

Measurement of Flow and Heat Quantity in Gas- and Liquid-Carrying Pipes

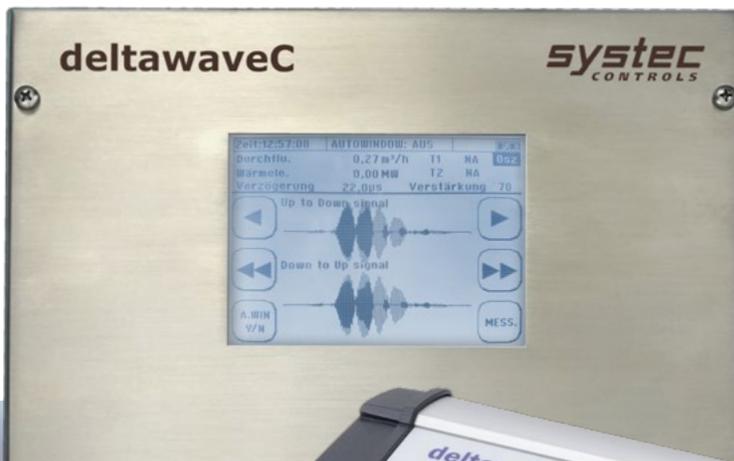
- precise
- simple
- non-intrusive and maintenance-free

I.01.940-E-210811
www.tempco.be

deltawaveC

deltawaveC-F stationary

deltawaveC-P portable



Contactless flow measurement for liquids and gases

deltawaveC-P is for mobile sample measurements and measurement tasks over a longer period of time. deltawaveC-F is for continuous measurements in fixed installation. Both devices use the proven, highly precise ultrasonic transit time difference method. With latest digital signal Processors works deltawaveC extremely precise.

Saves Installation and operating costs

Thanks to clamp-on technology, the ultrasonic transducers used can be installed in a matter of minutes. Disconnecting the pipeline and process interruptions are not necessary. deltawaveC-Devices contribute to the optimization of operating costs.

The contactless measurement is virtually...

- 100% leak-proof and pressure-resistant
- 100% drift free
- 100% wear-free and thus maintenance-free
- 100% free of pressure loss and thus energy-saving

With the Quick Setup option parameterization takes less than one minute. Online help makes the manual unnecessary for most tasks. The large, backlit display presents all menu items and displays in plain text. Also, the clear menu structure and the easy operation via eight keys ensure user-friendliness.

Highly precise through auto-optimizer even under the most difficult conditions

Thanks to the auto-optimizer, deltawaveC also gets problematic measuring points well under control. Pipe and fluid are a complex sound system. The acoustic characteristics define how well the coupling of the ultrasonic signals works and how much signals are distorted. The optimal attach of the ultrasonic transducers and an intelligent signal optimization affect massively the signal strength and -distort and thus the accuracy and reliability. High signal levels provide reserves when interference is impinge e.g., in the form of gas bubbles, growing incrusts, EMC or fouling in the pipeline.

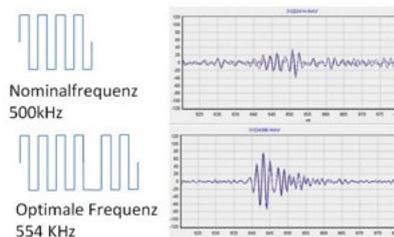
Automatic signal generation and evaluation

The distortion of the received signal and the achievable signal levels depend on the quality of the coupling, but also of whether the transmitting frequency and the frequency spectrum of the Pipeline harmonizes well. The variation of the signal frequency and the selection of transmit signals with different stimulus-/damping proportions was previously reserved for experts with the help of an oscilloscope. In the cross-correlation the ultrasonic scans of the up- and downstream signals are placed on top of each other and moved until an optimal "Coverage" of the signals is reached.

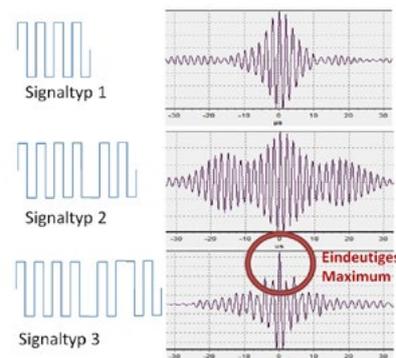
Automatic signal optimization facilitated "impossible" clamp-on measurements

On Click, deltawaveC varies the transmission frequencies as well as the signal encoding and analyzes the results regarding amplitude, signal-noise-ratio, signal distortion and significance of cross-correlation results. These evaluation provides the optimal settings for this measuring point.

The automatic signal optimization improves especially with unfavorable pipe/sensor combinations the signal quality enormously: The measurement has smaller zero point errors, better accuracies, lower measurement noise and more reserves against influences such as gas bubbles, solids or EMC- disturbances. Even at "simple" measuring points, the Signal optimization reduces the zero point errors and allows more dynamic measurements with lower measured value variance.



By automatic adapting frequency to the pipeline the coupling and decoupling of the signals works significantly better



By selecting the optimal combination of excitation pulses and damping pulses, a maximum can be found in the correlation-function.

deltawaveC

Clamp-on-gas measurement made easy

Until the development of the self-optimization of the delta-waveC, the clamp-on-gas measurement was very sensitive: Due to the large Impedance jump between the pipe wall and the gas in the pipeline, the sound energy is 10-potencies lower than for liquids. Since the pipeline and the process parameters of the fluid are usually fixed by the application, the measurement technology must be optimized for the measuring point.

Adjusted signal frequency and special damping for optimal signal quality

One solution is to offer a variety of different ultrasonic transducers for the various pipes and pipe materials to avoid the dreaded mismatching. The Consequence: Users would have to buy numerous transducers.

The new deltawaveCoG devices are using a different approach: The ultrasonic transducers are broadband, i.e. they are proficient not to use only one frequency but can be „detuned“. By adjusting the signal frequency to the pipeline, the coupling succeeds much better than with a fixed Frequency. In problematic applications, the benefit is considerable in signal strength: With the same gain, often the 2- to 8-fold signal amplitudes are achieved.

Another problem is the „distortion“ of the signals that are resulting from multiple reflections and the ringing (linger of sound) of the pipeline. A good but very up-to-work method is the mechanical damping of the pipeline. In this case damping elements, e.g. thick adhesive films or pressed plastic plates, are used in the vicinity of the ultrasonic transducers, which reduce the reverberation of the pipeline.

Here, too, the new deltawaveCoG device generation is more convenient: The transmission signals do not only consist of a transmitting part, but also, an attenuation part, in which a damping signal is generated in phase opposition to the transmitting signal, which effectively reduces the ringing in the pipeline. The result: Clearer reception signals, distortion and ringing are significantly reduced and thus more stable measured values as well as higher accuracies.



Gases	Natural gas, air (other gases on request)		
Temperature range for transducers	-40 – 150°C		
Pipe materials	Carbon steel, VA steel (other materials on request)		
Diameter	DN25-DN700		
Pipe wall thickness	LW10	2 – 5 mm	
	LW05	4 – 9 mm	
	LW03	7 – 15 mm	
Pipe inside diameter	LW10	40 – 90 mm	
	LW05	90 – 450 mm	
	LW03	90 – 700 mm	
	(other dimensions on request)		
Assembly mode	Z		
Media pressure (bar) Application dependent, typical field of application for Naturalgas, nitrogen, compressed air	Minimum pressure	metal	plastic
		LW10	10 (ID > 60 mm)
	LW05	5 (ID < 60 mm)	
		15 (ID > 120 mm)	1
	LW03	10 (ID < 120 mm)	1
(low pressure on request)			
Flow velocity	0.01...35 m/s, depending on the pipe diameter		
accuracy (volume flow)	± 1...3 % v. MW ±0.01 m/s application dependent		
	± 0.5 % v. MW ±0.01 m/s for field calibration		
reproducibility	0.15 % v. MW ±0.01 m/s		

Precise and reliable flow measurement

deltawaveC flowmeters operate according to the high-precision ultrasonic transit time difference method. Here, two ultrasonic transducers are mounted externally on the pipe and connected to the processing electronics.

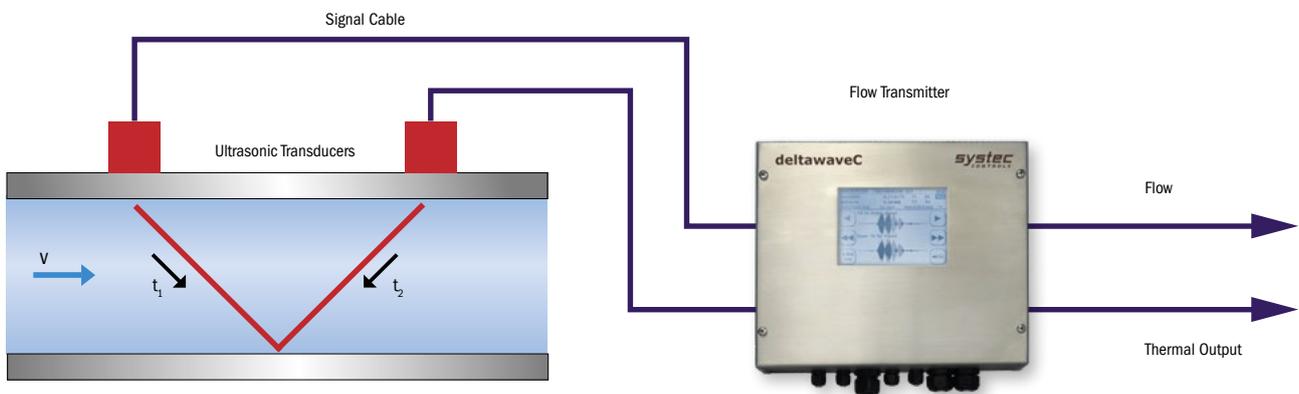
The ultrasonic transducers operate alternately as transmitters and receivers and transmit ultrasonic signals to one another, whereby the respective signal transit times of the outgoing and return signal (t_1 , t_2) are measured.

The deltaxwaveC measures the transit time difference of the ultrasonic signals

t_1 and t_2 that run with and against the direction of flow. These signals are accelerated (t_1) or delayed (t_2) by the flow of medium. The resulting difference in the two signal transit times is proportional to the flow velocity and, together with the pipe geometry, is used to precisely calculate the flow.

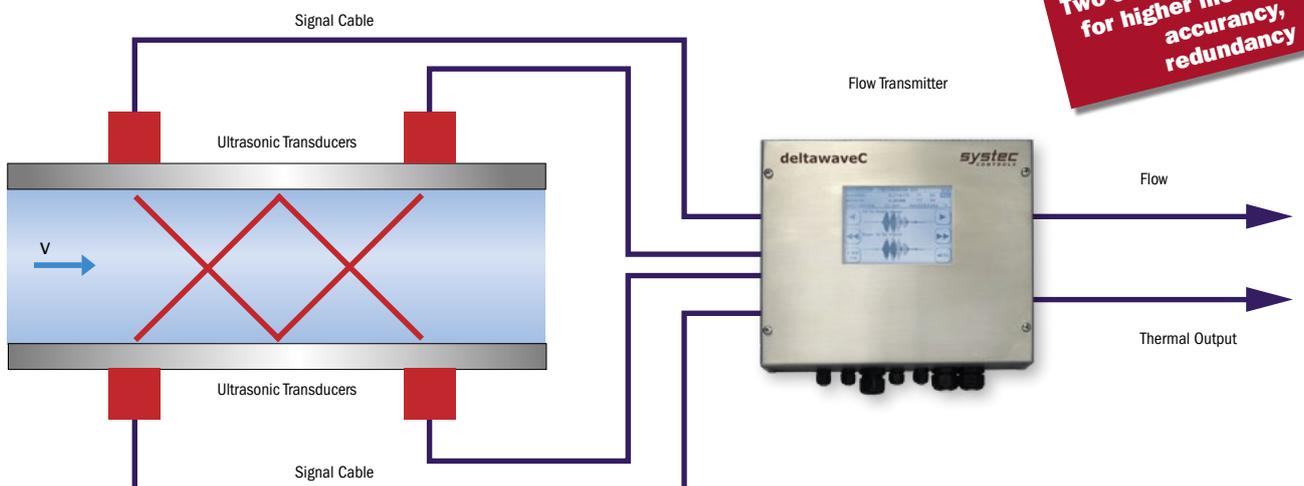
The use of multiple processors working in parallel means that deltaxwaveC achieves an extremely high measurement rate. Signal processing takes place in high-performance DSPs which are extremely precise and operate at very

high resolution. This enables the device to achieve internal resolution below 0.001 m/s flow velocity. Because the transit time measurement is completely digital, the measurement electronics are virtually drift and calibration-free. In this method, the flow rate is measured many times over, or typically from 50-150 times per second. The high number of measurements – as well as the use of the most modern digital signal processing – makes the deltaxwaveC highly reliable even under extremely dynamic, challenging processing conditions.



Flow measurement according to the precise and reliable ultrasonic transit time difference method – shown here in V mode

deltawaveC-F offers an optional two-channel measurement. Thus it is possible to realize either two different measuring points in one device or provide a conduit with two measurement paths. By using two different measuring points, the channels can be combined. Outputs such as addition, subtraction and averaging of the channels are possible. Equipping one flow measurement on a pipe with two measuring paths enables the compensation of disturbed flow profiles and reduce uncertainties. Additionally the redundancy ensures a higher measuring certainty.



Two-channel measurement for higher measurement accuracy, redundancy

Compensation of disturbed flow profiles with two-channel measurement

deltawaveC

High-performance measurement and evaluation process - even for difficult applications

Stable and reliable measurement under extremely difficult conditions

Ultrasonic signals are disturbed by a variety of influencing variables, including electromagnetic radiation, the presence of gas or solids, machine noise, etc. In conventional devices, in order to detect the ultrasonic signals to be evaluated within this "ambient noise" the signal amplitude must be several times that of the noise. An intelligent analysis method was developed for deltawaveC that detects the ultrasonic signals when the amplitude of the noise is several times more than that of the signal amplitude. The advantage for deltawaveC users: absolutely reliable and stable measurements, even in extremely unfavorable conditions.

This enables measurements even under conditions where high particle and gas loads are present – an impossible task for conventional devices.

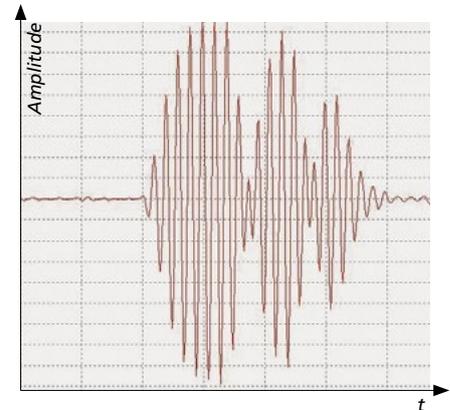
Verified signal quality ensures reliable measurement

deltawaveC's integrated oscilloscope function checks and verifies signal quality. This allows graphical signal display and the quick and easy verification of signal quality.

Modern cross-correlation process tackles the toughest measurement tasks

To ensure reliable measuring results even under difficult measuring conditions, for deltawaveC systec Controls developed modern and powerful signal processing algorithms. For reliable detection, deltawaveC employs - similar to the GPS satellite navigation system - encoded signal packets (bursts). Via the built-in phase shifts and clearly defined number of oscillations, prior to being sent the bursts receive a unique identity - just like a fingerprint. On the receiving end, the digital signal processor (DSP) then employs a cross-correlation method to uniquely determine the time (maximum correlation) at which the transmission signal matches a stored reference signal.

This allows the signal reception times required to determine the transit time to be determined very precisely. This also permits the clear identification of the desired signals in the event of high noise levels and/or low signal amplitude (e.g. high particle content in the medium) by means of cross-correlation. Your advantage: reliable and accurate measurement results even under difficult measurement conditions.



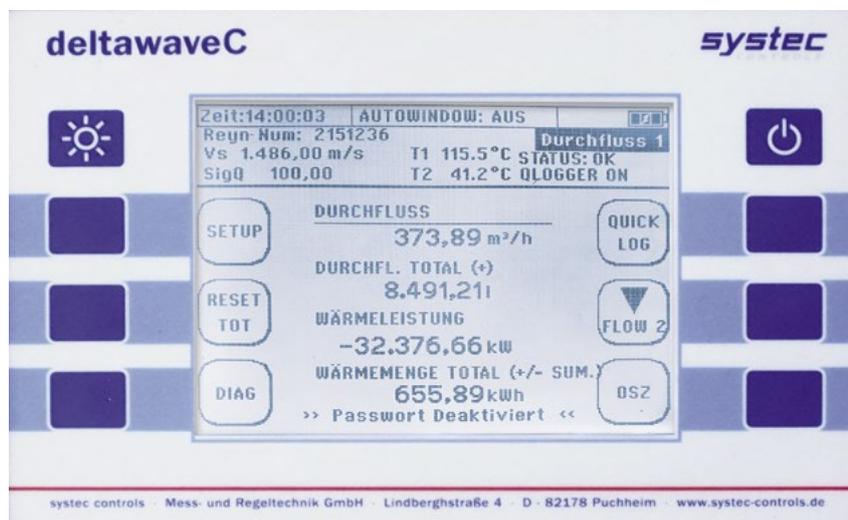
Encoded signals: typical signal packet with two 180° phase shifts for reliable signal recognition.

AFC technology for high accuracy under changing process conditions

AFC Automatic Fluid Control

Ultrasonic meters are dependent on the acoustic velocity of the relevant medium, which varies with the composition and temperature. This is well-known and with proper parameterization is not a problem. However, many conventional devices are programmed for water with a temperature of 20° Celsius, for example. If the temperature changes to 50° C the transducers would basically have to be repositioned. In everyday measurement practice this would be impractical, and is rarely done. The result is a loss of accuracy.

deltawaveC compensates for this effect by means of AFC technology and by newly developed, high-performance algorithms. The advantage is that the transducers need not be repositioned, and accuracy is virtually unaffected by typical process fluctuations. This also results in high measurement accuracy even under changing medium conditions, e.g. due to changes in temperature or composition.



All relevant measured variables at one screen

Integrated Heat Quantity Measurement

deltawaveC-P is compatible with the most common pipe sizes (DN10 - DN6000) and cross-sector applications. deltawaveC is not only a flowmeter, but also includes an integrated heat quantity measuring function. Together with the optionally available clamp-on temperature and ultrasonic transducers, heat and cooling quantities can be recorded and documented with reliability and accuracy. deltawaveC now also records mass (kg, T) and mass flow (kg/s; kg/h; T/s; T/h).

Rising energy prices and legal requirements regarding environmental protection and plant efficiency necessitate the ongoing optimization of energy flows. Whether monitoring the district heating networks that span from power stations to the consumer, process heat in the chemicals industry or in building services

engineering – assessing the energy performance of heat flows is tremendously important in many application areas. The integrated thermal energy measuring function of the deltawaveC enables rapid and convenient recording of heat flows. External, optionally available temperature sensors placed in the feed and return flow are used to measure the temperature difference. In parallel, deltawaveC-P measures the volume flow and, from this, calculates the heat flow, taking into account the specific heat coefficient of the medium. The temperature sensors can be matched in pairs on the device in order to increase measurement accuracy. All this takes place without penetrating the piping system – temperature and flow sensors are simply clamped on the pipe from the outside.

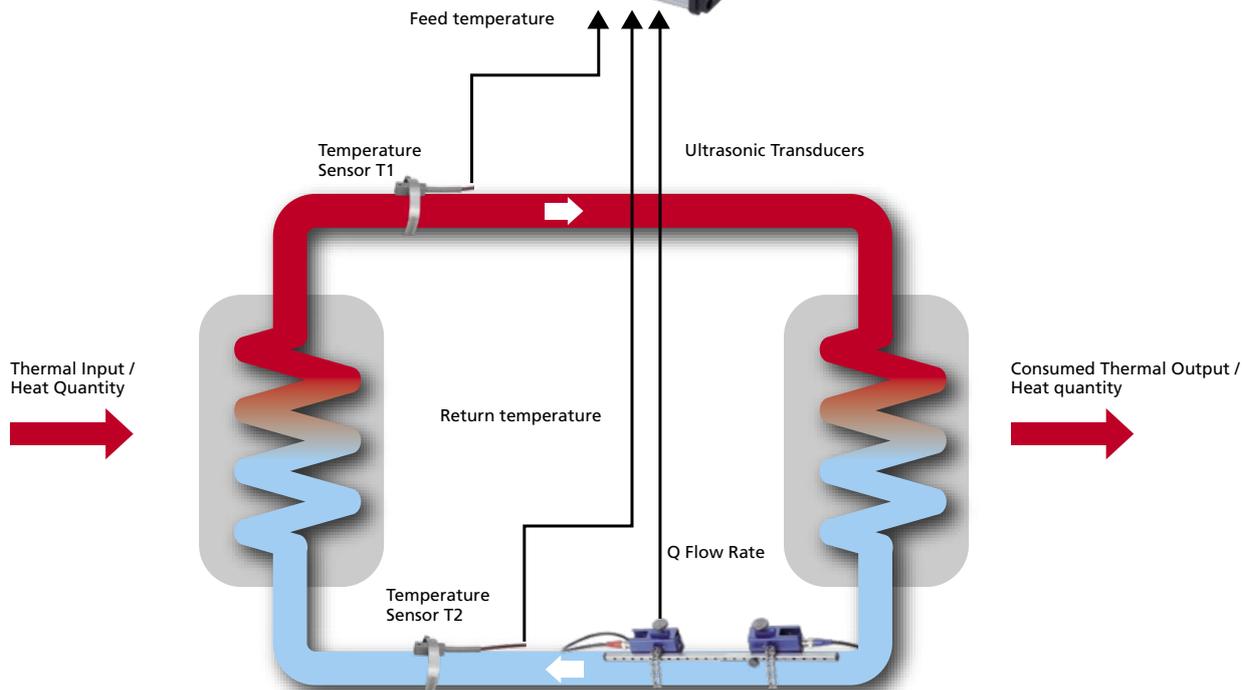


Thermal energy metering at Stadtwerke München



Thermal Output / Heat quantity

Volume Flow / Quantity



deltawaveC

A single device for multiple metering applications

Broad Application Spectrum

deltawaveC-P is compatible with the most common pipe sizes (DN10 - DN6000) and cross-sector applications. deltaxwaveC is not only a flowmeter, but also includes an integrated heat quantity measuring function. Together with the optionally available clamp-on temperature and ultrasonic transducers, heat and cooling quantities can be recorded and documented with reliability and accuracy.

Typical applications include:

Power Stations

- Circulating water/service water
- District heating networks
- Pump protection
- Condensate and feed water measurement
- Heavy and light oil

Water and wastewater management

- Sewage treatment plant inflow/effluent
- Drinking water networks, verification of water meters
- Pump protection
- Distribution and consumption metering
- Leakage detection

Building Services Engineering

- Hot and cold water
- Cooling systems & air-conditioning units
- Hydraulic compensation
- Pump control and set-up
- Optimization of heating systems

Chemicals and Petrochemicals

- Crude and light oil
- Industrial and waste water
- Aggressive and toxic media
- Measurement of heat carriers, e.g. thermal oils

Food and Beverage Industry

- Hygienic, reliable measurement of media
- Dosage measurements
- Cleaning solutions
- Water
- Beverages

Another advantage of the clamp-on ultrasonic flow metering: since the ultrasonic transducer does not come into contact with the medium, the measurement is:

- 100% contamination-free
- 100% hygienically safe

This is particularly interesting for quantity measurement of food and pharmaceutical products, and simplifies volume measurement of toxic or environmentally harmful liquids. Flow metering with the deltaxwaveC means no additional sealing surfaces or dead volumes!

Ex applications

The pressure encapsulated housing and the ultrasonic Ex-transducers make sure that the deltaxwaveC can be used in hazardous areas. Also a cost-effective way to combine a standard permanently installed deltaxwaveC-F device (outside hazardous area) with Ex-transducer (inside hazardous area) is possible.



High-performance ultrasonic transducer

AND technology ensures outstanding signal quality

AND Technology (Anti-Noise Deflector)

With the aid of AND technology the ultrasonic waves are guided and coupled such that unwanted echoes and signal dispersion are avoided, reducing noise and thus making energy available in the form of useful signal energy.

This is made possible by the newly developed design of the ultrasonic transducer (deflector), which achieves a signal yield several multiples greater in comparison to conventional devices.

Thanks to high-performance metal housing, the ultrasonic transducers are suitable for applications up to 380°C. This enables many high-temperature applications to be realized cost-effectively without special transducers, e.g. in district heating networks.

Fast, secure transducer mounting

Mounting with the mounting rail is simple: using the pre-defined hole matrix makes positioning the ultrasonic transducers on pipes a quick, secure and precise affair. This also avoids failed installation.

Selection of Ultrasonic Transducers for Transit Time Measurement

Typ	Medium temperature	Inside diameter
deltawaveC-P portable: XUC-PW-F40	-40...150°C	DN10...DN100
deltawaveC-F permanently installed: XUC-FW-F40	-40...150°C	DN10...DN100 <i>optional:</i> ☒
deltawaveC-P portable: XUC-PW-F10	-40...150°C	DN32...DN400
deltawaveC-F permanently installed: XUC-FW-F10	-40...150°C	DN32...DN400 <i>optional:</i> ☒
deltawaveC-P portable: XUC-PW-F05	-40...150°C	DN200...DN6000
deltawaveC-F permanently installed: XUC-FW-F05	-40...150°C	DN200...DN6000 <i>optional:</i> ☒

us-transducers also available with Ex-accreditation



Ex-Version

Ex us-transducer ambient temperature
-40°C < Ta ≤ 80°C
Accreditation: ☒ II 2G Exd II C T6...T3 Gb

New:

Now also high temperature transducers available DN25 ... DN400



HT XDR 500 - 55 ... 380°C
DN25 ... DN400

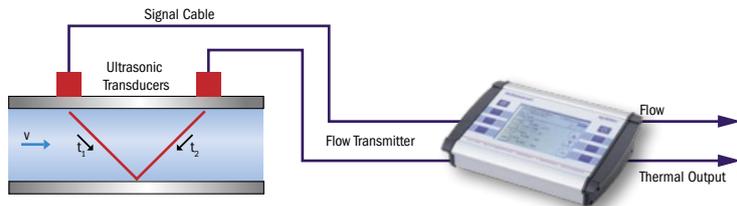
Ultrasonic transducers for permanent installation, degree of protection: IP68

deltawaveC

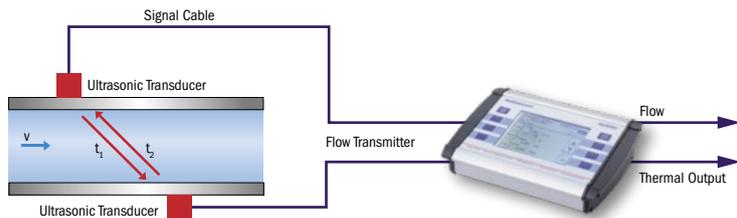
deltawaveC ultrasonic transducers – optimum metering performance for your application

The high-performance ultrasonic transducers are optimized for maximum signal yield and outstanding metering performance. deltaxwaveC's three ultrasonic transducer types can be used for most flow applications. One device for almost all measurement tasks! All ultrasonic transducers are clamped on the pipe externally and delivered with practical installation material. Installation is a matter of minutes – and there's no need to penetrate or open your pipe. Your process does not have to be interrupted.

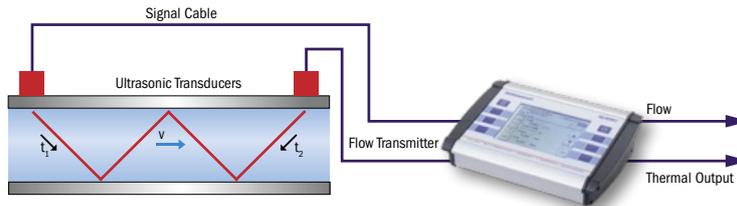
Typically, depending on the application and amount of space available, the sensors can be attached to your piping in the Z, V and W mode.



Mounting in V mode, standard mode



Mounting in Z mode, typical for large pipes



Mounting in W mode, typical for small pipes



deltawaveC transmitters and their data

Measurement	
Principle	Ultrasonic transit time difference with AFC technology
Values Measured	Flow, flow speed, heat flow
Totalizers	Heat quantity, volume
Measurement range	-30...+30 m/s
Signal damping	0...100 sec (adjustable)
Diagnostic functions	Acoustic velocity, signal strength, SNR, signal quality, amplitude, energy. Oscilloscope function allows graphical display and analysis of signals.

Measurement Accuracy		
Inner Diameter Ø	Range	Deviation
10...25 mm	2...30 m/s	2,5% of reading
	0...2 m/s	± 0,05 m/s
25...50 mm	2...30 m/s	1,5% of reading
	0...2 m/s	± 0,03 m/s
50...300 mm	2...30 m/s	1% of reading
	0...2 m/s	± 0,02 m/s
300...6000 mm	1...30 m/s	1% of reading
	0...1 m/s	± 0,01 m/s

Reproducibility for the vast majority of applications is <0.2%



Fast, safe transducer assembly, thanks to systec „Quickmount“ technology



Large QVGA display, easy handling



deltawaveC-P	
Operation	Intuitive via 8 main keys (Soft Keys), plain text display
Languages	DE, EN, CHN, F, E, RU among others
Units	Metric / US
Outputs	2x 4...20 mA (NAMUR NE43) 1x Impuls (20; 40; 60 ms) 1x Relais 1x MicroUSB
Inputs	2x PT100
Integrated Data Logger	4 GB
Data Logged	Measurement, diagnostic data and totalizers
Data Format	Text format, can be directly imported into all standard programs such as MS Office, MS Works etc.
Memory Cycle	Adjustable 1 second to 24 hours
Measurement Channels	1
Power Supply	Integrated rechargeable battery and 100-240V AC wide range adapter
Battery Operation	Approximately 12 hours (expandable on request)
Protection Class	IP40
Housing	Aluminium, PVC
Dimensions (LxWxD)	265 x 190 x 70 mm
Operating Temperature	-20...60°C
Weight	1,5 kg
Display	QVGA (320x240), black and white, adjustable back-lighting

deltawaveC-F	
Operation	Intuitive via 8 main keys (Soft Keys), plain text display
Languages	DE, EN, CHN, F, E, RU among others
Units	Metric / US
Outputs	2x 4...20 mA (NAMUR NE43) 1x Impuls (20; 40; 60 ms) 1x Relais <i>optionally:</i> RS232 / RS485 RS485 supports Modbus (RTU/ASCII)
Inputs	2x PT100
Integrated data storage	4GB, local data logging optional
Measurement Channels	1, optionally 2
Power Supply	85-264VAC, 18-36VDC (opt.)
Power Consumption	10 W
Protection Class	IP65
Cable Connections	Screw terminals
Housing	Stainless steel, wall-mounted
Dimensions (WxHxD)	300 x 260 x 108 mm
Operating Temperature	-20...60°C
Weight	4.1 kg
Display	QVGA (320x240), black and white, adjustable back-lighting

deltawaveC-F Ex	
<i>Technical data as deltaxwaveC-F except for:</i>	
Accreditation	II 2 G Ex de IIC T6
Housing	Stainless steel wall mounting
Dimensions (WxHxD)	398 x 310 x 242 mm
Operating Temperature	-20...50°C
Weight	19,93 kg

2 Kanal-Version deltaxwaveC-F / C-F Ex	
<i>Technical data as 1-channel version except for:</i>	
Outputs	2x 4...20 mA (NAMUR NE43) 1x Impuls (20; 40; 60 ms) 1x MicroUSB 1x Relais <i>optionally:</i> RS232 / RS485 RS485 supports Modbus (RTU/ASCII)
Measurement options	2 Individual channels Channel sum Channel difference Average of channels



deltawaveC

Accessories

deltawaveC-WD, the new wall thickness gauge for precise and easy measurements of the thickness of pipes and components, not only performs well as an accessory to the deltaxwaveC. Like the deltaxwaveC flowmeter, the device operates on the ultrasonic transit time method.

The thickness measurement is possible for all conventional piping materials like steel, copper and plastics.

Simply power on, input the pipe material and place the ultrasonic sensor on the pipe. The deltaxwaveC-WD shows the exact wall thickness.



Also available
for hire

deltawaveC units are for hire

You only need an ultrasonic flow metering unit temporarily, or you'd like to extensively test the deltaxwaveC-P? Simple: our deltaxwaveC-P units are for hire.

We'll also be happy to visit you on-site to carry out measurements.



The mobile deltaxwaveC-P measuring device comes in a robust practical carrying case complete with flow transmitter, ultrasonic transducers, installation material, signal cable and coupling grease, SD memory card and power supply.

Online Enquiries

directly under
"Contact & Information" at
www.system-controls.de

Flow metering technology “by systec”

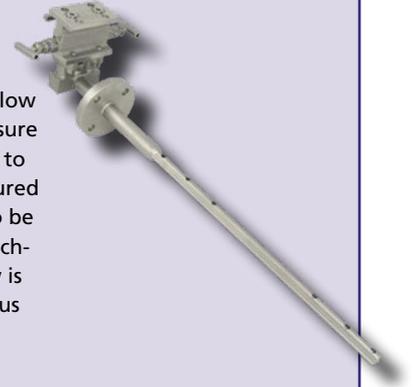


deltawaveV2 flow meter for channels, pipes and rivers

deltawaveV2 measures the flow of water and wastewater according to the multiple-path ultrasonic transit time difference method. This – as well as thanks to the use of modern digital signal processing - enables accuracies of better than 0.5%. A single deltaxwaveV2 electronic unit can serve up to 4 independent measurement points. Precise, reliable and virtually maintenance-free, deltaxwaveV2 is ideal for monitoring, control and accounting measurements.

deltaflow for flow metering of gas, steam and liquids

The deltaflow pitot tube has proven its effectiveness a thousand times over for measuring the flow and volume measurement of gas, steam and liquids in pipes. Pitot tubes induce the lowest pressure loss of all differential pressure elements, which means that many applications can look forward to energy savings of several thousand Euros per year. With an accuracy of up to 0.4% of the measured value as tested by the Physikalisch-Technische Bundesanstalt (PTB), the deltaflow probe can also be reliably used in the most adverse conditions. deltaflow is extremely robust and TÜV (German Technical Inspection Agency) tested for use in condensing, aggressive and dirty flue gases. deltaflow is available for pipe diameters from 1 mm – 15 m and a pressure level of up to 690 bar and can thus be used for the vast majority of flow applications.



deltaflowC

The deltaflowC measures the mass flow of gases in pipes and channels. Thanks to the integrated differential pressure, pressure and temperature sensors and patented microprocessor technology, measurement accuracies of greater than 2% can be achieved. The deltaflowC is particularly impressive on the strength of its high dynamic performance, zero-point stability and ease of operation. Practical, maintenance-free and available at good value for money, deltaflowC enables you to keep your process costs under control.



The head office of systec Controls is located in Puchheim, near Munich. Here, we develop and manufacture our products according to DIN EN ISO 9001. But innovation and product quality alone are not enough for us. We have also had our systems tested by independent institutes – with clear,

proven success. And of course, we are there for you even after the installation of your system. Our service-crew will assist you at your plant.

systec Controls – the specialist in flow measurement technology.

Presented by:

systec
CONTROLS

Mess- und Regeltechnik GmbH
Lindberghstraße 4
82178 Puchheim
Germany
Phone: ++49 89 / 8 09 06 - 0
Fax: ++49 89 / 8 09 06 - 2 00
info@systec-controls.de

systec Controls
++49 89 / 809 060

www.systec-controls.de