Data Sheet Probes FA

Vane Wheel Flow Sensors + Accessories
Prices for adapter cable on request. An adapter cable may be necessary when using probe extension tubes should the appropriate plug for connection to the evaluation unit not fit through the probe extension tube.

Cylindrical Probes

ZS = Cylindrical probes
FT = Cylindrical probes with PT100
ZSR = Cylindrical probes sensing ± direction of flow

Extendable probes Ø 30 mm
ZS30GA-md20/140/p6
B014/000
ZS30GE-md20/100/p10
B014/100
ZS30GE-md20/260-2/p10
B014/101
ZS30GT-md20/100/p10
B014/300

Probes of an exact length Ø 16 mm
sensing + direction of flow
ZSR16-16-340GA-md20/100/p3
B005/500

Extendable probes Ø 25 mm
ZS25GA-md20/140/p6
B002/500
ZS25GE-md20/100/p10
B002/504
ZS25GT-md20/240-2/p6
B002/516

Extendable probes Ø 30 mm
sensing ± direction of flow
ZS30GA-md20/140/p6
B014/500
ZS30GE-md20/100/p6
B014/501

v-Sensor
Vane wheel flow sensor with integral temperature sensor PT100 4-wire configured

Extendable probes Ø 25 mm
FT25GA-md20/140/p3
B002/600
FT25GE-md20/100/p6
B002/604
FT25GE-md25/200-2/p6
B002/608
FT25GT-md20/100/p6
B002/612
FT25GT-md20/260-2/p6
B002/616

Cylindrical Probes

The following standard prices apply to cylindrical probes with handle:

- v-Sensor
- Probes of an exact length Ø14/15 mm
- Extendable probes Ø18 mm
- Extendable probes Ø25 mm

Extra charge for other models

Please pay attention to our delivery range (see page 4)

Cylindrical probes

The following standard prices apply to cylindrical probes with handle:

- v-Sensor
- Probes of an exact length Ø14/15 mm
- Extendable probes Ø18 mm
- Extendable probes Ø25 mm

Extra charge for other models

Please pay attention to our delivery range (see page 4)

Vane wheel flow sensors FA

Type of vane wheel
Vane wheel material
Medium
Working temperature range
Connection type
Installation length
E=stainless steel
F=flange
G=water/liquids
M=air/gases
T=titanium

ZSR = Cylindrical Probes
ZS = Cylindrical Probes
Cylindrical Probes

ZS25/27 GF E-mm40 / 13/70- 2/ p6
FT30 G E-mm20 T/100 / p6

Sensor Probe diameter in mm Diameter in mm from sensor Medium G = air/gases F = water/liquids Probe material A = aluminium E = stainless steel T = titanium Typ of vane wheel Vane wheel material integrated through hole Ø in mm Guide piece SFB 20E-65 / F-DN50PN16 ZG1
SFZ 18E-200/G1" ZG2
SFB 25E-200/G1" ZG3
SFZ 27E-200/G1 1/2" ZG4
SFB 30E-200/G1 1/4" ZG5
SFZ 18E-200/1/2" ZG6
SFB 25E-200/1/4" ZG7
SFZ 27E-200/1/4" ZG8
SFB 30E-200/1/4" ZG9

Extra charge for other models

Please pay attention to our delivery range (see page 4)

Ex design in protective system
ATEX Ex ia IIC T4 für HFA-Ex
ATEX Ex ia IIC T6

Special cable lengths
Standard price
FALK

For probes designed for 100 °C or 140 °C or behind cable amplifier, longer than standard length for each additional meter
FAKLM100
For probes designed for 240 °C or 260 °C, longer than standard length for each additional meter
FAKLM260
For probes designed for 350 °C ... 450 °C, longer than standard length for each additional meter
FAKLM450
For probes designed for 500 °C, longer than standard length for each additional meter
FAKLM500

Seal materials DuPont trademark
- VITON® O-Ring
- TEFLON®
- VITON® lip seal
- VITON® , PTFE clamping bush
- Graphite

http://www.hoentzsch.com

U116_ZS_D_e_110722
Probes

Measurements A ... D: see page 4

Probe guide pieces SF

SFZ SF Probe attachment with collet chuck for any repeated positioning at subatmospheric / above atmospheric pressures of up to 10 bar

SFB SF Probe attachment by clamping bush for any repeated positioning at lower subatmospheric / above atmospheric pressures

SFS SF Probe attachment by cutting ring fitting for non-recurring positioning at higher subatmospheric / above atmospheric pressures and higher temperatures
### Other models available on request

<table>
<thead>
<tr>
<th>Type of sensor</th>
<th>ZS16</th>
<th>ZS18</th>
<th>ZS25</th>
<th>ZS30</th>
<th>ZS30</th>
<th>ZSR25</th>
<th>ZSR30</th>
<th>FT25</th>
<th>FT30</th>
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<tbody>
<tr>
<td>Medium</td>
<td>G: air/gases</td>
<td>GFA</td>
<td>GFA</td>
<td>GFA</td>
<td>GFA</td>
<td>GFA</td>
<td>GFA</td>
<td>GFA</td>
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<tr>
<td>f: water/liquids</td>
<td>GFE</td>
<td>GFE</td>
<td>GFE</td>
<td>GFE</td>
<td>GFE</td>
<td>GFE</td>
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</tr>
</tbody>
</table>

- Subject to alteration
- Available as option
- Connection cable water-protected: available as option
- -10 from 6m half measurement range of the nominal value

---

### Vane Wheel Flow Sensors FA

<table>
<thead>
<tr>
<th>Probe diameter in mm</th>
<th>30</th>
<th>30</th>
<th>30</th>
<th>30</th>
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Vane Wheel Flow Sensors FA 07/2010

Probes  ·  Probe Extensions  ·  Probe Guide Pieces  ·  Measuring Tubes

Flow  ·  Flow rate
Also combined with temperature  ·  Pressure

Specifications
Designs
Information for the user
The principle of measurement

is based on the fact that a vane wheel rotates at a speed proportional to the flow velocity \( v \) of a fluid into which it is immersed. The rotational speed is almost independent of density, pressure and temperature of the medium.

The sensing of the vane wheel rotation is carried out by an inductive proximity switch. By fitting a further inductive proximity switch, sensing of the direction of the vane wheel rotation and the indication of the ± direction of flow is made possible.

This form of measurement of rotational speed is carried out without the slightest braking effect on the vane wheel. Soilage does not affect the impulse recognition. The light weight of the vane wheel makes it most suitable for adapting its rotational speed in millisecond range to intervening velocity changes. All vane wheel flow sensors are calibrated on the same frequency, so that sensors of the same type are interchange-able.

The length of cable between sensor and electronic evaluation unit can measure up to several hundred meters.

Types of sensor with vane wheel

• \( v \)-sensors for measuring the flow velocity \( v \)
• \( vt \)-sensors for measuring the flow velocity \( v \) and also the temperature \( t \)
• \( v \)-sensors for sensing the ± direction of flow: FAR
• \( v \)-sensors FA/FAR also in protective system Ex ia IIC T6 Ex
• \( vt \)-sensors FT for HFA-Ex also in protective system Ex ia IIC T4

Designs

• cylinder probes with Ø from 14/15 mm
• cylinder probes with Ø from 16 mm also sensing ± direction of flow
• cylinder probes with Ø from 25 mm also as vt-sensors
• probes of fixed length and extendable probes

Measuring tubes FA-Di...

for direct, independent of position, stationary installation in pipelines with inside diameters \( D_i \) from 9.7...150 mm. Measuring tubes FA Di... are designed for the smallest possible blockage. Tube connection by flange, cutting ring fitting, pipe fitting, connecting nipple, etc.
Customer-specific designs, special designs

T-probes and T-probes with cone for higher indifference to indirect oncoming flow

and others, for example

cylinder probe with integral flange as well as lapped flange
cylinder probes ZS25 or ZS30 with integrated transducer

Cylinder probe with protective mesh for measuring water velocity up to max. 1.5 m/s

Cylinder probe with 90° elbow

Cylinder probe of an exact length with connector box
Types of sensor
ZS cylinder probe, v-sensor FA
ZSR cylinder probe sensing ±direction of flow, v-sensor FAR
FT cylinder probe with integrated temperature sensor
Pt100, Flowtherm sensor, vt-sensor:
v-sensor FA
t-sensor Pt100, DIN IEC 751, tolerance class B, 4-wire configured

Probe diameter Ø
Ø14/15, Ø16, Ø18, Ø25 or Ø30 mm

Probe tube diameter
from sensor in mm

Should details of the conical expansion be missing then probe extension and sensor have the same diameter.

Medium
G = air/gases
GF = water/liquids and air/gases

Vane wheel flow sensors FA are primarily intended for measurements in single-phase flow streams. Slight medium impurities, especially the usual dust content in the air, are of no impairment to the fatigue strength for infinite time. When measuring gases with a solids content a reduction in the fatigue strength of the vane wheel axle tips must be reckoned with depending on type and quantity of the solid particles.

Likewise moisture in gases is of no disadvantage, as long as condensation does not set in. In the case of slight condensation a self-cleaning effect can be reckoned with, as long as the velocities are greater than 10% of the nominal value. Drops of condensation must not come in to contact with the vane wheel.

Höntzsch vane wheel flow sensors are calibrated in air. GF sensors calibrated in air can also be used for measuring in liquids, as research has shown that in the case of measurements in water the sensor characteristic which is deposited as a straight line simply causes parallel shift. GF commutable evaluation units take into account the respective corresponding characteristic.

When measuring in liquids with a viscosity greater than 10 cSt or less than 1 cSt measured value divergencies must be reckoned with. Nevertheless, positive experience has been made, for example, when measuring with fuel. In all cases the mediums must not contain fibres.

Sensor materials
A = aluminium
E = stainless steel, antirust and acidproof
T = titanium

The material reference given to a sensor is the principal material used.

Vane wheel material
As a rule a vane wheel is made of the same material as that referred to in the sensor identification. Should another material be used for the vane wheel then this material will be referred to separately in the sensor identification. The vane wheels in Höntzsch vane wheel flow sensors are pivot suspended. The materials used for vane wheel axes and jewel bearings guarantee highest quality with regard to fatigue strength for infinite time, temperature stability and corrosion resistance.

Axes: sintered hard metal
Stones: synthetic sapphire

Type of vane wheel / Measuring range
The vane wheels differ in size micro = mc, mini = mn, midi = md and the designated measuring range up to 20, 40, 80 or 120 m/s when measuring in air/gases (G) or up to 7.5 or 10 m/s when measuring in water/liquids (F).
The measuring operation only up to 25% of the nominal value should also be favoured in continuous use when the temperatures of the medium continually exceed +300 °C. Probes with a midi vane wheel should only be put into continuous use when the velocity lies in a range of up to 20% of nominal value.

**Smallest measurable value, density influence**

The smallest measurable value for measurements in air/gases specified in our documents results from a measuring medium density \( \rho \leq 1.2 \text{ kg/m}^3 \). The smallest measurable value \( v_0 \) is also increased / decreased negligibly even with a considerably different medium density \( \rho \neq 1.2 \text{ kg/m}^3 \) and follows in good approximation the relation

\[
v_0, \text{real} = v_0, \text{specif} \cdot \sqrt{\frac{1.2 \text{ kg/m}^3}{\rho, \text{real}}}.
\]

The characteristic is displaced by the difference

\[
v_0, \text{specif} - v_0, \text{real} = \Delta v.
\]

Readout of measured values is too great by the amount \( \Delta v \) when measuring in gases of a density of \( \rho_{\text{real}} > 1.2 \text{ kg/m}^3 \), and too small by the amount \( \Delta v \) when measuring in gases of a density of \( \rho_{\text{real}} < 1.2 \text{ kg/m}^3 \). \( \Delta v \) is to be added to or subtracted from the respective output value.

High **endurance** with vane wheel flow sensors can also be attained by choosing the sensor with higher nominal value, but using it only in the range of up to 25% of the nominal value. In such cases we recommend optimum calibration of the measuring probe up to 25% of terminal value or the linearizing of characteristics. Case example: sensor with vane wheel mn80A, clean air at +20 °C, flow velocities 5...15 m/s; in these conditions 5 years continuous operation can be altogether expected. Of course the increased smallest measurable value resulting from this must be acceptable.

The measuring operation only up to 25% of the nominal value should also be favoured in continuous use when the temperatures of the medium continually exceed +300 °C. Probes with a midi vane wheel should only be put into continuous use when the velocity lies in a range of up to 20% of nominal value.

U117_FA_D_e_100726

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**Working temperature range**

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>Density Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 -20 °C ... +100 °C C also</td>
<td>( \rho_{\text{real}} = 1.2 \text{ kg/m}^3 )</td>
</tr>
<tr>
<td>-30 °C ... +100 °C C</td>
<td></td>
</tr>
<tr>
<td>140 -20 °C ... +125 °C C also</td>
<td>( \rho_{\text{real}} = 1.2 \text{ kg/m}^3 )</td>
</tr>
<tr>
<td>-30 °C ... +140 °C S</td>
<td></td>
</tr>
<tr>
<td>240 -20 °C ... +240 °C C</td>
<td></td>
</tr>
<tr>
<td>-25 °C ... +240 °C S</td>
<td></td>
</tr>
<tr>
<td>260 -40 °C ... +260 °C C</td>
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</tr>
<tr>
<td>-40 °C ... +300 °C S also</td>
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</tr>
<tr>
<td>260 -40 °C ... +260 °C C</td>
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<td>-40 °C ... +550 °C S</td>
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<td></td>
</tr>
<tr>
<td>-40 °C ... +550 °C S</td>
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</tr>
</tbody>
</table>

**C** = continuous operation  
**S** = short-time operation

The respective sensor working temperature range is especially influenced by the internal connection system, the materials, the proximity switch, the cable as well as the seals.

Measurements at temperatures for which short-time operation is specified should only last for a few minutes. If this advice is adhered to, then the measuring probe cannot be damaged.

In the case of vt-sensors the working temperature range corresponds to the temperature measurement range.
Cable amplifier in a bush

Cable length up to cable amplifier
Standard length 2 m. For example, the sensor identification 260-2 means that the sensor is resistant up to +260 °C and the length of cable between sensor and bush with cable amplifier is 2 m.

Type of cable up to cable amplifier
This connection cable is TEFLON-coated for +260 °C sensors. The connection cable for the 350 °C ... 450 °C sensors is temperature resistant up to 450 °C. This cable withstands atmospheric influences; it is resistant to almost all chemical substances and is corrosion-proof. The connection cable for the 500 °C sensors is temperature resistant up to 600 °C. This cable is not moisture-proof.

Warning: frequent movement and bending of cable for 350 °C should be avoided. Observe large bending radius whenever possible.

Cable after cable amplifier
Standard length 1.5...2 m. SILICONE-coated and temperature resistant up to +125 °C. Sensors for +100 °C and +140 °C also have as standard a 2 m long SILICONE-coated connection cable for max. +125 °C.

When ordering please name the accompanying evaluation unit so that the appropriate connector plug /connection identification can be supplied.

Seal materials
are, depending on sensor, VITON®, PFTE / TEFLON®, pure graphite. KALREZ® or SILICONE on request.

Working temperature range of the seal materials:

<table>
<thead>
<tr>
<th>Material</th>
<th>Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>VITON®</td>
<td>-20°C ... +240 °C C</td>
</tr>
<tr>
<td></td>
<td>-25°C ... +240 °C S</td>
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<tr>
<td>KALREZ®</td>
<td>0°C ... +300 °C C</td>
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<tr>
<td>PTFE/TEFLON®</td>
<td>-40°C ... +260 °C C</td>
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<tr>
<td></td>
<td>-40°C ... +300 °C S</td>
</tr>
<tr>
<td>Pure graphite</td>
<td>-200 °C ... +600 °C C</td>
</tr>
</tbody>
</table>

C : continuous operation, S : short-time operation® : DuPont trademark

Protective system
Explosion protection Ex
v-sensors FA and FAR are also available in protective system Ex ia IIC T6, electric circuit intrinsically safe.

Protection against medium
Neither liquids nor corrosive gases must be allowed to penetrate the sensor from the cable connection side. In this respect please enquire about protected sensors, e. g. for use under water, before ordering.

Maximum working pressure
p0 sensor is not tight, not pressure resistant
p... sensor is structurally designed for pressures above atmospheric of up to ...bar (1 bar = 100 kPa). When necessary a leak test should be carried out.
**Probe extensions**

are used for deeper insertion of probes in mediums, when the standard probe length is not sufficient for the required insertion depth. Extendable cylinder probes have, for this purpose, a connection thread onto which extension tubes can be fitted which are also suited for feed-through of sensor connection cable, if necessary bush with cable amplifier and connector plug.

In addition they are protected against mediums - water or corrosive gases - which should not be allowed to penetrate the sensor from the cable connection side. Probe tubes are suitable for use with probe guide pieces, even in corrosive mediums or at high temperatures and offer a mechanically steady probe support.

Probe tubes made of titanium can be manufactured only together with a complete order with the same diameter. The diameter of these tubes may differ slightly from the respective nominal diameter. Probe guide pieces must be manufactured to match these probe tubes. The mechanical burden of the tubes on the connection threads (burden due to weight of probe and extension tube as well as force of the flowing medium) limits the number of extension tubes which can be screwed together.

Besides this, the sensor must not be allowed to undergo any vibration. For the most cases we recommend that not more than 4 extension tubes of 350 mm or 400 mm in length or rather 2 extension tubes of 1000 mm in length should be screwed together without additional support.

**Seal materials**

on the screw fittings of extension tubes. The tube walls of the extension tubes are as thin as possible. As a result, the sealing functions of the normally used VITON O-rings at high temperatures can only be guaranteed up to a certain limit. Extension tubes with pure graphite seals fulfill high requirements of tightness and corrosion resistance. Besides this they are also temperature resistant between -200 °C ... +600 °C.

PTFE / TEFNOL and KALREZ O-rings on request. PTFE O-rings can only be recommended if the corrosion resistance of VITON should not be adequate and the temperatures are not too high. KALREZ O-rings are temperature resistant for certain mediums, according to DuPont, in a range from 0 °C ... +300 °C.

**Probe guide pieces SF**

are used for inserting and retracing probes in and out of pipelines and ducts. The fixing device of the probe tube is to be chosen taking the temperature and pressure operating conditions into consideration.
Measurement uncertainty

Vane wheel probes ZS, TS, ZSR and TSR are specified with a measurement uncertainty of <1.5 % of measured value + 0.5 % of terminal value.

Validity of this measurement uncertainty specification is limited for FT sensors and sensors with a measuring range terminal value greater than 60 m/s.

For these sensors, a linearising of characteristics with pairs of values is essential in order to achieve the lowest possible measurement uncertainty. An application with the standard characteristic (available in each evaluation unit with FA-input) is possible, but results in an uncertainty of <5% of measured value + 2 % of terminal value.

Coefficient / Profile factor

In larger free jet as well as in larger ducts and measuring tubes the local velocity \( v_p \) will be displayed with \( PF = 1.000 \). PF is also used to calculate the local velocity \( v_p \) to the average velocity \( v_m \) in a measurement cross-section:

\[
    v_m = v_p \cdot PF
\]

When measuring with cylinder probes in circular measurement cross-sections with interior diameter \( D_i \):

- centric positioning of the sensor
- irrotational flow

- developed flow profile (measurement cross-section so chosen, that 20 \( D_i \) straight, unhindered input section amount to 10 \( D_i \) straight, unhindered output section)

following coefficients are to be taken as a basis:

<table>
<thead>
<tr>
<th>( D_i )</th>
<th>( PF ) (ZS16)</th>
<th>( PF ) (ZS18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>0.914</td>
<td>0.898</td>
</tr>
<tr>
<td>50</td>
<td>0.933</td>
<td>0.916</td>
</tr>
<tr>
<td>60</td>
<td>0.950</td>
<td>0.932</td>
</tr>
<tr>
<td>70</td>
<td>0.964</td>
<td>0.948</td>
</tr>
<tr>
<td>80</td>
<td>0.976</td>
<td>0.962</td>
</tr>
<tr>
<td>90</td>
<td>0.987</td>
<td>0.975</td>
</tr>
<tr>
<td>100</td>
<td>0.994</td>
<td>0.986</td>
</tr>
<tr>
<td>120</td>
<td>1.004</td>
<td>1.004</td>
</tr>
<tr>
<td>170</td>
<td>1.008</td>
<td>1.021</td>
</tr>
<tr>
<td>180</td>
<td>1.008</td>
<td>1.021</td>
</tr>
<tr>
<td>220</td>
<td>1.008</td>
<td>1.021</td>
</tr>
<tr>
<td>...</td>
<td>1.008</td>
<td>1.021</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( D_i )</th>
<th>( PF ) (ZS25, ZS30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>0.735</td>
</tr>
<tr>
<td>60</td>
<td>0.760</td>
</tr>
<tr>
<td>70</td>
<td>0.784</td>
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<tr>
<td>80</td>
<td>0.807</td>
</tr>
<tr>
<td>90</td>
<td>0.829</td>
</tr>
<tr>
<td>100</td>
<td>0.849</td>
</tr>
<tr>
<td>120</td>
<td>0.882</td>
</tr>
<tr>
<td>170</td>
<td>0.935</td>
</tr>
<tr>
<td>180</td>
<td>0.945</td>
</tr>
<tr>
<td>220</td>
<td>0.955</td>
</tr>
<tr>
<td>...</td>
<td>0.955</td>
</tr>
</tbody>
</table>

If these conditions for application of the coefficients are not prevailing then a pre-examination of flow should be carried out in the greater measurement cross-section with

PF = 1.000. As a result of this examination an optimal measurement point is to be determined and the corresponding coefficient is to be set.

For further information please consult VDI/VDE 2640, “Measurement of velocity area methods in flow cross-sections”.
User’s Information FA Probes

Supplementary to this User’s Information we refer to the corresponding Technical Data Sheet with the specific data relating to your order and details of the Manual as well as to Data Sheets Vane Wheel Flow Sensors FA and Flow Velocity Calibration FA. The data in these documents supplements the following User’s Information.

Warning
- Probe in pressurized pipeline:
  - insertion or retraction of probe in depressurized conditions only!
  - In the case of probe guide pieces with probe attachment by TEFLO® clamping bush: increase the tension on the clamping bush from time to time (TEFLON runs causing the clamping fixture to lose initial gripping power)
- Probe with probe guide piece: after positioning a probe in the pipeline fix the probe tube!

Fitting instructions
The probes should be so fitted that
- flow is according to the flow direction provided for.
- Alignment estimated by sight does not interfere with the measurement. Rather more deviations from the nominal position can however affect the measurement.

In the case of probes without connection housing an adjustable ‘direction indicator’ can be used to determine the sensor flow direction and insertion depth.

In the case of probes with connection housing the screwed cable gland on the connection housing is to be aligned to the direction of flow or the direction indicator on the housing is to be aligned to the direction of flow.

In the case of flowtherm probes FT a direction indicator on the probe cap points in the intended direction of flow.

In the case of ZSR probes sensing the direction of flow the allocation of the direction is to be undertaken by the customer during initial operation.

- the probe mounting device does not affect the flow if possible.
- they are fitted vibration-free and not in the immediate vicinity of electromagnetic sources of interference.

Warning
- when using several probes together, two probes should not be placed in too short a distance from each other. A space of 1 m in the direction of flow is always “good”; however, the space between two probes on the measuring plane may be 15 cm.
- no drops hit the sensor.

The diagram shows, taking a cylinder probe with Ø25 mm as an example, how the measured velocity values \( v \) in a wind tunnel with uniform velocity in blower stream \( v_0 \) can change by twisting the probe. Typical of this is that probes with a smaller diameter demonstrate a stronger directional dependance. On the other hand, in the case of T-shaped probes, the measured values \( v \) remain almost constantly up to \( \alpha = \pm 20^\circ \), even by twisting and tilting the probe.
Greater measurement cross sections
To determine the average flow velocity $v_m$ in greater measurement cross sections a preliminary examination is to be carried out to determine the flow profile/measurement cross section topography. As a result of this study an optimum measuring point is to be fixed and the associated coefficient for the conversion of the local velocity $v_p$ to the average velocity $v_m$ is to be stipulated.

For further information see for example

* VDI/VDE 2640-3 'Measurement of gas flow... velocity area method'
* Data Sheet FA, ‘Coefficient / Profile factor’

Input/output sections
When measuring in a measurement section of inside diameter $D_i$ it must be observed that optimal accuracy when converting the local velocity $v_p$ to the average velocity $v_m$ is only guaranteed when

- input/output sided irrotational flow prevails and moreover
- sufficient straight, unhindered input section as well as sufficient straight, unhindered output section is available.

The illustrations show the recommended minimum pipe length, given as a multiple of $D_i$. The use of greater lengths is always advisable.

Should a suitably long, straight section line not be available then the measurement cross section is to be so placed that 2/3 of the straight pipe section are upstream and 1/3 downstream of the measurement cross section.

Instrument settings
- in the case of an evaluation unit with keypad and display: check the effective parameter settings by using the key (inquiry mode) and if necessary enter type of vane wheel and type of medium pertaining to the sensor via the keypad.
- in the case of a transducer without keypad and display please make sure that the type of vane wheel and type of medium shown on the transducer match the connected sensor.

Standard designs of flow straighteners, see for example DIN ISO 5167-1 ‘Measurement of fluid flow by means of pressure differential devices’
Double-shielded line is recommended: lay inner shield on one side of the evaluation unit, lay outer shield on both sides covering a large area and of low impedance at sensor and evaluation unit.

Connection recommendation for a FA, FT or FAR sensor with longer lines or lines with severe electromagnetic interference

- Spacial separation of lines emitting interference from measuring cables and evaluation units.
- When using frequency converters the influence of RF interference emittance must be taken into consideration from the outset and increased active and passive anti-interference measures must be taken: Decouple the mains input of the frequency converter by means of a spark filter against active interference emittances. In addition this increases the passive resistance to jamming of the facility.
- Special attention should be directed to the motor wire. The motor wire between converter and motor should be shielded, the shielding being on both sides.
- Metallic parts in the service cabinet - as for instance sub-rack with control electronics or mounting plates - very good large area and RF-like conductive connection.
- Relays, contactors, electro valves installed in the same circuit to be wired by means of spark arrester combinations or excess-voltage limiting components.
- Lay the shielding from analog signal lines only on one side - if possible at the evaluation unit - and of low impedance. Twist non-shielded lines: is effective against balanced interference to source terminals.
- Lay shieldings from digital signal lines on both sides over a large area. In the case of potential differences between these points: lay separate potential equalization lines.
- For connections on connection cable points of separation use preferred shielded plug connector. When using terminals: place terminals in an RF-shielded housing and use EMC-correct cable lead-ins. Contact outer shielding of the connecting line to the cable leadins.
- All lines to be kept short! Loops in the line can destroy protective measures. Lay non-reserved wires in a cable on both sides on earthed wire potential. Lay cables and wires close to the reference potential, for instance side panels, mounting plates or steel girders.

Circuit diagram
FA sensor with evaluation unit only to be connected according to appropriate circuit diagram.

Connection recommendation for a FA, FT or FAR sensor with shorter lines with no electromagnetic interference

- Connection line
For the connection between sensor and evaluation unit - in the case of shorter lines with no electromagnetic interference - a wire with simple copper shielded braid can be used: LiYCY. In the case of longer lines or lines with severe electromagnetic interference a double-shielded line only is to be used: LiYCY-CY. Number of wires and cross section in mm² for each wire: for FA sensor 2 conductors 2·0.25, FA sensor 3 conductors 3·0.25, FAR sensor 2 conductors 2·0.25, FAR sensor 3 conductors 4·0.25, FT sensor 2 conductors 6·0.25. Maximum conductor resistance for each wire: 25 Ω. Maximum operating capacity between the wires with 2 conductors: 1.5 nF. Resistances for fine-strand wires according to VDE 0295 / IEC 228:
  - 79 Ω/km with wire cross section 0.25 mm²
  - 39 Ω/km with wire cross section 0.50 mm²
  - 26 Ω/km with wire cross section 0.75 mm²

EMC information
For installation in facilities with interference emitting components:
- In the case of lines over 30 m or lines with severe electromagnetic interference - lines between sensor and evaluation unit - the use of a double-shielded line is recommended: lay inner shield on one side of the evaluation unit, lay outer shield on both sides covering a large area and of low impedance at sensor and evaluation unit.
- Spacial separation of lines emitting interference from measuring cables and evaluation units.
- When using frequency converters the influence of RF interference emittance must be taken into consideration from the outset and increased active and passive anti-interference measures must be taken: Decouple the mains input of the frequency converter by means of a spark filter against active interference emittances. In addition this increases the passive resistance to jamming of the facility.
- Special attention should be directed to the motor wire. The motor wire between converter and motor should be shielded, the shielding being on both sides.
- Metallic parts in the service cabinet - as for instance sub-rack with control electronics or mounting plates - very good large area and RF-like conductive connection.
- Relays, contactors, electro valves installed in the same circuit to be wired by means of spark arrester combinations or excess-voltage limiting components.
- Lay the shielding from analog signal lines only on one side - if possible at the evaluation unit - and of low impedance. Twist non-shielded lines: is effective against balanced interference to source terminals.
- Lay shieldings from digital signal lines on both sides over a large area. In the case of potential differences between these points: lay separate potential equalization lines.
- For connections on connection cable points of separation use preferred shielded plug connector. When using terminals: place terminals in an RF-shielded housing and use EMC-correct cable lead-ins. Contact outer shielding of the connecting line to the cable leadins.
- All lines to be kept short! Loops in the line can destroy protective measures. Lay non-reserved wires in a cable on both sides on earthed wire potential. Lay cables and wires close to the reference potential, for instance side panels, mounting plates or steel girders.
Causes of trouble

no measured value:
- coefficient set at 0.000
- sensor not connected (display EEEE or FFFF)
- parting of connection cable or short in the connection cable (display EEEE or FFFF)

measured value too low:
- coefficient set too low
- coefficient too low for the measuring position. See ‘Greater Measurement Cross Sections’: Flow profile other than expected, e.g. caused by subsequent structural alterations to the measurement section. Please note: the flow profile can change dependent on velocity when the input/output sections are too short.
- volumetric display: pipe inside diameter Di setting too small
- rotational flow with centric positioning of the sensor
- sensor not optimally aligned to the flow
- vane wheel no longer smooth running as a result of lengthy use, strong vibration or impact (sensor dropped, for instance)
- vane wheel sluggish as a result of soilage or worn out axle tips
- effective electromagnetic interferences
- burden at current output greater than permissible according to Technical Data Sheet. Effect: correct output values in a lower part of the measuring range, no longer increasing output values in an upper part of the measuring range.
- setting of the scaling for the analog output not as expected
- wrong setting of type of vane wheel or type of fluid in the case of evaluation unit with keypad and display.

Measured value fluctuates:
- time constant set at too low a value
- expected measured value fluctuation does not correspond to the actual measured value fluctuation
- effective electromagnetic interferences

Corrective maintenance
to be carried out by Höntzsch GmbH. Please enclose a description of errors when returning faulty instruments. If the instruments have been used in hazardous materials please inform us of any safety precautions to be taken during corrective maintenance. We see it as a conscientious duty to our staff to request you to furnish us with this information.

Maintenance
In applications where dirt can settle on the sensor, sensor should be cleaned at regular intervals!

Cleaning the sensor
Soiled probes can be rinsed in a cleaning agent (e.g. etyl alcohol, isopropanol or washing-up liquid with warm water) which does not leave a dry residue. Please check compatibility of cleaning agent with sensor material.

The measuring probe should only be immersed in the cleaning agent as far as the vane wheel and its boring. On no account must liquid be allowed to penetrate the probe from where the cable emerges.

An ultrasonic cleaning appliance should not be used! After cleansing, blow through the vane wheel from both sides with a hair-dryer. Purpose: to achieve self-cleaning effect of axle tips and bearings!

Warning: do not clean or direct airflow against the probe with compressed air.

Vane wheel flow sensors should be cleaned at regular intervals when being used where dirt can be deposited on the sensor. Start by checking the necessity for cleaning at short intervals by close inspection in order to establish an optimal cleaning interval.