensions

'aluminium', for max. 100 °C, as in Drawing 1 (Page 1)								
dimensions	Ø K	16 mm	Ø S	16 mm	B	10.65 mm	LK	53 mm
	C	163 mm	IG	M14x1.5				
'stainless steel' or 'titanium', for max. 100 °C, as in Drawing 1 (Page 1)								
dimensions	Ø K	16 mm	Ø S	16 mm	B	11 mm	LK	65 mm
	C	161 mm	IG	M14x1.5				
'stainless steel' or 'titanium', for max. 260 °C or 370 °C, as in Drawing 2 (Page 1)								
dimensions	Ø K	16 mm	Ø S	16 mm	B	11 mm	LK	65 mm
	C	161 mm	IG	M14x1.5	Ø V	9.5 mm		

Electromagnetic Compatibility (EMC)
according to EN 61 000-6-2 and EN 61 000-6-4

Option 'Ex-protextion'		
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 input
* remark: media and ambient temperature according to the valid operating instructions		

Measuring ranges (with an air/gas density of approx. 1.2 kg/m³) / vane wheel type			
measuring range air/gases	**measuring range water/liquids***	**vane wheel type**	**article no.**
with 'aluminium' probes up to 100 °C			
0.6 ... 20 m/s	0.06 ... 7.5 m/s	mc 20 A	V_MC20GFA
0.7 ... 40 m/s	0.07 ... 10 m/s	mc 40 A	V_MC40GFA
1.2 ... 80 m/s	0.08 ... 10 m/s	mc 80 A	V_MC80GFA
1.4 ... 120 m/s	0.10 ... 10 m/s	mc 120 A	V_MC120GFA
with 'stainless steel' and 'titanium' probes up to 100 °C and 260 °C			
0.8 ... 20 m/s	0.08 ... 7.5 m/s	mc 20 T	V_MC20GFT
1.0 ... 40 m/s	0.10 ... 10 m/s	mc 40 T	V_MC40GFT
1.6 ... 80 m/s	0.10 ... 10 m/s	mc 80 T	V_MC80GFT
with 'stainless steel' probes up to 370 °C			
0.8 ... 20 m/s		mc 20 T	V_MC20GT
1.0 ... 40 m/s		mc 40 T	V_MC40GT
1.6 ... 80 m/s		mc 80 T	V_MC80GT
* precondition: no cavitation!			

Measurement uncertainty / repeatability with a gas density of approx. 1.2 kg/m³ or with water*		
Linearisation of characteristics (standard)	all types	< 1.0 % of measured value + 0.5 % of terminal value
Linearisation of characteristics (DAkkS)	all types	< 0.9 % of measured value + 0.25 % of terminal vlaue
Frequency response characteristics ** (interchangeability is guaranteed)	all types	< 2 % of terminal value (in gas up to 40 m/s)
Repeatability		±(0.05 % of terminal 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 document 'U183 and U325 Calibration'		
* for water and liquids with a viscosity of up to approx. 0.0002 m²/s (200 cSt) < 2 % FS applies with linearisation of characteristics < 1.0 % of measured value + 0.5 % of terminal value ** if the evaluation electronics do not support linearisation of characteristics		

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

Smallest measurable value, density influence

The smallest measurable value for measurements in air/gases specified in our documents results from a measuring medium density *rho* ≅ 1.204 kg/m³. The smallest measurable value v_0 is also increased / decreased negligibly even with a considerably different medium density from 1.204 kg/m³ and follows in good approximation the relation:

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

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 rho_{real} greater than 1.204 kg/m³, and too small by the amount Δv when measuring in gases of a density of rho_{real} less than 1.204 kg/m³. Δv is to be added to or subtracted from the respective output value.

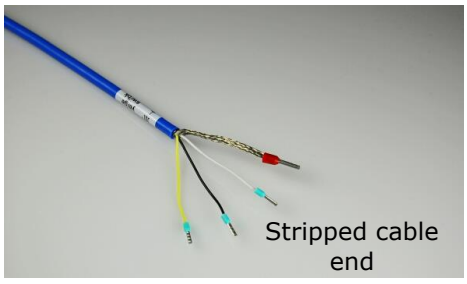
Evaluation unit connection

for unit with 8-pin screw-type connector

		article no.
plug 680-8*	type of protection IP40	A099/055
plug 423-8*	type of protection IP67	A099/056
plug LEMO.0-4	with extension rods VS16 ... incl. LEMO.0-4 / 423-8 adapter cable	A099/078
for unit with connecting terminals		
stripped cable end	marked strands with end sleeves	A099/110

* with extension rods VS16 ... please use article no. A099/078 or A099/110

Connection possibilities



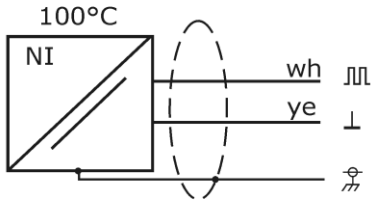
Extension rods				
	material	**length**	**outside diameter**	**article no.**
VS16A-350	aluminium FKM O-Ring	350 mm	16 mm	B099/000
VS16E-350	stainless steel FKM O-Ring	350 mm	16 mm	B099/001

Other accessories		
		article no.
direction indicator RZ16		B099/950

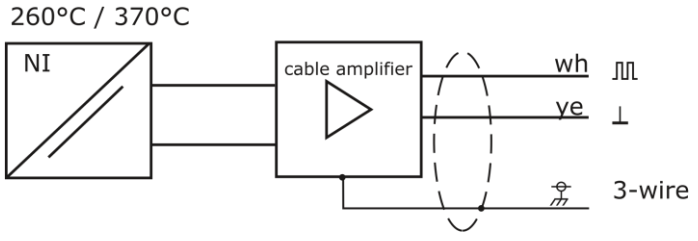
Profile factors depending on inside diameter (see also 'Measuring ranges', Page 5)			
Measuring tube inside diameter Di [mm]	Profile factor PF* [-]	Measuring tube inside diameter Di [mm]	Profile factor PF* [-]
40	0.914	100	0.994
50	0.933	120	1.004
60	0.950	170	1.008
70	0.964	180	1.008
80	0.976	220	1.008
90	0.987	...	1.009

* 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.

Wiring Diagram 100 °C Sensors



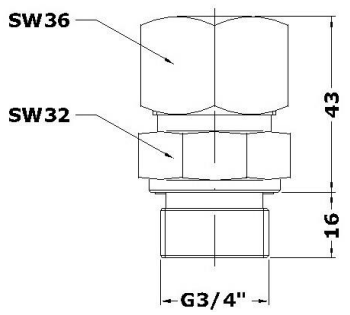
Wiring Diagram 260 °C or 370 °C Sensors



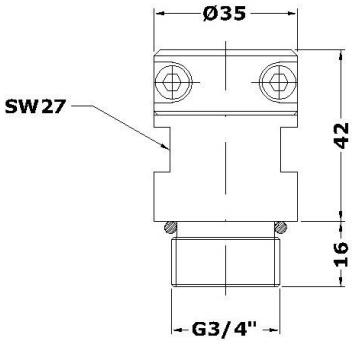
probe guide pieces *		
designation	**description**	**articles no.**
SFB 16 E-45 / G 3/4" according **drawing 5** (see below)	connection: outside thread G 3/4" max. pressure: 2 bar / 200 kPa temperature: -40 … +240 °C materials: stainless steel, FKM, PTFE fixation: clamping bush length L: 45 mm	B004/520
SFB 16 E-45 / 3/4" NPT according **drawing 5** (see below)	connection: outside thread 3/4" NPT max. pressure: 2 bar / 200 kPa temperature: -20 … +240 °C materials: stainless steel, PTFE fixation: clamping bush length L: 45 mm	B004/521
SFB 16 E-45 / G 3/4" according **drawing 5** (see below)	connection: outside thread G 3/4" max. pressure: 2 bar / 200 kPa temperature: -40 … +370 °C materials: stainless steel, graphite fixation: clamping bush length L: 45 mm	B004/525
SFK 16 E-42 / G 3/4" according **drawing 2** (see below)	connection: outside thread G 3/4" max. pressure: 16 bar /1.6 MPa temperature: -20 … +240 °C materials: stainless steel, FKM, fixation: clamping yoke length L: 42 mm	B004/221

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

Drawing 5
Probe guide piece



Drawing 2
Probe guide piece



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Subject to alteration