

Thermal Flow Sensors TA20 05/04

Probes · Probe Extensions · Probe Guides



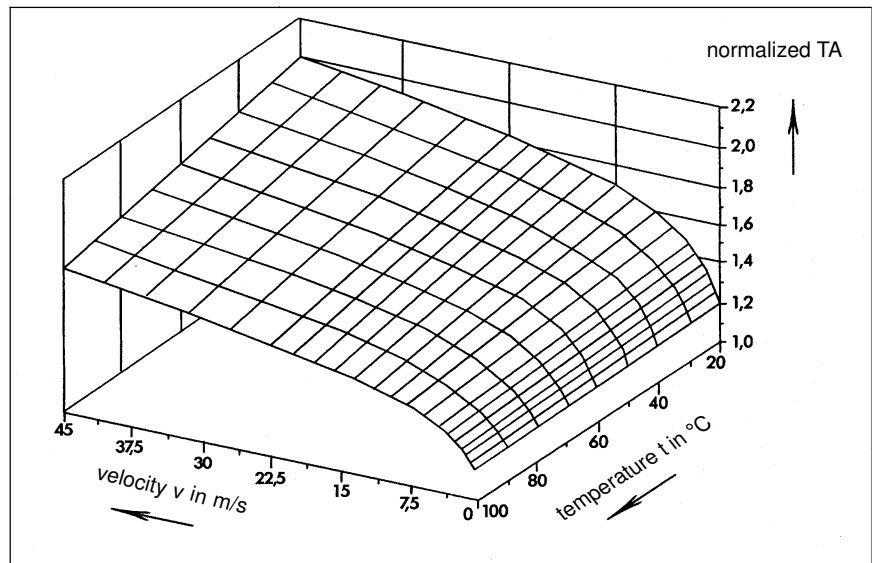
Flow · Flow rate
also combined with
Temperature · Pressure

Specifications
Designs
Information for the user

The principle of measurement

is based on heat transport from an electrically heated body in ambient air dependent on the relative velocity between both. Höntzsch TA sensors consist of an electrically heated Pt100 and two Pt100 temperature probes. One of the two temperature probes measures the temperature of the electrically heated Pt100, the other the temperature of the flowing air.

The feed circuit for the heated element and the temperature difference between heated element and medium are the dimensions for the flow velocity of the air.



Heating current I dependent on the standard velocity Nv and the temperature t

Thermal flow sensors TA from Höntzsch are able to measure not only the lowest but also high velocities and meet all requirements for industrial application:

- chemical corrosion resistance
- robust mechanical design
- small dimensions
- interchangeability (unrestricted allocation to the evaluation unit)
- easy to clean
- wide measuring range

The diagram shows that the correspondence between heating current and the standard velocity is also temperature-dependent. Höntzsch flow evaluation unit VT-TA compensates this dependency over the entire temperature application range provided for one sensor respectively.

The T_{95} time constant of all TA sensors at air velocities of around 5 Nm/s is approx. 10 s. The time constant decreases at higher velocities.

The sensors are realized in a modified Pt100 4-wire technique. This allows for maximum precision in the case of measurement of temperature and also results in the connection cable between electronic evaluation unit and sensor being able to measure up to several hundred meters.

A characteristic feature to be emphasized when measuring with thermal flow sensors is that the measurement accuracy increases in decreasing flow velocities. In contrast to this, the measurement accuracy increases in increasing flow velocities in the case of vane wheel and vortex flow sensors.

Measurable variables

are the standard flow velocity N_v and the temperature t . The standard volume flow and mass flow can be determined with N_v independent of pressure and temperature.

Standard flow velocity and actual flow

The standard velocity N_v is the velocity at which a gas moves when gas temperature and gas pressure are identical with the standard condi-

B_v is the velocity at which a microscopically small particle floats in a flowing medium.

Thermal anemometers measure the standard velocity N_v , that is a velocity which is referred to so-called standard conditions. Measuring the standard velocity with a thermal flow sensor is independent of pressure and temperature.

The standard conditions for Höntzsch are $+21\text{ °C}$ ($+70\text{ °F}$) and 1014 hPa (14.7 psia).

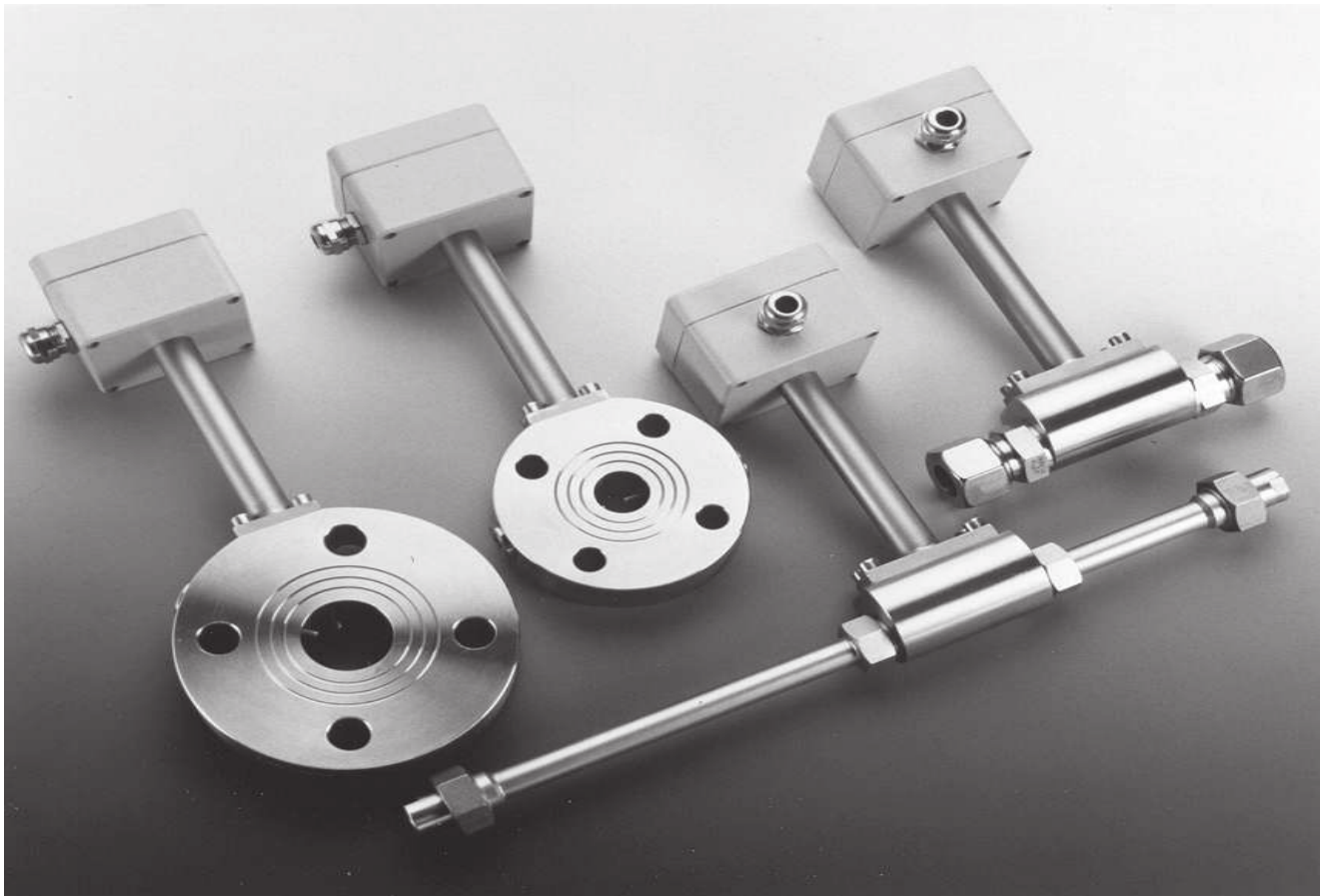
The decision whether to apply the standard or actual velocities depends entirely on the measurement requirements. The standard velocity can be converted to an actual velocity and vice versa using the universal gas equation.

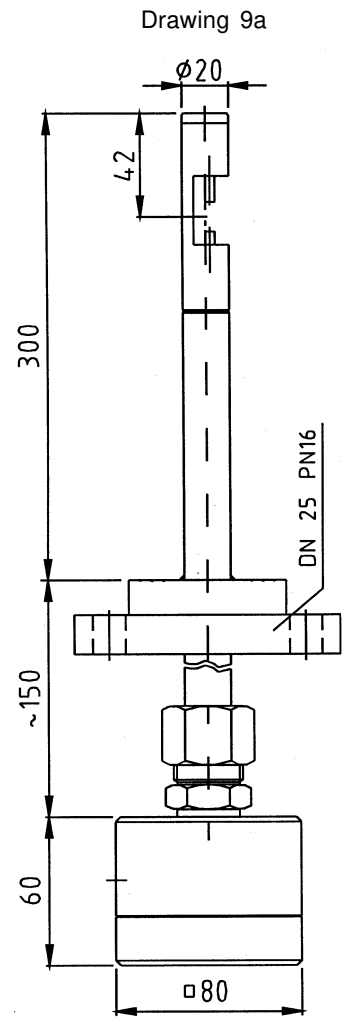
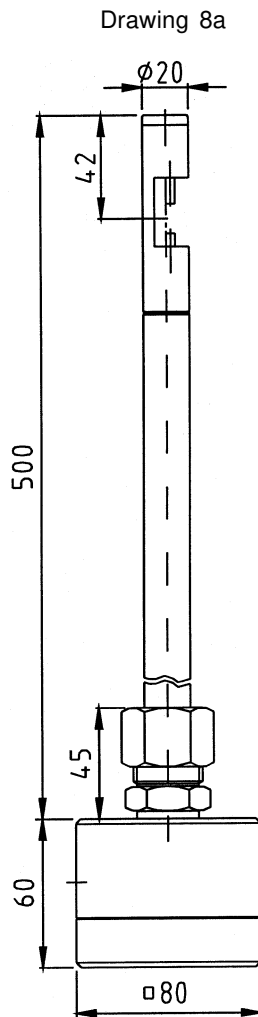
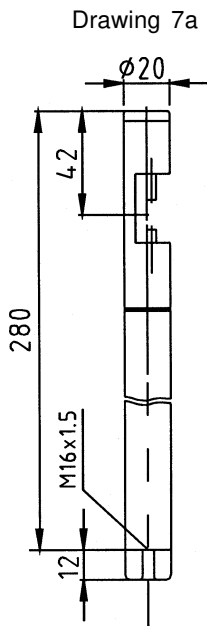
Höntzsch flow evaluation units VT-TA and PTW can carry out this conversion automatically.

Measuring tubes TA·Di...

for direct, independent of position, stationary installation in pipelines with inside diameters from 10 mm ... 65 mm. Tube connection by flange, cutting ring fitting, pipe fitting, connecting nipple, etc.

*TA-Di 32 GE 60 Nm/s /100/p12
for installation between flanges*





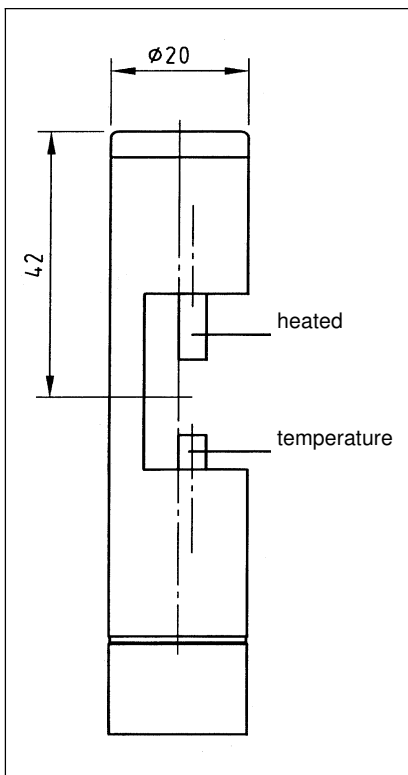
	TA20-300	GE	40m/s	100p	10	ZG9a
	TA20	GE	60m/s	240p	10	ZG7a
Sensor, probe diameter in mm						
Probe length in mm, if not extendable						
Medium						
G = air/gases						
Probe material						
E = stainless steel...						
Nominal value						
Working temperature range						
Working pressure (above atmospheric)						
Design according to drawing ZG... Drawing, German: Zeichnung						

Model designations of thermal flow sensors TA

Types of sensor

- TA with constant heating current at variable temperature difference between heated element and medium: normal operating mode for TA20 sensors and measuring tubes TA-Di...
- temperature sensor Pt100

Sensor TA20



Medium

Thermal sensors TA are calibrated with air and are primarily intended for measurements in air. Gases other than air can have varied cooling effects and can therefore influence the measurement. Disregarding this, thermal flow sensors are also suitable for measurements in single-phase gaseous flows. Measurements in gas mixtures with air or other gases are affected to such an extent that the heat transfer property of the gas mixture differentiates from the heat transfer property of the air.

The use of a TA sensor in particle-charged flows is permissible as long as the finish of the sensor material stainless steel does not change and deposits are not allowed to collect on the sensor. Mediums may even contain fibres.

Deposits or abrasions on the sensor can change the heat transmissions and so influence the measurement. The effect of condensation on the sensor is to be regarded in the same way. Clean soiled sensor heads!

Drifts resulting from variable humidity of the air are covered by our specifications for measuring uncertainty.

Measuring range

The smallest measurable value with velocity measurements of air is approx. 0.08 m/s, the terminal value 40 m/s or 60 m/s, air at 21 °C, 1014 hPa. Velocities of less than 0.08 m/s can be measured and are also output on the appropriate evaluation units. Velocities of less than 0.1 m/s are however not controlled by calibration.

The velocity overload capacity of the TA20 sensors up to 100 m/s. If the velocity in blower stream is higher than the specified nominal flow then measured values greater than the nominal flow will be issued. These values however are no longer covered for by the standard data relevant to measuring uncertainty. In the case of velocities in blower stream which are distinctly higher than the specified nominal flow, then overflow is displayed.

The fatigue strength for infinite time of the thermal flow sensor TA is independent of the flow conditions within the measuring range and independent of the velocity overload.

Sensor materials

materials coming into contact with the medium

TA20 for 100 °C

E stainless steel 1.4571, epoxy resin, VITON®

TA20 for 240 °C

E stainless steel 1.4571, VITON®, glass

Working temperature range

100 -10 °C ... +100 °C **C**

240 -10 °C ... +240 °C **C**

C = continuous operation

The working temperature range indication is equivalent to the temperature measuring range. Measurements of around 0 °C and less are only then possible if no ice, hair-frost, snow or other agglomerations are allowed to collect on the sensor heated element.

The zero point is influenced by absolute pressures which are distinctly higher than 1014 hPa. In the case of non-compensated pressure dependence the following approximate values arise:

0 Nm/s, 5065 hPa abs/≈ 5 bar:

measured value 0.25 Nm/s

0 Nm/s, 10130 hPa abs/≈ 10 bar:

measured value 0.50 Nm/s

This influence is no longer effective at velocities higher than approx. 1 Nm/s. The standard software TA of the flow evaluation units VT-TA is equipped, since 6/97 or in the case of the PTW since 12/97, with an inquiry to the mean working pressure for the purpose of the best possible compensation of the described pressure dependence.



Sensor TA20

Maximum working pressure, pressure dependence

p0 sensor is not tight, not pressure resistant

p... sensor is tight and structurally designed for pressures above atmospheric of up to ... bar (1 bar = 100 kPa)

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 before ordering.

Measurements with absolute pressure of less than approx. 0.7 bar absolute are no longer covered for by the standard data relevant to measuring uncertainty.



Sensor TA20... ZG9a

Measuring uncertainty

see data sheet Flow Velocity Calibration TA (U194_EN)

Connection cable

As a rule the connection cable for probes with direct connection cable outlet is 8-wire, 2 m long and for probes with a working temperature range of up to +100 °C and +240 °C TEFLON coated. It has a continuous working temperature range of up to +260 °C, short-time up to +300 °C, and has an overall shielding for reasons of electromagnetic resistance.

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

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 probes TA20 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 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.

Seal material

on the screw fittings: VITON® O-rings. VITON® is an extremely versatile corrosion resistant material and is temperature resistant in a range from

-20 °C ... +240 °C **C**
-25 °C ... +240 °C **S**

C = continuous operation
S = short-time operation

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 400 mm in length or rather 2 extension tubes of 1000 mm in length should be screwed together without additional support.

Probe guide pieces SF

are used for inserting and retracting 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.

SFB SF with clamping bush for unlimited repeated positioning of a probe at low subatmospheric and above atmospheric pressures

SFS SF with cutting ring fitting for single/one-off positioning of a probe at higher subatmospheric and above atmospheric pressures and higher temperatures



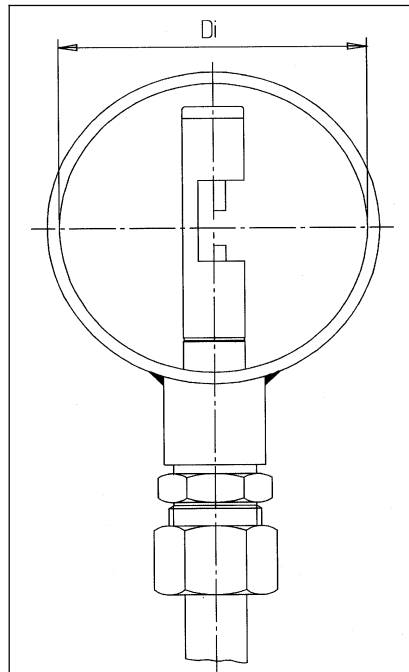
TA20...ZG8a, probe guide piece with ball valve and chain safety device

Coefficient / Profile factor (PF = BW)

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:

$$v_m = v_p \cdot PF$$

This relation applies likewise to standard and actual flow velocities.



When measuring with thermal flow sensors TA in circular measurement cross-sections with interior diameter D_i then in turbulent flow the coefficient 0.84 is to be taken as a basis as long as the following conditions are adhered to

- sensor to be so positioned that the sensor heated element is centric
- sensor to be so positioned that the medium temperature sensor is within the tube flow and a constant distribution of temperature above the measurement cross-section exists
- irrotational flow
- developed flow profile, i.e. measurement cross-section so chosen that 20 D_i straight, un hindered input section, amounts to 10 D_i straight, unhindered output section.

Pressure drop

Pressure drop of several Höntzsch flow sensors when measuring in air under normal atmospheric conditions, +20 °C

