

deltaflow

Flow Metering for Gas, Steam and Liquid

**deltaflow**  
made by **systemc**



**systemc**  
CONTROLS

# Metering for Gas, Steam and Liquid

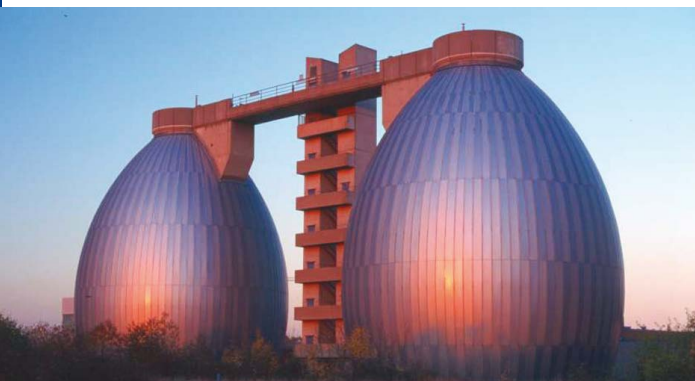
The deltaflow is a pitot tube which measures the flow in conduits according to the differential pressure principle. It can be used to meter gases, steams, and liquids under almost any operating condition in many different industries.

### In Power Plants:

The deltaflow meters all gaseous media reliably and precisely, including fresh air, preheated air, recycled stack gas, and flue gas before and after wash scrubber, as well as media with an extremely high particulate load (when used with the LSP air purging system), live steam, medium-pressure steam, low-pressure steam and feed water – all tested to PED97/23/EC with CE certification.

### Special Advantages:

- Energy savings realized from using deltaflow are so significant that a deltaflow purchased to meter steam or feed water often pays for itself within just a few weeks.
- With exact measurements of combustion exhausts from boilers, burnout, slagging and efficiency levels can be adjusted for optimum performance. Because pressure loss levels are so minor, smaller pumps, blowers and compressors can be used.
- Your deltaflow is a reliable exhaust gas meter, suitable for high and very high temperatures up to above 1200 °C, which has been tested by the TÜV (German Technical Inspection Agency) under the guidelines of §13 and §17 of the Federal Emission Control Ordinances.



*DF25 with LSP air purging system for combustion gas with high particulate content after air preheating.*

## Chemistry and Petrochemistry

The deltaflow is also a viable solution in the chemical and petrochemical industries - for metering products, exhaust or flue gasses, or inert or aggressive media. In an endurance test, complying with the guidelines of §13 and 17 of the Federal Emission Control Ordinances (German BImSchV), lasting several months and performed in 1996 at Wacker-Chemie in Burghausen, Germany, the deltaflow proved its durability measuring 100% steam-saturated, aggressive and polluted flue gas.

### Special Advantages:

- The deltaflow's high degree of precision and accuracy increases the quality of your process and your products
- Your deltaflow can be made of materials suited for especially corrosive or high-temperature media, thus providing a solution even for your "problem areas." Such as pyrolysis, for example: the deltaflow can be manufactured using acid-resistant materials which allow continuous operation at temperatures over 1200 °C.
- Neither vacuum nor high-pressure explosive environments nor high pressure applications are a problem; all probes conform to ATEX standards (explosion proofed) and TÜV certified up to 690 bar.



DF25HDD3 for polluted, high-pressure natural gas behind a drill head.

## Water and Wastewater Treatment

The deltaflow is especially valuable for metering biogas and sewer gas in the water and wastewater treatment industry. The deltaflow proves its reliability metering air flow into aeration tanks.

### Special Advantages:

- Because the deltaflow is not sensitive to condensation or pollution, it is the ideal metering tool for measuring sewer gas.
- The deltaflow is designed for stability in long-term use and is drift-free, making it particularly suitable for metering under rough conditions.
- deltaflow is useful for metering air, water, and steam in gasification and sludge incineration applications

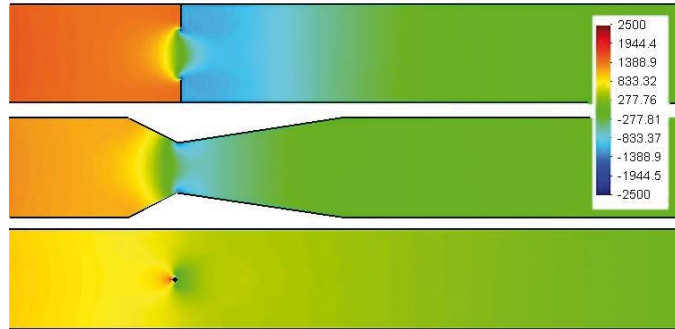


Deployment of deltaflow for biogas flow metering.

# Economical, Precise, and Versatile

## Minimal Pressure Loss Results in Minimal Energy Costs

Unnecessary pressure loss costs money! In many applications, these losses may add up to several tens of thousands of dollars each year. One decisive advantage a pitot tube has over classic differential pressure elements is its low-impact, streamlined design: it creates virtually no constrictions inside a conduit, resulting in the lowest residual pressure loss compared to traditional primary elements such as orifices or venturis.



Pressure loss when using: orifice (upper fig.), Venturi (middle fig.), and deltaflow (bottom fig.)

## Save Up To 90% in Installation Times and Costs

To install your deltaflow, simply weld in a single stud. There is no need to cut open a conduit or spend time welding numerous flanges. The deltaflow can be completely installed in only 1 to 2 hours for most applications! And because it is so lightweight, an installer can single-handedly manage the installation of even the largest probes without the aid of any heavy equipment. Neither is there any need for complicated alignment procedures, since incoming flow can approach at an angle of  $\pm 10^\circ$  without affecting the targeted precision levels.

## Highest metering precision thanks to optimized probe profile and high precision manufacturing

The shape of a probe and the manufacturing quality strongly influence the measurement's precision and therefore also your process' factor of quality. Thanks to a continuous further development and a number of patents, deltaflow offers you:

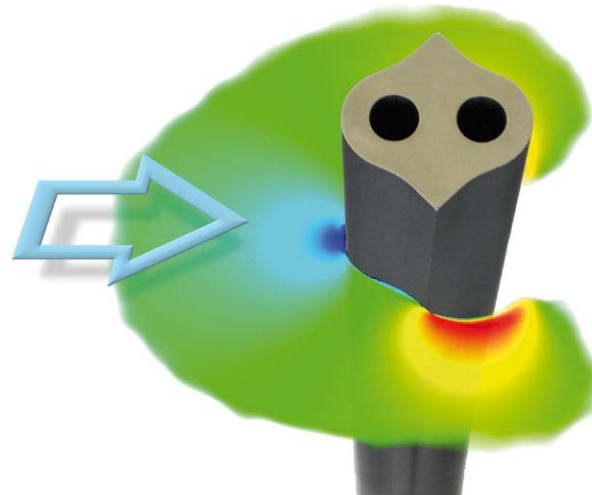
- absence of drift
- precision
- long-term stability
- reliability.

## Optimized Flow Profile Yields Maximum Precision

The originality to the deltaflow's profile is in its acceleration curves and its sharp tear-off edges. The profile was developed and optimized through extensive testing by systec Controls in collaboration with the Department of Flow Dynamics at the University of Erlangen. The acceleration curves increase the flow speed towards the tear-off edges several times over. The sharp tear-off edge causes a defined and drift-free break-off point of the flow independent of velocity.

## Patented probe profile

The particularity of the deltaflow profile lies in its acceleration curves and its tear-off edges. Thanks to the streamlined profile the flow speed towards the tear-off edge is accelerated by approximately a factor 2.3. This increases the differential pressure. The probe's calibration factor, i. e. its resistance coefficient, which strongly influences the flow metering results, remains extremely constant.

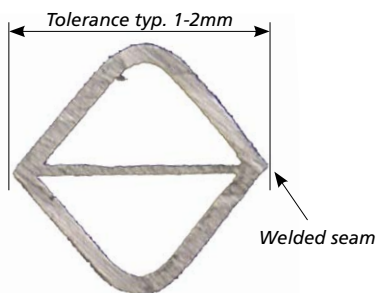


Flow rate at the edge of the deltaflow is accelerated to approximately 2.3 times the previous speed.

**Result: The resistance coefficient remains constant throughout the entire measuring range.** The degree of precision is maintained even in the lower measuring ranges because there is no critical drift of the breakoff point. Measuring ranges of 1:30 and larger are completely feasible.

## No Measuring Errors Caused by Welded Seams at Probe's Cross Section

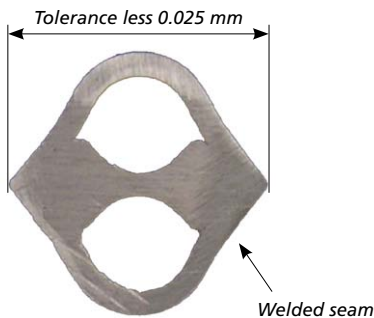
Most pitot tubes are constructed of two outer walls and a separating wall welded between the two chambers. These are generally manufactured by welding them in sideways and then manually adjusting them, resulting in production tolerances at the edge to edge width of between 1 and 2 mm. But a production tolerance of as little as 1 mm can result in a measuring error of up to 10% in a conduit measuring 100 mm, and the error can be even greater in conduits of smaller diameter! To solve this problem, systec developed a production process in which the deltaflow's welds are located along the probe's curves instead of at the critical cross section.



*Traditional probe profile: Welded seams and surface adjustment at the critical front surfaces, resulting in asymmetries at the edge to the edge width.*

## Production Tolerance of <0.025 mm Through New Manufacturing Processes

The deltaflow uses cold-rolled profiles. The measurement tolerance at the edge to edge width therefore does not exceed +/- 0.025mm which gives a very accurate shape.



*Flow profile of the DF25: Welded seams are located on the noncritical curves; there is no impact on the measurements at the edge to edge width.*

## Absence of Capillaries Prevents Measurement Errors Caused by Water Columns

Internal differential pressure pipes and the dp-tappings of the DF25 and DF44 have a diameter of at least 8mm which allows any accumulated flow to drain. This means that there is no error in differential pressure caused by water columns. For liquid service this also allows gases to vent properly. This means that there is no error caused by capillary action.

## Tested by the TÜV (German Technical Inspection Authority) for Compliance with the § 13 and § 17 of the Federal Emission Control Ordinance

Already in 1996 the deltaflow DF25 and DF50 were successfully subjected to a three-month durability test conducted by the TÜV Compliance Board in accordance with clean air requirements identified in § 13 and § 17 of the Federal Emission Control Ordinance and were included in the Environmental Control Agency's clean-air guidelines for water / steam saturated flue and exhaust gasses. By the way: the deltaflow was neither heated nor cleaned throughout the entire test.

## High Pressures and Temperatures

The deltaflow DF25-HDD3 can be used for live steam at pressures far exceeding 600 bar and temperatures far hotter than 600° C. Tests were performed in accordance with pressure equipment guidelines 97/23/EC (formerly TRD). And because special demands are made on materials used in high-pressure applications, we have developed the DF25-HD3 with a unique flow profile specifically intended for use with live steam. This profile has the most minimal tolerances and is manufactured from massive blocks, which means that it is not subject to any influence from heat used in welding processes. Advantage: Maximum measurement precision, maximum durability, maximum security.



*The high-precision profile of the DF25-HDD3 is manufactured using massive steel blocks - this means there are neither welding seams nor heat-affected zones.*

## Integrated Pressure and Temperature Sensors

The deltaflow can easily be equipped with integrated pressure and temperature sensors in order to compensate for pressure or temperature if necessary, eliminating the need for separate attachments.

## Low Maintenance

In most applications, the deltaflow works for years without requiring any maintenance at all. In media with high particulate content or in polluted media, we recommend using the LSP air purging system from systec Controls for periodic cleaning cycles.


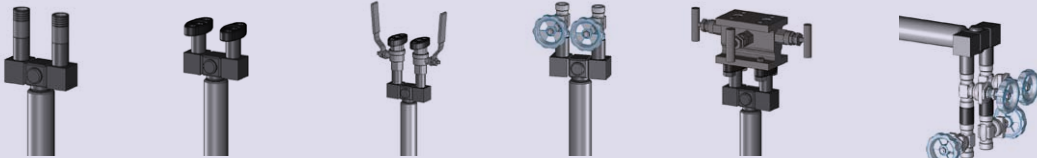
## The deltaflow's precision performance has been confirmed by the Technical University at Erlangen:

"Based on the calibration results, it can be stated that the deltaflow pitot tube causes less pressure and energy loss in conduits and enables more precise measurements than the orifices previously used in conduits."

(Dr. F. Durst, Professor)

# deltaflow Model Series



	DF 8	DF 12	DF 25			
						
<b>Pipe diameter</b>	1 - 25 mm	DN20 - DN100	DN65 - ID2500 mm			
<b>Media</b>	Gas, Liquid, Steam		Gas, Liquid, Humid Gas			
<b>Precision</b>	Better than 1% of the measured value, 0.5% after calibration (optional)					
<b>Installation</b>	weld-in, flanged or screw-in spool piece	cutting ring stud (PN40), flange connector, spool piece (screw-in, flange connection, weld-in)	cutting ring stud (PN40), flange connector, weld-in, spool piece (weld-in, with flange connection)			
<b>Sampling range</b>	To >1:30, bi-directional					
<b>Pressure range</b>	0 - 690 bar	0 - 160 bar	0 - 250 bar			
<b>Temperature range</b>	-200 to +1240 °C					
<b>Materials</b>	<ul style="list-style-type: none"> <li>• 1.0305 (studs only)</li> <li>• 1.4571 (ANSI/ASME 316Ti) (standard)</li> <li>• 1.4828 (309) (high temperature)</li> <li>• 1.4539 (904L), Hastelloy C4, Haynes Alloy (oxidizing media)</li> <li>• 1.5415 (A204), 1.7380 (A182-F22), 1.7335 (A182-F12), 1.4903 (P91) (boiler steels)</li> <li>• Additional materials available on request</li> </ul>					
<b>Options</b>	Integrated pressure and temperature sensors Weather-proof casing for harsh outdoor applications LSP air purging system for very dusty fluids (up to 200 g/m <sup>3</sup> ) Flowcom for industrial heat and energy calculation and for gas compensation Calibration by our testing stand / by external testing stands (e. g. PtB) (up to nominal length DN400. Larger nominal lengths are available on request.					
<b>Connecting the dp transmitter</b>						
	thread	oval adapter	ball valve	needle valve	three-way manifold	double needle valve
	By request the following components are also available: five-way block, Ermeto and Swagelok fittings etc.					
<b>Accreditations</b>	Eex / ATEX PED 97/23/EC	Eex / ATEX PED 97/23/EC	Eex / ATEX (Emission quantity measurement per §13 and §17 of the Federal Emission Control Ordinance (on request)) PED 97/23/EC			
<b>Material Certifications</b>	3.1 / EN 10204 3.2 / EN 10204 2.2 / EN 10204					

**DF 25HDD3**

**DF 25 Quicklock**

**DF 44**



65 -1000 mm

High Pressure Steam,  
High Pressure Liquids

weld-in

60 - 690 bar

Eex / ATEX  
PED 97/23/EC

DN65 - ID2500 mm

High pressure Gases or Liquids with  
strong tendency to pollution,  
Online cleaning

ball valve stud

0 - 100 bar

Eex / ATEX  
PED 97/23/EC

DN200 - ID15000 mm

Gas Liquid, Humid Gas,  
Liquid, Steam

flange connector

0 - 100 bar

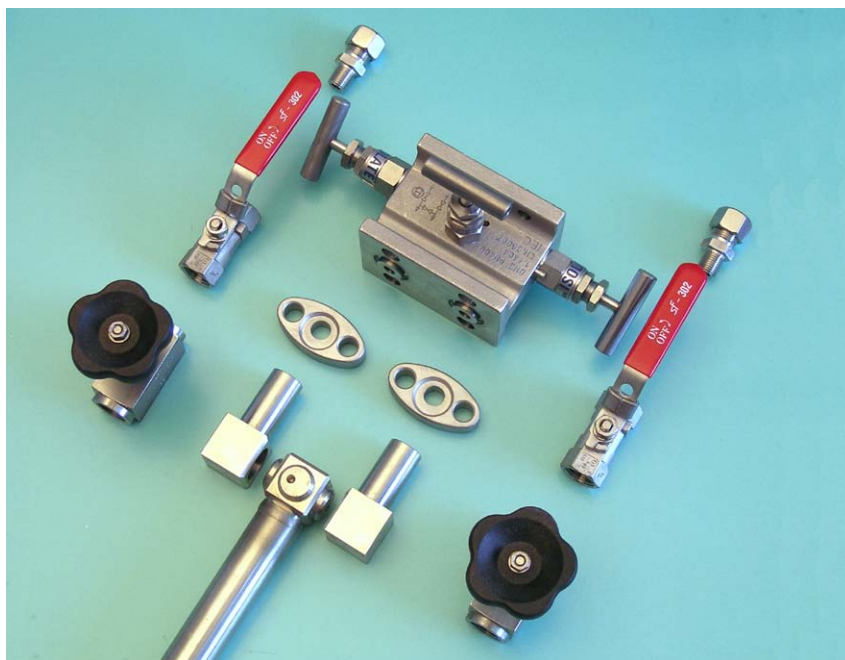
Eex / ATEX  
(Emission quantity measurement per  
§13 and §17 of the Federal Emission  
Control Ordinance (on request))  
PED 97/23/EC

# deltaflow multitask - the patented connecting concept

## The connecting concept that helps you save time and money

A connecting system is needed to transfer the differential pressure to the evaluation instrument (differential pressure transmitter); when using a traditional probe, this connecting system must be adapted to each given application, and this is usually time consuming and expensive. This problem doesn't exist if you use the patented connecting concept of systec Controls!

The deltaflow's connecting system consists of a head and two universal adapters. These components are identical for every type of fluid, i. e. for steam, gas or liquids. According to the orientation of the conduit, the head may be oriented horizontally or vertically. This means that you don't need a particular set of components for every single measurement application. And, since the deltaflow connecting concept is so flexible, it has a name which it deserves: Multitask.



deltaflow Multitask connection and a choice of primary shut-offs

## The multitask concept offers users several advantages

- Shorter delivery times and stable prices. Since all dimensions, in particular the adapter spacings, are standardized, it is possible to realize all common connections in a very short time: three-way manifold for direct transmitter installation, thread connections, needle valves and ball valves, weld-on ends as well as many others. Thanks to this modular design, delivery times are short. And the respective prices remain unchanged, as they are since many years.

### • Tested (pressure) safety

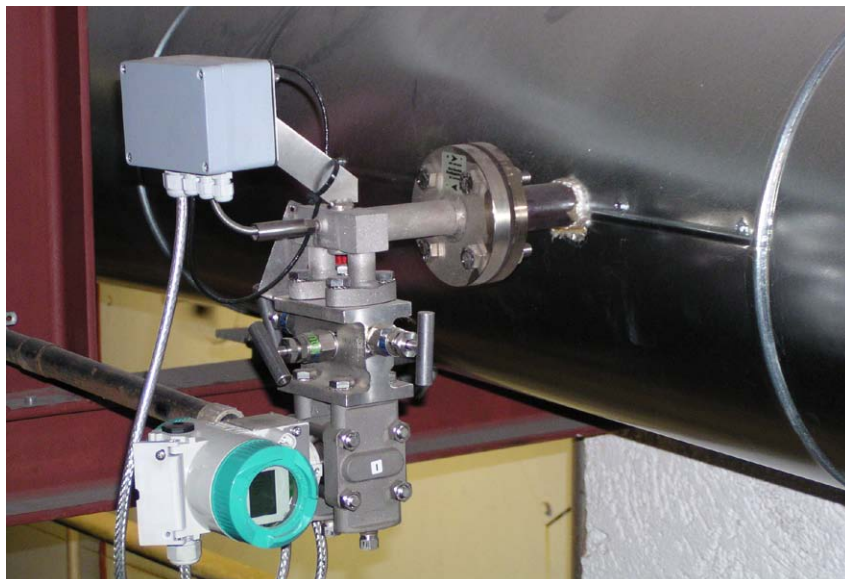
A decisive advantage: the new probe head is TÜV certified in compliance with the directive for pressure equipment PED 97/23/EC. The deltaflow therefore guarantees, in all high pressure applications, the safety users need.

## A special advantage when metering steam

An important difference, when compared with other pressure probes, is that the deltaflow doesn't need expensive condensation containers. The volume of the Multitask connection adapters has been dimensioned so that enough steam condensation is always secured. Moreover the deltaflow is insensitive to installation errors because of its condensation pots that are smaller than those of traditional probes.

## Low straight run requirements

For the purposes of flow metering, low straight run are required – more precisely, a long, straight, and undisturbed inlet path. While it is true that pitot tubes have the advantage of being able to cope very well with extremely short inlet paths, what do you do when even a short inlet path is not feasible? There is often a lack of space when installing into previously-existing conduits and in situations involving large diameter conduits.



Steam flow metering with direct installed transmitter and integrated directly temperature measurement

# ImproveIT – Installation without straight run requirements

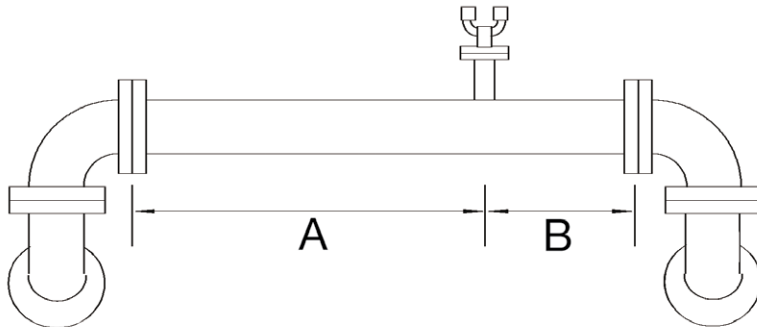
## Installation without inlet path

The ImproveIT database was compiled based on years of experience and thousands of individual calibrations using the deltaflow in situations involving shortened inlet paths. ImproveIT documents the deviations and lists calibration constants for a large number of different installation conditions. This allows us to provide well-substantiated information about the deviations and linearities you can expect in almost any flow disturbance you may encounter. Simply draw a sketch of your installation, and we will calculate the adjusted flow values for you. It really is that simple.



The systec testing facility determines the effect shortened inlet paths have on the deltaflow.

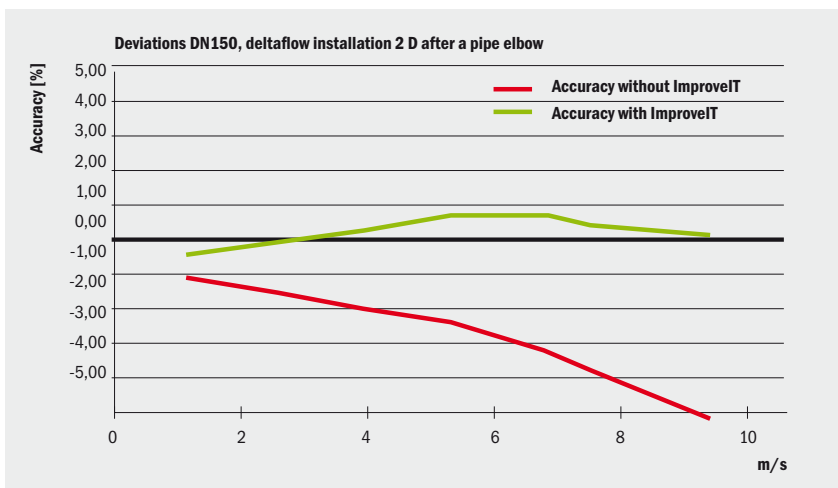
Inlet Path A	1D	2D	3D	5D	7D	10D	15D	20D	Outlet Path A
With ImproveIT	2%	2%	1,5%	1%	1%	1%	<1%	<1%	3D
Without ImproveIT			5%	3%	3%	2%	1,5%	1%	4D



An example of a double pipe elbow on multiple levels: Most flow meters require an inlet path of 20 to 40 D. The deltaflow can be installed after only 1 D with a very small degree of error. After only 7 D, the accuracy of the deltaflow enhanced with the ImproveIT database is less than 1%.

## Here's How It Works:

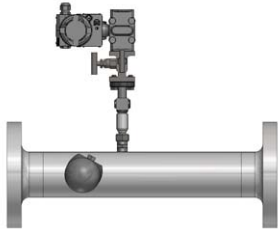
When you place your deltaflow order, you include a sketch or a drawing of your application. We will make a recommendation about the best place for installation, determine your adjustment factor, and tell you what degree of precision you can expect—all free of charge! For a small fee to cover costs, your local sales representative can take the pertinent measurements on-site if you prefer. The data provided by ImproveIT can even be transferred to probes made by other manufacturers with a slight increase in the error factor.



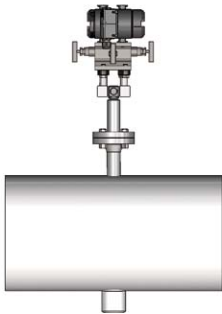
deltaflow installation 2 D after a pipe elbow. There are significant deviations without ImproveIT; all values are better than 1% with ImproveIT

### Some examples of typical installations

The deltaflow offers several installation and mounting possibilities convenient for your application as. for instance:



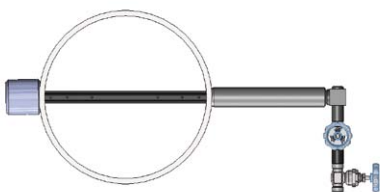
Spool piece (DF8 / DF 12 / DF 25)



Flange connection (DF12 / DF25 / DF44)



Cutting ring stud (DF 12 / DF 25)



Weld-in probe (DF12 / DF25HDD3)

### deltaflow Installation Position

#### Liquid:

In order to consider proper venting or draining location depends on type of media and orientation of pipe. To meter liquids, the entire probe should be filled with liquid allowing gas bubbles to vent off. To allow this to happen, the unit should be installed with a slight downward slope from the dp transmitter towards the measurement profile.



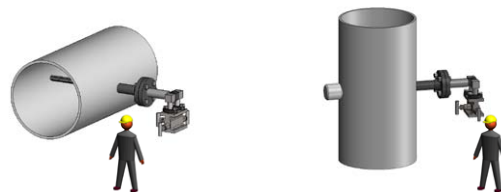
#### Gas:

For gasses, the installation theory is exactly opposite to that of liquids. The deltaflow should be completely filled with the gas, and condensation should be able to drain freely back into the conduit.



#### Steam:

The deltaflow for steam is always installed into the conduit in a horizontal position. The steam condenses in the connection adapters. The differential pressure is then transmitted across the condensate column to the transducer which is located below it.



### Upstream & Downstream Distances

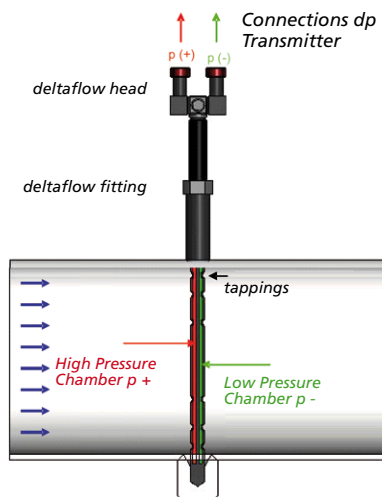
The new ImproveIT database makes it possible to use the deltaflow in applications where the inlet runs are very short. The following table shows upstream and downstream distances (in multiples of inner pipe diameter ID) and the corresponding accuracies when using ImproveIT.

	Inlet-/Out-let-path	<1 %	1%	1,5%	2%
	A (ID)	7 ID	4 ID	3 ID	1 ID
	B (ID)	4 ID	3ID	3 ID	2 ID
	A (ID)	7 ID	4 ID	3 ID	1 ID
	B (ID)	3 ID	3 ID	3 ID	2 ID
	A (ID)	7 ID	4 ID	2 ID	1 ID
	B (ID)	3 ID	3 ID	2 ID	1 ID
	A (ID)	12 ID	5 ID	3 ID	2 ID
	B (ID)	4 ID	3 ID	3 ID	2 ID

## The differential pressure method: - A proven metering principle for highest precision

The deltaflow's working principle is the highly precise differential-pressure metering method. The two separated chambers of the deltaflow are provided with pressure sensing holes (dp tapplings). These drillings isolate different pressure values in the two chambers: in the upstream one a higher and in the downstream chamber a lower pressure.

Therefore between both chambers

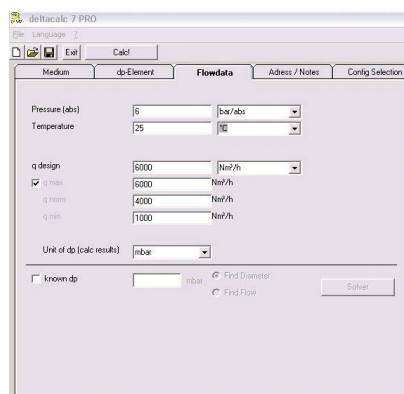


exists a pressure difference that allows the mass flow to be determined very precisely. Using a differential pressure transmitter, the differential pressure is converted in an electric signal (e. g. 4 ...20 mA / bus), proportional to the mass flow, that is then transmitted to the process control system.

A benefit for the user is that the deltaflow contains several dp tapplings making it completely bi directional and provides a steady averaging. This design facilitates extremely precise metering even with irregular flow profiles.

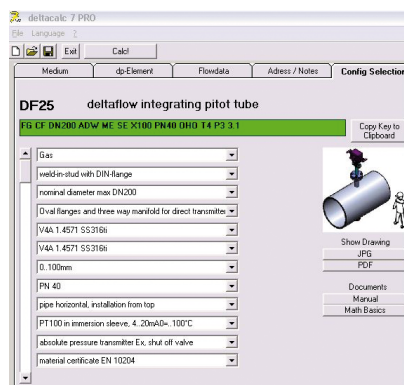
## Flow calculations

The resulting differential pressure and flow rates are calculated in the same way as with traditional primary elements. You will find the exact calculation formulas in the in the computation fundamentals which can be found on the Internet site of systec Controls and in the EN-ISO 5167. Generally, you'll receive the calculation protocol from systec Controls. Using the deltacalc calculation software you may easily verify the results your deltaflow provides you with.



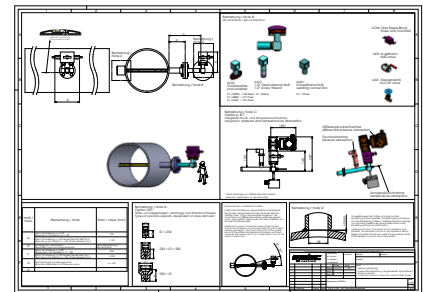
Installation and Maintenance Guide or in the EN-ISO 5167. The deltacalc calculation software allows you to easily and efficiently double-check the figures you receive from your deltaflow - to get started, download it free of charge from our website ([www.systec-controls.de](http://www.systec-controls.de)).

**Special advantages offered by deltacalc**  
With deltacalc you can configure your probe so that it exactly fits your application and then order it using the automatically generated model code. The deltacalc also generates information drawings for most applications: they also provide you with the most common dimensions.



The deltacalc always verifies if the chosen probe type suits your application so that you can be sure your deltaflow complies with your application's requirements.

A suggestion: if you get a licence from systec Controls for your deltacalc (at a small fee) you will be able to calculate and dimension not only deltaflow, but also other components like orifices and Venturis.



You can find more information and application examples at [www.systec-controls.de](http://www.systec-controls.de) products deltaflow

## This is the information we need to know when you place your request/order:

**Conduit:** Material  
Inner diameter  
Wall thickness

**Operating Conditions:** Medium  
Min.Max. pressure,  
Min.Max. temperature,  
Min.Max. flow range

**Required Certifications:** Ex / ATEX  
PED 97/23/EC  
3.1  
3.2  
Other

Your request is welcome even at on-line form at [www.systec-controls.de](http://www.systec-controls.de) (information&contact)

## Flow Metering Technology “by systec”



### deltawave

deltawave ultrasonic flow-meters are conceived for flow metering in filled or partially filled conduits as well as in open or closed canals. When installed in thermal power plants, the deltaxwave is used for the precision flow metering of the cooling water volume and for measuring its temperature. In hydroelectric power plants it controls the water supply or it may be used for leakage control, e. g. in penstocks. Thanks to its high precision, it is admitted for the acceptance test of turbines in compliance with ISO 60041; moreover, it determines the efficiency of turbines too. And also in the hydrologic field deltaxwave proved its strengths: as an outlet flow meter or even in the flood-wave forecasting. deltaxwave's ultrasonic transducers are simply mounted in the existing cross-section of the canal or of the conduit.

### flowcom made by systec

When measuring professionally, you need to evaluate the results professionally too. The flowcom is the ideal complement of deltaxflow or of any other flow metering system. It compensates the errors, due to temperature and pressure, occurring in flow meters and determines the mass or the volume of gas flows. When used for steam and water applications, it can also compute energy amounts. Its suitability is TÜV (German Technical Inspection Agency) certified and is officially licensed in accordance with §13 and 17 of the Federal Emission Control Ordinance (German BImSchV).



### deltaxflowC

The deltaxflowC meters gas flows in conduits and canals applying the highly precise differential pressure principle. Thanks to its integrated microcontroller, which performs the measurement of differential pressure and of temperature, the deltaxflowC delivers a completely pressure- and temperature-compensated mass flow signal; additionally it provides signal outputs for pressure or temperature. When it comes to gas flow metering: deltaxflowC is the multitalent at your disposal.



The headquarters of the systec Controls is located in Puchheim near Munich. Here we develop and produce our products in accordance with DIN EN ISO. But innovation and product quality alone are not enough for us. We have also submitted our systems for examination by independent institutions—and they have been clearly proven to be efficient and

reliable. And we are always available to help you, even after your equipment has been installed. You can reach our hot-line **24 hours a day, 7 days a week.**  
systec Controls - the specialists in flow metering technology.

**systec**  
CONTROLS

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