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Description

DUC uses the effect of acceleration and decelaration of acoustic signals travelling in a moving fluid. Two ultrasonic clamp on transducers are mounted (from outside) on a pipe and produce an acoustic path. The transducers send and receive acoustic signals and the transit times t1 and t2 are measured by an electronic flow transmitter. The signal from transducer A towards transducer B is accelerated by the flow (short t1). The return signal from transducer B to transducer A is decelerated by the flow (longer t2). The difference between t1 and t2 together with the path length L can be used to determine the average flow velocity. This principle is known as the acoustic time-of-flight principle. The flow is calculated from the geometry data of the pipe and the flow velocity.

DUC emits coded signal pattern into the pipe. The received signals will be compared with the sent signals and only signal pattern which correlates with the original one will be used for flow calculation (cross correlation based signal evaluation). The calculation of the flow is done with the integrated DSP (digital signal processor). Thus the calculation has high sampling rates.

The DSP calculation of the time-of-flight is a pure digital transit time measurement, it works very precise, is completely drift and maintenance free and there is no need for recurring calibrations.

Applications Areas

- Power plants (cooling water), district heating, pump protection, condensate and boiler feedwater measurements
- Water and waste water industry (treatment plant inflow), treatment plant outflow, drinking water networks, verification of water meters, pump protection, distribution and consumption measurements, leakage detection
- Facility management (hot and cold water, cooling systems and air conditioning systems, optimisation of energy efficiency, pump control, optimisation of heating and air conditioning)
- Chemical and petrochemical industry (crude oil and light oil), raw and waste water, aggressive and toxic media, measurement of heat carriers (e.g. thermal oils)
- Food and beverage (correct hygienic measurement of media, heat volume measurement in energy supply)

Features

- Clear text based user interface with LED backlight QVGA display
- User interface control with 6 soft buttons
- Quick-Mount-System with space bar for ultrasonic transducers 1 MHz and 2 MHz
- AFC compensation algorithm: compensates influences of changing media temperatures to the ultrasonic transducer distance
- Reynolds compensation: compensates influences of media viscosity on the ultrasonic measurement
- Ultrasonic transducers AND technology: reducing signal echoes and dispersion effects and having a positive effect on the signal to noise ratio
- 2 channel operation (only with stationary transmitter)

Flow Transmitter

DUC-xP portable flow transmitter

The flow measurement, thermal output and heat quantity measurement is possible for one measurement point with a pair of ultrasonic transducers in combination with a pair of PT100 temperature sensors. Other features of DUC-xP transmitter are battery operation, integrated data logger and a stable aluminum/ABS housing.

DUC-xF stationary 1-channel flow transmitter

Flow measurement, thermal output and heat quantity measurement is applicable for one measurement point in combination with one pair ultrasonic transducers and one pair PT100.

DUC-xF stationary 2-channel flow transmitter

Flow measurement is applicable for one or two different measurement points with two pairs of ultrasonic transducers. **DUC-xF** 2-channel version supports different mathematical operations like CH1+CH2, CH1-CH2, (CH1+CH2)/2; due to the appliance of two pair ultrasonic-transducers mounted. Opposite mounting of 2 pairs of transducers on the same pipe will increase the accuracy of measurement, a redundancy operation is possible and disruptive influences of gaseous flow profile will be compensated. Thermal output and heat quantity measurement is only supported in operation mode (CH1+CH2)/2.

No responsibility taken for errors;

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Ultrasonic Transducers

DUC-W standard ultrasonic transducers

The ultrasonic transducers are mounted onto the piping and transmit and receive the ultrasonic signals that are used in the flow transmitter to calculate the volumetric flow rate.

Ultrasonic transducer DUC-Wx21 (2 MHz):

Red housing,	
pipe diameters:	DN10DN100
Operating temperature:	-40°C150°C
Protection:	IP68 (for stationary transducer)
Material:	PEEK/aluminium

DUC-WP21

DUC-WF21



Ultrasonic transducer DUC-Wx10 (1 MHz):

Blue housing, pipe diameters: DN32...DN400 Operating temperature: -40°C...150°C Protection: IP68 (for stationary transducer) Material: PEEK/aluminium

DUC-WP10

DUC-WF10





Ultrasonic transducer DUC-Wx05 (0,5 MHz):

Green housing,	
pipe diameters:	DN200DN6000
Operating temperature:	-40 °C 150 °C (with stainless
	steel strap) ¹⁾
	-40 °C 80 °C (with textile
	tightening straps)
Protection:	IP68 (for stationary transducer)
Material:	PEEK/aluminium

Material:

DUC-WP05

DUC-WF05



¹⁾ Attention: stainless steel strap is only for one-time use

Measurement Accuracy for each Channel

Pipe size	Flow velocity	Accuracy	
10, 05 mm	02 m/s	±0.05 m/s	
10-25 1111	230 m/s	2.5% of reading	
05 50 mm	02 m/s	±0.03 m/s	
29-30 mm	230 m/s	1.5% of reading	
50, 200 mm	02 m/s	±0.02 m/s	
50-500 mm	230 m/s	1% of reading	
300-6000 mm	02 m/s	±0.02 m/s	
	230 m/s	1% of reading	



Technical Details

Flow transmitter DUC-MF (stationary)



Flow transmitter DUC-MP (portable)



	DUC-MF (stationary)	DUC-MP (portable)	
Measuring principle	ultrasonic time-of-flight	ultrasonic time-of-flight	
Physical Quantities	volume flow, flow velocity, power	volume flow, flow velocity, power	
Installation	wallmount	portable	
Counter	heat quantity, volume	heat quantity, volume	
Measuring range	-30+30 m/s	-30+30 m/s	
Signal damping	0 100 s (adjustable)	0100 s (adjustable)	
Diagnostic functions	ultrasonic velocity, signal strength, SNR, signal quality, Amplitude, energy, oscilloscope function for graphical display and evaluation of signal	ultrasonic velocity, signal strength, SNR, signal quality, Amplitude, energy, oscilloscope function for graphical display and evaluation of signal	
Human interface	intuitive via 8 soft keys, clear text display	intuitive via 8 soft keys, clear text display	
Menu language packages	EN/DE/FR, EN/ES/FR ¹⁾ EN/RU/CHN ¹⁾	EN/DE/FR, EN/ES/FR, EN/RU/CHN	
Flow transmitter units	metric/US	metric/US	
Outputs	2x420 mA, 1x pulse with 1 channel/ 2x pulse with 2 channel, 1x micro USB, 1x relay optional RS232/RS485 (RS485 supports Modbus communication)	2x420 mA, 1x pulse, 1x micro USB, 1x relay	
Additional inputs for heat measurement 2 x Pt 100		2 x Pt 100	
Measuring channels	1, optional 2	1	
Power supply	90 - 240 V_{AC} , optional 18-36 V_{DC}	Integrated battery or 100 240 $V_{\rm AC}$ wide range power supply	
Battery operation	-	approx. 5 h	
Integrated data storage	-	4 GB	
Saved data	-	measuring and diagnostic value counter	
Data format	-	text format (CSV) directly importable into all popular programs like MS Office, MS Works, etc.	
Memory cycle	-	adjustable, 1 s up to 24 h	
Protection	IP 65	IP 40	
Cable connections	screw terminals	BNC-connection	
Housing ABS		Aluminium, ABS	
Operating temperature	-2060°C	-2060°C	
Dimensions	260 x 240 x 120 mm (W, H, D)	265 x 190 x 70 mm (W, H, D)	
Weight	1.3 kg	1.5 kg	
Display	QVGA (320 x 240), black and white, adjustable backlight	QVGA (320 x 240), black and white, adjustable backlight	
Measuring modes ²⁾	CH1, CH2, CH1+CH2, CH1-CH2, (CH1+CH2)/2	-	

¹⁾ for 1-channel operation only

²⁾ for 2-channel operation only

1/11-2016





General Specifications Ultrasonic transducer

Ultrasonic transducers for transit time measurement

Model	Description		Media temperature	Pipe sizes
DUC-WP21			-40150°C	DN 10 DN 100
DUC-WP10	-	portable	-40150°C	DN 32 DN 400
DUC-WP05			-40 80 °C -40 150 °C (optional)	DN 200 DN 6000
DUC-WF21			-40150°C	DN 10 DN 100
DUC-WF10	Comment State Comment	stationary	-40150°C	DN 32 DN 400
DUC-WF05			-40150°C	DN 200 DN 6000



Mounting arrangement of the ultrasonic transducer

Mounting in V-mode (standard)



Mounting in Z-mode (applicable for big pipe dimensions or high acoustic damping)



Mounting in W-mode (for pipe dimensions < DN 32)



1/11-2016



Measuring mode 2-channel system

Simultaneous measurement at 2 different measurement points with two pairs of ultrasonic transducers



Simultaneous measurement with two pairs of ultrasonic transducers at one common metering point (Compensation of cross-flow effect on measurement, redundancy operation and higher accuracy)





Measurement of heat quantity

DUC-M is more than a flowmeter. Together with external temperature sensors it can also measure the heat transfer of your media. Only two optional Pt100 have to be connected to DUC-MF for measuring feed/return temperatures (RTD 1/RTD 2) within the heating circuit.

The measured temperature difference and the measured flow Q can then be used to calculate the thermal output and the heat quantity.





Model	Version	Channel	Supply	Ex-approval	Language packages	Options
DUC-M	F = stationary	1 = 1-channel 2 = 2-channel	0 = 90 240 V _{AC} 7 = 18 36 V _{DC}	0 = none E = ATEX Exd (suitable for zone 1 and 2) (on request)	$D = EN/DE/FR$ $S = EN/ES/FR^{1)}$ $C = EN/RU/CHN^{1)}$	00 = none R2 = RS232 R4 = RS485 RL ¹⁾ = data logger
	P = portable	1 = 1-channel	0 = 100 240 V _{AC}	0 = none		00 = none

Order Details Transmitter (Example DUC-M F 1 0 0 D R2)

¹⁾ Only with 1-channel

Order Details Transducer (Example DUC-W F 21 0 05)

Model	Version	Frequency (NW)	Ex-approval	Cable length
DUC-W	\mathbf{F} = stationary $\mathbf{V}^{1)}$ = stationary, PVC	10 = 1 MHz (DN32DN400) 21 = 2 MHz (DN10DN100) 05 = 0,5 MHz (DN200DN6000)	0 = none 1 = ATEX Exd (suitable for zone 1 and 2) ^{1) 2)}	10 = 10 m 20 = 20 m 30 = 30 m 40 = 40 m 50 = 50 m XX ³⁾ = other (multiple of 10 m)
	P = portable		0 = none	03 = 3 m

¹⁾ On request ²⁾ Not for PVC transducer ³⁾ Max. length 250 m

Delivery Scope for portable Transmitter

Following accessories are included in shipment:

- 1. Hard-shell carrying case
- 2. Operating manual on CD, Quickstart printed
- 3. Analogue output cable Mini DIN, crocodile clips 0.5 m
- 4. Relay / pulse output cable Mini DIN crocodile clips, 0.5 m
- 5. USB cable
- 6. Signal cable (1 pair), BNC-connection, 3 m
- 7. Measuring tape

Delivery Scope for Transducer (portable and stationary)

Following accessories are included in shipment:

- 1. Mounting rail (not for DUC-Wx05)
- 2. Coupling foil for stationary, ultrasonic coupling gel for portable device
- 3. Suitable mounting accessories, such as strap or chains, depending on the transducer type







Order Details Acessories/Spare Parts (Example DUC-Z F P1)

Model	el Version Description	
		MS = mounting rails suitable for transducer DUC-WF10 (max. DN 400), max.150 °C
	F = stationary	 PT = PT100, surface contact, 1 pair, cable length 5 m, incl. stainless steel strap up to DN 900 P1 = PT100, surface contact, 1 pair, cable length 10 m, incl. stainless steel strap up to DN 900 P2 = PT100, surface contact, 1 pair, cable length 20 m, incl. stainless steel strap up to DN 900 P2 = PT100, surface contact, 1 pair, cable length 20 m, incl. stainless steel strap up to DN 900 WK = factory calibration 1 MHz or 2 MHz, 5-point on pipe size DN 50 WR = factory recalibration 1 MHz or 2 MHz 5-point on pipe size DN 50 I0 = coupling foil 2 pair for DUC-WF10 21 = coupling foil 2 pair for DUC-WF21 O5 = coupling foil 1 pair for DUC-WF05 SB = short mounting rails (spacer short bar) suitable for DUC-WF21, max. 150 °C EB = stainless steel strap (1 pair) suitable for ultrasonic transducer DUC-WF21, DUC-WF10 (max. DN400) BE = stainless steel strap (1 pair) suitable for ultrasonic transducer DUC-WF05
		DE = venting unit for gaseous fluids, pipe connection max. DN25
	P = portable	KG = ultrasonic coupling gel, tube, 10 g MS = mounting rails suitable for transducer DUC-WP10 (max. DN400), max.150 °C
		SB = short mounting rails (spacer short bar) suitable for DUC-WP21, max. 150 °C
		MK = clamping chains (1 pair) suitable for transducer DUC-WP21, DUC-WP10 (max. DN400), max. 150 °C
		BT = textile tightening straps suitable for transducer DUC-WP05, max. 80 °C
		PT = PT100, 1 pair, Mini DIN, cable length 5 m, incl. stainless steel strap up to DN 900
		WK = factory calibration 1 MHz or 2 MHz 5-point on pipe size DN50 WR = factory recalibration 1 MHz or 2 MHz 5-point on pipe size DN50
	U	WD = wall thickness gauge (Universal) Technical details see description DUC-ZUWD

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Description DUC-ZUWD

With the precise wall thickness gauge DUC-ZUWD reliable measurements of pipe wall thicknesses become a matter of minutes. Switch on, put in your pipe data and press transducer onto your pipe – that's it.

DUC-ZUWD determines the thickness of a structure or a pipe by accurately measuring the time required for an ultrasonic signal to travel through the thickness of the material, reflect from the back or inside surface, and be returned to the transducer. The measured two-way transit time of the ultrasonic together with the specific speed of sound of your material is used to accurately measure the wall thickness. The resolution is 0.1 mm!

The light-weight and robust transmitter makes DUC-ZUWD the perfect instrument for harsh environments within the process industry and therefore also a reliable and useful accessory for your clamp-on ultrasonic flowmeter DUC.

The long-life battery mode gives you the independence you need for your measurements. The integrated calibration sample ensures best possible accuracy and high repeatability.

Technical Details

Measuring principle:	ultrasonic transit time
Measuring range:	0.7580 mm (steel)
Accuracy:	\pm (0.5 % of thickness + 0.04 mm)
Operating temperature	:-20+70°C
Ultrasonic transducers:	7 MHz
Supported materials:	all common pipeline materials (sound conductive, e.g. PVC, PE, steel, copper, etc.)
Display:	128x64 LCD with backlight
Resolution:	0.1mm
Measuring units:	metric and US
Languages:	DE, GB, IT, FR, ES
Housing material:	aluminium
Power supply:	2x mignon type AA 1.5V
Dimensions:	132x76,2x32mm (HxWxD)
Weight:	345 g





Dimensions [mm]

Transmitter DUC-MF (stationary) Front



Side



Bottom



Transducer DUC-WF (stationary) 2 MHz



1 MHz



0,5 MHz





Dimensions [mm] (continuation) Transmitter DUC-MP (portable



Transducer DUC-WP (portable) 2 MHz



1 MHz











Sideview of aluminium body, including cover plate

