Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Easy to go with dp flow!

Reliable differential pressure flow measurement with Deltatop

Endress+Hauser

People for Process Automation

Flow measurement – more important than ever before!

Plant safety, consistent product quality, process optimization, environmental protection – these are only some reasons why flow measurement is increasingly more significant in industrial instrumentation.

Endress+Hauser supports you with application-oriented, innovative flow instruments of high quality standards – be it in filling, batching, controlling as well as registration and indication. From individual measuring points capable of communicating through to complete solutions for higher-ranking process control systems – you can always rely that we customize them according to industry and application requirements to serve your measuring task.

In recent years, flow measurement has persistently developed new fields of application using the most modern communication interfaces (fieldbuses).

The most important tasks in flow measurement comprise:

- Counting, indication and registration
- Monitoring, controlling and balancing
- Dosing and filling

And in particular, also:

- Measurement in pulsating flow
- Concentration measurement in two-phase media
- In-line viscosity measurement
- Enhanced diagnostics

You find flow instrumentation from Endress+Hauser in almost all industries, processes and utility applications:

- Chemical industry
- Petrochemical industry (e.g. oil & gas)
- Gas refueling
- Pharmaceutical industry / Life science
- Food production
- Breweries
- Dairies
- Potable water production
- Wastewater treatment
- Energy generation
- Paper production
- Filling and dosing plants
- Ship construction
- Automotive industry
- Cement processing
- Mining, etc.

A fitting solution for any application

Endress+Hauser has unique flow measurement know-how at its disposal. Our skills do not only become apparent in standard applications, but also in applications considered to be sophisticated and requiring customized solutions.
Our customer orientation starts in research and development. Together with our customers, we have developed many products considered industrial standards today. Make use of our strong dp flow competence team to increase your plant availability in an optimum fashion. Today, users benefit from our flow innovations worldwide.

Deltatop – flexibility at its best!

Flow measurement according to the differential pressure principle

A wide range of primary elements is used in liquid, gas and steam flow measurement up to 420bar (6,091psi) and 1,000°C (1,832°F). A wealth of experience contained in numerous standards makes this type of measurement well accepted and widespread all over the world.

One of the main areas of application is still measurement in hot water and cooling cycles as well as steam and condensate in secondary circuits at very high temperatures. Pitot tubes offer an alternative to orifice plates wherever keeping pressure losses low is demanded or in large pipelines with diameters of up to several meters. Differential pressure measuring systems permit the exchange of transmitters at any time without interrupting the process.

The Deltatop product family made by Endress+Hauser features proven and tested technologies with excellent operational characteristics. The combination of an innovative primary element and best practices in the selection and installation provides increased accuracy of measurements and, at the same time, lower installation and operating costs. More than 20 years of practical experience ensure perfected products and reliable results. Let us have details of your application and we will provide you with the solution.

Deltatop advantages at a glance:

- Standards applicable worldwide (since 1929), long-standing measurement tradition and a high degree of acceptance
- Universally applicable in liquids, gases and steam
- For extreme process conditions up to 420bar (6,091psi) and up to 1,000°C (1,832°F)
- Robust primary elements. Purely mechanical no moving parts
- Large range of pipe sizes (DN 10...2000). Pitot tubes even up to a diameter of 12 meters (39ft)

Compact version

The primary element and the transmitter form a mechanical unit. Every Deltatop measuring point is equipped with a primary element, valve manifold, condensate pots (for steam) as well as the Deltabar transmitter – ready for commissioning:

- For temperatures up to 200°C (390°F) (gases, liquids) or up to 300°C (572°F) (steam)
- For process pressures up to 160bar (2,320psi)

Remote version

The primary element and the transmitter are arranged at a distance from each other and connected by impulse pipes (provided by the customer). Deltatop is a modular measuring point consisting of a primary element, shut-off valves, condensate pots (for steam) as well as the Deltabar transmitter with a mounted valve manifold. The measuring point is supplied preassembled and configured.

- For temperatures up to 500°C (932°F) (of standard materials) or up to 1,000°C (1,832°F) (of special materials)
- For process pressures up to 420bar (6,091psi)

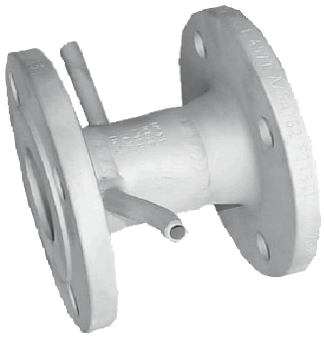
Orifice plates (DO), pitot tubes (DP), venturi tubes (DV), or nozzles (DN) are used as primary elements and are available in different designs and with various process connections.

Deltatop – flexible in application, simple in use

Orifice

Sensor	▪ Size [mm]	DN10…DN1000
	▪ Temperature	-200°C…+ 1,000°C (-328°F…1,832°F)
	▪ Max. flow velocity	Liquid: 8m/s; Gas/Steam: 60m/s
	▪ Material	Stainless steel, Hastelloy C, Duplex,…
	▪ Shape	round
Fluid	▪ State	Liquid, Gas, Steam (Gas also mixed; humid)
	▪ Max. pressure	420bar (6,091psi)
	▪ Max. viscosity	50mPas
Primary element	▪ Accuracy	0.5-1% of reading
	▪ Reproduceability	0.1% of reading
	▪ Dynamic range	max. 12:1
	▪ dp with liquid	40…2500mbar (0.6…36psi)
	▪ dp with gas	5…200mbar (0.07…2.9psi)
	▪ dp with steam	60…600mbar (0.9…8.7psi)
	▪ Pressure loss	30-90% of dp
Transmitter	▪ Display	4-line
	▪ Programming	Buttons from outside
	▪ Material	Aluminium / Stainless steel
	▪ Interfaces	PROFIBUS® PA FOUNDATION™ fieldbus FF
	▪ Power supply	10…45VDC
	▪ Ambient temperature	-40°C…+85°C (-40°F…185°F)

Nozzle



Sensor	▪ Size [mm]	DN50…DN600
	▪ Temperature	-200°C…+ 1,000°C (-328°F…1,832°F)
	▪ Max. flow velocity	Liquid: 8m/s; Gas/Steam: 60m/s
	▪ Material	Stainless steel, Hastelloy C, Duplex,…
	▪ Shape	round
Fluid	▪ State	Liquid, Gas, Steam
	▪ Max. pressure	420bar (6,091psi)
	▪ Max. viscosity	50mPas
Primary element	▪ Accuracy	1-1.5% of reading
	▪ Reproduceability	0.1% of reading
	▪ Dynamic range	max. 12:1
	▪ dp with liquid	40…2500mbar (0.6…36psi)
	▪ dp with gas	5…200mbar (0.07…2.9psi)
	▪ dp with steam	60…600mbar (0.9…8.7psi)
	▪ Pressure loss	20-60% of dp
Transmitter	▪ Display	4-line
	▪ Programming	Buttons from outside
	▪ Material	Aluminium / Stainless steel
	▪ Interfaces	PROFIBUS® PA FOUNDATION™ fieldbus FF
	▪ Power supply	10…45VDC
	▪ Ambient temperature	-40°C…+85°C (-40°F…185°F)

Pitot tube

Sensor	■ Size [mm]	DN40…DN12000
	■ Temperature	-200°C…1,000°C (-328°F…1,832°F)
	■ Max. flow velocity	Liquid: 40m/s; Gas/Steam: 150m/s
	■ Material	Stainless steel, Hastelloy C, Duplex,…
	■ Shape	round, square
Fluid	■ State	Liquid, Gas, Steam (Gas also mixed; humid)
	■ Max. pressure	420bar (6,091psi)
	■ Max. viscosity	80mPas
Primary element	■ Accuracy	1% of reading
	■ Reproduceability	0.1% of reading
	■ Dynamic range	max. 12:1
	■ dp with liquid	5…80mbar (0.07…1.1psi)
	■ dp with gas	0.5…20mbar (0.007…0.3psi)
	■ dp with steam	3…200mbar (0.04…2.9psi)
	■ Pressure loss	5-20% of dp
Transmitter	■ Display	4-line
	■ Programming	Buttons from outside
	■ Material	Aluminium / Stainless steel
	■ Interfaces	PROFIBUS® PA FOUNDATION™ fieldbus FF
	■ Power supply	10…45VDC
	■ Ambient temperature	-40°C…+85°C (-40°F…185°F)

Venturi tube

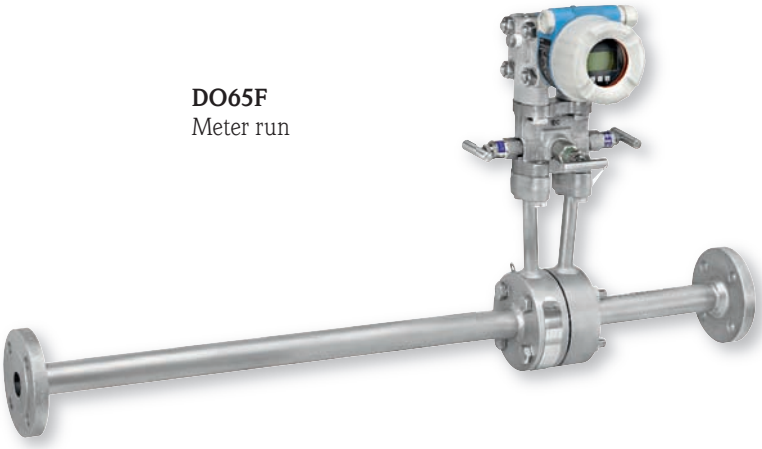
Sensor	■ Size [mm]	DN100…DN1200
	■ Temperature	-200°C … +1,000°C (-328°F…1,832°F)
	■ Max. flow velocity	Liquid: 8m/s; Gas/Steam: 60m/s
	■ Material	Stainless steel, Hastelloy C, Duplex,…
	■ Shape	round, square
	■	
Fluid	■ State	Liquid, Gas, Steam
	■ Max. pressure	420bar (6,091psi)
	■ Max. viscosity	60mPas
Primary element	■ Accuracy	1-2% of reading
	■ Reproduceability	0.1% of reading
	■ Dynamic range	max. 12:1
	■ dp with liquid	40…2500mbar (0.6…36psi)
	■ dp with gas	5…200mbar (0.07…2.9psi)
	■ dp with steam	60…600mbar (0.9…8.7psi)
	■ Pressure loss	5-20% of dp
Transmitter	■ Display	4-line
	■ Programming	Buttons from outside
	■ Material	Aluminium / Stainless steel
	■ Interfaces	PROFIBUS® PA FOUNDATION™ fieldbus FF
	■ Power supply	10…45VDC
	■ Ambient temperature	-40°C…+85°C (-40°F…185°F)

Deltatop

Orifice plates

DO61W
Measuring flange

DO62C
Corner tapping



DO65F
Meter run

Differential pressure transmitter Deltabar

Deltabar is a differential pressure transmitter which does not only meet the highest process safety requirements but also offers an intelligent operating and instrument concept:

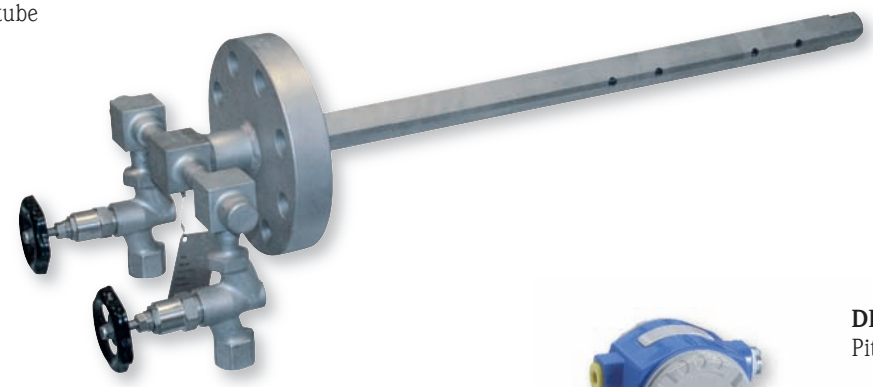
- Housing rotatable by 380° (Deltabar S)
- Clear on-site operation with display
- Sensor technology with high overpressure resistance
- Quick setup menu for easy commissioning
- Diagnosis and data storage functions
- Interfaces: HART®, PROFIBUS® PA, FOUNDATION™ fieldbus
- Approvals: Ex ia and Ex d, ATEX, FM, CSA, IEC Ex, NEPSI, TIIS and Triple Approval (ATEX, FM and CSA)

Deltabar S

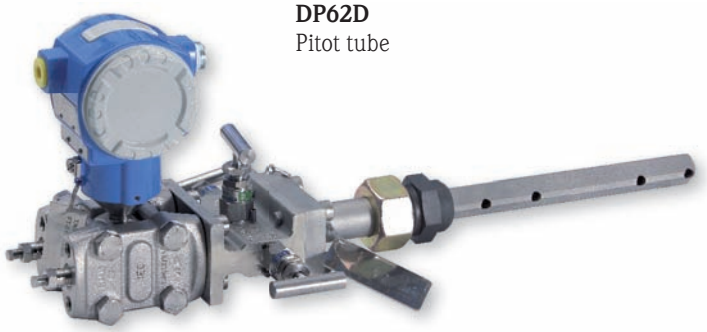
Deltatop

Pitot tubes

DP63D
Pitot tube



DP62D
Pitot tube



DP61D
Pitot tube

Deltabar M

Accessories (DA)

For the remote Deltatop version, we offer an extensive range of accessories and fittings of various materials and designs for every measuring point.

Valve manifolds

Shut-off valves

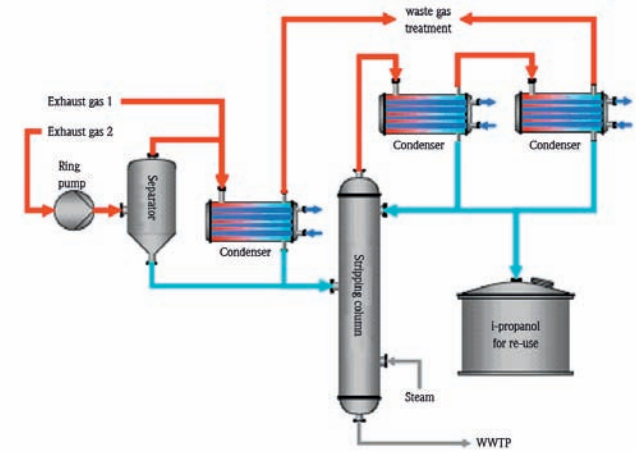
Purge unit

Condensate pot

Chemical industry

Liquid ring vacuum pumps using solvents as the ring medium

Differential pressure measurement with an orifice plate is the optimum system for flow measurement in a solvent processing plant. It is unaffected by pressure and temperature conditions and even very aggressive media can be measured after the selection of resistant orifice plate material. Differential pressure flow measurements may be adapted to process conditions in an optimum fashion. The orifice plates are designed either for the lowest pressure loss or the highest accuracy depending upon prevailing conditions. Measurements are reliable even in very low flow rates.



Layout for a liquid ring pump using 1-propanol as ring liquid.

Deltatop DO61W, DO62C, DO63C, DO64P, DO65F
Differential pressure flow measurement with orifice plates and Deltabar differential pressure transmitter

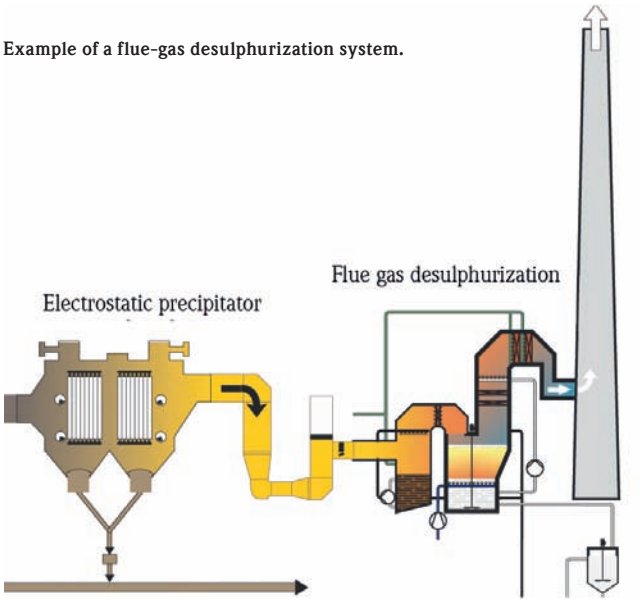
- Flow measurement of gases, steam and liquids
- Pipe diameter from DN10 (3/8") to DN1000 (40")
- Medium temperatures from -200°C (-328°F) to 1,000°C (1,832°F)
- Pressures up to 420bar (6,091psi)
- Optimized to minimum pressure loss, highest accuracy and maximum measuring dynamics

Oil & gas

Desulphurization – hydro-desulphurization

The distillate feed can range from naphta and kerosene through to middle distillate and long vacuum gas oil or mixtures thereof. Hydrocarbon feed is mixed with hydrogen-rich gas, heated and vaporized in the reactor feed/reactor effluent heat exchanger and the hydro-treatment heater and fed into the reactor with a fixed catalyst bed. Reactor conditions can vary but are typically at 30bar (435psi) to 80bar (1,160psi) and 320°C (608°F) to 400°C (752°F). Apart from steam measurement, dp flow is also used to measure any kind of gas or liquid. Specially in high pressure and temperature conditions, dp flow is quite often the only solution or a cost-effective alternative to other flow measurement principles.

Example of a flue-gas desulphurization system.



Deltatop DP61D, DP62D, DP63D
Differential pressure flow measurement with pitot tube and Deltabar differential pressure transmitter

- Universally applicable in gases, steam and liquids
- Pipe diameter from 40-12,000mm (1,5-480")
- Medium temperatures from -200°C to 1,000°C (-328°F to 1,832°F)
- Pressure up to 420bar (6,091psi)
- Compact version ready for operation to minimize installation work
- Modular remote version for demanding process conditions
- Optimized to minimum pressure loss and highest accuracy

Flue gas measurement

Flue gases are measured to regulate and control the combustion in power plants and other heating systems. This helps to reduce emission and to save fuel costs. Optimum combustion is achieved if all COx gases can be burnt with minimum oxygen consumption. Great savings can be achieved if possible deviations from optimum operation can be recognized quickly.

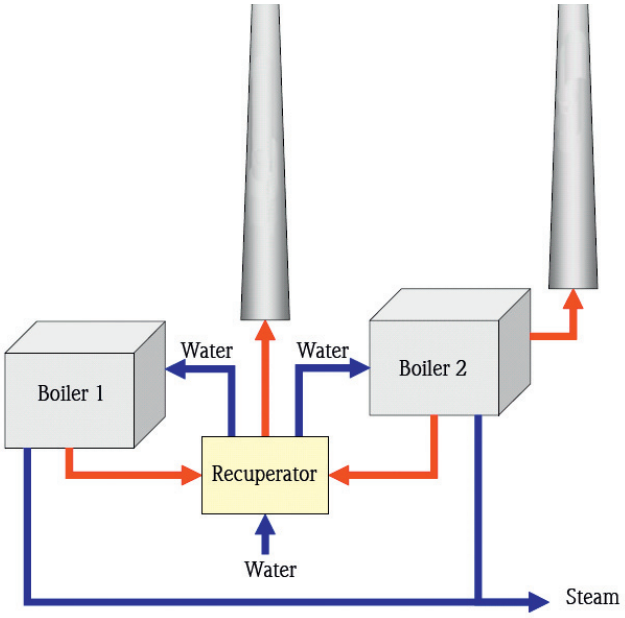
The Deltatop pitot tube is ideally suited to flue gas measurement. Due to its optimum design, the pitot tube causes only marginal pressure loss. Particularly where large nominal widths are concerned, Deltatop is a cost-effective, often the only, solution.

In dust-carrying gases, the Deltatop pitot tube is equipped with an automatic air purging facility which cleans the transmitter and the probe regularly.

Energy

Level and flow in water- and steam systems

Generally, steam is produced on-site whereas electricity is supplied by an external source. In-house cogeneration of electricity and steam is advantageous at large sites. Energy is normally provided by boilers equipped with turbines which mainly burn natural gas (about 95%) but also fuel oil. Spent solvents are often used as fuel together with gas.



The diagram shows an example of a setup with two boilers sharing an exhaust gas recuperator.

Differential pressure measurement Deltabar

The differential pressure transmitter Deltabar is the universal compact instrument for flow, level or differential pressure measurement.

- Static pressure up to 420bar (6,091psi)
- Measuring ranges from 0.5bar (0,007psi) up to 40bar (580psi)
- Sensors are function monitored
- Zero point and range are freely adjustable without calibration tools
- Simple maintenance due to modular design
- Easily exchangeable parts

The boiler feedwater circulates within the water/steam cycle. This is the main component in the power plant. After the steam has condensed in the main condenser, pumps convey the feedwater into the boiler through downstream low-pressure and high-pressure heaters. When it arrives at the boiler, the feedwater is vaporized under high pressures (up to 260bar/3,770psi) and high temperatures (550°C/1,022°F). The steam is then supplied to the turbine in order to drive the generator. Condensation in the main condenser begins again and the whole procedure is repeated. For the safe operation of the circuit, monitoring levels in the vessels, controlling flow volumes in the water and steam lines and measuring the overpressure in all parts of the plant is of great importance. High pressure and temperature resistance require that Deltatop pressure and differential pressure transmitters assume this task.

Different applications

Deltabar S PMD75
Application: Steam measurement

Differential pressure transmitter to measure flow in combination with an orifice plate, pitot tube, venturi tube or nozzle. In this case, Deltabar S is used for process steam measurement together with a standard orifice plate with corner taps. The system is equipped with heat tracing to protect it against freezing in case of a breakdown during the cold season. The advantage is constituted by simple measurement point handling. All parts are delivered to customers preassembled and configured.

Pitot tube DP63D
Application: Water measurement

Cooling water measurement in a pipe of 900mm (2,95ft) with a pitot tube. Customers have the advantage of simple and cost-effective installation. This merely requires drilling a hole into the pipe, welding a connector onto the pipe and inserting a pitot tube. Depending on the medium, pipe diameter and speed of flow, an end support is located on the opposite side to secure the pitot tube.

Pitot tube DP62D
Application: Exchangeable pitot tube for natural gas measurement

The measuring points are maintained without interfering with the process. The pitot tube does not have any moving parts and can be employed in all pressure and temperature conditions. Due to the Deltatop design the pitot tube generates low pressure losses and can be used for bidirectional measurements.

We are precise

The innovative design of Endress+Hauser primary elements facilitates higher performance and reliability. Our complete primary element product program offers a high degree of flexibility for your applications.

New insights, materials and technologies are one half of the innovation process. The other half concerns people who jointly develop the optimized solution on the basis of experience in and knowledge of our customers' processes. The development departments increase the safety and efficiency of your processes through continuous optimization. We know the specific requirements. A test center certificate or approval does not only mean having a piece of paper but the fact that the properties developed into the product for a specific industry have been tested and verified under the strictest conditions.

ATEX FM APPROVED CSA PED NACE

Testcenter

The Endress+Hauser test center (internationally accredited by: DATECH, FM, CSA) comprises three laboratories – for instrument safety, application engineering and electromagnetic compatibility. These test facilities ensure the reliability and quality of Endress+Hauser instruments under realistic test conditions and assist in their improvement. Furthermore, the instruments can be subjected to prelimary testing for new applications thus accompanying their development.

In different "endurance tests", they are exposed to the extreme conditions expected in later applications. These include dust tests (explosion protection), abrasion tests, climatic tests (heat and chill), mechanical stress tests and splash-water tightness tests. Apart from a fully automatic tank test facility with a capacity of 6,000 liter to simulate the most difficult applications the Endress+Hauser test center has an accredited EMC laboratory at its disposal.

Fully automated DKD calibration in the production process

Since November 2004 we have also successfully integrated automated calibration in the running production process. Our modern production line for the entire pressure instruments is a global innovation in the production of complex measurement technology. For the first time we offer fully automated DKD calibration of pressure instruments in the running production process.

Experience creates quality and accuracy

The best basis for manufacturing a product is quality. The experience of Endress+Hauser manifests itself in the quality of Deltatop production. Components, assemblies and products are manufactured with state-of-the-art machines by committed and highly qualified associates at different sites in Germany. This makes Endress+Hauser the right partner for your applications also in the area of flow measurement according to the differential pressure principle.

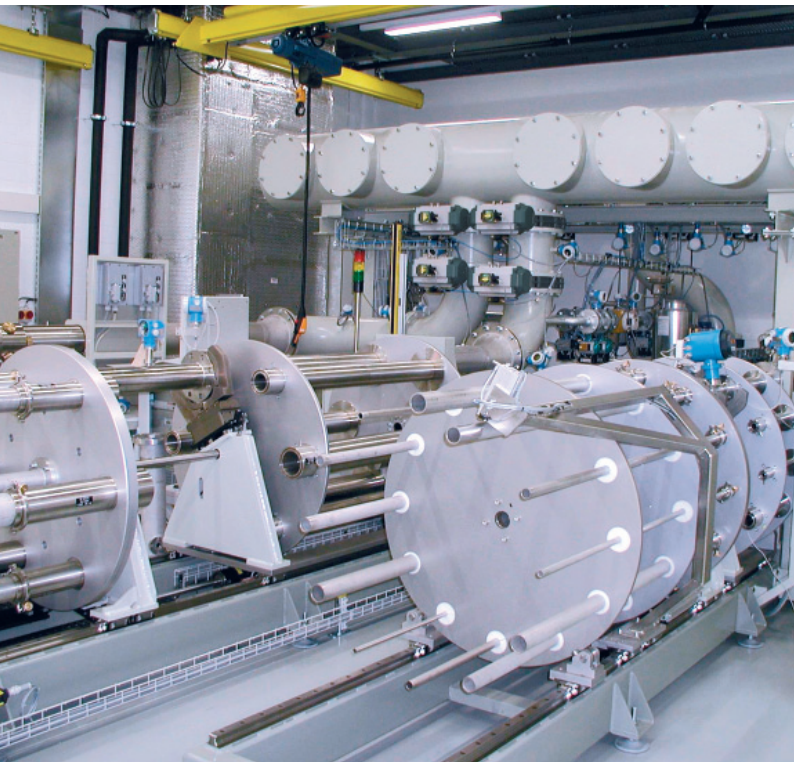
The dp flow competence team of Endress+Hauser makes sure that your Deltatop custom-made solution fits correctly.

This means customized full service for you – from consultation through to specific fabrication and support in the integration of the instrumentation into your applications. The high degree of vertical integration in manufacturing ensures optimum availability as well as the quality of products.

You may plan long-term with Endress+Hauser as your flow partner. After all, we have 50 years of experience in innovative instrumentation and many good ideas for the years to come.

The accuracy of Deltatop pitot tubes is checked, upon customers' request, by the calibration facilities of external test laboratories or by the calibration facilities at our plant. We calibrate according to specifications and document the results in a manufacture test certificate.

Gas calibration facility at Endress+Hauser for highly accurate air calibrations.



The water calibration facility ensures reproducible quality.

Applicator gives you the answer

The selection and sizing tool for your planning processes

Applicator software made by Endress+Hauser is a tool which makes the engineering process extremely reliable and also economically efficient. It facilitates safe, targeted and fast product selection as well as simple, application-oriented sizing. The Applicator made by Endress+Hauser guides you through your Deltatop dp flow application.

Advantages at a glance:

- Planning safety
- Time saving
- Secure project data
- Flexibility in work processes

The direct path to Applicator

Applicator from Endress+Hauser may be used free of charge via the Internet or on CD. You can also order the CD version online.

www.products.endress.com/applicator

Worldwide service right at your doorstep

For customers and users, Endress+Hauser instruments not only distinguish themselves by technological innovations but also by the presence of the people behind this progress, be it in service, sales or production and development. All over the world, you get exactly the service you need at your local Endress+Hauser organization or regional customer support center. And this for commissioning, repair work, on-site support, training or maintenance and calibration services.
Having one of the biggest networks of service experts in process automation at our disposal we would like to support you in discovering new possibilities and potentials to maximize benefits and lower the operational risks. We see ourselves as your reliable partner with the right advice and recommendations which will enable you to reduce costs and risks continually.

Endress+Hauser service:
Global, competent and reliable

At a glance

- Installation and commissioning
- Project management
- Upkeep concepts
- Maintenance contracts
- Spare part service
- Workshop service
- Training
- Helpdesk
- On-line documentation
- Calibration services

People for Process Automation

Endress+Hauser is a provider of process automation solutions operating world-wide. We develop measuring technology which acquires, transmits and handles information from processes for production and logistic purposes. The excellent products in relation to performance and price as well as future-oriented services support the competitiveness of customers by the highest degree of quality, safety and efficiency. Operating a closely woven network of its own production and sales companies and together with agencies, Endress+Hauser maintains a strong presence in all world markets. We owe our good reputation to our industry-specific know-how and the creativity and the commitment of our associates. Endress+Hauser stands for financial strength and continuity, the broadest product range in process industry and long-term customer relations.

More about us: www.endress.com

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Instruments International

Endress+Hauser
Instruments International AG
Kaegenstrasse 2
4153 Reinach
Switzerland
Tel. +41 61 715 81 00
Fax +41 61 715 25 00
http://www.endress.com
info@ii.endress.com

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UE/INDD CS2

Endress+Hauser
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